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CASS REPORT # 93-3-01

IMAGING RADAR STUDIES OF ATMOSPHERIC WINDS AND WAVES

by

Kent L. Miller, R.G. Roper, G.W. Adams

and John W. Brosnahan

August 30, 1993

FINAL REPORT: AIRFORCE OFFICE OF SCIENTIFIC RESEARCH
CONTRACT # F49620-92-J-0193

93-26590

UTAH STATE UNIVERSITY

CENTER FOR ATMOSPHERIC AND SPACE SCIENCES
UTAH STATE UNIVERSITY • LOGAN • UTAH • 84322

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	Sept. 2, 1993	Final Report-1 Mar 9~~3~~2 - 31 Aug 93

4. TITLE AND SUBTITLE

Imaging Radar Studies of Atmospheric Winds and Waves

5. FUNDING NUMBERS

F49620-92-J-0193
61102F
2310
CS

6. AUTHOR(S)

Kent L. Miller, R. G. Roper, G. W. Adams and John W. Brosnahan

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Center for Atmospheric and Space Sciences
Utah State University
Logan, UT 84322-4405

8. PERFORMING ORGANIZATION REPORT NUMBER

CASS Report #93-3-01

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

AFOSR/NL
110 Duncan Avenue Suite B115
Bolling AFB, DC 20332-0001
Maj Kroll

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Unrestricted

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

In this report, further analyses of data taken during the Arecibo Initiative in Dynamics of the Atmosphere (AIDA'89) campaigns is presented, concentrating on the third campaign (Scene III) from May 2 through May 9, 1989. The major emphasis is on the comparison between the MAPSTAR Imaging Doppler Interferometry (IDI) radar and the Arecibo Observatory incoherent scatter (ISR) radar, but some comparisons with the Geospace Corporation meteor wind radar (MWR), and the Arecibo Observatory Fabry-Perot spectrometer (FPS) are also included. A reanalysis of four IDI - ISR - MWR comparisons show better agreement between all three techniques than previously reported. In general, better agreement was found between the daytime radar winds than that previously published for the April campaign, with the zonal winds agreeing better than the meridional. In contrast, the nighttime IDI - FPS comparisons showed better agreement in the meridional component, and considerably better agreement after midnight than before.

14. SUBJECT TERMS	15. NUMBER OF PAGES
	298
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

IMAGING RADAR STUDIES OF ATMOSPHERIC WINDS AND WAVES

PREFACE

The untimely death of Dr. Gene Adams, the original Principal Investigator, occurred on March 14, 1992, just two weeks after the initiation of this contract. This report is dedicated to his memory.

ABSTRACT

In this report, we present further analyses of data taken during the Arecibo Initiative in Dynamics of the Atmosphere (AIDA'89) campaigns, concentrating on the third campaign (Scene III) from May 2 through May 9, 1989.The major emphasis is on the comparison between the MAPSTAR imaging Doppler interferometry (IDI) radar and the Arecibo Observatory incoherent scatter (ISR) radar, but some comparisons with the Geospace Corporation meteor wind radar (MWR), and the Arecibo Observatory Fabry-Perot spectrometer (FPS) are also included. A reanalysis of four IDI - ISR - MWR comparisons shows better agreement between all three techniques than previously reported. In general, we find better agreement between the daytime radar winds than that previously published for the April campaign, with the zonal winds agreeing better than the meridional. In contrast, the nighttime IDI - FPS comparisons show better agreement in the meridional component, and considerably better agreement after midnight than before.

[The report consists of two parts - Part 1, in which plots are presented and discussed, and Part 2, which details the data reduction and analysis procedures, and contains listings of the computer programs used].

STUDENTS GRADUATED UNDER THIS CONTRACT

Captain R. Scott Turek, an AFIT student in the Center for Atmospheric and Space Science, successfully defended his doctoral thesis entitled "Radar Studies of the Middle Atmosphere: Morphology and Comparison of Techniques" on June 28, 1993, and is now a professor at the Air Force Academy, Colorado Springs, Colorado.

PUBLICATIONS THIS CONTRACT PERIOD

Brosnahan, J.W., and G.W. Adams, "The MAPSTAR Imaging Doppler Interferometry (IDI) radar: description and first results," J. Atmos. Terrest Phys., 55, 203 - 228, 1993

Roper, R.G., G.W. Adams and J.W. Brosnahan, "Tidal winds at mesopause altitudes over Arecibo (18°N, 67°W), April 5 - 11, 1989 (AIDA'89)", J. Atmos. Terrest. Phys., 289-312, 1993

Contents

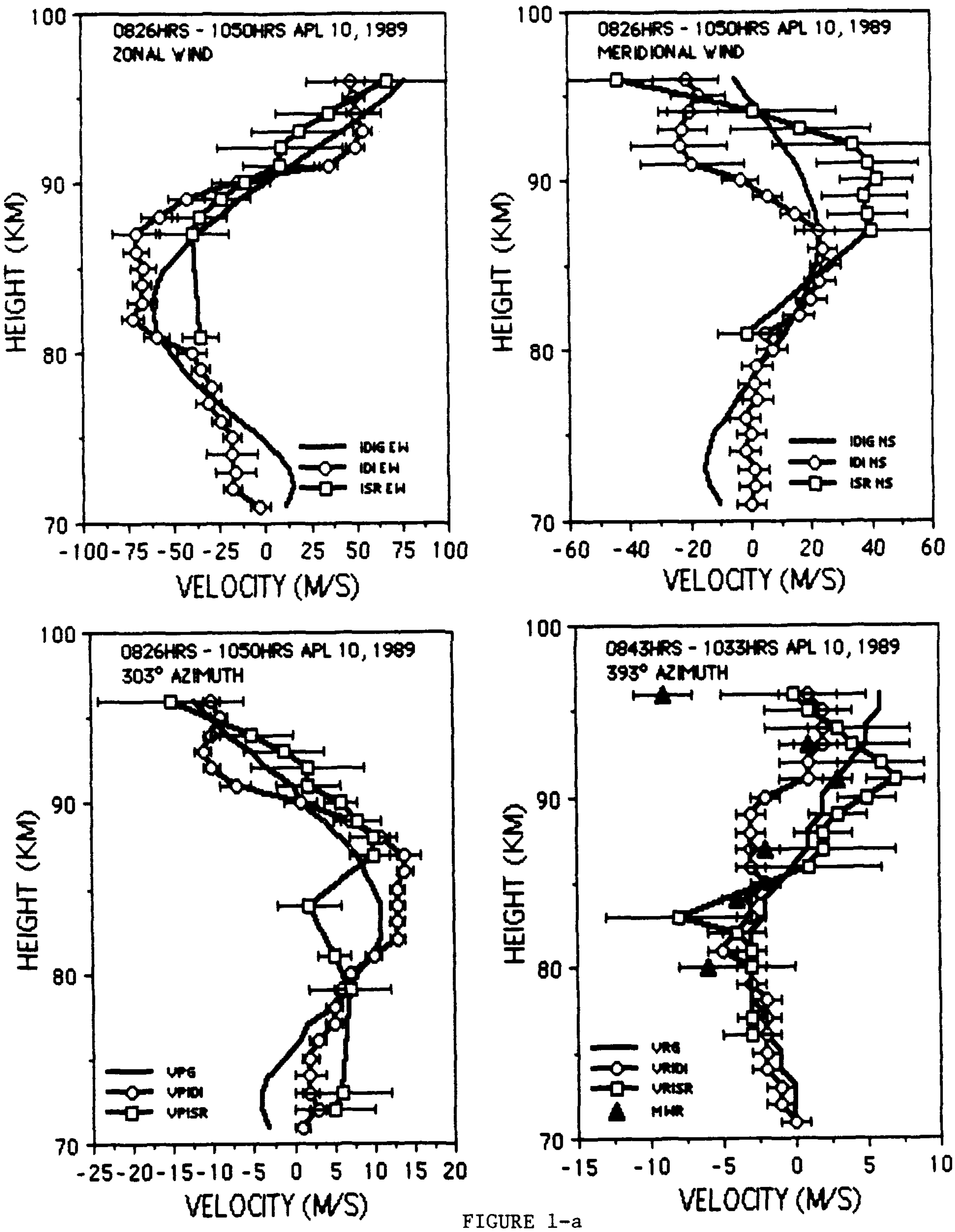
Part 1 - Results from AIDA Scene III - May 2 - 9, 1993

IDI - ISR Comparisons

Since the submission of the papers published in the AIDA Special Issue of the Journal of Atmospheric and Terrestrial Physics in March, 1993, some of the analysis criteria for both the Arecibo Observatory incoherent scatter (ISR) and MAPSTAR imaging doppler interferometry (IDI) radars have been changed.This is illustrated in the results of the IDI - ISR - meteor wind radar (MWR) comparisons presented in Figure 1a-d, the same intervals as plotted in Figure 5 of Hines et al. (1993). We have here included results from not only the 393° azimuth soundings, but also those at 303° azimuth (note that the velocities at these azimuths are the line of sight at 11.3° zenith angle), and the zonal and meridional components inferred from these measurements. Note that, unlike the Hines et al. plots, the IDI results have been produced by projecting the IDI three dimensional wind vector onto the ISR lines of sight and then using the resultant projections into the horizontal to calculate the zonal and meridional wind velocities. This parrallels the ISR reduction, which considers the vertical wind to be zero when producing the horizontal projections. Also plotted are the velocity components inferred from a Groves analysis of the IDI data, fitting mean, diurnal and semidiurnal components to the IDI scattering point parameters for each 24 hours (from noon to noon) of the campaign. These are plotted as IDIG.

The next section concentrates on the reduction and analysis of the May 2 - 9, 1989 IDI - ISR comparisons. Figures 2 through 33 are similar plots to those presented in Figure 1 (but note that no MWR data is available for these intervals). Instead of the two hour intervals published in Hines et al. (1993) and Roper et al. (1993), the intervals used here span some 43 minutes, with the ISR radar integrating data for some 25 minutes at the 393° (123°) azimuth, and for 11 minutes at the 303° (213°) azimuth, with six to seven minutes spent in moving the gondola to change the viewing azimuth. The IDI data has been averaged for the total 43 minutes - the 11 minute timeslot is marginal for IDI wind profile determination, although the 25 minute line of sight measurements have been subject to closer scrutiny and will be published in Turek et al. (1993).

We are in the process of interpreting these results. Of interest is the apparently better agreement between the IDI and ISR velocities in the zonal (and 303° and 123° azimuths - those closer to the east - west direction) than the meridional (and 393° and 213° azimuths). This warrants further investigation.



0826HRS - 1050HRS APL 10, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
0826HRS - 1050HRS APL 10, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
0826HRS - 1050HRS APL 10, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
0843HRS - 1033HRS APL 10, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
MWR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 1-a

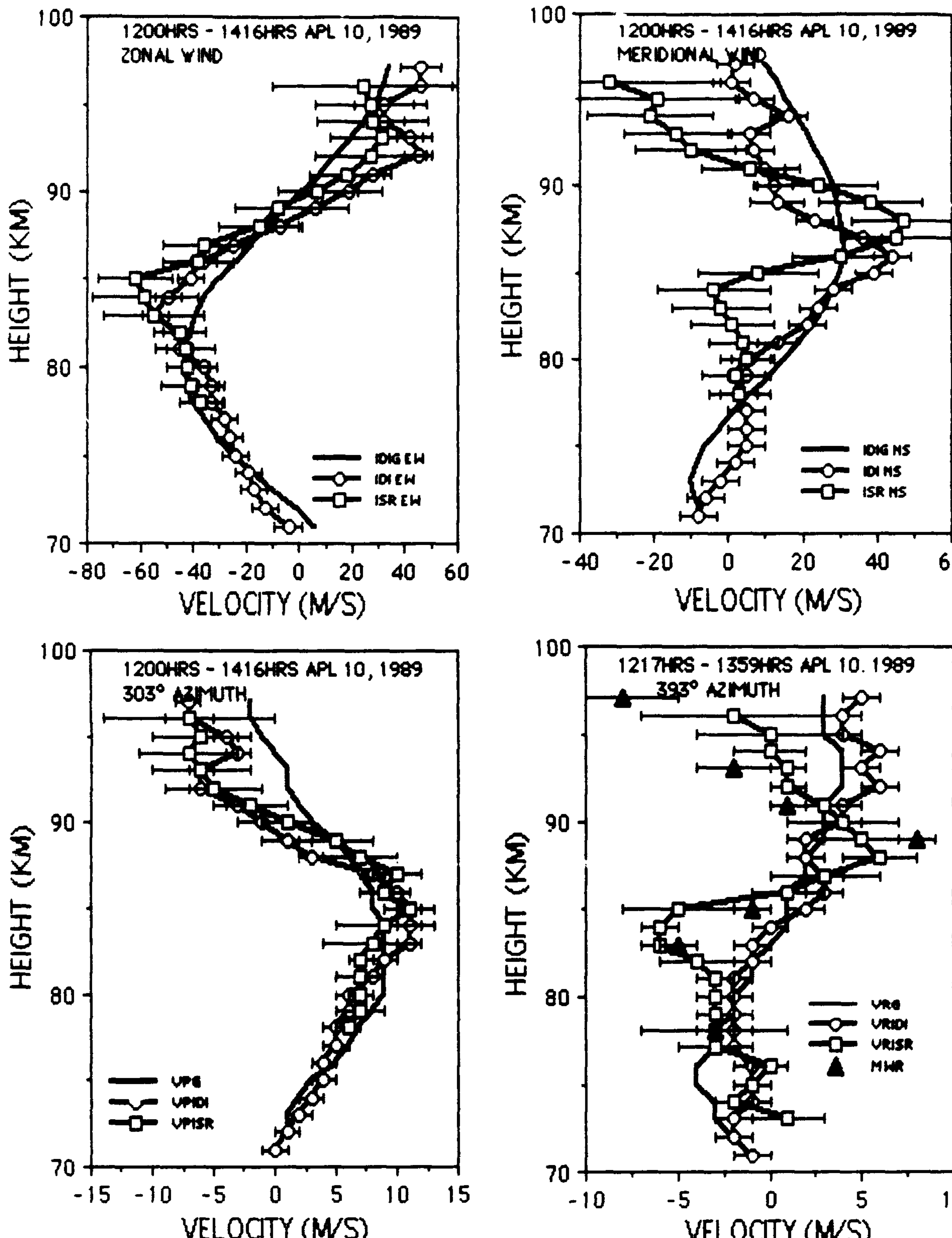
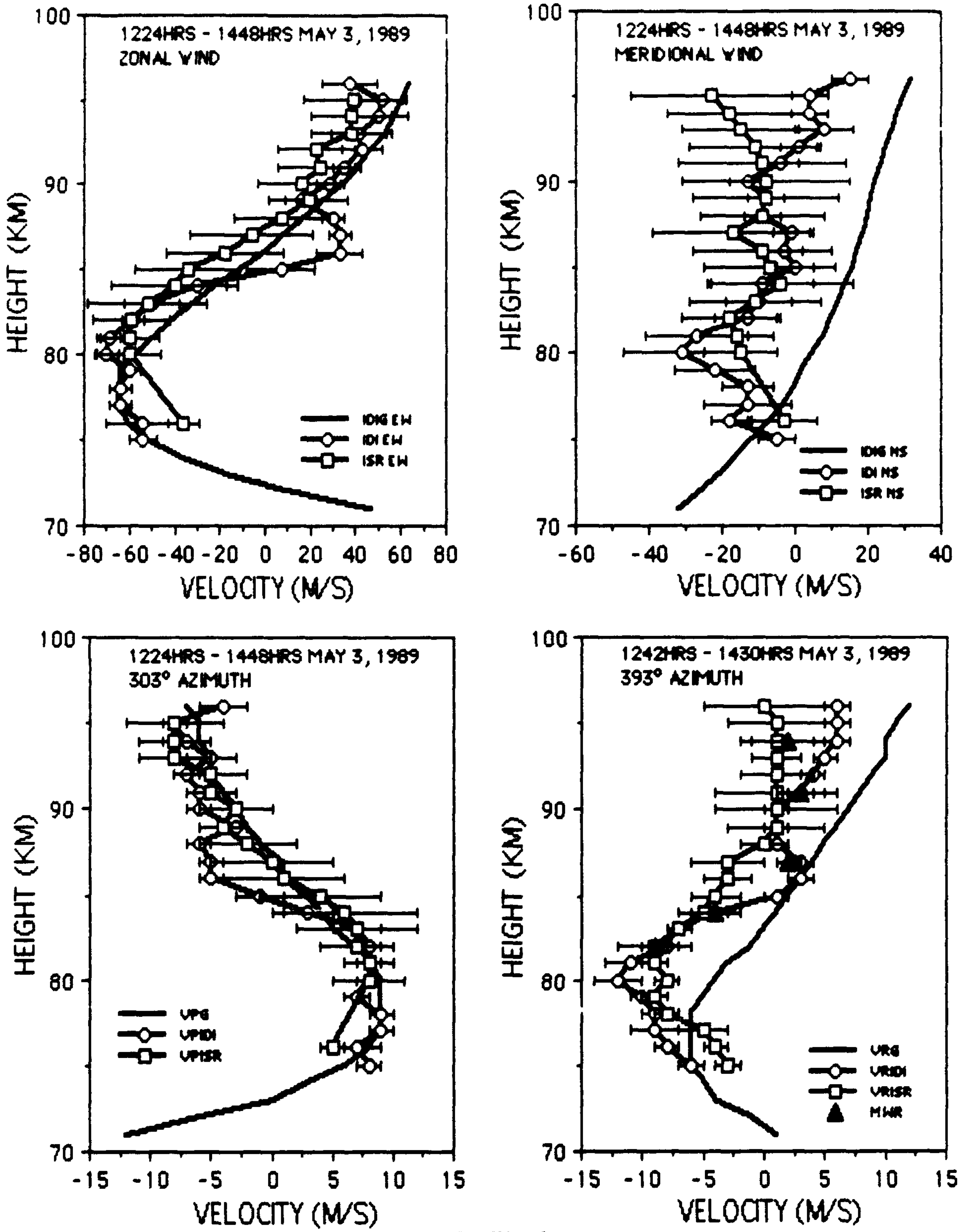

1200HRS - 1416HRS APL 10, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1200HRS - 1416HRS APL 10, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1200HRS - 1416HRS APL 10, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1217HRS - 1359HRS APL 10. 1989
393° AZIMUTH
VRG
VRIDI
VRISR
MWR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 1-b



1224HRS - 1448HRS MAY 3, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1224HRS - 1448HRS MAY 3, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1224HRS - 1448HRS MAY 3, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1242HRS - 1430HRS MAY 3, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
MWR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 1-c

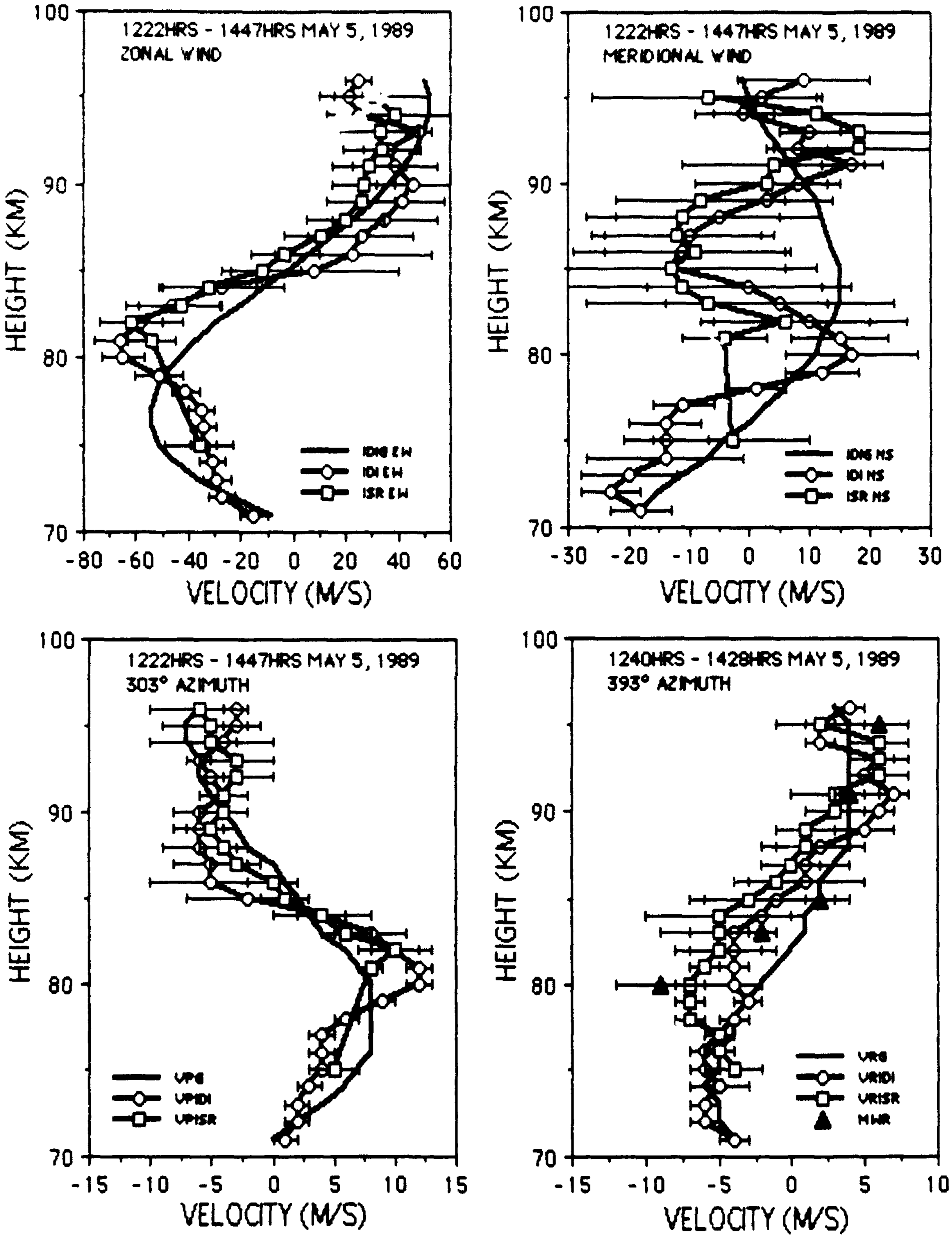

1222HRS - 1447HRS MAY 5, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1222HRS - 1447HRS MAY 5, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1222HRS - 1447HRS MAY 5, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1240HRS - 1428HRS MAY 5, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
MWR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 1-d

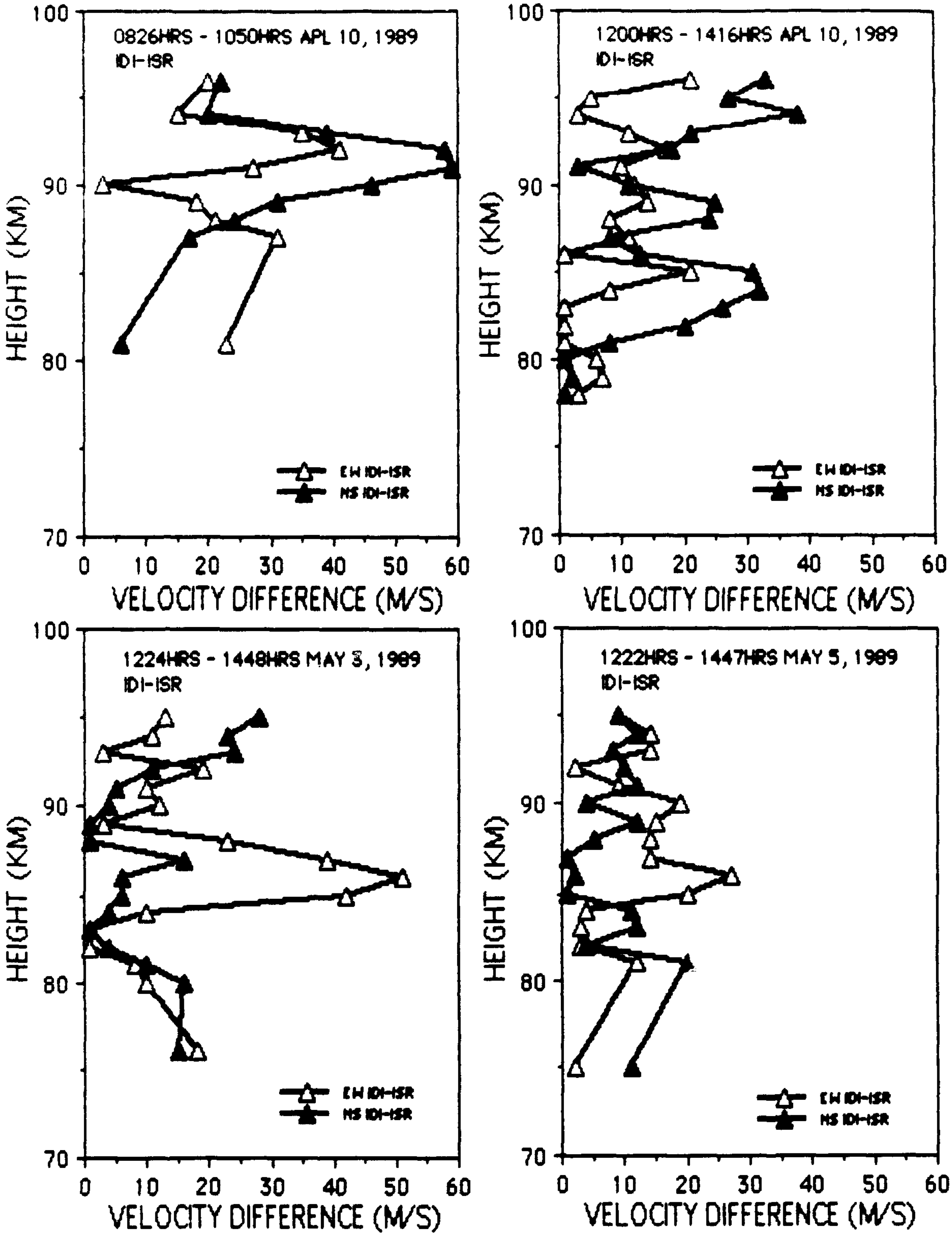

0826HRS - 1050HRS APL 10, 1989
IDI-ISR
1200HRS - 1416HRS APL 10, 1989
IDI-ISR
1224HRS - 1448HRS MAY 3, 1989
IDI-ISR
1222HRS - 1447HRS MAY 5, 1989
IDI-ISR
EW IDI-ISR
NS IDI-ISR
HEIGHT (KM)
VELOCITY DIFFERENCE (M/S)
100
90
80
70
0
10
20
30
40
50
60

FIGURE 1-e

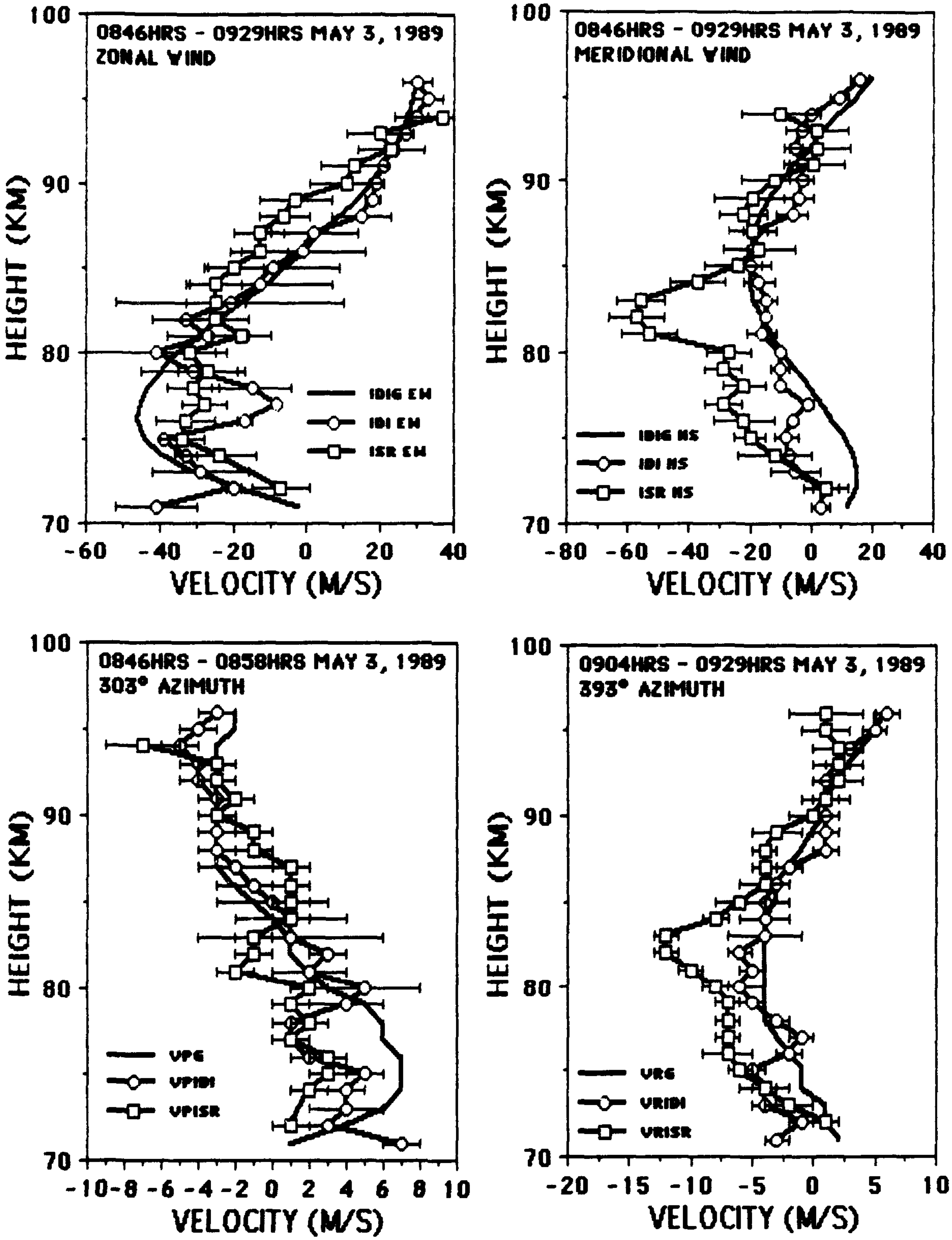
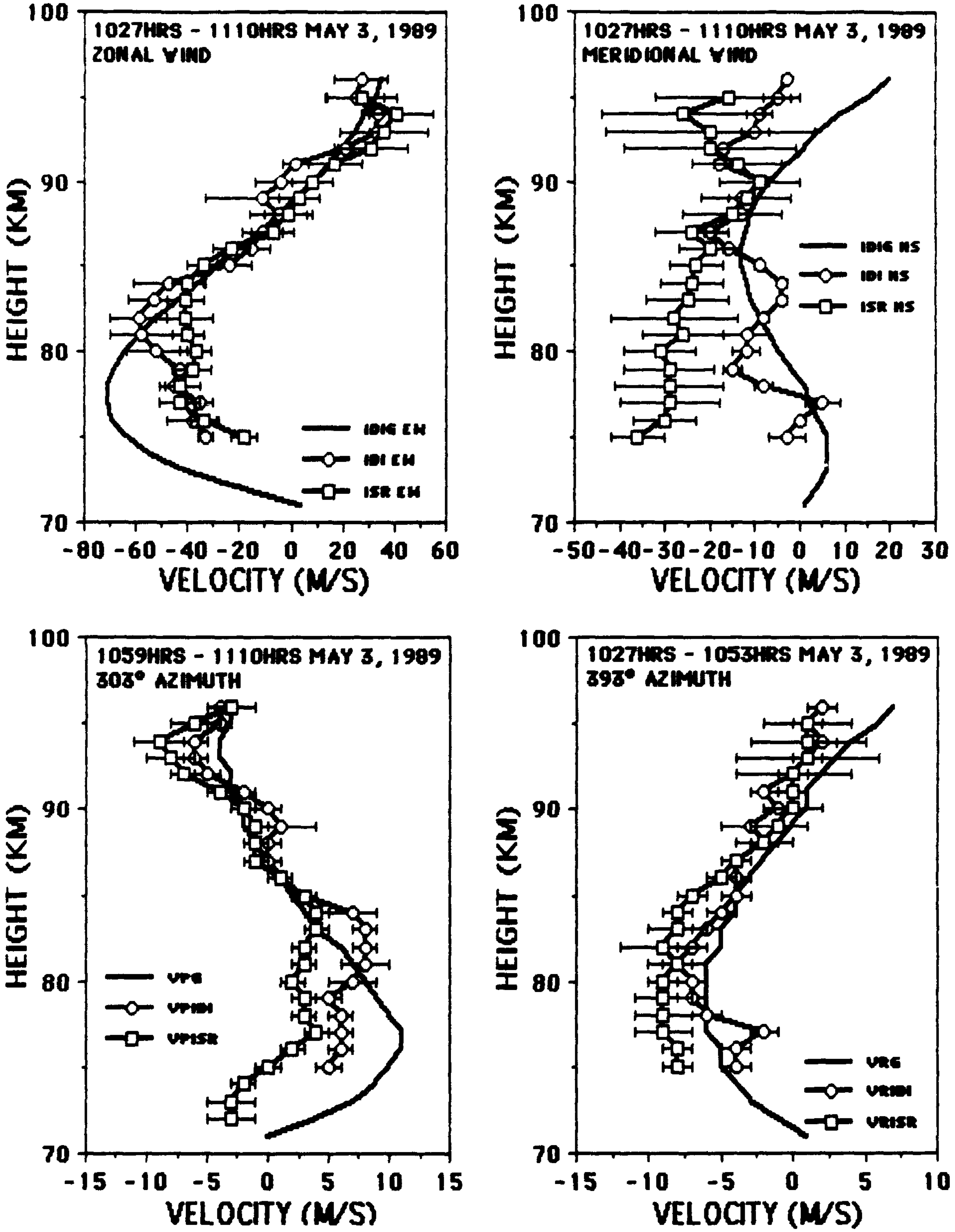
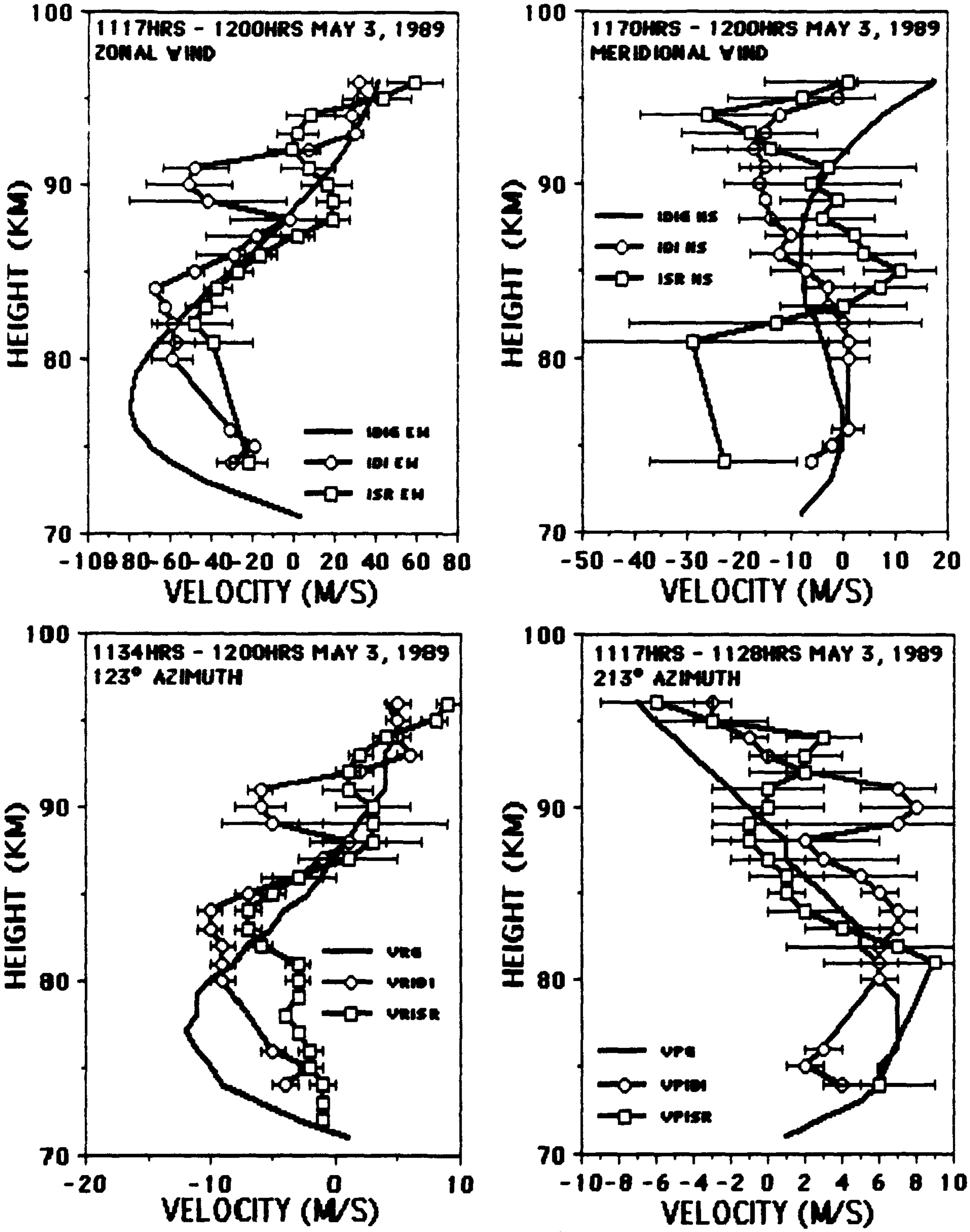

0846HRS - 0929HRS MAY 3, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
IDIG EW
IDI EW
ISR EW
0846HRS - 0929HRS MAY 3, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
IDIG NS
IDI NS
ISR NS
0846HRS - 0858HRS MAY 3, 1989
303° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
VPG
VPIDI
VPISR
0904HRS - 0929HRS MAY 3, 1989
393° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
VRG
VRIDI
VRISR

FIGURE 2



1027HRS - 1110HRS MAY 3, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1027HRS - 1110HRS MAY 3, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1059HRS - 1110HRS MAY 3, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1027HRS - 1053HRS MAY 3, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 3



1117HRS - 1200HRS MAY 3, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
IDIG EW
IDI EW
ISR EW
1170HRS - 1200HRS MAY 3, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
IDIG NS
IDI NS
ISR NS
1134HRS - 1200HRS MAY 3, 1989
123° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
VRG
VRIDI
VRISR
1117HRS - 1128HRS MAY 3, 1989
213° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
VPG
VPIDI
VPISR

FIGURE 4

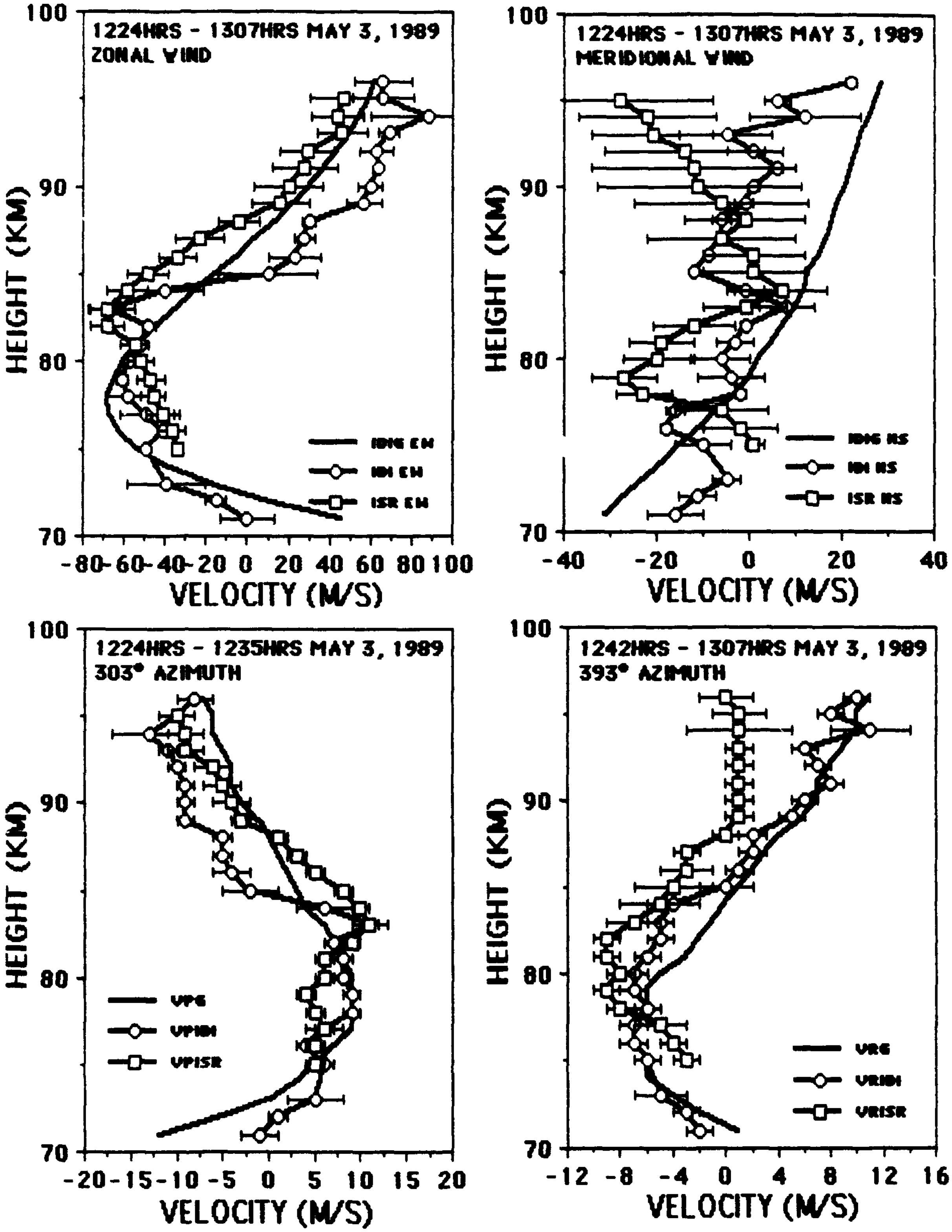

1224HRS - 1307HRS MAY 3, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1224HRS - 1307HRS MAY 3, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1224HRS - 1235HRS MAY 3, 1989
303° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
1242HRS - 1307HRS MAY 3, 1989
393° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 5

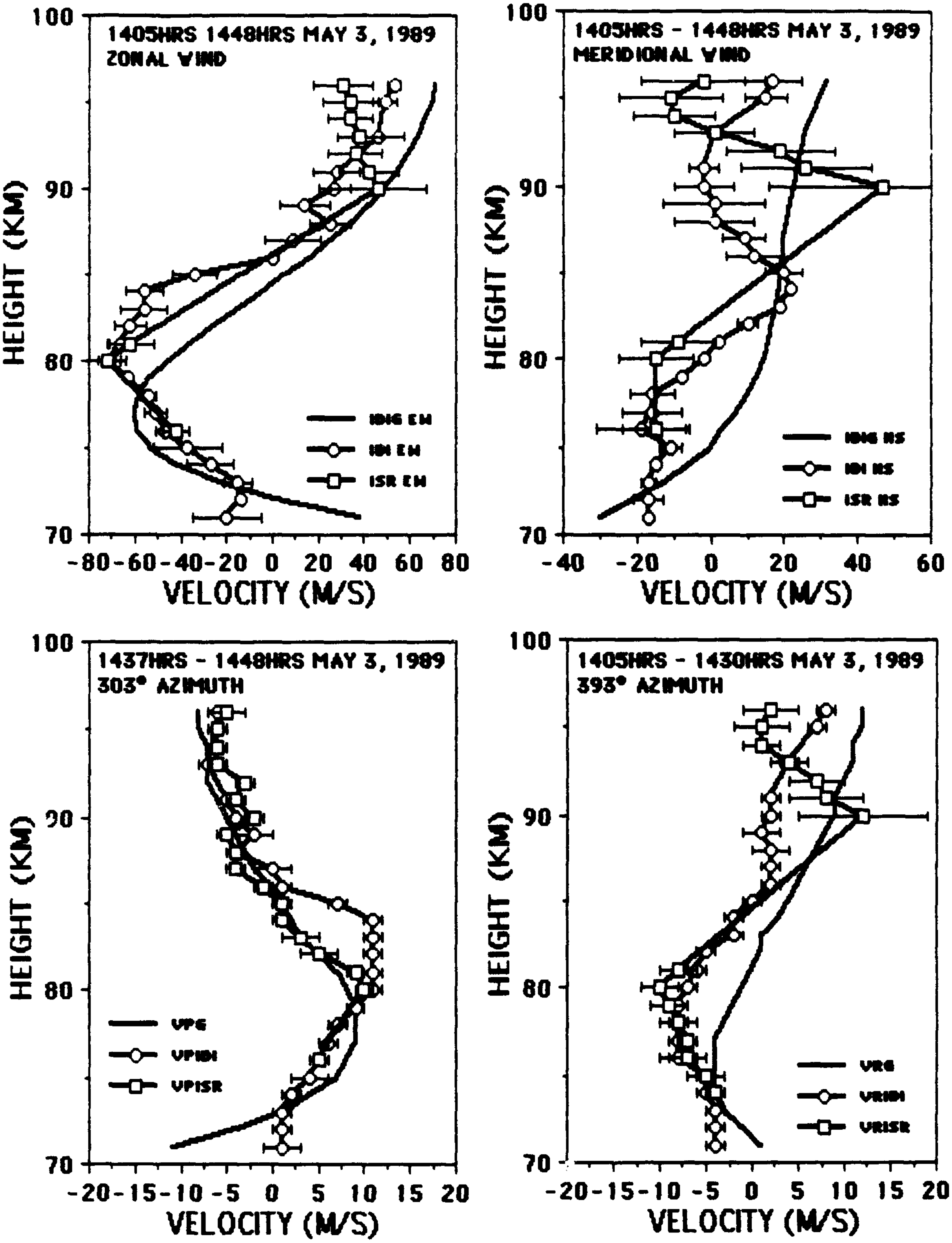

1405HRS 1448HRS MAY 3, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
-80 -60 -40 -20 0 20 40 60 80
70 80 90 100
1405HRS - 1448HRS MAY 3, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
-40 -20 0 20 40 60
70 80 90 100
1437HRS - 1448HRS MAY 3, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
-20 -15 -10 -5 0 5 10 15 20
70 80 90 100
1405HRS - 1430HRS MAY 3, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)
-20 -15 -10 -5 0 5 10 15 20
70 80 90 100

FIGURE 6

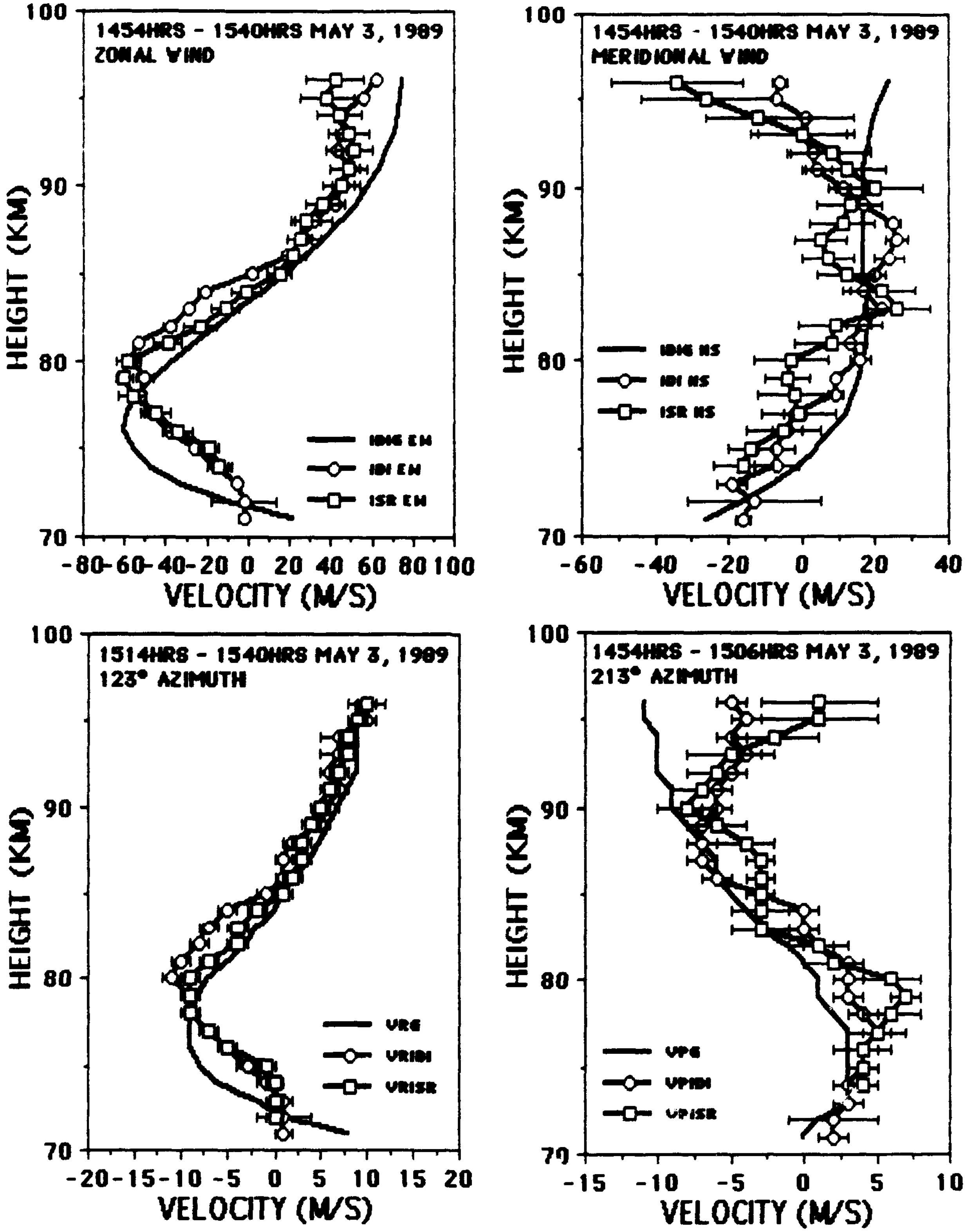

1454HRS - 1540HRS MAY 3, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1454HRS - 1540HRS MAY 3, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1514HRS - 1540HRS MAY 3, 1989
123° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)
1454HRS - 1506HRS MAY 3, 1989
213° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 7

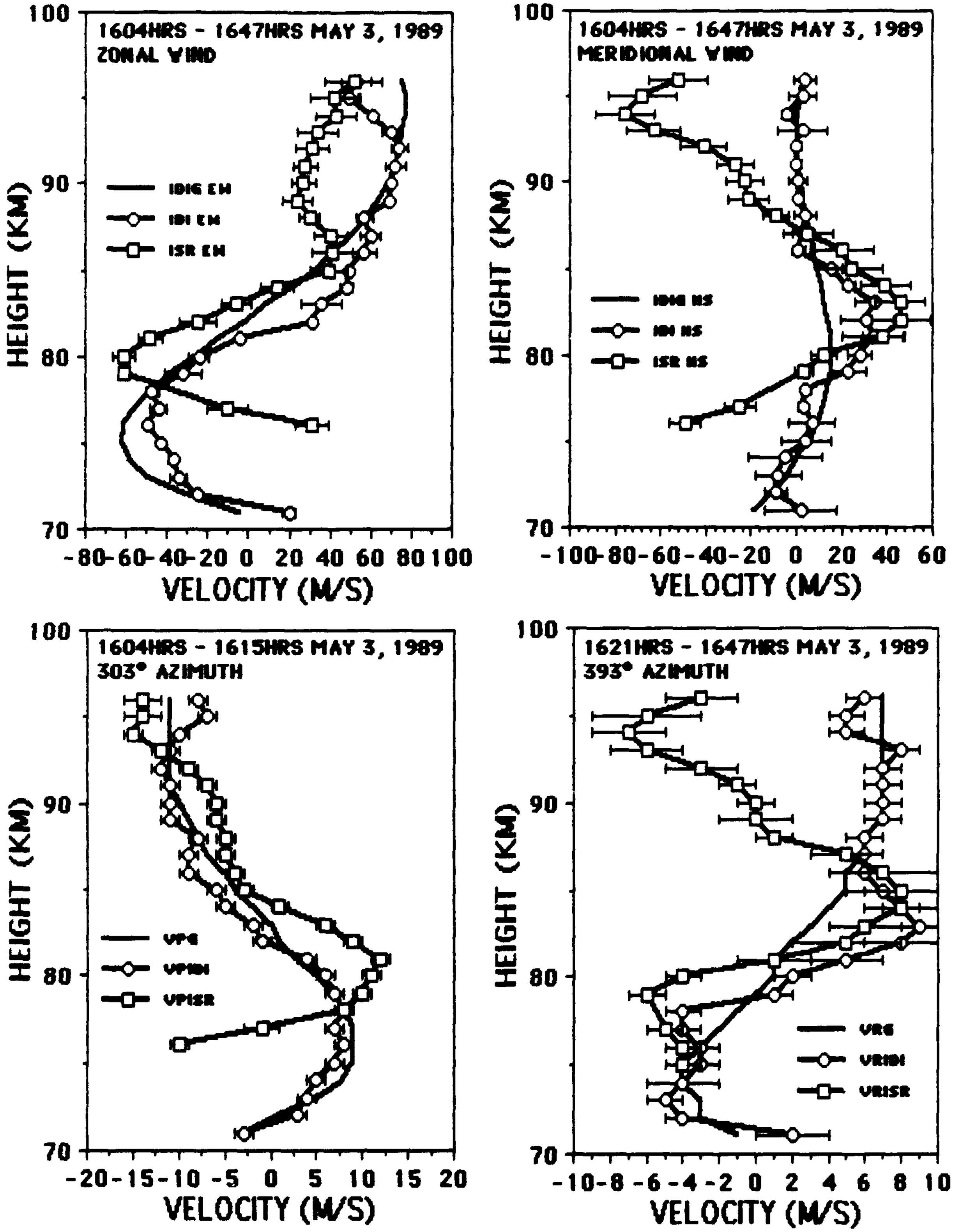

1604HRS - 1647HRS MAY 3, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1604HRS - 1647HRS MAY 3, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1604HRS - 1615HRS MAY 3, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1621HRS - 1647HRS MAY 3, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 8

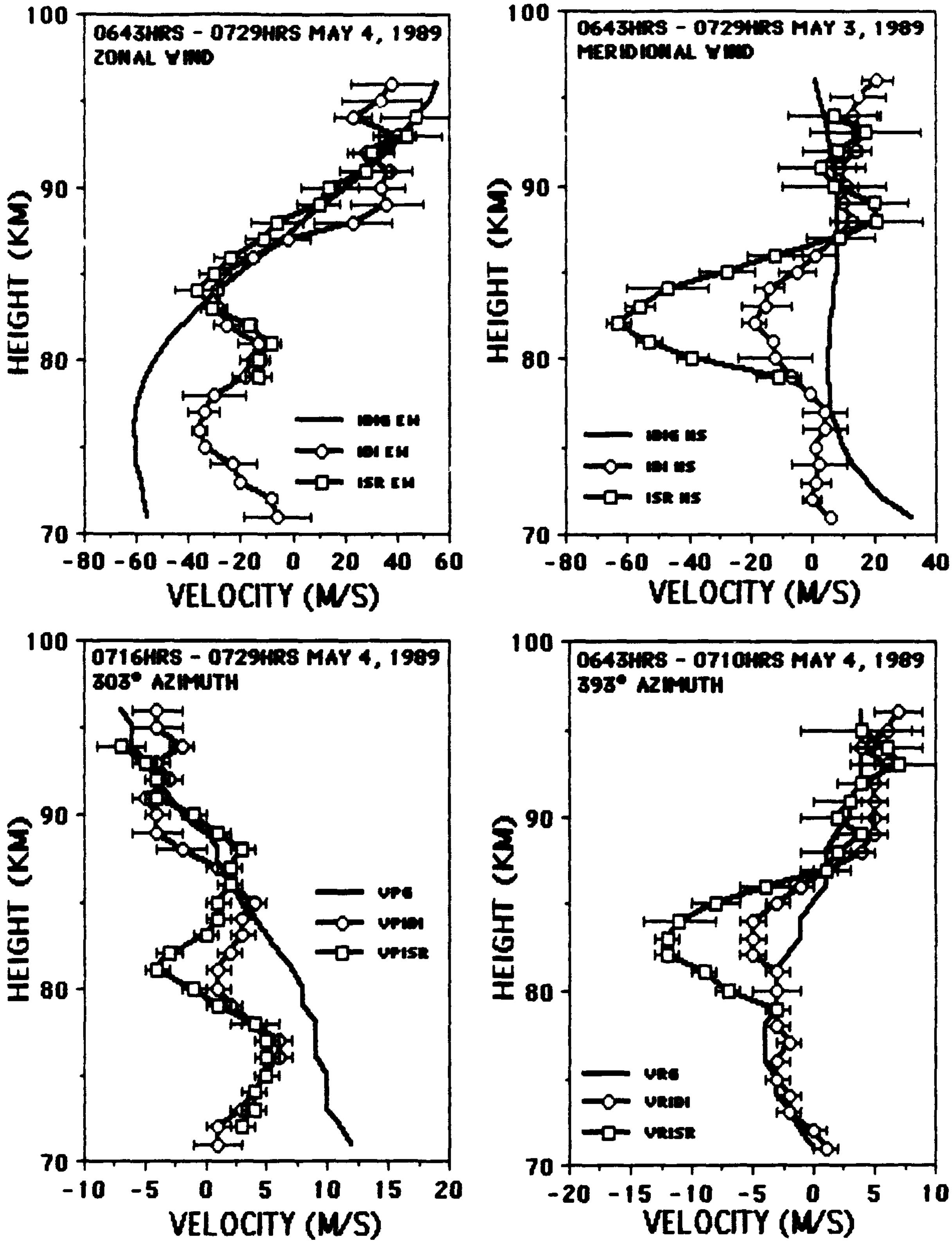

0643HRS - 0729HRS MAY 4, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0643HRS - 0729HRS MAY 3, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0716HRS - 0729HRS MAY 4, 1989
303° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
0643HRS - 0710HRS MAY 4, 1989
393° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 9

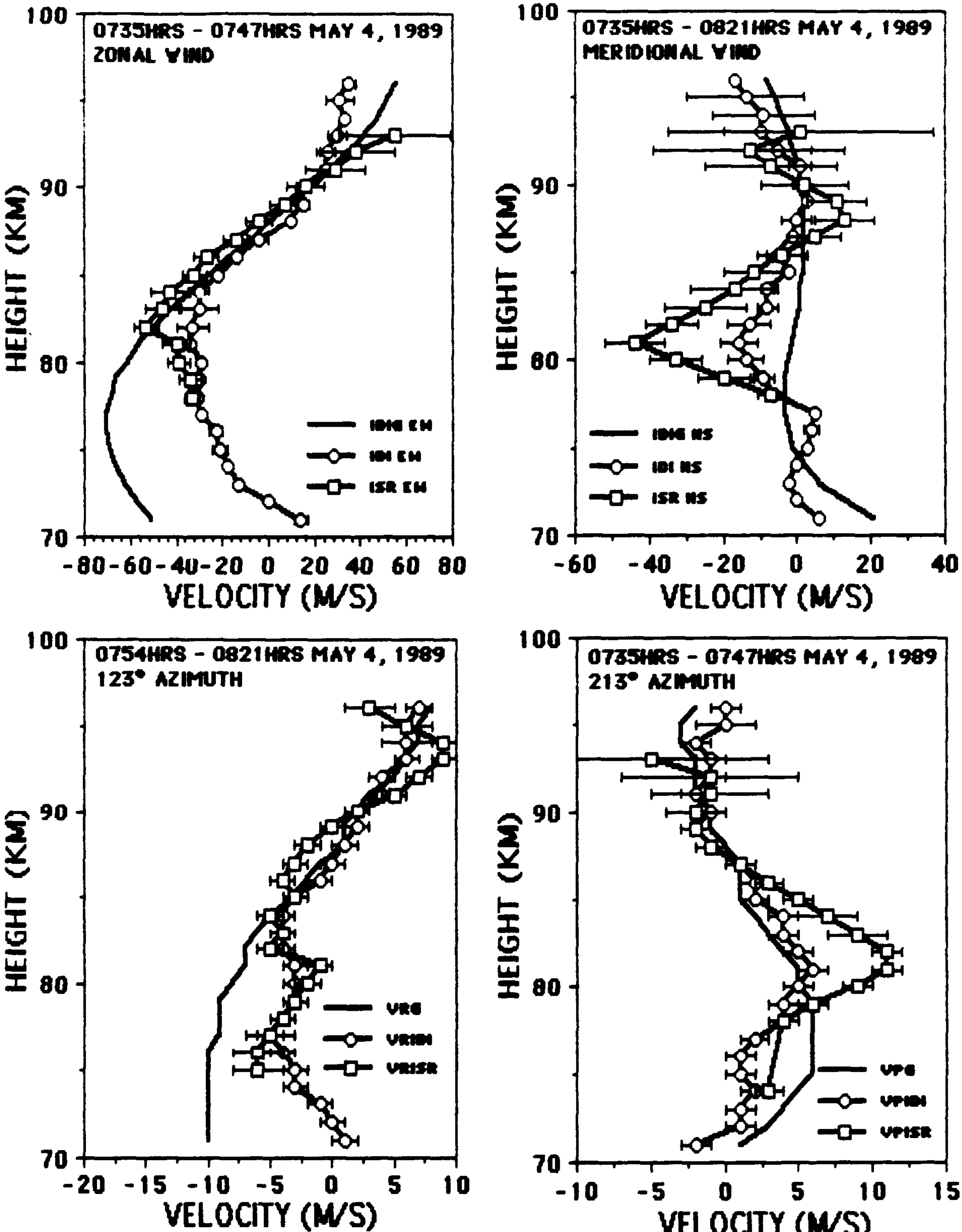

0735HRS - 0747HRS MAY 4, 1989
ZONAL WIND
0735HRS - 0821HRS MAY 4, 1989
MERIDIONAL WIND
0754HRS - 0821HRS MAY 4, 1989
123° AZIMUTH
0735HRS - 0747HRS MAY 4, 1989
213° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
ISR EW
ISR NS
VPISR

FIGURE 10

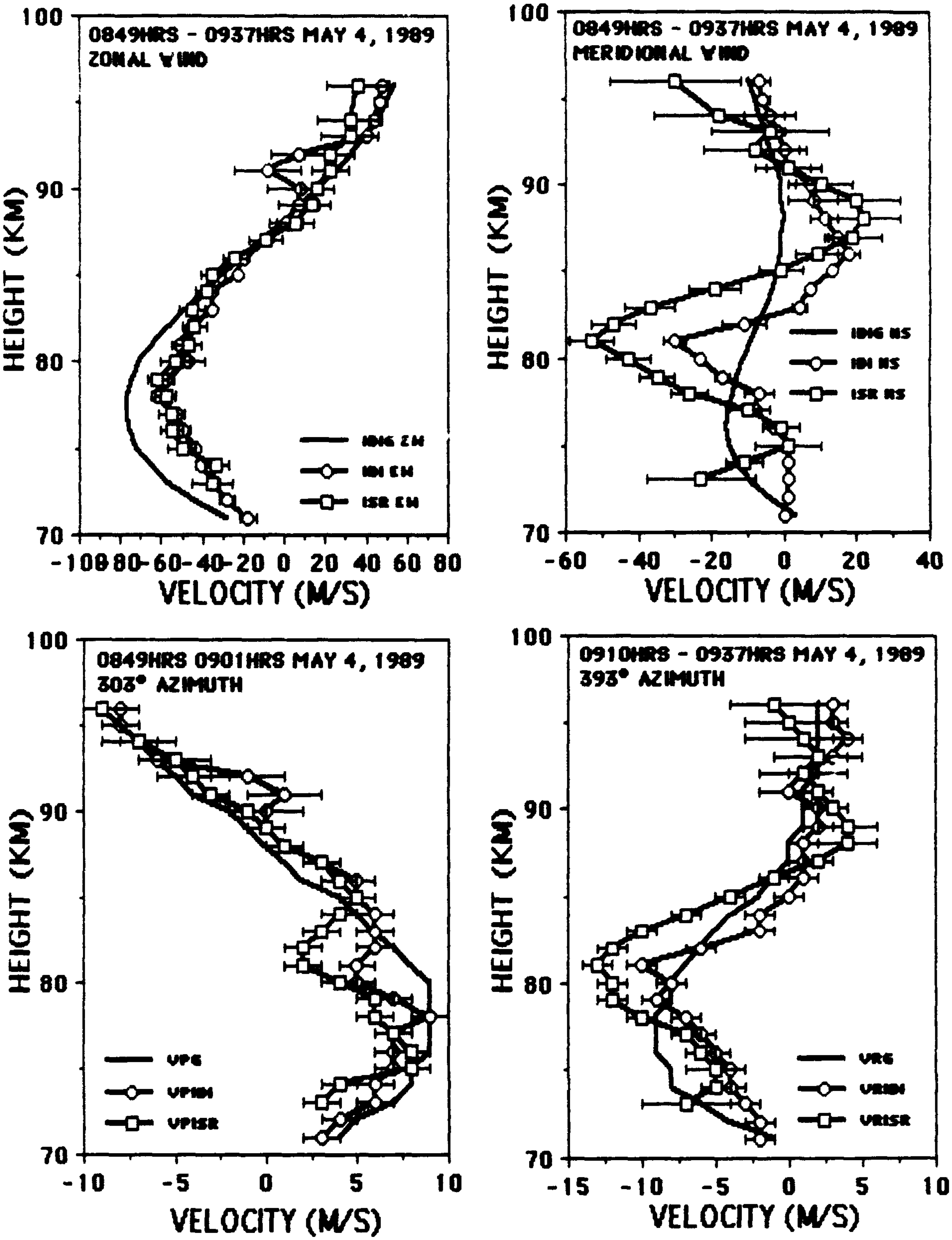

0849HRS - 0937HRS MAY 4, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0849HRS - 0937HRS MAY 4, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0849HRS 0901HRS MAY 4, 1989
303° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
0910HRS - 0937HRS MAY 4, 1989
393° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 11

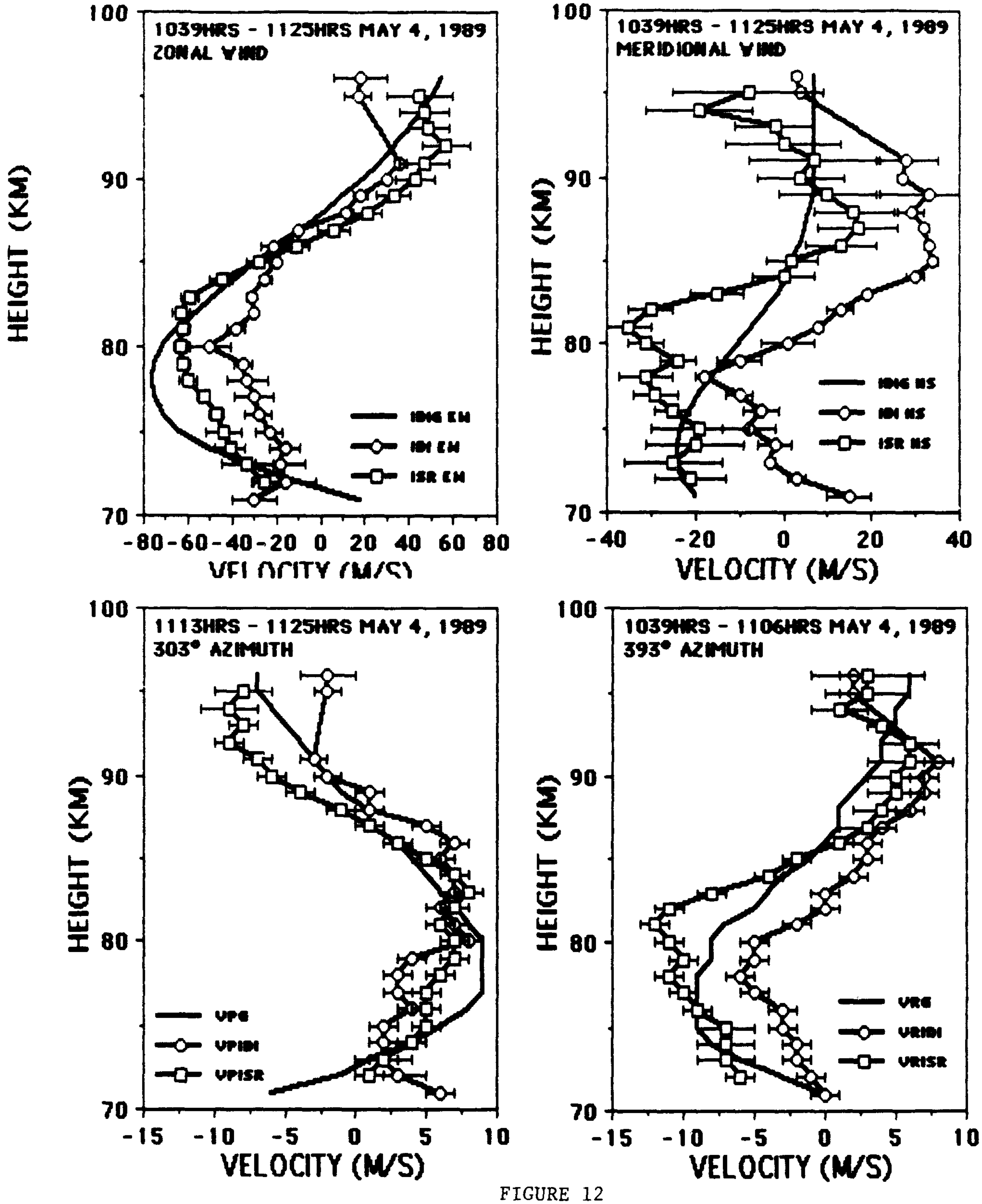

1039HRS - 1125HRS MAY 4, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1039HRS - 1125HRS MAY 4, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1113HRS - 1125HRS MAY 4, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1039HRS - 1106HRS MAY 4, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 12

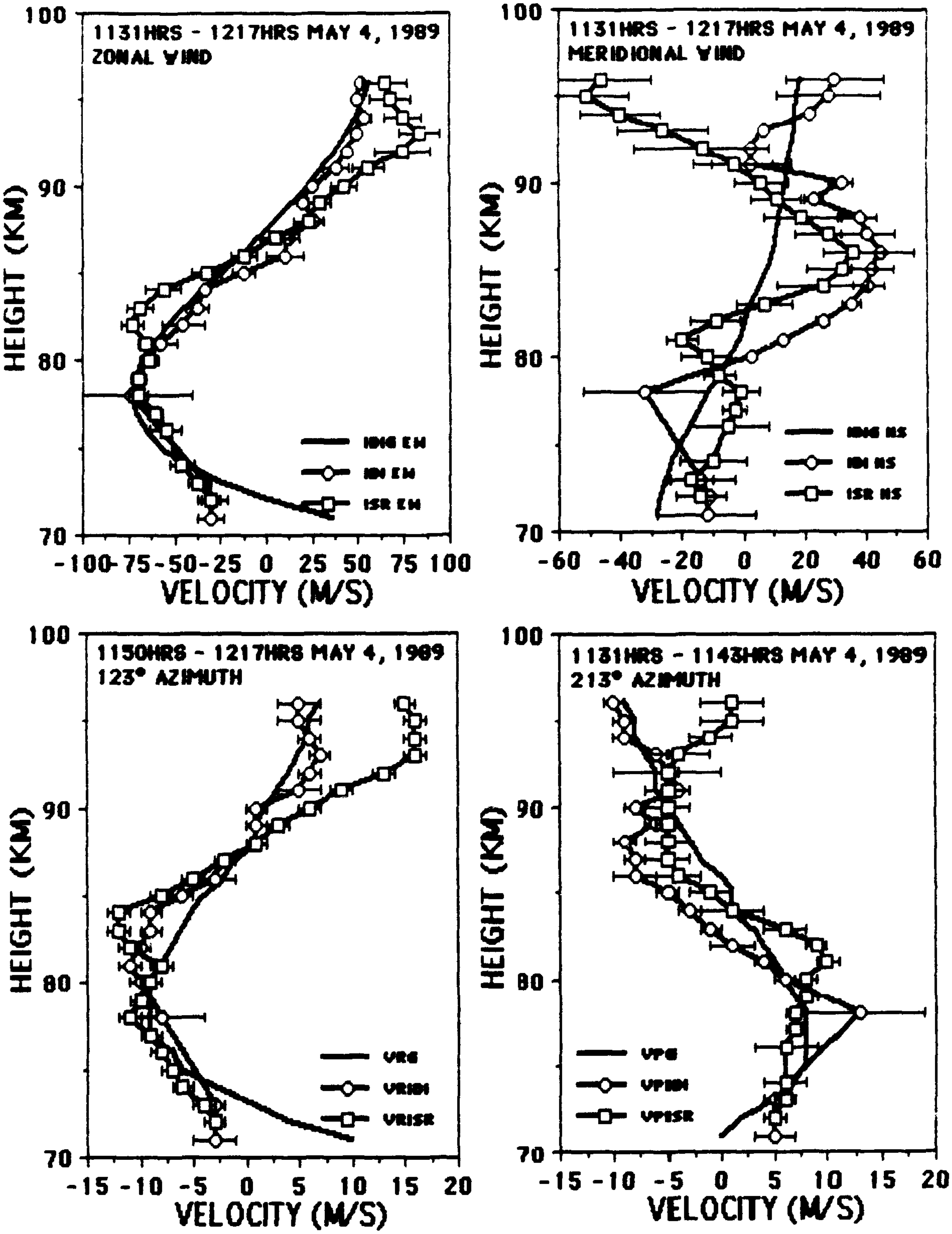

1131HRS - 1217HRS MAY 4, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1131HRS - 1217HRS MAY 4, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1150HRS - 1217HRS MAY 4, 1989
123° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)
1131HRS - 1143HRS MAY 4, 1989
213° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 13

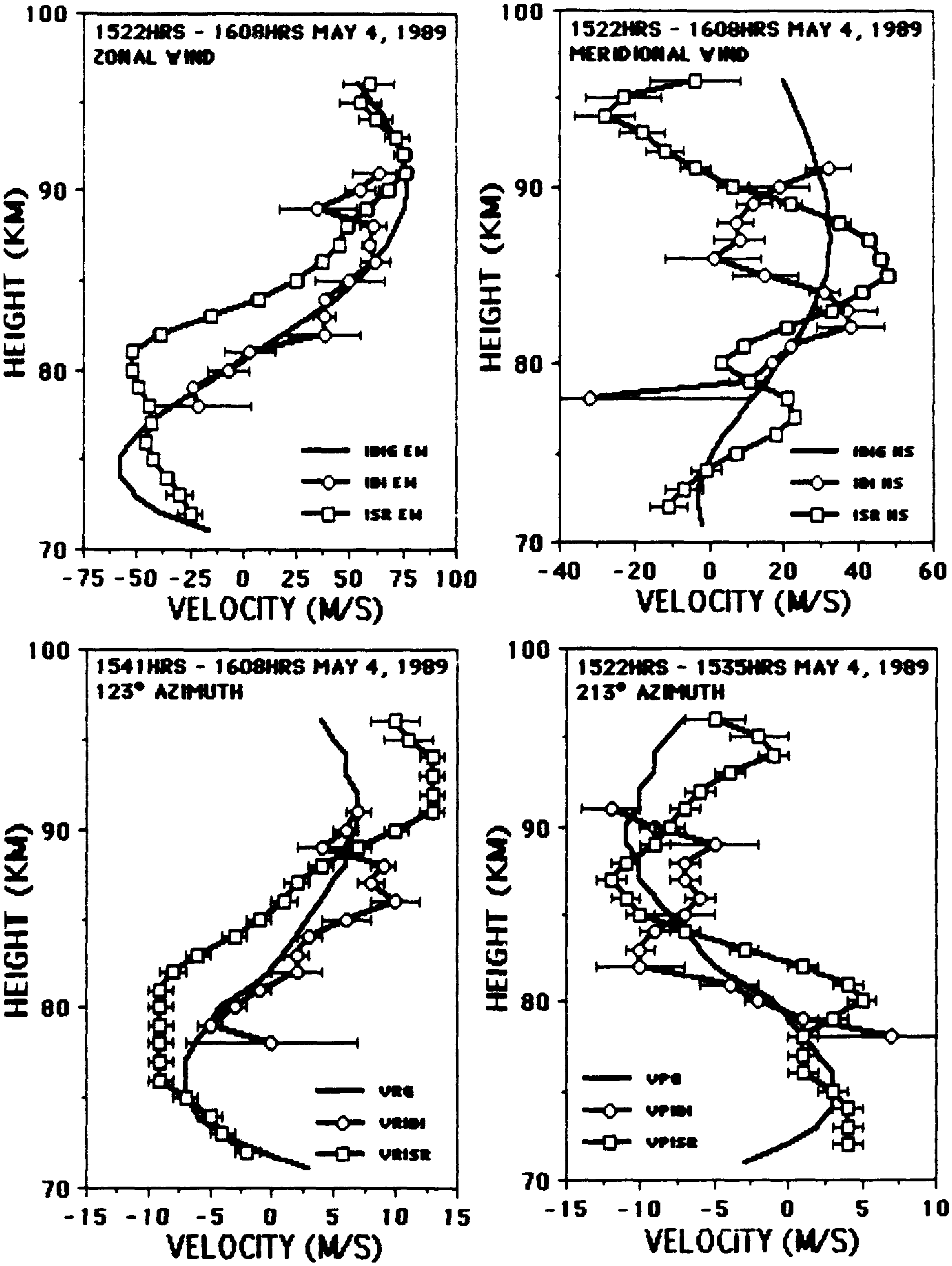

1522HRS - 1608HRS MAY 4, 1989
ZONAL WIND
1522HRS - 1608HRS MAY 4, 1989
MERIDIONAL WIND
1541HRS - 1608HRS MAY 4, 1989
123° AZIMUTH
1522HRS - 1535HRS MAY 4, 1989
213° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
VRG
VRIDI
VRISR
VPG
VPIDI
VPISR

FIGURE 14

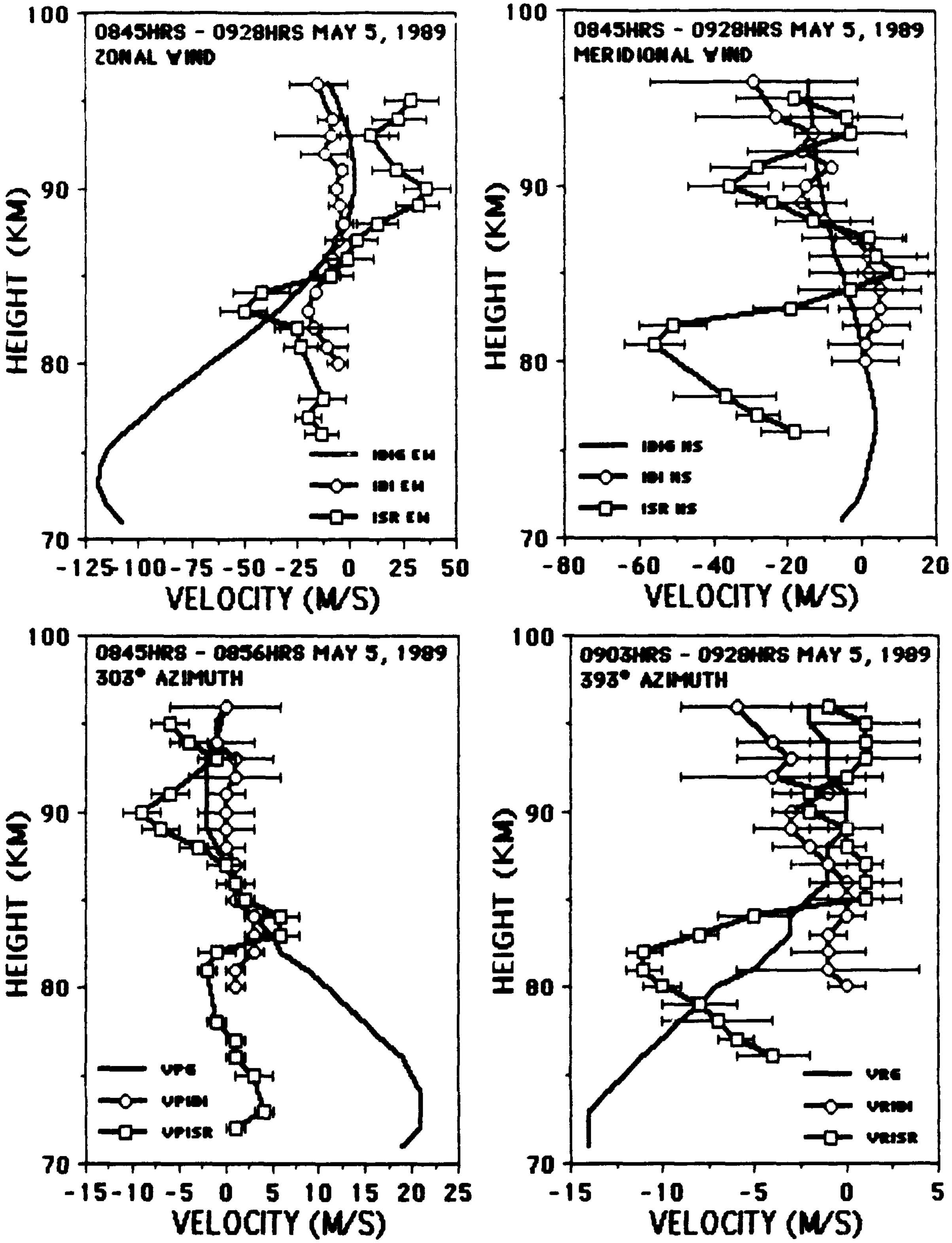

0845HRS - 0928HRS MAY 5, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
0845HRS - 0928HRS MAY 5, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
0845HRS - 0856HRS MAY 5, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
0903HRS - 0928HRS MAY 5, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 15

