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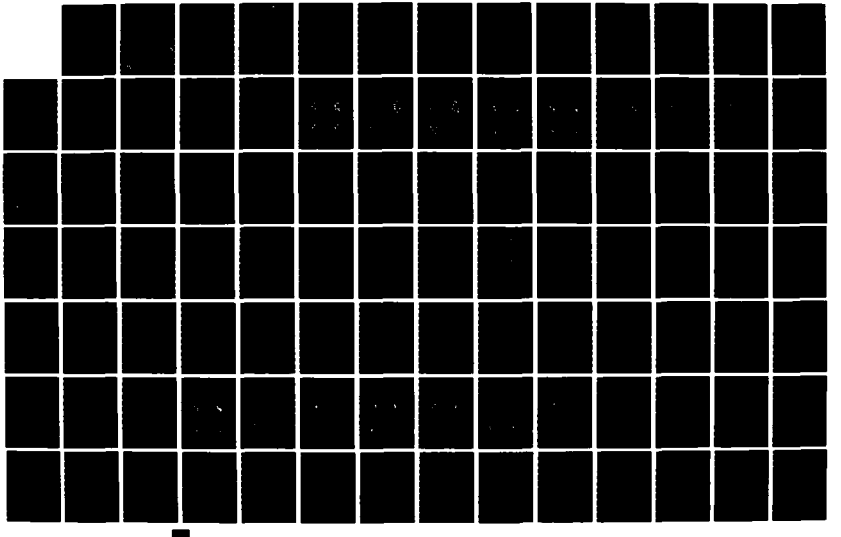

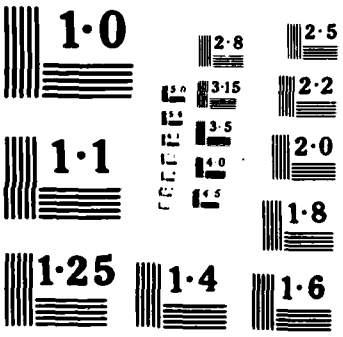
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MEDIUM RANGE (10 DAY) FORECASTS WITH THE UCLA GENERAL CIRCULATION MODEL

C.R. Mechoso, M.J. Suarez, K.Yamazaki,
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The UCLA general circulation model is run for a large number of medium range (10 day) forecasts. The forecasts are for a selected set of FGGE IIB initial conditions from both the winter and summer special observing periods. The forecasts are run with different resolutions to test the sensitivity of the forecast to model resolution. Comparisons also are made between versions of the model with and without a stratosphere. The stratospheric versions include the effects of ozone photochemistry.

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1. Introduction

In this report we present a series of medium-range (10-day) forecasts performed with the UCLA general circulation model (GCM). For most of the forecasts we have used more than one version of the GCM with different horizontal resolutions and vertical extents. The impact of these model characteristics on the accuracy of the forecasts, therefore, can be assessed.

Section 2 contains an outline of the UCLA GCM. Descriptions of the dataset and the initialization procedure are given in Section 3. An inventory of cases and models used for each case is in Section 4. The major part of this report consists of the forecast results, presented as maps of sea-level pressure (SLP) and geopotential (Z) fields at selected pressure levels.

2. Outline of the UCLA GCM

The prognostic variables of the UCLA GCM are the horizontal velocity, the potential temperature, the water vapor mixing ratio, the ozone mixing ratio, the surface pressure, the planetary boundary layer (PBL) depth and the ground temperature.

One of the unique aspects of the UCLA GCM is the treatment of the PBL. This is assumed to be well-mixed and is made the variable-depth bottom layer of the model. In parameterizing PBL processes, we use bulk assumptions for the description of the turbulence (Suarez et al., 1983). When the top of the PBL is above the condensation level, it has a sublayer of stratocumulus clouds. The parameterization of cumulus convection and its interaction with the PBL is based on Arakawa and Schubert (1974). Details of this parameterization are given by Lord

(1978) and Lord et al. (1982). Surface fluxes of sensible heat, moisture and momentum are modelled with the bulk parameterization proposed by Deardorff (1972). The entrainment of mass at the PBL top is calculated using Randall's (1979) closures. In addition to the surface drag, the model includes the effects of vertical redistribution of momentum by cumulus clouds and lateral redistribution by a non-linear "eddy viscosity".

In the vertical, the model is based on a modified σ-coordinate system for which the lower boundary, the PBL top, and isobaric surfaces above a prescribed pressure level (100 mb) are coordinate surfaces. The top of the model atmosphere is assumed to be a material surface. The vertical finite-differencing used above the PBL is that described by Arakawa and Suarez (1983). It guarantees conservations of the global mass integrals of potential temperature and total potential plus kinetic energy under frictionless adiabatic processes.

The equations are horizontally discretized using a staggered latitude-longitude grid. The scheme for the horizontal advection term in the momentum equation is based on the potential enstrophy conserving scheme presented by Arakawa and Lamb (1981), modified to give fourth-order accuracy for the advection of potential vorticity. The horizontal advection scheme used for the potential temperature is also fourth-order and conserves the global mass integral of its square. The scheme for the horizontal advection of water vapor and ozone is based on the same formulation, although exact fourth-order accuracy is abandoned in favor of a formulation that prevents the occurrence of negative values. In all other terms, including the continuity

equation, the pressure gradient force and the definition of absolute vorticity, the differencing is of second-order accuracy.

The model includes both diurnal and seasonal changes. Solar and infrared radiative heating rates are computed following the formulation of Katayama (1972) as described by Schlesinger (1976). The calculation includes the effects of absorption of solar radiation by ozone and water vapor, and absorption and emission of long-wave radiation by ozone, water vapor and CO_2 at levels below 30 km. Above 30 km infrared cooling is modeled using Dickinson's (1973) approximation. The cloudiness used in the radiation calculation is predicted by the model by assuming overcast conditions whenever the predicted relative humidity exceeds saturation at levels below 100 mb or when cumulus clouds penetrate above 500 mb. The parameterization of the ozone photochemistry is described by Schlesinger (1976) and Schlesinger and Mintz (1979). The CO_2 amount is prescribed.

The geographical distributions of surface albedo, ground wetness, and sea surface temperature are interpolated from prescribed monthly means based on the observed climatology.

For the forecasts described in this report, we used the 15-layer and 9-layer versions of the model with low and high horizontal resolutions (5^o in longitude by 4^o in latitude and 3^o in longitude by 2.4^o in latitude, respectively). The 15-layer version has the top at 1 mb and six layers above 51.8 mb (with interfaces at 26.8, 13.9, 7.20, 3.73 and 1.93 mb), resulting in a stratospheric resolution of about 5 km. The 9-layer version has the top at 51.8 mb and is identical to the 15-layer version below that level, except that the ozone mixing ratio is prescribed.

The GCM has been evaluated in terms of long-term simulations of monthly mean fields. Suarez et al. (1983) presented a July simulation with the low-resolution 9-layer version. A more extensive evaluation of that version in terms of a three-year simulation has been performed by Randall et al. (1985). The high-resolution 15-layer and 9-layer versions have also been evaluated by performing simulations over several months.

3. Data and initialization procedure

The dataset consists of the FGGE Level III-b analysis by the European Centre for Medium Range Weather Forecasts (ECMWF) below 10 mb, and the U.S. National Meteorological Center (NMC) global height and temperature fields above that level. Winds for the levels above 10 mb and latitudes higher than 20^{o} were obtained by using the geostrophic relations, while for lower latitudes they were obtained by linear interpolation between 20^{o}N and 20^{o}S.

For the primary prognostic variables, the initial conditions of the forecasts were obtained from the dataset. The surface pressure was obtained from the observed sea level pressure and geopotential fields. The horizontal velocity was then obtained by interpolation of the observed values. The geopotentials at the interfaces of the model's layers were also obtained by interpolation from the observed values. This particular interpolation procedure is designed such that the model's pressure gradient force is a proper interpolation of that on the pressure surfaces. The potential temperature was then obtained from those geopotentials using the model's hydrostatic equation. No further initialization procedures were performed for these variables.

To obtain initial conditions for the ozone mixing ratio and the PBL depth and those for the water vapor mixing ratio with some degree of consistency with the model, we performed an "update cycle", in which the model was integrated for several (generally five) days preceding each forecast period. For this integration, the initial PBL depth was 50 mb everywhere, the water vapor mixing ratio was obtained from the dataset below 300 mb and was set equal to 2.5×10^{-6} above that level, and the initial ozone mixing ratio was zonally uniform and taken from Schlesinger and Mintz (1979). During the update cycle, the horizontal velocity, the potential temperature and the surface pressure were updated at regular time intervals. The water vapor mixing ratio was updated by preserving the relative humidity predicted by the model. Below 10 mb, the updating interval was 6 hours during the FGGE Special Observing Periods, when data are available with that frequency, and 12 hours outside those periods. Above 10 mb, the interval was 24 hours since the NMC data are available only at 1200 GMT.

4. Case Studies

Tables 1 and 2 show the forecasts presented in this report and the versions of the UCLA GCM used for each case, respectively. A detailed analysis of some forecasts is given in Mechoso et al. (1985, 1986).

Table 1

Inventory of forecasts

Forecast	Starting Date			
1	0000 GMT	12	January	1979
2	0000 GMT	14	January	1979
3	0000 GMT	16	January	1979
4	0000 GMT	21	January	1979
5	0000 GMT	13	February	1979
6	0000 GMT	15	February	1979
7	0000 GMT	17	February	1979
8	1200 GMT	11	June	1979
9	1200 GMT	1	July	1979
10	1200 GMT	3	July	1979
11	1200 GMT	5	July	1979

Table 2

Versions of the UCLA GCM used for each forecast

Forecast	9-layer		15-layer	
	$5^{o} \times 4^{o}$	$3^{o} \times 2.4^{o}$	$5^{o} \times 4^{o}$	$3^{o} \times 2.4^{o}$
1	X	X	X	
2	X	X		
3	X	X	X	
4	X	X	X	X
5			X	X
6	X	X	X	X
7	X		X	X
8	X		X	
9				X
10				X
11	X		X	X

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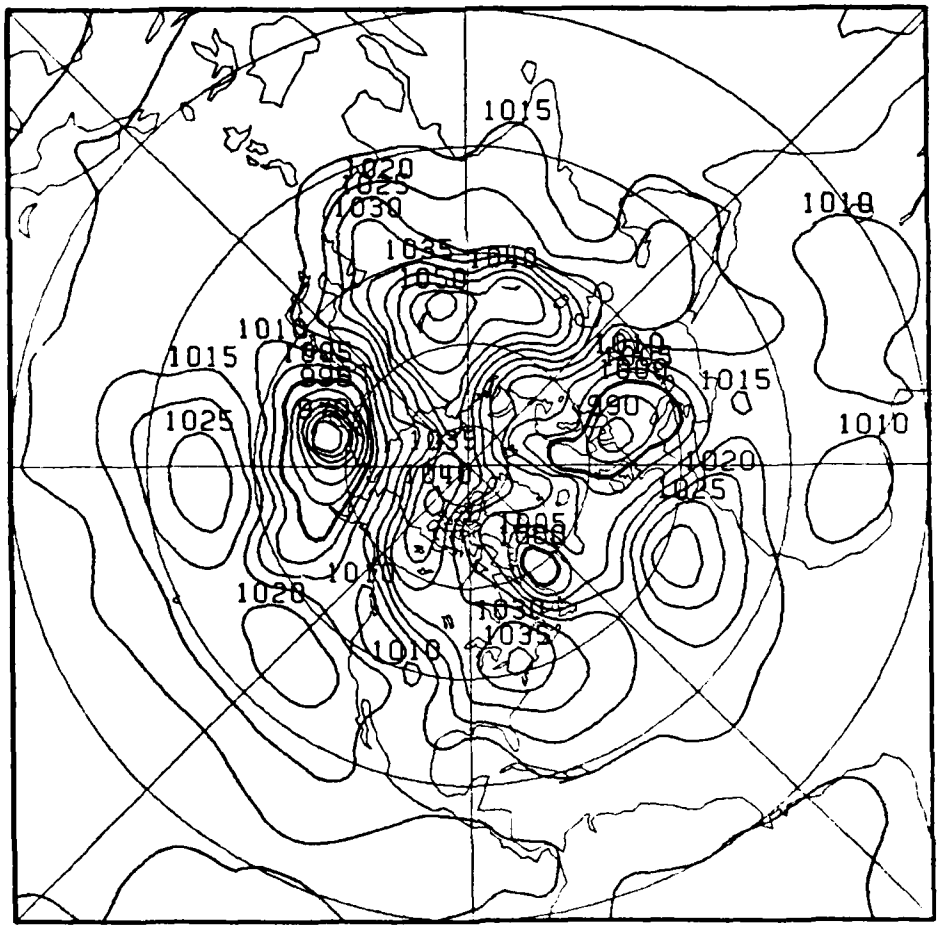

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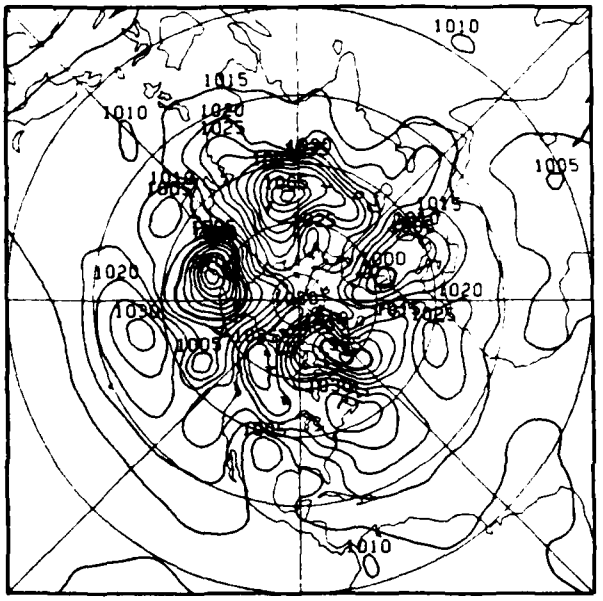

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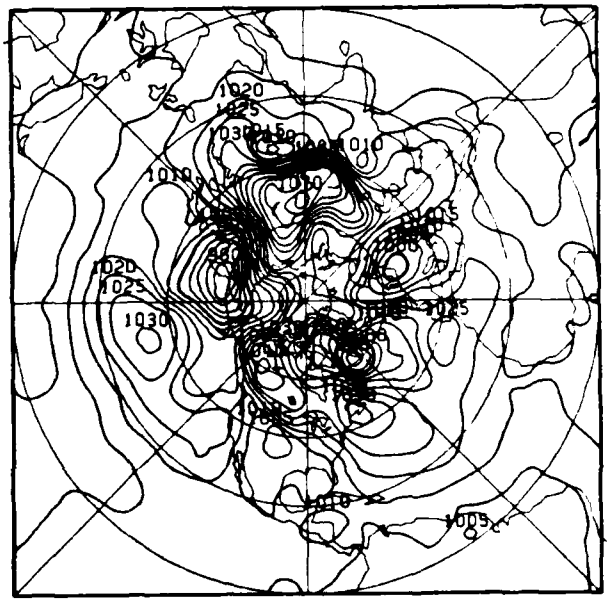

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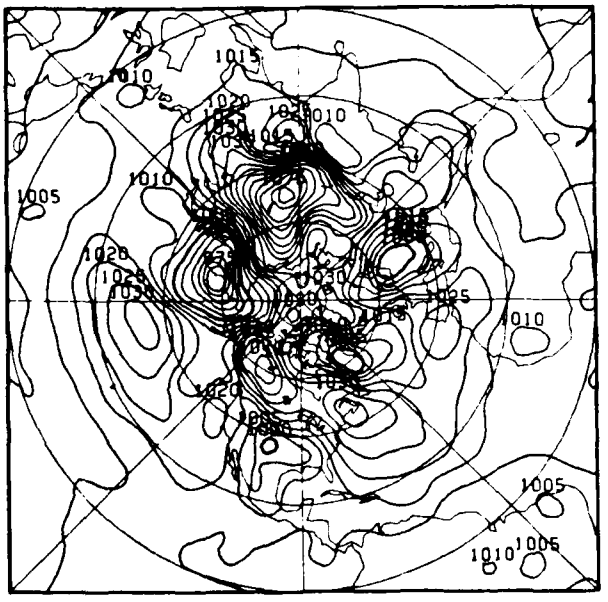

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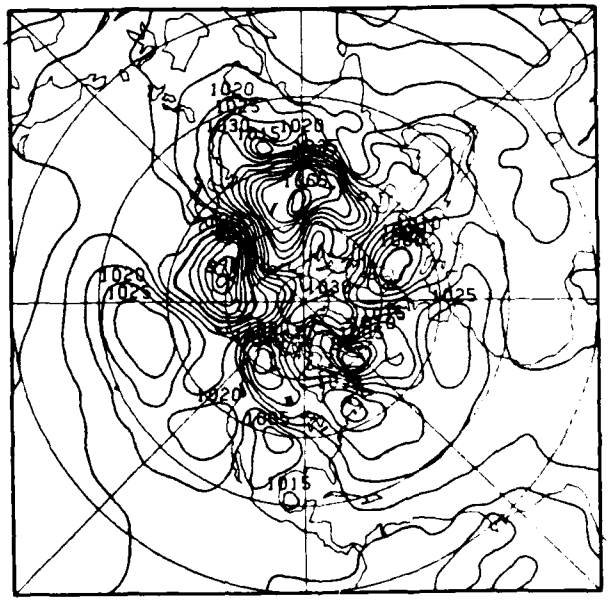

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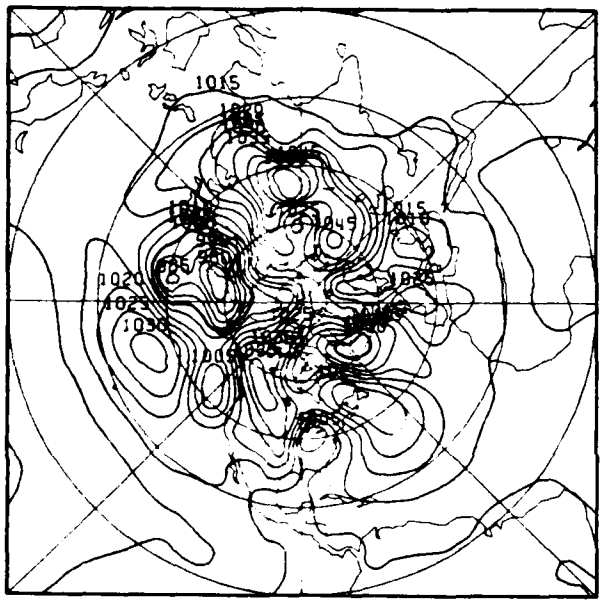

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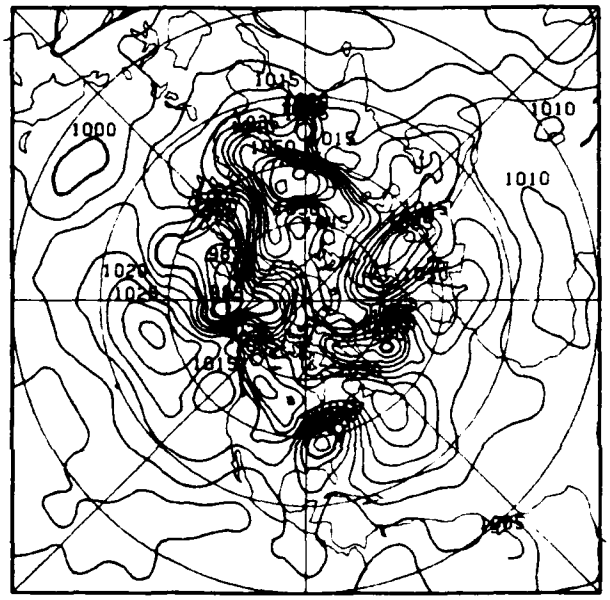

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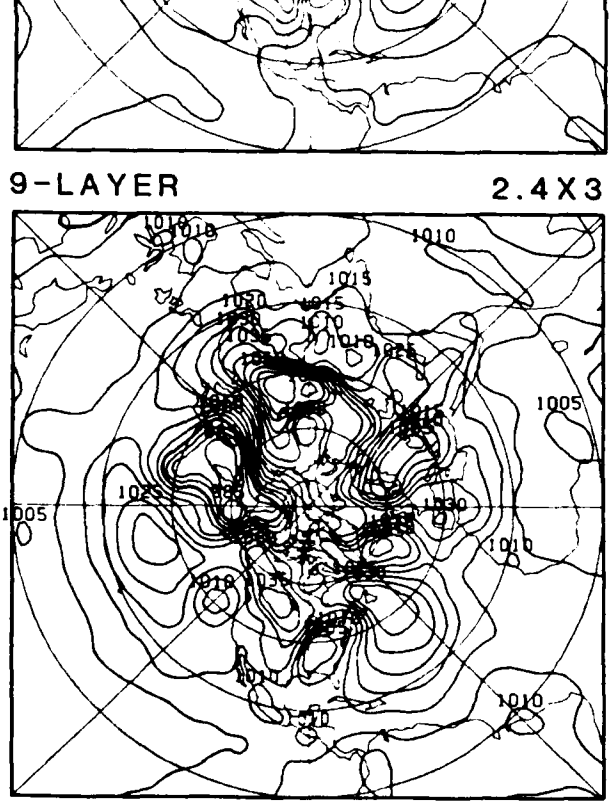

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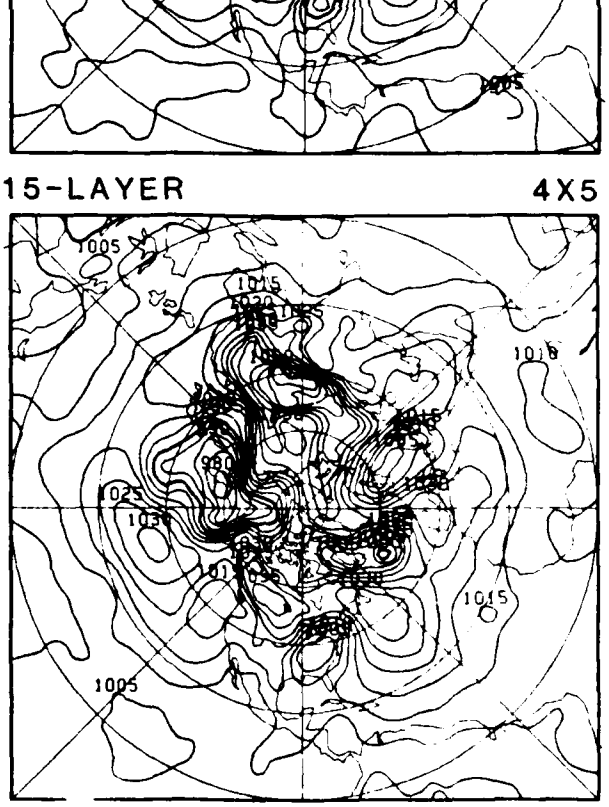

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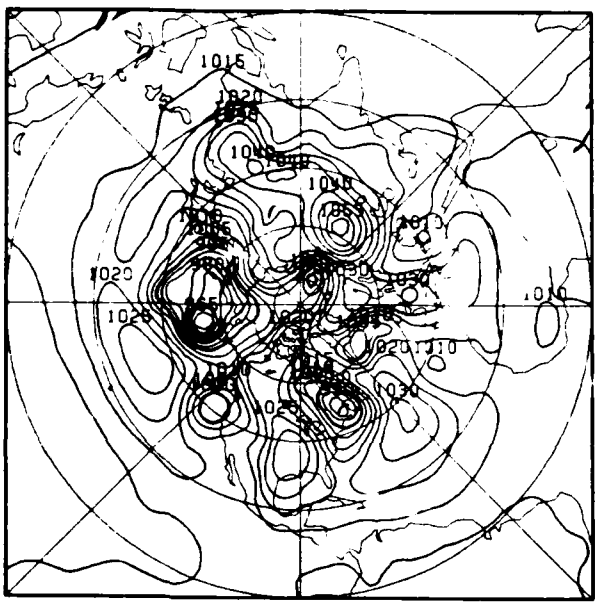

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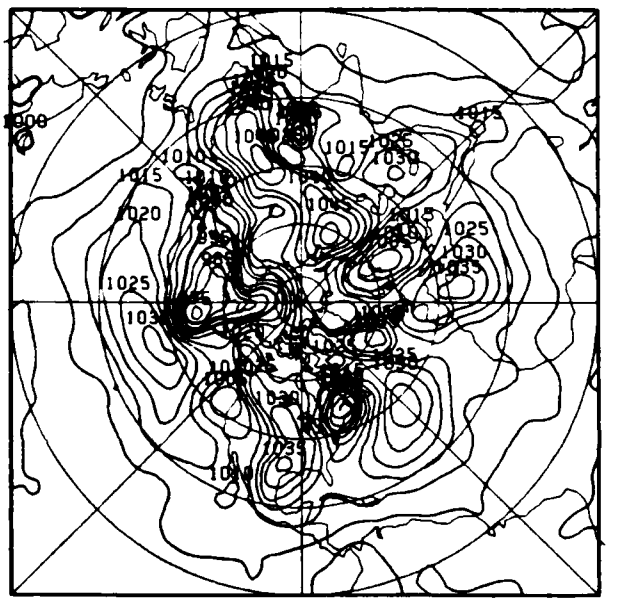

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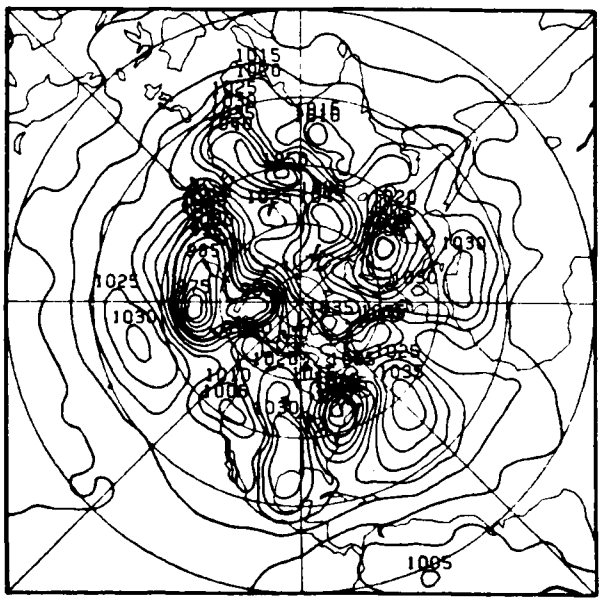

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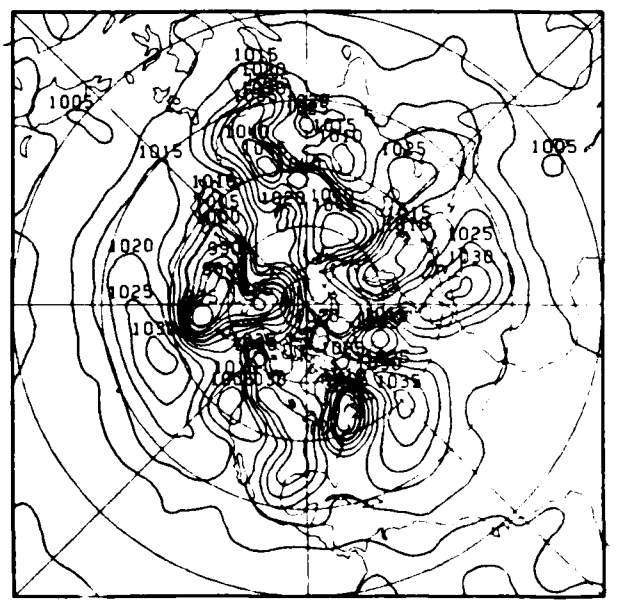

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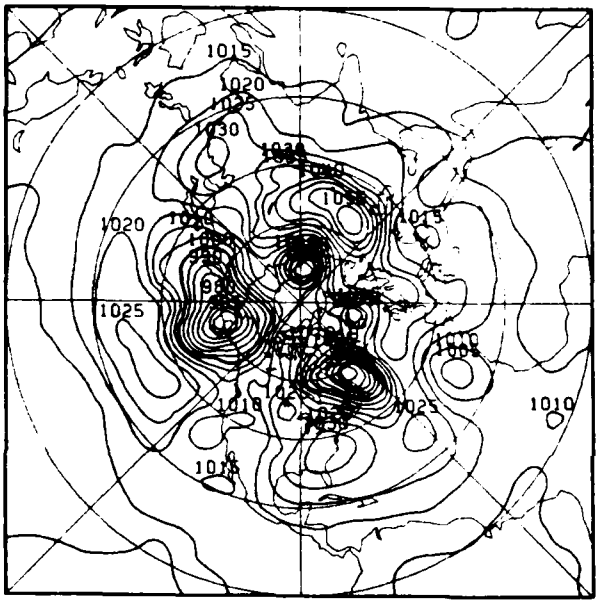

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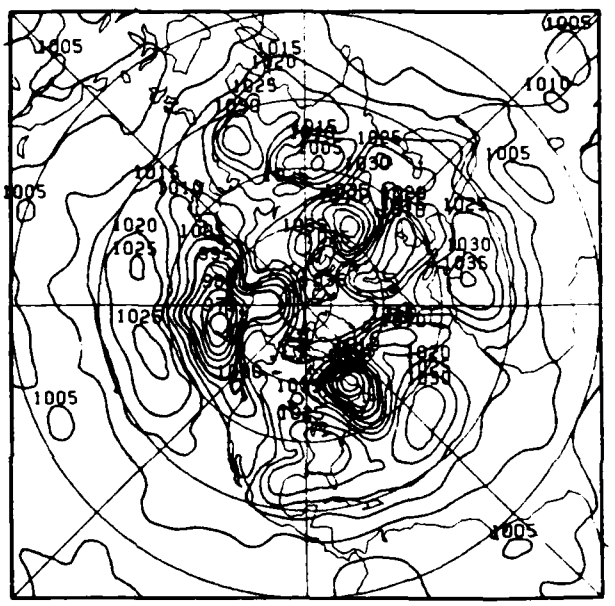

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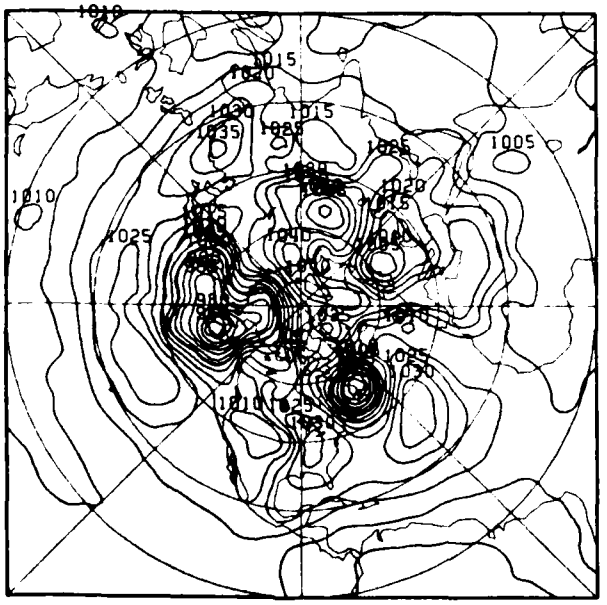
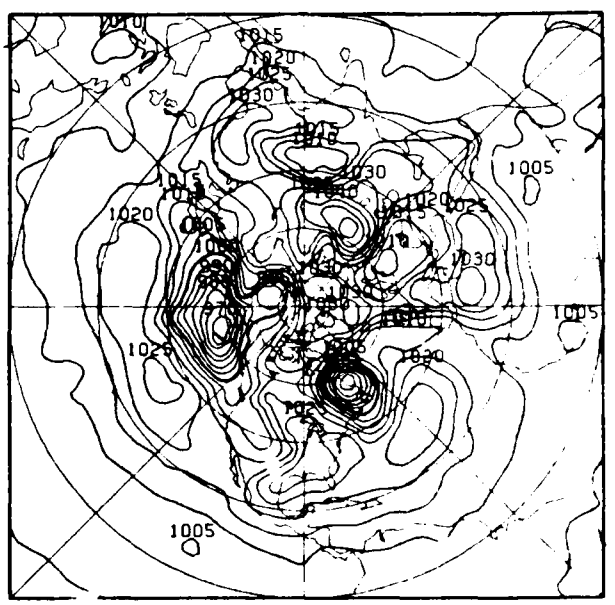


15-LAYER 4X5



SLP

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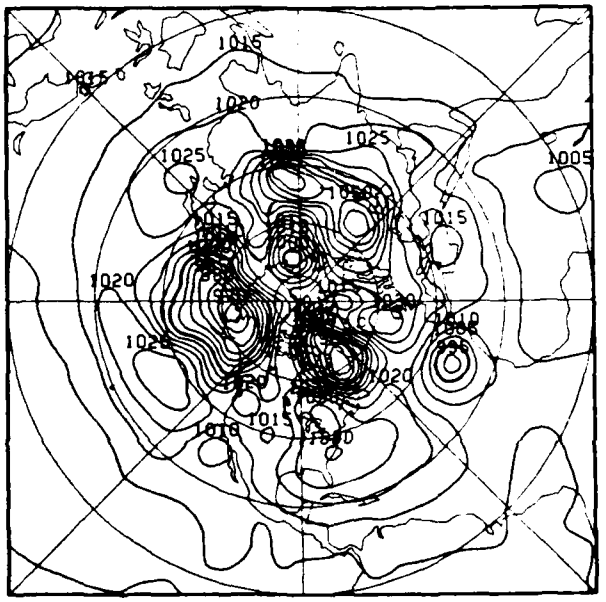
DAY 5

OBSERVED



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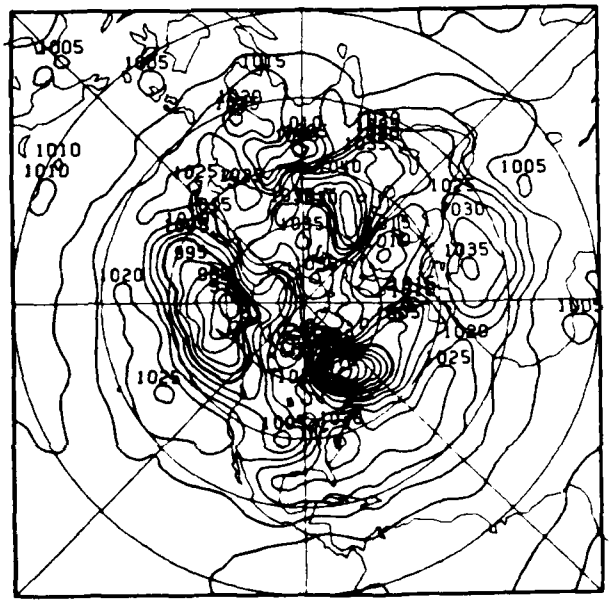

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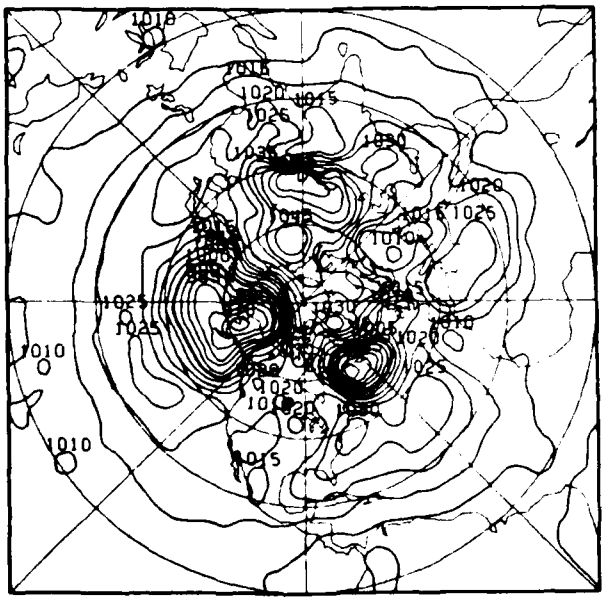

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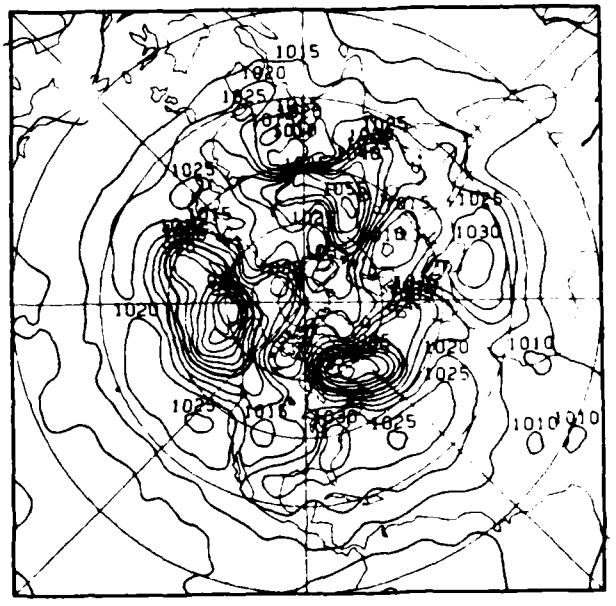

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DAY 6

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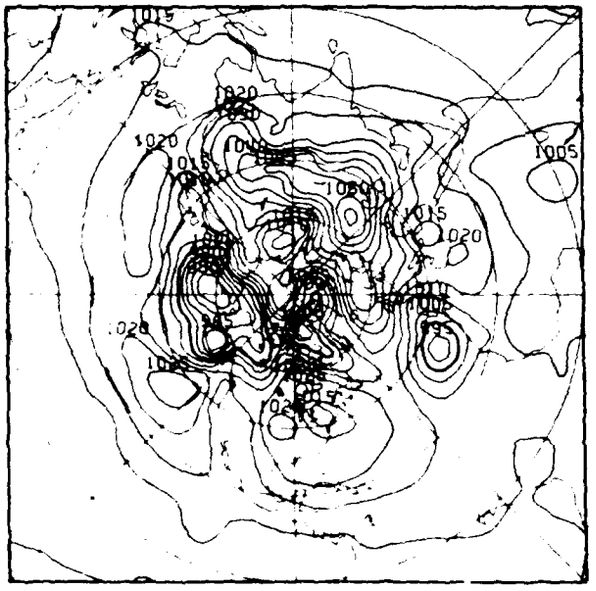

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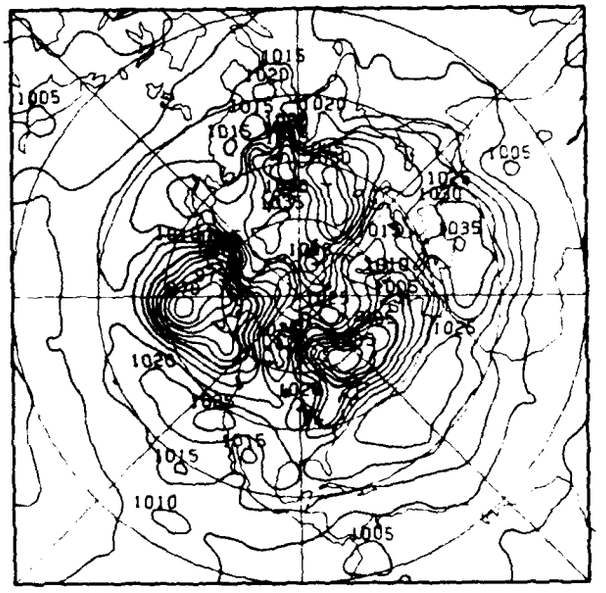

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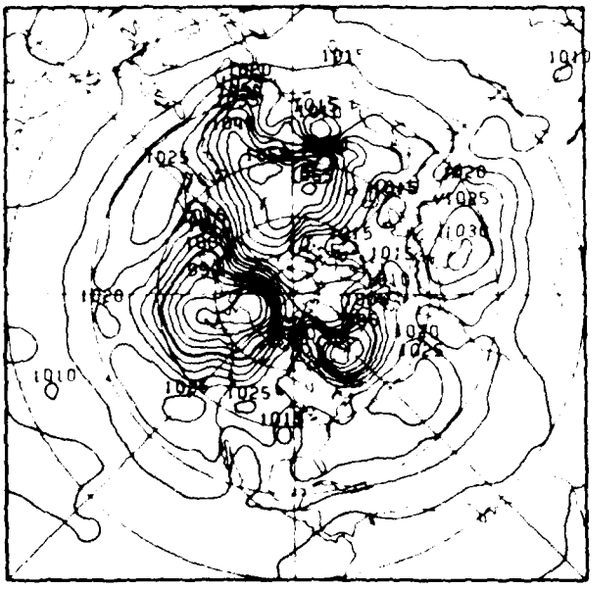

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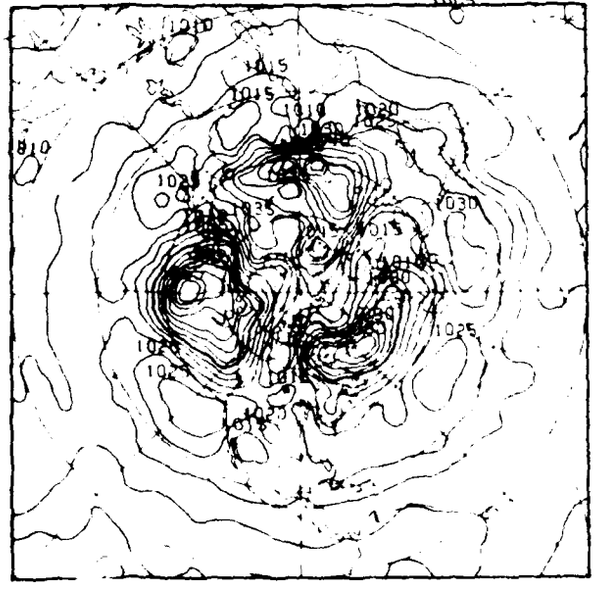

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DAY 7

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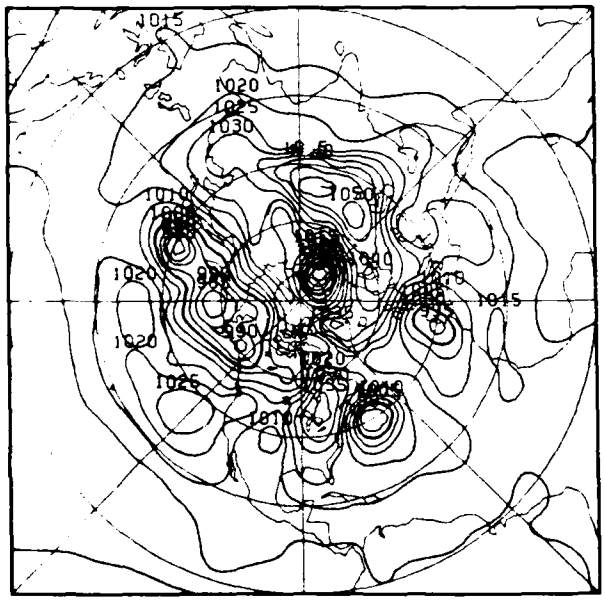

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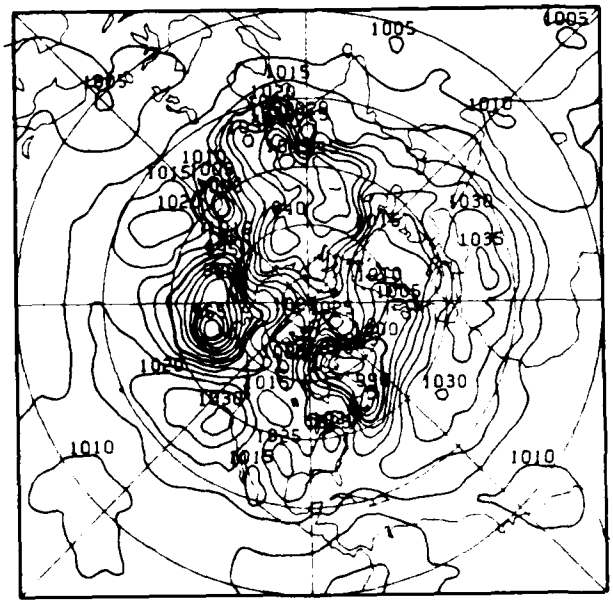

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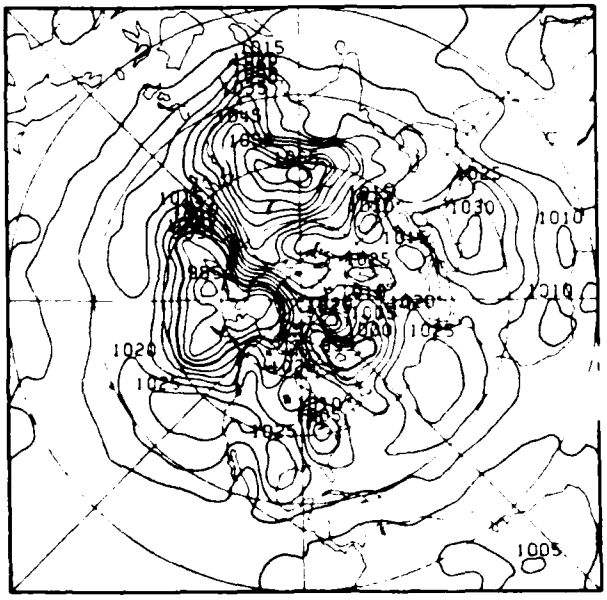

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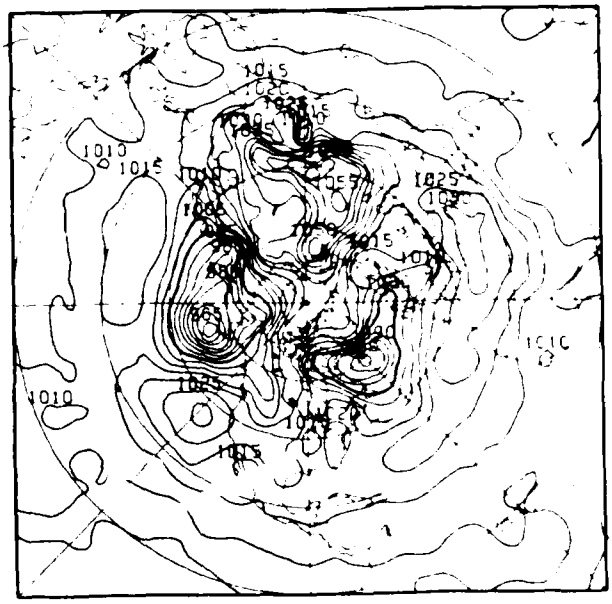

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DAY 8

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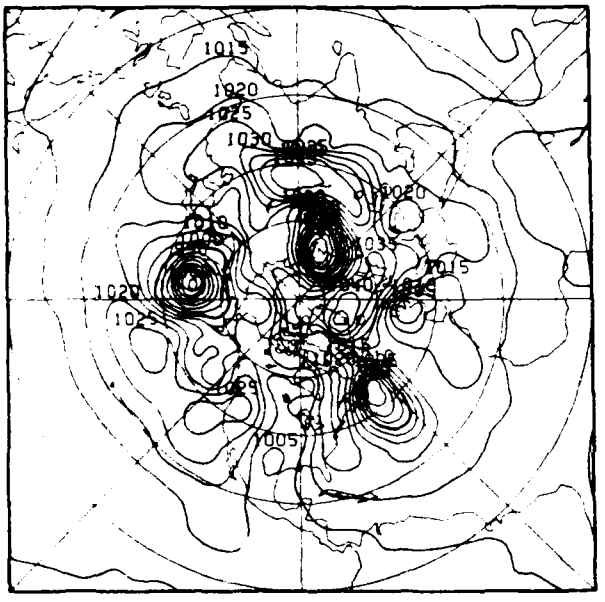

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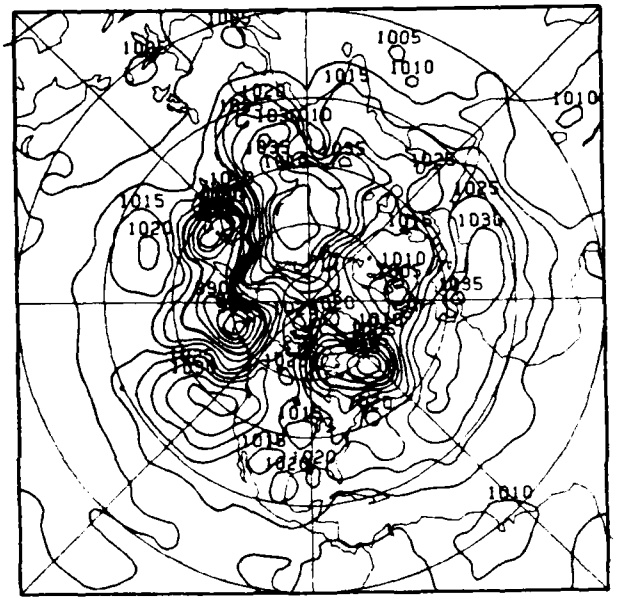

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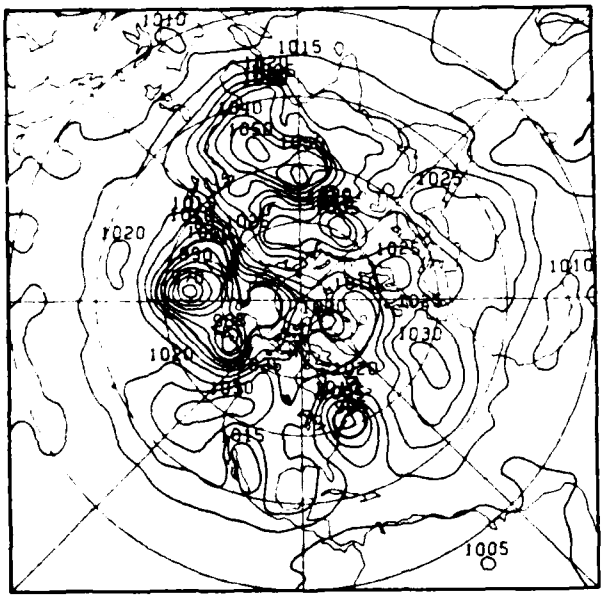

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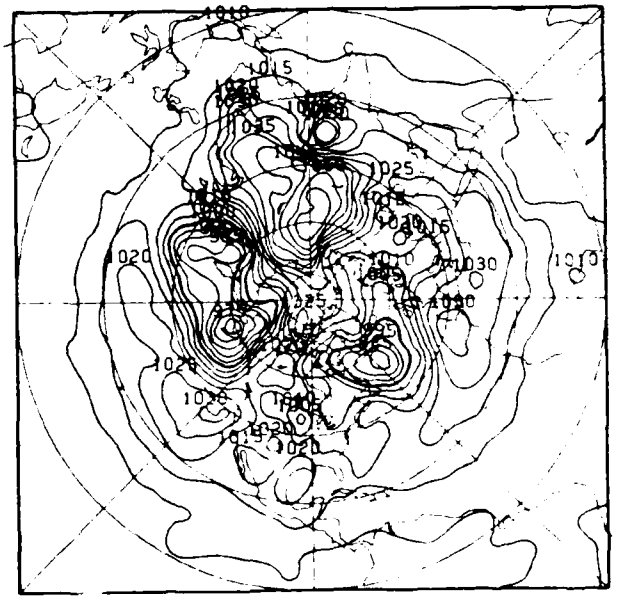

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DAY 9

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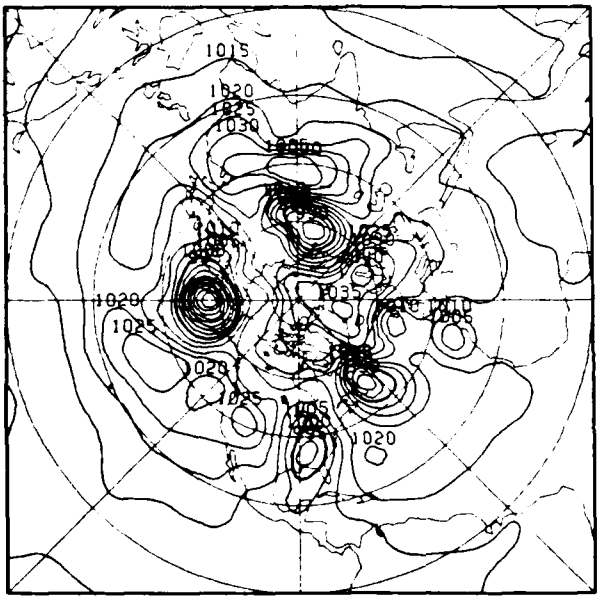

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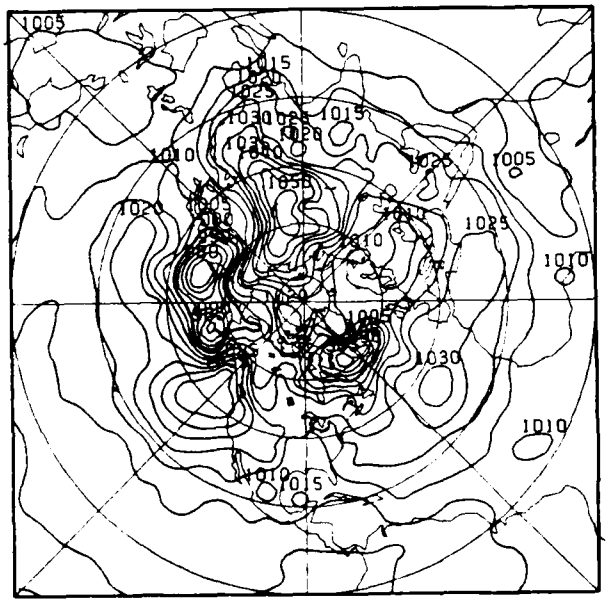

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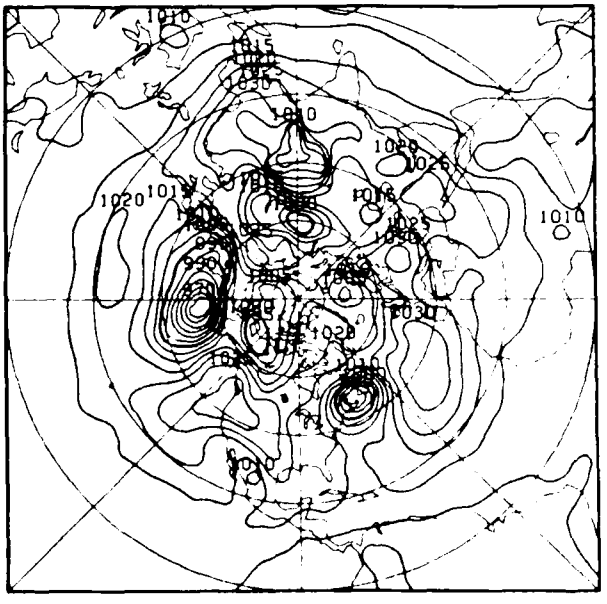

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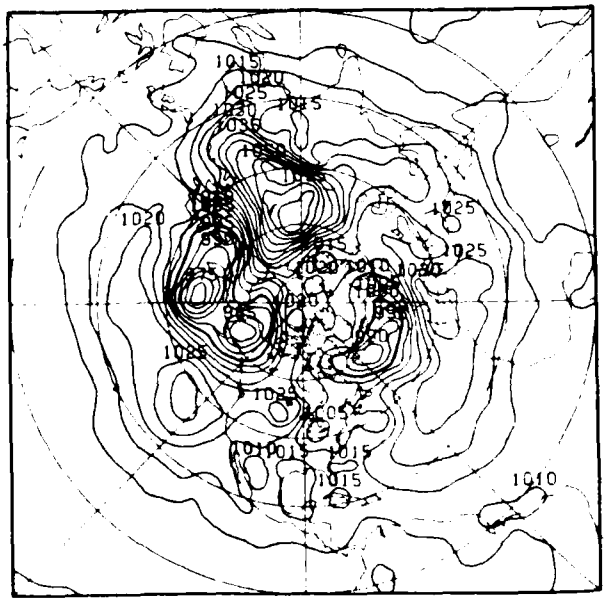

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DAY 10

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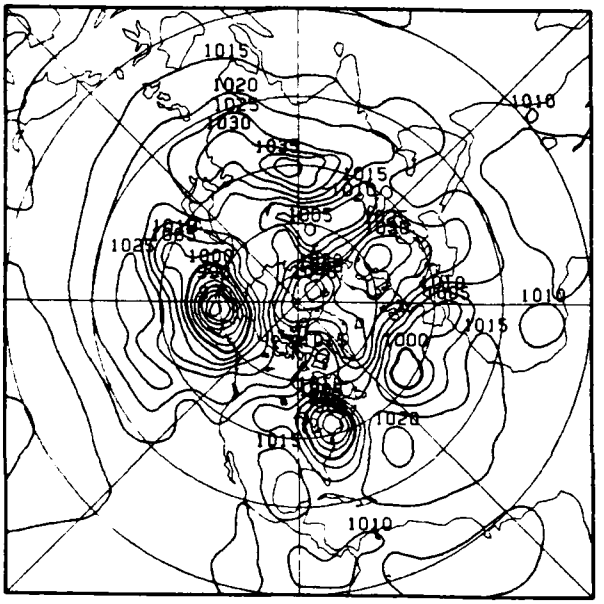

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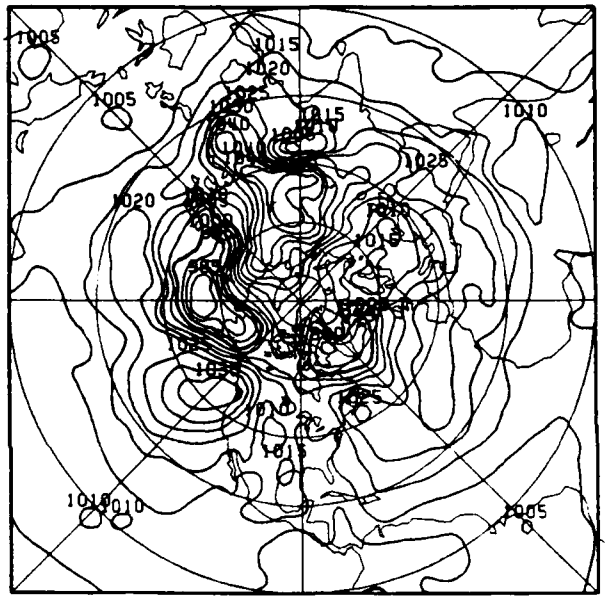

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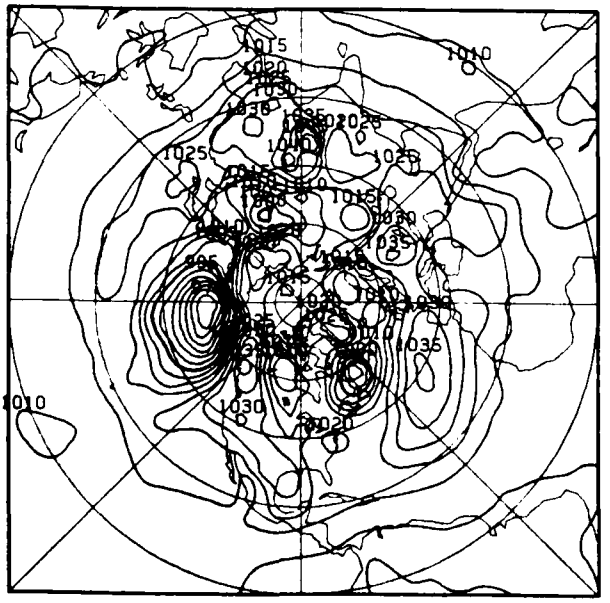

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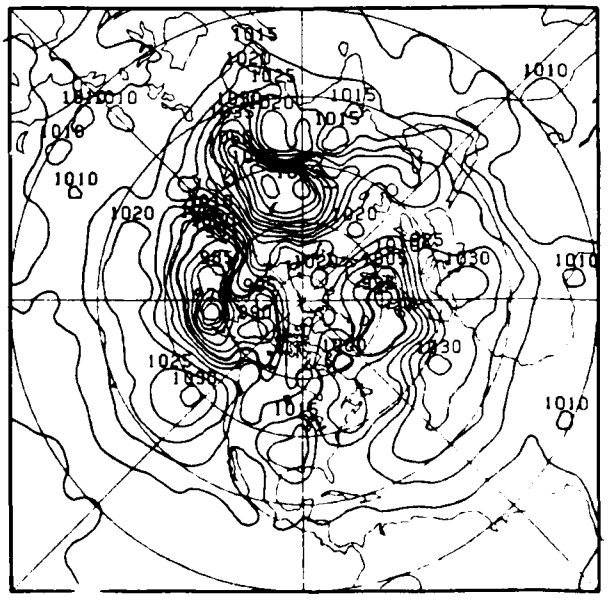

500 mb Z

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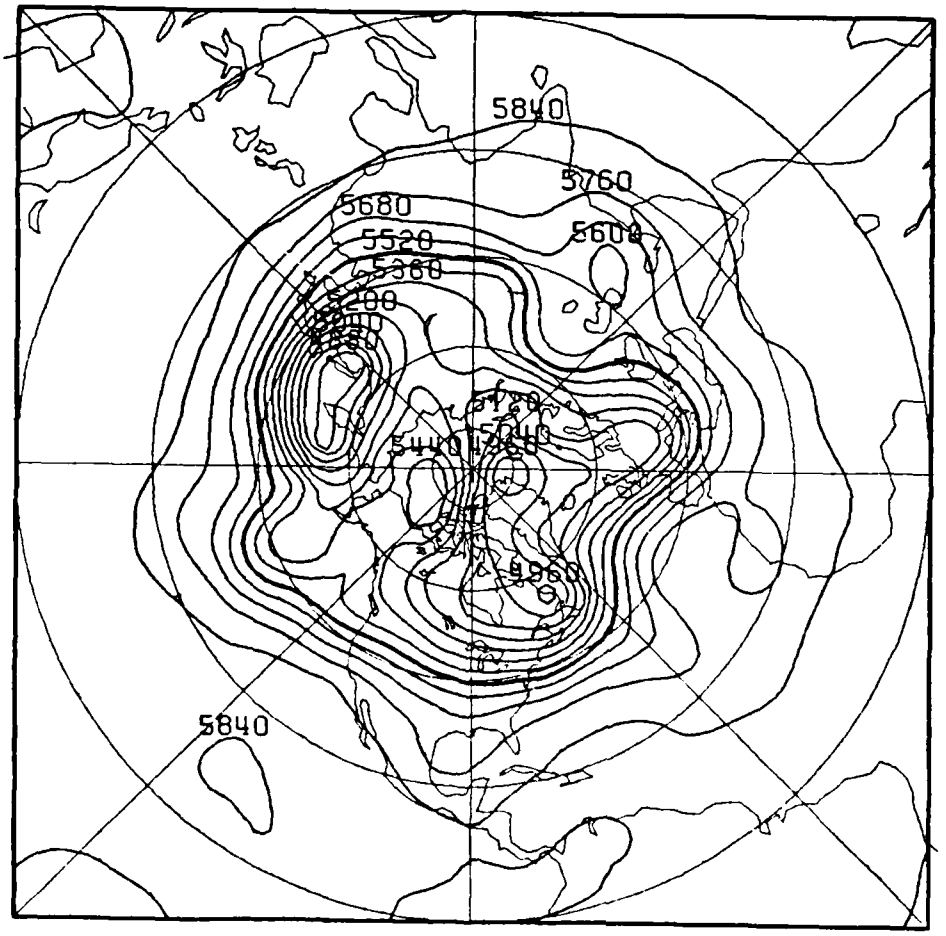

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DAY 1

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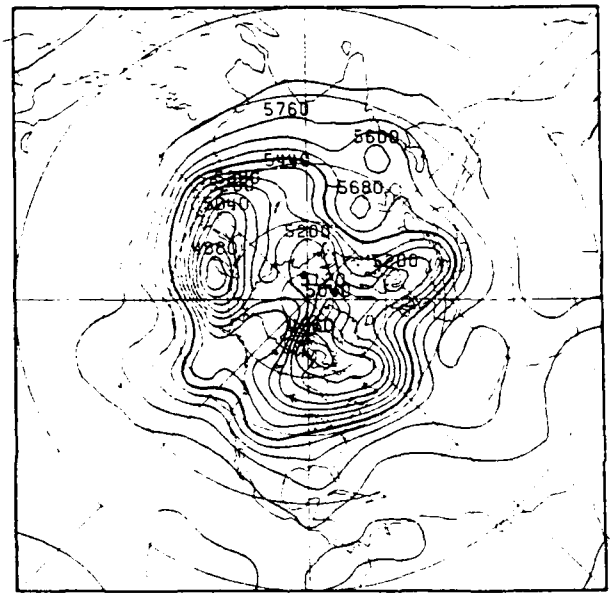

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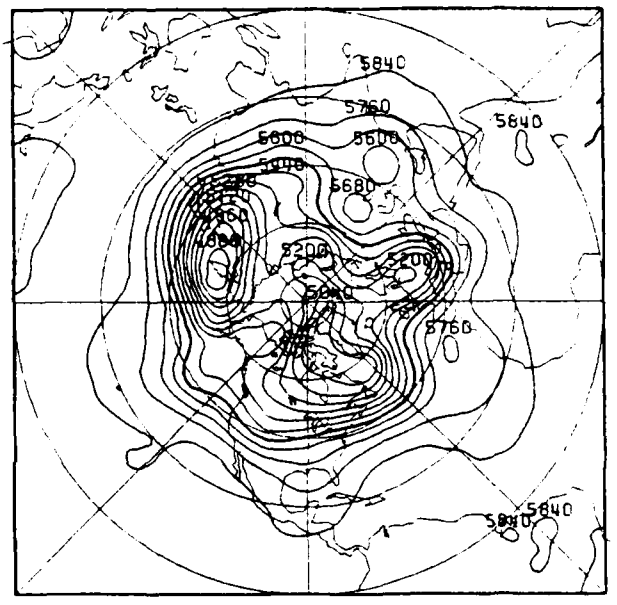

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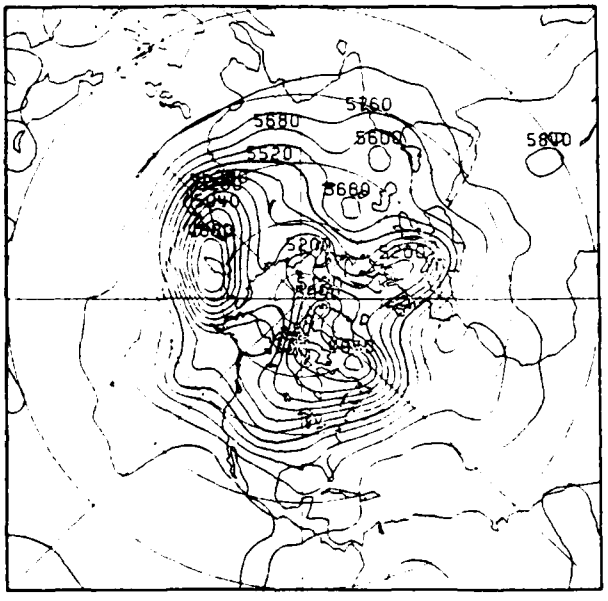

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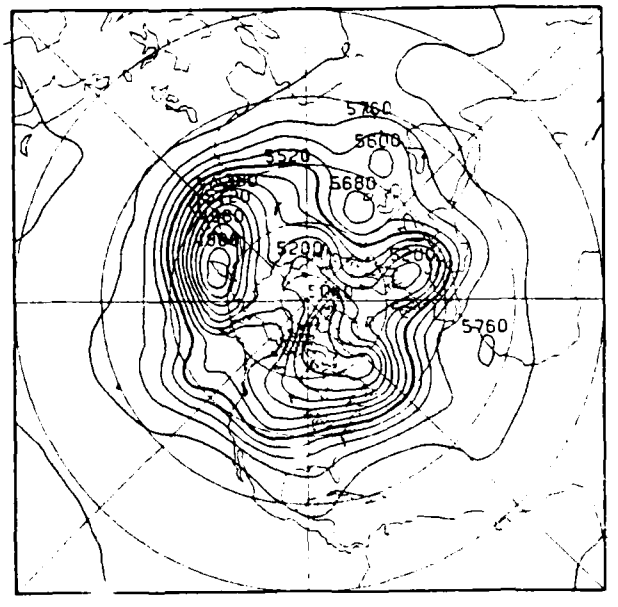

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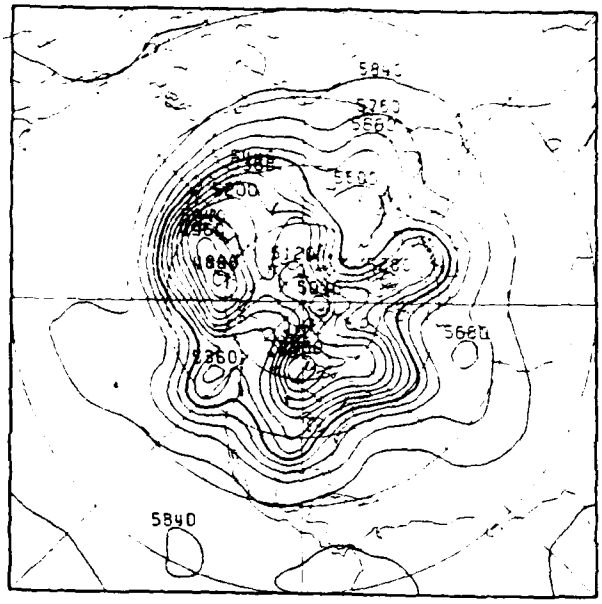

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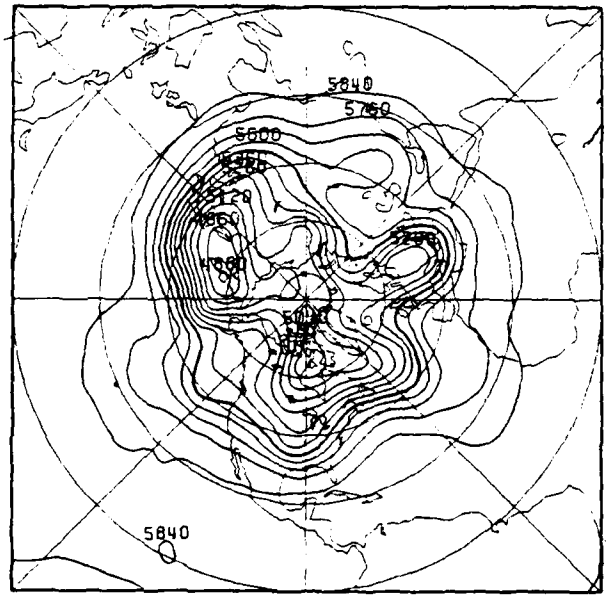

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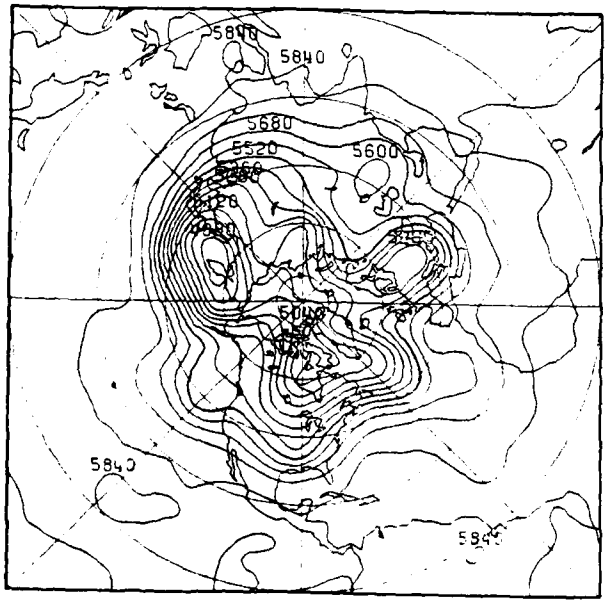

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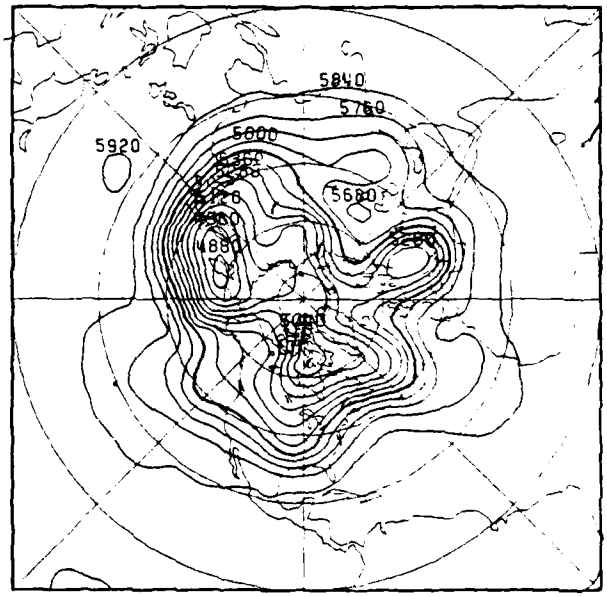

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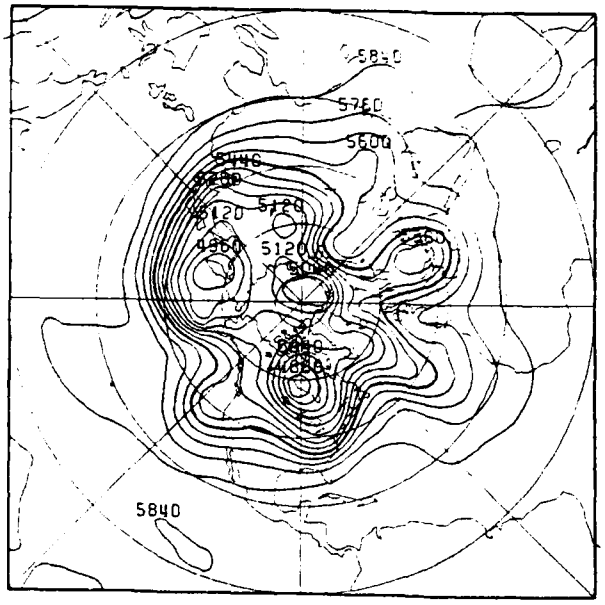

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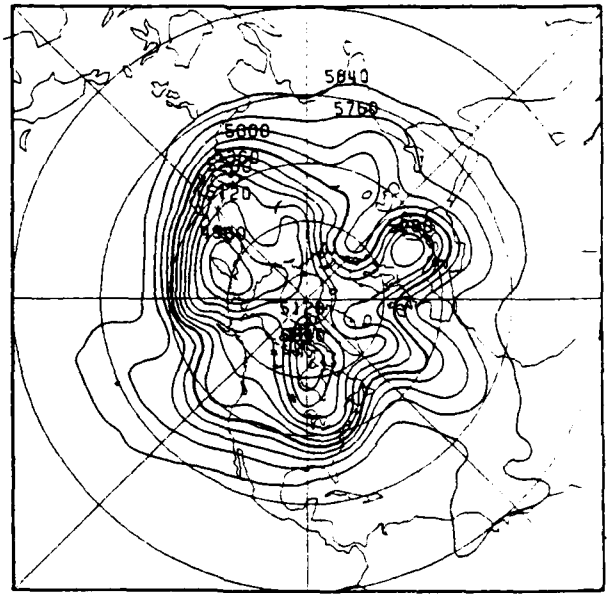

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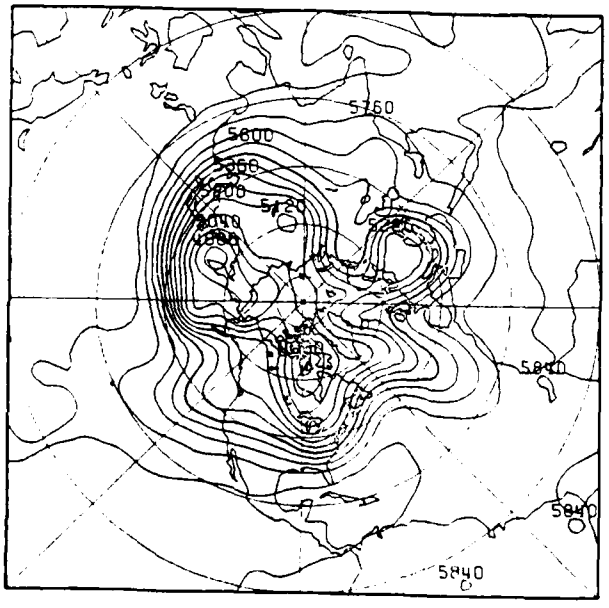

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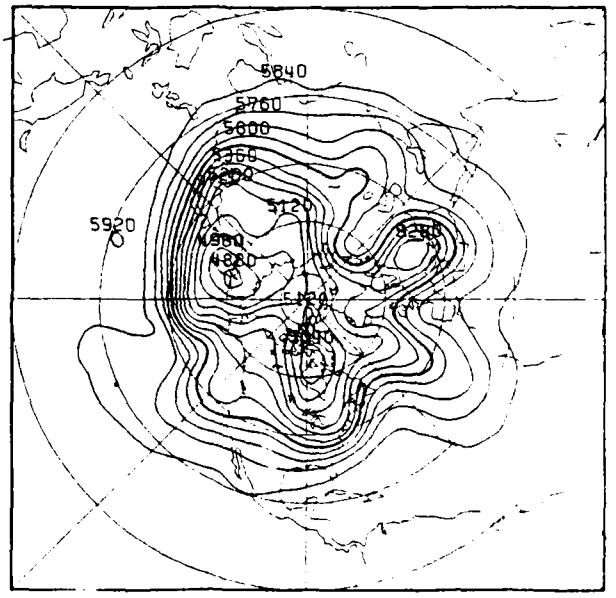

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DAY 4

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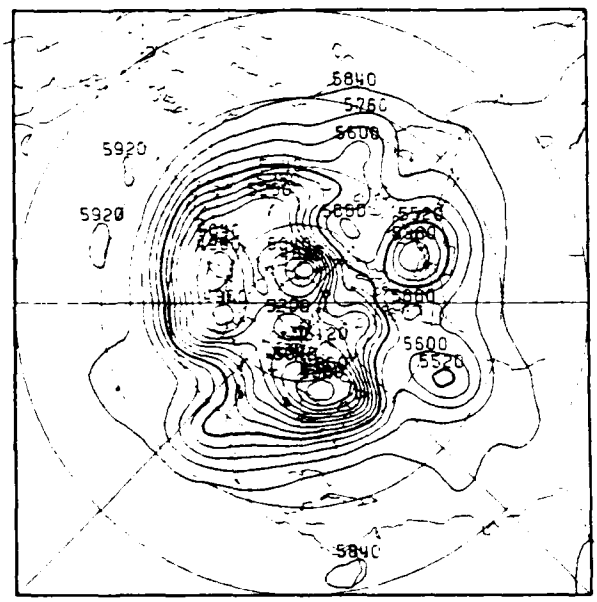

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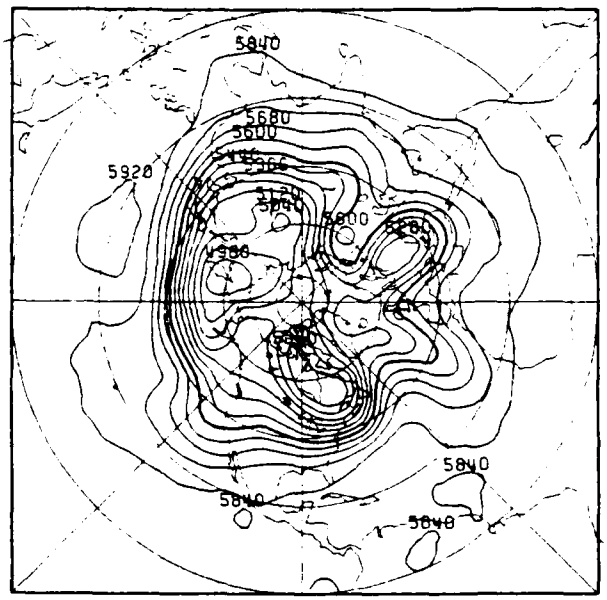

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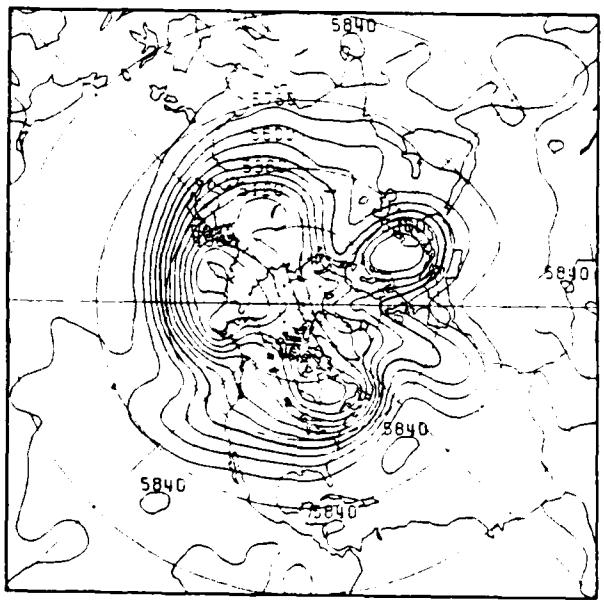

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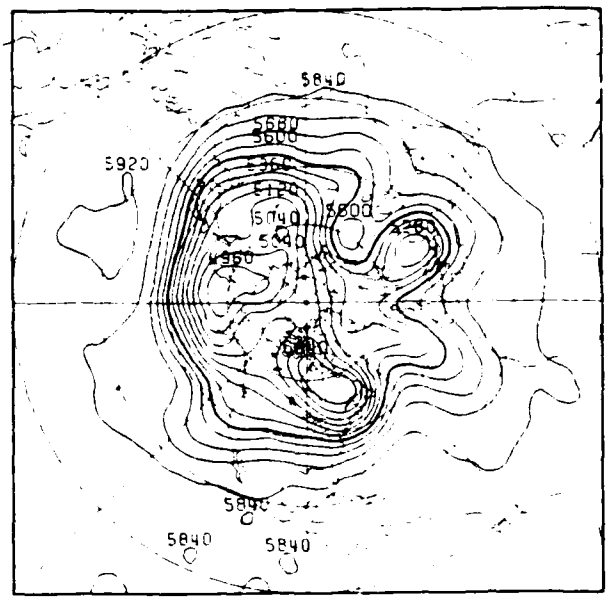

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DAY 5

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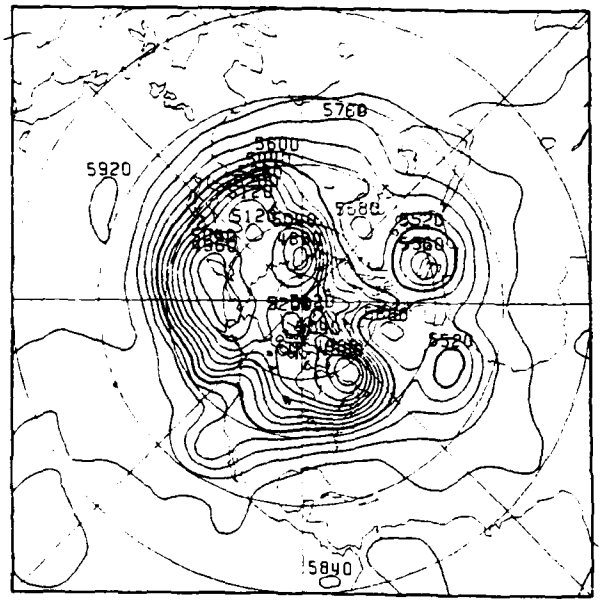

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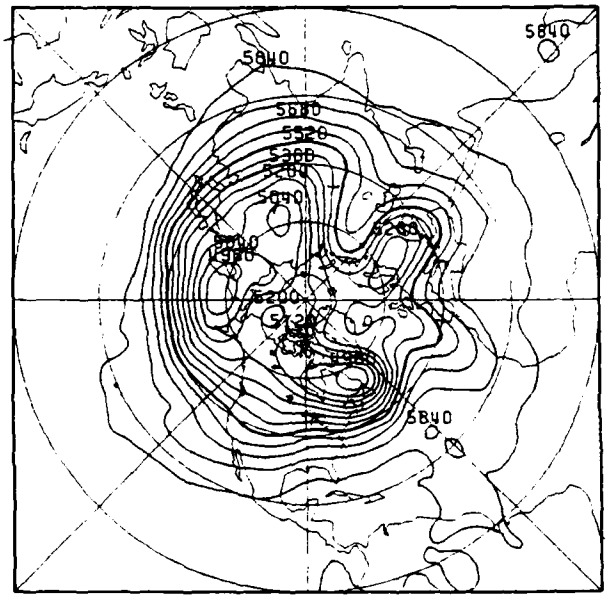

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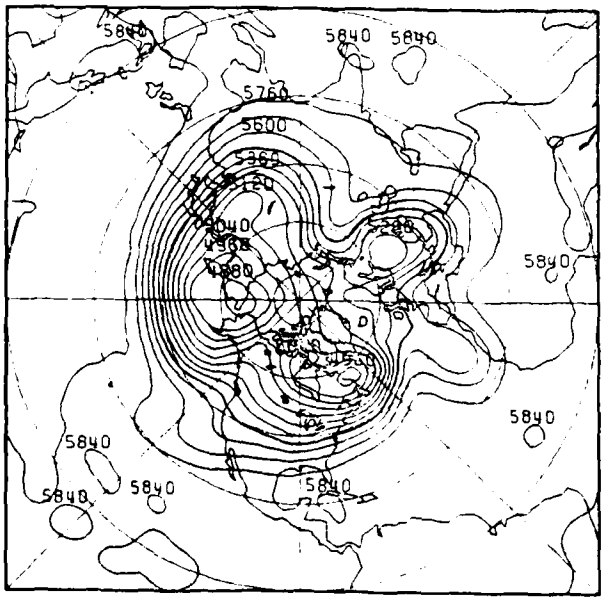

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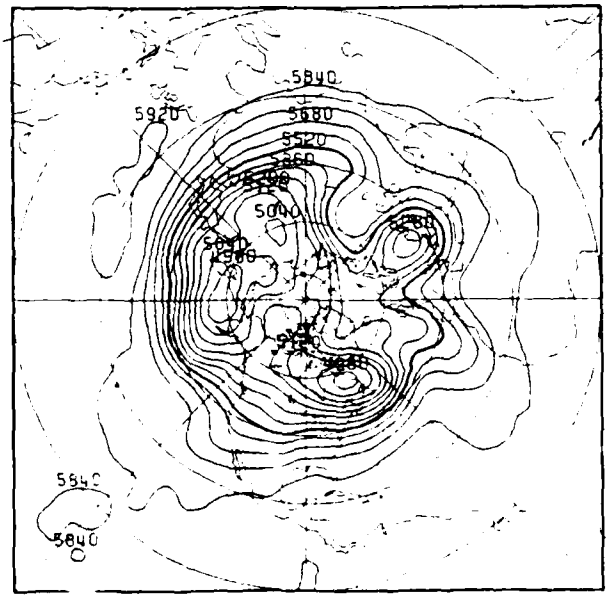

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DAY 6

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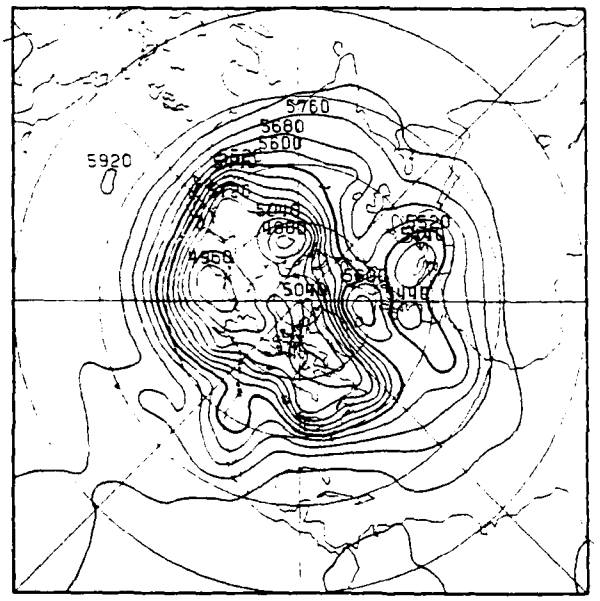

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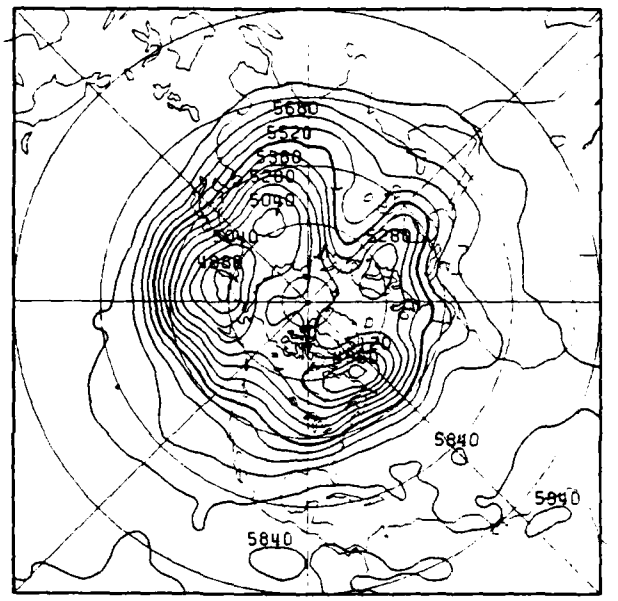

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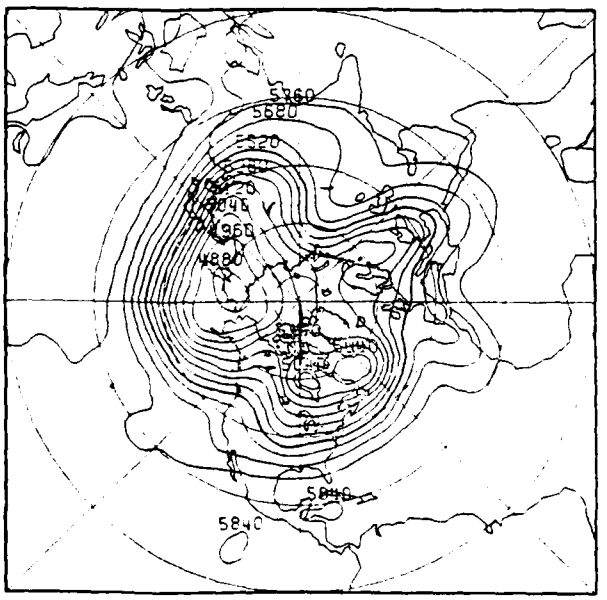

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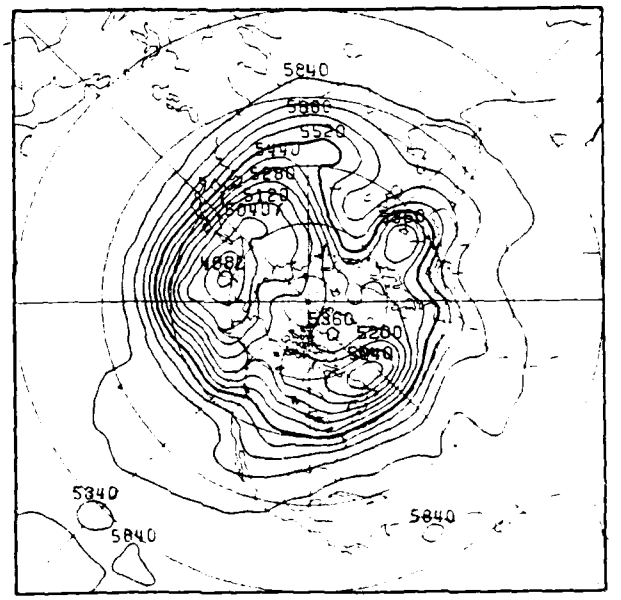

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DAY 7

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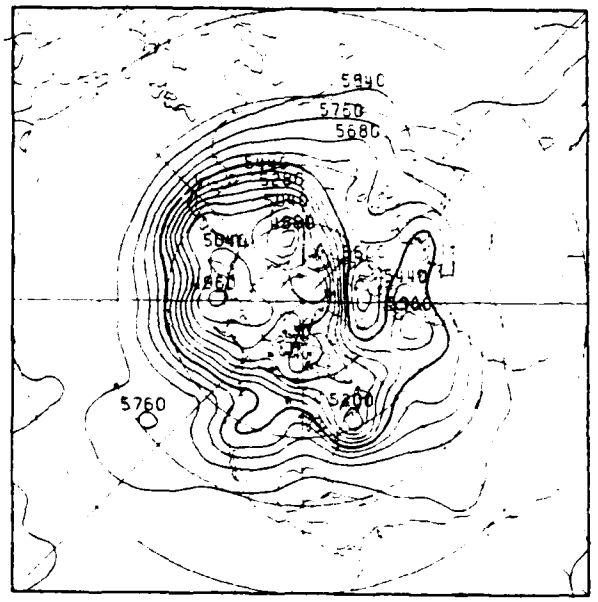

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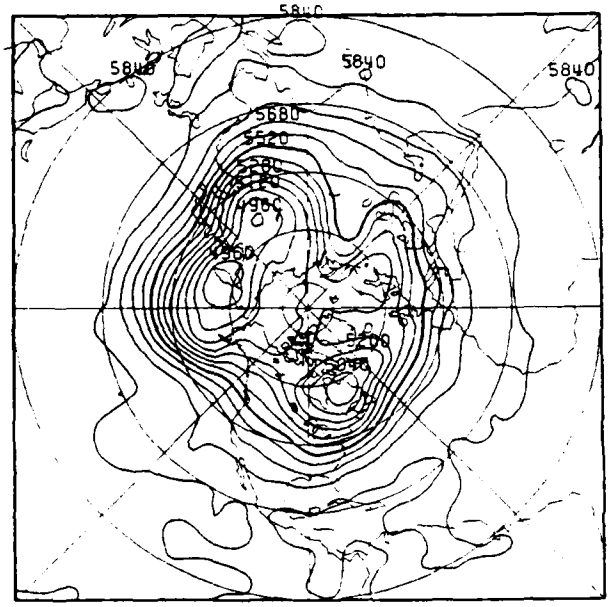
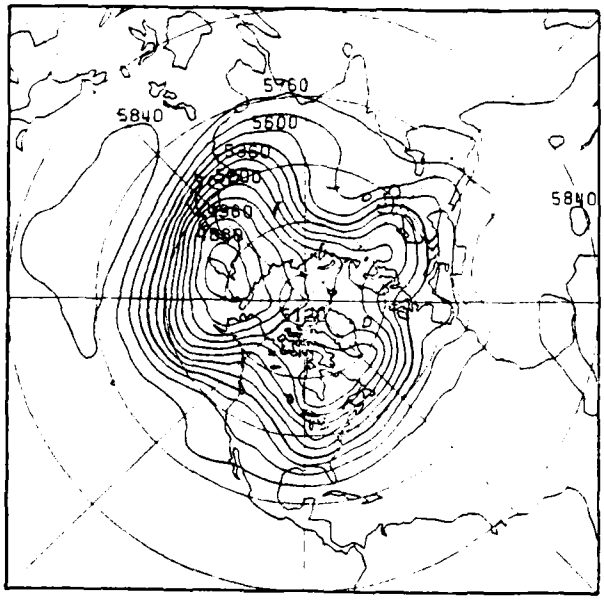
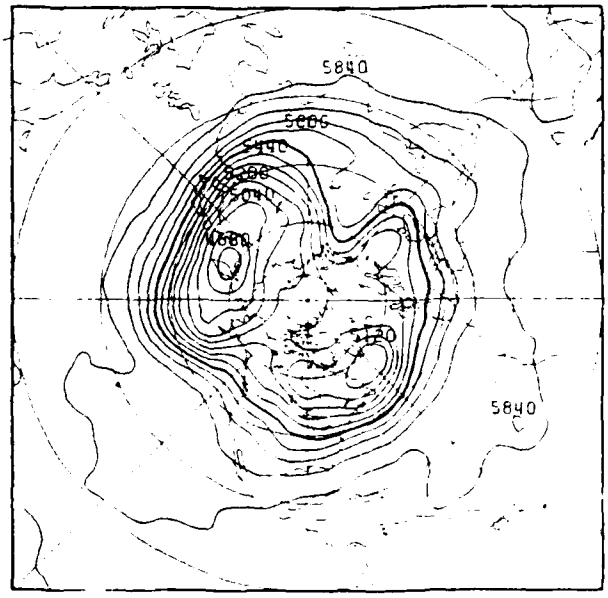


9-LAYER 2.4X3



15-LAYER 4X5

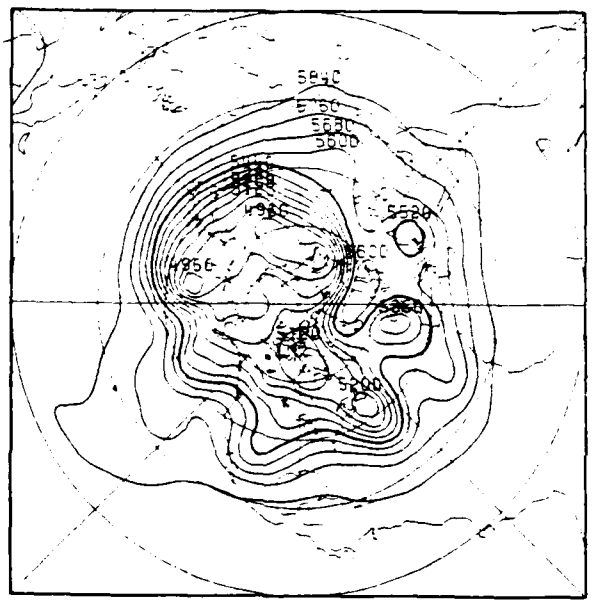


500 mb Z

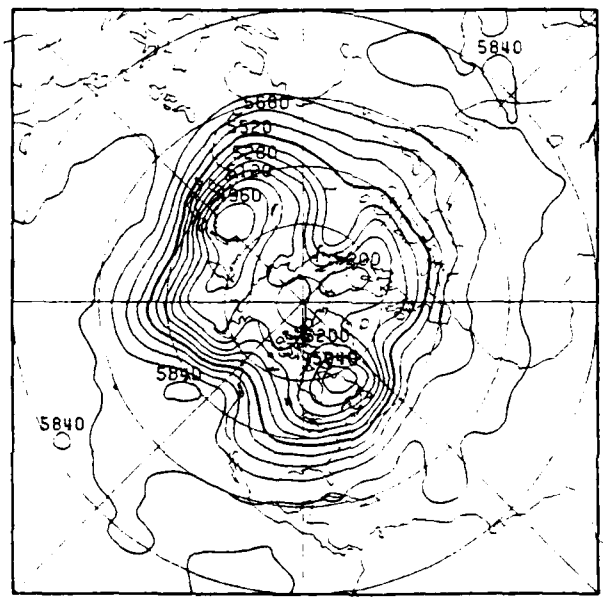
0000 GMT 20 JAN 1979

DAY 8

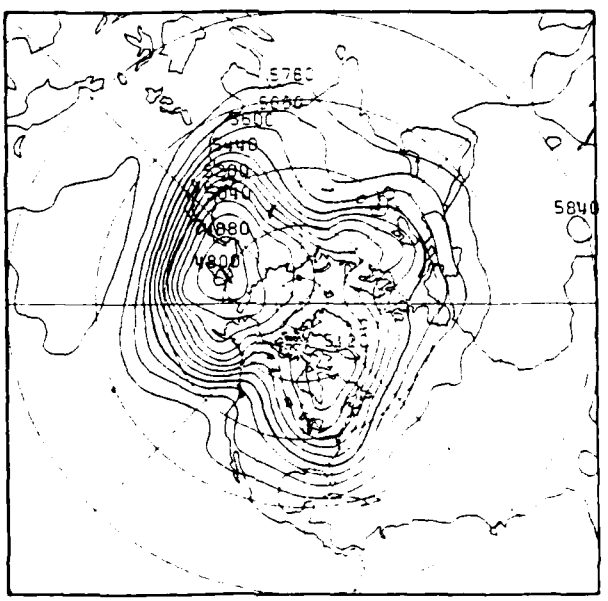
OBSERVED



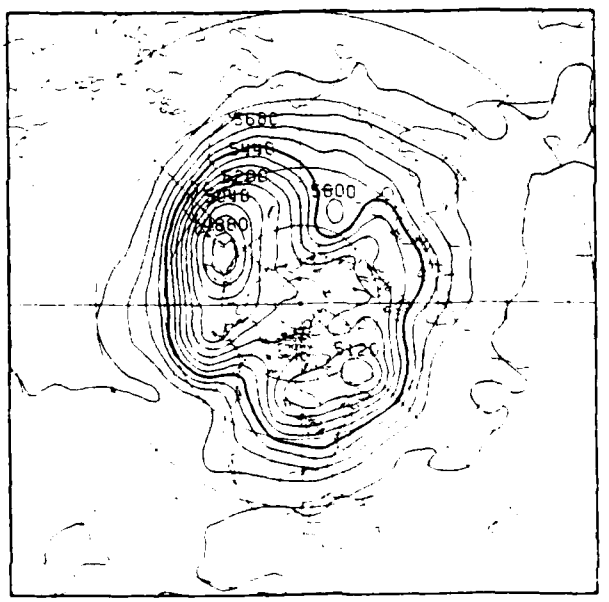
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

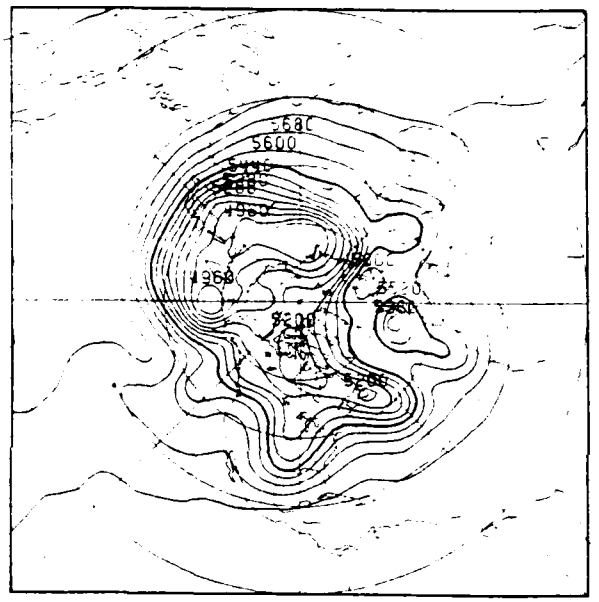


500 mb Z

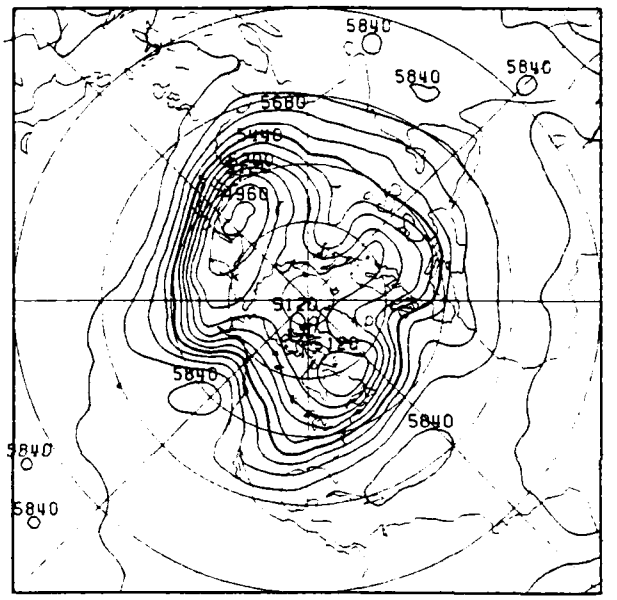
0000 GMT 21 JAN 1979

DAY 9

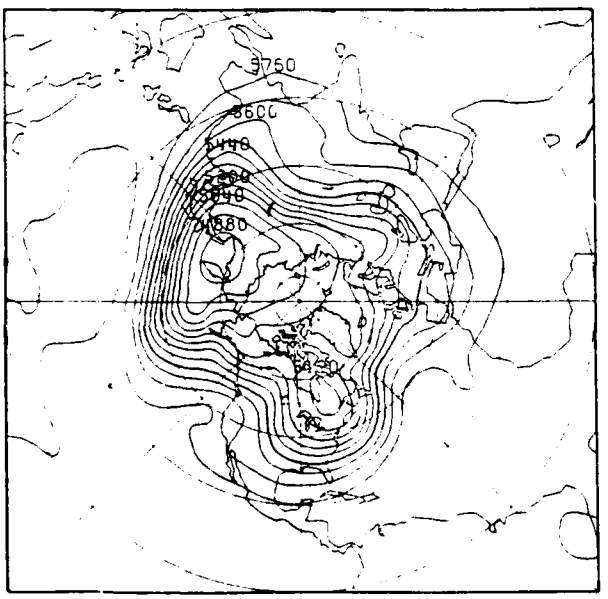
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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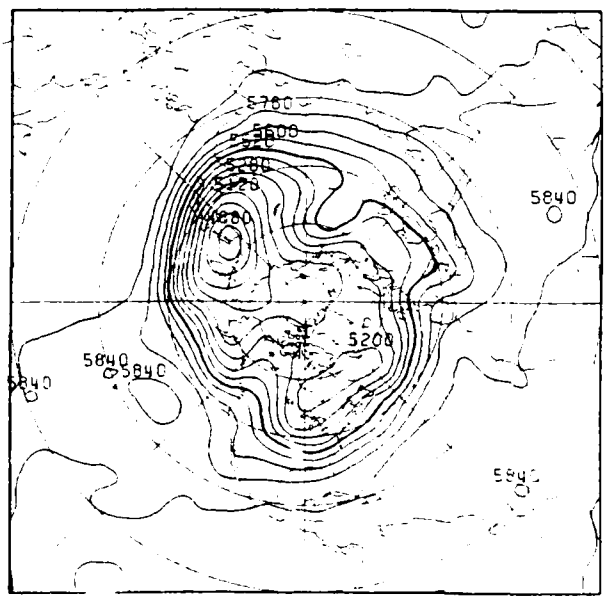
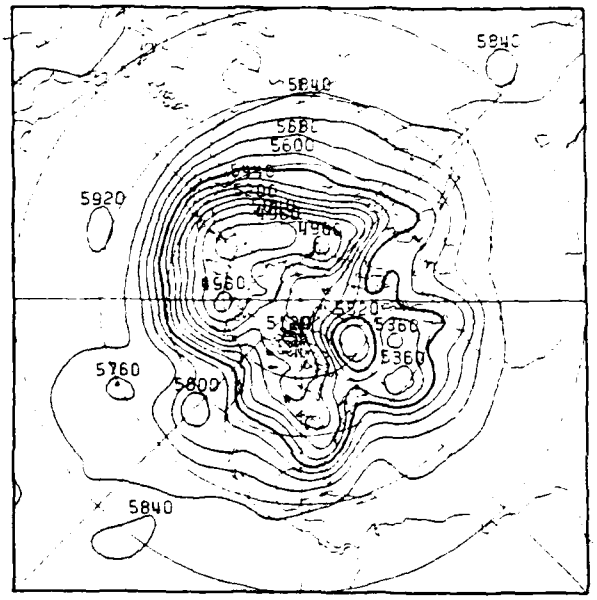


500 mb Z

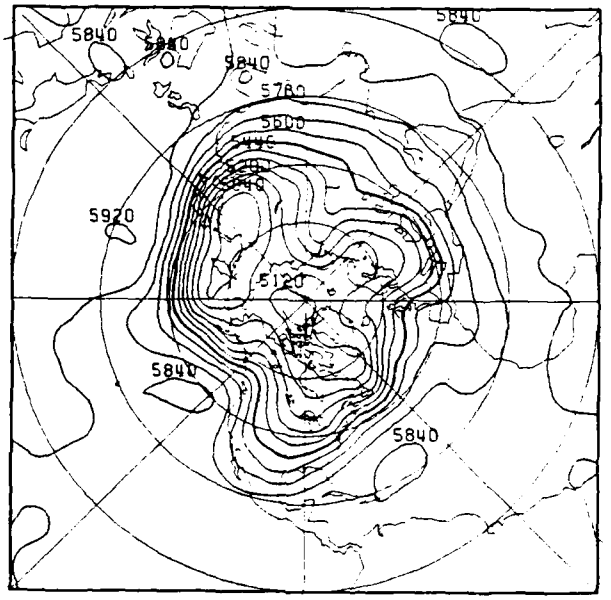
0000 GMT 22 JAN 1979

DAY 10

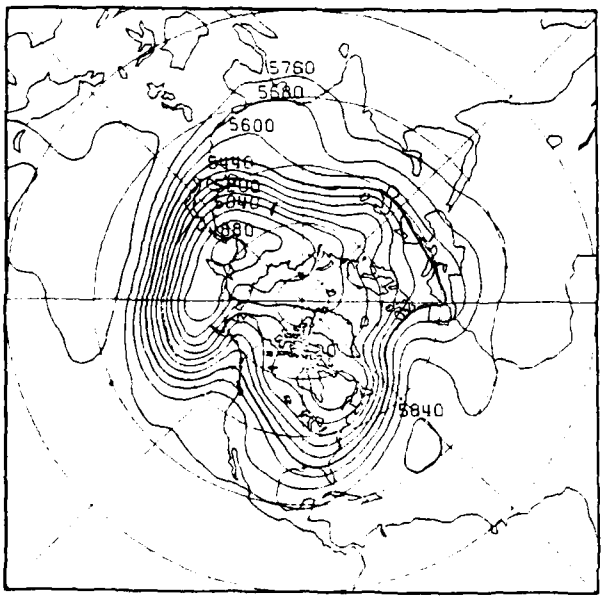
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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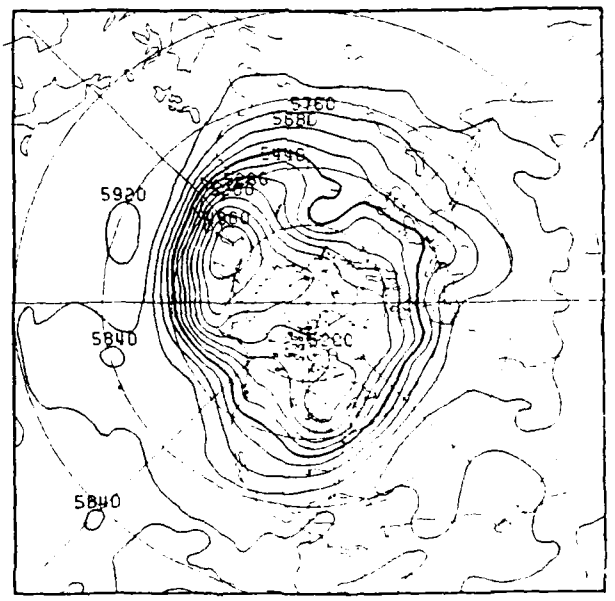
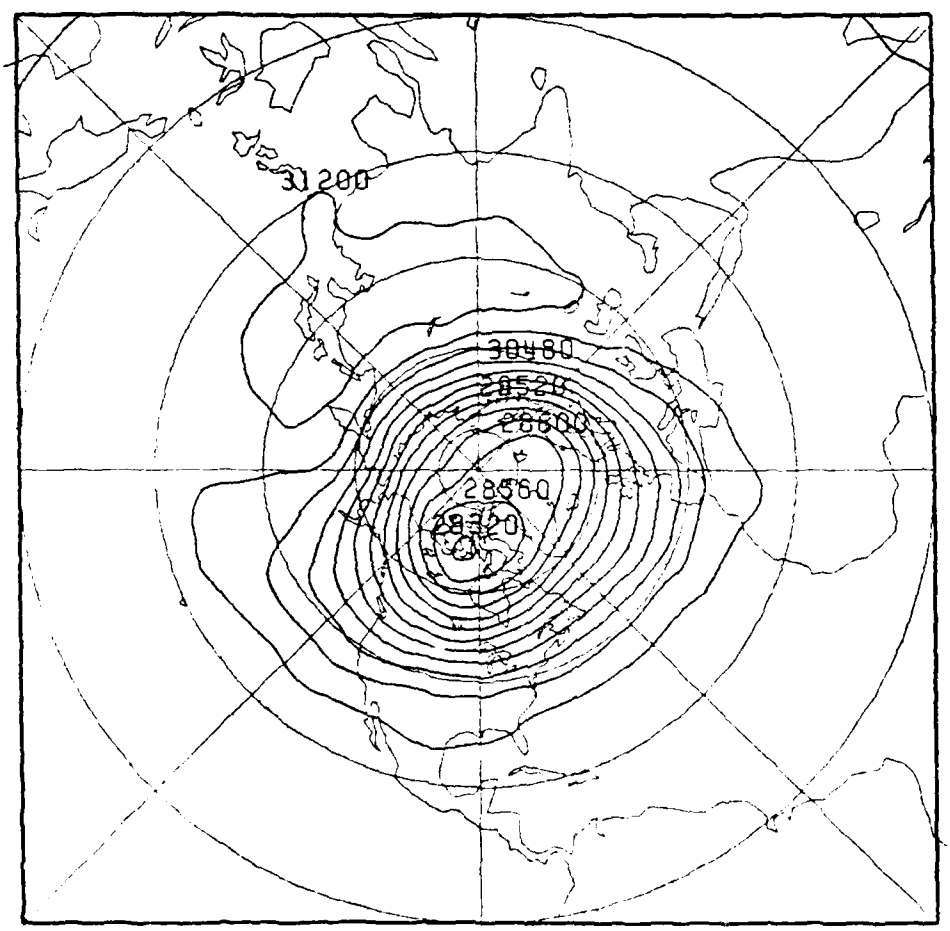


10 mb Z

0000 GMT 12 JAN 1979

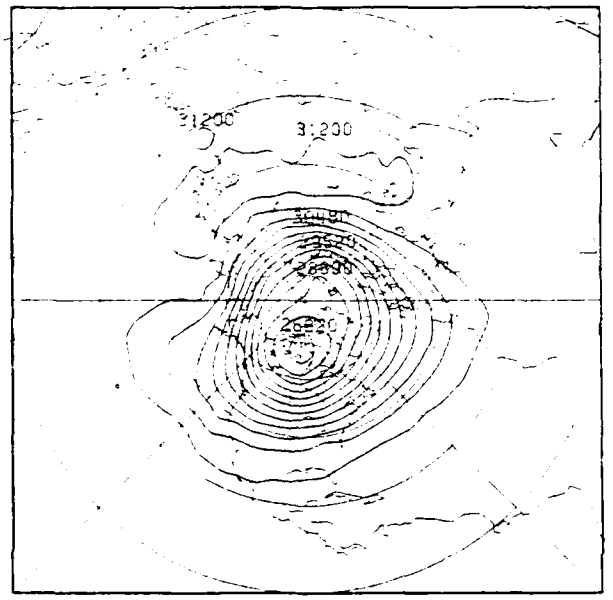
OBSERVED



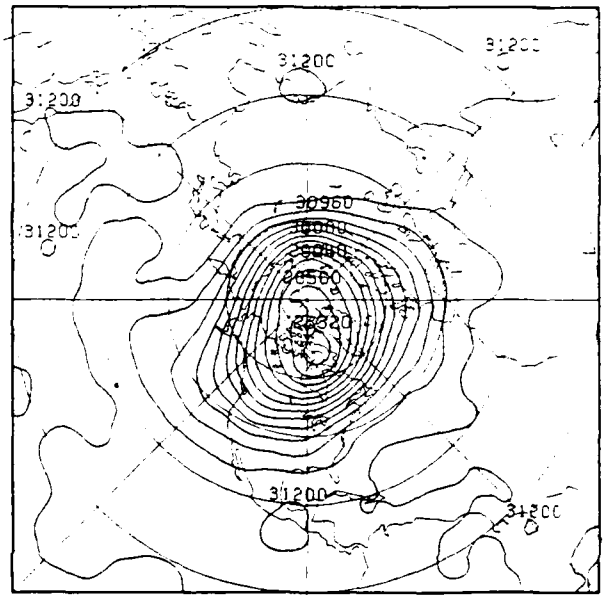
10 mb Z

0000 GMT 13 JAN 1979 DAY 1

OBSERVED

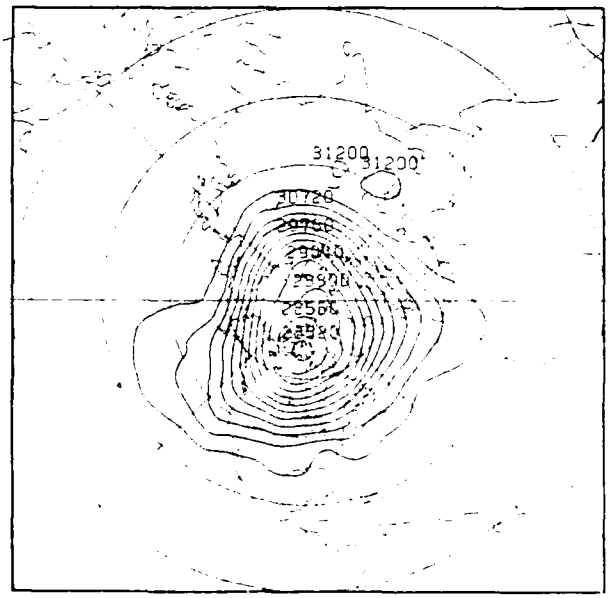


15-LAYER 4X5



0000 GMT 14 JAN 1979 DAY 2

OBSERVED



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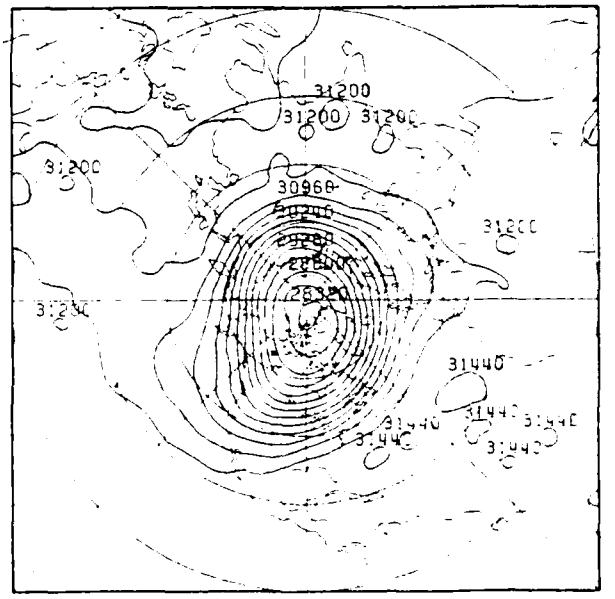
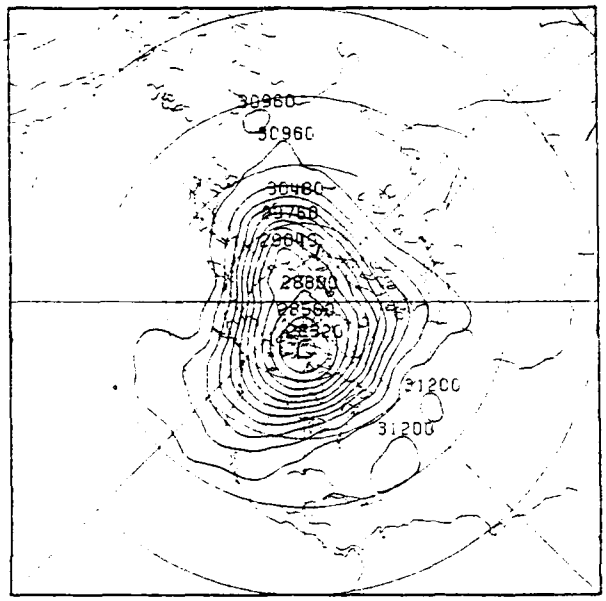


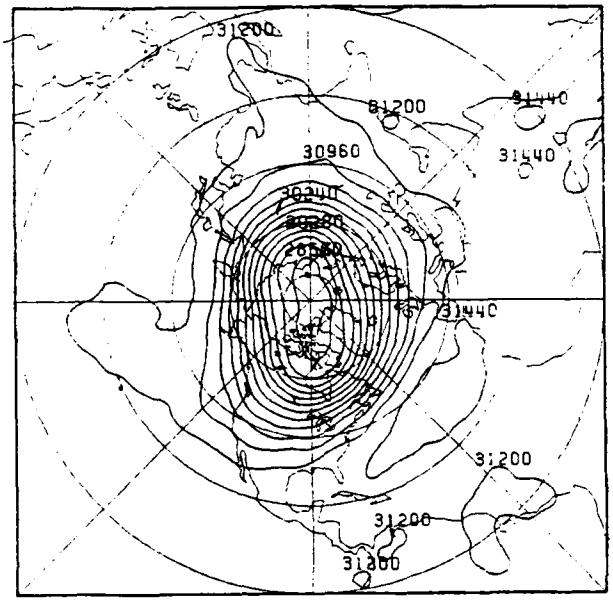
10 mb Z

0000 GMT 15 JAN 1979 DAY 3

OBSERVED

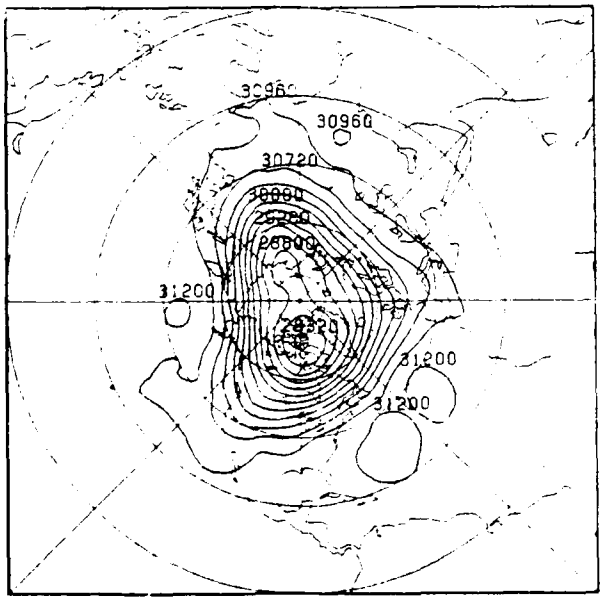


15-LAYER 4X5



0000 GMT 16 JAN 1979 DAY 4

OBSERVED



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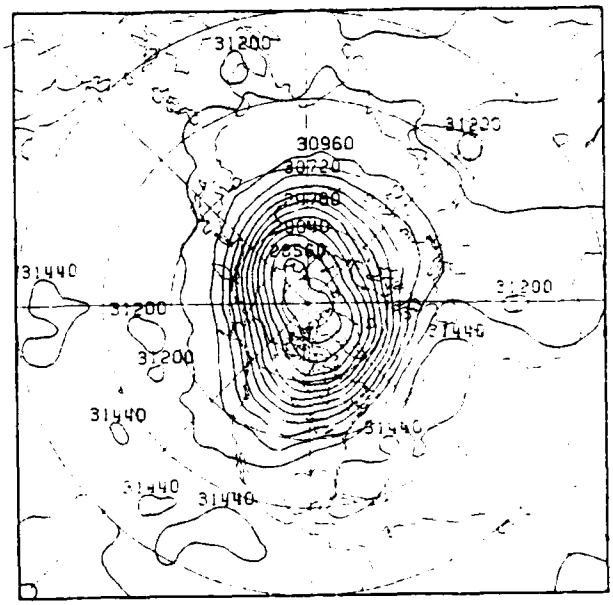

10 mb Z

0000 GMT 17 JAN 1979 DAY 5

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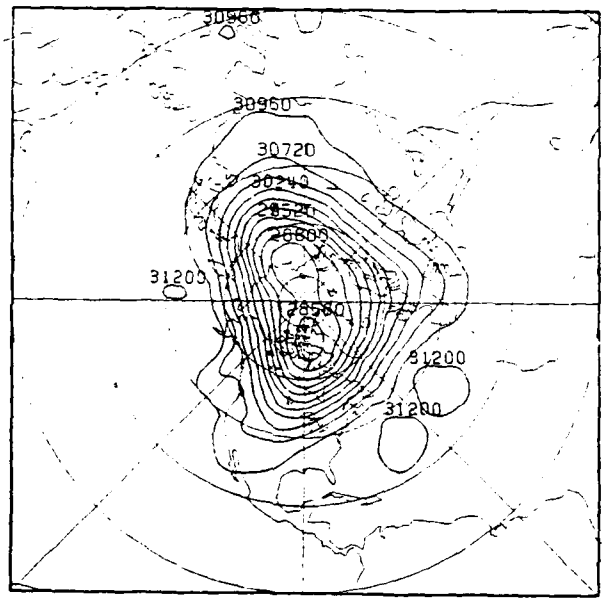

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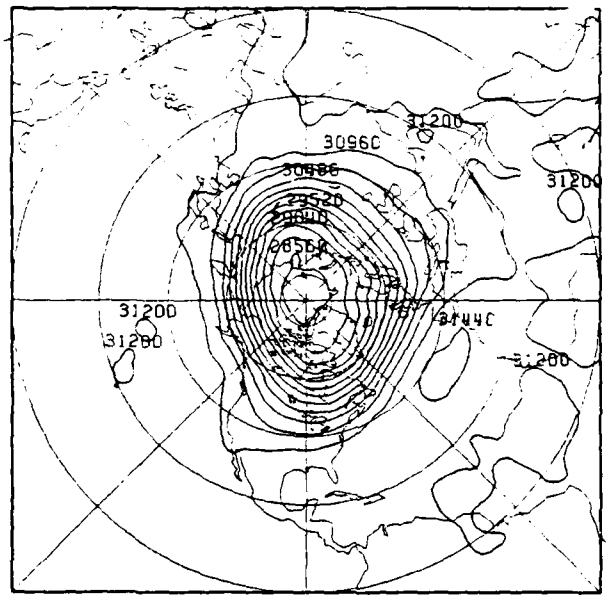
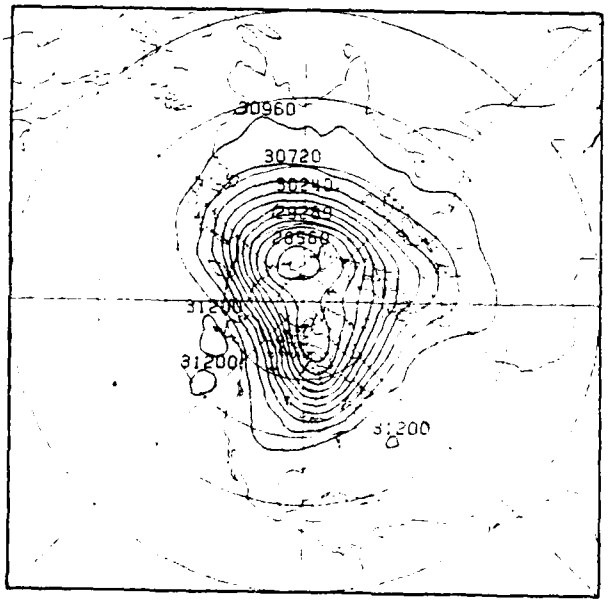
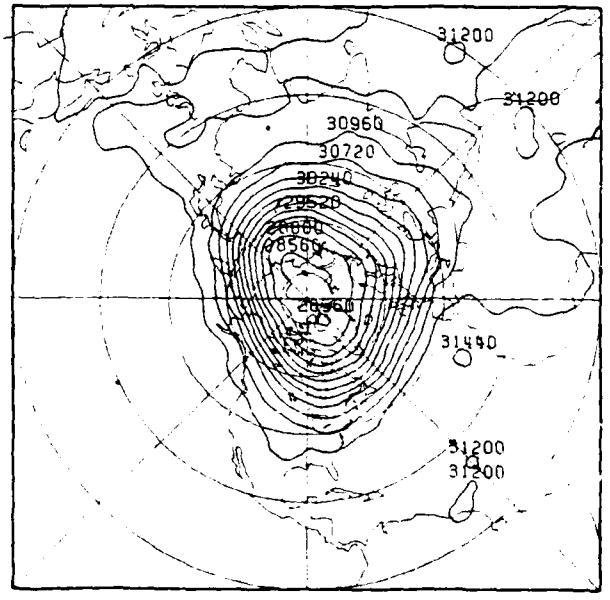


0000 GMT 18 JAN 1979 DAY 6

OBSERVED



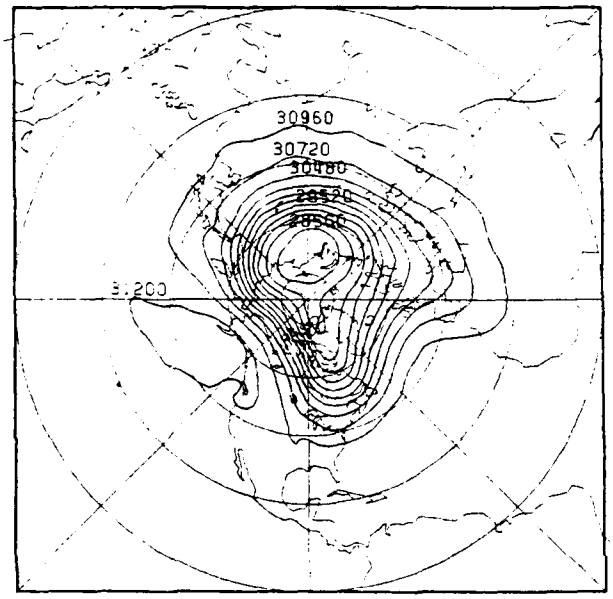
15-LAYER 4X5



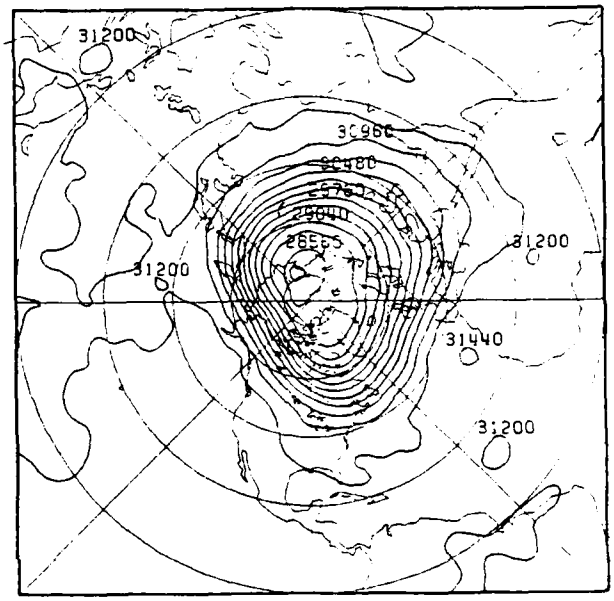
10 mb Z

0000 GMT 19 JAN 1979 DAY 7

OBSERVED

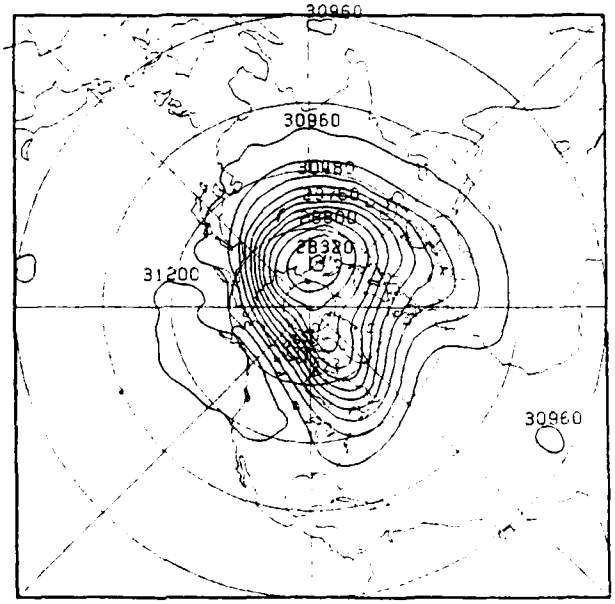


15-LAYER 4X5

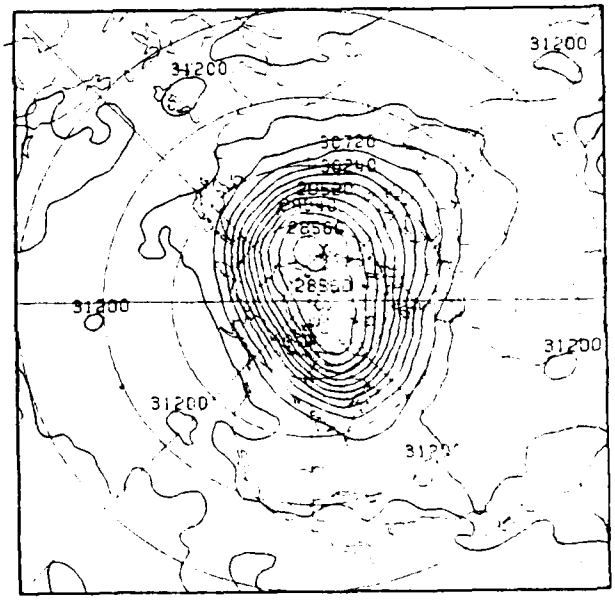


0000 GMT 20 JAN 1979 DAY 8

OBSERVED



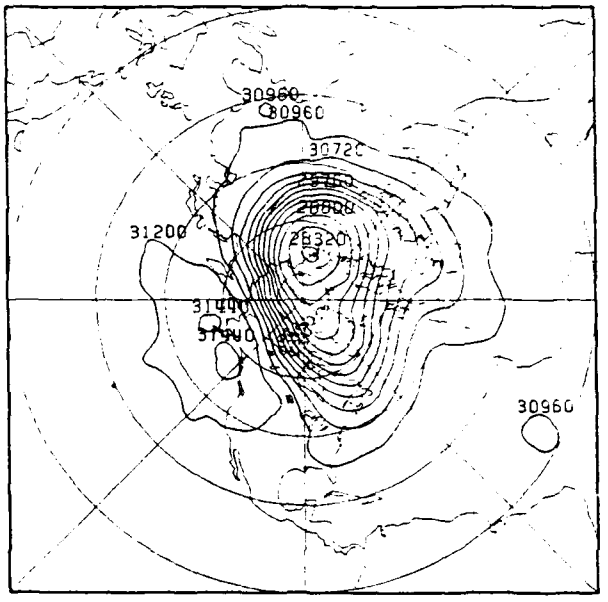
15-LAYER 4X5



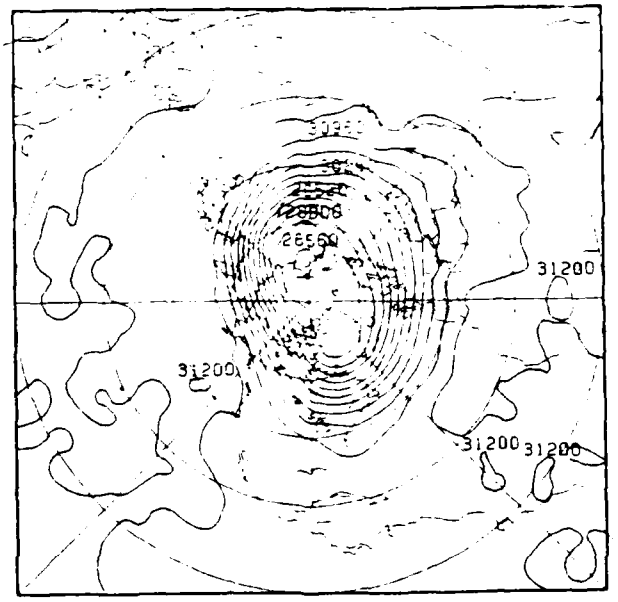
10 mb Z

0000 GMT 21 JAN 1979 DAY 9

OBSERVED

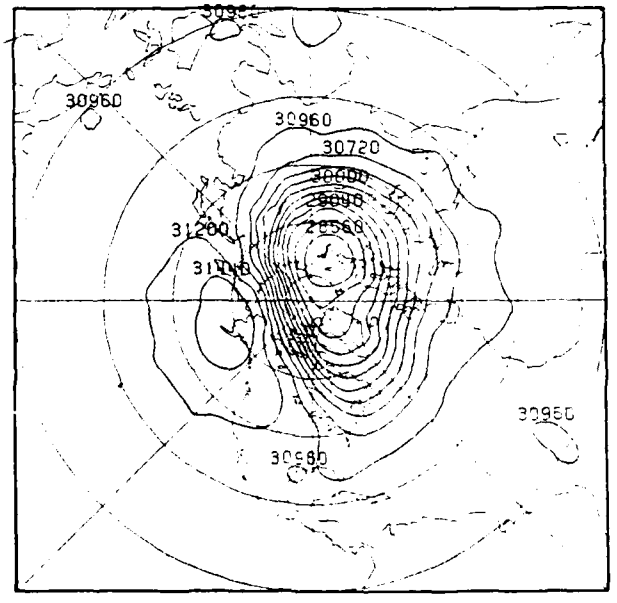


15-LAYER 4X5

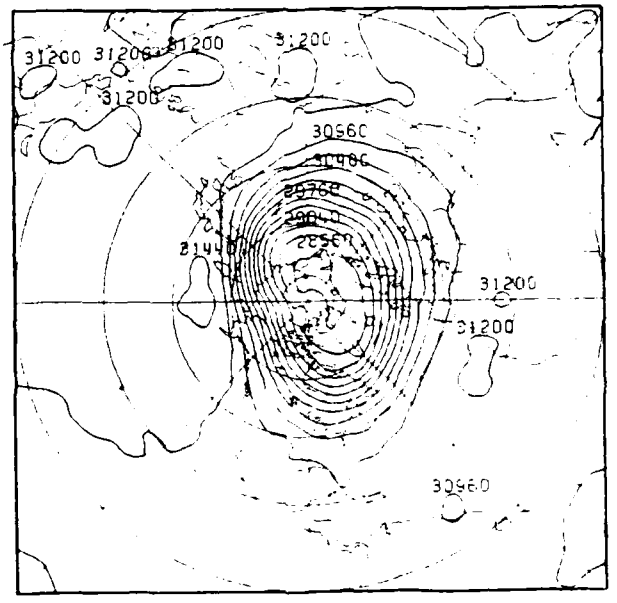


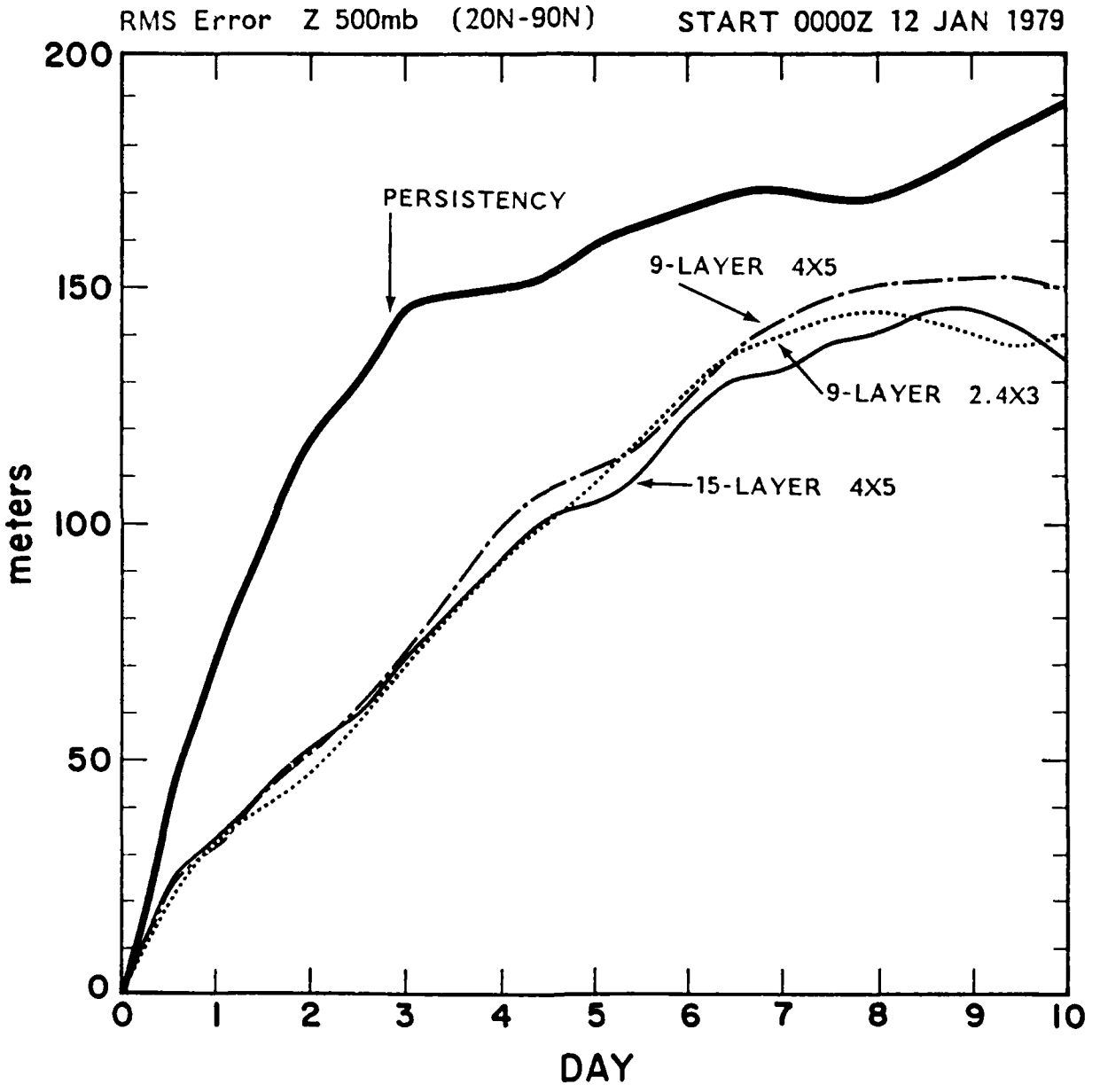
0000 GMT 22 JAN 1979 DAY 10

OBSERVED



15-LAYER 4X5




RMS Error Z 500mb (20N-90N)
START 0000Z 12 JAN 1979
200
150
100
50
0
meters
PERSISTENCY
9-LAYER 4X5
9-LAYER 2.4X3
15-LAYER 4X5
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

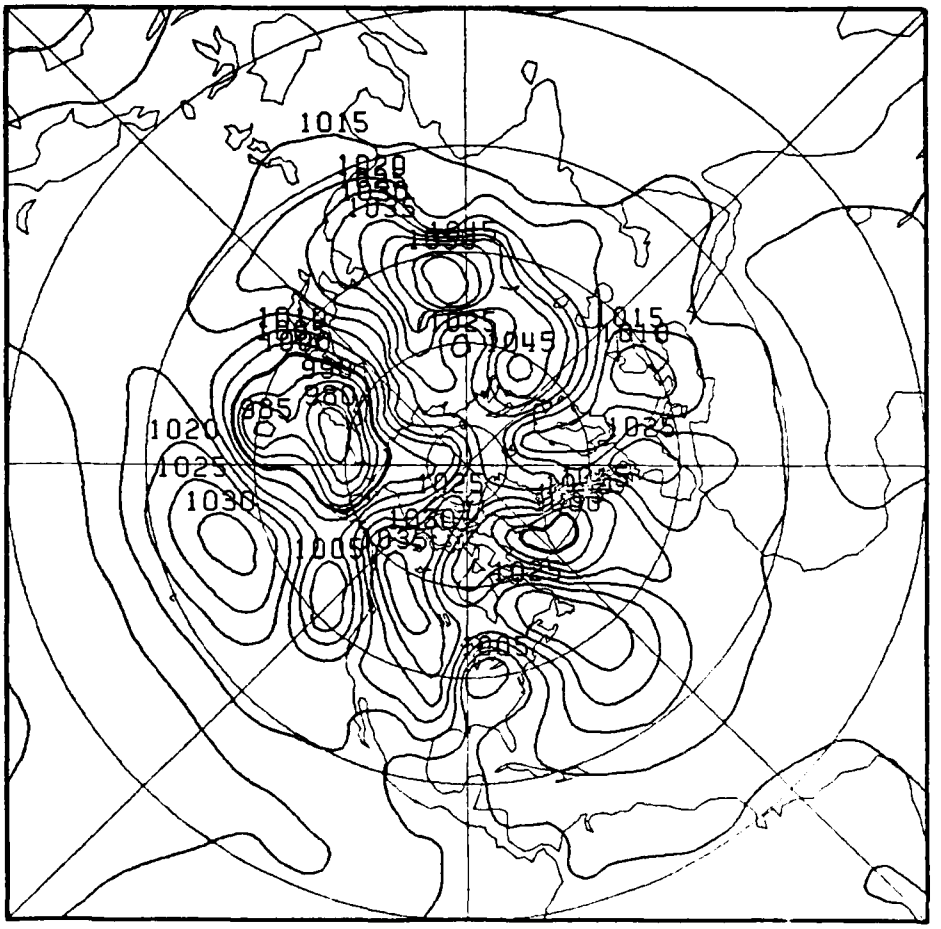
0000 GMT

14 JANUARY 1979

SLP

0000 GMT 14 JAN 1979

OBSERVED

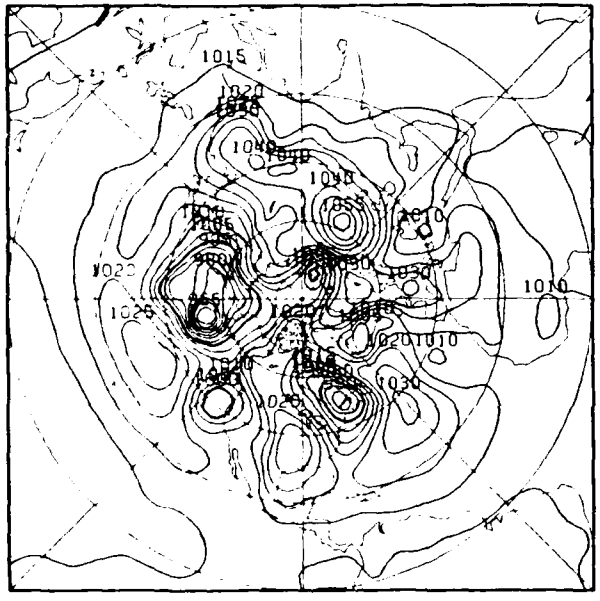


SLP

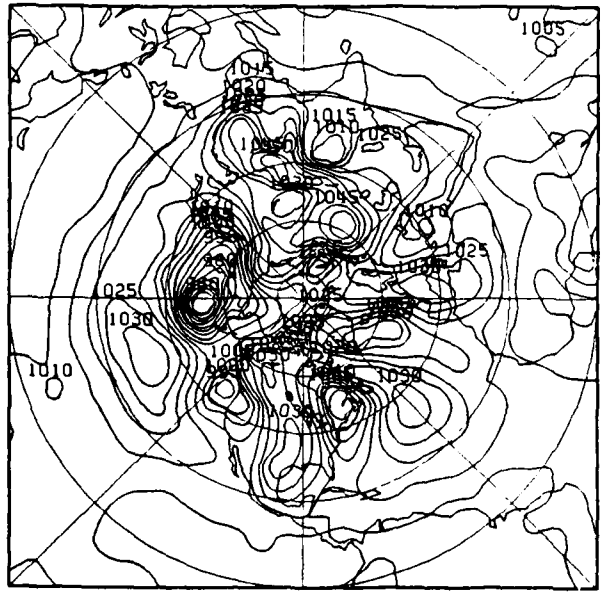
0000 GMT 15 JAN 1979

DAY 1

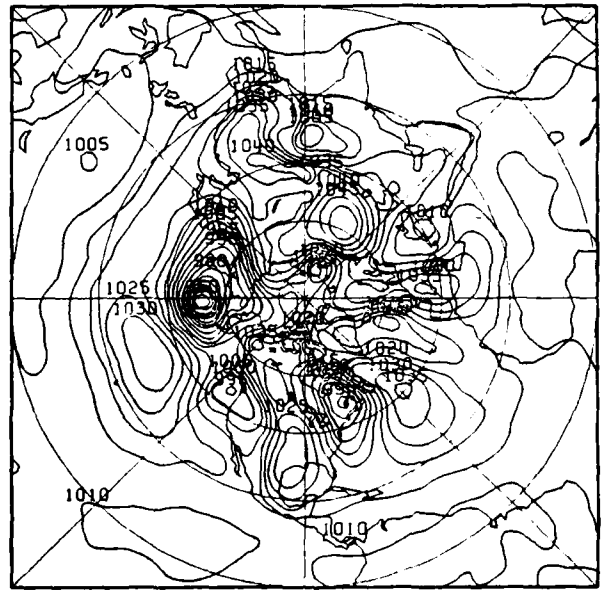
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

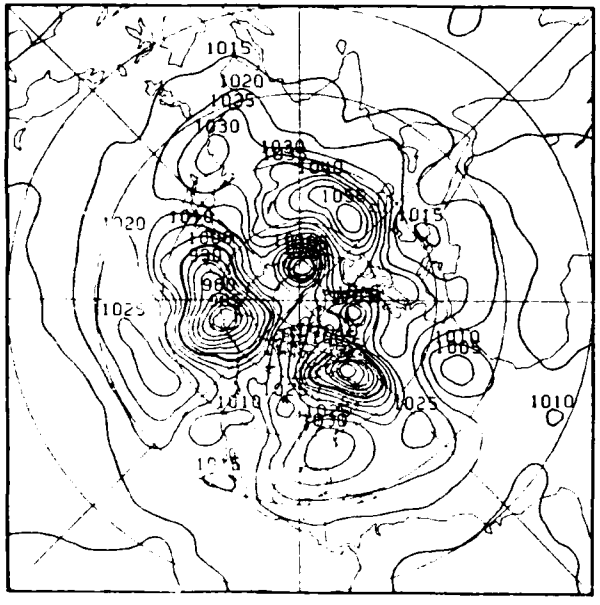


SLP

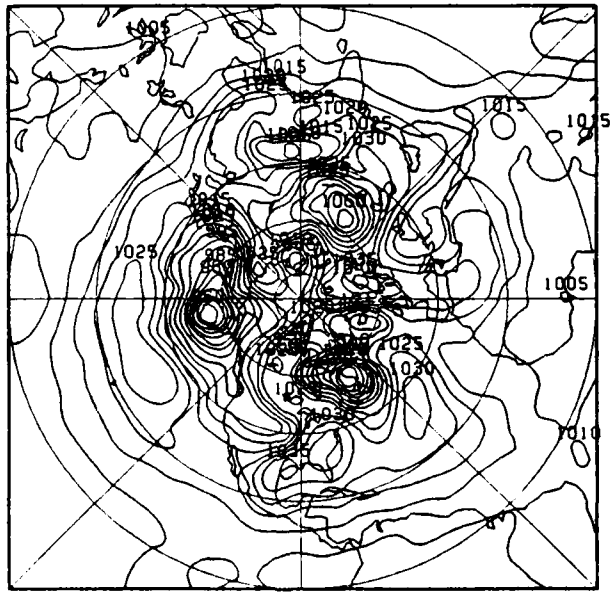
0000 GMT 16 JAN 1979

DAY 2

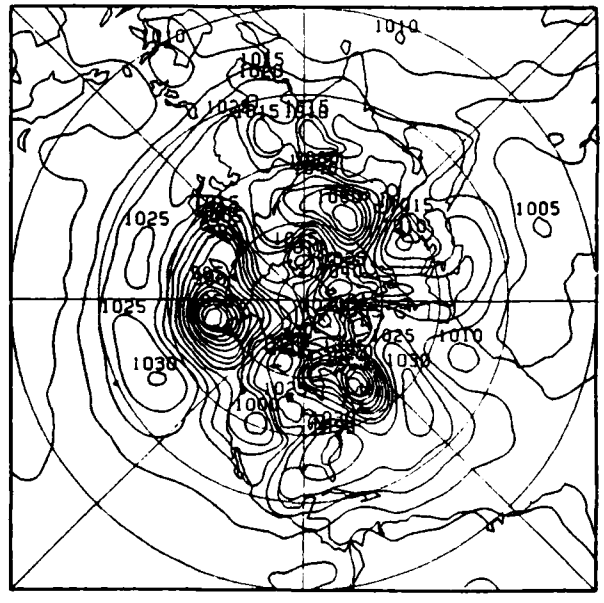
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

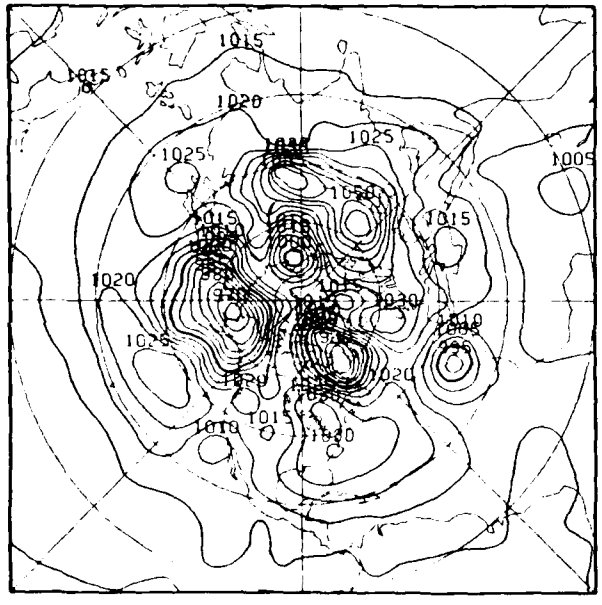


SLP

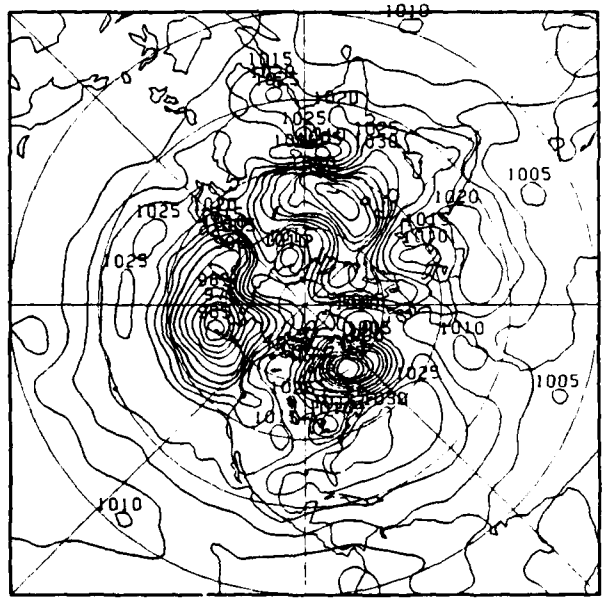
0000 GMT 17 JAN 1979

DAY 3

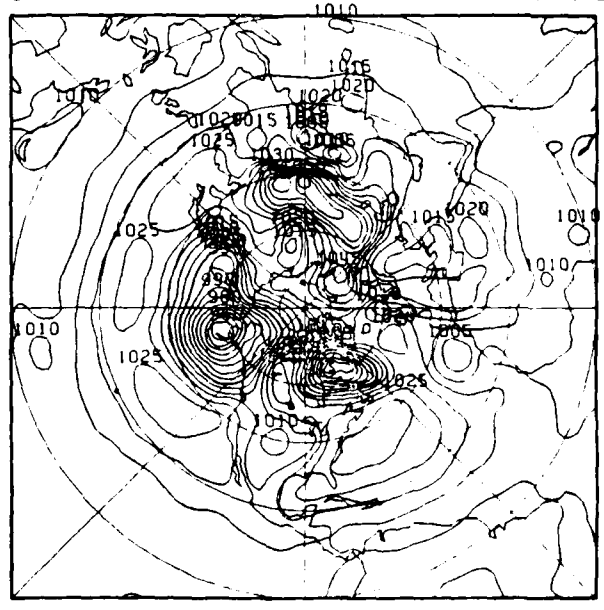
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

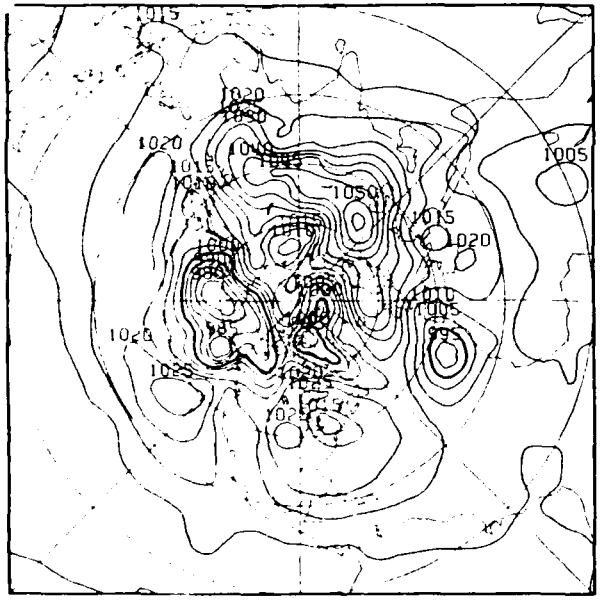


SLP

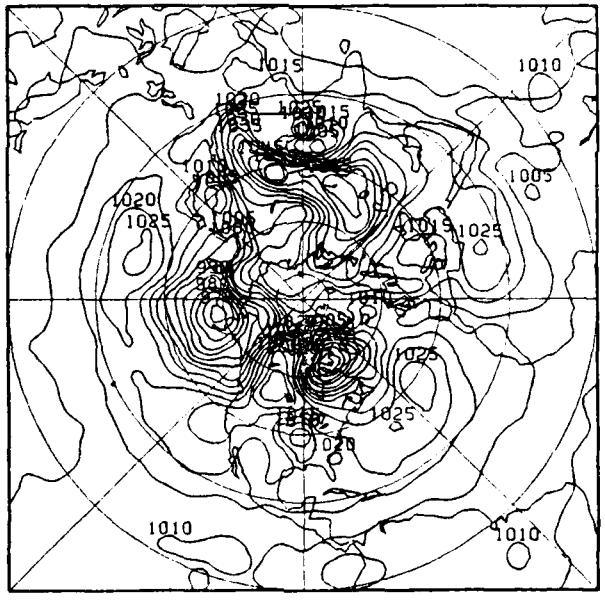
0000 GMT 18 JAN 1979

DAY 4

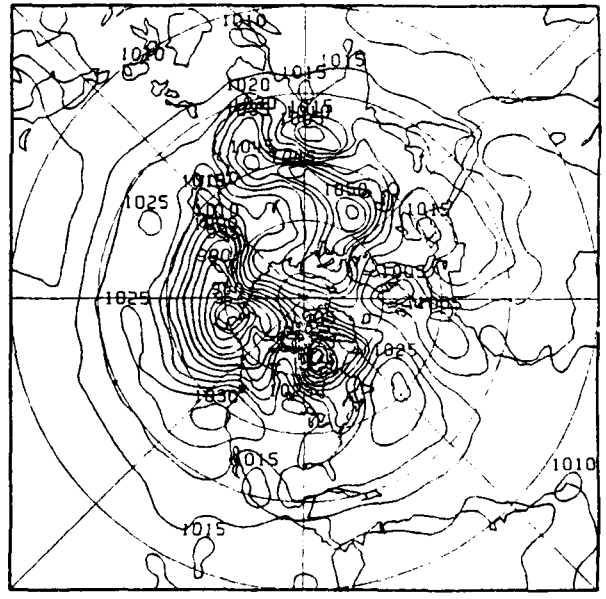
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

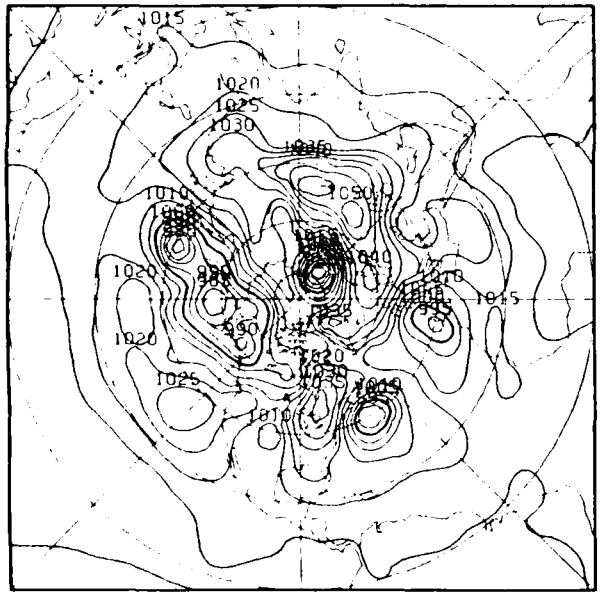


SLP

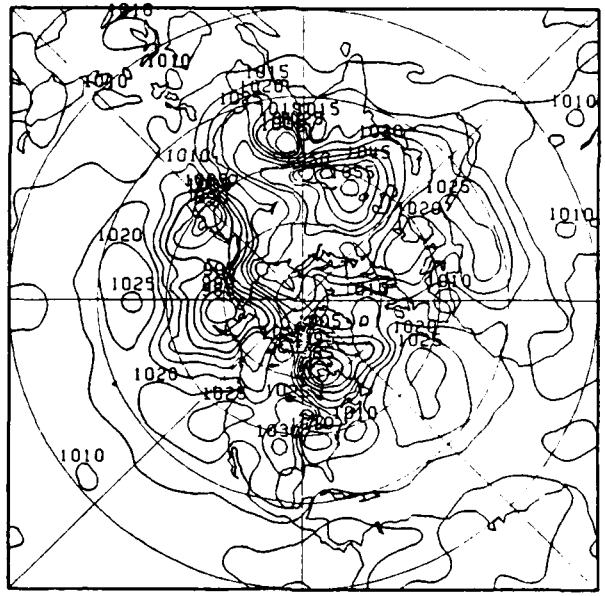
0000 GMT 19 JAN 1979

DAY 5

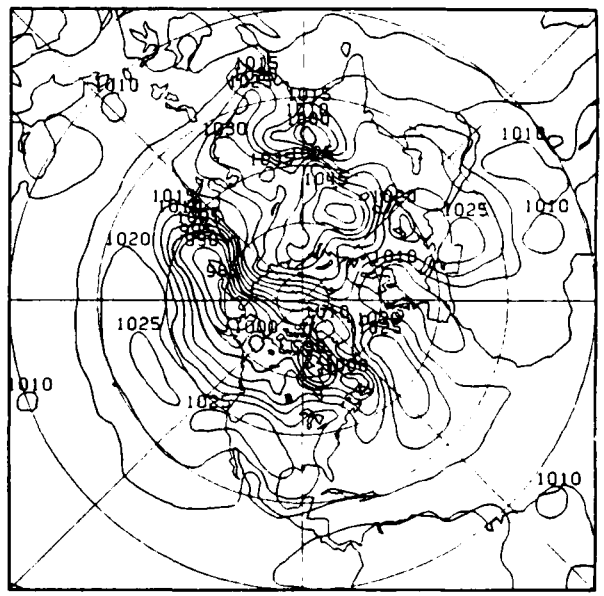
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

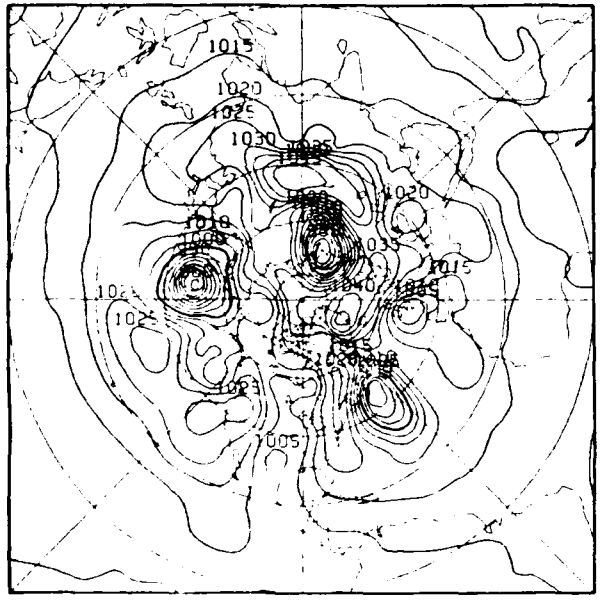


SLP

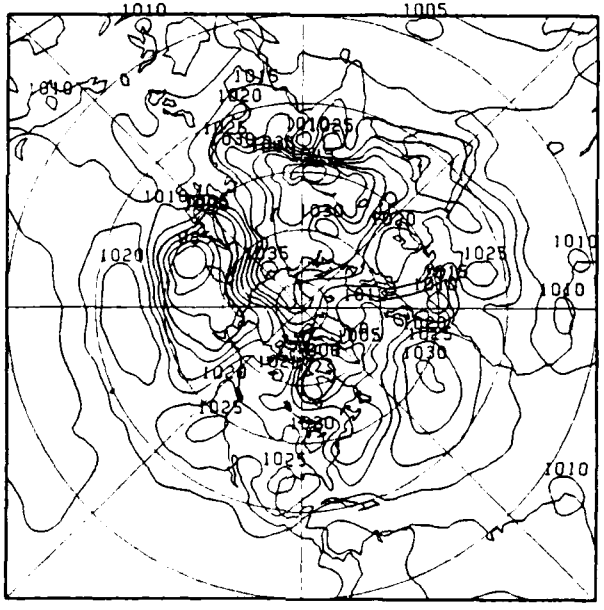
0000 GMT 20 JAN 1979

DAY 6

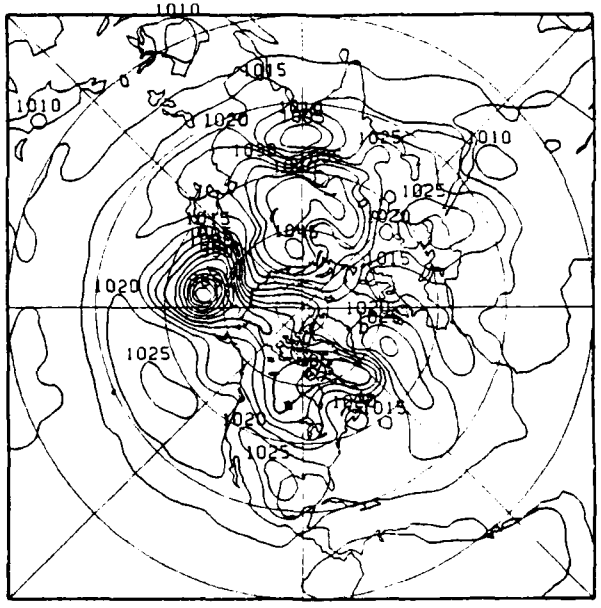
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



SLP

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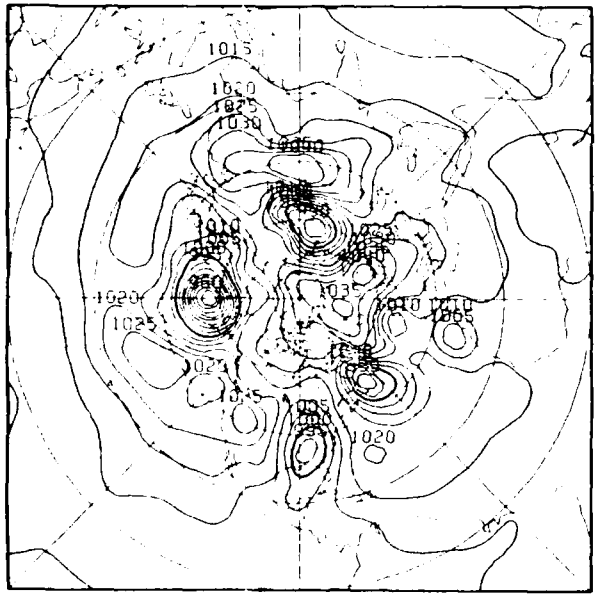
DAY 7

OBSERVED



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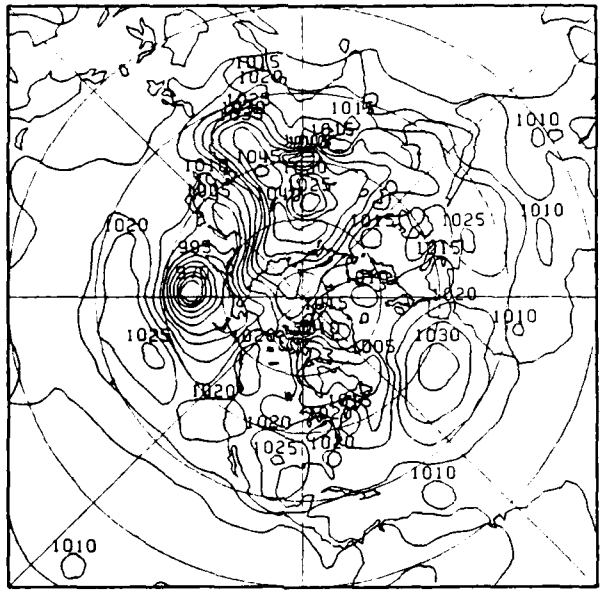
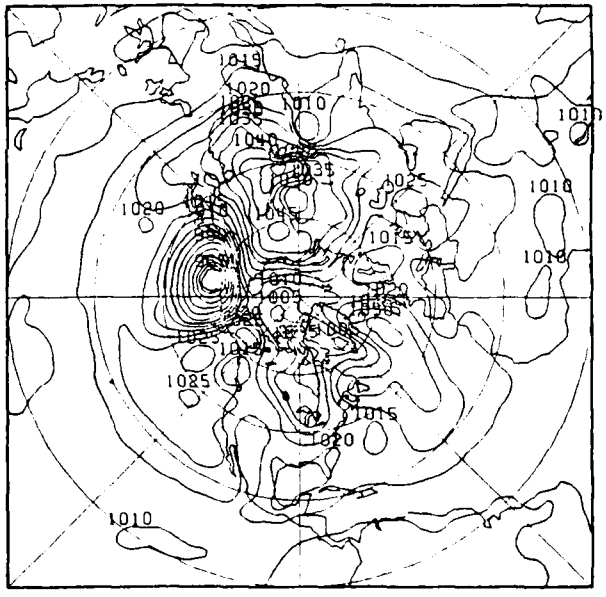


9-LAYER 2.4X3



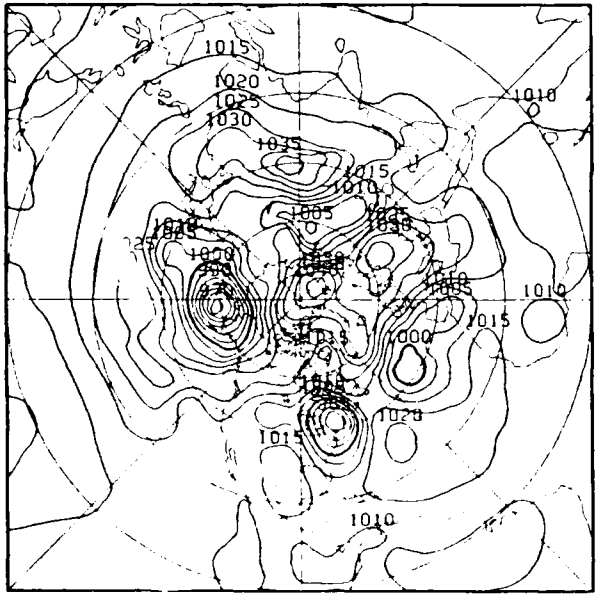
SLP

0000 GMT 22 JAN 1979

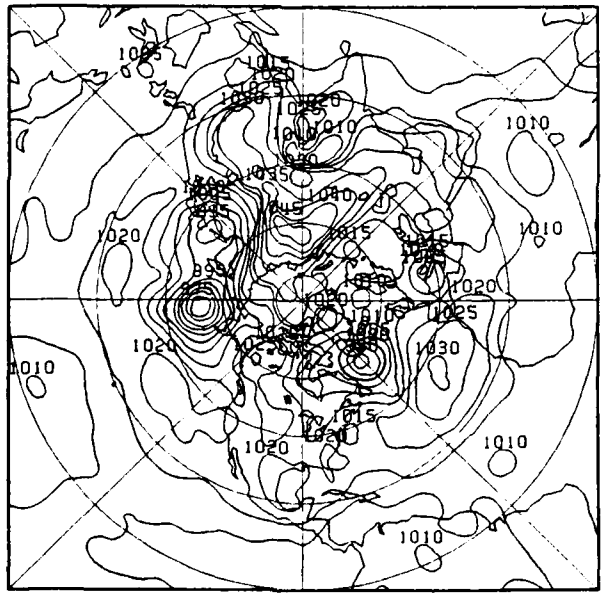
DAY 8

2-10

OBSERVED



9-LAYER 4X5



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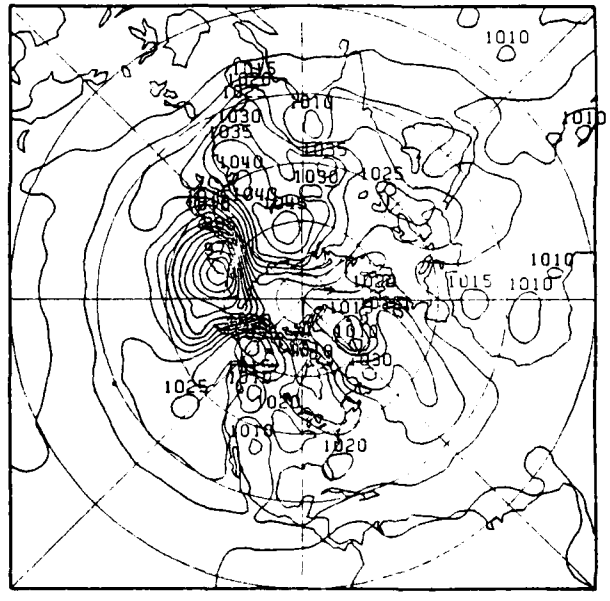
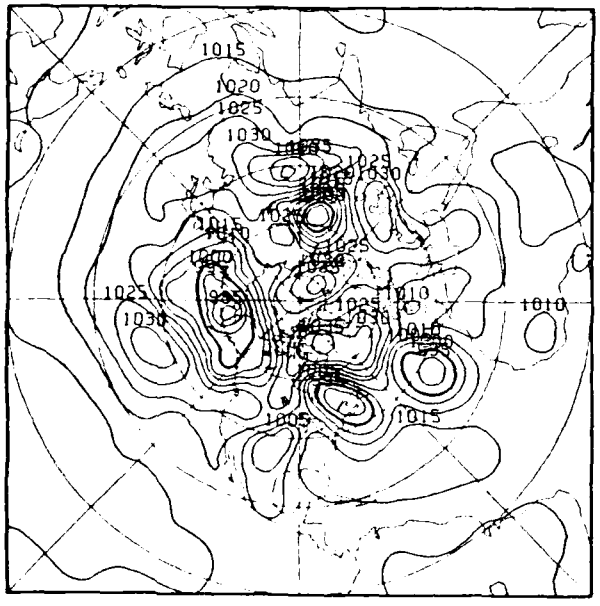


SLP

0000 GMT 23 JAN 1979

DAY 9

OBSERVED



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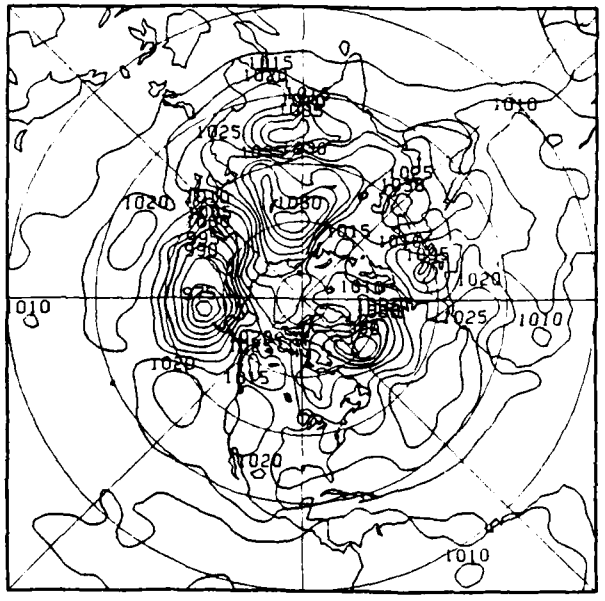
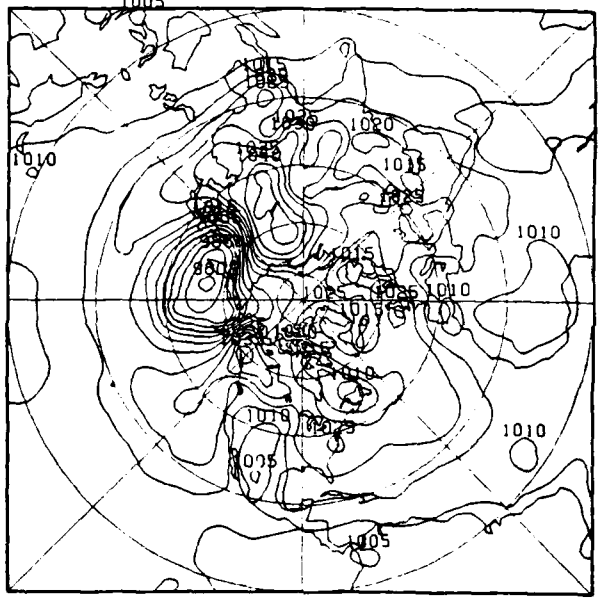


9-LAYER 2.4X3

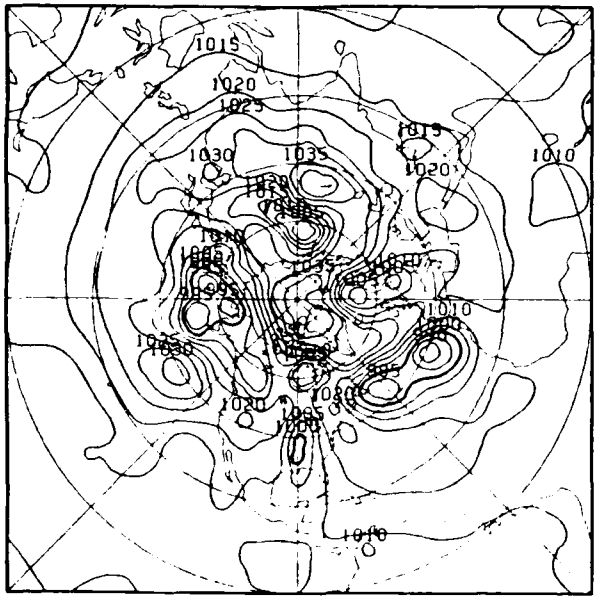


SLP

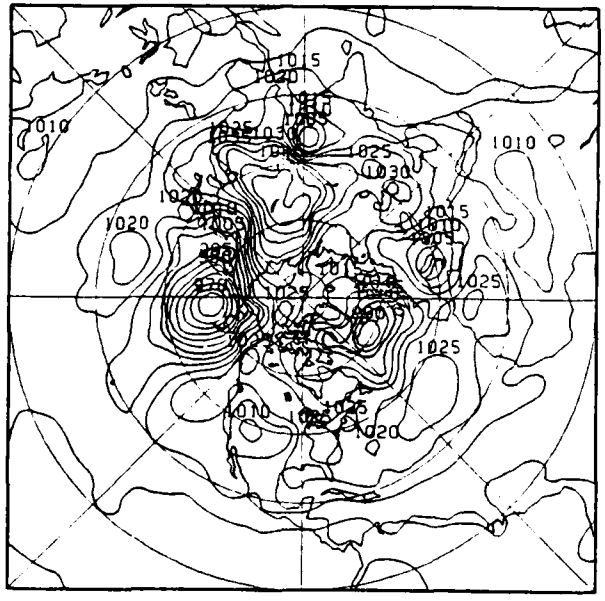
0000 GMT 24 JAN 1979

DAY 10

OBSERVED



9-LAYER 4X5

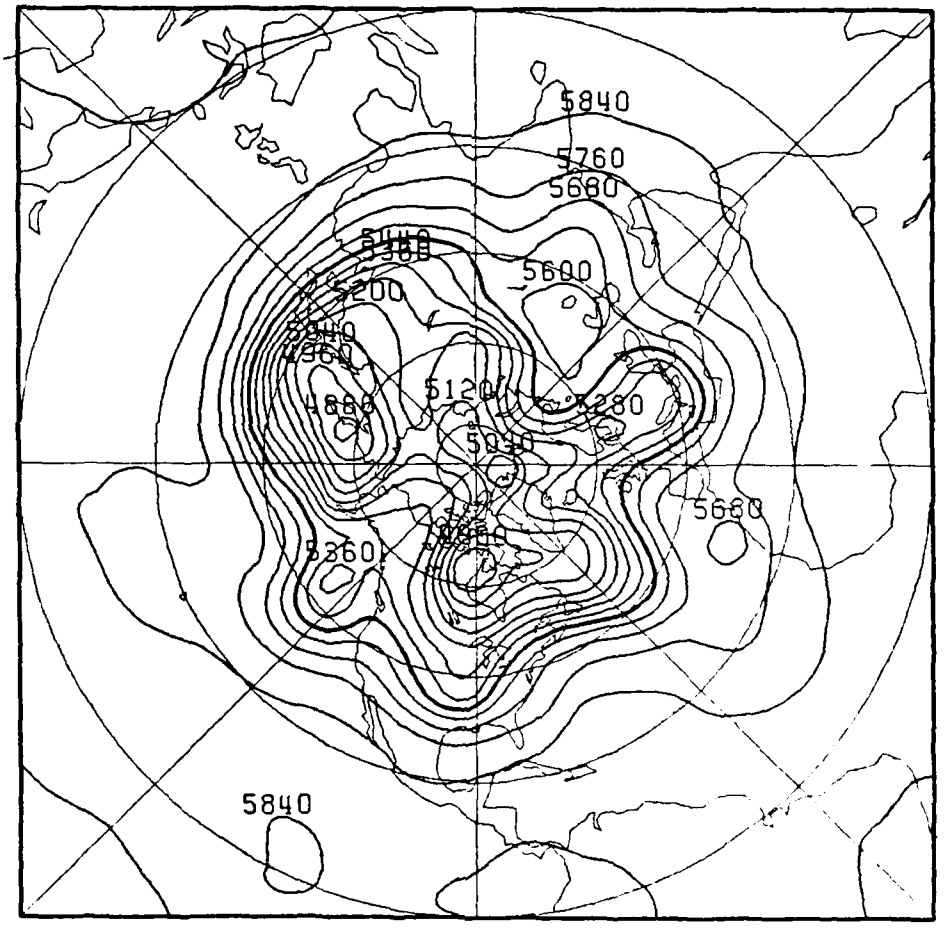


9-LAYER 2.4X3

500 mb Z

0000 GMT 14 JAN 1979

OBSERVED

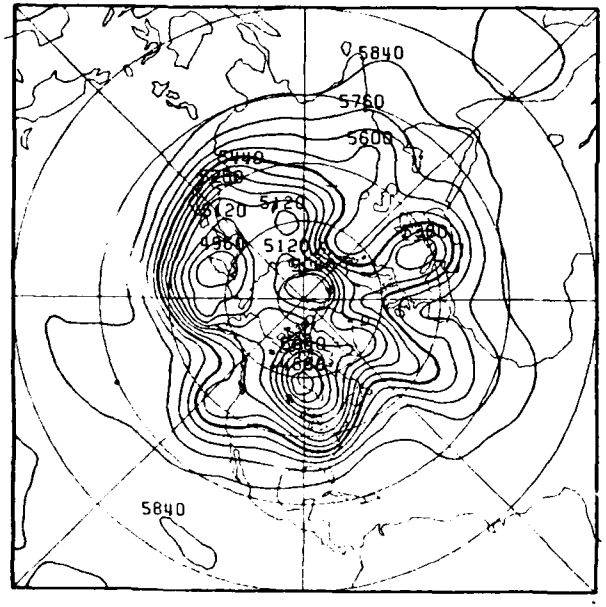


500 mb Z

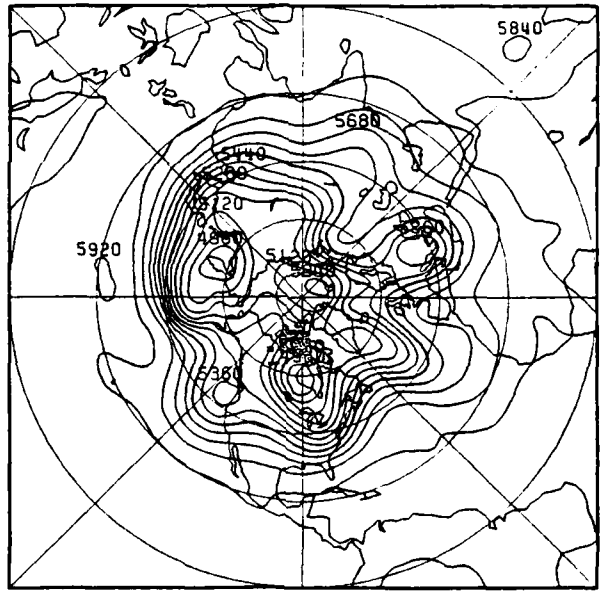
0000 GMT 15 JAN 1979

DAY 1

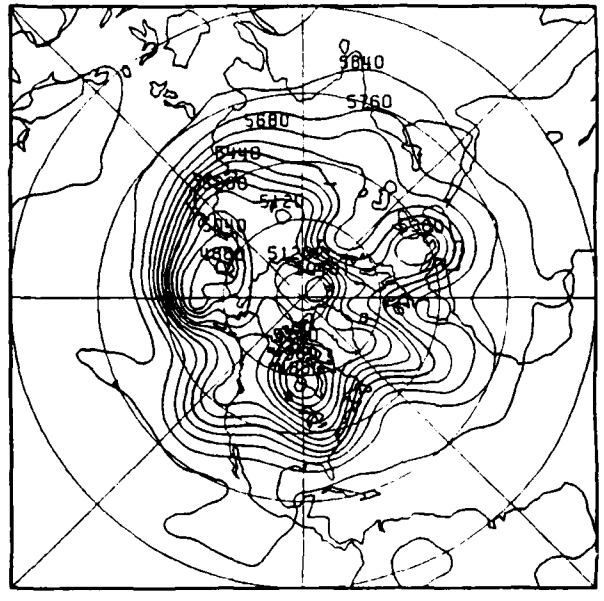
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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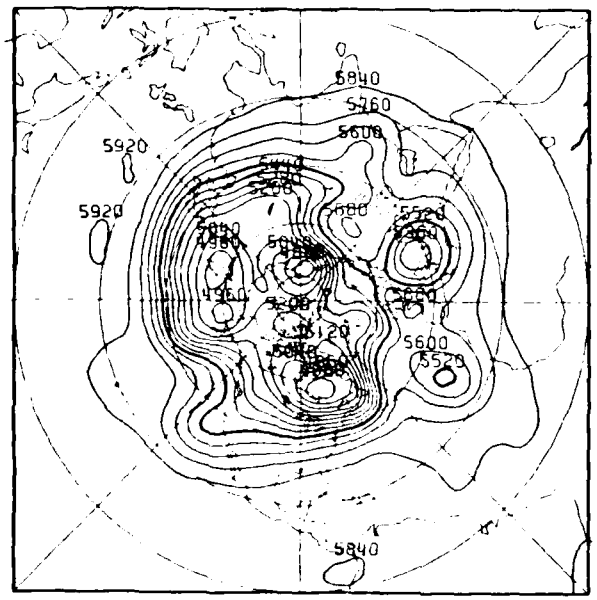
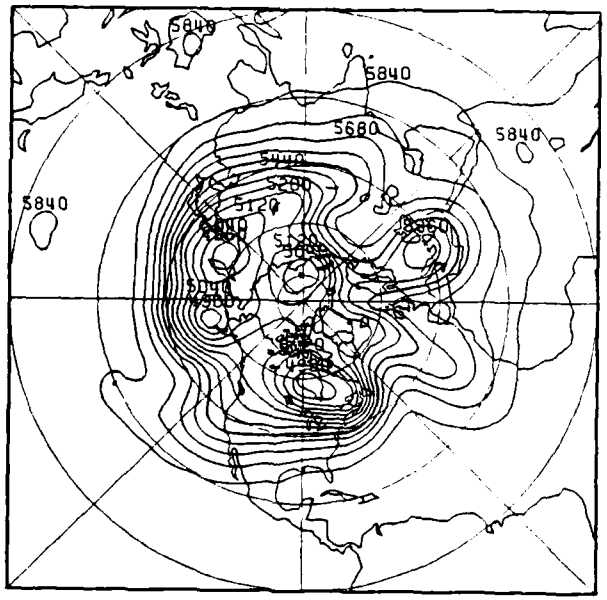
DAY 2

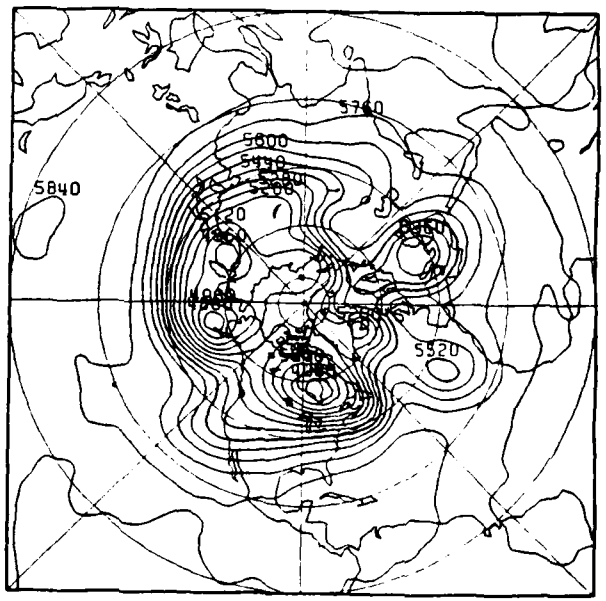
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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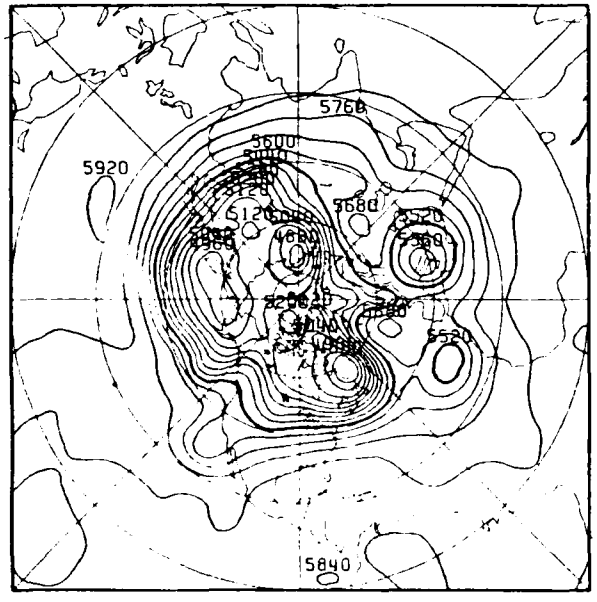
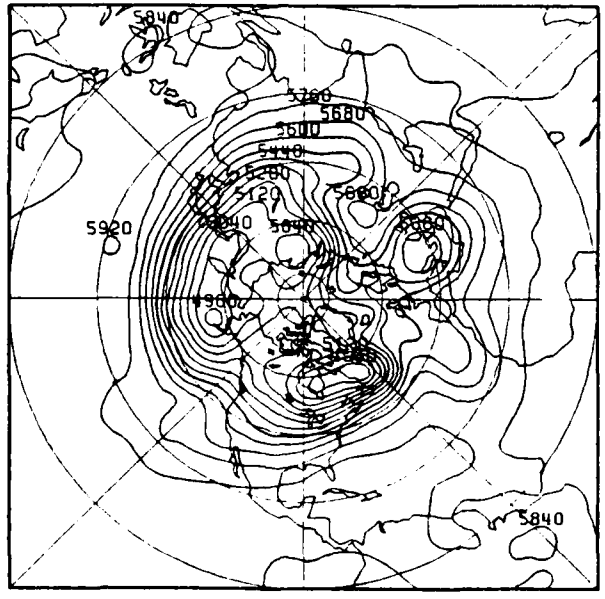
DAY 3

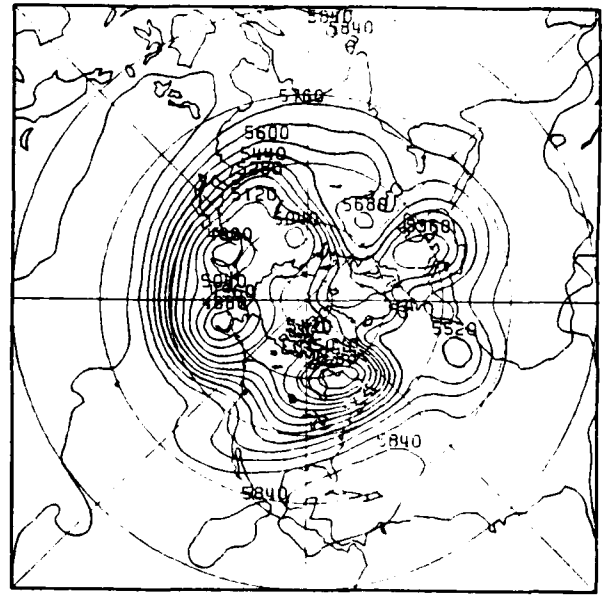
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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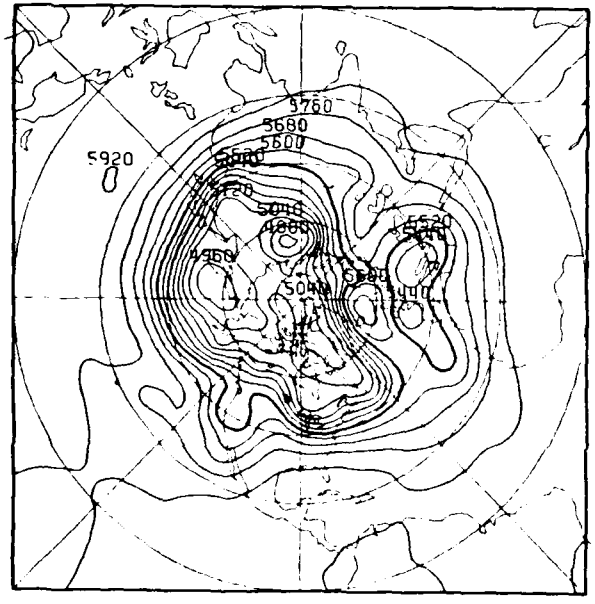
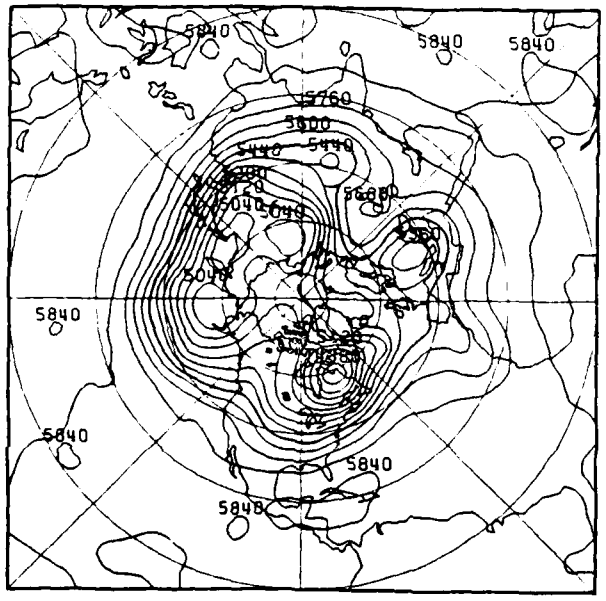
DAY 4

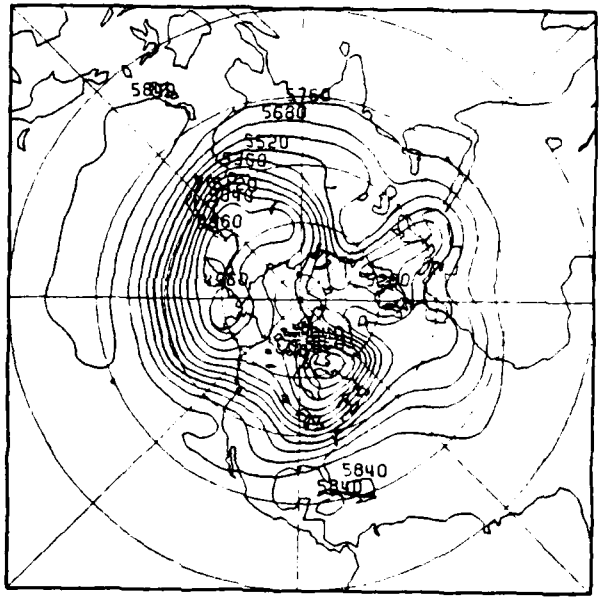
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

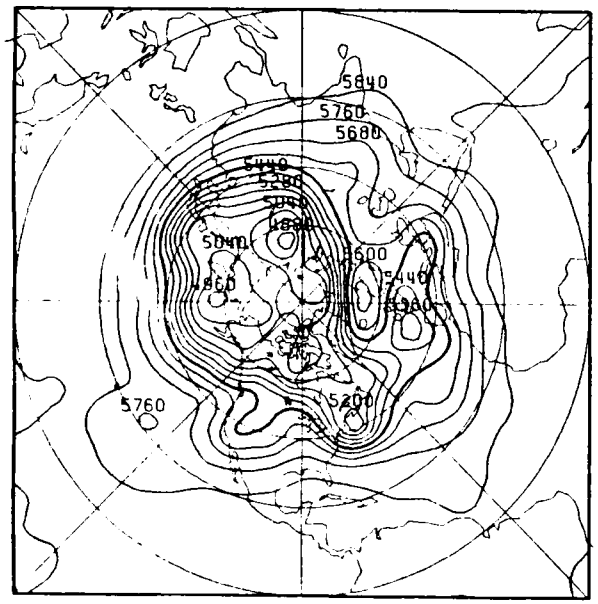


500 mb Z

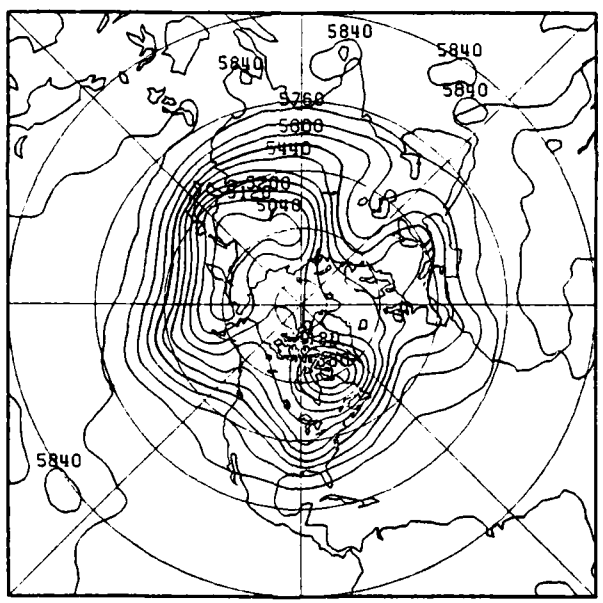
0000 GMT 19 JAN 1979

DAY 5

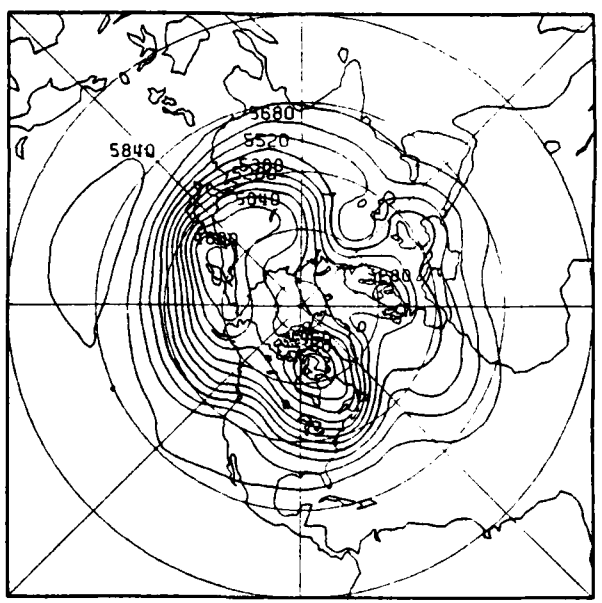
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3

