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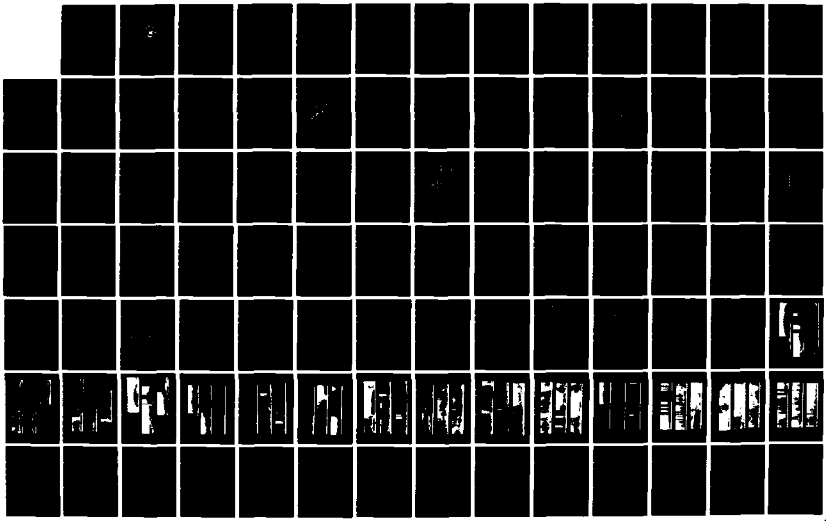

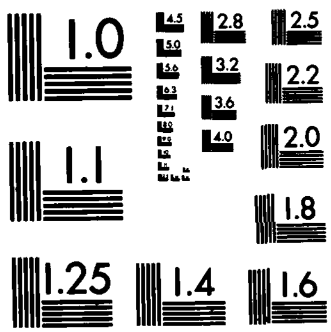

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NPS-61-82-007

NAVAL POSTGRADUATE SCHOOL

Monterey, California

CALIFORNIA COASTAL OFFSHORE TRANSPORT AND DIFFUSION EXPERIMENTS - METEOROLOGICAL CONDITIONS AND DATA

G. E. Schacher, D. E. Spiel, C. W. Fairall,
K. L. Davidson, C. A. Leonard
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Monterey, California

06 December 1982

Approved for public release: distribution unlimited

Prepared for:
Outer Continental Shelf Office
Minerals Management Service
Los Angeles, California 90017

NAVAL POSTGRADUATE SCHOOL
Monterey, California

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The work reported herein was supported in part by the Naval Ocean Systems Center, San Diego, California.

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REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER NPS 61-82-007	2. GOVT ACCESSION NO. AD-A123582	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) California Coastal Offshore Transport and Diffusion Experiment - Meteorological Conditions and Data		5. TYPE OF REPORT & PERIOD COVERED Technical Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) G.E. Schacher, D.E. Spiel[1], C.W. Fairall[1], K.L. Davidson, C.A. Leonard and C.H. Reheis[2]		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, CA 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 62759N; SF59551697 N6600182WR00017
11. CONTROLLING OFFICE NAME AND ADDRESS Outer Continental Shelf Office Minerals Management Service 1340 W. 6th St. Los Angeles, CA 90017		12. REPORT DATE 9/1/82
		13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release: distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

1. BDM Contract Employee   Contract Number ~~N00014-82-0-0251~~
2. ERCO, La Jolla, CA

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Overwater Transport
Coastal Meteorology
Marine Boundary Layer
Diffusion

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Four series of tracer experiments habe been performed to parameterize an overwater-coastal transport and diffusion model. The experiment were carried out in the winter and summer near Ventura, CA and Pismo Beach, CA. The tracer gas SF_6 was released from the research ship RV/Acania, which also collected and extensive amount of overwater meteorological data. This report contains descriptions of all experiments, the overwater meteorological data, and calculated meteorological parameters that are needed to characterize the transport and diffusion.

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Figures 12. Radiosonde profiles and mixed layer parameter profiles (potential temperature and water vapor mixing ratio) from RV/Acania releases. The figures are labeled: "12a or b (cruise number-date)". a is for the radiosonde data and b for the mixed layer parameters.

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I. Introduction

The Minerals Management Service (formeraly the Bureau of Land Management) has supported a series of experiments to obtain emperical data needed to parameterize EPA-approved, Gaussian and trajectory dispersion models for the California coastal regions. The model is to be used by Federal, state, and local regulatory agencies to assess the onshore impact of material released into the atmosphere in the outer continental shelf area as the result of the development of offshore oil and gas activities. Four experiments have been performed to date, two in the Santa Barbara Channel, near Ventura, and two in an open coastal area, near Pismo Beach. These sites were chosen to be representative of the types of areas encountered along the coast. Two studies were performed in each area so that both the winter and summer seasons could be examined.

The general scenario for the experiments was as follows: SF_6 gas was released within the outer continental shelf area, outside of 3 nautical miles (nmi) from shore. The plume location was determined by continuous analyzers in aircraft and ground vehicles, by grab samples from a boat and on land, and by stationary one-hour average samplers on land. The release ship was equipped with a complete set of meteorological instrumentation, including radiosondes, to determine overwater conditions. An aircraft performed soundings to obtain mean meteorological parameter profiles. Onshore instrumentation included fixed and tetroon borne sensors and a Doppler acoustic sounder for determining wind profiles.

Several contractors have been involved in these efforts. The Environmental Physics Group of the Naval Postgraduate School (NPS) operated the research ship RV/Acania and was responsible for the overwater meteorological data for all four experiments. The contractors involved in the tracer and onshore experiments are listed in the next section.

Some of the material included here also appears in previous reports.[1] The purpose of this report is to consilidate, in a single document, descriptions of all experiments. This report is divided into three parts: general descriptions, data reduction methods, and data and calculated parameters. No data obtained by other contractors is included here; contractor data reports are available.[2,3] Final documents on the results of the first two experiments are also available.[4,5,6]

II. General Descriptions

II-1. Participants

The experiments were performed in two phases. Phase I in the Santa Barbara Channel and Phase II in an open coastal location, as described in the introduction. For conformity with previous reports, we refer to the experiments of Phase I as BLM 1 and 2 and Phase II as BLM 3 and 4. The contractors for each of the phases, and their basic responsibilities, are listed in Table 1. The last experiment included more data collection than the first three. NPS contracted with ERCO to supply and operate continuous SF_6 analyzers to obtain additional overwater tracer data and the California Air Resources Board contracted with California Institute of Technology to obtain tracer data over a wide inland geographical area. These additional data will not be available in the reports of the BLM work.

Table 1. Participants in the BLM series of experiments and their responsibilities.

Responsibility	BLM 1 & 2	BLM 3 & 4
Research Ship	NPS	NPS
Tracer Gas Measurements	AV	SRI
Continuous Analyzers	ERCO	BNL
Onshore Meteorology	MRI	NAW
Aircraft	Atmospherics	Coastal Air

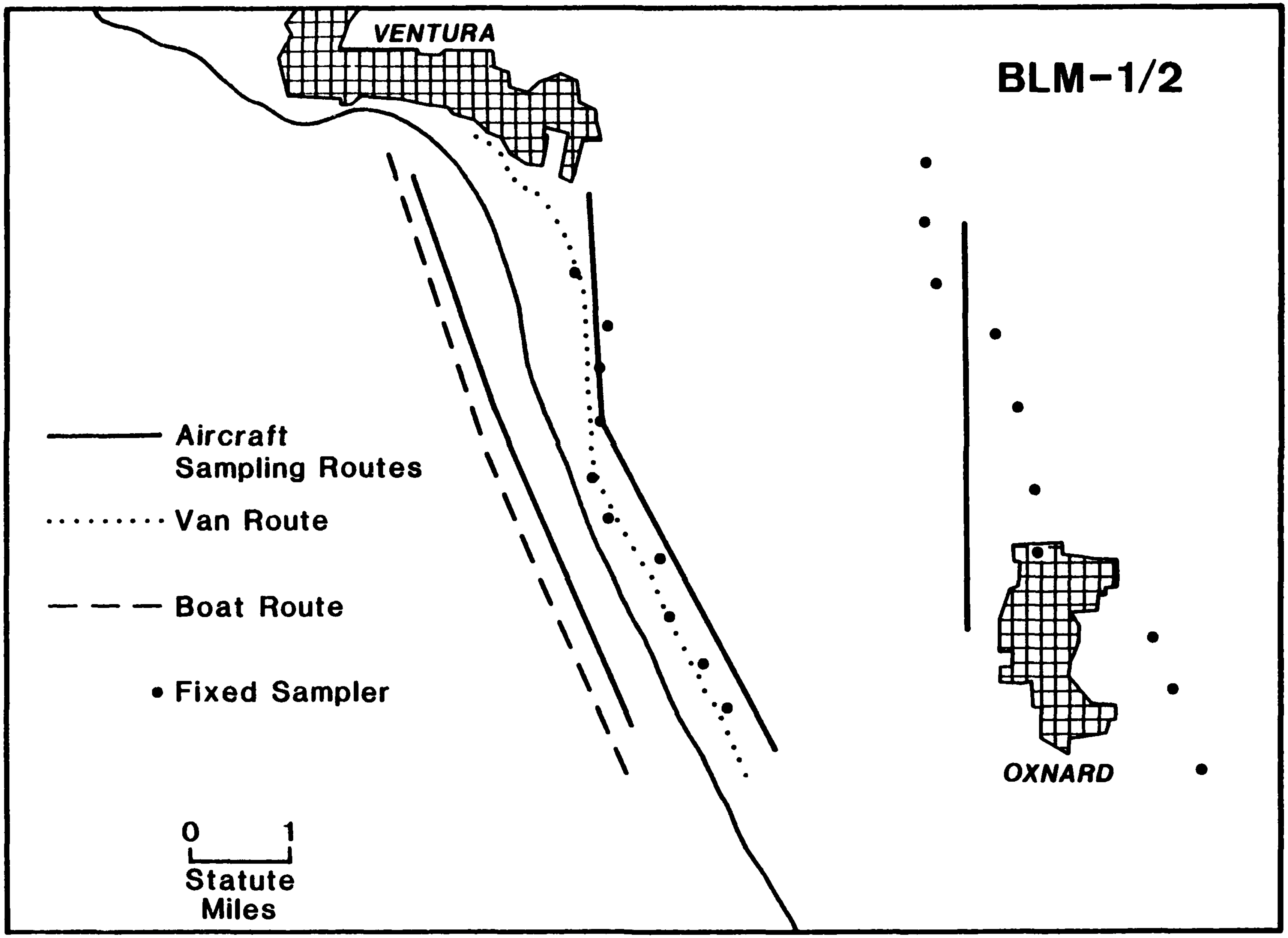
AV-AeroVironment, Inc.; SRI-Stanford Research International; ERCO-Energy Resources Co., Inc.; BNL-Brookhaven National Laboratory; MRI-Meteorology Research, Inc.; NAR-North American Weather Consultants.

II-2. Description of Experiments

Charts showing the locations of the ship, aircraft trajectories, and ground level sampling are in Figures 1 and 2. The scenarios for all experiments were similar, although during Phase I near Ventura the ship was approximately 5 nmi from shore, whereas during Phase II off Pismo Beach the distance was 3 nmi. During BLM-1 and 2 the SF_6 tracer gas was released through the exhaust of one of the ship's motor generator sets, which added some heat to the plume. During BLM-3 and 4 the release was at ambient temperature from a tube attached to the ship's radio mast.

The sequence of events on a sampling day was approximately as follows: Throughout the early morning the ship reported winds to the shore command station. These data and shore wind information were used for initial positioning of the ship. Continuous monitoring of the wind was done to determine when the sea breeze had become well established and to position the ship so that at the shoreline the plume would intersect the center of the fixed sampler array. The ship was anchored at a fixed position since movement of the ship during a release would introduce apparent meander to the plume, contaminating the test results. The tracer gas release usually occurred between 1100 and 1300 hours. Mobile sampling began about one-half hour after the start of the release. A complete experiment lasted 6-8 hours. The tracer gas was monitored continuously at the source to produce a constant flow rate.

For all experiments, an aircraft carrying a continuous SF_6 analyzer made near shorline transects of the plume at several elevations. The instrument provided readings of the instantaneous concentrations of SF_6 in the ambient air as a function of position and time. This allowed the plume dimensions to be defined in both the horizontal and vertical directions. Ground level transects were made by a similarly equipped van, operating at the shoreline and/or inland. Ground level plume concentrations were determined by placing fixed one-hour average collectors along one or more fixed arrays paralled to the shoreline. These samplers were placed close enough together so that several would be within the narrowest plume expected. The array was wide enough so that the plume would be within its extent even if considerable wander occurred. This necessitated the use of a large number of samplers.


BLM-1/2
VENTURA
OXNARD
Aircraft Sampling Routes
Van Route
Boat Route
Fixed Sampler
0
1
Statute Miles

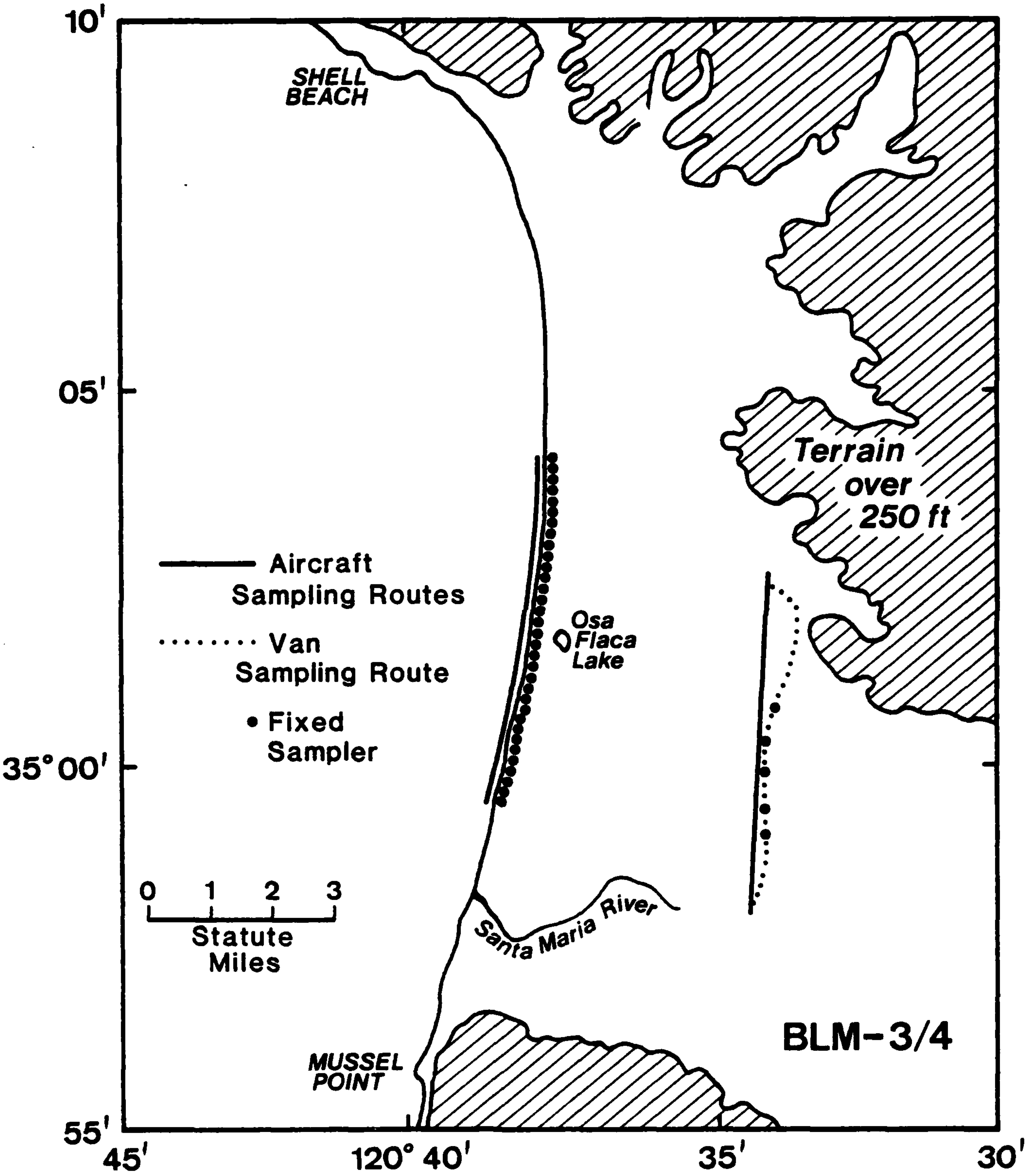

10'
05'
35°00'
55'
45'
120° 40'
35'
30'
SHELL BEACH
MUSSEL POINT
Terrain over 250 ft
Osa Flaca Lake
Santa Maria River
Aircraft Sampling Routes
Van Sampling Route
Fixed Sampler
0 1 2 3
Statute Miles
BLM-3/4

Figure [illegible]

II-3. Description of Localities

The test areas were chosen for two reasons: first, because they are representative of important types of coastal areas, and second, because both are candidates for new or increased outer continental shelf oil development. Thus, the areas afford the opportunity to investigate transport under differing meteorological conditions and also satisfy the needs for BLM modeling for regulatory purposes.

Charts of the geographical areas surrounding the two areas are shown in Figures 3 and 4. The Ventura chart, Figure 3, includes detailed topography because of the importance of the surrounding hills. The Pismo Beach chart only shows the location of prominant hills, which are located far from the experiment area.

In this section the general nature of the localities and the climatological behavior are described in order to outline the expected meteorological conditions.[7] The following section is a description of the synoptic and local conditions during the experiments. The purpose of this description is to delineate the meteorological framework for the tests so that the results can be more easily related to other work and applied to differing conditions off the California coast.

A. Ventura (Phase I)

Ventura lies within the Los Angeles Bight, an embayment formed by the Santa Barbara Channel, Santa Monica Bay, and the Gulf of Santa Catalina. Pt. Conception, the surrounding hills, and the Channel Islands strongly affect the local flow and produce local conditions controlled by the interplay of numerous local influences and mesoscale features which are typical of the general coastal area. The air flow in this are is quite different than over the majority of the California coast where an air mass reaches the shore after a long over-water fetch.

The test area was a portion of the Oxnard plain, which is approximately 20 miles long, and extends 5 to 10 miles inland from the beach. The plain is surrounded by hills with peaks two to three thousand feet high. Immediately to the north the coastline runs in a generally east-west direction to Pt. Conception, which is approximately 50 miles away. The geographic features cause many effects, the major ones are as follows:

1. The mountains to the north act as a partial barrier to the normal movement of air from the northwest.
2. These mountains and the east-west orientation of the shore turn the wind to a westerly direction and produce a complex pattern of eddies.
3. Inland hills and the Channel Islands tend to steer the flow, yielding complex trajectories. Winds inside and outside the Channel Islands are different.
4. The surrounding high hills contain the cool, moist marine air. Only infrequent, strong, synoptic air mass changes displace the marine air.
5. Due to nighttime downslope drainage from the surrounding hills, the diurnal land-sea breeze cycle is very strong, being enhanced by the local topography.

B. Pismo Beach (Phase II)

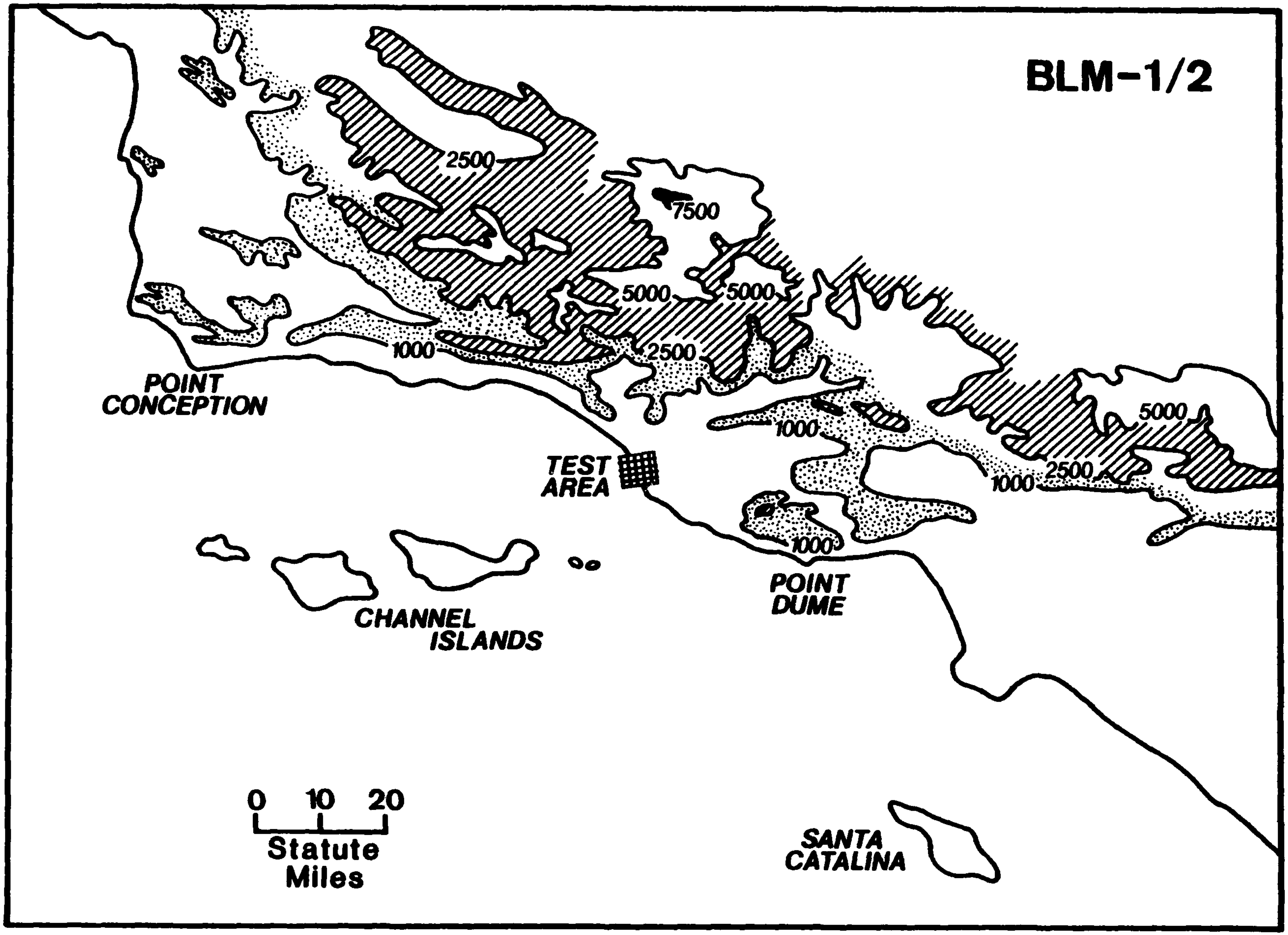
Pismo Beach is approximately 50 miles north of Pt. Conception, in a fairly open coastal area. Pt. Buchon, with 1000 to 2000 foot hills, lies immediately to the north, projecting some 5 miles out to sea. The point influences the local flow somewhat but the influence appears to be slight. The immediate inland hills are low giving a weaker land-sea breeze cycle than near Ventura. The experiments were carried out at the mouth of the Santa Maria valley, which steers the local flow slightly. The entrance to the valley at the beach is approximately 8 miles wide and the immediate hills on each side of the valley are only one to two hundred feet high, so their effect is small. The area is representative of an open California region where air mass movement is controlled by the synoptic pressure gradient, giving predominantly northwest flow with a long over-water fetch, and by the land-sea breeze cycle.

C. California Coast Seasonal Climatology

The synoptic climatology is the same for the two test areas and will be presented here. Also included are historical wind data for the two areas, which include local influences and are site specific.

Summer

The North Pacific semipermanent subtropical high lies to the west of the area and controls the synoptic scale flow. Clockwise flow around the high produces northwesterlies along much of the coast, with the local sea-breeze turning the wind more westerly.



BLM-1/2
2500
7500
5000
5000
2500
1000
1000
5000
2500
1000
1000
POINT CONCEPTION
TEST AREA
POINT DUME
CHANNEL ISLANDS
0 10 20
Statute Miles
SANTA CATALINA

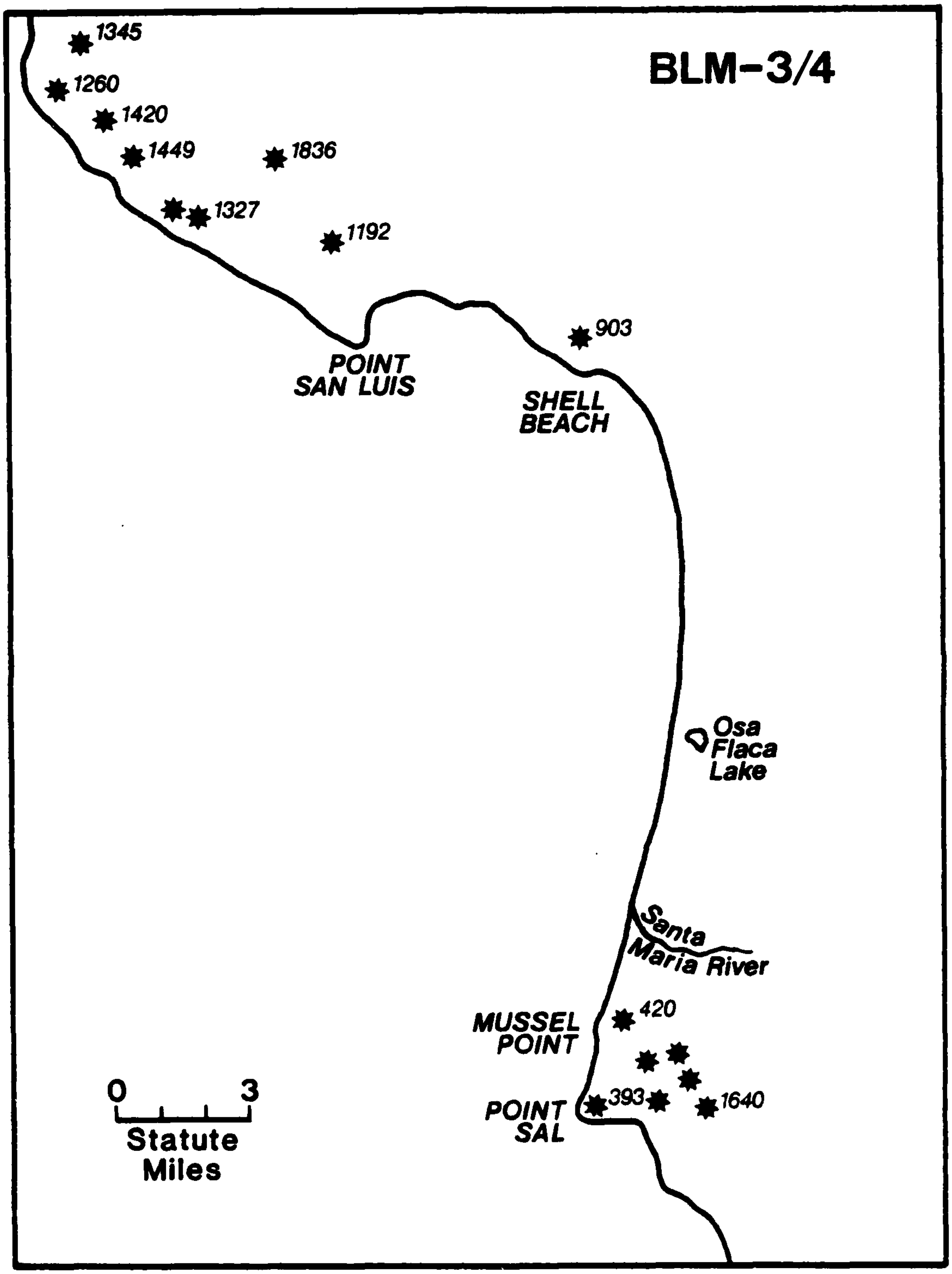

BLM-3/4
1345
1260
1420
1449
1836
1327
1192
903
POINT SAN LUIS
SHELL BEACH
Osa Flaca Lake
Santa Maria River
MUSSEL POINT
420
393
1640
POINT SAL
0 3
Statute Miles

Figure 2

The general onshore flow is aided by the inland thermal trough which is created by overland heating. Strong subsidence creates the prevalent capping inversion and the occasional passage of weak upper level troughs will dissipate or lift the inversion for periods of 12-24 hours.

Fall

The building of high pressure in the Great Basin causes frequent Santa Ana conditions. The pattern of storms and upper level westerlies moves further south breaking up the summer pattern. Frontal passage becomes more frequent and the subtropical high becomes displaced or shrinks, resulting in a break up of the marine inversion.

Winter

Frontal passage becomes much more frequent and strong surface westerlies often follow the passage. Santa Ana winds can still occur when the surface pressure in the Great Basin becomes sufficiently high. Also, the Pacific High and capping inversion can reform between frontal passage occurrences.

Spring

As the storm pattern moves north, the Pacific High again becomes the dominant feature. Cold lows pass frequently, followed by strong westerlies.

D. Wind Climatology

Wind climatologies are useful in determining expected conditions and for assessing whether observed conditions are typical. It is not possible to use the climatology to accurately predict local conditions on a day by day basis but seasonal patterns are quite reproduceable. In coastal areas, conditions differ from location to location so that site specific climatologies are needed.

Climatological data are presented for Pt. Mugu, CA[7] and Vandenberg Air Force Base, CA[8], which are near Ventura and Pismo Beach, respectively. Pt. Mugu and Ventura are close geographically, while Vandenberg is approximately 20 miles from the Pismo Beach experiment area. No closer coastal climatology is available. Both data sets were obtained at meteorological stations which are two to three miles inland. The data from Pt. Mugu is much more extensive due to the support needed for the Pacific Missile Range, as is reflected in the data included here.

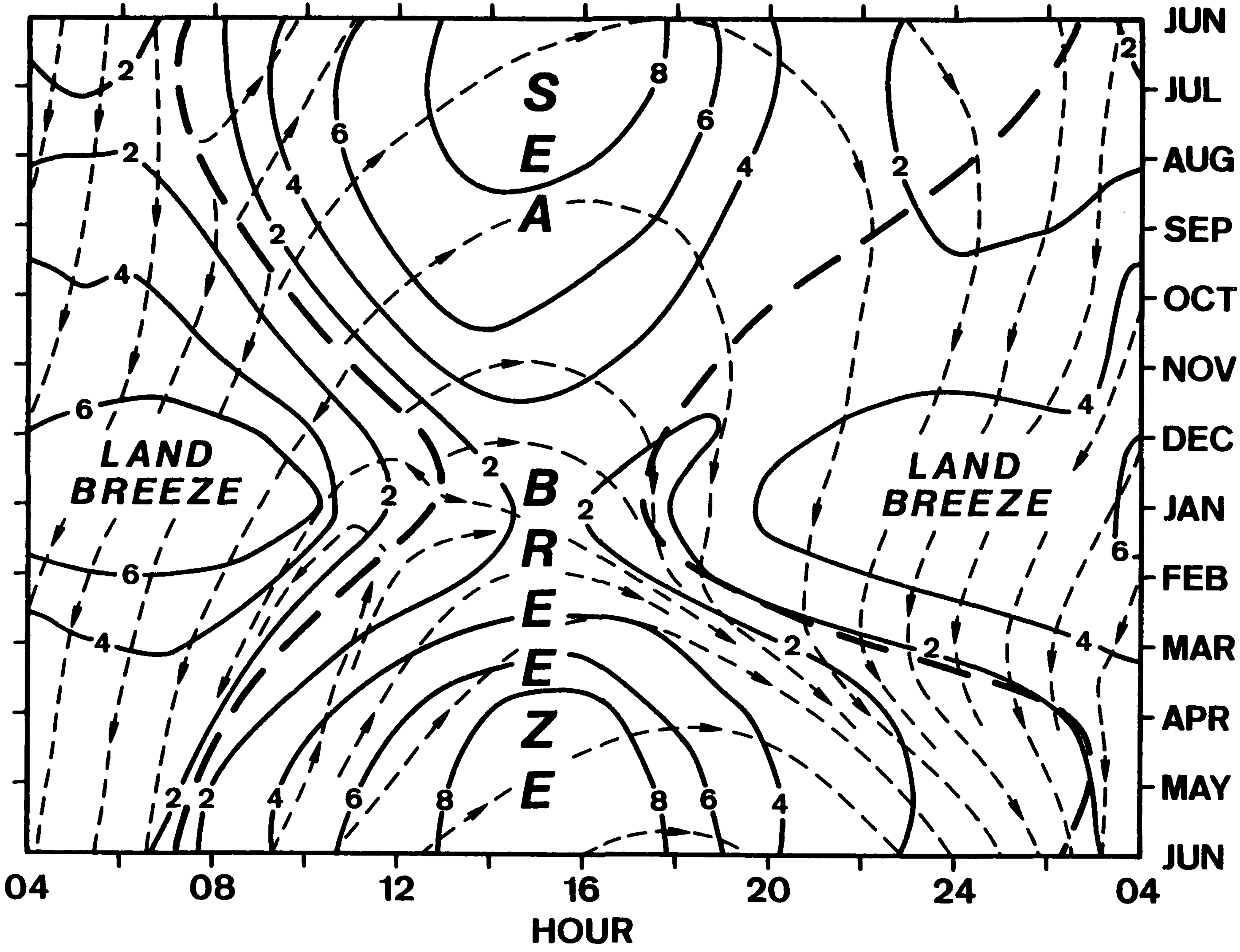
Monthly wind averages for Pt. Mugu, including the number of days of occurrence of Santa Ana conditions are presented in Table 2. Santa Ana conditions are widespread so that this data would be approximately correct for Vandenberg also.

Table 2. Monthly averages of the most frequently observed wind direction, percent of time the wind speed is greater than 21 knots, and the number of days of Santa Ana winds per month. The maximum number is the maximum observed over a ten year period.

	Most Frequent				Santa Ana Occurance	
		Wind		% greater	Average	Maximum
Month	Direction	Speed	%	than 21 knots	No. days	No. days
JAN	NE	10	15.5	2.3	9.3	16
FEB	W	9	12.3	1.8	5.2	12
MAR	W	10	18.3	1.1	2.8	8
APR	W	10	26.7	1.4	0.6	2
MAY	W	9	28.7	0.3	0.3	2
JUN	W	8	27.5	0.0	0	1
JUL	W	7	25.2	0.0	0	0
AUG	W	8	23.6	0.0	0	0
SEP	W	7	19.5	0.1	0.4	4
OCT	W	7	16.3	0.5	2.7	8
NOV	NE	7	12.1	1.0	7.0	19
DEC	N	5	12.8	1.4	9.3	18

Average prevailing winds for Pt. Mugu as a function of time of day and time of year are shown in Figure 5. The dashed lines show wind direction, where a vector from top to bottom on the page indicates a north wind. The solid lines are wind speed isopleths, while the heavy dashed lines approximately divide the land and sea breeze regimes.

Surface wind roses for each month for Pt Mugu are shown in Figure 6 and for three month periods for Vandenberg in Figure 7. Wind speed is indicated by the width of each "vector", wind direction by the angle, and frequency of occurrence by the length. The numbers in each wind rose circle are the percent of the time the wind is ≤ 3 knots. The wind speed averages for Vandenberg are always less than 10 knots, which is not the case for Pt. Mugu. The wind roses for Pt. Mugu contain more information since each monthly average direction shows not just the cumulative average for the month (toPal length of the vector) but also the fractional occurrence for each wind speed category (fractional lengths of the segments of each vector).


SEA BREEZE
LAND BREEZE
LAND BREEZE
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
04
08
12
16
20
24
04
HOUR

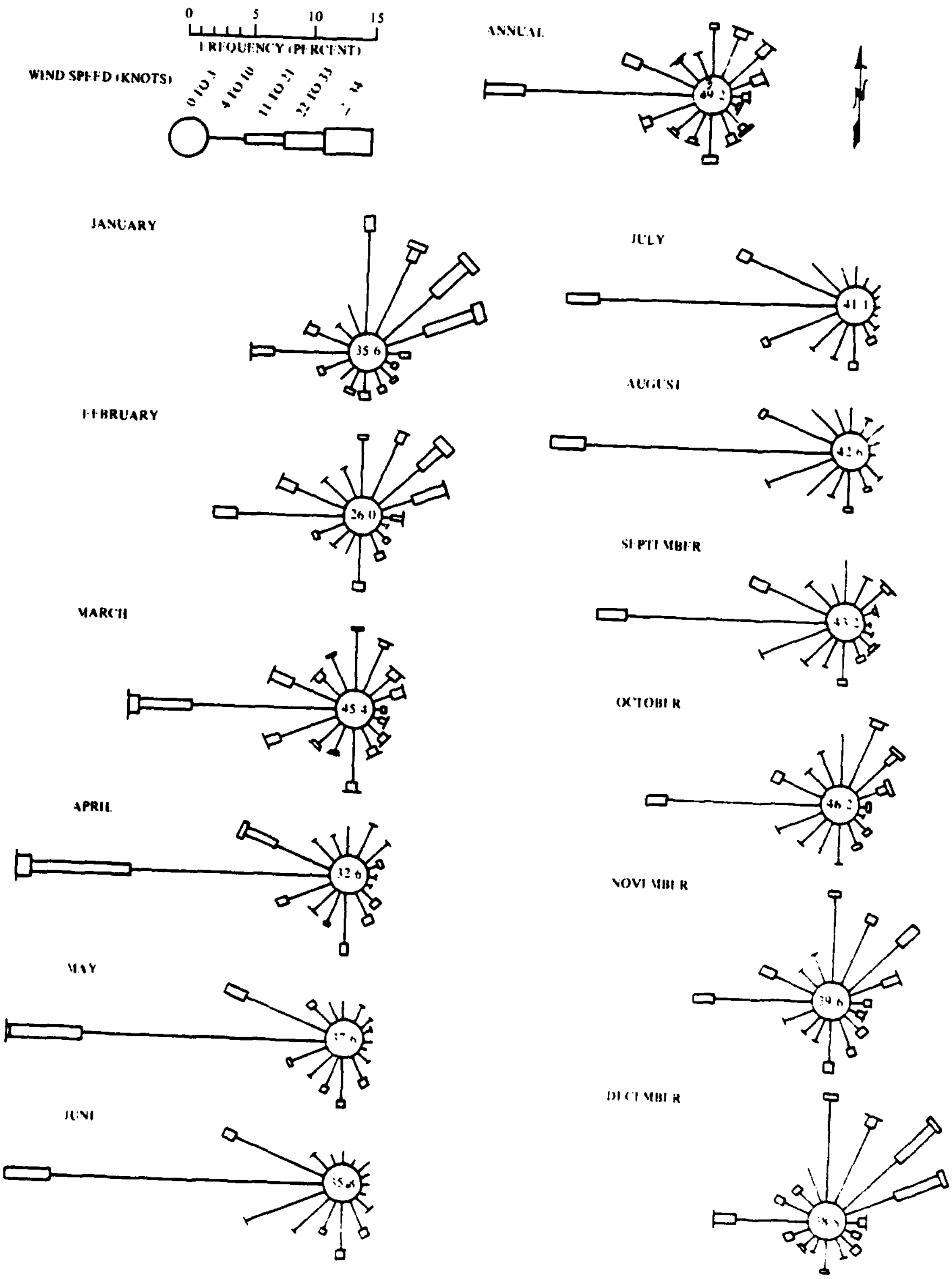
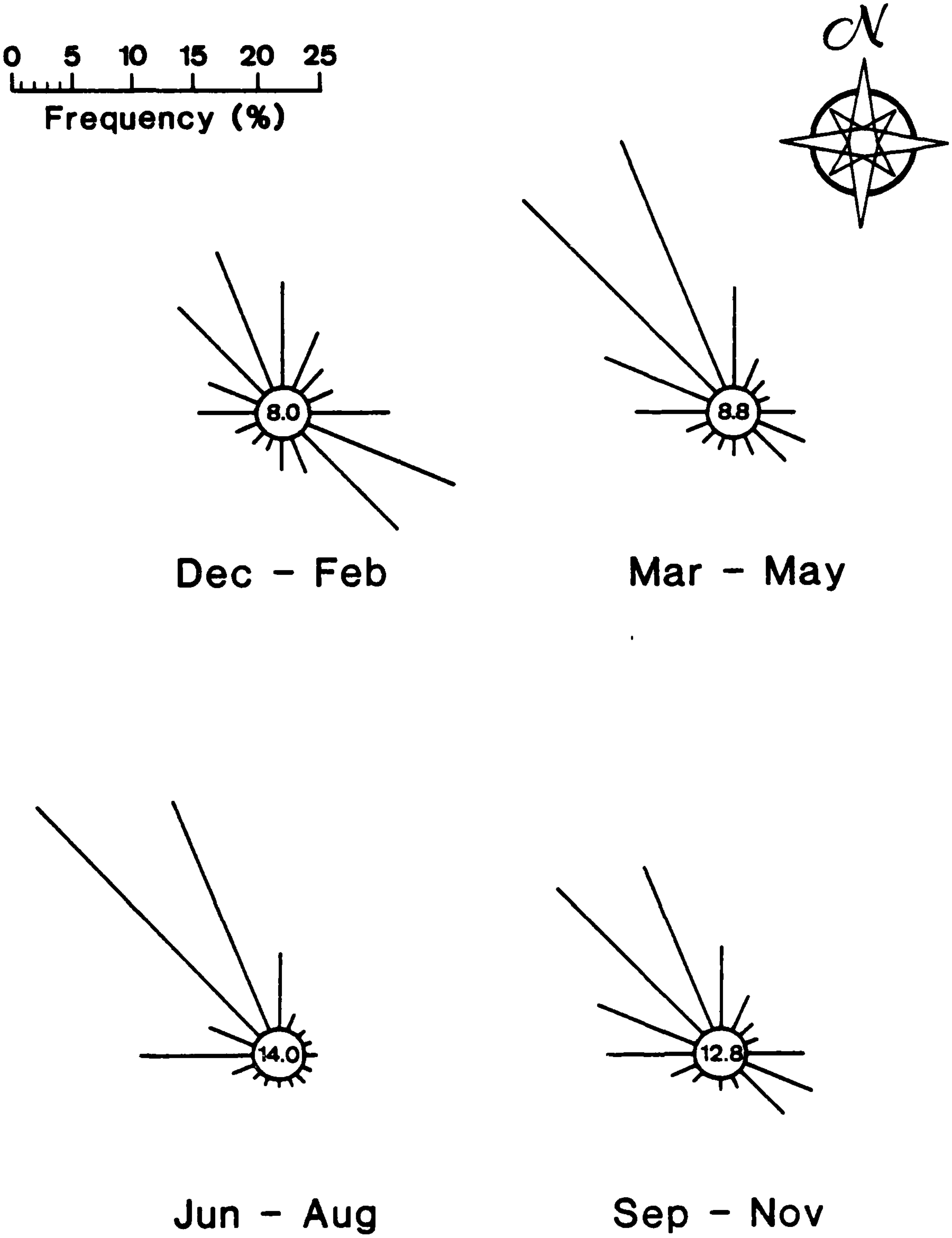

0
5
10
15
FREQUENCY (PERCENT)
WIND SPEED (KNOTS)
0 TO 3
4 TO 10
11 TO 21
22 TO 33
ANNUAL
JANUARY
35.6
FEBRUARY
26.0
MARCH
45.4
APRIL
32.6
MAY
JUNE
JULY
41.1
AUGUST
42.6
SEPTEMBER
OCTOBER
46.2
NOVEMBER
29.6
DECEMBER

Figure 4


0 5 10 15 20 25
Frequency (%)
N
8.0
8.8
Dec - Feb
Mar - May
14.0
12.8
Jun - Aug
Sep - Nov

II-4. Test Periods Weather Description

The following is a description of the synoptic and local conditions during the four test periods. The synoptic conditions are derived from the daily weather maps, weekly series, published by the National Oceanic and Atmospheric Administration. The description of local conditions is based on the overwater meteorological data obtained on the RV/Acania. The data are presented in later sections.

A. Synoptic Descriptions

BLM-1 (September 1980)

General Comments: The whole period was dominated by the Pacific high. All frontal activity was to the north of California. The thermal low over Mexico was not strong enough to produce a dominant onshore flow. The surface pressure gradients in the coastal region were weak, so that the local flow was dominated by the diurnal land-sea breeze cycle. Low subsidence inversions were present under the dominant high pressure. Weak Santa Ana conditions can occur under these conditions.

9/22: Surface highs were centered over the Northwest and Wyoming, and pressure gradients in the western U.S. were weak. Strong onshore flow was not expected.

9/23: Surface highs were located over Colorado. Pressure gradients were even weaker.

9/24: Surface highs were moving in off the Canadian coast. A weak upper level ridge was forming in the same area and a weak trough forming over north central U.S. Surface gradients were increasing off the California coast, causing weak onshore flow.

9/25: Surface highs were located over the northern portion of the continent. The upper level ridge was strengthening, but only over the area north of California, and the trough over the central U.S. was strengthening. Only very weak surface gradients existed in the coastal region.

9/26: A surface low was on the Washington coast and a very large high was situated over the Midwest. The upper level ridge over western Canada was strong but did not extend south to California; the trough was moving to the East coast. The gradients were somewhat higher, with weak onshore flow expected.

9/27: The situation was much the same as on 9/26 with additional highs over the northern U.S. and a weak front moving in off Washington.

9/28: The pattern continued with the addition of a weak frontal passage north of San Francisco and some trailing precipitation.

9/29: A large surface high was centered over Idaho and Nevada. The upper level north-south ridge moved east to extend from Canada into Montana. Location of the high caused weak Santa Ana conditions.

9/30: The thermal low over nothwestern Mexico weakened, essentially disappearing. The whole of the western U.S. was dominated by surface high pressure.

BLM-2 (January 1981)

The weather patterns for BLM-2 and BLM-1 were similar and general comments will suffice to describe the situation. The

Pacific high was unusually strong producing a mini-drought for what is normally the beginning of the rainy season for California. Frontal passages were again far to the north. There was no well established onshore flow regime except for a short period during 1/12-1/13 when the surface gradient in the Southern California area increased. As before, the land-sea breeze cycle would dominate, however, fairly persistent highs over the inland western U.S. strengthened the offshore flow so that periods of sea breeze were shortened.

BLM-3 (December 1981)

General Comments: Synoptic scale features and associated West Coast flow patterns were typical for this time of the year. An upper air North-South ridgeline over the western states was the dominant feature and led to generally weak surface pressure gradients off the southern California coast. The Mexican thermal low and afternoon sea breeze determined the flow associated with the ridge's presence. Also typical for the time of year was the passage of a fast moving upper wave, and associated precipitation and moderate northwest winds. Another wave was approaching at the end of the period. More detailed descriptions of the synoptic scale features and resulting coastal flow pattern follows.

On 7 December a 500 mb ridgeline extended North-South from eastern British Columbia to southern California. It had a slow eastward progression in advance of an approaching upper level trough extending southward from a closed low centered over the Gulf of Alaska. Coastal winds on 8 December were easterly during most of the day due to the unusual location of the Mexican thermal trough. Light westerly winds occurred from 1000 to 1600 in conjunction with the local sea-breeze.

The approaching upper level trough crossed the west coast on 10 December and a surface front passed the experimental area late on the same day. An extensive precipitation area existed along the west coast from Southern California to Washington state. Coastal winds progressed from southerly on 9 December to northerly on 10 December with the frontal passage. The northerly gradient flow behind the front combined with the afternoon sea breeze led to a maximum onshore wind of 15 kts during the afternoon of 11 December.

A weak north-south ridgeline re-established over the West Coast on 11 December and existed through 14 December. A fast moving upper level short wave (trough) moved through the weak ridge and crossed the West Coast in the vicinity of northern Washington on 15 December. The associated surface front reached northern California but did not affect the experimental area. During the 12 to 16 December period the coastal wind directions and speeds exhibited flow associated with a Mexican thermal trough and the afternoon sea breeze. The winds were east to northeast except for the afternoon (1100-2400) when onshore flow (northwest) occurred with speeds of 10-15 kts.

The upper level ridge intensified on 16 December and the associated large surface high region extended from eastern British Columbia to Nevada. The increased gradient on the western side of the surface high led to general easterly winds on 17 December with no discernable influence from the sea-breeze effects.

BLM-4 (June 1982)

The synpotic scale conditions and resulting precipitation and coastal wind regimes were atypical for the early summer season. The Mexican thermal trough should dominate this region, with resulting light coastal winds influenced by the sea-breeze during this period. Two upper level troughs passed over the west coast during the period. The first (22 June) was a fast moving short wave and the second (28-30 June) was a deep system associated with a closed low at 500 mb, which became nearly stationary over central California. Both systems had considerable north-south extent which led to the southern California surface pressure patterns reflecting their passage. This resulted in a greater than normal offshore pressure gradient and a fairly steady onshore wind, lacking the usual strong land-sea breeze cycle. Hence, strong onshore winds occurred.

During the 21-23 June period, an upper level trough was moving from off the west coast into the mountain states. A surface trough extended from western British Columbia into northern California which was an intensification of the northern extension of the Mexican thermal trough.

During the 24-26 June period, a more intense upper level trough was developing off the west coast. A surface trough line extended from upper Mexico to Washington and the offshore pressure gradient was moderate. By 25 June, a closed 500 mb low had formed west of the Oregon-Washington coastline. The trough and low intensified as they progressed slowly eastward. Precipitation was observed along the northern California coast on both 25 and 26

June and a cold front existed over northern California on 26 June.

During the 27 June - 1 July period, the upper level trough and closed low moved across the west coast. The closed low moved south-eastward and was centered over central California on 30 June. Widespread precipitation occurred over the central and northern California coastal regions on 27 and 28 June and extended southward into the experimental area during the 29-30 June period. A closed surface low and associated frontal systems formed over northern Utah on 28 June. Because of the offshore pressure gradient, winds remained southwest to northwest during this period. They were maximum on 27 June (15-20 kts) and decreased gradually, to a 5-10 kts range, on the remaining days as the above systems moved across the coast and inland.

II-5. RV/Acania Equipment

The Acania not only served as the platform for the offshore release of the SF_6 tracer gas, but also provided continuous measurement of several critical meteorological parameters. These measurements were performend to document atmospheric transport and stability conditions of the overwater boundary layer during each test day. The basic meteorological and data acquisition equipment has been the same for all four of the experiments. However, as with most experimental programs new equipment has been added for special purposes as the work progressed. The following sections describe all of the equipment that has been used, and indicate with special notations those components which were not used throughout..

A. Sensors and Their Locations

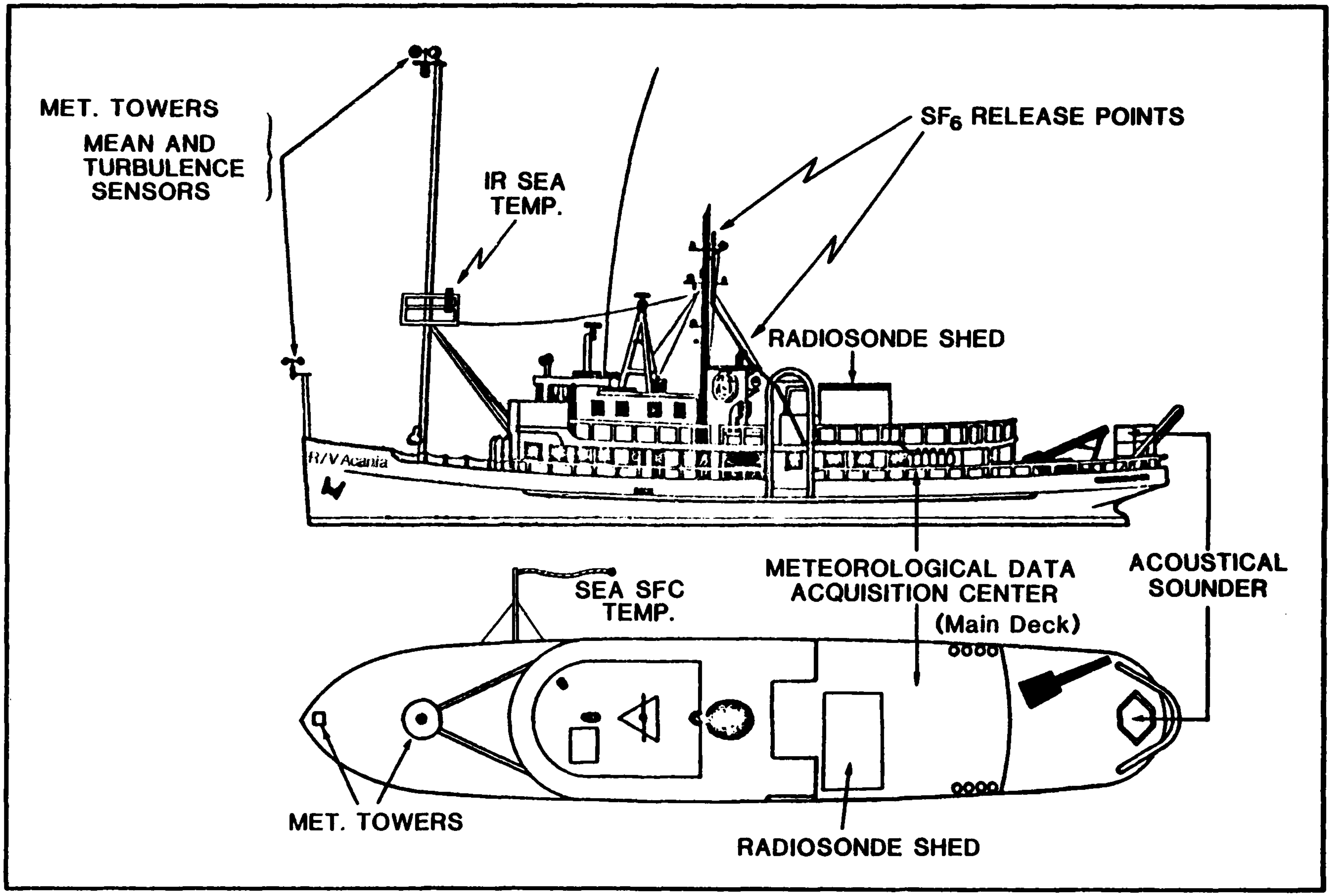
A complete set of meteorological equipment is used on the ship when it is outfitted for atmospheric research. The purpose is to obtain as complete a characterization of the atmospheric boundary layer (BL) as possible. Data of this type is needed for BL modeling in which the Environmental Physics Group is engaged, including transport and dispersion modeling. Basically, what is needed is a determination of the dynamic and mean parameters from the surface to the top of the BL, which is often defined by a temperature inversion. For the purposes of the work described here, the dynamics of the layer are especially important because they are the driving mechanism behind dispersion, and mean properties are needed in order to parameterize models in terms of readily measured quantities.

A side view of the RV/Acania with the locations of the meteorological sensors is shown in Figure 8. The ship has two masts, located on the bow, dedicated to the sensors. The foreward mast is on the tip of the bow and the sensors located there are at a height of 7m above the mean water level; the second mast is 5m behind the bow with sensors at 20.5m above the mean water level. This mast telescopes down to a personnel platform so that the sensors can be made easily accessible. The platform also holds sensors that do not need to be elevated (aerosol and IR sensors).

The ship is approximately 40m long, 7m wide, and only 7m high (9m at the ship's stack). The low profile and narrowness of the ship cause minimal disturbance to the air flow, making it ideal for overwater atmospheric research. The sensors on the high mast are well above any significant ship influence but there is some distortion of the flow at the elevation of the foreward mast. For this reason only data from the upper station are used in subsequent data analysis. Lower mast sensors are used as a backup in the event of an upper sensor failure.

A summary of the monitoring equipment and associate meteorological parameters measure is given in Table 2. Details of the various pieces of equipment can be found in a previous report.[9] The Mini-Ranger and the Ultrasonic Anemometer are new to the BLM-4 experiment and are described below.

The Mini-Ranger is a microwave transceiver-transponder system that is used for accurate positioning of the ship. The transceiver is on the ship and two transponders are on the shore (approximately 3 km apart for BLM-4). The transceiver sends a



MET. TOWERS
MEAN AND TURBULENCE SENSORS
IR SEA TEMP.
SF6 RELEASE POINTS
RADIOSONDE SHED
R/V Acania
METEOROLOGICAL DATA ACQUISITION CENTER (Main Deck)
ACOUSTICAL SOUNDER
SEA SFC TEMP.
MET. TOWERS
RADIOSONDE SHED

coded pulse, the transponder that recognizes the code sends a return pulse, and upon receiving the return pulse the transceiver signal processing determines the elapsed time and, hence, the distance to that transponder. Using two transponders and triangulation, the ship's position can be located to within 2m. In order to obtain this accuracy it is necessary to accurately measure the baseline between the two transponders. This measurement was made with a radar ranger to an accuracy of $\pm$ 10 cm It must be noted here that this system located the ship with respect to the transponders, not the exact geographic location. No attempt was made to reference the transponders locations to a known benchmark.

The sonic anemometer measures the time of flight of a pulse of sound along three directions, two in the horizontal and one vertical. Because the sound propagates through the local air mass, the times of flight can be resolved to determine the wind vector. The system has a transmitter/receiver spacing of 20 cm, a speed resolution of 2 cm/sec, and samples at 440 times/sec. Thus, the system is sensitive to both the wind speed and wind fluctuations well into the inertial subrange. Orientation of the unit is critical, so corrections must be made for both ship orientation and rate of change of orientation. We assume that purely vertical and transverse ship motions and rate of change of yaw are negligible. Then it is possible to correct for ship motion by knowing its speed, roll, pitch, and roll and pitch rates. The angular orientations are sensed by pendulums located on the ship's roll and pitch axes.

Table 3. Meteorological measurements made aboard the RV/Acania and the equipment used.

Measurement	Equipment
Relative Wind Speed	MRI 1022 Wind System
Relative Wind Direction	"
Air Temperature (T)	100 Ohm Rosemount platinum resistor in a Gill aspirator
Dew Point Temperature (T_D)	General Eastern 1200 AP cooled mirror dew pointer, modified for 4 wire resistance
Sea Surface Temperature (T_S)	100 Ohm Rosemount platinum resistor and thermal balast in a floating tube and Barnes PRT-5 infrared radiometer (a)
Wind Speed Fluctuation (U')	TSI Constant Temperature Resistance Bridge and 60μ platinum coated quartz resistance probes
Three Axis Wind Velocity and Fluctuation (b)	Kaijo-Denki Ultrasonic Anemometer
Ship Roll and Roll Rate Ship Pitch and Pitch Rate (b)	Pendulums on the ship's pitch and roll axes
Inversion Height (Z_i)	Aerovironment 300 acoustic sounder
Temperature Profile Humidity Profile	Radiosonde
Ship Location	Loran C and Motorola Mini-Ranger III (b)
Aerosol Content (a)	Particle Measurement Systems Optical Counters
Cloud Cover and Weather Conditions	Weather observations

a) Not used on BLM-4
b) Used only on BLM-4

3. <u>Data Acquisition and Recording</u>

Four methods of data acquisition and recording are used: strip charts, analog tape recorders, computer controlled data acquisition and recording systems, and spectral analysis. (Direct digital tape recording of aerosol data is also used but those data are not important for this work.)

Strip chart recording is used only for the acoustic sounder, relative wind direction and speed, and the wind fluctuation signals from the hot films (TSI system). The internal strip chart is the only output available from the acoustic sounder. The other strip chart data are seldom used for analysis. These recordings are made because they provide an immediate check on shipboard conditions.

The analog tape recorder is essentially a back up instrument. Every signal that can be is recorded in this manner. The temperatures are measured by resistors, which cannot be readily analog recorded. If failure of the primary data acquisition equipment should occur, it is possible to retrieve the data by using this recording.

The central data acquisition components are the computer controlled data acquisition systems. Two are used: one dedicated to the ultrasonic anemometer and the ship motion sensors, the second devoted to obtaining meteorological data. A computer operates a scanner, voltmeter, and printer, and files data and calculated parameters on its internal cassette tape.

The basic procedure for acquiring data for a given time period and averaging using a computer and scanner is straightforward and will not be described here. We store only averaged data and calculated parameters to prevent using a large amount of computer memory and/or tape storage. All of the data and parameters are also printed at the end of an averaging period, providing a hard copy output and real time assessment of systems behavior.

The actual averaging used is somewhat complex since we need to obtain both short term averages for turbulence parameters and long term averages for mean parameters. We use 10 sec and one-half hour intervals for the averaging periods. A data acquisition cycle takes approximately 1 sec so that 10 readings are obtained for each short term average. All 10 sec averages are held in computer memory until the end of the one-half hour period, when they and the mean data are averaged for the period. Then both short and long-term averages are stored on tape and all long-term averages are printed.

True wind direction, corrected for ship's roll, and the true wind speed are obtained as short term averages from the meteorological data acquisition system. The ultrasonic anemometer outputs are processed to obtain short term averages of the three wind vectors, corrected for ship's pitch and roll.

Spectral analysis has two functions: to determine the power spectral density of turbulence signals and to detect and identify system noise which would invalidate results obtained by other acquisition methods. It is normally used on a regular basis only for the hot-film signals.

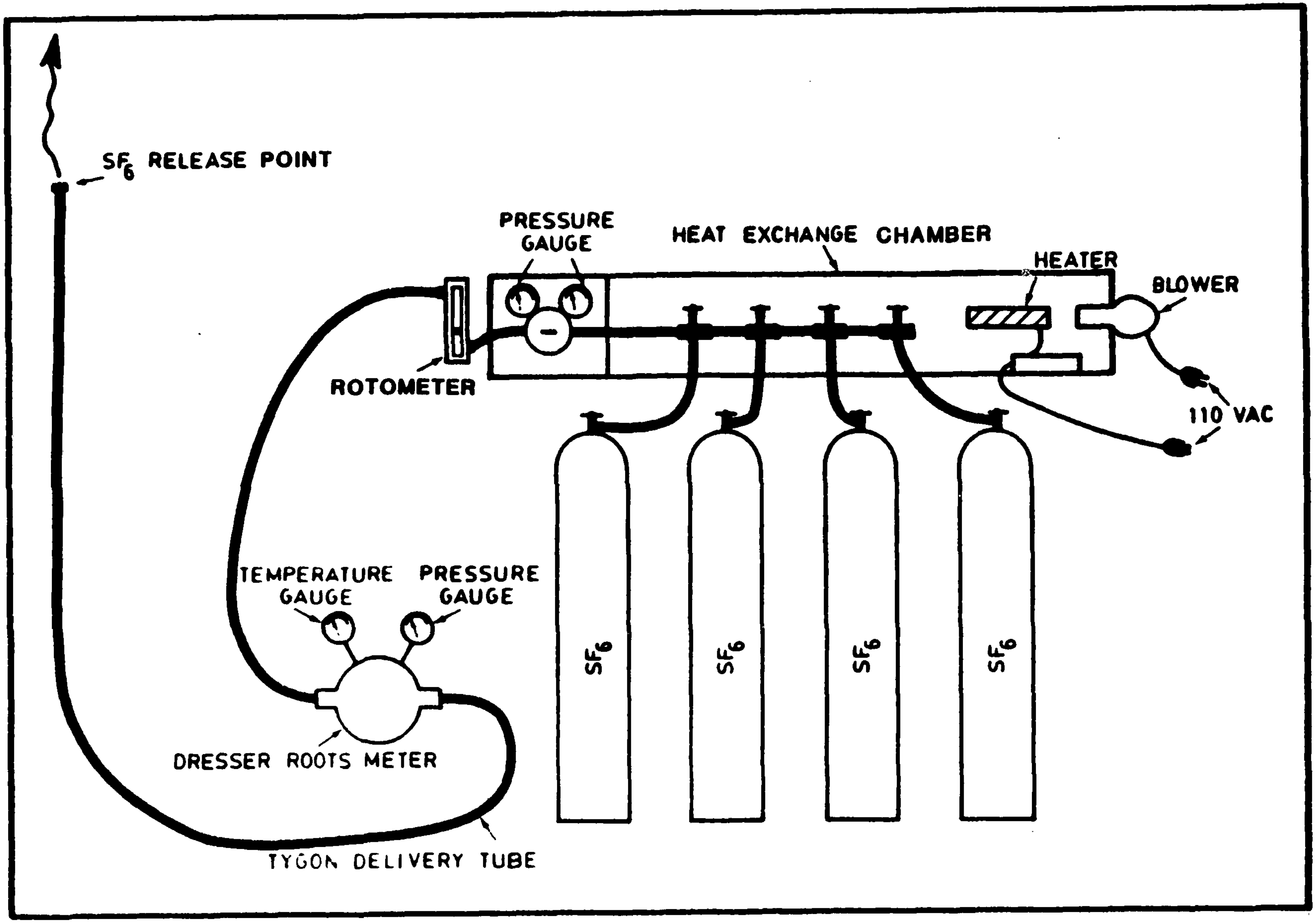
II-6. SF_6 Gas Release, Equipment and Rates

The SF_6 used in these experiments was contained, in liquid form, in pressurized cylinders. When it is released, expansion produces considerable cooling, which can make maintaining a constant flow difficult. For this reason, the gas is passed through a heated manifold, shown in Figure 6, to bring it to ambient temperature before the flow measurement and gas release. Heating the manifold is accomplished by blowing air over a Variac controlled heating element, and flowing that air over the manifold in a wooden enclosure. As many as four bottles can be connected to the manifold. The number of bottles used depends on the flow rate. Using more bottles decreases the expansion rate and the cooling.

The output from the manifold goes to a pressure regulator, a rotometer for coarse monitoring of the flow, and the flow measuring device. For BLM-1 and 2 the flow was measured by a calibrated rotometer supplied by AeroVironment, Inc.; for BLM-3 and 4, SRI used a Dresser Roots Meter.

During BLM-1 and 2 the gas was released through a ship's exhaust stack at 26'7" above the water. During BLM-3 and 4 the release was at 43' and 44'8" above the water respectively, with the gas at ambient temperature. The pertinent parameters to calculate plume rise for the cases of the gas released with the heated exhaust are given in Table 3.

The flow rates in Table 3 are determined from the weights of the gas bottles before and after a release and the elapsed time. The bottles were weighed by NPS before and after the start of a cruise (except for BLM-1, where weighing was also done in the



SF_6 RELEASE POINT
PRESSURE GAUGE
HEAT EXCHANGE CHAMBER
HEATER
BLOWER
ROTOMETER
110 VAC
TEMPERATURE GAUGE
PRESSURE GAUGE
SF_6
SF_6
SF_6
SF_6
DRESSER ROOTS METER
TYGON DELIVERY TUBE

middle of the cruise). Checks on bottle weights over a long period has shown that leakage while not in use is insignificant. Note that flow rates are not available for BLM-4. This was due to operator failure when performing the initial weighing for that cruise.

The flow rate determined from bottle weight is a useful quantity, and should perhaps be the absolute calibration for determining the total amount of gas released. The nominal release rate for BLM-1 and 2 and the first experiment of BLM-3; was 50 lbs/hr; all subsequent experiments used 25 lbs/hr. For BLM-1 and 2 the weight determined flow was somewhat less than the flowmeter value, which was reasonable considering the low accuracy of the rotometer used. For BLM-3 the weight determined value was about 20% high. This was surprising since an accurate Roots meter was used for continuous flow monitoring. One possible explanation for the discrepancy is undetected gas leaks between the bottles and the flow meter.

Table 4. Flow characteristics of the SF_6 gas releases for the t four BLM experiments.

Release		Exhaust Flow & Temp (Cu ft/hr)	SF_6 Flow Rate (Cu ft/hr)	SF_6 Flow Rate (lbs/hr)	Plume Hea Output (Watts)
BLM-1	#1	19.1×10^3 (99°C)	126	49.01	4440
	#2	14.9×10^3 (121°C)	131	50.74	4370
	#3	"	125	48.54	"
	#4	"	124	47.91	"
BLM-2	#1	"	125	48.35	"
	#2	"	124	48.06	"
	#3	"	115	44.45	"
	#4	"	119	46.21	"
BLM-3	#1	None	153	59.40	None
	#2	"	77.6	30.09	"
	#3	"	77.1	29.88	"
	#4	"	74.9	29.05	"
	#5	"	75.5	29.25	"
BLM-4	#1	"	Not Available		"
	#2	"	"		"
	#3	"	"		"
	#4	"	"		"
	#5	"	"		"

III Data Reduction Methods

Data reduction is directed toward producing mean meteorological parameters and parameters which describe the turbulence in the marine layer. The mean quantities are easy to calculate from sensor response functions and the techniques need not be described here. Characterizing the turbulence requires sophisticated techniques and is subject to error caused by measurement uncertainties and by misinterpretation of the measurements. In this section the several methods used to make these determinations are described. The redundancy in methods provides cross checks on the results.

The quantities of interest are the horizontal wind direction variance σ_θ, the vertical wind direction variance σ_ϕ, the wind speed variances σ_u, σ_v, and σ_w, the rate of dissipation of turbulence kinetic energy, the friction velocity, and the convective mixing velocity. All of these quantities describe various aspects of turbulence mixing in the atmosphere and are important for describing expected plume properties. Also, some measure of the hydrostatic stability must be made to characterize the state of the surface layer. For this we use the Monin-Obukhov length.

Determination of the wind variances is straightforward. Ten second averages of all components, corrected for pitch, roll, and ship velocity are available from the data acquisition system stored data. These quantities can be used as is or formed into longer term averages and thus related to short and long term plume properties. The only redundancy here is that direction variances can be determined both from the ultrasonic anemometer and from the cup and vane wind data.

The stability, friction velocity, dissipation rate, and mixing velocity are all determined using the bulk-aerodynamic method. The method is valuable because it makes use of readily measured quantities, specifically, differences in mean temperature, wind, and water vapor at the surface and at some reference height. Turbulence measurements from the hot films can also be used to determine these parameters. This is the back up method used to check the validity of the results. The bulk method is described below in detail, followed by a brief description of the signal processing and calculations involved in the turbulence method.

A. Bulk Aerodynamic Method

In this method it is assumed that the pertinent meteorological parameters (T = temperature, U = wind speed, and q = water vapor mixing ratio) have vertical gradients which are inversely proportional to height, Z. The magnitude of a gradient is parameterized by a scaling quantity, X_* (X = T, U, q) and a stability correction function $\phi_X(\xi)$:

$$\frac{dX}{dZ} = \frac{X_*}{\alpha_X \kappa Z} \phi_X(\xi). \qquad (1)$$

$\xi = Z/L$, with L the Monin-Obukhov length, is the stability parameter used. κ is VonKarman's constant, 0.35, and α_X is the turbulence diffusivity ratio ($\alpha_U = 1$). For convenience we drop the subscript on α.

Current evidence shows that transport of the scalars, heat and water vapor, obey the same relationship to their gradients. Thus $\phi_T = \phi_q$ and $\alpha_T = \alpha_q = 1.35$. The stability correction functions are:[10]

$$\phi_T(\xi) = (1-9\xi)^{-1/2} \quad \xi<0 \qquad \phi_u(\xi) = (1-15\xi)^{-1/4}$$
$$= 1+6.4\xi \quad \xi>0 \qquad = 1+4.7\xi \tag{2}$$

The Monin-Obukhov length is a measure of the balance between wind driven turbulence and buoyancy. It is defined as

$$L = \frac{T}{\kappa g} \frac{(\overline{wu})^2}{(\overline{w\theta})} \tag{3}$$

where g is the acceleration due to gravity. For our purposes it is most convenient to rewrite L in terms of the scaling parameters:

$$L = \frac{T}{\kappa g} \frac{U_*^2}{\theta_{v*}} \tag{4}$$

θ_v is the virtual potential temperature.

The above are the basic equations used to describe the atmospheric surface layer. The bulk method uses measurements of mean properties to evaluate L and the X_*. In order to develop the needed relations Equation 2 is integrated from the surface to the measurement height, Z. The integration is actually carried out from some reference height, Z_{oX}, very near the surface. Z_{oX}, the roughness length, is used in recognition of the fact that the logarithmic profile may not extend all the way to the surface. For measurement purposes, a measurement at the surface, rather than at Z_o, is used with no loss of accuracy. The integration gives

$$X_Z - X_S = \frac{X_*}{\alpha\kappa} \int_o^Z \frac{\phi_X(\xi)}{Z} \, dZ$$
$$= \frac{X_*}{Z_{oX}} \left[\ln \frac{Z}{Z_{oX}} - \psi_X(\xi) \right], \qquad (5)$$

where X_s is the surface value and $\psi_X(\xi)$ is the profile stability function. The profile stability functions are obtained upon performing the integration and are:

$$\xi > 0: \qquad \psi_T = -6.5\xi \qquad \psi_U = -4.7\xi$$

$$\xi < 0: \qquad \psi_T = 2 \ln(\frac{1+x}{2}) \qquad (6)$$

$$\text{with } x = (1-9\xi)^{1/2}$$

$$\psi_U = 2 \ln (\frac{1+y}{2}) + \ln (\frac{1+y^2}{2}) - 2 \tan^{-1}y + \frac{\pi}{2}$$

$$\text{with } y = (1 - 15\xi)^{1/4}$$

The difficulty in carrying out analyses of data is immediately apparent upon examination of Equations 4 and 5. They cannot be solved analytically for X_* and ξ, necessitating the use of an iterative calculation with a convergence test. Note that there are two homogeneous equations and three unknowns: X_*, ξ(or L), and Z_{OX}. In order to use an iterative calculation the number of unknowns must be reduced to two. This is done by determining the roughness length, Z_o, from the wind speed (for X = U we drop the subscript) and assuming a constant value for Z_{OT}. This will be described more fully below.

In developing the iteration scheme it is more convenient to rewrite Equation 5 in terms of the drag coefficient. The drag coefficient, C_X, is defined to be the constant of proportionality between the scaling parameter and the air-sea difference.

$$X_* = C_X^{\frac{1}{2}} \; (X_Z - X_s). \qquad (7)$$

Thus, from Equation 5, the drag coefficient is

$$C_X^{\frac{1}{2}} = C_{NX}^{\frac{1}{2}}[1 - \psi_X(\xi)C_{NX}/\alpha\kappa]^{-1}, \qquad (8)$$

where the neutral stability drag coefficient is defined as

$$C_{NX}^{\frac{1}{2}} = \frac{\alpha\kappa}{\ln Z/Z_o}. \qquad (9)$$

The stability parameter, $\xi = Z/L$, can be expanded from Equation 4 as

$$\xi = \frac{gZ}{T} \frac{\theta_* + 0.61\ Tq^*}{U_*^2} \tag{10}$$

For the humidity correction term, T = 288°C is used and $0.61\ T \simeq 0.18$ (q in gm/kg), introducing negligible error. Rewriting in drag coefficient form gives

$$\xi = \xi_o \frac{[1 - \psi_U\ C_{NU}^{1/2}/\kappa]^2}{[1 - \psi_T\ C_{NT}^{1/2}/\alpha\kappa]}, \tag{11}$$

with

$$\xi_o = \frac{\kappa g Z}{T} \frac{C_{NT}}{C_{NU}} \frac{(\theta - \theta_s) + 0.18(q - q_s')}{U^2}, \tag{12}$$

where U = 0 is assumed at the surface. Note that ξ_o depends only on the measured meteorological quantities and the neutral stability drag coefficients. Thus, it can be directly determined and used as the first estimate in determining ξ_c for the iteration scheme.

Either the neutral stability drag coefficient or the roughness length can be specified to reduce the number of unknowns to two (they are related by Equation 9). The former is done here. For temperature the drag coefficient is[11]

$$C_{NT} = 1.3 \times 10^{-3}, \qquad (13)$$

whereas for wind the formulation of Kondo[12] is used (for a height Z = 10m):

U(m/sec)	$C_{NU} \times 10^3$	
0.3 - 2.2	$1.08\ U^{-1.5}$	
2.2 - 5.0	$0.77 + 0.086\ U$	
5.0 - 8.0	$0.87 + 0.067\ U$	(14)
8.0 - 25	$1.20 + 0.025\ U$	

The iteration scheme used to perform the data analysis is as follows:

1. Calculate q_s from T_s assuming a relative humidity of 100% at the surface. Calculate q from T and the relative humidity or from the dew point temperature, T_D.
2. Calculate ξ_o from Equation 12 using the meteorological data and the neutral stability drag coefficients.
3. Calculate ψ_u and ψ_T from Equation 6.
4. Calculate ξ from Equation 11.
5. Iterate steps 3 and 4 until the desired accuracy is obtained, giving ξ (and L).
6. Calculate U_*, θ_*, and q_* from Equation 7.

B. Turbulence Method

The fluctuation signal from the constant temperature film is analyzed by determining the power spectral density in the inertial subrange. For this purpose two methods, are used 1) spectral analysis and 2) determining the rms level of the signal after band pass filtering. The purpose is to obtain U_* and the rate of dissipation of turbulent kinetic energy, . These two parameters are related by[13]

$$\varepsilon = (U^3/\kappa Z)\phi_\varepsilon(\xi), \tag{15}$$

where ϕ_ε is the dissipation stability function. It is calculated using the bulk determined ξ in the following equations

$$\begin{aligned} \phi_\varepsilon(\xi<0) &= (1 + 0.5|\xi|^{2/3})^{3/2}, \\ \phi_\varepsilon(\xi>0) &= (1 + 2.5\xi^{2/3})^{3/2}. \end{aligned} \tag{16}$$

The power spectral density is related to the dissipation rate by

$$S(k) = 0.5\varepsilon^{2/3} k^{-5/3}, \tag{17}$$

where k is the wavenumber of the turbulence. If the fluctuation signal from a single sensor is bandpass filtered at lower and upper wave numbers k and k_u, then the square of the rms signal is

$$(U'_{rms})^2 = \int_{k_\ell}^{k_u} S(k)\,dk. \tag{18}$$

Substituting Equation 17, integrating, and introducing frequency using the frozen turbulence hypothesis, k = 2 f/U, gives

$$\varepsilon^{2/3} = \frac{4}{3}\left(\frac{2\pi}{U}\right)^{2/3} (U'_{rms})^2/(f_\ell^{-2/3}-f_u^{-2/3}). \tag{19}$$

Thus, a measurement of the rms signal yields ε directly.

The spectral analysis method uses Equation 17. A spectrum analyzer gives the power spectral density as a function of frequency. Thus, Equation 17 is rewritten for frequency using $fS(f) = kS(k)$ and solving for ε.

$$\epsilon^{2/3} = 2\left(\frac{2\pi}{U}\right)^{2/3} f^{5/3}\, S(f). \tag{20}$$

A 5/3 slope is fitted through the spectrum in the inertial subrange (5 to 100 Hz) and extrapolated to f = 1 Hz to determine S(1 Hz).

In both Equations 19 and 20 the wind speed fluctuation signal is needed, whereas measurements yield a voltage fluctuation level. The wind speed signal can be obtained from the response function of the constant temperature films used as sensors. The voltage response to wind speed is given by

$$V^2 = V_o^2 + B\sqrt{U}. \tag{21}$$

Differentiating this equation gives

$$dU/dV = 4\ V\sqrt{U}/B. \tag{22}$$

Thus

$$(U'_{rms})^2 = (4V\sqrt{U}/B)(V'_{rms})^2 \tag{23}$$

$$S(1\ \text{Hz}) = (4V\sqrt{U}/B)S_V(1\ \text{Hz}) \tag{24}$$

where V'_{rms} is the measured rms voltage fluctuation and $S_V(1\ \text{Hz})$ is the voltage power spectral density at 1 Hz determined by the spectrum analyzer. Equations 23 and 24 are substituted into Equations 19 and 20 to yield the final equations used to determine ϵ. Note that the measurements are always made over a time interval of the order of one-half hour. V and U are the voltage and wind speed averages over that period.

C. Convective Mixing Velocity

The above data analysis is made on data gathered in the atmosphere's surface layer (perhaps 50 m deep) and applies to that region. The scaling parameters determined can be used to calculate the surface layer fluxes of momentum, heat, and water vapor:

$$F_m = U_*^2,$$
$$F_h = -U_*\theta_{v*}, \quad (25)$$
$$F_q = -U_* q_*.$$

These are not the true fluxes, but those normalized by density and specific heat. F_h is the virtual rather than the sensible heat flux.

The surface layer scaling developed above applies only to that layer. If the boundary layer is well mixed covective scaling applies in the region above the surface layer. The appropriate scaling parameters for this region are [14]

$$Z_i$$
$$\omega_* = [(g/T)F_h Z_i]^{1/3} \quad (26)$$
$$H_* = F_h/\omega_*$$

Z_i is the boundary layer depth, normally defined by the height of an inversion layer, and ω_* is the convective mixing velocity.

ω_* is the appropriate velocity to use to determine the rate of mixing in the convective boundary layer. This has been demonstrated by previous SF_6 tracer experiments[15] and by laboratory experiments.[16]

Equation (26) is not correct for the cloud topped boundary layer. In that case the presence of the cloud modifies the heat flux due to release of latent heat upon condensation and absorption and emmission of radiation. The term F_h must be replaced with 2.5 $\langle F_h \rangle$, the average heat flux in the boundary layer. Ues of the equation as it stands will typically lead to underestimates of about 30% (it is this small due to the 1/3 power dependence of ω_* on F_h).

A. Gas Release Locations and Times

The location of the RV/Acania during each SF_6 gas release and the release start and end times are listed in Table 5. The ship locations listed were determined by the ship's Loran C.

Table 5. Locations and start and end times for tracer gas releases. Times are Pacific Local.

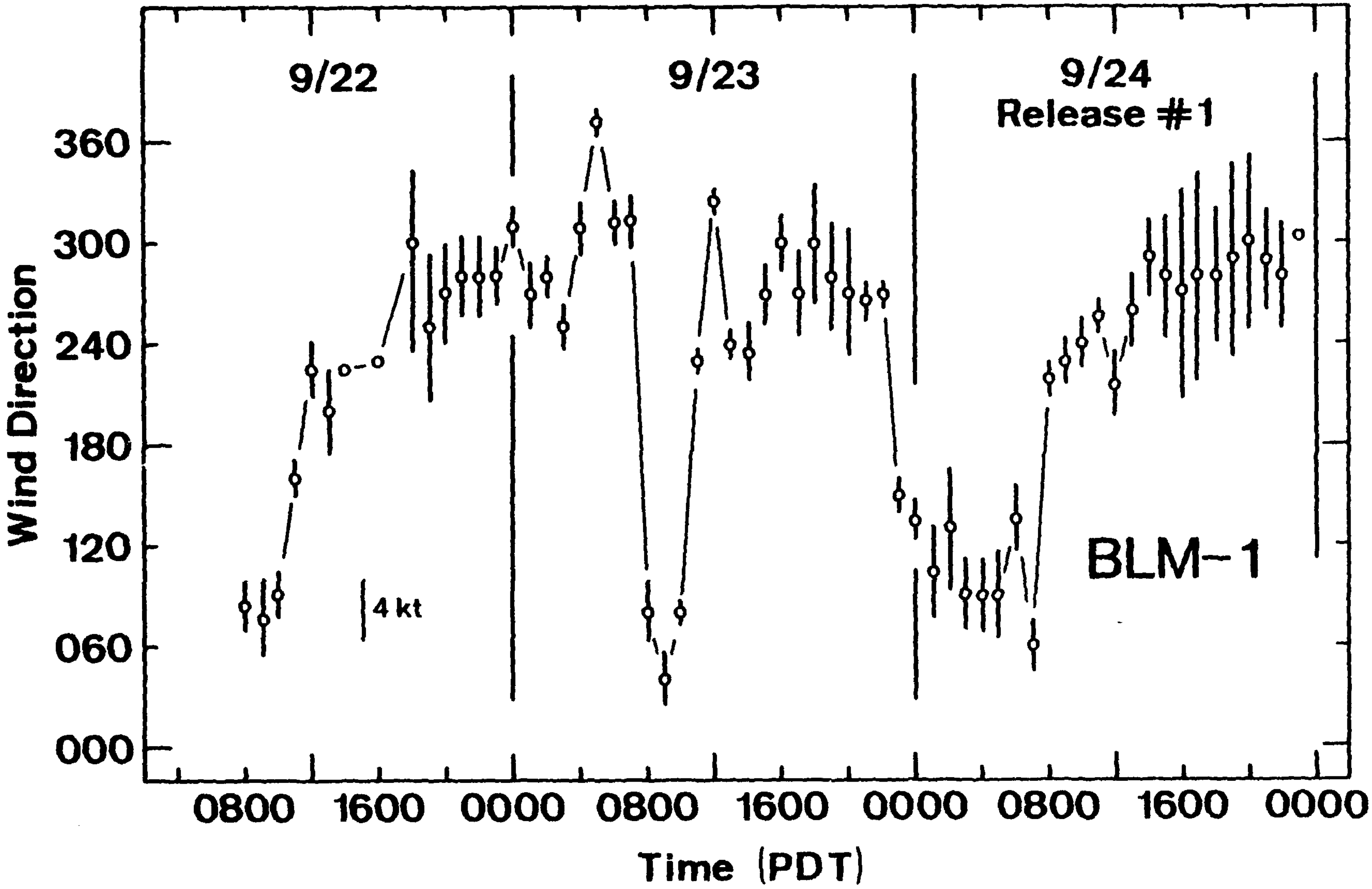
Release	Date	Latitude	Longitude	Start Time	End Time
BLM-1					
1	9/24	34°14.2'N	119°21.2'W	1135	1900
2	9/27	34°14.8'N	119°21.1'W	1107	1815
3	9/28	34°14.2'N	119°21.1'W	1243	1900
4	9/29	34°12.8'N	119°20.4'W	1143	1900
BLM-2					
1	1/6	34°15.0'N	119°20.0'W	1322	1800
2	1/9	34°14.4'N	119°20.3'W	1123	1800
3	1/13	34°14.4'N	119°20.3'W	1134	1702
4	1/15	34°11.4'N	119°19.4'W	1406	1700
BLM-3					
1	12/8	35°2.6'N	120°42.1'W	1158	1658
2	12/11	35°4.0'N	120°41.9'W	1229	1849
3	12/13	35°2.9'N	120°42.0'W	1152	1852
4	12/14	35°3.3'N	120°41.8'W	1038	1858
5	12/15	35°3.5'N	120°41.8'W	1117	1902
BLM-4					
1	6/21	35°2.9'N	120°42.1'W	1221	1800
2	6/22	35°0.5'N	120°42.3'W	1339	2000
3	6/24	35°2.1'N	120°42.0'W	1148	1800
4	6/25	35°2.2'N	120°42.1'W	1040	1800
5	6/27	35°3.5'N	120°42.0'W	1030	1800

IV. Data and Results

In the following sections the data for the four cruises and the calculated results are presented. The sections are grouped according to the type of data, not the cruise, in order to make it easier to compare data from all cruises.

IV-1. Wind Histories

During the time the ship was on station, wind data was obtained at least every one-half hour. These data are plotted and yield a real-time history which is useful for planning the times of tracer gas releases. The data are presented in Figures 10, with three days plotted in sequence so that the diurnal land-sea breeze cycle can be readily identified.


9/22
9/23
9/24
Release #1
BLM-1
4 kt
Wind Direction
000
060
120
180
240
300
360
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PDT)

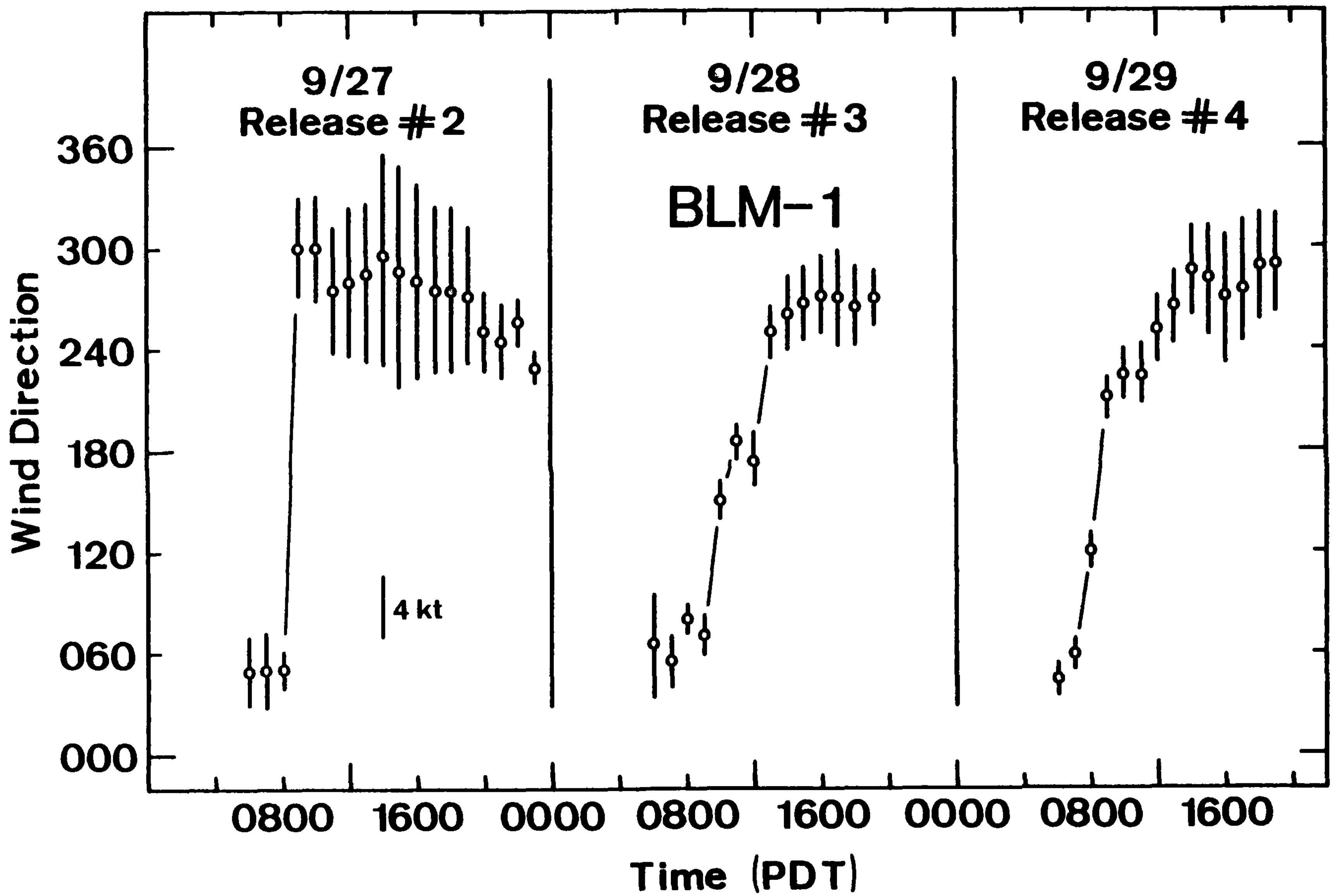
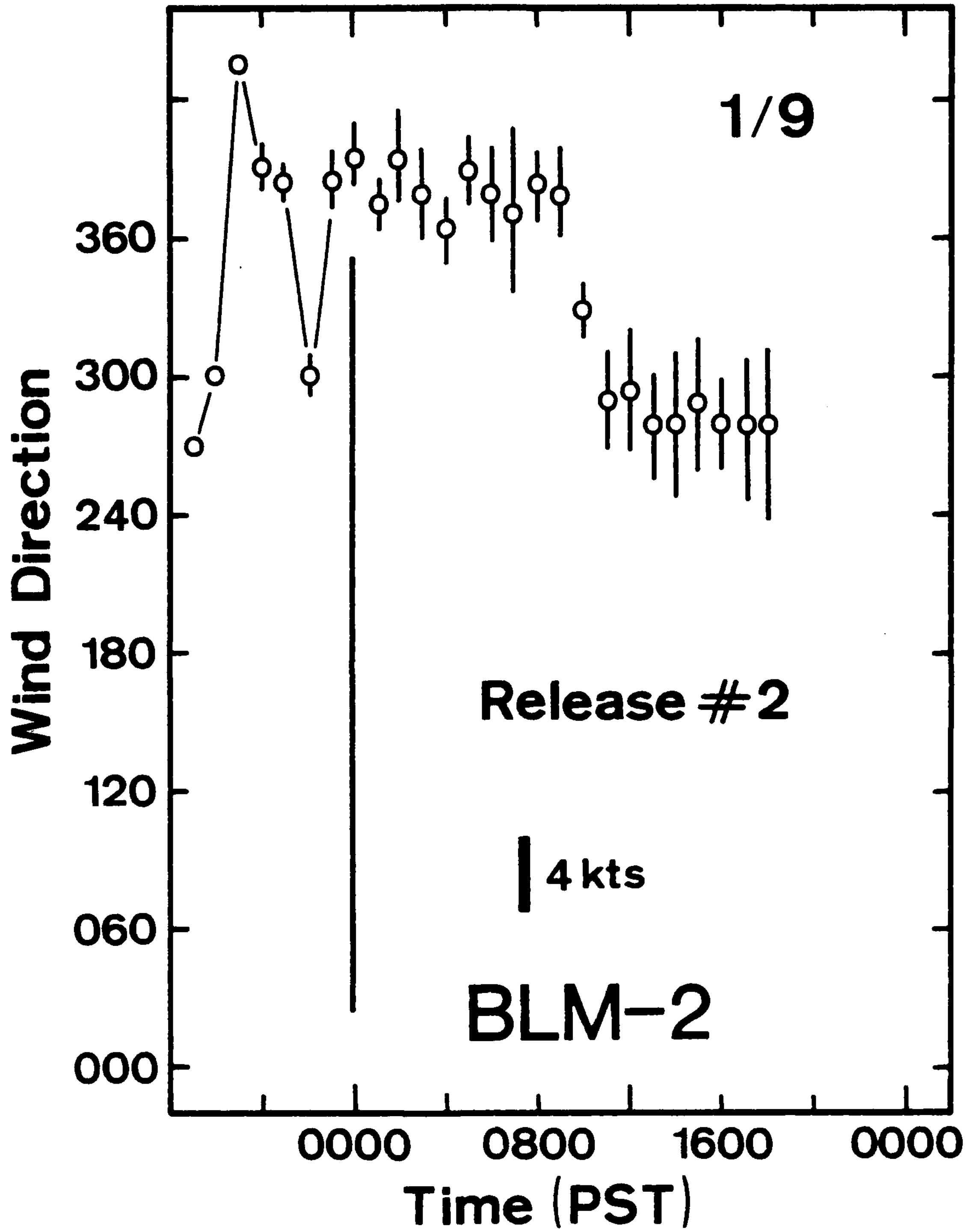
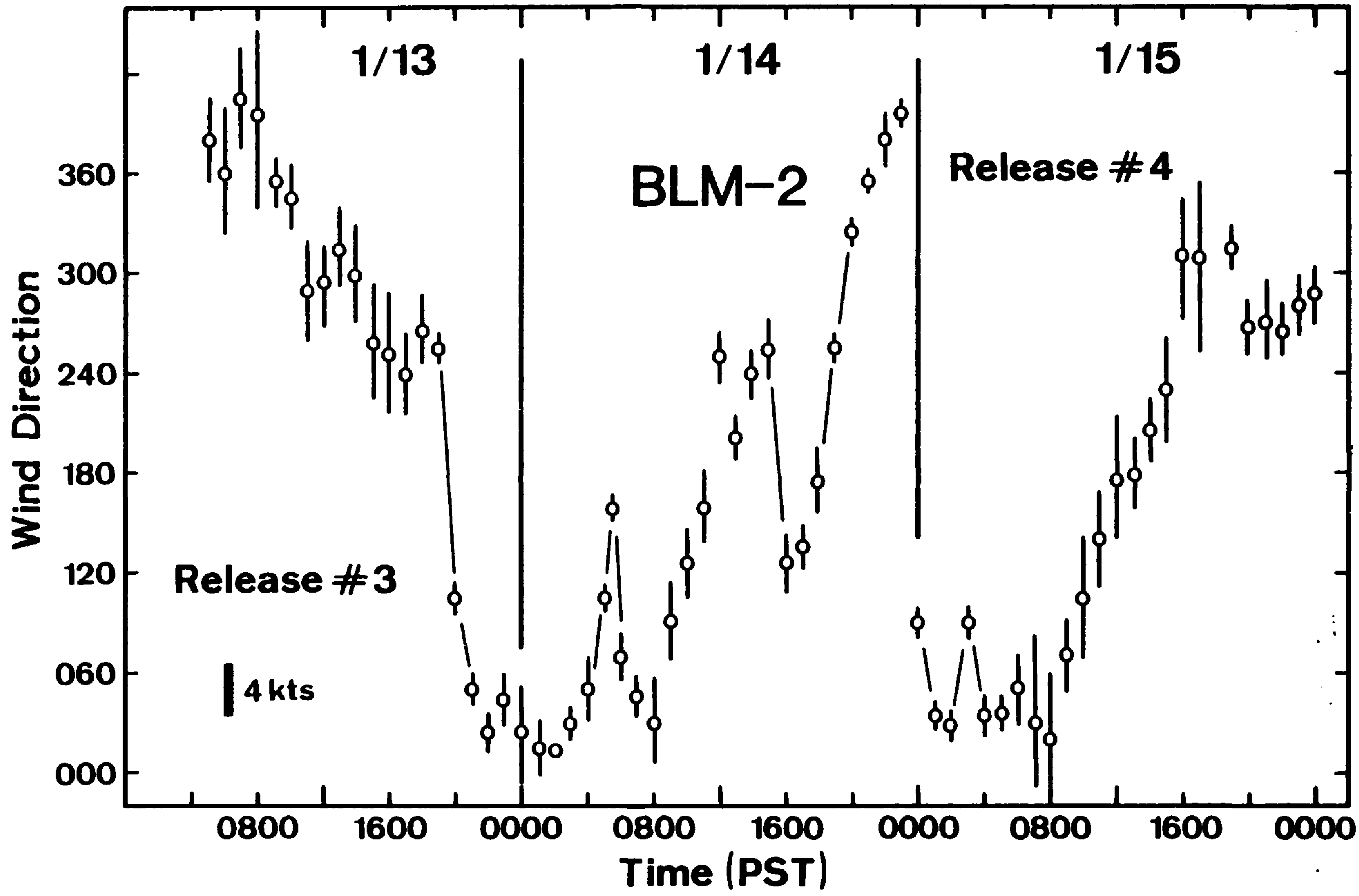
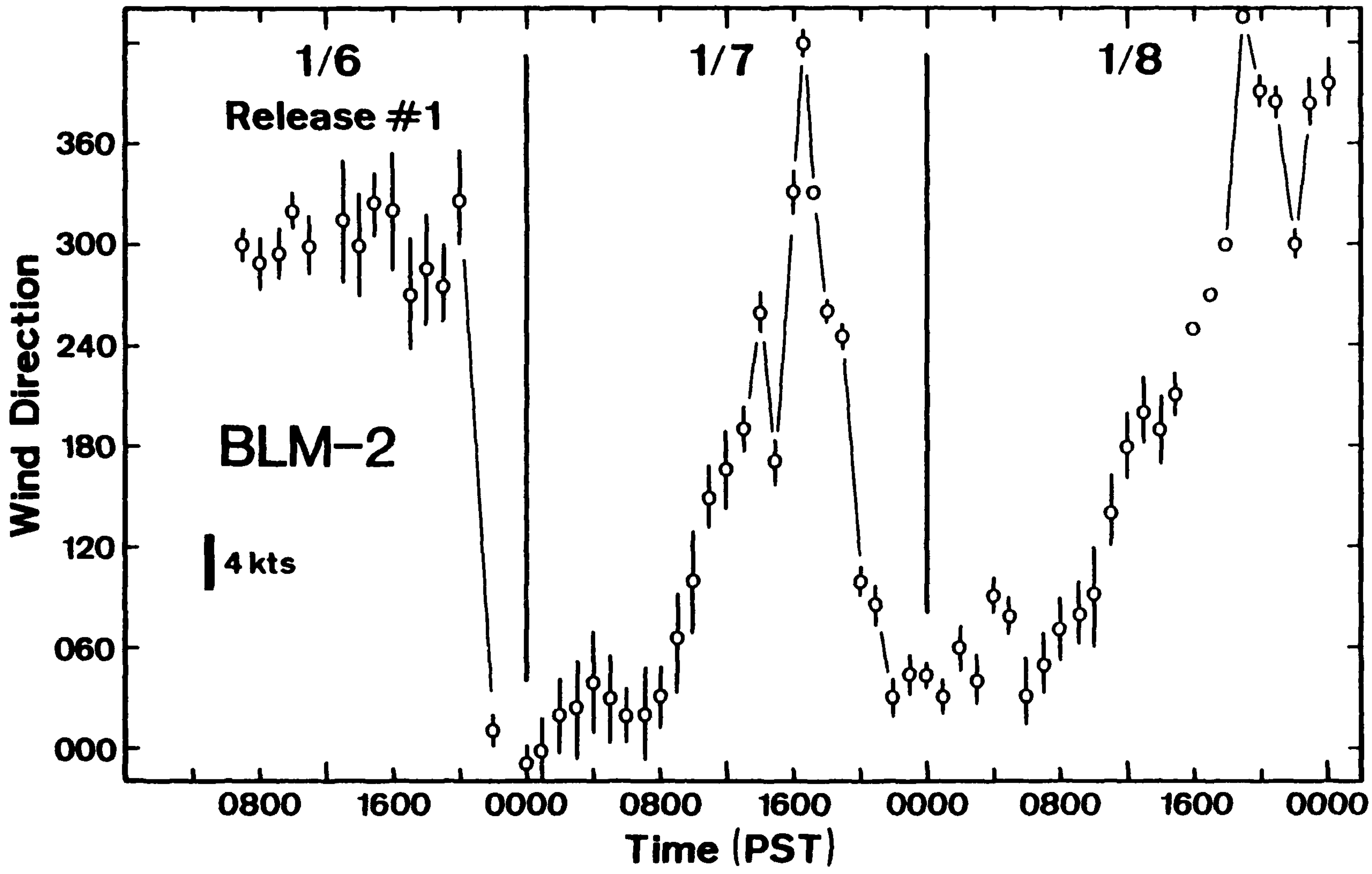


Figure 10 (1,27-29)



1/9
Release #2
4 kts
BLM-2
Wind Direction
360
300
240
180
120
060
000
0000
0800
1600
0000
Time (PST)


1/13
1/14
1/15
BLM-2
Release #3
Release #4
4 kts
Wind Direction
360
300
240
180
120
060
000
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PST)



1/6
Release #1
1/7
1/8
BLM-2
4 kts
Wind Direction
360
300
240
180
120
060
000
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PST)

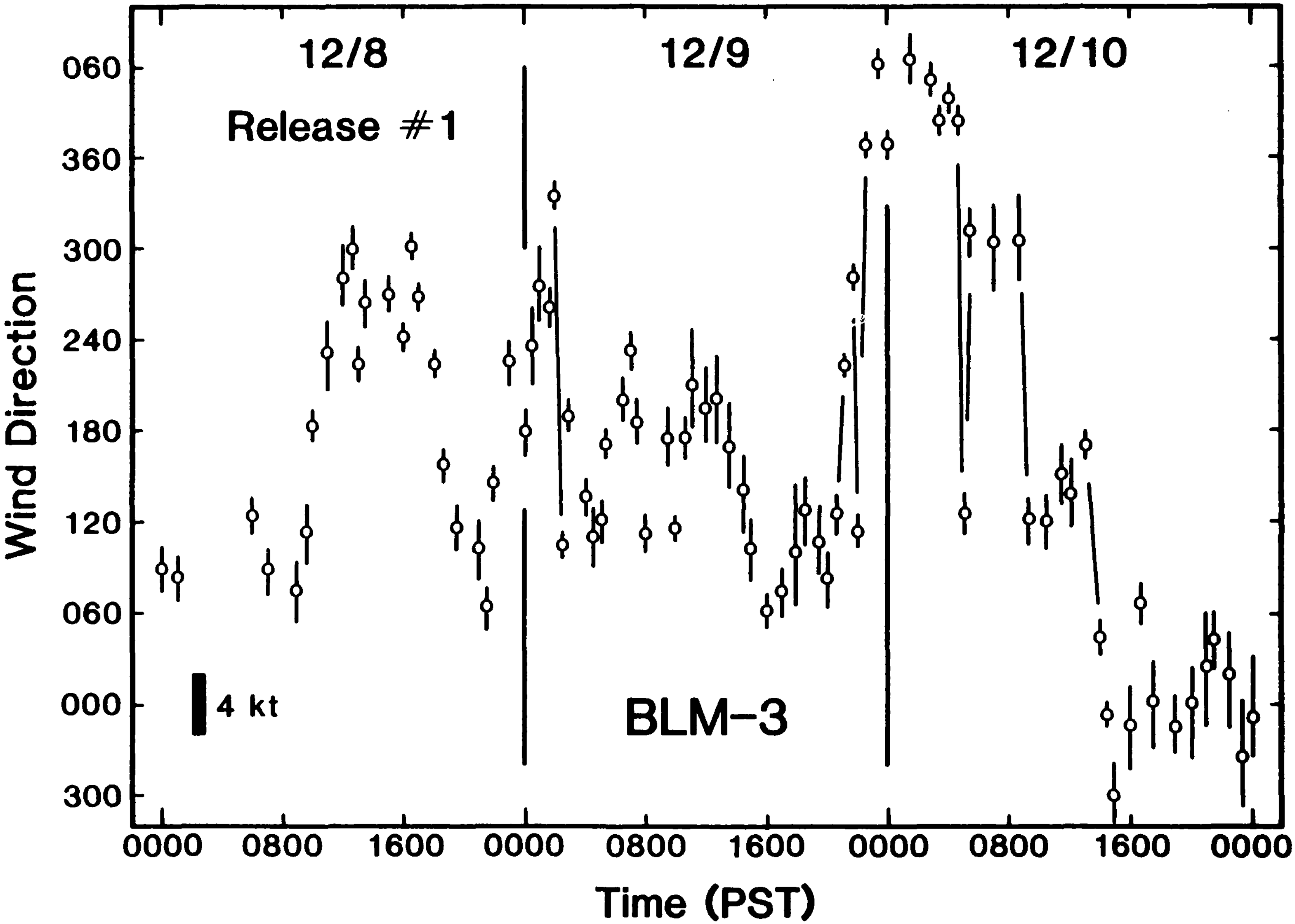
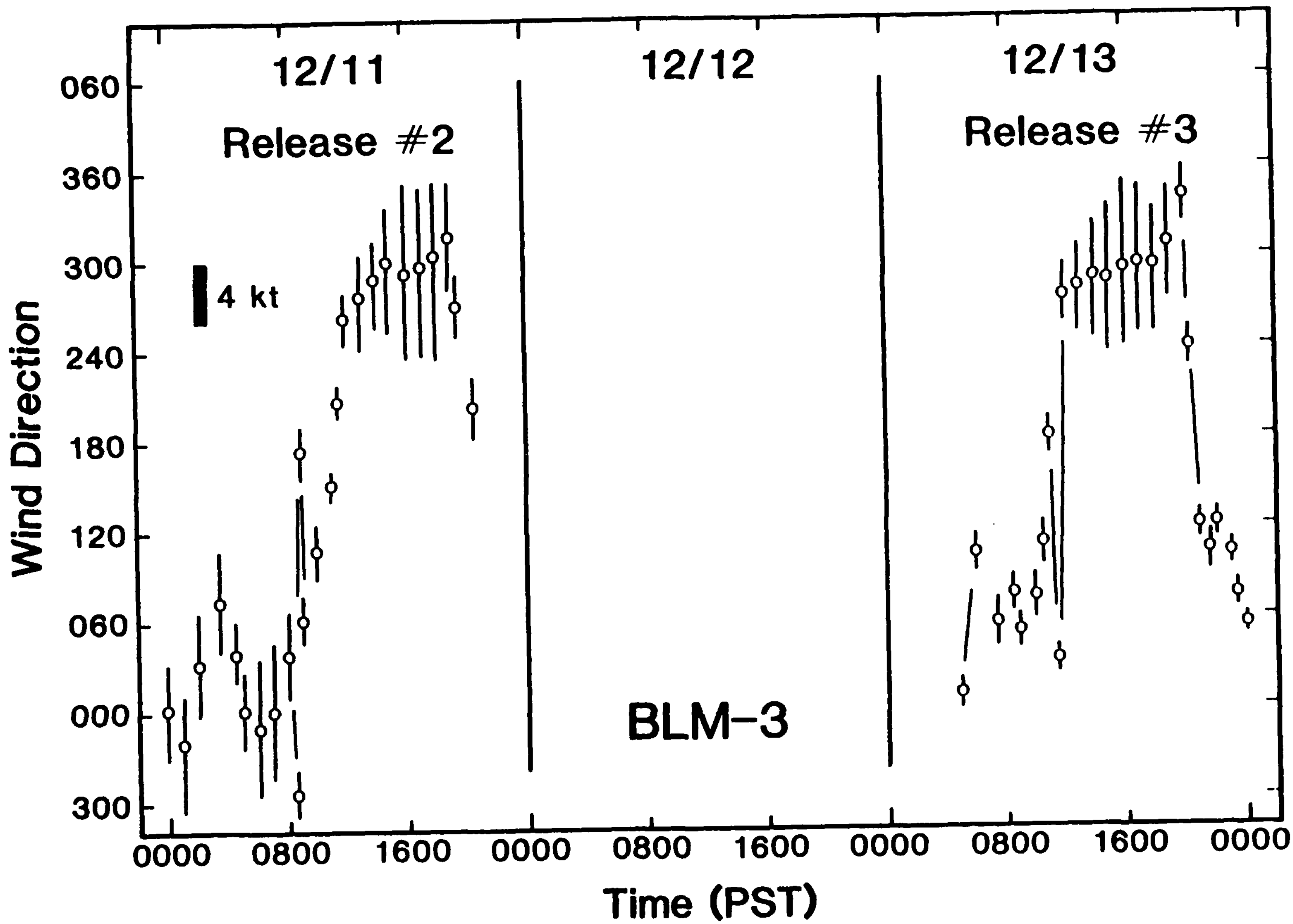

12/8
12/9
12/10
Release #1
4 kt
BLM-3
Wind Direction
060
360
300
240
180
120
060
000
300
Time (PST)
0000
0800
1600
0000
0800
1600
0000
0800
1600
0000

Figure 10



12/11
12/12
12/13
Release #2
Release #3
4 kt
BLM-3
Wind Direction
060
360
300
240
180
120
060
000
300
0000
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PST)

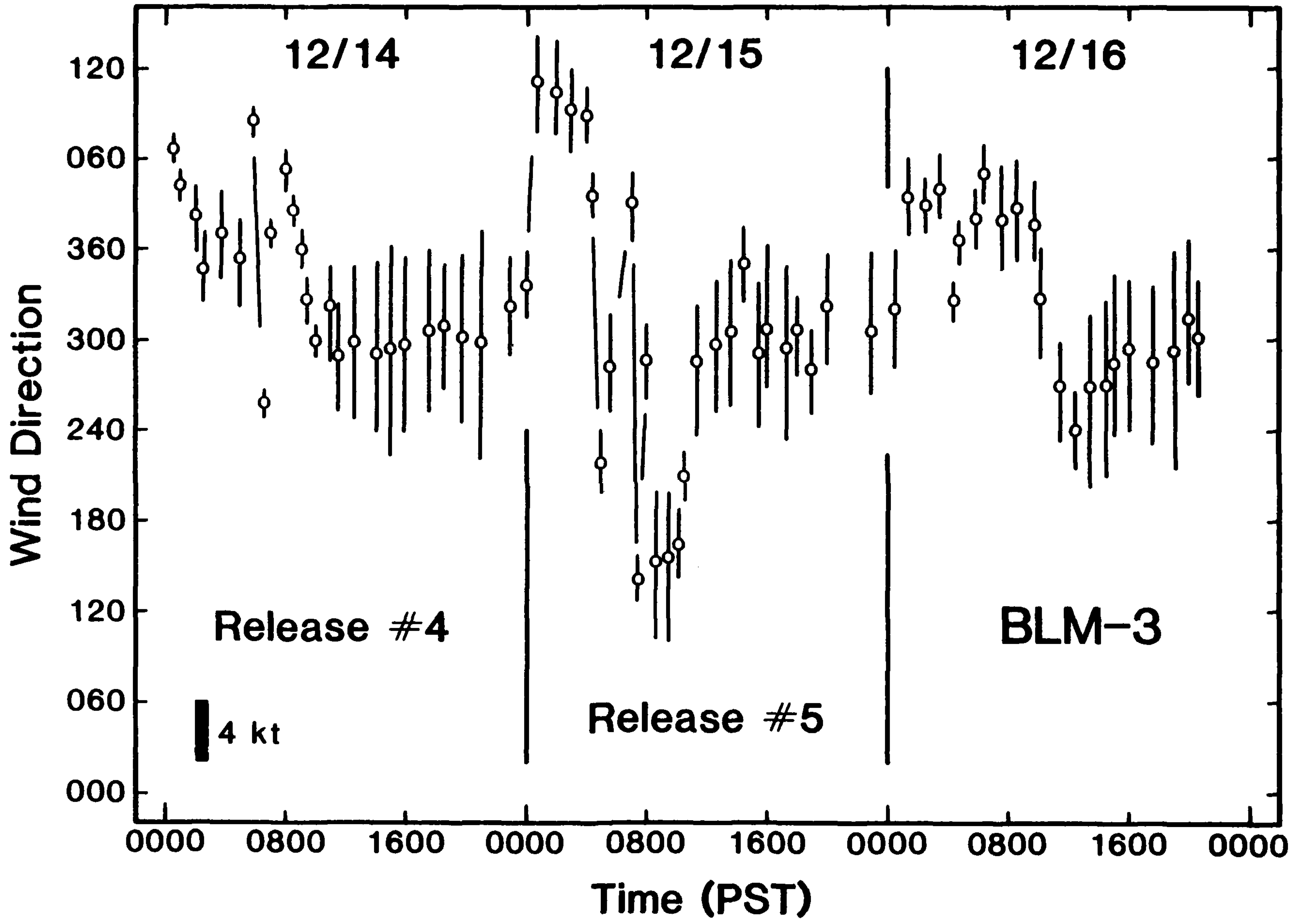
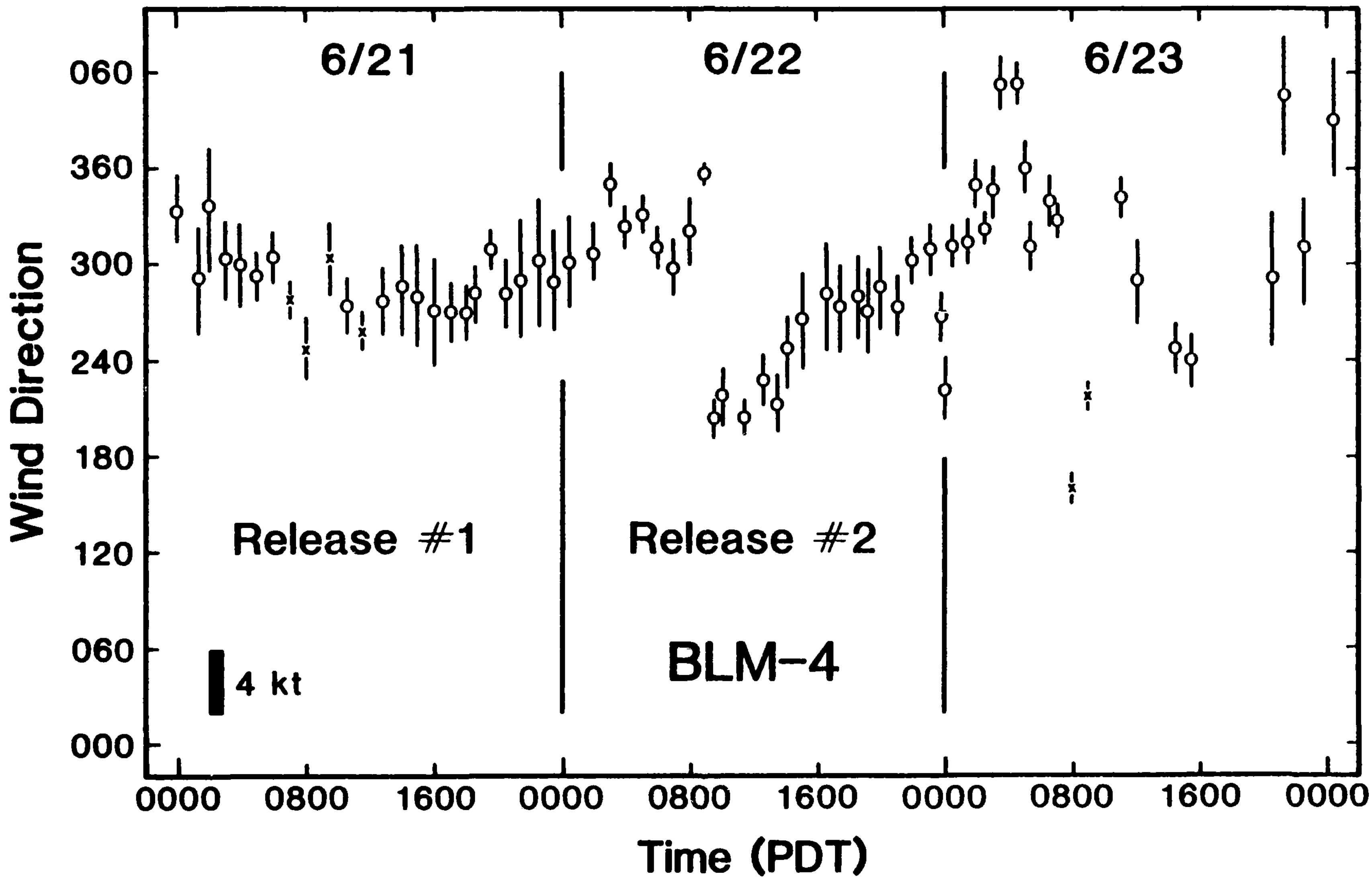
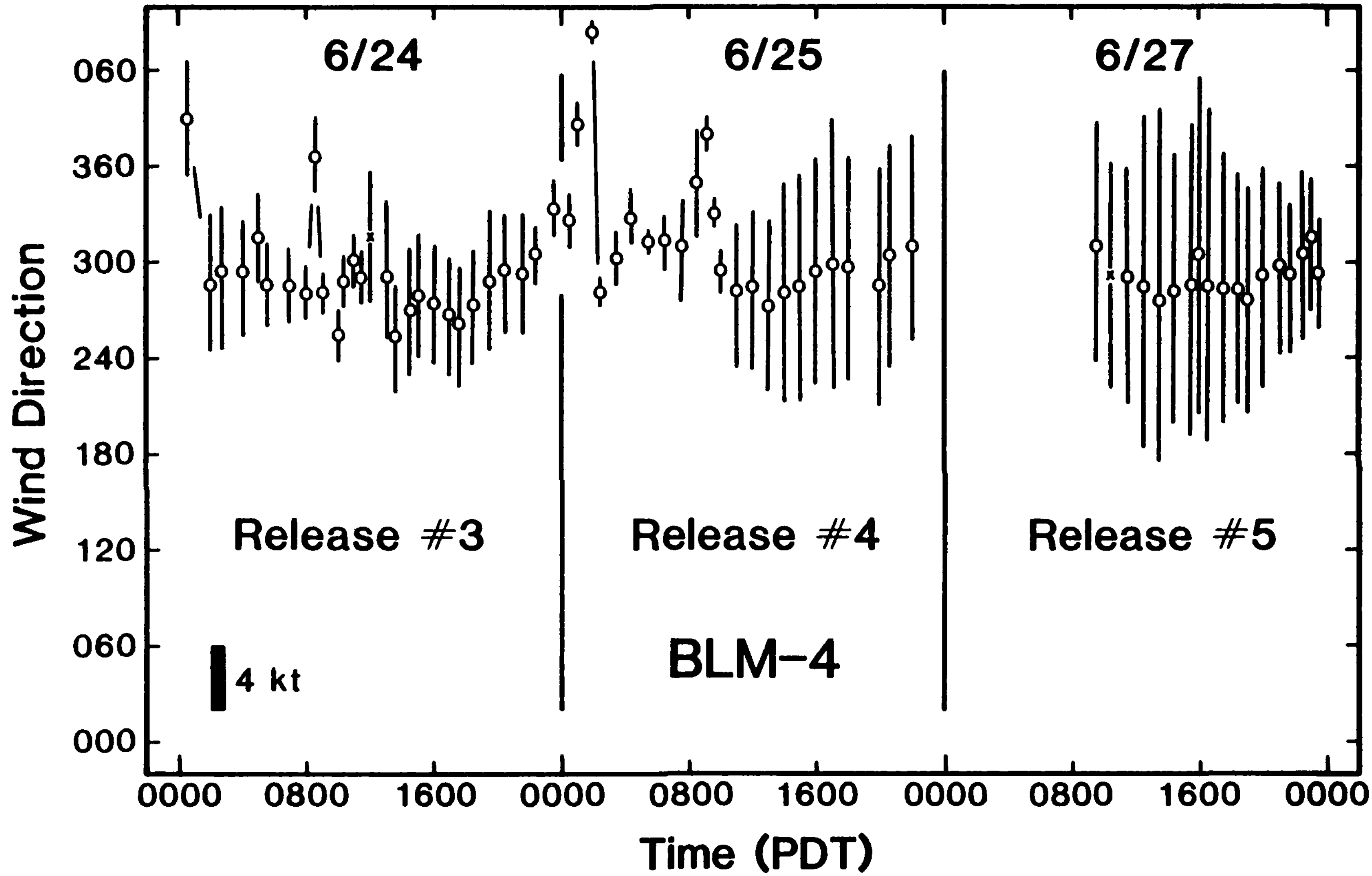
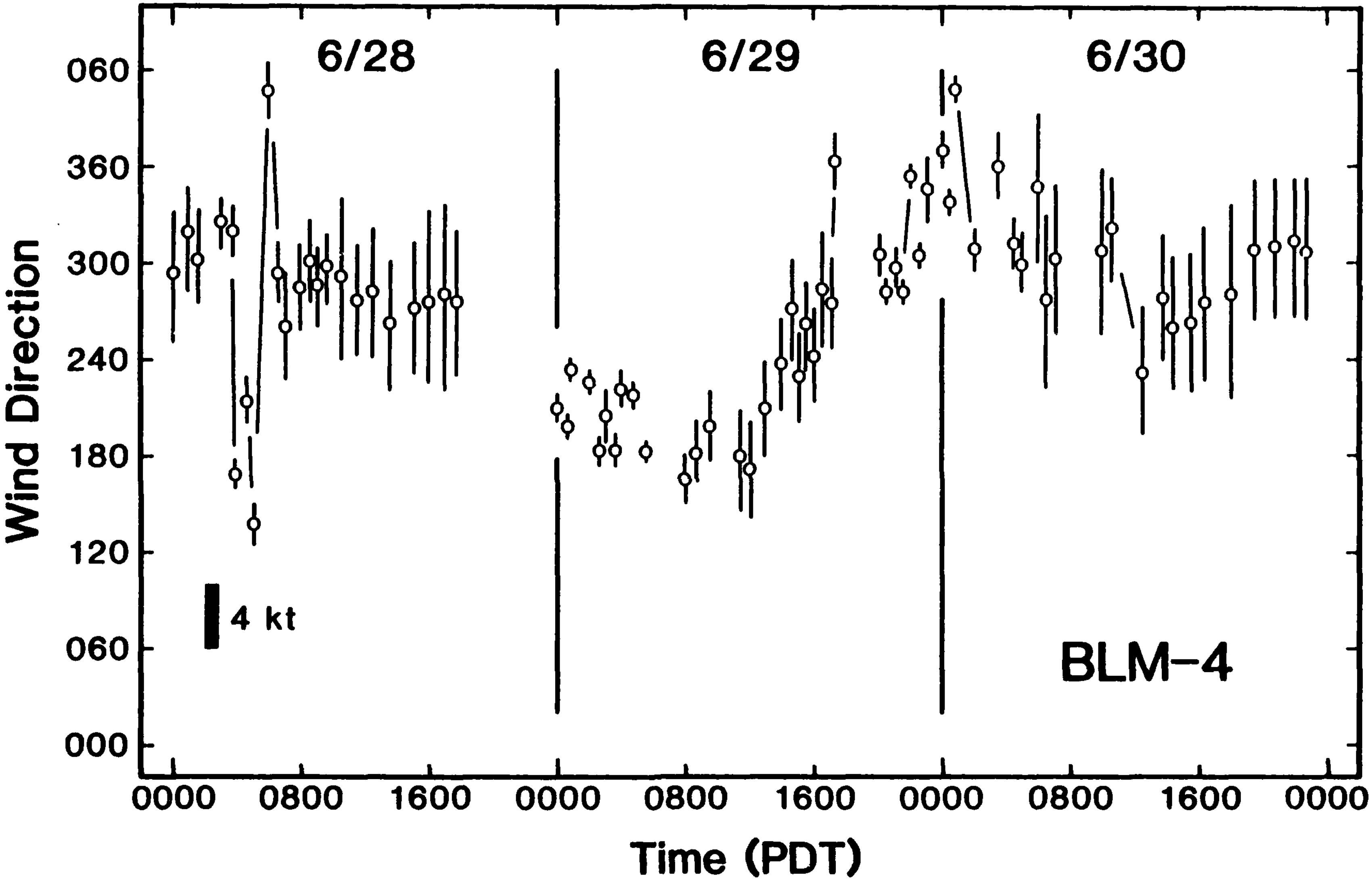


Figure 16 (3,1,-16)


Wind Direction
060
360
300
240
180
120
060
000
6/21
6/22
6/23
Release #1
Release #2
4 kt
BLM-4
0000
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PDT)


6/24
6/25
6/27
060
360
300
240
180
120
060
000
Wind Direction
Release #3
Release #4
Release #5
4 kt
BLM-4
0000
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PDT)



6/28
6/29
6/30
060
360
300
240
180
120
060
000
Wind Direction
4 kt
BLM-4
0000
0800
1600
0000
0800
1600
0000
0800
1600
0000
Time (PDT)

IV-2. Acoustic Sounder

The acoustic sounder was operated continuously throughout all cruises to obtain a continuous record of the boundary layer depth, in order to define the height of the mixing region. This instrument is very useful when there is a single, well defined, temperature inversion yielding an unambiguous indication on the sounder strip chart. As can be seen from examination of the results, this is not always the case.