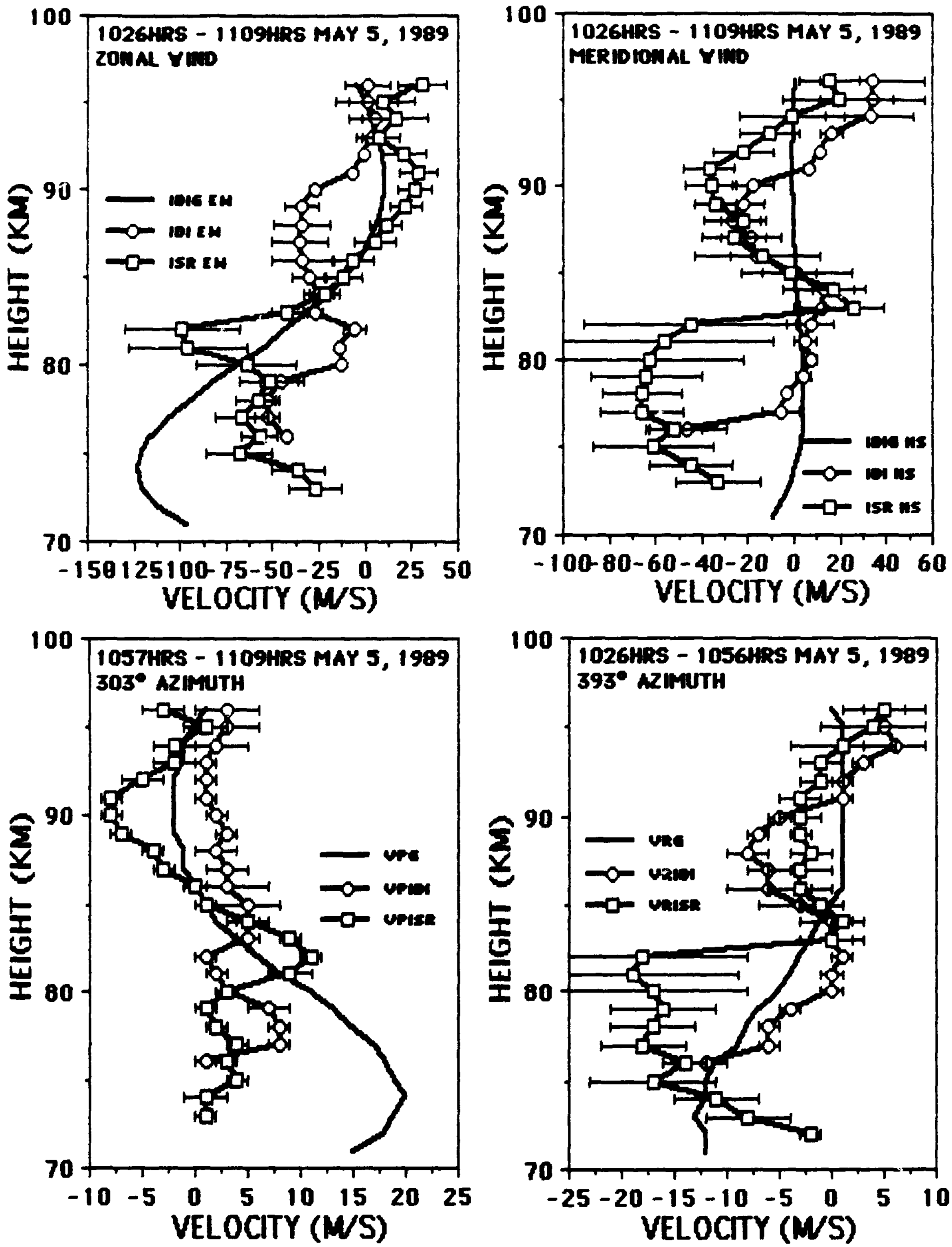
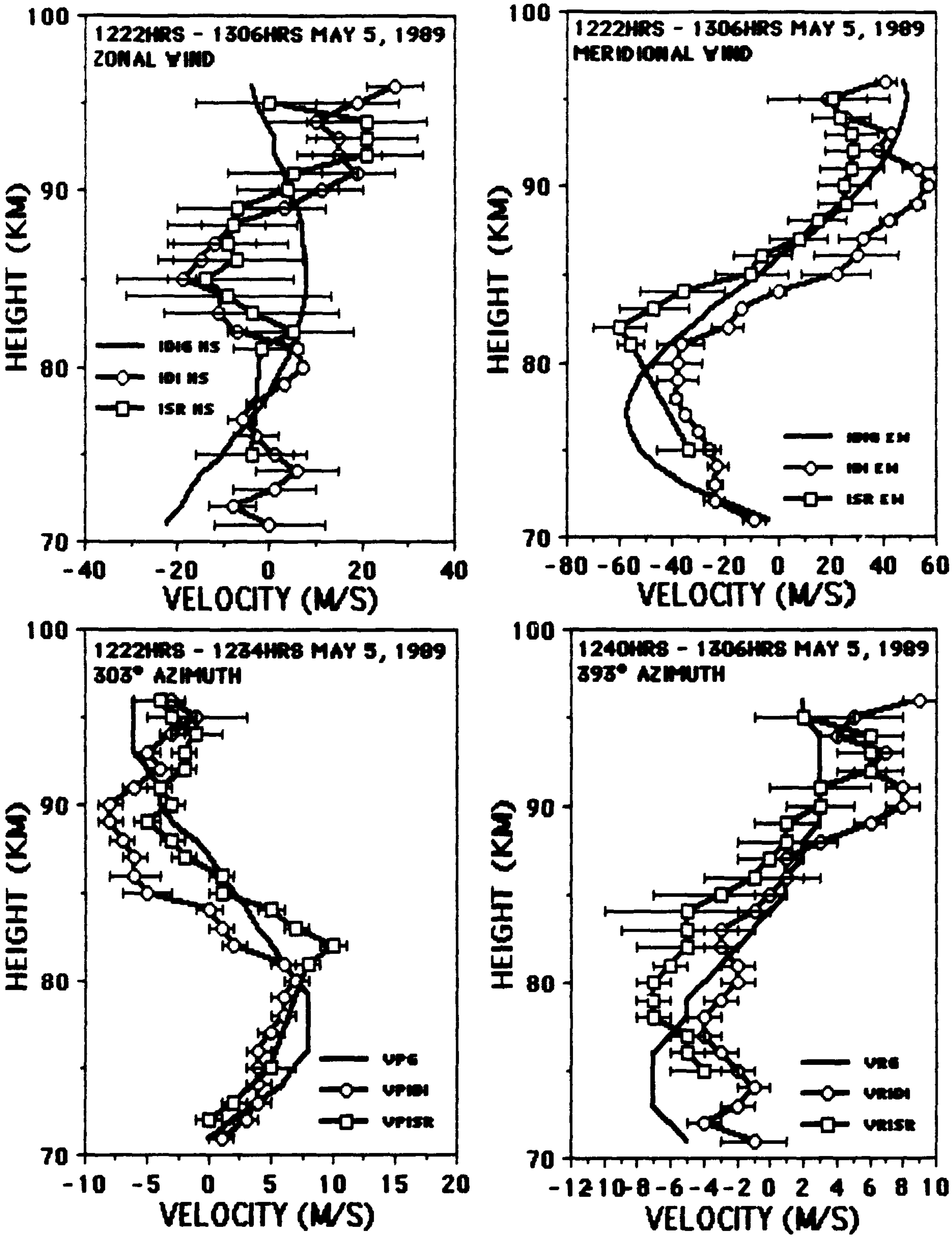

1026HRS - 1109HRS MAY 5, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1026HRS - 1109HRS MAY 5, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1057HRS - 1109HRS MAY 5, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1026HRS - 1056HRS MAY 5, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 16



1222HRS - 1306HRS MAY 5, 1989
ZONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1222HRS - 1306HRS MAY 5, 1989
MERIDIONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1222HRS - 1234HRS MAY 5, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1240HRS - 1306HRS MAY 5, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 17

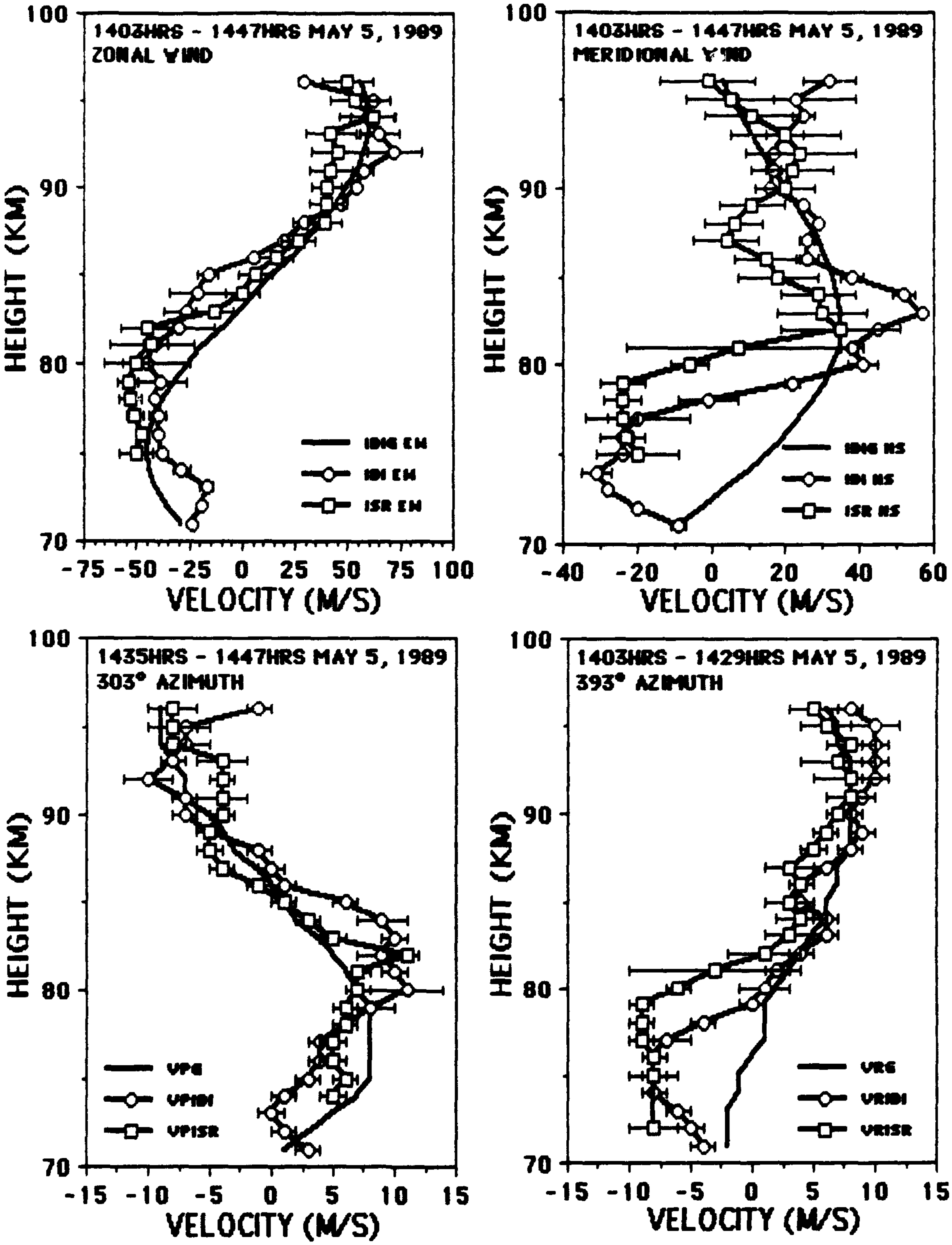

1403HRS - 1447HRS MAY 5, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1403HRS - 1447HRS MAY 5, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1435HRS - 1447HRS MAY 5, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1403HRS - 1429HRS MAY 5, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 18

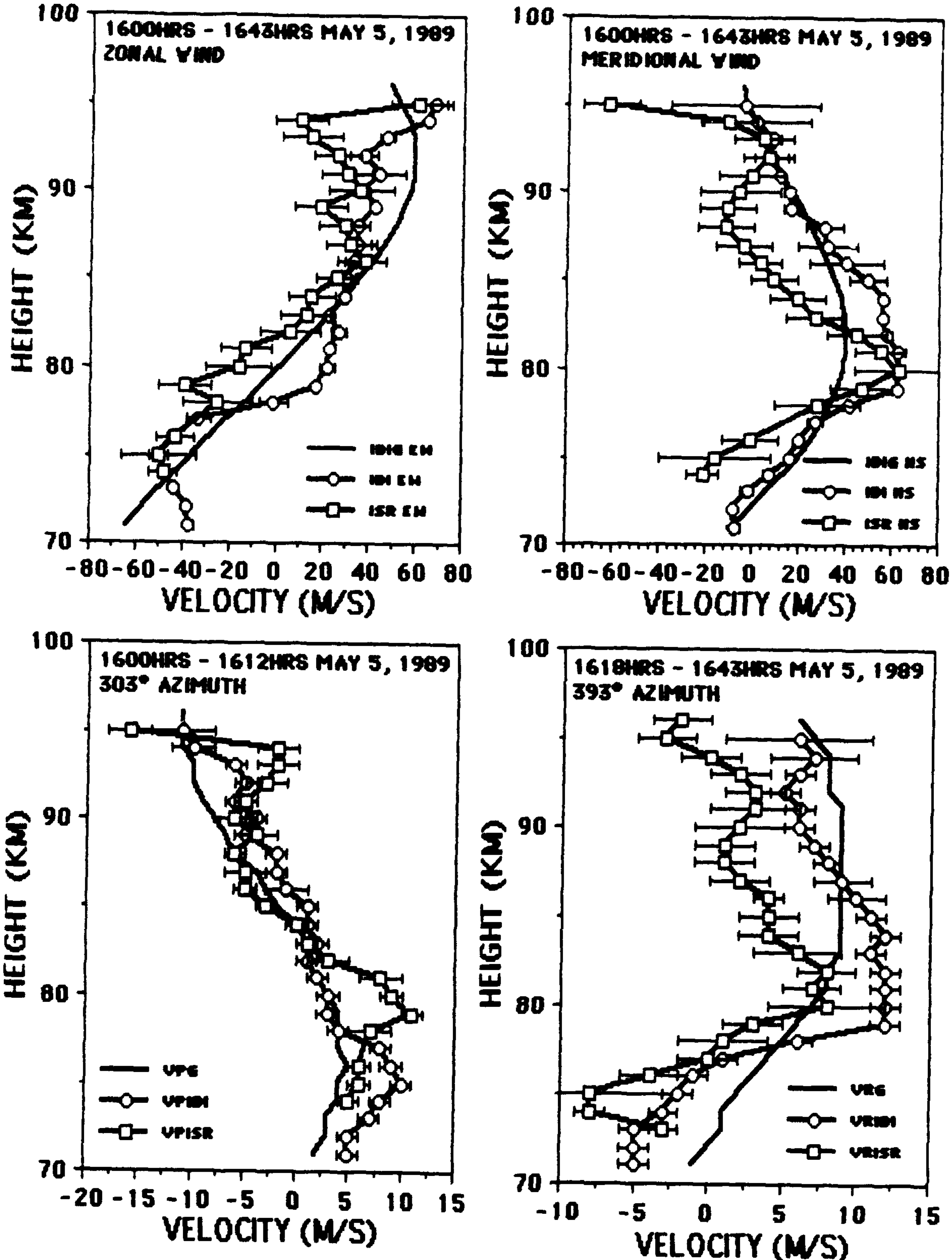

1600HRS - 1643HRS MAY 5, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1600HRS - 1643HRS MAY 5, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1600HRS - 1612HRS MAY 5, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1618HRS - 1643HRS MAY 5, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 19

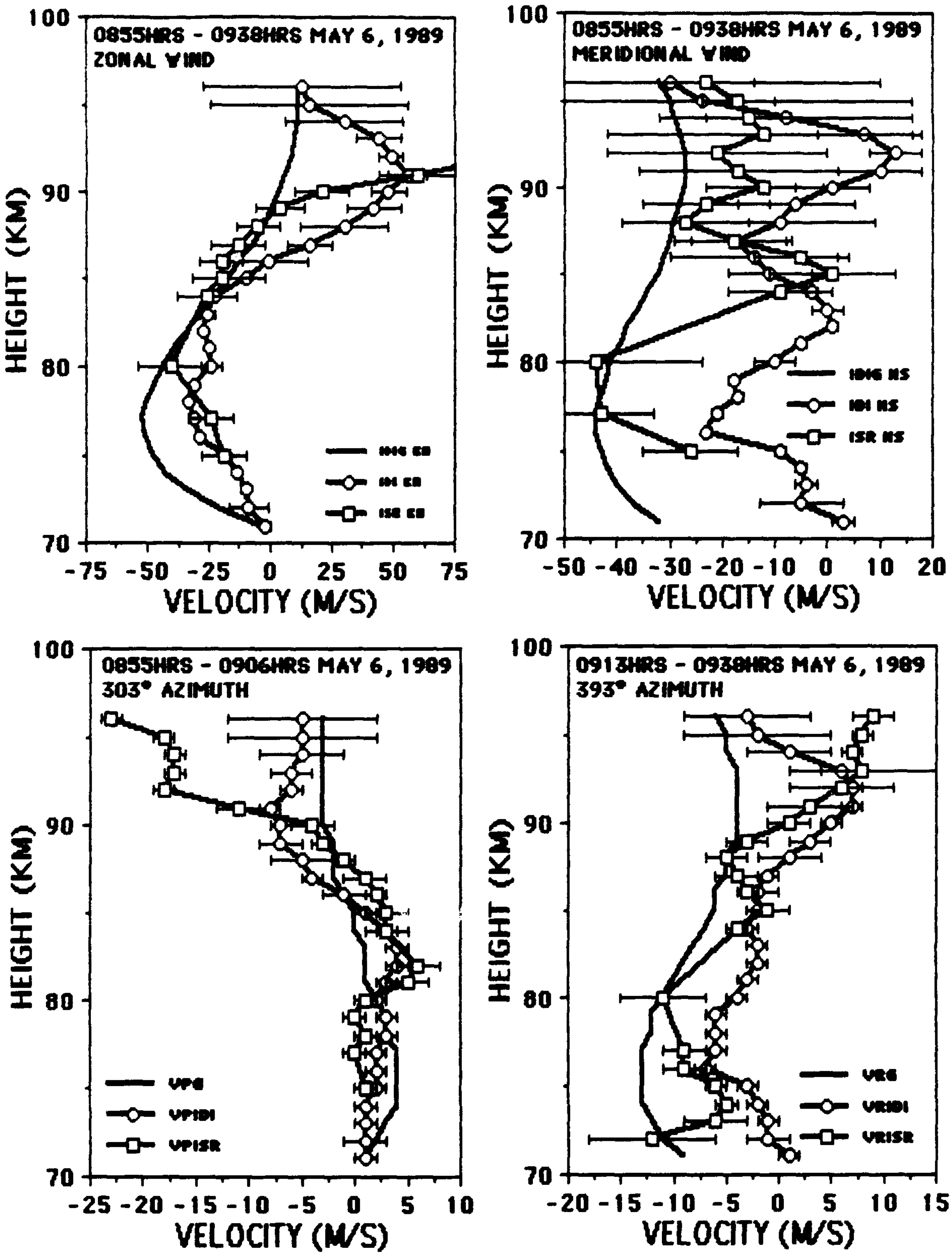

0855HRS - 0938HRS MAY 6, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0855HRS - 0938HRS MAY 6, 1989
MERIDIONAL WIND
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
0855HRS - 0906HRS MAY 6, 1989
303° AZIMUTH
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
0913HRS - 0938HRS MAY 6, 1989
393° AZIMUTH
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 20

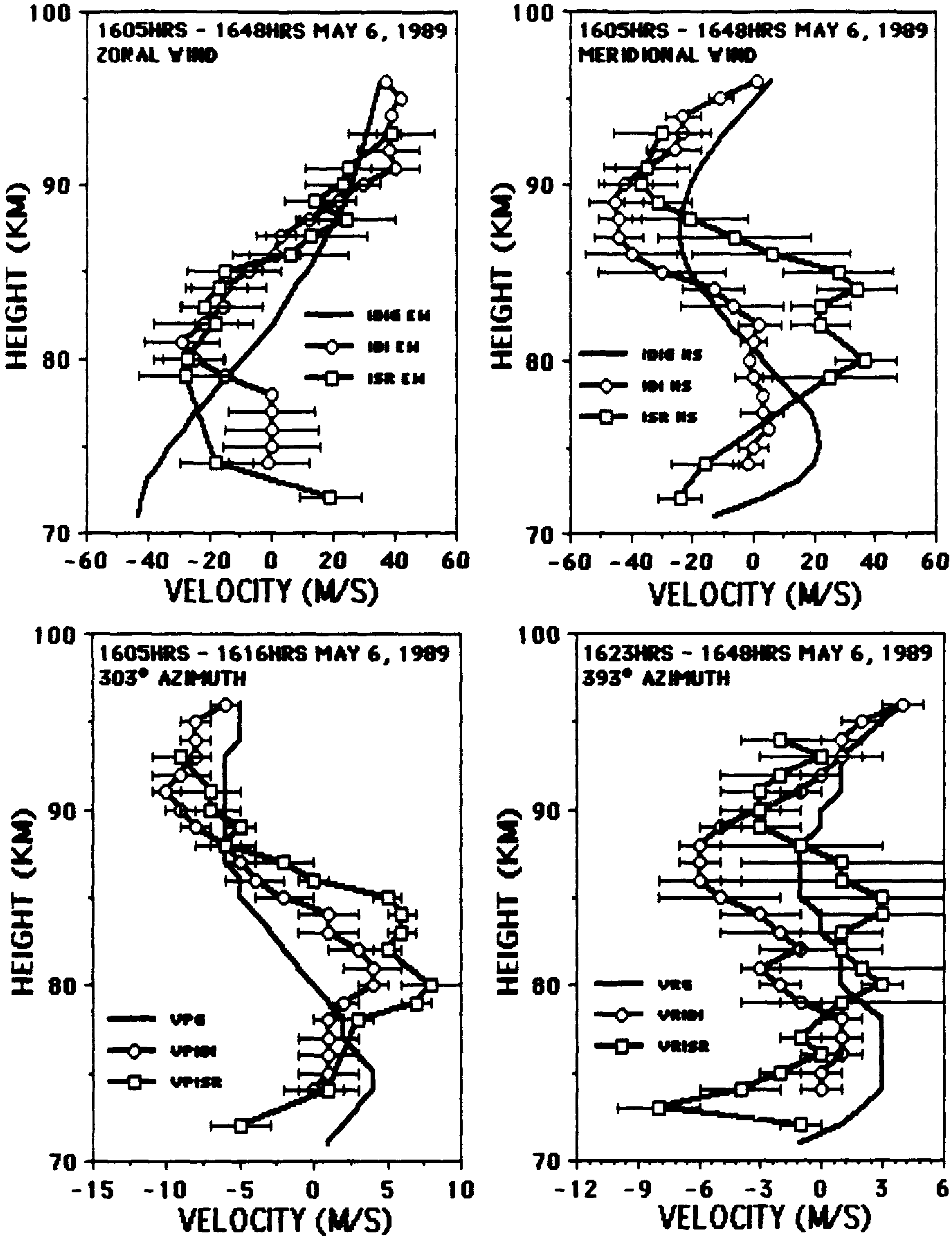
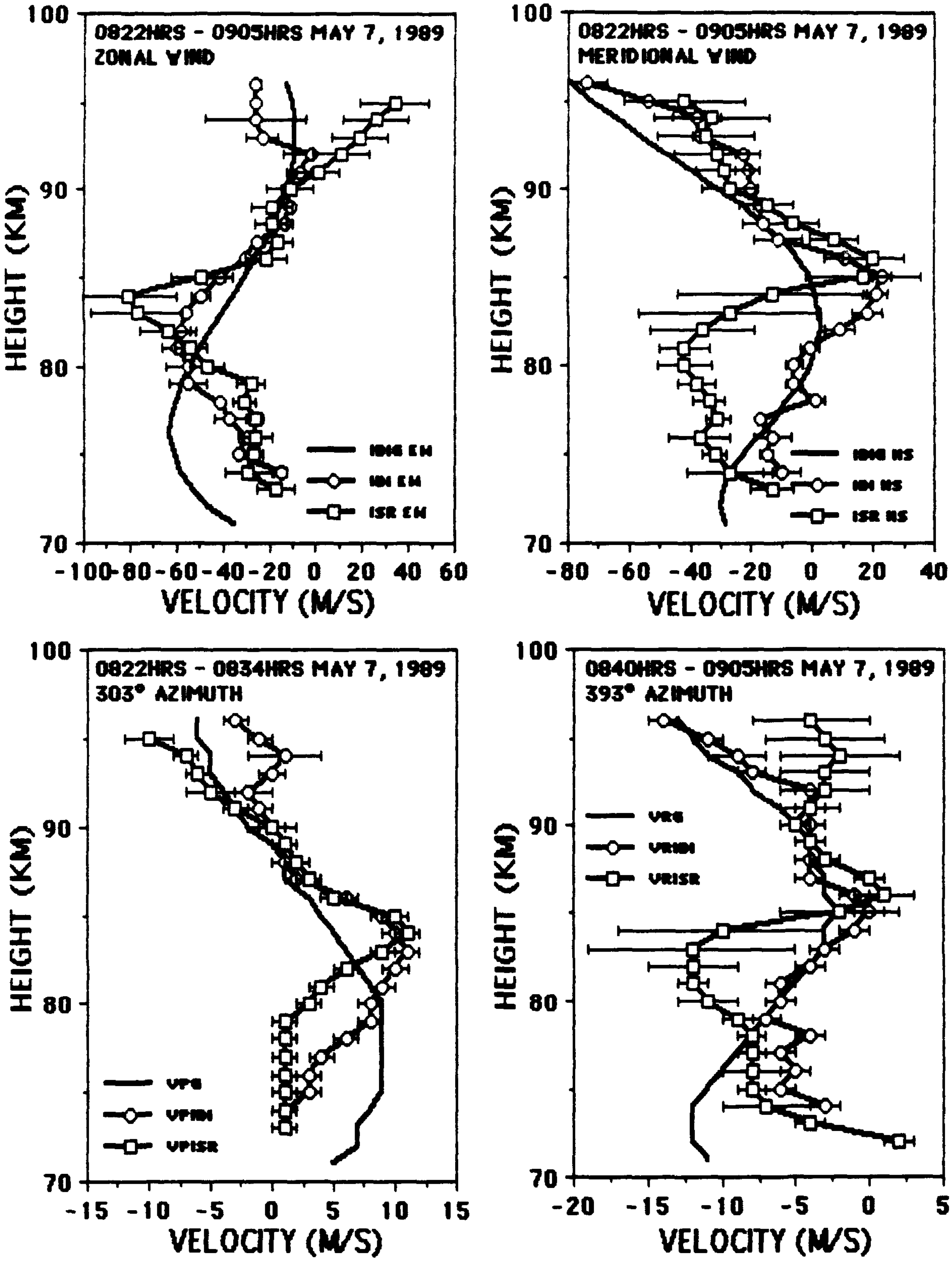

1605HRS - 1648HRS MAY 6, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
100
90
80
70
-60 -40 -20 0 20 40 60
1605HRS - 1648HRS MAY 6, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1605HRS - 1616HRS MAY 6, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
-15 -10 -5 0 5 10
1623HRS - 1648HRS MAY 6, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)
-12 -9 -6 -3 0 3 6

FIGURE 21



0822HRS - 0905HRS MAY 7, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0822HRS - 0905HRS MAY 7, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0822HRS - 0834HRS MAY 7, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
0840HRS - 0905HRS MAY 7, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 22

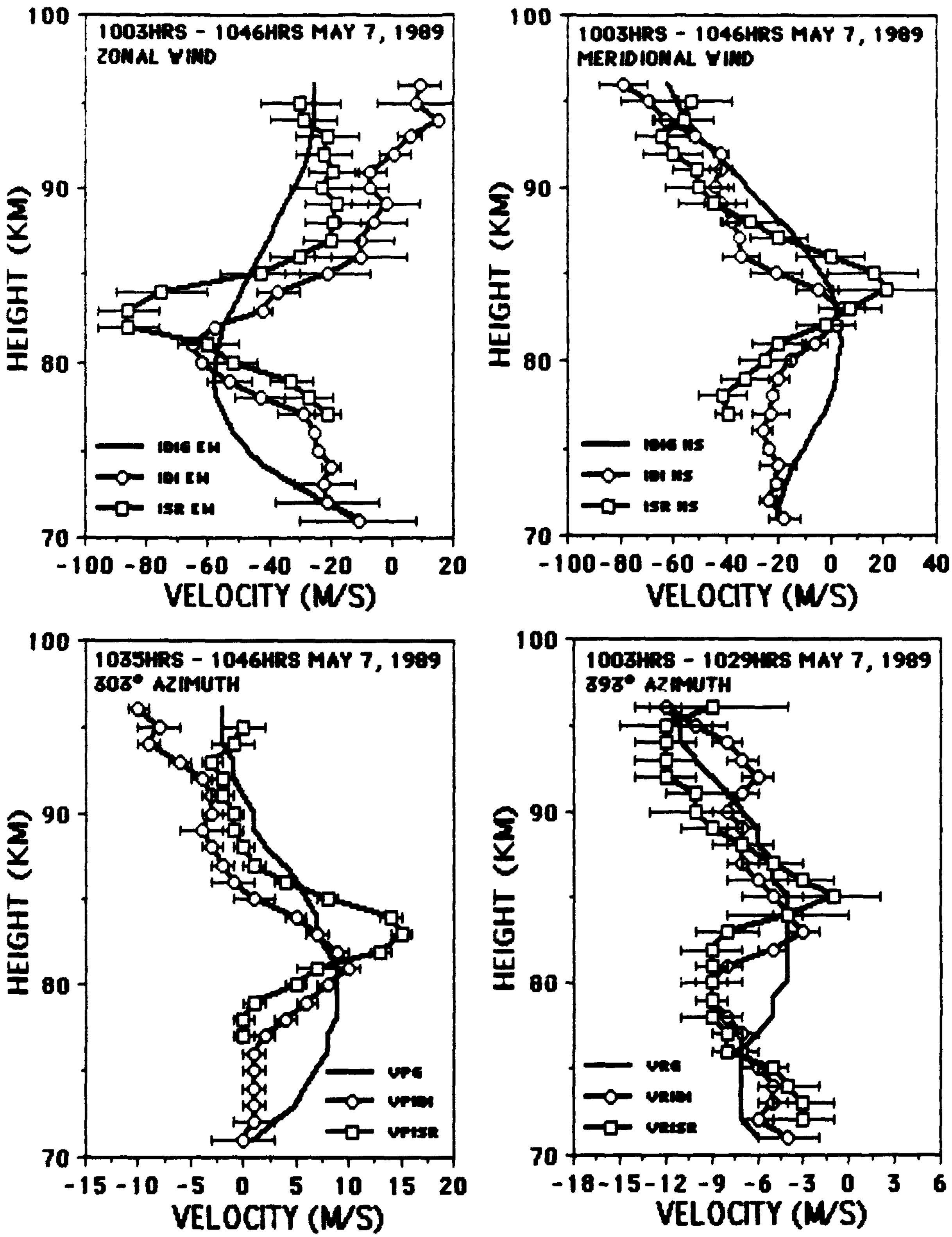

1003HRS - 1046HRS MAY 7, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1003HRS - 1046HRS MAY 7, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1035HRS - 1046HRS MAY 7, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1003HRS - 1029HRS MAY 7, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 23

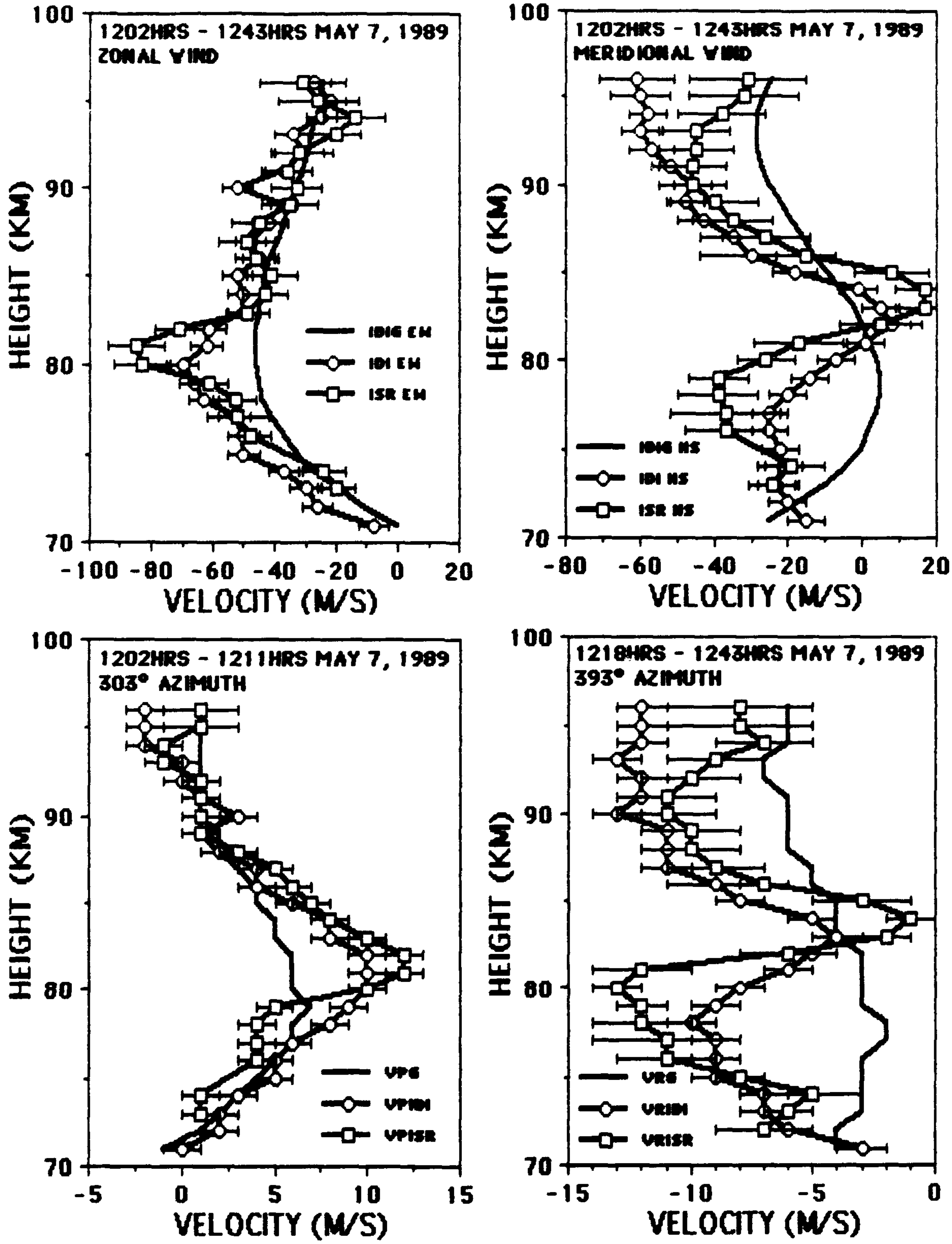

1202HRS - 1243HRS MAY 7, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1202HRS - 1243HRS MAY 7, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1202HRS - 1211HRS MAY 7, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1218HRS - 1243HRS MAY 7, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 24

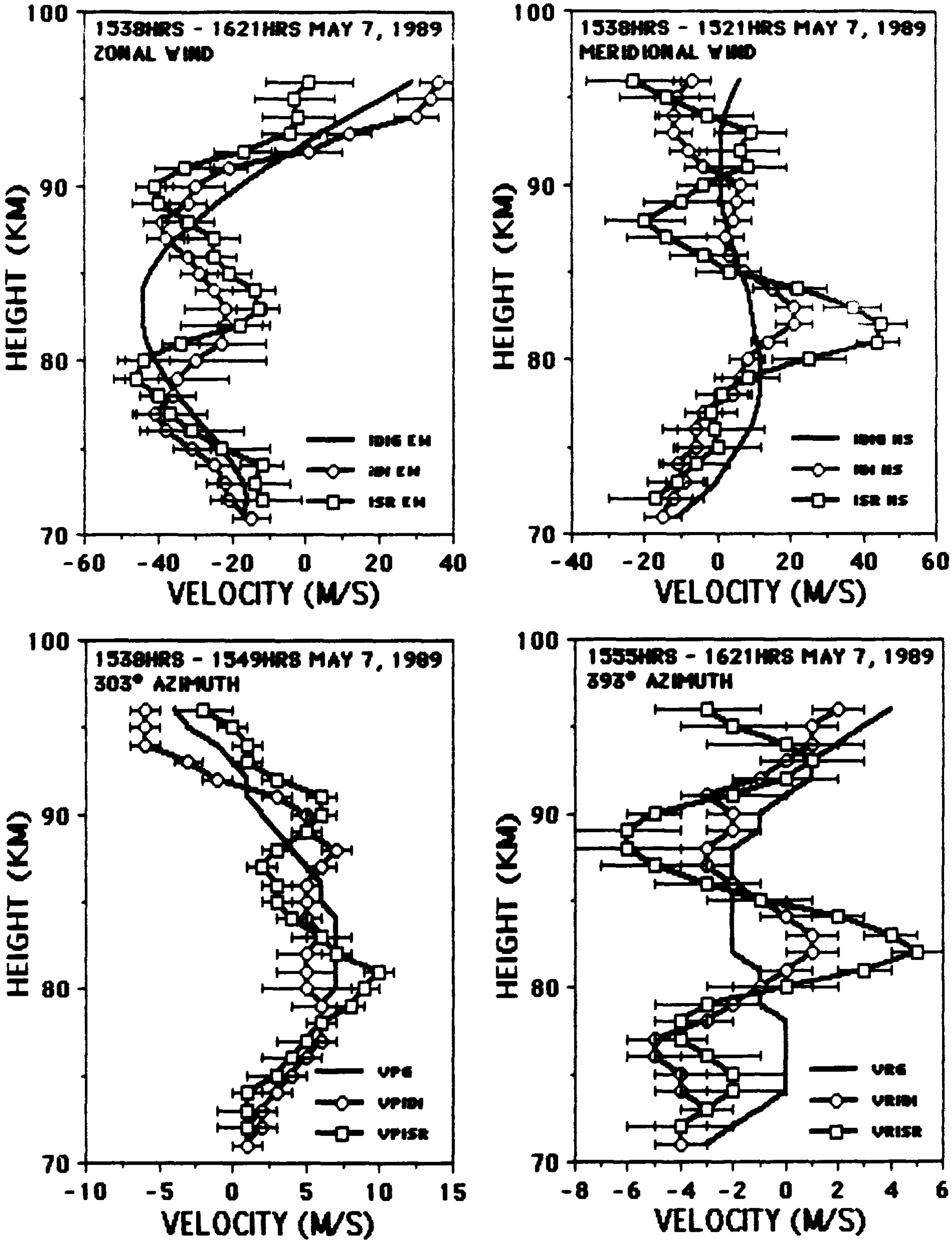

1538HRS - 1621HRS MAY 7, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1538HRS - 1521HRS MAY 7, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1538HRS - 1549HRS MAY 7, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1555HRS - 1621HRS MAY 7, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 25

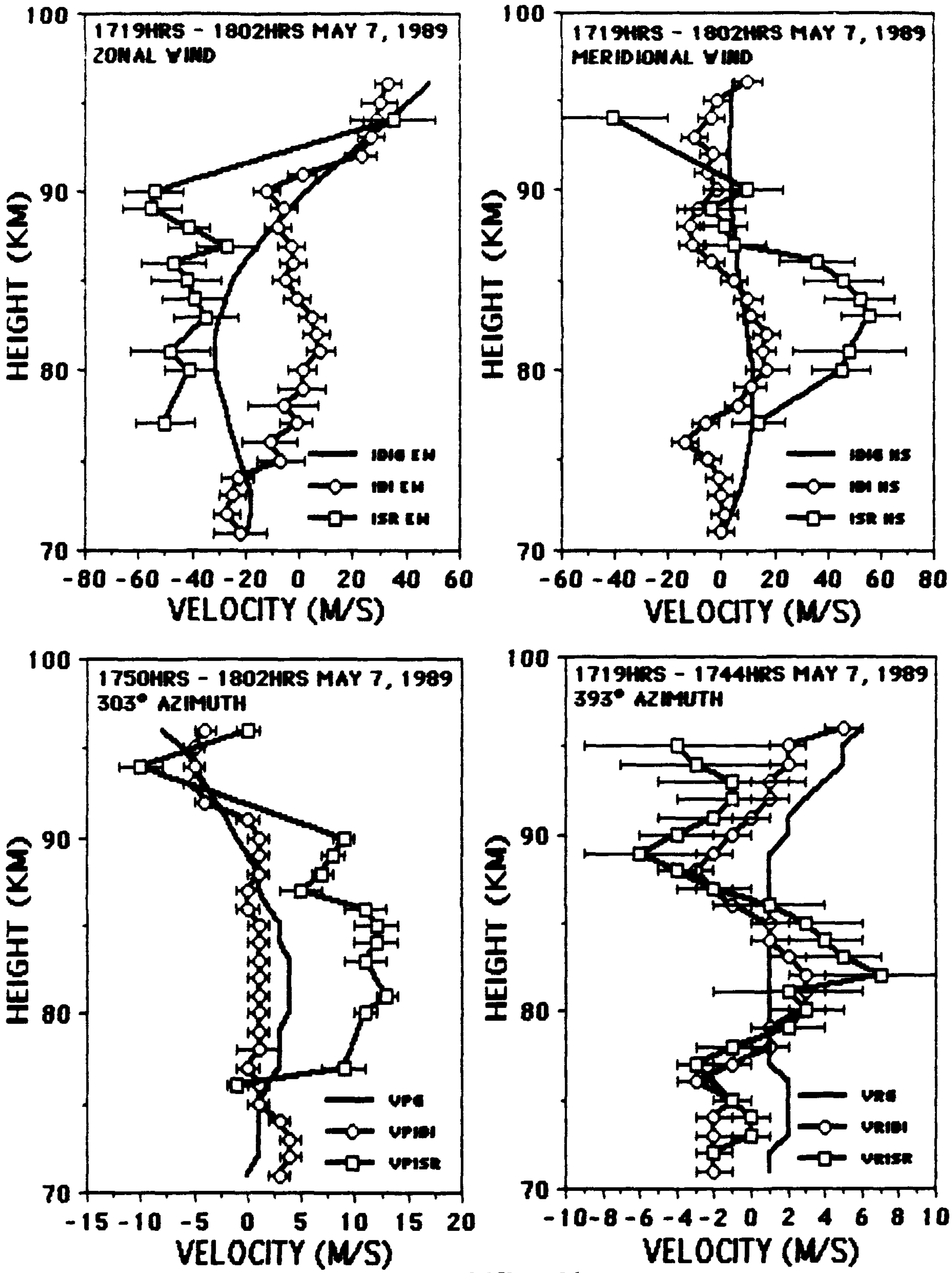

1719HRS - 1802HRS MAY 7, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1719HRS - 1802HRS MAY 7, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1750HRS - 1802HRS MAY 7, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1719HRS - 1744HRS MAY 7, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 26

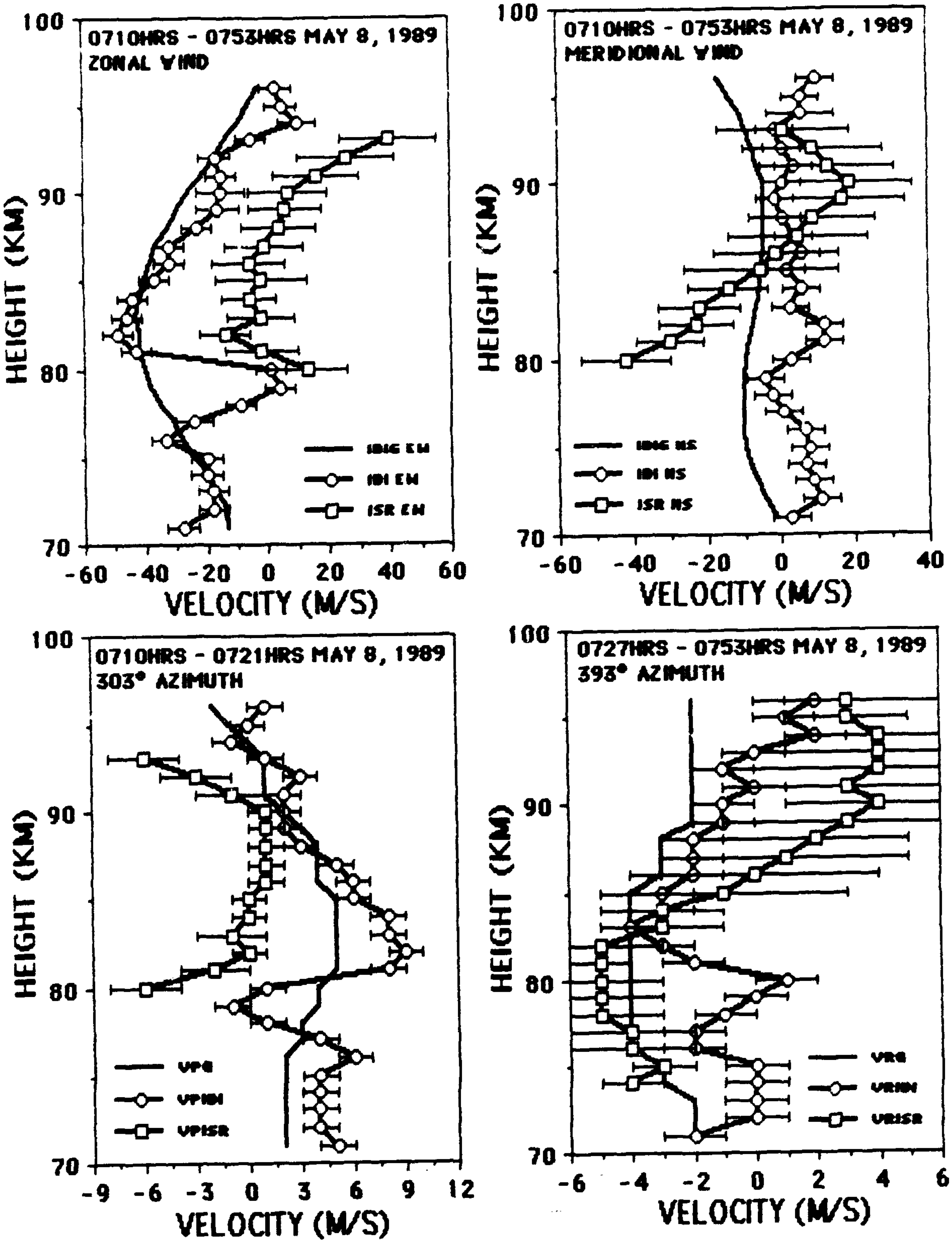

0710HRS - 0753HRS MAY 8, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0710HRS - 0753HRS MAY 8, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
0710HRS - 0721HRS MAY 8, 1989
303° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
0727HRS - 0753HRS MAY 8, 1989
393° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 27

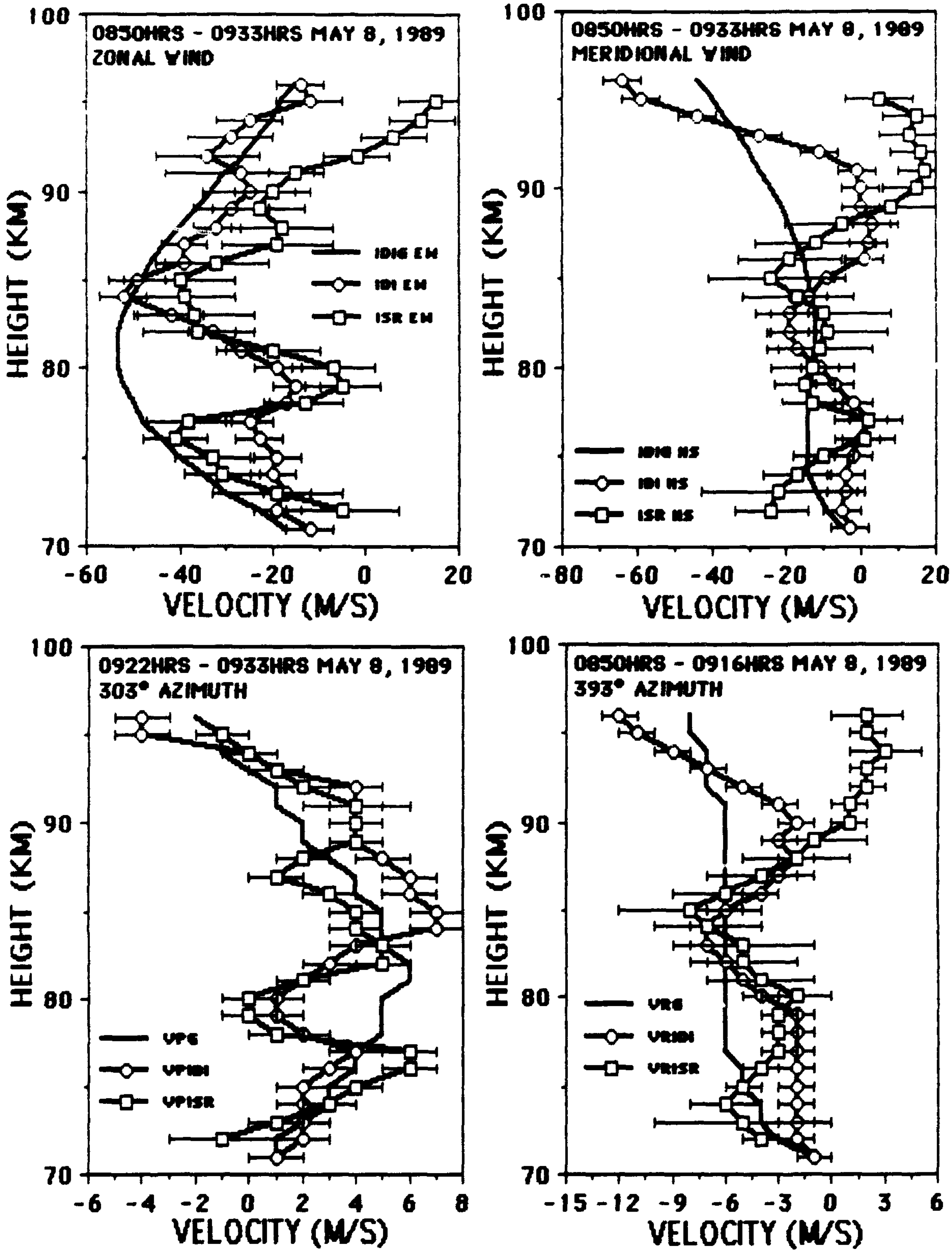

0850HRS - 0933HRS MAY 8, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
0850HRS - 0933HRS MAY 8, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
0922HRS - 0933HRS MAY 8, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
0850HRS - 0916HRS MAY 8, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 28

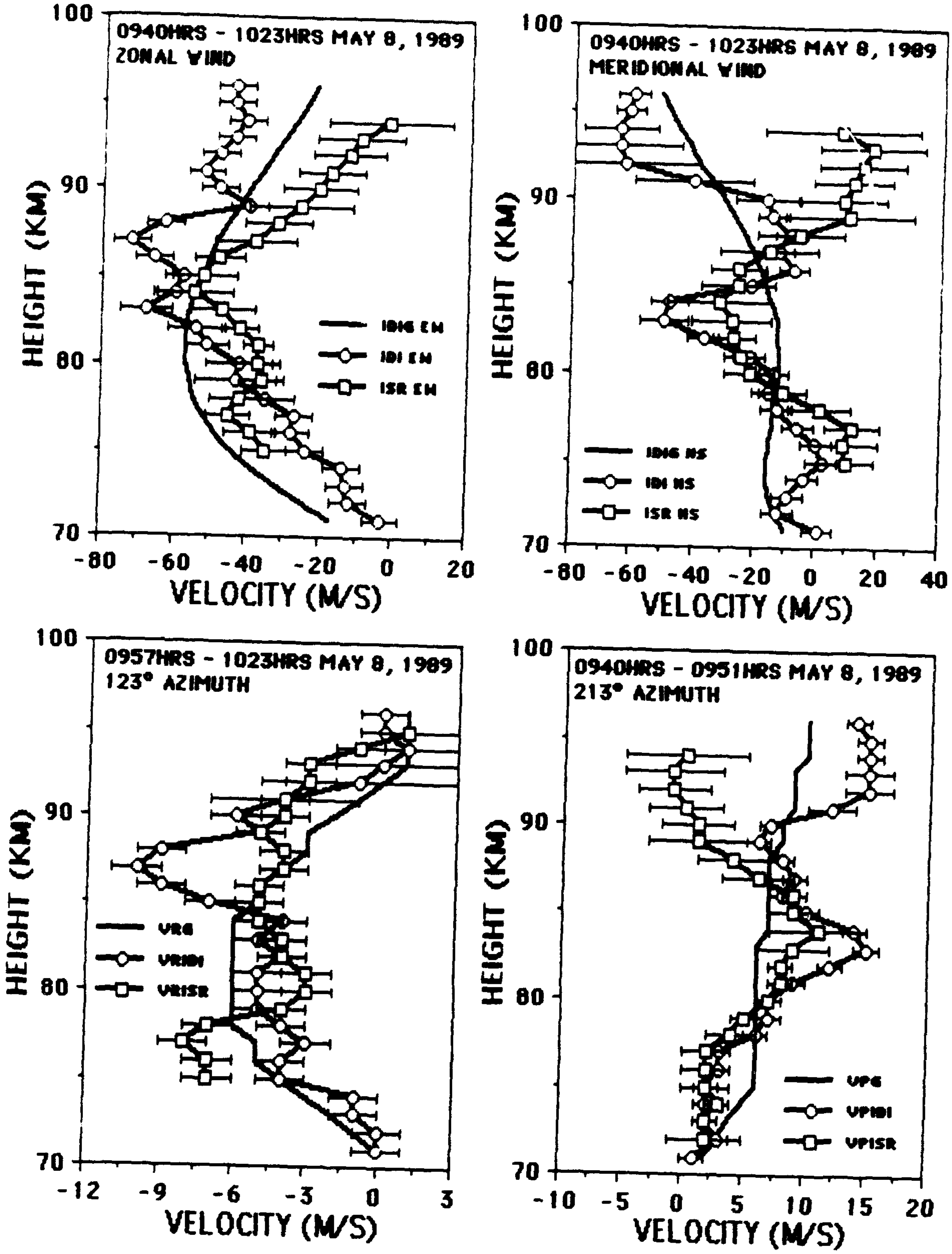

0940HRS - 1023HRS MAY 8, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
0940HRS - 1023HRS MAY 8, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
0957HRS - 1023HRS MAY 8, 1989
123° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)
0940HRS - 0951HRS MAY 8, 1989
213° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 29

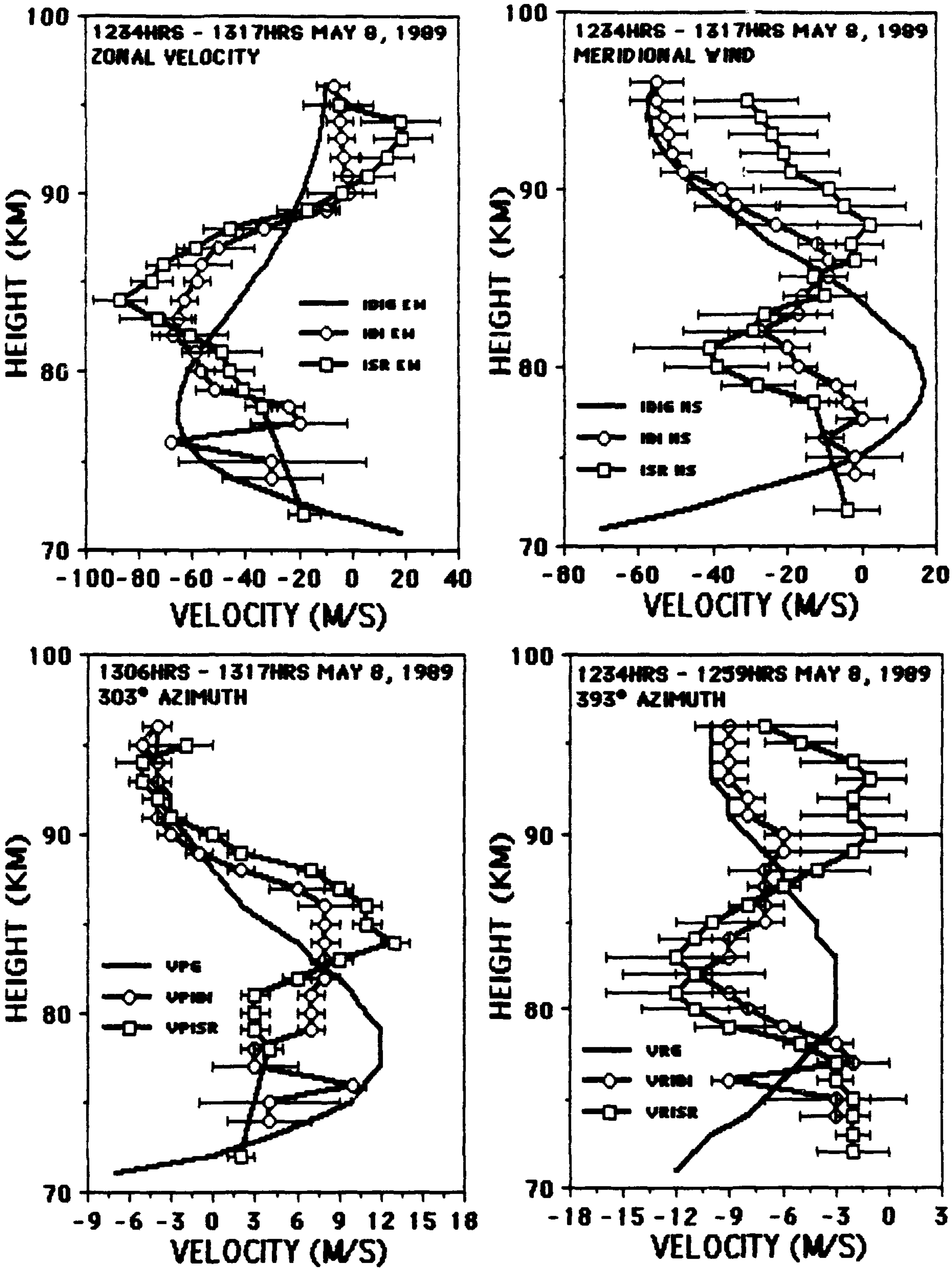

1234HRS - 1317HRS MAY 8, 1989
ZONAL VELOCITY
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
1234HRS - 1317HRS MAY 8, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
1306HRS - 1317HRS MAY 8, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
1234HRS - 1259HRS MAY 8, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 30

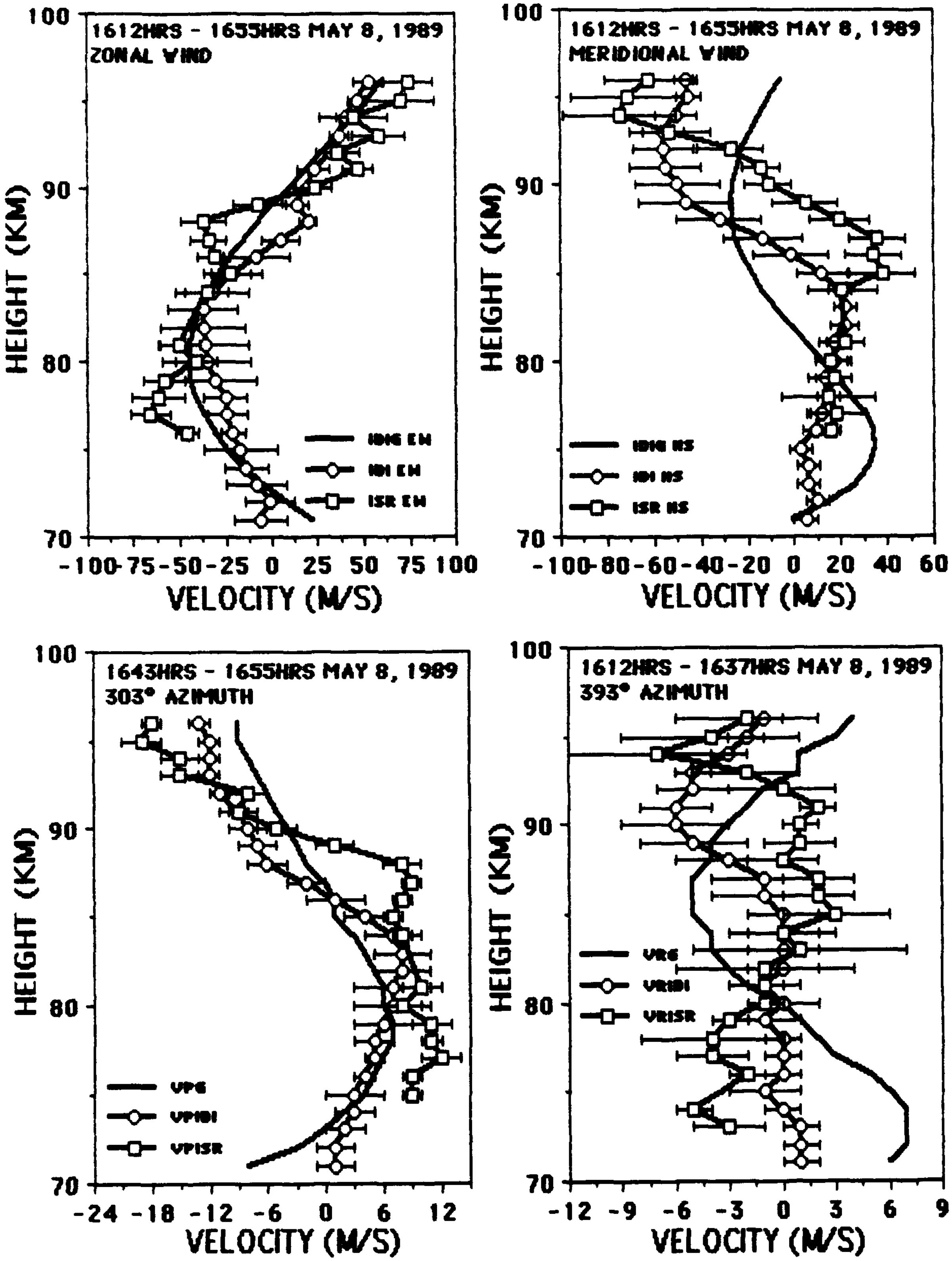
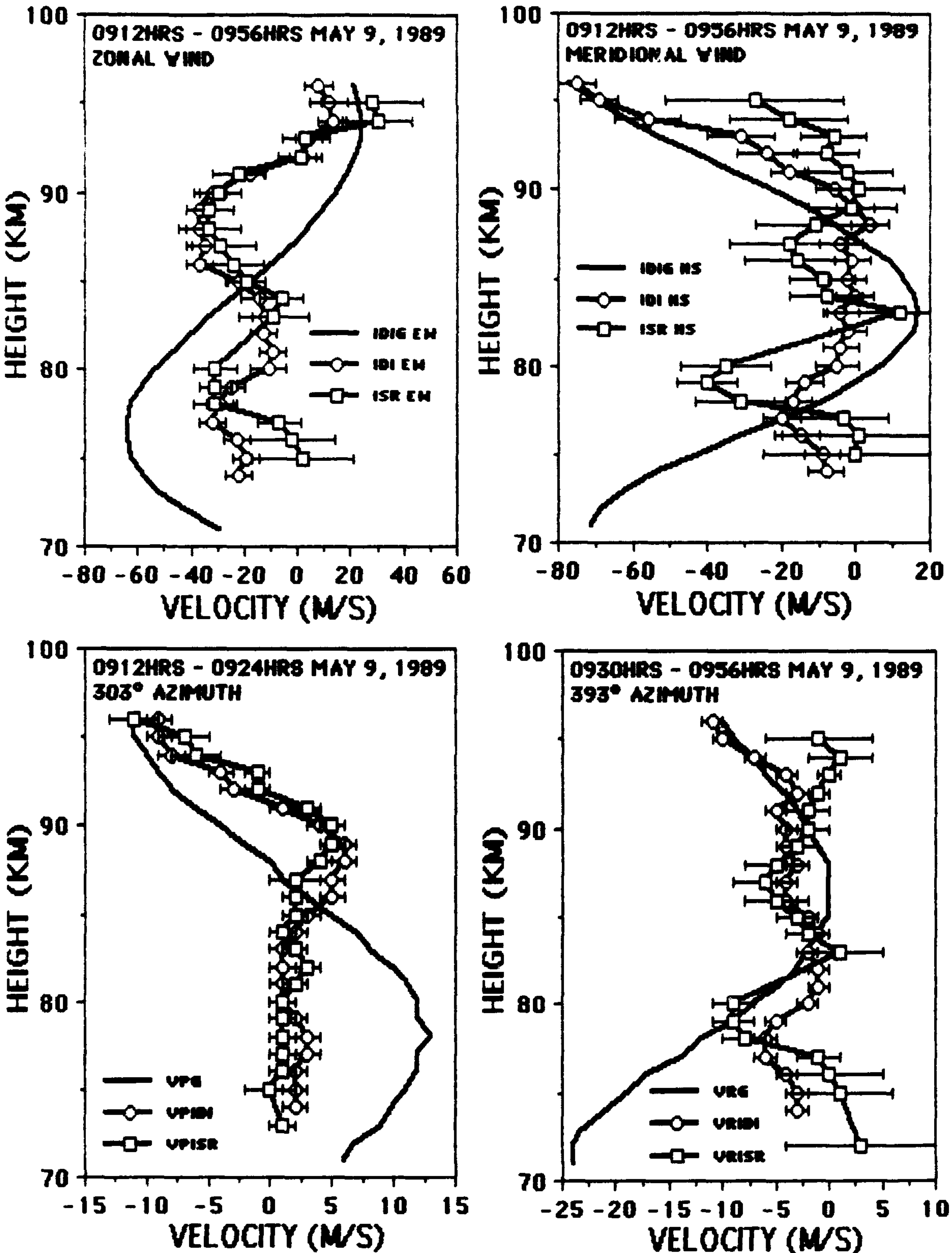

1612HRS - 1655HRS MAY 8, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
-100 -75 -50 -25 0 25 50 75 100
70
80
90
100
1612HRS - 1655HRS MAY 8, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
-100 -80 -60 -40 -20 0 20 40 60
1643HRS - 1655HRS MAY 8, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
-24 -18 -12 -6 0 6 12
1612HRS - 1637HRS MAY 8, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)
-12 -9 -6 -3 0 3 6 9

FIGURE 31



0912HRS - 0956HRS MAY 9, 1989
ZONAL WIND
IDIG EW
IDI EW
ISR EW
HEIGHT (KM)
VELOCITY (M/S)
0912HRS - 0956HRS MAY 9, 1989
MERIDIONAL WIND
IDIG NS
IDI NS
ISR NS
HEIGHT (KM)
VELOCITY (M/S)
0912HRS - 0924HRS MAY 9, 1989
303° AZIMUTH
VPG
VPIDI
VPISR
HEIGHT (KM)
VELOCITY (M/S)
0930HRS - 0956HRS MAY 9, 1989
393° AZIMUTH
VRG
VRIDI
VRISR
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 32

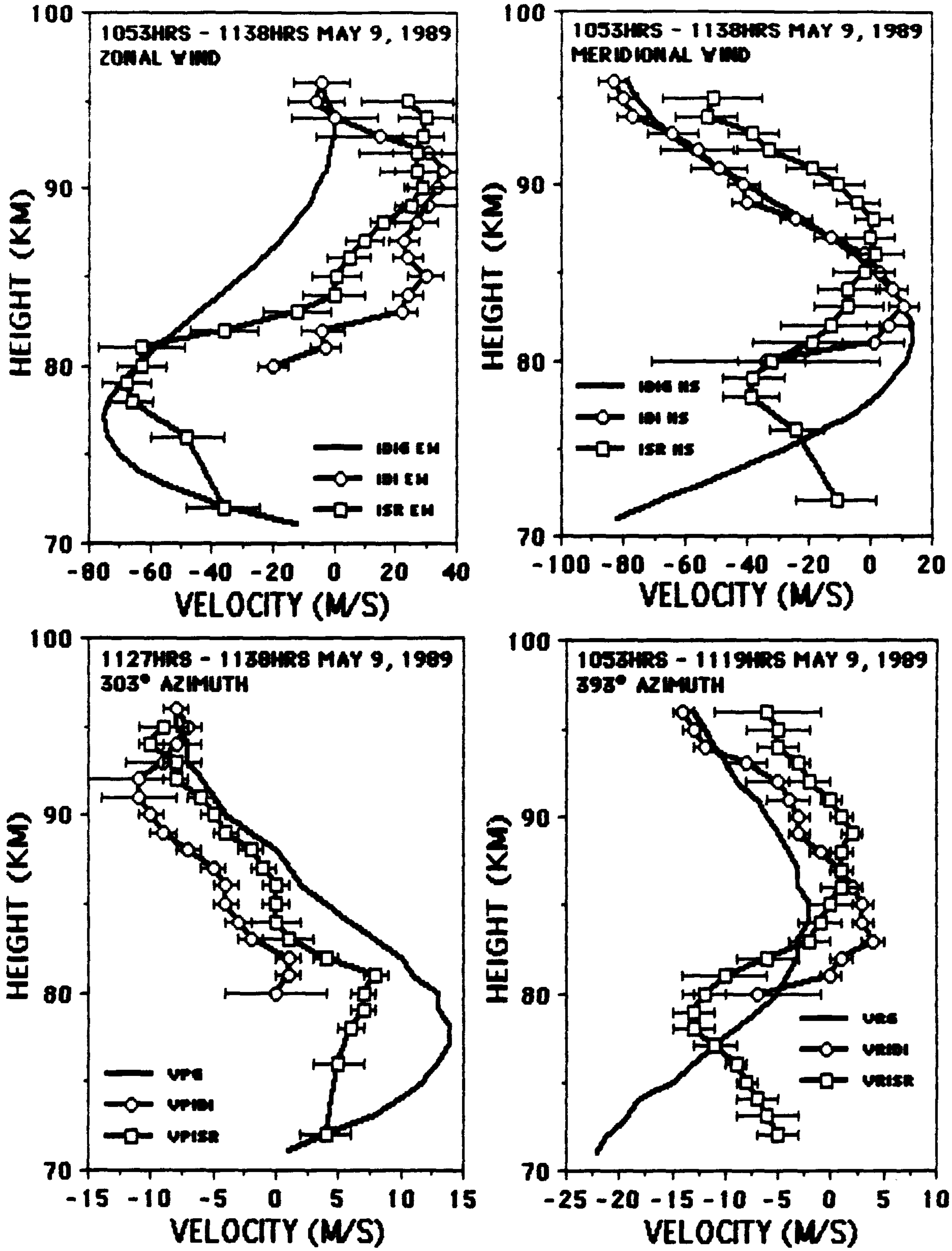

1053HRS - 1138HRS MAY 9, 1989
ZONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1053HRS - 1138HRS MAY 9, 1989
MERIDIONAL WIND
HEIGHT (KM)
VELOCITY (M/S)
1127HRS - 1138HRS MAY 9, 1989
303° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)
1053HRS - 1119HRS MAY 9, 1989
393° AZIMUTH
HEIGHT (KM)
VELOCITY (M/S)

FIGURE 33

IDI - FPS Comparisons

In this section, we present a preliminary look at six additional IDI - FPS comparisons not included in the Hines et al. (1993) paper,. The FPS data used here is from the Arecibo Radio Observatory Fabry-Perot Spectrometer as published in Bird et al. (1993).

In contrast to Hines et al., who compared the FPS data with the IDI winds at 94, 97 and 100km, we follow the method of Hernandez and Roper (1979), who, in comparing meteor radar and FPS winds, smoothed the meteor radar wind profiles with a green line profile to produce height averaged wind values. The smoothing profile used here weights the IDI data from 93 to 102km with the function graphed in Figure 34 (a gaussian of 7km half-width centered on 97km).

The FPS data was collected by stepping the spectrometer around eight cardinal points whose intersection with the 97km altitude level defined a circle of radius 170km, across which the line of sight drifts are averaged (allowing for a linear gradient with separation) to produce a horizontal wind vector every 21 minutes. The IDI scattering point parameter data (which are confined by rhe transmitter beamwidth to a circle of radius 20km at 97km) were analysed in 21 minute segments to produce altitude profiles which were then smoothed with the green line weighting function. We have not used the Hines et al. "discrepancy line" representation, but rather have shown our results in Figures 35 through 37 as zonal and meridional wind plots. We have also plotted the green line smoothed Groves winds (prevailing plus diurnal plus semidiurnal fits to the IDI data) for comparison.

Again, we have spent little time on the interpretation of these results. However, the IDI and FPS winds do show better agreement in the meridional than they do in the zonal (see Figure 38), which is just the opposite of the IDI - ISR comparisons! Of interest also is the considerably better agreemen t between the IDI and FPS winds after 0030 hours. The velocity differences are a factor of two smaller after 0030hrs than before (see, again, Figure 38). One might speculate, given the high shear with height of the IDI winds, that the green line maximum emmission altitude is not constant, at least before midnight. The solution is not that simple, however. The results from the night of May 3 - 4 (Figure 36) compare well throughout the night in the meridional component, and in the zonal component after midnight, but disagree by some 100m/s in the zonal at 20 - 2100hours! Obviously, these results warrant further investigation.

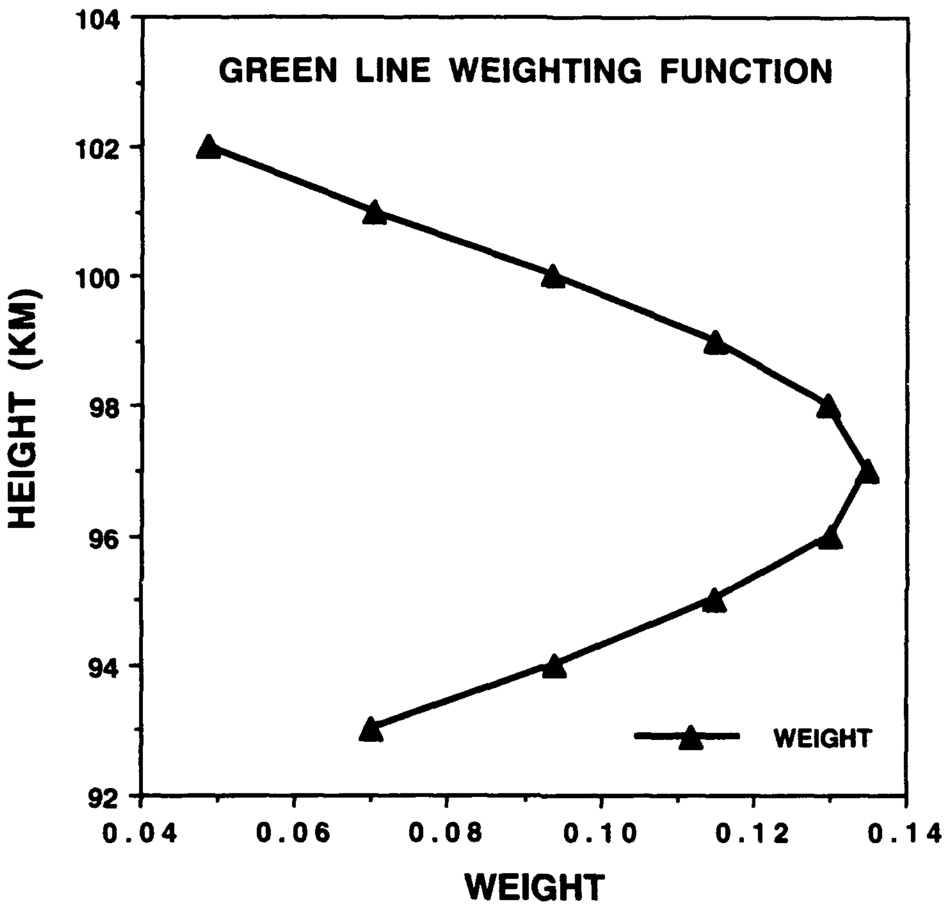

GREEN LINE WEIGHTING FUNCTION
104
102
100
98
96
94
92
HEIGHT (KM)
0.04
0.06
0.08
0.10
0.12
0.14
WEIGHT
WEIGHT

FIGURE 34

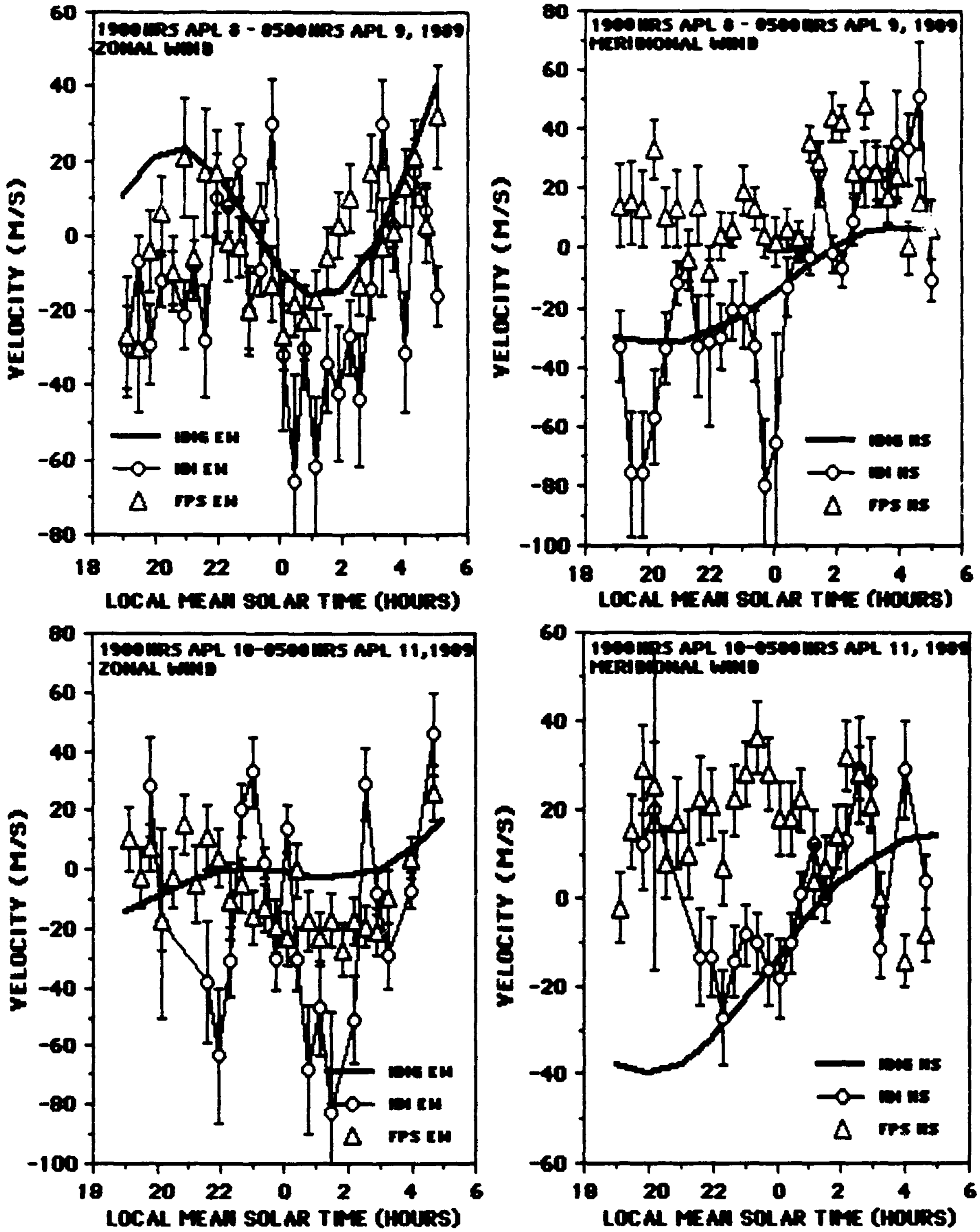

1900HRS APL 8 - 0500HRS APL 9, 1989
ZONAL WIND
MERIDIONAL WIND
1900HRS APL 10-0500HRS APL 11,1989
1900HRS APL 10-0500HRS APL 11, 1989
VELOCITY (M/S)
LOCAL MEAN SOLAR TIME (HOURS)

FIGURE 35

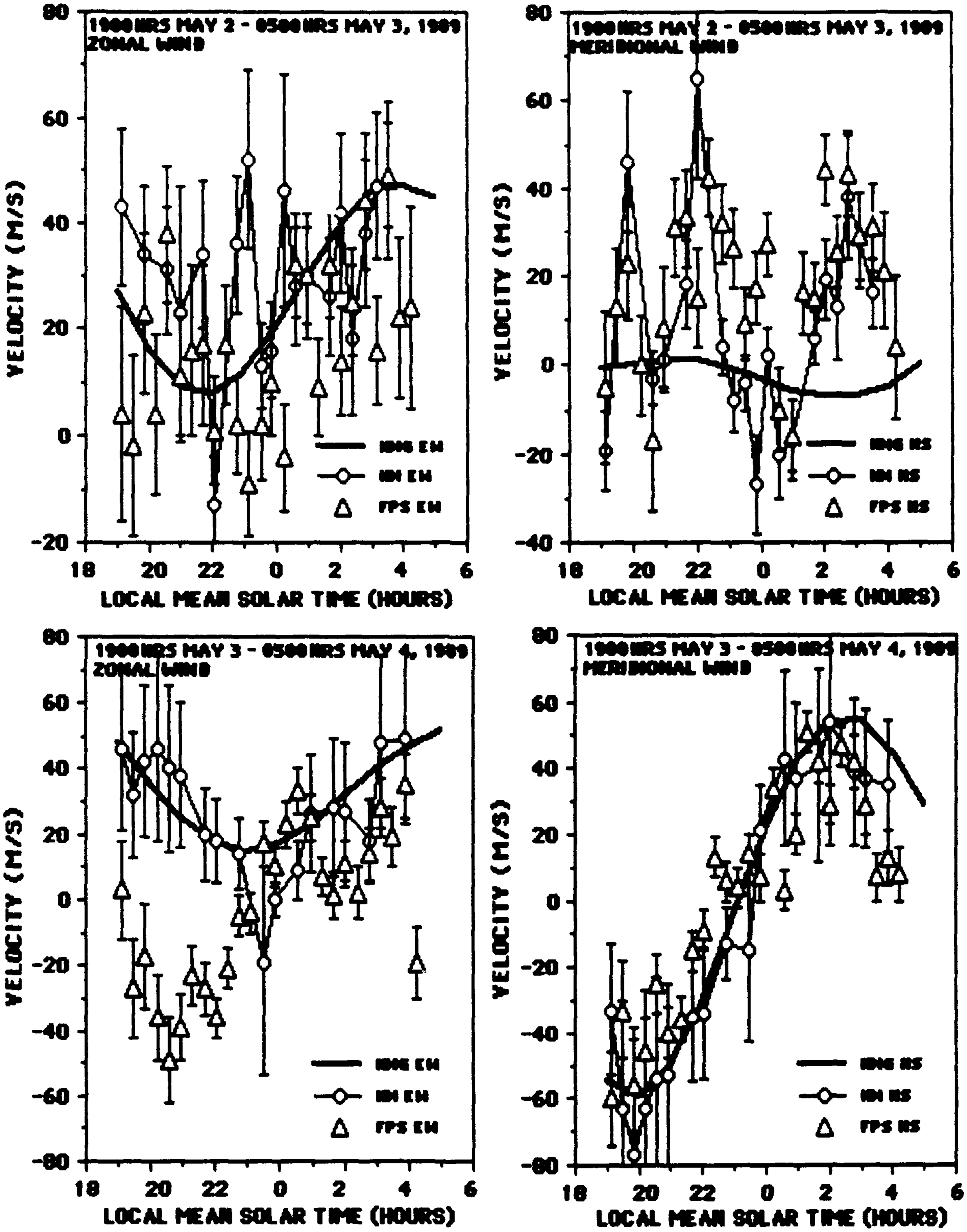

1900 HRS MAY 2 - 0500 HRS MAY 3, 1989
ZONAL WIND
1900 HRS MAY 2 - 0500 HRS MAY 3, 1989
MERIDIONAL WIND
1900 HRS MAY 3 - 0500 HRS MAY 4, 1989
ZONAL WIND
1900 HRS MAY 3 - 0500 HRS MAY 4, 1989
MERIDIONAL WIND
VELOCITY (M/S)
LOCAL MEAN SOLAR TIME (HOURS)
FPS EW
FPS NS

FIGURE 36

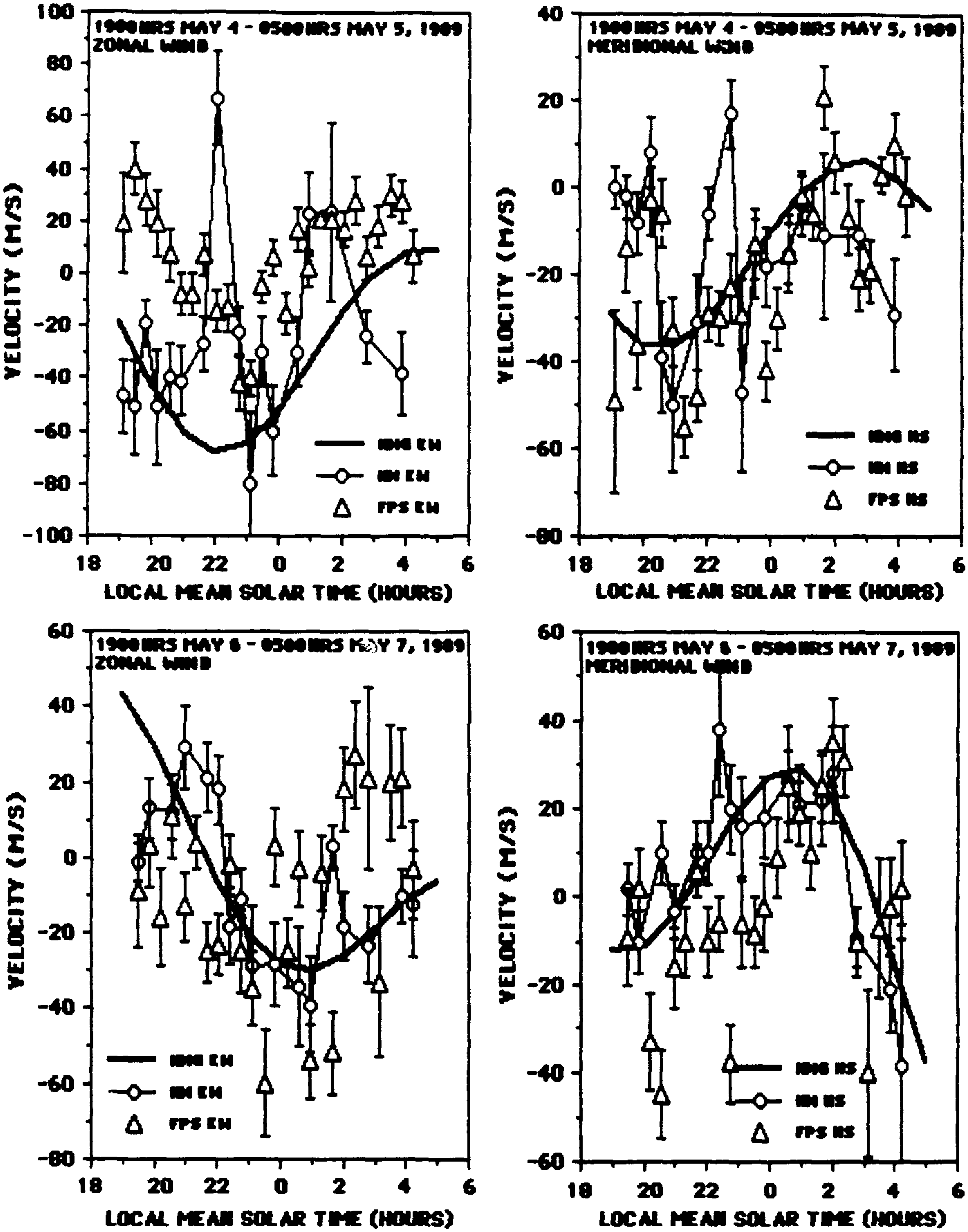

1900 HRS MAY 4 - 0500 HRS MAY 5, 1989
ZONAL WIND
1900 HRS MAY 4 - 0500 HRS MAY 5, 1989
MERIDIONAL WIND
1900 HRS MAY 6 - 0500 HRS MAY 7, 1989
ZONAL WIND
1900 HRS MAY 6 - 0500 HRS MAY 7, 1989
MERIDIONAL WIND
VELOCITY (M/S)
LOCAL MEAN SOLAR TIME (HOURS)
FPS EW
FPS NS

FIGURE 37

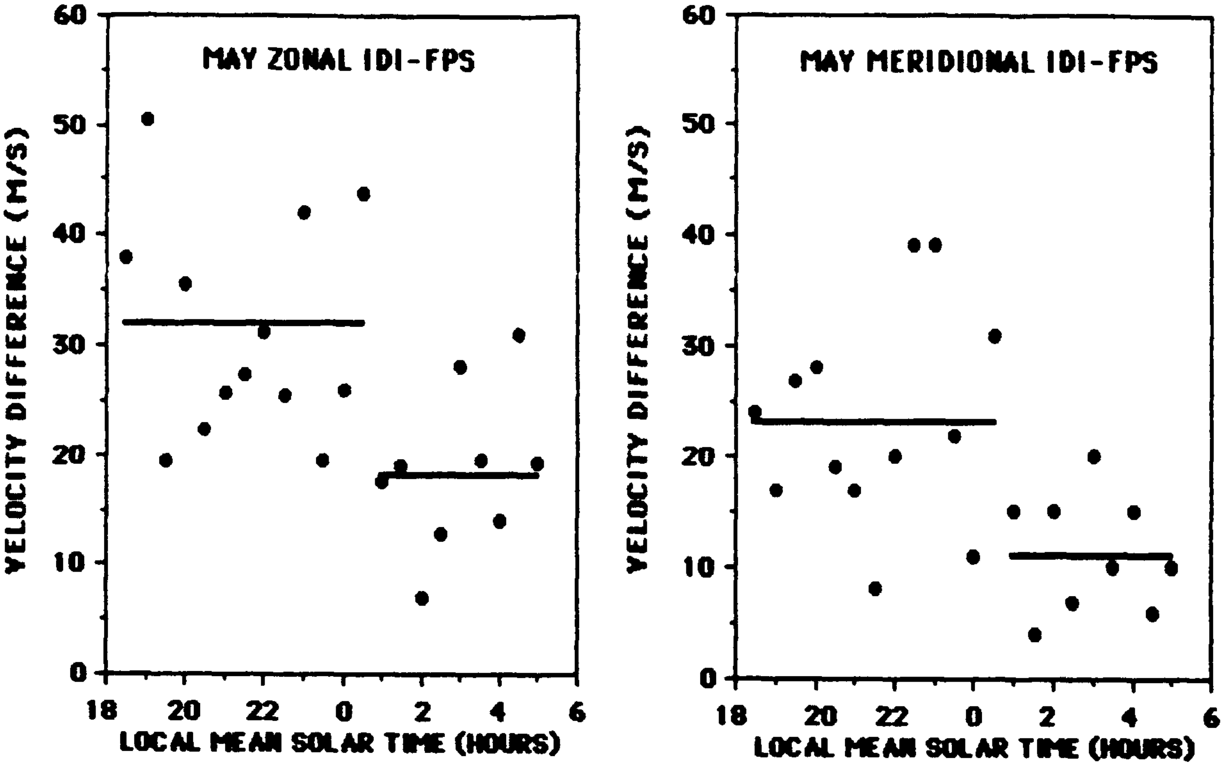


FIGURE 38

References

Bird, J.C., G.G. Shepherd and C.A. Tepley, "Comparison of lower thermospheric winds measured by a Polarizing Michelson Interferometer and a Fabry-Perot spectrometer during the AIDA campaign.," J. Atmos. Terrest. Phys., 55, 313-324, 1993

Groves, G.V., "A theory for determinimg upper atmospheric winds from radio observations of meteor trails," J. Atmos. Terrest. Phys., 16, 344-356, 1959

Hernandez, G and R.G. Roper," A comparison between radio meteor and airglow winds," J. Geomag. Geoelect., 31, 419-, 1979.