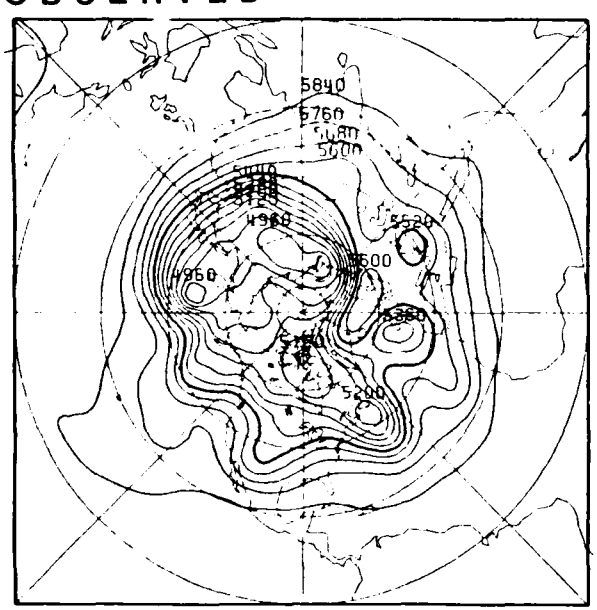


500 mb Z

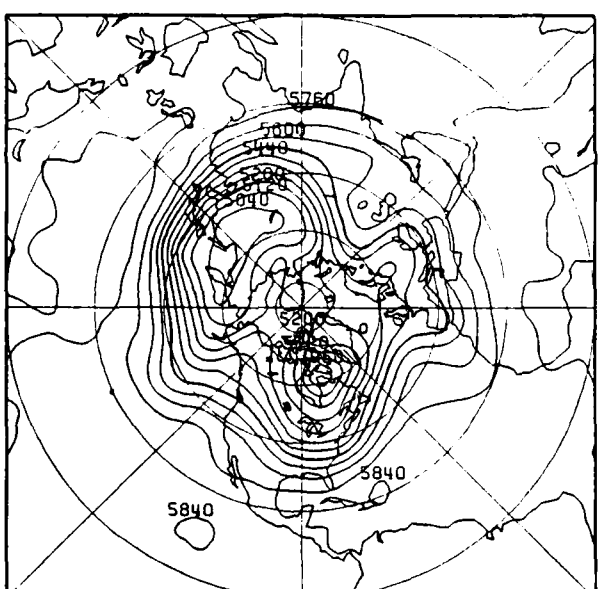
0000 GMT 20 JAN 1979

DAY 6

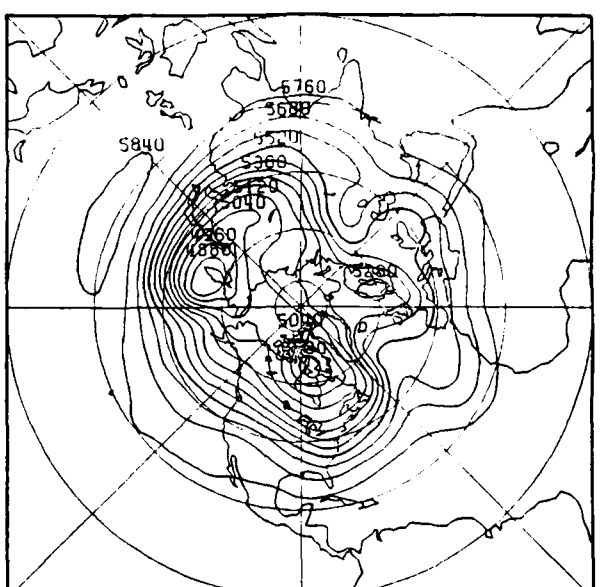
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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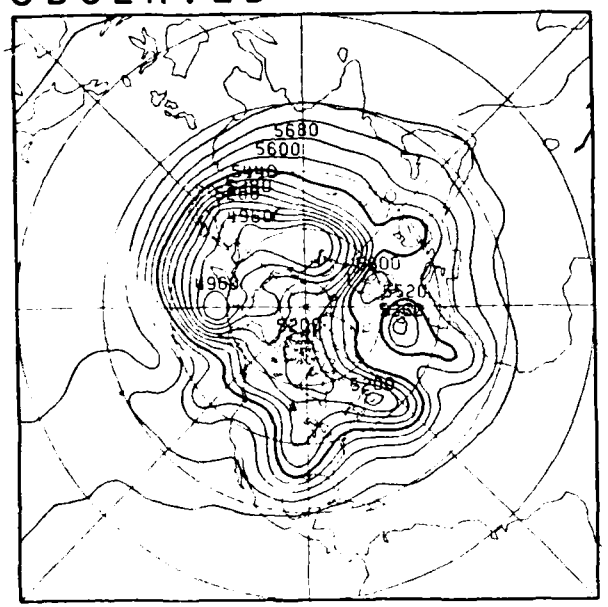
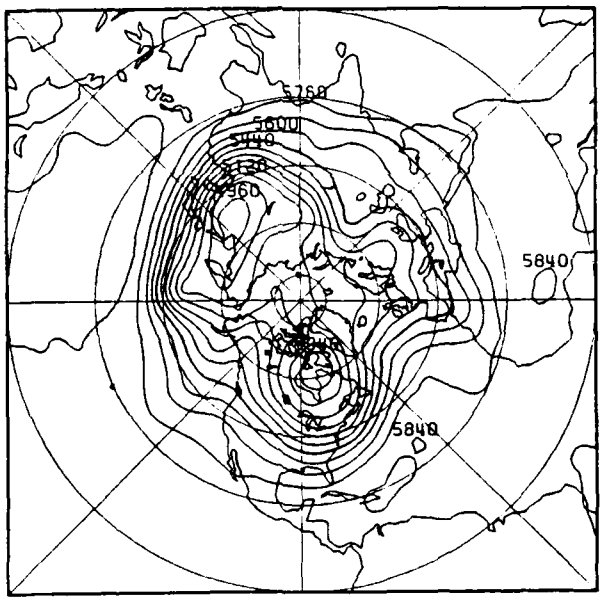
0000 GMT 21 JAN 1979

DAY 7

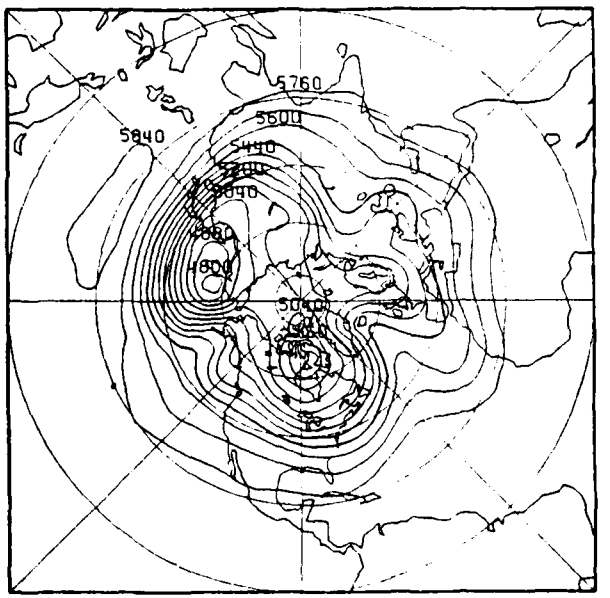
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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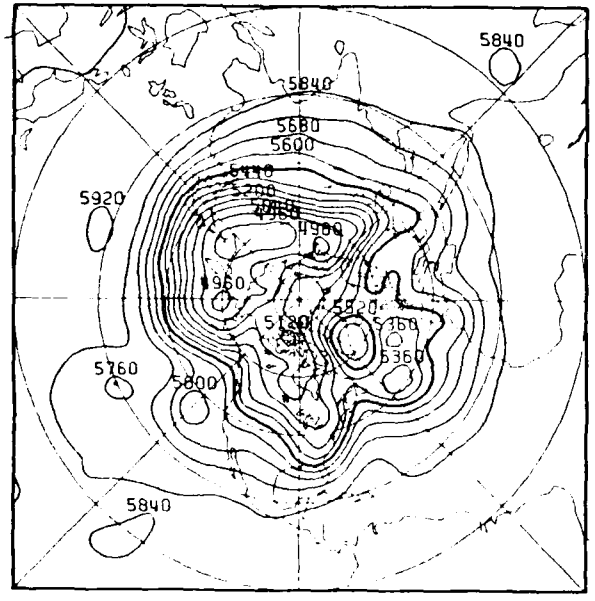
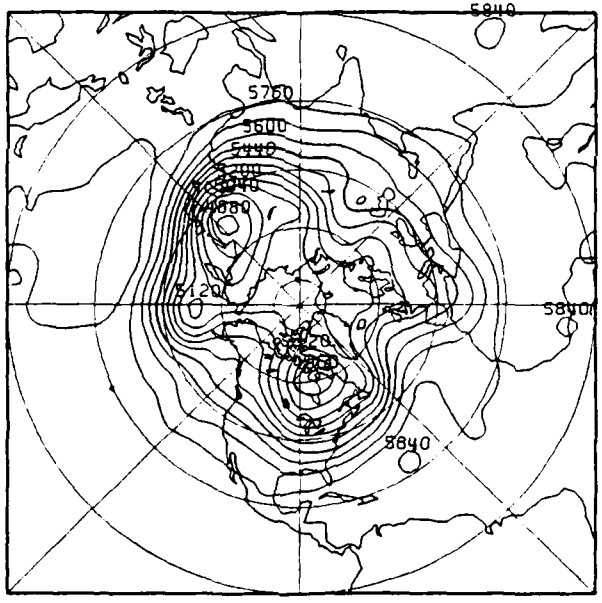
0000 GMT 22 JAN 1979

DAY 8

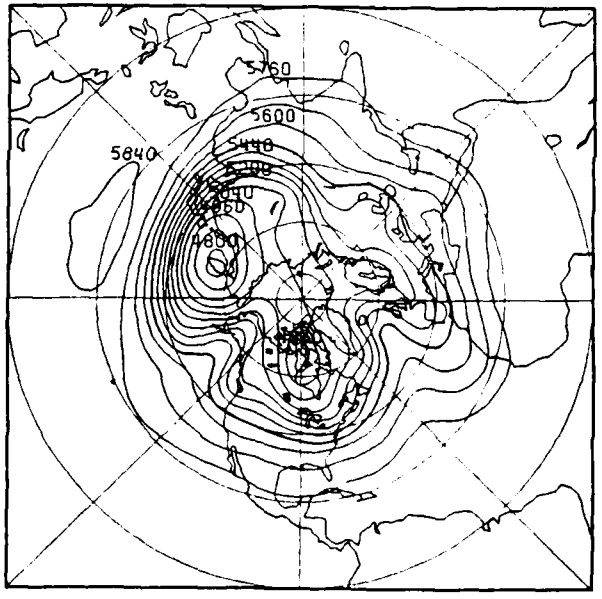
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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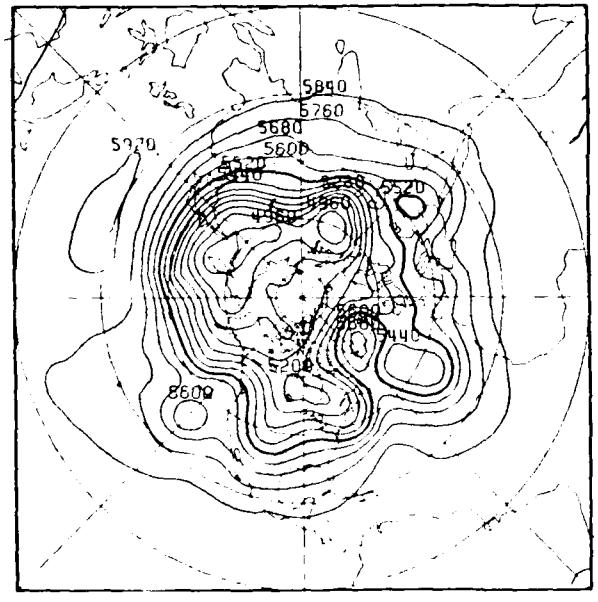
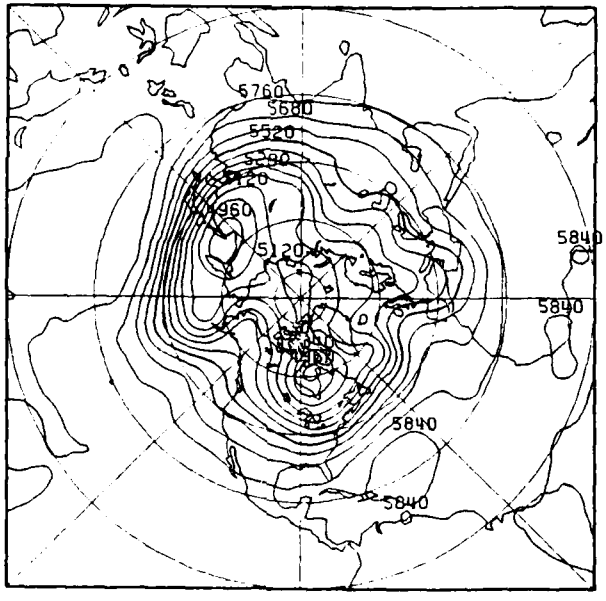
0000 GMT 23 JAN 1979

DAY 9

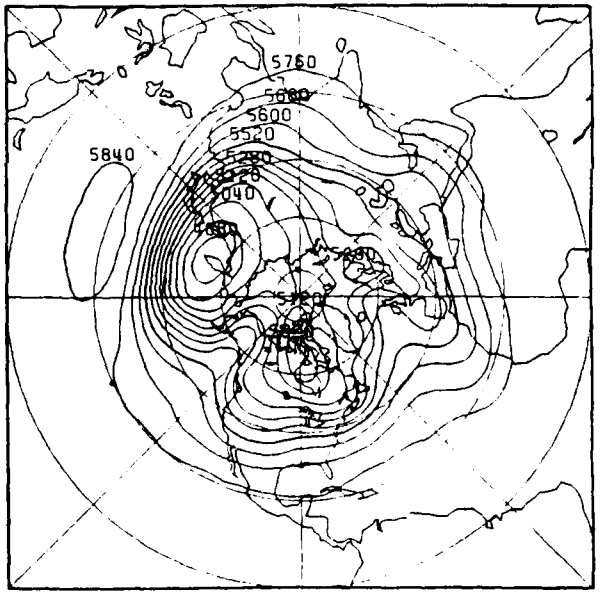
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



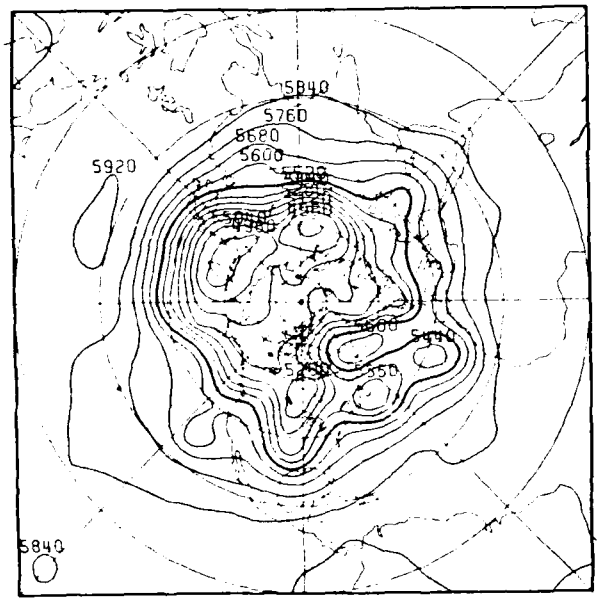
500 mb Z

0000 GMT 24 JAN 1979

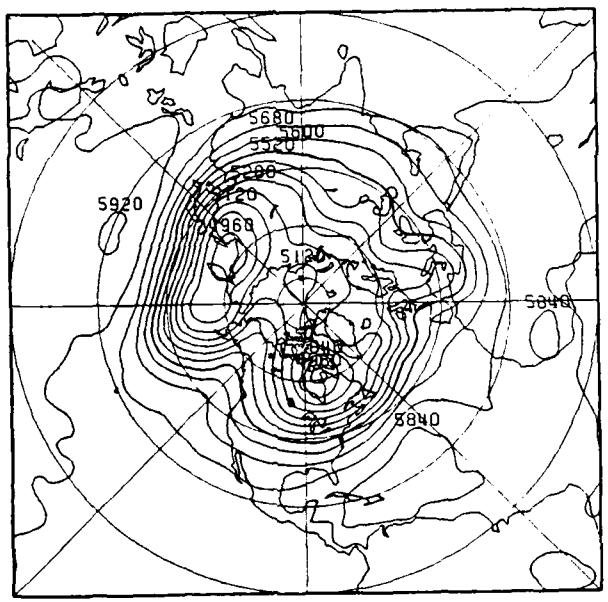
DAY 10

2-23

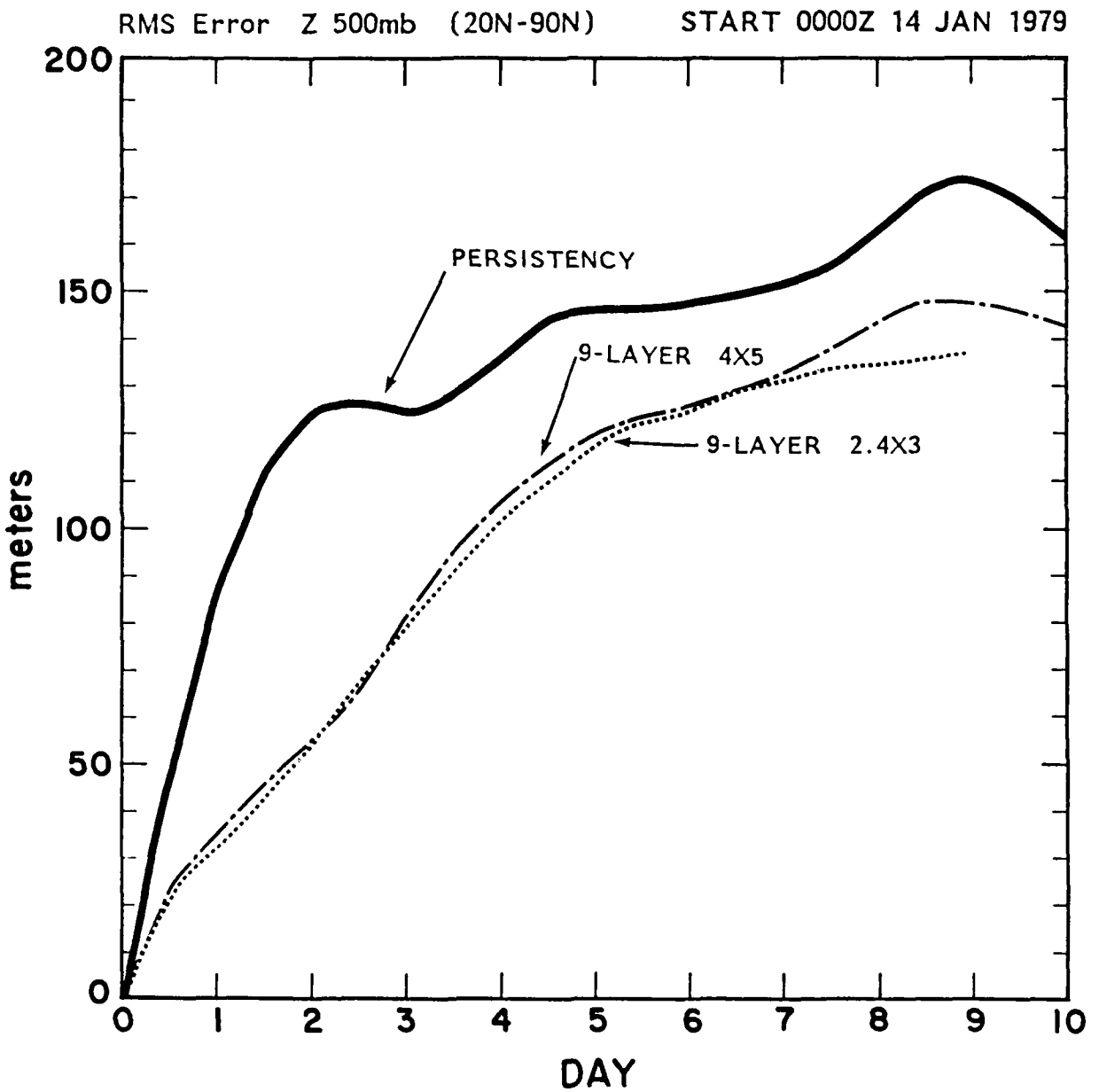
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3


RMS Error Z 500mb (20N-90N)
START 0000Z 14 JAN 1979
200
150
100
50
0
meters
PERSISTENCY
9-LAYER 4X5
9-LAYER 2.4X3
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

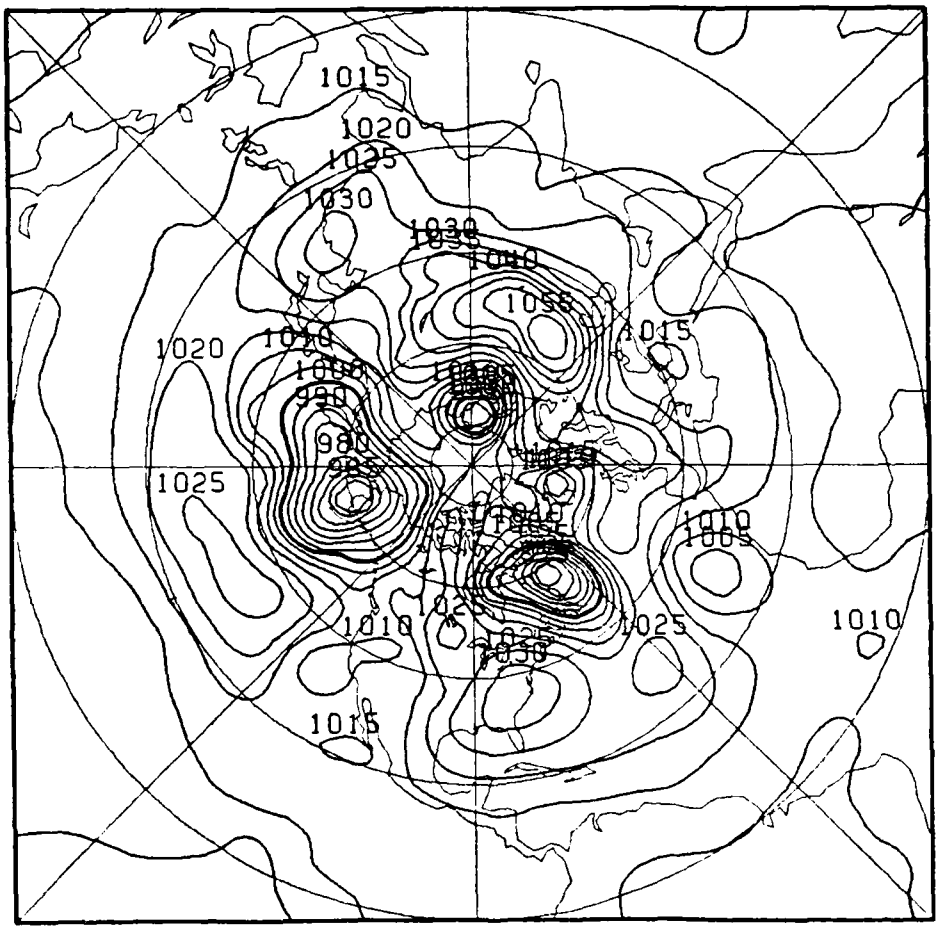
0000 GMT

16 JANUARY 1979

SLP

0000 GMT 16 JAN 1979

OBSERVED

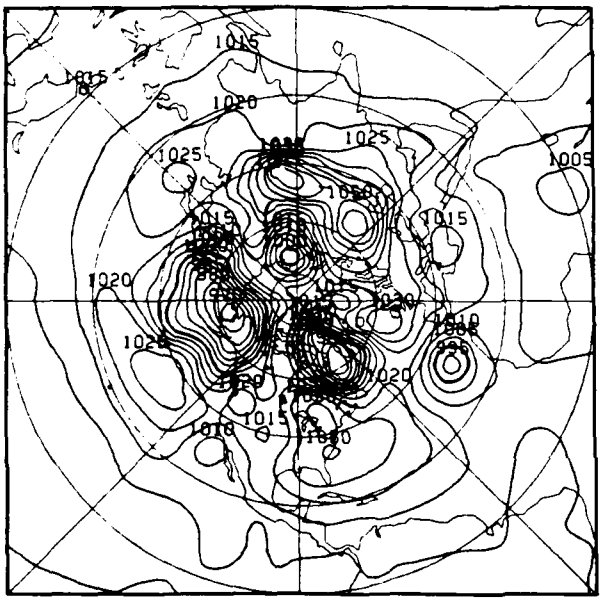


SLP

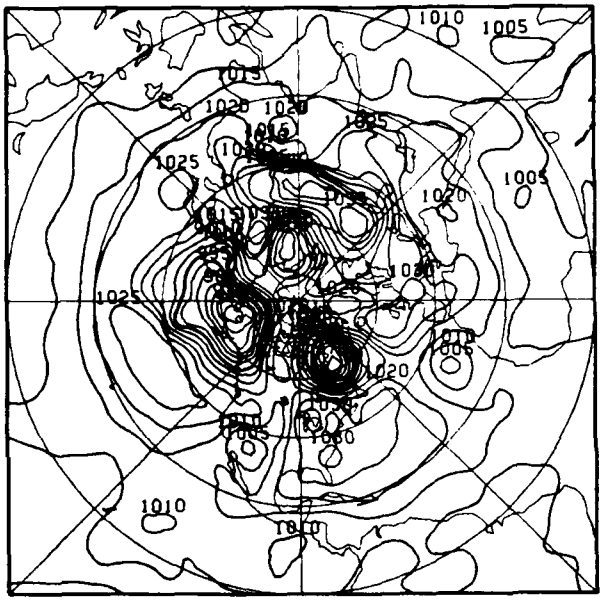
0000 GMT 17 JAN 1979

DAY 1

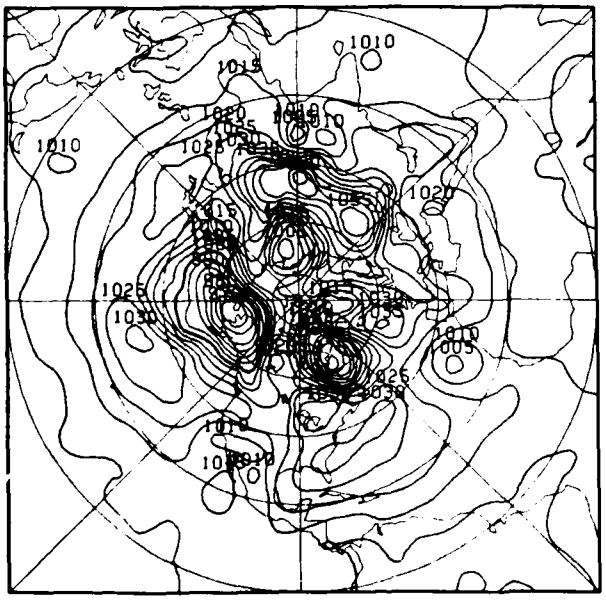
OBSERVED



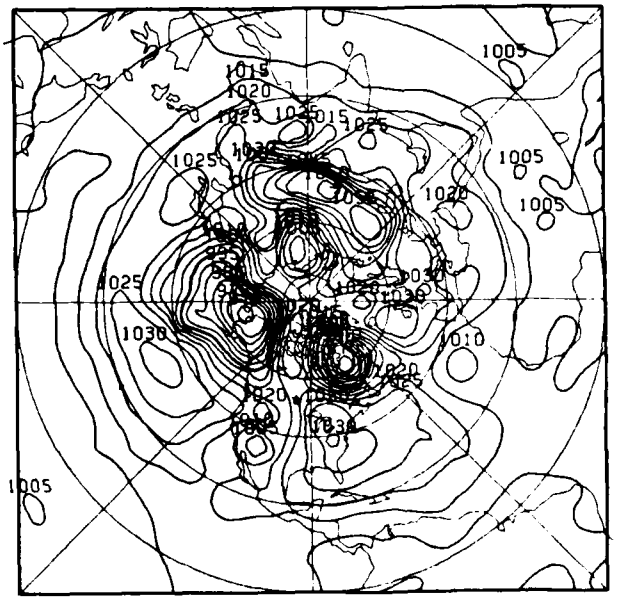
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

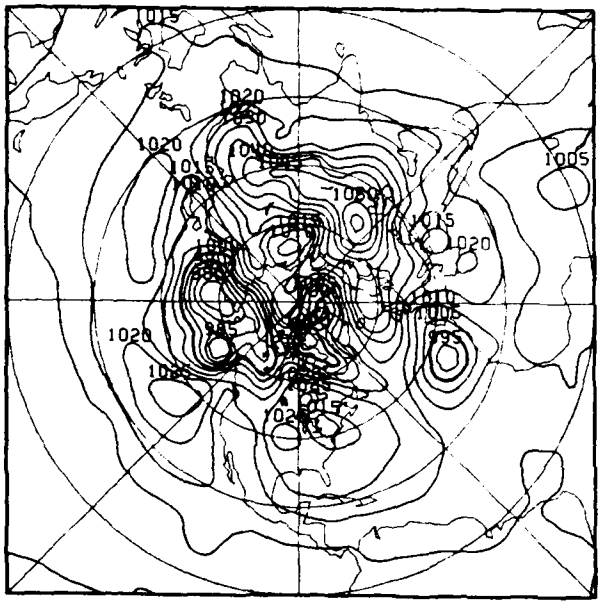


SLP

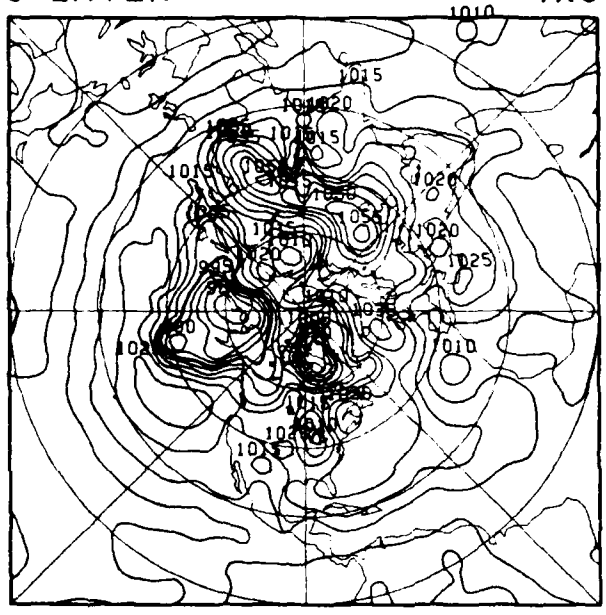
0000 GMT 18 JAN 1979

DAY 2

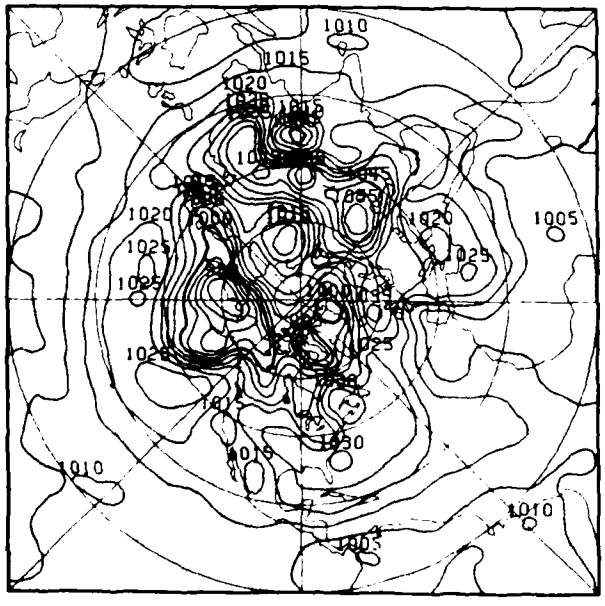
OBSERVED



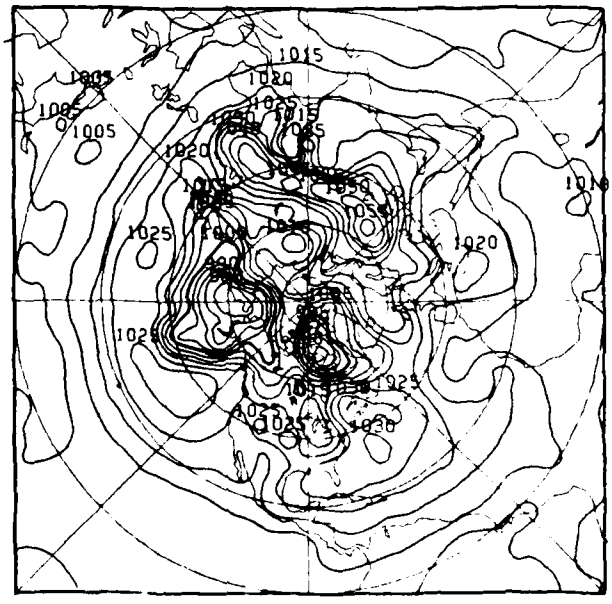
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



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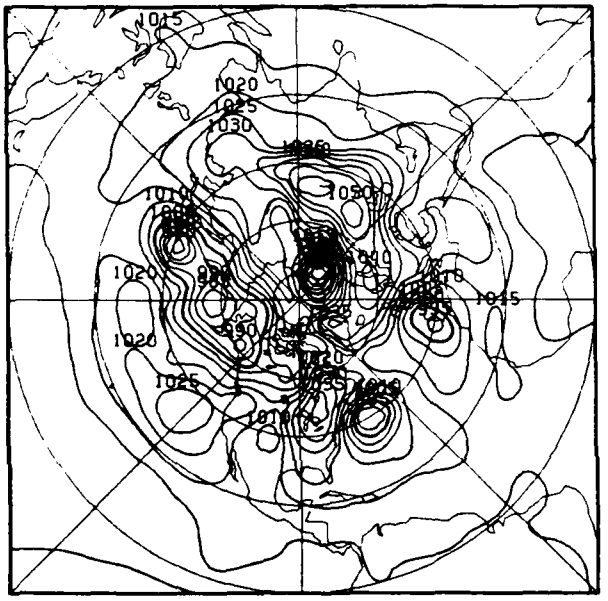
DAY 3

OBSERVED



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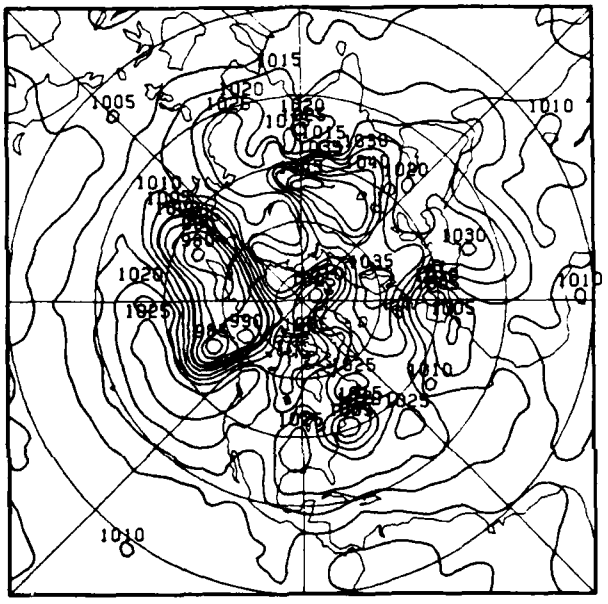
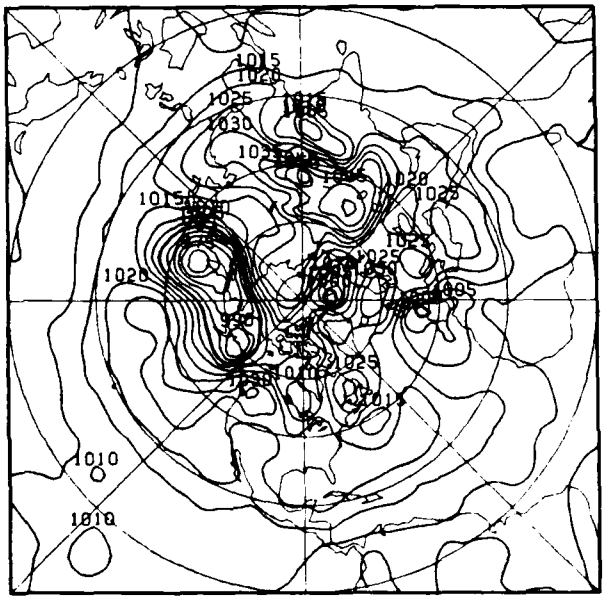


9-LAYER 2.4X3



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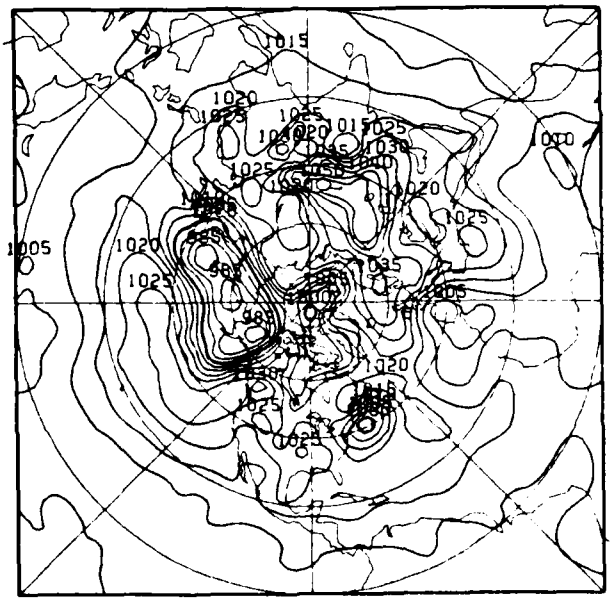

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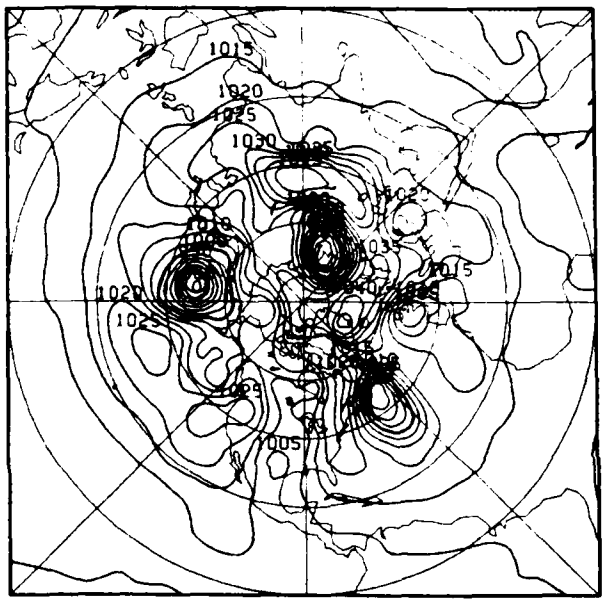
DAY 4

OBSERVED



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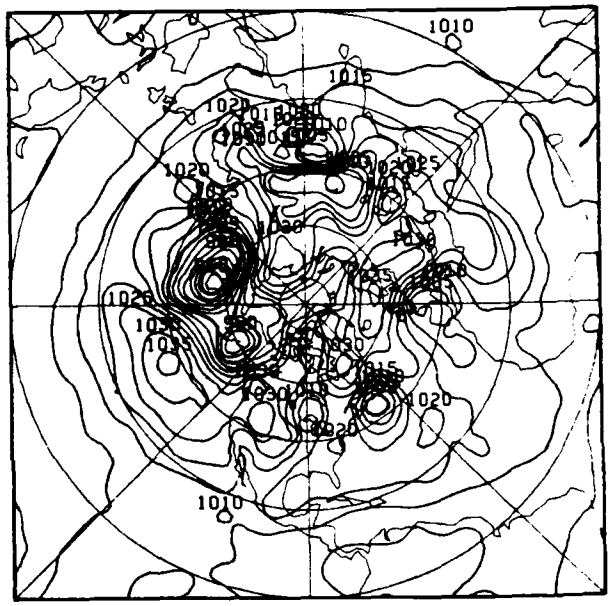

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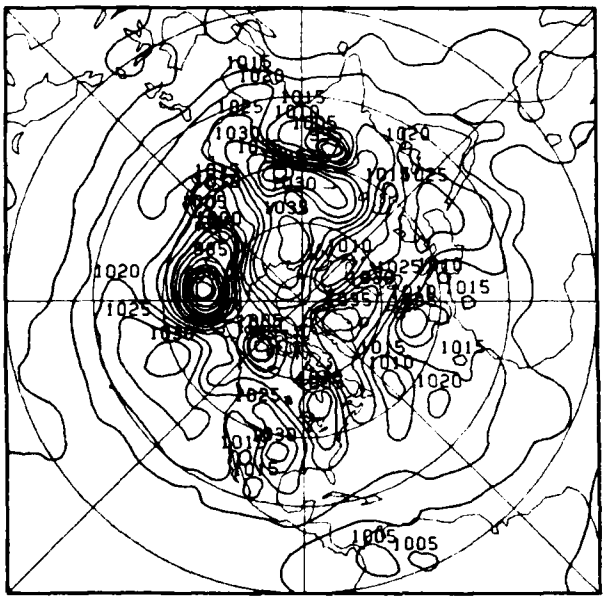

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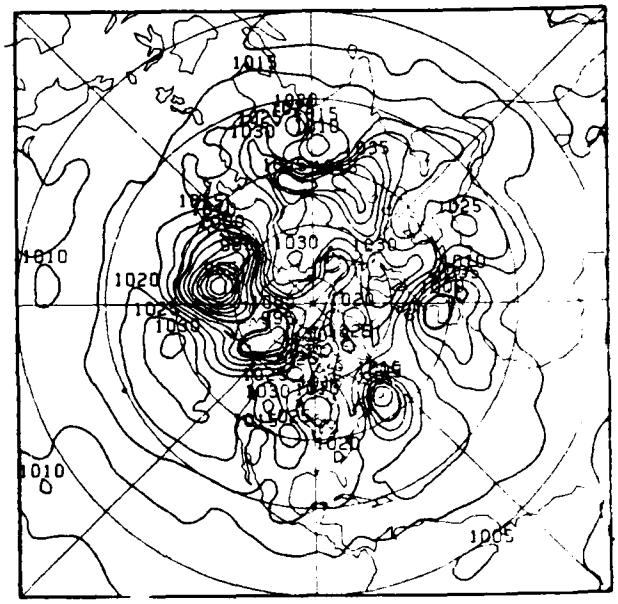

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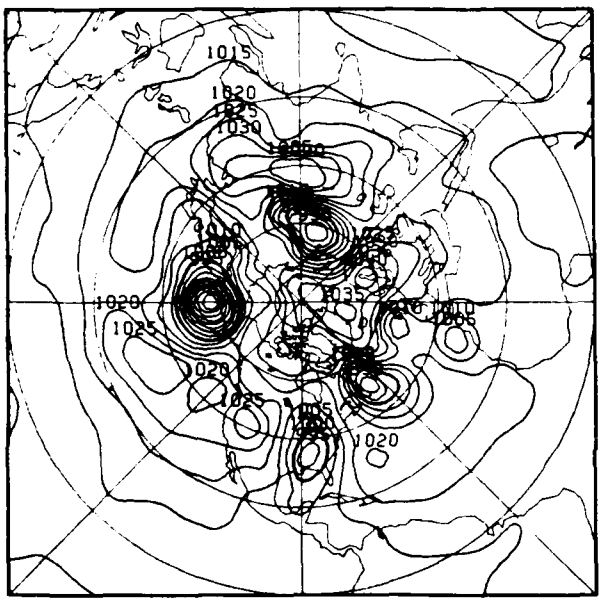
DAY 5

OBSERVED



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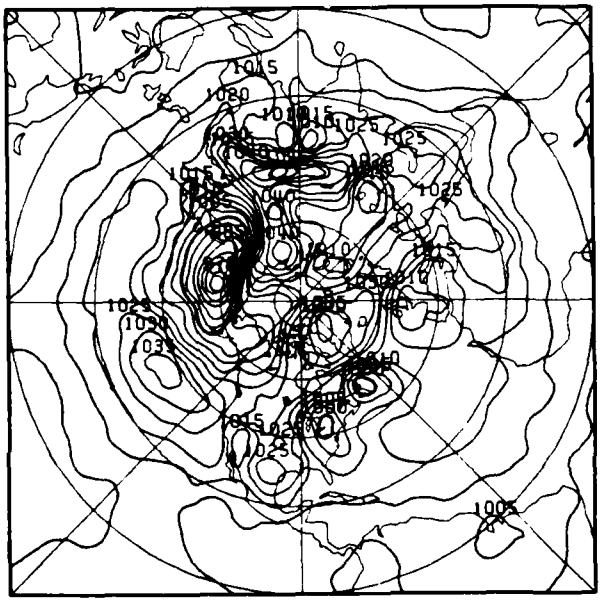
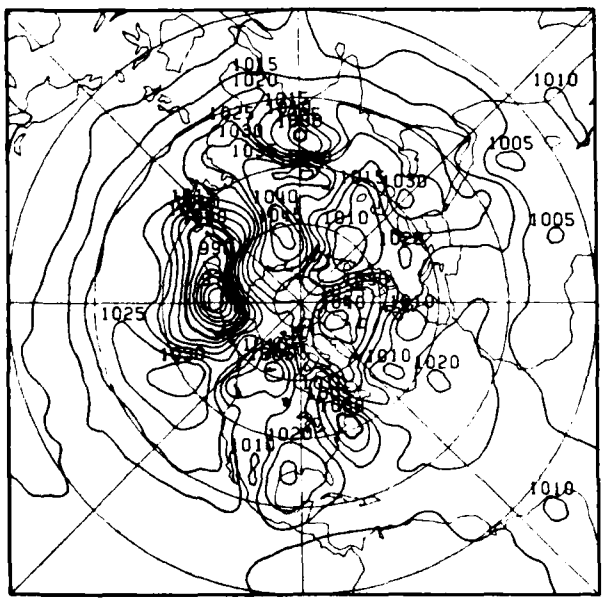


9-LAYER 2.4X3



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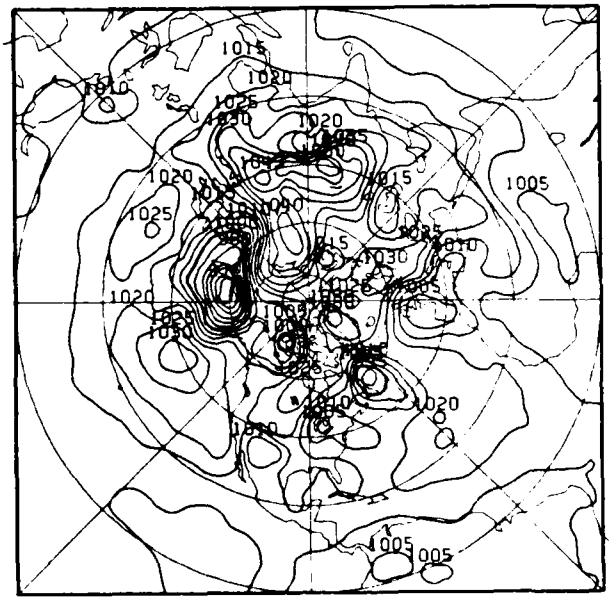

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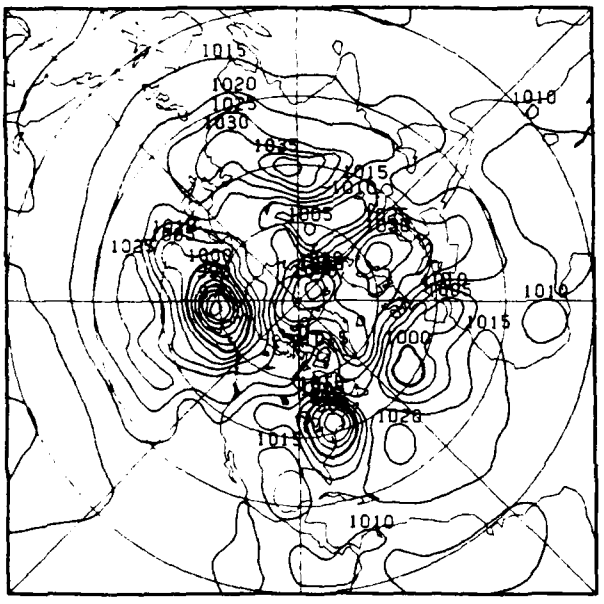
DAY 6

OBSERVED



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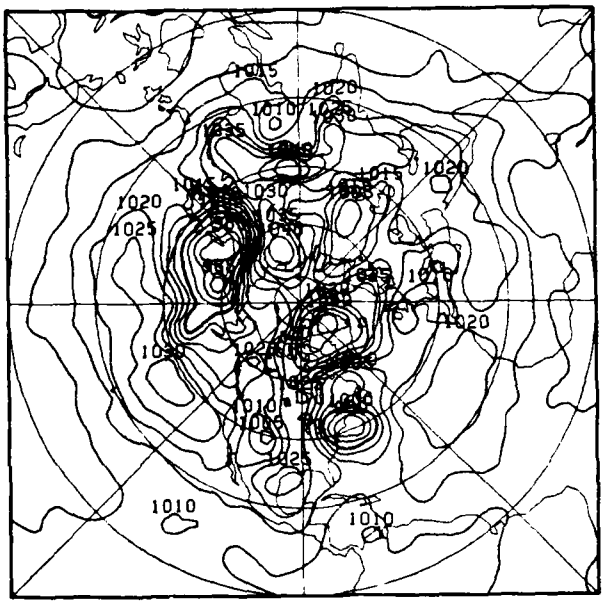
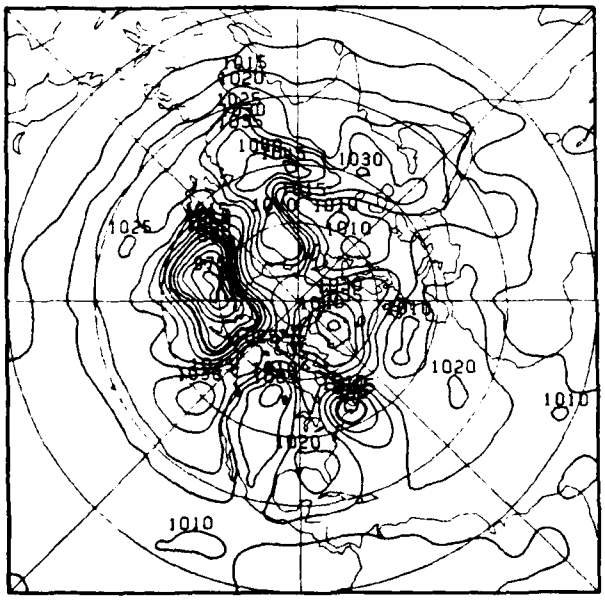


9-LAYER 2.4X3



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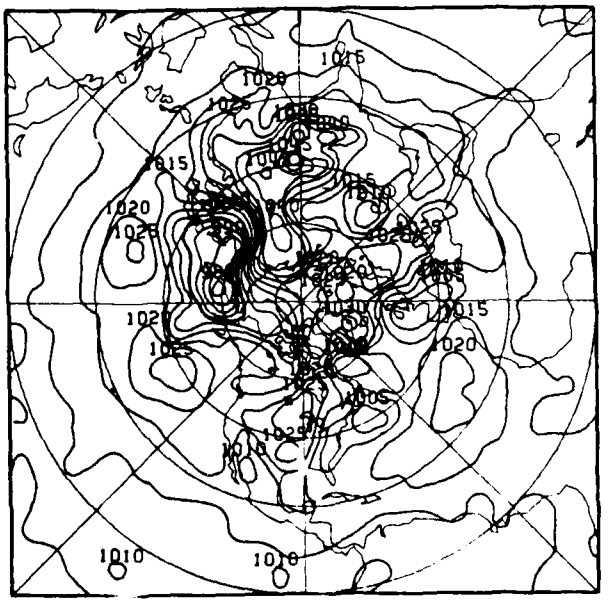

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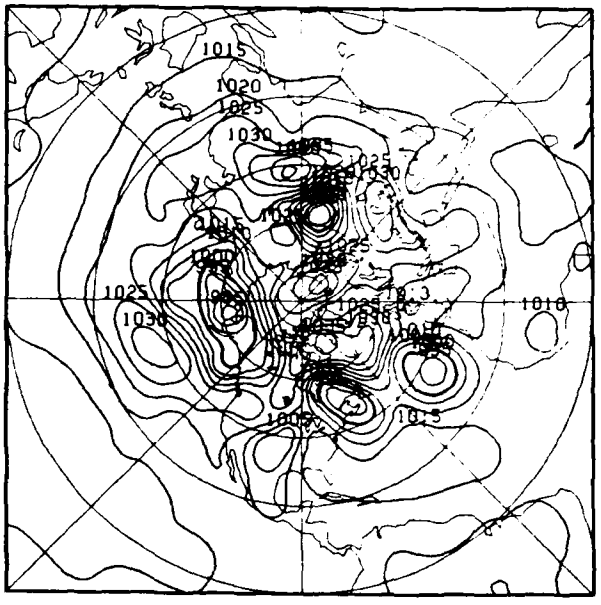
DAY 7

OBSERVED



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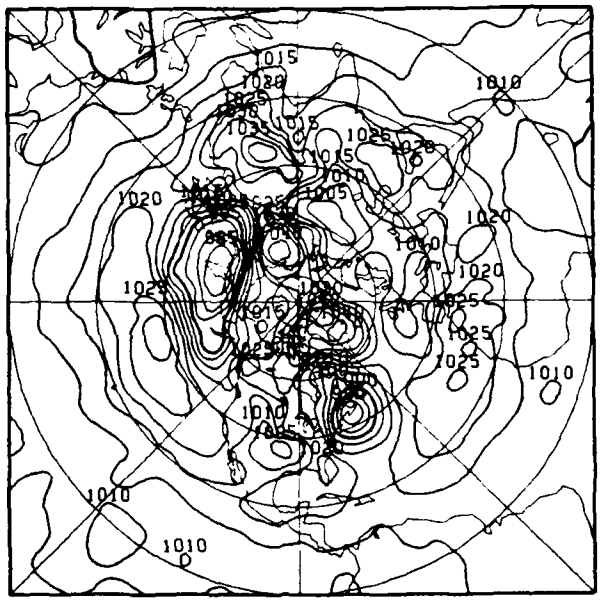
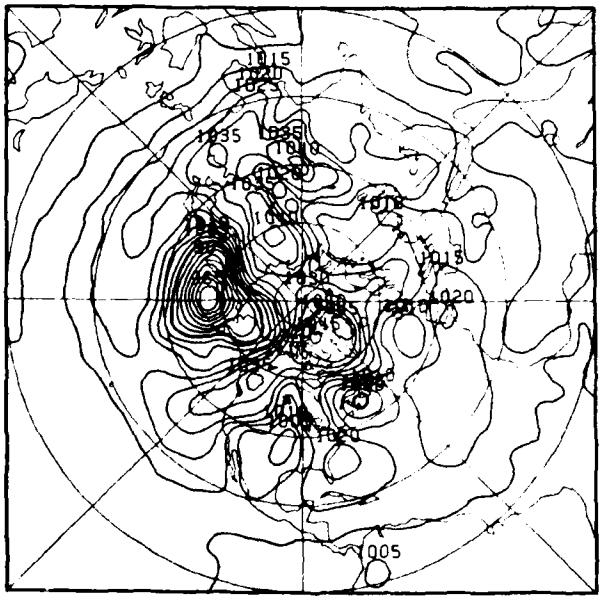


9-LAYER 2.4X3



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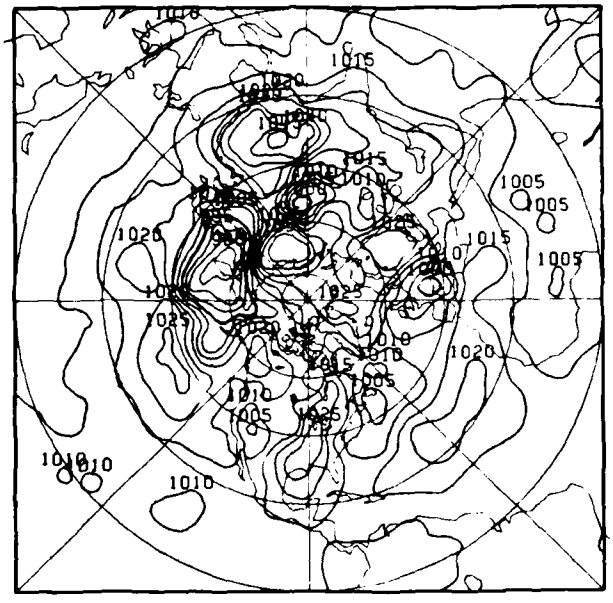

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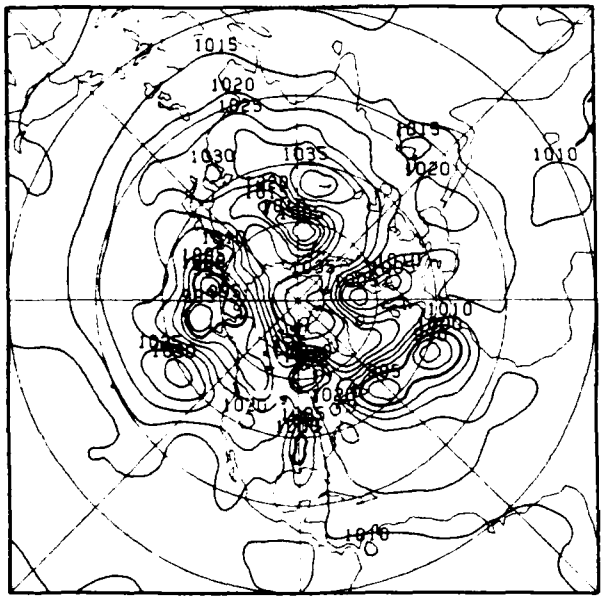
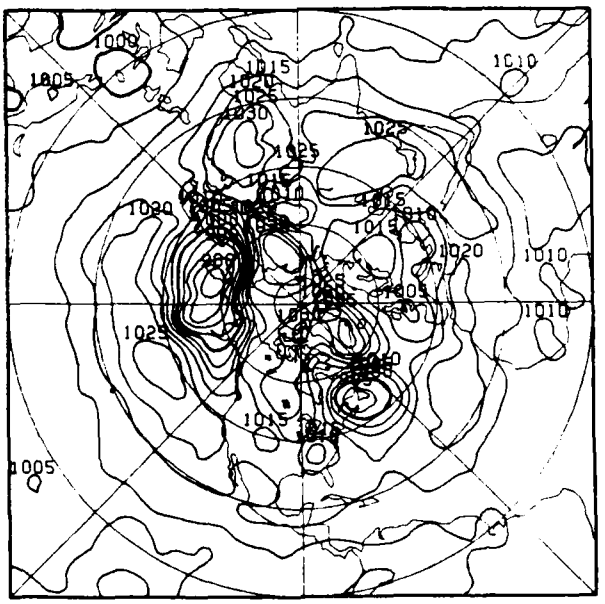
DAY 8

OBSERVED



9-LAYER 4X5



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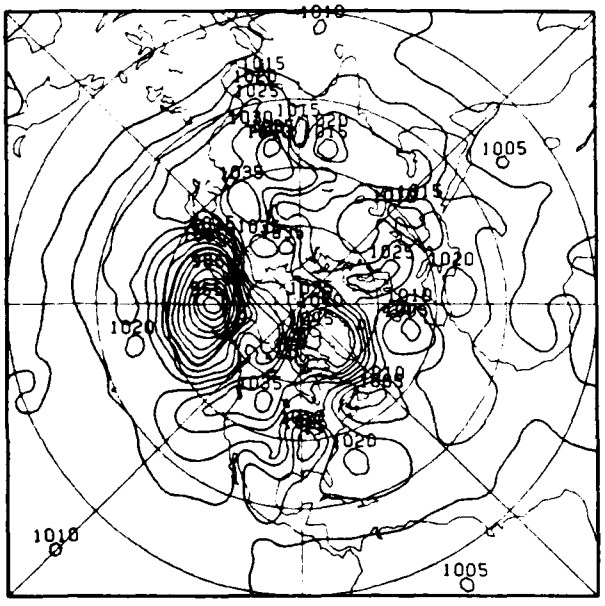

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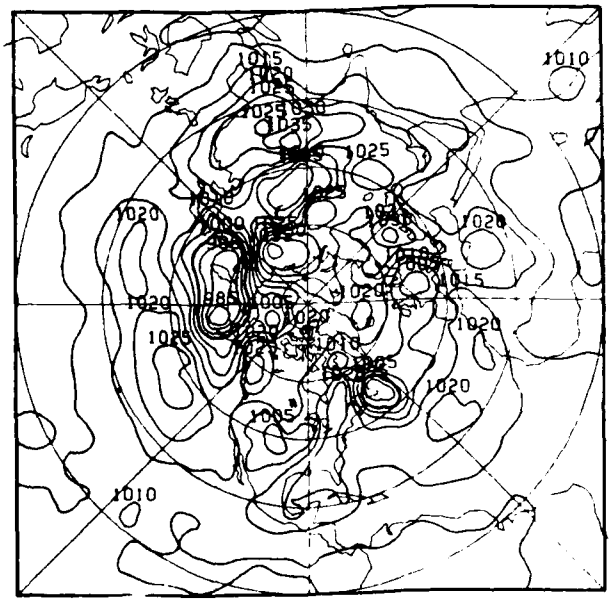

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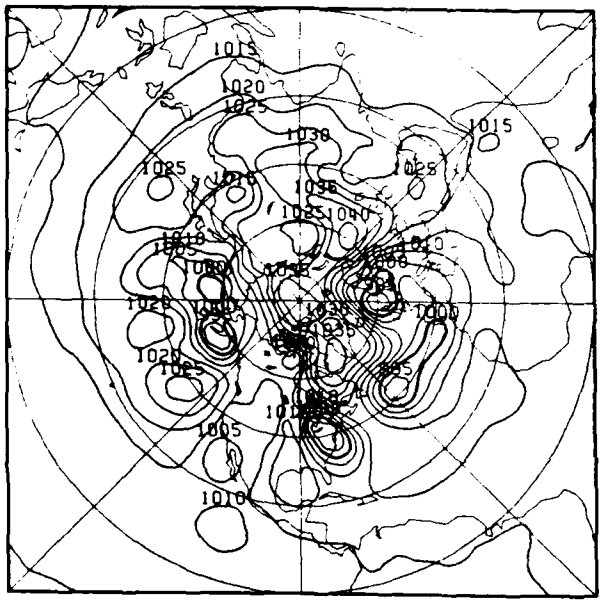
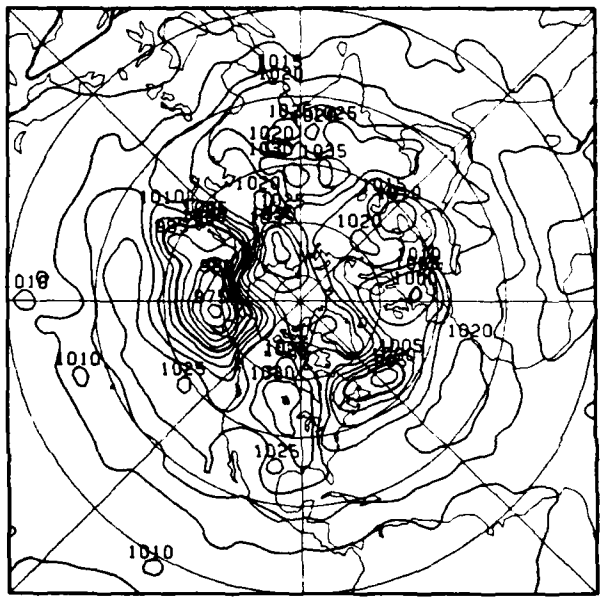
DAY 9

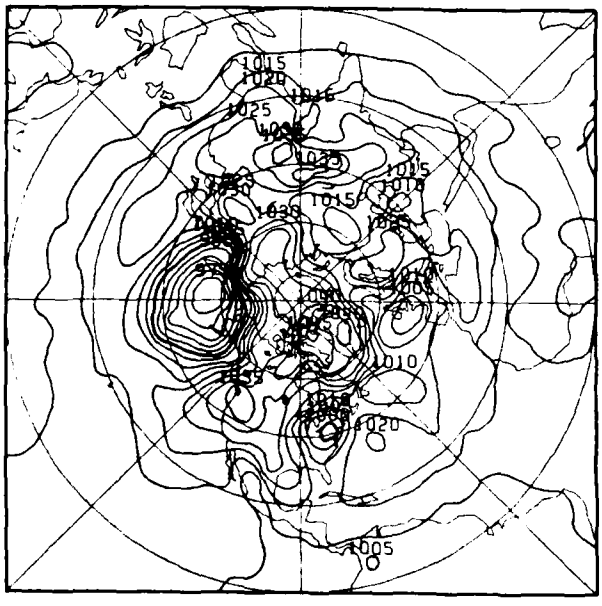
OBSERVED



9-LAYER 4X5



9-LAYER 2.4X3



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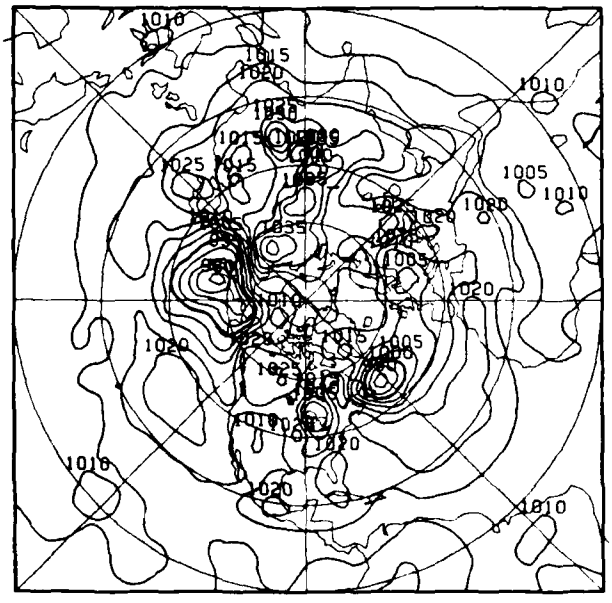

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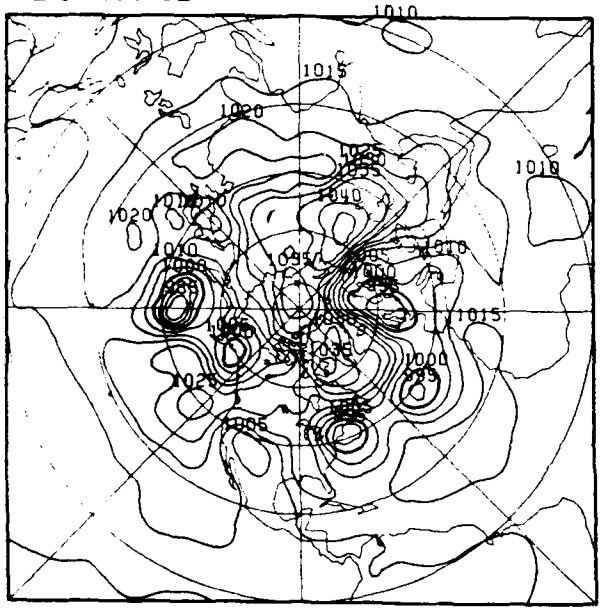
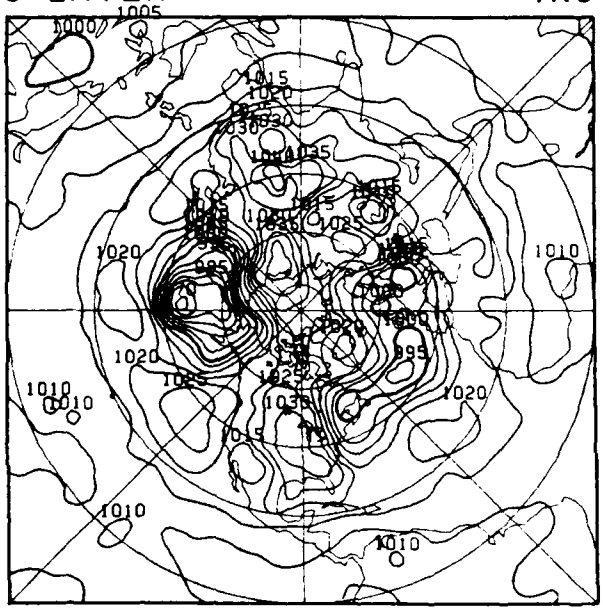
DAY 10

OBSERVED



9-LAYER 4X5



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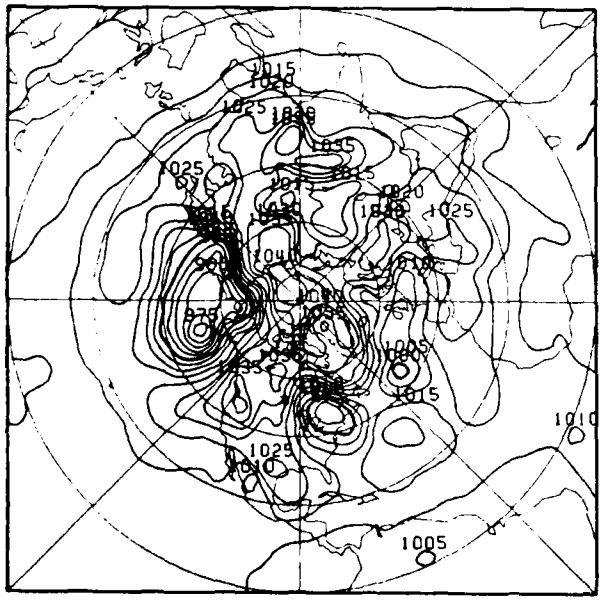

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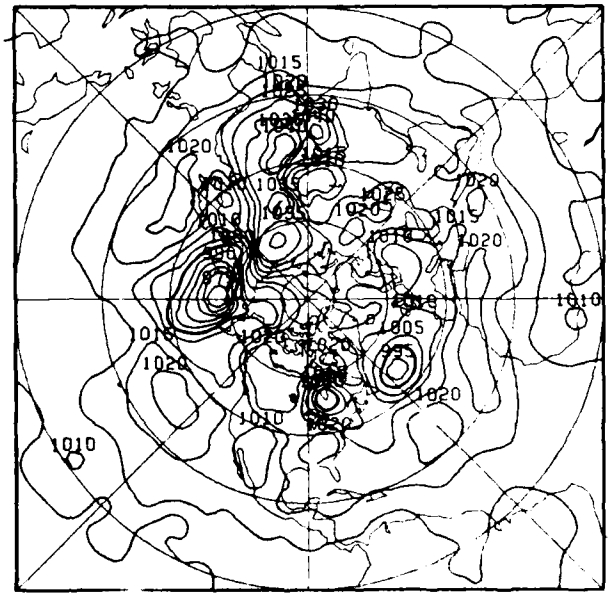

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0000 GMT 16 JAN 1979

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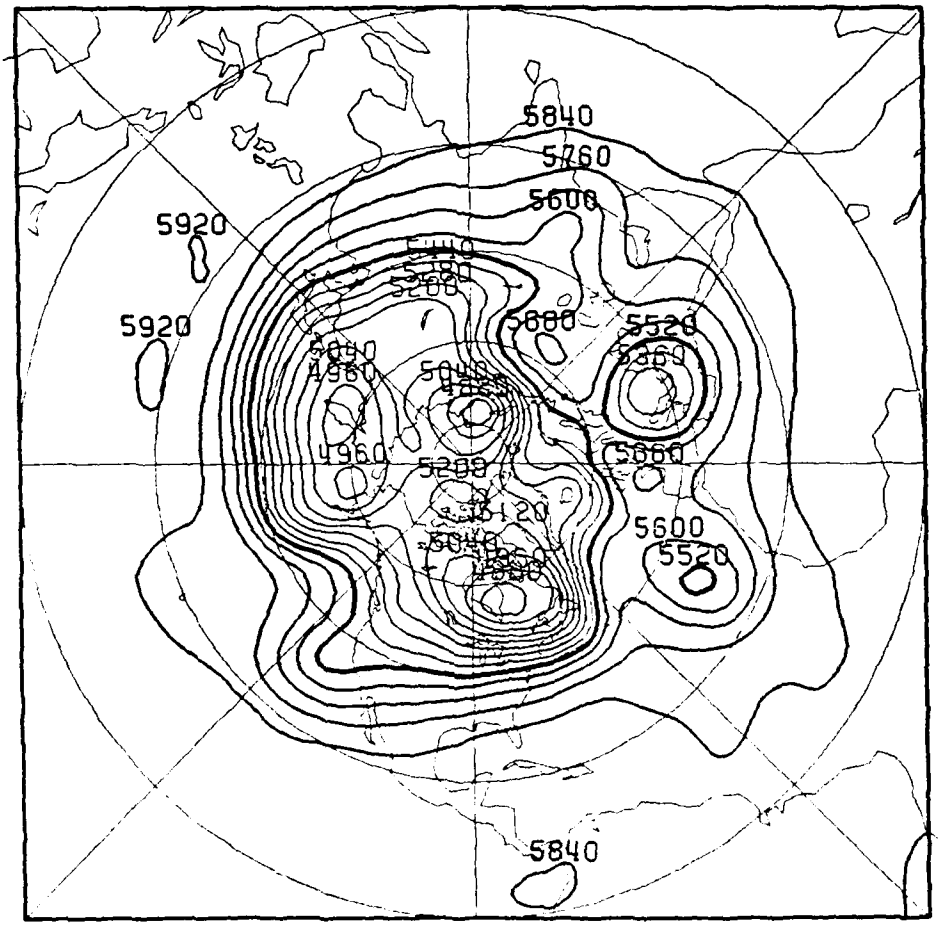

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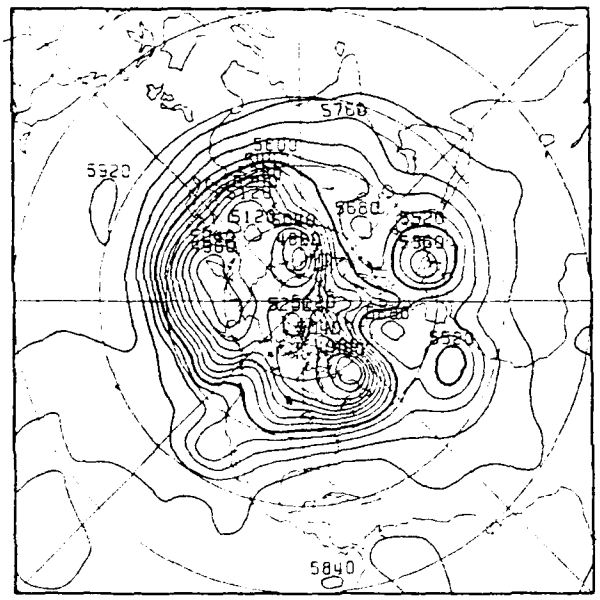
DAY 1

OBSERVED



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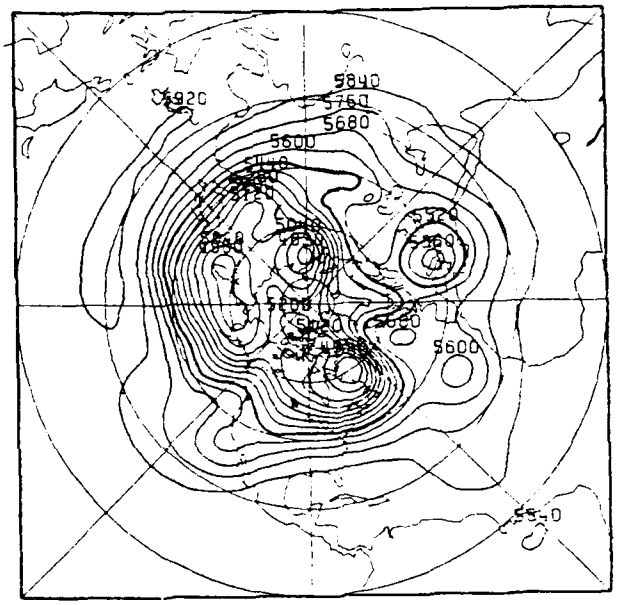
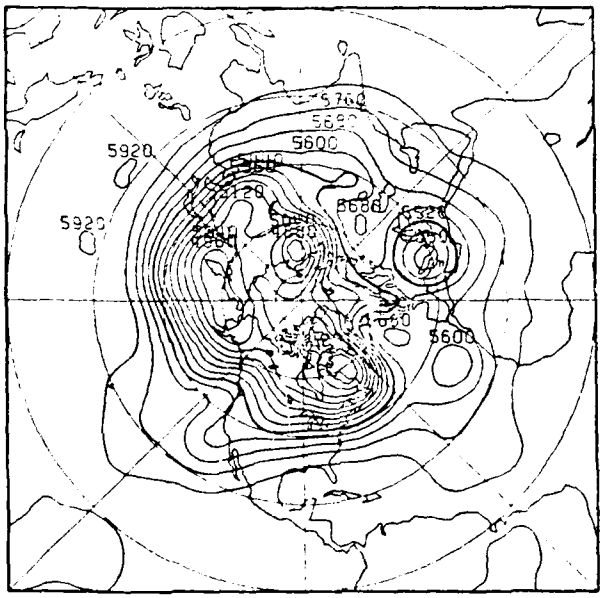


9-LAYER 2.4X3



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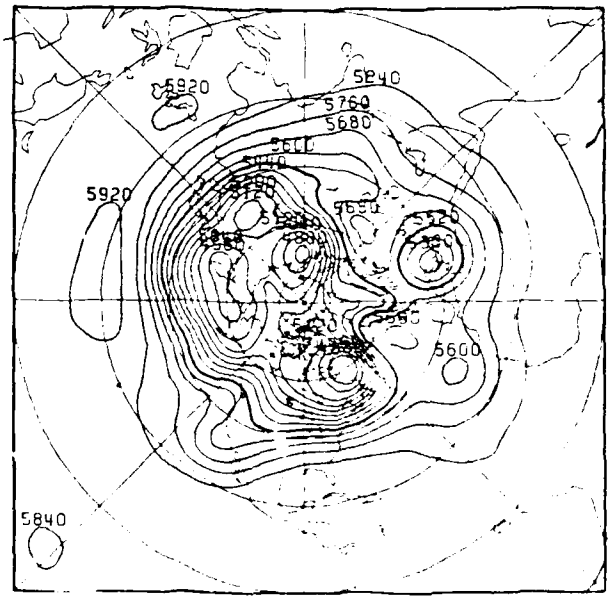

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DAY 2

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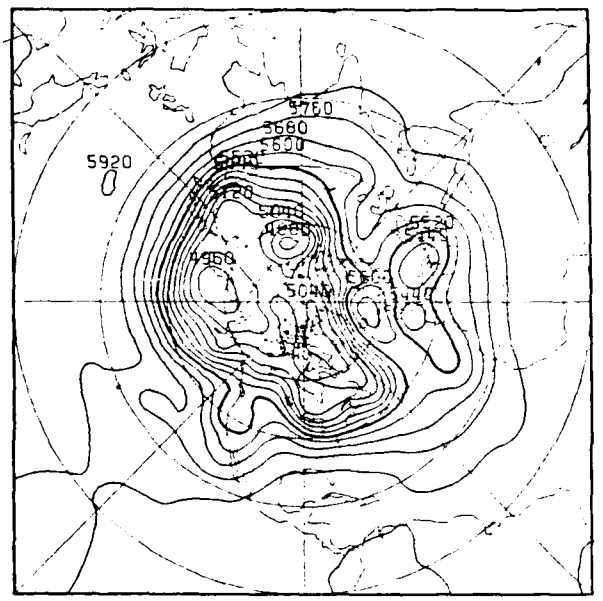

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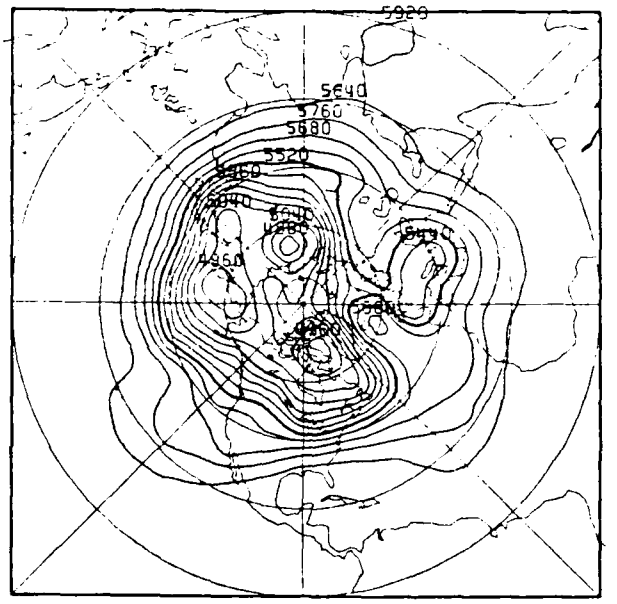
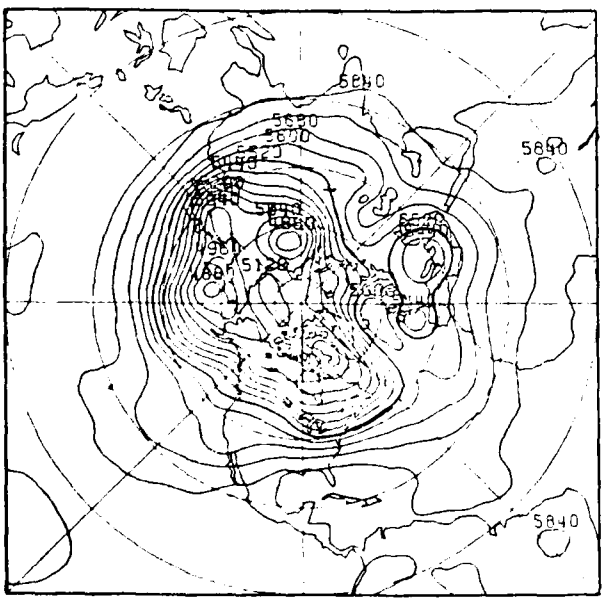


9-LAYER 2.4X3



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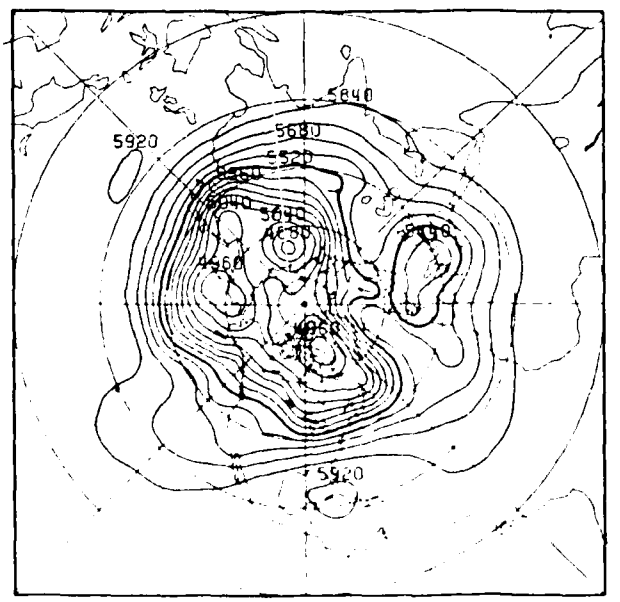

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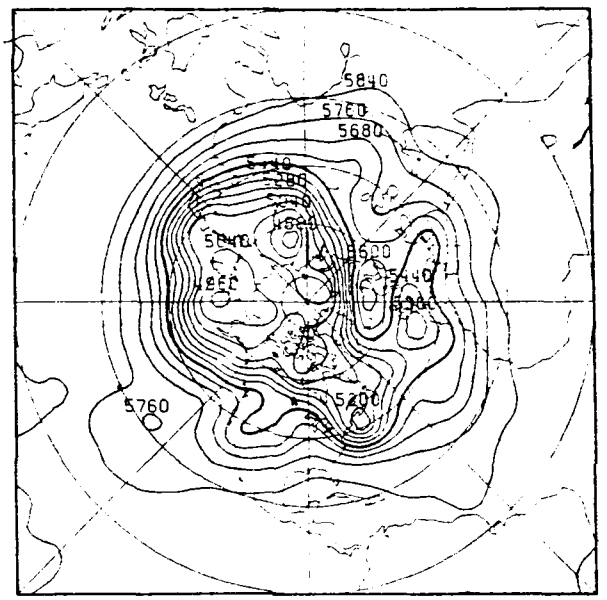
DAY 3

OBSERVED



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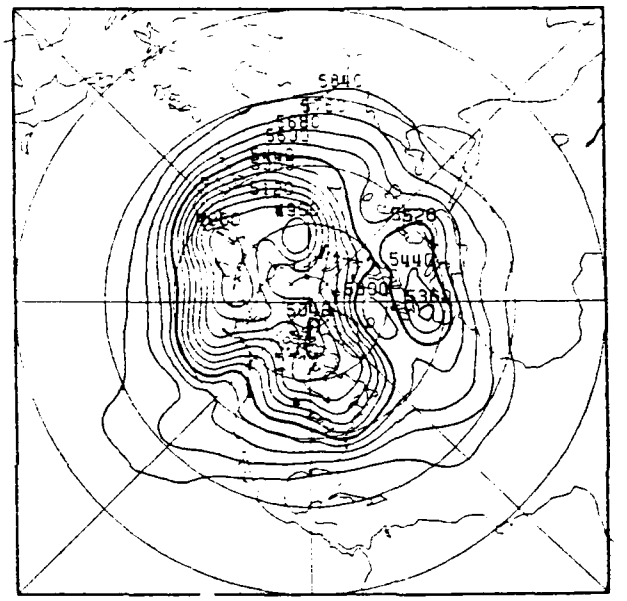
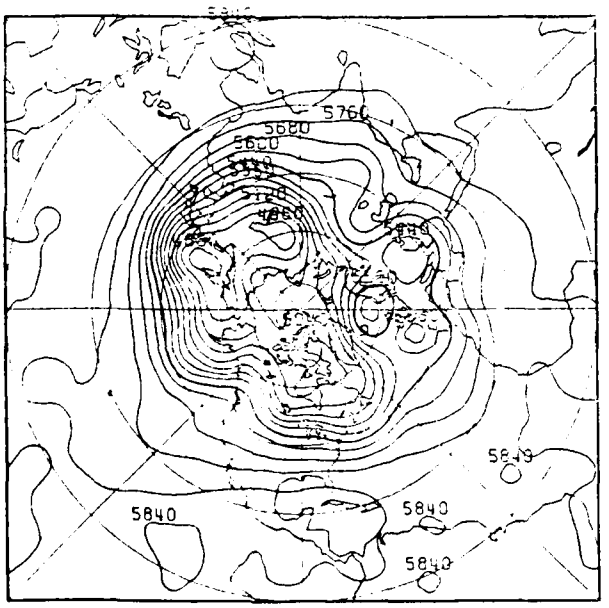
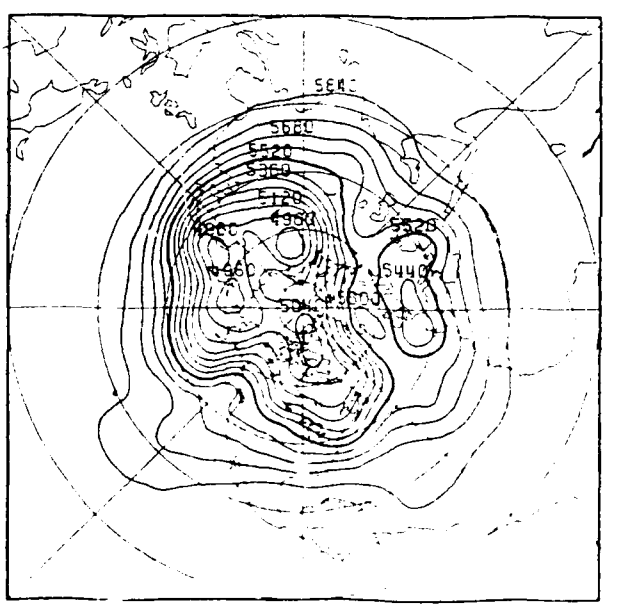


9-LAYER 2.4X3



15-LAYER 4X5



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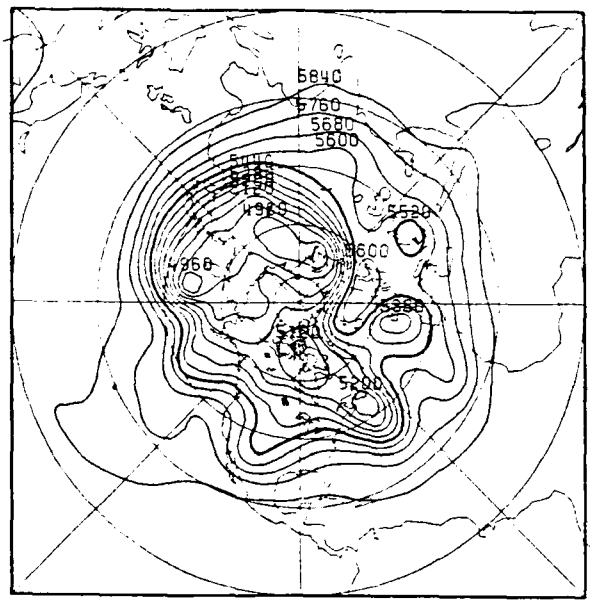
DAY 4

OBSERVED



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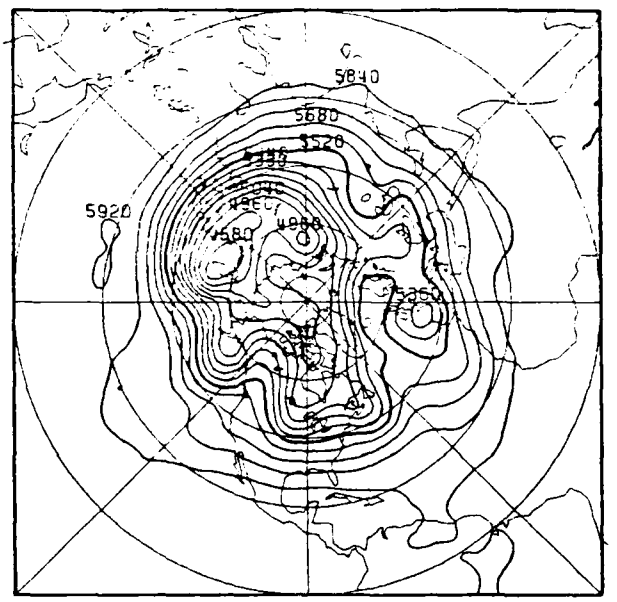
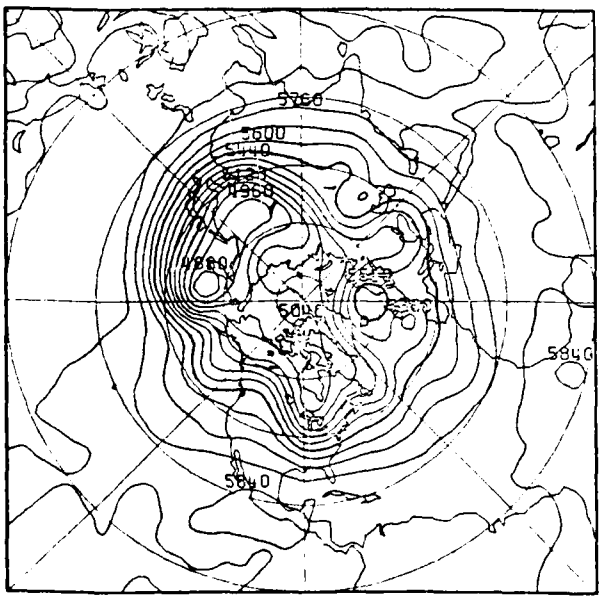


9-LAYER 2.4X3



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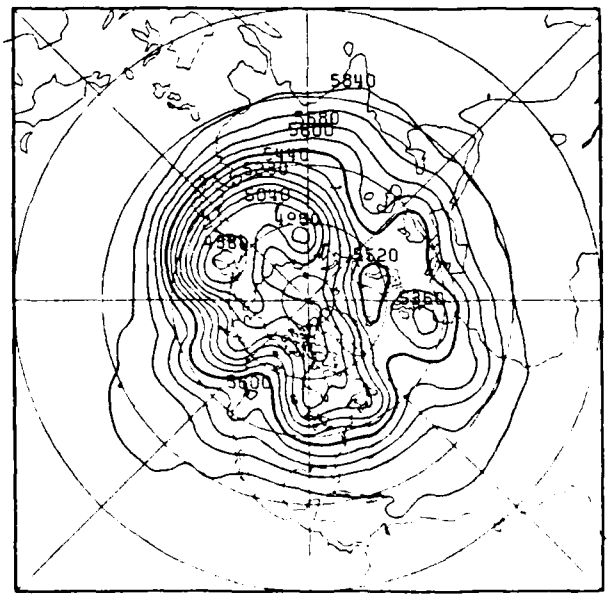

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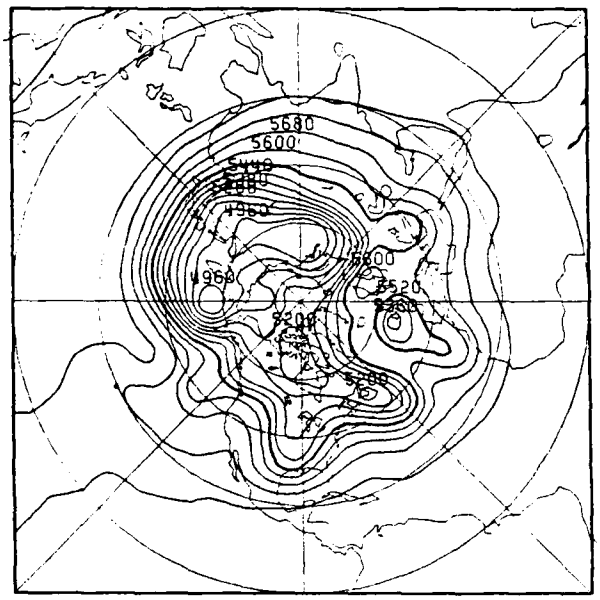
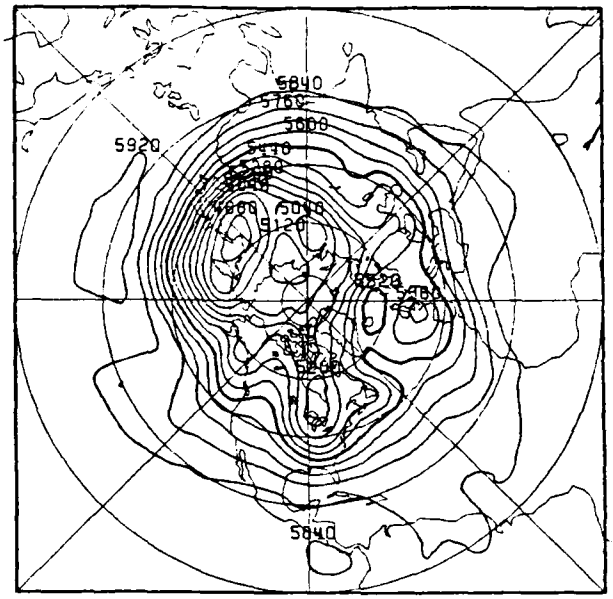
0000 GMT 21 JAN 1979

DAY 5

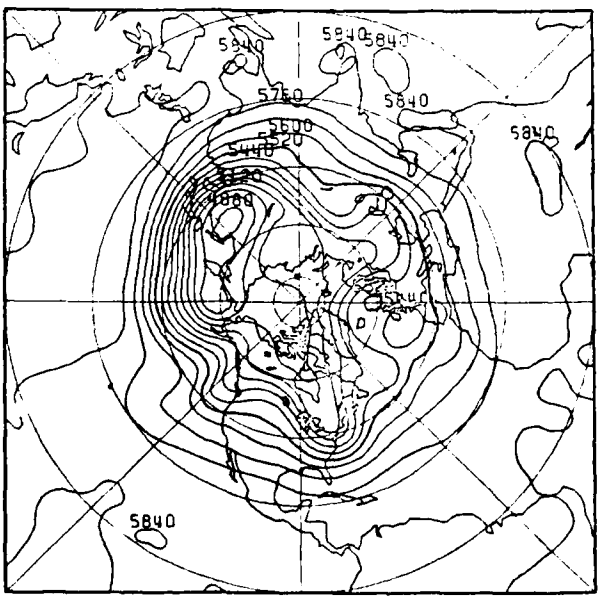
OBSERVED



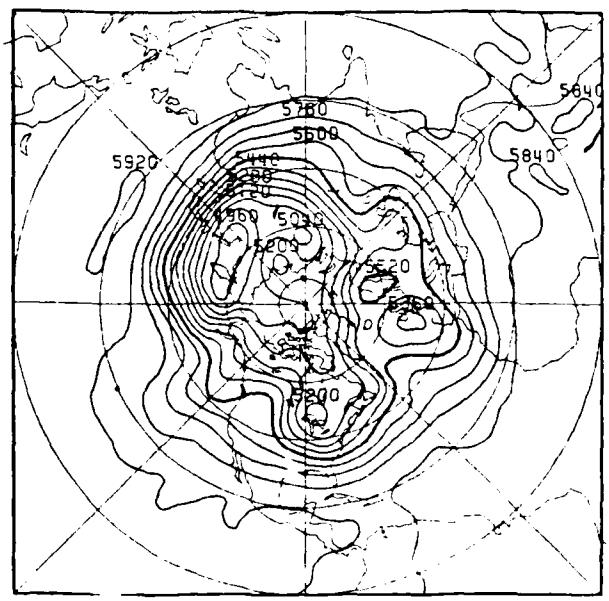
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

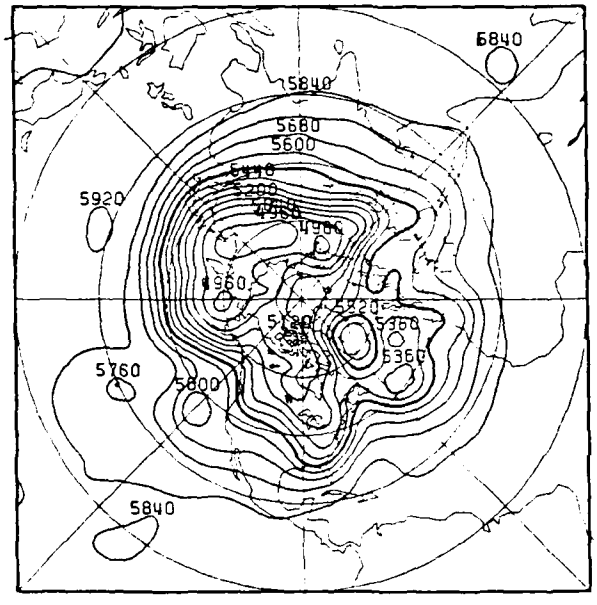


500 mb Z

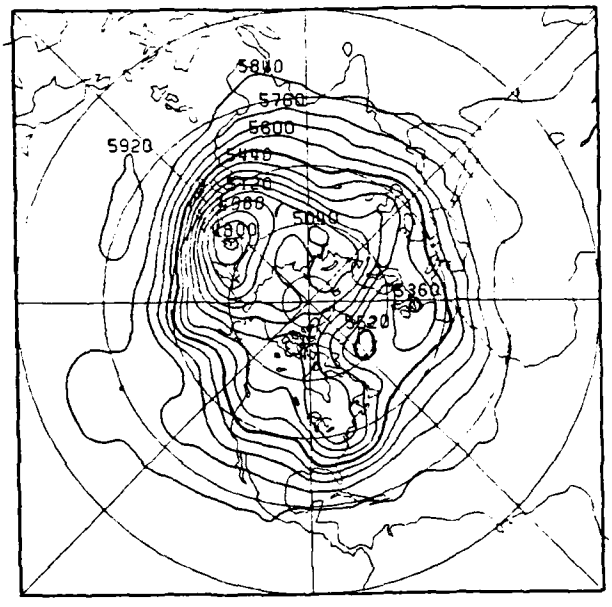
0000 GMT 22 JAN 1979

DAY 6

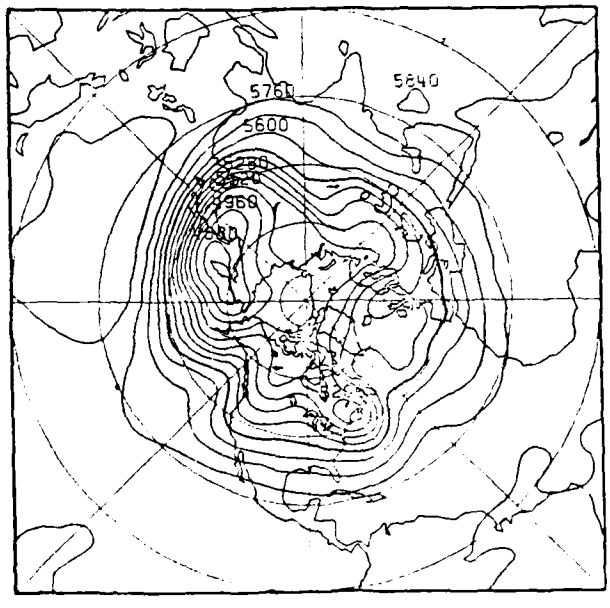
OBSERVED



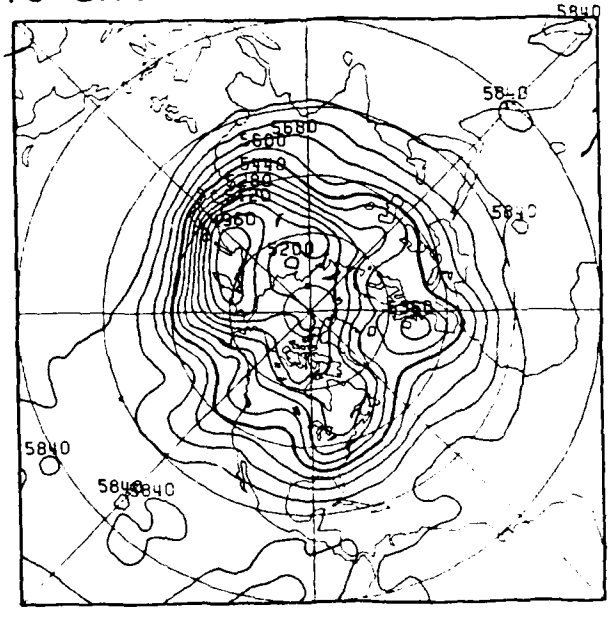
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

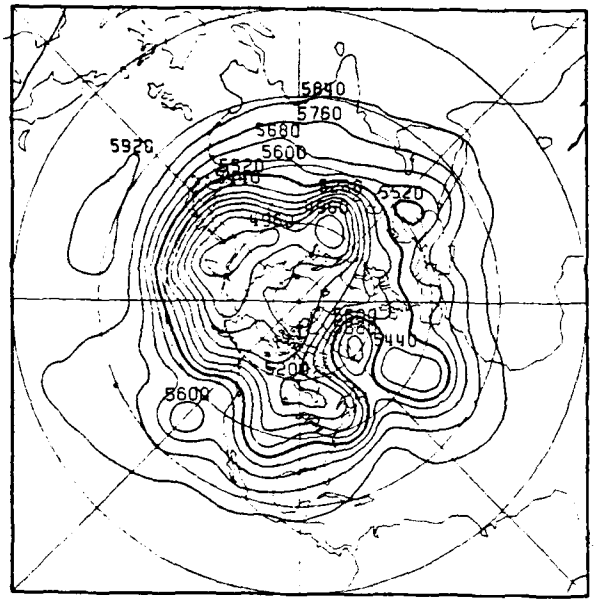


500 mb Z

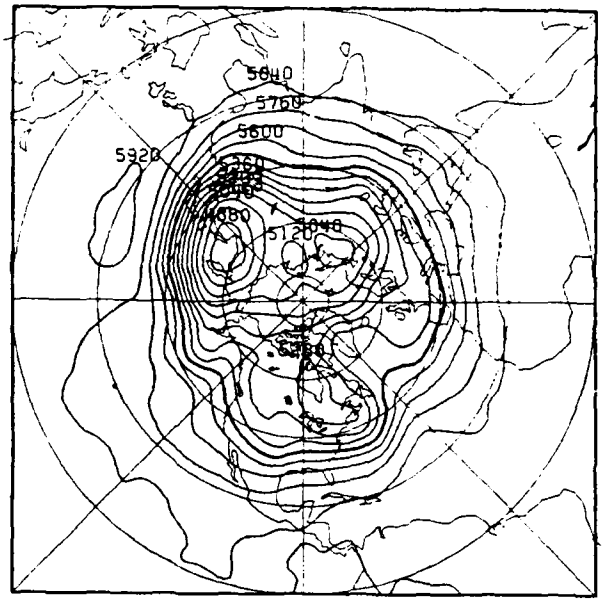
0000 GMT 23 JAN 1979

DAY 7

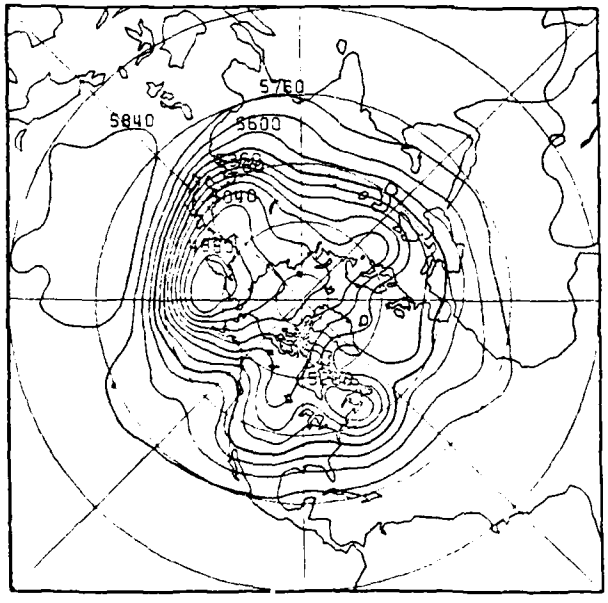
OBSERVED



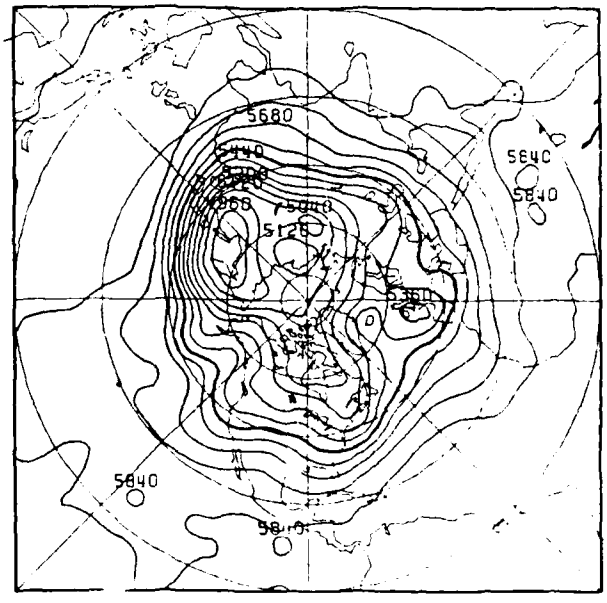
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

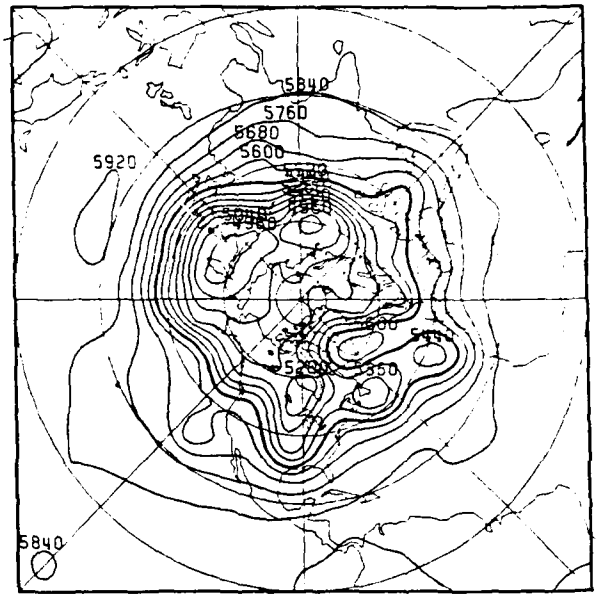


500 mb Z

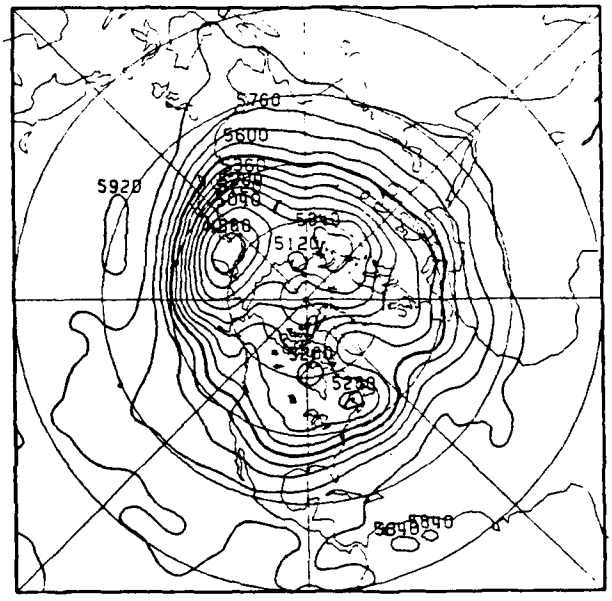
0000 GMT 24 JAN 1979

DAY 8

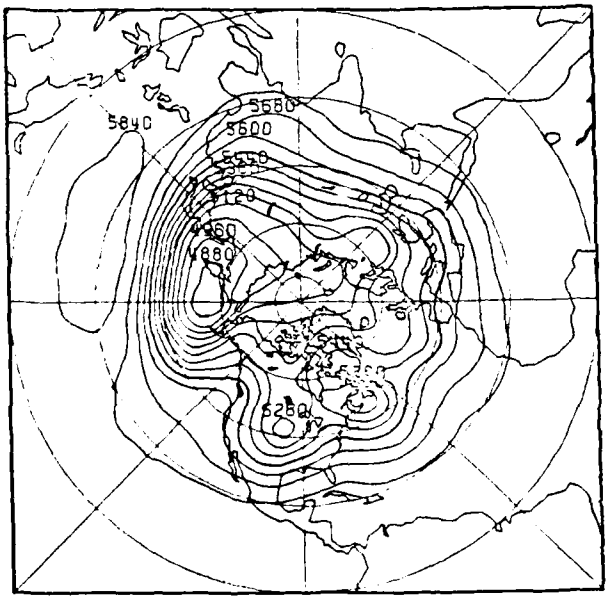
OBSERVED



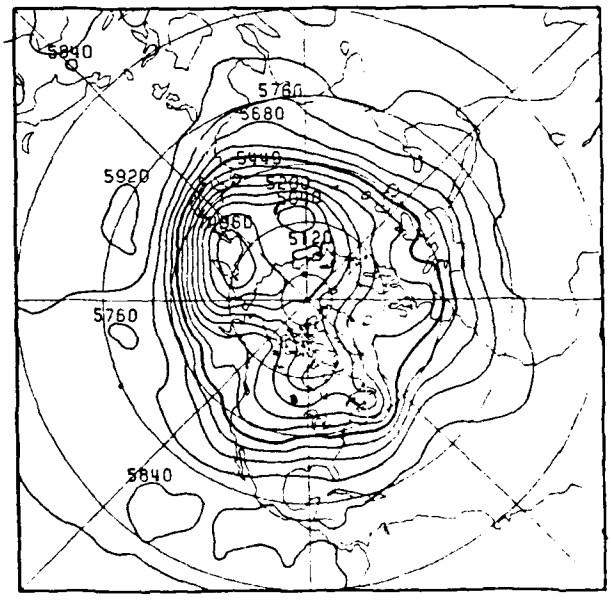
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

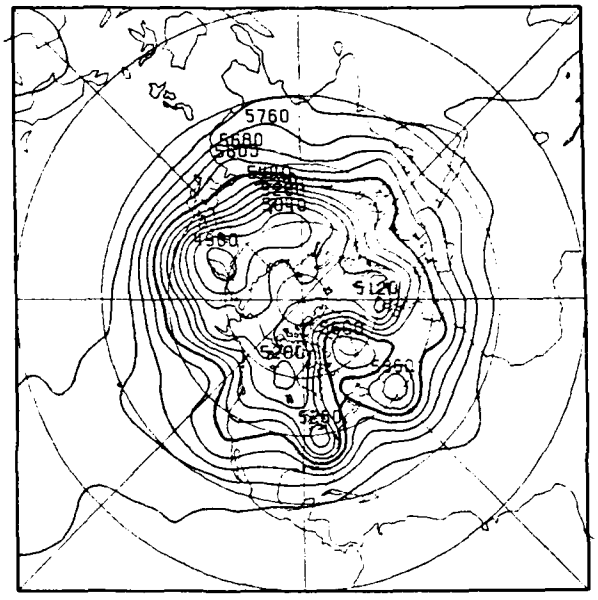


500 mb Z

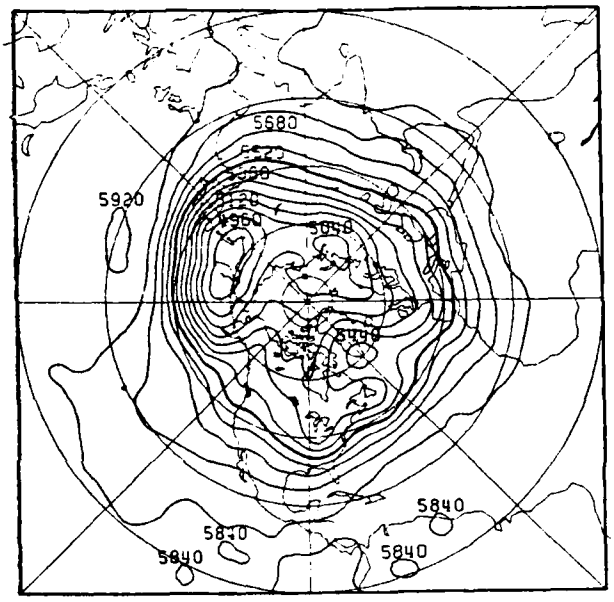
0000 GMT 25 JAN 1979

DAY 9

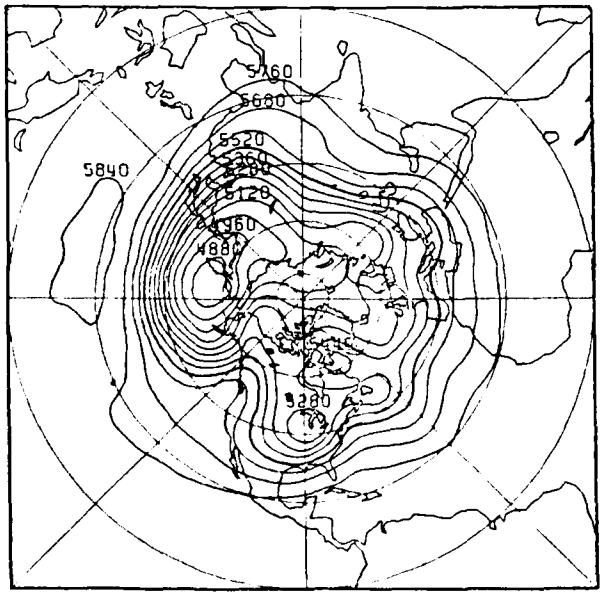
OBSERVED



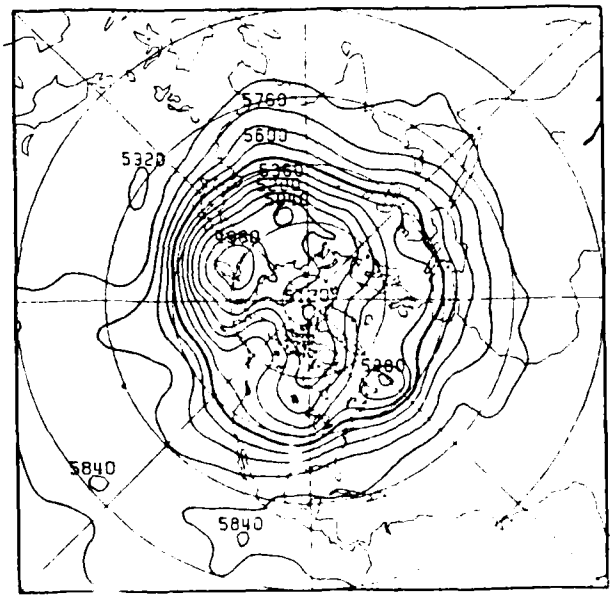
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

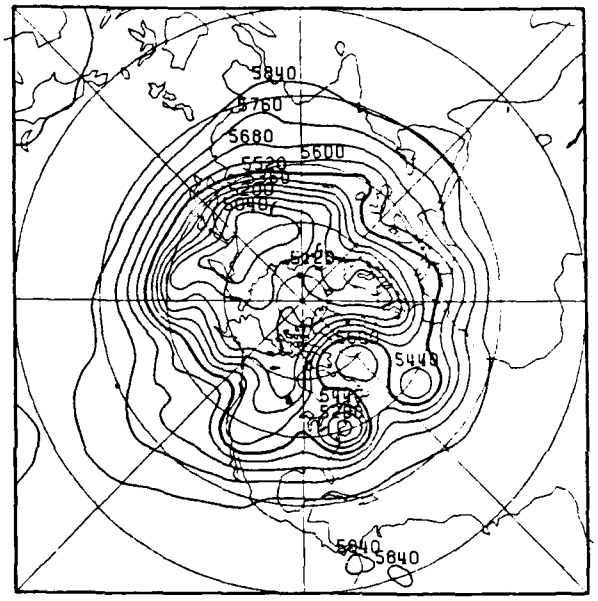


500 mb Z

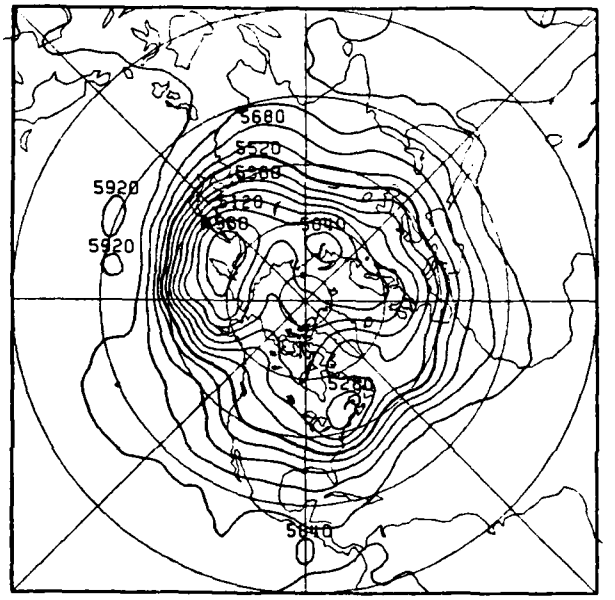
0000 GMT 26 JAN 1979

DAY 10

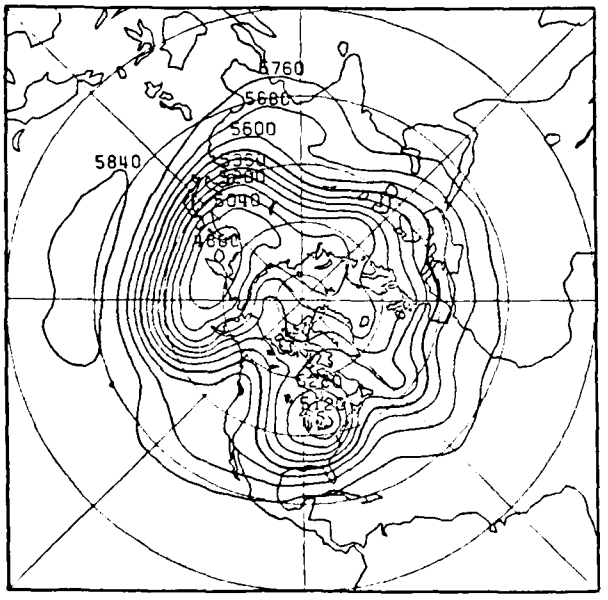
OBSERVED



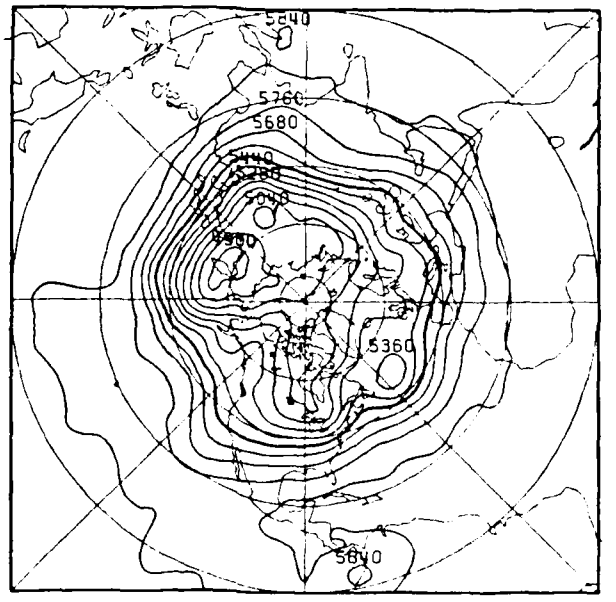
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5

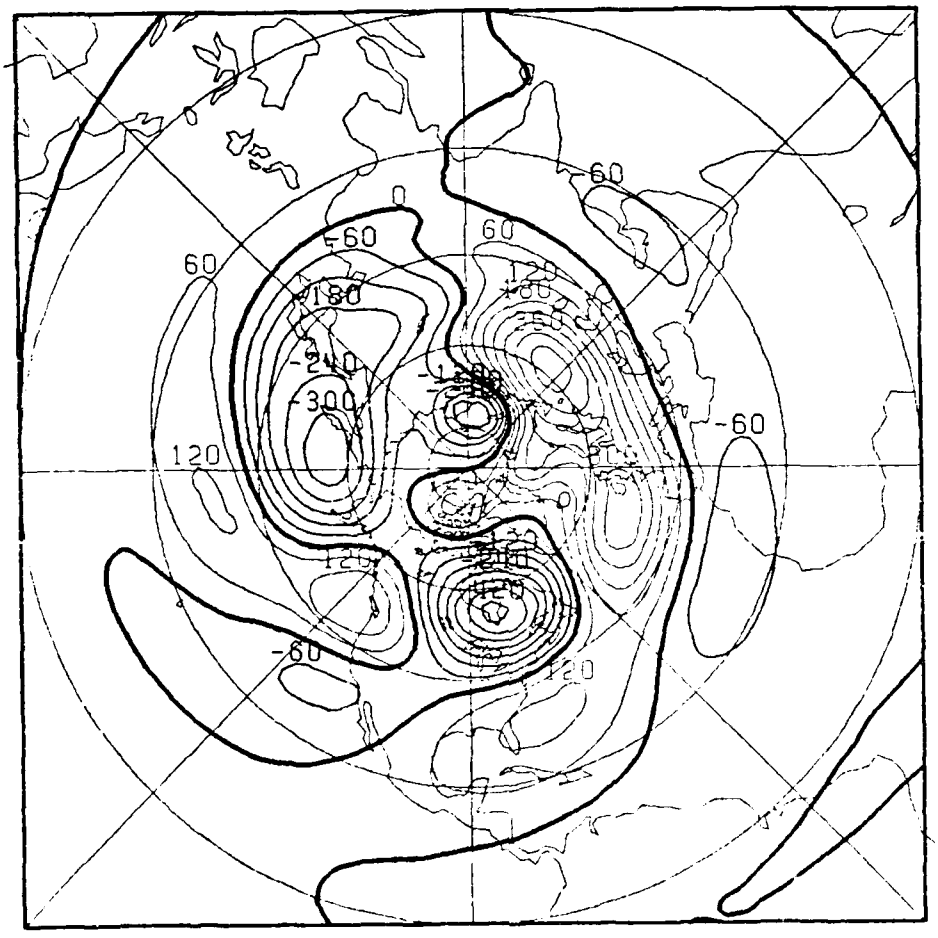


500 mb Z

WAVENUMBER S 1-4

0000 GMT 16 JAN 1979

OBSERVED



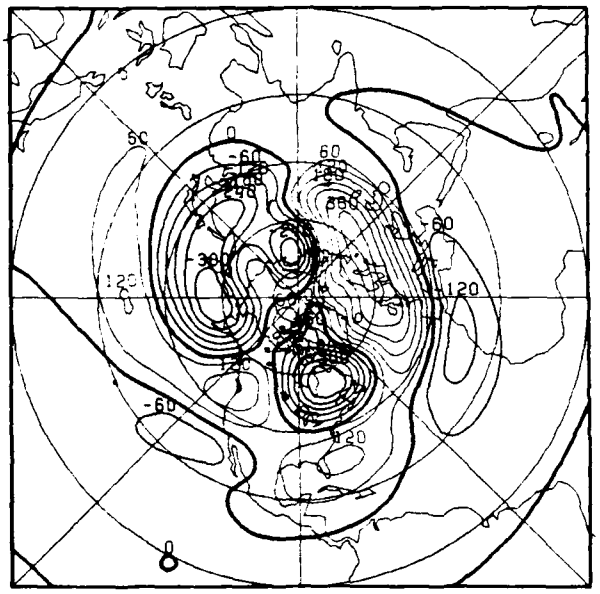
500 mb Z

WAVENUMBERS 1-4

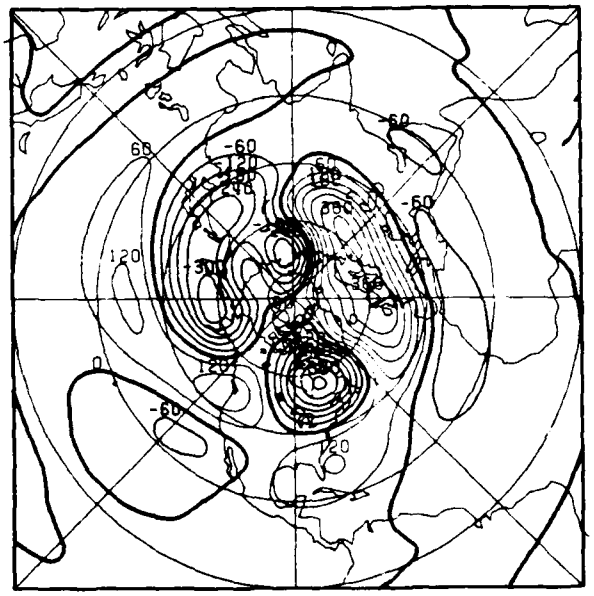
0000 GMT 17 JAN 1979

DAY 1

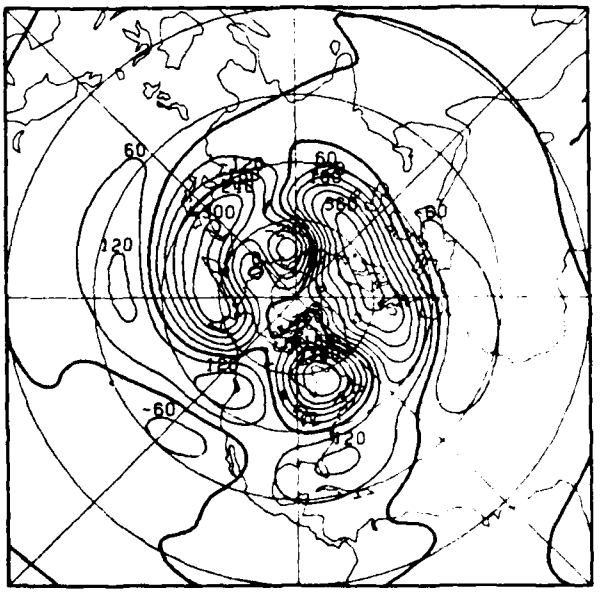
OBSERVED



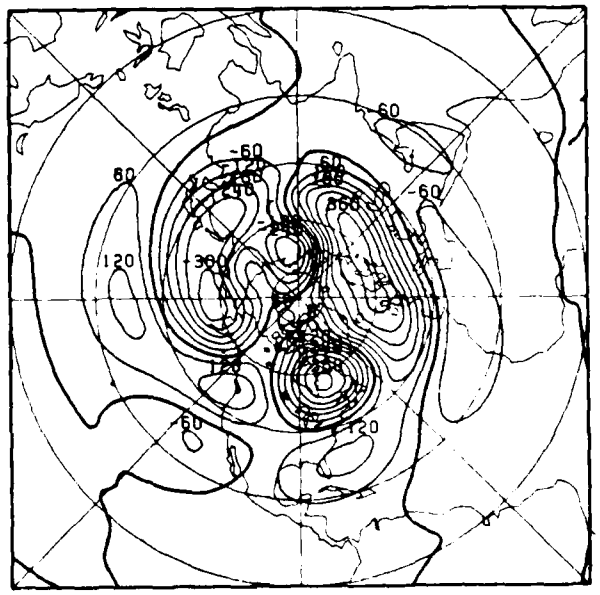
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



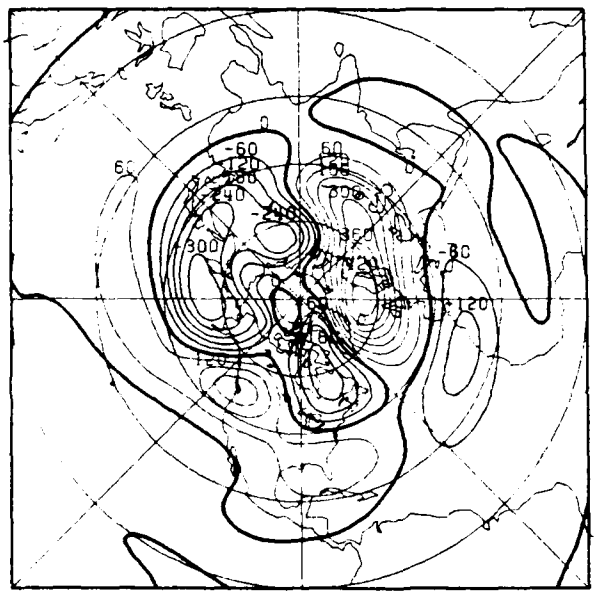
500 mb Z

WAVENUMBERS 1-4

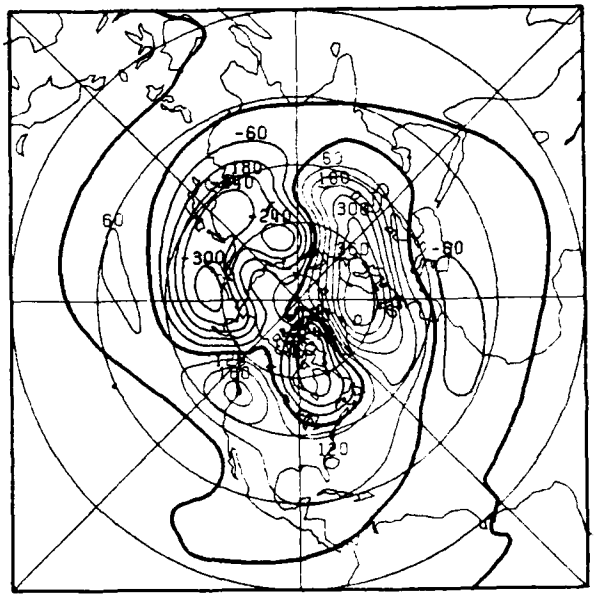
0000 GMT 18 JAN 1979

DAY 2

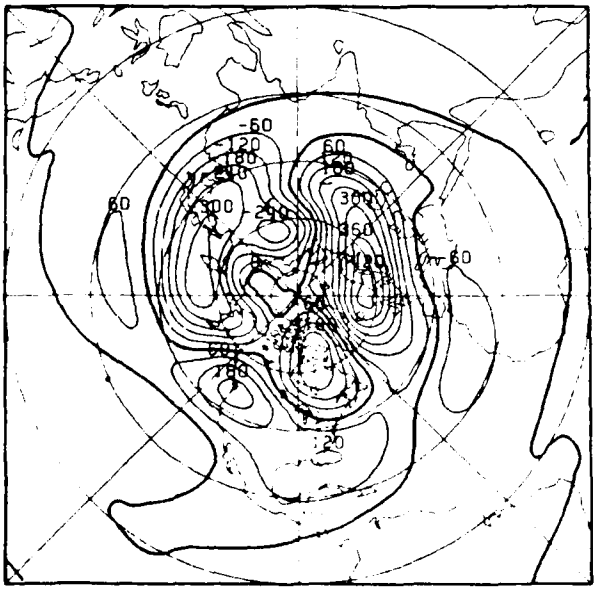
OBSERVED



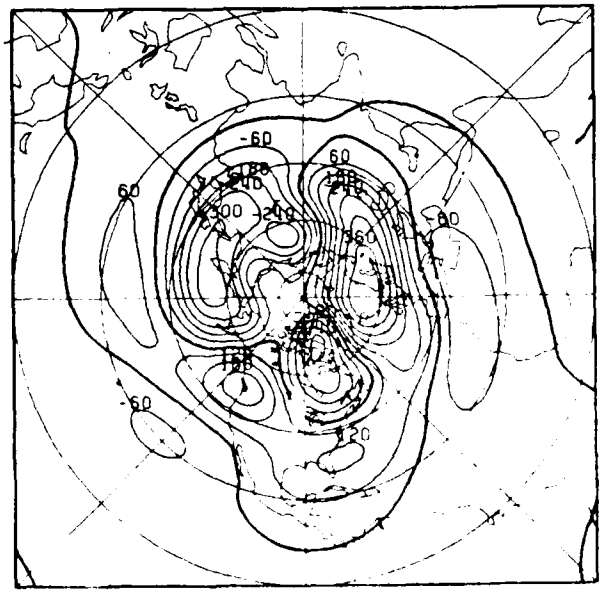
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



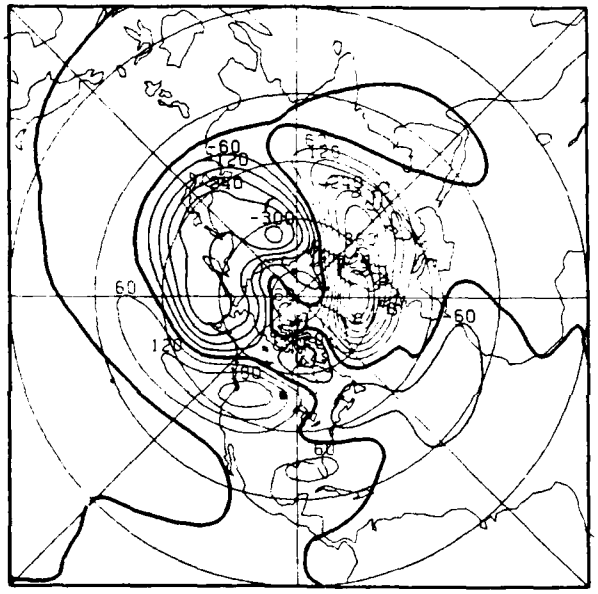
500 mb Z

WAVENUMBERS 1-4

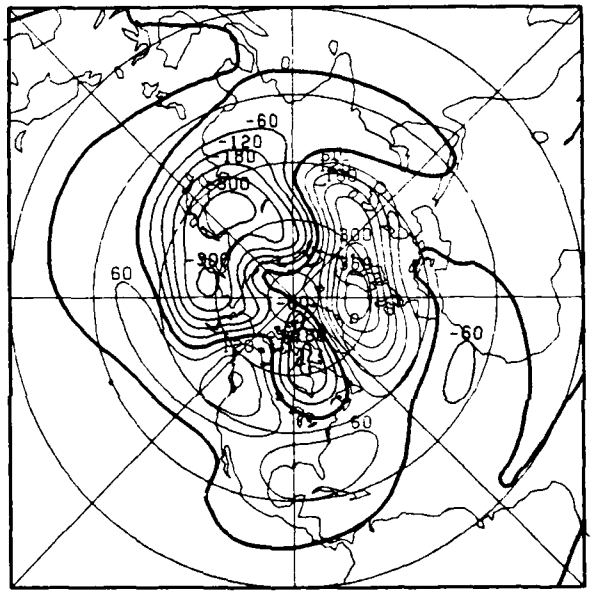
0000 GMT 19 JAN 1979

DAY 3

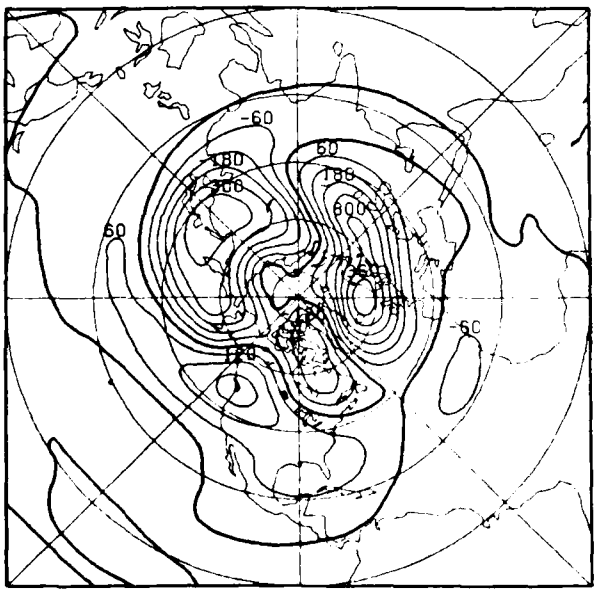
OBSERVED



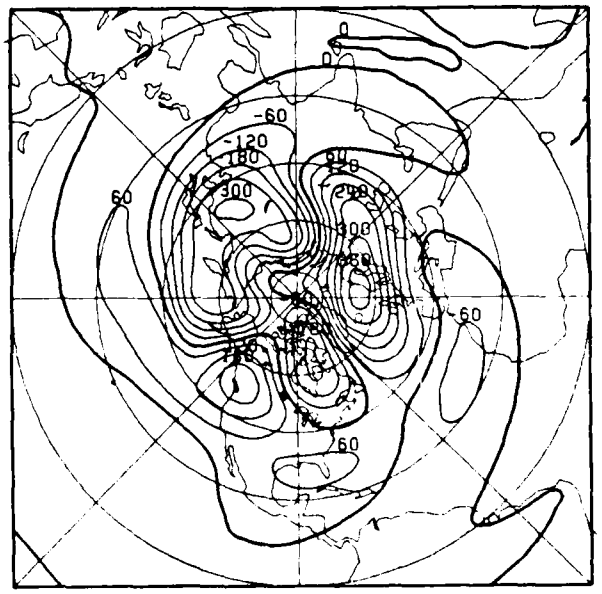
9-LAYER 4X5



9-LAYER 2.4X3

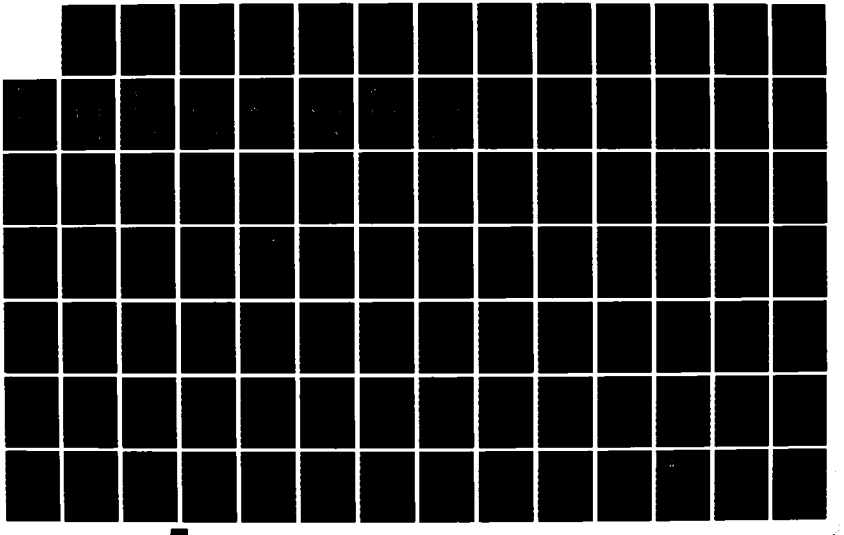


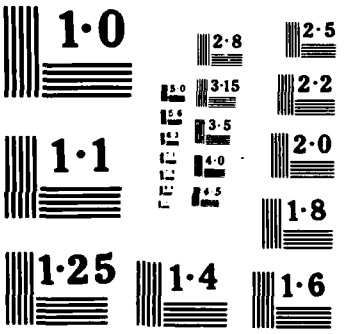
15-LAYER 4X5



AD-A170 188 MEDIUM RANGE (10 DAY) FORECASTS WITH THE UCLA GENERAL CIRCULATION MODEL..(U) CALIFORNIA UNIV LOS ANGELES DEPT OF ATMOSPHERIC SCIENCES C R MECHOSO ET AL. JAN 86 2/5

UNCLASSIFIED NEPRF-CR-86-01 N00014-80-K-0947 F/G 4/2 NL




1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
2·5
2·2
2·0
1·8
1·4
1·6

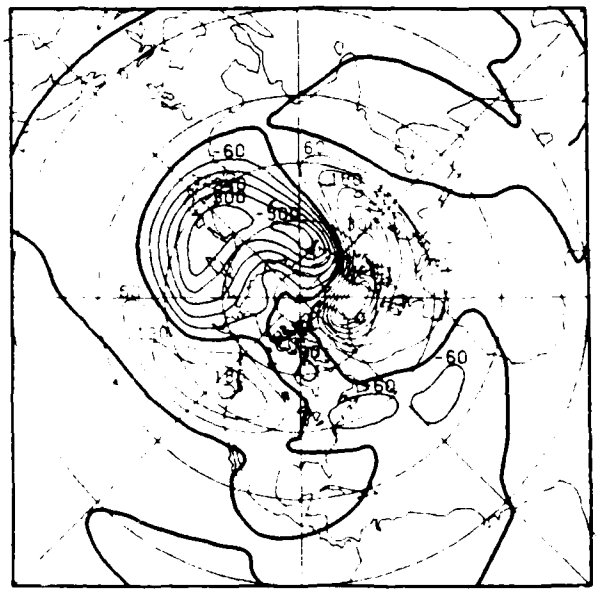
500 mb Z

WAVENUMBERS 1-4

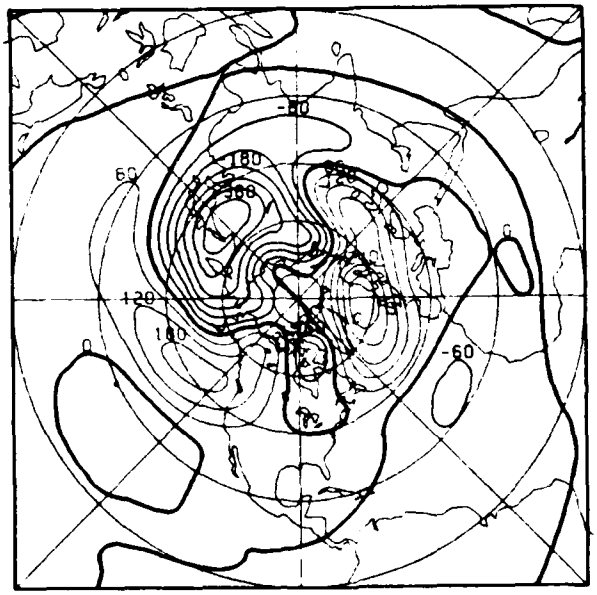
0000 GMT 20 JAN 1979

DAY 4

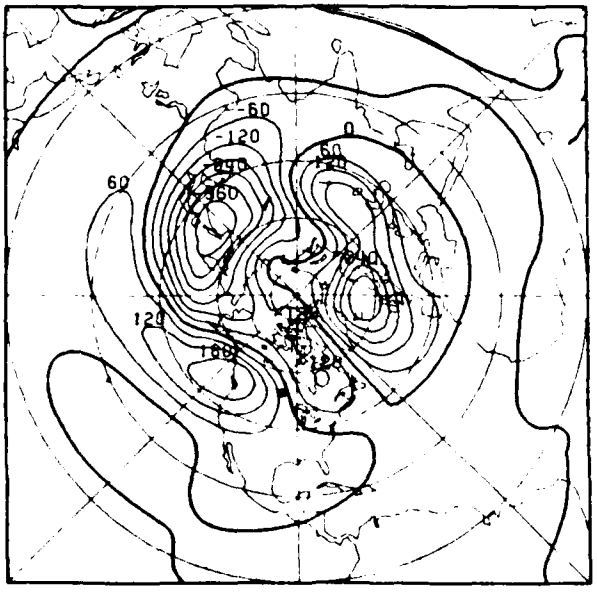
OBSERVED



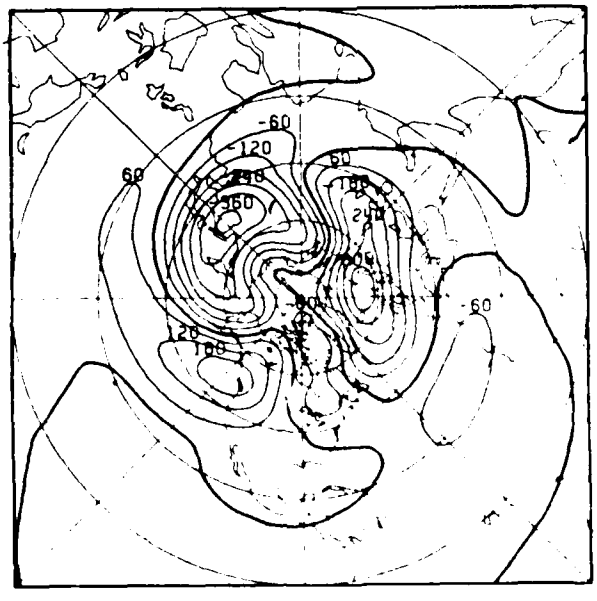
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



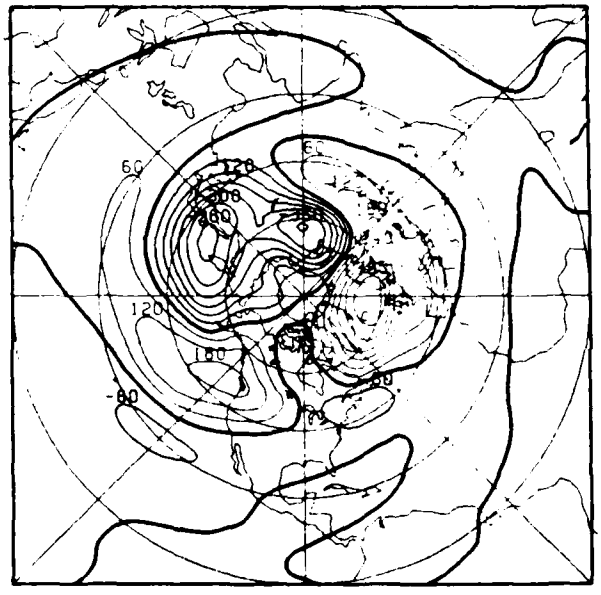
500 mb Z

WAVENUMBERS 1-4

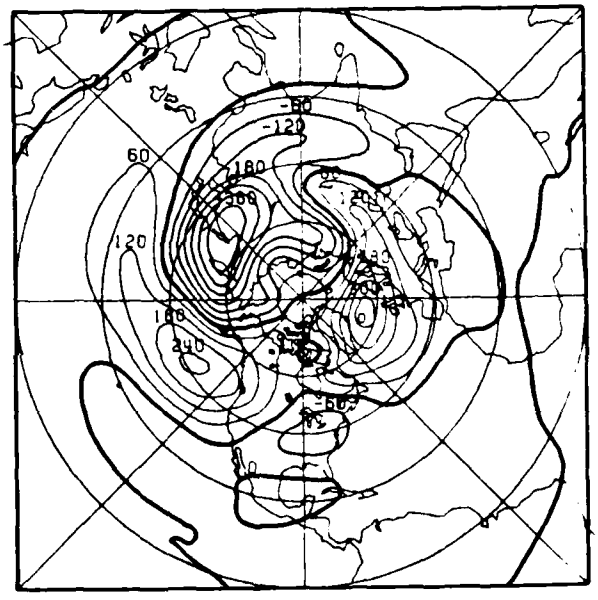
0000 GMT 21 JAN 1979

DAY 5

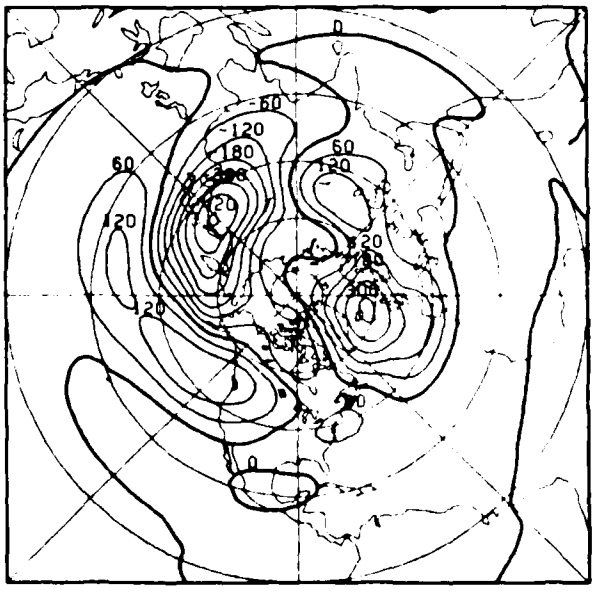
OBSERVED



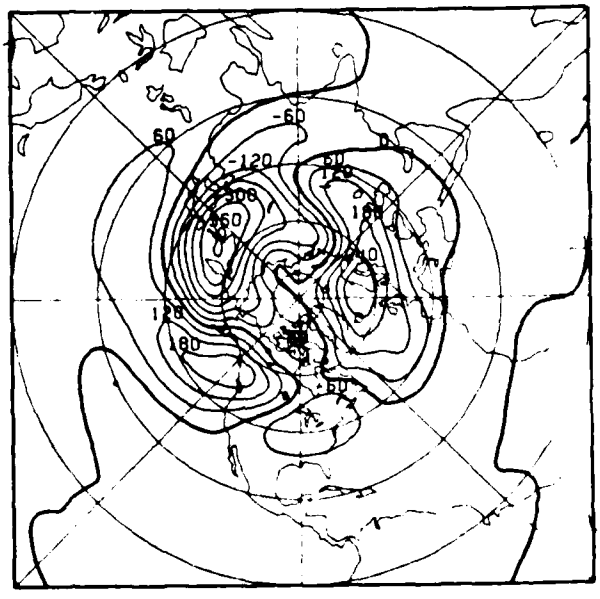
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



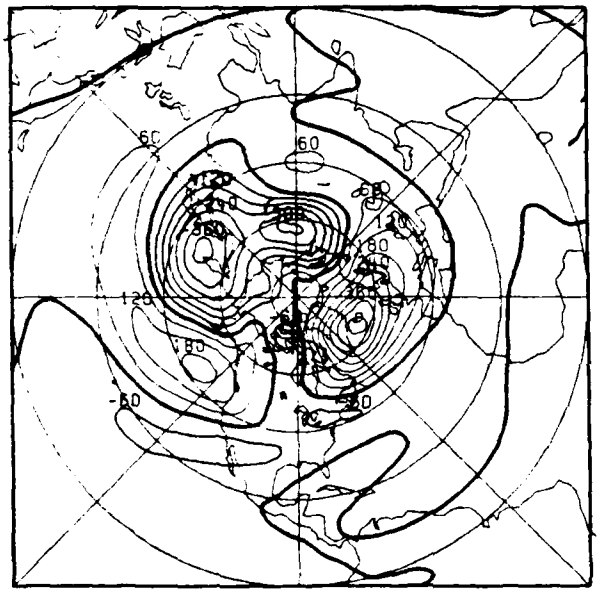
500 mb Z

WAVENUMBERS 1-4

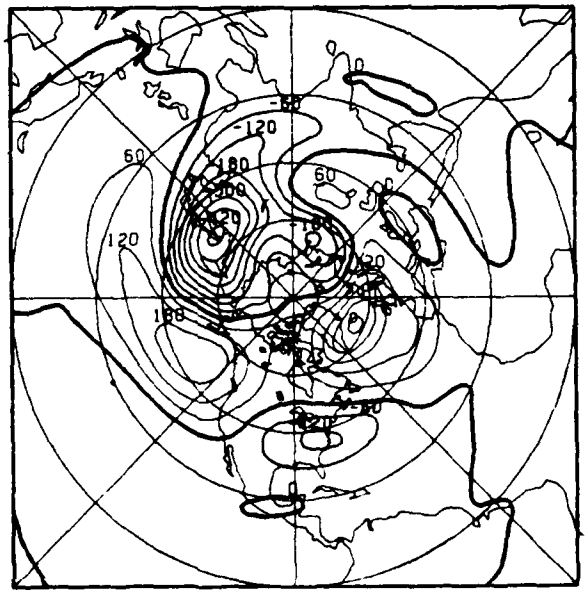
0000 GMT 22 JAN 1979

DAY 6

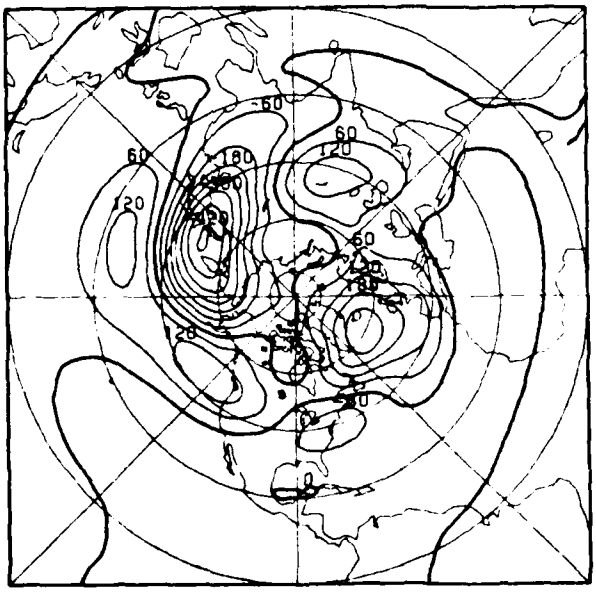
OBSERVED



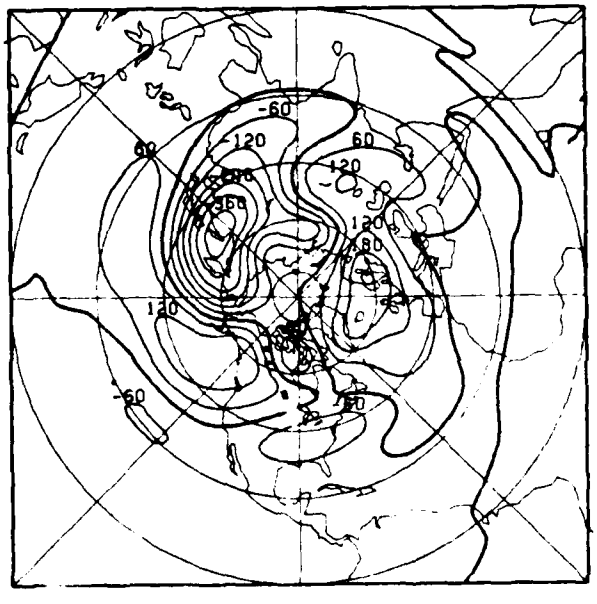
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



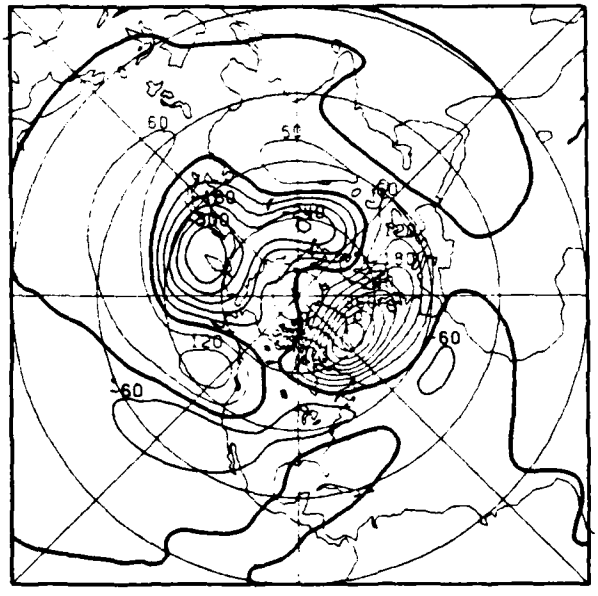
500 mb Z

WAVENUMBERS 1-4

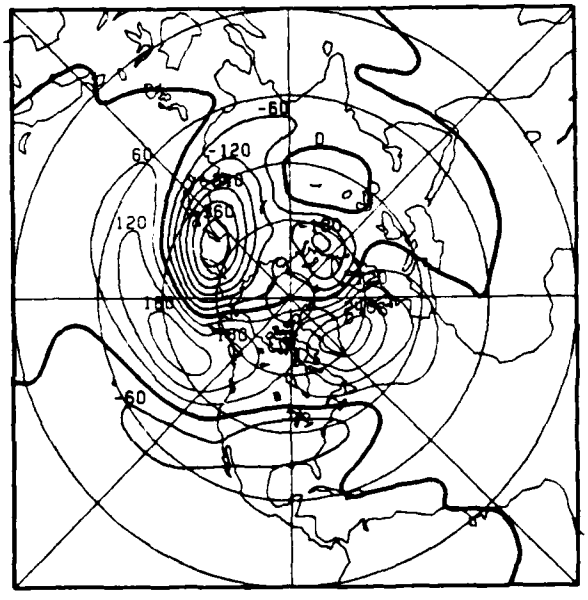
0000 GMT 23 JAN 1979

DAY 7

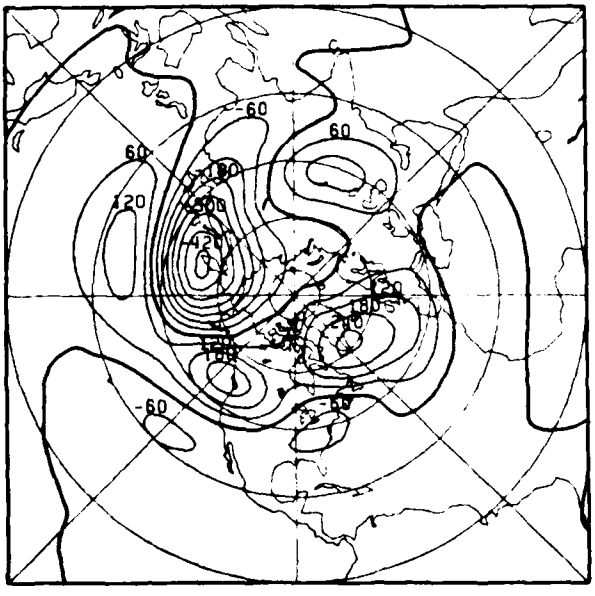
OBSERVED



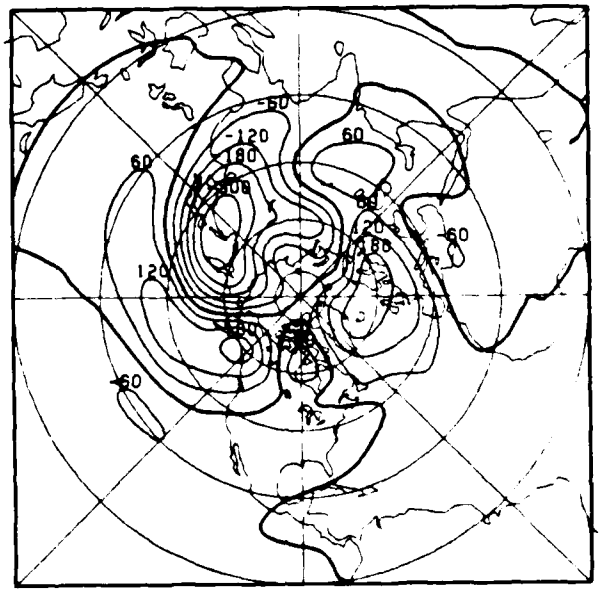
9-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 4X5



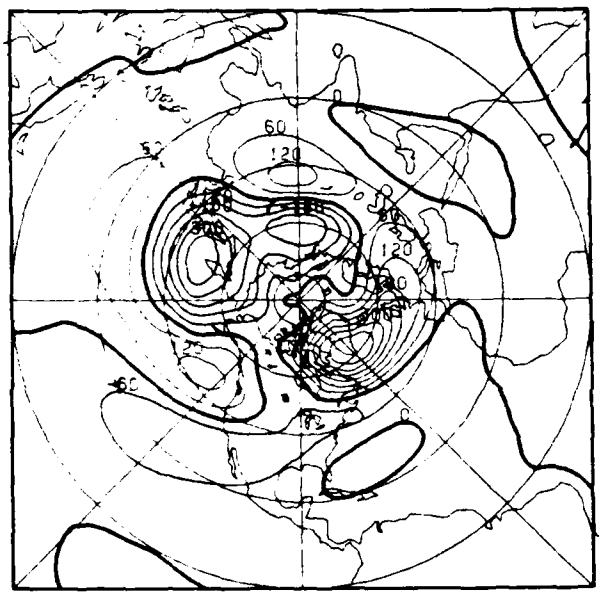
500 mb Z

WAVENUMBERS 1-4

0000 GMT 24 JAN 1979

DAY 8

OBSERVED



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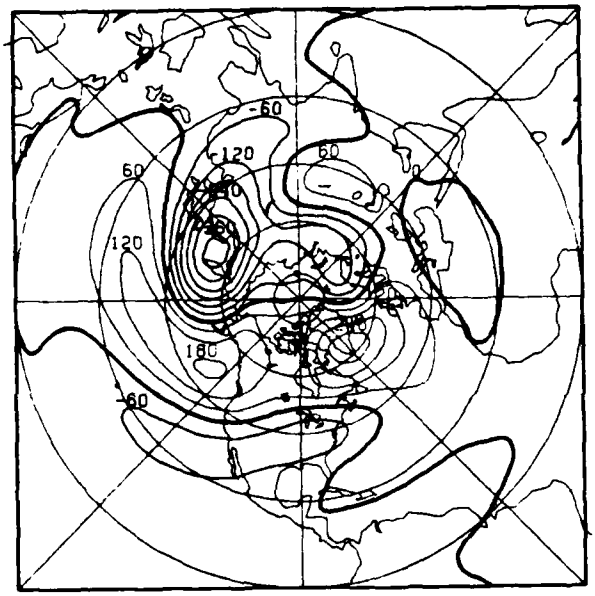
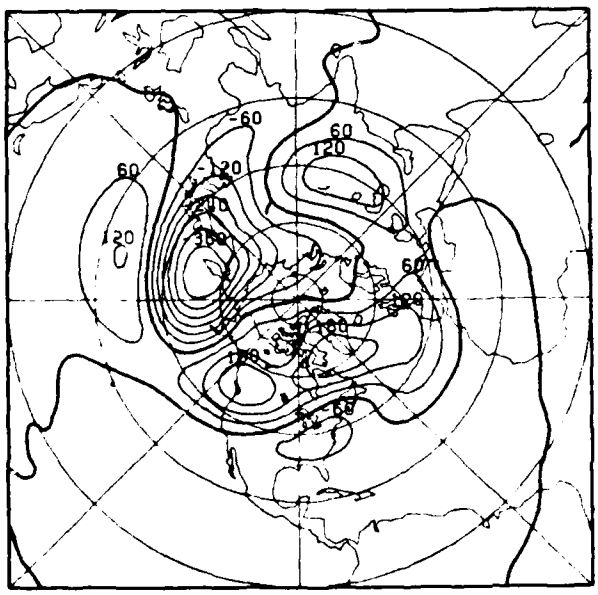


9-LAYER 2.4X3



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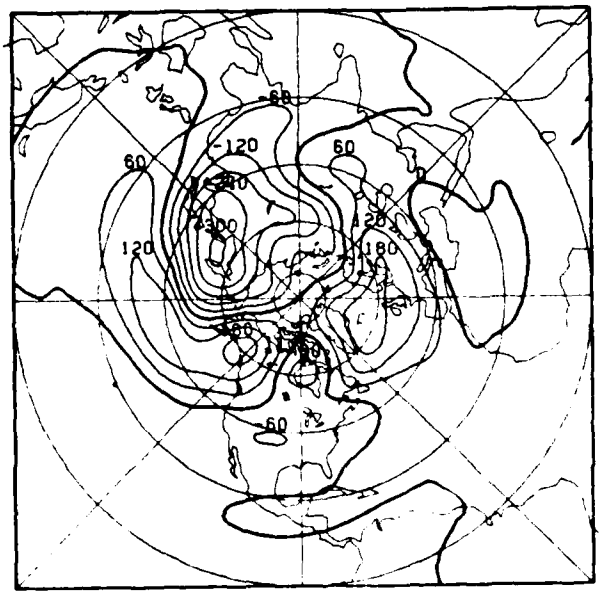


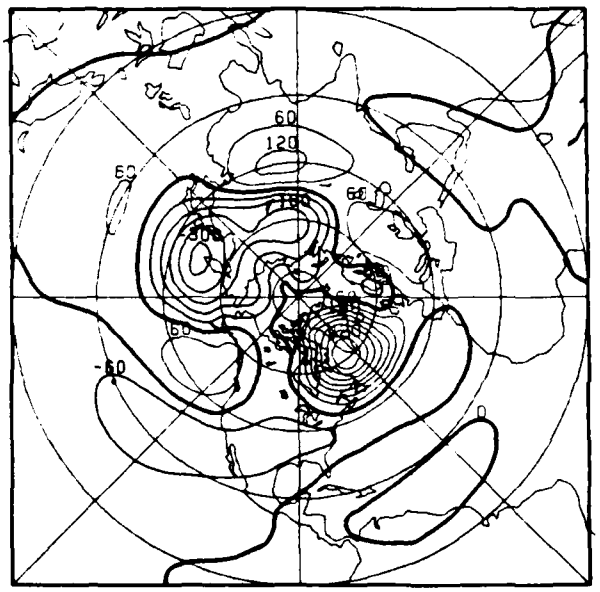
500 mb Z

WAVENUMBERS 1-4

0000 GMT 25 JAN 1979

DAY 9

OBSERVED



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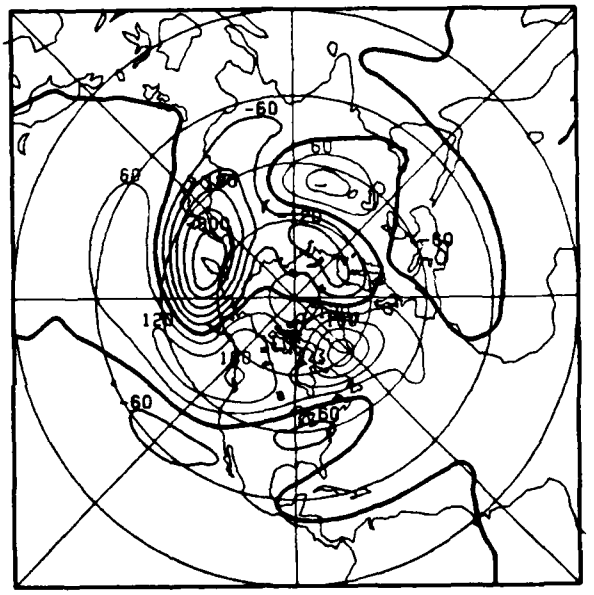

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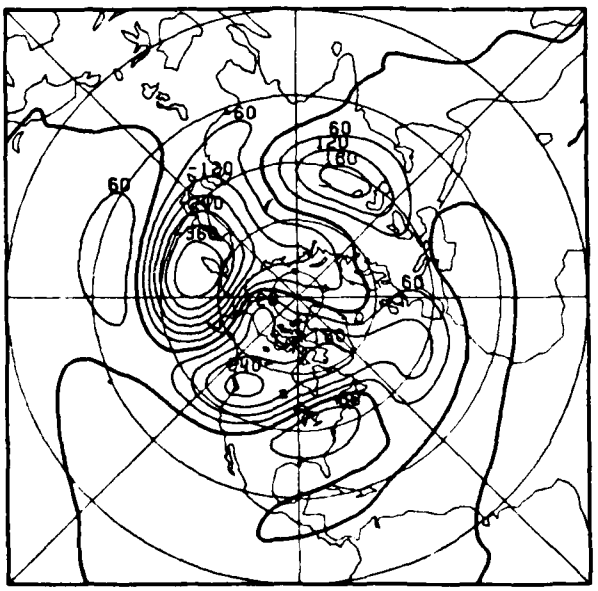

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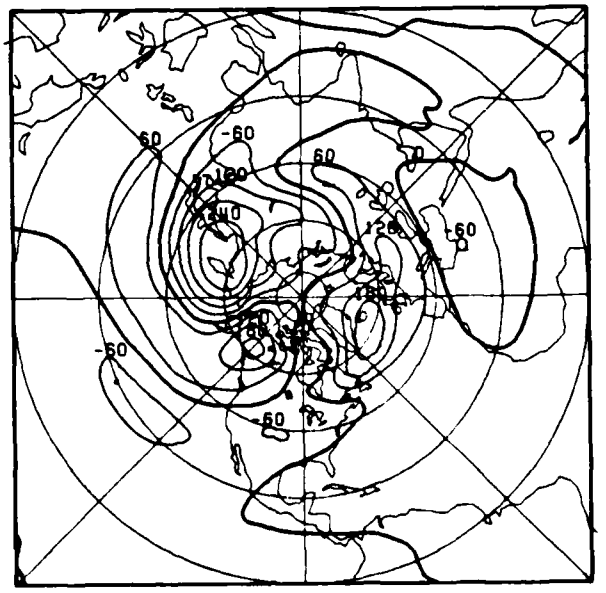


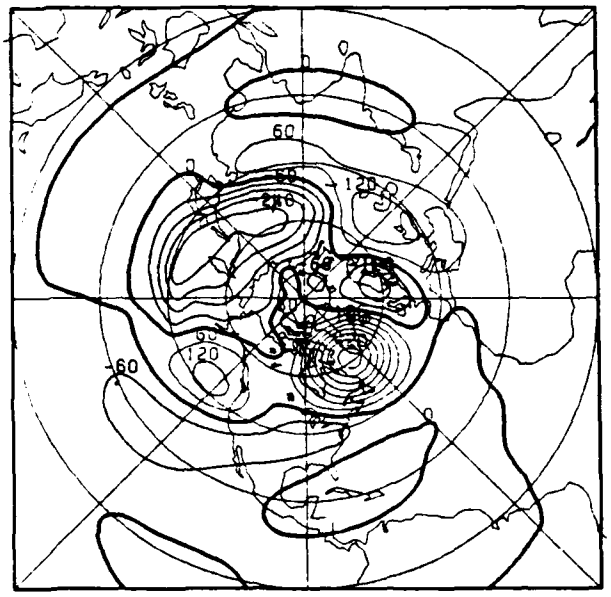
500 mb Z

WAVENUMBERS 1-4

0000 GMT 26 JAN 1979

DAY 10

OBSERVED



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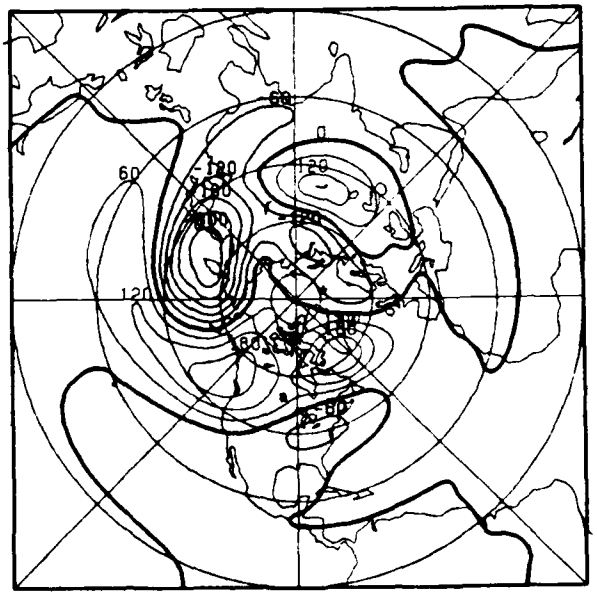

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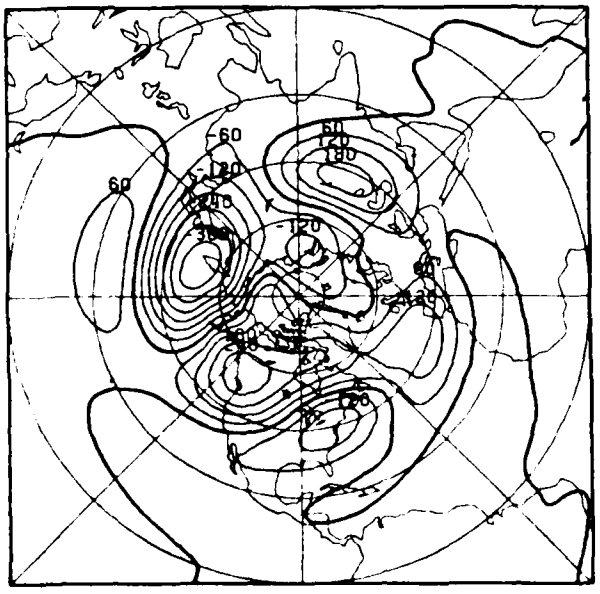

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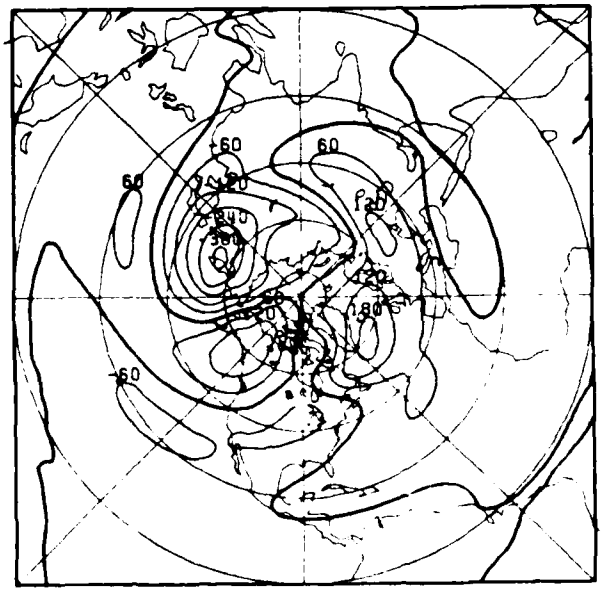
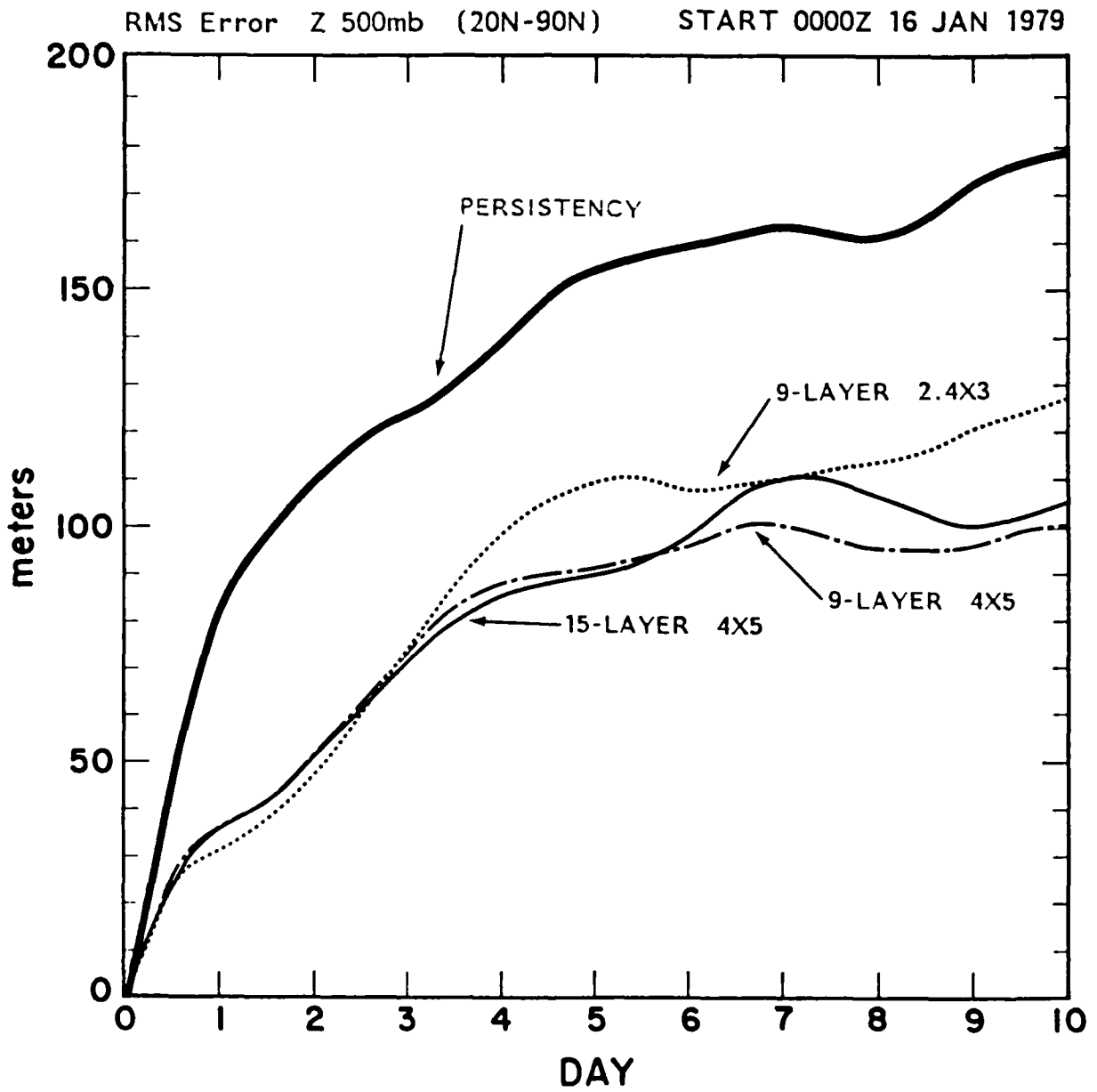



RMS Error Z 500mb (20N-90N)
START 0000Z 16 JAN 1979
200
150
100
50
0
meters
PERSISTENCY
9-LAYER 2.4X3
9-LAYER 4X5
15-LAYER 4X5
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

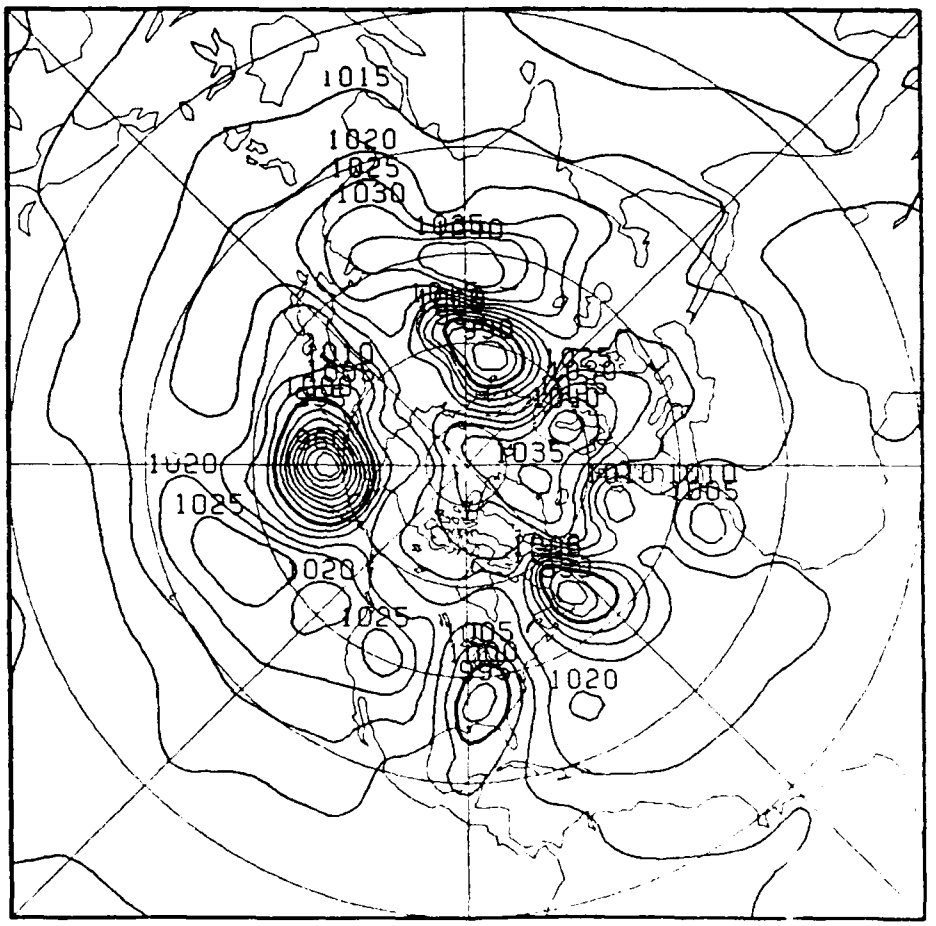
0000 GMT

21 JANUARY 1979

SLP

0000 GMT 21 JAN 1979

OBSERVED



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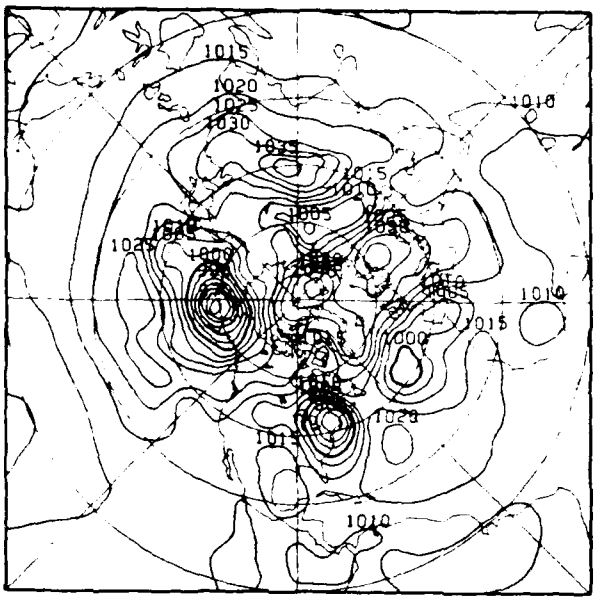


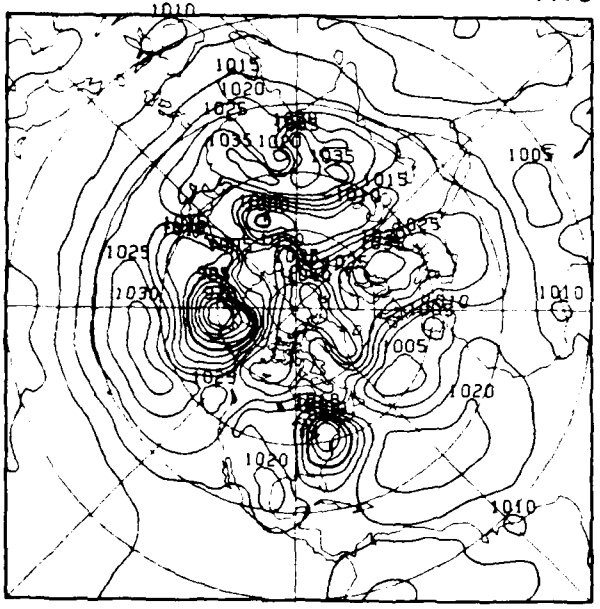
SLP

0000 GMT

22 JAN 1979

DAY 1

9-LAYER 4X5



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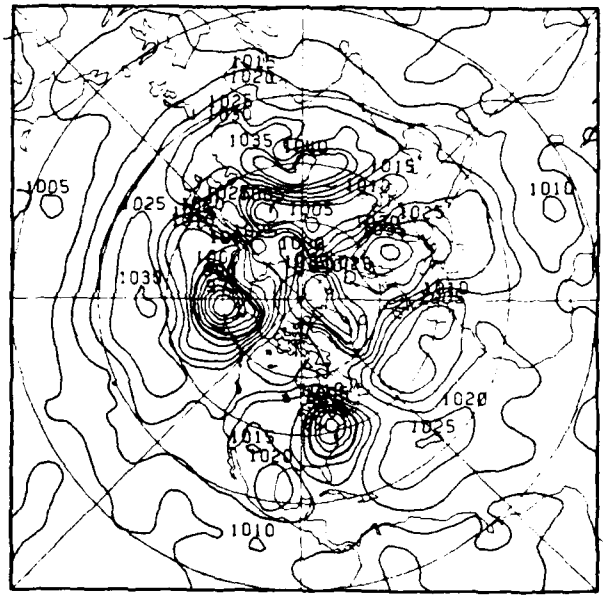
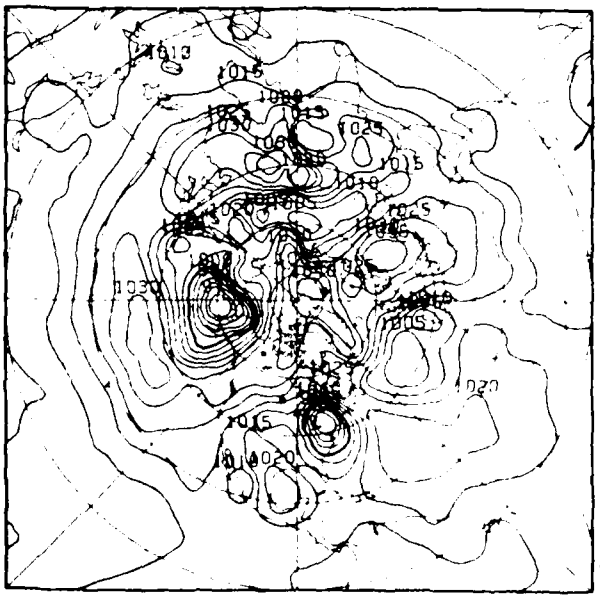
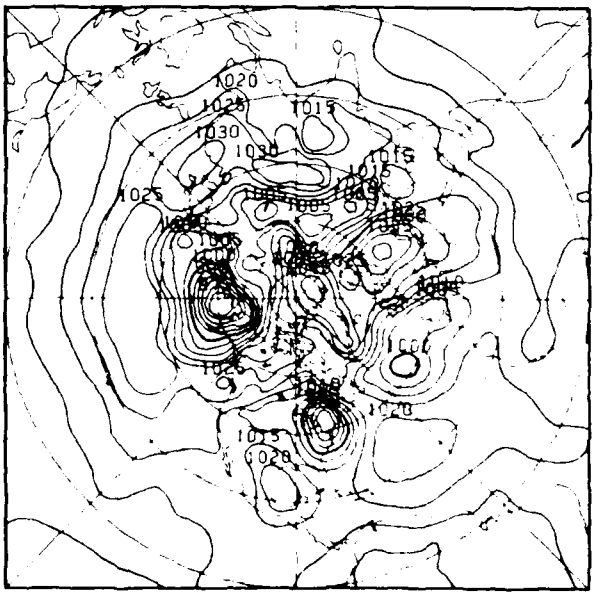


9-LAYER 2.4X3



15-LAYER 2.4X3



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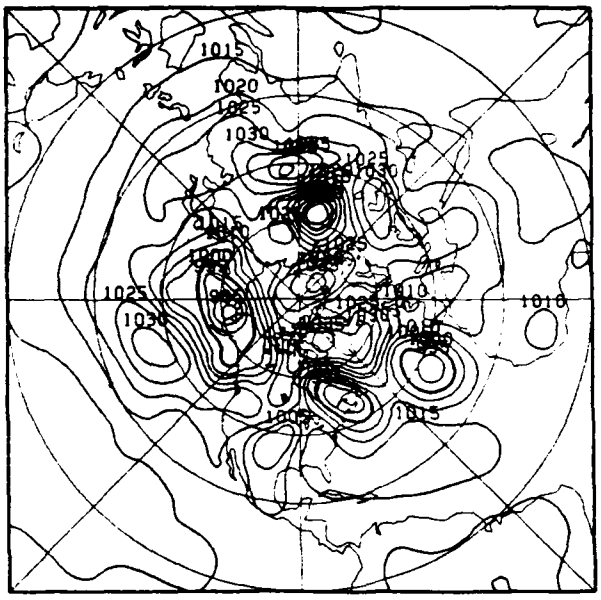


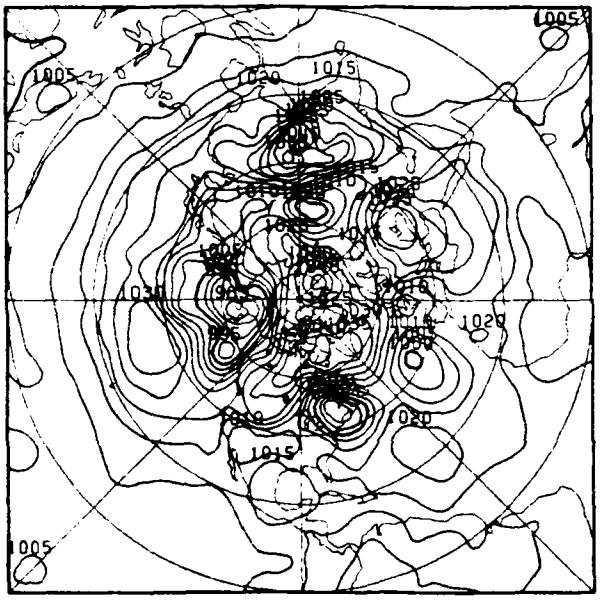
SLP

0000 GMT

23 JAN 1979

DAY 2

9-LAYER 4X5



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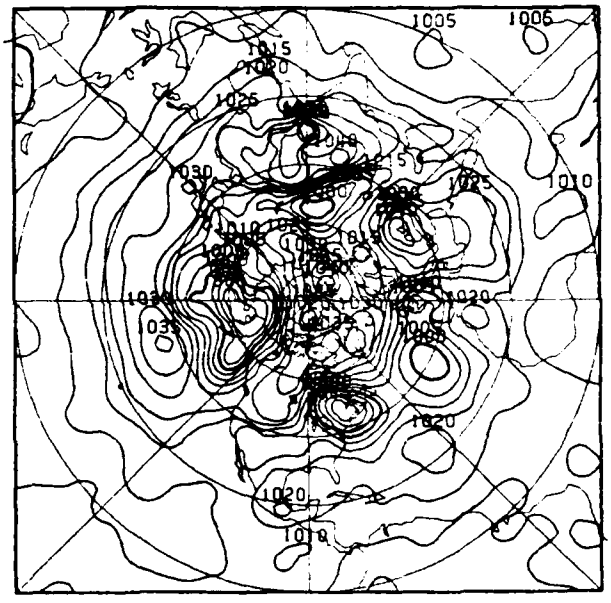

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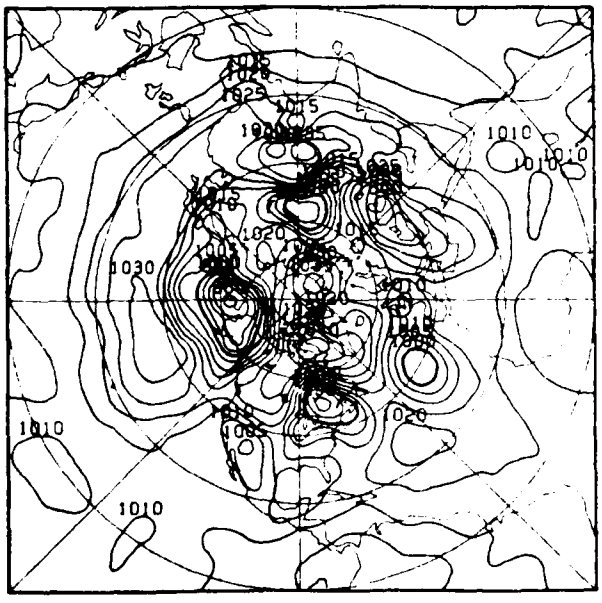

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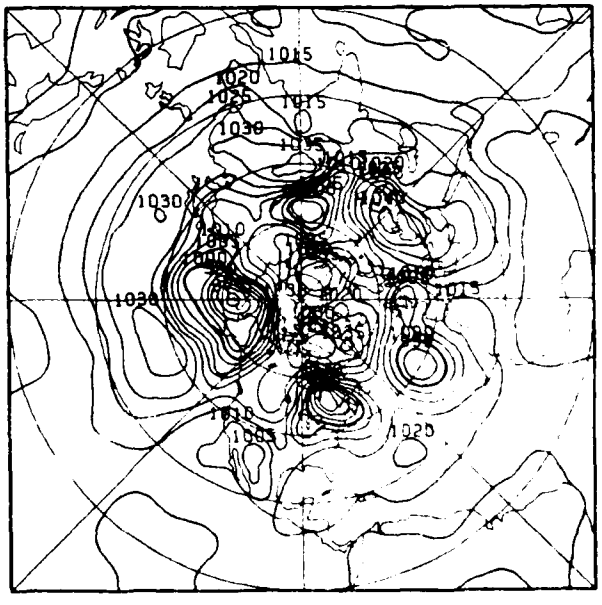

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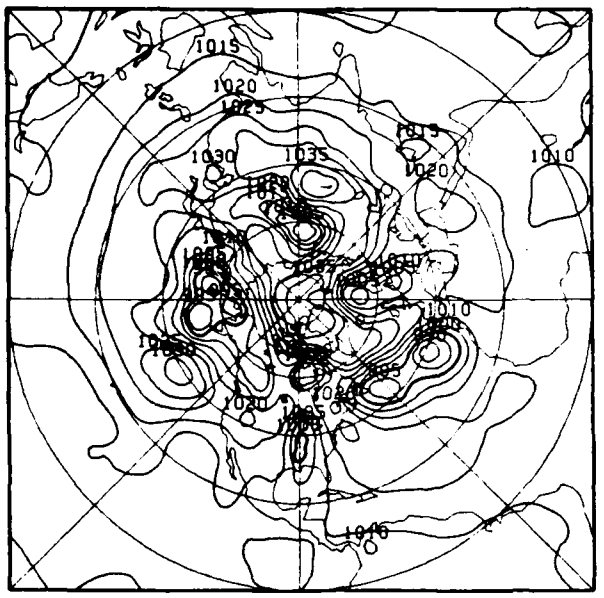

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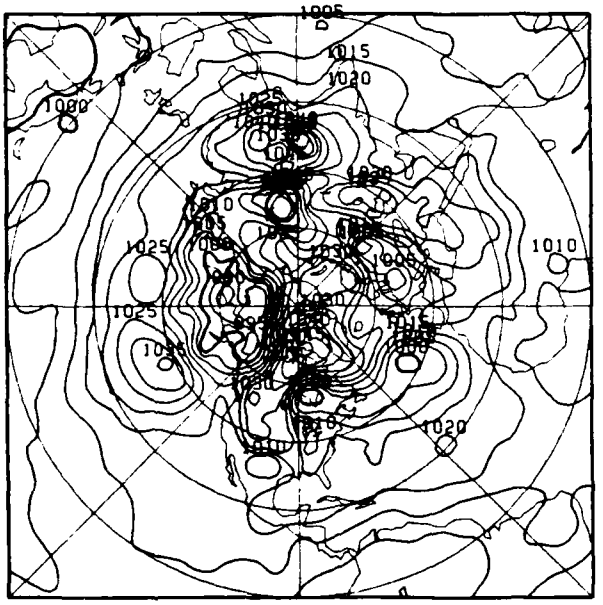
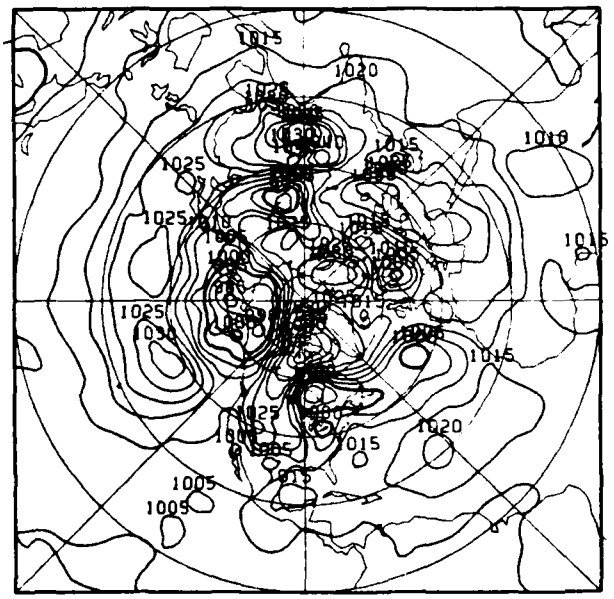
24 JAN 1979

DAY 3

9-LAYER 4X5



15-LAYER 4X5



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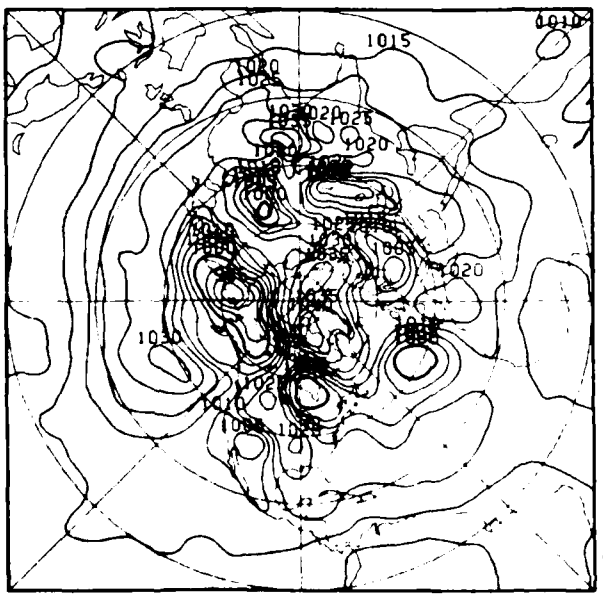
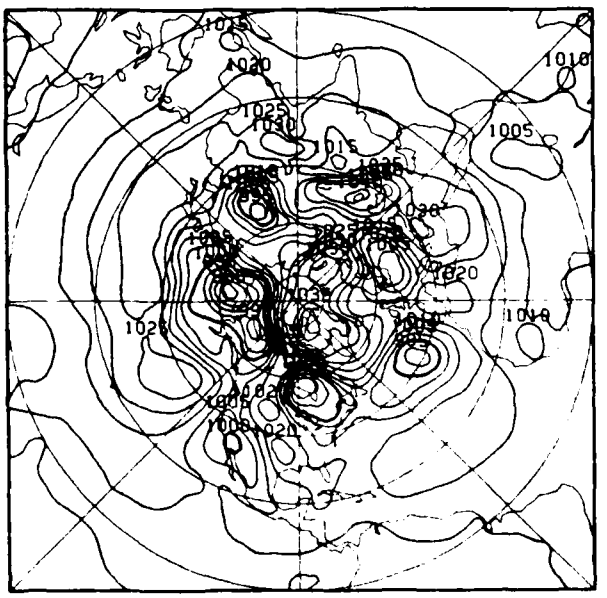


15-LAYER 2.4X3



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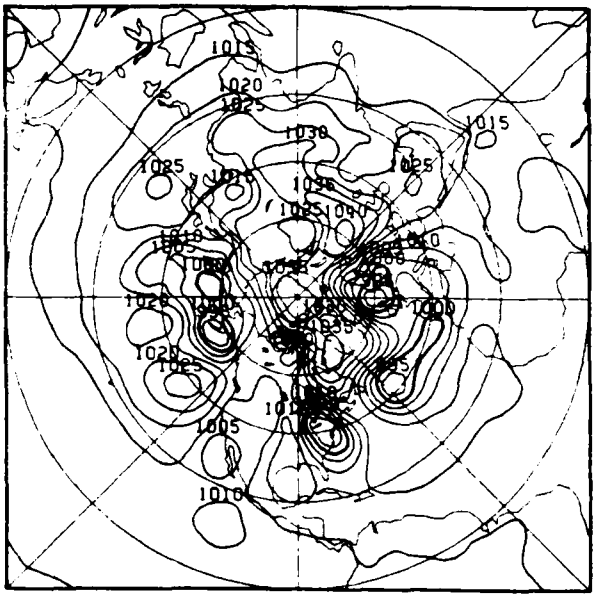

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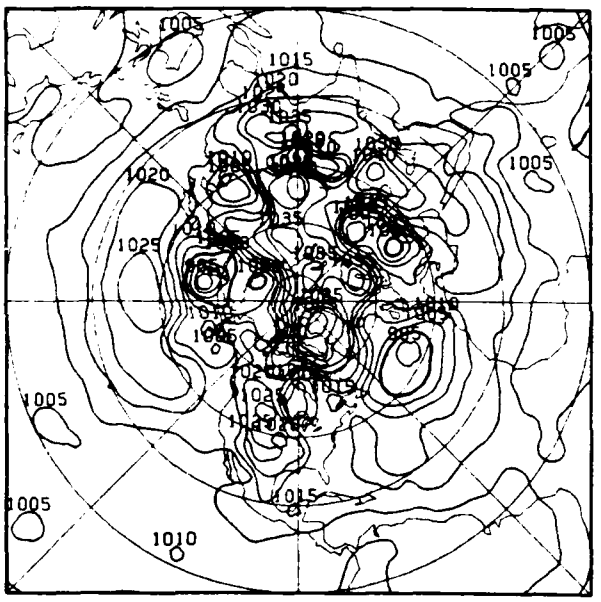
25 JAN 1979

DAY 4

9-LAYER 4X5



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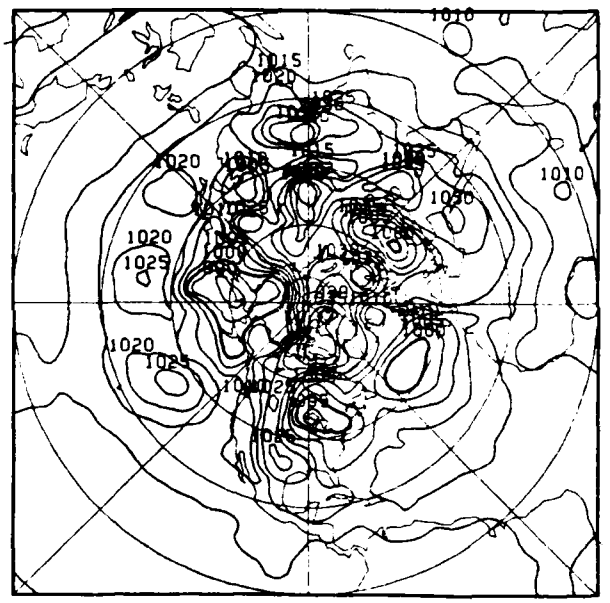

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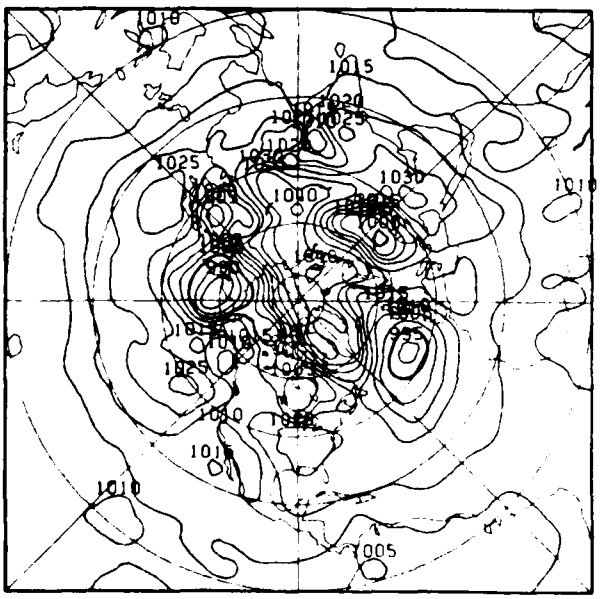