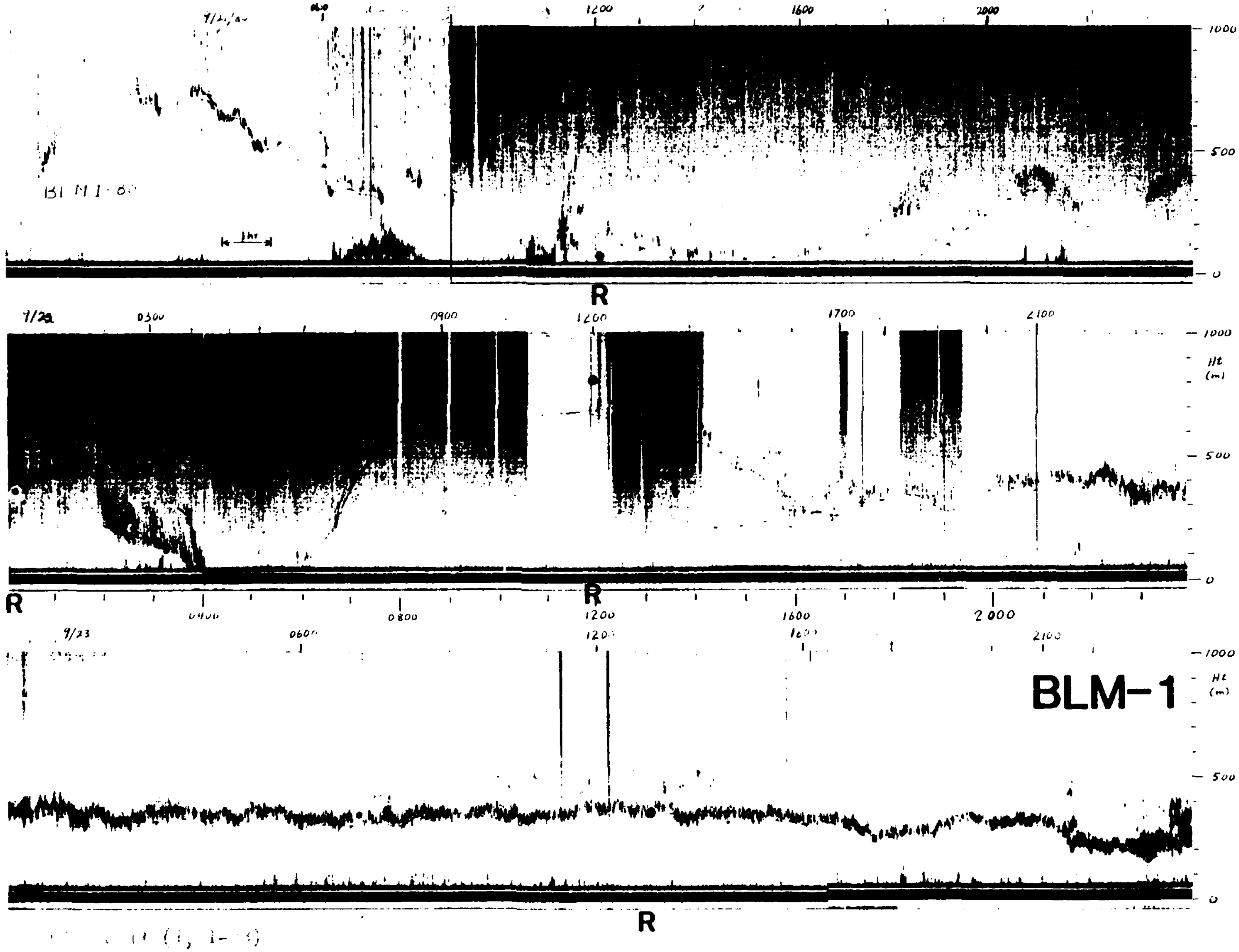
The sounder transmits a pulse of acoustic energy and receives reflected sound that is scattered from small scale speed of sound inhomogenities, which are mainly due to temperature inhomogeneities. These inhomogeneities occur due to the turbulent mixing of air of varying temperature in the region of a temperature inversion, in thermal plumes, and any other region where inhomogeneities exist. Thermal plumes are easily identified since they give a strong near surface return. The strongest acoustic echo that is not associated with thermal plumes is normally from the base of an inversion. However, when the temperature gradient at the inversion is weak this may not be the case. In many cases there may be several echos from different heights so that the mixing layer depth cannot be determined without additional data, such as from a radiosonde.

Photographs of the acoustic sounder strip chart outputs are presented in Figures 11. The dark bands on the charts are due to the increase in ambient noise that occurs when the ship is in motion. Small black or white dots on the photographs show the heights of the base of the temperature inversions as determined from the radiosondes.

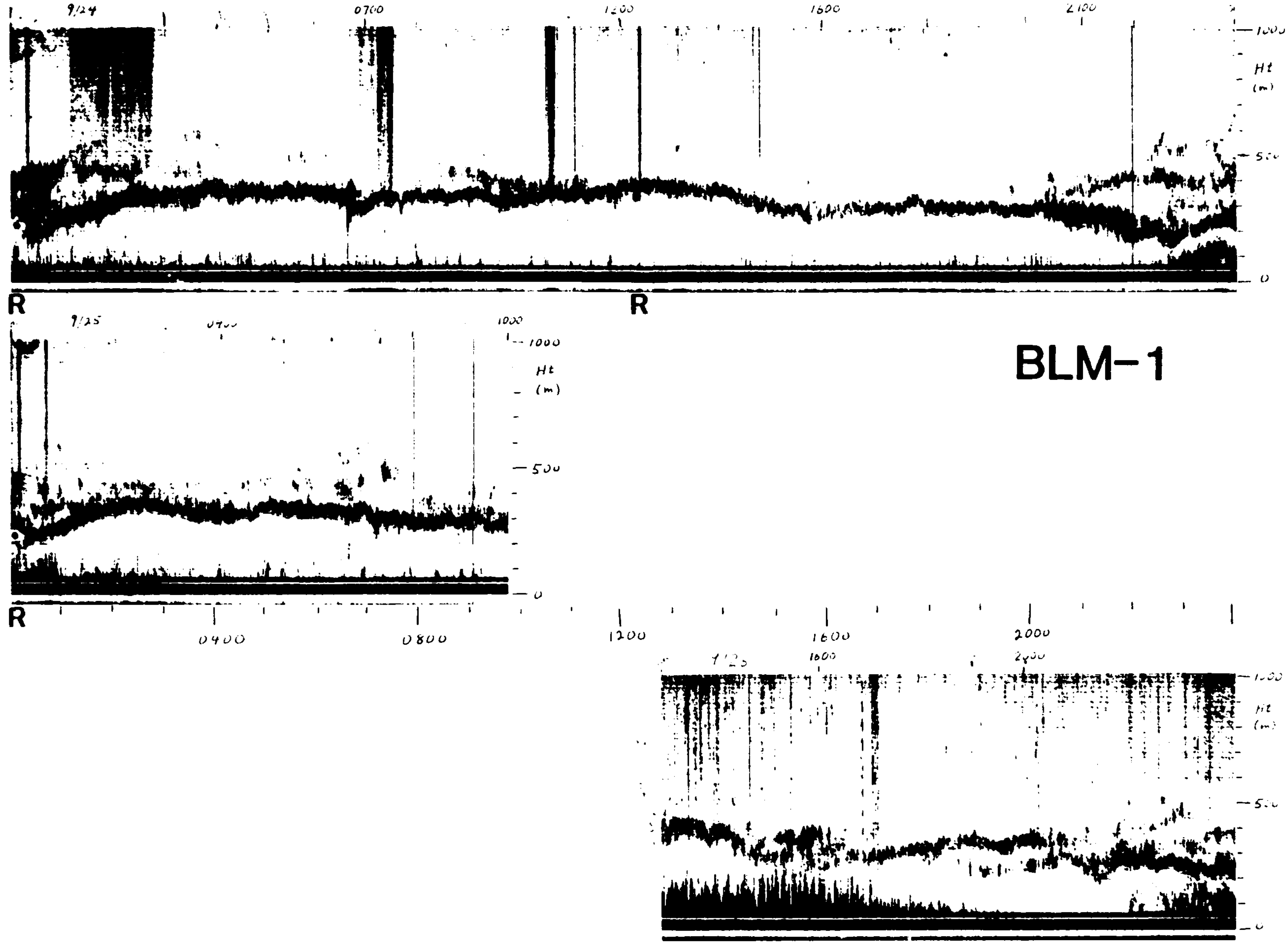
It is not easy to interpret these data from the photographs in Figure 9. Thus, tables of the heights of the acoustic echo returns, averaged for each half-hour, are given in Tables 6a-d.

The boundary layer depths, as determined from the radiosondes, are given in Table 7. Examination of the radiosonde profiles, Figures 12, shows that the potential temperature and water vapor mixing ratio do not always identify the same height for the boundary layer. In many such cases the discrepancy is due to the poor response of the radiosonde relative humidity sensor when leaving the top of a cloud. In such cases we rely on the temperature sensor to identify the boundary layer height.

Several returns can occur at one time, one of which may be the height of the base of the inversion. We arbitrarily assign the return heights as Z_i, Z_2, or Z_3 in the tables. The only rationale in the assignment is to make it possible to easily follow height changes with time in the table.

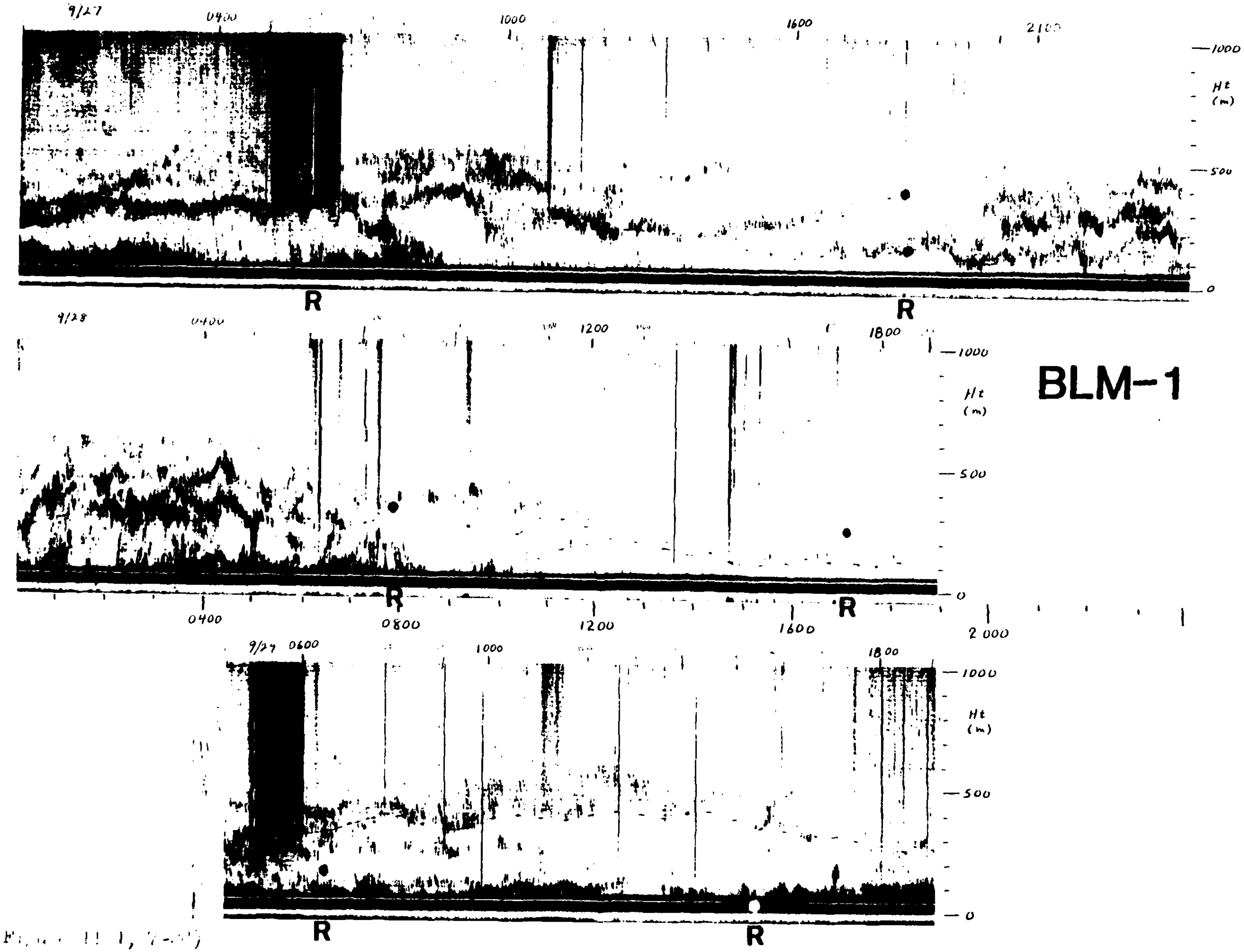


BLM-1
BLM 1-80
9/21/80
9/22
9/23
1 hr
0300
0400
0600
0800
0900
1200
1600
1700
2000
2100
1000
500
0
Ht (m)
R



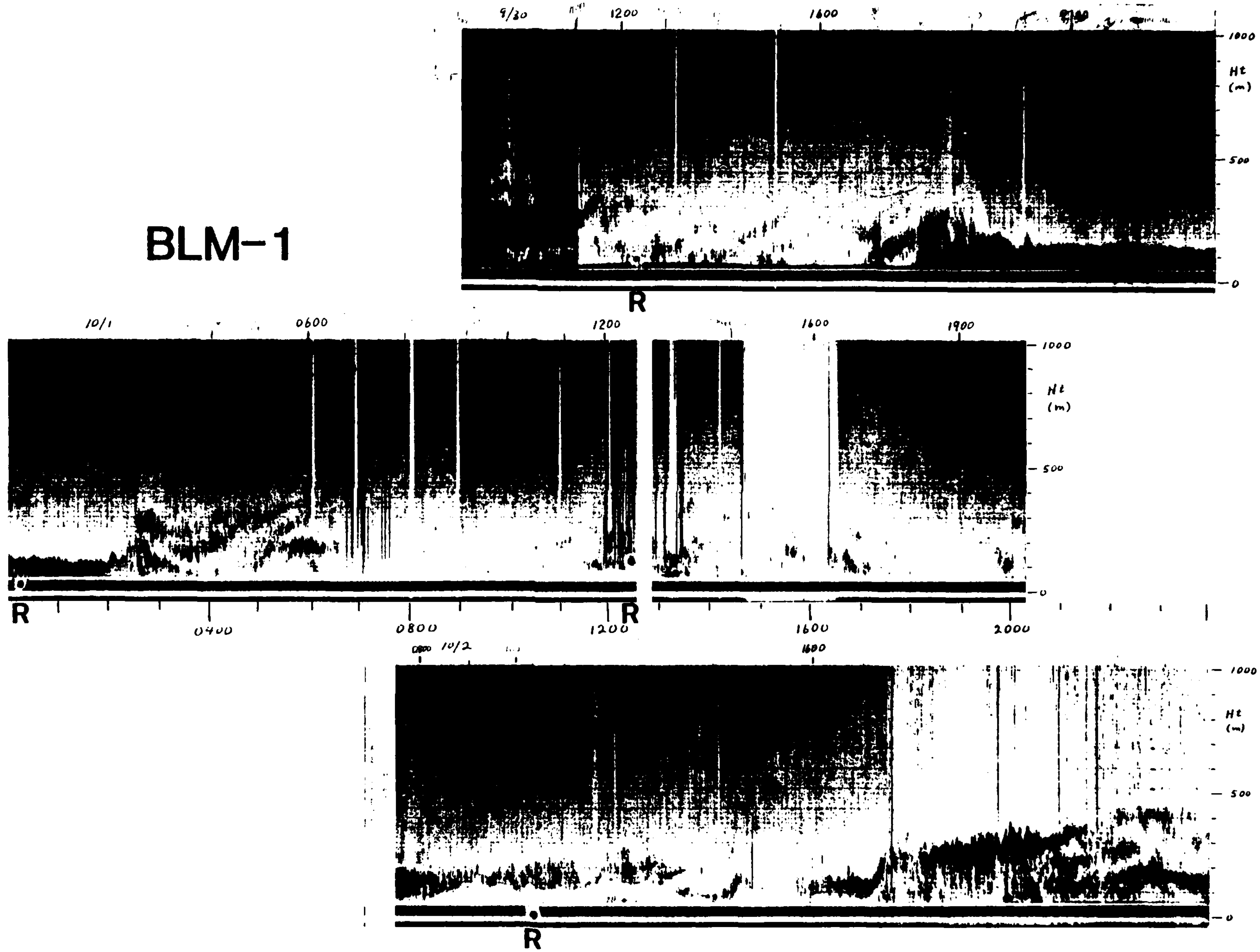
9/24
0700
1200
1600
2100
1000
Ht
(m)
500
0
R
R
9/25
0400
1000
1000
Ht
(m)
500
0
R
0400
0800
1200
1600
2000
9/25
1600
2000
1000
Ht
(m)
500
0

BLM-1



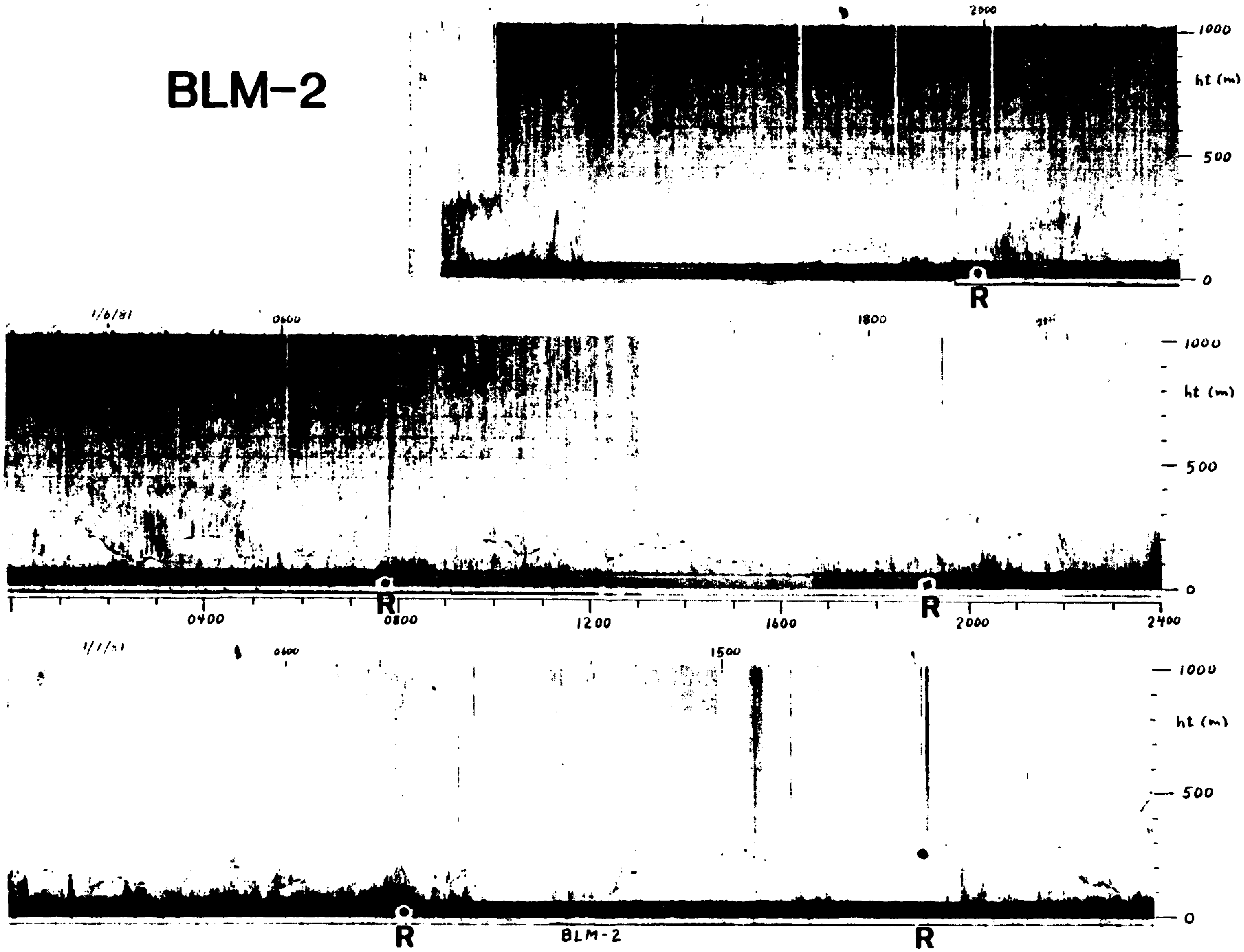
BLM-1
9/27
0400
1000
1600
2100
R
R
9/28
0400
1200
1800
R
R
0400
0800
1200
1600
2000
9/29
0600
1000
1800
R
R
1000
Ht
(m)
500
0

BLM-1



9/30
1200
1600
Ht
(m)
1000
500
0
R
10/1
0400
0600
0800
1200
1600
1900
2000
10/2

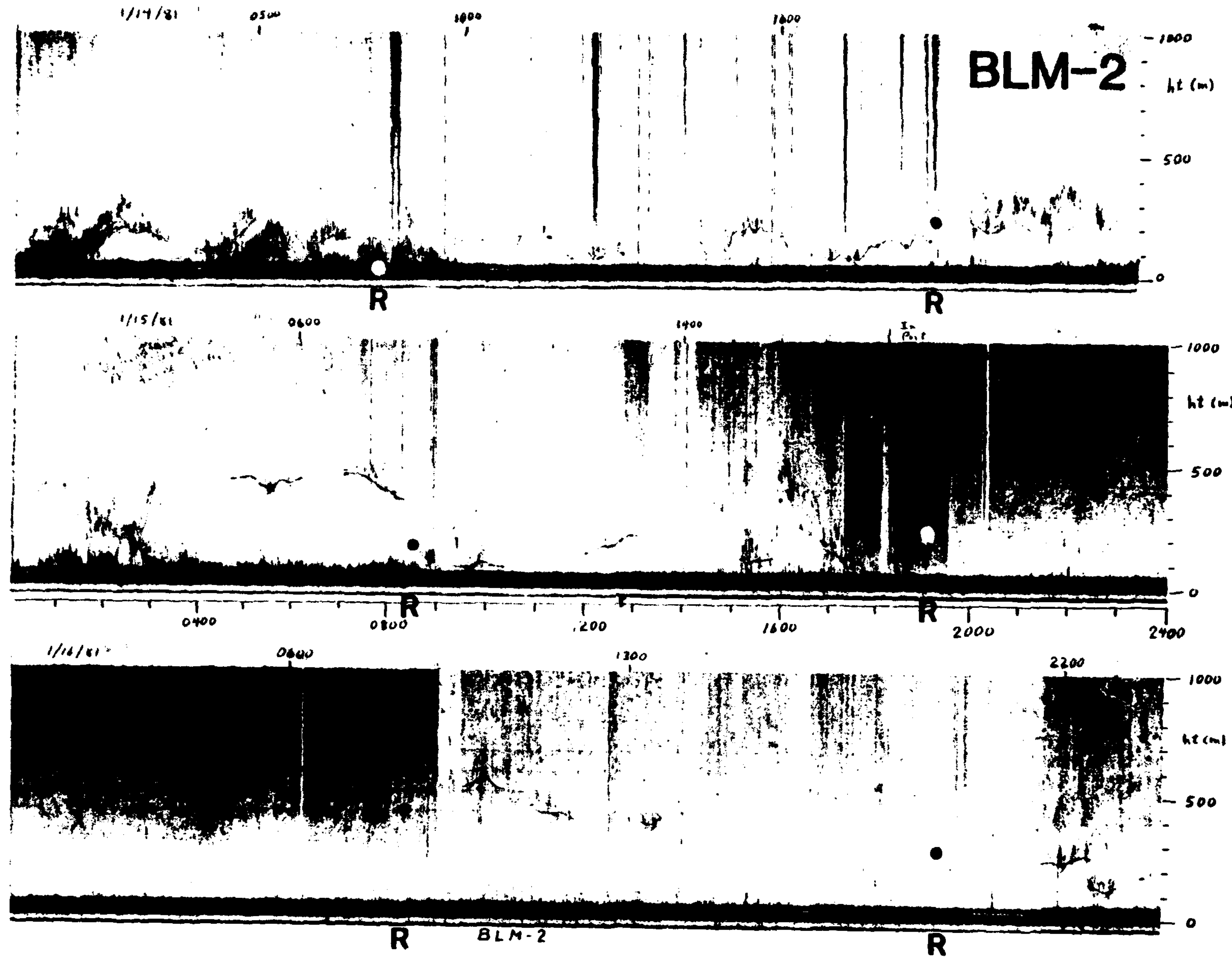
BLM-2



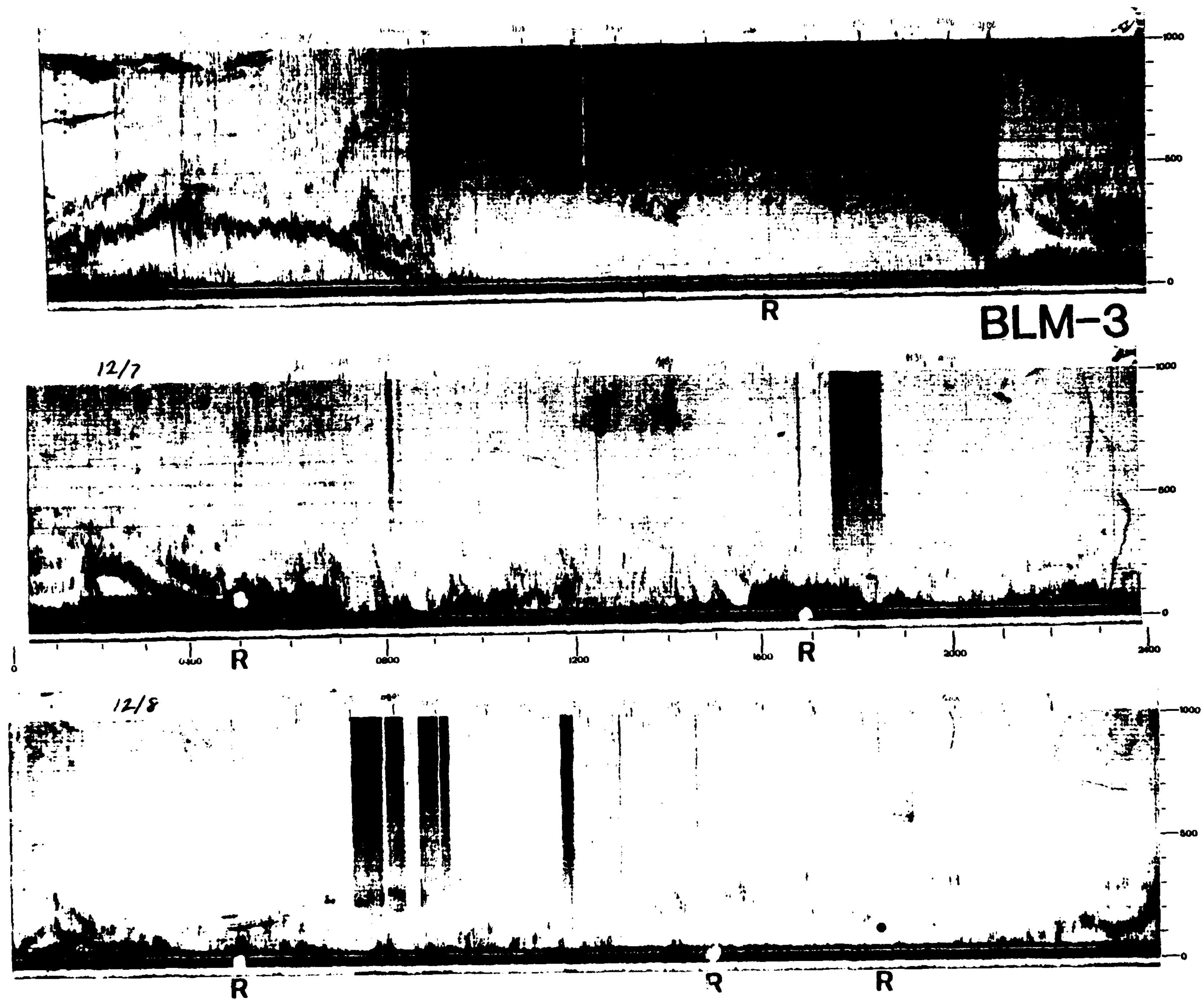
2000
1000
ht (m)
500
0
R
1/6/81
0600
1800
1000
ht (m)
500
0
R
R
0400
0800
1200
1600
2000
2400
1/7/81
0600
1500
1000
ht (m)
500
0
R
R
BLM-2

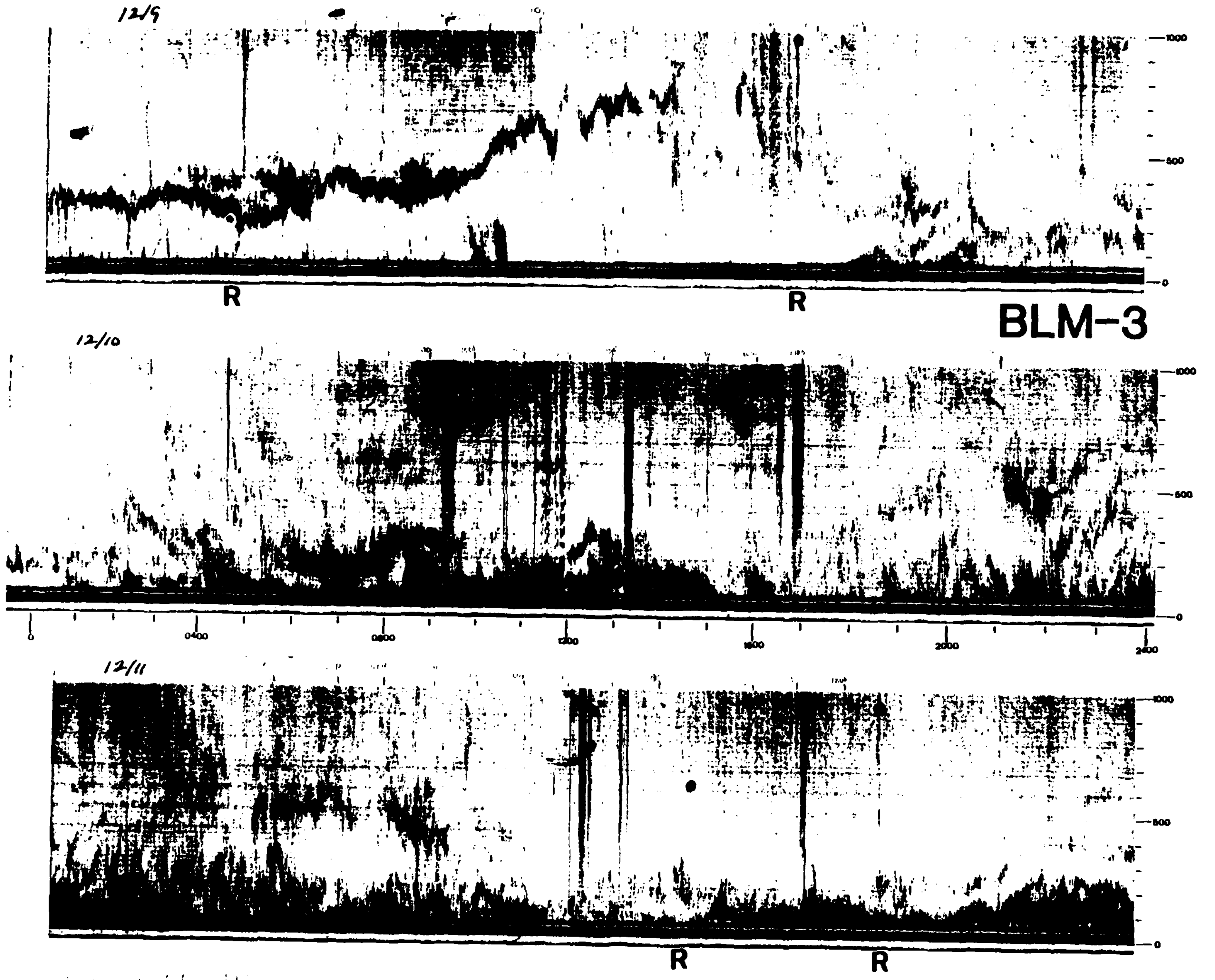
BLM-2
1/8/81
0800
1500
1000
ht (m)
500
0
R
R
1/9/81
0600
1500
2400
0400
0800
1200
1600
2000
2400
1/13/81
0600
1400
BLM-2

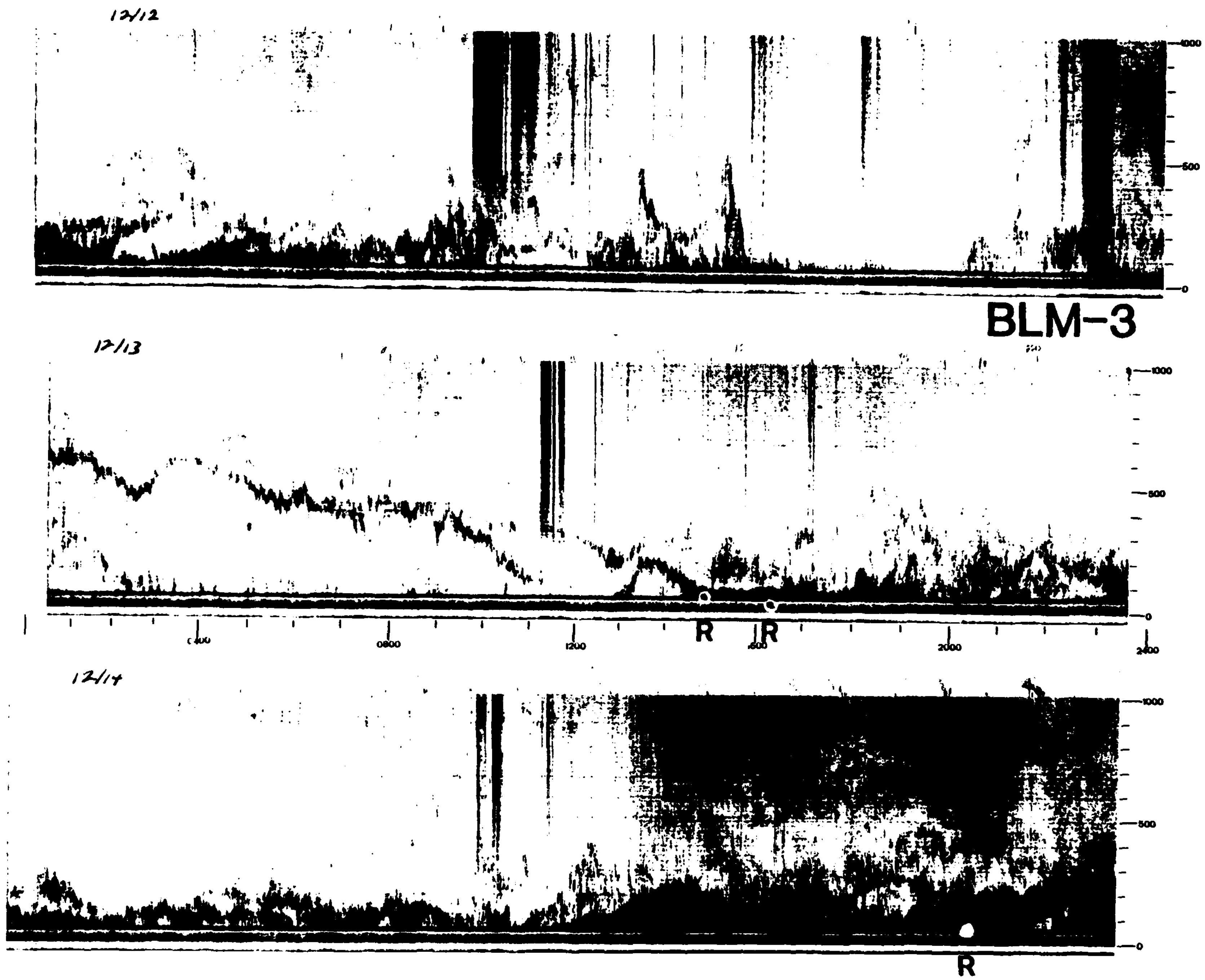
Figure 11 [illegible]



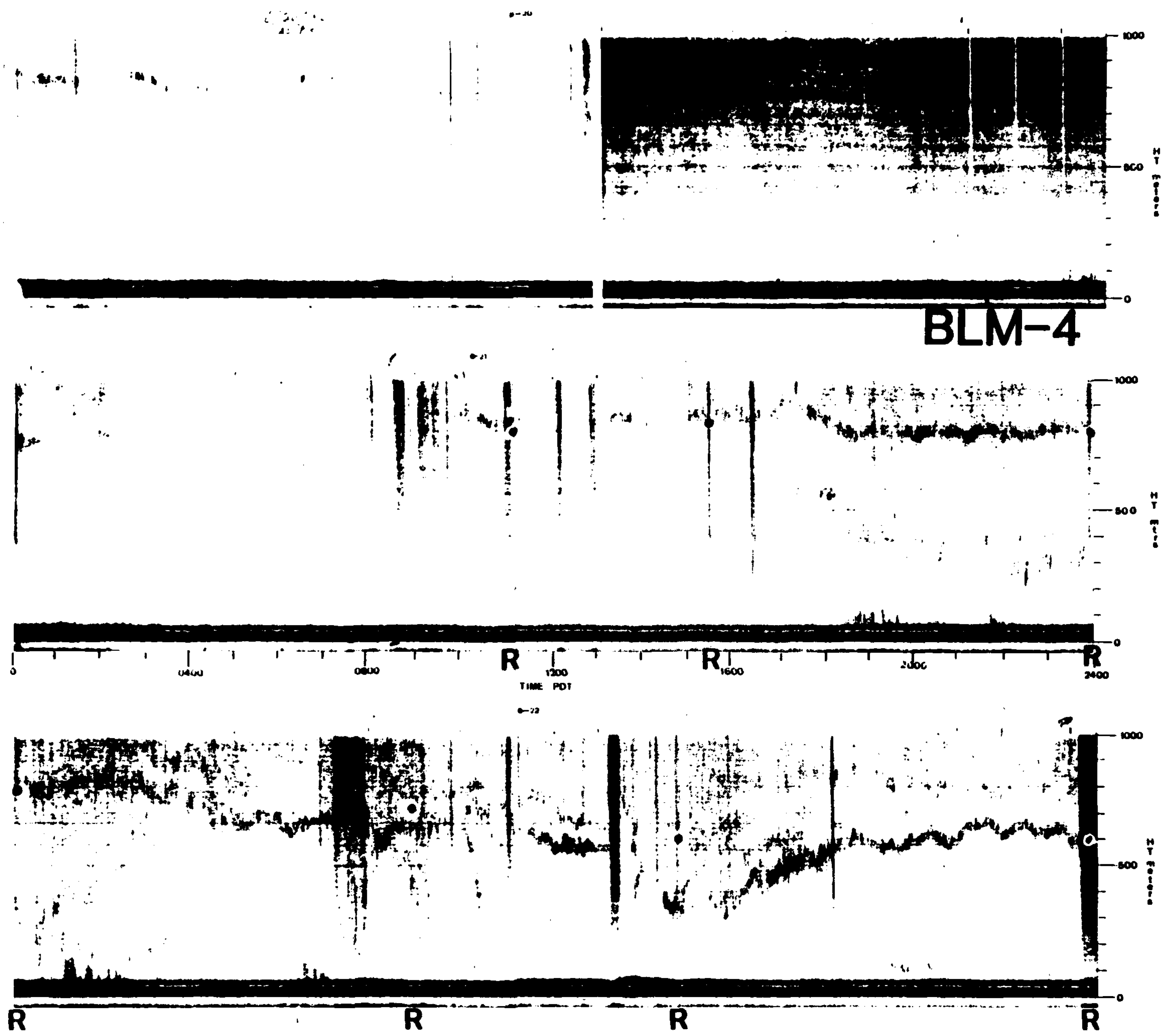
BLM-2
1/14/81
0500
0800
1600
1000
ht (m)
500
0
R
R
1/15/81
0600
1400
1000
ht (m)
500
0
0400
0800
1200
1600
2000
2400
R
R
1/16/81
0600
1300
2200
1000
ht (m)
500
0
R
BLM-2
R

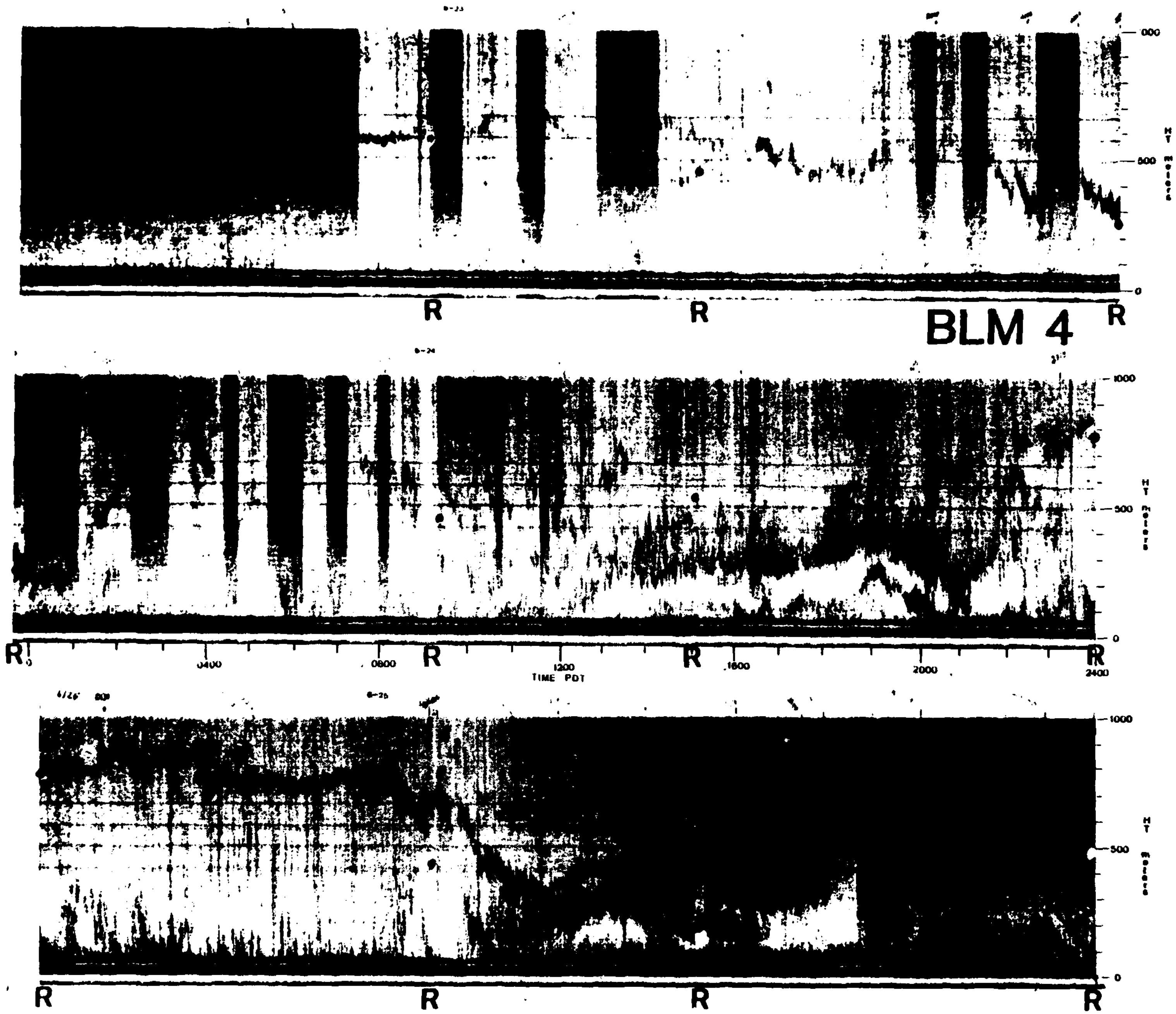

BLM-3
12/7
12/8
R
R
R
R
R
R
1000
500
0
0400
0800
1200
1600
2000
2400


12/9
R
R
BLM-3
12/10
12/11
R
R
0
500
1000
0
0400
0800
1200
1600
2000
2400

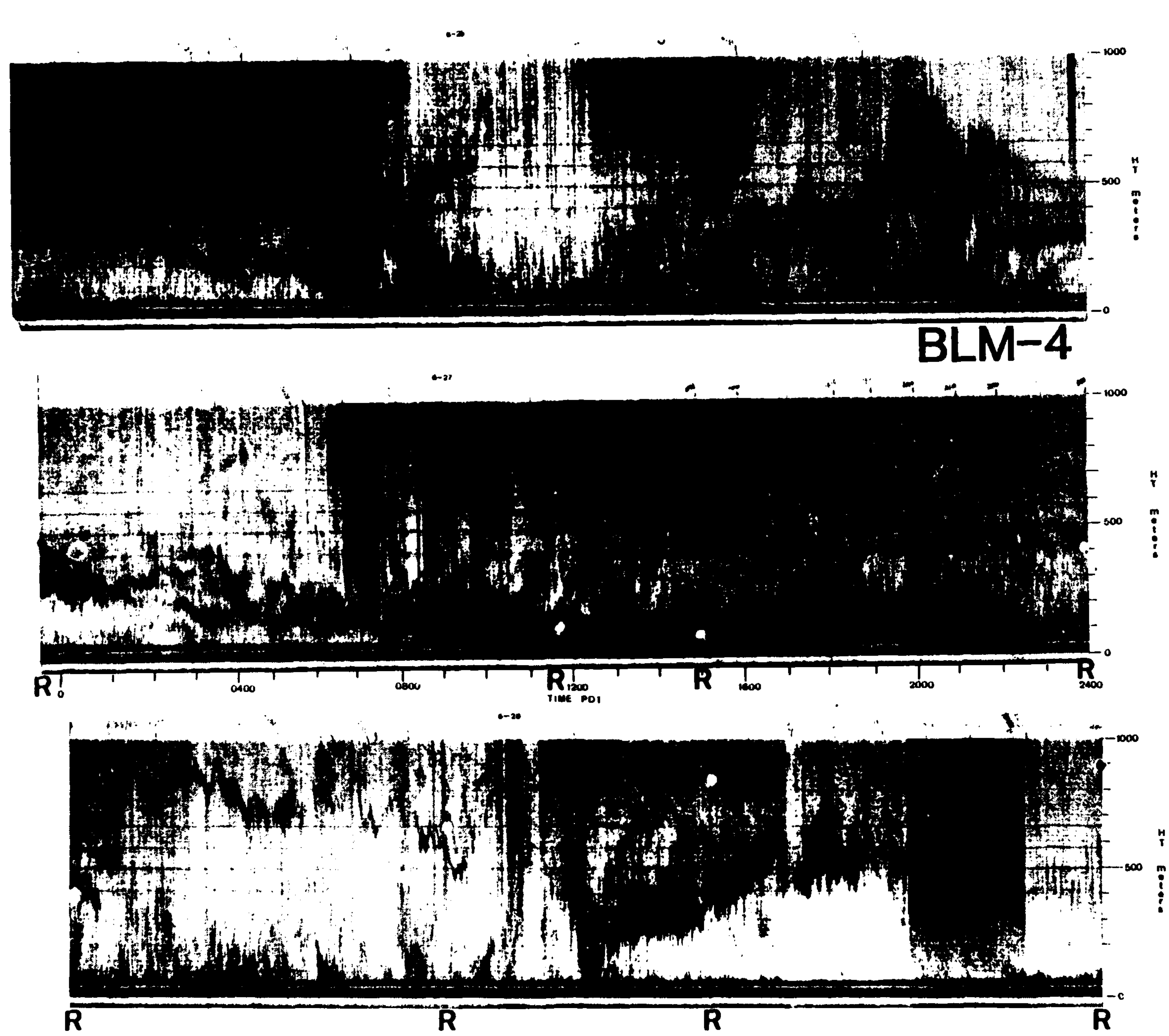

12/12
1000
500
0
BLM-3
12/13
1000
500
0
R
R
0400
0800
1200
2000
2400
12/14
1000
500
0
R

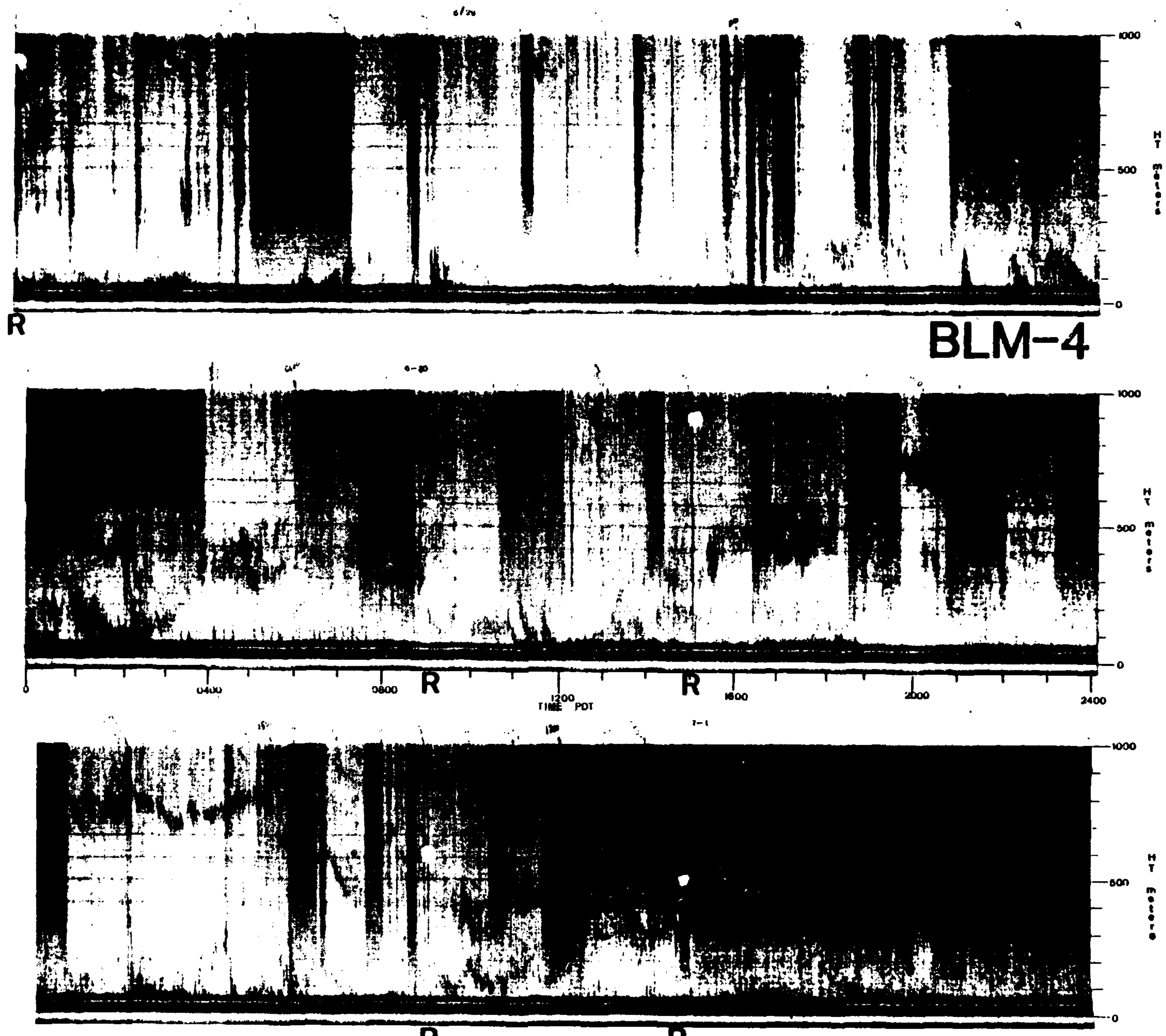

12/15
R
BLM-3
1000
500
0
0400
0800
1200
1600
2000
2400
12/17


BLM-4
HT meters
1000
500
0
TIME PDT
0400
0800
1200
1600
2000
2400
R
R
R
R
R
R
R



BLM 4
R
HT meters
1000
500
0
0400
0800
1200
1600
2000
2400
TIME PDT


BLM-4
HT meters
1000
500
0
0400
0800
1200
TIME PDT
1600
2000
2400
R



BLM-4
HT meters
1000
500
0
0400
0800
1200
1600
2000
2400
TIME PDT
R

Table 6a. Heights from which acoustic echos were detected from the acoustic sounder for BLM-1.

DATE	TIME	height (m) Z_1	Z_2
09/21	0900	0	
	1130	0	
	1200	90	
	1230	120	
	1300	100	
	1330	70	
	1500	60	
	1530	70	
	1600	70	
	1630	0	
	1730	0	160
	1800	0	210
	1830	80	260
	1900	120	
	1930	180	
	2000	240	
	2030	300	
	2100	340	
	2130	290	
	2200	190	
	2230	0	
	2300	300	
	2330	340	
	2400	380	
9/22	0030	400	
	0100	430	
	0130	460	
	0145	350	
	0200	220	
	0230	190	
	0300	160	
	0330	140	
	0400	80	
	0600	0	
	0630	280	
	0700	320	
	0730	410	
	0800	460	
	0830	500	
	0900	520	
	0930	550	
	1000	560	
	1030	570	
	1100	580	
	1130	140	580
	1200	230	590
	1400		
	1430	220	520
	1500	220	450
	1530	240	410
	1600	210	
	1630	270	
9/22	1700	260	
	1730	310	
	1800	320	
	1830	340	
	1900	280	
	2000	360	
	2030	370	
	2100	360	
	2130	400	
	2200	370	
	2230	380	
	2300	300	
	2330	330	
	2400	320	
9/23	0030	340	
	0100	340	
	0130	330	
	0200	320	
	0230	310	
	0300	320	
	0330	330	
	0400	320	
	0430	310	
	0500	320	
	0530	330	
	0600	310	
	0630	320	
	0700	300	
	0730	320	
	0800	310	
	0830	340	
	0900	330	
	0930	340	
	1000	320	
	1030	310	
	1100	330	
	1130	340	
	1200	350	
	1230	360	
	1300	370	
	1330	350	
	1400	330	
	1430	310	
	1500	320	
	1530	330	
	1600	310	
	1630	300	
	1700	290	
	1730	280	
	1300	260	
	1330	270	
	1900	290	

DATE	TIME	height(m) z_1	z_2
9/23	1930	300	
	2000	290	
	2030	310	
	2100	300	
	2130	240	
	2200	210	
	2230	200	
	2300	180	
	2330	200	
9/24	0000	210	
	0030	190	390
	0100	230	
	0130	250	
	0200	270	
	0230	300	
	0300	310	
	0330	320	
	0400	340	
	0430	320	
	0500	330	
	0530	340	
	0600	320	
	0630	310	
	0700	290	
	0730	310	
	0800	320	
	0830	310	
	0900	320	
	0930	310	
	1000	300	
	1030	330	
	1100	320	
	1130	330	
	1200	350	
	1230	360	
	1300	340	
	1330	350	
	1400	340	
	1430	310	
	1500	230	
	1530	270	
	1600	250	
	1630	270	
	1700	280	
	1730	270	
	1800	230	
	1830	270	
	1900	280	
	1930	270	
	2000	260	
	2030	240	
	2100	220	

DATE	TIME	height(m) z_1	z_2
9/24	2130	210	
	2200	170	
	2230	160	
	2300	130	
	2330	200	
9/25	0000	220	
	0030	210	
	0100	230	
	0130	290	
	0200	310	
	0230	330	
	0300	320	
	0330	300	
	0400	290	
	0430	300	
	0500	320	
	0530	310	
	0600	300	
	0630	290	
	0700	240	
	0730	270	
	0800	250	
	0830	270	
	0900	260	
	0930	250	
	1000	240	
9/26	1300	350	
	1330	350	380
	1400	360	
	1430	310	
	1500	280	
	1530	300	
	1600	240	340
	1630	270	
	1700	280	
	1730	290	
	1800	300	
	1830	320	
	1900	330	
	1930	310	
	2000	240	330
	2030	250	
	2100	220	
	2130	240	
	2200	230	
	2230	210	

DATE	TIME	height(m) Z_1	Z_2
9/27	0000	200	
	0100	210	
	0130	220	
	0200	250	
	0230	240	
	0300	260	
	0330	250	
	0400	260	
	0430	270	
	0500	250	
	0530	270	
	0600	270	
	0630	290	
	0700	200	
	0730	180	280
	0800	300	400
	0830	330	440
	0900	340	450
	0930	280	400
	1000	160	380
	1030	180	380
	1100	240	
	1130	230	
	1200	210	
	1230	240	
	1300	230	
	1330	210	
	1400	200	
	1430	210	
	1500	140	230
	1530	130	240
	1600	110	250
	1630	120	270
	1700	110	290
	1730	130	340
	1800	140	360
	1830	150	
	1900	160	
	1930	120	
	2000	100	
	2030	110	220
	2100	90	230
	2130	220	250
	2200	240	260
	2230	230	270
	2300	250	290
	2330	200	280
9/28	0000	200	
	0030	230	
	0100		
	0130		
	0200	280	

DATE	TIME	height(m) Z_1	Z_2
9/28	0200	280	
	0230	250	
	0300	260	
	0330	270	
	0400	260	
	0430	270	
	0500	250	
	0530		
	0600		
	0630	200	
	0700		
	0730		
	0800		
	0830		
	0900		
	0930	250	
	1000	230	
	1030	240	
	1100	300	
	1130	290	
	1200	260	
	1230	210	
	1300	200	
	1330	170	
	1400	150	
	1430	160	
	1500	120	
	1530	110	
	1600	120	
	1630	140	
	1700	130	
	1730	120	
	1800	110	
	1830	130	
	1900		
9/29	0430	240	
	0500	200	280
	0530	240	
	0600	310	
	0630	320	
	0700	350	
	0730	380	
	0800	390	
	0830	360	

DATE	TIME	height (m) Z_1	Z_2
9/29	0900	340	
	0930	360	
	1000	380	
	1030	80	400
	1100	330	
	1130	80	370
	1200	400	
	1230	410	
	1300	100	400
	1330	80	390
	1400	410	
	1430	420	
	1500	330	
	1530	340	
	1600	330	
	1630	310	
	1700	320	
	1730	300	
	1800	280	
	1830	260	
	1900	270	
9/30	No well	defined	
10/1	Inver	sion	
10/2	0800	90	
	0830	110	
	0900	140	
	0930	130	
	1000	110	
	1030	120	
	1100	130	
	1130	140	
	1200	150	
	1230	140	
	1300	190	
	1330	120	
	1400	90	
	1430	100	
	1500	110	
	1530		
	1600	100	
	1630	110	
	1700	80	
	1730		
	1800		
	1330	220	
	1900	230	
	1930	220	
	2000	230	

DATE	TIME	height (m) Z_1	Z_2
10/2	2030	240	
	2100		
	2130		
	2200	110	
	2230	140	
	2300	150	
	2330	130	
10/3	0000	120	
	0030	110	
	0100	90	
	0130	110	
	0200	100	
	0230	130	
	0300	140	
	0330	150	
	0400	170	
	0430	160	
	0500	120	
	0530	140	
	0600	120	
	0630	130	
	0700	140	
	0730	100	
	0800	90	

Table 6b. Heights from which acoustic echos were detected from the acoustic sounder for BLM-2.

DATE	TIME	height(m) Z_1	height(m) Z_2
1/6	1230	120	
	1300	140	
	1330	140	
	1400	160	
	1700	180	
	1730	180	
	1800	240	
	1830	160	
	1900	300	
	1930	280	
	2000	300	
	2030	200	
	2100	200	
1/7	0200	140	
	0600	120	
	0900	120	
	1100	80	
	1130	80	
	1200	80	
	1230	100	180
	1300	200	
	1500	250	
	1530	260	
	1600	200	
	1730	160	
	1930	300	
	2000	300	
	2130	400	
	2200	280	
	2230	160	450
	2300	120	
	2330	340	
	2400	440	
1/8	0030	520	
	0100	500	
	0130	540	
	0200	100	
	0230	140	
	0300	80	
	0330	100	
	0400	100	
	0530	260	
	0830	180	

DATE	TIME	height(m) Z_1	height(m) Z_2
1/8	1936	R 320-600	
	2000	330	
	2100	320	
	2200	320	
	2230	240	
	2300	270	
	2330	360	
1/9	0430	200	
	0500	190	
	0530	200	300
	0600	200	300
	0630	160	240
	0730	250	
	0800	160	
	0830	200	
	0900	160	
	1000	160	
	1030	100	
	1100	100	
	1130	100	
	1200	120	
	1230	140	
	1430	100	
	1530	260	
	1600	360	
	1630	140	300
	1700	180	340
	1730	300	
	1800	260	
	1900	80	160
	1930	200	
	2000	160	
	2030	120	280
	2100	120	
1/13	0200	160	
	0230	220	
	0300	260	
	0330	250	
	0400	260	
	0430	240	
	0500	220	
	0800	180	500
	1800	100	
	1830	130	
	1900	120	
	1930	100	
	2000	140	

DATE	TIME	height (m) Z_1	Z_2
1/13	2030	160	
	2100	200	
	2130	180	
	2330	180	
1/14	0130	100	
	0200	180	
	0230	180	
	0300	160	
	0400	80	
	0500	100	
	0630	160	
	1000	200	
	1100	170	
	1130	160	
	1200	100	
	1230	80	
	1300	100	
	1400	180	
	1500	200	
	1600	160	
	1700	80	
	1730	80	
	1800	160	
	1830	120	
	1900	160	
	2000	200	
	2030	230	
	2100	220	
	2130	160	240
	2200	200	300
	2230	210	300
	2300	300	
	2330	190	
1/15	0100	350	
	0130	260	
	0200	180	
	0230	160	
	0300	100	300
	0330	300	
	0400	420	
	0500	420	
	0530	360	
	0600	400	
	0700	460	
	0730	450	
	0800	380	
	0830	340	
	0930	140	

DATE	TIME	height (m) Z_1	Z_2
1/15	1200	120	
	1230	160	
	1300	200	
	1530	100	
	1600	350	
	1630	260	
	1700	150	
1/16			
	1000	550	
	1130	400	
	1330	360	
	2200	220	
	2230	160	260
	2300	100	
	2330	180	

Table 6c. Heights from which acoustic echos were detected from the acoustic sounder for BLM-3.

DATE	TIME	height (m) Z_1	height (m) Z_2
12-6-81	0900		
	0930		
	1000		
	1030		
	1100		
	1130	480	
	1200	420	
	1230	360	70
	1300	350	90
	1330	320	100
	1400		100
	1430		110
	1500		110
	1530		100
	1600		120
	1630		130
	1700	360	
	1730	320	
	1800	330	
	1830	360	
	1900	380	
	1930	350	
	2000	240	
	2030	180	
	2100	140	
	2130	250	
	2200	220	
	2230	180	
	2300	150	
	2330	140	
12-7-81	0000	160	
	0030	160	
	0200	200	
	0230	230	
	0300	170	
	0330	220	
	0400	180	
	0430	140	
	0500		
	0530	260	
	0600	220	
	0630	240	
	0700	210	
	0730	170	
	0800	160	
	0830	210	
	0900	250	
	0930	280	
	1000	240	
	1030	200	
	1100		
	1130	225	
	1200	240	
	1230	300	
	1300	350	
	1330	290	
	1400	245	
	1430	200	
	1500	190	
	1530	160	
	1600		
	1630		
	1700		
	1730		
	1800		
	1830	170	
	1900	180	
	1930	160	
	2000	150	
	2030	170	
	2100	160	
	2130	170	
	2200	190	
	2230	190	
	2300	250	
	2330		
	2400		
12-8-81	0030	120	
	0100	130	230
	0130	110	170
	0200	130	
	0230	160	
	0300	180	
	0330	150	
	0400	130	
	0430	150	
	0500	160	
	0530	150	
	0600	120	
	0630	150	
	0700	130	
	0730		
	0800		
	0830		
	0900		
	0930	340	
	1000	350	
	1030	330	
	1100		
	1130		
	1200	300	
	1230	260	
	1300	210	
	1330	220	
	1400	220	
	1430	230	

DATE	TIME	height(m) Z_1	height(m) Z_2
12-8-81	1500	250	
	1530	210	
	1600	200	
	1630	210	
	1700	170	300
	1730	160	320
	1800	150	280
	1830	140	290
	1900	140	280
	1930	310	
	2000	290	
	2030		
	2100		
	2130		
	2200	80	
	2230	125	
	2300	110	260
	2330	120	280
	2400	200	350
12-9-81	0030	290	
	0100	280	
	0130	240	
	0200	290	
	0230	270	
	0300	280	
	0330	310	
	0400	290	
	0430	250	
	0500	200	
	0530	220	
	0600	240	
	0630	310	
	0700	350	
	0730	330	
	0800	320	
	0830	310	
	0900	330	
	0930	360	
	1000	410	
	1030	540	
	1100	600	
	1130	540	
	1200	640	
	1230	660	
	1300	680	
	1330	500	680
	1400	430	720
	1430	440	700
	1500	430	780
	1530	425	750
	1600	380	500
	1630	350	440
	1700	310	460

DATE	TIME	height(m) Z_1	height(m) Z_2
	1730	230	360
	1800	260	360
	1830	270	
	1900	250	80
	1930	270	200
	2000	340	160
	2030	300	140
	2100	340	580
	2130	240	570
	2200	280	520
	2230	290	450
	2300	300	200
	2330	310	170
	2400	250	130
12-10-81	0030		140
	0100		130
	0130	240	
	0200	340	
	0230	290	
	0300	270	
	0330	190	
	0400		
	0430	340	
	0500	250	
	0530	190	
	0600	150	
	0630	110	
	0700	120	
	0730	150	
	0800	210	
	0830	200	
	0900		
	0930		
	1000		
	1030		
	1100		
	1130		
	1200	190	
	1230	240	
	1300	230	
	1330	100	
	1400		
	1430		
	1500		
	1530		
	1600		
	1630		
	1700		
	1730		
	1800		
	1830	410	
	1900	420	
	1930	440	

		height(m)				height(m)	
DATE	TIME	Z_1	Z_2	DATE	TIME	Z_1	Z_2
12-10-81	2000	490			2230	400	
	2030	510			2300	380	
	2100	490			2330	320	
	2130	460			2400	340	
	2200	430		12-12-81	0030	420	310
	2230	440			0100	430	320
	2300	380			0130	450	330
	2330	390			0200	440	320
	2400	340			0230	440	280
12-11-81	0030				0300	450	260
	0100				0330	430	260
	0130				0400	400	260
	0200				0430	370	
	0230				0500	350	
	0300				0530	330	
	0330				0600	300	
	0400				0630	310	
	0430	510			0700	320	
	0500	460			0730	280	
	0530	460			0800	250	
	0600	470			0830	230	
	0630	490			0900		
	0700	480			0930	100	
	0730	460			1000	120	
	0800	480			1030	140	
	0830	420			1100	100	
	0900	360			1130		
	0930	420			1200	450	
	1000	430			1230	200	700
	1030	370			1300	140	450
	1100	350			1330	200	340
	1130	340			1400		
	1200				1430		
	1230				1500		
	1300				1530		
	1330	100			1600		
	1400	160			1630		
	1430	140			1700		
	1500				1730		
	1530				1800		
	1600				1830		
	1630				1900		
	1700				1930		
	1730				2000	420	
	1800				2030	500	
	1830	180			2100		
	1900				2130		
	1930	200			2200	700	
	2000	230			2230	650	
	2030	210			2300	600	
	2100	220			2330	580	
	2130	260			2400	580	
	2200	350		12-13-81	0030	580	

DATE	TIME	height (m) Z_1	height (m) Z_2
12-13-81	0100	580	
	0130	580	
	0200	540	
	0230	460	
	0300	450	
	0330	580	
	0400	580	
	0430	540	
	0500	480	
	0530	420	
	0600	430	
	0630	420	
	0700	390	
	0730	380	
	0800	400	
	0830	380	
	0900	350	
	0930	320	
	1000	280	
	1030	320	160
	1100	330	130
	1130	300	100
	1200	260	120
	1230	250	160
	1300	200	160
	1330	250	180
	1400	280	120
	1430	240	60
	1500	150	
	1530	120	
	1600	130	
	1630		
	1700	280	
	1730		
	1800	400	
	1830		
	1900	340	
	1930	280	
	2000	420	
	2030		
	2100		
	2130		
	2200	240	
	2230	160	
	2300	140	
	2330	100	
	2400		
12-14-81	0030	210	
	0100	170	
	0130	140	
	0200	240	
	0230		
	0300	230	

DATE	TIME	height (m) Z_1	height (m) Z_2
	0330	200	
	0400	220	400
	0430	180	
	0500	160	250
	0530		
	0600	140	
	0630		
	0700		
	0730		
	0800		
	0830	300	
	0900		
	0930	400	
	1000		
	1030	220	
	1100	240	
	1130	300	
	1200		
	1230		
	1300		
	1330		
	1400		
	1430		
	1500		
	1530		
	1600	200	
	1630	200	
	1700		
	1730	200	
	1800		
	1830	230	
	1900	250	
	1930	320	210
	2000	340	
	2030	380	
	2100	320	
	2130	280	
	2200	320	100
	2230		140
	2300	200	
	2330	320	
	2400	340	
12-15-81	0030	310	
	0100		
	0130	330	
	0200	300	
	0230	240	
	0300	280	200
	0330		200
	0400	300	140
	0430		
	0500	220	
	0530	160	

		height (m)				height (m)	
DATE	TIME	Z_1	Z_2	DATE	TIME	Z_1	Z_2
12-15-81	0600	140	500		0830	240	
	0630	120	400		0900		
	0700				0930		
	0730				1000		
	0800				1030		
	0830		90		1100		
	0900		120		1130	80	
	0930		160		1200	170	
	1000	300	140		1230	270	
	1030	340	100		1300		
	1100	360	150		1330		
	1130	390	200		1400	110	
	1200				1430	150	
	1230				1500	160	
	1300				1530		
	1330				1600		
	1400	400			1630		
	1430				1700	140	
	1500				1730	130	
	1530				1800	220	
	1600	380			1830		
	1630				1900	160	
	1700				1930	100	
	1730	220			2000		
	1800				2030	140	
	1830				2100		
	1900	320			2130		
	1930	310			2200	250	130
	2000	320			2230	270	
	2030				2300	290	
	2100	210			2330		
	2130				2400		
	2200			12-17-81	0030		
	2230				0100		
	2300	250			0130		
	2330				0200	100	
	2400	140			0230	120	
12-16-81	0030				0300	100	320
	0100				0330		340
	0130				0400		
	0200	150			0430	140	280
	0230				0500		
	0300				0530		380
	0330	170			0600	100	270
	0400				0630	120	300
	0430	160			0700		280
	0500				0730		
	0530	230			0800		
	0600				0830		
	0630				0900	180	
	0700				0930		
	0730				1000		
	0800	240			1030		

DATE	TIME	height(m) Z_1	height(m) Z_2	DATE	TIME	height(m) Z_1	height(m) Z_2
12-17-81	1100	80					
	1130	100					
	1200	120					
	1230	170					
	1300	230					
	1330	220					
	1400	230					
	1430	190					
	1500	180					
	1530	170					
	1600						
	1630	80					
	1700	90					
	1730	120					
	1800	120					
	1830	160					
	1900	240					
	1930	280					
	2000	200					
	2030	160					
	2100	130					
	2130	140					
	2200						
	2230	200					
	2300	170					
	2330	160					
	2400	170					

Table 6d. Heights from which acoustic echos were detected from the acoustic sounder for BLM-4.

DATE/ TIME	height (m) Z_1	Z_2	Z_3	DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/20/82				6/21/82			
1300		260	750	1430	140		800
1330		230	760	1500	170		840
1400		220	770	1530	160		840
1430		260	780	1600	110		850
1500		260	770	1630	140		840
1530		210	760	1700		220	880
1600		210	760	1730		320	890
1630		260	770	1800		360	830
1700		210	750	1830		390	790
1730		220	770	1900		350	780
1800		210	760	1930		300	780
1830		230	770	2000		310	770
1900		270	770	2030		280	780
1930	200		720	2100		270	780
2000	120		750	2130		270	780
2030	210		760	2200	150		760
2100	170		720	2230	200		760
2130	150		740	2300	220		790
2200			750	2330	160		790
2230			760	2400	140		780
2300			740	6/22/82			
2330			710	0030	170		790
6/21/82				0100	150		740
0000			720	0130	130		750
0030			740	0200	110		780
0100			760	0230	140		800
0130			760	0300	110		770
0200			760	0330	120		720
0230			760	0400	180		710
0300			750	0430	190		680
0330			740	0500	230		670
0400			710	0530	170		700
0430			710	0600	140		640
0500			730	0630	110		630
0530			700	0700	130		660
0600			700	0730	180		640
0630			660	0800		210	610
0700			670	0830		290	580
0730			720	0900		300	610
0800			760	0930		300	590
0830			760	1000		310	620
0900			780	1030		350	650
0930	90		820	1100		330	600
1000		200	850	1130		240	590
1030		240	820	1200	150		550
1100		170	820	1230			540
1130	80		790	1300			520
1200			800	1330			520
1230			810	1400		360	
1300			820	1430		330	
1330			840	1500		310	
1400	100		830	1530		260	

DATE/TIME	height (m) Z_1	Z_2	Z_3
6/22/82			
1600		300	
1630		410	
1700		430	
1730		480	
1800		480	
1830			570
1900			560
1930			560
2000			580
2030			590
2100			570
2130			640
2200			610
2230			620
2300			610
2330			590
2400			
6/23/82			
0730			550
0800			540
0830			580
0900			600
0930			590
1000			600
1030			640
1100			620
1130			640
1200			550
1230			
1300			
1330			650
1400			610
1430			600
1500			560
1530		480	
1600		520	
1630		440	
1700		460	
1730		440	
1800		420	
1830		420	
1900		490	
1930			560
2000			500
2030			500
2100		480	
2130		360	
2200		240	
2230		400	
2300		410	
2330		320	

DATE/TIME	height (m) Z_1	Z_2	Z_3
6/24/82			
0000		240	
0030			
0100			
0130	100		
0200	200	400	
0230	110		590
0300			620
0330			600
0400			580
0430			520
0500	100	400	
0530	180		490
0600			490
0630			540
0700			560
0730			560
0800			520
0830	180	420	
0900	200		580
0930	200		500
1000	180		480
1030	170		480
1100	150		500
1130	220		500
1200	200		520
1230	100	280	550
1300	200	300	600
1330	180	300	680
1400	190	340	640
1430	220	390	600
1500	240	400	600
1530	220	400	670
1600	200	400	710
1630	220	380	730
1700	230	340	730
1730		260	740
1800		280	760
1830	100	340	[illegible]
1900		240, 33[illegible]	[illegible]
1930	160	300, 4[illegible]	[illegible]
2000	80	240, [illegible]	[illegible]
2030	180		
2100	100		
2130		[illegible]	
2200		[illegible]	
2300	[illegible]		
2330	[illegible]		
2400			
6/25/82			
0030			
[illegible]			
[illegible]			

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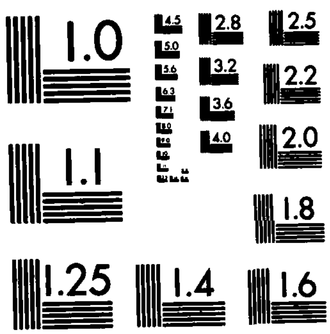


MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/25/82			
0200			850
0230			760
0300			840
0330	160		820
0400	100		700
0430			730
0500			720
0530			710
0600			700
0630			710
0700			740
0730			720
0800	100		710
0830	160		670
0900		240	580
0930		270	660
1000	160		560
1030	90	380	
1100	100	320	
1130	140	300	
1200	160	310	
1230	200	360	
1300	230		
1330	230	350	
1400	220	370	
1430	180	240,350	
1500	120	280,320	
1530	120	270	
1600	120	260	
1630	120	260	
1700		280	
1730		260	
1800			
1830			
1900	100		
1930	160		
2000	140		
2030	90		
2100	100		
2130	120		
2200	60		
2230	90		640
2300	120		600
2330	60	420	
2400		450	
6/26/82			
0030		500	
0100	90	480	
0130	120	340	
0200		340	
0230		300	
0300		280	

DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/26/82			
0330		220	
0400		240	
0430	160		
0500	180		
0530	160		
0600	180		
0630	120		
0700			
0730	100		
0800	200		
0830	160		
0900	120		
0930	80		
1000	100		
1030	80		
1100	80		
1130	120		
1200	140		
1230	160		
1300	180		
1330	240		
1400	220		
1430	160		
1500	160		
1530	200		
1600		270	
1630	220		
1700	180		
1730		280	
1800	160		
1830	160		
1900	200		
1930		300	
2000			540
2030			500
2100		440	
2130		380	
2200		360	
2230		340	
2300		340	
2330	70	360	
2400		360	
6/27/82			
0030		240	
0100		240	
0130		260	
0200	100	210,280	
0230	120	200,340	
0300	100	200,280	
0330	150	300	
0400	140	270	
0430	200		

DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/27/82			
0500	140	200	
0530	100	200	
0600	180	230	
0630	100	200	
0700	110		
0730	110	160	
0800	80	180	
0830	100	240	
0900	100		
0930	120		
1000	80		
1030		240	
1100		240	
1130	90	270	
1200	120	240	
1230		180	
1300			
1330			
1400			
1430			
1500			
1530			
1600			
1630	140		
1700	80	200	
1730	100	240	
1800	100	250	
1830	100	300	
1900	100	200	410
1930	100	240	520
2000	100	300	600
2030	100	360	620
2100	100	390	630
2130	100	440	680
2200		460	710
2230		300	680
2300	80	330	630
2330		390	620
2400		380	640
6/28/82			
0030		360	660
0100		310	680
0130		260	730
0200	180		740
0230			840
0300			760
0330	100		840
0400	170		700
0430	230		660
0500	230		660
0530	230		690
0600	200		740

DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/28/82			
0630	190		760
0700	160		660
0730	100		700
0800			710
0830			580
0900			540
0930		490	
1000			660
1030		480	
1100		490	
1130		400	
1200		260	
1230	90		
1300		200	
1330		240	
1400		240	
1430		240	
1500		290	
1530		340	
1600		420	
1630		460	
1700		430	
1730		390	
1800		440	
1830		450	
1900		470	
1930		430	
2000		420	
2030		410	
2100		400	
2130		400	
2200		400	
2230		400	
2300		390	
2330		360	
2400		300	
6/29/82			
0030		340	
0100		320	
0130		300	
0200			
0230			
0300			
0330			
0400			
0430			
0500			
0530			
0600			
0630			
0700			
0730			

DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/29/82			
0800			
0830			
0900			
0930			
1000			
1030			
1100			
1130			
1200			
1230			
1300			
1330			
1400			
1430			
1500			
1530			
1600			
1630			
1700			
1730			
1800			
1830			
1900			
1930			
2000			
2030			
2100			
2130			
2200			
2230			
2300			
2330			
2400			
6/30/82			
0030			
0100		360	
0130		420	
0200		380	
0230			
0300			
0330		290	
0400		300	
0430		290	
0500		250	
0530		290	
0600		330	
0630		300	
0700		300	
0730		300	
0800		220	
0830		200	
0900		300	

DATE/ TIME	height (m) Z_1	Z_2	Z_3
6/30/82			
0930			
1000			
1030			
1100			
1130			
1200			
1230			
1300	100		
1330	120		
1400	170		
1430		240	
1500		270	
1530		300	
1600		360	
1630		340	
1700		340	
1730		320	
1800		400	
1830		460	
1900			540
1930			650
2000			750
2030			740
2100			710
2130			660
2200			600
2230			580
2300			580
2330			610
2400			630
7/1/82			
0030			670
0100			720
0130			730
0200			740
0230			770
0300			670
0330			710
0400			700
0430			720
0500			770
0530			750
0600			590
0630			530
0700			560
0730		400	
0800		370	
0830		360	
0900		350	
0930		340	
1000	100	270	
1030	100	280	

DATE/ TIME	height (m) Z_1	Z_2	Z_3	DATE/ TIME	height (m) Z_1	Z_2	Z_3
7/1/82							
1100	100	390					
1130	140	400					
1200	120	360					
1230	200	370					
1300	280	380					
1330	290	400					
1400	220						
1430	310						

Table 7. Boundary layer depth as determined from radiosondes

BLM-1 Date/Time	BLM-1 Z_i (m)	BLM-2 Date/Time	BLM-2 Z_i (m)	BLM-3 Date/Time	BLM-3 Z_i (m)	BLM-4 Date/Time	BLM-4 Z_i (m)
9/21-1205	70	1/5 -1953	230	12/6-1615	340	6/21-1100	890
22-0015	360	6 -0740	110	7-0450	150	1535	840
1215	800	1905	60	1645	130	22-0000	810
23-0715	370	7 -0800	5	8-0450	5	0900	720
1250	340	1850	270	1445	5	1500	880
24-0010	220	8 -0815	570	1825	130	2345	750
1215	310	1915	410	9-0435	230	23-0900	600
25-0040	230	9 -0810	80	1635	980	1500	600
27-0607	400	1800	100	10-0435	5	24-0000	260
1820	400	13-1930	140	1640	1270	0900	470
28-0740	280	14-0705	40	11-0500	600	1500	550
1705	260	1920	230	1445	630	25-0000	790
29-0630	150	15-0830	150	1851	920	0900	420
1735	30	0900	30	13-0507	150	1500	600
30-1207	70	1905	220	1455	50	27-0000	480
10/1-0025	5	16-0820	400	1620	5	1145	120
1230	110	1935	280	14-2030	60	1500	90
2200	5			15-1253	60	28-0000	410
2-1040	20			2007	1110	0900	750
				16-1610	5	1500	860
						29-0000	1020
						0900	100
						1500	150
						30-0000	1380
						0900	600
						1500	850
						7/1-0900	680
						1500	600

IV-3. Radiosonde Profiles and Mixed Layer Parameters

During BLM-1,2 and 3, radiosondes were released from the ship twice a day, generally near 0700 and 1900, local time. During BLM-4 three daily releases were made, at 0900, 1500, and 2400, local time. This operation was performed by Navy radiosonde teams from the Naval Oceanography Command Facility, North Island, San Diego, CA. Upon completion of the launch and initial evaluation of a sounding, the team immediately reported the inversion height to the meteorology team watch so it could be logged into the data acquisition system. The radiosonde determined inversion height was used when available because of difficulties in interpreting the acoustic sounder, which were described in the previous section.

The common procedure of determining temperature and humidity at standard levels and significant points is too coarse for our purposes. We are interested in the detailed structure of the boundary layer. Thus, the original strip chart output and the radiosonde calibrations are used to obtain finer scale data. These data are then entered into a computer and the virtual potential temperature, θ_v, and water vapor mixing ratio, q, profiles calculated and plotted. These plots are digitized to produce the well mixed values of θ_v and q in the boundary layer, their jumps at the layer top (assuming no gradient or a 1st order jump) and the gradients above. The digitized results are then plotted as dashed line profiles and the determined quantities printed on the same graph.

This procedure allows one to obtain as good a determination of boundary layer properties as is possible from these types of data. The well mixed values, jumps, and gradients above are the parameters that are needed as inputs to an integrated boundary layer model.[17] Examination of the graphs also allows one to determine quickly whether the layer is well mixed or not.

There are two apparent sources of error in radiosonde results. The data from the lowest height, which is obtained at the ship, and the first reading after release, where the sonde has not come to equilibrium, are often in error and should not be used. Thus, it is not possible to use the radiosonde to determine surface layer properties. Also, the humidity sensor is not capable of determining a value below 20% so that errors can be introduced in the dry region above the marine layer.

The fine scale radiosonde profiles and the and q digitized profiles are presented in Figures 12. The two types of plots for a given day are on facing pages for easy comparison. On the temperature/humidity plots the solid line is temperature and the dashed line humidity. On the potentential temperatue/specific humidity plots the curve on the right is potential temperature, and the units in the enclosed table are gm/kgm and °C.