Hines, C.O., G.W. Adams, J.W. Brosnahan F.T. Djuth, M.P. Sulzer, C.A. Tepley and J.S. Van Baelen, "Multi-instrument observations of mesospheric motions over Arecibo: comparisons and interpretations", J. Atmos. Terrest. Phys., 55, 241-288, 1993

Roper, R.G., G.W. Adams and J.W. Brosnahan, "Tidal Winds at mesopause altitudes over Arecibo (18°N, 67°W), 5 - 11 April, 1989 (AIDA'89)," J. Atmos. Terrest. Phys., 55, 289-312, 1993

Turek, R. Scott, K.L. Miller, G.W. Adams, R.G. Roper and J.W. Brosnahan, "Mesospheric wind studies during AIDA Act '89: morphology and comparison of various techniques," in preparation.

Part 2 - The MAPSTAR Imaging Doppler Interferometry (IDI) radar Data Reduction and Comparative Analysis Computer Programs.

This second part of this two part report outlines the procedures to produce the data tables and graphs presented in Part 1.

The first section deals with the reduction and analysis procedures developed by Gene Adams and used by him and his students to reduce and analyse the MAPSTAR radar data at Utah State University. Input data are the digitized raw signal tapes (for the purposes of this report, those recorded as the outputs of each of the MAPSTAR radar receivers during AIDA Scene III - May 2 - 9, 1989, but applicable to any interval). Data was recorded in this form so that it could be subsequently analysed using algorithms appropriate to other partial reflection interferometry and spaced antenna techniques. The results of such other analyses are part of currently proceeding analyses, and will be reported later. Here, we concentrate on the Imaging Doppler Interferometry (IDI) analysis, details of which may be found in Brosnahan and Adams (1993).These programs, written in IBM PC compatible FORTRAN 77, determine the individual scattering point parameters (time of occurrence, height, line of sight velocity, azimuth and zenith angles and polarization of return) and use these to determine hourly mean zonal, meridional and vertical wind profiles, with errors, over selected height ranges. A detailed writeup of these procedures, produced by Gene only two months before his death, follows.

process2.mem

To: Files

From: Gene W. Adams

Subject: Explanation of GR-AIDA Tape Processing

This documentation initially follows a 20-point check list I made for myself. This memo will, I hope, explain enough of what's going on to get you through it. There's more after the 20-point list, but it's not crucial (you could redo the software if you had to).

Processing a tape on an IBM-PC involves reading the original raw-data 9-track tape, separating and somehow storing the information in the tape and record headers and the associated strings of data, inverting the byte order of the data (program named GAFIX.for), putting the data through a 4-pass filter (program named FLTRB.for) to remove spikes, removing the dc components of the signal, adjusting all 10 channels to have common gain, and correcting the phases of the 10 channels. The "calibrated" data are stored on dat and erasable optical (EO) disks, and on 9-track tape as needed to satisfy requests from others that want to reduce our data with their algorithms (Joel Van Baelen and Erhan Kudeki, so far). The IDI algorithms are then used (program named BSPPM.for) to determine the scattering-point parameters (SPPs) from the calibrated data. The bulk of the processing sequence can be done from a batch file (batch file named MOJO.bat), but manual intervention is still needed to identify tape-write errors, enter the tape number, etc. That's why my check list is long.

The quoted command at each number is from my 20-point check list:

1. "Boot up with \final disk in EO drive." An erasable-optical disk with a \final directory is where I collect the scattering-point parameter files for the tape just processed. They carry the time of each sounding (102.4sec/sounding) followed by the SPPs, ordered by altitude, lowest altitude first.

2. "Open and close Windows." Opening and closing Windows 3.0 seems to be required on my system to get the cursor to go fast. Otherwise, it's slow.

3. "Delete all files in \Buffer01 and \Buffer02." \Buffer01 and \Buffer02 are two subdirectories on the C: drive, each big enough to hold a tape's worth of data. Since the filter processes an entire tape at once, the tape in its various stages of processing are written from \Buffer01 to \Buffer02, back to \Buffer01, etc., until it's done. It starts with the raw data in \Buffer01, and finishes with the calibrated data in \Buffer02.

4. "Mound and load raw data tape on 9-track drive." An original data tape should never be read but once. They're far too precious and irreplaceable to do anything but immediately make a back-up. This is where we make the back-up.

5. "Put up post-it with tape number on it." The tape number (e.g., GR-235) is not automatically entered anywhere, so keep careful track and you can enter it in the appropriate place below.

6. "Run TapetoC.bat, which read tape files into C:\Buffer01." A copy of TapetoC.bat is attached. It's pretty simple, and names the files as read in as 1.mbr, 2.mbr, etc. The extensions are used to label the type of file. The first letter is m for medium frequency (the MAPSTAR radar) or v for vhf (the MENTOR radar). The second letter is b for binary or a for ascii. The third letter is r for raw data, t for time-domain-average (calibrated) data, etc.

7. "Invoke DAT software with C:>tpu -<return>, then FSFnn at the ~ prompt to advance DAT nn files to end." This assumes that you're putting the calibrated data tapes on a DAT tape, and that you've already got some files on the tape. This command just moves the DAT tape to the end of the nn files you've already got, and leaves it ready to record the next tape's worth of files (there's usually 46-50 files per tape).

8. "Examine \Buffer01; note odd-length files." If there was a tape-write error during the radar operation, you'll get a file that's longer than all the others, because two files get transmogrified into one. You want to skip these files, and can erase them if it seems better.

9. "Edit FixTape.bat to skip odd-length raw-data files." FixTape.bat (attached) invokes the fortran program GAFix.for (copy attached, along with subroutines RdHdr.for, Names.for, and WrHdr.for) to separate the data from the ascii header information, and write the byte-inverted data to \Buffer02 (which can be changed in the source code, where it is named "pathout".) FixTape.bat can be made to skip file number 29, for instance, by just putting a "goto 30" right before :29. Notice that it uses drive E:, which is my ram drive. Change this to whatever drive you have available so that GAFix has a place to work (it needs room for 2 copies of a single data file: less than 2 Mbytes.

10. "Edit MOJO.bat to write properly named files." MOJO.bat, in step number 5, names the list of sounding times (contianed in gafix.txt) and the SPPs (contianed in bsppm.mbs) according to the tape number (the GR number). It is entered manually at this point by editing MOJO.bat.

11. "Fill up paper tray." It takes about half a tray of paper if you're going to image the screen so you can tell if it all worked once you're done. It can make a catastrophic mistake and return you pure garbage, and if you haven't been monitoring the screen you probably won't know about it.

12. "Turn on screen copy." Cntrl-P toggles the print-screen command. Hit it again when you're all done.

13. "Run Mojo.bat (takes about 4hr 40min)."
13A. "Copy raw files from \Buffer01 to DAT (45min)." This gets a true back-up of the original data tape onto DAT. We will also save the calibrated tape, but just in case you ever want to change the calibration procedure...

13B. "Run FixTape.Bat". As explained above, this separates data from header info and inverts the byte order (if selected by a switch in the source code). An entire tape is processed, and the finished files written to \Buffer02. The file names, which carry the time of the sounding to the second, have been written to gafix.txt. The format is MMDDHHMM.SSt where MM = month, DD = day, HH = hour, MM = minute, SS = second, and t denotes calibrated time-domain data. Example: 04281345.17t. Time is corrected to WWV and to the center of the sounding, so time span is +/- 102.4/2sec around given time. The tape-header and sounding-header is read by GAFix, but is not handled by the software beyond this. You have to edit the header.dat file for each run. However, the time is kept by the name of the file, and generally nothing else changes, so this works out okay.

13C. "Run FltrB.exe." FltrB.for is attached, as are the subroutines FltrB1.for, FltrB2.for, FltrB3.for, and FltrB4.for. The batch file (Mojo.bat) copies the list of file names, which are also the times, from gafix.txt to FltrB.txt. FltrB.for just keeps the file-names straight and the buffers straight, and calls the four subroutines. FltrB1.for makes one pass through the tape to determine the dc average for each of the 20 channels, a second pass to determine the rms deviation of the averaage, and a third pass to recalculate the dc average excluding points whose deviation from the average is more than 3 sgima. A fourth pass is made to subtract the dc average from the data in each channel. FltrB2 removes noise burts, defined as single data points that are 20(?)dB or more above the running average. FltrB3 calculates the average power in each of the 20 channels. FltrB4 adjusts the signal strength in each of the 20 channels so that they all have the same average power, and the phases are adjusted relative to the x-quadrature channel of antenna/receiver #5, which is used as the phase reference). The phase corrections were determined by averaging over 2+ hours of solid daytime E region, and assuming that the echoes were, on the average, in the zenith. This clearly needs to be repeated and several episodes averaged to get better numbers.

13D. "Run Bsppm.exe." B is for batch and m is for medium-frequency. This will need rewriting when the MENTOR data comes in, but it's all in one subroutine and it's easy. The screen displays, one sounding at a time, the number of scattering points found at each altitude and the number rejected by the various criteria. The program is Bsppm.for, with subroutines BfftM.for (the FFT driver), FFT2cm.for (the FFT routine itself), Header (which reads header.dat, an ascii file that contains all the radar settings, and which you construct out of the existing one edited to be accurate for whatever you're doing), BtestM.for (which applies the IDI algorithms to see if a particular spectral window at a particular altitude is a scattering point or not), BSteerM.for (which steers the array towards scattering points to get the best estimate of their amplitudes and phases), and BSortM.for (which orders the scattering points by altitude, ready for output). The SPPs are written in binary to a file called BSppM.mbs (m = medium-frequency; b = binary; s = scattering-poing parameters). Notice that this one .mbs file contains the SPPs for the entire tape; the format is a 10-numbered time line (first number is -999) followed by many 10-numbered lines of SPPs. These are: altitude, radial velocity, E-W zenith angle, N-S zenith angle, E-W amplitude, E-W phase, N-S amplitude, N-S phase, E-W zentih-angle window (from BSppm, Btest2. This measures the noisiness of the scattering point), and N-S zenith-angle window. The rest of my programs (like for winds) don't work until you've put these SPP strings through a program (discussed later) that will gather them into, say, 30min intervals, then reorder them by altitude.

13E. "Copy gafix.txt and bsppm.mbs to D:\final." I kept a copy of each gafix.txt (list of sounding times) and the SPPs in BSppM.mbs (renamed to, say, GR245.txt and GR245.mbs) on my hard drive, as well as backing them up to both DAT and EO later on. Be sure you rename the files so that you have them named by the AIDA tape number.

13F. "Copy gafix.txt, \Buffer02 files, and BSppm.mbs to DAT." I backed up the SPPs, the file names, and the calibrated tap (which is in \Buffer02 at this point) to DAT. Bookkeeping is miserable; needs a better system than mine. Sure is handy and fast to recover from DAT though.

13G. "Run SppMoxl on bsppm.mbs." The most useful tape-at-a-time diagnostic I have found is to plot the radial velocity vs altitude for all the scattering points, separately for the ordinary, extraordinary, and linear modes. SppMoxl.for will separate the tape-files SPPs into O, X, and L for plotting.

14. "Turn off screen copy." The screen output to this point is fairly condensed and makes a good diagnostic; you should survey it carefully to ensure that the entire processing went sensibly (you got no error messages during FltrB; you got scattering points where you expected them in BSppM, etc.)

15. "Print gafix.txt." I keep the list of files (which are the sounding times) as part of my hard-copy documentation on each tape; the plots of O, X, and L are the rest of it.

16. "Edit Sppm21o.grf, Sppm21X.grf, and Sppm21L.grf.' I had to enter the tape number and the times onto each graph (3 per tape) manually by editing the Golden-Graphics .grf file. It's pretty fast, but I'm sure there are better ways.

17. "Run PlotOXL.bat to generate 3 "21" plots." A 21 plot is SPP #2 (radial velocity) on the abscissa and #1 (altitude) on the ordinate. These three plots and the list of files are the hard-copy documentation I keep on each tape. (See Brosnahan and Adams, 1992, for samples of these polarization-filtered plots.)

18. "Update DatLog.txt." Since the DAT tapes require external bookkeeping, this is where I do it, on a one-page list (attached) called DatLog.txt. There's got to be a better way than this.

19. "Reboot with propper 10-tape disk in EO drive." I store 10 calibrated tapes and the associated SPP files on EO disks. Overkill.

20. "Copy \Buffer02, gafix.txt, and Bsppm.mbs to EO." But I do it anyhow.

Now the SPPs are in a format that is sounding time (10 4-byte words) followed by n SPPs (n lines of 10 4-byte numbers). I have a program called SGroup.for (subroutines SName.for, SMerge.for, and BellSub.for, which rings the bell a few times when the program is finished--it can be a slow program) that will read through a series of GRxxx.mbs files, group them into user-specified intervals (e.g. 10min, 2hour, etc.), and reorder them by altitude. This makes it a lot faster for wind calculations, but if I were doing it over, I'd let the wind program make multiple passes instead. This program is too complicated, and I've had trouble with it lately (the SPPs would come out close to, but not always exactly, ordered by altitude. Usually the error would be a fraction of a km; sometimes I'd find a 40km point up around 90km.) The program is designed to take a variety of inputs, but it's really hacked together. Sorry.

There are two versions of the wind-calculation program available. These are WindErr.for (subroutines SppFltr.for, Header.for, WFV.for, and WFH.for) and Wind.for (subroutines inName.for, outName.for, Header.for, WFV.for, WFH.for, and PhFit.for). (WFV = Wind-Fit, Vertical; WFH = Wind-Fit, Horizontal.) The first will do the 129 repeats of the calculations, with each variable (radial velocity, altitude, horizontal location) taking on its extreme values. This is done to determine the error bars due to calculational uncertainty. The second program uses just the nominal values for the input parameters to calculate the wind profile, but also calculates the components (sort of) of the velocity variance vector. This was just getting developed, so it will take some work. Probably best to junk my calculation and do it right. I don't do an actual fit to the perpendicular and parallel components of the velocity variance vector, but count them only if they're within 90 degrees (binary sorting). Works okay, but needs to be a full fit (which looks easy) before you do anything with the velocity variance vectors (which I'm sure carry all the information there is about the breaking waves).

```
copyin c:\buffer01\1.mbr/b:16384
copyin c:\buffer01\2.mbr/b:16384
copyin c:\buffer01\3.mbr/b:16384
copyin c:\buffer01\4.mbr/b:16384
copyin c:\buffer01\5.mbr/b:16384
copyin c:\buffer01\6.mbr/b:16384
copyin c:\buffer01\7.mbr/b:16384
copyin c:\buffer01\8.mbr/b:16384
copyin c:\buffer01\9.mbr/b:16384
copyin c:\buffer01\10.mbr/b:16384

copyin c:\buffer01\11.mbr/b:16384
copyin c:\buffer01\12.mbr/b:16384
copyin c:\buffer01\13.mbr/b:16384
copyin c:\buffer01\14.mbr/b:16384
copyin c:\buffer01\15.mbr/b:16384
copyin c:\buffer01\16.mbr/b:16384
copyin c:\buffer01\17.mbr/b:16384
copyin c:\buffer01\18.mbr/b:16384
copyin c:\buffer01\19.mbr/b:16384
copyin c:\buffer01\20.mbr/b:16384

copyin c:\buffer01\21.mbr/b:16384
copyin c:\buffer01\22.mbr/b:16384
copyin c:\buffer01\23.mbr/b:16384
copyin c:\buffer01\24.mbr/b:16384
copyin c:\buffer01\25.mbr/b:16384
copyin c:\buffer01\26.mbr/b:16384
copyin c:\buffer01\27.mbr/b:16384
copyin c:\buffer01\28.mbr/b:16384
copyin c:\buffer01\29.mbr/b:16384
copyin c:\buffer01\30.mbr/b:16384

copyin c:\buffer01\31.mbr/b:16384
copyin c:\buffer01\32.mbr/b:16384
copyin c:\buffer01\33.mbr/b:16384
copyin c:\buffer01\34.mbr/b:16384
copyin c:\buffer01\35.mbr/b:16384
copyin c:\buffer01\36.mbr/b:16384
copyin c:\buffer01\37.mbr/b:16384
copyin c:\buffer01\38.mbr/b:16384
copyin c:\buffer01\39.mbr/b:16384
copyin c:\buffer01\40.mbr/b:16384

copyin c:\buffer01\41.mbr/b:16384
copyin c:\buffer01\42.mbr/b:16384
copyin c:\buffer01\43.mbr/b:16384
copyin c:\buffer01\44.mbr/b:16384
copyin c:\buffer01\45.mbr/b:16384
copyin c:\buffer01\46.mbr/b:16384
copyin c:\buffer01\47.mbr/b:16384
copyin c:\buffer01\48.mbr/b:16384
copyin c:\buffer01\49.mbr/b:16384
copyin c:\buffer01\50.mbr/b:16384
rew/unl
```

MOJO.BAT

```
:1                                  This copies the calibrated SPP data
cd \Buffer01
tpu dt dfs tfs b116384 dn"*.*"
cd \work                                                 to the DAT

:2
: FixTape runs GAFix on the .mbr files in Buffer01, and puts
: the fixed files into Buffer02.  Data file names are in
: gafix.txt.
Call FixTape

:3
: FltrB does the dc removal and phase correction for the list of
: files in FltrB.txt. The filtered files are written to Buffer02.
del \Buffer01\*.mbr
copy gafix.txt FltrB.txt
FltrB

:4
: BsppM runs the SPP program on the list of files in BsppM.txt,
: which is the same as gafix.txt.
copy gafix.txt BsppM.txt
BsppM

:5
copy gafix.txt d:\final\gr215.txt
copy bsppm.mbs d:\final\gr215.mbs

:6
tpu dt dfs tfs b116384 dn"gafix.txt"
cd \Buffer02
tpu dt dfs tfs b116384 dn"*.*"
cd \work
tpu dt dfs tfs b116384 dn"bsppm.mbs"

:7
sppmoxl bsppm.mbs

:8
sppmchk bsppm.mbs

Bell

time
```

```
del gafix.txt
echo off

:2
copy \buffer01\2.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:3
copy \buffer01\3.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:4
copy \buffer01\4.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:5
copy \buffer01\5.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:6
copy \buffer01\6.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:7
copy \buffer01\7.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:8
copy \buffer01\8.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:9
copy \buffer01\9.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:10
copy \buffer01\10.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:11
copy \buffer01\11.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:12
copy \buffer01\12.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:13
```

```
copy \buffer01\13.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:14
copy \buffer01\14.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:15
copy \buffer01\15.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:16
copy \buffer01\16.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:17
copy \buffer01\17.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:18
copy \buffer01\18.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:19
copy \buffer01\19.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:20
copy \buffer01\20.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:21
copy \buffer01\21.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:22
copy \buffer01\22.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:23
copy \buffer01\23.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:24
copy \buffer01\24.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:25
```

```
copy \buffer01\25.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:26
copy \buffer01\26.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:27
copy \buffer01\27.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:28
copy \buffer01\28.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:29
copy \buffer01\29.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:30
copy \buffer01\30.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:31
copy \buffer01\31.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:32
copy \buffer01\32.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:33
copy \buffer01\33.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:34
copy \buffer01\34.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:35
copy \buffer01\35.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:36
copy \buffer01\36.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:37
```

```
copy \buffer01\37.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:38
copy \buffer01\38.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:39
copy \buffer01\39.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:40
copy \buffer01\40.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:41
copy \buffer01\41.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:42
copy \buffer01\42.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:43
copy \buffer01\43.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:44
copy \buffer01\44.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:45
copy \buffer01\45.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:46
copy \buffer01\46.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:47
copy \buffer01\47.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:48
copy \buffer01\48.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:49
```

```
copy \buffer01\49.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

:50
copy \buffer01\50.mbr e:x.mbr
gafix e:x.mbr
del e:x.mbr

*******
goto 51
*******

:51
```

```
c
$Debug
c
      program GAFix
c
********************************************************************
*                                                                  *
*    IDI Radar Utility Program                                     *
*    Copyright 1990, Holodyne Limited 1986                         *
*    All Rights Reserved                                           *
*                          March 2, 1991                           *
*                                                                  *
********************************************************************
c
c
c  This program takes a data file from a MAPSTAR tape and creates
c  two files: a binary data files and an ascii header file.
c  Some information for the header file, such as the "TapeLabel",
c  must be user-input.
c  The data file inverts the byte order for PCs, if selected.
c  Data files are named by the date and time of each file:
c  YYMMHHMM.SSt.  Each header file is written to a YYHHMM.SSh
c  file and also to "Header.Dat".  The raw-data input file is specified
c  by the user on the command line.  "Pathout" is a character*12
c  variable that specifies the DOS path to the time-named output
c  files.  Header.dat is written to the default drive.
c
c  GAFix calls RdHdr, Names, and WrHdr
$Include:'GAFix.inc'
$Include:'Header.inc'
c
c  Invert is a flag for byte inversion.  Set Invert=0 for
c  sensible computers; -1 for PCs.
c
      icount = 0
      Invert = 1
      pathout = 'c:\buffer02\'
      open (1,file=' ',status='old',form='binary')
c
c  Read the header info
c
      read (1) (hdr(i),i=1,512)
c
c  FixHdr will extract from hdr all the radar-operating parameters.
c
      Call RdHdr
      icount = icount + 1
c     write (*,90001) icount,year,month,day,hour,minute,second
90001 format (1x,i2,'   TIME:                     ',6(i2,2x))
c
c  Names will generate the names of the output files from the date
c  and time info in the header.
c
      Call Names
c     write (*,90002) year,month,day,hour,minute,second
90002 format (' CORRECTED and CENTERED TIME:',6(i2,2x))

      write (*,90003) datafile
90003 format (' FILE BEING PREPARED: ',a24)
      open (2,file='gafix.txt')
```

```
20101 read (2,end=20102,fmt=90004) oldname
      go to 20101
90004 format (a24)

20102 backspace (2)
      write (2,90004) datafile
      close (2)
c
c  Write the Header file.
c
c       open (3,file=hdrfile,status='unknown')
        open (3,file='GAFix.hdr',status='unknown')
        Call WrHdr
        close (3)

c
c  Read the data.
c
      open (3,file=datafile,status='unknown',form='binary')
      PCount = 0
c     write (*,*) ' '
c     write (*,*) 'PROCESSING BLOCK # '
      do 10002 iblock=1,52
c     if ((iblock/13)*13 .ne. iblock) then
c     write (*,90201) iblock
c     else
c     write (*,90202) iblock
c     endif
90201 format (1x,i2,\)
90202 format (1x,i2)
      read (1) ((data(pulse,byte),
     1                byte=1,4),pulse=1,3968)
      PCount = PCount + 3968
c
c  If Invert=1, invert the byte order.
c
      if (Invert .eq. 1) then
      do 10001 pulse=1,3968
      hold = data(pulse,1)
      data(pulse,1) = data(pulse,4)
      data(pulse,4) = hold
      hold = data(pulse,2)
      data(pulse,2) = data(pulse,3)
      data(pulse,3) = hold
10001 continue
      endif
c
c  Write the data.
c
      if (PCount .lt. 206336) then
      write (3) ((data(pulse,byte),
     1                 byte=1,4),pulse=1,3968)
      read(1) (hdr(i),i=1,512)
      else
      write (3) ((data(pulse,byte),
     1                 byte=1,4),pulse=1,2432)
      go to 20002
      endif
10002 continue
20002 close (1)
```

```
close (2)
close (3)
close (4)
end
```

```
c
$Debug
c
      Subroutine RdHdr
c
*****************************************************************
*                                                               *
*    IDI Radar Utility Program                                  *
*    Copyright 1991, Holodyne Limited 1986                      *
*    All Rights Reserved                                        *
*                      March 1, 1991                            *
*                                                               *
*****************************************************************
c
c
c  This subroutine takes a 512-integer header string and reads
c  from it the radar operating parameters.  All parameters are
c  converted to MKS on input.
c
c  Link: GAFix RdHdr Names WrHdr
$Include:'GAFix.inc'
$Include:'Header.inc'

      do 10001 i=1,512
      hdr(i) = hdr(i) - 48
10001 continue
c
c  First Line of Header:
c
      SoundingNumber = hdr(3)*1000 + hdr(4)*100 + hdr(5)*10 + hdr(6)
      Year = hdr(14)*10 + hdr(15)
      Month = hdr(16)*10 + hdr(17)
      Day = hdr(18)*10 + hdr(19)
      Hour = hdr(21)*10 + hdr(22)
      Minute = hdr(23)*10 + hdr(24)
      Second = hdr(25)*10 + hdr(26)
c      write (SiteName,90001) hdr(i),i=33,46)
c90001 format (i1)
c      write (*,'(a14)') SiteName
      SiteName = 'Islote, P.R.  '
      DataType = '0001'
      DataMode = '0003'
      FFTPts = hdr(61)*1000 + hdr(62)*100
     1       + hdr(63)*10   + hdr(64)
c
c  Second Line of Header:
c
      Freq1 = hdr(78)*1e8 + hdr(79)*1e7 + hdr(80)*1e6
     1      + hdr(81)*1e5 + hdr(82)*1e4 + hdr(83)*1e3
     2      + hdr(84)*1e2 + hdr(85)*1e1 + hdr(86)
      Freq2 = hdr(91)*1e8 + hdr(92)*1e7 + hdr(93)*1e6
     1      + hdr(94)*1e5 + hdr(95)*1e4 + hdr(96)*1e3
     2      + hdr(97)*1e2 + hdr(98)*1e1 + hdr(99)
      PulseDuration = hdr(104)*1e-4 + hdr(105)*1e-5 + hdr(106)*1e-6
     1              + hdr(107)*1e-7 + hdr(108)*1e-8 + hdr(109)*1e-9
      FFTPeriod =  hdr(115)*1e+2 + hdr(116)*1e+1 + hdr(117)
     1          + hdr(118)*1e-1 + hdr(119)*1e-2 + hdr(120)*1e-3
      NumCohAve = hdr(125)*1e5 + hdr(126)*1e4 + hdr(127)*1e3
     1          + hdr(128)*1e2 + hdr(129)*1e1 + hdr(130)
c
```

```
c  Third Line of Header:
c
      NumRangeGates = hdr(136)*1000 + hdr(137)*100
     1              + hdr(138)*10   + hdr(139)
      NumRx = hdr(144)*10 + hdr(145)
      PRP = hdr(151)*1e-2 + hdr(152)*1e-3 + hdr(153)*1e-4
     1    + hdr(154)*1e-5 + hdr(155)*1e-6 + hdr(156)*1e-7
     2    + hdr(157)*1e-8 + hdr(158)*1e-9
c
c  Offset is the offset to the bottom of the first range-gate.
c  This is set by the radar operator, picked up automatically
c  by the system, and written to the header.  Offset in seconds:
c
      Offset = hdr(166)*1e-4 + hdr(167)*1e-5 + hdr(168)*1e-6
     1       + hdr(169)*1e-7 + hdr(170)*1e-8 + hdr(171)*1e-9
c
c  Delay is the equipment delay.  This depends on pulse length,
c  cable length, etc.  In Islote it was 7.4km.  This can
c  be entered by the operator into the radar's header, but that
c  didn't happen in Islote.
c
c      Delay = hdr(173)*1e-4 + hdr(174)*1e-5 + hdr(175)*1e-6
c     1       + hdr(176)*1e-7 + hdr(177)*1e-8 + hdr(178)*1e-9
c
      Delay =  7.4e3
      AltMin = Offset*1.5e8 - Delay
c
c  SS is the sample (range-gate) spacing.  This
c  is set by the radar operator, picked up automatically by the
c  system, and written to the header.
c
      SS = hdr(183)*1e-4 + hdr(184)*1e-5 + hdr(185)*1e-6
     1  + hdr(186)*1e-7 + hdr(187)*1e-8 + hdr(188)*1e-9
      AltStep = SS*1.5e8
      RxAttn = 0
      RxPolarization = 'L1'
c
c  Fourth Line of Header
c
      TxPower = 100000
      do 10002 i=1,10
      RxMask(i) = 1
10002 continue
      TapeLabel = 'SF030'
      return
      end
```

```
c
$Debug
c
      Subroutine Names
c
*******************************************************************
*                                                                 *
*    IDI Radar Utility Program                                    *
*    Copyright 1990, Holodyne Limited 1986                        *
*    All Rights Reserved                                          *
*                         March 1, 1991                           *
*                                                                 *
*******************************************************************
c
c
c  This subroutine creates the names for data and header files
c  from the header information.  Files are named by time at
c  center of the sounding, with clock correction.
c  Link: GAFix RdHdr Names WrHdr
$Include:'GAFix.inc'
$Include:'Header.inc'
      dimension DaysPerMo(12),DaysInMonth(12)
      character*2 ascmonth,ascday,aschour,ascminute,ascsecond
      real*4 Timecorrection
      real*8 BigTime
      integer*4 DaysPerMonth,DaysInMonth,spermin,sperhr,sperday
      character*1 char1,char2,char3
      data DaysPerMonth /31,28,31,30, 31, 30, 31, 31, 30, 31, 30, 31/
      data DaysInMonths  /0,31,59,90,120,151,181,212,243,273,304,334/

      char1 = '.'
      char2 = 't'
      char3 = 'h'

      spermin = 60
      sperhr = 3600
      sperday = 86400

      TimeCorrection = +40

      BigTime = Second + Minute*spermin + Hour*sperhr
     1        + (Day+DaysInMonths(month))*sperday
     1        + FFTPeriod/2 + TimeCorrection

      do 10002 i=1,11
      If (BigTime .lt. DaysInMonths(i+1)*SperDay) go to 20001
10002 continue
      write (*,*) 'Looks like a New Year to Me!'
      return

20001 Month = i
      BigTime = BigTime - sperday*DaysInMonths(month)

      Day = int(BigTime/sperday)
      BigTime = BigTime - Day*sperday
      Hour = int(BigTime/sperhr)
      BigTime = BigTime - Hour*sperhr
      Minute = int(BigTime/spermin)
      second = BigTime - Minute*spermin
c
```

```
c  Correct for temporal wrap-around.
c
20002 if (second .ge. 60) then
      Second = Second - 60
      Minute = Minute + 1
      go to 20002
      endif

20003 if (Minute .ge. 60) then
      Minute = Minute - 60
      Hour = Hour + 1
      go to 20003
      endif

20004 if (Hour .ge. 24) then
      Hour = Hour - 24
      Day = Day + 1
      go to 20004
      endif

20005 if (Day .gt. DaysPerMonth(Month)) then
      Day = Day - DaysPerMonth(Month)
      Month = Month + 1
      go to 20005
      endif

      if (month .lt. 10) then
      write (ascmonth,90001) '0',month
90001 format (a1,i1)
      else
      write (ascmonth,90002) month
90002 format (i2)
      endif

      if (day .lt. 10) then
      write (ascday,90001) '0',day
      else
      write (ascday,90002) day
      endif

      if (hour .lt. 10) then
      write (aschour,90001) '0',hour
      else
      write (aschour,90002) hour
      endif

      if (minute .lt. 10) then
      write (ascminute,90001) '0',minute
      else
      write (ascminute,90002) minute
      endif

      if (second .lt. 10) then
      write (ascsecond,90001) '0',second
      else
      write (ascsecond,90002) second
      endif

      write (datafile,90003)
     1 pathout,ascMonth,ascDay,ascHour,ascMinute,
```

```
     2 char1,ascsecond,char2

      write (hdrfile,90003)
     1 pathout,ascMonth,ascDay,ascHour,ascMinute,
     2 char1,ascsecond,char3

90003 format (24a)
      return
      end
```

```
c
$Debug
c
      Subroutine WrHdr
c
*****************************************************************
*                                                               *
*    IDI Radar Utility Program                                  *
*    Copyright 1990, Holodyne Limited 1986                      *
*    All Rights Reserved                                        *
*                        May 5, 1990                            *
*                                                               *
*****************************************************************
c
c  This subroutine writes the header file.
c  Link: GAFix RdHdr Names WrHdr
$Include:'GAFix.inc'
$Include:'Header.inc'

      write (3,90001) SoundingNumber
90001 format (1x,i4,20x,'SoundingNumber')

      write (3,90002) Year
90002 format (1x,i2,22x,'Year')

      write (3,90003) Month
90003 format (1x,i2,22x,'Month')

      write (3,90004) Day
90004 format (1x,i2,22x,'Day')

      write (3,90005) Hour
90005 format (1x,i2,22x,'Hour')

      write (3,90006) Minute
90006 format (1x,i2,22x,'Minute')

      write (3,90007) Second
90007 format (1x,i2,22x,'Second')

      write (3,90008) SiteName
90008 format (1x,a14,10x,'SiteName')

      write (3,90009) DataType
90009 format (1x,a4,20x,'DataType')

      write (3,90010) DataMode
90010 format (1x,a4,20x,'DataMode')

      write (3,90011) FFTPts
90011 format (1x,i4,20x,'FFTPts')

      write (3,90012) Freq1
90012 format (1x,1Pe12.5,12x,'Freq1 (Hz)')

      write (3,90013) Freq2
90013 format (1x,1Pe12.5,12x,'Freq2 (Hz)')

      write (3,90014) PulseDuration
90014 format (1x,1Pe12.5,12x,'PulseDuration (seconds)')
```

```
      write (3,90015) FFTPeriod
90015 format (1x,1Pe12.5,12x,'FFTPeriod (seconds)')

      write (3,90016) NumCohAve
90016 format (1x,1Pe12.5,12x,'NumCohAve')

      write (3,90017) NumRangeGates
90017 format (1x,i4,20x,'NumRangeGates')

      write (3,90018) NumRx
90018 format (1x,i4,20x,'NumRx')

      write (3,90019) PRP
90019 format (1x,1Pe12.5,12x,'PRP (seconds)')

      write (3,90020) AltMin
90020 format (1x,1Pe12.5,12x,'AltMin (meters)')

      write (3,90021) AltStep
90021 format (1x,1Pe12.5,12x,'AltStep (meters)')

      write (3,90022) RxAttn
90022 format (1x,i4,20x,'RxAttn')

      write (3,90023) RxPolarization
90023 format (1x,a2,22x,'RxPolarization')

      write (3,90024) TxPower
90024 format (1x,1Pe12.5,12x,'TxPower (Watts)')

      write (3,90025) (RxMask(i),i=1,NumRx)
90025 format (10(1x,i1),5x,'RxMask')

      write (3,90026) TapeLabel
90026 format (1x,a5,19x,'TapeLabel')

      close (2)
      return
      end
```

GAFix.inc

```
c
c  GAFix.inc
c
      common /GAFix1/ hdr(512),data(3968,4)
      common /GAFix2/ hold,invert,range,pathout
      integer*1 hdr,data,hold
      integer*2 invert,range,pulse,byte
      integer*4 PCount
      character*12 pathout
```

Header.inc

```
c
c  Header.inc
c
      common /H/ SoundingNumber,Year,Month,Day,Hour,Minute,Second,
     1               SiteName,DataType,DataMode,FFTpts,Freq1,Freq2,
     2               PulseDuration,FFTPeriod,NumCohAve,NumRangeGates,
     3               NumRx,PRP,AltMin,AltStep,RxAttn,RxPolarization,
     4               TxPower,RxMask(10),datafile,TapeLabel
      integer*4 SoundingNumber,Year,Month,Day,Hour,Minute,Second
      character*14 SiteName
      character*4 DataType,DataMode
      integer*4 FFTpts
      real*4 Freq1,Freq2,PulseDuration,FFTPeriod,NumCohAve
      integer*4 NumRangeGates,NumRx
      real*4 PRP,AltMin,AltStep
      integer*4 RxAttn
      character*2 RxPolarization
      real*4 TxPower
      integer*4 RxMask
      character*24 datafile,hdrfile,snake
      character*5 TapeLabel
```

```
c
$DEBUG
c
      program FltrB
C
C   FltrB ( = Filter B) is a replacement for Fltr to use when you
c   can't apply the pulse-256 correction, i.e., when you've lost
c   track, due to missing files or whatever, of the pulse-256 offset.
c   FltrB is a 4-pass process that will (1) remove the local DC
c   offsets for each file, range, receiver, and quadrature channel,
c   (2) remove single-pulse noise spikes, (3) calculate the receiver
c   receiver gains, and (4) adjust the gains and phases of the receivers.
c   A list of input files are expected in FltrB.txt.
c
C   Link FltrB+Header+FltrB1+FltrB2+FltrB3+FltrB4
C
$Include:'Header.inc'
$Include:'FltrB.inc'
      Dimension FileA(60),FileB(60)
      CHARACTER*24 FileA,FileB

c
c   get the names of the input and output files.
c
      open (1,file='FltrB.txt',status='old')
      ifile = 1
20001 read (1,end=20002,fmt=90001) FileA(ifile)
90001 format (a24)
      ifile = ifile + 1
      go to 20001
20002 Numfiles = ifile - 1
      datafile = fileA(1)
      call Header
      write (*,*) 'NumFiles = ',NumFiles
      close (1)
      do 10001 ifile = 1,NumFiles
      Snake = FileA(ifile)
      write (FileB(ifile),90002) 'c:\Buffer01\',Snake(13:24)
90002 format (a12,a12)
      write (*,*) ifile,'  ',FileA(ifile),'  ',FileB(ifile)
10001 continue

*************************************************************
c
c Filter #1.  Remove local DC offsets.
c
      do 10011 ifile = 1,NumFiles
      infile(ifile) = FileA(ifile)
      outfile(ifile) = FileB(ifile)
10011 continue
      write (*,*) 'FltrB1:'
      Call FltrB1

*************************************************************
c
c Filter #2.  Remove noise spikes.
c
      do 10021 ifile = 1,NumFiles
      infile(ifile) = FileB(ifile)
      outfile(ifile) = FileA(ifile)
```

```
10021 continue

      write (*,*) 'FltrB2:'
      Call FltrB2

*****************************************************************
c
c  Filter #3.  Calculate receiver gains.
c
      do 10031 ifile = 1,NumFiles
      infile(ifile) = FileA(ifile)
      outfile(ifile) = FileB(ifile)
10031 continue

      write (*,*) 'FltrB3:'
      Call FltrB3

*****************************************************************
c
c  Filter #4.  Adjust receiver gains and phases.
c
      do 10041 ifile = 1,NumFiles
      infile(ifile) = FileB(ifile)
      outfile(ifile) = FileA(ifile)
10041 continue

      write (*,*) 'FltrB4:'
      Call FltrB4
*****************************************************************

90909 end
```

```
c
$DEBUG
c
      Subroutine FltrB1
C
C   FltrB1( = Filter #B1) will identify and remove DC offsets.
c
C   Link FltrB+Header+FltrB1+FltrB2+FltrB3+FltrB4
C
$Include:'Header.inc'
$Include:'FltrB.inc'
      Dimension power(10,512),pdB(10,512),
     1          RunAve(40,10),dc1(10,2),dc2(10,2),
     2          NumAve(10),erms(10,2),NumNoise(10)
      Real*4 x1,x2,y1,y2,dc1,dc2,erms,errorx,errory,alpha,beta,sigma
      Integer*4 Finish,NumBig,pend,NumAve,NumNoise
c
c  Alpha is the inverse width of the exponential running average.
c  Sigma*erms is the quadrature error criterion for inclusion in
c  the dc average.
c
      Alpha = 0.1
      Sigma = 2
      do 10402 ifile = 1,Numfiles
      if (((ifile/25)*25 .eq. ifile) .or. (ifile .eq. Numfiles)) then
      write (*,90002) ifile
      else
      write (*,90001) ifile
      endif
90001 format (1x,i2,\)
90002 format (1x,i2)

      open (1,file=infile(ifile),status='old',form='binary')
      open (2,file=outfile(ifile),status='unknown',form='binary')
c     write (*,*) 'In FltrB1: ifile,outfile = ',ifile,outfile(ifile)
      do 10401 range = 1,NumRangeGates
c
c  3-pass dc average.  First Pass: get raw dc average (dc1).
c
      do 10101 rx = 1,NumRx
      NumAve(rx) = 0
      NumNoise(rx) = 0
      do 10101 quad = 1,2
      dc1(rx,quad) = 0
      dc2(rx,quad) = 0
      DCave(rx,quad) = 0
10101 continue
      read (1) (((data(rx,pulse,quad),quad=1,2),
     1                          pulse=1,FFTPts),
     2                              rx=1,NumRx)
      do 10102 rx = 1,NumRx
      do 10102 pulse = 1,FFTPts
      do 10102 quad = 1,2
      dc1(rx,quad) = dc1(rx,quad) + float(data(rx,pulse,quad))
10102 continue
      do 10103 rx = 1,NumRx
      do 10103 quad = 1,2
      dc1(rx,quad) = dc1(rx,quad)/FFTPts
10103 continue
c
```

```
c  Second pass: get rms deviation from average.
c
      do 10201 rx = 1,NumRx
      do 10201 pulse = 1,FFTPts
      do 10201 quad = 1,2
      erms(rx,quad) = erms(rx,quad)
     1   + (dc1(rx,quad)-float(data(rx,pulse,quad)))**2
10201 continue
      do 10202 rx = 1,NumRx
      do 10202 quad = 1,2
      erms(rx,quad) = sqrt(erms(rx,quad)/FFTPts)
10202 continue
c
c  Third pass: recalculate the dc average; exclude points that
c  lie more than sigma times the rms deviation.
c
      do 10301 rx = 1,NumRx
      do 10301 pulse = 1,FFTPts
      errorx = abs(dc1(rx,1)-float(data(rx,pulse,1)))
      errory = abs(dc1(rx,2)-float(data(rx,pulse,2)))
      if (errorx .lt. Sigma*erms(rx,1) .and.
     1    errory .lt. Sigma*erms(rx,2)) then
      dc2(rx,1) = dc2(rx,1) + float(data(rx,pulse,1))
      dc2(rx,2) = dc2(rx,2) + float(data(rx,pulse,2))
      NumAve(rx) = NumAve(rx) + 1
      endif
10301 continue
      do 10302 rx = 1,NumRx
      do 10302 quad = 1,2
      if (NumAve(rx) .gt. 0) then
      dc2(rx,quad) = dc2(rx,quad)/float(NumAve(rx))
      else
      write (*,*) 'rx,quad,NumAve = ',rx,quad,NumAve(rx)
      endif
10302 continue
      do 10303 rx = 1,NumRx
      NumAve(rx) = 0
      do 10303 pulse = 1,FFTPts
      do 10303 quad = 1,2
      data(rx,pulse,quad) = data(rx,pulse,quad) - nint(dc2(rx,quad))
10303 continue

      write (2) (((data(rx,pulse,quad),quad=1,2),
     1                              pulse=1,FFTPts),
     2                                 rx=1,NumRx)
10401 continue
      close (1)
      close (2)
10402 continue

      return
      end
```

```
c
$DEBUG
c
      Subroutine FltrB2
C
C   FltrB2( - Filter #B2) will identify and remove noise bursts.
c   By definition here,
c   an increase in signal power in one receiver is a noise burst if
c   its power exceed the criterion for a single pulse. (Fix this!!!)
c   The noise-burst data are replaced with a linear
c   interpolation.
c   Receivers are treated individually for noise elimination.
c   FltrB2 uses an exponential running average to look for noise
c   bursts.  To get starting values for the running
c   average of each sounding, we use the arithmetic average.
c   Beta is the number of dB above the running average for the
c   point to be considered too big.
c
C   Link FltrB+Header+FltrB1+FltrB2+FltrB3+FltrB4
C
$Include:'Header.inc'
$Include:'FltrB.inc'
      Common power(10,512),pdB(10,512)
      Dimension RunAve(40,10),NumAve(10),NumNoise(10)
      Real*4 x1,x2,y1,y2,dc1,dc2,erms,error,alpha,beta,sigma
      Integer*4 Finish,NumBig,pend,NumAve,NumNoise
c
c  Alpha is the inverse width of the exponential running average.
c  Beta is the number of dB above the running average for a point to
c  be declared a noise burst, and removed from the data.
c
      Alpha - 0.1
      Beta - 10

      do 10409 ifile - 1,Numfiles
      if (((ifile/25)*25 .eq. ifile) .or. (ifile .eq. Numfiles)) then
      write (*,90002) ifile
      else
      write (*,90001) ifile
      endif
90001 format (1x,i2,\)
90002 format (1x,i2)

      open (1,file-infile(ifile),status-'old',form-'binary')
      if (ifile .lt. Numfiles)
     1  open (2,file-infilein(ifile+1),status-'old',form-'binary')
      open (3,file-outfile(ifile),status-'old',form-'binary')
c     write (*,*) 'FltrB2: ifile,infile,outfile - ',
c    1                        ifile,infile(ifile),outfile(ifile)

      do 10408 range - 1,NumRangeGates
*************************************************************************
c
c                     Fill the Arrays
c
c  Fill the Left-Hand Side of the Pulse String from file #1
c  and the RHS from file #2.  On last file, skip #2.
c
      read (1) (((data(rx,pulse,quad),quad-1,2),
     1                         pulse-1,FFTPts),
```

```
     2                                 rx=1,NumRx)
      if (ifile .lt. Numfiles) then
      read (2) (((data(rx,pulse,quad),quad=1,2),
     1                 pulse=FFTPts+1,2*FFTPts),
     2                                 rx=1,NumRx)
      pend = 2*FFTPts
      else
      pend = FFTPts
      endif
      do 10401 rx = 1,NumRx
      do 10401 pulse = 1,pend
      power(rx,pulse) = float(data(rx,pulse,1))**2
     1                + float(data(rx,pulse,2))**2
      if (power(rx,pulse) .ge. 1) then
      pdB(rx,pulse) = 10*log10(power(rx,pulse))
      else
      pdB(rx,pulse) = 1
      endif
10401 continue

      if (ifile .eq. 1) then
      do 10403 rx = 1,NumRx
      RunAve(range,rx) = 0
      do 10402 pulse = 1,pend
      RunAve(range,rx) = RunAve(range,rx) + pdB(rx,pulse)
10402 continue
      RunAve(range,rx) = RunAve(range,rx)/pend
10403 continue
      endif

*************************************************************
c
c  Check the data point by point; look for noise.
c
      do 10407 rx = 1,NumRx
      W = Beta + RunAve(range,rx)
      if (ifile .eq. 1) then
      if (pdB(rx,1) .gt. W .and. pdB(rx,2) .le. W) then
      data(rx,1,1) = data(rx,2,1)
      data(rx,1,2) = data(rx,2,2)
      NumNoise(rx) = NumNoise(rx) + 1
      else
      RunAve(range,rx) = RunAve(range,rx)*(1-alpha)
     1                 + pdB(rx,1)*alpha
      endif
      endif

      if (ifile .lt. NumFiles) pend = FFTPts+1
      if (ifile .eq. NumFiles) pend = FFTPts-1
      do 10406 pulse = 2,pend
      if ((pdB(rx,pulse-1) .le. W) .and.
     1   (pdB(rx,pulse) .gt. W) .and.
     2   (pdB(rx,pulse+1) .le. W)) then
      x1 = float(data(rx,pulse-1,1))
      x2 = float(data(rx,pulse+1,1))
      y1 = float(data(rx,pulse-1,2))
      y2 = float(data(rx,pulse+1,2))
      data(rx,pulse,1) = nint((x1+x2)/2.)
      data(rx,pulse,2) = nint((y1+y2)/2.)
      NumNoise(rx) = NumNoise(rx) + 1
```

```
      else
      RunAve(range,rx) = RunAve(range,rx)*(1-alpha)
     1                 + pdB(rx,pulse)*alpha
      endif
10406 continue

      if (ifile .eq. NumFiles) then
      if (pdB(rx,FFTPts-1). lt. W .and. pdB(rx,FFTPts) .ge. W) then
      data(rx,FFTPts,1) = data(rx,FFTPts-1,1)
      data(rx,FFTPts,2) = data(rx,FFTPts-1,2)
      NumNoise(rx) = NumNoise(rx) + 1
      else
      RunAve(range,rx) = RunAve(range,rx)*(1-alpha)
     1                 + pdB(rx,FFTPts)*alpha
      endif
      endif

10407 continue
      write (3) (((data(rx,pulse,quad),quad=1,2),
     1                            pulse=1,FFTPts),
     2                                rx=1,NumRx)
10408 continue
      close (1)
      close (2)
10409 continue

      do 10412 rx = 1,NumRx
      write (*,*) rx,NumNoise(rx)
10412 continue
      close (3)
      return
      end
```

```
c
$DEBUG
c
      Subroutine FltrB3
c
c   FltrB3( = Filter #B3) will calculate the channel voltage gains.
c
c   Link FltrB+Header+FltrB1+FltrB2+FltrB3+FltrB4
c
$Include:'header.inc'
$Include:'FltrB.inc'
      Dimension power(10,2)
      Integer*4 RefRx,RefQuad,RGL,RGU
      RefRx = 5
      RefQuad = 1
      RGL = 31
      RGU = 40
      do 10003 ifile = 1,NumFiles
      if (((ifile/25)*25 .eq. ifile) .or. ifile .eq. Numfiles) then
      write (*,90002) ifile
      else
      write (*,90001) ifile
      endif
90001 format (1x,i2,\)
90002 format (1x,i2)

      open (1,file=infile(ifile),form='binary')
      open (2,file=outfile(ifile),form='binary')
      do 10002 range = 1,NumRangeGates
      read (1) (((data(rx,pulse,quad),quad=1,2),
     1                           pulse=1,FFTPts),
     2                               rx=1,NumRx)

      do 10001 rx = 1,NumRx
      do 10001 pulse = 1,FFTPts
      do 10001 quad = 1,2
      if (range .ge. RGL .and. range .le. RGU)
     1    power(rx,quad) = power(rx,quad)
     2                   + float(data(rx,pulse,quad))**2
10001 continue

      write (2) (((data(rx,pulse,quad),quad=1,2),
     1                           pulse=1,FFTPts),
     2                               rx=1,NumRx)

10002 continue
      close (1)
      close (2)
10003 continue

      do 10011 rx = 1,NumRx
      do 10011 quad = 1,2
      Vgain(rx,quad) = sqrt(power(rx,quad)/power(RefRx,RefQuad))
10011 continue
      write (*,*) 'Voltage Gains:'
      write (*,*) '         rx       quad      Vgain'
      do 10021 rx = 1,NumRx
      do 10021 quad = 1,2
      write (*,*) rx,quad,Vgain(rx,quad)
10021 continue
```

```
99999 end
```

FltrB4.for

```
c
$DEBUG
c
      Subroutine FltrB4
c
c   FltrB4( = Filter #B4) will adjust the receiver voltage gains and
c   phase offsets
c
c   Link FltrB+Header+FltrB1+FltrB2+FltrB3+FltrB4
c
$Include:'header.inc'
$Include:'FltrB.inc'
      Dimension Correct(10)
      complex*8 V,srmo
      Real*4 x,y,vtemp
      srmo = cmplx(0,1)
      pi = 3.1415927
      contor = pi/180

      Correct(1) = 0
      Correct(2) = 0
      Correct(3) = 0
      Correct(4) = 0
      Correct(5) = 0
      Correct(6) = 0
      Correct(7) = 0
      Correct(8) = 0
      Correct(9) = 0
      Correct(10) = 0
c
c  experimental set to adjust to airplane.
c
      Correct(1) = contor * (-17.86)
      Correct(2) = contor * (66.23 - 90 - 25)
      Correct(3) = contor * (41.16)
      Correct(4) = contor * (86.92 - 90 - 25)
      Correct(5) = contor * (0.00)
      Correct(6) = contor * (74.71 - 90 - 25)
      Correct(7) = contor * (-26.81 - 15)
      Correct(8) = contor * (71.20 - 90 - 25 -10)
      Correct(9) = contor * (-14.01)
      Correct(10) =contor * (75.71 - 90 - 25 + 10)

c
c  The following corrections from an average over 5 tapes
c  (Gr-237,238,239,242,254).
c  These judged best: 11/30/89.
c
      Correct(1) = contor * (-17.86)
      Correct(2) = contor * (66.23 - 90)
      Correct(3) = contor * (41.16)
      Correct(4) = contor * (86.92 - 90)
      Correct(5) = contor * (0.00)
      Correct(6) = contor * (74.71 - 90)
      Correct(7) = contor * (-26.81)
      Correct(8) = contor * (71.20 - 90)
      Correct(9) = contor * (-14.01)
      Correct(10) =contor * (75.71 - 90)

      do 10006 ifile = 1,NumFiles
```

```
      if (((ifile/25)*25 .eq. ifile) .or. ifile .eq. Numfiles) then
      write (*,90002) ifile
      else
      write (*,90001) ifile
      endif
90001 format (1x,i2,\)
90002 format (1x,i2)

      open (1,file=infile(ifile),form='binary')
      open (2,file=outfile(ifile),form='binary')
      do 10005 range = 1,NumRangeGates
      read (1) (((data(rx,pulse,quad),quad=1,2),
     1                          pulse=1,FFTPts),
     2                              rx=1,NumRx)

      do 10002 rx = 1,NumRx
      do 10002 pulse = 1,FFTPts
c
c  Correct voltage gains.
c
      do 10001 quad = 1,2
      vtemp = float(data(rx,pulse,quad))
      data(rx,pulse,quad) = nint(vtemp/Vgain(rx,quad))
10001 continue
c
c  Correct phases.
c
      x = float(data(rx,pulse,1))
      y = float(data(rx,pulse,2))
      V = cmplx(x,y)*cexp(+srmo*correct(rx))
      data(rx,pulse,1) = nint(real(V))
      data(rx,pulse,2) = nint(aimag(V))
10002 continue

      write (2) (((data(rx,pulse,quad),quad=1,2),
     1                          pulse=1,FFTPts),
     2                              rx=1,NumRx)
10005 continue
      close (1)
      close (2)
10006 continue
99999 end
```

```
c
$Debug
c
      Program BSPPM
c
************************************************************************
*                                                                      *
*     Scattering-Point Parameter Analysis Program                      *
*     Copyright 1989, Holodyne Limited 1986.                           *
*     All Rights Reserved.                                             *
*                                                  December 8, 1989    *
************************************************************************
c
c   Format for Scattering-Point Parameters:
c   1.  Altitude (km).
c   2.  Radial velocity (m/sec).
c   3.  Zenith angle in East-West meridian (degrees).
c   4.  Zenith angle in North-South meridian (degrees).
c   5.  Voltage amplitude on Dipole #1 (East-pointing);
c       sum of 5 steered voltages.
c   6.  Phase on Dipole #1 at vertex of array (degrees).
c   7.  Voltage amplitude on Dipole #2 (North-pointing);
c       sum of 5 steered voltages.
c   8.  Phase on Dipole #1 at vertex of array (degrees).
c   9.  Width of E-W zenith-angle window.
c   10. Width of N-S zenith-angle window.
c
c  bsppM.for calls bfftM,fft2cm,header,btestM,bsteerM, and bsortM.
c
c  March 10, 1991
c  Scattering-point parameters 9 & 10 added: 3/18/91.
c
$Include:'Bsppm.inc'
$Include:'header.inc'
      real*4 ZAWdegrees
      integer*4 SPPbyRange,NoiseCount,NoiseLimit
      srmo = cmplx(0,1)
      pi = 3.14159265
      Clight = 3e8
      contod = 180/pi
      contor = 1/contod
      AntLocation(1) = -1.0
      AntLocation(2) = -0.5
      AntLocation(3) =  0.0
      ZAWdegrees = 20
      ZAWindow = ZAWdegrees*contor
      Threshold = 1e-2
      LPswitch = 0
      TxPolarization = 'L'
      NoiseLimit = 255*5

      open (3,file='Bsppm.mbs',form='binary')
      open (1,file='Bsppm.txt')
20001 read (1,fmt=90001,end=90909) datafile
      write (*,*) ' '
      write (*,90002) datafile
90001 format (a24)
90002 format (' Processing',1x,a24)
c     write (*,90003) ZAWdegrees,Threshold,NoiseLimit
90003 format (1x,'ZAWindow = ',f4.1,'      Threshold = ',1Pe6.0,
```

```
     1            '      NoiseLimit = ',i4)
      Call Header
      DataMode = '0003'
      open (2,file=datafile,status='old',form='binary')
      SPPnumber = 0
      SumPower = 0
      ibelly = 0
      NoiseCount = 0

      do 10001 ireject = 1,12
      reject(ireject) = 0
10001 continue

      write (*,*) 'Number of Scattering Points:'
      Do 10004 jRange = 1,NumRangeGates
      SPPbyRange = 0

      read (2) ((((Data(1,ant,dipole,pulse,quad), quad=1,2),
     1                                            pulse=1,256),
     2                                            dipole=1,2),
     3                                            ant=1,3)
      read (2) (((Data(2,2,dipole,pulse,quad), quad=1,2),
     1                                         pulse=1,256),
     2                                         dipole=1,2)
      read (2) (((Data(2,1,dipole,pulse,quad), quad=1,2),
     1                                         pulse=1,256),
     2                                         dipole=1,2)

      do 10002 quad = 1,2
      do 10002 pulse = 1,256
c  (Channels 3 and 4 are reversed on tapes 44-88.)
c     iswap = data(1,2,1,pulse,quad)
c     data(1,2,1,pulse,quad) = data(1,2,2,pulse,quad)
c     data(1,2,2,pulse,quad) = iswap
      do 10002 dipole = 1,2
      Data(2,3,dipole,pulse,quad) = Data(1,3,dipole,pulse,quad)
10002 continue

      Call BFFTM

      do 10003 dopp = 1,256
      if (dopp .eq. 128) go to 10003
      failflag = 0
      Call BTESTM
      if (failflag .eq. 1) go to 10003
      Range = (AltMin + (jRange-1)*AltStep)*1e-3
      if (Range .le. 0) go to 10003
c
c  Real scattering point.
c
      Altitude = Range*SqRt(1-Sin(ThetaEW)**2
     1                        -Sin(ThetaNS)**2)
      FDopp = (dopp-128.)/(FFTPeriod)
      VDopp = FDopp*CLight/(2*Freq1)
      Call BSTEERM
c  Filters, if any, go here (if fail go to 10003):
c
c  End filter. Fill the next SPPtemp slot with the 10 SPPs.
      SPPnumber = SPPnumber + 1
      SPPbyRange = SPPbyRange + 1
```

```
      SPPtemp(SPPnumber,1) = Altitude
      SPPtemp(SPPnumber,2) = VDopp
      if (DataMode .eq. '0002') then
      SPPtemp(SPPnumber,3) = ThetaEW*contod
      SPPtemp(SPPnumber,4) = ThetaNS*contod
      elseif (DataMode .eq. '0003') then
      rotate = pi/4
      sinEW = sin(ThetaEW)
      sinNS = sin(ThetaNS)
      sinZA = sqrt(sinEW**2 + sinNS**2)
      if ((abs(sinEW) .gt. le-5) .or. (abs(sinNS) .gt. le-5)) then
      phinew = atan2(sinNS,sinEW) + rotate
      else
      phinew = 0
      endif
      SPPtemp(SPPnumber,3) =
     1    contod*asin(sinZA*cos(phinew))
      SPPtemp(SPPnumber,4) =
     1  contod*asin(sinZA*sin(phinew))
      endif

      spptemp(SPPnumber,5) = VAmplitude(1)
      spptemp(SPPnumber,6) = Faze(1)*contod
      spptemp(SPPnumber,7) = VAmplitude(2)
      spptemp(SPPnumber,8) = Faze(2)*contod
      spptemp(SPPnumber,9) = ZASpread(1)*contod/3
      spptemp(SPPnumber,10) = ZASpread(2)*contod/3
c  spptemp overflow protection:
      if (SPPnumber .eq. 2500) then
      write (*,*) 'Hit 2500 scattering points.  Full belly.'
      ibelly = 1
      go to 20002
      endif

10003 continue

20002 if ((jRange/10)*10 .ne. jRange) then
      write (*,90004) sppByRange
      else
      write (*,90005) SppByRange
      endif
      if (jRange .ge. 11 .and. jRange .le. 15)
     1    NoiseCount = NoiseCount + SppByRange
90004 format (1x,i5,\)
90005 format (1x,i5)
      if (ibelly .eq. 1) go to 20003
10004 continue
20003 close (2)
      write (*,*) 'Total # of scattering points found: ',sppnumber

      if ((NoiseCount .lt. NoiseLimit) .and. (sppnumber .gt. 0)) then
      S(1) = -999
      S(2) = Year
      S(3) = Month
      S(4) = Day
      S(5) = Hour
      S(6) = Minute
      S(7) = Second
      S(8) = sppnumber
      s(9) = -999
```

```
      s(10) = -999
      write (3) (S(is),is=1,10)

      Call BSORTM
      else
      write (*,*) 'Rejected.  NoiseCount = ',NoiseCount
      endif
c      write (*,*) 'Rejection Statistics:'
c      write (*,*)
c     1'     1      2      3      4      5      6      7      8      9     10     11'
c      write (*,90006) (reject(ireject),ireject=1,11)
90006 format (1x,11(i6))
      go to 20001
90909 close (1)
      close (2)
      close (3)
c     call BellSub
      end
```

```
c
$Debug
c
      Subroutine BFFTM
c
$include:'BsppM.inc'
$include:'Header.inc'

      dimension a(256),iwk(9)
      complex*16 a
      real*4 xend,yend
      integer*2 dp,dp2
      integer*4 iwk
      do 10004 dir=1,2
      do 10004 dipole = 1,2
      Voltage(dir,dipole) = 0
      do 10004 ant=1,3
c
c  replace the endpoints by the average endpoint.
c
      xend = float(data(dir,ant,dipole,1,1)+data(dir,ant,dipole,256,1))
      yend = float(data(dir,ant,dipole,1,2)+data(dir,ant,dipole,256,2))
      data(dir,ant,dipole,1,1) = nint(xend/2.0)
      data(dir,ant,dipole,256,1) = nint(xend/2.0)
      data(dir,ant,dipole,1,2) = nint(yend/2.0)
      data(dir,ant,dipole,256,2) = nint(yend/2.0)
c
c  transfer the data into "a" and perform the fft.
c
      do 10001 dp=1,256
      a(dp) = cmplx(data(dir,ant,dipole,dp,1),data(dir,ant,dipole,dp,2))
10001 continue

      call fft2cm(a,8,iwk)
c
c  find the total power.
c
      psum = 0
      do 10002 dp = 1,256
      x = float(Data(dir,ant,dipole,dp,1))
      y = float(Data(dir,ant,dipole,dp,2))
      psum = psum + x**2 + y**2
10002 continue

      do 10003 dp = 1,256
      p = cabs(a(dp))**2
      if (p .ge. psum*THRESHOLD) then
      xdata(dir,ant,dipole,dp,1) = real(a(dp))
      xdata(dir,ant,dipole,dp,2) = aimag(a(dp))
      else
      xdata(dir,ant,dipole,dp,1) = 0
      xdata(dir,ant,dipole,dp,2) = 0
      endif
10003 continue
10004 continue
      return
      end
```

```
C-----------------------------------------------------------------------
C
C   COMPUTER            - PC
C
C   PURPOSE             - COMPUTE THE FAST FOURIER TRANSFORM OF A
C                           COMPLEX VALUED SEQUENCE OF LENGTH EQUAL TO
C                           A POWER TWO
C
C   USAGE               - CALL FFT2CM (A,M,IWK)
C
C   ARGUMENTS     A     - COMPLEX VECTOR OF LENGTH N, WHERE N=2**M.
C                           ON INPUT A CONTAINS THE COMPLEX VALUED
C                           SEQUENCE TO BE TRANSFORMED.
C                           ON OUTPUT A IS REPLACED BY THE
C                           FOURIER TRANSFORM.
C                 M     - INPUT EXPONENT TO WHICH 2 IS RAISED TO
C                           PRODUCE THE NUMBER OF DATA POINTS, N
C                           (I.E. N = 2**M).
C                 IWK   - WORK VECTOR OF LENGTH M+1.
C
C   REMARKS  1.   FFT2CM COMPUTES THE FOURIER TRANSFORM, X, ACCORDING
C                 TO THE FOLLOWING FORMULA;
C
C                   X(K+1) = SUM FROM J = 0 TO N-1 OF
C                            A(J+1)*CEXP((0.0,(2.0*PI*J*K)/N))
C                   FOR K=0,1,...,N-1 AND PI=3.1415...
C
C                 NOTE THAT X OVERWRITES A ON OUTPUT.
C            2.   FFT2CM CAN BE USED TO COMPUTE
C
C                   X(K+1) = (1/N)*SUM FROM J = 0 TO N-1 OF
C                            A(J+1)*CEXP((0.0,(-2.0*PI*J*K)/N))
C                   FOR K=0,1,...,N-1 AND PI=3.1415...
C
C                 BY PERFORMING THE FOLLOWING STEPS;
C
C                      DO 10 I=1,N
C                         A(I) = CONJG(A(I))
C                   10 CONTINUE
C                      CALL FFT2CM (A,M,IWK)
C                      DO 20 I=1,N
C                         A(I) = CONJG(A(I))/N
C                   20 CONTINUE
C
C-----------------------------------------------------------------------
C
      SUBROUTINE  FFT2CM (A,M,IWK)
C                                  SPECIFICATIONS FOR ARGUMENTS
      INTEGER*4          M
      INTEGER*4          IWK(1)
      COMPLEX*16         A(1)
C                                  SPECIFICATIONS FOR LOCAL VARIABLES
      INTEGER*4          I,ISP,J,JJ,JSP,K,K0,K1,K2,K3,KB,KN,MK,MM,MP,N,
     1                   N4,N8,N2,LM,NN,JK
      DOUBLE PRECISION   RAD,C1,C2,C3,S1,S2,S3,CK,SK,SQ,A0,A1,A2,A3,
     1                   B0,B1,B2,B3,TWOPI,TEMP,
     2                   ZERO,ONE,Z0(2),Z1(2),Z2(2),Z3(2)
      COMPLEX*16         ZA0,ZA1,ZA2,ZA3,AK2,sort(16384)
```

```
      EQUIVALENCE        (ZA0,Z0(1)),(ZA1,Z1(1)),(ZA2,Z2(1)),
     1                   (ZA3,Z3(1)),(A0,Z0(1)),(B0,Z0(2)),(A1,Z1(1)),
     2                   (B1,Z1(2)),(A2,Z2(1)),(B2,Z2(2)),(A3,Z3(1)),
     3                   (B3,Z3(2))
      DATA               SQ/.70710678118654750O/,
     1                   SK/.38268343236508980O/,
     2                   CK/.92387953251128680O/,
     3                   TWOPI/6.2831853071795860O/
      DATA               ZERO/0.0D0/,ONE/1.0D0/
C                                  SQ=SQRT2/2,SK=SIN(PI/8),CK=COS(PI/8)
C                                  TWOPI=2*PI
C                                  FIRST EXECUTABLE STATEMENT
      MP = M+1
      N = 2**M
      IWK(1) = 1
      MM = (M/2)*2
      KN = N+1
C                                  INITIALIZE WORK VECTOR
      DO 5  I=2,MP
         IWK(I) = IWK(I-1)+IWK(I-1)
    5 CONTINUE
      RAD = TWOPI/N
      MK = M - 4
      KB = 1
      IF (MM .EQ. M) GO TO 15
      K2 = KN
      K0 = IWK(MM+1) + KB
   10 K2 = K2 - 1
      K0 = K0 - 1
      AK2 = A(K2)
      A(K2) = A(K0) - AK2
      A(K0) = A(K0) + AK2
      IF (K0 .GT. KB) GO TO 10
   15 C1 = ONE
      S1 = ZERO
      JJ = 0
      K = MM - 1
      J = 4
      IF (K .GE. 1) GO TO 30
      GO TO 70
   20 IF (IWK(J) .GT. JJ) GO TO 25
      JJ = JJ - IWK(J)
      J = J-1
      IF (IWK(J) .GT. JJ) GO TO 25
      JJ = JJ - IWK(J)
      J = J - 1
      K = K + 2
      GO TO 20
   25 JJ = IWK(J) + JJ
      J = 4
   30 ISP = IWK(K)
      IF (JJ .EQ. 0) GO TO 40
C                                  RESET TRIGONOMETRIC PARAMETERS
      C2 = JJ * ISP * RAD
      C1 = DCOS(C2)
      S1 = DSIN(C2)
   35 C2 = C1 * C1 - S1 * S1
      S2 = C1 * (S1 + S1)
      C3 = C2 * C1 - S2 * S1
      S3 = C2 * S1 + S2 * C1
```

```
   40 JSP = ISP + KB
C                                            DETERMINE FOURIER COEFFICIENTS
C                                              IN GROUPS OF 4
      DO 50 I=1,ISP
         K0 = JSP - I
         K1 = K0 + ISP
         K2 = K1 + ISP
         K3 = K2 + ISP
         ZA0 = A(K0)
         ZA1 = A(K1)
         ZA2 = A(K2)
         ZA3 = A(K3)
         IF (S1 .EQ. ZERO) GO TO 45
         TEMP = A1
         A1 = A1 * C1 - B1 * S1
         B1 = TEMP * S1 + B1 * C1
         TEMP = A2
         A2 = A2 * C2 - B2 * S2
         B2 = TEMP * S2 + B2 * C2
         TEMP = A3
         A3 = A3 * C3 - B3 * S3
         B3 = TEMP * S3 + B3 * C3
   45    TEMP = A0 + A2
         A2 = A0 - A2
         A0 = TEMP
         TEMP = A1 + A3
         A3 = A1 - A3
         A1 = TEMP
         TEMP = B0 + B2
         B2 = B0 - B2
         B0 = TEMP
         TEMP = B1 + B3
         B3 = B1 - B3
         B1 = TEMP
         A(K0) = DCMPLX(A0+A1,B0+B1)
         A(K1) = DCMPLX(A0-A1,B0-B1)
         A(K2) = DCMPLX(A2-B3,B2+A3)
         A(K3) = DCMPLX(A2+B3,B2-A3)
   50 CONTINUE
      IF (K .LE. 1) GO TO 55
      K = K - 2
      GO TO 30
   55 KB = K3 + ISP
C                                            CHECK FOR COMPLETION OF FINAL
C                                              ITERATION
      IF (KN .LE. KB) GO TO 70
      IF (J .NE. 1) GO TO 60
      K = 3
      J = MK
      GO TO 20
   60 J = J - 1
      C2 = C1
      IF (J .NE. 2) GO TO 65
      C1 = C1 * CK + S1 * SK
      S1 = S1 * CK - C2 * SK
      GO TO 35
   65 C1 = (C1 - S1) * SQ
      S1 = (C2 + S1) * SQ
      GO TO 35
   70 CONTINUE
```

```
C                                          PERMUTE THE COMPLEX VECTOR IN
C                                            REVERSE BINARY ORDER TO NORMAL
C                                            ORDER
      IF(M .LE. 1) GO TO 9005
      MP = M+1
      JJ = 1
C                                          INITIALIZE WORK VECTOR
      IWK(1) = 1
      DO 75  I = 2,MP
         IWK(I) = IWK(I-1) * 2
   75 CONTINUE
      N4 = IWK(MP-2)
      IF (M .GT. 2) N8 = IWK(MP-3)
      N2 = IWK(MP-1)
      LM = N2
      NN = IWK(MP)+1
      MP = MP-4
C                                          DETERMINE INDICES AND SWITCH A
      J = 2
   80 JK = JJ + N2
      AK2 = A(J)
      A(J) = A(JK)
      A(JK) = AK2
      J = J+1
      IF (JJ .GT. N4) GO TO 85
      JJ = JJ + N4
      GO TO 105
   85 JJ = JJ - N4
      IF (JJ .GT. N8) GO TO 90
      JJ = JJ + N8
      GO TO 105
   90 JJ = JJ - N8
      K = MP
   95 IF (IWK(K) .GE. JJ) GO TO 100
      JJ = JJ - IWK(K)
      K = K - 1
      GO TO 95
  100 JJ = IWK(K) + JJ
  105 IF (JJ .LE. J) GO TO 110
      K = NN - J
      JK = NN - JJ
      AK2 = A(J)
      A(J) = A(JJ)
      A(JJ) = AK2
      AK2 = A(K)
      A(K) = A(JK)
      A(JK) = AK2
  110 J = J + 1
C                                          CYCLE REPEATED UNTIL LIMITING NUMBER
C                                            OF CHANGES IS ACHIEVED
      IF (J .LE. LM) GO TO 80
C
 9005 CONTINUE

c
c  re-order the spectrum so that it runs from most-negative
c  to most-positive, with dc in the middle, and positive
c  defined as increasing phase with time.
c
      iflip = 0
```

```
      ipa = N/2
      ipb = 1
      do 10001 ip = ipa,ipb,-1
      iflip = iflip + 1
      sort(iflip) = A(ip)
10001 continue

      iflip = N/2
      ipa = N
      ipb = N/2+1
      do 10002 ip = ipa,ipb,-1
      iflip = iflip+1
      sort(iflip) = A(ip)
10002 continue

      ipb = N
      do 10003 ip = 1,ipb
      A(ip) = sort(ip)
10003 continue
      RETURN
      END
```

```
c
c
      Subroutine Header
c
c  This subroutine reads "Header.dat", an ascii file
c  containing the radar parameters.  The time of the
c  sounding is obtained from the name of the data file
c  "datafile".  Since time is the only parameter that
c  changes from sounding to sounding, this eliminates
c  handling a separate header file for each data file.
c
c  March 10, 1991
c
$Include:'Header.inc'
      character*1 thing1,thing2
c     write (*,*) datafile
      iunit = 88
20001 open (iunit,file='Header.dat',iostat=iocheck,status='old')
      if (iocheck .gt. 0) then
      iunit = iunit+1
      go to 20001
      endif

      read (iunit,*) SoundingNumber
      read (iunit,*) Year
      read (iunit,*) Month
      read (iunit,*) Day
      read (iunit,*) Hour
      read (iunit,*) Minute
      read (iunit,*) Second
      read (iunit,'(A)') SiteName
      read (iunit,'(A)') DataType
      read (iunit,'(A)') DataMode
      read (iunit,*) FFTpts
      read (iunit,*) Freq1
      read (iunit,*) Freq2
      read (iunit,*) PulseDuration
      read (iunit,*) FFTPeriod
      read (iunit,*) NumCohAve
      read (iunit,*) NumRangeGates
      read (iunit,*) NumRx
      read (iunit,*) PRP
      read (iunit,*) AltMin
      read (iunit,*) AltStep
      read (iunit,*) RxAttn
      read (iunit,'(A)') RxPolarization
      read (iunit,*) TxPower
      read (iunit,*) (RxMask(i),i=1,NumRx)
      read (iunit,'(A)') TapeLabel
      close (iunit)
c
c  Get the real time from the name of the data file.
c
      do 10001 iplace = 1,24
      if (datafile(iplace:iplace) .eq. '.') then
      imark = iplace
      go to 20002
10001 endif
      write (*,*) 'No . found in datafile name.'
      return
```

```
20002 do 10002 iplace = imark-8,imark-2,2
      thing1 = datafile(iplace:iplace)
      thing2 = datafile(iplace+1:iplace+1)
      if (thing1 .eq. '0') then
      i1 = 0
      elseif (thing1 .eq. '1') then
      i1 = 1
      elseif (thing1 .eq. '2') then
      i1 = 2
      elseif (thing1 .eq. '3') then
      i1 = 3
      elseif (thing1 .eq. '4') then
      i1 = 4
      elseif (thing1 .eq. '5') then
      i1 = 5
      elseif (thing1 .eq. '6') then
      i1 = 6
      elseif (thing1 .eq. '7') then
      i1 = 7
      elseif (thing1 .eq. '8') then
      i1 = 8
      elseif (thing1 .eq. '9') then
      i1 = 9
      else
      i1 = 0
      endif
      if (thing2 .eq. '0') then
      i2 = 0
      elseif (thing2 .eq. '1') then
      i2 = 1
      elseif (thing2 .eq. '2') then
      i2 = 2
      elseif (thing2 .eq. '3') then
      i2 = 3
      elseif (thing2 .eq. '4') then
      i2 = 4
      elseif (thing2 .eq. '5') then
      i2 = 5
      elseif (thing2 .eq. '6') then
      i2 = 6
      elseif (thing2 .eq. '7') then
      i2 = 7
      elseif (thing2 .eq. '8') then
      i2 = 8
      elseif (thing2 .eq. '9') then
      i2 = 9
      else
      i2 = 0
      endif

      if (iplace .eq. imark-8) Month = 10*i1 + i2
      if (iplace .eq. imark-6) Day = 10*i1 + i2
      if (iplace .eq. imark-4) Hour = 10*i1 + i2
      if (iplace .eq. imark-2) Minute = 10*i1 + i2
10002 continue

      thing1 = datafile(imark+1:imark+1)
      thing2 = datafile(imark+2:imark+2)
      if (thing1 .eq. '0') then
```

```
il - 0
elseif (thingl .eq. '1') then
il - 1
elseif (thingl .eq. '2') then
il - 2
elseif (thingl .eq. '3') then
il - 3
elseif (thingl .eq. '4') then
il - 4
elseif (thingl .eq. '5') then
il - 5
elseif (thingl .eq. '6') then
il - 6
elseif (thingl .eq. '7') then
il - 7
elseif (thingl .eq. '8') then
il - 8
elseif (thingl .eq. '9') then
il - 9
else
il - 0
endif
if (thing2 .eq. '0') then
i2 - 0
elseif (thing2 .eq. '1') then
i2 - 1
elseif (thing2 .eq. '2') then
i2 - 2
elseif (thing2 .eq. '3') then
i2 - 3
elseif (thing2 .eq. '4') then
i2 - 4
elseif (thing2 .eq. '5') then
i2 - 5
elseif (thing2 .eq. '6') then
i2 - 6
elseif (thing2 .eq. '7') then
i2 - 7
elseif (thing2 .eq. '8') then
i2 - 8
elseif (thing2 .eq. '9') then
i2 - 9
else
i2 - 0
endif
Second - 10*il + i2

return
end
```

```
c
c
      Subroutine BTESTM
c
c  This subroutine applies the interferometry algorithms.
c
c  May 7, 1990
c
$include:'BsppM.inc'
$include:'Header.inc'

      complex xx,SumVolt,VA,VB,ordinary

      do 10099 dir = 1,2
      ZASpread(dir) = 0
      do 10098 dipole = 1,2
      ZAW = 3*ZAWindow - ZASpread(dir)
      do 10004 ant = 1,3
c
c  Test #1: Reject this Doppler frequency if both quadrature
c  components are too small on any antenna for an accurate calculation
c  of the phase.  This happens not too often.
c
      if (abs(xData(dir,ant,dipole,dopp,1)) .le. 10 .and.
     1    abs(xData(dir,ant,dipole,dopp,2)) .le. 10) then
      reject(1) = reject(1) + 1
      failflag = 1
      go to 90909
      endif
c
c  calculate the phase.
c
      Phase(dir,ant,dipole) =
     1          ATan2(xData(dir,ant,dipole,dopp,2),
     2                xData(dir,ant,dipole,dopp,1))
10004 continue

c
c  Calculate the antenna-to-antenna phase differences.
c
      pd12(dir,dipole) = Phase(dir,2,dipole)-Phase(dir,1,dipole)

      If (pd12(dir,dipole) .gt. pi)
     1    pd12(dir,dipole) = pd12(dir,dipole) - 2*pi
      If (pd12(dir,dipole) .lt. -pi)
     1    pd12(dir,dipole) = pd12(dir,dipole) + 2*pi

      pd23(dir,dipole) = Phase(dir,3,dipole)-Phase(dir,2,dipole)
      If (pd23(dir,dipole) .gt. pi)
     1    pd23(dir,dipole) = pd23(dir,dipole) - 2*pi
      If (pd23(dir,dipole) .lt. -pi)
     1    pd23(dir,dipole) = pd23(dir,dipole) + 2*pi

c
c  Tests #2,3,6,&7: The two zenith angles derived from the two phase
c  differences for each dipole, each direction, must agree.
c
c  Each time through, the maximum allowed
c  zenith angle spread, ZAW, is 3*ZAWindow - ZASpread(dir).
c  The actual maxima are accumulated in ZASpread(dir).
```

```
c  Each time through, the actual spread is added to ZASpread(dir),
c  which is the only measure of the zenith-angle spread that is
c  saved as part of the scattering-point parameters.
c
c   Antenna Pair 1-2:
c
      thetal = asin(-pd12(dir,dipole)/pi)
c
c  Antenna Pair 2-3:
c
      theta2 = asin(-pd23(dir,dipole)/pi)
c
c  Are the two zenith angles close enough together to
c  qualify as a scattering point?
c  If thSpread is greater than the maximum spread allowed (ZAW),
c  set failflag=1 and get out.  Otherwise, possible scattering point.
c  This gives reject(2,3,6,&7).
c
      thSpread = abs(thetal-theta2)
      if (thSpread .gt. ZAW) then
      index = (dir-1)*4 + dipole + 1
      reject(index) = reject(index) + 1
      failflag = 1
      go to 90909
      endif

c
c  Possible scattering point; we've found an acceptably small
c  disagreement (thSpread) between the two theta values.
c  Accumulate thSpread in ZASpread(dir) (which will become two of the
c  scattering-point parameters), and locate the average zenith angle
c  for this dir and dipole at the middle of the window.
c
      ZASpread(dir) = ZASpread(dir) + thSpread
      thlDipole(dipole) = (thetal+theta2)/2
10098 continue
c
c  Tests #4 and #8: Both dipoles have separately determined zenith
c  angles for one direction.  Do these two values agree?
c
      ZAW = 3*ZAWindow - ZASpread(dir)
      if (abs(thlDipole(1)-thlDipole(2)) .gt. ZAW) then
      index = 4*dir
      reject(index) = reject(index) + 1
      failflag = 1
      go to 90909
      endif

      thConsensus = (thlDipole(1)+thlDipole(2))/2
      thSpread = abs(thlDipole(1)-thlDipole(2))
      ZASpread(dir) = ZASpread(dir) + thSpread
c
c  Now we are convinced that the two dipoles together
c  indicate that a real scattering point exist.  Before we
c  can test the two directions together, we need the best
c  possible estimate of the zenith angles.
c  We use the 1-3 antenna pair with the dipoles combined to match
c  the transmit polarization.
c
      if (TxPolarization .eq. 'O') then
```

```
      VA = cmplx(xdata(dir,1,1,dopp,1),xdata(dir,1,1,dopp,2))
     1   + srmo*cmplx(xdata(dir,1,2,dopp,1),xdata(dir,1,2,dopp,2))

      VB = cmplx(xdata(dir,3,1,dopp,1),xdata(dir,3,1,dopp,2))
     1   + srmo*cmplx(xdata(dir,3,2,dopp,1),xdata(dir,3,2,dopp,2))

      elseif (TxPolarization .eq. 'X') then
      VA = cmplx(xdata(dir,1,1,dopp,1),xdata(dir,1,1,dopp,2))
     1   - srmo*cmplx(xdata(dir,1,2,dopp,1),xdata(dir,1,2,dopp,2))

      VB = cmplx(xdata(dir,3,1,dopp,1),xdata(dir,3,1,dopp,2))
     1   - srmo*cmplx(xdata(dir,3,2,dopp,1),xdata(dir,3,2,dopp,2))

      elseif (TxPolarization .eq. 'L') then
      VA = cmplx(xdata(dir,1,1,dopp,1),xdata(dir,1,1,dopp,2))
     1   + cmplx(xdata(dir,1,2,dopp,1),xdata(dir,1,2,dopp,2))

      VB = cmplx(xdata(dir,3,1,dopp,1),xdata(dir,3,1,dopp,2))
     1   + cmplx(xdata(dir,3,2,dopp,1),xdata(dir,3,2,dopp,2))

      else
      write (*,*) 'TxPolarization = ',TxPolarization
      write (*,*) 'is NOT SUPPORTED by this version of SPPM'
      go to 90909
      endif
c
c  Antenna Pair A-B (= 1-3 with polarization):
c
      VAr = real(VA)
      VAi = aimag(VA)
      VBr = real(VB)
      VBi = aimag(VB)

      if ((abs(VAr) .gt. 1e-5) .or. (abs(VAi) .gt. 1e-5)) then
      PhaseA = Atan2(VAi,VAr)
      else
      PhaseA = 0
      endif

      if ((abs(VBr) .gt. 1e-5) .or. (abs(VBi) .gt. 1e-5)) then
      PhaseB = Atan2(VBi,VBr)
      else
      PhaseB = 0
      endif

      pdAB = PhaseB-PhaseA
      If (pdAB .gt. +pi) pdAB = pdAB - 2*pi
      If (pdAB .lt. -pi) pdAB = pdAB + 2*pi

      do 10007 ithree = -1,1
      sinTheta = -(pdAB+2*pi*ithree)/(2*pi)

      if (abs(sinTheta) .lt. 1.0) then
      thAB = asin(sinTheta)

      if (abs(thAB-thConsensus) .lt. ZAWindow) then
      thetafinal(dir) = thAB
      go to 10099

      endif
```

```
      endif

10007 continue

c
c  Test #5 and #9: If there is no final zenith angle in adequate
c  agreement with the Consensus zenith angle, then you fall through
c  to here and leave a failure.
c
      index = 5 + 4*(dir-1)
      reject(index) = reject(index) + 1
      failflag = 1
      go to 90909
c
10099 continue
c
c  Test #10: Reject if no real altitude is possible.
c
      arg =  sin(thetafinal(1))**2+sin(thetafinal(2))**2
      if (arg .ge. 1) then
      reject(10) = reject(10) + 1
      failflag = 1
      go to 90909
      endif
c
c  If you got to here, it's a real scattering point, and the
c  cardinal zenith angles are:
c
      ThetaEW = thetafinal(1)
      ThetaNS = thetafinal(2)
c
c  these will get rotated by 45 degrees in the main program if
c  DataMode = 3.
c
90909 return
      end
```

```
c
c
      Subroutine BSTEERM
c
c  Now that you've found the point, "steer" the full array toward the
c  point and determine its power and phase.
c  May 7, 1990.
c
$include:'BsppM.inc'
$include:'Header.inc'

      complex Vsteer(2)
c
c  Each direction and dipole is steered separately, and the voltage
c  amplitudes and phases determined.
c

      do 10002 dipole = 1,2
      Vsteer(dipole) = 0
      do 10001 dir = 1,2
      delphi(dir) = 2*pi*sin(thetafinal(dir))
      do 10001 ant = 1,3
      if (ant .eq. 3 .and. dir .eq. 2) go to 10001
      Vsteer(dipole) = Vsteer(dipole)
     1 + cmplx(1.0*xdata(dir,ant,dipole,dopp,1),
     2           xdata(dir,ant,dipole,dopp,2))
     3 * cexp(+srmo*AntLocation(ant)*delphi(dir))
10001 continue

      Vx = Real(Vsteer(dipole))
      Vy = Aimag(Vsteer(dipole))

      VAmplitude(dipole) = cabs(Vsteer(dipole))

      if (VAmplitude(dipole) .ge. 1) then
      Faze(dipole) = ATan2(Vy,Vx)
      else
      Faze(dipole) = 0
      endif

10002 continue

90909 return
      end
```

```fortran
c
$Debug
c
      Subroutine BSORTM
c
c  The scattering-point parameters are in spptemp
c  in order by range, but only roughly by altitude.
c  This subroutine orders them by altitude and writes
c  them into the output file, SPPList.
c
$include:'Bsppm.inc'
$include:'Header.inc'

      real*4 zlast
      integer*4 itop,ipoint,ipmin
      isort = 1
      itop = sppnumber
20001 zmin = 999
      zlast = 0
c
c  Look through all the points to find the smallest altitude.
c
      do 10001 ipoint = 1,itop
      if (spptemp(ipoint,1) .gt. -990 .and.
     1    spptemp(ipoint,1) .lt. zmin) then
      zmin = spptemp(ipoint,1)
      ipmin = ipoint
      endif
10001 continue

      if (zmin .lt. zlast) WRITE (*,*) 'PROBLEM! ',zmin,ipmin,zlast
      zlast = zmin

      write (3) (spptemp(ipmin,parameter),parameter=1,10)
      if (itop .gt. 1) then
c
c  Replace the last scattering point by the one at the top.
c
      do 10004 parameter=1,10
      spptemp(ipmin,parameter) = spptemp(itop,parameter)
10004 continue
c
c  Repeat until they're all gone.  I didn't say it was efficient.
c
      itop = itop-1
      go to 20001
      endif
30001 return
      end
```

```
c
c  BsppM.inc
c
      common /sppA/ spptemp(2500,10)
      Common /sppB/ Data(2,3,2,256,2),Phase(2,3,2),theta(3,3),
     1              delphi(2),thetafinal(2),ZASpread(2),
     2              Voltage(2,2),VAmplitude(2),Power(2,2),Faze(2),
     3              pd12(2,2),pd23(2,2),reject(12),th1Dipole(2),
     4              AntLocation(5),S(10),xdata(2,3,2,256,2)
      common /sppC/ dopp,failflag,jRange,rg1,rg2,TxPolarization,
     1              SumPower,SPPNumber,ThetaEW,ThetaNS,ZAWindow,
     2              pi,contod,contor,srmo,clight,Threshold,LPswitch
      Complex*16 Voltage,srmo
      Real*8 pi,xorig,yorig,xyangle,rotate,ThetaEW,ThetaNS
      Real*4 zmin,spptemp,Threshold,plimit,S,xdata
      Integer*4 Data,reject
      Integer*4 ant,count,dipole,dir,dopp,failflag,parameter,pmin,
     1         point,pulse,quad,rg1,rg2,spacing,SPPNumber
      Character*2 TxPolarization
```