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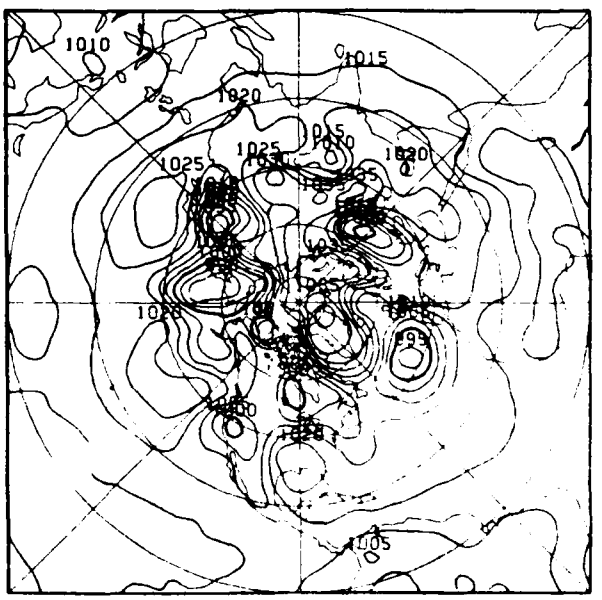

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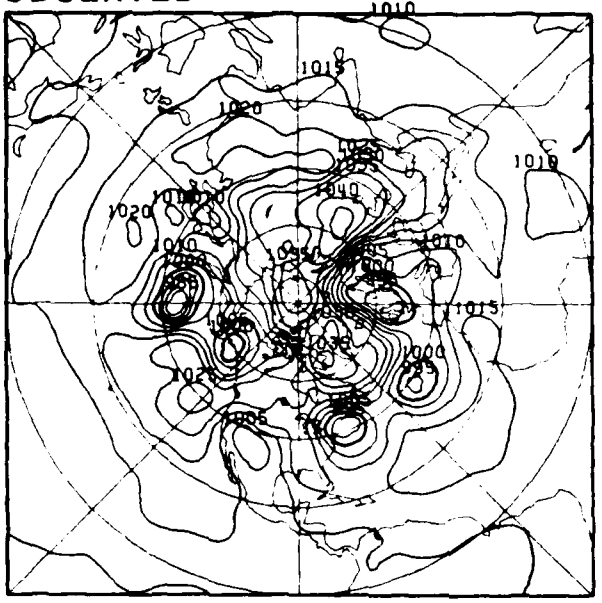

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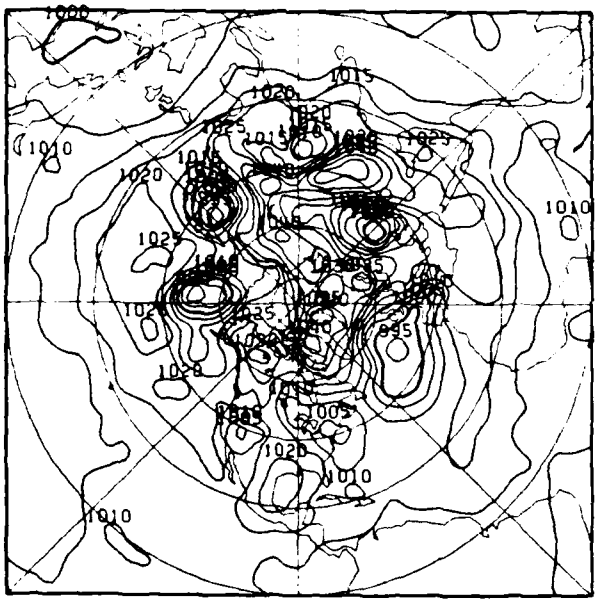
26 JAN 1979

DAY 5

9-LAYER 4X5



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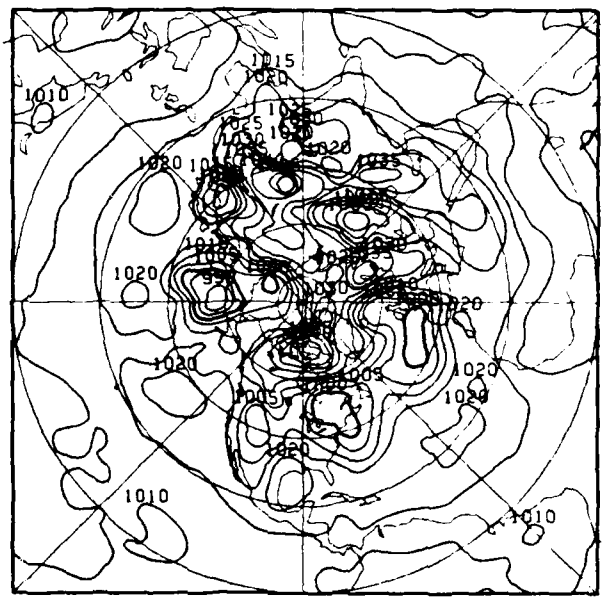
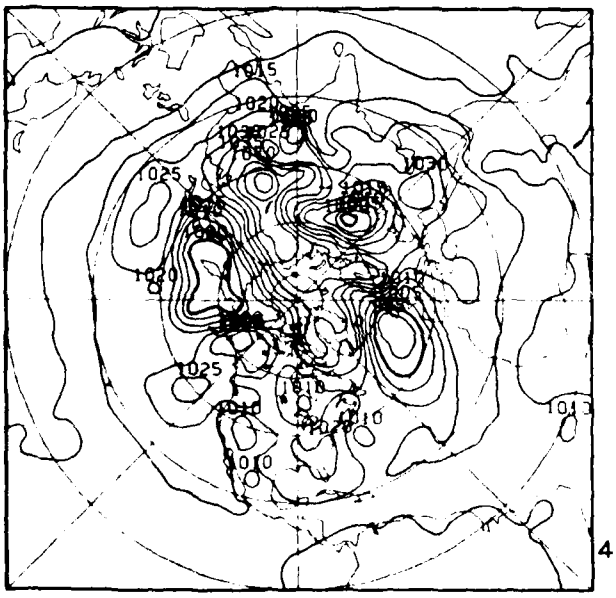


9-LAYER 2.4X3



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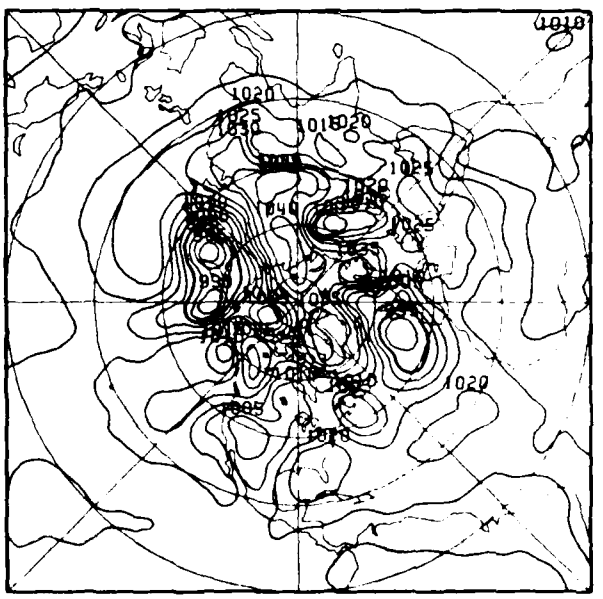

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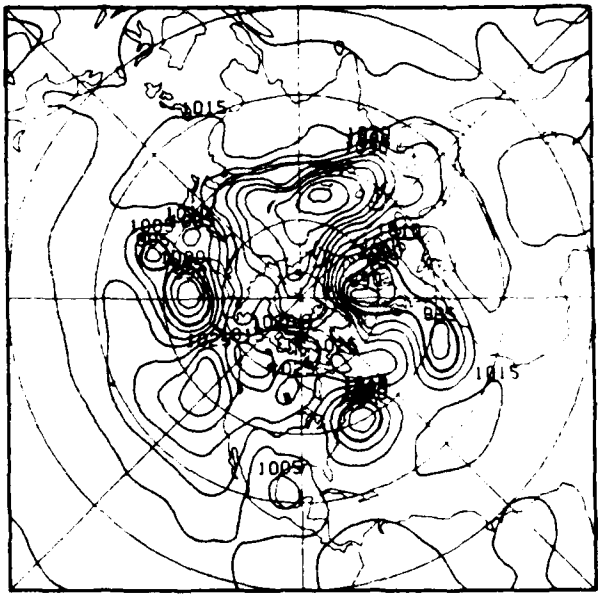

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27 JAN 1979

DAY 6

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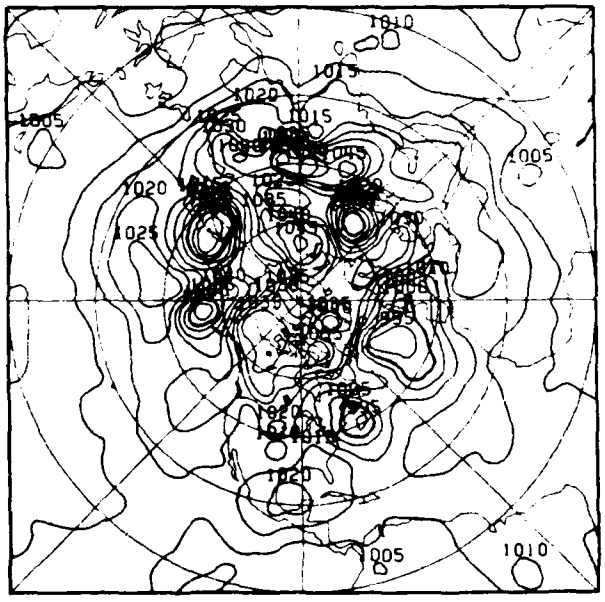

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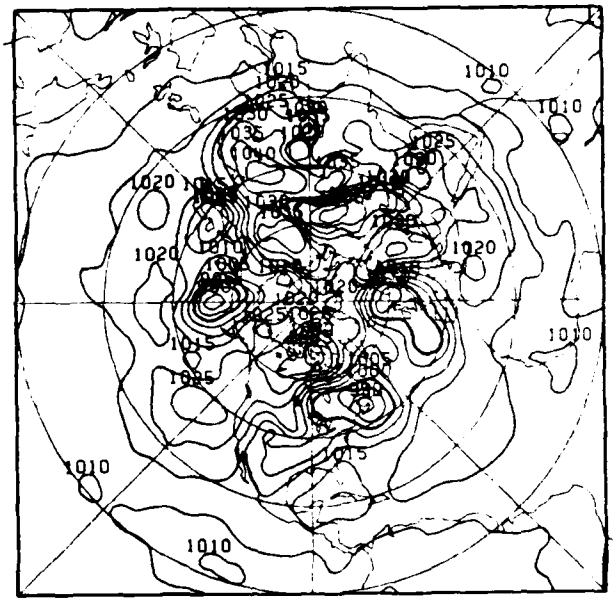
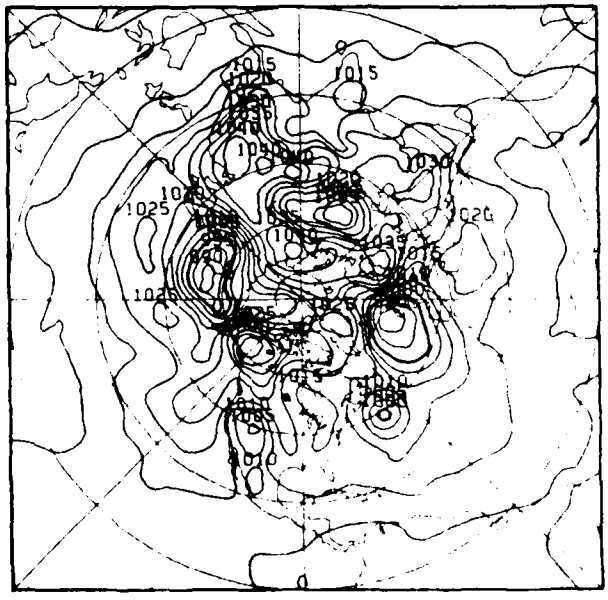
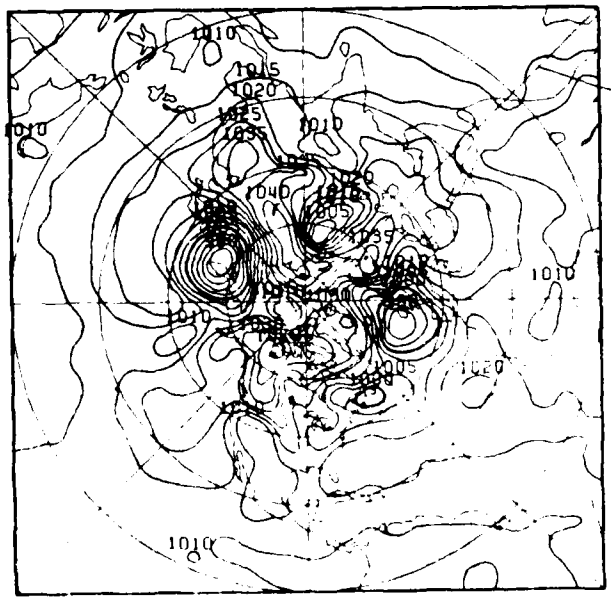


9-LAYER 2.4X3



15-LAYER 2.4X3



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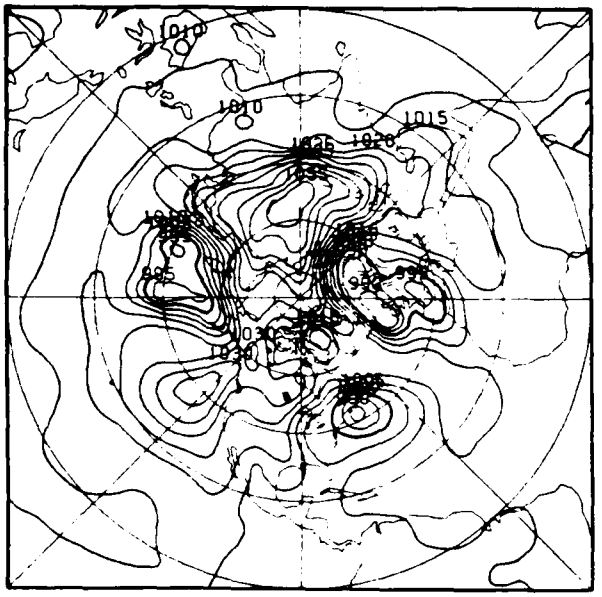

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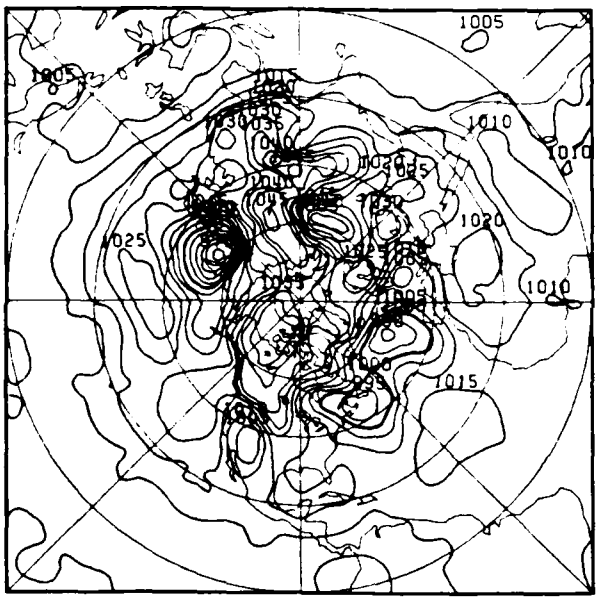
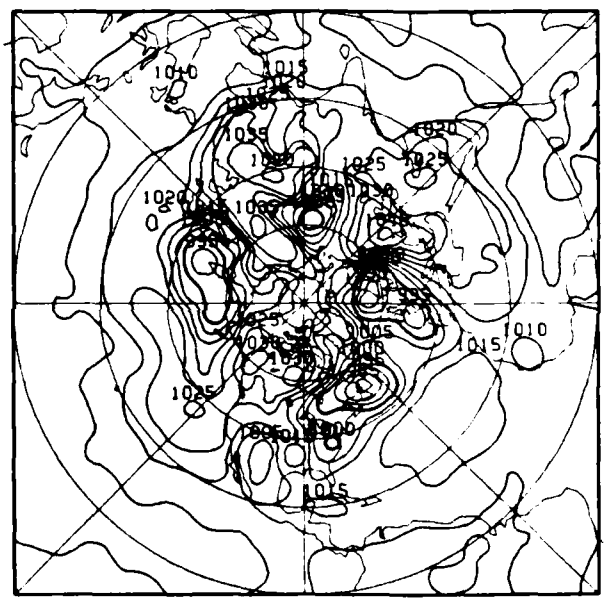
28 JAN 1979

DAY 7

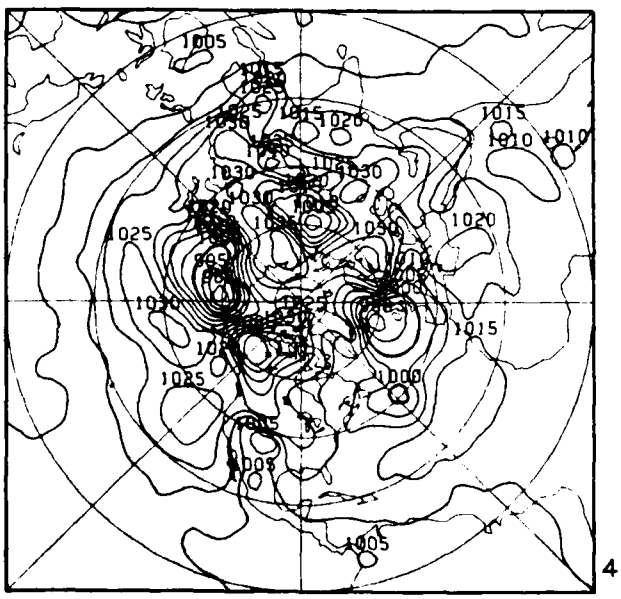
9-LAYER 4X5



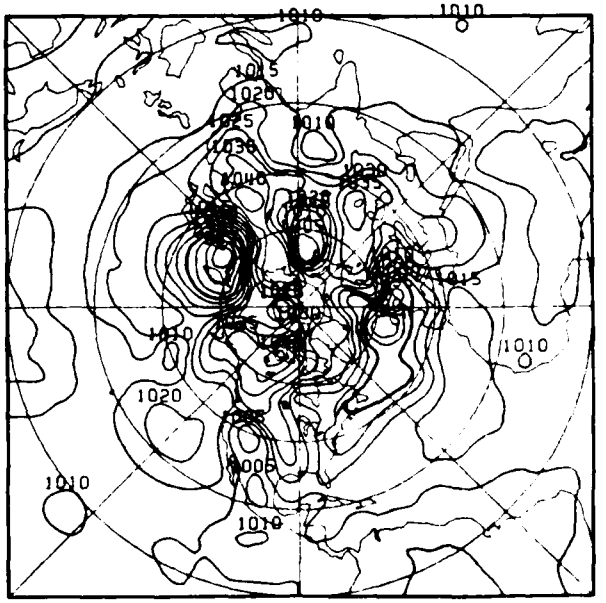
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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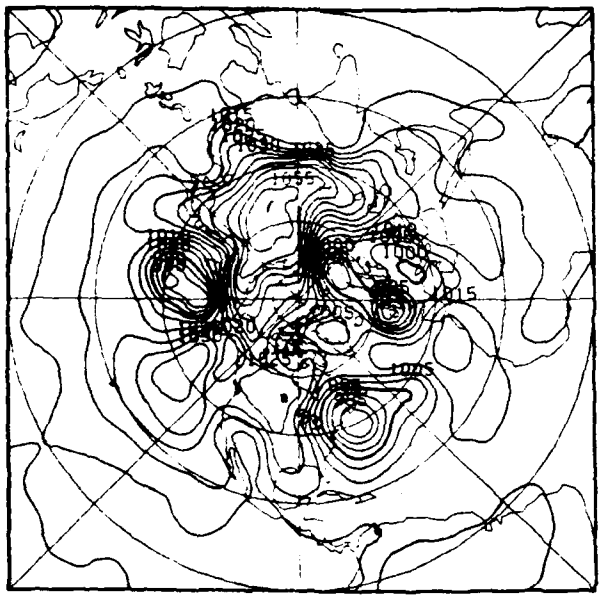

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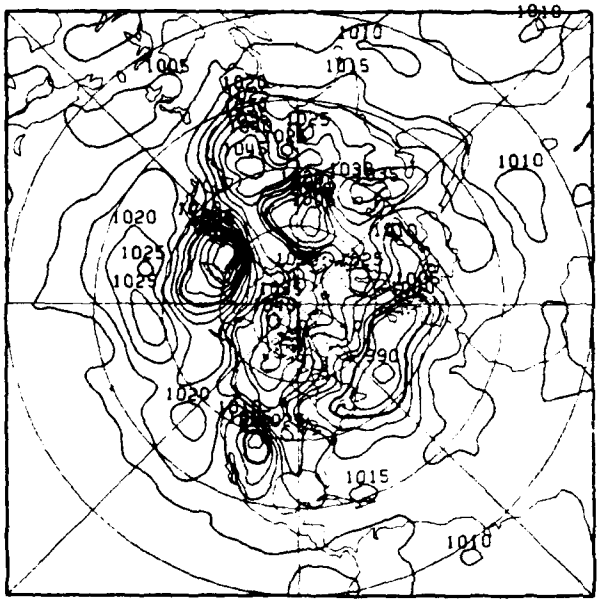
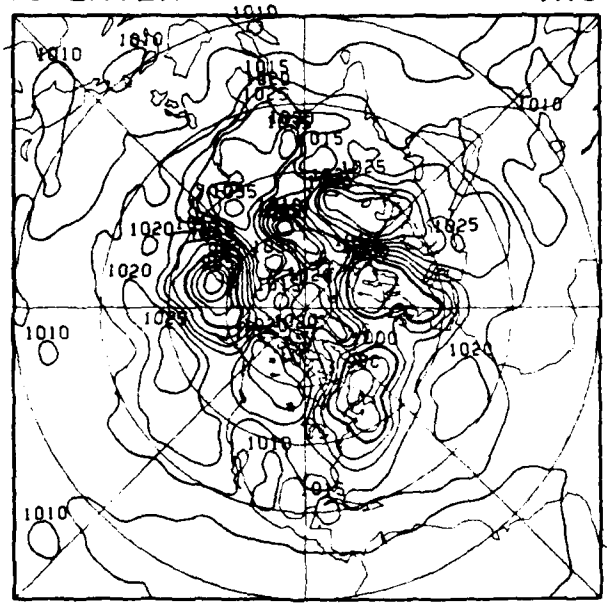
DAY 8

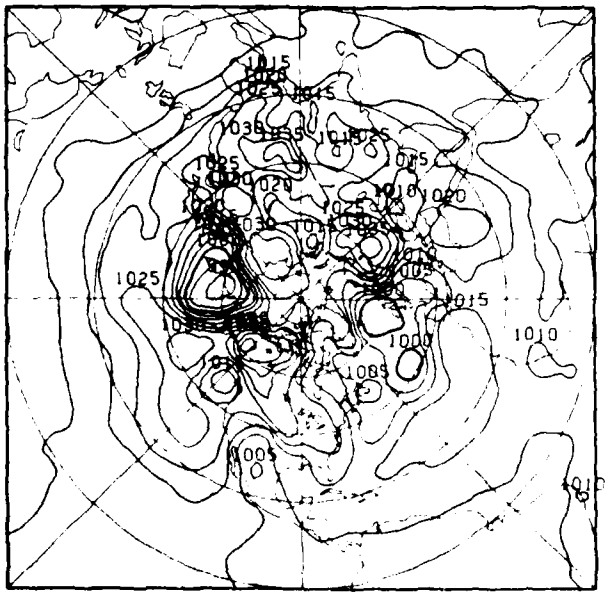
9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3



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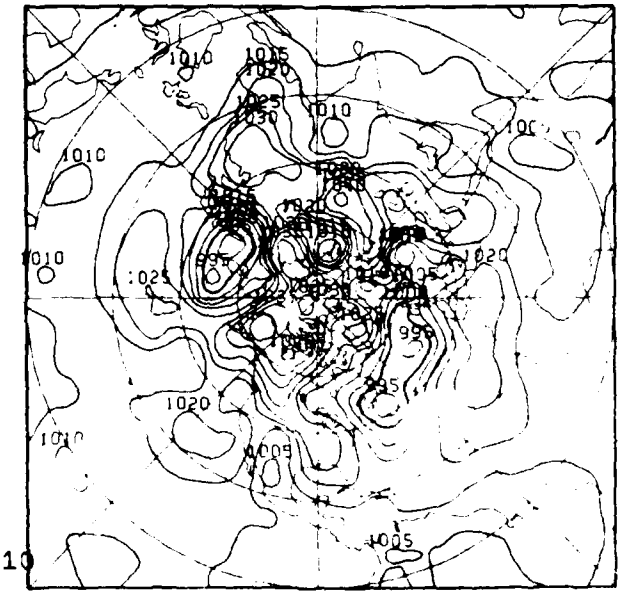

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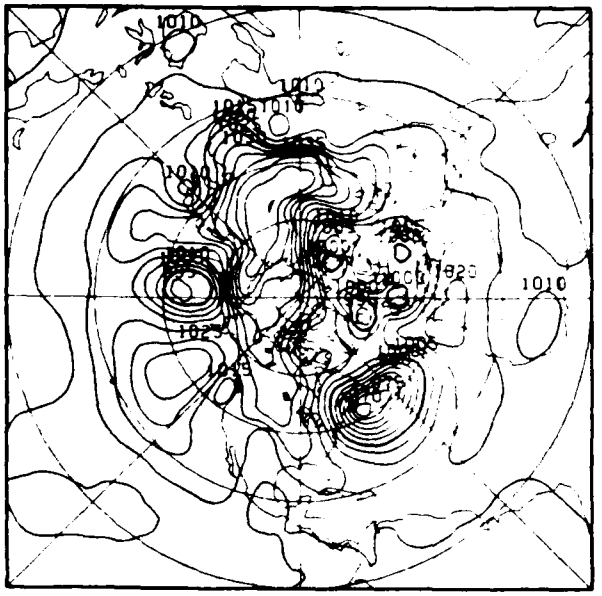

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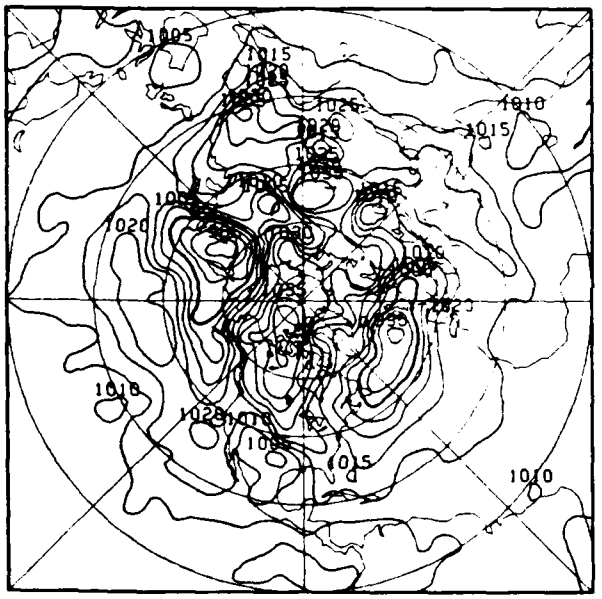
DAY 9

9-LAYER 4X5



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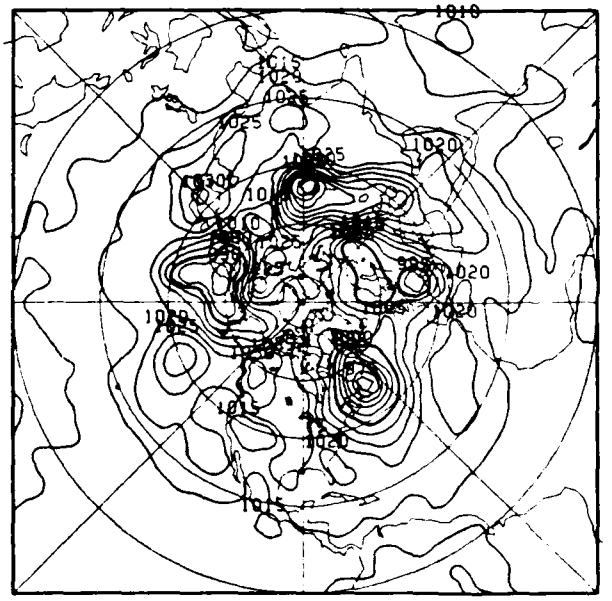

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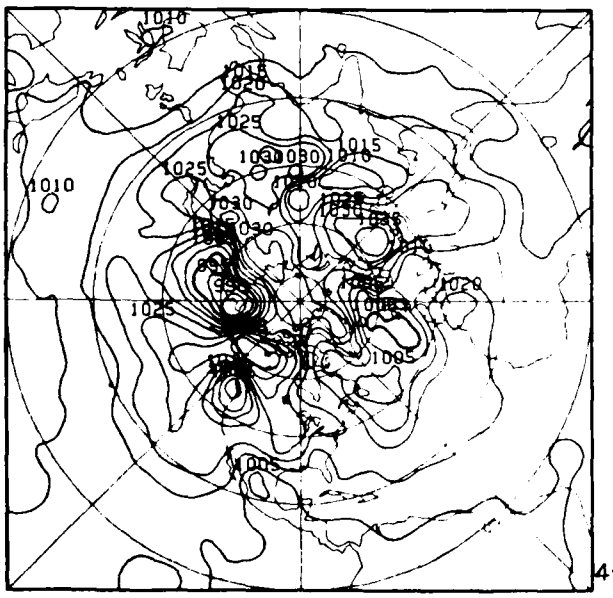

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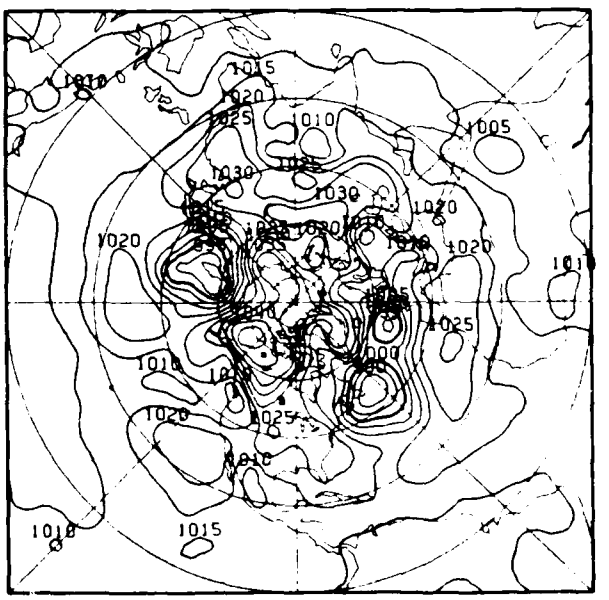

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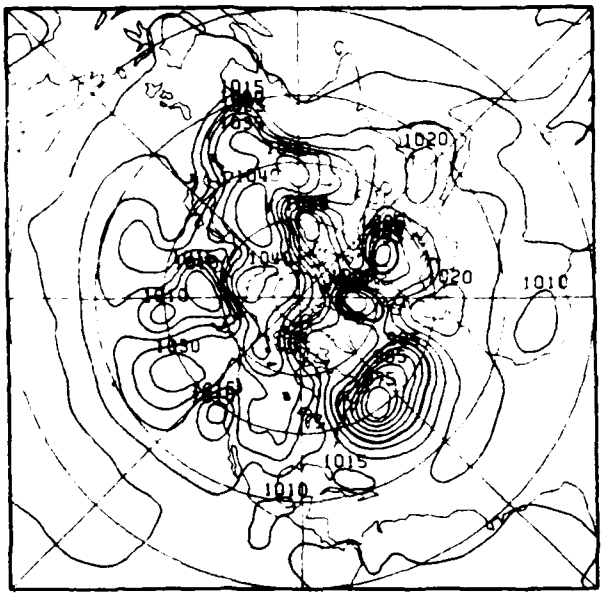

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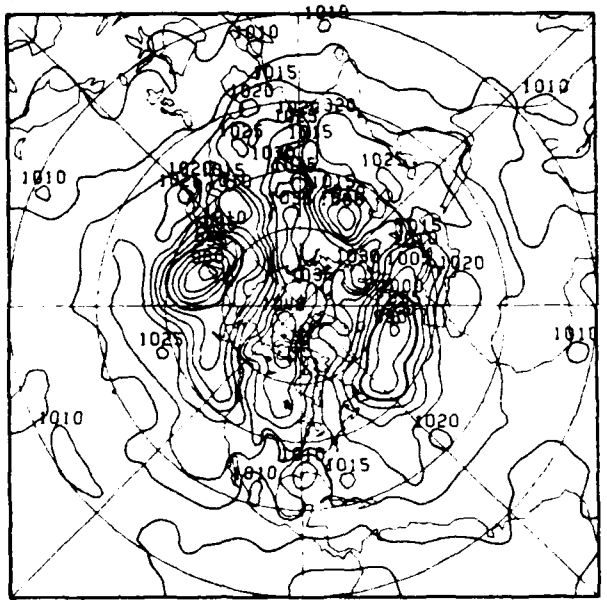
DAY 10

9-LAYER 4X5



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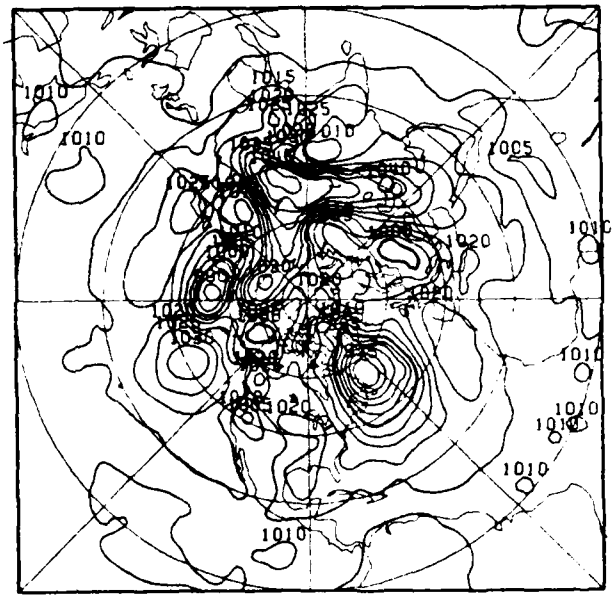

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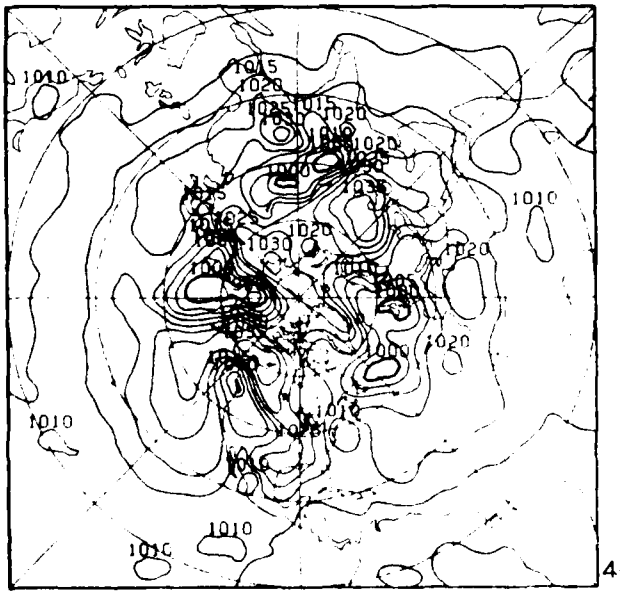

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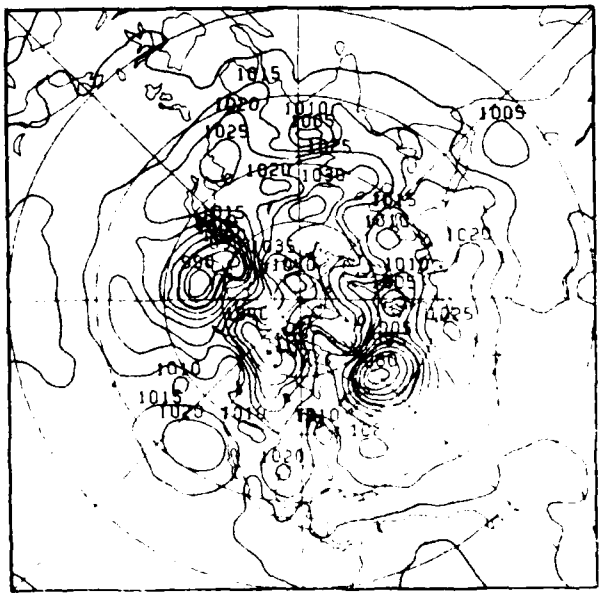

500 mb Z

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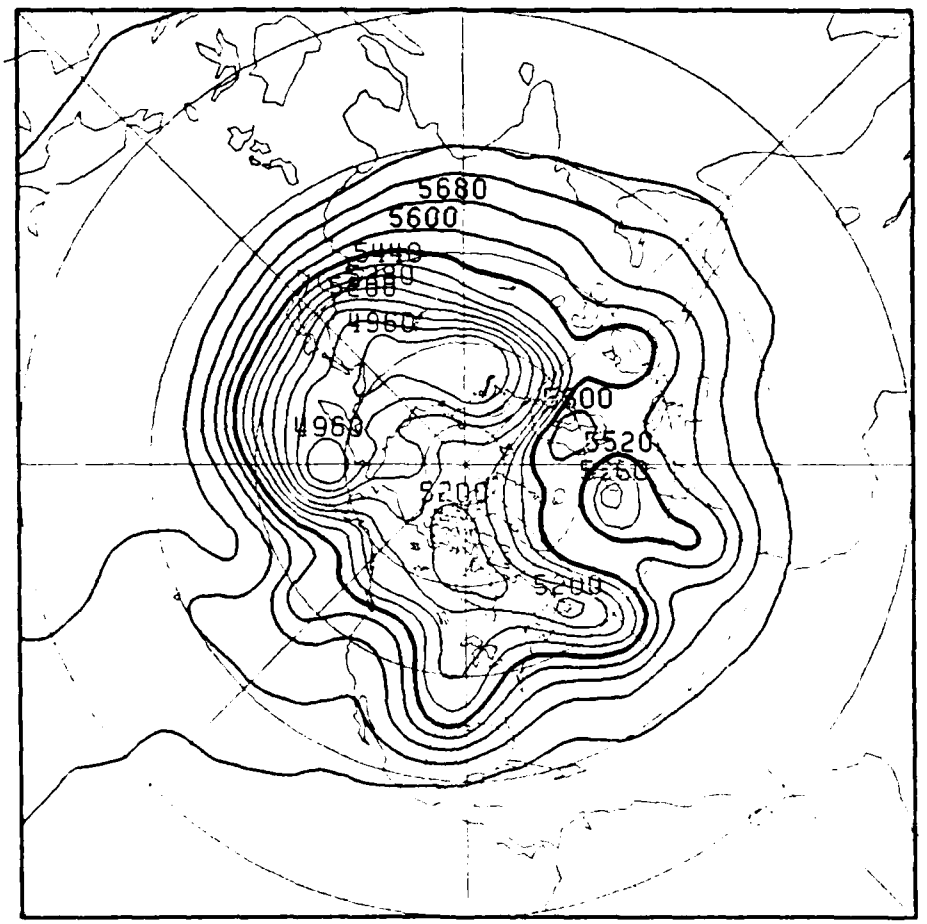
OBSERVED



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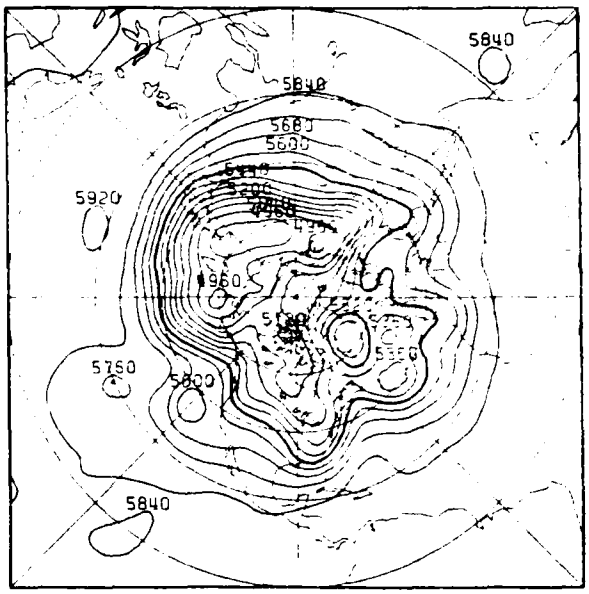

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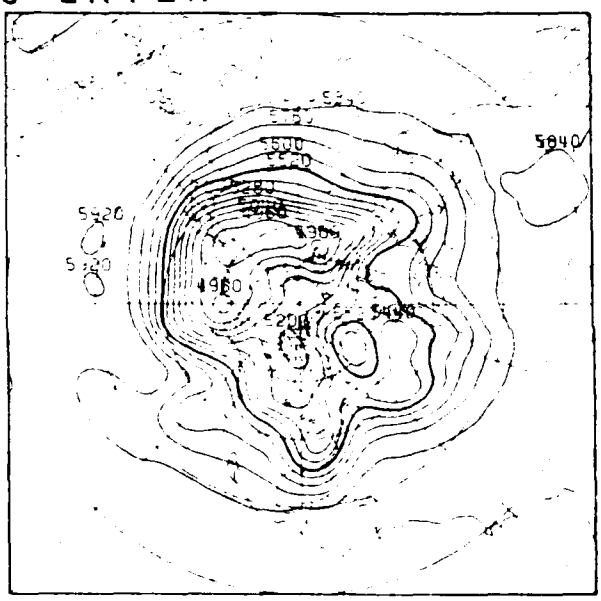
DAY 1

9-LAYER 4X5



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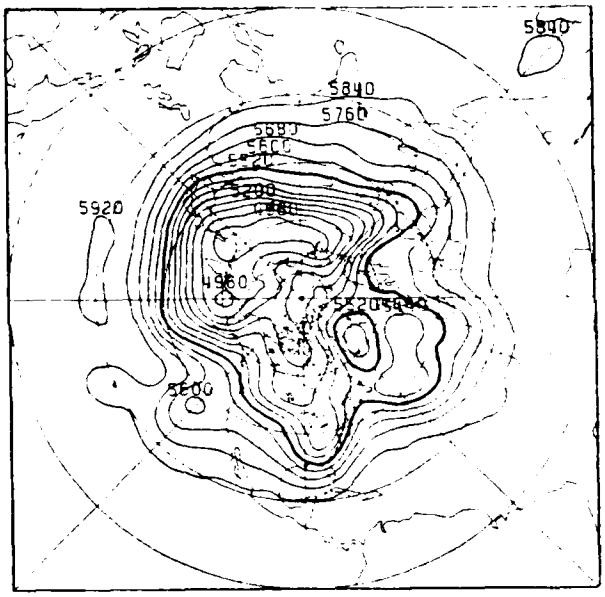
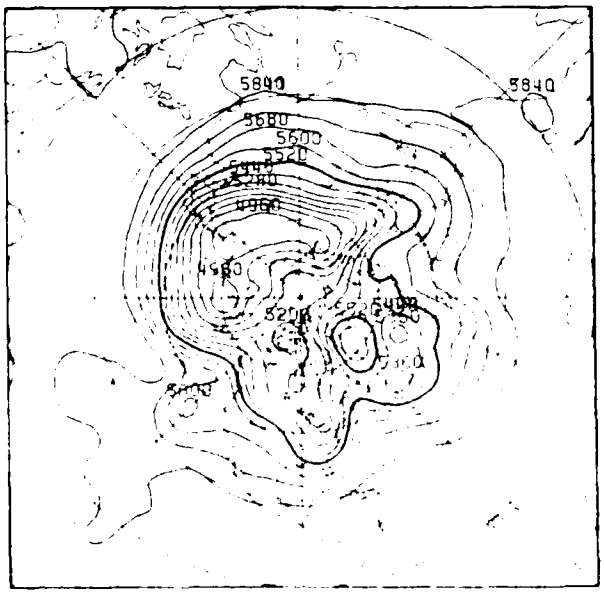


9-LAYER 2.4X3



15-LAYER 2.4X3

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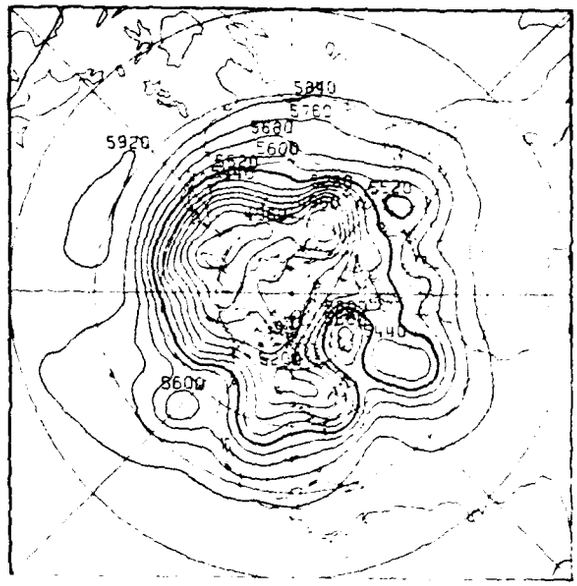

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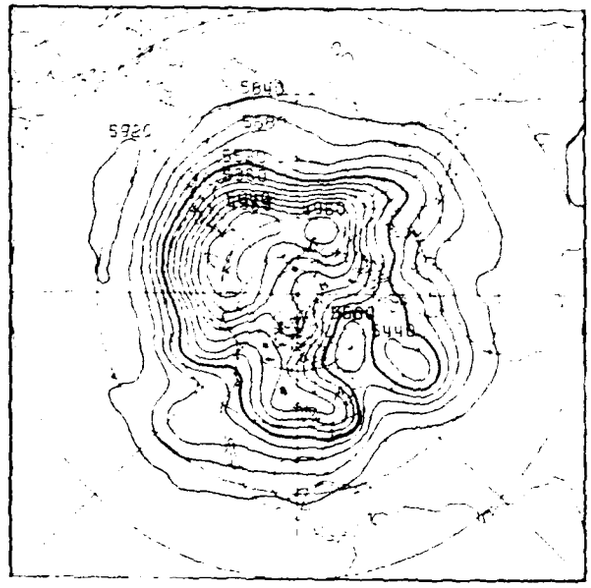
0000 GMT

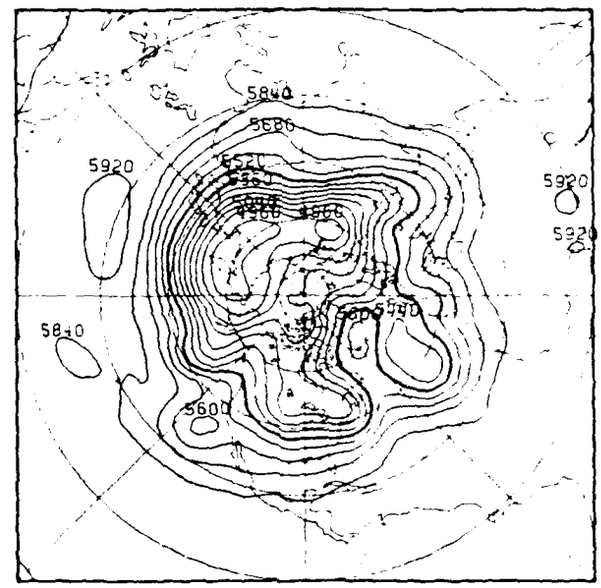
23 JAN 1979

DAY 2

9-LAYER 4X5



15-LAYER 4X5



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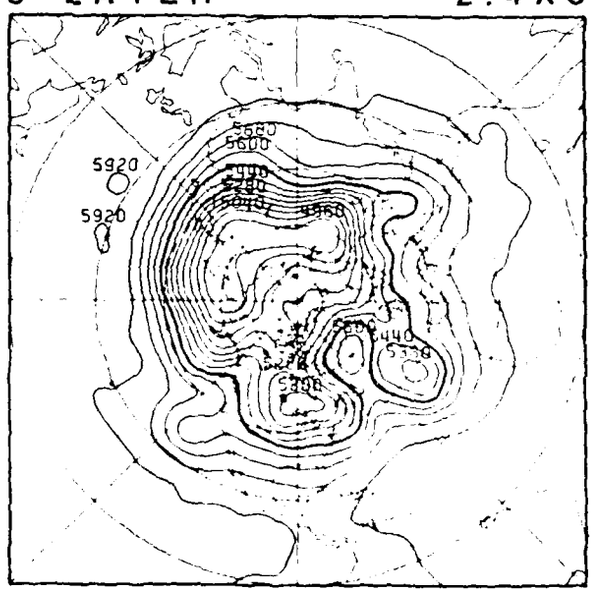

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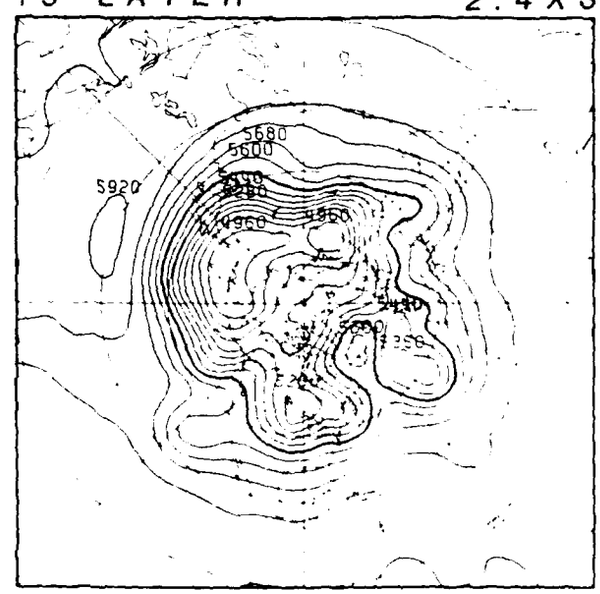

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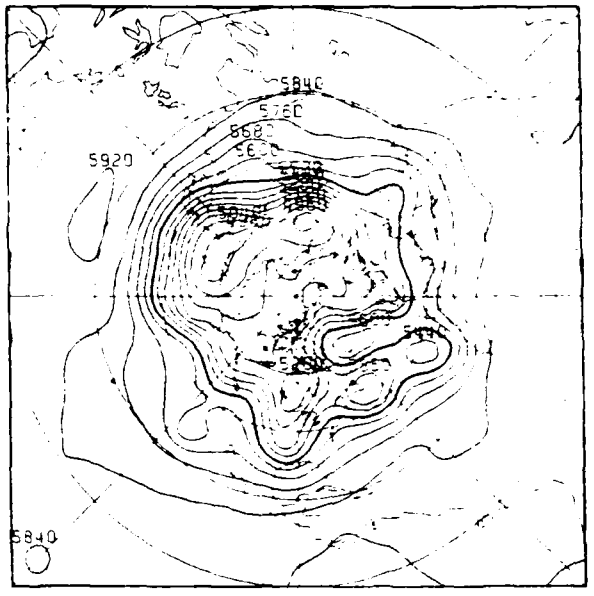

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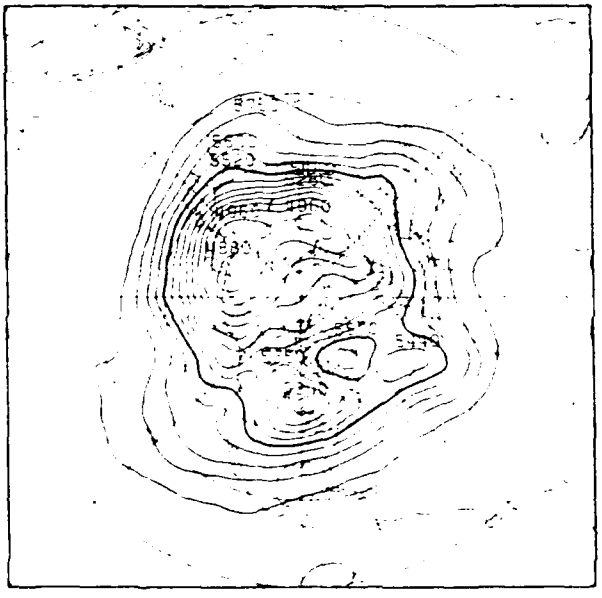
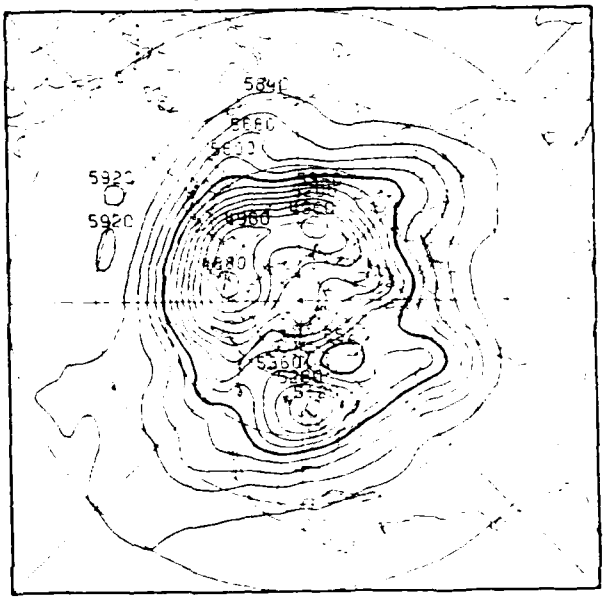
DAY 3

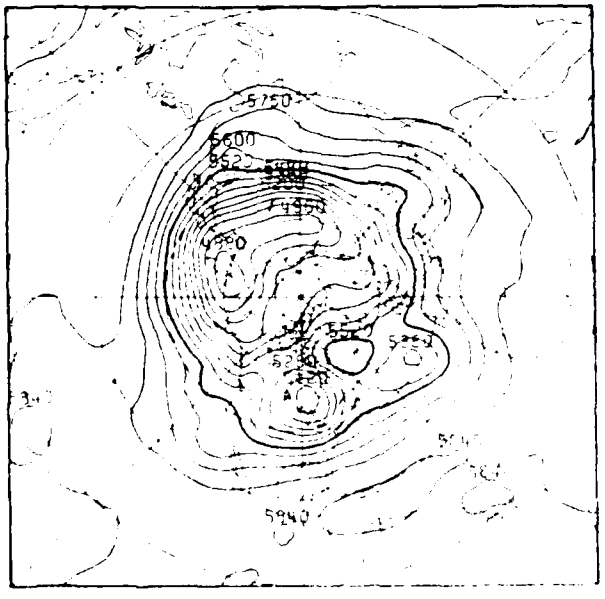
9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3



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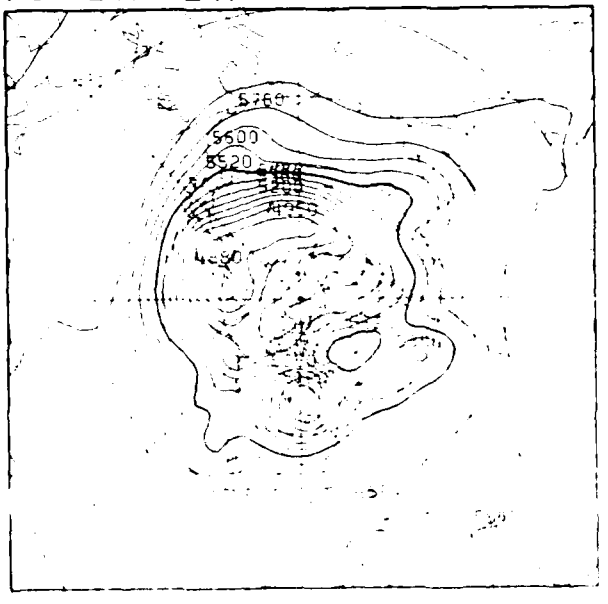

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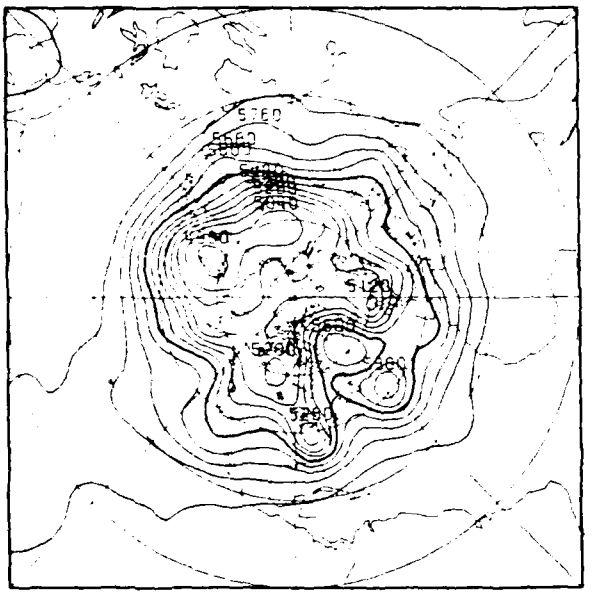

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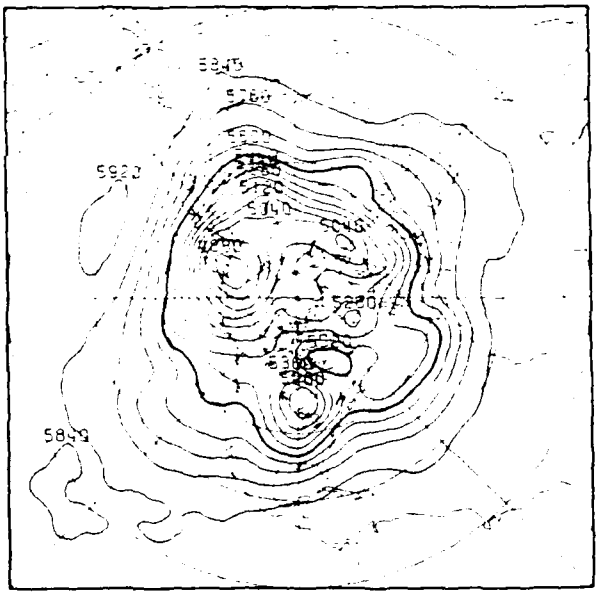
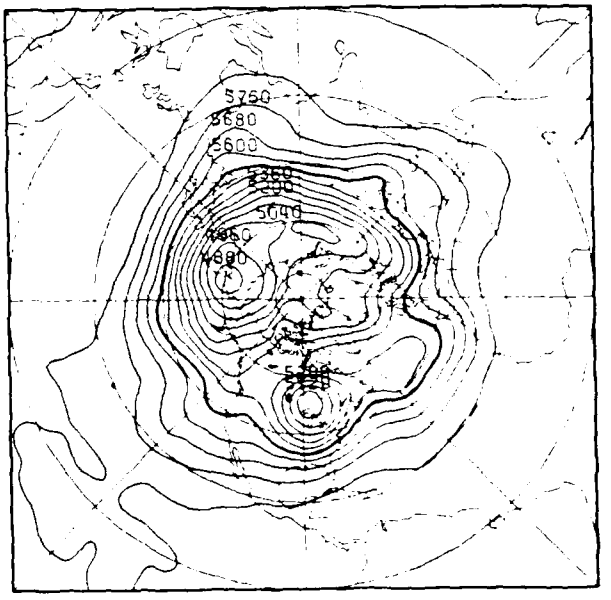
25 JAN 1979

DAY 4

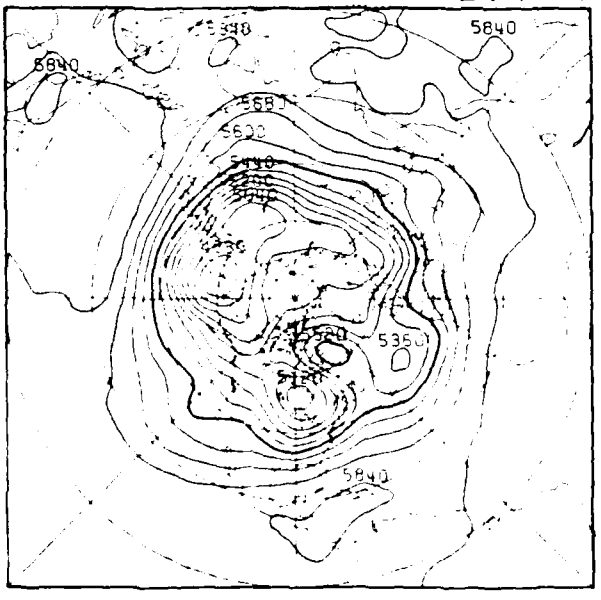
9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3



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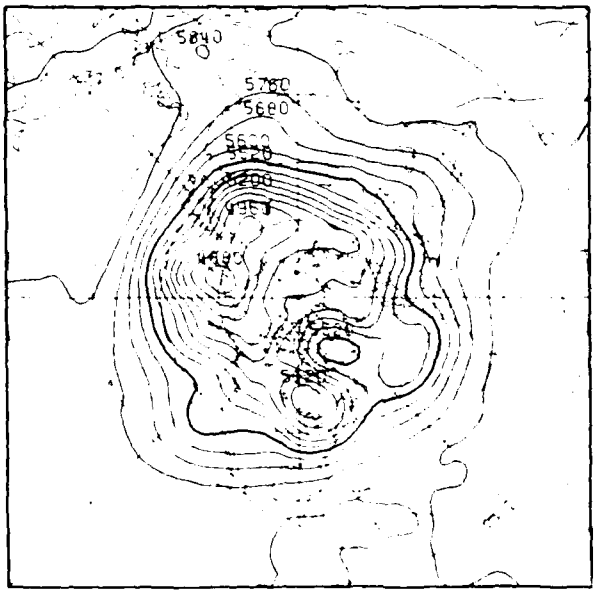

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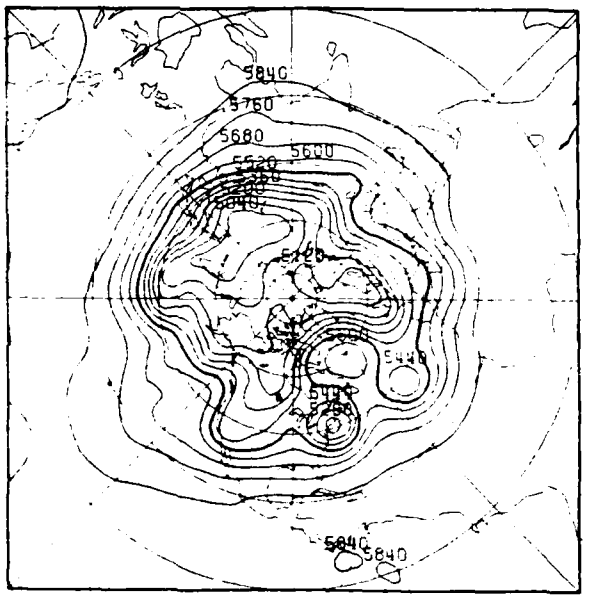

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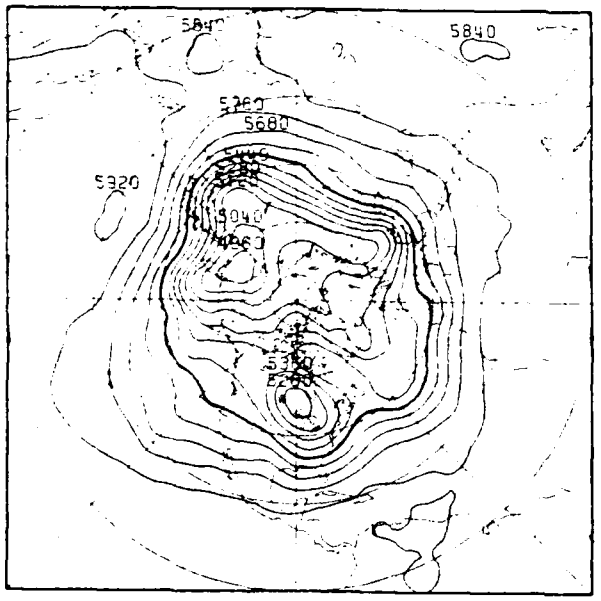
DAY 5

9-LAYER 4X5



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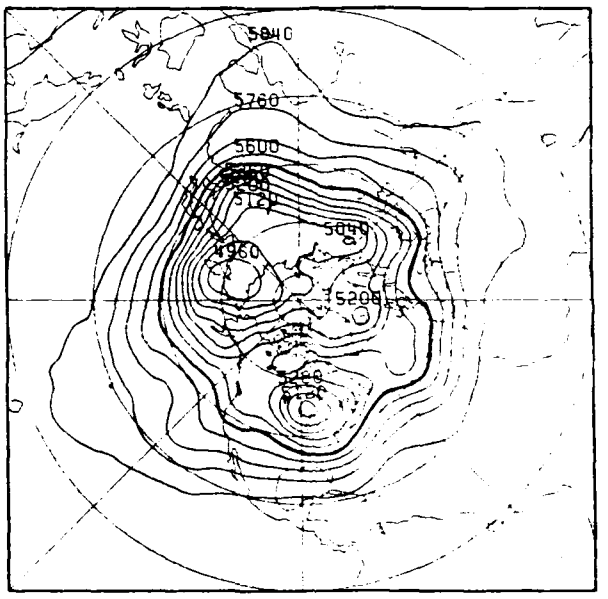
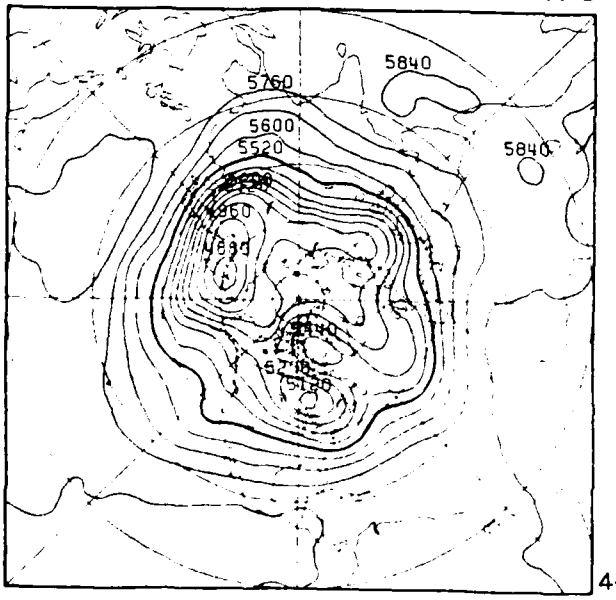


9-LAYER 2.4X3



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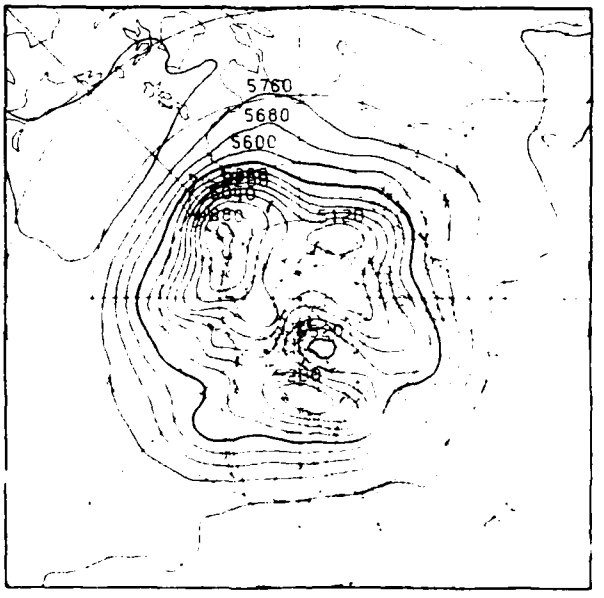

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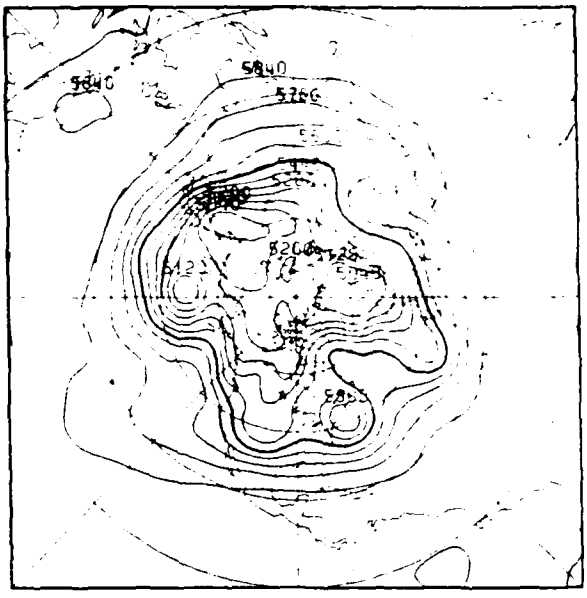

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DAY 6

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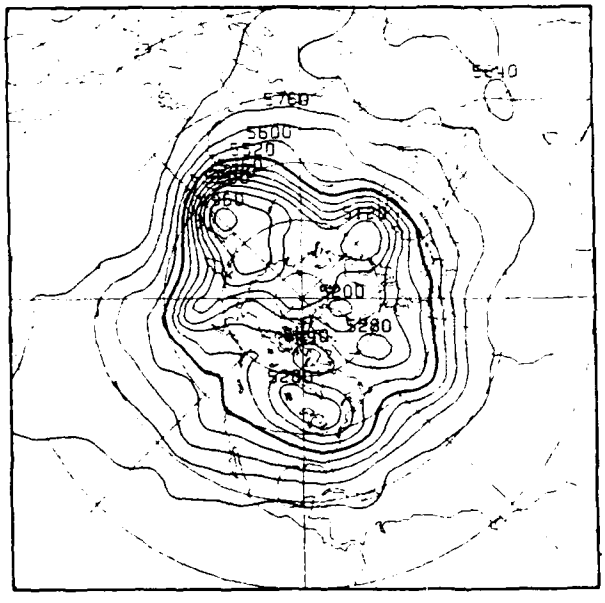
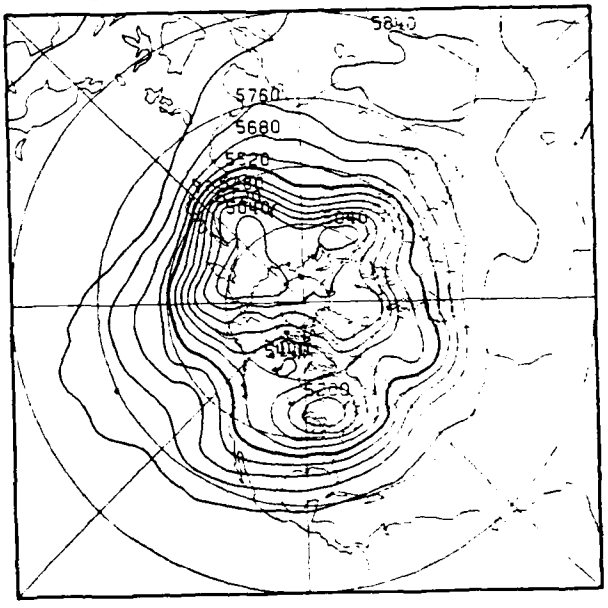
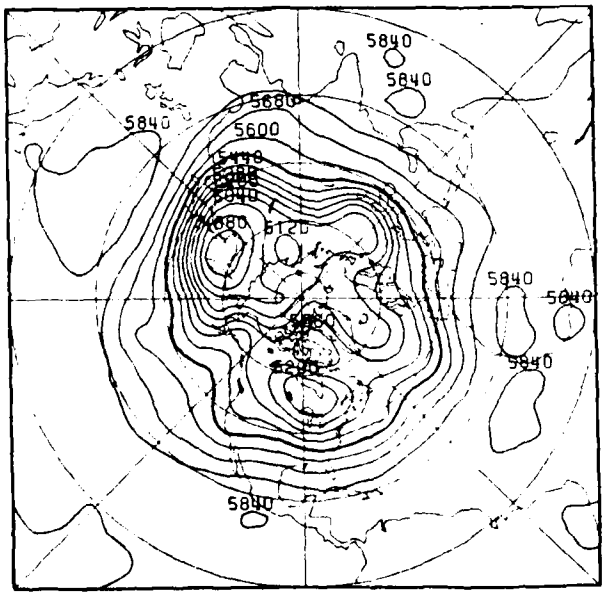


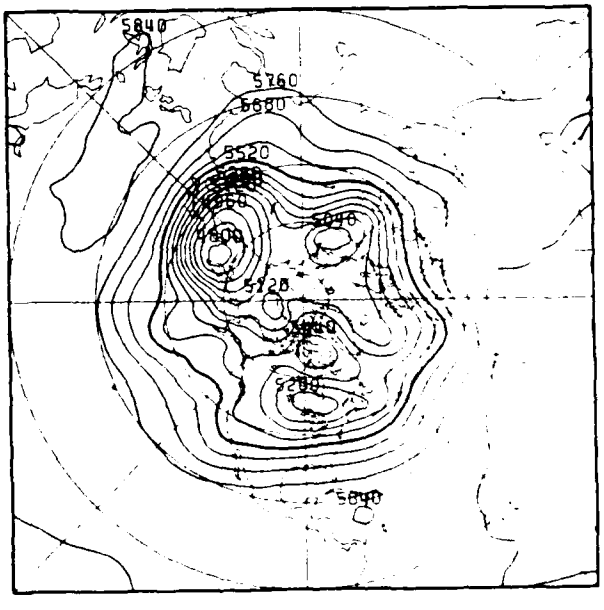
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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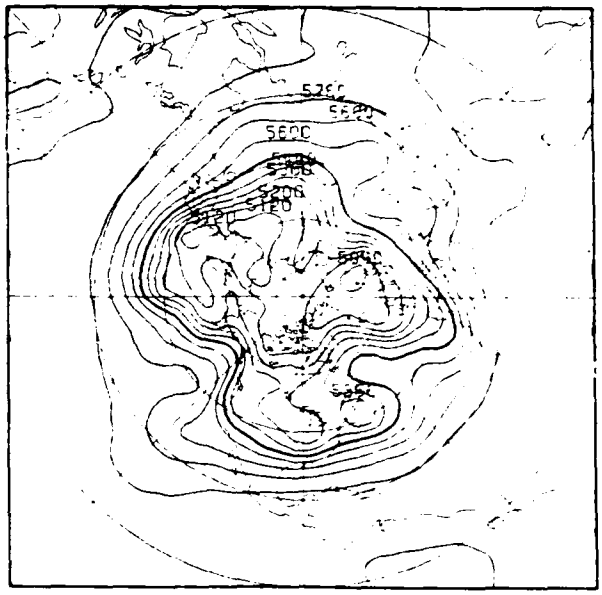

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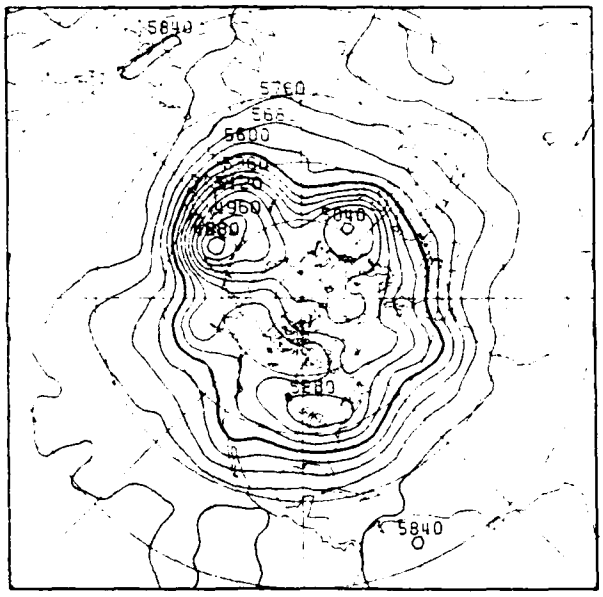
28 JAN 1979

DAY 7

9-LAYER 4X5



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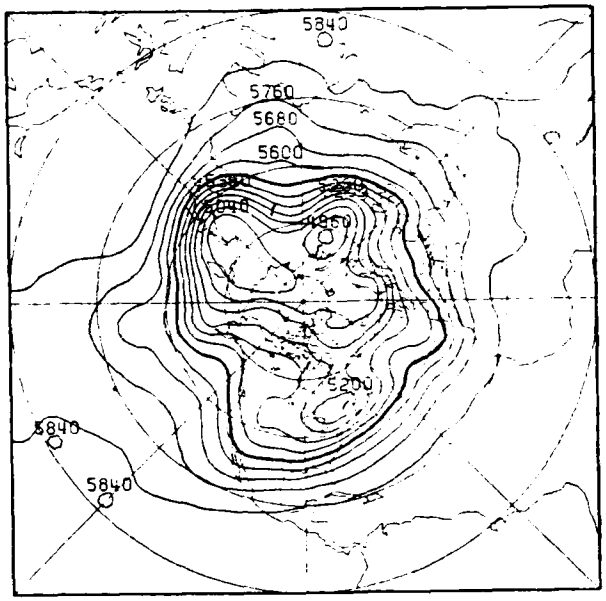
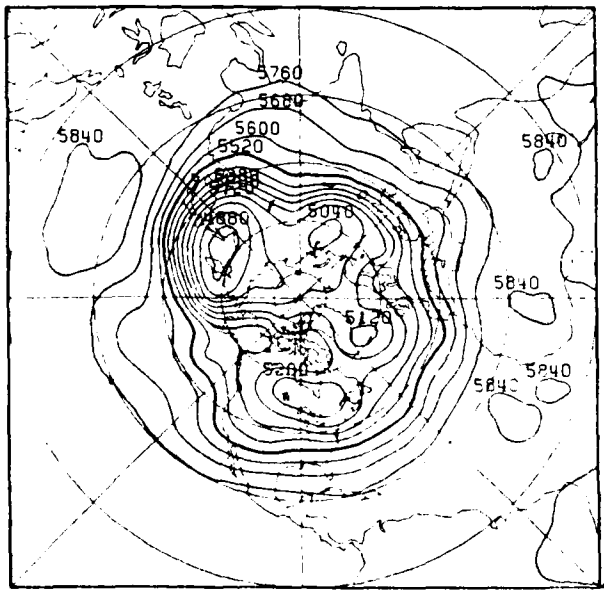
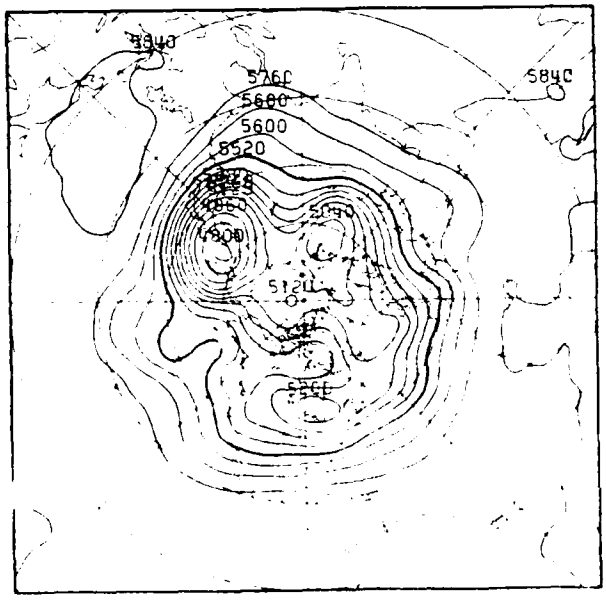


9-LAYER 2.4X3



15-LAYER 2.4X3



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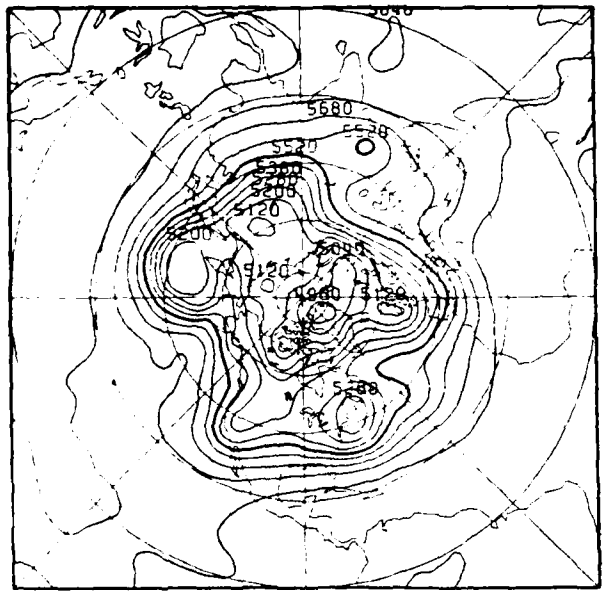

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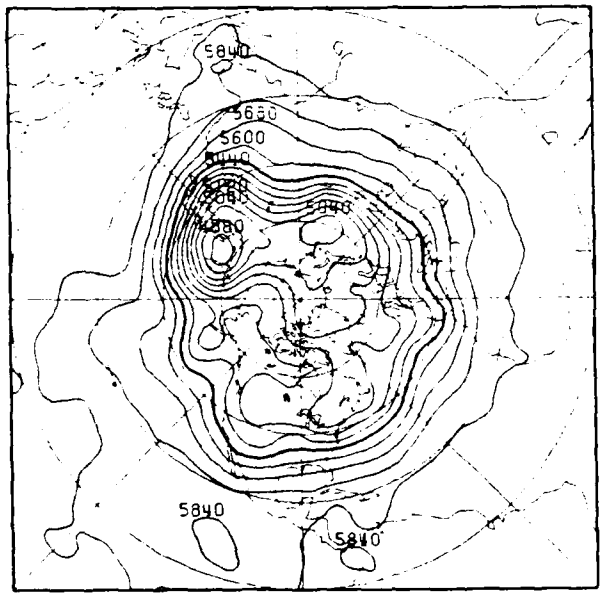
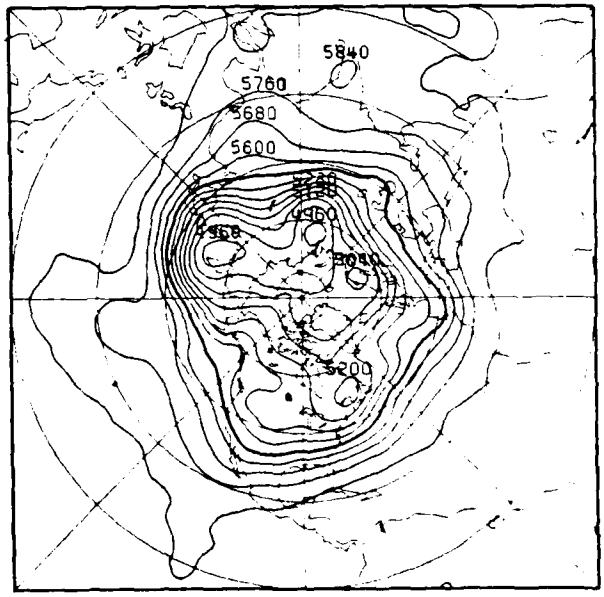
29 JAN 1979

DAY 8

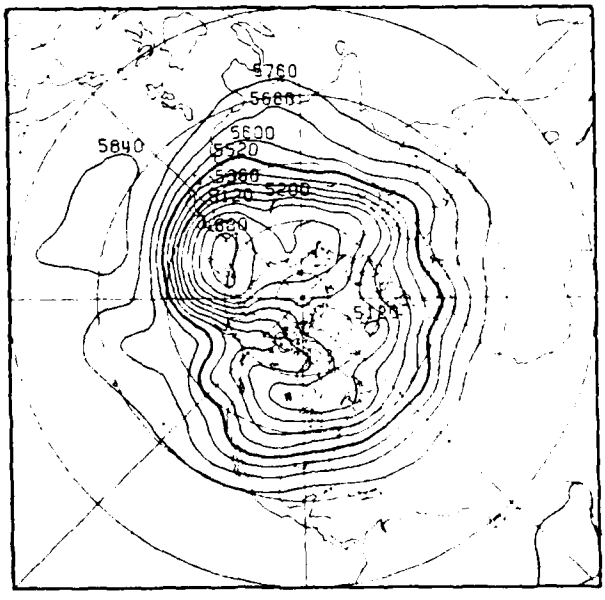
9-LAYER 4X5



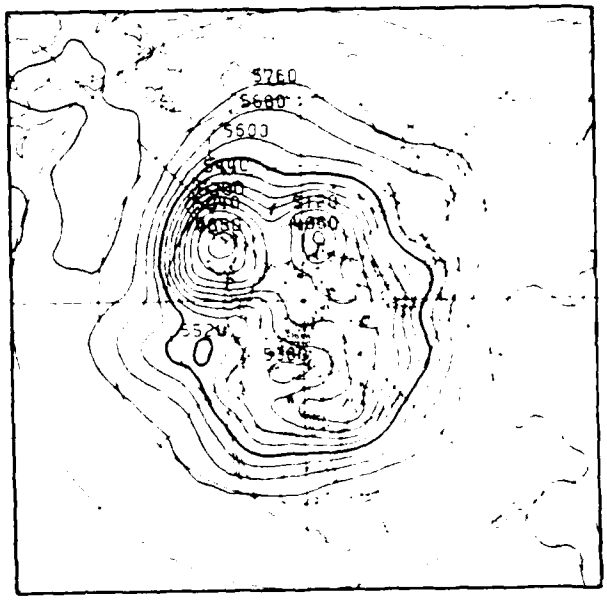
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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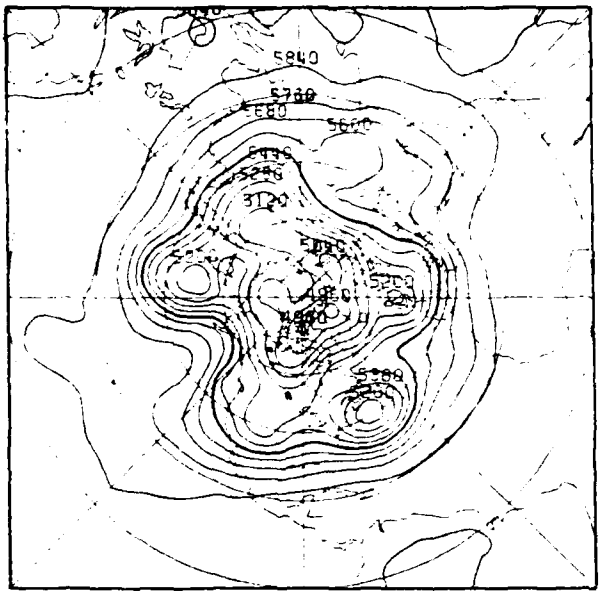

500 mb Z

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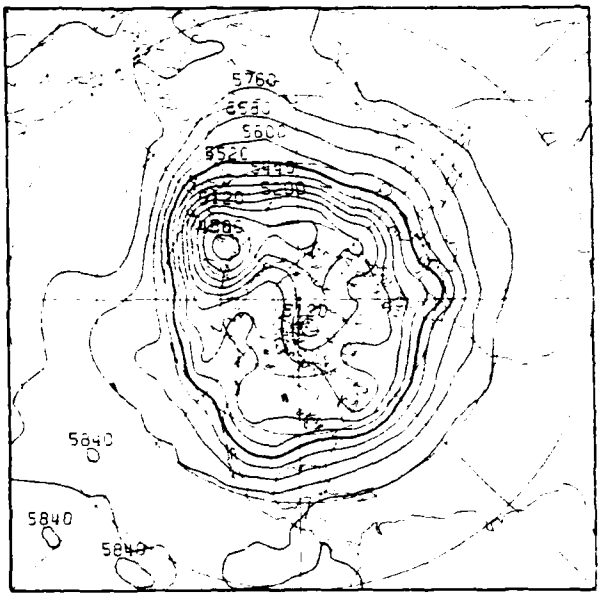
30 JAN 1979

DAY 9

9-LAYER 4X5



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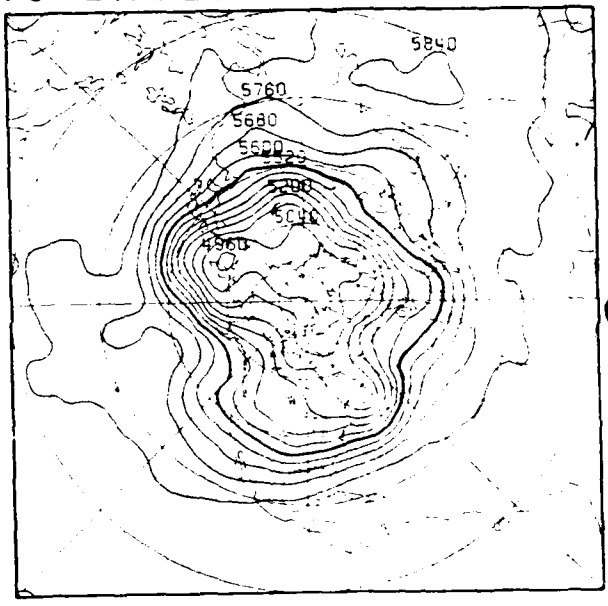
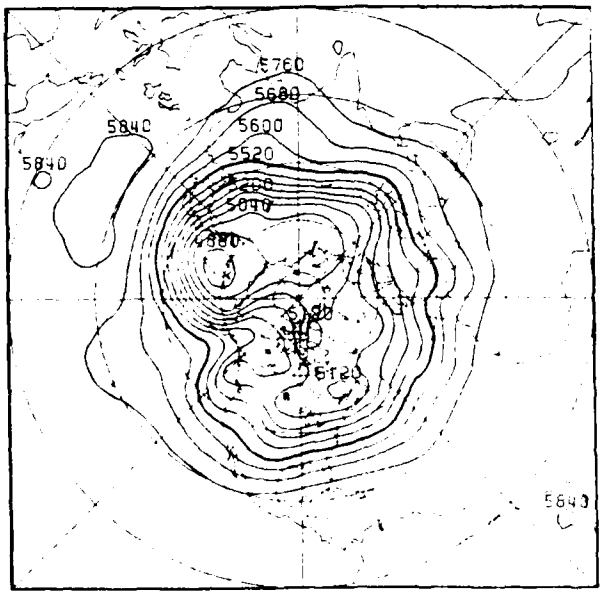
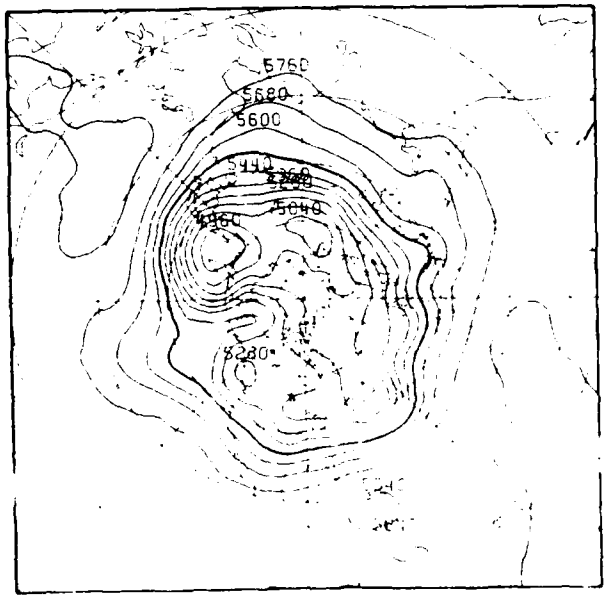


9-LAYER 2.4X3



15-LAYER 2.4X3



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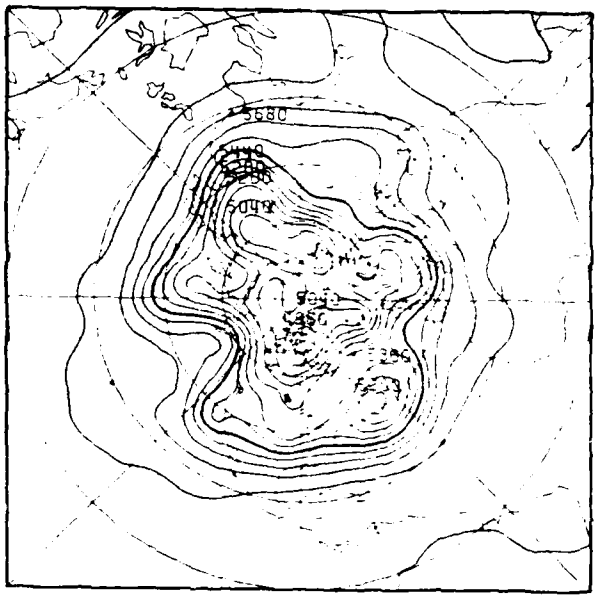

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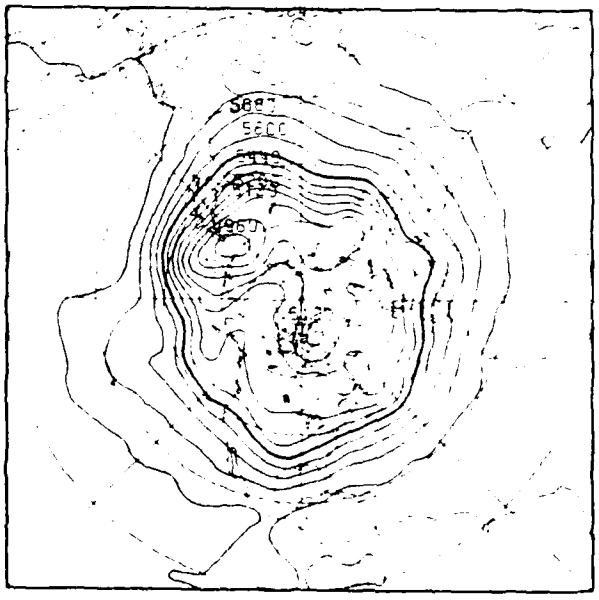
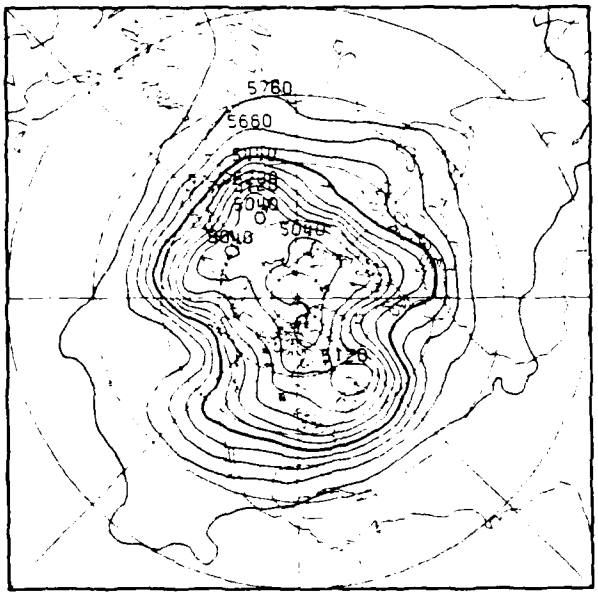
31 JAN 1979

DAY 10

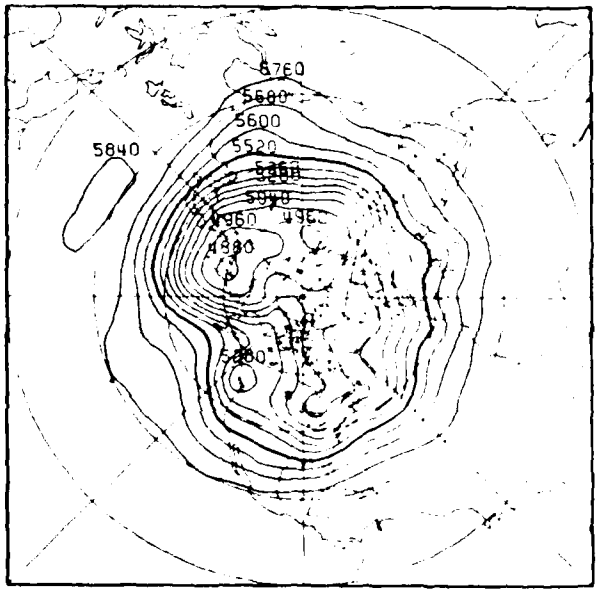
9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3



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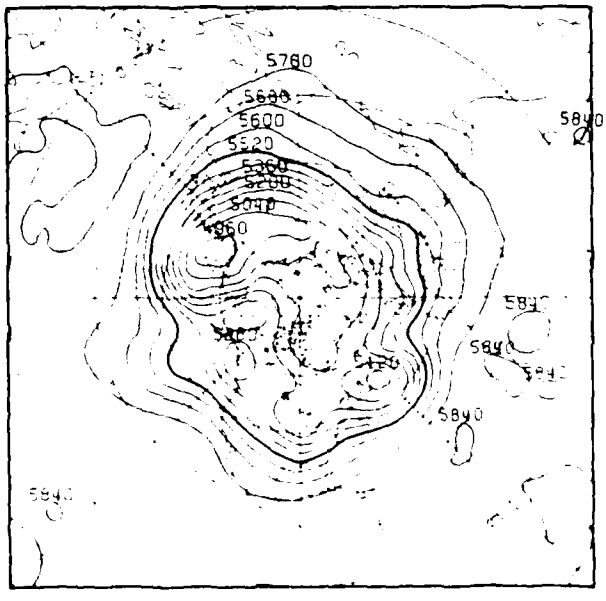

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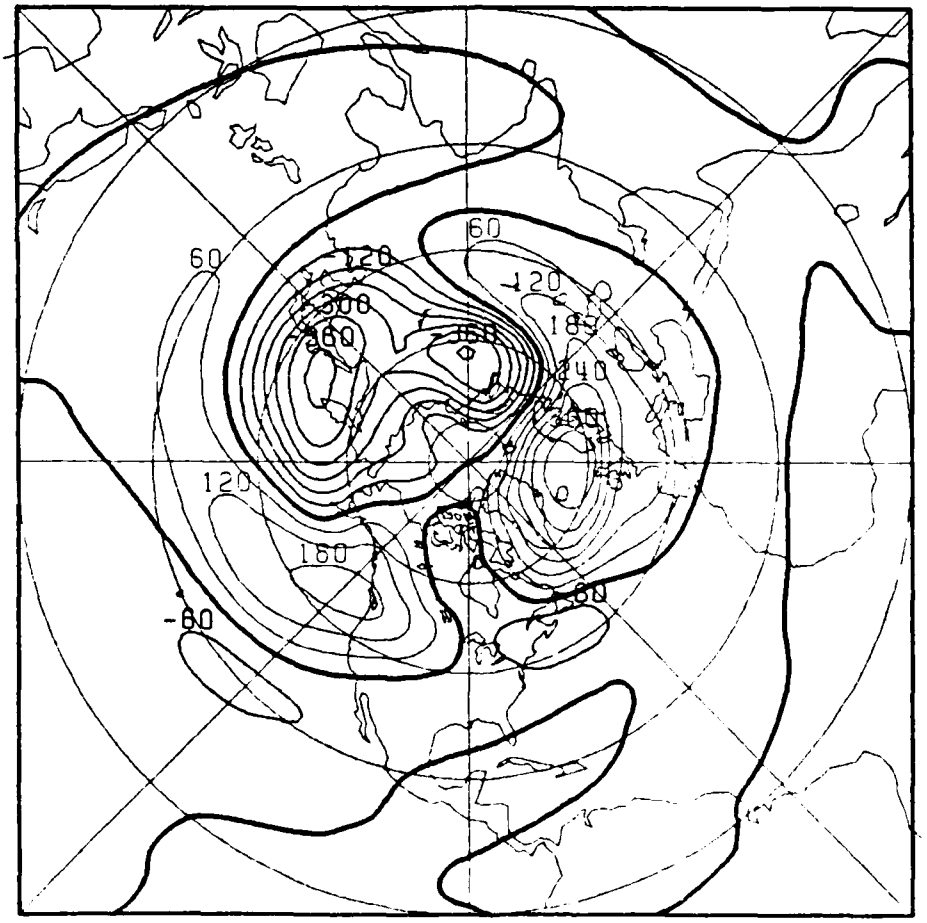
WAVENUMBER'S 1-4

0000 GMT 21 JAN 1979

OBSERVED



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500 mb Z

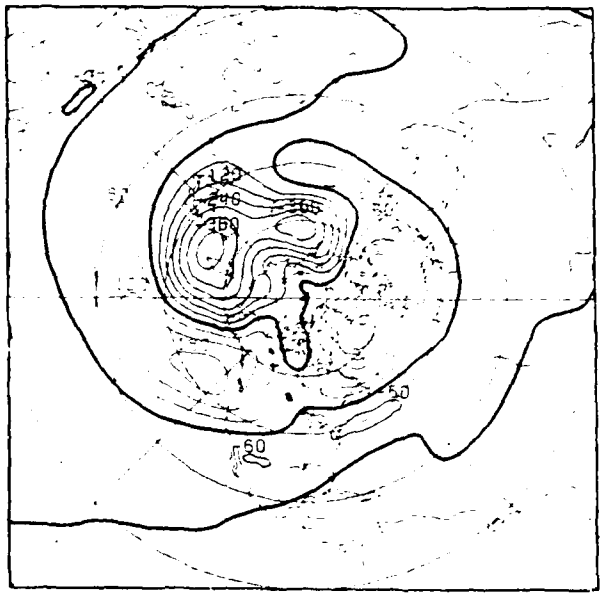
WAVENUMBERS 1-4

0000 GMT

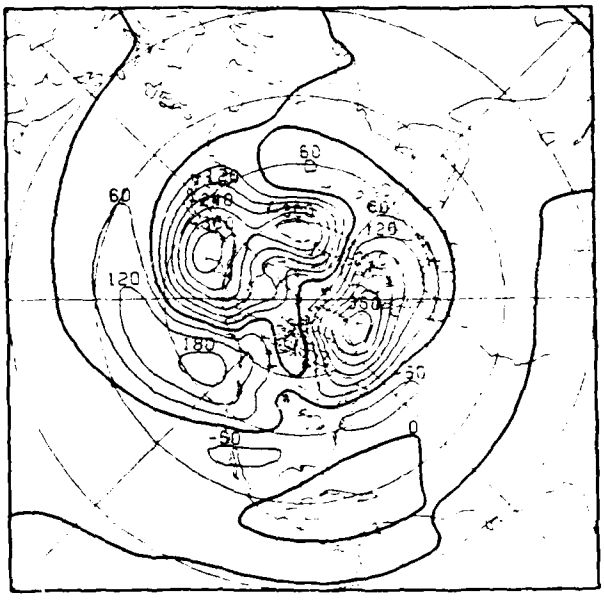
22 JAN 1979

DAY 1

9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3

15-LAYER 2.4X3

OBSERVED

500 mb Z

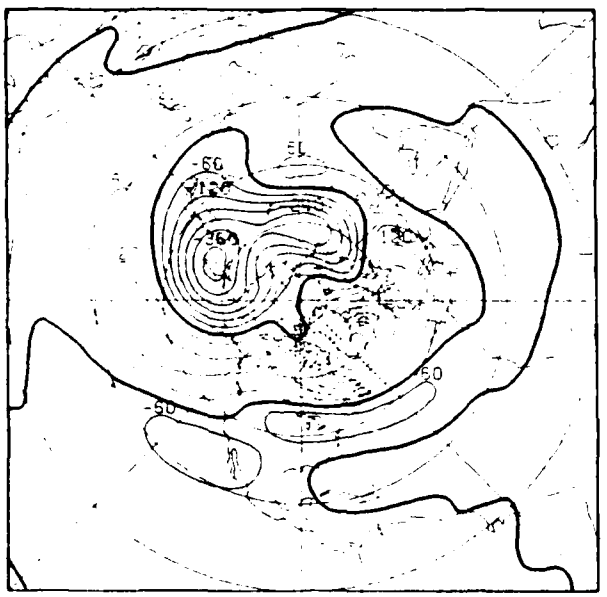
WAVENUMBERS 1-4

0000 GMT

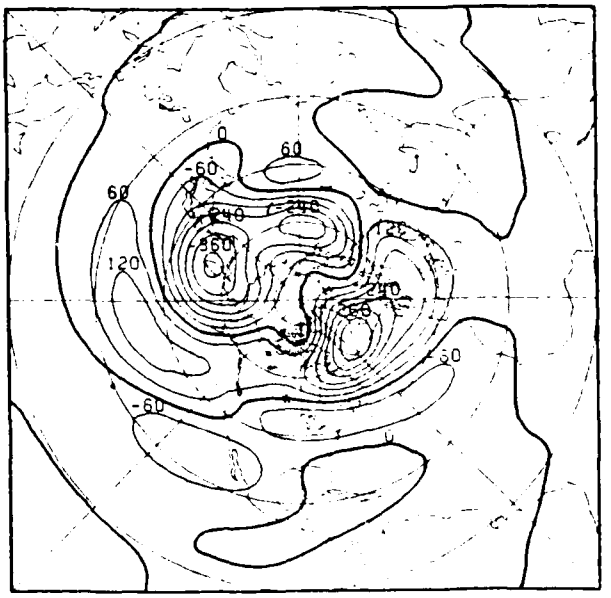
23 JAN 1979

DAY 2

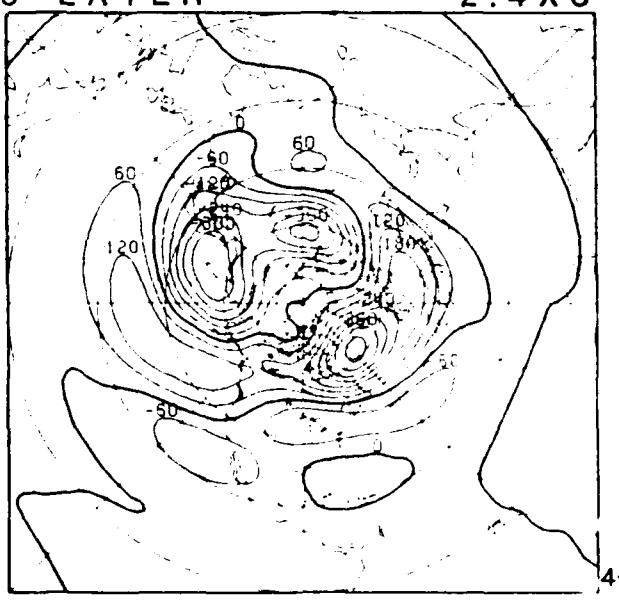
9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3



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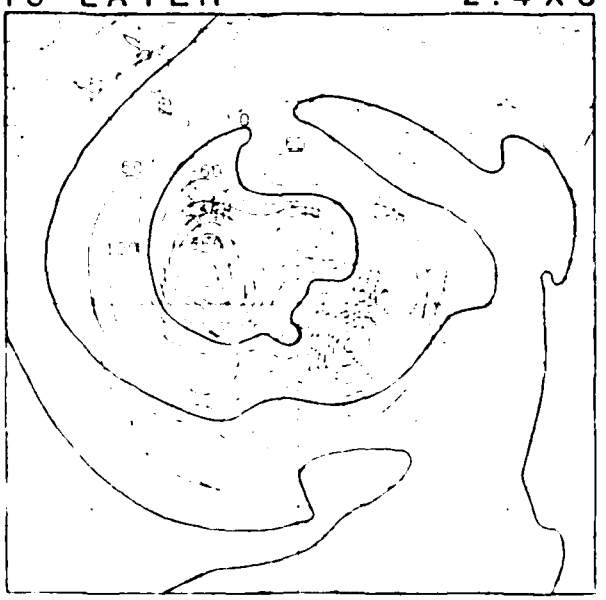

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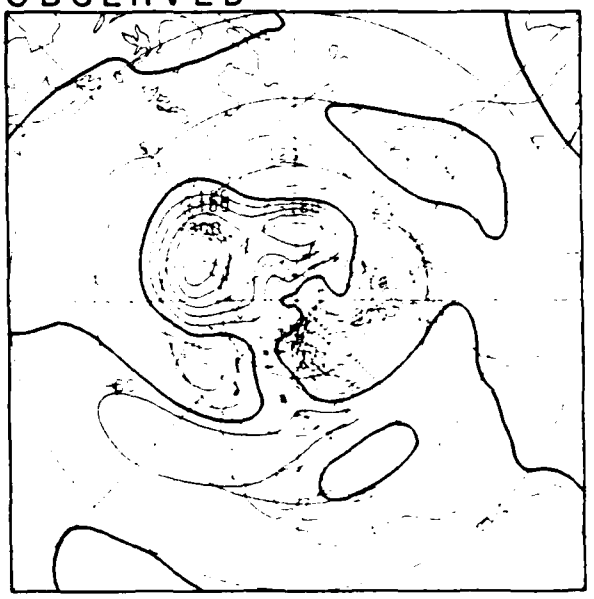


500 mb Z

WAVENUMBERS 1-4

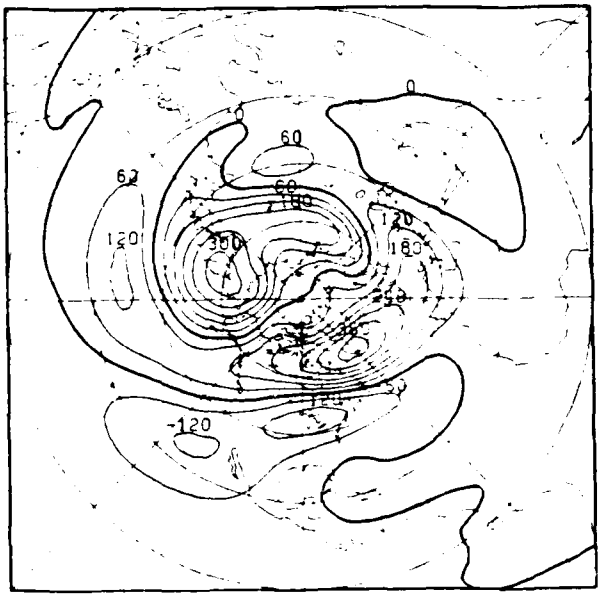
0000 GMT

24 JAN 1979

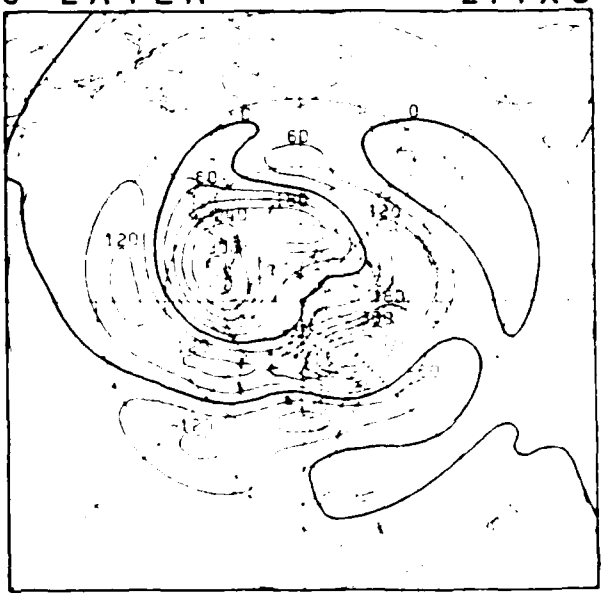
DAY 3

9-LAYER 4X5

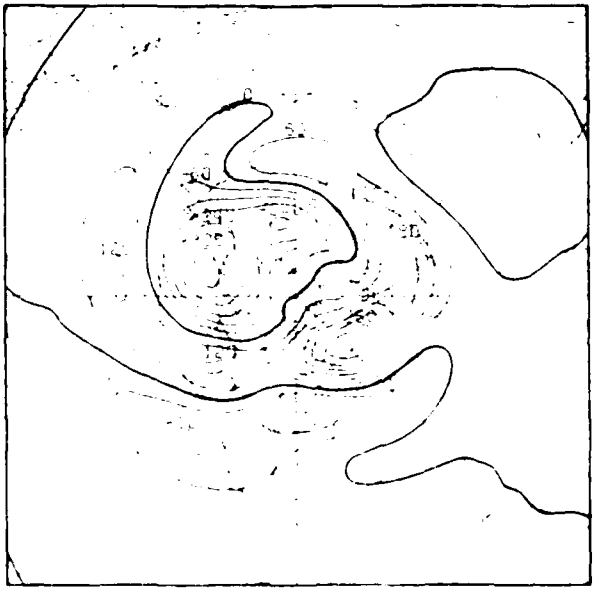
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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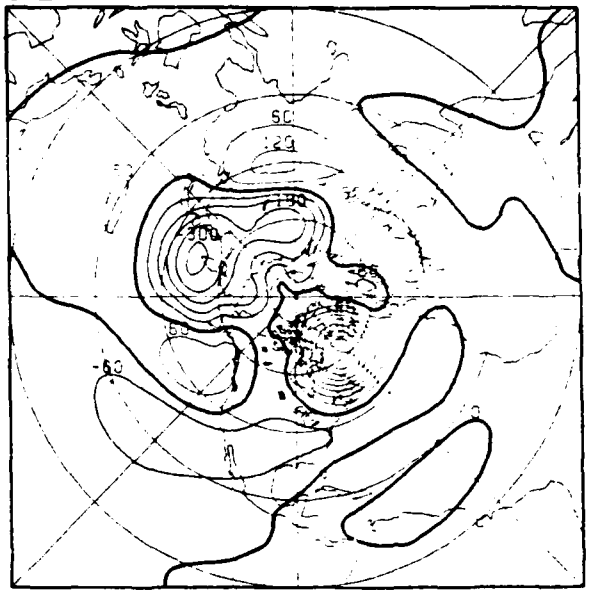

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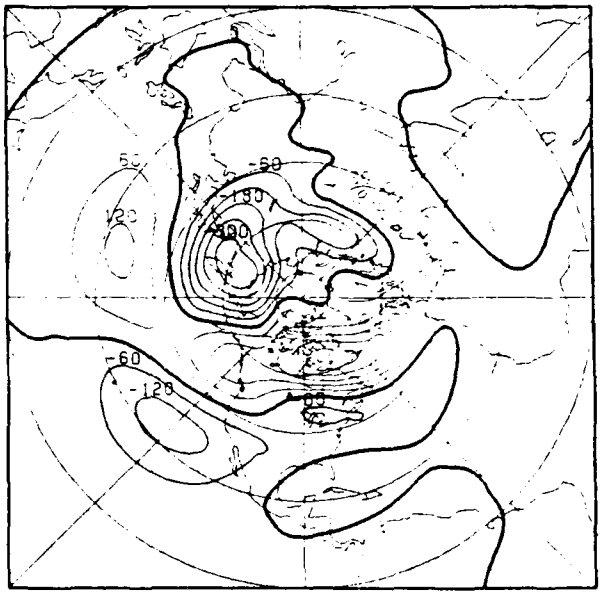
WAVENUMBERS 1-4

0000 GMT

25 JAN 1979

DAY 4

9-LAYER 4X5



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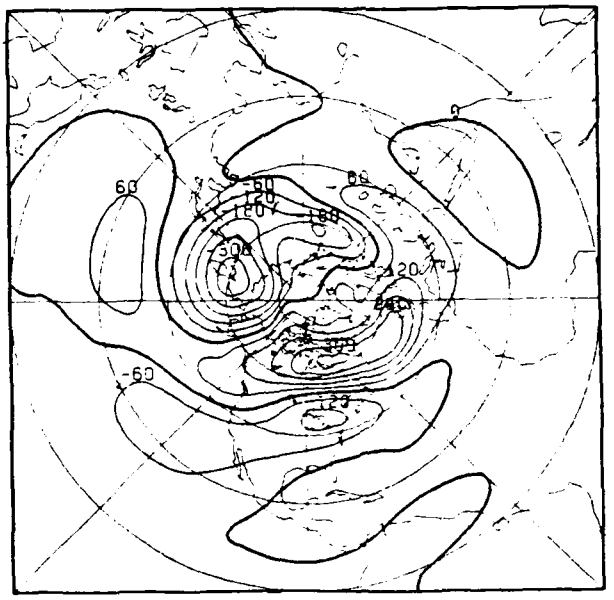
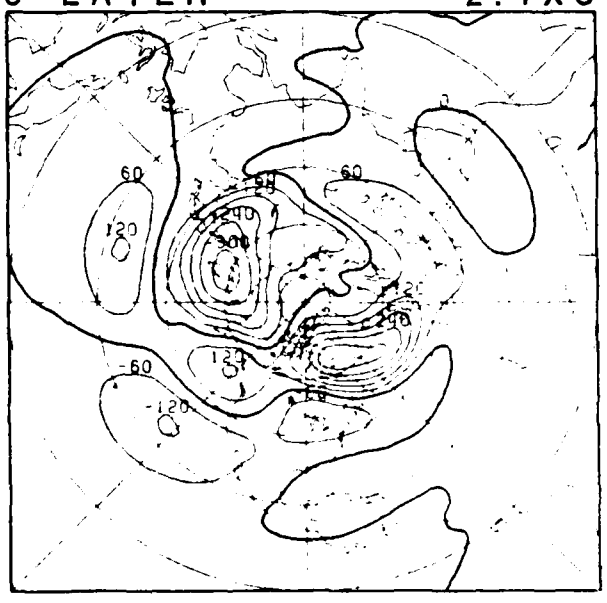
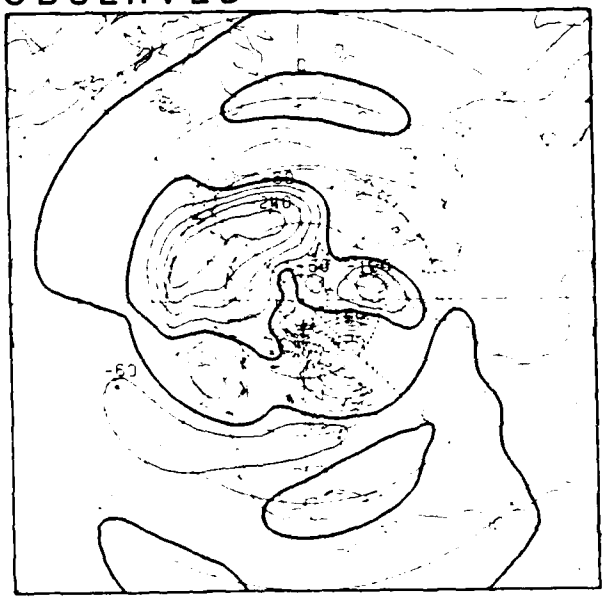


9-LAYER 2.4X3



15-LAYER 2.4X3

OBSERVED



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WAVENUMBERS 1-4

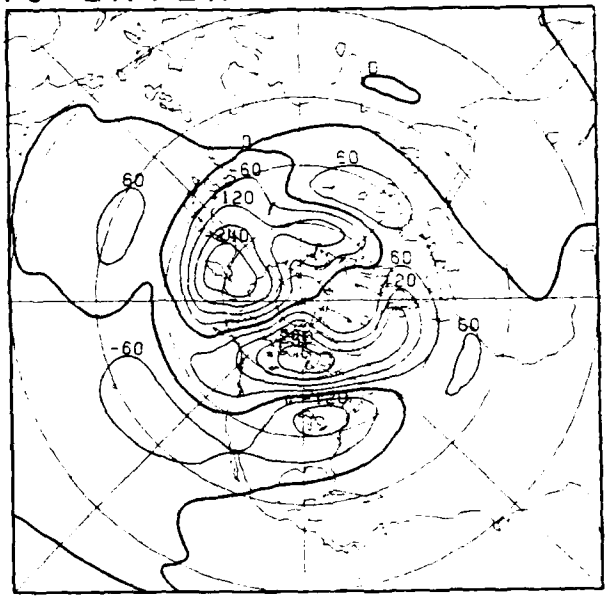
0000 GMT

26 JAN 1979

DAY 5

9-LAYER 4X5

15-LAYER 4X5



9-LAYER 2.4X3

15-LAYER 2.4X3

OBSERVED

500 mb Z

WAVENUMBERS 1-4

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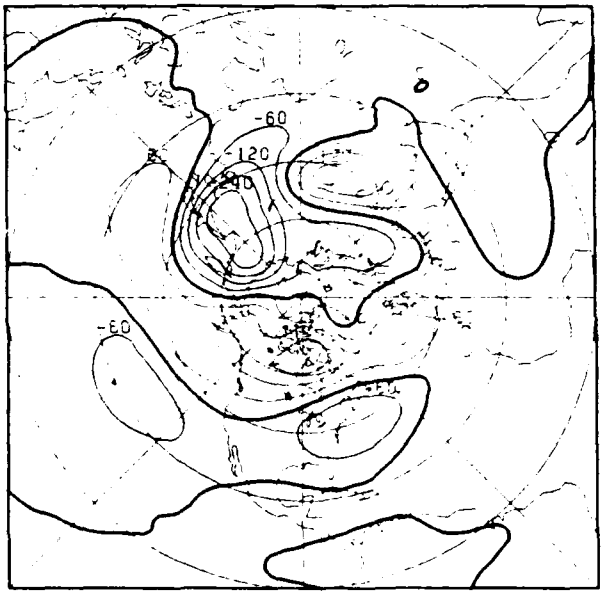
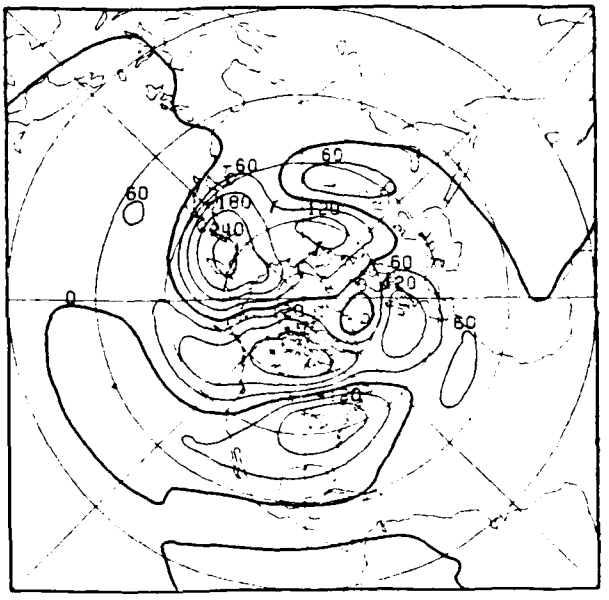
27 JAN 1979

DAY 6

9-LAYER 4X5



15-LAYER 4X5



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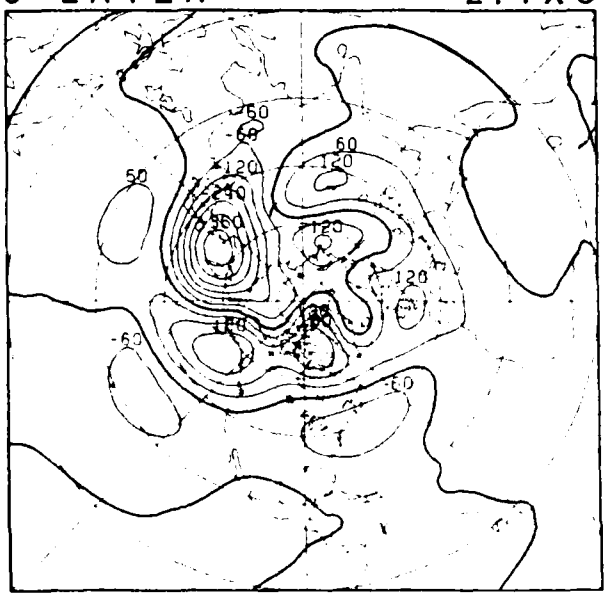
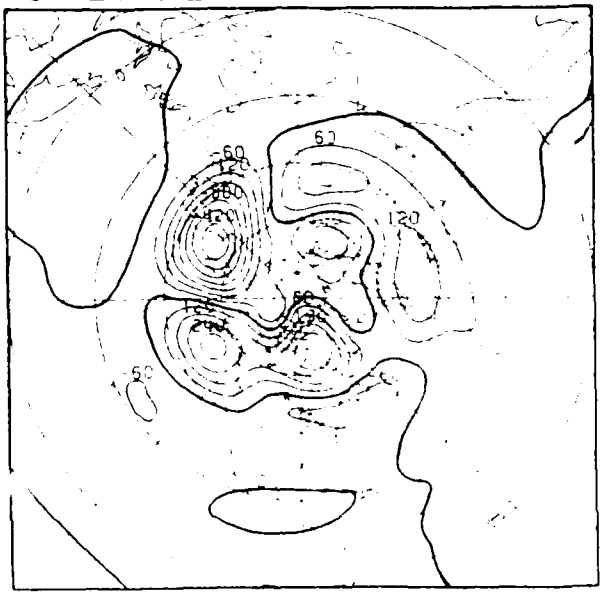


15-LAYER 2.4X3



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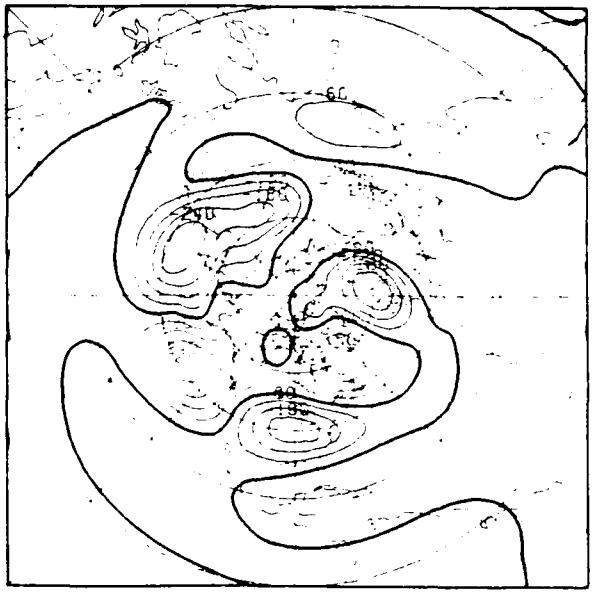

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WAVENUMBERS 1-4

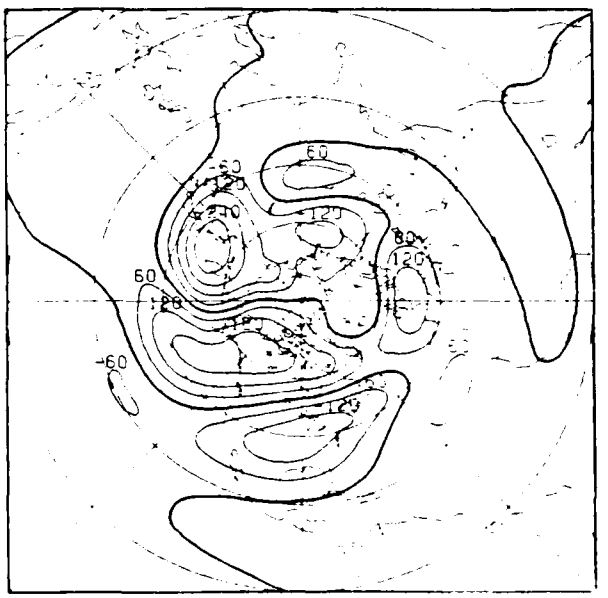
0000 GMT

28 JAN 1979

DAY 7

9-LAYER 4X5

15-LAYER 4X5



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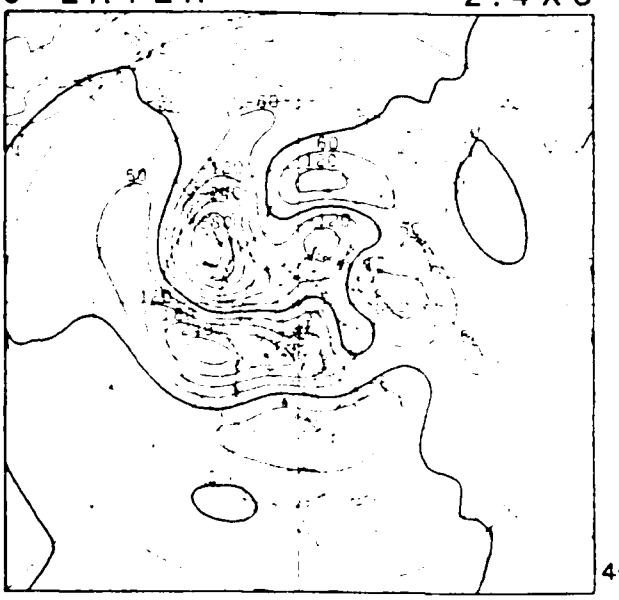

15-LAYER 2.4X3

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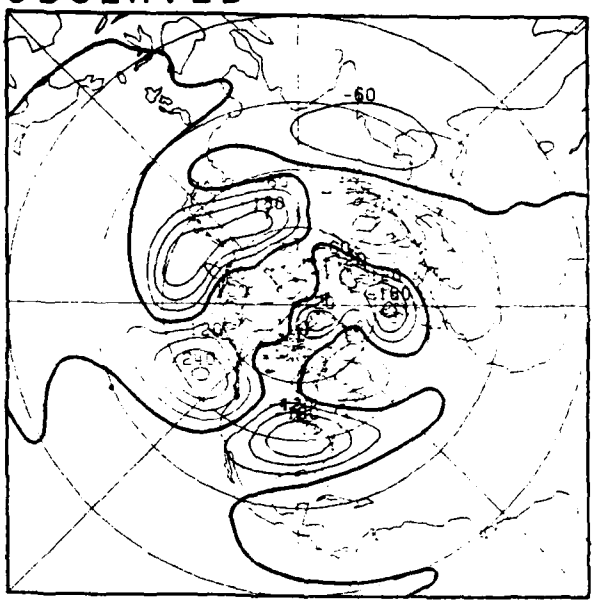

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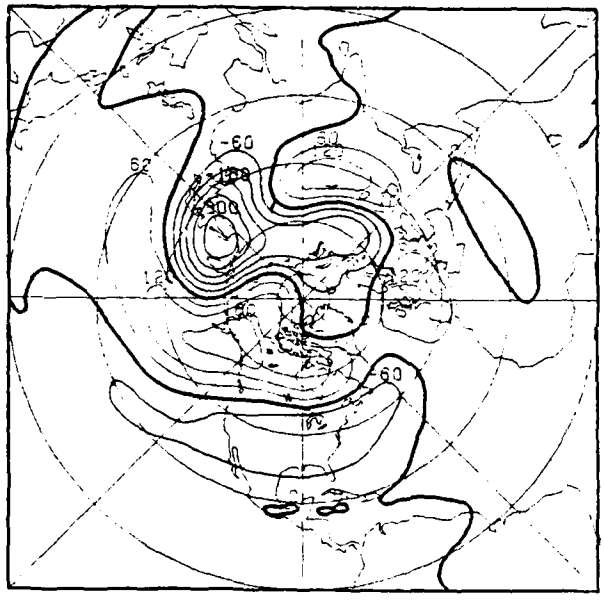
WAVENUMBERS 1-4

0000 GMT

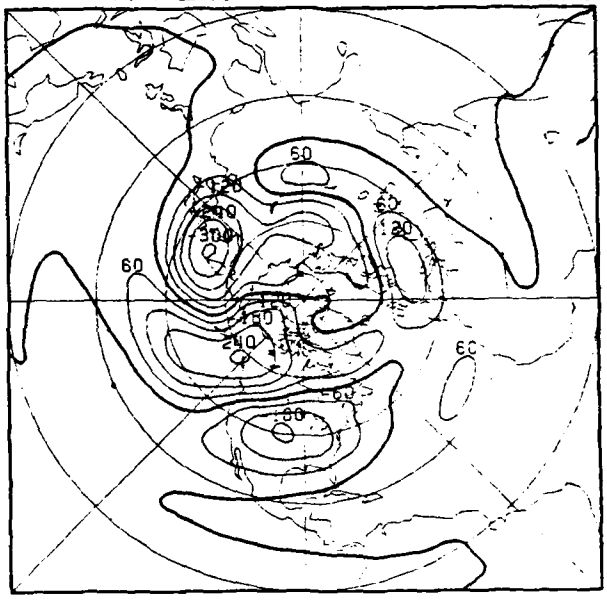
29 JAN 1979

DAY 8

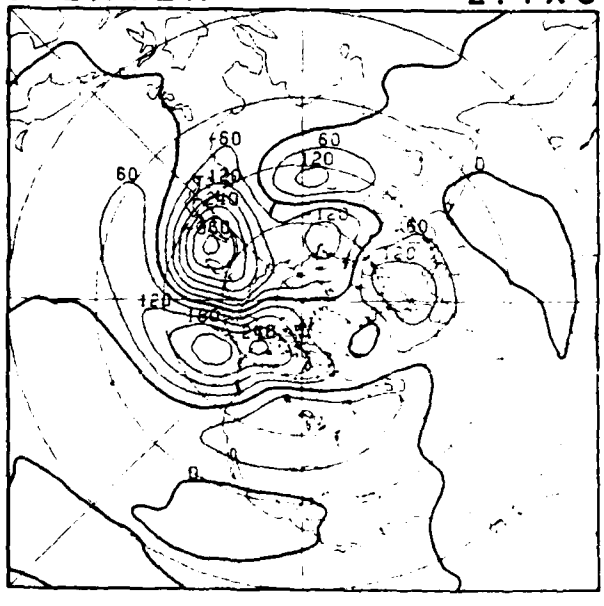
9-LAYER 4X5



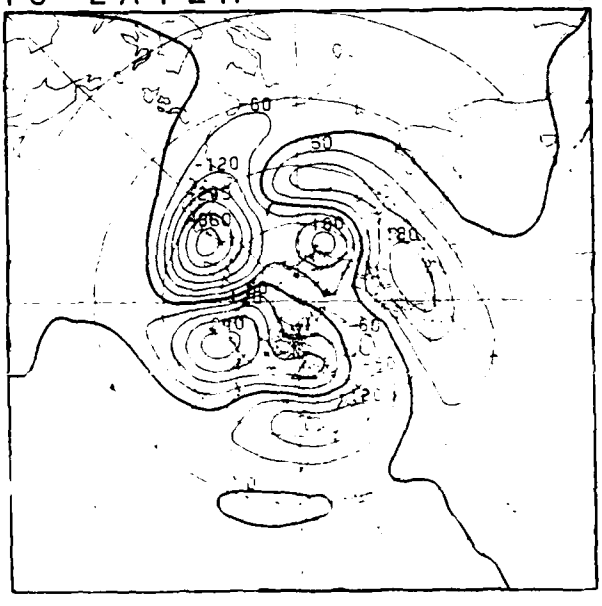
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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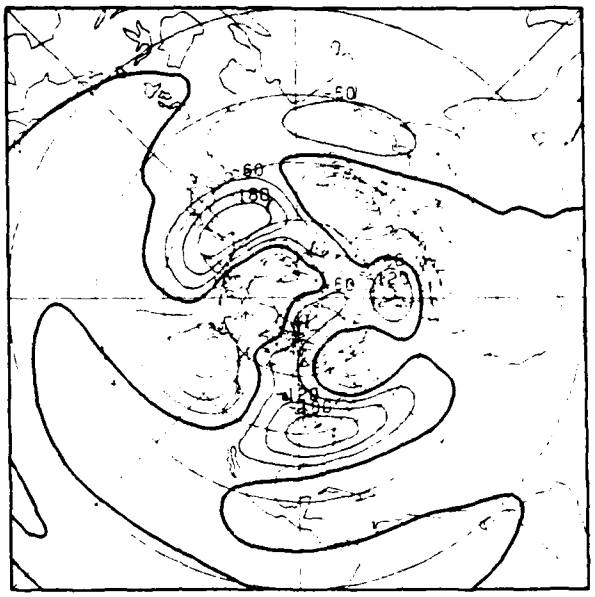

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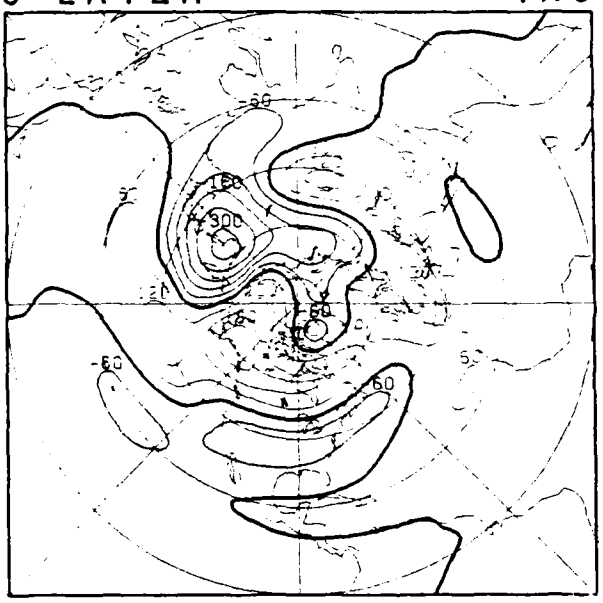
WAVENUMBERS 1-4

0000 GMT

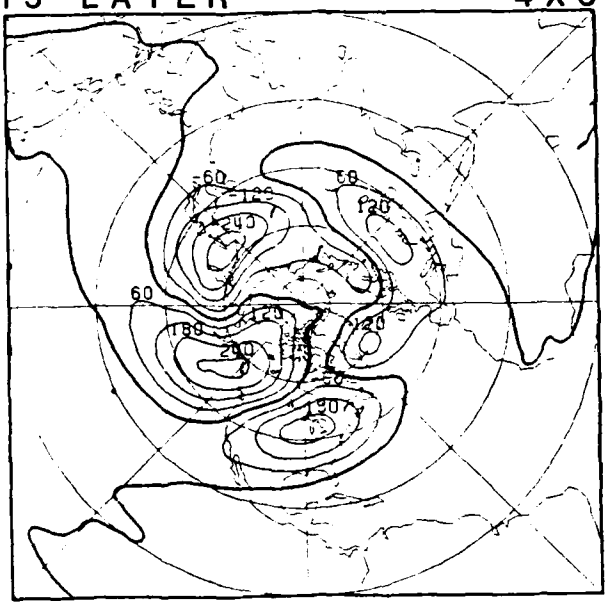
30 JAN 1979

DAY 9

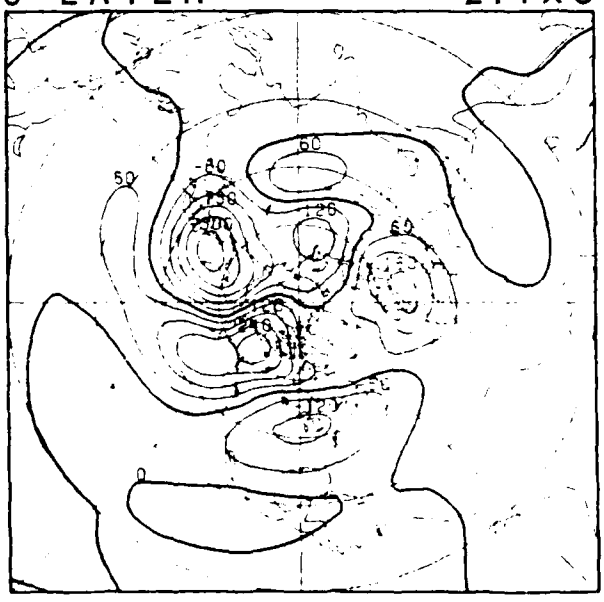
9-LAYER 4X5



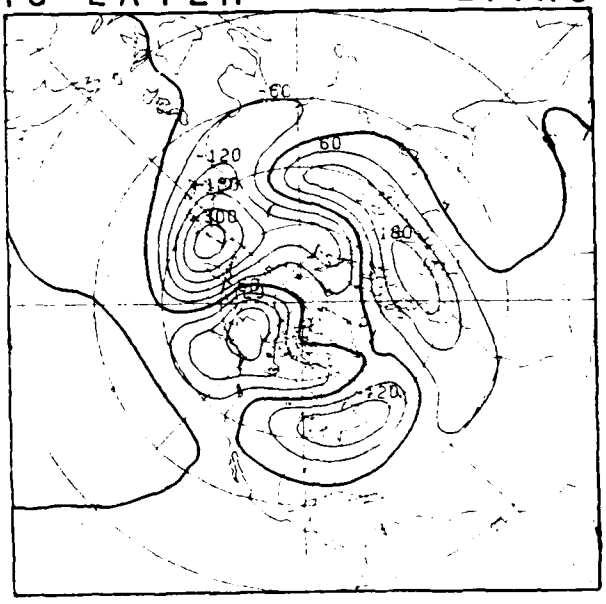
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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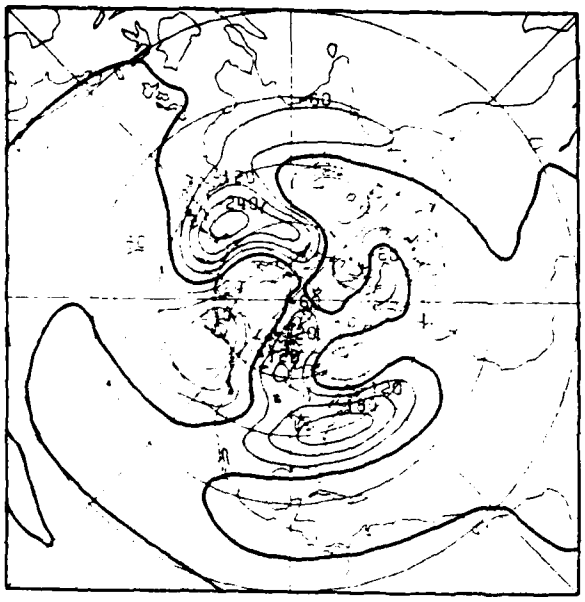

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WAVENUMBERS 1-4

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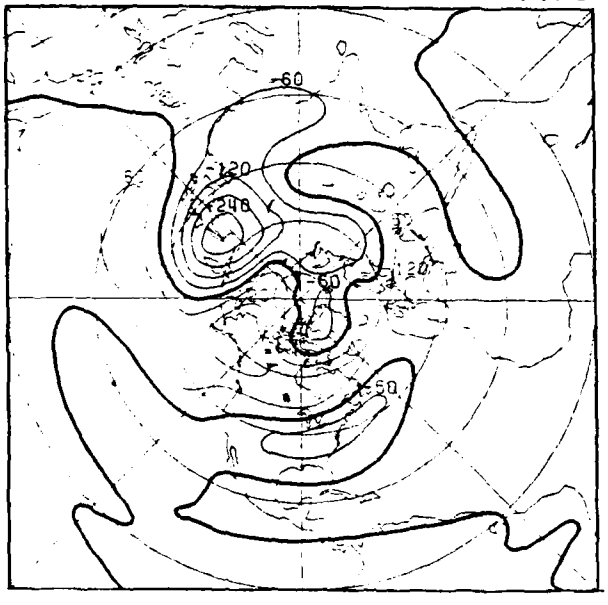
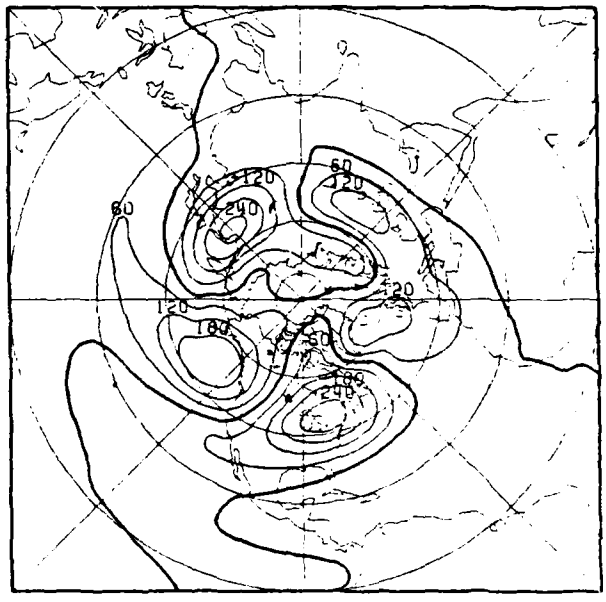
31 JAN 1979

DAY 10

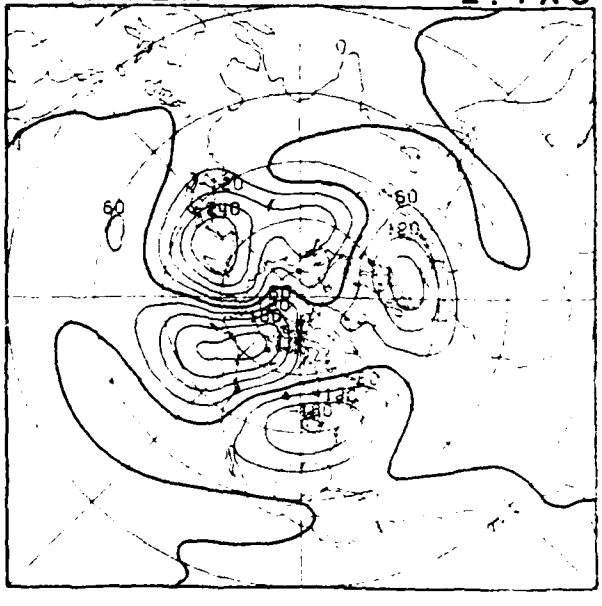
9-LAYER 4X5



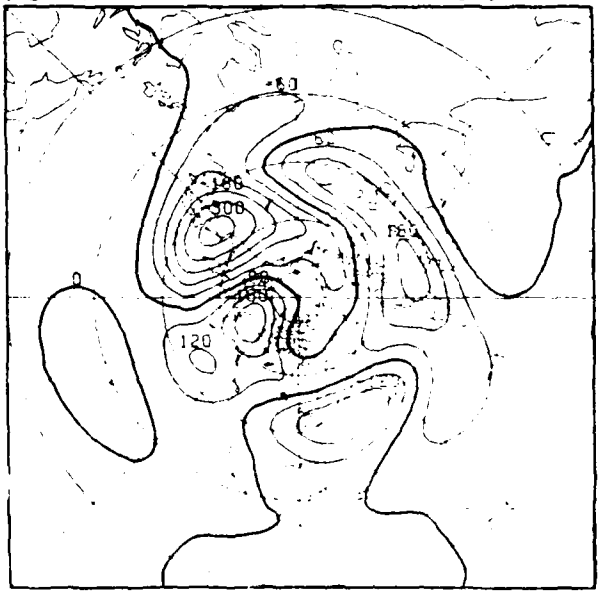
15-LAYER 4X5



9-LAYER 2.4X3



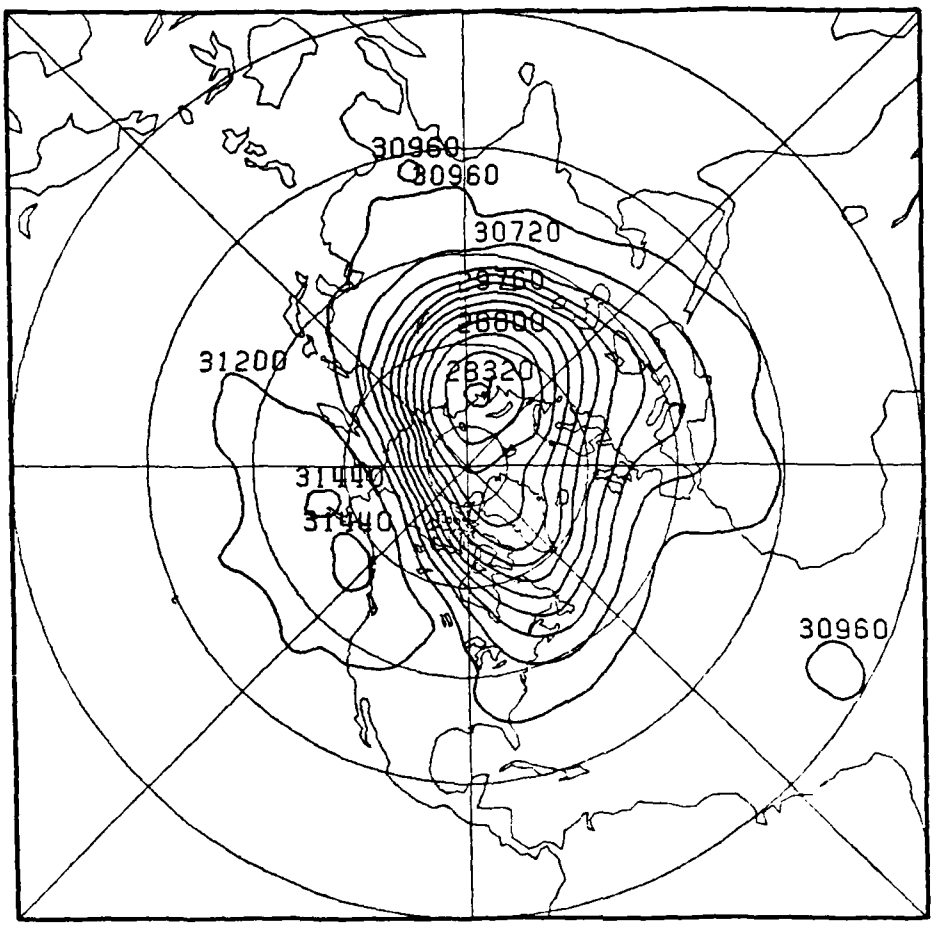
15-LAYER 2.4X3



10 mb Z

0000 GMT 21 JAN 1979

OBSERVED

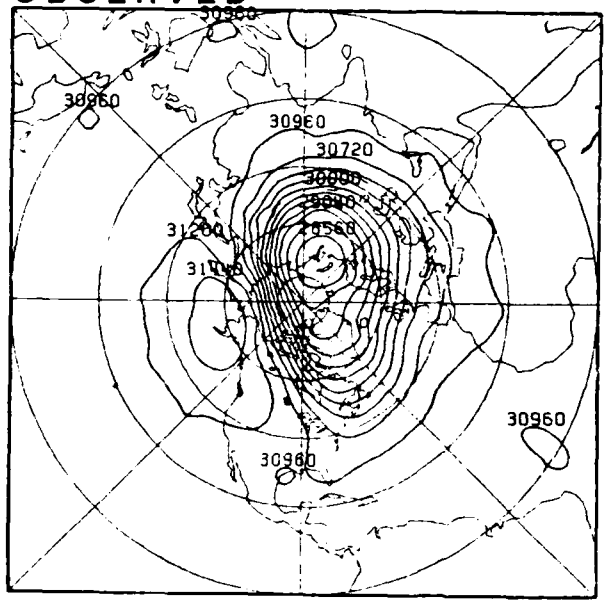


10 mb Z

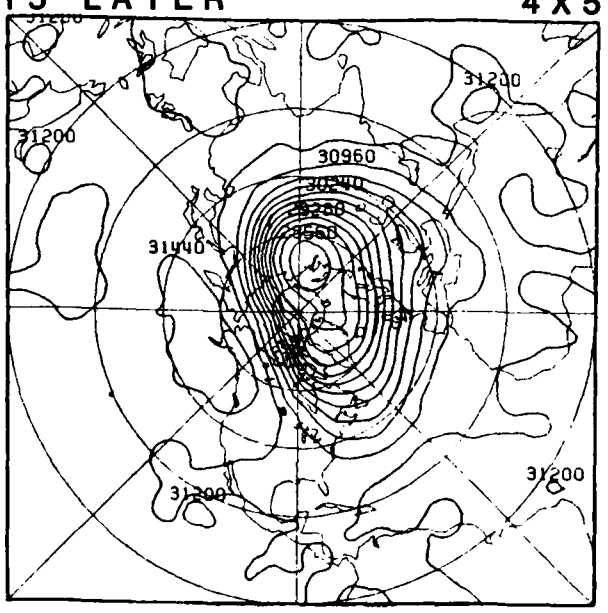
0000 GMT 22 JAN 1979

DAY 1

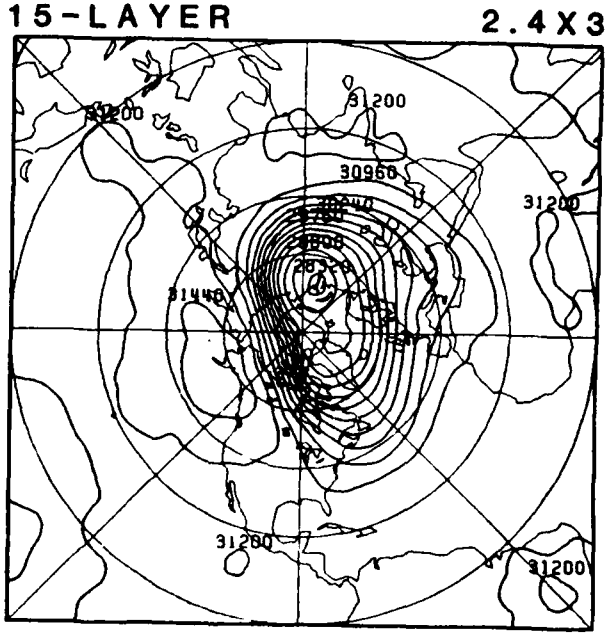
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

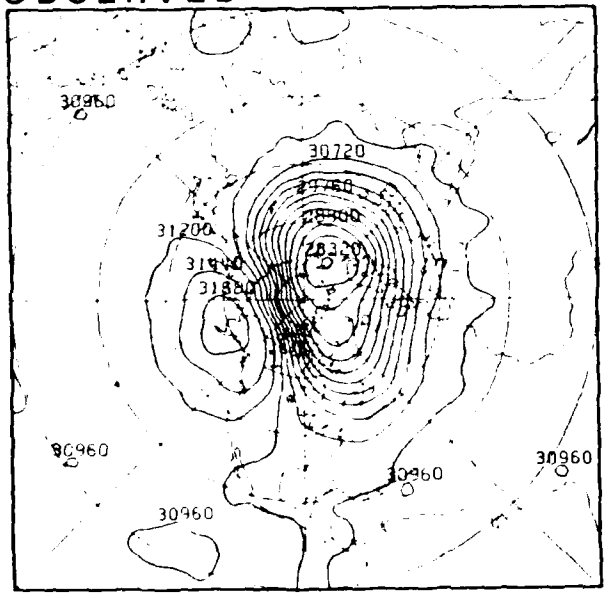


10 mb Z

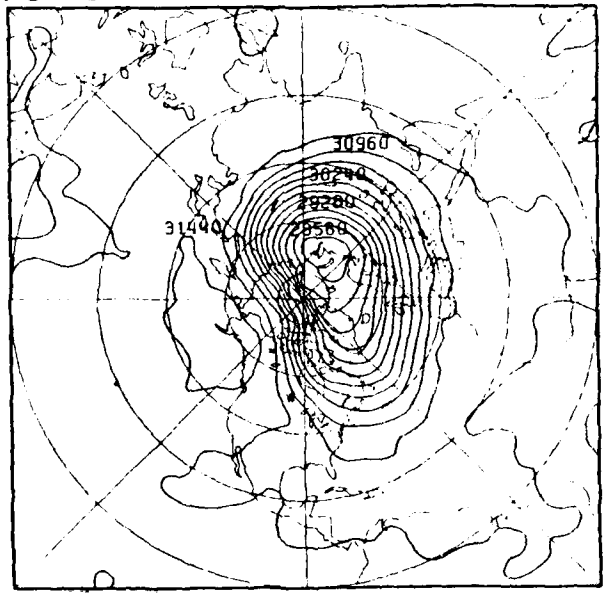
0000 GMT 23 JAN 1979

DAY 2

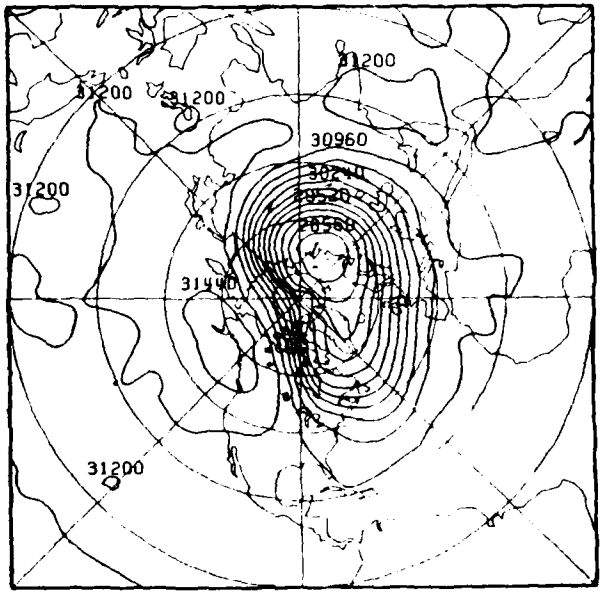
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

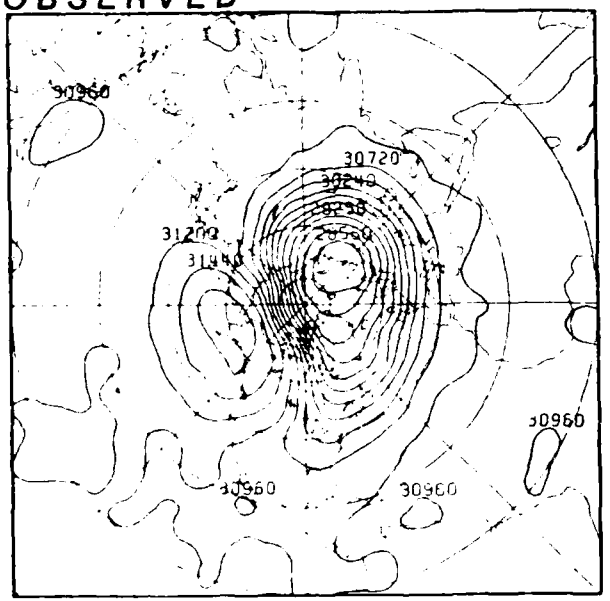


10 mb Z

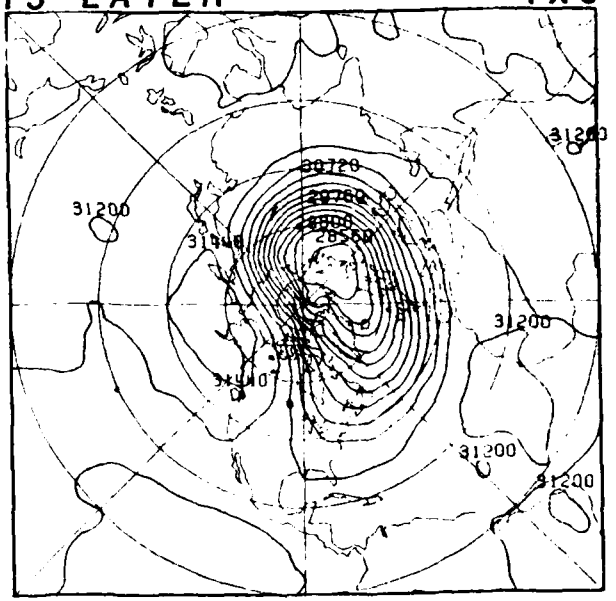
0000 GMT 24 JAN 1979

DAY 3

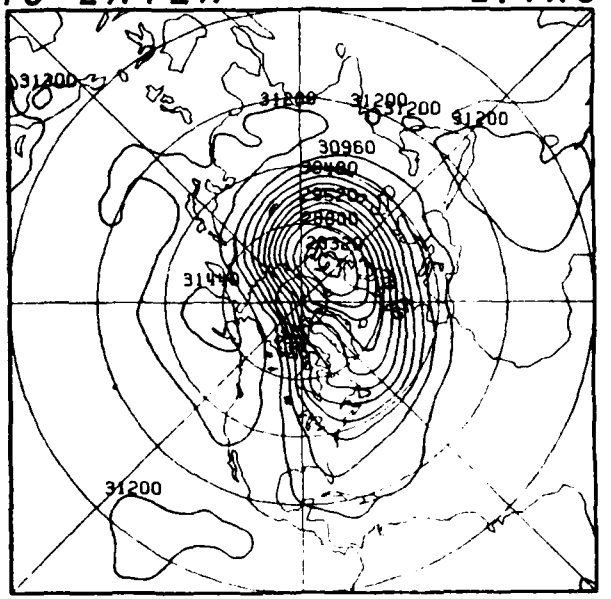
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

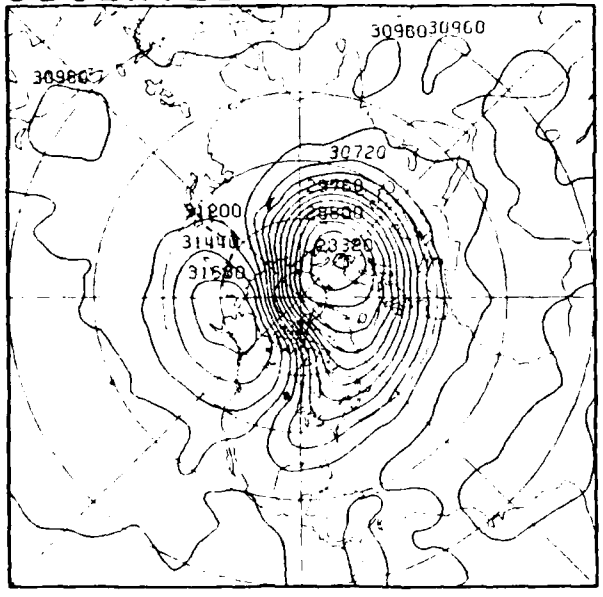


10 mb Z

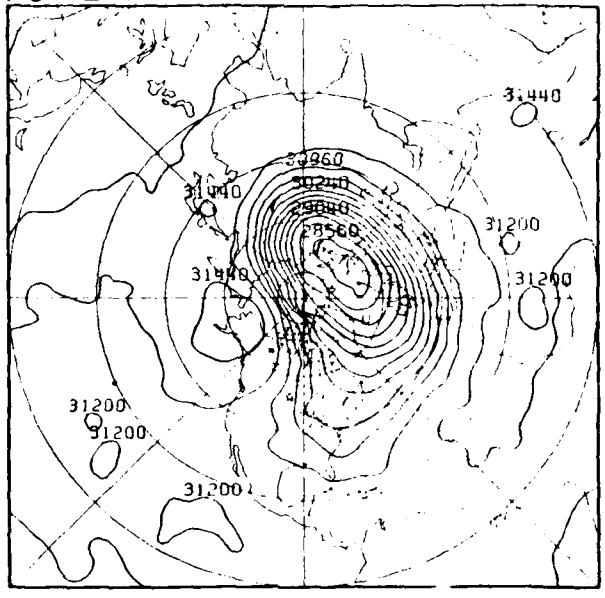
0000 GMT 25 JAN 1979

DAY 4

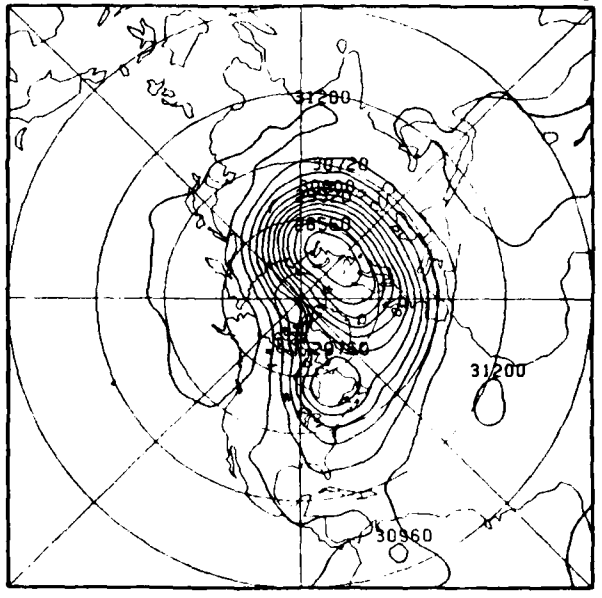
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

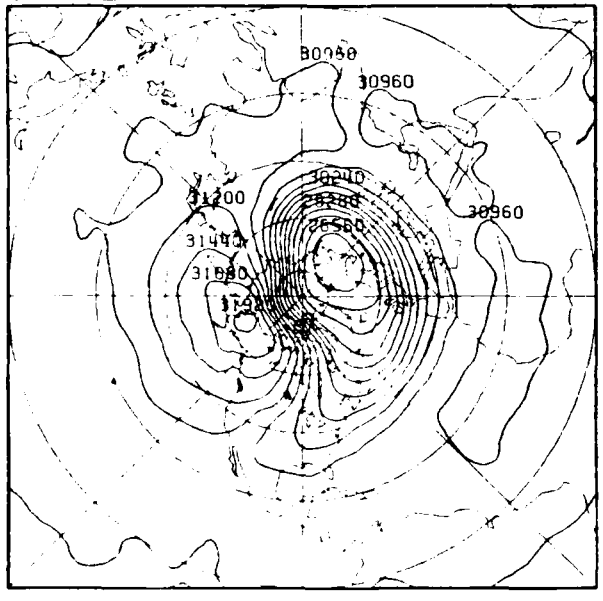


10 mb Z

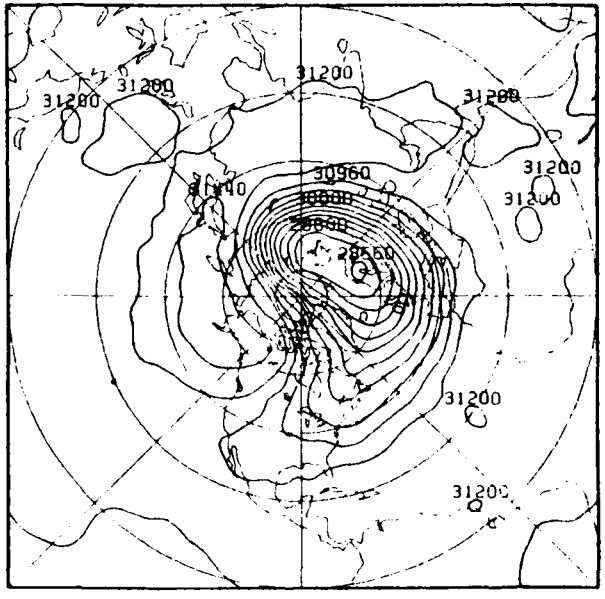
0000 GMT 26 JAN 1979

DAY 5

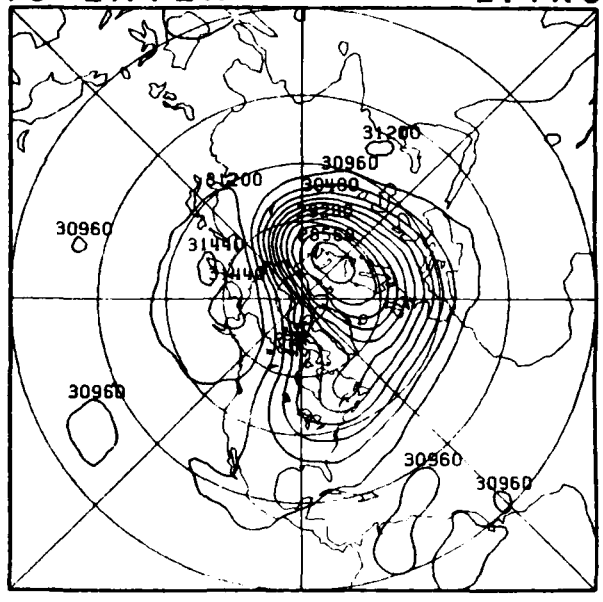
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

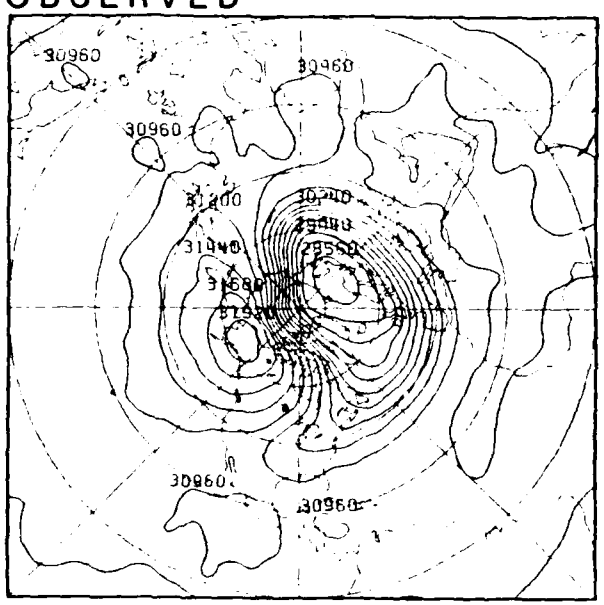


10 mb Z

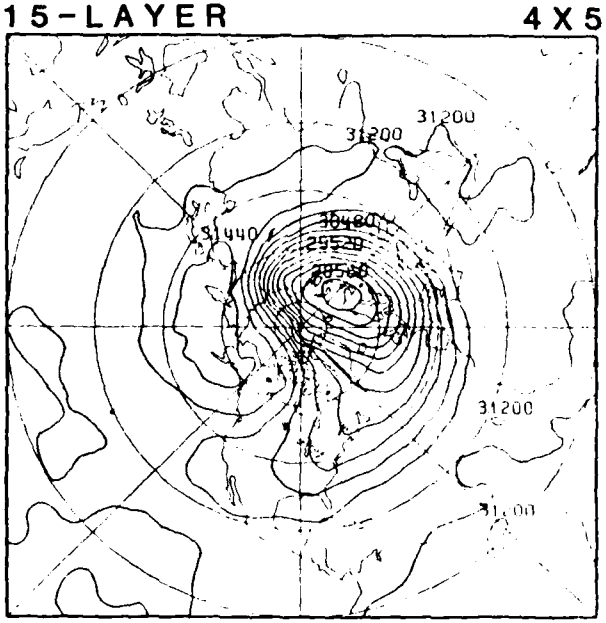
0000 GMT 27 JAN 1979

DAY 6

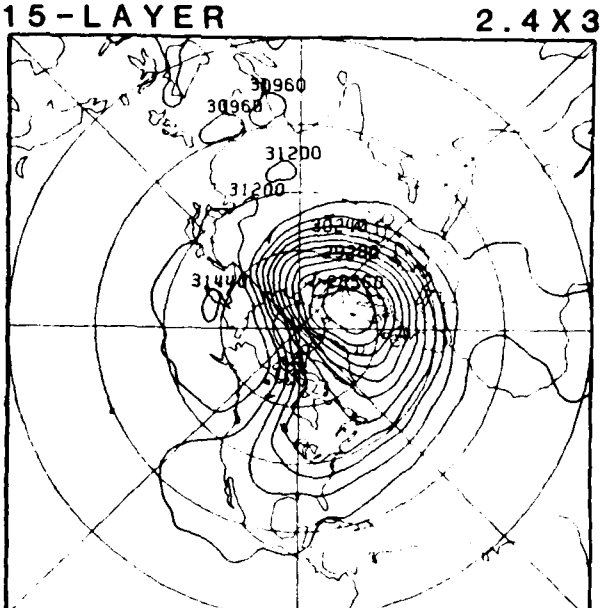
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

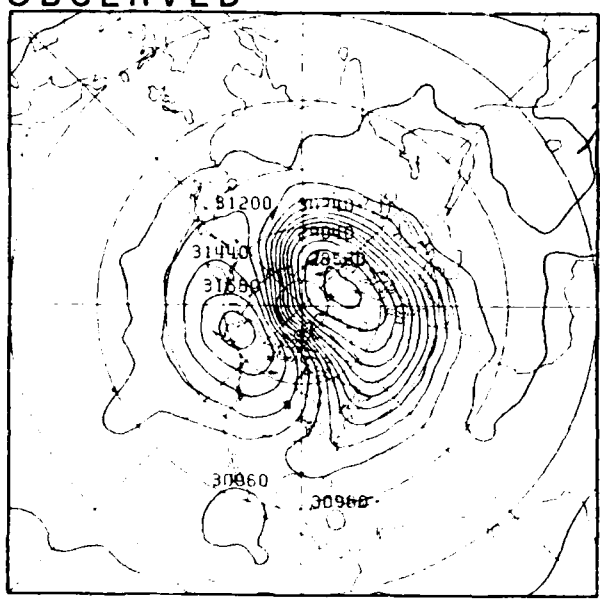


10 mb Z

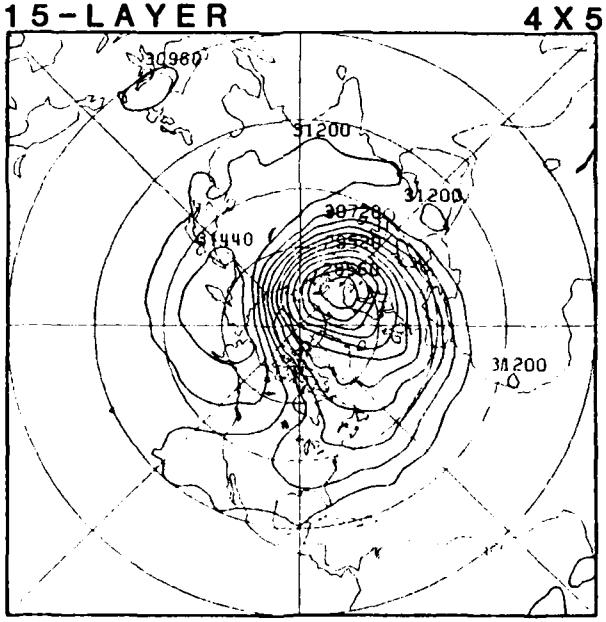
0000 GMT 28 JAN 1979

DAY 7

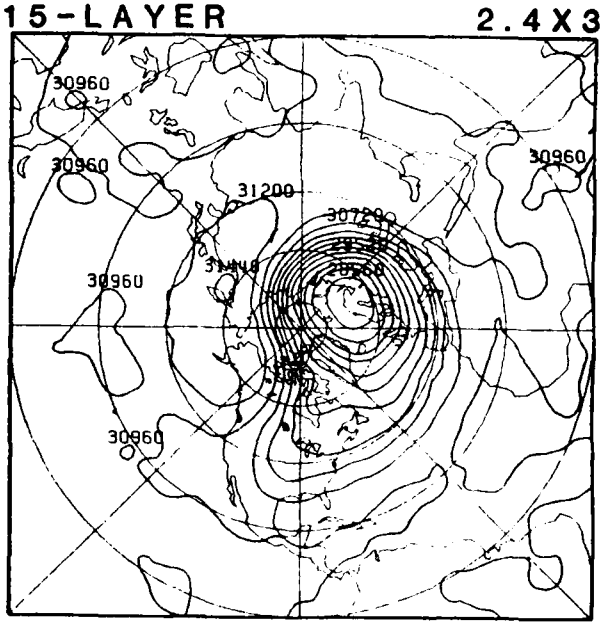
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

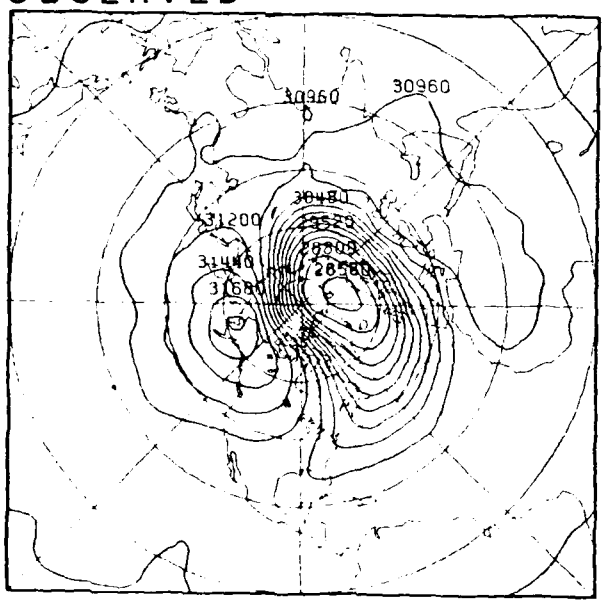


10 mb Z

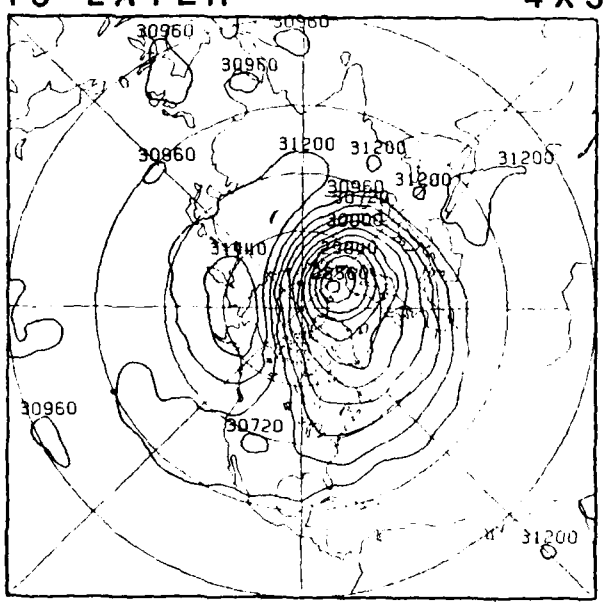
0000 GMT 29 JAN 1979

DAY 8

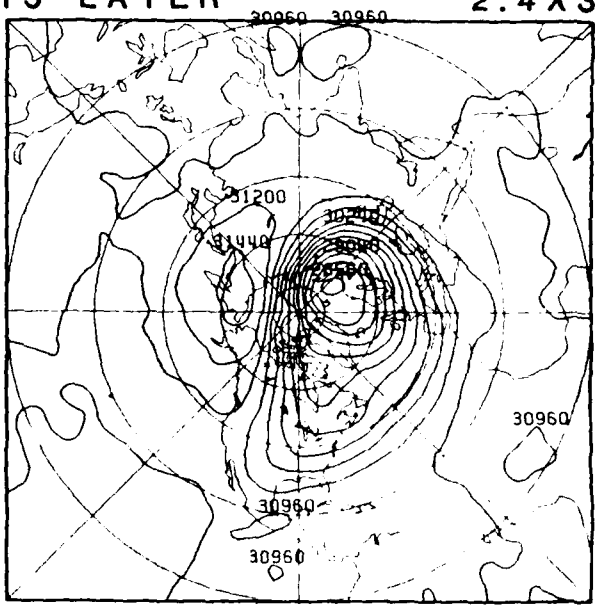
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

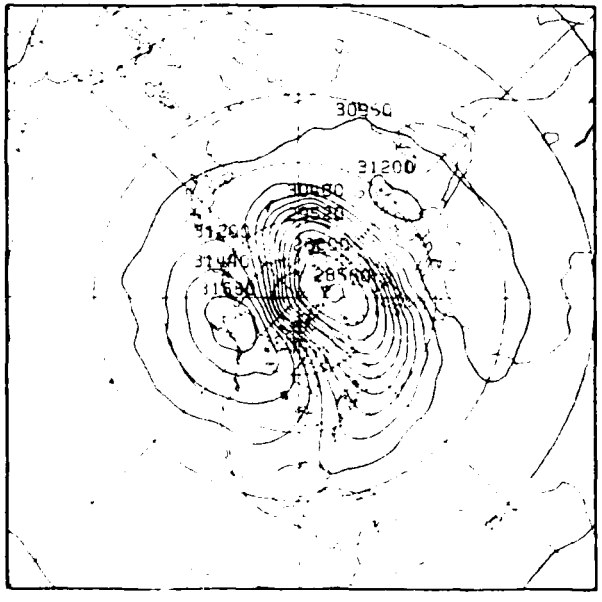


10 mb Z

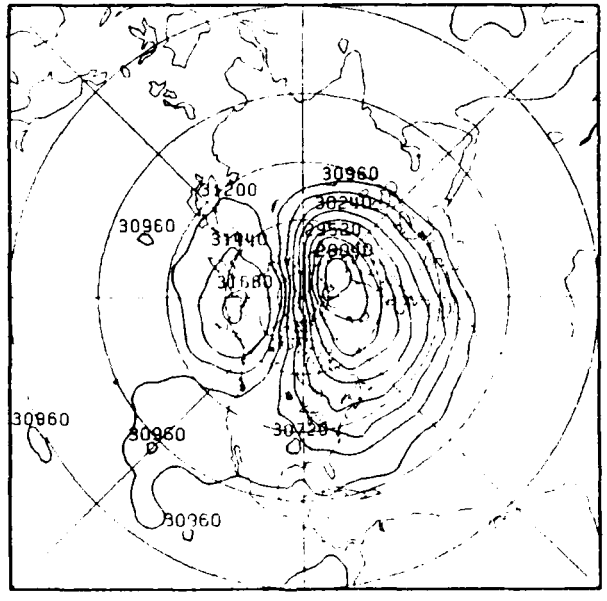
0000 GMT 30 JAN 1979

DAY 9

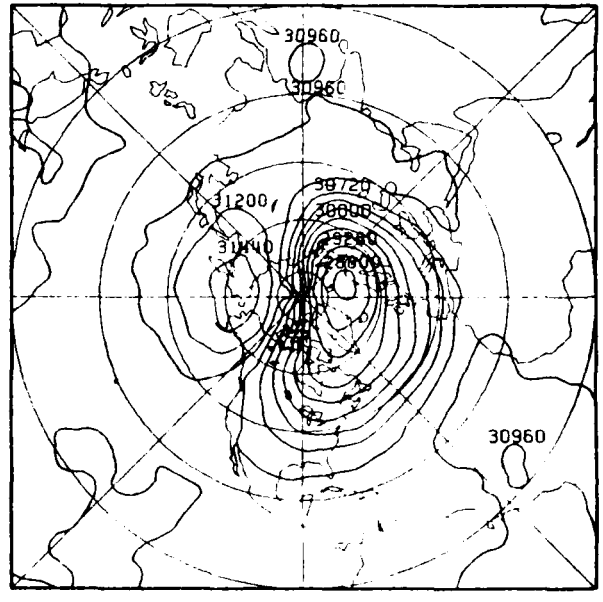
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

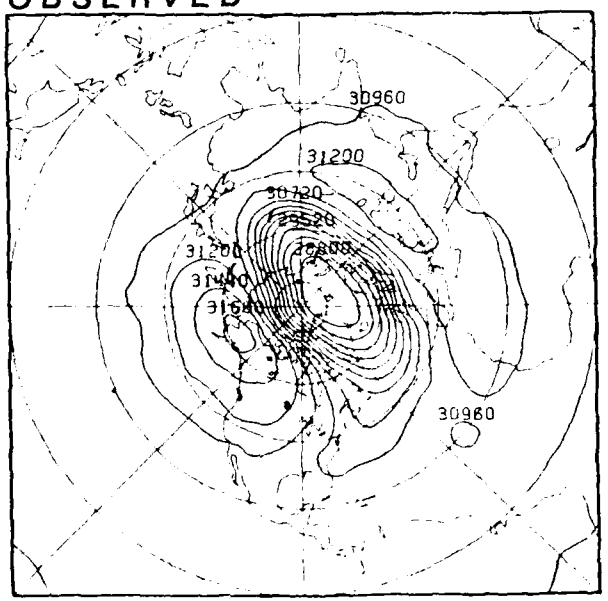


10 mb Z

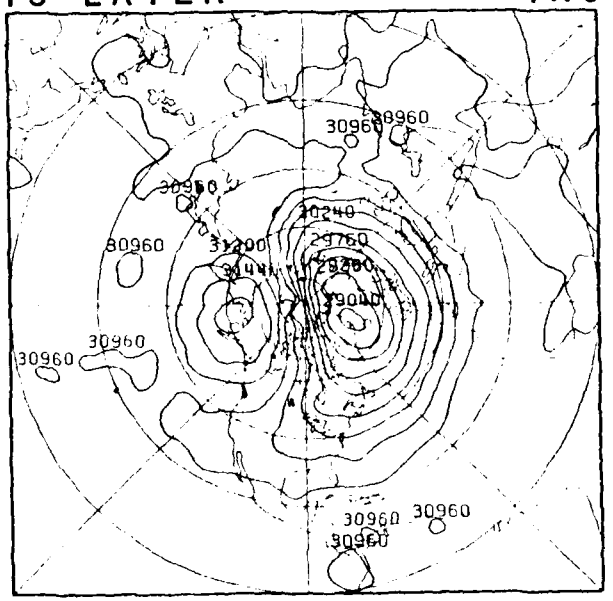
0000 GMT 31 JAN 1979

DAY 10

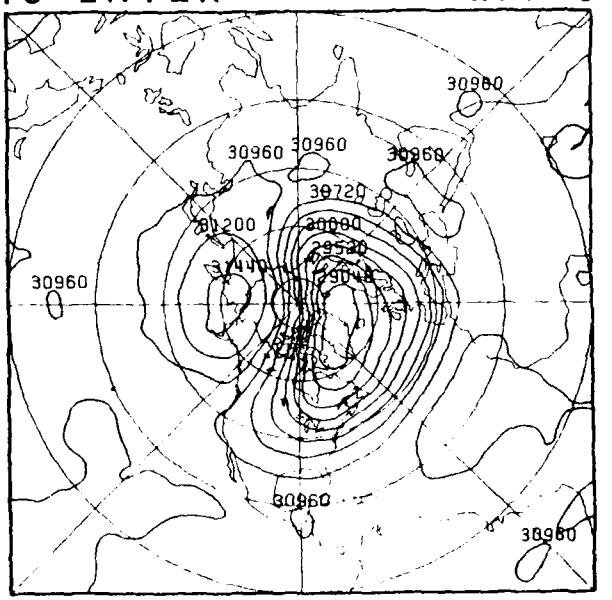
OBSERVED

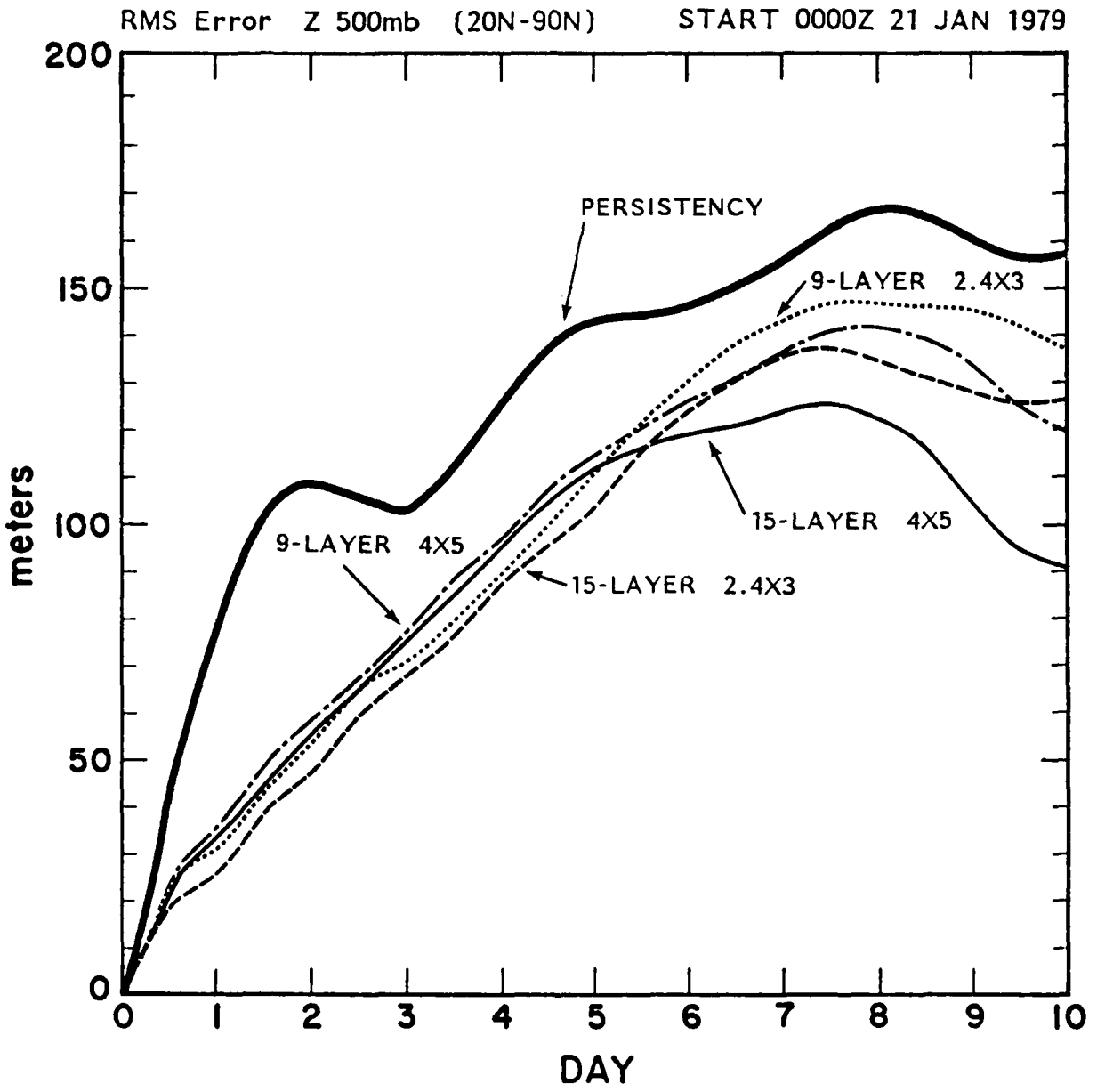


15-LAYER 4X5



15-LAYER 2.4X3




RMS Error Z 500mb (20N-90N)
START 0000Z 21 JAN 1979
200
150
100
50
0
meters
PERSISTENCY
9-LAYER 2.4X3
9-LAYER 4X5
15-LAYER 4X5
15-LAYER 2.4X3
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

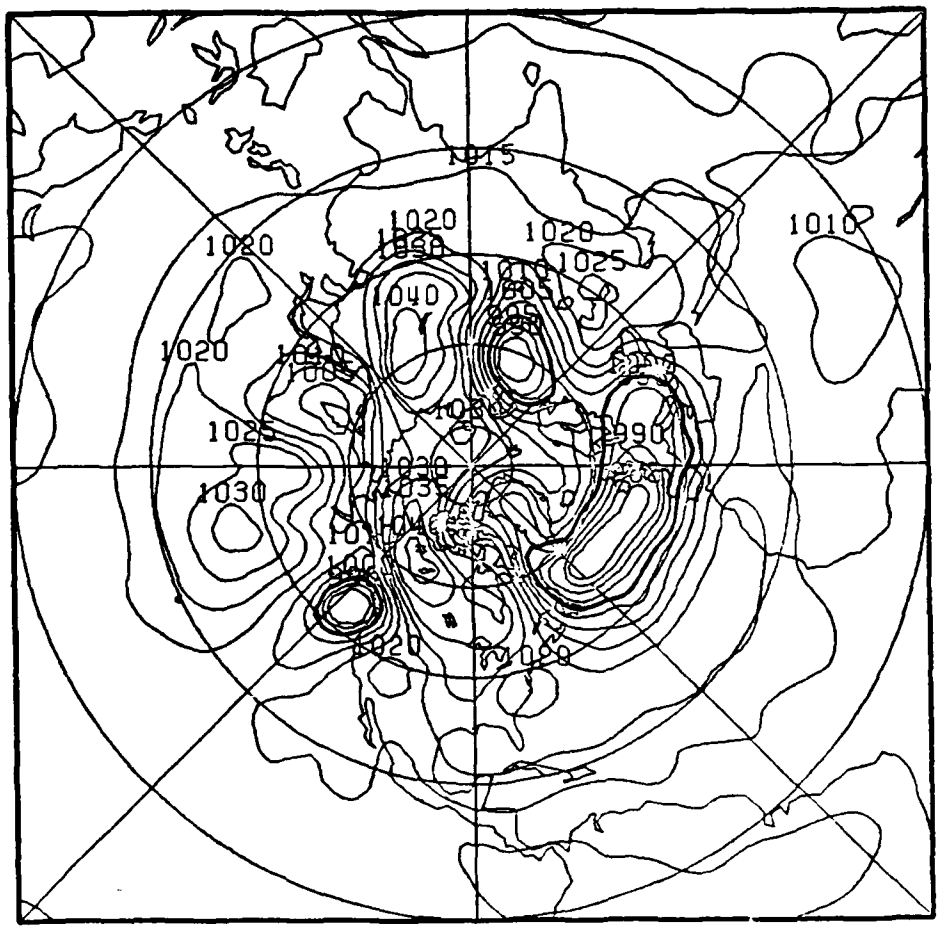
0000 GMT

13 FEBRUARY 1979

SLP

0000 GMT 13 FEB 1979

OBSERVED

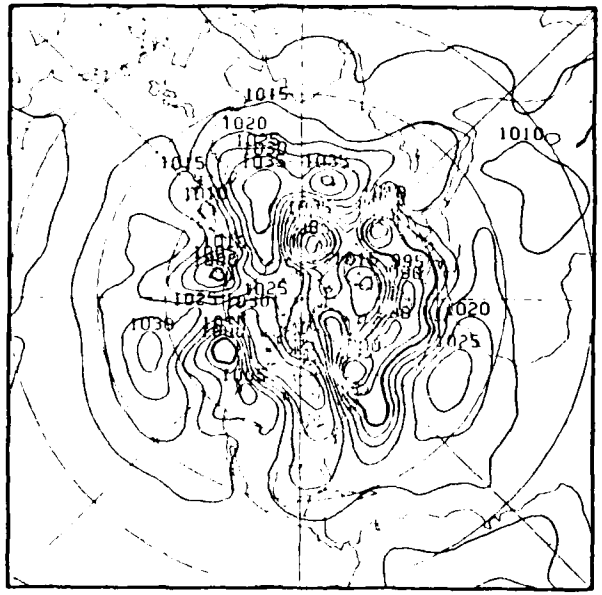


SLP

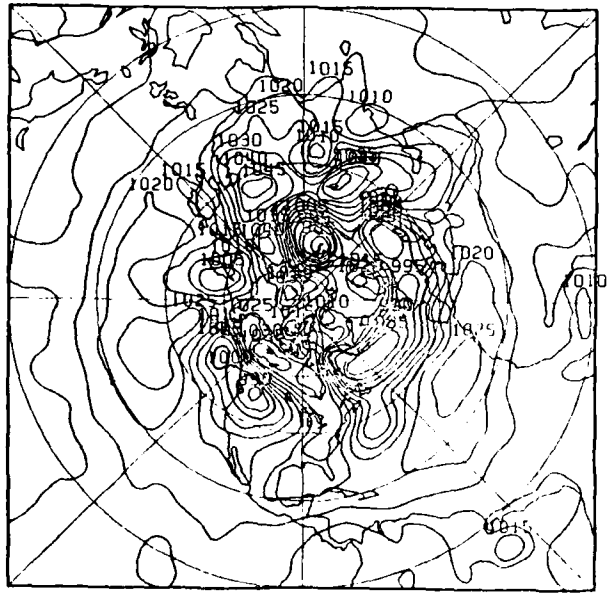
0000 GMT 14 FEB 1979

DAY 1

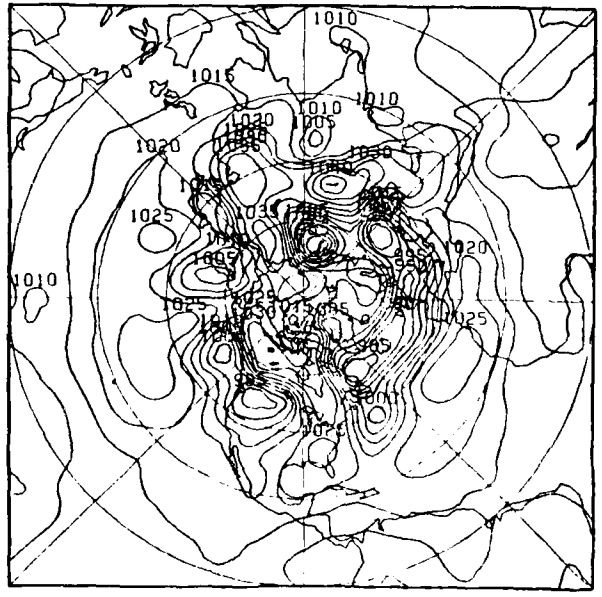
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

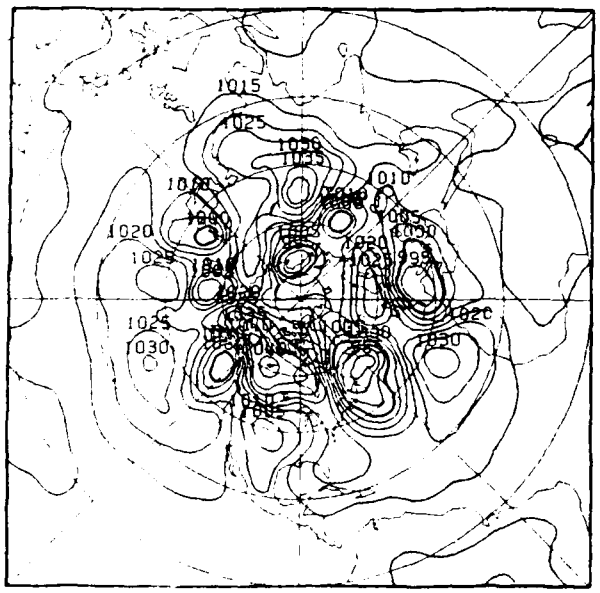


SLP

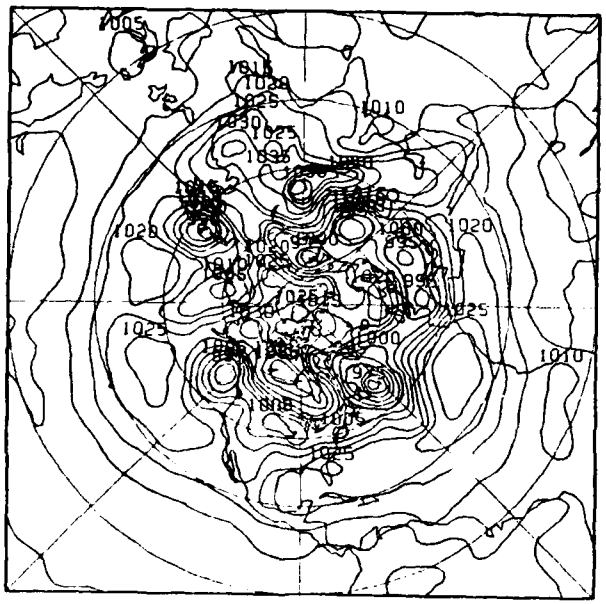
0000 GMT 15 FEB 1979

DAY 2

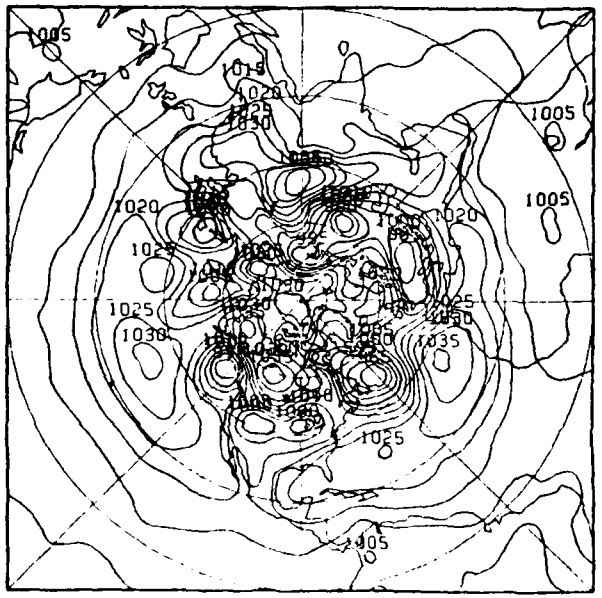
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



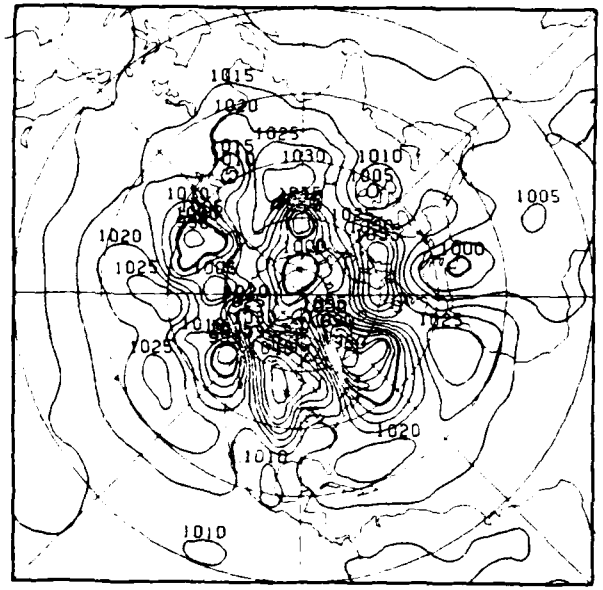
SLP

0000 GMT 16 FEB 1979

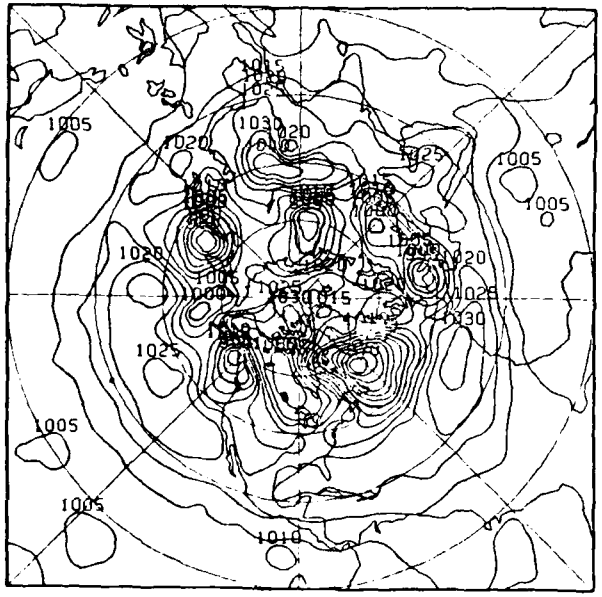
DAY 3

5-5

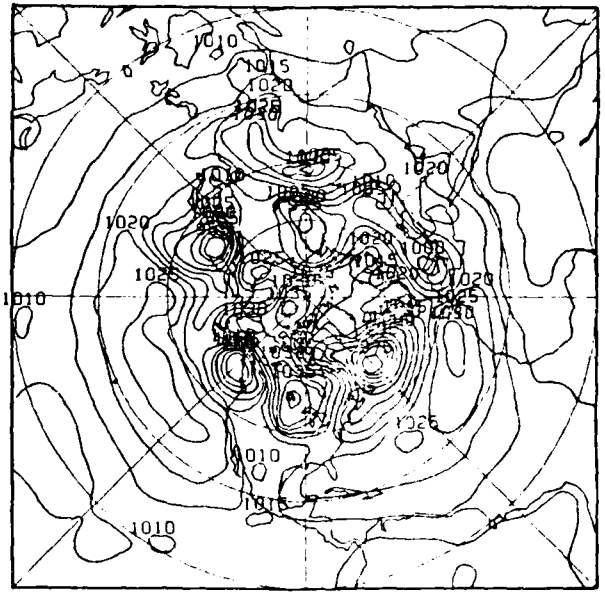
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