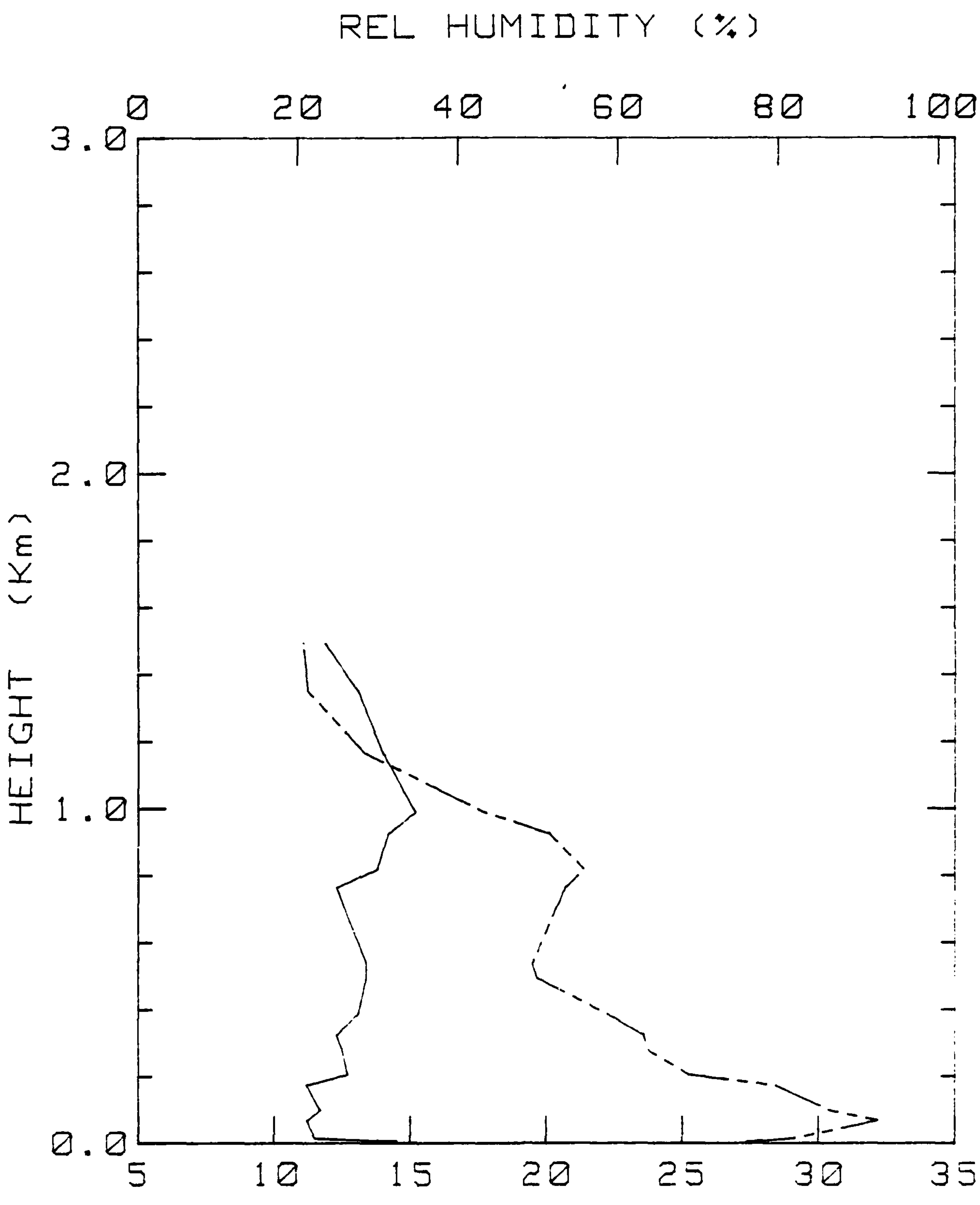


Figure 12 a (1, 9,21,20)

TEMP (CENT)

BLM-I 21 SEPT 80 1205

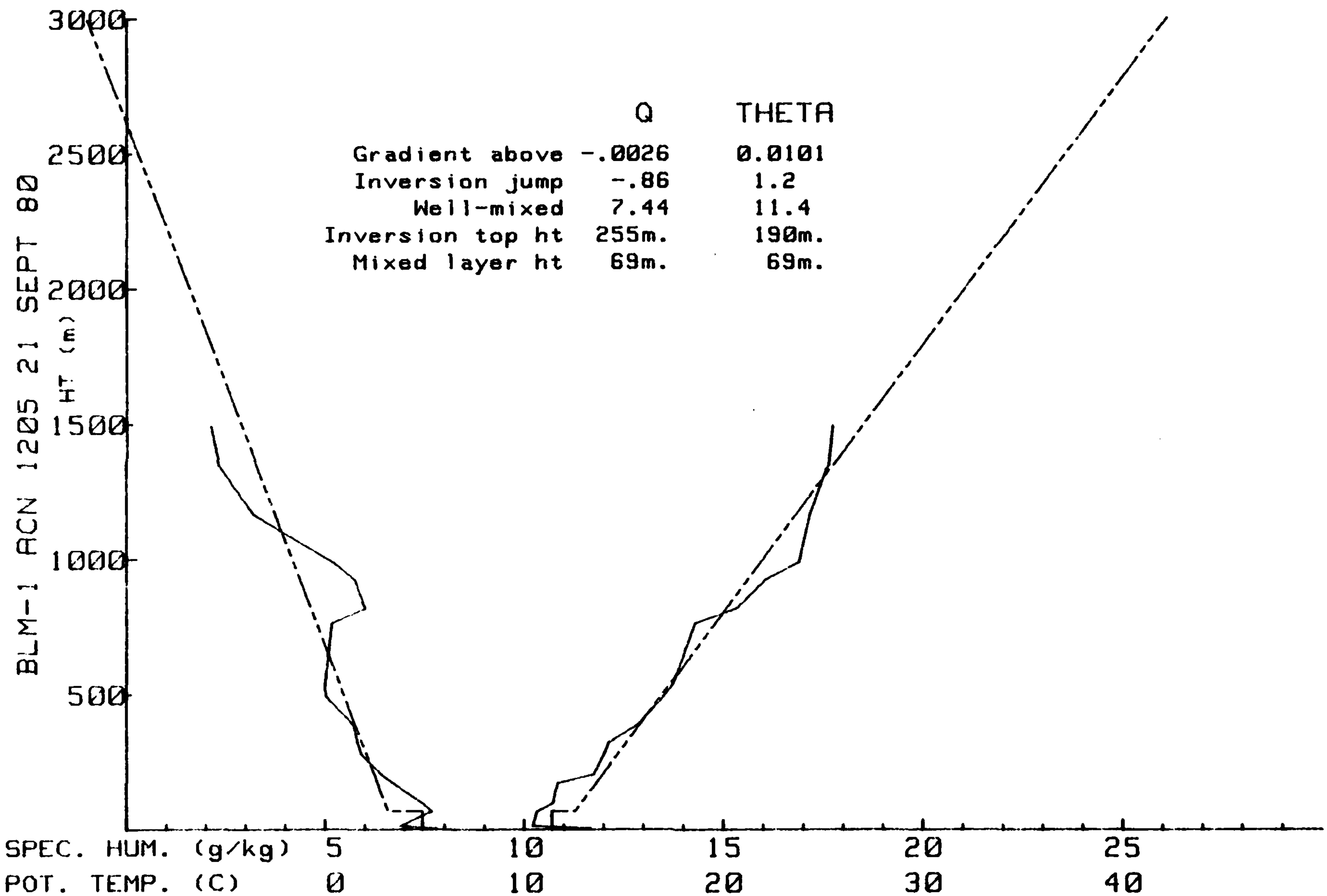


Figure 1-b (1, 9, 21, 80)

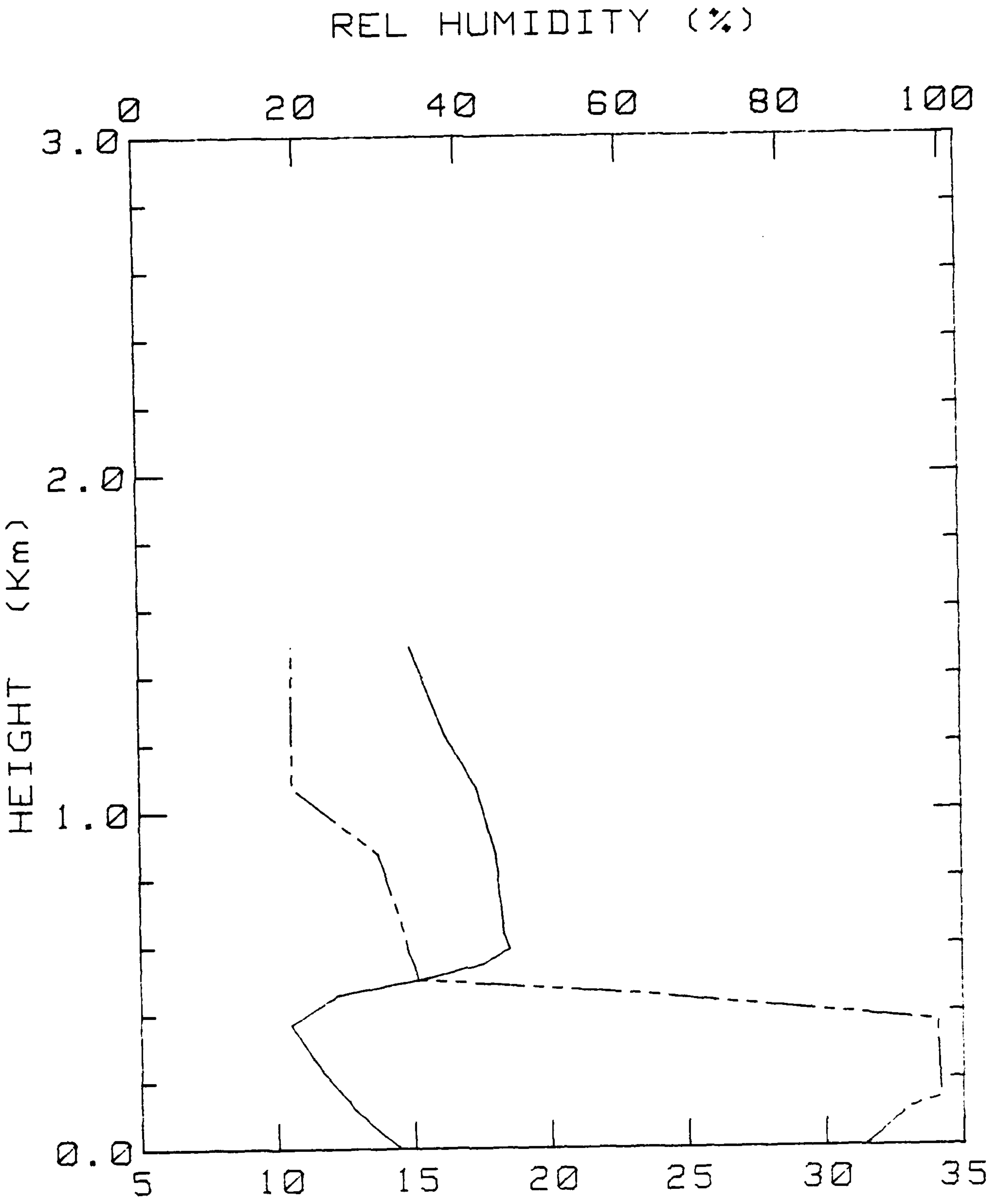


Figure 12 a (1, 9,21,80)

TEMP (CENT)

BLM-I 22 SEPT 80 15

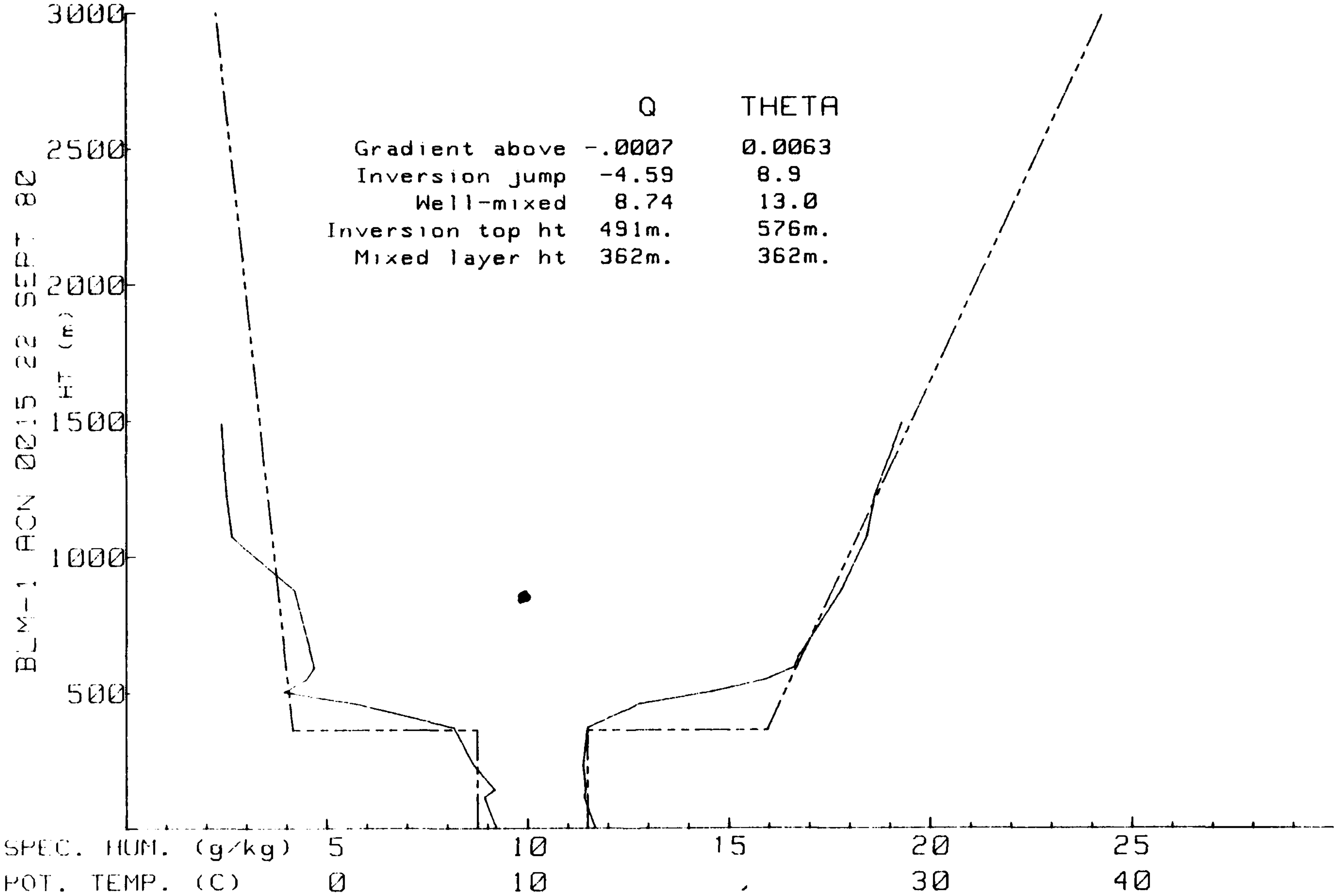


Figure 1? b (1, 9,22,80)

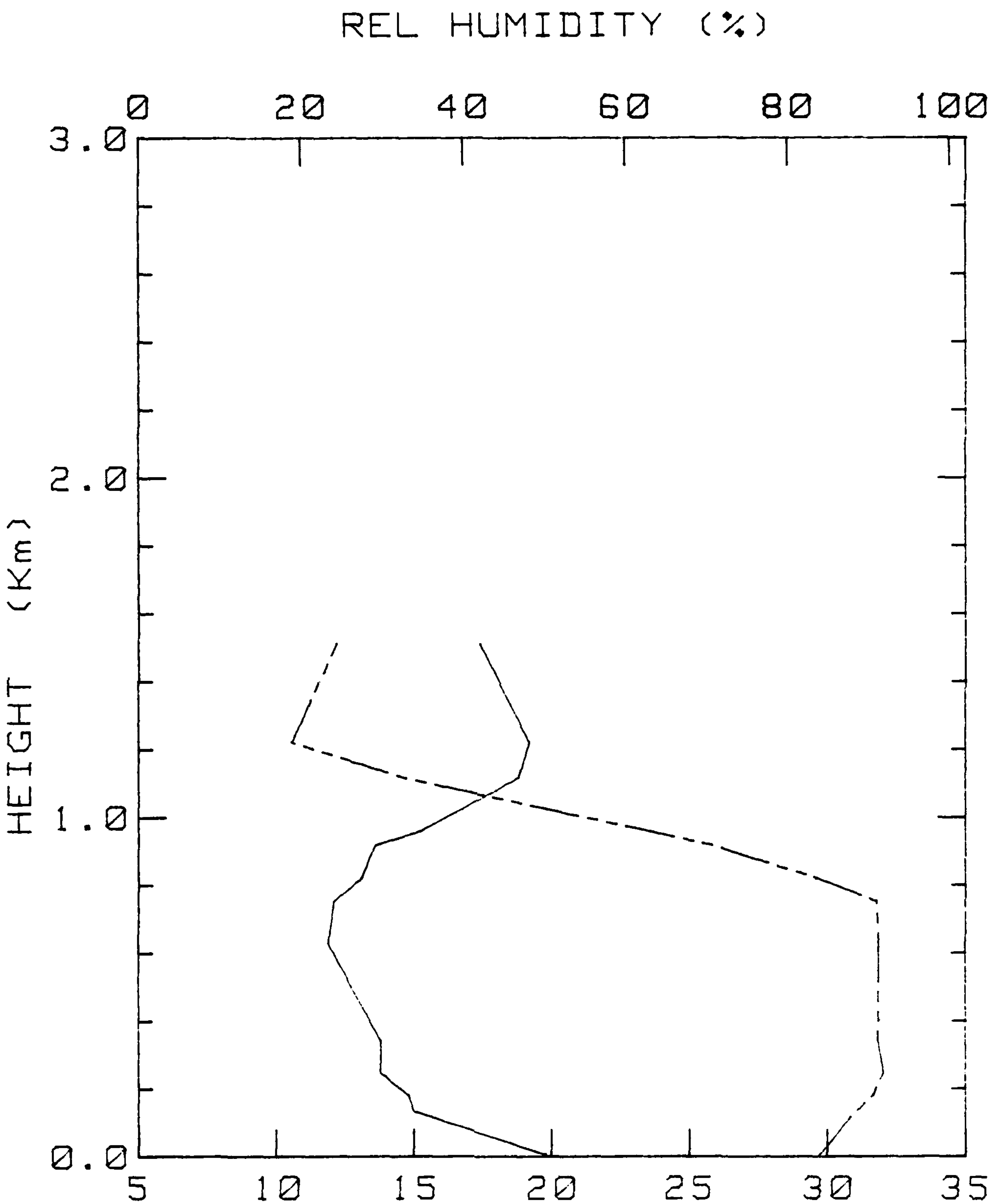


Figure 12 a (1, 9,22,80)

TEMP (CENT)

BLM-I 22 SEPT 80 1215

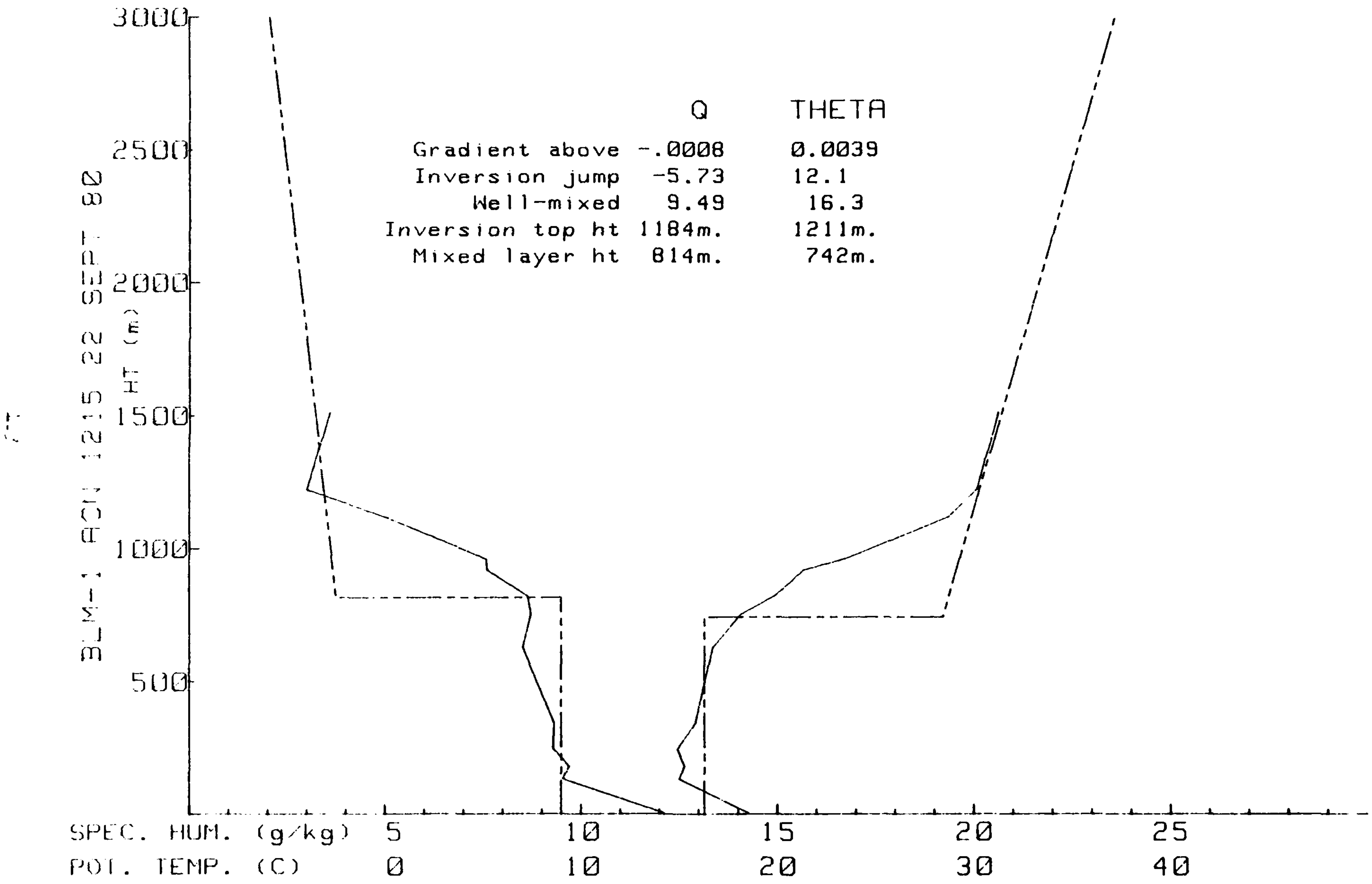


Figure 12 b (1, 9, 22, 80)

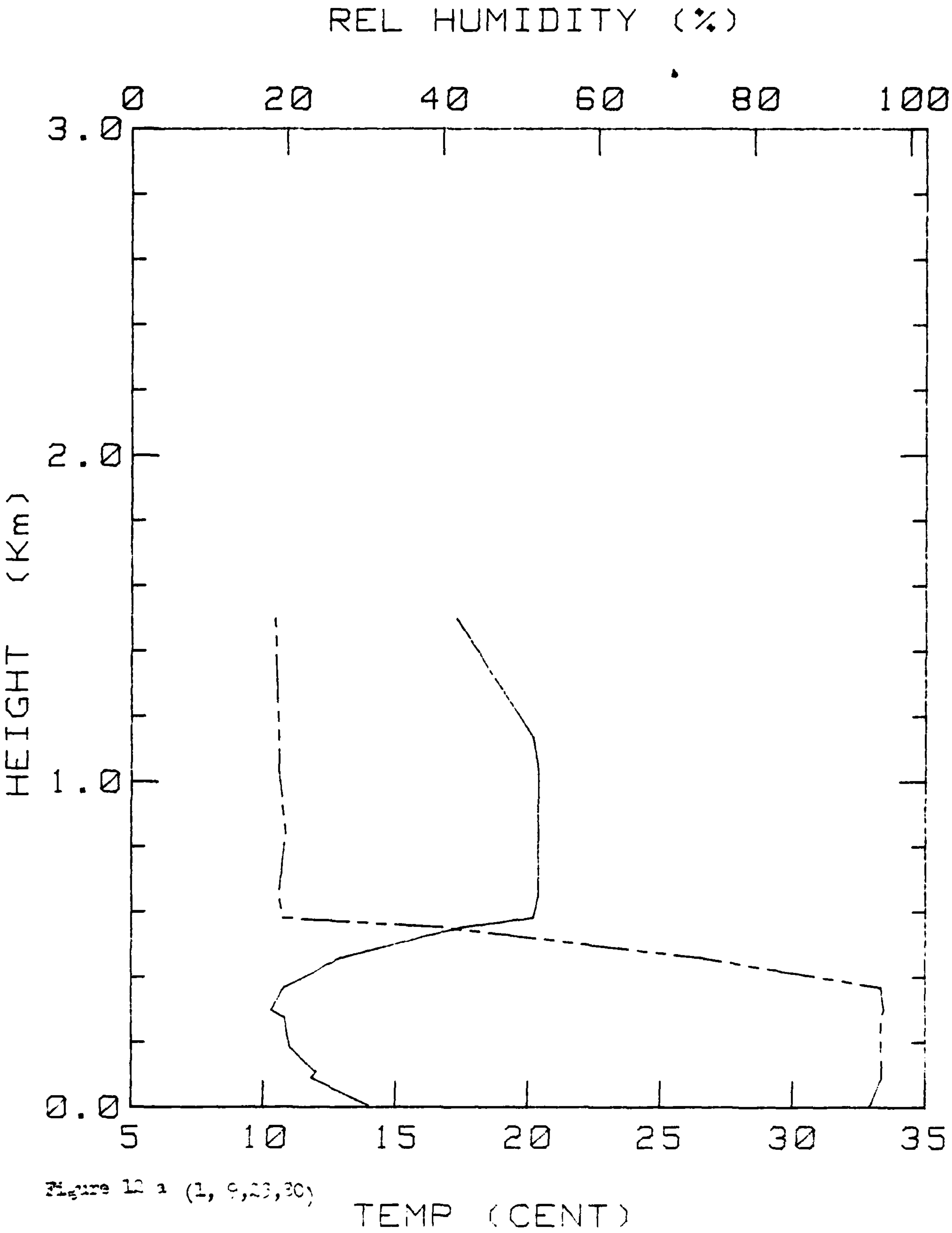


Figure 12 a (1, 9,23,30)

BLM-I 23 SEPT 80 715

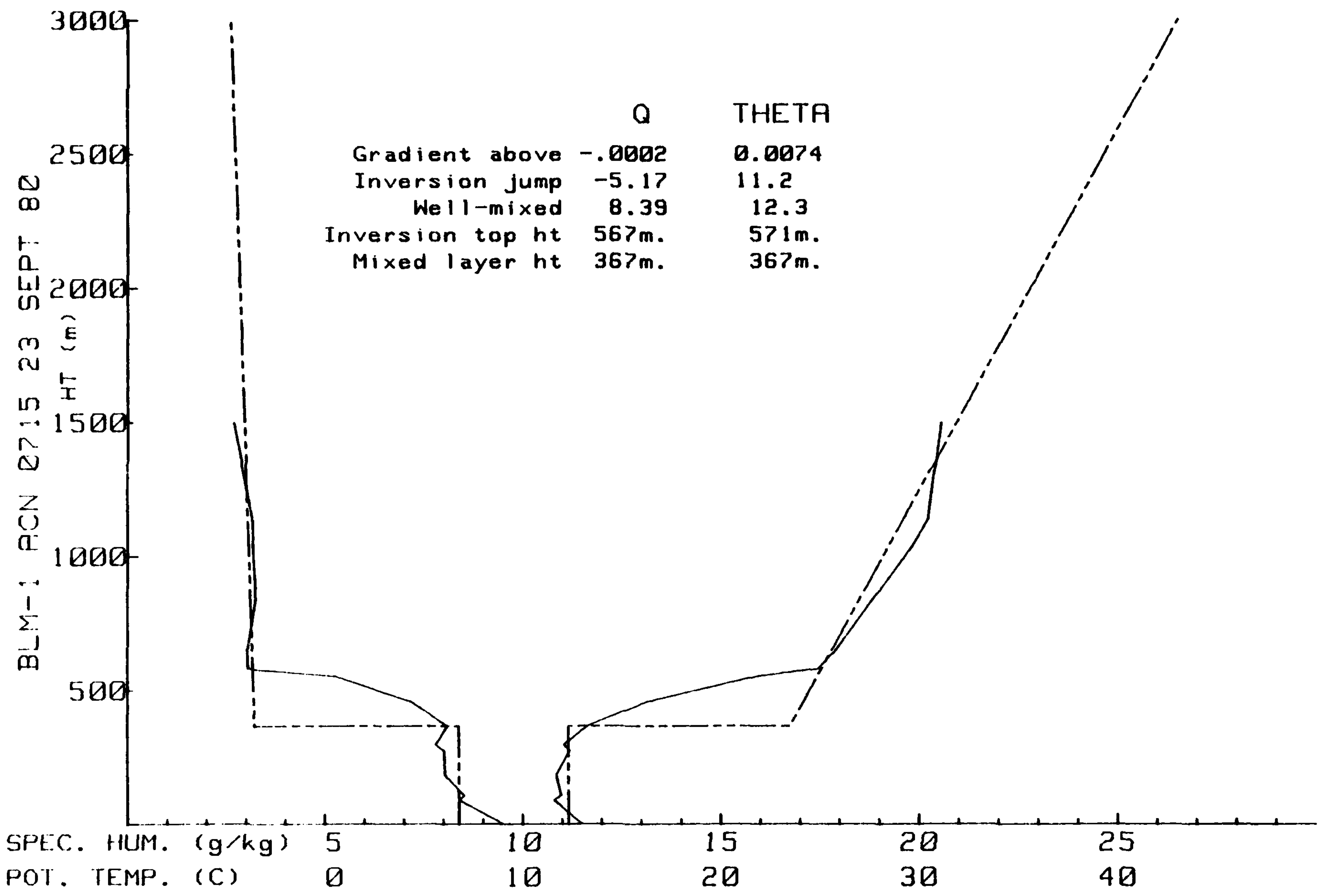


Figure L. b (1, 9,23,80)

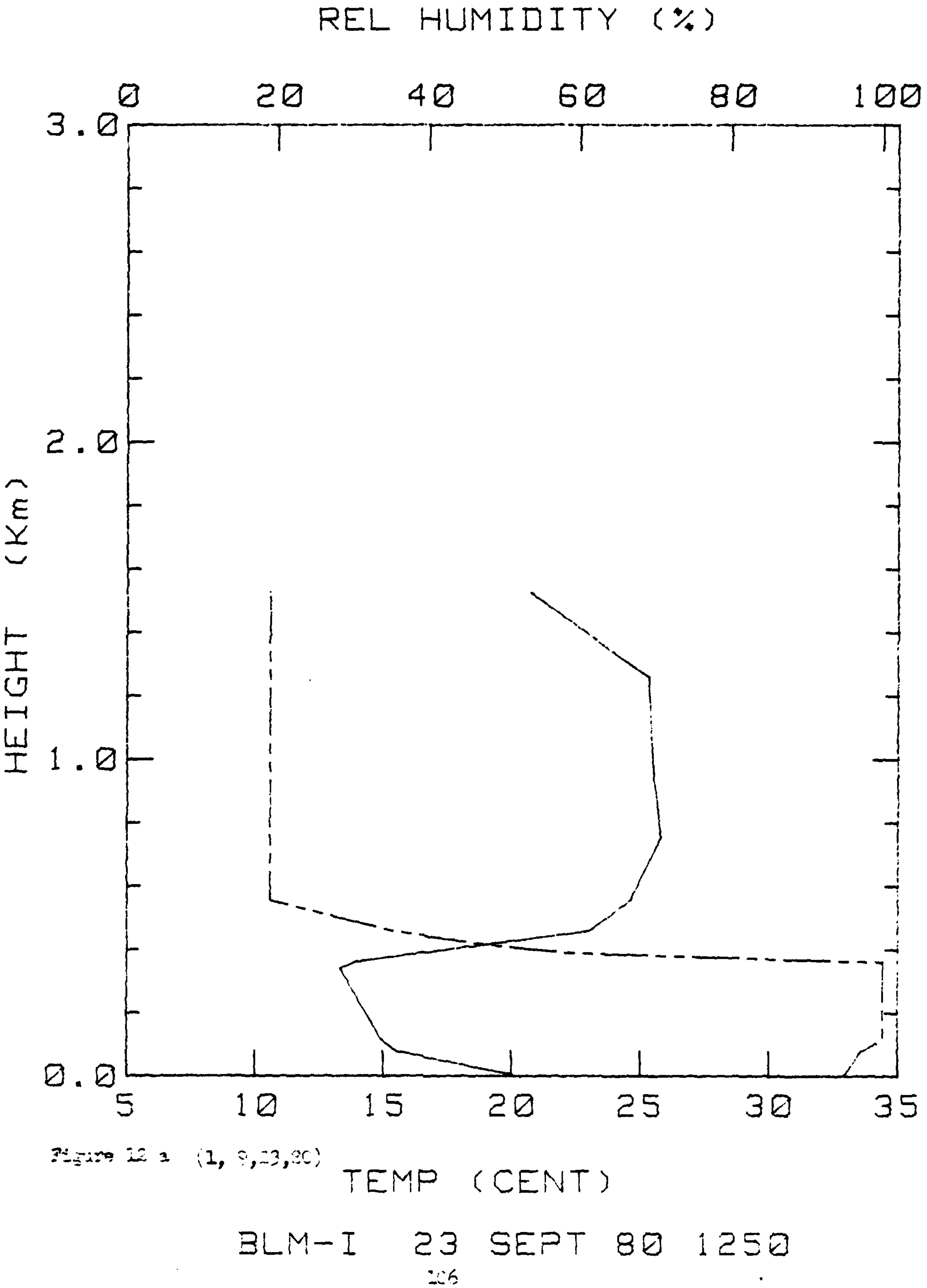


Figure 12 a (1, 9,23,80)

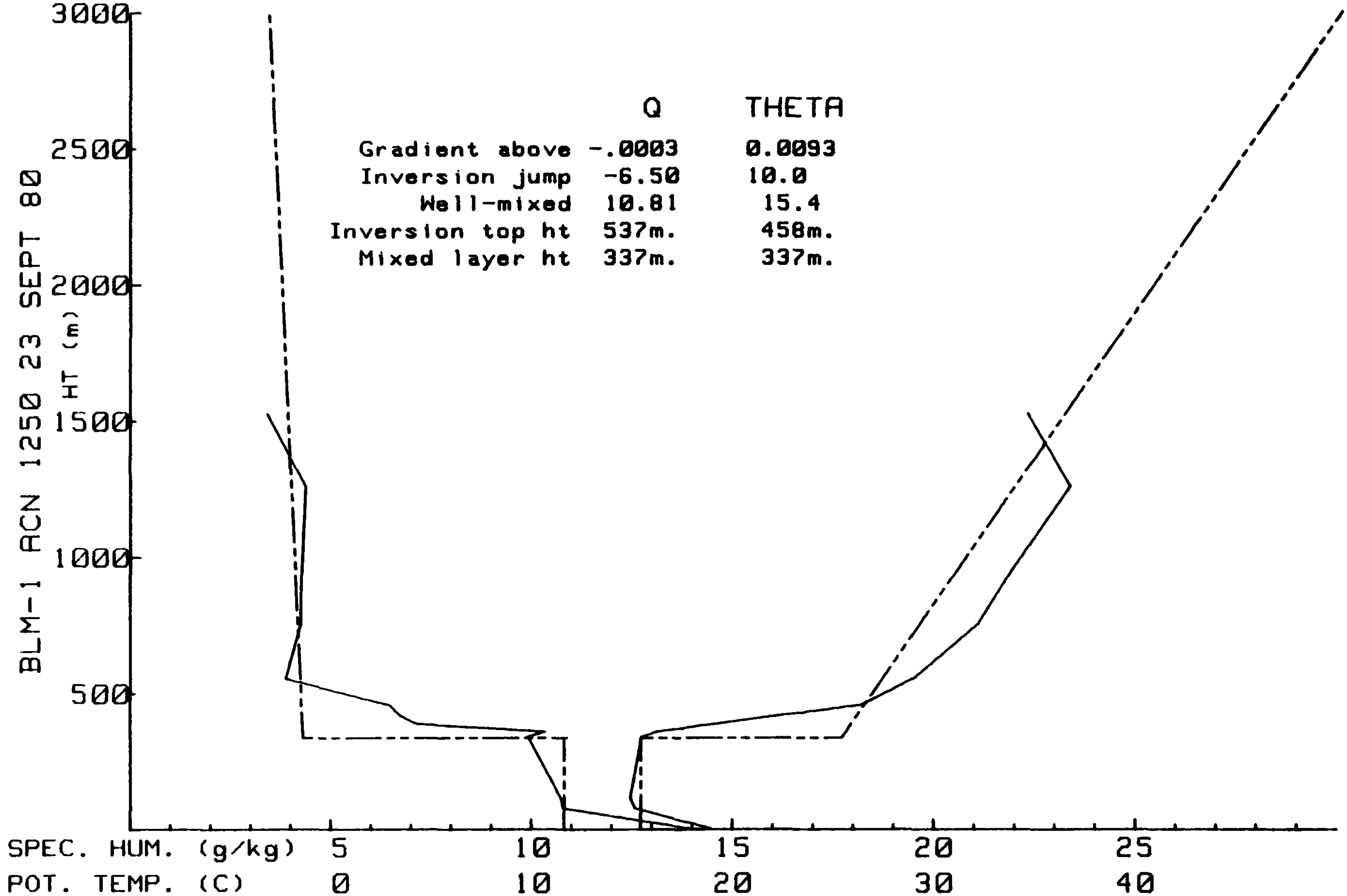


Figure 1-b (1, 9, 23, 80)

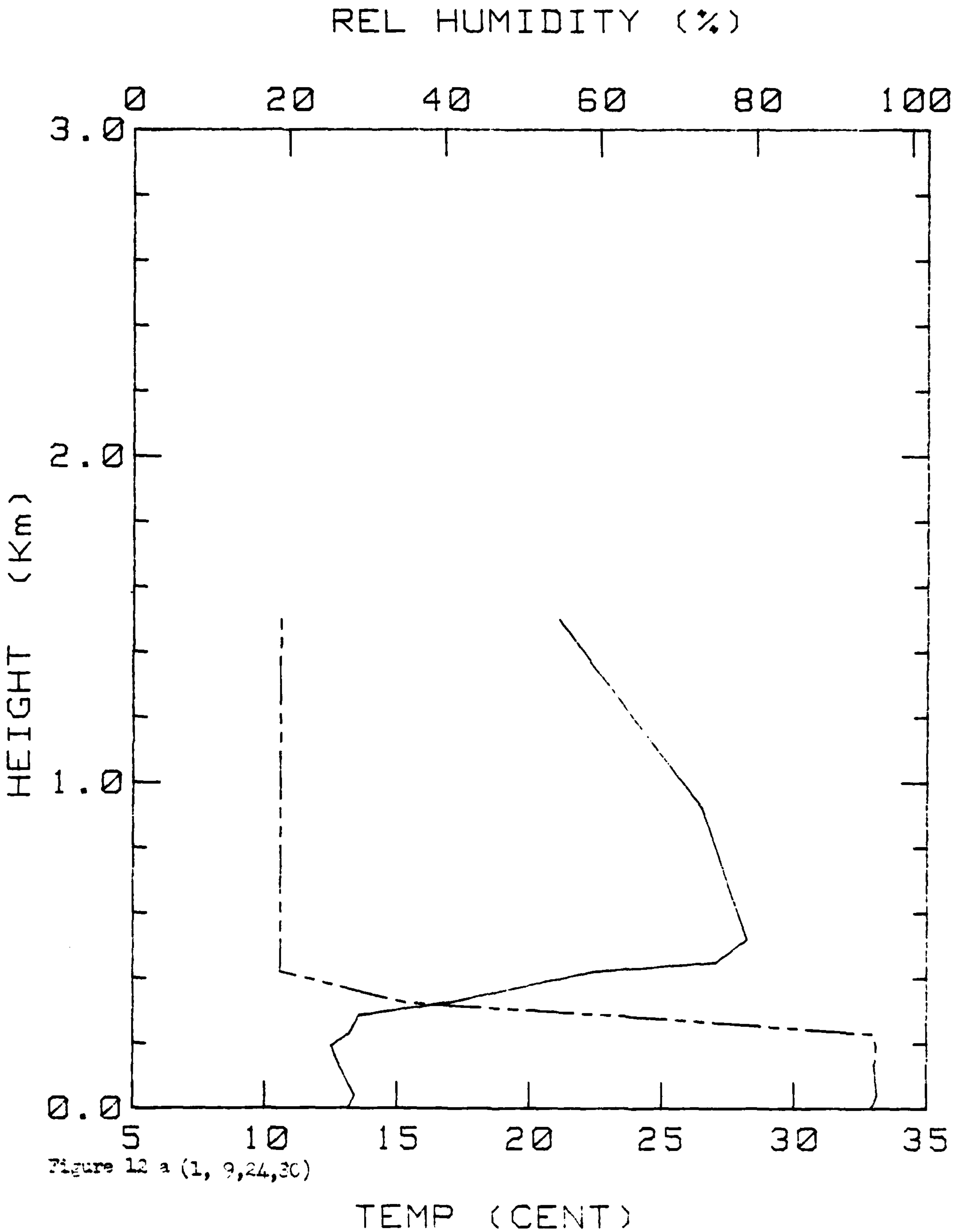


Figure 12 a (1, 9,24,30)

BLM-I 24 SEPT 80 10

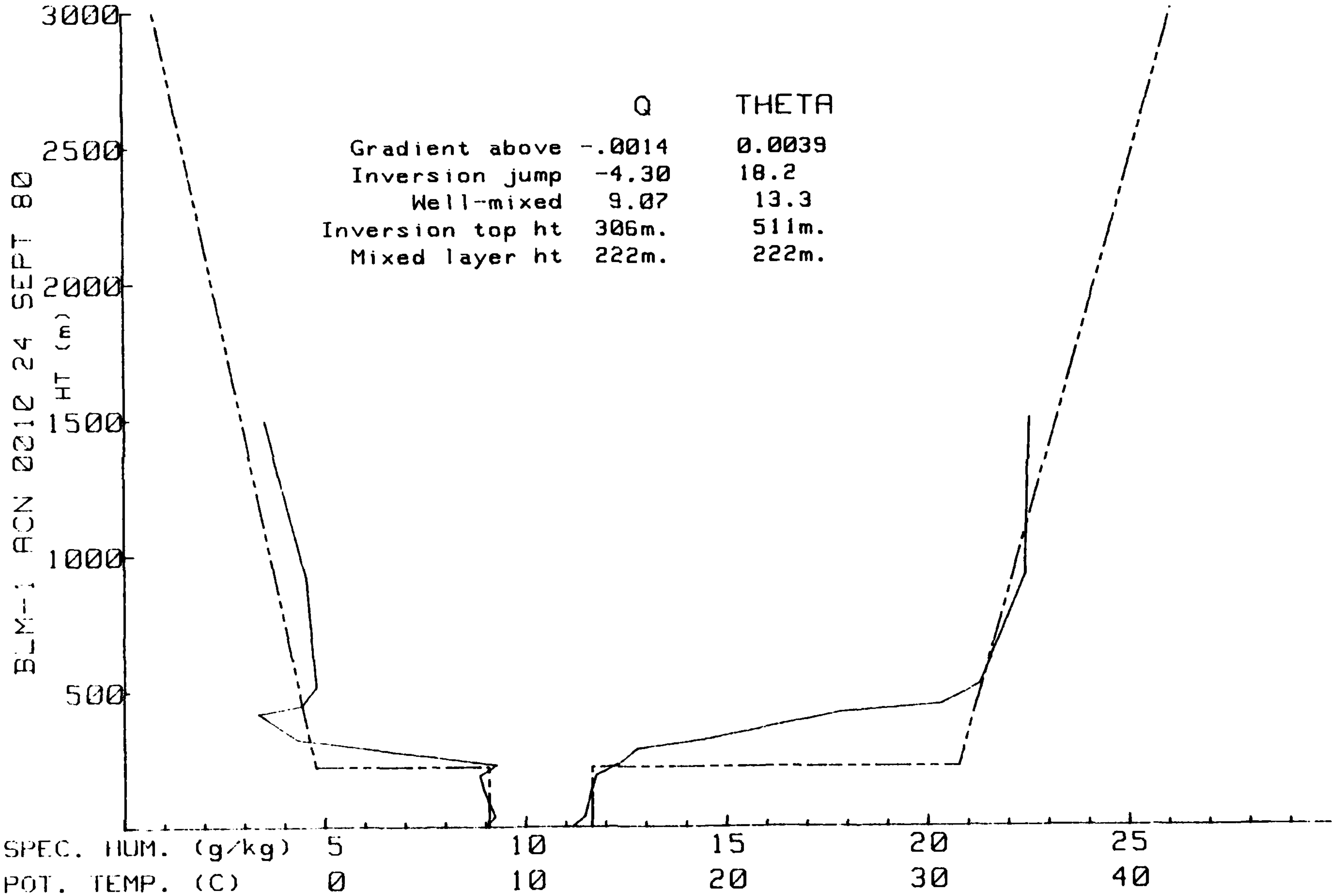


Figure 1? b (1, 9,24,80)

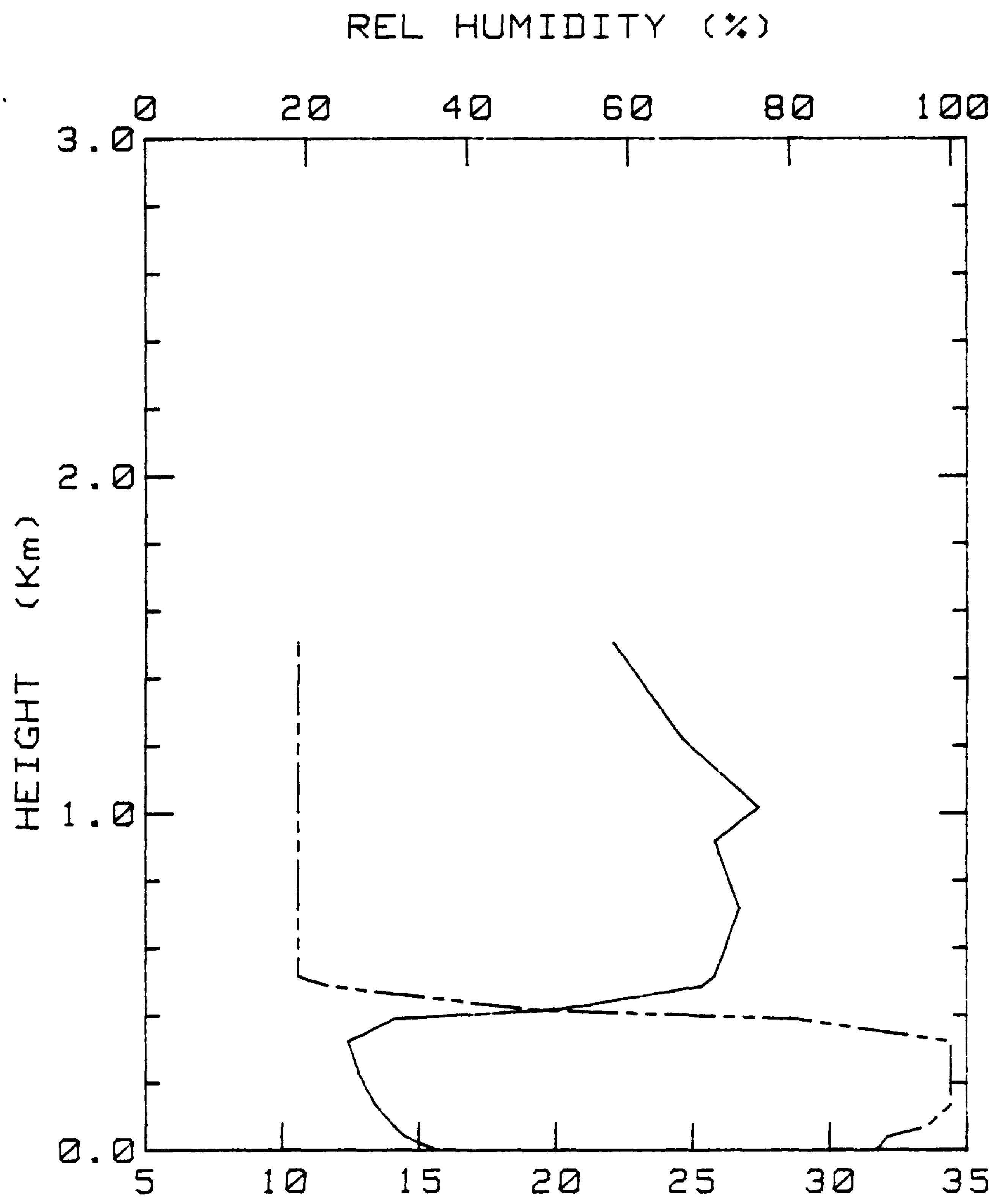
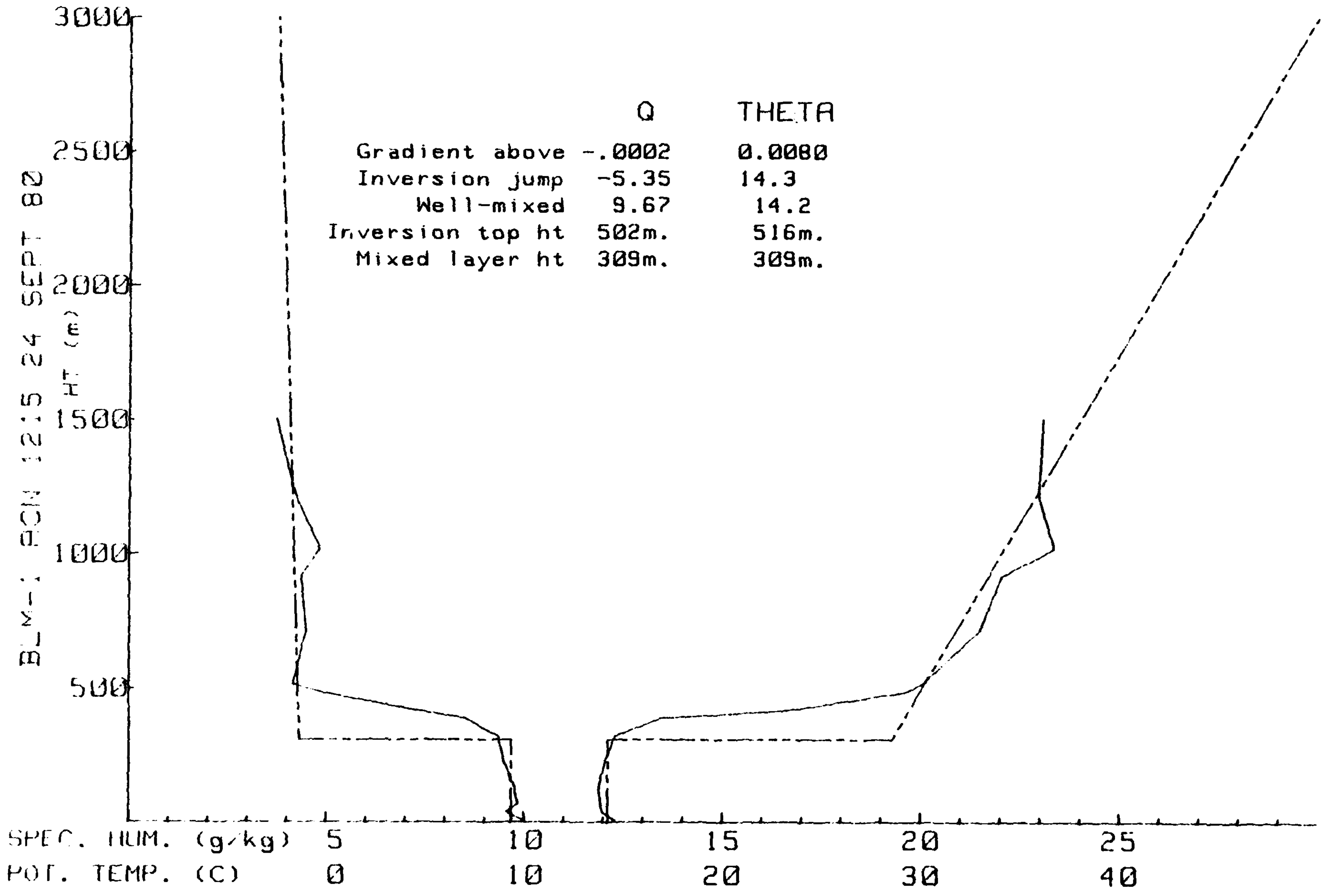


Figure 12 a (1, 9, 21, 80) TEMP (CENT)

BLM-I 24 SEPT 80 1215



BLM-1 RON 1215 24 SEPT 80
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0002 0.0080
Inversion jump -5.35 14.3
Well-mixed 9.67 14.2
Inversion top ht 502m. 516m.
Mixed layer ht 309m. 309m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

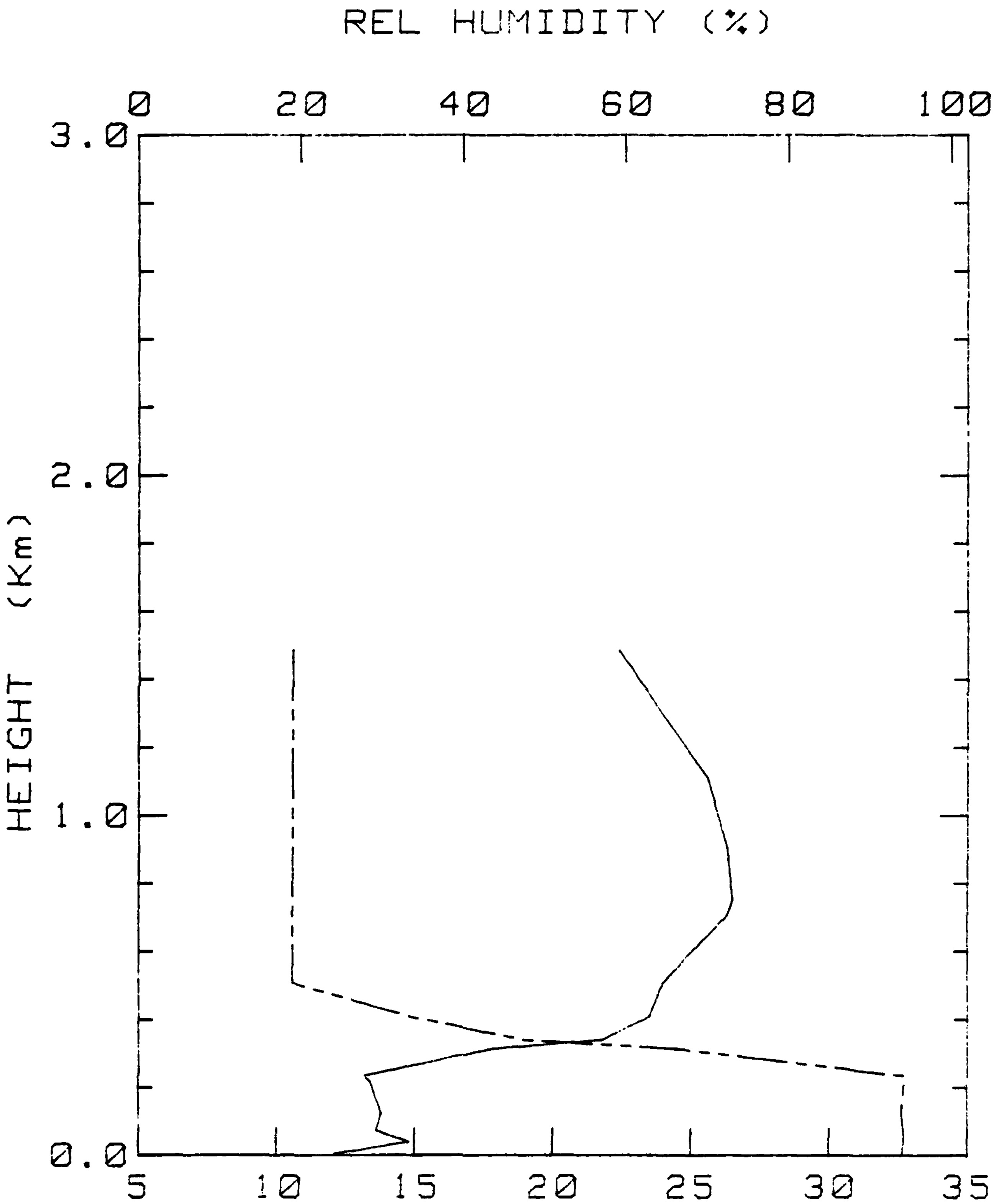


Figure 11 a (1, 9,25,30)

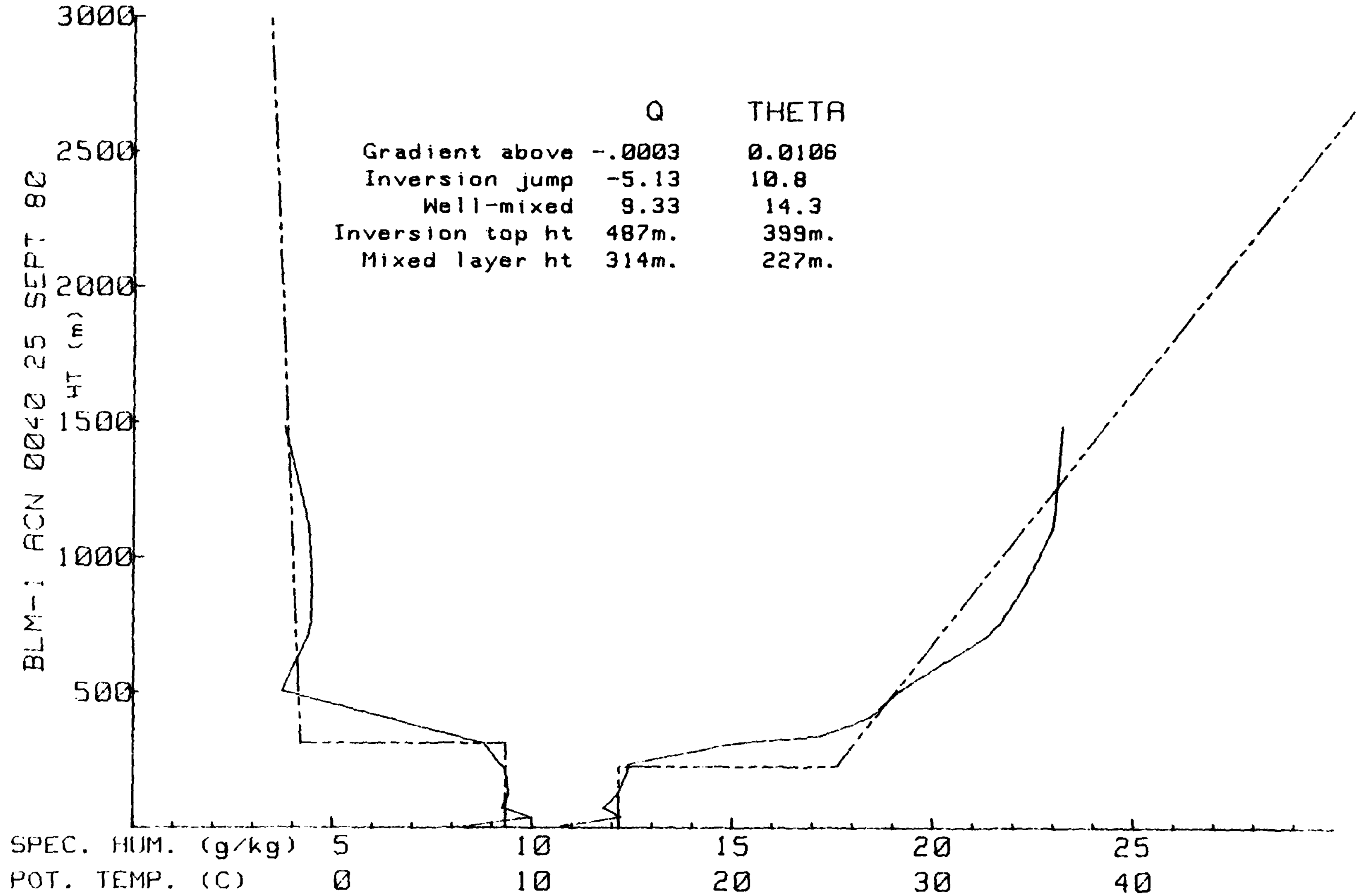


Figure 1. b (1, 9,25,80)

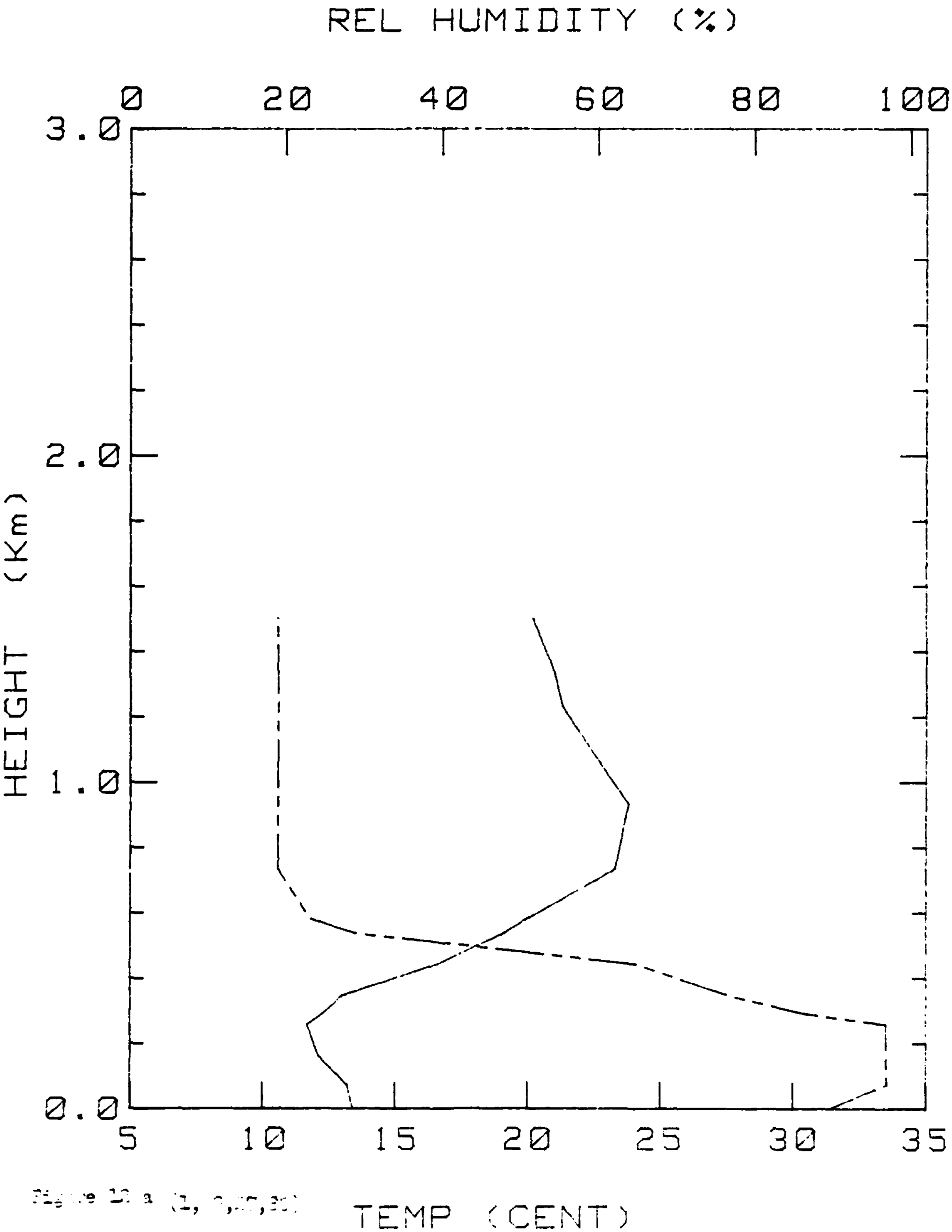


Figure 12 a (1, [illegible])

BLM-I 27 SEPT 80 607

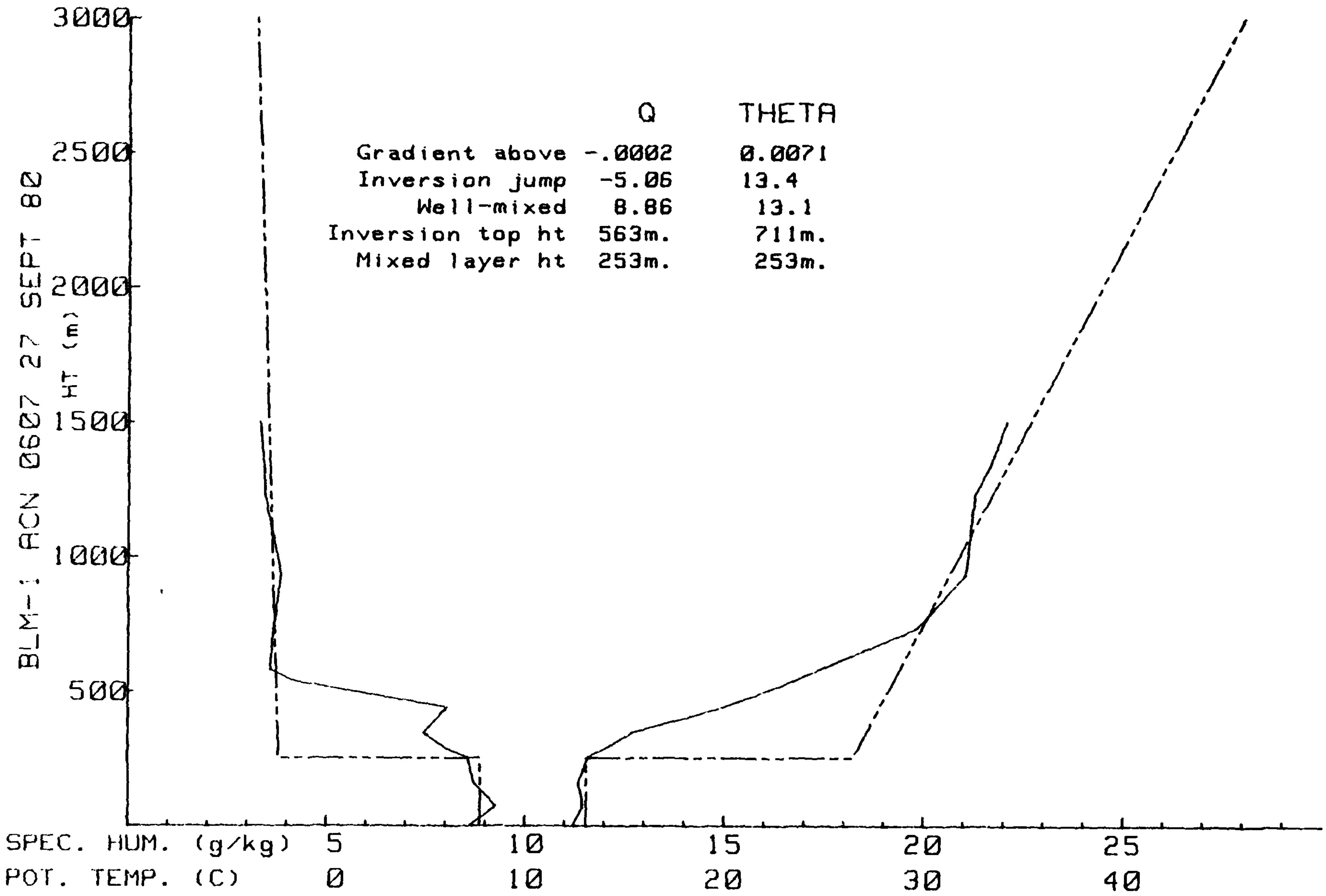


Fig. 12 b (1 9,27,80)

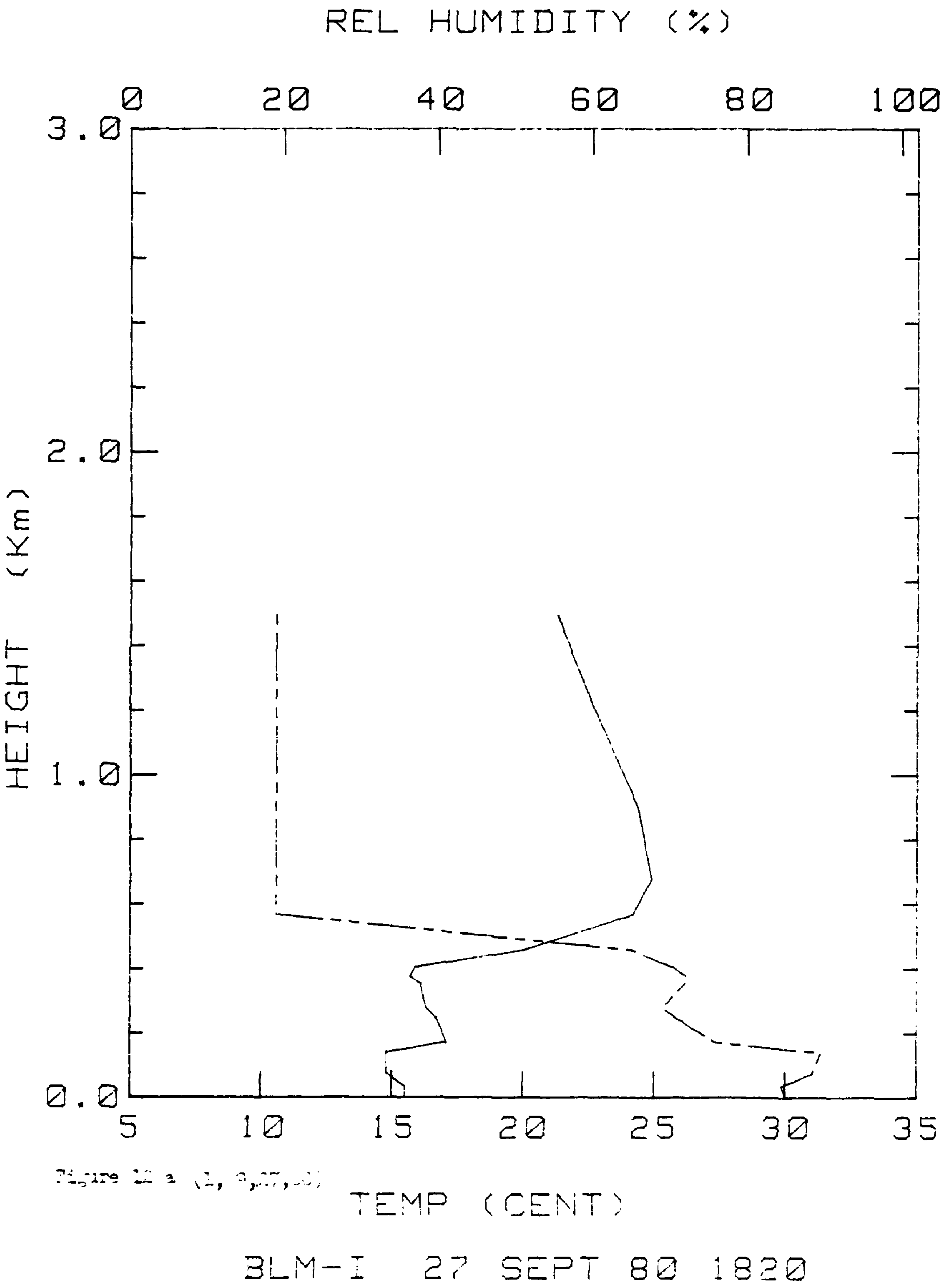
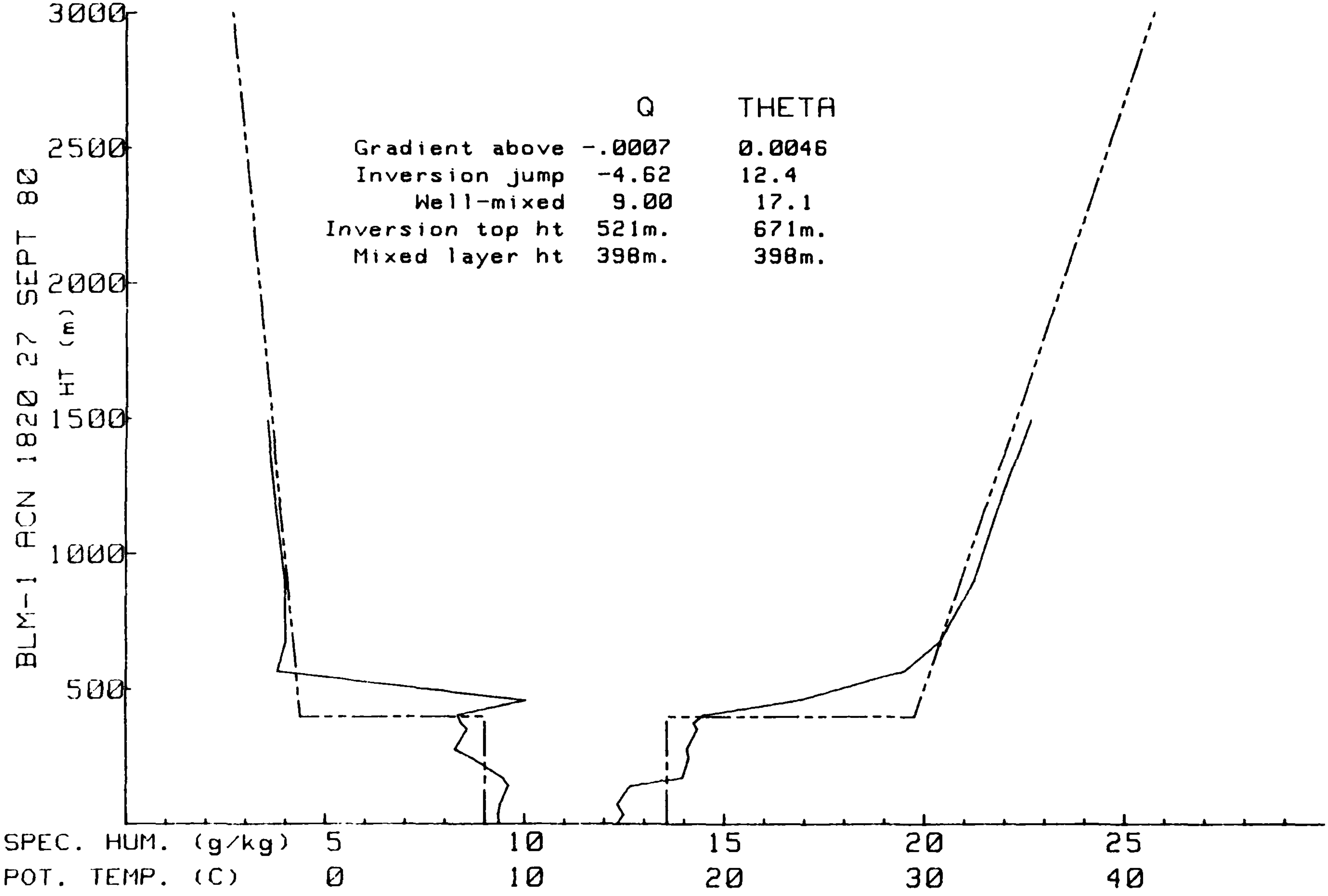


Figure 12 a (1, 9,27,80)


BLM-1 ACN 1820 27 SEPT 80
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0007 0.0046
Inversion jump -4.62 12.4
Well-mixed 9.00 17.1
Inversion top ht 521m. 671m.
Mixed layer ht 398m. 398m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

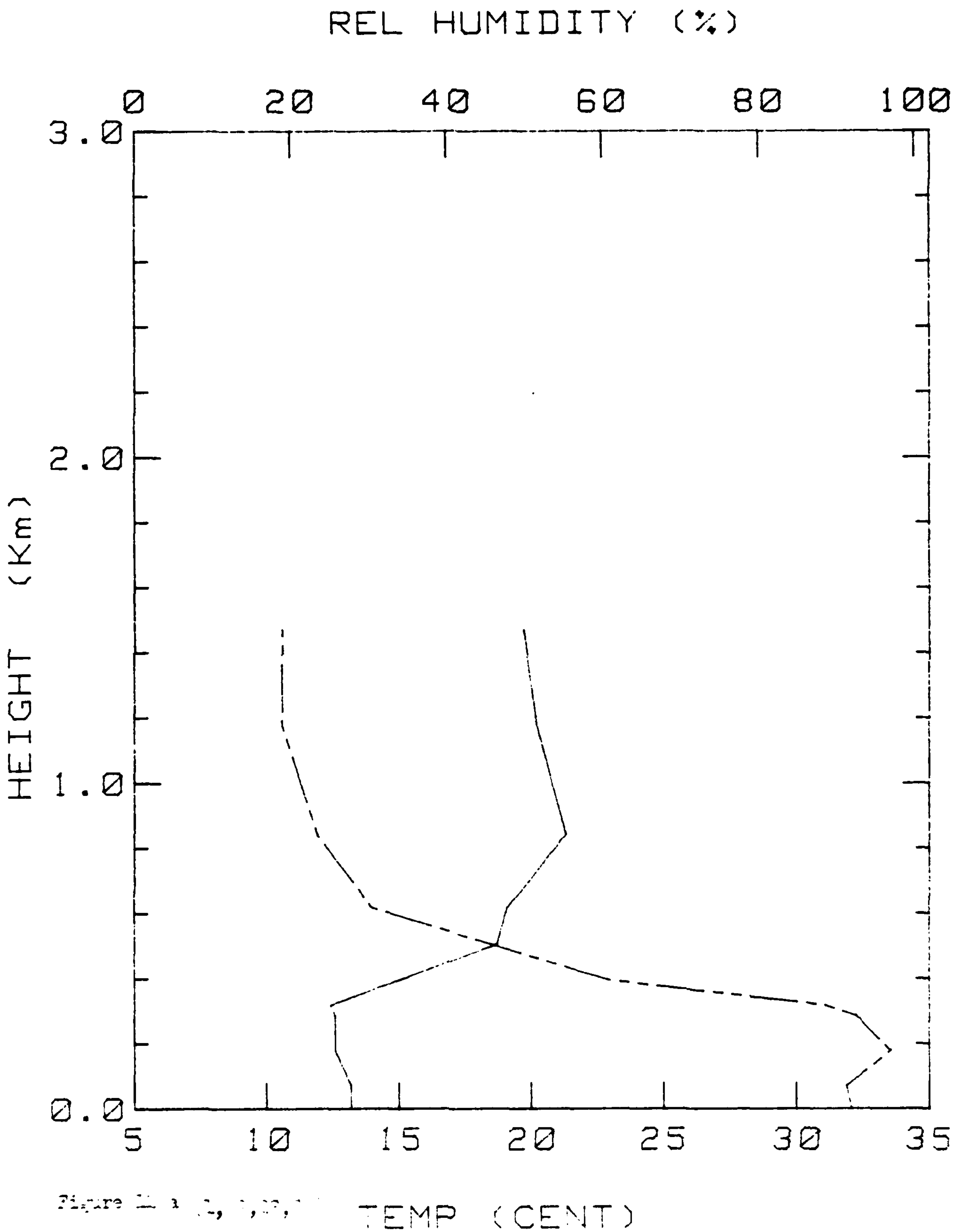


Figure [illegible]

BLM-I 28 SEPT 80 740

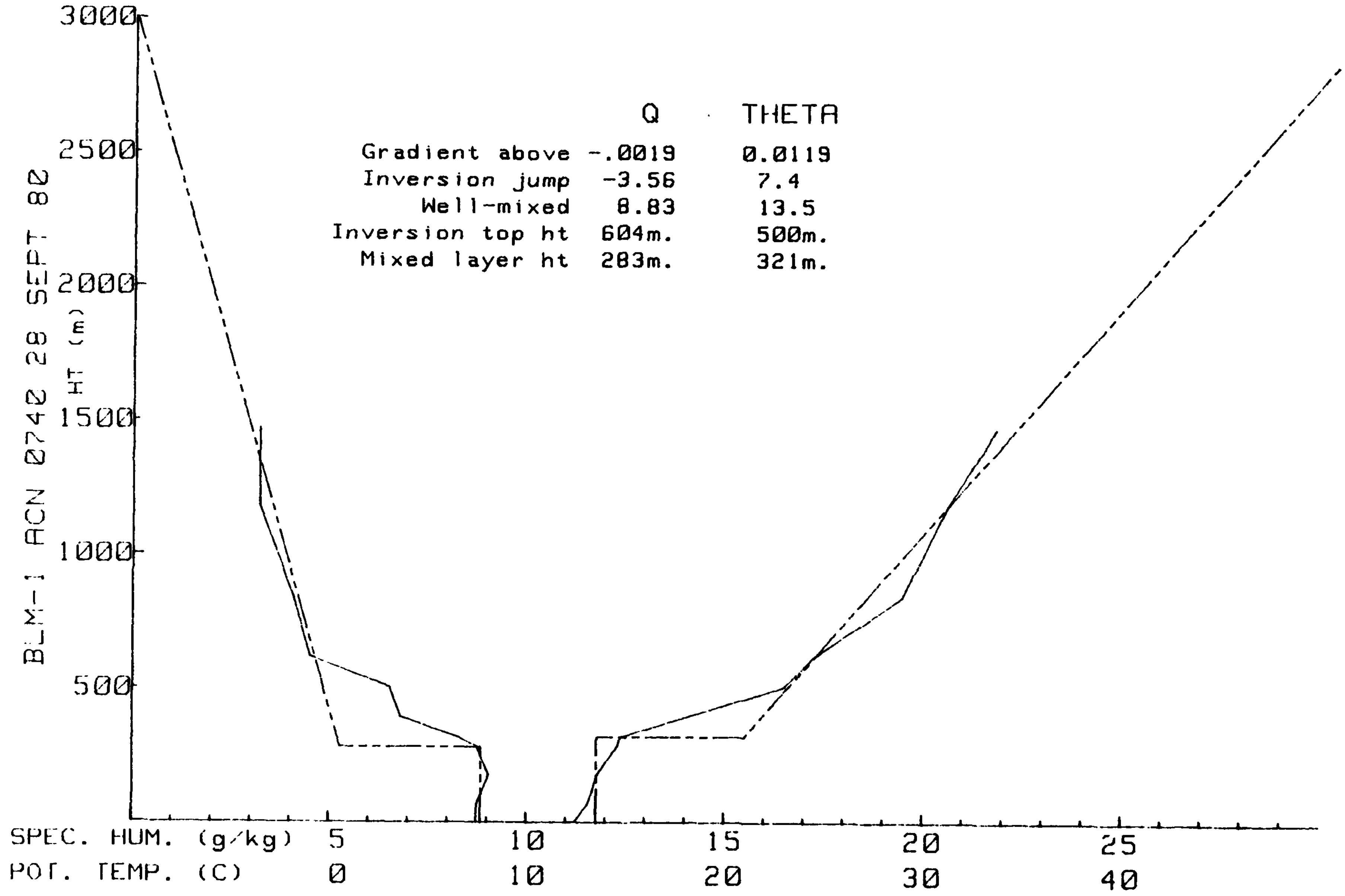


Figure 17 b (1, 9, 28,80)

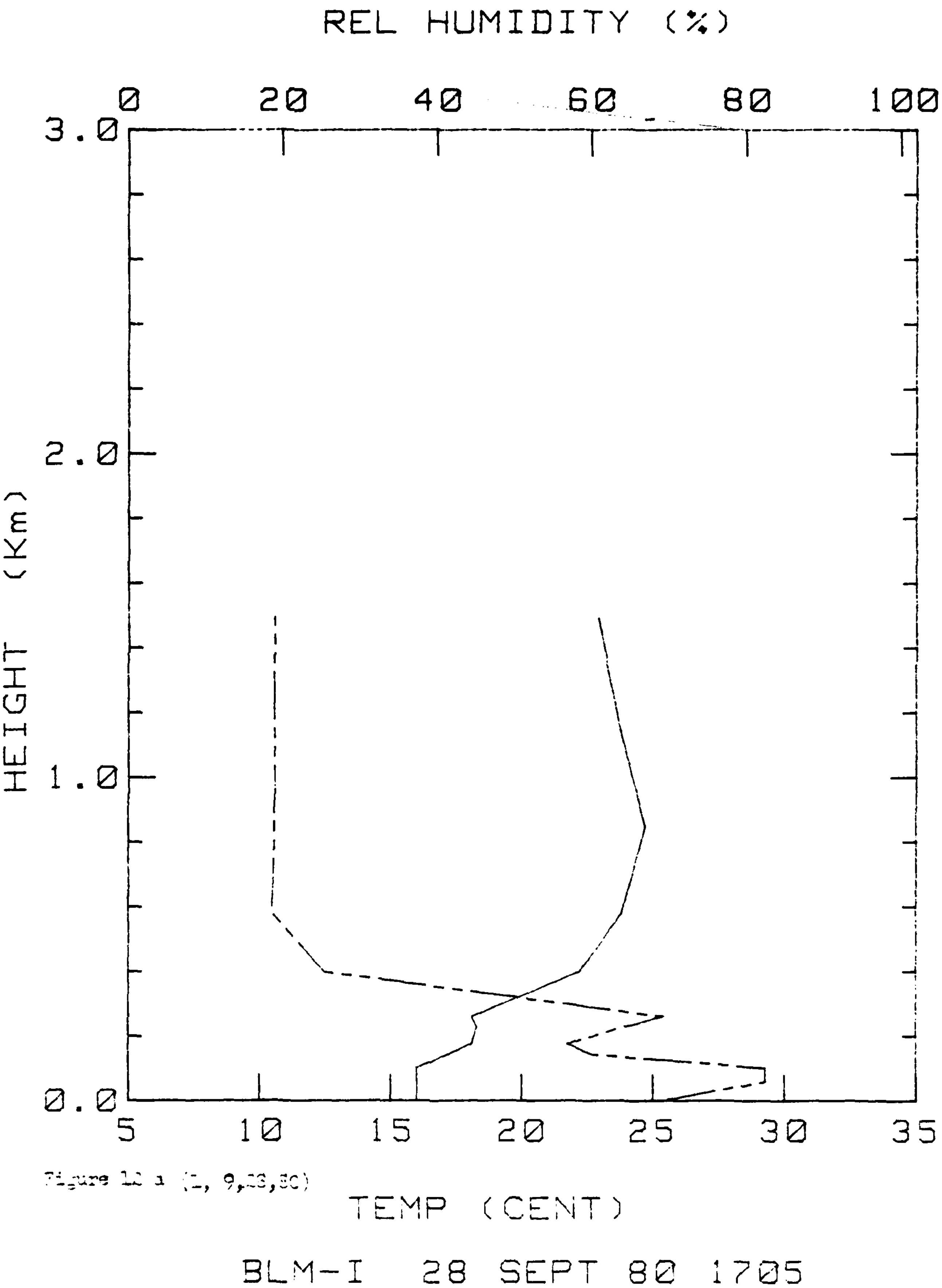
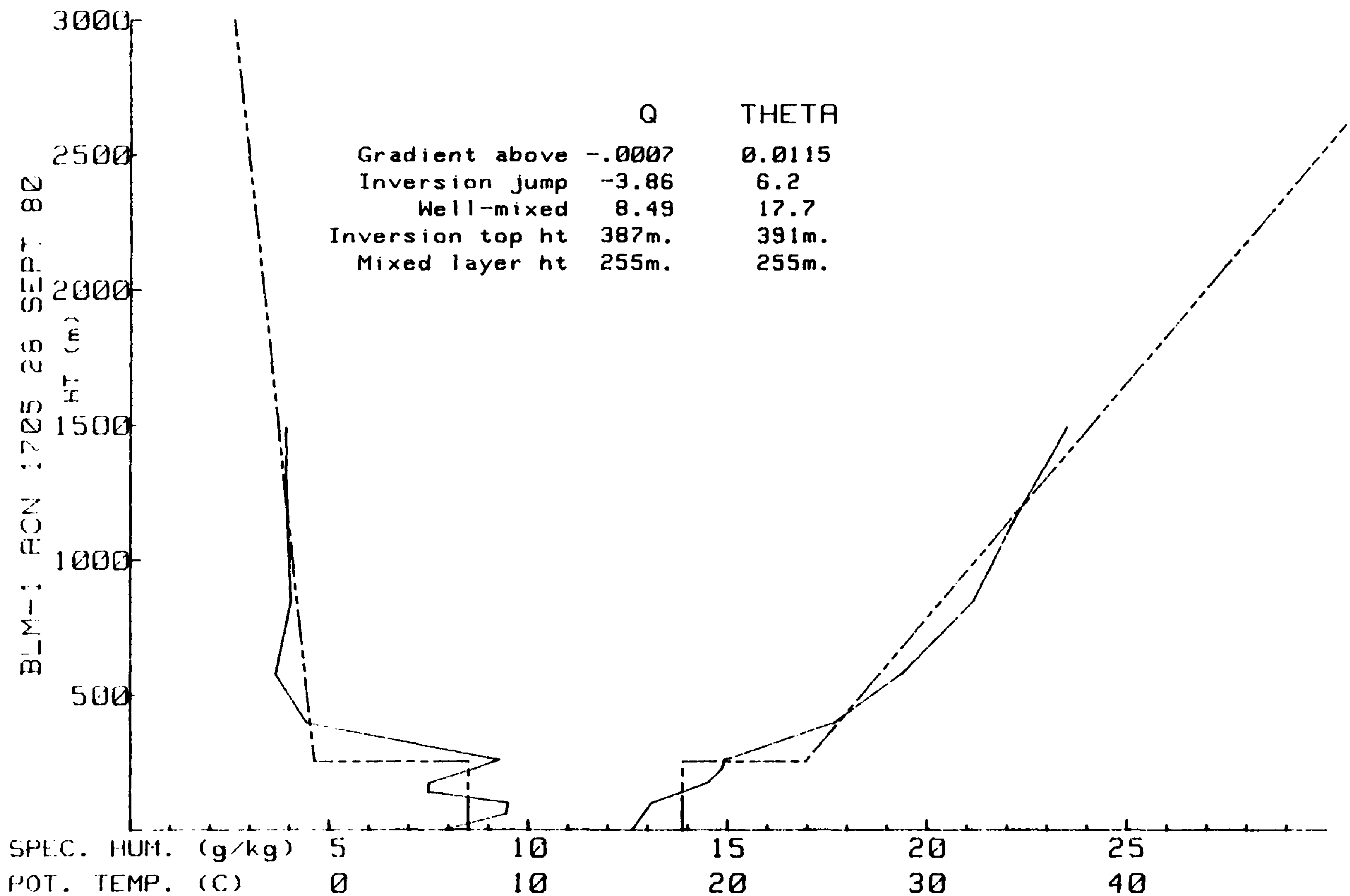


Figure 12 a (1, 9,28,80)



BLM-1 RCN 1725 26 SEPT 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0007 0.0115
Inversion jump -3.86 6.2
Well-mixed 8.49 17.7
Inversion top ht 387m. 391m.
Mixed layer ht 255m. 255m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

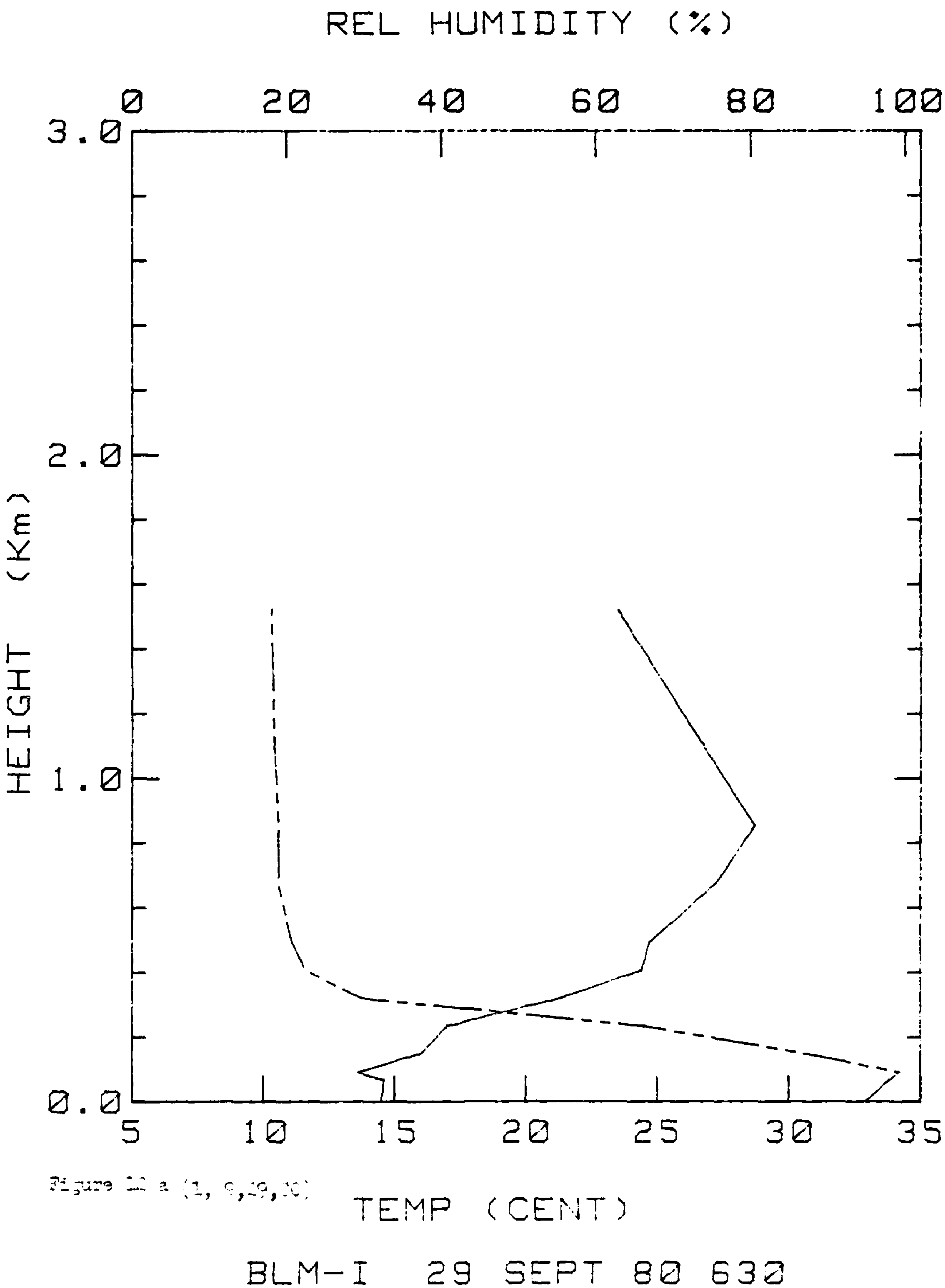


Figure 12 a (1, 9,29,80)

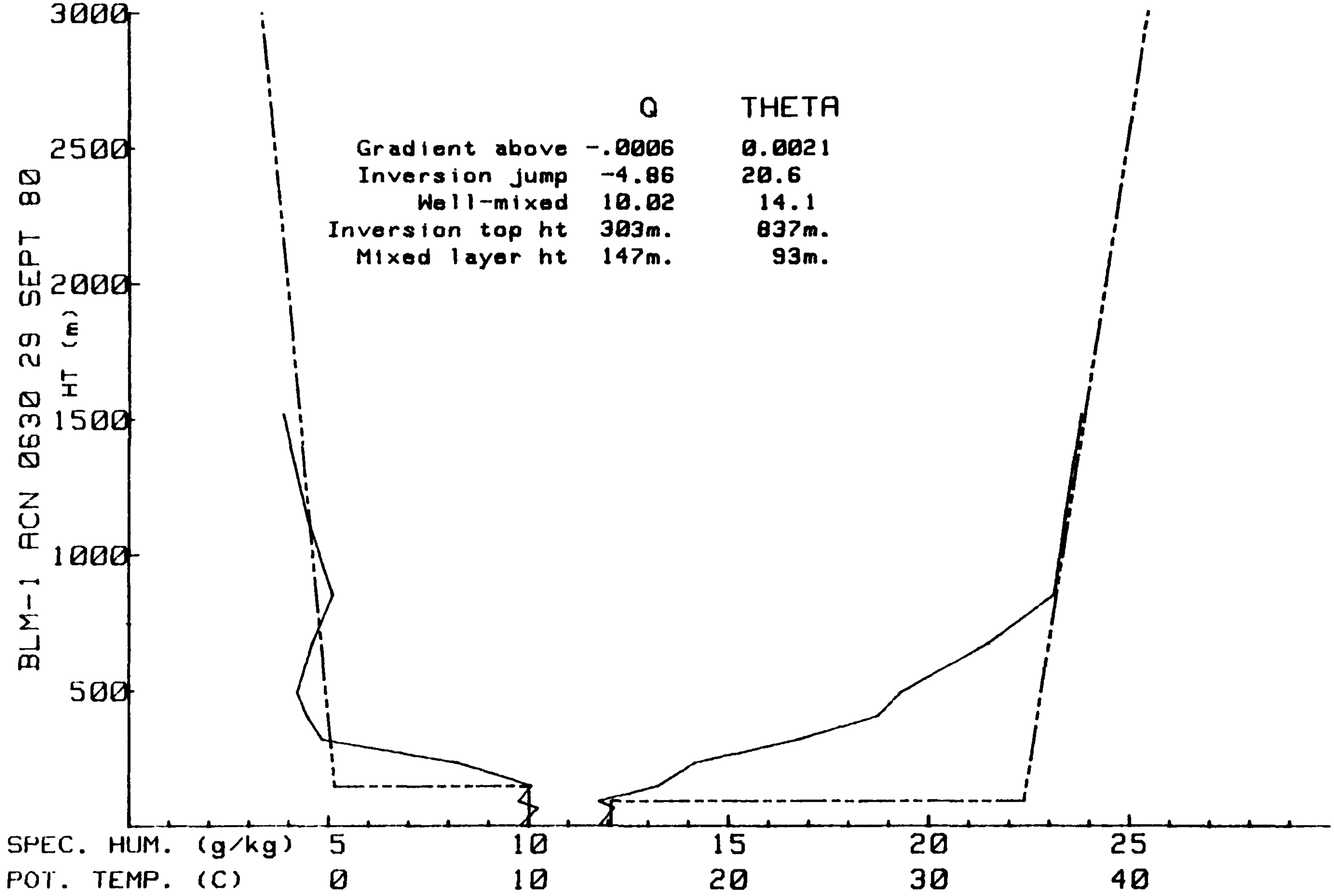


Figure 12 b (1, 9,29,80)

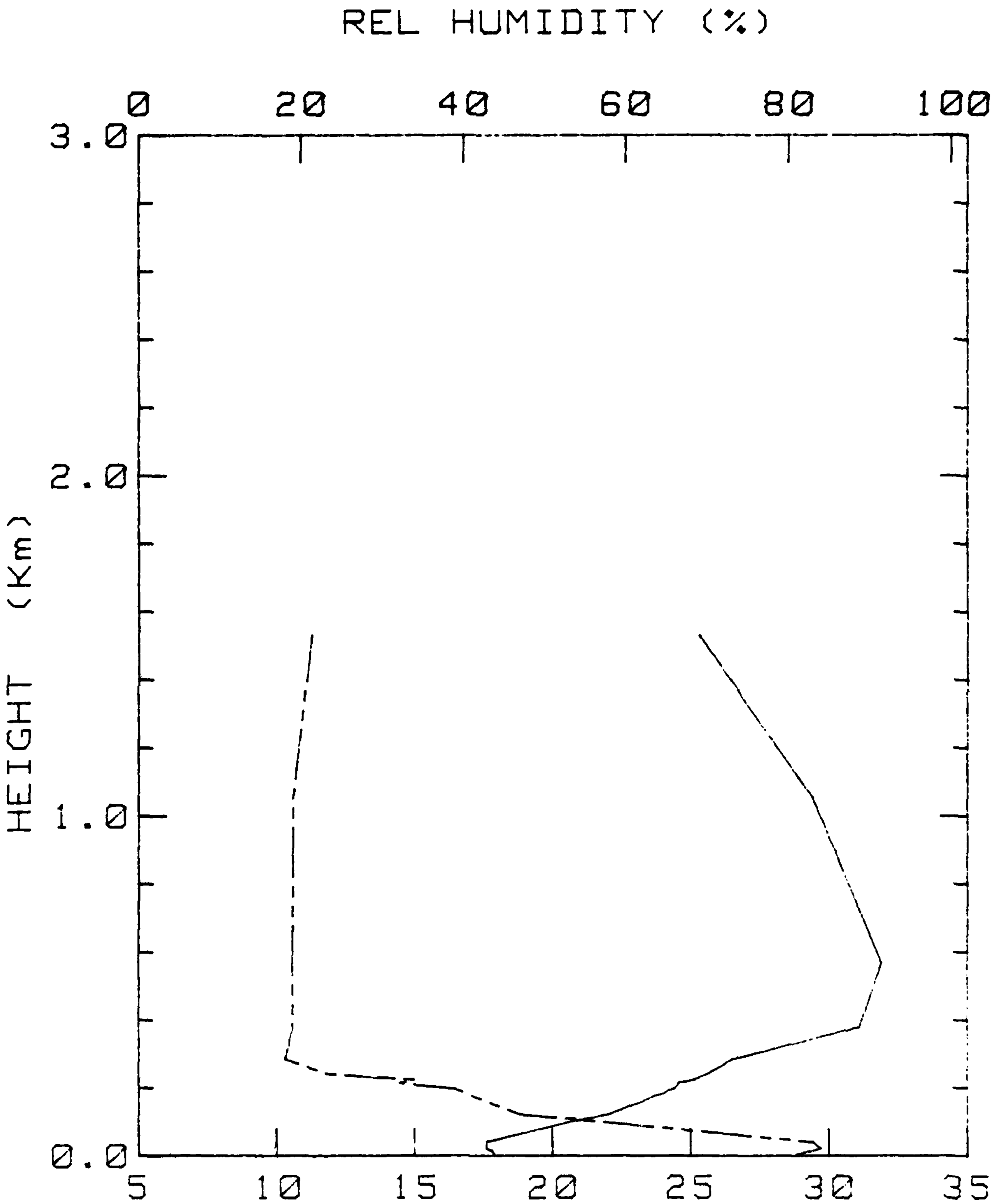


Figure 12 a (1, 9,29,80)

TEMP (CENT)

BLM-I 29 SEPT 80 1735

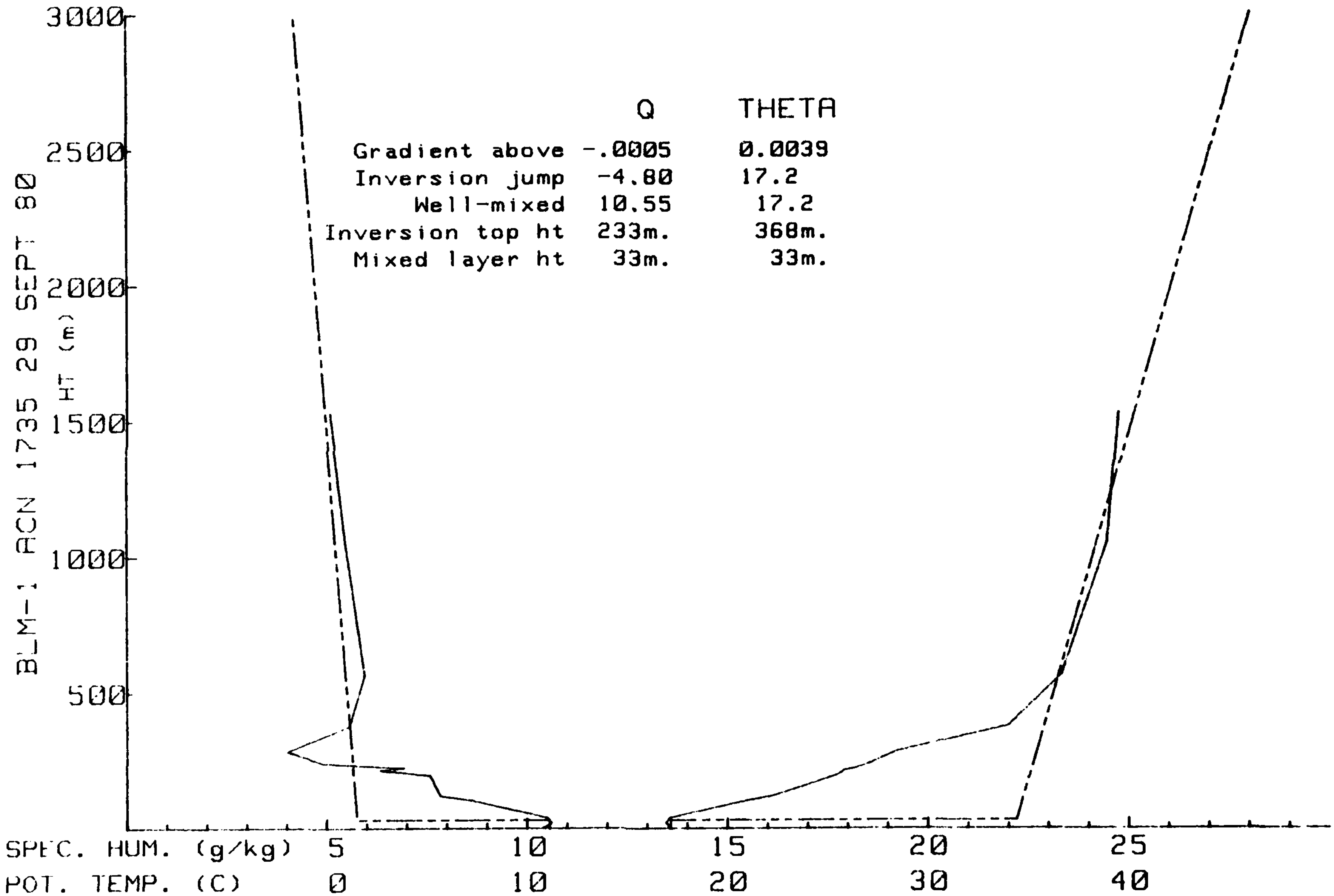


Figure 12 b (1, 9, 29,80)

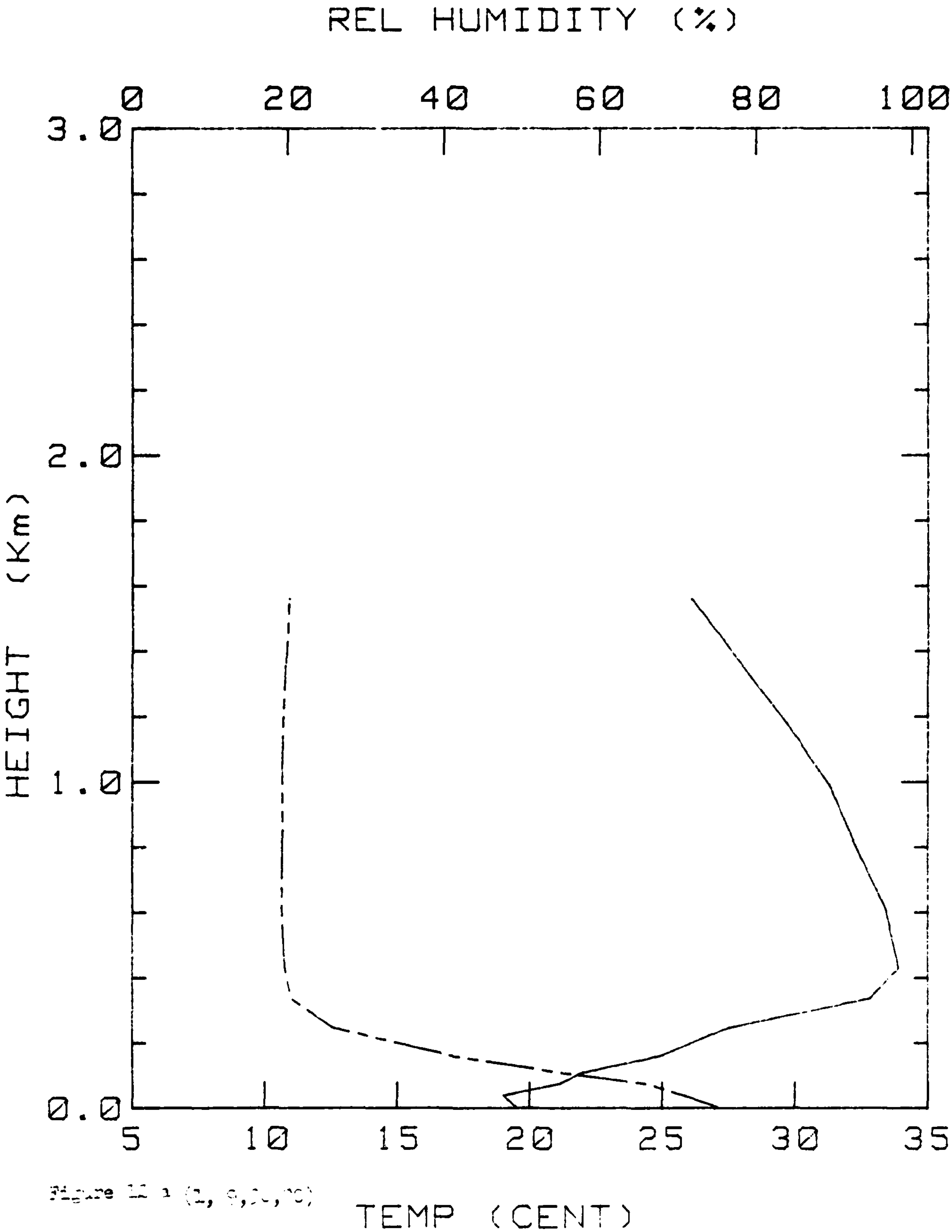


Figure 12 a [illegible]

BLM-I 30 SEPT 80 1207

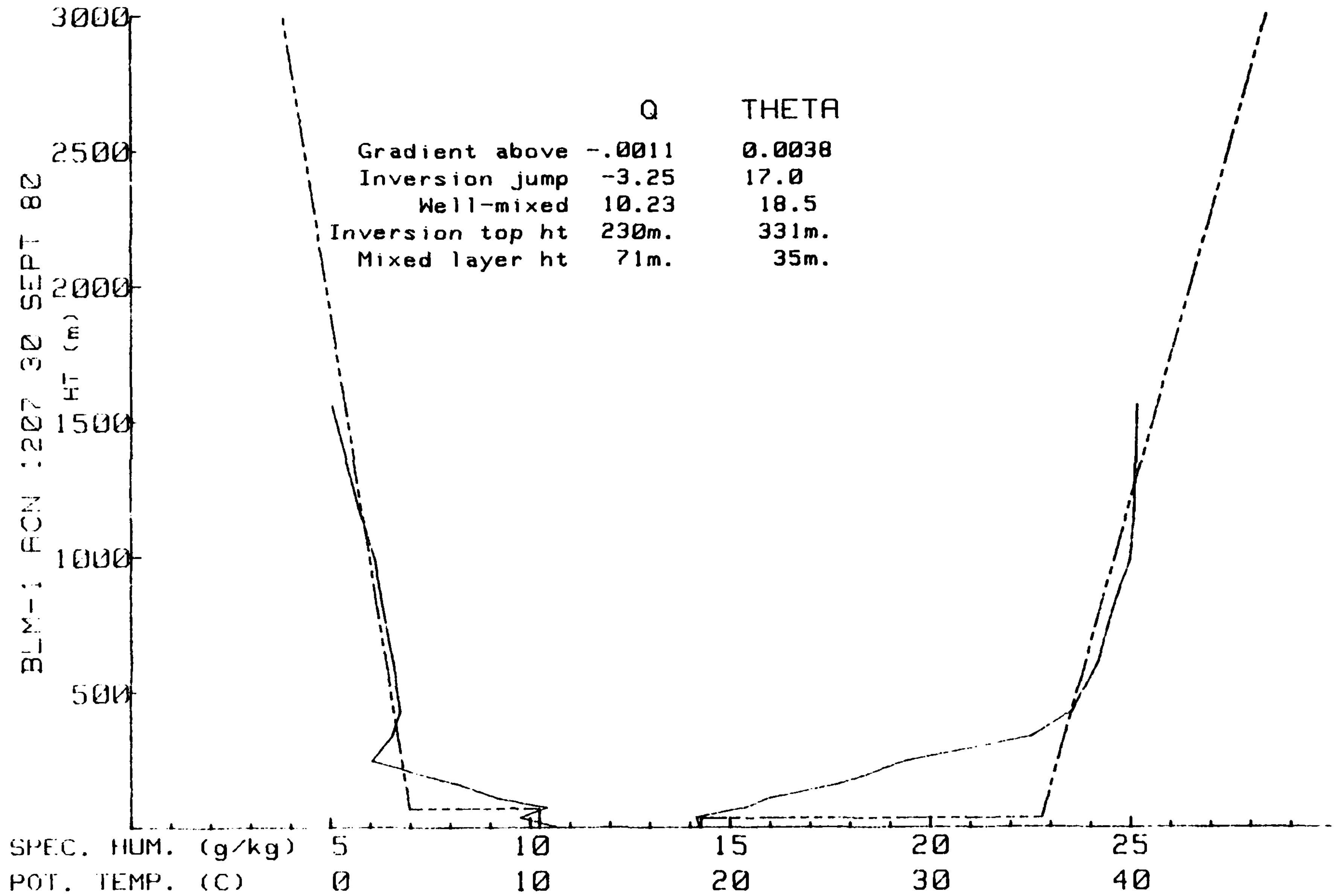


Figure 17b (1, 9, 30, 80)

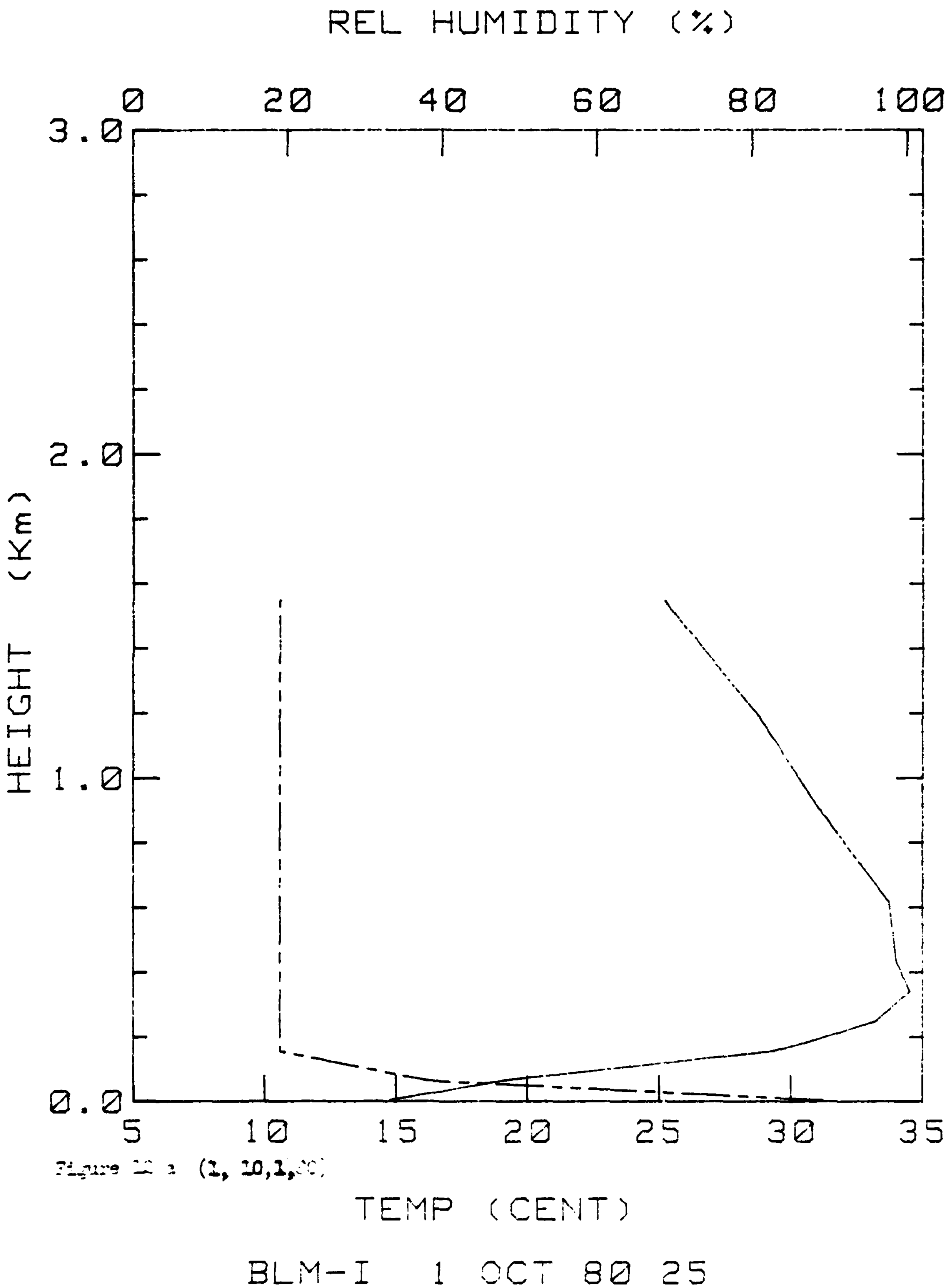
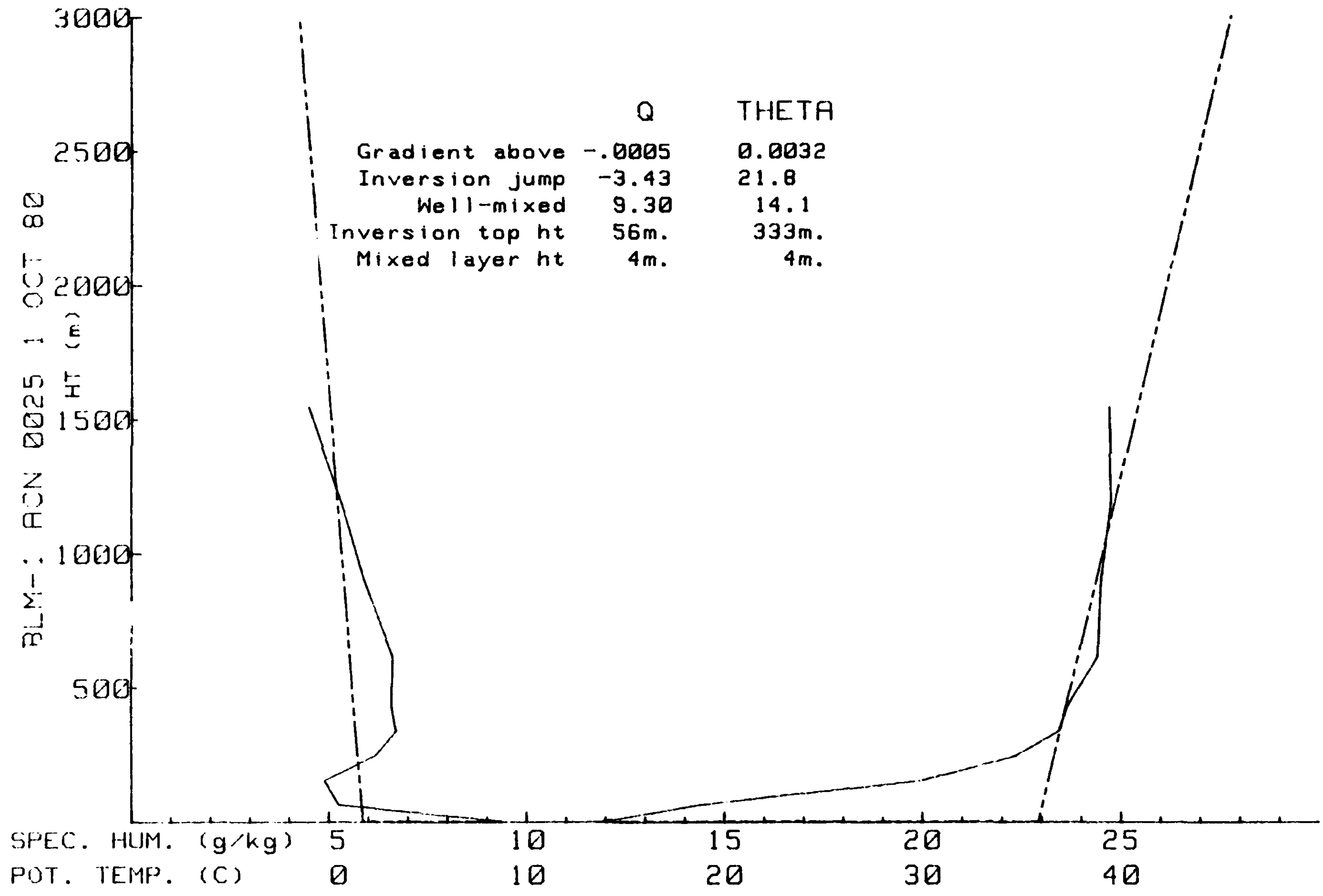
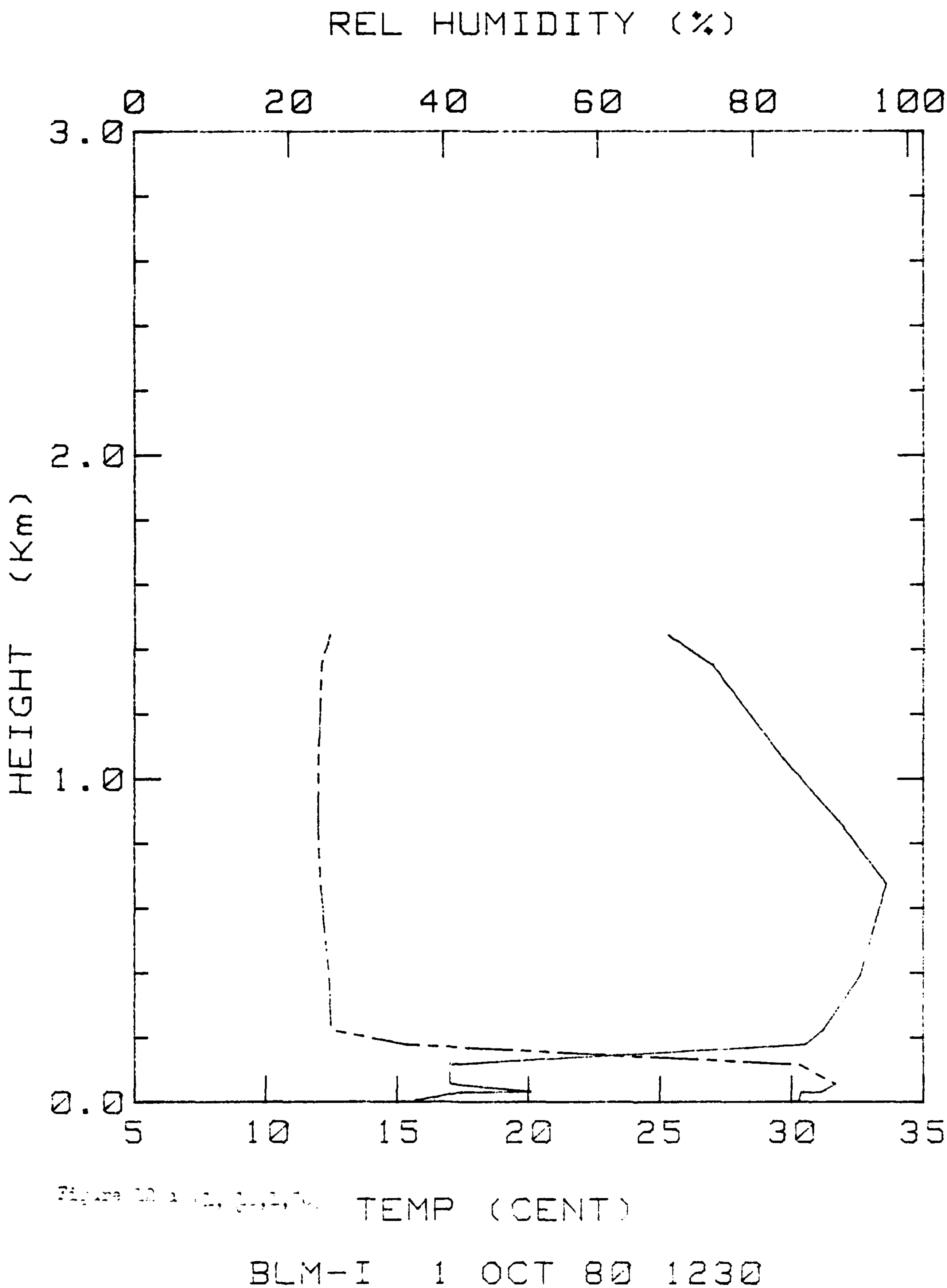
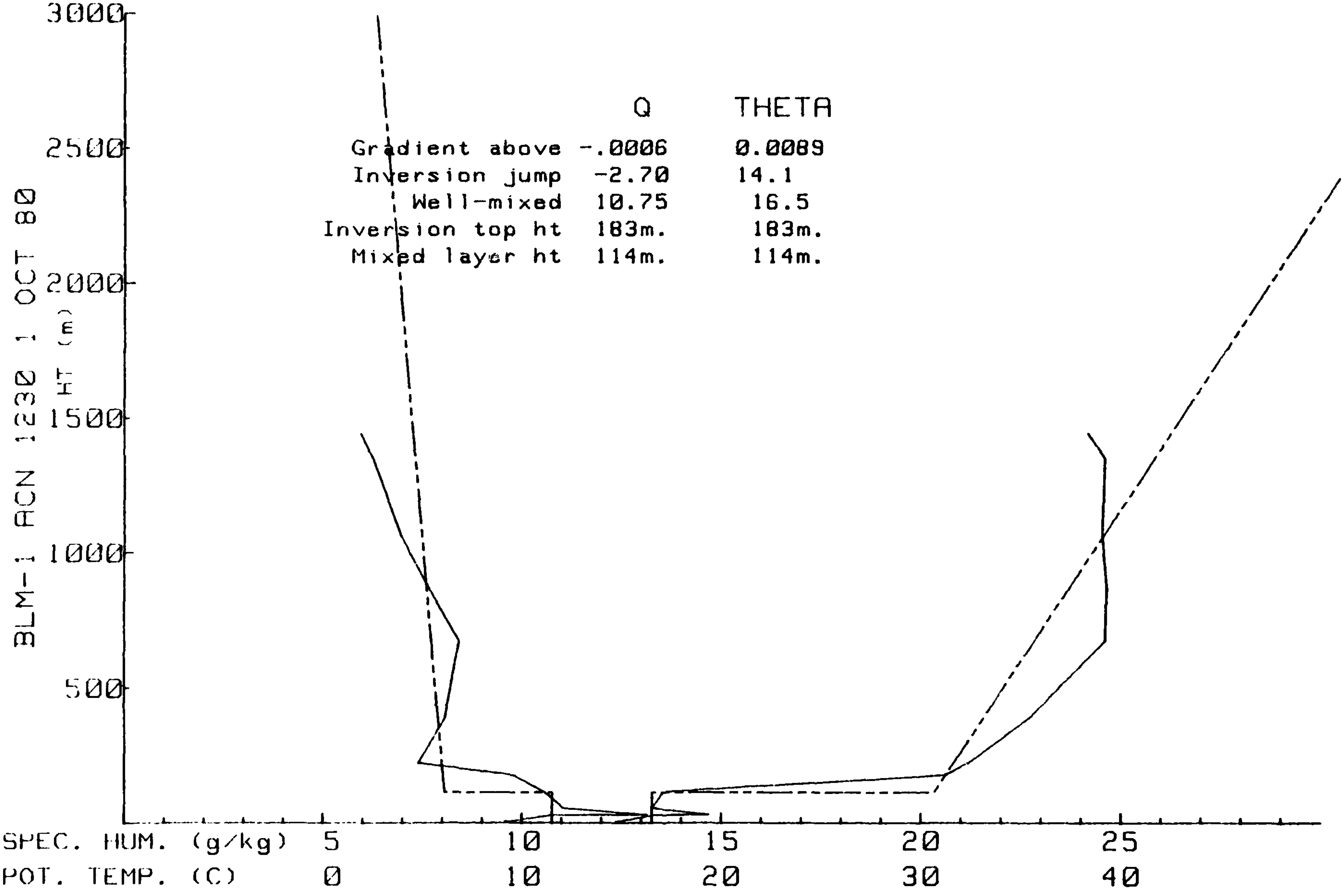

REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-I 1 OCT 80 25

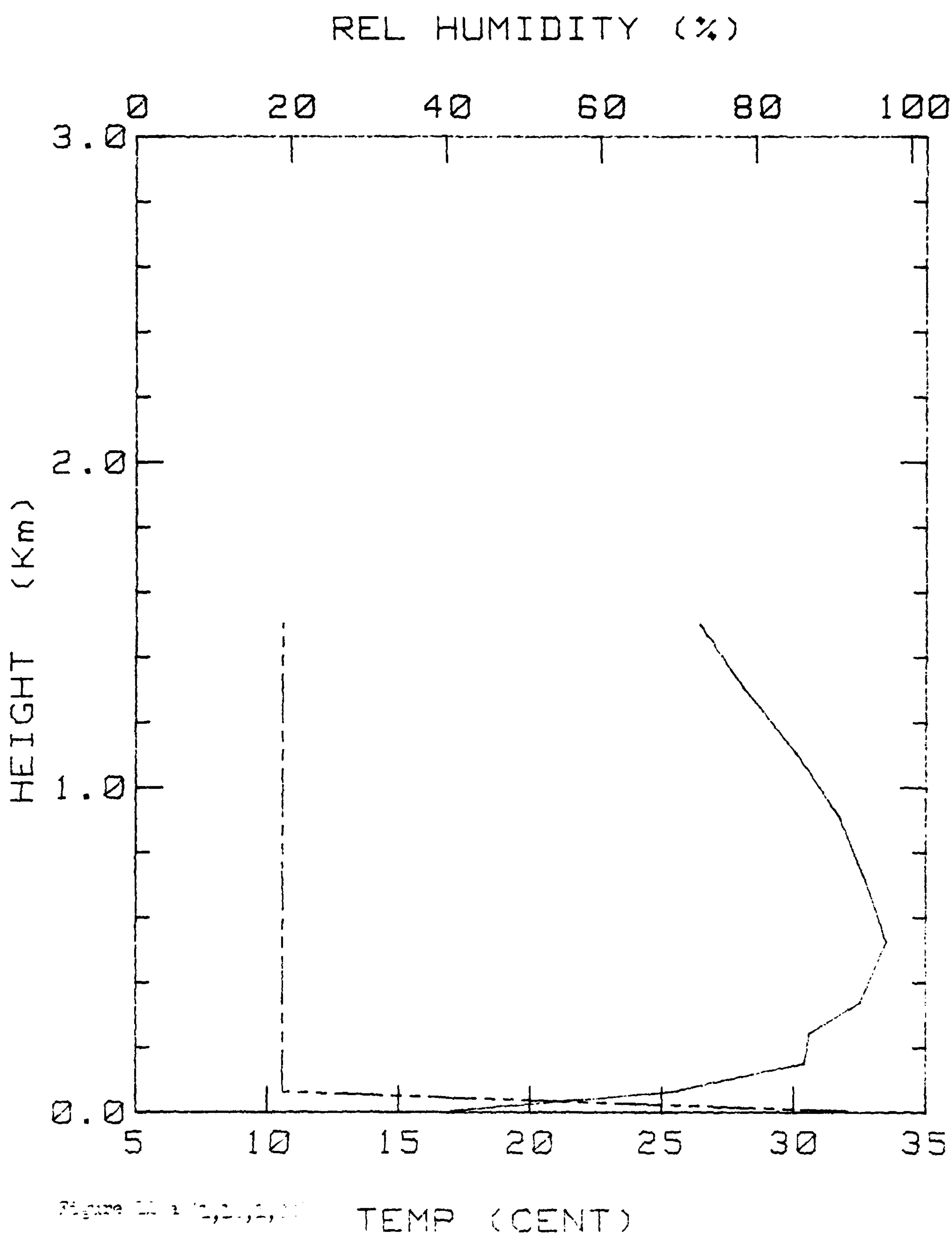
Figure [illegible] (1, 10,1,[illegible])



BLM-1 ACN 0025 1 OCT 80
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0032
Inversion jump -3.43 21.8
Well-mixed 9.30 14.1
Inversion top ht 56m. 333m.
Mixed layer ht 4m. 4m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40


REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-I 1 OCT 80 1230


BLM-1 ACN 1230 1 OCT 80
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0006 0.0089
Inversion jump -2.70 14.1
Well-mixed 10.75 16.5
Inversion top ht 183m. 183m.
Mixed layer ht 114m. 114m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40



BLM-I 1 OCT 80 2200

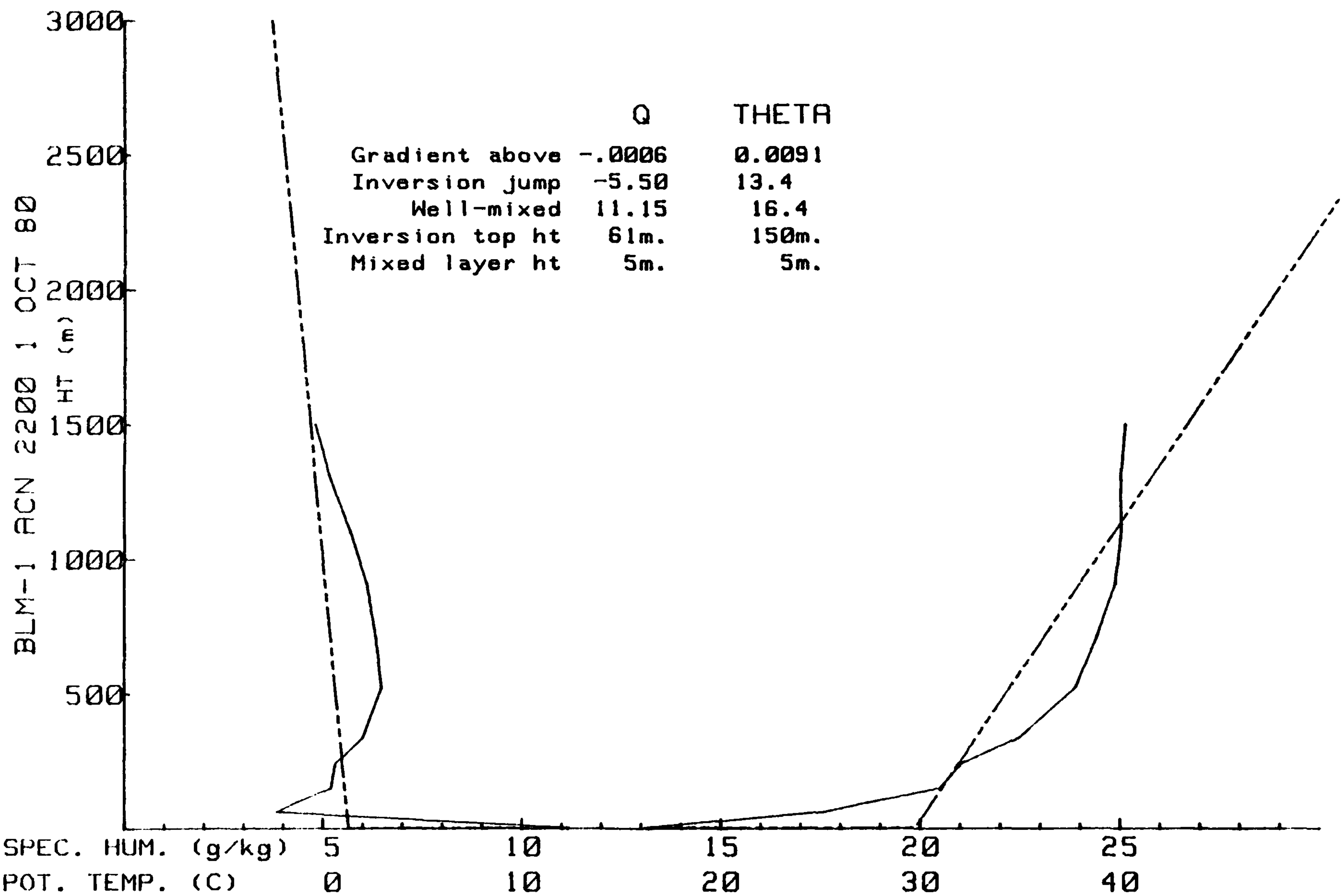
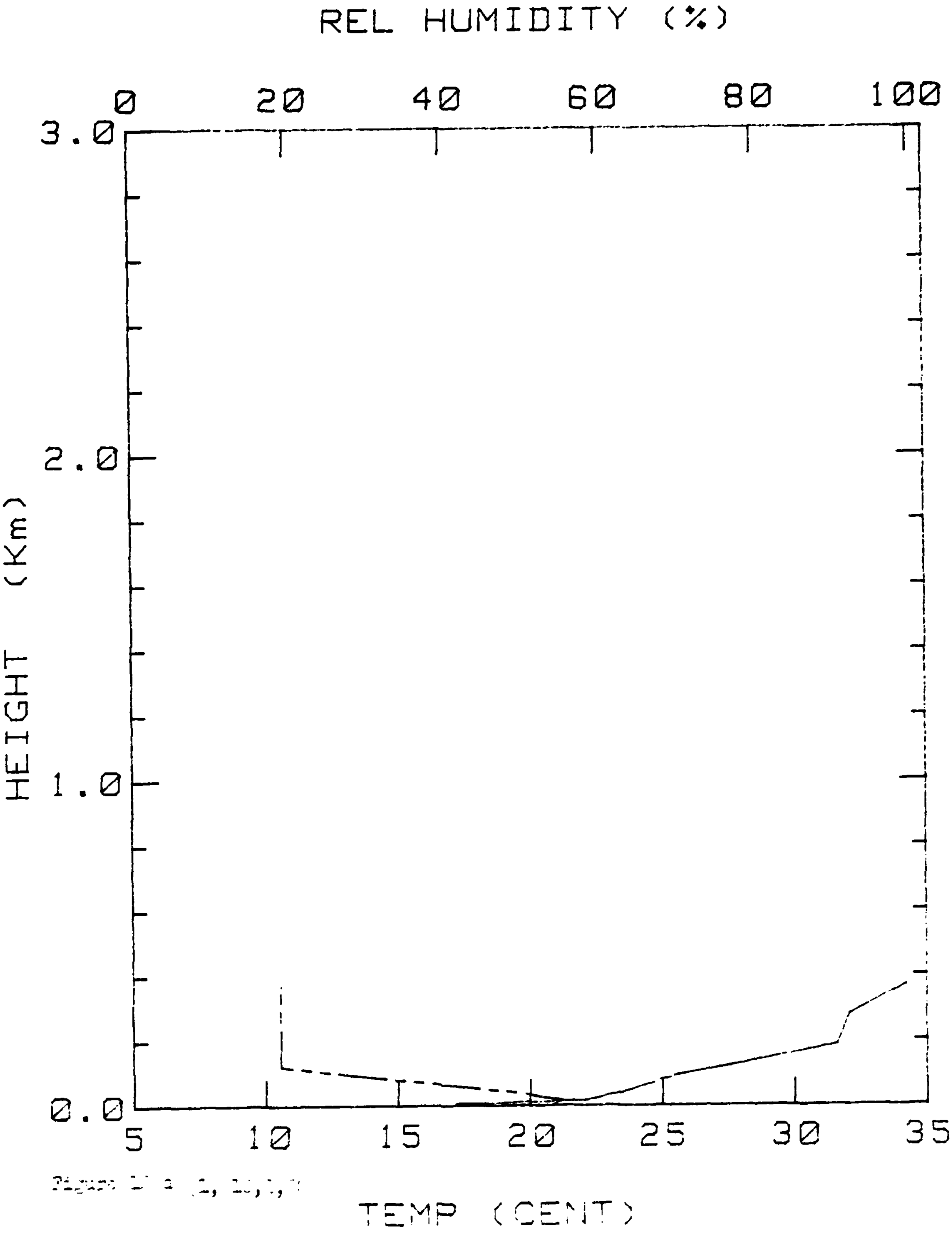
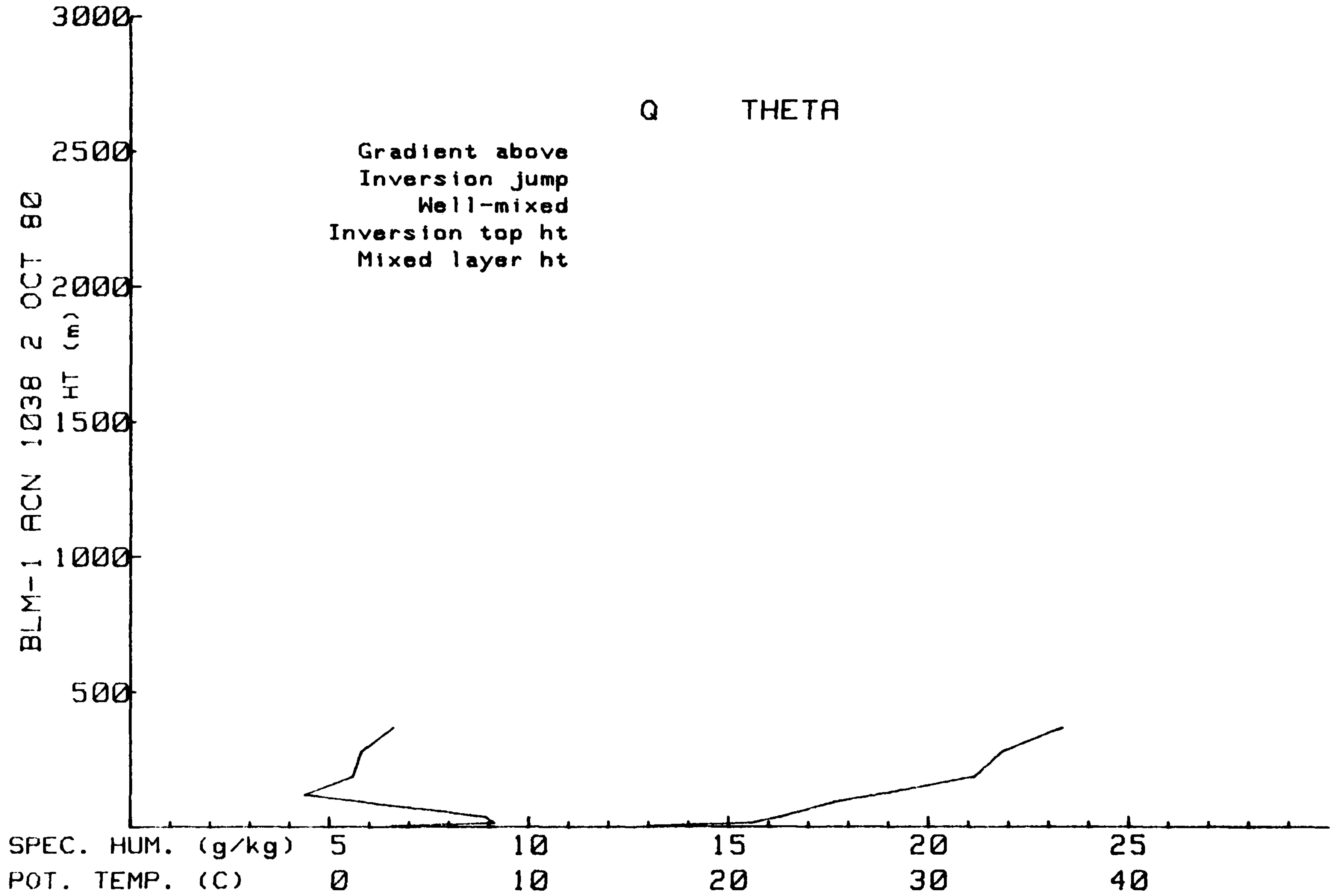


Figure 1[illegible] (1, 1[illegible],1,30)



BLM-I 2 OCT 80 1038


BLM-1 ACN 1038 2 OCT 80
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above
Inversion jump
Well-mixed
Inversion top ht
Mixed layer ht
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

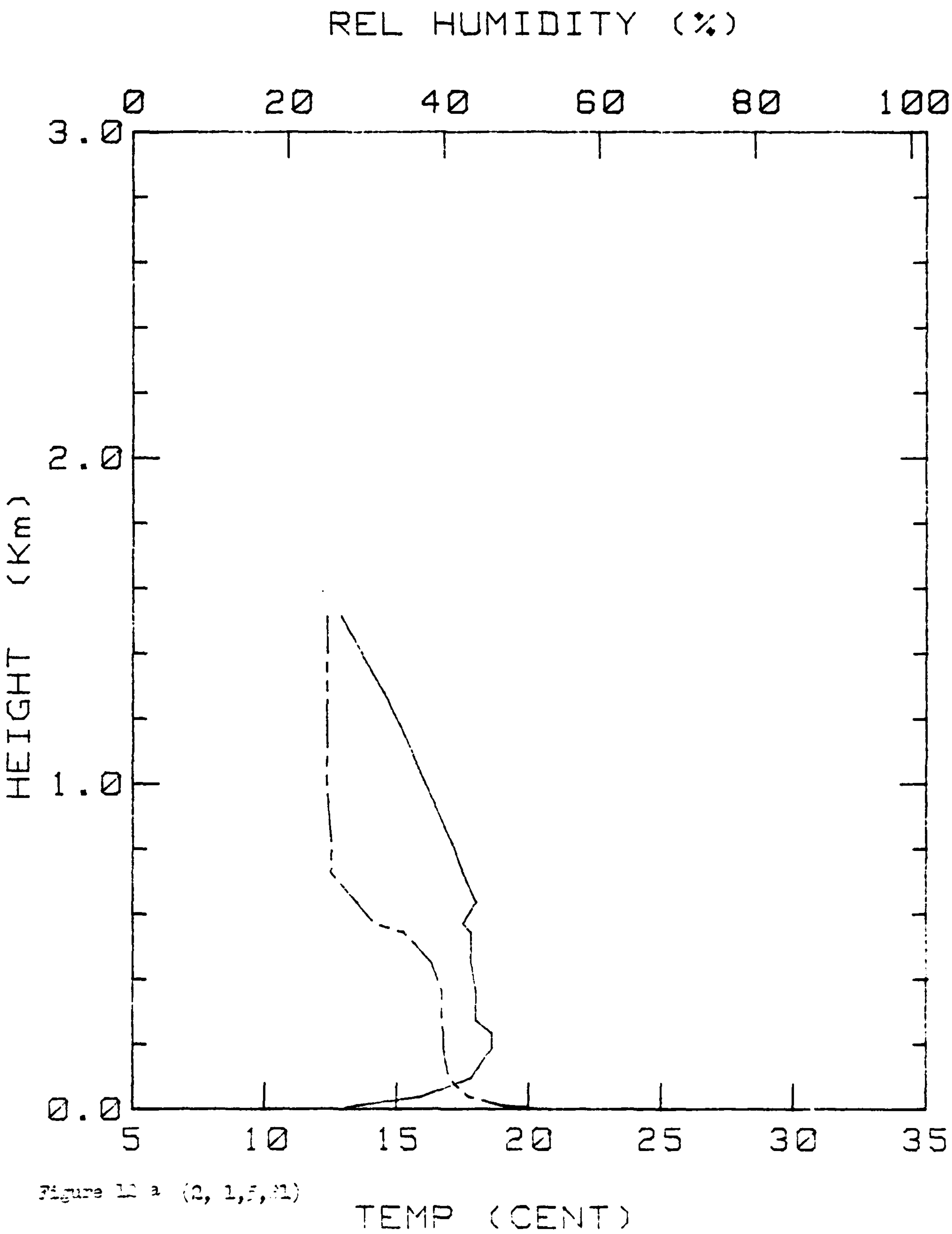


Figure 12 a (2, 1,5,21)

BLM-II 05 JAN 81 1953

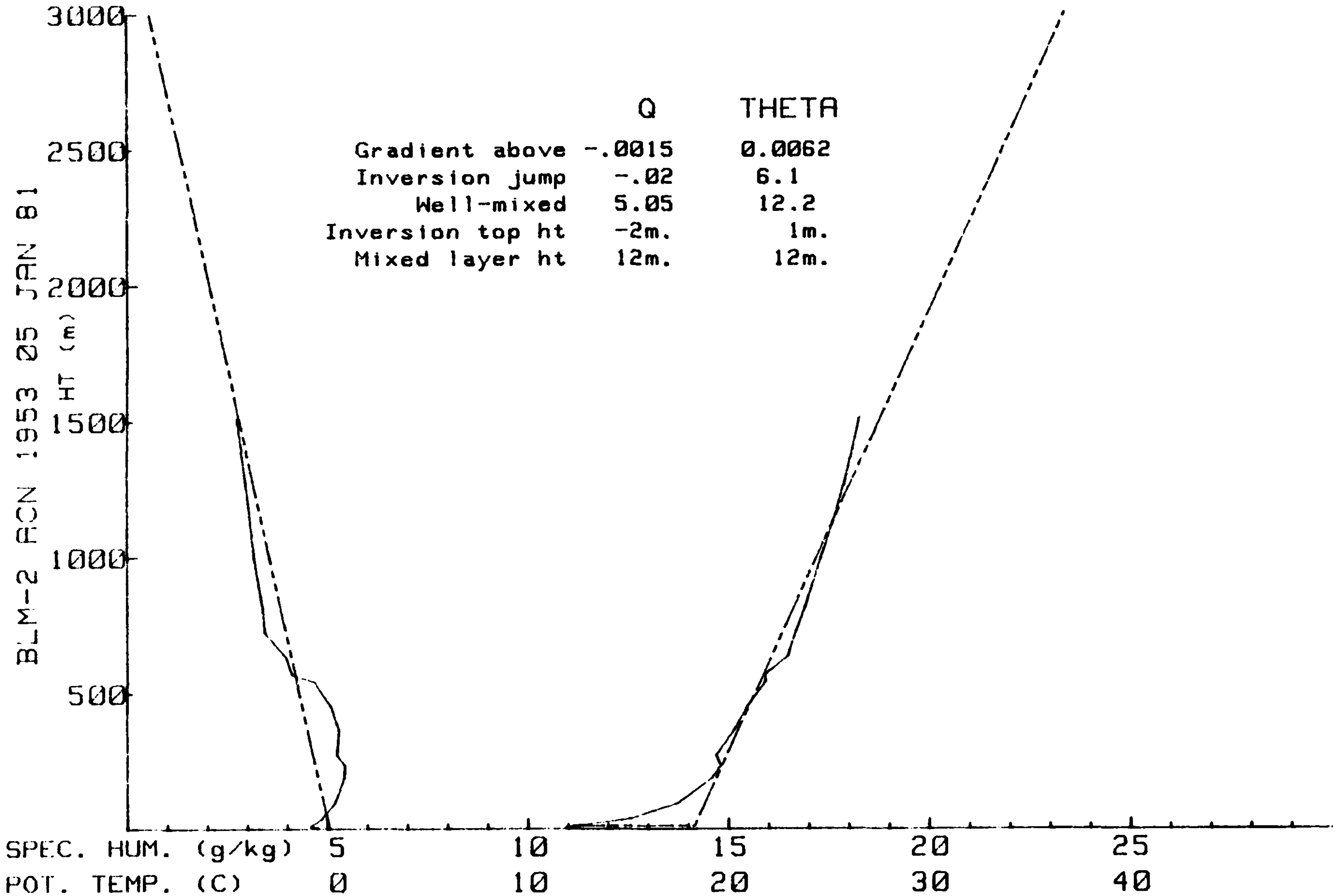


Figure 1-b (2, 1, [illegible],81)

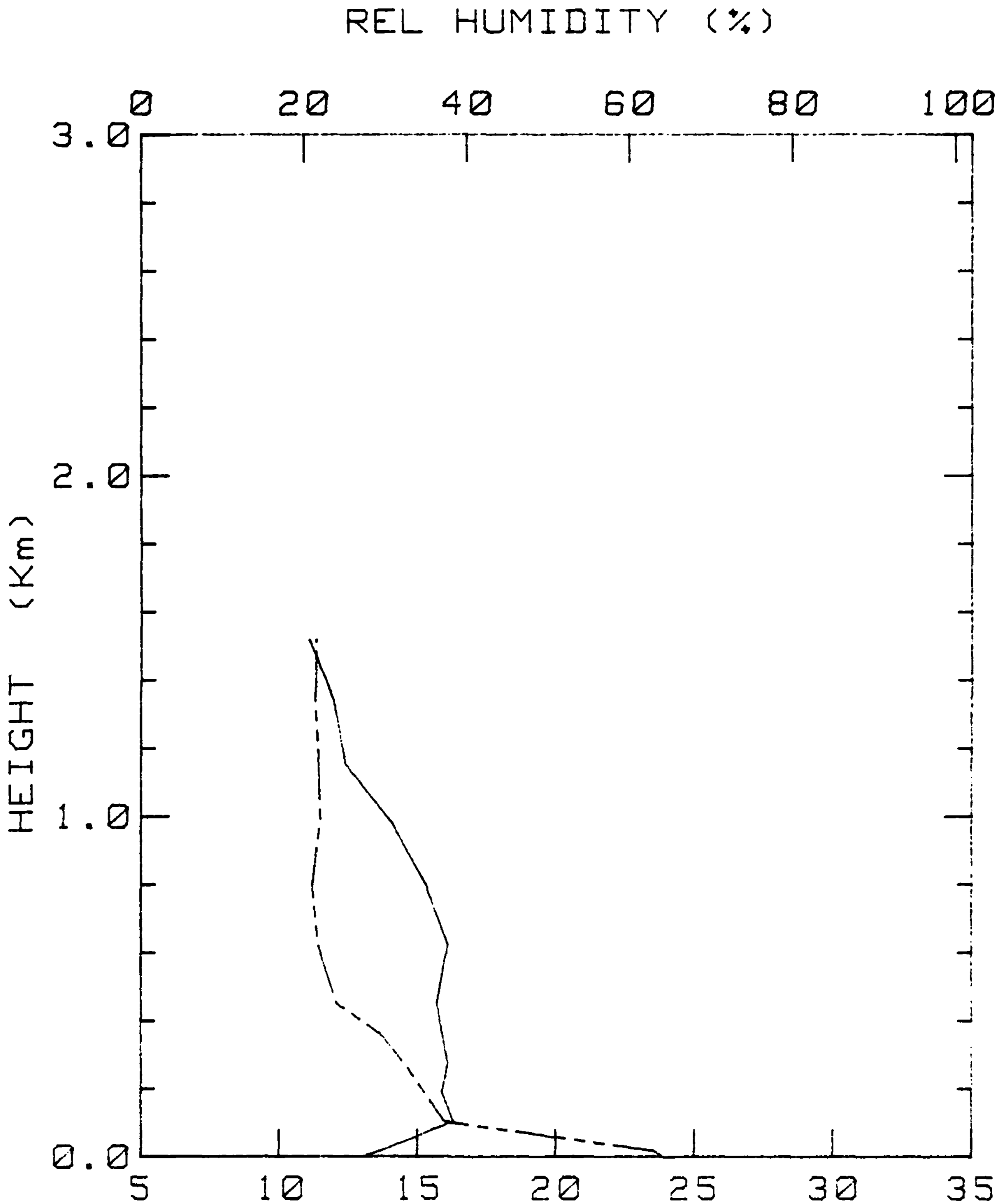
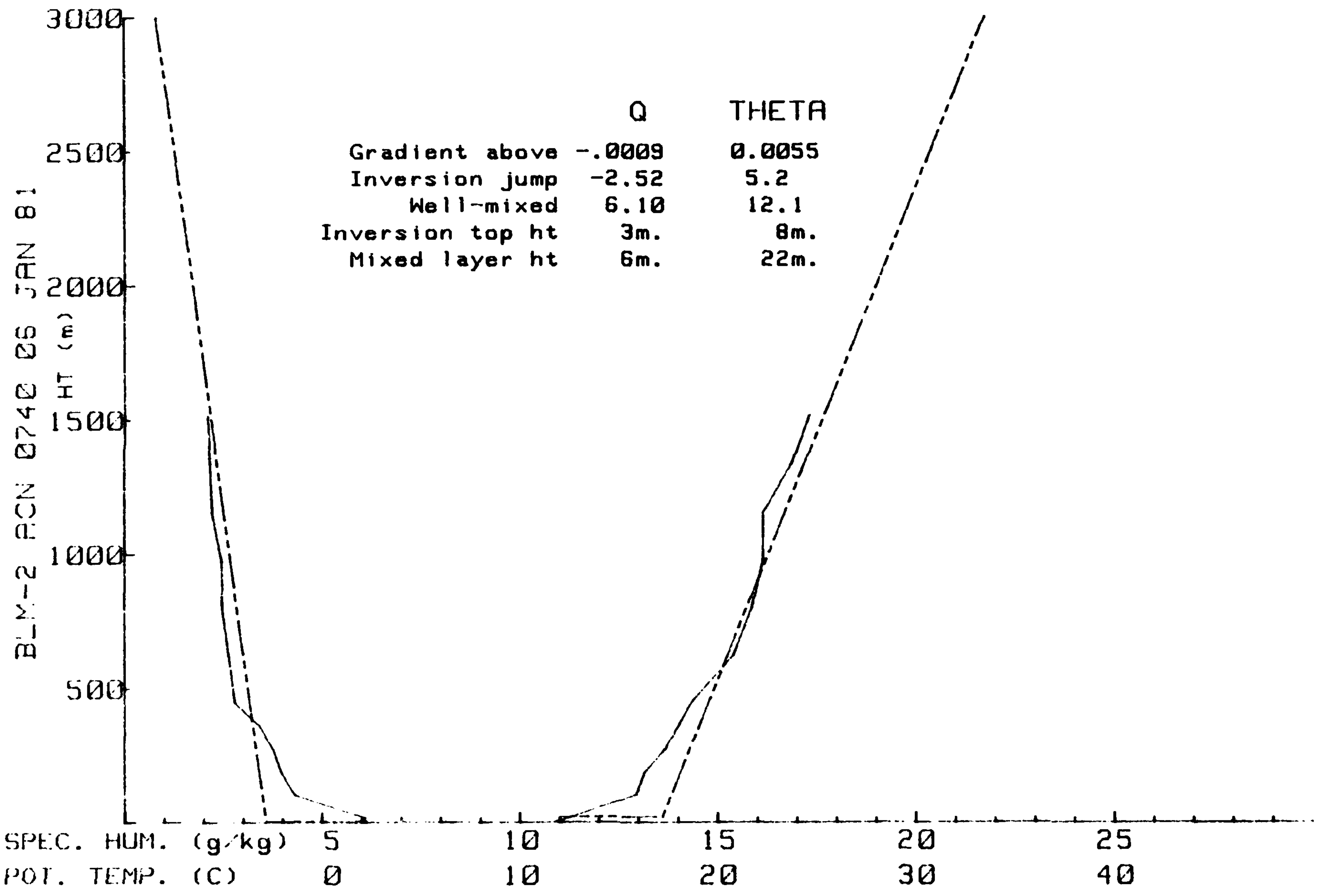


Figure 11 a (2, 1, 5, 11)

TEMP (CENT)

BLM-II 06 JAN 81 740



BLM-2 RCN 0740 05 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0009 0.0055
Inversion jump -2.52 5.2
Well-mixed 6.10 12.1
Inversion top ht 3m. 8m.
Mixed layer ht 6m. 22m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

Fig. ... b (., 1, 7, 1)

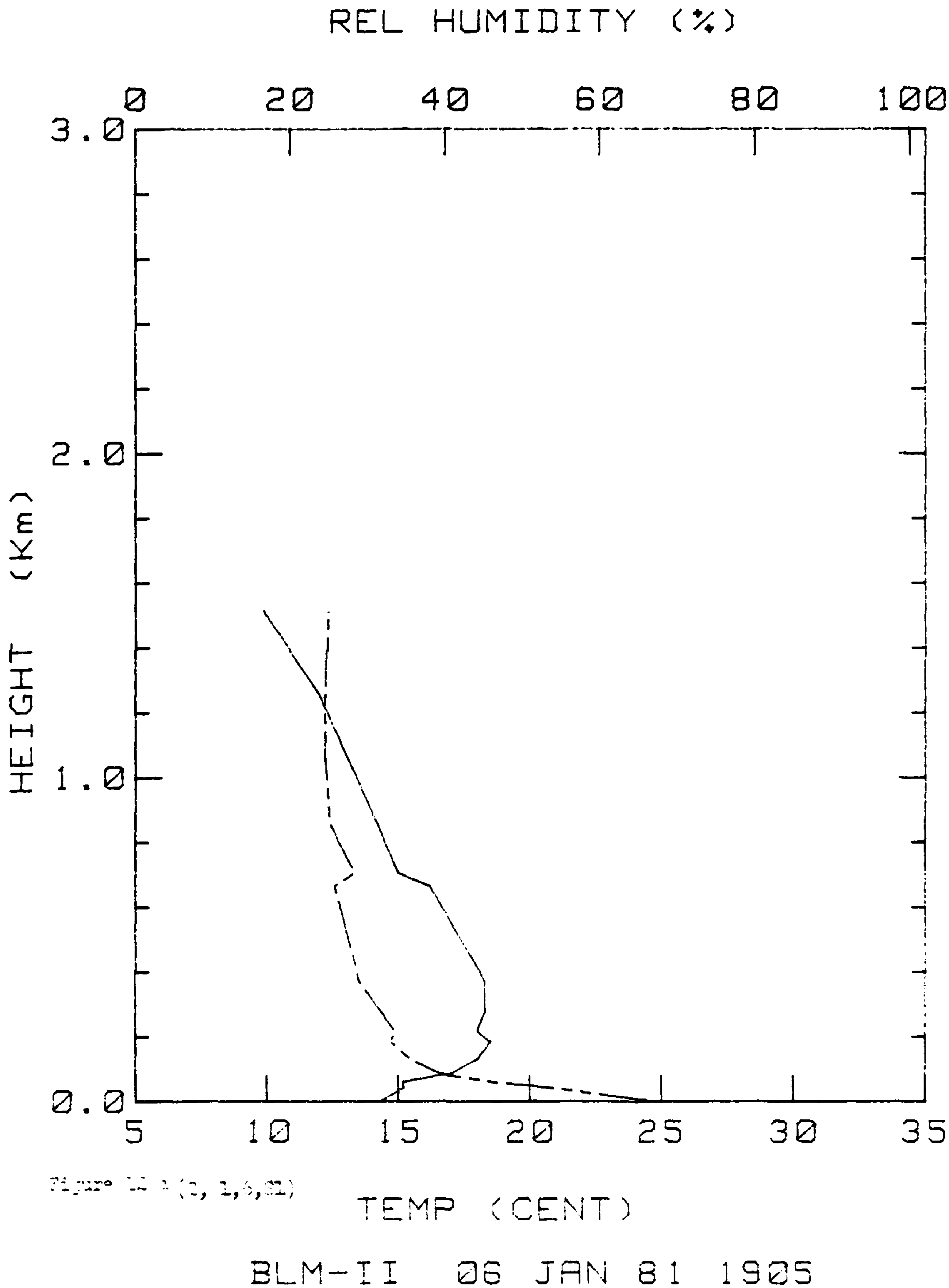
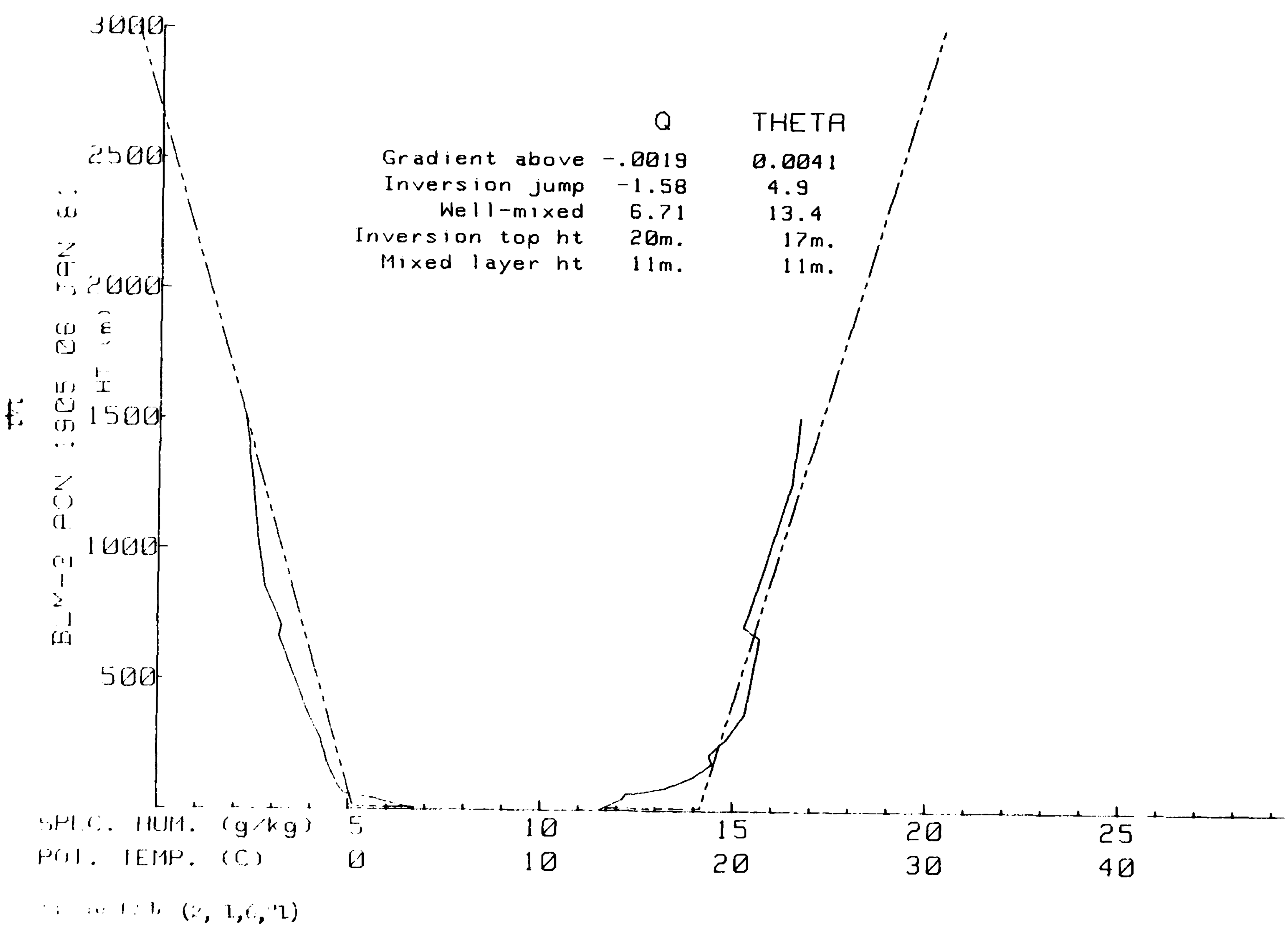
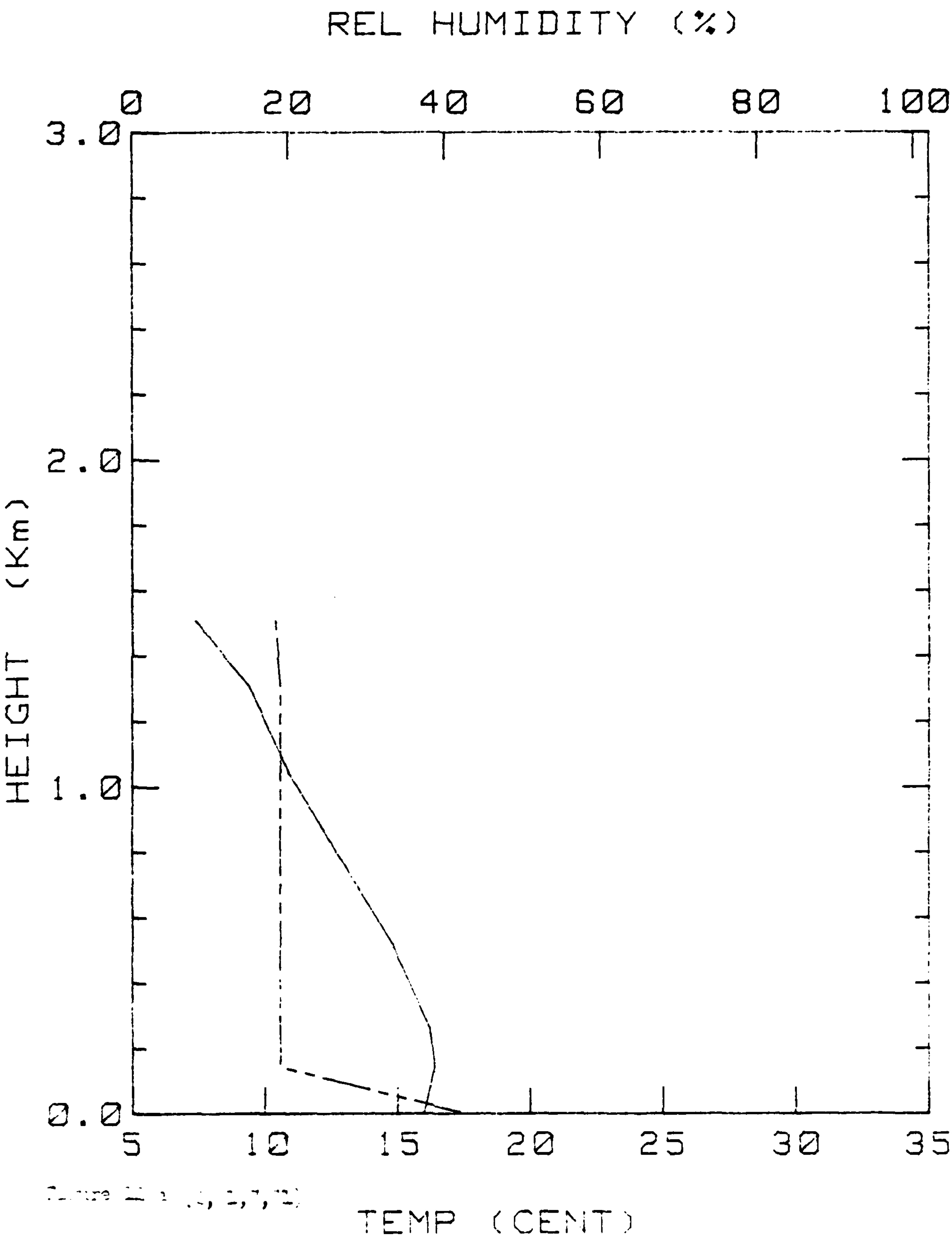
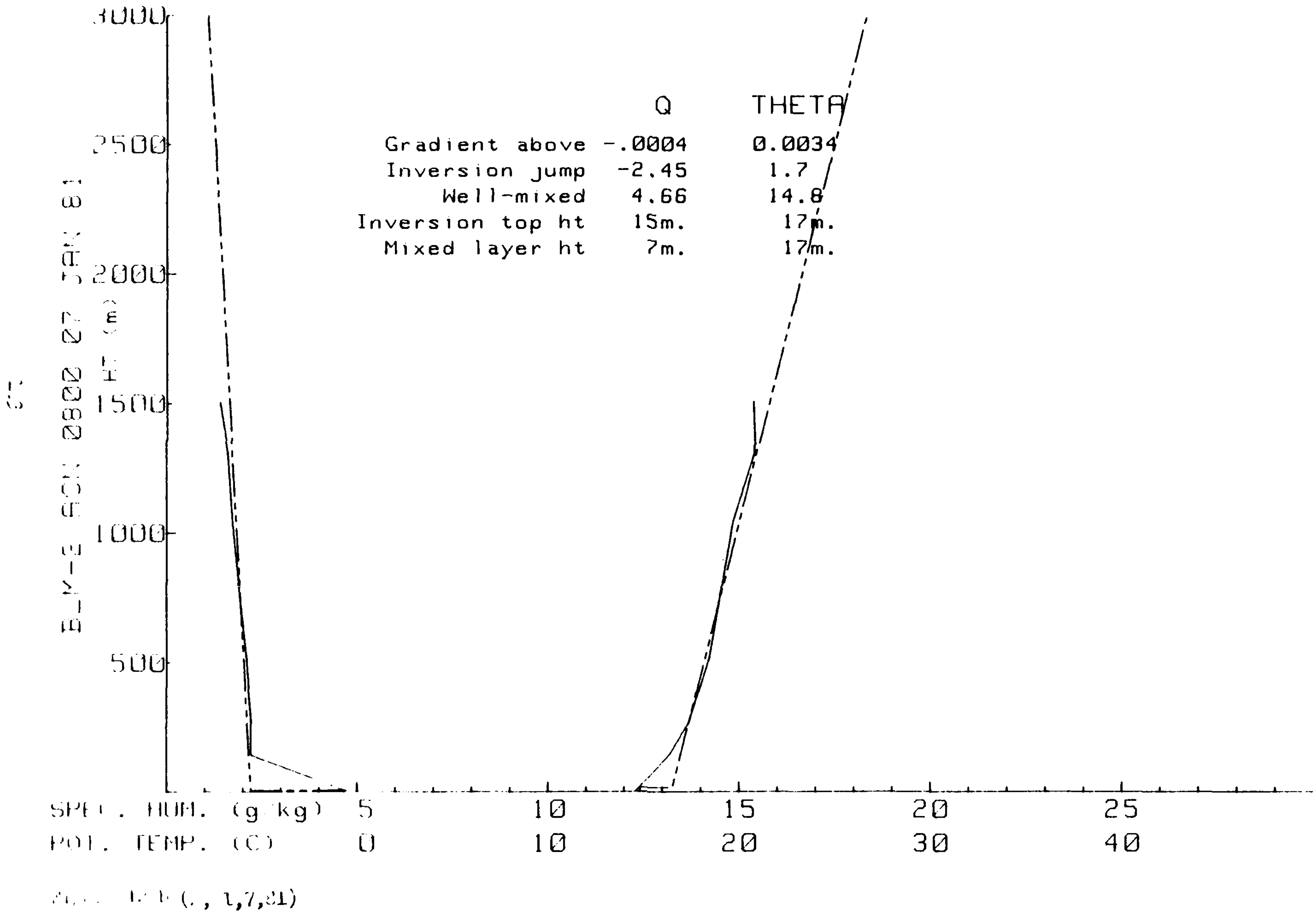


Figure 12 a (c, 1,6,81)


Q THETA
Gradient above -.0019 0.0041
Inversion jump -1.58 4.9
Well-mixed 6.71 13.4
Inversion top ht 20m. 17m.
Mixed layer ht 11m. 11m.
3000
2500
2000
1500
1000
500
HT (m)
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40



BLM-II 07 JAN 81 800



BLM-E RCN 0800 07 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0004 0.0034
Inversion jump -2.45 1.7
Well-mixed 4.66 14.8
Inversion top ht 15m. 17m.
Mixed layer ht 7m. 17m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

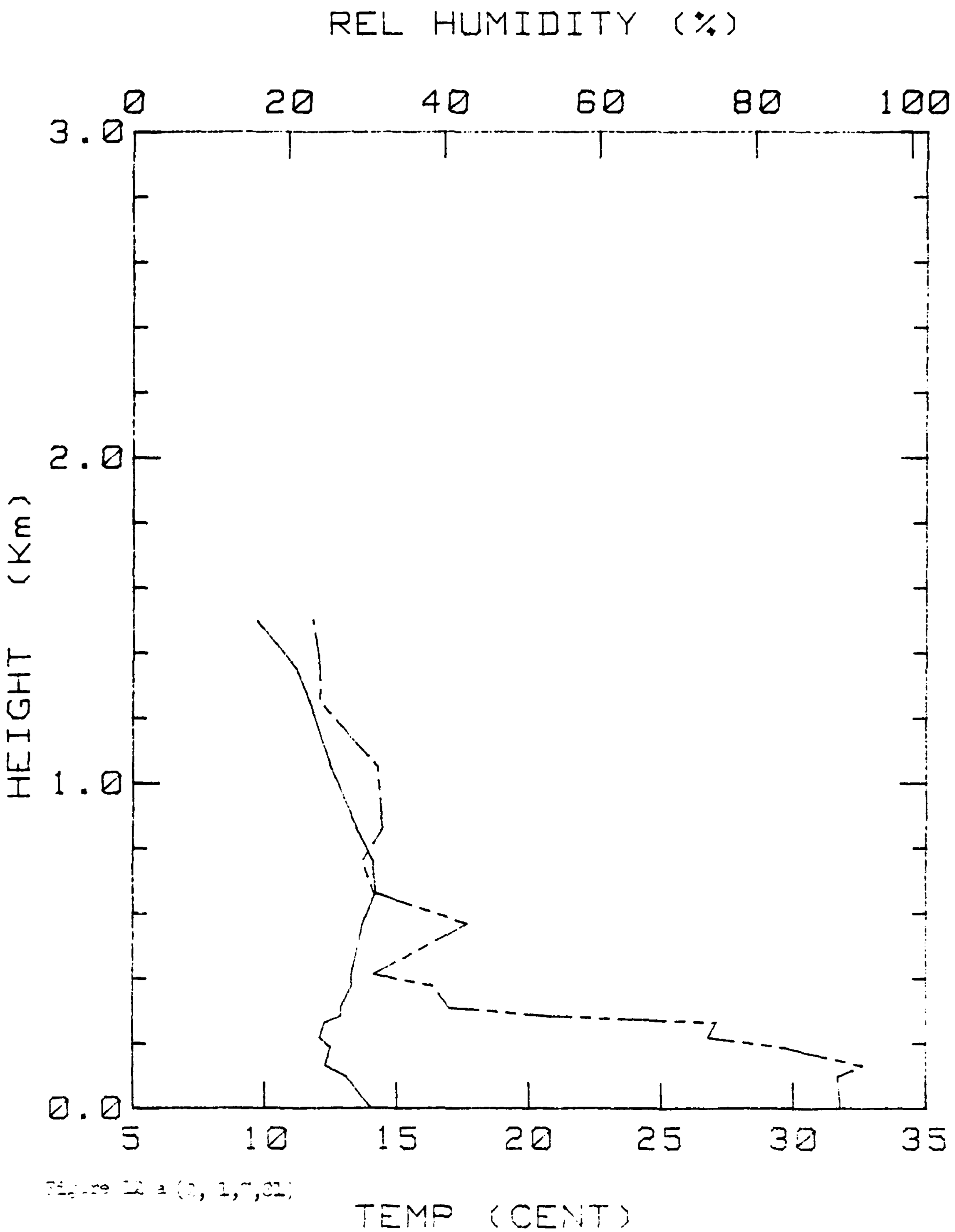
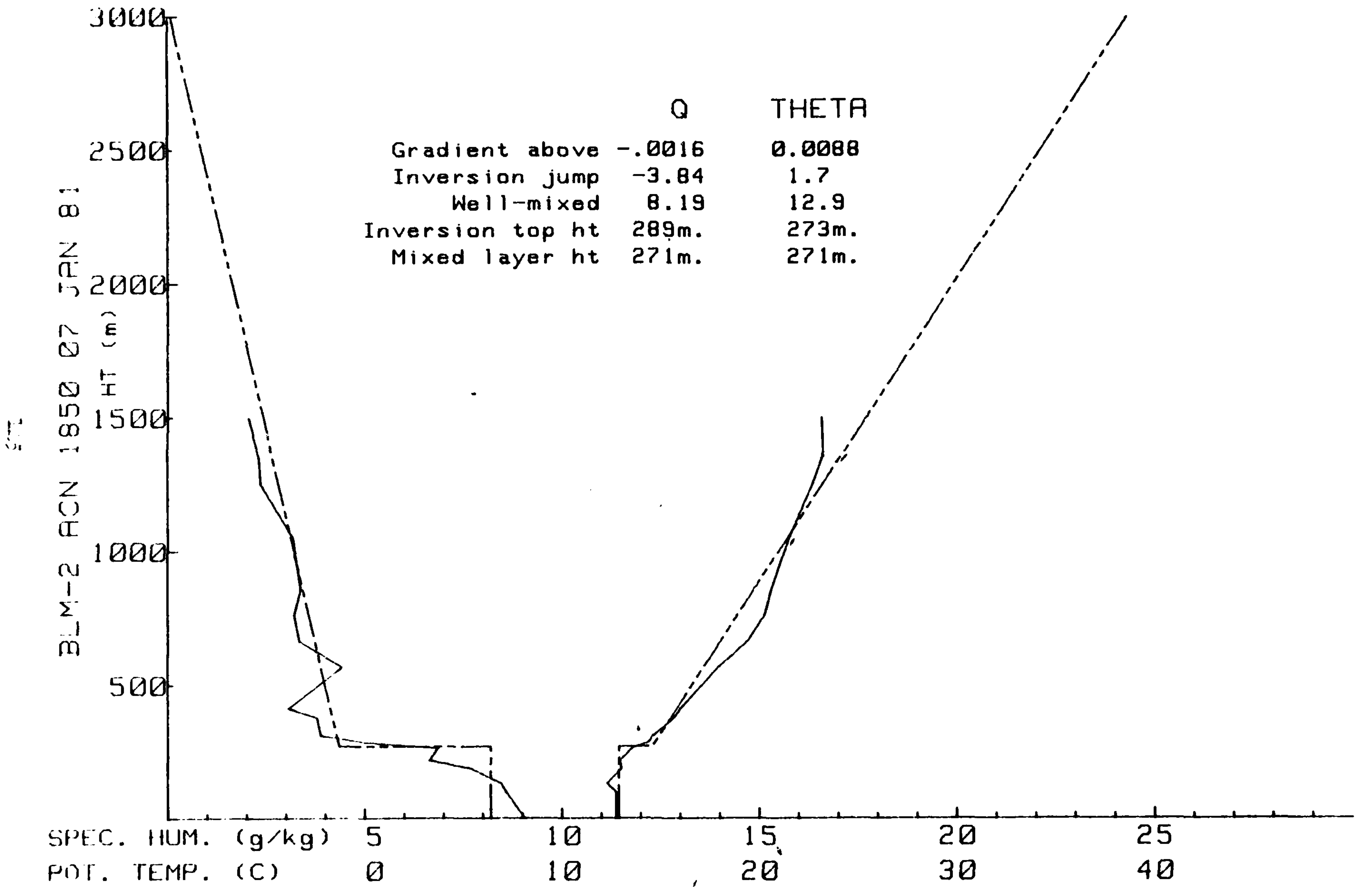


Figure 12 a (2, 1,7,81)

BLM-II 07 JAN 81 1850


BLM-2 ACN 1850 07 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0016 0.0088
Inversion jump -3.84 1.7
Well-mixed 8.19 12.9
Inversion top ht 289m. 273m.
Mixed layer ht 271m. 271m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

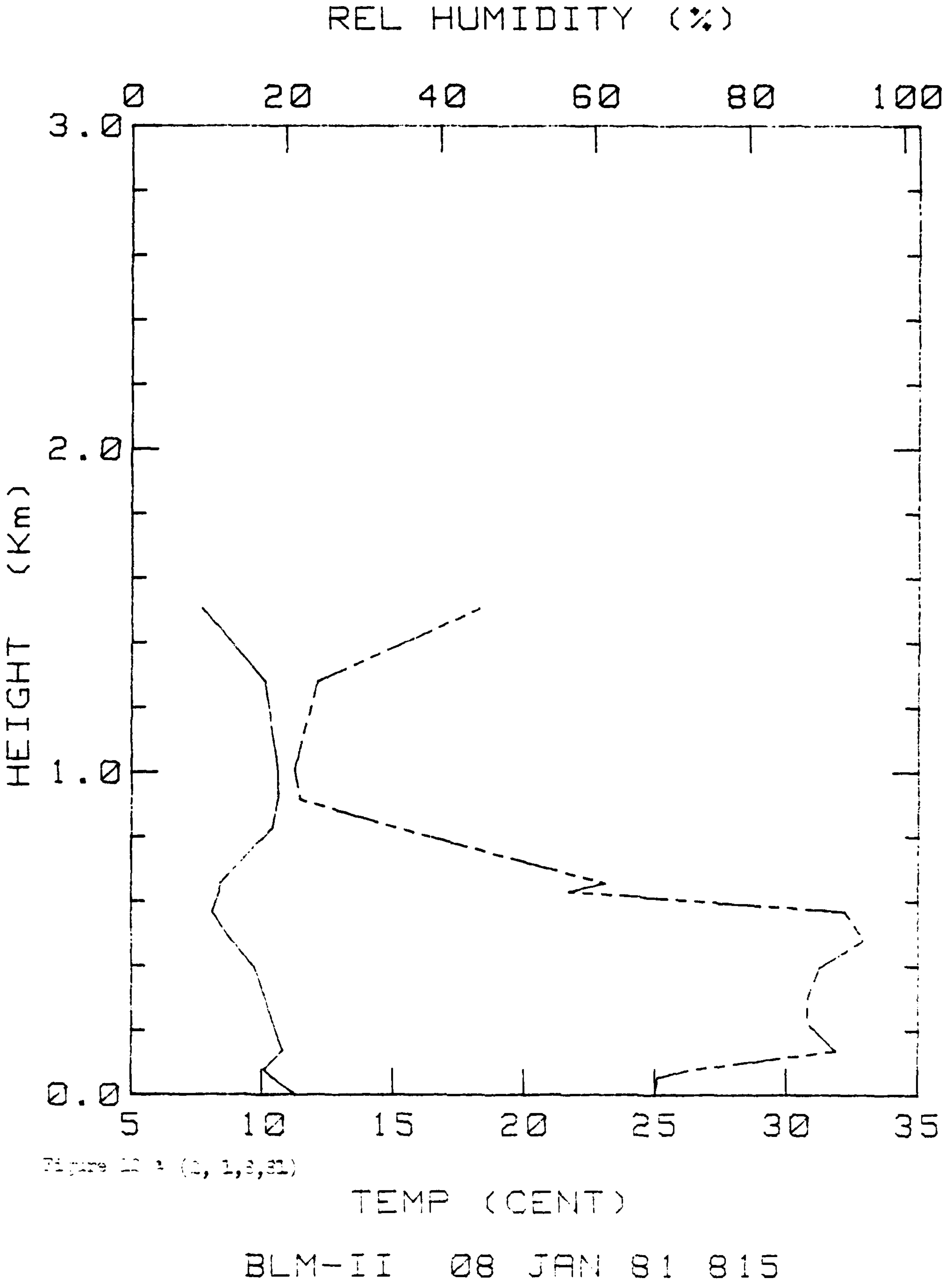
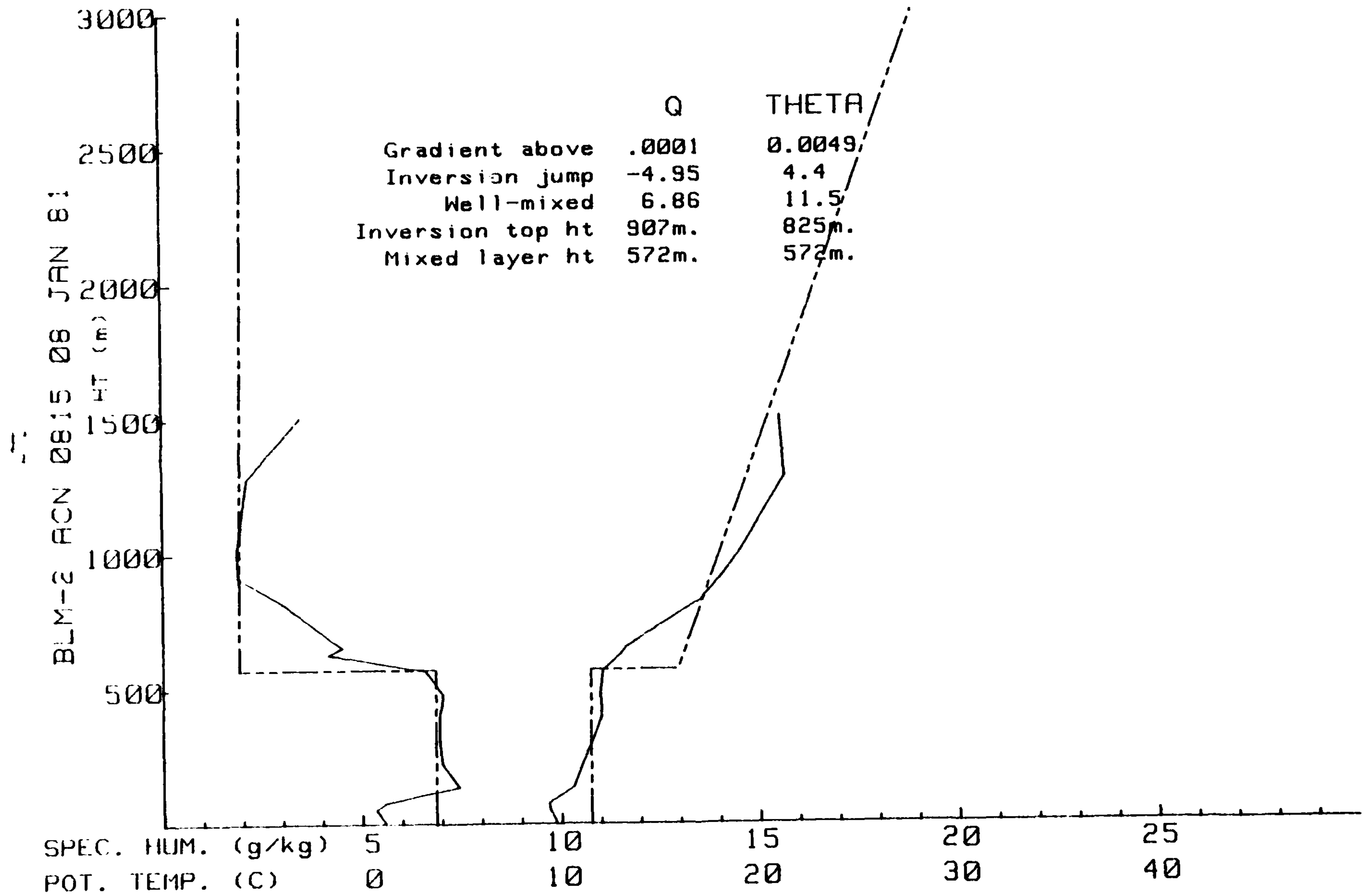


Figure 12 a (2, 1,8,81)


BLM-2 ACN 0815 08 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above .0001 0.0049
Inversion jump -4.95 4.4
Well-mixed 6.86 11.5
Inversion top ht 907m. 825m.
Mixed layer ht 572m. 572m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

b (2, 1,8,81)

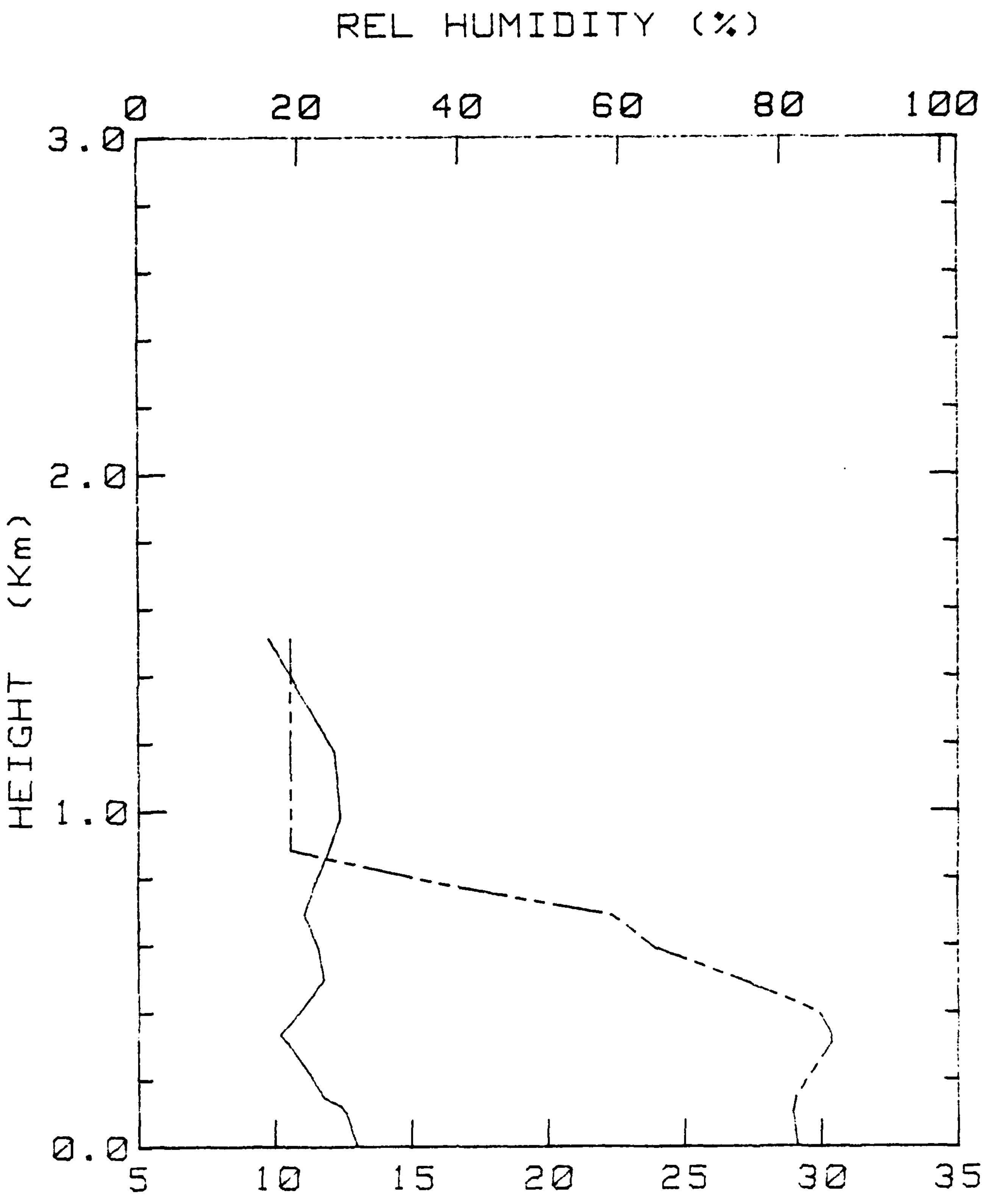


Figure [illegible] a (2, 1,3,81)

TEMP (CENT)

BLM-II 08 JAN 81 1915

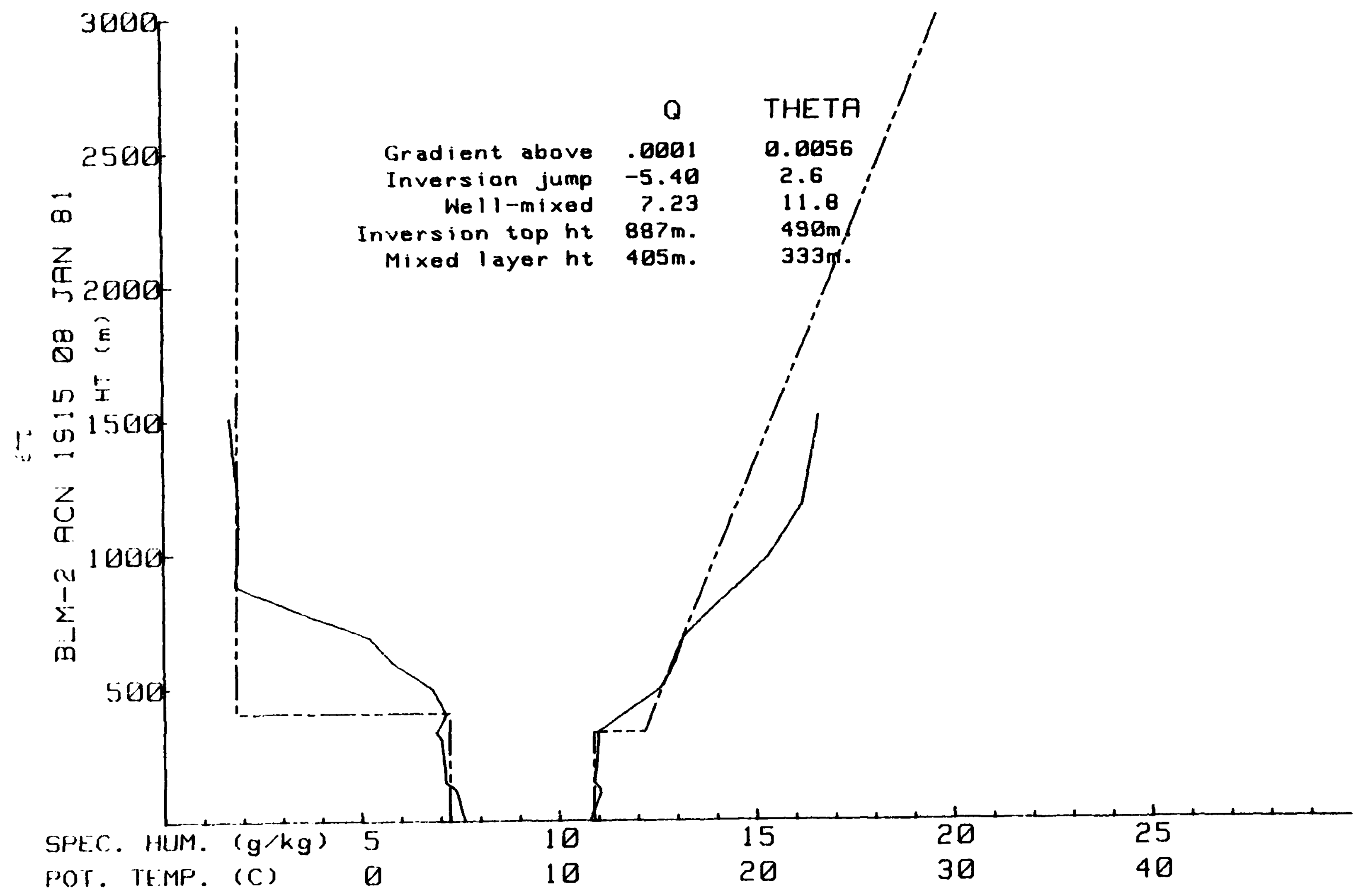


Figure [illegible] b (2, 1,8,81)

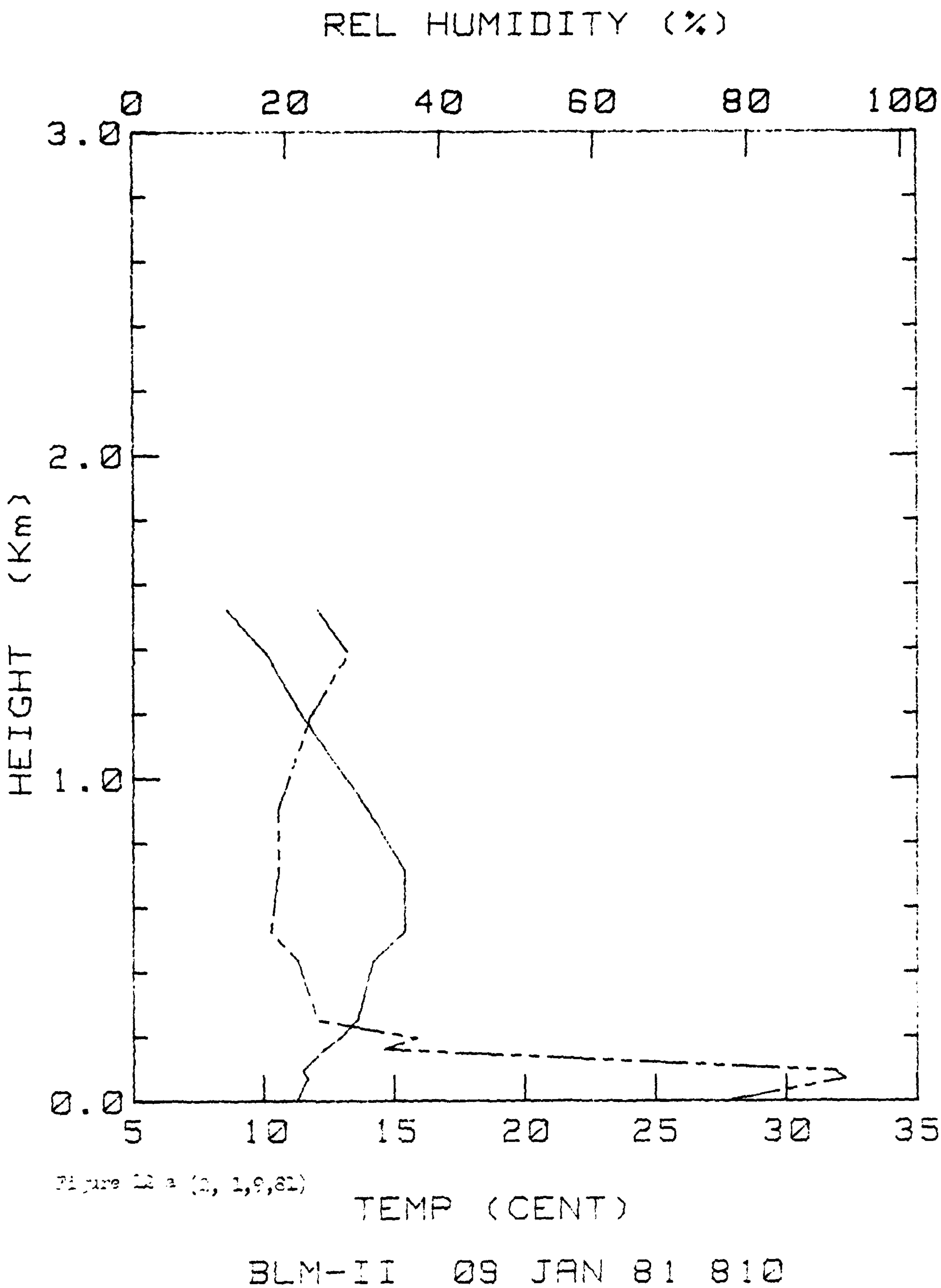
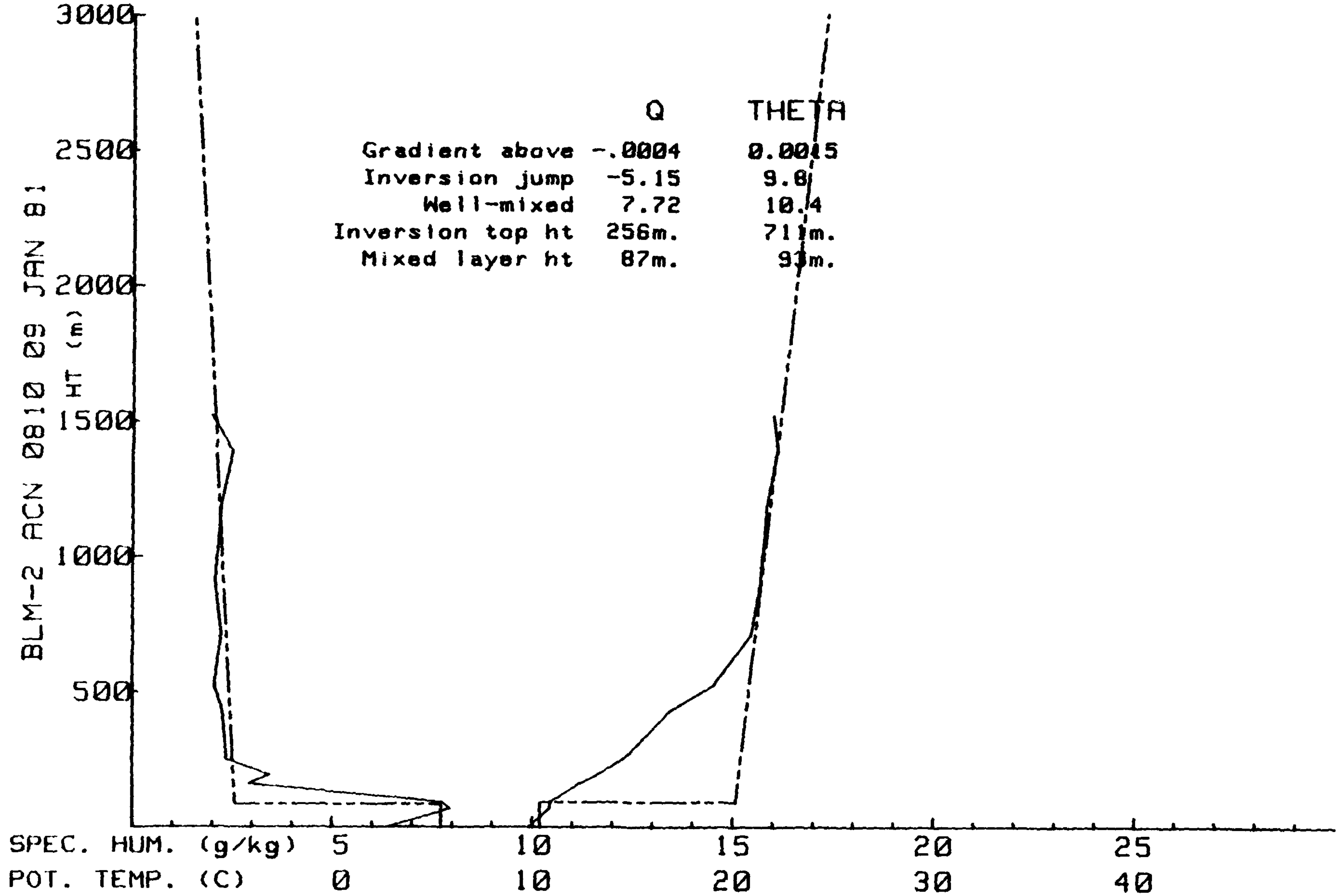


Figure 12 a (2, 1,9,81)


BLM-2 ACN 0810 09 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0004 0.0015
Inversion jump -5.15 9.8
Well-mixed 7.72 10.4
Inversion top ht 256m. 711m.
Mixed layer ht 87m. 93m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

(2, 1,9,81)

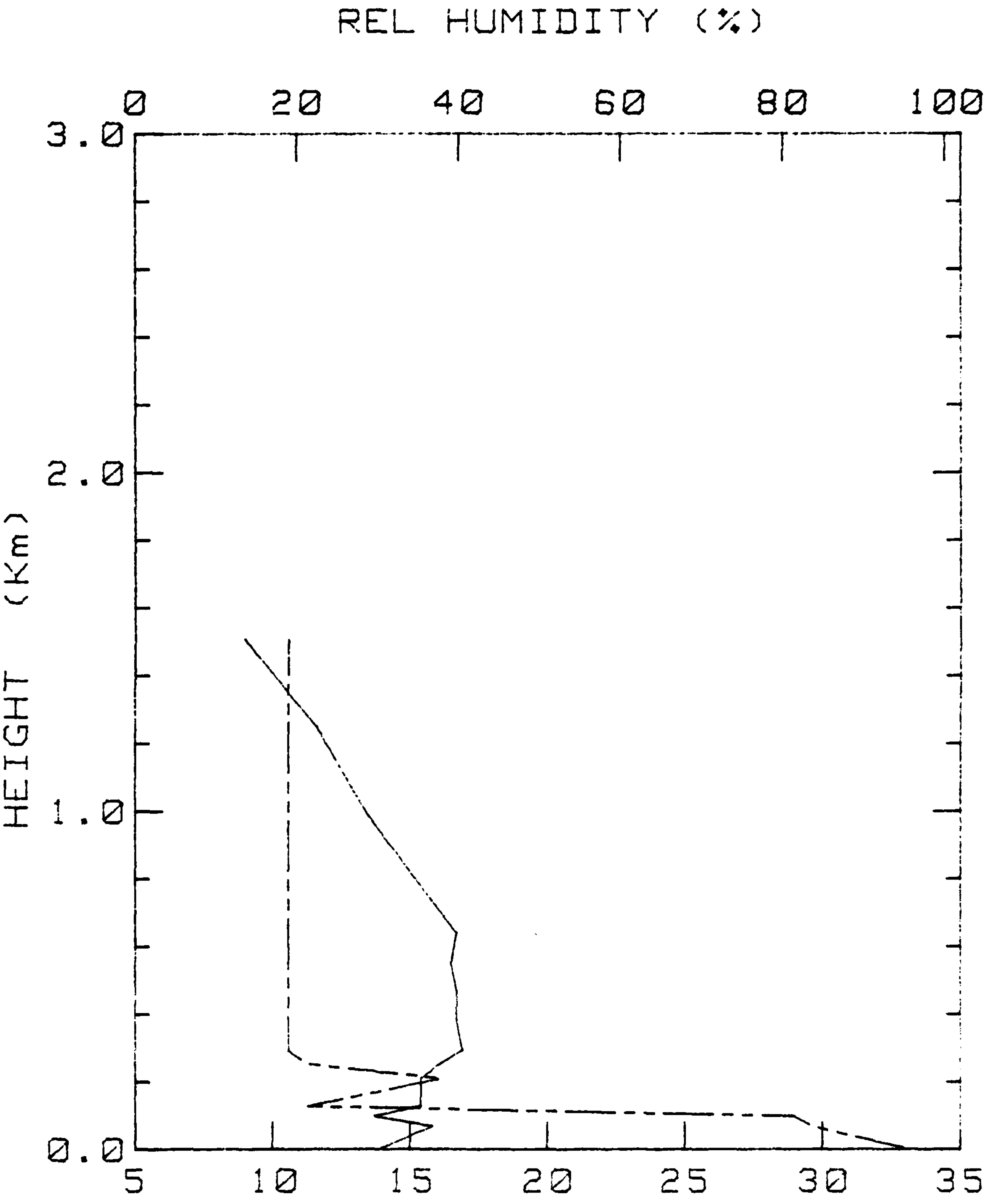
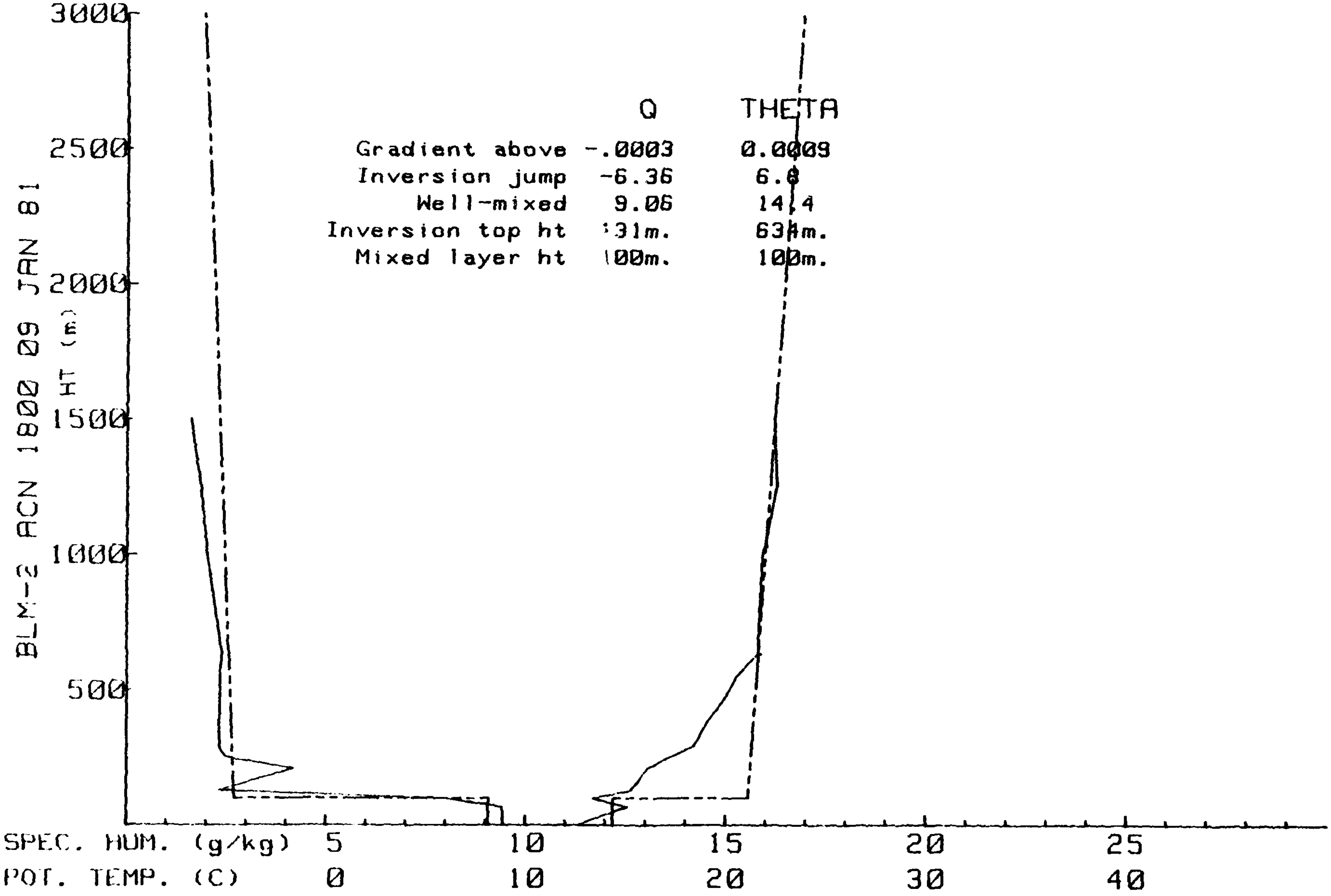


Figure 12 a (C, 1,9,81)

BLM-II 09 JAN 81 1800



BLM-2 ACN 1800 09 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0003 0.0009
Inversion jump -6.36 6.8
Well-mixed 9.06 14.4
Inversion top ht 131m. 634m.
Mixed layer ht 100m. 100m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

(2, 1,9,81)

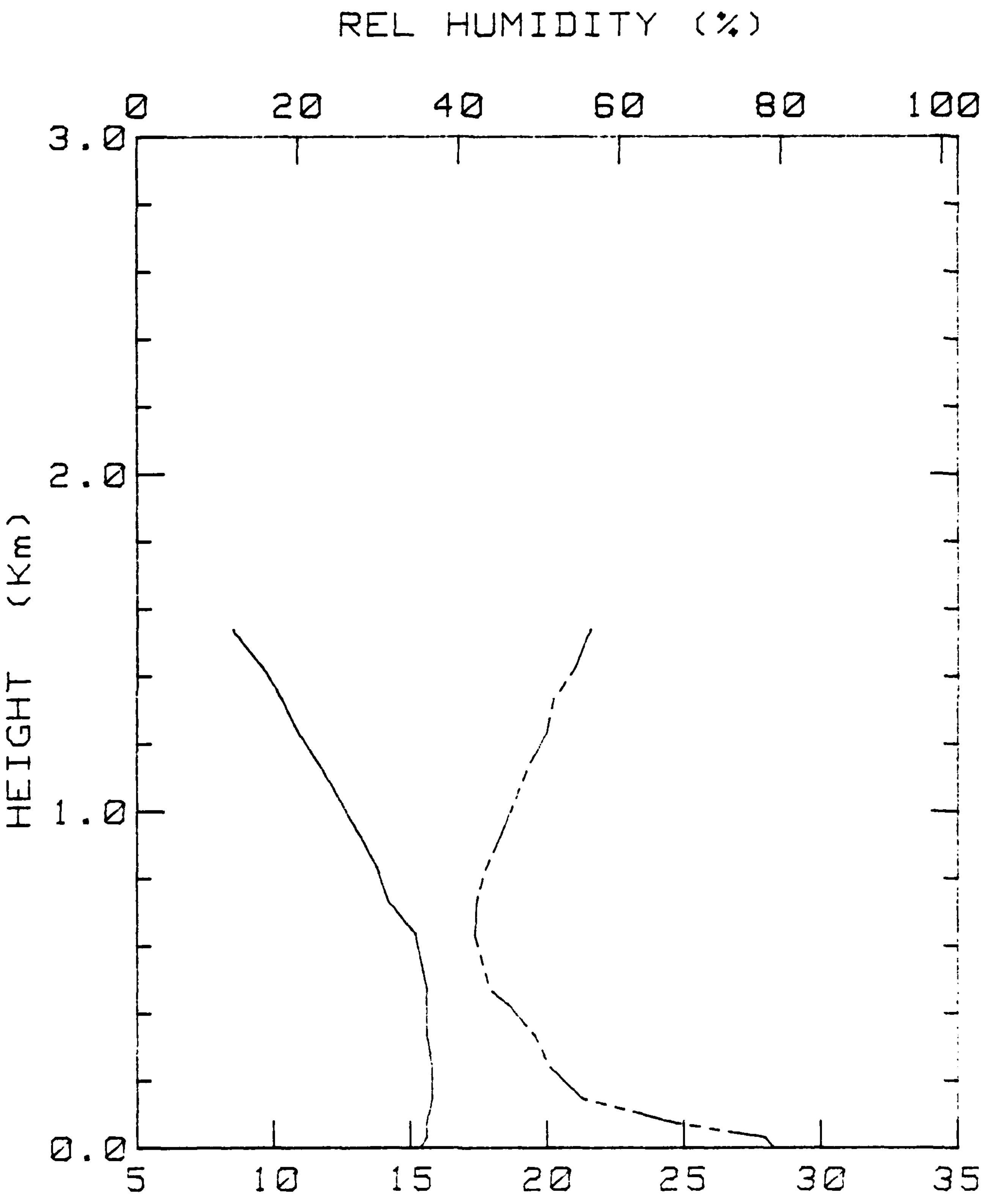
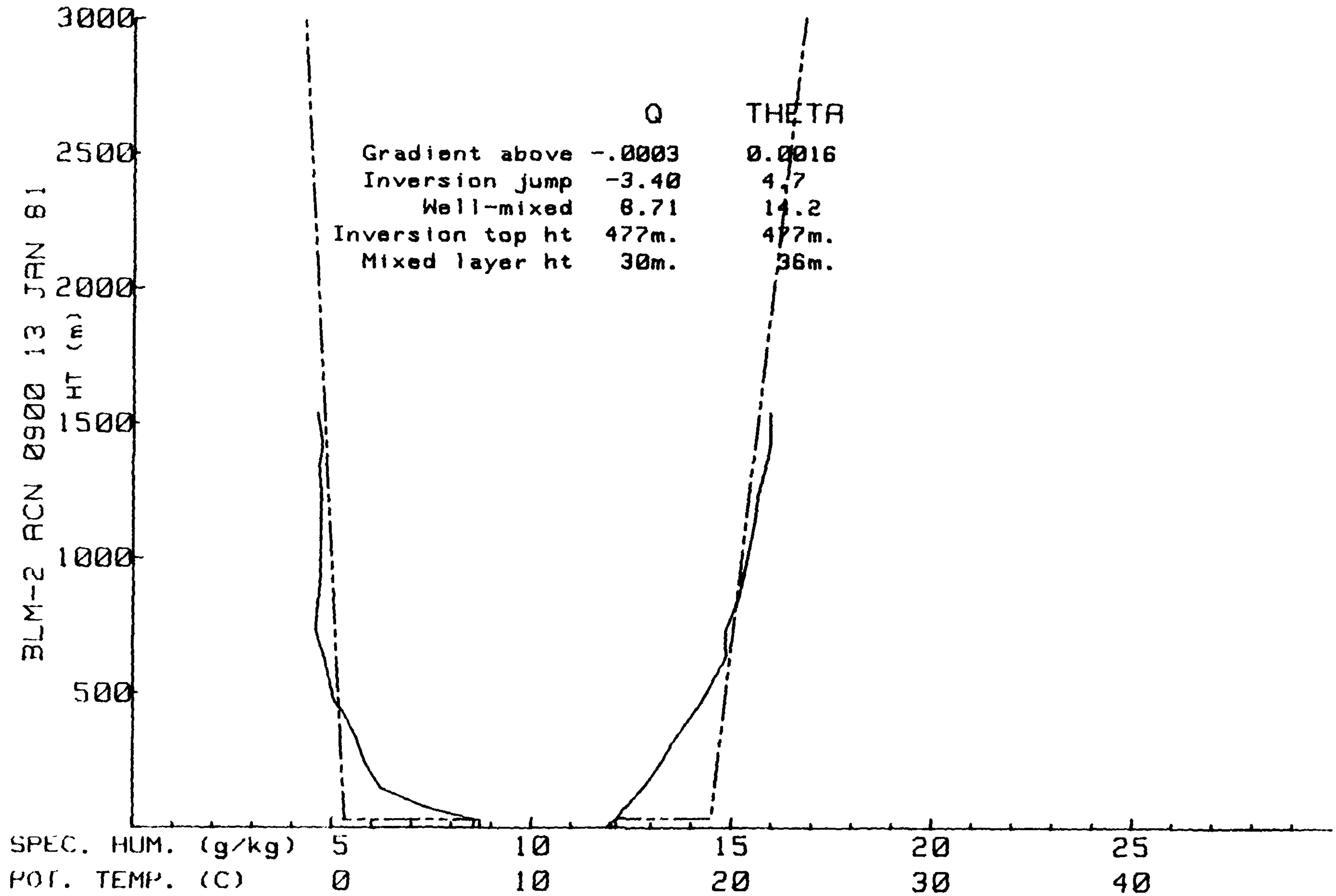


Figure 11 ? (2, 1,13,81)

TEMP (CENT)

BLM-2 13 JAN 81 900


BLM-2 ACN 0900 13 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0003 0.0016
Inversion jump -3.40 4.7
Well-mixed 8.71 14.2
Inversion top ht 477m. 477m.
Mixed layer ht 30m. 36m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

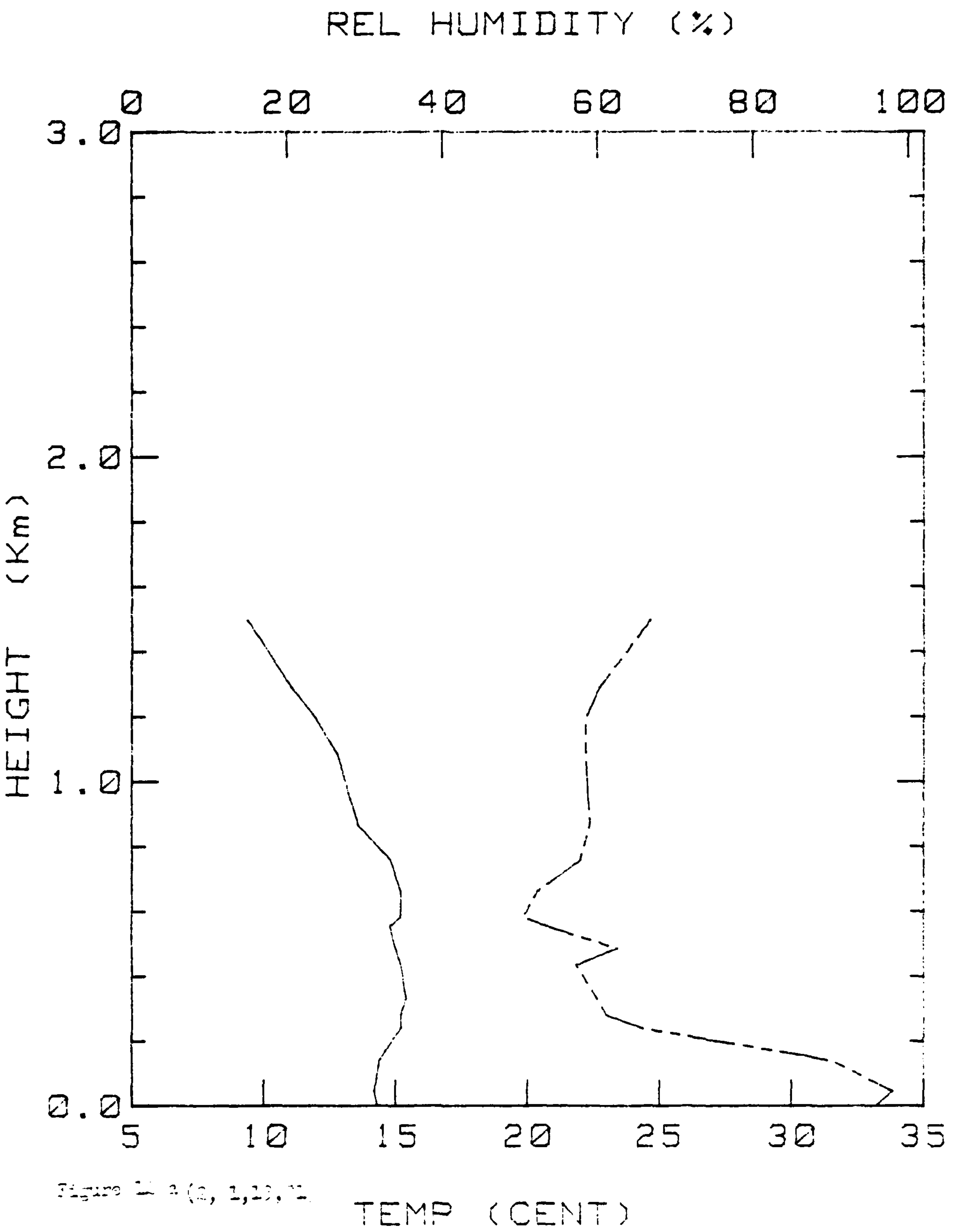
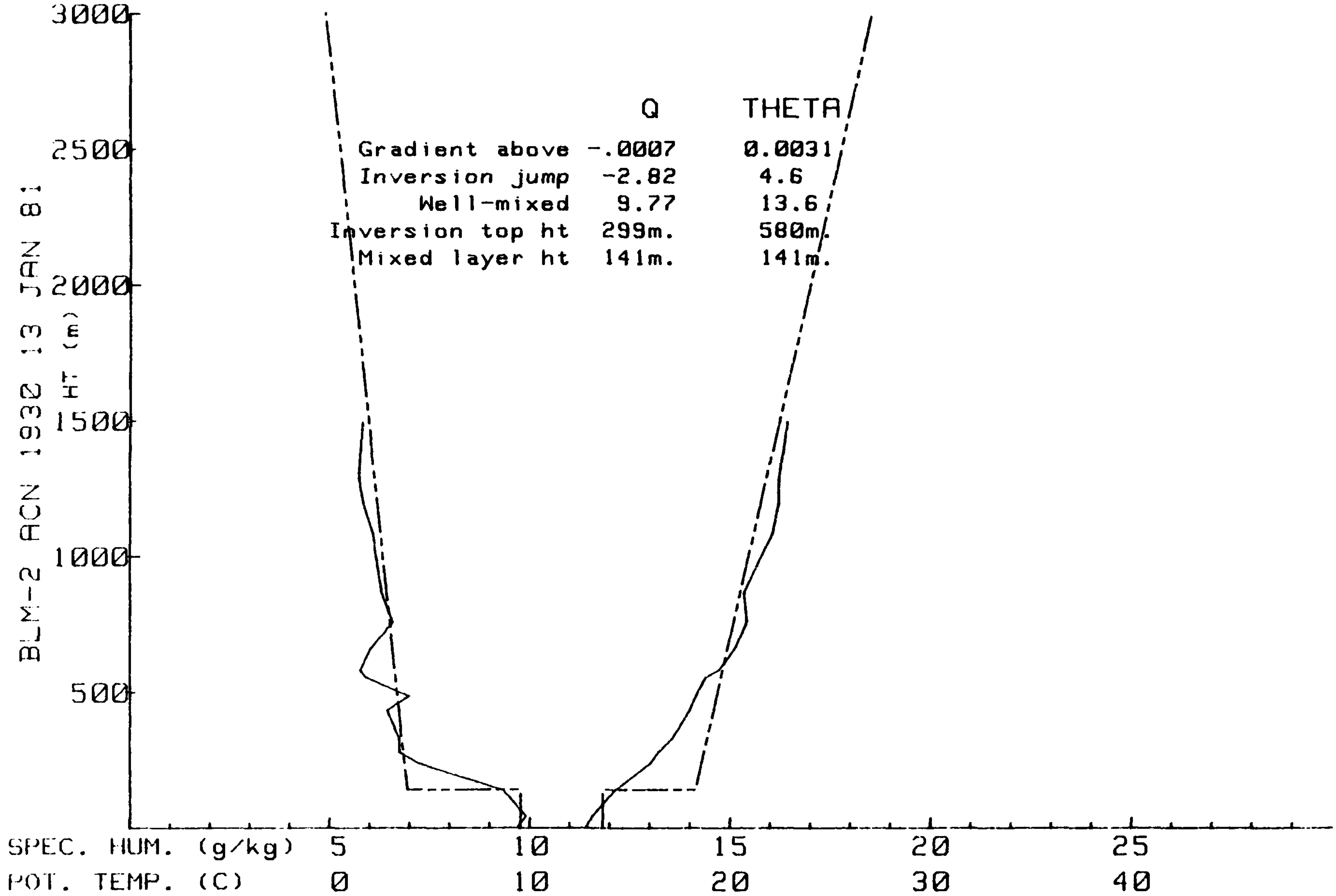
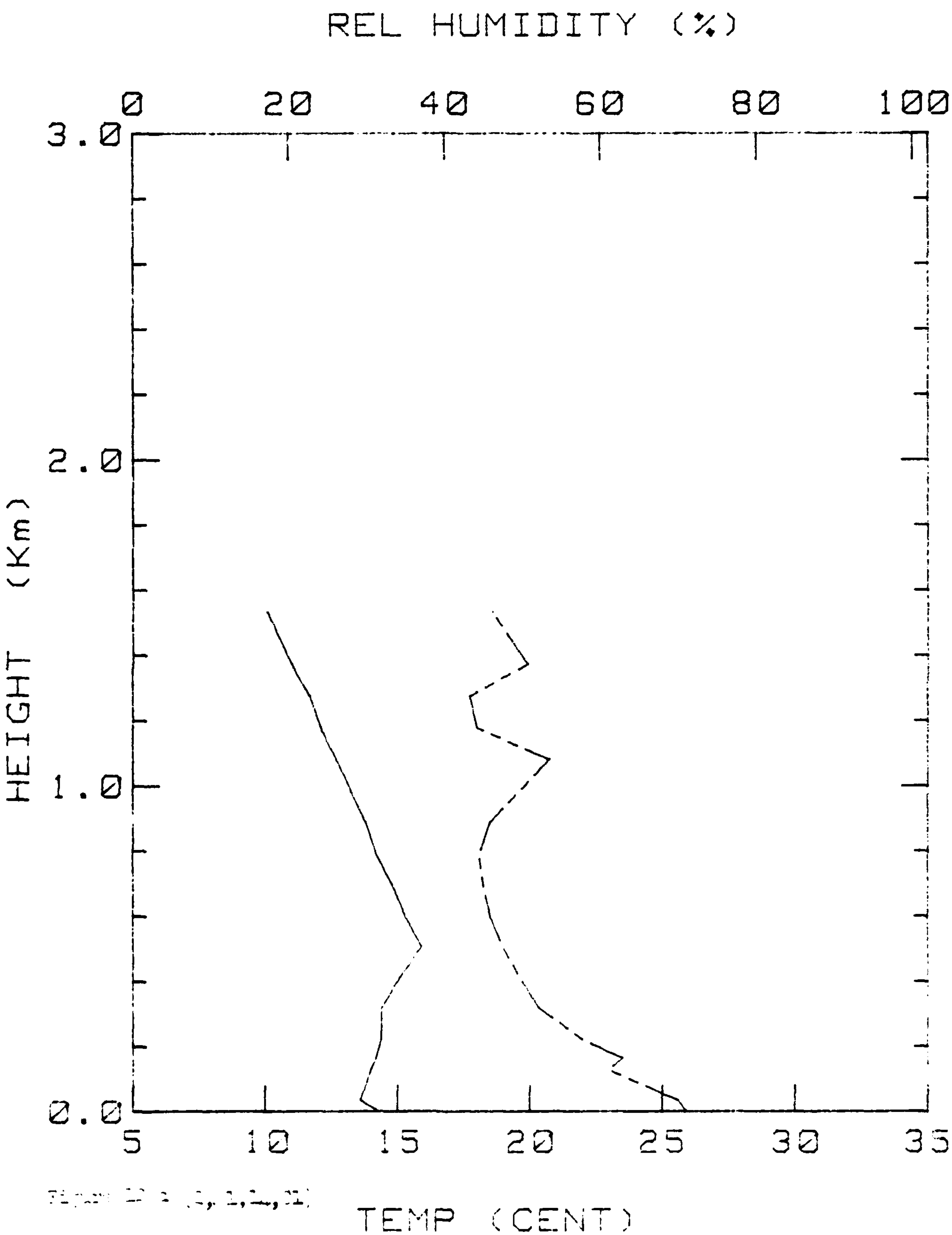


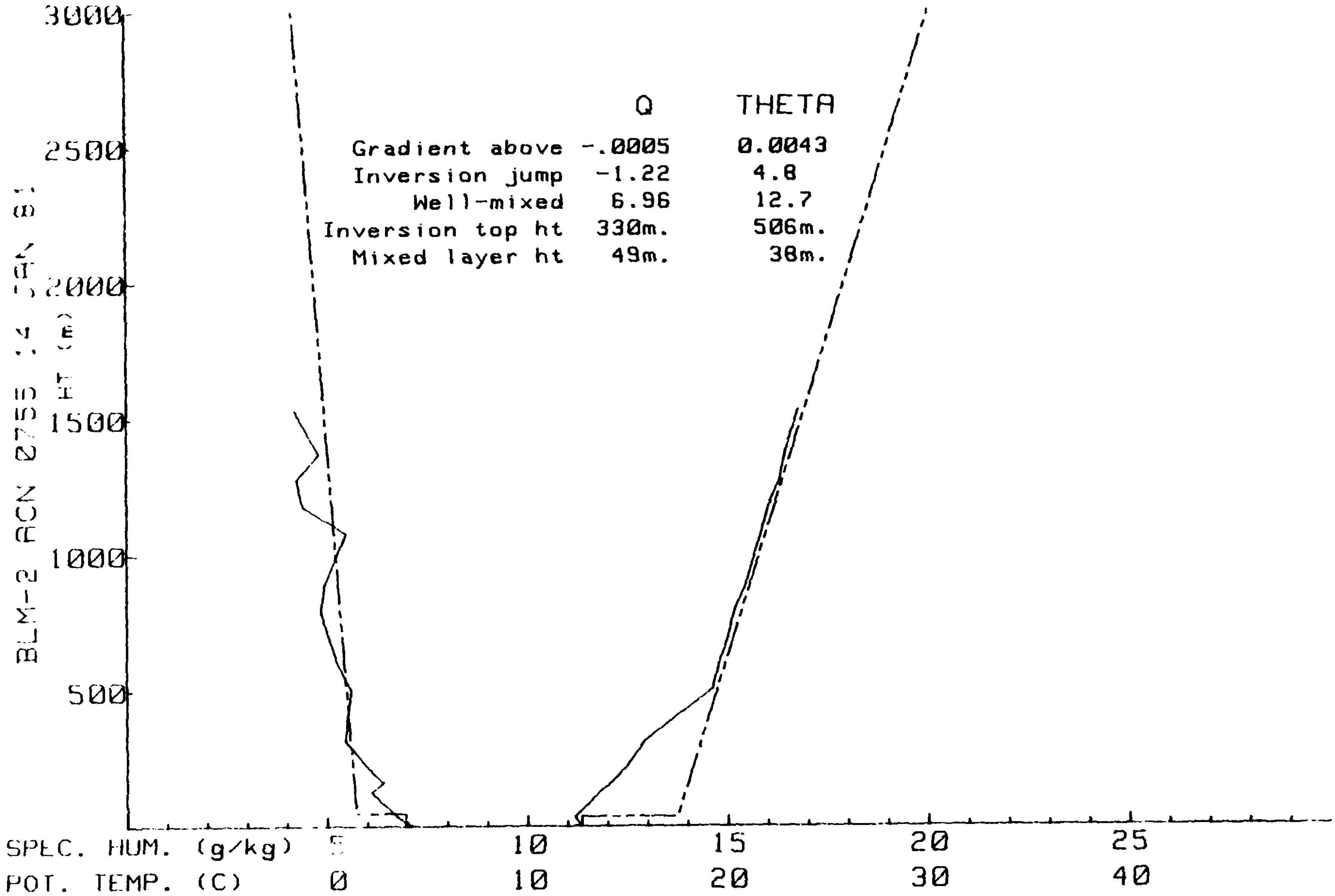
Figure [illegible]

BLM-II 13 JAN 81 1930


BLM-2 ACN 1930 13 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0007 0.0031
Inversion jump -2.82 4.6
Well-mixed 9.77 13.6
Inversion top ht 299m. 580m.
Mixed layer ht 141m. 141m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40



BLM-II 14 JAN 81 755


BLM-2 ACN 0755 14 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0043
Inversion jump -1.22 4.8
Well-mixed 6.96 12.7
Inversion top ht 330m. 506m.
Mixed layer ht 49m. 38m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

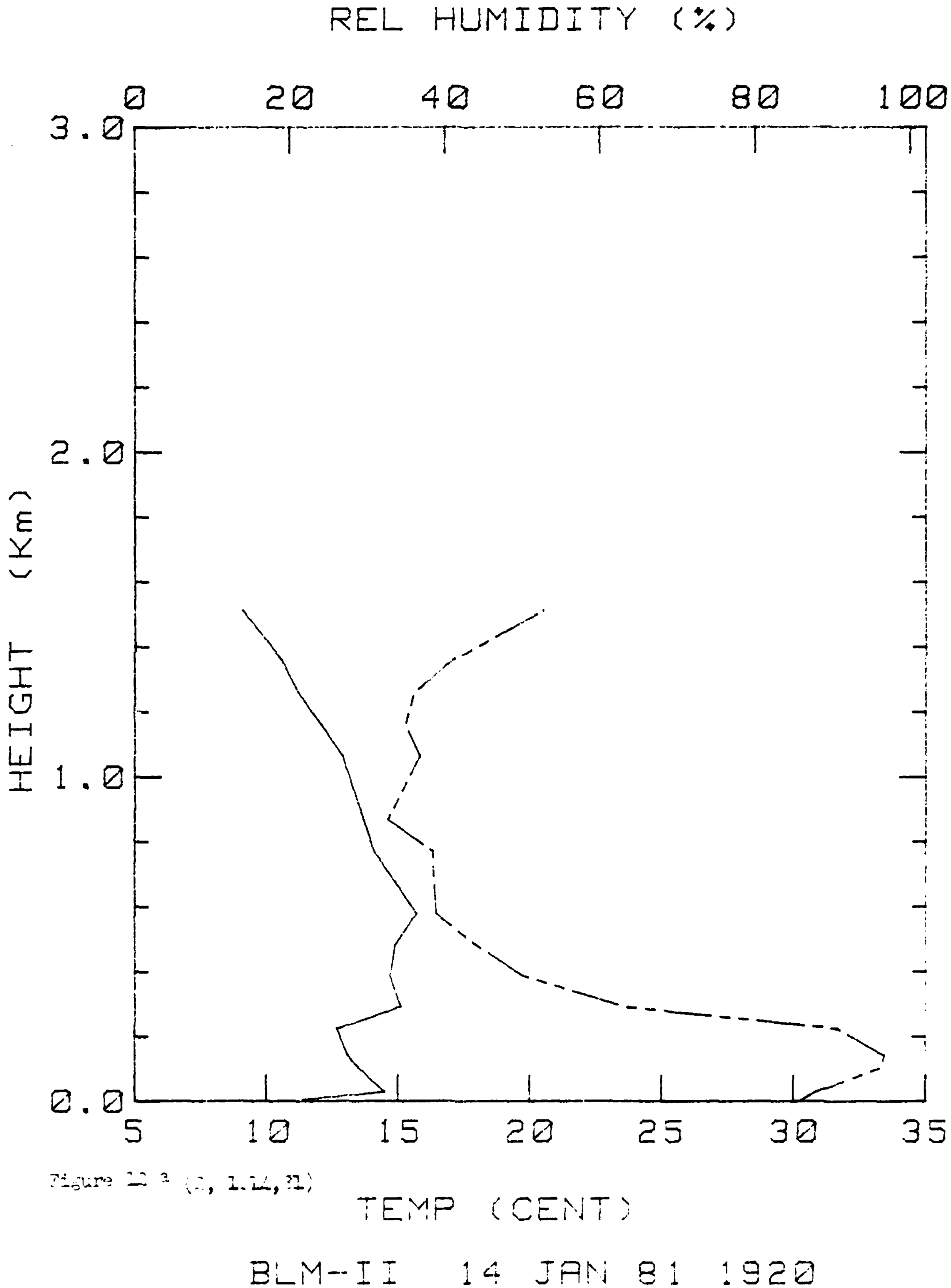
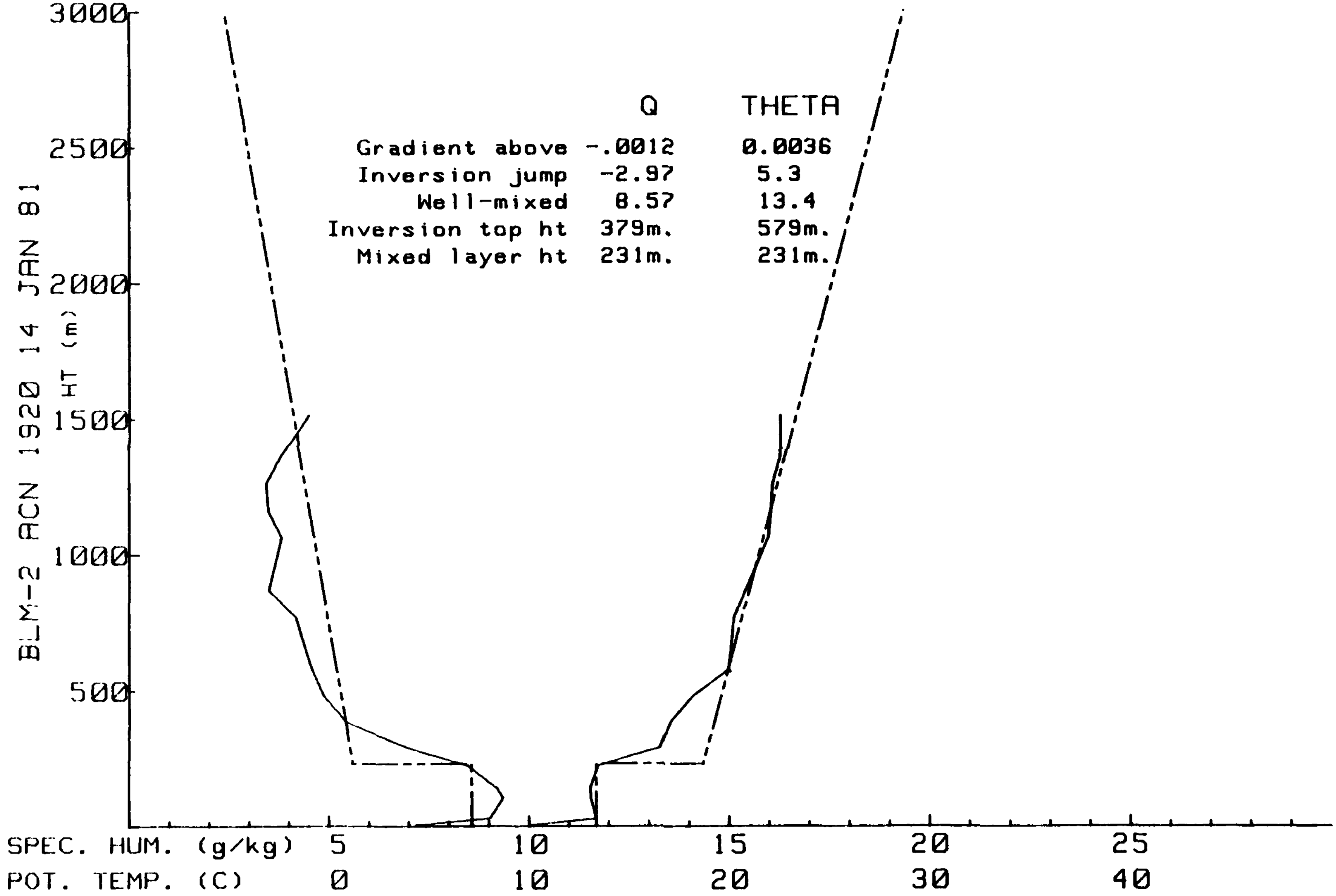