Header.dat

```
 938                    SoundingNumber
89                      Year
 5                      Month
 3                      Day
17                      Hour
31                      Minute
16                      Second
Islote, P.R.            SiteName
0001                    DataType
0003                    DataMode
 256                    FFTPts
 3.17500E+06            Freq1 (Hz)
 3.17500E+06            Freq2 (Hz)
 3.00000E-05            PulseDuration (seconds)
 1.02400E+02            FFTPeriod (seconds)
 4.00000E+01            NumCohAve
  40                    NumRangeGates
  10                    NumRx
 1.00000E-02            PRP (seconds)
+3.10000E+03            AltMin (meters)
 3.00000E+03            AltStep (meters)
   0                    RxAttn
L1                      RxPolarization
 1.00000E+05            TxPower (Watts)
1 1 1 1 1 1 1 1 1 1     RxMask
GRxxx                   TapeLabel
```

```
c
$Debug
      program WindErr
c
***************************************************************
*                                                             *
*      IDI Wind-Calculation Program; MAPSTAR Radar.           *
*      Copyright 1990, Holodyne Limited 1986.                 *
*      All Rights Reserved.                                   *
*                                                             *
***************************************************************
c   April 8, 1991
c
c   This program will calculate 129 wind profiles
c   for a single scattering-point parameter file.  The spread due to
c   errors in the calculation are determined by varying the range,
c   the Doppler velocity, and the E-W and N-S zenith angles.  The
c   129 profiles so generated are examined to get max and min at
c   each altitude.  Files generated are u.dat, ubar.dat, v.dat,
c   vbar.dat, w.dat, and wbar.dat, which are for plotting the
c   three components and their error bars, and winderr.dat, which
c   contains all the information in a single file.
c
c   The scattering-point parameters
c   are :
c   1.  Altitude (km).
c   2.  Radial velocity (m/sec).
c   3.  Zenith angle in East-West meridian (degrees).
c   4.  Zenith angle in North-South meridian (degrees).
c   5.  Voltage amplitude on #1 Dipoles.
c   6.  Phase of #1 Dipoles (degrees).
c   7.  Voltage amplitude on #2 Dipoles.
c   8.  Phase of #2 Dipoles (degrees).
c   9.  E-W zenith-angle spread.
c   10. N-S zenith-angle spread.
c
c   Explanation of easily-reprogrammed parameters (just change the source-
c      code value given below:
c   vHmax is the largest allowed horizontal velocity. We test each point
c     against Vmax by projecting its radial velocity into the horizontal
c     plane, and reject it if it's bigger than vHmax.
c   ThMaxV is the largest acceptable radial zenith angle for w.
c   ThMinV is the smallest acceptable radial zenith angle for w.
c   ThMaxH is the largest acceptable radial zenith angle for u and v.
c   ThMinH is the smallest acceptable radial zenith angle for u and v.
c   MinNumPts is the minimum number of points.  If there are not sufficient
c      points, that altitude is skipped.
c   NSigma is the maximum number of standard deviations from the fit any
c     individual point can lie without being rejected from the velocity
c     calculation.
c   Zmin is the bottom altitude for which winds are to be calculated.
c
c  WindErr calls SppFltr, Header, WFV, and WFH.
c
$Include:'Wind.Inc'
$Include:'Header.inc'
      dimension umax(100),u0(100),umin(100),
     1          vmax(100),v0(100),vmin(100),
     2          wmax(100),w0(100),wmin(100),scale(100),
     3          Number(100),Uvar(100),Vvar(100),Wvar(100)
```

```
      real*4 NumSndgs,scale
      integer*4 jzMax
      pi = 3.14159265

      vHmax = 300
      ThMinV = 0
      ThMaxV = 10
      ThMinH = 3
      ThMaxH = 16
      MinH = 5
      MinV = 5
      Nsigma = 3.0
      Zmin = 60
      Zmax = 120
      polarization = 'o'
************************************************************************
*
      Open (1,err=90909,file=' ',status='old',form='binary')
      Open (2,err=90909,file='SppFltr.mbs',form='binary')
      Call SppFltr
      close (1)
      rewind (2)
      CALL Head-.

      open (1,file='WE2.dat')

      do 10001 jz = 1,100
      Z(jz) =  float(jz-1) + Zmin
      Umax(jz) = -100
      Umin(jz) = +100
      u0(jz) = 0
      Uvar(jz) = 0
      Vmax(jz) = -100
      Vmin(jz) = +100
      v0(jz) = 0
      Vvar(jz) = 0
      Wmax(jz) = -10
      Wmin(jz) = +10
      w0(jz) = 0
      Wvar(jz) = 0
      Number(jz) = 0
      scale(jz) = 1
      if (Z(jz) .ge. Zmax) then
      jZmax = jz
      go to 20301
      endif
10001 continue


20301 do 10501 jZinc = 1,3
      if (jZinc .eq. 1) then
      write (*,*) '.'
      elseif (jZinc .eq. 2) then
      write (*,*) '..'
      else
      write (*,*) '...'
      endif
      write (*,90008)
90008 format (1x,\)
      do 10301 idR = 0,2
```

```
      dR = idR*2.5
      if (idR .eq. 2) dR = -2.5
      do 10301 idVr = 0,4
      if (idVr .eq. 0) dVrad =  0
      if (idVr .eq. 1) dVrad = +0.23
      if (idVr .eq. 2) dVrad = -0.23
      if (idVr  eq. 3) dVrad = +0.23
      if (idVr .eq. 4) dVrad = -0.23
      do 10301 idThEW = 0,4
      do 10301 idThNS = 0,4
      rewind (2)
      iSum = idR + idVr + idThEW + idThNS
      if (((idR .eq. 0) .or. (idVr .eq. 0) .or.
     1     (idThEW .eq. 0) .or. (idThNS .eq. 0)) .and.
     2      iSum .gt. 0) go to 10301

      index = (idVr-1)*16 + (idThEW-1)*4 + idThNS
      if (index/64 .lt. 1) then
      write (*,90005)
90005 format ('.',\)
      else
      write (*,90006)
90006 format ('.')
      write (*,90007)
90007 format (1x,\)
      endif

      QuitFlag = 0
      jzW = jZinc
      do 10101 jz = 1,jZmax
      u(jz) = 0
      v(jz) = 0
      w(jz) = 0
10101 continue
      read (2,err=90909,end=20203) (line(parameter),parameter=1,10)

***************************************************************************
*  Return to here for new altitude.
***************************************************************************
c
20201 NumPts = 0
      read (2,err=90909,end=20203) (line(parameter),parameter=1,10)
20202 if (line(1)+dR*scale(jzW) .le. Z(jzW)-1.5) then
      read (2,err=90909,end=20203) (line(parameter),parameter=1,10)
      go to 20202
      endif
      if (line(1)+dR*scale(jzW) .gt. Z(jzW)+1.5) then
      if ((NumPts .lt. MinV) .or. (NumPts .lt. MinH)) go to 20206
      go to 20204
      endif

      TestFlag = 1
      if (NumPts .eq. 5000) then
      write (*,*) 'Thanks anyhow, but Ive already got 5000 points.'
      TestFlag = 0
      endif

      if (TestFlag .eq. 1) then
      NumPts = NumPts + 1
```

```
      do 10201 parameter = 1,10
      if (parameter .eq. 2) then
      if (idVr .le  2) then
      if (line(2) .lt. 0) spp(NumPts,2) = line(2) - dVrad*scale(jzW)
      if (line(2) .gt. 0) spp(NumPts,2) = line(2) + dVrad*scale(jzW)
      else
      spp(NumPts,2) = line(2) + dVrad*scale(jzW)
      endif

      elseif (parameter .eq. 3) then
      if (idThEW .eq. 0) then
      spp(NumPts,3) = line(3)
      elseif (idThEW .eq. 1) then
      if (line(3) .lt. 0) spp(NumPts,3) = line(3) - line(9)*scale(jzW)/2
      if (line(3) .ge. 0) spp(NumPts,3) = line(3) + line(9)*scale(jzW)/2
      elseif (idThEW .eq. 2) then
      if (line(3) .lt. 0) spp(NumPts,3) = line(3) + line(9)*scale(jzW)/2
      if (line(3) .ge. 0) spp(NumPts,3) = line(3) - line(9)*scale(jzW)/2
      elseif (idThEW .eq. 3) then
      spp(Numpts,3) = line(3) + line(9)*scale(jzW)/2
      elseif (idThEW .eq. 4) then
      spp(NumPts,3) = line(3) - line(9)*scale(jzW)/2
      endif

      elseif (parameter .eq. 4) then
      if (idThNS .eq. 0) then
      spp(NumPts,4) = line(4)
      elseif (idThNS .eq. 1) then
      if (line(4) .lt. 0) spp(NumPts,4) = line(4)-line(10)*scale(jzW)/2
      if (line(4) .ge. 0) spp(NumPts,4) = line(4)+line(10)*scale(jzW)/2
      elseif (idThNS .eq. 2) then
      if (line(4) .lt. 0) spp(NumPts,4) = line(4)+line(10)*scale(jzW)/2
      if (line(4) .ge. 0) spp(NumPts,4) = line(4)-line(10)*scale(jzW)/2
      elseif (idThNS .eq. 3) then
      spp(Numpts,4) = line(4) + line(10)*scale(jzW)/2
      elseif (idThNS .eq. 4) then
      spp(NumPts,4) = line(4) - line(10)*scale(jzW)/2
      endif

      else
      spp(NumPts,parameter) = line(parameter)
      endif
10201 continue

      endif

      read (2,err=90909,end=20203) (line(parameter),parameter=1,10)
      go to 20202

20203 quitflag = 1

20204 Fitflag = 1
c
c  Fit the scattering points in this window with a 3-vector.
c
20205 CALL WFV
      if (Fitflag .eq. 0) then
c     write (*,*) 'Vertical Failure at ',jzW,Z(jzW)
      go to 20206
      endif
```

```
      Call WFH

      if (Fitflag .eq. 0) then
c     write (*,*) 'Horizontal Failure at ',jzW,Z(jzW)
      else
      if ((idR .eq. 0) .and. (idVr .eq. 0) .and.
     1    (idThEW .eq. 0) .and. (idThNS .eq. 0)) then
      if (NumPts .eq. 0) then
      scale(jzW) = 1
      else
      scale(jzW) = 1/sqrt( float(NumPts)/3.0)
      endif
      endif

c     write (*,90001) idR,idVr,idThEW,idThNS,Z(jzW),u(jzW),v(jzW),w(jzW)
      write (1,90004) Z(jzW),u(jzW),v(jzW),w(jzW)
      endif
90001 format (1x,4(i2,1x),f4.0,2(1x,f6.1),1x,f5.1)
90004 format (1x,f4.0,2(1x,f6.1),1x,f5.1)
90002 format (1x,4(e12.4,1x))
c
c  If it's not time to quit, increment jzW and go read the next points.
c
20206 if (QuitFlag .eq. 0) then
      jzW = jzW + 3
      if (jzW .gt. jZmax) go to 10301
      read (2,err=90909,end=20203) (line(parameter),parameter=1,10)
      go to 20201
      endif

10301 continue
10501 continue
90909 close (2)

      rewind (1)

20401 read (1,90004,end=20402) Zx,ux,vx,wx
      ijz = Zx-Zmin+1
      U0(ijz) = U0(ijz) + ux
      V0(ijz) = V0(ijz) + vx
      W0(ijz) = W0(ijz) + wx
      Number(ijz) = Number(ijz) + 1
      go to 20401

20402 do 10601 jz = 1,jzMax
      if (Number(jz) .gt. 0) then
      U0(jz) = U0(jz)/Number(jz)
      V0(jz) = V0(jz)/Number(jz)
      W0(jz) = W0(jz)/Number(jz)
      endif
10601 continue

      rewind (1)

20403 read (1,90004,end=20404) Zx,ux,vx,wx
      ijz = Zx-Zmin+1
      Uvar(ijz) = Uvar(ijz) + abs(u0(ijz)-ux)
      Vvar(ijz) = Vvar(ijz) + abs(v0(ijz)-vx)
      Wvar(ijz) = Wvar(ijz) + abs(w0(ijz)-wx)
```

```
      go to 20403

20404 do 10602 jz = 1,jzMax
      if (Number(jz) .gt. 0) then
      Uvar(jz) = Uvar(jz)/Number(jz)
      Vvar(jz) = Vvar(jz)/Number(jz)
      Wvar(jz) = Wvar(jz)/Number(jz)
      endif
10602 continue

20405 CLOSE (1)

      open (1,file='u.dat')
      open (2,file='ubar.dat')
      do 10401 jz = 1,jzMax
      if (Number(jz) .gt. 0) then
      umin(jz) = u0(jz) - 2*uvar(jz)
      umax(jz) = u0(jz) + 2*uvar(jz)
      if (umin(jz) .lt. -100) umin(jz) = -100
      if (umax(jz) .gt. +100) umax(jz) = +100
      write (1,*) z(jz),u0(jz)
      write (2,*) z(jz),umin(jz)
      write (2,*) z(jz),umax(jz)
      write (2,*) -10,0
      else
      write (1,*) -10,0
      endif
10401 continue
      close (1)
      close (2)

      open (1,file='v.dat')
      open (2,file='vbar.dat')
      do 10402 jz=1,jzMax
      if (Number(jz) .gt. 0) then
      vmin(jz) = v0(jz) - 2*vvar(jz)
      vmax(jz) = v0(jz) + 2*vvar(jz)
      if (vmin(jz) .lt. -100) vmin(jz) = -100
      if (vmax(jz) .gt. +100) vmax(jz) = +100
      write (1,*) z(jz),v0(jz)
      write (2,*) z(jz),vmin(jz)
      write (2,*) z(jz),vmax(jz)
      write (2,*) -10,0
      else
      write (1,*) -10,0
      endif
10402 continue
      close (1)
      close (2)

      open (1,file='w.dat')
      open (2,file='wbar.dat')
      open (11,file='winderr.dat')

      do 10403 jz=1,jzMax
      if (Number(jz) .gt. 0) then
      wmin(jz) = w0(jz) - 2*wvar(jz)
      wmax(jz) = w0(jz) + 2*wvar(jz)
      if (wmin(jz) .lt. -10) wmin(jz) = -10
      if (wmax(jz) .gt. +10) wmax(jz) = +10
```

```
      write (1,*) z(jz),w0(jz)*10
      write (2,*) z(jz),wmin(jz)*10
      write (2,*) z(jz),wmax(jz)*10
      write (2,*) 0,-10

      if (z(jz) .ge. Zmin) then
      write (11,90003) z(jz),
     1        umin(jz),u0(jz),umax(jz),
     2        vmin(jz),v0(jz),vmax(jz),
     3        wmin(jz),w0(jz),wmax(jz)
      endif
      else
      write (1,*) -10,0
      endif
10403 continue
      close (1)
      close (2)
      close (11)
90003 format (1x,10(f7.2))
c      call BellSub
91919 End
```

```
c
$Debug
c
      subroutine SppFltr
      dimension spp(10)
      real*4 Zmin,Zmax,ThMin,ThMax,ZA
      character*1 polarization
      integer*4 parameter,Nraw,Nfltr
      pi = 3.14159265
      write (*,*) 'SppFltr expects the input (.mbs) file to be on the co
     1mmand line.'
      write (*,*)
     1 'The filtered file will be written to SppFltr.mbs.'
      Zmin = 60
      Zmax = 120
      ThMin = 0
      ThMax = 16
      VRmin = -60
      VRmax = 60
      vHmax = 300
      Nraw = 0
      Nfltr = 0
      polarization = 'o'
20001 read (1,end=20002) (spp(parameter),parameter=1,10)
      Nraw = Nraw + 1
**********************************************************************
c                  Filter Section
c
c  Filters go here.  If fail, go to 20001.
c
      if (spp(1) .lt. zmin .or. spp(1) .gt. zmax) go to 20001
      if (spp(2) .eq. 0) go to 20001
      if (spp(2) .lt. VRmin .or. spp(2) .gt. VRmax) go to 20001
      sinZA = sqrt(sin(spp(3)*pi/180)**2+sin(spp(4)*pi/180)**2)
      if (sinZA .ge. 1) go to 20001
      if (sinZA .gt. 1e-3) then
      if (abs(spp(2)/sinZA) .gt. vHmax) go to 20001
      endif
      ZA = (180/pi)*asin(sinZA)
      if ((ZA .lt. ThMin) .or. (ZA .gt. ThMax)) go to 20001
c
c  Linear polarization filter (removes linearly polarized points):
c
      if ((polarization .eq. 'o') .or. (polarization .eq. 'x') .or.
     1     (polarization .eq. 'c')) then
      if (abs(spp(6)-spp(8)) .lt. 45)  go to 20001
      if ( (abs(spp(6)-spp(8)) .gt. 135) .and.
     1       (abs(spp(6)-spp(8)) .lt. 225) ) go to 20001
      if ( (abs(spp(6)-spp(8)) .gt. 315) .and.
     1       (abs(spp(6)-spp(8)) .lt. 360) ) go to 20001
      endif
c
c
c  Ordinary polarization filter (removes ordinary points):
c
      if ((polarization .eq. 'l') .or. (polarization .eq. 'x')) then
      if (spp(6)-spp(8) .gt. 45  .and.
     1    spp(6)-spp(8) .lt. 135 )  go to 20001
      if (spp(6)-spp(8) .gt. -315  .and.
     1    spp(6)-spp(8) .lt. -225 )  go to 20001
```

```
      endif
c
c
c  Extraordinary polarization filter (removes extraordinary points):
c
      if ((polarization .eq. '1') .or. (polarization .eq. 'o')) then
      if (spp(6)-spp(8) .gt. -135  .and.
     1    spp(6)-spp(8) .lt. -45 )  go to 20001
      if (spp(6)-spp(8) .gt. 225  .and.
     1    spp(6)-spp(8) .lt. 315 )  go to 20001
      endif
c
**********************************************************************

      Nfltr = Nfltr + 1
      write (2) (spp(parameter),parameter=1,10)
      go to 20001
20002 write (*,*) 'Points in, points out = ',Nraw,Nfltr
      return
      end
```

```
c
$Debug
c
*********************************************************************
      Subroutine WFV
*********************************************************************
C
C   THIS SUBROUTINE CALCULATES the vertical WINDS FROM MAPSTAR SPPs.
C   August 17, 1990
c
$Include:'Wind.Inc'
$Include:'Header.inc'

      Dimension a(3,3),WindV(3)
      Real*4 Sigma,SigmaLast
      integer*4 flag,iZA
      pi = 3.14159265
      Do 10101 Ia = 1,3
      WindV(ia) = 0
      Do 10101 ib = 1,3
      A(ia,ib) = 0
10101 Continue
      NPV = NumPts
      do 10201 point = 1,NumPts
      iwtv(point) = 1
      sinZA(point) = sqrt(sin(spp(point,3)*pi/180)**2
     1      +      sin(spp(point,4)*pi/180)**2)
      if ((sinZA(point) .lt. sin(ThMinV*pi/180)) .or.
     1    (sinZA(point) .gt. sin(ThMaxV*pi/180))) then
      iwtv(point) = 0
      NPV = NPV - 1
      if (NPV .lt. MinV) then
      FitFlag = 0
      go to 90909
      endif
      endif
      CosL(point) = Sin(spp(point,3)*pi/180)
      CosM(point) = Sin(spp(point,4)*pi/180)
      CosN(point) = sqrt(1 - CosL(point)**2 - CosM(point)**2)
10201 continue
      SigmaLast = 1e8
20001 flag = 0
      Do 10301 point = 1,NumPts
      if (iwtv(point) .eq. 0) go to 10301
      A(1,1) = A(1,1) + CosL(point)**2
      A(1,2) = A(1,2) + CosL(point)*CosM(point)
      A(1,3) = A(1,3) + CosL(point)*CosN(point)
      A(2,2) = A(2,2) + CosM(point)**2
      A(2,3) = A(2,3) + CosM(point)*CosN(point)
      A(3,3) = A(3,3) + CosN(point)**2
      WindV(1) = WindV(1) + SPP(point,2)*CosL(point)
      WindV(2) = WindV(2) + SPP(point,2)*CosM(point)
      WindV(3) = WindV(3) + SPP(point,2)*CosN(point)
10301 Continue
      A(2,1) = A(1,2)
      A(3,1) = A(1,3)
      A(3,2) = A(2,3)
      det = a(1,1)*a(2,2)*a(3,3) + 2*a(1,2)*a(1,3)*a(2,3) -
     1      a(1,1)*a(2,3)**2 - a(2,2)*a(1,3)**2 - a(3,3)*a(1,2)**2
```

```
      If (abs(det) .lt. 1.0e-7) then
      write (*,*) 'WFV: no solution'
      Fitflag = 0
      go to 90909
      endif

      u(jzW) = (WindV(1)*(a(2,2)*a(3,3)-  a(2,3)**2) +
     1     WindV(2)*(a(2,3)*a(1,3) - a(1,2)*a(3,3)) +
     2     WindV(3)*(a(1,2)*a(2,3) - a(1,3)*a(2,2)))/det
      v(jzW) = (WindV(1)*(a(2,3)*a(1,3) - a(1,2)*a(3,3)) +
     1      WindV(2)*(a(1,1)*a(3,3) - a(1,3)**2) +
     2      WindV(3)*(a(1,3)*a(1,2) - a(1,1)*a(2,3)))/det
      w(jzW) = (WindV(1)*(a(1,2)*a(2,3) - a(1,3)*a(2,2)) +
     1      WindV(2)*(a(1,2)*a(1,3) - a(1,1)*a(2,3)) +
     2      WindV(3)*(a(1,1)*a(2,2) - a(1,2)**2))/det
c
c  Calculate the Standard Deviation (Sigma)
c
      ErrorSum = 0
      Do 10401 point = 1,NumPts
      if (iwtv(point) .eq. 0) go to 10401
      dvr(point) = spp(point,2) - u(jzW)*CosL(point)
     1            - v(jzW)*CosM(point) - w(jzW)*CosN(point)
      ErrorSum = ErrorSum + dvr(point)**2
10401 Continue
      Sigma = sqrt(ErrorSum/NPV)

      Do 10501 point = 1,NumPts
      if (iwtv(point) .eq. 0) go to 10501
      if (abs(dvr(point)) .gt. NSigma*Sigma) then
      iwtv(point) = 0
      flag = 1
      NPV = NPV - 1
      if (NPV .lt. MinV) then
      FitFlag = 0
      go to 90909
      endif
      endif
10501 Continue

      if (flag .eq. 0) go to 20002
      if (flag .eq. 1) then
      if (Sigma .ge. 0.999*SigmaLast) go to 20002
      if (Sigma .le. 0.01) go to 20002
      SigmaLast = Sigma
      go to 20001
      endif
c
c  good velocity.
c
20002 if ( (abs(u(jzW)) .gt. vHmax)      .or.
     1     (abs(v(jzW)) .gt. vHmax)      .or.
     2     (abs(w(jzW)) .gt. vHmax/20) ) then
c     write (*,*) 'jzw,NumPts,u,v,w = '
c     write (*,*) jzw,NumPts,u(jzw),v(jzw),w(jzw)
      FitFlag = 0
      go to 90909
      endif

90909 Return
```

End

```
c
$Debug
c
************************************************************************
      Subroutine WFH
************************************************************************
C
C   THIS SUBROUTINE CALCULATES horizontal WINDS FROM MAPSTAR SPPs.
C   August 17, 1990
c
$Include:'Wind.Inc'
$Include:'Header.inc'

      Dimension H(3,3),Wind(3)
      Real*4 Sigma,SigmaLast
      integer*4 flag,iZA
      pi = 3.14159265
      Do 10101 Ia = 1,3
      Wind(ia) = 0
      Do 10101 ib = 1,3
      H(ia,ib) = 0
10101 Continue
      do 10102 iDir = 1,3
      PPCnt(iDir) = 0
      do 10102 ii = 1,17
      Numrad(ii,iDir) = 0
      vrad(ii,iDir) = 0
10102 Continue
      NPH = NumPts
      do 10201 point = 1,NumPts
      iwth(point) = 1
      if ((sinZA(point) .lt. sin(ThMinH*pi/180)) .or.
     1    (sinZA(point) .gt. sin(ThMaxH*pi/180))) then
      iwth(point) = 0
      NPH = NPH - 1
      if (NPH .lt. MinH) then
      FitFlag = 0
      go to 90909
      endif
      endif
      CosL(point) = Sin(spp(point,3)*pi/180)
      CosM(point) = Sin(spp(point,4)*pi/180)
      CosN(point) = sqrt(1 - CosL(point)**2 - CosM(point)**2)
10201 continue
      SigmaLast = 1e8
20001 flag = 0
      Do 10301 point = 1,NumPts
      if (iwth(point) .eq. 0) go to 10301
      H(1,1) = H(1,1) + CosL(point)**2
      H(1,2) = H(1,2) + CosL(point)*CosM(point)
      H(2,2) = H(2,2) + CosM(point)**2
      Wind(1) = Wind(1) + SPP(point,2)*CosL(point)
     1                  - CosL(point)*w(jzW)
      Wind(2) = Wind(2) + SPP(point,2)*CosM(point)
     1                  - CosM(point)*w(jzW)
10301 Continue
      H(2,1) = H(1,2)
      det = H(1,1)*H(2,2) - H(1,2)**2

      If (abs(det) .lt. 1.0e-7) then
```

```
      write (*,*) 'MVH: no solution'
      Fitflag = 0
      go to 90909
      endif

      u(jzW) = (wind(1)*H(2,2) - wind(2)*H(1,2))/det
      v(jzW) = (H(1,1)*wind(2) - H(1,2)*wind(1))/det
c
c  Calculate the Standard Deviation (Sigma)
c
      ErrorSum = 0
      Do 10401 point = 1,NumPts
      if (iwth(point) .eq. 0) go to 10401
      dvr(point) = spp(point,2) - u(jzW)*CosL(point)
     1           - v(jzW)*CosM(point) - w(jzW)*CosN(point)
      ErrorSum = ErrorSum + dvr(point)**2
10401 Continue
      Sigma = sqrt(ErrorSum/NPH)

      Do 10501 point = 1,NumPts
      if (iwth(point) .eq. 0) go to 10501
      if (abs(dvr(point)) .gt. NSigma*Sigma) then
      iwth(point) = 0
      flag = 1
      NPH = NPH - 1
      if (NPH .lt. MinH) then
      FitFlag = 0
      go to 90909
      endif
      endif
10501 Continue

      if (flag .eq. 0) go to 20002
      if (flag .eq. 1) then
      if (Sigma .ge. 0.999*SigmaLast) go to 20002
      if (Sigma .le. 0.01) go to 20002
      SigmaLast = Sigma
      go to 20001
      endif
c
c  good velocity.
c
20002 if ( (abs(u(jzW)) .gt. vHmax)      .or.
     1     (abs(v(jzW)) .gt. vHmax)      .or.
     2     (abs(w(jzW)) .gt. vHmax/20) ) then
      FitFlag = 0
      go to 90909
      endif

      WD = (180/pi)*atan2(v(jzW),u(jzW))

      do 10601 point = 1,NumPts
      if ((iwtv(point) .eq. 1) .or. (iwth(point) .eq. 1)) then
      Theta = (180/pi)*atan2(CosM(point),CosL(point))
      diff = Theta-WD
      if (diff .lt. -180) diff = diff + 360
      if (diff .gt. +180) diff = diff - 360

      if ((abs(diff) .lt. 45) .or. (abs(diff) .gt. 135)) then
      iDW = 1
```

```
      else
      iDW = 2
      endif
      PPCnt(iDW) = PPCnt(iDW) + 1
      PPCnt(3) = PPCnt(3) + 1

      dvr(point) = spp(point,2) - u(jzW)*CosL(point)
     1           - v(jzW)*CosM(point) - w(jzW)*CosN(point)
      ZA = (180/pi)*asin(sinZA(point))
      iZA = int(ZA) + 1

      if (iza .eq. 17) iZA = 16
      vrad(iZA,iDW) = vrad(iZA,iDW) + dvr(point)**2
      vrad(iZA,3) = vrad(iZA,3) + dvr(point)**2
c        vrad(iZA,iDW) = vrad(iZA,iDW) + abs(dvr(point))
c        vrad(iZA,3) = vrad(iZA,3) + abs(dvr(point))
      Numrad(iZA,iDW) = Numrad(iZA,iDW) + 1
      Numrad(iZA,3) = Numrad(iZA,3) + 1
      endif
10601 continue

      do 10702 iDir = 1,3
      if (PPCnt(iDir) .gt. 0) then
      do 10701 ialpha = 1,16
      if (Numrad(ialpha,iDir) .eq. 0) go to 10701
      vrad(ialpha,iDir) = sqrt(vrad(ialpha,iDir)/Numrad(ialpha,iDir))
c        vrad(ialpha,iDir) = vrad(ialpha,iDir)/Numrad(ialpha,iDir)
10701 continue
      endif
10702 continue

90909 Return
      End
```

wind.inc

```
 common /wind1/ Spp(5500,10)
 common /wind2/ z(130),u(130),v(130),w(130),TRP(130),
1           rej(7),line(10),sinZA(5500),Width(130),
2           iwtv(5500),iwth(5500),rmsdvr(130,3),PPCnt(3),
4           CosL(5500),CosM(5500),CosN(5500),dvr(5500),
5           Numrad(17,3),vrad(17,3),PPslope(2)
 common /wind3/ pi,vHmax,ThMaxH,ThMinH,ThMaxV,ThMinV,MinH,MinV,
1          Nsigma,Single,TestFlag,polarization,
1          jzW,QuitFlag,NumPts,interval,infile,outfile,
2          inpath,outpath,emonth,eday,ehour,eminute,NPH,NPV,NPV0,
3          slope,intercept,FitFlag
 real*4 pi,vHmax,ThMax,ThMaxV,dz,z,u,v,w,TRP,SigmaFinal,sinZA,
1      line,rmsdvr,CosL,CosM,CosN,dvr,slope,intercept,
2      vrad,PPslope
 integer*4 QuitFlag,rej,jzW,parameter,Single,TestFlag,
1         point,NumPts,interval,BigTime,NPV,NPV0,Testflag,FitFlag,
2         emonth,eday,ehour,eminute,MinH,MinV,
3         Numrad,PPCnt
 character*10 outpath
 character*40 infile,outfile
 character*9 inpath
 character*1 polarization
```

```
c
$Debug
      program Wind
c
**********************************************************************
*                                                                    *
*      IDI Wind-Calculation Program; MAPSTAR Radar.                  *
*      Copyright 1990, Holodyne Limited 1986.                        *
*      All Rights Reserved.                                          *
*                                                                    *
**********************************************************************
c
c   This program will calculate wind profiles in 3-km steps, with
c   smoothing, for a single scattering-point parameter file from SppM
c   or a group of files from SGroup.  The scattering-point parameters
c   are :
c   1.  Altitude (km).
c   2.  Radial velocity (m/sec).
c   3.  Zenith angle in East-West meridian (degrees).
c   4.  Zenith angle in North-South meridian (degrees).
c   5.  Voltage amplitude on #1 Dipoles.
c   6.  Phase of #1 Dipoles (degrees).
c   7.  Voltage amplitude on #2 Dipoles.
c   8.  Phase of #2 Dipoles (degrees).
c   9.  E-W zenith-angle window.
c   10. N-S zenith-angle window.
c
c   Explanation of easily-reprogrammed parameters (just change the source-
c      code value given below:
c   vHmax is the largest allowed horizontal velocity. We test each point
c     against Vmax by projecting its radial velocity into the horizontal
c     plane, and reject it if it's bigger than Vmax.
c   ThMaxV is the largest acceptable radial zenith angle for w.
c   ThMinV is the smallest acceptable radial zenith angle for w.
c   ThMaxH is the largest acceptable radial zenith angle for u and v.
c   ThMinH is the smallest acceptable radial zenith angle for u and v.
c   MinNumPts is the minimum number of points.  If there are not sufficient
c      points, that altitude is skipped.
c   NSigma is the maximum number of standard deviations from the fit any
c     individual point can lie without being rejected from the velocity
c     calculation.
c  Wind calls Header, inname, outname, WFV, WFH, and PhFit.
c
c  April 16, 1991.
c
$Include:'Wind.Inc'
$Include:'Header.inc'
      character*1 ans1,ans2,polarization
      real NumSndgs,Rate,Zmin,Zmax
      pi = 3.14159265
      polarization = 'a'
      VrMax = 300
      Zmin = 78
      Zmax = 102
      jzW = 26
      jzWmax = 34
c
c  Set ipick = 0/1 to disable/enable the vHmax filter.
c
      ipick = 1
```

```
      vHmax = +300

      ThMinV = 0
      ThMaxV = 10
      ThMinH = 3
      ThMaxH = 16
      ThMin = 0
      ThMax = 16

      MinH = 5
      MinV = 5
      Nsigma = 3.0

      CALL Header
      delZ = AltStep*1e-3/2
************************************************************************
*   Communicate with User
*
20001 write (*,*) 'Single file, Group, or Loop? (s/g/L)'
      read (*,'(a)') ans1
      loop = 0
      if (ans1 .eq. 'L') then
      ijk = 1
      loop = 1
      go to 20009
      elseif (ans1 .eq. 's') then
      write (*,*) 'Input file name?'
      read (*,'(a)') infile
      outfile = 'Wind.dat'
      Single = 1
      elseif (ans1 .eq. 'g') then
      Single = 0
      open (3,file='wind.txt')
      write (*,*) 'Use Default Values? (y/n)'
      read (*,'(a)') ans2
      if (ans2 .eq. 'y') then
c
c  user must set these values before compilation to use the default option.
c
      interval = 60
      inpath = 'e:\1hour\'
      outpath = 'c:\w1hour\'
      Month = 4
      Day = 5
      Hour = 14
      Minute = 00
      eMonth = 4
      eDay = 11
      eHour = 16
      eMinute = 0
c
cccccccccccccccccccccccccccccccccccccccccccccccccccc
      else
      write (*,*) 'Grouping interval (minutes)?'
      read (*,*) interval
      write (*,*) 'Center time of first file (month,day,hr,min)?'
      read (*,*) Month,Day,Hour,Minute
      write (*,*) 'Time of last file (month,day,hr,min)?'
      read (*,*) eMonth,eDay,eHour,eMinute
      write (*,*) 'Input path (9 characters)'
```

```
      read (*,'(a)') inpath
      write (*,*) 'Output path (10 characters)'
      read (*,'(a)') outpath
      endif
      else
      go to 20001
      endif
      go to 20010

20009 continue
      Month = 4
      Day = 5
      Hour = 14
      Minute = 00
      eMonth = 4
      eDay = 11
      eHour = 16
      if (ijk .eq. 1) then
      interval = 5
      inpath = 'e:\05min\'
      outpath = 'c:\w05min\'
      elseif (ijk .eq. 2) then
      interval = 15
      inpath = 'e:\15min\'
      outpath = 'c:\w15min\'
      elseif (ijk .eq. 3) then
      interval = 60
      inpath = 'e:\1hour\'
      outpath = 'c:\w1hour\'
      elseif (ijk .eq. 4) then
      interval = 120
      inpath = 'e:\2hour\'
      outpath = 'c:\w2hour\'
      endif
20010 continue
**************************************************************************

      if (Single .eq. 1) go to 20102
      open (3,file='Wind.txt')
**************************************************************************
*    Return to here for new file
**************************************************************************
20101 call inname
      call outname
      write (*,*) 'infile = ',infile
      write (*,*) 'outfile = ',outfile
      write (3,'(a)') outfile

20102 write (*,90003)
90003 format
     1 (1x,' alt    u       v     w   TRP  Ntot  Rate',
     2 '  slope intercept PPs(1)  PPs(2)')
      Open (1,err=90909,file=infile,status='old',form='binary')
20103 Read (1,err=90909,end=90909) (line(parameter),parameter=1,10)
      if (line(1) .gt. -990) go to 20103
      NumSndgs = line(2)
      rewind (1)
      Open (2,err=90909,file=outfile)
      QuitFlag = 0
c     jzW = 1
```

```
      do 10101 jz = 1,40
      Z(jz) = (AltStep*float(jz-1) + AltMin)*1e-3
      u(jz) = 0
      v(jz) = 0
      w(jz) = 0
      TRP(jz) = 0
      rmsdvr(jz,1) = 0
      rmsdvr(jz,2) = 0
10101 continue

      do 10102 irej=1,4
      rej(irej) = 0
10102 continue
c     Read (1,err=90909,end=20203) (line(parameter),parameter=1,10)

************************************************************************
*  Return to here for new altitude.
************************************************************************
c
20201 NumPts = 0
      rewind (1)
      Read (1,err=90909,end=20203) (line(parameter),parameter=1,10)

20202 if (line(1)  .le. Z(jzW)-delZ) then
      Read (1,err=90909,end=20203) (line(parameter),parameter=1,10)
      go to 20202
      endif
      if (line(1) .gt. Z(jzW)+delZ) then
      if ((NumPts .lt. MinV) .or. (NumPts .lt. MinH)) go to 20206
      go to 20204
      endif
c
c  Reject the point if: (1) altitude < 1 km.
c                       (2) zenith angle not between ThMin and ThMax,
c                       (3) projected horizontal velocity > vHmax,
c                       (4) radial velocity = 0
c                       (5) linear polarization
c                       (6) ordinary polarization
c                       (7) extraordinary polarization
c
      TestFlag = 1

c     if ((line(3) .gt. 0) .and.
c    1    (line(4) .lt. 0)) then
      if (line(1) .lt. 1) then
      rej(1) = rej(1) + 1
      TestFlag = 0
      endif

      sinZAx = sqrt(sin(line(3)*pi/180)**2
     1          + sin(line(4)*pi/180)**2)
      if ( (sinZAx .lt. sin(ThMin*pi/180))   .or.
     1     (sinZAx .gt. sin(ThMax*pi/180)) ) then
      rej(2) = rej(2) + 1
      TestFlag = 0
      endif

      if (sinZAx .gt. 0.02 .and. ipick .eq. 1) then
      if(abs(line(2)/sinZAx) .gt. vHmax) then
      rej(3) = rej(3) + 1
```

```
      TestFlag = 0
      endif
      endif

      if (line(2) .eq. 0) then
      rej(4) = rej(4) + 1
      TestFlag = 0
      endif

      if (abs(line(2)) .gt. VrMax) then
      TestFlag = 0
      endif

c
c  Linear polarization filter (removes linearly polarized points):
c
      if (polarization .eq. 'o' .or. polarization .eq. 'x') then
      if (abs(line(6)-line(8)) .lt. 45)  TestFlag = 0
      if ( (abs(line(6)-line(8)) .gt. 135) .and.
     1       (abs(line(6)-line(8)) .lt. 225) ) TestFlag = 0
      if ( (abs(line(6)-line(8)) .gt. 315) .and.
     1       (abs(line(6)-line(8)) .lt. 360) ) TestFlag = 0
      endif
c
c
c  Ordinary polarization filter (removes ordinary points):
c
      if (polarization .eq. 'l' .or. polarization .eq. 'x') then
      if (line(6)-line(8) .gt. 45  .and.
     1    line(6)-line(8) .lt. 135 )  TestFlag = 0
      if (line(6)-line(8) .gt. -315  .and.
     1    line(6)-line(8) .lt. -225 )  TestFlag = 0
      endif
c
c
c  Extraordinary polarization filter (removes extraordinary points):
c
      if (polarization .eq. 'l' .or. polarization .eq. 'o') then
      if (line(6)-line(8) .gt. -135  .and.
     1    line(6)-line(8) .lt. -45 )  TestFlag = 0
      if (line(6)-line(8) .gt. 225  .and.
     1    line(6)-line(8) .lt. 315 )  TestFlag = 0
      endif
c
c
c
***********************************************************************
      if (NumPts .eq. 6500) then
      write (*,*) 'Thanks anyhow, but Ive already got 6500 points.'
      TestFlag = 0
      endif

c     else
c     TestFlag = 0
c     endif

      if (TestFlag .eq. 1) then
      NumPts = NumPts + 1

      do 10201 parameter = 1,10
```

```
      spp(NumPts,parameter) = line(parameter)
10201 continue

      TRP(jzW) = TRP(jzW) + line(5)**2 + line(7)**2
      endif

      Read (1,err=90909,end=20203) (line(parameter),parameter=1,10)
      go to 20202

20203 quitflag = 1

20204 Fitflag = 1
c
c  Fit the scattering points in this window with a 3-vector.
c
20205 CALL WFV
      if (Fitflag .eq. 0) then
      write (*,*) 'Vertical Failure at ',jzW,Z(jzW)
      write (2,90002) -1000.0,-1000.0,-1000.0,-1000.0,-1000.0,-1000.0,
     1                -1000.0,-1000.0,-1000.0,-1000.0,-1000.0,-1000.0
      go to 20206
      endif

      Call WFH

      if (Fitflag .eq. 0) then
      write (*,*) 'Horizontal Failure at ',jzW,Z(jzW)
      write (2,90002) -1000.0,-1000.0,-1000.0,-1000.0,-1000.0,-1000.0,
     1                -1000.0,-1000.0,-1000.0,-1000.0,-1000.0,-1000.0
      else
      if (TRP(jzW) .lt. 1) then
      TRP(jzW) = 0
      else
      TRP(jzW) = 10*log10(TRP(jzW))
      endif
      call PhFit
      Rate = float(NumPts)/NumSndgs
      write (*,90001)
     1 Z(jzW),u(jzW),v(jzW),w(jzW),TRP(jzW),NumPts,Rate,
     2 slope,intercept,PPslope(1),PPslope(2)
      x1 = float(NumPts)
      x2 = float(NPV)
      x3 = float(NPH)
      write (2,90002)
     1  Z(jzW),u(jzW),v(jzW),w(jzW),w(jzW)*10,TRP(jzW),x1,Rate,
     2  slope,intercept,PPslope(1),PPslope(2)
      endif
90001 format (1x,f4.0,2(1x,f6.1),2(1x,f5.1),1x,i4,5(1x,f5.2))
90002 format (1x,12(e12.4,1x))
c
c  If it's not time to quit, increment jzW and go read the next points.
c
20206 if (QuitFlag .eq. 0) then
      jzW = jzW + 1
      if (jzW .le. jzWmax) then
c     Read (1,err=90909,end=20203) (line(parameter),parameter=1,10)
      go to 20201
      endif
      endif
```

```
      Close (1)
      Close (2)

      write (*,*) 'Rejections:'
      WRITE (*,*) '        Z<1km      ThLimits       vHmax        Vr=0'
      write (*,*) (rej(irej),irej=1,4)

      If (Single .eq. 1) go to 90909
      if (month .eq. emonth .and. day .eq. eday .and.
     1    hour .eq. ehour .and. minute .eq. eminute) go to 90909
      BigTime = minute+hour*60+day*24*60+month*30*24*60 + interval
      month = BigTime/(30*24*60)
      day = (Bigtime-month*30*24*60)/(24*60)
      hour = (BigTime-month*30*24*60-Day*24*60)/60
      minute = BigTime-month*30*24*60-Day*24*60-Hour*60
      go to 20101
90909 close (1)
      close (2)
      close (3)
91919 if (loop .eq. 1) then
      ijk = ijk + 1
      if (ijk .le. 4) go to 20009
      endif

      End
```

```
c
$Debug
c
      Subroutine inName
c
c  inName creates the input file names for WGroup.
c
$Include:'Wind.inc'
$Include:'Header.inc'
c
c
      character*2 ascmonth,ascday,aschour,ascminute
      if (month .lt. 10) then
      write (ascmonth,90001) '0',month
90001 format (a1,i1)
      else
      write (ascmonth,90002) month
90002 format (i2)
      endif
      if (day .lt. 10) then
      write (ascday,90001) '0',day
      else
      write (ascday,90002) day
      endif
      if (hour .lt. 10) then
      write (aschour,90001) '0',hour
      else
      write (aschour,90002) hour
      endif
      if (minute .lt. 10) then
      write (ascminute,90001) '0',minute
      else
      write (ascminute,90002) minute
      endif
      write (infile,90003)
     1  inpath,ascMonth,ascDay,ascHour,ascMinute,'.mbs'
90003 format (21a)
      return
      end
```

```
c
$Debug
c
      Subroutine outName
c
c  outName creates the output file names for WGroup.
c
$Include:'Wind.inc'
$Include:'Header.inc'
c
c
      character*2 ascmonth,ascday,aschour,ascminute
      if (month .lt. 10) then
      write (ascmonth,90001) '0',month
90001 format (a1,i1)
      else
      write (ascmonth,90002) month
90002 format (i2)
      endif
      if (day .lt. 10) then
      write (ascday,90001) '0',day
      else
      write (ascday,90002) day
      endif
      if (hour .lt. 10) then
      write (aschour,90001) '0',hour
      else
      write (aschour,90002) hour
      endif
      if (minute .lt. 10) then
      write (ascminute,90001) '0',minute
      else
      write (ascminute,90002) minute
      endif
      write (outfile,90003)
     1  outpath,ascMonth,ascDay,ascHour,ascMinute,'.maw'
90003 format (21a)
      return
      end
```

```
c
$Debug
c
*********************************************************************
      Subroutine PhFit
*********************************************************************
C
C   THIS SUBROUTINE fits two straight lines to the variation of velocity
c   variance vs zenith angle; one line to variations along the wind
c   vector, the second to variations perpendicular to the wind vector.
C   August 18, 1990
c
$Include:'Wind.Inc'
$Include:'Header.inc'
c
c  First, use all the points to get the intercept.
c
      sumvr = 0
      sumvrph = 0
      sumph = 0
      sumph2 = 0
      sumI = 0


      do 10101 ialpha = 1,17
      if (Numrad(ialpha,3) .eq. 0) go to 10101
      ZA = ialpha - 0.5
      sumvr = sumvr + vrad(ialpha,3)
      sumvrph = sumvrph + vrad(ialpha,3)*ZA
      sumph = sumph + ZA
      sumph2 = sumph2 + ZA**2
      sumI = sumI + 1
10101 continue
10102 continue

      if ((sumI .ge. 3) .and.
     1    (sumI*sumph2 - sumph**2 .ne. 0)) then
      slope = (sumI*sumvrph - sumvr*sumph)/(sumI*sumph2 - sumph**2)
      intercept = (sumvr - slope*sumph)/sumI
      else
      slope = 0
      intercept = 0
      PPslope(1) = 0
      PPslope(2) = 0
      return
      endif
c
c  Now fit the parallel and perpendicular variances separately.
c
      do 10202 iDir = 1,2
      sumvr = 0
      sumvrph = 0
      sumph = 0
      sumph2 = 0
      sumI = 0

      do 10201 ialpha = 1,17
      if (Numrad(ialpha,iDir) .eq. 0) go to 10201
      ZA = ialpha - 0.5
      sumvr = sumvr + vrad(ialpha,iDir)
```

```
      sumph = sumph + ZA
      sumI = sumI + 1
10201 continue
      PPslope(iDir) = 0
      if (sumI .gt. 0) PPslope(iDir)=(sumvr-intercept*sumI)/sumph
10202 continue

c     write (*,*) 'NPH,PPCnt(1),PPCnt(2),PPCnt(3) = '
c     write (*,*)  NPH,PPCnt(1),PPCnt(2),PPCnt(3)
c     do 10301 ialpha = 1,17
c     write (*,*)
c    1 ialpha,NumRad(ialpha,1),NumRad(ialpha,2),NumRad(ialpha,3)
10301 continue
      return
      end
```

```
c
$Debug
c
      program SGroup
c
c  SGroup (Scattering-point Grouping software) takes a list of (presumably
c  tape-long) scattering-point parameter (.mbs) files (which are specified
c  in SGroup.txt), groups them into
c  time intervals specified by the user, sorts them by altitude, and
c  names them according to the time at the center of the interval.
c  Filtering by zenith angle (ThetaMax) and maximum projected horizontal
c  velocity (Vmax) are also done here.
c  Converted to 10 parameters/point: 3/21/91
c
$Include:'SGroup.inc'
$include:'sname.inc'
c
c  Link Sgroup+SName+SMerge+BellSub
c
***********  SET-UP AND INITIALIZE  ************
c
      real*4 xnumsndgs
      integer*4 filecount
      character*3 filter
      character*1 answer
      pi = 3.14159265
      ThetaMax = 16
      vHmax = 300
      Zmin = 60
      Zmax = 120
      filter = 'on'
      write (*,*) 'SGroup expects the list of input (.mbs) files and'
      write (*,*)
     1'their polarization codes to be in SGroup.txt.'
      path = 'd:\1hour\'
      write (*,*) 'Single file? (y/n)'
      read (*,'(a)') answer
      if (answer .eq. 'y') then
      write (*,*) 'DataSpan,month,day,hour,min = '
      read (*,*) DataSpan,month,day,hour,minute
      polarization(1) = 'o'
      else
      DataSpan = 60
      Spacing = 60
      month = 4
      day = 5
      hour = 14
      minute = 00
      endif
      call SName
      write (*,*) 'Ready to Fill First Output File ',sfile
      open (102,file=sfile,form='binary')
      filecount = 1
      BigTime = Minute + Hour*60 + Day*24*60 + Month*30*24*60
      FirstTime = BigTime - DataSpan/2
      LastTime = BigTime + DataSpan/2
      open (101,file='SGroup.txt',status='old')
      iTape = 1
20001 read (101,90201,end=20002) infile(iTape),polarization(iTape)
90201 format (a,2x,a)
```

```
      iTape = iTape + 1
      go to 20001
20002 close (101)
      NumTapes = iTape-1
      write (*,*) 'Number of tapes to process = ',NumTapes
      do 10001 iSndg = 1,9
      write (asciSndg,90101) '000',iSndg
90101 format (a3,i1)
      write (Sndg(iSndg),90005) 'c:\holda\',asciSndg,'.mbs'
10001 continue
90005 format (17a)
      do 10002 iSndg = 10,99
      write (asciSndg,90102) '00',iSndg
90102 format (a2,i2)
      write (Sndg(iSndg),90005) 'c:\holda\',asciSndg,'.mbs'
10002 continue
      do 10003 iSndg = 100,500
      write (asciSndg,90103) '0',iSndg
90103 format (a1,i3)
      write (Sndg(iSndg),90005) 'c:\holda\',asciSndg,'.mbs'
10003 continue
      do 10004 iSndg = 501,999
      write (asciSndg,90103) '0',iSndg
      write (Sndg(iSndg),90005) 'c:\holdb\',asciSndg,'.mbs'
10004 continue
      iTape = 1
      Now = 0
      iSndg = 0
*****************  NOW START PROCESSING TAPES  ****************
c
c  Return to here when another input tape is needed.
c
20003 write (*,*) 'Ready to Process Tape ',infile(iTape)
      write (*,*) 'Polarization: ',polarization(iTape)
      open (101,file=infile(iTape),form='binary')
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
c
c  Return to here when another output file is needed.
c
20004 iSndg = 0
      Now = 0
      filecount = filecount + 1
      call SName
      write (*,*) 'Ready to fill Output File ',sfile
      open (102,file=sfile,form='binary')
20005 if (spp(1) .lt. -990) then
      iswitch = 0
      ThisTime = spp(3)*30*24*60 + spp(4)*24*60 + spp(5)*60 + spp(6)
      if (ThisTime .lt. FirstTime) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      elseif (ThisTime .gt. LastTime) then
      go to 20007
      else
      Now = 1
      Select = 0
      endif
      endif
c
```

```
c  Go back; not time yet.
c
      if (Now .eq. 0) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      if (filter .eq. 'off') go to 20006
c
c  Filter by altitudes.
c
      if (spp(1) .lt. Zmin .or. spp(1) .gt. Zmax) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
c
c  Polarization Filters:
c   o = ordinary
c   p = ordinary plus linear
c   x = extraordinary
c   y = extraordinary plus linear
c   l = linear
c   c = circular = ordinary plus extraordinary
c   n = none (filtering done at 20009).
c
c  linear polarization filter
c
      if ((polarization(iTape) .eq. 'o') .or.
     1    (polarization(iTape) .eq. 'x') .or.
     2    (polarization(iTape) .eq. 'c')) then
      pd = abs(spp(6)-spp(8))
      if ( (pd .le. 45) .or.
     1   ( (pd .ge. 135) .and. (pd .le. 225) ) .or.
     2     (pd .ge. 315) ) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      endif
c
c  ordinary polarization filter
c
      if ((polarization(iTape) .eq. 'x') .or.
     1    (polarization(iTape) .eq. 'y') .or.
     2    (polarization(iTape) .eq. 'l')) then
      if (spp(6)-spp(8) .gt. 45 .and. spp(6)-spp(8) .lt. 135) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      if (spp(6)-spp(8) .gt. -315 .and. spp(6)-spp(8) .lt. -225) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      endif
c
c  extraordinary polarization filter:
c
      if ((polarization(iTape) .eq. 'o') .or.
     1    (polarization(iTape) .eq. 'p') .or.
     2    (polarization(iTape) .eq. 'l')) then
      if (spp(6)-spp(8) .ge. -135 .and.
     1    spp(6)-spp(8) .le. -45) then
```

```
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      if (spp(6)-spp(8) .ge. 225 .and.
     1    spp(6)-spp(8) .le. 315) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      endif
c
c  Filter on zenith angle.
c
      sinZA = sqrt(sin(spp(3)*pi/180)**2 + sin(spp(4)*pi/180)**2)
      if (asin(sinZA)*180/pi .gt. ThetaMax) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
c
c  Filter on vHmax.
c
      if (sinZA .gt. .01) then
      if (abs(spp(2)/sinZA) .gt. vHmax) then
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
      endif
      endif

20006 if (iswitch .eq. 0) then
      iswitch = 1
      iSndg = iSndg + 1
      if (iSndg .gt. 999) go to 20008
      close (103)
      open (103,file=Sndg(iSndg),form='binary')
      endif

      if (spp(1) .gt. -990)
     1    write (103) (spp(parameter),parameter=1,10)
      read (101,end=20008) (spp(parameter),parameter=1,10)
      go to 20005
c
c  if you're past the time limit, merge the individual output files into
c  the outfile, set the new time limits, and go do the next output file.
c
20007 close  (103)
      NumSndgs = iSndg
      write (*,*) 'Number of Soundings in this group:',NumSndgs
      write (*,*) ' '
      if (NumSndgs .gt. 0) call SMerge
      xnumsndgs = float(numsndgs)
      write (102) -999.0, xnumsndgs, .0, .0, .0, .0, .0, .0, .0, .0
      close (102)
      if (answer .eq. 'y') go to 90909
      if (iTape .eq. NumTapes+1) go to 90909
      BigTime = BigTime + Spacing
      Month = BigTime/(30*24*60)
      Day = (BigTime-Month*30*24*60)/(24*60)
      Hour = (BigTime-Month*30*24*60-Day*24*60)/60
      Minute = (BigTime-Month*30*24*60-Day*24*60-Hour*60)
      FirstTime = BigTime - DataSpan/2
      LastTime = BigTime + DataSpan/2
```

```
      go to 20004

20008 close (101)
      iTape = iTape + 1
20009 if (polarization(iTape) .eq. 'n') then
      iTape = iTape + 1
      go to 20009
      endif
      if (iTape .le. NumTapes) go to 20003
      if (iTape .eq. NumTapes+1) go to 20007
90909 close (201)
      call BellSub
      end
```

```
c
$Debug
c
      Subroutine SName
c
c  SName creates the file names for SGroup.
c
$Include:'Sname.inc'
c
c
      if (month .lt. 10) then
      write (ascmonth,90001) '0',month
90001 format (a1,i1)
      else
      write (ascmonth,90002) month
90002 format (i2)
      endif
      if (day .lt. 10) then
      write (ascday,90001) '0',day
      else
      write (ascday,90002) day
      endif
      if (hour .lt. 10) then
      write (aschour,90001) '0',hour
      else
      write (aschour,90002) hour
      endif
      if (minute .lt. 10) then
      write (ascminute,90001) '0',minute
      else
      write (ascminute,90002) minute
      endif
      write (sfile,90003)
     1  path,ascMonth,ascDay,ascHour,ascMinute,'.mbs'
90003 format (28a)
      return
      end
```

```
$Debug
c
      Subroutine SMerge
c
c  This subroutine will merge a number of binary scattering-point
c  parameter (.mbs) files generated by SGroup into a single file sorted
c  by altitude.  The names of the files are c:\holda\0001.mbs to 0500.mbs,
c  and c:\holdb\0501.mbs to 0999.mbs.
c  December 30, 1989.
c  Modified for 10-parameter points: 3/21/91
c  Looking for problem that results in altitude order problem: 5/30/91.
c
$Include:'SGroup.inc'
      dimension sppl(10),spp2(10)
      real*4 zlast
      integer*4 index
***********************************************************************
c
c  read the first file into templ.mbs to get started.
c
      open (1,file=Sndg(1),status='old',form='binary')
      open (2,file='c:templ.mbs',status='unknown',form='binary')
20001 read (1,end=20002) (sppl(parameter),parameter=1,10)
      write (2) (sppl(parameter),parameter=1,10)

      go to 20001
20002 imark = 1
      close (1)
      close (2)

      if (NumSndgs .eq. 2) go to 20030
      if (NumSndgs .eq. 1) go to 20040

***********************************************************************
********************** Process Files By Pairs ************************
c
c        ************ First File of Pair *************
c
      do 10002 ifile = 2,NumSndgs-1,2

      open (1,file=Sndg(ifile),status='old',form='binary')
      open (2,file='c:templ.mbs',status='old',form='binary')
      open (3,file='c:temp2.mbs',status='unknown',form='binary')
40001 read (1,end=20013) (sppl(parameter),parameter=1,10)
40002 read (2,end=20012) (spp2(parameter),parameter=1,10)
20011 if (sppl(1) .lt. spp2(1)) then
      write (3) (sppl(parameter),parameter=1,10)

40003 read (1,end=20013) (sppl(parameter),parameter=1,10)
      go to 20011

      else
      write (3) (spp2(parameter),parameter=1,10)

40004 read (2,end=20012) (spp2(parameter),parameter=1,10)
      go to 20011
      endif
c
c  you get here if templ.vbs ran out of points before Sndg.
```

```
c
20012 write (3) (spp1(parameter),parameter=1,10)

20112 read (1,end=20014) (spp1(parameter),parameter=1,10)
      write (3) (spp1(parameter),parameter=1,10)

      go to 20112
c
c  you get here if Sndg ran out of points before templ.vbs.
c
20013 write (3) (spp2(parameter),parameter=1,10)

20113 read (2,end=20014) (spp2(parameter),parameter=1,10)
      write (3) (spp2(parameter),parameter=1,10)

      go to 20113

20014 imark = imark + 1
      close (1)
      close (2)
      close (3)
c
c        ************** Second File of Pair **************
c
      open (1,file=Sndg(ifile+1),status='old',form='binary')
      open (2,file='c:temp2.mbs',status='unknown',form='binary')
      open (3,file='c:templ.mbs',status='unknown',form='binary')

40005 read (1,end=20023) (spp1(parameter),parameter=1,10)
40006 read (2,end=20022) (spp2(parameter),parameter=1,10)
20021 if (spp1(1) .lt. spp2(1)) then
      write (3) (spp1(parameter),parameter=1,10)

40007 read (1,end=20023) (spp1(parameter),parameter=1,10)
      go to 20021
      else
      write (3) (spp2(parameter),parameter=1,10)

40008 read (2,end=20022) (spp2(parameter),parameter=1,10)
      go to 20021
      endif
c
c  you get here if templ.vbs ran out of points before Sndg.
c
20022 write (3) (spp1(parameter),parameter=1,10)

20122 read (1,end=20024) (spp1(parameter),parameter=1,10)
      write (3) (spp1(parameter),parameter=1,10)

      go to 20122
c
c  you get here if Sndg ran out of points before templ.vbs.
c
20023 write (3) (spp2(parameter),parameter=1,10)

20123 read (2,end=20024) (spp2(parameter),parameter=1,10)
      write (3) (spp2(parameter),parameter=1,10)

      go to 20123
```

```
20024 imark = imark + 1
      close (1)
      close (2)
      close (3)

10002 continue
      if (NumSndgs-imark .eq. 1) go to 20030
      if (NumSndgs-imark .eq. 0) go to 20040

*************************************************************************
c
c  if the number of files is even, there will still be one file left.
c

20030 open (1,file=Sndg(NumSndgs),status='old',form='binary')
      open (2,file='c:templ.mbs',status='old',form='binary')
40009 read (1,end=20033) (sppl(parameter),parameter=1,10)
40010 read (2,end=20032) (spp2(parameter),parameter=1,10)
20031 if (sppl(1) .lt. spp2(1)) then
       write (102) (sppl(parameter),parameter=1,10)

40011 read (1,end=20033) (sppl(parameter),parameter=1,10)
      go to 20031

      else
      write (102) (spp2(parameter),parameter=1,10)

40012 read (2,end=20032) (spp2(parameter),parameter=1,10)
      go to 20031
      endif
c
c  you get here if templ.vbs ran out of points before Sndg.
c
20032 write (102) (sppl(parameter),parameter=1,10)

20132 read (1,end=30001) (sppl(parameter),parameter=1,10)
      write (102) (sppl(parameter),parameter=1,10)

      go to 20132
c
c  you get here if Sndg ran out of points before templ.vbs.
c
20033 write (102) (spp2(parameter),parameter=1,10)

20133 read (2,end=30001) (spp2(parameter),parameter=1,10)
      write (102) (spp2(parameter),parameter=1,10)

      go to 20133

*************************************************************************
c
c  If the number of files was odd, or there was only one file
c  initially, transfer the sorted file into mergeout.vbs.
c
20040 open (1,file='c:templ.mbs',status='old',form='binary')
20041 read (1,end=30001) (sppl(parameter),parameter=1,10)
      write (102) (sppl(parameter),parameter=1,10)

      go to 20041
```

```
*************************************************************************
30001 close (1)
      close (2)
      close (3)
      end
```

```
c
$Debug
c
      subroutine Bellsub
      integer*2 ihr,imin,isec,i100th
      integer*4 duration
      real*4 LastTime,ThisTime
      character*1 ding
      Call gettim(ihr,imin,isec,i100th)
      Duration = 0
      LastTime = ihr*3600 + imin*60 + isec + i100th*.01
      ding = char(7)

20001 write (*,90001) ding
90001 format (a1,\)
20002 Call gettim(ihr,imin,isec,i100th)
      ThisTime = ihr*3600 + imin*60 + isec + i100th*.01
      if (ThisTime - LastTime .lt. 1) go to 20002
      Last Time = ThisTime
      Duration = Duration + 1
      if (Duration .le. 10) go to 20001
      return
      end
```

sname.inc

```
c sname.inc
      common /sname1/ month,day,hour,minute,sfile,path
      character*2 ascmonth,ascday,aschour,ascminute
      integer*4 month,day,hour,minute
      character*9 path
      character*40 sfile
```

SGroup.inc

```
c
c
c  SGroup.inc
c
      common /SG1/ BigTime,pi,ThetaMax,Vmax,NumSndgs,Sndg
c     common /SG2/ SumNum(44),SumPwr(44)
      dimension spp(10),infile(1000),Sndg(1000),polarization(1000)
      real*8 SumNum,SumPwr
      real*4 spp,ThetaMax,Vmax,pi
      integer*4 iTape,group,NoiseLimit,NoiseCount,iSndg,
     1          BigTime,FirstTime,LastTime,DataSpan,Spacing,
     2          NumSndgs,parameter,select,Now
      character*4 ascisndg
      character*16 infile
      character*17 Sndg
      character*1 polarization
```

```
DatLog.txt

Dat #01
GR233: 50 raw files; list, 49 processed files, .mbs file. 101   101
GR235: 50 raw files; list, 49 processed files, .mbs file. 101   202
GR236: 50 raw files; list, 49 processed files, .mbs file. 101   303
GR239: 49 raw files; list, 47 processed files, .mbs file.  98   401
GR240: 49 raw files; list, 47 processed files, .mbs file.  98   499
GR241: 48 raw files; list, 45 processed files, .mbs file.  95   594
GR242: 50 raw files; list, 49 processed files, .mbs file. 101   695
GR243: 50 raw files; list, 49 processed files, .mbs file. 101   796
GR244: 49 raw files; list, 47 processed files, .mbs file.  98   894
GR245: 50 raw files; list, 49 processed files, .mbs file. 101   995

Dat #02
GR246: 50 raw files; list, 49 processed files, .mbs file. 101   101
GR247: 46 raw files; list, 43 processed files, .mbs file.  91   192
GR248: 50 raw files; list, 49 processed files, .mbs file. 101   293
GR249: 50 raw files; list, 49 processed files, .mbs file. 101   394
GR250: 50 raw files; list, 49 processed files, .mbs file. 101   495
GR251: 50 raw files; list, 49 processed files, .mbs file. 101   596
GR252: 50 raw files; list, 49 processed files, .mbs file. 101   697
GR253: 49 raw files; list, 45 processed files, .mbs file.  96   793
GR254: 50 raw files; list, 49 processed files, .mbs file. 101   894
GR255: 49 raw files, list, 31 processed files, .mbs file.  82   976

Dat #03 (Djuth)
GR267: 40 raw files, list, 38 processed files, .mbs file.   80    80
GR268: 41 raw files, list, 38 processed files, .mbs file.   80   160
GR292: 41 raw files, list, 39 processed files, .mbs file.   82   242
GR293: 40 raw files, list, 38 processed files, .mbs file.   80   322
GR334: 49 raw files, list, 48 processed files, .mbs file.   99   421
GR335: 49 raw files, list, 47 processed files, .mbs file.   98   519
GR336: 49 raw files, list, 48 processed files, .mbs file.   99   618

Dat #04
GR160: 49 raw files, list, 48 processed files, .mbs file.   99    99
GR161: 49 raw files, list, 48 processed files, .mbs file.   99   198
GR162: 49 raw files, list, 48 processed files, .mbs file.   99   297
GR163: 48 raw files, list, 47 processed files, .mbs file.   97   394
GR164: 49 raw files, list, 48 processed files, .mbs file.   99   493
GR165: 48 raw files, list, 46 processed files, .mbs file.   96   589
GR166: 47 raw files, list, 44 processed files, .mbs file.   93   682
GR167: 49 raw files, list, 48 processed files, .mbs file.   99   781
GR168: 49 raw files, list, 48 processed files, .mbs file.   99   880
GR169: 49 raw files, list, 48 processed files, .mbs file.   99   979

Dat #05
GR170: 49 raw files, list, 48 processed files, .mbs file.   99    99
GR171:    raw files, list,    processed files, .mbs file.
GR172:    raw files, list,    processed files, .mbs file.
GR173:    raw files, list,    processed files, .mbs file.
```

The DAT to disc copying program TAPEREAD.f

This, and the following Macintosh II compatible FORTRAN 77 programs have been developed by Bob Roper to facilitate the comparisons of IDI - ISR and IDI - Fabry-Perot spectrometer (FPS) winds, with appropriately acknowledged portions of the Adams' programs used to obviate reinvention.

TAPEREAD.f copies the scattering point parameter files from DAT to hard drive as SPP - GR XXX files (where XXX is the original MAPSTAR 9 track data tape number) for subsequent processing by programs IDIWIND.f, GROVES.f and ISRIDIIDIG.f. This may seem redundant, but the original scattering point parameter files contain Universal Coordinated Time (UTC) data from close to the surface to as high as 130km.TAPEREAD changes the timing to local mean solar time (LMST = UTC - 4 hours 28 minutes for Arecibo, which is at 18°N, 67°W. The change to LMST conforms to the international protocol for the reporting of atmospheric tidal wind phases) and records only those scattering points whose altitudes are between 66 and 116km, which spans the altitude range (70 - 95Km) of primary interest in the AIDA comparisons; the altitudes from 66 to 116km are used in the IDI wind and GROVES analyses. A considerable amount of time in subsequent processing is saved because of not only the smaller data set, but also the decreased data access time..

TAPEREAD uses a subroutine IQTAPE, which is a proprietary item. The WangDAT tape drive accessing IQTAPE routines may be purchased from

Cyber-Comp Inc.,
10522 Topeka Drive,
Northridge, CA 91326-3032

Phone (818) 366-6786

```
C       PROGRAM TAPEREAD
C       READS WangDAT TAPE, WRITES SPP - GR XXX FILES TO DISC
C       (ONE FILE PER RAW DATA TAPE)
C       AND PRINTS STATISTICS TO SCREEN.
C       REJECTS ALL DATA OUTSIDE HEIGHT RANGE ZMIN TO ZMAX,
C       AND ALL ABS(ARRIVAL ANGLES) > 90 DEGREES.
C       CONVERTS TIMES TO LOCAL MEAN SOLAR (ARECIBO; 18N,67W)
C
C       REQUIRES SUBROUTINES
C                                   RDYWANG
C                                   SWITCH7 (IBM TO MAC REALS)
C                                   IBAD
C                                   IQTAPE
C
        REAL*4 SPBLOCK(10),SPBYTE(10),FLAG
        INTEGER*1 STATS(64)
        INTEGER*4 CHAN,IFIX,NUM,ISIZE,NBOUT,SKIP
        CHARACTER*1 DUM(40),BITE(16384)
        CHARACTER*40 DUMMY
        COMMON STATS,BITE
        EQUIVALENCE (DUMMY,DUM)
        LAST=341
        ZMAX=116.0
        ZMIN=66.0
        FLAG=-999.0
        NOUGHT=0
        ZERO=0.0
        NBAD=NOUGHT
        NINETY=90.0
        CHAN=3
        IFIX=NOUGHT
        NUM=1
        SIZE=16384
        NBOUT=16384
        HOLD=ZERO
C
        WRITE (*,*) " PROGRAM TAPECOPY - WangDAT TO DISC"
        WRITE (*,*) " "
C
        WRITE (*,*) " ENTER FIRST SPP TAPE NUMBER THIS DAT TAPE"
        READ (*,*) ITAPE
        WRITE (*,*) " ENTER START TAPE NUMBER"
        READ (*,*) NTAPE
        WRITE (*,*) " ENTER LAST TAPE NUMBER"
        READ (*,*) LAST
        SKIP=NTAPE-ITAPE
        CALL RDYWANG (SKIP)
        OPEN (17,FILE="DIAGNOS",FORM="FORMATTED")
C
      6 LOOP=NOUGHT
        NGOOD=NOUGHT
        WRITE (*,*) " PROCESSING TAPE ",NTAPE
        WRITE (17,*) " PROCESSING TAPE ",NTAPE
C
C       DEFINE SCRATCH TAPE
C
```

```
      OPEN (16,FILE="TEMP",FORM="UNFORMATTED")
C
C     OPEN DISC FILE FOR NTAPE
C
      DUMMY="SPP - GR "
      I100=NTAPE/100
      I10=(NTAPE-I100*100)/10
      I1=NTAPE-I100*100-I10*10
      DUM(10)=CHAR(I100+48)
      DUM(11)=CHAR(I10+48)
      DUM(12)=CHAR(I1+48)
      OPEN (26,FILE=DUMMY,FORM="UNFORMATTED")
C
    7 JERR=IQTAPE (15,CHAN,IFIX,NUM,BITE,SIZE,NBOUT,STATS)     !READ TAPE
      IF (JERR.EQ.8) GO TO 20
      IF (JERR.GT.-1) GO TO 15
      IF (JERR.EQ.-1) GO TO 16
      WRITE (*,*) "+++++ TAPE READ ERROR +++++ JERR = ",JERR,HOLD
      GO TO 7
C
C     WRITE TEMPORARY FILE
C
   15 WRITE(16) BITE
      GO TO 7
C
C     SELECT USEFUL DATA FROM FILE "TEMP"
C
   16 REWIND (16)
   30 READ (16,END=33) SPBYTE
      CALL SWITCH7 (SPBLOCK,SPBYTE)
      IF (SPBLOCK(1).EQ.FLAG) GO TO 310
C
C     ACCEPT ONLY ECHOES BETWEEN ZMIN AND ZMAX
C
      IF (SPBLOCK(1).LT.ZMIN) GO TO 30
      IF (SPBLOCK(1).GT.ZMAX) GO TO 30
C
C     REJECT ANGLES GREATER THAN 90 DEGREES
C
      IF (ABS(SPBLOCK(3)).GT.NINETY) GO TO 31
      IF (ABS(SPBLOCK(4)).GT.NINETY) GO TO 31
      GO TO 32
C
   31 NBAD=NBAD+1
      GO TO 30
C
  310 MY=SPBLOCK(2)
      MO=SPBLOCK(3)
      JO=SPBLOCK(4)
      LTIMH=SPBLOCK(5)
      LTIMM=SPBLOCK(6)
      MSEC=SPBLOCK(7)
C
C     CHANGE UT TO LOCAL MEAN SOLAR (UT-4H 28M)
C

      LTIMM=LTIMM-28
      IF(LTIMM.GE.0) GO TO 130
```

```
      LTIMM=LTIMM+60
      LTIMH=LTIMH-1
  130 LTIMH=LTIMH-4
      IF(LTIMH.GE.0) GO TO 195
      LTIMH=LTIMH+24
      JO=JO-1
  195 SPBLOCK(4)=JO
      SPBLOCK(5)=LTIMH
      SPBLOCK(6)=LTIMM
      SPBLOCK(7)=MSEC
C
C     THIS IS A USEABLE POINT!
C     WRITE SPBLOCK TO DISC
C
   32 WRITE (26) SPBLOCK
      IF(SPBLOCK(1).EQ.FLAG) GO TO 320
      NGOOD=NGOOD+1
      GO TO 30
  320 LOOP=LOOP+1
      IF(LOOP.NE.1) GO TO 30
      WRITE (*,*) SPBLOCK
      WRITE (17,*) SPBLOCK
      GO TO 30
C
C     CLOSE DISC FILE OF CURRENT NTAPE
C
   33 WRITE (*,100) NBAD,NGOOD
  100 FORMAT (/" NUMBER OF BAD RECORDS THIS TAPE =",I6/
     *" NUMBER OF USEABLE RECORDS THIS TAPE =",I6/)
      WRITE (17,100) NBAD,NGOOD
      WRITE (*,*) "                    ***** EOF ***** EOF ***** EOF *****"
      WRITE (17,*) "                    ***** EOF ***** EOF ***** EOF *****"
      WRITE (*,*) " "
      WRITE (17,*) " "
      NBAD=NOUGHT
      CLOSE (26)
      CLOSE (16,STATUS="DELETE")
   34 NTAPE=NTAPE+1
      IF (NTAPE.GT.LAST) GO TO 20
      CALL IBAD (NTAPE,SKIP)
      IF (SKIP.EQ.1) JERR=IQTAPE (7,CHAN,IFIX,SKIP,
     *BITE,SIZE,NBOUT,STATS)                                     !SKIP FILE
      IF (SKIP.EQ.1) WRITE (*,*) " SKIPPING FILE SPP - GR",NTAPE
      IF (SKIP.EQ.1) WRITE (17,*) " SKIPPING FILE SPP - GR",NTAPE
      IF(JERR.EQ.8) GO TO 20                                     !END OF
TAPE MARKER
      IF (SKIP.EQ.1) GO TO 34
      GO TO 6
C
C     PROCESSING COMPLETE
C
   20 CLOSE (17)
      PAUSE " ALL DONE"
      STOP
      END
      SUBROUTINE RDYWANG (SKIP)
C                                  DECEMBER 13, 1991
C     SCATTERING POINT PARAMETERS - WangDAT TAPE SETUP
```

```
C
C
      CHARACTER*40 DFILE,INSTART,INEND
      integer*1 buf(1),stats(64)
      INTEGER*4 CHAN,SIZE,SKIP,SKIPIT,TRY,TAPEONE
C     ALL INTEGERS MUST BE LONGWORD (INTEGER*4)
      COMMON STATS,BUF
C
      WRITE (*,*) " READYING WangDAT TAPE DRIVE"
      WRITE (*,*) " "
      CHAN=3
      IFIX=0
      SKIPIT=0
      NUM=1
      SIZE=16384
      NBOUT=1
      NFILE=0
      TRY=0
C
      WRITE (*,*) " "
    1 WRITE (*,*) " TAPE DRIVE POSITIONING - PLEASE WAIT."
        jerr=iqtape(0,chan,ifix,skipit,buf,size,nbout,stats)      !UNIT
READY?
      TRY=TRY+1
      IF(TRY.GT.2) GO TO 2
      IF(JERR.NE.0) GO TO 1
        jerr=iqtape(5,chan,ifix,skipit,buf,size,nbout,stats)    !rewind
the tape
      IF(JERR.NE.0) GO TO 2
      jerr=iqtape(7,chan,ifix,SKIP,buf,size,nbout,stats)    !skip SKIP
files
      RETURN
    2 WRITE (*,104) JERR
  104 format (" ERROR ",I3,"  CHECK WANGDAT DRIVE")
      WRITE (25,104) JERR
      PAUSE " HIT RETURN TO EXIT"
      STOP
      END
      SUBROUTINE SWITCH7 (BLOCK,BYTE)
C                                               MAY 15, 1991
C     SWITCHES TO AND FROM IBM/MAC FLOATING POINT NUMBERS.
C
      CHARACTER*1 A(4),I(4)
      REAL BLOCK(10),BYTE(10)
      EQUIVALENCE (R,A)
      DO 1 J=1,10
      R=BYTE(J)
      I(1)=A(4)
      I(2)=A(3)
      I(3)=A(2)
      I(4)=A(1)
      A(1)=I(1)
      A(2)=I(2)
      A(3)=I(3)
      A(4)=I(4)
      BLOCK(J)=R
    1 CONTINUE
      RETURN
```

```
      END
      SUBROUTINE IBAD (IFILE,SKIP)
C
C     SETS SKIP TO 1 IF IFILE IS BAD
C
C     THIS ROUTINE FOR AIDA'89 APRIL 5-11,
C     AND MAY 2 - 9 (NO BAD FILES?), 1989 ONLY.
C
      INTEGER*4 BADFILES(8),SKIP
      DATA BADFILES/168,218,223,233,245,247,249,250
      SKIP=0
      DO 1 I=1,8
      IF(IFILE.EQ.BADFILES(I)) GO TO 2
    1 CONTINUE
      RETURN
    2 SKIP=1
      RETURN
      END
```

The tidal wind analysis program GROVES.f

The FORTRAN 77 program GROVES calculates the zonal, meridional and vertical components of the mean (prevailing) wind and periodic components (up to 4 harmonics, including the fundamental) from the scattering point parameter files SPP - GR XXX on disc. The usual configuration (see input file 7GRODAT below) selects the diurnal (24hr) and semidiurnal (12hr) tidal components, but any fundamental period (less than the data interval, of course!) may be specified.