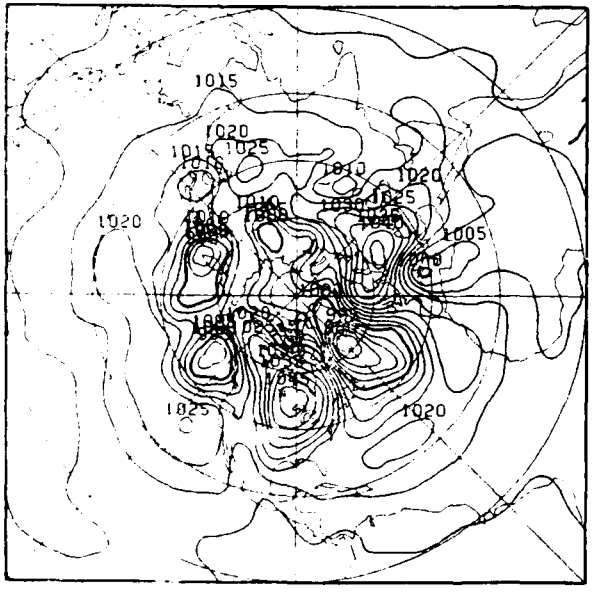


SLP

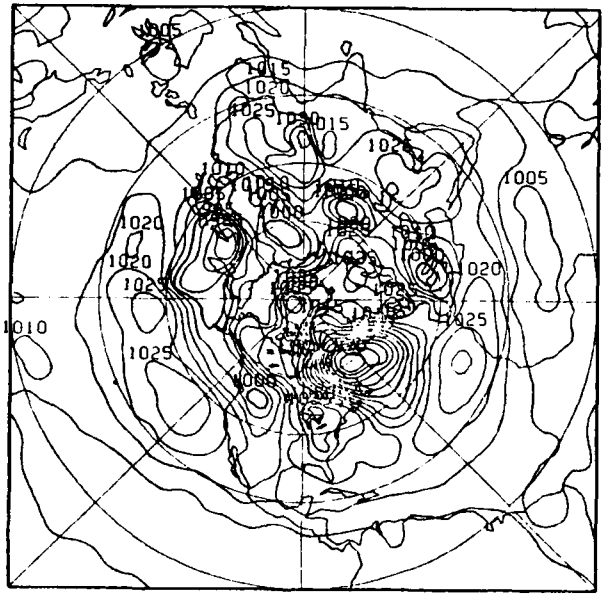
0000 GMT 17 FEB 1979

DAY 4

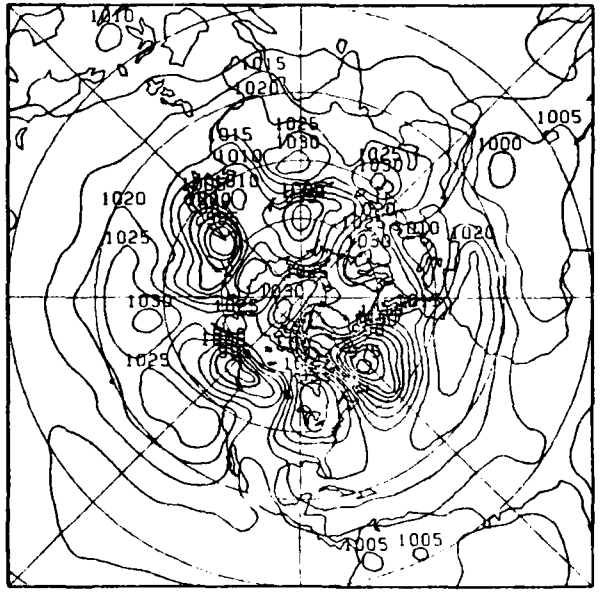
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

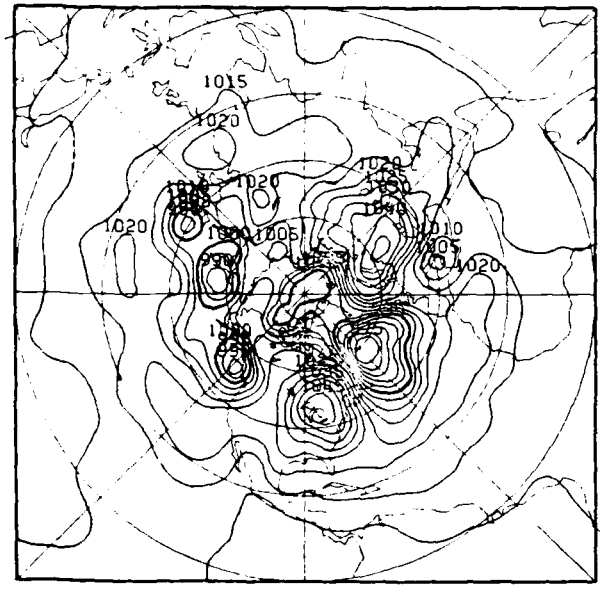


SLP

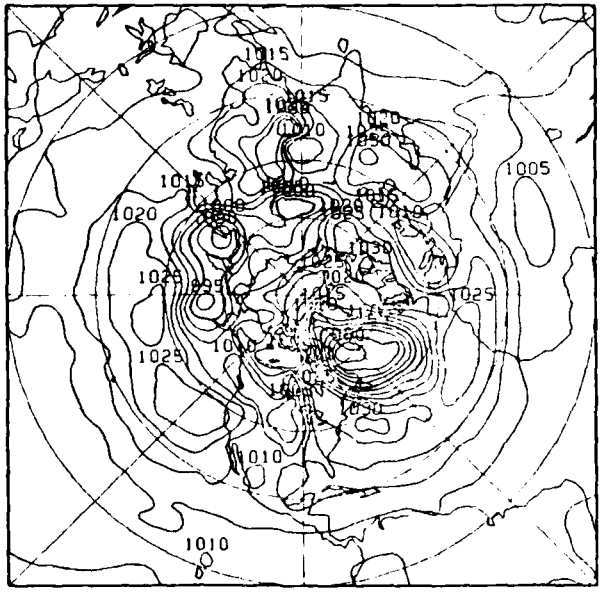
0000 GMT 18 FEB 1979

DAY 5

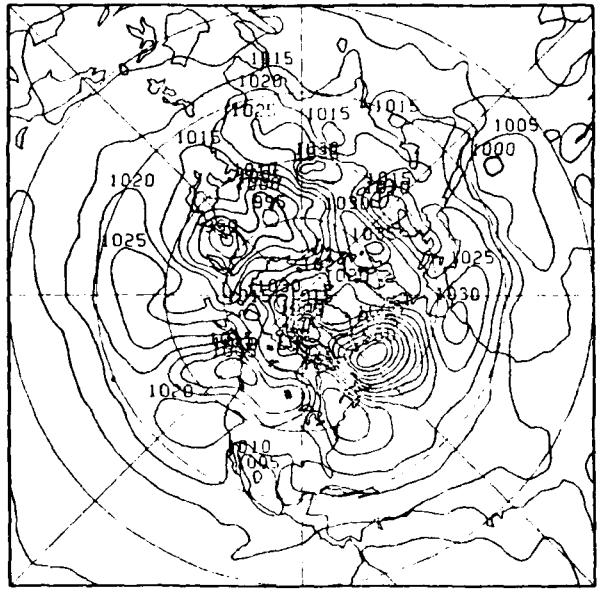
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

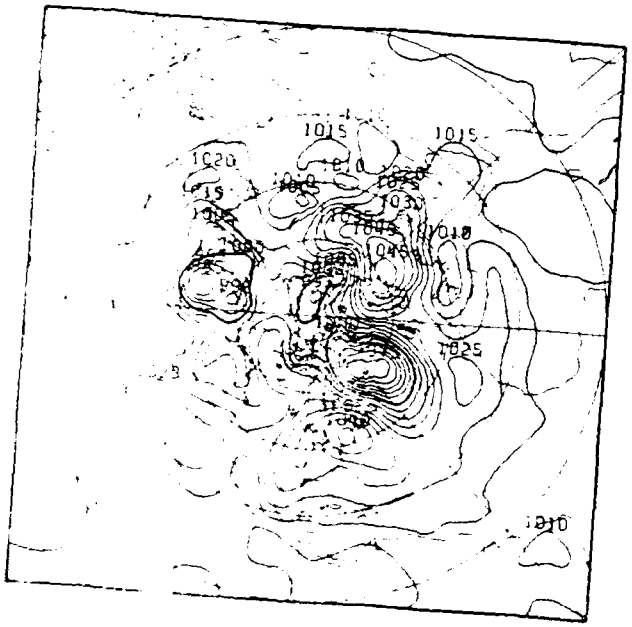


SLP

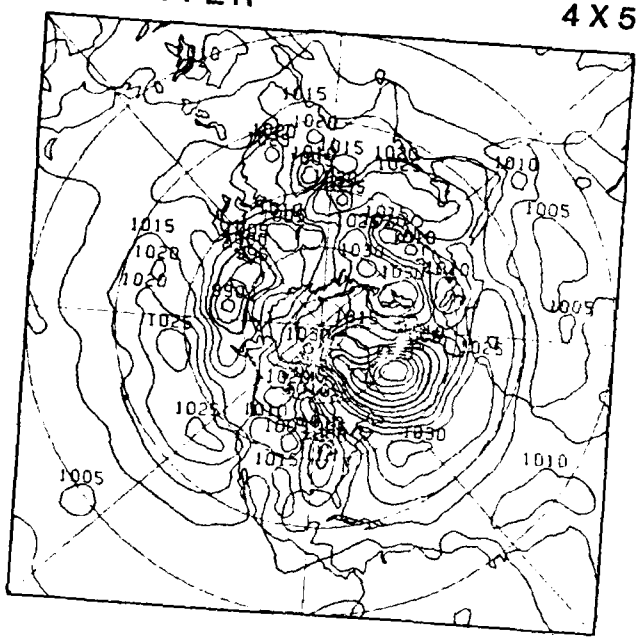
0000 GMT 19 FEB 1979

DAY 6

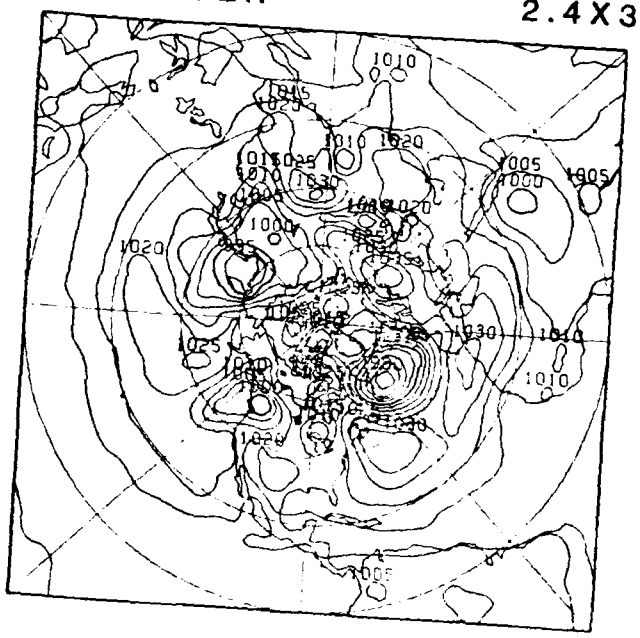
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

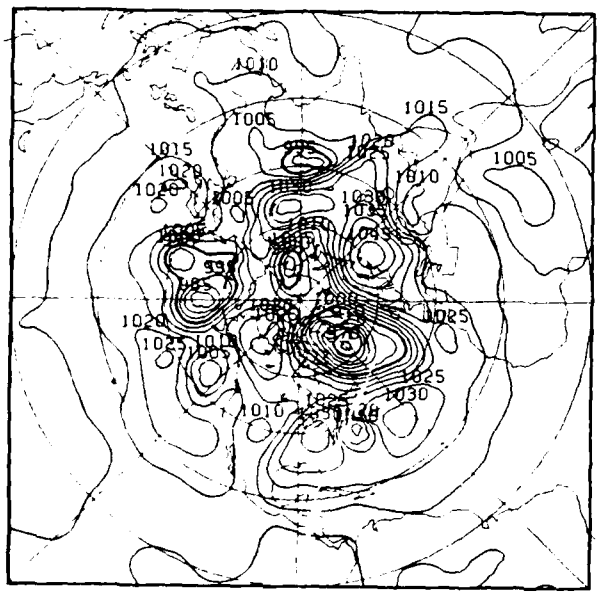


SLP

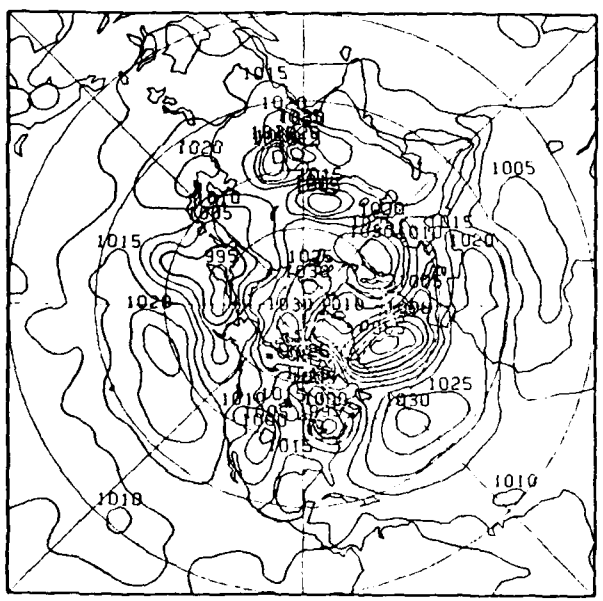
0000 GMT 20 FEB 1979

DAY 7

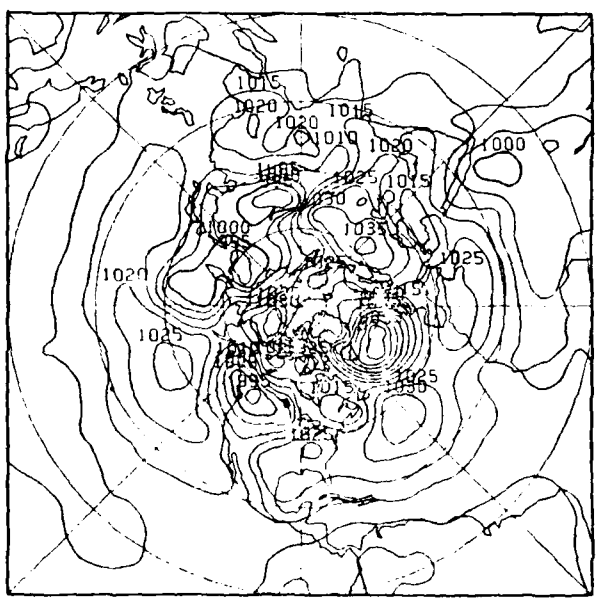
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

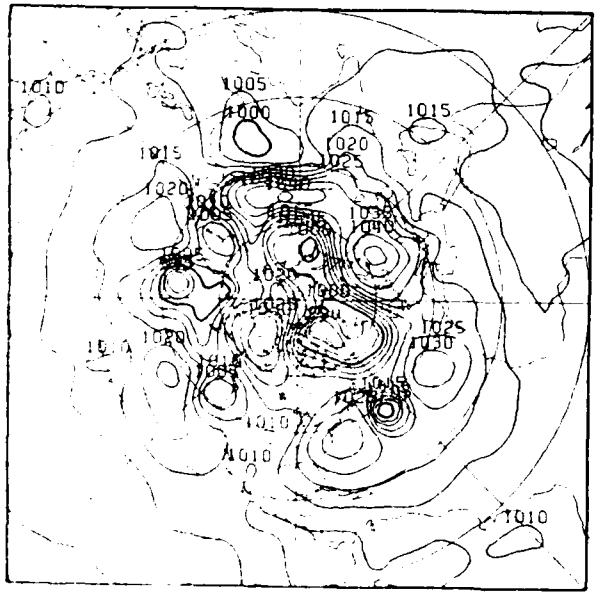


SLP

0000 GMT 21 FEB 1979

DAY 8

OBSERVED



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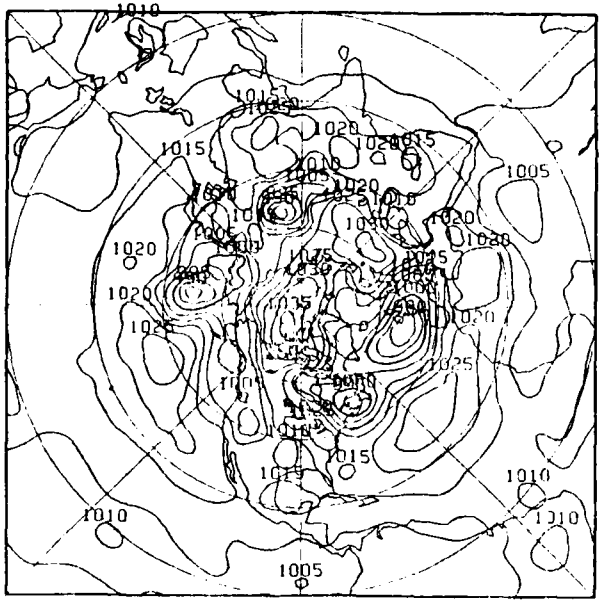

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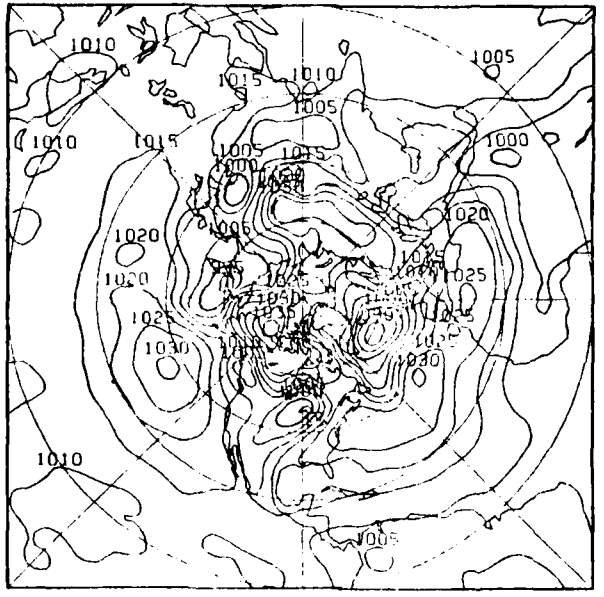
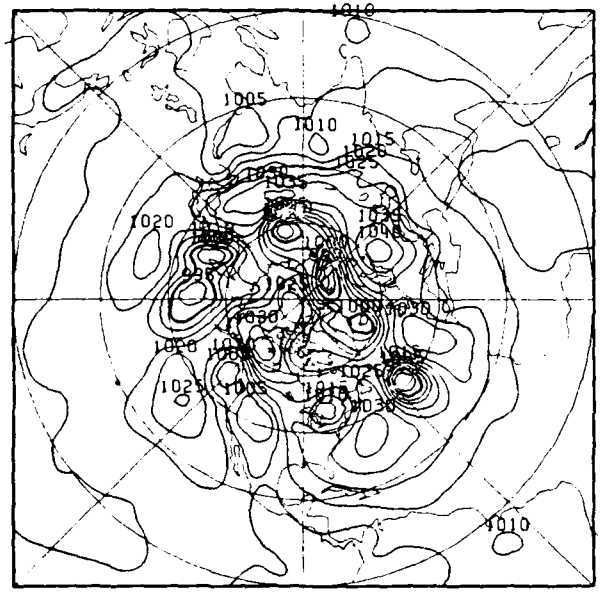


SLP

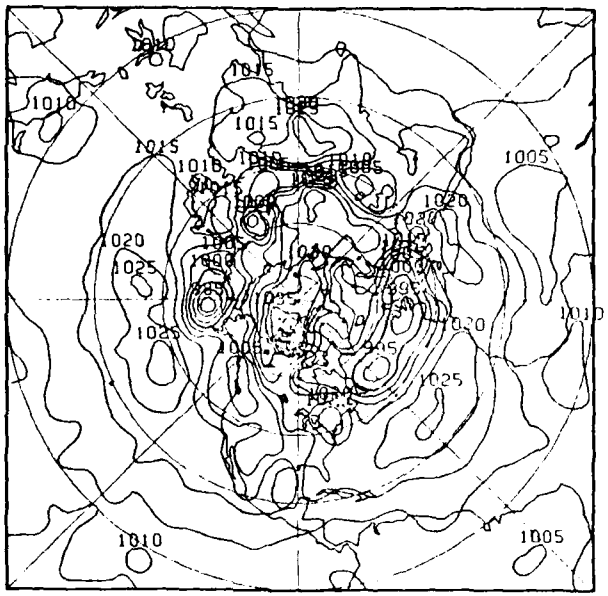
0000 GMT 22 FEB 1979

DAY 9

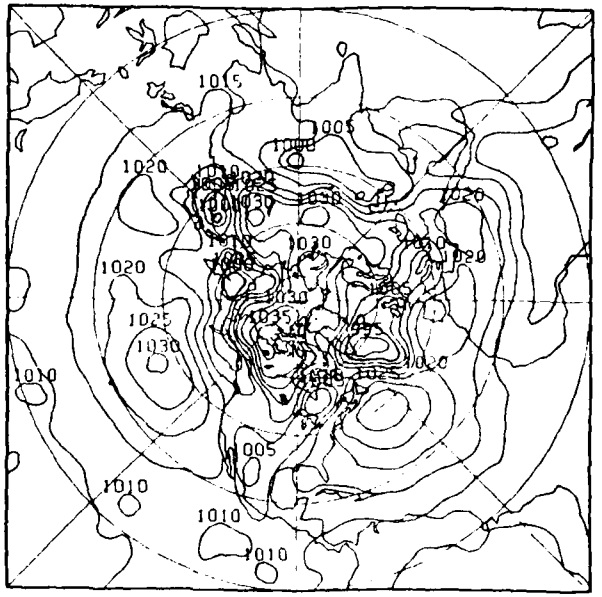
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

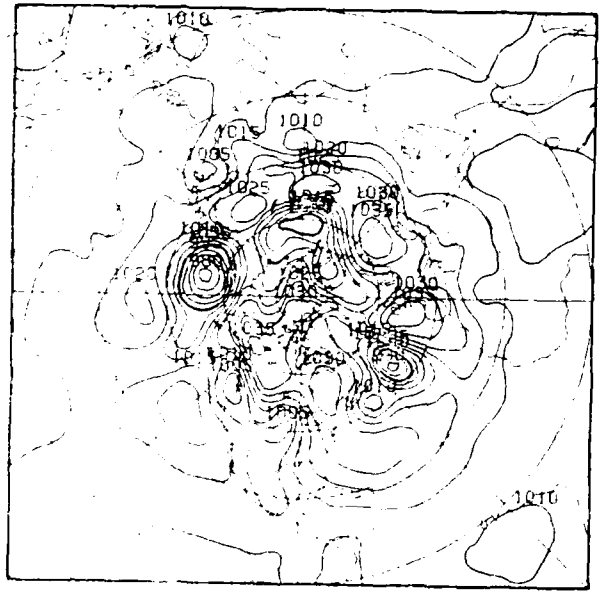


SLP

0000 GMT 23 FEB 1979

DAY 10

OBSERVED



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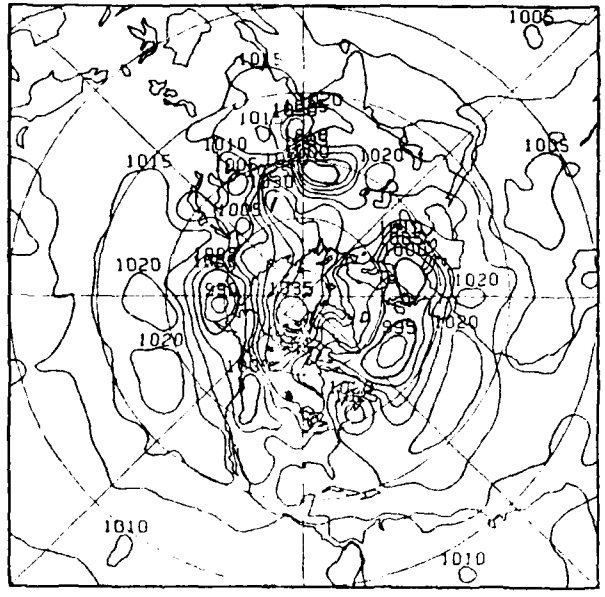
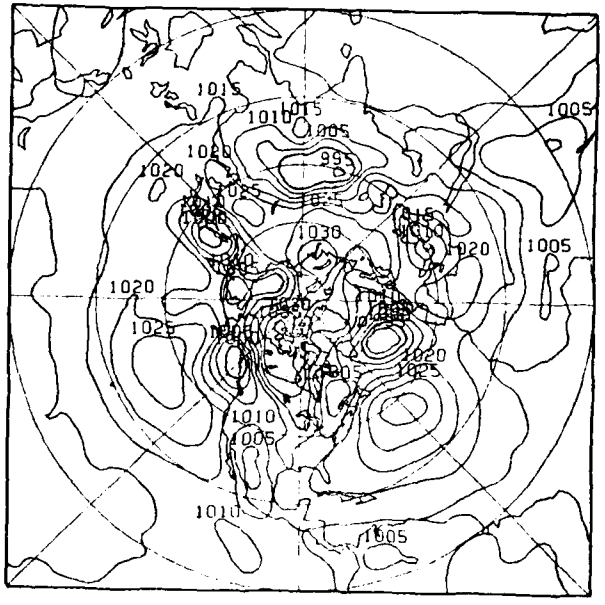


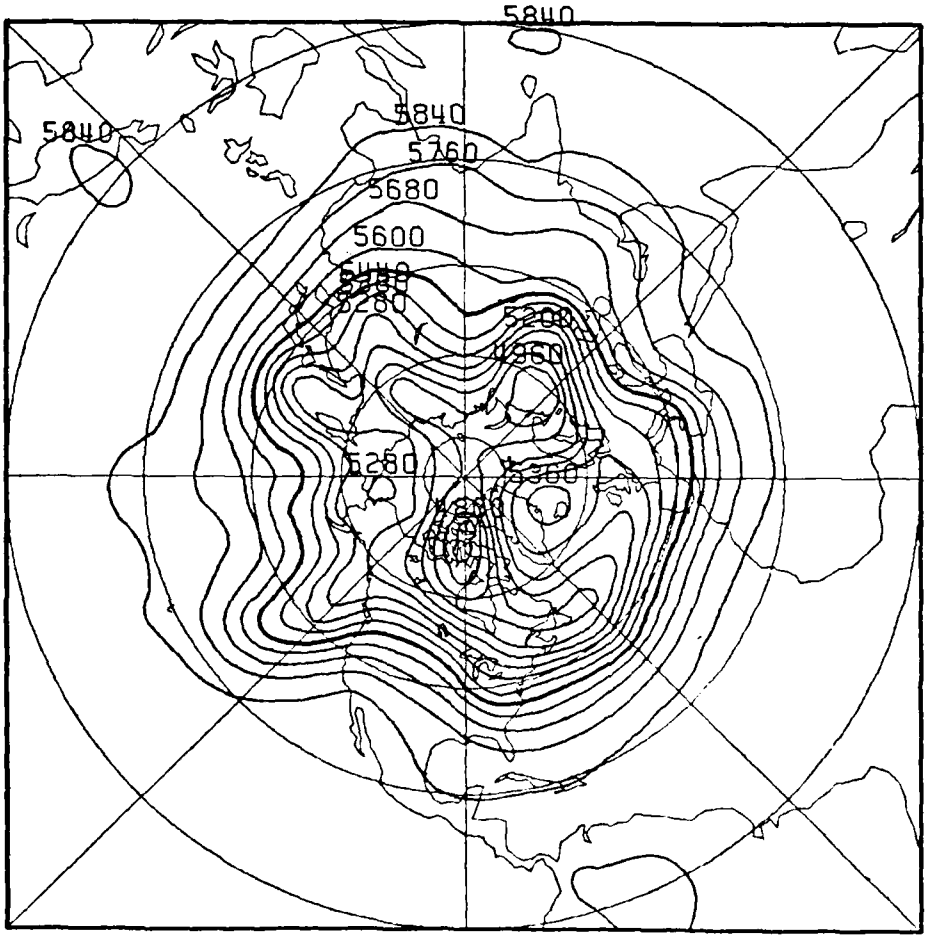
15-LAYER 2.4X3



500 mb Z

0000 GMT 13 FEB 1979

OBSERVED

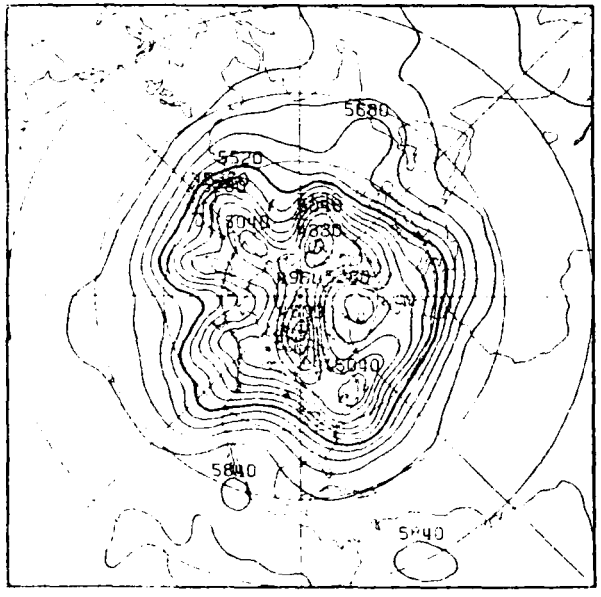


500 mb Z

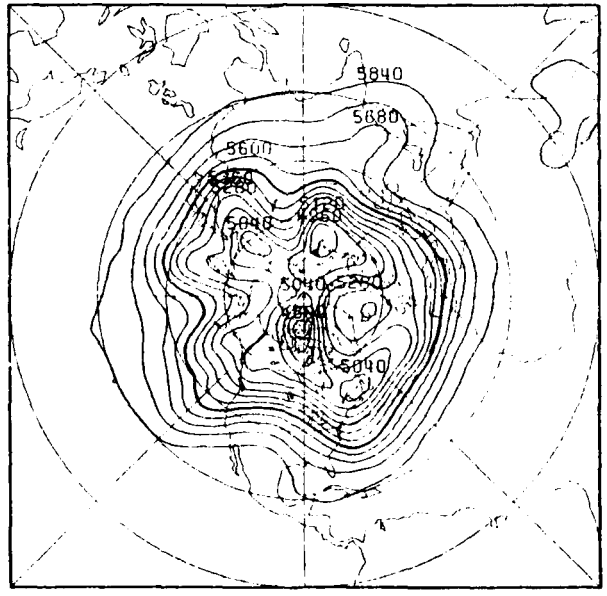
0000 GMT 14 FEB 1979

DAY 1

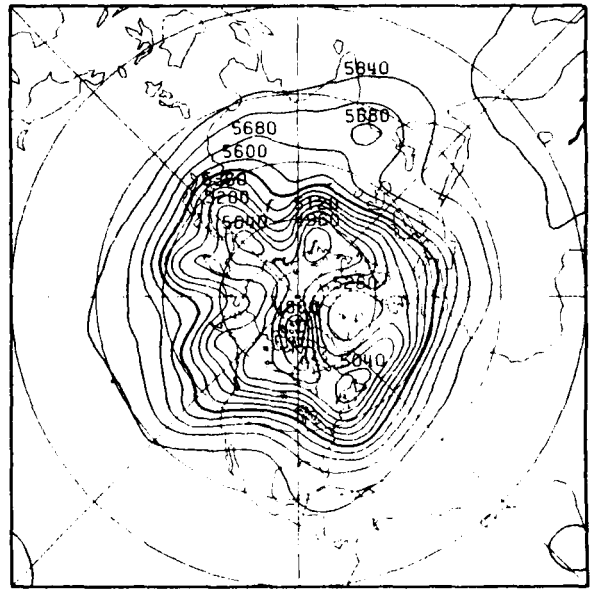
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



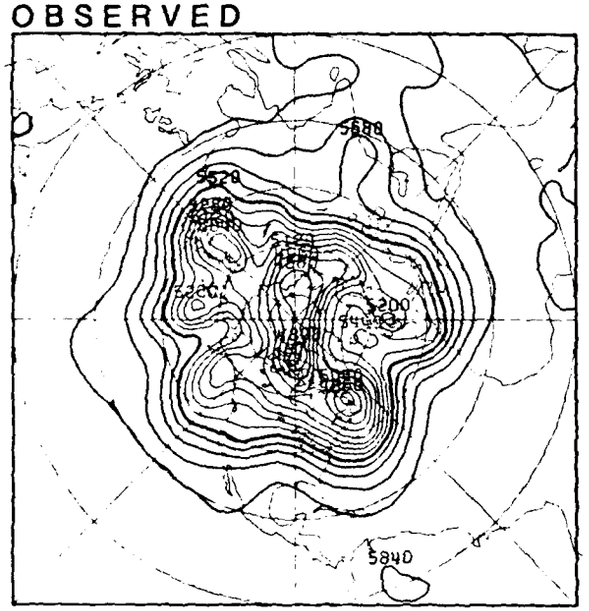
500 mb Z

0000 GMT 15 FEB 1979

DAY 2

5-15

OBSERVED



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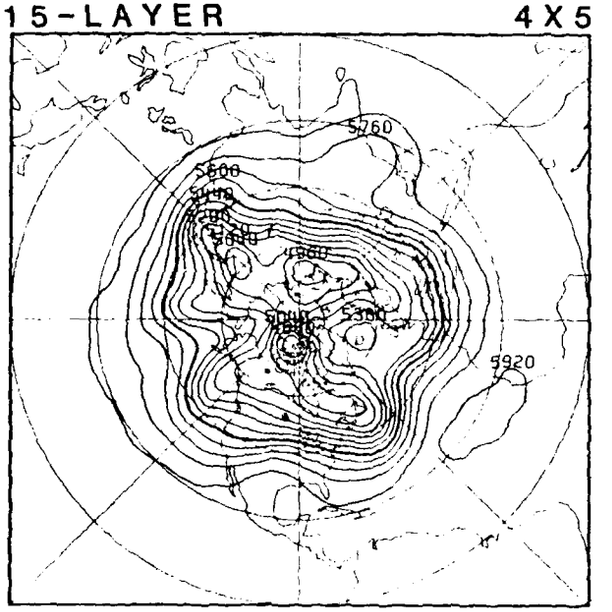
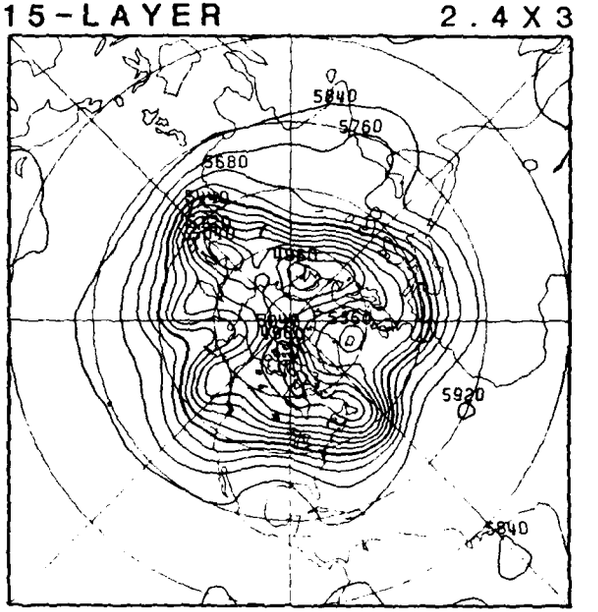


15-LAYER 2.4X3

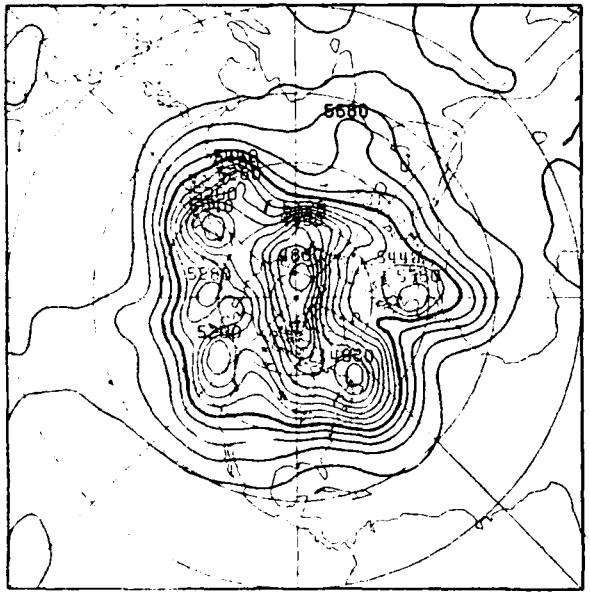


500 mb Z

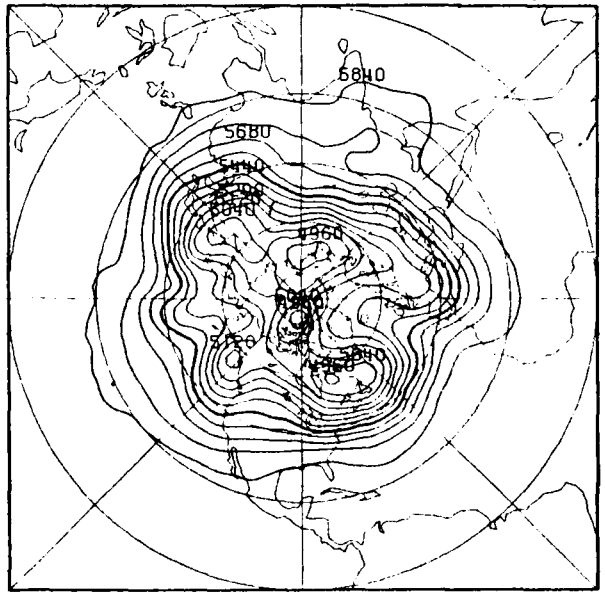
0000 GMT 16 FEB 1979

DAY 3

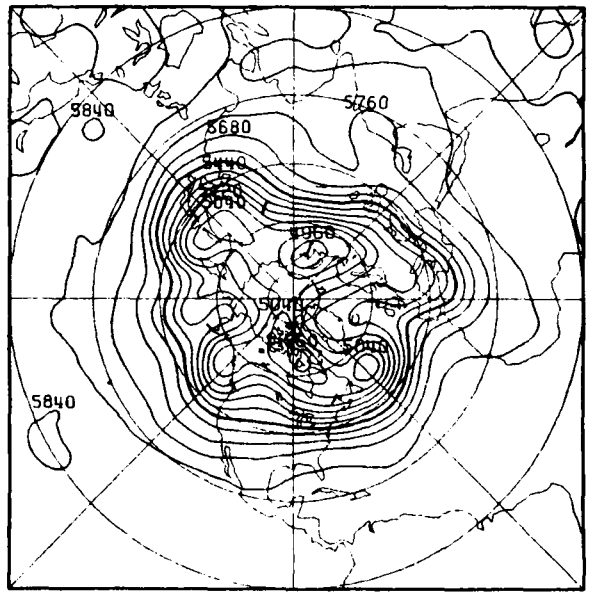
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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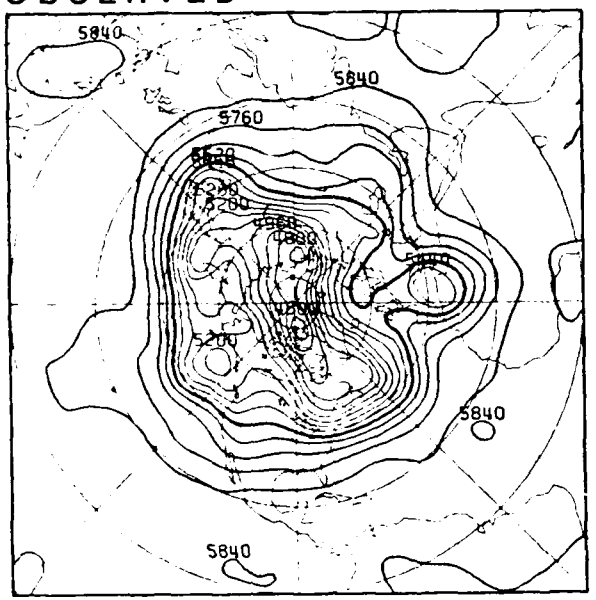
DAY 4

OBSERVED



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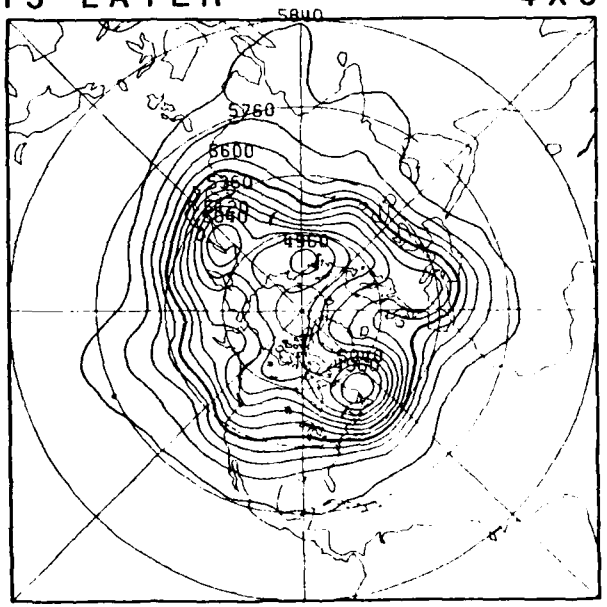

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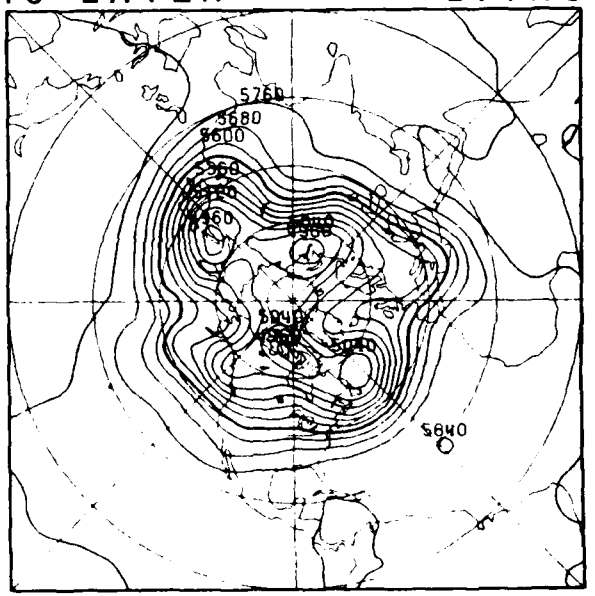


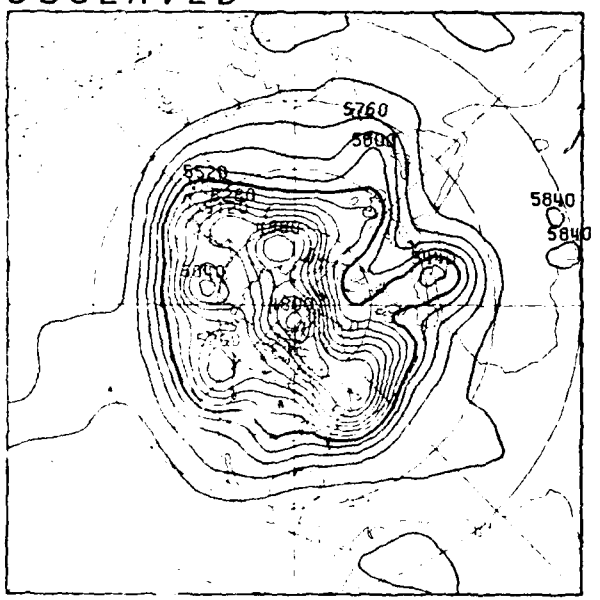
500 mb Z

0000 GMT 18 FEB 1979

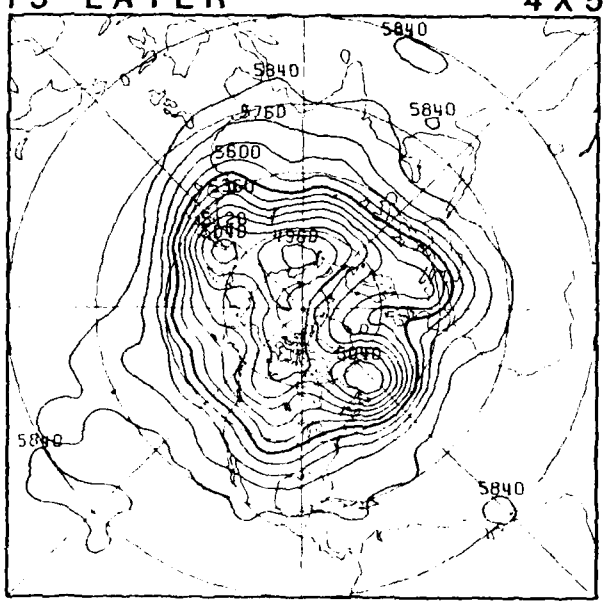
DAY 5

5-18

OBSERVED



15-LAYER 4X5



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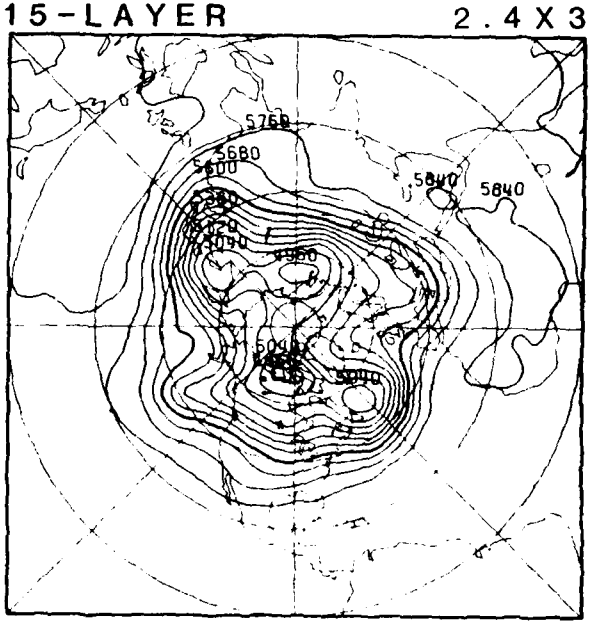
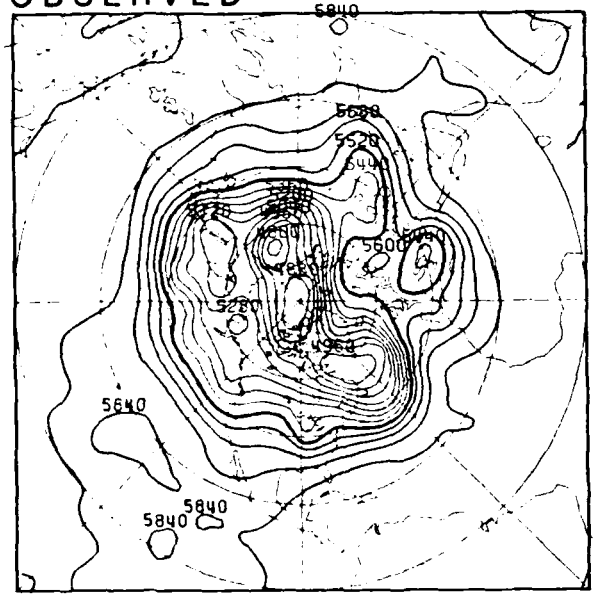


500 mb Z

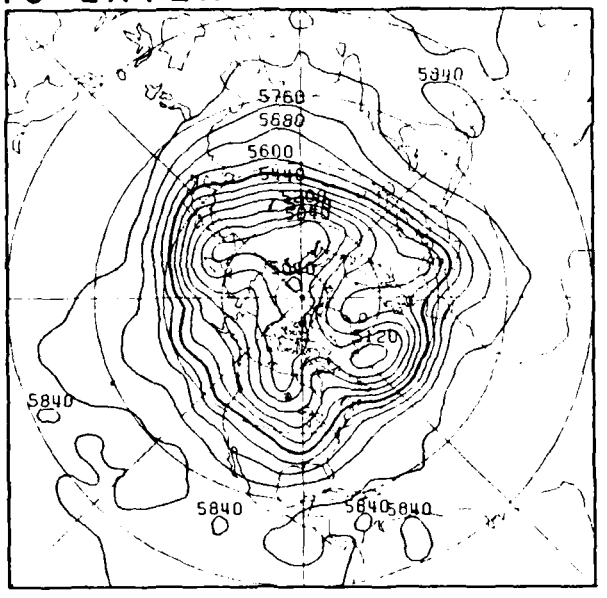
0000 GMT 19 FEB 1979

DAY 6

OBSERVED



15-LAYER 4X5



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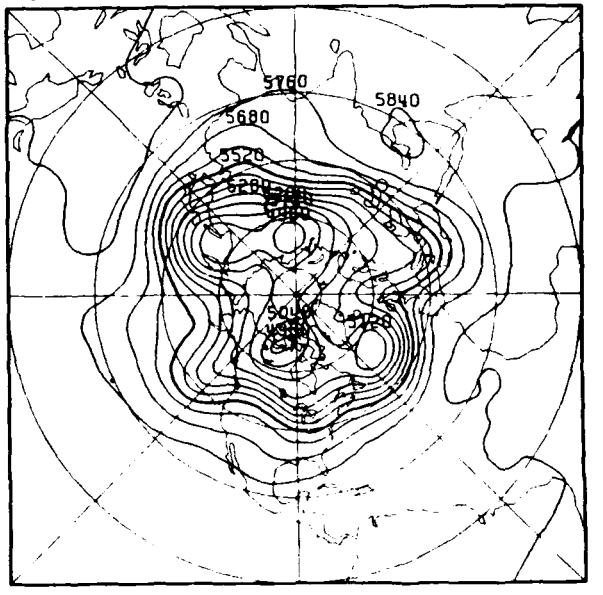
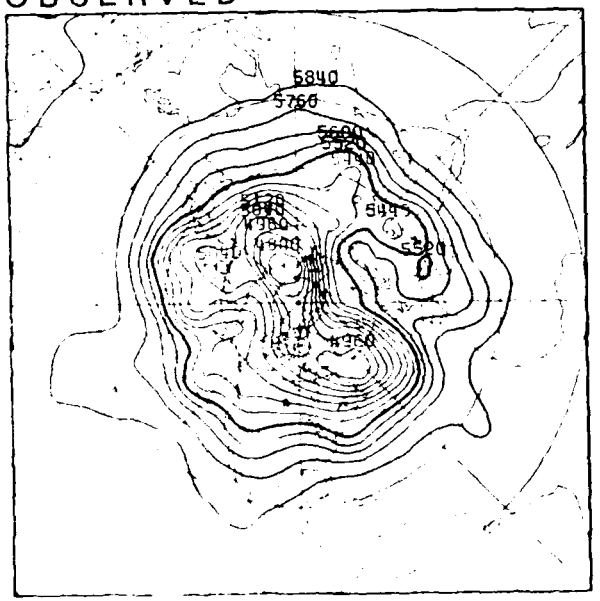


500 mb Z

0000 GMT 20 FEB 1979

DAY 7

OBSERVED



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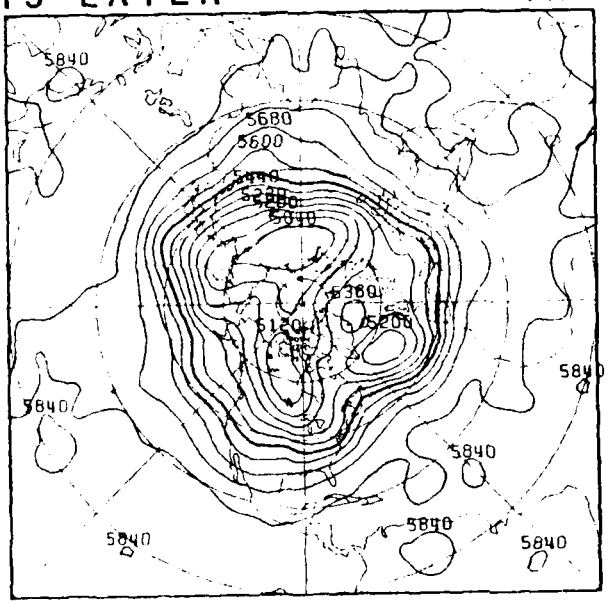

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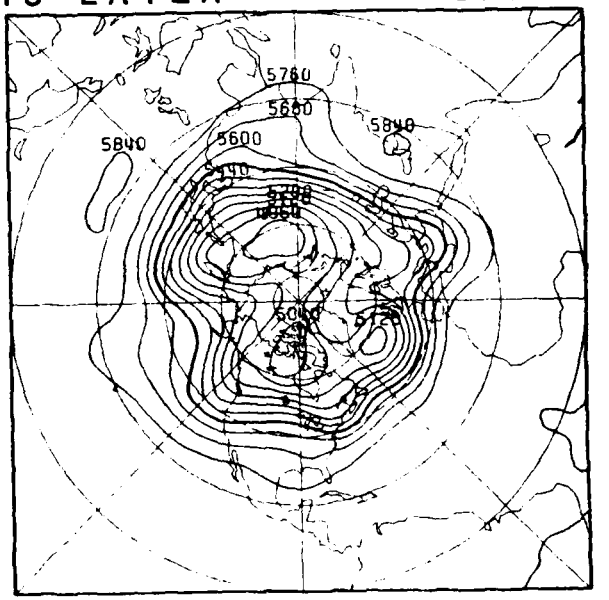
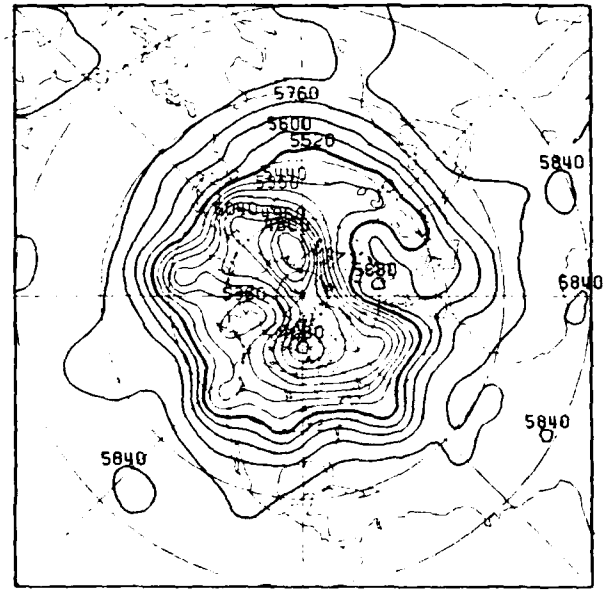


500 mb Z

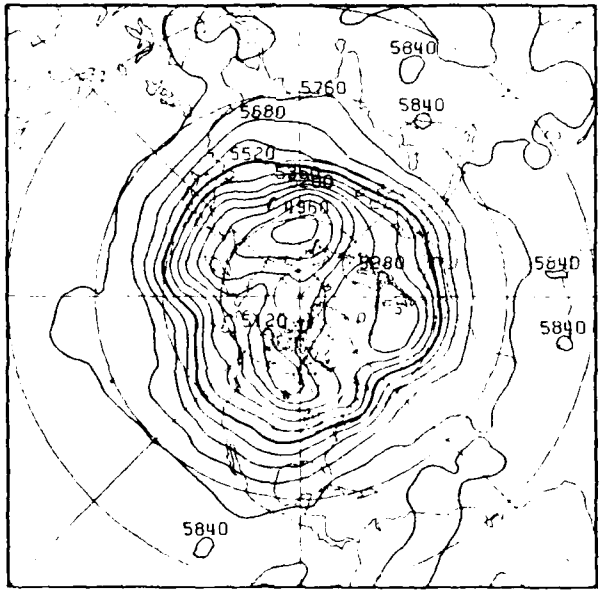
0000 GMT 21 FEB 1979

DAY 8

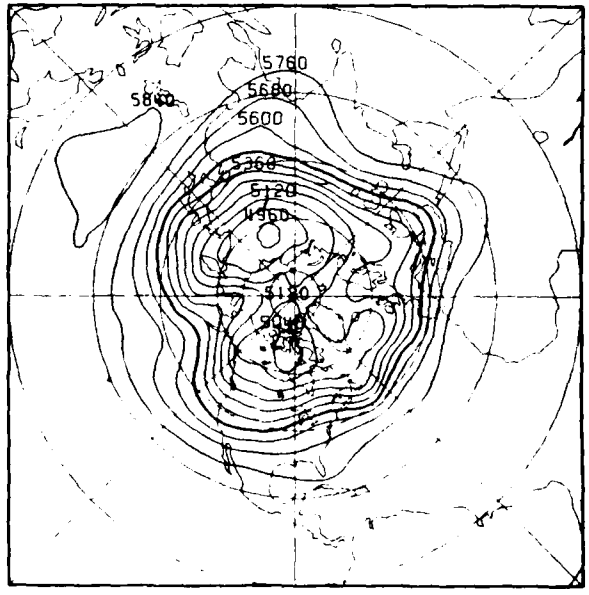
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



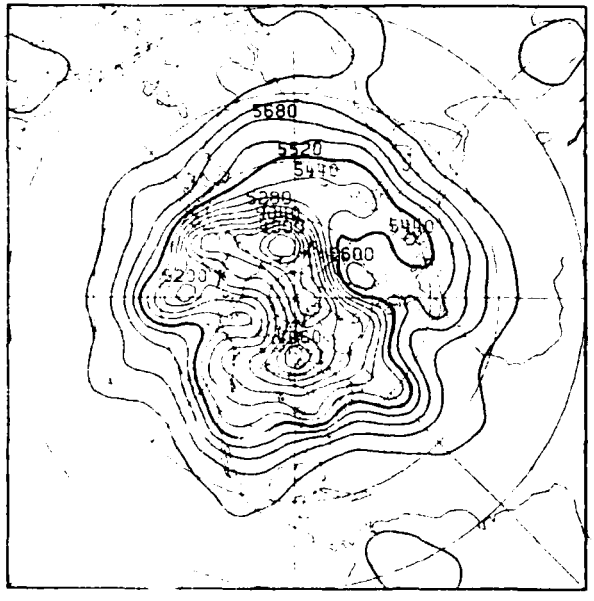
500 mb Z

0000 GMT 22 FEB 1979

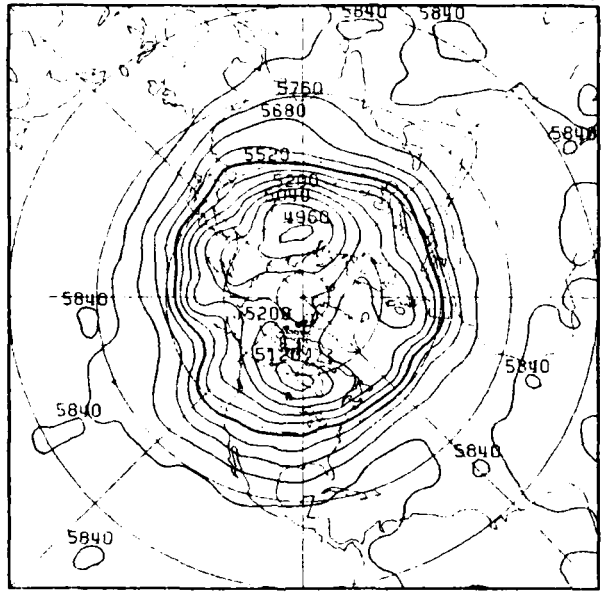
DAY 9

5-22

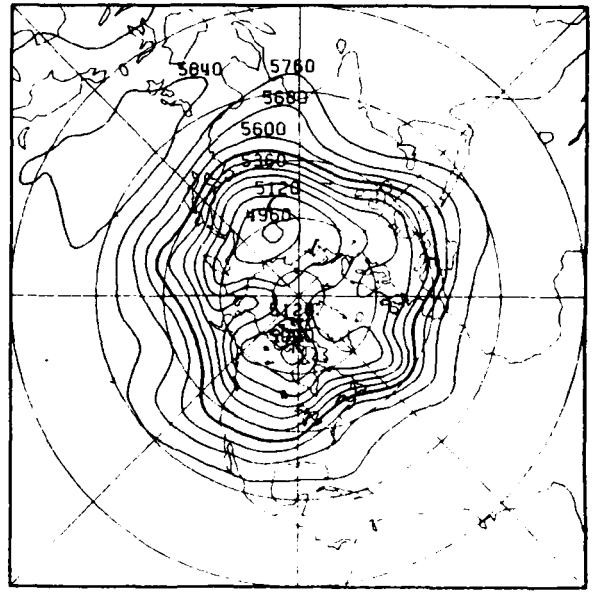
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

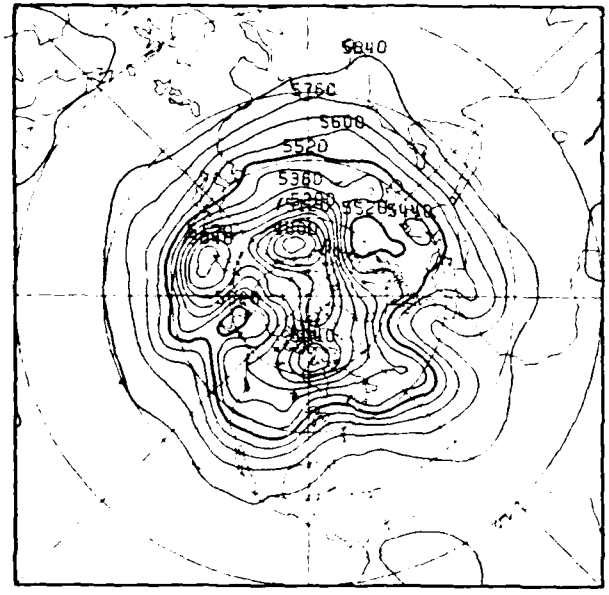


500 mb Z

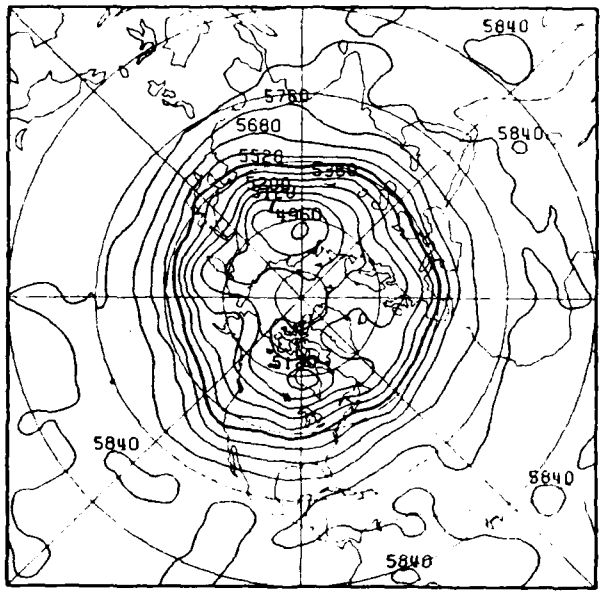
0000 GMT 23 FEB 1979

DAY 10

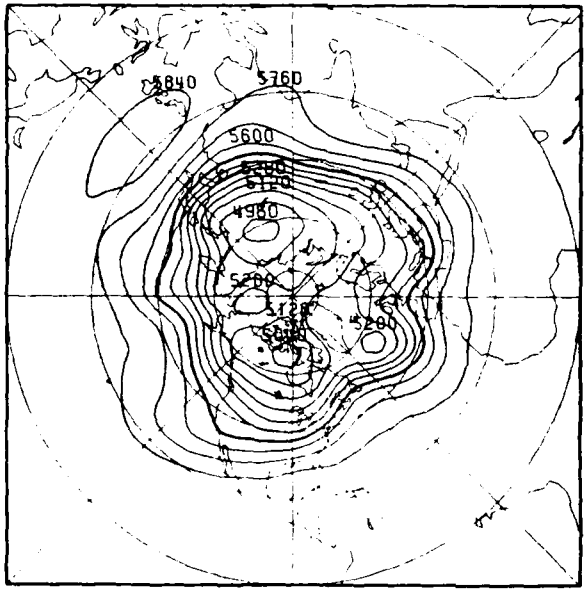
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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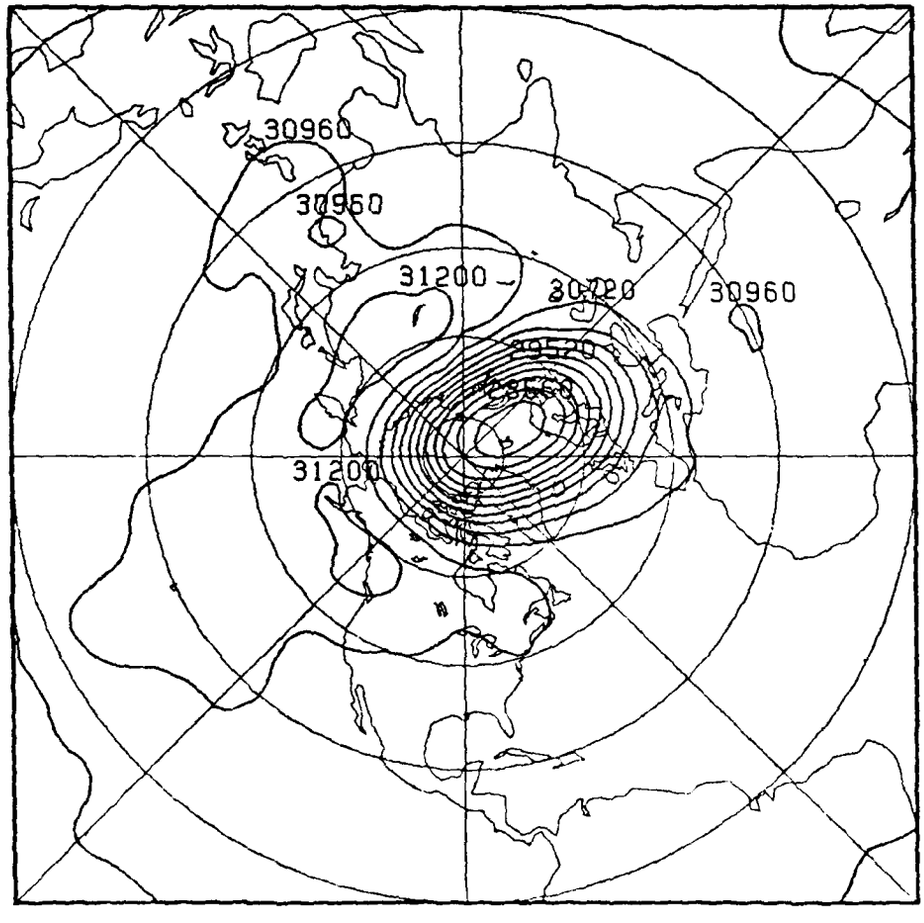
0000 GMT 13 FEB 1979

OBSERVED



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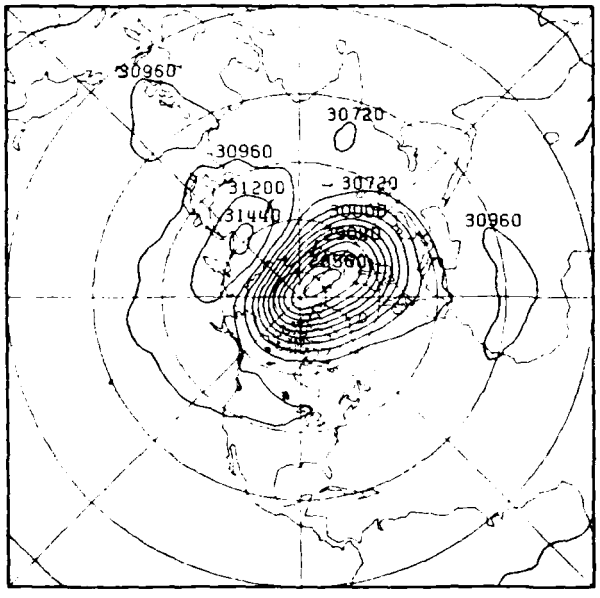
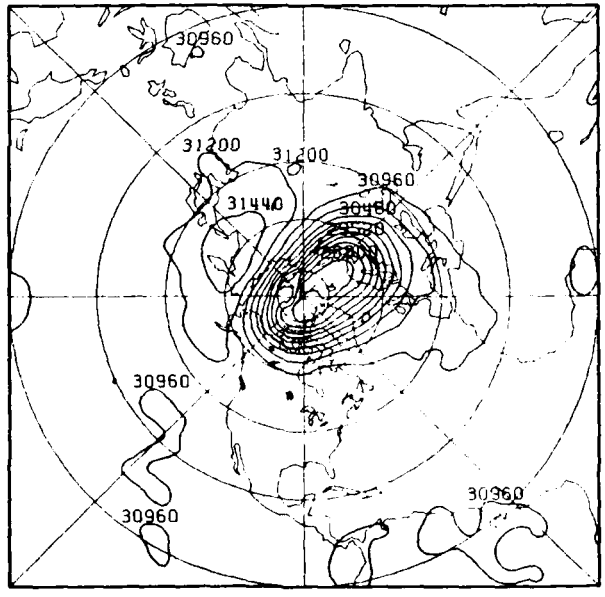
DAY 1

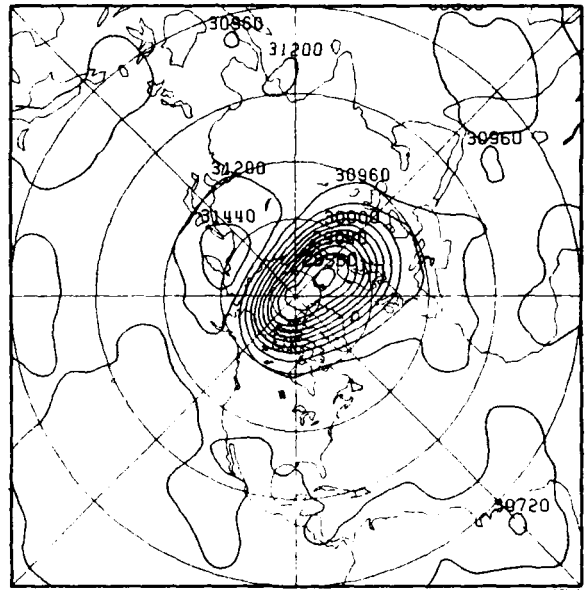
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

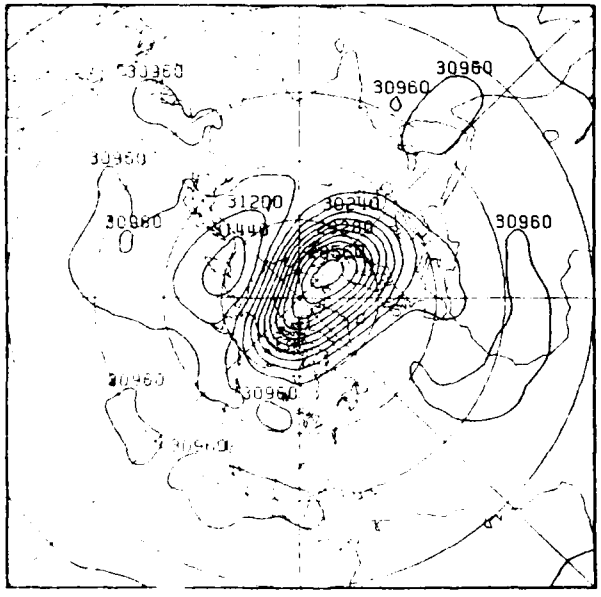


10 mb Z

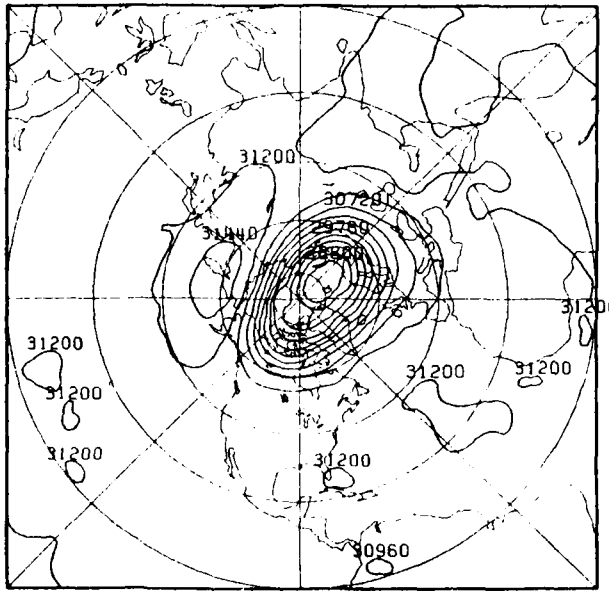
0000 GMT 15 FEB 1979

DAY 2

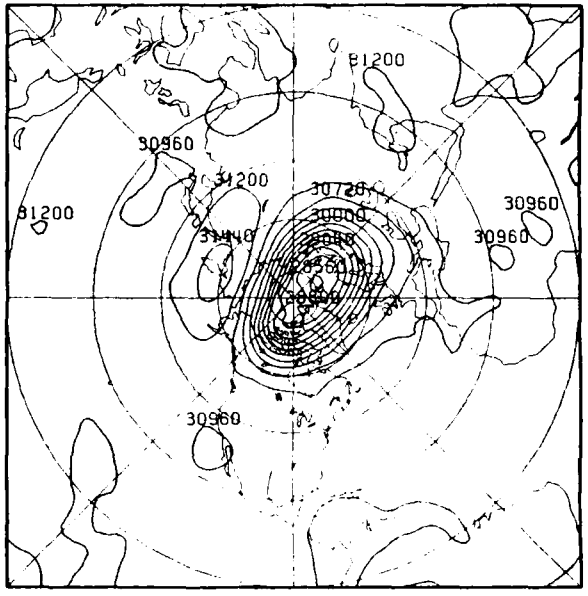
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

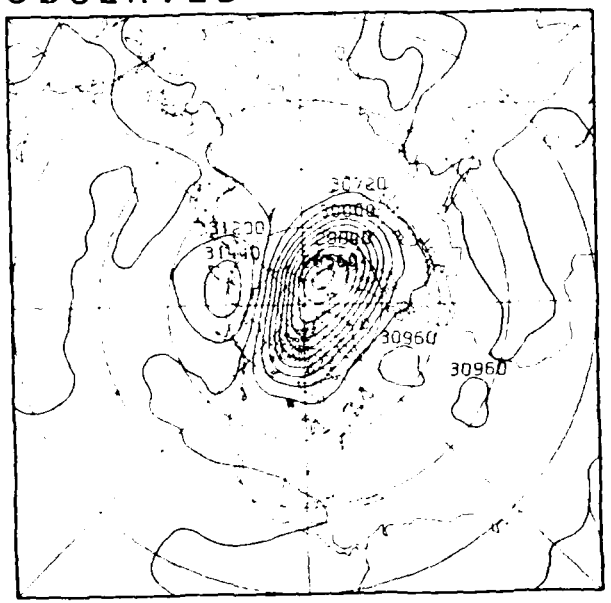


10 mb Z

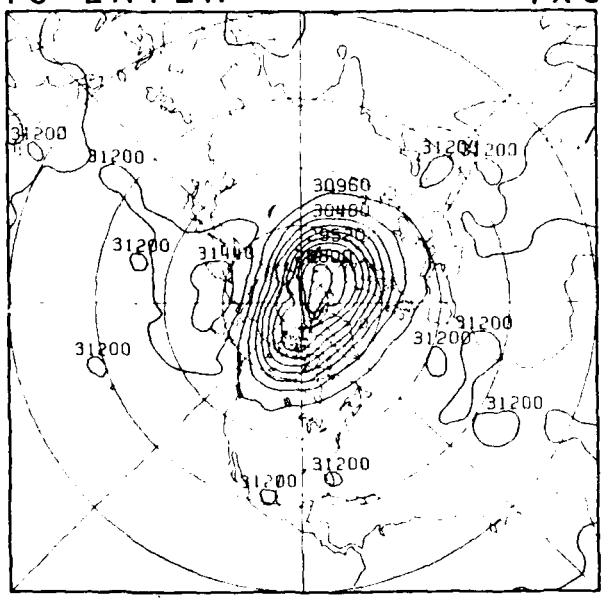
0000 GMT 16 FEB 1979

DAY 3

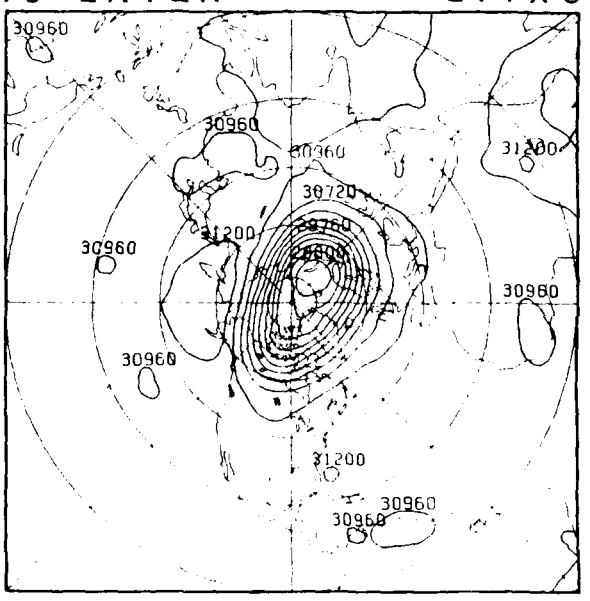
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

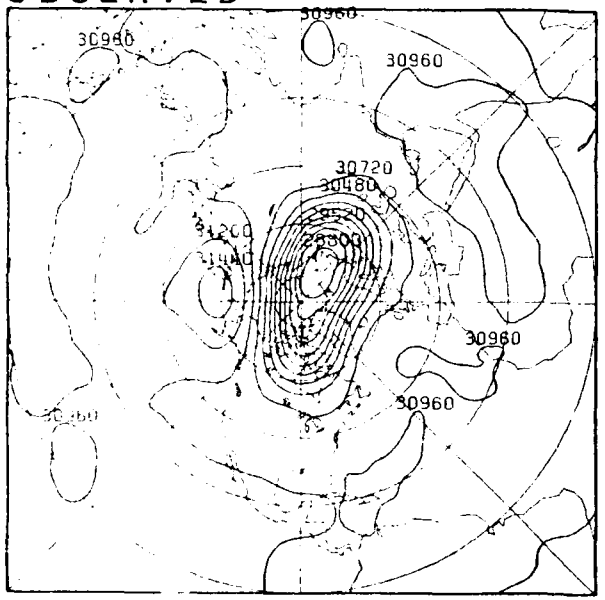


10 mb Z

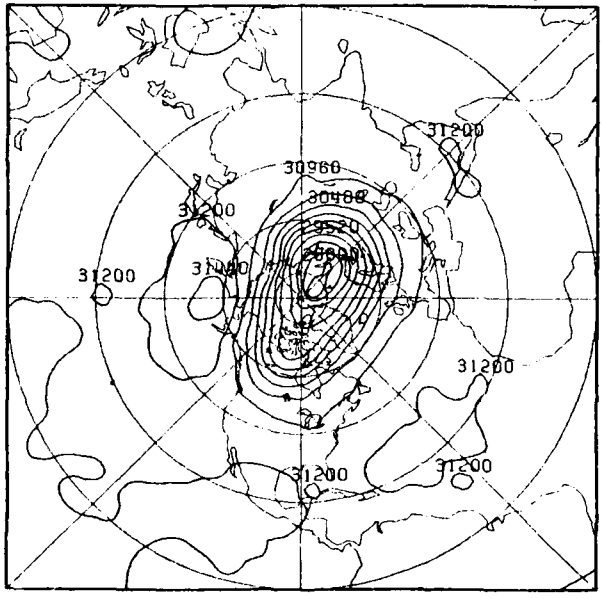
0000 GMT 17 FEB 1979

DAY 4

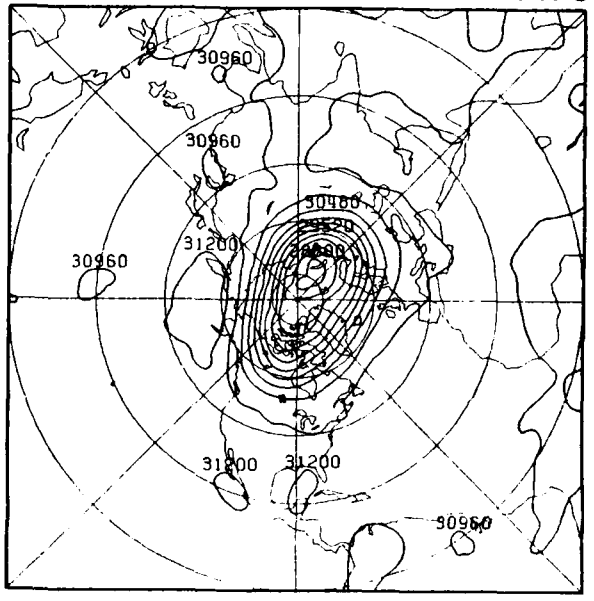
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

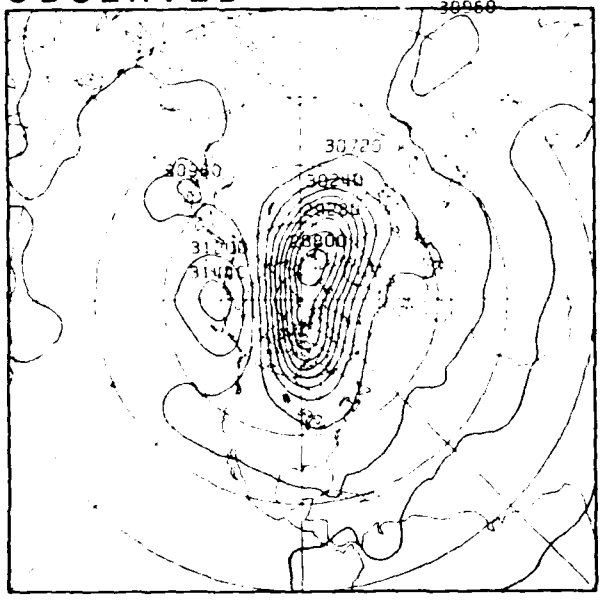


10 mb Z

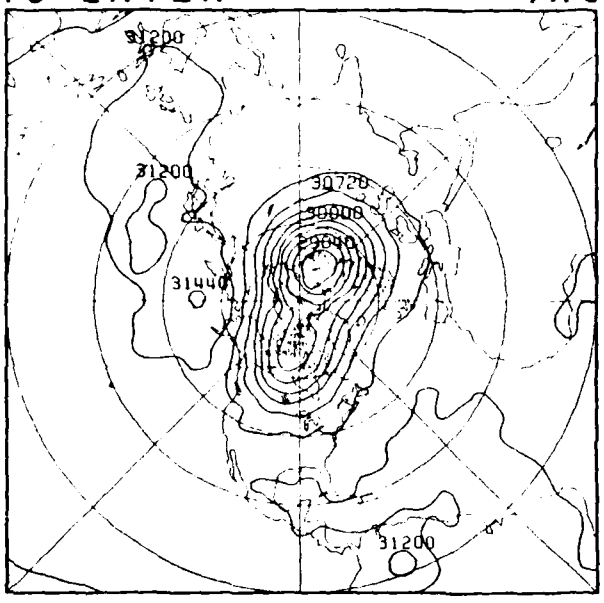
0000 GMT 18 FEB 1979

DAY 5

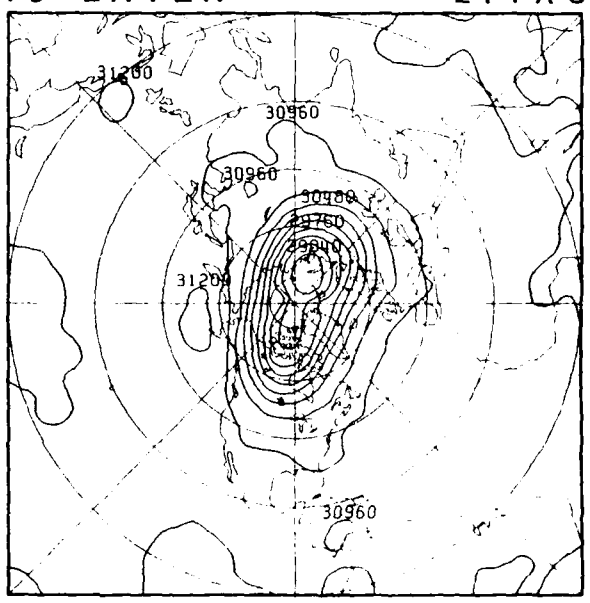
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

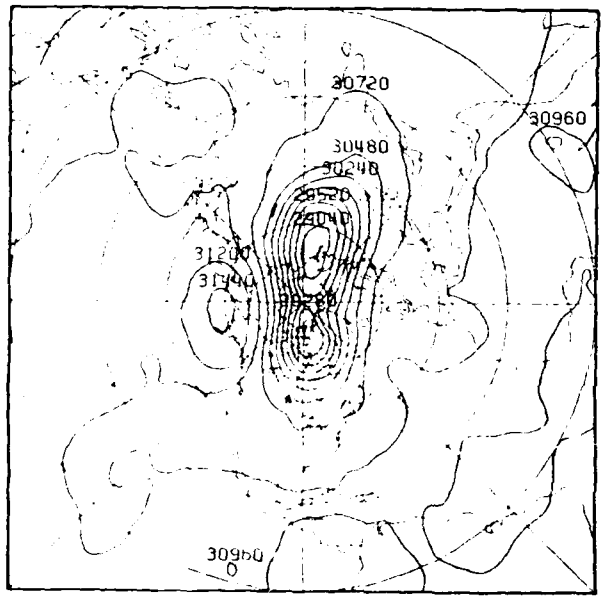


10 mb Z

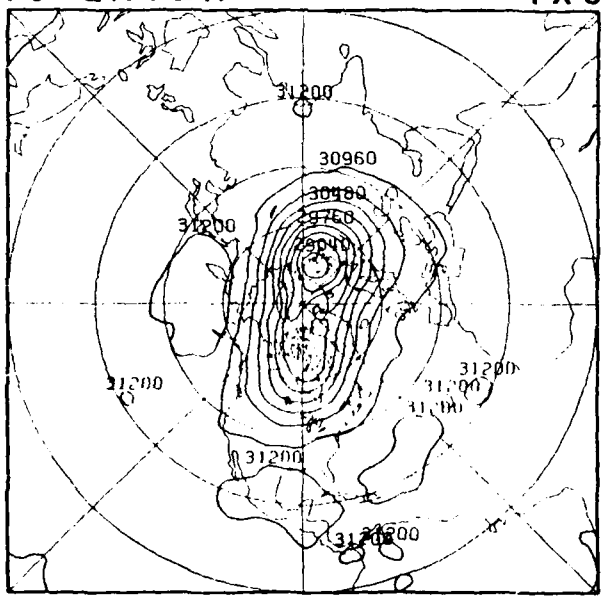
0000 GMT 19 FEB 1979

DAY 6

OBSERVED



15-LAYER 4X5



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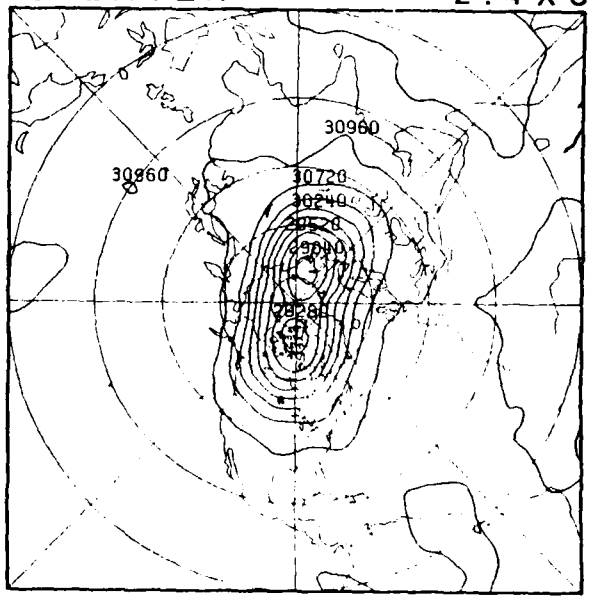
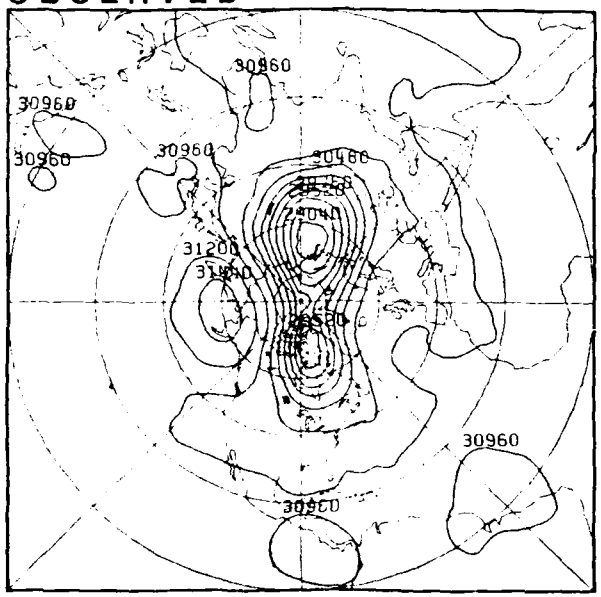


10 mb Z

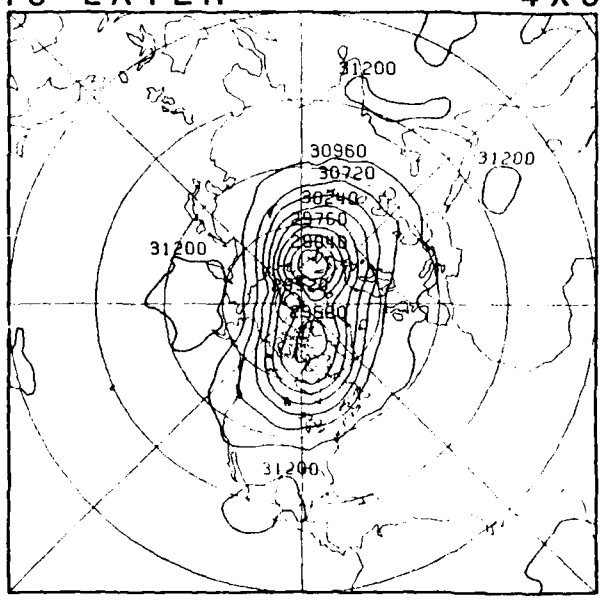
0000 GMT 20 FEB 1979

DAY 7

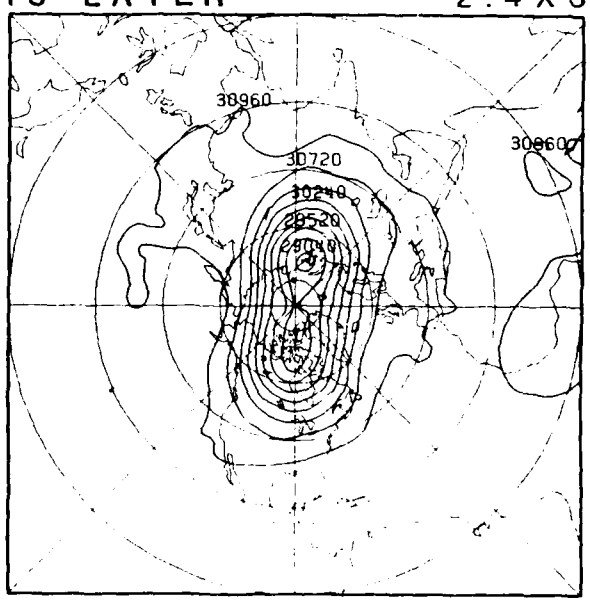
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

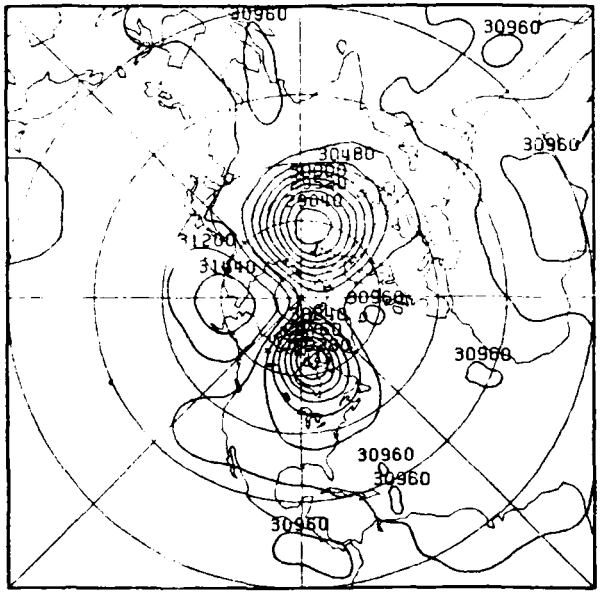


10 mb Z

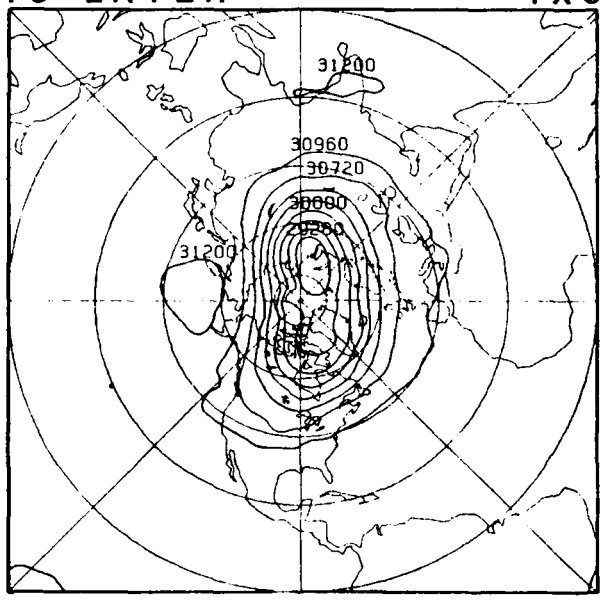
0000 GMT 21 FEB 1979

DAY 8

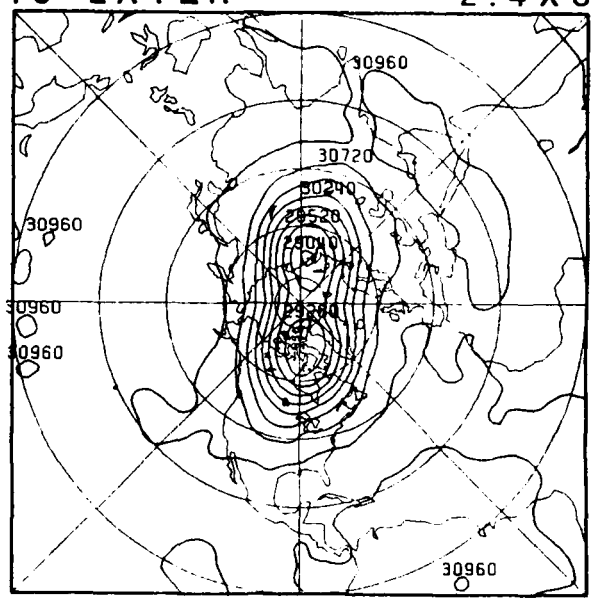
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

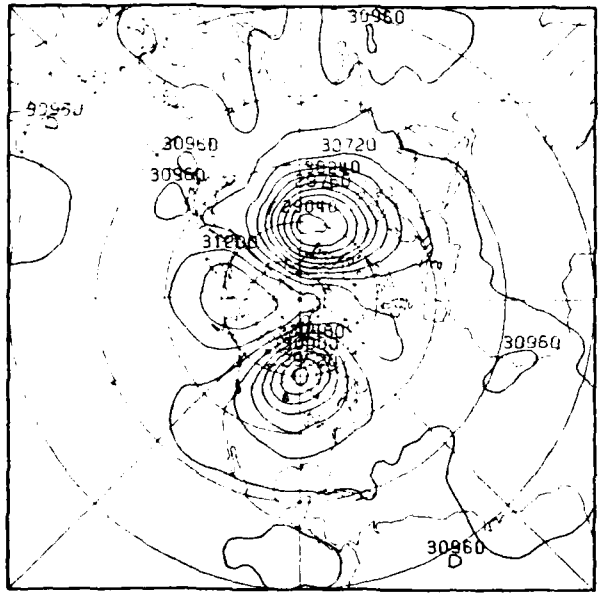


10 mb Z

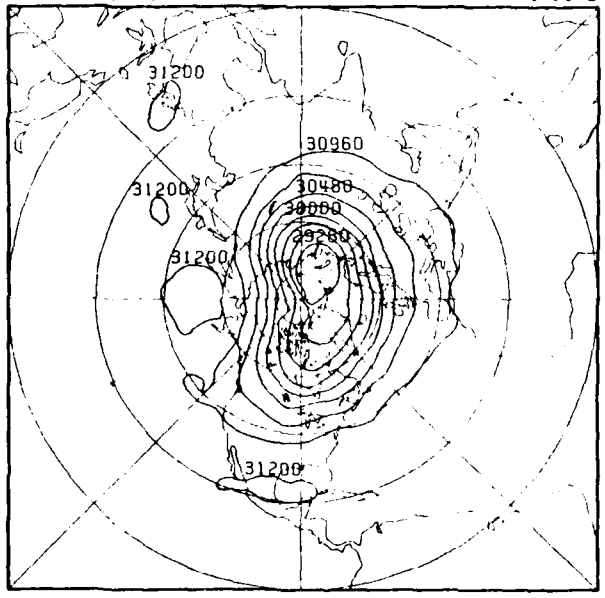
0000 GMT 22 FEB 1979

DAY 9

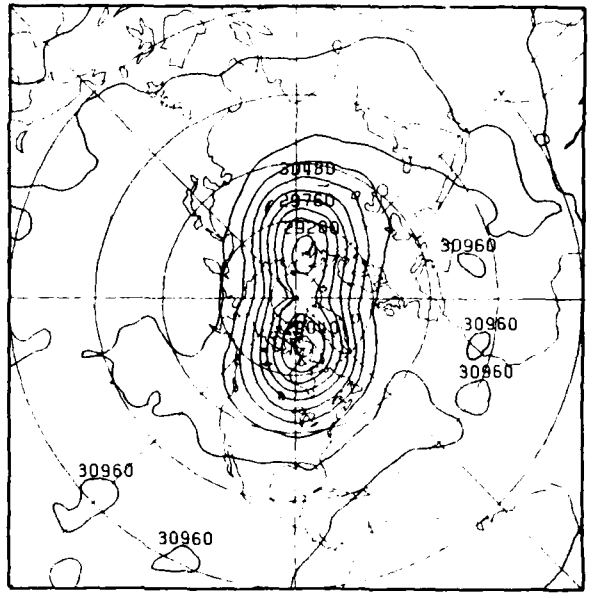
OBSERVED



15-LAYER 4X5



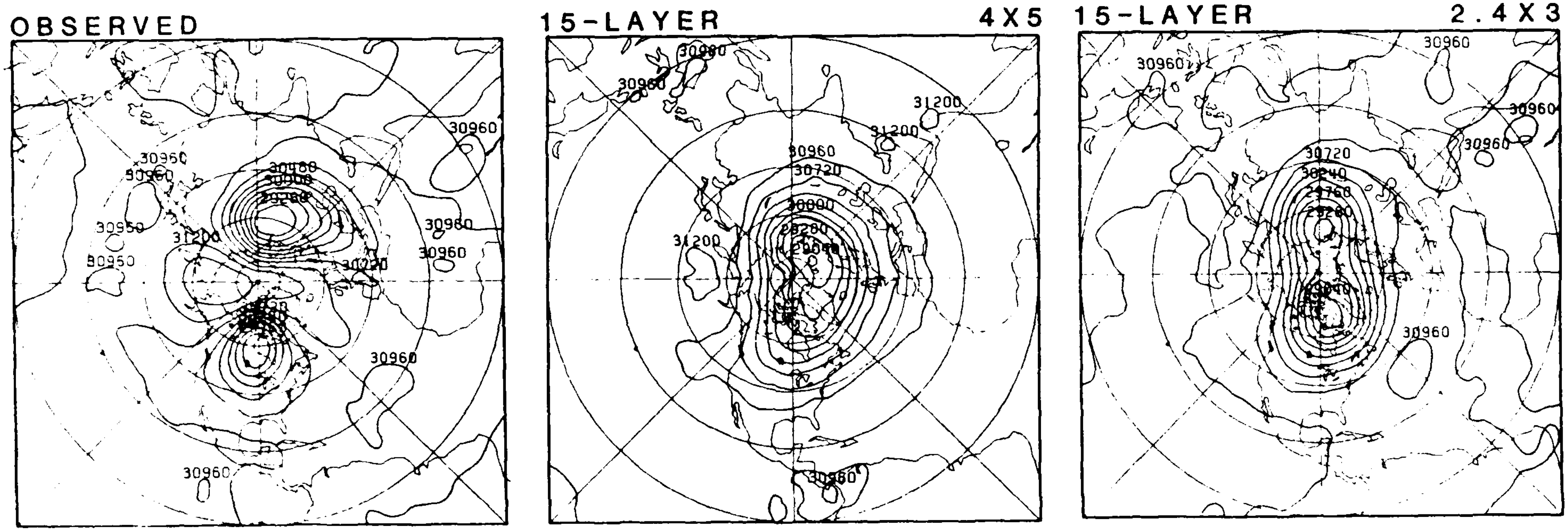
15-LAYER 2.4X3

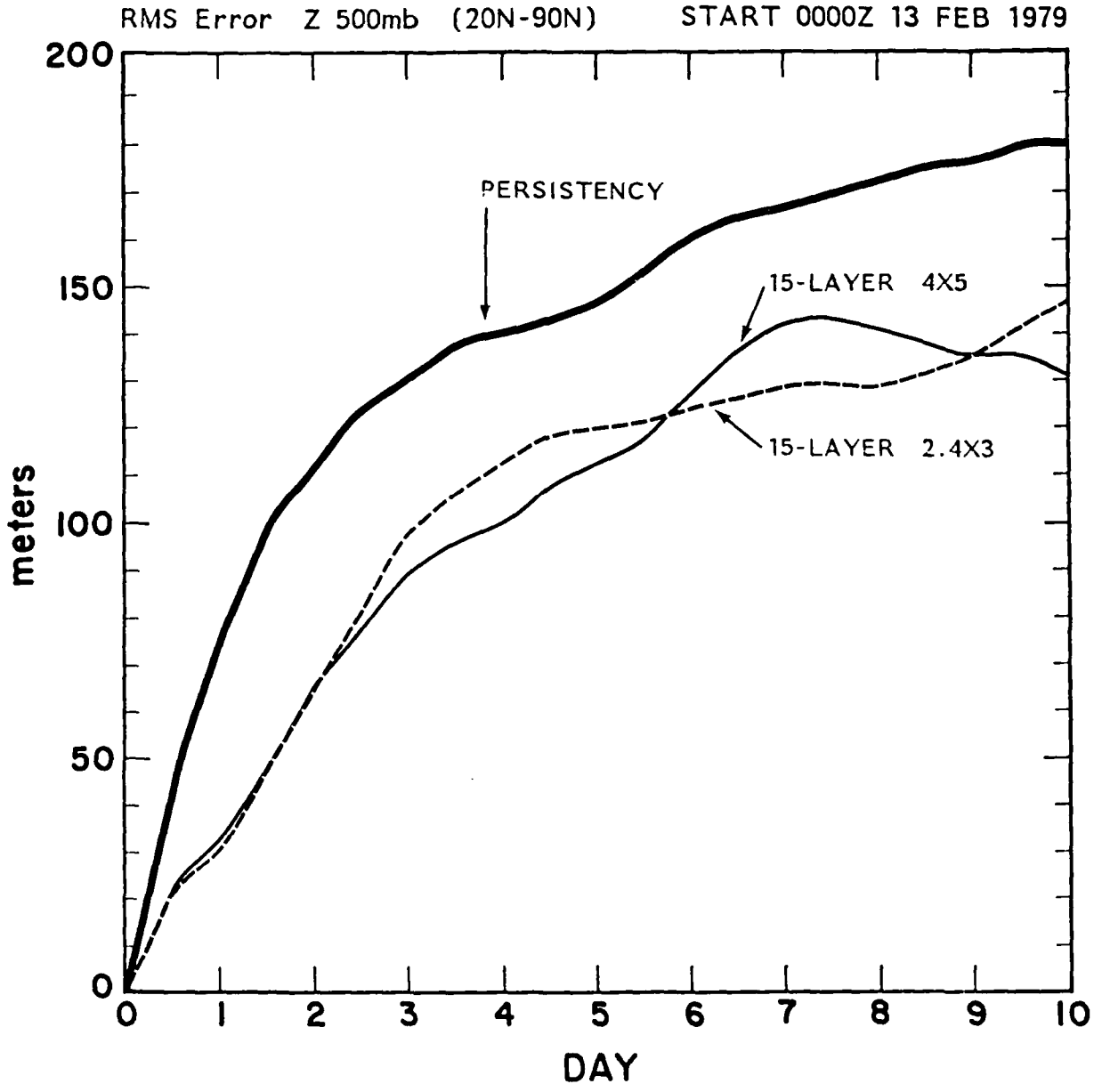


10 mb Z

0000 GMT 23 FEB 1979

DAY 10




RMS Error Z 500mb (20N-90N)
START 0000Z 13 FEB 1979
200
150
100
50
0
meters
PERSISTENCY
15-LAYER 4X5
15-LAYER 2.4X3
0
1
2
3
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5
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7
8
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10
DAY

FORECAST FROM

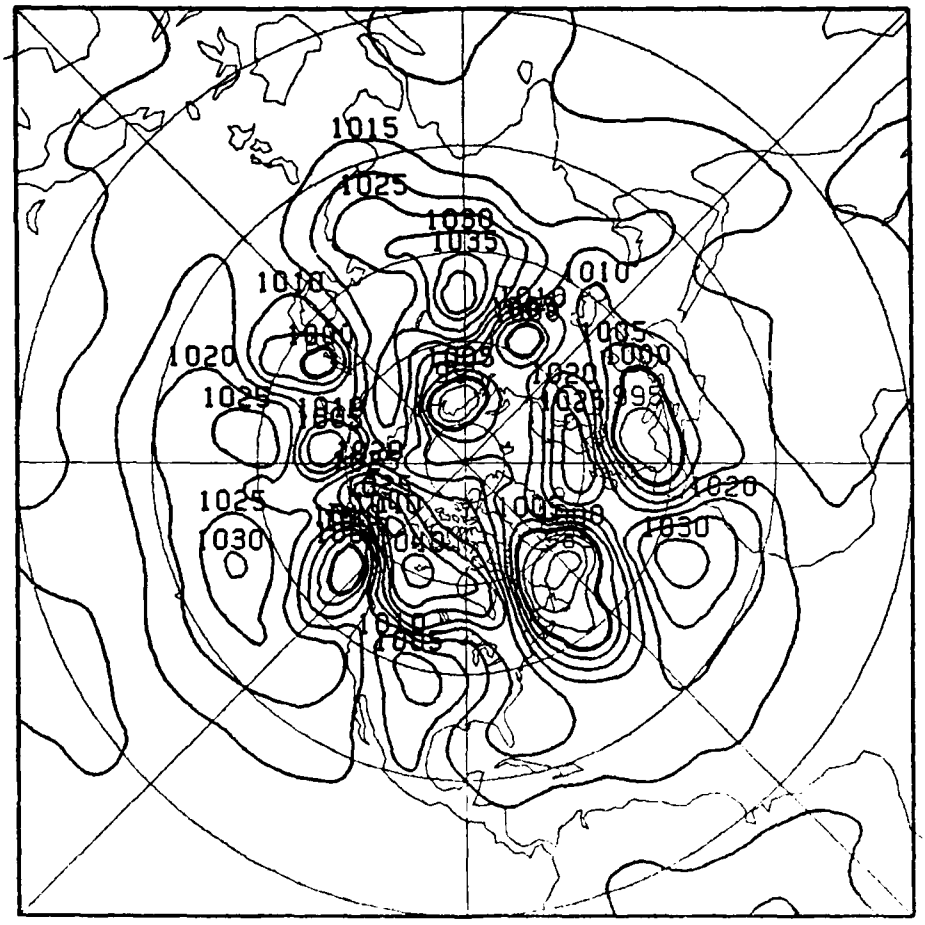
0000 GMT

15 FEBRUARY 1979

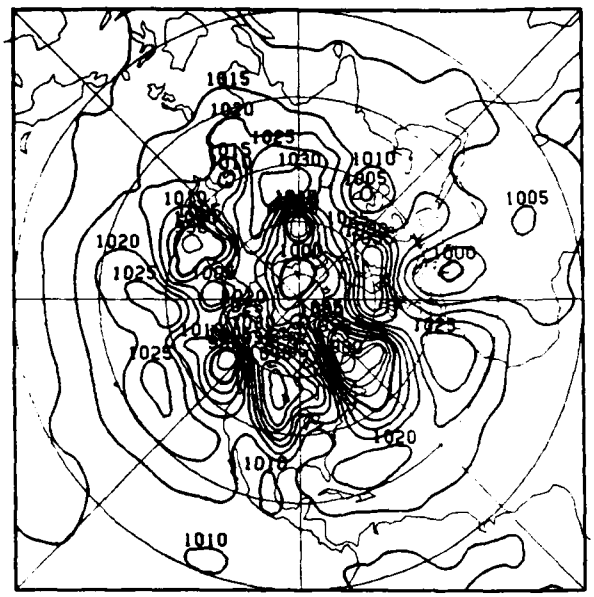
SLP

0000 GMT 15 FEB 1979

OBSERVED



OBSERVED



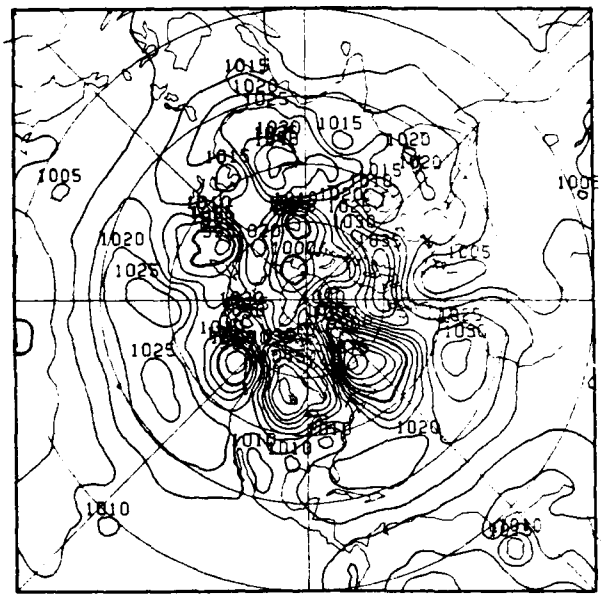
SLP

0000 GMT

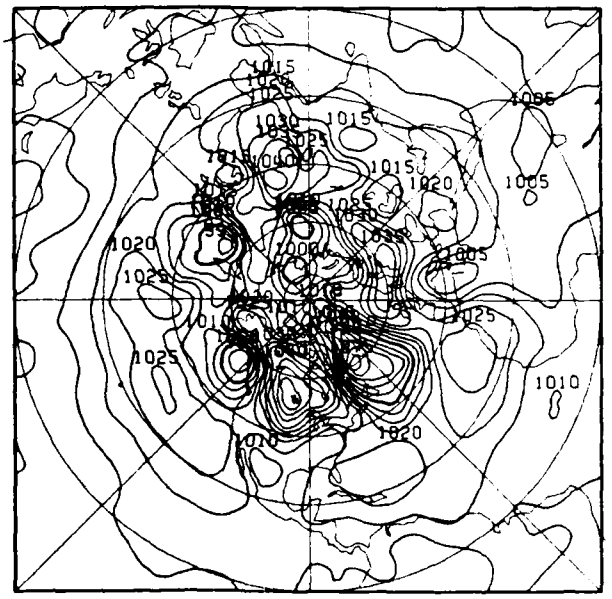
16 FEB 1979

DAY 1

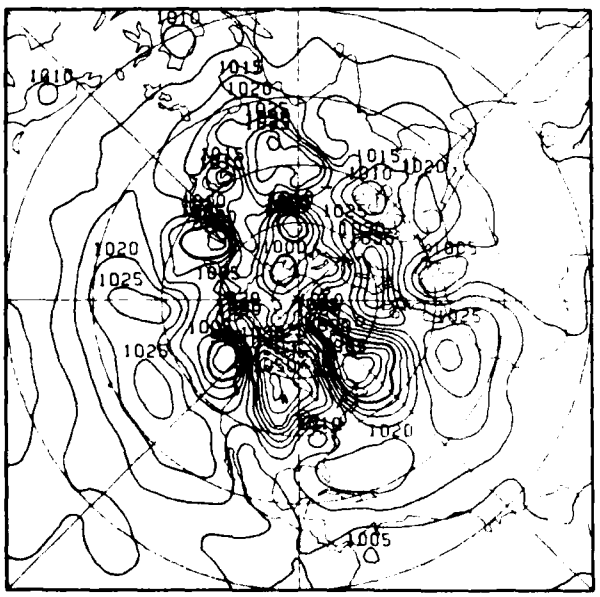
9-LAYER 4X5



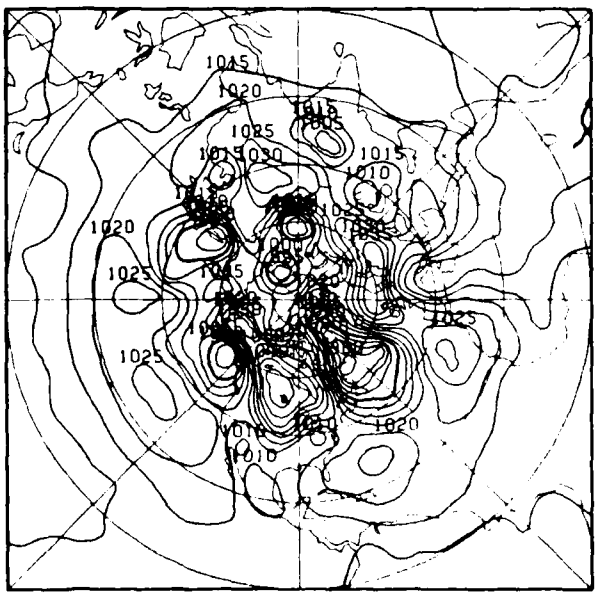
15-LAYER 4X5



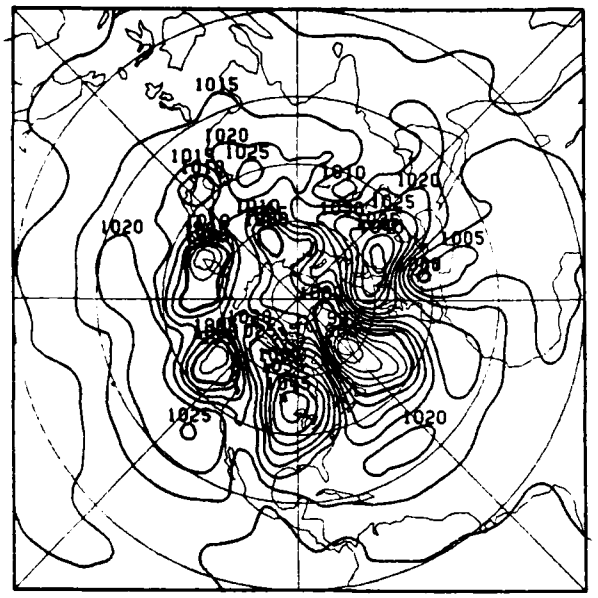
9-LAYER 2.4X3



15-LAYER 2.4X3



OBSERVED



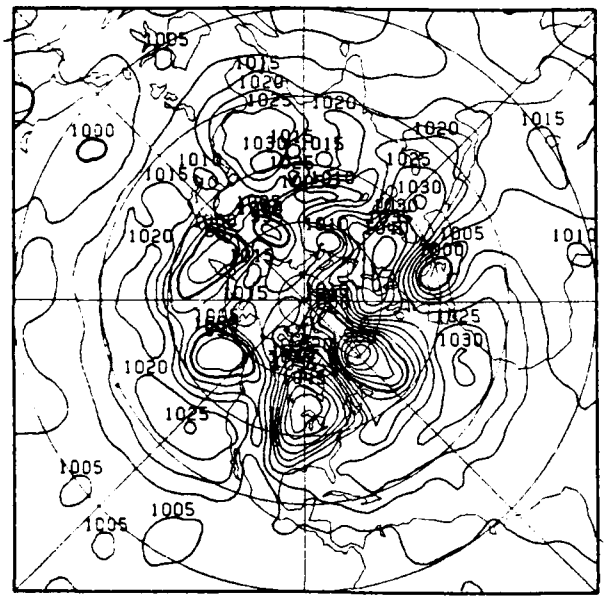
SLP

0000 GMT

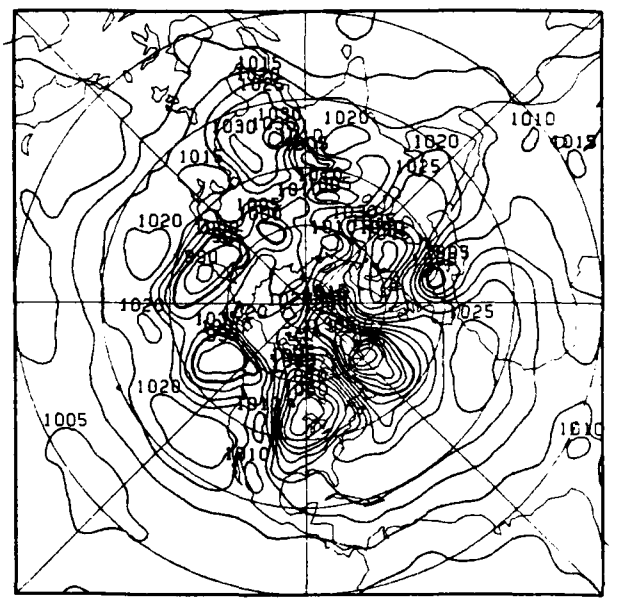
17 FEB 1979

DAY 2

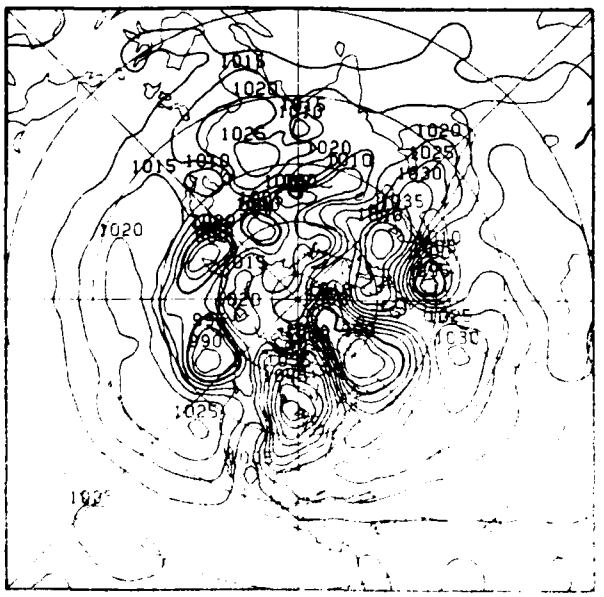
9-LAYER 4X5



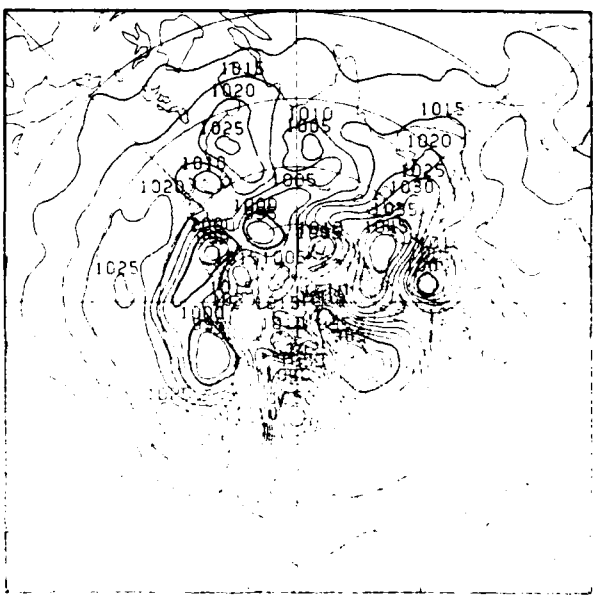
15-LAYER 4X5



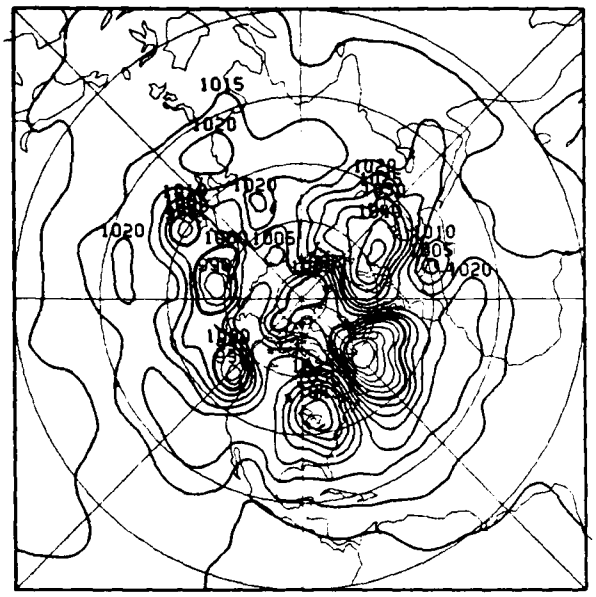
9-LAYER 2.4X3



15-LAYER 2.4X3



OBSERVED



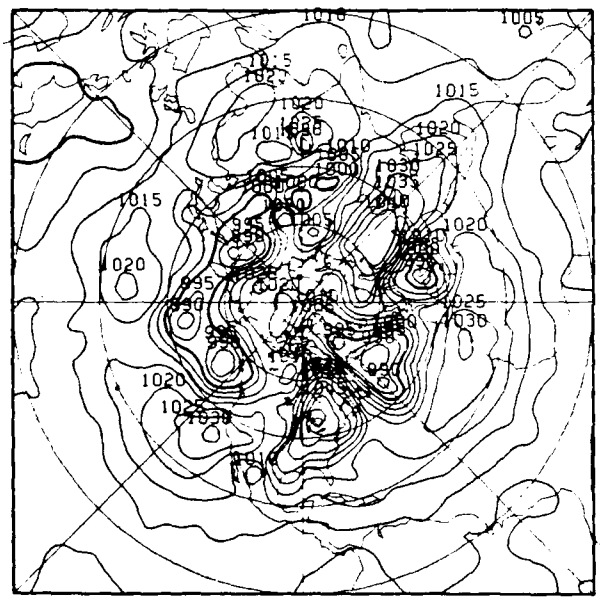
SLP

0000 GMT

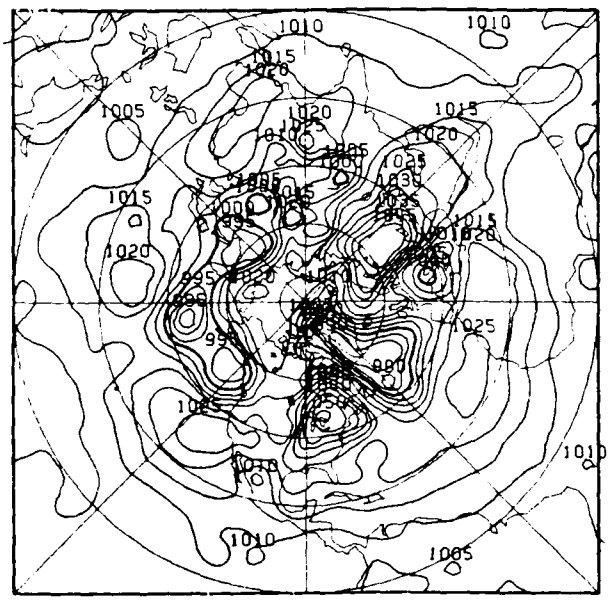
18 FEB 1979

DAY 3

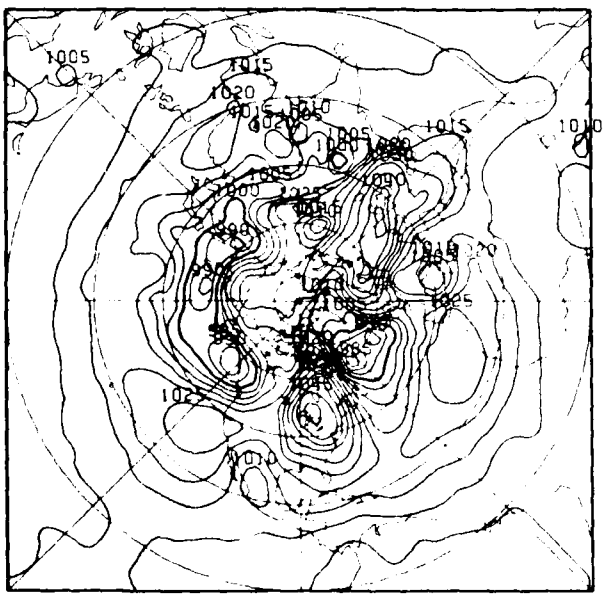
9-LAYER 4X5



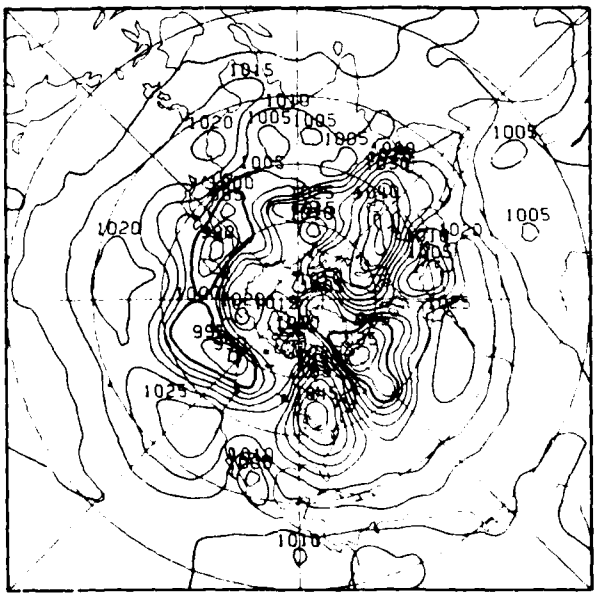
15-LAYER 4X5



9-LAYER 2.4X3

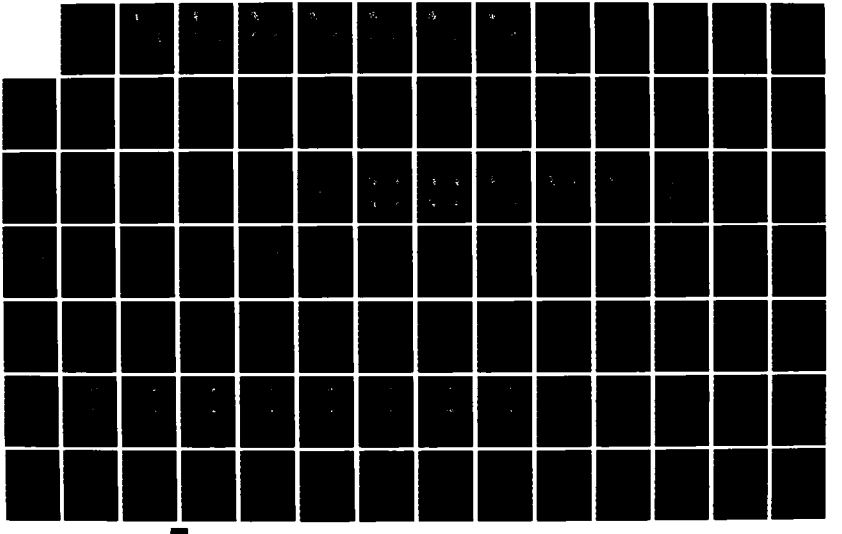


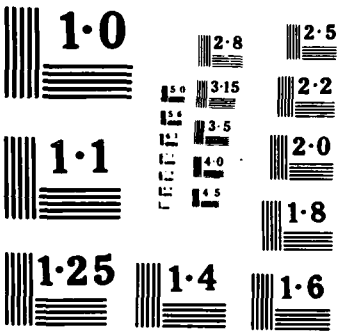
15-LAYER 2.4X3



AD-A170 108 MEDIUM RANGE (10 DAY) FORECASTS WITH THE UCLA GENERAL CIRCULATION MODEL.. (U) CALIFORNIA UNIV LOS ANGELES DEPT OF ATMOSPHERIC SCIENCES C R MECHOSO ET AL. JAN 86 3/3

UNCLASSIFIED NEPRF-CR-86-01 N00014-80-K-0947 F/G 4/2 NL




1·0
1·1
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1·8
2·0
2·2
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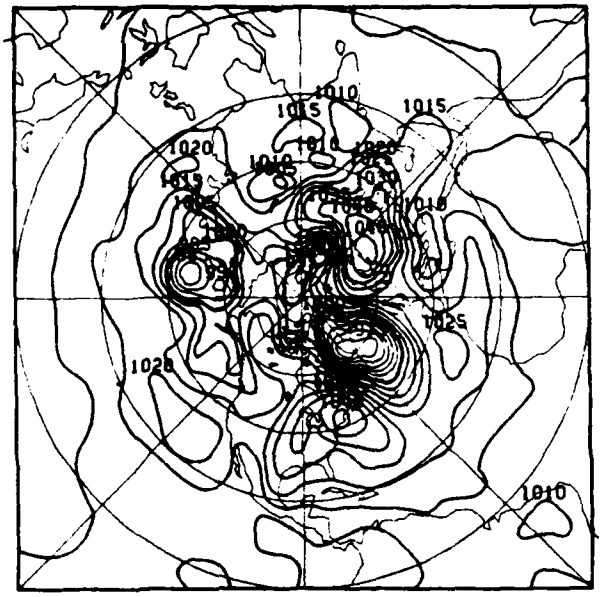
OBSERVED



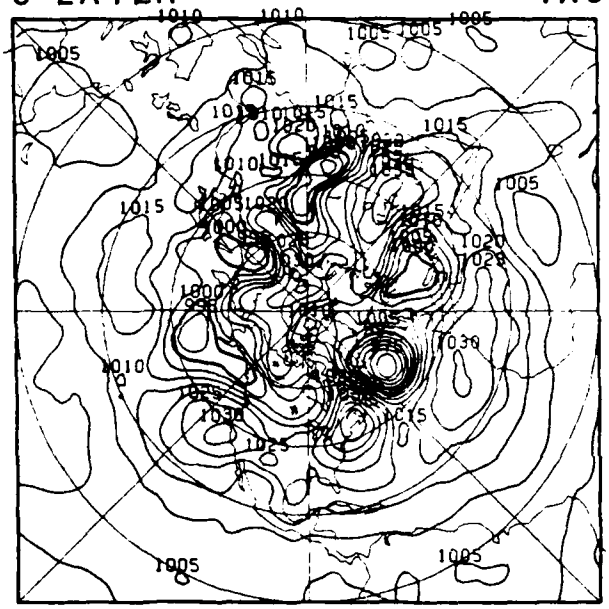
SLP

0000 GMT

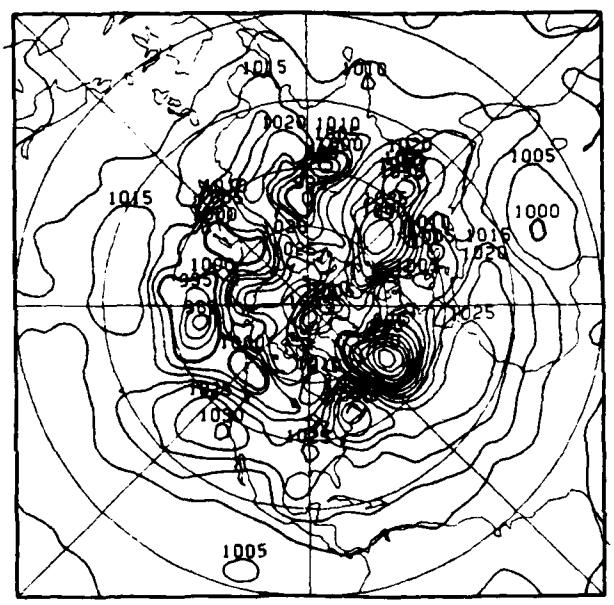
19 FEB 1979

DAY 4

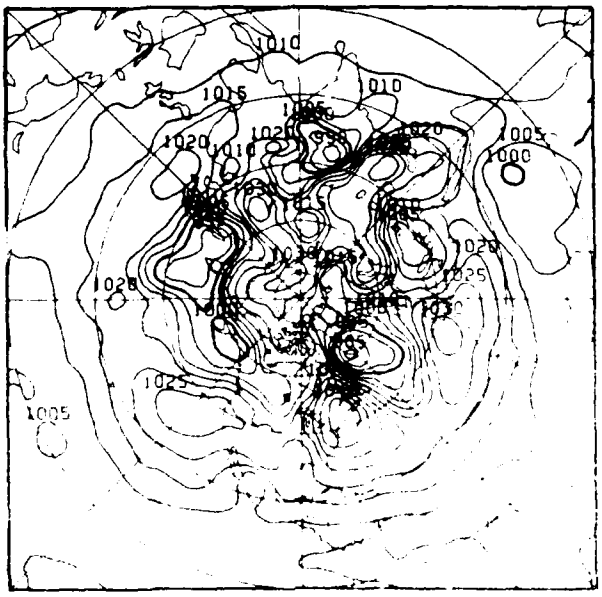
9-LAYER 4X5



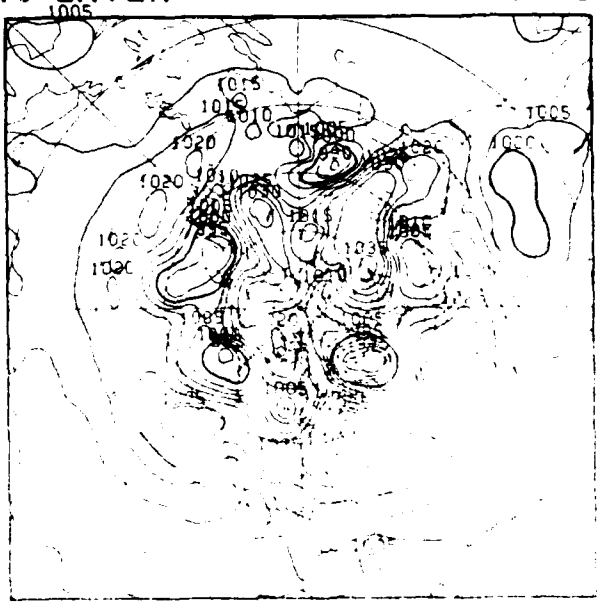
15-LAYER 4X5



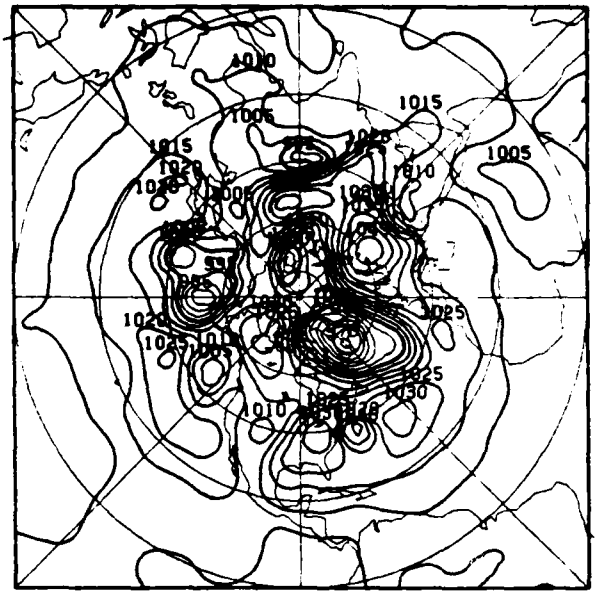
9-LAYER 2.4X3



15-LAYER 2.4X3



OBSERVED



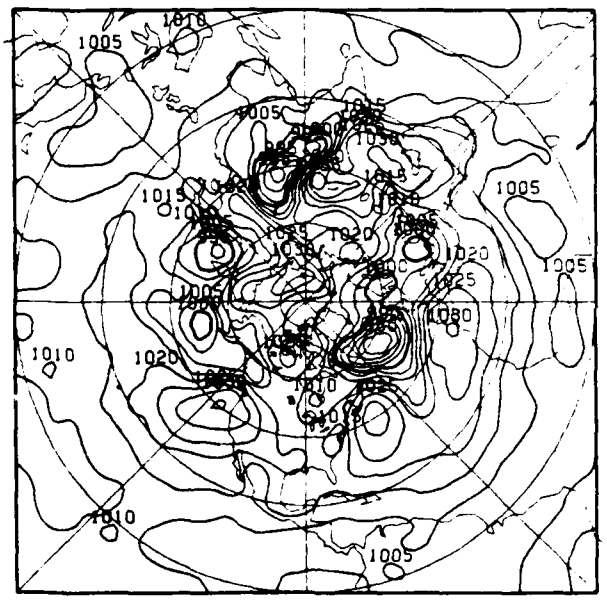
SLP

0000 GMT

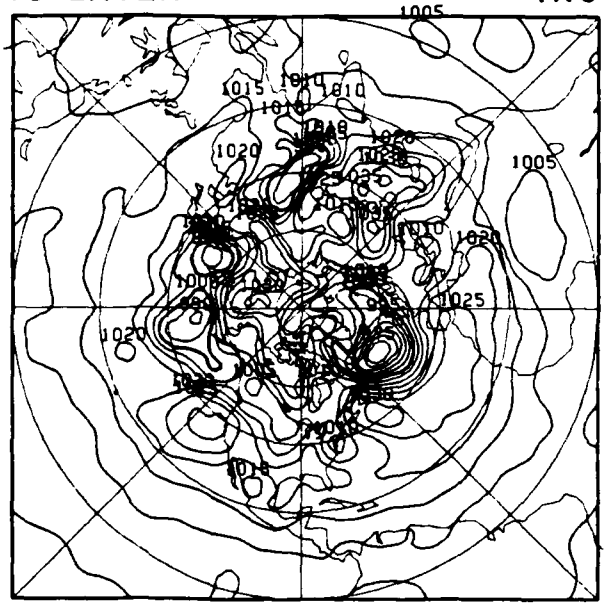
20 FEB 1979

DAY 5

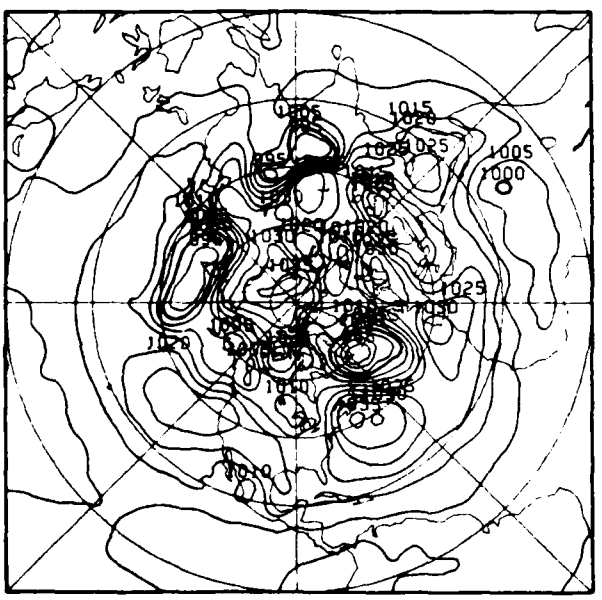
9-LAYER 4X5



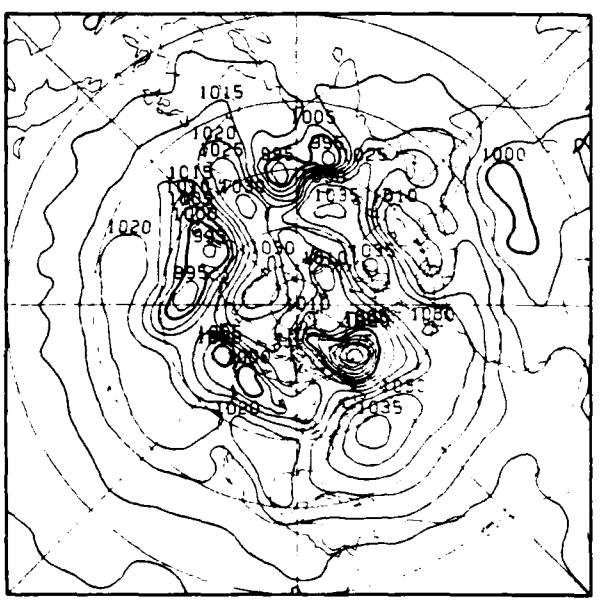
15-LAYER 4X5



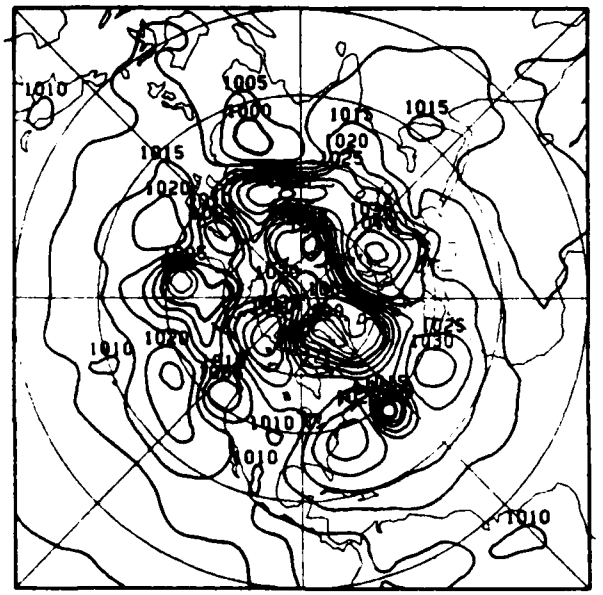
9-LAYER 2.4X3



15-LAYER 2.4X3



OBSERVED



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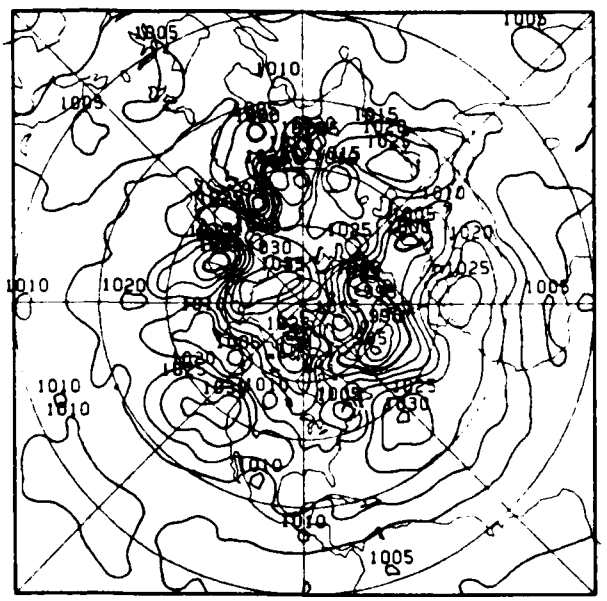
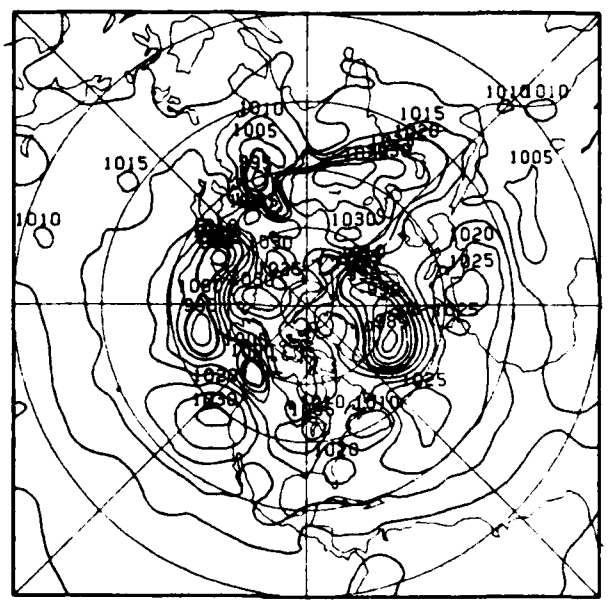
DAY 6

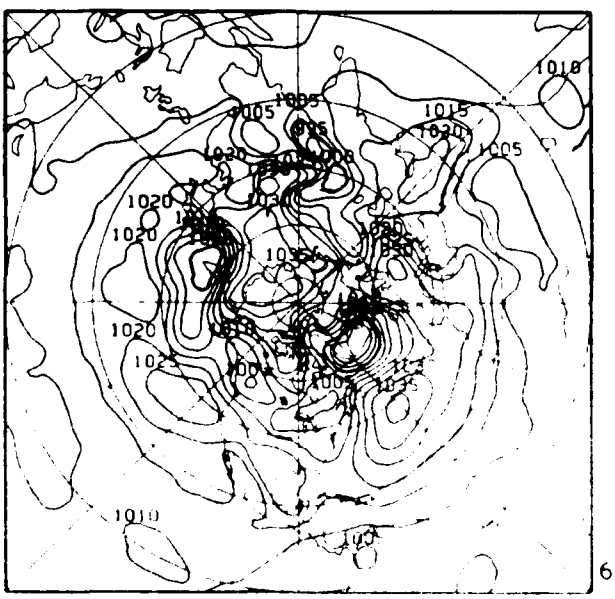
9-LAYER 4X5



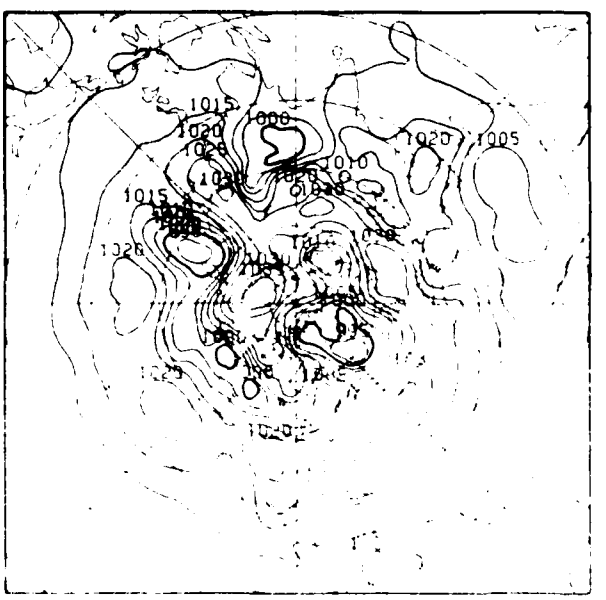
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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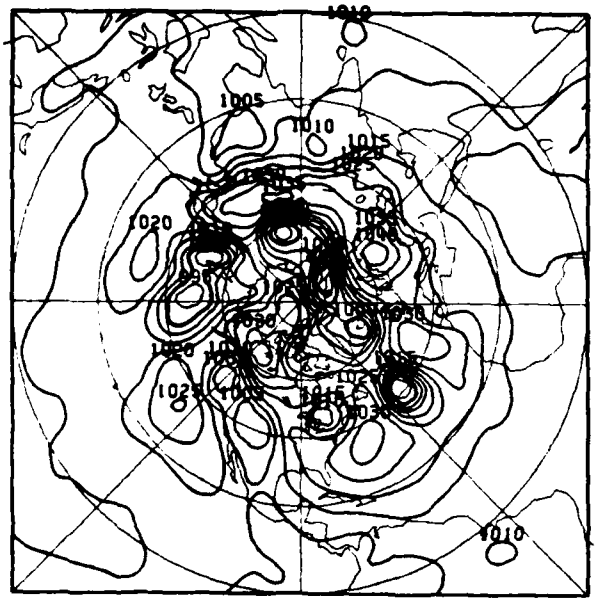

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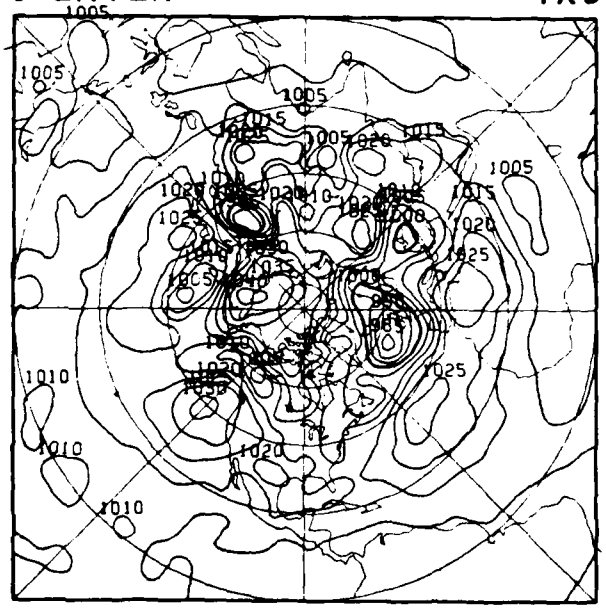
DAY 7

9-LAYER 4X5



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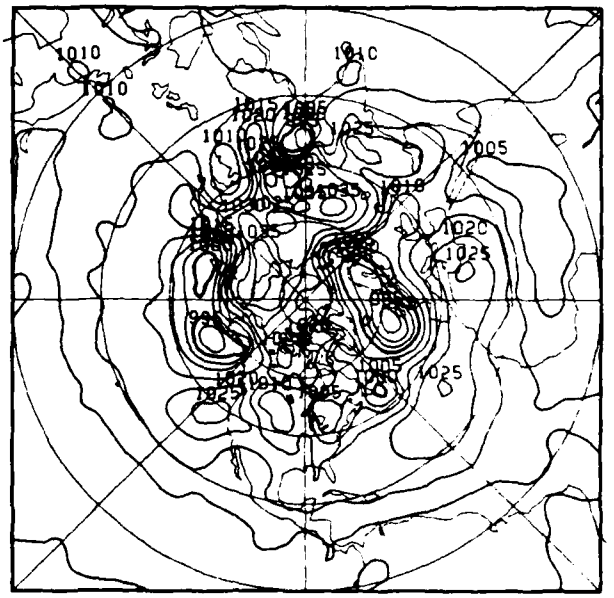
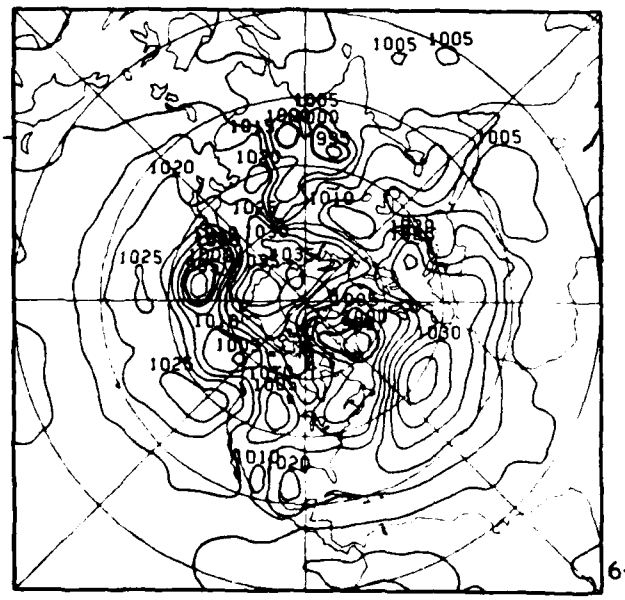


9-LAYER 2.4X3



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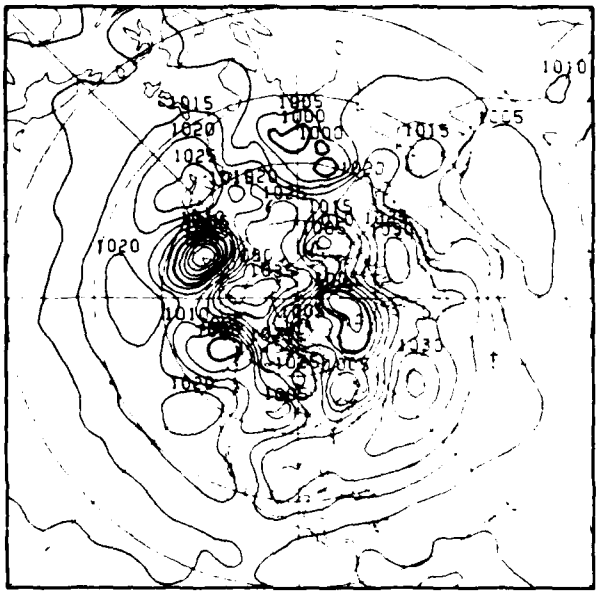

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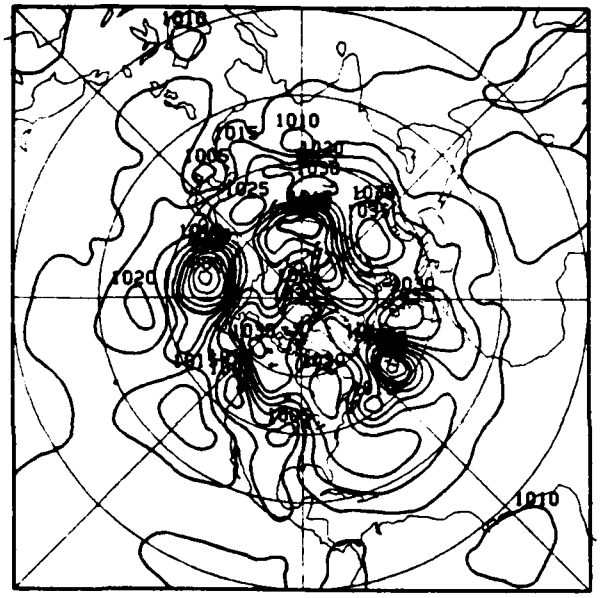

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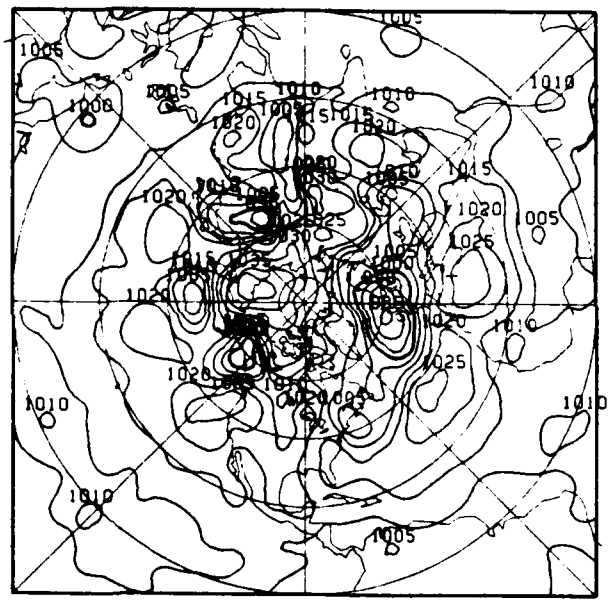
DAY 8

9-LAYER 4X5



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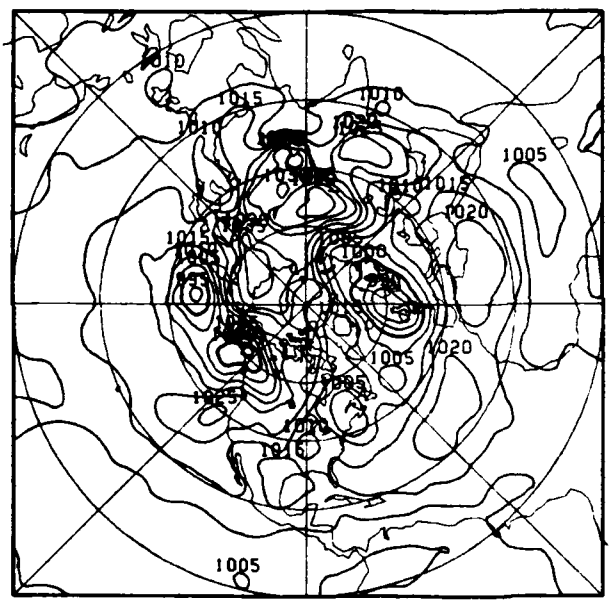

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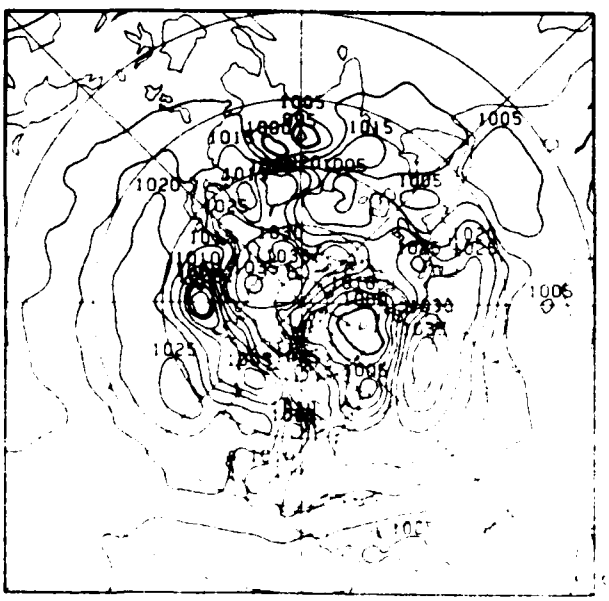

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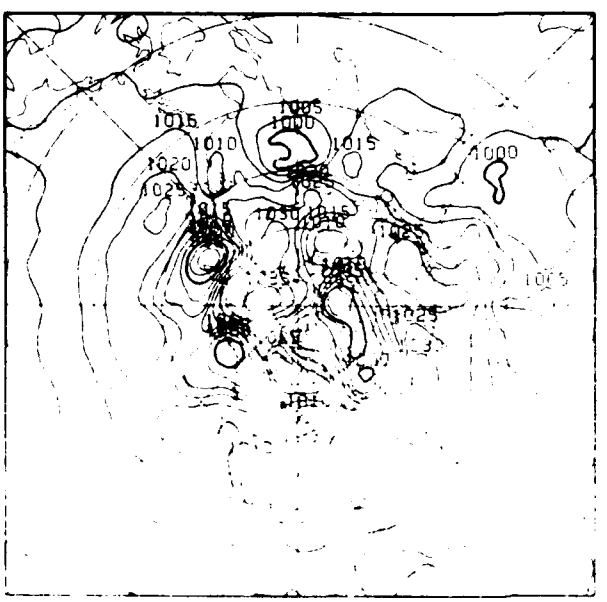

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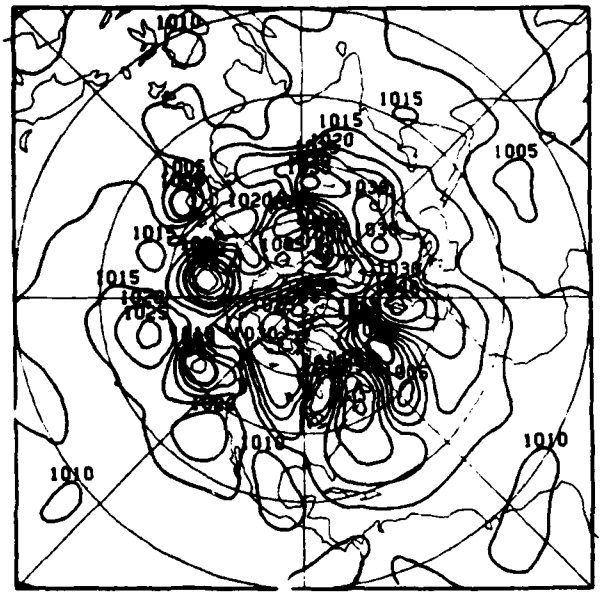

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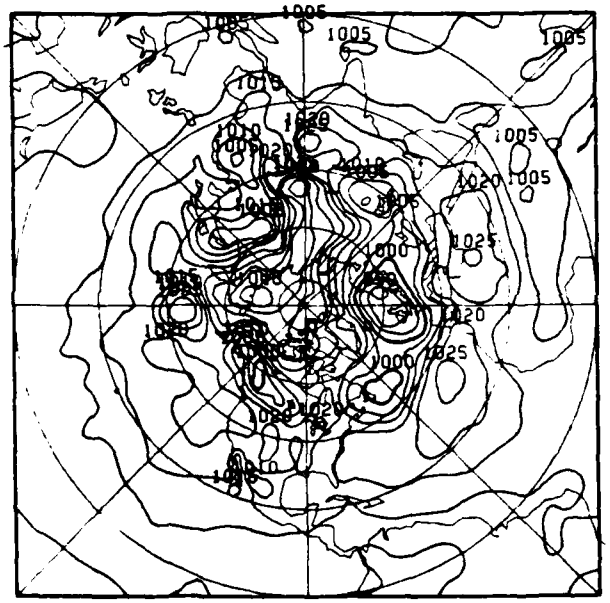
DAY 9

9-LAYER 4X5



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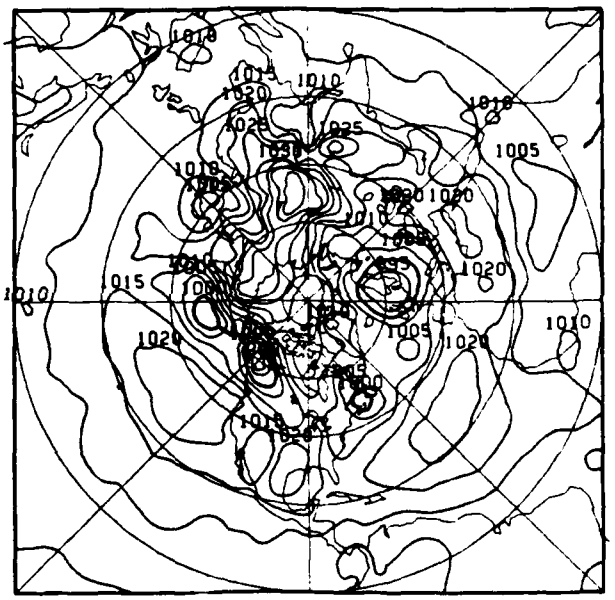

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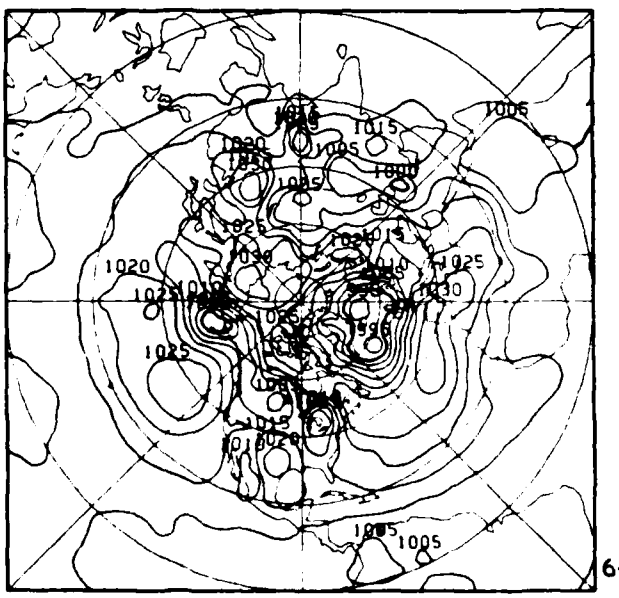

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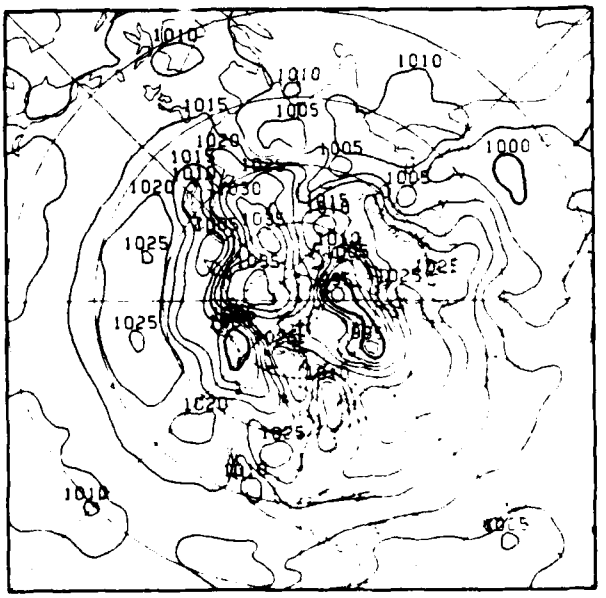

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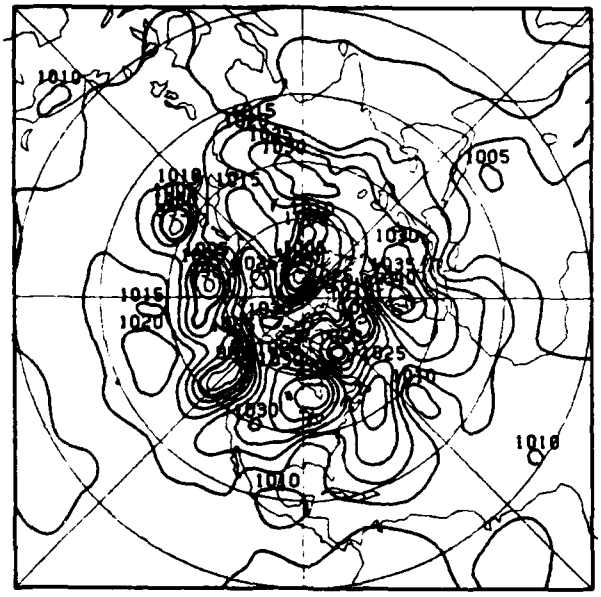

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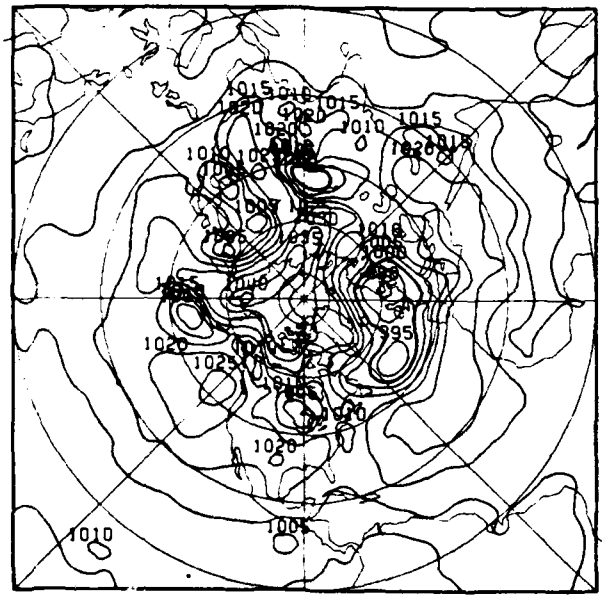
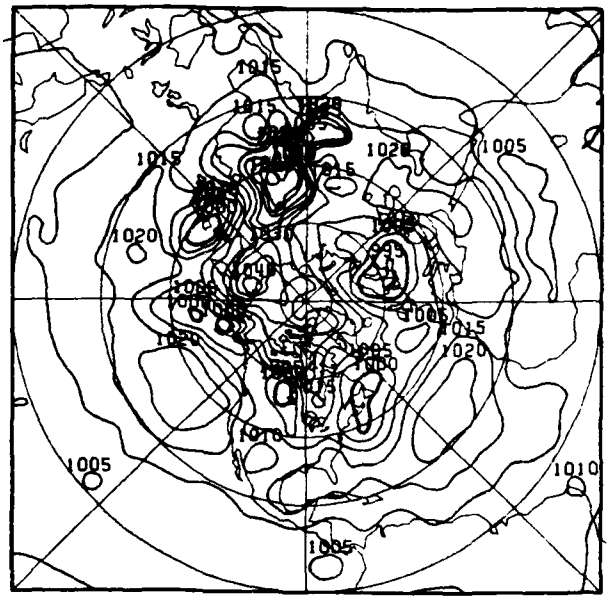
25 FEB 1979

DAY 10

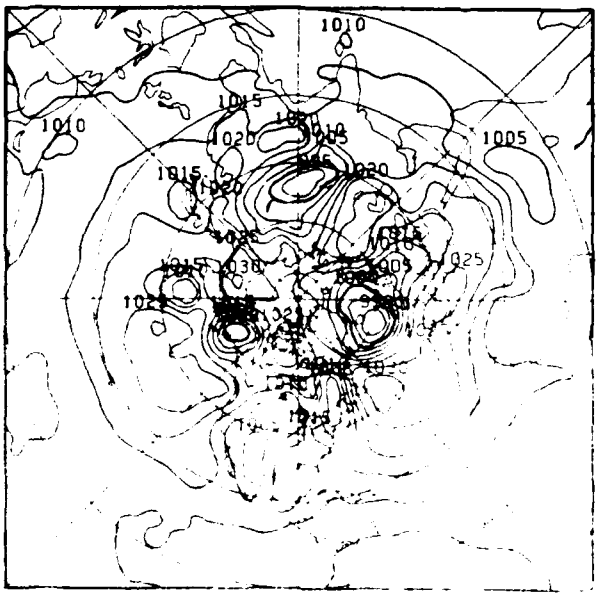
9-LAYER 4X5



15-LAYER 4X5



9-LAYER 2.4X3



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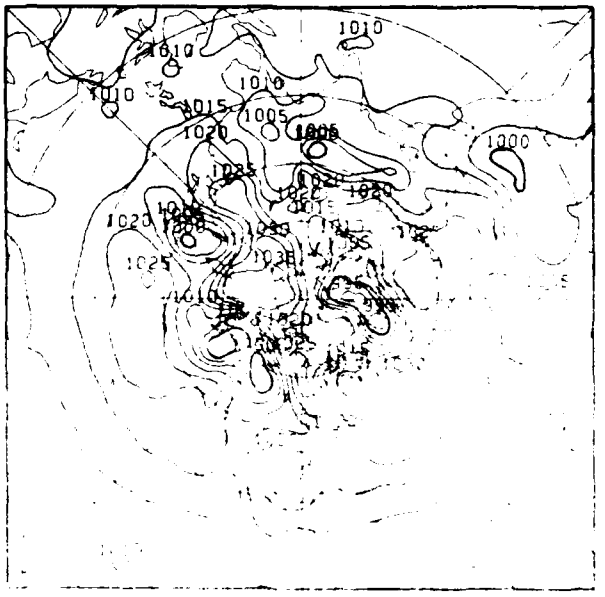

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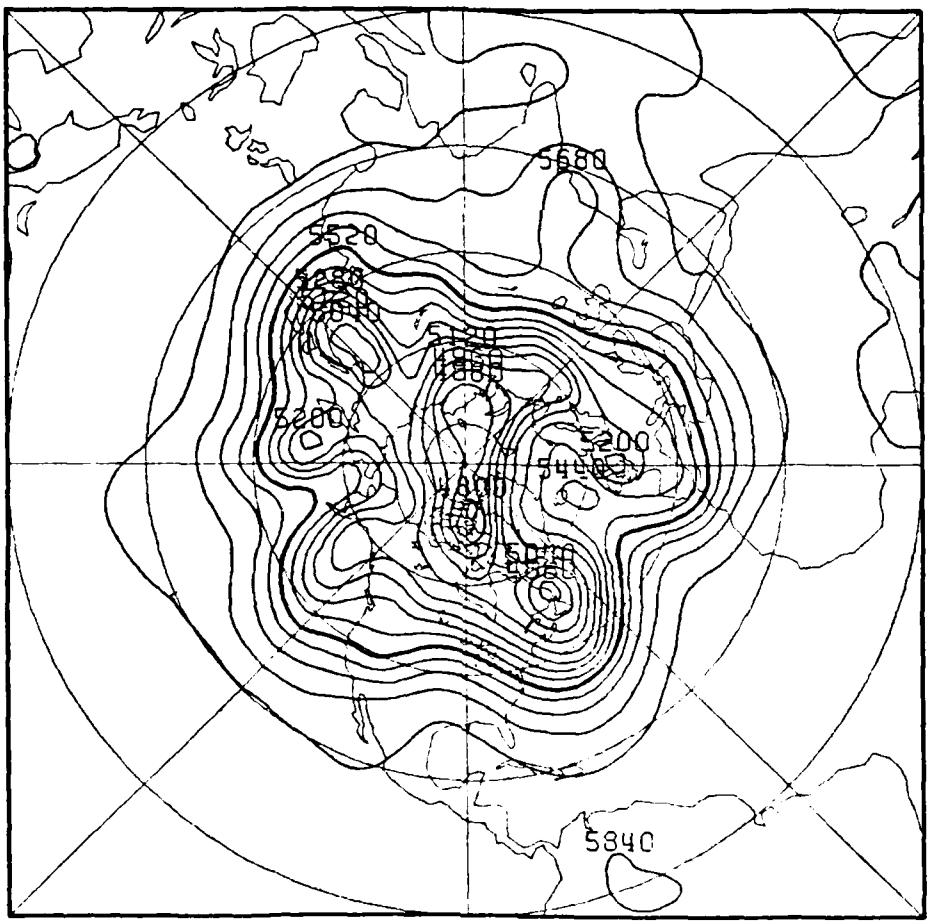

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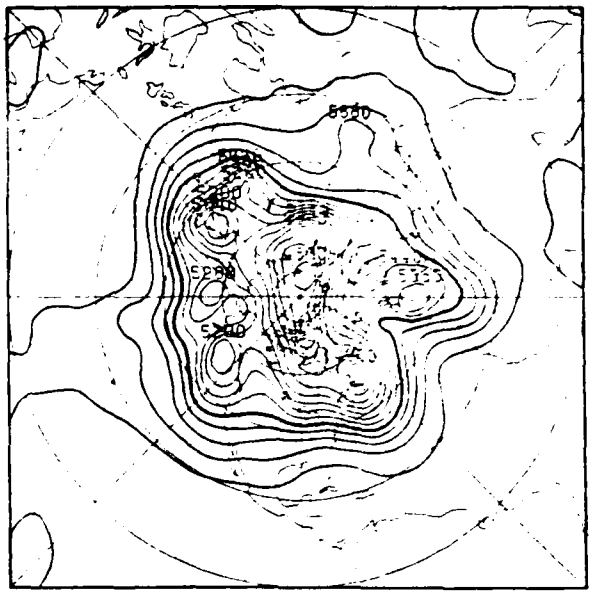

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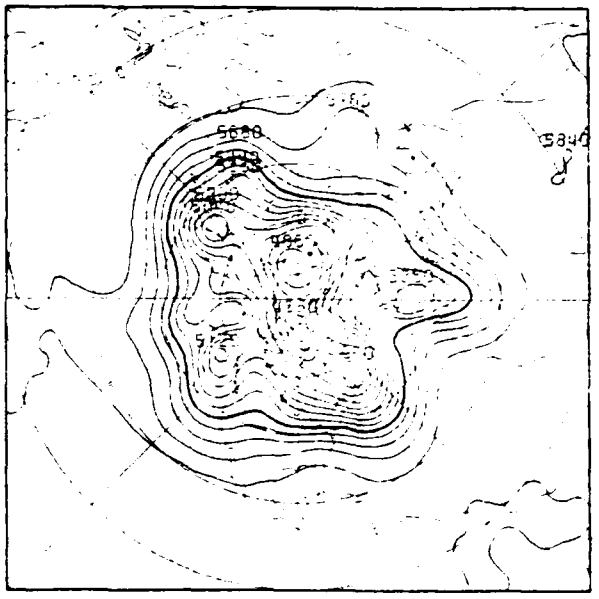
DAY 1

9-LAYER 4X5



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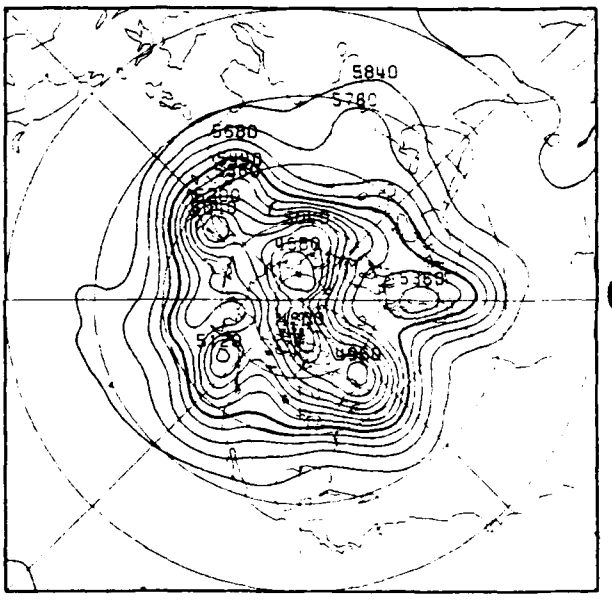
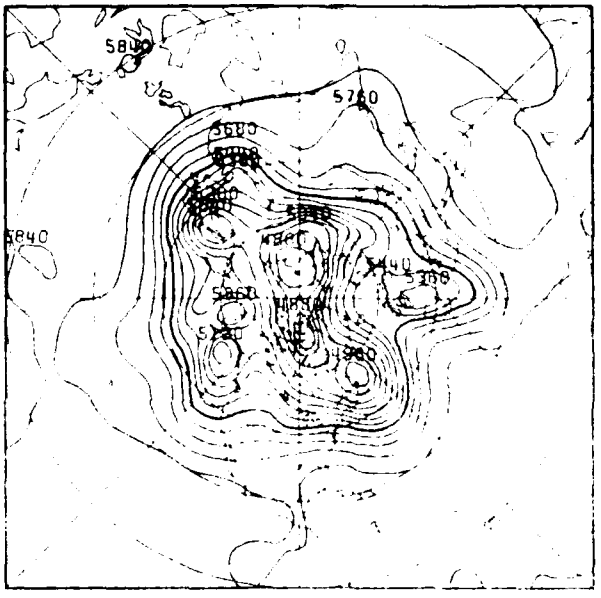
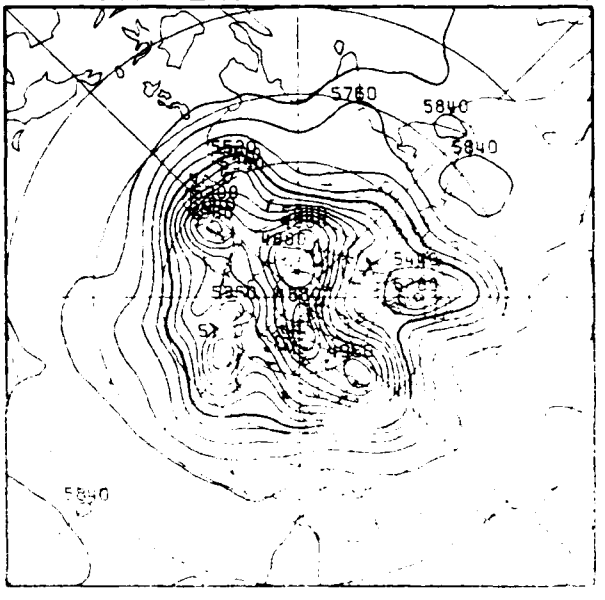


9-LAYER 2.4X3



15-LAYER 2.4X3



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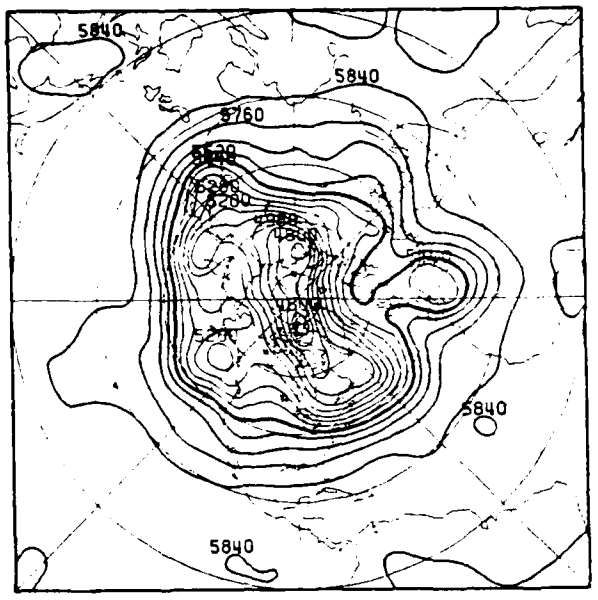

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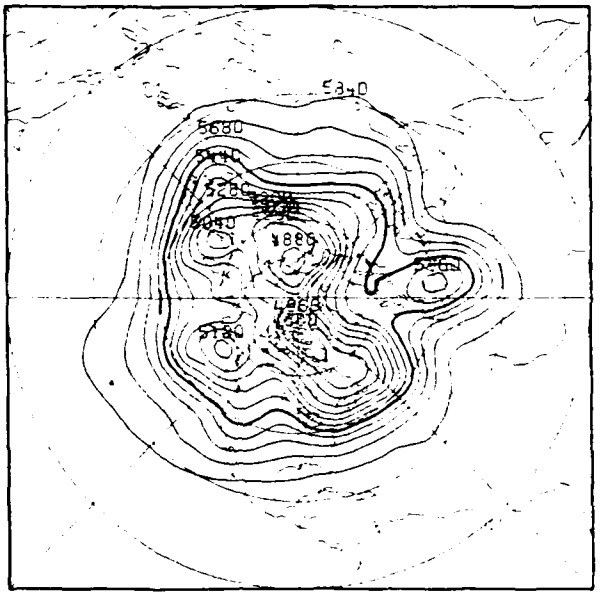
17 FEB 1979

DAY 2

9-LAYER 4X5



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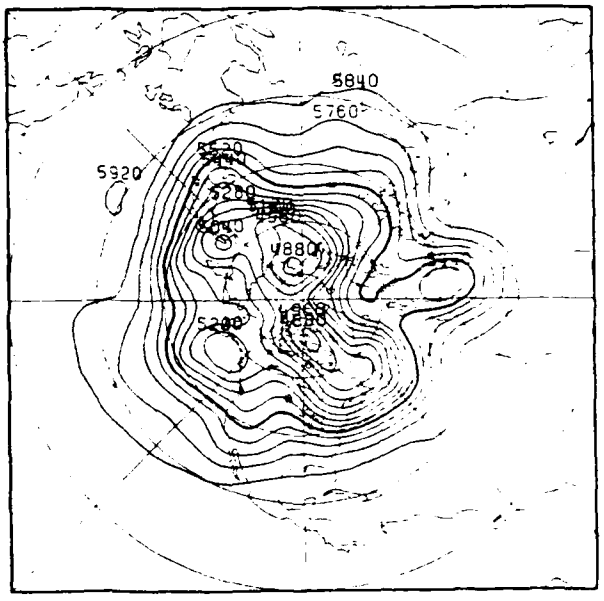

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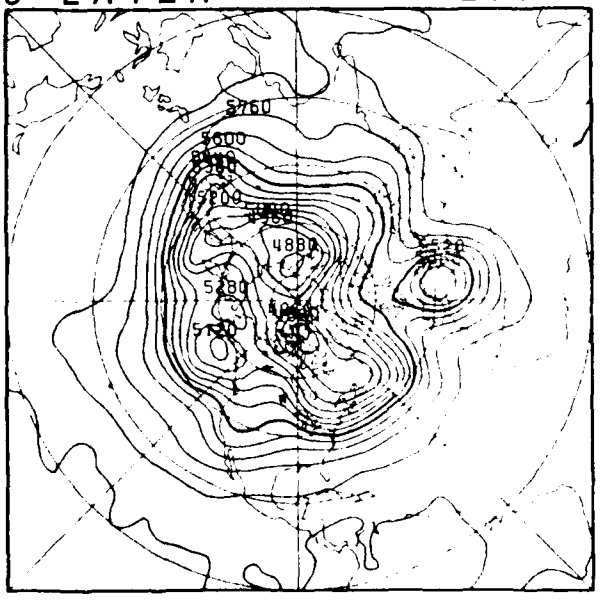
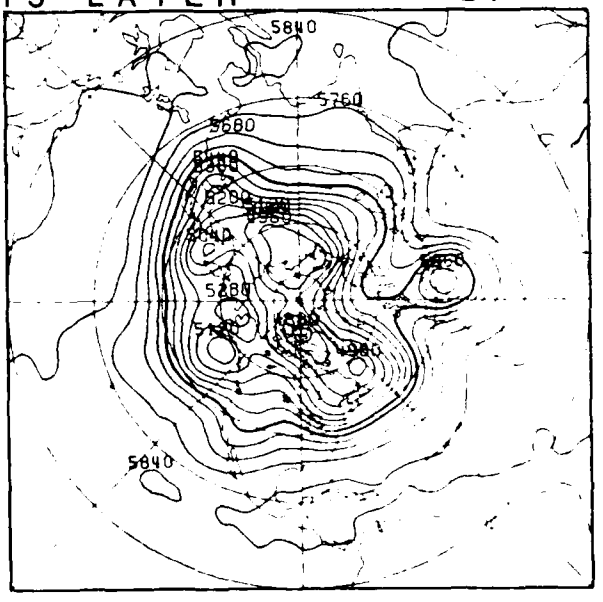


15-LAYER 2.4X3



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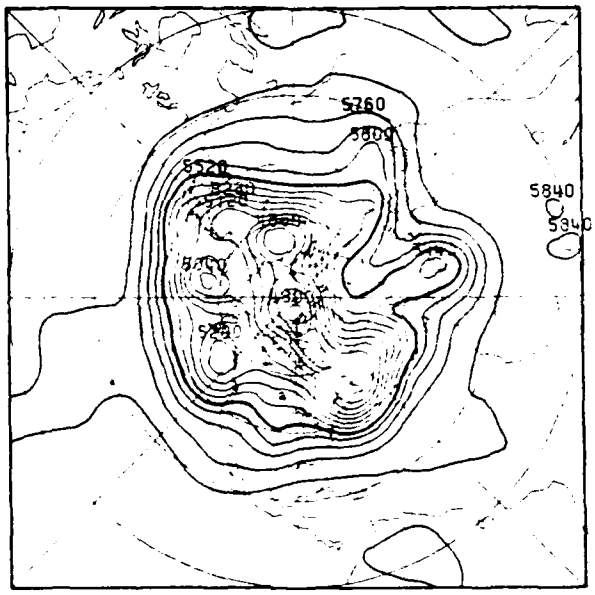

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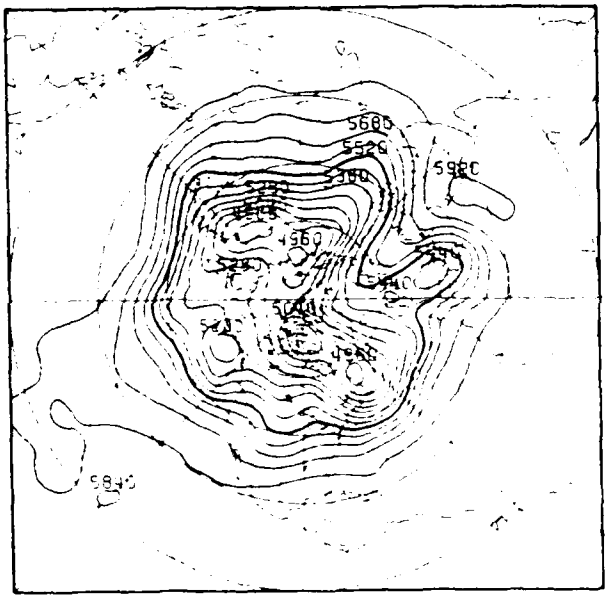
18 FEB 1979

DAY 3

9-LAYER 4X5

15-LAYER 4X5



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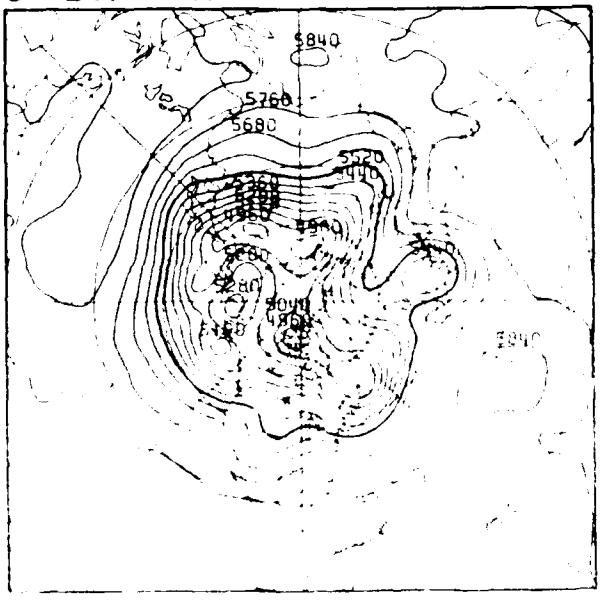
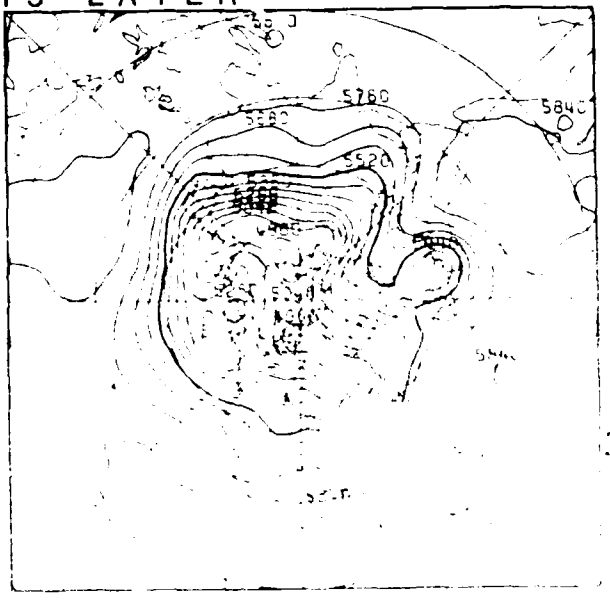


15-LAYER 2.4X3



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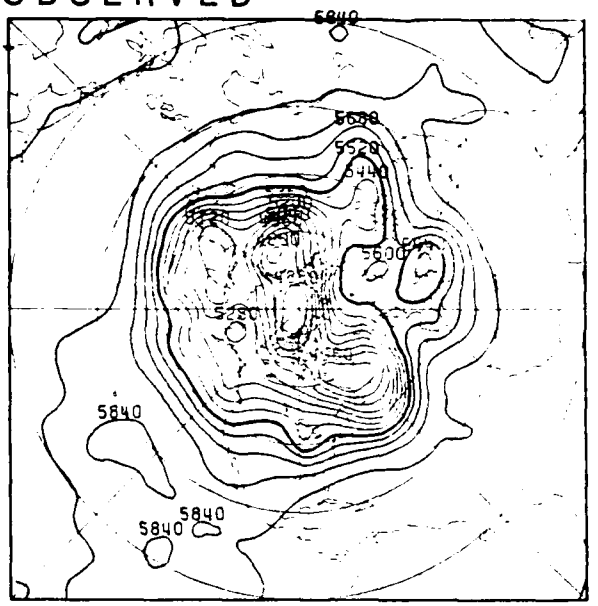

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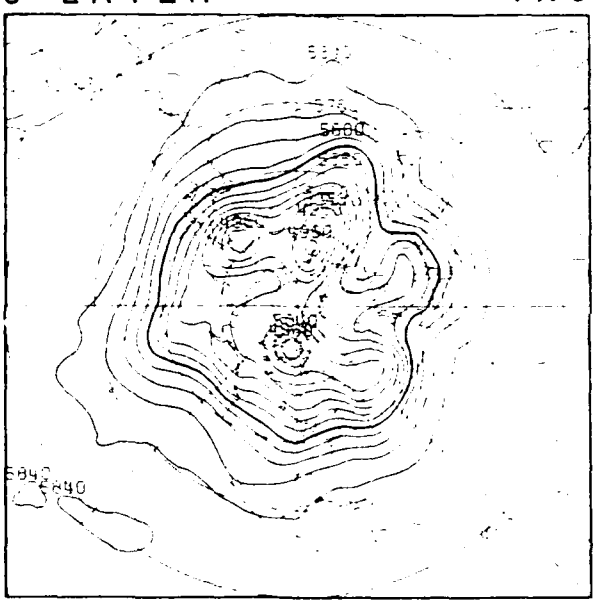
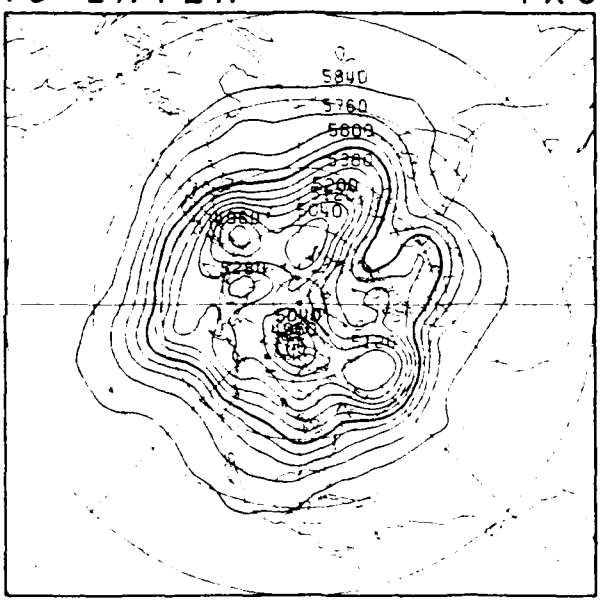
19 FEB 1979

DAY 4

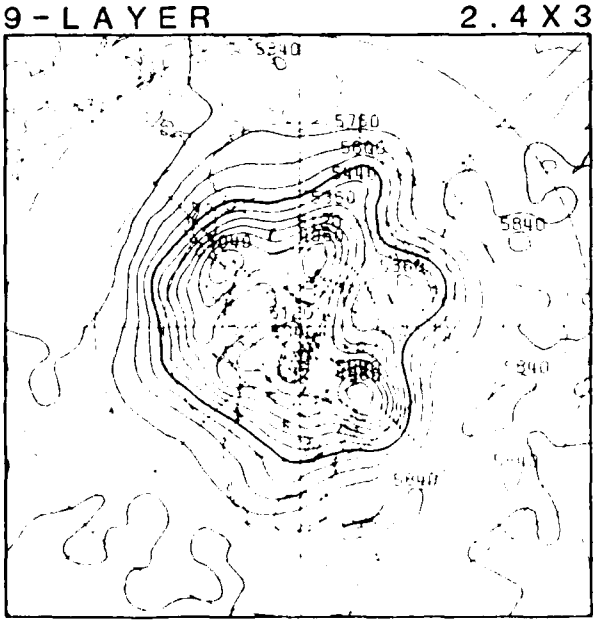
9-LAYER 4X5



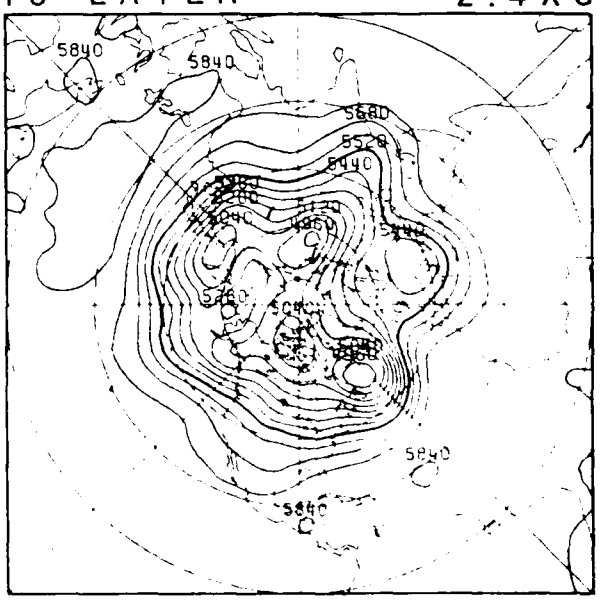
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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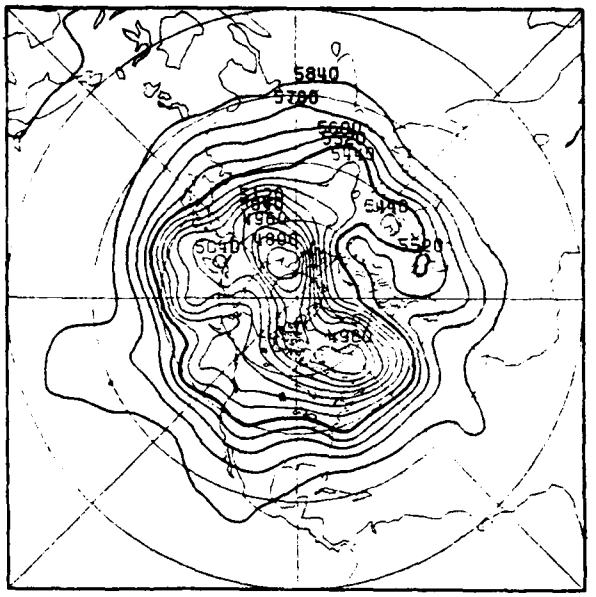

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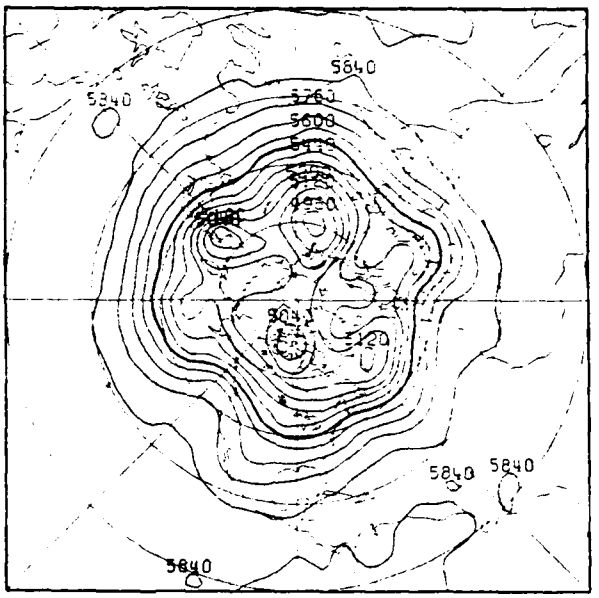
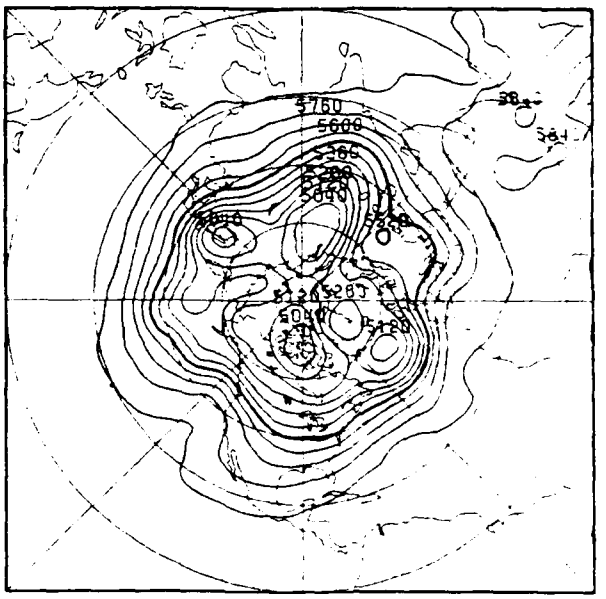
20 FEB 1979

DAY 5

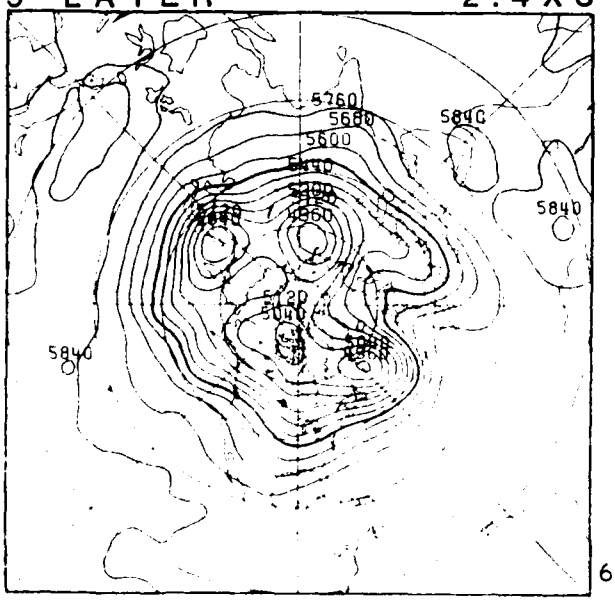
9-LAYER 4X5



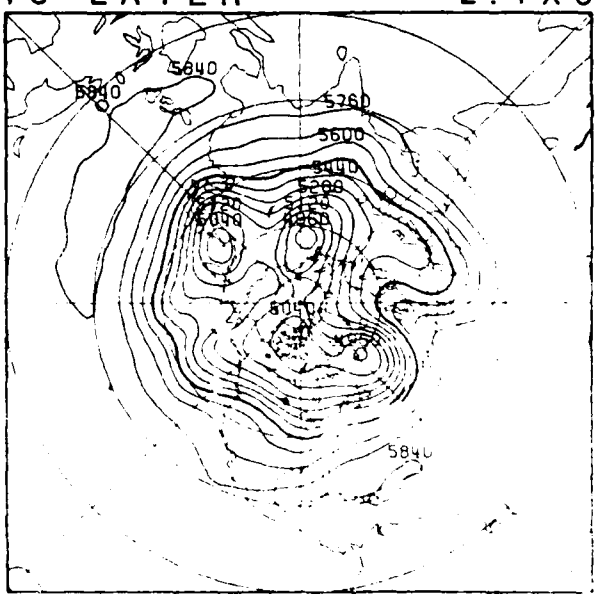
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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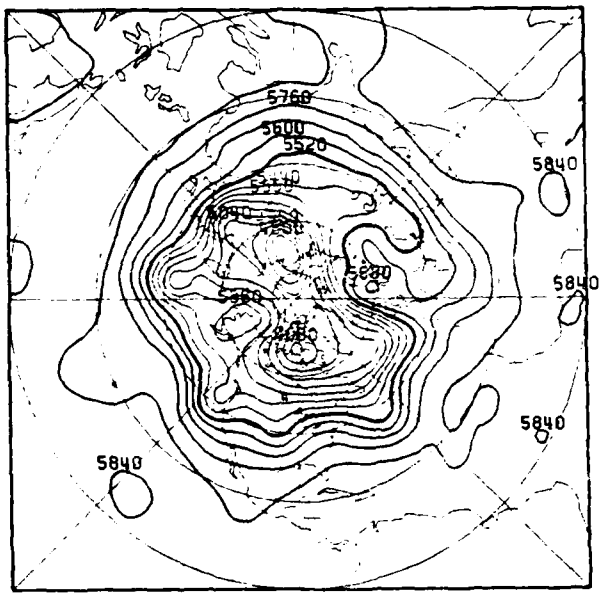