Figure 12 a ([illegible], 1.14, 81)


BLM-2 ACN 1920 14 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0012 0.0036
Inversion jump -2.97 5.3
Well-mixed 8.57 13.4
Inversion top ht 379m. 579m.
Mixed layer ht 231m. 231m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

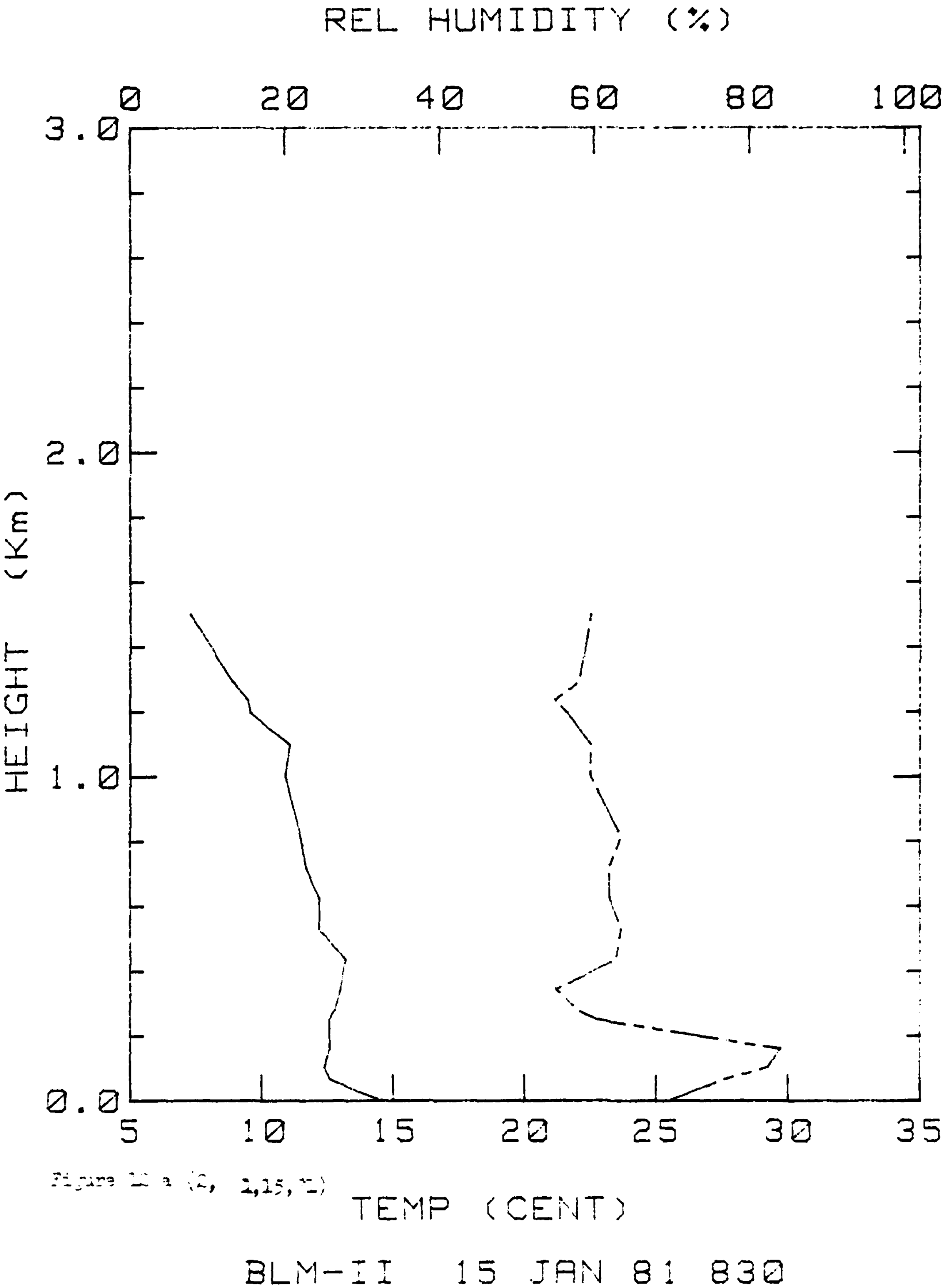


Figure 12 a (2, 1,15,81)

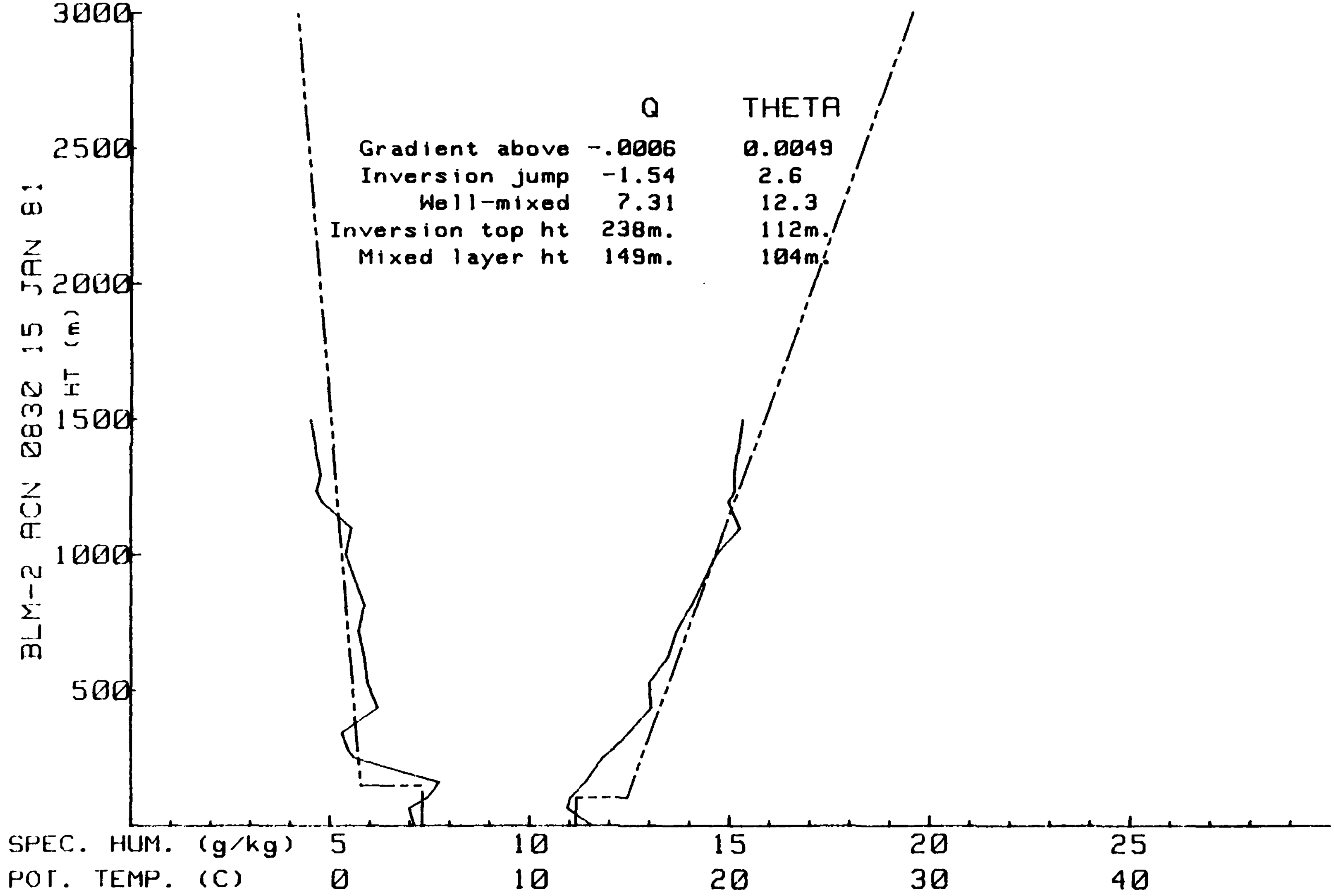


Figure [illegible] (·, 1,15,81)

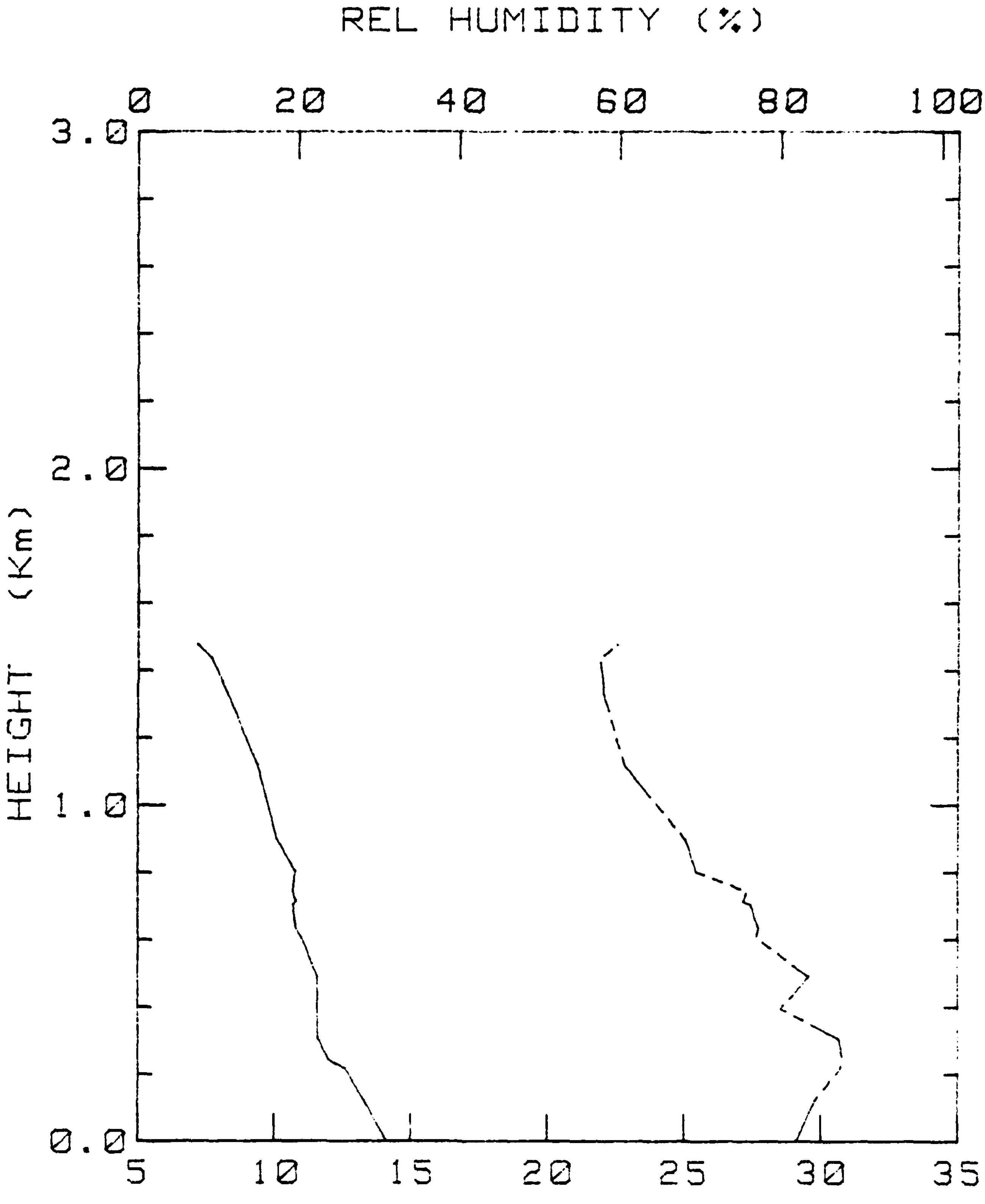
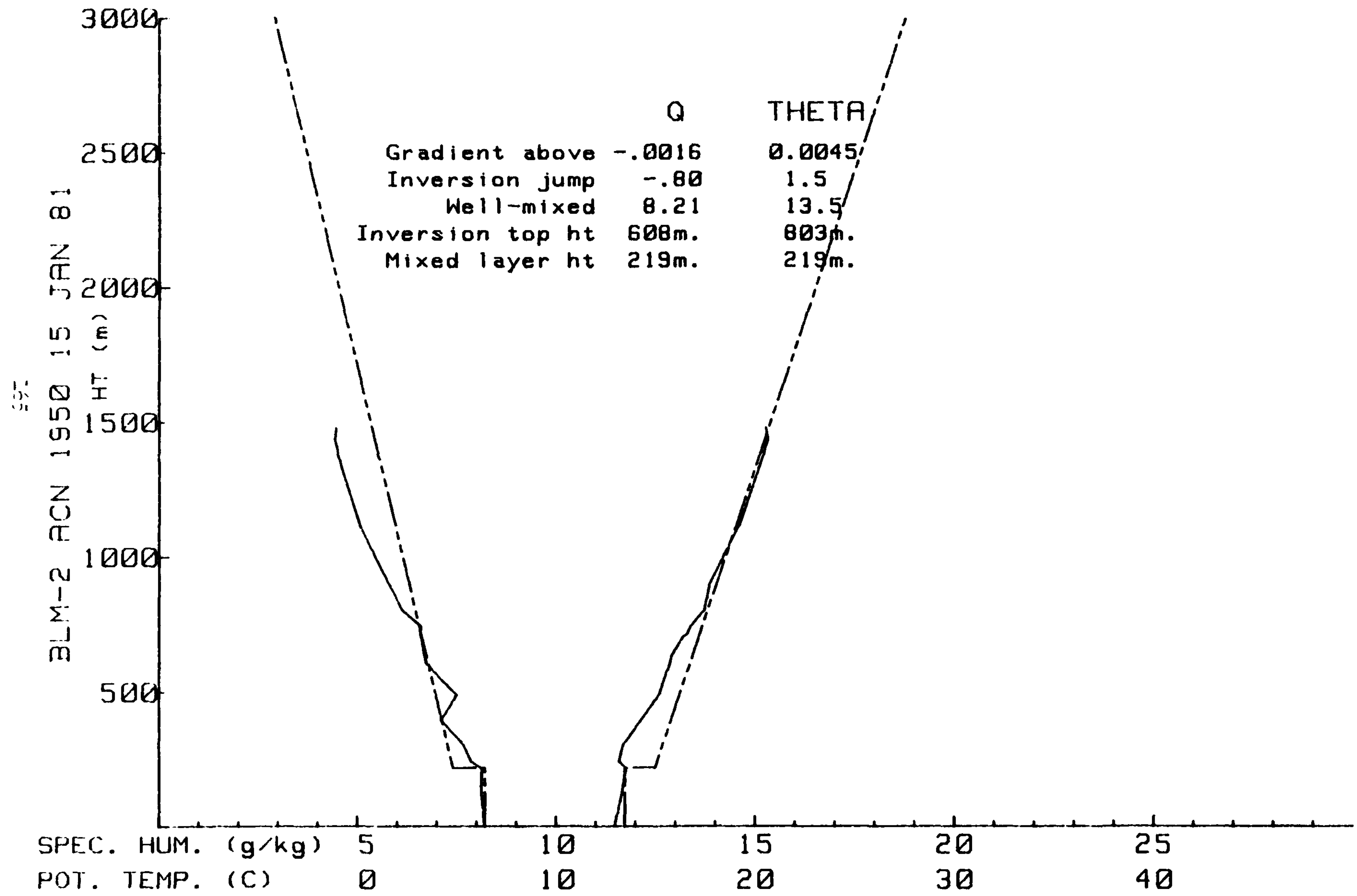


Figure 10 a (2, 1,15,81)

TEMP (CENT)

BLM-II 15 JAN 81 1950


BLM-2 ACN 1950 15 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0016 0.0045
Inversion jump -.80 1.5
Well-mixed 8.21 13.5
Inversion top ht 608m. 803m.
Mixed layer ht 219m. 219m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

[illegible] b ([illegible], 1,15,81)

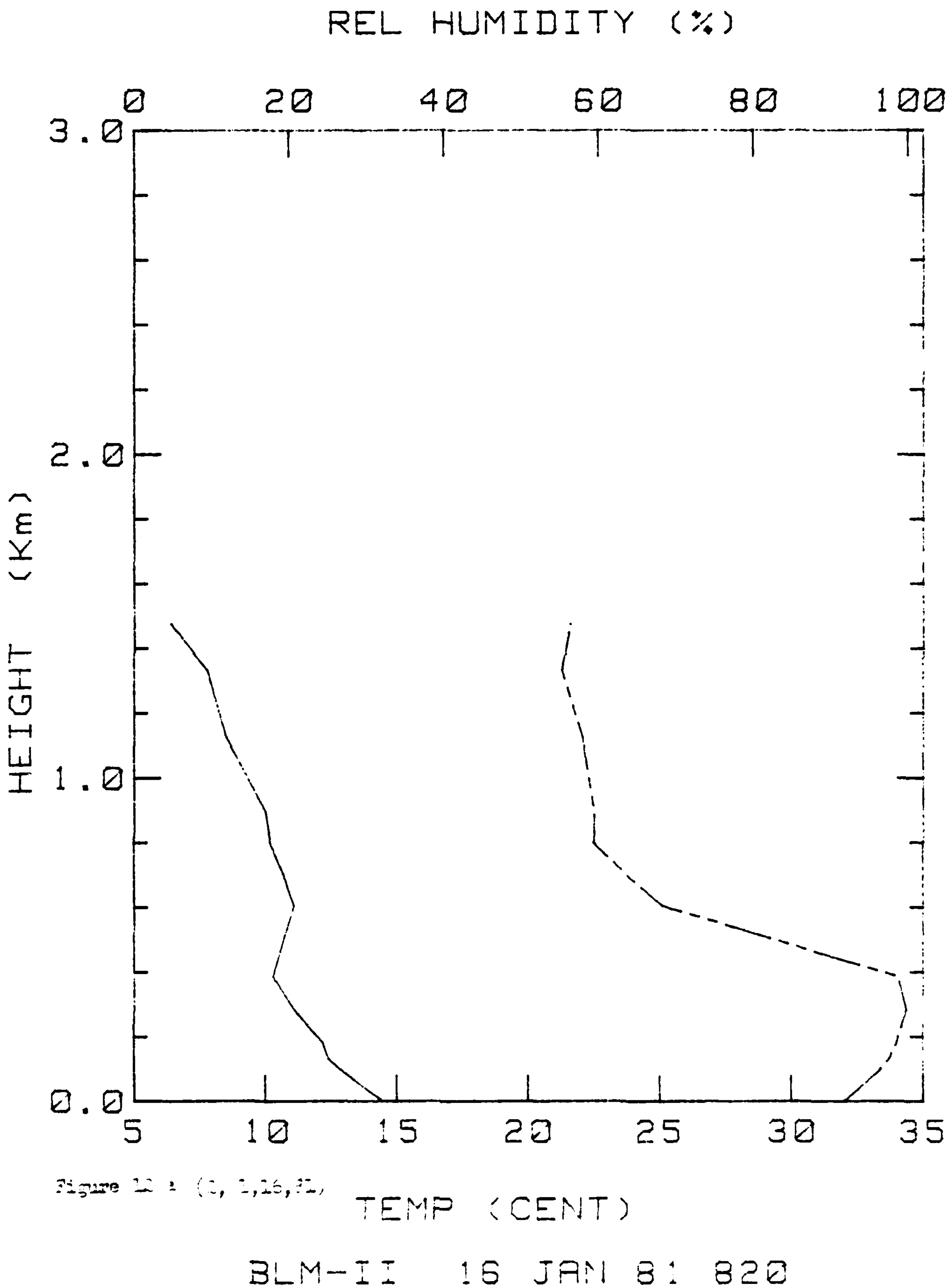
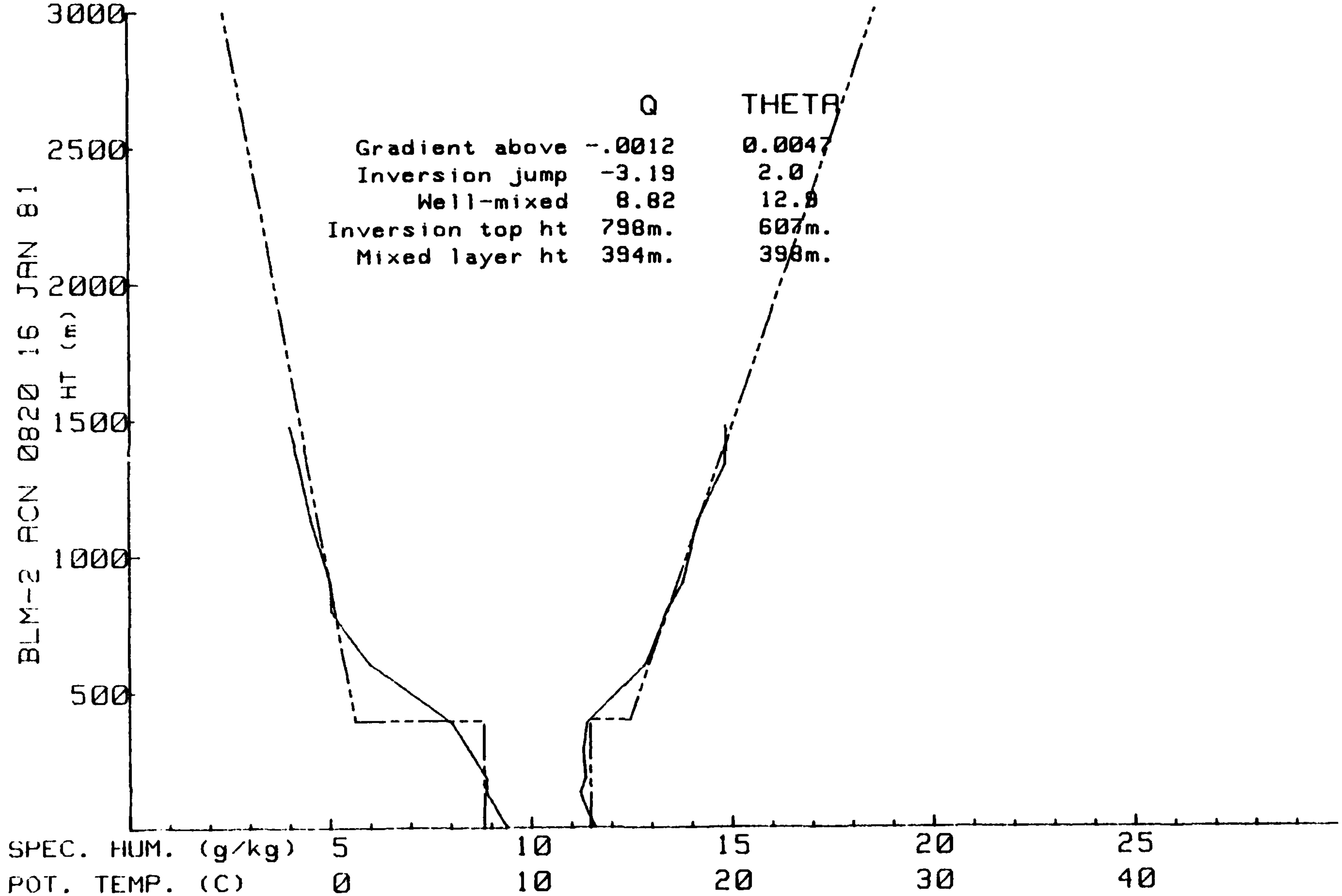


Figure 12 a (C, 1,16,81,


BLM-2 ACN 0820 16 JAN 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0012 0.0047
Inversion jump -3.19 2.0
Well-mixed 8.82 12.8
Inversion top ht 798m. 607m.
Mixed layer ht 394m. 398m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

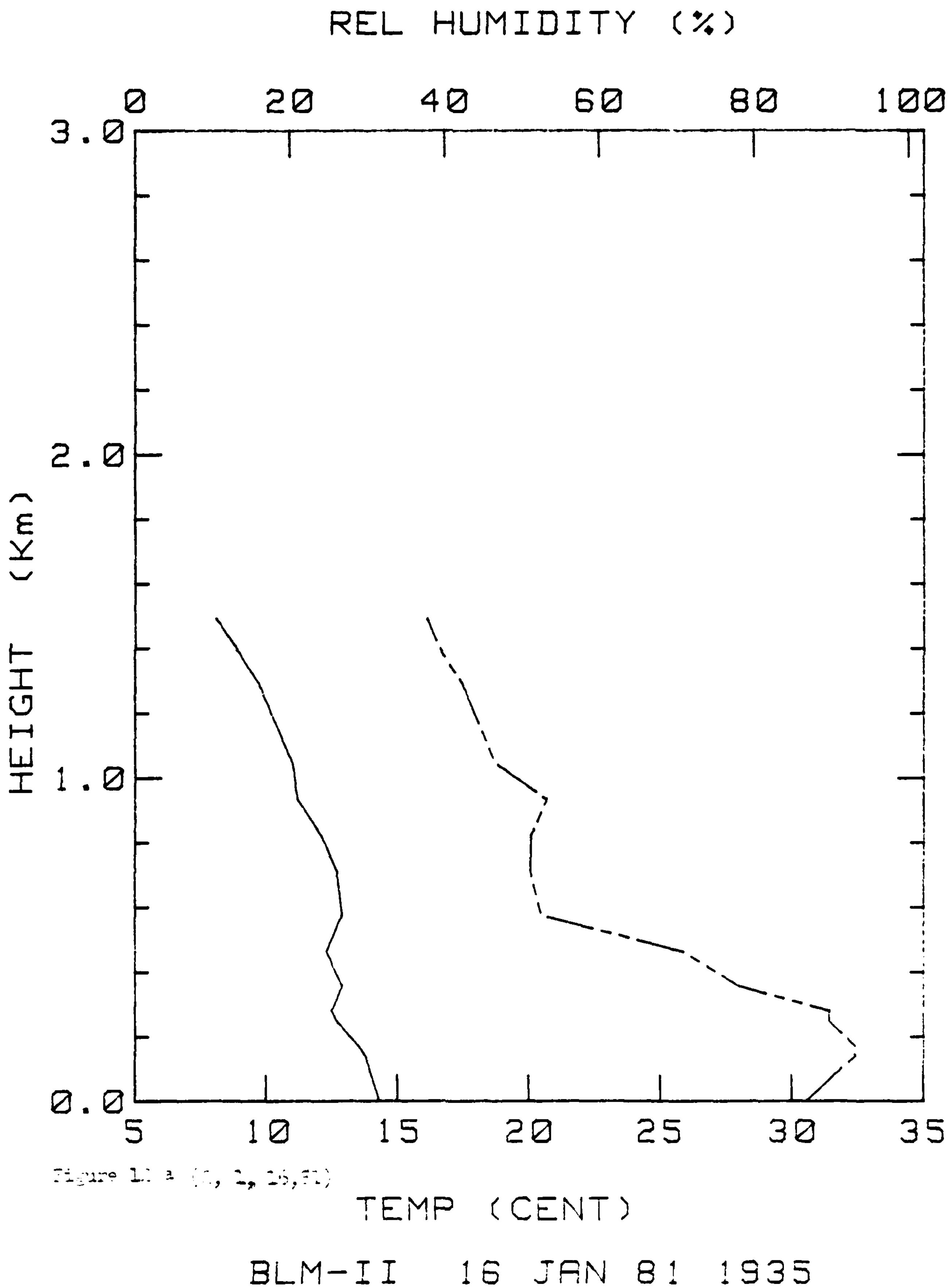


Figure 11 a ([illegible], 1, 16,81)

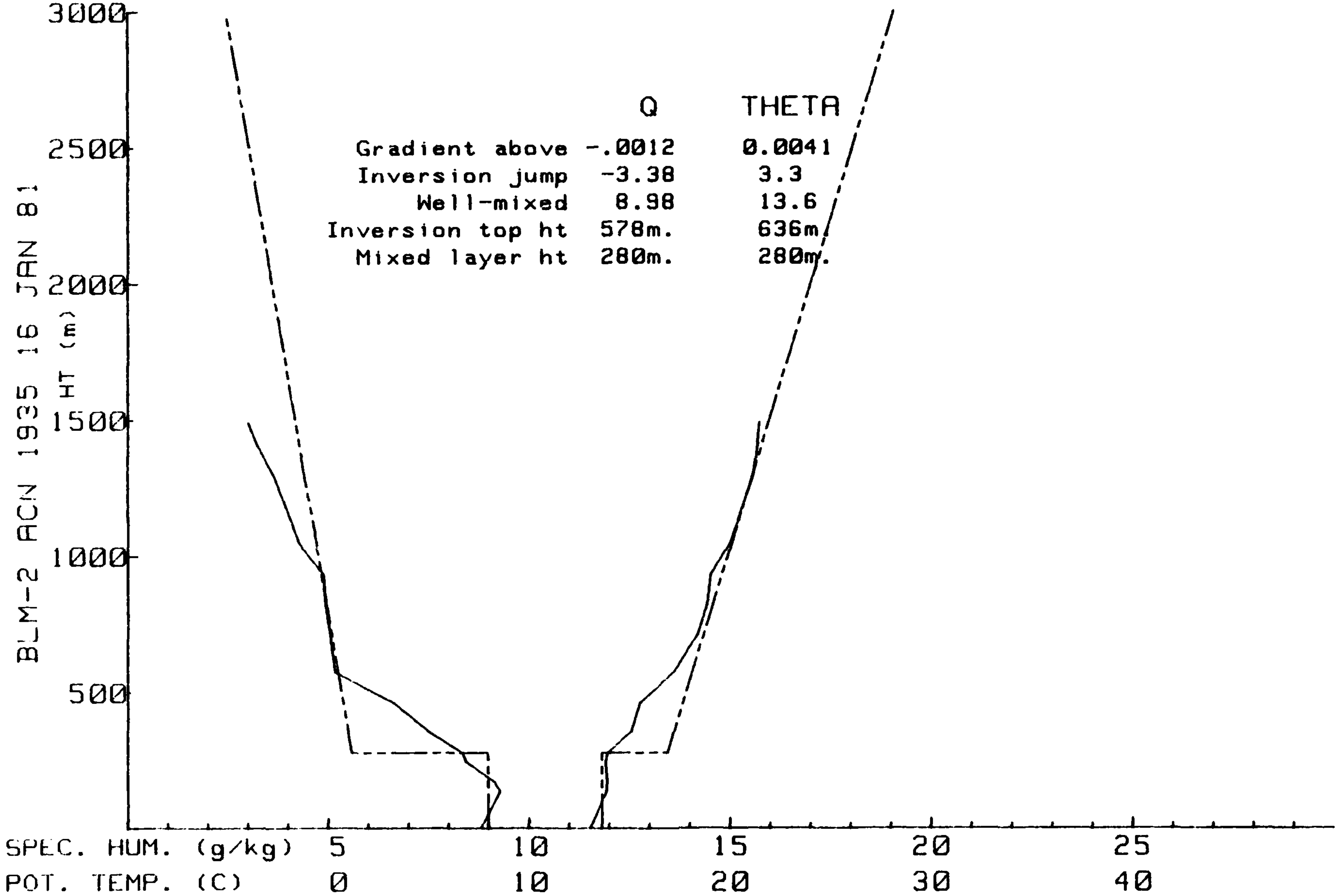
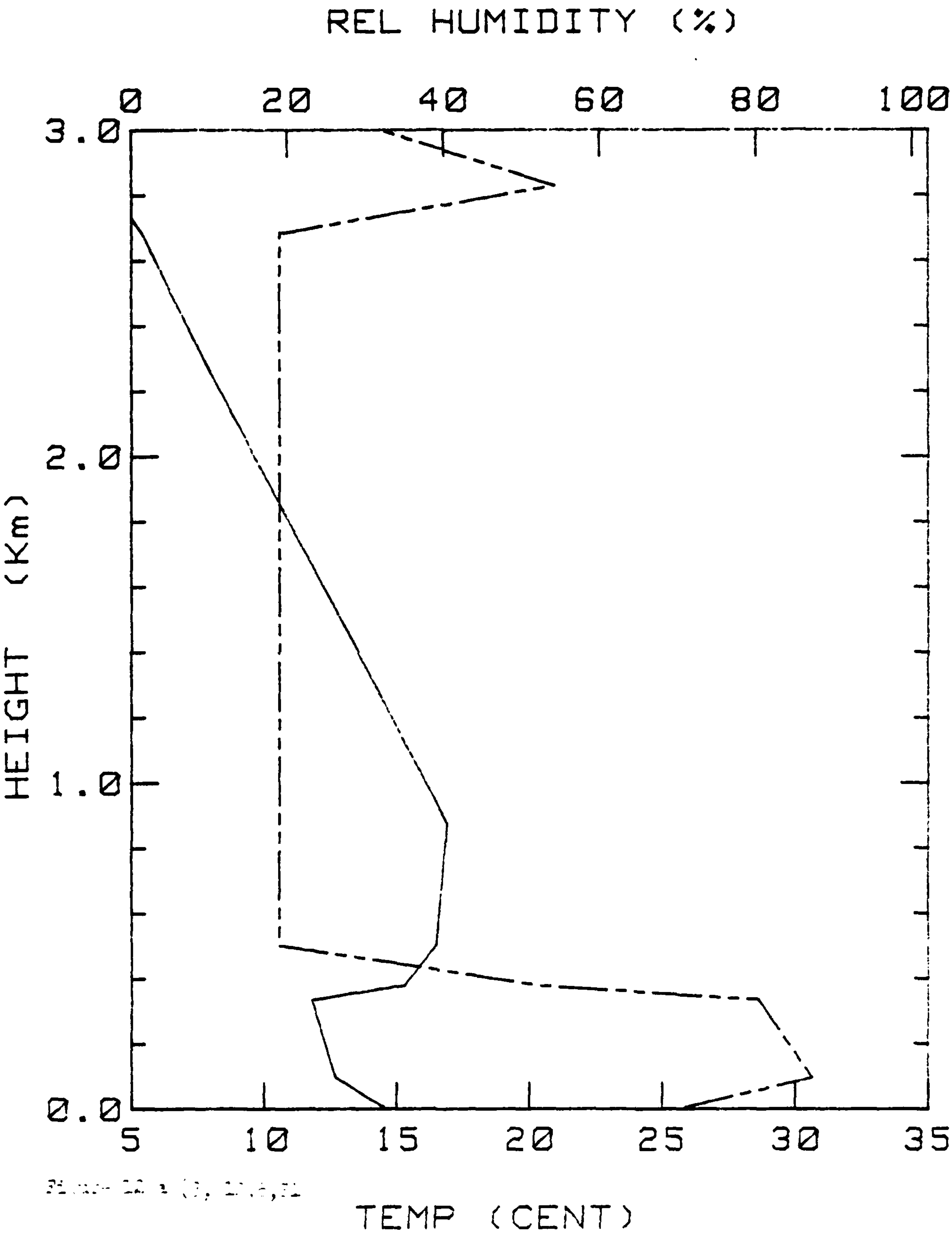
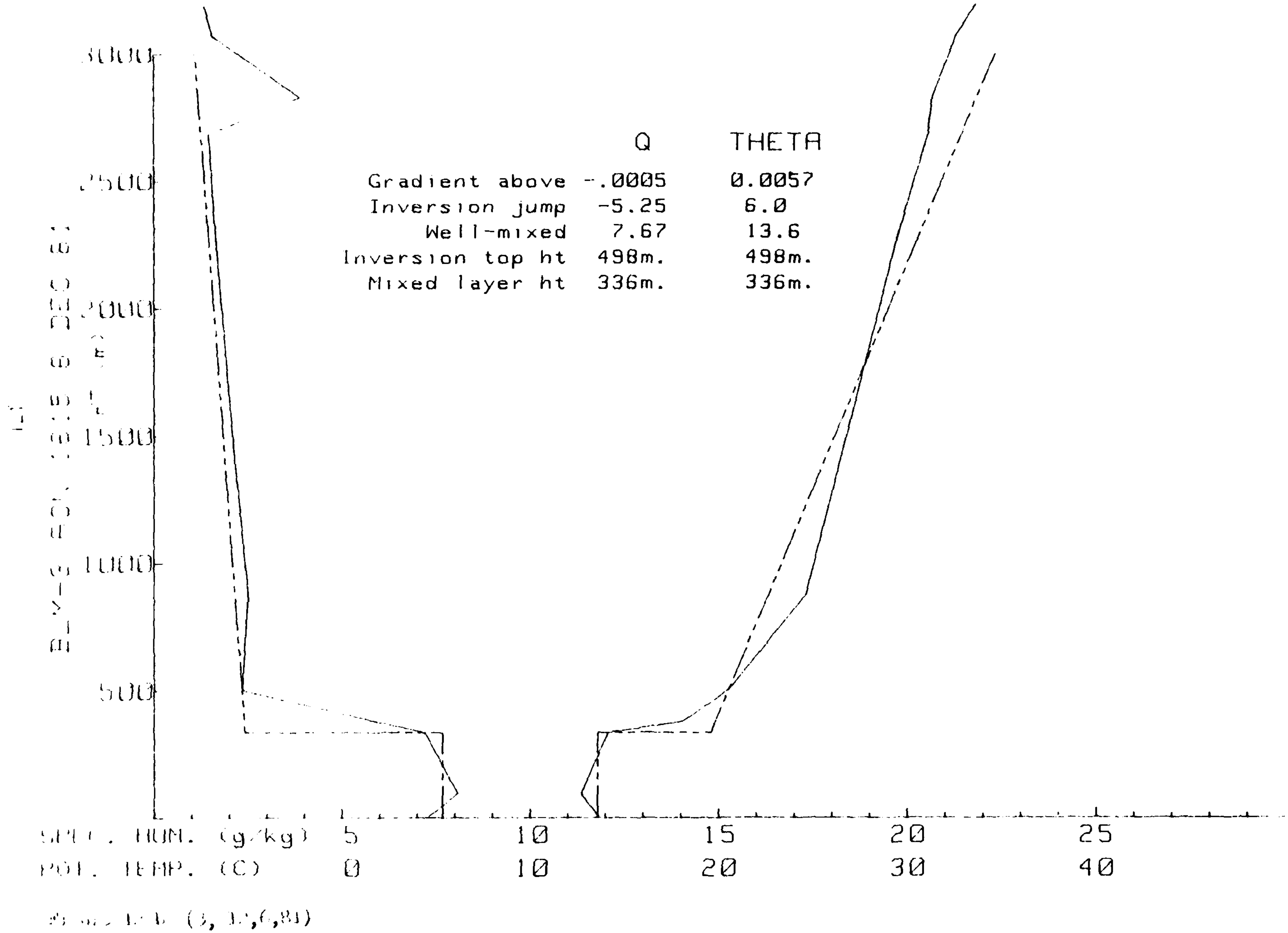


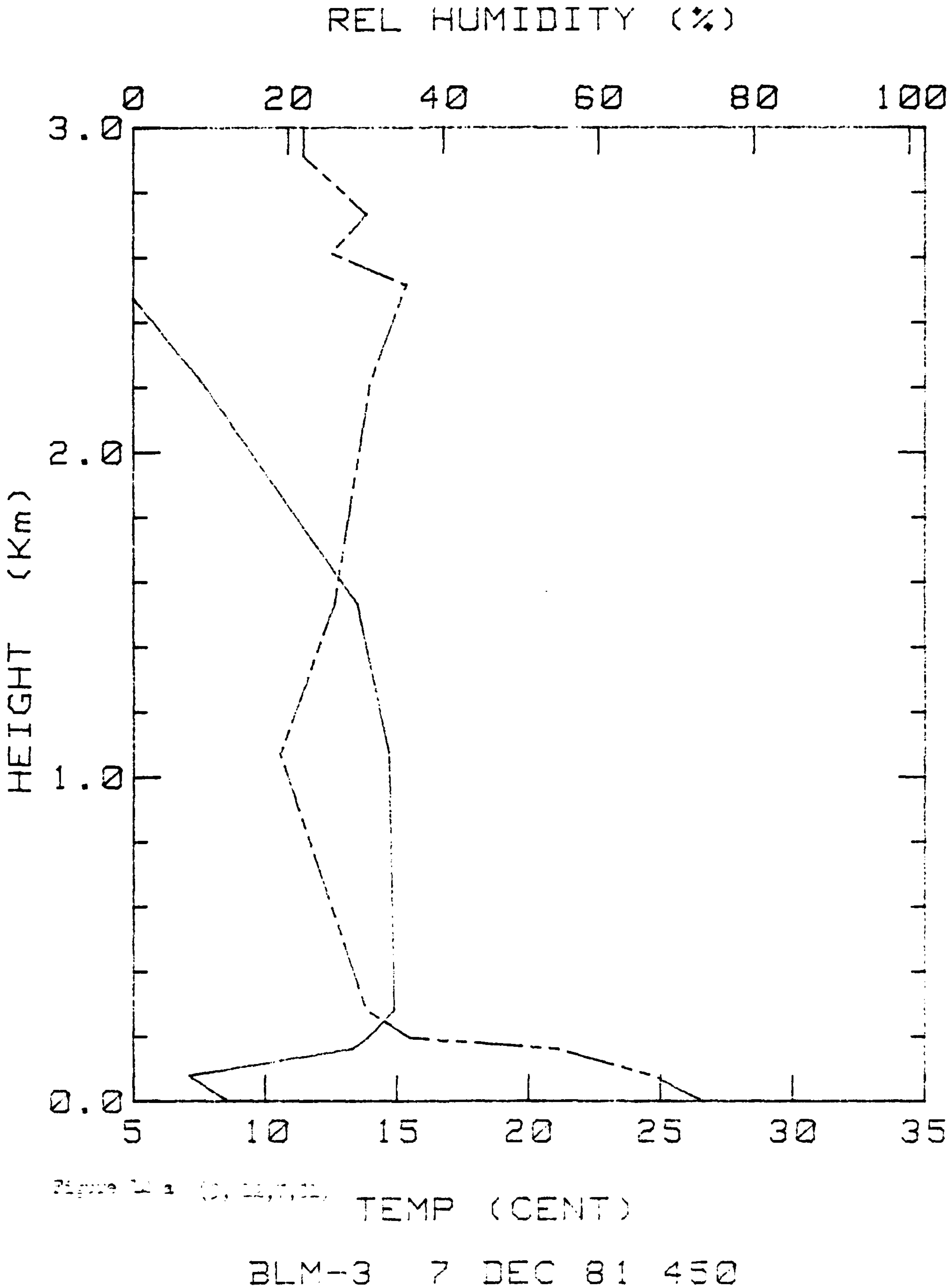
Figure 12 b ([illegible],1,16,81)

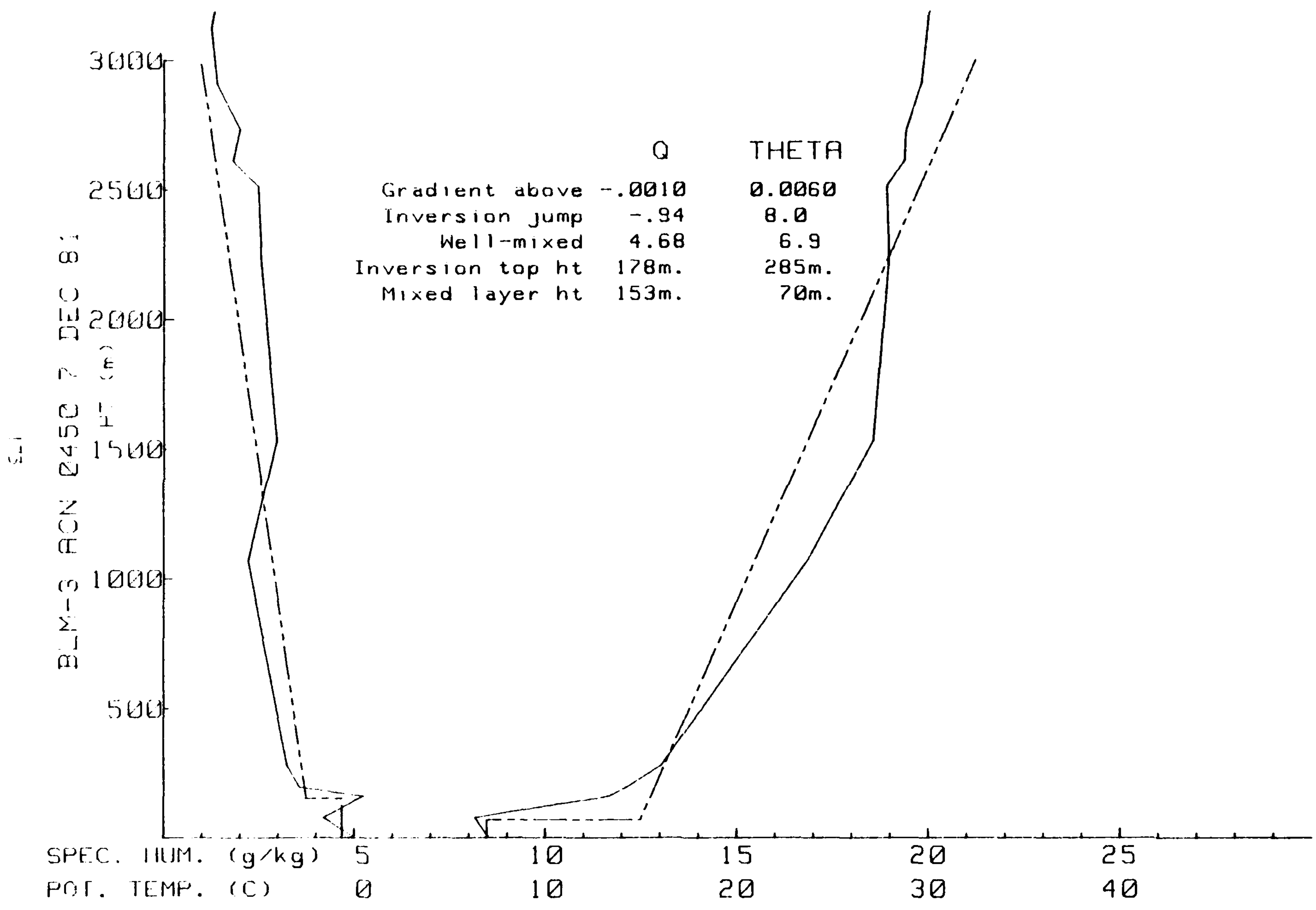


BLM-3 6 DEC 81 1615



Q THETA
Gradient above -.0005 0.0057
Inversion jump -5.25 6.0
Well-mixed 7.67 13.6
Inversion top ht 498m. 498m.
Mixed layer ht 336m. 336m.
3000
2500
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40


REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 7 DEC 81 450



BLM-3 ACN 0450 7 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0010 0.0060
Inversion jump -.94 8.0
Well-mixed 4.68 6.9
Inversion top ht 178m. 285m.
Mixed layer ht 153m. 70m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

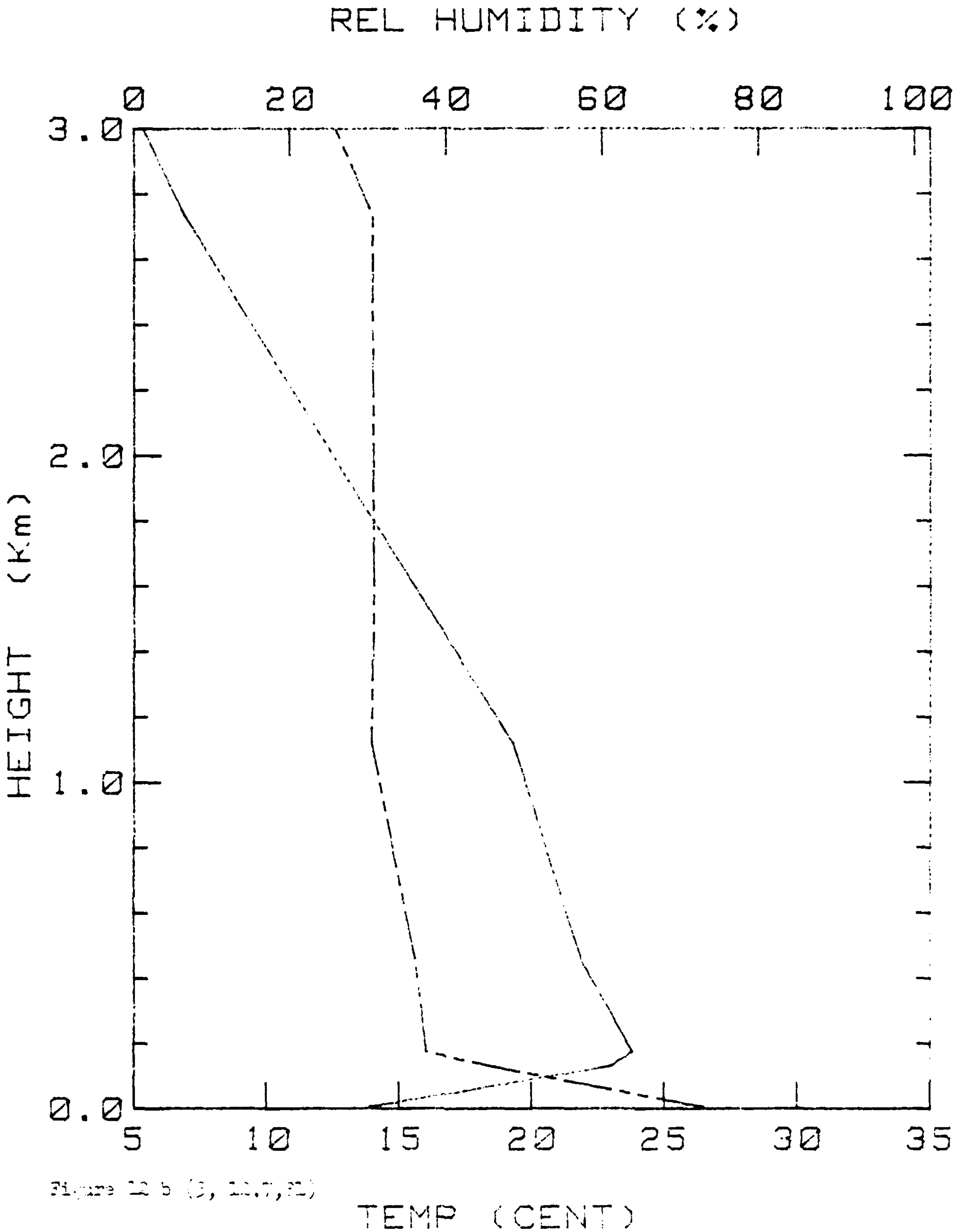
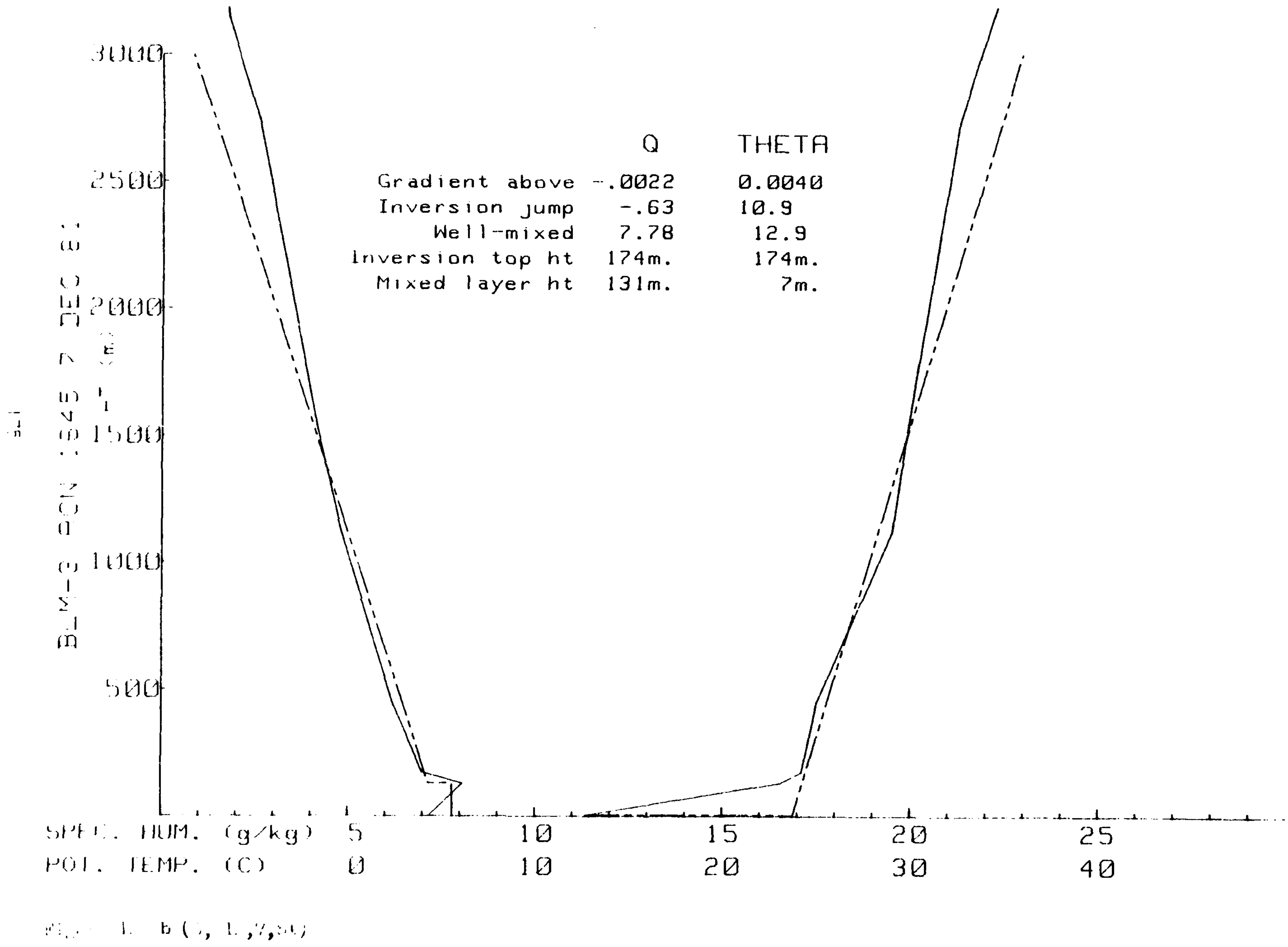


Figure 12 b (3, 12.7,81)

BLM-3 7 DEC 81 1645



Q THETA
Gradient above -.0022 0.0040
Inversion jump -.63 10.9
Well-mixed 7.78 12.9
Inversion top ht 174m. 174m.
Mixed layer ht 131m. 7m.
3000
2500
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

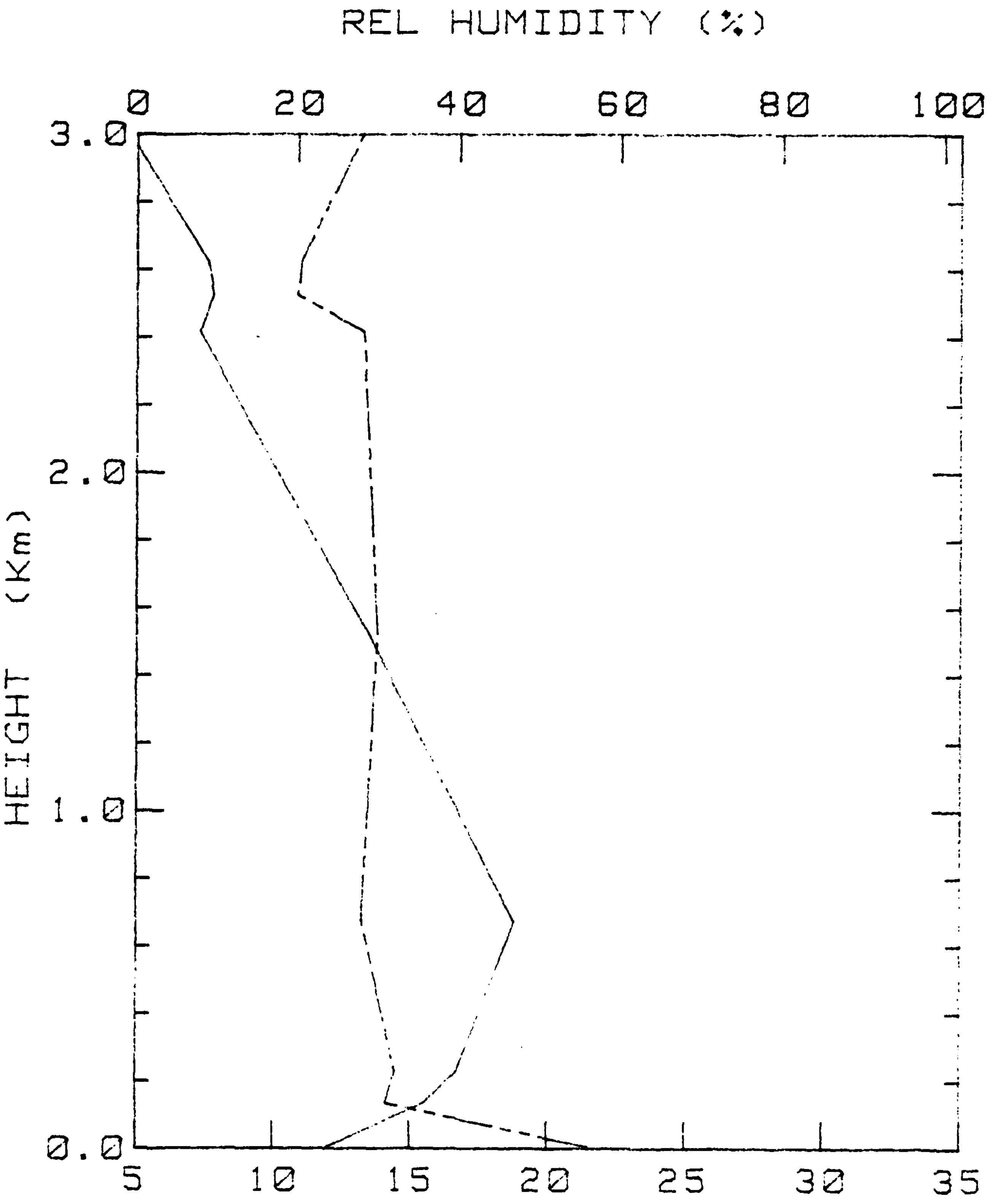
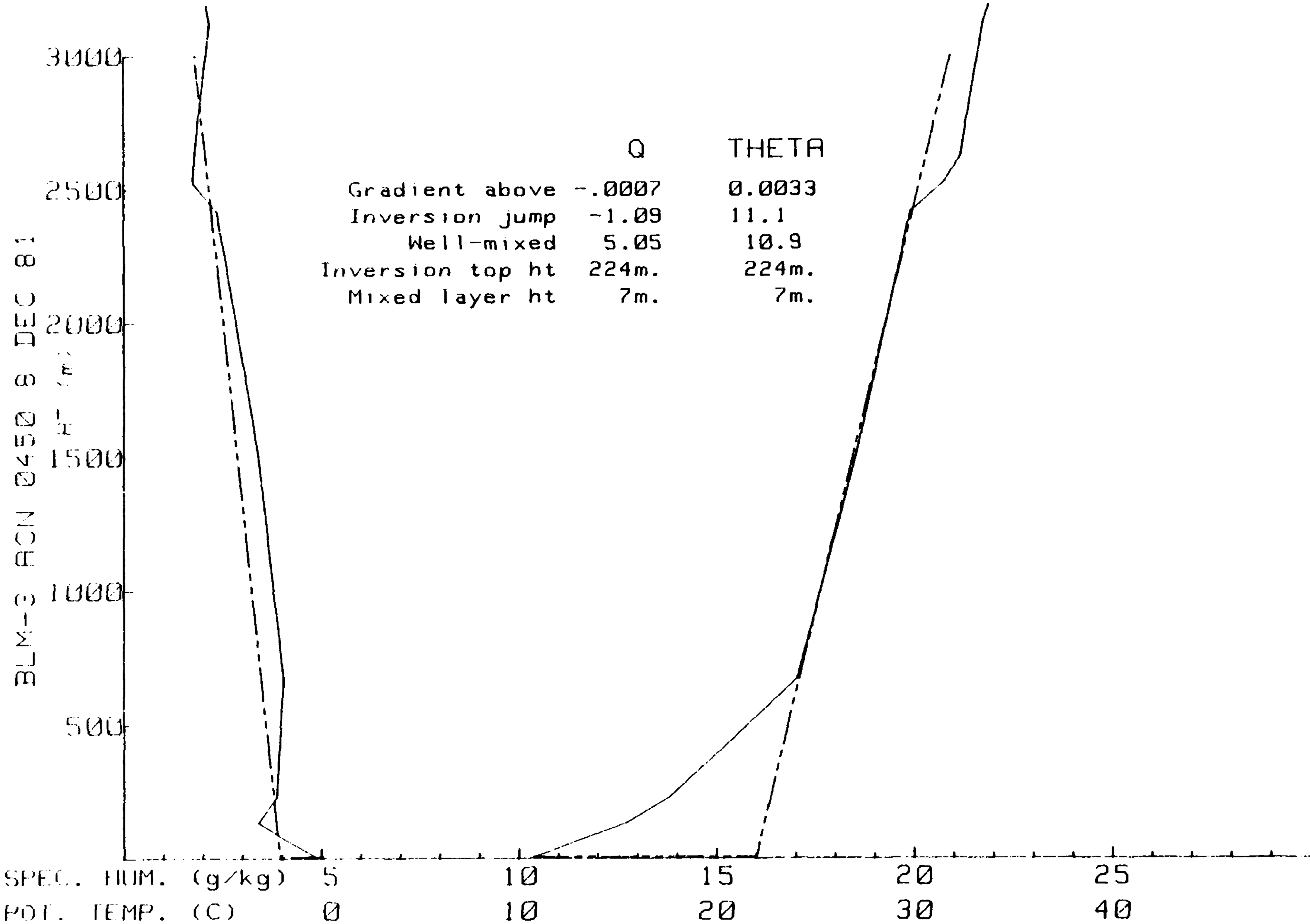


Figure 12 a [illegible]

TEMP (CENT)

BLM-3 8 DEC 81 450



BLM-3 RCN 0450 8 DEC 81
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0007 0.0033
Inversion jump -1.09 11.1
Well-mixed 5.05 10.9
Inversion top ht 224m. 224m.
Mixed layer ht 7m. 7m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

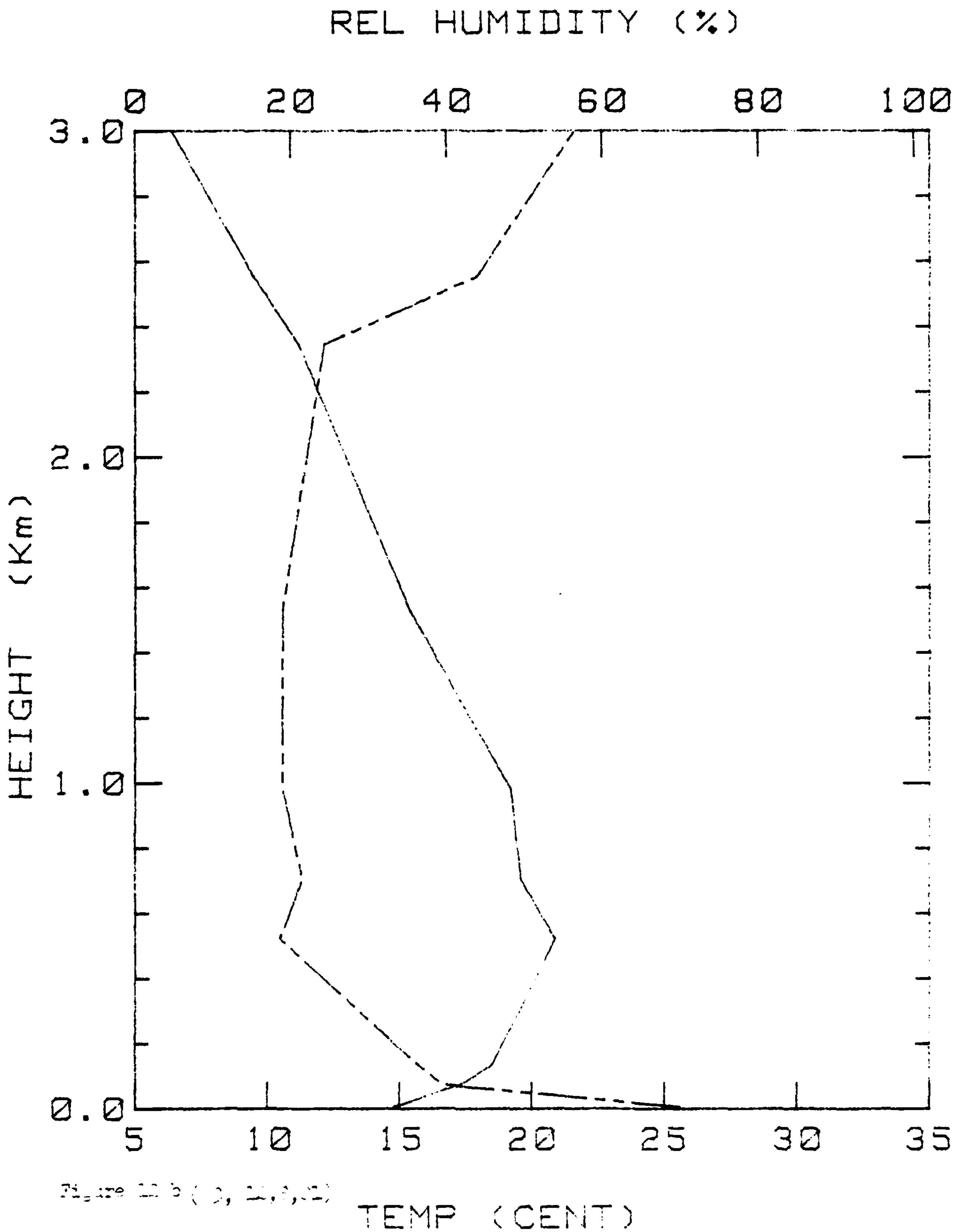
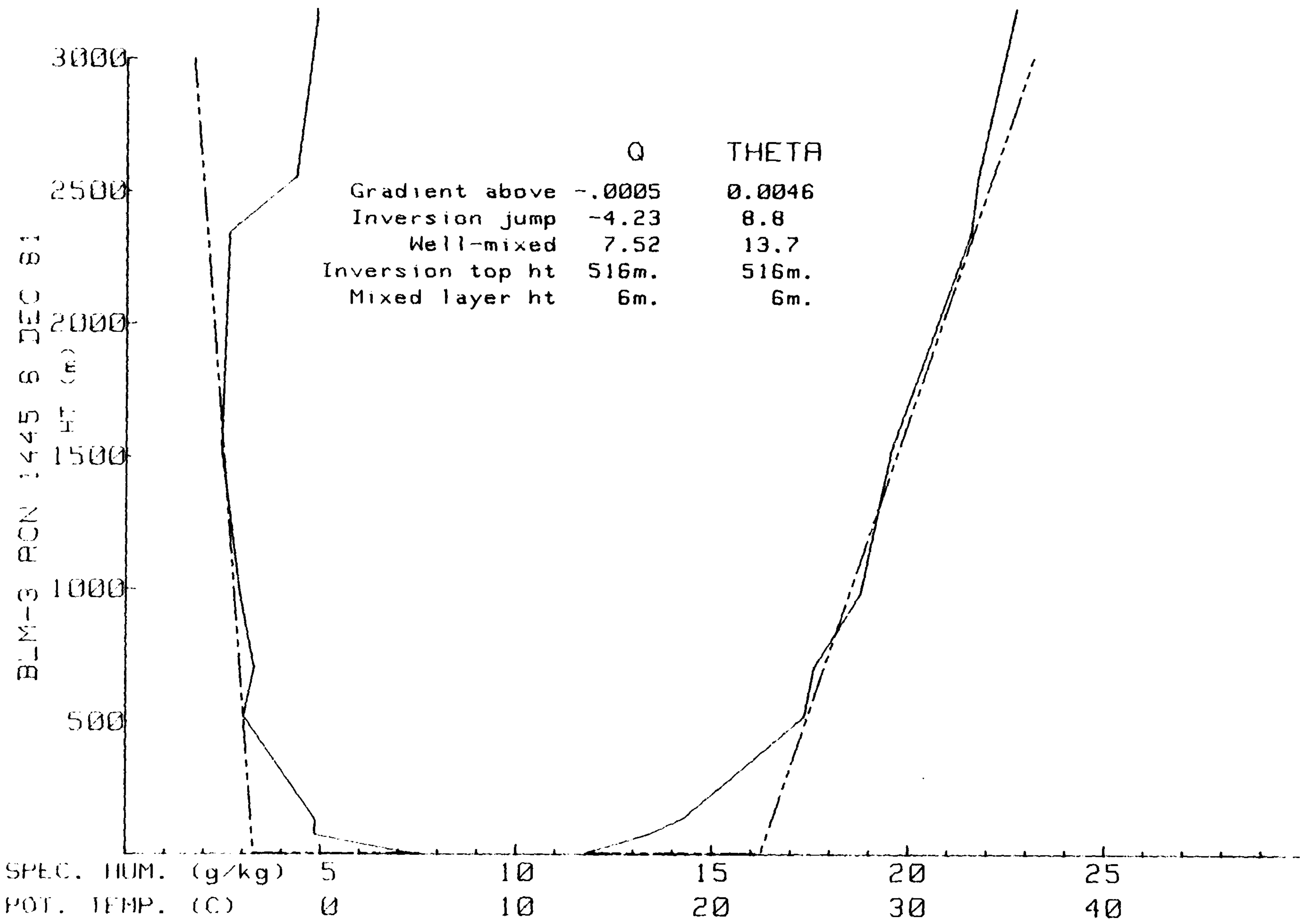


Figure 12 b ([illegible])

BLM-3 8 DEC 81 1445


BLM-3 RCN 1445 8 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0005 0.0046
Inversion jump -4.23 8.8
Well-mixed 7.52 13.7
Inversion top ht 516m. 516m.
Mixed layer ht 6m. 6m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

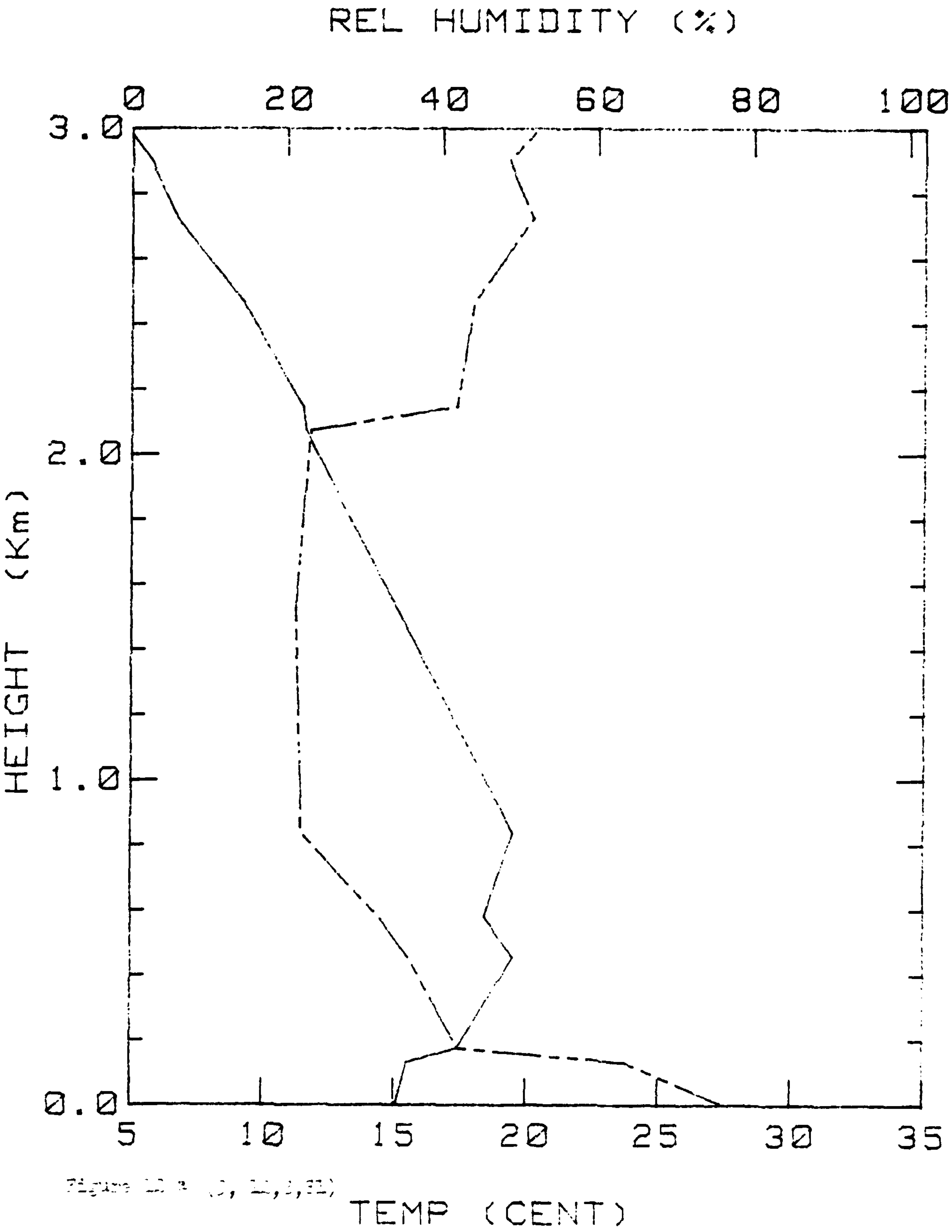


Figure [illegible]

BLM-3 8 DEC 81 1825

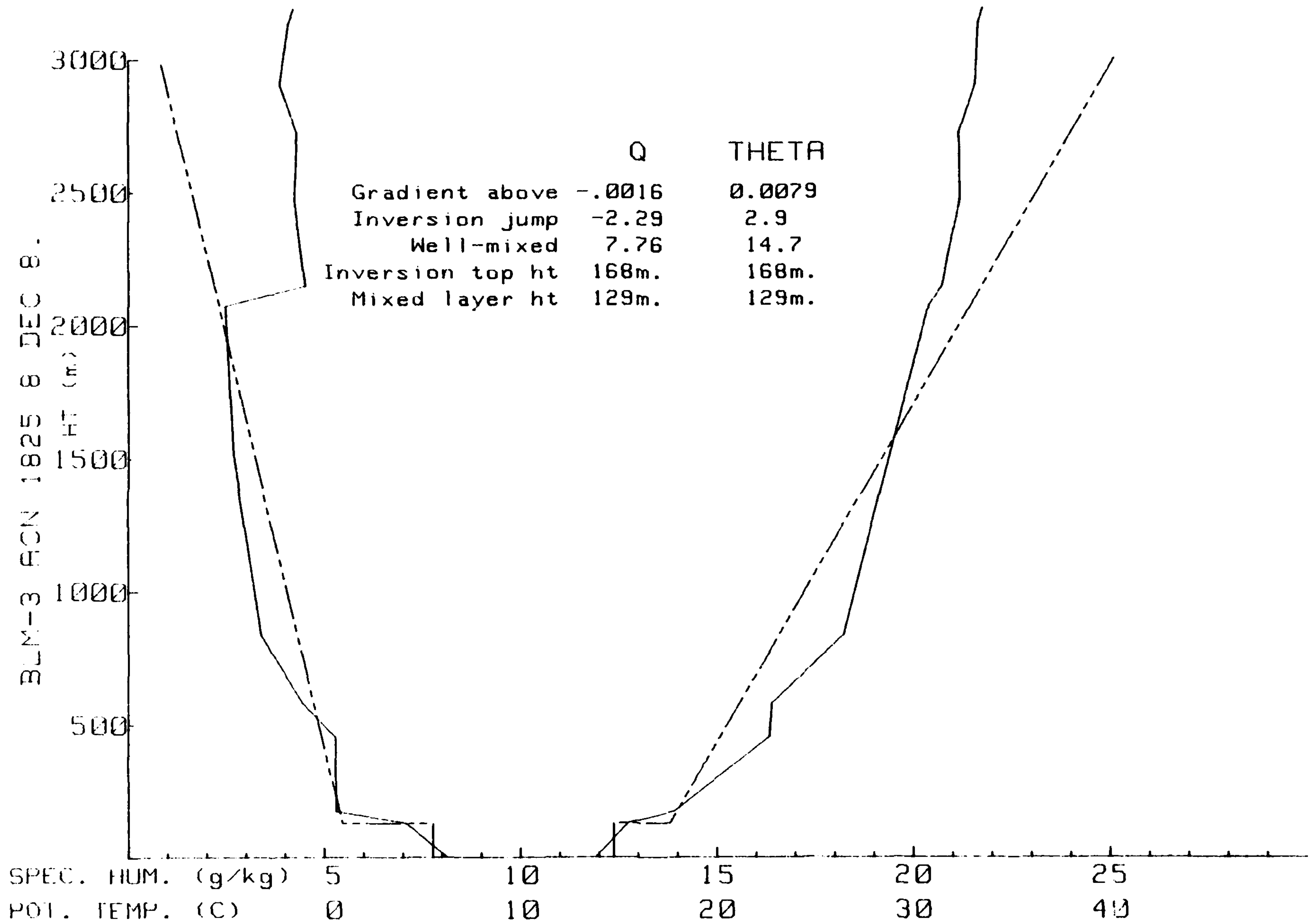

BLM-3 RON 1825 8 DEC 8.
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0016 0.0079
Inversion jump -2.29 2.9
Well-mixed 7.76 14.7
Inversion top ht 168m. 168m.
Mixed layer ht 129m. 129m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

Figure 12 b (, 1?,?,?)

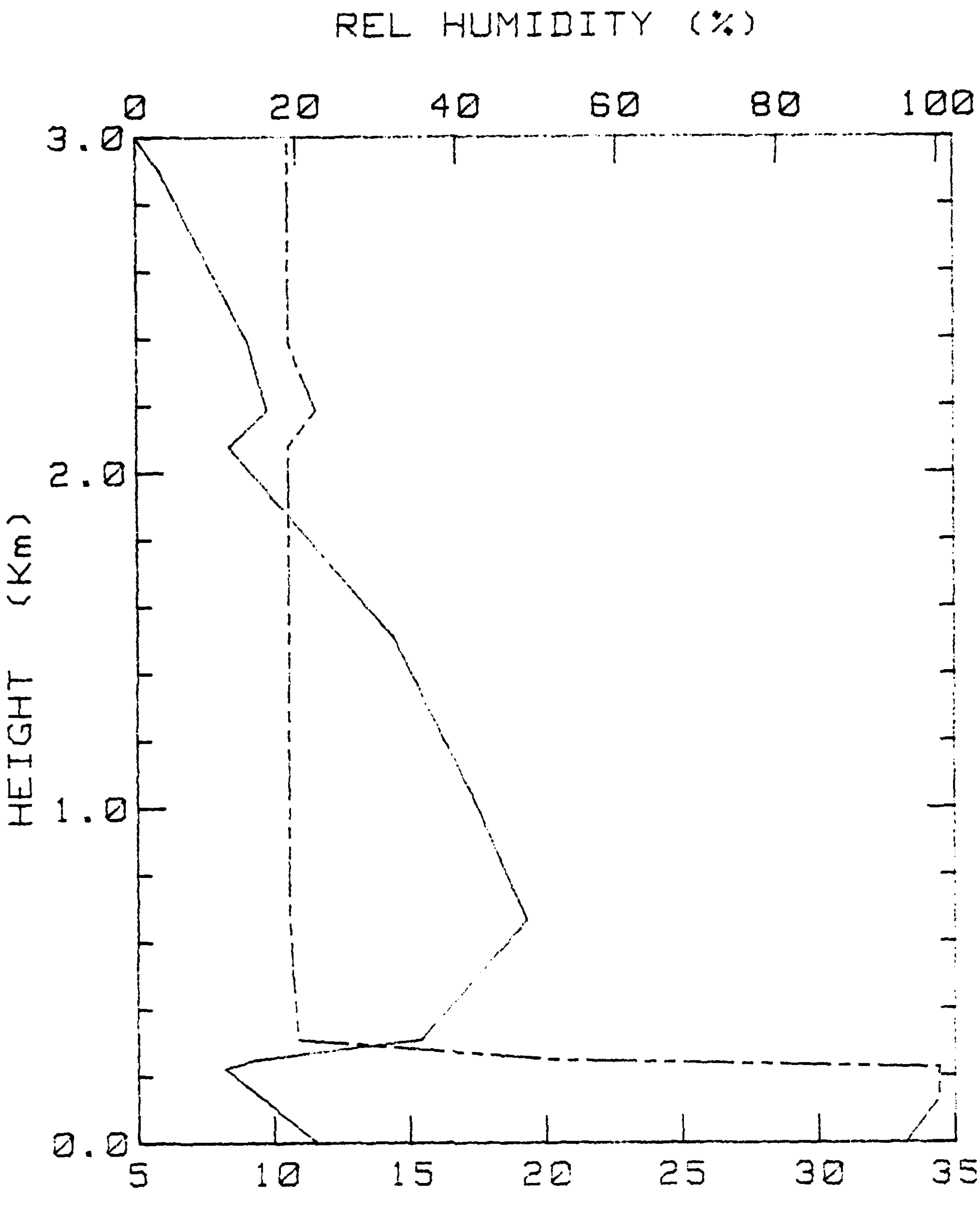
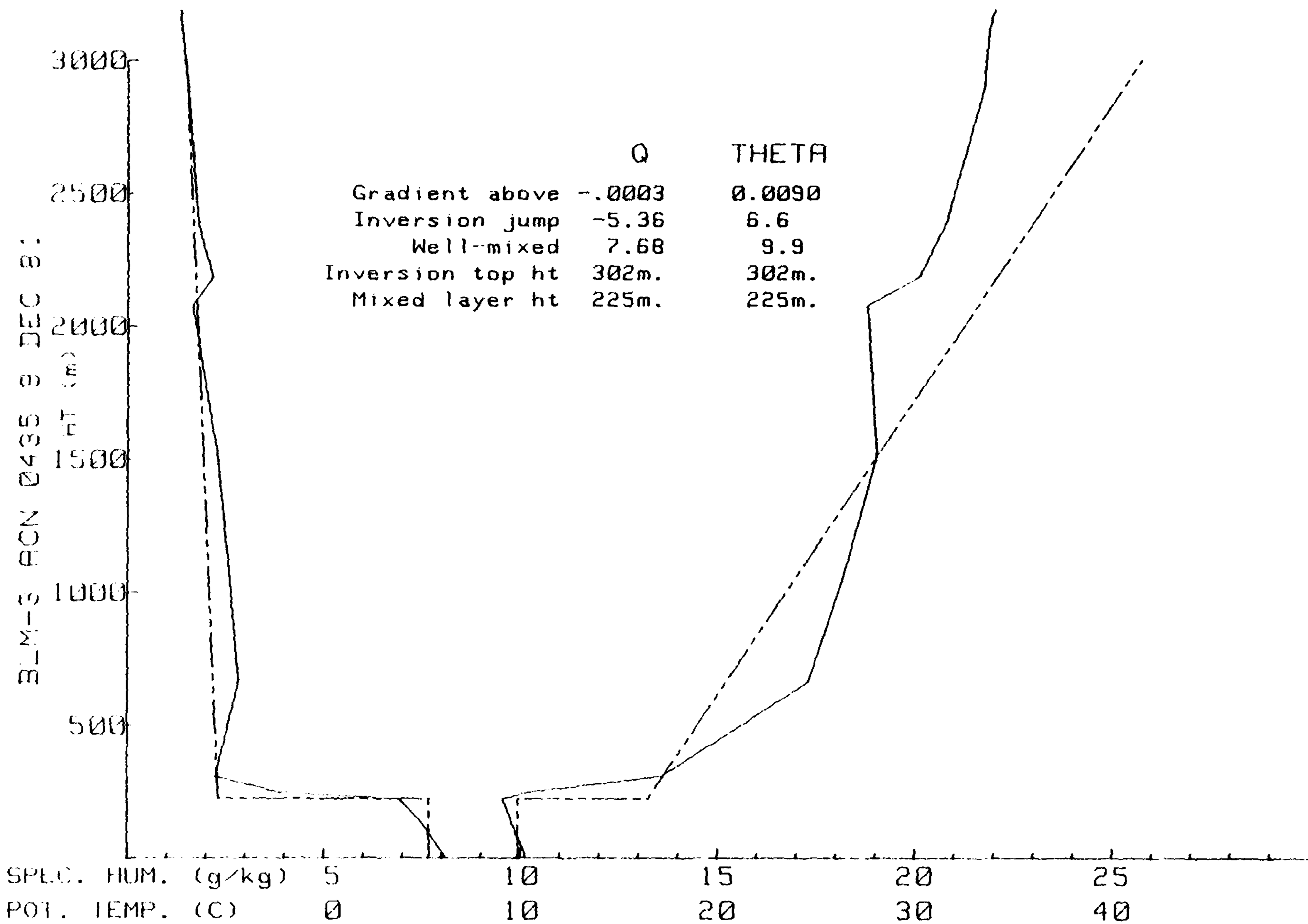


Figure [illegible]

TEMP (CENT)

BLM-3 9 DEC 81 435


BLM-3 RON 0435 8 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0003 0.0090
Inversion jump -5.36 6.6
Well-mixed 7.68 9.9
Inversion top ht 302m. 302m.
Mixed layer ht 225m. 225m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

b (3,

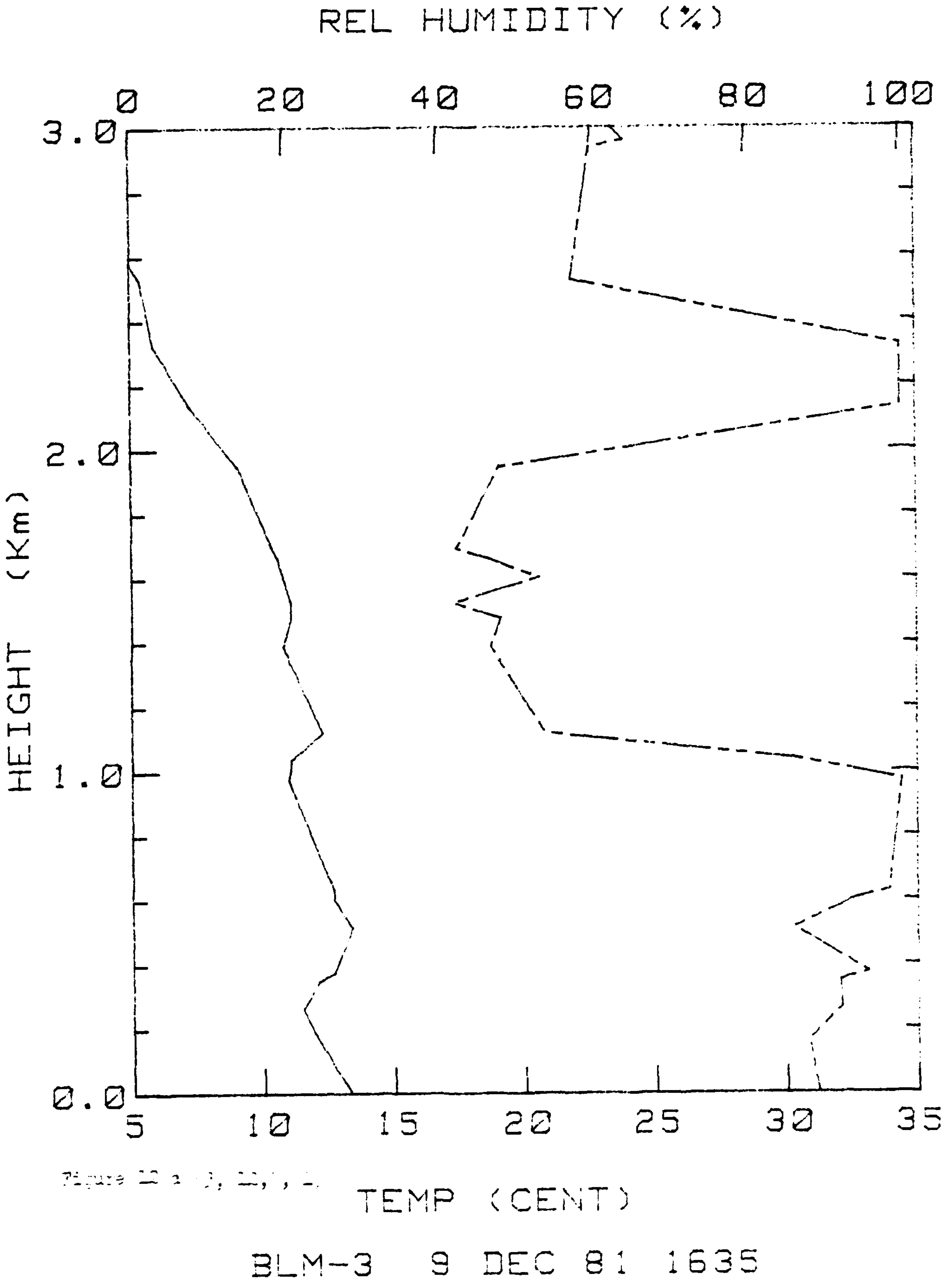
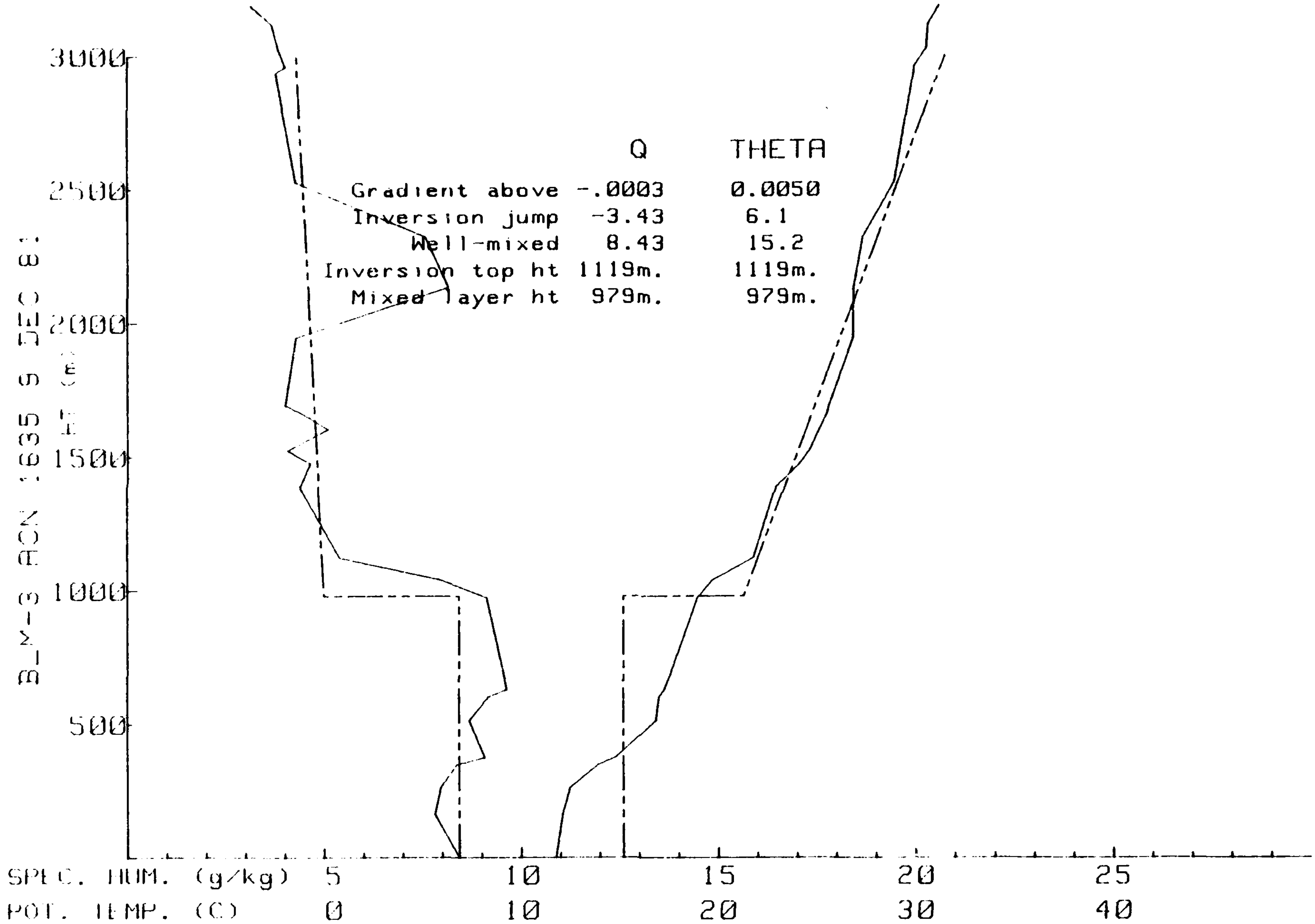

REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 9 DEC 81 1635

Figure 22 a [illegible]


BLM-3 RON 1635 5 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0003 0.0050
Inversion jump -3.43 6.1
Well-mixed 8.43 15.2
Inversion top ht 1119m. 1119m.
Mixed layer ht 979m. 979m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

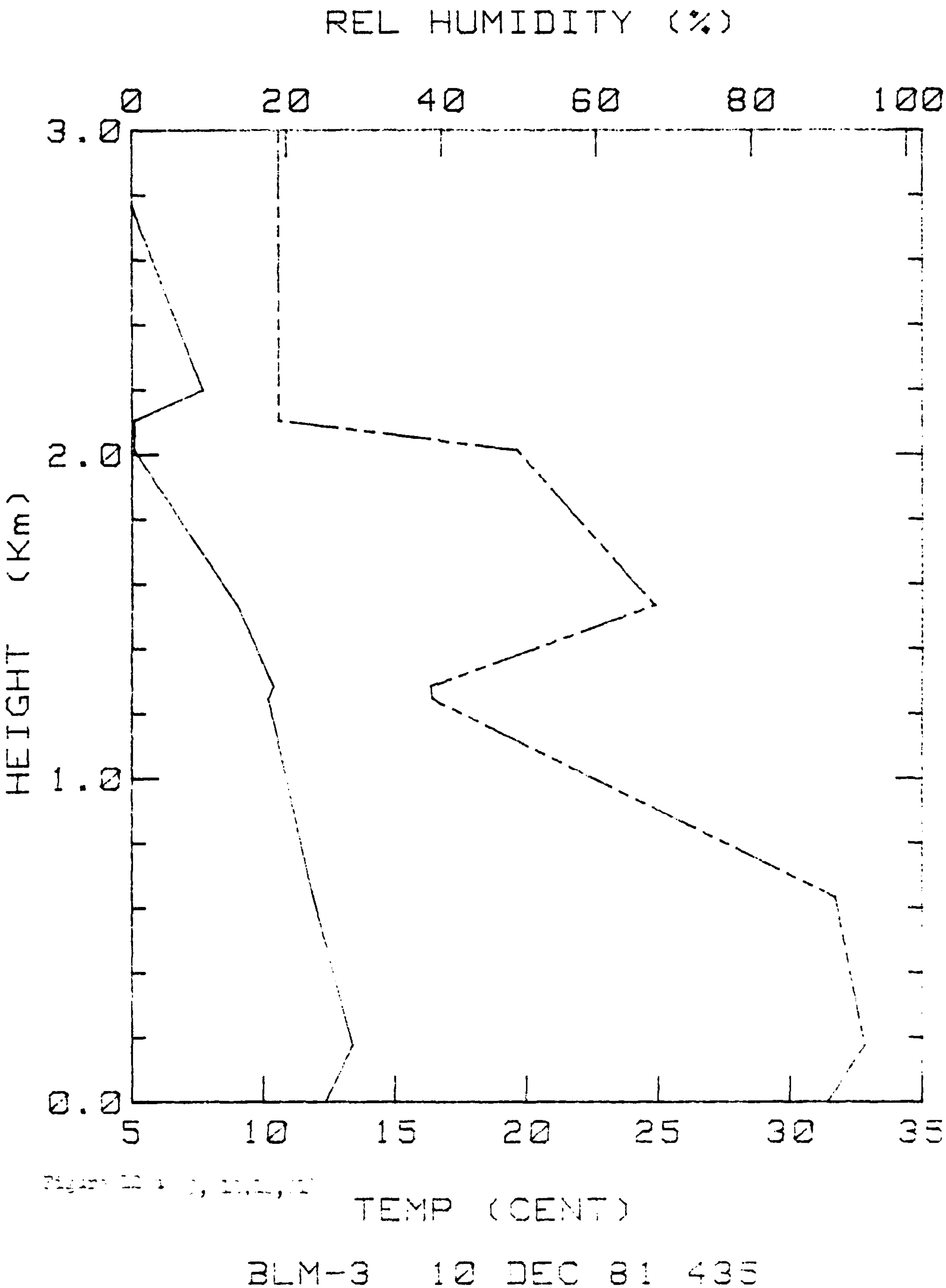
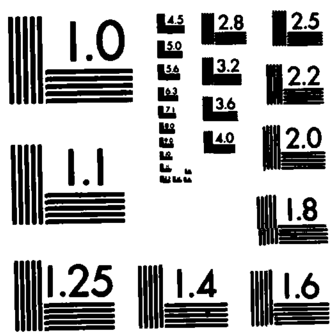
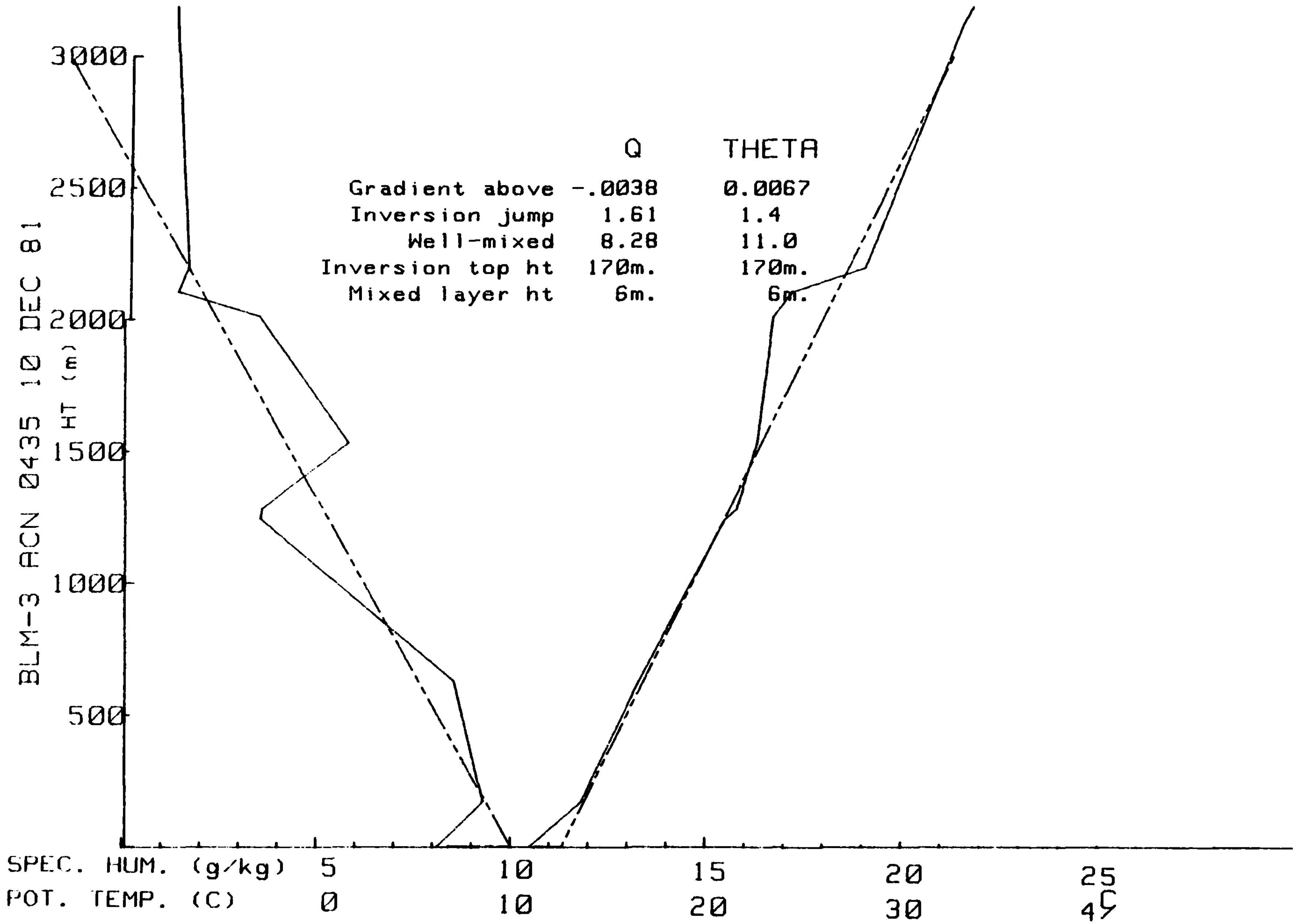

REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 10 DEC 81 435

Figure 22 [illegible]

AD-A123 582 CALIFORNIA COASTAL OFFSHORE TRANSPORT AND DIFFUSION 3/5
EXPERIMENTS - METEORO..(U) NAVAL POSTGRADUATE SCHOOL
MONTEREY CA G E SCHACHER ET AL. 06 DEC 82
UNCLASSIFIED NPS-61-82-007 F/G 4/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A


BLM-3 ACN 0435 10 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0038 0.0067
Inversion jump 1.61 1.4
Well-mixed 8.28 11.0
Inversion top ht 170m. 170m.
Mixed layer ht 6m. 6m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

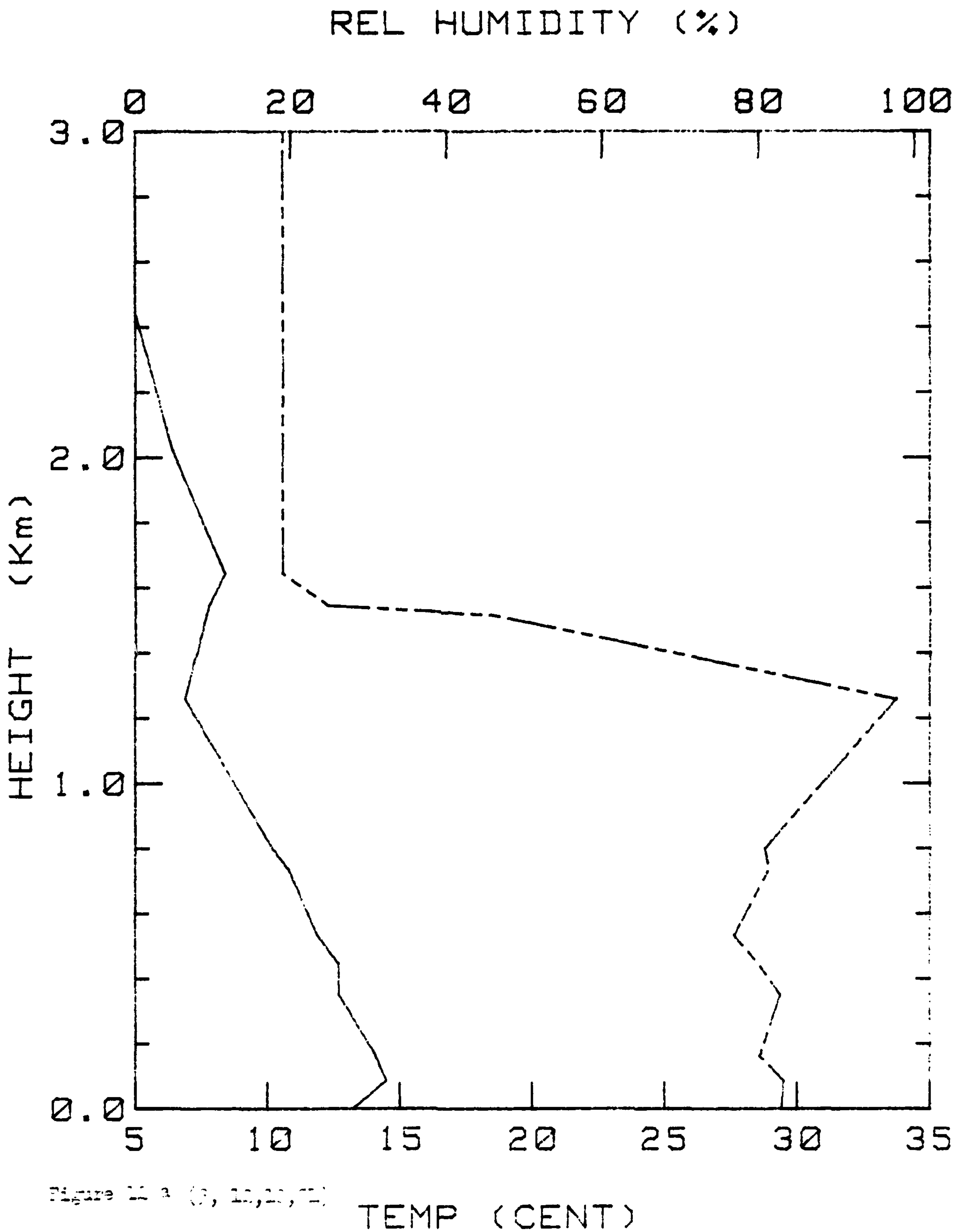


Figure 11 3 ([illegible])

BLM-3 10 DEC 81 1640

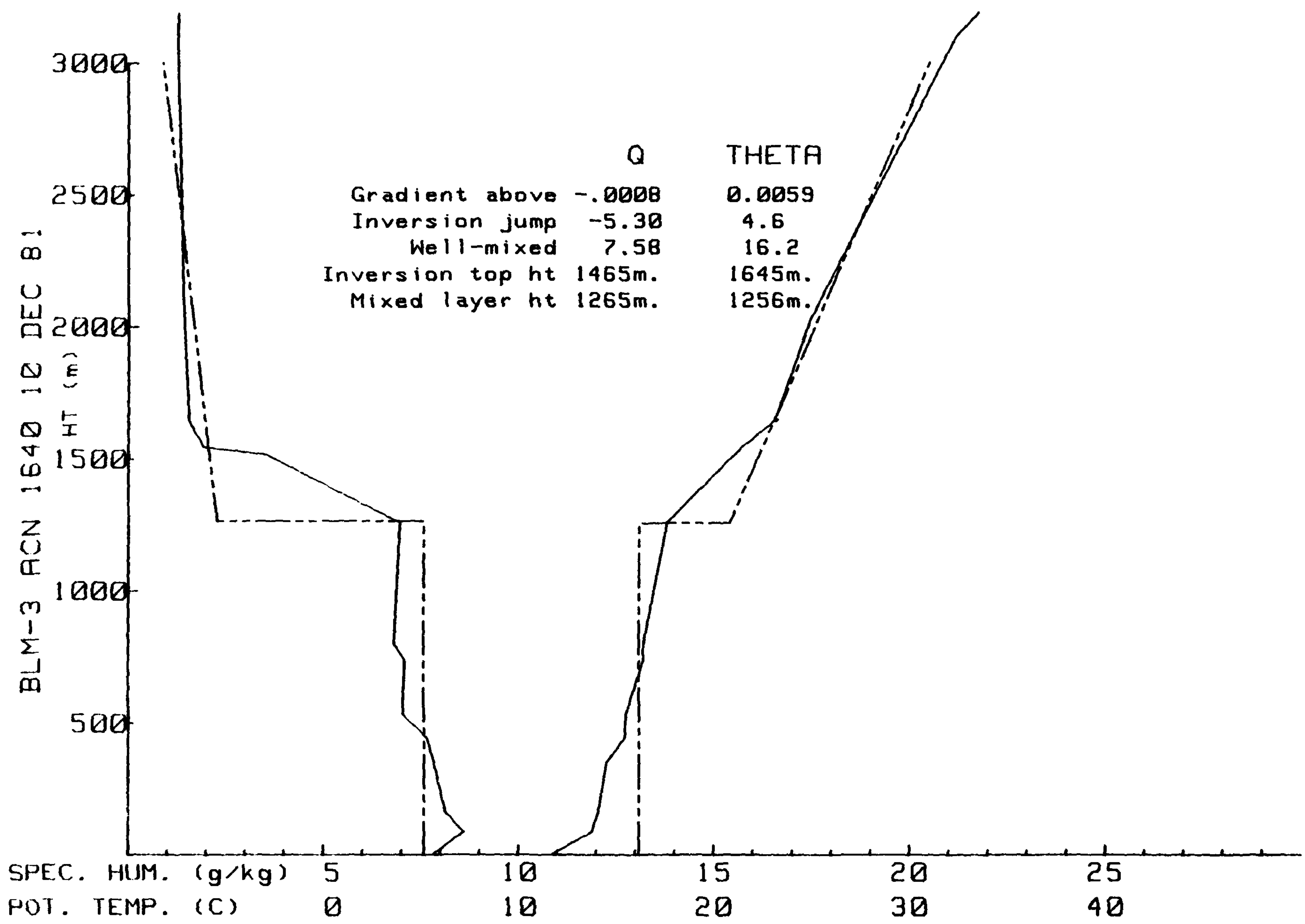

BLM-3 ACN 1640 10 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0008 0.0059
Inversion jump -5.30 4.6
Well-mixed 7.58 16.2
Inversion top ht 1465m. 1645m.
Mixed layer ht 1265m. 1256m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

Figure [illegible] b ([illegible])

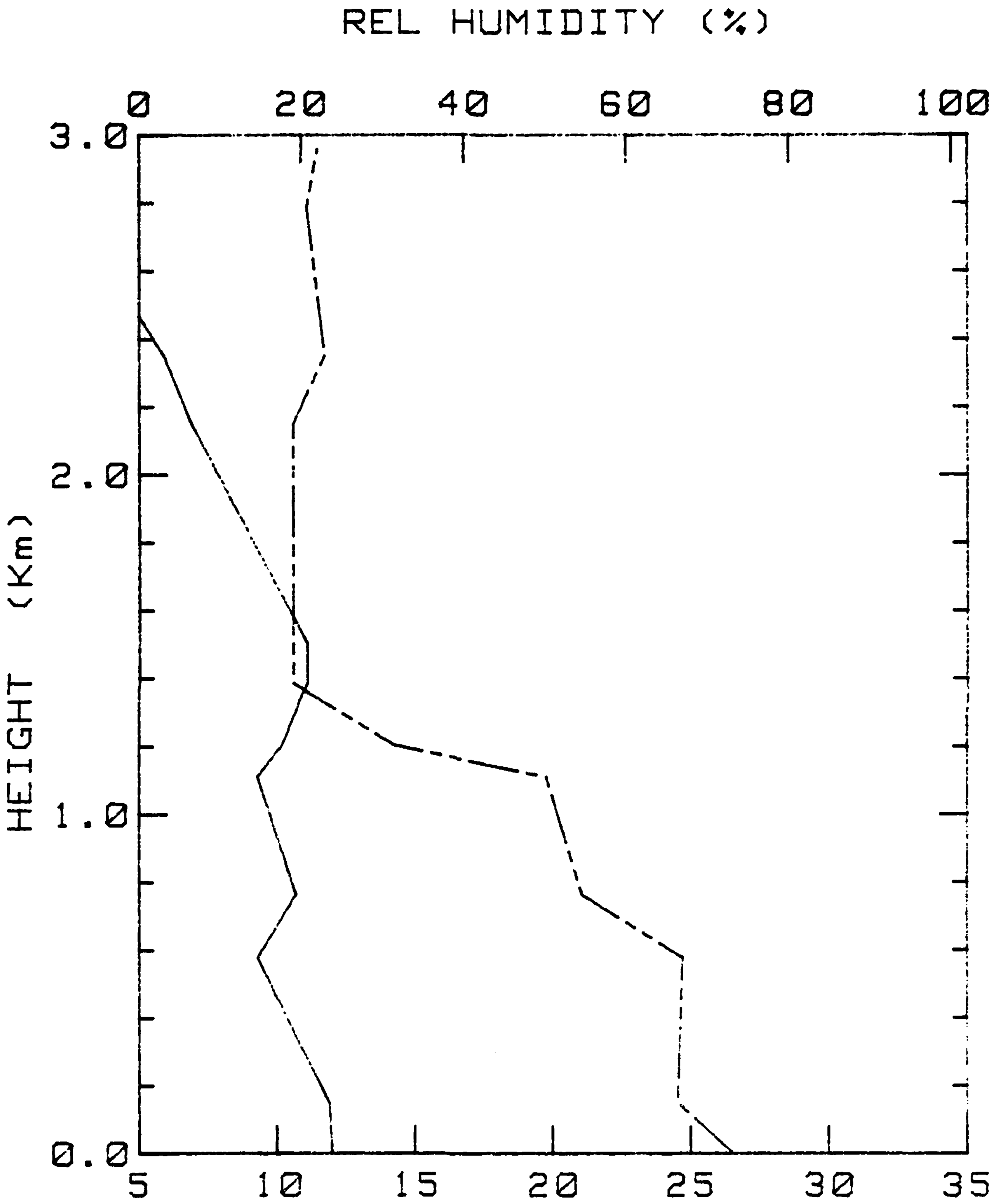


Figure 12 a (3. 12,11,81)