Requires the following input files in the same folder

CADDSPEC, which specifies the designator for the output files. Specification is year, month, startday of interval to be analysed.

```
890503
XXXXXX
```

7DUNK, which contains the header for each page of the output file XXXXXXGROOUT.

```
 RESULTS FOR     APRIL  5 -     APRIL 11    1989      MAPSTAR
AIDA '89
0000000000000000000000000000000000000000000000000000000000000000000000
00000000
```

7DATES, which contains date and location information.

```
000000000000000000000000000000000000000000000000
    APL  5   APL 11  1989
 ARECIBO (18N,67W)
0000XXX0XX000XXX0XX00XXXX000000X0000000000000000000
```

7GRODAT, which determines the processing parameters as follows

```
890405.   890411.        INCLUSIVE DATES
    0                    START HOUR
    5.   10.             ZENITH ANGLES ACCEPTED
    0                    RANGE CORRECTION
  2  2  2                NO. OF HARMONICS (INCLUDING FUNDAMENTAL)
  66.116.                HEIGHT RANGE
    24.                  FUNDAMENTAL PERIOD
  5  5  5  5  5  5       POLYNOMIAL FIT COEFFICIENTS NA
  5  5  5  5  5  5                                   NB
  3  3  3  3  3  3                                   NC
  0                      PROCESS AZIMUTH QUADRANTS 1-4  (0 FOR ALL
QUADRANTS)
```

The subroutines used are listed as include files in the main program. The purpose of each is detailed as comments in each program.

The output files , with prefixes as in CADDSPEC above, are

ECHORATE, a height/time table of scattering point rate

GLDPRNT, a report format table of wind components

ARCHIT, a binary file used internally

DIAGS, a file of runtime diagnostics

GROOUT, contains all information appropriate to processing, including a listing of all SPP - GR XXX files read, an echo rate map and tables of zonal, meridional and vertical wind components

TIDE, a binary file containing the tidal amplitudes and phases

ERROR, a binary with the tidal amplitude and phase errors and

ATIDE, an ASCII version of TIDE.

```
OOOOOO.OOOOOOOOO.XOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
OOOO
C     PROGRAM GROSTAR
C                                            SEPTEMBER 17, 1992
C     GROVES ANALYSIS  - MACINTOSH II MPW VERSION,
C                                WITH INCLUDE FILES.
C
C     APPLIES STANDARD GROVES METEOR WIND ANALYSIS TO MAPSTAR RADAR
C     SCATTERING POINT PARAMETER DATA AS SPP - GR XXX FILES
C     WRITTEN ON DISC BY PROGRAM TAPEREAD.
C
C     A RUN CONSISTS OF
C     MAIN PROGRAM GROSTAR.apl
C     WHICH CONTAINS AS APPENDED FILES
C           SUBROUTINE MAPARAM
C           SUBROUTINE MAPSTAR
C           SUBROUTINE MATSIN
C           SUBROUTINE GMONTH
C           SUBROUTINE DAYMON
C           SUBROUTINE SDIANA
C           SUBROUTINE SVARY
C           SUBROUTINE SDESIG
C           SUBROUTINE ECHO
C           SUBROUTINE GROWZ
C           SUBROUTINE GWINGZ
C           SUBROUTINE GPRINT7
C           SUBROUTINE TRANS7
C            SUBROUTINE IBAD.f
C            SUBROUTINE DateTime
C
C     FILES XXXXARCHIT, XXXXECHORATE, XXXXERROR AND XXXXTIDE
C     (FOR INPUT TO ARCHIVE), XXXXATIDE (FOR INPUT TO ARCH.ETC)
C     XXXXZONAL AND XXXXMERIDIONAL (FOR INPUT TO "WINGZ"),
C     AND XXXXGLDPRNT (REPORT FORMAT WIND COMPONENT LISTING)
C     ARE CREATED BY  GROVES.
C     XXXX DENOTES THE FILE SDESIGNATOR FOR ANY GIVEN RUN, INPUT
C     AT RUNTIME FROM AUTOMATICALLY UPDATED HDISC FILE CADDSPEC.
C
C     READS RESULT SOURCE FROM FILE 7DUNK (INPUT FILE, HDISC) FORMAT
72A1,8A1
C     READS INPUT DATA FROM 7GRODAT (INPUT FILE, HDISC)
C     IN THE FOLLOWING ORDER
C     DATA INTERVAL TO BE PROCESSED,  FORMAT I6,3X,I6
C     STRTDA = START DAY,  6 DIGITS - YEAR MONTH DAY.  690307 IS MARCH
7,1969
C     ENDDAY = END DAY,     6 DIGITS - YEAR MONTH DAY.  700529 IS MAY
29,1970.
C     IF STRTDA-ENDDAY IS BLANK, ALL DATA IN FILE WILL BE PROCESSED.
C     START HOUR,                       FORMAT I6
C     IF START HOUR > 0, ONLY 24 HOURS OF DATA WILL BE PROCESSED.
C     ZENITH ANGLES ACCEPTED,          FORMAT 2F6.0
C     RANGE CORRECTION,                 FORMAT F6.0
C     EAST-WEST TIME VARIATION NP, NORTH-SOUTH TIME VARIATION NQ,
C     AND VERTICAL TIME VARIATION NR, FORMAT 3I3
C     PERIODICITY OF FUNDAMENTAL TIME VARIATION FORMAT F7.0
C     HEIGHT RANGE ZMIN, ZMAX. FORMAT I5,I4
C     EAST-WEST HEIGHT PROFILE.   FORMAT 24I3
```

```
C      NORTH-SOUTH HEIGHT PROFILE. FORMAT 24I3
C      VERTICAL HEIGHT PROFILE.    FORMAT 24I3
C      WINDS ARE CONSIDERED HORIZONAL IF VERTICAL HEIGHT PROFILE IS
C      SDESIGNATED NEGATIVE
C      QUADRANTS TO BE PROCESSED - ZERO FOR ALL QUADRANTS.  FORMAT I3
C      SUBROUTINE GPRINT7 READS DATA INTERVAL FROM 7DATES (INPUT FILE,
HDISC)
C      MONTH, DAY, - MONTH, DAY, YEAR, FORMAT  3X,A4,I3,3X,A4,I3,I5
C      REQUIRES SCATTERING POINT PARAMETER DATA ON WANGDAT TAPE (AS
C      FILE(S) "DUMMY" WHICH IS(ARE) SPECIFIED AT RUNTIME.
C      DATA MUST BE IN SPP OUTPUT TAPE FORMAT - 10 REALS PER RECORD
C      IN IBM PC REAL FORMAT, COMPLETE WITH TIMING FRAMES.
C
       GLOBAL DEFINE
       INCLUDE "Types.inc"
       INCLUDE "OSUtils.inc"
       END
C
       DIMENSION Q(200,200),P(200),AC(200),NA(10),NB(10),NC(10),
      1D(200),SIGMA(200),SINJ(10),COSJ(10),NTIME(24),A(200,200)
       CHARACTER*1 NGO,NPRINT,RESULT(72),SOURCE(8),FF
       CHARACTER*1 CADD(6)
       CHARACTER*40 ECHORATE,DUMMY,INSTART,INEND,TFILE,T4
       INTEGER*1 ICADD(6),ZERO
       INTEGER*2 STRTHR
       INTEGER*4 M,IDATE(3),ISEC,ISEC1,ISEC2,ISEC3
       COMMON/WINDS/ N,Q,NOP,ZMIN,MIN,ZMAX,MAX,NA,NB,NC,NAO,NBO,
      *NCO,SUM,AC,NTIME,NP,NQ,NR,RESULT,SOURCE,PERIOD,
      *FF,CADD,Z,A
       COMMON/ECHOES/ P,VEL,SINJ,COSJ,DCL,DCM,DCN,SUM1,SUM2,SUM3,
      *D,SIGMA,AZENMIN,AZENMAX,IEND
       COMMON/EXTRAS/ IUNIT,ICADD,NGO,STRTDA,ENDDAY,LEAPYR,JMO,
      *MNO(20,24),NFILE,LENGTH,NEG,NPMAX,ZERO,NPRINT,DAY,JOBAD
       COMMON/GENE/ M,UR,MY,MO,JO,LTIMH,LTIMM,MSEC,EL3,EM3
       COMMON/FSPEC/IFILE,DUMMY,INSTART,INEND,NSTART,NPOINTS
       COMMON/HRSTRT/ STRTHR,RNGCOR,ISEC1,ISEC2,ISEC3
       COMMON/HEIGHTS/NOZ,NQUAD
       COMMON/TEMPO/IDATE,LHOUR,LMIN,LSEC

C
       CALL DateTime
       ISEC1=3600*LHOUR+60*LMIN+LSEC
C
C      SET UP PROCESSING PARAMETERS
C
       NBOMB=1
       CALL MAPARAM
C
C      READ DATA, ECHO BY ECHO.
C
       M=0
       UR=0.0
       JOBAD=0
 3     CALL MAPSTAR
       IF (UR.LT.0.9) GO TO 100
C
C      NEXT COMES PROCESSING OF ECHO DATA TO PRODUCE COLUMNS D AND P,
C      AND MATRIX Q.
```

```
C
      DCL=EL3
      DCM=EM3
      DCN=SQRT(1.0-EL3**2-EM3**2)
C
C     CHANGE DIRECTION COSINES AND VELOCITY IF WIND IS TO BE CONSIDERED
C     HORIZONTAL
C
      IF(NEG.NE.-1) GO TO 333
      SINKI=SQRT(1.0-DCN**2)
      DCL=DCL/SINKI
      DCM=DCM/SINKI
      DCN=0.0
      VEL=VEL/SINKI
C
 333  CONTINUE
      CALL ECHO
      GO TO 3
C
C     PRELIMINARY OUTPUT.
C

  100 NBOMB=2
      CLOSE (IUNIT)
      IF (NQUAD.NE.0) GO TO 198
      WRITE (26,197)
  197 FORMAT (/"  ALL QUADRANTS PROCESSED"/)
      GO TO 150
  198 WRITE (26,199) NQUAD
  199 FORMAT(/"  QUADRANT",I2," PROCESSED",/)
  150 ENDDAY=DAY
      WRITE(26,200) STRTDA,ENDDAY
 200  FORMAT(/15H  DATA INTERVAL,3X,F7.0,4H  TO,F8.0//
     11X," VARIATION OF UPPER ATMOSPHERE WINDS WITH HEIGHT",/
     2/1X," GROVES ANALYSIS, WITH ERROR DETERMINATION"//)
      WRITE(26,201) CADD
  201 FORMAT(1X," OUTPUT FILES FROM THIS RUN HAVE PREFIX ",4A1)
      WRITE(26,202) M,NSTART,NPOINTS,AZENMIN,AZENMAX,N,INSTART,
     *INEND,STRTHR,NP,NQ,NR,MAX,MIN,NAO,NA,NBO,NB,NCO,NC,PERIOD
 202  FORMAT(1X//1X," NUMBER OF SCATTERING POINTS PROCESSED   =",
     1I8/"  (STARTING FROM ",I5," AND PROCESSING ",I5," POINT(S)
     2",/"  FOR EACH 1 KM HEIGHT INTERVAL OF EACH RADAR FRAME",
     3/"  WITH ZENITH ANGLES BETWEEN",F4.0,"AND",F4.0," DEGREES)"/
     4/1X," NUMBER OF INPUT PARAMETERS    =",I4,///1X," DATA READ
     5 FROM TAPE FILES STARTFILE   ",A40/24X," TO ENDFILE     ",A40,/
     *1X," STARTING AT HOUR ",I3/
     6/1X," TIME SERIES PARAMETERS P =",I4,"  Q =",I4,"  R =",I4,/
     7/1X," HEICHT RANGE, MAXIMUM  ",I5,1X,"  MINIMUM  ",I5,///1X,
     8" POWER SERIES PARAMETERS"///29X,"NA",11I3//29X,"NB",11I3/
     9/29X,"NC",11I3////1X," PERIOD",F7.1," HOURS")
C
C    SCATTERER RATE AS A FUNCTION OF TIME AND HEIGHT.
C
      NOP=NOP+1
      WRITE (26,999) FF, RESULT,SOURCE,NOP
  999 FORMAT(A1/72A1,8A1,26X,"PAGE",I3)
      WRITE(26,4000) NTIME
 4000 FORMAT(//" SCATTER RATE AS A FUNCTION OF TIME AND HEIGHT."//)
```

```
     11X,7H HEIGHT,24I5/1X)
      NH=(MAX-MIN)/3+1
      DO 4002 K=1,NH
      NZ=MAX-3*K+3
      KK=NH-K+1
      WRITE(26,4001) NZ,(MNO(KK,J),J=1,24)
 4001 FORMAT(1X,I5,2X,24I5/)
C
C      FILE ECHO RATE MAP IN "ECHORATE"
C
      ECHORATE="ECHORATE "
      CALL SDESIG (ECHORATE,CADD)
      OPEN (12,FILE=ECHORATE,FORM="UNFORMATTED")
      WRITE (12) (MNO(KK,J),J=1,24)
 4002 CONTINUE
      CLOSE (12)
C
      IF(M.GT.120) GO TO 400
      NBOMB=3
      GO TO 1102
C
C     INVERSION OF Q, AND FORMATION OF COEFFICIENT COLUMN AC.
C
 400  CONTINUE
      DO 101 J=1,N
      DO 101 K=1,N
      A(J,K)=Q(J,K)
 101  CONTINUE
      NBOMB=4
      WRITE (*,*) M," POINTS PROCESSED"
      WRITE (*,*) " "
      WRITE (*,*) " ATTEMPTING INVERSION OF MATRIX Q (TO A) "
      WRITE (*,*) " "
      CALL MATSIN(A,N,DETERM)
      IF(DETERM.GT.-12.0) GO TO 1103
 1102 WRITE(25,1104) FF, RESULT,N,N,DETERM,NBOMB
 1104 FORMAT(A1////1X,72A1////1X,52H **** ERROR IN INPUT DATA HAS
RESULTED
     1 IN MATRIX  Q(I3,1H,I3,34H) BEING UNSUITABLE FOR INVERSION.////
     2 10X,50H     $$$$$     $$$$$     $$$$$     $$$$$     $$$$$/////
     31X,13H DETERMINANT ,E12.4///1X,18H CONTINGENCY LEVEL,I5///
     41X,30H PROGRAMME CANNOT BE CONTINUED)
      PAUSE " NON-INVERTABLE MATRIX Q  -  CHECK DATES IN 7GRODAT!"
      GO TO 302
C
C     FORMULATE MODEL COEFFICIENTS ( AC )
C
 1103 CONTINUE
      DO 103 K=1,N
      DO 103 J=1,N
      AC(K)=AC(K)+P(J)*A(J,K)
 103  CONTINUE
      DO 104 J=1,N
      DO 104 K=1,N
      SUM1=SUM1+AC(J)*AC(K)*Q(J,K)
 104  CONTINUE
      DO 105 J=1,N
      SUM2=SUM2+AC(J)*P(J)
```

```
 105  CONTINUE
      M10=M-10
      SUM=(SUM1-(2.0*SUM2)+SUM3)/FLOAT(M10*N)
      DO 106 J=1,N
      CHECK=A(J,J)*SUM
      ACHECK=ABS(CHECK)+0.01
      SIGN=CHECK/ACHECK
 106  SIGMA(J)=SIGN*SQRT(ACHECK)
C
C     OUTPUT
C
      NOP=NOP+1
      WRITE (26,999) FF, RESULT,SOURCE,NOP
      WRITE(26,35) DETERM,N
 35   FORMAT(/36H LOG (BASE 10) OF MATRIX DETERMINANT,E13.6
     *//" COLUMN MATRIX AC(",I3,")"/1X)
      LINE=0
      MA=N/2+1
      DO 205 I=1,MA
 208  WRITE(26,209) AC(I),SIGMA(I),AC(I+MA),SIGMA(I+MA)
 209  FORMAT(13X,2(13X,F7.2,3X,F7.1))
      LINE=LINE+1
      IF (LINE.LT.42) GO TO 205
      LINE=0
      NOP=NOP+1
      WRITE (26,999) FF, RESULT,SOURCE,NOP
      WRITE(26,36) N
 36   FORMAT(1X//" COLUMN MATRIX AC(",I3,") (CONTD) "/1X)
 205  CONTINUE
      WRITE(25,*) " AC RECORDED"
      IF (PERIOD.NE.24.0) GO TO 300
      WRITE (*,*) "    CALLING SDIANA"
      CALL SDIANA
      WRITE (*,*) "    DIURNAL VARIATION COMPLETED"
      WRITE (25,*) "    DIURNAL VARIATION COMPLETED"
 300  WRITE (*,*) "    CALLING SVARY"
      CALL SVARY
      WRITE (*,*) "    TIDES FILED "
      WRITE (25,*) "    TIDES FILED "
      IF (PERIOD.NE.24.0.OR.NPMAX.GT.2) GO TO 301
C
C     PREPARE FILE "GLDPRNT"
C
      CALL GPRINT7
C
C     PREPARE INPUT FILES FOR "WINGZ"
C
      CALL GROWZ (CADD)
      WRITE (25,*) " WINGZ FILES COMPLETED"
C
C     PREPARE SPYGLASS TRANSFORM PLOT FILES
C
      TFILE="UUU"
      T4="T4U "
      CALL TRANS7 (TFILE,T4)
      TFILE="VVV"
      T4="T4V "
      CALL TRANS7 (TFILE,T4)
```

```
      T4="T4W "
      TFILE="WWW"
      CALL TRANST (TFILE,T4)
      WRITE (25,*) " SPYGLASS FILES COMPLETED"
      WRITE (*,*) " SPYGLASS FILES COMPLETED"
C
  301 CALL DateTime
      ISEC2=3600*LHOUR+60*LMIN+LSEC
      ISEC=ISEC2 ISEC3-ISEC1
      JHOUR=ISEC 3600
      JMIN=ISEC/60-JHOUR*60
      JSEC=ISEC-JHOUR*3600-JMIN*60
      WRITE (*,107) JHOUR,JMIN,JSEC,M
  107 FORMAT (/// " PROGRAM TOOK ",I3," HOURS ",I2," MINS ",I2," SECS
     * TO PROCESS ",I6," ECHOES" A1)
      WRITE (25,107) JHOUR,JMIN,JSEC,M
      WRITE (26,107) JHOUR,JMIN,JSEC,M,FF
      WRITE (25,108)
  108 FORMAT (" SUCCESSFUL COMPLETION OF GROVES ANALYSIS!")
      CLOSE (25)
      CLOSE (26)
      WRITE (*,*) " "
      WRITE (*,108)
      WRITE (*,*) " "
      WRITE (*,*) " "
      WRITE (*,*) " ISN'T THIS FUN?"
      WRITE (*,*) " "
      WRITE (*,*) " "
      WRITE (*,*) "                              - HIT RETURN TO EXIT"
      PAUSE
      STOP
  302 WRITE (*,*) " "
      PAUSE " ERROR EXIT"
      WRITE (25,109)
  109 FORMAT (" ERROR EXIT. STATEMENT 302")
      WRITE (26,109)
      CLOSE (25)
      CLOSE (26)
      STOP
      END



      SUBROUTINE DateTime
      IMPLICIT NONE
      integer*4 month,day,year,hour,minute,second
      COMMON/TEMPO/year,month,day,hour,minute,second
C define a datetime record, structure and comments taken
C from Inside MacIntosh, Vol 2, page 378

      RECORD /DateTimeRec/ DateTime

      CALL GetTime(DateTime)
        month=DateTime.month
        day=DateTime.day
        year=DateTime.year
        hour=DateTime.hour
```

```
  minute=DateTime.minute
second=DateTime.second
  RETURN
  END
```

```
      SUBROUTINE DAYMON(MYRDAY,L,MO,JO)
C
C                                        MARCH [illegible]
C     CALCULATES DAY OF YEAR RELATIVE TO ZERO HOUR, JANUARY 1
C
      GO TO (1,2,3,4,5,6,7,8,9,10,11,12) MO
    1 MYRDAY=JO
      RETURN
    2 MYRDAY=31+JO
      RETURN
    3 MYRDAY=59+JO+L
      RETURN
    4 MYRDAY=90+JO+L
      RETURN
    5 MYRDAY=120+JO+L
      RETURN
    6 MYRDAY=151+JO+L
      RETURN
    7 MYRDAY=181+JO+L
      RETURN
    8 MYRDAY=212+JO+L
      RETURN
    9 MYRDAY=243+JO+L
      RETURN
   10 MYRDAY=273+JO+L
      RETURN
   11 MYRDAY=304+JO+L
      RETURN
   12 MYRDAY=334+JO+L
      RETURN
      END
```

```
      SUBROUTINE ECHO
C                                                MAY 14, 1991
C     SETS UP MATRIX EQUATION BY PROCESSING  JFF DATA FILE
C
      SAVE
      DIMENSION NA(10),NB(10),NC(10),AC(200),SUMSA(10),SUMSB(10),
     *SUMSC(10),D(200),P(200),Q(200,200),NTIME(24),SINJ(10),COSJ(10)
     *,SIGMA(200)
      CHARACTER*1 CADD(6),RESULT(72),SOURCE(8),FF
      COMMON/WINDS/ N,Q,NOP,ZMIN,MIN,ZMAX,MAX,NA,NB,NC,NAO,NBO,
     *NCO,SUM,AC,NTIME,NP,NQ,NR,RESULT,SOURCE,PERIOD,
     *FF,CADD,Z
      COMMON/ECHOES/ P,VEL,SINJ,COSJ,DCL,DCM,DCN,SUM1,SUM2,SUM3,
     *D,SIGMA
C
C     CALCULATE NORMALIZED HEIGHT OF SCATTERING POINT
C
      S=(2.0*Z-ZMAX-ZMIN)/(ZMAX-ZMIN)+1.0E-06
C
      SUMP=0.0
      SUMQ=0.0
      SUMR=0.0
      NCOUNT=0
 1000 NAOT=2*NAO
      SUMSAO=1
      IF(NAOT) 110,110,84
 84   DO 8 K=2,NAOT,2
      SUMSAO=SUMSAO+S**K
 8    CONTINUE
      IF(NP) 110,110,85
 85   DO 10 J=1,NP
      NA2=2*NA(J)
      SUMSA(J)=1
      DO 9 K=2,NA2,2
 9    SUMSA(J)=SUMSA(J)+S**K
      SUMP=SUMP+SUMSA(J)
 10   CONTINUE
 110  SUMP=SUMP+SUMSAO
      NBOT=2*NBO
      SUMSBO=1
      IF(NBOT) 130,130,114
 114  DO 11 K=2,NBOT,2
      SUMSBO=SUMSBO+S**K
 11   CONTINUE
      IF(NQ) 130,130,115
 115  DO 13 J=1,NQ
      NB2=2*NB(J)
      SUMSB(J)=1
      DO 12 K=2,NB2,2
 12   SUMSB(J)=SUMSB(J)+S**K
      SUMQ=SUMQ+SUMSB(J)
 13   CONTINUE
 130  SUMQ=SUMQ+SUMSBO
      NCOT=2*NCO
      SUMSCO=1
      IF(NCOT) 160,160,135
 135  DO 14 K=2,NCOT,2
      SUMSCO=SUMSCO+S**K
```

```
14    CONTINUE
      IF(NR) 160,160,145
145   DO 16 J=1,NR
      NC2=2*NC(J)
      SUMSC(J)=1.0
      DO 15 K=2,NC2,2
15    SUMSC(J)=SUMSC(J)+S**K
      SUMR=SUMR+SUMSC(J)
16    CONTINUE
160   SUMR=SUMR+SUMSCO
      WF=1.0/((DCL**2)*SUMP+(DCM**2)*SUMQ+(DCN**2)*SUMR)
      SUM3=SUM3+WF*VEL**2
      NAOE=NAO+1
      DO 20 K=1,NAOE
      NCOUNT=NCOUNT+1
20    D(NCOUNT)=DCL*(S**(K-1))
      IF(NP) 322,322,320
320   DO 21 J=1,NP
      NAE=NA(J)+1
      DO 21 K=1,NAE
      NCOUNT=NCOUNT+1
21    D(NCOUNT)=DCL*(S**(K-1))*SINJ(J)
      DO 22 J=1,NP
      NAE=NA(J)+1
      DO 22 K=1,NAE
      NCOUNT=NCOUNT+1
22    D(NCOUNT)=DCL*(S**(K-1))*COSJ(J)
322   NBOE=NBO+1
      DO 23 K=1,NBOE
      NCOUNT=NCOUNT+1
23    D(NCOUNT)=DCM*(S**(K-1))
      IF(NQ) 325,325,323
323   DO 24 J=1,NQ
      NBE=NB(J)+1
      DO 24 K=1,NBE
      NCOUNT=NCOUNT+1
24    D(NCOUNT)=DCM*(S**(K-1))*SINJ(J)
      DO 25 J=1,NQ
      NBE=NB(J)+1
      DO 25 K=1,NBE
      NCOUNT=NCOUNT+1
25    D(NCOUNT)=DCM*(S**(K-1))*COSJ(J)
325   NCOE=NCO+1
      DO 26 K=1,NCOE
      NCOUNT=NCOUNT+1
26    D(NCOUNT)=DCN*(S**(K-1))
      IF(NR) 328,328,326
326   DO 27 J=1,NR
      NCE=NC(J)+1
      DO 27 K=1,NCE
      NCOUNT=NCOUNT+1
27    D(NCOUNT)=DCN*(S**(K-1))*SINJ(J)
      DO 28 J=1,NR
      NCE=NC(J)+1
      DO 28 K=1,NCE
      NCOUNT=NCOUNT+1
28    D(NCOUNT)=DCN*(S**(K-1))*COSJ(J)
328   DO 29 J=1,N
```

```
      P(J)=P(J)+WF*VEL*D(J)
 29   CONTINUE
      DO 30 J=1,N
      DO 30 K=1,N
      Q(J,K)=Q(J,K)+WF*D(J)*D(K)
 30   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE GMONTH (RMONTH,I)
C                                 MARCH 30, 1990
C     DETERMINES HOLERITH MONTH
C
      CHARACTER*4 MO(12),RMONTH
      INTEGER*4 I
      DATA MO/" JAN"," FEB"," MAR"," APL"," MAY"," JUN"," JLY",
     *" AUG"," SEP"," OCT"," NOV"," DEC"/
      IF(I.LT.1.OR.I.GT.12) GO TO 1
      RMONTH=MO(I)
      RETURN
    1 WRITE(*,100) I
  100 FORMAT("ILLEGAL MONTH ",I5)
      PAUSE
      STOP
      END
```

```
      SUBROUTINE GPRINT7
C                                                         MAY 14, 1991
C     FOR USE WHEN ONLY MEAN, DIURNAL AND SEMIDIURNAL GROVES
C     FITS ARE USED TO GENERATE FILE "XXXXTIDE".
C
C     PREPARES FILE OF GROVES OUTPUT FOR PRINTING
C     IN REPORT STYLE FORMAT, WITH OUTPUT AT 4KM INTERVALS
C     FOR ZONAL, MERIDIONAL AND VERTICAL COMPONENTS.
C
C
C     ACCESSES FILES "XXXXTIDE" AND "XXXXERROR" (OUTPUT FROM QUARY)
C     AND "7DATES", IF AVAILABLE
C
      DIMENSION IH(47),AM(765),ER(765),AO(153),AU24(153),PH24(153),
     *AU12(153),PH12(153),EO(153),ER24(153),ERPH24(153),ER12(153),
     *ERPH12(153)
      CHARACTER*1 FF,WHERE(32),RESULT(72),SOURCE(8)
      CHARACTER*4 CADD,FILE,FMON1,FMON2
      CHARACTER*40 GLDPRNT
      COMMON/WINDS/ N,Q(200,200),NOP,ZMIN,MIN,ZMAX,MAX,
     *NA(10),NB(10),NC(10),NAO,NBO,NCO,SUM,AC(200),
     *NTIME(24),NP,NQ,NR,RESULT,SOURCE,PERIOD,
     *FF,CADD
C
      MHITE=MAX-MIN+1
      NHITE=MHITE-4
      IHITE=15*MHITE
      OPEN (5,FILE="7DATES",FORM="FORMATTED")
      REWIND (15)
      REWIND (16)
      GLDPRNT="GLDPRNT "
      CALL SDESIG (GLDPRNT,CADD)
      OPEN (17,FILE=GLDPRNT,FORM="FORMATTED")
C
C     CHECK DATES
C
      WRITE (*,*) " LOOKING FOR FILE DATES."
C
      GO TO 11
C
C     ENTER DATA INTERVAL IF FILE 1DATES MISSING
C
    9 WRITE(*,98)
   98 FORMAT("ENTER DATA INTERVAL; MONTH,DAY,MONTH,DAY,YEAR,
     * WHERE (3X,A4,I3,2X,A4,I3,1X,I5/32A1)")
      READ(*,99,ERR=9) FMON1,JO1,FMON2,JO2,MYEAR,WHERE
   99 FORMAT(/3X,A4,I3,2X,A4,I3,1X,I5/32A1)
      GO TO 12
   11 READ(5,99,ERR=9) FMON1,JO1,FMON2,JO2,MYEAR,WHERE
      CLOSE (5)
C
C     INITIALIZE
C
   12 DO 10 I=1,NHITE
      IH(I)=MAX+1-I
   10 CONTINUE
C
C     READ AMPLITUDES, PHASES AND ERRORS
```

```
C
      FILE="ERROR"
      READ (16,END=14,ERR=13) (ER(I),I=1,IHITE)
      FILE="TIDE "
      READ (15,END=14,ERR=13) (AM(I),I=1,IHITE)
C
C     SET UP APPROPRIATE ARRAYS
C
      DO 8 I=1,IHITE,5
      J=(I/5)+1
      AO(J)=AM(I)
      AU24(J)=AM(I+1)
      PH24(J)=AM(I+2)
      AU12(J)=AM(I+3)
      PH12(J)=AM(I+4)
      EO(J)=ER(I)
      ER24(J)=ER(I+1)
      ERPH24(J)=ER(I+2)
      ER12(J)=ER(I+3)
      ERPH12(J)=ER(I+4)
    8 CONTINUE
C
C     OUTPUT EAST-WEST WIND COMPONENTS
C
      WRITE(17,100) CADD,WHERE
  100 FORMAT(1X,A4/12X,"EAST-WEST WIND COMPONENTS, ",2X,32A1/)
      WRITE(17,101) FMON1,JO1,FMON2,JO2,MYEAR
  101 FORMAT(12X,A4,I3," - ",A4,I3,I5)
      WRITE(17,102)
  102 FORMAT(38X,"24 HOUR                12 HOUR",/
     *12X,"HEIGHT  MEAN ERROR  AMP ERROR  PHI ERROR
     *  AMP ERROR  PHI ERROR"/)
      DO 1 I=7,NHITE,4
      WRITE(17,103) IH(I),AO(I),EO(I),AU24(I),ER24(I),PH24(I),ERPH24(I),
     *AU12(I),ER12(I),PH12(I),ERPH12(I)
  103 FORMAT(12X,I4,F8.0,F5.0,4(F6.0,F5.0)/)
    1 CONTINUE
C
C     OUTPUT NORTH-SOUTH WIND COMPONENTS
C
      KHITE=(NHITE-6)/4+1
      IF (KHITE.GT.6) WRITE (17,1040) FF
 1040 FORMAT (A1)
      WRITE(17,104) CADD,WHERE
  104 FORMAT(1X,A4/12X,"NORTH-SOUTH WIND COMPONENTS ",32A1/)
      WRITE(17,101) FMON1,JO1,FMON2,JO2,MYEAR
      WRITE(17,102)
      DO 2 I=7,NHITE,4
      J=I+MHITE
      WRITE(17,103) IH(I),AO(J),EO(J),AU24(J),ER24(J),
     *PH24(J),ERPH24(J),AU12(J),ER12(J),PH12(J),ERPH12(J)
    2 CONTINUE
C
C     OUTPUT VERTICAL WIND COMPONENTS
C
      IF (KHITE.GT.6) WRITE (17,1040) FF
      WRITE(17,105) CADD,WHERE
  105 FORMAT(1X,A4/12X,"VERTICAL WIND COMPONENTS, ",3X,32A1/
```

```
     *12X," NOTE - VELOCITIES ARE IN CM S" )
      WRITE(17,101) FMON1,JO1,FMON2,JO2,MYEAR
      WRITE(17,102)
      DO 3 I=7,NHITE,4
      J=I+2*MHITE
      WRITE(17,103) IH(I),AO(J),EO(J),AU24(J),ER24(J),
     *PH24(J),ERPH24(J),AU12(J),ER12(J),PH12(J),ERPH12(J)
    3 CONTINUE
      WRITE(*,106)
      WRITE(25,106)
  106 FORMAT(" GLDPRNT FILED")
      CLOSE (15)
      CLOSE (16)
      WRITE (17,1040) FF
      CLOSE (17)
      RETURN
   13 WRITE(*,107) FILE
  107 FORMAT(" NO DATA IN FILE ",A5)
      STOP " ERROR TERMINATION"
   14 WRITE(*,108) FILE
  108 FORMAT(" ERROR IN DATA FILE ",A5)
      PAUSE " ERROR TERMINATION"
      STOP
      END
```

```
      SUBROUTINE GROWZ (CADD)
C                                                 SEPTEMBER 17, 1991
C      READS XXXXARCHIT (ARCHIVE) FILE
C
C     WRITES FILES XXXXZONAL, XXXXMERIDIONAL AND XXXXVERTICAL WINDS
C     FOR PLOTTING BY "WINGZ"
C
C     REQUIRES SUBROUTINES
C                                            GWINGZ
C                                            SDESIG
C     AND INPUT FILE XXXXARCHIT
C     WHERE XXXX IS THE FILE DESIGNATOR "CADD"
C
C     (NOTE THAT X IS A DUMMY BLOCK
C     INTO WHICH WINDS ABOVE 100KM AND BELOW 80KM ARE READ, SINCE
C     OUTPUT FILES ARE DEFINED ONLY BETWEEN 80 AND 100KM.)
C
      DIMENSION U(25,41),V(25,41),W(25,41),NZ(41),X(25,6)
      CHARACTER*1 TAB
      CHARACTER*4 CADD
      CHARACTER*40 ARCHIT,WZFILE,OUTFILE
      COMMON/HEIGHTS/NOZ
      WRITE (*,*) "       SUBROUTINE GROWZ- PREPARING WINGZ INPUT FILES"
      WRITE (*,*) "       FROM GROVES ZONAL, MERIDIONAL AND VERTICAL
     * OUTPUT (IN ARCHIT)"
      OPEN (15,FILE="UUU",FORM="FORMATTED")
      OPEN (16,FILE="VVV",FORM="FORMATTED")
      OPEN (17,FILE="WWW",FORM="FORMATTED")
      ARCHIT="ARCHIT "
      CALL SDESIG (ARCHIT,CADD)
      OPEN (18,FILE=ARCHIT,FORM="UNFORMATTED")
      ITAB=9
      TAB=CHAR(ITAB)
      N=0
   10 DO 11 I=1,6
      READ (18) NZ(I),(X(J,I),J=1,25)
   11 CONTINUE
      DO 1 I=1,NOZ
      IF (N.EQ.0) READ (18) NZ(I),(U(J,I),J=1,25)
      IF (N.EQ.1) READ (18) NZ(I),(V(J,I),J=1,25)
      IF (N.EQ.2) READ (18) NZ(I),(W(J,I),J=1,25)
    1 CONTINUE
      DO 2 I=1,4
      READ (18) KZ,(X(J,I),J=1,25)
    2 CONTINUE
      N=N+1
      IF(N.LE.2) GO TO 10
      CLOSE (18)
      DO 4 J=1,NOZ,2
      WRITE  (15,100) NZ(J),TAB,(U(I,J),TAB,I=1,24),U(25,J)
      WRITE  (16,100) NZ(J),TAB,(V(I,J),TAB,I=1,24),V(25,J)
      WRITE  (17,100) NZ(J),TAB,(W(I,J),TAB,I=1,24),W(25,J)
  100 FORMAT (I6,A1,24(F8.2,A1),F8.2)
    4 CONTINUE
      CLOSE (15)
      CLOSE (16)
      CLOSE (17)
      OUTFILE="ZONAL "
```

```
CALL SDESIG (OUTFILE,CADD)
WZFILE="UUU"
CALL GWINGZ (WZFILE,OUTFILE)
OUTFILE="MERIDIONAL "
CALL SDESIG (OUTFILE,CADD)
WZFILE="VVV"
CALL GWINGZ (WZFILE,OUTFILE)
OUTFILE="VERTICAL "
CALL SDESIG (OUTFILE,CADD)
WZFILE="WWW"
CALL GWINGZ (WZFILE,OUTFILE)
RETURN
END
```

```
      SUBROUTINE GWINGZ (INFILE,OUTFILE)
C                                                              MAY 11, 1991
C     REFORMATS INPUT FILE INFILE FOR INPUT TO "WINGZ"
C     AS FILE OUTFILE.
C
C     "WINGZ" REQUIRES EACH COLUMN OF DATA TO BE SEPARATED
C     BY A TAB.
C     A CARRIAGE RETURN MUST APPEAR AT THE END OF EACH DATA ROW.
C     A SPREADSHEET DATA FIELD (CELL) WILL BE CONSIDERED TEXT
C     IF IT CONTAINS AT LEAST ONE BLANK CHARACTER.
C     THE FIRST ROW OF A "WINGZ" SPREADSHEET CONTAINS X AXIS
C     SCALE DESIGNATORS. THE FIRST COLUMN, THE Y AXIS DESIGNATORS
C     (I.E. NUMBERS, NOT LABELS)
C     AN AXIS ROW (OR COLUMN) DESIGNATOR CELL MUST APPEAR BLANK
C     IF IT CONTAINS NOTHING BUT A BLANK CHARACTER.
C     INTEGER ROW (OR COLUMN) DESIGNATOR FIELDS MUST END WITH
C     A BLANK, OTHERWISE THEY MAY APPEAR AS FLOATING POINT NUMBERS.
C
C
      INTEGER*1 IHR,JHR
      INTEGER*2 IF,ITAB,LCHAR,NTOP,ISTOP,STRTHR
      INTEGER*4 NCHAR,LINES
      CHARACTER*1 BLANK,HR(14),HOUR(104),REFMT(250),TAB
      CHARACTER*40 OUTFILE,INFILE
      COMMON/HRSTRT/ STRTHR
      COMMON/HEIGHTS/NOZ
      OPEN(15,FILE=INFILE,FORM="UNFORMATTED")
      OPEN(16,FILE=OUTFILE,FORM="FORMATTED")
C     LINES=NO. OF LINES IN INPUT FILE.
C     NCHAR=NO. OF CHARACTERS PER LINE.
      LINES=NOZ/2+1
      NCHAR=232
      BLANK=" "
      I48=48
      ITAB=9
      TAB=CHAR(ITAB)
      IHR=STRTHR/10
      JHR=STRTHR-10*IHR
      HR(1)=CHAR(IHR+I48)
      IF(IHR.EQ.0) HR(1)=BLANK
      HR(2)=CHAR(JHR+I48)
      J=0
      DO 1 I=1,11,2
      J=J+1
      JSTRT=STRTHR+4*J
      IF(JSTRT.GE.24) JSTRT=JSTRT-24
      IHR=JSTRT/10
      JHR=JSTRT-10*IHR
      HR(I+2)=CHAR(IHR+I48)
      IF(IHR.EQ.0) HR(I+2)=BLANK
      HR(I+3)=CHAR(JHR+I48)
    1 CONTINUE
      DO 10 I=1,104,4
      HOUR(I)=BLANK
      HOUR(I+1)=BLANK
      HOUR(I+2)=BLANK
      HOUR(I+3)=TAB
   10 CONTINUE
```

```
      HOUR(5)=HR(1)
      HOUR(6)=HR(2)
      HOUR(21)=HR(3)
      HOUR(22)=HR(4)
      HOUR(37)=HR(5)
      HOUR(38)=HR(6)
      HOUR(53)=HR(7)
      HOUR(54)=HR(8)
      HOUR(69)=HR(9)
      HOUR(70)=HR(10)
      HOUR(85)=HR(11)
      HOUR(86)=HR(12)
      HOUR(101)=HR(13)
      HOUR(102)=HR(14)
      WRITE (*,*) "  PREPARING ",OUTFILE
      WRITE (16,100) (HOUR(IH),IH=1,103)
  100 FORMAT(103A1)
      DO 5 I=1,LINES
      READ (15) (REFMT(IC),IC=1,NCHAR)
      NTOP=NCHAR
      IF=7
    2 IF=IF+1
      IF(IF.EQ.ISTOP) GO TO 4
   20 IF(REFMT(IF).NE.BLANK) GO TO 2
      KTOP=NTOP-IF
      DO 3 KK=1,KTOP
      REFMT(IF-1+KK)=REFMT(IF+KK)
    3 CONTINUE
      NTOP=NTOP-1
      ISTOP=NTOP-1
      GO TO 20
    4 LCHAR=NTOP-1
      WRITE (16,101) (REFMT(IC),IC=1,LCHAR)
  101 FORMAT(250A1)
    5 CONTINUE
      CLOSE (15)
      CLOSE (16)
      RETURN
      END
```

```
      SUBROUTINE IBAD (IFILE,SWITCH)
C
C     SETS SKIP TO 1 IF IFILE IS BAD
C
C     THIS ROUTINE FOR AIDA'[illegible] APRIL [illegible]-11, [illegible] ONLY.
C
      INTEGER*4 BADFILES(8),SKIP
      DATA BADFILES/168,218,223,233,245,247,249,251/
      SKIP=0
      DO 1 I=1,8
      IF(IFILE.EQ.BADFILES(I)) GO TO 2
    1 CONTINUE
      RETURN
    2 SKIP=1
      RETURN
      END
```

```
      SUBROUTINE MAPARAM
C                                        [illegible]
C     SETS UP PROCESSING PARAMETERS [illegible] READING [illegible] MIN
      DATA FROM DISK
C
      DIMENSION [illegible]
     *NA(10),NB(10),NC(10),SIGMA([illegible]),
     *[illegible],NTIME(24)
      CHARACTER*1 NGO,NPRINT,RESULT(72),SOURCE(8),FF
      CHARACTER*1 CADD(6),DUMSTA(40),DUMEND(40)
      CHARACTER*4 KDATE
      CHARACTER*6 WHICH
      CHARACTER*40 GROOUT,DUMMY,INSTART,INEND,DIAGS
      INTEGER*1 ADD,ICADD(6),ZERO
      INTEGER*2 STRTHR
      INTEGER*4 IDATE(3)
      COMMON/HRSTRT/ STRTHR,RNGCOF
      COMMON/WINDS/ N,Q,NOP,ZMIN,MIN,ZMAX,MAX,NA,NB,NC,NAO,NBO,
     *NCO,SUM,AC,NTIME,NP,NQ,NR,RESULT,SOURCE,PERIOD,
     *FF,CADD,Z
      COMMON/ECHOES/ P,VEL,SINZ,COSZ,DCL,DCM,DCN,SUM1,SUM2,SUM3,
     *D,SIGMA,AZENMIN,AZENMAX,IEND
      COMMON/EXTRAS/ IUNIT,ICADD,NGO,STRTDA,ENDDAY,LEAPYR,JMO,
     *MNO(20,24),NFILE,LENGTH,NEG,NPMAX,ZERO,NPRINT
      COMMON/FSPEC/IFILE,DUMMY,INSTART,INEND,NSTART,NPOINTS
      COMMON/HEIGHTS/NOZ,NQUAD
      COMMON/TEMPO/IDATE,LHOUR,LMIN,LSEC
      EQUIVALENCE (DUMSTA,INSTART)
      EQUIVALENCE (DUMEND,INEND)
C
C     FILE ORGANIZATION
C
      WRITE (*,*) "            GROVES ANALYSIS"
      WRITE (*,*) " "
      WRITE (*,*) " READING OUTPUT FILE SDESIGNATOR"
      OPEN (25,FILE="CADDSPEC",FORM="FORMATTED")
      READ (25,98) ICADD
   98 FORMAT(6I1)
      CLOSE (25)
      ADD=48
      CADD(1)=CHAR (ADD+ICADD(1))
      CADD(2)=CHAR (ADD+ICADD(2))
      CADD(3)=CHAR (ADD+ICADD(3))
      CADD(4)=CHAR (ADD+ICADD(4))
      CADD(5)=CHAR (ADD+ICADD(5))
      CADD(6)=CHAR (ADD+ICADD(6))
      WRITE (*,99) ICADD,CADD
   99 FORMAT (4I1,3X,4A1)
      DIAGS="DIAGS "
      CALL SDESIG (DIAGS,CADD)
      OPEN (25,FILE=DIAGS,FORM="FORMATTED")
      OPEN (5,FILE="7GRODAT",FORM="FORMATTED")
      IUNIT=19
      ZERO=0
      FF=CHAR(12)
C
C     SPECIFY CENTURY
C
```

```
      MYR19=1900
      LEAPYR=0
C
C     SELECT DATA INTERVAL, START HOUR ETC. TO BE PROCESSED
C
      READ (5,32,END=299) STRTDA,ENDDAY
   32 FORMAT(F7.0,3X,F7.0)
       READ (5,33,END=299)STRTHR
   33 FORMAT(I6)
      READ (5,34,END=299) AZENMIN,AZENMAX
   34 FORMAT(2F6.0)
      READ (5,34,END=299) RNGCOR
      IF (ABS(RNGCOR).GT.10) PAUSE " BAD RANGE CORRECTION;
     *  TYPE COMMAND PERIOD TO EXIT "
      WRITE (*,35) STRTDA,ENDDAY,STRTHR,AZENMIN,AZENMAX,RNGCOR
   35 FORMAT(F7.0,3X,F7.0,3X,I6,3F6.1, " IS TO BE PROCESSED. CORRECT?"
      IMYMO=STRTDA/100
      IMY=IMYMO/100
      LEAP=(MYR19+IMY)/4
      LEAP=LEAP*4-(MYR19+IMY)
      IF(LEAP.EQ.0) LEAPYR=1
      IMO=IMYMO-IMY*100
      GROOUT="GROOUT "
      CALL SDESIG (GROOUT,CADD)
      OPEN (26,FILE=GROOUT,FORM="FORMATTED")
C
C     INITIALIZATION
C
      NBOMB=0
      NEG=0
      NRDERR=0
      DO 500 IT=1,24
      IHR=IT+STRTHR-1
      IF(IHR.GE.24) IHR=IHR-24
      NTIME(IT)=IHR
  500 CONTINUE
      DO 38 I=1,200
      P(I)=0.0
      D(I)=0.0
      SIGMA(I)=0.0
      AC(I)=0.0
      DO 38 L=1,200
      Q(I,L)=0.0
 38   CONTINUE
      NUMNA=0
      NUMNB=0
      NUMNC=0
      SUM1=0.0
      SUM2=0.0
      SUM3=0.0
      M=0
      NOP=0
      DO 39 I=1,10
      NA(I)=0
      NB(I)=0
      NC(I)=0
 39   CONTINUE
      DO 41 I=1,20
```

```
      DO 41 J=1,24
      MNO(I,J)=0
 41   CONTINUE
C
C     INTERROGATE MACHINE FOR DATE
C
      CALL DateTime
      IDATE(1)=IDATE(1)-1900
      CALL GMONTH (KDATE,IDATE(2))
      OPEN (16,FILE="7DUNK",FORM="FORMATTED")
C
C     READ AND PRINT FIRST PAGE HEADER
C
      READ(16,990) RESULT,SOURCE
  990 FORMAT(72A1,8A1)
      CLOSE (16)
      NOP=1
      WRITE(26,998) RESULT,SOURCE,KDATE,IDATE(3),IDATE(1),NOP
 998  FORMAT(////1X,72A1,8A1,4X,6HRUN ON,A4,I3," 19",I2,3X,"PAGE ",
     *I3////)
      WRITE(25,998) RESULT,SOURCE,KDATE,IDATE(3),IDATE(1),NOP
C
C     THIS SECTION OF THE PROGRAM READS PROCESSING PARAMETERS.
C
      NBOMB=NBOMB+1
      IF(STRTDA.GT.ENDDAY) GO TO 299
      IF(ENDDAY.EQ.0) GO TO 6
      JUMP=0
      JMYMO=ENDDAY/100
      IJO=STRTDA-IMYMO*100
      JJO=ENDDAY-JMYMO*100
      JMY=JMYMO/100
      JMO=JMYMO-JMY*100
      GO TO 7
C
 299  NBOMB=NBOMB+1
      WRITE(25,210) FF, NBOMB
 210  FORMAT(A1////1X,"EXIT, CONTIGENCY LEVEL",I2////1X,"NO DATA IN FI
     1LE 5")
      PAUSE "NO DATA IN FILE"
      STOP
C
 6    JUMP=1
      ENDDAY=1.0E+06
 7    CONTINUE
      READ(5,1) NP,NQ,NR
 1    FORMAT(24I3)
      NPMAX=NP
C
      IF(NQ.LE.NPMAX) GO TO 60
      NPMAX=NQ
 60   IF(NR.LE.NPMAX) GO TO 61
      NPMAX=NR
 61   CONTINUE
      READ(5,2) ZMIN,ZMAX
 2    FORMAT(1X,2F4.0)
      WRITE (*,*) ZMIN,ZMAX
      MIN=ZMIN
```

```
      MA:
      GO TO 7
C
 244  NBOMB=NBOMB-1
      WRITE(25,210) FF, NBOMB
 210  FORMAT(A1//  1X,"EXIT, CONTIGENCY LEVEL",I2    1X,"NO DATA IN FI
     1LE 5")
      PAUSE "NO DATA IN FILE"
      STOP
C
 6    JUMP=1
      ENDDAY=1.0E+06
 7    CONTINUE
      READ(5,1) NP,NQ,NR
 1    FORMAT(24I3)
      NPMAX=NP
C
      IF(NQ.LE.NPMAX) GO TO 60
      NPMAX=NQ
 60   IF(NR.LE.NPMAX) GO TO 61
      NPMAX=NR
 61   CONTINUE
      READ(5,2) ZMIN,ZMAX
 2    FORMAT(1X,2F4.0)
      WRITE (*,*) ZMIN,ZMAX
      MIN=ZMIN
      MA  CHECK TO SEE IF WINDS ARE CONSIDERED TO BE HORIZONTAL
C
 58   IF(NCO.GE.0) GO TO 36
      NEG=-1
      NCO=0
      NR=0
      NC(1)=0
C
 36   CONTINUE
      DO 19 J=1,NR
 19   NUMNC=NUMNC+NC(J)
      N=3+NAO+NBO+NCO+2*(NP+NQ+NR+NUMNA+NUMNB+NUMNC)
      WRITE (*,*) "AC(",N,")"
      IF(N-200) 4,4,3000
 3000 WRITE(25,3001) FF,N
 3001 FORMAT(A1////1X,9HEXECUTION      /////
     +1X,8H    ****,3X,16HDIMENSION OF N (,I4,23H ) EXCEEDS THAT ALLOWED
     2////1X,8H    ****,3X,29HPROGRAMME CANNOT BE CONTINUED//)
      PAUSE " MATRIX > 200*200"
      STOP
 4    CONTINUE
      NE=N+1
      N2=2*N
C
C     GET NAME OF SPP INPUT FILE
C
      WRITE (*,*) " "
      WHICH=" FIRST"
      WRITE (*,3002) WHICH
 3002 FORMAT (" ENTER INTEGER PART (XXX) OF ",A6," FILENAME  ",$)
      READ (*,*) IFILE
      INSTART="SPP - GR "
```

```
      I100=IFILE/100
      I10=(IFILE-I100*100)/10
      I1=IFILE-I100*100-I10*10
      DUMSTA(10)=CHAR(I100+48)
      DUMSTA(11)=CHAR(I10+48)
      DUMSTA(12)=CHAR(I1+48)
      WHICH="  LAST"
      WRITE (*,3002) WHICH
      READ (*,*) IEND
      INEND="SPP - GR "
      I100=IEND/100
      I10=(IEND-I100*100)/10
      I1=IEND-I100*100-I10*10
      DUMEND(10)=CHAR(I100+48)
      DUMEND(11)=CHAR(I10+48)
      DUMEND(12)=CHAR(I1+48)
      WRITE (*,*) " "
C
C     ENTER NUMBER OF POINTS PER HEIGHT TO BR PROCESSED
C
      WRITE (*,3003)
 3003 FORMAT (" NUMBER OF POINTS PER HEIGHT?    ",$)
      READ (*,*) NPOINTS
      WRITE (*,*) " "
C
      WRITE (*,3004)
 3004 FORMAT (" PRINT DATA TO SCREEN? Y OR N    ",$)
      READ (*,3005) NPRINT
 3005 FORMAT(A1)
      WRITE (*,*) " "
      RETURN
      END
```

```
      SUBROUTINE MAPSTAR
C                                        SEPTEMBER 18, 1991
C     STARTING FROM HOUR STRTHR, THIS SUBROUTINE
C     READS RADAR FRAME HEADERS AND RECORDS
C     FROM SCATTERING POINT PARAMETER FILES JPP - OR KKK
C     RECORDED ON HARD DRIVE.
C
C     THIS SUBROUTINE PROCESSES ALL DATA IN THE SELECTED
C     INPUT FILES, SUBJECT ONLY TO THE SELECTION OF WHICH HEIGHTS,
C     ZENITH ANGLES AND DAY(S) WILL BE PROCESSED, AS DECLARED
C     IN FILES 7DATES, 7DUNK AND 7GRODAT.
C
      SAVE
      DIMENSION P(200),Q(200,200),NA(10),NB(10),NC(10),AC(200),D(200),
     *SIGMA(200),NTIME(24)
      REAL*4 SPBLOCK(10),SPSKIP(10),FLAG
      CHARACTER*1 NGO,YES,NO,NPRINT,RESULT(72),SOURCE(8),
     *CADD(6),FF,DUM(40)
      CHARACTER*40 DUMMY,INSTART,INEND
      INTEGER*1 ICADD(6),ZERO
      INTEGER*2 STRTHR
      INTEGER*4 M,IDATE(3),ISEC1,ISEC2,ISEC3,ISEC4
      INTEGER*4 IFIX,SKIP
      COMMON/HRSTRT/ STRTHR,RNGCOR,ISEC1,ISEC2,ISEC3
      COMMON/WINDS/ N,Q,NOP,ZMIN,MIN,ZMAX,MAX,NA,NB,NC,NAO,NBO,
     *NCO,SUM,AC,NTIME,NP,NQ,NR,RESULT,SOURCE,PERIOD,
     *FF,CADD,Z
      COMMON/ECHOES/ P,VEL,SINJ(10),COSJ(10),DCL,DCM,DCN,SUM1,
     *SUM2,SUM3,D,SIGMA,AZENMIN,AZENMAX,IEND
      COMMON/EXTRAS/ IUNIT,ICADD,NGO,STRTDA,ENDDAY,
     *LEAPYR,JMO,MNO(20,24),NFILE,LENGTH,NEG,NPMAX,ZERO,
     *NPRINT,DAY,JOBAD
      COMMON/GENE/ M,UR,MY,MO,JO,LTIMH,LTIMM,MSEC,EL3,EM3
      COMMON/FSPEC/IFILE,DUMMY,INSTART,INEND,NSTART,NPOINTS
      COMMON/HEIGHTS/NOZ,NQUAD
      COMMON/TEMPO/IDATE,LHOUR,LMIN,LSEC
      EQUIVALENCE(DUMMY,DUM)
      DATA MAPRD,NEXIT,RADIAN/0,0,57.295779/
      IF(MAPRD.EQ.1) GO TO 1
      WRITE (*,*) " "
      WRITE (*,*) " START HOUR ",STRTHR
      MAPRD=1
      UR=1.0
      IZS=0
      TWOPI=6.2831852
      FLAG=-999.0
      ONE=1.0
      THREE=3.0
      LINE=0
      IHOLD=64
      LHOLD=-5
      MHOLD=0
      NZ=0
      M=0
      JSEC=ISEC1
      ISEC3=0
      NSTART=1
```

```
      ZIP=0.0
      DUMMY="SPP - GR "
      I100=IFILE/100
      I10=(IFILE-I100*100)/10
      I1=IFILE-I100*100-I10*10
      DUM(10)=CHAR(I100+48)
      DUM(11)=CHAR(I10+48)
      DUM(12)=CHAR(I1+48)
C
C     OPEN FIRST SPP - GR XXX DISC FILE
C
      OPEN (22,FILE=DUMMY,FORM="UNFORMATTED")
      WRITE (25,1011) DUMMY
C
      WRITE (*,*) " "
      WRITE(*,995) NPOINTS,NQUAD
  995 FORMAT(" PROCESSING",I3," POINT(S) PER 1KM HEIGHT
     * IN QUADRANT",I3/)
      WRITE(*,996) AZENMIN,AZENMAX
  996 FORMAT(" ZENITH ANGLE SPREAD",F4.0," TO ",F4.0," DEG."/)
      ZENMIN=COS(AZENMIN/RADIAN)
      ZENMAX=COS(AZENMAX/RADIAN)
      YES="Y"
      NO="N"
      NFRAME=0
      NULL=0
      NH=(MAX-MIN)/3-1
      WRITE (*,*) " "
      WRITE (*,*) " "
      WRITE (*,*) " ******** EXECUTION PROCEEDING ********"
      WRITE (*,*) " "
C
    1 READ (22,END=5) SPBLOCK
      IF (SPBLOCK(1).NE.FLAG) GO TO 2
      MY=SPBLOCK(2)
      MO=SPBLOCK(3)
      IF(MO.LT.1.OR.MO.GT.12) GO TO 4
      JO=SPBLOCK(4)
      LTIMH=SPBLOCK(5)
      LTIMM=SPBLOCK(6)
      MSEC=SPBLOCK(7)
C
      IF(LTIMH.EQ.LHOLD) GO TO 1
      MH=M-MHOLD
      MHOLD=M
      LHOLD=LTIMH
      LINE=LINE+1
      IF (LINE.LE.48) GO TO 195
      NOP=NOP+1
      LINE=0
      WRITE (26,1003) FF
      WRITE (26,1004) RESULT,SOURCE,NOP
  195 SPBLOCK(4)=JO
      SPBLOCK(5)=LTIMH
      SPBLOCK(6)=LTIMM
      SPBLOCK(7)=MSEC
      WRITE (*,998) IFILE,(SPBLOCK(II),II=2,10),MH
  998 FORMAT(1X,"SPP - GR ",I3,9F8.3,I8)
```

```
      WRITE (26,336) IFILE,(SPBLOCK(II),II=1,11),MH
      GO TO 1
C
C     USE FILE TGRODAT HEIGHT RANGE SPECIFICATION
C
    2 IF(SPBLOCK(1).LT.ZMIN) GO TO 1
      IF(SPBLOCK(1).GT.ZMAX) GO TO 1
C
C     DETERMINE DIRECTION COSINES
C
      EL3=SIN(SPBLOCK(3)/RADIAN)
      EM3=SIN(SPBLOCK(4)/RADIAN)
      EN3=SQRT(ONE-EL3*EL3-EM3*EM3)
C
C     CHECK ZENITH ANGLE
C
      IF(EN3.LT.ZENMAX.OR.EN3.GT.ZENMIN) GO TO 1
C
      Z=SPBLOCK(1)
C
C     ELIMINATE IF LINEARLY POLARIZED
C
      ANGLE=SPBLOCK(6)-SPBLOCK(8)
      IF (ABS(ANGLE).LT.45.0) GO TO 1
      IF (ABS(ANGLE).GT.135.0.AND.ABS(ANGLE).LT.225.0) GO TO 1
      IF (ABS(ANGLE).GT.315.0.AND.ABS(ANGLE).LT.360.0) GO TO 1
C
C     ELIMINATE IF X POLARIZATION
C
      IF (ANGLE.GT.-135.0.AND.ANGLE.LT.-45.0) GO TO 1
      IF (ANGLE.GT.-135.0.AND.ANGLE.LT.-45.0) GO TO 1
      IF (ANGLE.GT.225.0.AND.ANGLE.LT.315.0) GO TO 1
C
C     SELECT QUADRANTS TO BE PROCESSED
C
C     IF NQUAD = O    PROCESS ALL QUADRANTS
C                1             FIRST AND SECOND QUADRANTS
C                2             SECOND AND THIRD QUADRANTS
C                3             THIRD AND FOURTH QUADRANTS
C                4             FOURTH AND FIRST QUADRANTS
C
      IF (NQUAD.EQ.0) GO TO 25
      GO TO (21,22,23,24) NQUAD
   21 IF ((EL3.GT.ZIP.AND.EM3.GT.ZIP).OR.(EL3.GT.ZIP.AND.EM3.LT.ZIP))
     *GO TO 25
      GO TO 1
   22 IF ((EL3.GT.ZIP.AND.EM3.LT.ZIP).OR.(EL3.LT.ZIP.AND.EM3.LT.ZIP))
     *GO TO 25
      GO TO 1
   23 IF ((EL3.LT.ZIP.AND.EM3.LT.ZIP).OR.(EL3.LT.ZIP.AND.EM3.GT.ZIP))
     *GO TO 25
      GO TO 1
   24 IF ((EL3.LT.ZIP.AND.EM3.GT.ZIP).OR.(EL3.GT.ZIP.AND.EM3.GT.ZIP))
     *GO TO 25
      GO TO 1
C
C     SELECT NUMBER OF POINTS AT EACH HEIGHT
C
```

```
   15 IZ=I
      IF(IZ.EQ.IHOLD) IZS=IZS+1
      IF(IZ.NE.IHOLD) IZS=1
      IF(IZ.NE.IHOLD) IHOLD=IZ
      IF(IZS.LE.NPOINTS) GO TO 3
      GO TO 1
C
C     DETERMINE WHETHER POINT FALLS IN DESIRED TIME INTERVAL
C
    3 DAY=FLOAT(MY)*10000.+FLOAT(MO)*100.+FLOAT(JO)
      IF(DAY.LT.STRTDA) GO TO 1
      IF(DAY.LE.ENDDAY) GO TO 30
      IF(DAY.NE.STRTDA.AND.LTIMH.GE.STRTHR) GO TO 8
  600 WRITE (*,*) " LOST FRAME SYNC - LOOK FOR NEXT TIME FRAME"
      WRITE (25,*) " LOST FRAME SYNC - LOOK FOR NEXT TIME FRAME"
  667 READ (22,END=5) SPBLOCK
      IF (SPBLOCK(1).NE.FLAG) GO TO 667
      WRITE (*,*) " FOUND IT!"
      WRITE (25,*) " FOUND IT!"
      GO TO 1
   30 IF(DAY.EQ.STRTDA.AND.LTIMH.LT.STRTHR) GO TO 1
      IF (STRTHR.LT.0.5) GO TO 31
      IF(DAY.NE.STRTDA.AND.LTIMH.GE.STRTHR) GO TO 8
   31 VEL=SPBLOCK(2)
      IF(NFRAME.EQ.1) IHOLD=64
      NFRAME=0
      GO TO 11
    4 NEXIT=NEXIT+1
      WRITE(25,999) DUMMY,UR,MY,MO,JO,LTIMH,LTIMM,MSEC
  999 FORMAT(///1X,A12," READ ERROR AT OR NEAR ECHO NUMBER ",
     *F7.0,6X,6I2)
      WRITE(*,999) DUMMY,UR,MY,MO,JO,LTIMH,LTIMM,MSEC
      IF(NEXIT.LT.1000) GO TO 1
      WRITE (*,1000) DUMMY,MY,MO,JO,LTIMH,LTIMM,MSEC,DUMMY
 1000 FORMAT(///1X,A12," BAD FILE ",3I2,1X,3I2,A12)
      WRITE (25,1000) DUMMY,MY,MO,JO,LTIMH,LTIMM,MSEC,DUMMY
      PAUSE "CR"
      STOP
C
C     SELECT NEXT SPP INPUT FILE
C
    5 CONTINUE
      IF(UR.LT.0.6) GO TO 8
      IFILE=IFILE+1
      CALL IBAD (IFILE,SKIP)
      IF(IFILE.GT.IEND) GO TO 8
      IF (SKIP.EQ.1) GO TO 5
      CLOSE (22)
      I100=IFILE/100
      I10=(IFILE-I100*100)/10
      I1=IFILE-I100*100-I10*10
      DUM(10)=CHAR(I100+48)
      DUM(11)=CHAR(I10+48)
      DUM(12)=CHAR(I1+48)
      UR=1.0
      IHOLD=64
      WRITE (25,1011) DUMMY
 1011 FORMAT(" ACCESSING FILE ",A12)
```

```
      OPEN (22,FILE=DUMMY,FORM="UNFORMATTED")
      GO TO 1
C
C     ACCEPTABLE POINT HAS BEEN FOUND
C
   11 DO 599 I=1,10
      CFCKIP(I)=SPBLOCK(I)
  599 CONTINUE
      M=M+1
      UR=UR+ONE
 1001 FORMAT(I8,$)
      IF(MOD(M,500).NE.0) GO TO 6
      WRITE (*,*) "    ",M," POINTS PROCESSED"
      CALL DateTime
      ISEC4=3600*LHOUR+60*LMIN-LSEC
      IF(ISEC4.GT.JSEC) GO TO 6
      ISEC3=24*3600
      JSEC=20*60
    6 IF(NPRINT.EQ.YES) WRITE (*,1002) UR,MY,MO,JO,LTIMH,LTIMM,Z,VEL,
     *EL3,EM3
 1002 FORMAT(F7.0,I3,I3,I3,I3,I2,2X,2F6.1,2F6.3)
      IF(M.EQ.1) STRTDA=DAY
C
C     CALCULATE TIME WITH RESPECT TO INPUT PERIODICITY
C
      CALL DAYMON (MYRDAY,LEAPYR,MO,JO)
      TMINIT=1440.0*FLOAT(MYRDAY-1)+60.0*FLOAT(LTIMH)+FLOAT(LTIMM)
     *+FLOAT(MSEC)/60.0
      THOUR=TMINIT/60.0
      NEWDAY=THOUR/PERIOD
      T=(THOUR/PERIOD-FLOAT(NEWDAY))*TWOPI
      DO 7 J=1,NPMAX
      FJT=FLOAT(J)*T
      SINJ(J)=SIN(FJT)
      COSJ(J)=COS(FJT)
    7 CONTINUE
C
C     ENTER COUNT IN POINT RATE MATRIX
C
      LT=LTIMH-STRTHR+1
      IF(LT.LE.0) LT=LT+24
      Z0=ZMIN-0.01
      Z3=ZMIN+THREE
      DO 13 I=1,NH
      IF(Z.GT.Z0.AND.Z.LE.Z3) GO TO 14
      Z0=Z0+THREE
      Z3=Z3+THREE
   13 CONTINUE
   14 MNO(I,LT)=MNO(I,LT)+1
      RETURN
C
C     SPP DATA READ AND PROCESSED. FLAG WINDS CALCULATION
C
    8 UR=0.5
      WRITE (26,1003) FF
 1003 FORMAT(A1)
      NOP=NOP+1
      WRITE (26,1004) RESULT,SOURCE,NOP
```

```
1004 FORMAT( 1X,70A1,8A1,16X,"PAGE  ",I3)
     CLOSE (22)
     INEND=DUMMY
     IF (IFILE.GE.IEND) RETURN
     IF (JERR.EQ.16) RETURN
     WRITE (25,1005) DUMMY,IFILE,IEND
1005 FORMAT ( /," FILE ERROR RESULTED IN EXIT FROM ",A11
    *" CURRENT FILE DESIGNATOR IS ",I3,". IEND SET TO ",I3)
     WRITE (*,1005) DUMMY,IFILE,IEND
     WRITE (25,1006) NFRAME,MY,MO,JO,LTIMH,LTIMM,SPSKIP,SPBLOCK
1006 FORMAT (" NFRAME =",I3," TIME ",4I3,I2 "  SPSKIP ",1 E10.3
    *" SPBLOCK ",10E10.3 /)
     WRITE (*,1006) NFRAME,MY,MO,JO,LTIMH,LTIMM,SPSKIP,SPBLOCK
     WRITE (*,*) " ATTEMPTING WIND ANALYSIS"
     RETURN
     END
```

```
      SUBROUTINE MATSIN(A,N,DETERM)
C                                            MAY 3, [illegible]
C     MATRIX INVERSION, TO 200 X 200
C     (SIZE OF MATRIX DETERMINED BY N)
C
      DIMENSION IPIVOT(200),A(200,200),INDEX(200,2),PIVOT(200)
      EQUIVALENCE (IROW,JROW),(ICOLUM,JCOLUM),(AMAX,SWAP)
C
C     INITIALIZATION
C
      ZERO=0.0
      DETERM=0.0
 15   DO 20 J=1,N
 20   IPIVOT(J)=0
C
C     SEARCH FOR PIVOT ELEMENT
C
 30   DO 550 I=1,N
 40   AMAX=0.0
 45   DO 105 J=1,N
 50   IF(IPIVOT(J)-1) 60,105,60
 60   DO 100 K=1,N
 70   IF(IPIVOT(K)-1) 80,100,740
 80   IF(ABS(AMAX)-ABS(A(J,K))) 85,100,100
 85   IROW=J
 90   ICOLUM=K
 95   AMAX=A(J,K)
 100  CONTINUE
 105  CONTINUE
 110  IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1
C
C     INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
C
 130  IF(IROW-ICOLUM) 140,260,140
 140  DETERM=-DETERM
 150  DO 200 L=1,N
 160  SWAP=A(IROW,L)
 170  A(IROW,L)=A(ICOLUM,L)
 200  A(ICOLUM,L)=SWAP
 260  INDEX(I,1)=IROW
 270  INDEX(I,2)=ICOLUM
 310  PIVOT(I)=A(ICOLUM,ICOLUM)
      ABSPIV=ABS(PIVOT(I))
      IF(ABSPIV.GT.ZERO) GO TO 320
      DETERM=-13.0
      RETURN
 320  DETERM=DETERM+ALOG10(ABSPIV)
      IF(DETERM.GT.-12.0) GO TO 330
      RETURN
C
C     DIVIDE PIVOT ROW BY PIVOT ELEMENT
C
 330  A(ICOLUM,ICOLUM)=1.0
 340  DO 350 L=1,N
 350  A(ICOLUM,L)=A(ICOLUM,L)/PIVOT(I)
```

```
C
C     REDUCE NON-PIVOT ROWS
C
  380 DO 550 L1=1,N
  390 IF(L1-ICOLUM) 400,550,400
  400 T=A(L1,ICOLUM)
  420 A(L1,ICOLUM)=0.0
  430 DO 450 L=1,N
  450 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
  550 CONTINUE
C
C     INTERCHANGE  COLUMNS
C
  600 DO 710 I=1,N
  610 L=N+1-I
  620 IF(INDEX(L,1)-INDEX(L,2)) 630,710,630
  630 JROW=INDEX(L,1)
  640 JCOLUM=INDEX(L,2)
  650 DO 705 K=1,N
  660 SWAP=A(K,JROW)
  670 A(K,JROW)=A(K,JCOLUM)
  700 A(K,JCOLUM)=SWAP
  705 CONTINUE
  710 CONTINUE
  740 RETURN
      END



      SUBROUTINE SDESIG (NAME,A)
C                                                   MARCH 30, 1990
C     ADDS DESIGNATOR "A" TO FILENAME "NAME"
C     AS PREFIX
C
      CHARACTER*1 A(6),NAME(40)
C
      DO 1 I=40,7,-1
      NAME(I)=NAME(I-6)
    1 CONTINUE
    2 DO 3 J=1,6
      NAME(J) = A(J)
    3 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SDIANA
C                                                    JUNE 1[illegible], 19[illegible]
C     PRINTS OUT HOUR BY HOUR WIND PROFILES OF FUNDAMENTAL [illegible]
HOURS
C
C
      DIMENSION Q(200,200),NA([illegible]),NB([illegible]),NC([illegible]),
     1AC(200),U(24),NTIME(24),NANEW([illegible])
      CHARACTER*1 RESULT(72),SOURCE(8),FF,CADD(6)
      CHARACTER*40 ARCHIT
      INTEGER*1 ICADD(6)
      INTEGER*2 STRTHR
      COMMON/HRSTRT/ STRTHR
      COMMON/WINDS/ N,Q,NOP,ZMIN,MIN,ZMAX,MAX,NA,NB,NC,NAO,NBO,
     *NCO,SUM,AC,NTIME,NP,NQ,NR,RESULT,SOURCE,PERIOD,
     *FF,CADD,Z
      COMMON/EXTRAS/ IUNIT,ICADD,NGO

C
      CENTIM=1.0
      ARCHIT="ARCHIT "
      CALL SDESIG (ARCHIT,CADD)
      OPEN (14,FILE=ARCHIT,FORM="UNFORMATTED")
C
      NOP=NOP+1
      WRITE (26,998) FF,RESULT,SOURCE,NOP
 998  FORMAT(A1/72A1,8A1,26X,"PAGE",I3/)
C
C     EAST-WEST WIND COMPONENT, HOUR BY HOUR
C
      WRITE(26,597)MIN,MAX
 597  FORMAT(1X,52HEAST-WEST COMPONENTS OF THE MEAN WIND
     *, HOUR BY HOUR,
     1/1X,34HAS DETERMINED FOR THE HEIGHT RANGE,I5,6H KM TO,I5,4H KM.
     2/)
      WRITE(26,600)NTIME
 600  FORMAT(1X,6HHEIGHT,24I5/1X)
      DO 128 J=1,NP
 128  NANEW(J)=NA(J)
      NPNEW=NP
      KEND=0
      NAOE=NAO+1
      NBOE=NBO+1
      NCOE=NCO+1
      NSIGN=-1
 105  KA=KEND
      DO 307 KZ=MIN,MAX
      UO=0.0
      DO 303 LT=1,24
 303  U(LT)=0.0
      Z=MAX+MIN-KZ
      NZ=Z
      S=(2.0*Z-ZMAX-ZMIN)/(ZMAX-ZMIN)+1.0E-6
      DO 304 K=1,NAOE
      KUA=K+KA
 304  UO=UO+AC(KUA)*S**(K-1)
      UO=UO*CENTIM
      IF(NPNEW) 310,310,308
```

```
 308  DO 306 IT=1,24
      KEND=KA+NAOE
      LT=IT+STRTHR-1
      IF(LT.GE.24) LT=LT-24
      DO 305 J=1,NPNEW
      KSTART=KEND
      NAEND=NANEW(J)+1
      KEND=KSTART+NAEND
      JLT=J*LT
      DO 305 K=1,NAEND
      KU=K+KSTART
 305  U(IT)=U(IT)+AC(KU)*S**(K-1)*SIN(FLOAT(JLT)*0.2618)
      DO 312 J=1,NPNEW
      KSTART=KEND
      NAEND=NANEW(J)-1
      KEND=KSTART+NAEND
      JLT=J*LT
      DO 312 K=1,NAEND
      KU=K+KSTART
 312  U(IT)=U(IT)+AC(KU)*S**(K-1)*COS(FLOAT(JLT)*0.2618)
      U(IT)=U(IT)*CENTIM+UO
      IF(ABS(U(IT))-999.0) 306,306,309
 309  U(IT)=SIGN(999.0,U(IT))
 306  CONTINUE
      GO TO 313
 310  KEND=KA+NAOE
      U(1)=UO
      IF(ABS(U(1))-999.0) 107,107,311
 311  U(1)=SIGN(999.0,U(1))
 107  DO 108 LT=2,24
 108  U(LT)=U(1)
  313 WRITE(14) NZ,U,U(1)
  307 WRITE(26,888) NZ,U
 888  FORMAT(1X,I4,3X,24F5.0)
      IF(NSIGN) 129,131,133
C
C     NORTH-SOUTH WIND COMPONENTS, HOUR BY HOUR.
C
 129  NAOE=NBOE
      NPNEW=NQ
      DO 130 J=1,NQ
 130  NANEW(J)=NB(J)
      NSIGN=0
      NOP=NOP+1
      WRITE(26,998) FF, RESULT,SOURCE,NOP
      WRITE(26,598)MIN,MAX
 598  FORMAT(1X,54HNORTH-SOUTH COMPONENTS OF THE MEAN WIND,
     * HOUR BY HOUR.
     1/1X,34HAS DETERMINED FOR THE HEIGHT RANGE,I5,6H KM TO,I5,4H KM.
     2/)
      WRITE(26,600) NTIME
      GO TO 105
C
C     VERTICAL WIND COMPONENTS, HOUR BY HOUR.
C
 131  NAOE=NCOE
      CENTIM=100.0
      NPNEW=NP
```

```
      DO 132 J=1,NR
132   NANEW(J)=NC(J)
      NSIGN=1
      NOP=NOP-1
      WRITE(26,998) FF, RESULT,SOURCE,NOP
      WRITE(26,599)MIN,MAX
599   FORMAT(1X,50HVERTICAL COMPONENT OF THE MEAN WIND,
     * HOUR BY HOUR,
     1/1X,34HAS DETERMINED FOR THE HEIGHT RANGE,I5,6H KM TO,I5,3H KM.
     2/"  **** NOTE THAT VERTICAL WINDS ARE IN CENTIMETERS PER SECOND
     3 ****"/)
      WRITE(26,600) NTIME
      GO TO 105
133   CLOSE (14)
      RETURN
      END
```

```
      SUBROUTINE SVARY
C                                                 MAY 4,1991
C     CALCULATES THE AMPLITUDE AND PHASE OF PREVAILING AND PERIODIC
C     COMPONENTS, UP TO THE FOURTH HARMONIC,
C     TOGETHER WITH THE MOST PROBABLE ERROR IN EACH.
C     PRINTS THESE OUT AT 1 KM INTERVALS OVER THE HEIGHT RANGE
SPECIFIED.
C
      DIMENSION Q(200,200),NA(10),NB(10),NC(10),
     1NTIME(24),AC(200),SI(10),CO(10),AU(10),PH(10),SIGSIN(10),
     2SIGSC(10),SIGCOS(10),SIGPH(10),SIGAMP(10),ERPH(10),ERAMP(10),
     3PTEM(4)
      CHARACTER*1 RESULT(72),SOURCE(8),FB,FF,CADD(6),NGO
      CHARACTER*40 TIDE,ERROR,ATIDE
      COMMON/WINDS/ N,Q,NOP,ZMIN,MIN,ZMAX,MAX,NA,NB,NC,NAO,NBO,NCO,SUM,
     1AC,NTIME,NP,NQ,NR,RESULT,SOURCE,PERIOD,FF,CADD,Z,A(200,200)
      COMMON/EXTRAS/ IUNIT,ICADD,NGO,STRTDA,ENDDAY,LEAPYR,JMC,
     *MNO(20,24),NFILE,LENGTH,NEG,NPMAX,ZERO,NPRINT
C
      CENTIM=1.0
      TIDE="TIDE "
      CALL SDESIG (TIDE,CADD)
      OPEN (15,FILE=TIDE,FORM="UNFORMATTED")
      ERROR="ERROR "
      CALL SDESIG (ERROR,CADD)
      OPEN (16,FILE=ERROR,FORM="UNFORMATTED")
      ATIDE="ATIDE "
      CALL SDESIG (ATIDE,CADD)
      OPEN (17,FILE=ATIDE,FORM="FORMATTED")
C
      FB=" "
      NOP=NOP+1
      WRITE(26,998) FF,RESULT,SOURCE,NOP
      WRITE(17,998) FB,RESULT,SOURCE,NOP
 998  FORMAT(A1/72A1,8A1,26X,"PAGE",I3/)
      NAOE=NAO+1
      NBOE=NBO+1
      NCOE=NCO+1
      KEND=0
      DO 86 J=1,4
      PTEM(J)=PERIOD/FLOAT(J)
 86   CONTINUE
      NSIGN=-1
      WRITE(26,597) MIN,MAX
      WRITE(17,597) MIN,MAX
 597  FORMAT(1X58H EAST-WEST COMPONENTS OF THE MEAN WIND, AMPLITUDE AND
     1PHASE,/1X,35H AS DETERMINED FOR THE HEIGHT RANGE,I5,6H KM TO,I5,
     24H KM.//)
 98   IF(NP) 89,89,88
 89   WRITE(26,87)
      WRITE(17,87)
 87   FORMAT(1X,18HHEIGHT MEAN ERROR/1X)
      GO TO 105
 88   GO TO (99,99,101,103),NP
 99   WRITE(26,100) (PTEM(J),J=1,2)
      WRITE(17,100) (PTEM(J),J=1,2)
 100  FORMAT(22X,F6.1,15H HOUR COMPONENT,3X,F9.1,15H HOUR COMPONENT/ 1X,
     175HHEIGHT   MEAN     ERROR   AMP    ERROR PHASE    ERROR   AMP    ERROR P
```

```
     2HASE   ERROR/1X)
      GO TO 105
101   WRITE(26,102) (PTEM(J),J=1,3)
      WRITE(17,102) (PTEM(J),J=1,3)
102   FORMAT(22X,F6.1,15H HOUR COMPONENT,3X,F9.1,15H HOUR COMPONENT,3X,
     1F9.1,15H HOUR COMPONENT          1X,1
     222HHEIGHT  MEAN    ERROR  AMP   ERROR PHASE   ERROR  AMP   ERROR P
     3HASE   ERROR  AMP   ERROR PHASE   ERROR 1X)
      GO TO 105
103   WRITE(26,104) (PTEM(J),J=1,4)
      WRITE(17,104) (PTEM(J),J=1,4)
104   FORMAT(22X,F6.1,15H HOUR COMPONENT,3X,F9.1,15H HOUR COMPONENT,3X,
     1F9.1,15H HOUR COMPONENT,3X,F9.1,15H HOUR COMPONENT 1X,          1
     229HHEIGHT  MEAN    ERROR  AMP   ERROR PHASE   ERROR  AMP   ERROR P
     3HASE   ERROR  AMP   ERROR PHASE   ERROR  AMP   ERROR PHASE   ERROR
     4/1X)
105   KA=KEND
      DO 128 KZ=MIN,MAX
      UO=0.0
      Z=MAX+MIN-KZ
      NZ=Z
      S=(2.0*Z-ZMAX-ZMIN)/(ZMAX-ZMIN)+1.0E-06
      DO 106 K=1,NAOE
      KUA=K+KA
106   UO=UO+AC(KUA)*S**(K-1)
      UO=UO*CENTIM
      SIGUO=0.0
      DO 107 K=1,NAOE
      DO 107 L=1,NAOE
      KS=K+KA
      LS=L+KA
107   SIGUO=SIGUO+S**(K-1)*S**(L-1)*A(KS,LS)*SUM
      ASIGUO=ABS(SIGUO)+0.01
      SIGN=SIGUO/ASIGUO
      EO=SIGN*SQRT(ASIGUO)*CENTIM
      IF(NP) 126,126,108
108   KEND=KA+NAOE
      NUMNA=0
      DO 109 J=1,NP
      SI(J)=0.0
      CO(J)=0.0
      SIGSIN(J)=0.0
      SIGSC(J)=0.0
      SIGCOS(J)=0.0
      NUMNA=NUMNA+NA(J)
109   CONTINUE
      DO 121 J=1,NP
      NUSIN=NP+NUMNA
      KSTART=KEND
      NAEND=NA(J)+1
      KEND=KSTART+NAEND
      DO 110 K=1,NAEND
      KS=K+KSTART
      SI(J)=SI(J)+AC(KS)*S**(K-1)
      KC=KS+NUSIN
110   CO(J)=CO(J)+AC(KC)*S**(K-1)
      SINSQJ=SI(J)**2
      COSSQJ=CO(J)**2
```

```
      SUMSQJ=SINSQJ+COSSQJ
      AU(J)=SQRT(SUMSQJ)*CENTIM
      FJ=J
      FJ=PERIOD/FJ
      IF(CO(J)) 114,111,115
111   IF(SI(J)) 113,113,112
112   PH(J)=FJ/4.0
      GO TO 116
113   PH(J)=FJ*0.75
      GO TO 116
114   PH(J)=FJ*0.5+(FJ/6.28318)*ATAN(SI(J)/CO(J))
      GO TO 116
115   PH(J)=(FJ/6.28318)*ATAN(SI(J)/CO(J))
116   IF(PH(J)) 117,118,118
117   PH(J)=FJ+PH(J)
118   DO 119 K=1,NAEND
      DO 119 L=1,NAEND
      KS=K+KSTART
      LS=L+KSTART
      KC=KS+NUSIN
      LC=LS+NUSIN
      SIGSIN(J)=SIGSIN(J)+S**(K-1)*S**(L-1)*A(KS,LS)
      SIGSC(J)=SIGSC(J)+S**(K-1)*S**(L-1)*A(KS,LC)
119   SIGCOS(J)=SIGCOS(J)+S**(K-1)*S**(L-1)*A(KC,LC)
      PROD=2.0*SI(J)*CO(J)*SIGSC(J)
      SIGPH(J)=(COSSQJ*SIGSIN(J)+SINSQJ*SIGCOS(J)-PROD)*SUM/SUMSQJ**2
      SIGAMP(J)=(SINSQJ*SIGSIN(J)+COSSQJ*SIGCOS(J)+PROD)*SUM/SUMSQJ
      ERPH(J)=SQRT(SIGPH(J))*FJ/6.28318
121   ERAMP(J)=SQRT(SIGAMP(J))*CENTIM
      KEND=KEND+NUSIN
      GO TO (122,122,124,125),NP
122   WRITE(26,123) NZ,UO,EO,(AU(J),ERAMP(J),PH(J),ERPH(J),J=1,2)
      WRITE(17,123) NZ,UO,EO,(AU(J),ERAMP(J),PH(J),ERPH(J),J=1,2)
123   FORMAT(1X,I4,2X,F6.0,2X,F6.0,4(1X,2F6.0,2F7.1))
      WRITE (15) UO,(AU(J),PH(J),J=1,2)
      WRITE (16) EO,(ERAMP(J),ERPH(J),J=1,2)
      GO TO 28
124   WRITE(26,123) NZ,UO,EO,(AU(J),ERAMP(J),PH(J),ERPH(J),J=1,3)
      WRITE(17,123) NZ,UO,EO,(AU(J),ERAMP(J),PH(J),ERPH(J),J=1,3)
      WRITE (15) UO,(AU(J),PH(J),J=1,3)
      WRITE (16) EO,(ERAMP(J),ERPH(J),J=1,3)
      GO TO 28
125   WRITE(26,123) NZ,UO,EO,(AU(J),ERAMP(J),PH(J),ERPH(J),J=1,4)
      WRITE(17,123) NZ,UO,EO,(AU(J),ERAMP(J),PH(J),ERPH(J),J=1,4)
      WRITE (15) UO,(AU(J),PH(J),J=1,4)
      WRITE (16) EO,(ERAMP(J),ERPH(J),J=1,4)
      GO TO 28
126   WRITE(26,123) NZ,UO,EO
      WRITE(17,123) NZ,UO,EO
      WRITE (15) UO
      WRITE (16) EO
      KEND=KA+NAOE
 28   CONTINUE
128   CONTINUE
      IF(NSIGN) 129,131,133
129   NAOE=NBOE
      NP=NQ
      DO 130 J=1,NQ
```

```
130   NA(J)=NB(J)
      NSIGN=0
      NOP=NOP+1
      WRITE(26,998) FF,RESULT,SOURCE,NOP
      WRITE(26,598) MIN,MAX
      WRITE(17,998) FF,RESULT,SOURCE,NOP
      WRITE(17,598) MIN,MAX
598   FORMAT(1X," NORTH-SOUTH COMPONENTS OF THE MEAN WIND, AMPLITUDE AN
     1D PHASE"/1X," AS DETERMINED FOR THE HEIGHT RANGE",I5,6H KM TO,I5,
     2" KM."//)
      GO TO 98
131   IF(NEG.EQ.-1) GO TO 133
      NAOE=NCOE
      NP=NR
      DO 132 J=1,NR
132   NA(J)=NC(J)
      NSIGN=1
      NOP=NOP+1
      WRITE(26,998) FF, RESULT,SOURCE,NOP
      WRITE(26,599) MIN,MAX
      WRITE(17,998) FF, RESULT,SOURCE,NOP
      WRITE(17,599) MIN,MAX
599   FORMAT(1X," VERTICAL   COMPONENTS OF THE MEAN WIND, AMPLITUDE AND
     1 PHASE"/1X," AS DETERMINED FOR THE HEIGHT RANGE",I5,6H KM TO,I5,
     2" KM."/"  **** NOTE THAT VERTICAL WINDS ARE IN CENTIMETERS
     3 PER SECOND! ****"//)
      CENTIM=100.0
      GO TO 98
133   WRITE(26,85) FF
      WRITE(17,85) FF
85    FORMAT(A1)
      CLOSE (17)
      RETURN
      END
```

```
      SUBROUTINE TRANS7 (INFILE,OUTFILE)
C                                                    SEPTEMBER 17, 1992
C     CONVERTS FILE INFILE TO FILE OUTFILE
C     IN A FORMAT SUITABLE FOR PLOTTING BY
C     SPYGLASS TRANSFORM.
C
C     FOR USE WITH TRANCFORM 2.1
C
      SAVE
      CHARACTER*1 TAB,FF,REFMT(250),RESULT(72),SOURCE(8
      CHARACTER*4 CADD
      CHARACTER*40 INFILE,OUTFILE
      COMMON/WINDS/ N,Q(200,200),NOP,ZMIN,MIN,ZMAX,MAX,
     *NA(10),NB(10),NC(10),NAO,NBO,NCO,SUM,AC(200),NTIME(24),
     *NP,NQ,NR,RESULT,SOURCE,PERIOD,FF,CADD,Z
      COMMON/HEIGHTS/NOZ
      DATA LOOP/0/
C
C     OPEN I/O FILES
C
      OPEN(15,FILE=INFILE,FORM="UNFORMATTED")
      CALL SDESIG (OUTFILE,CADD)
      OPEN(16,FILE=OUTFILE,FORM="FORMATTED")
      IF(LOOP.EQ.1) GO TO 1
      LOOP=1
      ISTOP=0
      TAB=CHAR(9)
      NCHAR=232
    1 DO 8 I=1,NOZ,2
      READ (15) (REFMT(IC),IC=1,NCHAR)
      NTOP=NCHAR
      IF=6
    4 IF=IF+1
      IF(IF.EQ.ISTOP) GO TO 7
    5 IF(REFMT(IF).NE.TAB) GO TO 4
      KTOP=NTOP-IF
      DO 6 KK=1,KTOP
      REFMT(IF-1+KK)=REFMT(IF+KK)
    6 CONTINUE
      NTOP=NTOP-1
      ISTOP=NTOP-1
      GO TO 5
    7 LCHAR=NTOP-1
      WRITE (16,100) (REFMT(IC),IC=8,LCHAR)
  100 FORMAT(250A1)
    8 CONTINUE
      CLOSE (15,STATUS="DELETE")
      CLOSE (16)
      RETURN
      END
```

The IDI wind analysis program IDIWIND.f

This program is a variant of Wind.for, and reads the scattering point parameter files SPP - GR XXX files from the hard drive. Output profiles of zonal, meridional and vertical winds is located in folder OUTFILE as file YYYYYYYY.MAW, where YYYYYYYYY is two digit (leading zero) month, day, hour and minute of the midpoint of the selected interval, whose duration is entered (in minutes) at program prompt.