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DAY 6

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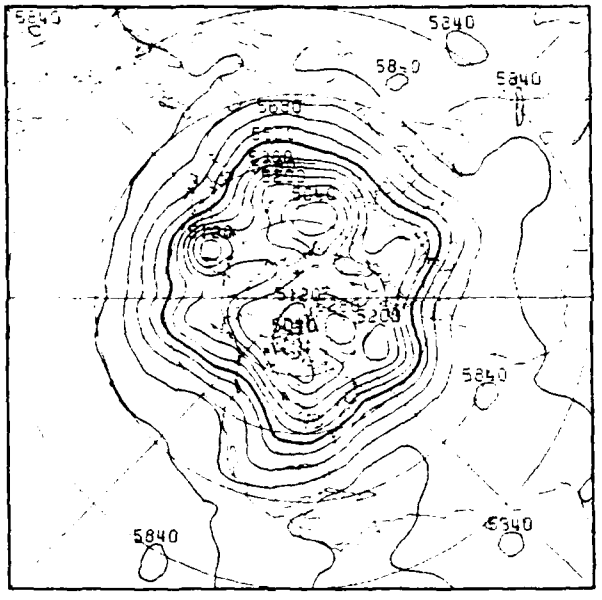
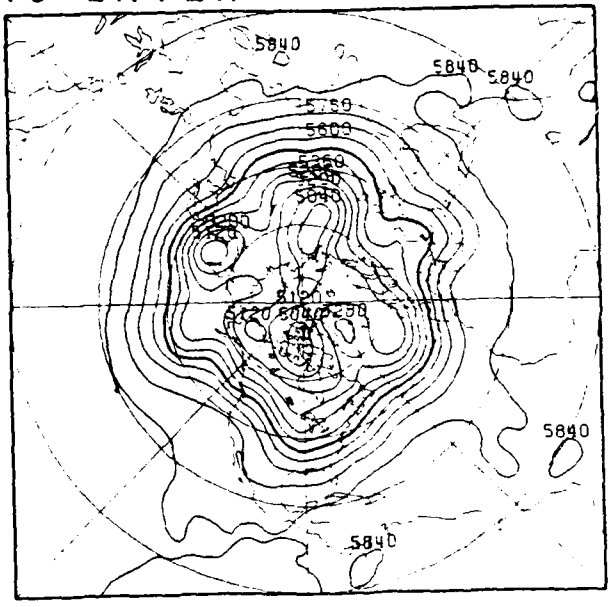
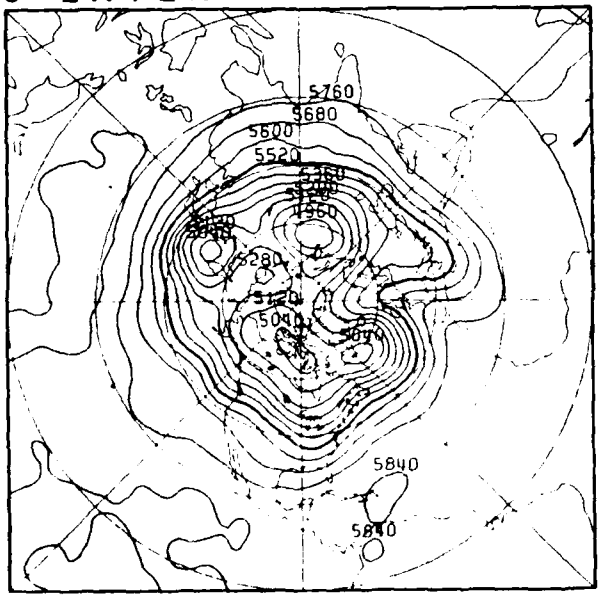


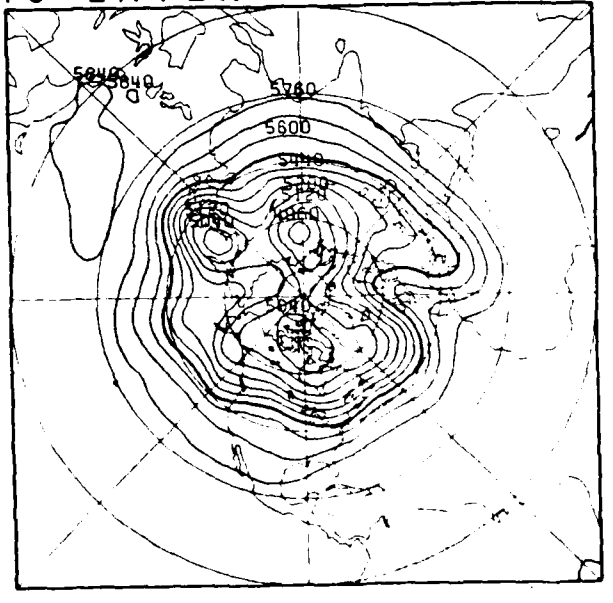
15-LAYER 4X5



9-LAYER 2.4X3



15-LAYER 2.4X3



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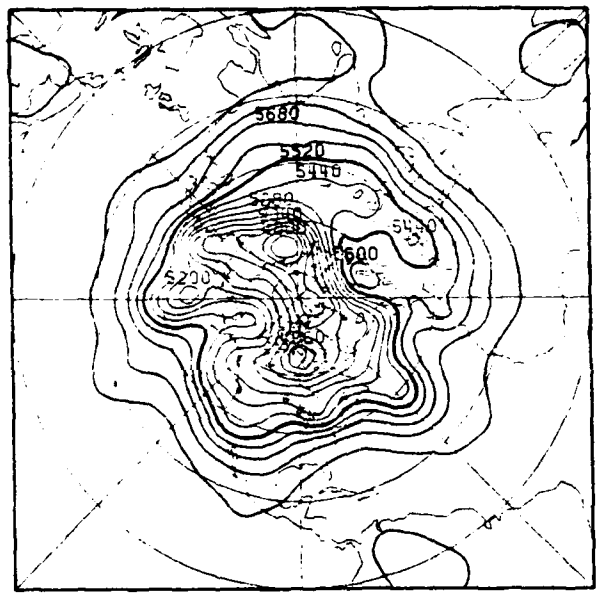


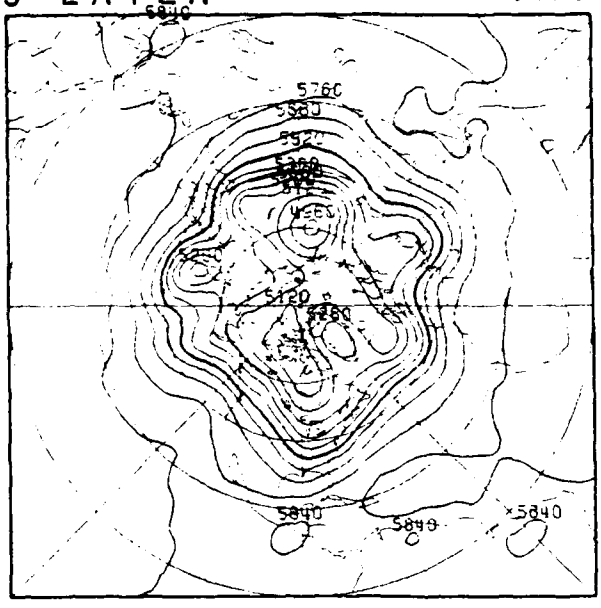
500 mb Z

0000 GMT

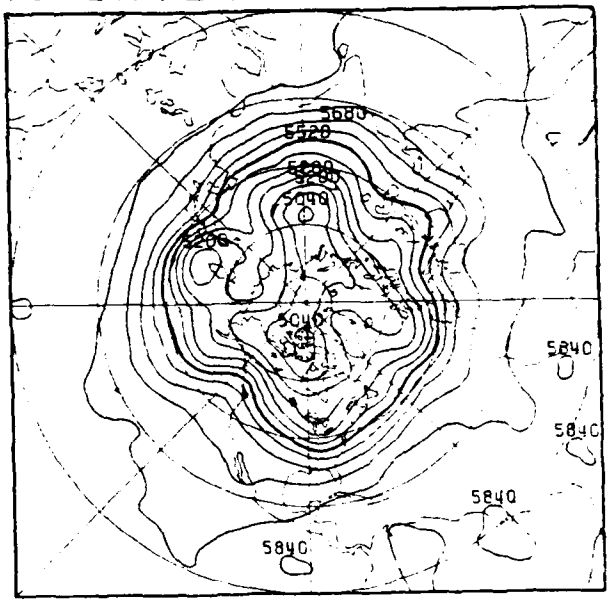
22 FEB 1979

DAY 7

9-LAYER 4X5



15-LAYER 4X5



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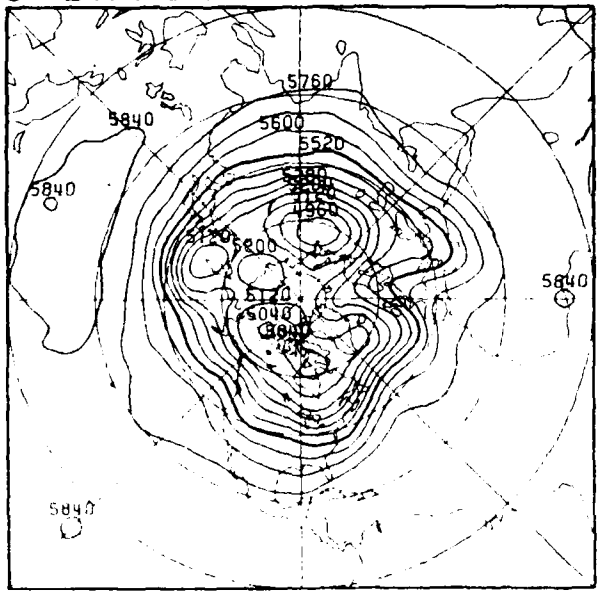

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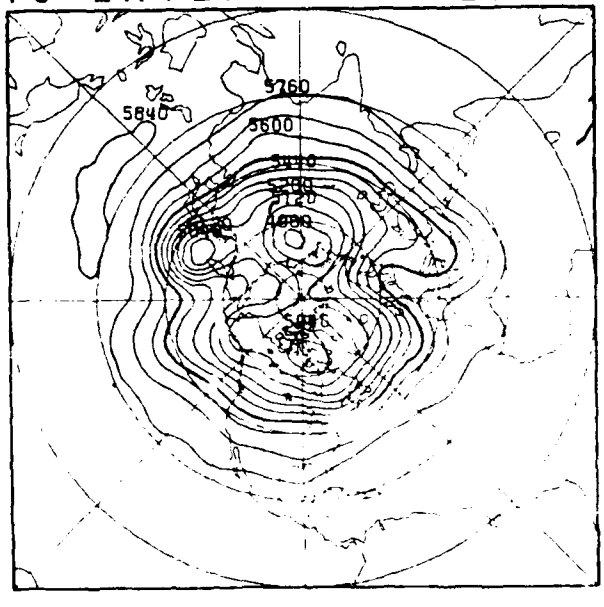

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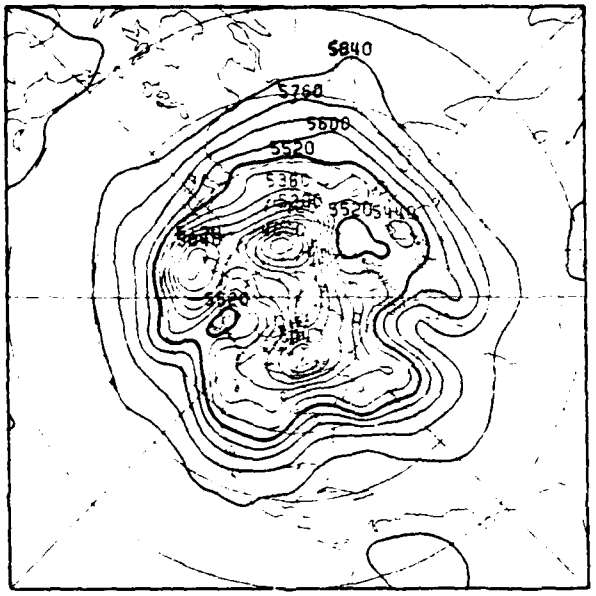

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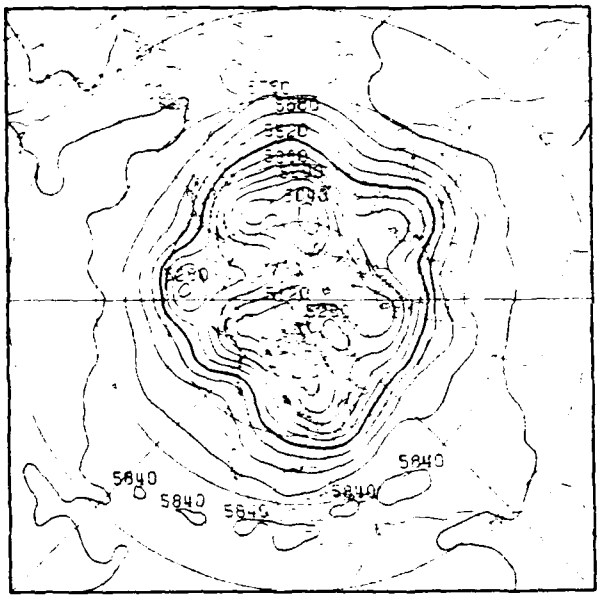
23 FEB 1979

DAY 8

9-LAYER 4X5



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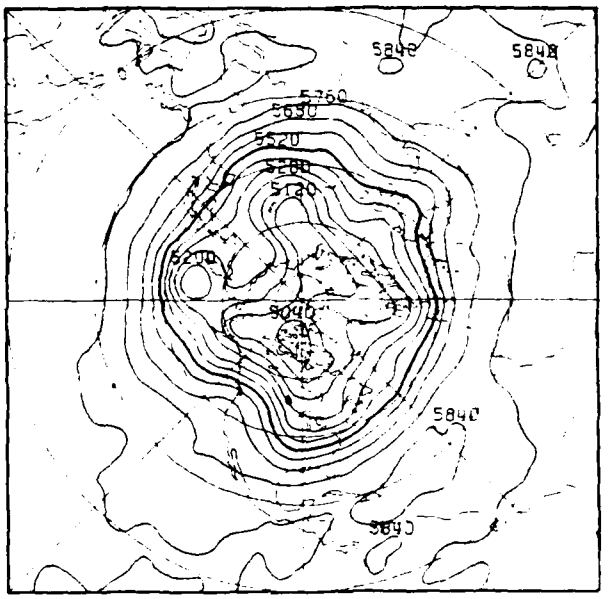

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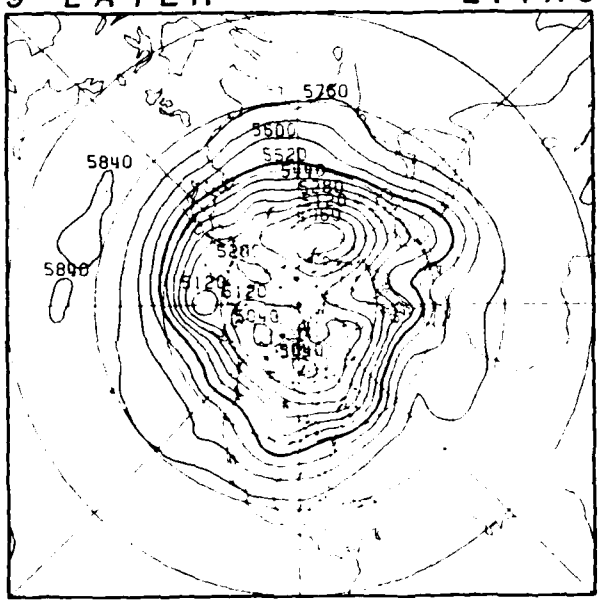

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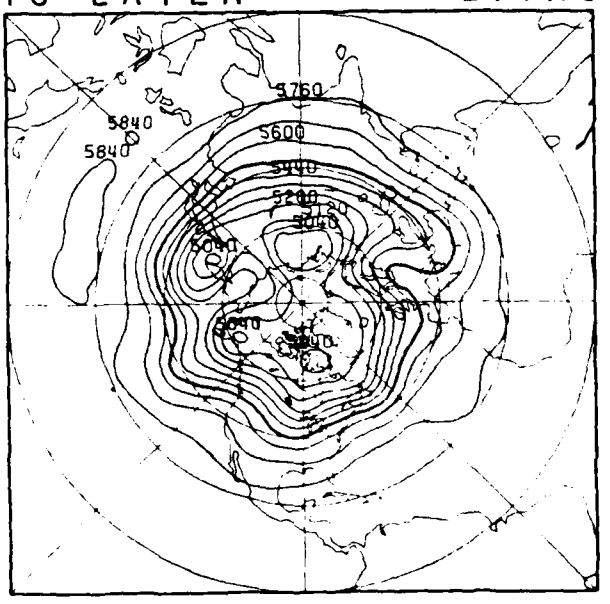

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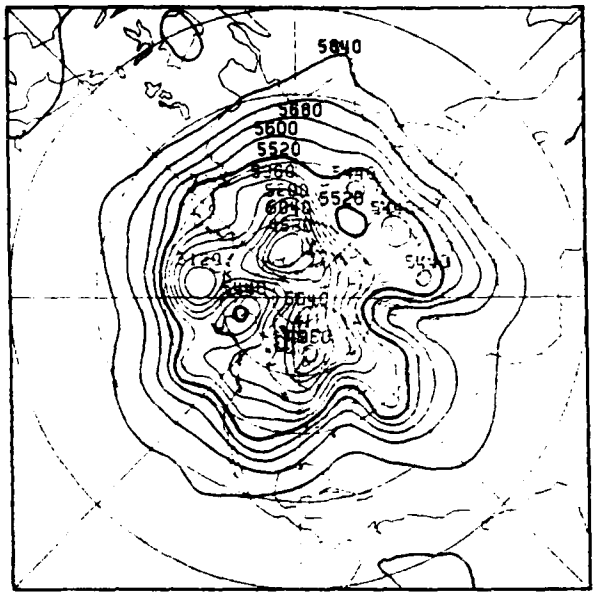

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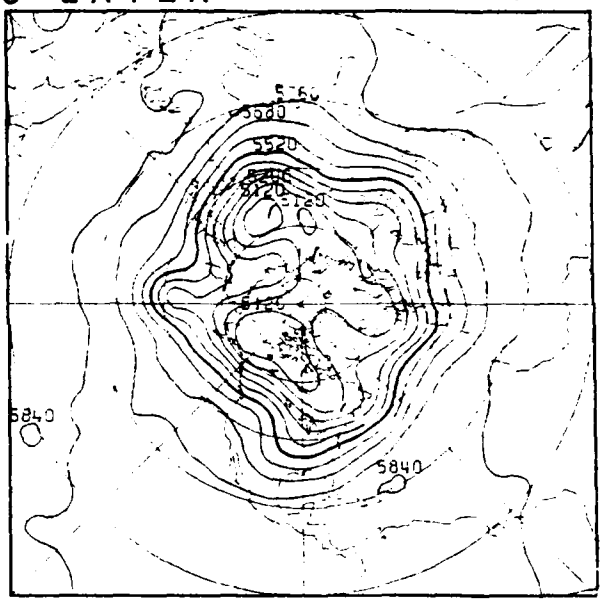
24 FEB 1979

DAY 9

9-LAYER 4X5



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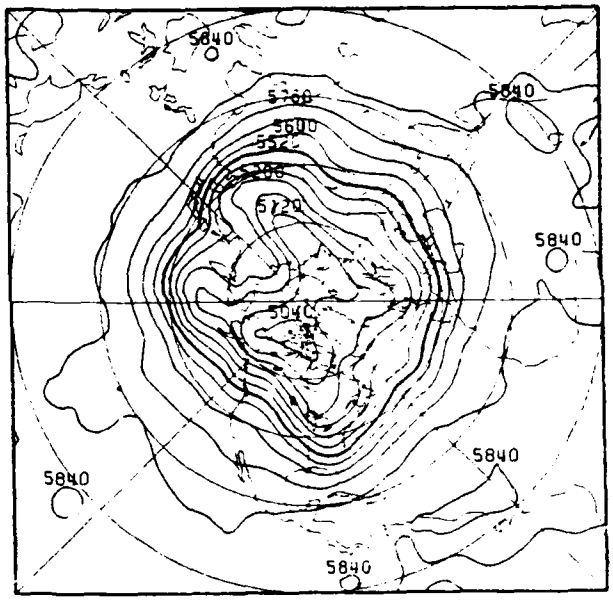

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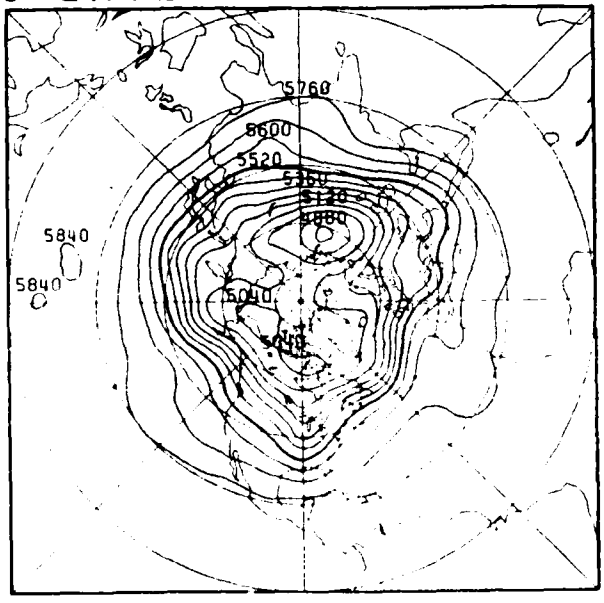

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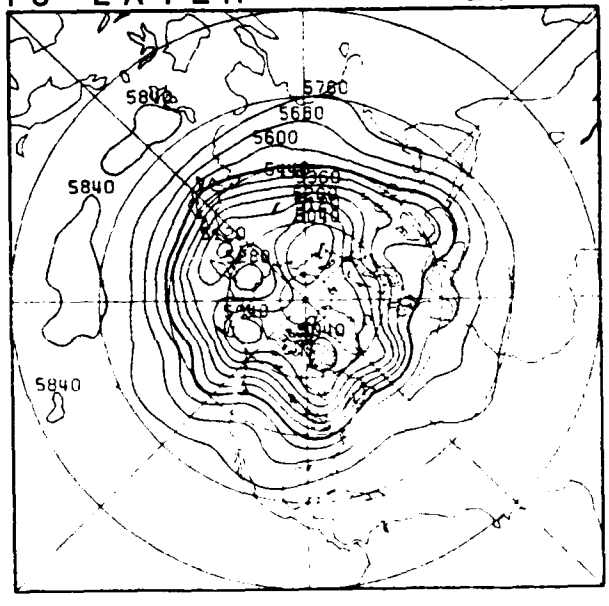

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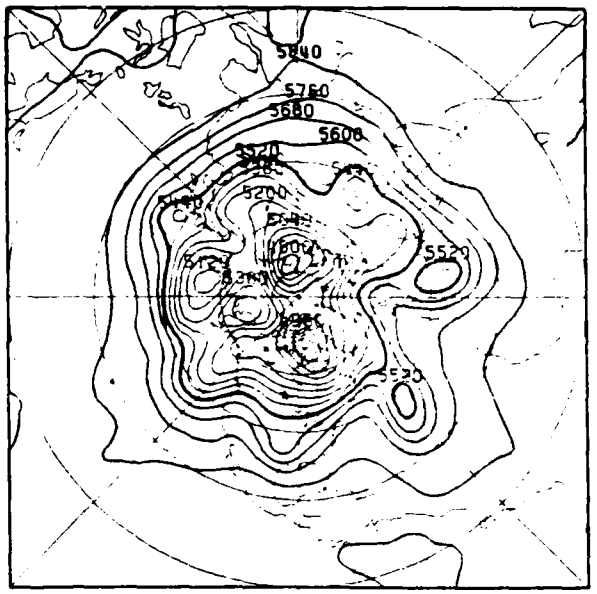

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25 FEB 1979

DAY 10

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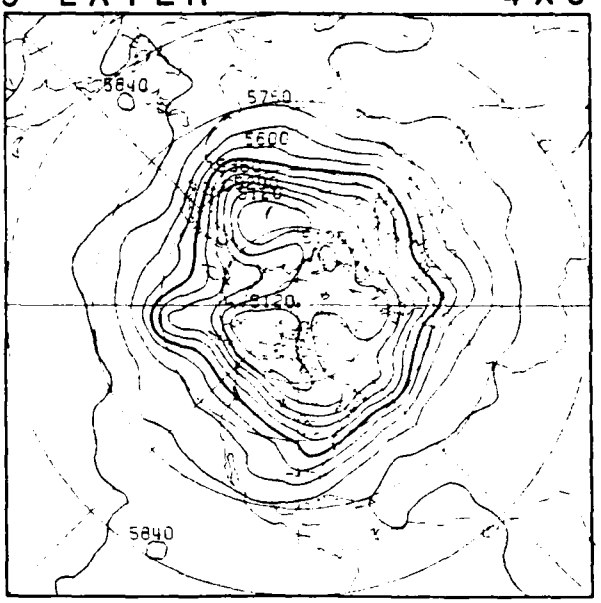

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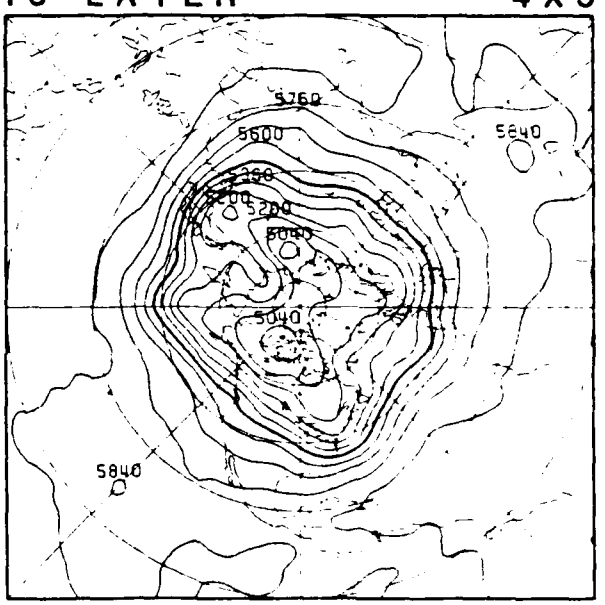

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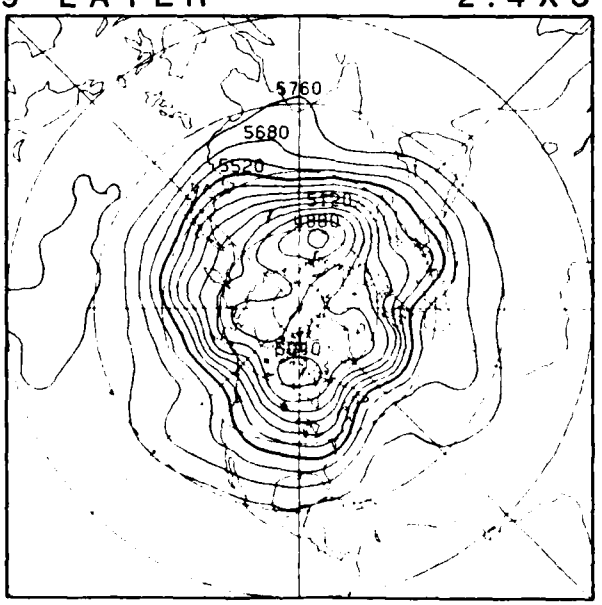

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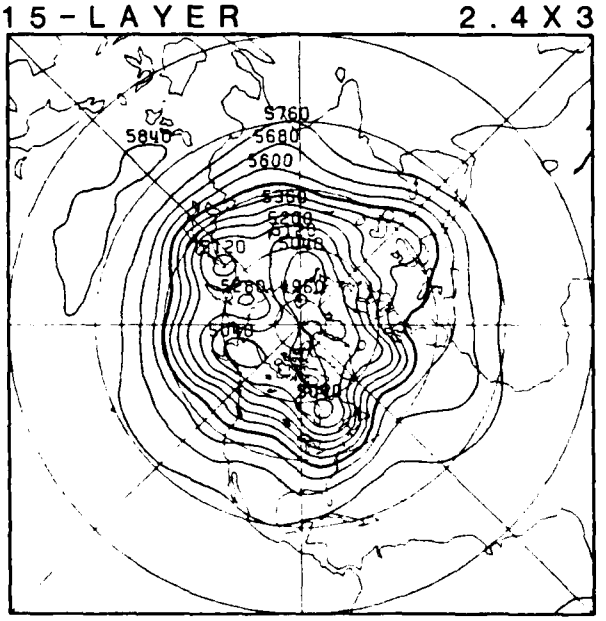

10 mb Z

0000 GMT 15 FEB 1979

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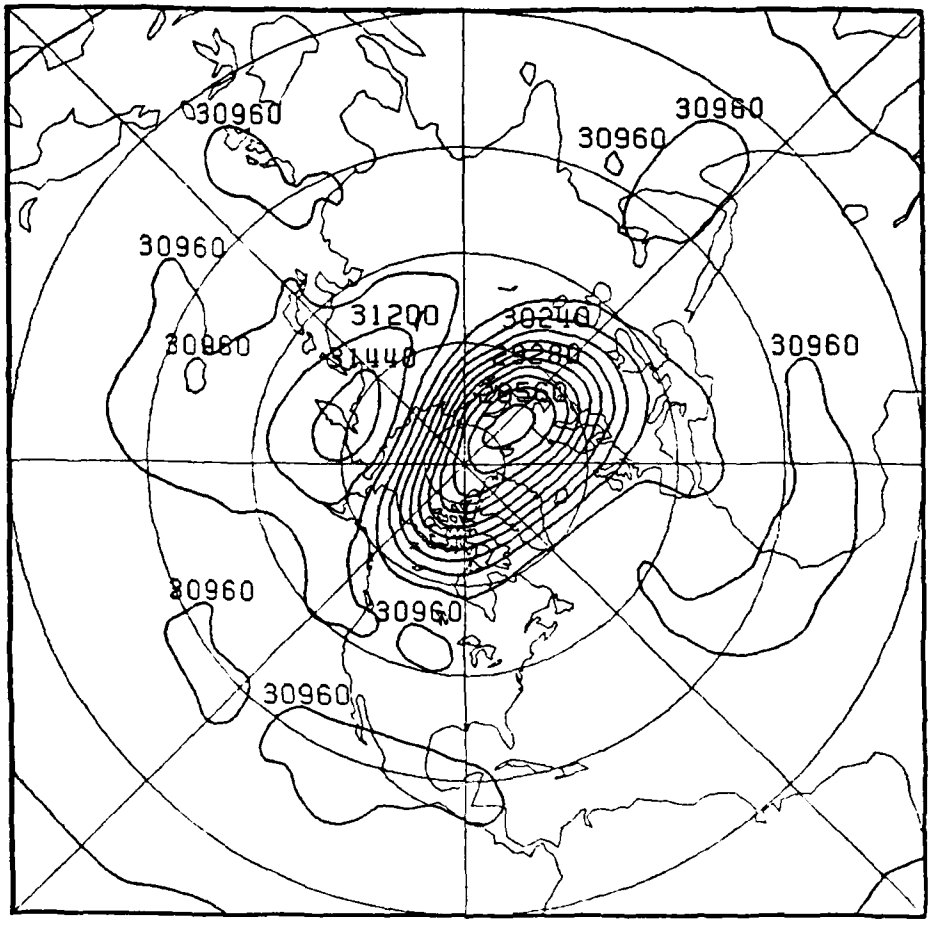

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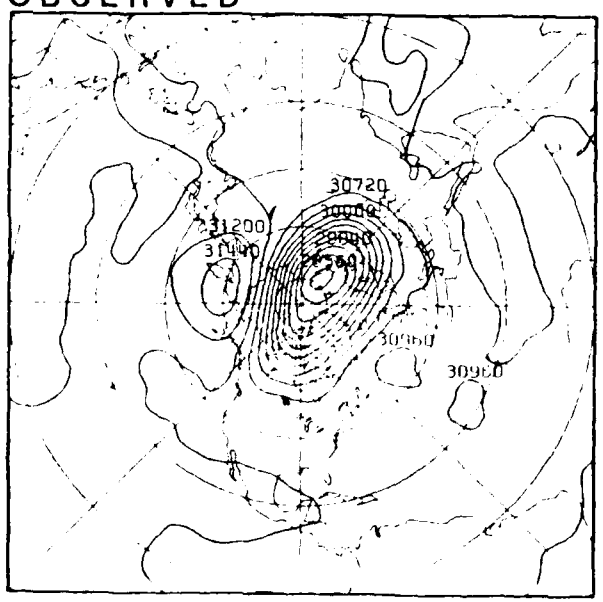
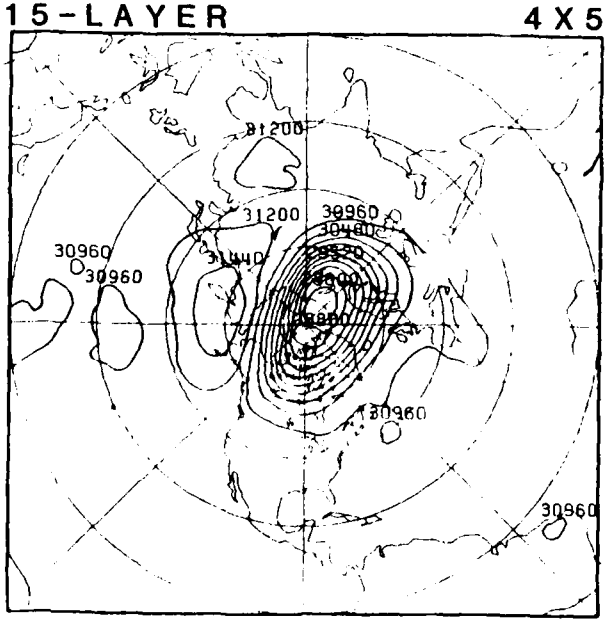
DAY 1

6-25

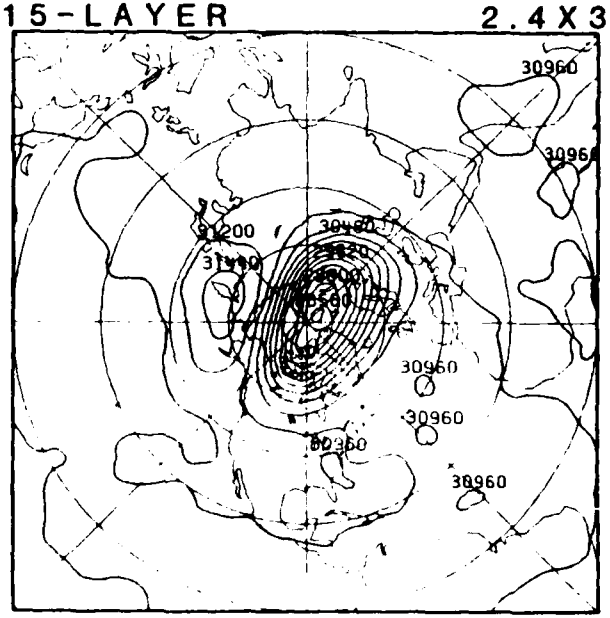
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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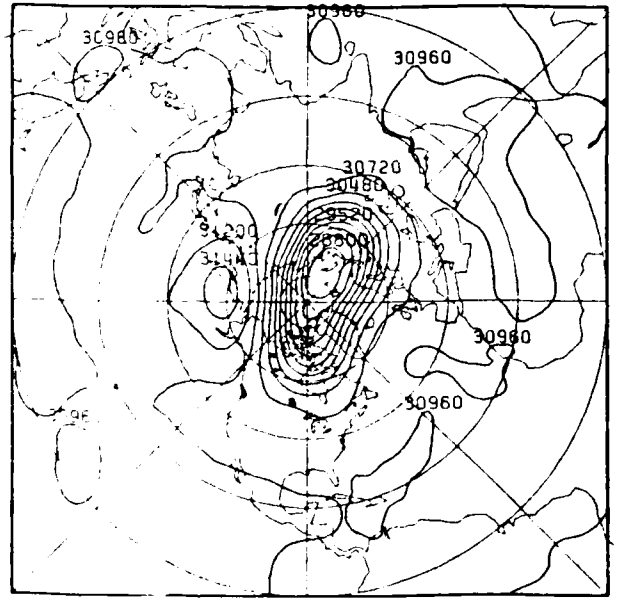
0000 GMT 17 FEB 1979

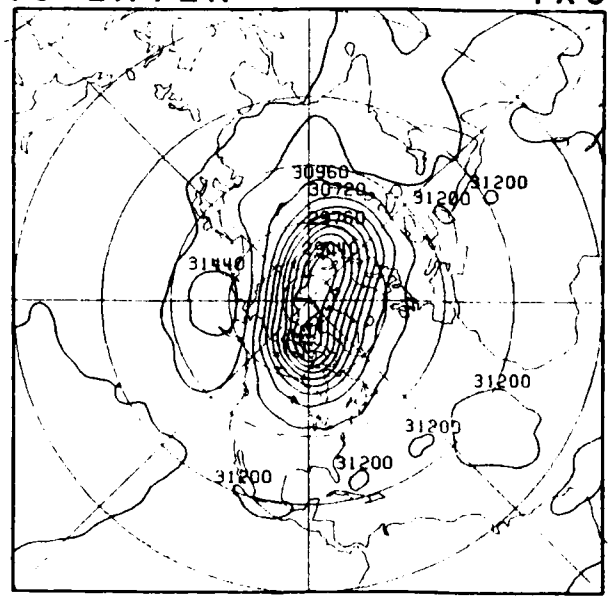
DAY 2

6-26

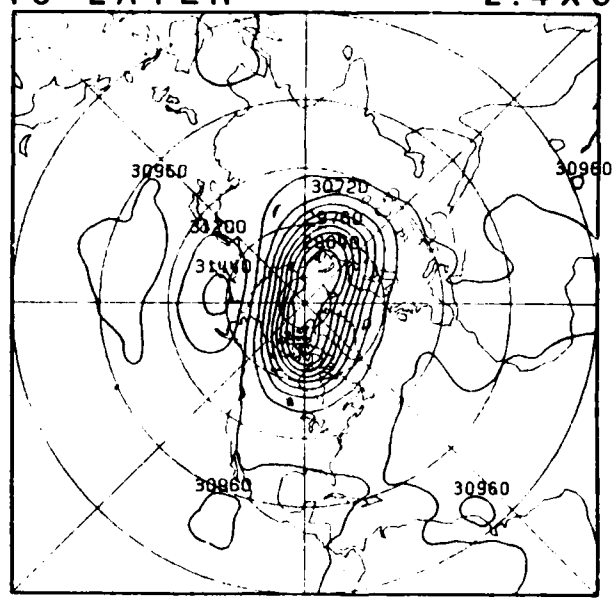
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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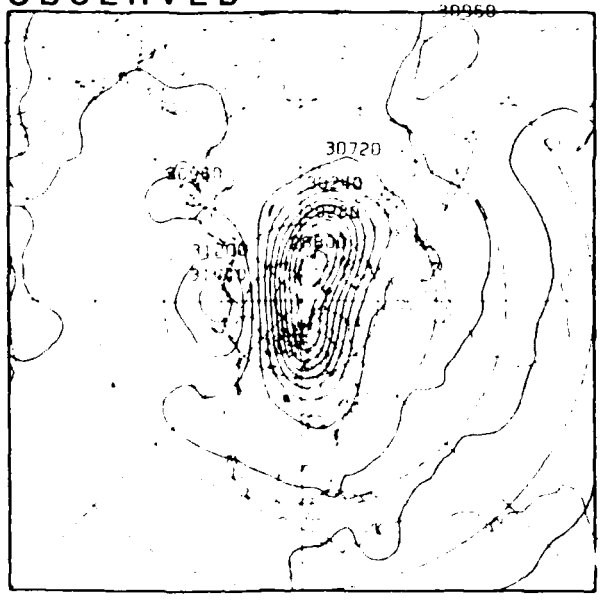
0000 GMT 18 FEB 1979

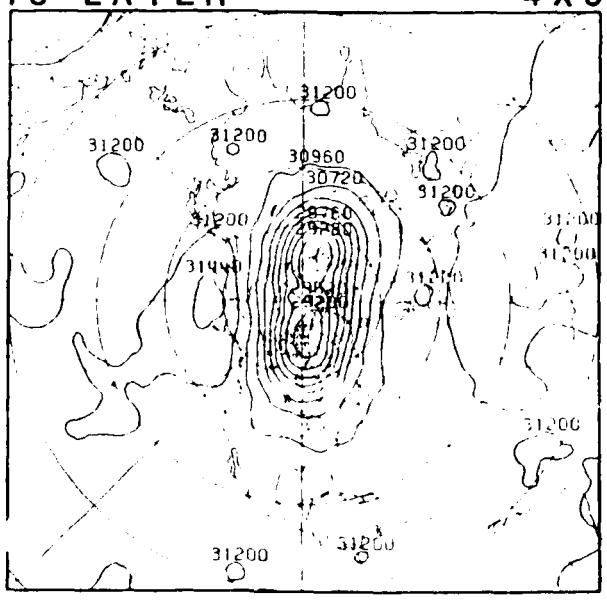
DAY 3

6-27

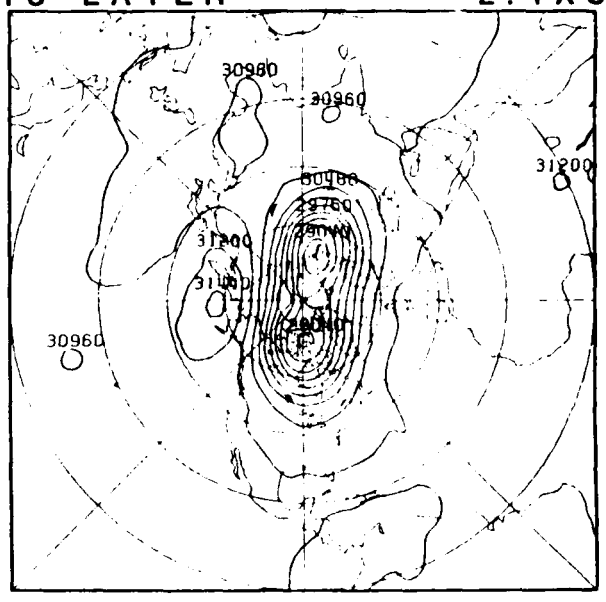
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

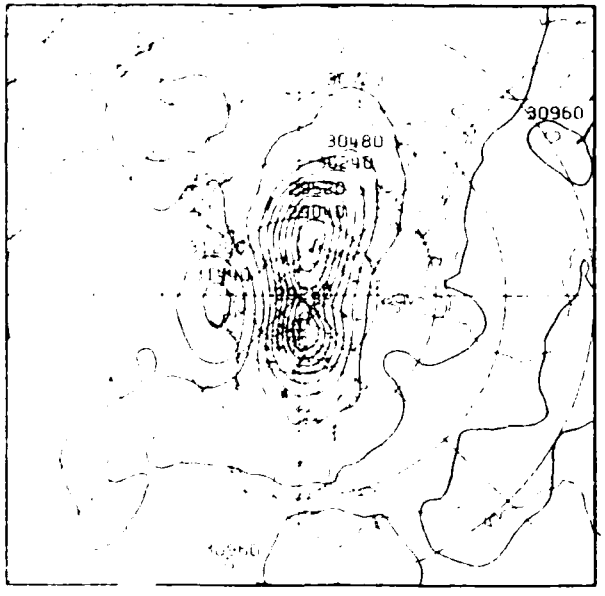


10 mb Z

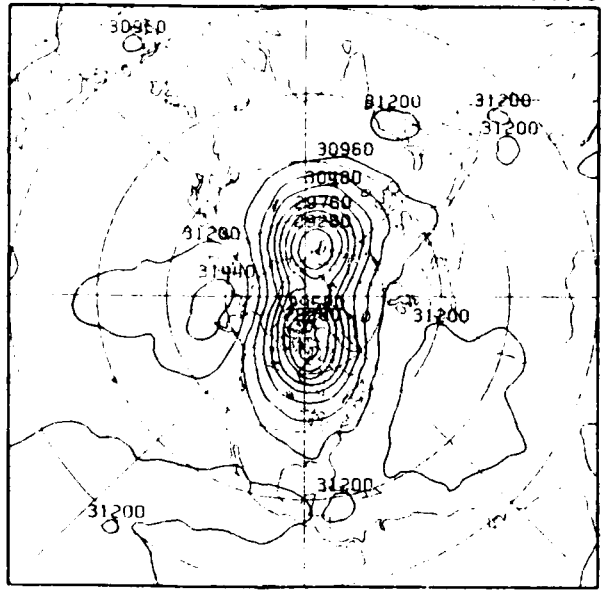
0000 GMT 19 FEB 1979

DAY 4

OBSERVED



15-LAYER 4X5



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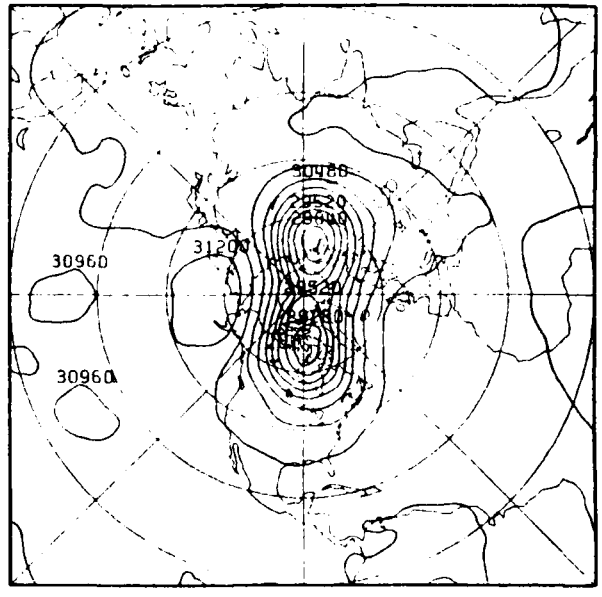


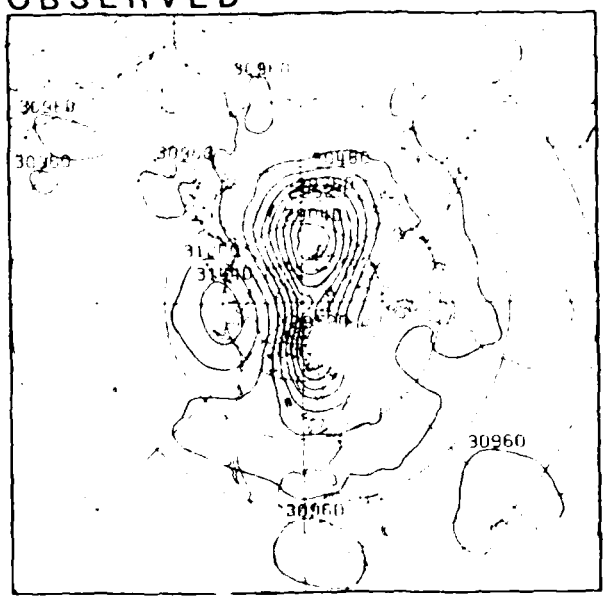
10 mb Z

0000 GMT 20 FEB 1979

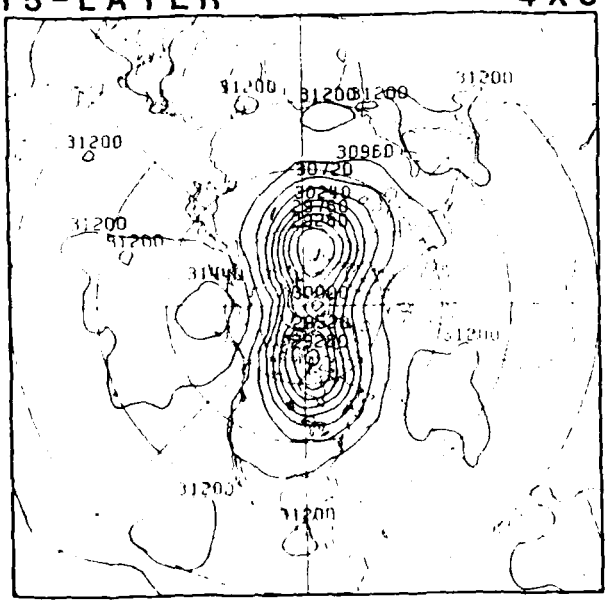
DAY 5

6-29

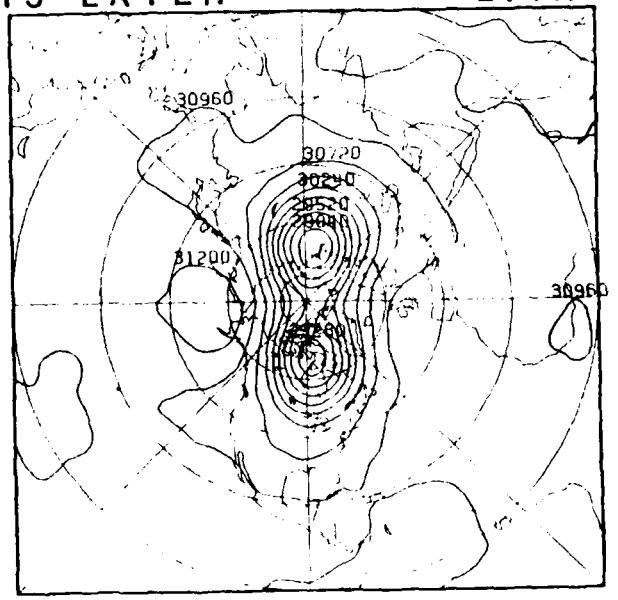
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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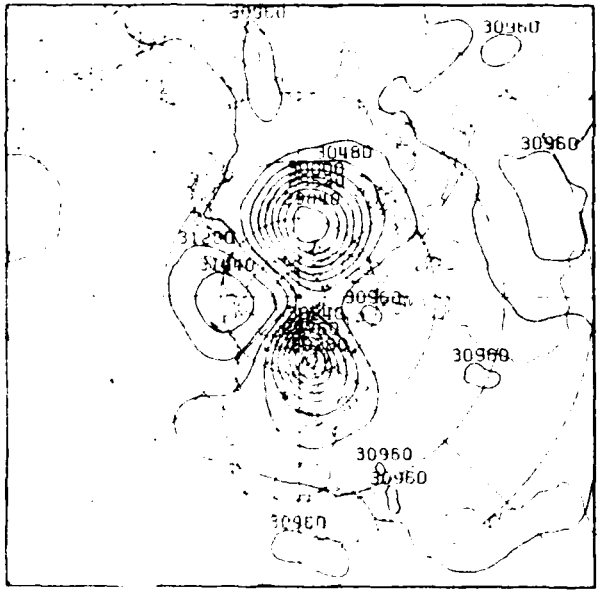
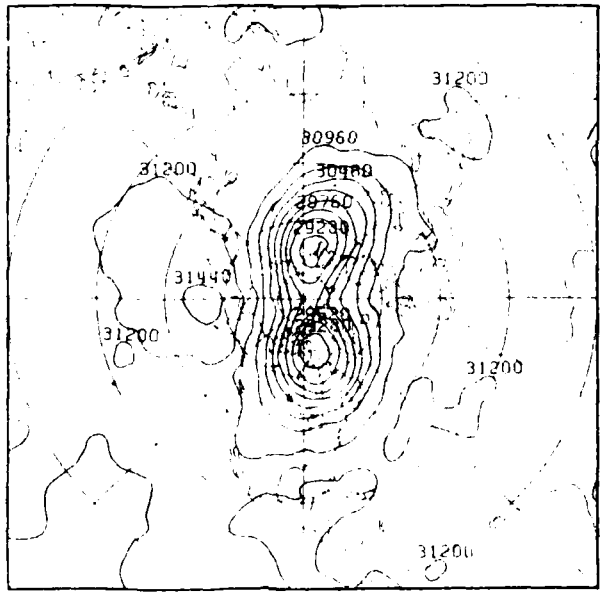
DAY 6

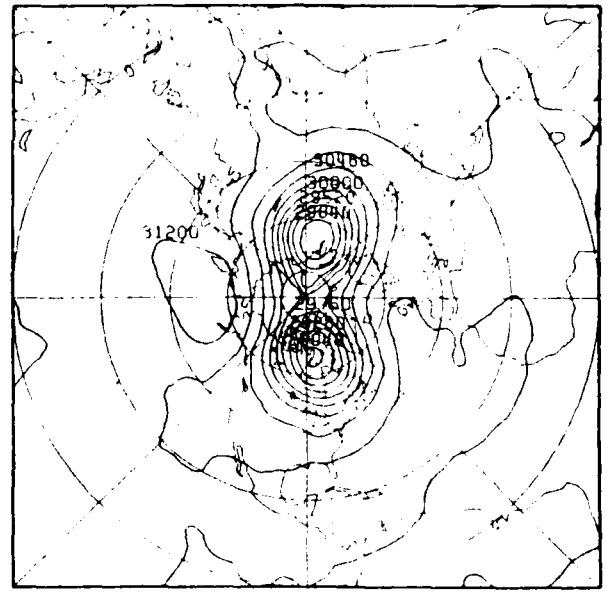
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

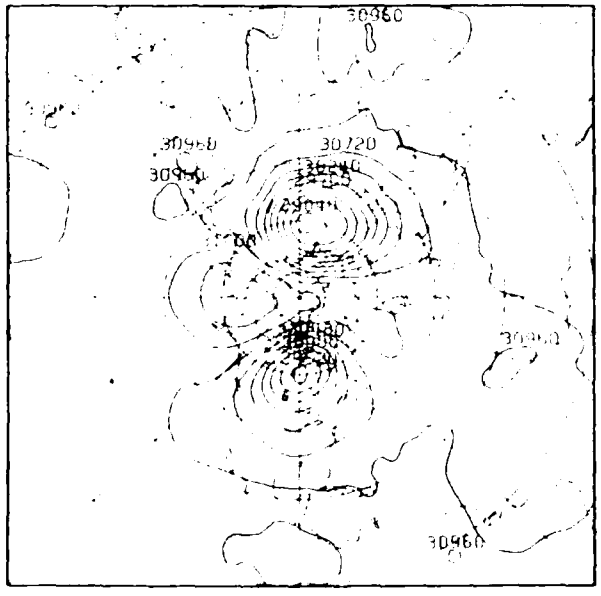


10 mb Z

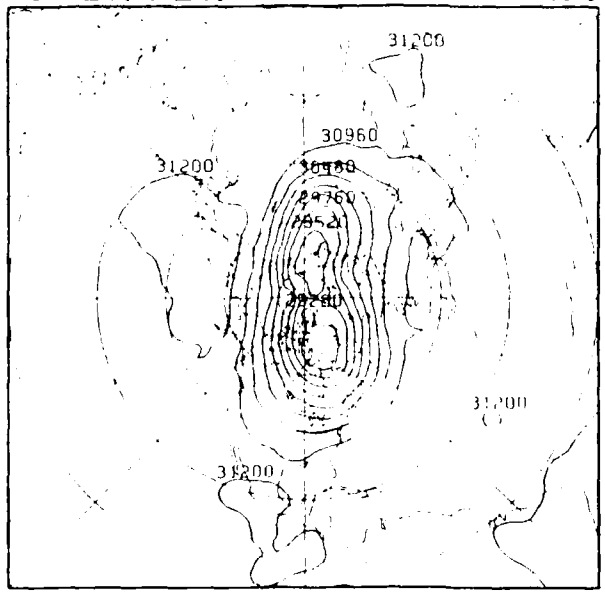
0000 GMT 22 FEB 1979

DAY 7

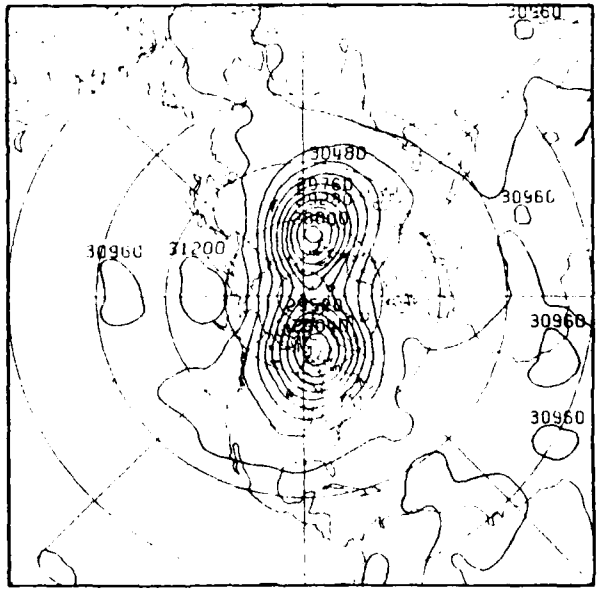
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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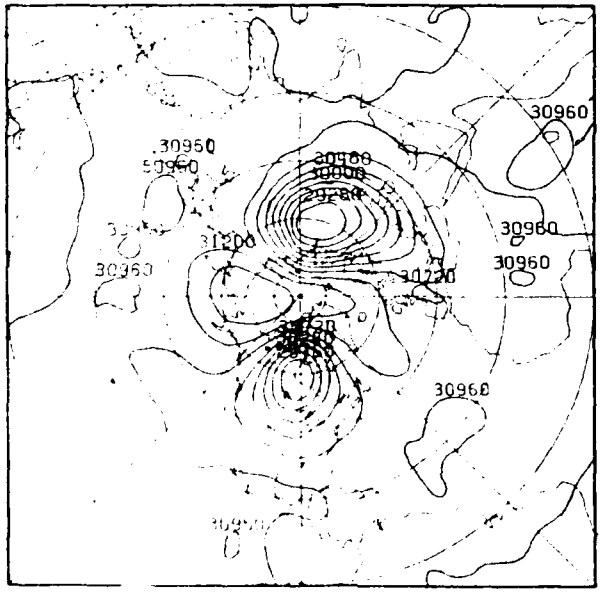
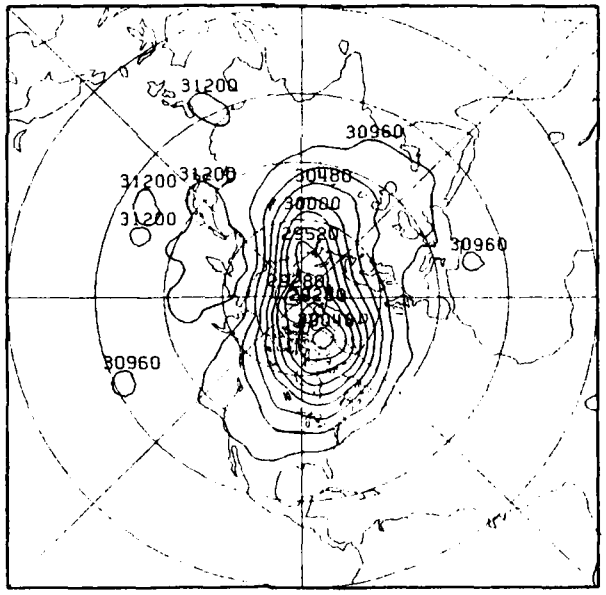
DAY 8

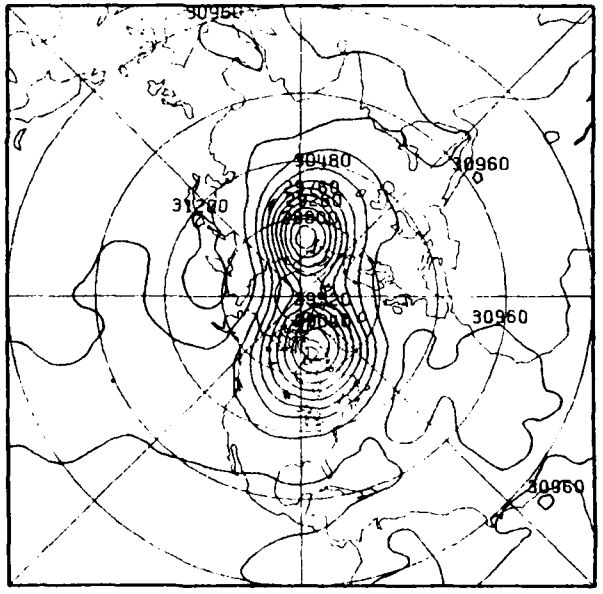
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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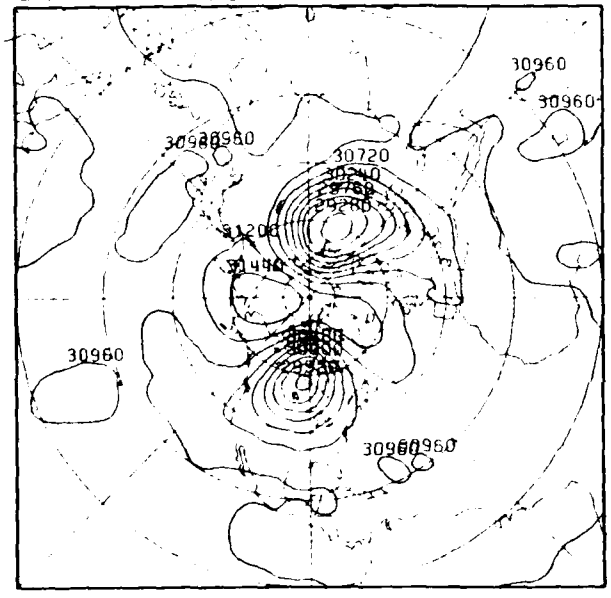
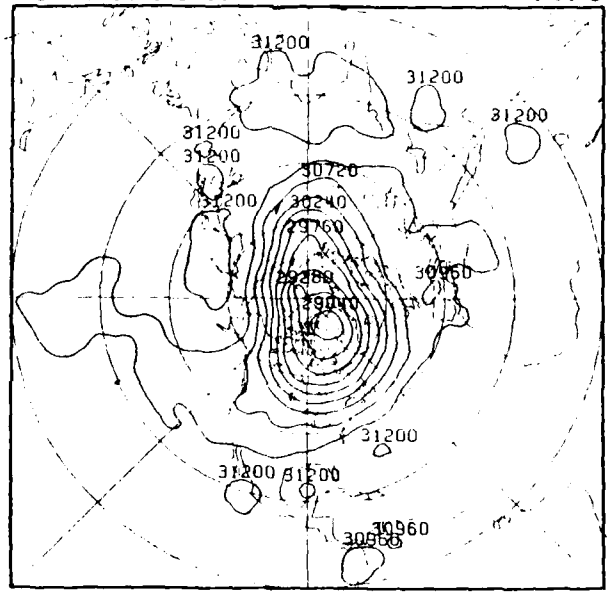
0000 GMT 24 FEB 1979

DAY 9

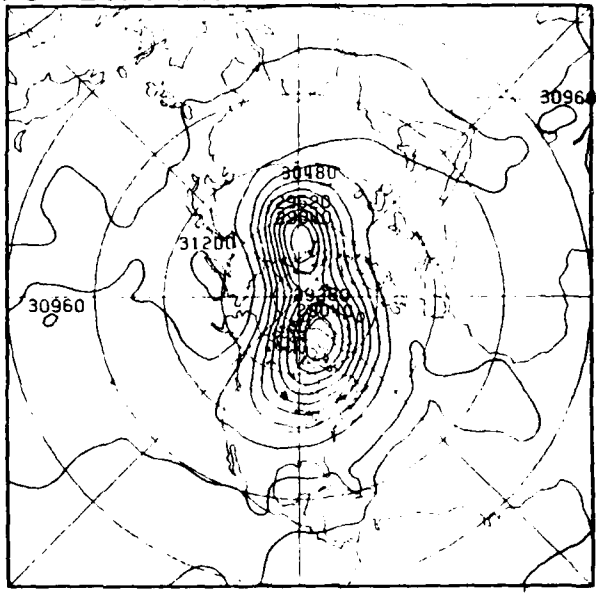
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

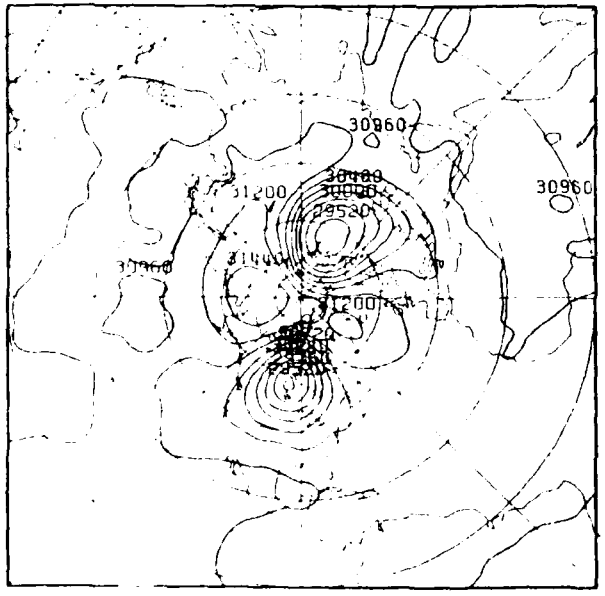


10 mb Z

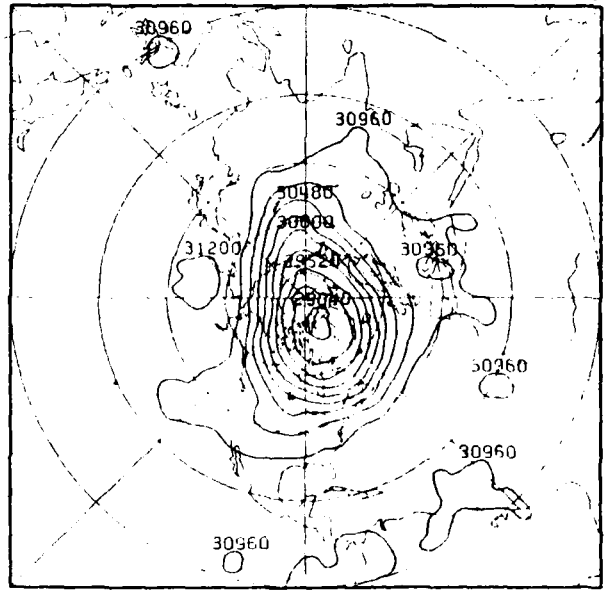
0000 GMT 25 FEB 1979

DAY 10

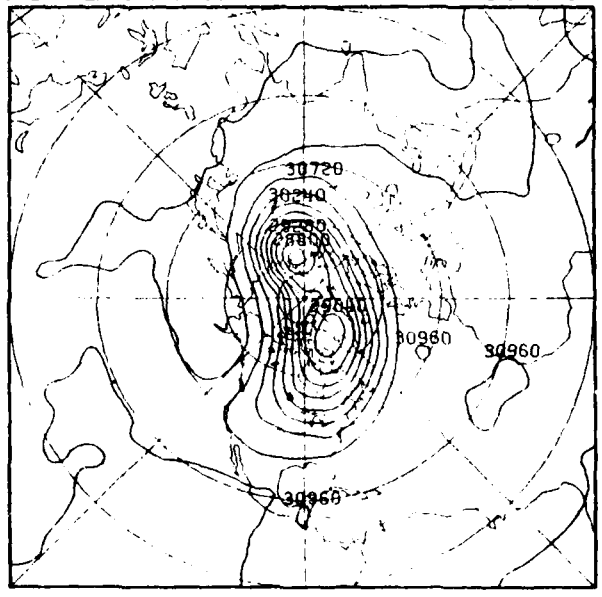
OBSERVED

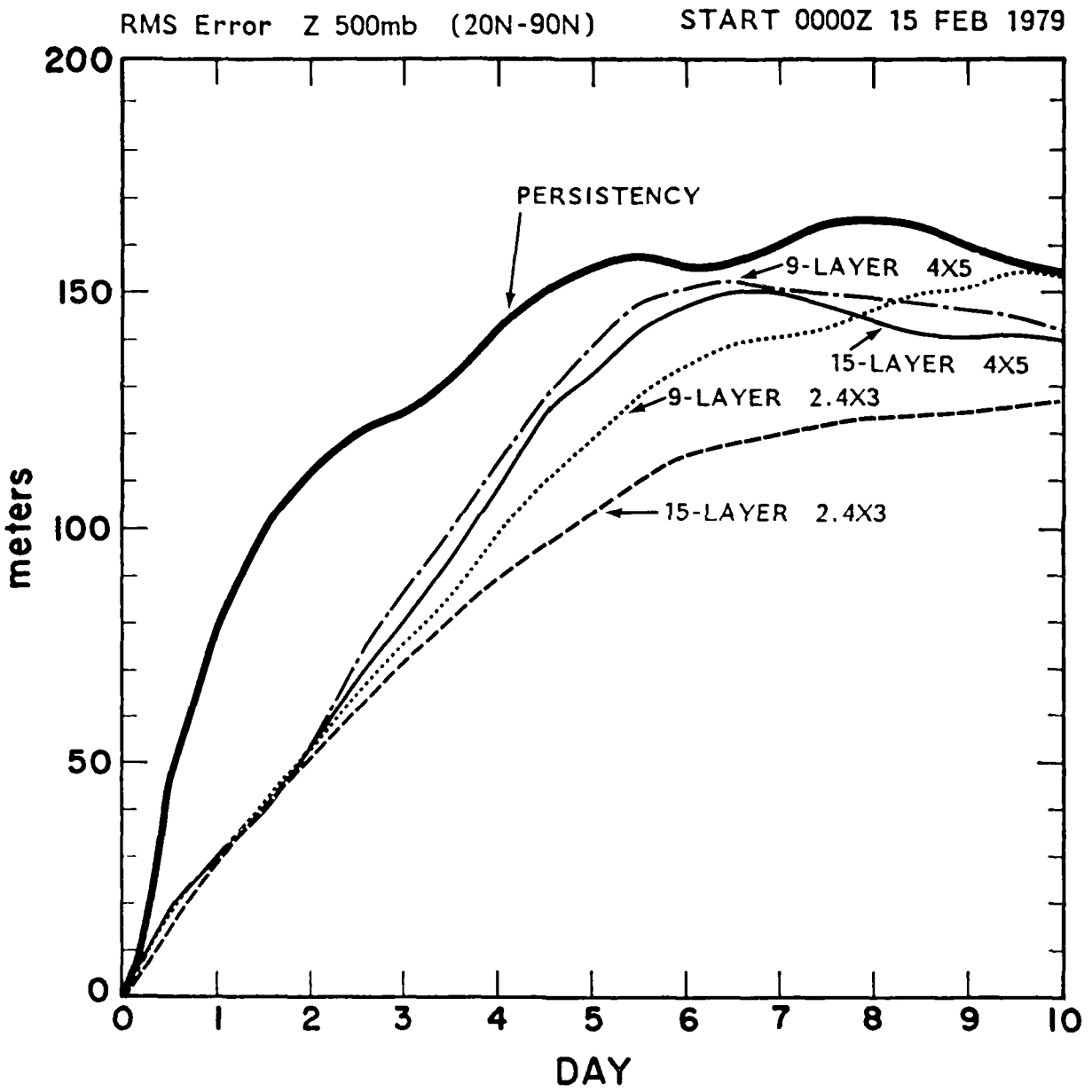


15-LAYER 4X5



15-LAYER 2.4X3




RMS Error Z 500mb (20N-90N)
START 0000Z 15 FEB 1979
200
150
100
50
0
meters
PERSISTENCY
9-LAYER 4X5
15-LAYER 4X5
9-LAYER 2.4X3
15-LAYER 2.4X3
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

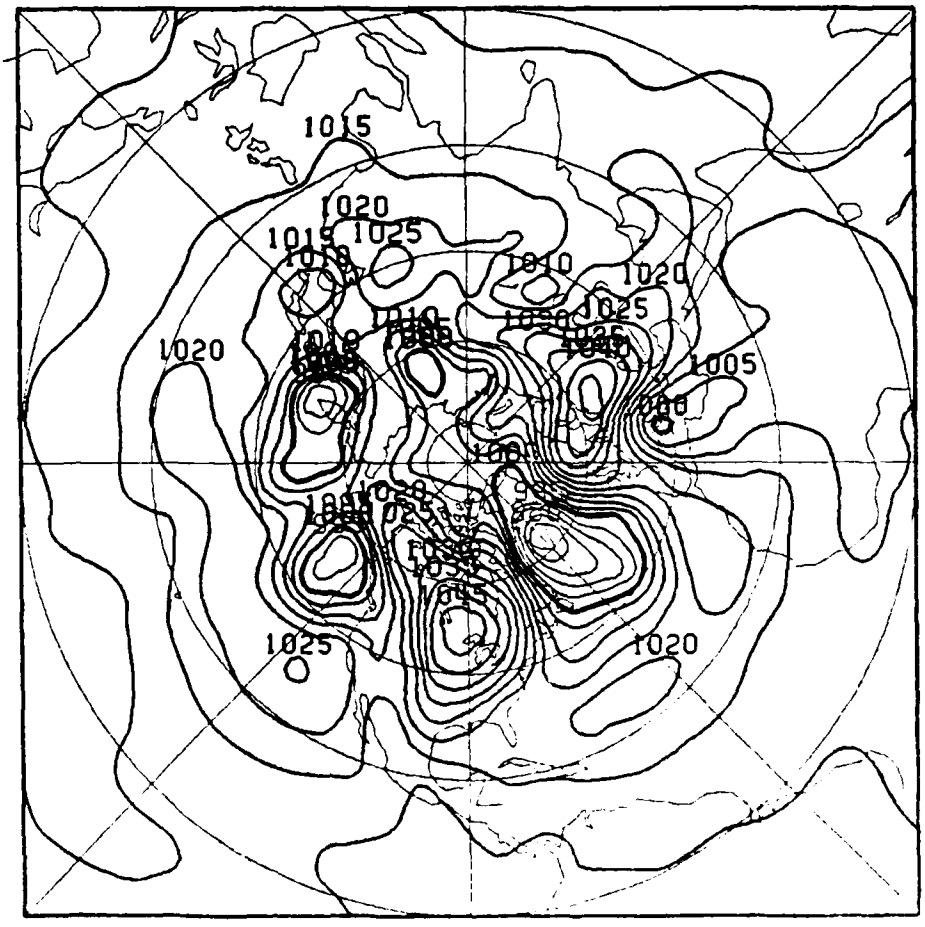
0000 GMT

17 FEBRUARY 1979

SLP

0000 GMT 17 FEB 1979

OBSERVED

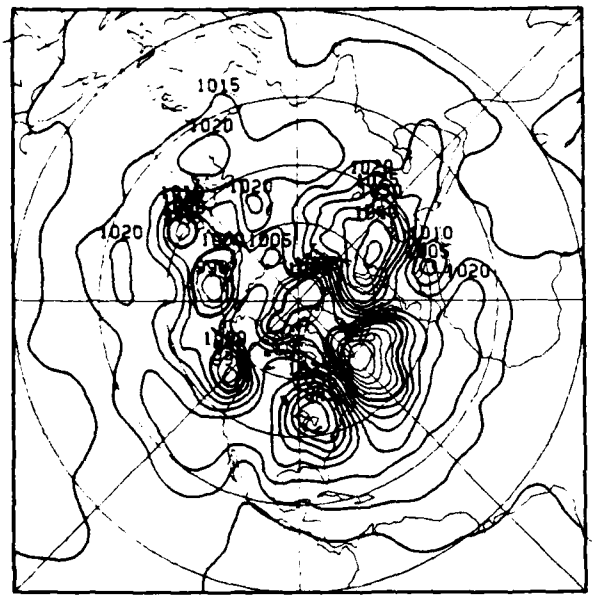


SLP

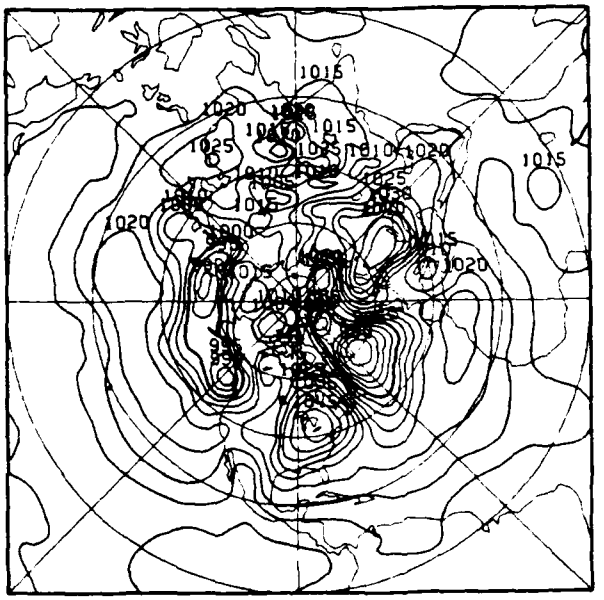
0000 GMT 18 FEB 1979

DAY 1

OBSERVED



9-LAYER 4X5



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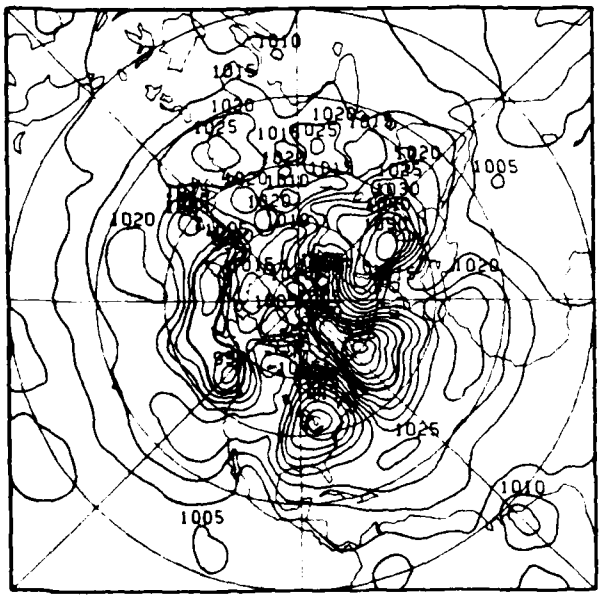
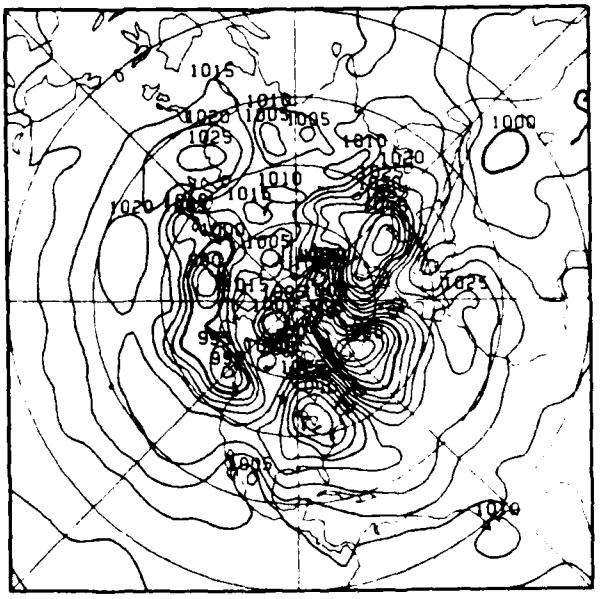


15-LAYER 2.4X3



SLP

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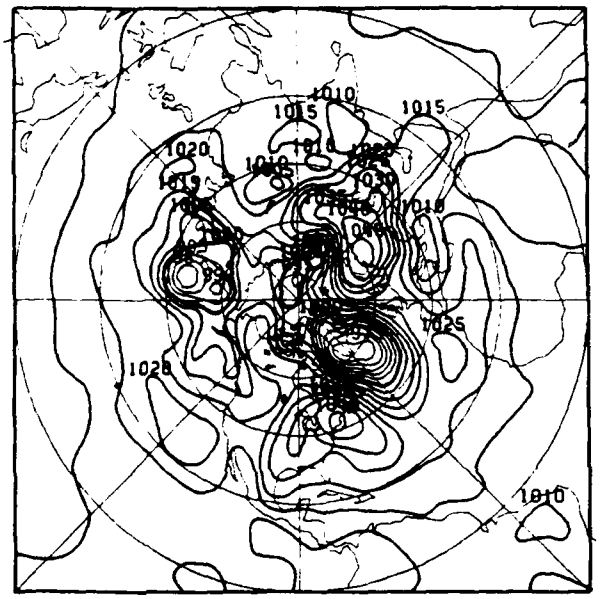
DAY 2

OBSERVED



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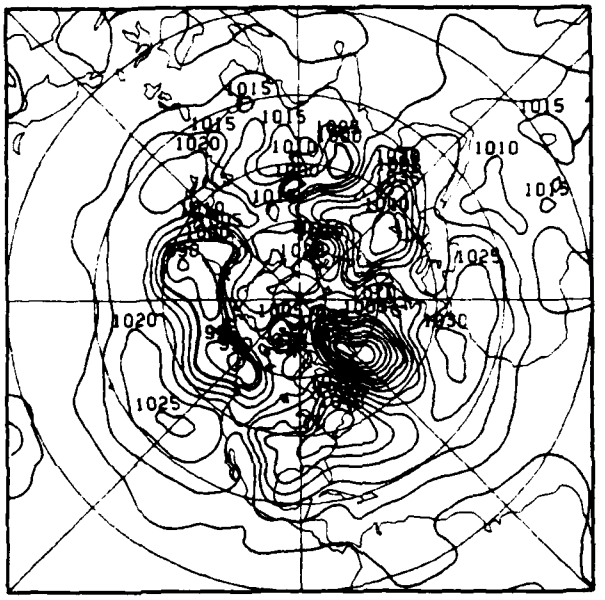

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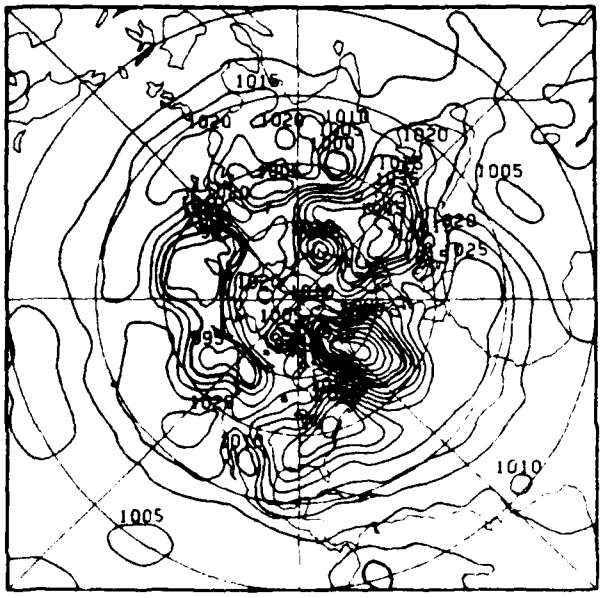

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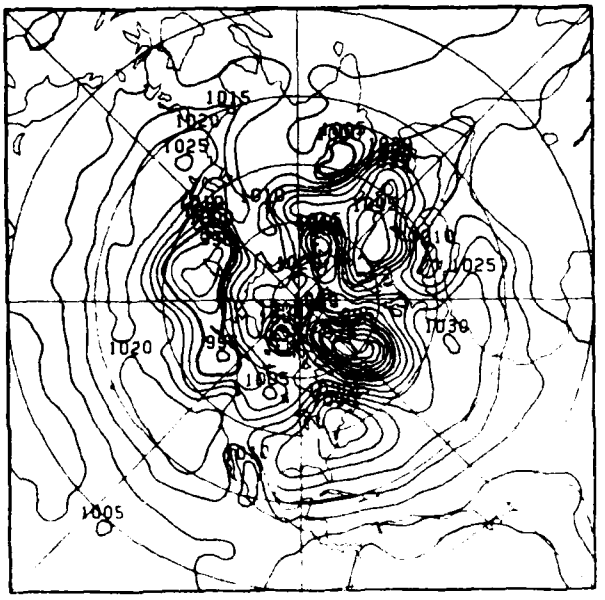

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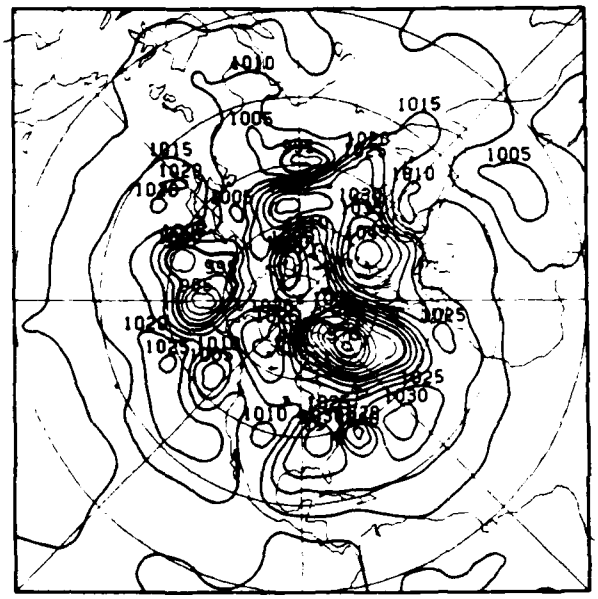
DAY 3

OBSERVED



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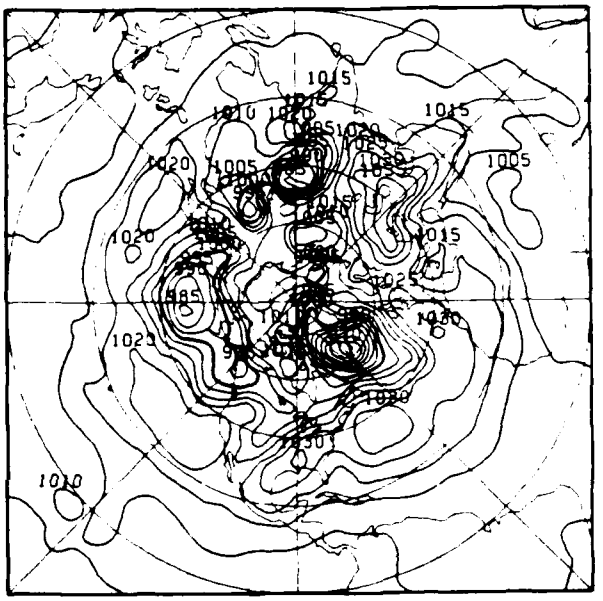

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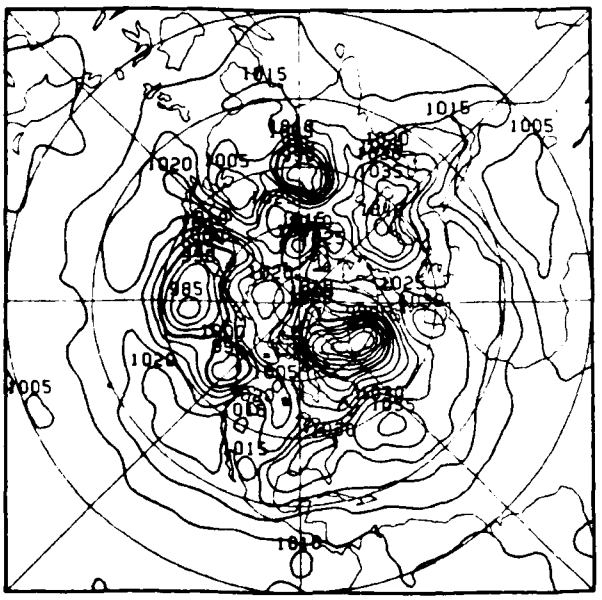

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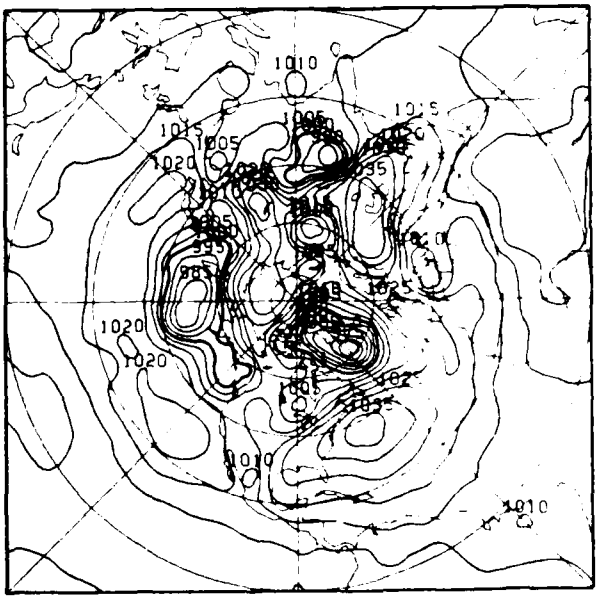

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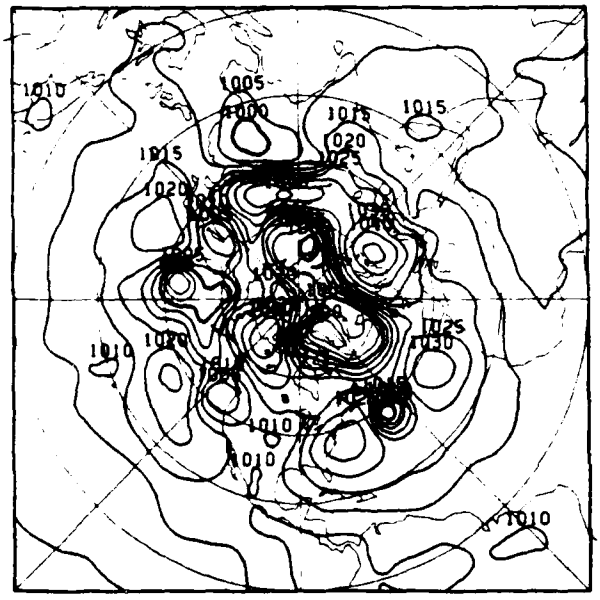
DAY 4

OBSERVED



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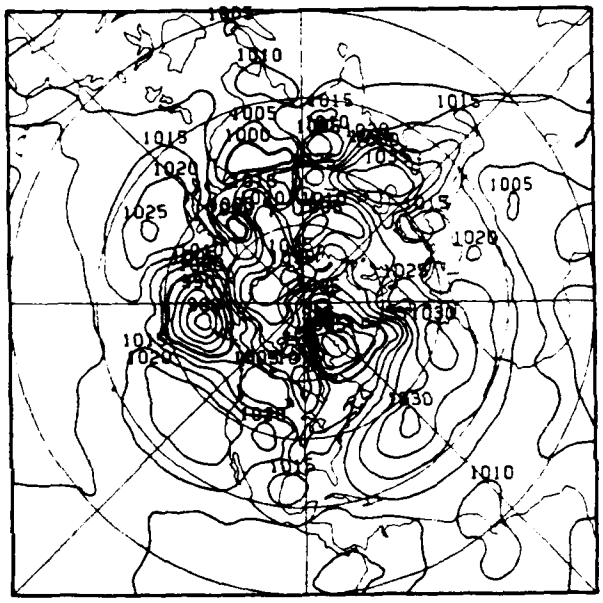

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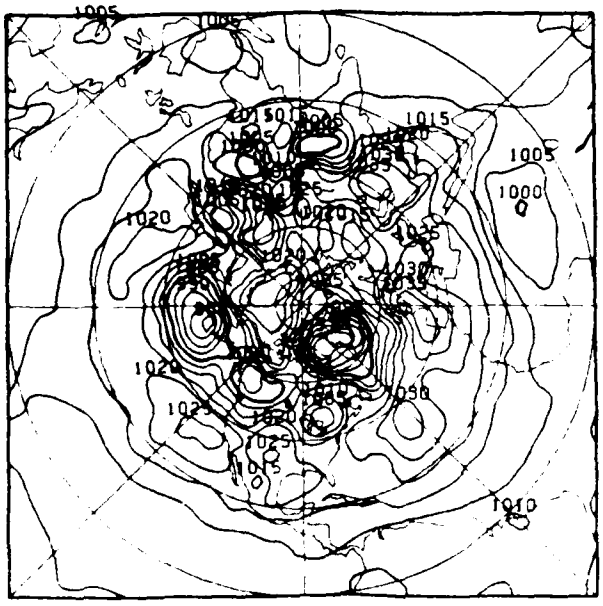

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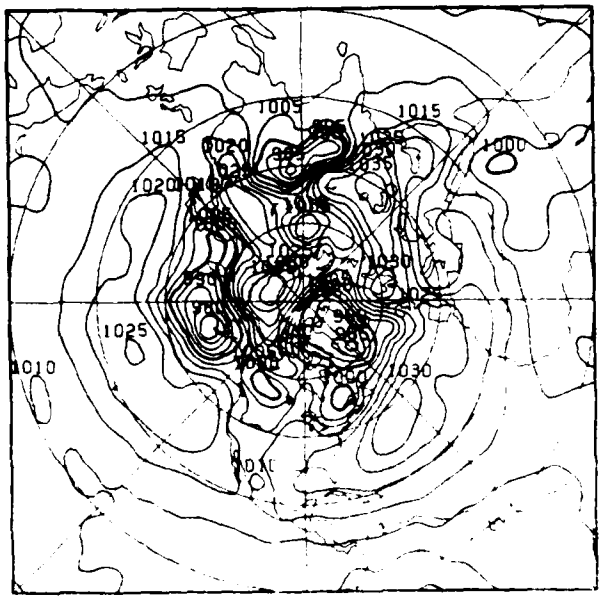

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DAY 5

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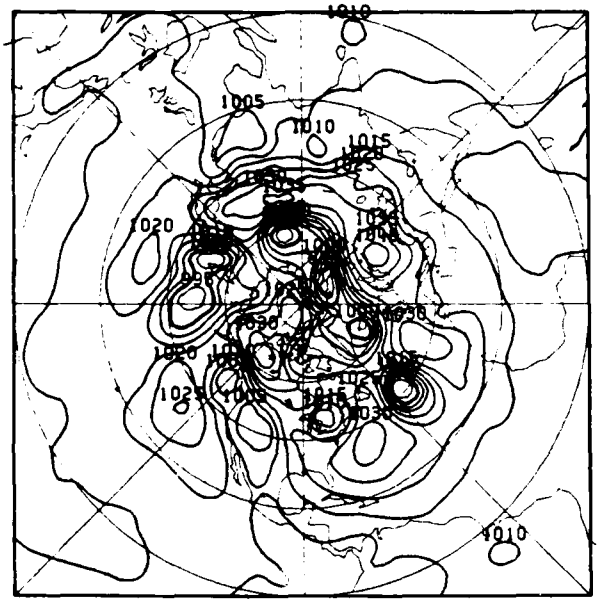

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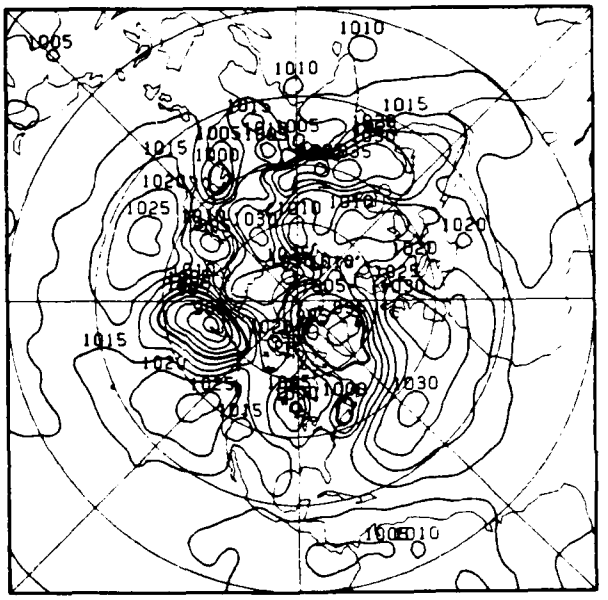

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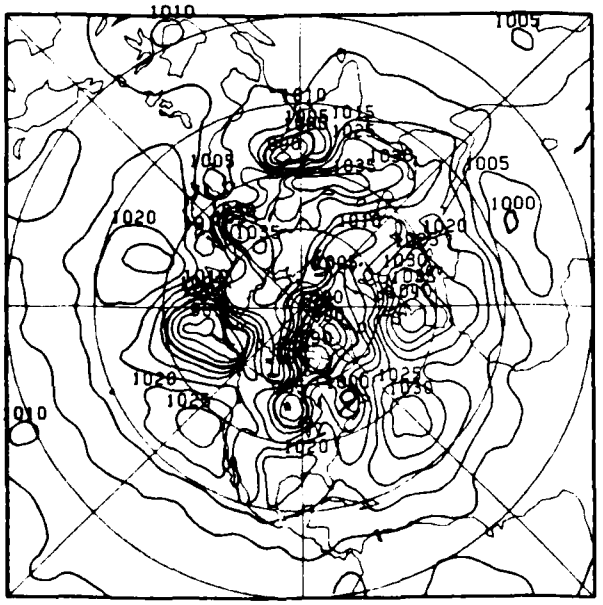

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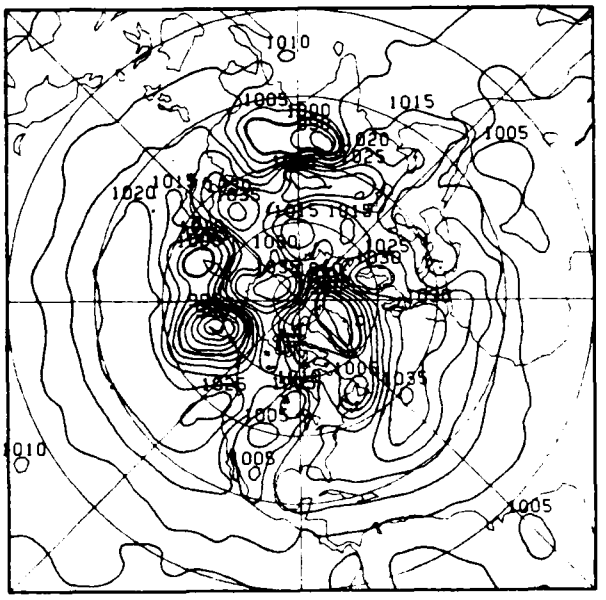

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DAY 6

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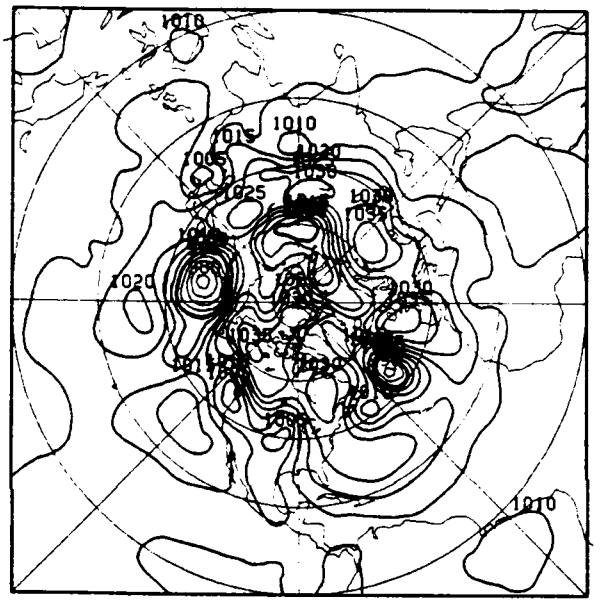

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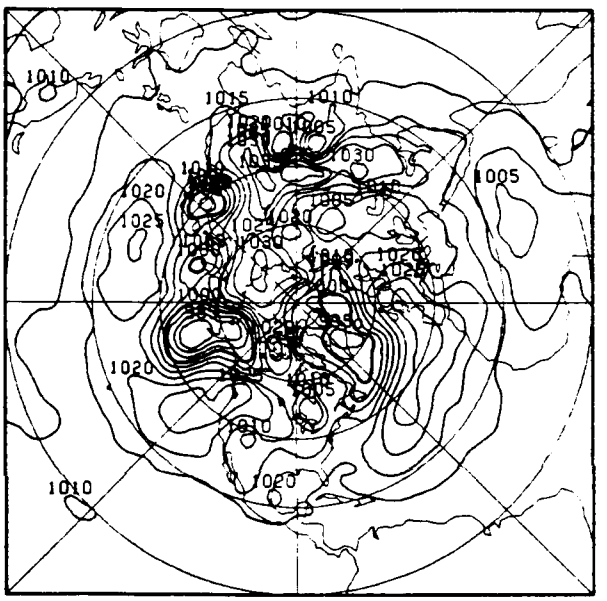

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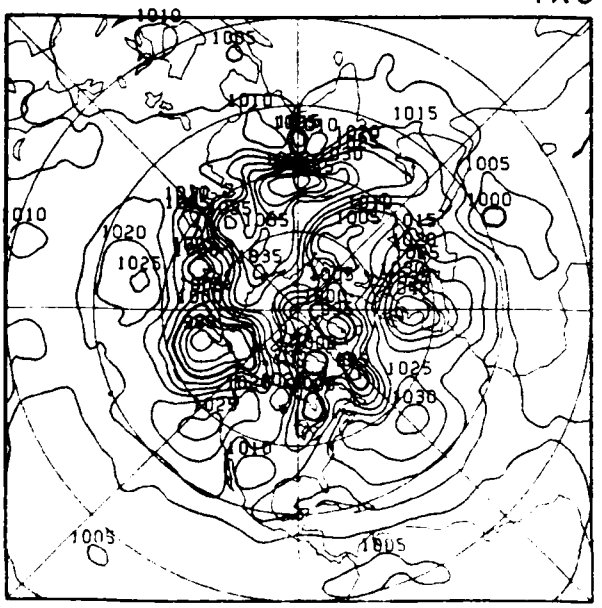

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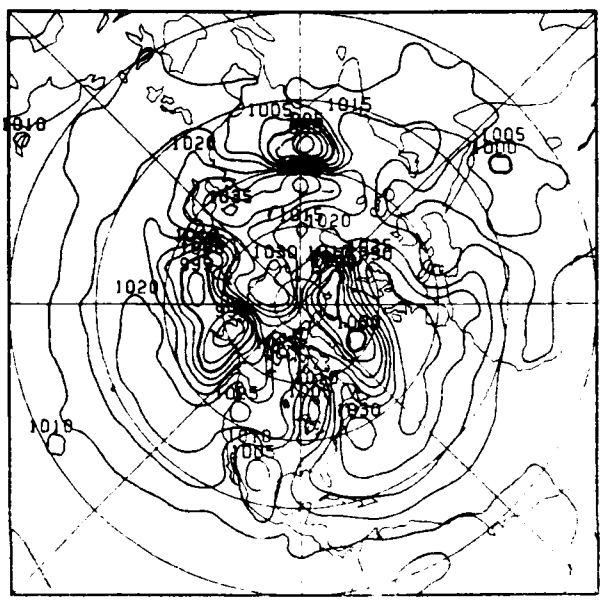

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DAY 7

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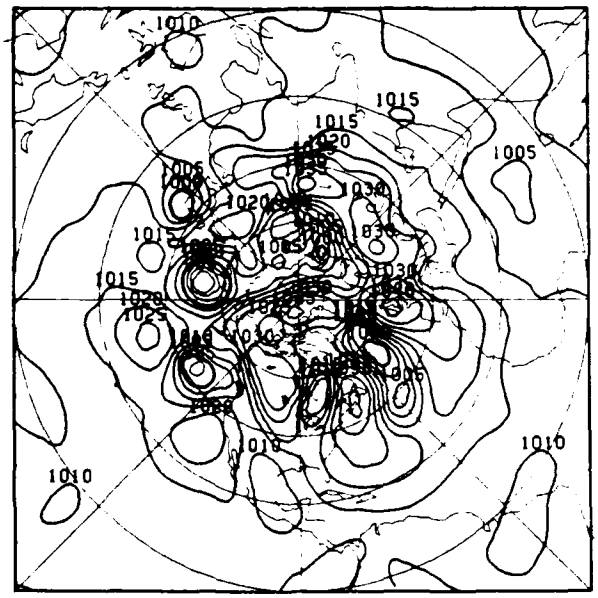

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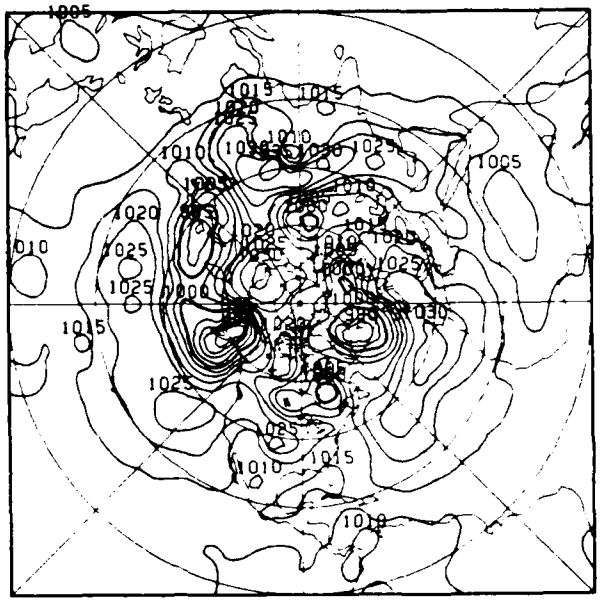

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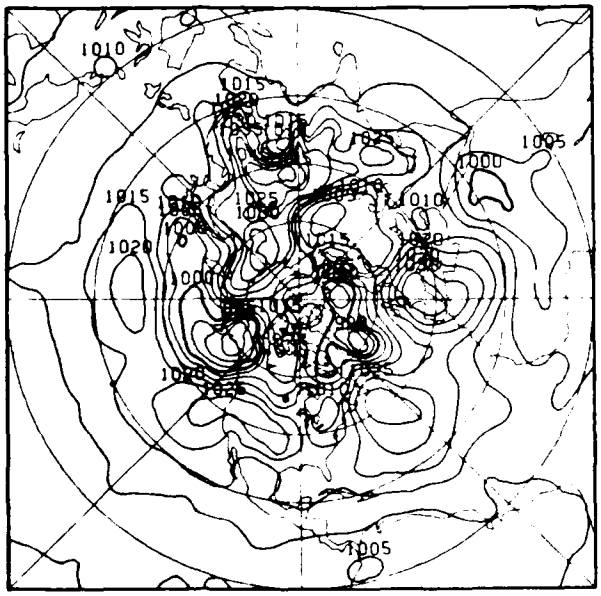

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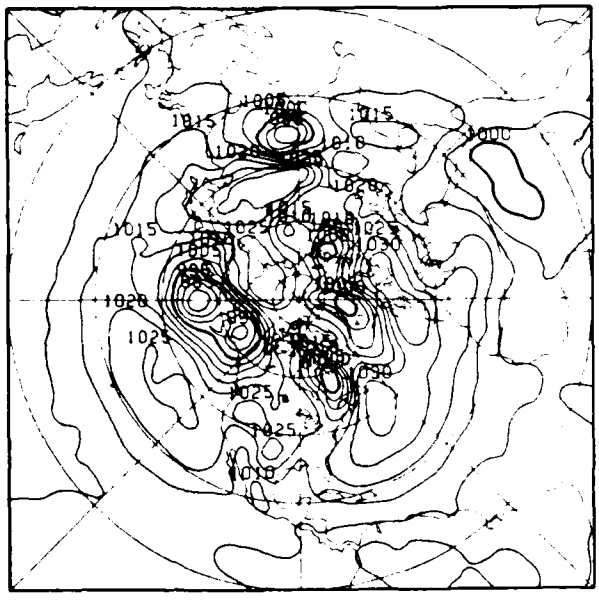

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DAY 8

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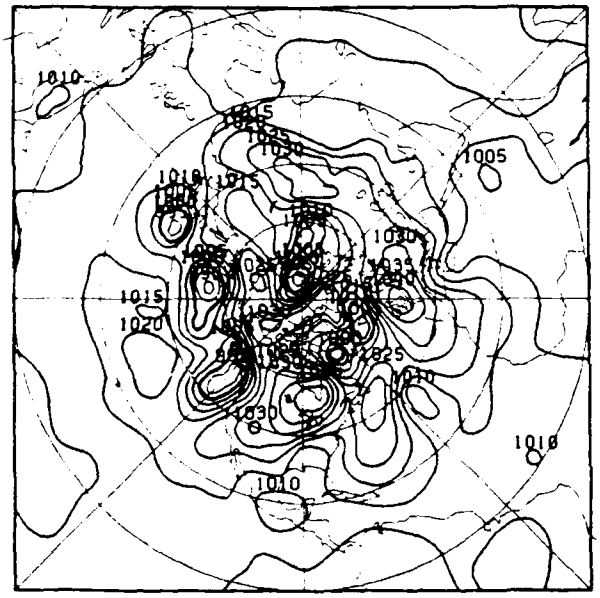
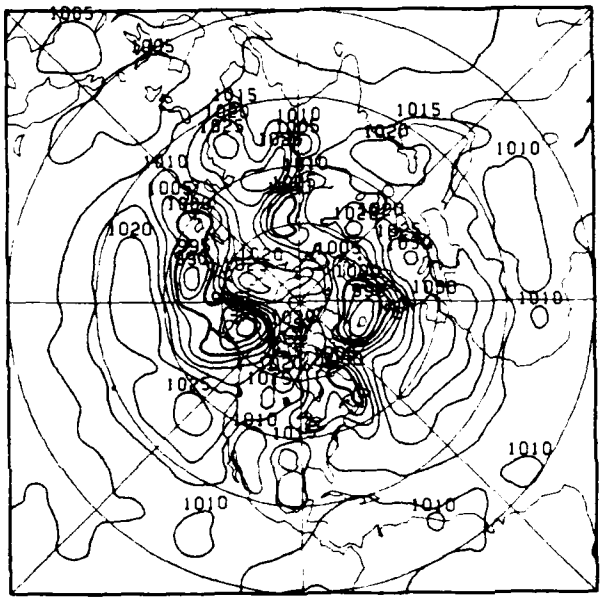


9-LAYER 4X5



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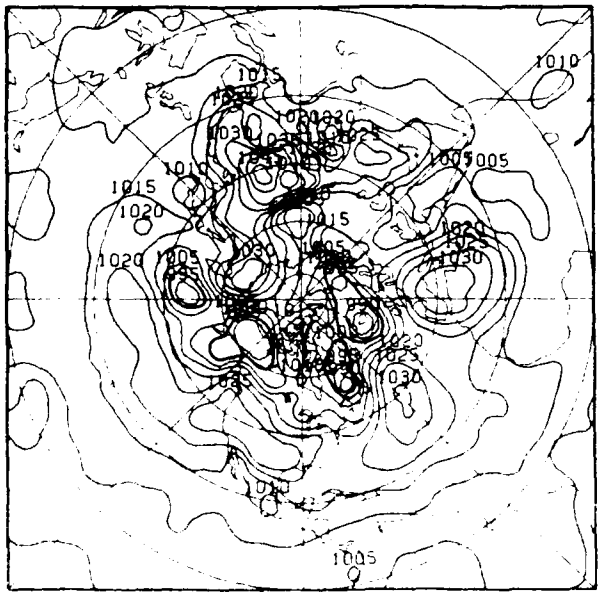

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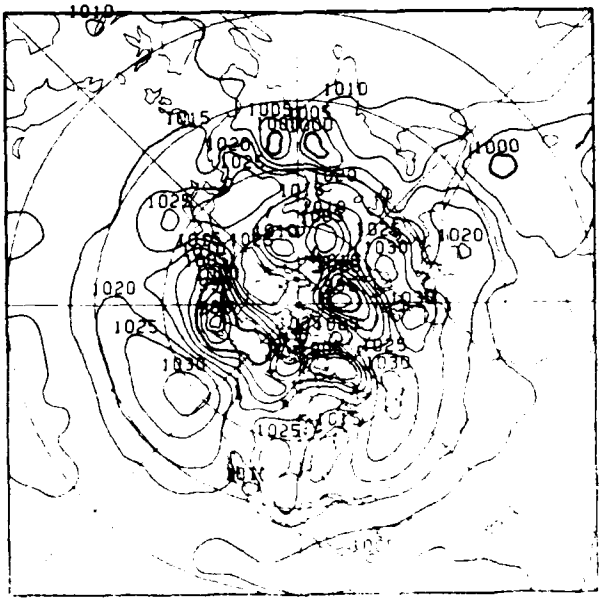

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DAY 9

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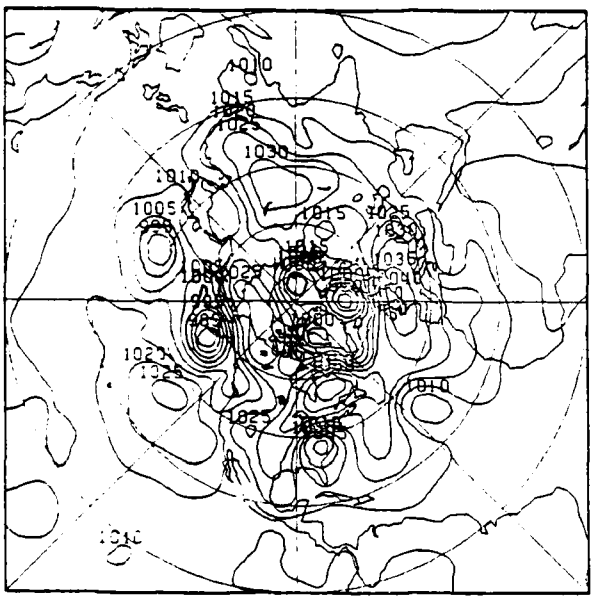
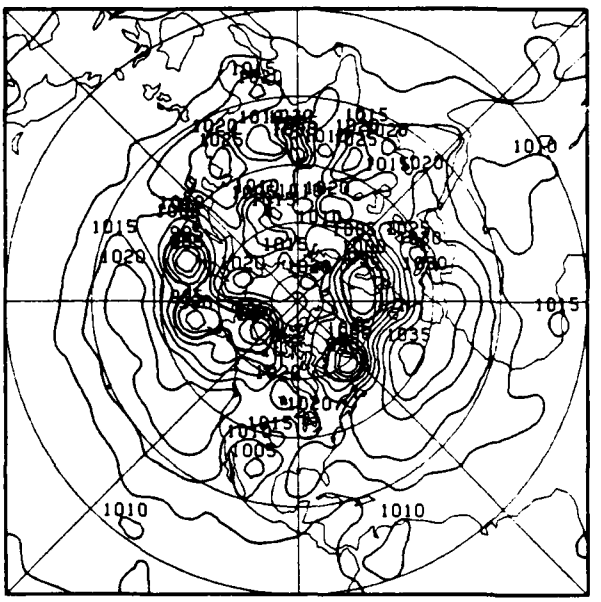


9-LAYER 4X5



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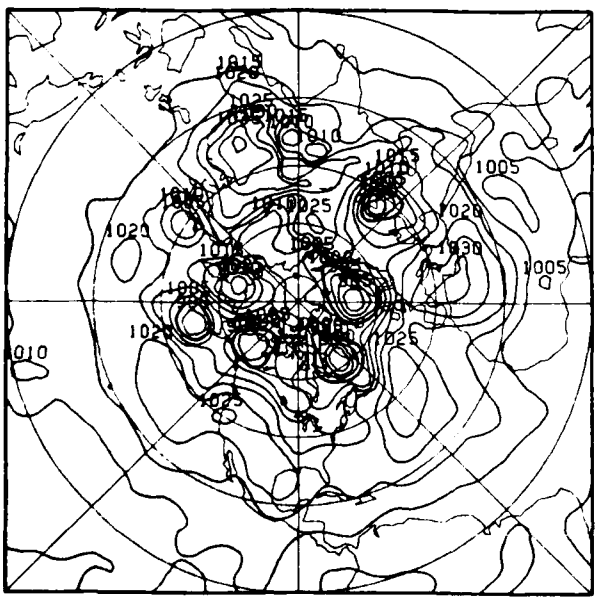

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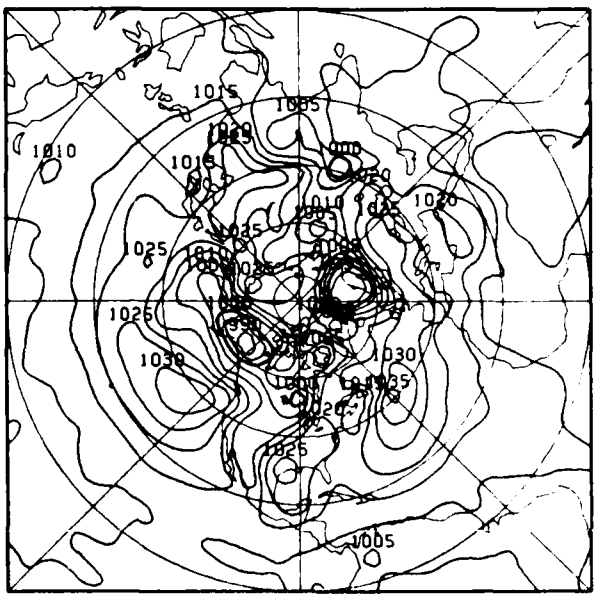

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DAY 10

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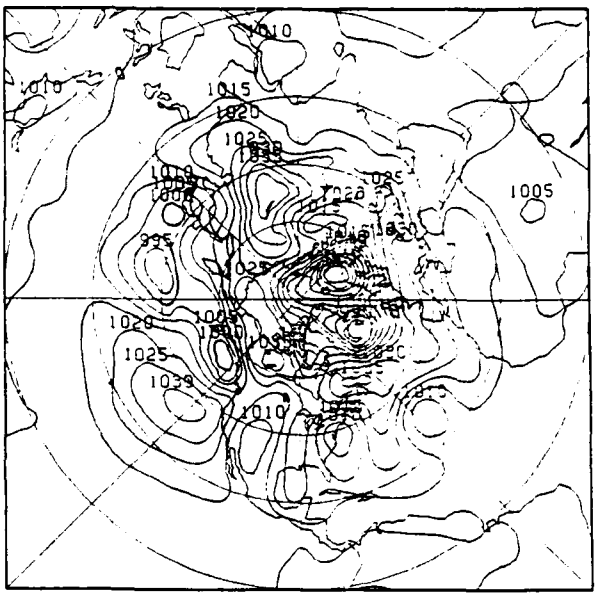
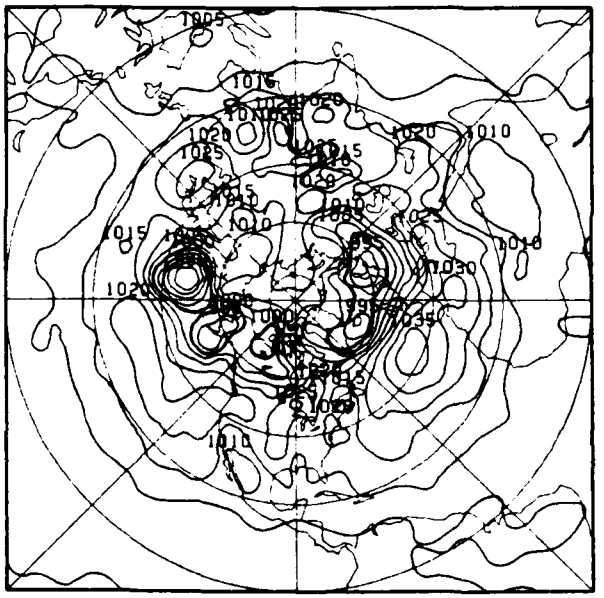


9-LAYER 4X5



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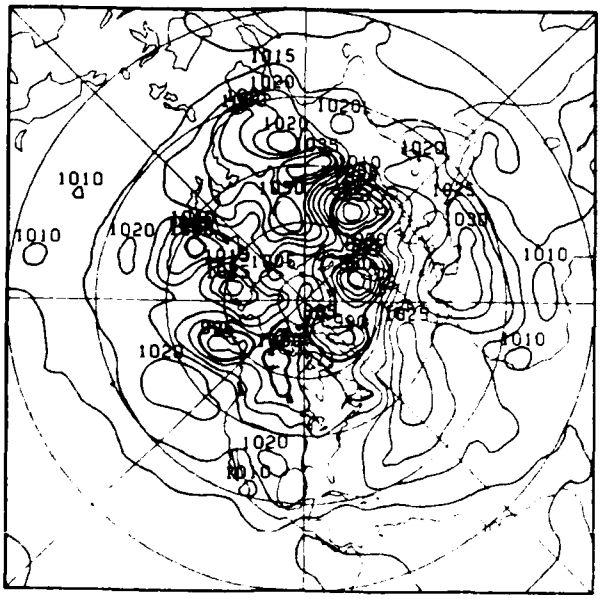
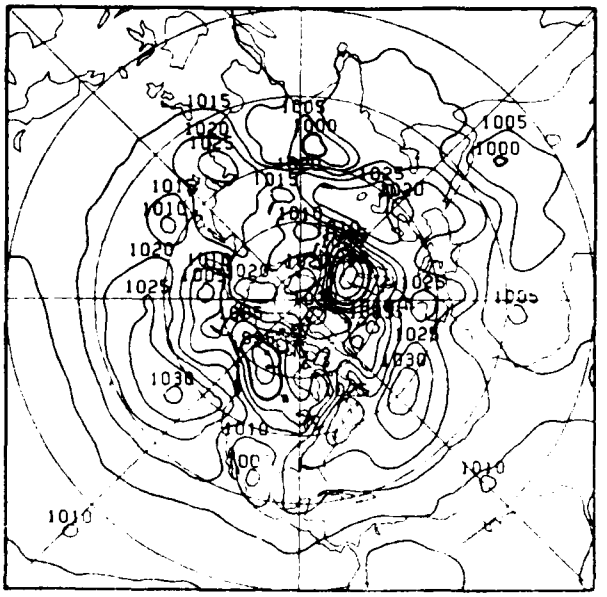


15-LAYER 2.4X3



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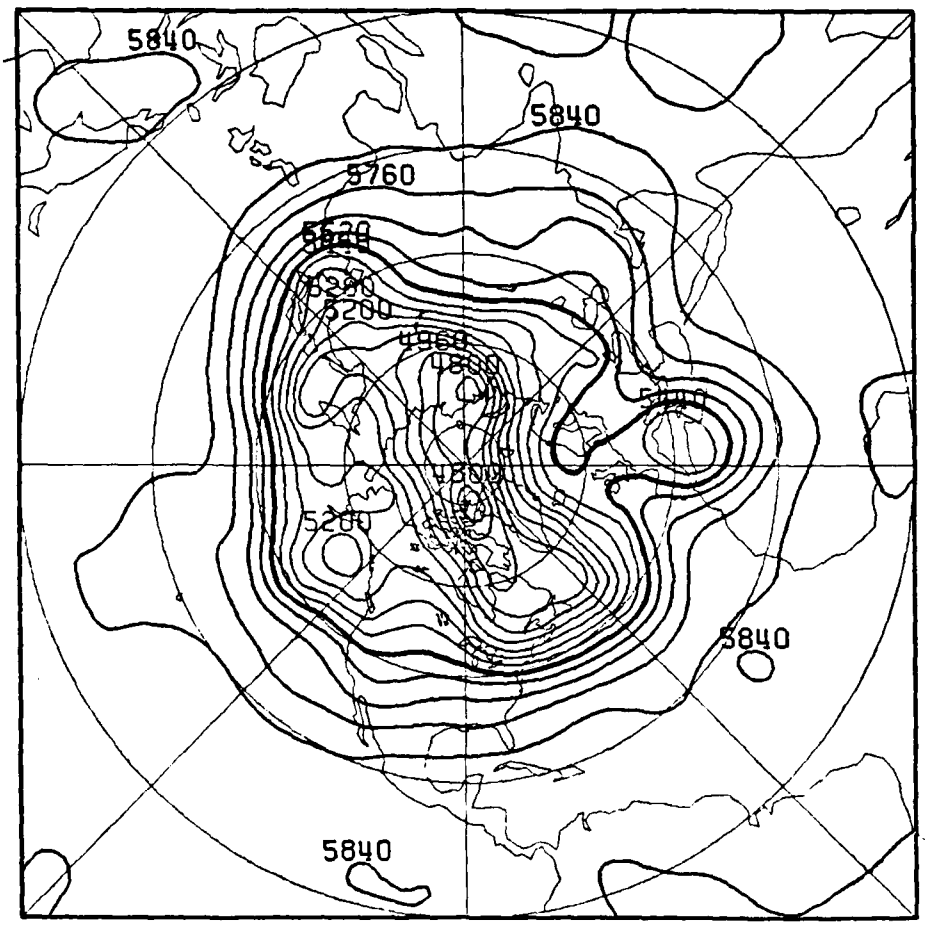

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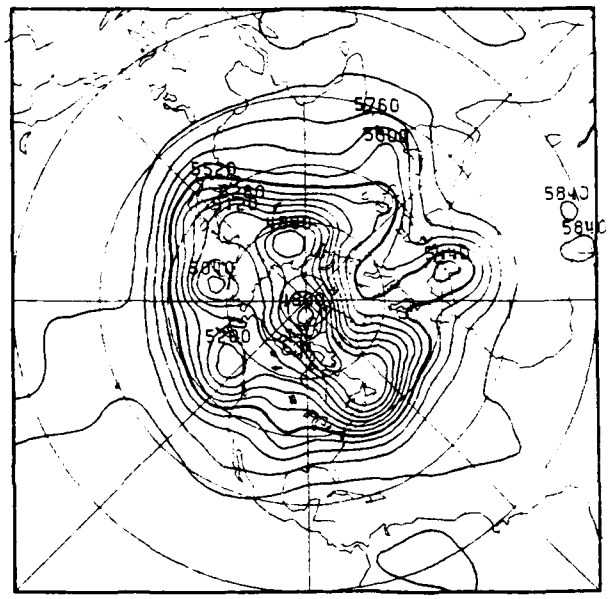
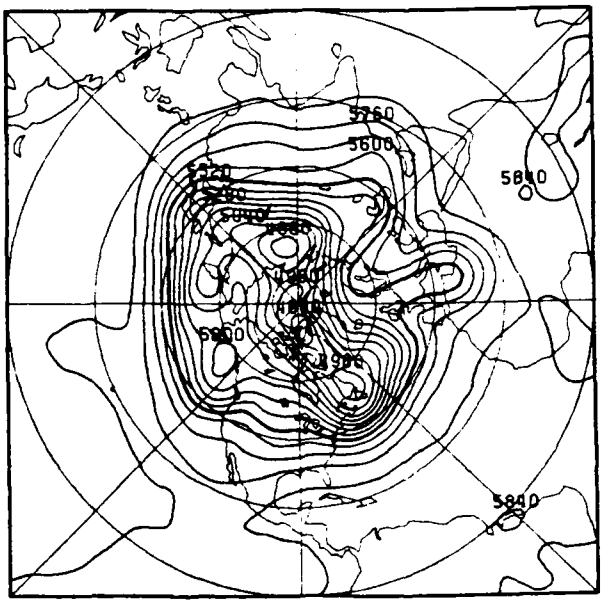
DAY 1

OBSERVED



9-LAYER 4X5



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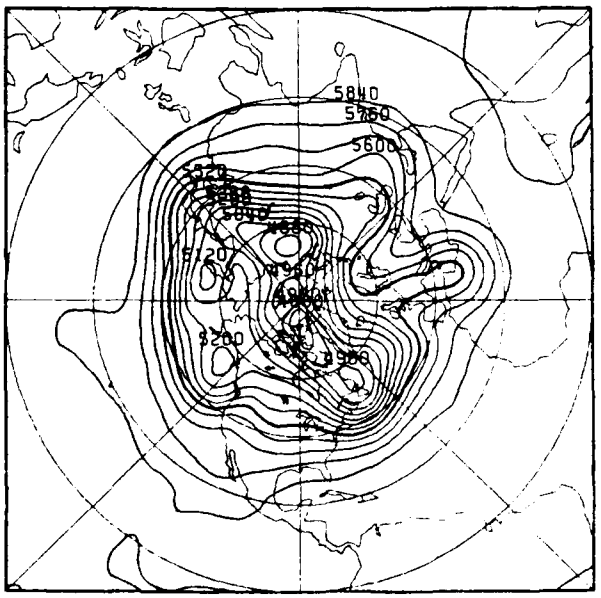
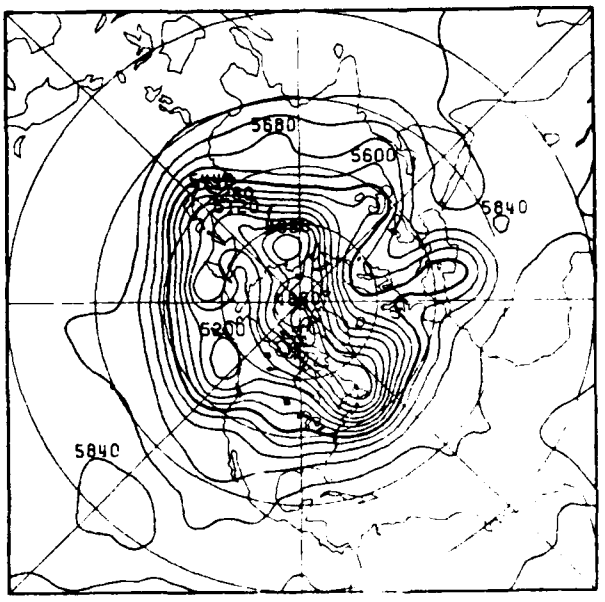


15-LAYER 2.4X3



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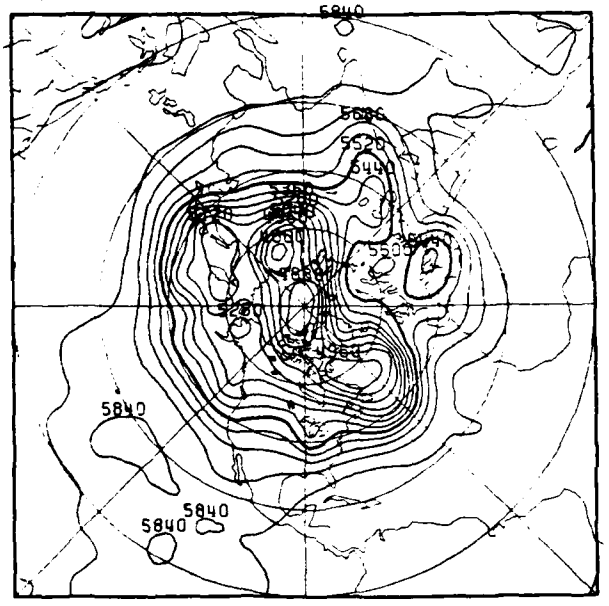
0000 GMT 19 FEB 1979

DAY 2

OBSERVED



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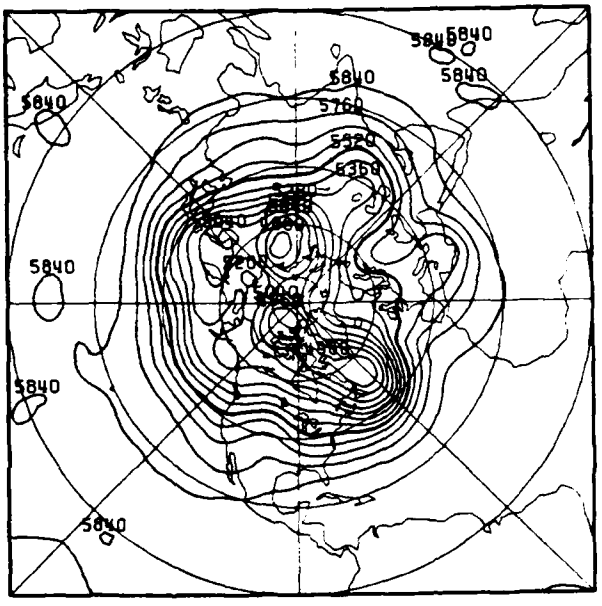
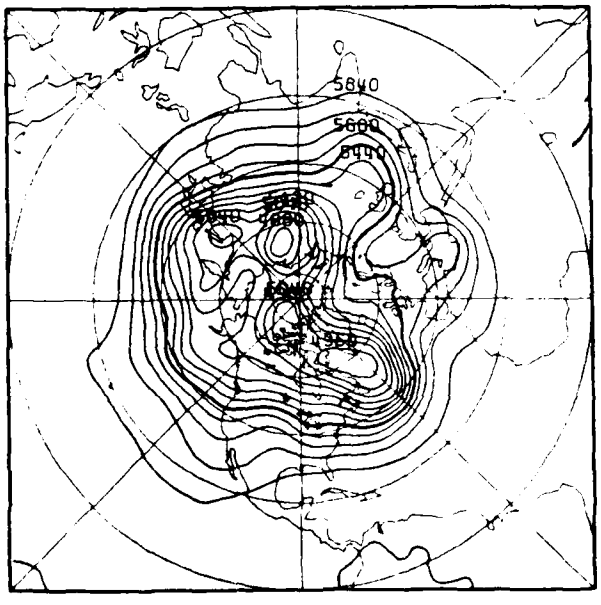
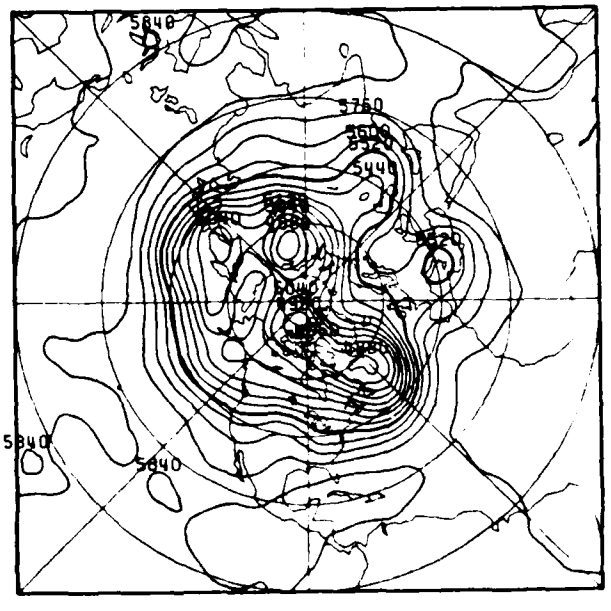


15-LAYER 4X5



15-LAYER 2.4X3

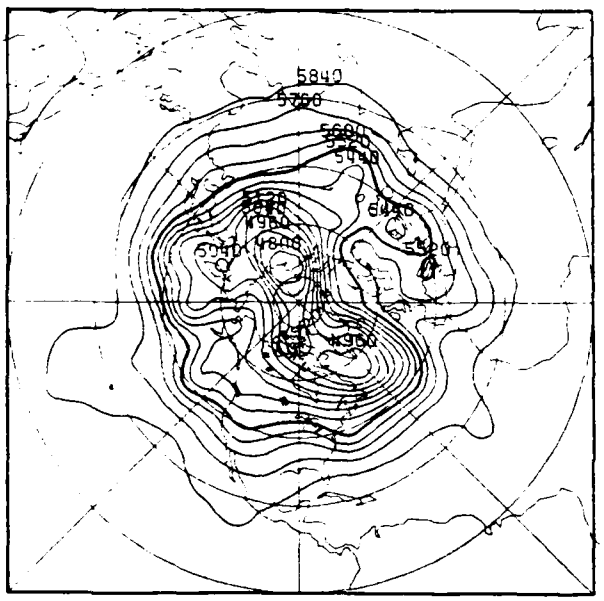


500 mb Z

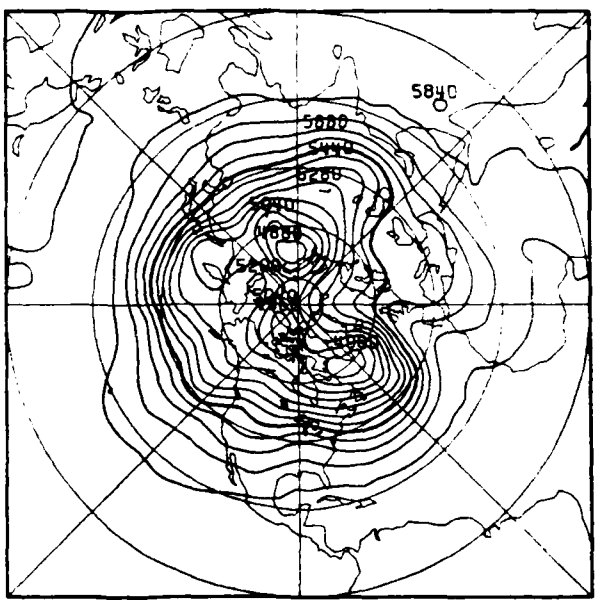
0000 GMT 20 FEB 1979

DAY 3

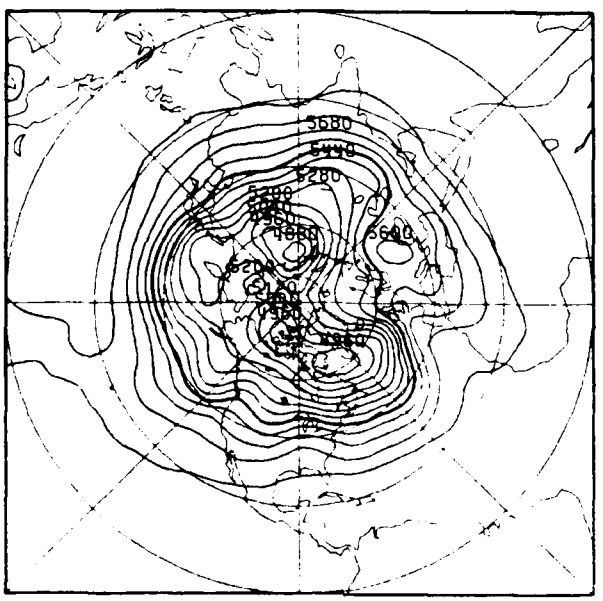
OBSERVED



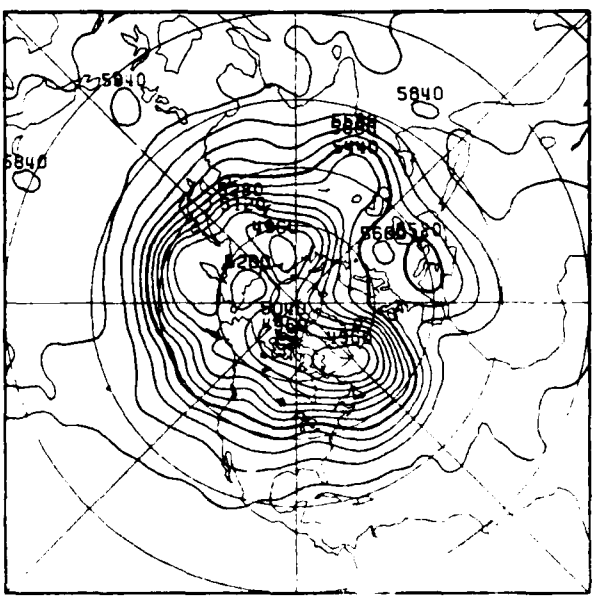
9-LAYER 4X5



15-LAYER 4X5



15-LAYER 2.4X3

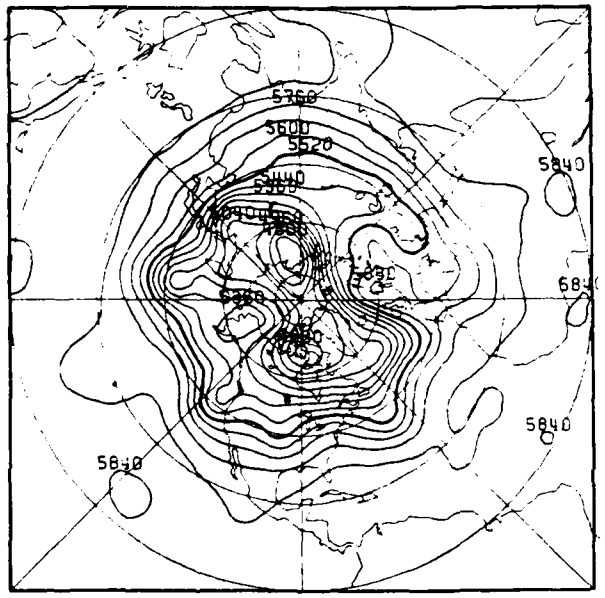


500 mb Z

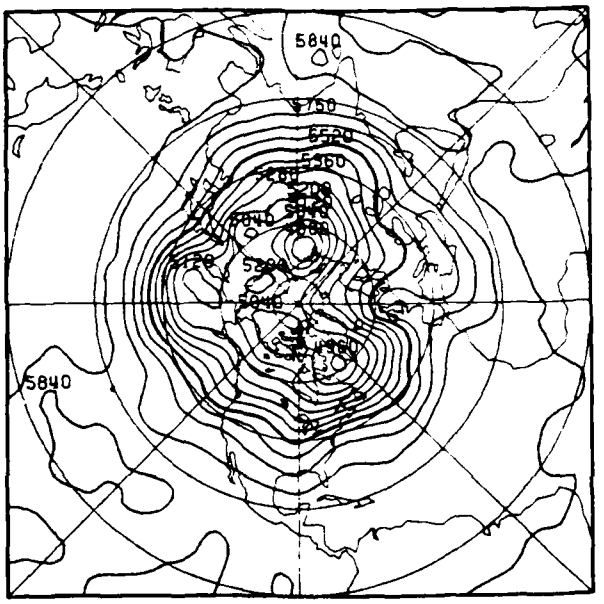
0000 GMT 21 FEB 1979

DAY 4

OBSERVED



9-LAYER 4X5



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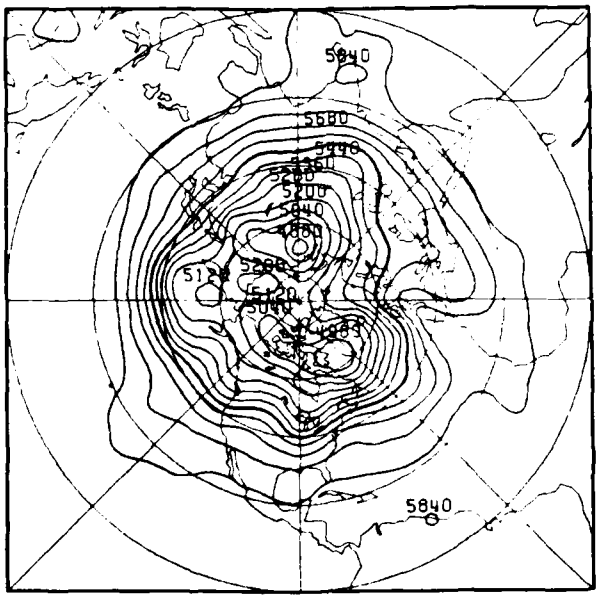
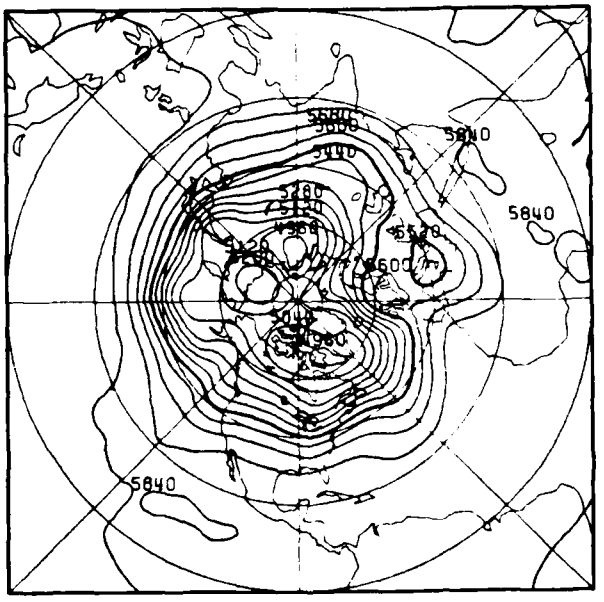


15-LAYER 2.4X3

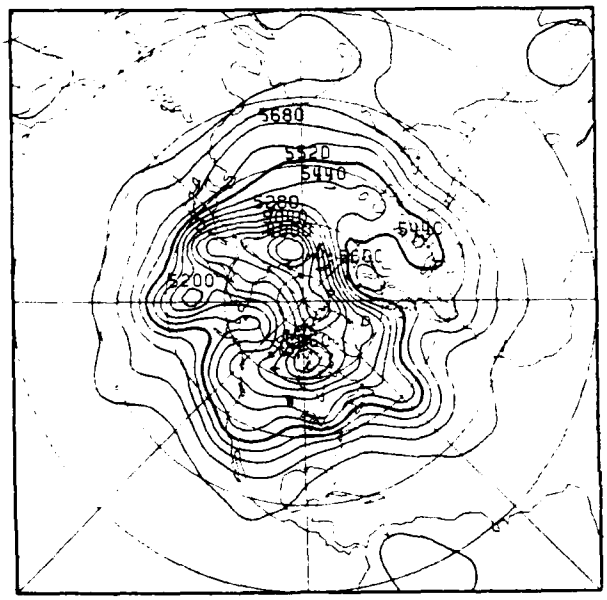


500 mb Z

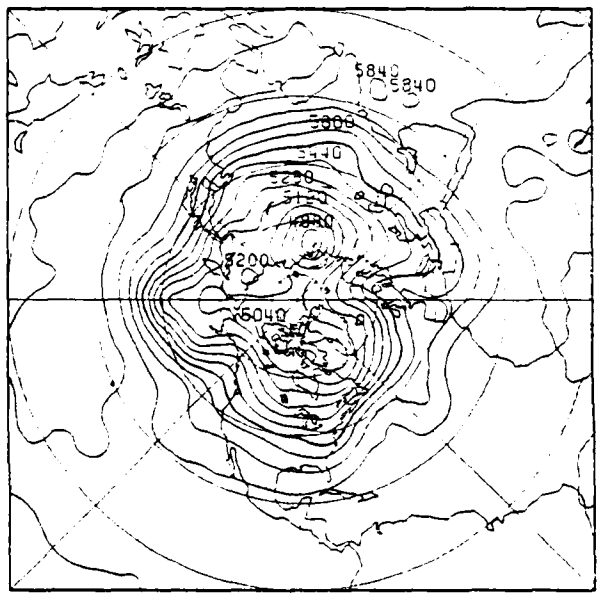
0000 GMT 22 FEB 1979

DAY 5

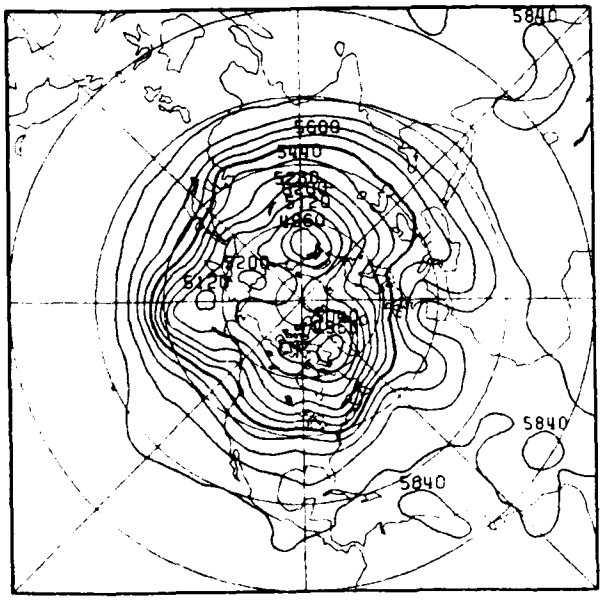
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



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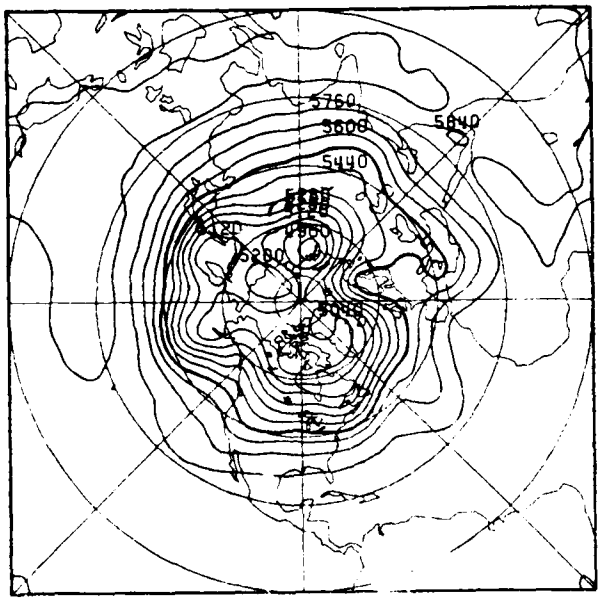
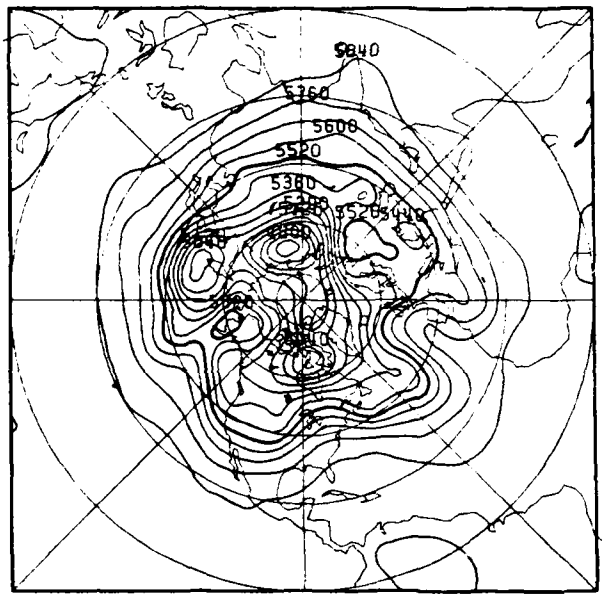


500 mb Z

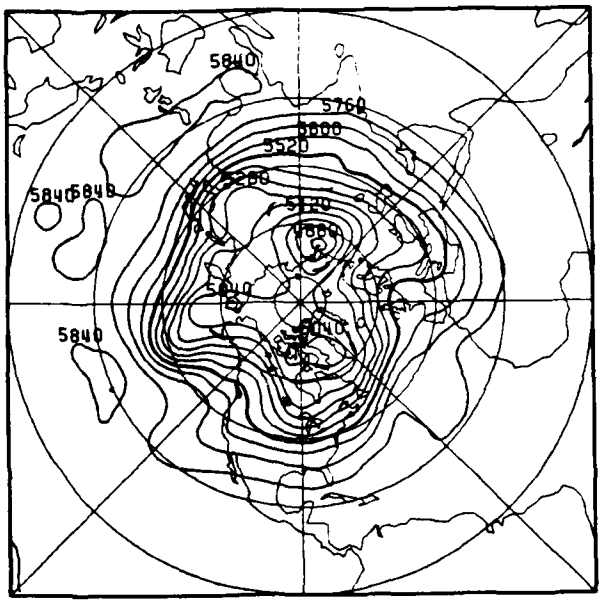
0000 GMT 23 FEB 1979

DAY 6

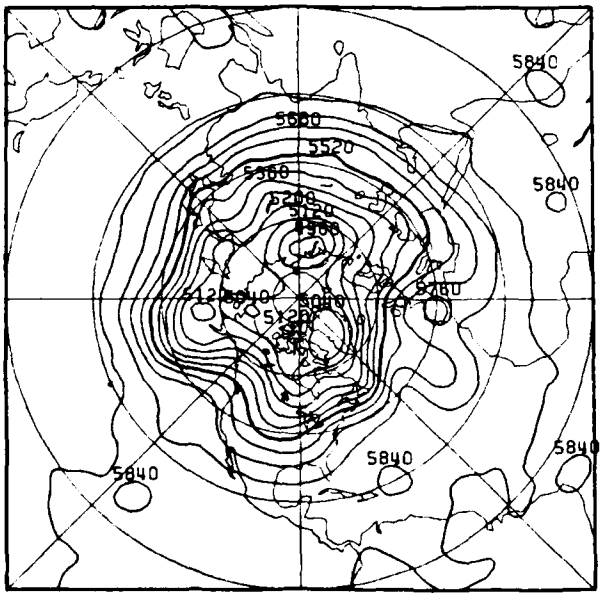
OBSERVED



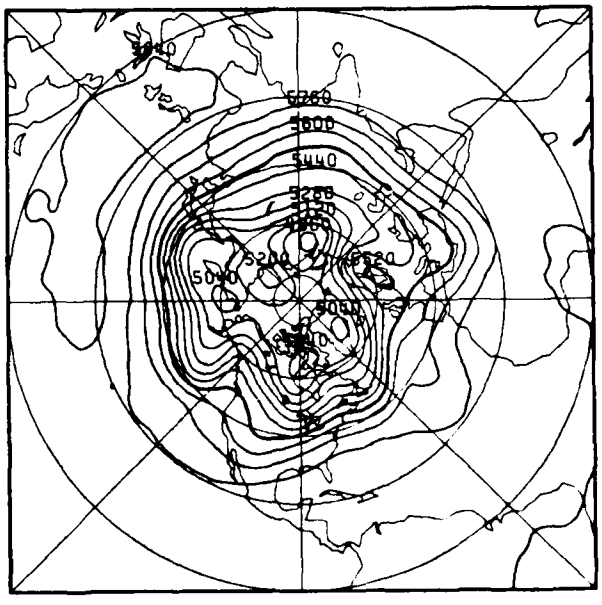
9-LAYER 4X5



15-LAYER 4X5



15-LAYER 2.4X3

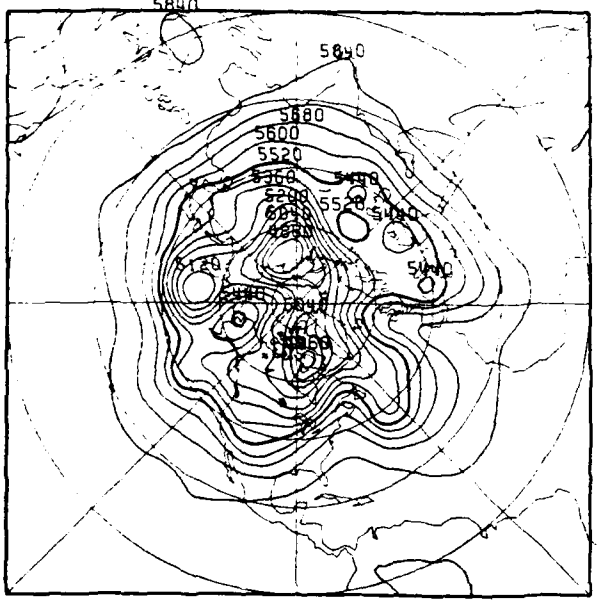


500 mb Z

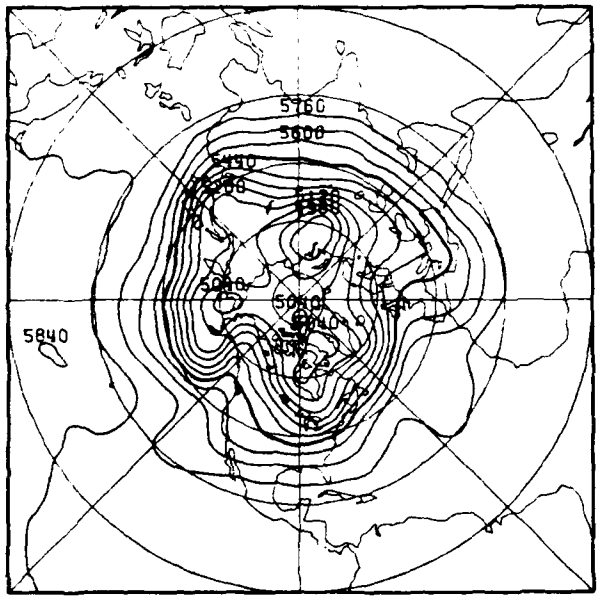
0000 GMT 24 FEB 1979

DAY 7

OBSERVED



9-LAYER 4X5



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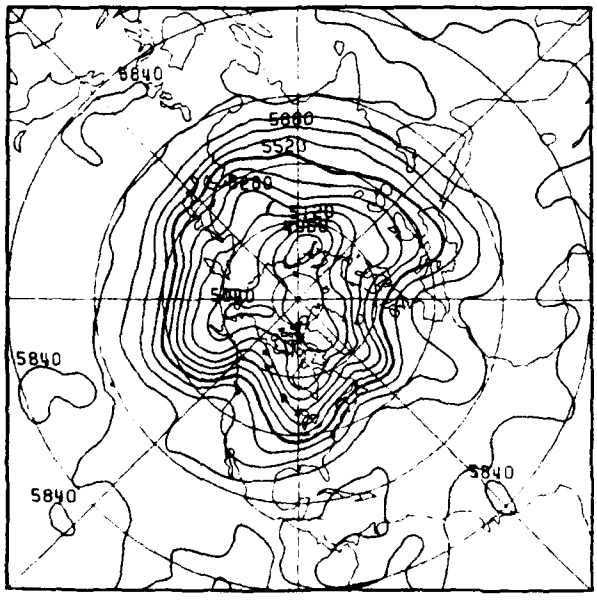
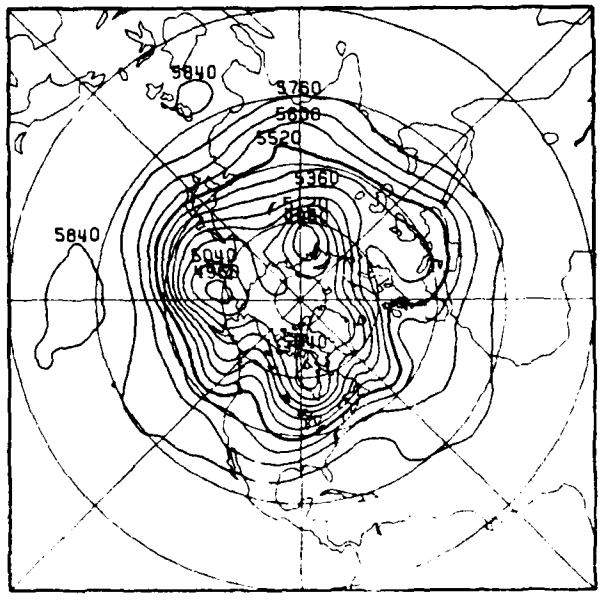


15-LAYER 2.4X3

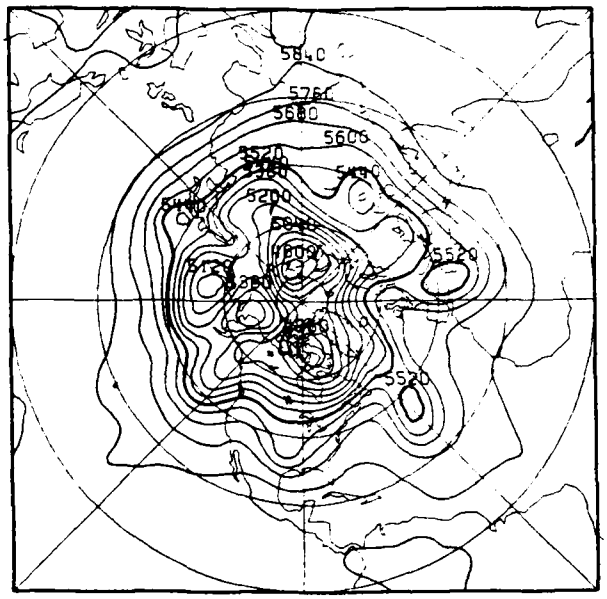


500 mb Z

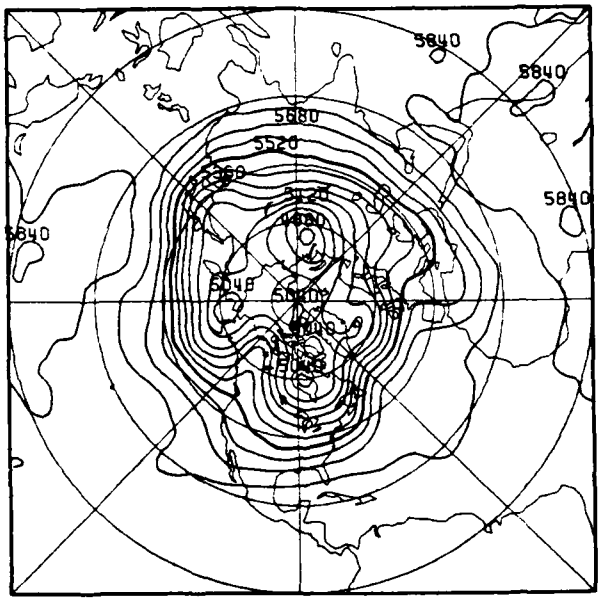
0000 GMT 25 FEB 1979

DAY 8

OBSERVED



9-LAYER 4X5



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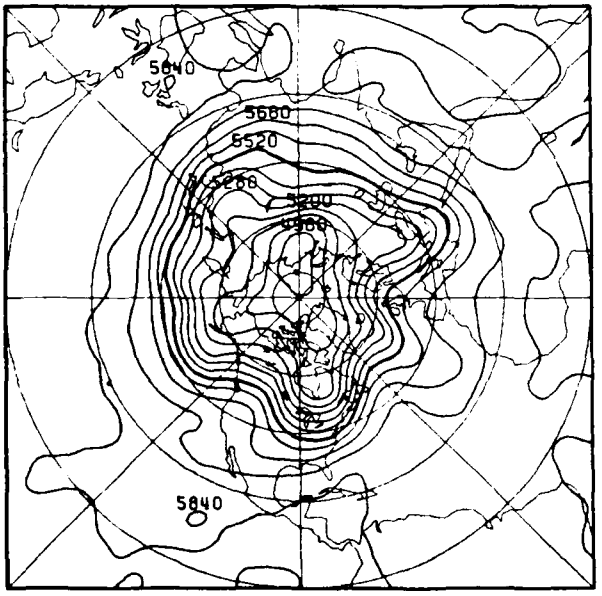
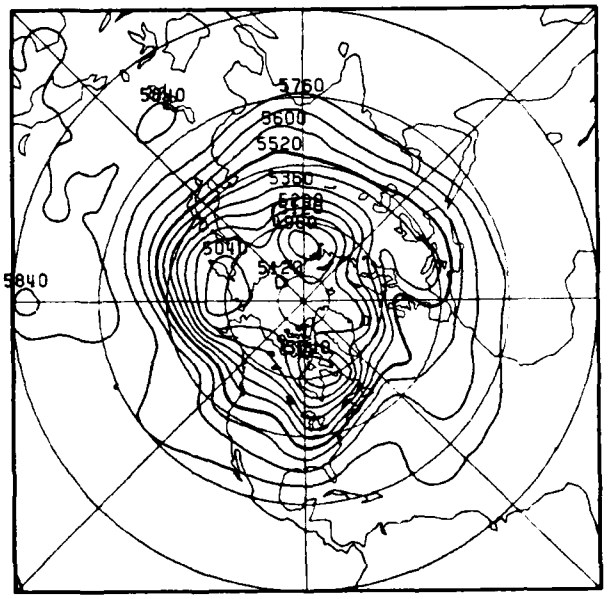


15-LAYER 2.4X3

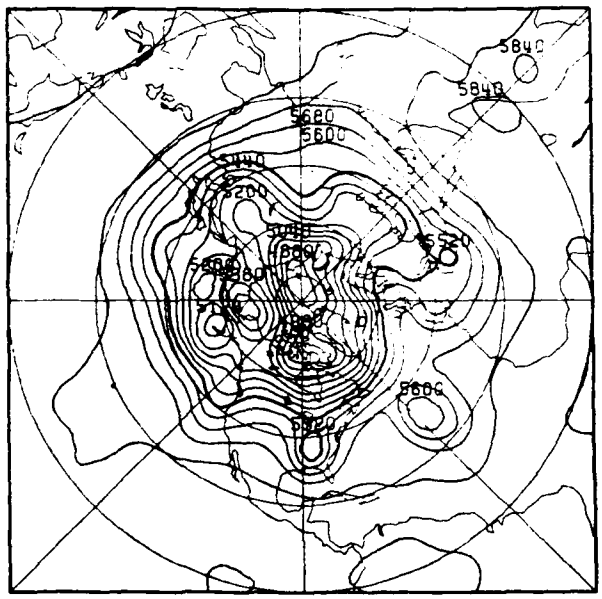


500 mb Z

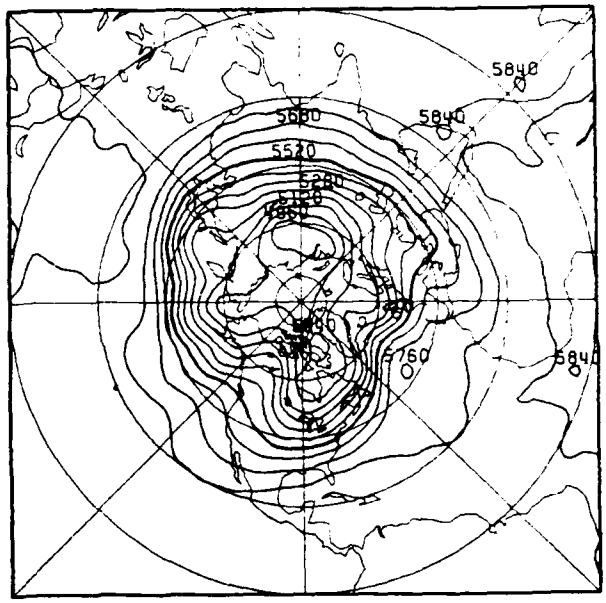
0000 GMT 26 FEB 1979

DAY 9

OBSERVED



9-LAYER 4X5



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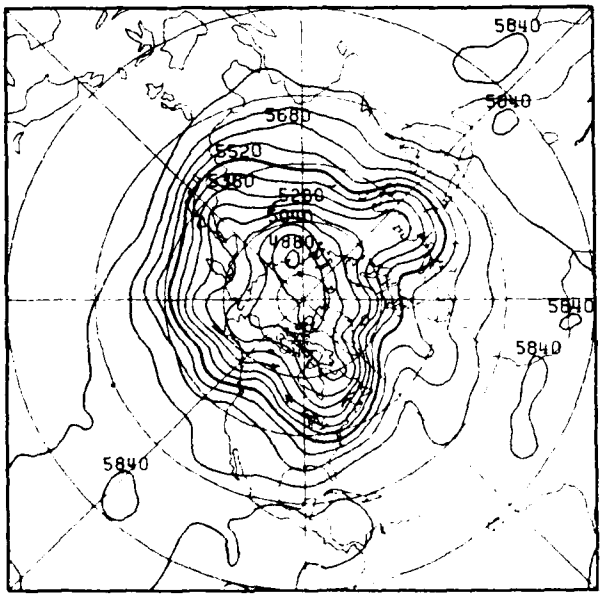
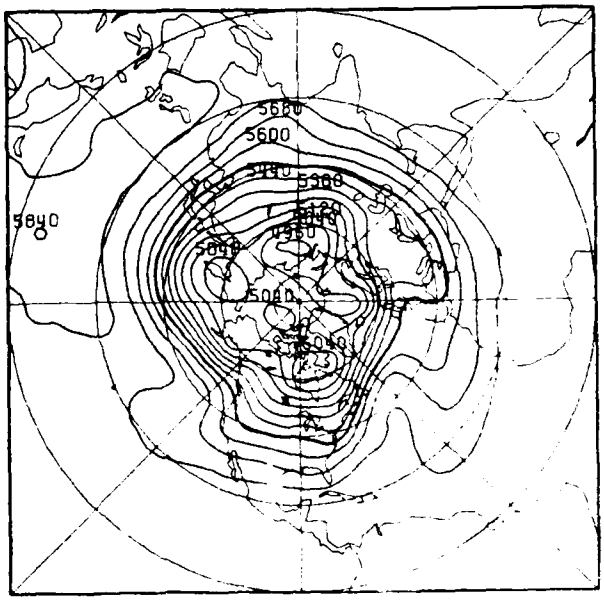


15-LAYER 2.4X3

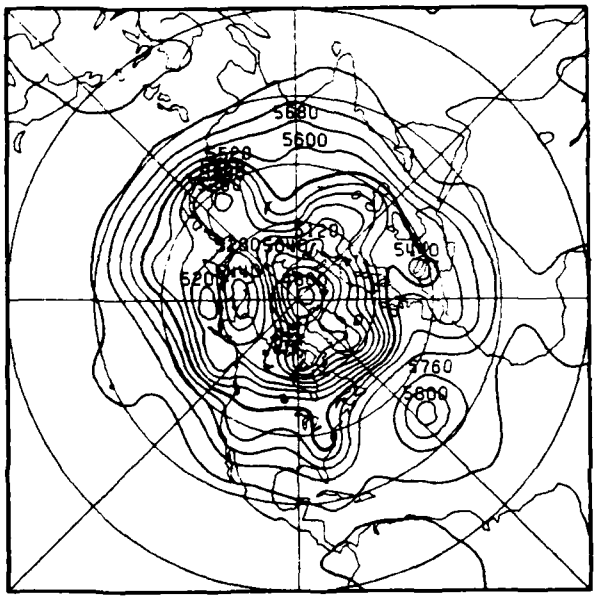


500 mb Z

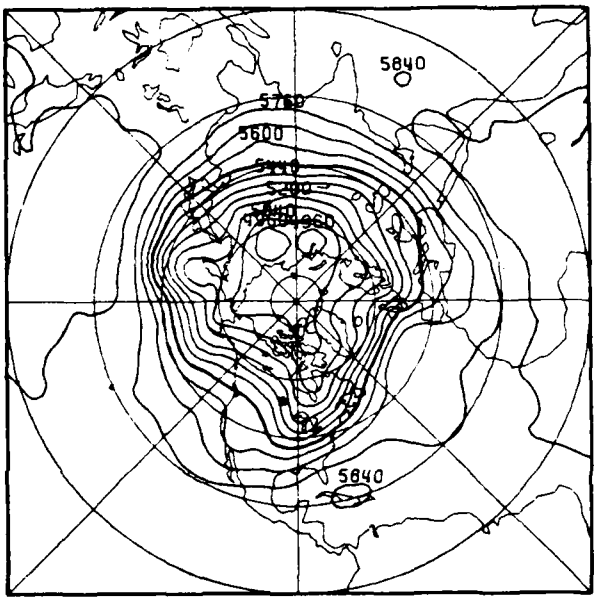
0000 GMT 27 FEB 1979

DAY 10

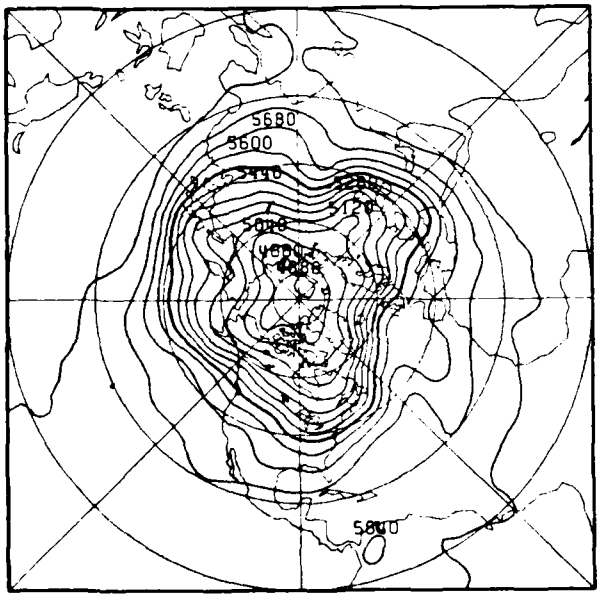
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



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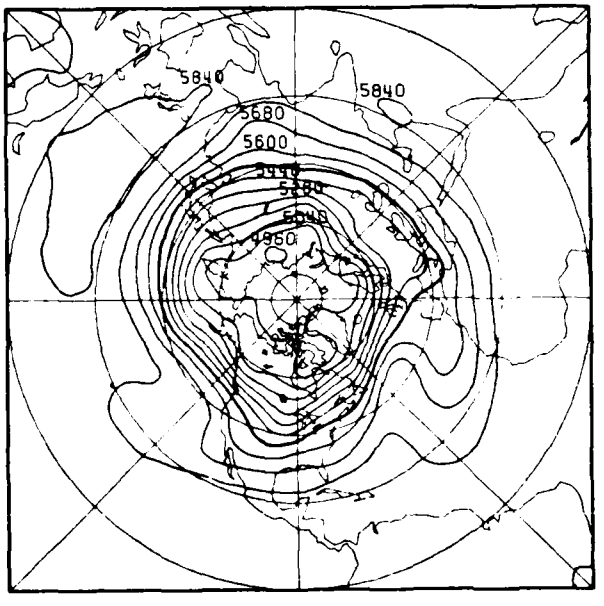
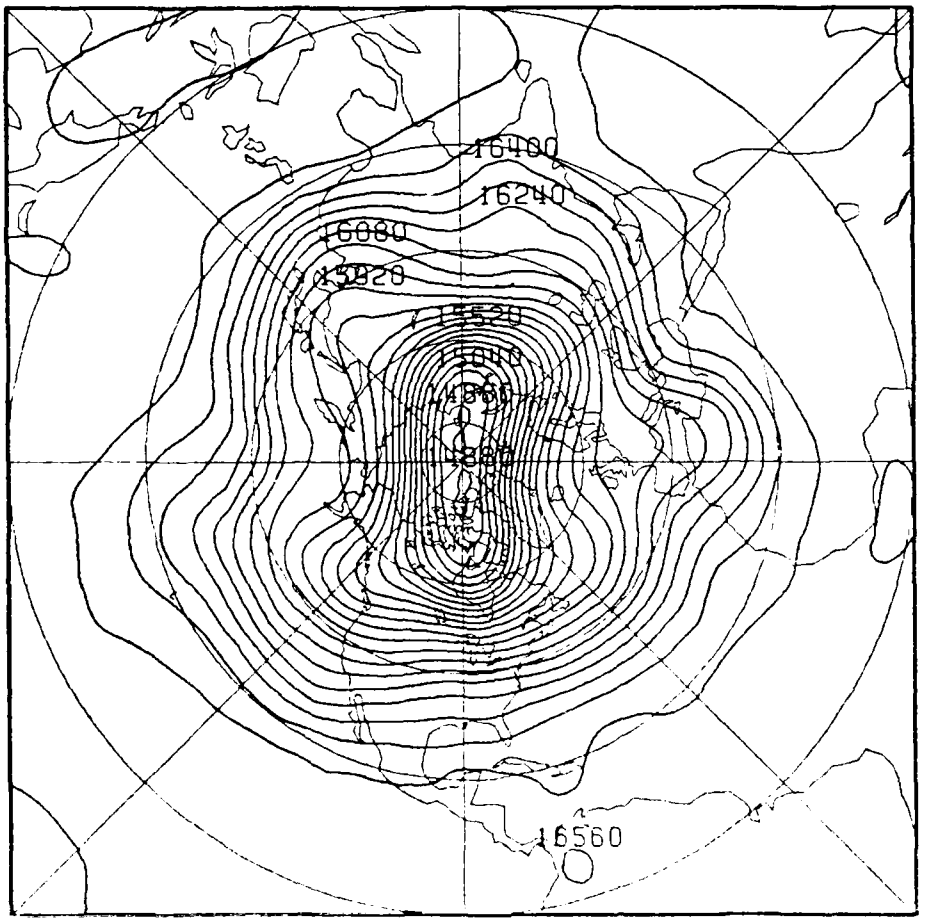


10 mb Z

0000 GMT 17 FEB 1979

OBSERVED



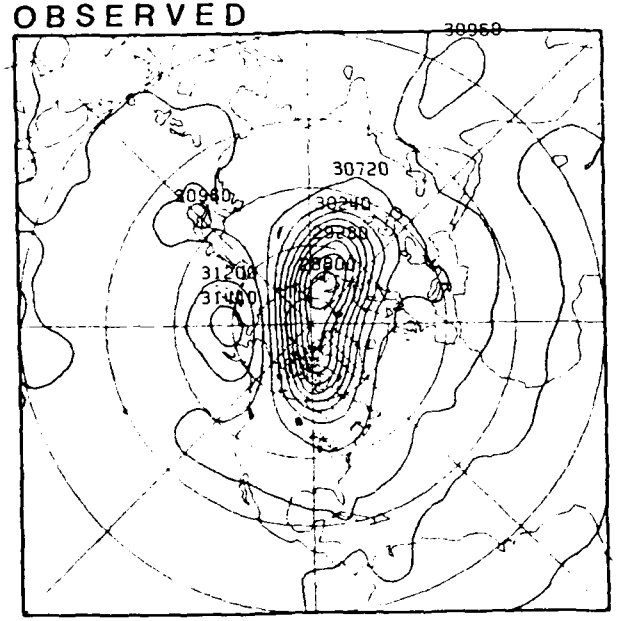
10 mb Z

18 FEB 1979 00 GMT

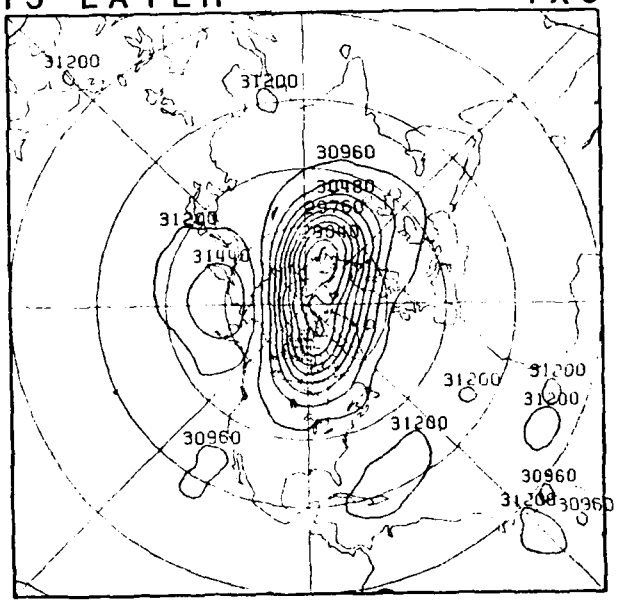
DAY 1

7-25

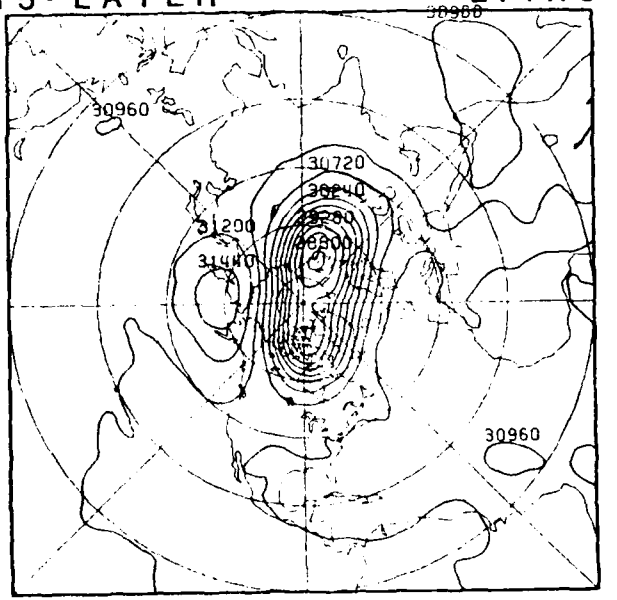
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

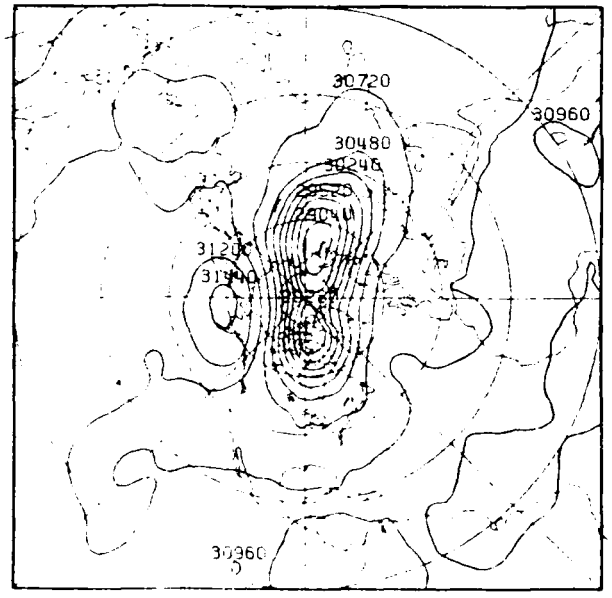


10 mb Z

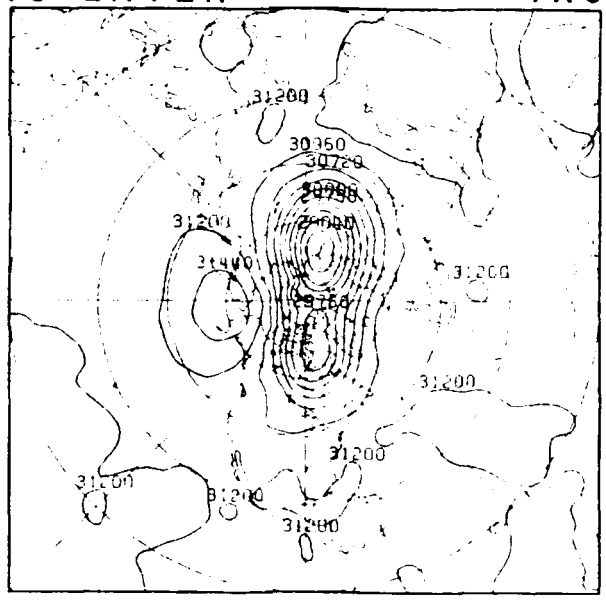
19 FEB 1979 00 GMT

DAY 2

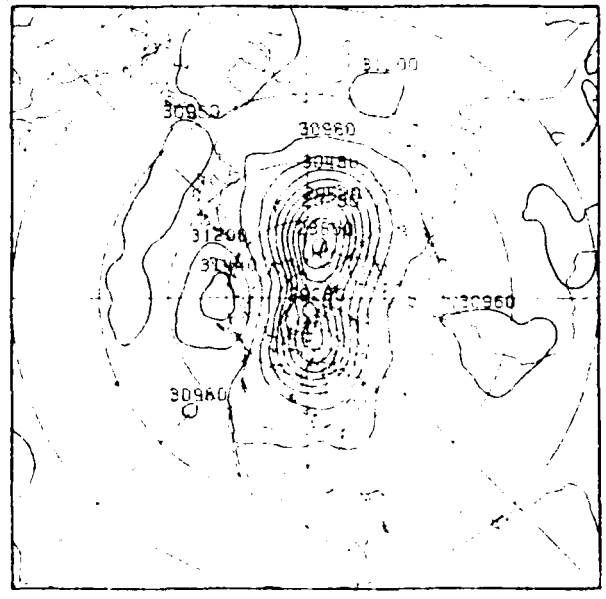
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

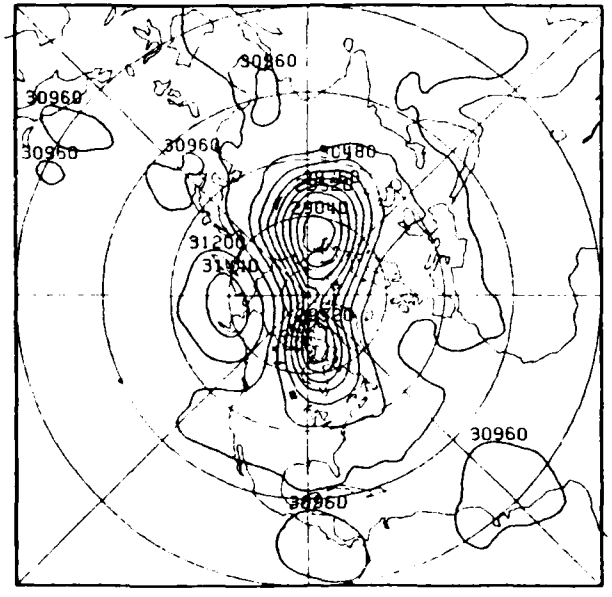


10 mb Z

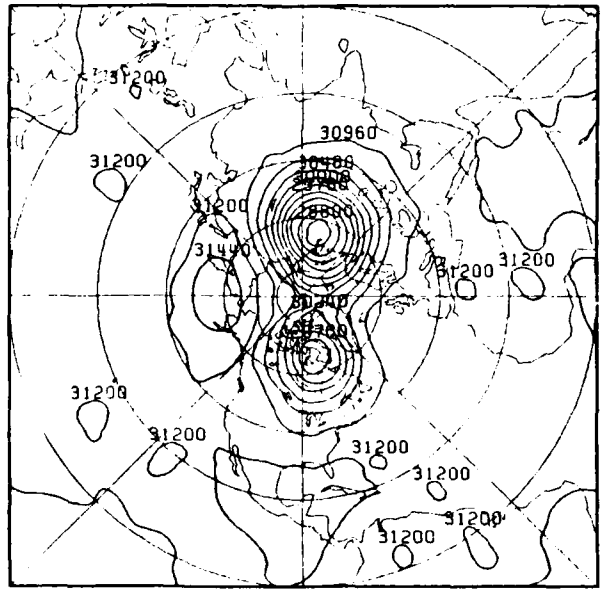
20 FEB 1979 00 GMT

DAY 3

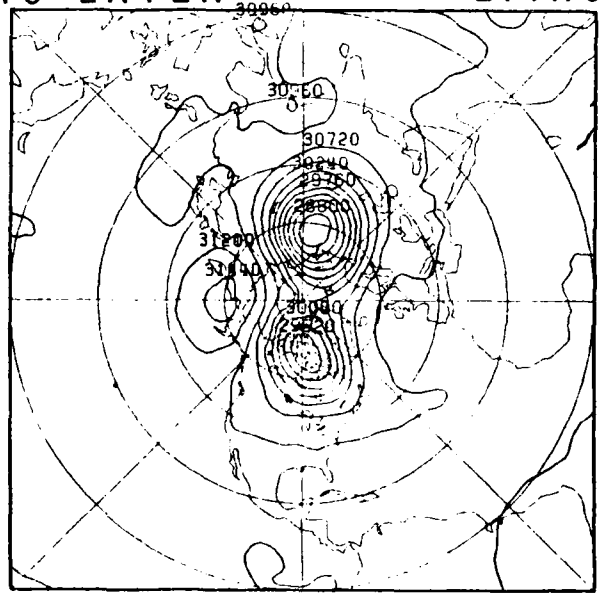
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

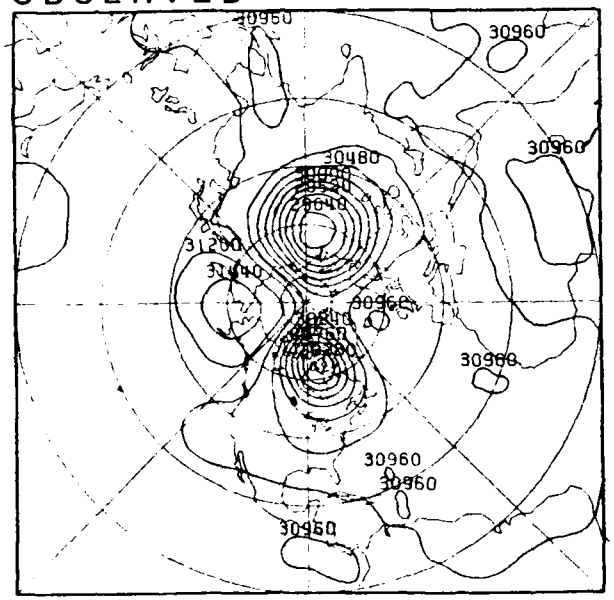


10 mb Z

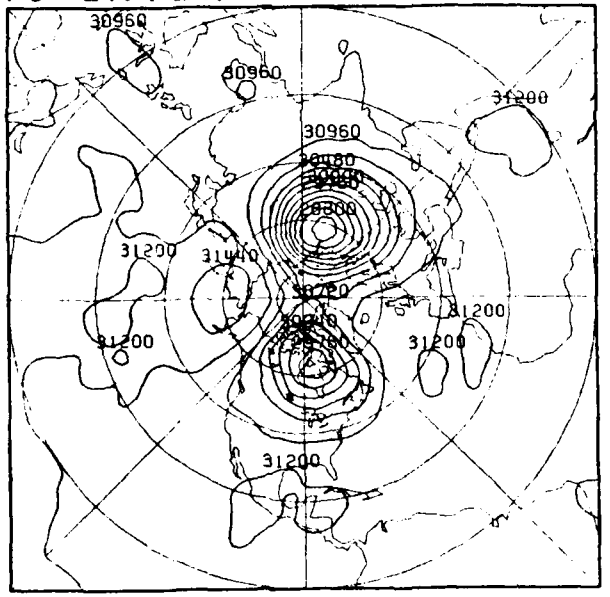
21 FEB 1979 00 GMT

DAY 4

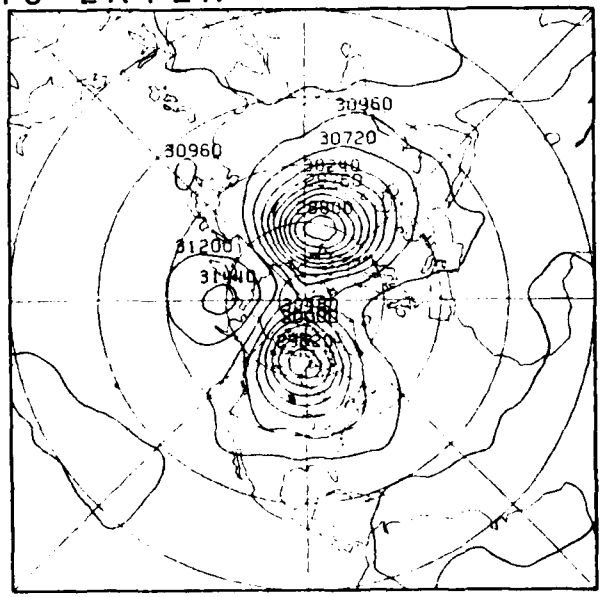
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

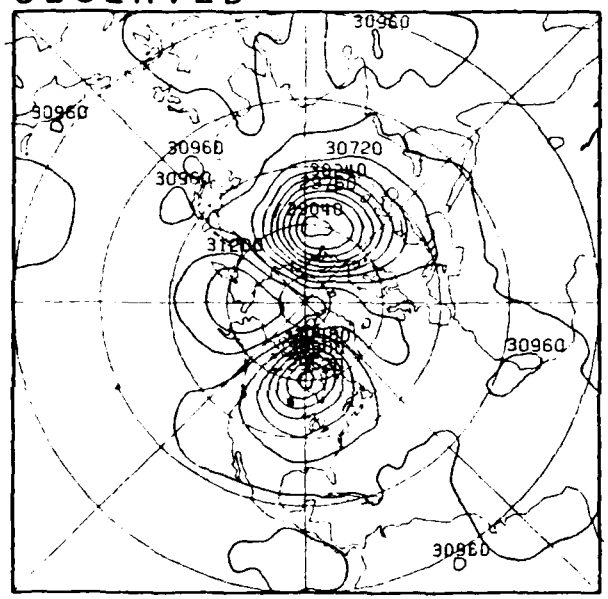


10 mb Z

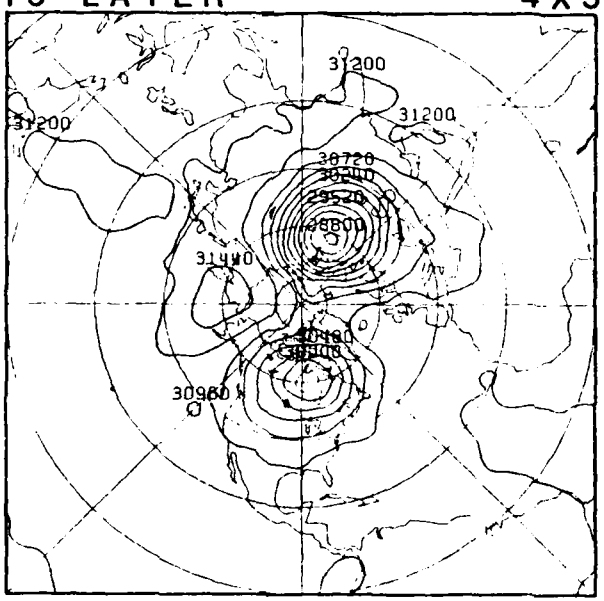
22 FEB 1979 00 GMT

DAY 5

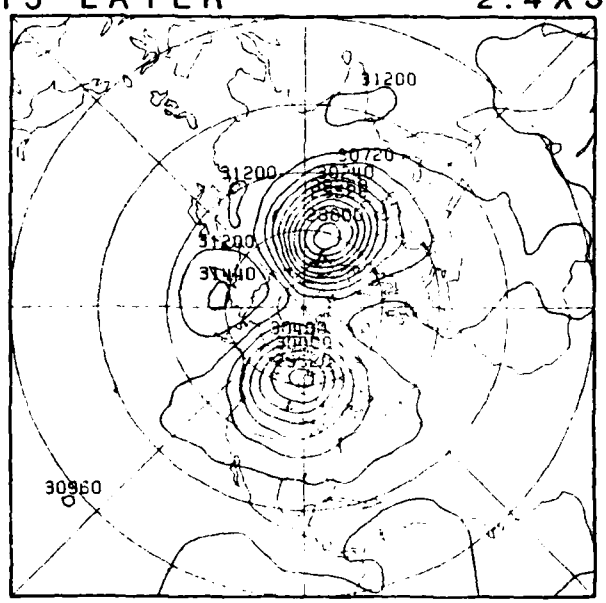
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

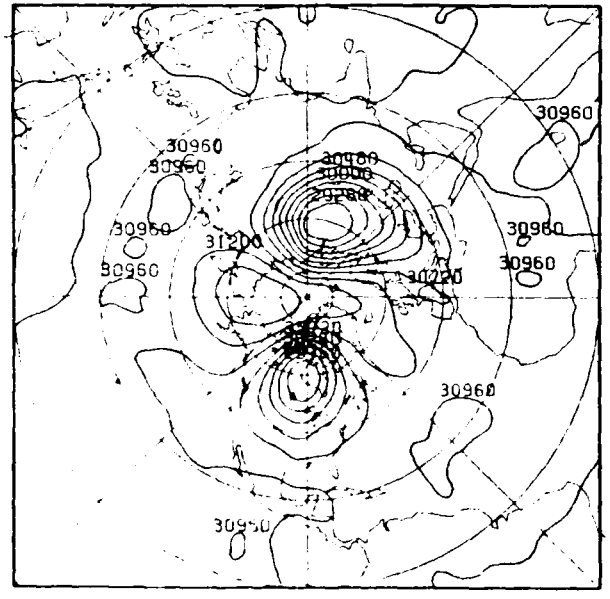


10 mb Z

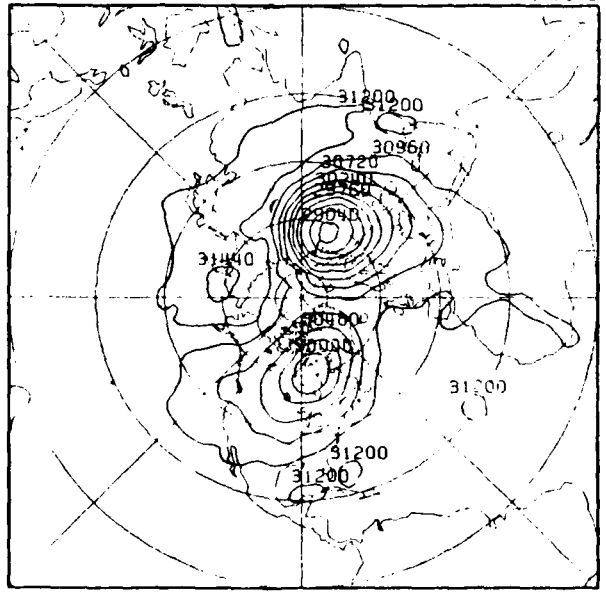
23 FEB 1979 00 GMT

DAY 6

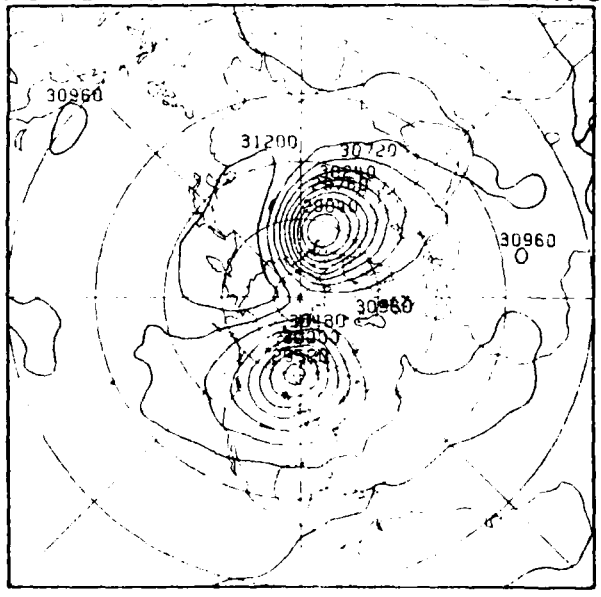
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

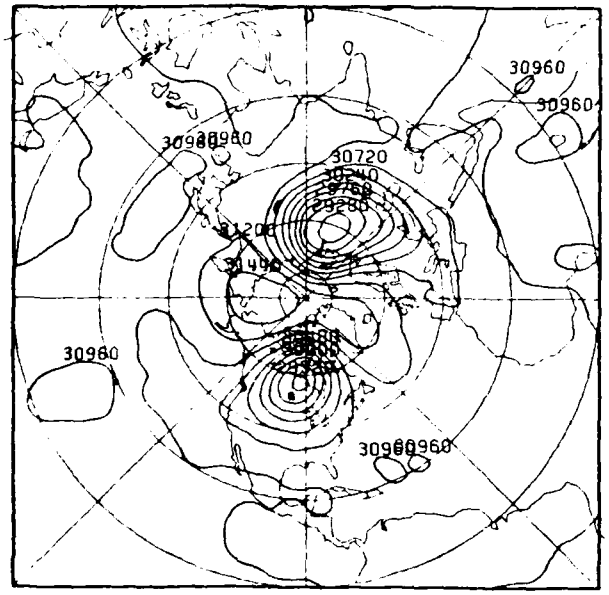


10 mb Z

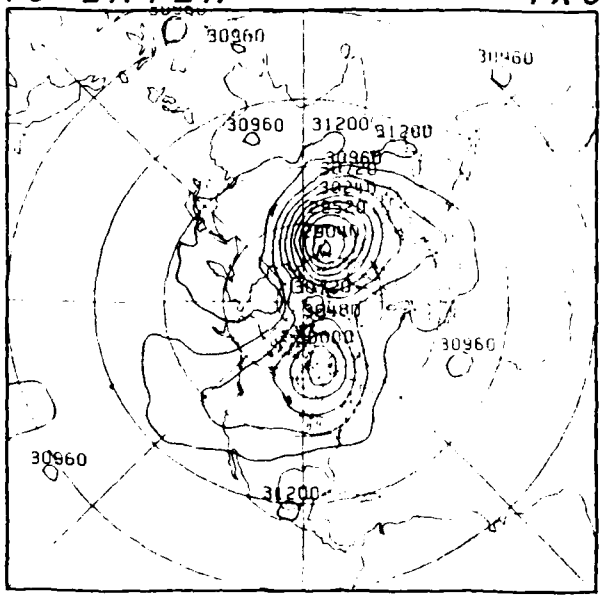
24 FEB 1979 00 GMT

DAY 7

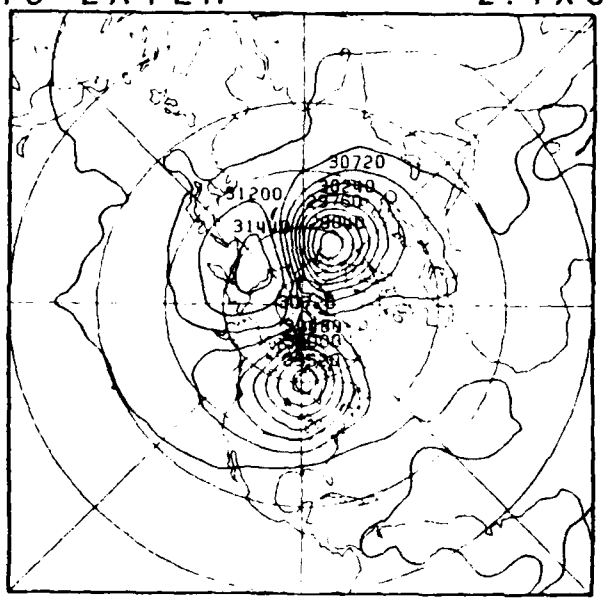
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

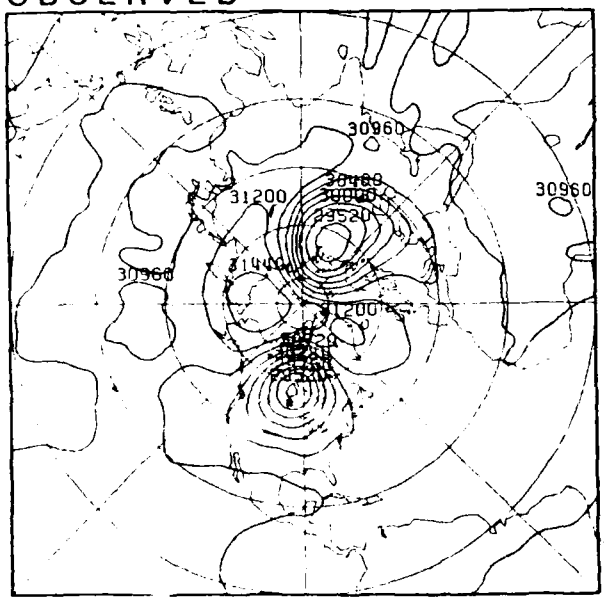


10 mb Z

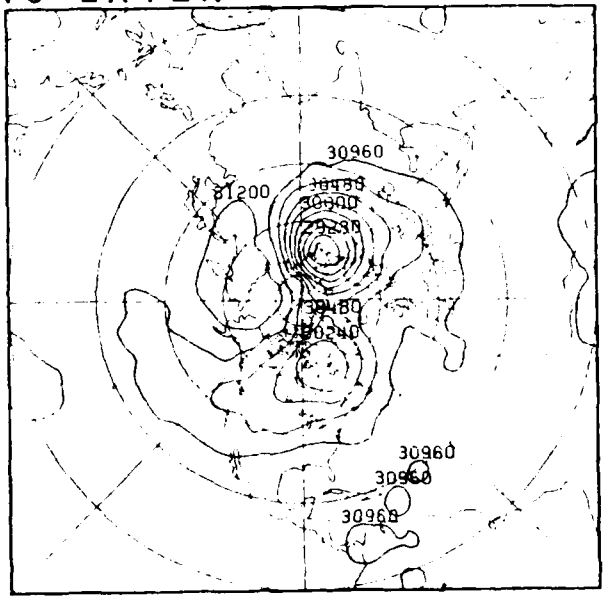
25 FEB 1979 00 GMT

DAY 8

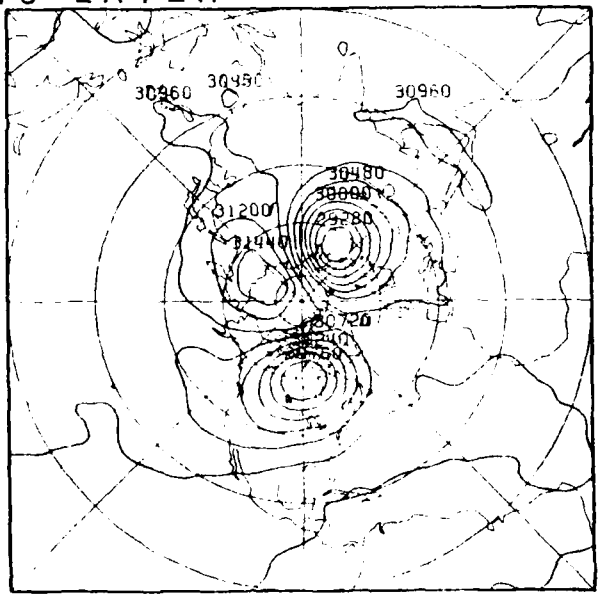
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