TEMP (CENT)

BLM-3 11 DEC 81 500

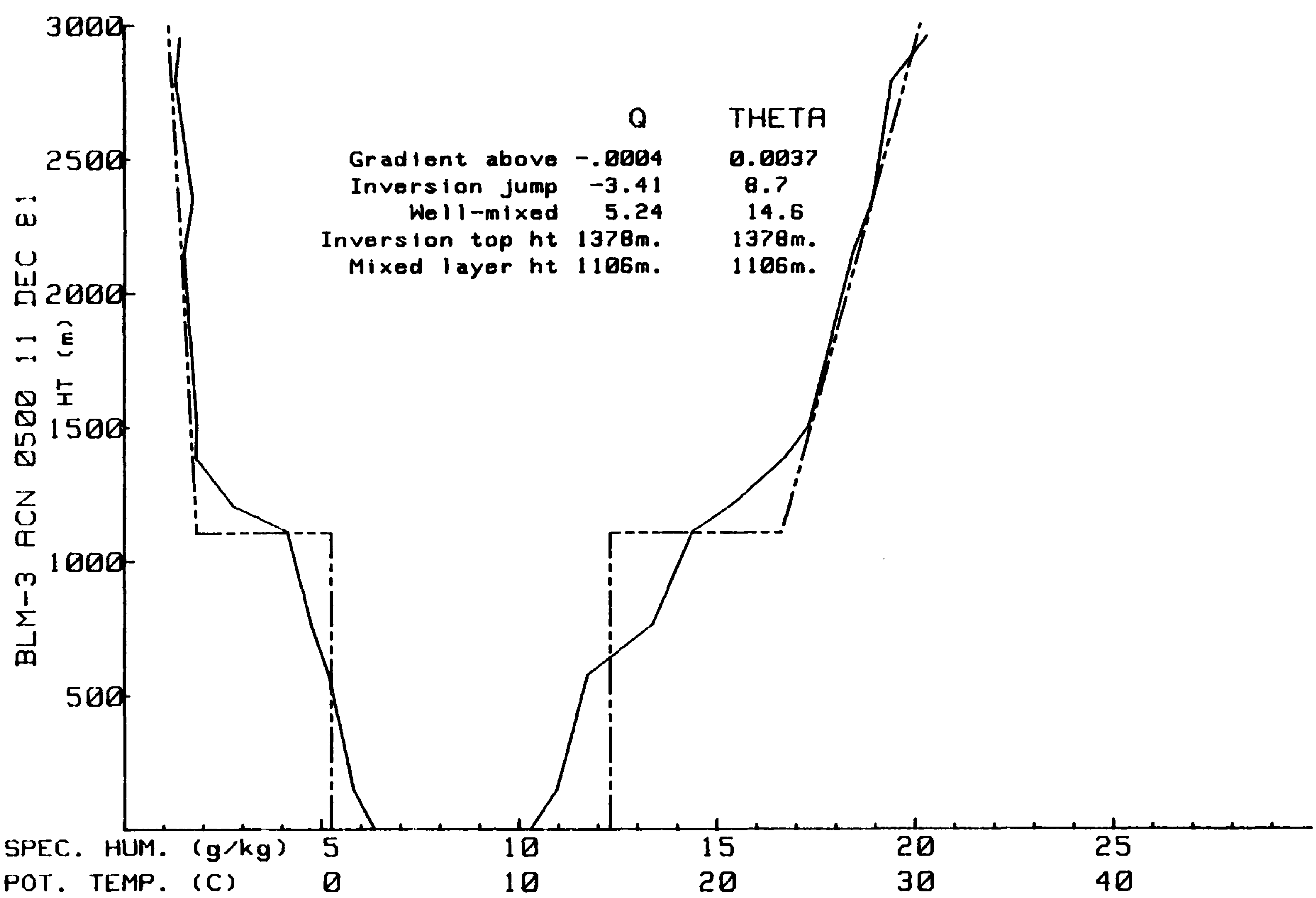
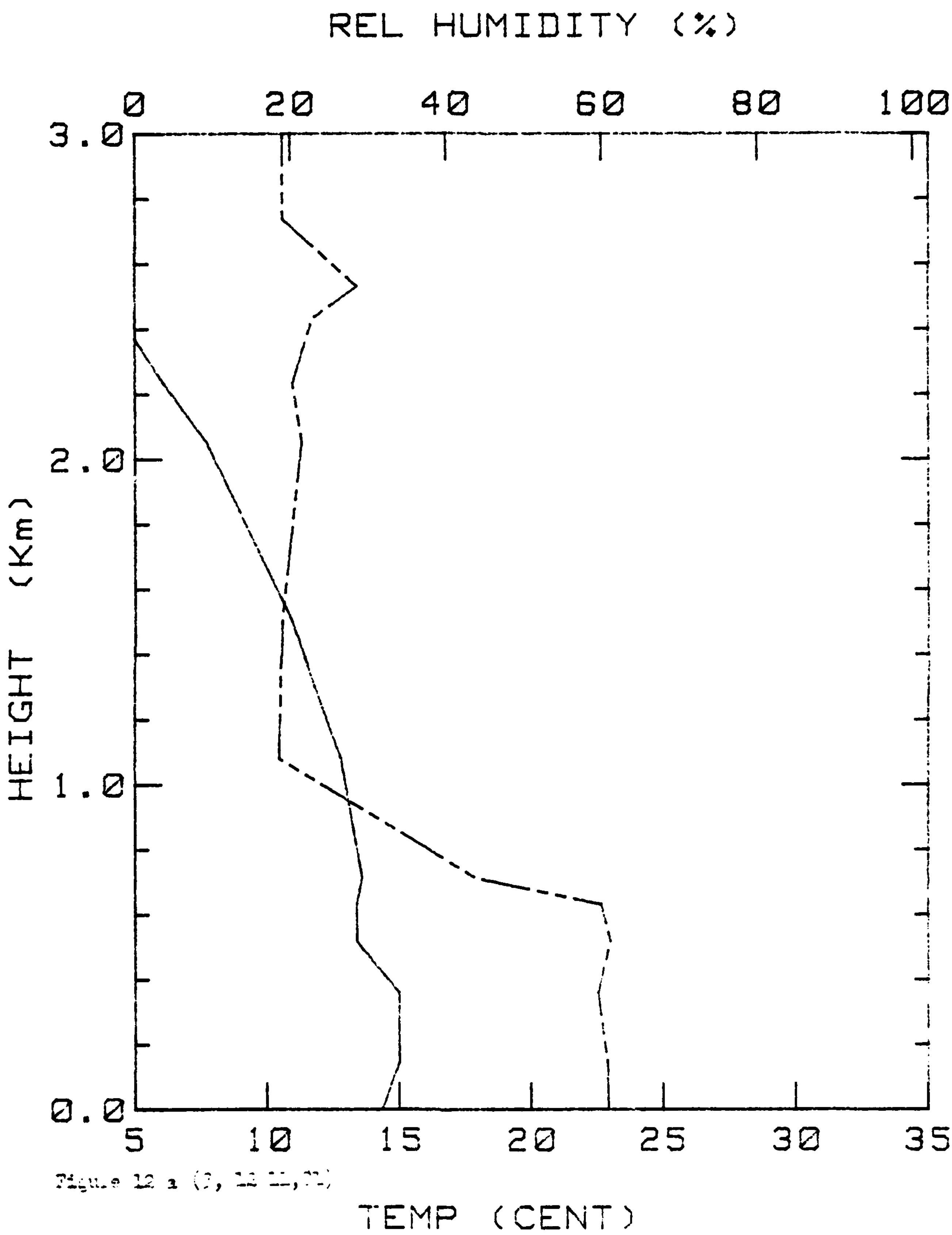
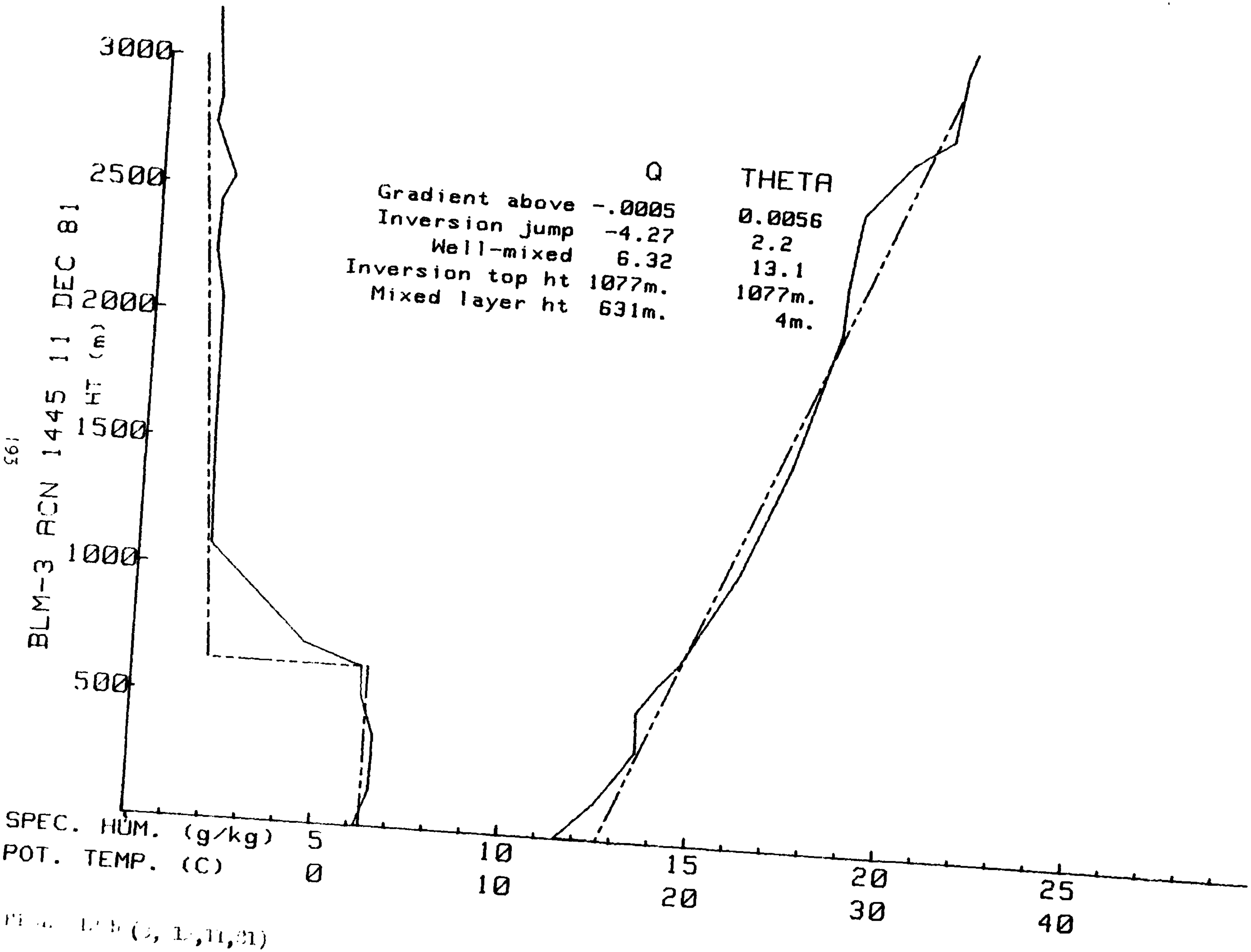


Figure 12 b (3, 12 11,81)



BLM-3 11 DEC 81 1445


BLM-3 RCN 1445 11 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0056
Inversion jump -4.27 2.2
Well-mixed 6.32 13.1
Inversion top ht 1077m. 1077m.
Mixed layer ht 631m. 4m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

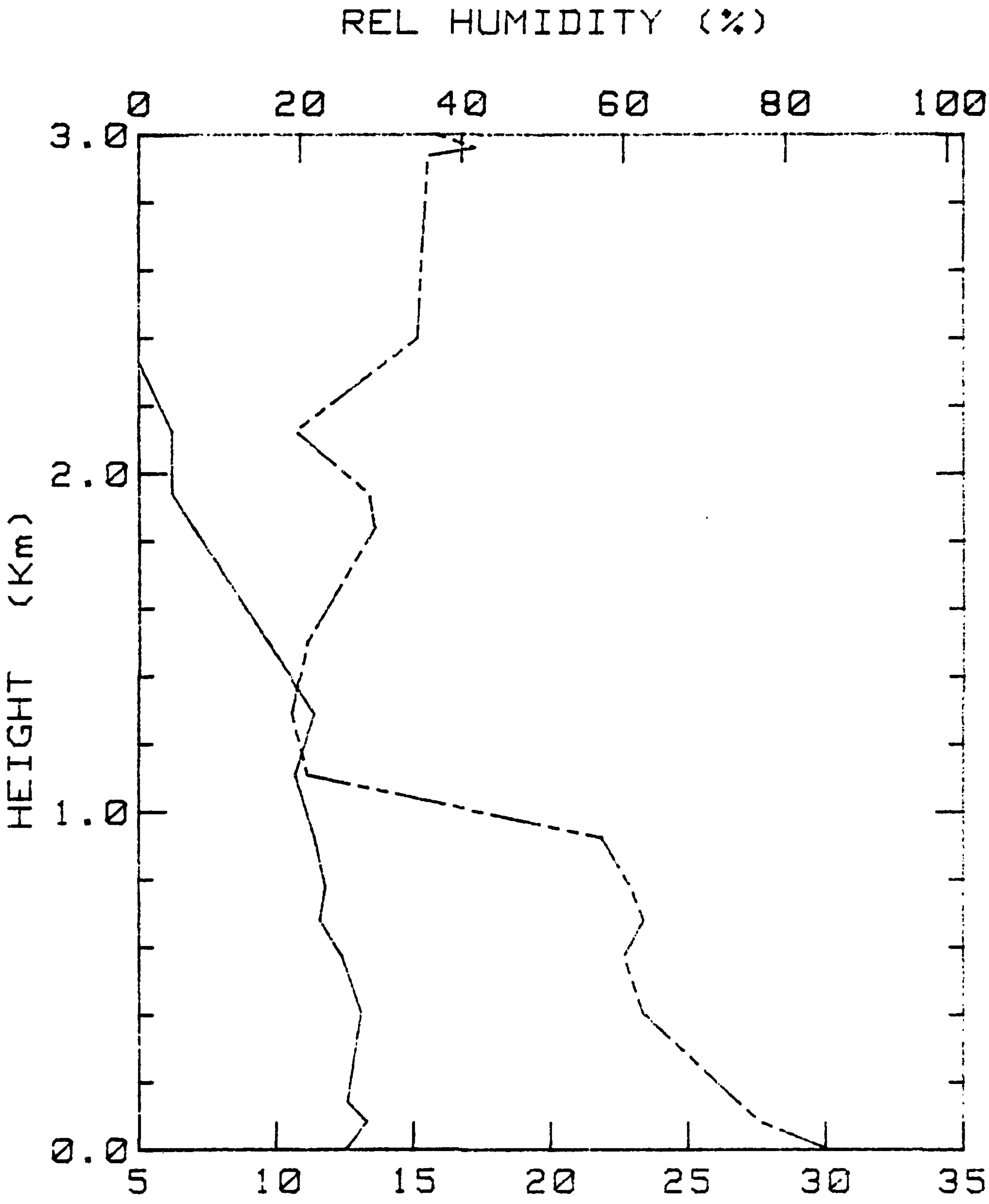


Figure 12 a ([illegible])

TEMP (CENT)

BLM-3 11 DEC 81 1851

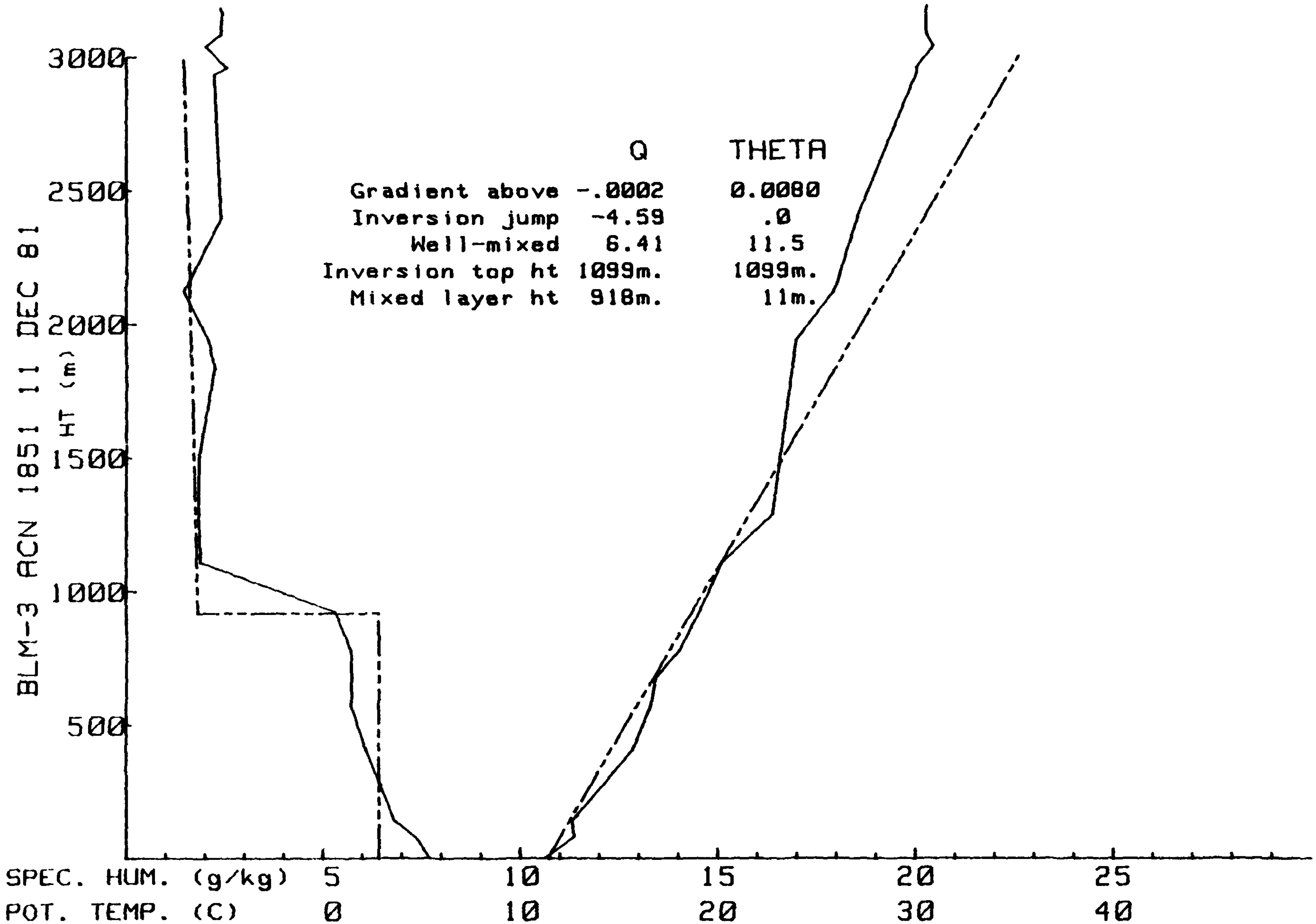


Figure 12 b (, 12,11,81)

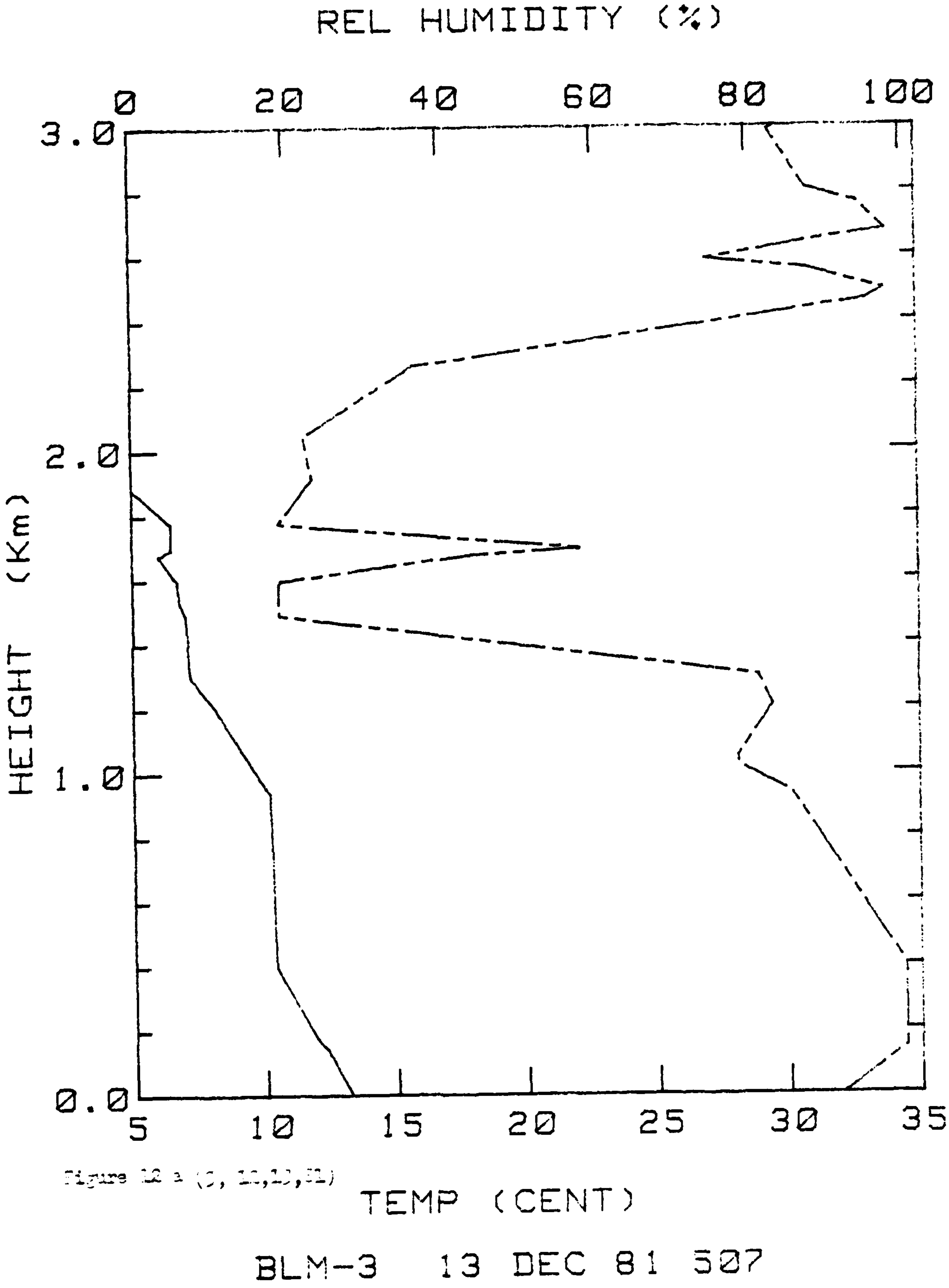


Figure 12 a ([illegible], 12,13,81)

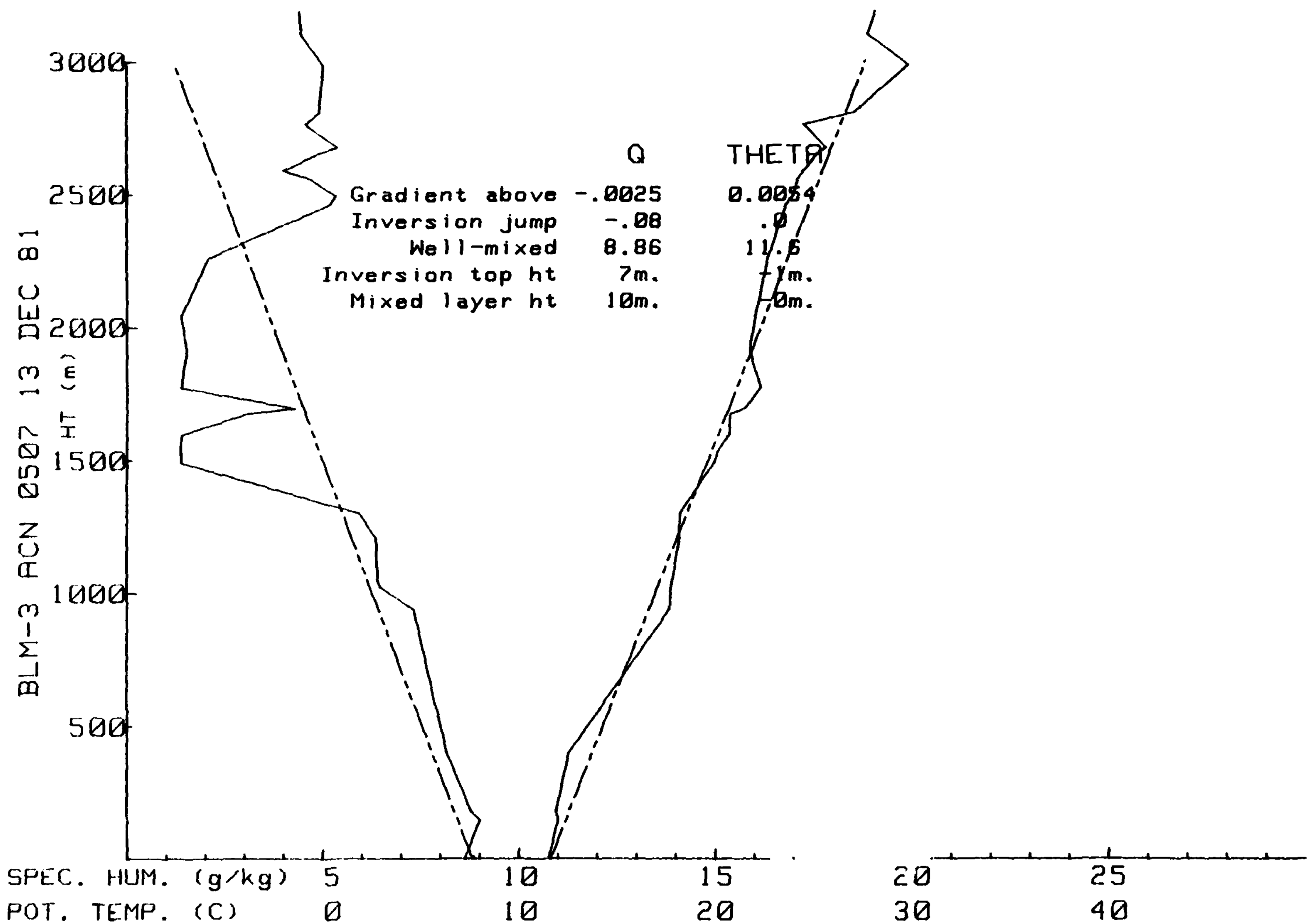

BLM-3 ACN 0507 13 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0025 0.0054
Inversion jump -.08 .0
Well-mixed 8.86 11.6
Inversion top ht 7m.
Mixed layer ht 10m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

Figure [illegible] b [illegible]

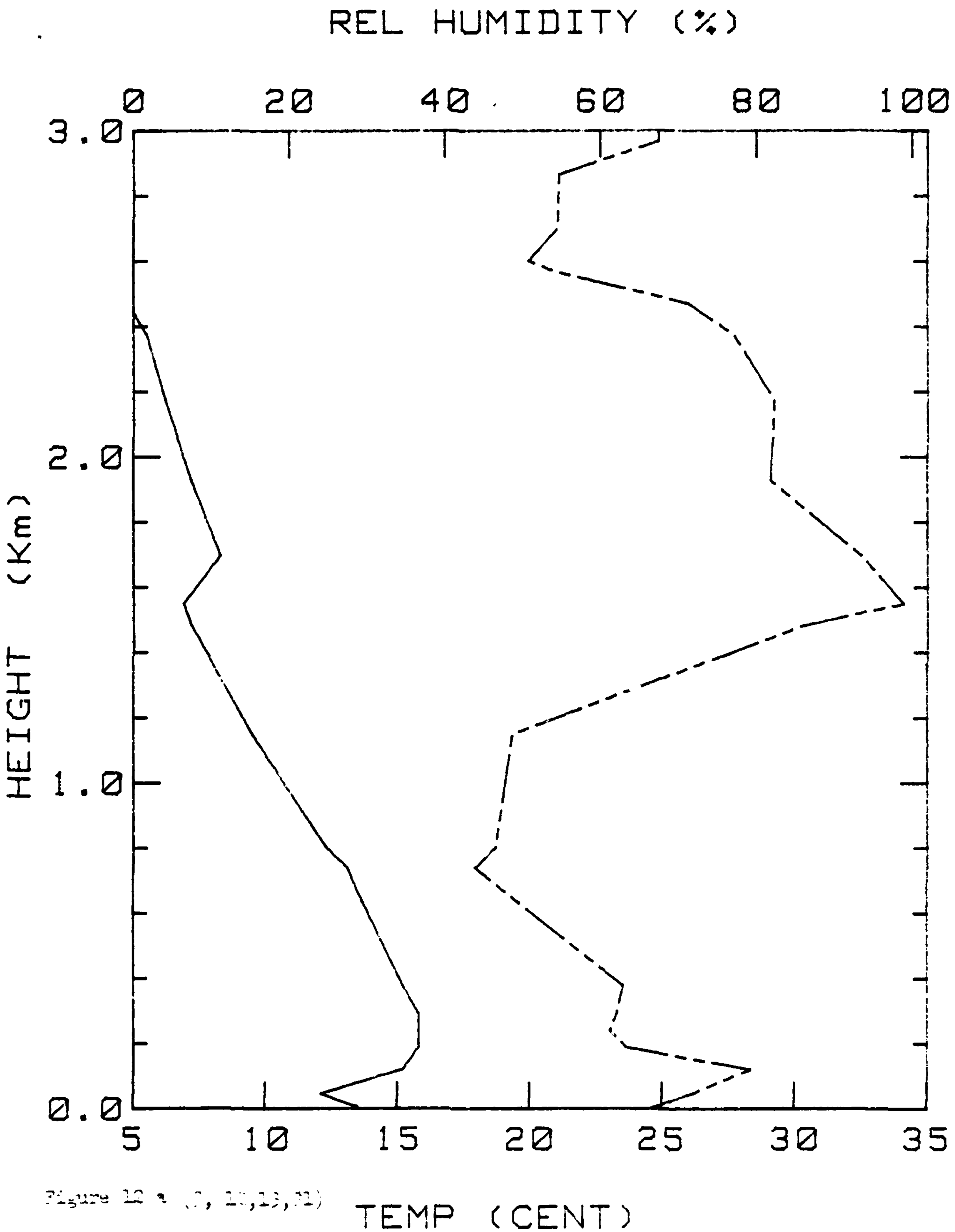


Figure 12 a ([illegible], 1[illegible],13,[illegible])

BLM-3 13 DEC 81 1455

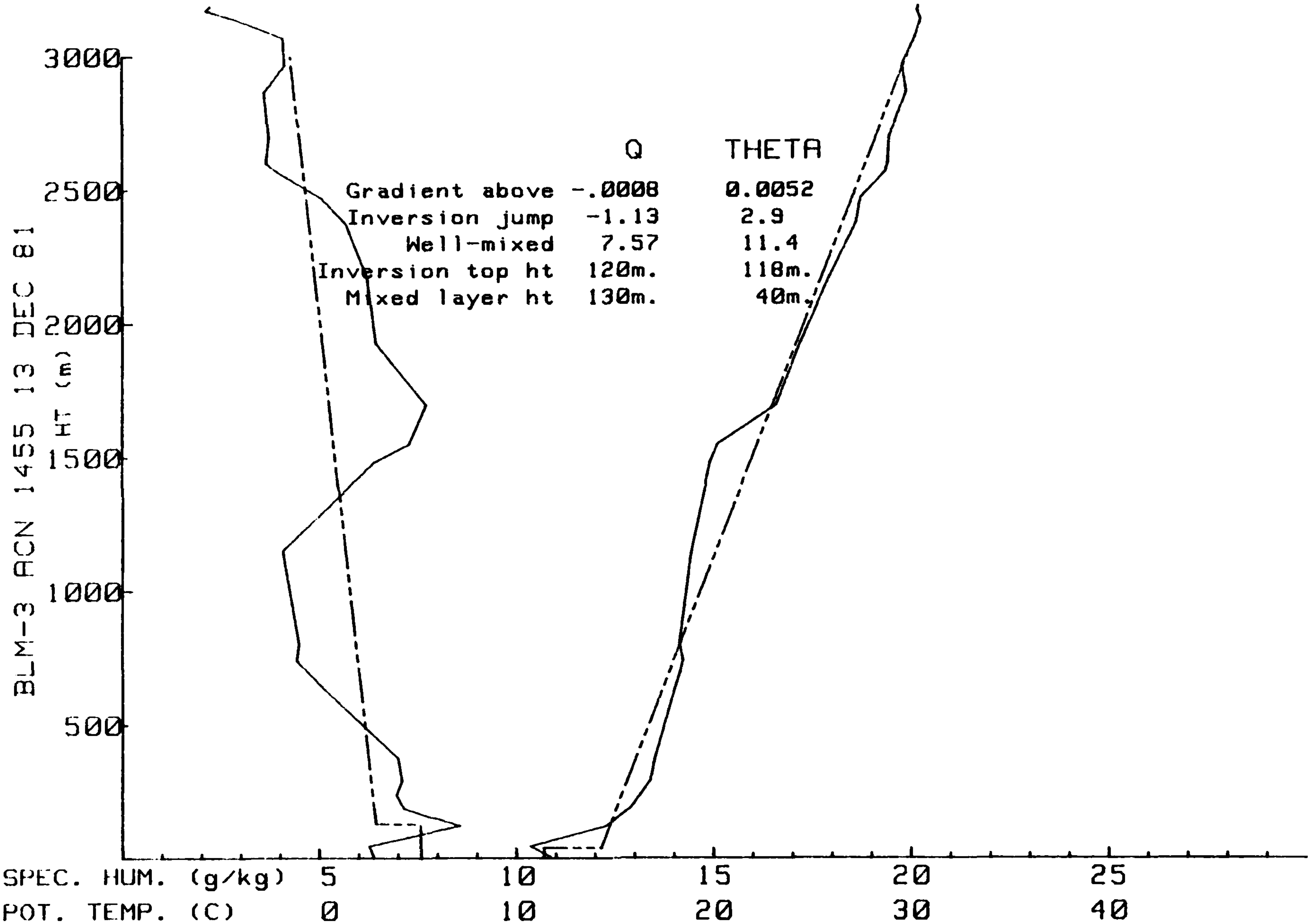


Figure 1[illegible] b (3, 1[illegible],13,81)

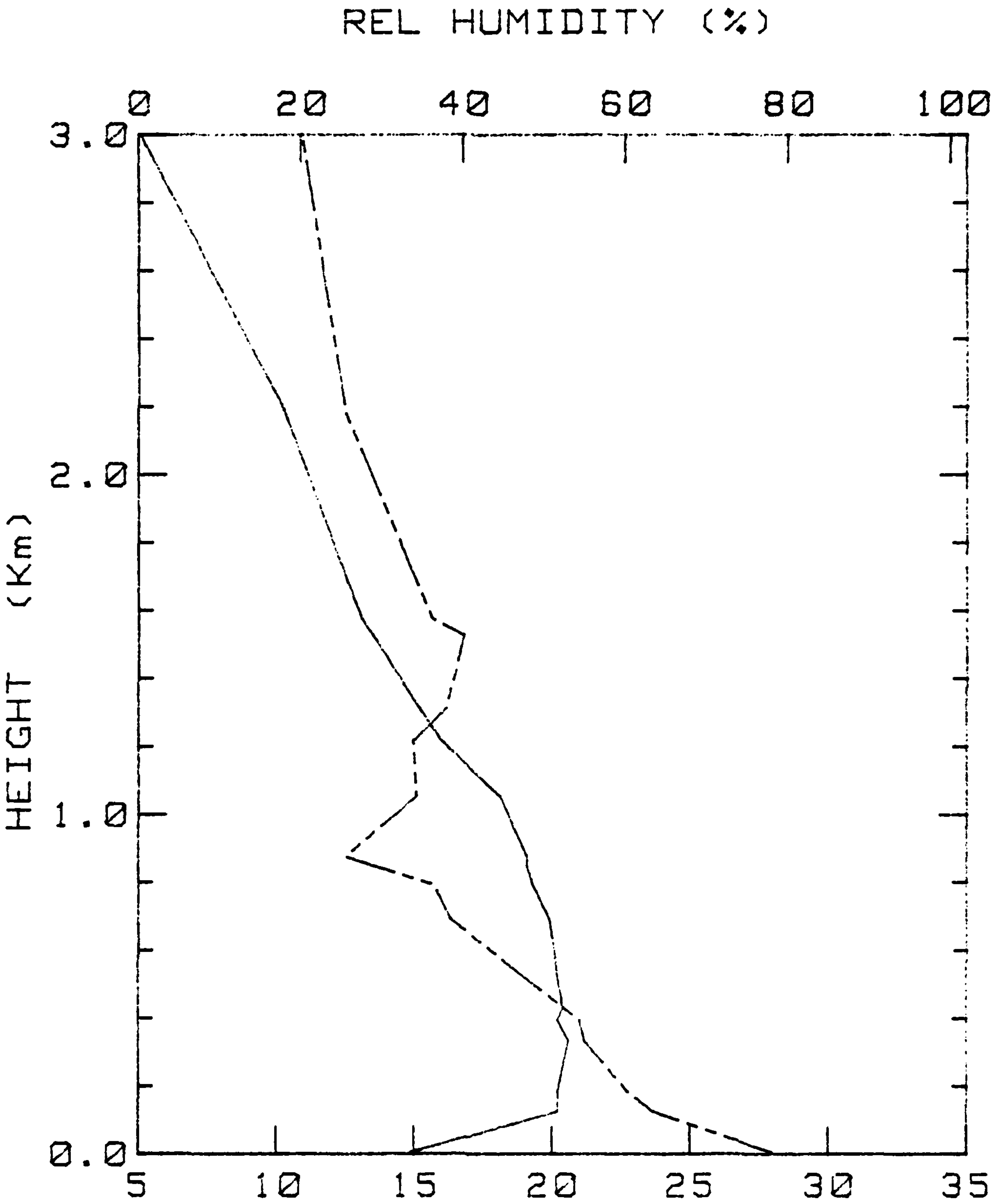


Figure 12 a (3, 12,13,22)

TEMP (CENT)

BLM-3 13 DEC 81 1620

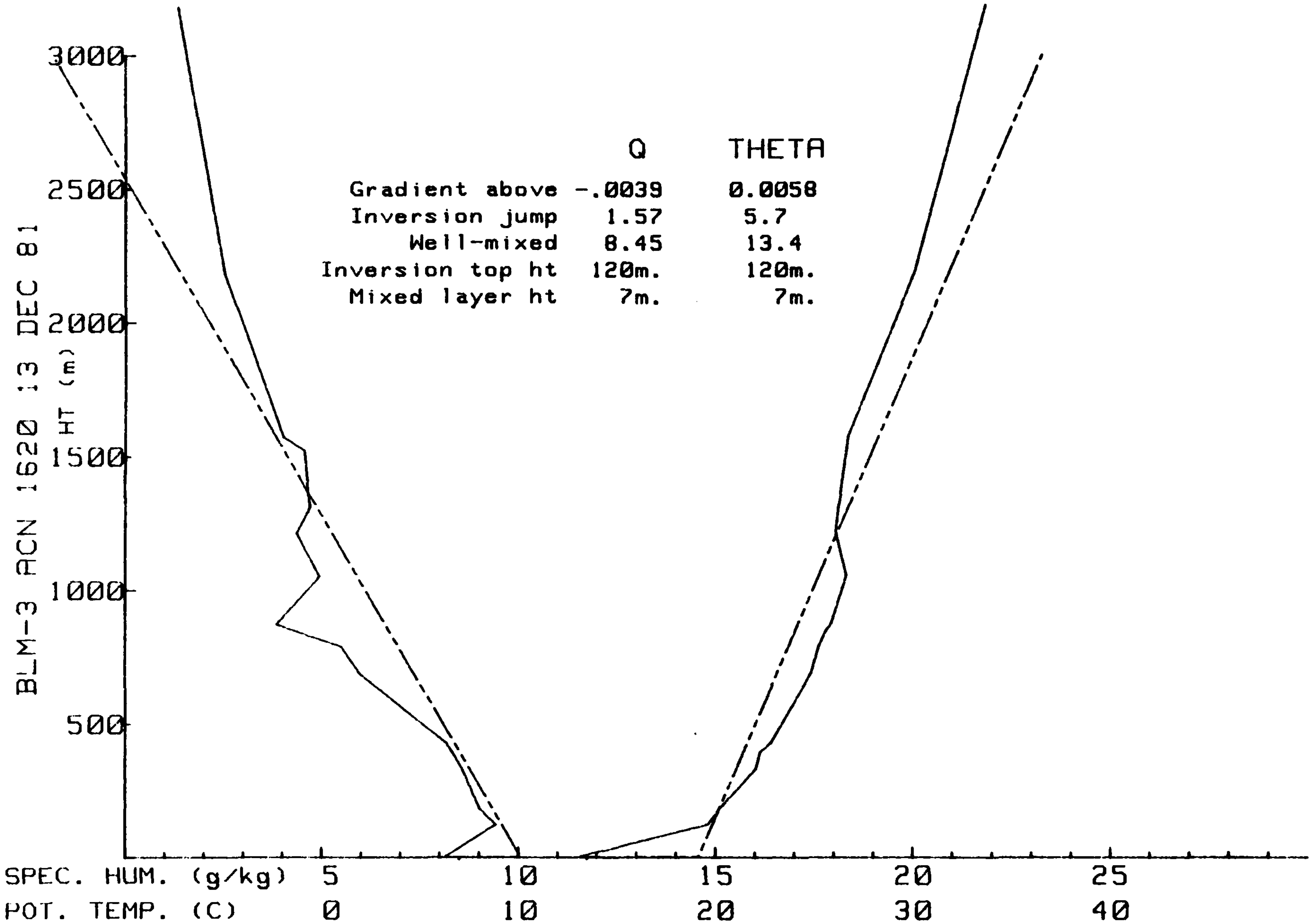


Figure 12 b (?, 12 13,81)

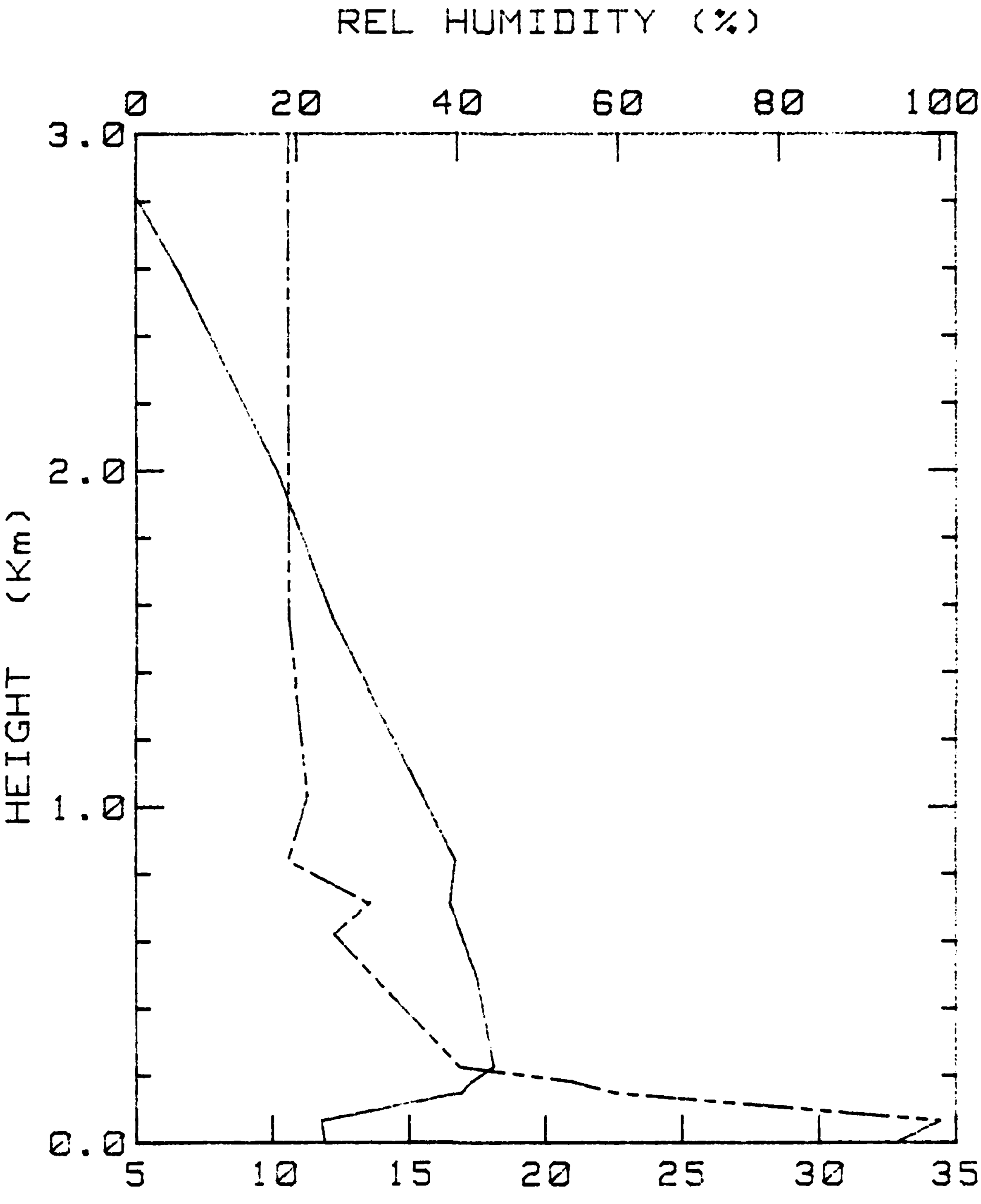
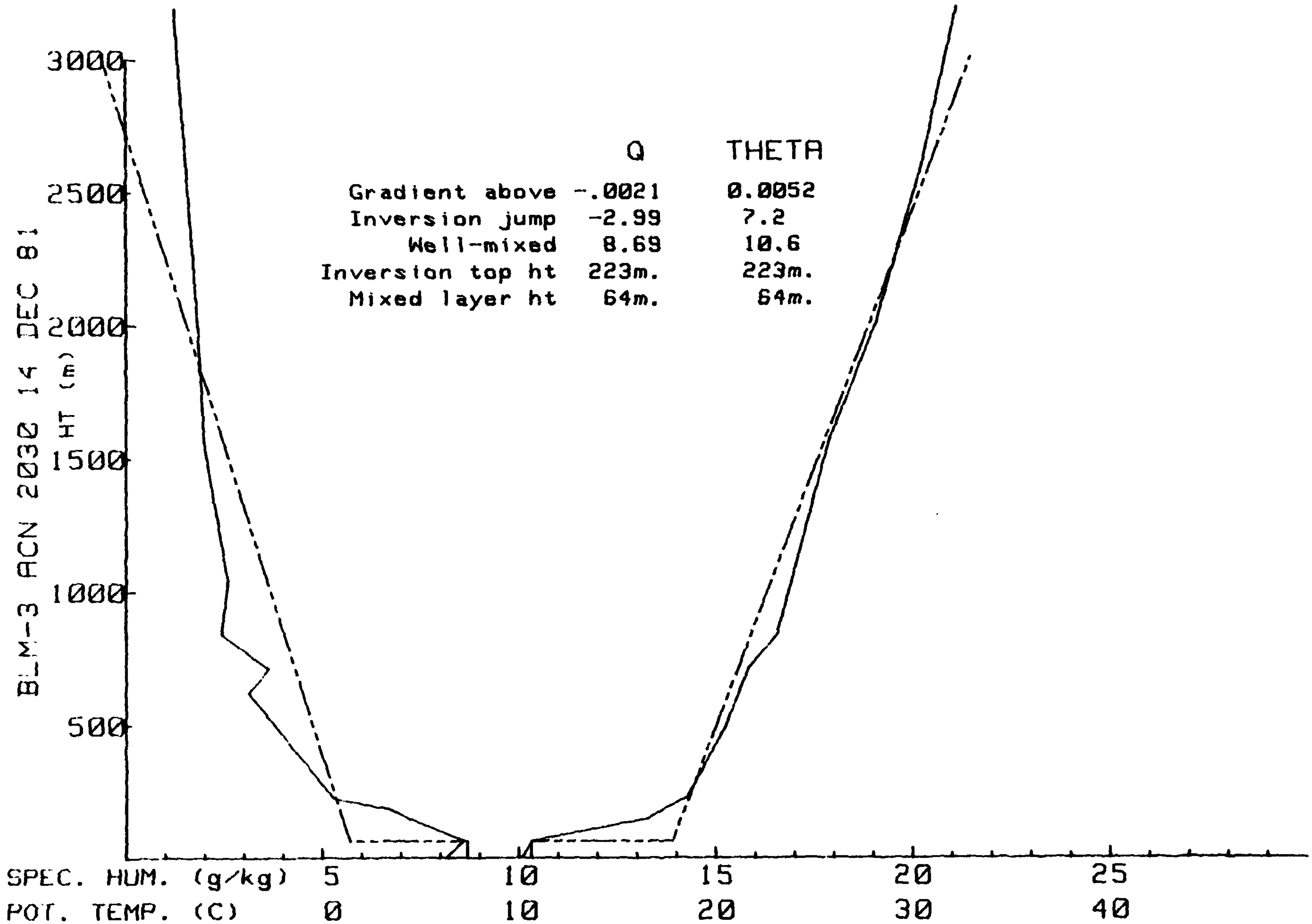


Figure 12 a (3, 12,14,81) TEMP (CENT)

BLM-3 14 DEC 81 2030


BLM-3 ACN 2030 14 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0021 0.0052
Inversion jump -2.99 7.2
Well-mixed 8.69 10.6
Inversion top ht 223m. 223m.
Mixed layer ht 64m. 64m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

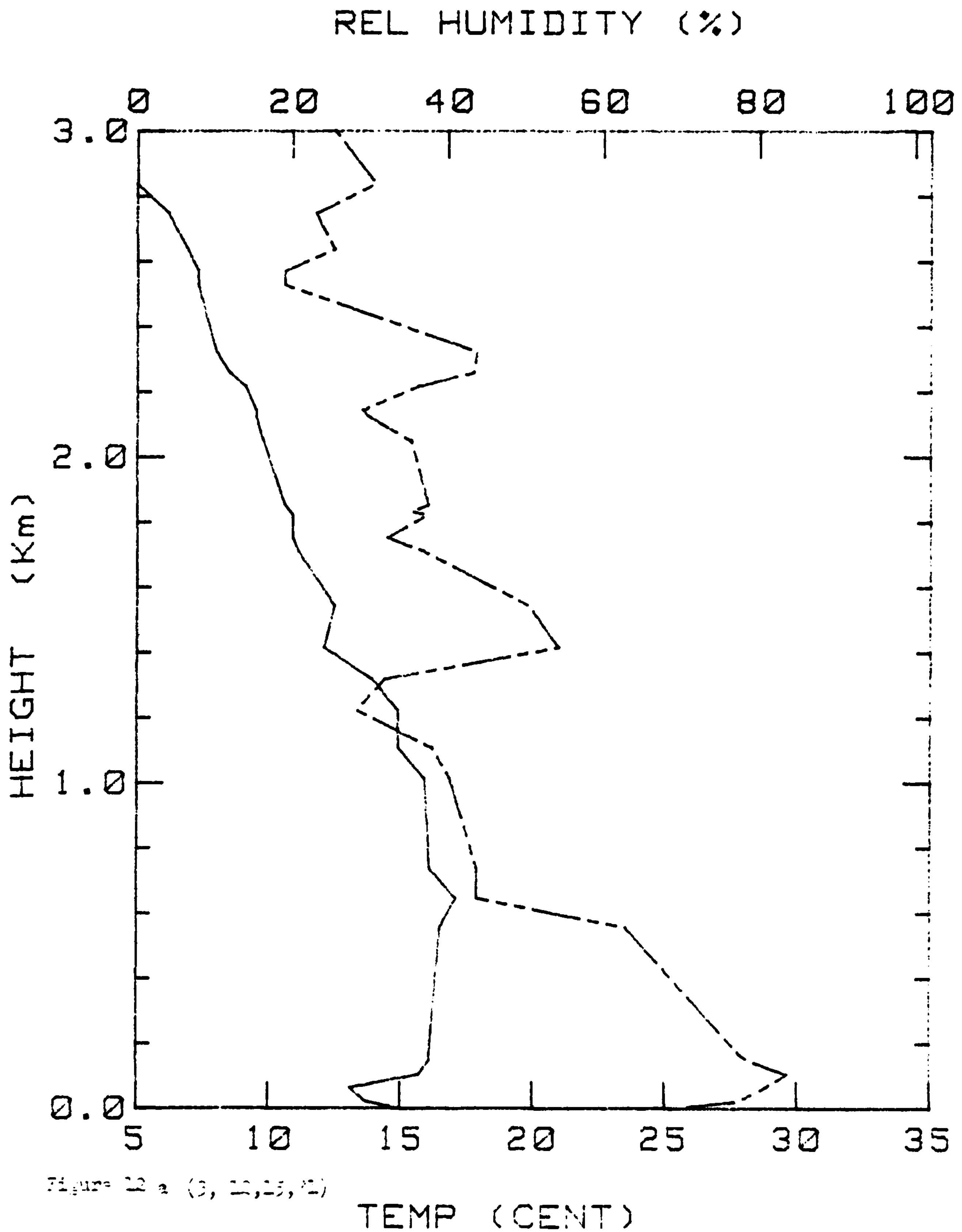


Figure 12 a (3, 12,15,81)

BLM-3 15 DEC 81 1253

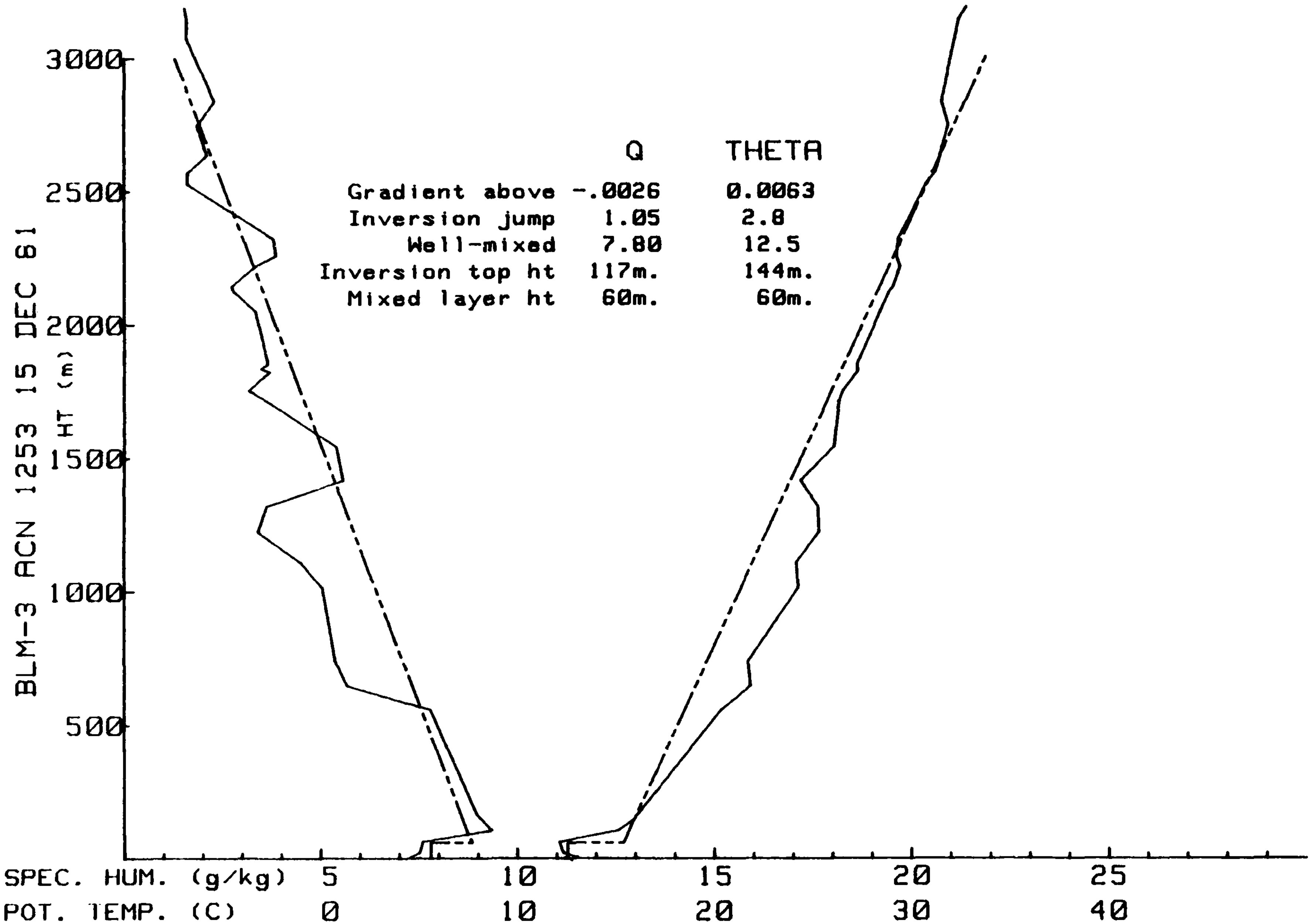


Figure 12 b (3, 1?,15,21)

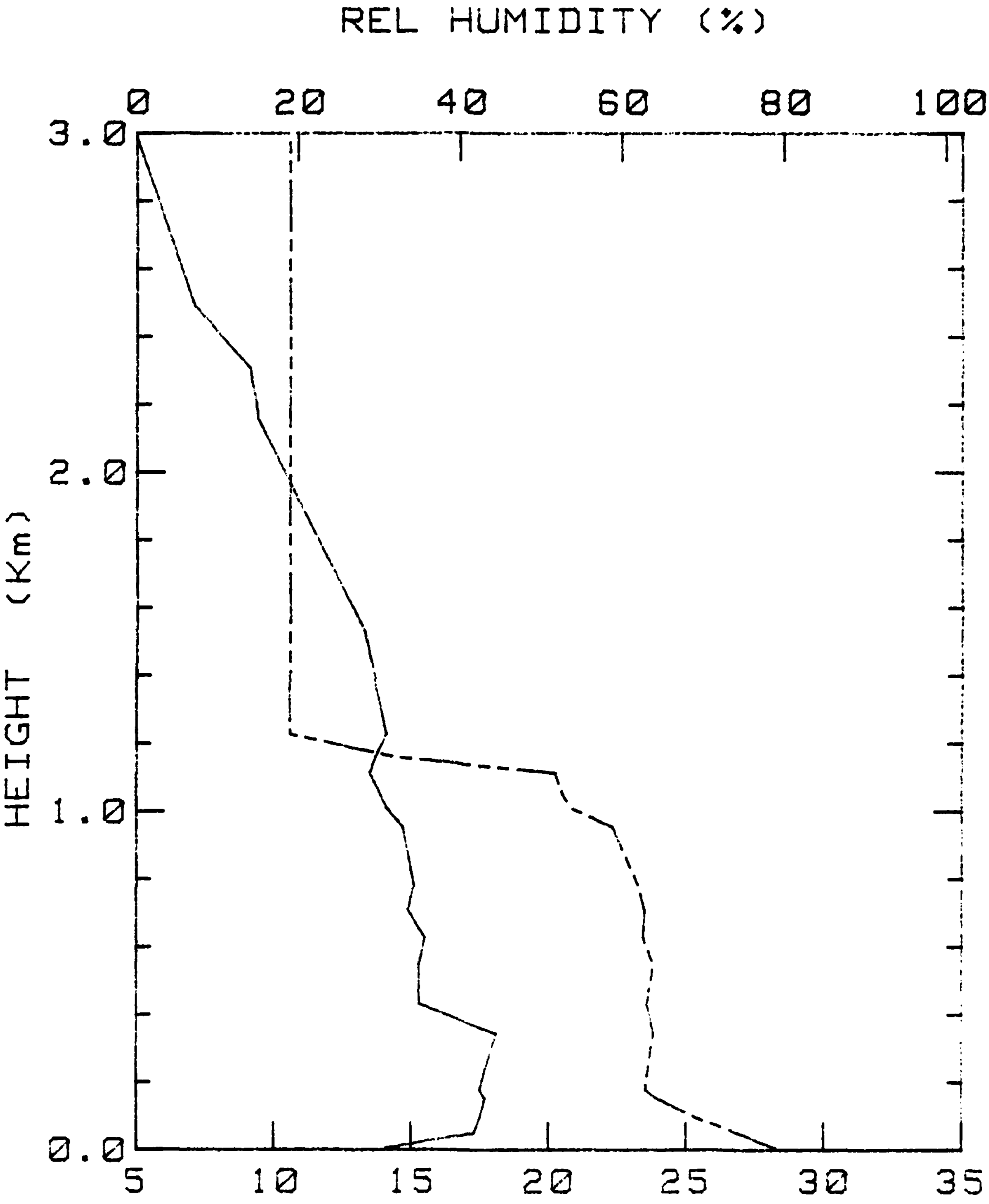
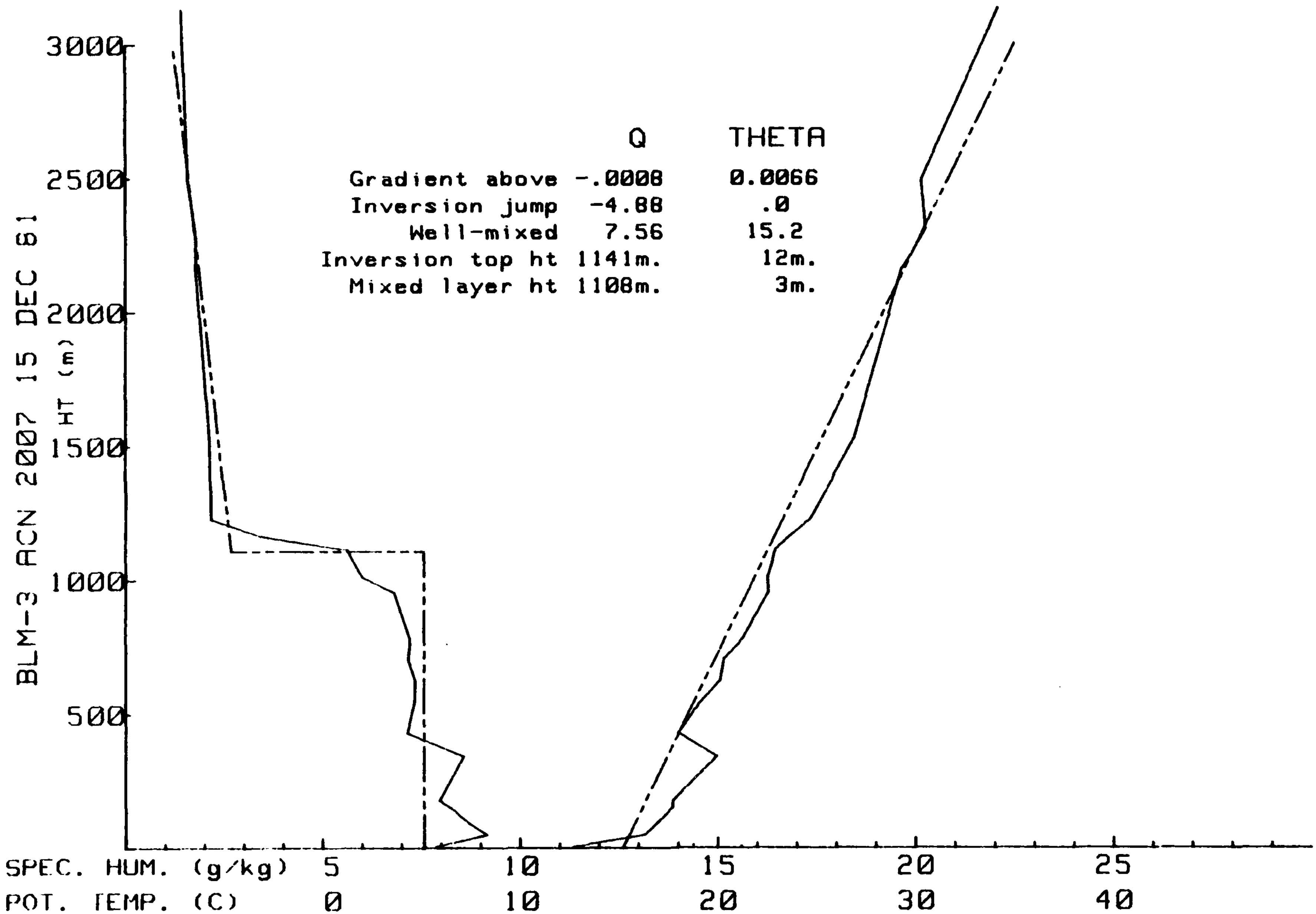


Figure 12 a ([illegible], 12,15,31)

TEMP (CENT)

BLM-3 15 DEC 81 2007



Q THETA
Gradient above -.0008 0.0066
Inversion jump -4.88 .0
Well-mixed 7.56 15.2
Inversion top ht 1141m. 12m.
Mixed layer ht 1108m. 3m.
BLM-3 ACN 2007 15 DEC 81
HT (m)
3000
2500
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

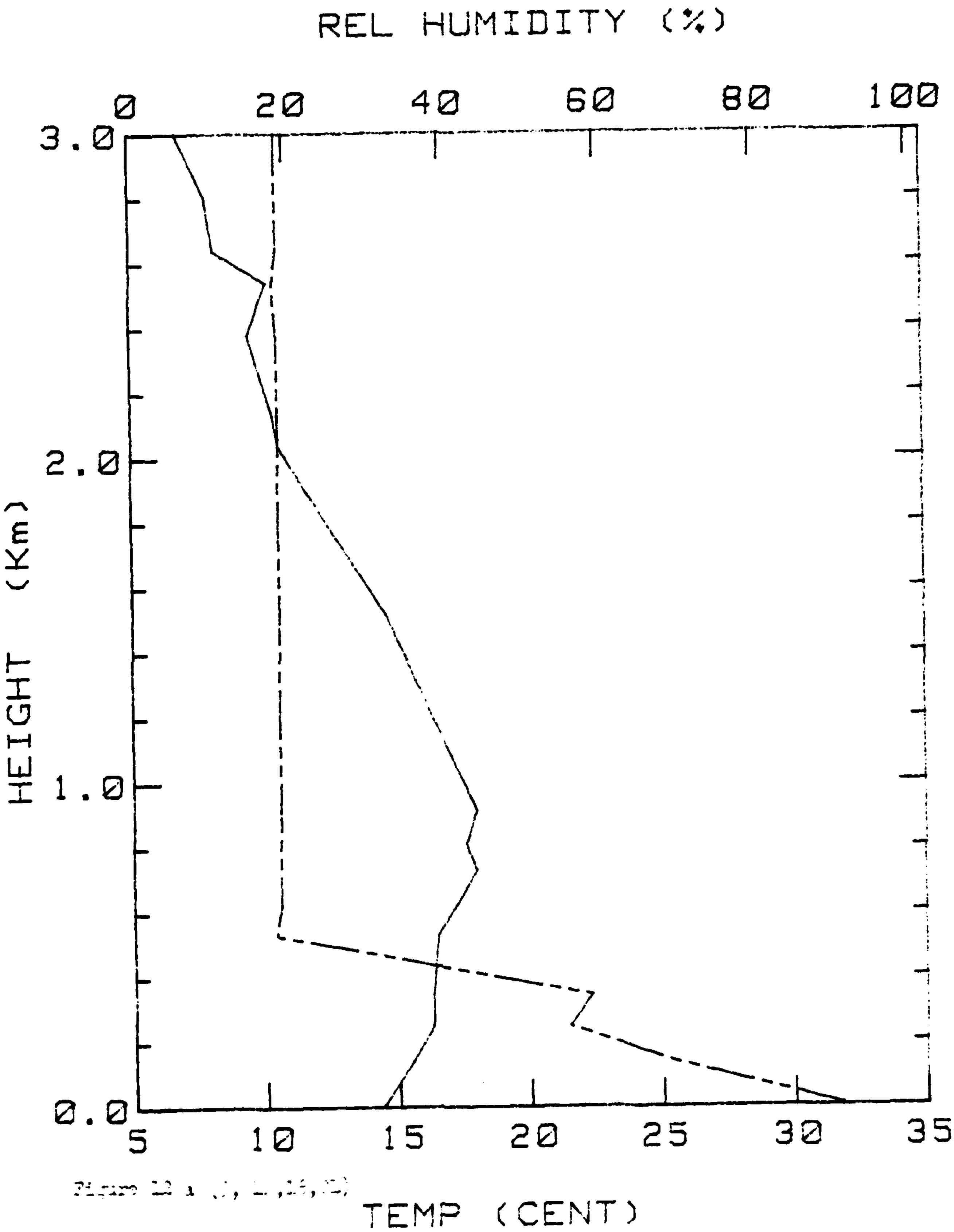


Figure 22 a [illegible]

BLM-3 16 DEC 81 1610

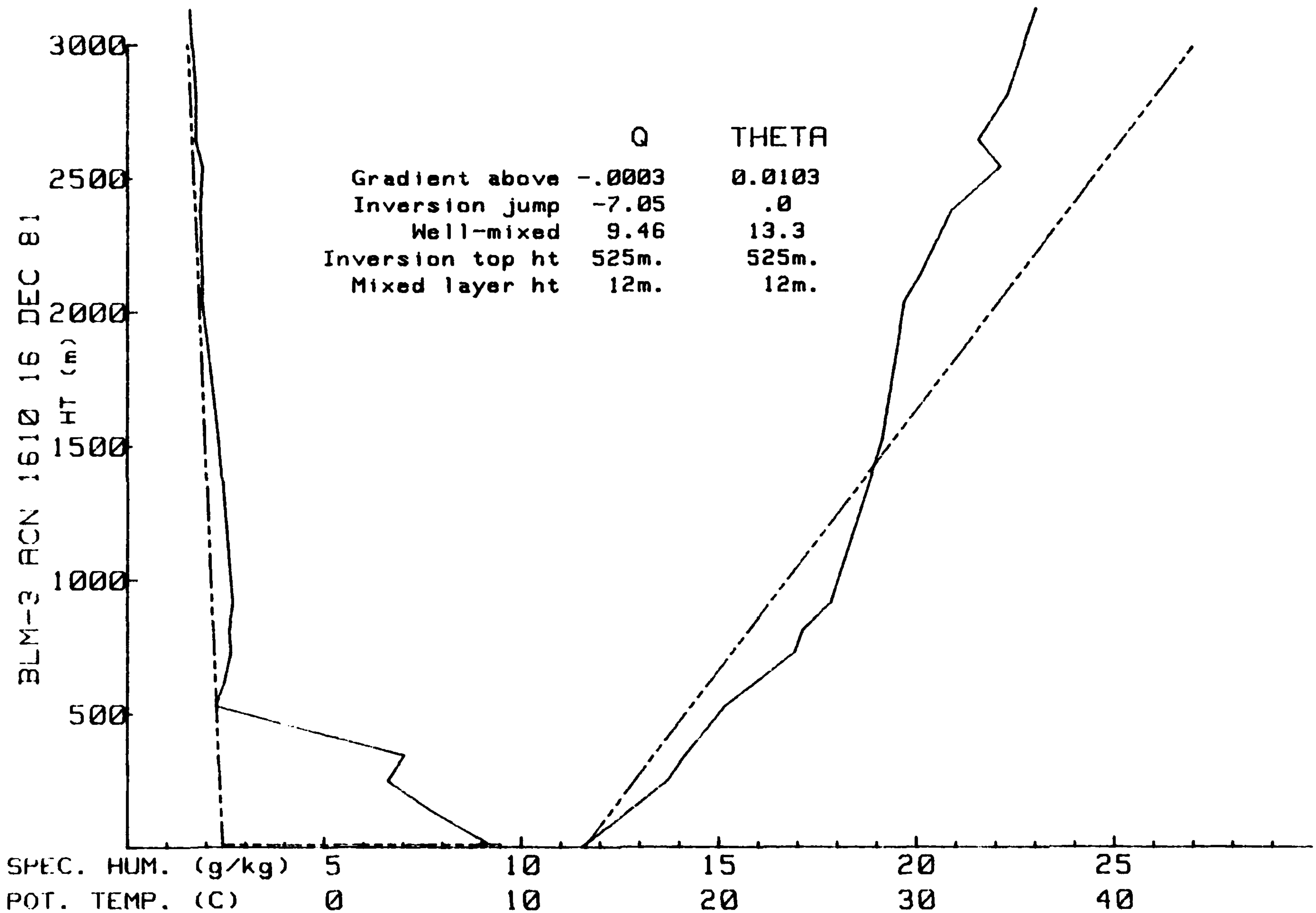


Figure 12 b (3, 12,16,81)

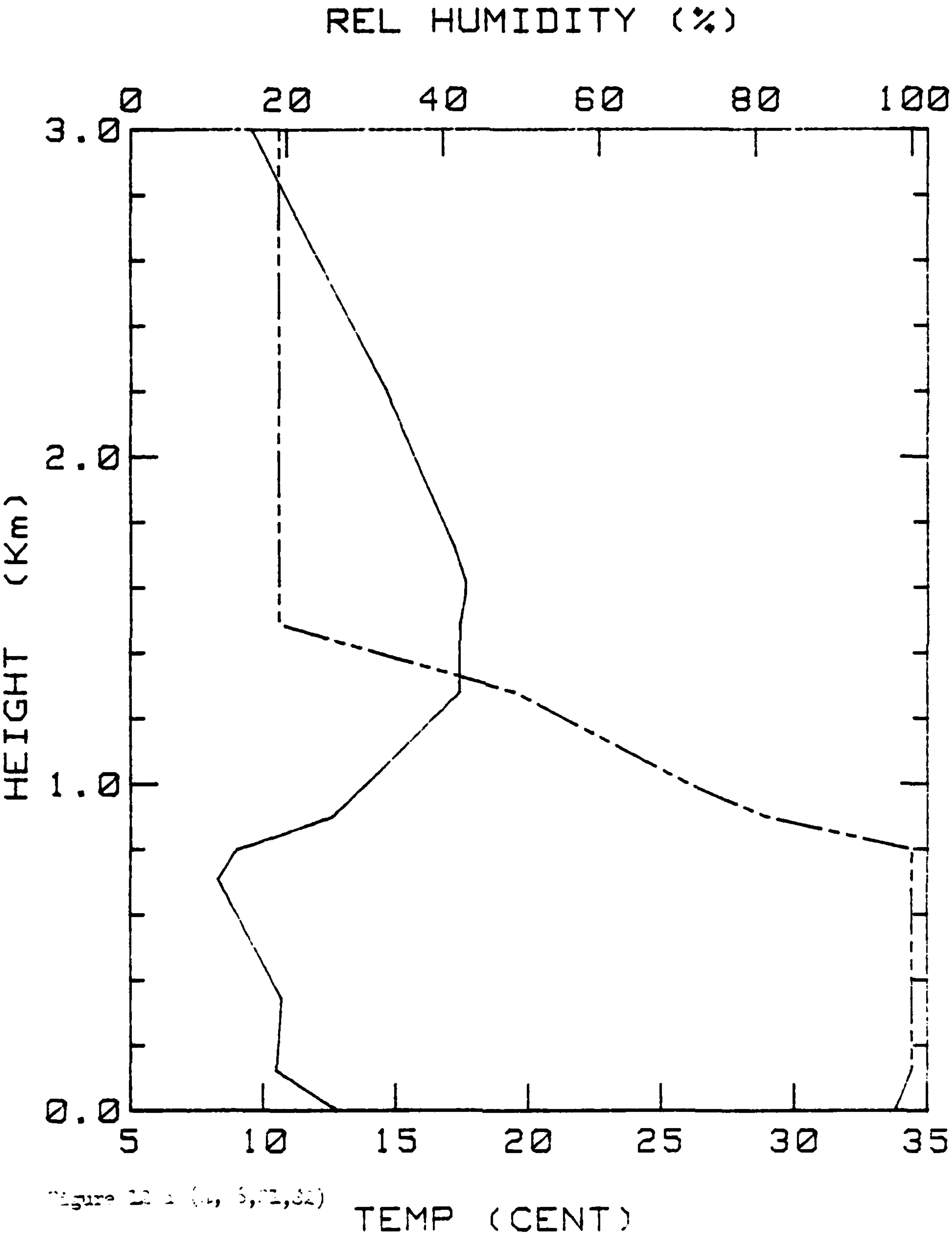
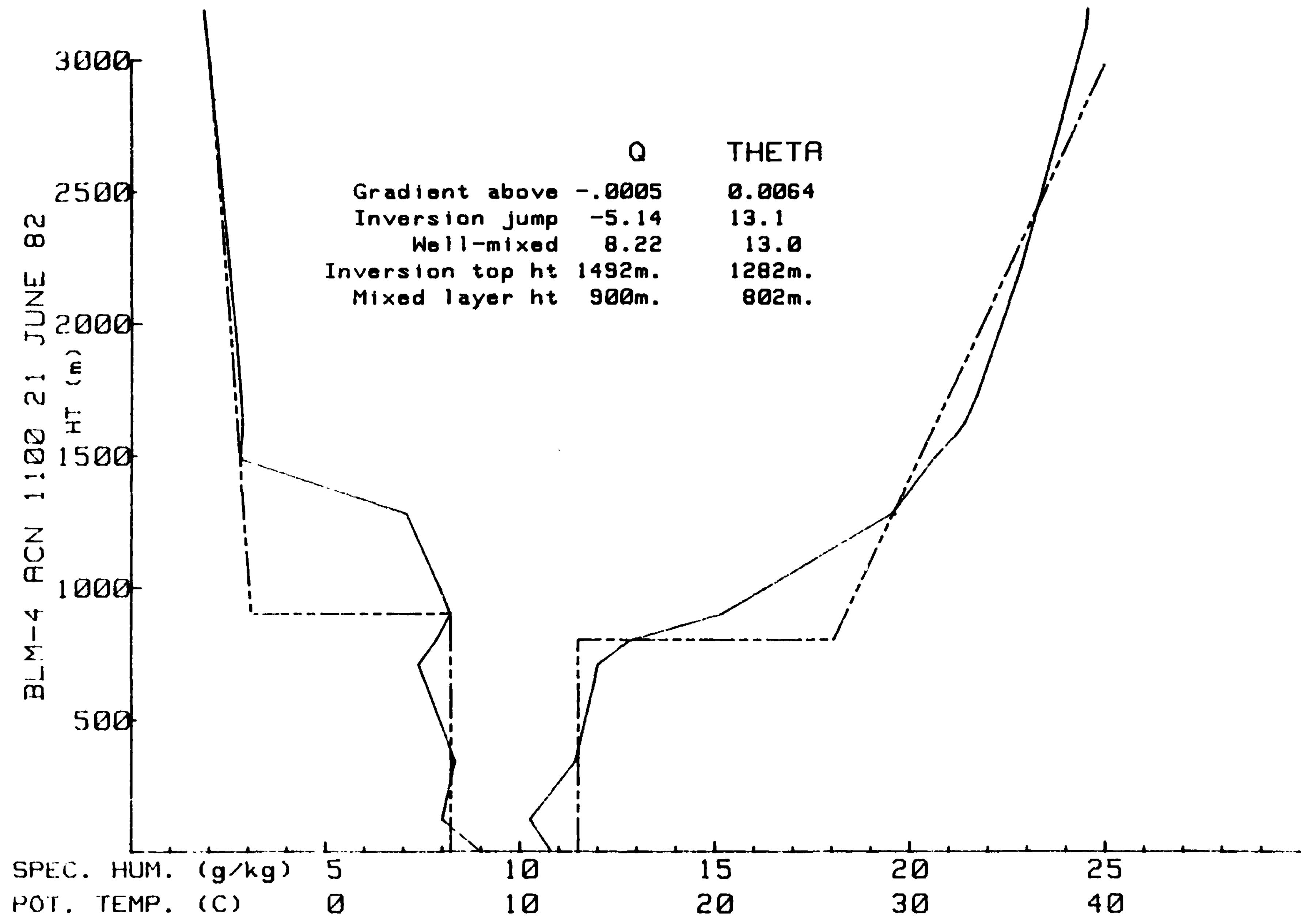


Figure [illegible] ([illegible], [illegible],[illegible],82)

BLM-4 21 JUNE 82 1100



BLM-4 ACN 1100 21 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0005 0.0064
Inversion jump -5.14 13.1
Well-mixed 8.22 13.0
Inversion top ht 1492m. 1282m.
Mixed layer ht 900m. 802m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

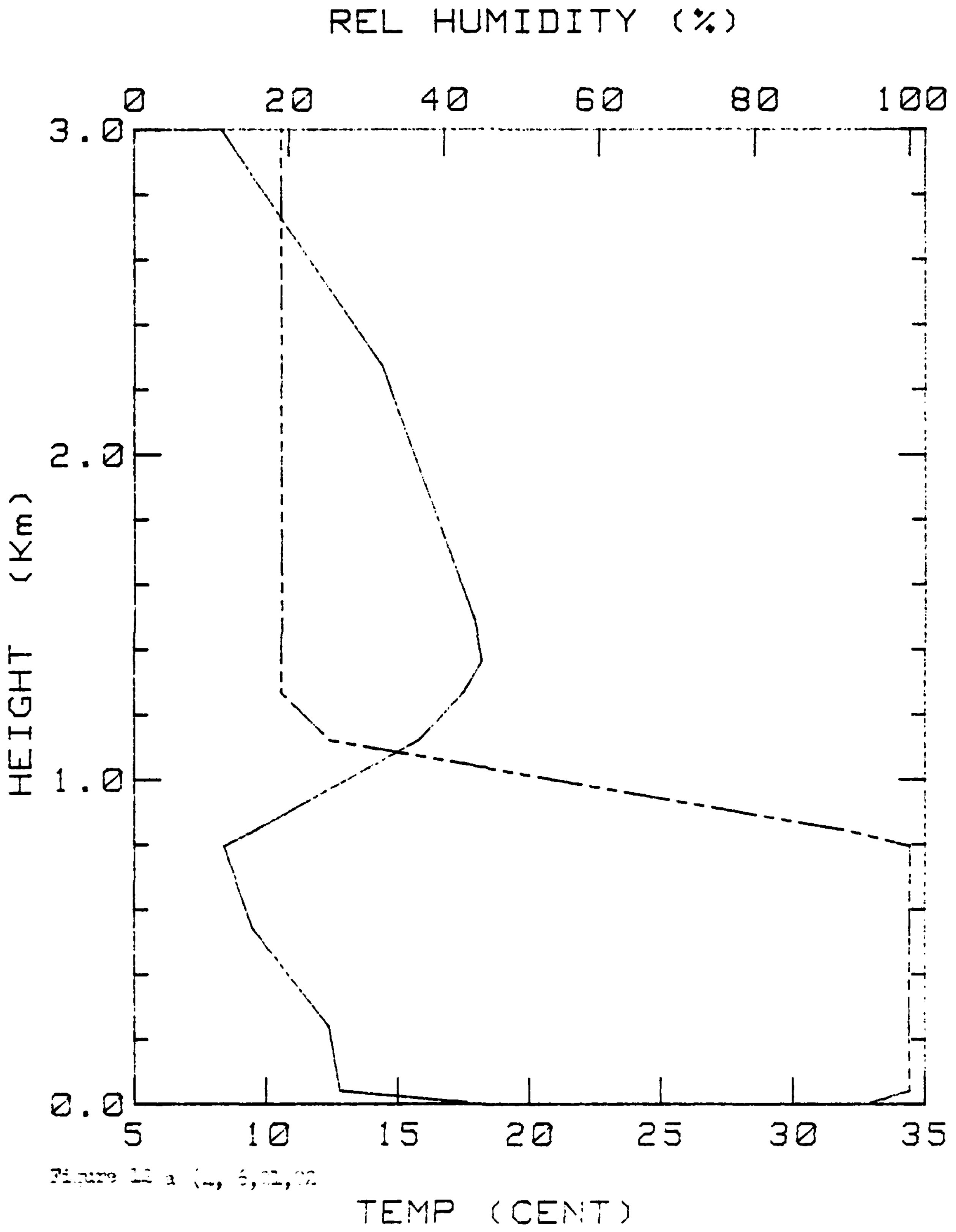
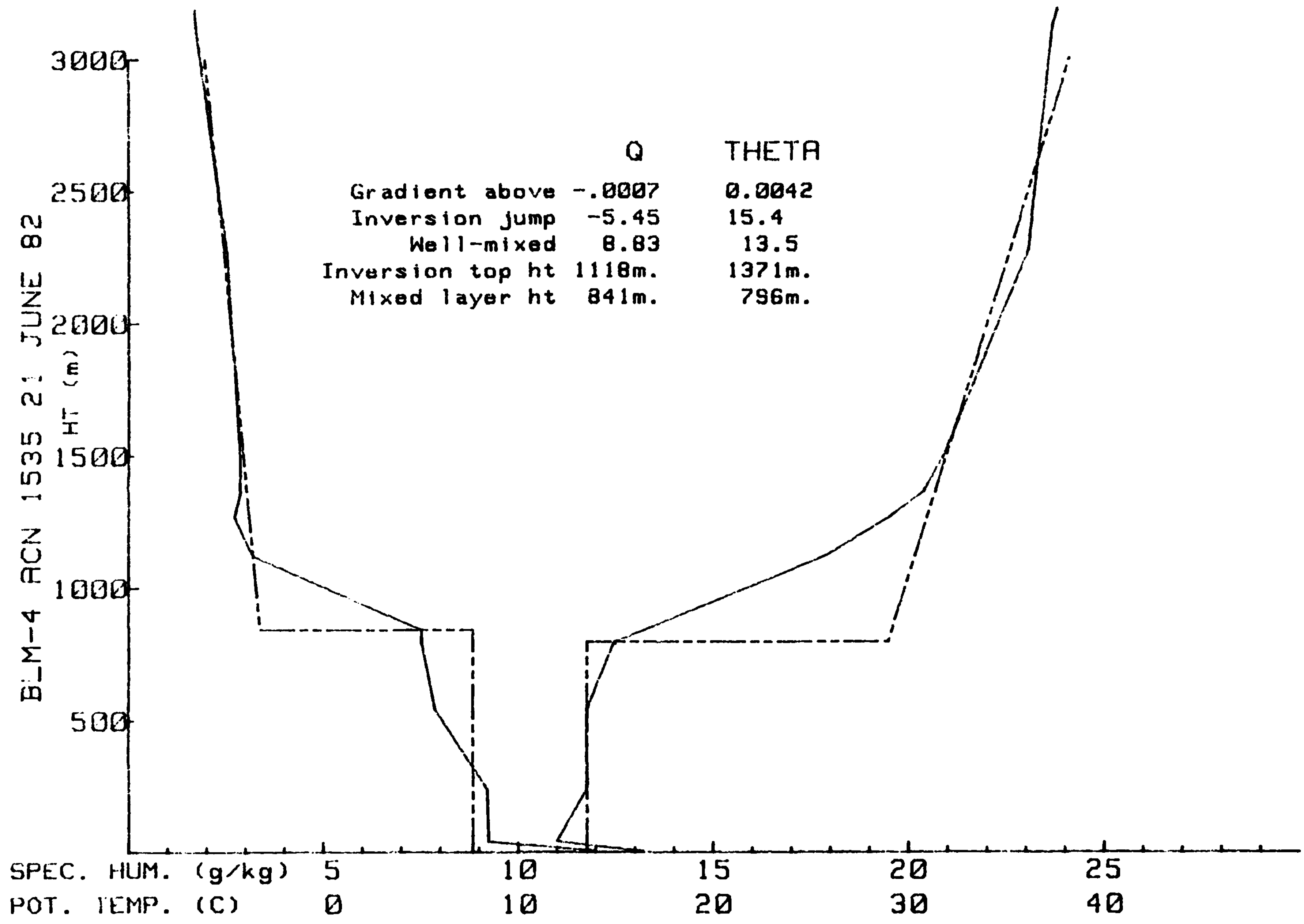


Figure 12 a [illegible]

BLM-4 21 JUNE 82 1535


BLM-4 ACN 1535 21 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0007 0.0042
Inversion jump -5.45 15.4
Well-mixed 8.83 13.5
Inversion top ht 1118m. 1371m.
Mixed layer ht 841m. 796m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

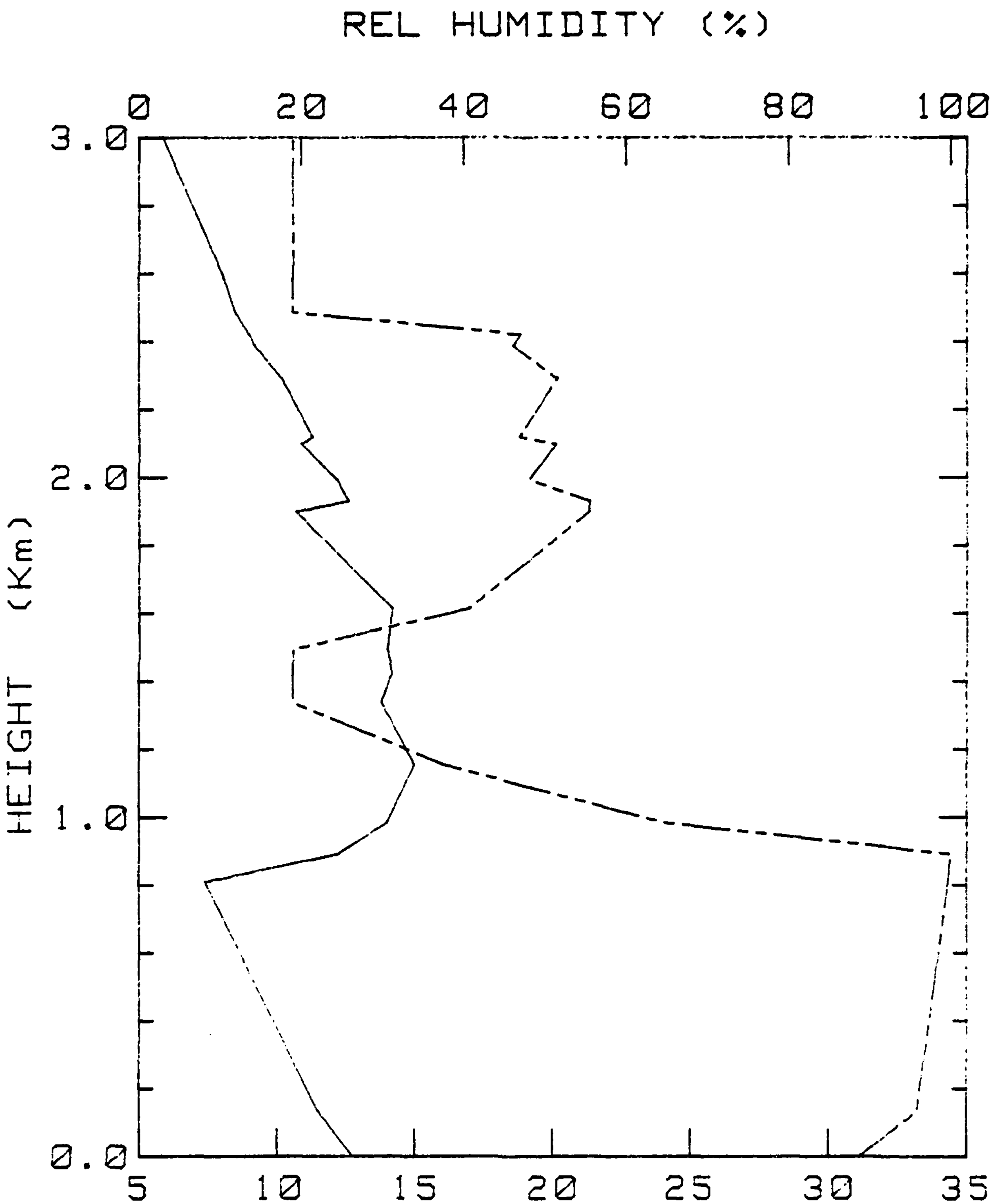
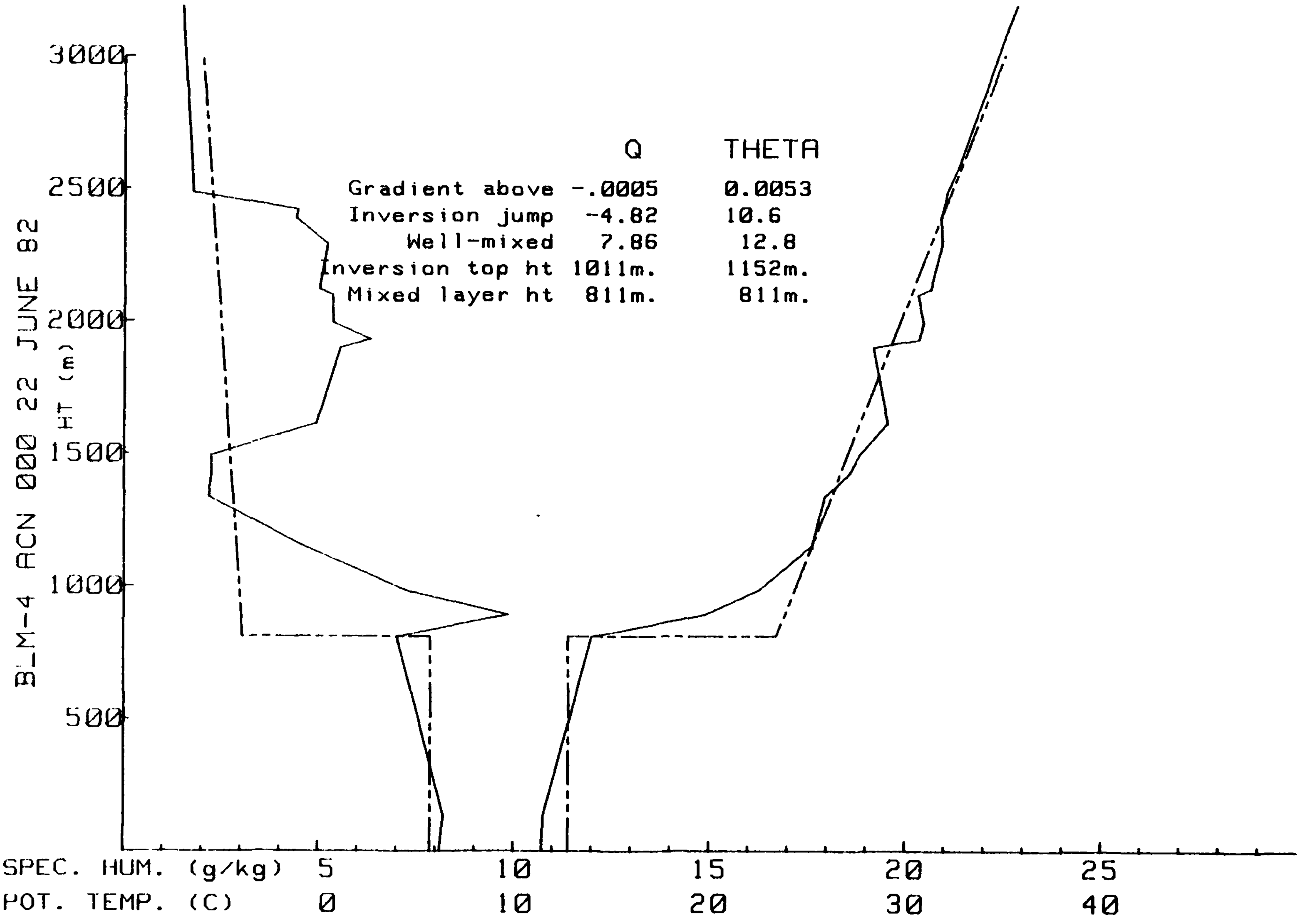


Figure [illegible] a [illegible], 6,22,82)

TEMP (CENT)

BLM-4 22 JUNE 82 0



BLM-4 ACN 000 22 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0053
Inversion jump -4.82 10.6
Well-mixed 7.86 12.8
Inversion top ht 1011m. 1152m.
Mixed layer ht 811m. 811m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

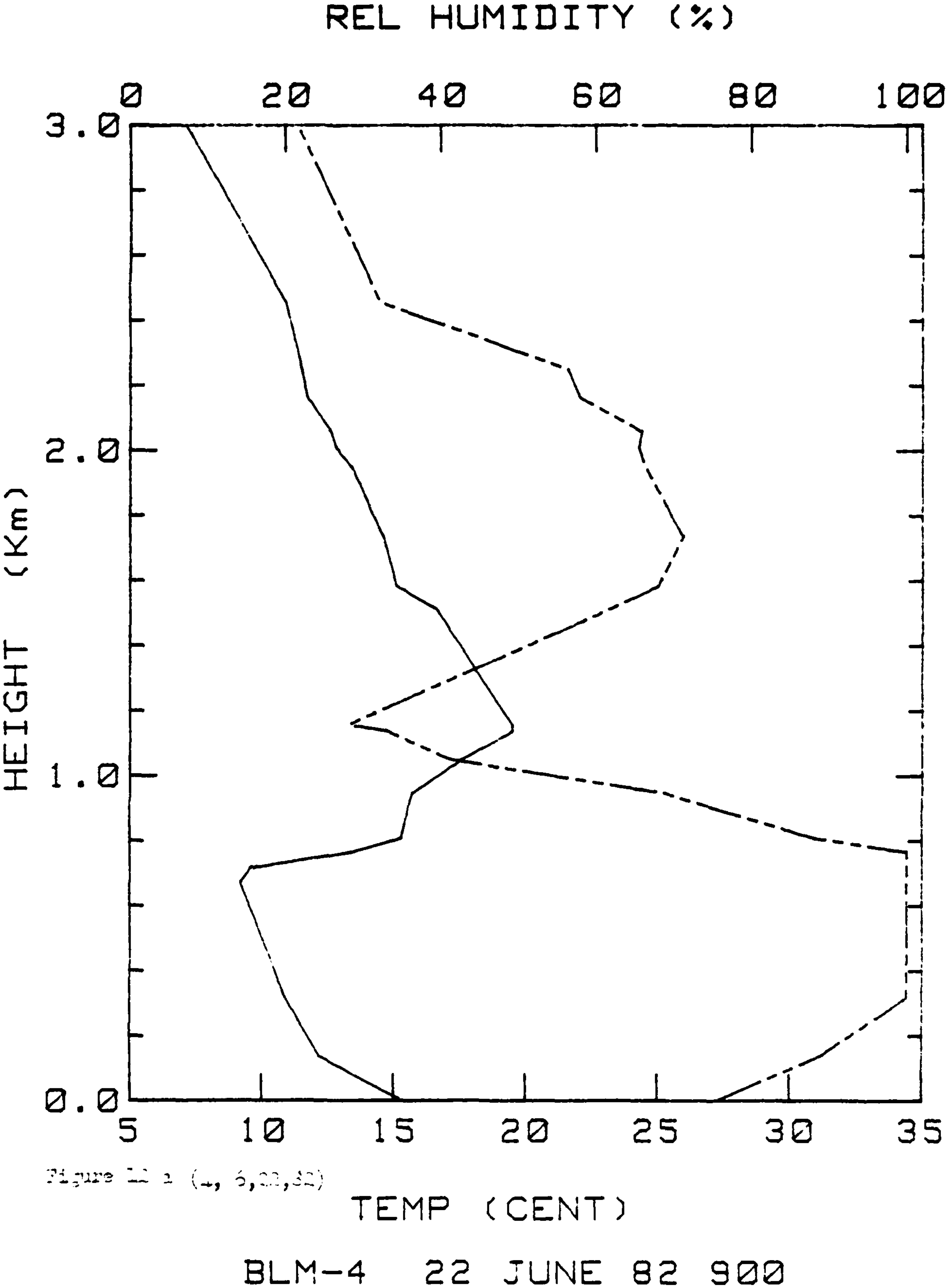
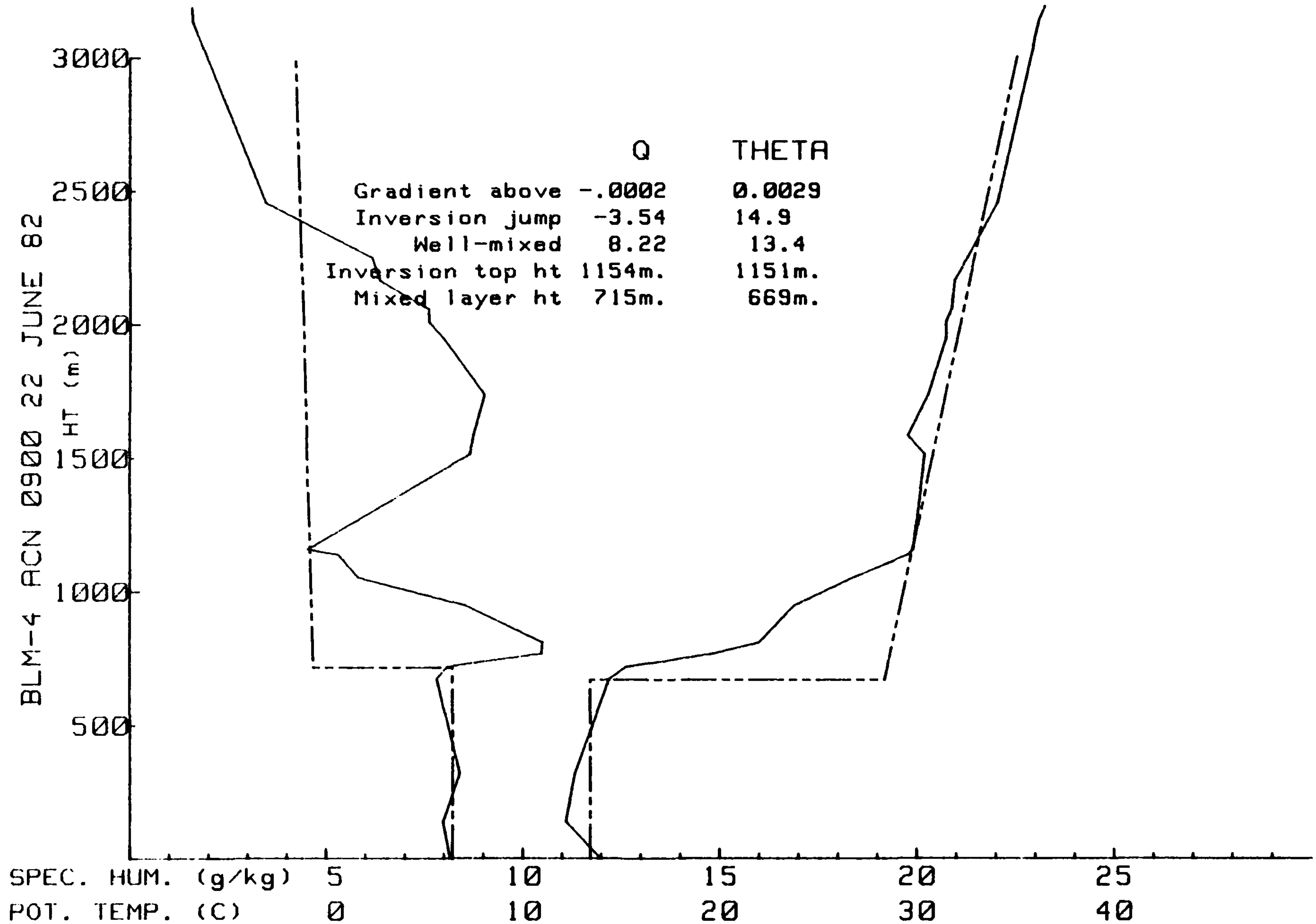

REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-4 22 JUNE 82 900

Figure [illegible] a ([illegible], 6, [illegible], 32)


BLM-4 ACN 0900 22 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0002 0.0029
Inversion jump -3.54 14.9
Well-mixed 8.22 13.4
Inversion top ht 1154m. 1151m.
Mixed layer ht 715m. 669m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

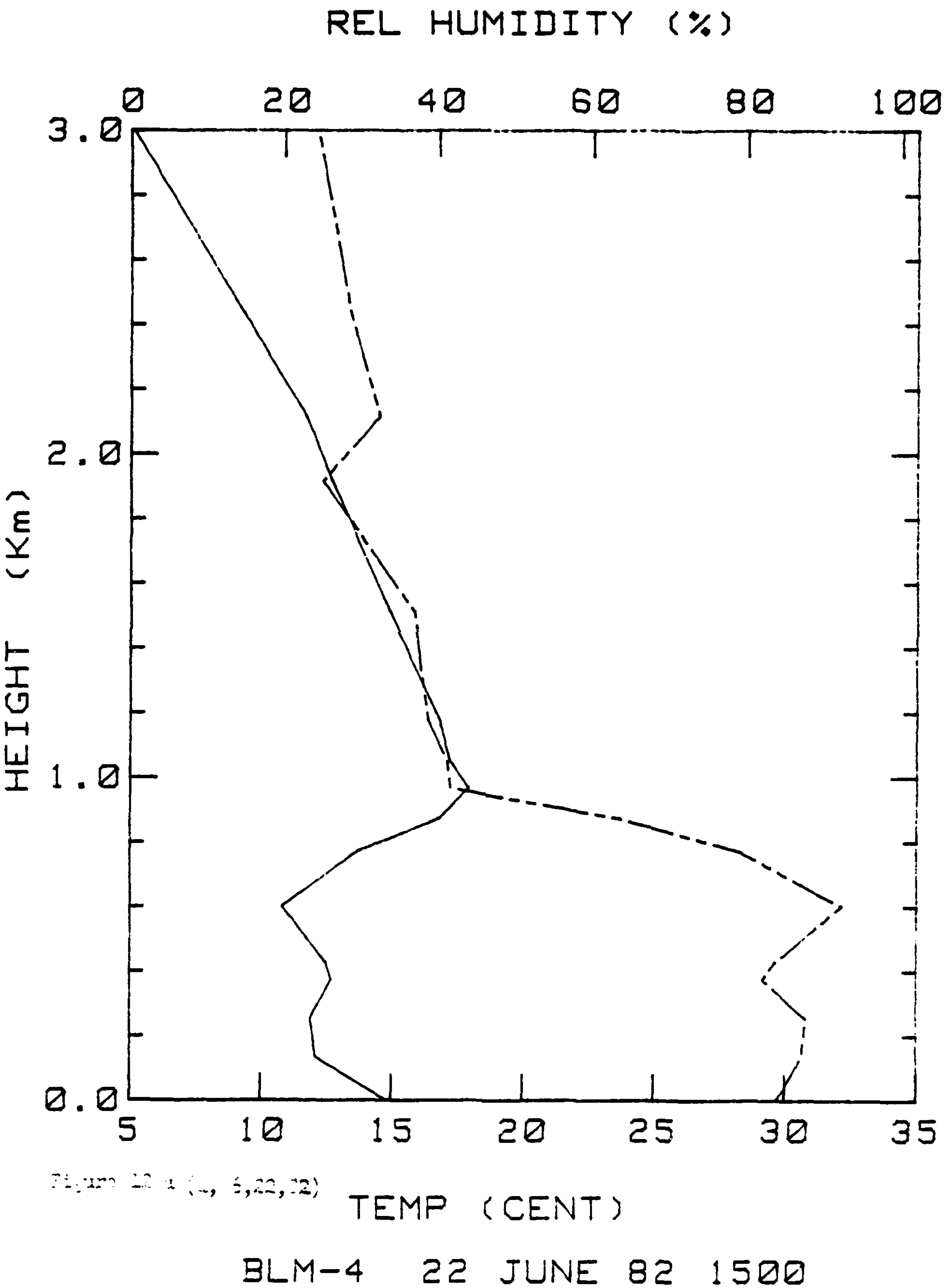
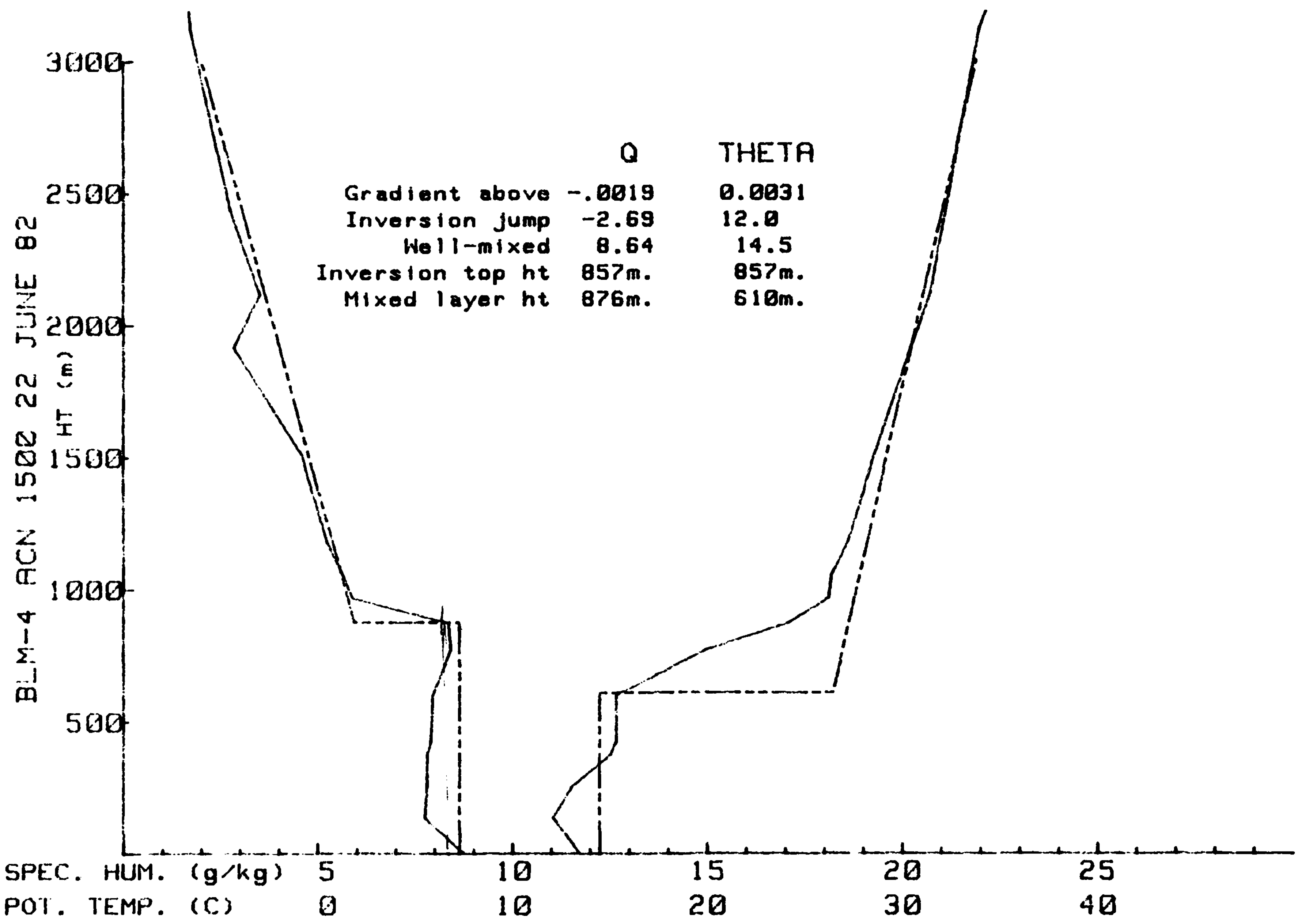

REL HUMIDITY (%)
0
20
40
60
80
100
3.0
2.0
1.0
0.0
HEIGHT (Km)
5
10
15
20
25
30
35
TEMP (CENT)
BLM-4 22 JUNE 82 1500

Figure 12 a [illegible]


BLM-4 ACN 1500 22 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0019 0.0031
Inversion jump -2.69 12.0
Well-mixed 8.64 14.5
Inversion top ht 857m. 857m.
Mixed layer ht 876m. 610m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