INPUT

Reads file SET.TIME, which is simply a listing of all the interval center point times to be reduced, formatted as follows

```
8905031215
8905031322
..........
..........
..........
0000000000        ! EOF FLAG
```

Requests length of interval (in minutes)

Requests selection of polarization of received returns

[Winds will be contaminated by using other than the transmitted polarization - O (ordinary) in the case of the AIDA data. L (linear) has been identified, in the AIDA data, as RF interference from an harmonic of a broadcast band AM signal. The origin of X (extraordinary) has not been determined]

OUTPUT

In addition to data file XXXXXXXX.MAW, a status file WIND.TXT contains run diagnostics.

```
C       PROGRAM IDIWIND
**********************************************************************
*                                                                    *
*       IDI WIND-CALCULATION PROGRAM; MAPSTAR RADAR                  *
*       COPYRIGHT 1988, HOLODYNE LIMITED 1988.                       *
*       ALL RIGHTS RESERVED.                                         *
*                                                                    *
**********************************************************************
C   MAC VERSION 1.00
C                                 APRIL 15, 1991.
C   THIS PROGRAM WILL CALCULATE ZONAL, MERIDIONAL AND VERTICAL WIND
C   PROFILES IN 1-KM STEPS, WITH  SMOOTHING, FROM REGULAR SCATTERING-
C   POINT PARAMETER FILES, TYPE SPP - SR XXX (ON DISC)
C
C   CURRENTLY SET UP FOR 69-111KM (15 HEIGHTS); NEED TO CHANGE IH
C   DIMENSION OF SPPZ(IH,I,J), AND SOME CODE, TO MATCH OTHER HEIGHT
C   RANGES.
C   THE SCATTERING-POINT PARAMETERS ARE :
C   1.  ALTITUDE (KM).
C   2.  RADIAL VELOCITY (M/SEC).
C   3.  ZENITH ANGLE IN EAST-WEST MERIDIAN (DEGREES).
C   4.  ZENITH ANGLE IN NORTH-SOUTH MERIDIAN (DEGREES).
C   5.  VOLTAGE AMPLITUDE ON #1 DIPOLES.
C   6.  PHASE OF #1 DIPOLES (DEGREES).
C   7.  VOLTAGE AMPLITUDE ON #2 DIPOLES.
C   8.  PHASE OF #2 DIPOLES (DEGREES).
C   9.  ERROR IN 3
C  10.  ERROR IN 4
C  EXPLANATION OF EASILY-REPROGRAMMED PARAMETERS (JUST CHANGE THE SOURCE
C   CODE VALUE GIVEN BELOW:
C    VMAX IS THE LARGEST ALLOWED HORIZONTAL VELOCITY. WE TEST EACH POINT
C   AGAINST VMAX BY PROJECTING ITS RADIAL VELOCITY INTO THE HORIZONTAL
C   PLANE, AND REJECT IT IF IT'S BIGGER THAN VMAX.
C     THMAX IS THE LARGEST ACCEPTABLE RADIAL ZENITH ANGLE.
C     THMIN IS THE SMALLEST ACCEPTABLE RADIAL ZENITH ANGLE.
C     MINH, MINV ARE THE MINIMUM NUMBER OF POINTS.  IF THERE ARE NOT
C   SUFFICIENT POINTS, THAT ALTITUDE IS SKIPPED.
C    NSIGMA IS THE MAXIMUM NUMBER OF STANDARD DEVIATIONS FROM THE FIT AN
C   INDIVIDUAL POINT CAN LIE WITHOUT BEING REJECTED FROM THE VELOCITY
C   CALCULATION.
C     ZMIN IS THE BOTTOM ALTITUDE FOR WHICH WINDS ARE TO BE CALCULATED.
C     ZMAX IS THE TOP ALTITUDE FOR WHICH WINDS ARE TO BE CALCULATED.
C  WIND CALLS INNAME, OUTNAME, WFV, WFH, PHFIT AND SORT.
      REAL*4 PI,VMAX,THMAXV,U(50),V(50),W(50),TRP(50),SUCKS(8),
     1       LINE(10),RMSDVR(50),COSL(2300),COSM(2300),COSN(2300),
     2       DVR(2300),SLOPE,INTERCEPT,VRAD(17)
      INTEGER*4 REJ(4),IH,PARAMETER,TESTFLAG,POINT,NPROFS,NHITES,
     1          NPOINTS(50),INTERVAL,BIGTIME,NPV,NPV0,FITFLAG,MISS,NBAD,
     2          YEAR,MONTH,DAY,HOUR,MINUTE,MINH,MINV,MSEC,IO,NGO,NFILE,
     3          NUMRAD(17),MY,MO,JO,LTIMH,LTIMM,INTHALF,NOWSTART,NOWEND
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*6 STATE
      CHARACTER*1 ANS1,POLAR
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,U,V,W,TRP,REJ,LINE,WIDTH(50),IWT(2300),
     4            RMSDVR(50),COSL,COSM,COSN,DVR,NUMRAD,VRAD
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1            NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE,
     2            INPATH,OUTPATH,NPH,NPV,NPV0,
     3            SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
```

```
C
      PI = 3.14159265
      NTOTAL=0
      VFMAX = 60
      UMAX = 200
      THMAXH = 16
      THMINH = 0
      THMAXV = 5
      THMINV = 0
      THMIN =
      MINH = 5
      MINV = 5
      NSIGMA = 3.0
      DO 20000 I=1,8
      SUCKS(I)=999.0
20000 CONTINUE
C
************************************************************************
*   COMMUNICATE WITH USER
************************************************************************
20001 WRITE (*,*) ' HAVE YOU UPDATED FILE SET.TIME? Y OR N'
      READ (*,'(A)') ANS1
      IF (ANS1 .NE. 'Y') THEN
      WRITE (*,*) ' EXITING SO THAT SET.TIME CAN BE UPDATED'
      PAUSE 'CR TO EXIT'
      STOP
      END IF
C
C     OPEN STATS FILE 'WIND.TXT'
C
  665 OPEN (15,FILE='WIND.TXT',ERR=666,STATUS="NEW",IOSTAT=IO,
     1FORM="FORMATTED")
  666 IF (IO.NE.0) THEN
      WRITE (*,*) ' A WIND.TXT FILE ALREADY EXISTS,'
      WRITE (*,*) ' DO YOU WISH TO WRITE OVER IT? Y OR N'
      READ (*,*) ANS1
      IF (ANS1.EQ.'Y') THEN
      OPEN (15,FILE='WIND.TXT',ERR=666,IOSTAT=IO,FORM="FORMATTED")
      CLOSE (15,STATUS='DELETE')
      GO TO 665
      ELSE
      NERR=0
      GO TO 90909
      END IF
      END IF
  667 WRITE (*,*) ' ENTER LENGTH OF INTERVAL (MINUTES)'
      READ (*,*) INTERVAL
      INTHALF=INTERVAL/2
      WRITE (*,*) " SELECT POLARIZATION - ENTER O, X, L OR ALL"
      READ (*,*) POLAR
      INPATH = 'MAXTOR600:INFILES:SPP - GR '
      OUTPATH = 'MAXTOR600:OUTFILES:'
      WRITE (*,*) ' ENTER FIRST SPP - GR  FILE NUMBER'
  668 READ (*,*) NFILE
      LOOP=0
C
C     OPEN 'MIDPOIN TIME OF EACH DATA INTERVAL FILE' = SET.TIME
C
      OPEN (17,FILE="SET.TIME",FORM="FORMATTED")
C
  669 IFILE=NFILE-1
C
C     PROGRAM ACCEPTS SPP DATA OVER 3KM HEIGHT RANGE FOR EACH ALTITUDE
C     AND LOOPS THREE TIMES THROUGH SPP DATA TO PRODUCE OUTPUT AT 1KM
```

```
C     HEIGHT INTERVALS. ZMIN, ZMAX ARE ADJUSTED AS FOLLOWS.
C
      LOOP=LOOP+1
      IF (LOOP.EQ.1) THEN
      STATE="REWIND"
      ZMIN = 67.5
      ZMAX = 110.5
      END IF
      IF (LOOP.EQ.2) THEN
      STATE="APPEND"
      REWIND (17)
      ZMIN = 65.5
      ZMAX = 110.5
      END IF
      IF (LOOP.EQ.3) THEN
      STATE="APPEND"
      REWIND (17)
      ZMIN = 69.5
      ZMAX = 111.5
      END IF
      NHITES=(ZMAX-ZMIN)/3.0+0.1
      NGO=0
      GO TO 203
************************************************************************
*     RETURN HERE FOR NEW INPUT FILE
************************************************************************
20203 NGO=1
  203 CALL INNAME
      WRITE (*,*) 'INFILE = ',INFILE
      NERR=1
      OPEN (18,ERR=90909,FILE=INFILE,STATUS='OLD',IOSTAT=IO,
     *FORM='UNFORMATTED')
      WRITE (15,'(A)') INFILE
 2010 READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .GT. -990.0) GO TO 2010
      WRITE (*,100) (LINE(KK),KK=1,10)
  100 FORMAT (10F8.0)
      WRITE (15,100) (LINE(KK),KK=1,10)
      MY=LINE(2)
      MO=LINE(3)
      JO=LINE(4)
      LTIMH=LINE(5)
      LTIMM=LINE(6)
      MSEC=LINE(7)
      NOWTIME= LTIMM+LTIMH*60+JO*24*60+MO*30*24*60
      REWIND (18)
      IF (NGO.EQ.1) GO TO 20103
************************************************************************
*     RETURN TO HERE FOR NEW OUTPUT FILE
************************************************************************
20101 NERR=2
      READ (17,101,END=90910) YEAR,MONTH,DAY,HOUR,MINUTE
  101 FORMAT (5I2)
      IF (MONTH.EQ.0) GO TO 90910
      NPROFS=0
      BIGTIME = MINUTE+HOUR*60+DAY*24*60+MONTH*30*24*60
      NOWSTART=BIGTIME-INTHALF
      IF (NGO.EQ.1) GO TO 670
      IF (NOWTIME.GT.NOWSTART) THEN
      WRITE (*,*) " BAD CHOICE OF SPP INPUT FILE; RE-ENTER SPP INPUT
     *FILENAME"
      CLOSE (18)
      GO TO 668
```

```
      END IF
[illegible] NOWEND=NOWTIME+INTHALF
      CALL [illegible]NAME
      NERR=[illegible]
      WRITE (*,*) [illegible]
      WRITE (*,*) [illegible] [illegible]TFILE
      [illegible]
     *F[illegible]RM[illegible]F[illegible]RMATTED'
      [illegible] [illegible]TFILE
[illegible] [illegible]
      [illegible]
      [illegible]
      [illegible]
      [illegible]
      TRF(IH) [illegible]
      RMDIVF(IH)=[illegible]
[illegible] CONTINUE
      IH=0
      MI[illegible]=0
      NBAD=0
      DO [illegible] IREJ=1,4
      REJ(IREJ) = 0
[illegible] CONTINUE
[illegible] WRITE (*,[illegible])
[illegible] FORMAT
     1 ( 1X,' ALT     U       V      W   TRF  NT[illegible]  [illegible]  MIN  RATE'
     2 '   SLOPE INTERCEPT')
[illegible] NERR=4
      READ (18,ERR=90909,IOSTAT=IO,END=[illegible]) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .GT. -990.0) GO TO [illegible]
***********************************************************************
*  RETURN TO HERE FOR NEW PROFILE .
***********************************************************************
20133 MY=LINE(2)
      MO=LINE(3)
      JO=LINE(4)
      LTIMH=LINE(5)
      LTIMM=LINE(6)
      MSEC=LINE(7)
      NOWTIME= LTIMM+LTIMH*60+JO*24*60+MO*30*24*60
      IF (NOWTIME.LT.NOWSTART) GO TO 20133
      IF (NOWTIME.GT.NOWEND) THEN
      BACKSPACE (18)
      GO TO 20204
      END IF
      NPROFS=NPROFS+1
      NERR=5
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .LT. -990.0) THEN
      NPROFS=NPROFS-1
      GO TO 20133
      END IF
C
C     TEST THE POINT FOR:  ALTITUDE
C
20202 IF (LINE(1) .LT. ZMIN) THEN
      NERR=6
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .LT. -990.0) GO TO 20133
      GO TO 20202
      ENDIF
```

```
      IF (LINE(1).GT.DMAX) GO TO [illegible]
      INDEX=(LINE(1)-DMIN)/[illegible]+1.
      IF (NF(INDEX).GT.[illegible]) GO TO [illegible]   [illegible] THERE ARE TOO MANY
C
C     TEST FOR:
C                         1. PERPENDICULAR HORIZONTAL VELOCITY > VHMAX
C                         2. RADIAL VELOCITY
C                         3. RADIAL VELOCITY > VRMAX
C                         4. POLARIZATION
C
C
      TESTFLAG = 1
      VHSTAR = [illegible] SIN(LINE( )*PI/180.)**2
     1                 [illegible](LINE(4)*PI/180.)**2
      DAX=A[illegible]
      SINDAX=SIN(DAX)
      IF (SINDAX.GT.[illegible]) THEN
      VHORIZ=ABS(LINE(2)/SINDAX)
      IF (VHORIZ.GT.VHMAX) THEN
      REJ(1) = REJ(1) + 1
      TESTFLAG = 0
      ENDIF
      ENDIF
      IF (LINE(2).EQ.0) THEN
      REJ(2) = REJ(2) + 1
      TESTFLAG = 0
      ENDIF
      IF (ABS(LINE(2)).GT. VRMAX) THEN
      REJ(3)=REJ(3)+1
      TESTFLAG = 0
      ENDIF
C
C     DETERMINE POLARIZATION
C
      ANGLE=LINE(5)-LINE(8)
C
      IF (POLAR.EQ."A") GOTO 10201
C
      IF (POLAR.EQ."L") THEN
C
      IF (ABS(ANGLE).LT.45.0) GO TO 10201
      IF (ABS(ANGLE).GT.135.0.AND.ABS(ANGLE).LT.225.0) GO TO 10201
      IF (ABS(ANGLE).GT.315.0.AND.ABS(ANGLE).LT.360.0) GO TO 10201
      GO TO 10200
      END IF
C
      IF (POLAR.EQ."X") THEN
C
      IF (ANGLE.GT.-135.0.AND.ANGLE.LT.-45.0) GO TO 10201
      IF (ANGLE.GT.225.0.AND.ANGLE.LT.315.0) GO TO 10201
      GO TO 10200
      END IF
C
      IF (POLAR.EQ."O") THEN
C
      IF (ANGLE.GT.45.0.AND.ANGLE.LT.135.0) GO TO 10201
      IF (ANGLE.GT.-315.0.AND.ANGLE.LT.-225.0) GO TO 10201
C
10200 TESTFLAG=0
      REJ(4)=REJ(4)+1
      END IF
C
C     CHECK FOR TOO MANY POINTS
C
```

```
10201 NPOINTS(INDEX)=NPOINTS(INDEX)+1
      IF (NPOINTS(INDEX) .EQ. 2300) THEN
      WRITE (*,*) 'THANKS ANYHOW, BUT IVE ALREADY GOT 2300 POINTS.'
      GO TO 20104
      ENDIF
      IF (TESTFLAG .EQ. 1) THEN
      DO 10202 PARAMETER = 1,7
      SPPZ(INDEX,NPOINTS(INDEX),PARAMETER) = LINE(PARAMETER)
10202 CONTINUE
      TRP(INDEX) = TRP(INDEX) + LINE(5)**2 + LINE(7)**2
      ENDIF
20104 NERR=0
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .LT. -990.0) GO TO 20133
      GO TO 20202
20204 IH=IH+1
      FITFLAG = 1
      IF (IH.GT.NHITES) GO TO 20206
      Z=ZMIN+1.5+3.0*(FLOAT(IH-1))
      IF (NPOINTS(IH).EQ.0) THEN
      MISS=MISS+1
      GO TO 20250
      END IF
      DO 2 POINT=1,NPOINTS(IH)
      DO 2 PARAMETER=1,7
      SPP(POINT,PARAMETER)=SPPZ(IH,POINT,PARAMETER)
    2 CONTINUE
C
C  FIT THE SCATTERING POINTS IN THIS WINDOW WITH A 3-VECTOR.
C
20205 CALL WFV
      IF (FITFLAG .EQ. 0) THEN
      NBAD=NBAD+1
      WRITE (*,*) 'VERTICAL FAILURE AT ',IH,NPOINTS(IH),Z
      WRITE (16,90002) Z,(SUCKS(KK),KK=1,8)
      GO TO 20204
      ENDIF
      CALL WFH
      IF (FITFLAG .EQ. 0) THEN
      NBAD=NBAD+1
      WRITE (*,*) 'HORIZONTAL FAILURE AT ',IH,NPOINTS(IH),Z
C
C     WRITE FLAG RECORD FOR THIS ALTITUDE  ( U = 999.0 )
C
20250 WRITE (16,90002) Z,(SUCKS(KK),KK=1,8)
      GO TO 20204
C
C     WRITE GOOD VELOCITY
C
      ELSE
      IF (TRP(IH) .LT. 1) THEN
      TRP(IH) = 0
      ELSE
      TRP(IH) = 10*LOG10(TRP(IH))
      ENDIF
      ENDIF
      CALL PHFIT
      RATE = FLOAT(NPOINTS(IH))/NPROFS
      WRITE (*,90001)
     1 Z,U(IH),V(IH),W(IH),TRP(IH),NPOINTS(IH),NPV,NPH,RATE,
     2 SLOPE,INTERCEPT
90001 FORMAT (1X,F4.0,2(1X,F6.1),2(1X,F5.1),3(1X,I4),3(1X,F5.1))
      X1 = FLOAT(NPOINTS(IH))
```

```
      X2 = FLOAT(NPV)
      X3 = FLOAT(NPH)
      WRITE (16,90002)
     1  Z,U(IH),V(IH),W(IH),TRP(IH),X1,RATE,
     2  SLOPE,INTERCEPT
90002 FORMAT (9(E13.4))
      GO TO 20204
C
C     IT'S NOT TIME TO QUIT; OUTPUT REJECTION STATS TO SCREEN, DATA
C     STATS TO WIND.TXT, AND GO SET UP NEXT OUTFILE
C
20206 CLOSE (16)
      IF (NBAD.EQ.NHITES) THEN
      WRITE (15,90004)
90004 FORMAT (1X/5X," BAD DATA THIS INTERVAL", /
      WRITE (*,90004)
      END IF
      IF (MISS.EQ.NHITES) THEN
      WRITE (15,90005)
90005 FORMAT (1X/5X," NO DATA THIS INTERVAL",
      WRITE (*,90005)
      GO TO 20101
      ELSE
      WRITE (*,*) 'REJECTIONS:'
      WRITE (*,*) '     VMAX     VR=0     VRMAX     POLAR'
      WRITE (*,102) (REJ(IREJ),IREJ=1,4)
  102 FORMAT (3I8,1X,I8)
      GO TO 20101
      END IF
C
C     TOO BAD - ERROR EXIT
C
90909 WRITE (*,*) ' ERROR EXIT AT NERR = ',NERR,' STATUS =',IO
      GO TO 90950
C
90910 IF (LOOP.LT.3) GO TO 669
C
      CALL REORDER
C
C     LOOKS LIKE WE MAY HAVE SOME WINDS!
C
90940 WRITE (*,*) ' SUCCESSFUL RUN'
90950 CLOSE (15)
      CLOSE (16)
      CLOSE (17)
      CLOSE (18)
      PAUSE ' CR TO EXIT'
      STOP
      END
      SUBROUTINE INNAME
C  INNAME CREATES SSP INPUT FILE.
      INTEGER*4 REJ,IH,NPOINTS(50),INTERVAL,NPV,NPV0,TESTFLAG,FITFLAG,
     1          MINH,MINV,NUMRAD
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*1 FNUM(3)
      INTEGER*4 YEAR,MONTH,DAY,HOUR,MINUTE,SKIP
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,U(50),V(50),W(50),TRP(50),
     1             REJ(4),LINE(10),
     2             WIDTH(50),IWT(2300),RMSDVR(50),
     4             COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5             NUMRAD(17),VRAD(17)
```

```
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1               NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE,
     2               INPATH,OUTPATH,NPH,NPV,NPV0,
     3               SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
C
    1 IFILE=IFILE+1
      SKIP=0
C      CALL IBAD (IFILE,SKIP)
      IF (SKIP.EQ.1) GO TO 1
      I100=IFILE/100
      I10=IFILE/10-10*I100
      I1=IFILE-100*I100-10*I10
      FNUM(1)=CHAR(I100+48)
      FNUM(2)=CHAR(I10+48)
      FNUM(3)=CHAR(I1+48)
      WRITE (INFILE,90003) INPATH,FNUM
90003 FORMAT (A27,3A1)
      RETURN
      END
      SUBROUTINE OUTNAME
C  OUTNAME CREATES OUTPUT FILENAMES.
C
      CHARACTER*2 ASCMONTH,ASCDAY,ASCHOUR,ASCMINUTE
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      INTEGER*4 REJ,IH,NPOINTS(50),INTERVAL,NPV,NPV0,TESTFLAG,FITFLAG,
     1          MINH,MINV,NUMRAD,YEAR,MONTH,DAY,HOUR,MINUTE
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,U(50),V(50),W(50),TRP(50),
     1               REJ(4),LINE(10),
     2               WIDTH(50),IWT(2300),RMSDVR(50),
     4               COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5               NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1               NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE,
     2               INPATH,OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
C
      IF (MONTH .LT. 10) THEN
      WRITE (ASCMONTH,90001) '0',MONTH
90001 FORMAT (A1,I1)
      ELSE
      WRITE (ASCMONTH,90002) MONTH
90002 FORMAT (I2)
      ENDIF
      IF (DAY .LT. 10) THEN
      WRITE (ASCDAY,90001) '0',DAY
      ELSE
      WRITE (ASCDAY,90002) DAY
      ENDIF
      IF (HOUR .LT. 10) THEN
      WRITE (ASCHOUR,90001) '0',HOUR
      ELSE
      WRITE (ASCHOUR,90002) HOUR
      ENDIF
      IF (MINUTE .LT. 10) THEN
      WRITE (ASCMINUTE,90001) '0',MINUTE
      ELSE
      WRITE (ASCMINUTE,90002) MINUTE
      ENDIF
      WRITE (OUTFILE,90003)
     1 OUTPATH,ASCMONTH,ASCDAY,ASCHOUR,ASCMINUTE,'.MAW'
```

```
90003 FORMAT (A19,4A2,A4)
      RETURN
      END
      SUBROUTINE WFV
*****************************************************************
C
C   THIS SUBROUTINE CALCULATES THE VERTICAL WINDS FROM MAPSTAR SPPS.
C   AUGUST 17, 1990
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      INTEGER*4 YEAR,MONTH,DAY,HOUR,MINUTE
      DIMENSION A(3,3),WINDV(3)
      REAL*4 SIGMA,SIGMALAST,PI
      INTEGER*4 FLAG,IZA
      INTEGER*4 REJ,IH,POINT,NPOINTS(50),INTERVAL,NPV,NPV0,TESTFLAG,
     1FITFLAG,MINH,MINV,NUMRAD
      COMMON /WIND1/ SPP(2300,7),SPP2(15,2300,7)
      COMMON /WIND2/ Z,U(50),V(50),W(50),TRP(50),
     1               REJ(4),LINE(10),
     2               WIDTH(50),IWT(2300),RMSDVR(50),
     4               COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5               NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1              NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE,
     2              INPATH,OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
C
      DO 10101 IA = 1,3
      WINDV(IA) = 0.0
      DO 10101 IB = 1,3
      A(IA,IB) = 0.0
10101 CONTINUE
      DO 10102 II = 1,17
      NUMRAD(II) = 0
      VRAD(II) = 0
10102 CONTINUE
      NPV = NPOINTS(IH)
      DO 10201 POINT = 1,NPOINTS(IH)
      IWT(POINT) = 1
      SINZAX = SQRT(SIN(SPP(POINT,3)*PI/180)**2
     1       +      SIN(SPP(POINT,4)*PI/180)**2)
      IF ((SINZAX .LT. SIN(THMINV*PI/180)) .OR.
     1    (SINZAX .GT. SIN(THMAXV*PI/180))) THEN
      IWT(POINT) = 0
      NPV = NPV - 1
      IF (NPV .LT. MINV) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
      COSL(POINT) = SIN(SPP(POINT,3)*PI/180)
      COSM(POINT) = SIN(SPP(POINT,4)*PI/180)
      COSN(POINT) = SQRT(1 - COSL(POINT)**2 - COSM(POINT)**2)
10201 CONTINUE
      SIGMALAST = 1E8
20001 FLAG = 0
      DO 10301 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10301
      A(1,1) = A(1,1) + COSL(POINT)**2
      A(1,2) = A(1,2) + COSL(POINT)*COSM(POINT)
      A(1,3) = A(1,3) + COSL(POINT)*COSN(POINT)
      A(2,2) = A(2,2) + COSM(POINT)**2
      A(2,3) = A(2,3) + COSM(POINT)*COSN(POINT)
```

```
      A(3,3) = A(3,3) + COSN(POINT)**2
      WINDV(1) = WINDV(1) + SPP(POINT,2)*COSL(POINT)
      WINDV(2) = WINDV(2) + SPP(POINT,2)*COSM(POINT)
      WINDV(3) = WINDV(3) + SPP(POINT,2)*COSN(POINT)
10301 CONTINUE
      A(2,1) = A(1,2)
      A(3,1) = A(1,3)
      A(3,2) = A(2,3)
      DET = A(1,1)*A(2,2)*A(3,3) + 2*A(1,2)*A(1,3)*A(2,3) -
     1       A(1,1)*A(2,3)**2 - A(2,2)*A(1,3)**2 - A(3,3)*A(1,2)**2
      IF (ABS(DET) .LT. 1.0E-7) THEN
      WRITE (*,*) 'WFV: NO SOLUTION'
      FITFLAG = 0
      GO TO 90909
      ENDIF
      U(IH) = (WINDV(1)*(A(2,2)*A(3,3)- A(2,3)**2) +
     1     WINDV(2)*(A(2,3)*A(1,3) - A(1,2)*A(3,3)) +
     2     WINDV(3)*(A(1,2)*A(2,3) - A(1,3)*A(2,2))) / DET
      V(IH) = (WINDV(1)*(A(2,3)*A(1,3) - A(1,2)*A(3,3)) +
     1      WINDV(2)*(A(1,1)*A(3,3) - A(1,3)**2) +
     2      WINDV(3)*(A(1,3)*A(1,2) - A(1,1)*A(2,3))) / DET
      W(IH) = (WINDV(1)*(A(1,2)*A(2,3) - A(1,3)*A(2,2)) +
     1      WINDV(2)*(A(1,2)*A(1,3) - A(1,1)*A(2,3)) +
     2      WINDV(3)*(A(1,1)*A(2,2) - A(1,2)**2)) / DET
C  CALCULATE THE STANDARD DEVIATION (SIGMA)
      ERRORSUM = 0
      DO 10401 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10401
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1           - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      ERRORSUM = ERRORSUM + DVR(POINT)**2
10401 CONTINUE
      SIGMA = SQRT(ERRORSUM/NPV)
      DO 10501 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10501
      IF (ABS(DVR(POINT)) .GT. NSIGMA*SIGMA) THEN
      IWT(POINT) = 0
      FLAG = 1
      NPV = NPV - 1
      IF (NPV .LT. MINV) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
10501 CONTINUE
      IF (FLAG .EQ. 0) GO TO 20002
      IF (FLAG .EQ. 1) THEN
      IF (SIGMA .GE. 0.999*SIGMALAST) GO TO 20002
      IF (SIGMA .LE. 0.01) GO TO 20002
      SIGMALAST = SIGMA
      GO TO 20001
      ENDIF
C  GOOD VELOCITY.
20002 IF ( (ABS(U(IH)) .GT. VMAX)      .OR.
     1     (ABS(V(IH)) .GT. VMAX)      .OR.
     2     (ABS(W(IH)) .GT. VMAX/10.0) ) THEN
      WRITE (*,*) 'IH, U, V, W = ',IH,U(IH),V(IH),W(IH)
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (FITFLAG .EQ. 1) THEN
      RMSDVR(IH) = 0
      DO 10601 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10601
```

```
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1            - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      RMSDVR(IH) = RMSDVR(IH) + DVR(POINT)**2
      ZA = (180/PI)*ASIN(SQRT(1-COSN(POINT)**2))
      IZA = INT(ZA) + 1
      IF (IZA .GT. 17) THEN
      WRITE (*,*) 'IZA = ',IZA
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (IZA .EQ. 17) IZA = 16
      VRAD(IZA) = VRAD(IZA) + DVR(POINT)**2
      NUMRAD(IZA) = NUMRAD(IZA) + 1
10601 CONTINUE
      IF (NPV .GT. 0) THEN
      RMSDVR(IH) = SQRT(RMSDVR(IH)/NPV)
      DO 10701 IALPHA = 1,16
      IF (NUMRAD(IALPHA) .EQ. 0) GO TO 10701
C     WRITE (*,*) 'ZA,VRAD,NUMRAD= ',IALPHA,VRAD(IALPHA),NUMRAD(IALPHA
      VRAD(IALPHA) = SQRT(VRAD(IALPHA)/NUMRAD(IALPHA))
10701 CONTINUE
      ENDIF
      ENDIF
90909 RETURN
      END
      SUBROUTINE WFH
***********************************************************************
C
C   THIS SUBROUTINE CALCULATES HORIZONTAL WINDS FROM MAPSTAR SPPS.
C   AUGUST 17, 1990
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      INTEGER*4 REJ,IH,POINT,NPOINTS(50),INTERVAL,NPV,NPV0,TESTFLAG,
     1FITFLAG,MINH,MINV,NUMRAD
      INTEGER*4 YEAR,MONTH,DAY,HOUR,MINUTE
      DIMENSION H(3,3),WIND(3)
      REAL*4 SIGMA,SIGMALAST,PI
      INTEGER*4 FLAG,IZA
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,U(50),V(50),W(50),TRP(50),
     1             REJ(4),LINE(10),
     2             WIDTH(50),IWT(2300),RMSDVR(50),
     4             COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5             NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1            NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE,
     2            INPATH,OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
C
      DO 10101 IA = 1,3
      WIND(IA) = 0
      DO 10101 IB = 1,3
      H(IA,IB) = 0
10101 CONTINUE
      DO 10102 II = 1,17
      NUMRAD(II) = 0
      VRAD(II) = 0
10102 CONTINUE
      NPH = NPOINTS(IH)
      DO 10201 POINT = 1,NPOINTS(IH)
      IWT(POINT) = 1
      SINZAX = SQRT(SIN(SPP(POINT,3)*PI/180)**2
     1       +      SIN(SPP(POINT,4)*PI/180)**2)
```

```
      IF ((SINDAX .LT. SIN(THMINH*PI/180)) .OR.
     1    (SINDAX .GT. SIN(THMAXH*PI/180))) THEN
      IWT(POINT) = 0
      NPH = NPH - 1
      IF (NPH .LT. MINH) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
      COSL(POINT) = SIN(SPP(POINT,3)*PI/180)
      COSM(POINT) = SIN(SPP(POINT,4)*PI/180)
      COSN(POINT) = SQRT(1 - COSL(POINT)**2 - COSM(POINT)**2)
10201 CONTINUE
      SIGMALAST = 1E8
20001 FLAG = 0
      DO 10301 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10301
      H(1,1) = H(1,1) + COSL(POINT)**2
      H(1,2) = H(1,2) + COSL(POINT)*COSM(POINT)
      H(2,2) = H(2,2) + COSM(POINT)**2
      WIND(1) = WIND(1) + SPP(POINT,2)*COSL(POINT)
     1                  - COSL(POINT)*W(IH)
      WIND(2) = WIND(2) + SPP(POINT,2)*COSM(POINT)
     1                  - COSM(POINT)*W(IH)
10301 CONTINUE
      H(2,1) = H(1,2)
      DET = H(1,1)*H(2,2) - H(1,2)**2
      IF (ABS(DET) .LT. 1.0E-7) THEN
      WRITE (*,*) 'MVH: NO SOLUTION'
      FITFLAG = 0
      GO TO 90909
      ENDIF
      U(IH) = (WIND(1)*H(2,2) - WIND(2)*H(1,2))/DET
      V(IH) = (H(1,1)*WIND(2) - H(1,2)*WIND(1))/DET
C  CALCULATE THE STANDARD DEVIATION (SIGMA)
      ERRORSUM = 0
      DO 10401 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10401
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1           - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      ERRORSUM = ERRORSUM + DVR(POINT)**2
10401 CONTINUE
      SIGMA = SQRT(ERRORSUM/NPH)
      DO 10501 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10501
      IF (ABS(DVR(POINT)) .GT. NSIGMA*SIGMA) THEN
      IWT(POINT) = 0
      FLAG = 1
      NPH = NPH - 1
      IF (NPH .LT. MINH) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
10501 CONTINUE
      IF (FLAG .EQ. 0) GO TO 20002
      IF (FLAG .EQ. 1) THEN
      IF (SIGMA .GE. 0.999*SIGMALAST) GO TO 20002
      IF (SIGMA .LE. 0.01) GO TO 20002
      SIGMALAST = SIGMA
      GO TO 20001
      ENDIF
C  GOOD VELOCITY.
20002 IF ( (ABS(U(IH)) .GT. VMAX)      .OR.
```

```
     1      (ABS(V(IH)) .GT. VMAX)        .OR.
     2      (ABS(W(IH)) .GT. VMAX/2)) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (FITFLAG .EQ. 1) THEN
      RMSDVR(IH) = 0
      DO 10601 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10601
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1             - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      RMSDVR(IH) = RMSDVR(IH) + DVR(POINT)**2
      ZA = (180/PI)*ASIN(SQRT(1-COSN(POINT)**2))
      IZA = INT(ZA) + 1
      IF (IZA .GT. 17) THEN
      WRITE (*,*) 'IZA = ',IZA
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (IZA .EQ. 17) IZA = 16
      VRAD(IZA) = VRAD(IZA) + DVR(POINT)**2
      NUMRAD(IZA) = NUMRAD(IZA) + 1
10601 CONTINUE
      IF (NPH .GT. 0) THEN
      RMSDVR(IH) = SQRT(RMSDVR(IH)/NPH)
      DO 10701 IALPHA = 1,16
      IF (NUMRAD(IALPHA) .EQ. 0) GO TO 10701
C     WRITE (*,*) 'ZA,VRAD,NUMRAD= ',IALPHA,VRAD(IALPHA),NUMRAD(IALPHA)
      VRAD(IALPHA) = SQRT(VRAD(IALPHA)/NUMRAD(IALPHA))
10701 CONTINUE
      ENDIF
      ENDIF
90909 RETURN
      END
      SUBROUTINE PHFIT
***********************************************************************
C
C   THIS SUBROUTINE FITS A STRAIGHT LINE TO THE VARIATION OF VELOCITY
C   VARIANCE VS ZENITH ANGLE.
C   JULY 23, 1990
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
      INTEGER*4 YEAR,MONTH,DAY,HOUR,MINUTE,
     1          REJ,IH,NPOINTS(50),INTERVAL,NPV,NPV0,TESTFLAG,FITFLAG,
     2          MINH,MINV,NUMRAD
      REAL*4 INTERCEPT
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,U(50),V(50),W(50),TRP(50),
     1              REJ(4),LINE(10),
     2              WIDTH(50),IWT(2300),RMSDVR(50),
     4              COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5              NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1             NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE,
     2             INPATH,OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
C
      SUMVR = 0
      SUMVRPH = 0
      SUMPH = 0
      SUMPH2 = 0
      SUMI = 0
      DO 10101 IALPHA = 1,17
```

```
      IF (NUMRAD(IALPHA) .EQ. 0) GO TO 10101
      ZA = IALPHA - 0.5
      SUMVR = SUMVR + VRAD(IALPHA)
      SUMVRPH = SUMVRPH + VRAD(IALPHA)*ZA
      SUMPH = SUMPH + ZA
      SUMPH2 = SUMPH2 + ZA**2
      SUMI = SUMI + 1
10101 CONTINUE
      IF (SUMI .GT. 0) THEN
      IF (SUMI*SUMPH2 - SUMPH**2 .GT. 0) THEN
      SLOPE = (SUMI*SUMVRPH - SUMVR*SUMPH)/(SUMI*SUMPH2 - SUMPH**2)
      INTERCEPT = (SUMVR - SLOPE*SUMPH)/SUMI
      ELSE
      SLOPE = 0
      INTERCEPT = 0
      ENDIF
      ENDIF
      RETURN
      END
      SUBROUTINE REORDER
C
C     REORDERS OUTPUT FILES IN DESCENDING HEIGHT.
C     THIS PORTION OF THE PROGRAM IS SPECIFIC TO A 43KM HEIGHT RANGE
C
      CHARACTER*1 TAB
      CHARACTER*40 INFILE,OUTFILE
      DIMENSION H(50),U(50),V(50),W(50),TRP(50),
     *XH(50),RT(50),SL(50),ICPT(50)
      INTEGER*4 IFILE,YEAR,MONTH,DAY,HOUR,MINUTE,NPOINTS(50)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1             NSIGMA,TESTFLAG,IH,NPOINTS,INTERVAL,INFILE,OUTFILE
      COMMON /SPPFILE/ IFILE,YEAR,MONTH,DAY,HOUR,MINUTE
C
      TAB=CHAR(9)
      WRITE (*,*) " REORDERING FILES BY DESCENDING HEIGHTS"
      REWIND (17)
90911 READ (17,101,END=90940) YEAR,MONTH,DAY,HOUR,MINUTE
  101 FORMAT (5I2)
      IF (MONTH.EQ.0) GO TO 90940
      CALL OUTNAME
      CLOSE (16)
      NERR=8
      OPEN (16,ERR=90950,FILE=OUTFILE,STATUS="OLD",FORM="FORMATTED")
      IH=1
90912 READ (16,90001,END=90920,) H(IH),U(IH),V(IH),W(IH),TRP(IH),
     *XH(IH),RT(IH),SL(IH),ICPT(IH)
90001 FORMAT (9(E13.4))
      IH=IH+1
      GO TO 90912
90920 REWIND (16)
      J=15
90921 I=J
      K=0
90922 WRITE (16,90002)  H(I),TAB,U(I),TAB,V(I),TAB,W(I),TAB,TRP(I),
     *TAB,XH(I),TAB,RT(I),TAB,SL(I),TAB,ICPT(I)
90002 FORMAT (E13.4,8(A1,E13.4))
      IF (I.EQ.1) GO TO 90911
      K=K+1
      IF (K.EQ.1) THEN
      I=I+28
      GO TO 90922
      END IF
      IF (K.EQ.2) THEN
      I=I-14
```

```
      GO TO 40922
      ELSE
      J=J-1
      GO TO 40921
      END IF
      GO TO 40911
40940 RETURN
40950 WRITE (*,*) " ERROR IN RECORDERING FILES. NERR = ",NERR
      PAUSE " CR TO EXIT"
      STOP
      END
```

The ISR and IDI Wind Analysis Program ISRIDIIDIG.f

The FORTRAN program ISRIDIIDIG.f is written to comply with the FORTRAN 77 standard. The runtime program has been compiled as a stand alone application using the Absoft FORTRAN II Compiler running in the Apple MPW environment. Execution has been performed on a 16MHz Macintosh IIcx with 8.0Mb of memory running under System 7.1.

The following data folders and files are essential to execution:

ISRDATA folder, containing the ISR data in files of the form SCENE.$.4 where $ is 2 for Scene II and 3 for Scene III data, and file TUREKFILE. TUREKFILE contains a listing of the start and end times and line of sight azimuth of each ISR measurement. Each is associated with a three digit number AAA which is entered during execution, to determine the comparison interval.

IDIGNSEW folder, containing the GROVES analysis program output files XXXXXXTIDE, where XXXXXX are the year, month and day of the 24 hour interval of the comparison. The appropriate file is chosen automatically.

INFILES folder, containing the IDI scattering point parameter data files SPP - GR YYY from which the appropriate IDI wind profile is calculated. YYY is entered during execution.

OUTFILES folder, where the calculated IDI wind profile is stored as file ZZZZZZZZ.MAW, where ZZZZZZZZ are interval midpoint month, day, hour and minute.

All these files reside on the disc MAXTOR600. Execution on other platforms will require an appropriate global name change in the source code.

Output is a single tab spaced columns ASCII file AAACRKPLOT, where AAA is the three digit TUREKFILE interval number above.

Defenitions of the column headings follow on the next two pages, and are followed by a sample of the runtime screen.

DEFINITIONS OF GROVES, IDI AND ISR DATA SETS

HEIGHT (KM)	
IDIG EW	Zonal component from the Groves Analysis, m/s
ERR EW	Error, computed from change in Groves over comparison interval and inherent measurement error, m/s
IDIG NS	Meridional component
ERR NS	Error
IDIG W	Vertical component, cm/s
ERR W	Error, cm/s
IDI EW	Zonal component as measured by the IDI technique, assuming zero vertical velocity
ERR EW	Error, computed as change in IDI over comparison interval
IDI NS	Meridional component
ERR NS	Error
IDI W	Vertical component, cm/s
ERR W	Error, cm/s
ISR EW	Zonal component as measured by the Incoherent Scatter Radar
ERR EW	Error, computed from the change in 393° (or 213°) azimuth velocity over the comparison interval, and inherent measurement error
ISR NS	Meridional component
ERR NS	Error
EW IDI-ISR	Modulus of the zonal IDI-ISR velocities
NS IDI_ISR	Modulus of the meridional
VRG	Groves line of sight in the 393° (or 123°) azimuth direction
ERR	Error, scaled from the 3 component error
VRP	Groves line of sight in the 303° (or 213°) azimuth direction
ERR	Error
VRIDI	IDI line of sight in the 393° (or 123°) azimuth direction
ERR	Error
VPIDI	IDI line of sight in the 303° (or 213°) azimuth direction
ERR	Error

VRISR	ISR line of sight in the 393° (or 123°) azimuth direction
ERR	Error
VPISR	ISR line of sight in the 303° (or 213°) azimuth direction
ERR	Error
EW IDI	Zonal IDI wind from 3 component calculation
NS IDI	Meridional IDI wind from 3 component calculation

```
PROGRAM ISR1011D1G

ENTER TUREK INTERVAL NUMBER
(THREE FIGURES, WITH LEADING ZERO(ES))

378
 378 CORRESPONDS TO DATE/TIME 8904101200

IF CORRECT ENTER Y, IF INCORRECT, ENTER N

(OR ENTER ANY OTHER KEY TO EXIT)
Y
  PROCESSING ISR DATA


DETERMINE PROFILE TIMING SEQUENCE

ENTER 0, 1 OR 2 FOR EACH PROFILE

  0   READ PROFILE DATA, BUT DO NOT USE

  1   READ AND USE PROFILE DATA

  2   PROFILE MISSING FROM DATA - SKIP

NOTE - ALL SIX MUST BE DEFINED

0 1 2 3 4 5
1 1 1 1 1 1

SEARCHING FILE MAXTOR600:ISR.DATA:SCENE.2.4

    890410      120043          2          5          303
     70.00      -31.35      93.44

  75.0000  29.5000  4.89000  1  1
  76.0000  33.7000  5.56000  1  2
  77.0000  32.8300  6.11000  1  3
  78.0000  31.4200  5.13000  1  4
  79.0000  32.9700  6.25000  1  5
  80.0000  39.3000  6.10000  1  6
  81.0000  44.6600  8.34000  1  7
  82.0000  41.2100  7.73000  1  8
  83.0000  35.1300  9.09000  1  9
  84.0000  33.4700  9.52000  1  10
  85.0000  55.8800  9.84000  1  11
  86.0000  48.9800  10.8600  1  12
  87.0000  57.4200  10.4000  1  13
  88.0000  41.7500  12.2600  1  14
  89.0000  36.1900  10.9300  1  15
  90.0000  1.00000  10.2300  1  16
  91.0000 -18.9800  9.98000  1  17
  92.0000 -43.6200  9.91000  1  18
  93.0000 -45.8100  10.2000  1  19
  94.0000 -49.7300  9.35000  1  20
  95.0000 -44.7600  11.5400  1  21
  96.0000 -62.0700  12.6600  1  22
  97.0000 -52.6500  13.3900  1  23
```

```
    890410        121745          4          5          393
     70.00          3.90         36.99

73.0000   3.53000   2.51000   2   1
74.0000 -14.2200    5.59000   2   2
75.0000  -7.90000   4.81000   2   3
76.0000  -4.77000   4.08000   2   4
77.0000 -15.6600    3.83000   2   5



78.0000 -17.0600    3.55000   2   6
79.0000 -20.2700    3.47000   2   7
80.0000 -18.9800    3.25000   2   8
81.0000 -19.3800    3.25000   2   9
82.0000 -24.4300    4.10000   2  10
83.0000 -32.2300    5.64000   2  11
84.0000 -35.0800    7.05000   2  12
85.0000 -27.2700    7.60000   2  13
86.0000   5.03000   9.25000   2  14
87.0000  17.9100   10.2600    2  15
88.0000  31.2000    8.97000   2  16
89.0000  28.2700    8.00000   2  17
90.0000  24.2100    6.98000   2  18
91.0000  15.7300    6.51000   2  19
92.0000   5.66000   6.75000   2  20
93.0000   4.48000   6.57000   2  21
94.0000  -2.60000   7.70000   2  22
95.0000  -1.67000   7.89000   2  23
96.0000 -14.3500    8.96000   2  24
97.0000 -20.9500   11.1500    2  25
    890410        124405          4          5          393
     70.00        -31.33         25.14

72.0000 -14.7600    3.30000   3   1
73.0000 -15.4400    1.35000   3   2
75.0000  -4.97000   1.91000   3   3
77.0000  -8.97000  12.8500    3   4
78.0000  -9.01000   3.49000   3   5
79.0000 -11.2200    4.17000   3   6
80.0000 -14.9000    6.09000   3   7
81.0000 -27.3400    5.19000   3   8
82.0000 -38.9200    3.98000   3   9
83.0000 -30.5200    3.51000   3  10
84.0000 -32.5700    4.36000   3  11
85.0000  -7.69000   7.64000   3  12
86.0000   7.47000   7.77000   3  13
87.0000  27.7600    6.12000   3  14
88.0000  27.0300    7.86000   3  15
89.0000  20.3000    8.72000   3  16
90.0000   5.90000   8.43000   3  17
91.0000   9.68000   7.91000   3  18
92.0000   7.89000   6.46000   3  19
93.0000   3.31000   6.96000   3  20
94.0000 -11.3500    7.49000   3  21
95.0000 -30.7900    7.82000   3  22
96.0000 -47.6100    7.76000   3  23
97.0000 -55.1100    9.91000   3  24
```

890410 131012 4 5 393
70.00 -3.50 35.88

77.0000	-22.6200	14.8600	4	1
78.0000	-23.8100	2.57000	4	2
80.0000	-34.7500	2.82000	4	3
81.0000	-36.1500	4.36000	4	4
82.0000	-37.5700	3.34000	4	5
83.0000	-30.0000	5.24000	4	6
84.0000	-14.7000	7.17000	4	7
85.0000	-.560000	8.93000	4	8
86.0000	11.6000	9.89000	4	9
87.0000	18.3200	7.91000	4	10
88.0000	34.0800	7.98000	4	11
89.0000	36.6900	7.28000	4	12
90.0000	32.1800	7.21000	4	13
91.0000	15.6000	6.97000	4	14
92.0000	-9.000000E-02	7.76000	4	15
93.0000	-17.7100	8.37000	4	16
94.0000	-31.9200	8.78000	4	17
95.0000	-55.7700	8.44000	4	18
96.0000	-77.4000	10.2800	4	19
97.0000	-108.040	11.9500	4	20

890410 133634 4 5 393
70.00 -3.43 5.67

72.0000	-6.35000	2.38000	5	1
74.0000	-9.53000	4.85000	5	2
76.0000	-6.80000	1.66000	5	3
77.0000	-16.9300	4.06000	5	4
78.0000	-27.6200	4.25000	5	5
79.0000	-33.6400	3.05000	5	6
80.0000	-32.9700	3.25000	5	7
81.0000	-35.4100	4.64000	5	8
83.0000	-36.7700	2.04000	5	9
84.0000	-29.1900	6.00000	5	10
85.0000	-20.2900	8.17000	5	11
86.0000	13.4400	9.03000	5	12
87.0000	25.3500	7.82000	5	13
88.0000	26.2500	8.15000	5	14
89.0000	30.1300	9.97000	5	15
90.0000	31.1700	9.20000	5	16
91.0000	20.0600	8.10000	5	17
92.0000	8.24000	7.27000	5	18
93.0000	-3.28000	8.87000	5	19
94.0000	-23.2200	8.61000	5	20
95.0000	-53.6100	9.86000	5	21
96.0000	-63.6800	10.2000	5	22
97.0000	-66.1900	10.2400	5	23

890410	140648	2	5	303
70.00	-5.49	10.97		

72.0000	12.2500	8.11000	6	1
73.0000	14.8700	6.40000	6	2
74.0000	18.1700	4.60000	6	3
78.0000	34.7500	7.04000	6	4
79.0000	39.5900	9.02000	6	5
80.0000	37.7000	6.16000	6	6
81.0000	33.3800	4.07000	6	7
82.0000	36.0800	4.49000	6	8
83.0000	55.7500	13.9500	6	9
84.0000	59.5400	11.1200	6	10
85.0000	58.1100	8.76000	6	11
86.0000	48.3900	7.57000	6	12
87.0000	53.0300	9.82000	6	13
88.0000	36.7200	9.47000	6	14
89.0000	19.7800	6.70000	6	15
90.0000	12.6800	6.68000	6	16
91.0000	-4.30000	7.44000	6	17
92.0000	-13.9100	8.27000	6	18
93.0000	-22.8200	11.2500	6	19
94.0000	-22.1900	9.23000	6	20
95.0000	22.9000	8.70000	6	21
96.0000	-14.7000	12.2700	6	22

INTERVAL ACCEPTED

@ 393° AZIMUTH OUTPUT

96.0	-14.35	26.04
95.0	-1.67	22.97
94.0	-2.60	13.46
93.0	4.48	10.10
92.0	5.66	10.17
91.0	15.73	11.49
90.0	24.21	17.06
89.0	28.27	13.91
88.0	31.20	13.42
87.0	17.91	16.06
86.0	5.03	13.32
85.0	-27.27	18.11
84.0	-35.08	9.57
83.0	-32.23	7.59
82.0	-24.43	11.61
81.0	-19.38	8.00
80.0	-18.98	6.92
79.0	-20.27	8.45
78.0	-17.06	7.94
77.0	-15.66	11.07
76.0	-4.77	4.08
75.0	-7.90	6.56
74.0	-14.22	5.59
73.0	3.53	12.02

303° AZIMUTH OUTPUT

78.0	33.08	9.02
79.0	36.28	11.93
80.0	38.50	8.74
81.0	39.02	12.24
82.0	38.65	9.65
83.0	45.44	22.13
84.0	46.51	23.54
85.0	56.99	13.27
86.0	48.68	13.24
87.0	55.22	14.64
88.0	39.24	15.89
89.0	27.98	17.29
90.0	6.84	14.75
91.0	-11.64	16.21
92.0	-28.76	24.66
93.0	-34.31	22.25
94.0	-35.96	23.49
95.0	-33.83	21.16
96.0	-38.38	37.85

28 19

NS AND EW COMPONENTS

EARLY NS, EW WIND

HEIGHT	VEW	ERREW	VNS	ERRNS
75.0	-29.0	4.9	9.4	4.8
76.0	-30.9	5.2	14.4	4.6
77.0	-36.1	5.5	4.7	4.6
78.0	-35.6	4.7	2.8	4.1
79.0	-38.7	5.6	1.0	4.5
80.0	-43.3	5.4	5.5	4.3
81.0	-48.0	7.2	8.1	5.3
82.0	-47.9	6.9	2.0	5.4
83.0	-47.0	8.2	-7.9	6.8
84.0	-47.2	8.9	-11.2	7.9
85.0	-61.7	9.2	7.6	8.3
86.0	-38.3	10.4	30.9	9.8
87.0	-38.4	10.4	46.3	10.3
88.0	-18.0	11.4	48.9	10.1
89.0	-15.0	10.1	43.4	9.0
90.0	12.3	9.4	20.8	8.1
91.0	24.5	9.1	2.9	7.7
92.0	39.7	9.1	-19.0	7.8
93.0	40.9	9.3	-21.2	7.8
94.0	40.3	8.9	-29.3	8.2
95.0	36.6	10.6	-25.8	9.1

LATE NS, EW WIND

HEIGHT	VEW	ERREW	VNS	ERRNS
72.0	-13.7	10.6	1.3	9.1
74.0	-20.4	10.6	1.9	9.1
78.0	-44.2	10.6	-4.2	9.1
79.0	-51.5	10.6	-6.7	9.1
80.0	-49.6	10.6	-7.1	9.1
81.0	-47.3	10.6	-11.5	9.1
83.0	-66.8	10.6	-.5	9.1
84.0	-65.8	10.6	7.9	9.1
85.0	-59.8	10.6	14.6	9.1
86.0	-33.3	10.6	37.6	9.1
87.0	-30.7	10.6	50.1	9.1
88.0	-16.5	10.6	42.0	9.1
89.0	-.2	10.6	36.0	9.1
90.0	6.3	10.6	33.0	9.1
91.0	14.5	10.6	14.5	9.1
92.0	16.2	10.6	-.7	9.1
93.0	17.4	10.6	-15.2	9.1
94.0	6.0	10.6	-31.6	9.1
95.0	-10.0	10.6	-57.4	9.1

ZONAL AND MERIDIONAL ISR WINDS

@ HEIGHT	VEW	ERREW	VNS	ERRNS
96.0	24.4	34.8	-32.9	30.0
95.0	27.5	21.7	-19.8	22.4
94.0	28.7	21.0	-21.8	17.1
93.0	31.2	19.5	-14.9	14.8
92.0	27.2	21.4	-10.9	15.9
91.0	18.3	15.0	6.9	13.1
90.0	7.4	15.5	24.0	16.4
89.0	-8.1	16.4	39.0	15.0
88.0	-15.9	15.2	47.5	14.2
87.0	-36.6	15.1	45.1	15.6
86.0	-38.1	13.3	30.7	13.3
85.0	-62.7	14.9	8.2	16.8
84.0	-58.1	20.4	-4.1	15.1
83.0	-55.7	19.0	-2.3	13.6
82.0	-45.7	10.3	.6	11.1
81.0	-43.3	11.1	5.0	9.5
80.0	-42.6	8.2	5.1	7.5
79.0	-41.5	11.0	2.8	9.6
78.0	-37.0	8.7	3.7	8.3

ISR PROCESSING COMPLETED

GET GROVES VELOCITIES, ERRORS

ENTER T FOR TIDE, G FOR GROOUT INPUT
T

ACCESSING FILE MAXTOR600:IDIGNSEW:890410TIDE

TIDAL WINDS CALCULATED

DETERMINE IDI WINDS

ENTER FIRST SPP - GR FILE NUMBER
239

***** IDI WIND PROFILE *****

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999. 89. 4. 10. 10. 45. 36. 600. -999. -999.

OUTFILE = MAXTOR600:OUTFILES:04101214.MAW

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999. 89. 4. 10. 12. 19. 40. 965. -999. -999.

69.	5.2	-11.4	0.0	117.6	671	479	124	33.5	.1	1.5
72.	-13.9	-6.5	0.0	119.2	697	470	130	34.8	.1	1.3
75.	-24.8	5.1	0.0	122.2	644	365	172	32.2	.1	1.4
78.	-34.3	3.4	.1	124.4	762	373	267	38.1	.1	1.7
81.	-46.4	13.1	.2	126.6	829	295	352	41.5	.1	2.3
84.	-50.2	28.3	.2	130.3	1129	442	622	56.5	.2	3.3
87.	-21.7	37.0	-.5	137.1	1164	380	763	58.2	.3	4.2
90.	28.2	14.1	-1.2	140.3	798	214	520	39.9	0.0	7.6
93.	43.1	6.8	0.0	137.7	505	111	340	25.3	.2	4.7
96.	48.9	1.1	-.4	154.2	399	196	209	20.0	.2	5.3
99.	29.3	-4.2	-.2	167.8	668	535	241	33.4	0.0	6.2
102.	23.9	3.9	-.1	169.0	904	708	333	45.2	.1	5.9
105.	32.8	-19.5	-.6	165.8	892	640	374	44.6	.3	4.5
108.	39.2	-40.4	-.8	154.7	480	281	222	24.0	0.0	6.6
111.	65.5	-9.5	.1	127.3	174	99	67	8.7	.6	3.0

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
2243	0	0	2357

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999. 89. 4. 10. 10. 45. 36. 600. -999. -999.

OUTFILE = MAXTOR600:OUTFILES:04101214.MAW

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999. 89. 4. 10. 12. 19. 40. 965. -999. -999.

70.	1.1	-10.1	-.1	118.3	689	370	208	34.5	.1	1.8
73.	-17.5	-2.7	0.0	120.0	726	337	232	36.3	.1	1.6
76.	-28.2	5.5	.3	122.7	660	331	296	33.0	.1	1.6
79.	-37.6	4.8	.5	125.2	805	372	401	40.3	.1	1.7
82.	-53.7	20.0	1.0	127.2	917	278	552	45.8	.1	2.6
85.	-40.7	39.6	-.1	132.9	1199	371	806	60.0	.1	4.9
88.	-3.3	23.9	-.6	138.9	1090	328	745	54.5	.2	6.4
91.	41.5	13.1	-1.9	139.6	718	175	498	35.9	-.1	7.2
94.	31.1	16.7	.1	137.3	404	84	300	20.2	.6	3.6
97.	50.1	3.0	-.6	154.7	342	172	190	17.1	.2	4.9
100.	27.6	-1.3	-.3	167.8	705	522	312	35.3	.2	4.7
103.	26.3	-5.6	-.2	169.0	944	683	442	47.2	-.1	7.1
106.	38.4	-22.6	-.9	165.8	860	598	398	43.0	.2	5.4
109.	42.6	-37.2	-1.1	154.7	446	277	231	22.3	.4	4.6

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
2158	0	0	2226

```
INFILE = MAXTOR600:INFILES:SPP - GR 239
   -999.      89.       4.      10.       10.       45.       36.      600.     -999.     -999.

OUTFILE = MAXTOR600:OUTFILES:04101214.MAW
  ALT     U       V       W    TRP  NTOT  NPV   NPH  RATE  SLOPE INTERCEPT
INFILE = MAXTOR600:INFILES:SPP - GR 240
   -999.      89.       4.      10.       12.       19.       40.      965.     -999.     -999.
   71.   -3.9    -8.0    0.0 118.7  688   379   273  34.4    .1    1.4
   74.  -21.7     1.8     .3 121.6  619   332   277  31.0   0.0    1.9
   77.  -32.6     4.9     .5 124.2  750   358   393  37.5    .1    1.5
   80.  -43.1     5.5    1.0 125.9  772   281   448  38.6    .1    1.9
   83.  -56.0    24.2     .1 128.8 1110   360   715  55.5    .2    2.8
   86.  -32.5    45.1    -.6 136.3 1144   324   795  57.2    .2    4.5
   89.   18.1    16.1   -1.7 140.4  845   175   575  42.2    .1    6.9
   92.   44.1     7.5     .1 137.9  569    83   408  28.5    .1    5.2
   95.   37.5     8.3    -.7 154.1  431   153   277  21.5    .3    4.9
   98.   40.7    -3.6    -.3 167.8  675   509   283  33.8    .2    5.5

  101.   21.6     -.2    -.3 169.0  891   673   401  44.5    .1    5.4
  104.   28.5   -13.8    -.7 165.8  880   575   467  44.0    .1    5.6
  107.   38.5   -39.0   -1.3 154.7  503   283   272  25.1   0.0    6.4
  110.   45.6   -18.6    -.9 127.4  171    82    97   8.6    .3    6.0
REJECTIONS:
    VMAX     VR=0     VRMAX     POLAR
    1879       0         0      1877
 REORDERING FILES BY DESCENDING HEIGHTS
 SUCCESSFUL RUN

 ***** ERROR CALCULATION - PASS 1 *****

INFILE = MAXTOR600:INFILES:SPP - GR 239
   -999.      89.       4.      10.       10.       45.       36.      600.     -999.     -999.

OUTFILE = MAXTOR600:OUTFILES:04101239.MAW
  ALT     U       V       W    TRP  NTOT  NPV   NPH  RATE  SLOPE INTERCEPT
INFILE = MAXTOR600:INFILES:SPP - GR 240
   -999.      89.       4.      10.       12.       19.       40.      965.     -999.     -999.
   69.    1.0    -8.2    0.0 117.6  696   400   327  27.8    .1    1.7
   72.  -17.4    -1.3     .4 120.2  741   404   354  29.6    .1    1.8
   75.  -29.1     6.3     .7 122.9  742   306   438  29.7    .1    1.5
   78.  -41.4     4.9     .8 125.3  939   320   588  37.6    .1    1.7
   81.  -56.0    14.4     .9 127.2 1003   262   661  40.1    .2    2.2
   84.  -52.7    28.1     .2 130.9 1370   391   941  54.8    .1    4.1
   87.  -27.4    34.4    -.8 136.9 1250   314   921  50.0    .3    4.5
   90.   16.5    17.3   -1.4 139.5  781   177   594  31.2   0.0    6.8
   93.   47.0     3.7    -.2 138.1  405    94   332  16.2    .3    3.7
   96.   30.7     4.7    -.6 162.1  765   519   376  30.6   -.3    8.7
   99.   22.9    -9.3    -.5 172.5 1093   890   401  43.7   -.3    8.2
  102.   14.0   -30.1    -.2 170.8 1229   887   536  49.2    .1    6.0
  105.   26.3   -30.8    -.7 159.0  971   507   619  38.8    .4    5.2
  108.   51.8    -5.3    -.5 133.7  214    49   132   8.6   0.0    6.4
  111.   37.2     9.4     .8 131.5  198    65    93   7.9    .5    3.7
REJECTIONS:
    VMAX     VR=0     VRMAX     POLAR
    2273       0         0      2293
```

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999.	89.	4.	10.	10.	45.	36.	600.	-999.	-999.

OUTFILE = MAXTOR600:OUTFILES:04101239.MAW

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999.	89.	4.	10.	12.	19.	40.	965.	-999.	-999.

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT
70.	-.4	-7.9	-.2	118.4	707	381	362	28.3	.1	1.9
73.	-18.7	1.2	.5	120.6	786	395	397	31.4	0.0	2.4
76.	-30.9	8.1	.7	123.5	807	278	485	32.3	.1	1.6
79.	-45.6	5.2	.8	126.2	968	289	629	38.7	.1	1.9
82.	-58.9	18.4	1.2	128.4	1122	236	759	44.9	.3	2.1
85.	-47.7	33.1	.3	133.1	1423	377	1003	56.9	.1	4.8
88.	-11.8	27.6	-.9	138.0	1117	309	795	44.7	.1	6.0
91.	32.6	12.5	-1.4	139.4	646	169	512	25.8	0.0	5.8
94.	37.8	3.4	-.1	140.3	348	90	280	13.9	.2	5.1
97.	35.4	8.5	-.7	162.3	721	500	359	28.8	-.5	10.0
100.	18.7	-10.0	-.4	172.5	1132	886	454	45.3	-.1	6.5
103.	10.9	-35.5	-.1	170.8	1366	885	679	54.6	.1	6.5
106.	39.0	-23.6	-.8	158.9	811	494	499	32.4	.3	5.8
109.	40.6	5.8	.5	132.8	202	39	114	8.1	.2	4.9

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
2207	0	0	2180

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999.	89.	4.	10.	10.	45.	36.	600.	-999.	-999.

OUTFILE = MAXTOR600:OUTFILES:04101239.MAW

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999.	89.	4.	10.	12.	19.	40.	965.	-999.	-999.

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT
71.	-4.0	-6.5	.1	119.9	712	374	387	28.5	.1	1.6
74.	-21.1	2.8	.6	122.5	715	323	412	28.6	0.0	2.2
77.	-34.7	8.6	.7	125.0	913	297	588	36.5	.1	1.7
80.	-50.9	4.1	1.3	126.0	928	262	584	37.1	.1	1.7
83.	-61.1	23.1	.3	129.9	1342	383	897	53.7	.1	3.7
86.	-37.5	38.5	-.7	136.3	1280	318	937	51.2	.2	4.8
89.	4.0	22.4	-1.5	139.6	831	181	613	33.2	.1	6.4
92.	37.8	3.5	-.2	138.1	484	94	393	19.4	.1	4.1
95.	33.5	6.2	-.7	162.1	786	512	413	31.4	.1	6.7
98.	27.7	-5.2	-.5	172.5	1081	878	398	43.2	-.5	9.3
101.	14.4	-21.3	-.1	170.8	1171	889	507	46.8	0.0	6.5
104.	16.1	-35.4	-.9	159.0	1013	508	659	40.5	.2	5.9
107.	57.0	3.2	-.5	133.7	228	60	146	9.1	.1	6.3
110.	36.5	19.5	1.6	131.6	196	44	104	7.8	.6	2.7

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
1904	0	0	1816

REORDERING FILES BY DESCENDING HEIGHTS

SUCCESSFUL RUN

***** ERROR CALCULATION - PASS 2 *****

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999.	89.	4.	10.	10.	45.	36.	600.	-999.	-999.

OUTFILE = MAXTOR600:OUTFILES:04101149.MAW

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999.	89.	4.	10.	12.	19.	40.	965.	-999.	-999.

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT
69.	3.2	-9.5	-.1	122.2	808	425	430	32.3	.1	1.6
72.	-22.0	-3.8	.4	124.2	718	298	441	28.7	.1	1.7
75.	-33.2	2.9	1.2	124.9	763	228	523	30.5	.1	1.5
78.	-41.7	3.2	.9	125.1	819	262	494	32.8	.1	1.6
81.	-48.6	18.6	.8	126.4	999	294	645	40.0	.2	2.3
84.	-41.8	28.2	0.0	128.9	1237	325	798	49.5	.1	4.1
87.	-15.6	27.6	-.8	135.7	1457	393	923	58.3	.3	4.5
90.	41.7	6.5	-1.0	139.6	1042	208	673	41.7	-.1	5.7
93.	49.2	5.8	-.6	136.3	700	115	471	28.0	.2	4.6
96.	62.1	5.6	-.1	133.5	396	109	262	15.8	.4	4.2
99.	59.1	-7.0	0.0	157.1	551	306	316	22.0	0.0	7.1
102.	9.2	-16.6	-.1	169.1	1129	821	521	45.2	-.2	9.4
105.	32.8	-27.3	-.5	169.6	1325	996	484	53.0	0.0	7.0
108.	46.1	-34.4	-.9	159.4	1180	741	582	47.2	.4	5.3
111.	53.1	-9.7	0.0	133.0	285	69	164	11.4	.4	3.8

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
2567	0	0	2663

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999.	89.	4.	10.	10.	45.	36.	600.	-999.	-999.

OUTFILE = MAXTOR600:OUTFILES:04101149.MAW

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999.	89.	4.	10.	12.	19.	40.	965.	-999.	-999.

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT
70.	1.2	-11.0	-.2	122.6	828	391	471	33.1	.1	1.8
73.	-24.2	-4.5	.6	124.9	762	287	468	30.5	.1	1.6
76.	-31.8	4.0	1.2	125.0	754	225	511	30.2	.1	1.9
79.	-39.3	3.2	.8	125.2	879	275	537	35.2	.1	1.6
82.	-47.8	16.0	.9	127.0	1051	308	641	42.0	.2	1.9
85.	-36.7	33.4	.2	131.1	1360	310	883	54.4	.2	3.8
88.	4.9	18.7	-.7	137.7	1365	385	852	54.6	.1	6.1
91.	48.2	6.2	-1.1	139.2	993	194	626	39.7	-.1	5.5
94.	54.7	5.5	-.2	134.8	581	83	405	23.2	.3	4.4
97.	53.1	.3	1.1	137.3	367	47	301	14.7	.4	4.1
100.	30.7	-9.1	.3	157.2	508	299	269	20.3	-.1	8.0
103.	25.7	-9.0	-.1	169.1	1101	883	427	44.0	-.3	8.1
106.	31.6	-34.3	-.5	169.6	1417	1029	537	56.7	.2	5.2
109.	51.8	-24.5	-1.0	159.4	1120	777	592	44.8	.2	7.1

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
2473	0	0	2513

INFILE = MAXTOR600:INFILES:SPP - GR 239

-999.	89.	4.	10.	10.	45.	36.	600.	-999.	-999.

OUTFILE = MAXTOR600:OUTFILES:04101149.MAW

INFILE = MAXTOR600:INFILES:SPP - GR 240

-999.	89.	4.	10.	12.	19.	40.	965.	-999	999.