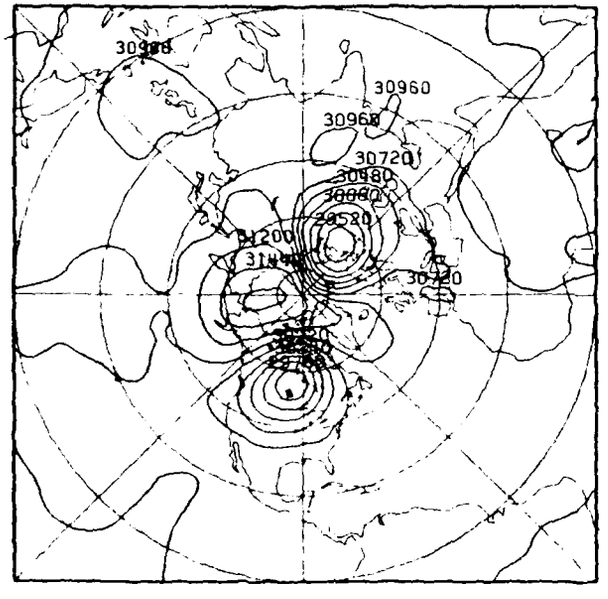


10 mb Z

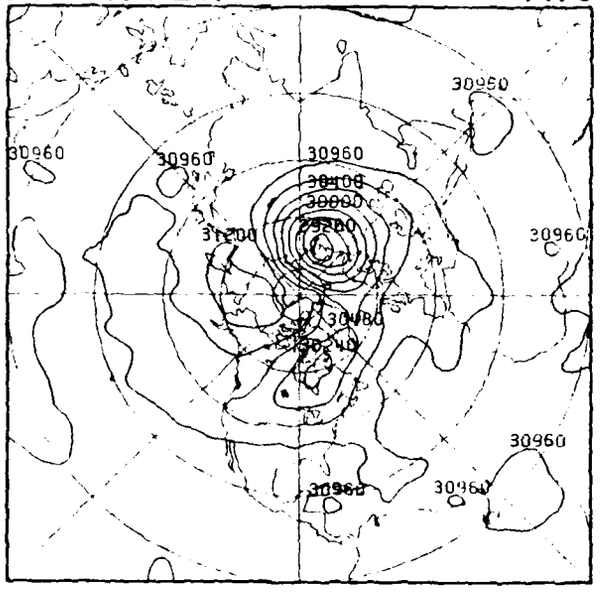
26 FEB 1979 00 GMT

DAY 9

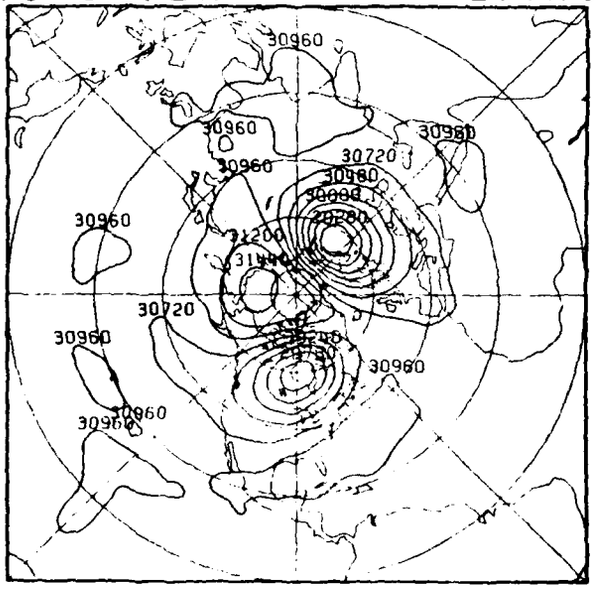
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

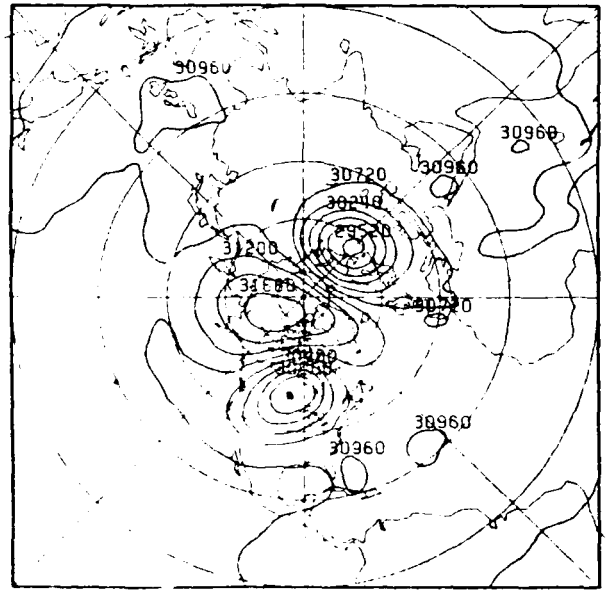


10 mb Z

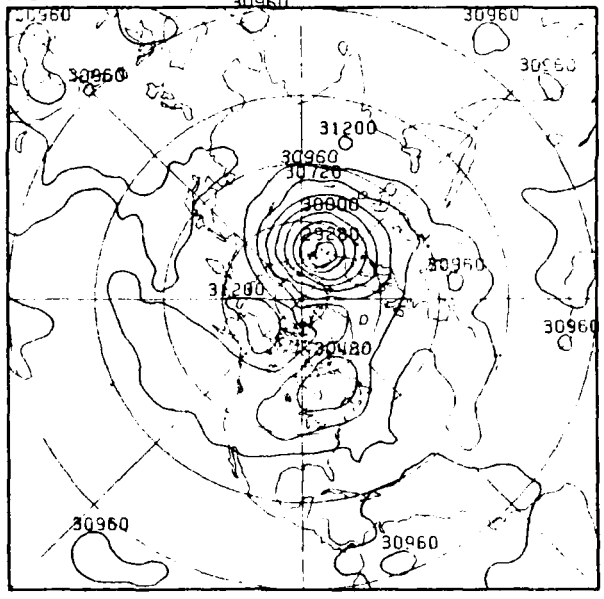
27 FEB 1979 00 GMT

DAY 10

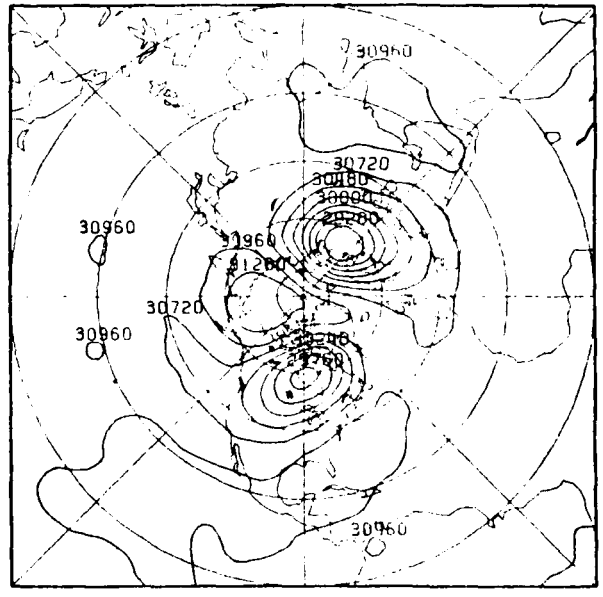
OBSERVED

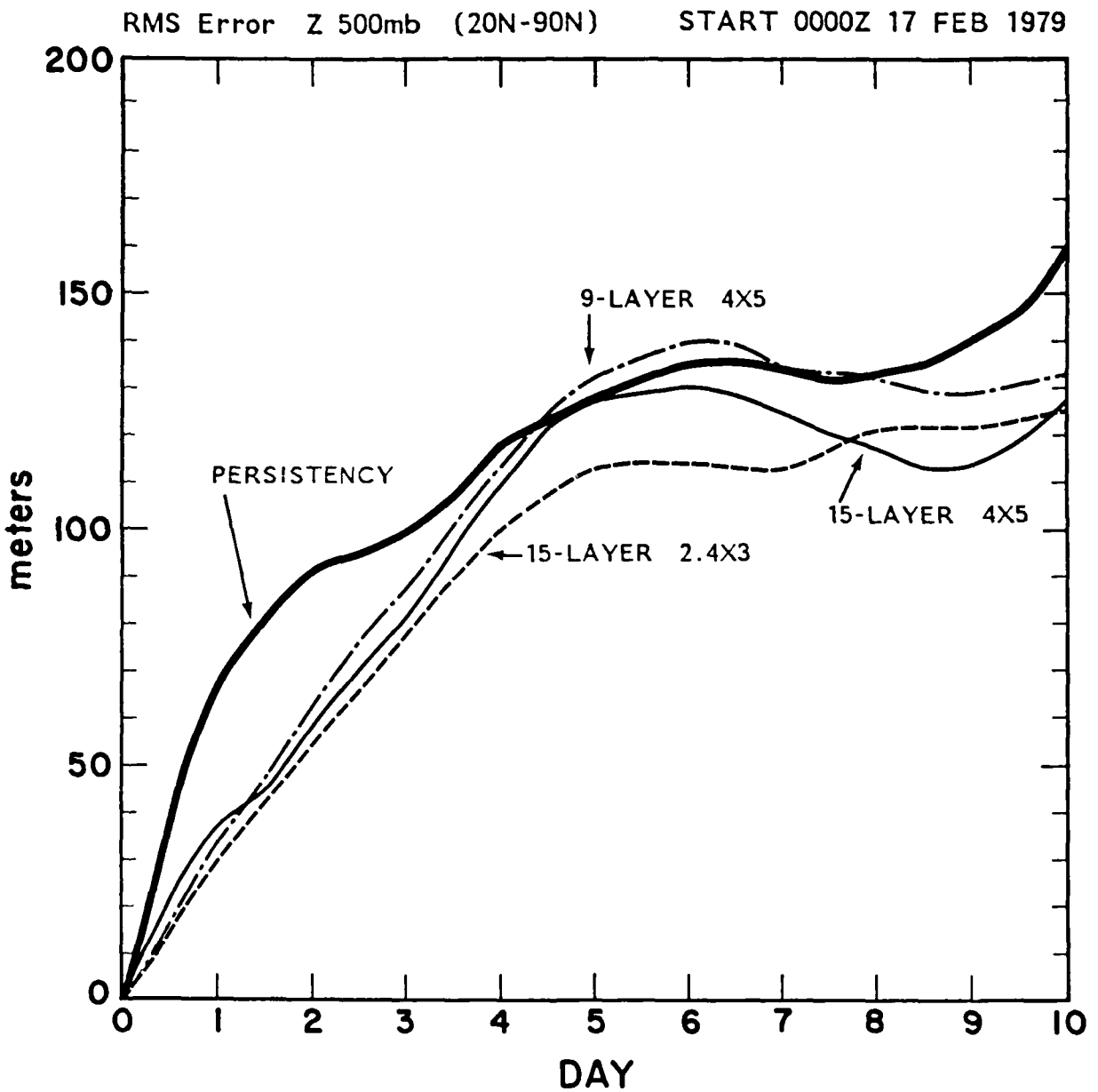


15-LAYER 4X5



15-LAYER 2.4X3




RMS Error Z 500mb (20N-90N)
START 0000Z 17 FEB 1979
200
150
100
50
0
meters
9-LAYER 4X5
PERSISTENCY
15-LAYER 4X5
15-LAYER 2.4X3
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

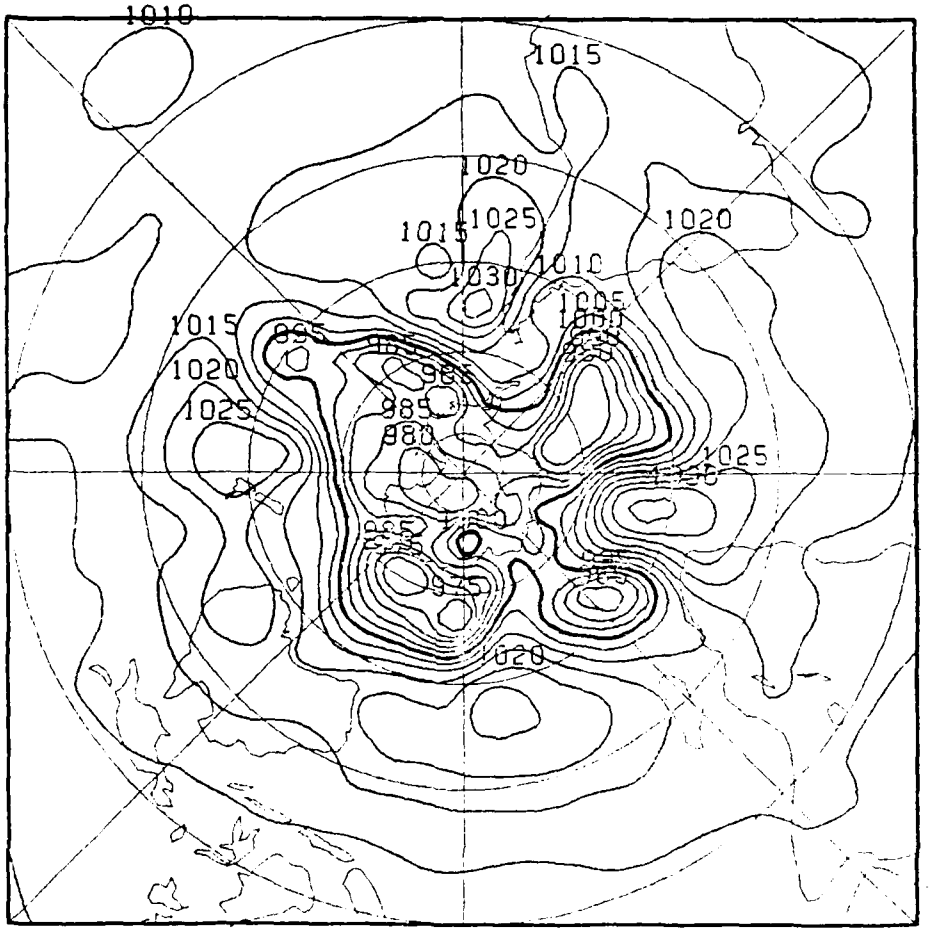
1200 GMT

11 JUNE 1979

SLP

1200 GMT 11 JUN 1979

OBSERVED

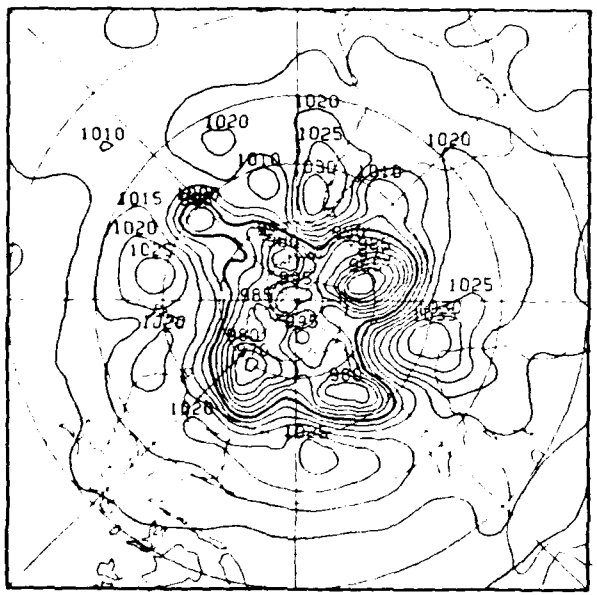


SLP

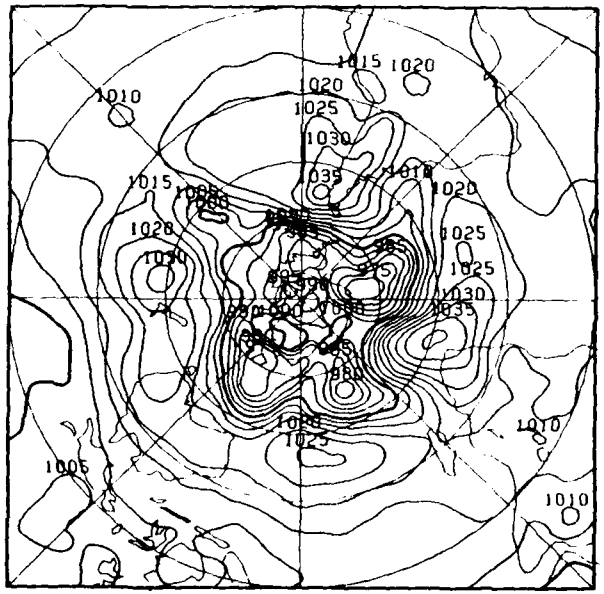
1200 GMT 12 JUN 1979

DAY 1

OBSERVED



9-LAYER 4X5



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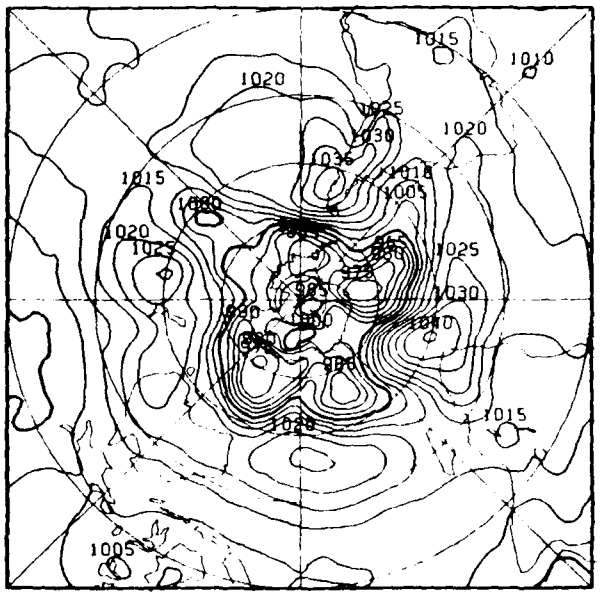
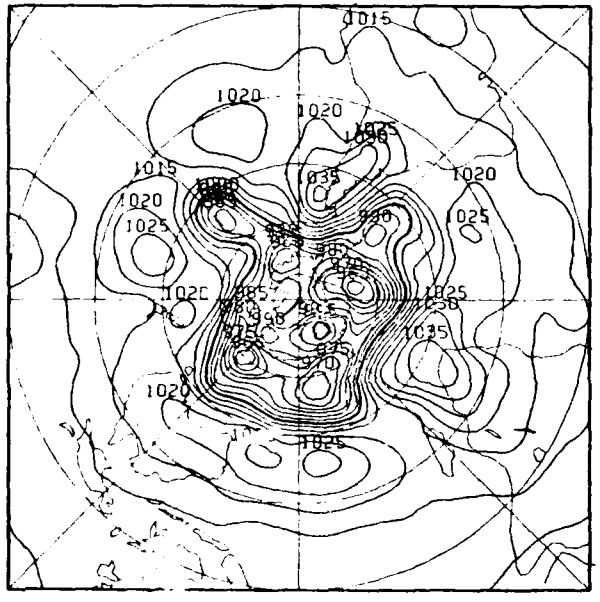


SLP

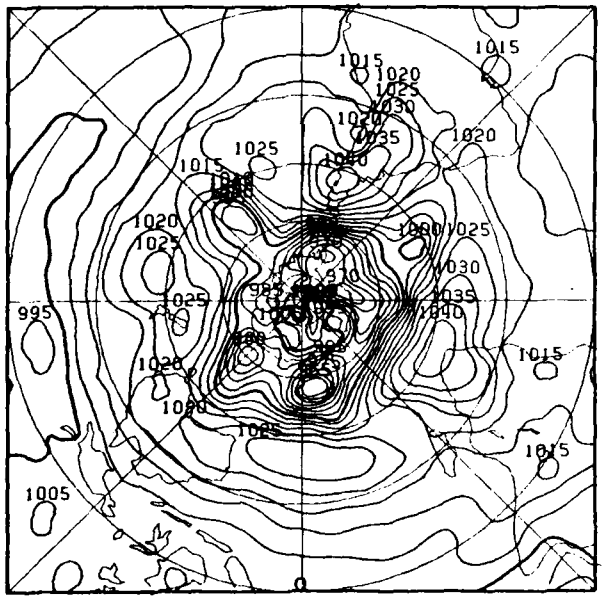
1200 GMT 13 JUN 1979

DAY 2

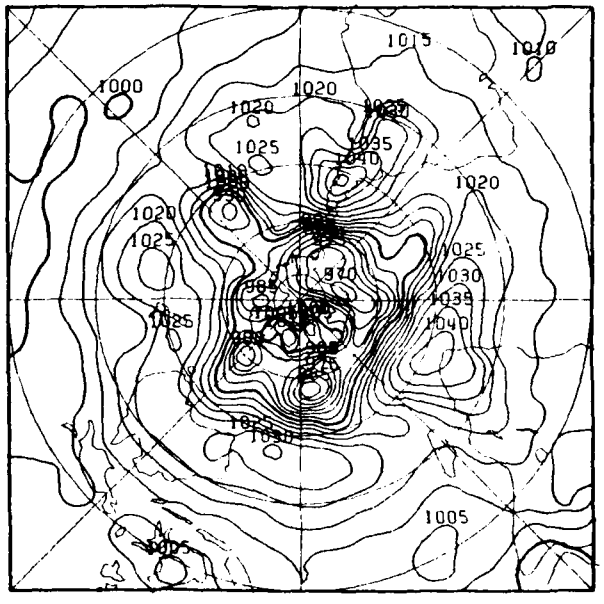
OBSERVED



9-LAYER 4X5



15-LAYER 4X5

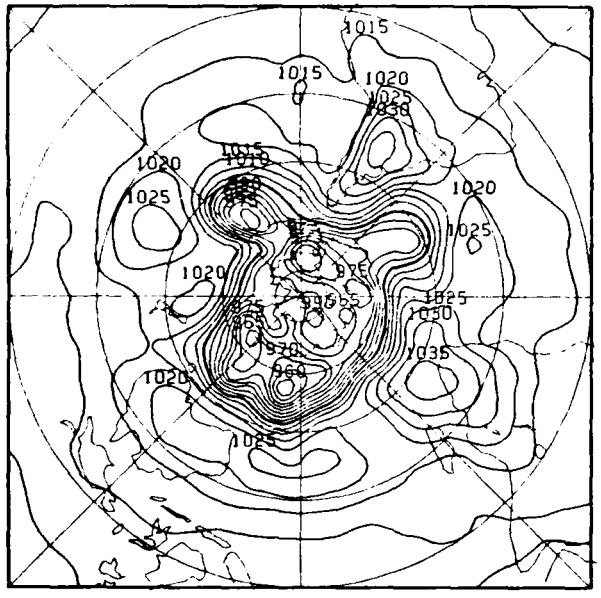


SLP

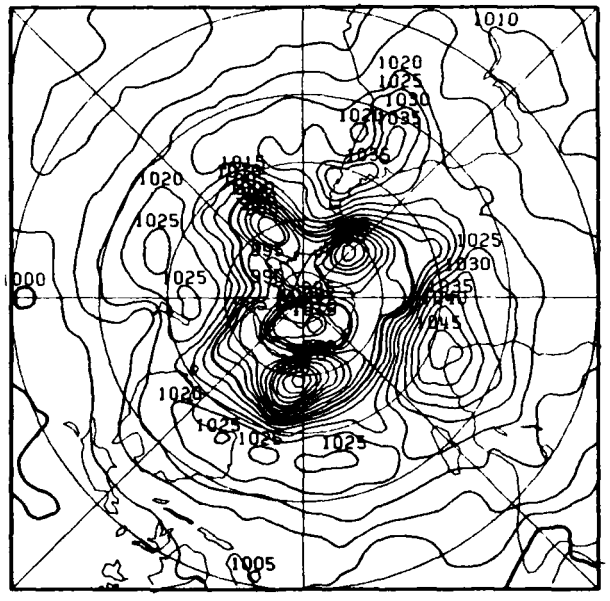
1200 GMT 14 JUN 1979

DAY 3

OBSERVED



9-LAYER 4X5



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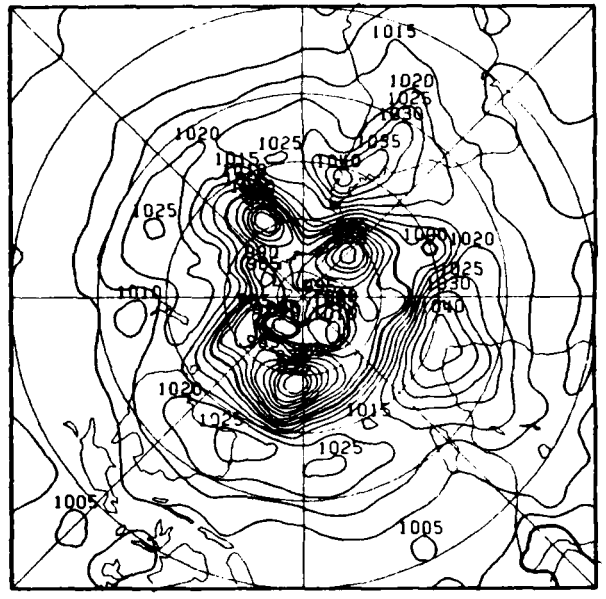
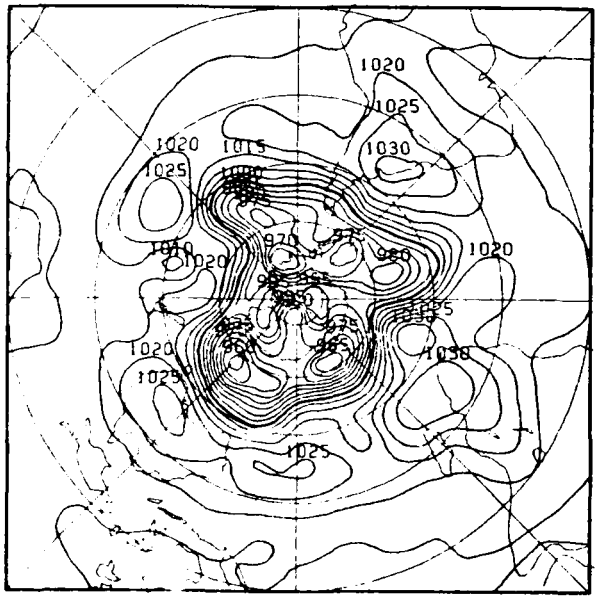


SLP

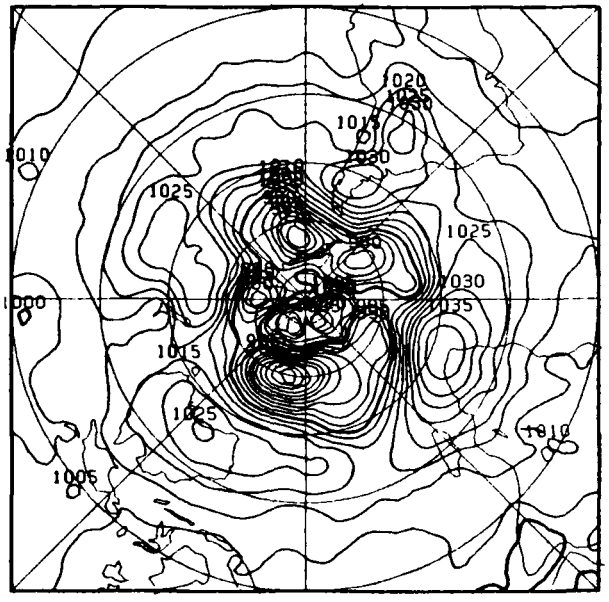
1200 GMT 15 JUN 1979

DAY 4

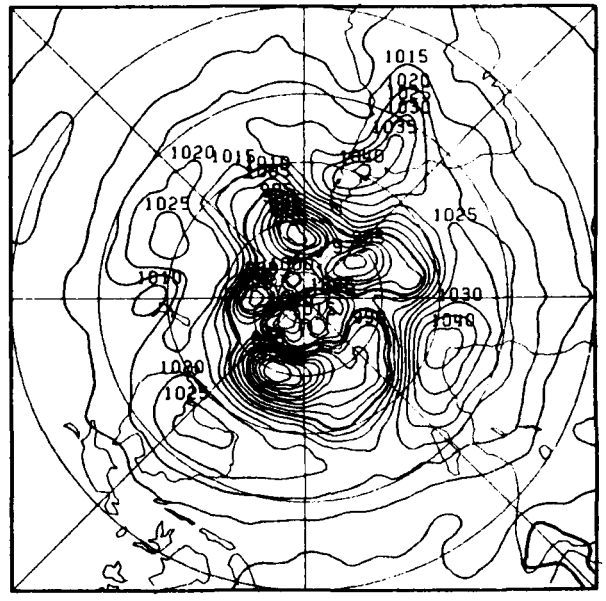
OBSERVED



9-LAYER 4X5



15-LAYER 4X5

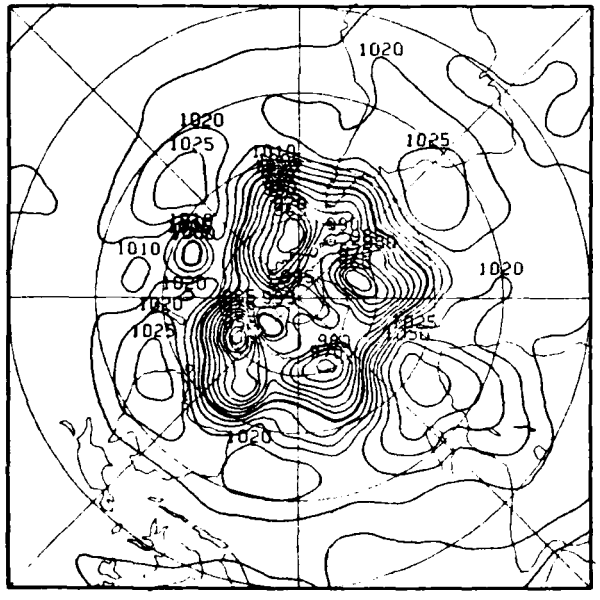


SLP

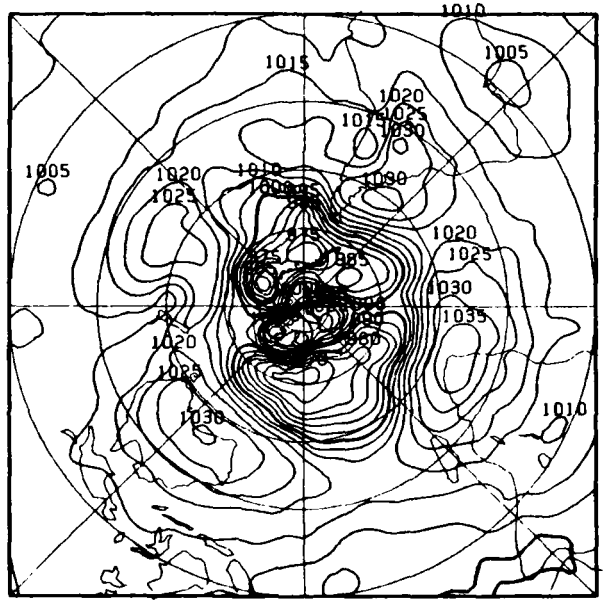
1200 GMT 16 JUN 1979

DAY 5

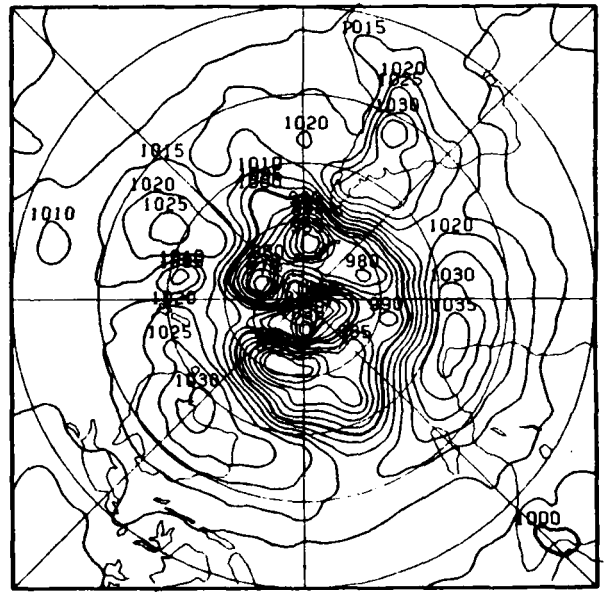
OBSERVED



9-LAYER 4X5



15-LAYER 4X5

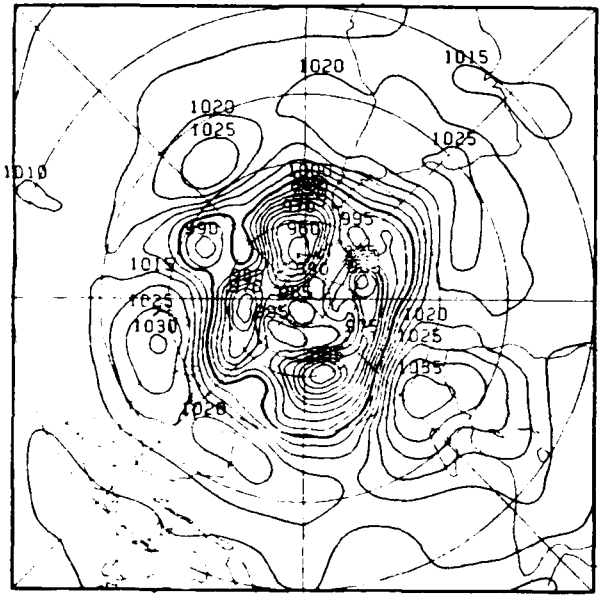


SLP

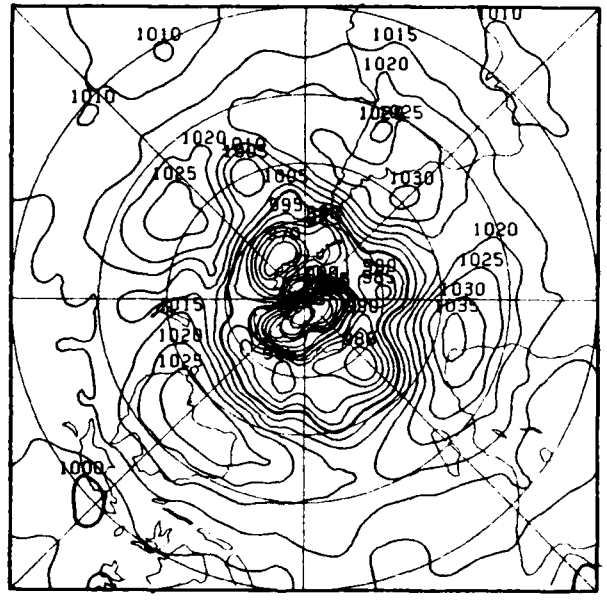
1200 GMT 17 JUN 1979

DAY 6

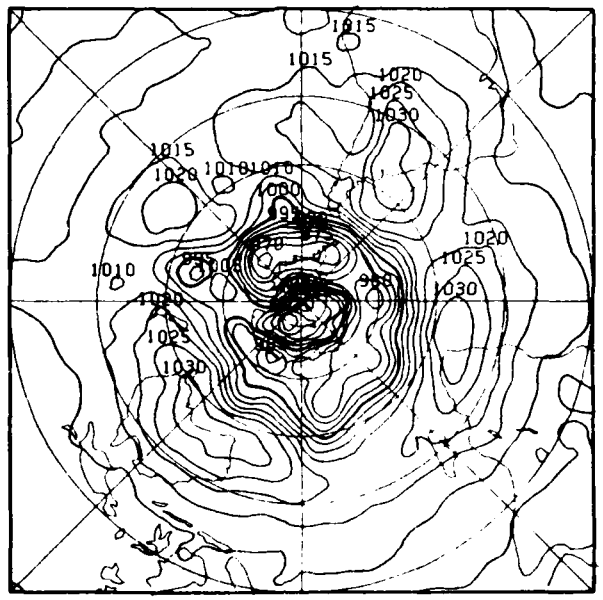
OBSERVED



9-LAYER 4X5



15-LAYER 4X5

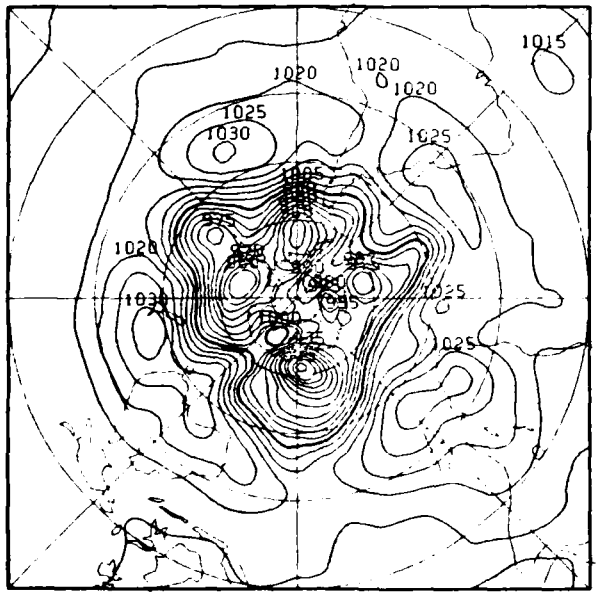


SLP

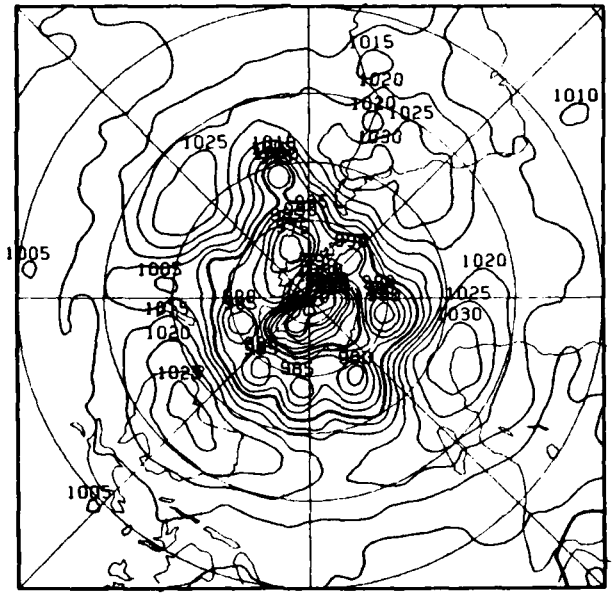
1200 GMT 18 JUN 1979

DAY 7

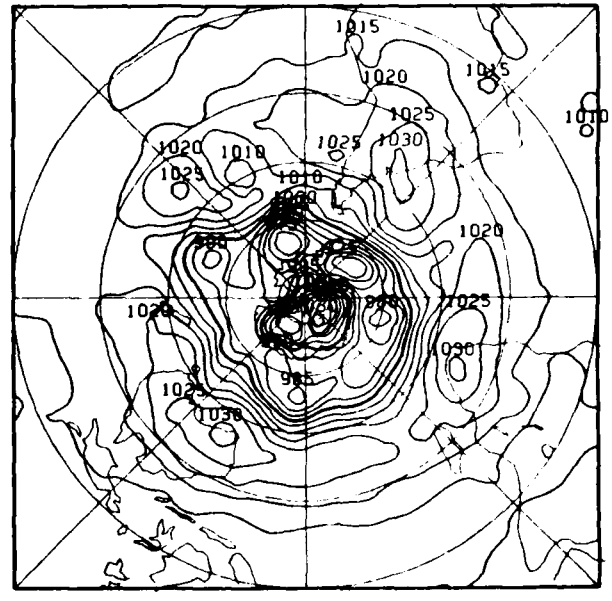
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



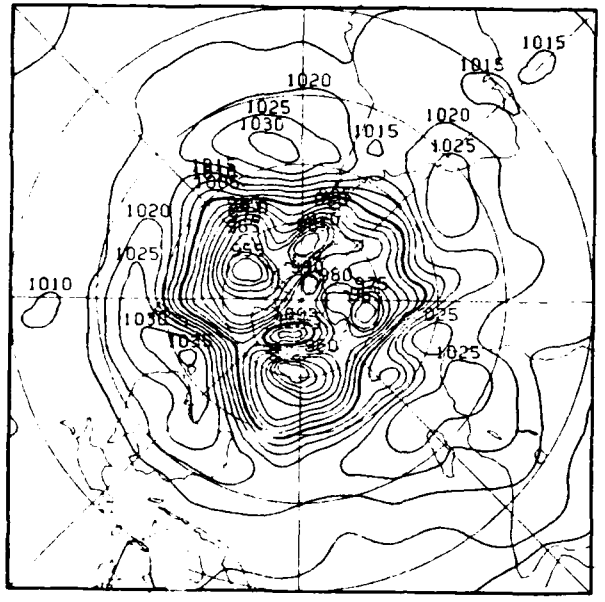
SLP

1200 GMT 19 JUN 1979

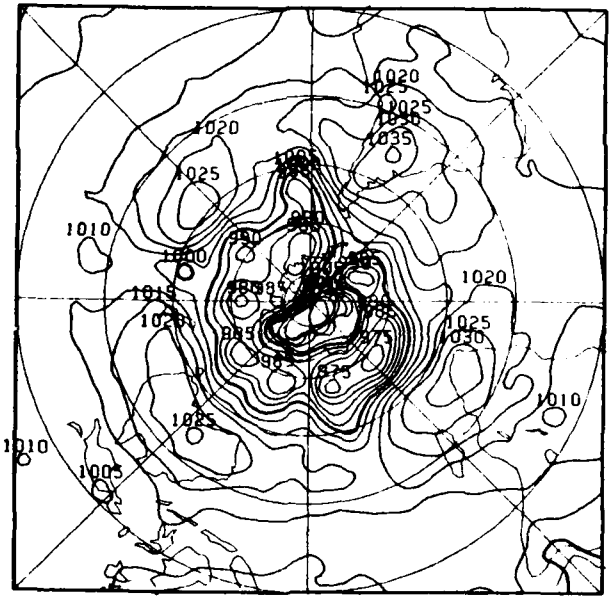
DAY 8

8-10

OBSERVED



9-LAYER 4X5



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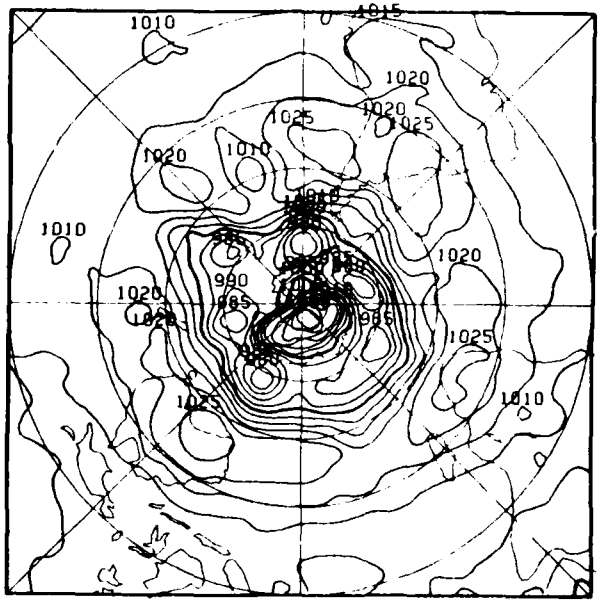


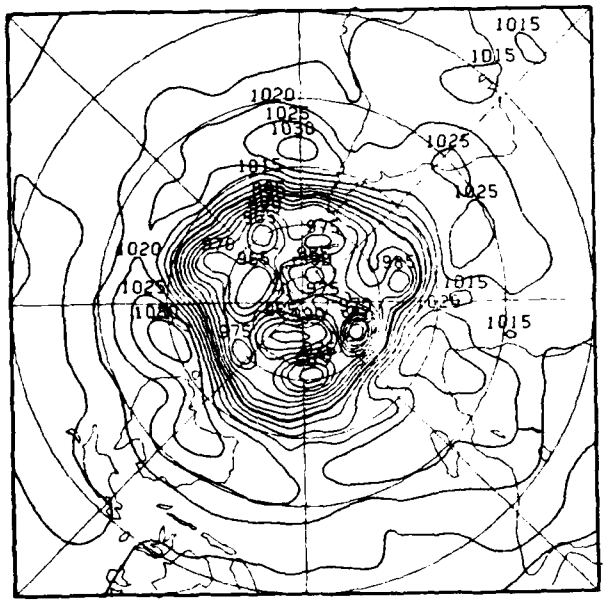
SLP

1200 GMT 20 JUN 1979

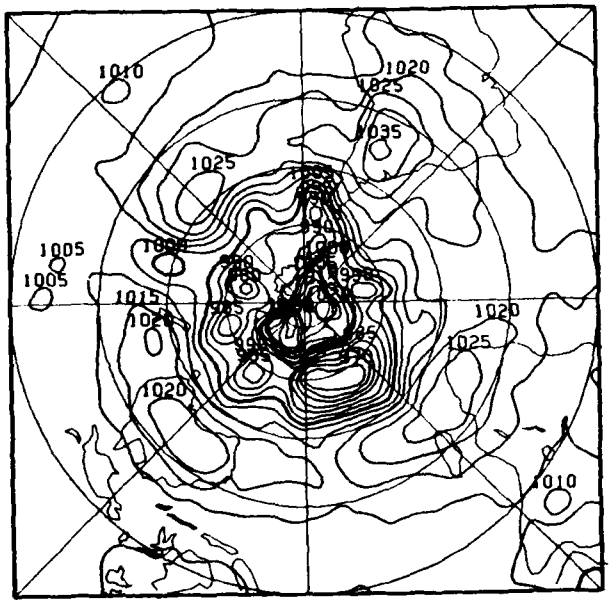
DAY 9

8-11

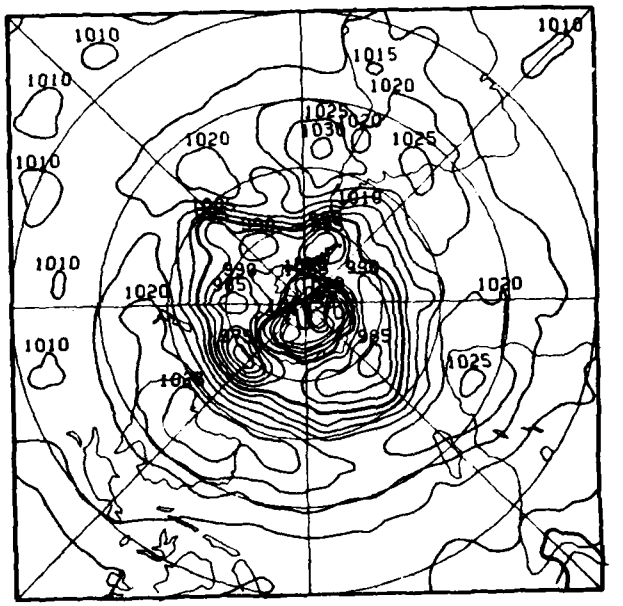
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



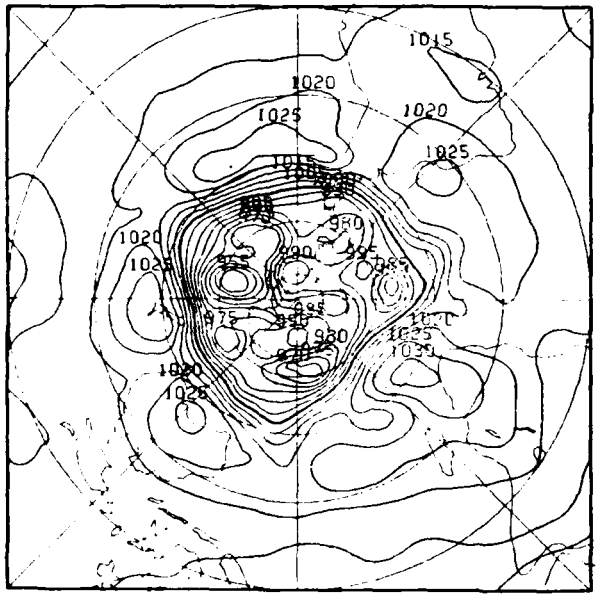
SLP

1200 GMT 21 JUN 1979

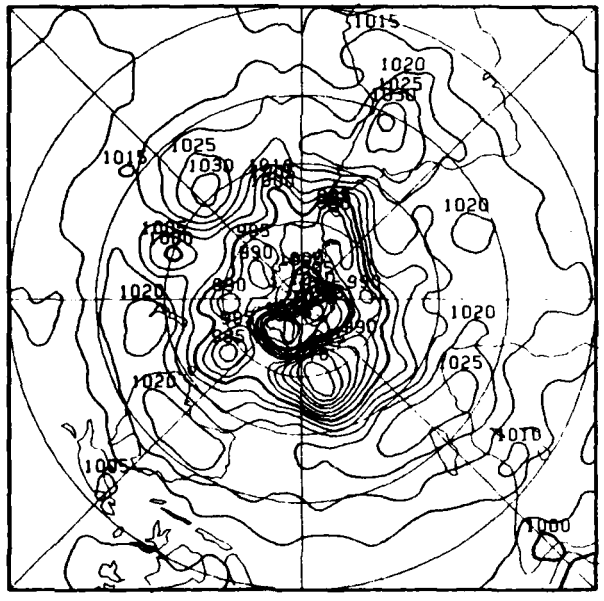
DAY 10

8-12

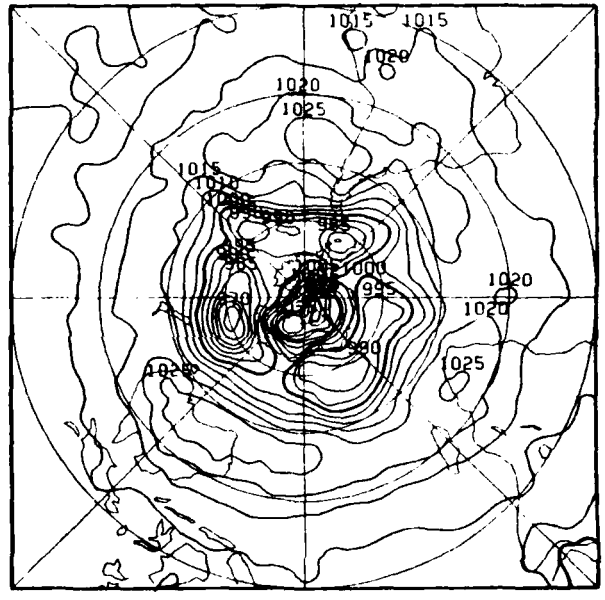
OBSERVED



9-LAYER 4X5



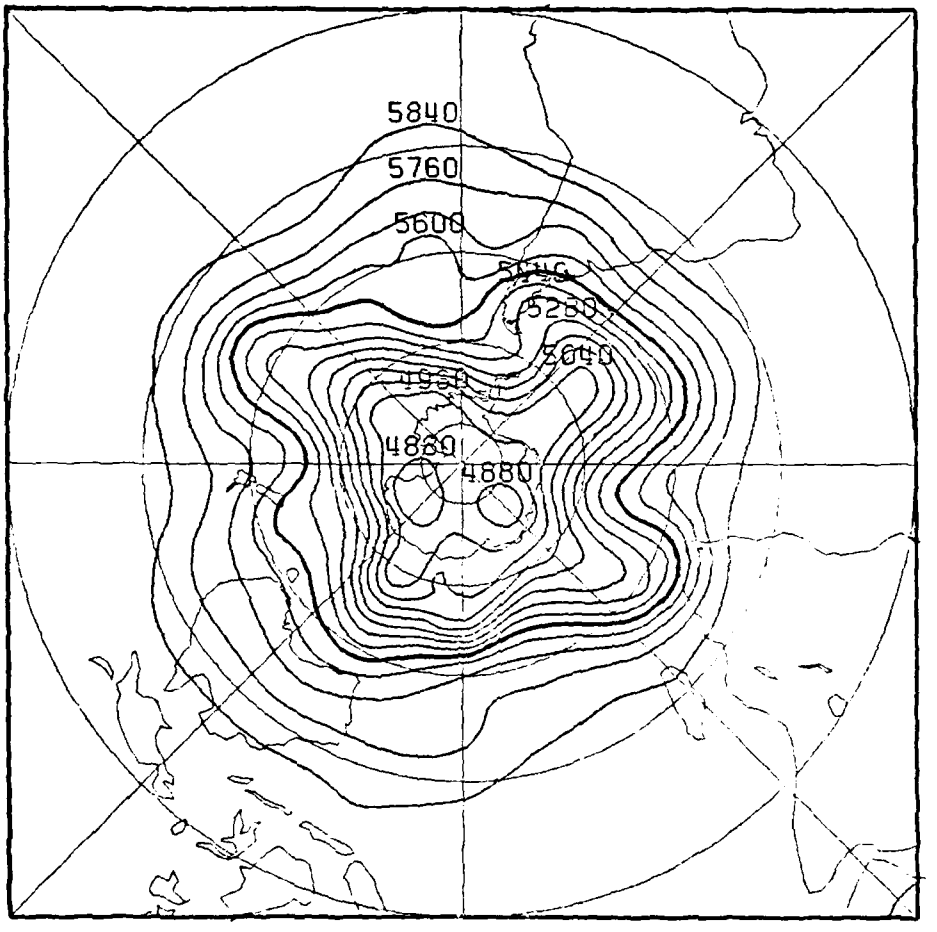
15-LAYER 4X5



500 mb Z

1200 GMT 11 JUN 1979

OBSERVED



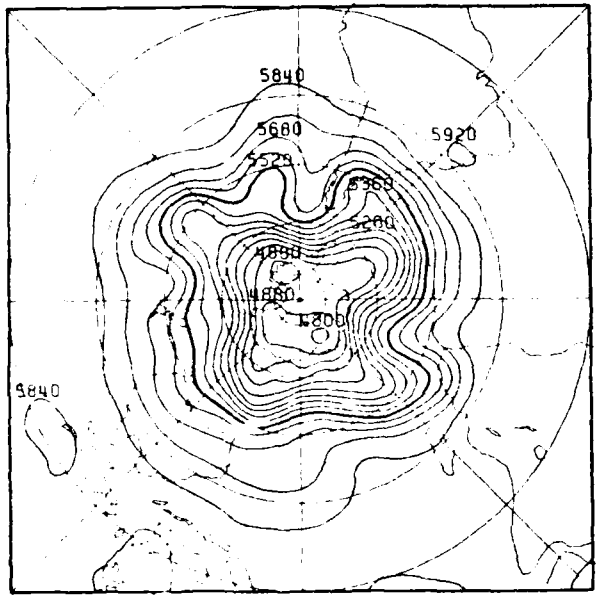
500 mb Z

1200 GMT 12 JUN 1979

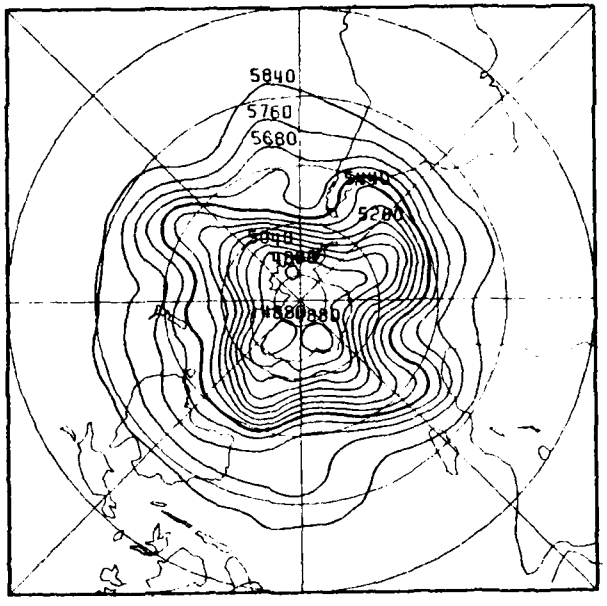
DAY 1

8-14

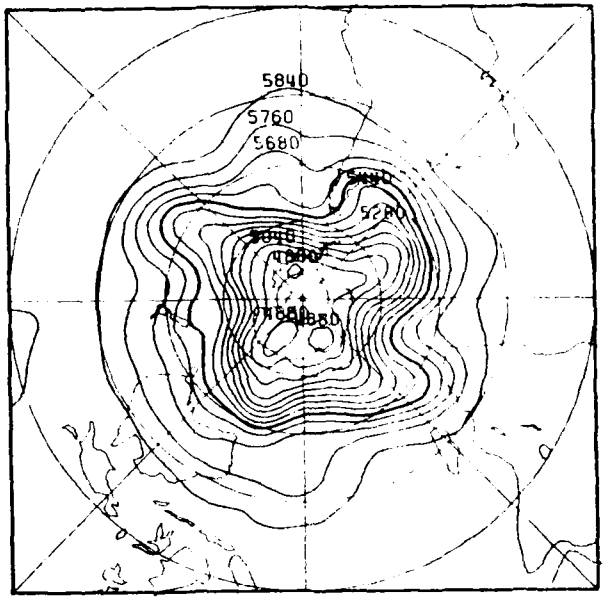
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



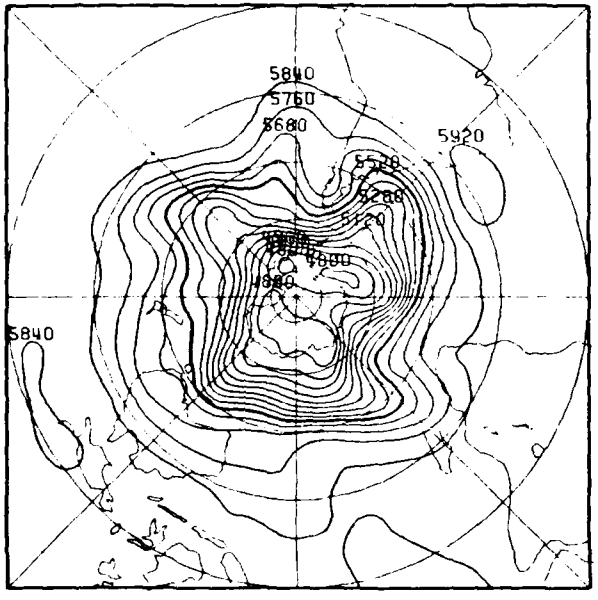
500 mb Z

1200 GMT 13 JUN 1979

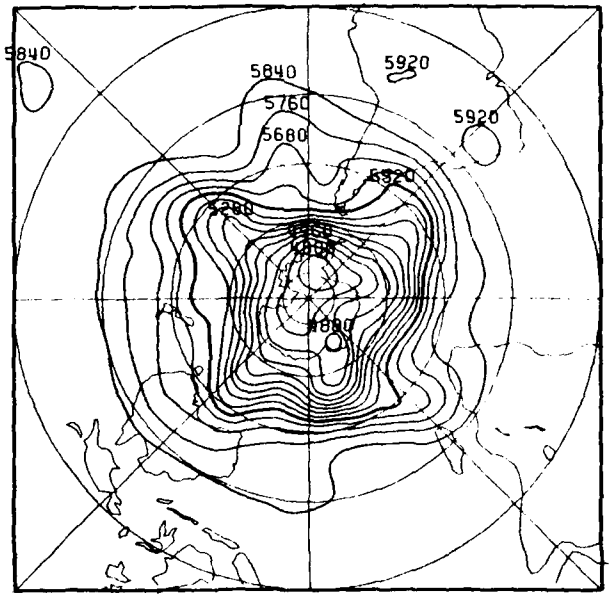
DAY 2

8-15

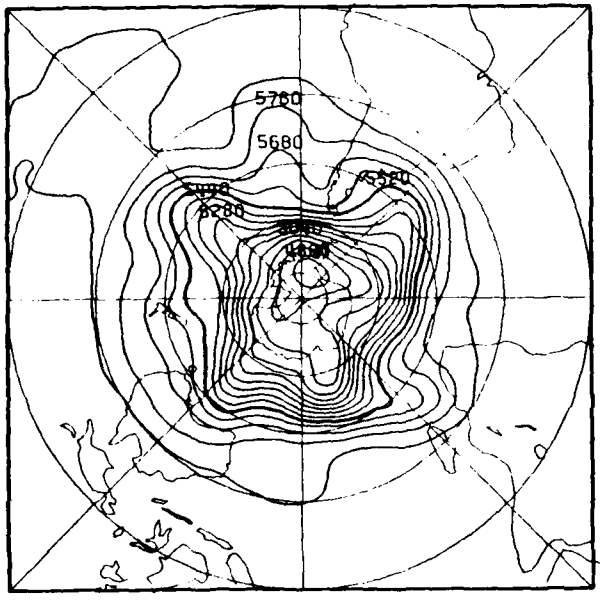
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



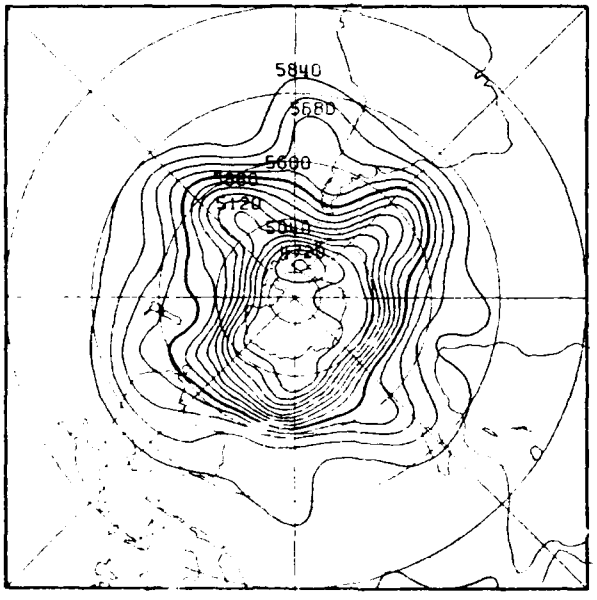
500 mb Z

1200 GMT 14 JUN 1979

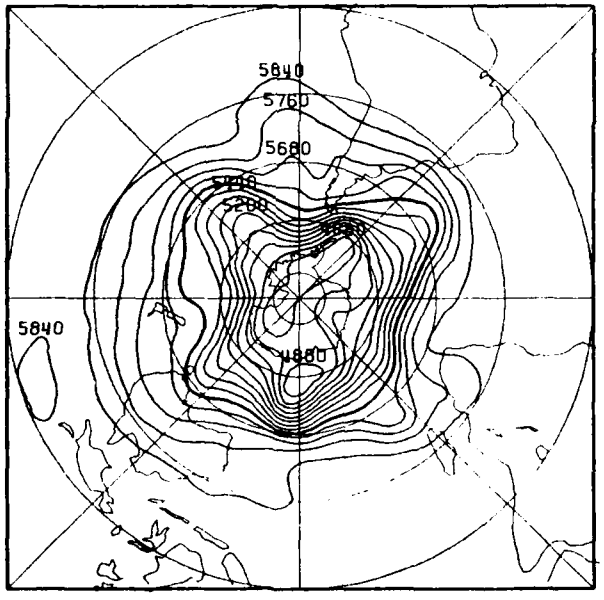
DAY 3

8-16

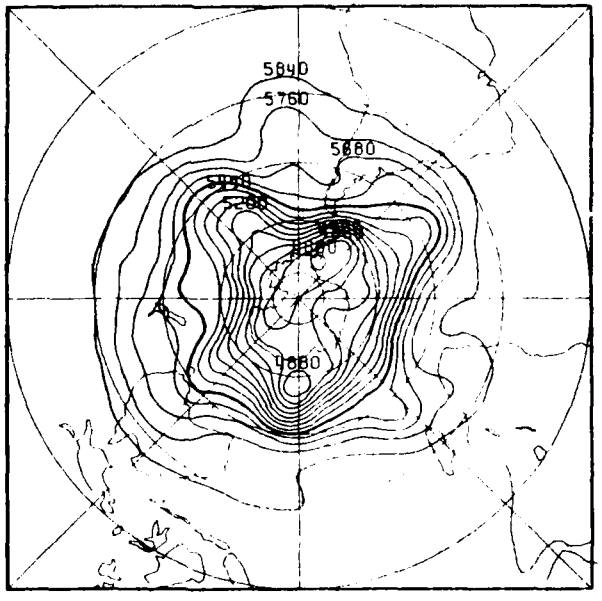
OBSERVED



9-LAYER 4X5



15-LAYER 4X5

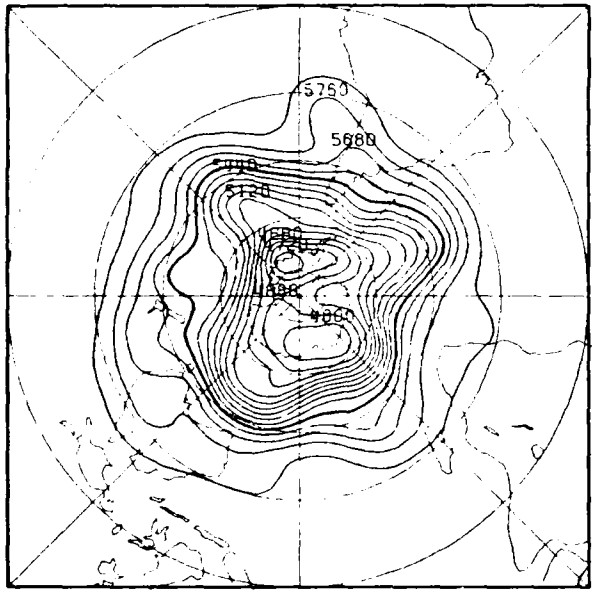


500 mb Z

1200 GMT 15 JUN 1979

DAY 4

OBSERVED



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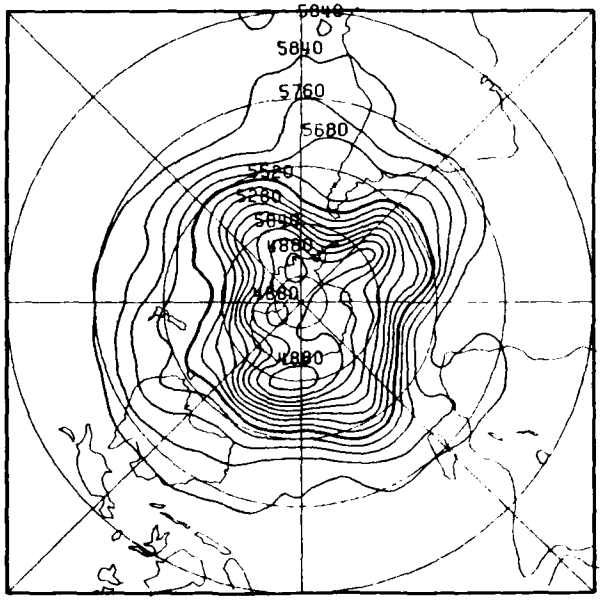

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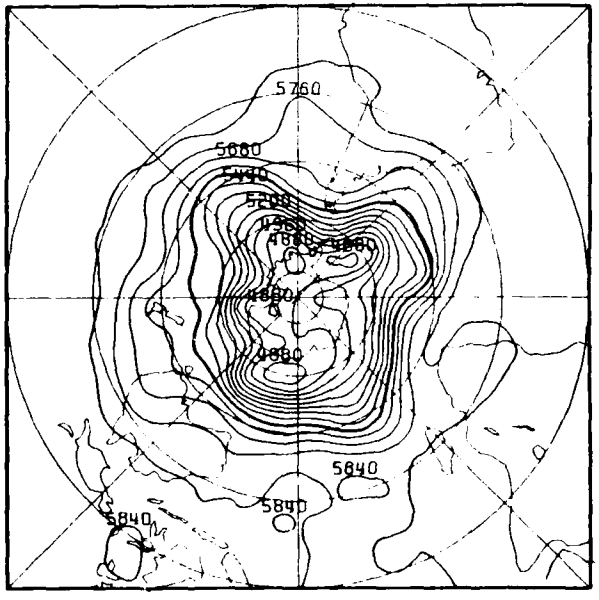

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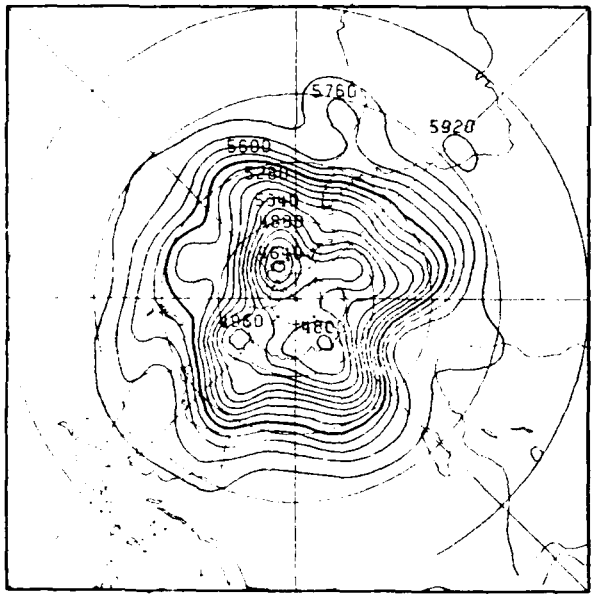
1200 GMT 16 JUN 1979

DAY 5

OBSERVED



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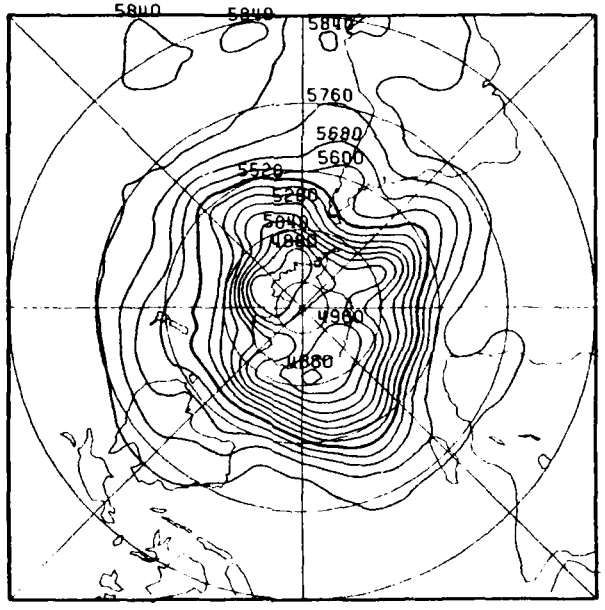

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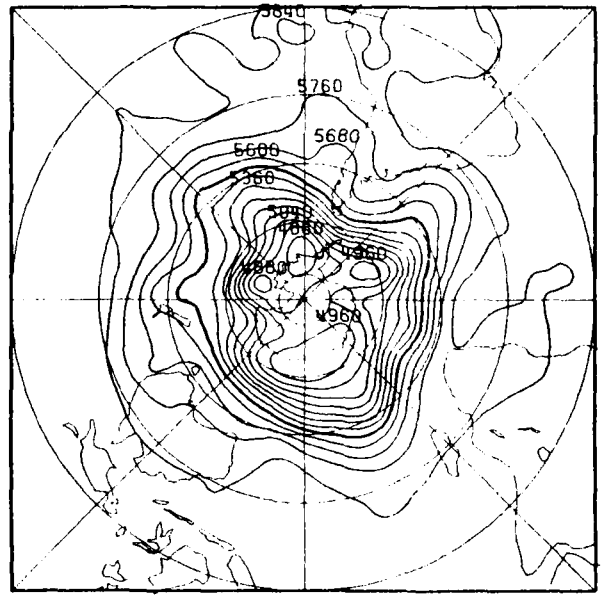


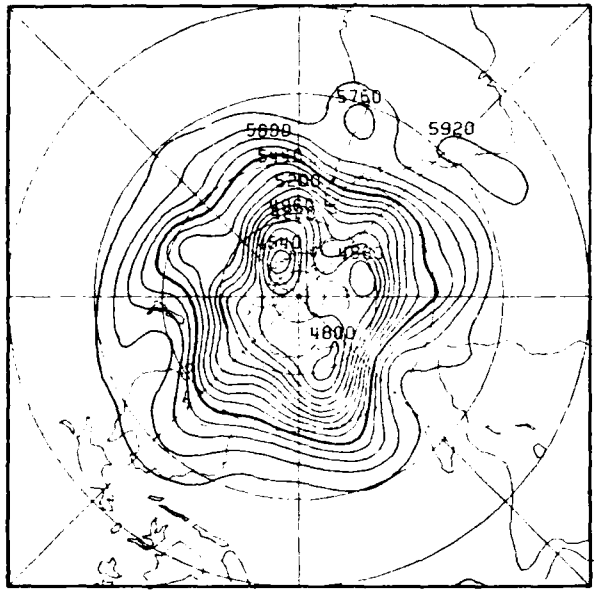
500 mb Z

1200 GMT 17 JUN 1979

DAY 6

8-19

OBSERVED



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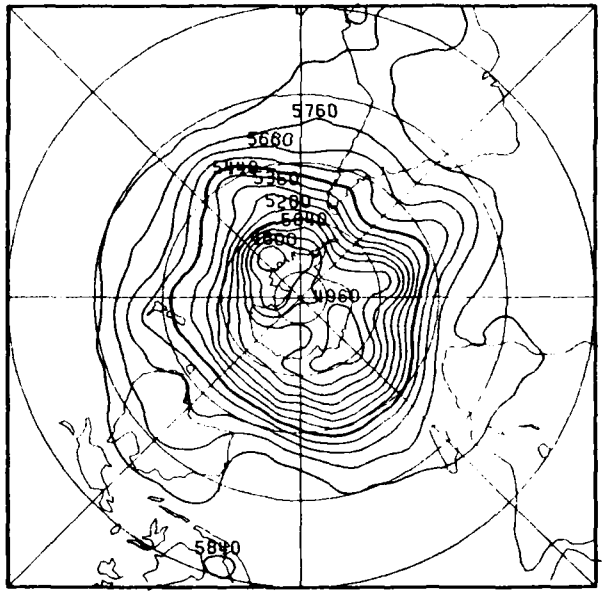

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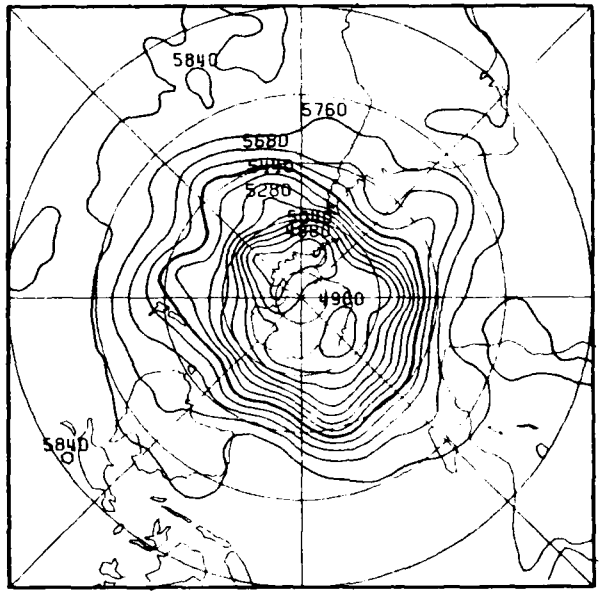
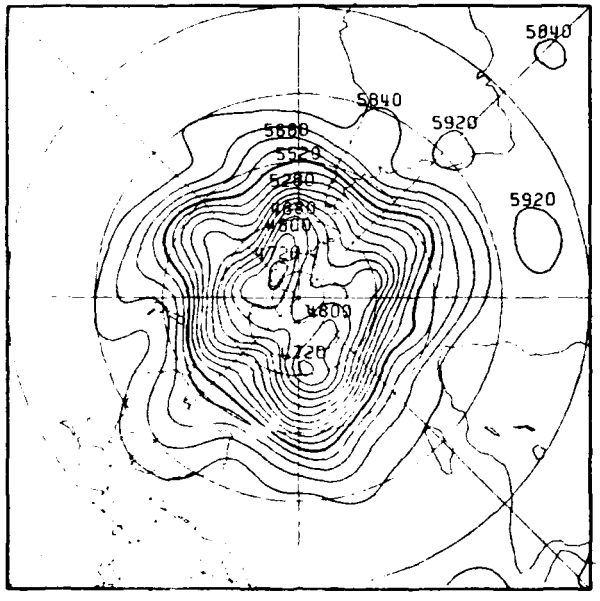


500 mb Z

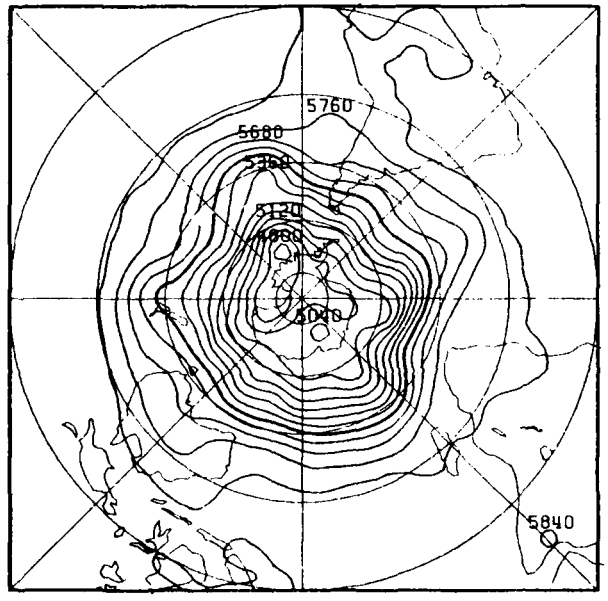
1200 GMT 18 JUN 1979

DAY 7

OBSERVED



9-LAYER 4X5



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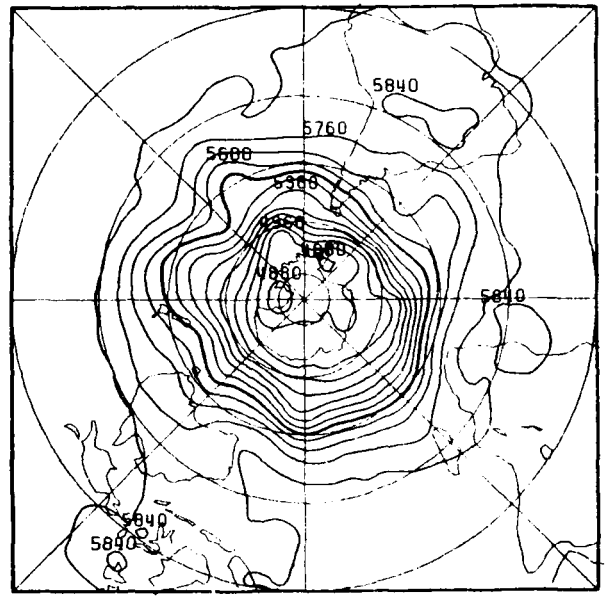


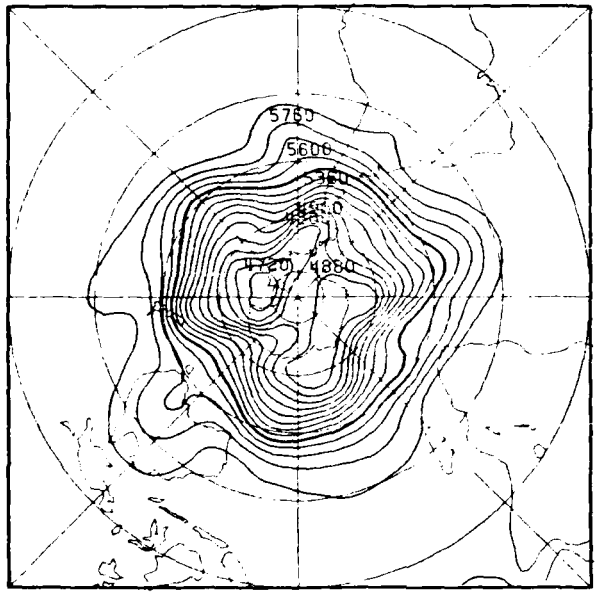
500 mb Z

1200 GMT 19 JUN 1979

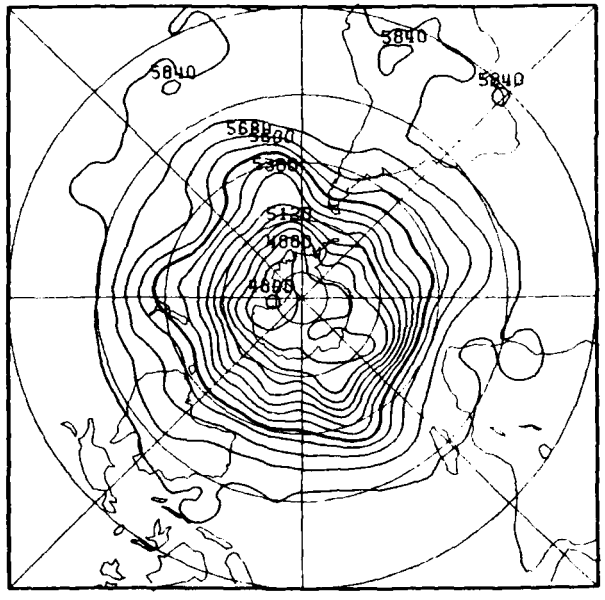
DAY 8

8-21

OBSERVED



9-LAYER 4X5



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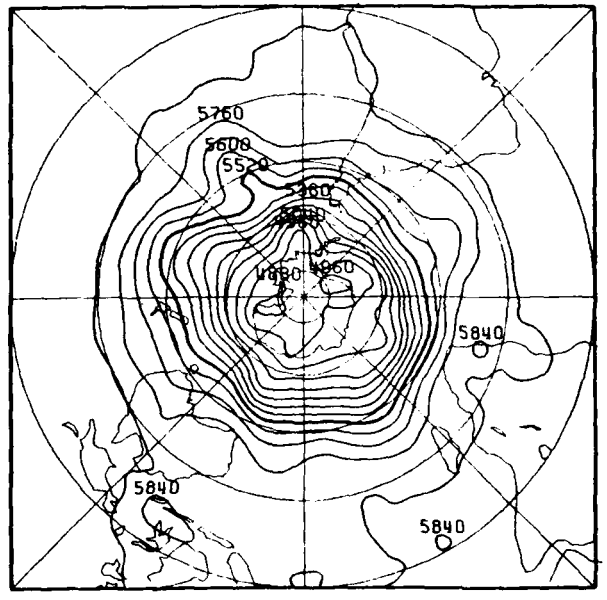
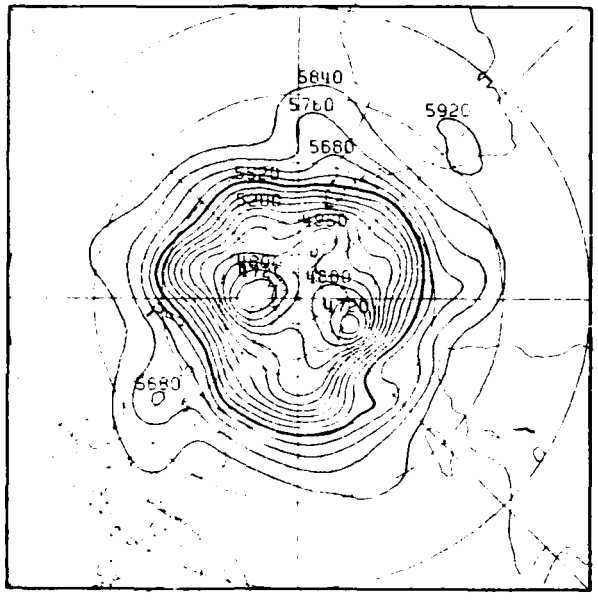


500 mb Z

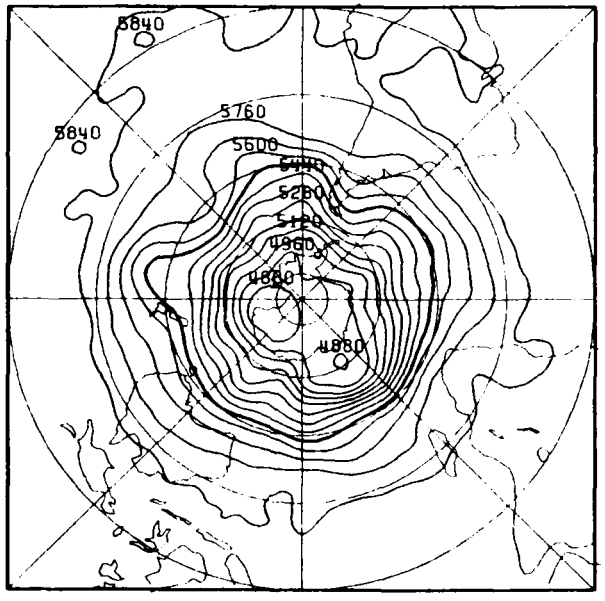
1200 GMT 20 JUN 1979

DAY 9

OBSERVED



9-LAYER 4X5



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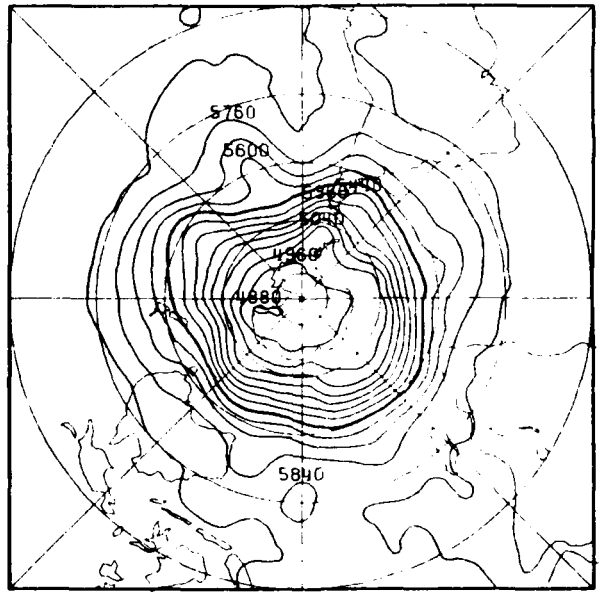


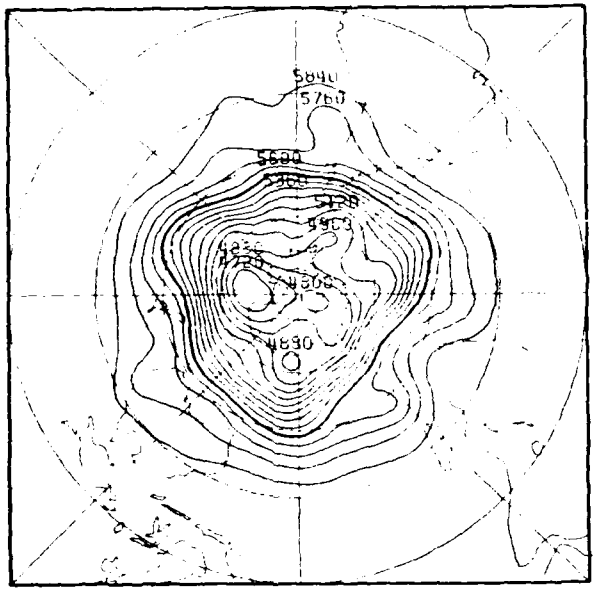
500 mb Z

1200 GMT 21 JUN 1979

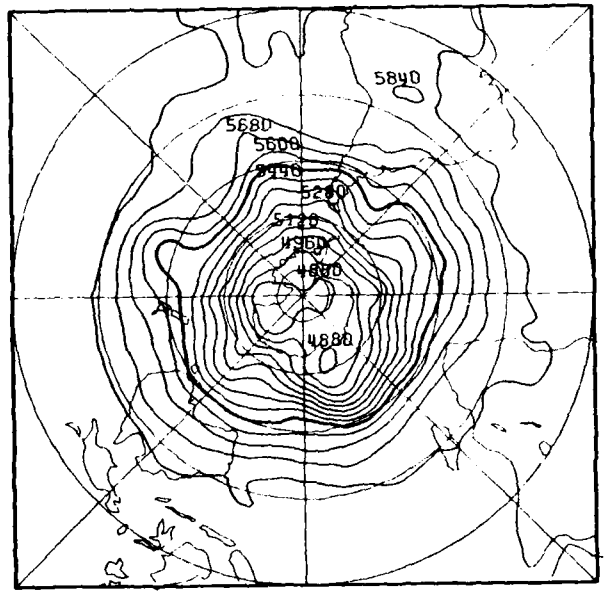
DAY 10

8-23

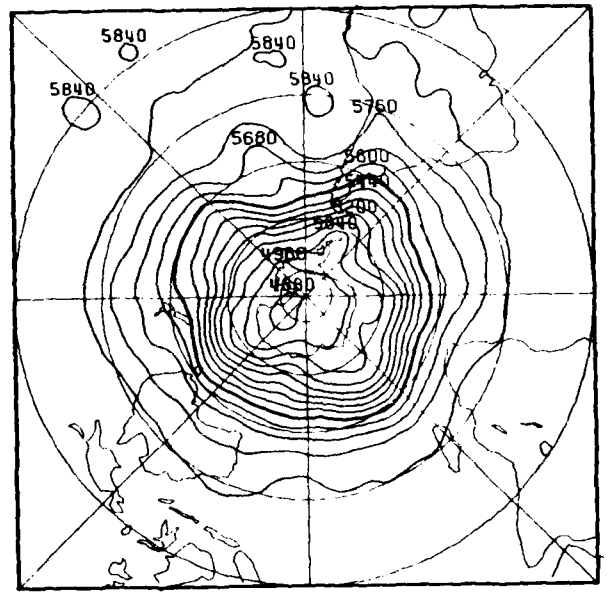
OBSERVED



9-LAYER 4X5



15-LAYER 4X5

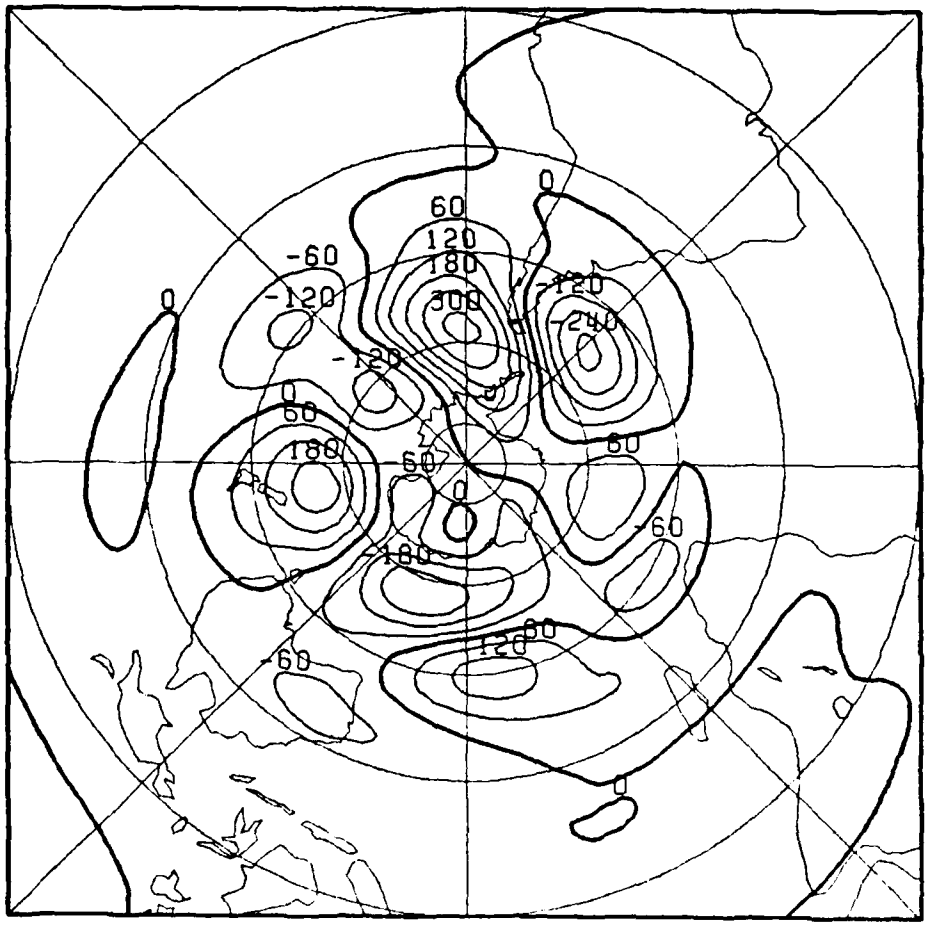


500 mb Z

WAVENUMBER S 1-4

1200 GMT 11 JUN 1979

OBSERVED



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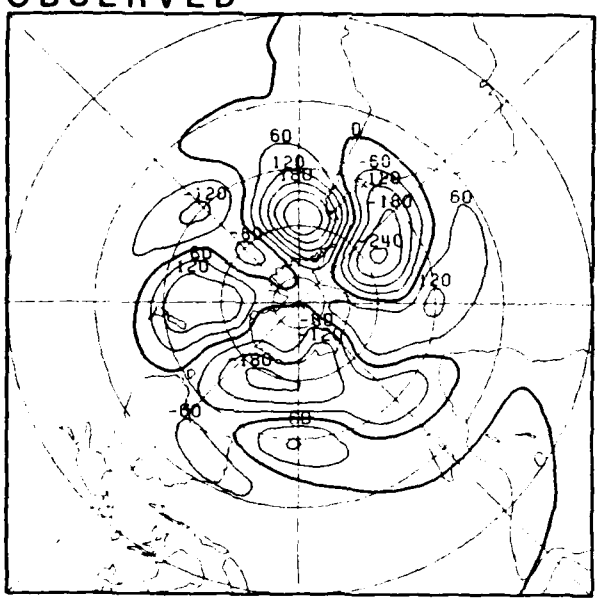
WAVENUMBERS 1-4

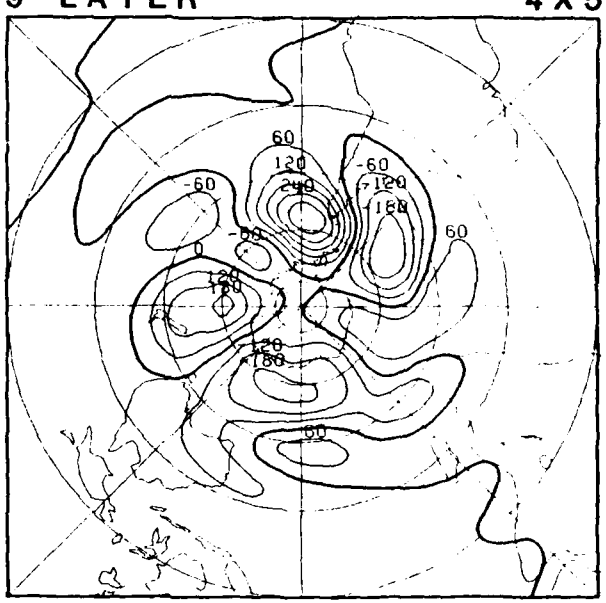
1200 GMT 12 JUN 1979

DAY 1

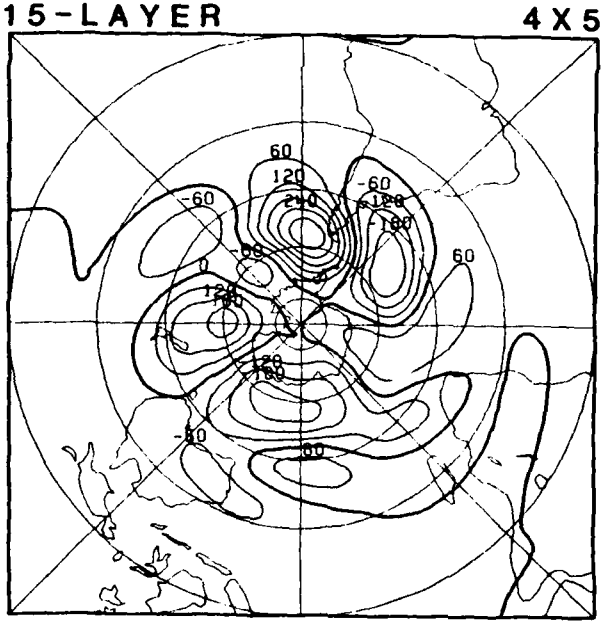
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



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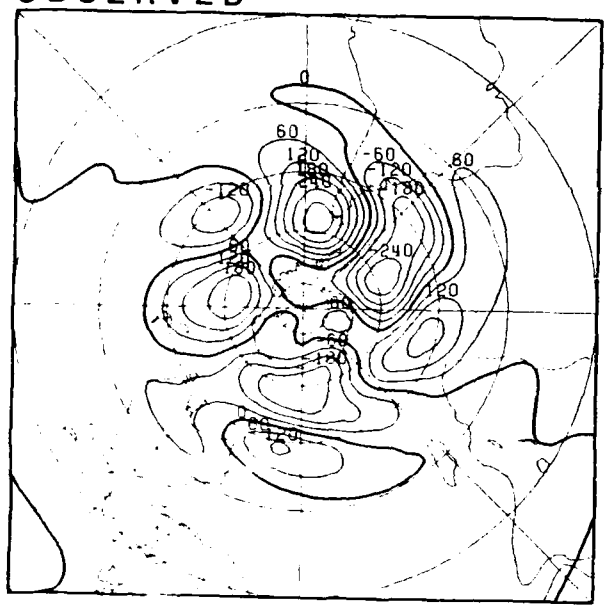
WAVENUMBERS 1-4

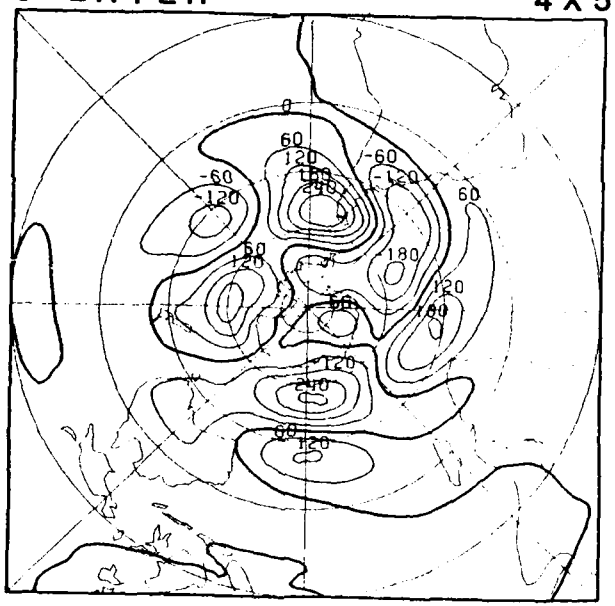
13 JUNE 1979 12 GMT

DAY 2

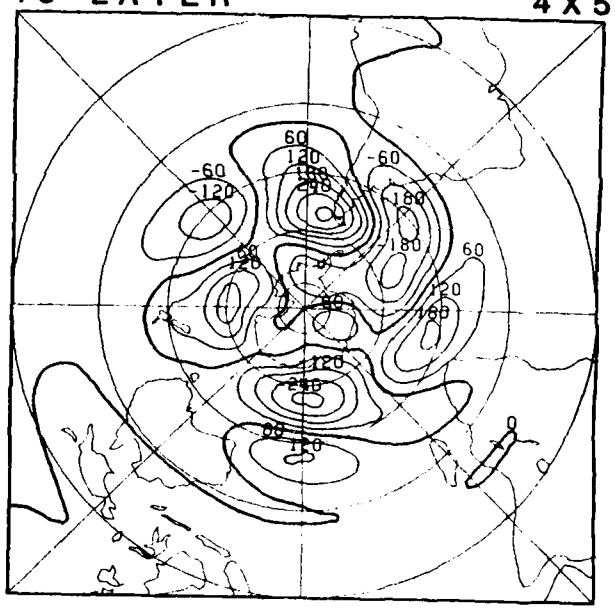
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



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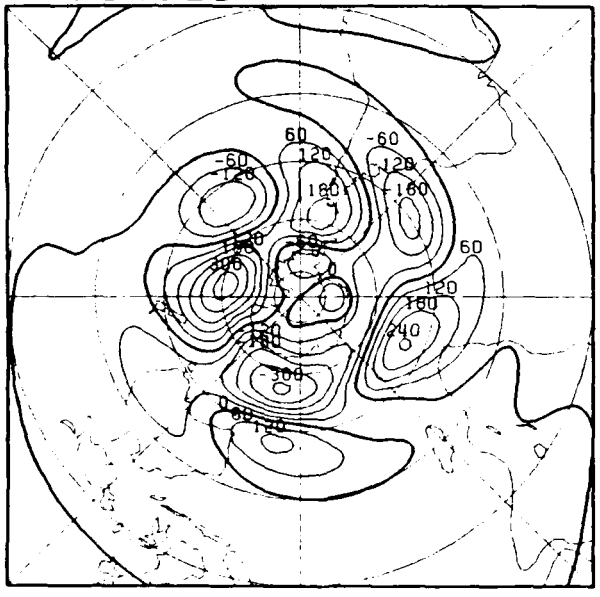
WAVENUMBERS 1-4

14 JUNE 1979 12 GMT

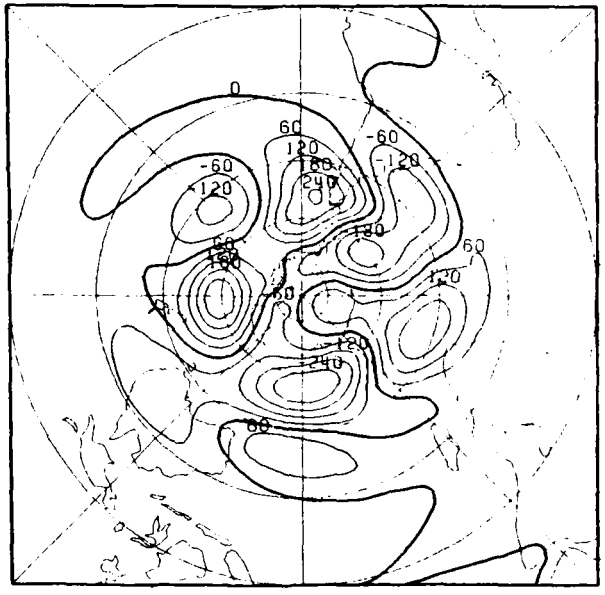
DAY 3

8-27

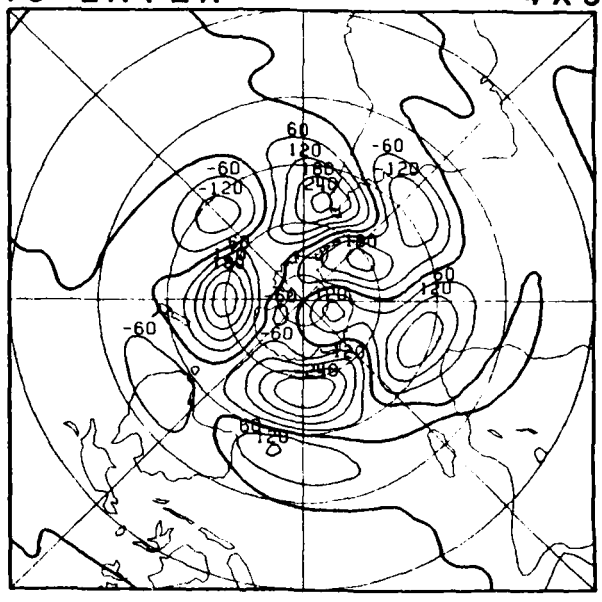
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



500 mb Z

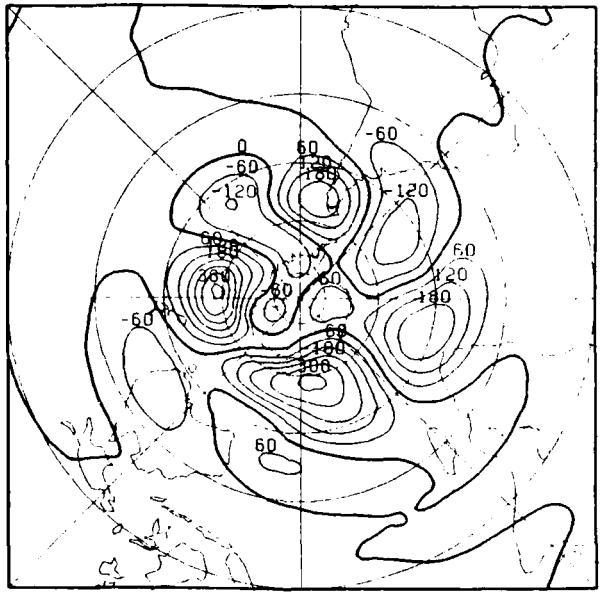
WAVENUMBERS 1-4

15 JUNE 1979 12 GMT

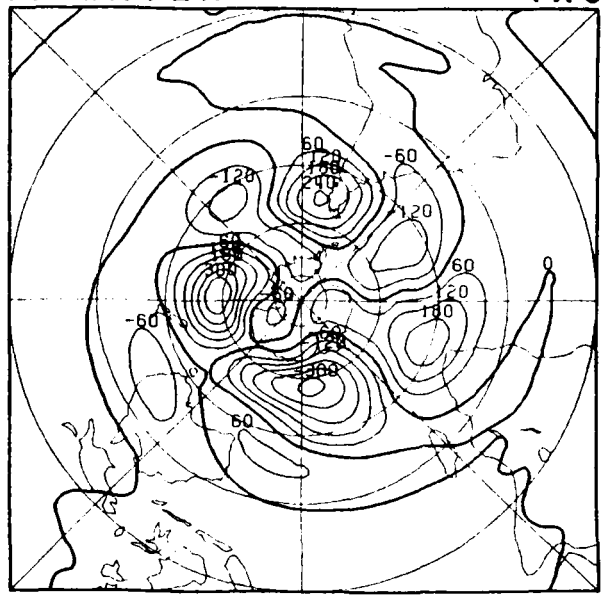
DAY 4

OBSERVED

9-LAYER 4X5



15-LAYER 4X5



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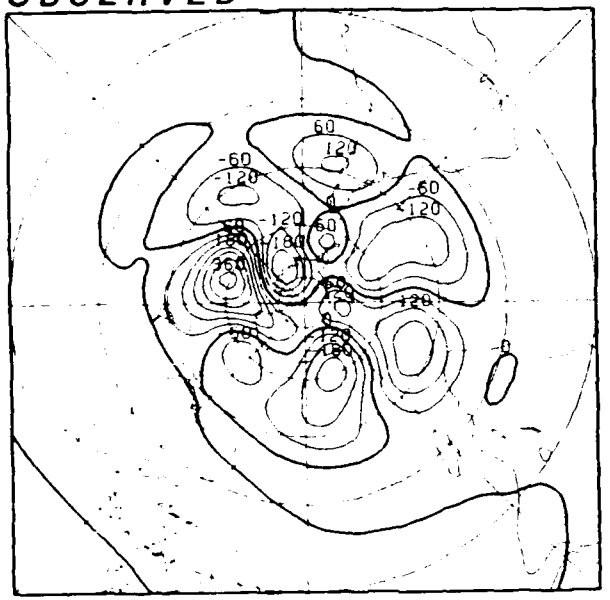
WAVENUMBERS 1-4

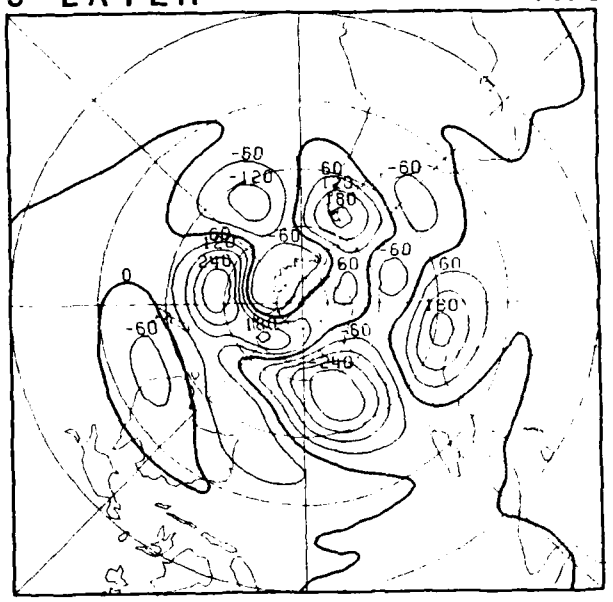
16 JUNE 1979 12 GMT

DAY 5

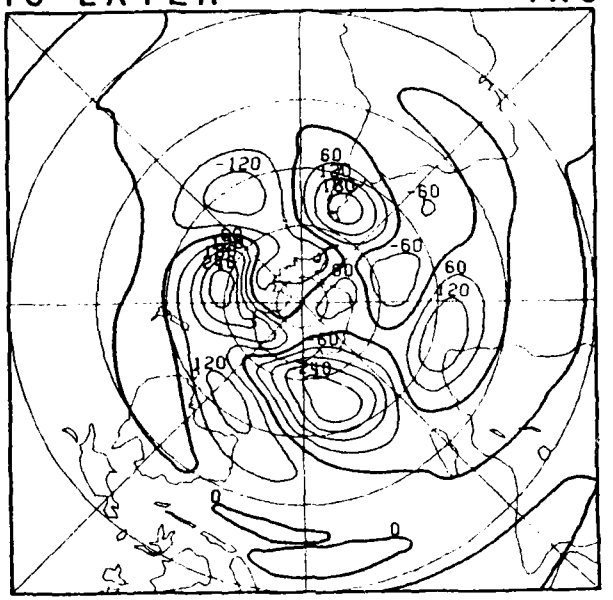
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



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WAVENUMBERS 1-4

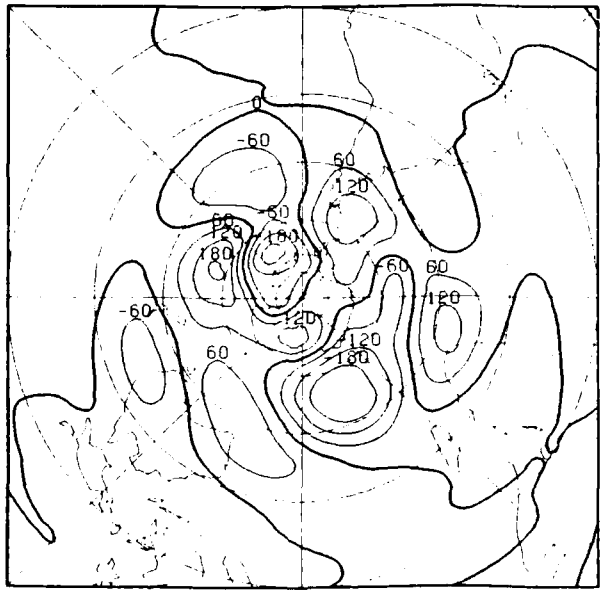
17 JUNE 1979 12 GMT

DAY 6

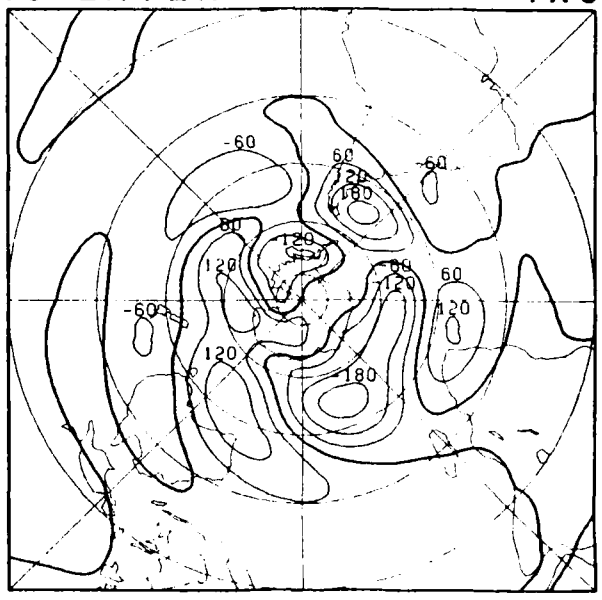
8-30

OBSERVED

9-LAYER 4X5



15-LAYER 4X5



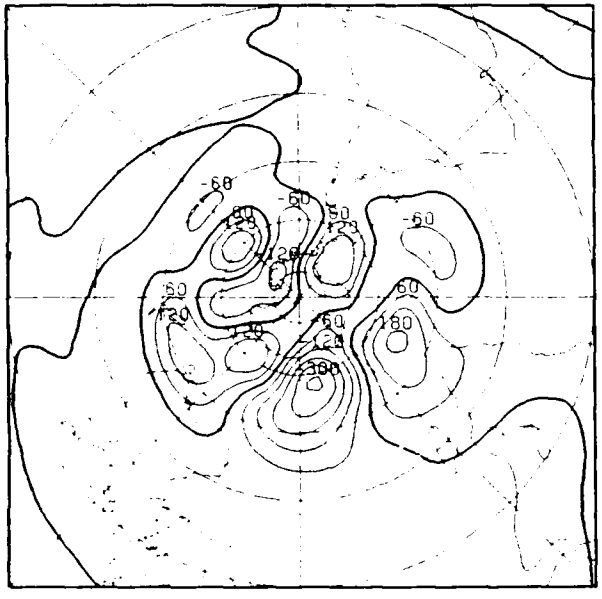
500 mb Z

WAVENUMBERS 1-4

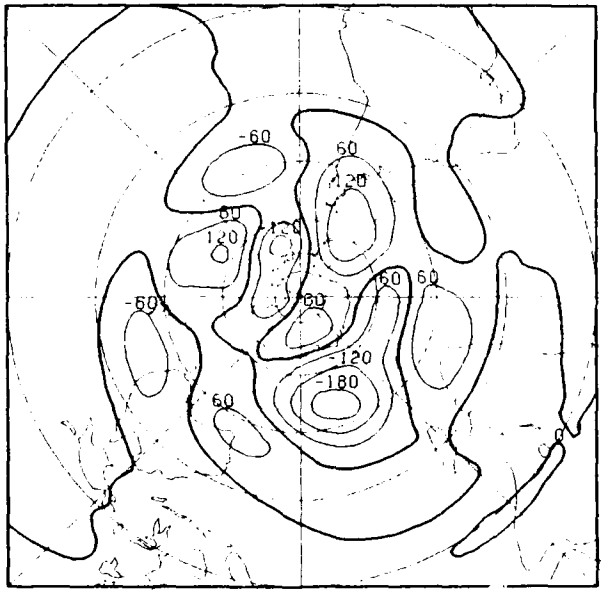
18 JUNE 1979 12 GMT

DAY 7

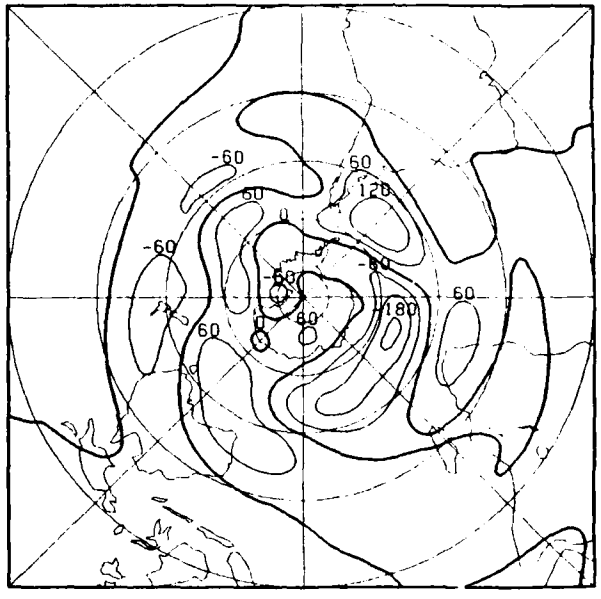
OBSERVED



9-LAYER 4X5

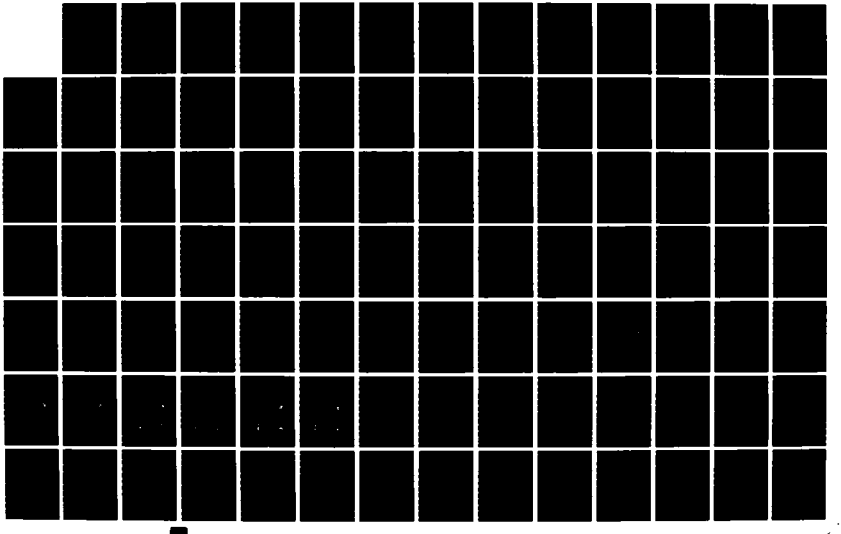


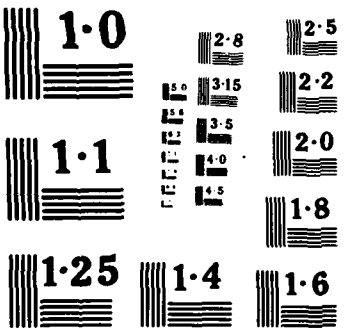
15-LAYER 4X5



AD-A170 188 MEDIUM RANGE (10 DAY) FORECASTS WITH THE UCLA GENERAL CIRCULATION MODEL.. (U) CALIFORNIA UNIV LOS ANGELES DEPT OF ATMOSPHERIC SCIENCES C R MECHOSO ET AL. JAN 86 4/5

UNCLASSIFIED NEPRF-CR-86-01 N00014-80-K-0947 F/G 4/2 NL




1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
2·5
2·2
2·0
1·8
1·4
1·6

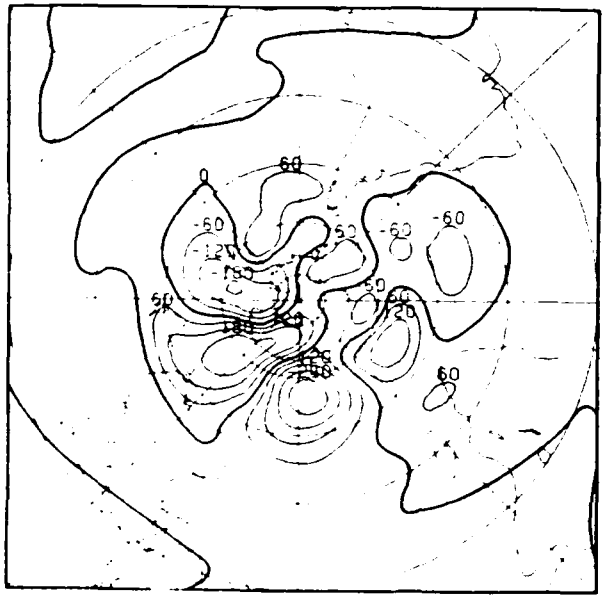
500 mb Z

WAVENUMBERS 1-4

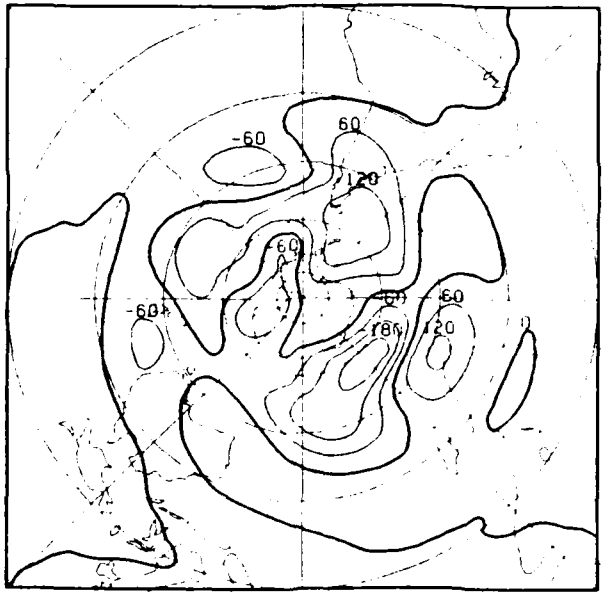
19 JUNE 1979 12 GMT

DAY 8

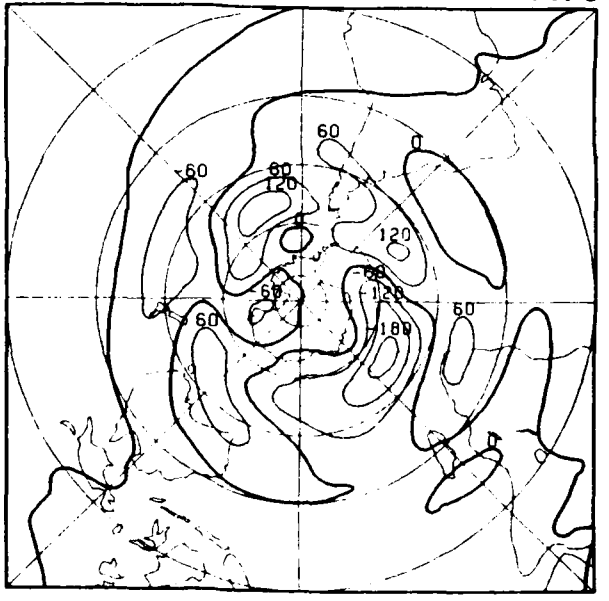
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



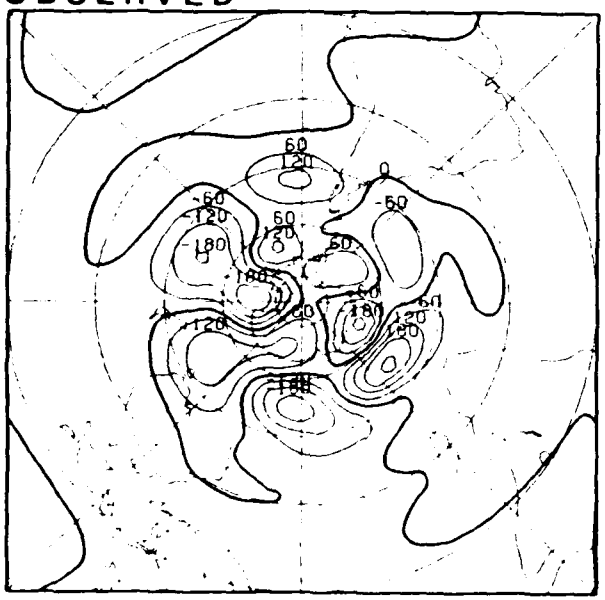
500 mb Z

WAVENUMBERS 1-4

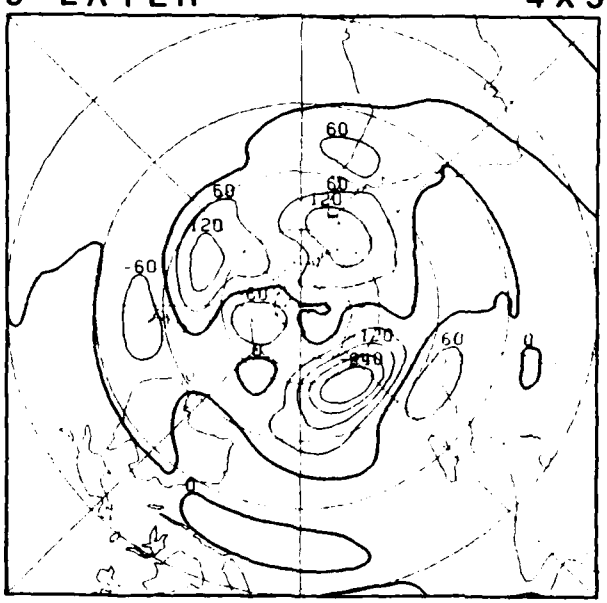
20 JUNE 1979 12 GMT

DAY 9

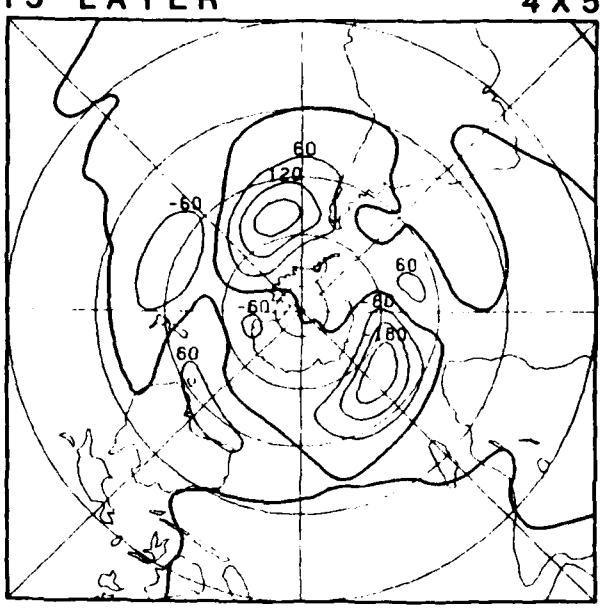
OBSERVED



9-LAYER 4X5



15-LAYER 4X5



500 mb Z

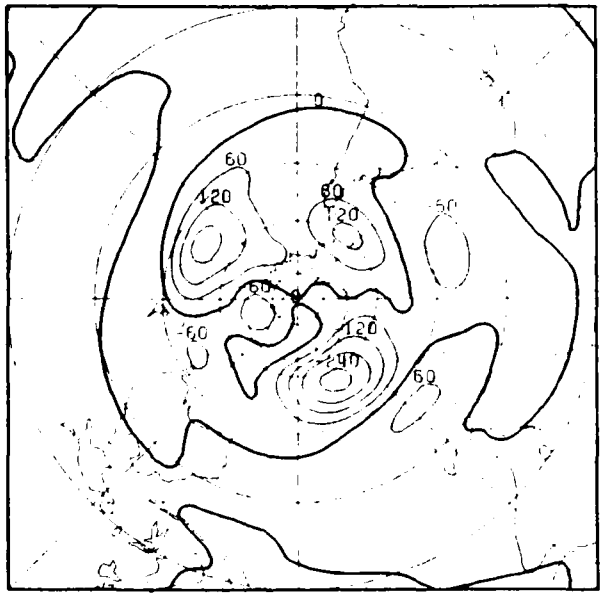
WAVENUMBERS 1-4

21 JUNE 1979 12 GMT

DAY 10

OBSERVED

9-LAYER 4X5



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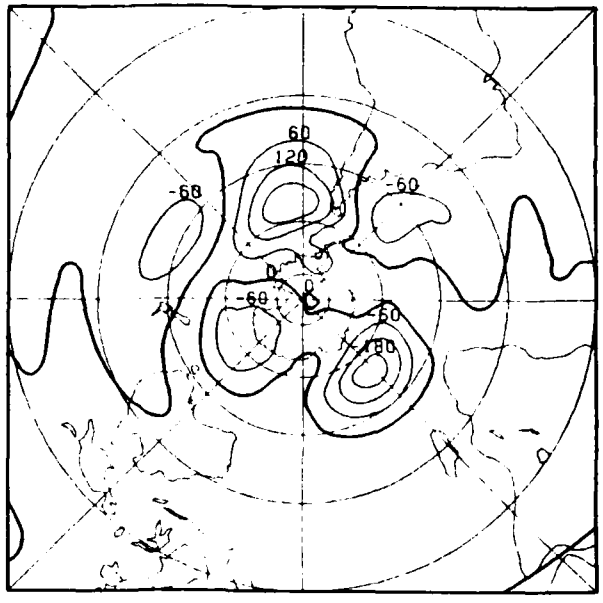
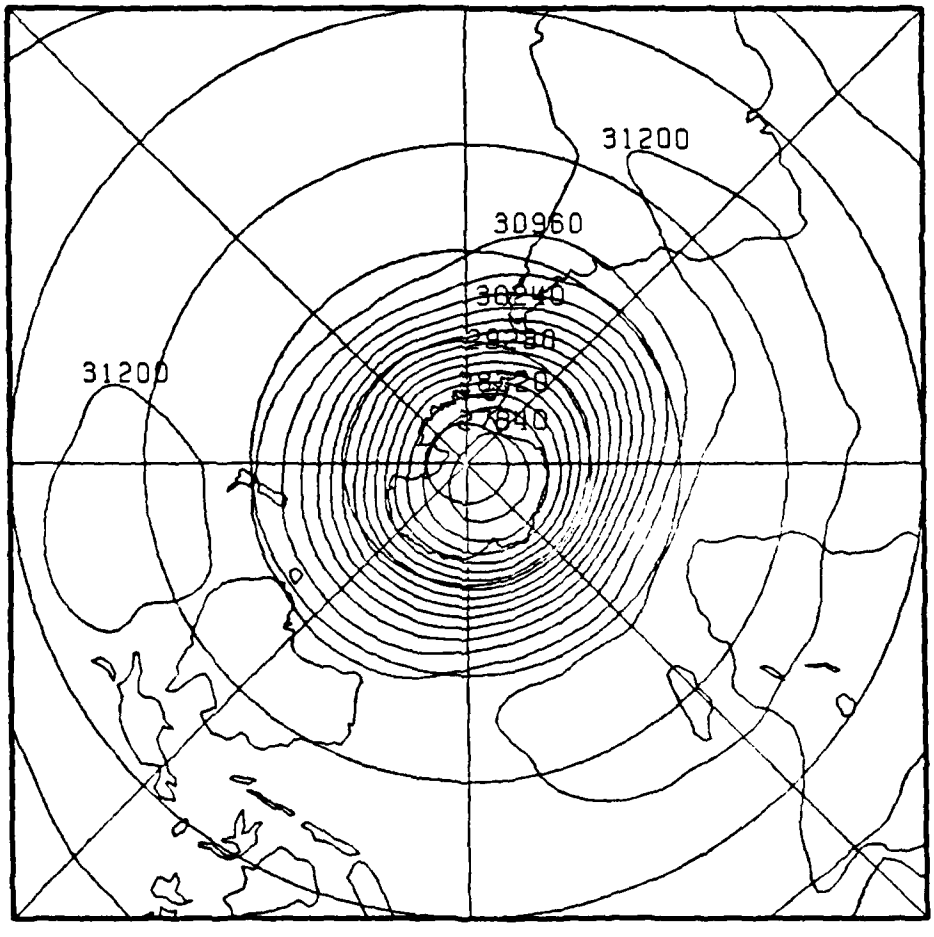


10 mb Z

1200 GMT 11 JUN 1979

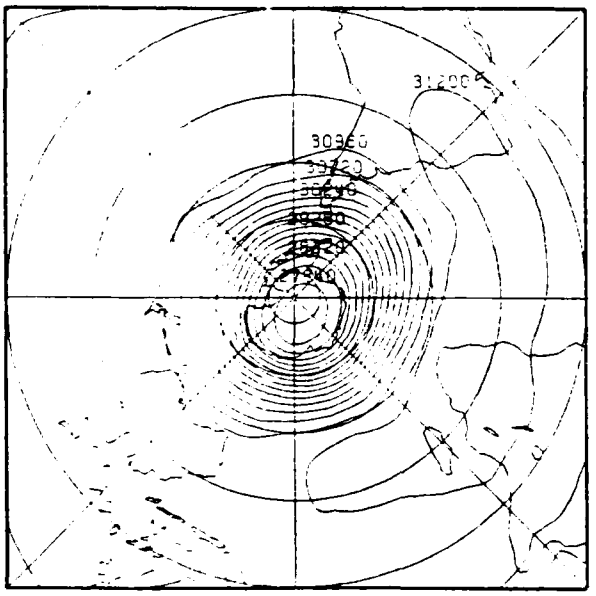
OBSERVED



10 mb Z

1200 GMT 12 JUN 1979 DAY 1

OBSERVED



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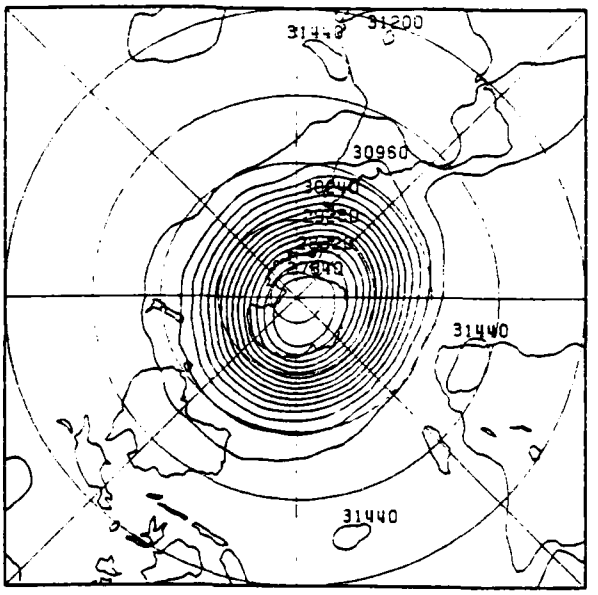
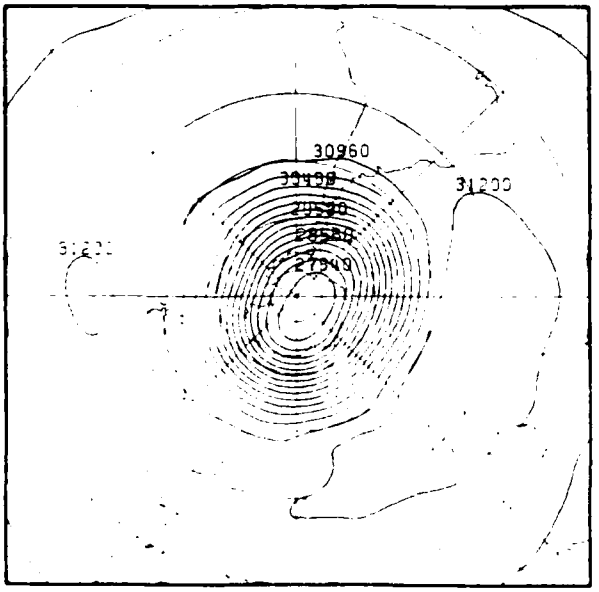


1200 GMT 13 JUN 1979 DAY 2

OBSERVED



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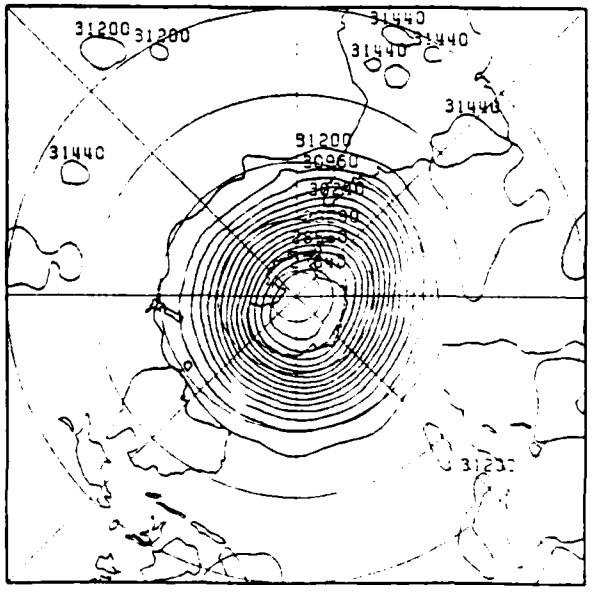
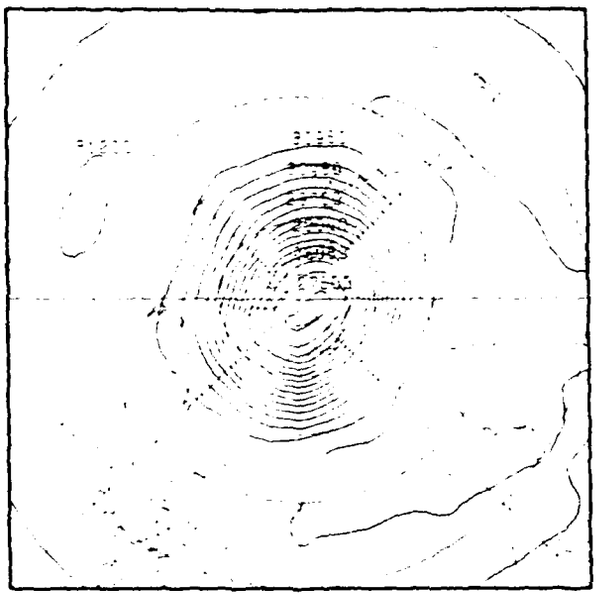


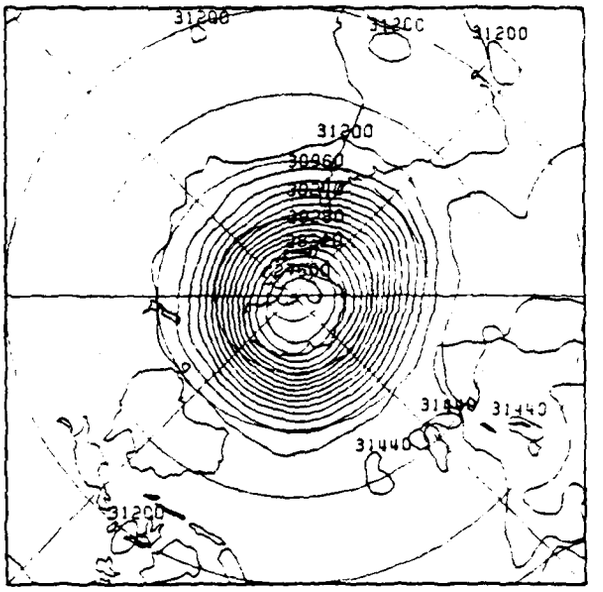
10 mb Z

1200 GMT 14 JUN 1979 DAY 3

OBSERVED

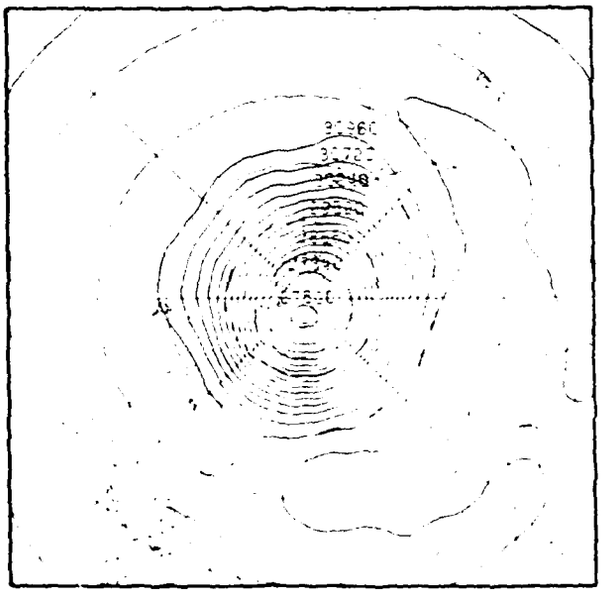


15-LAYER 4X5



1200 GMT 15 JUN 1979 DAY 4

OBSERVED



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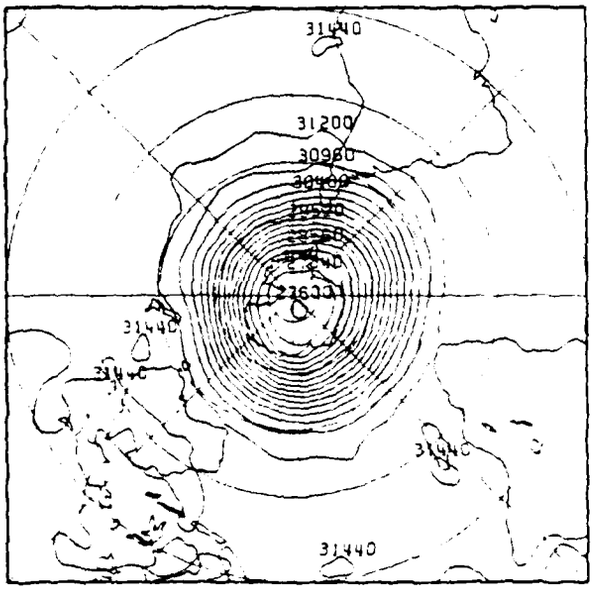
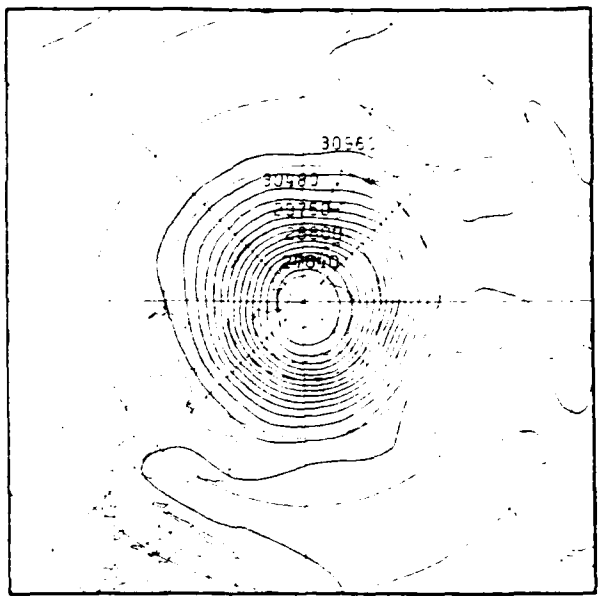


10 mb Z

1200 GMT 16 JUN 1979 DAY 5

OBSERVED



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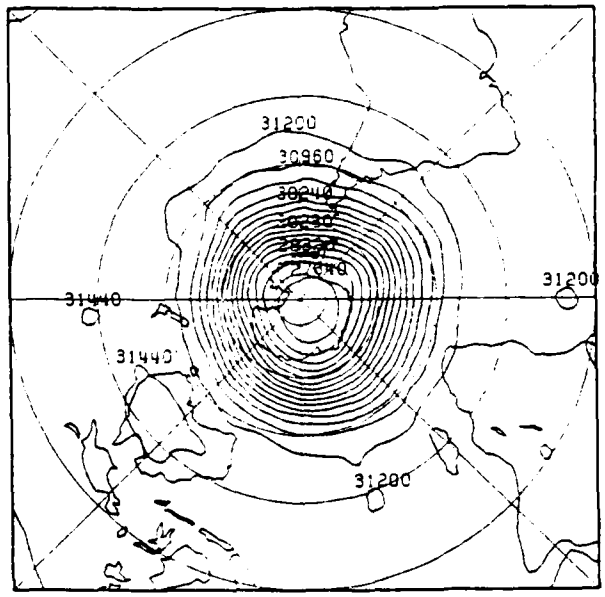
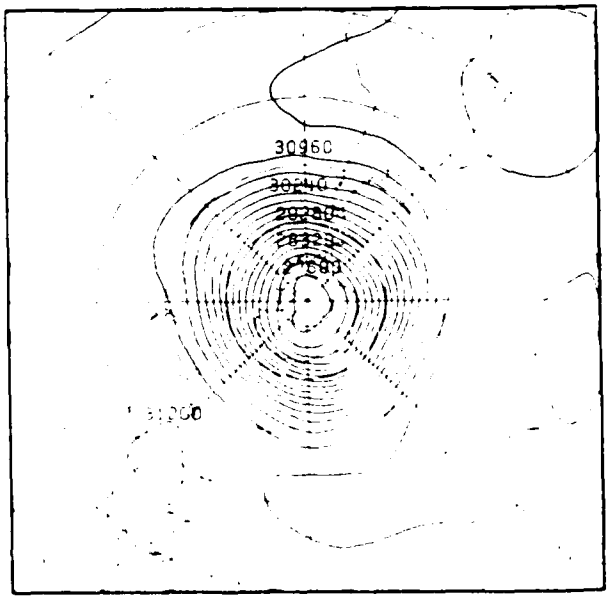


1200 GMT 17 JUN 1979 DAY 6

OBSERVED



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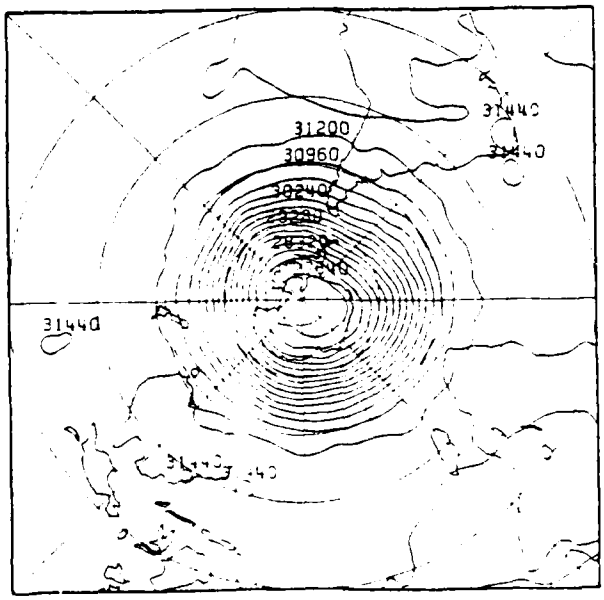
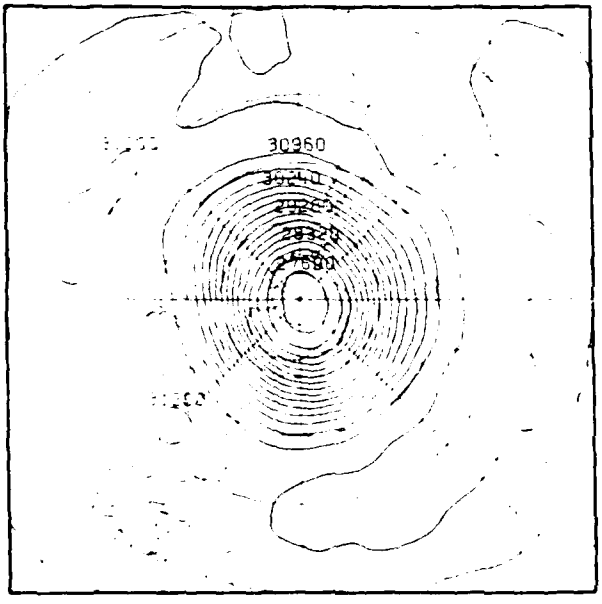


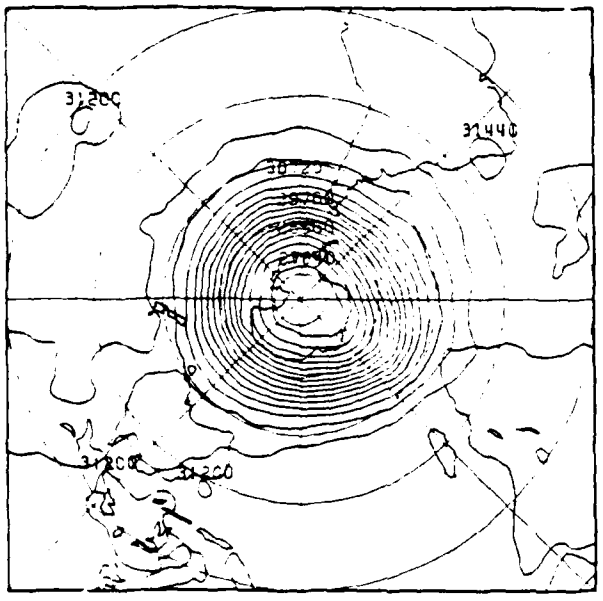
10 mb Z

1200 GMT 18 JUN 1979 DAY 7

OBSERVED

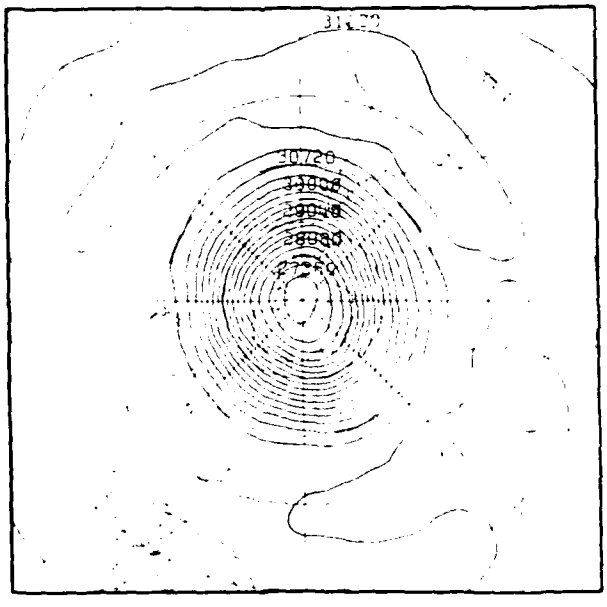


15-LAYER 4X5



1200 GMT 19 JUN 1979 DAY 8

OBSERVED



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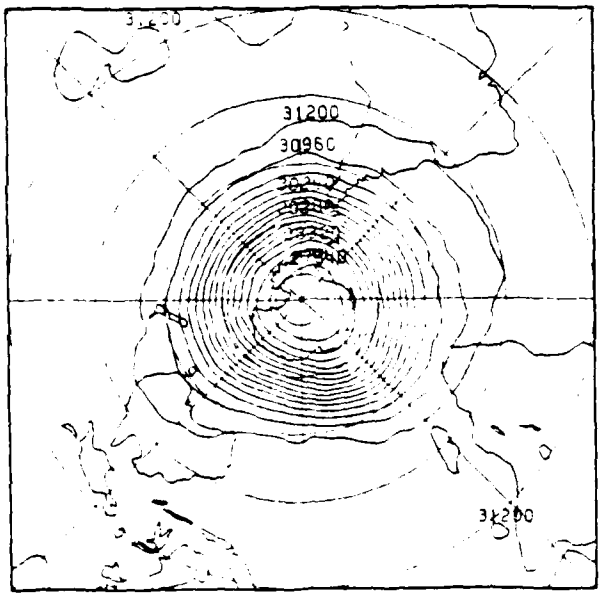
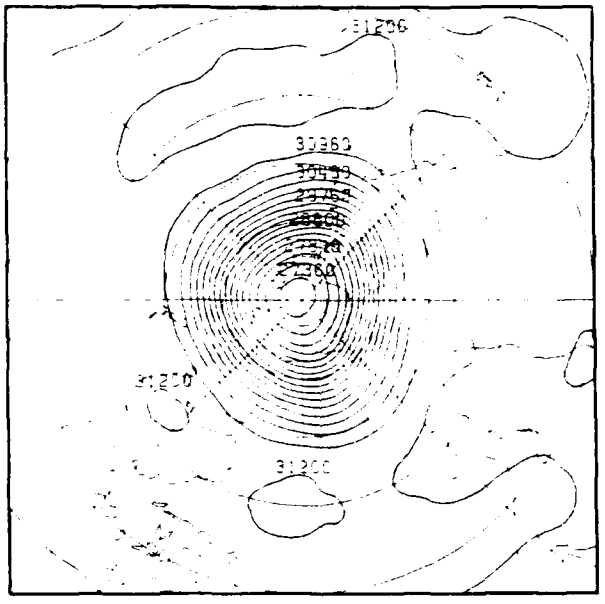


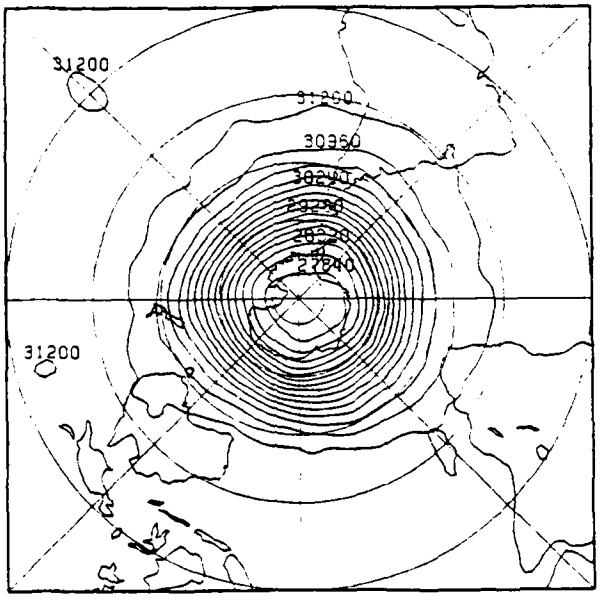
10 mb Z

1200 GMT 20 JUN 1979 DAY 9

OBSERVED



15-LAYER 4X5



1200 GMT 21 JUN 1979 DAY 10

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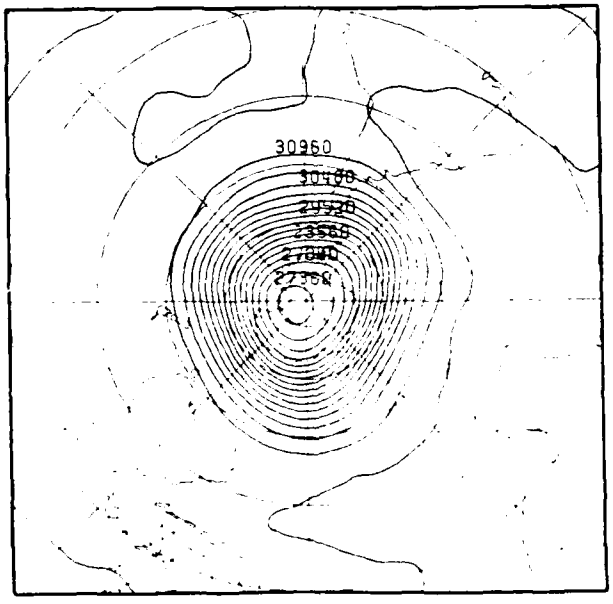
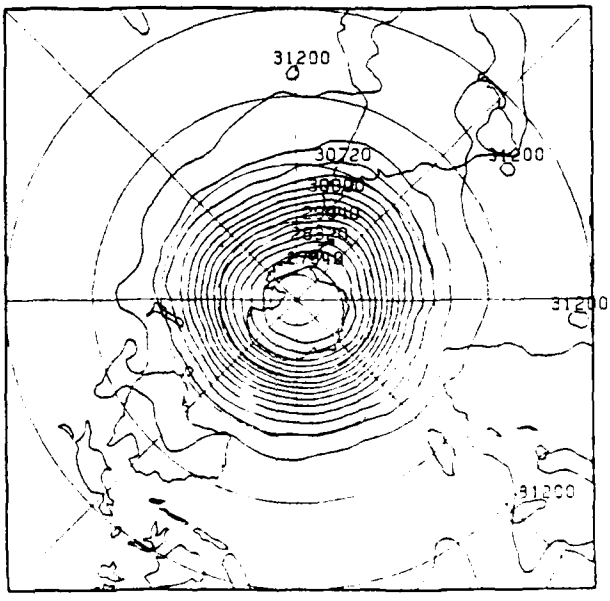
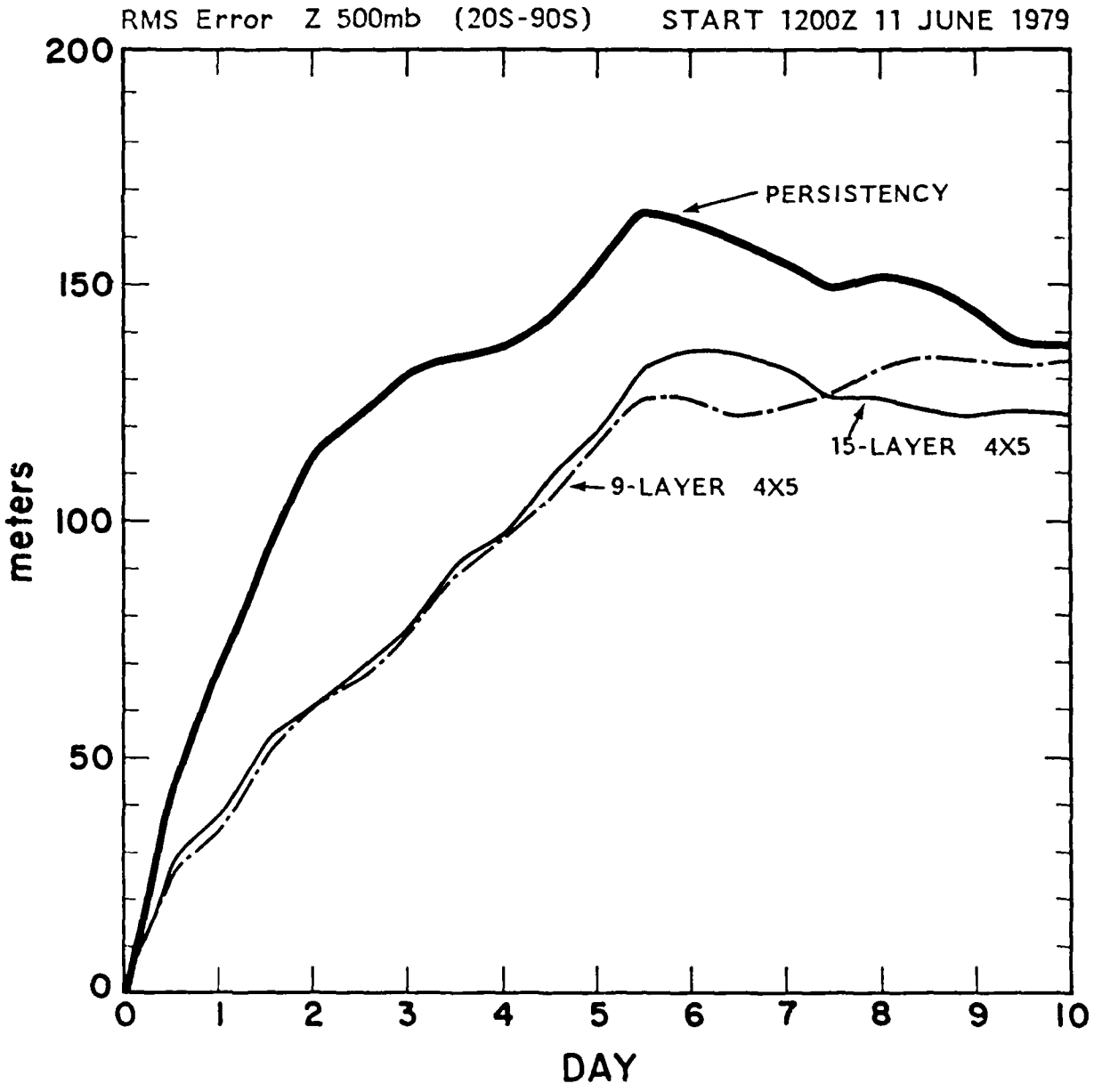


15-LAYER 4X5




RMS Error Z 500mb (20S-90S) START 1200Z 11 JUNE 1979
200
150
100
50
0
meters
PERSISTENCY
15-LAYER 4X5
9-LAYER 4X5
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

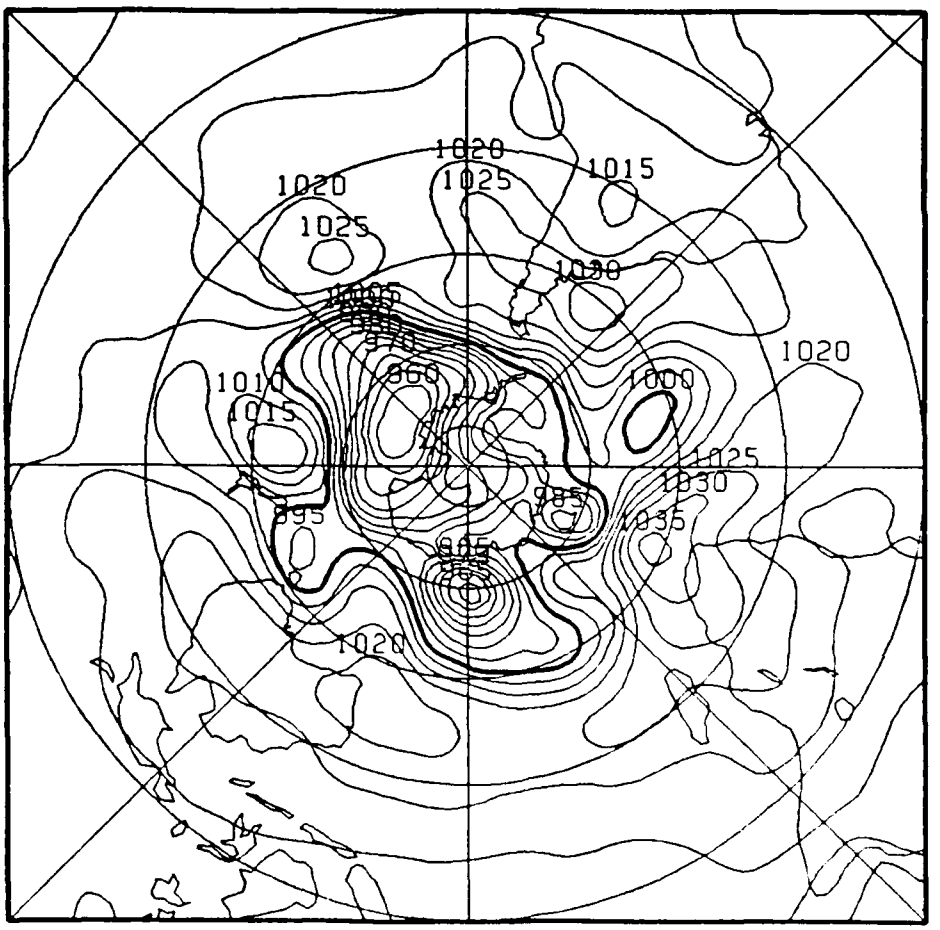
1200 GMT

1 JULY 1979

SLP

1200 GMT 1 JULY 1979

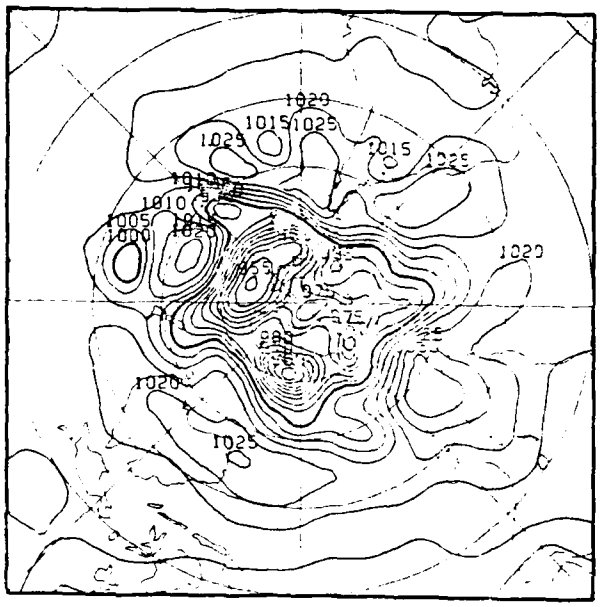
OBSERVED



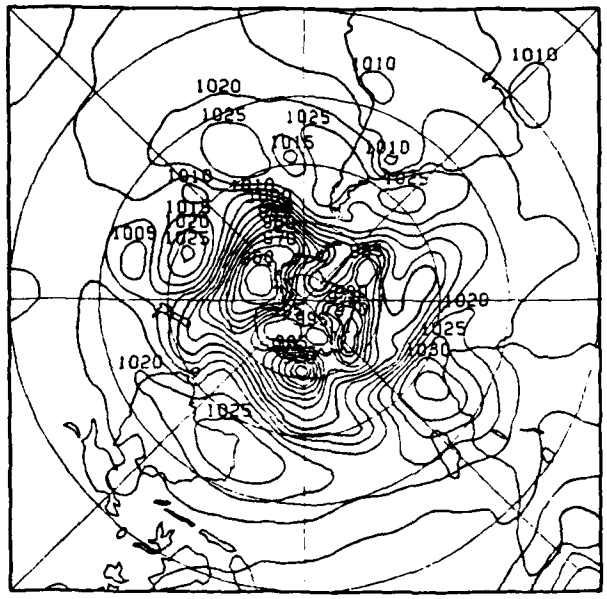
SLP

1200 GMT 2 JULY 1979 DAY 1

OBSERVED

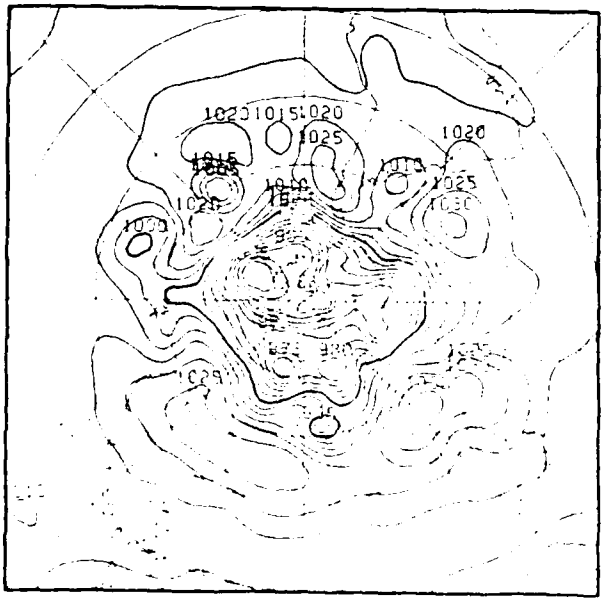


15-LAYER 2.4X3



1200 GMT 3 JULY 1979 DAY 2

OBSERVED



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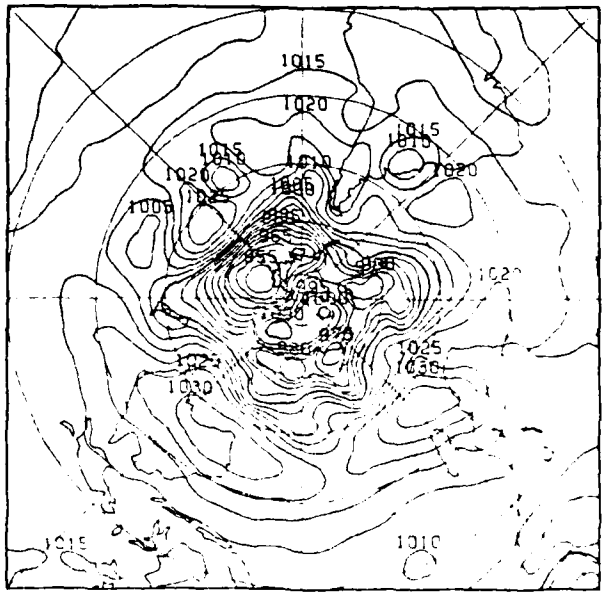
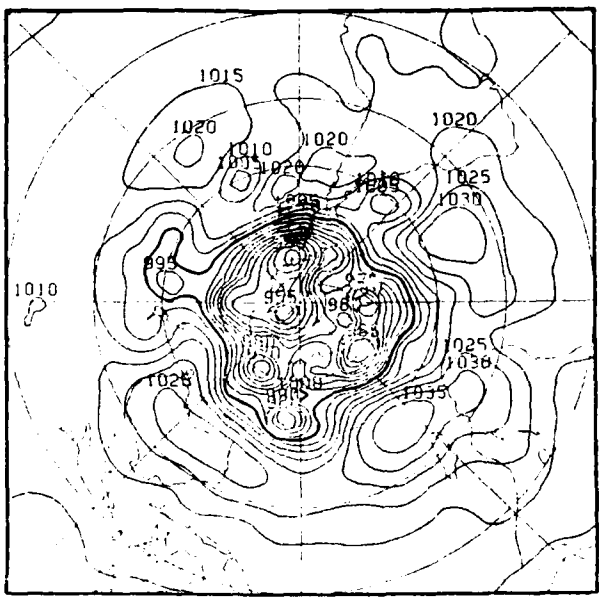


SLP

1200 GMT 4 JULY 1979 DAY 3

OBSERVED



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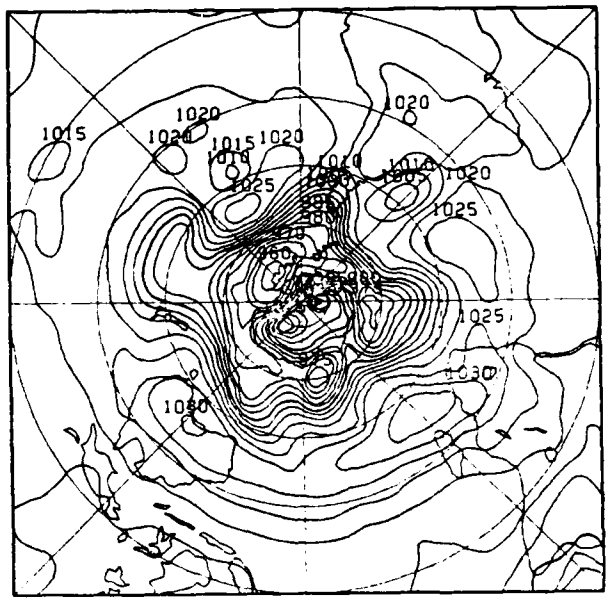
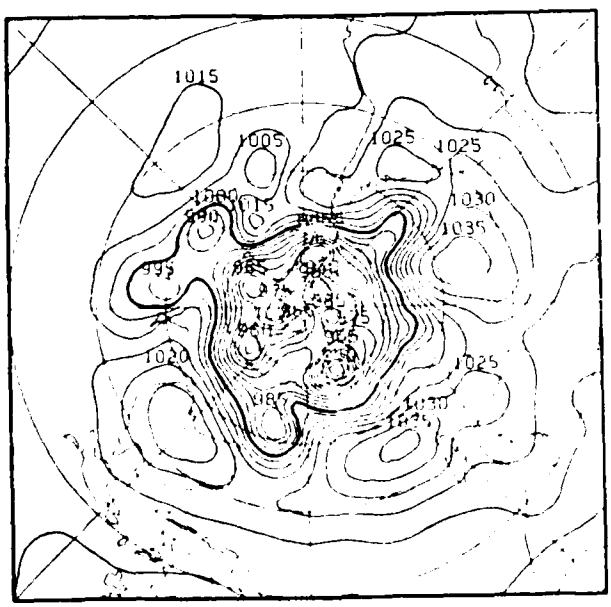


1200 GMT 5 JULY 1979 DAY 4

OBSERVED



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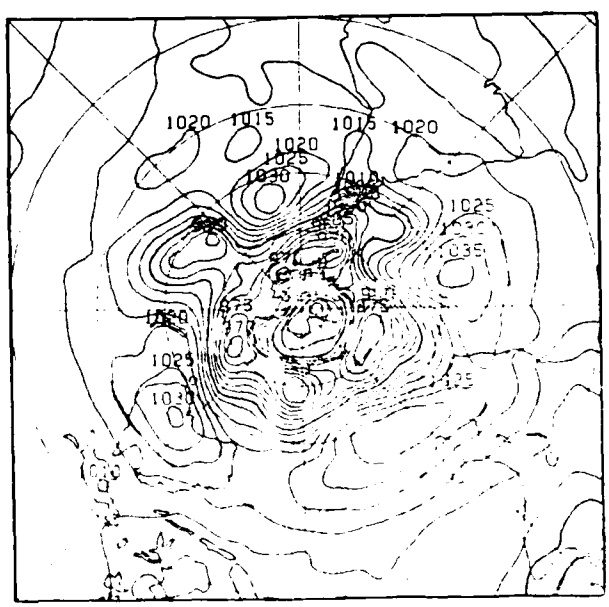
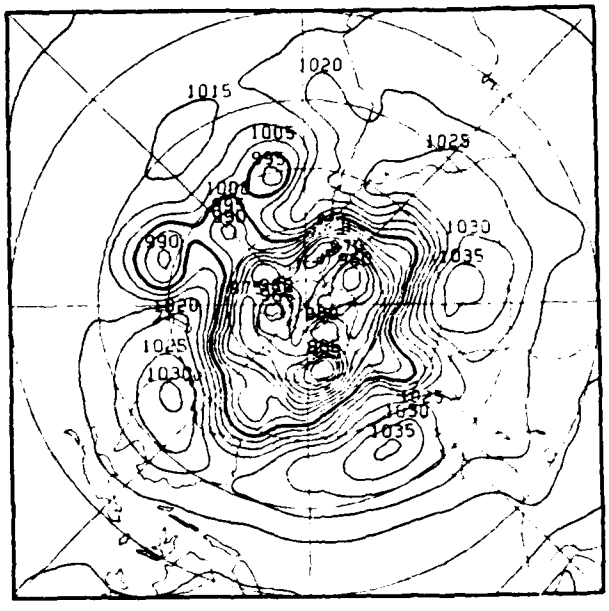


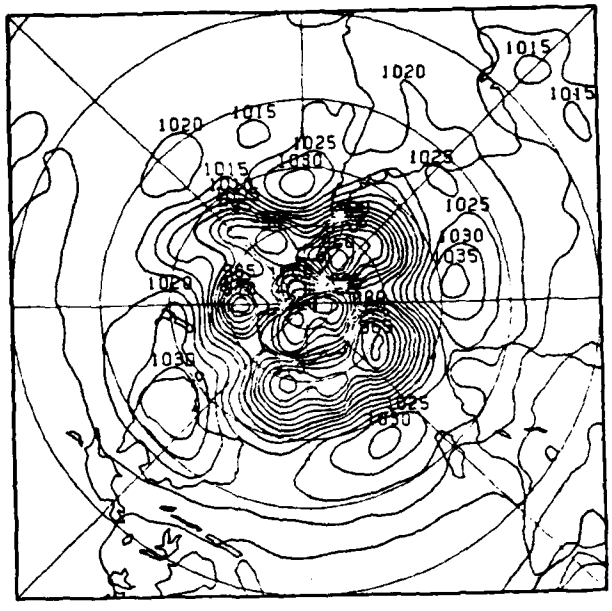
SLP

1200 GMT 6 JULY 1979 DAY 5

OBSERVED

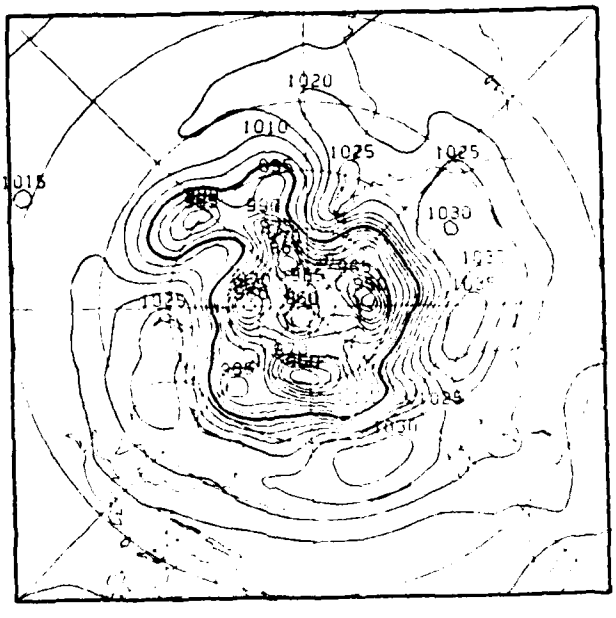


15-LAYER 2.4X3

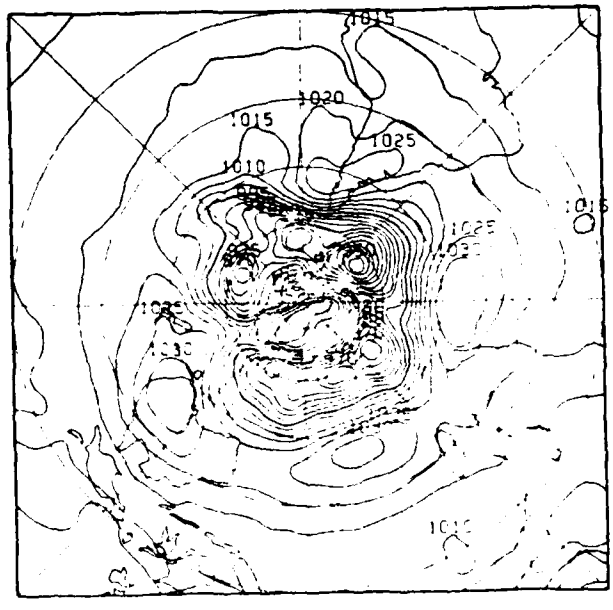


1200 GMT 7 JULY 1979 DAY 6

OBSERVED



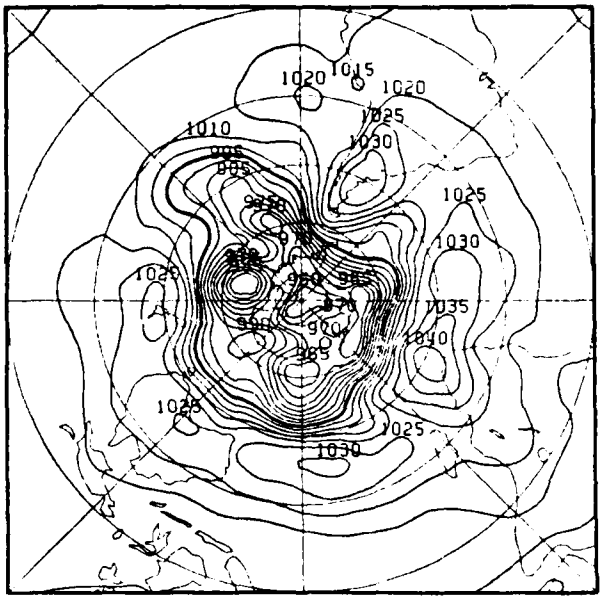
15-LAYER 2.4X3



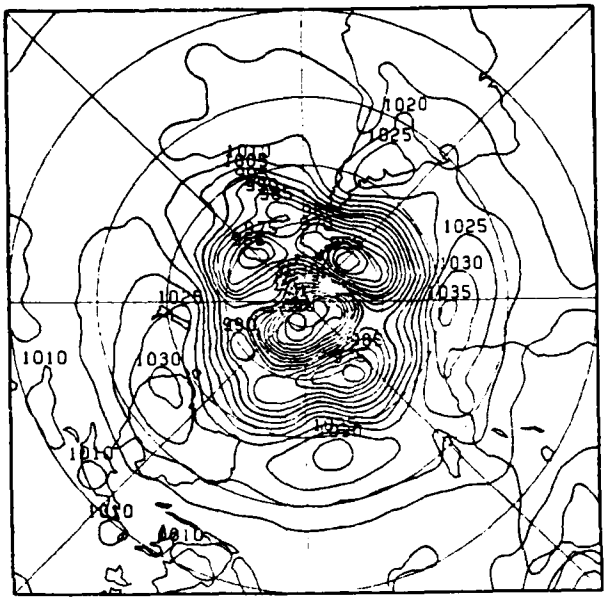
SLP

1200 GMT 8 JULY 1979 DAY 7

OBSERVED

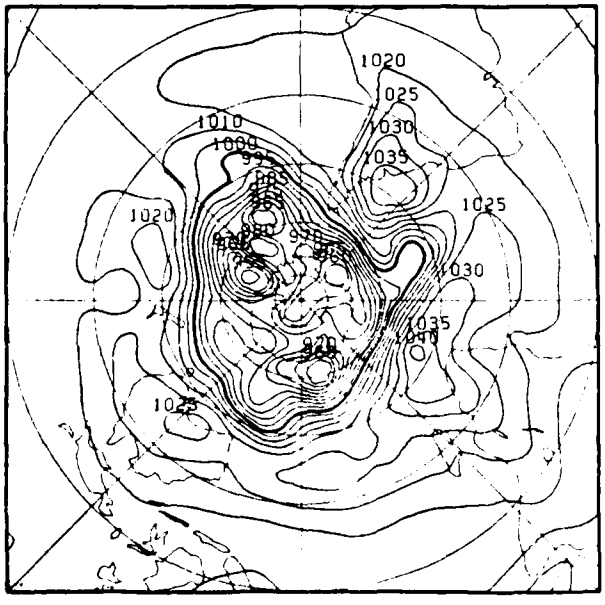


15-LAYER 2.4X3

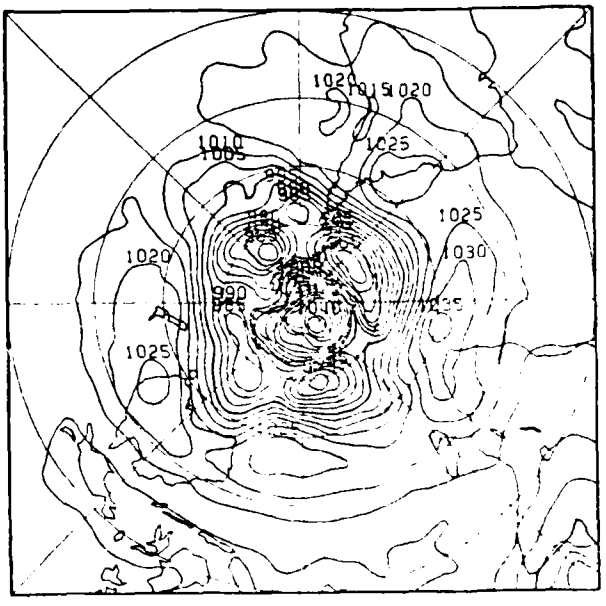


1200 GMT 9 JULY 1979 DAY 8

OBSERVED



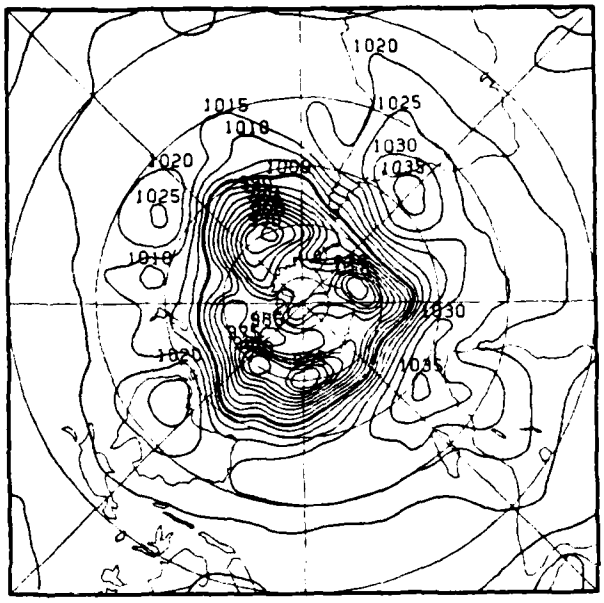
15-LAYER 2.4X3



SLP

1200 GMT 10 JULY 1979 DAY 9

OBSERVED



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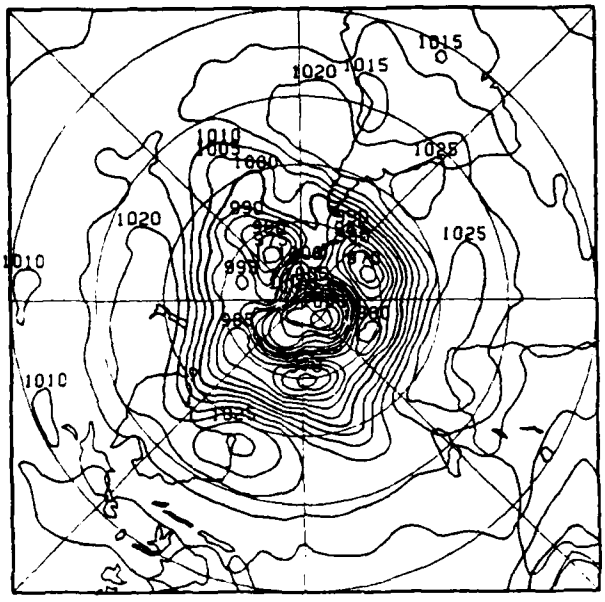

1200 GMT 11 JULY 1979 DAY 10

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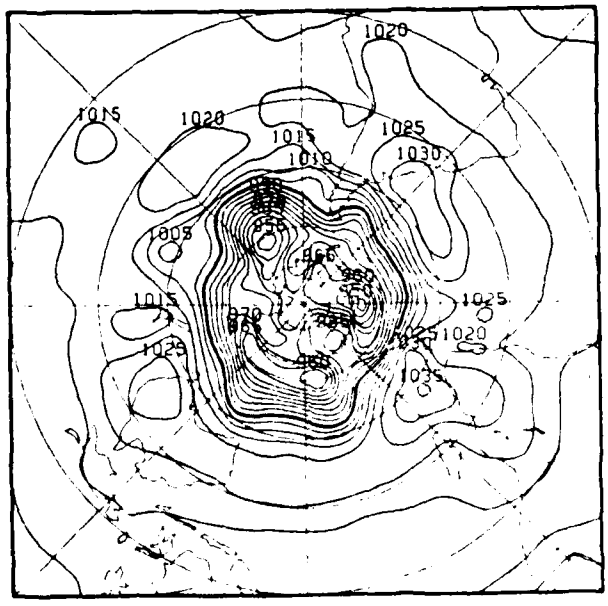

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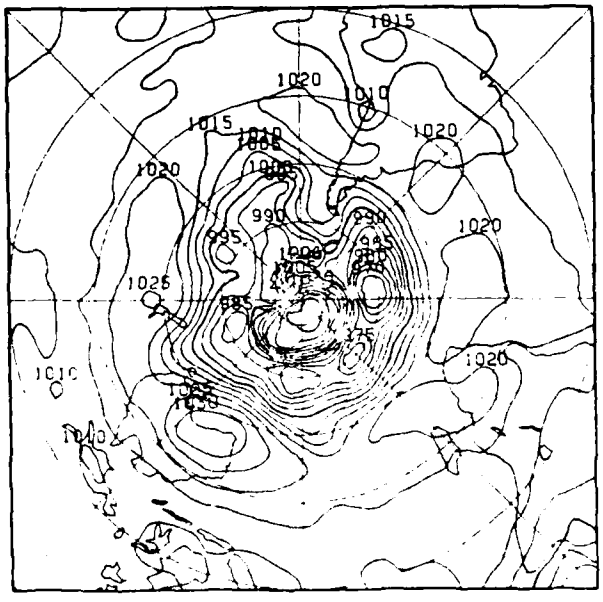
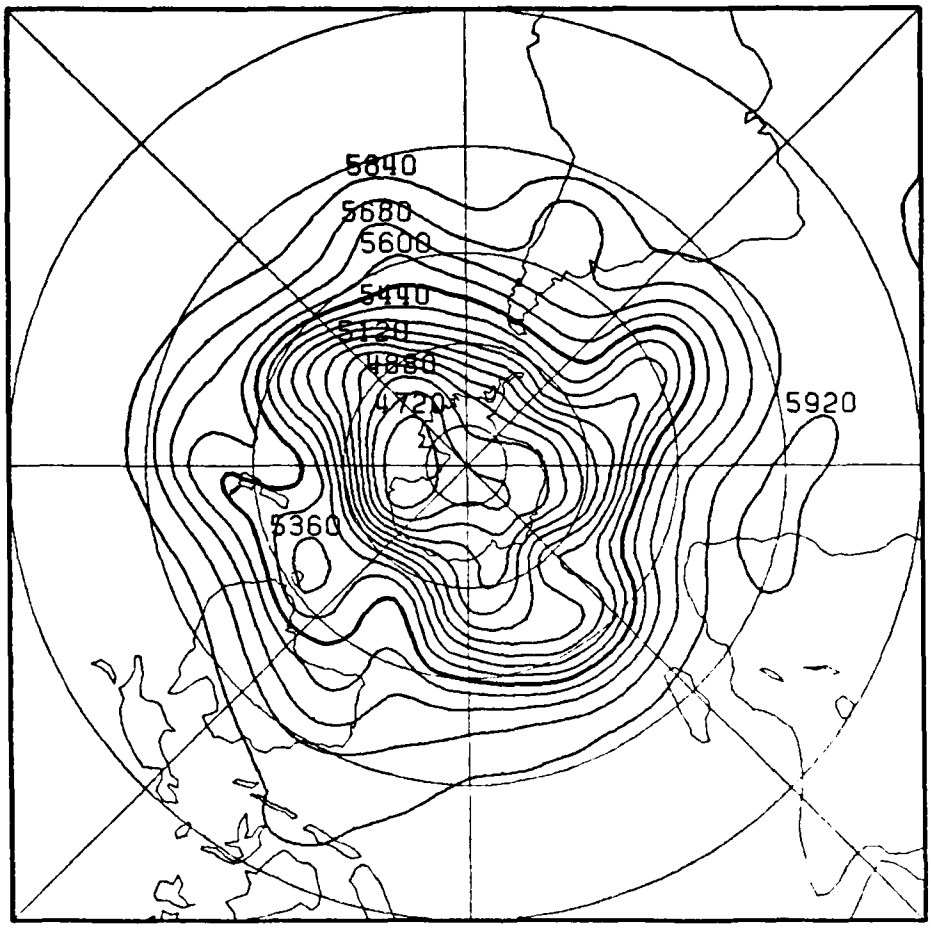


500 mb Z

1200 GMT 1 JULY 1979

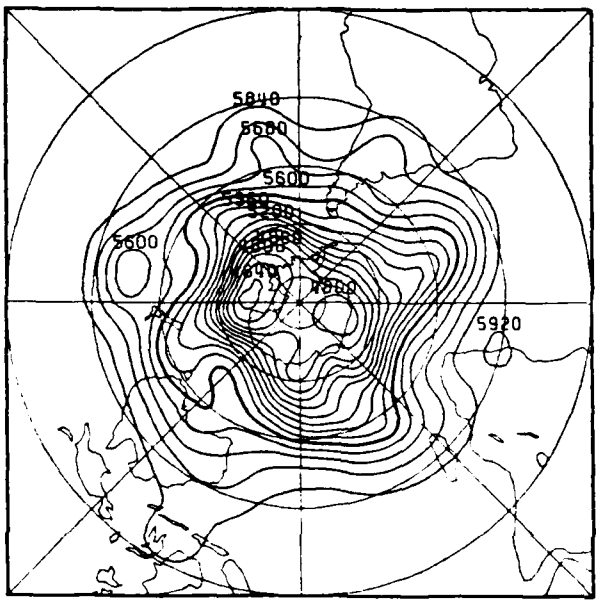
OBSERVED



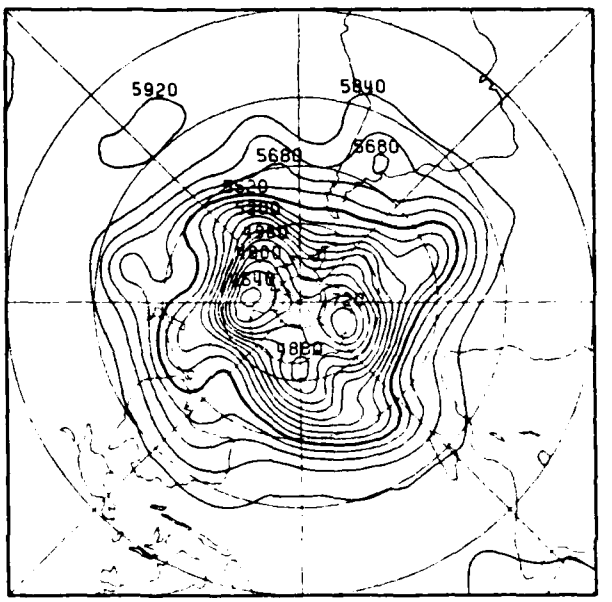
500 mb Z

1200 GMT 2 JULY 1979 DAY 1

OBSERVED

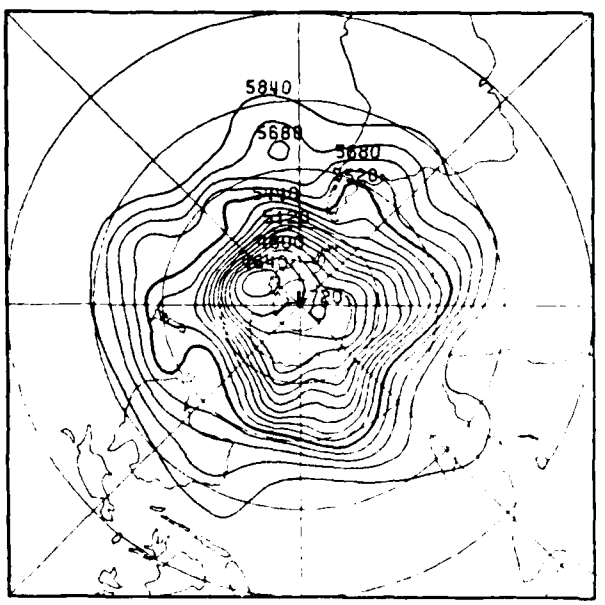


15-LAYER 2.4X3

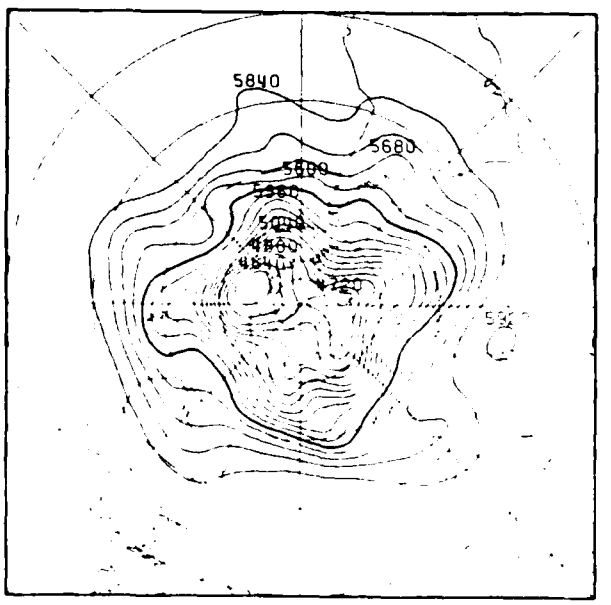


1200 GMT 3 JULY 1979 DAY 2

OBSERVED



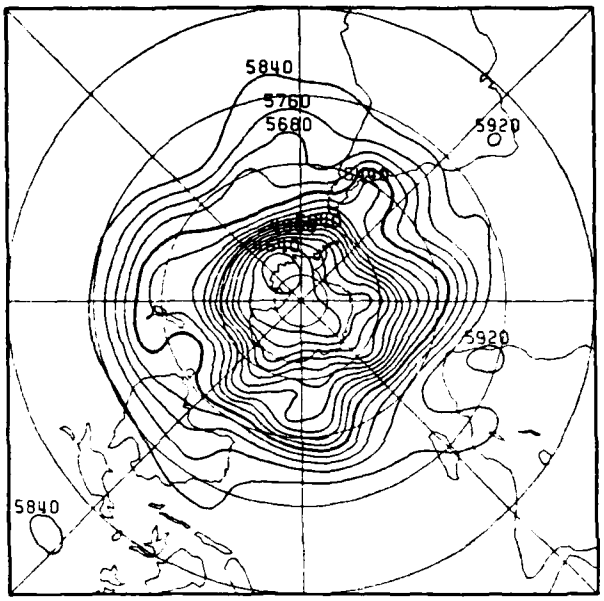
15-LAYER 2.4X3



500 mb Z

1200 GMT 4 JULY 1979 DAY 3

OBSERVED



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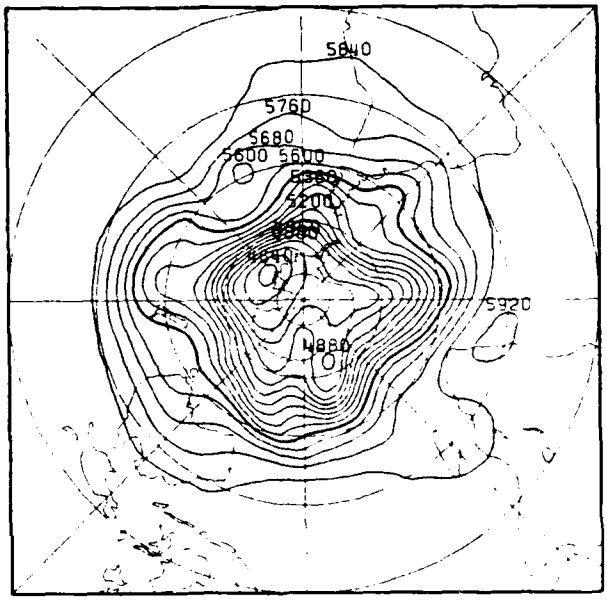
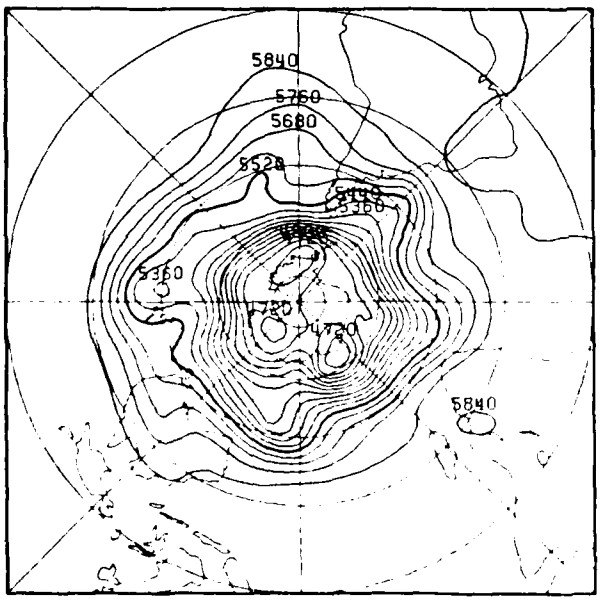


1200 GMT 5 JULY 1979 DAY 4

OBSERVED



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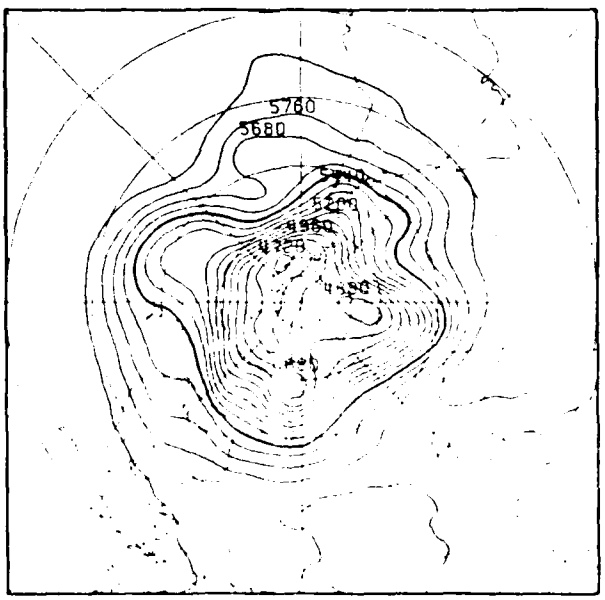

500 mb Z

1200 GMT 6 JULY 1979 DAY 5

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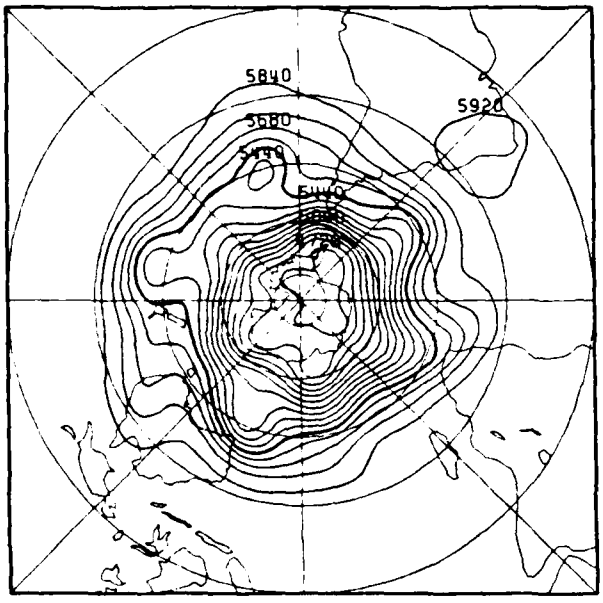

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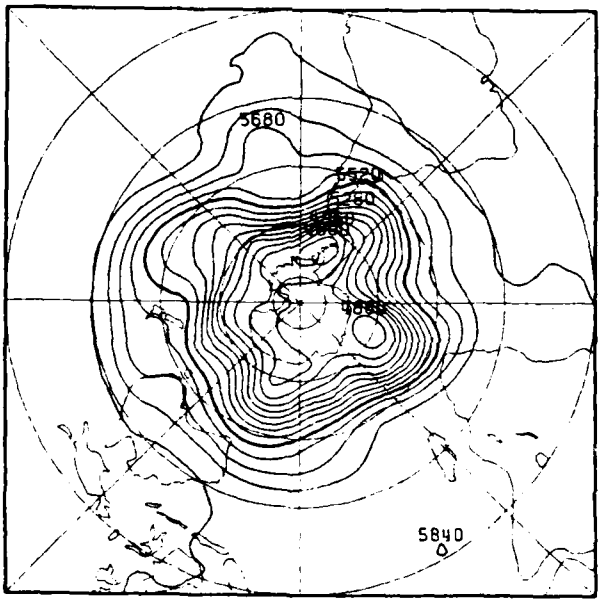