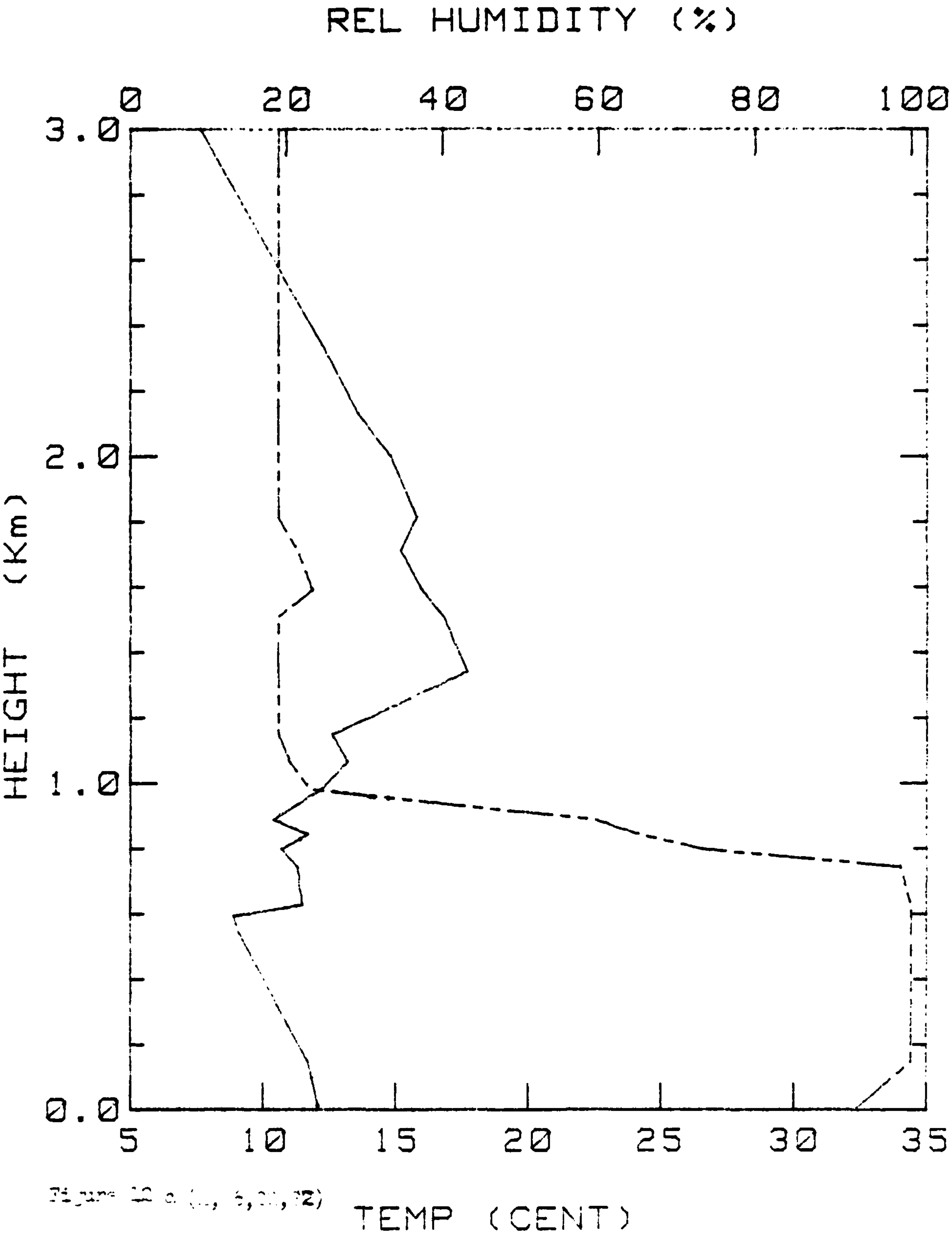
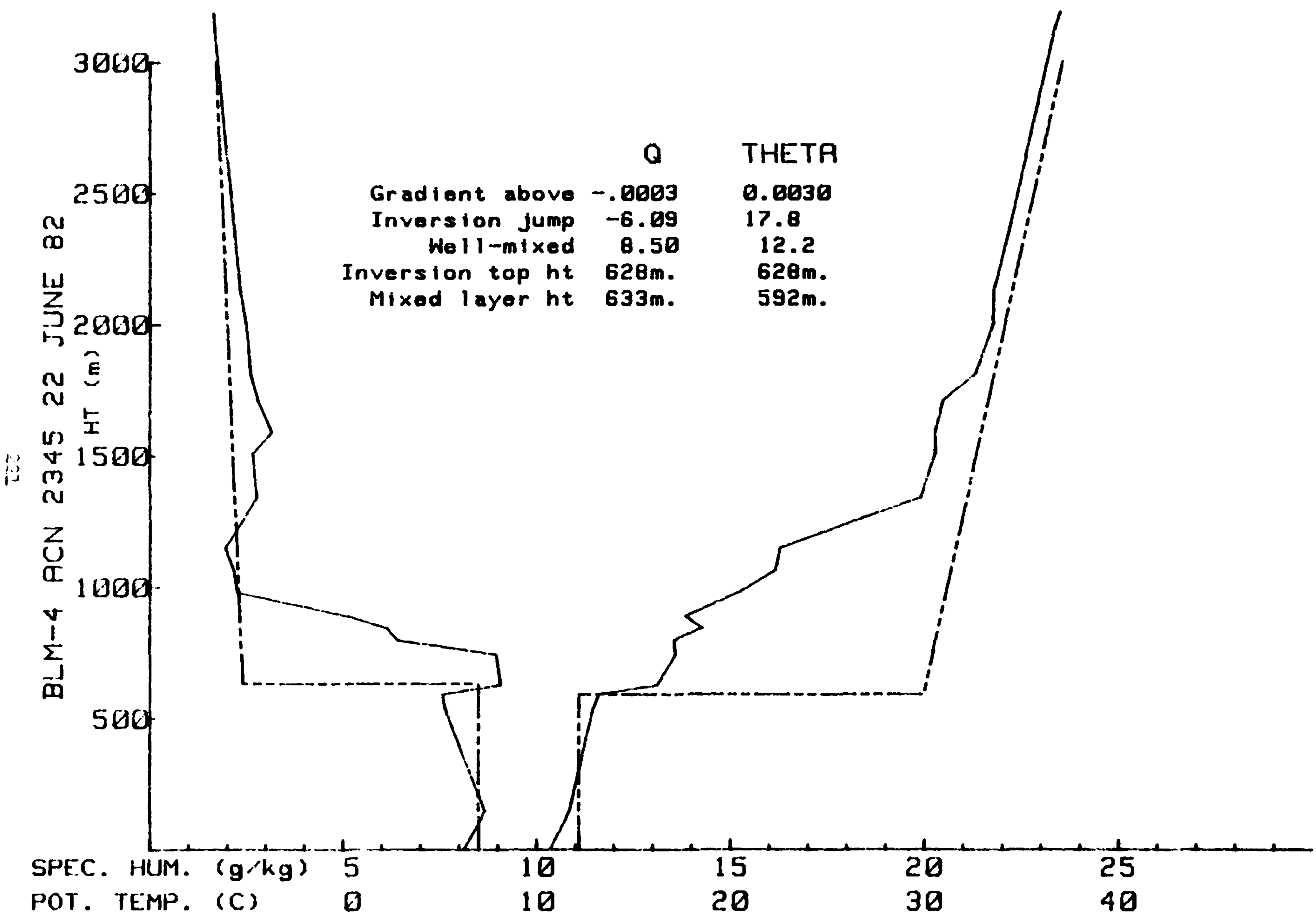


Figure 12 a [illegible]

BLM-4 22 JUNE 82 2345


BLM-4 ACN 2345 22 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0003 0.0030
Inversion jump -6.09 17.8
Well-mixed 8.50 12.2
Inversion top ht 628m. 628m.
Mixed layer ht 633m. 592m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

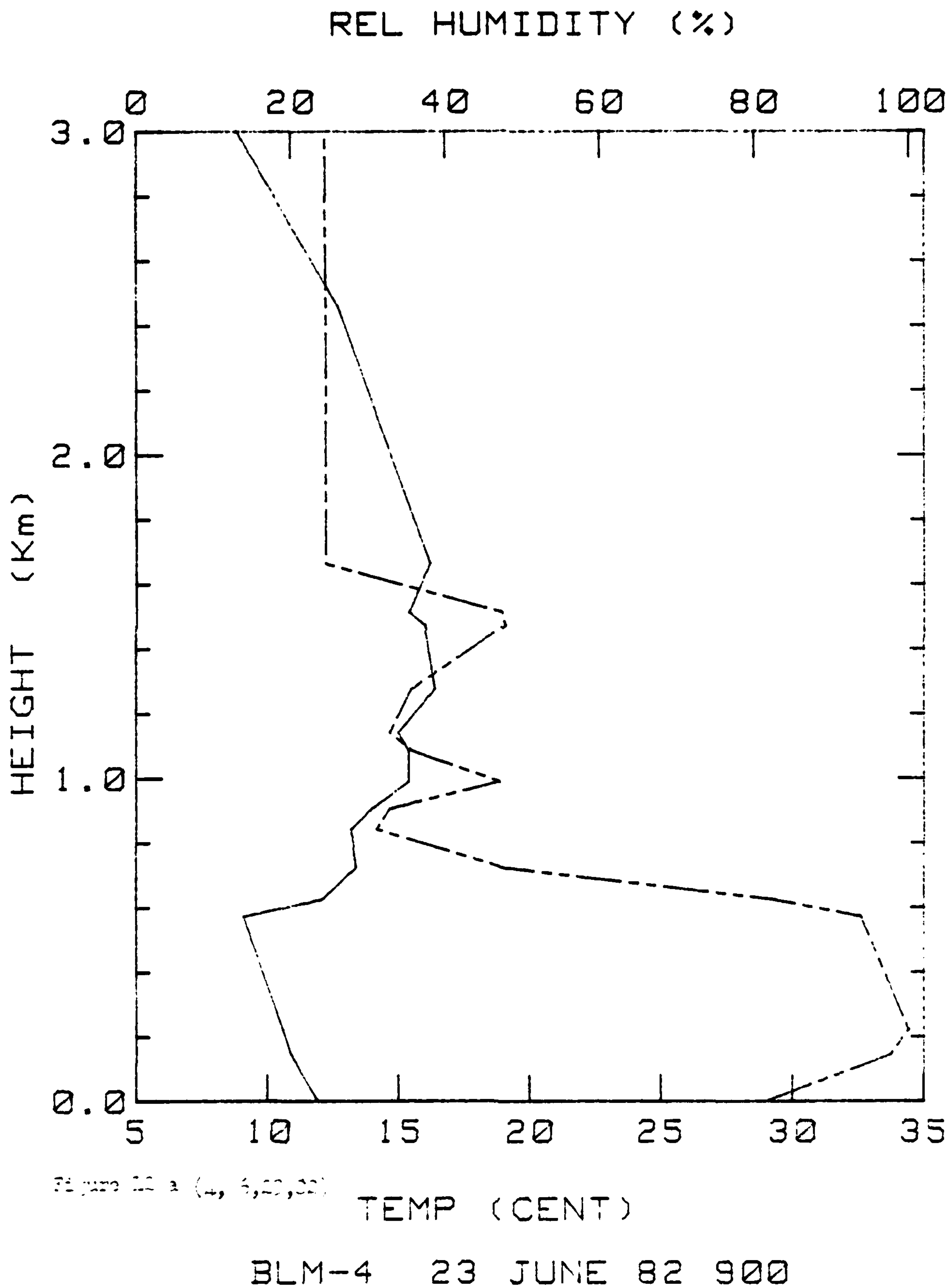
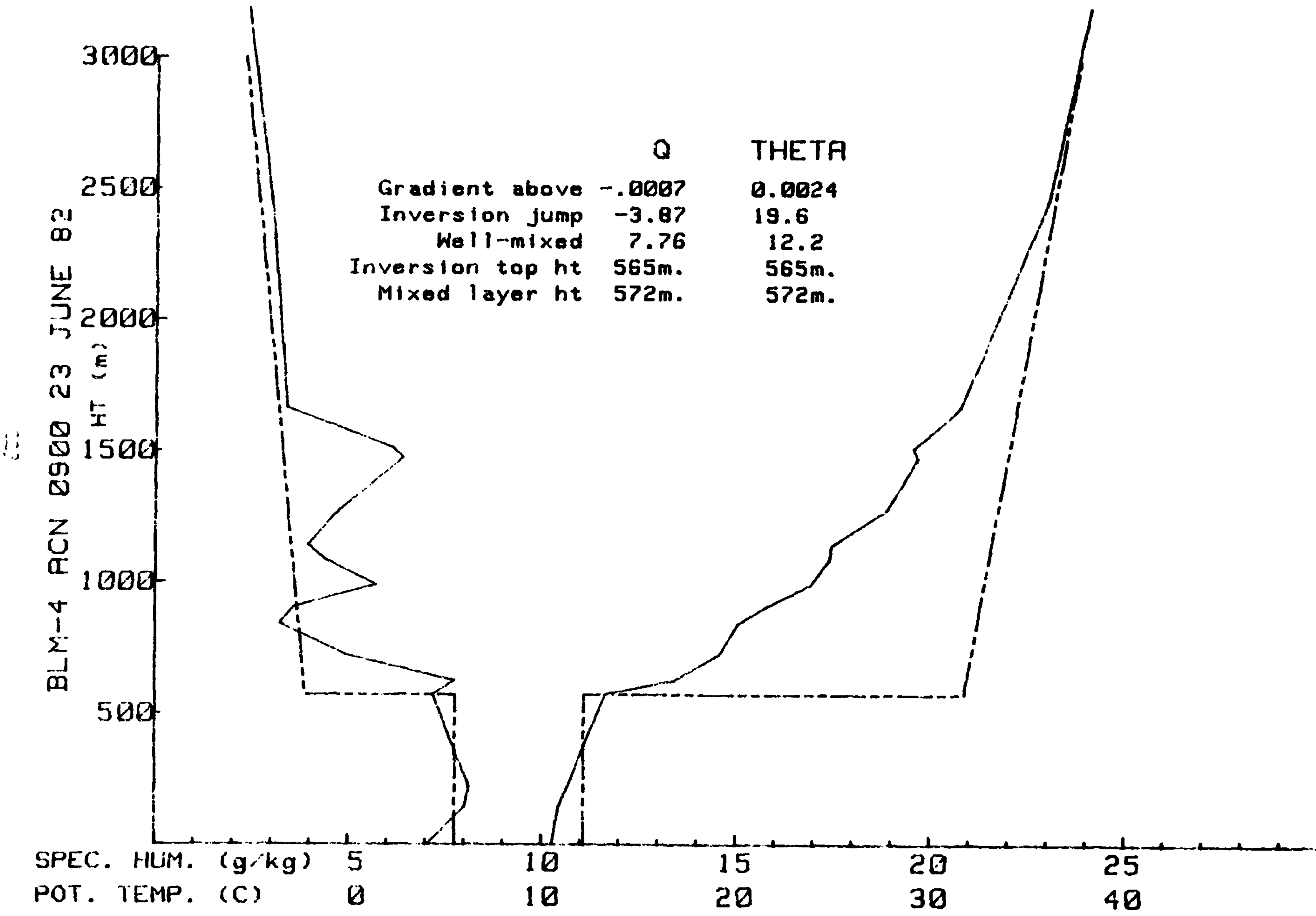
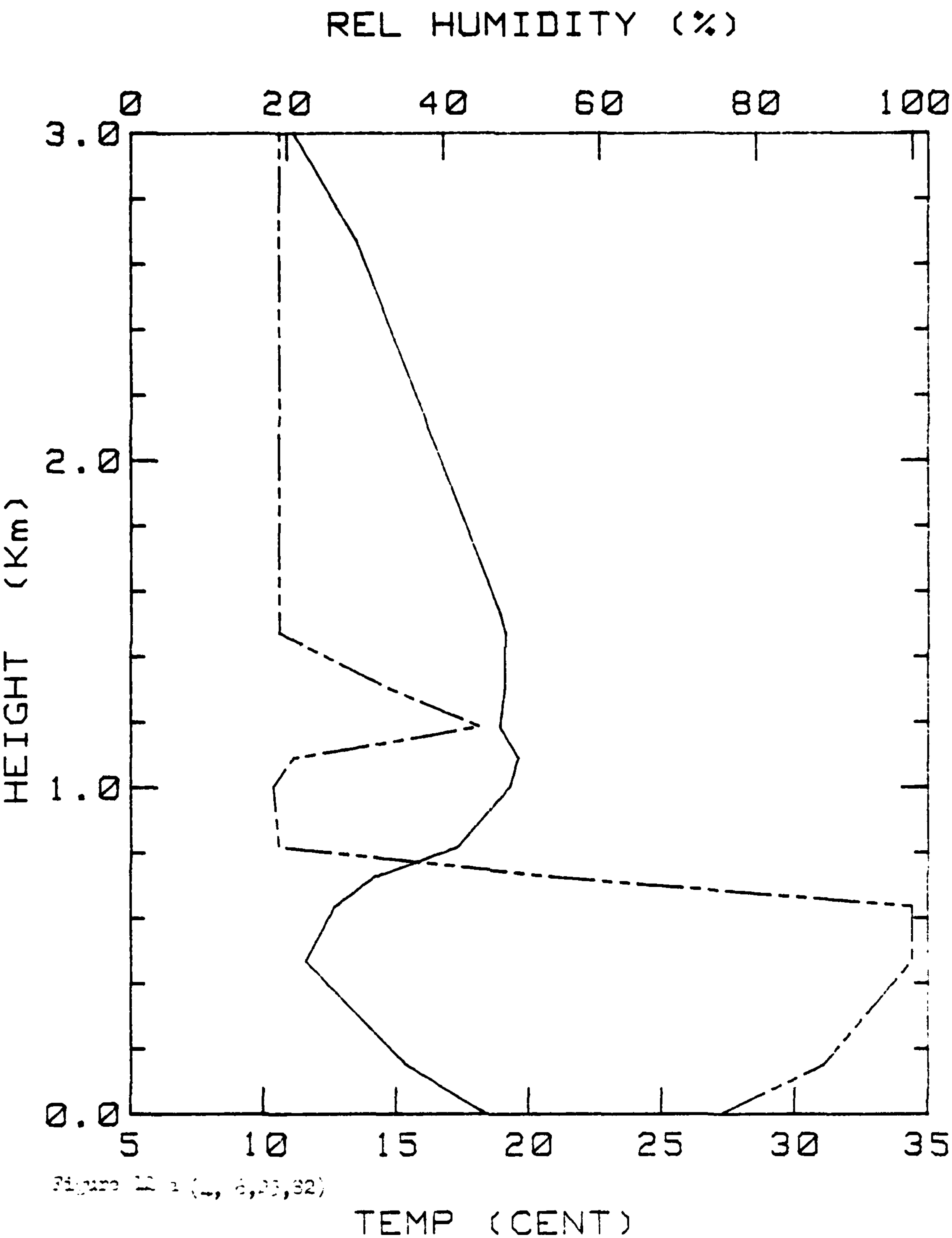


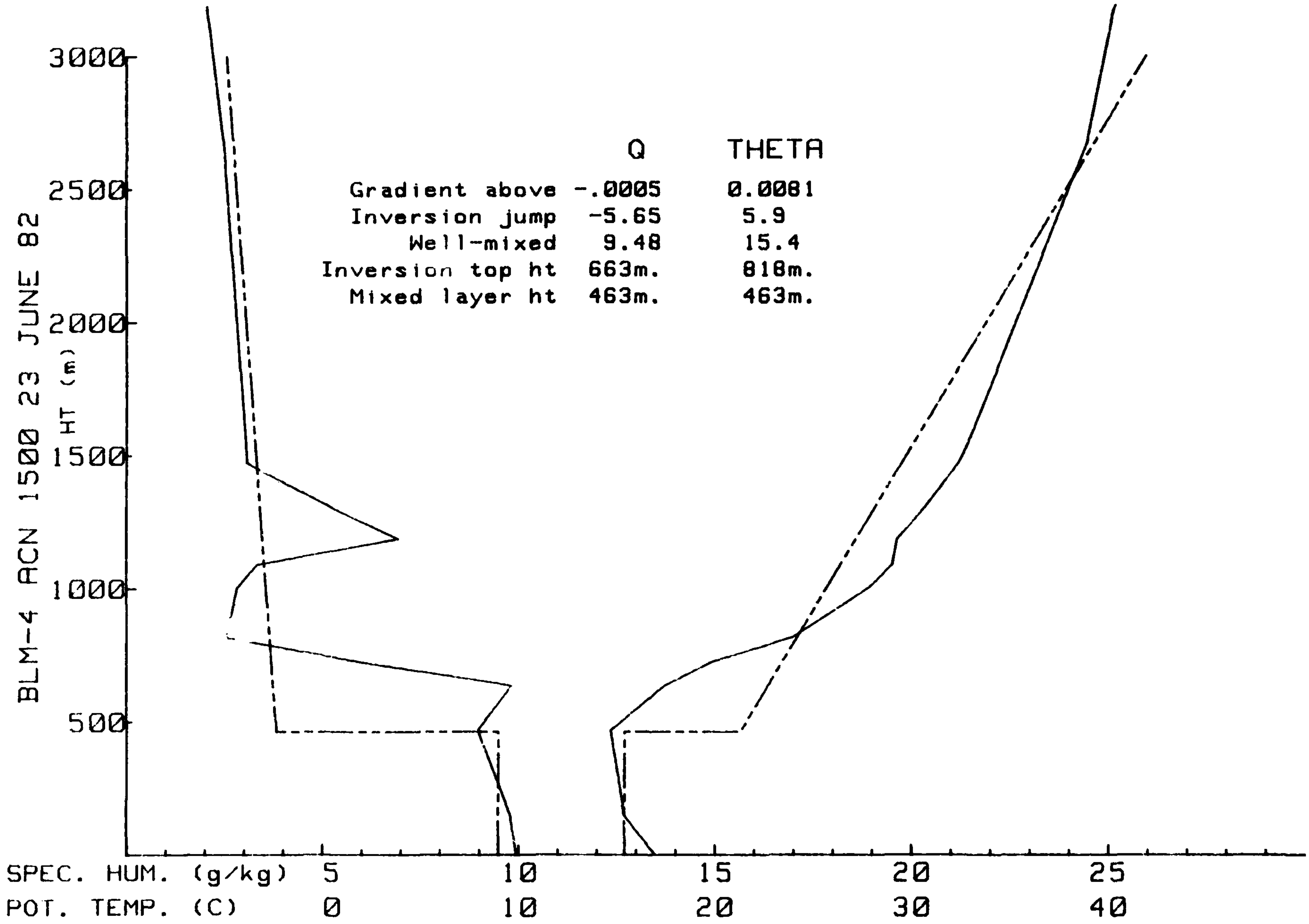
Figure 22 a (4, 6,20,22)



BLM-4 ACN 0900 23 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0007 0.0024
Inversion jump -3.87 19.6
Well-mixed 7.76 12.2
Inversion top ht 565m. 565m.
Mixed layer ht 572m. 572m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40



BLM-4 23 JUNE 82 1500


BLM-4 ACN 1500 23 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0081
Inversion jump -5.65 5.9
Well-mixed 9.48 15.4
Inversion top ht 663m. 818m.
Mixed layer ht 463m. 463m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

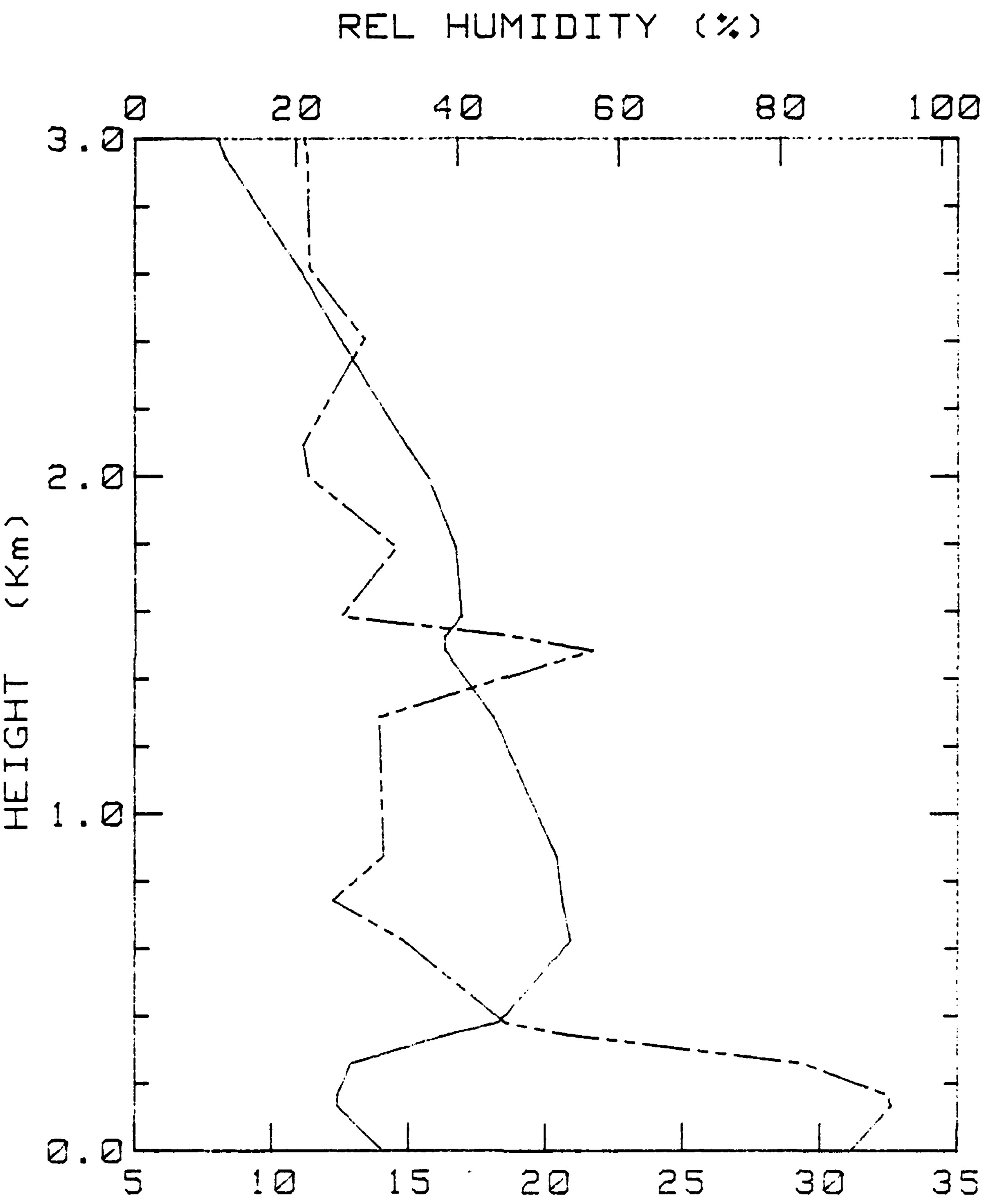
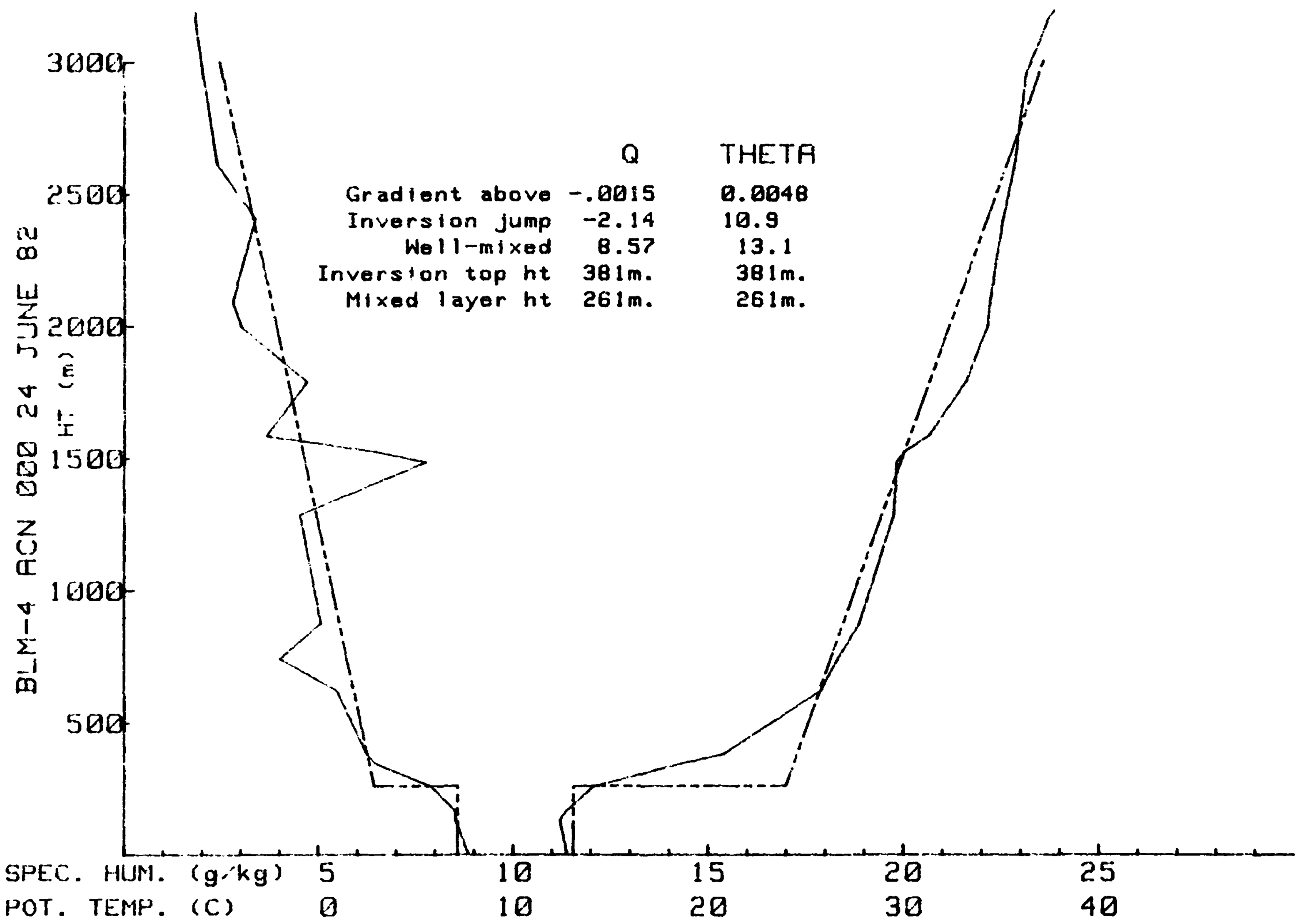


Figure 12 a ([illegible], 24,82)

TEMP (CENT)

BLM-4 24 JUNE 82 0


BLM-4 ACN 000 24 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0015 0.0048
Inversion jump -2.14 10.9
Well-mixed 8.57 13.1
Inversion top ht 381m. 381m.
Mixed layer ht 261m. 261m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

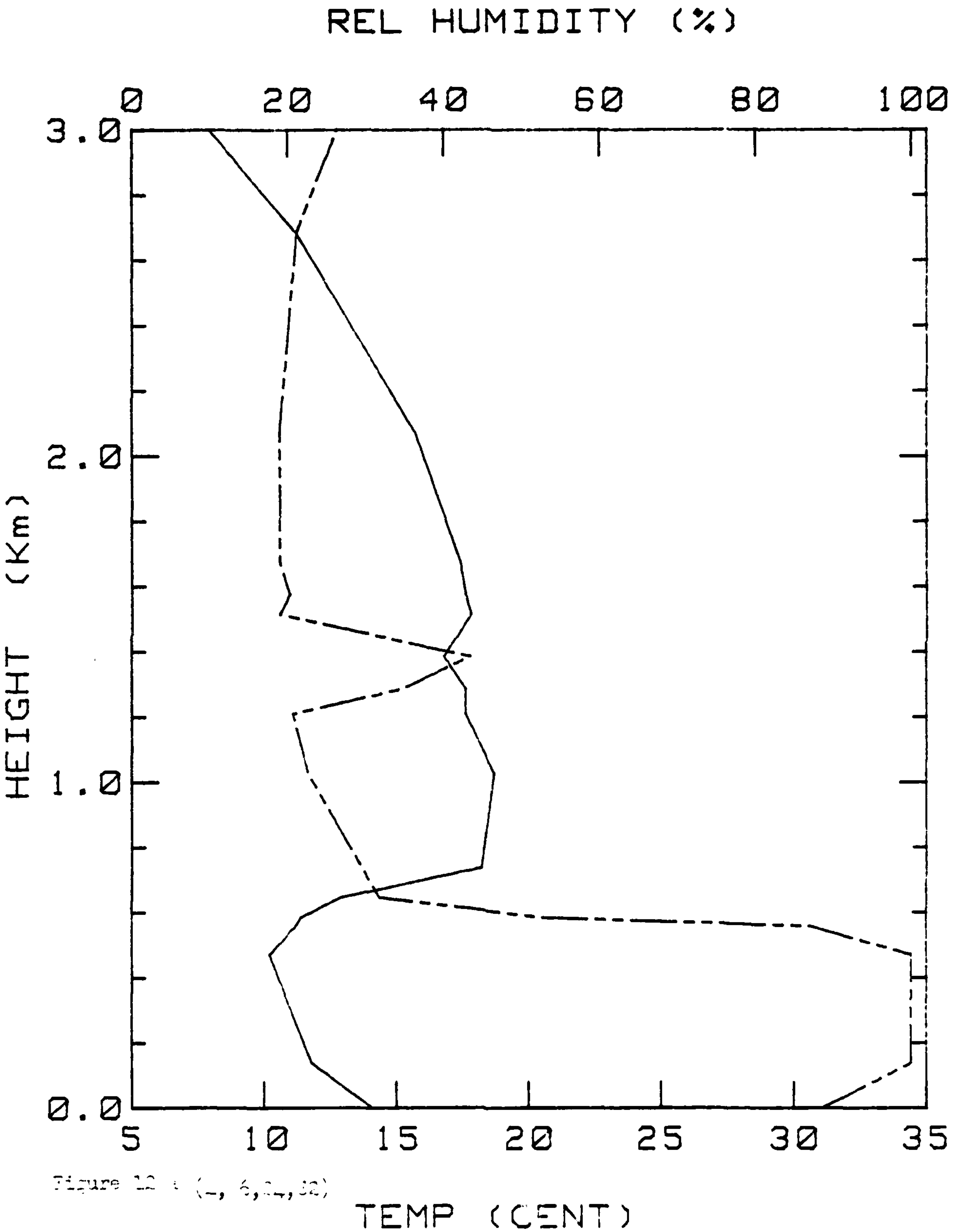
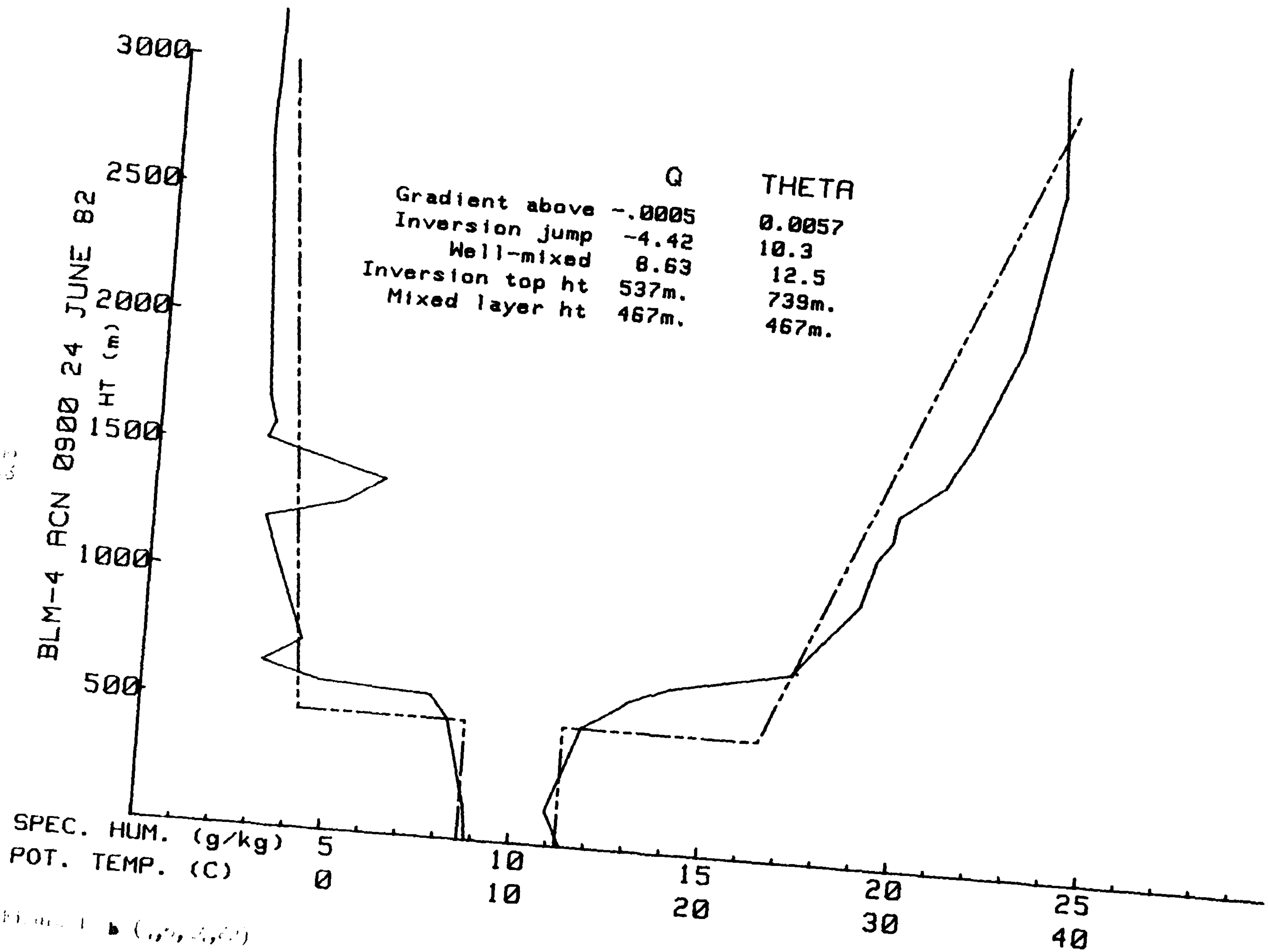


Figure 12 : (-, 6,24,82)

BLM-4 24 JUNE 82 900


BLM-4 ACN 0900 24 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0057
Inversion jump -4.42 10.3
Well-mixed 8.63 12.5
Inversion top ht 537m. 739m.
Mixed layer ht 467m. 467m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

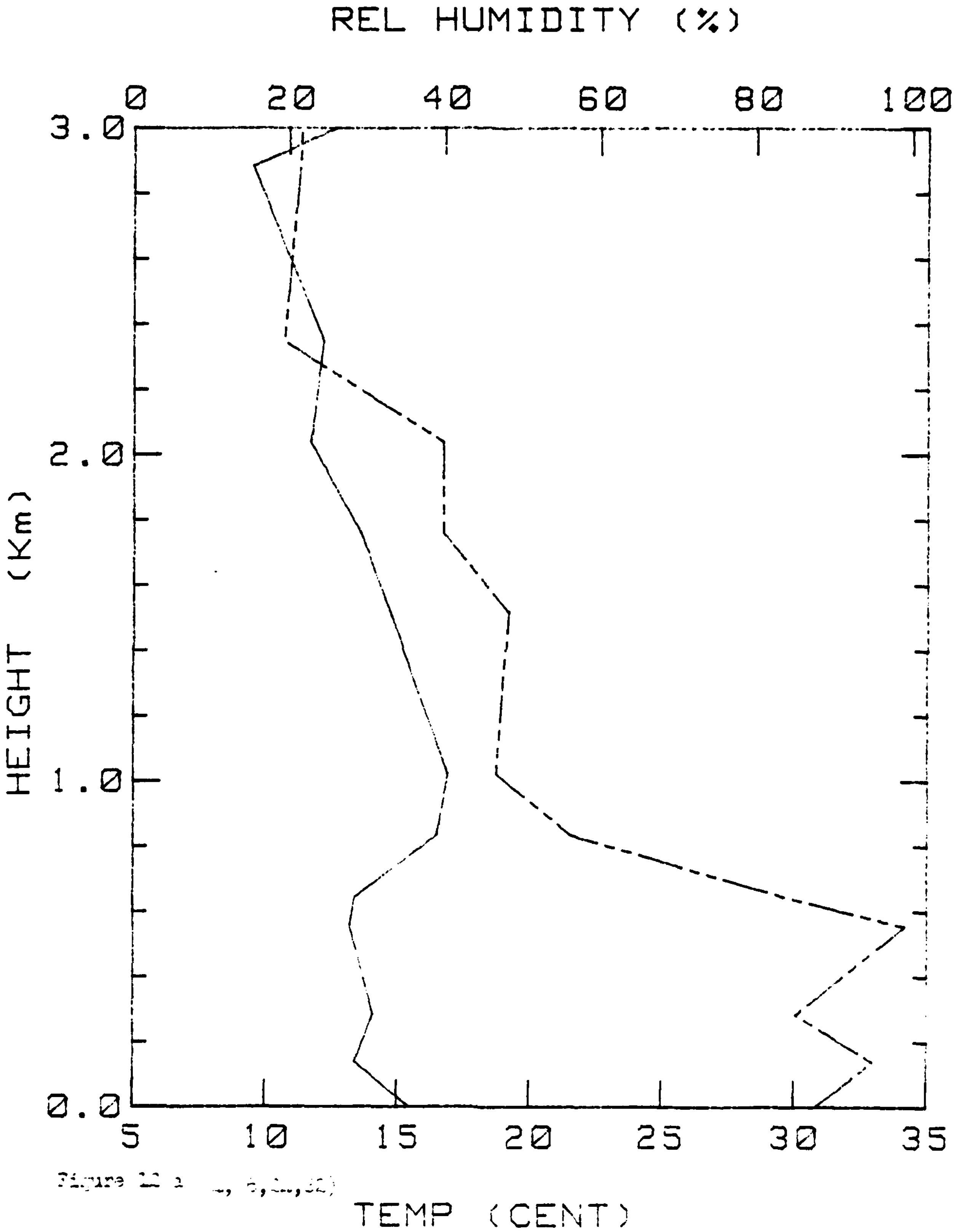
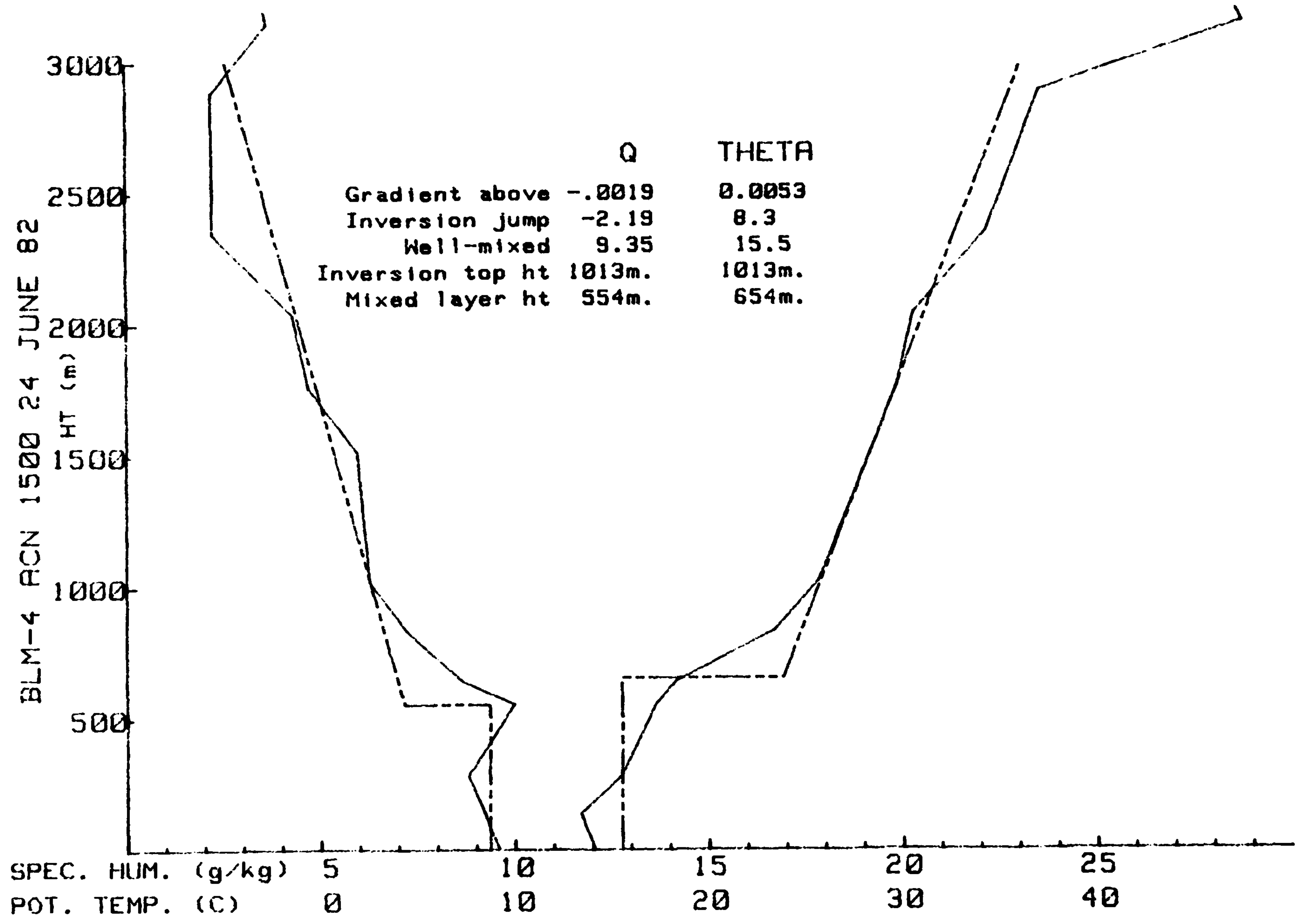


Figure 22 a [illegible]

BLM-4 24 JUNE 82 1500


BLM-4 ACN 1500 24 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0019 0.0053
Inversion jump -2.19 8.3
Well-mixed 9.35 15.5
Inversion top ht 1013m. 1013m.
Mixed layer ht 554m. 654m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

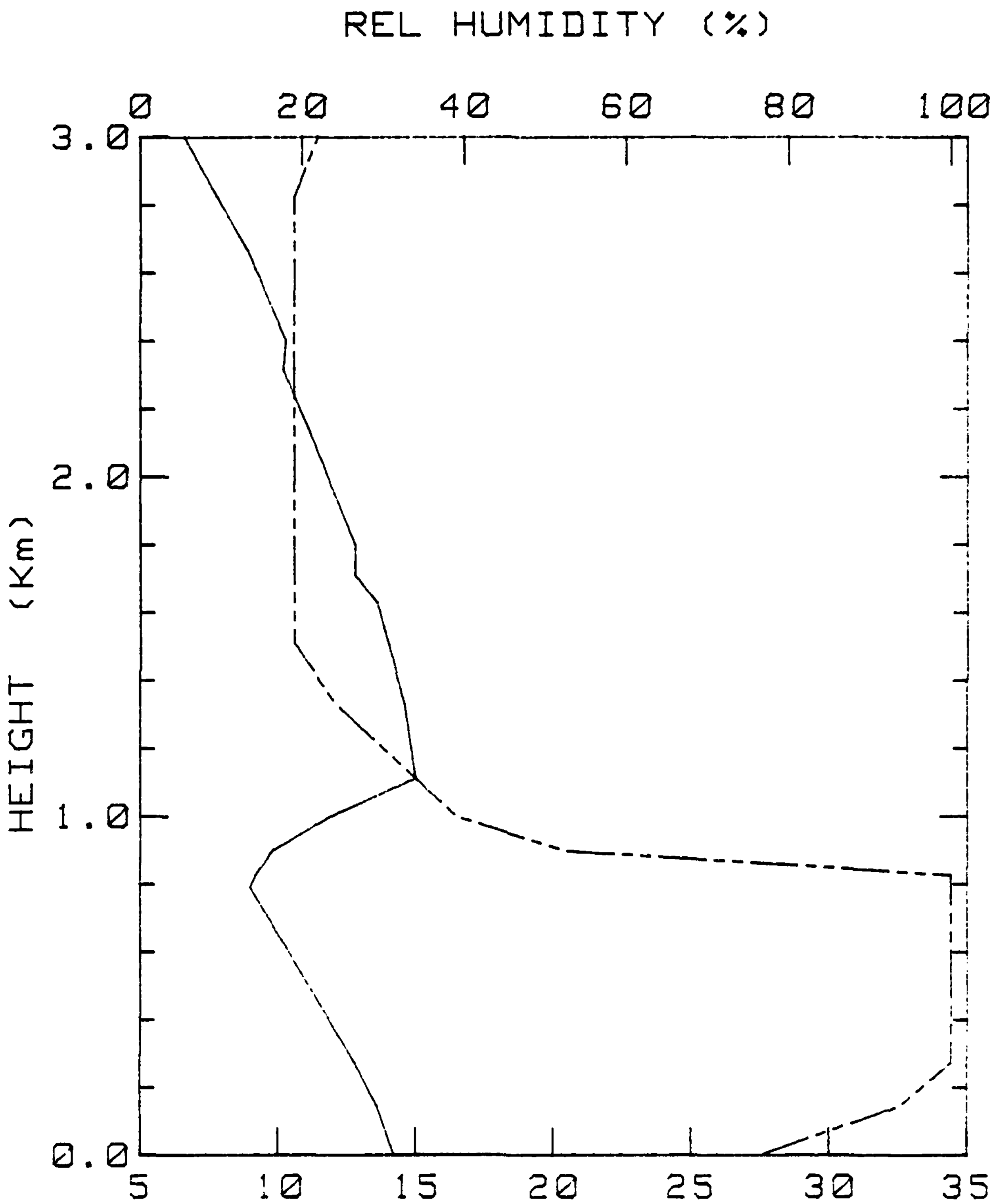
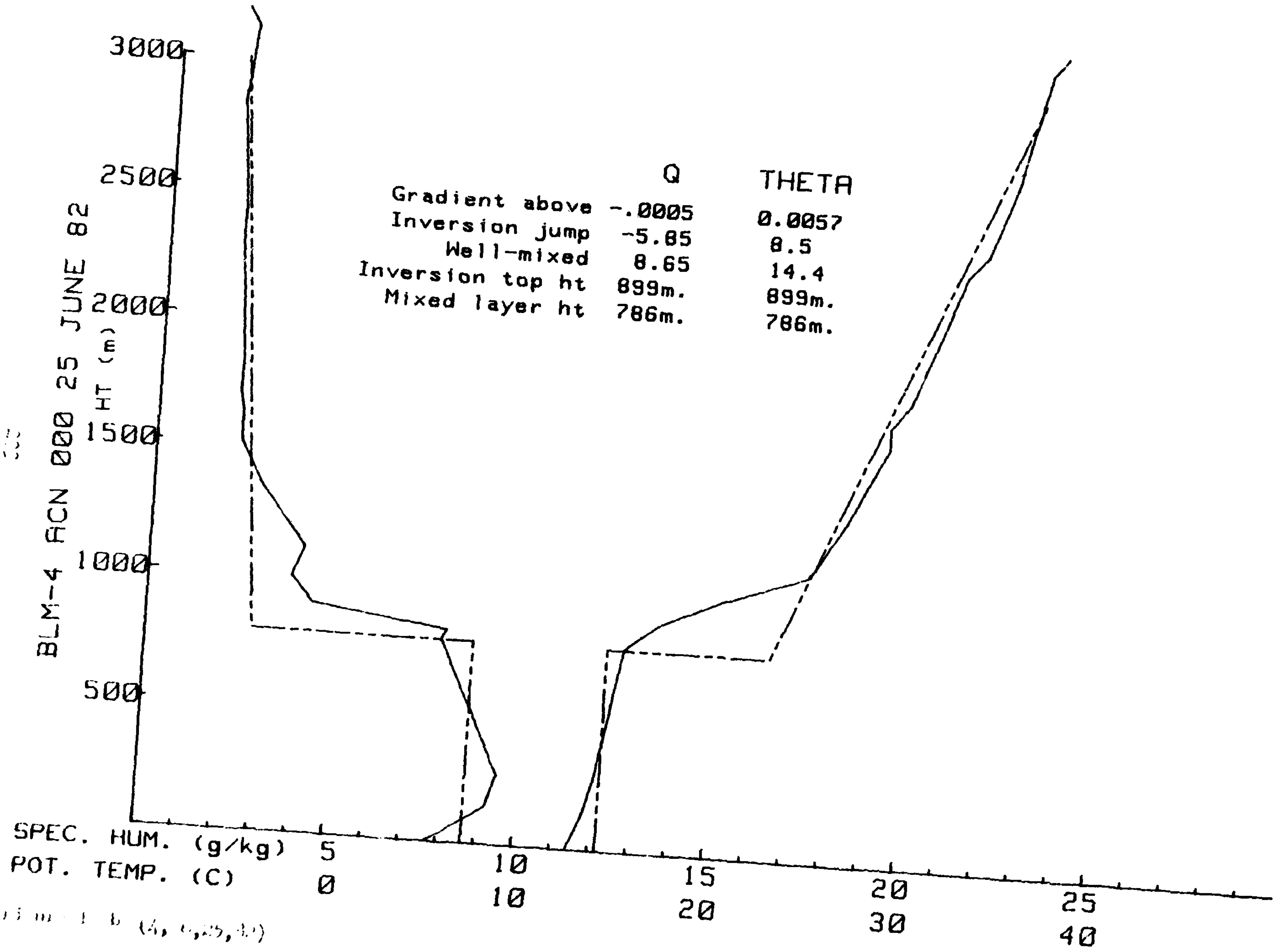


Figure 12 a (4, 6, 15, 32)

TEMP (CENT)

BLM-4 25 JUNE 82 0


BLM-4 ACN 000 25 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0057
Inversion jump -5.85 8.5
Well-mixed 8.65 14.4
Inversion top ht 899m. 899m.
Mixed layer ht 786m. 786m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

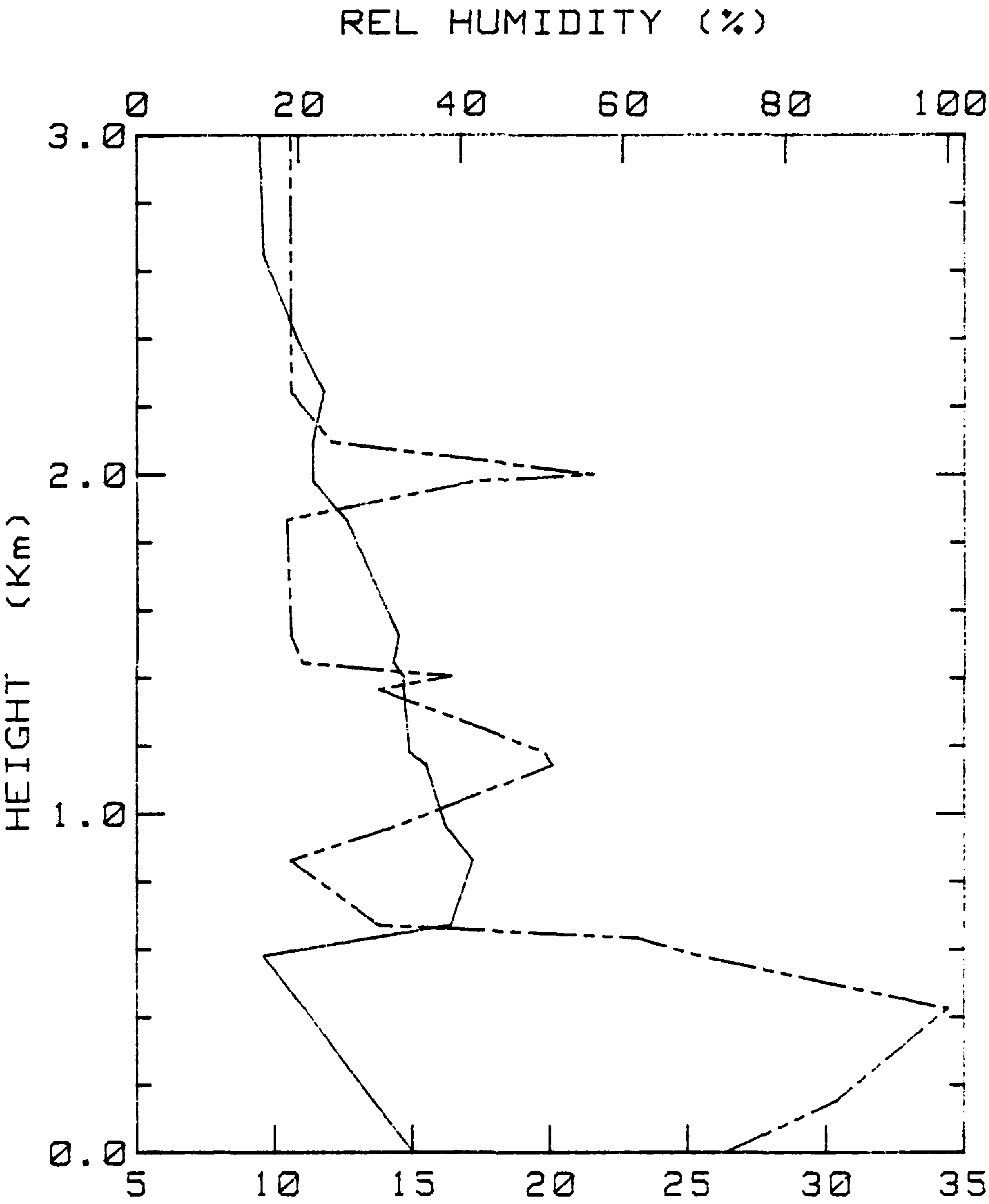
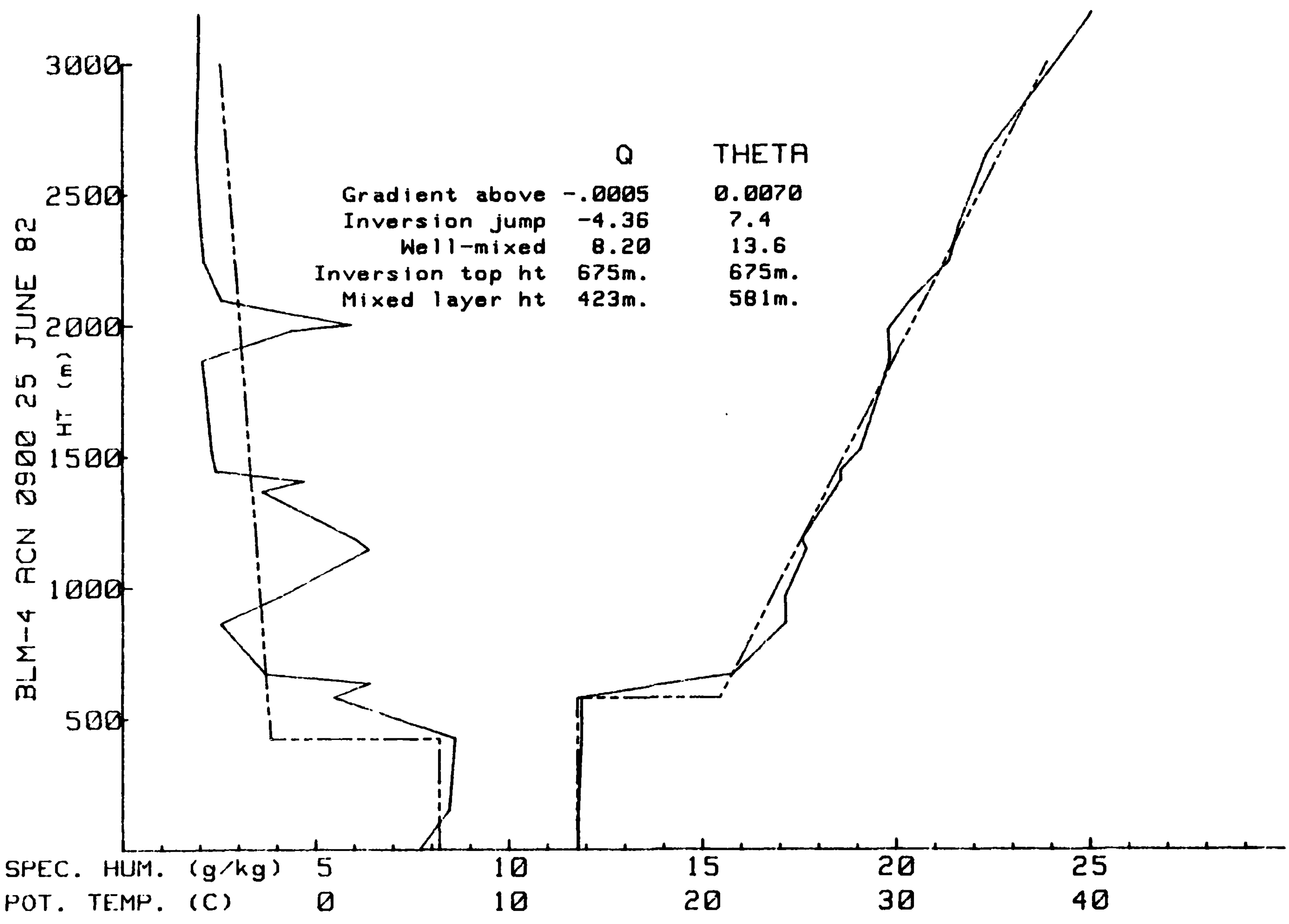


Figure [illegible] a ([illegible])

TEMP (CENT)

BLM-4 25 JUNE 82 900


BLM-4 ACN 0900 25 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0005 0.0070
Inversion jump -4.36 7.4
Well-mixed 8.20 13.6
Inversion top ht 675m. 675m.
Mixed layer ht 423m. 581m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

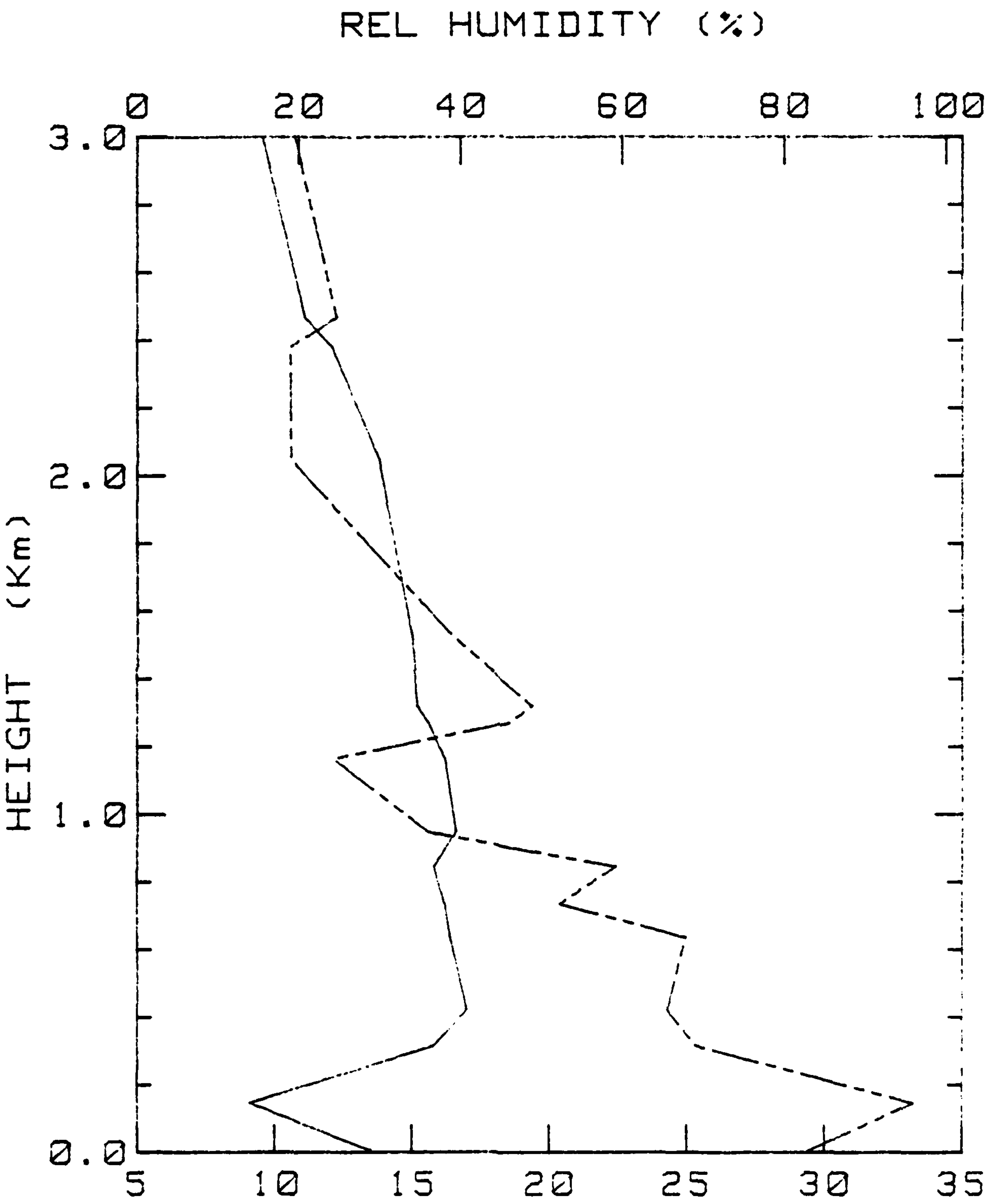
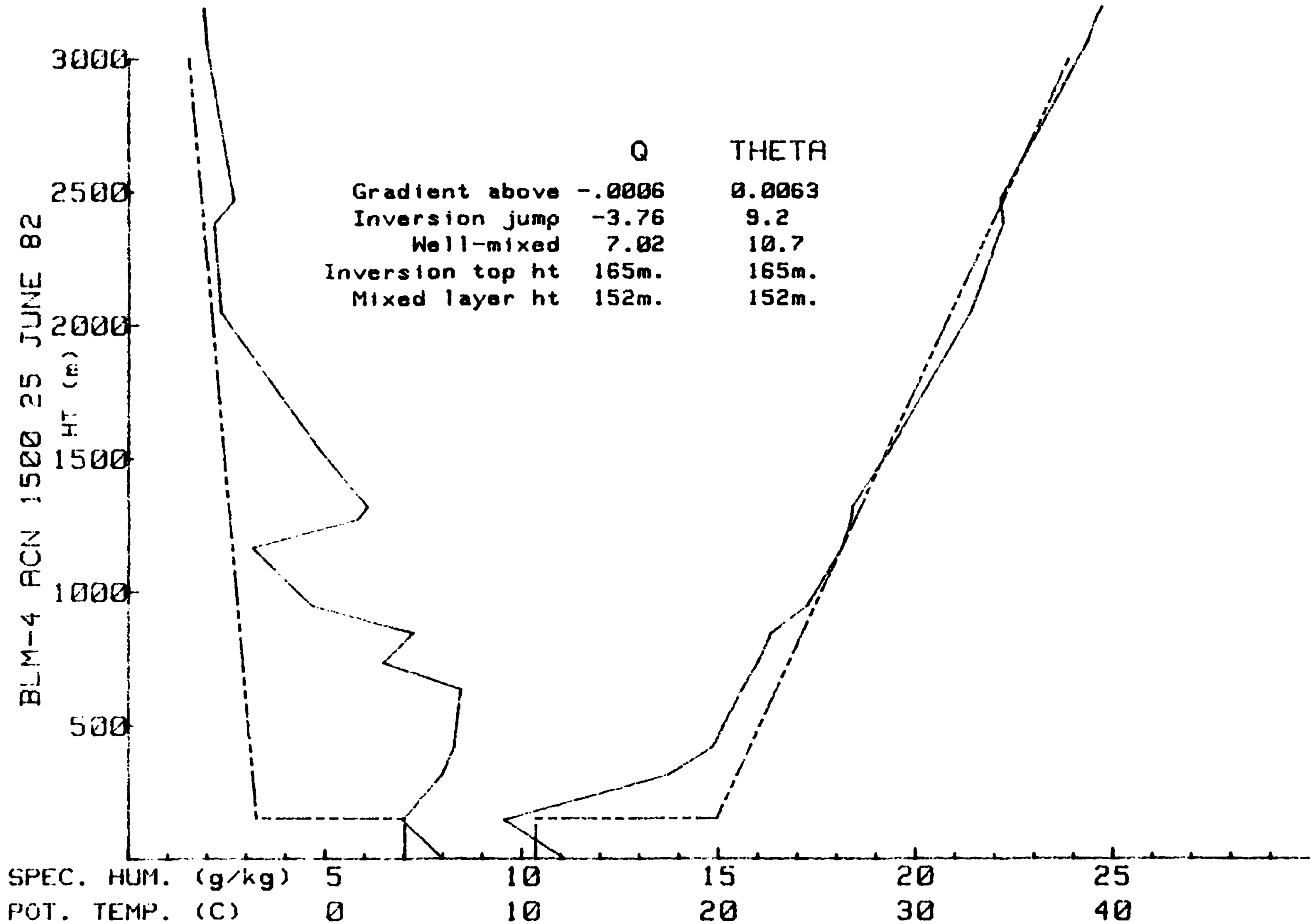


Figure 12 a (1 6,25,82)

TEMP (CENT)

BLM-4 25 JUNE 82 1500


BLM-4 ACN 1500 25 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0006 0.0063
Inversion jump -3.76 9.2
Well-mixed 7.02 10.7
Inversion top ht 165m. 165m.
Mixed layer ht 152m. 152m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

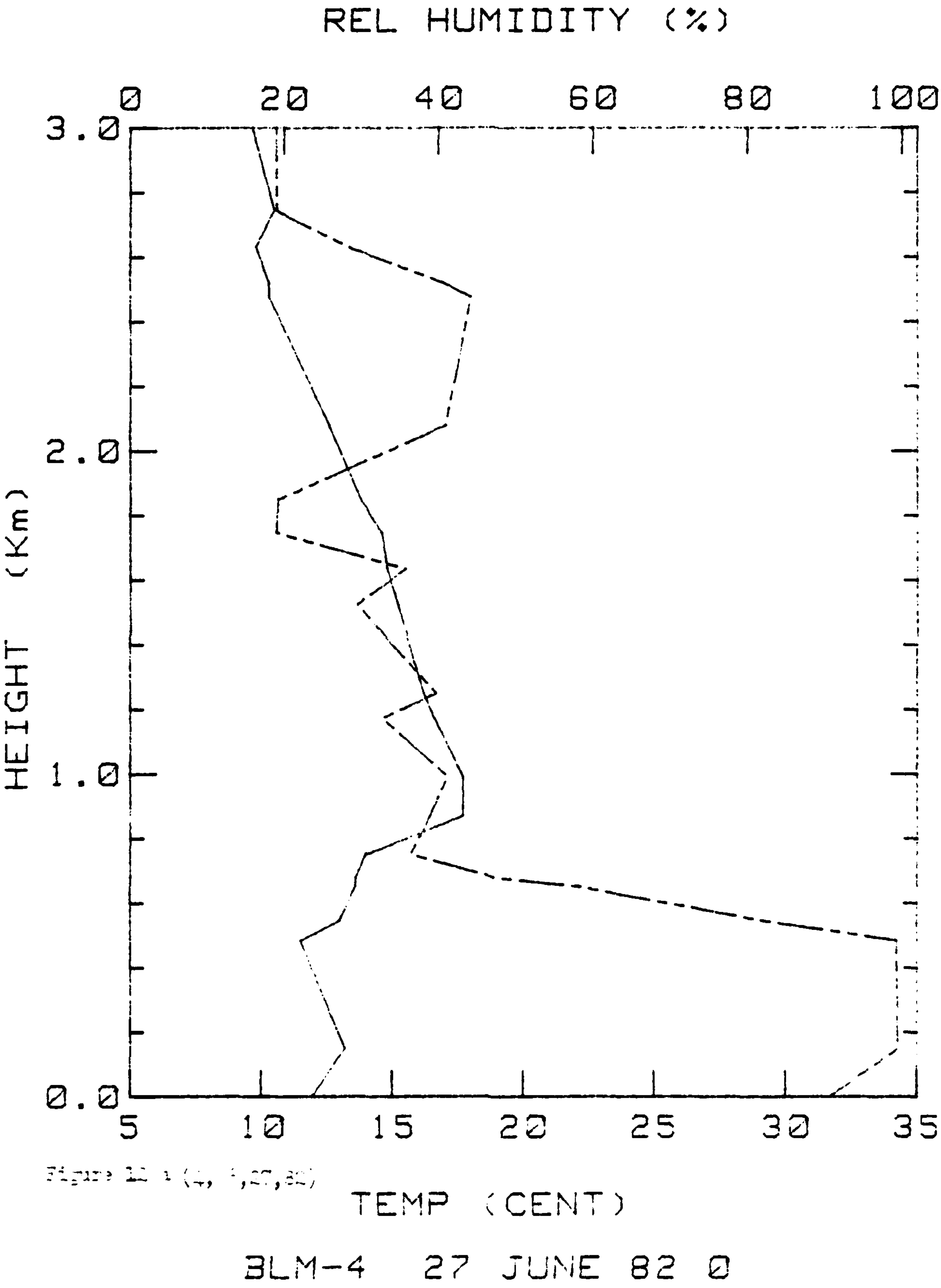
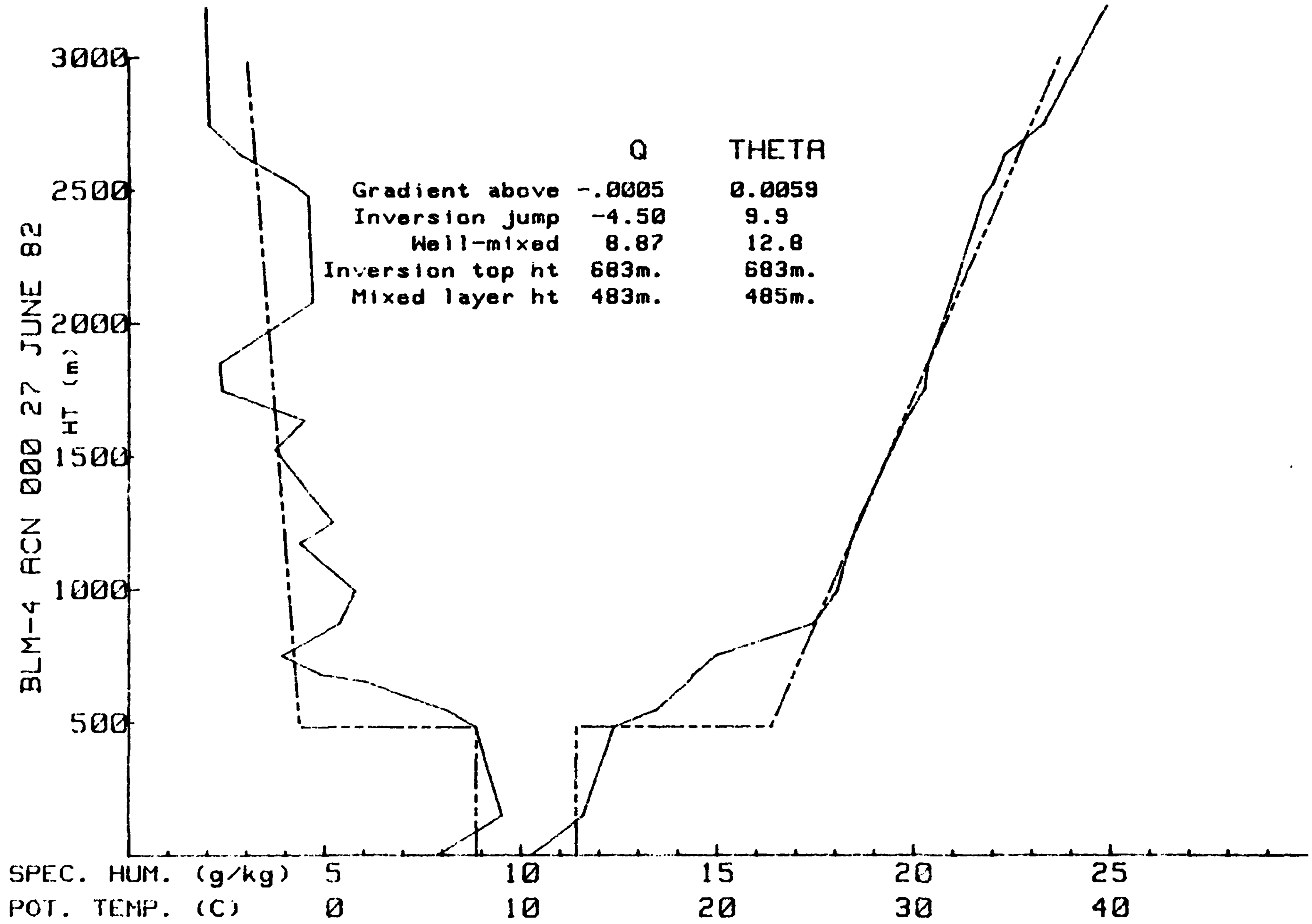


Figure 12 a (4, [illegible],27,82)


BLM-4 ACN 000 27 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0005 0.0059
Inversion jump -4.50 9.9
Well-mixed 8.87 12.8
Inversion top ht 683m. 683m.
Mixed layer ht 483m. 485m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

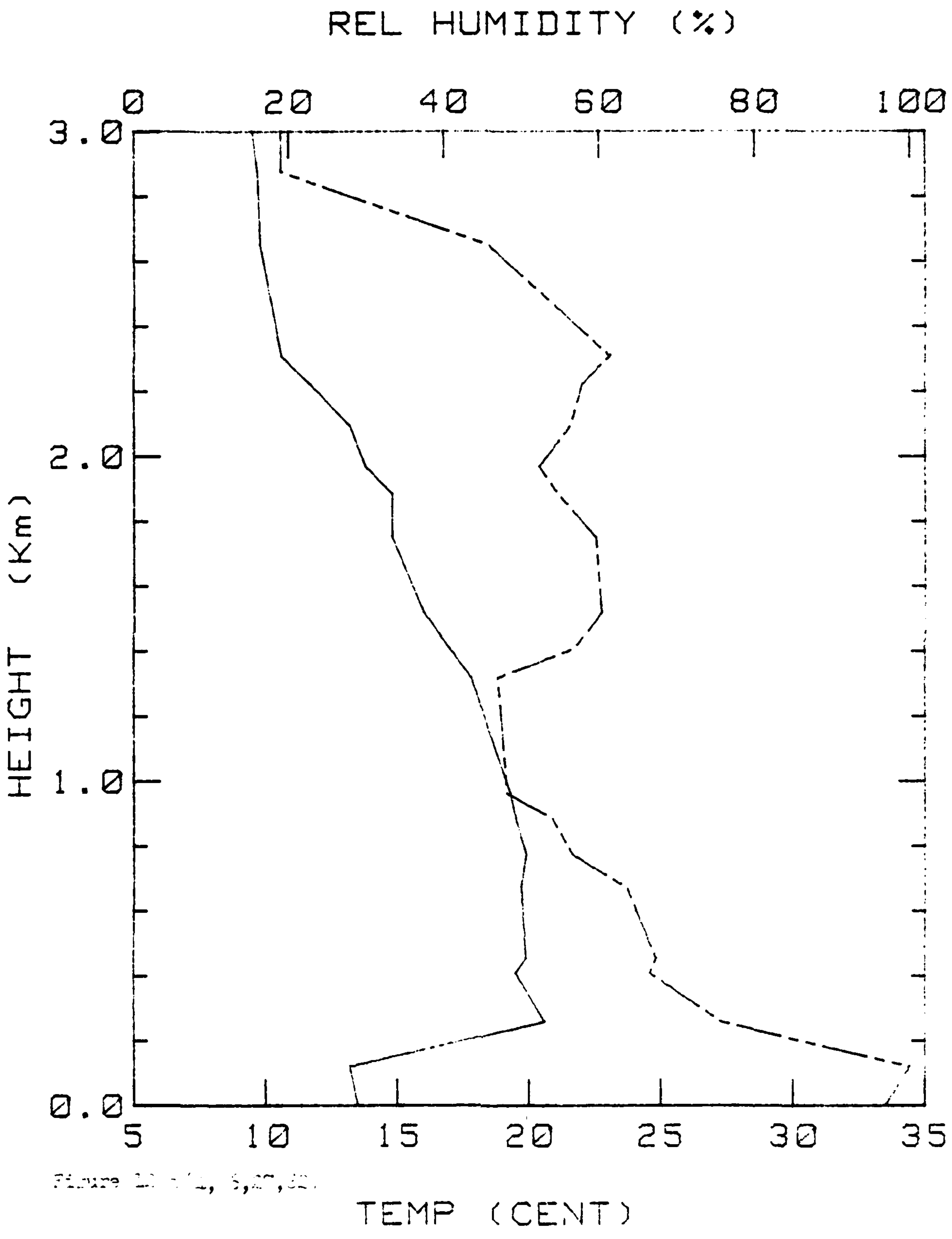
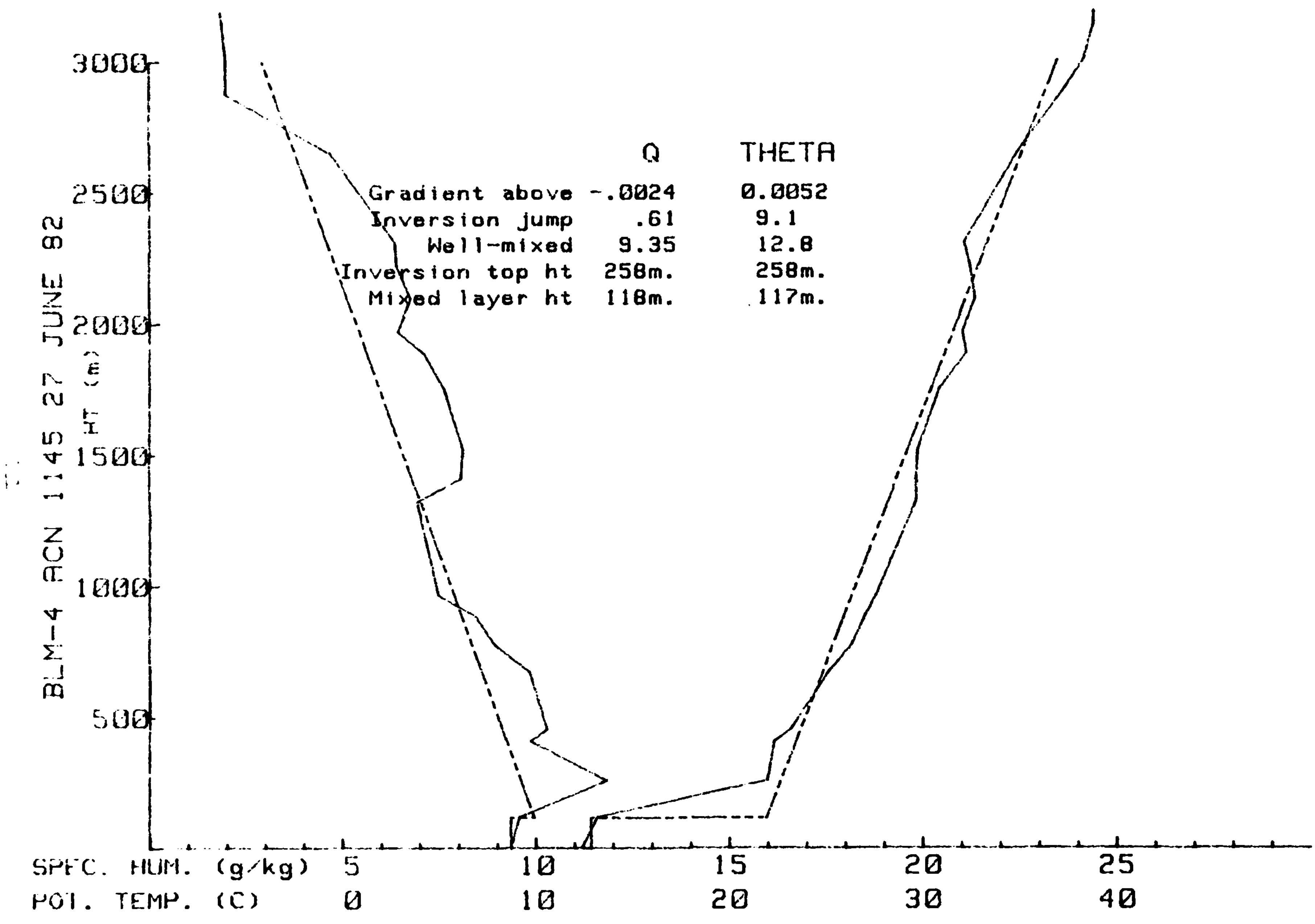


Figure [illegible]

BLM-4 27 JUNE 82 1145



BLM-4 ACN 1145 27 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0024 0.0052
Inversion jump .61 9.1
Well-mixed 9.35 12.8
Inversion top ht 258m. 258m.
Mixed layer ht 118m. 117m.
SPFC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

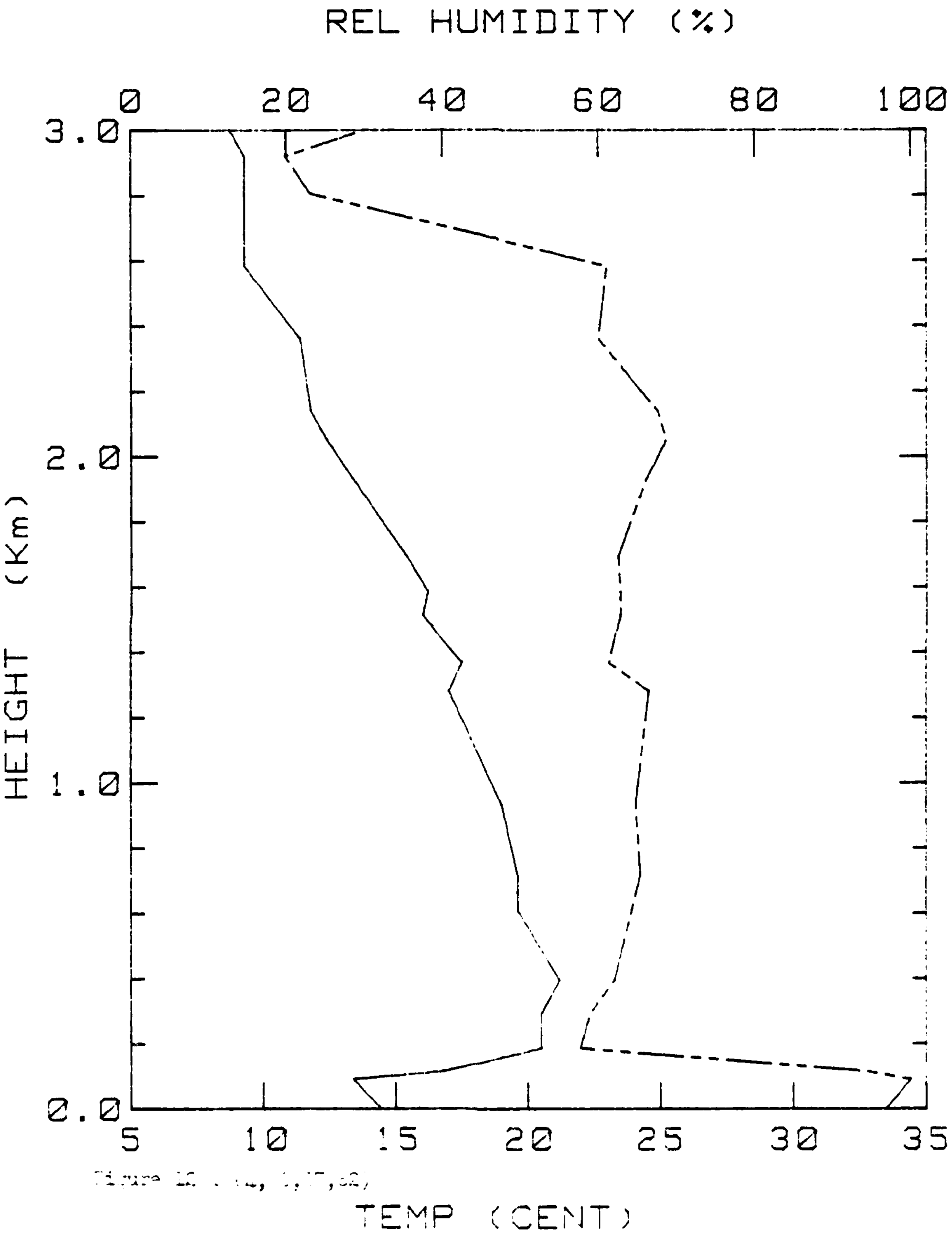
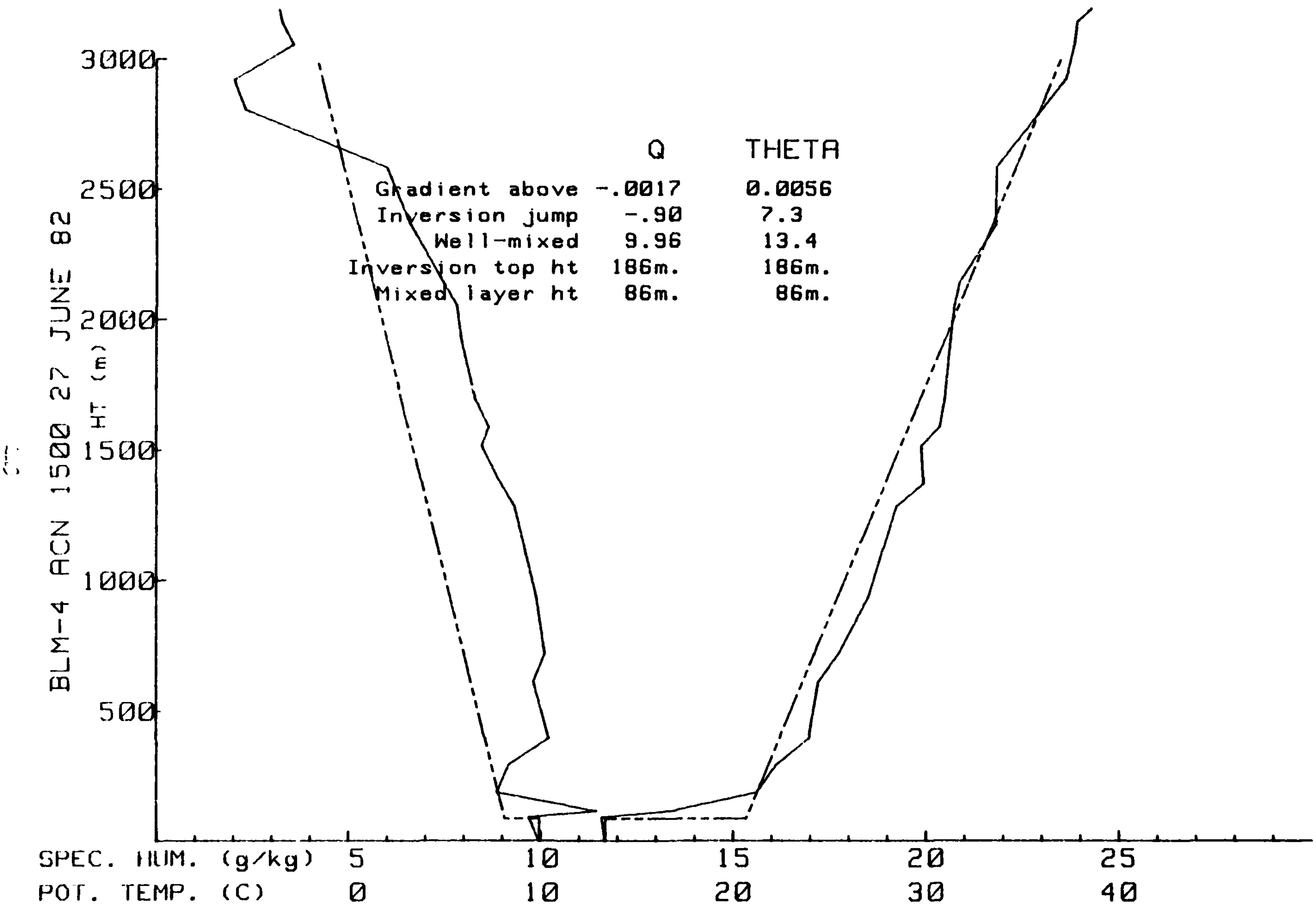


Figure 12 [illegible]

BLM-4 27 JUNE 82 1500


BLM-4 ACN 1500 27 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0017 0.0056
Inversion jump -.90 7.3
Well-mixed 9.96 13.4
Inversion top ht 186m. 186m.
Mixed layer ht 86m. 86m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

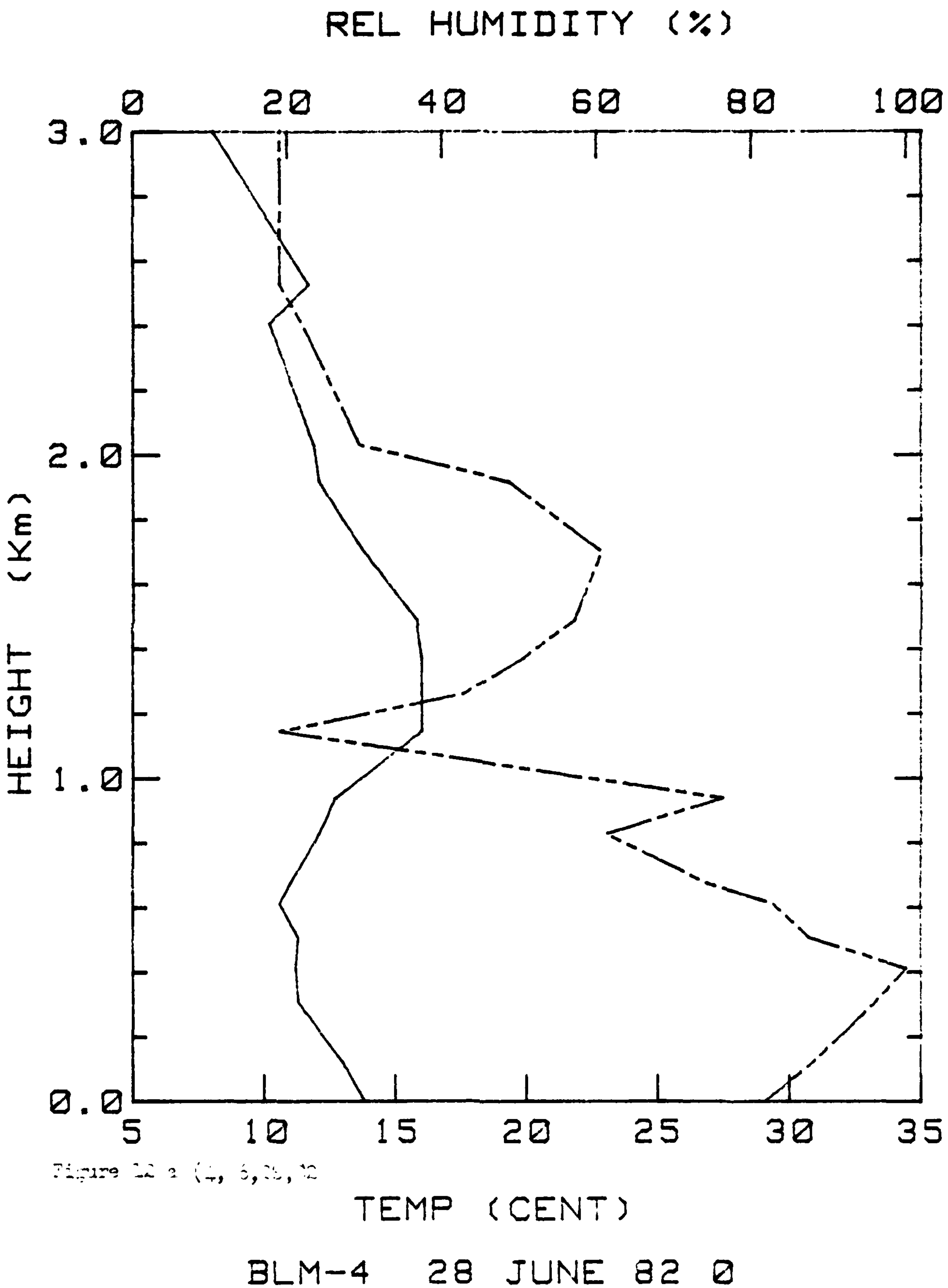
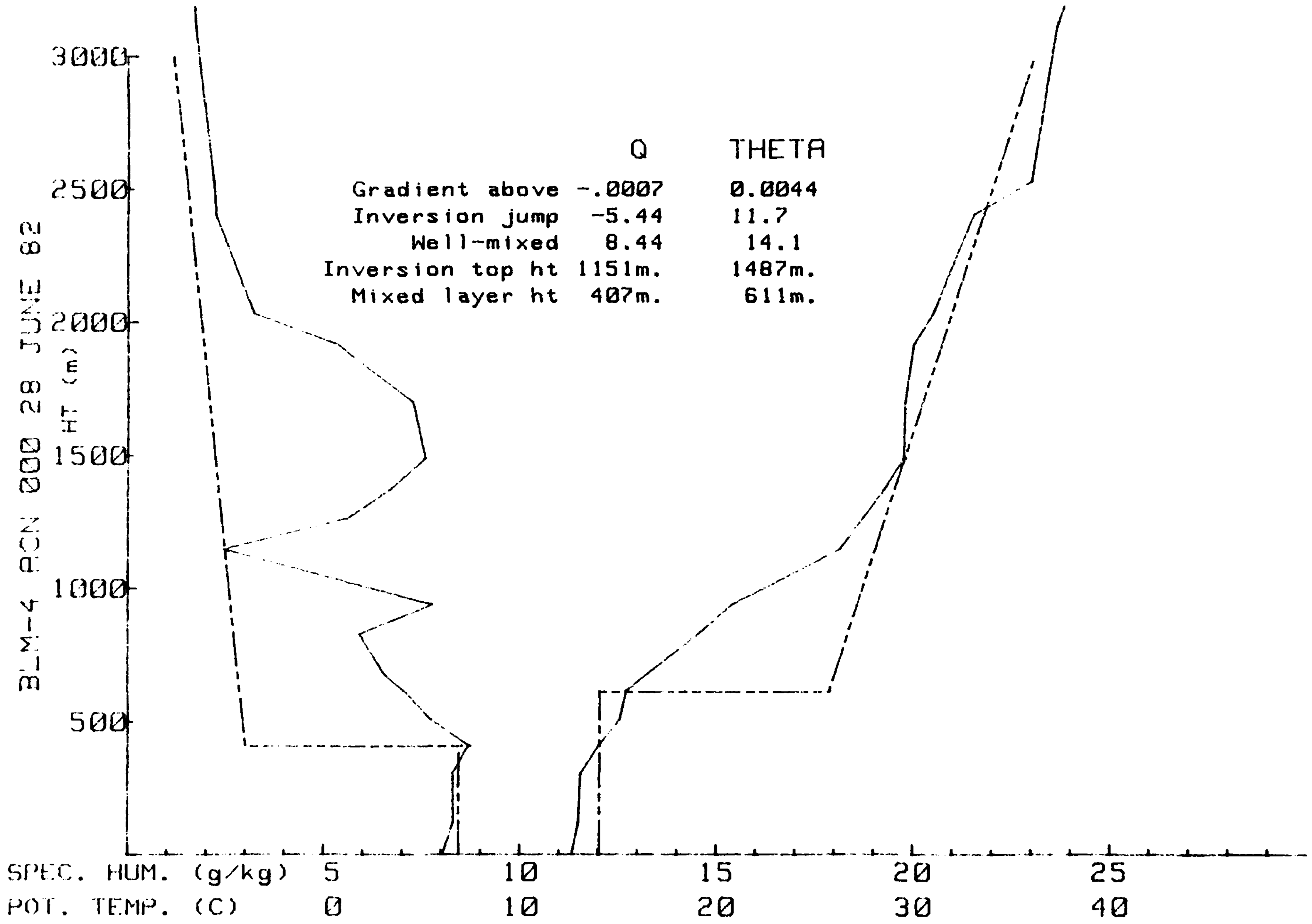


Figure 12 a (4, 6, 26, 82



BLM-4 RCN 000 28 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0007 0.0044
Inversion jump -5.44 11.7
Well-mixed 8.44 14.1
Inversion top ht 1151m. 1487m.
Mixed layer ht 407m. 611m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

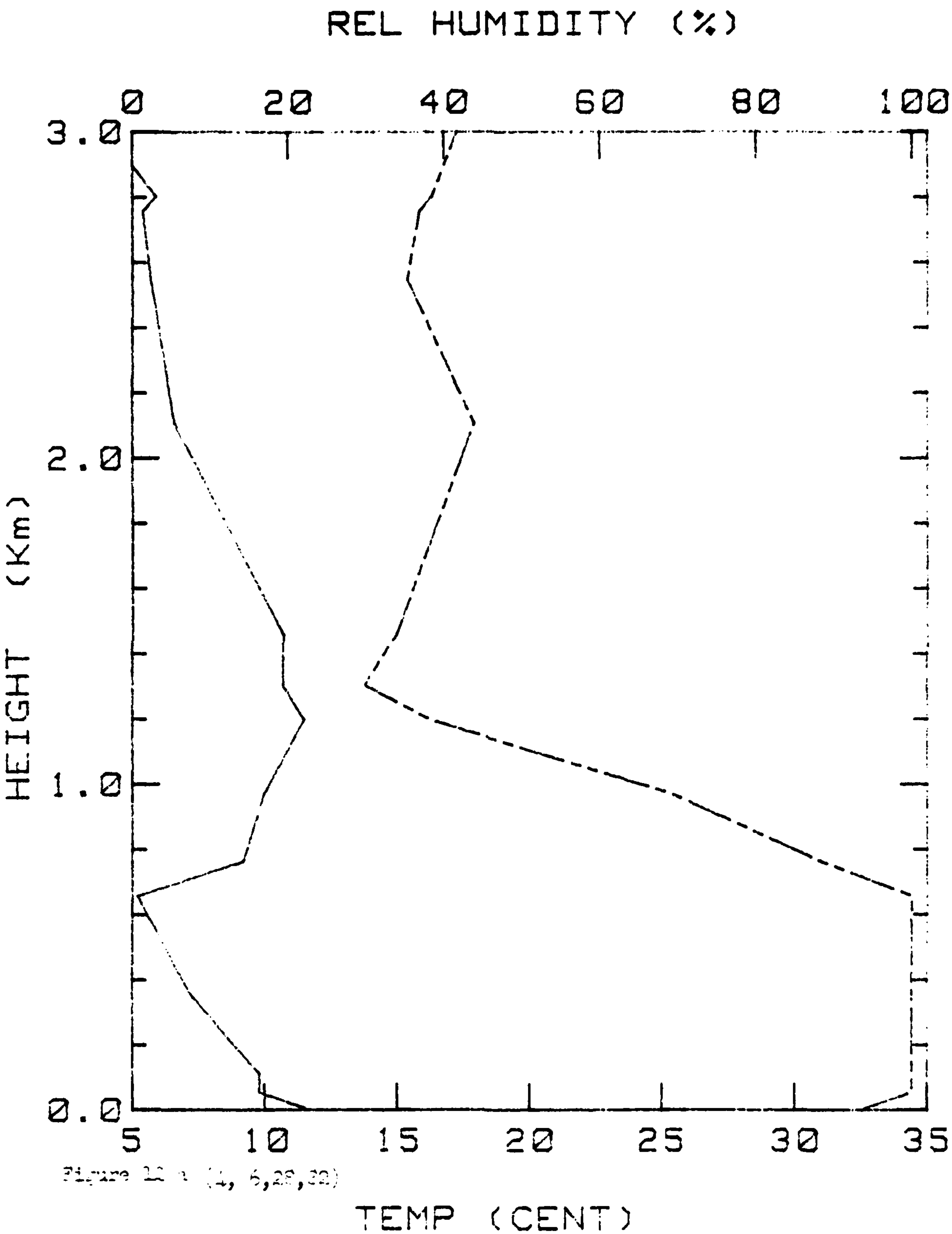
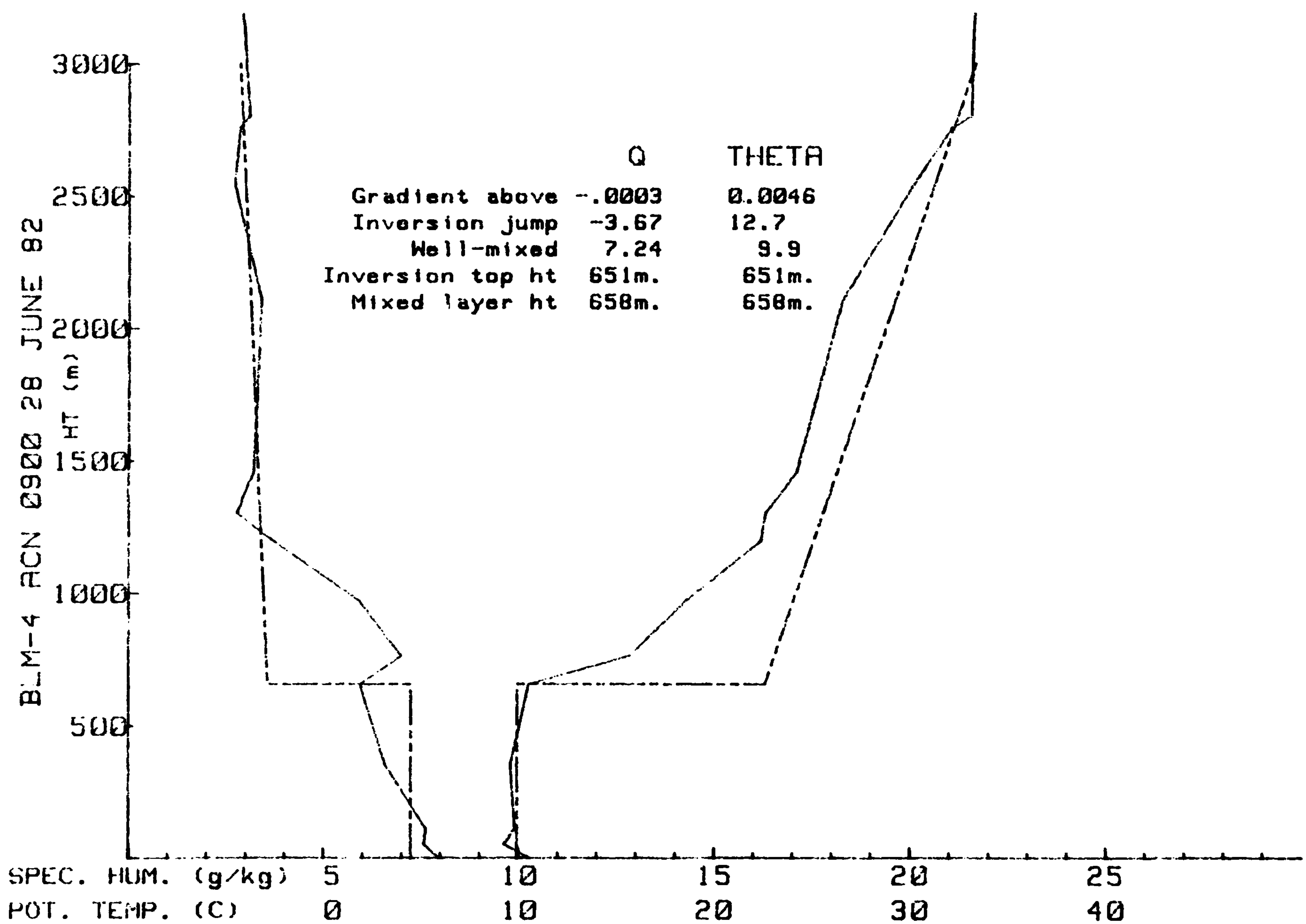


Figure 12 a (4, 6,28,82)

BLM-4 28 JUNE 82 900


BLM-4 ACN 0900 28 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0003 0.0046
Inversion jump -3.67 12.7
Well-mixed 7.24 9.9
Inversion top ht 651m. 651m.
Mixed layer ht 658m. 658m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

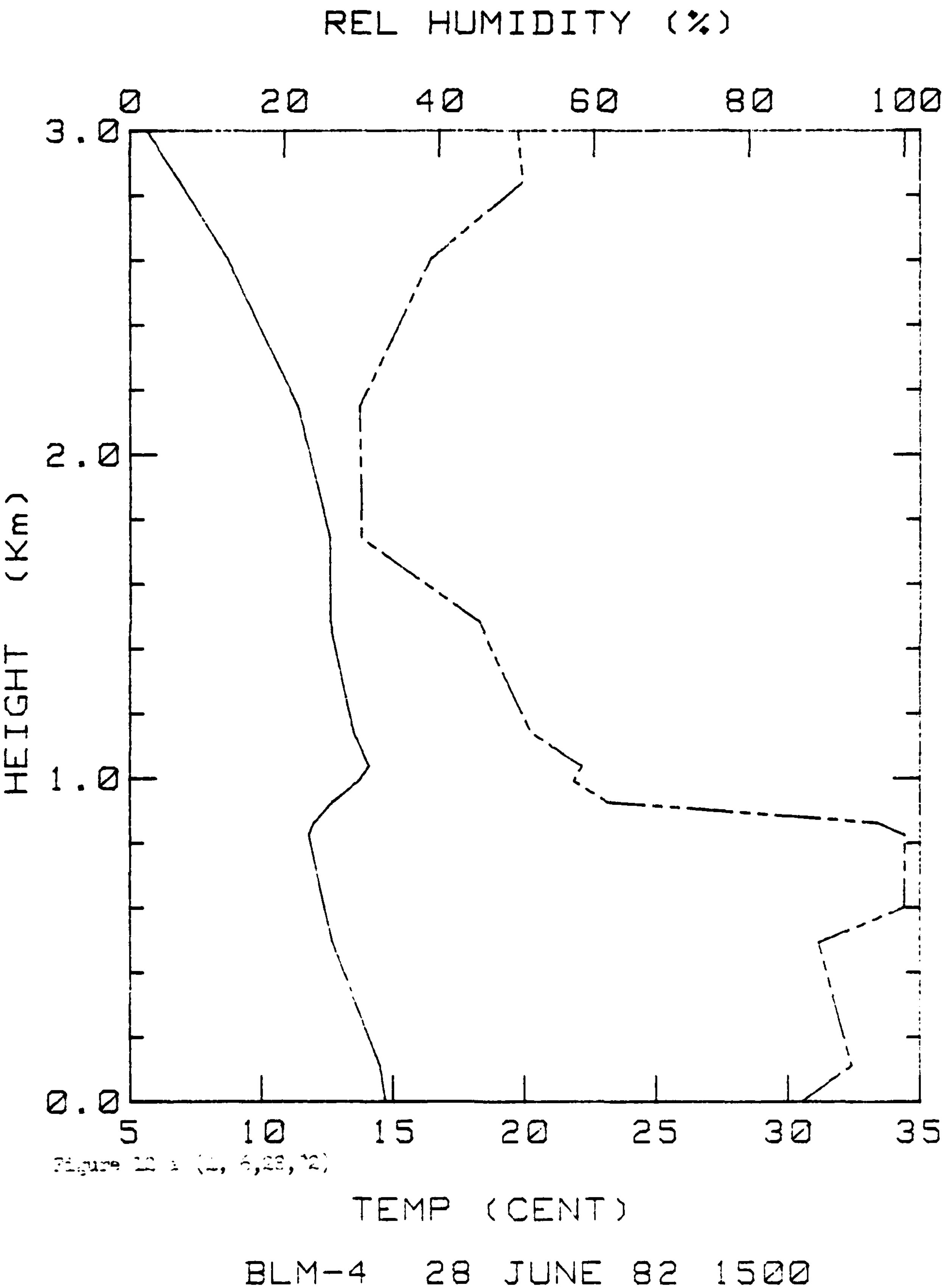
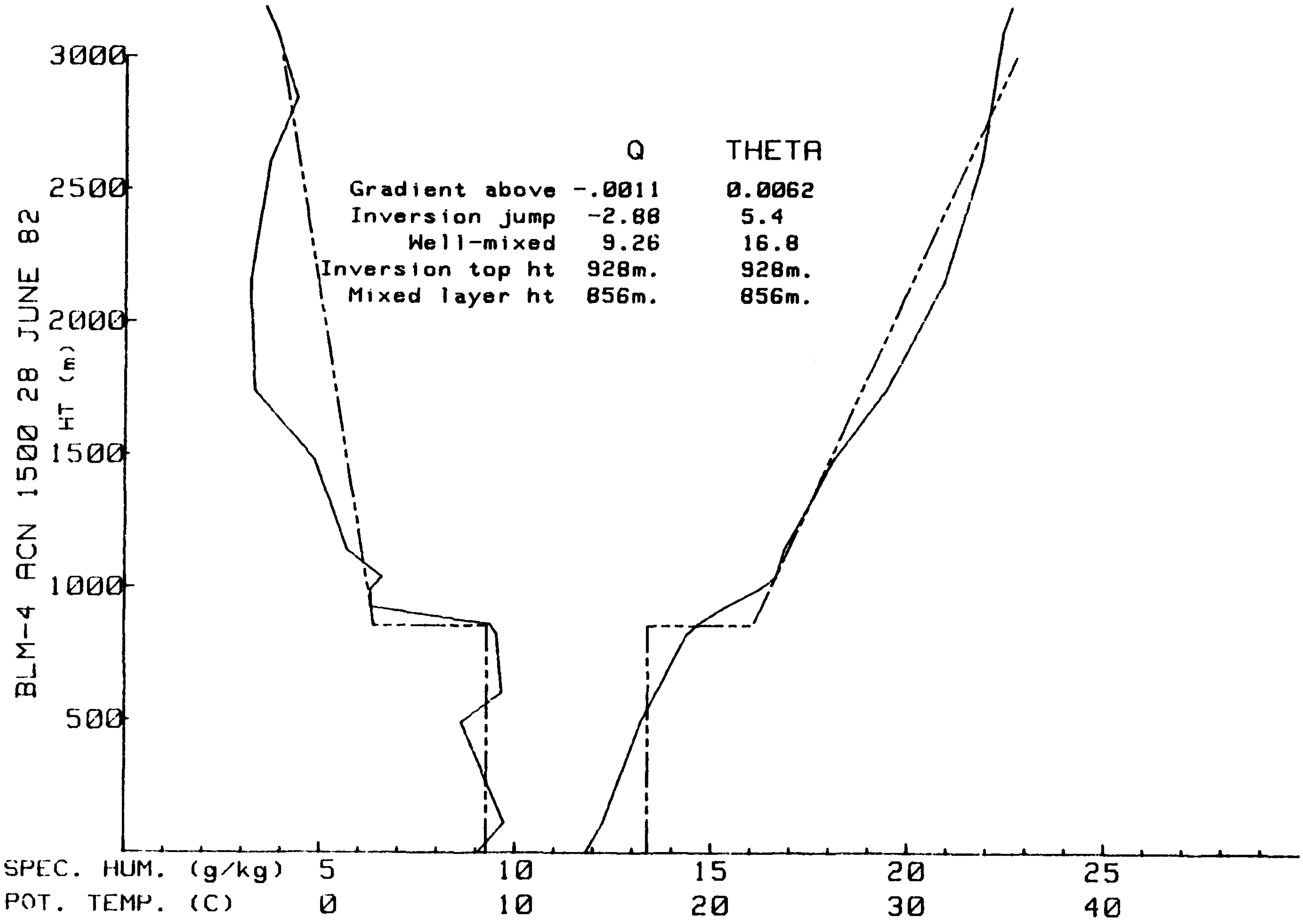
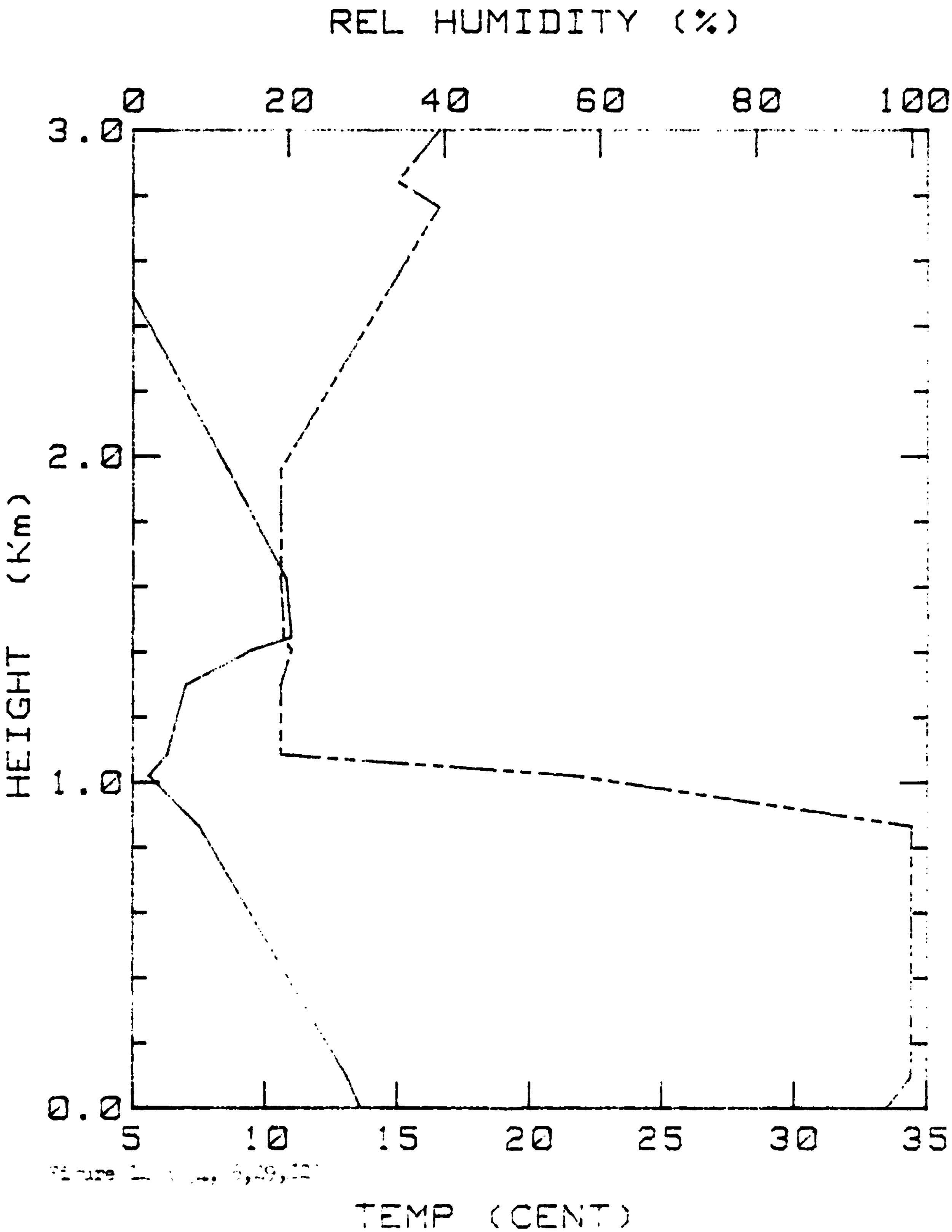


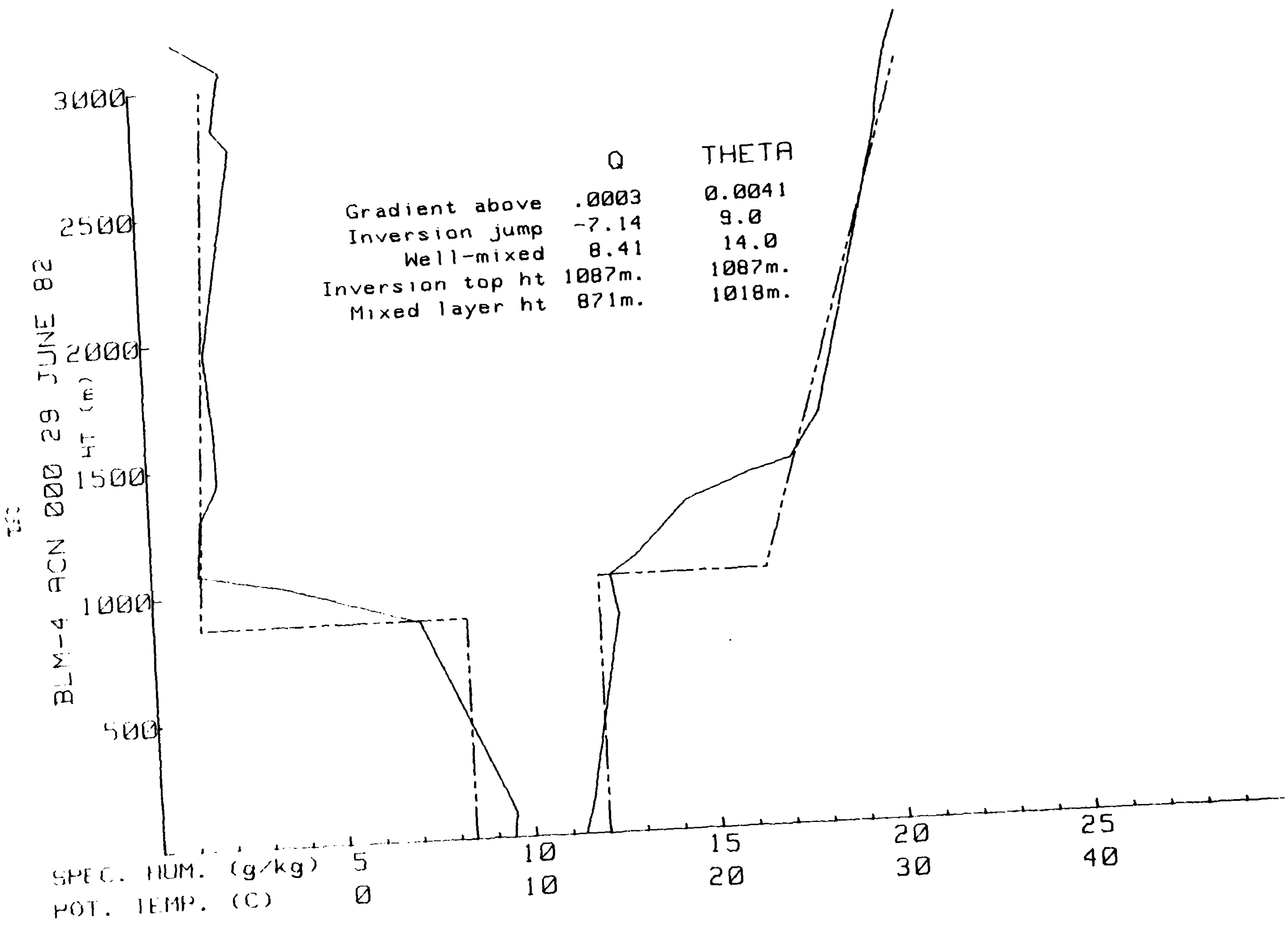
Figure 12 a (1, 6,28,'82)


BLM-4 ACN 1500 28 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0011 0.0062
Inversion jump -2.88 5.4
Well-mixed 9.26 16.8
Inversion top ht 928m. 928m.
Mixed layer ht 856m. 856m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

(4, 6,28,8.)