ALT	U	V	W	TRP	NTOT	NPV	NPH	RATE	SLOPE	INTERCEPT
71.	-8.1	-11.7	.1	124.0	706	279	440	28.2	.1	1.6
74.	-28.6	-3.1	1.1	124.8	740	255	475	29.6	0.0	2.2
77.	-34.4	4.6	.9	124.8	814	264	524	32.6	0.0	2.1
80.	-39.7	3.7	.9	125.6	970	310	605	38.8	.1	1.8
83.	-49.3	20.3	.6	127.6	1160	332	698	46.4	.2	2.2
86.	-29.3	38.0	-.7	134.4	1408	380	915	56.3	.1	4.8
89.	30.4	7.4	-1.0	139.7	1079	200	680	43.2	0.0	6.3
92.	48.7	2.4	0.0	137.1	780	81	505	31.2	0.0	4.1
95.	56.9	6.3	1.2	132.4	452	42	320	18.1	.5	3.1
98.	58.4	-4.9	.1	157.1	592	286	360	23.7	.3	5.5
101	18.2	-9.7	-.1	169.1	1130	850	496	45.2	-.2	9.2
104.	21.4	-24.7	-.3	169.6	1292	1052	444	51.7	-.2	7.8
107.	41.5	-31.6	-.8	159.4	1192	785	588	47.7	.3	5.1
110.	60.2	-37.2	-.8	133.1	295	125	212	11.8	.9	1.9

REJECTIONS:

VMAX	VR=0	VRMAX	POLAR
2224	0	0	2178

REORDERING FILES BY DESCENDING HEIGHTS

SUCCESSFUL RUN

ALL DONE. CR TO EXIT

```
C     PROGRAM ISRIDIIDIG
C                                JULY 14, 1993
C     USES SUBROUTINES BASED ON IDIGNSEW, IDIWIND AND ISRNSEW
C     TO PRODUCE FILE "XXXCRKPLOT" TO BE IMPORTED AND
C     GRAPHED BY CRICKETGRAPH (SEE MANUAL FOR DETAILS)
C
C     ACCESSES SUBROUTINES
C      FOR INPUT TIMING
C                         TIMED
C                         INTERVAL
C      FOR ISR PROFILES
C                         NSEWISR
C                         RADIAL
C                         NORMAL
C                         PERP
C                         NSEW1
C                         NSEW2
C      FOR GROVES PROFILES
C                         GNSEWIDI
C                         GPROF1
C                         GPROF2
C                         SUBVERT
C      FOR IDI PROFILES
C                         NSEWIDI
C                         IDI
C                         SUBVERT
C                         INNAME
C                         OUTNAME
C                         WFV
C                         WFH
C                         PHFIT
C                         REORDER
C      AND SETS UP OUTPUT
C                         DEVIANT
C
      CHARACTER*1 ATHERE,C4H(4),DUM(3),DUMIN(11),DUMMY(10),NEG,TAB,
     *SPACE(32),GO,YES,NO,POLAR
      CHARACTER*4 B(43,31),CH4,BLANK
      CHARACTER*10 TUREKTIME
      CHARACTER*11 CRKPLOT
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*40 INFILE,OUTFILE
      INTEGER*4 YEAR,MONTH,DAY,HOUR,MINUTE,HOWLONG
      REAL*4 NINES
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1            NSIGMA,TESTFLAG,IH,NPOINTS(50),INFILE,OUTFILE,INPATH,
     2            OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /HSKP/ ATHERE,DUM,DUMIN
      COMMON /ARRAYS/ A(43,33),B
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
      EQUIVALENCE (IDIDATA,DUMIN),(ISRDATA,DUMIN),
     *(CRKPLOT,DUMIN),(CH4,C4H),(TUREKTIME,DUMMY)
      WRITE (*,*) " PROGRAM ISRIDIIDIG"
      WRITE (*,*) " "
      BLANK="    "
```

```
      NEG='-'
      TAB=CHAR(9)
      YES="Y"
      NO="N"
      ATHERE="@"
      NINES=999.0
      DO 1 I=1,32
      SPACE(I)=TAB
    1 CONTINUE
      DO 2 I=1,43
      DO 2 J=1,33
      A(I,J)=NINES
    2 CONTINUE
************************************************************************
*   COMMUNICATE WITH USER
************************************************************************
    3 WRITE (*,*) " ENTER TUREK INTERVAL NUMBER"
      WRITE (*,*) " (THREE FIGURES, WITH LEADING ZERO(ES))"
      WRITE (*,*) " "
      READ (*,"(3A1)") DUM
      INTNUM=100*(ICHAR(DUM(1))-48)+10*(ICHAR(DUM(2))-48)+
     *ICHAR(DUM(3))-48
      DO 4 I=1,3
      DUMIN(I)=DUM(I)
    4 CONTINUE
      CALL TIMED
      WRITE (*,*) INTNUM," CORRESPONDS TO DATE/TIME ",TUREKTIME
      WRITE (*,*) " "
      WRITE (*,*) " IF CORRECT ENTER Y, IF INCORRECT, ENTER N"
      WRITE (*,*) " "
      WRITE (*,*) " (OR ENTER ANY OTHER KEY TO EXIT)"
      READ (*,"(A1)") GO
      IF (GO.EQ.YES) GO TO 5
      IF (GO.EQ.NO) GO TO 3
      IF (GO.NE.YES.OR.GO.NE.NO) THEN
      WRITE (*,*) " CHECK TUREK INTERVAL NUMBER"
      PAUSE
      STOP
      END IF
C
C     SET UP ARRAY SEGMENT A(I,14-31) FROM FILE ISR.DATA.SCENE.3.4
C
    5 CALL NSEWISR
C
C     DETERMINE INTERVAL AS PROCESSED BY NSEWISR
C
      CALL INTERVAL
C
C     SET UP ARRAY SEGMENT A(I,2-7) FROM "XXXXTIDE" (GROVES OUTPUT)
C
      CALL GNSEWIDI
C
C     SET UP ARRAY SEGMENT A(I,8-13) FROM SPP FILE
C
      CALL NSEWIDI
C
C     CALCULATE IDI AND ISR NS AND EW DIFFERENCES
C
```

```
      CALL DEVIANT
C
C     OUTPUT FILE "XXXCRKPLOT"
C
      CRKPLOT="   CRKPLOT "
      DO 7 I=1,3
      DUMIN(I)=DUM(I)
    7 CONTINUE
      OPEN (26,FILE=CRKPLOT,FORM="FORMATTED")
      WRITE (26,101) SPACE
  101 FORMAT ("  HEIGHT (KM)",A1,"IDIG EW",A1,"ERR",A1,"IDIG NS",A1,
     *"ERR",A1,"IDIG W",A1,"ERR",A1,"IDI EW",A1,"ERR",A1,"IDI NS",
     *A1,"ERR",A1,"IDI W",A1,"ERR",A1,"ISR EW",A1,"ERR",A1,"ISR NS",
     *A1,"ERR",A1,"EW IDI-ISR",A1,"NS IDI-ISR",
     *A1,"VRG",A1,"ERR",A1,"VPG",A1,"ERR",A1,"VRIDI",A1,"ERR",A1,"VPIDI"
     *,A1,"ERR",A1,"VRISR",A1,"ERR",A1,"VPISR",A1,"ERR",A1,"EW IDI",A1,
     *"NS IDI")
C
C     SET UP CHARACTER ARRAY B(43,33) FOR PRINTING
C
      DO 45 I=1,43
      DO 45 J=1,33
      IF (A(I,J).EQ.NINES) THEN
      CH4=BLANK
      GO TO 44
      END IF
      SIGN=A(I,J)/ABS(A(I,J))
      IA=ABS(A(I,J))
      IF (IA.EQ.0) A(I,J)=A(I,J)+1.0
      IA100=IA/100
      IA10=IA/10-10*IA100
      IA1=IA-100*IA100-10*IA10
      C4H(1)=BLANK
      C4H(2)=CHAR(IA100+48)
      IF (IA100.EQ.0) C4H(2)=BLANK
      C4H(3)=CHAR(IA10+48)
      C4H(4)=CHAR(IA1+48)
      IF (J.EQ.1) GO TO 42
      IF (C4H(2).NE.BLANK) GO TO 42
      IF (IA10.EQ.0) C4H(3)=BLANK
   42 IF (SIGN.GT.0.0) GO TO 44
      DO 43 K=3,1,-1
      IF (C4H(K).NE.BLANK) GO TO 43
      C4H(K)=NEG
      GO TO 44
   43 CONTINUE
   44 B(I,J)=CH4
   45 CONTINUE
      DO 51 I=1,43
      WRITE (26,501) B(I,1),(TAB,B(I,J),J=2,33)
  501 FORMAT (A4,32(A1,A4))
   51 CONTINUE
      PAUSE " ALL DONE. CR TO EXIT"
      CLOSE (26)
      STOP
      END
      SUBROUTINE TIMED
C
```

```
C     DETERMINES TIMES FOR USE IN CALCULATING INTERVAL
C     FROM TUREK NUMBER XXX BY ACCESSING FILE "TUREKFILE"
C
      CHARACTER*1 BLANK,DUMMY(10),FILETIME(12)
      CHARACTER*10 TUREKTIME,DUMFILE
      INTEGER*4 INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,HOWLONG,NOW,
     *STRT2HOUR,STRT3HOUR,STRT2MIN,STRT3MIN,
     *END2HOUR,END3HOUR,END2MIN,END3MIN,AZ1,AZ2
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,HOWLONG
     *,NOW,INTHALF,STRT2HOUR,STRT3HOUR,STRT2MIN,STRT3MIN,
     *END2HOUR,END3HOUR,END2MIN,END3MIN
      COMMON /ANGLES/ AZ1,AZ2
      EQUIVALENCE (DUMFILE,DUMMY)
      MTIME(M,N)=10*(ICHAR(DUMMY(M))-48)+ICHAR(DUMMY(N))-48
      BLANK=" "
      OPEN (18,FILE="MAXTOR600:ISR.DATA:TUREKFILE",STATUS="OLD",
     *FORM="FORMATTED")
      DO 1 I=1,1000
      READ (18,100,END=6) NUM,FILETIME,AZ1
  100 FORMAT (I5,2X,12A1,12X,I3)
      IF (NUM.EQ.INTNUM) GO TO 2
    1 CONTINUE
    2 DO 3 I=1,6
      DUMMY(I)=FILETIME(I)
    3 CONTINUE
      DUMMY(7)=FILETIME(9)
      DUMMY(8)=FILETIME(10)
      DUMMY(9)=FILETIME(11)
      DUMMY(10)=FILETIME(12)
    4 TUREKTIME=DUMFILE
      DO 5 I=1,10
      IF (DUMMY(I).EQ.BLANK) DUMMY(I )="0"
    5 CONTINUE
C
C     DETERMINE YEAR, MONTH, DAY, HOUR, MINUTE
C
      YEAR=MTIME(1,2)
      MONTH=MTIME(3,4)
      DAY=MTIME(5,6)
      HOUR=MTIME(7,8)
      MINUTE=MTIME(9,10)
C
C     READ HOURS, MINUTES TO BE USED TO FIND LENGTH OF INTERVAL
C
      READ (18,101,END=6) STRT2HOUR,STRT2MIN,END2HOUR,END2MIN
  101 FORMAT (15X,2I2,4X,2I2)
      READ (18,101,END=6) STRT3HOUR,STRT3MIN,END3HOUR,END3MIN
      CLOSE (18)
      RETURN
    6 WRITE (*,*) " DID NOT FIND INTERVAL - CHECK TUREK FILENUMBER"
      PAUSE
      STOP
      END
      SUBROUTINE NSEWISR
C
C                                                      MAY 4, 1993
C     READS "MAXTOR600:ISR.DATA:SCENE.$.4" FILE OF ISR DATA,
C     WITH APPROPRIATE FILE ( $ ) AND DATA INTERVAL BEING
```

```
C     CHOSEN BY THE MONTH AND TUREK INTERVAL NUMBER XXX ENTERED;
C     THE PROGRAM OUTPUTS THE NS AND EW WIND COMPONENTS,
C     TOGETHER WITH LINE OF SIGHT, FOR THE
C     CHOSEN INTERVAL AT HEIGHTS FOR WHICH BOTH QUADRATURE
C     COMPONENTS HAVE INSTRUMENTAL ERRORS WHICH ARE < 15 M/S.
C     THE NS AND EW COMPONENTS ARE CALCULATED AS AVERAGES
C     OF THE APPROPRIATE SOUNDINGS, WITH ERRORS
C     CALCULATED AS ONE SIGMA OF THE DATA USED.
C     IF THERE IS NOT AN AVAILABLE QUADRATURE COMPONENT
C     AT THE START OF THE INTERVAL, BUT THERE IS ONE AT THE END,
C     THEN THE 123' OR 393' TUREK NUMBER STARTING THE INTERVAL
C     SHOULD BE ENTERED WHEN REQUESTED.
C     PROGRAM CAN ALSO PROCESS INDIVIDUAL PROFILES, BUT NO
C     NS/EW COMPONENTS WILL RESULT (OBVIOUSLY!).
C
C     REQUIRES SUBROUTINES
C                         NSEW1
C                         NSEW2
C                         NORMAL
C                         PERP
C                         RADIAL
C
      CHARACTER*1 ALPHA1(3),ALPHA2(3),BLANK,D(3),
     *DUMSTAT(30),DUMIN(30),DUMOUT(30),DUMMY(10),LINE(64),
     *TIMES(10),TAB,YES,NO
      CHARACTER*3 ALPH1,ALPH2,AZ,AZIMUTH
      CHARACTER*10 TUREKTIME,DATTIME
      CHARACTER*30 INFILE,OUTFILE,STATFILE
      INTEGER*4 AZ1,AZ2,YEAR,MONTH,DAY,HOUR,MINUTE
      COMMON /ZPERP/ ZP1(60),VP1(60),ERP1(60),
     *               ZP2(60),VP2(60),ERP2(60)
      COMMON /ZRADIAL/  ZR1(60),VR1(60),ERR1(60),
     *                  ZR2(60),VR2(60),ERR2(60),
     *                  ZR3(60),VR3(60),ERR3(60),
     *                  ZR4(60),VR4(60),ERR4(60)
      COMMON /ZAP/ ZR0(60),VR0(60),ERR0(60),
     *             ZP0(60),VP0(60),ERP0(60)
      COMMON /EXTRAS/ ZERO,ALPH1,ALPH2,NR,NP,NMAX,TAB,NAVGE,NPROFS(6),
     *COS33,COS57,D
      COMMON /ARRAYS/ A(43,33)
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
      COMMON /ANGLES/ AZ1,AZ2
      EQUIVALENCE (ALPHA1,ALPH1),(ALPHA2,ALPH2),(STATFILE,DUMSTAT),
     *(OUTFILE,DUMOUT),(LINE(58),AZ),(TIMES,DATTIME),
     *(INFILE,DUMIN),(TUREKTIME,DUMMY)
      LTIME(M,N)=10*(ICHAR(LINE(M))-48)+ICHAR(LINE(N))-48
      BLANK=CHAR(32)
      ERRNEG=-50.0
      NMAX=0
      ZERO=0.0
      RAD=57.29578
      TAB=CHAR(9)
      YES="Y"
      NO="N"
      DO 11 I=1,10
      DUMOUT(I)=BLANK
      DUMSTAT(I)=BLANK
```

```
   11 CONTINUE
      DO 12 I=1,60
      ZP1(I)=ZERO
      ZP2(I)=ZERO
      ZR1(I)=ZERO
      ZR2(I)=ZERO
      ZR3(I)=ZERO
      ZR4(I)=ZERO
      ZPO(I)=ZERO
      ZRO(I)=ZERO
   12 CONTINUE
C
      WRITE (*,*) "   PROCESSING ISR DATA"
C     SELECT DATA SOURCE FILE
C
   14 WRITE (*,*) " "
      INFILE="MAXTOR600:ISR.DATA:SCENE.3.4 "
      IF (MONTH.EQ.3.OR.MONTH.EQ.4) DUMIN(26)="2"
      WRITE (*,*) " "
      OPEN (17,FILE=INFILE,STATUS="OLD",FORM="FORMATTED")
C
C     LOOK ANGLE AZIMUTHS
C     SPECIFIC TO AIDA'89        TAKES CARE OF ORIENTATION
C
      IF (AZ1.EQ.123.OR.AZ1.EQ.213) THEN
      AZ1=213
      AZ2=123
      END IF
      IF (AZ1.EQ.303) AZ2=393
      IF (AZ1.EQ.393) THEN
      AZ1=303
      AZ2=393
      END IF
      IAZ1=AZ1/100
      JAZ1=AZ1/10-10*IAZ1
      KAZ1=AZ1-100*IAZ1-10*JAZ1
      ALPHA1(1)=CHAR(IAZ1+48)
      ALPHA1(2)=CHAR(JAZ1+48)
      ALPHA1(3)=CHAR(KAZ1+48)
      IAZ2=AZ2/100
      JAZ2=AZ2/10-10*IAZ2
      KAZ2=AZ2-100*IAZ2-10*JAZ2
      ALPHA2(1)=CHAR(IAZ2+48)
      ALPHA2(2)=CHAR(JAZ2+48)
      ALPHA2(3)=CHAR(KAZ2+48)
      WRITE (*,*) " "
      WRITE (*,*) " DETERMINE PROFILE TIMING SEQUENCE"
      WRITE (*,*) " "
      WRITE (*,*) " ENTER 0, 1 OR 2 FOR EACH PROFILE"
      WRITE (*,*) " "
      WRITE (*,*) "   0   READ PROFILE DATA, BUT DO NOT USE"
      WRITE (*,*) " "
      WRITE (*,*) "   1   READ AND USE PROFILE DATA"
      WRITE (*,*) " "
      WRITE (*,*) "   2   PROFILE MISSING FROM DATA - SKIP"
      WRITE (*,*) " "
      WRITE (*,*) " NOTE - ALL SIX MUST BE DEFINED"
      WRITE (*,*) " "
```

```
      WRITE (*,*) "0 1 2 3 4 5"
      READ (*,*) NPROFS
      NAVGE=0
      DO 18 I=2,5
      M=NPROFS(I)
      IF (NPROFS(I).EQ.2) M=0
      NAVGE=NAVGE+M
   18 CONTINUE
      WRITE (*,*) " "
      WRITE (*,*) " SEARCHING FILE ",INFILE
      WRITE (*,*) " "
      L=0
    1 READ (17,100,END=80) LINE
  100 FORMAT (64A1)
      AZIMUTH=AZ
      IF (L.GT.0) GO TO 20
      DO 10 MTIME=1,6
      TIMES(MTIME)=LINE(MTIME+6)
   10 CONTINUE
      DO 120 MTIME=7,10
      TIMES(MTIME)=LINE(MTIME+12)
  120 CONTINUE
      IF (DATTIME.NE.TUREKTIME) GO TO 1
   20 L=L+1
      IF (L.EQ.7) GO TO 7
      IF (NPROFS(1).EQ.0.OR.NPROFS(1).EQ.2) GO TO 9
      IF (NPROFS(6).EQ.0.OR.NPROFS(6).EQ.2) GO TO 9
      IF ((L.EQ.1.AND.AZIMUTH.NE.ALPH1)
     *.OR.(L.EQ.6.AND.AZIMUTH.NE.ALPH1)) THEN
      WRITE (*,*) " "
      WRITE (*,104) L,AZIMUTH,ALPH1
  104 FORMAT (" AZIMUTH ERROR ",I3,2X,2A3)
      CLOSE (17)
      PAUSE " CR TO EXIT"
      STOP
      END IF
    9 MY=LTIME(7,8)
      IF (MY.NE.89) THEN
      WRITE (*,*) " ERROR EXIT - MY =",MY," CHECK STATS"
      PAUSE " CR TO EXIT"
      STOP
      END IF
      WRITE (*,100) LINE
      READ (17,100) LINE
      WRITE (*,100) LINE
      READ (17,100) LINE
      WRITE (*,*) " "
      I=0
    2 I=I+1
      GO TO (21,22,23,24,25,26),L
   21 IF (NPROFS(1).EQ.2) THEN
      L=2
      GO TO 22
      END IF
      READ (17,*,END=80) ZP1(I),VP1(I),ERP1(I)
      Z=ZP1(I)
      ERR=ERP1(I)
      GO TO 3
```

```
22 IF (NPROFS(2).EQ.2) THEN
   L=3
   GO TO 23
   END IF
   READ (17,*,END=80) ZR1(I),VR1(I),ERR1(I)
   Z=ZR1(I)
   ERR=ERR1(I)
   GO TO 3
23 IF (NPROFS(3).EQ.2) THEN
   L=4
   GO TO 24
   END IF
   READ (17,*,END=80) ZR2(I),VR2(I),ERR2(I)
   Z=ZR2(I)
   ERR=ERR2(I)
   GO TO 3
24 IF (NPROFS(4).EQ.2) THEN
   L=5
   GO TO 25
   END IF
   READ (17,*,END=80) ZR3(I),VR3(I),ERR3(I)
   Z=ZR3(I)
   ERR=ERR3(I)
   GO TO 3
25 IF (NPROFS(5).EQ.2) THEN
   L=6
   GO TO 26
   END IF
   READ (17,*,END=80) ZR4(I),VR4(I),ERR4(I)
   Z=ZR4(I)
   ERR=ERR4(I)
   GO TO 3
26 IF (NPROFS(6).EQ.2) GO TO 7
   READ (17,*,END=80) ZP2(I),VP2(I),ERP2(I)
   Z=ZP2(I)
   ERR=ERP2(I)
   GO TO 3
 3 IF (Z.LT.999.0) GO TO 4
   I=I-1
   BACKSPACE (17)
   IF (NMAX.LT.I) NMAX=I
   I=0
   GO TO 1
 4 IF (ERR.LT.ZERO.OR.ERR.GT.15.0) THEN
   I=I-1
   GO TO 2
   END IF
   IF (L.NE.1) GO TO 41
   WRITE (*,*) ZP1(I),VP1(I),ERP1(I),L,I
102 FORMAT (F12.1,A1,F14.2,A1,F15.2,2I5)
   GO TO 2
41 IF (L.NE.2) GO TO 42
   WRITE (*,*) ZR1(I),VR1(I),ERR1(I),L,I
   GO TO 2
42 IF (L.NE.3) GO TO 43
   WRITE (*,*) ZR2(I),VR2(I),ERR2(I),L,I
   GO TO 2
43 IF (L.NE.4) GO TO 44
```

```
      WRITE (*,*) ZR3(I),VR3(I),ERR3(I),L,I
      GO TO 2
   44 IF (L.NE.5) GO TO 45
      WRITE (*,*) ZR4(I),VR4(I),ERR4(I),L,I
      GO TO 2
   45 IF (L.NE.6) GO TO 26
      WRITE (*,*) ZP2(I),VP2(I),ERP2(I),L,I
      GO TO 2
    7 WRITE (*,103)
  103 FORMAT (/"     INTERVAL     ACCEPTED"/)
C
C     CALCULATE AVERAGE WINDS FROM PROFILES
C
      CALL RADIAL
C
      IF (NPROFS(1).EQ.1.AND.NPROFS(6).EQ.2) THEN
      CALL NORMAL (ZP1,VP1,ERP1)
      END IF
C
      IF (NPROFS(1).EQ.2.AND.NPROFS(6).EQ.1) THEN
      CALL NORMAL (ZP2,VP2,ERP2)
      END IF
C
      IF (NPROFS(1).EQ.1.AND.NPROFS(6).EQ.1) THEN
      CALL PERP
      END IF
C
      WRITE (*,*) NR,NP
      IF (NR.LT.2.OR.NP.LT.2) THEN
      WRITE (*,*) " INSUFFICIENT HEIGHTS - NO NS-EW CALCULATED;
     * EXECUTION TERMINATED"
      PAUSE " CR TO EXIT"
      STOP
      END IF
      WRITE (*,*) " NS AND EW COMPONENTS"
C
C     DEFINE PROJECTION ANGLES APPROPRIATE TO INPUT AZIMUTHS
C     FOR USE IN DETERMINING ZONAL AND MERIDIONAL WINDS
C
      COS33=COS(33.0/RAD)
      COS57=COS(57.0/RAD)
C
C     CALCULATE NS, EW PROFILES FROM ZP1,ZR1 AND ZP2,ZR4 ONLY
C     IF AVAILABLE (I.E. "EARLY" AND "LATE" COMPONENTS)
C
      IF (NPROFS(1).EQ.1.AND.NPROFS(6).EQ.1) CALL NSEW1
C
C     CALCULATE ZONAL AND MERIDIONAL COMPONENTS
C
      CALL NSEW2
C
   79 WRITE (*,*) " ISR PROCESSING COMPLETED"
      CLOSE (17)
      RETURN
   80 PAUSE " EOF - CHECK STATS FILE. CR TO EXIT"
      CLOSE (17)
      STOP
   90 PAUSE " ZP1=0. CR TO EXIT"
```

```
      CLOSE (17)
      STOP
      END
      SUBROUTINE RADIAL
      DIMENSION ZALL (30)
      CHARACTER*1 TAB
      CHARACTER*3 ALPH1,ALPH2
      COMMON /ZRADIAL/  ZR1(60),VR1(60),ERR1(60),
     *                  ZR2(60),VR2(60),ERR2(60),
     *                  ZR3(60),VR3(60),ERR3(60),
     *                  ZR4(60),VR4(60),ERR4(60)
      COMMON /ZAP/ ZRO(60),VRO(60),ERRO(60),
     *             ZPO(60),VPO(60),ERPO(60)
      COMMON /EXTRAS/ ZERO,ALPH1,ALPH2,NR,NP,NMAX,TAB,NAVGE,NPROFS(6)
      COMMON /ARRAYS/ A(43,33)
C
      SINZEN=SIN(11.3/57.29578)
      HALF=0.5
      WRITE (*,100) ALPH2
  100 FORMAT (" @ ",A3,"" AZIMUTH OUTPUT")
C
      DO 50 I=1,28
      ZALL(I)=97-I
   50 CONTINUE
      ZALL(29)=ZERO
      NR=0
      I=0
C
C     CHOOSE ONLY DATA BETWEEN 69 AND 96KM
C
      IF (NPROFS(2).NE.1) GO TO 56
   54 I=I+1
      NR=NR+1
      IF (ZALL(I).EQ.ZERO) THEN
      NR=NR-1
      GO TO 66
      END IF
      DO 55 II=1,60
      IF (ZR1(II).EQ.ZERO) GO TO 54
      IF (ZALL(I).NE.ZR1(II)) GO TO 55
      ZRO(NR)=ZALL(I)
      VRO(NR)=VR1(II)
      ERRO(NR)=ERR1(II)
      DO 540 JJ=1,60
      IF (ZR2(JJ).EQ.ZERO) GO TO 54
      IF (ZALL(I).NE.ZR2(JJ)) GO TO 540
      ERRO(NR)=ERRO(NR)+HALF*SQRT((VRO(NR)-VR2(JJ))**2
     *+ERR2(JJ)*ERR2(JJ))
  540 CONTINUE
   55 CONTINUE
      GO TO 54
C
   56 IF (NPROFS(5).NE.1) GO TO 66
      NR=0
      I=0
   64 I=I+1
      NR=NR+1
      IF (ZALL(I).EQ.ZERO) THEN
```

```
      NR=NR-1
      GO TO 66
      END IF
      DO 65 II=1,60
      IF (ZR4(II).EQ.ZERO) GO TO 64
      IF (ZALL(I).NE.ZR4(II)) GO TO 65
      ZRO(NR)=ZALL(I)
      VRO(NR)=VR4(II)
      ERRO(NR)=ERR4(II)
      DO 640 JJ=1,60
      IF (ZR3(JJ).EQ.ZERO) GO TO 64
      IF (ZALL(I).NE.ZR3(JJ)) GO TO 640
      ERRO(NR)=ERRO(NR)+HALF*SQRT((VRO(NR)-VR3(JJ))**2
     *+ERR3(JJ)*ERR3(JJ))
  640 CONTINUE
   65 CONTINUE
      GO TO 64
   66 I=0
      DO 67 IJ=1,NR
      IF (ZRO(IJ).NE.ZERO) THEN
      I=I+1
      ZRO(I)=ZRO(IJ)
      VRO(I)=VRO(IJ)
      ERRO(I)=ERRO(IJ)
      VRLOS=VRO(I)*SINZEN
      ERRLOS=ERRO(I)*SINZEN
      IH=112.1-ZRO(I)
      A(IH,28)=VRLOS
      A(IH,29)=ERRLOS
      WRITE (*,102) ZRO(I),TAB,VRO(I),TAB,ERRO(I)
  102 FORMAT (F12.1,A1,F14.2,A1,F15.2)
      END IF
   67 CONTINUE
      ZRO(I+1)=ZERO
   70 RETURN
      END
      SUBROUTINE NORMAL (ZP,VP,ERP)
      DIMENSION ZP(60),VP(60),ERP(60)
      CHARACTER*1 TAB
      CHARACTER*3 ALPH1,ALPH2
      COMMON /ZAP/ ZRO(60),VRO(60),ERRO(60),
     *             ZPO(60),VPO(60),ERPO(60)
      COMMON /EXTRAS/ ZERO,ALPH1,ALPH2,NR,NP,NMAX,TAB
      COMMON /ARRAYS/ A(43,33)
      SINZEN=SIN(11.3/57.29578)
      WRITE (*,106) ALPH1
  106 FORMAT ("  ",A3,"' AZIMUTH OUTPUT")
      DO 50 IK=1,60
      ZPO(IK)=ZP(IK)
      IF (ZPO(IK).EQ.ZERO.OR.ZPO(IK).GT.999.0) GO TO 51
      VPO(IK)=VP(IK)
      ERPO(IK)=ERP(IK)
      VPLOS=VPO(IK)*SINZEN
      ERPLOS=ERPO(IK)*SINZEN
      IH=112.1-ZPO(IK)
      A(IH,30)=VPLOS
      A(IH,31)=ERPLOS
      WRITE (*,101) ZPO(IK),TAB,VPO(IK),TAB,ERPO(IK)
```

```
  101 FORMAT (F12.1,A1,F14.2,A1,F15.2)
   50 CONTINUE
   51 NP=IK-1
      RETURN
      END
      SUBROUTINE PERP
      CHARACTER*1 TAB
      CHARACTER*3 ALPH1,ALPH2
      COMMON /ZPERP/ ZP1(60),VP1(60),ERP1(60),
     *               ZP2(60),VP2(60),ERP2(60)
      COMMON /ZAP/ ZRO(60),VRO(60),ERRO(60),
     *             ZPO(60),VPO(60),ERPO(60)
      COMMON /EXTRAS/ ZERO,ALPH1,ALPH2,NR,NP,NMAX,TAB,NAVGE,NPROFS(6)
      COMMON /ARRAYS/ A(43,33)
C
      WRITE (*,101) ALPH1
  101 FORMAT ("  ",A3," AZIMUTH OUTPUT")
C
      SINZEN=SIN(11.3/57.29578)
      NP=0
      DO 56 I=1,NMAX
      IF (ZP1(I).GT.1000.0) GO TO 60
      IF (ZP1(I).EQ.ZERO) GO TO 60
      DO 55 J=1,NMAX
      IF (ZP2(J).EQ.ZERO) GO TO 56
      IF (ZP1(I).NE.ZP2(J)) GO TO 55
      NP=NP+1
      ZPO(NP)=ZP2(J)
      VPO(NP)=(VP1(I)+VP2(J))/2.0
      ERPO(NP)=SQRT ((VP1(I)-VPO(NP))**2+(VP2(J)-VPO(NP))**2
     *+ERP1(I)**2+ERP2(J)**2)
      VPLOS=VPO(NP)*SINZEN
      ERPLOS=ERPO(NP)*SINZEN
      IH=112.1-ZPO(NP)
      A(IH,30)=VPLOS
      A(IH,31)=ERPLOS
      WRITE (*,102) ZPO(NP),TAB,VPO(NP),TAB,ERPO(NP)
  102 FORMAT (F12.1,A1,F14.2,A1,F15.2)
   55 CONTINUE
   56 CONTINUE
   60 RETURN
      END
      SUBROUTINE NSEW1
      CHARACTER*1 TAB
      CHARACTER*3 ALPH1,ALPH2
      COMMON /ZPERP/ ZP1(60),VP1(60),ERP1(60),
     *               ZP2(60),VP2(60),ERP2(60)
      COMMON /ZRADIAL/  ZR1(60),VR1(60),ERR1(60),
     *                  ZR2(60),VR2(60),ERR2(60),
     *                  ZR3(60),VR3(60),ERR3(60),
     *                  ZR4(60),VR4(60),ERR4(60)
      COMMON /EXTRAS/ ZERO,ALPH1,ALPH2,NR,NP,NMAX,TAB,NAVGE,NPROFS(6),
     *COS33,COS57
C
      IF (NPROFS(1).EQ.0.OR.NPROFS(1).EQ.2) GO TO 69
      WRITE (*,105)
  105 FORMAT (/" EARLY NS, EW WIND",//)
      WRITE (*,106)
```

```
106 FORMAT (/"    HEIGHT    VEW    ERREW      VNS       ERRNS"/)
    I=0
 64 I=I+1
    IF (I.GT.60) GO TO 69
    IF (ZR1(I).GT.95.0) GO TO 64
    IF(ZR1(I).EQ.ZERO) GO TO 69
    DO 65 J=1,60
    IF (ZP1(J).EQ.ZERO) GO TO 64
    IF(ZR1(I).NE.ZP1(J)) GO TO 65
    IF (ALPH1.EQ."303") THEN
    VEW=VR1(I)*COS57-VP1(J)*COS33
    VNS=VR1(I)*COS33+VP1(J)*COS57
    EREW=SQRT ((ERR1(I)*COS57)**2+(ERP1(J)*COS33)**2)
    ERNS=SQRT ((ERR1(I)*COS33)**2+(ERP1(J)*COS57)**2)
    ELSE
    VEW=VR1(I)*COS33-VP1(J)*COS57
    VNS=-VR1(I)*COS57-VP1(J)*COS33
    EREW=SQRT ((ERR1(I)*COS33)**2+(ERP1(J)*COS57)**2)
    ERNS=SQRT ((ERR1(I)*COS57)**2+(ERP1(J)*COS33)**2)
    END IF
    WRITE (*,107) ZP1(J),TAB,VEW,TAB,EREW,TAB,VNS,TAB,ERNS
107 FORMAT (F8.1,4(A1,F8.1))
    GO TO 66
 65 CONTINUE
 66 GO TO 64
 69 IF (NPROFS(6).EQ.0.OR.NPROFS(6).EQ.2) RETURN
    WRITE (*,108)
108 FORMAT (/" LATE NS, EW WIND",//)
    WRITE (*,106)
    I=0
 74 I=I+1
    IF (I.GT.60) GO TO 79
    IF (ZR4(I).GT.95.0) GO TO 74
    IF(ZR4(I).EQ.ZERO) GO TO 79
    DO 75 J=1,60
    IF (ZP2(J).EQ.ZERO) GO TO 74
    IF(ZR4(I).NE.ZP2(J)) GO TO 75
    IF (ALPH1.EQ."303") THEN
    VEW=VR4(I)*COS57-VP2(J)*COS33
    VNS=VR4(I)*COS33+VP2(J)*COS57
    ELSE
    VEW=VR4(I)*COS33-VP2(J)*COS57
    VNS=-VR4(I)*COS57-VP2(J)*COS33
    EREW=SQRT ((ERR4(I)*COS33)**2+(ERP2(J)*COS57)**2)
    ERNS=SQRT ((ERR4(I)*COS57)**2+(ERP2(J)*COS33)**2)
    END IF
    WRITE (*,107) ZP2(J),TAB,VEW,TAB,EREW,TAB,VNS,TAB,ERNS
    GO TO 76
 75 CONTINUE
 76 GO TO 74
 79 RETURN
    END
    SUBROUTINE NSEW2
    CHARACTER*1 D(3),TAB
    CHARACTER*3 ALPH1,ALPH2
    COMMON /ZAP/ ZRO(60),VRO(60),ERRO(60),
   *              ZPO(60),VPO(60),ERPO(60)
    COMMON /EXTRAS/ ZERO,ALPH1,ALPH2,NR,NP,NMAX,TAB,NAVGE,NPROFS(6),
```

```
     *COS33,COS57,D
      COMMON /ARRAYS/ A(43,33)
C
      WRITE (*,100)
  100 FORMAT (//" ZONAL AND MERIDIONAL ISR WINDS"
     *//" @ HEIGHT   VEW    ERREW     VNS       ERRNS"/)
      SIGN=1.0
      IF (ALPH1.EQ."213") SIGN=-1.0
      I=0
   74 I=I+1
      IF(ZRO(I).EQ.ZERO) GO TO 79
      DO 75 J=1,60
      IF (ZPO(J).EQ.ZERO) GO TO 74
      IF(ZRO(I).NE.ZPO(J)) GO TO 75
      IF (ALPH1.EQ."303") THEN
      VEW=VRO(I)*COS57-VPO(J)*COS33
      VNS=VRO(I)*COS33+VPO(J)*COS57
      EREW=SQRT ((ERRO(I)*COS57)**2+(ERPO(J)*COS33)**2)
      ERNS=SQRT ((ERRO(I)*COS33)**2+(ERPO(J)*COS57)**2)
      ELSE
      VEW=VRO(I)*COS33-VPO(J)*COS57
      VNS=-VRO(I)*COS57-VPO(J)*COS33
      EREW=SQRT ((ERRO(I)*COS33)**2+(ERPO(J)*COS57)**2)
      ERNS=SQRT ((ERRO(I)*COS57)**2+(ERPO(J)*COS33)**2)
      END IF
      WRITE (*,101) ZPO(J),TAB,VEW,TAB,EREW,TAB,VNS,TAB,ERNS
  101 FORMAT (F8.1,4(A1,F8.1))
      II=112.1-ZPO(J)
      A(II,14)=VEW
      A(II,15)=EREW
      A(II,16)=VNS
      A(II,17)=ERNS
      GO TO 74
   75 CONTINUE
      GO TO 74
   79 RETURN
      END
      SUBROUTINE INTERVAL
      CHARACTER*10 TUREKTIME
      CHARACTER*27 LIST
      INTEGER*4 INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,HOWLONG,NOW,
     *STRT2HOUR,STRT3HOUR,STRT2MIN,STRT3MIN,
     *END2HOUR,END3HOUR,END2MIN,END3MIN
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,HOWLONG
     *,NOW,INTHALF,STRT2HOUR,STRT3HOUR,STRT2MIN,STRT3MIN,
     *END2HOUR,END3HOUR,END2MIN,END3MIN
      COMMON /EXTRAS/ LIST,NPROFS(6)
C
      IF (NPROFS(1).EQ.1) THEN
      ENDHOUR=END2HOUR
      ENDMIN=END2MIN
      END IF
      IF (NPROFS(5).EQ.1) THEN
      HOUR=STRT2HOUR
      MINUTE=STRT2MIN
      ENDHOUR=END3HOUR
      ENDMIN=END3MIN
      END IF
```

```
C
      HOWLONG=(60*ENDHOUR+ENDMIN)-(60*HOUR+MINUTE)
C
C     DEFINE MIDPOINT TIME, AND CONVERT TO LOCAL MEAN SOLAR
C     ASSUMES DAYTIME INTERVAL I.E. DOES NOT TEST FOR CHANGE OF DAY
C
      INTHALF=HOWLONG/2
      MINUTE=MINUTE+INTHALF-28
      IF (MINUTE.GT.59) THEN
      HOUR=HOUR+1
      MINUTE=MINUTE-60
      END IF
      IF (MINUTE.LT.0) THEN
      HOUR=HOUR-1
      MINUTE=MINUTE+60
      END IF
      RETURN
      END
      SUBROUTINE GNSEWIDI
C                                    MAY 5, 1993
C     CALCULATES INPUT FILE DESIGNATOR XXXXXX AND
C     READS GROVES OUTPUT FILES "XXXXXXTIDE"oOR "XXXXXXGROOUT"
C     USING INTERVAL MIDPOINT  LOCAL MEAN SOLAR TIME
C     TO PRODUCE ZONAL MERIDIONAL AND LINE OF SIGHT
C     PROFILES, WITH ERRORS, AT 1 KM INTERVALS BETWEEN
C     69 AND 111 KM
C
C     REQUIRES SUBROUTINES
C                             GPROF1
C                             GPROF2
C
      DIMENSION STRTEW(50),STRTNS(50),ENDEW(50),ENDNS(50),
     *STRTVERT(50),ENDVERT(50),WINDEW(50),WINDNS(50),VERT(50),
     *ERREW(50),ERRNS(50),ERRVERT(50)

      CHARACTER *40 TIDE,GROOUT
      CHARACTER*10 TUREKTIME
      CHARACTER*1 DUMMY1(25),DUMMY2(25),WHICH
      INTEGER*4 INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,HOWLONG,NOW,
     *YEAR10,YEAR1,MONTH10,MONTH1,IDAY10,IDAY1
      COMMON /ARRAYS/ A(43,33)
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
      EQUIVALENCE (TIDE,DUMMY1)
      EQUIVALENCE (GROOUT,DUMMY2)
C
      WRITE (*,*) " "
      WRITE (*,*) " GET GROVES VELOCITIES, ERRORS"
      WRITE (*,*) " "
      TWO=2.0
      TWOPI=6.28318
      SIXTY=60.0
      RAD=57.29578
      SINZEN=SIN(11.3/RAD)
      COS57=COS(57.0/RAD)
      COS33=COS(33.0/RAD)
C
      T=HOUR+MINUTE/SIXTY
```

```
      HALFINT=FLOAT(HOWLONG)/(TWO*SIXTY)
C
C     DETERMINE U,V AND W
C
C     GET GROVES DATA  (XXXXGROOUT OR XXXXXXTIDE FILE)
C
      WRITE (*,*) " ENTER T FOR TIDE, G FOR GROOUT INPUT"
      READ (*,*) WHICH
      TIDE="MAXTOR600:IDIGNSEW:      TIDE"
      GROOUT="MAXTOR600:IDIGNSEW:      GROOUT"
C
C     CALCULATE GROVES INPUT FILENUMBER
C
      IDAY=DAY
      IF (HOUR.LT.12) IDAY=IDAY-1
      YEAR10=YEAR/10
      YEAR1=YEAR-10*YEAR10
      MONTH10=MONTH/10
      MONTH1=MONTH-10*MONTH10
      IDAY10=IDAY/10
      IDAY1=IDAY-10*IDAY10
      DUMMY1(20)=CHAR(YEAR10+48)
      DUMMY1(21)=CHAR(YEAR1+48)
      DUMMY1(22)=CHAR(MONTH10+48)
      DUMMY1(23)=CHAR(MONTH1+48)
      DUMMY1(24)=CHAR(IDAY10+48)
      DUMMY1(25)=CHAR(IDAY1+48)
      DO 1 I=20,25
      DUMMY2(I)=DUMMY1(I)
    1 CONTINUE
      IF (WHICH.EQ."T") THEN
      OPEN (15,FILE=TIDE,ACTION="READ",FORM="UNFORMATTED")
      WRITE (*,*) " "
      WRITE (*,*) " ACCESSING FILE ",TIDE
      CALL GPROF1 (T,WINDEW)
      CALL GPROF1 (T,WINDNS)
      CALL GPROF1 (T,VERT)
C
C     CALCULATE "ERRORS" IN U AND V BY DETERMINING GROVES
C     PROFILES FOR SAME LENGTH OF INTERVAL CENTERED ON BEGINNING
C     AND END OF ISR INTERVAL
C
      T=T-HALFINT
      REWIND (15)
      CALL GPROF1 (T,STRTEW)
      CALL GPROF1 (T,STRTNS)
      CALL GPROF1 (T,STRTVERT)
      T=T+TWO*HALFINT
      REWIND (15)
      CALL GPROF1 (T,ENDEW)
      CALL GPROF1 (T,ENDNS)
      CALL GPROF1 (T,ENDVERT)
      ELSE
      OPEN (15,FILE=GROOUT,ACTION="READ",FORM="FORMATTED")
      WRITE (*,*) " "
      WRITE (*,*) " ACCESSING FILE ",GROOUT
      CALL GPROF2 (T,WINDEW,WINDNS,VERT)
C
```

```
C     CALCULATE "ERRORS" IN U AND V BY DETERMINING GROVES
C     PROFILES FOR SAME LENGTH OF INTERVAL CENTERED ON BEGINNING
C     AND END OF ISR INTERVAL
C
      T=T-HALFINT
      REWIND (15)
      CALL GPROF2 (T,STRTEW,STRTNS,STRTVERT)
      T=T+TWO*HALFINT
      REWIND (15)
      CALL GPROF2 (T,ENDEW,ENDNS,ENDVERT)
      END IF
      CLOSE (15)
C
C     SAVE NS AND EW GROVES WIND, WITH ERRORS
C     NOTE THAT THESE ARE NOT EQUIVALENT VELOCITIES WITH W=0
C
C
      DO 2 I=1,43
      A(I,1)=112-I
      A(I,2)=WINDEW(I)
      ERREW(I)=ABS (ENDEW(I)-STRTEW(I))/TWO
      A(I,3)=ERREW(I)
      A(I,4)=WINDNS(I)
      ERRNS(I)=ABS (ENDNS(I)-STRTNS(I))/TWO
      A(I,5)=ERRNS(I)
      A(I,6)=VERT(I)
      ERRVERT(I)=ABS (ENDVERT(I)-STRTVERT(I))/TWO
      A(I,7)=ERRVERT(I)
      A(I,21)=SQRT((ERREW(I)*COS57*SINZEN)**2
     *+(ERRNS(I)*COS33*SINZEN)**2)
      A(I,23)=SQRT((ERREW(I)*COS33*SINZEN)**2
     *+(ERRNS(I)*COS57*SINZEN)**2)
    2 CONTINUE
C
C     CALCULATE GROVES LINE OF SIGHT VELOCITY
C
      CALL SUBVERT (WINDEW,WINDNS,VERT,1)
C
      WRITE (*,*) " "
      WRITE (*,*) " TIDAL WINDS CALCULATED"
      WRITE (*,*) " "
      RETURN
      END
      SUBROUTINE GPROF1 (T,WIND)
C                                           DECEMBER 16, 1992
C     DETERMINES GROVES WIND FROM FILE "XXXXXXTIDE"
C
      DIMENSION AU(4),PH(4),WIND(50)
      TWOPI=6.28318
C
C     SKIP DOWN TO 111KM
C
      DO 1 I=1,5
      READ (15) UO,(AU(J),PH(J),J=1,2)
    1 CONTINUE
C
C     DETERMINE WIND PROFILE
C
```

```
      DO 2 I=1,46
      READ (15) UO,(AU(J),PH(J),J=1,2)
      IF (PH(1).LT.T) PHASE1=PH(1)-T
      IF (PH(1).GE.T) PHASE1=T-PH(1)
      IF (PH(2).LT.T) PHASE2=PH(2)-T
      IF (PH(2).GE.T) PHASE2=T-PH(2)
      WIND(I)=UO+AU(1)*COS((PHASE1/24.0)*TWOPI)
     *+AU(2)*COS((PHASE2/12.0)*TWOPI)
    2 CONTINUE
      RETURN
      END
      SUBROUTINE GPROF2 (T,VX,VY,VW)
C                                                 MARCH 8, 1993
C     READS GROVES WIND FROM FILE "XXXXXXGROOUT"
C
      CHARACTER*8 DIRNVERT,WHATVERT
      CHARACTER*9 DIRNEW,WHATEW
      CHARACTER*11 DIRNNS,WHATNS
      DIMENSION VX(50),VY(50),VW(50),VXL(25),VYL(25),VWL(25)
      IF (T.LT.12) IT=T+24
      IF (T.GE.12) IT=T-11
      DIRNEW="EAST-WEST"
      DIRNNS="NORTH-SOUTH"
      DIRNVERT="VERTICAL"
C
C     SKIP DOWN TO EAST-WEST 111KM
C
    1 READ (15,*) WHATEW
      IF (WHATEW.NE.DIRNEW) GO TO 1
      DO 2 I=1,7
      READ (15,*) WHATEW
    2 CONTINUE
C
      DO 3 K=1,46
      READ (15,100) IH,(VXL(J),J=1,24)
  100 FORMAT (I5,F8.0,23F5.0)
      VX(K)=VXL(IT)
    3 CONTINUE
C
C     SKIP DOWN TO NORTH - SOUTH 111KM
C
    4 READ (15,*) WHATNS
      IF (WHATNS.NE.DIRNNS) GO TO 4
      DO 5 I=1,7
      READ (15,*) WHATNS
    5 CONTINUE
C
      DO 6 K=1,46
      READ (15,100) IH,(VYL(J),J=1,24)
      VY(K)=VYL(IT)
    6 CONTINUE
C
C
C     SKIP DOWN TO VERTICAL 111KM
C
    7 READ (15,*) WHATVERT
      IF (WHATVERT.NE.DIRNVERT) GO TO 7
      DO 8 I=1,8
```

```
      READ (15,*) WHATVERT
    8 CONTINUE
C
      DO 9 K=1,46
      READ (15,100) IH,(VWL(J),J=1,24)
      VW(K)=VWL(IT)
    9 CONTINUE
C
      RETURN
      END
      SUBROUTINE SUBVERT (U,V,W,NGO)
C                                         JULY 11, 1993
C
C     TRANSFER U,V AND W TO ISR LINES OF SIGHT
C     THEN RECOVER NS, EW COMPONENTS, ASSUMING W=0 (C.F. ISR)
C
      INTEGER*4 AZ1,AZ2
      DIMENSION U(50),V(50),W(50)
      COMMON /ANGLES/ AZ1,AZ2
      COMMON /ARRAYS/ A(43,33)
      RAD=57.29578
      ZEN=11.3/RAD
      SINZEN=SIN(ZEN)
      COS33=COS(33.0/RAD)
      COS57=COS(57.0/RAD)
      RAZ1=FLOAT(AZ1)/RAD
      RAZ2=FLOAT(AZ2)/RAD
      DO 4 I=1,43
      IF (U(I).GT.200.0) GO TO 4
      IF (NGO.EQ.1) W(I)=W(I)/100.0
      VR=U(I)*SIN(RAZ2)*SINZEN+V(I)*COS(RAZ2)*SINZEN+W(I)*COS(ZEN)
      VP=U(I)*SIN(RAZ1)*SINZEN+V(I)*COS(RAZ1)*SINZEN+W(I)*COS(ZEN)
      GO TO (1,2),NGO
    1 A(I,20)=VR
      A(I,22)=VP
      GO TO 3
    2 A(I,24)=VR
      A(I,26)=VP
    3 VRHOR=VR/SINZEN
      VPHOR=VP/SINZEN
      IF (AZ1.EQ.303) THEN
      U(I)=VRHOR*COS57-VPHOR*COS33
      V(I)=VRHOR*COS33+VPHOR*COS57
      ELSE
      U(I)=VRHOR*COS33-VPHOR*COS57
      V(I)=-VRHOR*COS57-VPHOR*COS33
      END IF
      IF (NGO.EQ.1) W(I)=W(I)*100.0
    4 CONTINUE
      RETURN
      END
      SUBROUTINE NSEWIDI
C                              MAY 19, 1993
C
C     CALCULATES NS, EW AND VERTICAL IDI WINDS WITH ERROR ESTIMATES
C
      CHARACTER*1 POLAR
      CHARACTER*10 TUREKTIME
```

```
      INTEGER*4 INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,HOWLONG,NOW
      REAL*4 NINES,HALF
      COMMON /IDIVEL/ U(50),V(50),W(50),U1(50),V1(50),W1(50),
     *U2(50),V2(50),W2(50)
      COMMON /ARRAYS/ A(43,33)
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
C
      WRITE (*,*) " "
      WRITE (*,*) " DETERMINE IDI WINDS"
      NINES=999.0
      HALF=0.5
      RAD=57.29578
      SINZEN=SIN(11.3/RAD)
      COS57=COS(57.0/RAD)
      COS33=COS(33.0/RAD)
C
C     MORE PARAMETERS
C
      POLAR="O"
C
C     FOLLOWING CAN BE ACTIVATED FOR POLARIZATION TESTS
C
C     CURRENTLY SET TO ACCEPT "O" ONLY
C
C     WRITE (*,*) " "
C     WRITE (*,*) " SELECT POLARIZATION - ENTER O, X, L OR ALL"
C     READ (*,*) POLAR
      WRITE (*,*) " "
      WRITE (*,*) ' ENTER FIRST SPP - GR  FILE NUMBER'
      READ (*,*) NFILE
C
      WRITE (*,*) " "
      WRITE (*,*) " ***** IDI WIND PROFILE *****"
      WRITE (*,*) " "
      CALL IDI (U,V,W)
C
C     SAVE IDI NS AND EW COMPONENTS
C
      DO 1 I=1,43
      IF (ABS(U(I)).GT.200.0) GO TO 1
      A(I,32)=U(I)
      A(I,33)=V(I)
    1 CONTINUE
C
C     TRANSFER TO ISR LINES OF SIGHT
C     THEN RECOVER IDI NS, EW COMPONENTS, ASSUMING W=0 (C.F. ISR)
C
      CALL SUBVERT (U,V,W,2)
C
C     CALCULATE ERROR AS HALF (VELOCITY FOR INTERVAL AFTER
C     MINUS VELOCITY FOR INTERVAL BEFORE) AT EACH ALTITUDE
C
      INTHALF=HOWLONG/2
      MINUTE=MINUTE+INTHALF
      IF (MINUTE.GT.59) THEN
      HOUR=HOUR+1
```

```
      MINUTE=MINUTE-60
      END IF
      WRITE (*,*) " "
      WRITE (*,*) " ***** ERROR CALCULATION - PASS 1 *****"
      WRITE (*,*) " "
      CALL IDI (U1,V1,W1)
      MINUTE=MINUTE-HOWLONG
      IF (MINUTE.LT.0) THEN
      HOUR=HOUR-1
      MINUTE=MINUTE+60
      END IF
      WRITE (*,*) " "
      WRITE (*,*) " ***** ERROR CALCULATION - PASS 2 *****"
      WRITE (*,*) " "
      CALL IDI (U2,V2,W2)
C
C     STORE IDI NS, EW AND VERTICAL COMPONENTS, WITH ERRORS, IN ARRAY A
C
          WRITE (*,*) " "
      DO 2 I=1,43
      IF (ABS(U(I)).GT.200.0) THEN
      U(I)=NINES
      V(I)=NINES
      W(I)=NINES
      GO TO 2
      END IF
      A(I,8)=U(I)
      ERREW=HALF*ABS(U1(I)-U2(I))
      IF (U1(I).EQ.NINES) ERREW=ABS(U(I)-U2(I))
      IF (U2(I).EQ.NINES) ERREW=ABS(U(I)-U1(I))
      IF (ERREW.LT.5.0) ERREW=5.0
      IF (ERREW.GT.50.0) ERREW=0.0 !NO ERROR CALCULATED - NO ERROR BAR
      A(I,9)=ERREW
      A(I,10)=V(I)
      ERRNS=HALF*ABS(V1(I)-V2(I))
      IF (V1(I).EQ.NINES) ERRNS=ABS(V(I)-V2(I))
      IF (V2(I).EQ.NINES) ERRNS=ABS(V(I)-V1(I))
      IF (ERRNS.LT.5.0) ERRNS=5.0
      IF (ERRNS.GT.50.0) ERRNS=0.0 !NO ERROR CALCULATED - NO ERROR BAR
      A(I,11)=ERRNS
      A(I,25)=SQRT((ERREW*COS57*SINZEN)**2+(ERRNS*COS33*SINZEN)**2)
      A(I,27)=SQRT((ERREW*COS33*SINZEN)**2+(ERRNS*COS57*SINZEN)**2)
      ERR=HALF*100.0*ABS(W1(I)-W2(I))
      IF (W1(I).EQ.NINES) ERRW=ABS(W(I)-W2(I))
      IF (W2(I).EQ.NINES) ERRW=ABS(W(I)-W1(I))
      IF (ERRW.GT.900.0) ERRW=0.0  !NO ERROR CALCULATED - NO ERROR BAR
      A(I,12)=100.0*W(I)
      A(I,13)=ERRW
    2 CONTINUE
      RETURN
      END
      SUBROUTINE IDI (U,V,W)
************************************************************************
*                                                                      *
*      IDI WIND-CALCULATION PROGRAM; MAPSTAR RADAR                     *
*      COPYRIGHT 1993, HOLODYNE LIMITED 1986.                          *
*      ALL RIGHTS RESERVED.                                            *
*                                                                      *
```

```
*******************************************************************
C  MAC VERSION 2.00
C                                       MAY 2, 1993.
C  THIS PROGRAM WILL CALCULATE WIND PROFILES IN 1-KM STEPS, WITH
C  SMOOTHING, FROM REGULAR SCATTERING-POINT PARAMETER HEIGHT
C  PROFILE FILES, TYPE SPP - GR XXX
C
C  CURRENTLY SET UP FOR 69-111KM (15 HEIGHTS); NEED TO CHANGE IH
C  DIMENSION OF SPPZ(IH,I,J), AND SOME CODE, TO MATCH HEIGHT RANGE.
C
C  THE SCATTERING-POINT PARAMETERS ARE :
C   1.  ALTITUDE (KM).
C   2.  RADIAL VELOCITY (M/SEC).
C   3.  ZENITH ANGLE IN EAST-WEST MERIDIAN (DEGREES).
C   4.  ZENITH ANGLE IN NORTH-SOUTH MERIDIAN (DEGREES).
C   5.  VOLTAGE AMPLITUDE ON #1 DIPOLES.
C   6.  PHASE OF #1 DIPOLES (DEGREES).
C   7.  VOLTAGE AMPLITUDE ON #2 DIPOLES.
C   8.  PHASE OF #2 DIPOLES (DEGREES).
C   9.  SPARE
C  10.  SPARE
C EXPLANATION OF EASILY-REPROGRAMMED PARAMETERS (JUST CHANGE THE SOURCE
C  CODE VALUE GIVEN BELOW:
C   VMAX IS THE LARGEST ALLOWED HORIZONTAL VELOCITY. WE TEST EACH POINT
C  AGAINST VMAX BY PROJECTING ITS RADIAL VELOCITY INTO THE HORIZONTAL
C  PLANE, AND REJECT IT IF IT'S BIGGER THAN VMAX.
C    THMAX IS THE LARGEST ACCEPTABLE RADIAL ZENITH ANGLE.
C    THMIN IS THE SMALLEST ACCEPTABLE RADIAL ZENITH ANGLE.
C    MINH, MINV ARE THE MINIMUM NUMBER OF POINTS.  IF THERE ARE NOT
C  SUFFICIENT POINTS, THAT ALTITUDE IS SKIPPED.
C   NSIGMA IS THE MAXIMUM NUMBER OF STANDARD DEVIATIONS FROM THE FIT AN
C  INDIVIDUAL POINT CAN LIE WITHOUT BEING REJECTED FROM THE VELOCITY
C  CALCULATION.
C    ZMIN IS THE BOTTOM ALTITUDE FOR WHICH WINDS ARE TO BE CALCULATED.
C    ZMAX IS THE TOP ALTITUDE FOR WHICH WINDS ARE TO BE CALCULATED.
C WIND CALLS INNAME, OUTNAME, WFV, WFH, PHFIT AND SORT.
      REAL*4 PI,VMAX,THMAXV,U(50),V(50),W(50),TRP(50),SUCKS(8),
     1       LINE(10),RMSDVR(50),COSL(2300),COSM(2300),COSN(2300),
     2       DVR(2300),SLOPE,INTERCEPT,VRAD(17)
      INTEGER*4 REJ(4),IH,PARAMETER,TESTFLAG,POINT,NPROFS,NHITES,EARLY,
     1          NPOINTS(50),HOWLONG,BIGTIME,NPV,NPV0,FITFLAG,MISS,NBAD,
     2          YEAR,MONTH,DAY,HOUR,MINUTE,MINH,MINV,MSEC,IO,NGO,NFILE,
     3          NUMRAD(17),MY,MO,JO,LTIMH,LTIMM,NOW,NOWSTART,NOWEND
      CHARACTER*40 INFILE
      CHARACTER*40 OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*10 TUREKTIME
      CHARACTER*6 STATE
      CHARACTER*1 POLAR
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,TRP,REJ,LINE,WIDTH(50),IWT(2300),
     2             RMSDVR(50),COSL,COSM,COSN,DVR,NUMRAD,VRAD
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1             NSIGMA,TESTFLAG,IH,NPOINTS,INFILE,OUTFILE,INPATH,
     2             OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
```

```
     *HOWLONG,NOW
C
      PI = 3.14159265
      NTOTAL=0
      VRMAX = 60
      VMAX = 200
      THMAXH = 16
      THMINH = 3
      THMAXV = 5
      THMINV = 0
      THMIN = 0
      MINH = 5
      MINV = 5
      NSIGMA = 3.0
      DO 20000 I=1,8
      SUCKS(I)=999.0
20000 CONTINUE
  668 LOOP=0
C
  669 IFILE=NFILE-1
C
C     PROGRAM ACCEPTS SPP DATA OVER 3KM HEIGHT RANGE FOR EACH ALTITUDE
C     AND LOOPS THREE TIMES THROUGH SPP DATA TO PRODUCE OUTPUT AT 1KM
C     HEIGHT INTERVALS. ZMIN, ZMAX ARE ADJUSTED ACCORDINGLY.
C
      LOOP=LOOP+1
      IF (LOOP.EQ.1) THEN
      STATE="REWIND"
      ZMIN = 67.5
      ZMAX = 112.5
      END IF
      IF (LOOP.EQ.2) THEN
      STATE="APPEND"
      ZMIN = 68.5
      ZMAX = 110.5
      END IF
      IF (LOOP.EQ.3) THEN
      STATE="APPEND"
      ZMIN = 69.5
      ZMAX = 111.5
      END IF
      NHITES=(ZMAX-ZMIN)/3.0+0.1
      NGO=0
      GO TO 203
************************************************************************
*     RETURN HERE FOR NEW INPUT FILE
************************************************************************
20203 NGO=1
  203 CALL INNAME
      WRITE (*,*) 'INFILE = ',INFILE
      NERR=1
      OPEN (18,ERR=90909,FILE=INFILE,STATUS='OLD',IOSTAT=IO,
     *FORM='UNFORMATTED')
20100 READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .GT. -990.0) GO TO 20100
      WRITE (*,100) (LINE(KK),KK=1,10)
  100 FORMAT (10F8.0)
```

```
      MY=LINE(2)
      MO=LINE(3)
      JO=LINE(4)
      LTIMH=LINE(5)
      LTIMM=LINE(6)
      MSEC=LINE(7)
      NOWTIME= LTIMM+LTIMH*60+JO*24*60+MO*30*24*60
      REWIND (18)
      IF (NGO.EQ.1) GO TO 20103
************************************************************************
*   SET UP  OUTPUT FILE
************************************************************************
20101 NERR=2
      IF (MONTH.EQ.0) GO TO 90909
      NPROFS=0
      BIGTIME = MINUTE+HOUR*60+DAY*24*60+MONTH*30*24*60
      NOWSTART=BIGTIME-HOWLONG/2
      IF (NGO.EQ.1) GO TO 670
      EARLY=(HOUR+24*(DAY+MONTH*30))-(LTIMH+24*(JO+MO*30))
      IF (EARLY.GT.3) THEN
      WRITE (*,*) " SPP FILE CHOICE EARLY BY ",EARLY," HOURS"
      WRITE (*,*) " NEED TO ENTER LATER SPP FILE NUMBER"
      CLOSE (18)
      READ (*,*) NFILE
      GO TO 668
      END IF
      IF (NOWTIME.GT.NOWSTART) THEN
      WRITE (*,*) " BAD CHOICE OF SPP INPUT FILE; NOWSTART = ",NOWSTART
      WRITE (*,*) "                                NOWTIME  = ",NOWTIME
      WRITE (*,*) " RE-ENTER SPP INPUT FILE NUMBER"
      CLOSE (18)
      READ (*,*) NFILE
      GO TO 668
      END IF
  670 NOWEND=NOWSTART+HOWLONG
      CALL OUTNAME
      NERR=3
      WRITE (*,*) " "
      WRITE (*,*) 'OUTFILE = ',OUTFILE
      OPEN (16,ERR=90909,FILE=OUTFILE,POSITION=STATE,IOSTAT=IO,
     *FORM="FORMATTED")
10100 DO 10101 IH = 1,NHITES
      NPOINTS(IH)=0
      U(IH) = 0.0
      V(IH) = 0.0
      W(IH) = 0.0
      TRP(IH) = 0.0
      RMSDVR(IH) = 0.0
10101 CONTINUE
      IH=0
      MISS=0
      NBAD=0
      DO 10102 IREJ=1,4
      REJ(IREJ) = 0
10102 CONTINUE
20102 WRITE (*,90003)
90003 FORMAT
     1 (1X,' ALT    U       V     W    TRP  NTOT  NPV  NPH  RATE',
```

```
    2 '   SLOPE INTERCEPT')
20103 NERR=4
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .GT. -990.0) GO TO 20103
*************************************************************************
*  RETURN TO HERE FOR NEW PROFILE .
*************************************************************************
20133 MY=LINE(2)
      MO=LINE(3)
      JO=LINE(4)
      LTIMH=LINE(5)
      LTIMM=LINE(6)
      MSEC=LINE(7)
      NOWTIME= LTIMM+LTIMH*60+JO*24*60+MO*30*24*60
      IF (NOWTIME.LT.NOWSTART) GO TO 20103
      IF (NOWTIME.GT.NOWEND) THEN
      BACKSPACE (18)
      GO TO 20204
      END IF
      NPROFS=NPROFS+1
      NERR=5
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .LT. -990.0) THEN
      NPROFS=NPROFS-1
      GO TO 20133
      END IF
C
C     TEST THE POINT FOR:  ALTITUDE
C
20202 IF (LINE(1) .LT. ZMIN) THEN
      NERR=6
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
      IF (LINE(1) .LT. -990.0) GO TO 20133
      GO TO 20202
      ENDIF
      IF (LINE(1).GT.ZMAX) GO TO 20103
      INDEX=(LINE(1)-ZMIN)/3.0+1.0
      IF (NPOINTS(INDEX) .GT. 2300) GO TO 20104   !THERE ARE TOO MANY
C
C     TEST FOR:
C                        (1) PROJECTED HORIZONTAL VELOCITY > VMAX,
C                        (2) RADIAL VELOCITY = 0
C                        (3) RADIAL VELOCITY > VRMAX
C                        (3) POLARIZATION
C
C
      TESTFLAG = 1
      COSZAX = SQRT(1.0-(SIN(LINE(3)*PI/180.0))**2
     1             - (SIN(LINE(4)*PI/180.0))**2)
      ZAX=ACOS(COSZAX)
      SINZAX=SIN(ZAX)
      IF (SINZAX .GT. 0.02) THEN
      VHORIZ=ABS(LINE(2)/SINZAX)
      IF(VHORIZ .GT. VMAX) THEN
      REJ(1) = REJ(1) + 1
```

```
      TESTFLAG = 0
      ENDIF
      ENDIF
      IF (LINE(2) .EQ. 0) THEN
      REJ(2) = REJ(2) + 1
      TESTFLAG = 0
      ENDIF
      IF (ABS(LINE(2)) .GT. VRMAX) THEN
      REJ(3)=REJ(3)+1
      TESTFLAG = 0
      ENDIF
C
C     DETERMINE POLARIZATION
C
      ANGLE=LINE(6)-LINE(8)
C
      IF (POLAR.EQ."A") GOTO 10201
C
      IF (POLAR.EQ."L") THEN
C
      IF (ABS(ANGLE).LT.45.0) GO TO 10201
      IF (ABS(ANGLE).GT.135.0.AND.ABS(ANGLE).LT.225.0) GO TO 10201
      IF (ABS(ANGLE).GT.315.0.AND.ABS(ANGLE).LT.360.0) GO TO 10201
      GO TO 10200
      END IF
C
      IF (POLAR.EQ."X") THEN
C
      IF (ANGLE.GT.-135.0.AND.ANGLE.LT.-45.0) GO TO 10201
      IF (ANGLE.GT.225.0.AND.ANGLE.LT.315.0) GO TO 10201
      GO TO 10200
      END IF
C
      IF (POLAR.EQ."O") THEN
C
      IF (ANGLE.GT.45.0.AND.ANGLE.LT.135.0) GO TO 10201
      IF (ANGLE.GT.-315.0.AND.ANGLE.LT.-225.0) GO TO 10201
C
10200 TESTFLAG=0
      REJ(4)=REJ(4)+1
      END IF
C
C     CHECK FOR TOO MANY POINTS
C
10201 NPOINTS(INDEX)=NPOINTS(INDEX)+1
      IF (NPOINTS(INDEX) .EQ. 2300) THEN
      WRITE (*,*) 'THANKS ANYHOW, BUT IVE ALREADY GOT 2300 POINTS.'
      GO TO 20104
      ENDIF
      IF (TESTFLAG .EQ. 1) THEN
      DO 10202 PARAMETER = 1,7
      SPPZ(INDEX,NPOINTS(INDEX),PARAMETER) = LINE(PARAMETER)
10202 CONTINUE
      TRP(INDEX) = TRP(INDEX) + LINE(5)**2 + LINE(7)**2
      ENDIF
20104 NERR=7
      READ (18,ERR=90909,IOSTAT=IO,END=20203) (LINE(PARAMETER),
     *PARAMETER=1,10)
```

```
      IF (LINE(1) .LT. -990.0) GO TO 20133
      GO TO 20202
20204 IH=IH+1
      FITFLAG = 1
      IF (IH.GT.NHITES) GO TO 20206
      Z=ZMIN+1.5+3.0*(FLOAT(IH-1))
      IF (NPOINTS(IH).EQ.0) THEN
      MISS=MISS+1
      GO TO 20250
      END IF
      DO 2 POINT=1,NPOINTS(IH)
      DO 2 PARAMETER=1,7
      SPP(POINT,PARAMETER)=SPPZ(IH,POINT,PARAMETER)
    2 CONTINUE
C
C  FIT THE SCATTERING POINTS IN THIS WINDOW WITH A 3-VECTOR.
C
20205 CALL WFV(U,V,W)
      IF (FITFLAG .EQ. 0) THEN
      NBAD=NBAD+1
      WRITE (*,*) 'VERTICAL FAILURE AT ',IH,NPOINTS(IH),Z
      WRITE (16,90002) Z,(SUCKS(KK),KK=1,8)
      GO TO 20204
      ENDIF
      CALL WFH(U,V,W)
      IF (FITFLAG .EQ. 0) THEN
      NBAD=NBAD+1
      WRITE (*,*) 'HORIZONTAL FAILURE AT ',IH,NPOINTS(IH),Z
C
C     WRITE FLAG RECORD FOR THIS ALTITUDE  ( U = 999.0 )
C
20250 WRITE (16,90002) Z,(SUCKS(KK),KK=1,8)
      GO TO 20204
C
C     WRITE GOOD VELOCITY
C
      ELSE
      IF (TRP(IH) .LT. 1) THEN
      TRP(IH) = 0
      ELSE
      TRP(IH) = 10*LOG10(TRP(IH))
      ENDIF
      ENDIF
      CALL PHFIT
      RATE = FLOAT(NPOINTS(IH))/NPROFS
      WRITE (*,90001)
     1 Z,U(IH),V(IH),W(IH),TRP(IH),NPOINTS(IH),NPV,NPH,RATE,
     2 SLOPE,INTERCEPT
90001 FORMAT (1X,F4.0,2(1X,F6.1),2(1X,F5.1),3(1X,I4),3(1X,F5.1))
      X1 = FLOAT(NPOINTS(IH))
      X2 = FLOAT(NPV)
      X3 = FLOAT(NPH)
      WRITE (16,90002)
     1  Z,U(IH),V(IH),W(IH),TRP(IH),X1,RATE,
     2  SLOPE,INTERCEPT
90002 FORMAT (9(E13.4))
      GO TO 20204
C
```

```
C     IT'S NOT TIME TO QUIT; OUTPUT REJECTION STATS TO SCREEN, DATA
C     STATS TO WIND.TXT, AND GO SET UP NEXT OUTFILE
C
20206 CLOSE (16)
      IF (NBAD.EQ.NHITES) THEN
      WRITE (*,90004)
90004 FORMAT (1X/5X," BAD DATA THIS INTERVAL",/)
      END IF
      IF (MISS.EQ.NHITES) THEN
      WRITE (*,90005)
90005 FORMAT (1X/5X," NO DATA THIS INTERVAL",/)
      GO TO 90910
      ELSE
      WRITE (*,*) 'REJECTIONS:'
      WRITE (*,*) '      VMAX     VR=0     VRMAX     POLAR'
      WRITE (*,102) (REJ(IREJ),IREJ=1,4)
  102 FORMAT (3I8,1X,I8)
      GO TO 90910
      END IF
C
C     TOO BAD - ERROR EXIT
C
90909 WRITE (*,*) ' ERROR EXIT AT NERR = ',NERR,' STATUS =',IO
      GO TO 90950
C
90910 IF (LOOP.LT.3) THEN
      IF (IFILE.EQ.NFILE) CLOSE (18)
      GO TO 669
      END IF
C
      CALL REORDER (U,V,W)
C
C     LOOKS LIKE WE MAY HAVE SOME WINDS!
C
90940 WRITE (*,*) ' SUCCESSFUL RUN'
90950 CLOSE (15)
      CLOSE (16)
      CLOSE (17)
      CLOSE (18)
      RETURN
      END
      SUBROUTINE INNAME
C
C     INNAME CREATES SPP INPUT FILENAME "SPP - GR XXX"
C
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH,OUTPATH
      CHARACTER*1 FNUM(3)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1            NSIGMA,TESTFLAG,IH,NPOINTS(50),INFILE,OUTFILE,INPATH,
     2            OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,NFILE
C
    1 IFILE=IFILE+1
      SKIP=0
C      CALL IBAD (IFILE,SKIP)
      IF (SKIP.EQ.1) GO TO 1
      I100=IFILE/100
```

```
      I10=IFILE/10-10*I100
      I1=IFILE-100*I100-10*I10
      FNUM(1)=CHAR(I100+48)
      FNUM(2)=CHAR(I10+48)
      FNUM(3)=CHAR(I1+48)
      INPATH = 'MAXTOR600:INFILES:SPP - GR '
      WRITE (INFILE,90003) INPATH,FNUM
90003 FORMAT (A27,3A1)
      RETURN
      END
      SUBROUTINE OUTNAME
C
C     OUTNAME CREATES IDI WINDS OUTPUT FILENAME "XXXXXXXX.MAW"
C
      CHARACTER*2 ASCMONTH,ASCDAY,ASCHOUR,ASCMINUTE
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH,OUTPATH
      CHARACTER*10 TUREKTIME
      INTEGER*4 INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,HOWLONG,NOW
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1            NSIGMA,TESTFLAG,IH,NPOINTS(50),INFILE,OUTFILE,INPATH,
     2            OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
C
      IF (MONTH .LT. 10) THEN
      WRITE (ASCMONTH,90001) '0',MONTH
90001 FORMAT (A1,I1)
      ELSE
      WRITE (ASCMONTH,90002) MONTH
90002 FORMAT (I2)
      ENDIF
      IF (DAY .LT. 10) THEN
      WRITE (ASCDAY,90001) '0',DAY
      ELSE
      WRITE (ASCDAY,90002) DAY
      ENDIF
      IF (HOUR .LT. 10) THEN
      WRITE (ASCHOUR,90001) '0',HOUR
      ELSE
      WRITE (ASCHOUR,90002) HOUR
      ENDIF
      IF (MINUTE .LT. 10) THEN
      WRITE (ASCMINUTE,90001) '0',MINUTE
      ELSE
      WRITE (ASCMINUTE,90002) MINUTE
      ENDIF
      OUTPATH = 'MAXTOR600:OUTFILES:'
      WRITE (OUTFILE,90003)
     1 OUTPATH,ASCMONTH,ASCDAY,ASCHOUR,ASCMINUTE,'.MAW'
90003 FORMAT (A19,4A2,A4)
      RETURN
      END
      SUBROUTINE WFV(U,V,W)
**********************************************************************
C
C   THIS SUBROUTINE CALCULATES THE VERTICAL WINDS FROM MAPSTAR SPPS.
C   AUGUST 17, 1990
```

```
C
**********************************************************************
      CHARACTER*1 POLAR
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*10 TUREKTIME
      DIMENSION A(3,3),WINDV(3)
      REAL*4 SIGMA,SIGMALAST,PI,U(50),V(50),W(50)
      INTEGER*4 FLAG,IZA
      INTEGER*4 REJ,IH,POINT,NPOINTS(50),HOWLONG,NPV,NPV0,TESTFLAG,
     1FITFLAG,MINH,MINV,NUMRAD,YEAR,MONTH,DAY,HOUR,MINUTE,NOW
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,TRP(50),
     1               REJ(4),LINE(10),
     2               WIDTH(50),IWT(2300),RMSDVR(50),
     4               COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5               NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1              NSIGMA,TESTFLAG,IH,NPOINTS,INFILE,OUTFILE,
     2              INPATH,OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
C
      DO 10101 IA = 1,3
      WINDV(IA) = 0.0
      DO 10101 IB = 1,3
      A(IA,IB) = 0.0
10101 CONTINUE
      DO 10102 II = 1,17
      NUMRAD(II) = 0
      VRAD(II) = 0
10102 CONTINUE
      NPV = NPOINTS(IH)
      DO 10201 POINT = 1,NPOINTS(IH)
      IWT(POINT) = 1
      SINZAX = SQRT(SIN(SPP(POINT,3)*PI/180)**2
     1      +      SIN(SPP(POINT,4)*PI/180)**2)
      IF ((SINZAX .LT. SIN(THMINV*PI/180)) .OR.
     1   (SINZAX .GT. SIN(THMAXV*PI/180))) THEN
      IWT(POINT) = 0
      NPV = NPV - 1
      IF (NPV .LT. MINV) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
      COSL(POINT) = SIN(SPP(POINT,3)*PI/180)
      COSM(POINT) = SIN(SPP(POINT,4)*PI/180)
      COSN(POINT) = SQRT(1 - COSL(POINT)**2 - COSM(POINT)**2)
10201 CONTINUE
      SIGMALAST = 1E8
20001 FLAG = 0
      DO 10301 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10301
      A(1,1) = A(1,1) + COSL(POINT)**2
      A(1,2) = A(1,2) + COSL(POINT)*COSM(POINT)
```

```
      A(1,3) = A(1,3) + COSL(POINT)*COSN(POINT)
      A(2,2) = A(2,2) + COSM(POINT)**2
      A(2,3) = A(2,3) + COSM(POINT)*COSN(POINT)
      A(3,3) = A(3,3) + COSN(POINT)**2
      WINDV(1) = WINDV(1) + SPP(POINT,2)*COSL(POINT)
      WINDV(2) = WINDV(2) + SPP(POINT,2)*COSM(POINT)
      WINDV(3) = WINDV(3) + SPP(POINT,2)*COSN(POINT)
10301 CONTINUE
      A(2,1) = A(1,2)
      A(3,1) = A(1,3)
      A(3,2) = A(2,3)
      DET = A(1,1)*A(2,2)*A(3,3) + 2*A(1,2)*A(1,3)*A(2,3) -
     1      A(1,1)*A(2,3)**2 - A(2,2)*A(1,3)**2 - A(3,3)*A(1,2)**2
      IF (ABS(DET) .LT. 1.0E-7) THEN
      WRITE (*,*) 'WFV: NO SOLUTION'
      FITFLAG = 0
      GO TO 90909
      ENDIF
      U(IH) = (WINDV(1)*(A(2,2)*A(3,3)-  A(2,3)**2) +
     1     WINDV(2)*(A(2,3)*A(1,3) - A(1,2)*A(3,3)) +
     2     WINDV(3)*(A(1,2)*A(2,3) - A(1,3)*A(2,2)))/DET
      V(IH) = (WINDV(1)*(A(2,3)*A(1,3) - A(1,2)*A(3,3)) +
     1      WINDV(2)*(A(1,1)*A(3,3) - A(1,3)**2) +
     2      WINDV(3)*(A(1,3)*A(1,2) - A(1,1)*A(2,3)))/DET
      W(IH) = (WINDV(1)*(A(1,2)*A(2,3) - A(1,3)*A(2,2)) +
     1      WINDV(2)*(A(1,2)*A(1,3) - A(1,1)*A(2,3)) +
     2      WINDV(3)*(A(1,1)*A(2,2) - A(1,2)**2))/DET
C  CALCULATE THE STANDARD DEVIATION (SIGMA)
      ERRORSUM = 0
      DO 10401 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10401
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1            - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      ERRORSUM = ERRORSUM + DVR(POINT)**2
10401 CONTINUE
      SIGMA = SQRT(ERRORSUM/NPV)
      DO 10501 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10501
      IF (ABS(DVR(POINT)) .GT. NSIGMA*SIGMA) THEN
      IWT(POINT) = 0
      FLAG = 1
      NPV = NPV - 1
      IF (NPV .LT. MINV) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
10501 CONTINUE
      IF (FLAG .EQ. 0) GO TO 20002
      IF (FLAG .EQ. 1) THEN
      IF (SIGMA .GE. 0.999*SIGMALAST) GO TO 20002
      IF (SIGMA .LE. 0.01) GO TO 20002
      SIGMALAST = SIGMA
      GO TO 20001
      ENDIF
C  GOOD VELOCITY.
20002 IF ( (ABS(U(IH)) .GT. VMAX)      .OR.
     1     (ABS(V(IH)) .GT. VMAX)      .OR.
```

```
     2     (ABS(W(IH)) .GT. VMAX/10.0) ) THEN
      WRITE (*,*) 'IH, U, V, W = ',IH,U(IH),V(IH),W(IH)
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (FITFLAG .EQ. 1) THEN
      RMSDVR(IH) = 0
      DO 10601 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10601
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1           - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      RMSDVR(IH) = RMSDVR(IH) + DVR(POINT)**2
      ZA = (180/PI)*ASIN(SQRT(1-COSN(POINT)**2))
      IZA = INT(ZA) + 1
      IF (IZA .GT. 17) THEN
      WRITE (*,*) 'IZA = ',IZA
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (IZA .EQ. 17) IZA = 16
      VRAD(IZA) = VRAD(IZA) + DVR(POINT)**2
      NUMRAD(IZA) = NUMRAD(IZA) + 1
10601 CONTINUE
      IF (NPV .GT. 0) THEN
      RMSDVR(IH) = SQRT(RMSDVR(IH)/NPV)
      DO 10701 IALPHA = 1,16
      IF (NUMRAD(IALPHA) .EQ. 0) GO TO 10701
C     WRITE (*,*) 'ZA,VRAD,NUMRAD= ',IALPHA,VRAD(IALPHA),NUMRAD(IALPHA)
      VRAD(IALPHA) = SQRT(VRAD(IALPHA)/NUMRAD(IALPHA))
10701 CONTINUE
      ENDIF
      ENDIF
90909 RETURN
      END
      SUBROUTINE WFH(U,V,W)
**********************************************************************
C
C   THIS SUBROUTINE CALCULATES HORIZONTAL WINDS FROM MAPSTAR SPPS.
C   AUGUST 17, 1990
C
**********************************************************************
      CHARACTER*1 POLAR
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*10 TUREKTIME
      INTEGER*4 REJ,IH,POINT,NPOINTS(50),HOWLONG,NPV,NPV0,TESTFLAG,
     1FITFLAG,MINH,MINV,NUMRAD,YEAR,MONTH,DAY,HOUR,MINUTE,NOW
      DIMENSION H(3,3),WIND(3),U(50),V(50),W(50)
      REAL*4 SIGMA,SIGMALAST,PI
      INTEGER*4 FLAG,IZA
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,TRP(50),
     1             REJ(4),LINE(10),
     2             WIDTH(50),IWT(2300),RMSDVR(50),
     4             COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5             NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
```

```
     1              NSIGMA,TESTFLAG,IH,NPOINTS,INFILE,OUTFILE,
     2              INPATH,OUTPATH,NPH,NPV,NPVO,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
C
      DO 10101 IA = 1,3
      WIND(IA) = 0
      DO 10101 IB = 1,3
      H(IA,IB) = 0
10101 CONTINUE
      DO 10102 II = 1,17
      NUMRAD(II) = 0
      VRAD(II) = 0
10102 CONTINUE
      NPH = NPOINTS(IH)
      DO 10201 POINT = 1,NPOINTS(IH)
      IWT(POINT) = 1
      SINZAX = SQRT(SIN(SPP(POINT,3)*PI/180)**2
     1      +      SIN(SPP(POINT,4)*PI/180)**2)
      IF ((SINZAX .LT. SIN(THMINH*PI/180)) .OR.
     1    (SINZAX .GT. SIN(THMAXH*PI/180))) THEN
      IWT(POINT) = 0
      NPH = NPH - 1
      IF (NPH .LT. MINH) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
      COSL(POINT) = SIN(SPP(POINT,3)*PI/180)
      COSM(POINT) = SIN(SPP(POINT,4)*PI/180)
      COSN(POINT) = SQRT(1 - COSL(POINT)**2 - COSM(POINT)**2)
10201 CONTINUE
      SIGMALAST = 1E8
20001 FLAG = 0
      DO 10301 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10301
      H(1,1) = H(1,1) + COSL(POINT)**2
      H(1,2) = H(1,2) + COSL(POINT)*COSM(POINT)
      H(2,2) = H(2,2) + COSM(POINT)**2
      WIND(1) = WIND(1) + SPP(POINT,2)*COSL(POINT)
     1                  - COSL(POINT)*W(IH)
      WIND(2) = WIND(2) + SPP(POINT,2)*COSM(POINT)
     1                  - COSM(POINT)*W(IH)
10301 CONTINUE
      H(2,1) = H(1,2)
      DET = H(1,1)*H(2,2) - H(1,2)**2
      IF (ABS(DET) .LT. 1.0E-7) THEN
      WRITE (*,*) 'MVH: NO SOLUTION'
      FITFLAG = 0
      GO TO 90909
      ENDIF
      U(IH) = (WIND(1)*H(2,2) - WIND(2)*H(1,2))/DET
      V(IH) = (H(1,1)*WIND(2) - H(1,2)*WIND(1))/DET
C  CALCULATE THE STANDARD DEVIATION (SIGMA)
      ERRORSUM = 0
      DO 10401 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10401
```

```
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1            - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      ERRORSUM = ERRORSUM + DVR(POINT)**2
10401 CONTINUE
      SIGMA = SQRT(ERRORSUM/NPH)
      DO 10501 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10501
      IF (ABS(DVR(POINT)) .GT. NSIGMA*SIGMA) THEN
      IWT(POINT) = 0
      FLAG = 1
      NPH = NPH - 1
      IF (NPH .LT. MINH) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      ENDIF
10501 CONTINUE
      IF (FLAG .EQ. 0) GO TO 20002
      IF (FLAG .EQ. 1) THEN
      IF (SIGMA .GE. 0.999*SIGMALAST) GO TO 20002
      IF (SIGMA .LE. 0.01) GO TO 20002
      SIGMALAST = SIGMA
      GO TO 20001
      ENDIF
C  GOOD VELOCITY.
20002 IF ( (ABS(U(IH)) .GT. VMAX)      .OR.
     1     (ABS(V(IH)) .GT. VMAX)      .OR.
     2     (ABS(W(IH)) .GT. VMAX/20) ) THEN
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (FITFLAG .EQ. 1) THEN
      RMSDVR(IH) = 0
      DO 10601 POINT = 1,NPOINTS(IH)
      IF (IWT(POINT) .EQ. 0) GO TO 10601
      DVR(POINT) = SPP(POINT,2) - U(IH)*COSL(POINT)
     1            - V(IH)*COSM(POINT) - W(IH)*COSN(POINT)
      RMSDVR(IH) = RMSDVR(IH) + DVR(POINT)**2
      ZA = (180/PI)*ASIN(SQRT(1-COSN(POINT)**2))
      IZA = INT(ZA) + 1
      IF (IZA .GT. 17) THEN
      WRITE (*,*) 'IZA = ',IZA
      FITFLAG = 0
      GO TO 90909
      ENDIF
      IF (IZA .EQ. 17) IZA = 16
      VRAD(IZA) = VRAD(IZA) + DVR(POINT)**2
      NUMRAD(IZA) = NUMRAD(IZA) + 1
10601 CONTINUE
      IF (NPH .GT. 0) THEN
      RMSDVR(IH) = SQRT(RMSDVR(IH)/NPH)
      DO 10701 IALPHA = 1,16
      IF (NUMRAD(IALPHA) .EQ. 0) GO TO 10701
C     WRITE (*,*) 'ZA,VRAD,NUMRAD= ',IALPHA,VRAD(IALPHA),NUMRAD(IALPHA)
      VRAD(IALPHA) = SQRT(VRAD(IALPHA)/NUMRAD(IALPHA))
10701 CONTINUE
      ENDIF
      ENDIF
```

```
90909 RETURN
      END
      SUBROUTINE PHFIT
************************************************************************
C
C   THIS SUBROUTINE FITS A STRAIGHT LINE TO THE VARIATION OF VELOCITY
C   VARIANCE VS ZENITH ANGLE.
C   JULY 23, 1990
C
************************************************************************
      CHARACTER*1 POLAR
      CHARACTER*40 INFILE,OUTFILE
      CHARACTER*27 INPATH
      CHARACTER*19 OUTPATH
      CHARACTER*10 TUREKTIME
      INTEGER*4 YEAR,MONTH,DAY,HOUR,MINUTE,
     1          REJ,IH,NPOINTS(50),HOWLONG,NPV,NPV0,TESTFLAG,FITFLAG,
     2          MINH,MINV,NUMRAD,NOW
      REAL*4 INTERCEPT
      COMMON /WIND1/ SPP(2300,7),SPPZ(15,2300,7)
      COMMON /WIND2/ Z,TRP(50),
     1             REJ(4),LINE(10),
     2             WIDTH(50),IWT(2300),RMSDVR(50),
     4             COSL(2300),COSM(2300),COSN(2300),DVR(2300),
     5             NUMRAD(17),VRAD(17)
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1            NSIGMA,TESTFLAG,IH,NPOINTS,INFILE,OUTFILE,
     2            INPATH,OUTPATH,NPH,NPV,NPV0,SLOPE,INTERCEPT,FITFLAG
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
C
      SUMVR = 0
      SUMVRPH = 0
      SUMPH = 0
      SUMPH2 = 0
      SUMI = 0
      DO 10101 IALPHA = 1,17
      IF (NUMRAD(IALPHA) .EQ. 0) GO TO 10101
      ZA = IALPHA - 0.5
      SUMVR = SUMVR + VRAD(IALPHA)
      SUMVRPH = SUMVRPH + VRAD(IALPHA)*ZA
      SUMPH = SUMPH + ZA
      SUMPH2 = SUMPH2 + ZA**2
      SUMI = SUMI + 1
10101 CONTINUE
      IF (SUMI .GT. 0) THEN
      IF (SUMI*SUMPH2 - SUMPH**2 .GT. 0) THEN
      SLOPE = (SUMI*SUMVRPH - SUMVR*SUMPH)/(SUMI*SUMPH2 - SUMPH**2)
      INTERCEPT = (SUMVR - SLOPE*SUMPH)/SUMI
      ELSE
      SLOPE = 0
      INTERCEPT = 0
      ENDIF
      ENDIF
      RETURN
      END
      SUBROUTINE REORDER (U,V,W)
```

```
C
C     REORDERS IDI WIND OUTPUT FILES IN DESCENDING HEIGHT.
C     THIS PORTION OF THE PROGRAM IS SPECIFIC TO A 43KM HEIGHT RANGE
C
      CHARACTER*1 TAB,POLAR
      CHARACTER*10 TUREKTIME
      CHARACTER*40 INFILE,OUTFILE
      DIMENSION H(50),U(50),V(50),W(50),UI(50),VI(50),WI(50),TRP(50),
     *XH(50),RT(50),SL(50),ICPT(50)
      INTEGER*4 IFILE,YEAR,MONTH,DAY,HOUR,MINUTE,NPOINTS(50),HOWLONG
      COMMON /WIND3/ PI,VMAX,THMAXH,THMINH,THMAXV,THMINV,MINH,MINV,
     1             NSIGMA,TESTFLAG,IH,NPOINTS,INFILE,OUTFILE
      COMMON /SPPFILE/ IFILE,NFILE,POLAR
      COMMON /TIMER/ INTNUM,YEAR,MONTH,DAY,HOUR,MINUTE,TUREKTIME,
     *HOWLONG,NOW
      COMMON /ARRAYS/ A(43,33)
C
      TAB=CHAR(9)
      WRITE (*,*) " REORDERING FILES BY DESCENDING HEIGHTS"
      CLOSE (16)
      NERR=8
      OPEN (16,ERR=90950,FILE=OUTFILE,STATUS="OLD",FORM="FORMATTED")
      IH=1
90912 READ (16,90001,END=90920,) H(IH),UI(IH),VI(IH),WI(IH),TRP(IH),
     *XH(IH),RT(IH),SL(IH),ICPT(IH)
90001 FORMAT (9(E13.4))
      IH=IH+1
      GO TO 90912
90920 REWIND (16)
      L=0
      J=15
90921 I=J
      K=0
90922 WRITE (16,90002)  H(I),TAB,UI(I),TAB,VI(I),TAB,WI(I),TAB,TRP(I),
     *TAB,XH(I),TAB,RT(I),TAB,SL(I),TAB,ICPT(I)
90002 FORMAT (E13.4,8(A1,E13.4))
      L=L+1
      U(L)=UI(I)
      V(L)=VI(I)
      W(L)=WI(I)
      IF (I.EQ.1) GO TO 90940
      K=K+1
      IF (K.EQ.1) THEN
      I=I+28
      GO TO 90922
      END IF
      IF (K.EQ.2) THEN
      I=I-14
      GO TO 90922
      ELSE
      J=J-1
      GO TO 90921
      END IF
90940 CLOSE (16)
      RETURN
90950 WRITE (*,*) " ERROR IN REORDERING FILES. NERR = ",NERR
      PAUSE " CR TO EXIT"
      STOP
```

```
      END
      SUBROUTINE DEVIANT
      CHARACTER*1 C4H(4),BLANK,NEG
      CHARACTER*4 CH4,BLANK4,B(43,33)
      REAL NINES
C
      COMMON /ARRAYS/ A(43,33),B
      EQUIVALENCE (CH4,C4H)
C
C     CALCULATE IDI AND ISR COMPONENT DIFFERENCES, AND SET UP OUTPUT
C     ARRAY FOR PRINTING AS XXXCRKOUT
C
      BLANK=CHAR(32)
      BLANK4="    "
      NINES=999.0
      NEG="-"
      DO 40 I=1,43
      IF (A(I,8).EQ.NINES)  GO TO 40
      IF (A(I,10).EQ.NINES) GO TO 40
      IF (A(I,14).EQ.NINES)  GO TO 40
      IF (A(I,16).EQ.NINES) GO TO 40
      A(I,18)=ABS(A(I,8)-A(I,14))
      A(I,19)=ABS(A(I,10)-A(I,16))
   40 CONTINUE
C
C     SET UP CHARACTER ARRAY B(43,33) FOR PRINTING
C
      DO 45 I=1,43
      DO 45 J=1,33
      IF (A(I,J).EQ.NINES) THEN
      CH4=BLANK
      GO TO 44
      END IF
      SIGN=A(I,J)/ABS(A(I,J))
      IA=ABS(A(I,J))
      IF (IA.EQ.0) A(I,J)=A(I,J)+1.0
      IA100=IA/100
      IA10=IA/10-10*IA100
      IA1=IA-100*IA100-10*IA10
      C4H(1)=BLANK
      C4H(2)=CHAR(IA100+48)
      IF (IA100.EQ.0) C4H(2)=BLANK
      C4H(3)=CHAR(IA10+48)
      C4H(4)=CHAR(IA1+48)
      IF (J.EQ.1) GO TO 42
      IF (C4H(2).NE.BLANK) GO TO 42
      IF (IA10.EQ.0) C4H(3)=BLANK
   42 IF (SIGN.GT.0.0) GO TO 44
      DO 43 K=3,1,-1
      IF (C4H(K).NE.BLANK) GO TO 43
      C4H(K)=NEG
      GO TO 44
   43 CONTINUE
   44 B(I,J)=CH4
   45 CONTINUE
      RETURN
      END
```

The FPS and IDI wind comparison program FPSREDUCT

This program prepares a tab spaced column output file of zonal and meridional greenline profile smoothed a) hourly mean GROVES winds and b) IDI winds (created by IDIWIND.f), and Fabry-Perot spectrometer winds, suitable for reading into a plotting program.