1200 GMT 7 JULY 1979 DAY 6

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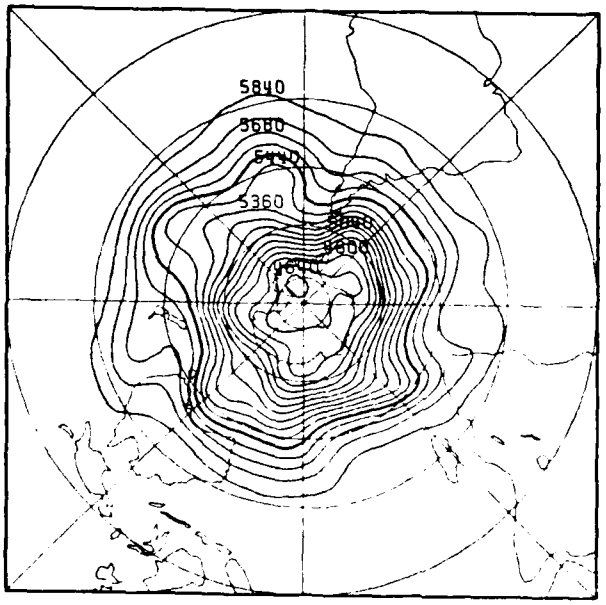

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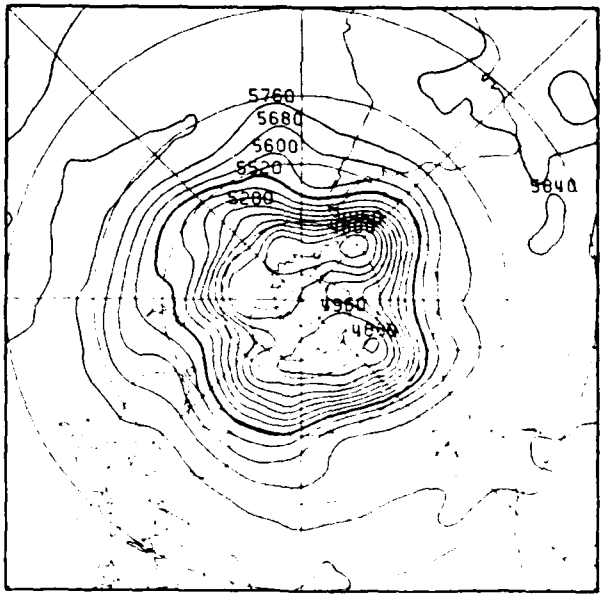

500 mb Z

1200 GMT 8 JULY 1979 DAY 7

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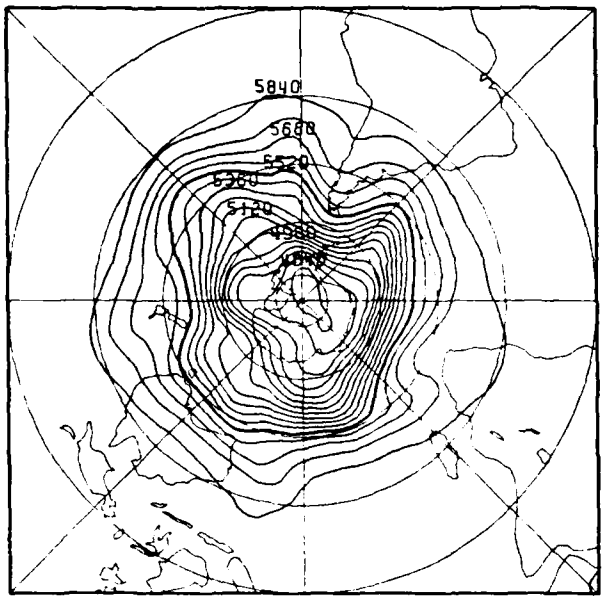

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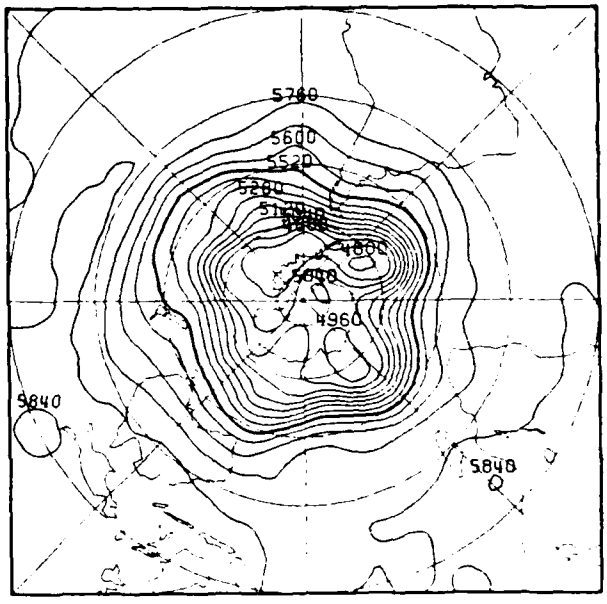

1200 GMT 9 JULY 1979 DAY 8

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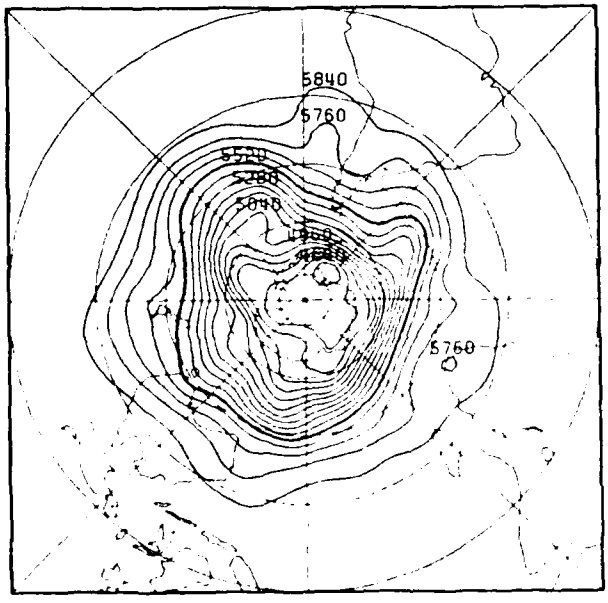

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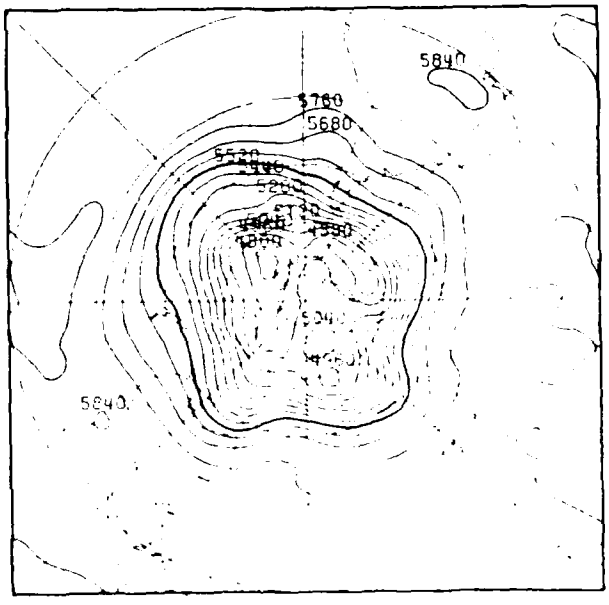

500 mb Z

1200 GMT 10 JULY 1979 DAY 9

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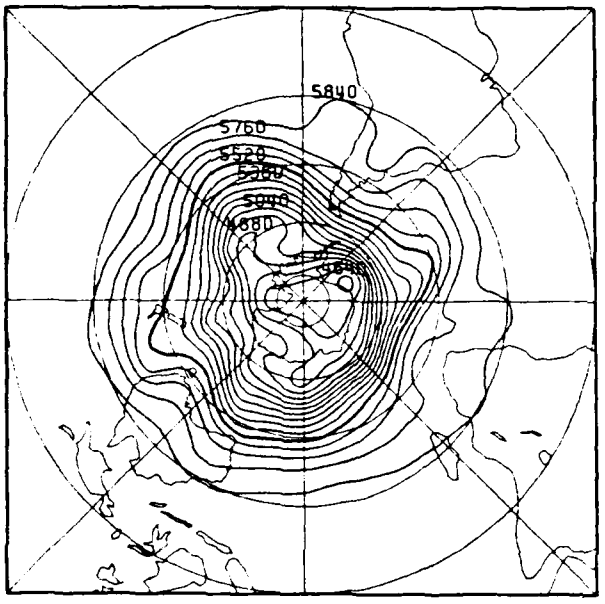

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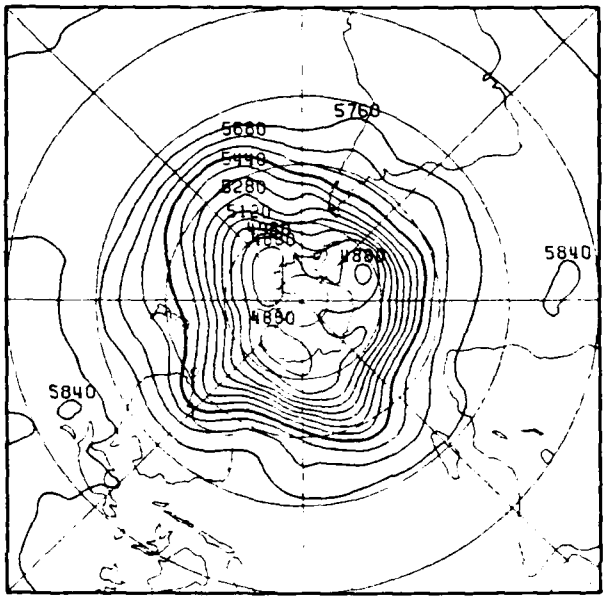

1200 GMT 11 JULY 1979 DAY 10

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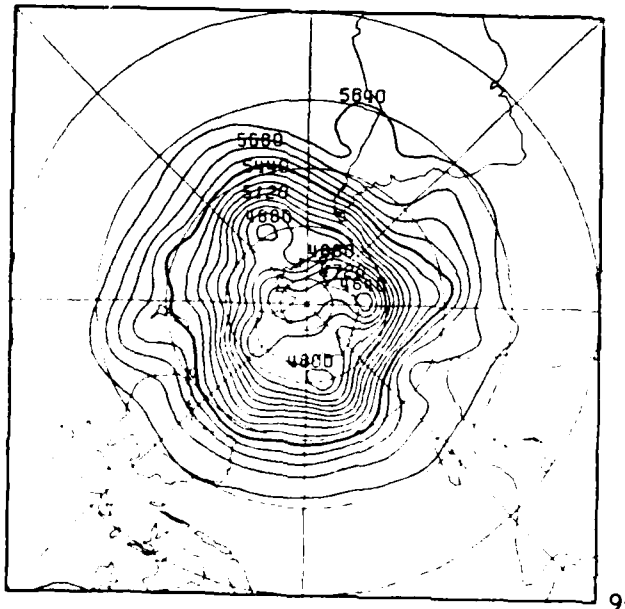

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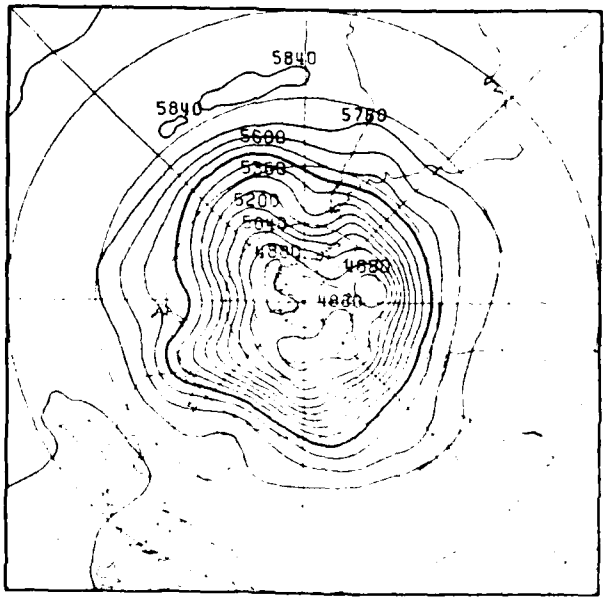
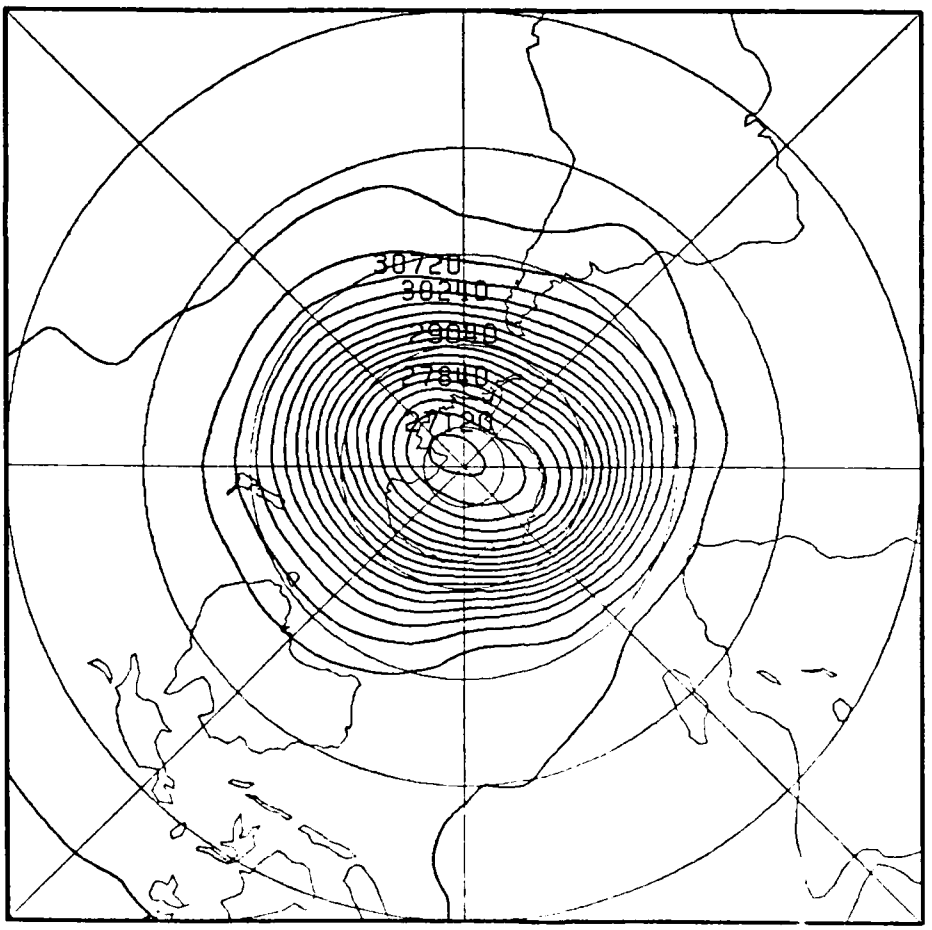


10 mb Z

1200 GMT 1 JULY 1979

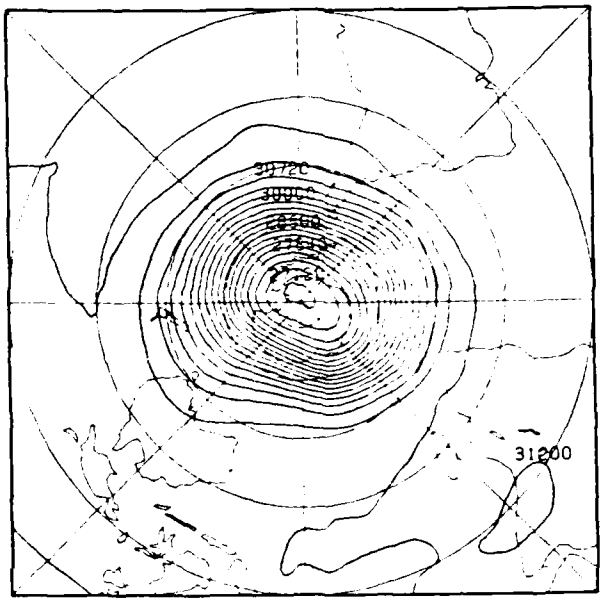
OBSERVED



10 mb Z

1200 GMT 2 JULY 1979 DAY 1

OBSERVED



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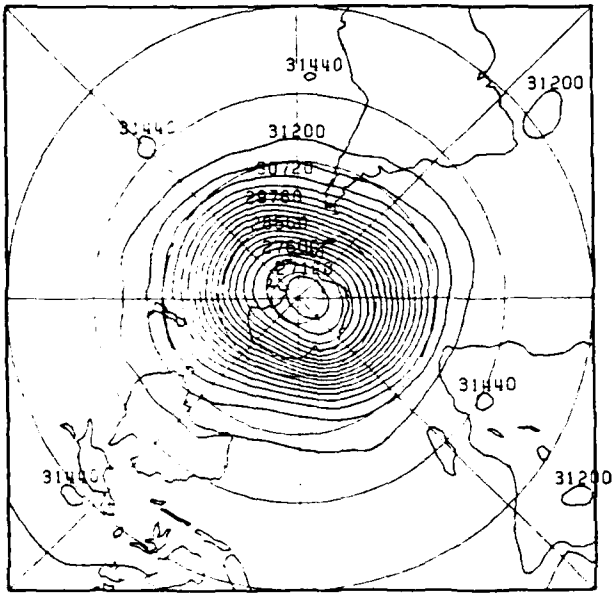
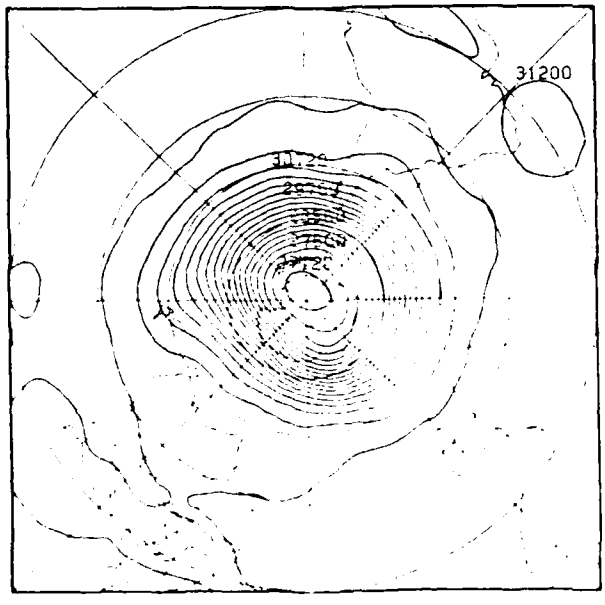


1200 GMT 3 JULY 1979 DAY 2

OBSERVED



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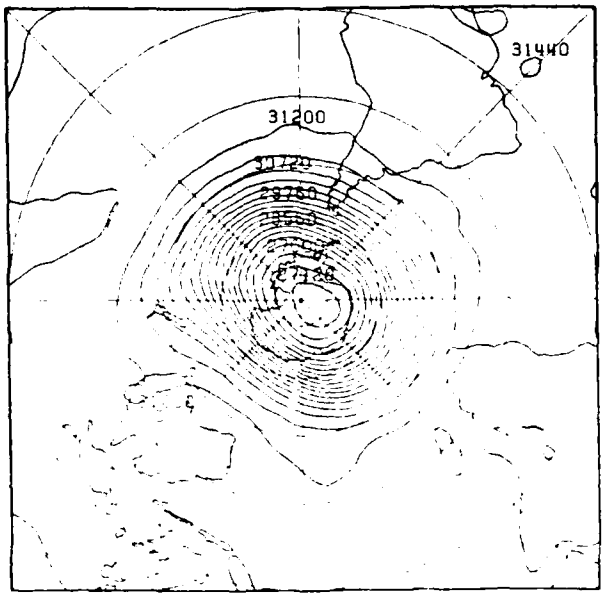

10 mb Z

1200 GMT 4 JULY 1979 DAY 3

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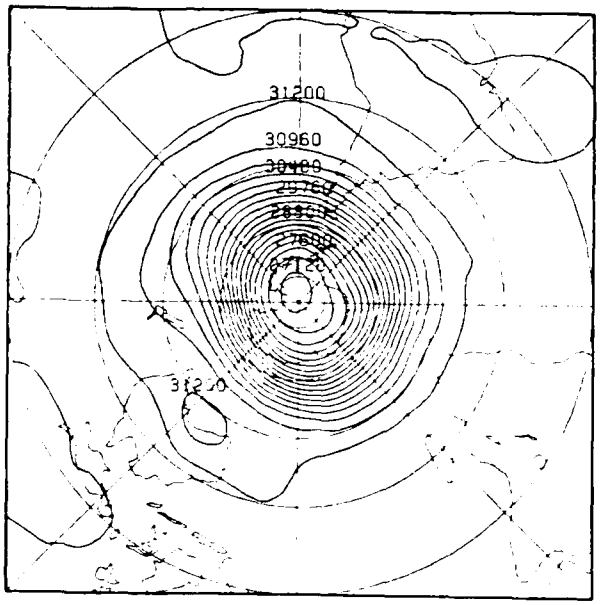

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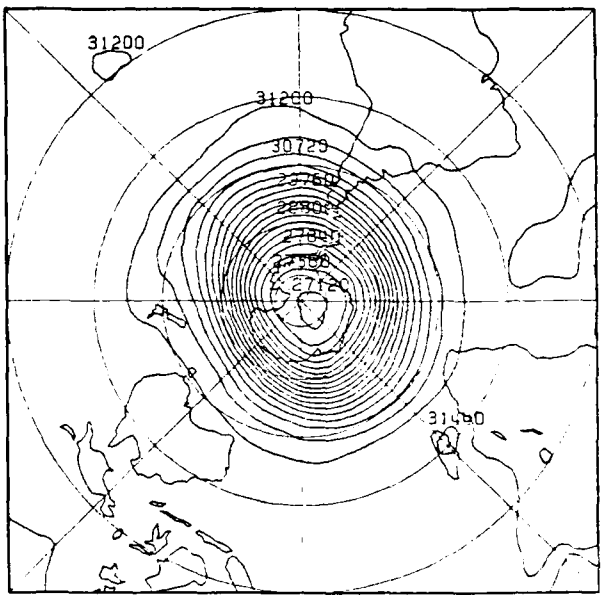
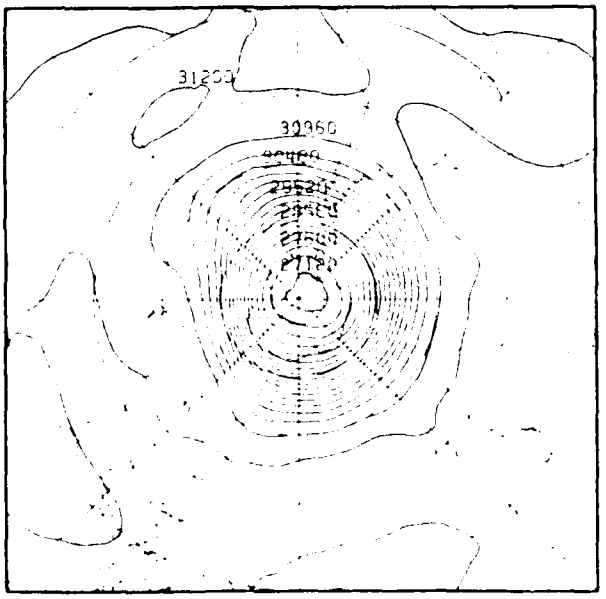


1200 GMT 5 JULY 1979 DAY 4

OBSERVED



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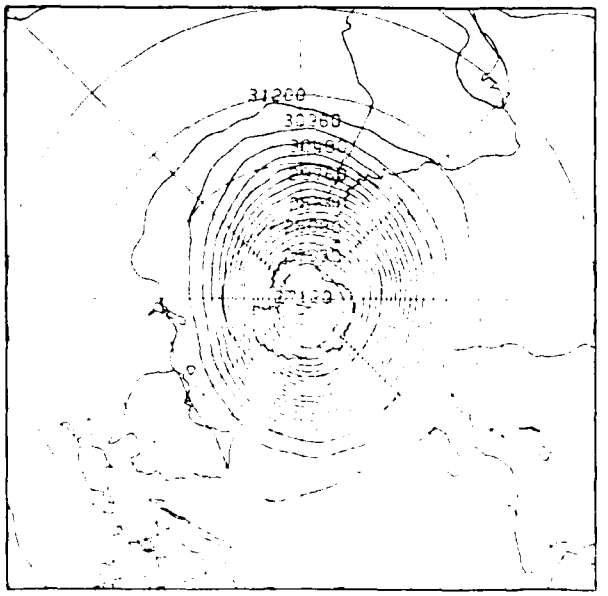

10 mb Z

1200 GMT 6 JULY 1979 DAY 5

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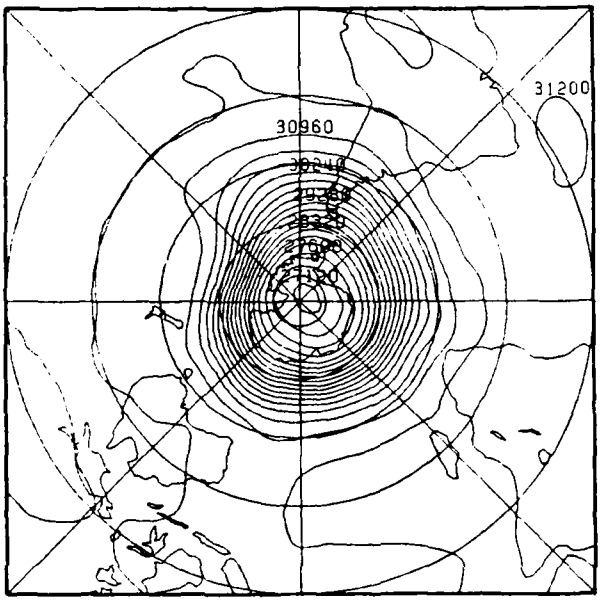
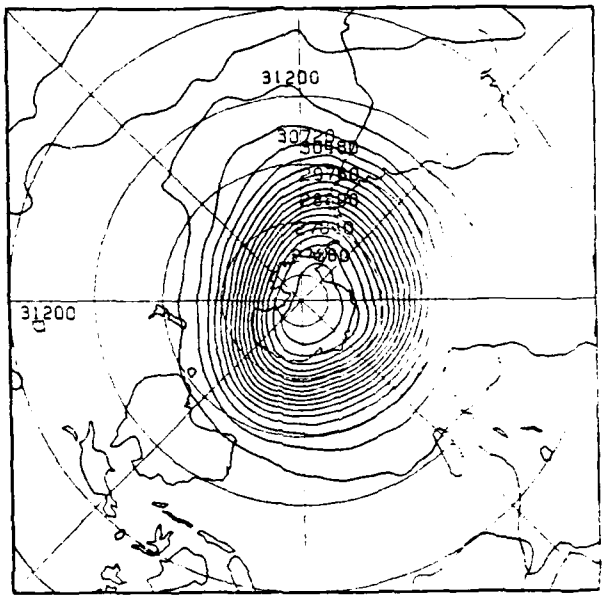


15-LAYER 2.4X3



1200 GMT 7 JULY 1979 DAY 6

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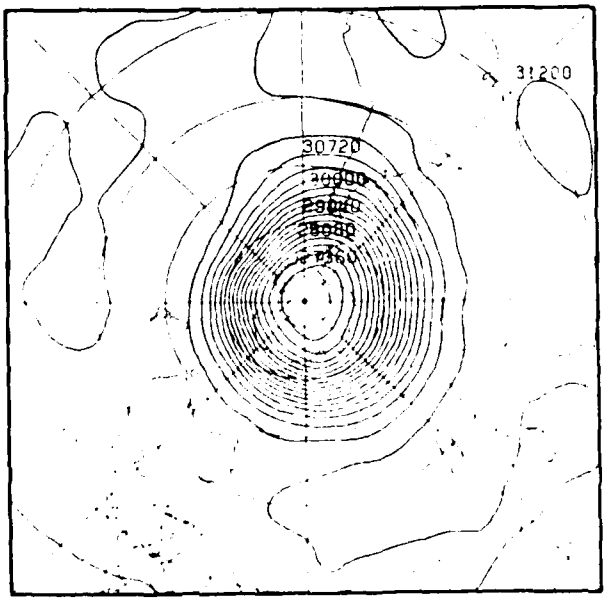

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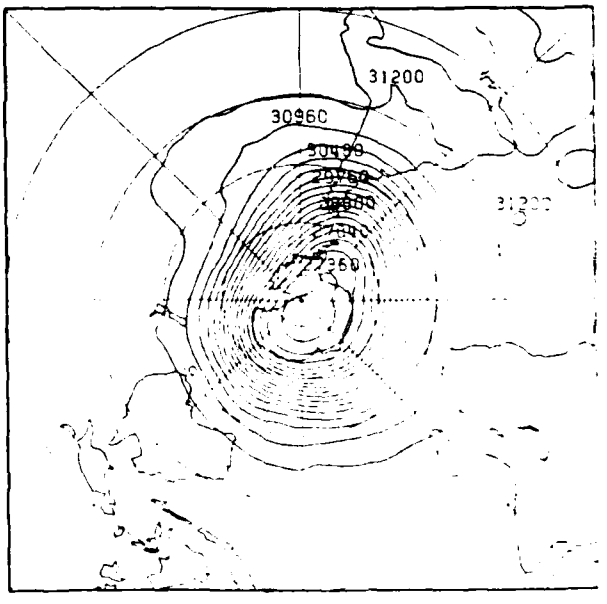

10 mb Z

1200 GMT 8 JULY 1979 DAY 7

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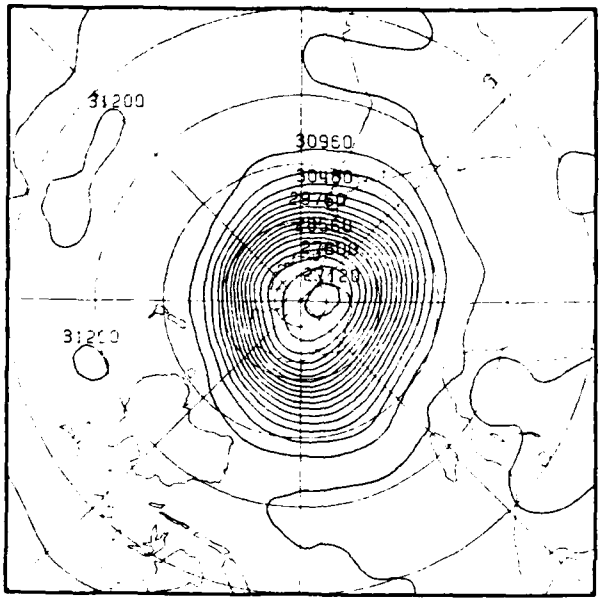

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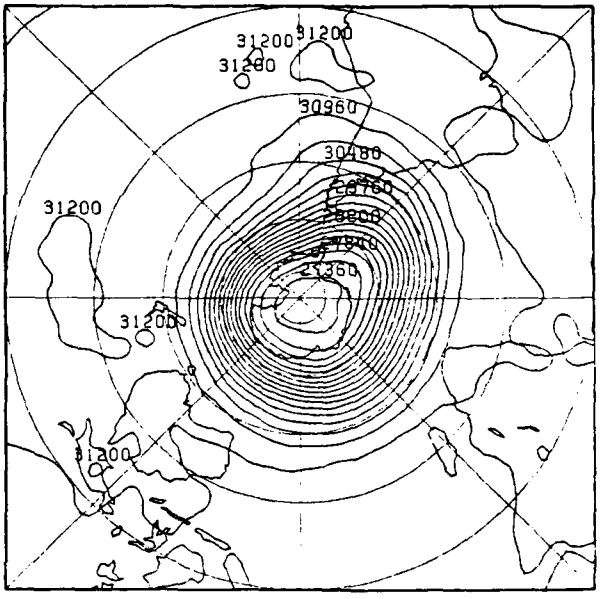
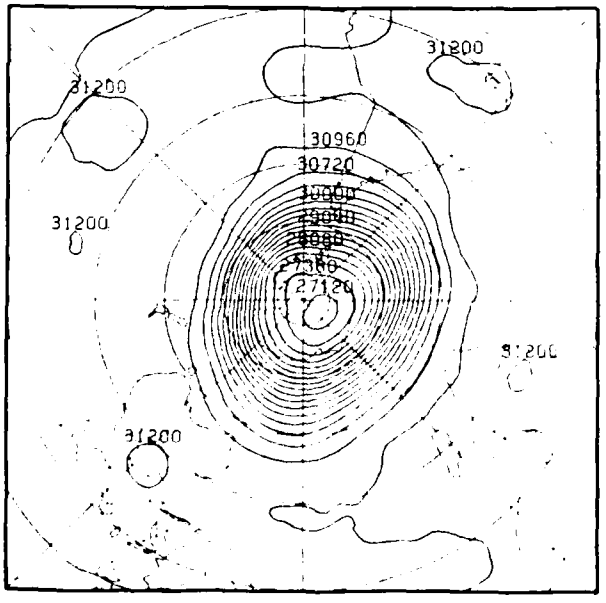


1200 GMT 9 JULY 1979 DAY 8

OBSERVED



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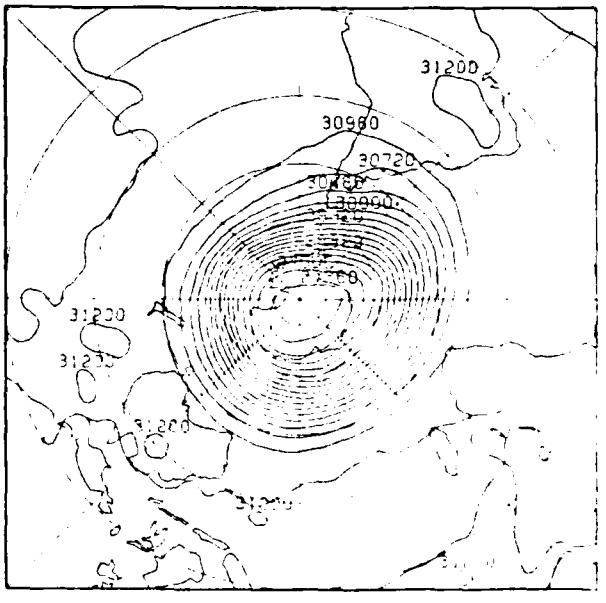

10 mb Z

1200 GMT 10 JULY 1979 DAY 9

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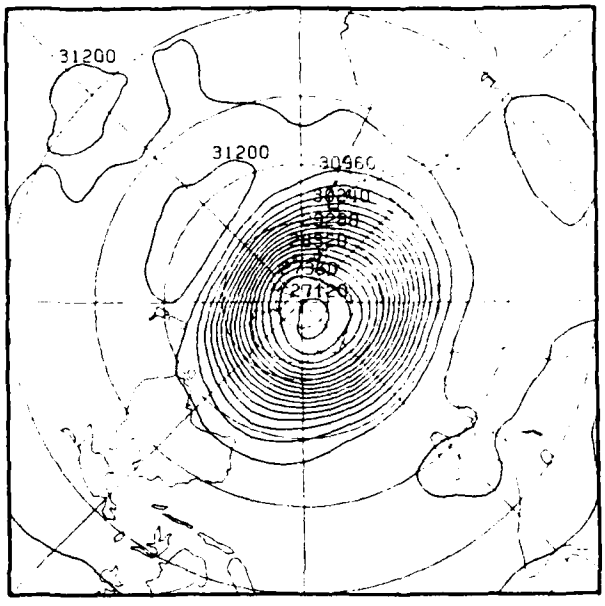

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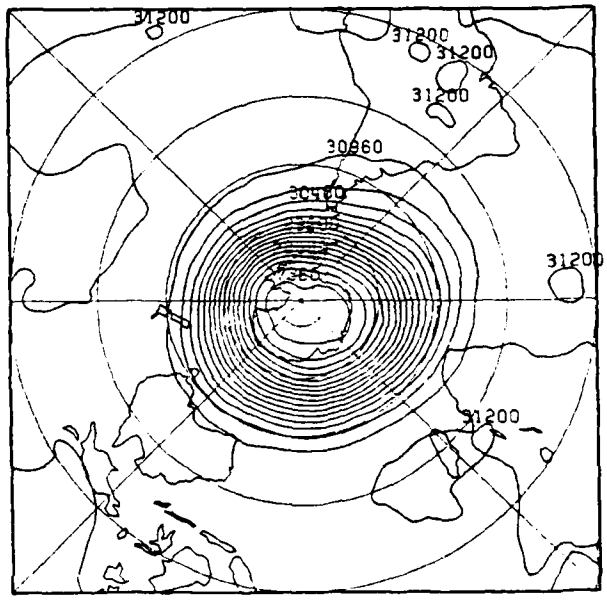

1200 GMT 11 JULY 1979 DAY 10

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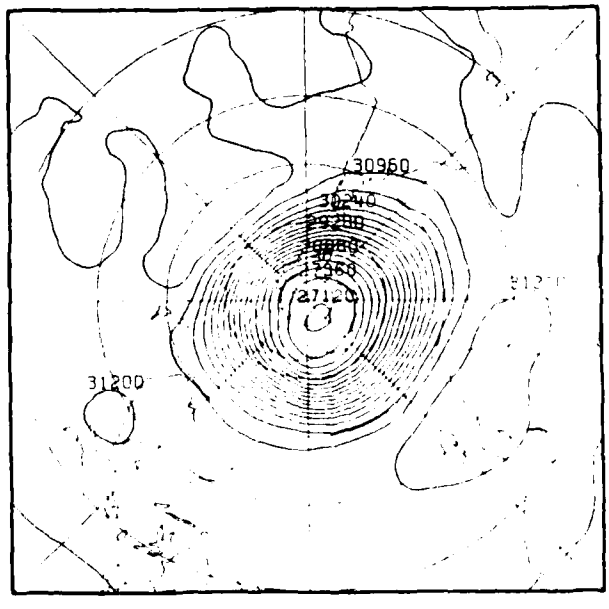

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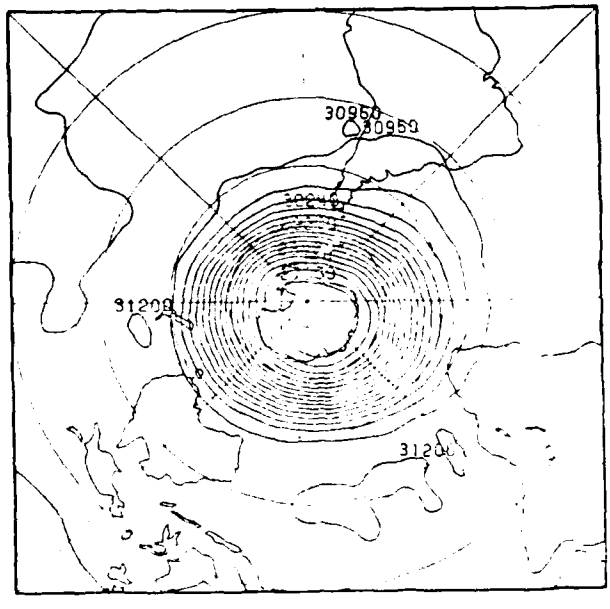
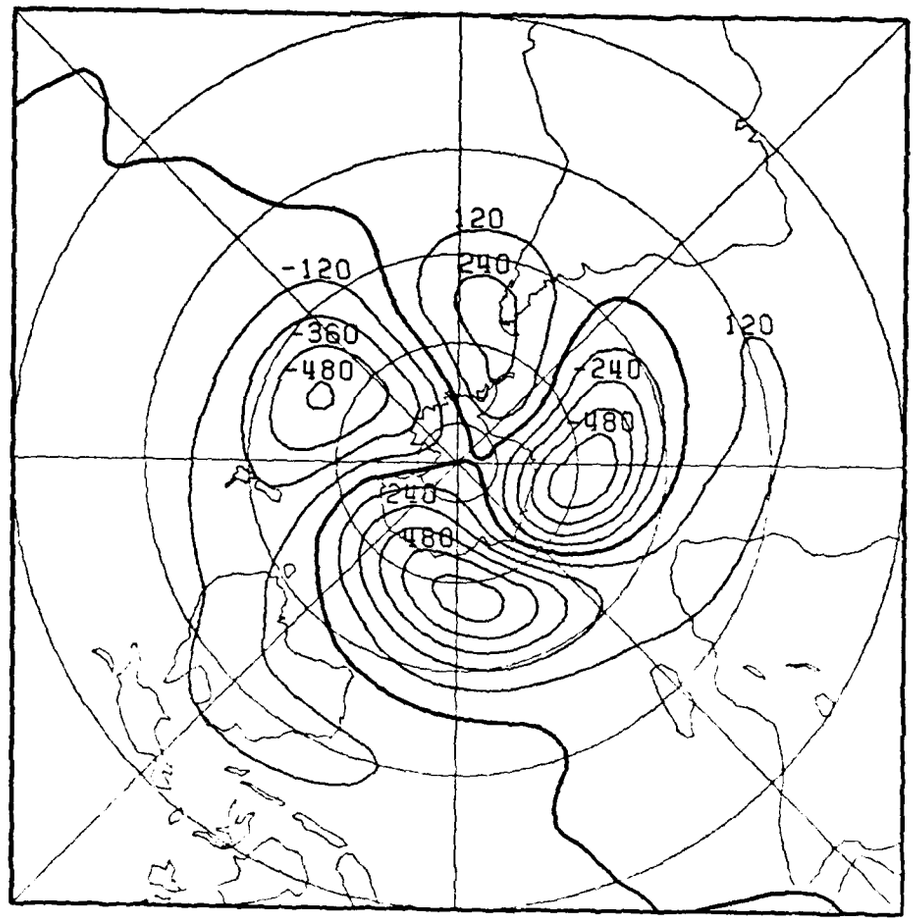


10 mb Z

WAVENUMBER S 1-4

1200 GMT 1 JULY 1979

OBSERVED

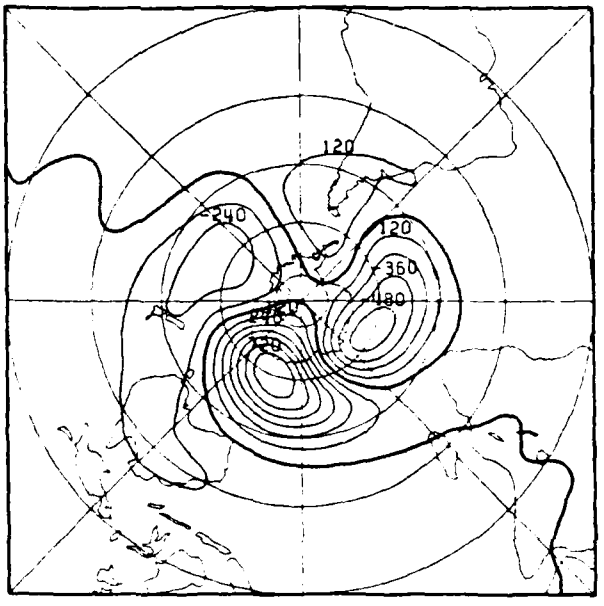


10 mb Z

WAVENUMBERS 1-4

1200 GMT 2 JULY 1979 DAY 1

OBSERVED



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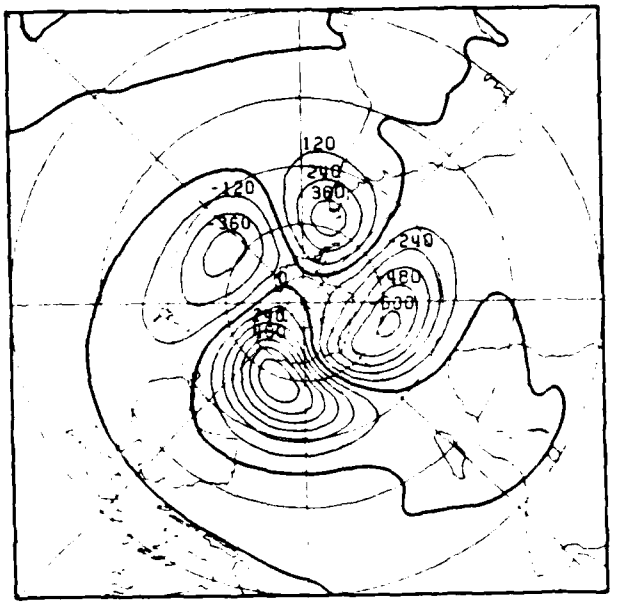

1200 GMT 3 JULY 1979 DAY 2

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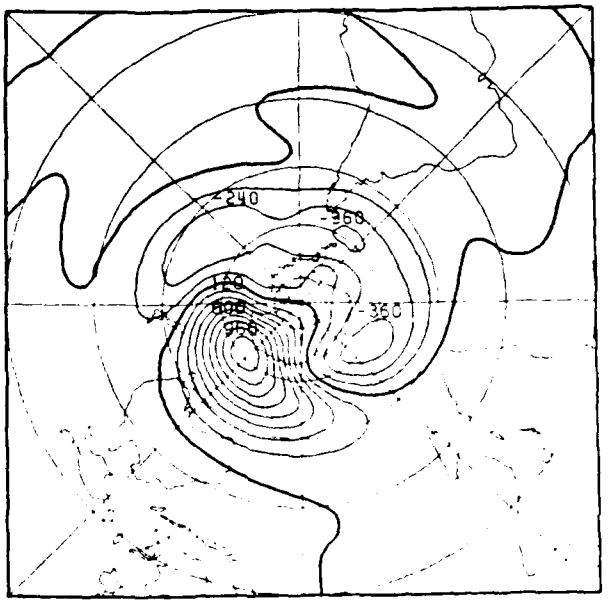

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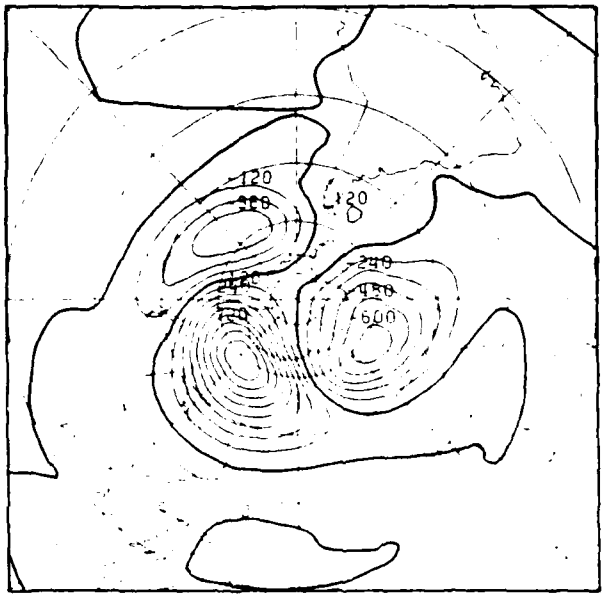

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WAVENUMBERS 1-4

1200 GMT 4 JULY 1979 DAY 3

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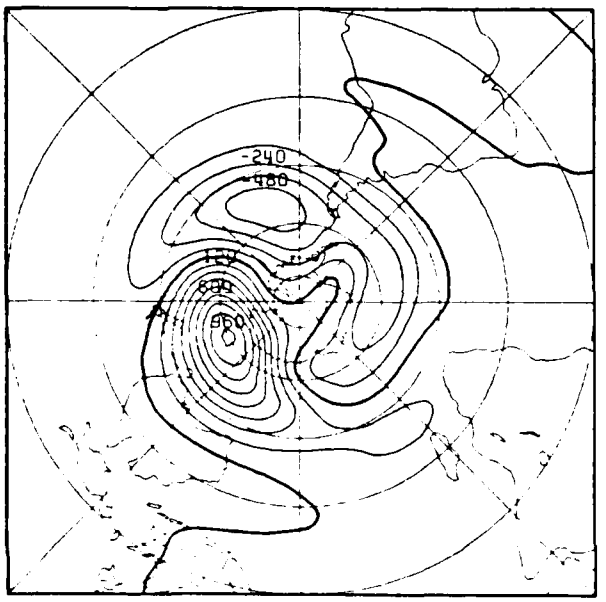

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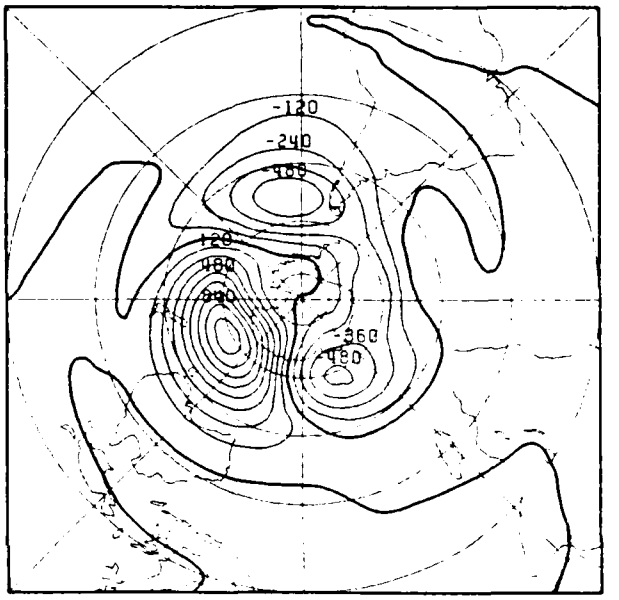

1200 GMT 5 JULY 1979 DAY 4

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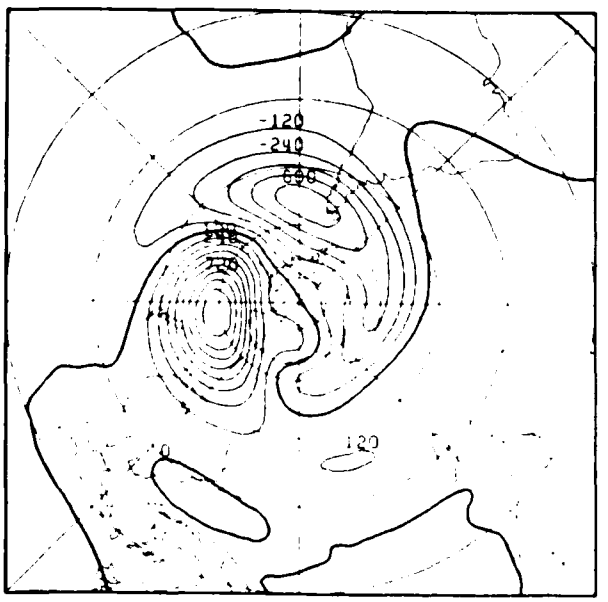
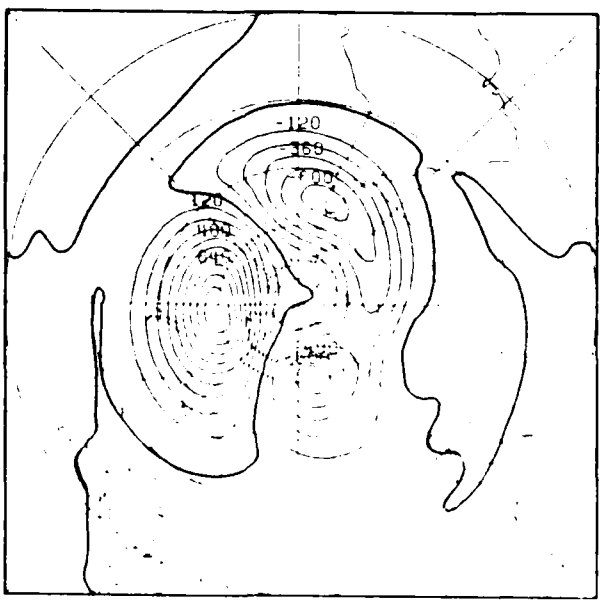


15-LAYER 2.4X3

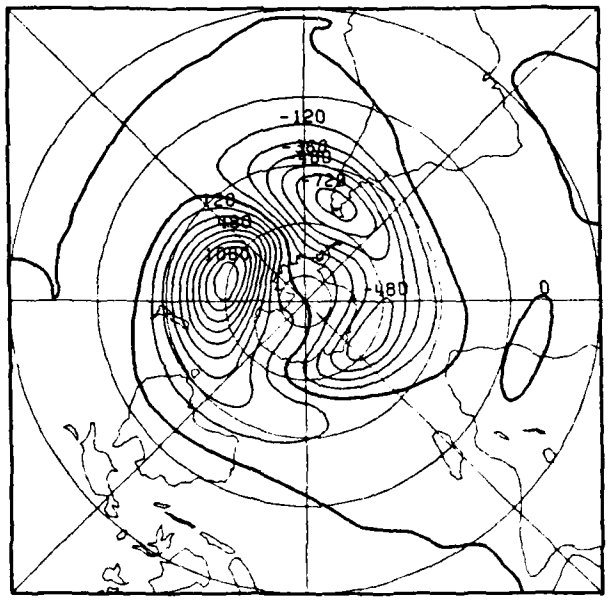


10 mb Z

WAVENUMBERS 1-4

1200 GMT 6 JULY 1979 DAY 5

OBSERVED



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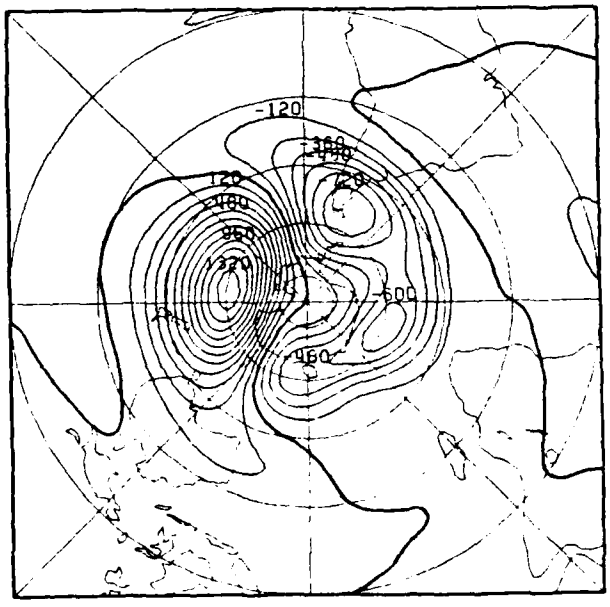
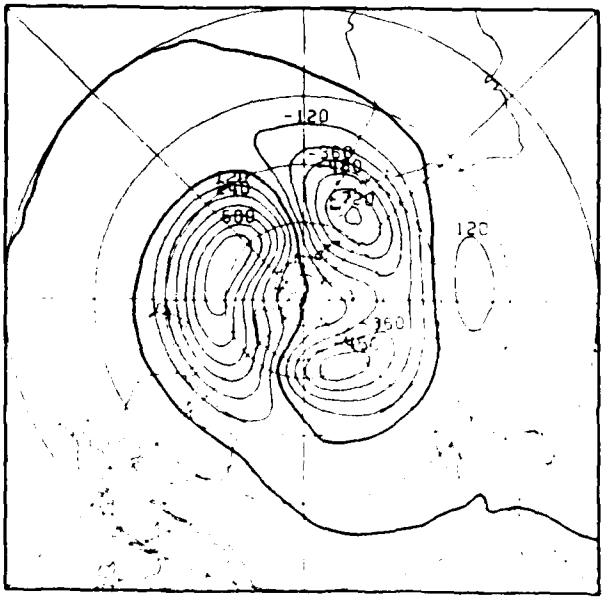
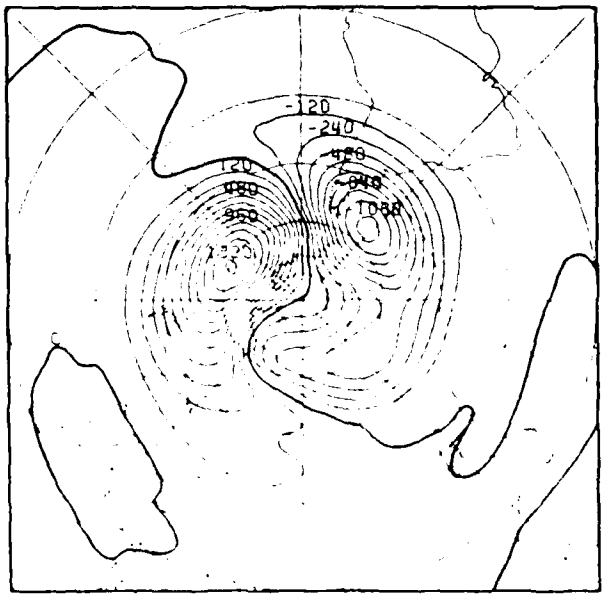


1200 GMT 7 JULY 1979 DAY 6

OBSERVED



15-LAYER 2.4X3

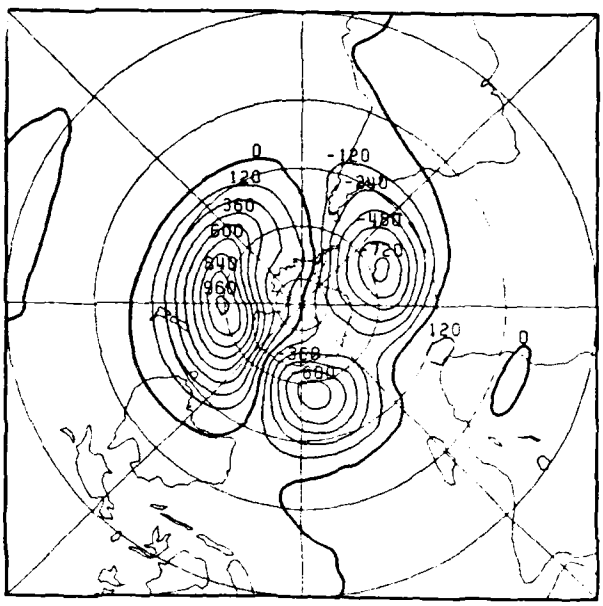


10 mb Z

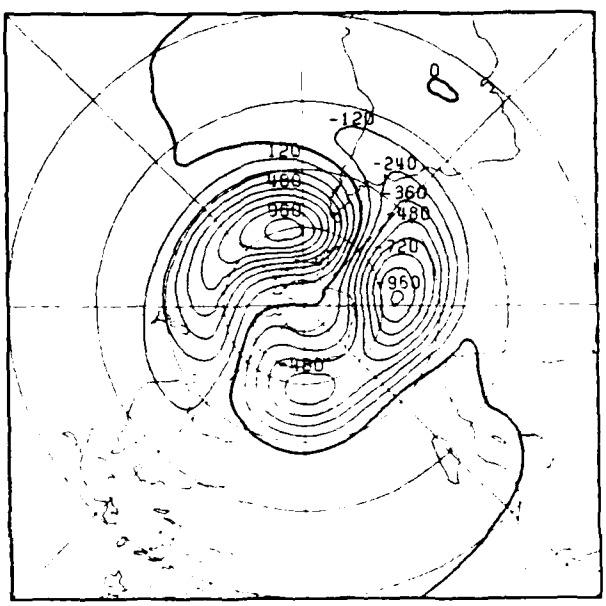
WAVENUMBERS 1-4

1200 GMT 8 JULY 1979 DAY 7

OBSERVED

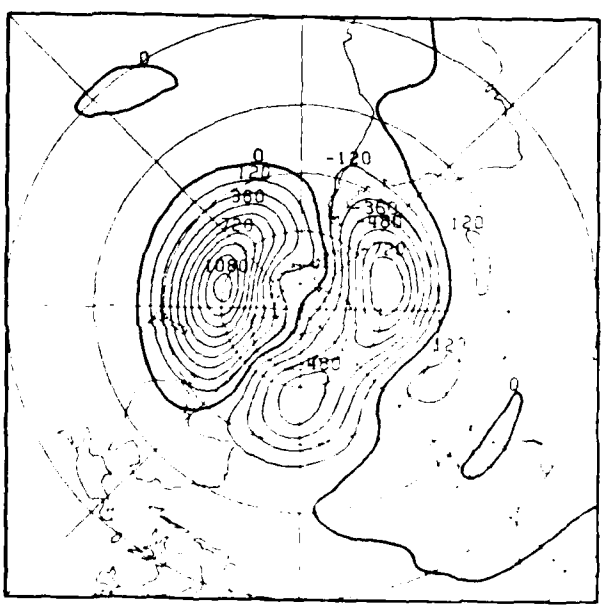


15-LAYER 2.4X3



1200 GMT 9 JULY 1979 DAY 8

OBSERVED



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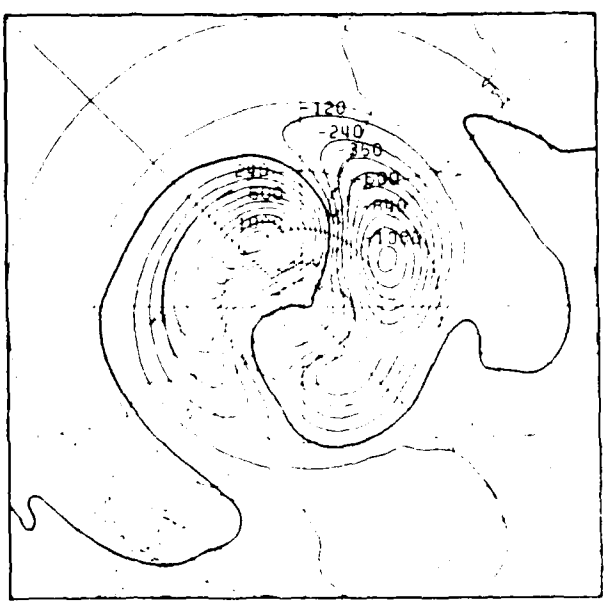
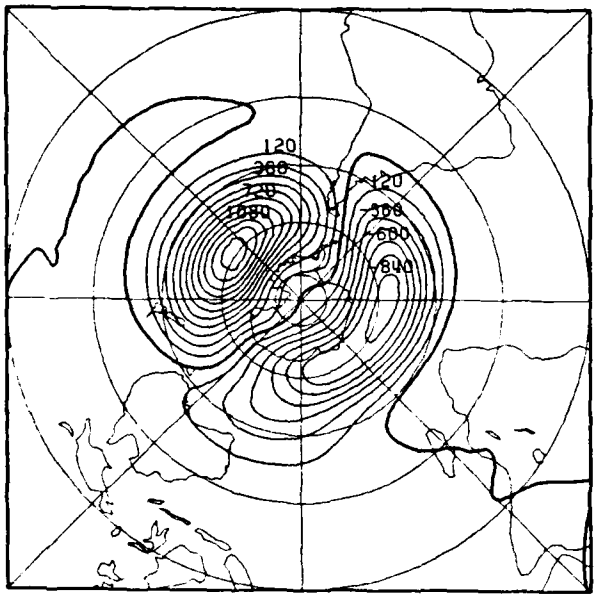


10 mb Z

WAVENUMBERS 1-4

1200 GMT 10 JULY 1979 DAY 9

OBSERVED



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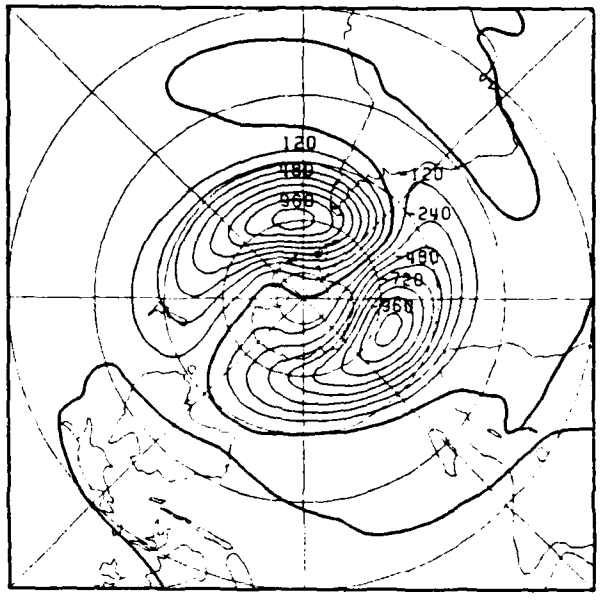
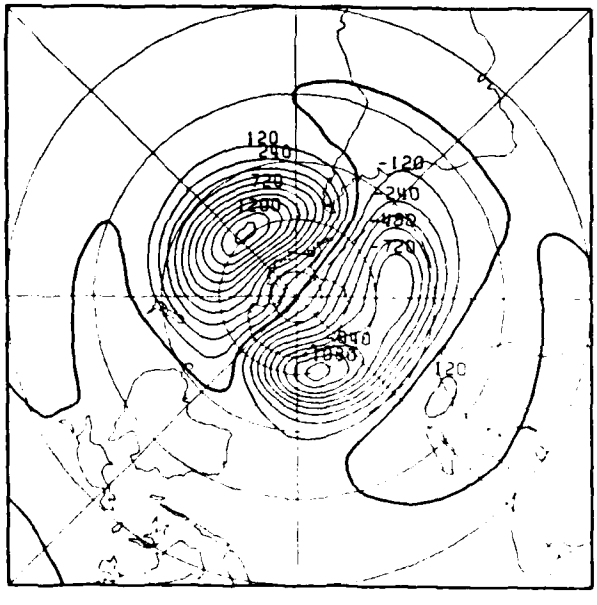


1200 GMT 11 JULY 1979 DAY 10

OBSERVED



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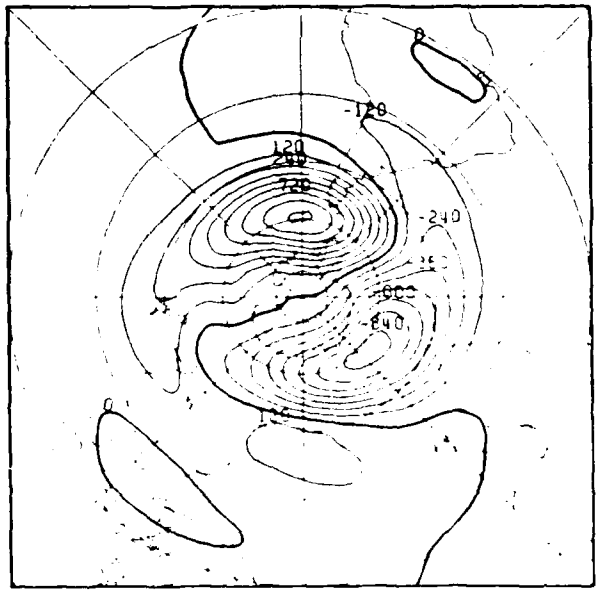
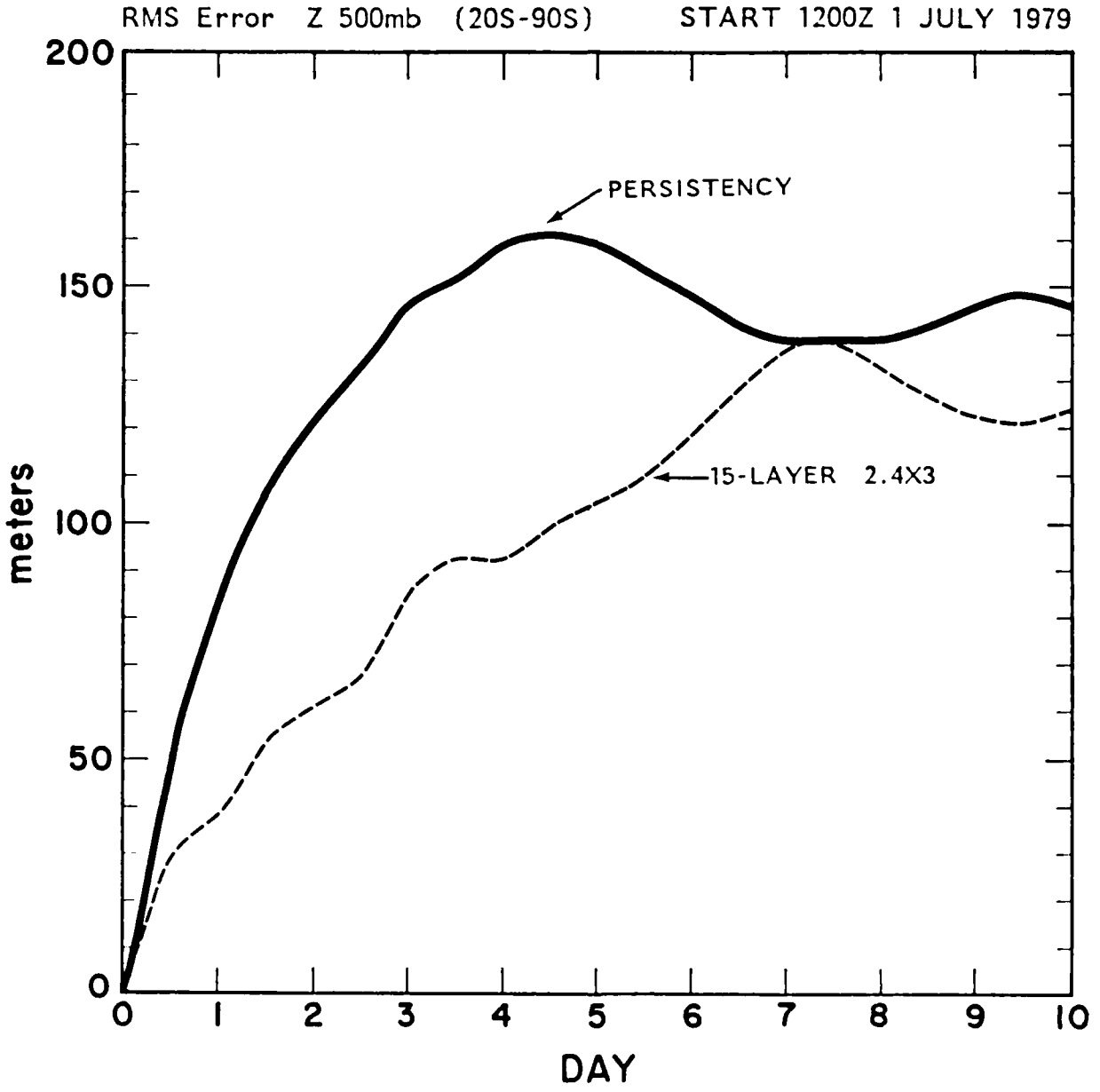



RMS Error Z 500mb (20S-90S)
START 1200Z 1 JULY 1979
200
150
100
50
0
meters
PERSISTENCY
15-LAYER 2.4X3
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

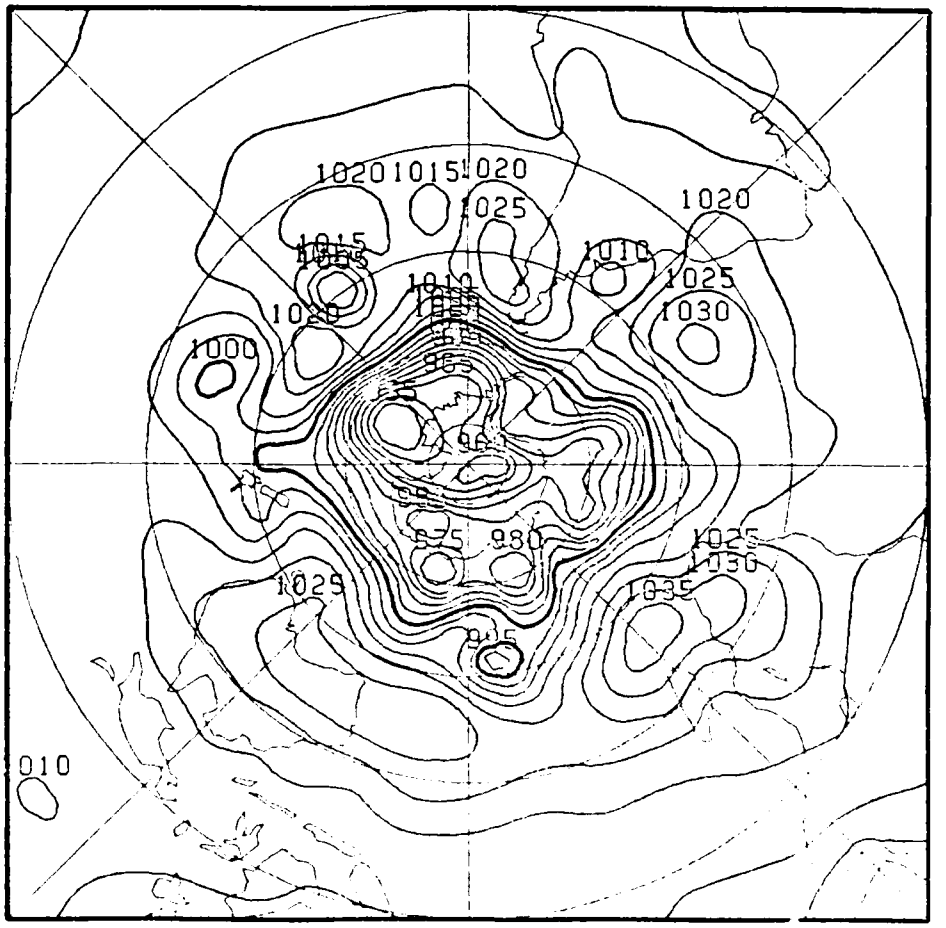
1200 GMT

3 JULY 1979

SLP

1200 GMT 3 JULY 1979

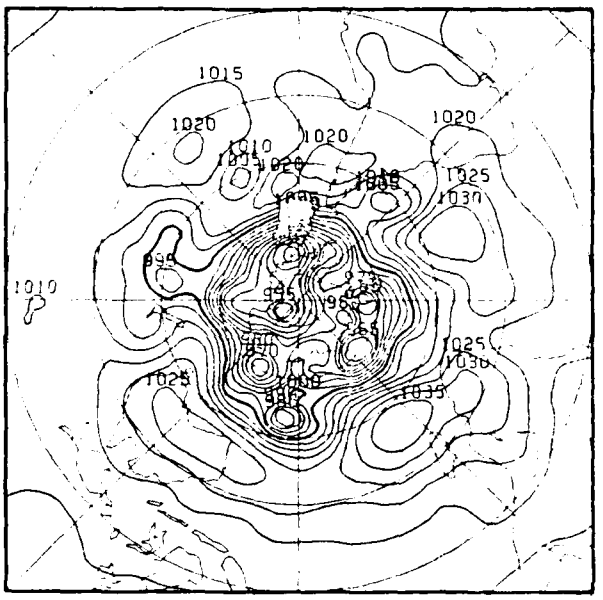
OBSERVED



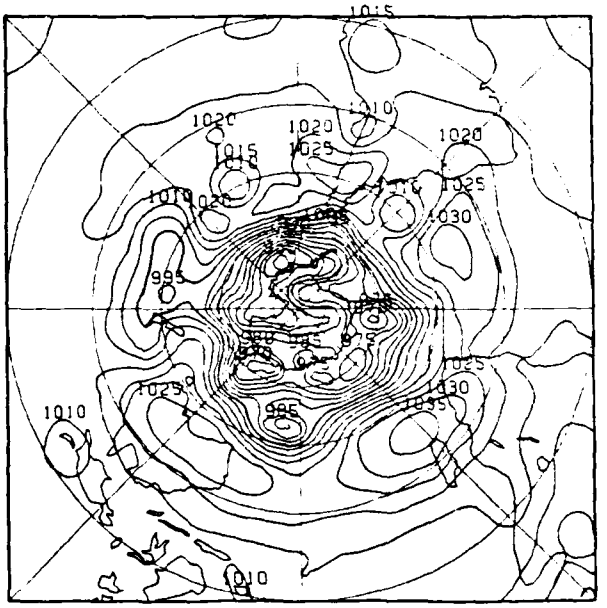
SLP

1200 GMT 4 JULY 1979 DAY 1

OBSERVED



15-LAYER 2.4X3



1200 GMT 5 JULY 1979 DAY 2

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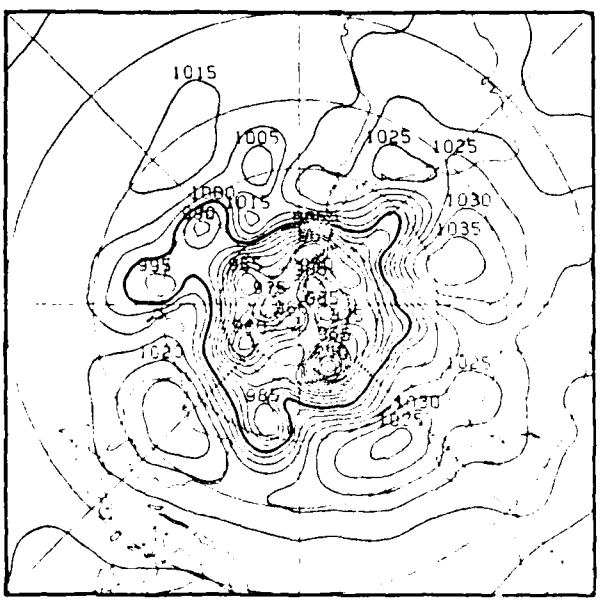

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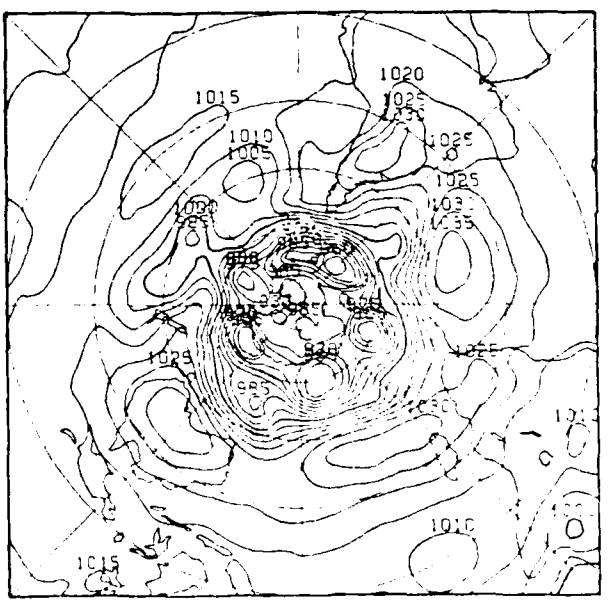

SLP

1200 GMT 6 JULY 1979 DAY 3

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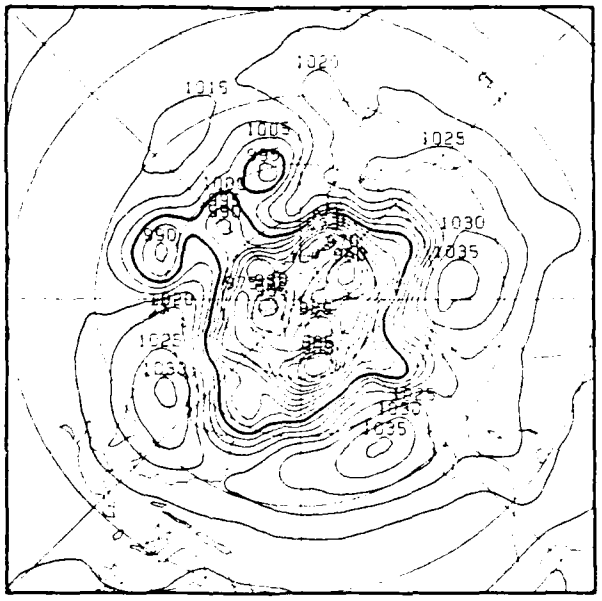

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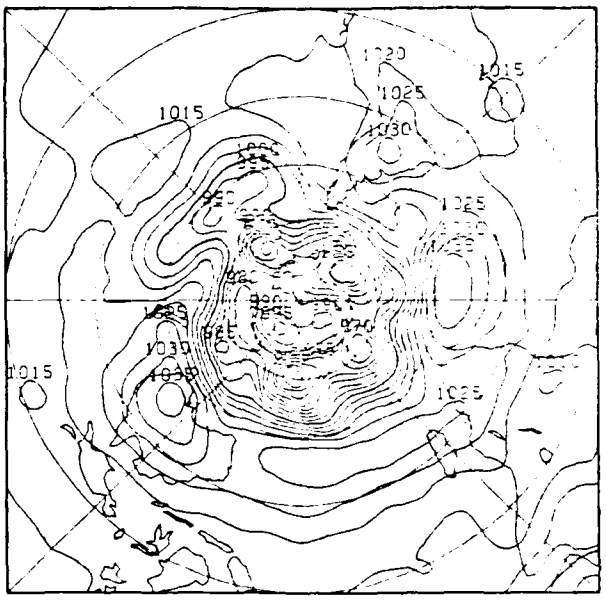

1200 GMT 7 JULY 1979 DAY 4

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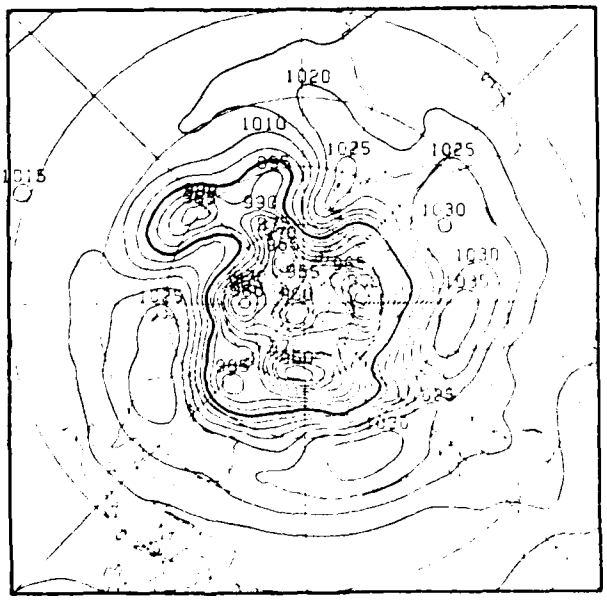
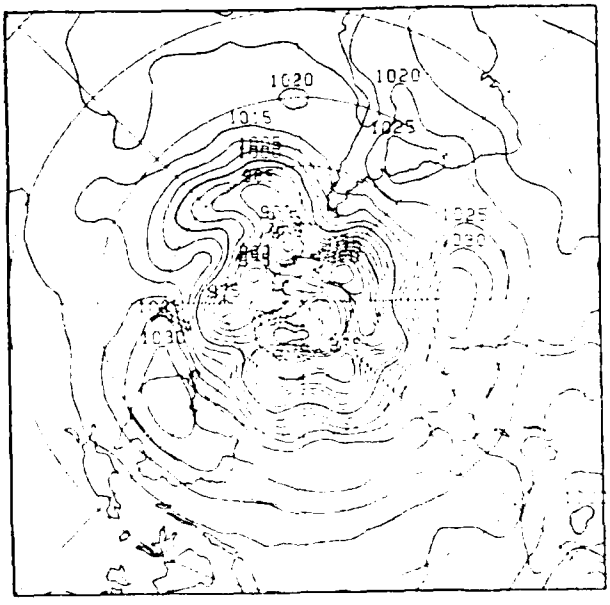


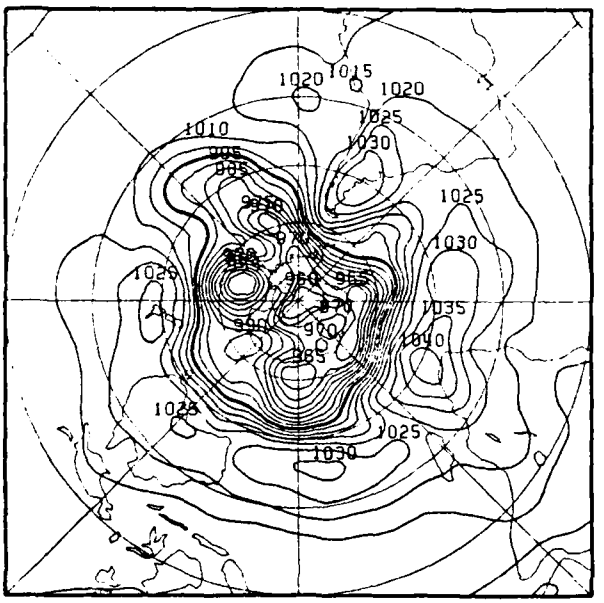
15-LAYER 2.4X3



SLP

1200 GMT 8 JULY 1979 DAY 5

OBSERVED



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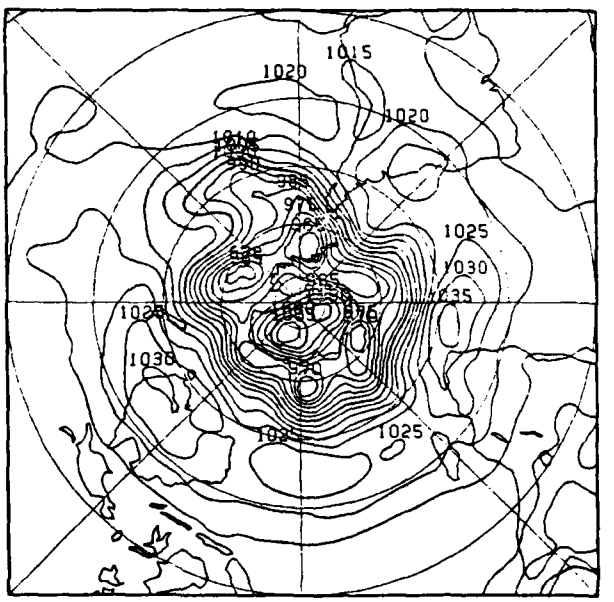

1200 GMT 9 JULY 1979 DAY 6

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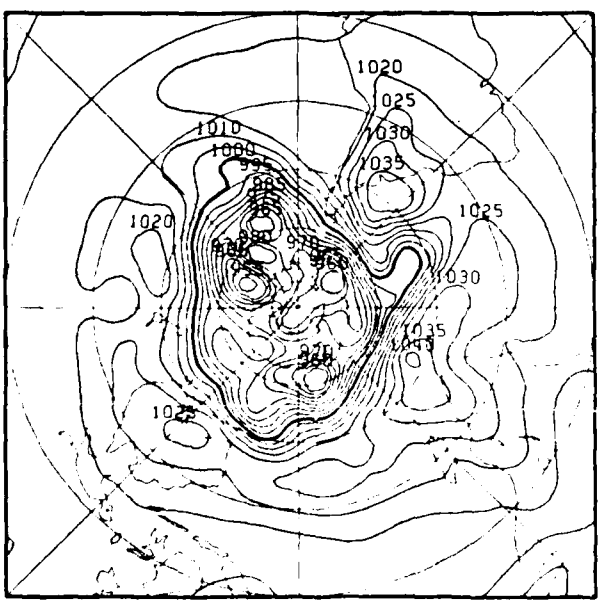
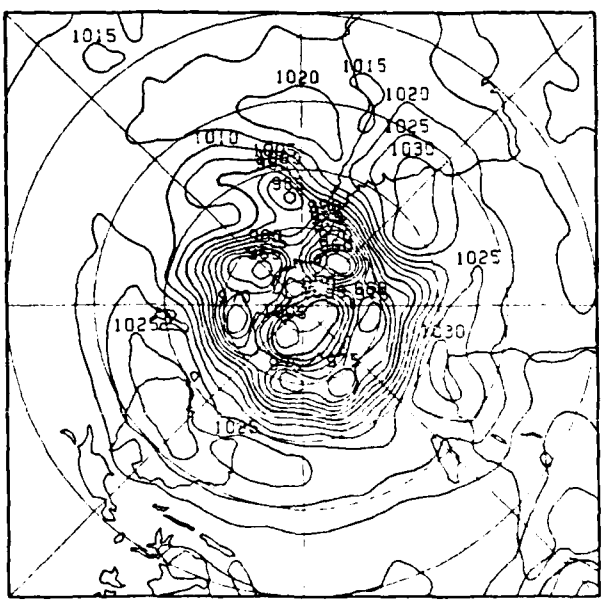


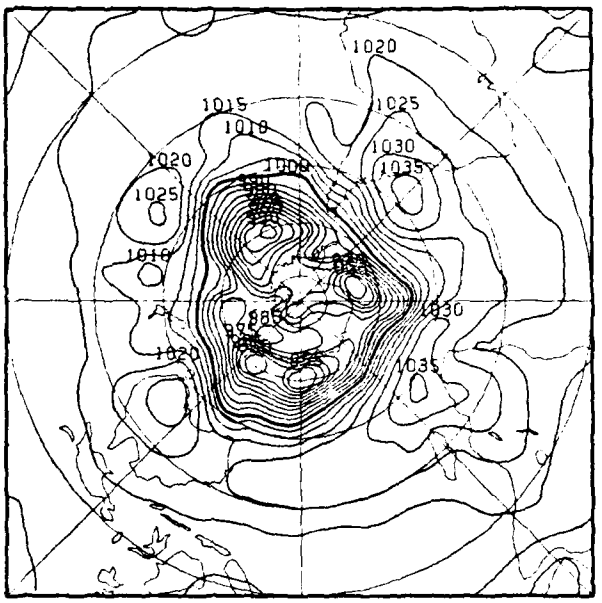
15-LAYER 2.4X3



SLP

1200 GMT 10 JULY 1979 DAY 7

OBSERVED



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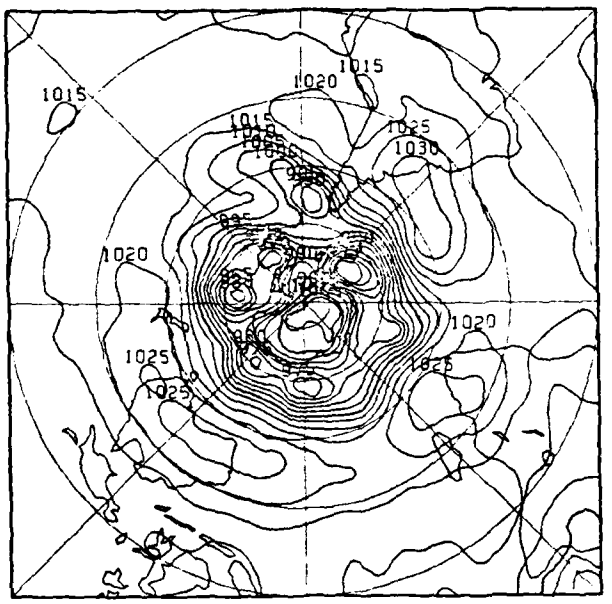

1200 GMT 11 JULY 1979 DAY 8

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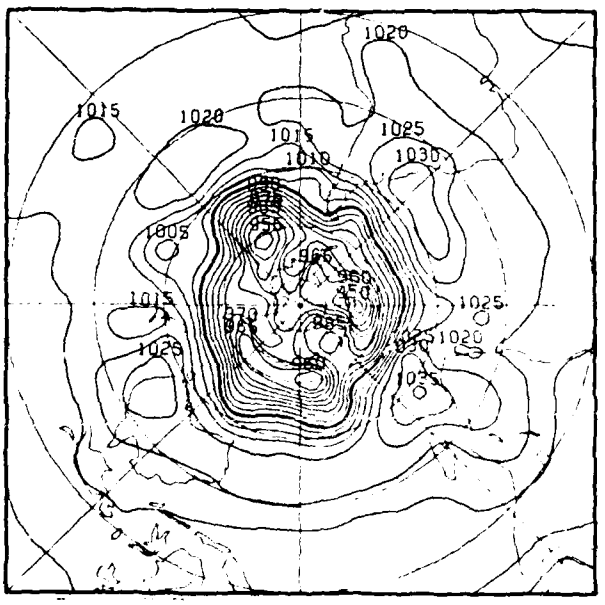

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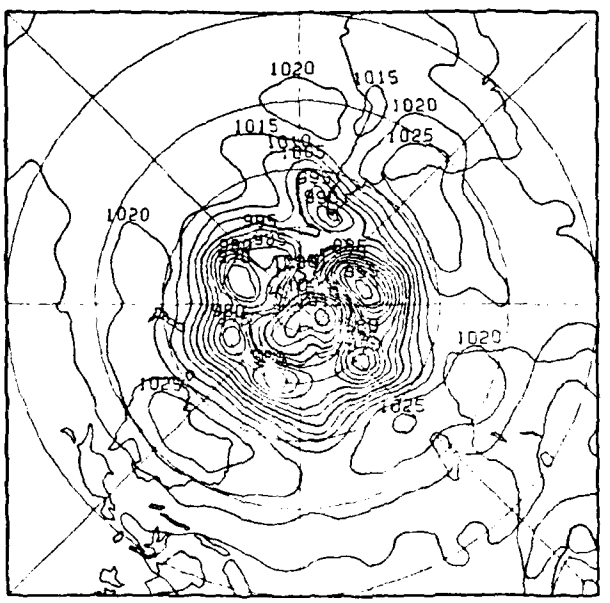

SLP

1200 GMT 12 JULY 1979 DAY 9

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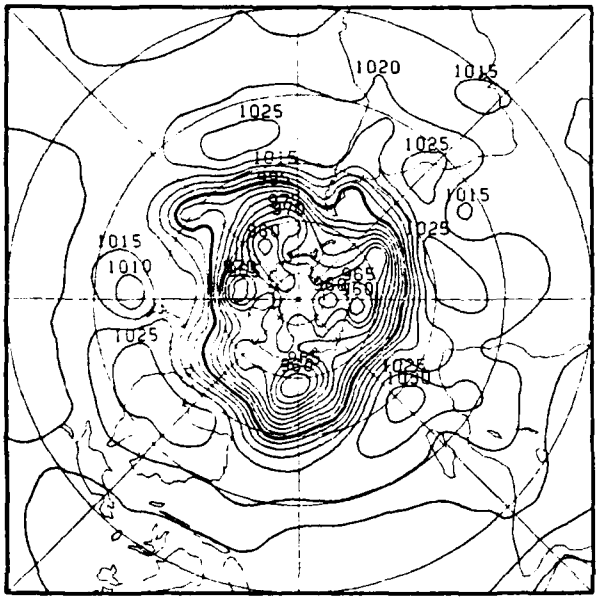

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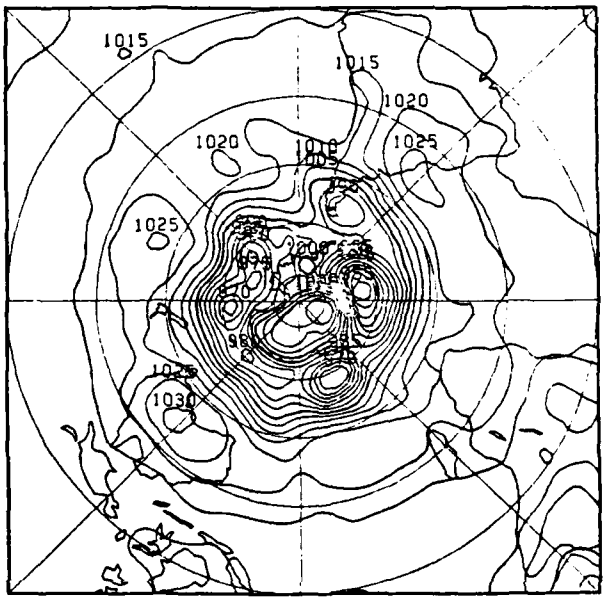

1200 GMT 13 JULY 1979 DAY 10

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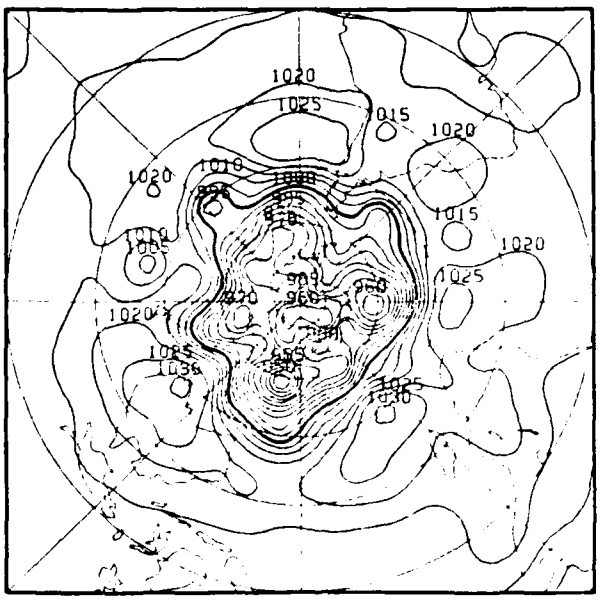

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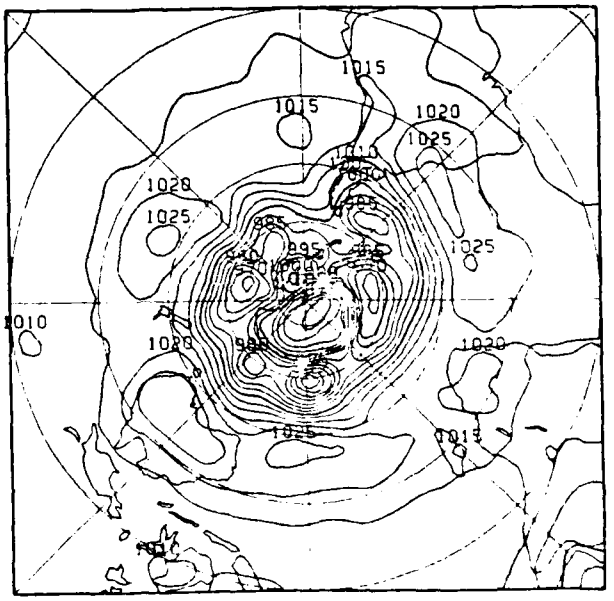

500 mb Z

1200 GMT 3 JULY 1979

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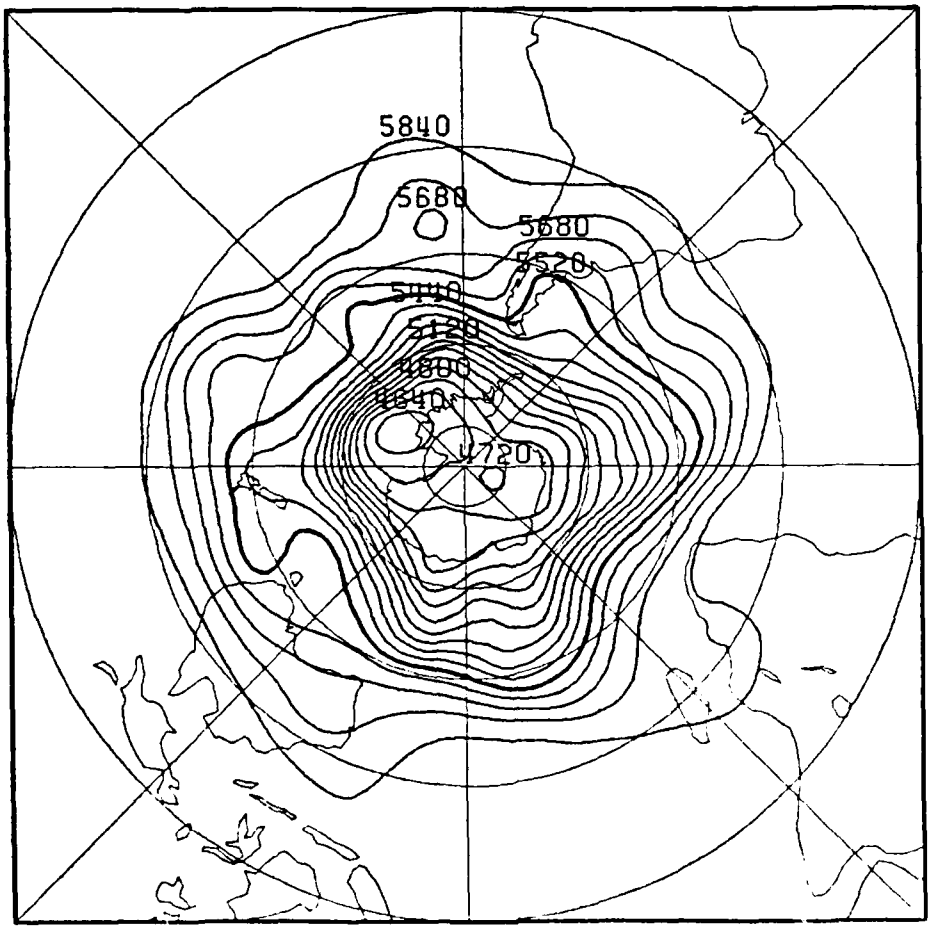

500 mb Z

1200 GMT 4 JULY 1979 DAY 1

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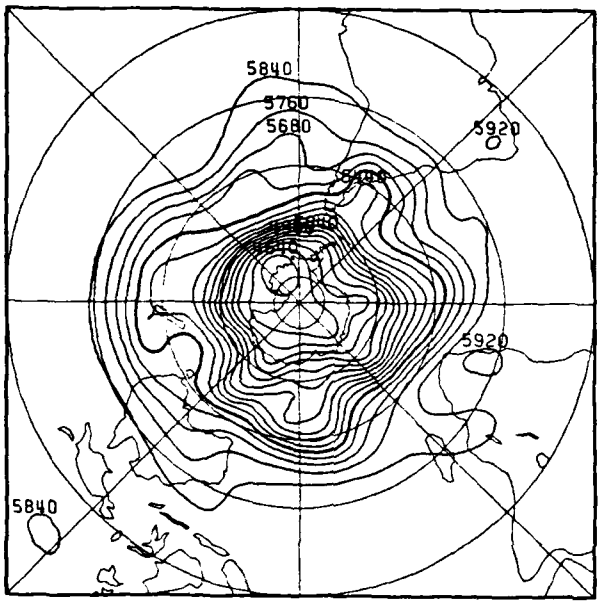

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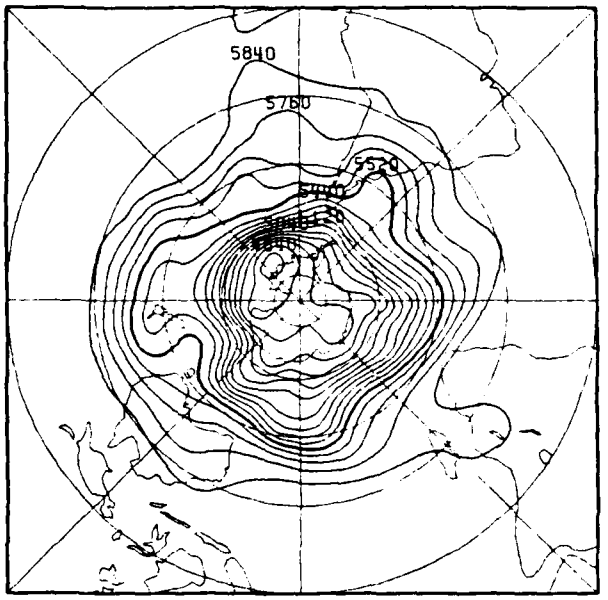

1200 GMT 5 JULY 1979 DAY 2

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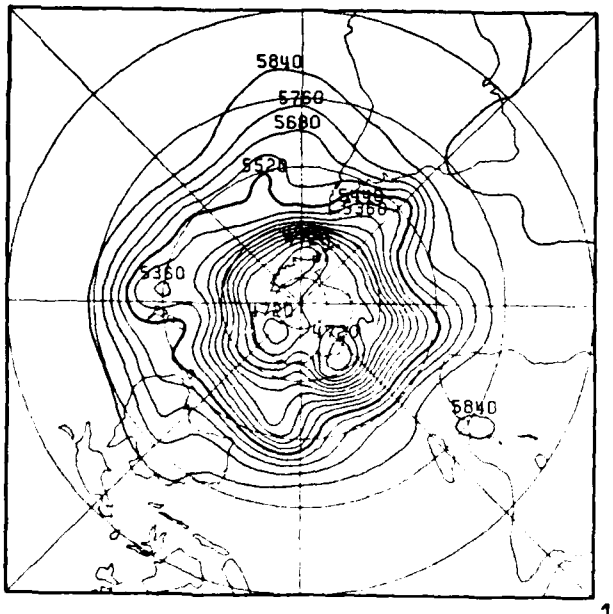

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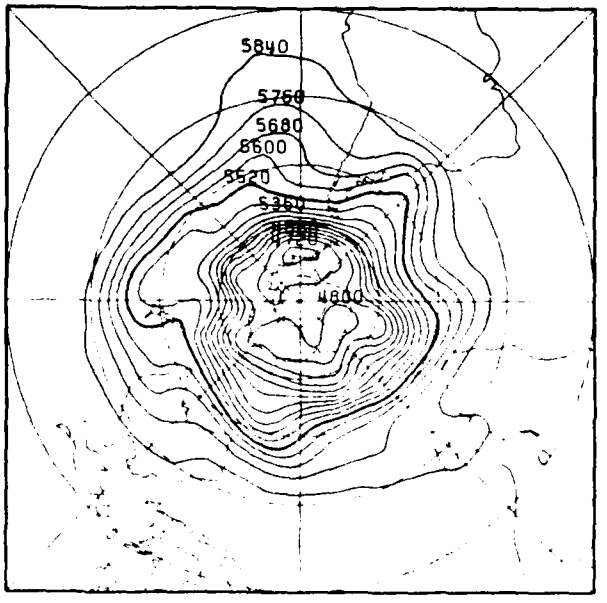

500 mb Z

1200 GMT 6 JULY 1979 DAY 3

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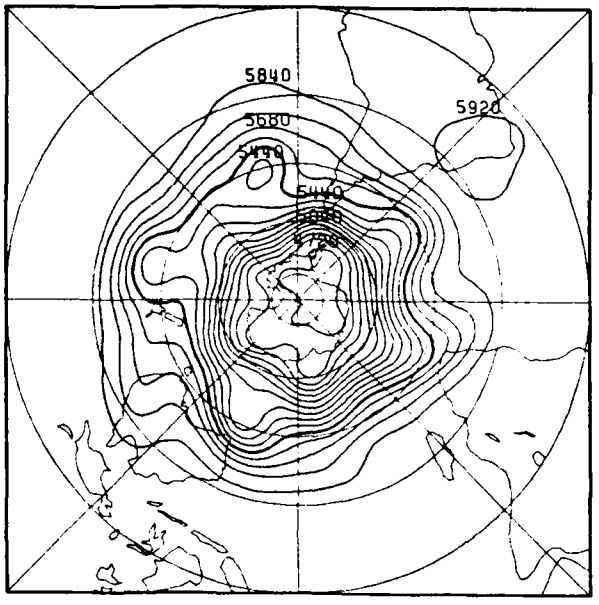

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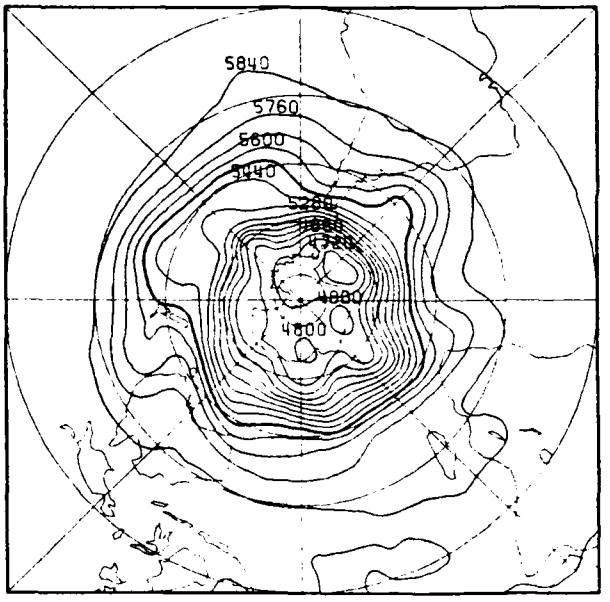

1200 GMT 7 JULY 1979 DAY 4

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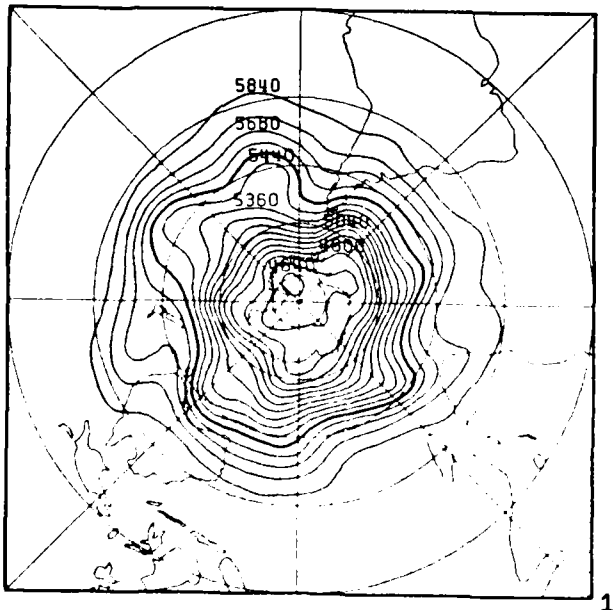

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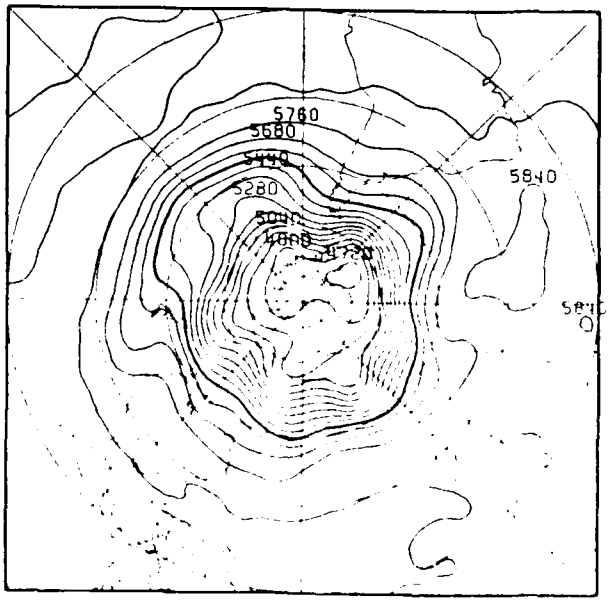
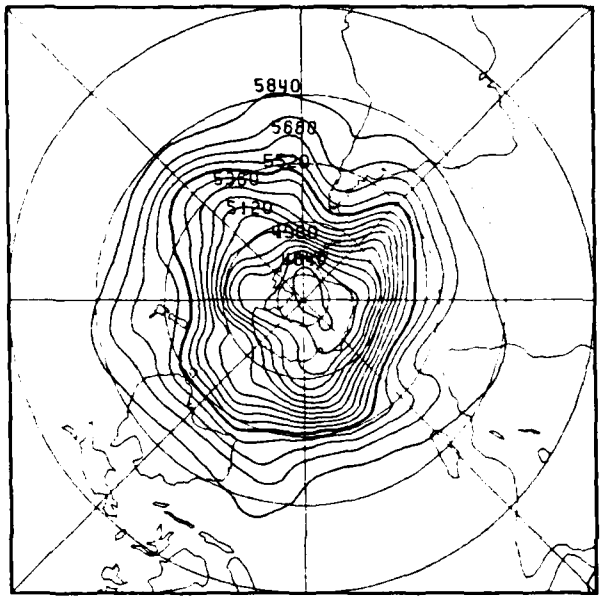


500 mb Z

1200 GMT 8 JULY 1979 DAY 5

OBSERVED



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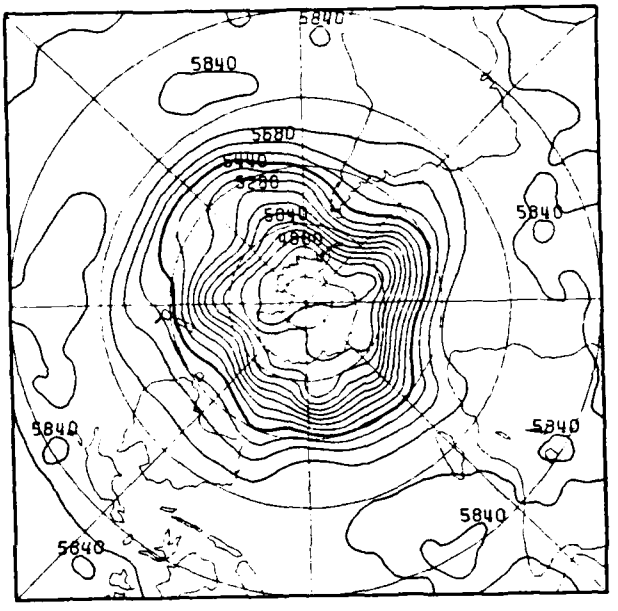

1200 GMT 9 JULY 1979 DAY 6

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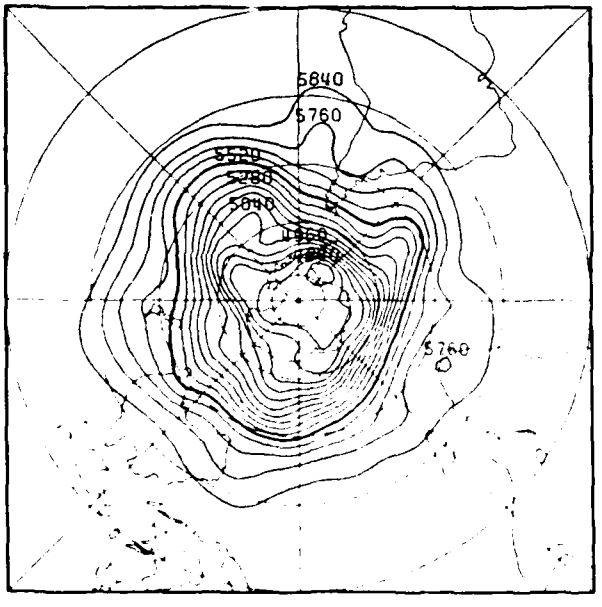

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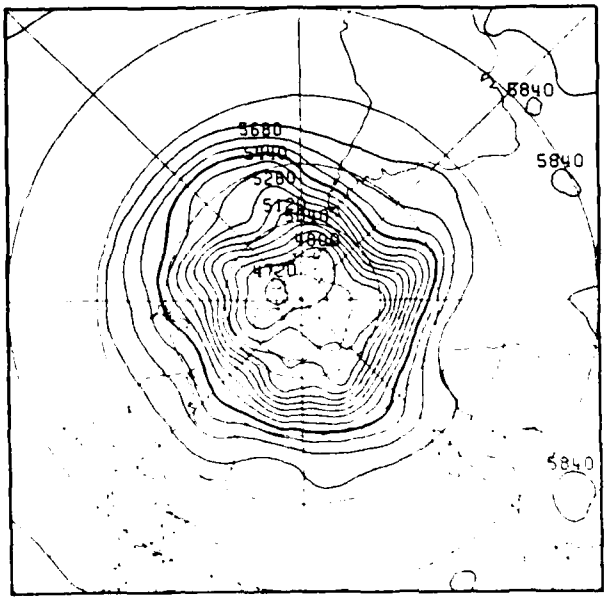

500 mb Z

1200 GMT 10 JULY 1979 DAY 7

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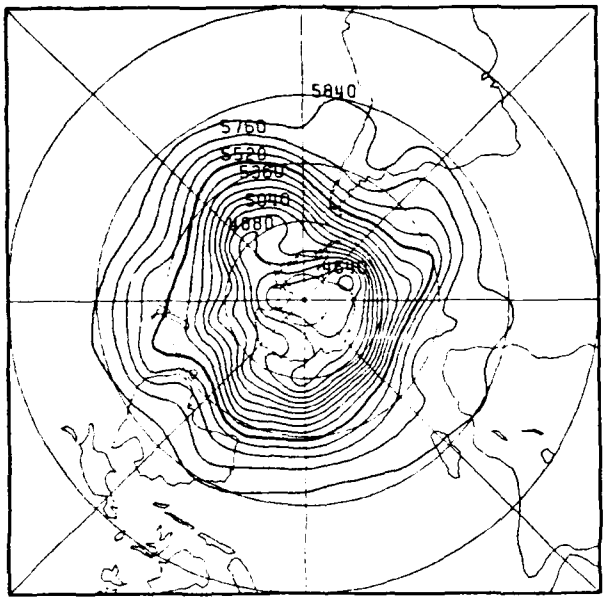

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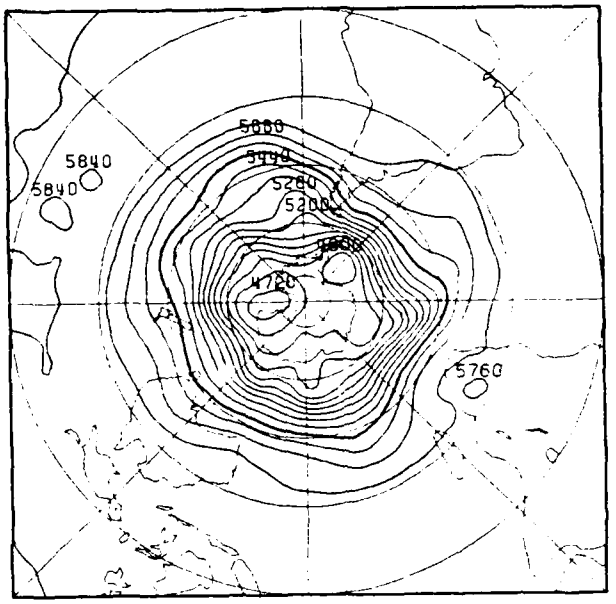

1200 GMT 11 JULY 1979 DAY 8

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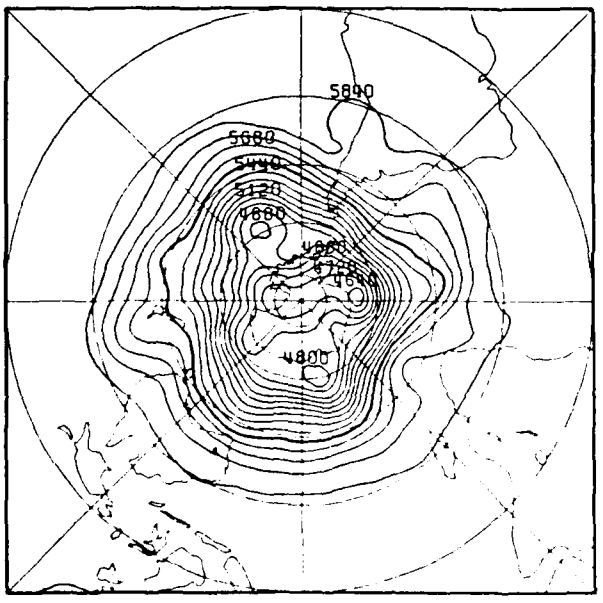

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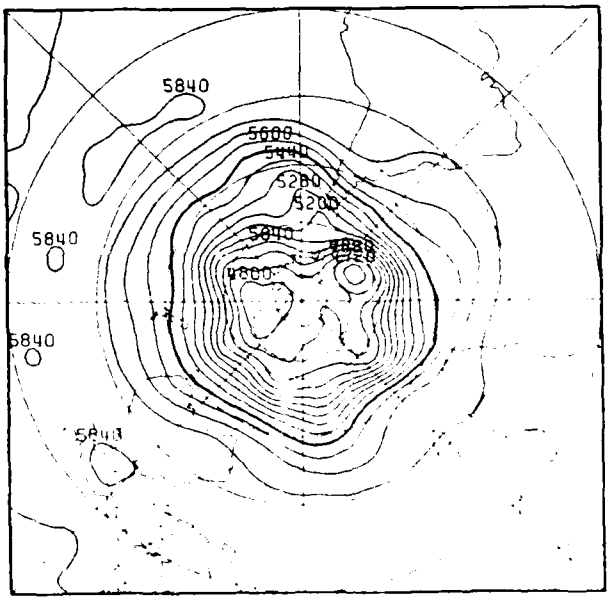

500 mb Z

1200 GMT 12 JULY 1979 DAY 9

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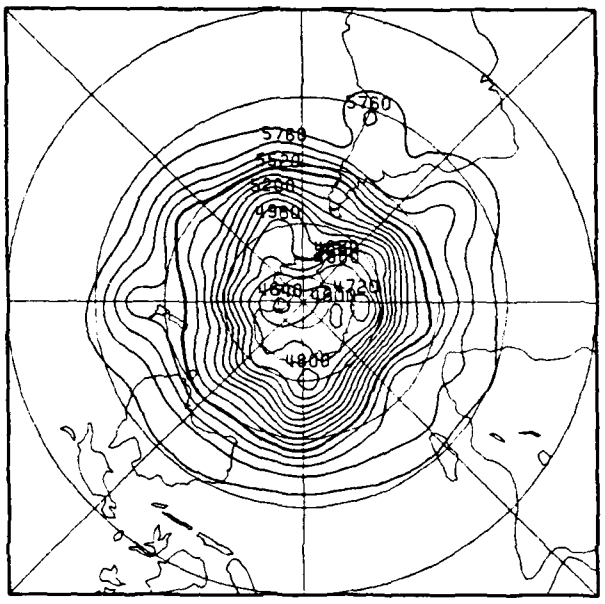

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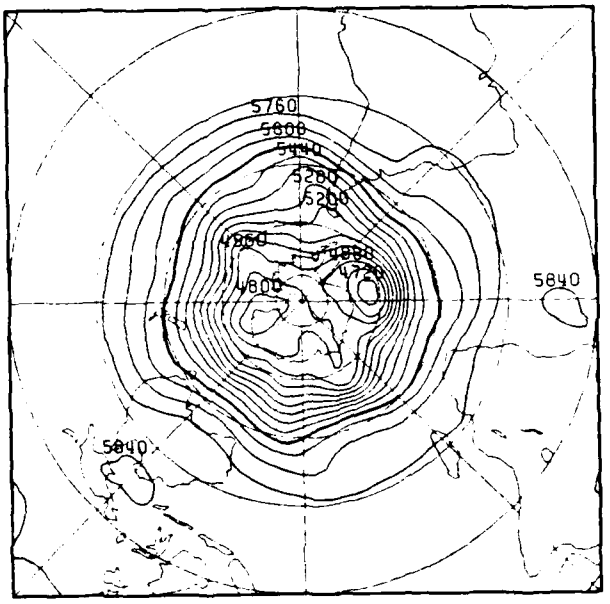

1200 GMT 13 JULY 1979 DAY 10

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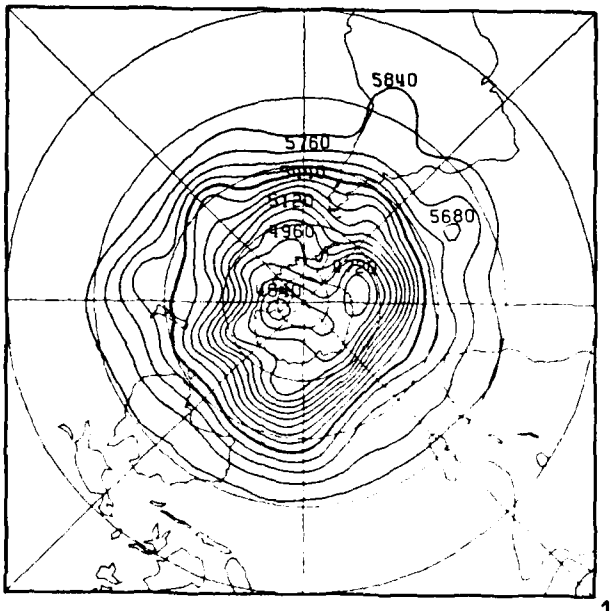

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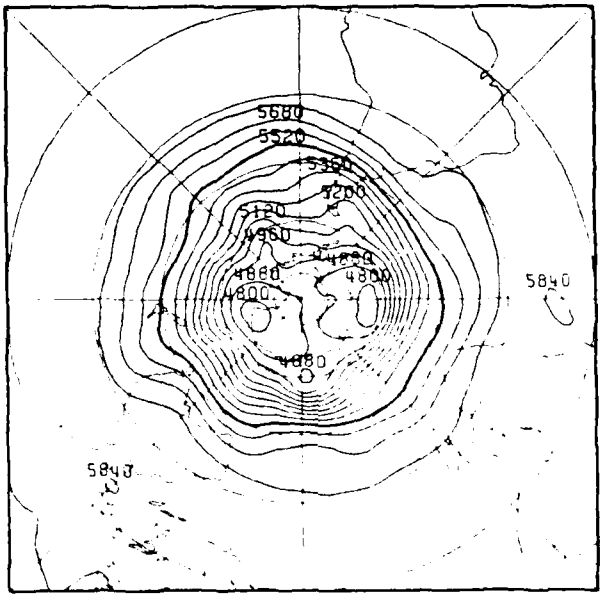
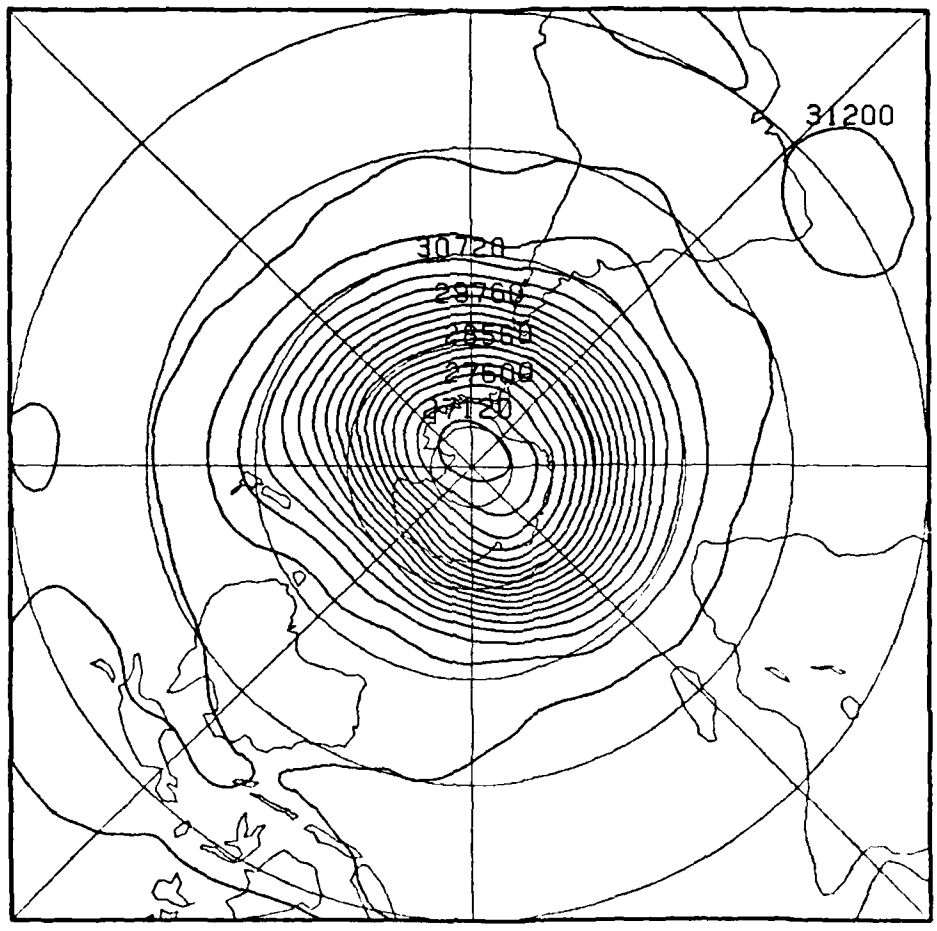


10 mb Z

1200 GMT 3 JULY 1979

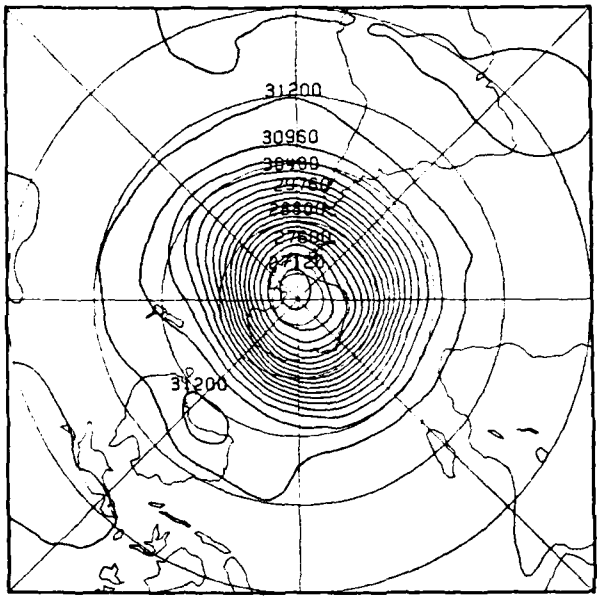
OBSERVED



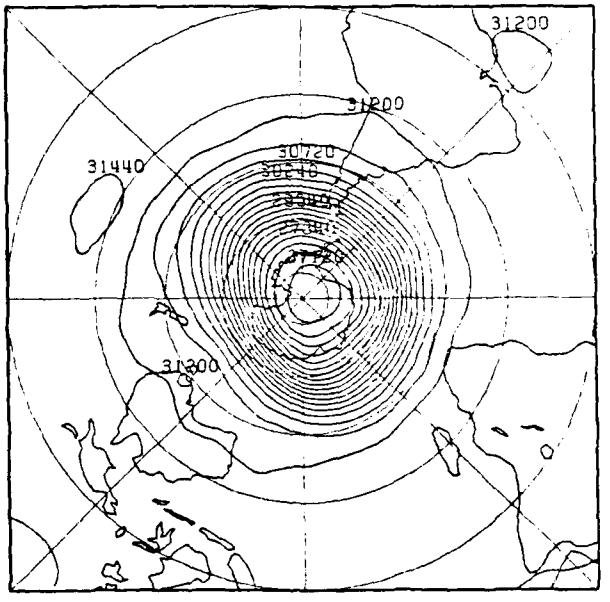
10 mb Z

1200 GMT 4 JULY 1979 DAY 1

OBSERVED

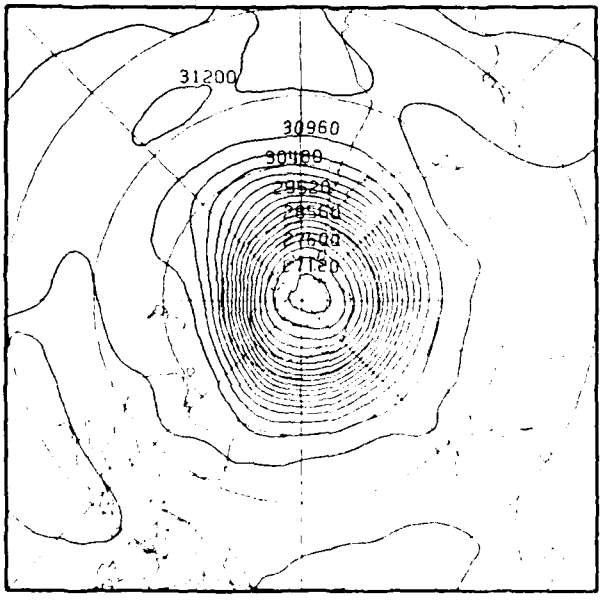


15-LAYER 2.4X3



1200 GMT 5 JULY 1979 DAY 2

OBSERVED



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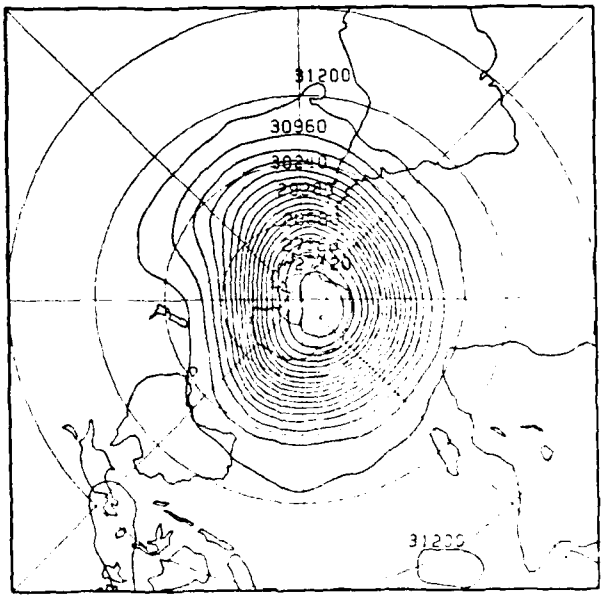
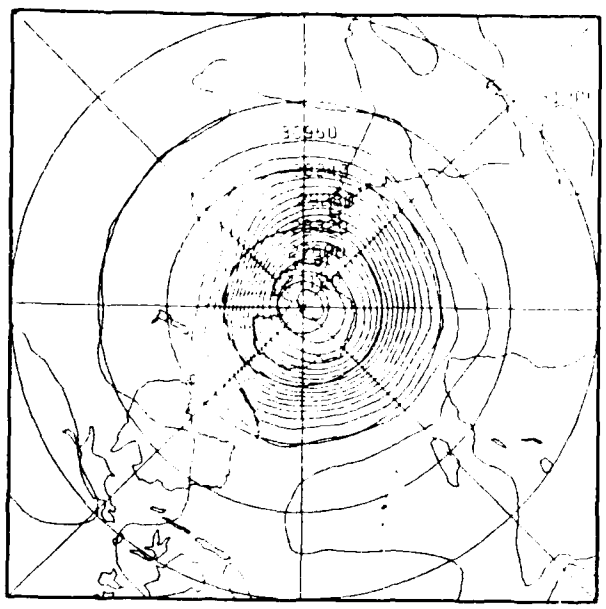


10 mb Z

1200 GMT 6 JULY 1979 DAY 3

OBSERVED



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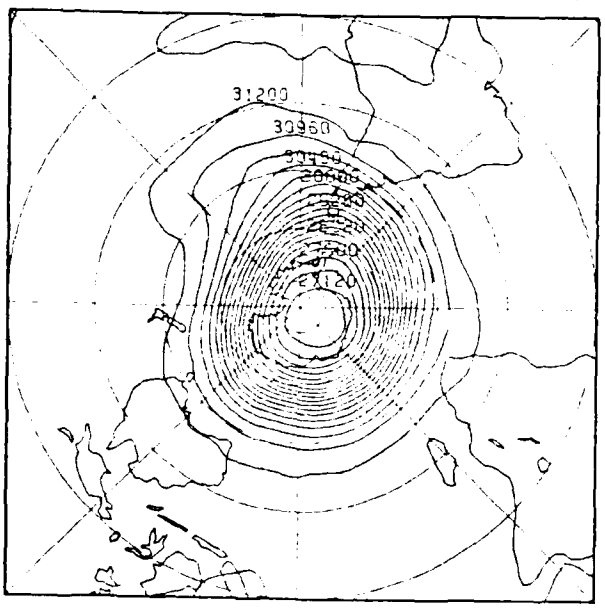
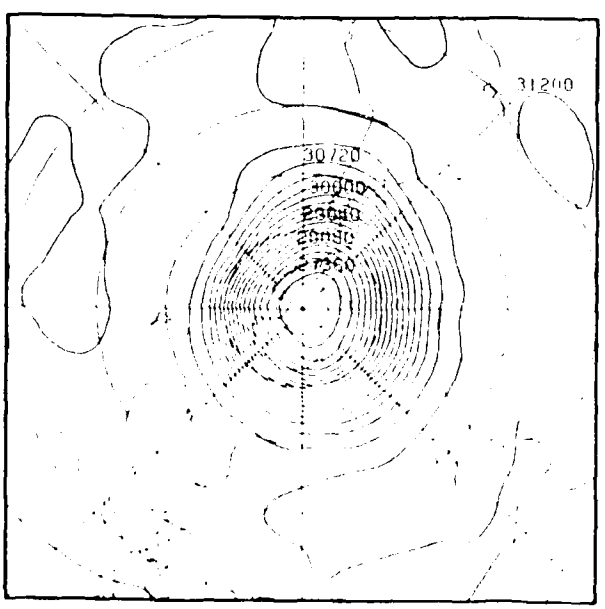


1200 GMT 7 JULY 1979 DAY 4

OBSERVED



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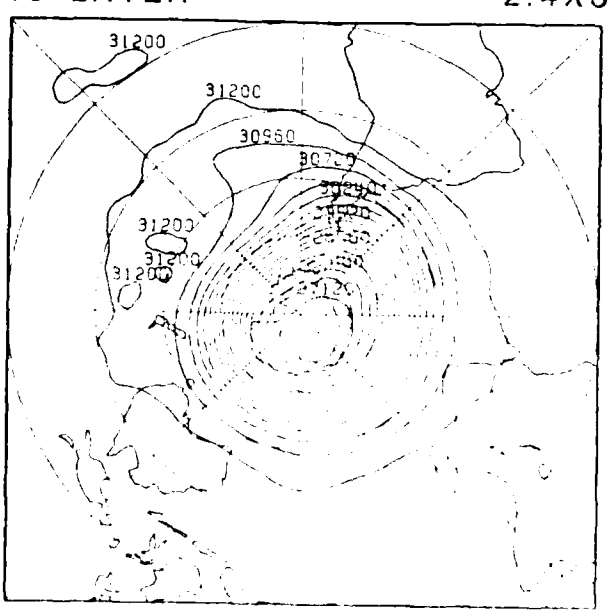
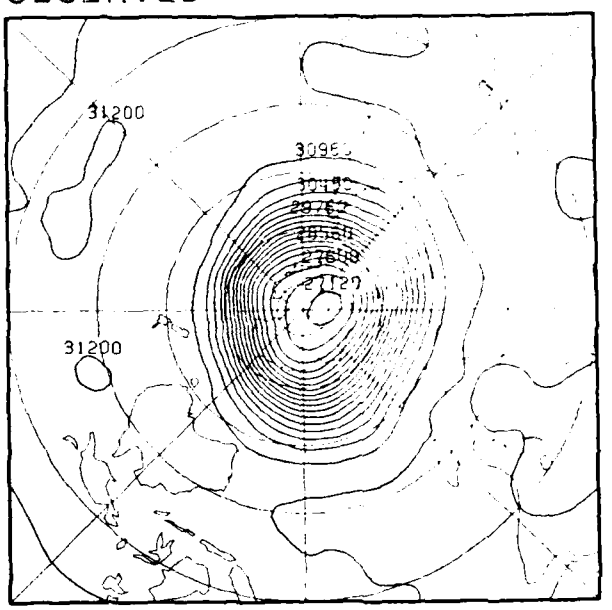


10 mb Z

1200 GMT 8 JULY 1979 DAY 5

OBSERVED



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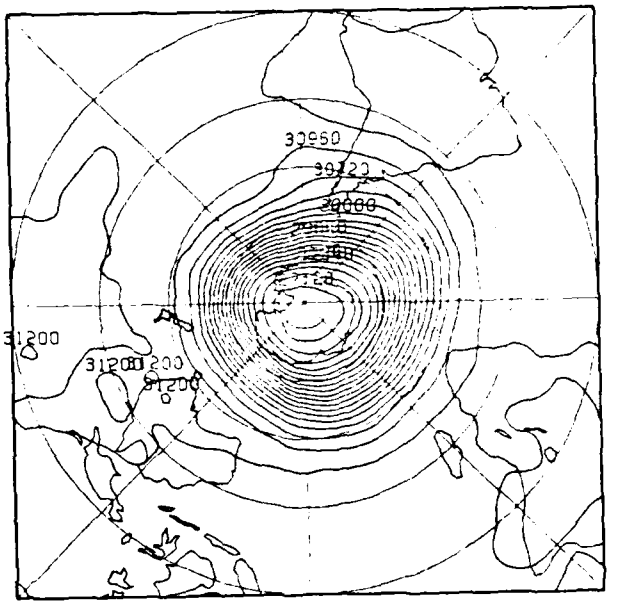
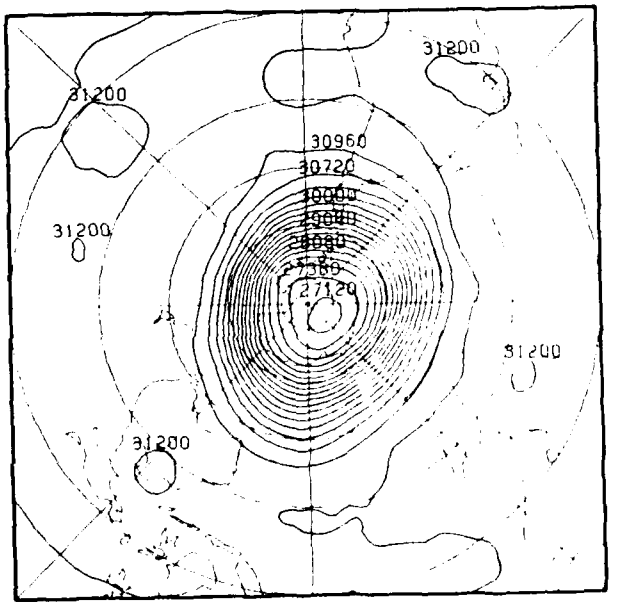


1200 GMT 9 JULY 1979 DAY 6

OBSERVED



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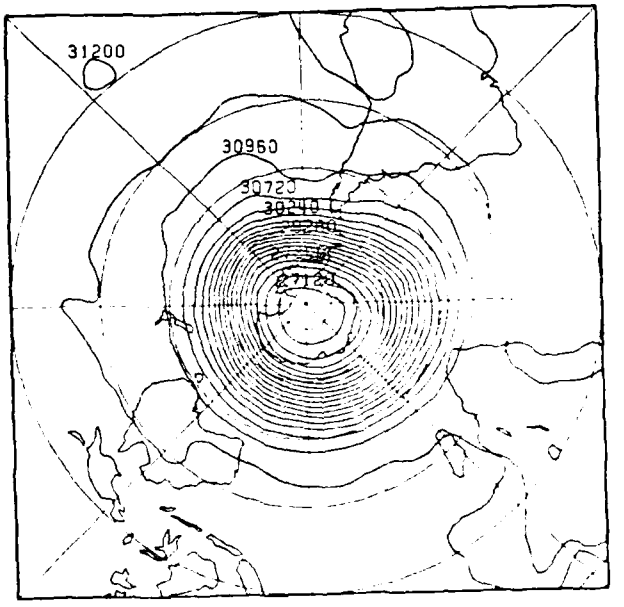
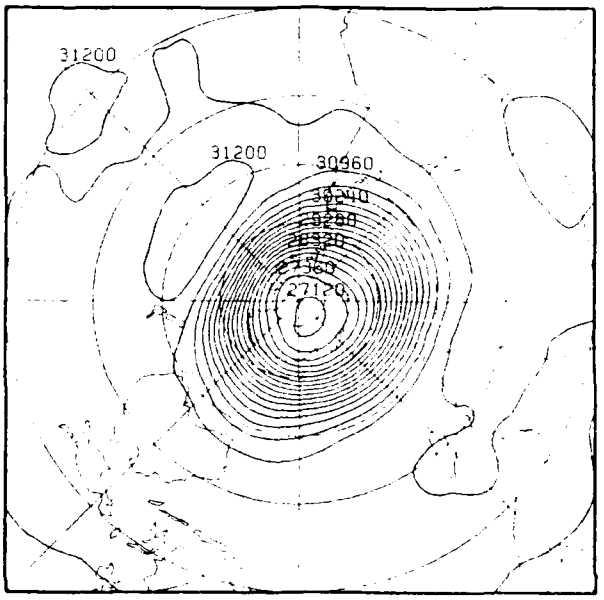


10 mb Z

1200 GMT 10 JULY 1979 DAY 7

OBSERVED



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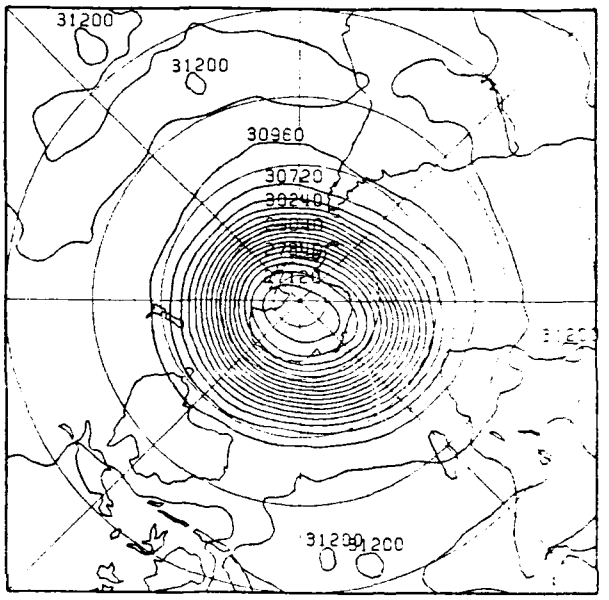
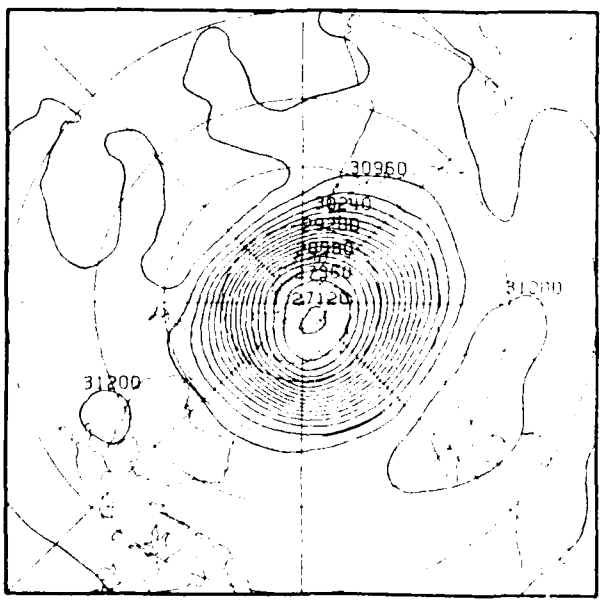


1200 GMT 11 JULY 1979 DAY 8

OBSERVED



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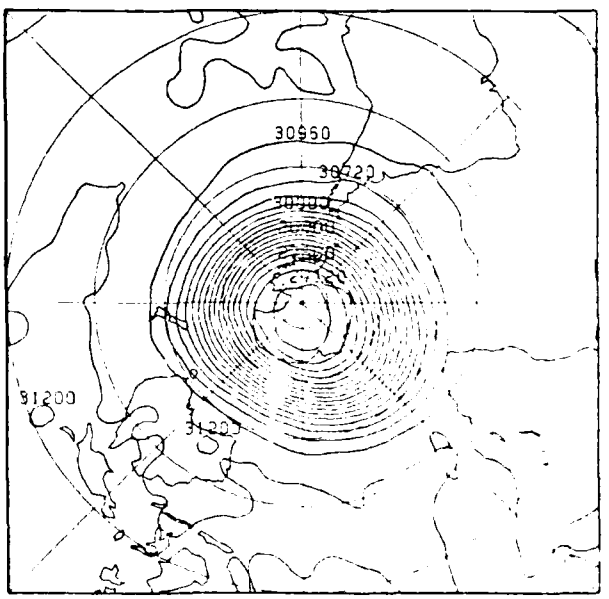
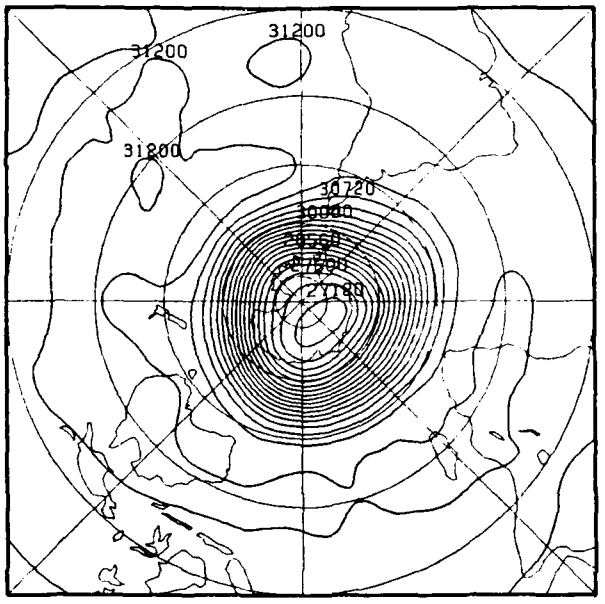


10 mb Z

1200 GMT 12 JULY 1979 DAY 9

OBSERVED



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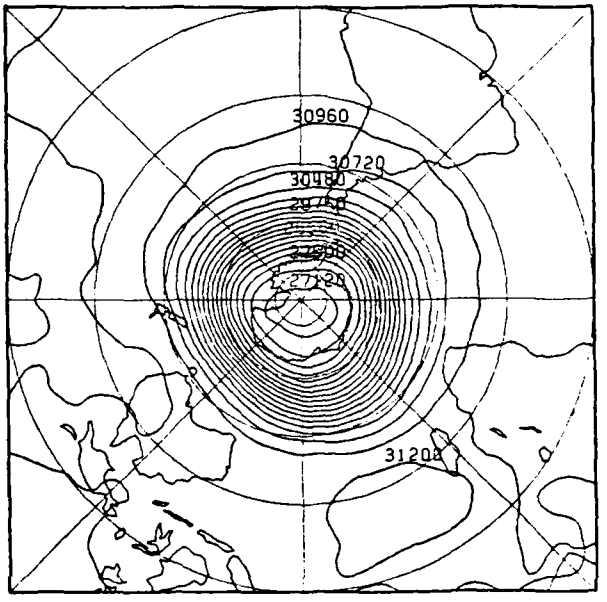
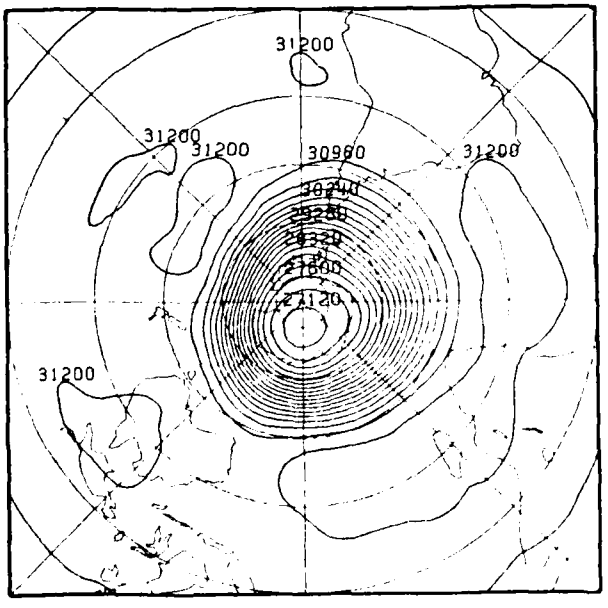
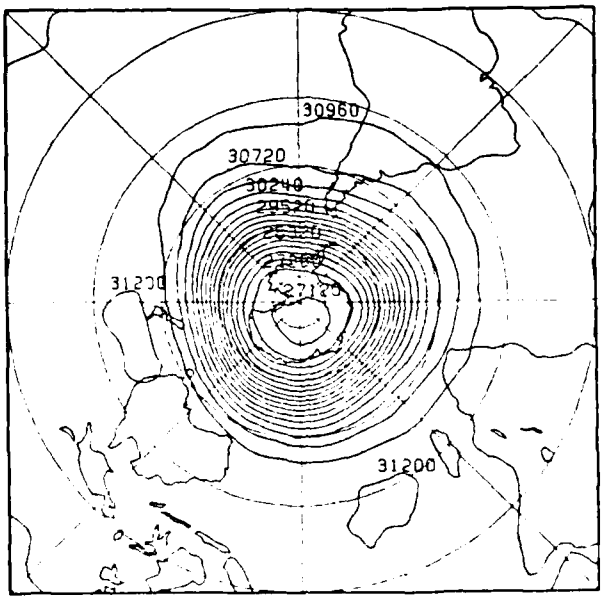


1200 GMT 13 JULY 1979 DAY 10

OBSERVED



15-LAYER 2.4X3

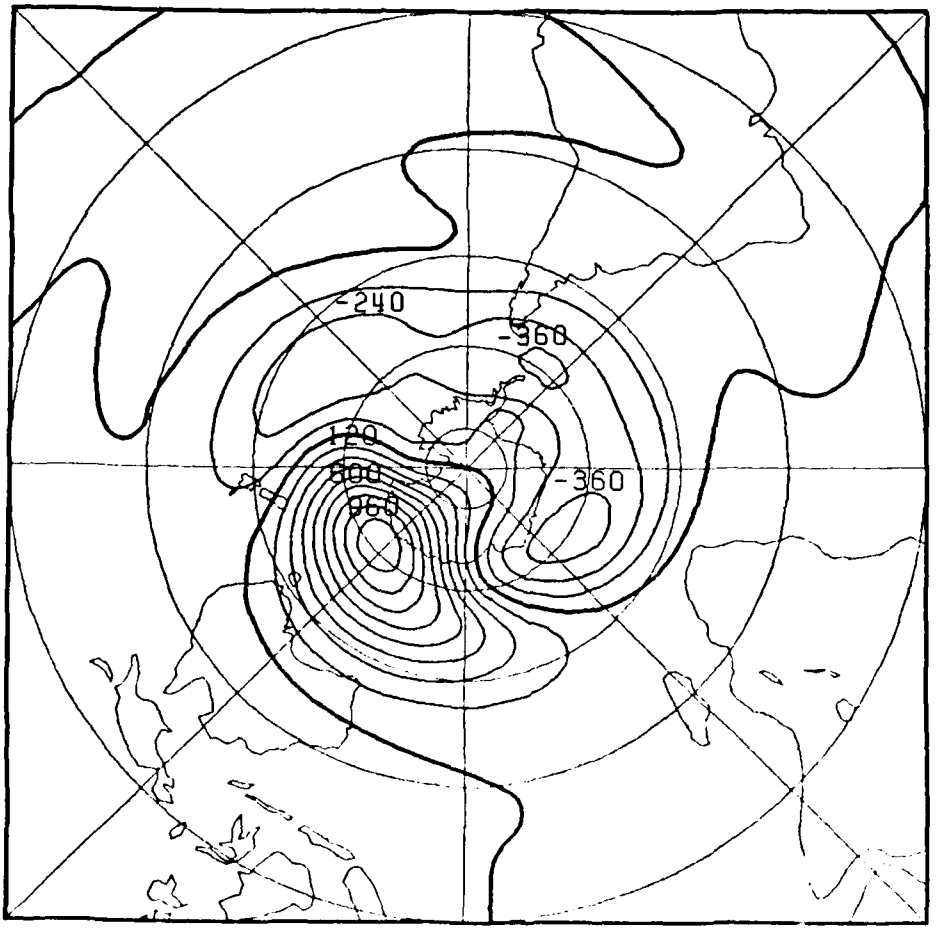


10 mb Z

WAVENUMBER S 1-4

1200 GMT 3 JULY 1979

OBSERVED

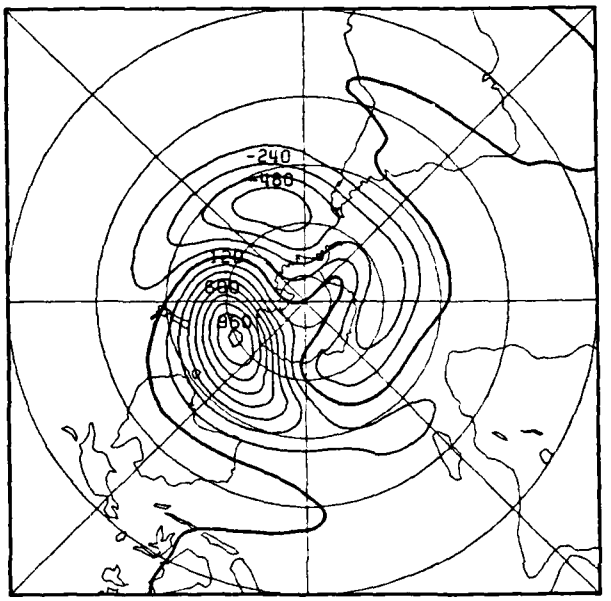


10 mb Z

WAVENUMBERS 1 - 4

1200 GMT 4 JULY 1979 DAY 1

OBSERVED



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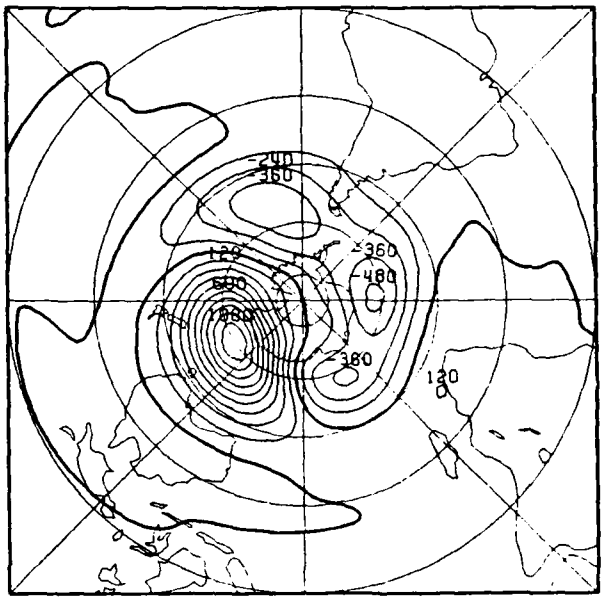

1200 GMT 5 JULY 1979 DAY 2

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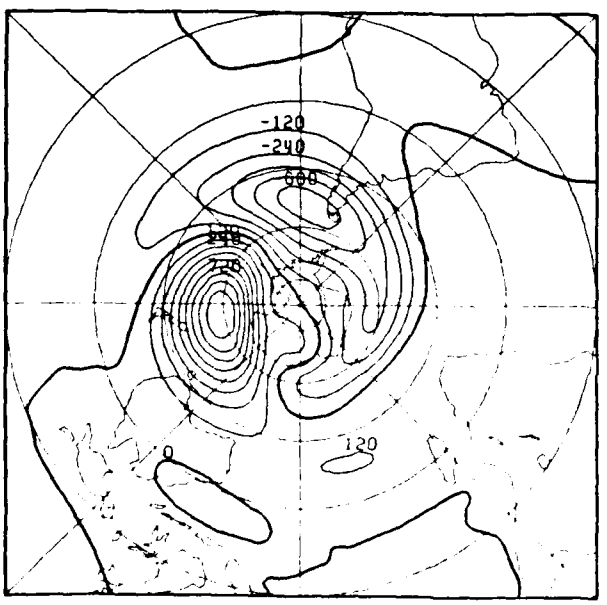

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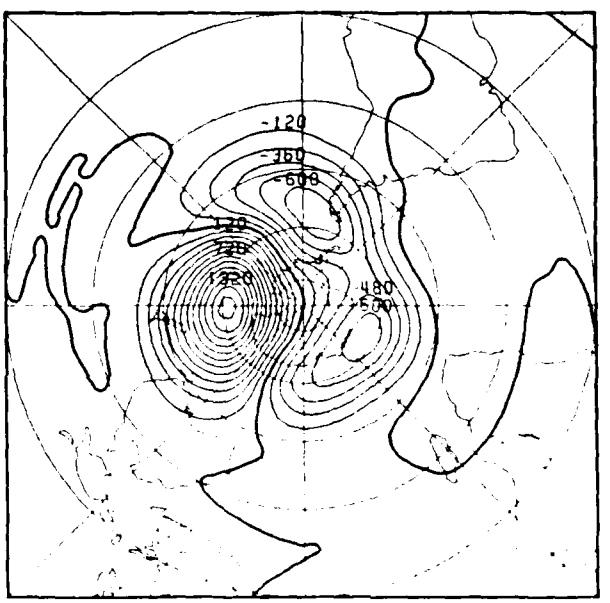
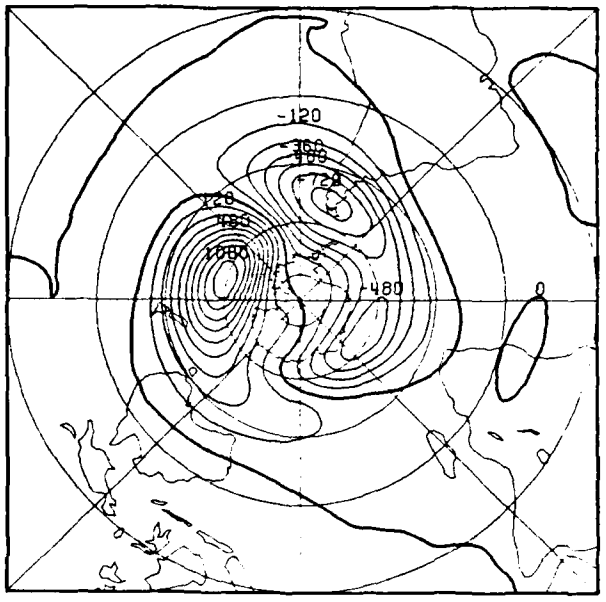


10 mb Z

WAVENUMBERS 1-4

1200 GMT 6 JULY 1979 DAY 3

OBSERVED



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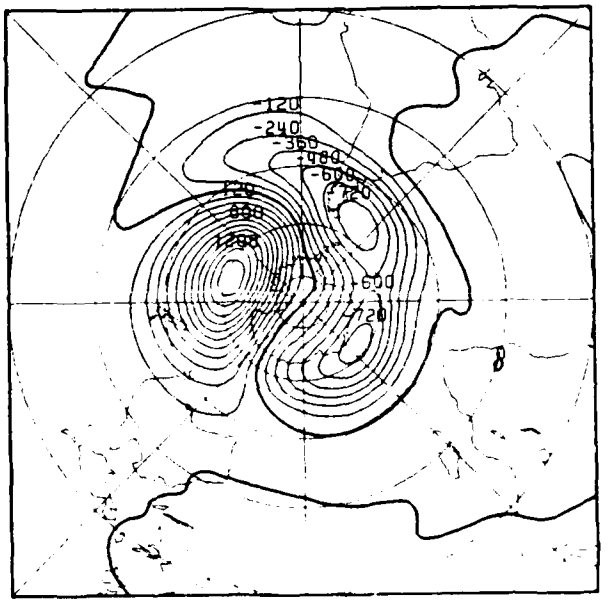
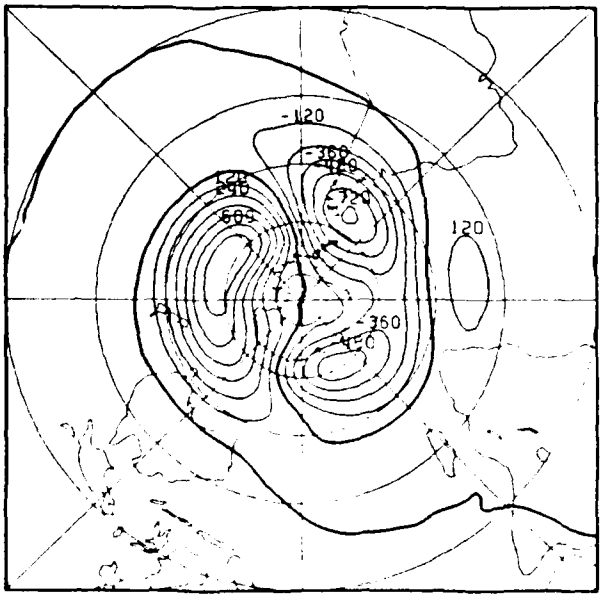
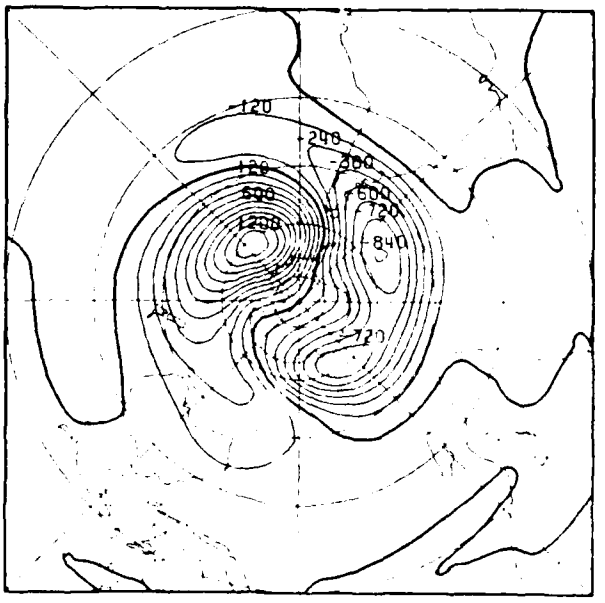


1200 GMT 7 JULY 1979 DAY 4

OBSERVED



15-LAYER 2.4X3

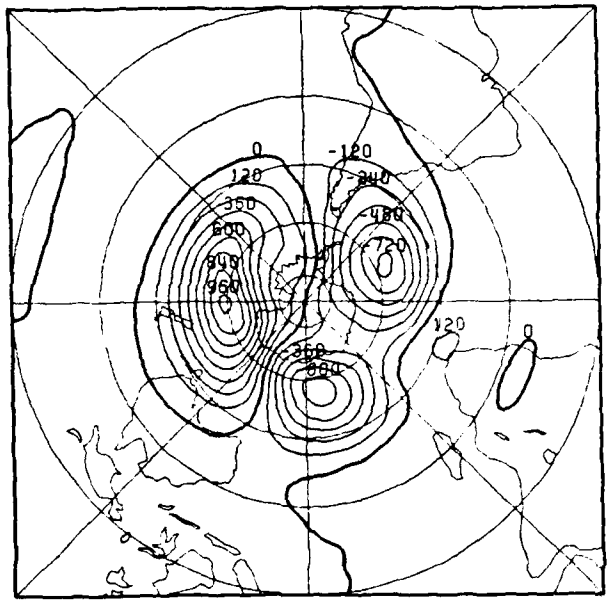


10 mb Z

WAVENUMBERS 1-4

1200 GMT 8 JULY 1979 DAY 5

OBSERVED



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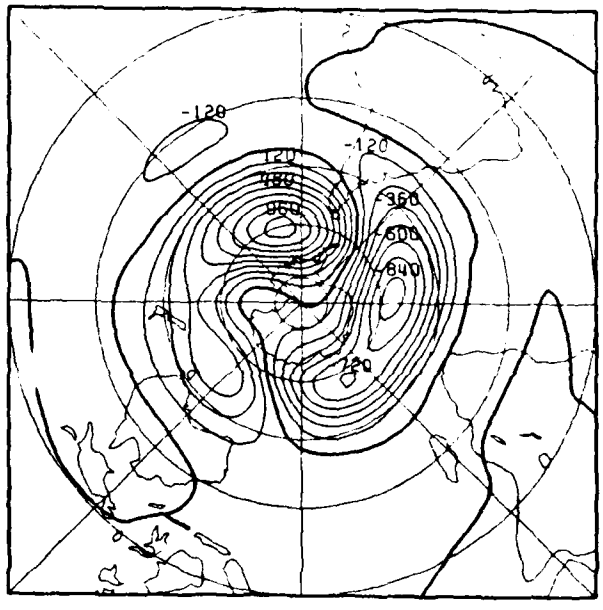
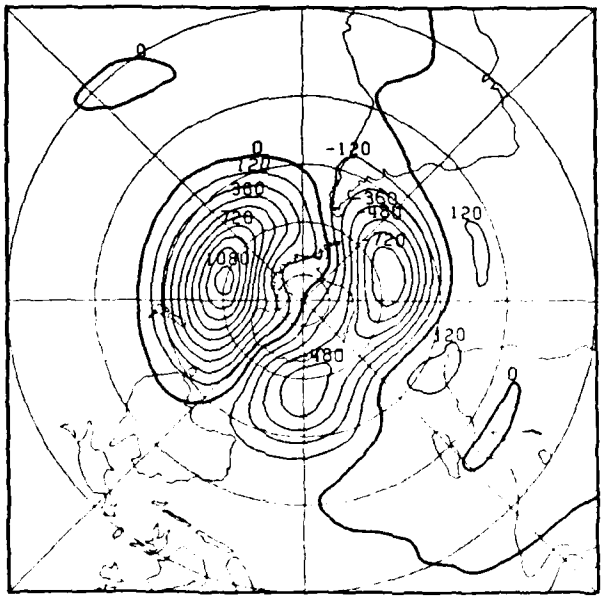
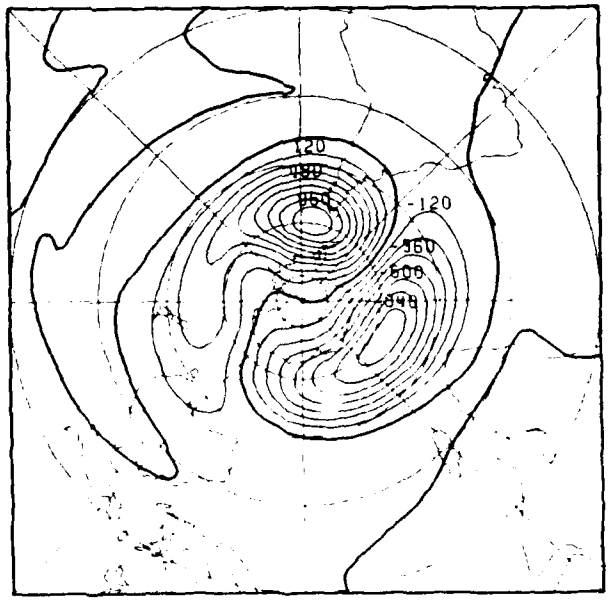


1200 GMT 9 JULY 1979 DAY 6

OBSERVED



15-LAYER 2.4X3

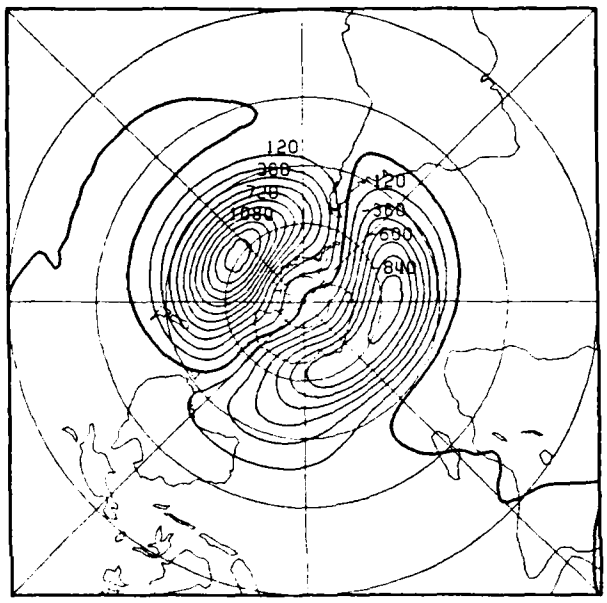


10 mb Z

WAVENUMBERS 1-4

1200 GMT 10 JULY 1979 DAY 7

OBSERVED



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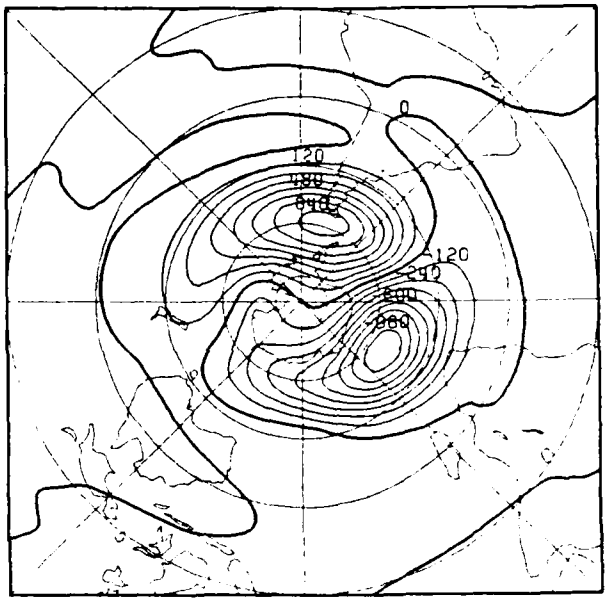
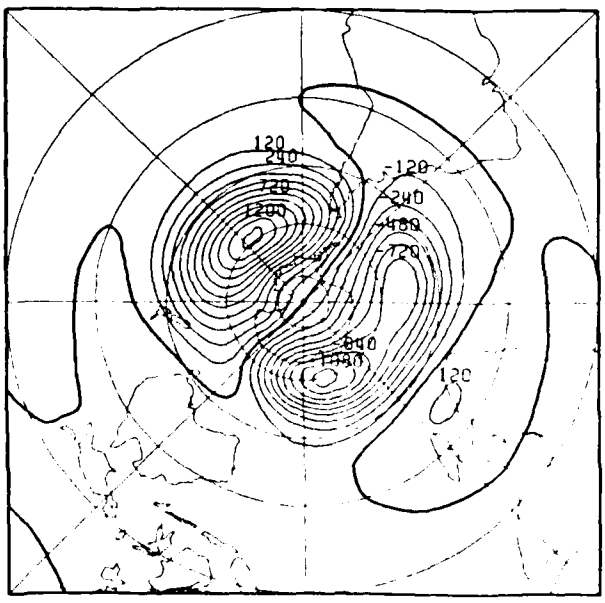
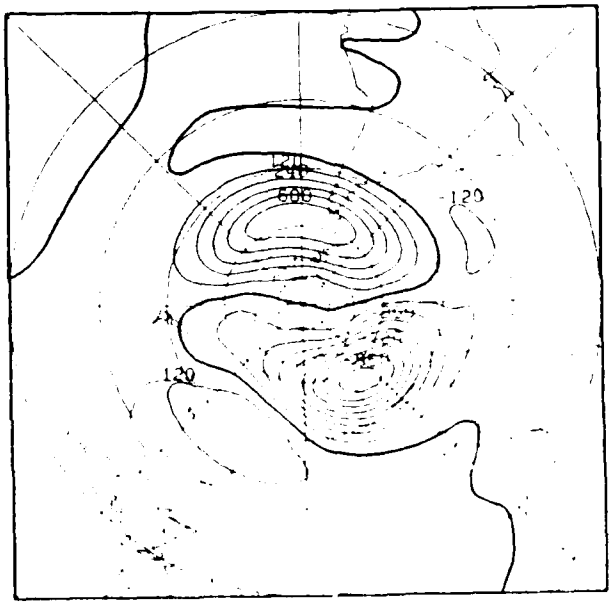


1200 GMT 11 JULY 1979 DAY 8

OBSERVED



15-LAYER 2.4X3

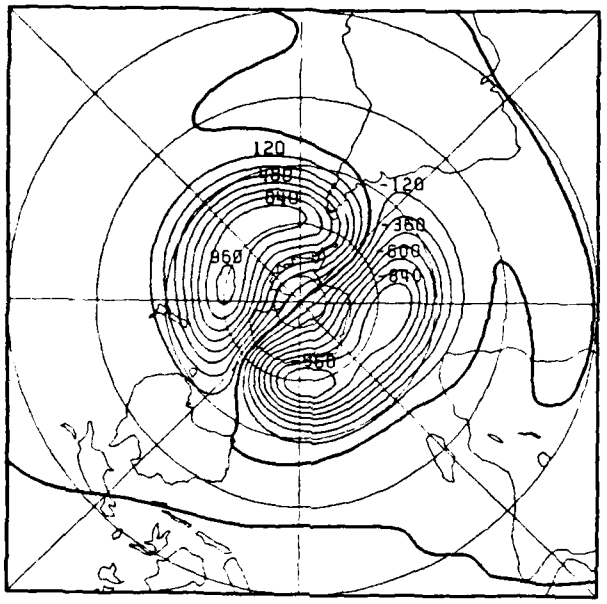


10 mb Z

WAVENUMBERS 1-4

1200 GMT 12 JULY 1979 DAY 9

OBSERVED



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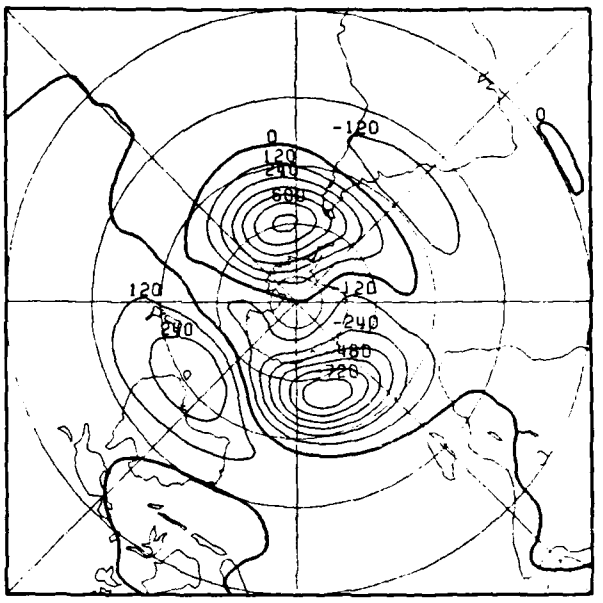
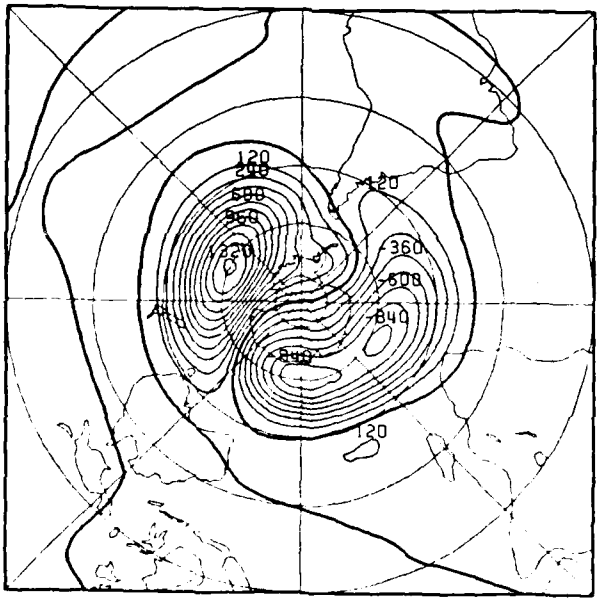
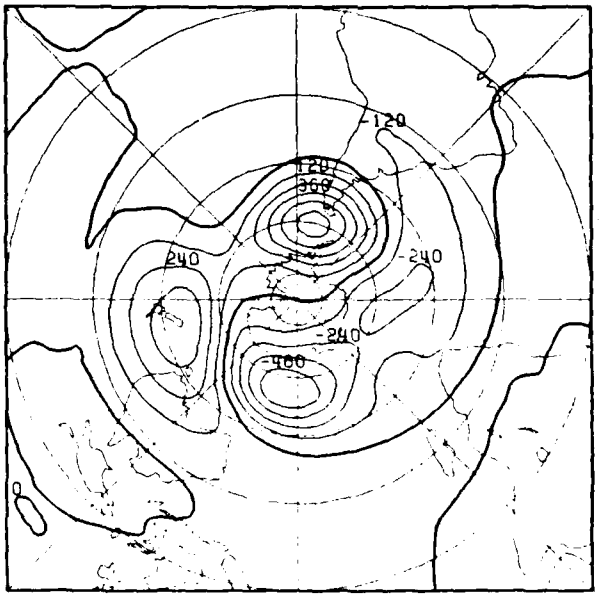


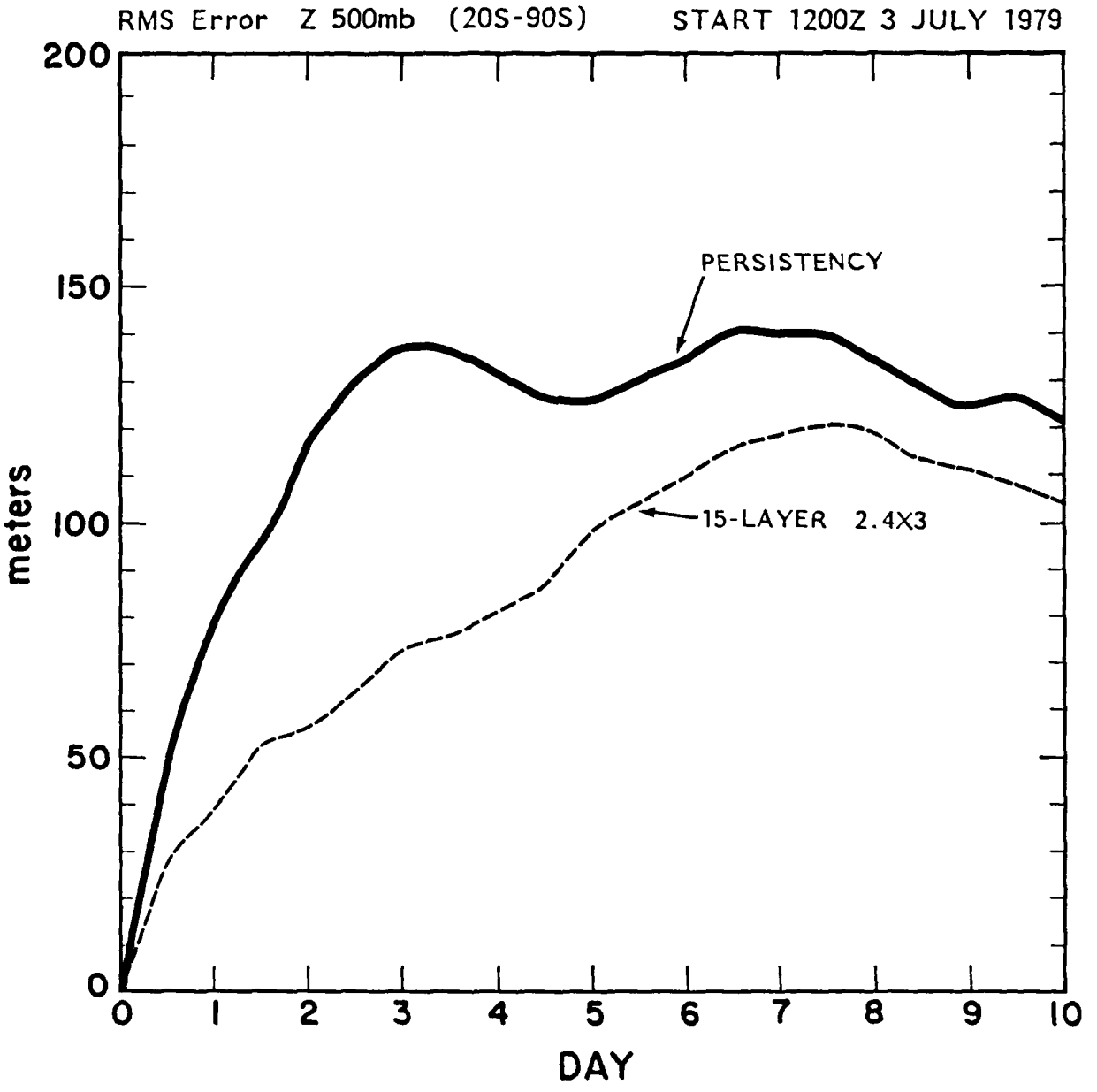
1200 GMT 13 JULY 1979 DAY 10

OBSERVED



15-LAYER 2.4X3




RMS Error Z 500mb (20S-90S)
START 1200Z 3 JULY 1979
200
150
100
50
0
meters
PERSISTENCY
15-LAYER 2.4X3
0
1
2
3
4
5
6
7
8
9
10
DAY

FORECAST FROM

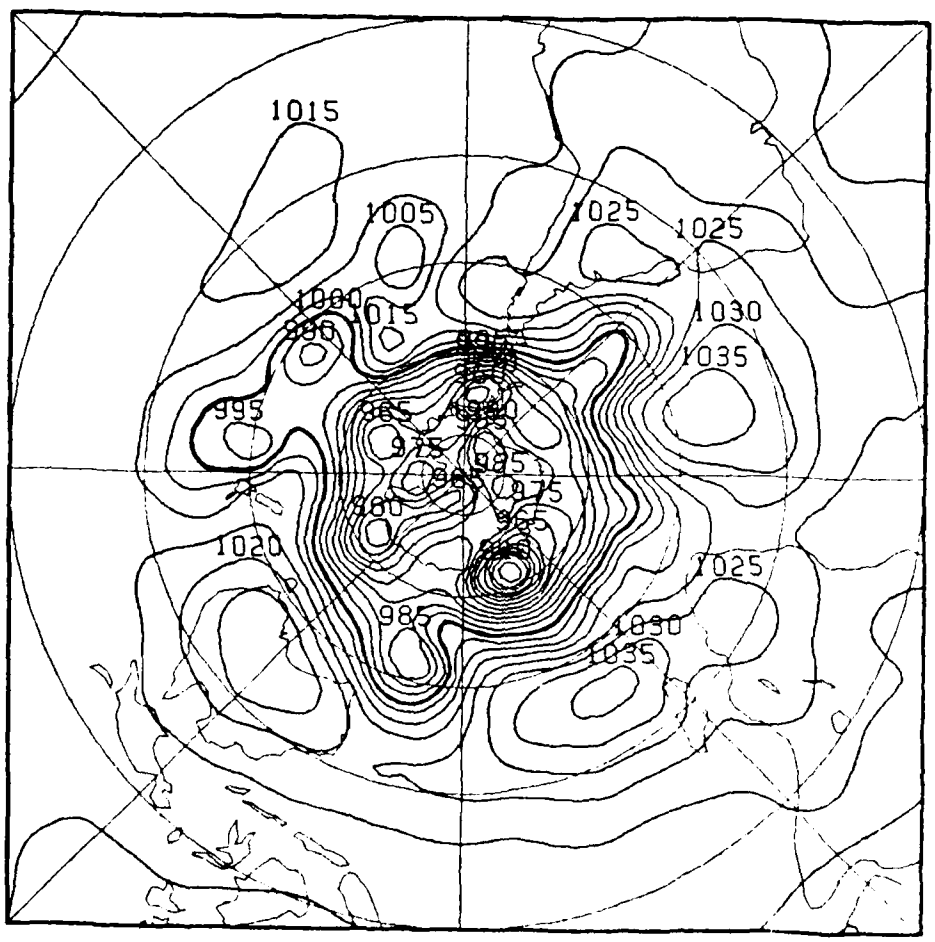
1200 GMT

5 JULY 1979

SLP

1200 GMT 5 JULY 1979

OBSERVED

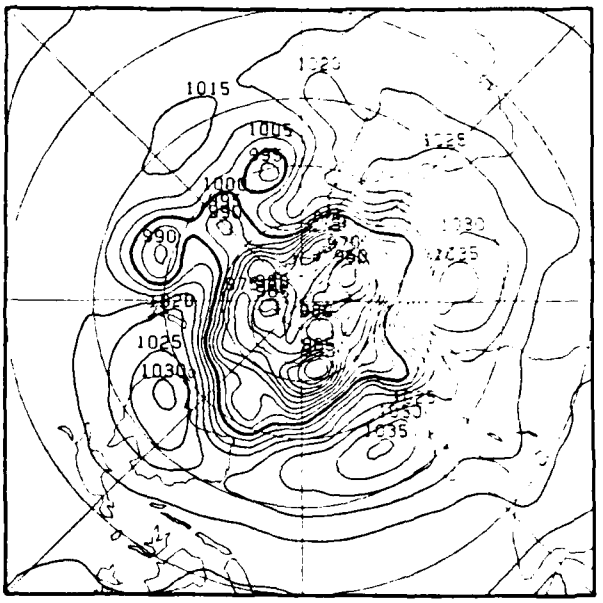


SLP

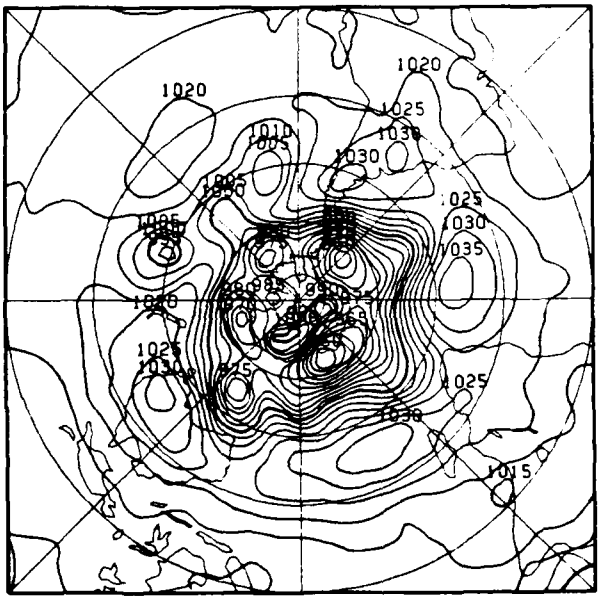
1200 GMT 6 JUL 1979

DAY 1

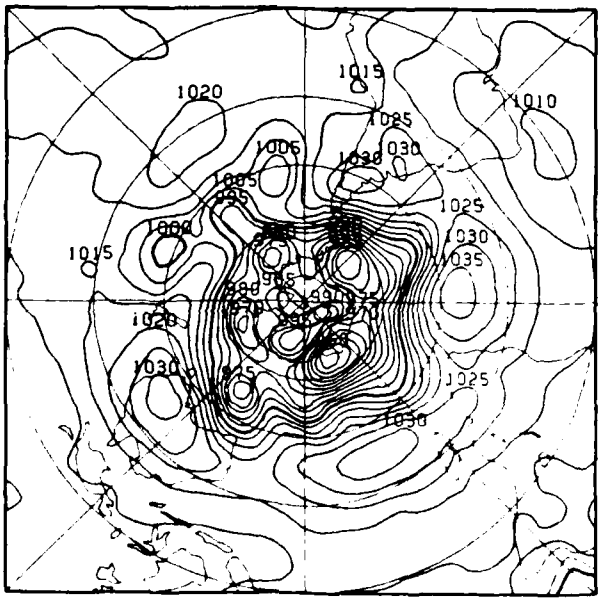
OBSERVED



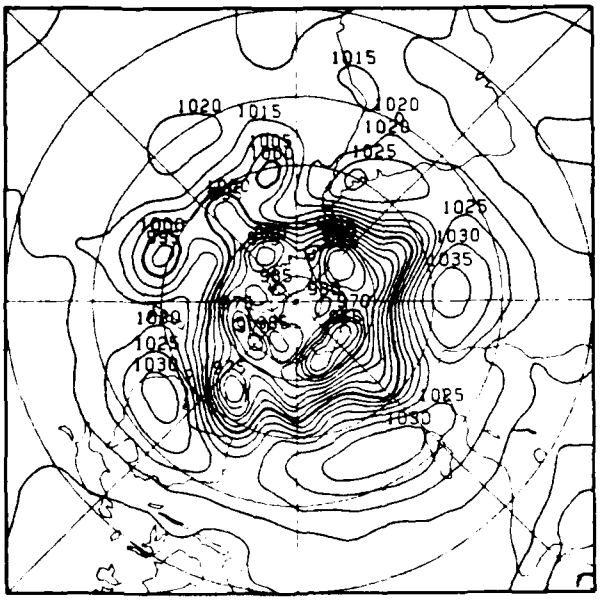
9-LAYER 4X5



15-LAYER 4X5



15-LAYER 2.4X3

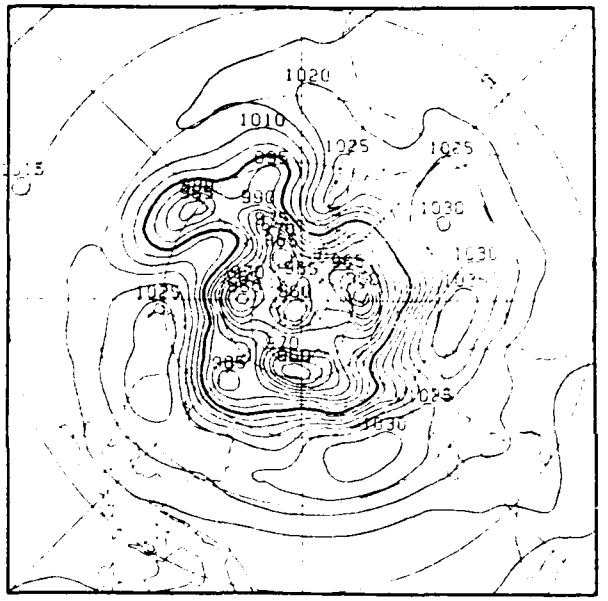


SLP

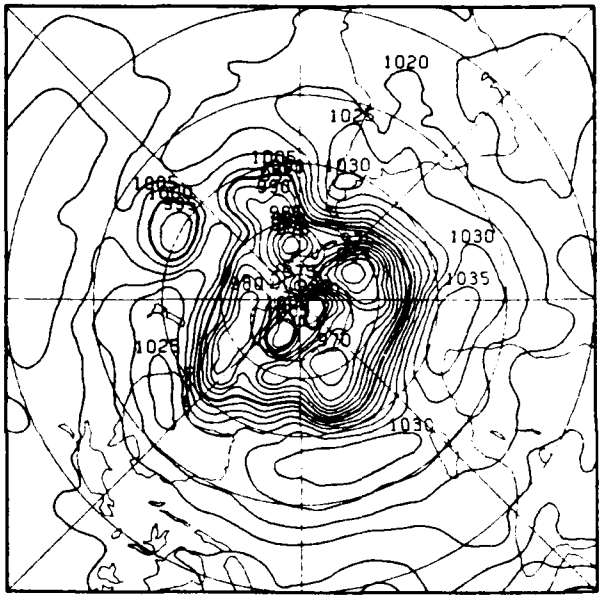
1200 GMT 7 JUL 1979

DAY 2

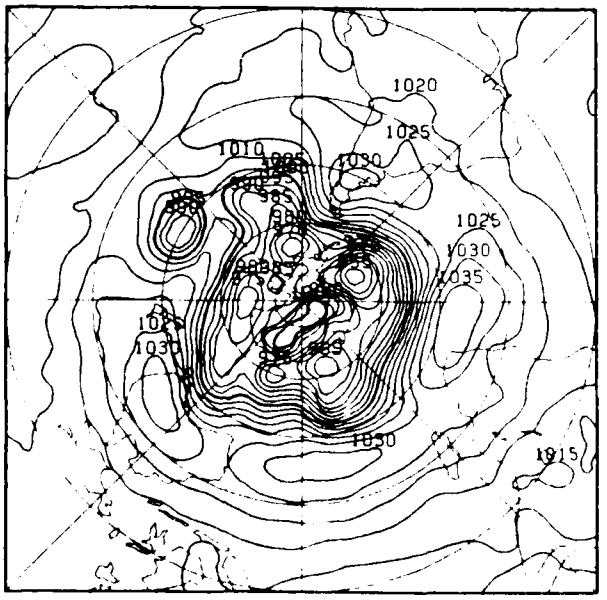
OBSERVED



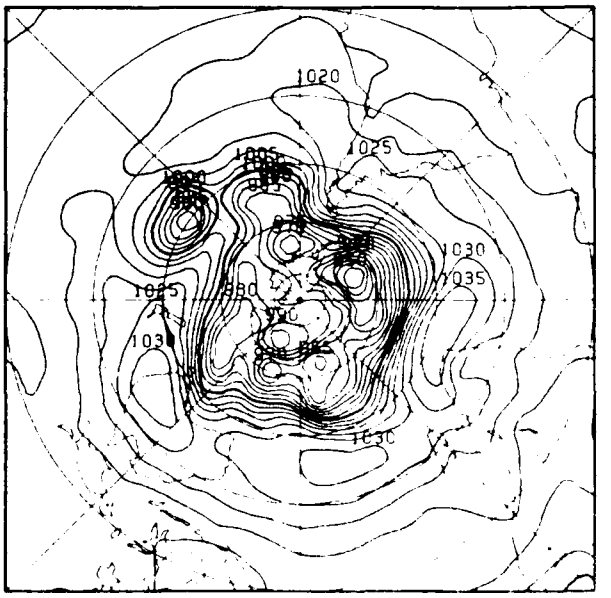
9-LAYER 4X5



15-LAYER 4X5



15-LAYER 2.4X3

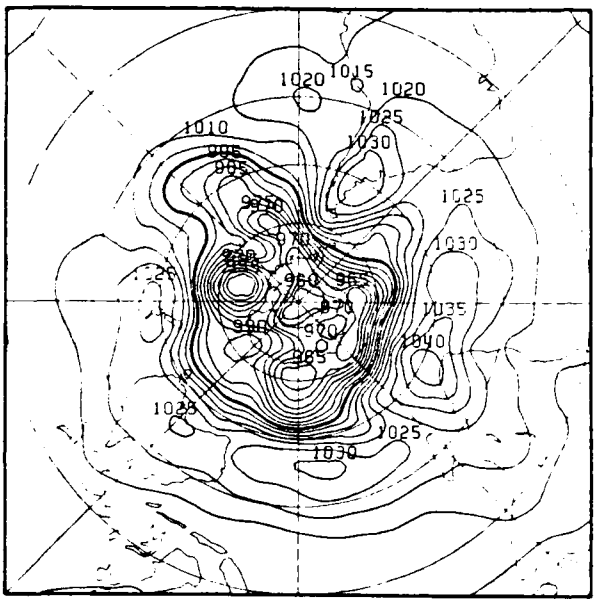


SLP

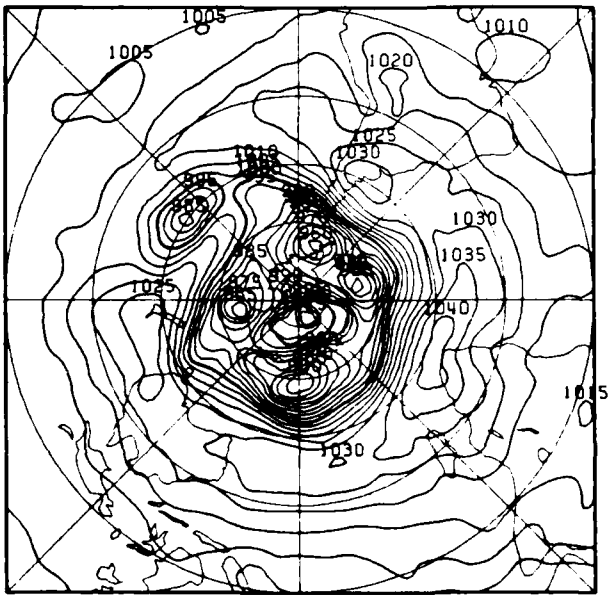
1200 GMT 8 JUL 1979

DAY 3

OBSERVED



9-LAYER 4X5



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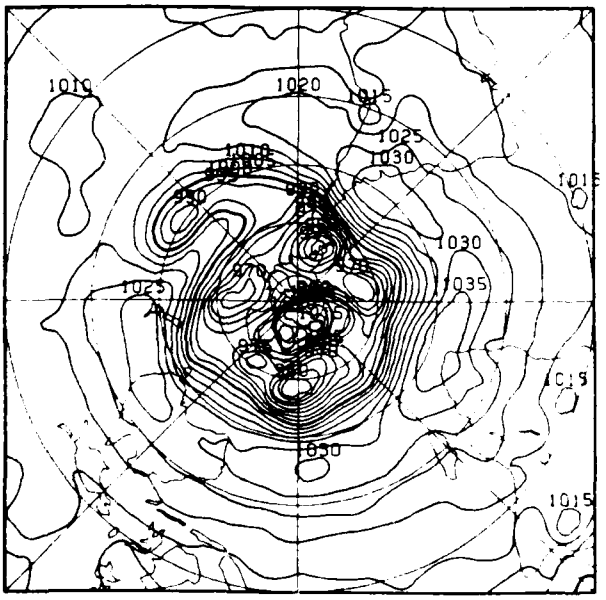

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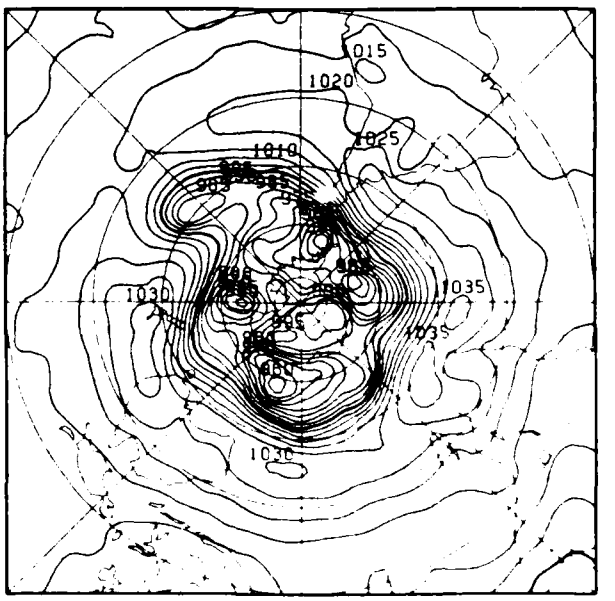
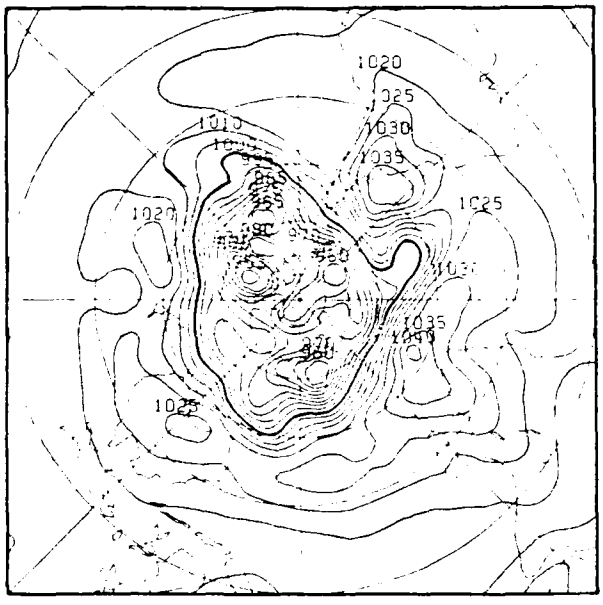


SLP

1200 GMT 9 JUL 1979

DAY 4

OBSERVED



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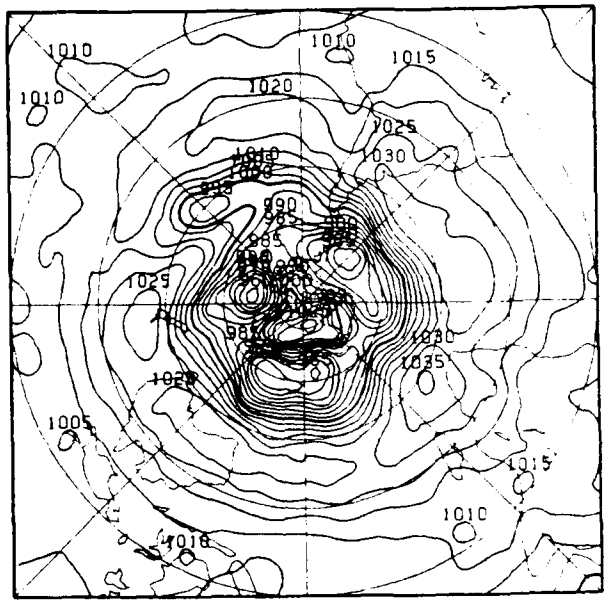

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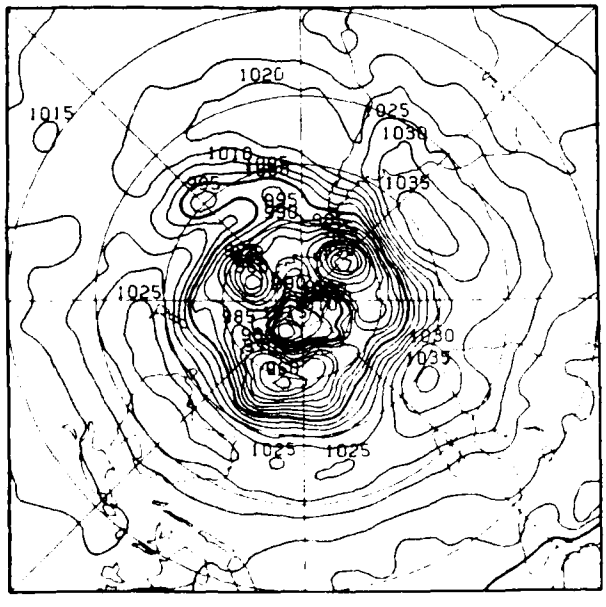

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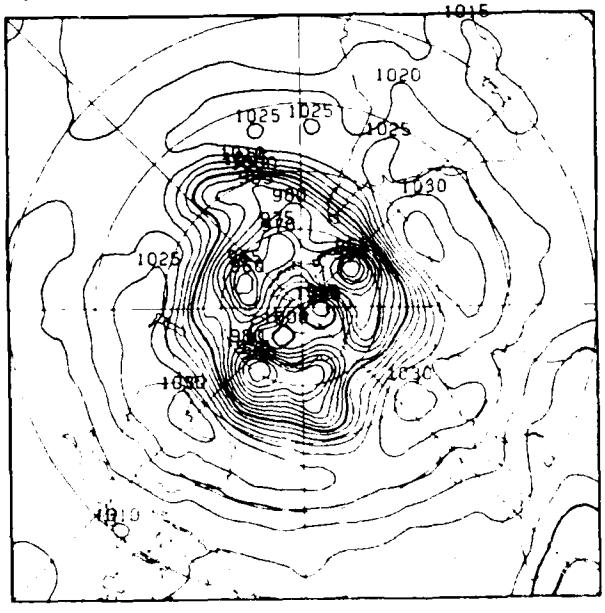
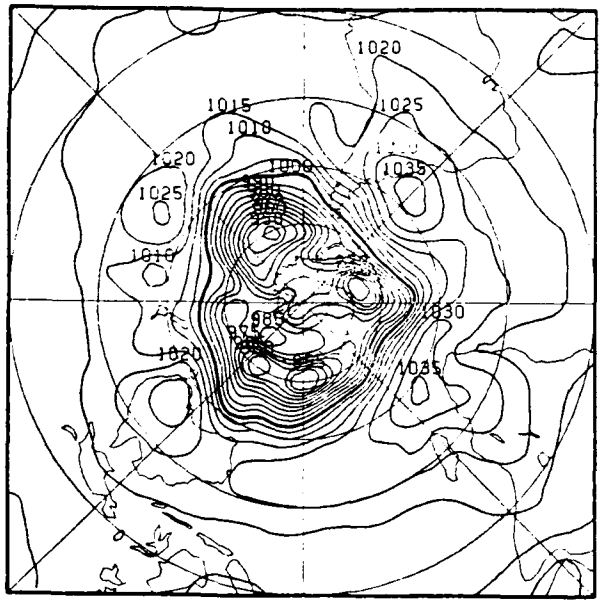


SLP

1200 GMT 10 JUL 1979

DAY 5

OBSERVED



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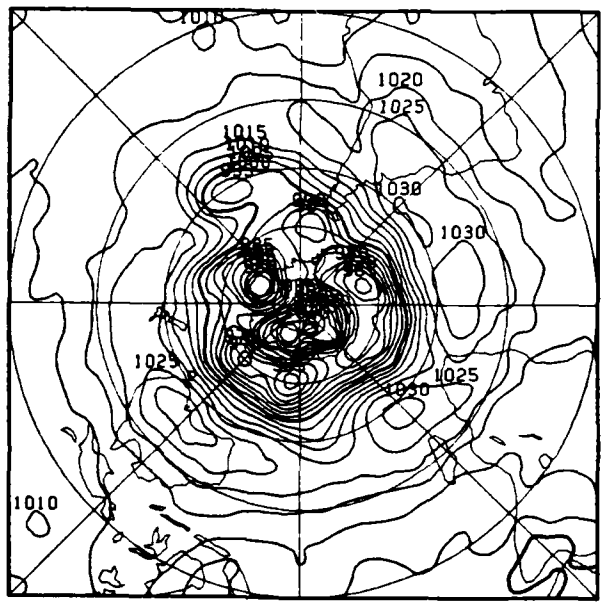

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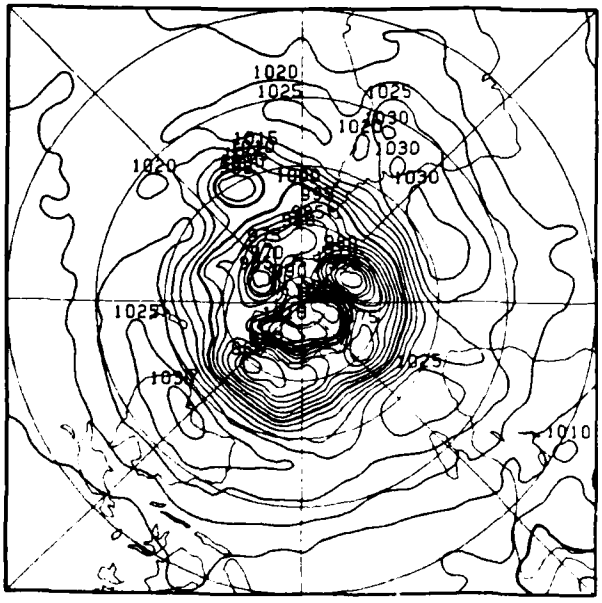

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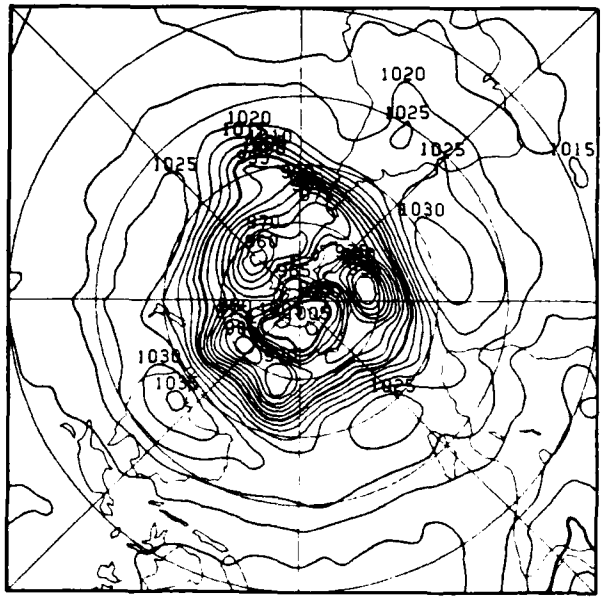
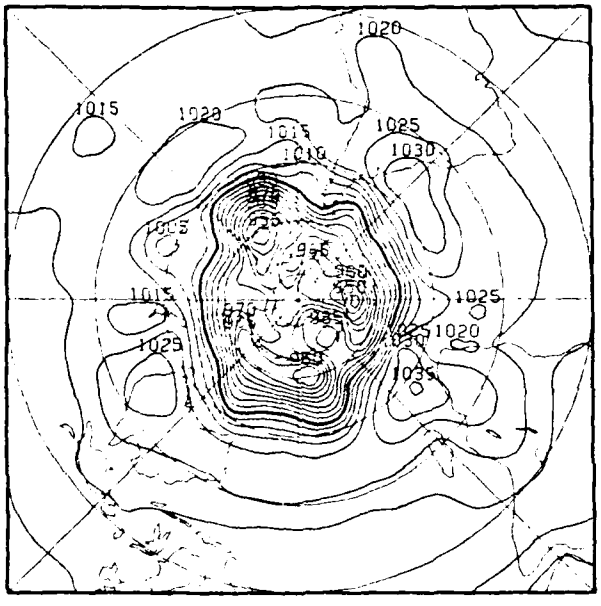


SLP

1200 GMT 11 JUL 1979

DAY 6

OBSERVED



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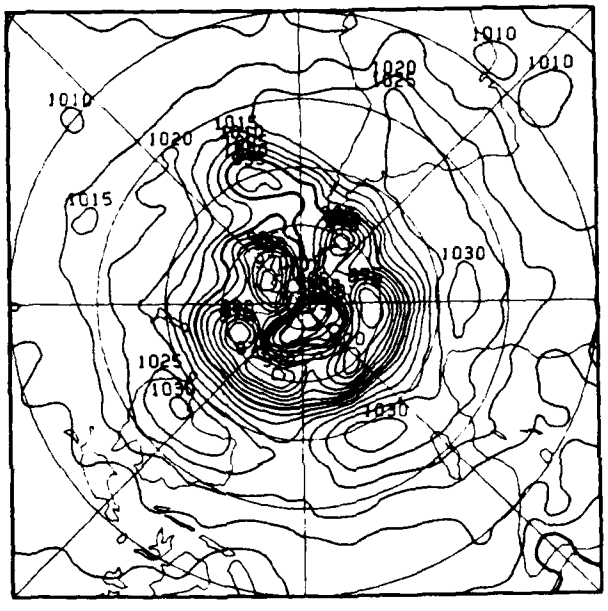

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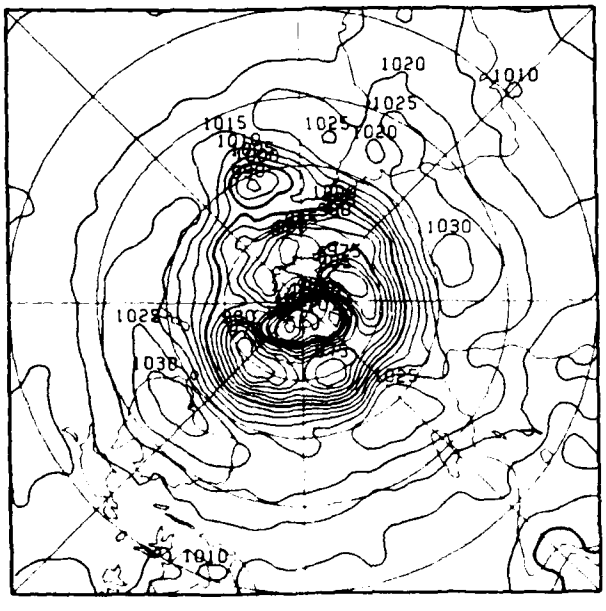

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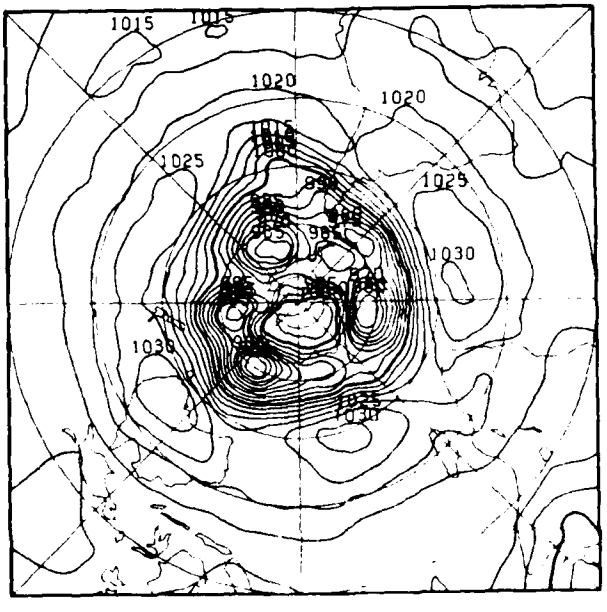
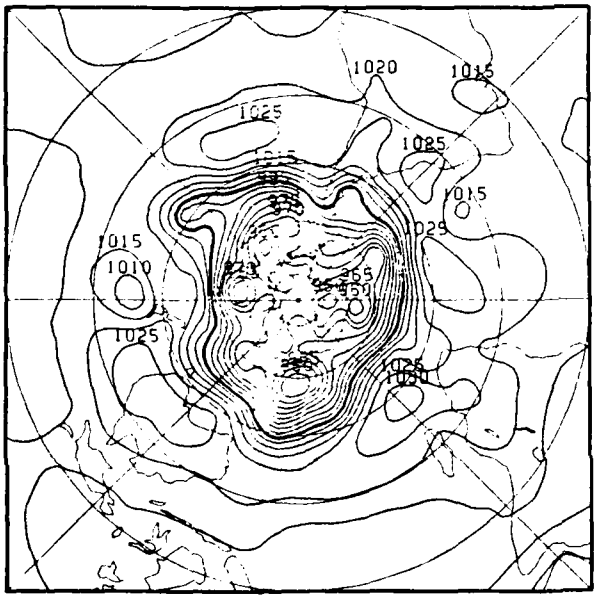


SLP

1200 GMT 12 JUL 1979

DAY 7

OBSERVED



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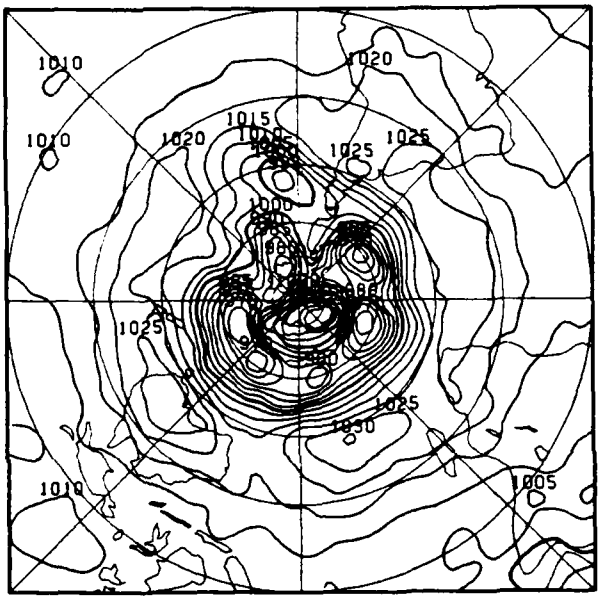

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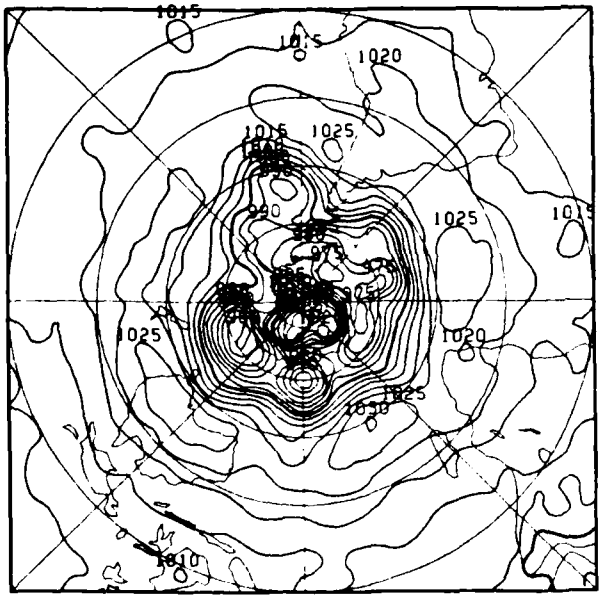

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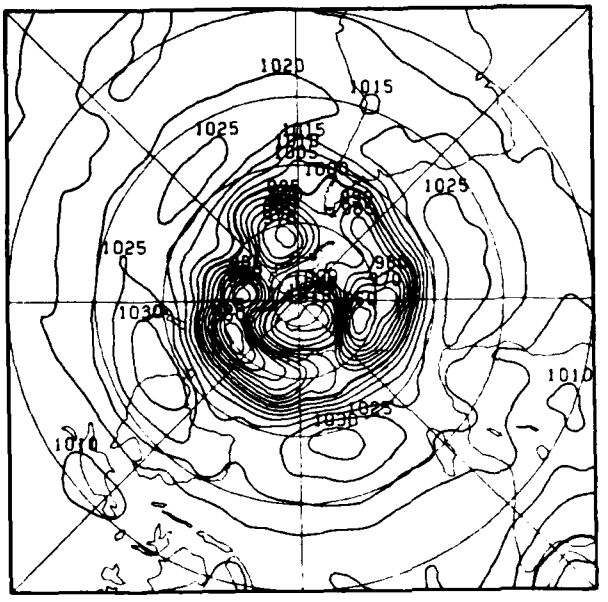

SLP

1200 GMT 13 JUL 1979

DAY 8

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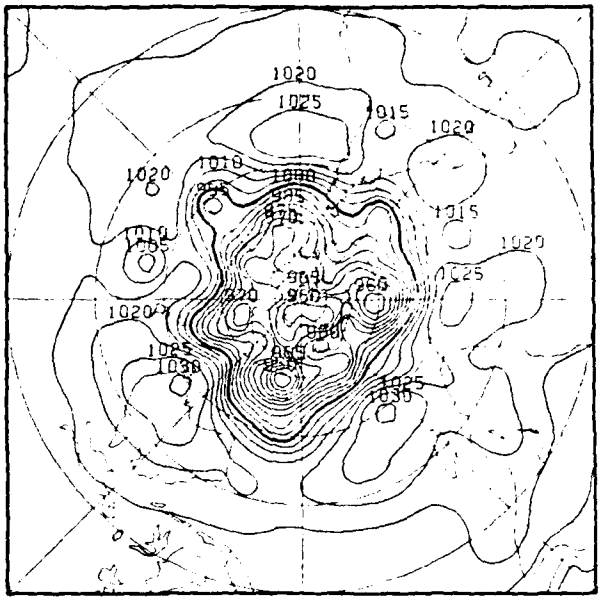

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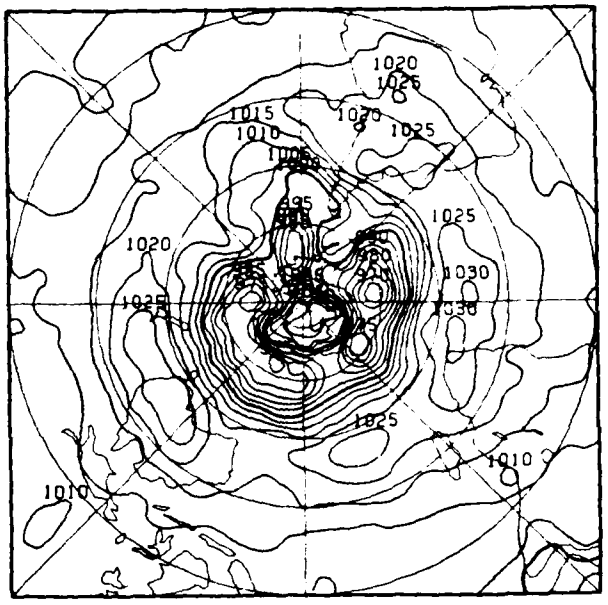

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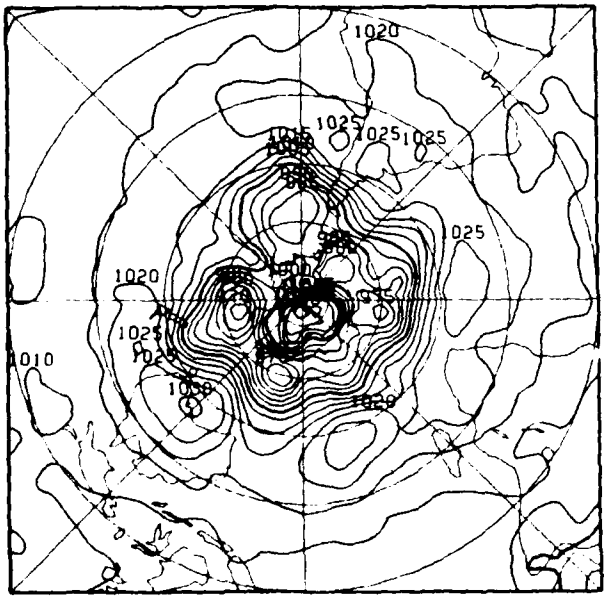

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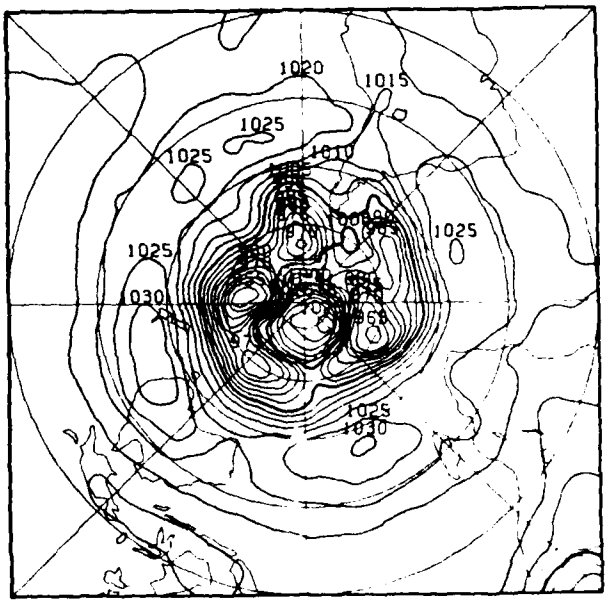
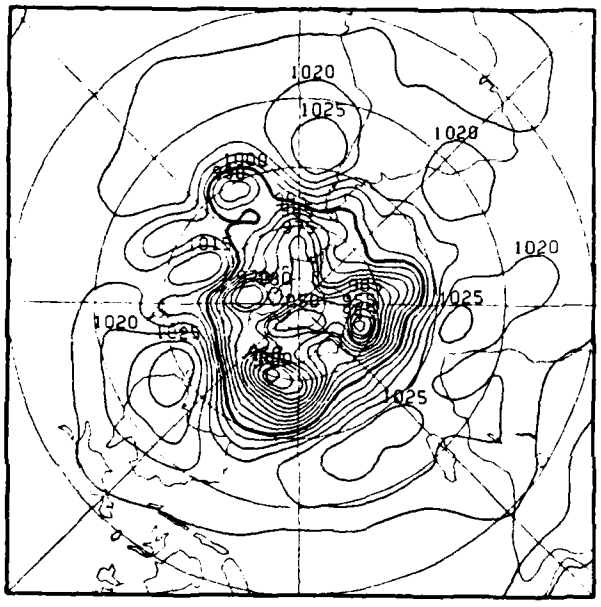


SLP

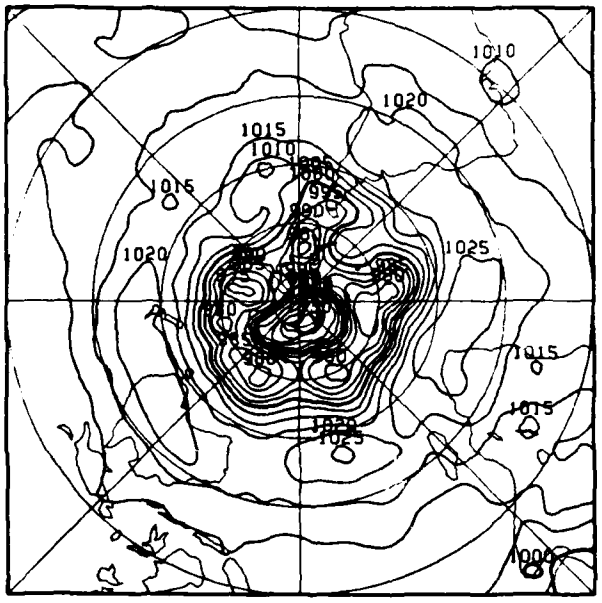
1200 GMT 14 JUL 1979

DAY 9

OBSERVED



9-LAYER 4X5



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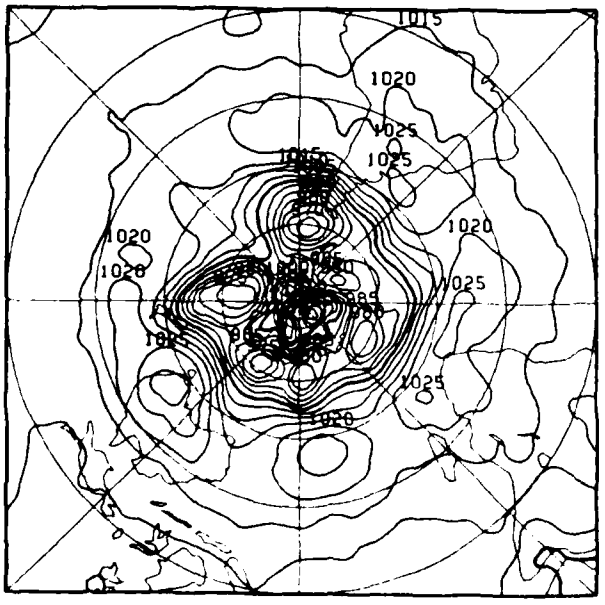

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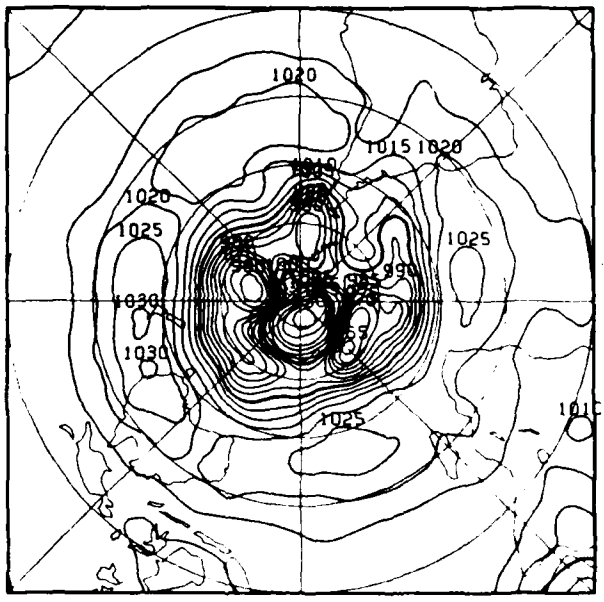
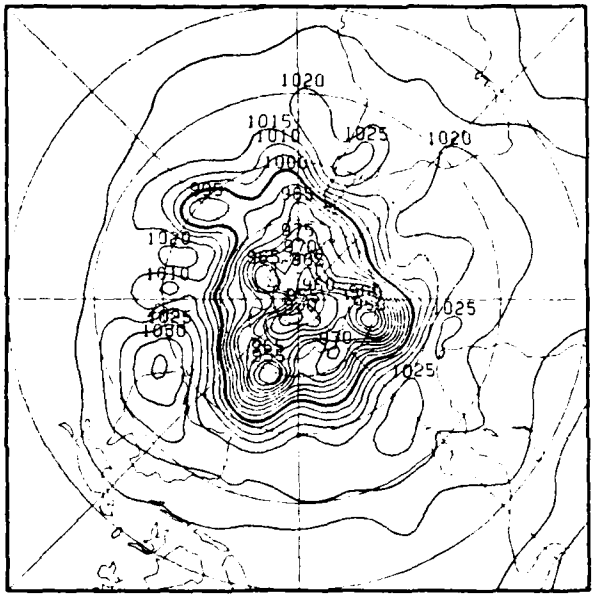


SLP

1200 GMT 15 JUL 1979

DAY 10

OBSERVED



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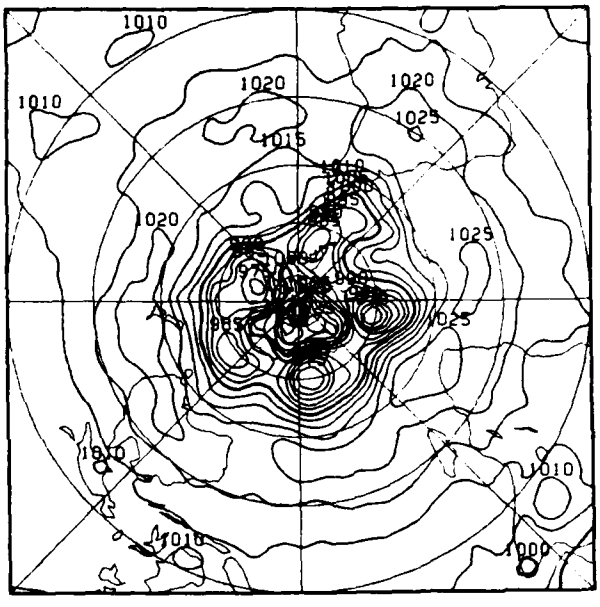

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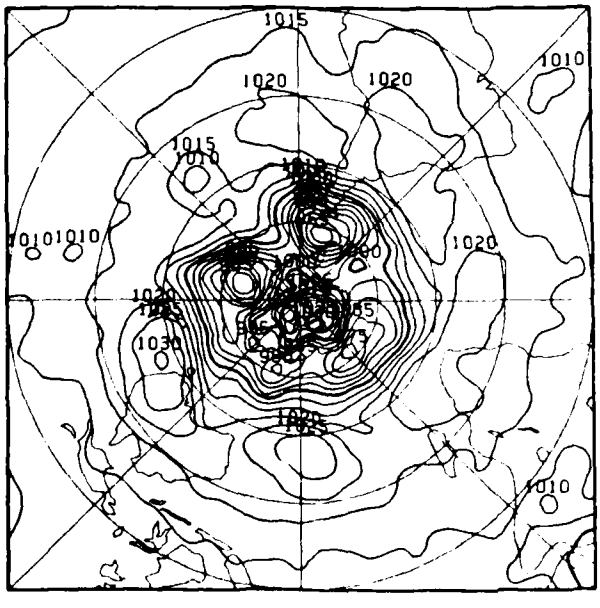

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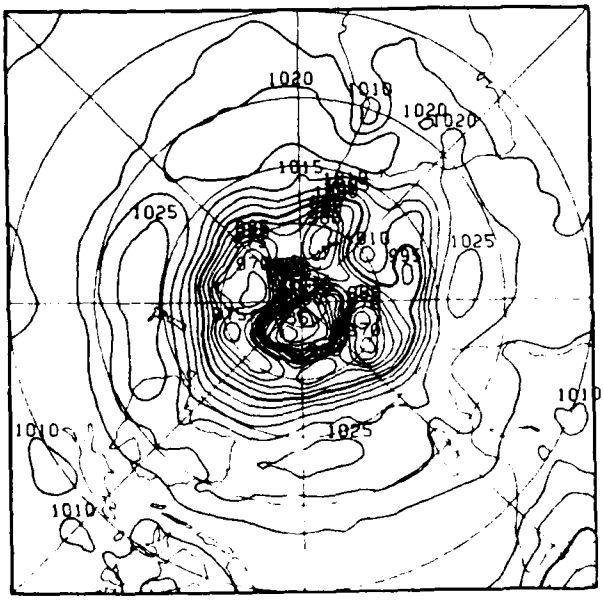
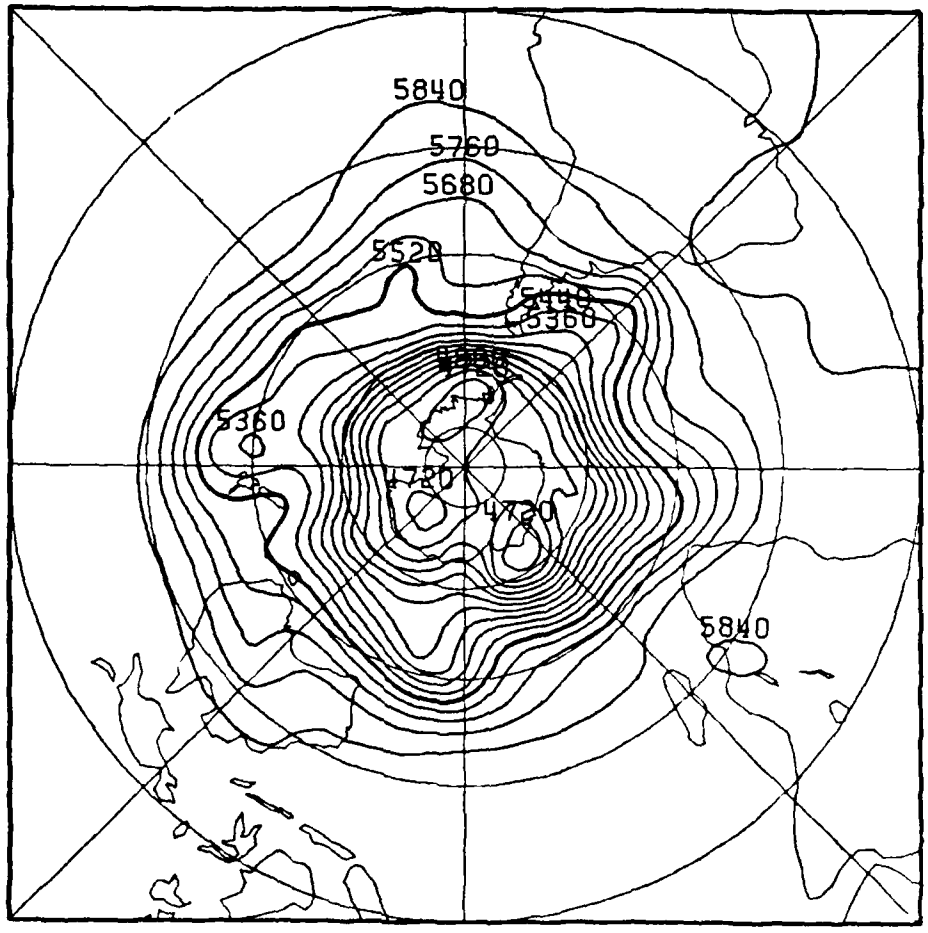


500 mb Z

1200 GMT 5 JULY 1979

OBSERVED



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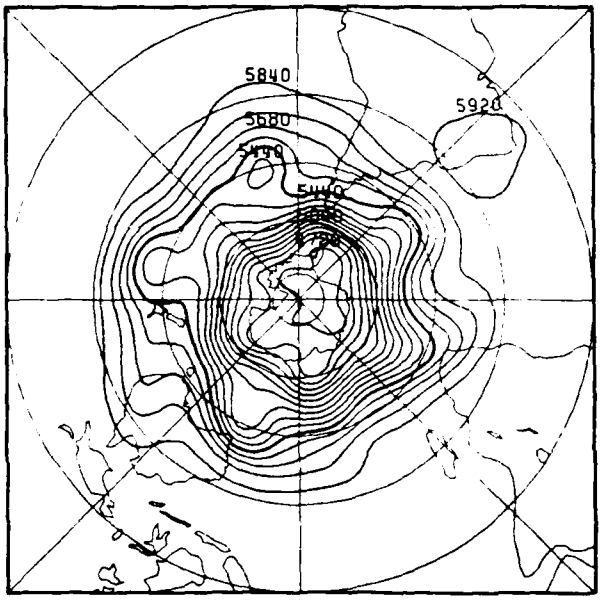
1200 GMT 6 JUL 1979

DAY 1

OBSERVED



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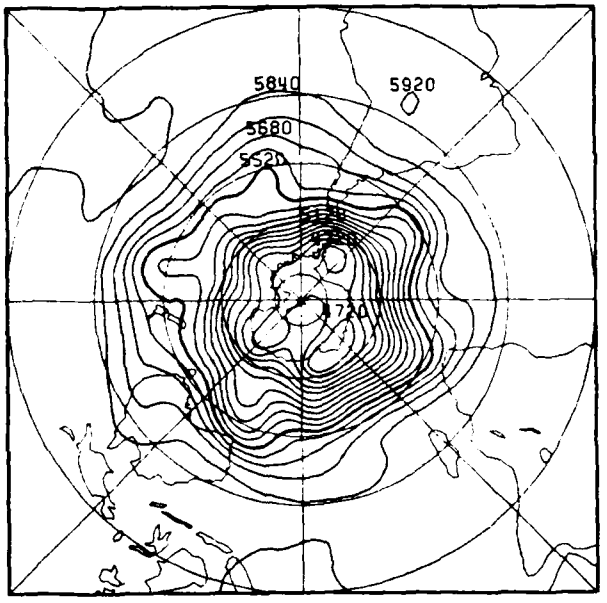

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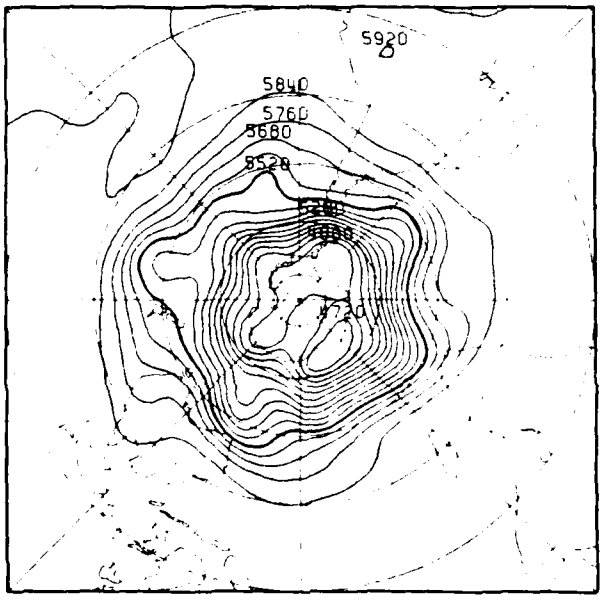

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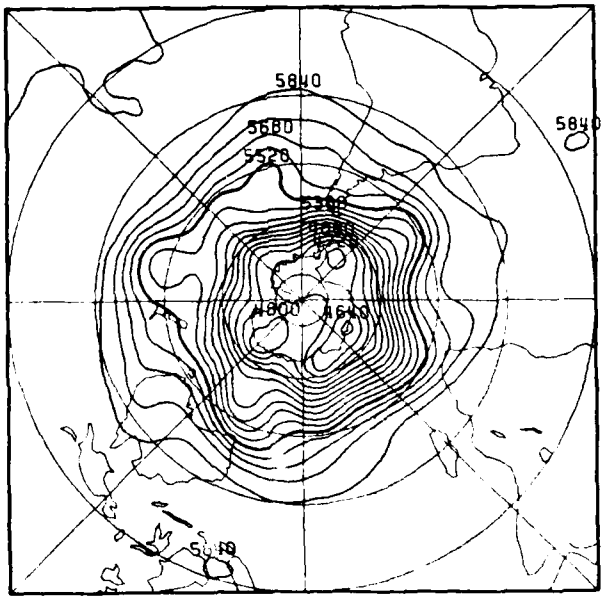
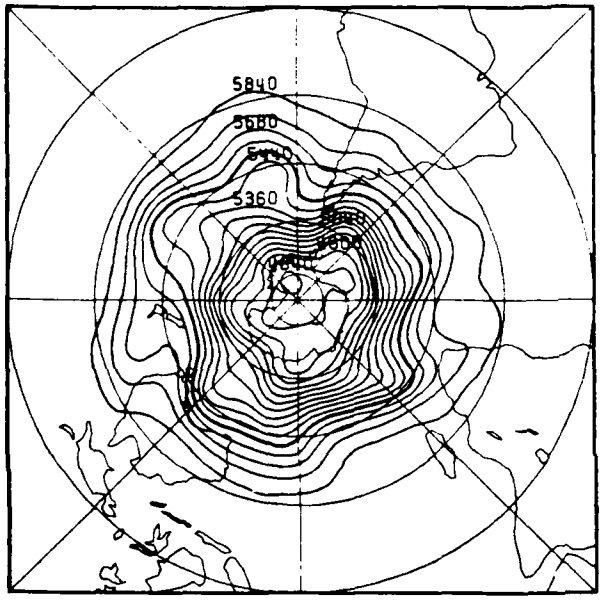


500 mb Z

1200 GMT 7 JUL 1979

DAY 2

OBSERVED



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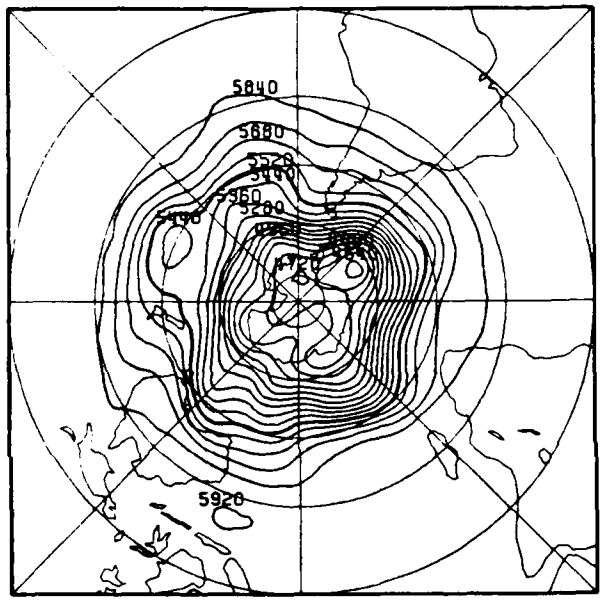

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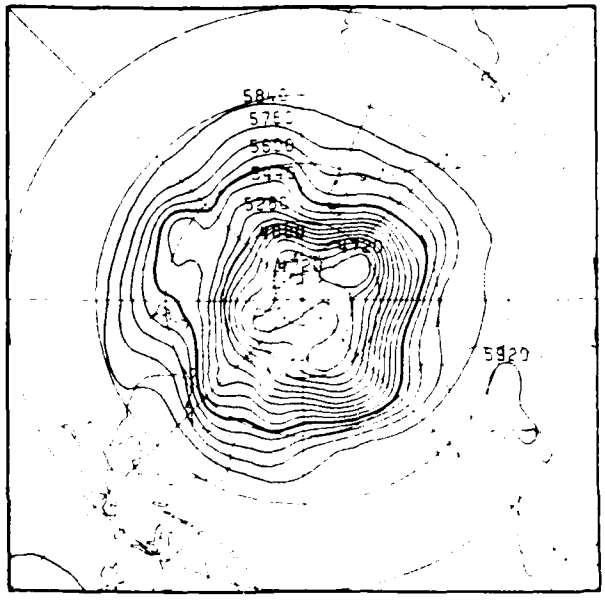
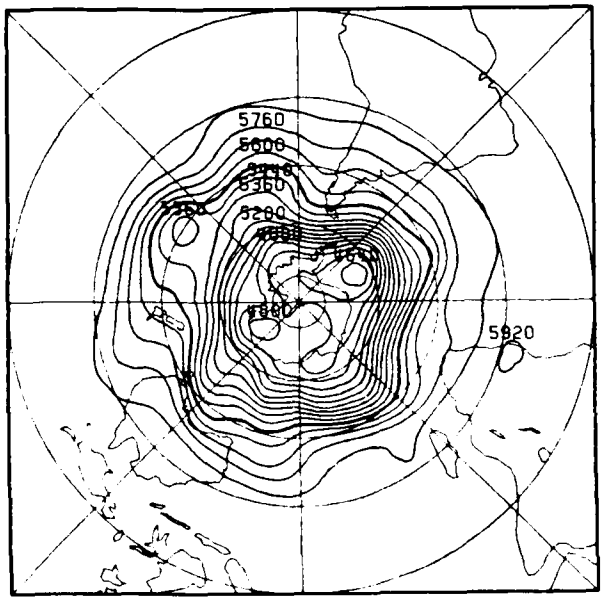


15-LAYER 2.4X3



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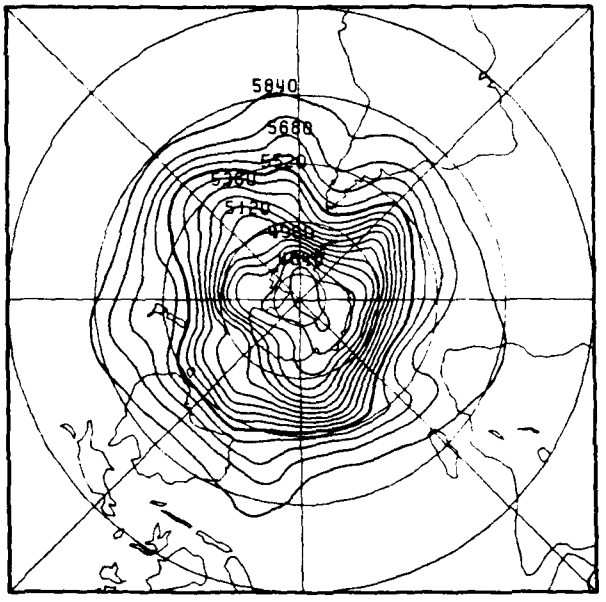
1200 GMT 8 JUL 1979

DAY 3

OBSERVED



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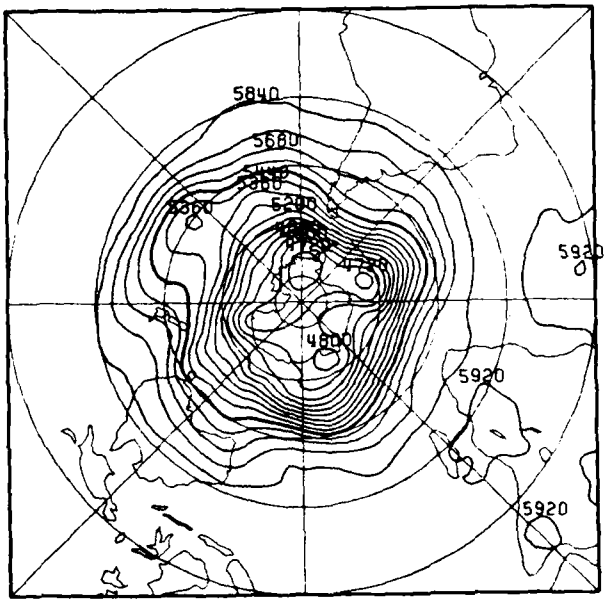

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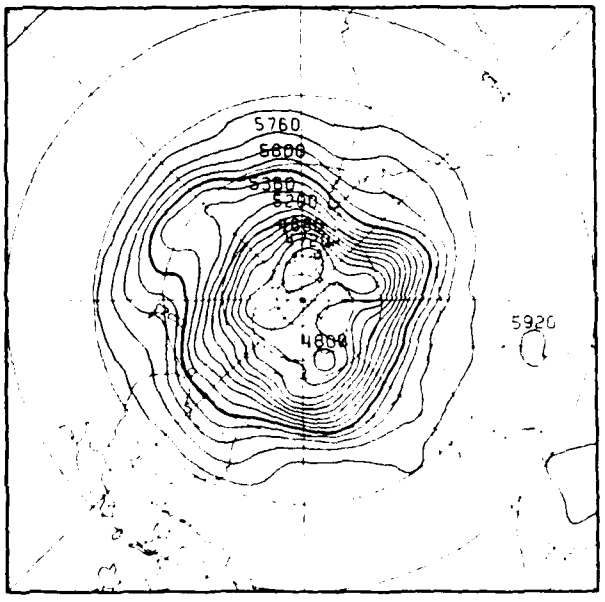
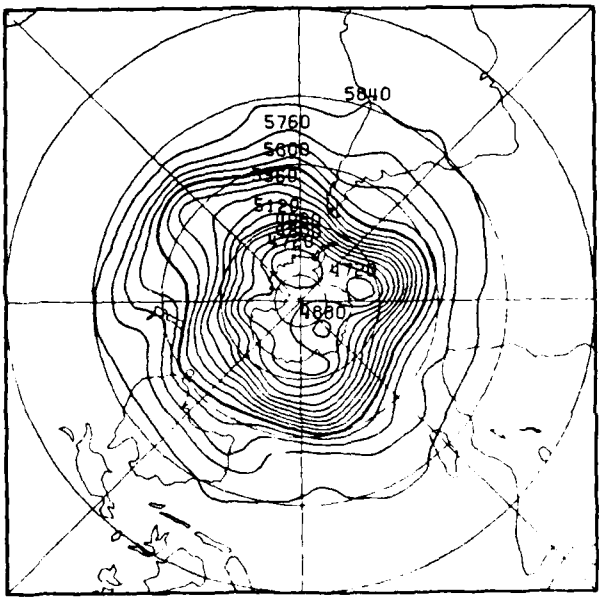


15-LAYER 2.4X3

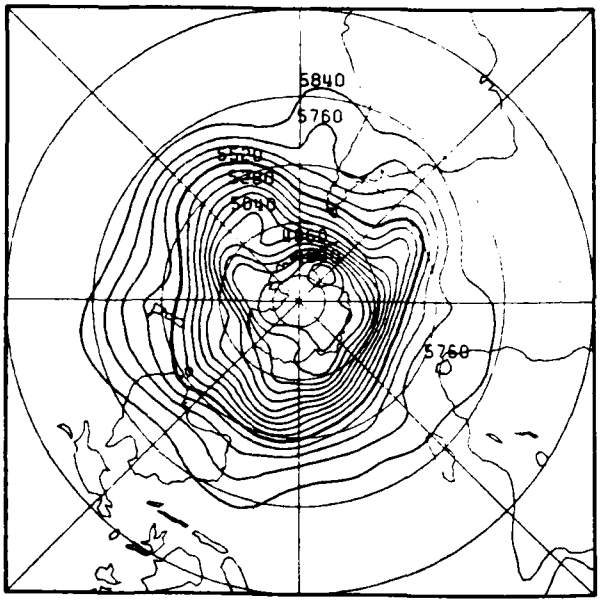


500 mb Z

1200 GMT 9 JUL 1979

DAY 4

OBSERVED



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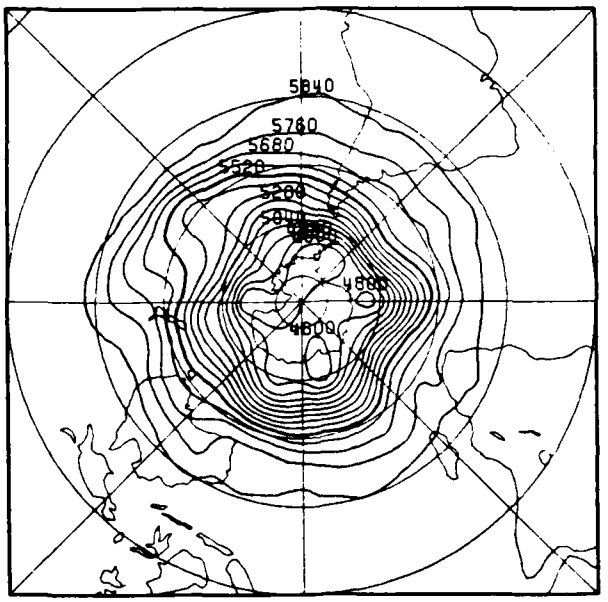

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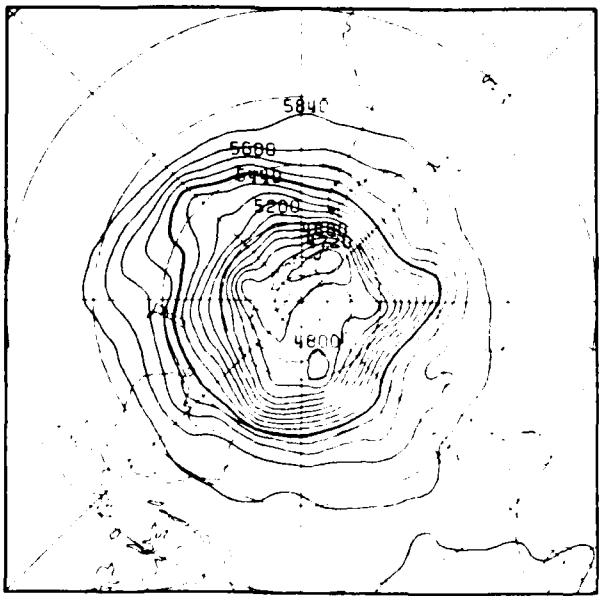
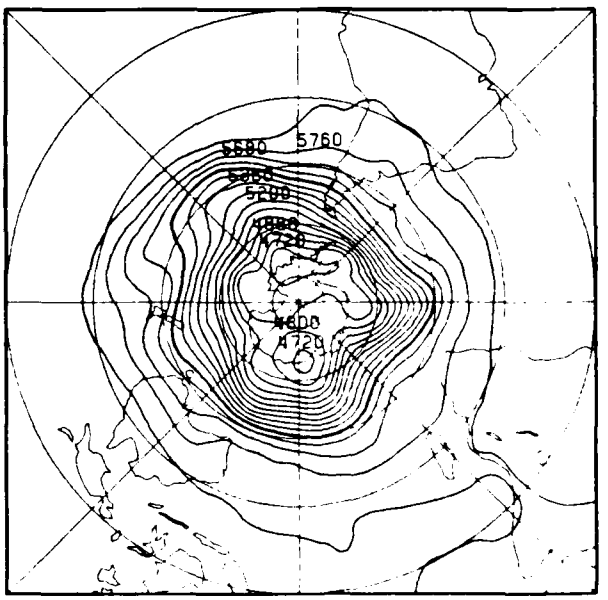


15-LAYER 2.4X3

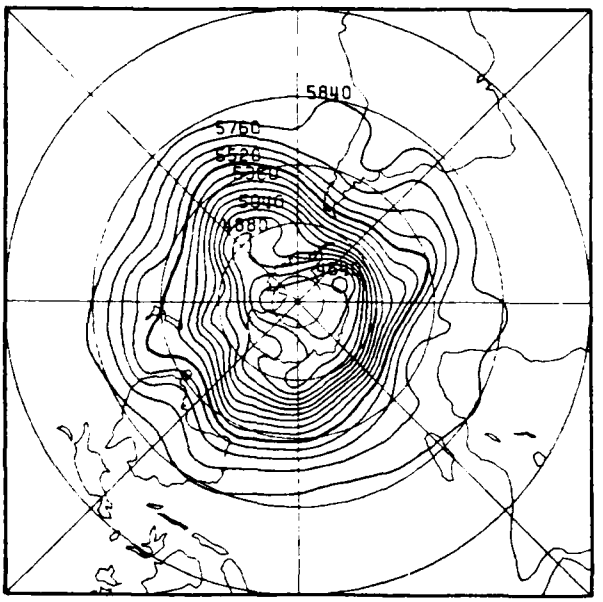


500 mb Z

1200 GMT 10 JUL 1979

DAY 5

OBSERVED



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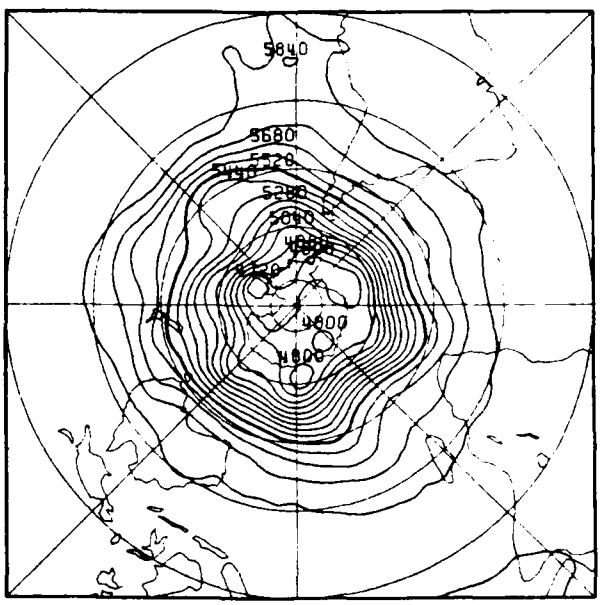
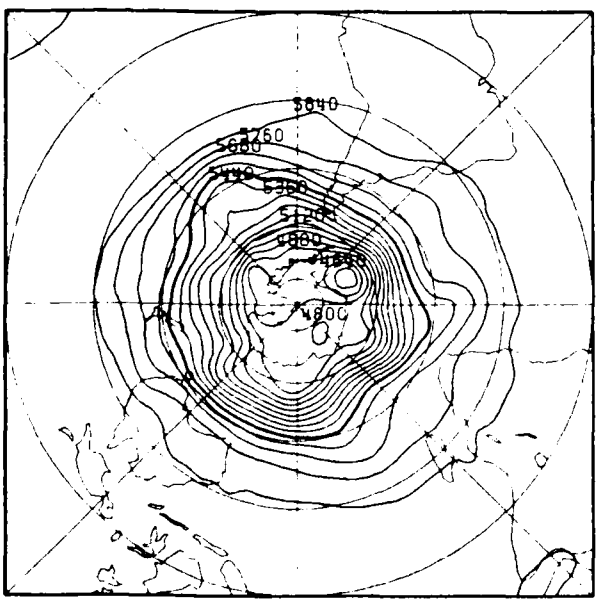
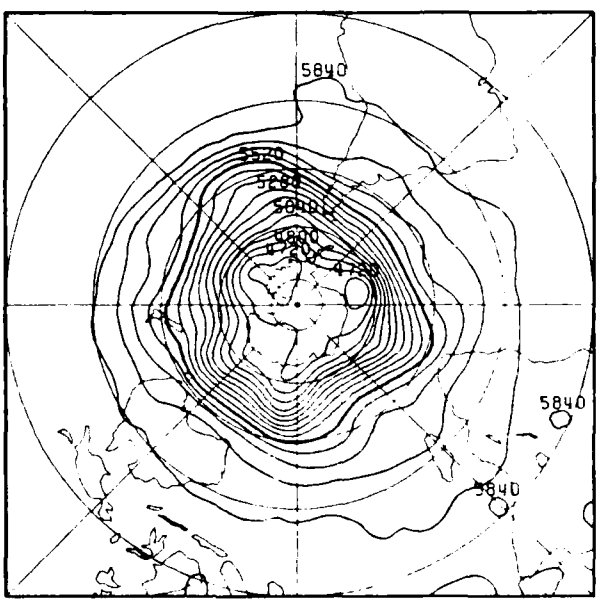


15-LAYER 4X5



15-LAYER 2.4X3

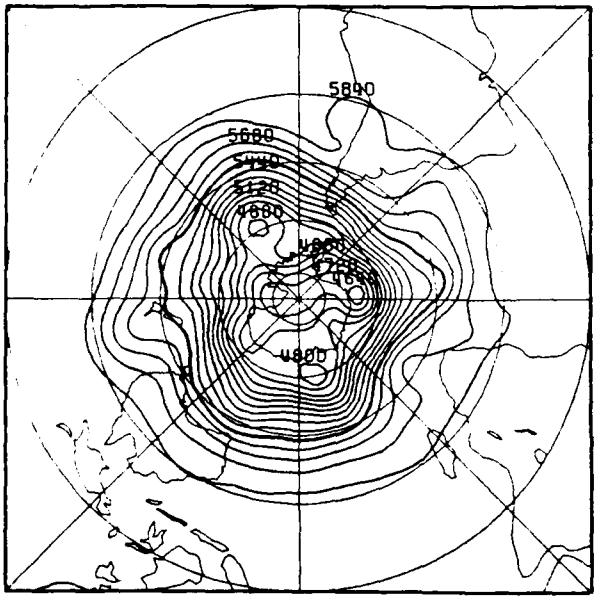


500 mb Z

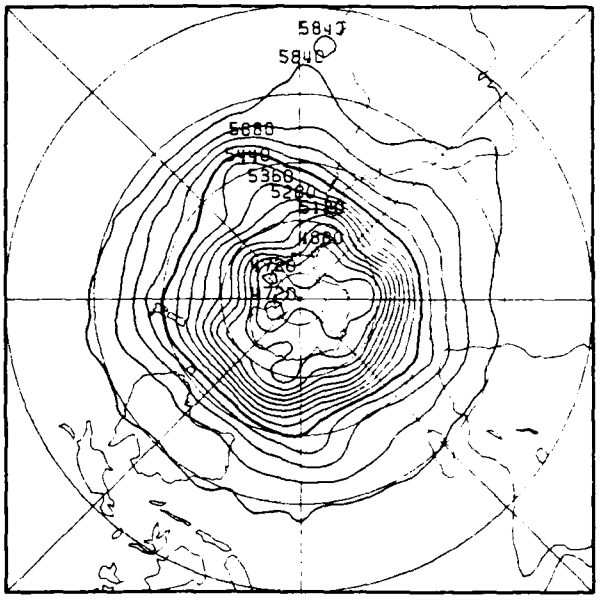
1200 GMT 11 JUL 1979

DAY 6

OBSERVED



9-LAYER 4X5



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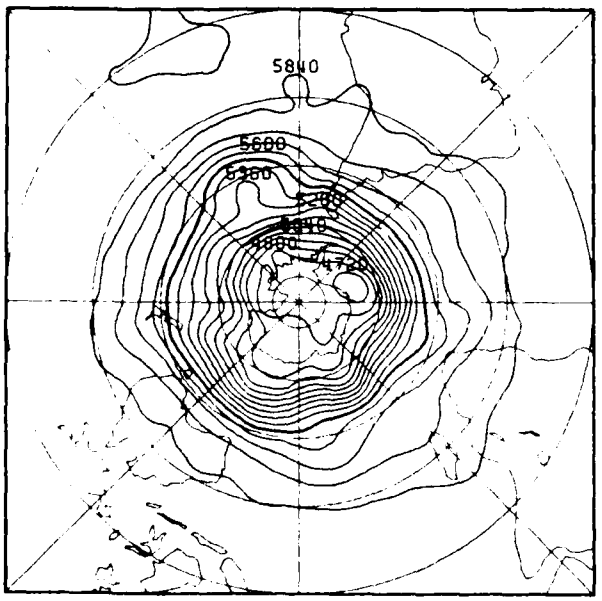

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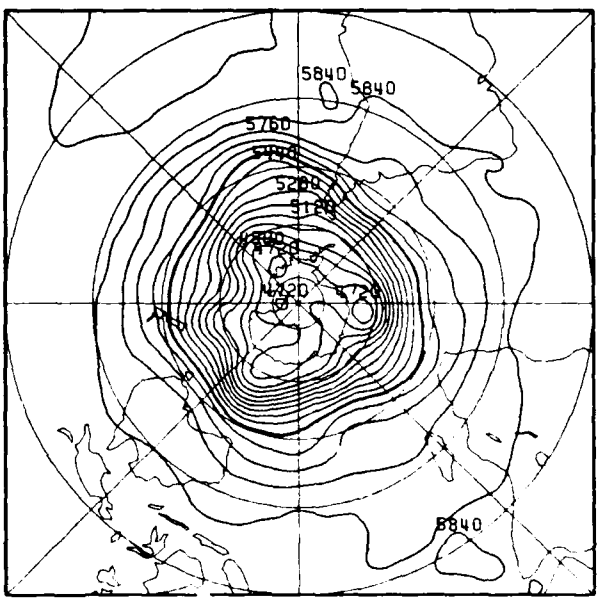
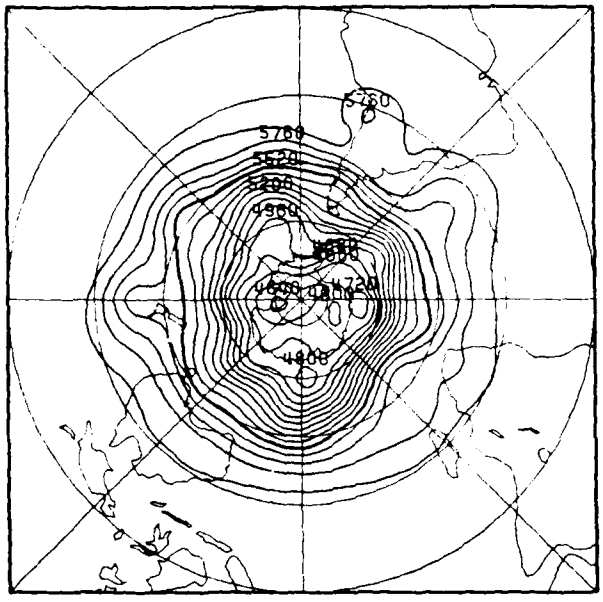


500 mb Z

1200 GMT 12 JUL 1979

DAY 7

OBSERVED



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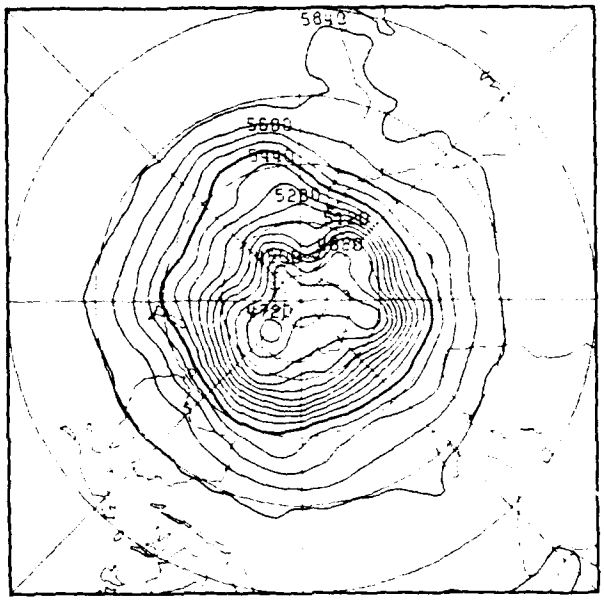

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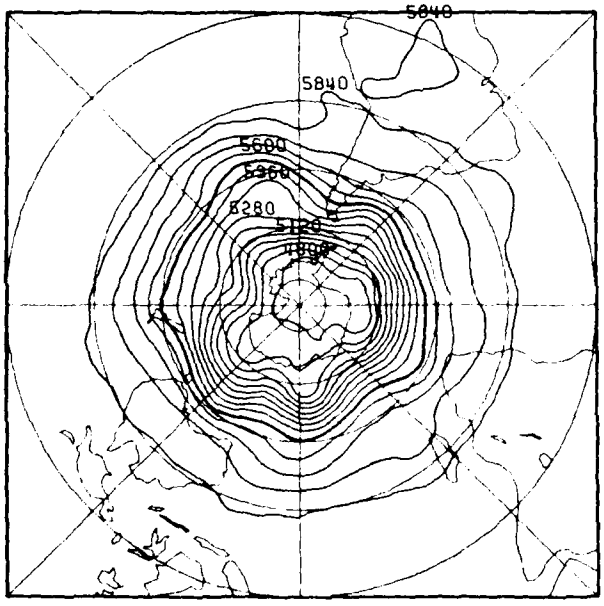

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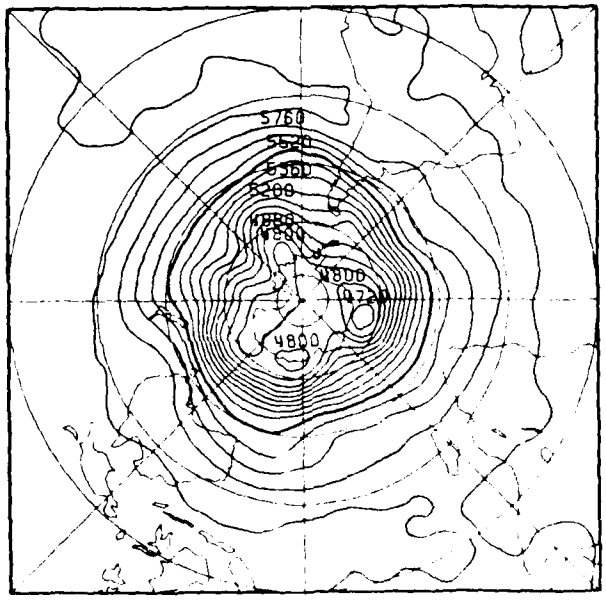
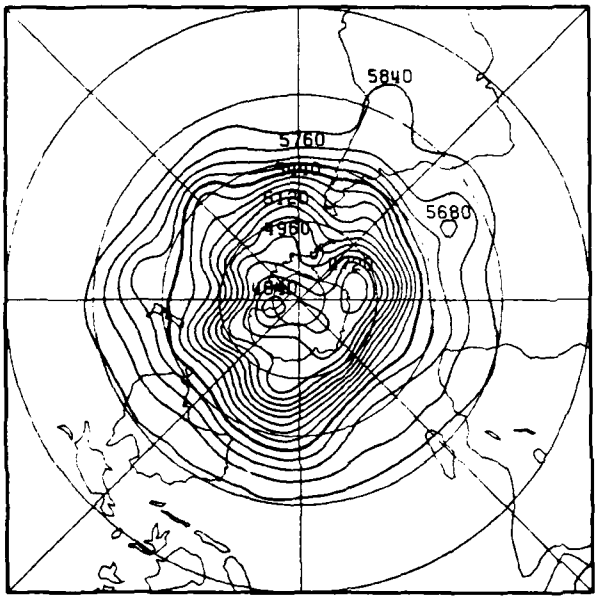


500 mb Z

1200 GMT 13 JUL 1979

DAY 8

OBSERVED



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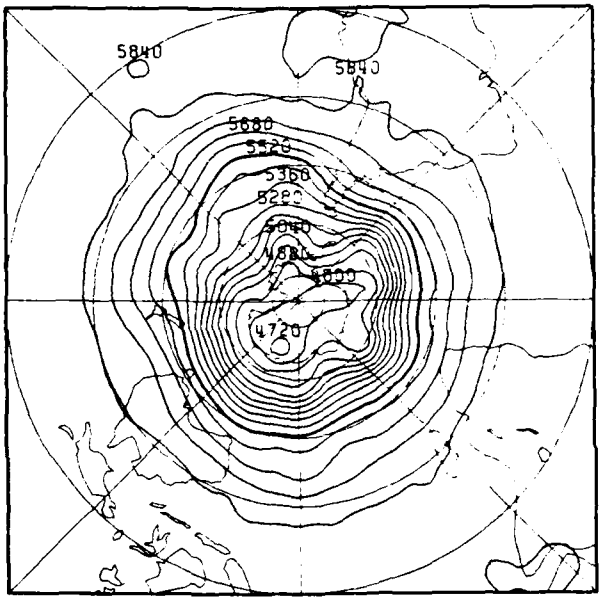

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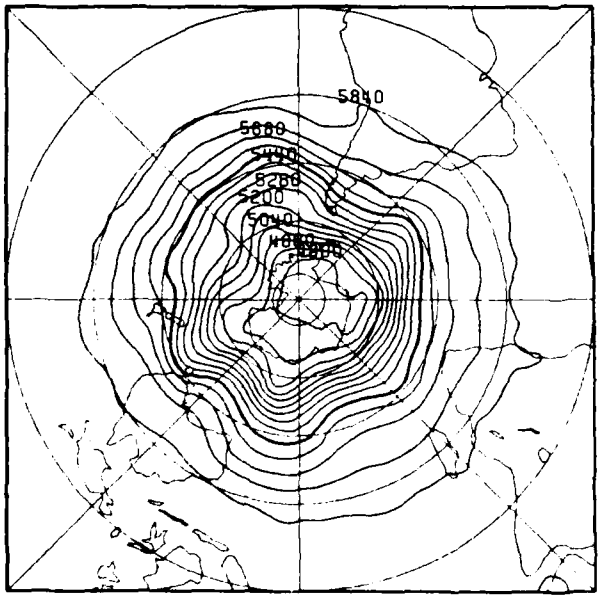

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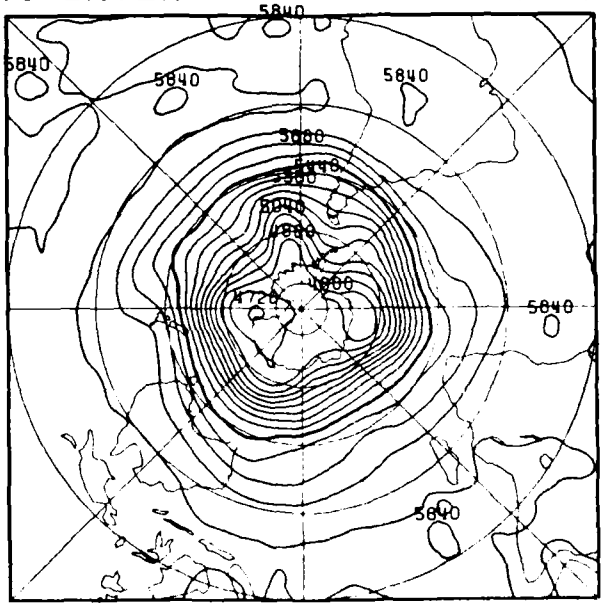
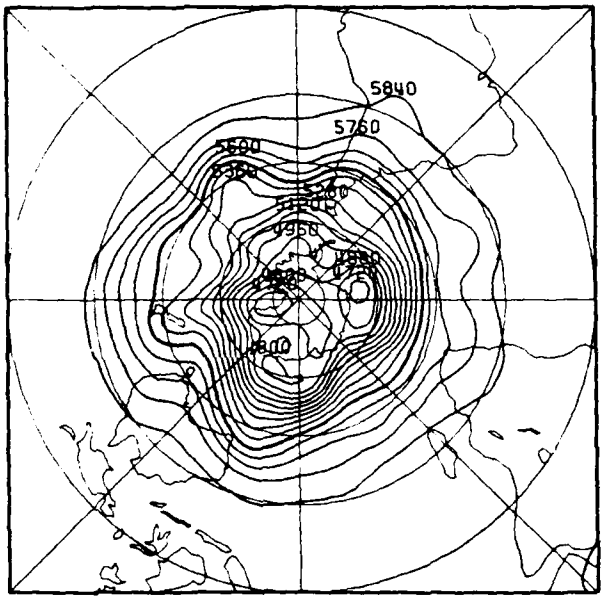


500 mb Z

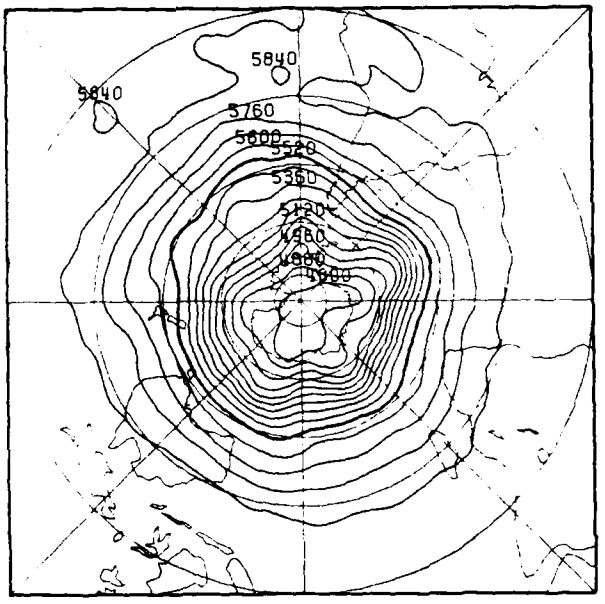
1200 GMT 14 JUL 1979

DAY 9

OBSERVED



9-LAYER 4X5



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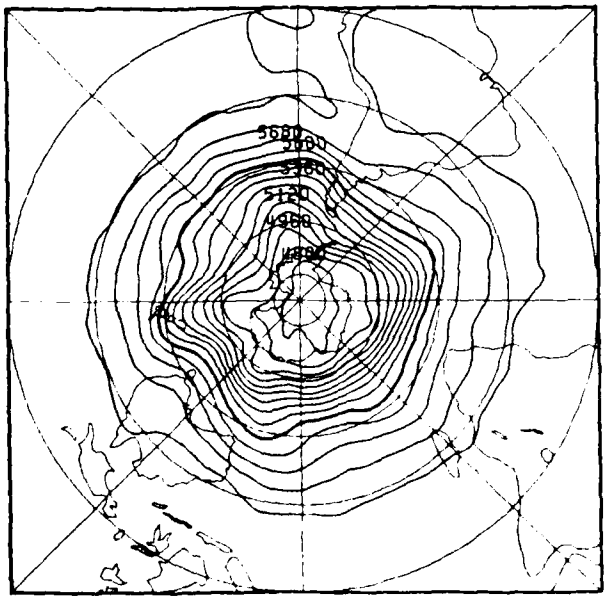
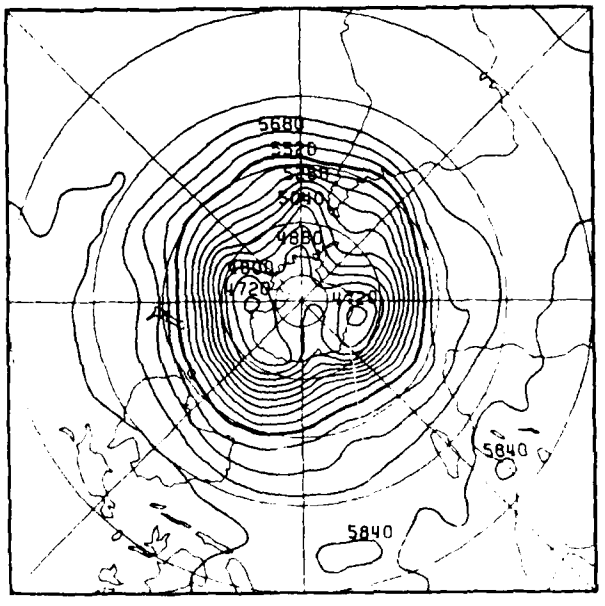


15-LAYER 2.4X3

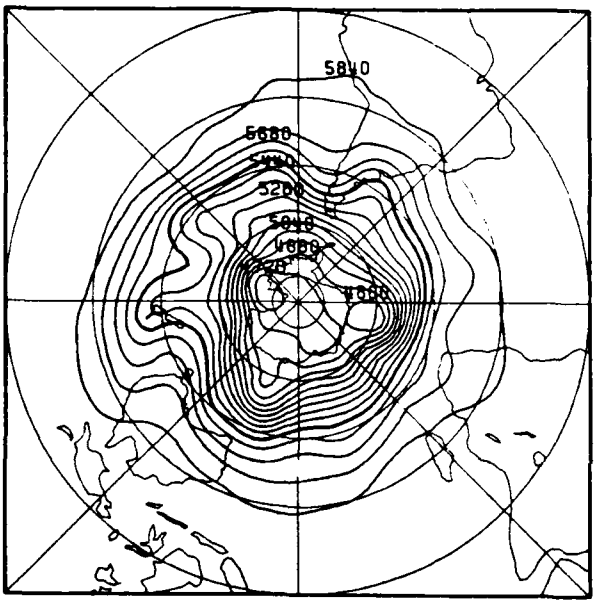


500 mb Z

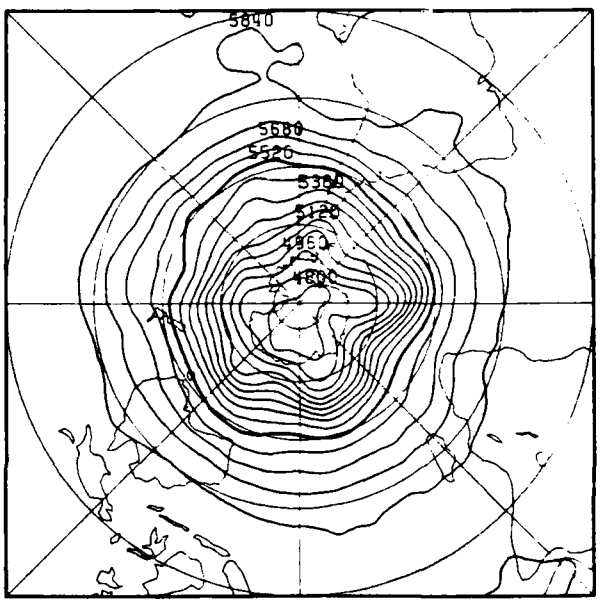
1200 GMT 15 JUL 1979

DAY 10

OBSERVED



9-LAYER 4X5



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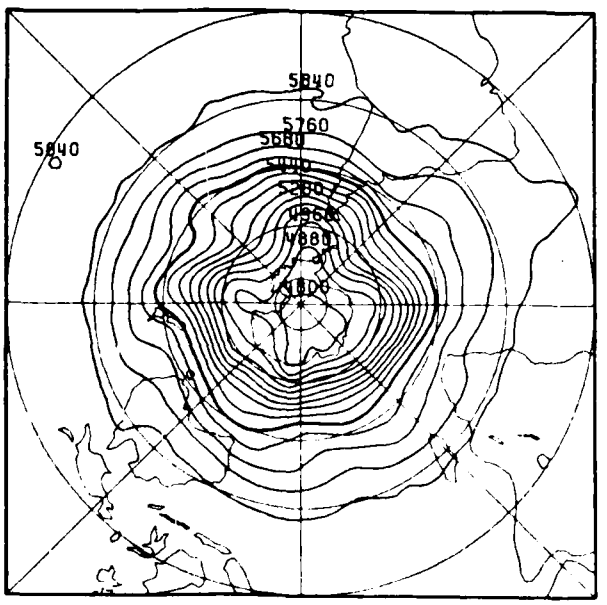

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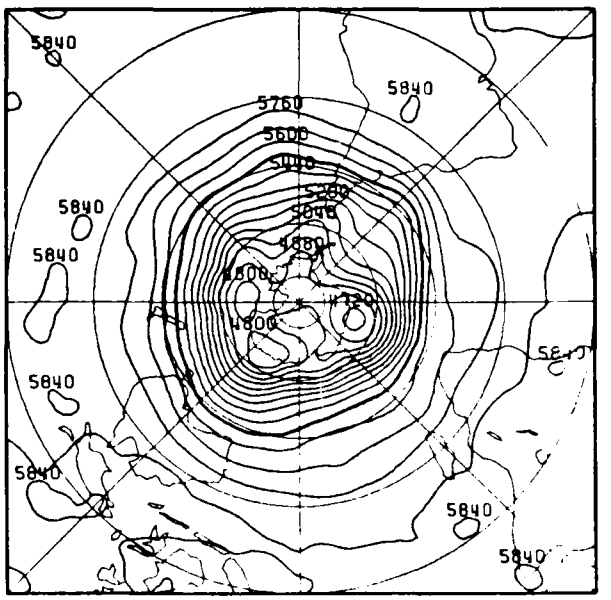
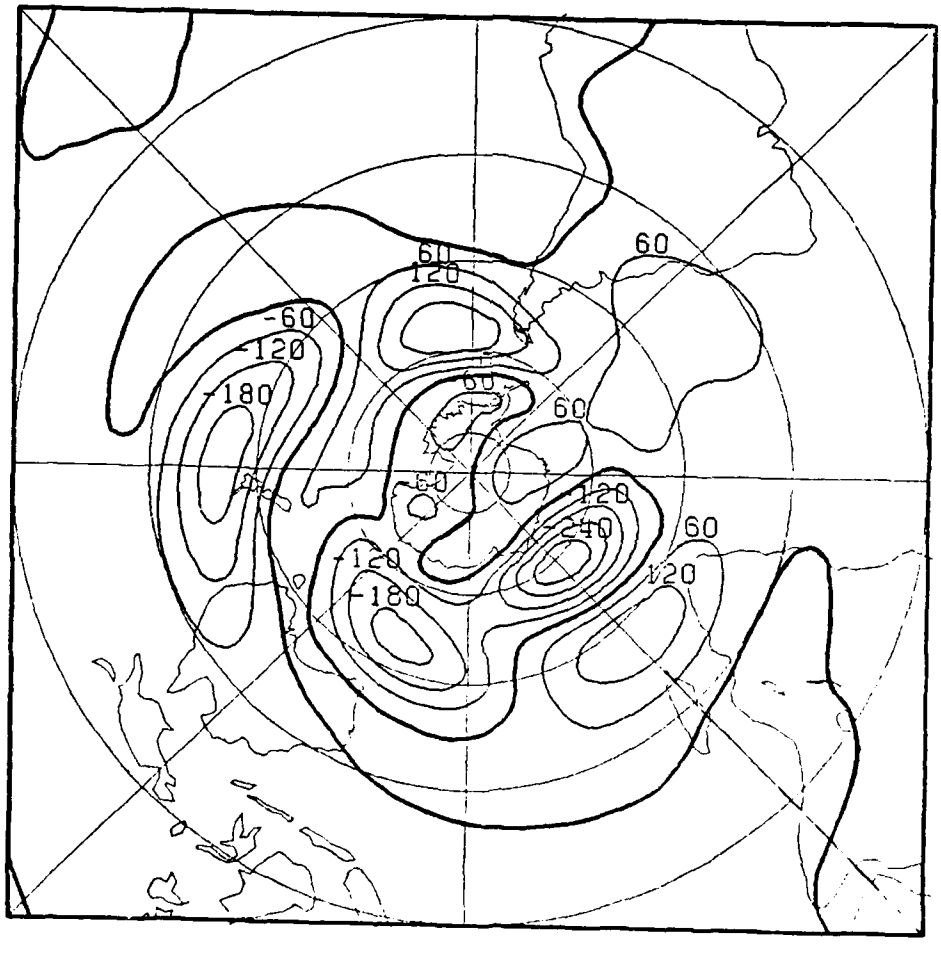


500 mb Z

WAVENUMBER S 1-4

1200 GMT 5 JULY 1979

OBSERVED



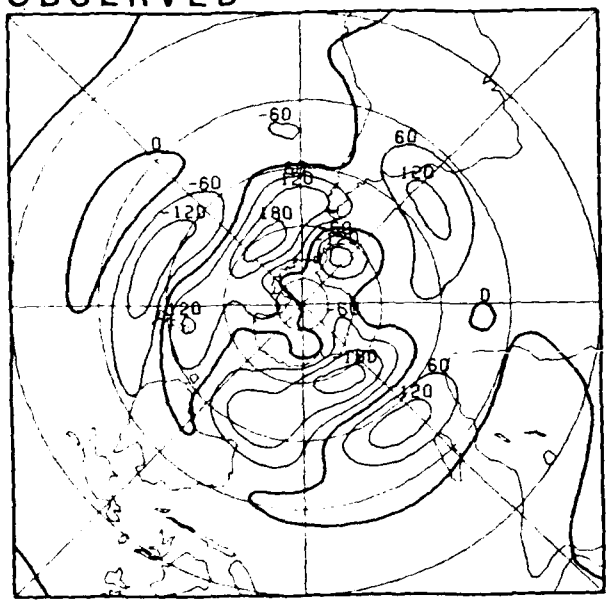
500 mb Z

WAVENUMBERS 1-4

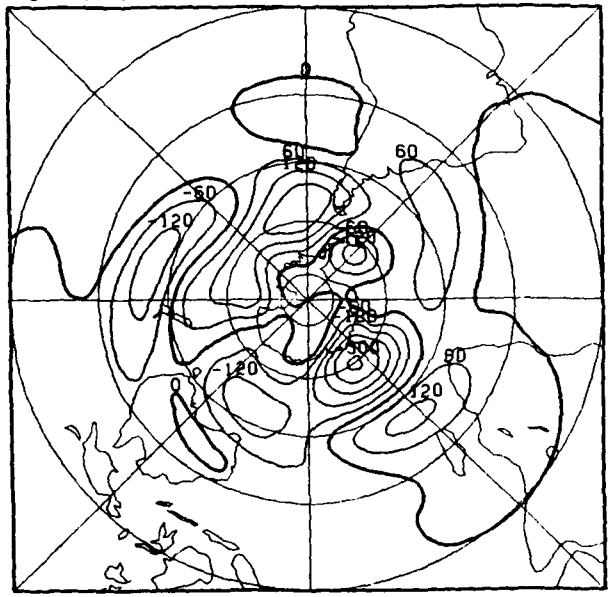
1200 GMT 6 JULY 1979

DAY 1

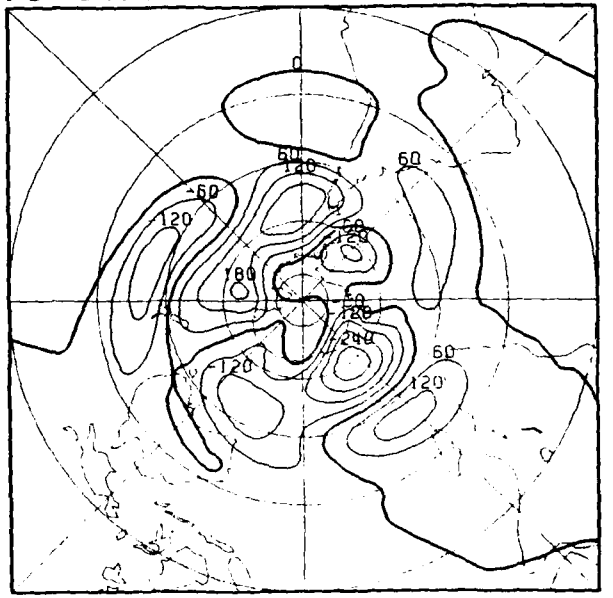
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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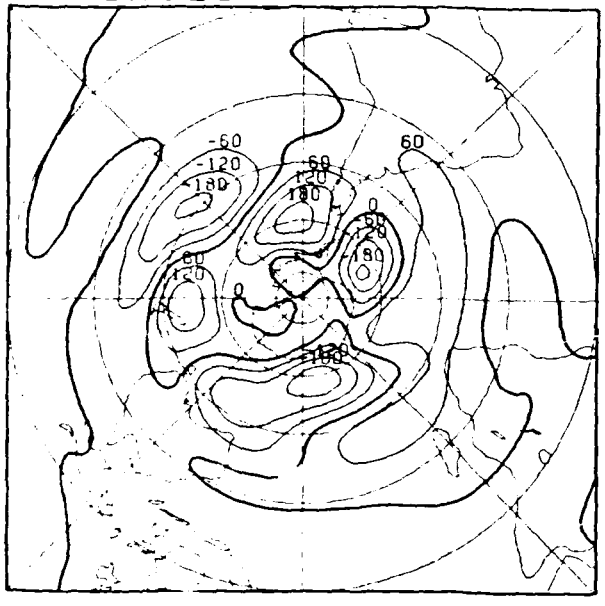
WAVENUMBERS 1-4

1200 GMT 7 JULY 1979

DAY 2

OBSERVED



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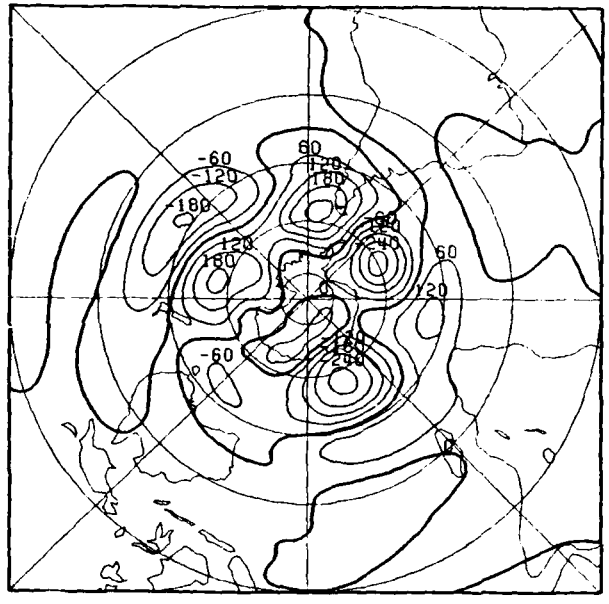
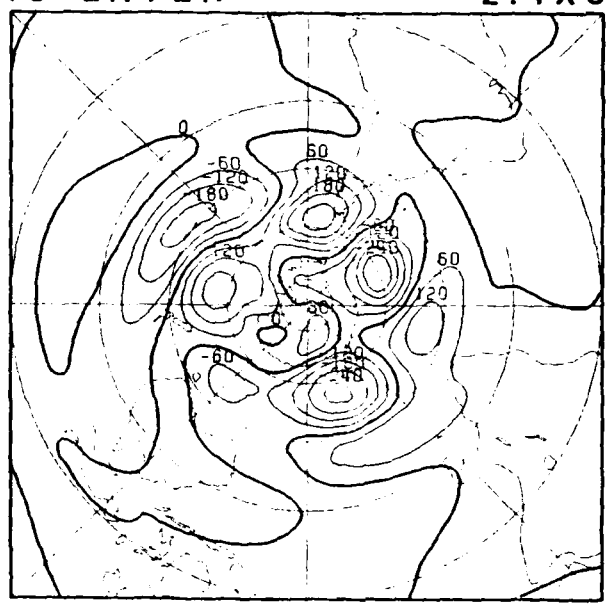


15-LAYER 2.4X3



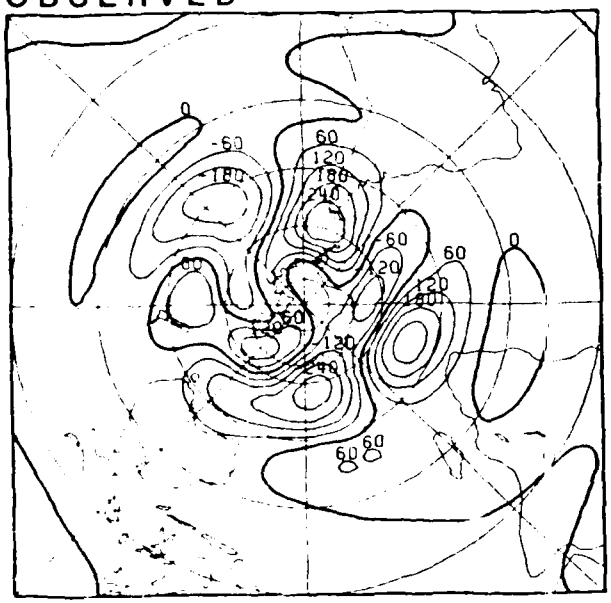
500 mb Z

WAVENUMBERS 1-4

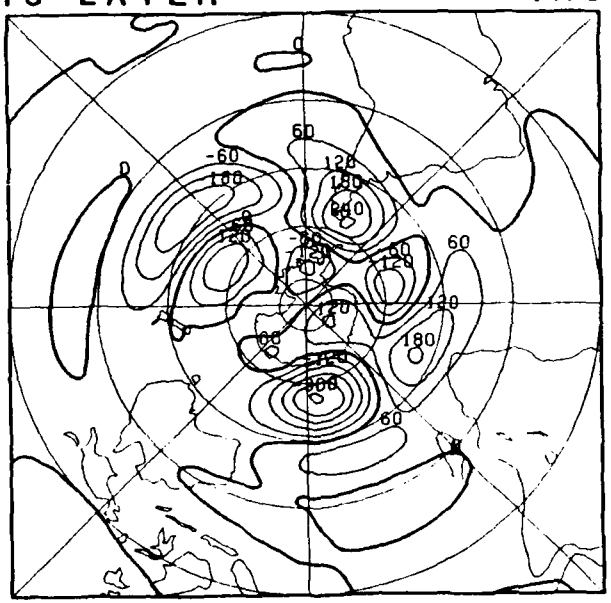
1200 GMT 8 JULY 1979

DAY 3

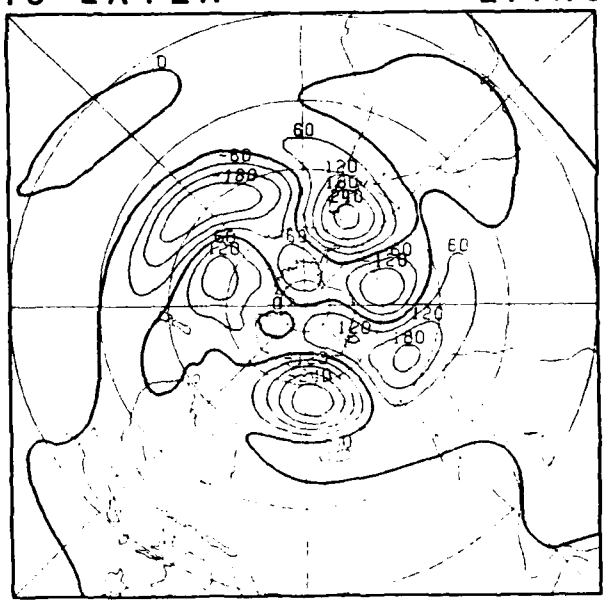
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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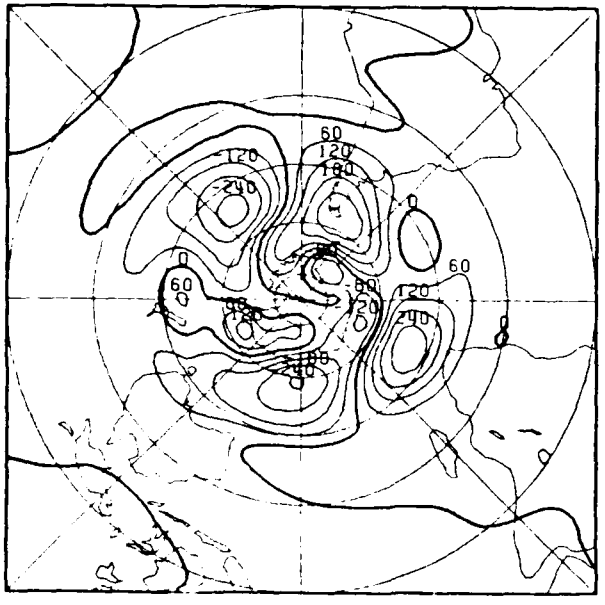
WAVENUMBERS 1-4

1200 GMT 9 JULY 1979

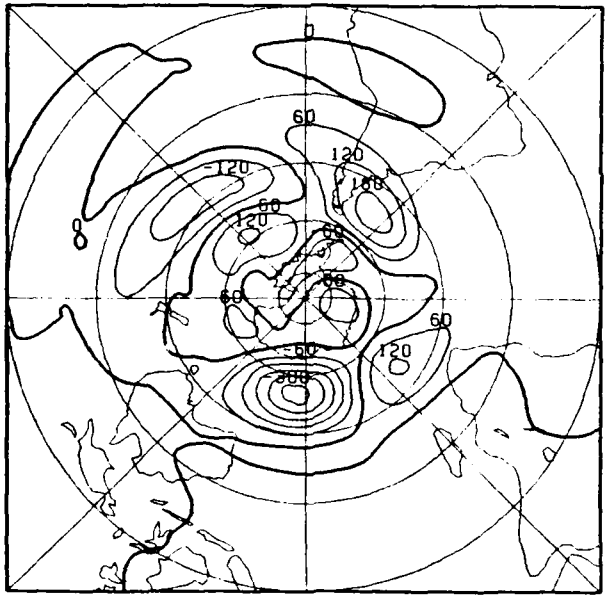
DAY 4

11-28

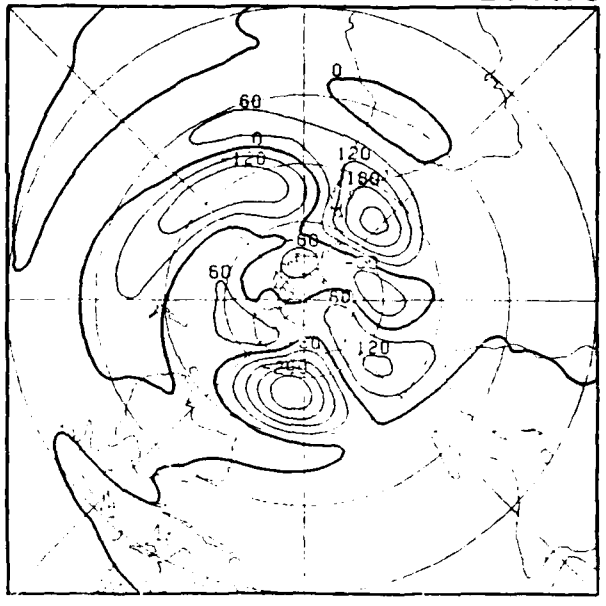
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



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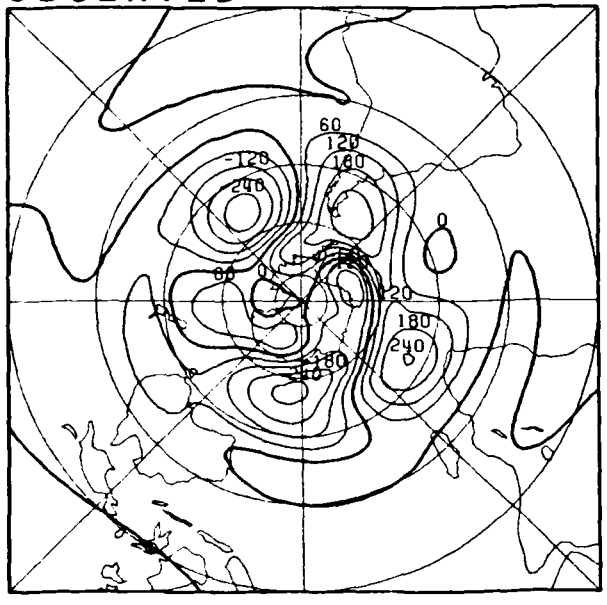
WAVENUMBERS 1-4

1200 GMT 10 JULY 1979

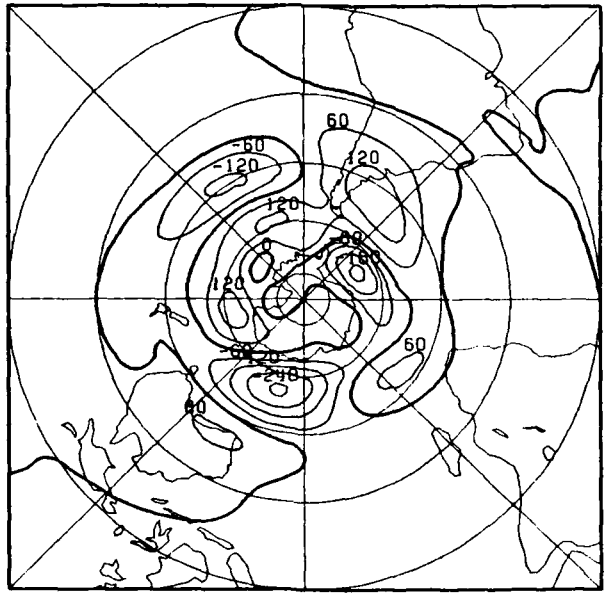
DAY 5

11-29

OBSERVED



15-LAYER 4X5



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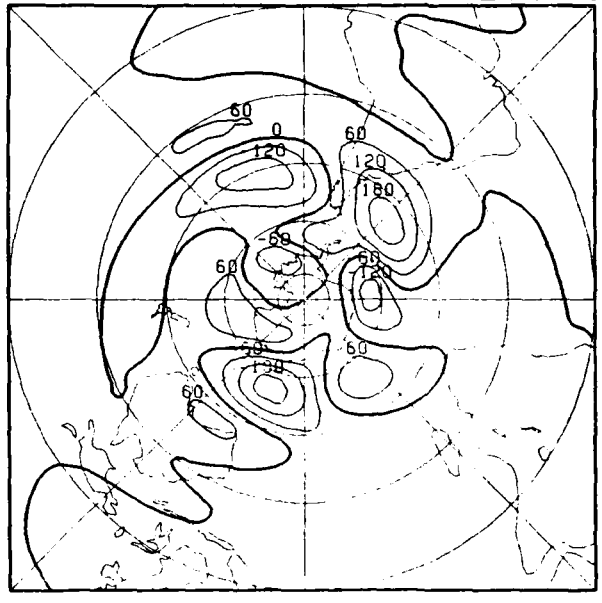


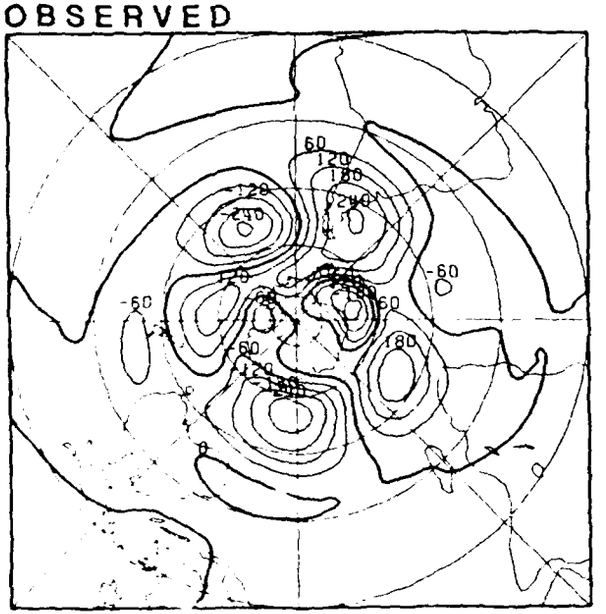
500 mb Z

WAVENUMBERS 1-4

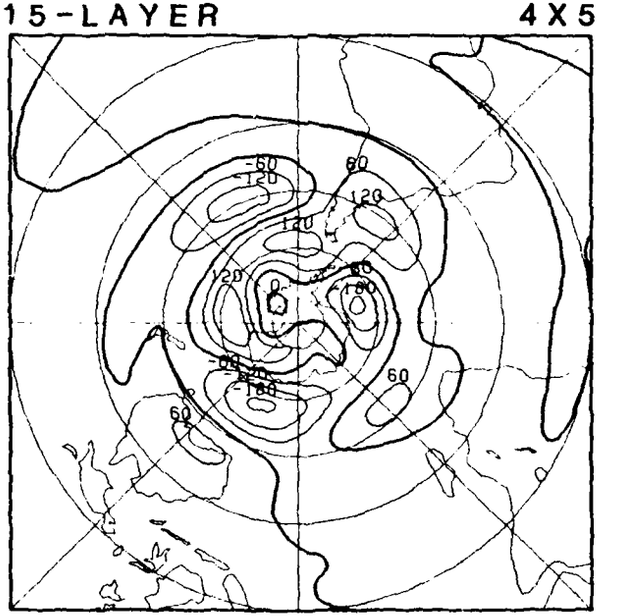
1200 GMT 11 JULY 1979

DAY 6

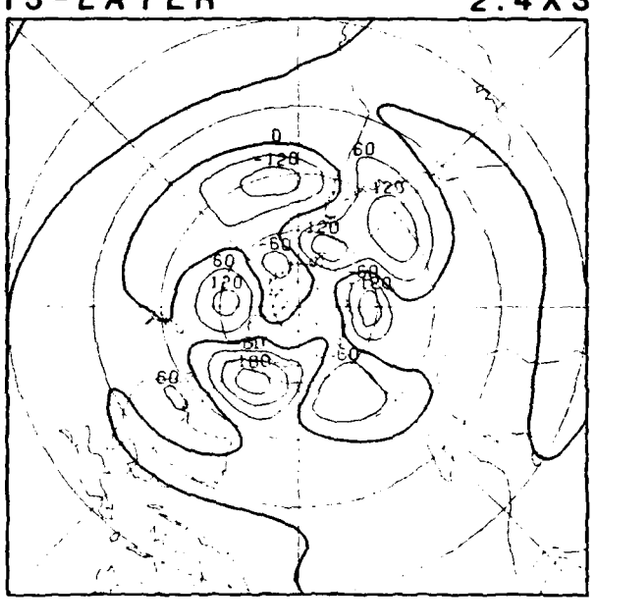
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



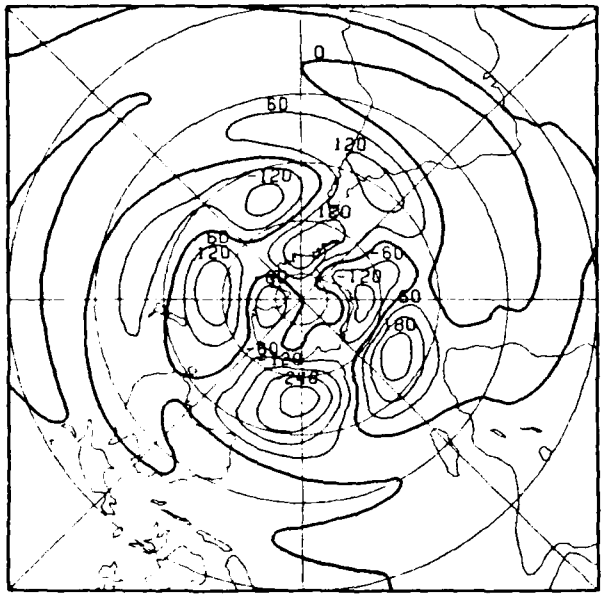
500 mb Z

WAVENUMBERS 1-4

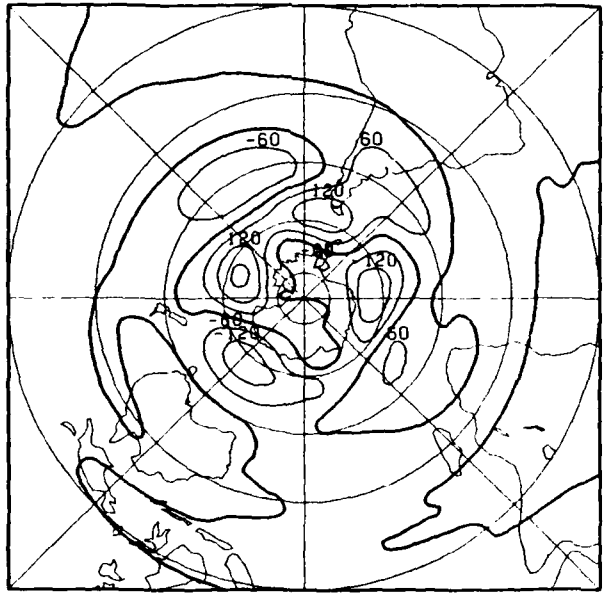
1200 GMT 12 JULY 1979

DAY 7

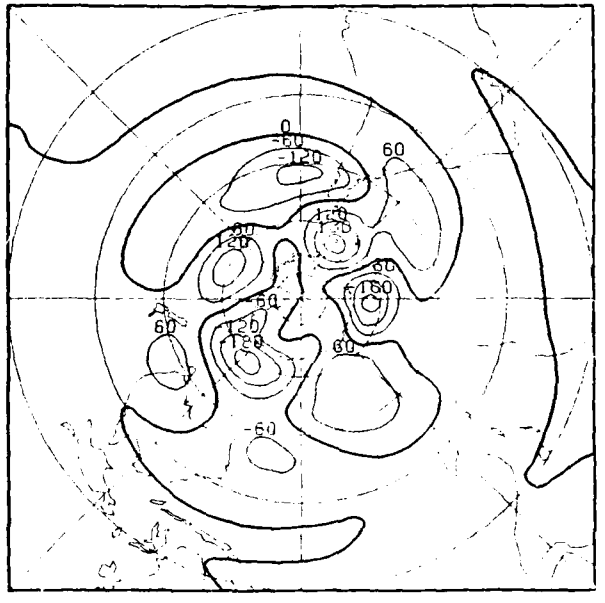
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



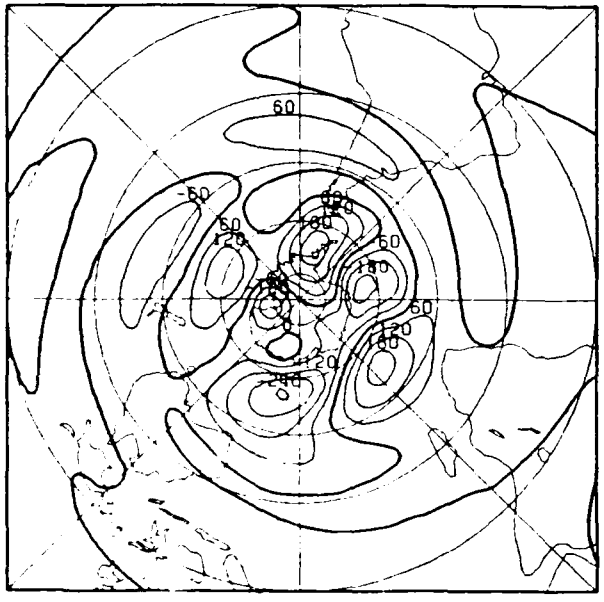
500 mb Z

WAVENUMBERS 1-4

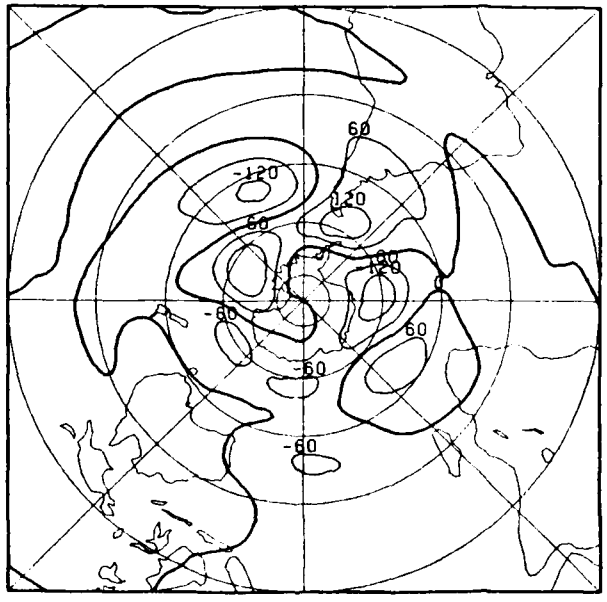
1200 GMT 13 JULY 1979

DAY 8

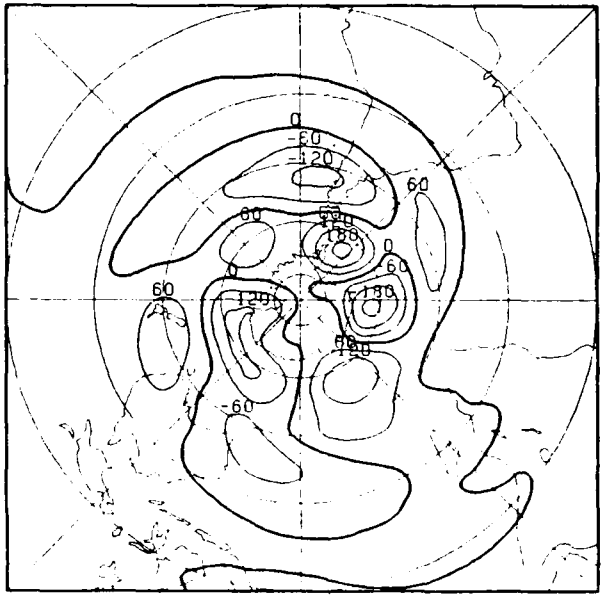
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



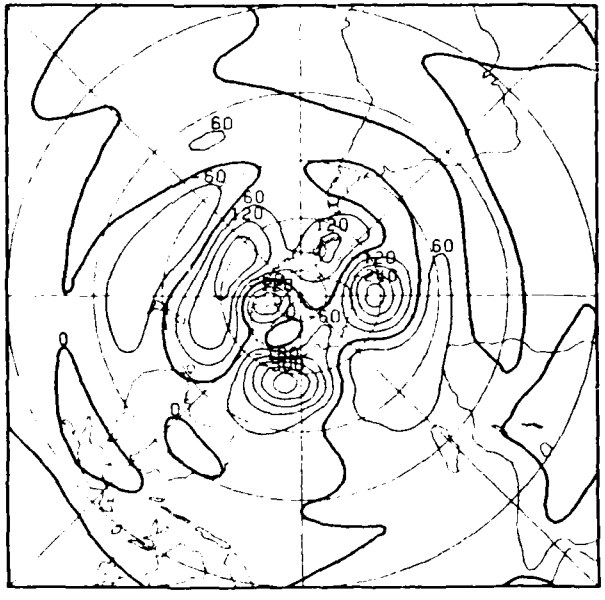
500 mb Z

WAVENUMBERS 1-4

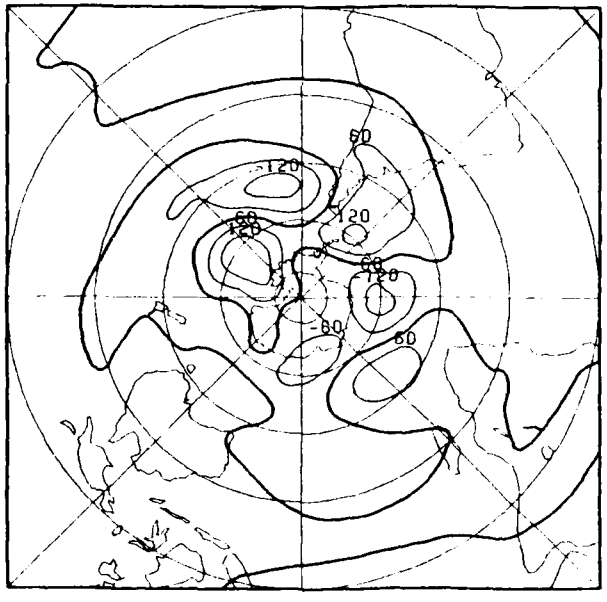
1200 GMT 14 JULY 1979

DAY 9

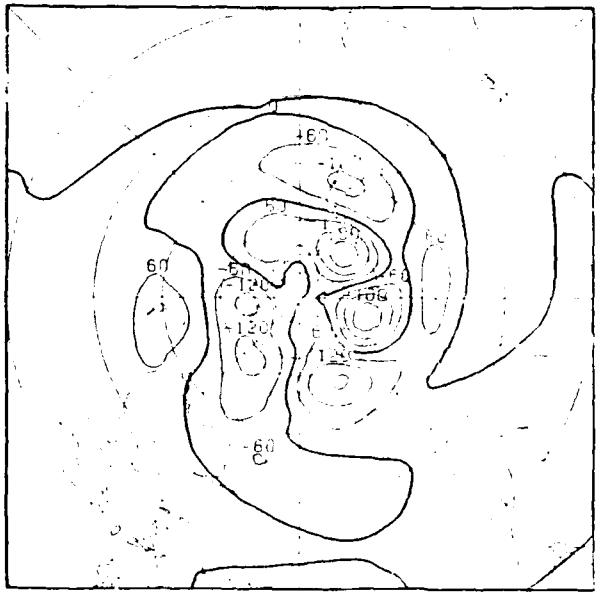
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3



500 mb Z

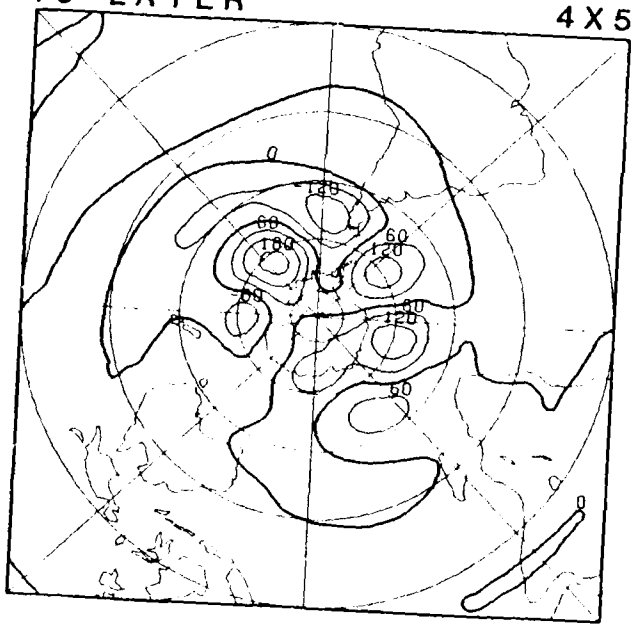
WAVENUMBERS 1-4

1200 GMT 15 JULY 1979

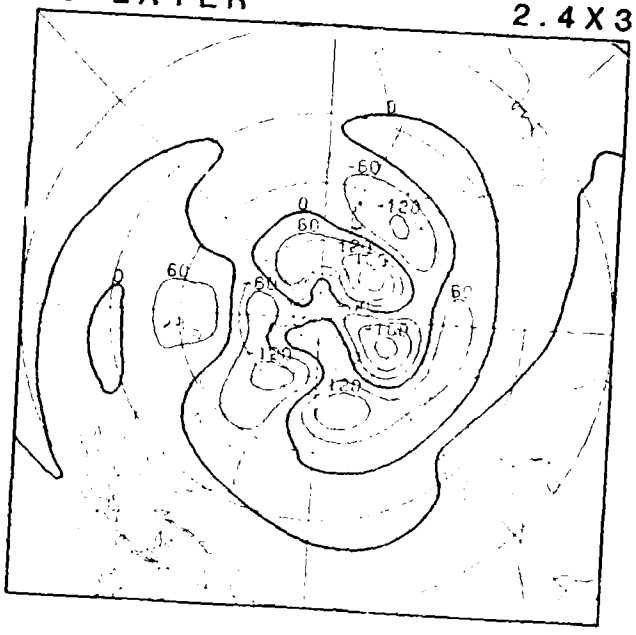
DAY 10

OBSERVED

15-LAYER 4X5

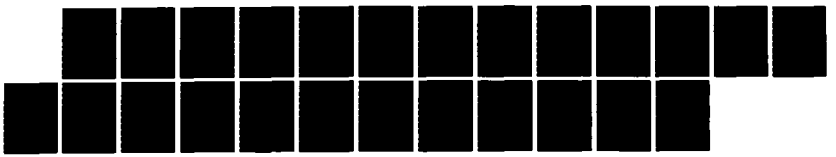


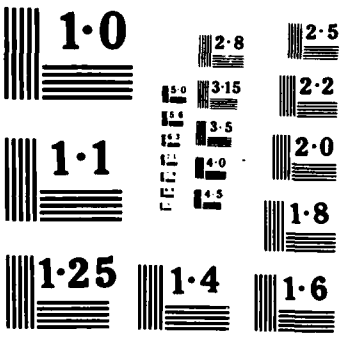
15-LAYER 2.4X3



AD-A170 188 MEDIUM RANGE (10 DAY) FORECASTS WITH THE UCLA GENERAL CIRCULATION MODEL..(U) CALIFORNIA UNIV LOS ANGELES DEPT OF ATMOSPHERIC SCIENCES C R MECHOSO ET AL. JAN 86 5/3

UNCLASSIFIED NEPRF-CR-86-01 N00014-80-K-0947 F/G 4/2 NL

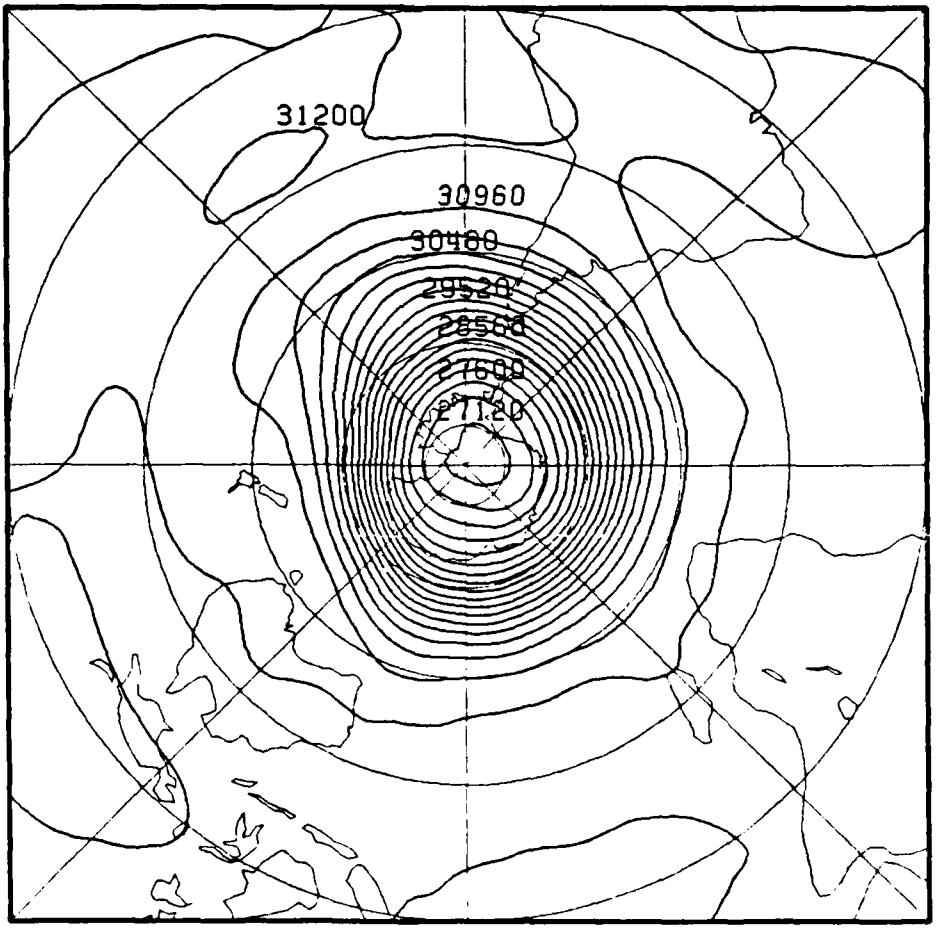



1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
1·4
2·5
2·2
2·0
1·8
1·6

10 mb Z

1200 GMT 5 JULY 1979

OBSERVED

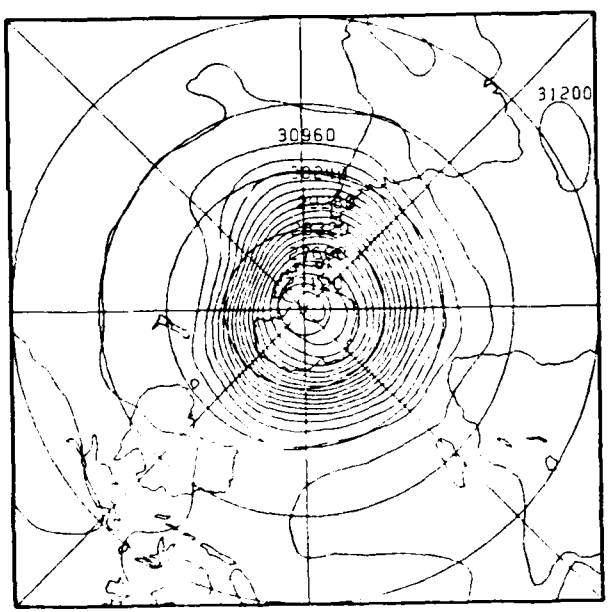


10 mb Z

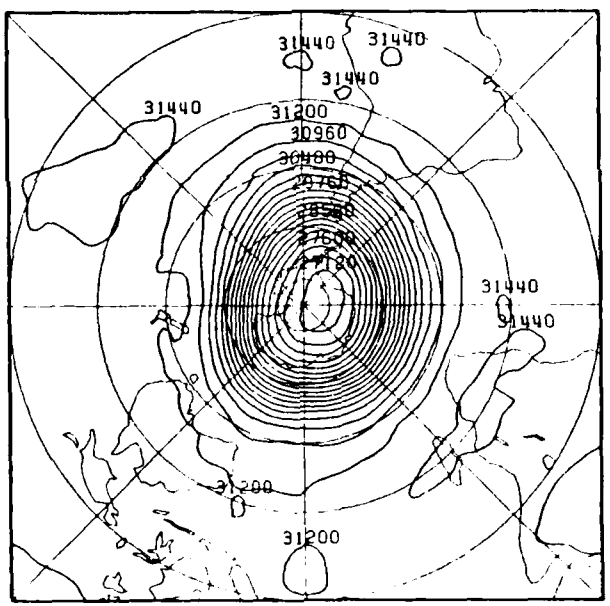
1200 GMT 6 JULY 1979

DAY 1

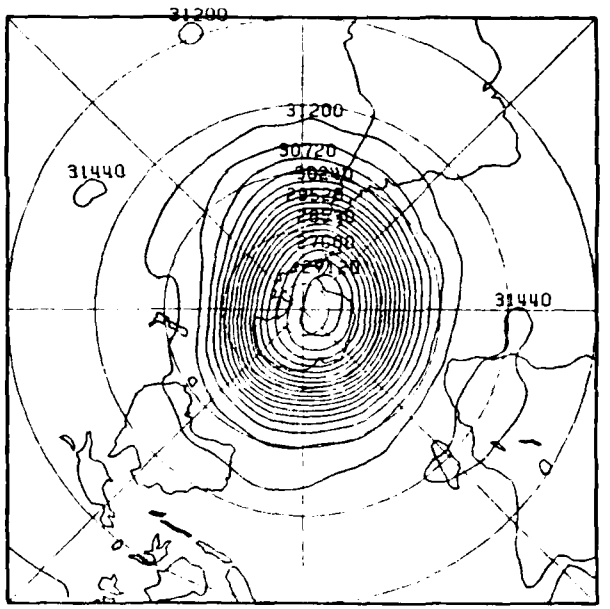
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

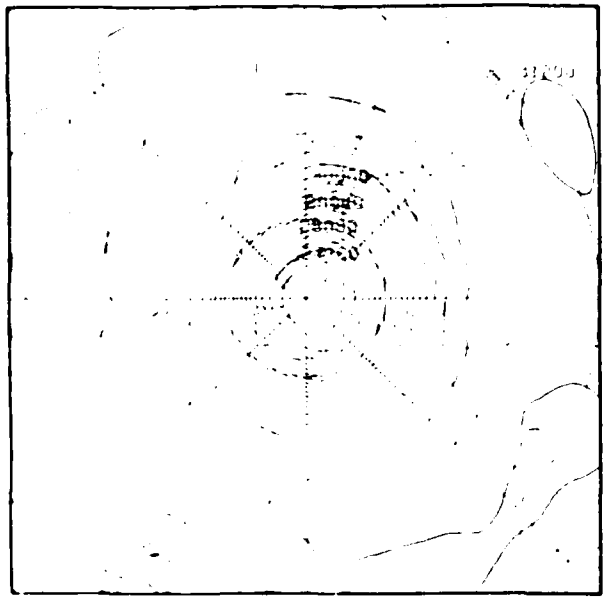


10 mb Z

1200 GMT 7 JULY 1979

DAY 2

OBSERVED



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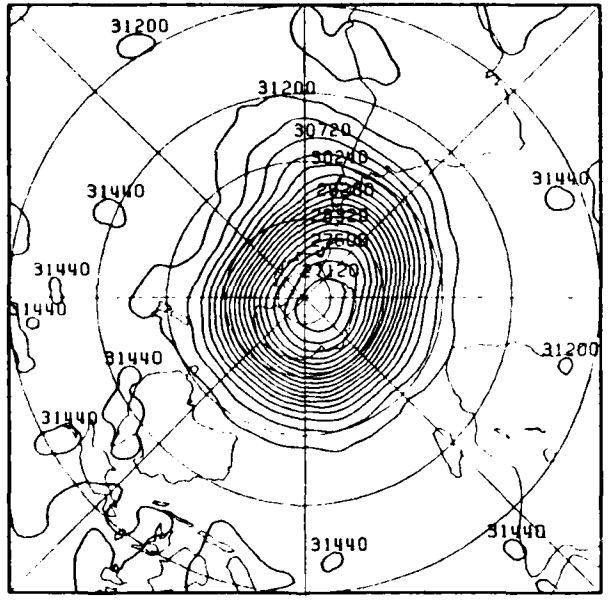
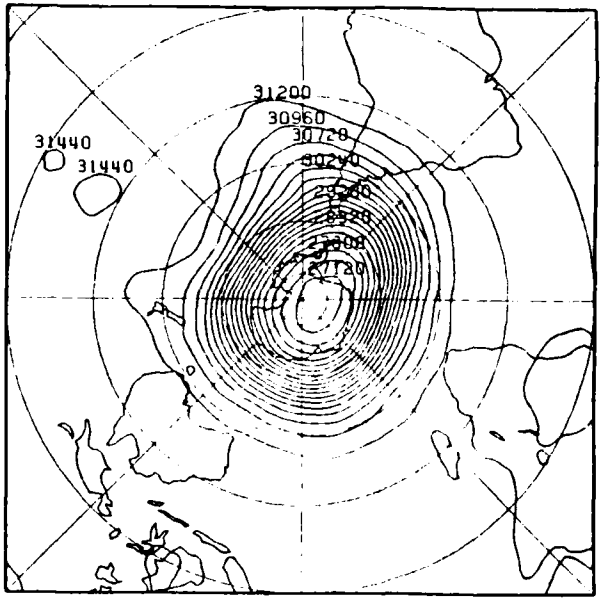


15-LAYER 2.4X3

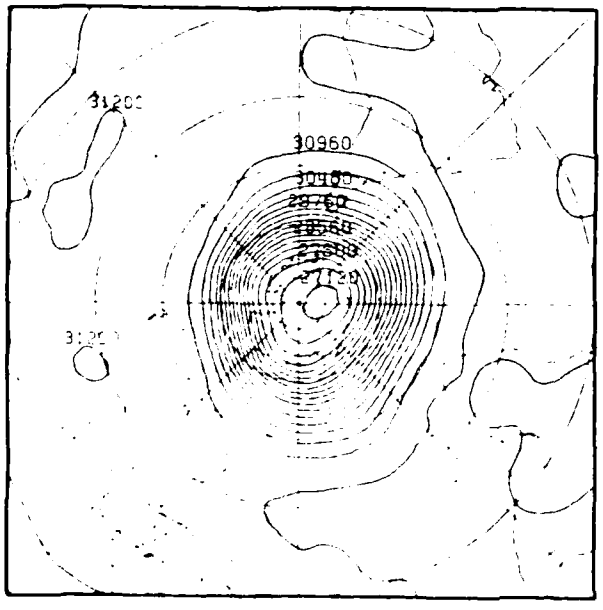


10 mb Z

1200 GMT 8 JULY 1979

DAY 3

OBSERVED



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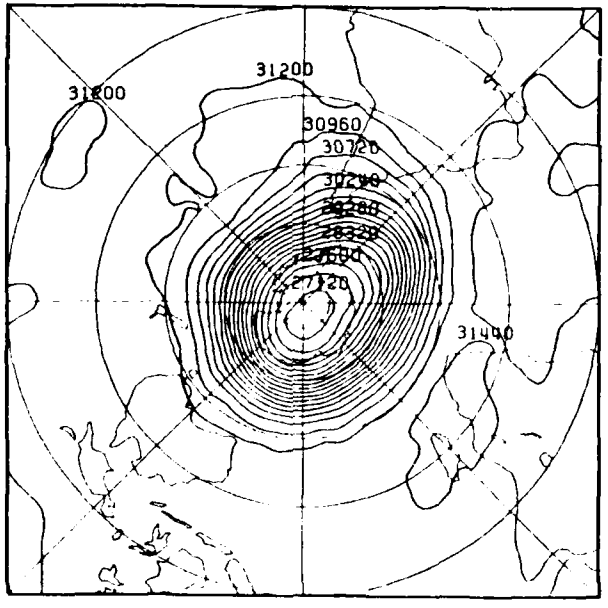

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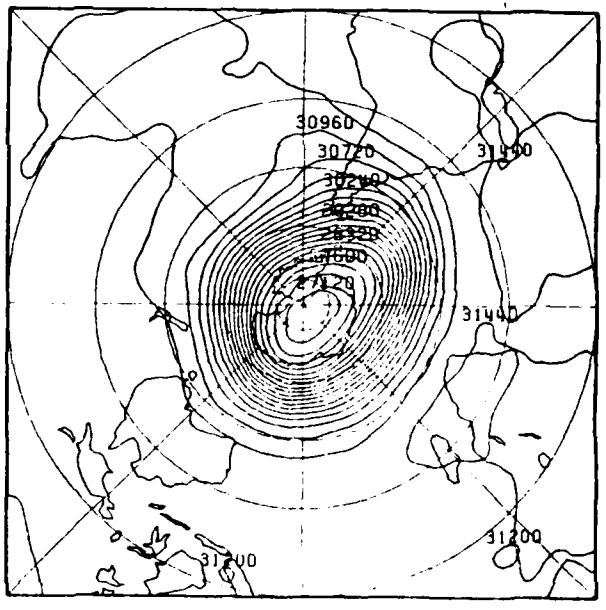
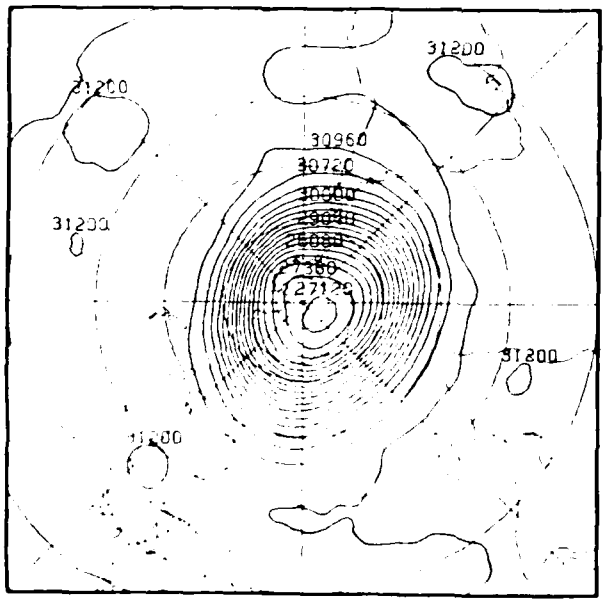


10 mb Z

1200 GMT 9 JULY 1979

DAY 4

OBSERVED



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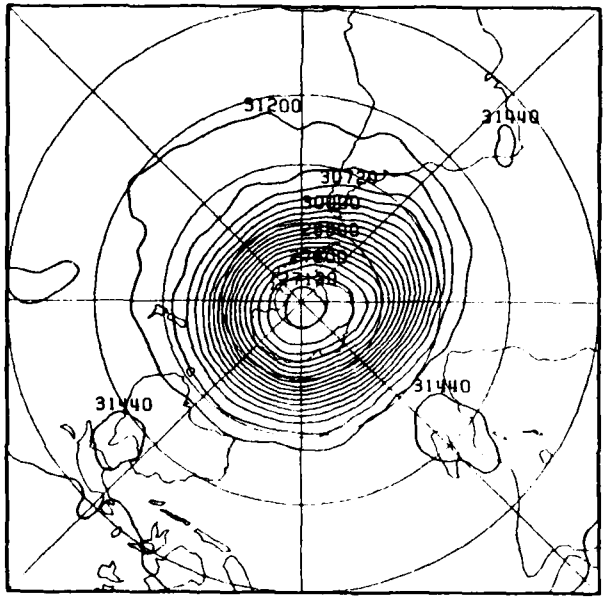
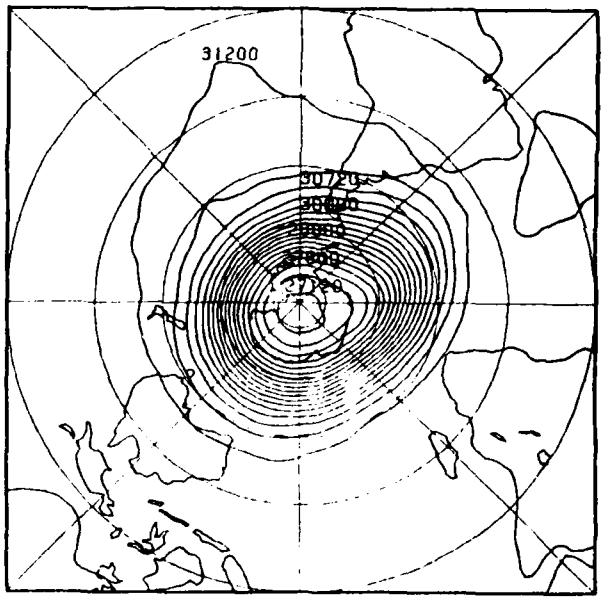


15-LAYER 2.4X3

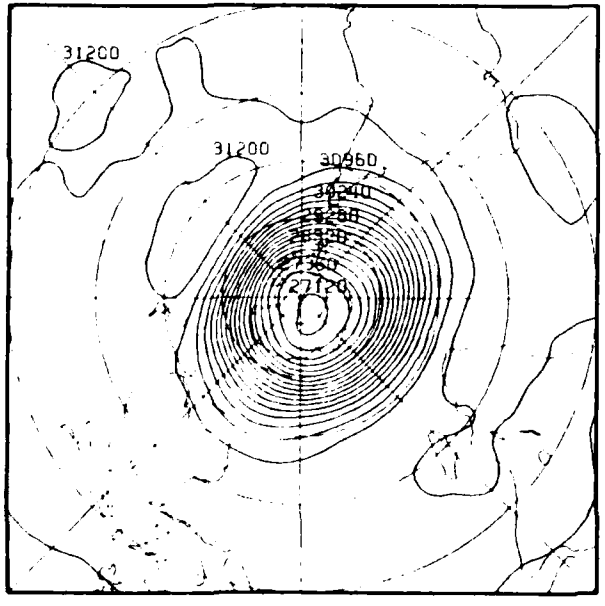


10 mb Z

1200 GMT 10 JULY 1979

DAY 5

OBSERVED



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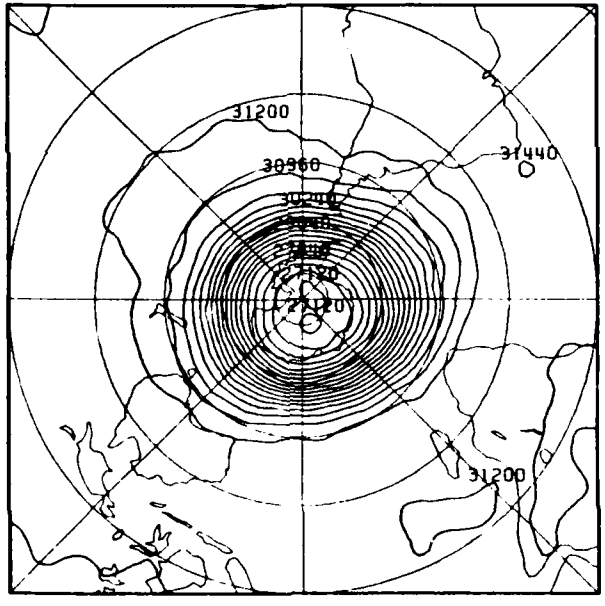

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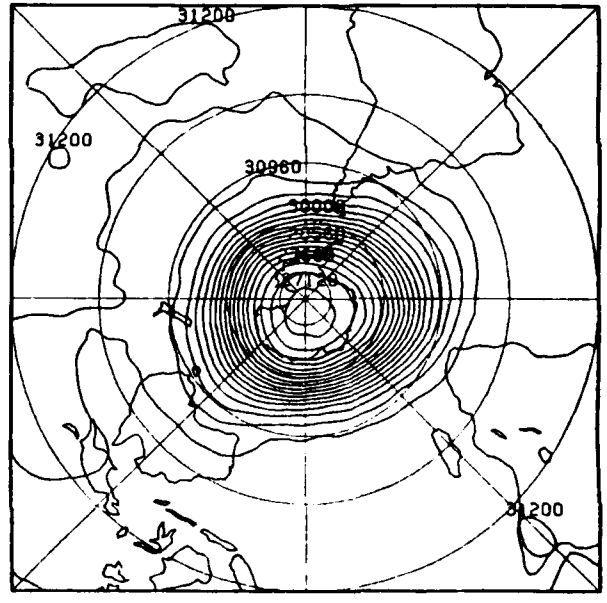
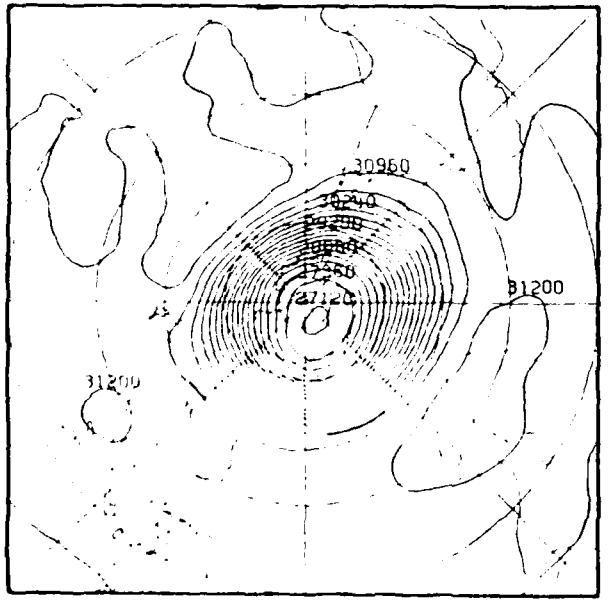


10 mb Z

1200 GMT 11 JULY 1979

DAY 6

OBSERVED



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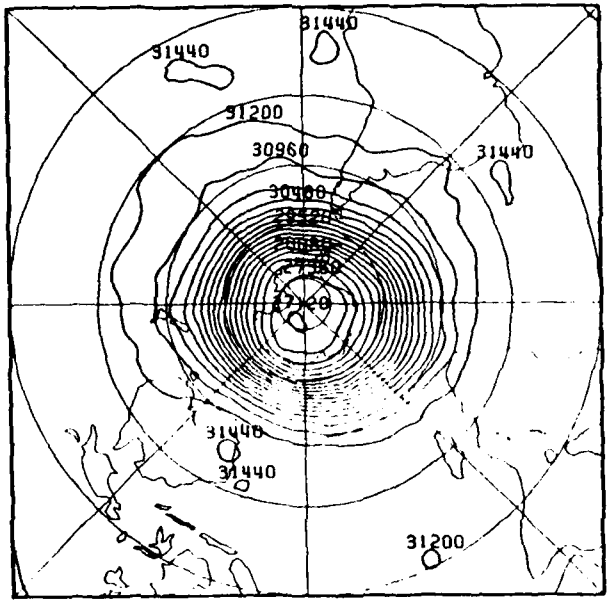

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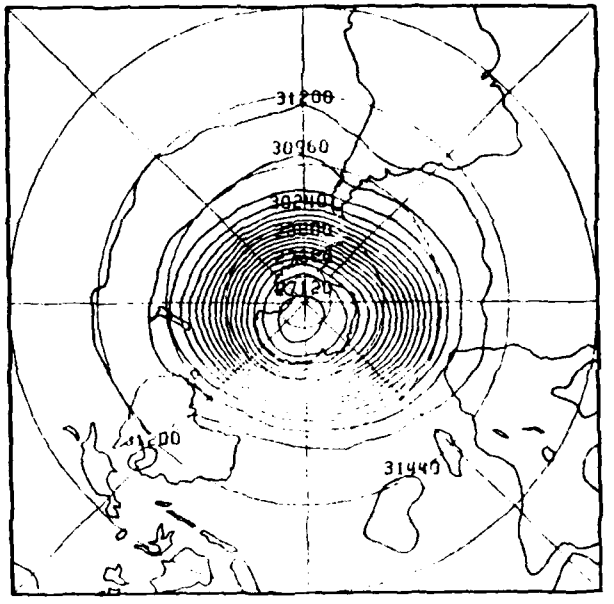
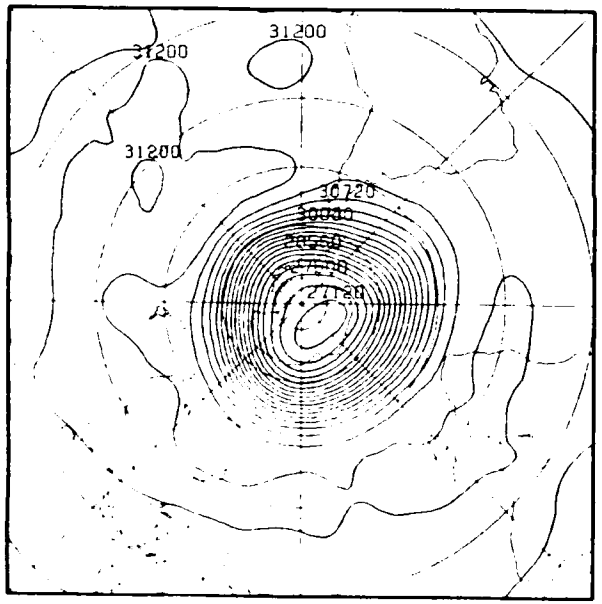


10 mb Z

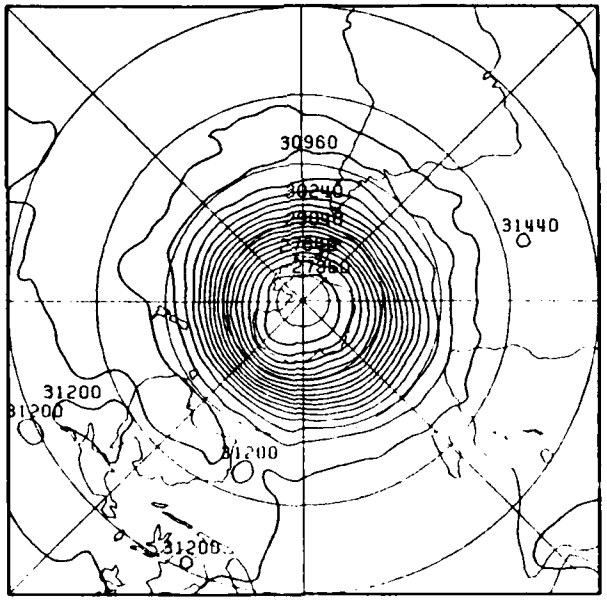
1200 GMT 12 JULY 1979

DAY 7

OBSERVED



15-LAYER 4X5



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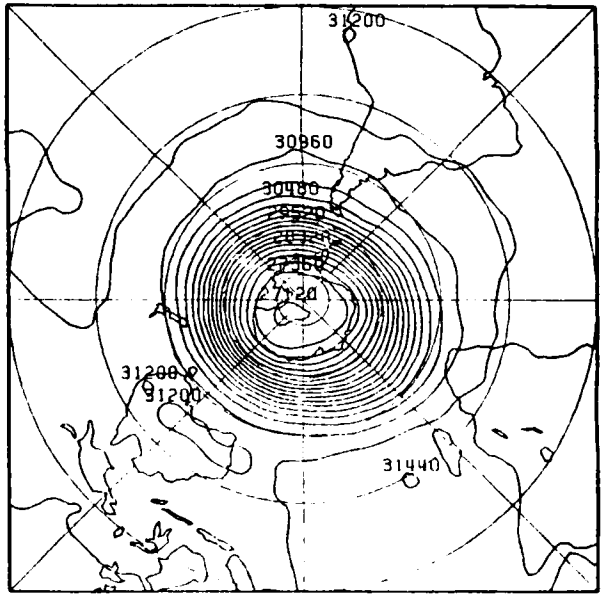
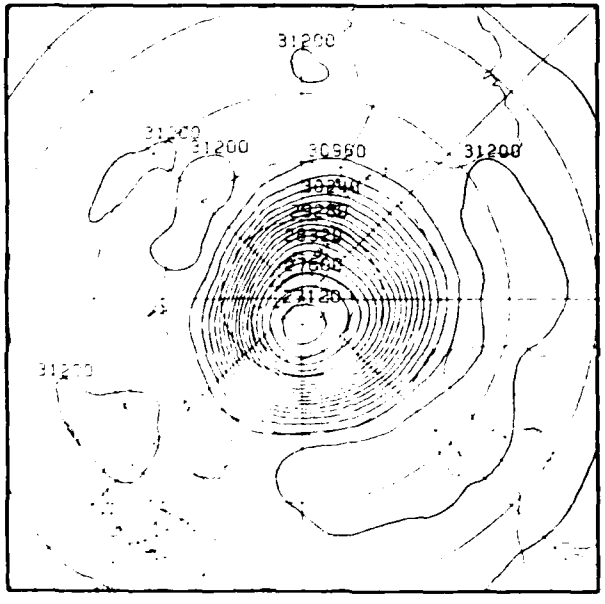


10 mb Z

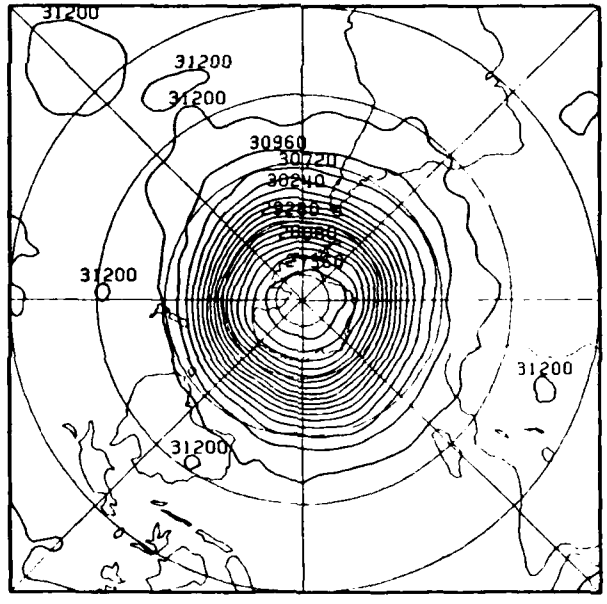
1200 GMT 13 JULY 1979

DAY 8

OBSERVED



15-LAYER 4X5



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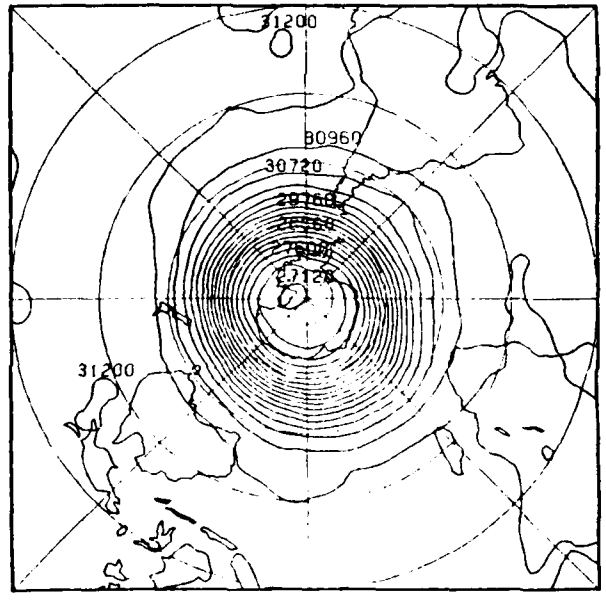
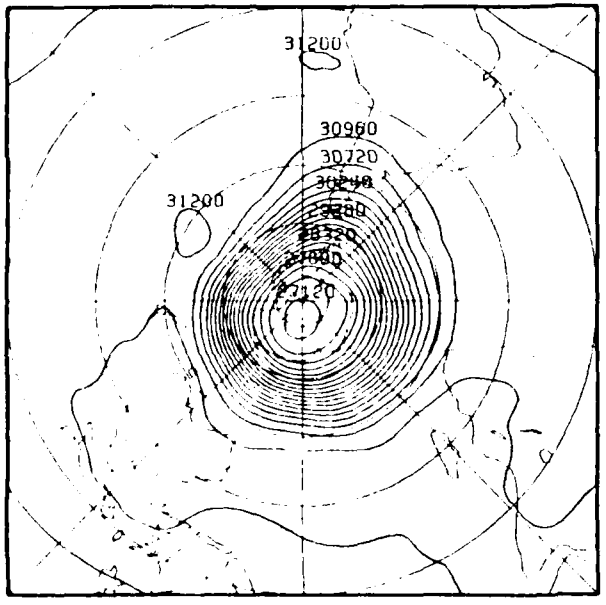


10 mb Z

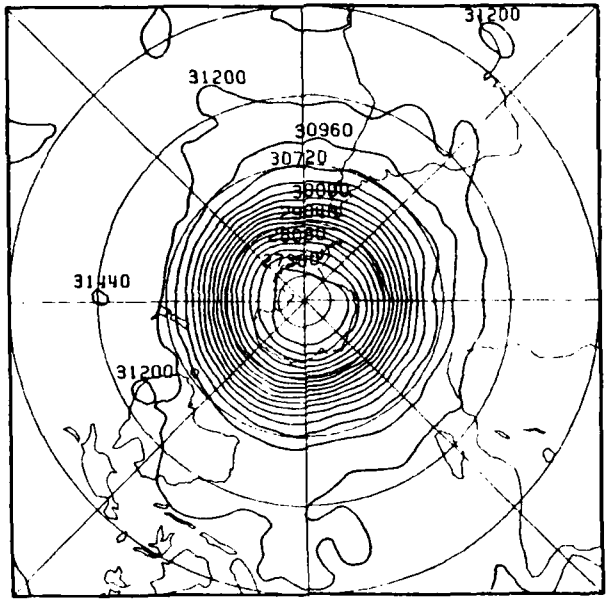
1200 GMT 14 JULY 1979

DAY 9

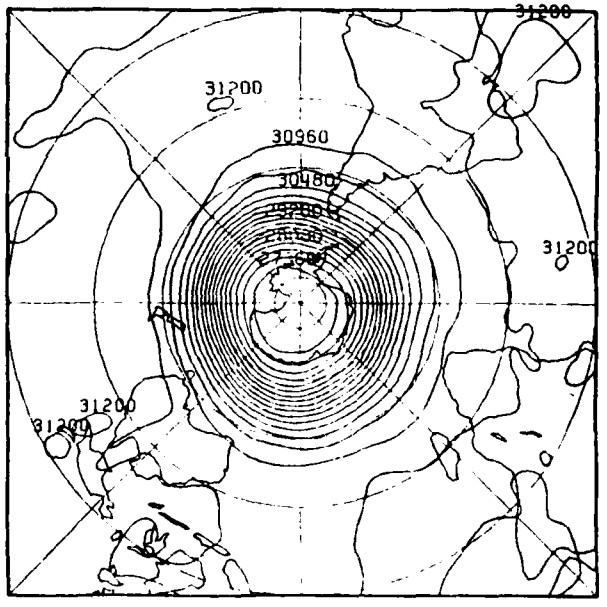
OBSERVED



15-LAYER 4X5



15-LAYER 2.4X3

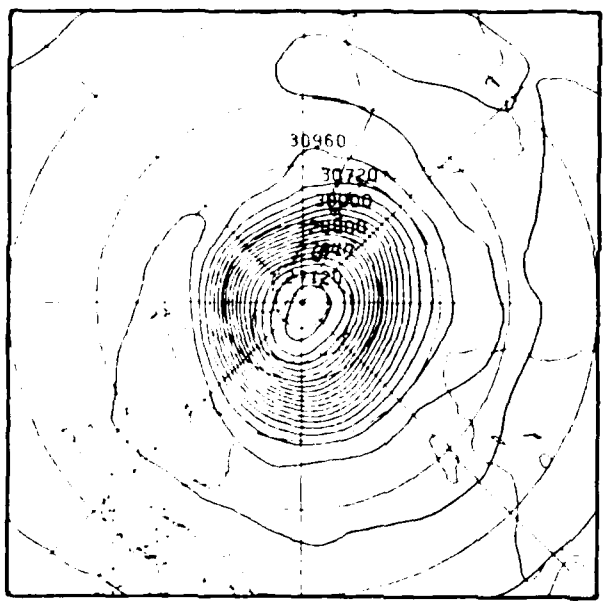


10 mb Z

1200 GMT 15 JULY 1979

DAY 10

OBSERVED



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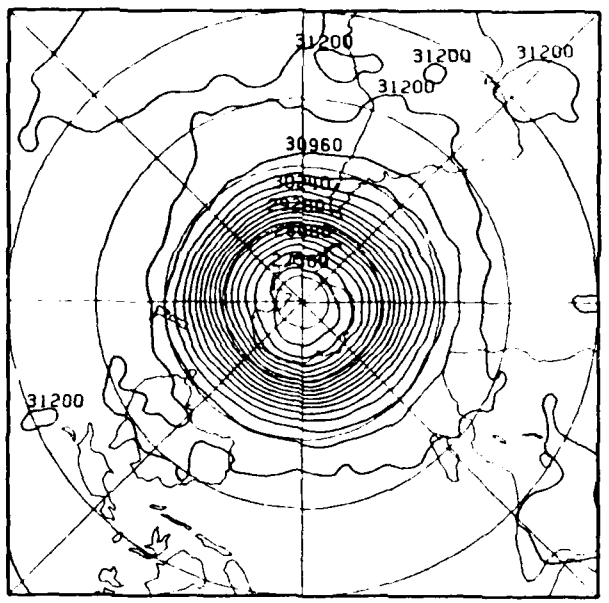
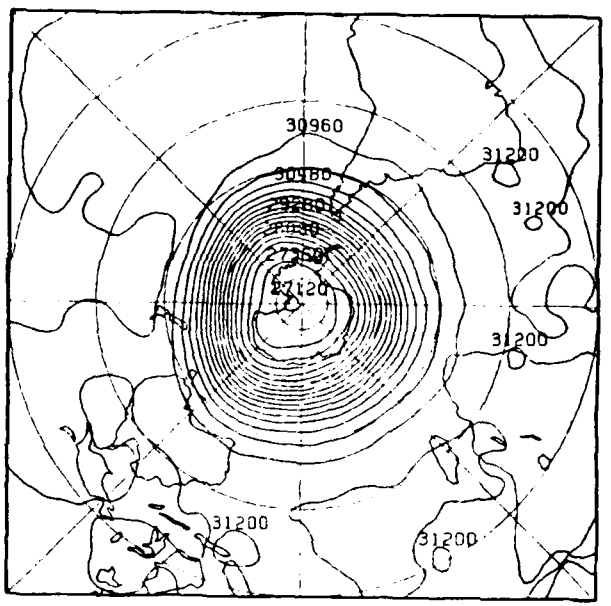


15-LAYER 2.4X3

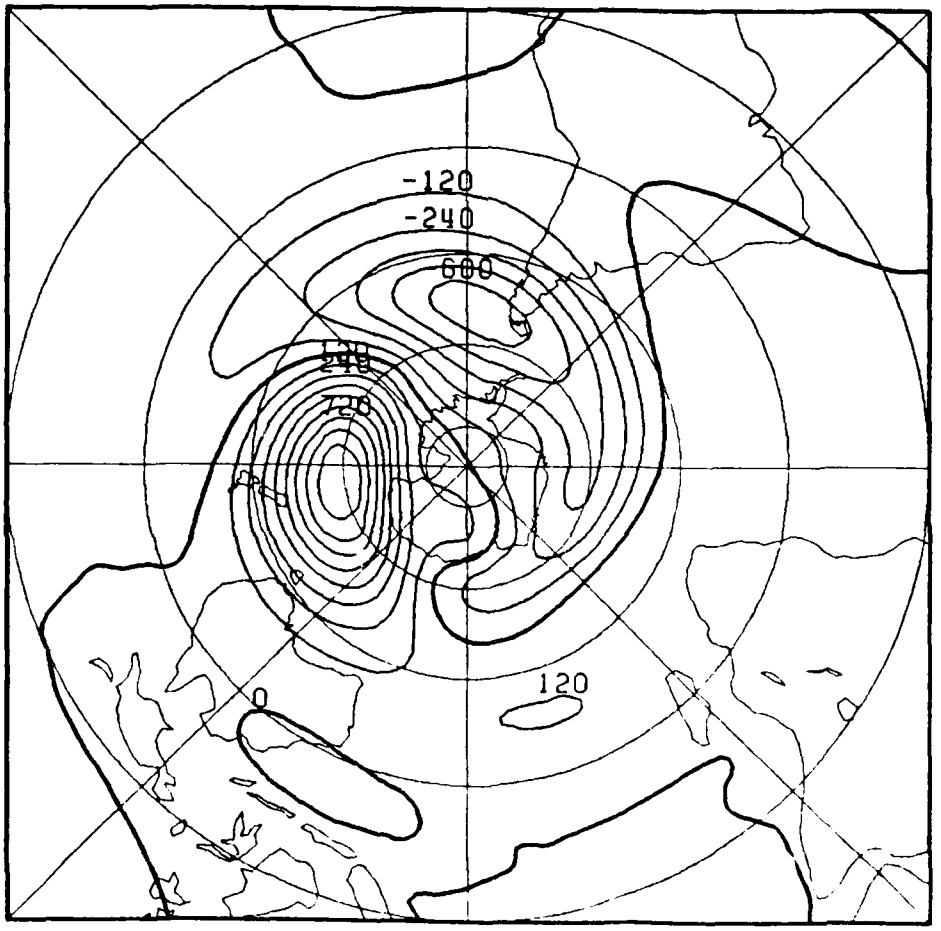


10 mb Z

WAVENUMBER S 1-4

1200 GMT 5 JULY 1979

OBSERVED



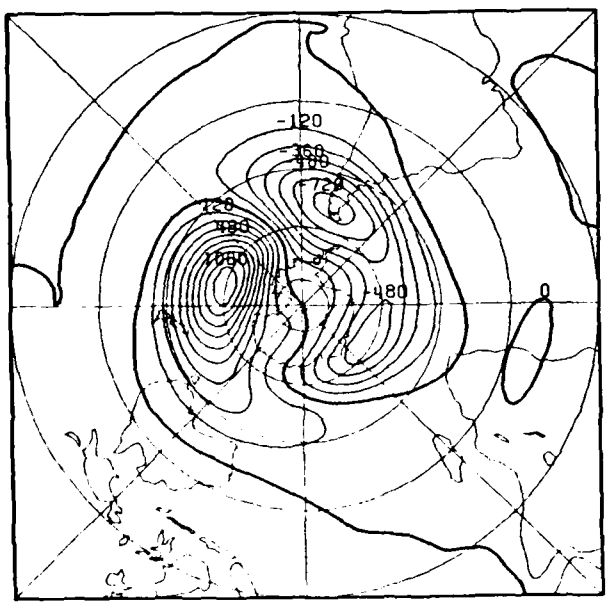
10 mb Z

WAVENUMBERS 1 - 4

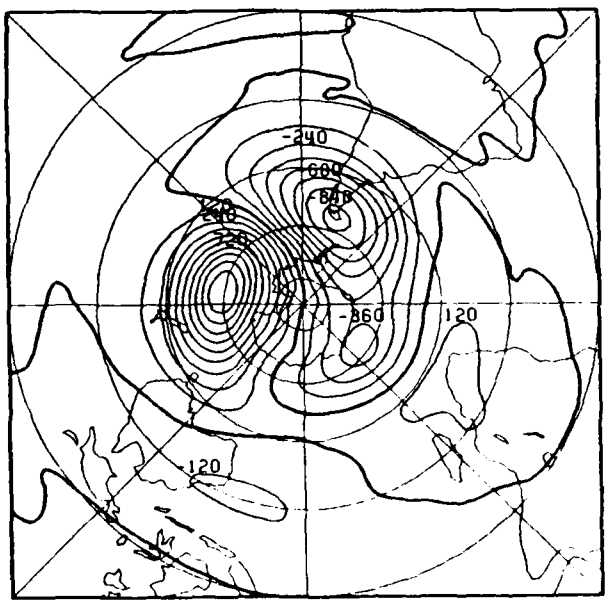
1200 GMT 6 JULY 1979

DAY 1

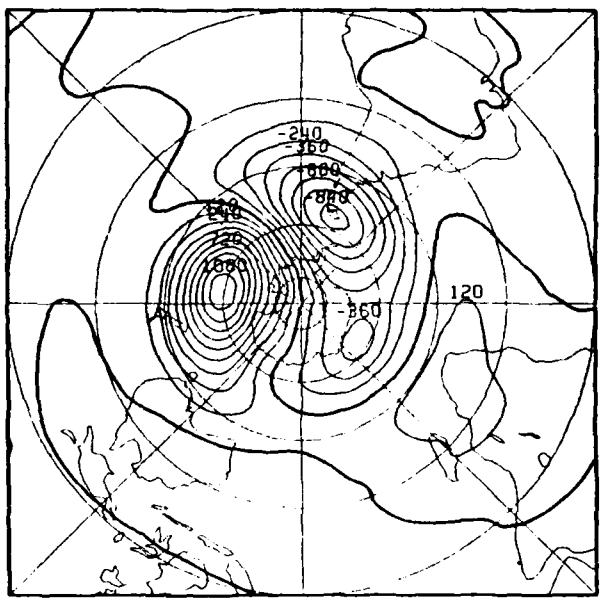
OBSERVED



15-LAYER 4 X 5



15-LAYER 2.4 X 3



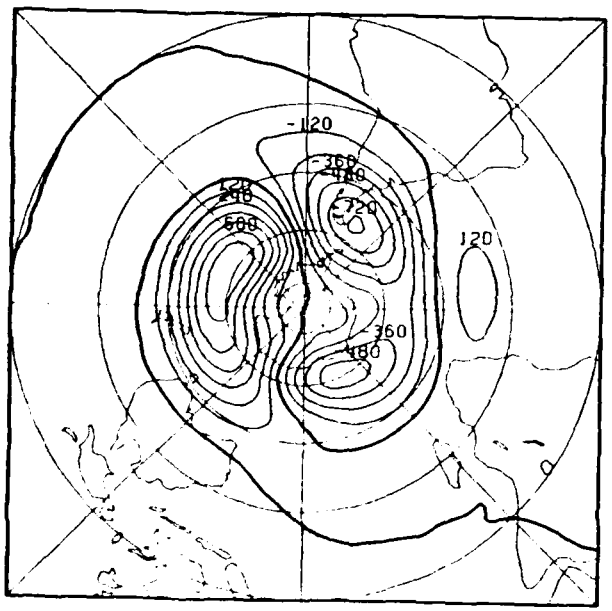
10 mb Z

WAVENUMBERS 1 - 4

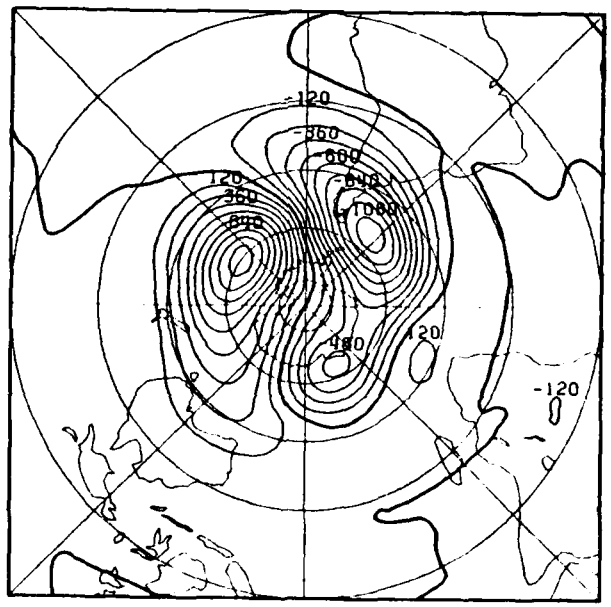
1200 GMT 7 JULY 1979

DAY 2

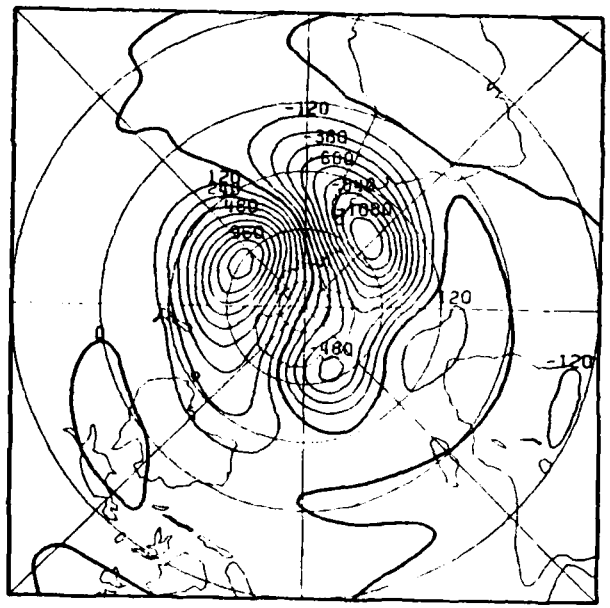
OBSERVED



15-LAYER 4 X 5



15-LAYER 2.4 X 3



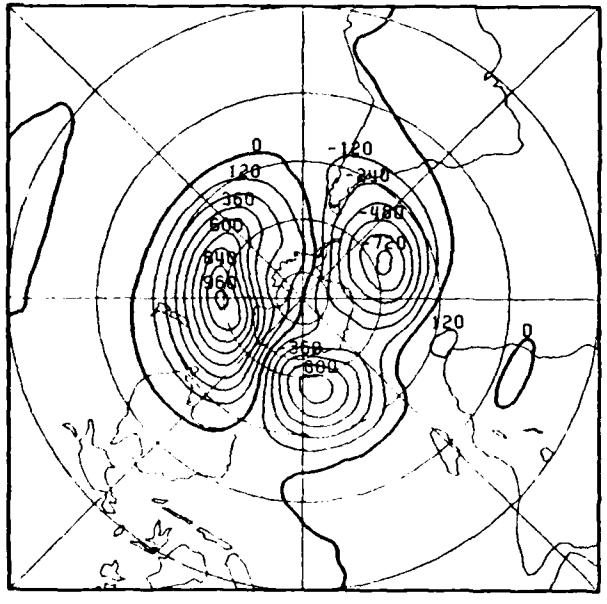
10 mb Z

WAVENUMBERS 1 - 4

1200 GMT 8 JULY 1979

DAY 3

OBSERVED



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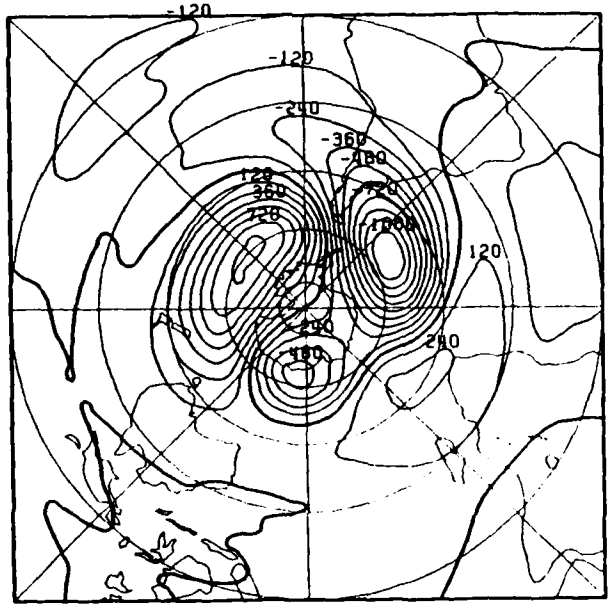
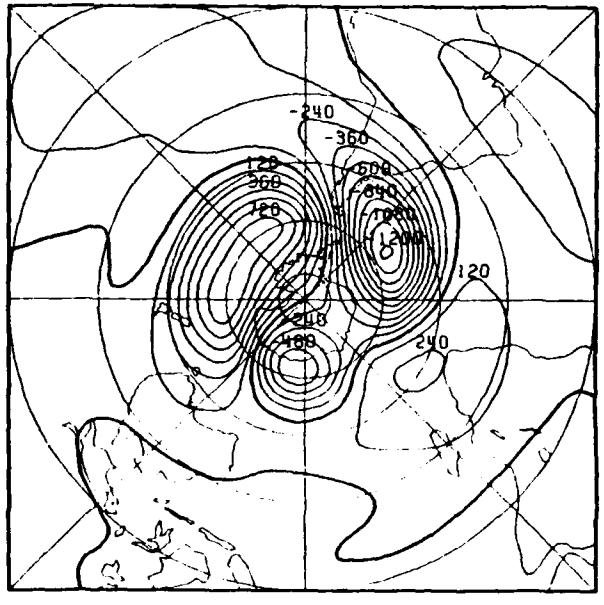


15-LAYER 2.4 X 3



10 mb Z

WAVENUMBERS 1 - 4

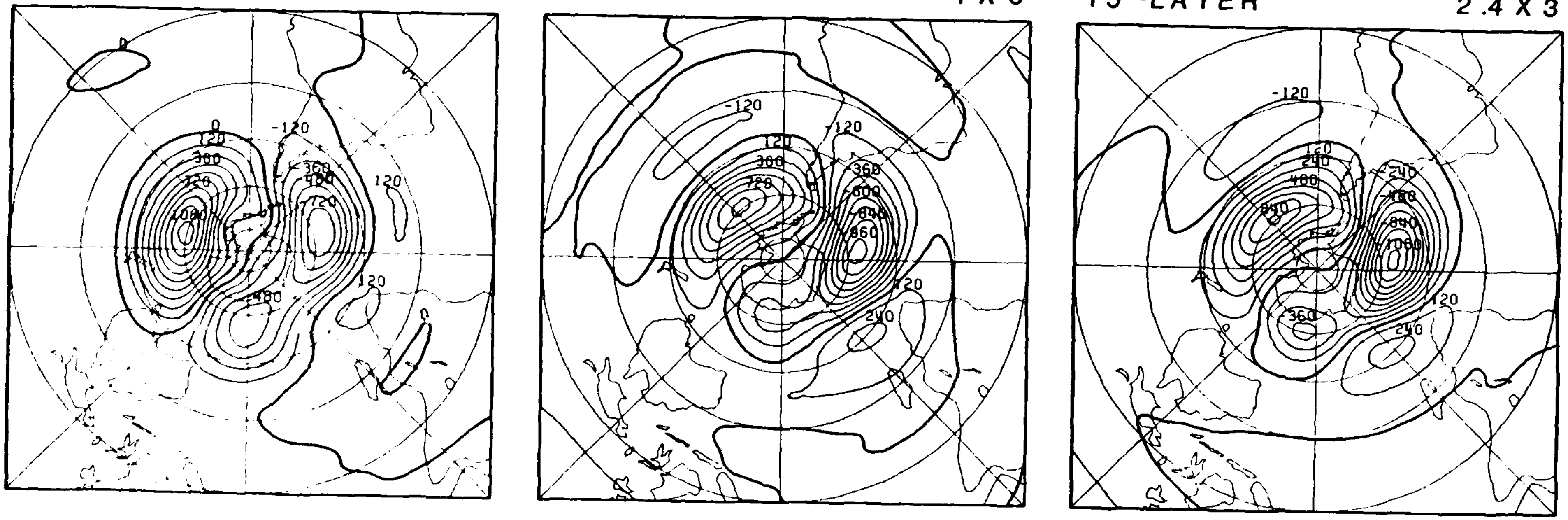
1200 GMT 9 JULY 1979

DAY 4

OBSERVED

15-LAYER 4 X 5

15-LAYER 2.4 X 3



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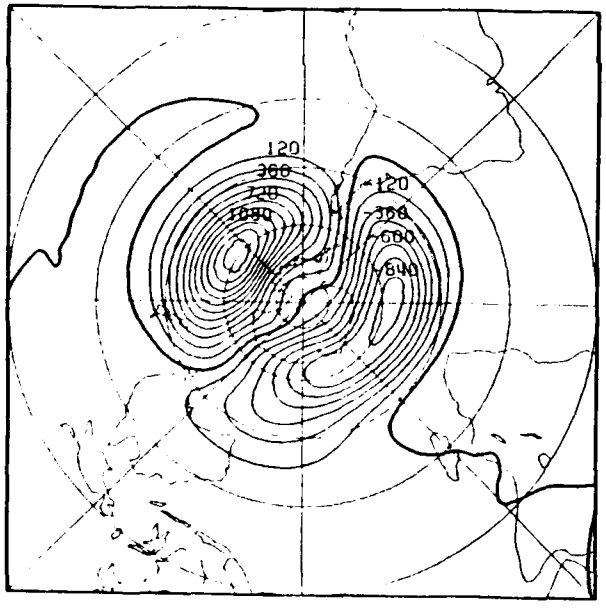
WAVENUMBERS 1 - 4

1200 GMT 10 JULY 1979

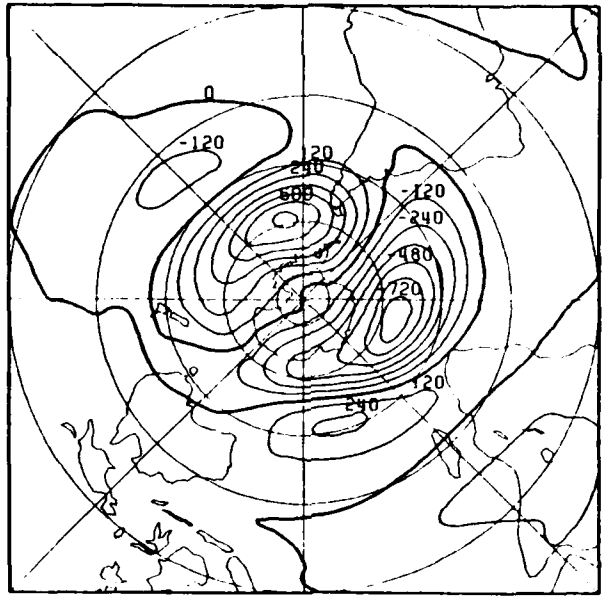
DAY 5

11-51

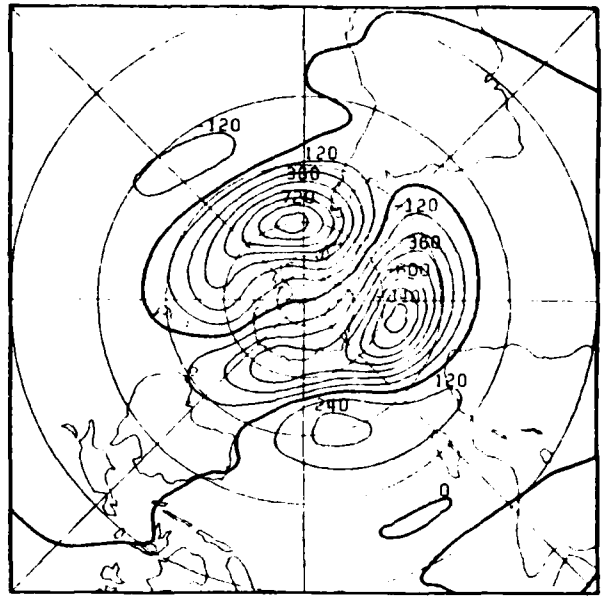
OBSERVED



15-LAYER 4 X 5



15-LAYER 2.4 X 3



10 mb Z

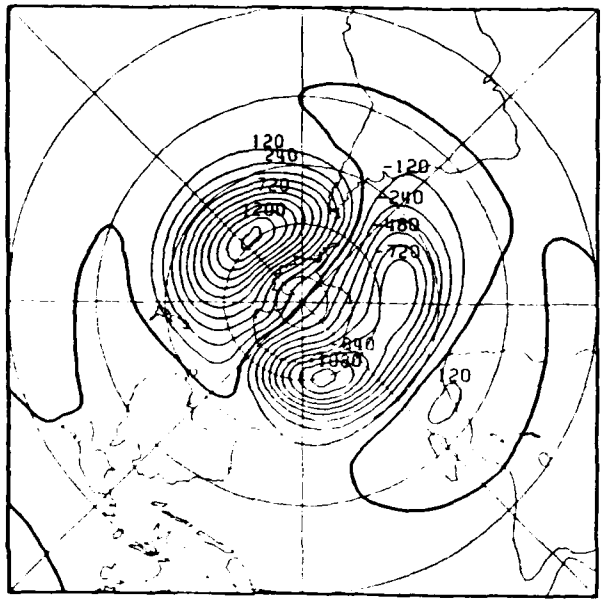
WAVENUMBERS 1 - 4

1200 GMT 11 JULY 1979

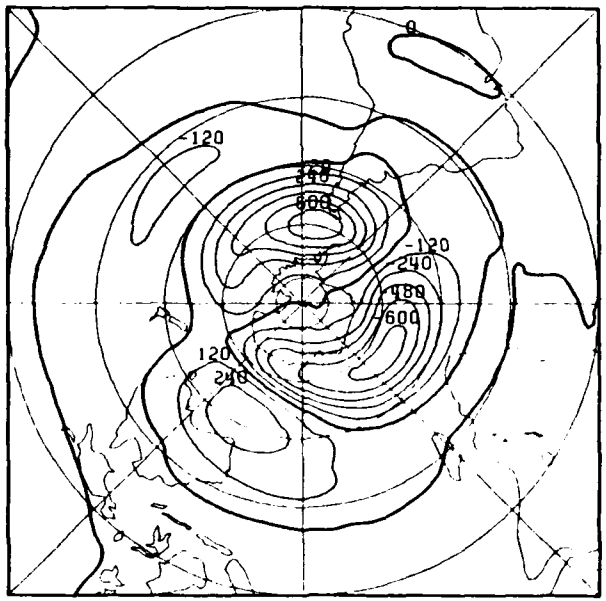
DAY 6

11-52

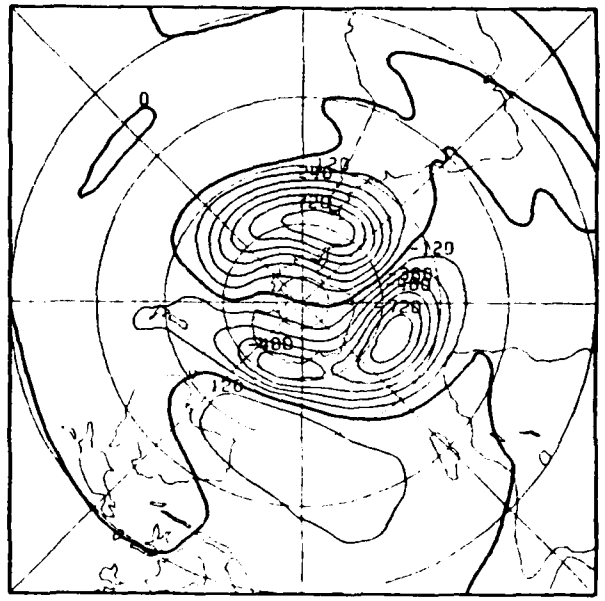
OBSERVED



15-LAYER 4 X 5



15-LAYER 2.4 X 3



10 mb Z

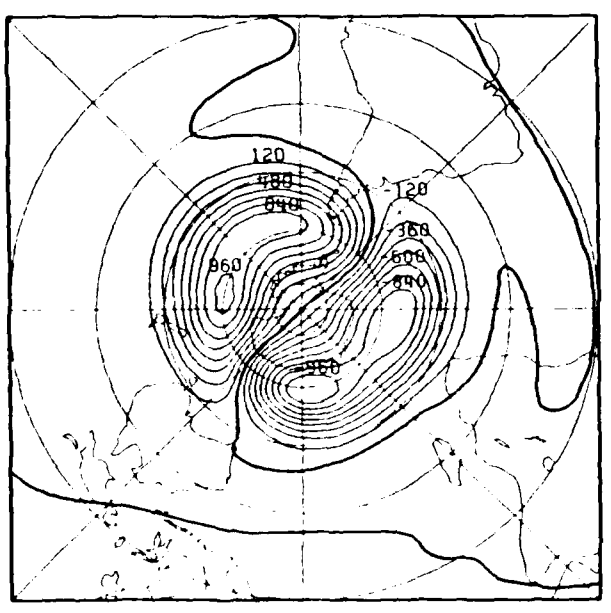
WAVENUMBERS 1 - 4

1200 GMT 12 JULY 1979

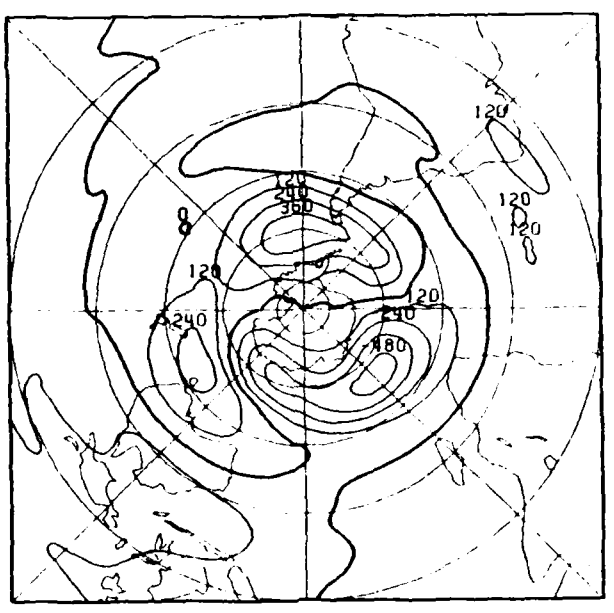
DAY 7

11-53

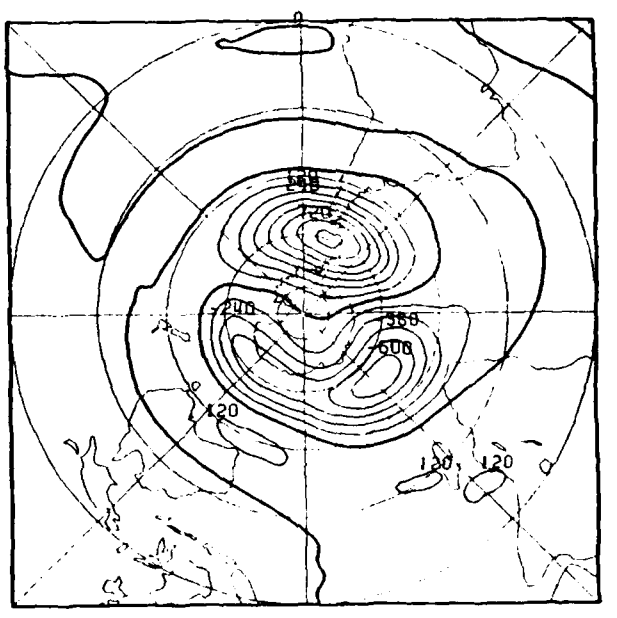
OBSERVED



15-LAYER 4 X 5



15-LAYER 2.4 X 3



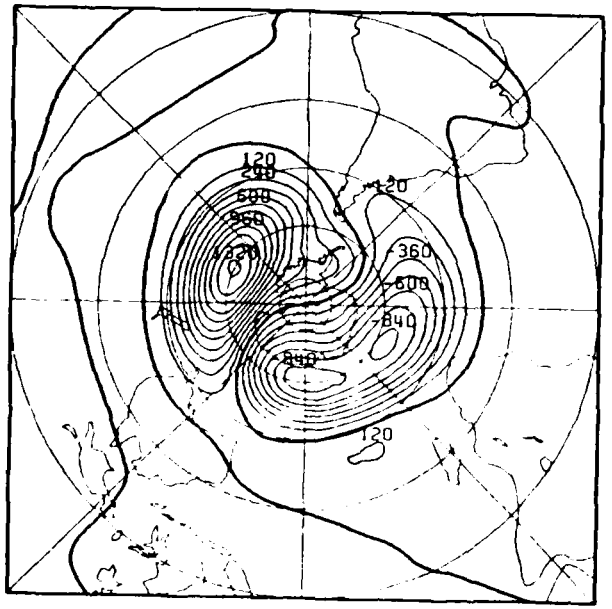
10 mb Z

WAVENUMBERS 1 - 4

1200 GMT 1 3 JULY 1979

DAY 8

OBSERVED



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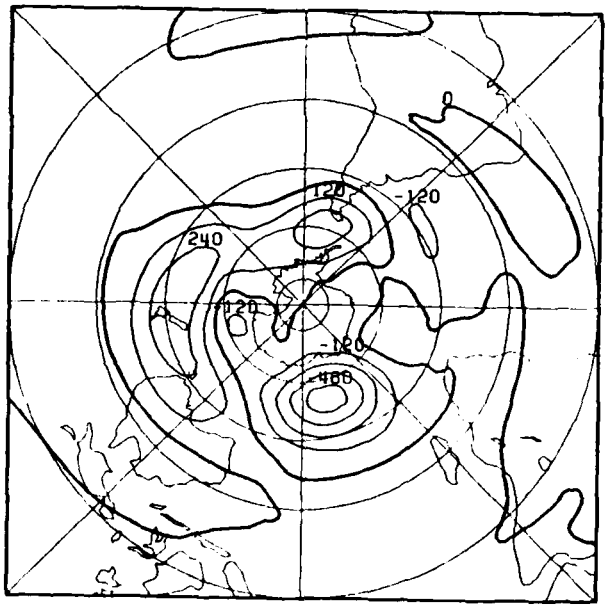

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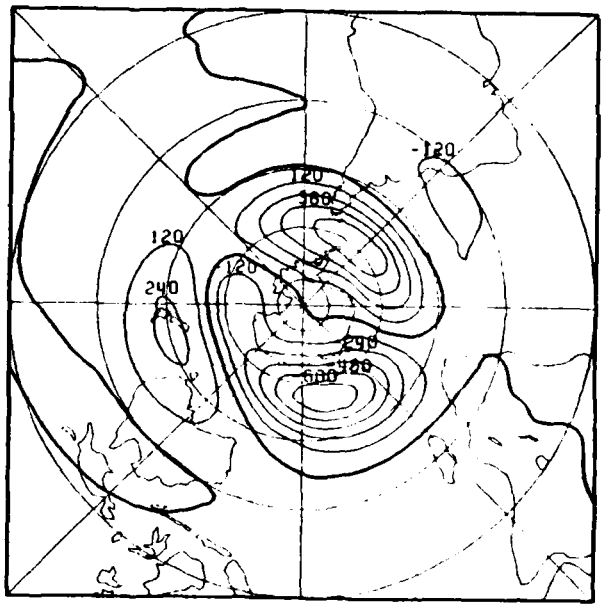


10 mb Z

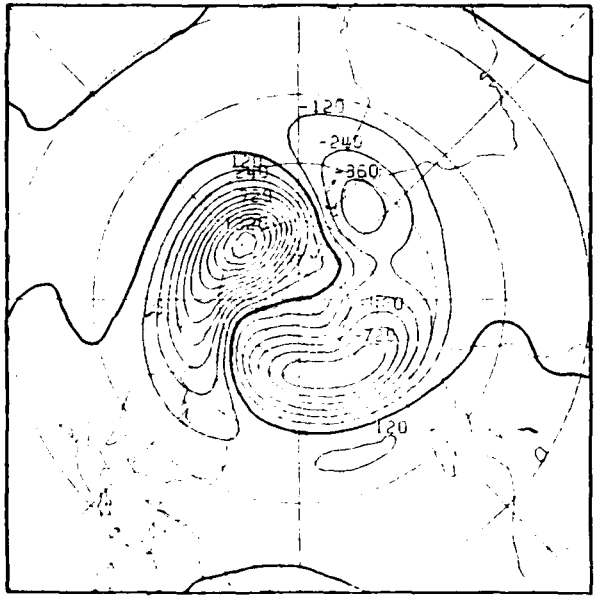
WAVENUMBERS 1 - 4

1200 GMT 14 JULY 1979

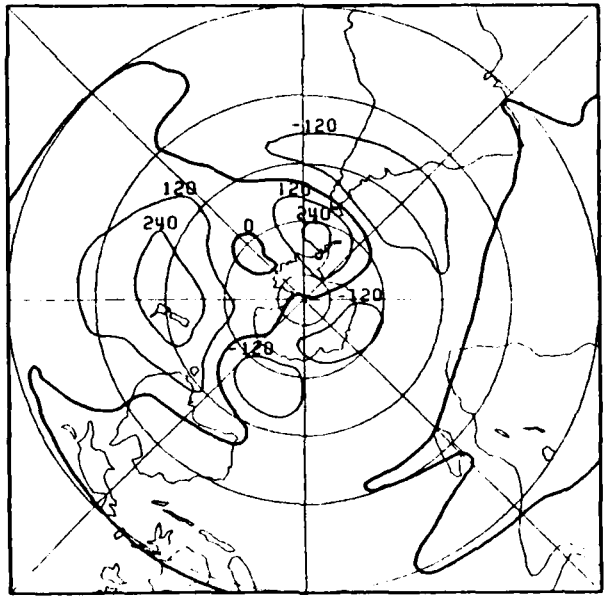
DAY 9

11-55

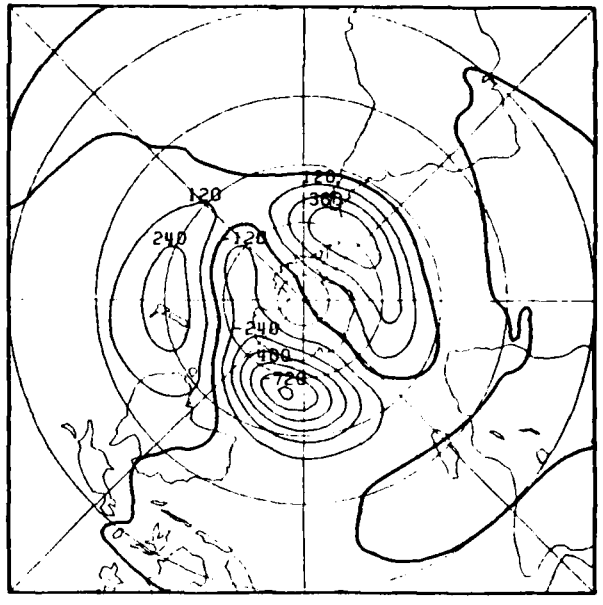
OBSERVED



15-LAYER 4 X 5



15-LAYER 2.4 X 3



10 mb Z

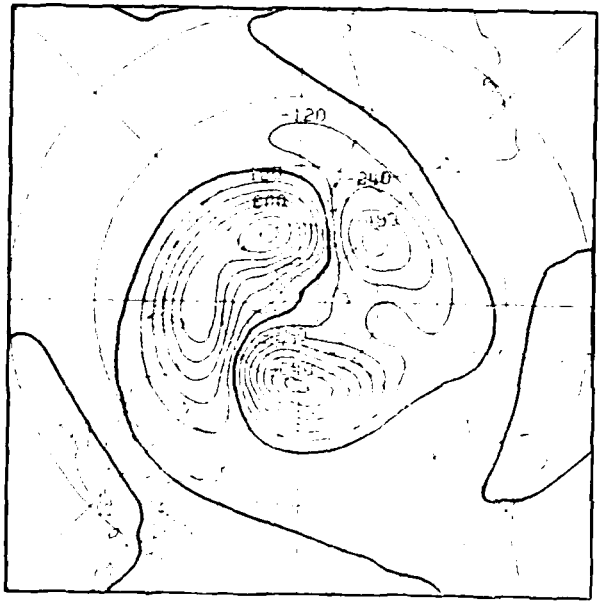
WAVENUMBERS 1 - 4

1200 GMT 15 JULY 1979

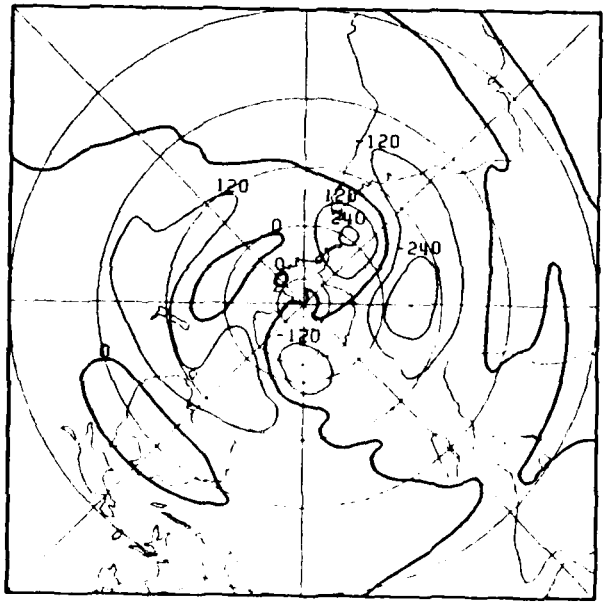
DAY 10

11-56

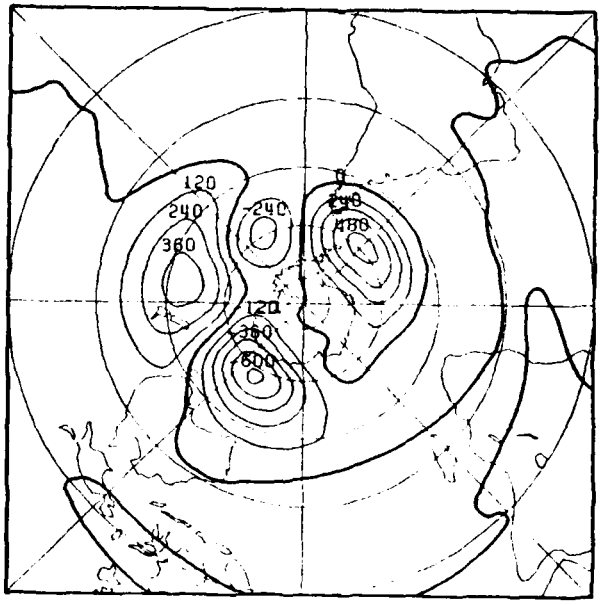
OBSERVED

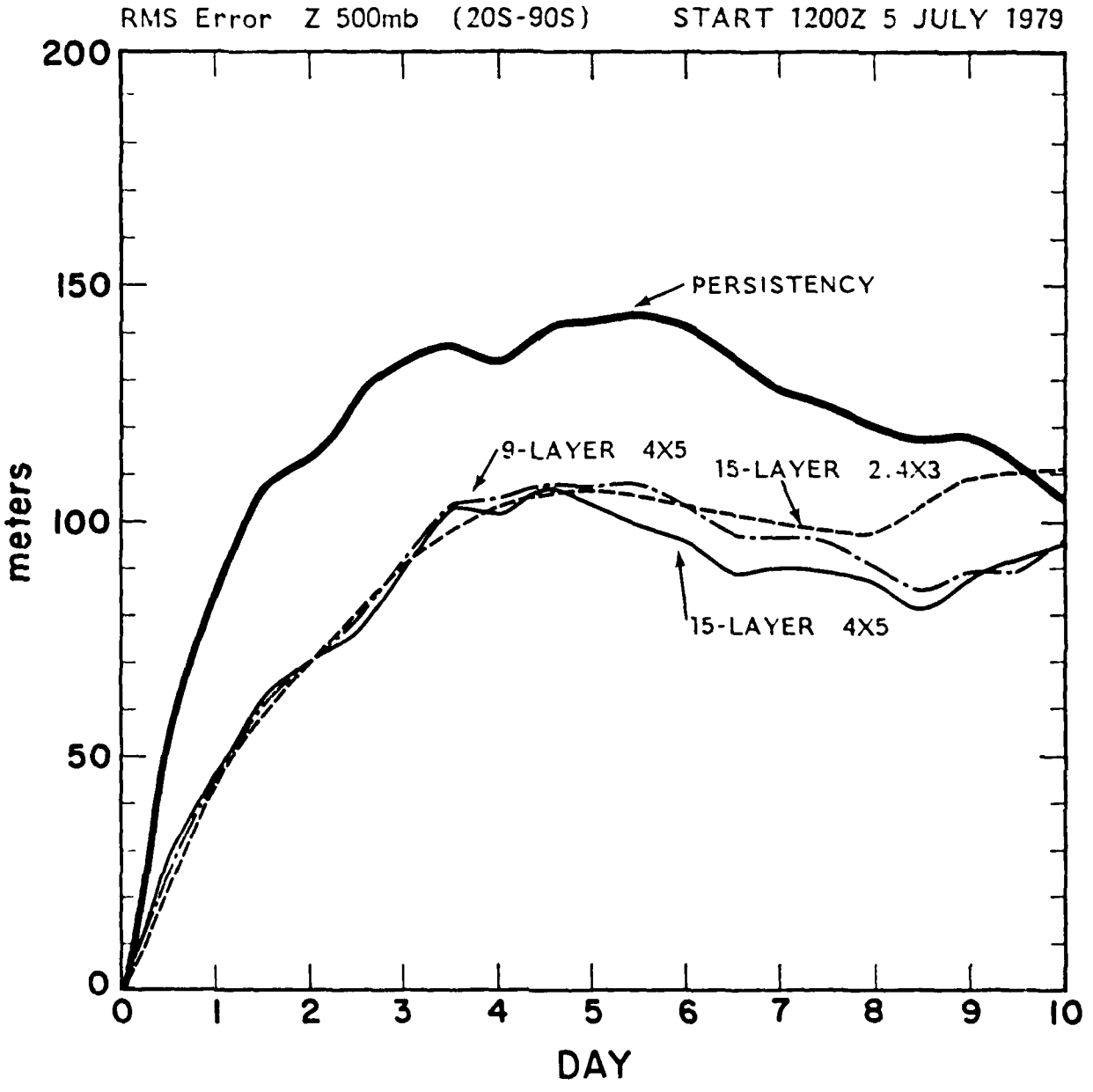


15-LAYER 4 X 5



15-LAYER 2.4 X 3




RMS Error Z 500mb (20S-90S)
START 1200Z 5 JULY 1979
200
150
100
50
0
meters
PERSISTENCY
9-LAYER 4X5
15-LAYER 2.4X3
15-LAYER 4X5
0
1
2
3
4
5
6
7
8
9
10
DAY

END

DTIC

8-86