INPUT

Reads either XXXXXXTIDE or XXXXXXGROOUT file output from GROVES, and smooths with a greenline profile to produce zonal, meridional and vertical winds at hourly intervals from 1900 LMST to 0500 LMST for the night of interest. Accesses the "TIDE" file if GROVES output consists only of mean (prevailing wind), diurnal and semidiurnal components only, via SUBROUTINE GLINE2, or accesses the "GROOUT" file (read by SUBROUTINE GLINE!) if more than two harmonic periods have been generated by GROVES. Selection is made by entering "T" (for "TIDE") or "G" (for "GROOUT") at the prompt request.

Enter FPS input (on disc) and output (your choice) filenames when prompted.

Enter IDI input file XXXXXXXX.MAW height spacing (all .MAW files generated after March 1, 1993, have 1km height spacing. Most of those generated before this date are spaced 3km). All files created by IDIWIND.f are 1km spacing.

Reads file SET.TIME, which is simply a listing of all the interval center point times of the .MAW files to be accessed, formatted as follows

```
8905031215
8905031322
..........
..........
..........
0000000000        ! EOF FLAG
```

Program then uses SUBROUTINE INNAME to create the appropriate IDI input filename.

After accessing the selected .MAW file, SUBROUTINE GREENIDI is then called, and the IDI profiles are greenline smoothed, and the ASCII output file written.

```
C     PROGRAM FPSREDUCT
C                                    APRIL 20, 1993
C     PREPARES CRICKETGRAPH FILE FOR COMPARISON OF
C     GROVES, IDI AND FABRY-PEROT WINDS
C     TO DETERMINE GROVES, READS EITHER XXXXXXGROOUT
C     (WHICH MAY HAVE BEEN GENERATED USING 2, 3 OR 4 HARMONICS
C     OR READS XXXXXXTIDE IF ONLY 2 HARMONICS WERE GENERATED.
C
      CHARACTER*1 DUM(8),TAB,WHICH
      CHARACTER 5 BLANK5
      CHARACTER*6 DUMMY1,DUMMY2
      CHARACTER*40 FILEIN,FILEOUT,GROOUT,TIDE,MAWFILE
      DIMENSION TIME(72),VEW(72),FERREW(72),VNS(72),FERRNS(72)
      INTEGER*4 YEAR,DAY,HOUR,MINUTE
      REAL*4 NINES
      COMMON /IDI/ PULSE,VEWIDI(72),ERREW(72),VNSIDI(72),ERRNS(72),
     *VWIDI(72),ERRW(72)
      COMMON /IDIG/ GTIME(24),GREW(24),GRNS(24),GRW(24)
      EQUIVALENCE (GROOUT,DUMMY1)
      EQUIVALENCE (TIDE,DUMMY2)
      EQUIVALENCE (MAWFILE,DUM)
      COMMON /IDIFILES/ MAWFILE,MONTH,DAY,HOUR,MINUTE
      TAB=CHAR(9)
      NINES=999.0
      DO 20 N=1,24
      GTIME(N)=NINES
      VEWIDI(N)=NINES
   20 CONTINUE
      DO 21 N=1,72
      TIME(N)=NINES
      VEW(N)=NINES
      VNS(N)=NINES
   21 CONTINUE
      BLANK5="     "
C
      WRITE (*,*) " PROGRAM FPSREDUCT"
      WRITE (*,*) " "
C
C     GET GROVES DATA  (XXXXGROOUT OR XXXXXXTIDE FILE)
C
      WRITE (*,*) " ENTER T FOR TIDE, G FOR GROOUT INPUT"
      READ (*,*) WHICH
      TIDE="      TIDE"
      GROOUT="      GROOUT"
      WRITE (*,*) " ENTER TIDE/GROOUT FILENUMBER"
      READ (*,*) DUMMY1
C
      IF (WHICH.EQ."G") THEN
      OPEN (17,FILE=GROOUT,ACTION="READ",FORM="FORMATTED")
      CALL GLINE1
      ELSE
      DUMMY2=DUMMY1
      OPEN (17,FILE=TIDE,ACTION="READ",FORM="UNFORMATTED")
      CALL GLINE2
      END IF
      CLOSE (17)
C
C     GET FPI DATA    (FPIYYYYYY FILE)
C
      WRITE (*,*) " ENTER FPI INPUT, OUTPUT FILENAMES"
      READ (*,*) FILEIN,FILEOUT
      OPEN (17,FILE=FILEIN,ACTION="READ",FORM="FORMATTED")
      OPEN (16,FILE=FILEOUT,FORM="FORMATTED")
```

```
      VEL=50.0/24.0
      DO 10 I=1,72
      READ (17,*,END=11) VEW(I),FERREW(I),VNS(I),FERRNS(I)
      VEW(I)=VEL*VEW(I)
      VNS(I)=VEL*VNS(I)
      FERREW(I)=VEL*FERREW(I)
      FERRNS(I)=VEL*FERRNS(I)
      WRITE (*,*) VEW(I),FERREW(I),VNS(I),FERRNS(I)
   10 CONTINUE
   11 TIME(I)=NINES
      CLOSE (17)
C
C     GET IDI WINDS (MOJOHRMIN.MAW FILES)
C
      WRITE (*,*) " ENTER IDI HEIGHT SPACING - 1 OR 3 KM"
      READ (*,*) LPULSE
      PULSE=0.2
      IF (LPULSE.EQ.3) PULSE=0.08
      WRITE (*,*) " PULSE = ",PULSE
      OPEN (27,FILE="SET.TIME",ACTION="READ",FORM="FORMATTED")
      I=1
   12 READ (27,101,END=13) YEAR,MONTH,DAY,HOUR,MINUTE
  101 FORMAT (5I2)
      IF (YEAR.EQ.0) GO TO 13
      TIME(I)=FLOAT(HOUR)+FLOAT(MINUTE)/60.0
      IF (TIME(I).LT.12.0) TIME(I)=TIME(I)+24.0
      CALL INNAME
      WRITE (*,*) " PROCESSING FILE ",MAWFILE
      OPEN (17,FILE=MAWFILE,STATUS="OLD",ACTION="READ",FORM="FORMATTED")
      CALL GREENIDI (I)
      CLOSE (17)
C
C     GET NEXT IDI FILE
C
      I=I+1
      GO TO 12
C
C     PREPARE OUTPUT FILE
C
   13 CLOSE (17)
      CLOSE (27)
      J=1
      K=1
   14 WRITE (*,*) GTIME(J),TIME(K)
      IF (GTIME(J).EQ.NINES.AND.TIME(K).EQ.NINES) GO TO 15
      IF (GTIME(J).LT.TIME(K)) THEN
      WRITE (16,102) GTIME(J),TAB,GREW(J),TAB,GRNS(J),TAB,GRW(J)
  102 FORMAT (F8.3,3(A1,F8.0))
      J=J+1
      GO TO 14
      ELSE
      IF (VEWIDI(K).LT.900.0.AND.VNSIDI(K).LT.900.0
     *.AND.VEW(K).LT.900.0.AND.VNS(K).LT.900.0)      WRITE (16,103)
     *TIME(K),TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,VEWIDI(K),TAB,
     *ERREW(K),TAB,VNSIDI(K),TAB,ERRNS(K),TAB,VWIDI(K),TAB,ERRW(K),
     *TAB,VEW(K),TAB,FERREW(K), TAB,VNS(K),TAB,FERRNS(K)
  103 FORMAT (F8.3,3(A1,A5),10(A1,F8.0))
      IF (VEWIDI(K).GT.900.0.OR.VNSIDI(K).GT.900.0
     *.AND.VEW(K).LT.900.0.AND.VNS(K).LT.900.0)      WRITE (16,104)
     *TIME(K),TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,
     *TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,VEW(K),TAB,
     *FERREW(K),TAB,VNS(K),TAB,FERRNS(K)
  104 FORMAT (F8.3,9(A1,A5),4(A1,F8.0))
      IF (VEWIDI(K).LT.900.0.AND.VNSIDI(K).LT.900.0
```

```
     *.AND.VEW(K).GT.9[illegible].OR.VNS(K).GT.[illegible]) THEN
      WRITE (16,105) TIME(K),TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,
     *VEWIDI(K),TAB,ERREW(K),TAB,VNSIDI(K),TAB,ERRNS(K),TAB,VWIDI(K),
     *TAB,ERRW(K),TAB,BLANK5,TAB,BLANK5,TAB,BLANK5,TAB,BLANK5
  105 FORMAT (F5.3,3(A1,A5),6(A1,F5.1),4(A1,A5))
      END IF
      K=K+1
      GO TO 14
      END IF
   15 CLOSE (16)
      PAUSE " ALL DONE - CR TO EXIT"
      STOP
      END
      SUBROUTINE GLINE1
C                                               MARCH 8, 1993
C     READS GROVES WIND FROM FILE "XXXXXXGROOUT"
C
      CHARACTER*8 DIRNW,WHATW
          CHARACTER*9 DIRNEW,WHATEW
      CHARACTER*11 DIRNNS,WHATNS
      DIMENSION VX(24),VY(24),VZ(24),WT(10)
      COMMON /IDIG/ GTIME (24),GREW(24),GRNS(24),GRW(24)
      DATA WT/0.04867,0.07028,0.09352,0.1147,0.1296,0.1350,
     *0.1296,0.1147,0.09352,0.07028/
      DO 10 I=1,11
      GREW(I)=0.0
      GRNS(I)=0.0
      GTIME(I)=18.0+FLOAT(I)
   10 CONTINUE
      DIRNEW="EAST-WEST"
      DIRNNS="NORTH-SOUTH"
          DIRNW="VERTICAL"
C
C     SKIP DOWN TO EAST-WEST 102KM
C
    1 READ (17,*) WHATEW
      IF (WHATEW.NE.DIRNEW) GO TO 1
      DO 2 I=1,16
      READ (17,*) WHATEW
    2 CONTINUE
C
C     DETERMINE GREEN LINE SMOOTHED VELOCITY
C
      DO 3 K=1,10
      READ (17,100) IH,(VX(J),J=1,11)
      WRITE (*,100) IH,(VX(J),J=1,11)
  100 FORMAT (I5,38X,11F5.0)
      DO 3 I=1,11
      GREW(I)=GREW(I)+VX(I)*WT(K)
    3 CONTINUE
C
C     SKIP DOWN TO NORTH - SOUTH 102KM
C
    4 READ (17,*) WHATNS
      IF (WHATNS.NE.DIRNNS) GO TO 4
      DO 5 I=1,16
      READ (17,*) WHATNS
    5 CONTINUE
C
C     DETERMINE GREEN LINE SMOOTHED VELOCITY
C
      DO 6 K=1,10
      READ (17,100) IH,(VY(J),J=1,11)
      WRITE (*,100) IH,(VY(J),J=1,11)
```

```
      DO 6 I=1,11
      GRNS(I)=(GRNS(I)+VY(I)*WT(K))
    6 CONTINUE
C
C     SKIP DOWN TO VERTICAL 102KM
C
    7 READ (17,*) WHATW
      IF (WHATNS.NE.DIRNW) GO TO 7
      DO 8 I=1,16
      READ (17,*) WHATW
    8 CONTINUE
C
C     DETERMINE GREEN LINE SMOOTHED VELOCITY
C
      DO 9 K=1,10
      READ (17,100) IH,(VZ(J),J=1,11)
      WRITE (*,100) IH,(VZ(J),J=1,11)
      DO 9 I=1,11
      GRW(I)=(GRW(I)+VZ(I)*WT(K))
    9 CONTINUE
C
      RETURN
      END
      SUBROUTINE GLINE2
C                                                MARCH 6, 1993
C     CALCULATES TIDAL WIND FROM TIDAL COEFFICIENTS,
C     READING FILE "XXXXXXTIDE"
C
      DIMENSION AU(4),PH(4),VX(10,24),VY(10,24),VZ(10,24),WT(10)
      COMMON /IDIG/ GTIME (24),GREW(24),GRNS(24),GRW(24)
      DATA WT/0.04867,0.07028,0.09352,0.1147,0.1296,0.1350,
     *0.1296,0.1147,0.09352,0.07028/
      TWOPI=6.28318
      DO 10 I=1,11
      GREW(I)=0.0
      GRNS(I)=0.0
      GTIME(I)=18.0+FLOAT(I)
   10 CONTINUE
C
C     SKIP DOWN TO EAST-WEST 102KM
C
      DO 1 I=1,14
      READ (17) UO,(AU(J),PH(J),J=1,2)
    1 CONTINUE
C
C     DETERMINE GREEN LINE SMOOTHED VELOCITY
C
      DO 2 I=1,10
      READ (17) UO,(AU(J),PH(J),J=1,2)
      DO 2 IT=1,11
      T=GTIME(IT)
      IF (PH(1).LT.T) PHASE1=PH(1)-T
      IF (PH(1).GE.T) PHASE1=T-PH(1)
      IF (PH(2).LT.T) PHASE2=PH(2)-T
      IF (PH(2).GE.T) PHASE2=T-PH(2)
      VX(I,IT)=UO+AU(1)*COS((PHASE1/24.0)*TWOPI)
     *+AU(2)*COS((PHASE2/12.0)*TWOPI)
    2 CONTINUE
      DO 3 J=1,11
      DO 3 I=1,10
      GREW(J)=GREW(J)+VX(I,J)*WT(I)
    3 CONTINUE
C
C     SKIP DOWN TO NORTH - SOUTH 102KM
```

```
C
      DO 4 I=1,42
      READ (17) UO,(AU(J),PH(J),J=1,2)
    4 CONTINUE

C
C     DETERMINE GREEN LINE SMOOTHED VELOCITY
C
      DO 5 I=1,10
      READ (17) UO,(AU(J),PH(J),J=1,2)
      DO 5 IT=1,11
      T=GTIME(IT)
      IF (PH(1).LT.T) PHASE1=PH(1)-T
      IF (PH(1).GE.T) PHASE1=T-PH(1)
      IF (PH(2).LT.T) PHASE2=PH(2)-T
      IF (PH(2).GE.T) PHASE2=T-PH(2)
      VY(I,IT)=UO+AU(1)*COS((PHASE1/24.0)*TWOPI)
     *+AU(2)*COS((PHASE2/12.0)*TWOPI)
    5 CONTINUE
      DO 6 J=1,11
      DO 6 I=1,10
      GRNS(J)=GRNS(J)+VY(I,J)*WT(I)
    6 CONTINUE
C
C     SKIP DOWN TO VERTICAL 102KM
C
      DO 7 I=1,42
      READ (17) UO,(AU(J),PH(J),J=1,2)
    7 CONTINUE

C
C     DETERMINE GREEN LINE SMOOTHED VELOCITY
C
      DO 8 I=1,10
      READ (17) UO,(AU(J),PH(J),J=1,2)
      DO 8 IT=1,11
      T=GTIME(IT)
      IF (PH(1).LT.T) PHASE1=PH(1)-T
      IF (PH(1).GE.T) PHASE1=T-PH(1)
      IF (PH(2).LT.T) PHASE2=PH(2)-T
      IF (PH(2).GE.T) PHASE2=T-PH(2)
      VZ(I,IT)=UO+AU(1)*COS((PHASE1/24.0)*TWOPI)
     *+AU(2)*COS((PHASE2/12.0)*TWOPI)
    8 CONTINUE
      DO 9 J=1,11
      DO 9 I=1,10
      GRW(J)=(GRW(J)+VZ(I,J)*WT(I))
    9 CONTINUE
      RETURN
      END
      SUBROUTINE INNAME
C
C     INNAME CREATES MOJOHRMIN.MAW INPUT FILENAMES.
C
      CHARACTER*2 ASCMONTH,ASCDAY,ASCHOUR,ASCMINUTE
      CHARACTER*40 MAWFILE
      CHARACTER*19 INPATH
      INTEGER*4 MONTH,DAY,HOUR,MINUTE
      COMMON /IDIFILES/ MAWFILE,MONTH,DAY,HOUR,MINUTE
C
      INPATH="MAXTOR600:OUTFILES:"
      IF (MONTH .LT. 10) THEN
      WRITE (ASCMONTH,90001) '0',MONTH
90001 FORMAT (A1,I1)
```

```
      ELSE
      WRITE (ASCMONTH,90002) MONTH
90002 FORMAT (I2)
      ENDIF
      IF (DAY .LT. 10) THEN
      WRITE (ASCDAY,'(A1,I1)') '0',DAY
      ELSE
      WRITE (ASCDAY,90002) DAY
      ENDIF
      IF (HOUR .LT. 10) THEN
      WRITE (ASCHOUR,90001) '0',HOUR
      ELSE
      WRITE (ASCHOUR,90002) HOUR
      ENDIF
      IF (MINUTE .LT. 10) THEN
      WRITE (ASCMINUTE,90001) '0',MINUTE
      ELSE
      WRITE (ASCMINUTE,90002) MINUTE
      ENDIF
      WRITE (MAWFILE,90003)
     1 INPATH,ASCMONTH,ASCDAY,ASCHOUR,ASCMINUTE,'.MAW'
90003 FORMAT (A19,4A2,A4)
      RETURN
      END
      SUBROUTINE GREENIDI (I)
      DIMENSION VX(10),VY(10),VZ(10),WT(10)
      REAL*4 NINES
      COMMON /IDI/ PULSE,VEWIDI(72),ERREW(72),VNSIDI(72),ERRNS(72),
     *VWIDI(72),ERRW(72)
      DATA WT/0.04867,0.07028,0.09352,0.1147,0.1296,0.1350,
     *0.1296,0.1147,0.09352,0.07028/
      NINES=999.0
      VXSUM=0.0
      VYSUM=0.0
      VZSUM=0.0
      WTSUM=0.0
      ONE=1.0
      J=1
    3 READ (17,"(4E13.4)",END=4) Z,VX(J),VY(J),VZ(J)
      IDIZ=Z
      IF (IDIZ.GT.102) GO TO 3
      IF (IDIZ.LT.93) GO TO 4
      IF (VX(J).GT.900.0) THEN
      J=J+1
      GO TO 3
      ELSE
      VXSUM=VXSUM+VX(J)*WT(J)
      VYSUM=VYSUM+VY(J)*WT(J)
      VZSUM=VZSUM+VZ(J)*WT(J)
      WTSUM=WTSUM+WT(J)
      J=J+1
      GO TO 3
      END IF
    4 IF (WTSUM.EQ.0.0) THEN
      VEWIDI(I)=NINES
      RETURN
      ELSE
      VEWIDI(I)=VXSUM*ONE/WTSUM
      VNSIDI(I)=VYSUM*ONE/WTSUM
      VWIDI(I)=VZSUM*100.0/WTSUM
      ERRWT=PULSE/WTSUM
      ERREW(I)=5.0+ABS(VEWIDI(I))*ERRWT
      ERRNS(I)=5.0+ABS(VNSIDI(I))*ERRWT
      ERRW(I)=100.0+ABS(VWIDI(I))*ERRWT
```

```
WRITE (*,*) VEWIDI(I),VNSIDI(I),VWIDI(I
IF (ERREW(I).GT.40.0) THEN
VEWIDI(I)=NINES
ERREW(I)=NINES
END IF
IF (ERRNS(I).GT.40.0) THEN
VNSIDI(I)=NINES
ERRNS(I)=NINES
END IF
RETURN
END IF
END
```

Appendix I

A listing of file TUREKFILE (accessed by ISRIDIIDIG.f) which gives the interval number, date, start time, end time and viewing azimuth of the Arecibo Observatory incoherent scatter radar for the three AIDA'89 campaigns. Because of problems with phase jitter in the MAPSTAR processor controller during the March Scene I campaign, only the Scene II and Scene III data have been tabulated.

1	890329	60850	63653	393
2	890329	64102	70905	393
3	890329	71638	72834	303
4	890329	73534	74619	213
5	890329	75318	81825	123
6	890329	82523	83610	213
7	890329	84307	85352	303
8	890329	90052	92559	393
9	890329	92934	95440	393
10	890329	95729	102235	393
11	890329	102610	105117	393
12	890329	105816	110901	303
13	890329	111600	112646	213
14	890329	113345	115851	123
15	890329	120550	121635	213
16	890329	122333	123419	303
17	890329	124116	130622	393
18	890329	130959	133506	393
19	890329	133754	140300	393
20	890329	141730	150344	393
21	890329	151042	151316	303
22	890329	163938	170923	123
23	890329	171619	172703	213
24	890329	173401	174444	303
25	890329	175142	181641	393
26	890329	182013	184513	393
27	890329	184759	191306	393
28	890330	65640	72139	393
29	890330	72514	73557	393
30	890330	74253	75336	303
31	890330	80034	81117	213
32	890330	81814	84313	123
33	890330	85010	90053	213
34	890330	90750	91833	303
35	890330	92532	95039	393
36	890330	95415	101921	393
37	890330	102210	104717	393
38	890330	105053	111560	393
39	890330	112258	113345	303
40	890330	114042	115129	213
41	890330	115827	122334	123
42	890330	123033	124118	213
43	890330	124816	125902	303
44	890330	130602	133109	393
45	890330	133444	140320	393
46	890330	140609	143116	393
47	890330	143451	145959	393
48	890330	151243	152329	303
49	890330	153039	154124	213
50	890330	154824	161331	123
51	890330	162029	163115	213
52	890330	163812	164858	303
53	890330	165556	172103	393
54	890330	172438	174947	393

55	890330	175235	181742	393
56	890330	182117	184624	393
57	890331	62312	64541	393
58	890331	64844	71114	393
59	890331	71811	72753	303
60	890331	73451	74434	213
61	890331	75131	81400	123
62	890331	82056	83040	213
63	890331	83736	84720	303
64	890331	85419	91648	393
65	890331	91951	94219	393
66	890331	94505	100738	393
67	890331	101041	103310	393
68	890331	104007	104950	303
69	890331	105648	110630	213
70	890331	111328	113558	123
71	890331	114254	115238	213
72	890331	115937	120919	303
73	890331	121618	123848	393
74	890331	124150	130420	393
75	890331	130706	132935	393
76	890331	133241	135514	393
77	890331	140212	141341	303
78	890331	142222	143349	213
79	890331	144229	151006	123
80	890331	151847	153012	213
81	890331	155001	160128	303
82	890331	161009	163756	393
83	890331	164244	171031	393
84	890331	171502	174248	393
85	890331	174736	181523	393
86	890331	182401	183530	303
87	890331	184411	185540	213
88	890331	190419	191548	123
89	890401	71634	74421	393
90	890401	74909	81657	393
91	890401	82538	83707	303
92	890401	84548	85717	213
93	890401	90559	93346	123
94	890401	94226	95356	213
95	890401	100237	101405	303
96	890401	102246	105033	393
97	890401	105521	112308	393
98	890401	112740	115526	393
99	890401	120015	122801	393
100	890401	123643	124812	303
101	890401	125654	130823	213
102	890401	131704	134452	123
103	890401	135333	140502	213
104	890401	141342	142511	303
105	890401	143352	150139	393
106	890401	150628	153416	393
107	890401	153847	160634	393
108	890401	161122	163910	393

109	890401	164748	165917	303
110	890401	170759	171928	213
111	890401	172810	175556	123
112	890401	180436	181605	213
113	890401	182446	183615	303
114	890402	63617	65854	393
115	890402	70159	72436	393
116	890402	73134	74121	303
117	890402	74820	75806	213
118	890402	80504	82741	123
119	890402	83439	84424	213
120	890402	85121	90107	303
121	890402	90805	93041	393
122	890402	93346	95623	393
123	890402	95912	102148	393
124	890402	102453	104731	393
125	890402	105430	110415	303
126	890402	111114	112060	213
127	890402	112758	115035	123
128	890402	115733	120719	213
129	890402	121416	122402	303
130	890402	123060	125338	393
131	890402	125643	131921	393
132	890402	132209	134447	393
133	890402	134752	141030	393
134	890402	141729	142715	303
135	890402	143413	144360	213
136	890402	145057	151334	123
137	890402	152032	153018	213
138	890402	153715	154701	303
139	890402	155359	161637	393
140	890402	161942	164219	393
141	890402	164506	170744	393
142	890402	171049	173326	393
143	890402	174025	175011	303
144	890402	175709	180654	213
145	890402	181352	183629	123
146	890402	184326	185313	213
147	890403	60804	63041	393
148	890403	63346	65624	393
149	890403	70322	71308	303
150	890403	72007	72953	213
151	890403	73651	75929	123
152	890403	80629	81615	213
153	890403	82312	83258	303
154	890403	83958	90235	393
155	890403	90540	92817	393
156	890403	93105	95343	393
157	890403	95649	101926	393
158	890403	102623	103609	303
159	890403	104310	105255	213
160	890403	105953	112231	123
161	890403	113130	114115	213
162	890403	114813	115760	303

163	890403	120504	122741	393
164	890403	123047	125324	393
165	890403	125612	131850	393
166	890403	132155	134433	393
167	890403	135131	140117	303
168	890403	140818	141804	213
169	890403	142502	144740	123
170	890403	145437	150423	213
171	890403	151120	152107	303
172	890403	152812	155050	393
173	890403	155355	161632	393
174	890403	161921	164158	393
175	890403	164503	170740	393
176	890403	171440	172426	303
177	890403	173124	174110	213
178	890403	174809	181047	123
179	890403	181745	182731	213
180	890403	183428	184414	303
181	890403	185113	191350	393
182	890403	191654	193933	393
183	890403	194221	200458	393
184	890403	200803	203040	393
185	890403	203739	204724	303
186	890403	205423	210409	213
187	890403	211107	213345	123
188	890403	214043	215029	213
189	890403	215727	220712	303
190	890403	221410	223646	393
191	890403	223952	224226	393
192	890404	73810	80557	123
193	890404	81440	82609	213
194	890404	83450	84619	303
195	890404	85500	92247	393
196	890404	92735	95523	393
197	890404	95954	103426	393
198	890404	103914	110660	393
199	890404	111542	112710	303
200	890404	113554	114722	213
201	890404	115604	122351	123
202	890404	123235	124404	213
203	890404	125245	130414	303
204	890404	131258	134044	393
205	890404	134533	141320	393
206	890404	141751	144537	393
207	890404	145026	151814	393
208	890404	152655	153823	303
209	890404	154706	155835	213
210	890404	160717	163504	123
211	890404	164345	165515	213
212	890404	170356	171525	303
213	890404	172405	175151	393
214	890404	175640	182426	393
215	890404	182857	184025	393
216	890405	64038	65024	303

217	890405	65722	70708	213
218	890405	71407	73643	123
219	890405	74341	75327	213
220	890405	130318	132631	393
221	890405	132943	135253	393
222	890405	135958	140956	303
223	890405	141702	142701	213
224	890405	143406	145718	123
225	890405	150421	151420	213
226	890405	152122	153120	303
227	890405	153826	160135	393
228	890405	160447	162759	393
229	890405	163055	165405	393
230	890405	165716	172026	393
231	890405	172730	173729	303
232	890405	174434	175433	213
233	890405	180138	182451	123
234	890405	183154	184152	213
235	890406	64101	70412	393
236	890406	75943	82255	393
237	890406	82606	84915	393
238	890406	85619	90618	303
239	890406	91323	92322	213
240	890406	93027	95337	123
241	890406	100041	101039	213
242	890406	101742	102739	303
243	890406	103443	105751	393
244	890406	110103	112414	393
245	890406	112710	115019	393
246	890406	115331	121639	393
247	890406	122343	123342	303
248	890406	124046	125045	213
249	890406	125750	132102	123
250	890406	132807	133805	213
251	890406	134508	135505	303
252	890406	140209	142516	393
253	890406	142829	145139	393
254	890406	151152	152150	303
255	890406	152854	155201	393
256	890406	155514	161822	393
257	890406	162118	164429	393
258	890406	164741	171049	393
259	890406	171752	172750	303
260	890406	173452	174450	213
261	890406	175154	181504	123
262	890406	182206	182441	213
263	890406	184430	185428	303
264	890407	64800	80819	393
265	890407	81308	83420	393
266	890407	83911	84144	393
267	890407	84848	85848	303
268	890407	90551	91550	213
269	890407	92254	94602	123
270	890407	95306	100304	213

271	890407	101008	102007	303
272	890407	102711	105023	393
273	890407	105336	111644	393
274	890407	111939	114247	393
275	890407	114600	120913	393
276	890407	121618	122618	303
277	890407	123321	124321	213
278	890407	125024	131333	123
279	890407	132037	133036	213
280	890407	133739	134737	303
281	890407	135442	141745	393
282	890407	142059	144408	393
283	890407	144703	151011	393
284	890407	151323	153634	393
285	890407	154338	155338	303
286	890407	160043	161042	213
287	890407	161746	164056	123
288	890407	164759	165757	213
289	890407	170460	171458	303
290	890407	172202	174511	393
291	890407	174824	181136	393
292	890407	181430	183738	393
293	890407	184049	190359	393
294	890407	191103	192103	303
295	890408	63835	70145	123
296	890408	70847	71846	213
297	890408	72549	73546	303
298	890408	74250	80560	393
299	890408	80914	83229	393
300	890408	83523	85831	393
301	890408	90143	92454	393
302	890408	93158	94157	303
303	890408	94902	95901	213
304	890408	100607	102919	123
305	890408	103622	104620	213
306	890408	105322	110321	303
307	890408	111025	113334	393
308	890408	113646	115958	393
309	890408	120254	122601	393
310	890408	122914	125222	393
311	890408	125926	130925	303
312	890408	131630	132630	213
313	890408	133334	135646	123
314	890408	140350	141350	213
315	890408	142053	143051	303
316	890408	143754	150102	393
317	890408	150414	152726	393
318	890408	153022	155606	393
319	890408	160056	162226	393
320	890408	162716	164302	393
321	890408	165007	170007	303
322	890408	170711	171711	213
323	890408	172416	174726	123
324	890408	175427	180426	213

325	890408	181129	182127	303
326	890408	182828	185138	393
327	890408	185452	191803	393
328	890408	192058	194559	393
329	890409	63251	65422	393
330	890409	65912	70146	393
331	890409	70849	71848	303
332	890409	72551	73550	213
333	890409	74254	80604	123
334	890409	81309	82309	213
335	890409	83014	84013	303
336	890409	84717	91026	393
337	890409	91338	93645	393
338	890409	93940	100252	393
339	890409	100605	102913	393
340	890409	103617	104615	303
341	890409	105319	110317	213
342	890409	111020	113330	123
343	890409	114034	115034	213
344	890409	115739	120738	303
345	890409	121443	123754	393
346	890409	124106	130414	393
347	890409	130708	133018	393
348	890409	133332	135642	393
349	890409	140346	141344	303
350	890409	142048	143046	213
351	890409	143749	150058	123
352	890409	150802	151800	213
353	890409	152504	153504	303
354	890409	154208	160519	393
355	890409	160833	163140	393
356	890409	163435	165744	393
357	890409	170058	172411	393
358	890409	173114	174114	303
359	890409	174818	175816	213
360	890409	180519	182828	123
361	890409	183531	184530	213
362	890409	185233	190232	303
363	890410	60817	63128	393
364	890410	63441	65752	393
365	890410	70456	71454	303
366	890410	72158	73157	213
367	890410	73901	80210	123
368	890410	80915	81914	213
369	890410	82616	83616	303
370	890410	84322	90634	393
371	890410	91633	93944	393
372	890410	94240	100548	393
373	890410	100900	103209	393
374	890410	103913	104912	303
375	890410	105616	110616	213
376	890410	111320	113634	123
377	890410	114342	115340	213
378	890410	120043	121041	303

379	890410	121745	124054	393
380	890410	124405	130716	393
381	890410	131012	133322	393
382	890410	133634	135942	393
383	890410	140648	141646	303
384	890410	142350	143349	213
385	890410	144054	150406	123
386	890410	151109	152109	213
387	890410	153536	153810	303
388	890410	154730	161038	393
389	890410	161351	163700	393
390	890410	163955	170307	393
391	890410	170619	172927	393
392	890410	173631	174630	303
393	890410	175333	180332	213
394	890410	181036	183347	123
395	890410	184052	185051	213
396	890411	61421	64026	393
397	890411	64413	71019	393
398	890411	71758	72907	303
399	890411	73645	74755	213
400	890411	75533	82140	123
401	890411	82917	84027	213
402	890411	84805	85914	303
403	890411	90652	93258	393
404	890411	93644	105404	393
405	890411	105927	112513	393
406	890411	113002	113821	393
501	890501	172508	174344	393
502	890501	174558	181050	393
503	890501	181305	190917	393
504	890502	61539	64059	393
505	890502	64325	70846	393
506	890502	71457	72624	303
507	890502	73236	74403	213
508	890502	75015	75250	123
509	890502	81232	82402	213
510	890502	83019	85546	123
511	890502	90602	91731	213
512	890502	93402	94532	303
513	890502	95451	102018	393
514	890502	102245	105536	393
515	890502	105735	112301	393
516	890502	112529	115055	393
517	890502	115712	120840	303
518	890502	121457	122627	213
519	890502	123243	125809	123
520	890502	130426	131556	213
521	890502	132212	133342	303
522	890502	133958	145746	393
523	890502	150014	152541	393
524	890502	152740	155306	393
525	890502	155534	162101	393
526	890502	162718	163848	303

527	890502	164504	165634	213
528	890502	170250	172817	123
529	890502	173433	174602	213
530	890502	175219	180349	303
531	890502	181005	183834	393
532	890503	64456	70628	393
533	890503	71249	71524	393
534	890503	72140	73310	303
535	890503	73927	75056	213
536	890503	75712	82238	123
537	890503	82855	84025	213
538	890503	84641	85810	303
539	890503	90426	92953	393
540	890503	93220	95747	393
541	890503	95945	102512	393
542	890503	102740	105306	393
543	890503	105922	111051	303
544	890503	111707	112836	213
545	890503	113453	120019	123
546	890503	120635	121805	213
547	890503	122421	123551	303
548	890503	124208	130734	393
549	890503	131002	133528	393
550	890503	133726	140254	393
551	890503	140521	143047	393
552	890503	143704	144833	303
553	890503	145449	150618	213
554	890503	151444	154011	123
555	890503	154628	155757	213
556	890503	160414	161543	303
557	890503	162160	164726	393
558	890503	164953	171520	393
559	890503	171718	174245	393
560	890503	174513	181039	393
561	890503	181655	182825	303
562	890504	61321	64040	393
563	890504	64308	71029	393
564	890504	71646	72912	303
565	890504	73528	74754	213
566	890504	75410	82131	123
567	890504	83024	84251	213
568	890504	84907	90134	303
569	890504	91038	93758	393
570	890504	94026	100746	393
571	890504	100946	103706	393
572	890504	103933	110654	393
573	890504	111310	112536	303
574	890504	113153	114420	213
575	890504	115036	121756	123
576	890504	122413	123639	213
577	890504	124256	125522	303
578	890504	130138	132858	393
579	890504	133127	135846	393
580	890504	140046	142806	393

581	890504	143034	145754	393
582	890504	150411	151637	303
583	890504	152254	153520	213
584	890504	154137	160857	123
585	890504	161513	162739	213
586	890504	163356	164623	303
587	890504	165239	171959	393
588	890504	172227	174948	393
589	890504	175147	181906	393
590	890504	182134	184854	393
591	890505	62040	64607	393
592	890505	64834	71401	393
593	890505	72017	73146	303
594	890505	73802	74932	213
595	890505	75548	82114	123
596	890505	82730	83900	213
597	890505	84516	85646	303
598	890505	90302	92828	393
599	890505	93055	95622	393
600	890505	95821	102347	393
601	890505	102615	105141	393
602	890505	105758	110926	303
603	890505	111543	112712	213
604	890505	113328	115855	123
605	890505	120511	121641	213
606	890505	122257	123426	303
607	890505	124043	130609	393
608	890505	130837	133404	393
609	890505	133603	140129	393
610	890505	140357	142922	393
611	890505	143539	144708	303
612	890505	145325	150454	213
613	890505	151111	153637	123
614	890505	154254	155423	213
615	890505	160039	161209	303
616	890505	161825	164352	393
617	890505	164620	171146	393
618	890505	171344	173911	393
619	890505	174139	180705	393
620	890505	181322	182452	303
621	890505	183108	184237	213
622	890505	184853	191420	123
623	890505	192036	193205	213
624	890505	193822	194950	303
625	890505	195607	202133	393
626	890505	202400	204915	393
627	890506	65336	71509	393
628	890506	72130	72404	393
629	890506	73021	74150	303
630	890506	74807	75936	213
631	890506	80553	83119	123
632	890506	83736	84906	213
633	890506	85522	90652	303
634	890506	91308	93835	393

635	890506	94103	95733	393
636	890506	140327	142459	393
637	890506	143121	143356	393
638	890506	144012	145141	303
639	890506	145758	150929	213
640	890506	151545	154111	123
641	890506	154728	155858	213
642	890506	160514	161644	303
643	890506	162300	164828	393
644	890506	165056	171622	393
645	890506	171821	174348	393
646	890506	174615	181141	393
647	890506	181758	182928	303
648	890507	55811	62338	393
649	890507	62604	65131	393
650	890507	65747	70916	303
651	890507	71532	72700	213
652	890507	73317	75844	123
653	890507	80460	81629	213
654	890507	82245	83414	303
655	890507	84031	90557	393
656	890507	90824	93350	393
657	890507	93549	100115	393
658	890507	100343	102908	393
659	890507	103525	104654	303
660	890507	105310	110439	213
661	890507	111056	113622	123
662	890507	114239	115408	213
663	890507	120024	121153	303
664	890507	121810	124336	393
665	890507	124604	131130	393
666	890507	131328	133855	393
667	890507	134122	140648	393
668	890507	141304	142434	303
669	890507	143050	144219	213
670	890507	144835	151402	123
671	890507	152018	153148	213
672	890507	153804	154932	303
673	890507	155549	162116	393
674	890507	162343	164909	393
675	890507	165107	171634	393
676	890507	171900	174427	393
677	890507	175043	180212	303
678	890507	180828	183455	213
679	890508	62106	64626	123
680	890508	65237	70404	213
681	890508	71015	72142	303
682	890508	72753	75313	393
683	890508	75538	82058	393
684	890508	82254	84813	393
685	890508	85038	91600	393
686	890508	92216	93346	303
687	890508	94002	95131	213
688	890508	95748	102314	123

689	890508	103326	104456	213	
690	890508	111120	113647	393	
691	890508	113915	120441	393	
692	890508	120639	123206	393	
693	890508	123433	125959	393	
694	890508	130616	131745	303	
695	890508	132401	133530	213	
696	890508	134147	140712	123	
697	890508	141329	142458	213	
698	890508	143115	144243	303	
699	890508	144859	151427	393	
700	890508	151654	154220	393	
701	890508	154419	160050	393	
702	890508	160712	160945	393	
703	890508	161213	163739	393	
704	890508	164354	165524	303	
705	890508	170140	171309	213	
706	890508	171926	174453	123	
707	890508	175108	180238	213	
708	890508	180853	182022	303	
709	890508	182638	185225	393	
710	890509	70847	73019	393	
711	890509	73641	73916	393	
712	890509	74531	75701	303	
713	890509	80317	80552	213	
714	890509	81213	81454	123	?
715	890509	82124	82959	213	?
716	890509	83221	84853	123	?
717	890509	85510	90639	213	
718	890509	91254	92425	303	
719	890509	93040	95607	393	
720	890509	95835	102402	393	
721	890509	102601	105127	393	
722	890509	105355	111921	393	
723	890509	112714	113844	303	
724	890600	120000	120000	0	END OF FILE FLAG

Appendix II

A listing of the scattering point parameter "tape" files SPP - GR XXX, which are the disc files corresponding to the original MAPSTAR data tapes numbered XXX.Also listed are the data date and hour, and number of scattering points between 66 and 116km recorded in the *previous* hour.

SPP - GR 45	89.	3.	28.	1800	0	SCATTERING POINTS
SPP - GR 45	89.	3.	28.	1900	124	SCATTERING POINTS
SPP - GR 45	89.	3.	28.	2000	4522	SCATTERING POINTS
SPP - GR 46	89.	3.	28.	2100	3201	SCATTERING POINTS
SPP - GR 47	89.	3.	28.	2200	4185	SCATTERING POINTS
SPP - GR 47	89.	3.	28.	2300	4383	SCATTERING POINTS
SPP - GR 48	89.	3.	29.	0000	1836	SCATTERING POINTS
SPP - GR 49	89.	3.	29.	0100	1030	SCATTERING POINTS
SPP - GR 49	89.	3.	29.	0200	2497	SCATTERING POINTS
SPP - GR 50	89.	3.	29.	0300	2291	SCATTERING POINTS
SPP - GR 51	89.	3.	29.	0400	3525	SCATTERING POINTS
SPP - GR 51	89.	3.	29.	0500	5690	SCATTERING POINTS
SPP - GR 52	89.	3.	29.	0600	4459	SCATTERING POINTS
SPP - GR 53	89.	3.	29.	0700	11776	SCATTERING POINTS
SPP - GR 53	89.	3.	29.	0800	14499	SCATTERING POINTS
SPP - GR 54	89.	3.	29.	0900	9260	SCATTERING POINTS
SPP - GR 55	89.	3.	29.	1000	8909	SCATTERING POINTS
SPP - GR 55	89.	3.	29.	1100	8733	SCATTERING POINTS
SPP - GR 56	89.	3.	29.	1200	11050	SCATTERING POINTS
SPP - GR 56	89.	3.	29.	1300	11733	SCATTERING POINTS
SPP - GR 57	89.	3.	29.	1400	9709	SCATTERING POINTS
SPP - GR 58	89.	3.	29.	1500	8529	SCATTERING POINTS
SPP - GR 59	89.	3.	29.	1600	6965	SCATTERING POINTS
SPP - GR 60	89.	3.	29.	1700	11103	SCATTERING POINTS
SPP - GR 60	89.	3.	29.	1800	3606	SCATTERING POINTS
SPP - GR 61	89.	3.	29.	1900	5820	SCATTERING POINTS
SPP - GR 61	89.	3.	29.	2000	4436	SCATTERING POINTS
SPP - GR 62	89.	3.	29.	2100	4468	SCATTERING POINTS
SPP - GR 63	89.	3.	29.	2200	14625	SCATTERING POINTS
SPP - GR 63	89.	3.	29.	2300	14147	SCATTERING POINTS
SPP - GR 64	89.	3.	30.	0000	3438	SCATTERING POINTS
SPP - GR 65	89.	3.	30.	0100	1185	SCATTERING POINTS
SPP - GR 66	89.	3.	30.	0200	3201	SCATTERING POINTS
SPP - GR 66	89.	3.	30.	0300	2336	SCATTERING POINTS
SPP - GR 67	89.	3.	30.	0400	2511	SCATTERING POINTS
SPP - GR 68	89.	3.	30.	0500	2859	SCATTERING POINTS
SPP - GR 68	89.	3.	30.	0600	2708	SCATTERING POINTS
SPP - GR 69	89.	3.	30.	0700	1611	SCATTERING POINTS
SPP - GR 69	89.	3.	30.	0800	3030	SCATTERING POINTS
SPP - GR 69	89.	3.	30.	0900	12626	SCATTERING POINTS
SPP - GR 70	89.	3.	30.	1000	10461	SCATTERING POINTS
SPP - GR 71	89.	3.	30.	1100	9236	SCATTERING POINTS
SPP - GR 71	89.	3.	30.	1200	4956	SCATTERING POINTS
SPP - GR 71	89.	3.	30.	1300	3225	SCATTERING POINTS
SPP - GR 72	89.	3.	30.	1400	2039	SCATTERING POINTS
SPP - GR 72	89.	3.	30.	1500	964	SCATTERING POINTS
SPP - GR 72	89.	3.	30.	1600	3060	SCATTERING POINTS
SPP - GR 73	89.	3.	30.	1700	6911	SCATTERING POINTS
SPP - GR 74	89.	3.	30.	1800	9243	SCATTERING POINTS
SPP - GR 74	89.	3.	30.	1900	6677	SCATTERING POINTS
SPP - GR 75	89.	3.	30.	2000	1834	SCATTERING POINTS
SPP - GR 76	89.	3.	30.	2100	1100	SCATTERING POINTS
SPP - GR 76	89.	3.	30.	2200	5823	SCATTERING POINTS
SPP - GR 77	89.	3.	30.	2300	5909	SCATTERING POINTS
SPP - GR 78	89.	3.	31.	0000	11999	SCATTERING POINTS
SPP - GR 78	89.	3.	31.	0100	7054	SCATTERING POINTS
SPP - GR 79	89.	3.	31.	0200	4703	SCATTERING POINTS
SPP - GR 80	89.	3.	31.	0300	1298	SCATTERING POINTS
SPP - GR 80	89.	3.	31.	0400	1266	SCATTERING POINTS
SPP - GR 81	89.	3.	31.	0500	5113	SCATTERING POINTS
SPP - GR 82	89.	3.	31.	0600	4787	SCATTERING POINTS
SPP - GR 82	89.	3.	31.	0700	12394	SCATTERING POINTS
SPP - GR 83	89.	3.	31.	0800	13202	SCATTERING POINTS
SPP - GR 84	89.	3.	31.	0900	13003	SCATTERING POINTS

SPP - GR 84	89.	3.	31.	1000	13038	SCATTERING	POINTS
SPP - GR 85	89.	3.	31.	1100	11332	SCATTERING	POINTS
SPP - GR 86	89.	3.	31.	1200	11122	SCATTERING	POINTS
SPP - GR 86	89.	3.	31.	1300	13417	SCATTERING	POINTS
SPP - GR 87	89.	3.	31.	1400	11780	SCATTERING	POINTS
SPP - GR 88	89.	3.	31.	1500	11306	SCATTERING	POINTS
SPP - GR 89	89.	3.	31.	1600	10354	SCATTERING	POINTS
SPP - GR 89	89.	3.	31.	1700	10123	SCATTERING	POINTS
SPP - GR 90	89.	3.	31.	1800	11582	SCATTERING	POINTS
SPP - GR 91	89.	3.	31.	1900	10709	SCATTERING	POINTS
SPP - GR 91	89.	3.	31.	2000	8235	SCATTERING	POINTS
SPP - GR 92	89.	3.	31.	2100	6441	SCATTERING	POINTS
SPP - GR 93	89.	3.	31.	2200	7091	SCATTERING	POINTS
SPP - GR 93	89.	3.	31.	2300	10953	SCATTERING	POINTS
SPP - GR 94	89.	4.	1.	0000	9177	SCATTERING	POINTS
SPP - GR 95	89.	4.	1.	0100	6691	SCATTERING	POINTS
SPP - GR 95	89.	4.	1.	0200	8231	SCATTERING	POINTS
SPP - GR 96	89.	4.	1.	0300	6754	SCATTERING	POINTS
SPP - GR 97	89.	4.	1.	0400	10161	SCATTERING	POINTS
SPP - GR 97	89.	4.	1.	0500	7319	SCATTERING	POINTS
SPP - GR 98	89.	4.	1.	0600	5931	SCATTERING	POINTS
SPP - GR 99	89.	4.	1.	0600	5218	SCATTERING	POINTS
SPP - GR 99	89.	4.	1.	0700	4877	SCATTERING	POINTS
SPP - GR 99	89.	4.	1.	0800	22972	SCATTERING	POINTS
SPP - GR 100	89.	4.	1.	0900	21179	SCATTERING	POINTS
SPP - GR 101	89.	4.	1.	1000	22363	SCATTERING	POINTS
SPP - GR 101	89.	4.	1.	1100	24097	SCATTERING	POINTS
SPP - GR 102	89.	4.	1.	1200	3205	SCATTERING	POINTS
SPP - GR 102	89.	4.	1.	1300	21481	SCATTERING	POINTS
SPP - GR 103	89.	4.	1.	1400	24053	SCATTERING	POINTS
SPP - GR 103	89.	4.	1.	1500	3473	SCATTERING	POINTS
SPP - GR 103	89.	4.	1.	1600	28734	SCATTERING	POINTS
SPP - GR 104	89.	4.	1.	1700	18901	SCATTERING	POINTS
SPP - GR 105	89.	4.	1.	1800	15120	SCATTERING	POINTS
SPP - GR 105	89.	4.	1.	1900	8908	SCATTERING	POINTS
SPP - GR 106	89.	4.	1.	2000	2948	SCATTERING	POINTS
SPP - GR 107	89.	4.	1.	2100	8139	SCATTERING	POINTS
SPP - GR 107	89.	4.	1.	2200	15322	SCATTERING	POINTS
SPP - GR 108	89.	4.	1.	2300	4407	SCATTERING	POINTS
SPP - GR 109	89.	4.	2.	0000	6711	SCATTERING	POINTS
SPP - GR 109	89.	4.	2.	0100	11299	SCATTERING	POINTS
SPP - GR 110	89.	4.	2.	0200	5654	SCATTERING	POINTS
SPP - GR 111	89.	4.	2.	0300	7220	SCATTERING	POINTS
SPP - GR 111	89.	4.	2.	0400	6366	SCATTERING	POINTS
SPP - GR 112	89.	4.	2.	0500	10171	SCATTERING	POINTS
SPP - GR 113	89.	4.	2.	0600	8629	SCATTERING	POINTS
SPP - GR 113	89.	4.	2.	0700	18642	SCATTERING	POINTS
SPP - GR 114	89.	4.	2.	0800	4263	SCATTERING	POINTS
SPP - GR 114	89.	4.	2.	0900	12119	SCATTERING	POINTS
SPP - GR 115	89.	4.	2.	1000	22881	SCATTERING	POINTS
SPP - GR 115	89.	4.	2.	1100	24797	SCATTERING	POINTS
SPP - GR 116	89.	4.	2.	1200	18282	SCATTERING	POINTS
SPP - GR 117	89.	4.	2.	1300	20341	SCATTERING	POINTS
SPP - GR 118	89.	4.	2.	1500	16177	SCATTERING	POINTS
SPP - GR 118	89.	4.	2.	1600	4174	SCATTERING	POINTS
SPP - GR 118	89.	4.	2.	1700	20598	SCATTERING	POINTS
SPP - GR 119	89.	4.	2.	1800	13256	SCATTERING	POINTS
SPP - GR 120	89.	4.	2.	1900	11120	SCATTERING	POINTS
SPP - GR 120	89.	4.	2.	2000	8341	SCATTERING	POINTS
SPP - GR 121	89.	4.	2.	2100	7506	SCATTERING	POINTS
SPP - GR 122	89.	4.	2.	2200	4661	SCATTERING	POINTS
SPP - GR 122	89.	4.	2.	2300	6587	SCATTERING	POINTS
SPP - GR 123	89.	4.	3.	0000	6098	SCATTERING	POINTS
SPP - GR 124	89.	4.	3.	0100	3580	SCATTERING	POINTS

SPP - GR 124	89.	4.	3.	0200	3049	SCATTERING POINTS
SPP - GR 125	89.	4.	3.	0300	8230	SCATTERING POINTS
SPP - GR 125	89.	4.	3.	0400	11324	SCATTERING POINTS
SPP - GR 126	89.	4.	3.	0500	11824	SCATTERING POINTS
SPP - GR 127	89.	4.	3.	0600	12506	SCATTERING POINTS
SPP - GR 127	89.	4.	3.	0700	18238	SCATTERING POINTS
SPP - GR 128	89.	4.	3.	0800	19989	SCATTERING POINTS
SPP - GR 129	89.	4.	3.	1000	18375	SCATTERING POINTS
SPP - GR 129	89.	4.	3.	1100	15741	SCATTERING POINTS
SPP - GR 130	89.	4.	3.	1200	18570	SCATTERING POINTS
SPP - GR 131	89.	4.	3.	1300	18546	SCATTERING POINTS
SPP - GR 131	89.	4.	3.	1400	20168	SCATTERING POINTS
SPP - GR 132	89.	4.	3.	1500	18879	SCATTERING POINTS
SPP - GR 133	89.	4.	3.	1600	16111	SCATTERING POINTS
SPP - GR 133	89.	4.	3.	1700	23191	SCATTERING POINTS
SPP - GR 134	89.	4.	3.	1800	18935	SCATTERING POINTS
SPP - GR 135	89.	4.	3.	1900	13342	SCATTERING POINTS
SPP - GR 135	89.	4.	3.	2000	5740	SCATTERING POINTS
SPP - GR 136	89.	4.	3.	2100	2440	SCATTERING POINTS
SPP - GR 137	89.	4.	3.	2200	10917	SCATTERING POINTS
SPP - GR 137	89.	4.	3.	2300	9477	SCATTERING POINTS
SPP - GR 138	89.	4.	4.	0000	10078	SCATTERING POINTS
SPP - GR 139	89.	4.	4.	0100	6287	SCATTERING POINTS
SPP - GR 139	89.	4.	4.	0200	12047	SCATTERING POINTS
SPP - GR 140	89.	4.	4.	0300	6277	SCATTERING POINTS
SPP - GR 141	89.	4.	4.	0400	6133	SCATTERING POINTS
SPP - GR 142	89.	4.	4.	0500	6042	SCATTERING POINTS
SPP - GR 142	89.	4.	4.	0600	14207	SCATTERING POINTS
SPP - GR 143	89.	4.	4.	0700	21747	SCATTERING POINTS
SPP - GR 144	89.	4.	4.	0900	26671	SCATTERING POINTS
SPP - GR 144	89.	4.	4.	1000	3868	SCATTERING POINTS
SPP - GR 144	89.	4.	4.	1100	23428	SCATTERING POINTS
SPP - GR 145	89.	4.	4.	1200	18363	SCATTERING POINTS
SPP - GR 146	89.	4.	4.	1300	21877	SCATTERING POINTS
SPP - GR 146	89.	4.	4.	1400	23588	SCATTERING POINTS
SPP - GR 147	89.	4.	4.	1500	18609	SCATTERING POINTS
SPP - GR 148	89.	4.	4.	1600	12921	SCATTERING POINTS
SPP - GR 149	89.	4.	4.	1700	4017	SCATTERING POINTS
SPP - GR 149	89.	4.	4.	1800	16914	SCATTERING POINTS
SPP - GR 150	89.	4.	4.	1900	10176	SCATTERING POINTS
SPP - GR 151	89.	4.	4.	2000	7170	SCATTERING POINTS
SPP - GR 151	89.	4.	4.	2100	10889	SCATTERING POINTS
SPP - GR 152	89.	4.	4.	2200	7139	SCATTERING POINTS
SPP - GR 153	89.	4.	4.	2300	10088	SCATTERING POINTS
SPP - GR 153	89.	4.	5.	0000	11742	SCATTERING POINTS
SPP - GR 154	89.	4.	5.	0100	10109	SCATTERING POINTS
SPP - GR 155	89.	4.	5.	0200	9409	SCATTERING POINTS
SPP - GR 155	89.	4.	5.	0300	5727	SCATTERING POINTS
SPP - GR 156	89.	4.	5.	0400	7750	SCATTERING POINTS
SPP - GR 157	89.	4.	5.	0500	12021	SCATTERING POINTS
SPP - GR 157	89.	4.	5.	0600	12790	SCATTERING POINTS
SPP - GR 158	89.	4.	5.	0700	23139	SCATTERING POINTS
SPP - GR 159	89.	4.	5.	0800	20998	SCATTERING POINTS
SPP - GR 160	89.	4.	5.	0900	25640	SCATTERING POINTS
SPP - GR 160	89.	4.	5.	1000	16473	SCATTERING POINTS

SPP - GR 161	89.	4.	5.	1100	26068	SCATTERING POINTS
SPP - GR 161	89.	4.	5.	1200	33275	SCATTERING POINTS
SPP - GR 162	89.	4.	5.	1300	26963	SCATTERING POINTS
SPP - GR 163	89.	4.	5.	1400	23106	SCATTERING POINTS
SPP - GR 163	89.	4.	5.	1500	21578	SCATTERING POINTS
SPP - GR 164	89.	4.	5	1600	19271	SCATTERING POINTS
SPP - GR 165	89.	4.	5.	1700	17394	SCATTERING POINTS
SPP - GR 165	89.	4.	5.	1800	17392	SCATTERING POINTS
SPP - GR 166	89.	4.	5.	1900	7803	SCATTERING POINTS
SPP - GR 167	89.	4.	5.	2000	2720	SCATTERING POINTS
SPP - GR 167	89.	4.	5.	2100	11035	SCATTERING POINTS
SPP - GR 168	89.	4.	5.	2200	15844	SCATTERING POINTS
SPP - GR 169	89.	4.	5.	2300	8885	SCATTERING POINTS
SPP - GR 170	89.	4.	6.	0000	14891	SCATTERING POINTS
SPP - GR 170	89.	4.	6.	0100	12061	SCATTERING POINTS
SPP - GR 171	89.	4.	6.	0200	13343	SCATTERING POINTS
SPP - GR 172	89.	4.	6.	0300	14350	SCATTERING POINTS
SPP - GR 172	89.	4.	6.	0400	10705	SCATTERING POINTS
SPP - GR 173	89.	4.	6.	0500	9101	SCATTERING POINTS
SPP - GR 174	89.	4.	6.	0700	6696	SCATTERING POINTS
SPP - GR 174	89.	4.	6.	0800	5583	SCATTERING POINTS
SPP - GR 174	89.	4.	6.	0900	19943	SCATTERING POINTS
SPP - GR 175	89.	4.	6.	1000	22871	SCATTERING POINTS
SPP - GR 176	89.	4.	6.	1100	23320	SCATTERING POINTS
SPP - GR 176	89.	4.	6.	1200	23139	SCATTERING POINTS
SPP - GR 177	89.	4.	6.	1300	19919	SCATTERING POINTS
SPP - GR 178	89.	4.	6.	1400	18610	SCATTERING POINTS
SPP - GR 179	89.	4.	6.	1500	21856	SCATTERING POINTS
SPP - GR 179	89.	4.	6.	1600	14893	SCATTERING POINTS
SPP - GR 180	89.	4.	6.	1700	16017	SCATTERING POINTS
SPP - GR 181	89.	4.	6.	1800	13495	SCATTERING POINTS
SPP - GR 181	89.	4.	6.	1900	8159	SCATTERING POINTS
SPP - GR 182	89.	4.	6.	2000	4663	SCATTERING POINTS
SPP - GR 183	89.	4.	6.	2100	4617	SCATTERING POINTS
SPP - GR 183	89.	4.	6.	2200	5325	SCATTERING POINTS
SPP - GR 184	89.	4.	6.	2300	6070	SCATTERING POINTS
SPP - GR 185	89.	4.	7.	0000	5978	SCATTERING POINTS
SPP - GR 185	89.	4.	7.	0100	17197	SCATTERING POINTS
SPP - GR 186	89.	4.	7.	0200	9273	SCATTERING POINTS
SPP - GR 187	89.	4.	7.	0300	10027	SCATTERING POINTS
SPP - GR 187	89.	4.	7.	0400	11959	SCATTERING POINTS
SPP - GR 188	89.	4.	7.	0500	8771	SCATTERING POINTS
SPP - GR 189	89.	4.	7.	0600	3055	SCATTERING POINTS
SPP - GR 189	89.	4.	7.	0700	1443	SCATTERING POINTS
SPP - GR 189	89.	4.	7.	0800	8433	SCATTERING POINTS
SPP - GR 190	89.	4.	7.	0900	15621	SCATTERING POINTS
SPP - GR 191	89.	4.	7.	1000	13454	SCATTERING POINTS
SPP - GR 191	89.	4.	7.	1100	4974	SCATTERING POINTS
SPP - GR 192	89.	4.	7.	1200	9879	SCATTERING POINTS
SPP - GR 193	89.	4.	7.	1300	24610	SCATTERING POINTS
SPP - GR 193	89.	4.	7.	1400	20688	SCATTERING POINTS
SPP - GR 194	89.	4.	7.	1500	13801	SCATTERING POINTS
SPP - GR 195	89.	4.	7.	1600	8986	SCATTERING POINTS
SPP - GR 195	89.	4.	7.	1700	7830	SCATTERING POINTS
SPP - GR 196	89.	4.	7.	1800	7290	SCATTERING POINTS
SPP - GR 197	89.	4.	7.	1900	5377	SCATTERING POINTS

SPP - GR 197	89.	4.	7.	2000	8469	SCATTERING POINTS
SPP - GR 198	89.	4.	7.	2100	10535	SCATTERING POINTS
SPP - GR 199	89.	4.	7.	2200	10495	SCATTERING POINTS
SPP - GR 199	89.	4.	7.	2300	15950	SCATTERING POINTS
SPP - GR 200	89.	4.	8.	0000	16833	SCATTERING POINTS
SPP - GR 201	89.	4.	8.	0100	12430	SCATTERING POINTS
SPP - GR 201	89.	4.	8.	0200	18070	SCATTERING POINTS
SPP - GR 202	89.	4.	8.	0300	12185	SCATTERING POINTS
SPP - GR 203	89.	4.	8.	0400	16297	SCATTERING POINTS
SPP - GR 203	89.	4.	8.	0500	19409	SCATTERING POINTS
SPP - GR 204	89.	4.	8.	0600	12945	SCATTERING POINTS
SPP - GR 205	89.	4.	8.	0700	13820	SCATTERING POINTS
SPP - GR 205	89.	4.	8.	0800	17333	SCATTERING POINTS
SPP - GR 206	89.	4.	8.	0900	15909	SCATTERING POINTS
SPP - GR 207	89.	4.	8.	1000	19966	SCATTERING POINTS
SPP - GR 207	89.	4.	8.	1100	25304	SCATTERING POINTS
SPP - GR 208	89.	4.	8.	1200	20020	SCATTERING POINTS
SPP - GR 209	89.	4.	8.	1300	19227	SCATTERING POINTS
SPP - GR 209	89.	4.	8.	1400	20352	SCATTERING POINTS
SPP - GR 210	89.	4.	8.	1500	15218	SCATTERING POINTS
SPP - GR 211	89.	4.	8.	1600	13476	SCATTERING POINTS
SPP - GR 211	89.	4.	8.	1700	13007	SCATTERING POINTS
SPP - GR 212	89.	4.	8.	1800	14255	SCATTERING POINTS
SPP - GR 213	89.	4.	8.	1900	9923	SCATTERING POINTS
SPP - GR 214	89.	4.	8.	2000	10210	SCATTERING POINTS
SPP - GR 214	89.	4.	8.	2100	6596	SCATTERING POINTS
SPP - GR 215	89.	4.	8.	2200	11267	SCATTERING POINTS
SPP - GR 216	89.	4.	8.	2300	9731	SCATTERING POINTS
SPP - GR 216	89.	4.	9.	0000	5447	SCATTERING POINTS
SPP - GR 217	89.	4.	9.	0100	6756	SCATTERING POINTS
SPP - GR 218	89.	4.	9.	0200	6316	SCATTERING POINTS
SPP - GR 218	89.	4.	9.	0300	9872	SCATTERING POINTS
SPP - GR 219	89.	4.	9.	0400	11270	SCATTERING POINTS
SPP - GR 220	89.	4.	9.	0500	12399	SCATTERING POINTS
SPP - GR 220	89.	4.	9.	0600	9564	SCATTERING POINTS
SPP - GR 221	89.	4.	9.	0700	18037	SCATTERING POINTS
SPP - GR 221	89.	4.	9.	0800	23490	SCATTERING POINTS
SPP - GR 222	89.	4.	9.	0900	21060	SCATTERING POINTS
SPP - GR 223	89.	4.	9.	1000	14868	SCATTERING POINTS
SPP - GR 223	89.	4.	9.	1100	17839	SCATTERING POINTS
SPP - GR 224	89.	4.	9.	1200	7539	SCATTERING POINTS
SPP - GR 225	89.	4.	9.	1300	17460	SCATTERING POINTS
SPP - GR 225	89.	4.	9.	1400	16862	SCATTERING POINTS
SPP - GR 226	89.	4.	9.	1500	13275	SCATTERING POINTS
SPP - GR 227	89.	4.	9.	1600	12418	SCATTERING POINTS
SPP - GR 227	89.	4.	9.	1700	9096	SCATTERING POINTS
SPP - GR 228	89.	4.	9.	1800	7455	SCATTERING POINTS
SPP - GR 229	89.	4.	9.	1900	13737	SCATTERING POINTS
SPP - GR 229	89.	4.	9.	2000	4760	SCATTERING POINTS
SPP - GR 230	89.	4.	9.	2100	5142	SCATTERING POINTS
SPP - GR 231	89.	4.	9.	2200	13490	SCATTERING POINTS
SPP - GR 231	89.	4.	9.	2300	16239	SCATTERING POINTS
SPP - GR 232	89.	4.	10.	0000	11484	SCATTERING POINTS
SPP - GR 233	89.	4.	10.	0100	9396	SCATTERING POINTS
SPP - GR 233	89.	4.	10.	0200	8593	SCATTERING POINTS
SPP - GR 234	89.	4.	10.	0300	15477	SCATTERING POINTS
SPP - GR 235	89.	4.	10.	0400	8490	SCATTERING POINTS
SPP - GR 235	89.	4.	10.	0500	9614	SCATTERING POINTS

SPP - GR 236	89.	4.	10	0600	12087	SCATTERING POINTS
SPP - GR 237	89.	4	10	0700	14089	SCATTERING POINTS
SPP - GR 237	89	4.	10.	0800	11768	SCATTERING POINTS
SPP - GR 238	89.	4.	10.	0900	5687	SCATTERING POINTS
SPP - GR 238	89.	4.	10	1000	17624	SCATTERING POINTS
SPP - GR 239	89	4.	10.	1100	9710	SCATTERING POINTS
SPP - GR 239	89.	4	10	1200	17650	SCATTERING POINTS
SPP - GR 240	89.	4.	10.	1300	13225	SCATTERING POINTS
SPP - GR 241	89	4	10	1400	16109	SCATTERING POINTS
SPP - GR 241	89.	4.	10.	1500	15634	SCATTERING POINTS
SPP - GR 242	89.	4.	10.	1600	15928	SCATTERING POINTS
SPP - GR 243	89.	4.	10.	1700	13047	SCATTERING POINTS
SPP - GR 243	89.	4.	10.	1800	12643	SCATTERING POINTS
SPP - GR 245	89.	4.	10.	1900	9097	SCATTERING POINTS
SPP - GR 245	89.	4.	10.	2000	3250	SCATTERING POINTS
SPP - GR 245	89.	4.	10.	2100	6495	SCATTERING POINTS
SPP - GR 246	89.	4.	10.	2200	5529	SCATTERING POINTS
SPP - GR 247	89.	4.	10.	2300	17396	SCATTERING POINTS
SPP - GR 248	89.	4.	11.	0000	11674	SCATTERING POINTS
SPP - GR 248	89.	4.	11.	0100	10545	SCATTERING POINTS
SPP - GR 249	89.	4.	11.	0200	6706	SCATTERING POINTS
SPP - GR 249	89.	4.	11.	0300	17942	SCATTERING POINTS
SPP - GR 250	89.	4.	11.	0400	19293	SCATTERING POINTS
SPP - GR 251	89.	4.	11.	0500	10177	SCATTERING POINTS
SPP - GR 251	89.	4.	11.	0600	18170	SCATTERING POINTS
SPP - GR 252	89.	4.	11.	0700	21042	SCATTERING POINTS
SPP - GR 253	89.	4.	11.	0800	21212	SCATTERING POINTS
SPP - GR 253	89.	4.	11.	0900	19311	SCATTERING POINTS
SPP - GR 254	89.	4.	11.	1000	18809	SCATTERING POINTS
SPP - GR 255	89.	4.	11.	1100	18967	SCATTERING POINTS
SPP - GR 256	89.	4.	11.	1600	10319	SCATTERING POINTS
SPP - GR 257	89.	5.	2.	1700	2142	SCATTERING POINTS
SPP - GR 257	89.	5.	2.	1800	1424	SCATTERING POINTS
SPP - GR 258	89.	5.	2.	1900	1546	SCATTERING POINTS
SPP GR 258	89.	5.	2.	2000	1980	SCATTERING POINTS
SPP - GR 259	89.	5.	2.	2100	2590	SCATTERING POINTS
SPP - GR 259	89.	5.	2.	2200	1403	SCATTERING POINTS
SPP - GR 260	89.	5.	2.	2300	1829	SCATTERING POINTS
SPP - GR 260	89.	5.	3.	0000	2158	SCATTERING POINTS
SPP - GR 261	89.	5.	3.	0100	4175	SCATTERING POINTS
SPP - GR 261	89.	5.	3.	0200	2775	SCATTERING POINTS
SPP - GR 262	89.	5.	3.	0300	2865	SCATTERING POINTS
SPP - GR 263	89.	5.	3.	0400	5987	SCATTERING POINTS
SPP - GR 263	89.	5.	3.	0500	4179	SCATTERING POINTS
SPP - GR 263	89.	5.	3.	0600	6843	SCATTERING POINTS
SPP - GR 264	89.	5.	3.	0700	4975	SCATTERING POINTS
SPP - GR 264	89.	5.	3.	0800	7225	SCATTERING POINTS
SPP - GR 265	89.	5.	3.	0900	6657	SCATTERING POINTS
SPP - GR 265	89.	5.	3.	1000	6131	SCATTERING POINTS
SPP - GR 266	89.	5.	3.	1100	6735	SCATTERING POINTS
SPP - GR 267	89.	5.	3.	1200	4715	SCATTERING POINTS
SPP - GR 267	89.	5.	3.	1300	5174	SCATTERING POINTS
SPP - GR 268	89.	5.	3.	1400	4832	SCATTERING POINTS
SPP - GR 268	89.	5.	3.	1500	4111	SCATTERING POINTS
SPP - GR 269	89.	5.	3.	1600	7444	SCATTERING POINTS
SPP - GR 269	89.	5.	3.	1700	7617	SCATTERING POINTS
SPP - GR 270	89.	5.	3.	1800	6223	SCATTERING POINTS
SPP - GR 270	89.	5.	3.	1900	5529	SCATTERING POINTS

SPP - GR 271	89	5	3.	2000	6513	SCATTERING POINTS
SPP - GR 271	89	5	3.	2100	5458	SCATTERING POINTS
SPP - GR 272	89.	5	3	2200	7629	SCATTERING POINTS
SPP - GR 272	89	5.	3.	2300	7595	SCATTERING POINTS
SPP - GR 273	89.	5	4.	0000	7374	SCATTERING POINTS
SPP - GR 273	89.	5	4.	0100	4191	SCATTERING POINTS
SPP - GR 274	89.	5	4.	0200	3260	SCATTERING POINTS
SPP - GR 274	89	5.	4.	0300	3744	SCATTERING POINTS
SPP - GR 275	89	5	4.	0400	4298	SCATTERING POINTS
SPP - GR 275	89	5.	4	0500	3750	SCATTERING POINTS
SPP - GR 276	89	5	4	0600	4326	SCATTERING POINTS
SPP - GR 276	89.	5.	4.	0700	5264	SCATTERING POINTS
SPP - GR 277	89.	5.	4.	0800	4778	SCATTERING POINTS
SPP - GR 277	89.	5	4	0900	5826	SCATTERING POINTS
SPP - GR 278	89.	5	4.	1000	3535	SCATTERING POINTS
SPP - GR 278	89.	5.	4.	1100	3868	SCATTERING POINTS
SPP - GR 279	89.	5.	4.	1200	4382	SCATTERING POINTS
SPP - GR 279	89.	5.	4	1300	721	SCATTERING POINTS
SPP - GR 280	89.	5.	4.	1400	1693	SCATTERING POINTS
SPP - GR 280	89.	5.	4.	1500	796	SCATTERING POINTS
SPP - GR 281	89.	5.	4.	1600	1019	SCATTERING POINTS
SPP - GR 281	89.	5.	4.	1700	2361	SCATTERING POINTS
SPP - GR 282	89.	5.	4.	1800	3310	SCATTERING POINTS
SPP - GR 282	89	5.	4.	1900	3157	SCATTERING POINTS
SPP - GR 283	89.	5.	4.	2000	7320	SCATTERING POINTS
SPP - GR 284	89.	5.	4.	2100	11013	SCATTERING POINTS
SPP - GR 284	89.	5.	4.	2200	5430	SCATTERING POINTS
SPP - GR 285	89.	5.	4.	2300	5145	SCATTERING POINTS
SPP - GR 285	89.	5.	5.	0000	4218	SCATTERING POINTS
SPP - GR 286	89.	5.	5.	0100	2511	SCATTERING POINTS
SPP - GR 286	89.	5.	5.	0200	2698	SCATTERING POINTS
SPP - GR 287	89.	5.	5.	0300	4075	SCATTERING POINTS
SPP - GR 287	89.	5.	5.	0400	2803	SCATTERING POINTS
SPP - GR 288	89.	5.	5.	0500	4000	SCATTERING POINTS
SPP - GR 288	89.	5.	5.	0600	2484	SCATTERING POINTS
SPP - GR 289	89.	5.	5.	0700	2755	SCATTERING POINTS
SPP - GR 289	89.	5.	5.	0800	5911	SCATTERING POINTS
SPP - GR 290	89.	5.	5.	0900	5870	SCATTERING POINTS
SPP - GR 290	89.	5.	5.	1000	6867	SCATTERING POINTS
SPP - GR 291	89.	5.	5.	1100	3528	SCATTERING POINTS
SPP - GR 292	89.	5.	5.	1200	1467	SCATTERING POINTS
SPP - GR 292	89.	5.	5.	1300	7820	SCATTERING POINTS
SPP - GR 293	89.	5.	5.	1400	3229	SCATTERING POINTS
SPP - GR 293	89.	5.	5.	1500	3388	SCATTERING POINTS
SPP - GR 294	89.	5.	5.	1600	4872	SCATTERING POINTS
SPP - GR 294	89.	5.	5.	1700	3182	SCATTERING POINTS
SPP - GR 295	89.	5.	5.	1800	6839	SCATTERING POINTS
SPP - GR 295	89.	5.	5.	1900	7009	SCATTERING POINTS
SPP - GR 296	89.	5.	5.	2000	2387	SCATTERING POINTS
SPP - GR 296	89.	5.	5.	2100	2408	SCATTERING POINTS
SPP - GR 297	89.	5.	5.	2200	4236	SCATTERING POINTS
SPP - GR 297	89.	5.	5.	2300	5798	SCATTERING POINTS
SPP - GR 298	89.	5.	6.	0000	7668	SCATTERING POINTS
SPP - GR 298	89.	5.	6.	0100	5067	SCATTERING POINTS
SPP - GR 299	89.	5.	6.	0200	3296	SCATTERING POINTS
SPP - GR 299	89.	5.	6.	0300	4678	SCATTERING POINTS
SPP - GR 300	89.	5.	6.	0400	11144	SCATTERING POINTS
SPP - GR 300	89.	5.	6.	0500	6825	SCATTERING POINTS

SPP - GR 301	89	5	6.	0600	18295	SCATTERING POINTS
SPP - GR 301	89	5	6	0700	7881	SCATTERING POINTS
SPP - GR 302	89.	5.	6.	0600	10105	SCATTERING POINTS
SPP - GR 302	89	5	6	0900	10130	SCATTERING POINTS
SPP - GR 303	89	5	6	1000	1427	SCATTERING POINTS
SPP - GR 303	89	5	6	1100	917	SCATTERING POINTS
SPP - GR 304	89	5	6	1200	4464	SCATTERING POINTS
SPP - GR 304	89	5	6	1300	4165	SCATTERING POINTS
SPP - GR 305	89	5	6	1400	5519	SCATTERING POINTS
SPP - GR 305	89	5	6	1500	6018	SCATTERING POINTS
SPP - GR 306	89.	5	6.	1600	6028	SCATTERING POINTS
SPP - GR 306	89.	5	6.	1700	6395	SCATTERING POINTS
SPP - GR 307	89.	5.	6.	1800	5639	SCATTERING POINTS
SPP - GR 307	89.	5.	6.	1900	9355	SCATTERING POINTS
SPP - GR 308	89.	5.	6.	2000	7113	SCATTERING POINTS
SPP - GR 308	89.	5.	6.	2100	3388	SCATTERING POINTS
SPP - GR 309	89.	5.	6.	2200	6611	SCATTERING POINTS
SPP - GR 309	89.	5.	6.	2300	5374	SCATTERING POINTS
SPP - GR 310	89.	5.	7.	0000	2932	SCATTERING POINTS
SPP - GR 310	89.	5.	7.	0100	4267	SCATTERING POINTS
SPP - GR 311	89.	5.	7.	0200	4537	SCATTERING POINTS
SPP - GR 311	89.	5.	7.	0300	4099	SCATTERING POINTS
SPP - GR 312	89.	5.	7.	0400	4326	SCATTERING POINTS
SPP - GR 312	89.	5.	7.	0500	3232	SCATTERING POINTS
SPP - GR 313	89.	5.	7.	0600	4964	SCATTERING POINTS
SPP - GR 313	89.	5.	7.	0700	5256	SCATTERING POINTS
SPP - GR 314	89.	5.	7.	0800	6073	SCATTERING POINTS
SPP - GR 314	89.	5.	7.	0900	11023	SCATTERING POINTS
SPP - GR 315	89.	5.	7.	1000	9978	SCATTERING POINTS
SPP - GR 315	89.	5.	7.	1100	8169	SCATTERING POINTS
SPP - GR 316	89.	5.	7.	1200	8321	SCATTERING POINTS
SPP - GR 316	89.	5.	7.	1300	11472	SCATTERING POINTS
SPP - GR 317	89.	5.	7.	1400	8636	SCATTERING POINTS
SPP - GR 317	89.	5.	7.	1500	7391	SCATTERING POINTS
SPP - GR 318	89.	5.	7.	1600	6701	SCATTERING POINTS
SPP - GR 318	89.	5.	7	1700	6309	SCATTERING POINTS
SPP - GR 319	89.	5.	7.	1800	4184	SCATTERING POINTS
SPP - GR 319	89.	5.	7.	1900	5511	SCATTERING POINTS
SPP - GR 320	89.	5.	7.	2000	1588	SCATTERING POINTS
SPP - GR 320	89.	5.	7.	2100	5026	SCATTERING POINTS
SPP - GR 321	89.	5.	7.	2200	3639	SCATTERING POINTS
SPP - GR 321	89	5.	7.	2300	3655	SCATTERING POINTS
SPP - GR 322	89.	5.	8.	0000	10926	SCATTERING POINTS
SPP - GR 322	89.	5.	8.	0100	5579	SCATTERING POINTS
SPP - GR 323	89.	5.	8.	0200	2079	SCATTERING POINTS
SPP - GR 323	89.	5.	8.	0300	3846	SCATTERING POINTS
SPP - GR 324	89.	5.	8.	0400	4082	SCATTERING POINTS
SPP - GR 324	89.	5.	8.	0500	3610	SCATTERING POINTS
SPP - GR 325	89.	5.	8.	0600	4551	SCATTERING POINTS
SPP - GR 325	89.	5.	8.	0700	5470	SCATTERING POINTS
SPP - GR 326	89.	5.	8.	0800	7715	SCATTERING POINTS
SPP - GR 326	89.	5.	8.	0900	12069	SCATTERING POINTS
SPP - GR 327	89.	5.	8.	1000	11089	SCATTERING POINTS
SPP - GR 328	89.	5.	8.	1200	10768	SCATTERING POINTS
SPP - GR 328	89.	5.	8.	1300	7909	SCATTERING POINTS
SPP - GR 329	89.	5.	8.	1400	5931	SCATTERING POINTS
SPP - GR 329	89.	5.	8.	1500	7599	SCATTERING POINTS
SPP - GR 330	89.	5.	8.	1600	5436	SCATTERING POINTS

SPP - GR 330	89	5.	8	1700	15183	SCATTERING POINTS
SPP - GR 331	89.	5.	8	1800	6390	SCATTERING POINTS
SPP - GR 332	89.	5.	8	1900	8455	SCATTERING POINTS
SPP - GR 332	89	5.	8.	2000	13600	SCATTERING POINTS
SPP - GR 333	89.	5.	8	2100	10171	SCATTERING POINTS
SPP - GR 333	89	5	8	2200	12110	SCATTERING POINTS
SPP - GR 334	89	5.	8	2300	7115	SCATTERING POINTS
SPP - GR 335	89	5.	9.	0000	17068	SCATTERING POINTS
SPP - GR 335	89.	5.	9.	0100	8490	SCATTERING POINTS
SPP - GR 336	89.	5	9.	0200	5021	SCATTERING POINTS
SPP - GR 336	89.	5.	9.	0300	6695	SCATTERING POINTS
SPP - GR 337	89.	5.	9.	0400	4885	SCATTERING POINTS
SPP - GR 337	89.	5.	9.	0500	5825	SCATTERING POINTS
SPP - GR 338	89.	5.	9.	0600	4973	SCATTERING POINTS
SPP - GR 339	89.	5.	9.	0700	5111	SCATTERING POINTS
SPP - GR 339	89.	5.	9.	0800	10634	SCATTERING POINTS
SPP - GR 340	89.	5.	9.	0900	10231	SCATTERING POINTS
SPP - GR 340	89.	5.	9.	1000	17392	SCATTERING POINTS
SPP - GR 341	89.	5.	9.	1100	10772	SCATTERING POINTS