BLM-4 29 JUNE 82 0



Q THETA
Gradient above .0003 0.0041
Inversion jump -7.14 9.0
Well-mixed 8.41 14.0
Inversion top ht 1087m. 1087m.
Mixed layer ht 871m. 1018m.
3000
2500
2000
1500
1000
500
HT (m)
BLM-4 ACN 000 29 JUNE 82
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

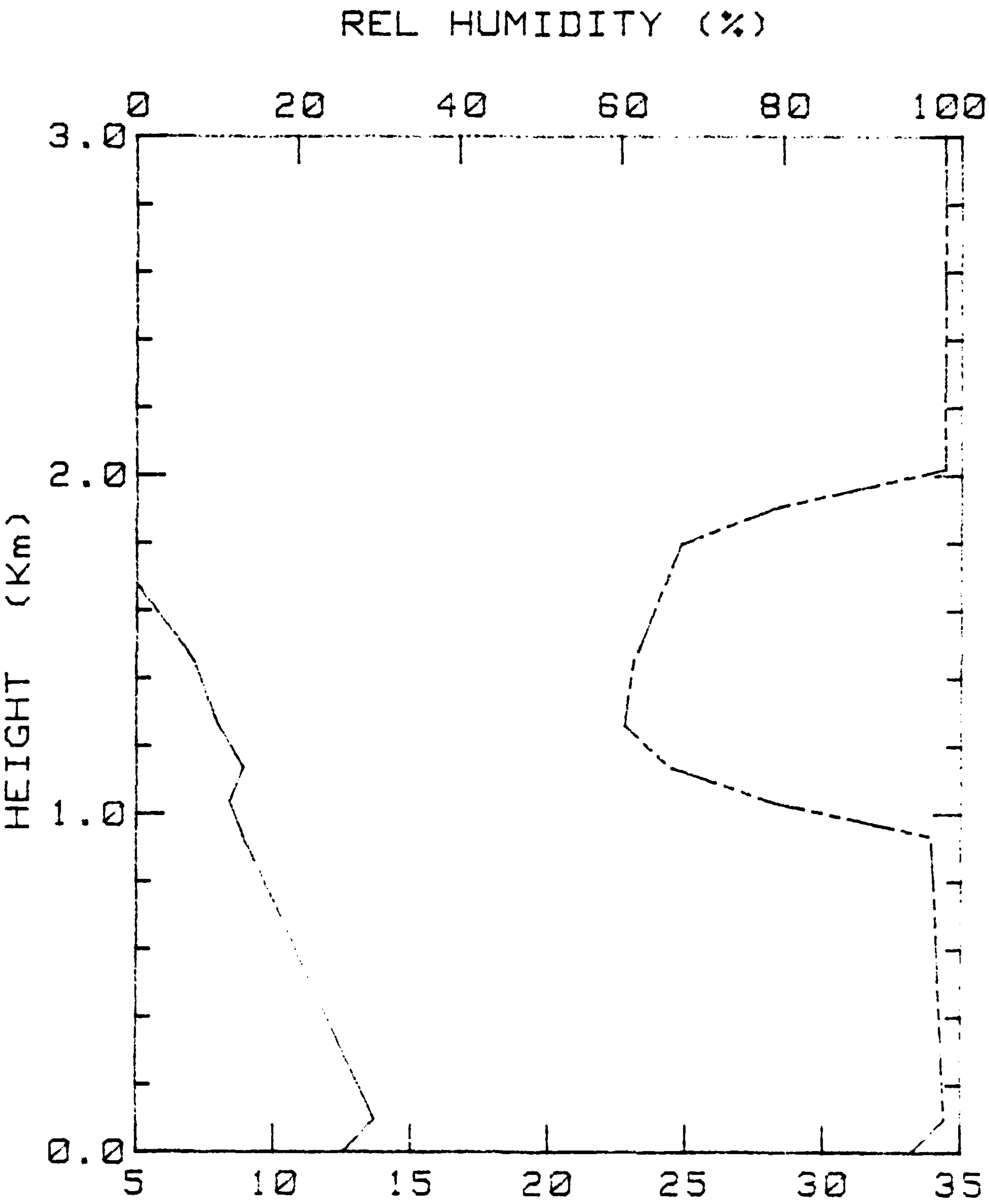
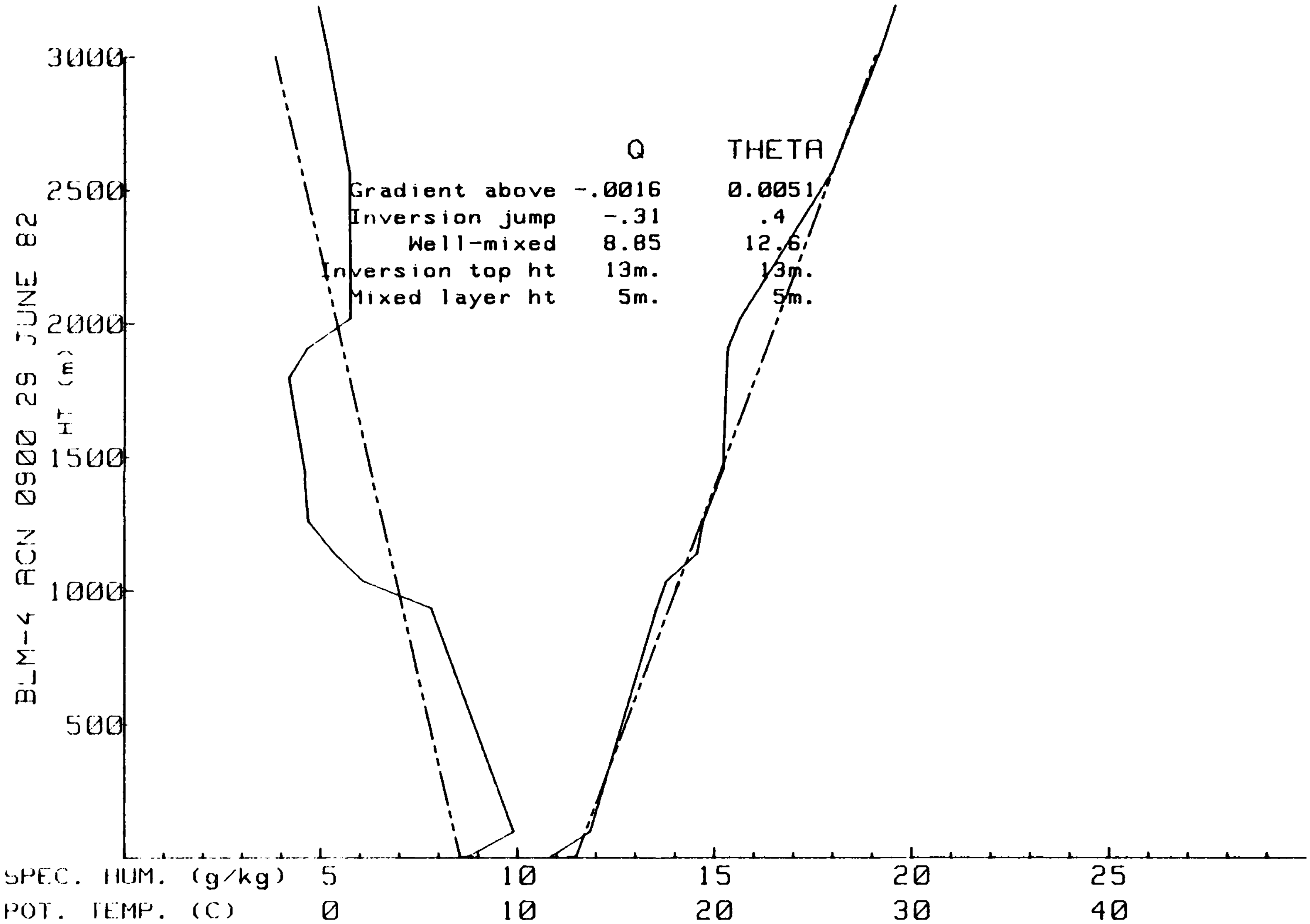


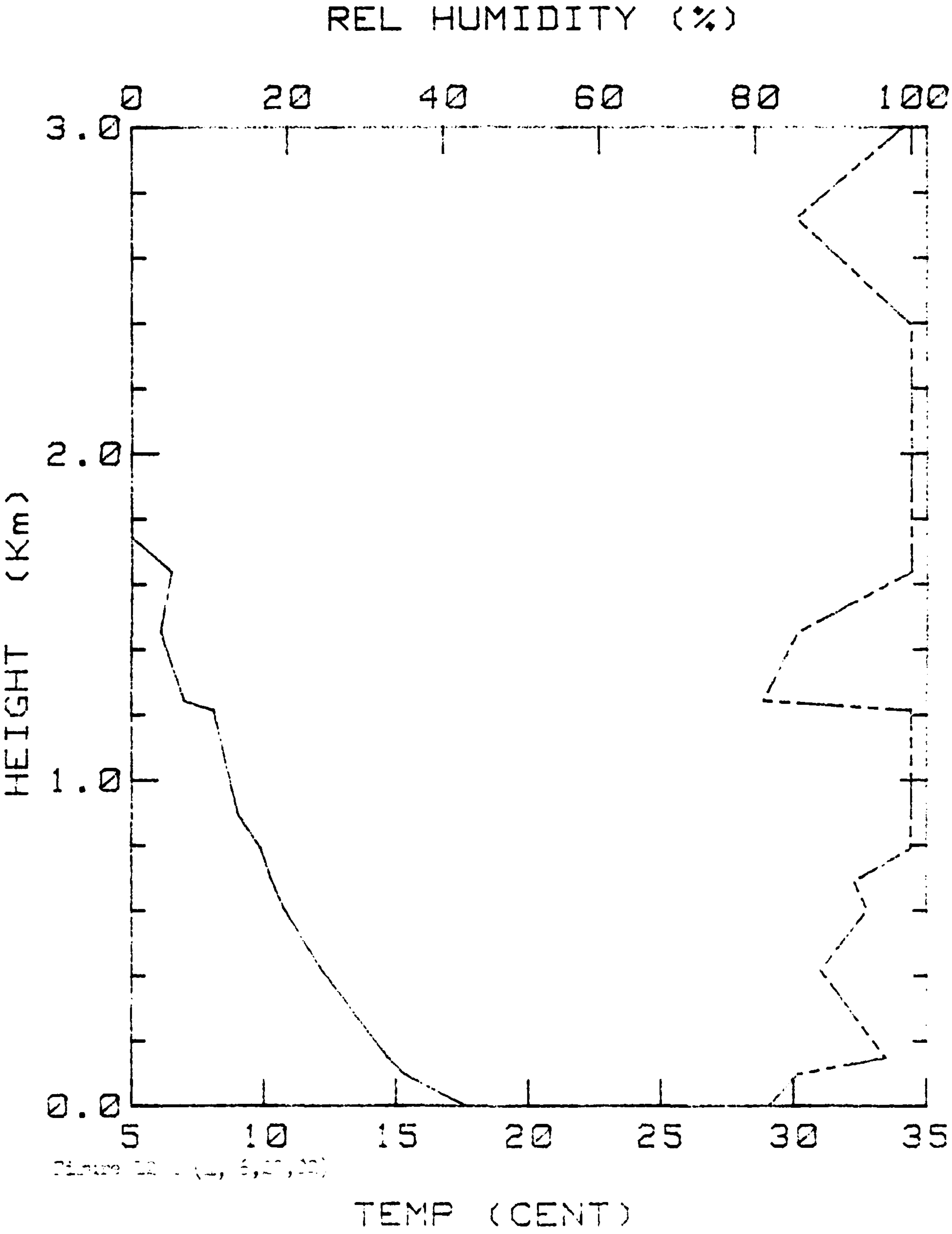
Figure 12 a

TEMP (CENT)

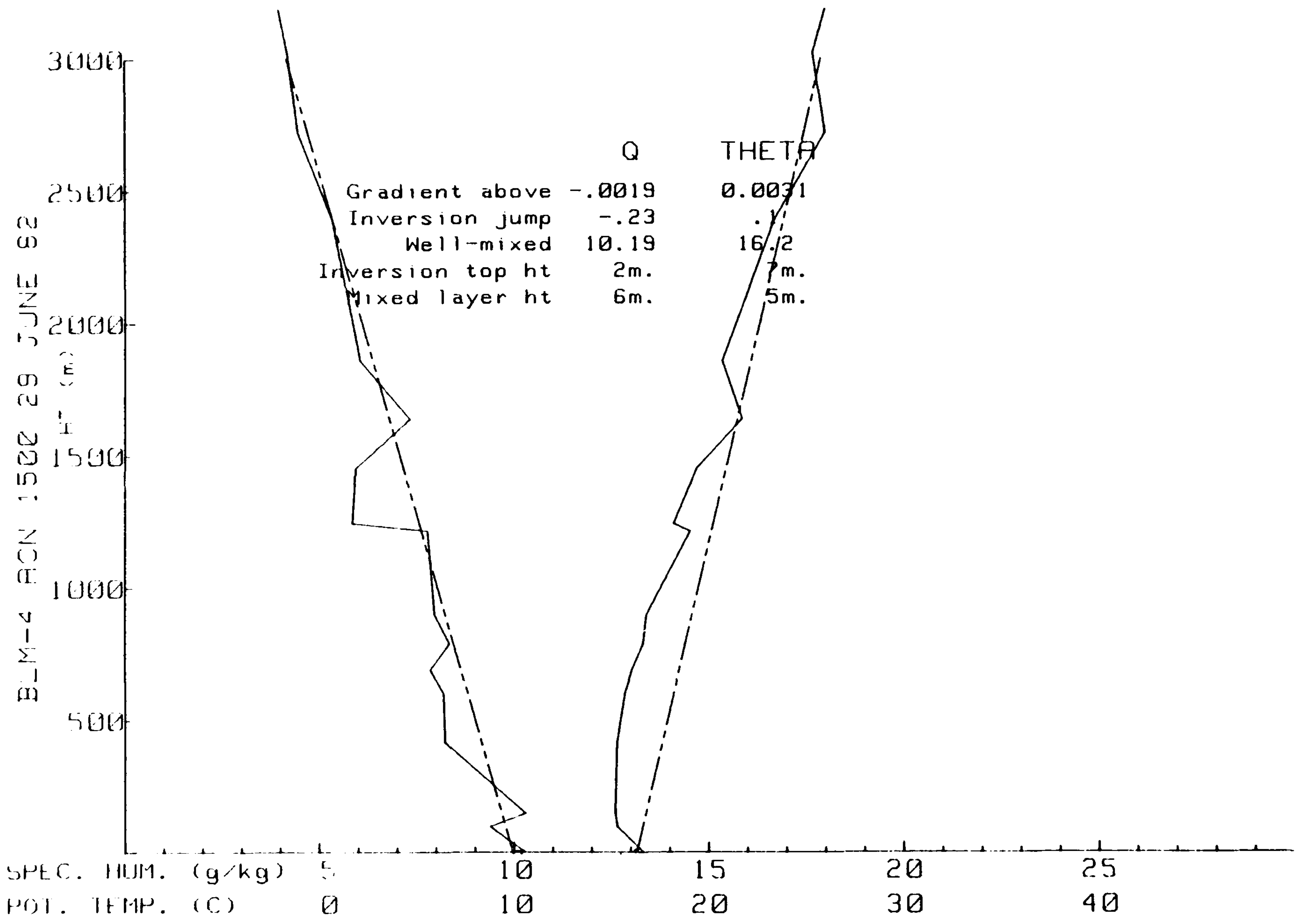
BLM-4 29 JUNE 82 900



BLM-4 ACN 0900 29 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0016 0.0051
Inversion jump -.31 .4
Well-mixed 8.85 12.6
Inversion top ht 13m. 13m.
Mixed layer ht 5m. 5m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40



BLM-4 29 JUNE 82 1500


BLM-4 RCN 1500 29 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0019 0.0031
Inversion jump -.23 .1
Well-mixed 10.19 16.2
Inversion top ht 2m. 7m.
Mixed layer ht 6m. 5m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

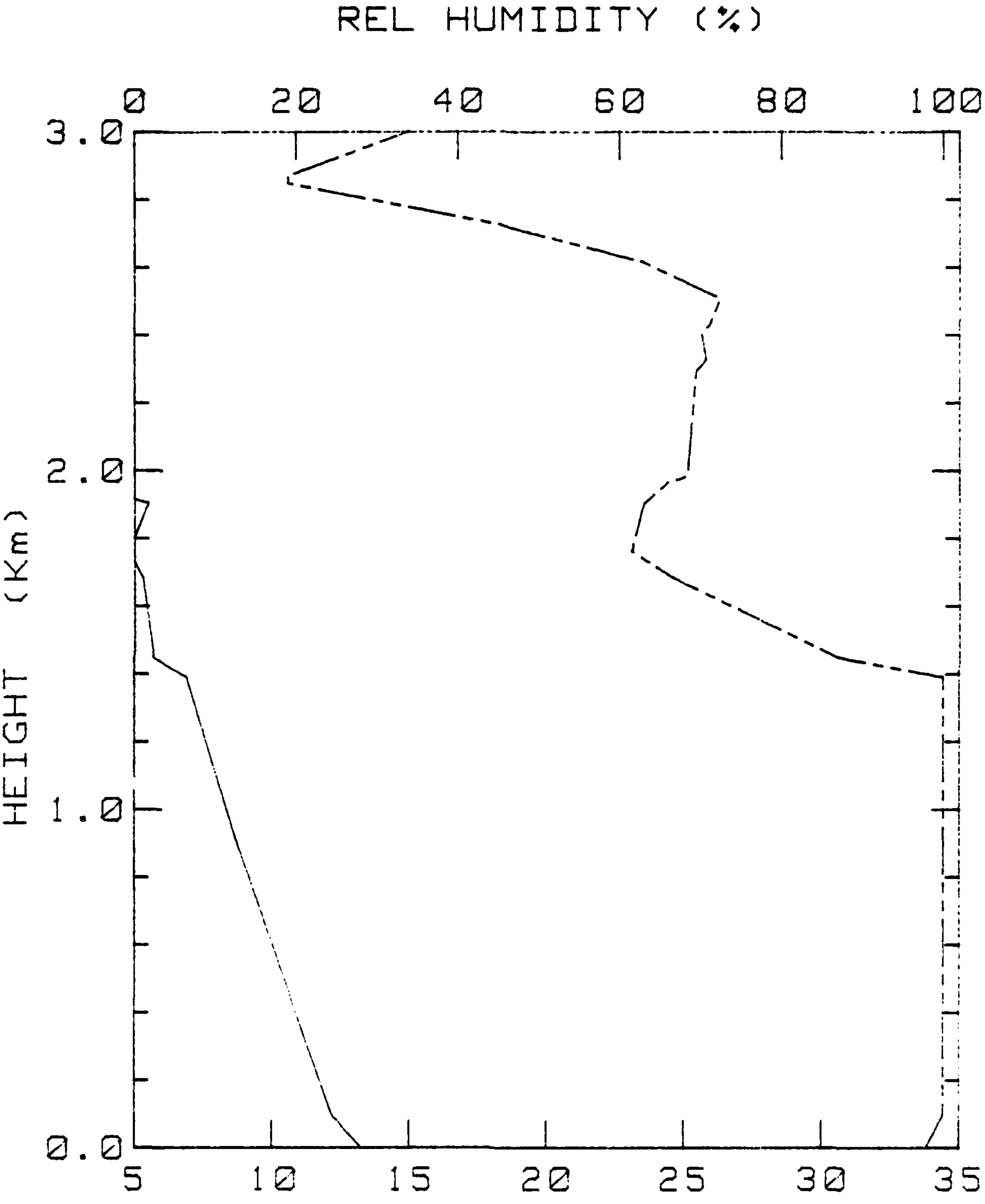
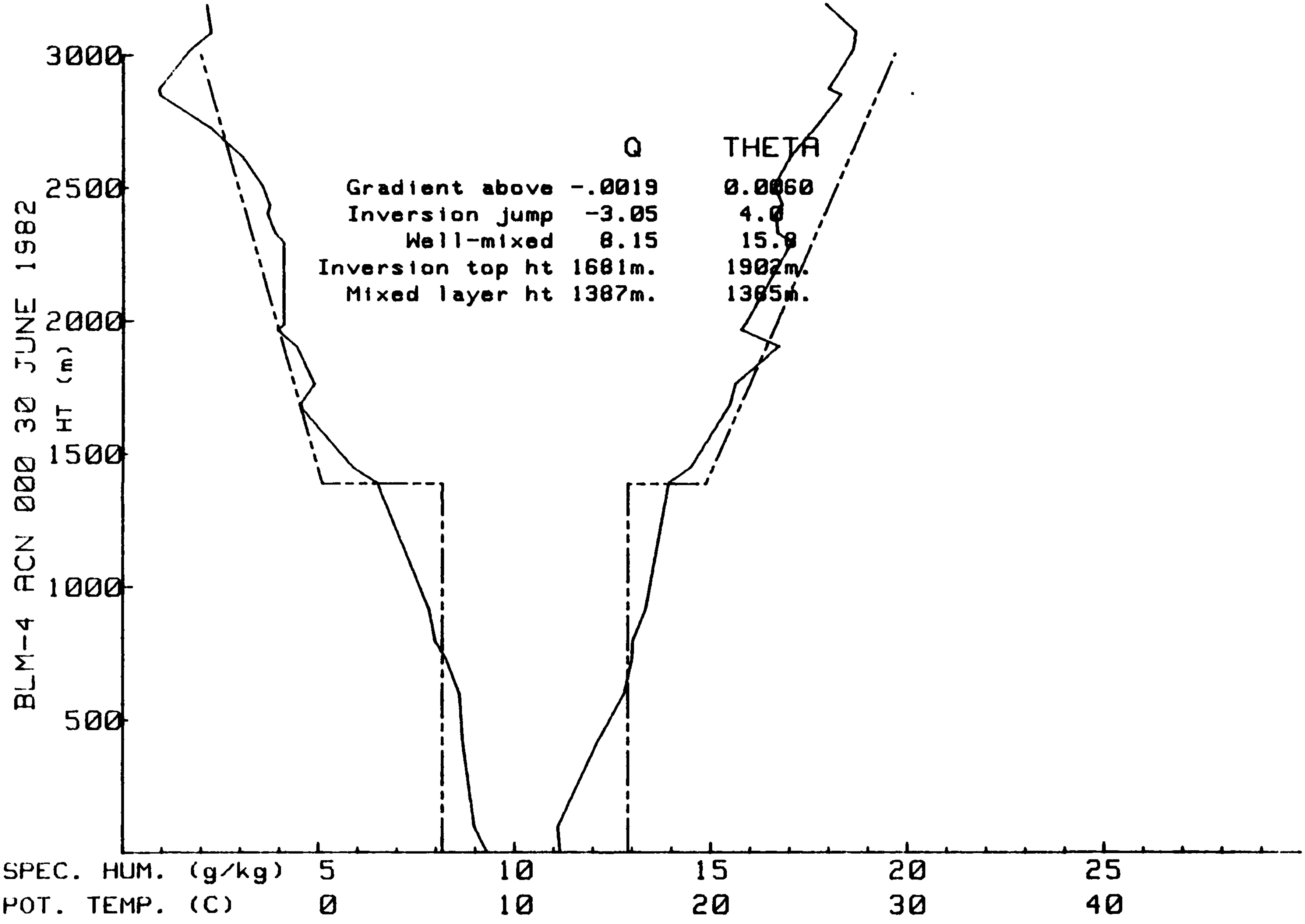


Figure [illegible] (…, 6,30,82)

TEMP (CENT)

BLM-4 30 JUNE 82 0


BLM-4 ACN 000 30 JUNE 1982
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0019 0.0060
Inversion jump -3.05 4.0
Well-mixed 8.15 15.8
Inversion top ht 1681m. 1902m.
Mixed layer ht 1387m. 1385m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

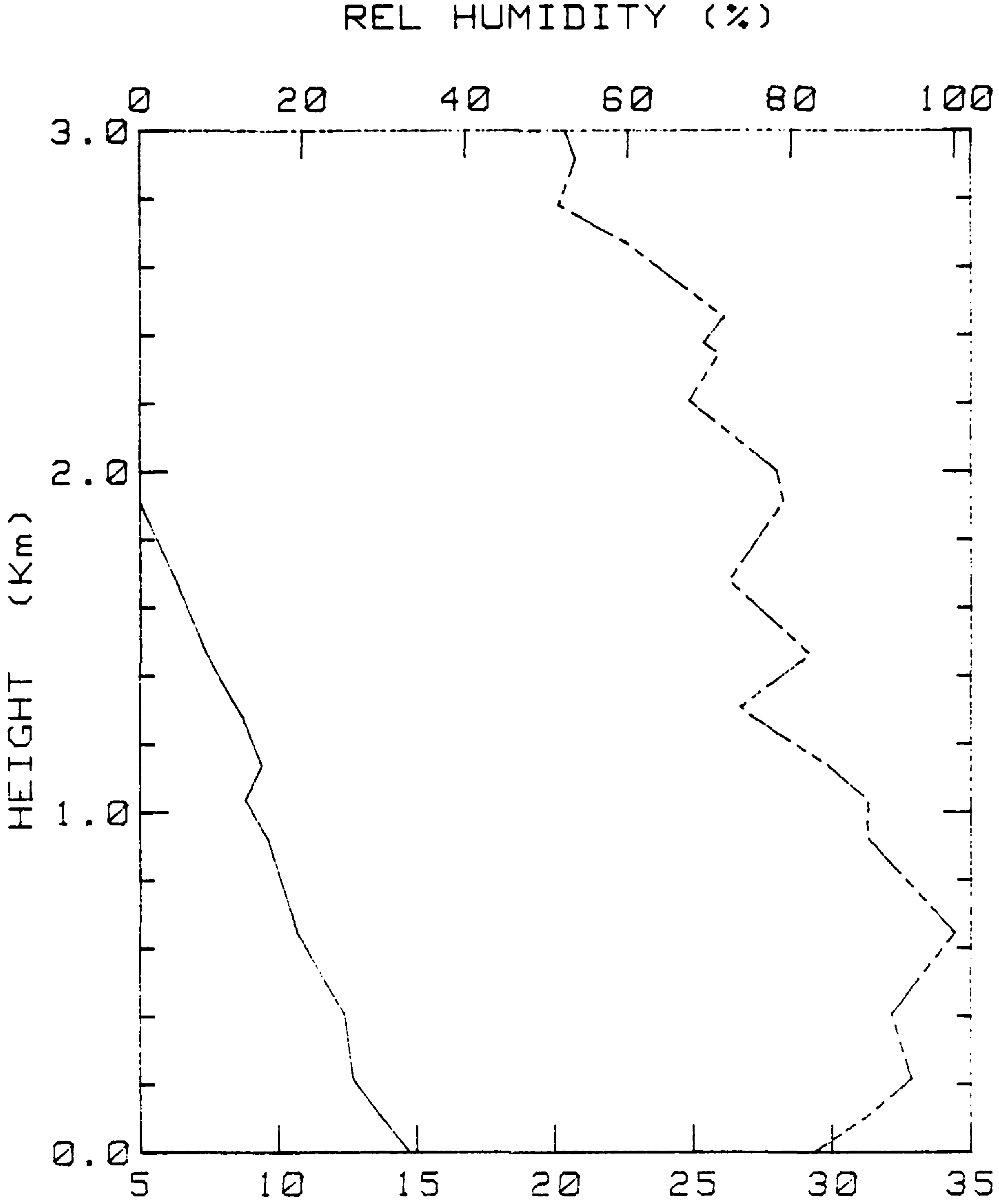


Figure [illegible] 6,30,82)

TEMP (CENT)

BLM-4 30 JUNE 82 900

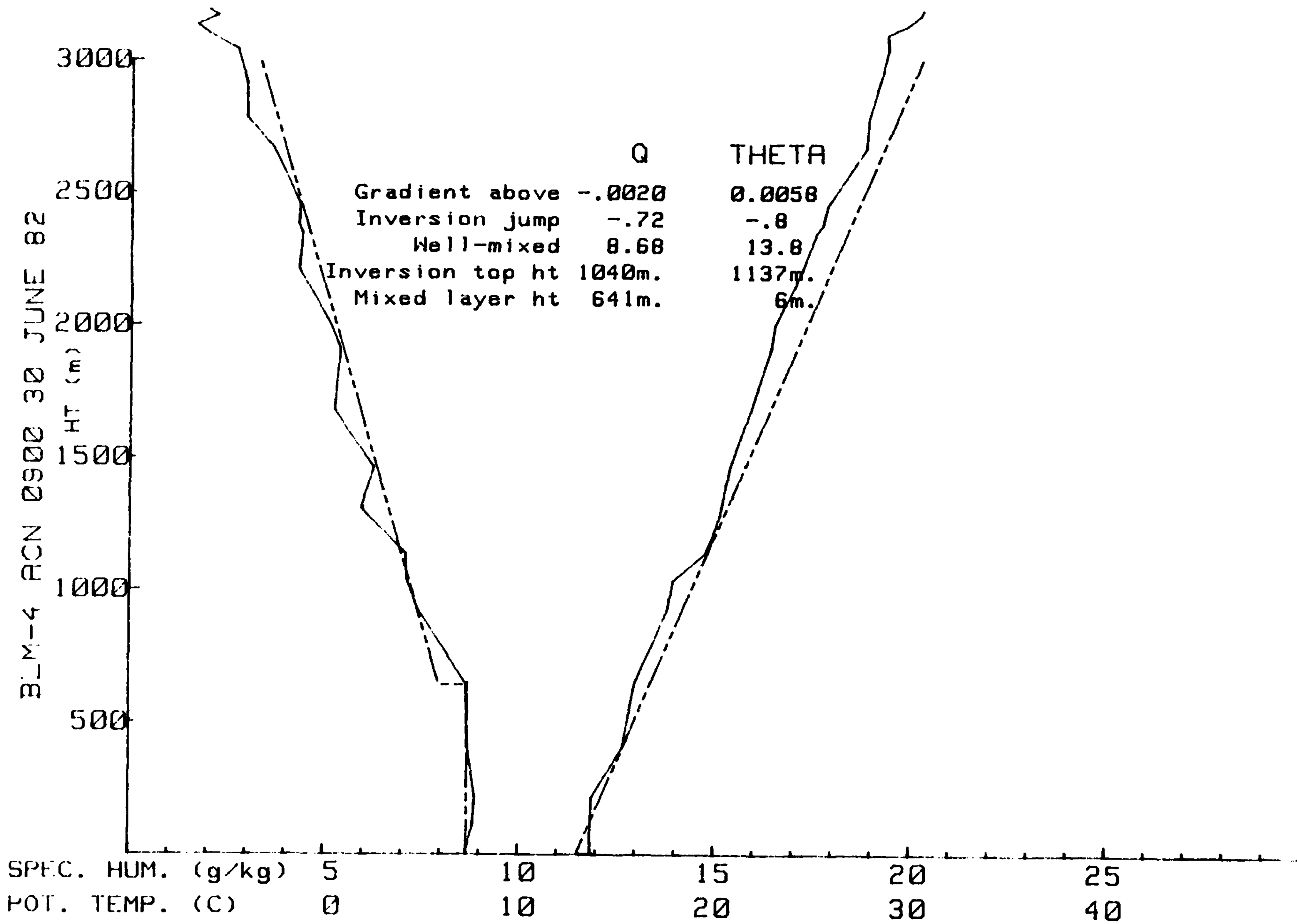

BLM-4 ACN 0900 30 JUNE 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0020 0.0058
Inversion jump -.72 -.8
Well-mixed 8.68 13.8
Inversion top ht 1040m. 1137m.
Mixed layer ht 641m. 6m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

Fig. [illegible]

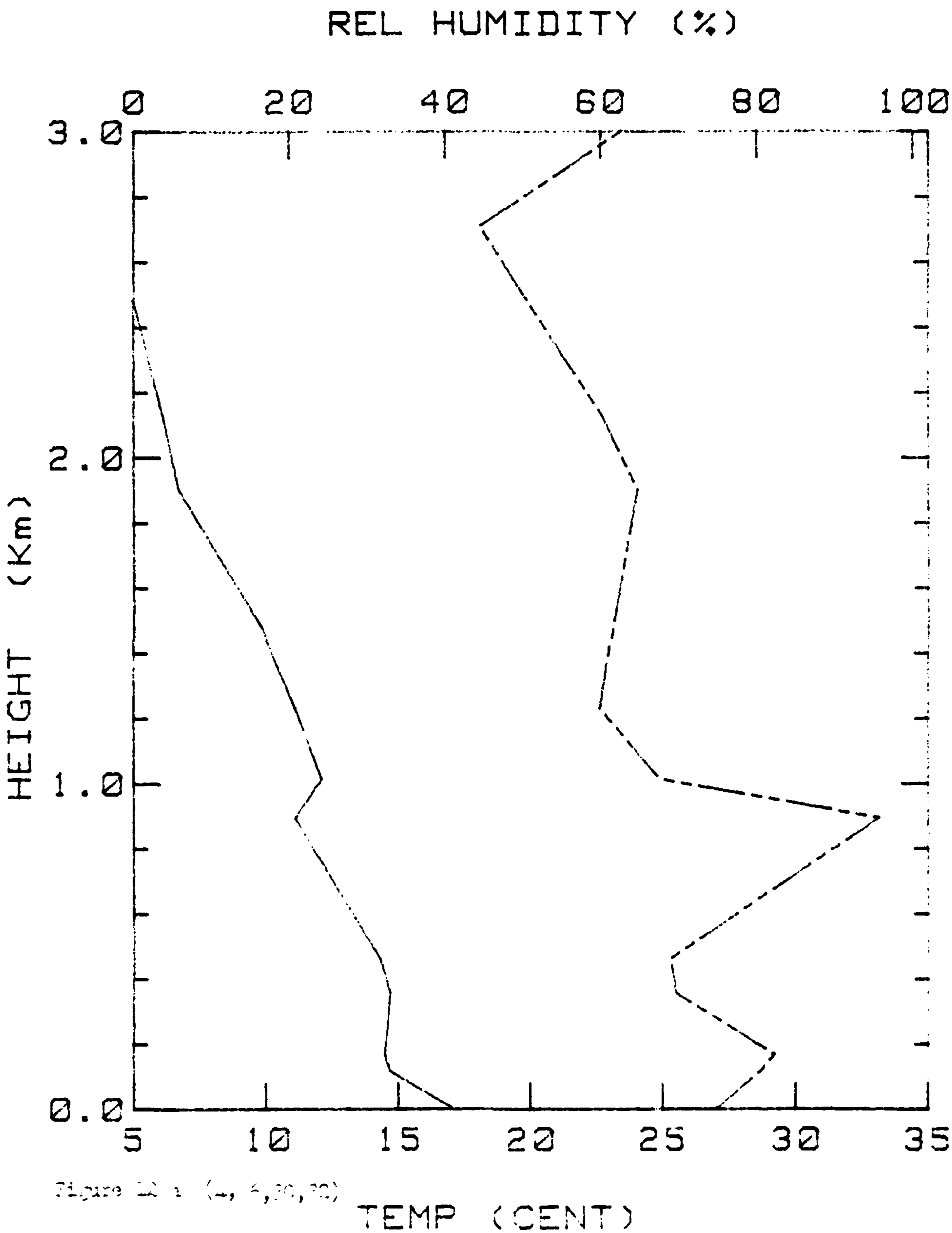


Figure 12 a (4, 6,30,70)

BLM-4 30 JUNE 82 1500

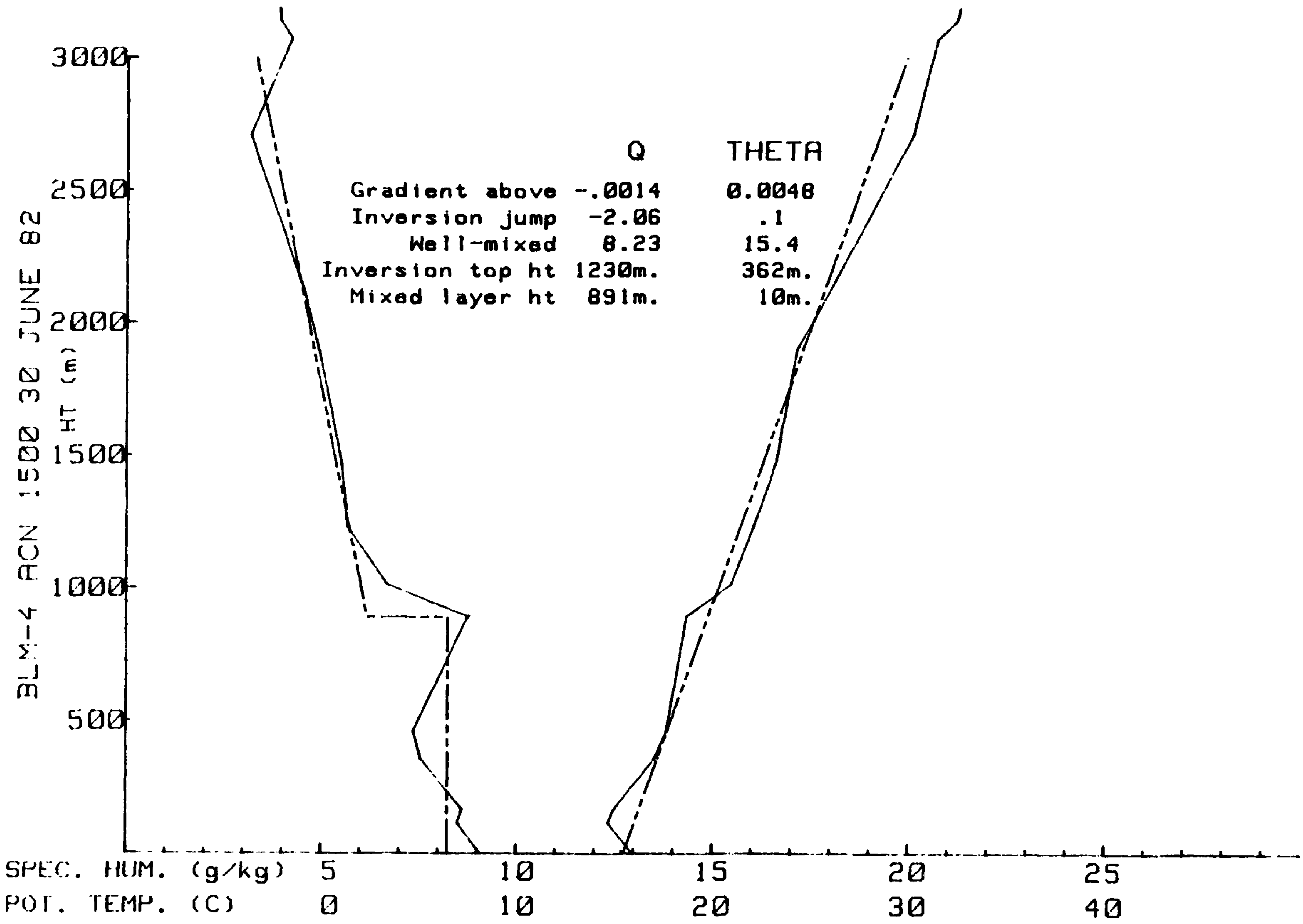


Figure 12 b (4, 6, 20, 3)

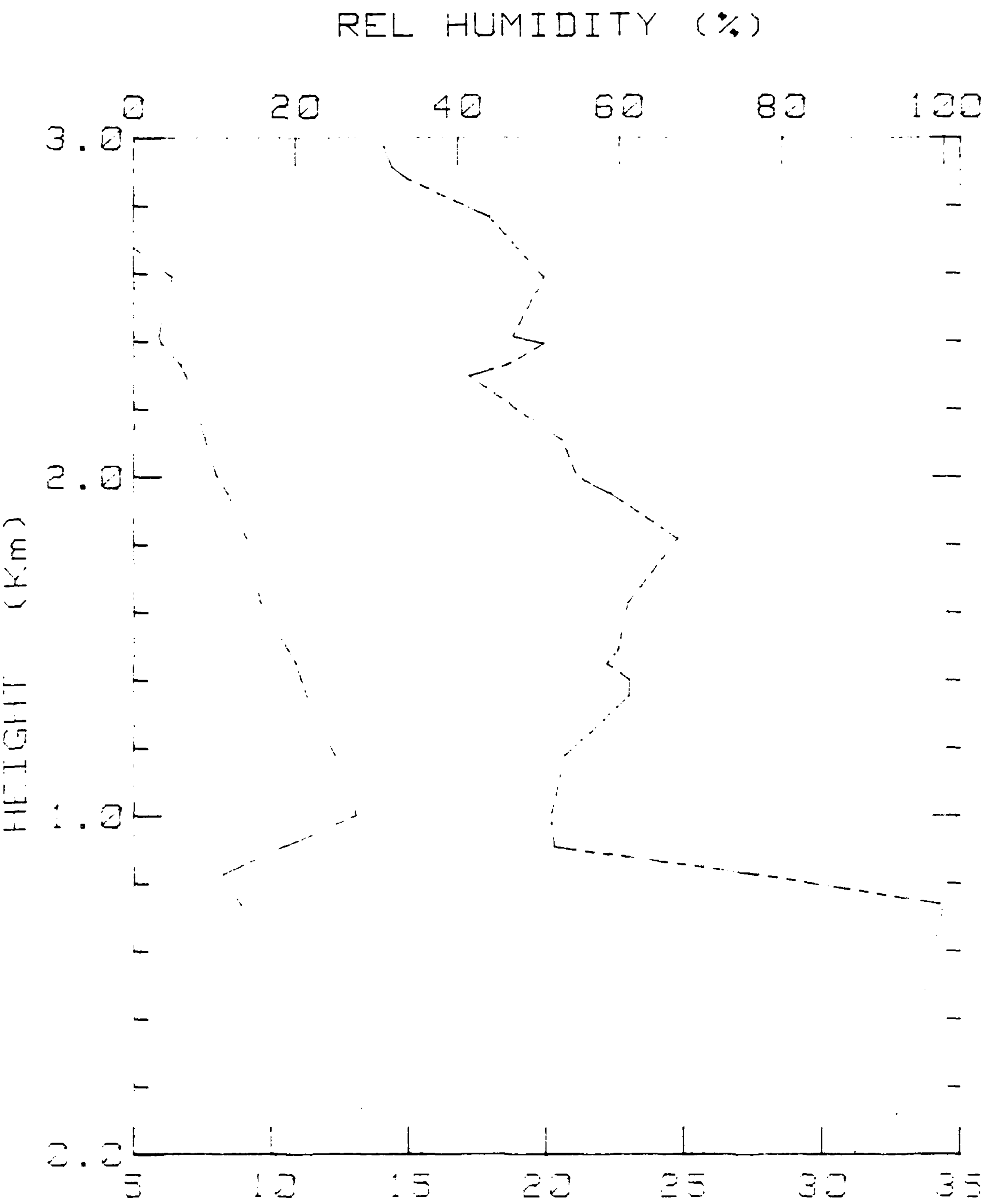
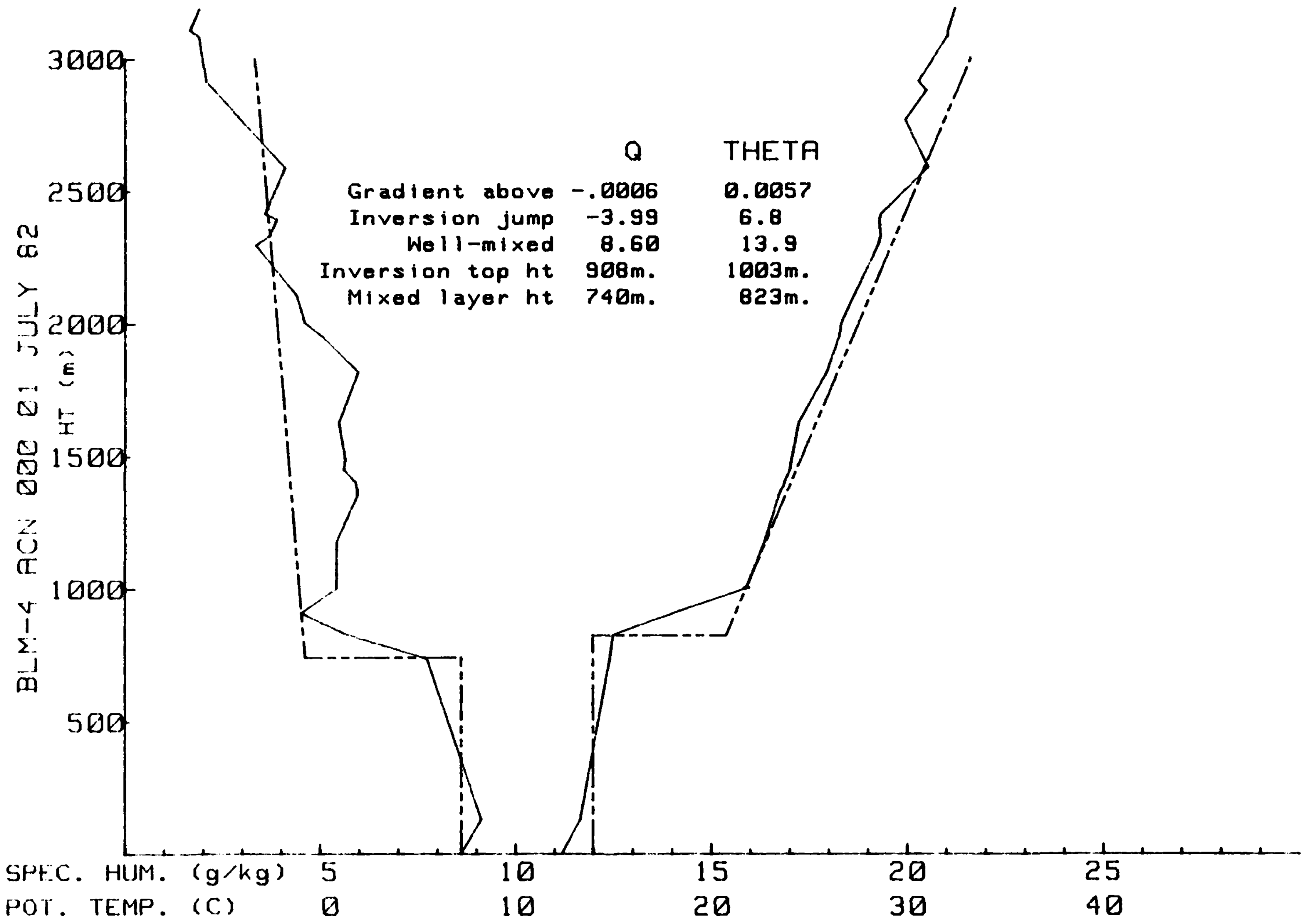


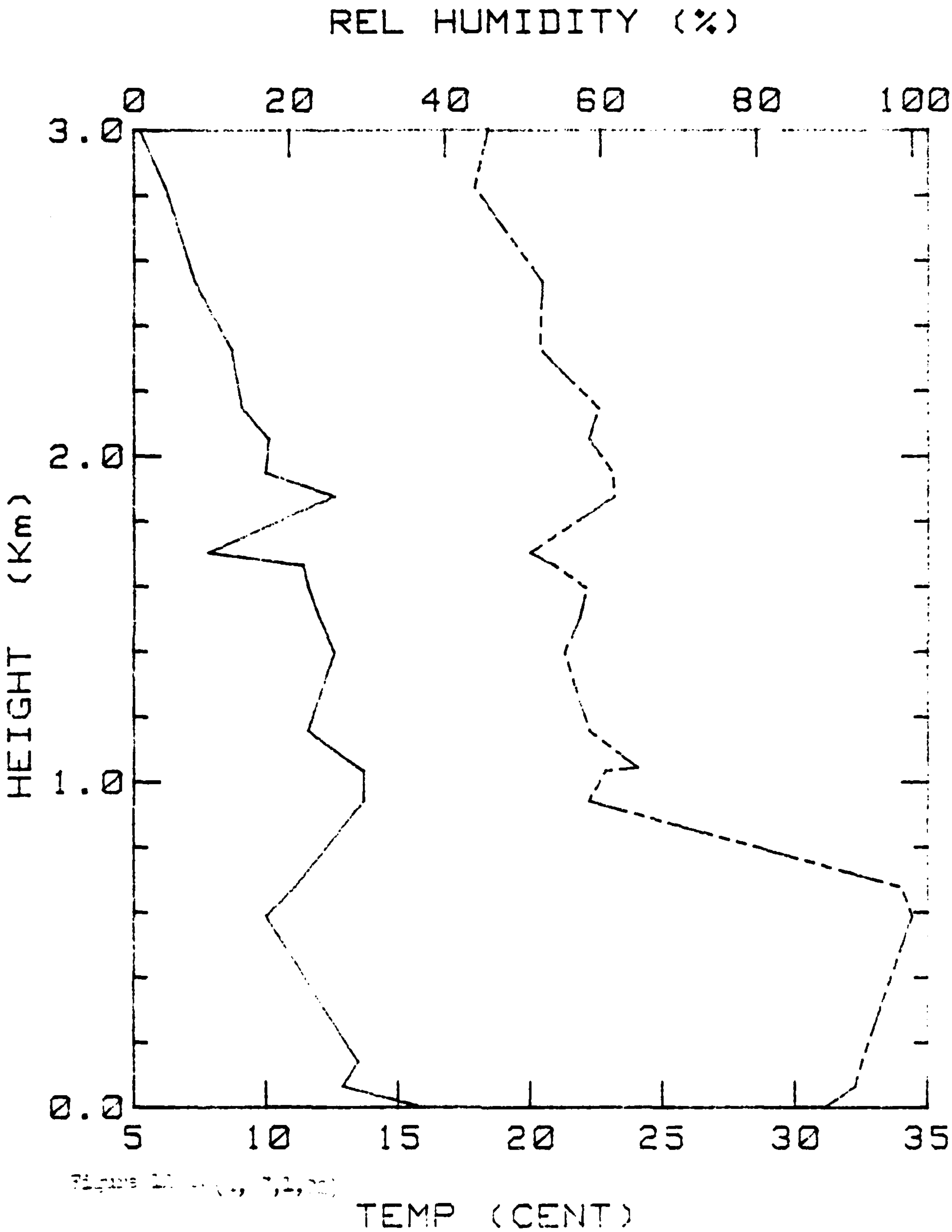
Figure 12 a (1, 7,10,82)

TEMP (CENT)

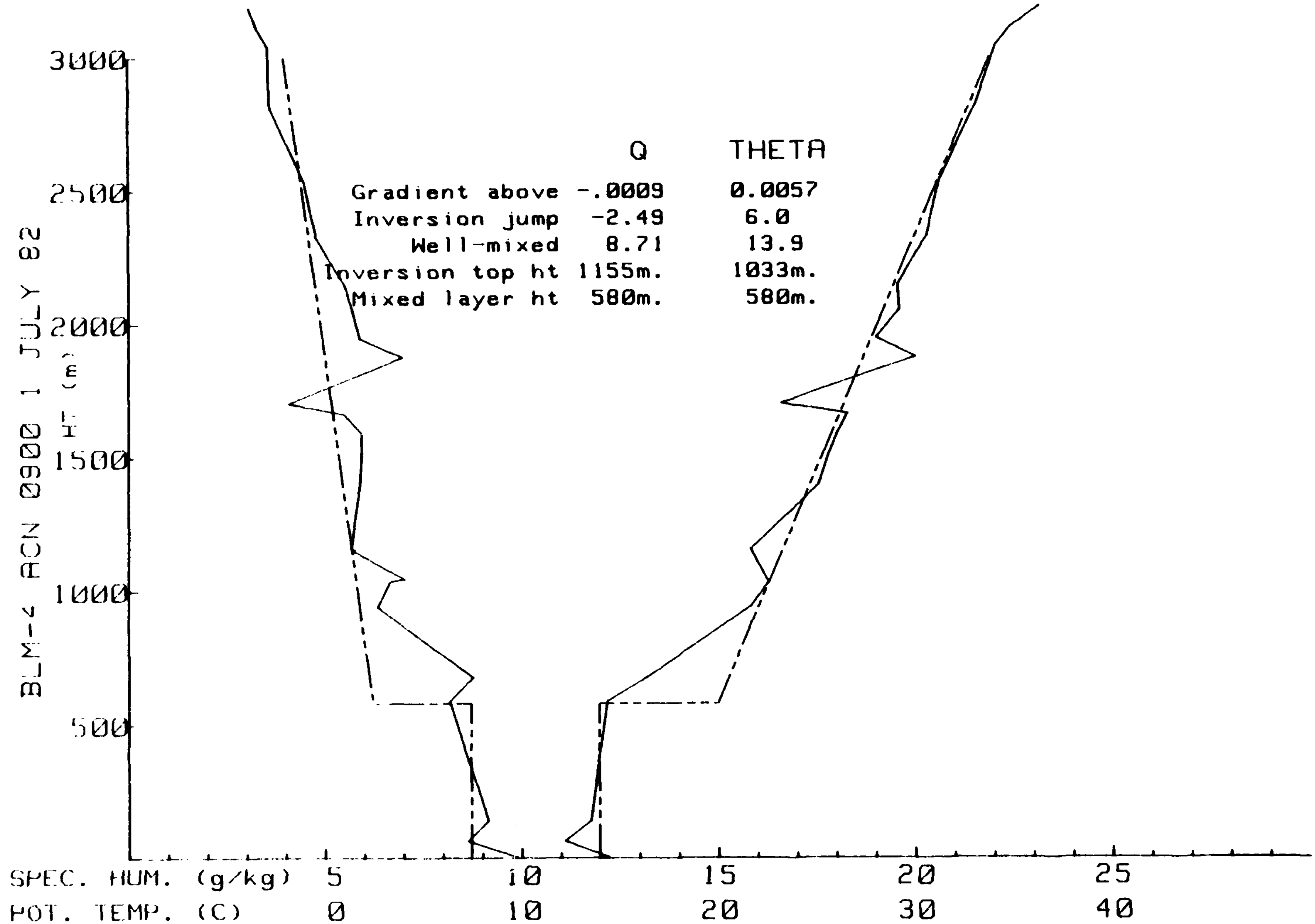
BLM-4 01 JUL 82 0


BLM-4 ACN 000 01 JULY 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0006 0.0057
Inversion jump -3.99 6.8
Well-mixed 8.60 13.9
Inversion top ht 908m. 1003m.
Mixed layer ht 740m. 823m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

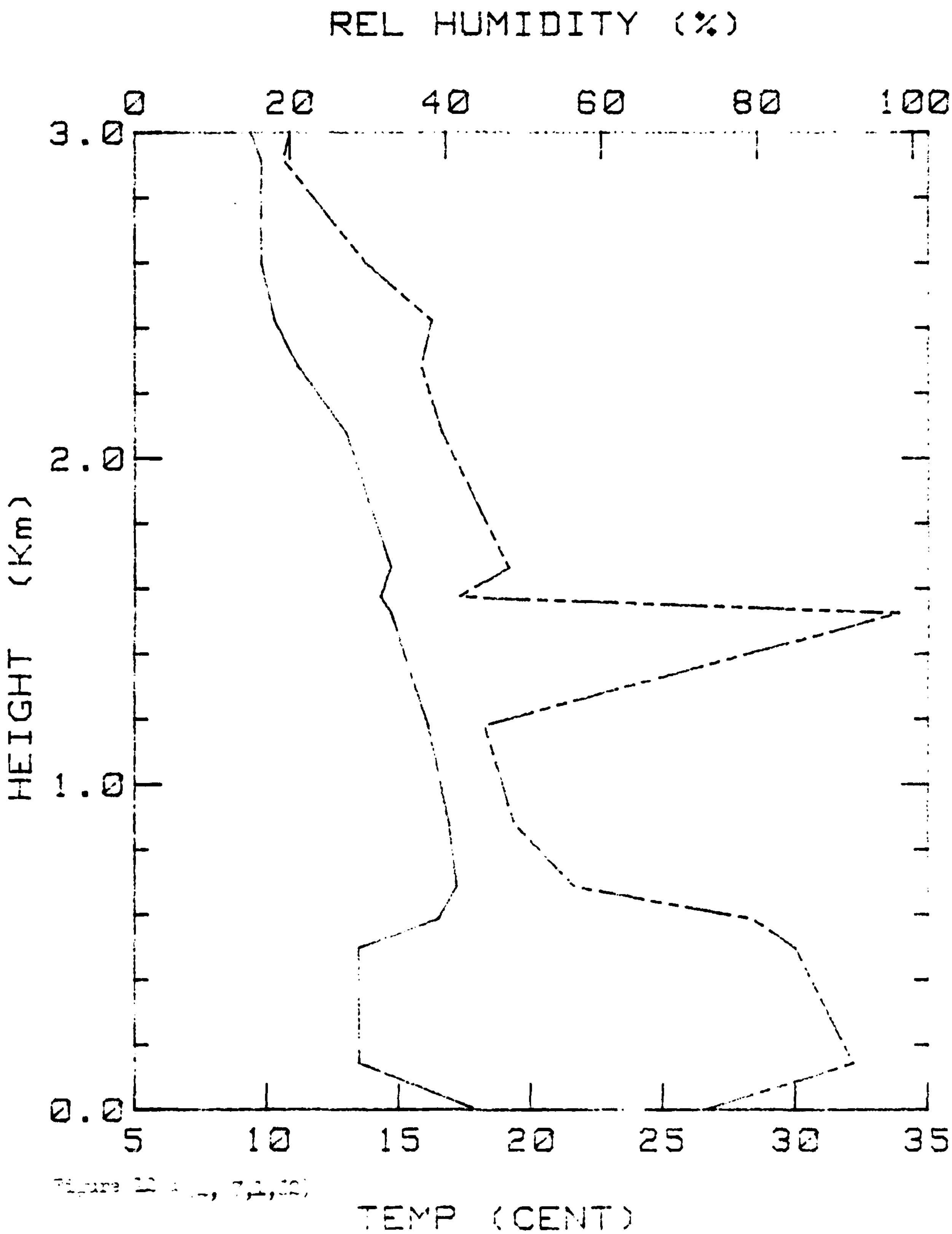
b (7,10,82)



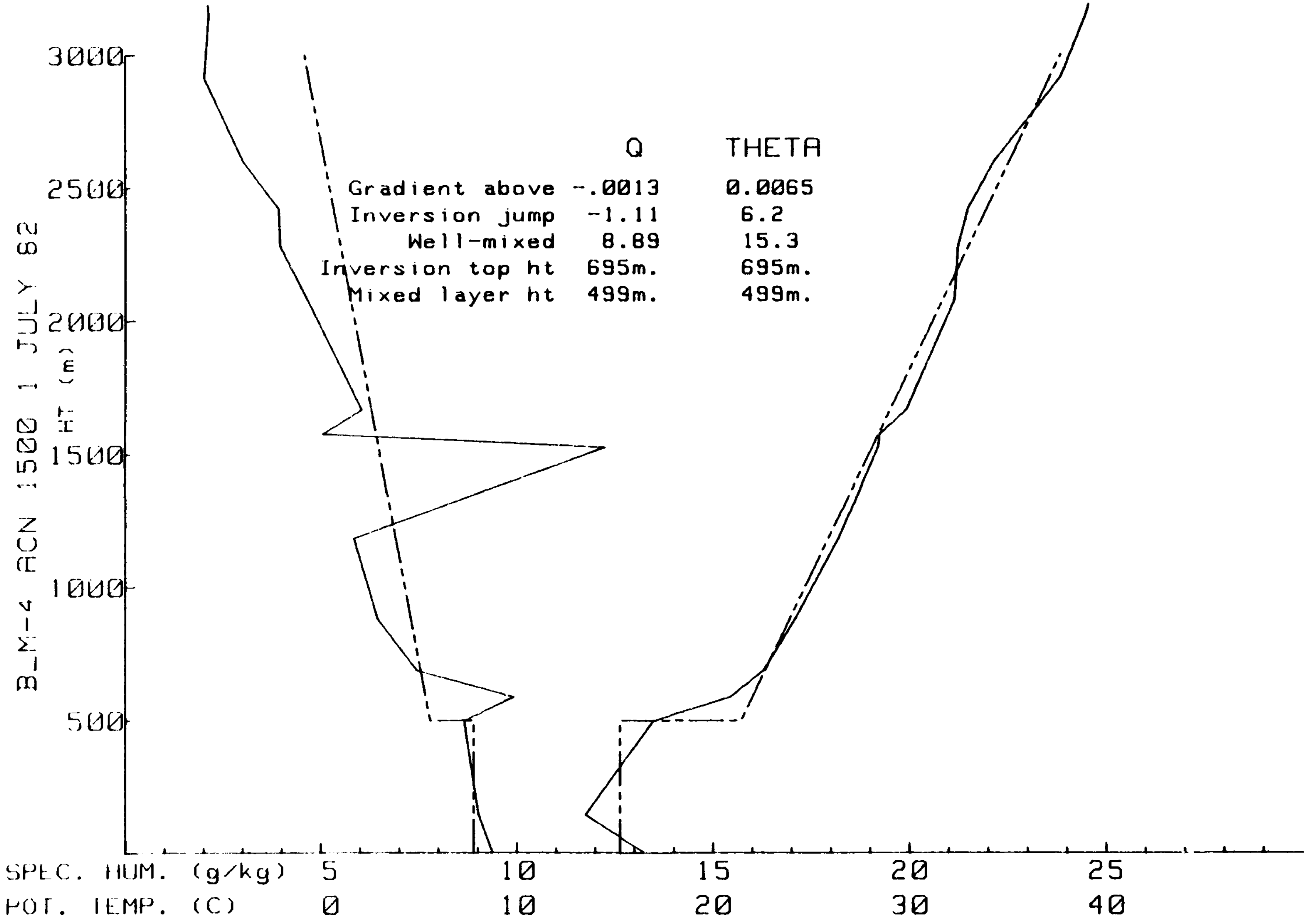
BLM-4 1 JULY 82 900



BLM-4 ACN 0900 1 JULY 82
HT (m)
3000
2500
2000
1500
1000
500
Q
THETA
Gradient above -.0009 0.0057
Inversion jump -2.49 6.0
Well-mixed 8.71 13.9
Inversion top ht 1155m. 1033m.
Mixed layer ht 580m. 580m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40



BLM-4 1 JULY 82 1500


BLM-4 ACN 1500 1 JULY 82
HT (m)
3000
2500
2000
1500
1000
500
Q THETA
Gradient above -.0013 0.0065
Inversion jump -1.11 6.2
Well-mixed 8.89 15.3
Inversion top ht 695m. 695m.
Mixed layer ht 499m. 499m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

IV-4. Meteorological Data and Calculated Parameters

Meteorological data was obtained on the ship on a near-continuous basis. Times when valid data could not be obtained, were associated with moving the ship to the release point, or with the wind being from the stern while underway.

These data and all calculated parameters are listed in Table 8. The wind speeds, air temperatures, and relative humidities are those measured at the upper level (20.5 m). All calculated parameters were obtained using the bulk aerodynamic method. The inversion base height, Z_i, was determined from a combination of acoustic sounder and radiosonde data.

The boundary layer mixing velocity, ω_*, and the mixing time, t, both depend on the mixing depth, Z_i. Thus, during those times when the depth cannot be accurately determined these parameters may be in error.

There are several parameters of interest which are not included in the table because of space limitations. These can be easily obtained from those listed by using the formulas listed in Section III. For example, the rate of dissipation of turbulent kinetic energy, ε, can be obtained from the scaling velocity (friction velocity), U_*, using Eq. 15.

Table 8a. Measured and calculated meteorological parameters for BLM-1.

BLM #1-80
Release #1

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/24 1137	2.1	73	14.7	16.6	330	0.073	0.075	107.0	-2.38E 00	0.4	14.0
09/24 1205	2.1	74	14.6	16.8	360	0.073	0.082	115.1	-2.55E 00	0.4	14.3
09/24 1233	2.0	73	14.9	16.9	350	0.068	0.075	107.5	-2.78E 00	0.4	14.9
09/24 1301	2.3	73	15.1	16.8	350	0.078	0.066	97.4	-1.91E 00	0.4	14.8
09/24 1329	1.9	72	15.0	16.9	340	0.065	0.073	105.9	-2.97E 00	0.4	14.9
09/24 1357	2.8	68	15.1	17.3	330	0.093	0.084	121.8	-1.67E 00	0.4	12.4
09/24 1425	3.9	70	15.2	17.3	300	0.131	0.075	108.5	-7.46E-01	0.5	10.8
09/24 1453	3.9	72	15.3	17.3	280	0.133	0.070	102.6	-6.87E-01	0.4	10.4
09/24 1521	3.6	71	15.2	17.3	260	0.123	0.075	108.7	-8.54E-01	0.4	10.0
09/24 1549	4.6	72	15.1	17.2	240	0.156	0.074	105.9	-5.13E-01	0.5	8.8
09/24 1617	5.9	76	15.0	17.1	250	0.206	0.071	98.8	-2.75E-01	0.5	8.3
09/24 1645	6.4	79	15.0	16.9	260	0.225	0.065	89.2	-2.09E-01	0.5	8.6
09/24 1713	5.8	76	14.8	16.8	270	0.200	0.068	94.5	-2.79E-01	0.5	9.0
09/24 1741	6.6	78	16.5	18.6	290	0.231	0.070	97.8	-2.17E-01	0.5	8.9
09/24 1809	7.0	79	14.8	16.7	290	0.243	0.061	25.1	-5.25E-02	0.5	9.2
09/24 1837	7.0	76	14.9	17.0	280	0.247	0.069	95.9	-1.86E-01	0.5	8.5
09/24 1905	6.8	77	14.8	16.9	280	0.239	0.071	97.4	-2.02E-01	0.5	8.5

BLM #1-80
Release #2

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/27 0715	2.8	85	13.1	16.9	300	0.096	0.156	187.3	-2.39E 00	0.5	9.3
09/27 0743	2.8	87	12.9	16.9	250	0.096	0.164	194.5	-2.51E 00	0.5	8.2
09/27 0859	2.9	80	14.1	16.9	340	0.098	0.109	138.9	-1.71E 00	0.5	11.4
09/27 0945	4.6	78	14.5	17.0	200	0.156	0.087	115.3	-5.61E-01	0.5	7.4
09/27 1013	3.9	80	14.8	17.1	380	0.132	0.082	108.9	-7.44E-01	0.5	12.2
09/27 1041	4.1	80	15.0	17.1	400	0.138	0.076	103.0	-6.41E-01	0.5	12.7
09/27 1138	5.1	80	15.1	17.1	230	0.175	0.071	96.1	-3.71E-01	0.5	8.3
09/27 1206	5.1	82	14.8	17.2	220	0.175	0.084	109.2	-4.20E-01	0.5	7.6
09/27 1234	5.5	83	15.0	17.2	200	0.190	0.078	101.7	-3.35E-01	0.5	7.2
09/27 1302	5.9	82	15.0	17.2	220	0.207	0.075	98.8	-2.74E-01	0.5	7.5
09/27 1330	6.4	81	15.3	17.2	210	0.226	0.064	87.6	-2.04E-01	0.5	7.5
09/27 1358	6.6	77	15.5	17.1	200	0.229	0.054	79.7	-1.80E-01	0.4	7.6
09/27 1426	7.6	80	15.6	17.1	200	0.270	0.050	73.2	-1.19E-01	0.5	7.4
09/27 1454	8.3	77	15.8	17.2	180	0.298	0.042	66.3	-8.84E-02	0.4	7.0
09/27 1522	8.9	77	15.9	17.1	220	0.337	0.036	59.2	-6.18E-02	0.4	8.2
09/27 1550	8.0	75	16.2	17.1	230	0.284	0.025	48.4	-7.06E-02	0.4	10.0
09/27 1618	7.8	75	16.4	17.1	260	0.274	0.018	41.2	-6.45E-02	0.4	12.2
09/27 1646	7.9	77	16.4	17.0	290	0.277	0.017	38.3	-5.87E-02	0.4	13.3
09/27 1714	7.4	80	16.2	17.0	310	0.257	0.022	41.3	-7.37E-02	0.4	13.2
09/27 1742	8.0	80	16.0	17.0	140	0.282	0.028	48.5	-7.23E-02	0.3	6.9
09/27 1810	7.0	80	16.0	17.0	140	0.243	0.030	50.1	-1.00E-01	0.3	7.2
09/27 1838	5.8	80	15.9	16.9	160	0.200	0.029	49.6	-1.47E-01	0.3	8.4
09/27 1906	5.6	80	15.9	16.9	160	0.192	0.029	49.3	-1.58E-01	0.3	8.5

BLM #1-80
Release #3

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10*3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/28 1307	2.0	81	15.8	17.1	210	0.067	0.045	68.0	-1.77E 00	0.3	12.6
09/28 1335	2.3	81	15.9	17.2	200	0.076	0.046	70.0	-1.43E 00	0.3	11.6
09/28 1408	2.9	81	16.0	17.3	160	0.094	0.046	69.1	-9.35E-01	0.3	9.3
09/28 1436	2.5	82	16.1	18.1	160	0.084	0.077	104.0	-1.74E 00	0.3	8.1
09/28 1504	3.0	83	16.2	18.0	400	0.100	0.065	90.5	-1.08E 00	0.4	15.0
09/28 1532	3.5	83	16.4	18.1	120	0.116	0.060	84.3	-7.41E-01	0.3	6.5
09/28 1600	3.4	81	16.6	18.0	140	0.111	0.046	70.1	-6.72E-01	0.3	8.0
09/28 1628	3.3	80	16.8	17.8	140	0.106	0.029	50.8	-5.32E-01	0.2	9.6
09/28 1740	3.1	80	16.9	17.8	400	0.102	0.029	51.1	-5.82E-01	0.3	19.5
09/28 1808	3.5	80	16.8	17.8	110	0.114	0.030	53.3	-4.85E-01	0.2	7.8
09/28 1836	2.7	81	16.6	17.6	400	0.088	0.031	52.9	-8.08E-01	0.3	20.0
09/28 1904	2.3	81	16.6	17.5	400	0.075	0.032	54.5	-1.15E 00	0.3	20.8

BLM #1-80
Release #4

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10*3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
09/29 1217	2.4	80	13.8	16.1	100	0.079	0.090	117.0	-2.20E 00	0.3	5.8
09/29 1245	2.2	78	14.6	16.1	400	0.072	0.052	76.9	-1.76E 00	0.4	18.0
09/29 1319	2.7	76	15.4	16.2	440	0.087	0.027	50.3	-7.80E-01	0.3	22.5
09/29 1347	3.3	76	15.6	16.3	400	0.106	0.024	46.4	-4.85E-01	0.3	20.6
09/29 1415	3.5	76	15.7	16.5	430	0.114	0.024	46.7	-4.26E-01	0.3	21.1
09/29 1443	4.0	76	15.9	16.6	440	0.129	0.018	40.5	-2.85E-01	0.3	22.3
09/29 1511	4.7	76	16.1	16.3	410	0.154	0.000	19.5	-9.64E-02	0.1	91.9
09/29 1540	5.5	76	16.1	15.9	360	0.179	-0.011	6.6	-2.32E-02	0.3	20.8
09/29 1626	4.8	76	16.0	16.0	300	0.154	-0.006	11.9	-5.76E-02	0.2	23.3
09/29 1654	4.6	76	16.1	16.0	320	0.149	-0.008	10.0	-5.17E-02	0.2	22.7
09/29 1722	4.9	76	16.0	16.1	310	0.162	-0.002	17.3	-7.72E-02	0.1	37.5
09/29 1750	5.4	76	15.9	16.1	320	0.180	0.002	21.8	-7.87E-02	0.2	31.4
09/29 1818	5.1	76	15.8	16.0	280	0.169	0.002	20.9	-8.62E-02	0.1	32.5
09/29 1846	4.5	76	15.7	15.9	260	0.146	0.003	22.0	-1.20E-01	0.2	28.1
09/29 1902	4.3	76	15.8	15.9	280	0.137	-0.001	18.0	-1.13E-01	0.1	50.2

Table 8b. Measured and calculated meteorological paramenters for BLM-2.

BLM-2 1981
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10**3*Qo (m/secK)	Z/L	w* (m/sec)	t (min)
01/06 1355	5.6	66	16.7	15.6	160	0.175	-0.039	-18.6	7.40E-02	0.3	8.0
01/06 1425	5.3	66	16.8	15.6	160	0.163	-0.041	-21.5	9.79E-02	0.3	8.0
01/06 1455	4.3	60	17.3	15.7	160	0.118	-0.051	-30.6	2.65E-01	0.3	8.3
01/06 1542	2.6	64	17.1	15.8	160	0.057	-0.036	-19.6	7.39E-01	0.2	11.9
01/06 1512	5.4	53	17.7	15.7	170	0.157	-0.068	-42.2	2.05E-01	0.4	7.2
01/06 1642	4.7	58	17.3	15.6	170	0.132	-0.056	-34.1	2.35E-01	0.4	8.1
01/06 1712	5.3	61	17.1	15.6	180	0.159	-0.051	-29.4	1.40E-01	0.4	8.2
01/06 1742	4.5	61	17.2	15.6	180	0.128	-0.050	-30.5	2.24E-01	0.3	8.8
01/06 1812	4.8	52	18.0	15.5	160	0.137	-0.064	-42.2	2.72E-01	0.4	7.4
01/06 1842	3.7	66	16.7	15.5	160	0.101	-0.041	-22.5	2.65E-01	0.3	9.5
01/06 1912	2.7	69	16.5	15.5	140	0.066	-0.032	-16.9	4.74E-01	0.2	10.8
01/06 1942	1.6	55	16.0	15.4	140	0.053	-0.015	18.7	-7.62E-01	0.2	14.9
01/07 1232	3.2	70	15.0	15.6	100	0.104	0.017	43.6	-4.76E-01	0.2	9.1
01/07 1320	1.8	71	15.4	15.8	200	0.058	0.009	34.8	-1.19E 00	0.2	22.0
01/07 1350	1.5	74	15.5	15.3	100	0.052	0.007	30.9	-1.34E 00	0.1	15.5
01/07 1420	1.6	76	15.6	15.8	100	0.052	0.000	21.1	-9.27E-01	0.0	43.2
01/07 1450	1.5	79	15.7	16.0	100	0.050	0.007	27.2	-1.28E 00	0.1	15.5
01/09 1149	3.7	79	14.0	15.4	80	0.122	0.046	68.9	-5.49E-01	0.2	5.4
01/09 1221	4.1	84	14.0	15.3	180	0.134	0.042	59.9	-3.94E-01	0.3	9.2
01/09 1309	4.1	85	14.1	15.3	200	0.137	0.037	54.2	-3.42E-01	0.3	10.2
01/09 1339	4.6	87	14.2	15.3	240	0.154	0.036	51.0	-2.53E-01	0.4	11.2
01/09 1409	4.7	88	14.2	15.3	240	0.156	0.033	47.1	-2.30E-01	0.3	11.5
01/09 1439	4.6	87	[illegible]	15.3	250	0.153	0.028	42.0	-2.13E-01	0.3	12.6
01/09 1509	5.0	84	[illegible]	15.3	260	0.166	0.019	34.0	-1.45E-01	0.3	14.2
01/09 1539	4.2	85	14.8	15.4	260	0.136	0.014	28.2	-1.79E-01	0.3	16.7
01/09 1609	3.2	[illegible]	15.0	15.3	200	0.101	0.008	21.0	-2.43E-01	0.2	16.9
01/09 1639	2.9	83	15.2	15.3	180	0.091	0.001	15.0	-2.10E-01	0.1	32.2
01/09 1709	4.1	87	15.1	15.3	160	0.131	0.004	15.7	-1.07E-01	0.1	18.3
01/09 1739	4.7	88	15.0	15.3	120	0.154	0.008	18.6	-9.16E-02	0.2	11.9
01/09 1809	5.2	85	15.0	15.3	100	0.170	0.005	17.8	-7.25E-02	0.1	11.5
01/13 0852	3.9	70	14.4	15.0	180	0.129	0.021	44.1	-3.14E-01	0.3	11.7
01/13 0948	3.0	79	15.1	15.0	100	0.090	-0.007	7.5	-1.06E-01	0.1	13.0
01/13 1049	3.3	67	16.0	15.2	100	0.096	-0.024	-6.2	8.59E-02	0.2	8.4
01/13 1119	4.5	76	15.5	15.2	100	0.141	-0.014	-0.2	2.68E-03	0.2	6.9
01/13 1239	4.9	73	16.0	15.3	100	0.152	-0.024	-9.0	4.79E-02	0.2	7.2
01/13 1309	5.4	77	15.9	15.4	100	0.172	-0.022	-8.2	3.42E-02	0.2	7.1

BLM-2 1981
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
01/13 1339	5.3	71	16.3	15.4	100	0.167	-0.030	-14.8	6.49E-02	0.3	6.5
01/13 1409	6.1	61	17.0	15.4	100	0.194	-0.046	-27.5	8.83E-02	0.3	5.3
01/13 1439	5.5	64	16.9	15.5	100	0.171	-0.045	-26.6	1.10E-01	0.3	5.6
01/13 1509	5.6	71	16.5	15.5	100	0.176	-0.036	-20.5	8.02E-02	0.3	6.0
01/13 1521	5.1	81	16.1	15.4	100	0.157	-0.027	-16.4	6.07E-02	0.2	6.9
01/13 1559	5.4	83	15.9	15.3	130	0.169	-0.023	-13.2	5.58E-02	0.3	6.4
01/13 1629	4.0	87	15.7	15.4	130	0.120	-0.015	-6.8	5.71E-02	0.2	10.9
01/13 1659	4.3	83	15.8	15.4	130	0.132	-0.014	-4.7	3.32E-02	0.2	10.7
01/13 1729	4.4	83	15.7	15.4	130	0.137	-0.013	-2.2	1.52E-02	0.2	11.0
01/14 1130	3.1	66	15.7	15.4	100	0.096	-0.013	8.2	-1.00E-01	0.2	10.2
01/14 1200	2.0	70	15.7	15.4	100	0.061	-0.012	8.5	-2.62E-01	0.1	12.3
01/14 1230	2.5	72	15.6	15.5	80	0.075	-0.008	12.5	-2.53E-01	0.1	11.3
01/14 1300	2.3	77	15.4	15.6	50	0.072	0.002	21.4	-4.82E-01	0.1	13.4
01/14 1330	1.8	81	15.3	15.5	50	0.058	0.002	18.4	-6.33E-01	0.1	13.5
01/14 1400	1.7	85	15.6	15.7	180	0.054	0.001	14.4	-5.76E-01	0.1	41.1
01/14 1430	1.8	86	15.6	15.8	180	0.057	-0.001	11.1	-4.04E-01	0.1	47.7
01/14 1500	2.6	86	15.5	15.7	200	0.079	0.001	12.4	-2.34E-01	0.1	43.1
01/15 1441	3.3	86	14.8	15.7	150	0.106	0.026	40.2	-4.23E-01	0.2	10.4
01/15 1500	4.8	84	14.8	15.7	200	0.160	0.026	41.1	-1.90E-01	0.3	10.9
01/15 1552	4.0	84	15.1	15.6	100	0.128	0.013	26.2	-1.87E-01	0.2	9.4
01/15 1622	5.3	85	14.9	15.6	360	0.176	0.021	34.6	-1.32E-01	0.4	16.6
01/15 1652	6.2	85	14.8	15.6	260	0.210	0.022	35.5	-9.56E-02	0.3	12.6
01/15 1722	5.9	85	14.8	15.5	120	0.200	0.021	34.9	-1.02E-01	0.3	7.8
01/16 0938	3.7	88	14.6	15.9	500	0.092	0.043	58.3	-8.14E-01	0.4	20.5
01/16 1008	3.6	88	14.7	15.9	500	0.089	0.042	56.9	-8.43E-01	0.4	20.9
01/16 1050	4.9	82	15.0	16.0	400	0.130	0.031	43.5	-3.40E-01	0.4	17.6
01/16 1120	4.4	83	15.0	16.0	400	0.113	0.032	49.7	-4.60E-01	0.4	18.1
01/16 1150	4.2	83	15.0	16.1	400	0.108	0.037	55.9	-5.61E-01	0.4	17.5
01/16 1220	4.0	84	14.9	16.2	380	0.102	0.044	61.9	-7.01E-01	0.4	16.4
01/16 1250	4.0	84	14.9	16.2	380	0.101	0.049	68.2	-7.91E-01	0.4	15.9
01/16 1320	4.1	84	14.9	16.2	360	0.104	0.046	65.0	-7.10E-01	0.4	15.4
01/16 1350	3.7	85	14.9	16.2	340	0.092	0.048	65.9	-9.22E-01	0.4	15.3
01/16 1420	3.9	86	15.0	16.3	320	0.101	0.045	62.6	-7.33E-01	0.4	14.5
01/16 1450	5.1	84	15.1	16.3	300	0.140	0.039	56.3	-3.38E-01	0.4	13.1
01/16 1520	6.2	80	15.3	16.2	400	0.179	0.027	46.1	-1.70E-01	0.4	16.5
01/16 1550	6.0	82	15.3	16.2	400	0.172	0.027	43.8	-1.76E-01	0.4	16.9

BLM-2 1981
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	zi (m)	U* (m/sec)	T* (C)	10*3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
01/16 1620	6.1	83	15.4	16.1	400	0.175	0.022	37.9	-1.46E-01	0.4	17.8
01/16 1650	6.4	84	15.5	16.1	400	0.186	0.016	30.5	-1.04E-01	0.3	19.3
01/16 1720	6.6	86	15.4	16.0	400	0.194	0.017	30.0	-9.37E-02	0.4	18.7
01/16 1750	6.2	87	15.4	16.0	400	0.176	0.019	30.8	-1.17E-01	0.4	18.8
01/16 1820	5.3	85	15.5	15.9	400	0.141	0.011	23.7	-1.40E-01	0.3	24.1
01/16 1850	4.7	86	15.5	15.9	400	0.122	0.010	21.9	-1.73E-01	0.3	26.6
01/16 1920	4.3	88	15.5	15.9	480	0.105	0.010	21.1	-2.26E-01	0.3	31.1
01/16 1950	3.2	88	15.4	15.9	480	0.073	0.015	26.7	-5.90E-01	0.3	30.5
01/16 2020	1.8	89	15.3	15.9	480	0.032	0.021	33.5	-3.80E 00	0.2	36.0
01/16 2050	0.8	90	15.1	15.8	400	0.044	0.022	33.6	-2.03E 00	0.2	28.1
01/16 2120	3.1	91	15.1	15.9	400	0.069	0.023	33.2	-8.32E-01	0.3	24.0
01/16 2150	4.3	92	15.1	15.8	400	0.127	0.019	28.3	-2.07E-01	0.3	20.7
01/16 2220	6.2	90	15.2	15.8	260	0.176	0.017	26.8	-1.03E-01	0.3	14.5
01/16 2250	7.1	91	15.2	15.7	160	0.211	0.012	20.1	-5.32E-02	0.2	11.2

Table 8c. Measured and calculated meteorological paramenters for BLM-3.

BLM 3 81
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/08 1109	3.4	34	14.9	12.9	80	0.000	-0.000	-0.0	9.99E 02	0.0	0.0
12/08 1119	3.8	34	15.0	12.8	80	0.091	-0.063	-40.9	6.00E-01	0.0	0.0
12/08 1129	3.6	33	15.3	12.8	80	0.079	-0.067	-45.8	8.76E-01	0.0	0.0
12/08 1139	6.0	33	15.8	12.8	80	0.020	-0.028	-20.0	5.98E 00	0.0	0.0
12/08 1149	5.2	29	17.2	12.9	80	0.001	-0.003	-2.1	9.99E 02	0.0	0.0
12/08 1159	2.8	34	17.4	12.7	80	0.005	-0.010	-3.2	3.39E 01	0.0	0.0
12/08 1209	2.5	51	15.2	12.5	80	0.023	-0.028	-22.8	5.12E 00	0.0	0.0
12/08 1219	2.0	63	13.9	12.5	80	0.028	-0.023	-16.7	2.64E 00	0.0	0.0
12/08 1252	1.0	69	13.6	12.8	80	0.001	-0.001	-0.4	9.99E 02	0.0	0.0
12/08 1352	2.0	64	14.3	13.2	80	0.035	-0.024	-15.5	1.56E 00	0.0	0.0
12/08 1422	1.9	62	14.7	13.0	80	0.014	-0.015	-11.8	6.84E 00	0.0	0.0
12/08 1452	0.9	69	14.4	12.9	80	0.000	-0.001	-0.5	9.99E 02	0.0	0.0
12/08 1522	1.3	75	14.2	13.1	80	0.004	-0.004	-2.9	1.92E 01	0.0	0.0
12/08 1552	0.8	75	14.4	13.3	130	0.000	-0.000	-0.3	9.99E 02	0.0	0.0
12/08 1622	1.1	73	14.5	13.1	130	0.000	0.000	0.0	9.99E 02	0.0	0.0
12/08 1652	0.8	69	14.6	13.0	130	0.000	0.000	0.0	9.99E 02	0.0	0.0
12/08 1722	0.8	71	14.4	13.0	130	0.000	0.000	0.0	9.99E 02	0.0	0.0
12/08 1752	0.9	72	14.3	12.9	130	0.000	0.000	0.0	9.99E 02	0.0	0.0
12/08 1822	1.5	75	14.3	12.8	130	0.000	0.000	0.0	9.99E 02	0.0	0.0
12/08 1852	1.3	74	14.2	12.6	130	0.000	0.000	0.0	9.99E 02	0.0	0.0
12/08 1922	2.0	78	13.5	12.5	130	0.033	-0.021	-16.4	1.85E 00	0.0	0.0
12/08 1952	2.1	80	12.7	12.6	130	0.061	-0.009	1.0	-2.12E-02	0.1	16.3
12/08 2022	2.8	80	12.4	12.7	130	0.087	0.007	19.8	-3.03E-01	0.1	15.6
12/08 2052	2.6	75	12.6	12.6	130	0.079	-0.002	12.7	-2.37E-01	0.1	24.1
12/08 2122	1.6	74	12.4	12.4	130	0.053	-0.000	14.8	-6.05E-01	0.0	45.0
12/08 2152	1.3	77	12.2	12.5	80	0.046	0.008	23.8	-1.31E 00	0.1	13.5
12/08 2222	2.1	84	11.7	12.5	125	0.067	0.029	41.0	-1.07E 00	0.2	10.3
12/08 2252	1.9	96	10.9	12.7	110	0.065	0.071	79.8	-2.23E 00	0.3	7.1
12/08 2322	1.3	100	10.7	12.7	120	0.047	0.088	97.3	-5.22E 00	0.3	7.8
12/08 2352	1.9	207	10.3	12.6	200	0.067	0.094	103.5	-2.77E 00	0.3	9.5
12/09 0022	3.8	100	10.2	12.6	290	0.128	0.088	97.4	-7.06E-01	0.5	10.0
12/09 0052	3.4	99	10.3	12.6	280	0.112	0.088	97.4	-9.17E-01	0.5	10.3
12/09 0122	1.5	98	10.3	12.6	240	0.054	0.098	109.5	-4.40E 00	0.4	11.4
12/09 0152	1.1	97	10.3	12.6	290	0.044	0.103	116.6	-7.25E 00	0.4	13.6
12/09 0222	1.1	94	10.3	12.6	270	0.043	0.104	118.4	-7.73E 00	0.3	13.1
12/09 0252	1.4	95	10.2	12.6	280	0.051	0.107	121.0	-5.42E 00	0.4	12.5

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Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/09 0322	1.6	95	10.2	12.6	310	0.058	0.101	114.3	-3.96E 00	0.4	13.0
12/09 0352	1.7	94	10.2	12.6	290	0.060	0.100	114.2	-3.73E 00	0.4	12.4
12/09 0422	2.6	95	10.2	12.6	250	0.087	0.097	109.9	-1.73E 00	0.4	10.0
12/09 0452	1.8	96	9.7	12.6	200	0.065	0.123	137.4	-3.84E 00	0.4	8.8
12/09 0522	1.1	96	9.7	12.5	220	0.044	0.128	143.9	-8.89E 00	0.3	10.5
12/09 0552	0.9	94	10.0	12.5	240	0.036	0.117	133.4	-1.19E 01	0.3	12.2
12/09 0622	2.1	94	10.1	12.5	310	0.071	0.101	114.8	-2.72E 00	0.4	12.3
12/09 0652	1.8	93	10.3	12.5	350	0.062	0.094	108.3	-3.32E 00	0.4	14.2
12/09 0722	2.0	91	10.3	12.5	330	0.069	0.091	105.5	-2.62E 00	0.4	13.3
12/09 0752	1.9	92	10.2	12.5	320	0.065	0.099	114.5	-3.22E 00	0.4	12.9
12/09 0822	1.7	92	10.1	12.5	310	0.060	0.107	122.9	-4.02E 00	0.4	12.7
12/09 0852	1.6	93	10.0	12.5	330	0.059	0.110	125.3	-4.32E 00	0.4	13.2
12/09 0922	2.1	94	9.3	12.5	360	0.081	0.113	127.2	-2.29E 00	0.5	12.5
12/09 0952	0.7	95	9.7	12.3	410	0.031	0.128	144.9	-1.78E 01	0.4	17.9
12/09 1022	1.7	94	10.2	12.3	540	0.059	0.083	101.4	-3.41E 00	0.5	19.6
12/09 1052	4.0	90	11.3	12.4	600	0.130	0.035	44.4	-3.12E-01	0.5	22.2
12/09 1122	4.4	88	11.4	12.4	540	0.146	0.033	43.9	-2.42E-01	0.4	20.1
12/09 1152	3.1	88	11.4	12.4	640	0.101	0.033	44.2	-5.09E-01	0.4	25.4
12/09 1222	3.9	87	11.6	12.4	660	0.126	0.027	37.6	-2.78E-01	0.4	25.8
12/09 1252	3.5	85	11.8	12.4	680	0.113	0.020	31.2	-2.88E-01	0.4	30.1
12/09 1322	3.6	85	11.8	12.4	680	0.116	0.021	32.2	-2.80E-01	0.4	29.5
12/09 1352	3.5	85	11.8	12.4	720	0.112	0.022	33.3	-3.13E-01	0.4	30.6
12/09 1422	3.4	86	11.8	12.4	700	0.107	0.019	29.4	-3.04E-01	0.4	32.2
12/09 1452	2.6	85	12.1	12.4	780	0.081	0.010	19.7	-3.55E-01	0.3	47.4
12/09 1522	0.7	83	12.3	12.4	0	0.025	0.001	12.4	-2.36E 00	0.0	0.0
12/09 1552	1.5	82	12.5	12.4	0	0.048	-0.006	3.7	-1.74E-01	0.0	0.0
12/09 1622	1.9	81	12.7	12.4	0	0.054	-0.011	-2.5	1.12E-01	0.0	0.0
12/09 1652	2.1	81	12.8	12.4	0	0.053	-0.015	-7.3	3.24E-01	0.0	0.0
12/09 1722	3.2	80	12.7	12.4	0	0.093	-0.015	-6.1	8.84E-02	0.0	0.0
12/09 1752	5.3	83	12.5	12.4	0	0.171	-0.006	3.2	-1.19E-02	0.0	0.0
12/09 1822	2.9	82	12.5	12.4	0	0.086	-0.007	2.6	-3.71E-02	0.0	0.0
12/09 1852	2.4	82	12.6	12.4	0	0.071	-0.009	0.2	1.56E-03	0.0	0.0
12/09 1922	3.2	78	13.0	12.4	0	0.083	-0.024	-14.6	2.31E-01	0.0	0.0
12/09 1952	2.2	84	12.5	12.4	0	0.065	-0.007	0.9	-1.75E-02	0.0	0.0
12/09 2022	1.4	81	12.6	12.3	0	0.037	-0.011	-4.0	3.72E-01	0.0	0.0
12/09 2052	0.3	86	12.5	12.4	0	0.020	-0.007	-1.3	5.82E-01	0.0	0.0

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Date/Time	U (m/sec)	RH (%)	T (C)	TS (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/sec K)	z/L	w* (m/sec)	t (min)
12/09 2122	1.4	93	12.0	12.4	0	0.047	0.014	20.2	-1.08E 00	0.0	0.0
12/09 2152	1.1	94	11.9	12.4	0	0.038	0.018	23.6	-1.89E 00	0.0	0.0
12/09 2222	1.0	96	11.7	12.5	0	0.038	0.027	32.6	-2.68E 00	0.0	0.0
12/09 2252	1.9	98	11.7	12.5	0	0.062	0.027	31.0	-9.64E-01	0.0	0.0
12/09 2322	1.2	98	11.7	12.5	0	0.043	0.028	32.7	-2.13E 00	0.0	0.0
12/09 2352	0.9	98	11.6	12.5	0	0.035	0.035	39.9	-3.77E 00	0.0	0.0
12/10 0022	1.2	98	11.6	12.5	0	0.044	0.035	39.9	-2.50E 00	0.0	0.0
12/10 0052	2.0	98	11.6	12.5	0	0.065	0.034	38.3	-1.06E 00	0.0	0.0
12/10 0122	2.2	96	11.5	12.5	0	0.072	0.035	40.7	-9.29E-01	0.0	0.0
12/10 0152	1.8	95	11.6	12.5	0	0.059	0.035	40.7	-1.37E 00	0.0	0.0
12/10 0222	2.4	94	11.6	12.5	0	0.076	0.031	37.9	-7.68E-01	0.0	0.0
12/10 0252	1.3	94	11.5	12.5	0	0.047	0.038	45.1	-2.43E 00	0.0	0.0
12/10 0322	1.4	94	11.6	12.5	100	0.049	0.033	39.9	-1.94E 00	0.2	9.4
12/10 0352	1.1	95	11.7	12.5	0	0.039	0.028	33.7	-2.60E 00	0.0	0.0
12/10 0422	1.3	96	11.8	12.5	0	0.046	0.025	29.9	-1.66E 00	0.0	0.0
12/10 0452	1.8	96	11.8	12.5	0	0.059	0.024	28.6	-9.76E-01	0.0	0.0
12/10 0522	2.2	93	12.3	12.5	0	0.067	0.005	8.9	-2.31E-01	0.0	0.0
12/10 0552	3.2	92	12.4	12.5	0	0.098	-0.001	3.2	-3.83E-02	0.0	0.0
12/10 0622	4.1	91	12.6	12.5	0	0.125	-0.008	-4.1	3.24E-02	0.0	0.0
12/10 0652	3.8	92	12.3	12.5	0	0.118	0.003	7.4	-6.24E-02	0.0	0.0
12/10 0722	4.2	89	12.6	12.5	0	0.127	-0.008	-3.1	2.35E-02	0.0	0.0
12/10 0752	4.3	90	12.8	12.5	0	0.129	-0.015	-10.6	7.68E-02	0.0	0.0
12/10 0822	3.6	91	12.7	12.5	0	0.106	-0.009	-5.3	5.72E-02	0.0	0.0
12/10 0852	2.0	92	11.3	12.5	0	0.066	0.049	58.6	-1.59E 00	0.0	0.0
12/10 1022	2.3	96	10.8	12.5	0	0.076	0.066	75.3	-1.55E 00	0.0	0.0
12/10 1052	2.2	94	11.2	12.6	0	0.072	0.052	61.1	-1.39E 00	0.0	0.0
12/10 1122	2.5	94	11.6	12.6	0	0.079	0.039	46.5	-8.79E-01	0.0	0.0
12/10 1152	3.0	95	11.7	12.7	0	0.096	0.034	40.5	-5.20E-01	0.0	0.0
12/10 1222	1.2	95	11.9	12.6	0	0.043	0.027	32.0	-2.06E 00	0.0	0.0
12/10 1252	1.1	92	12.3	12.7	0	0.039	0.012	17.5	-1.38E 00	0.0	0.0
12/10 1352	1.4	88	12.8	12.7	0	0.041	-0.007	-1.1	8.62E-02	0.0	0.0
12/10 1422	1.0	86	12.9	12.7	0	0.027	-0.008	-2.0	3.38E-01	0.0	0.0
12/10 1452	2.6	84	13.3	12.7	0	0.064	-0.020	-14.8	4.30E-01	0.0	0.0
12/10 1522	4.0	71	14.7	12.7	0	0.095	-0.058	-50.6	6.75E-01	0.0	0.0
12/10 1552	3.5	66	15.3	12.7	0	0.066	-0.057	-50.6	1.37E 00	0.0	0.0

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All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/10 1622	1.7	74	14.3	12.7	0	0.002	-0.002	-1.4	7.48E 01	0.0	0.0
12/10 1857	2.6	62	14.3	12.6	100	0.045	-0.036	-26.7	1.55E 00	0.0	0.0
12/10 1946	3.9	60	14.1	12.6	0	0.103	-0.048	-32.1	3.67E-01	0.0	0.0
12/10 2016	3.9	58	14.2	12.6	0	0.100	-0.051	-35.9	4.34E-01	0.0	0.0
12/10 2046	4.5	55	14.3	12.5	0	0.122	-0.059	-41.4	3.32E-01	0.0	0.0
12/10 2130	2.4	59	13.4	12.5	0	0.056	-0.029	-12.5	4.87E-01	0.0	0.0
12/10 2200	3.2	56	13.6	12.5	0	0.085	-0.037	-17.1	2.89E-01	0.0	0.0
12/10 2230	4.4	54	13.8	12.5	0	0.124	-0.048	-26.7	2.11E-01	0.0	0.0
12/10 2300	3.7	55	13.6	12.5	0	0.104	-0.038	-18.5	2.11E-01	0.0	0.0
12/10 2330	4.7	54	13.5	12.5	0	0.144	-0.037	-15.2	9.13E-02	0.0	0.0
12/11 0000	4.0	57	13.4	12.5	0	0.117	-0.032	-11.9	1.08E-01	0.0	0.0
12/11 0030	5.3	56	12.8	12.5	0	0.174	-0.014	11.0	-3.99E-02	0.0	0.0
12/11 0100	4.2	62	12.4	12.5	0	0.137	0.002	23.9	-1.47E-01	0.0	0.0
12/11 0130	4.3	63	12.2	12.5	0	0.139	0.008	29.9	-1.79E-01	0.0	0.0
12/11 0200	4.6	65	12.0	12.5	0	0.151	0.016	37.2	-1.90E-01	0.0	0.0
12/11 0230	5.3	65	11.6	12.5	0	0.178	0.029	51.4	-1.91E-01	0.0	0.0
12/11 0300	5.0	66	11.5	12.5	0	0.167	0.032	54.4	-2.29E-01	0.0	0.0
12/11 0330	4.5	63	12.1	12.5	0	0.148	0.009	32.4	-1.71E-01	0.0	0.0
12/11 0400	3.1	62	12.5	12.5	0	0.097	-0.003	19.9	-2.44E-01	0.0	0.0
12/11 0430	2.5	62	12.5	12.5	0	0.079	-0.003	20.2	-3.73E-01	0.0	0.0
12/11 0500	3.8	66	12.0	12.5	0	0.124	0.016	37.0	-2.83E-01	0.0	0.0
12/11 0530	4.3	67	12.0	12.5	0	0.141	0.015	34.8	-2.05E-01	0.0	0.0
12/11 0600	6.3	67	11.4	12.5	0	0.216	0.038	59.5	-1.49E-01	0.0	0.0
12/11 0630	5.5	67	11.5	12.5	0	0.186	0.032	53.7	-1.82E-01	0.0	0.0
12/11 0700	6.0	68	11.3	12.5	0	0.208	0.041	63.6	-1.72E-01	0.0	0.0
12/11 0730	5.1	69	11.3	12.5	0	0.174	0.039	61.0	-2.38E-01	0.0	0.0
12/11 0800	3.4	72	11.0	12.5	0	0.114	0.055	77.0	-7.00E-01	0.0	0.0
12/11 0830	2.0	73	10.6	12.5	0	0.068	0.077	100.9	-2.55E 00	0.0	0.0
12/11 0900	2.0	70	11.3	12.5	0	0.068	0.045	68.2	-1.72E 00	0.0	0.0
12/11 0930	2.1	71	11.2	12.5	0	0.070	0.044	67.5	-1.61E 00	0.0	0.0
12/11 1000	1.9	72	11.3	12.6	0	0.065	0.049	71.7	-1.98E 00	0.0	0.0
12/11 1030	1.6	73	11.5	12.6	0	0.056	0.042	64.3	-2.37E 00	0.0	0.0
12/11 1100	1.1	72	11.7	12.6	0	0.040	0.037	60.5	-4.35E 00	0.0	0.0
12/11 1130	1.5	72	11.9	12.7	0	0.053	0.031	53.0	-2.24E 00	0.0	0.0
12/11 1200	2.4	75	12.0	12.7	0	0.076	0.023	41.8	-8.45E-01	0.0	0.0
12/11 1300	4.6	75	12.1	12.7	0	0.151	0.016	32.8	-1.69E-01	0.0	0.0

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All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/11 1330	4.0	75	12.4	12.7	0	0.127	0.009	25.0	-1.81E-01	0.0	0.0
12/11 1400	3.9	72	12.7	12.8	0	0.125	0.003	20.1	-1.49E-01	0.0	0.0
12/11 1430	4.3	70	12.9	12.9	0	0.136	-0.004	14.0	-8.63E-02	0.0	0.0
12/11 1500	5.9	77	13.0	12.8	0	0.194	-0.010	1.7	-4.25E-03	0.0	0.0
12/11 1530	7.0	79	13.1	12.8	0	0.234	-0.013	-2.1	5.34E-03	0.0	0.0
12/11 1600	7.4	86	12.8	12.8	0	0.254	-0.004	4.1	-7.01E-03	0.0	0.0
12/11 1630	7.7	84	12.8	12.8	0	0.267	-0.004	4.9	-7.70E-03	0.0	0.0
12/11 1657	7.7	82	12.9	12.7	0	0.266	-0.007	3.2	-4.92E-03	0.0	0.0
12/11 1724	8.4	81	12.8	12.7	0	0.293	-0.007	3.6	-4.52E-03	0.0	0.0
12/11 1751	7.7	80	12.8	12.7	0	0.263	-0.008	2.9	-4.34E-03	0.0	0.0
12/11 1818	6.3	80	12.8	12.7	0	0.230	-0.008	2.8	-5.52E-03	0.0	0.0
12/11 1845	5.8	81	12.9	12.6	0	0.188	-0.010	-0.5	2.79E-03	0.0	0.0
12/11 1912	4.6	81	12.9	12.7	0	0.144	-0.011	-1.2	8.78E-03	0.0	0.0
12/11 1939	2.6	84	12.7	12.6	0	0.080	-0.002	7.0	-1.26E-01	0.0	0.0
12/11 2006	2.5	90	11.4	12.6	0	0.080	0.048	59.0	-1.08E 00	0.0	0.0
12/13 0730	2.0	88	12.6	12.7	380	0.063	0.000	8.1	-2.39E-01	0.1	122.3
12/13 0801	0.8	88	12.6	12.7	400	0.029	0.001	9.8	-1.39E 00	0.1	93.1
12/13 0831	1.2	89	12.4	12.7	380	0.040	0.010	18.0	-1.30E 00	0.2	37.0
12/13 0900	1.5	90	12.2	12.8	350	0.052	0.017	25.5	-1.12E 00	0.2	26.9
12/13 0928	2.4	90	12.3	12.8	320	0.073	0.015	23.3	-5.10E-01	0.2	23.3
12/13 1000	1.9	89	12.4	12.8	280	0.061	0.010	18.1	-5.62E-01	0.2	26.2
12/13 1030	1.6	89	12.4	12.8	160	0.053	0.011	20.0	-8.45E-01	0.1	18.1
12/13 1100	0.8	88	12.6	12.9	130	0.030	0.009	18.8	-2.38E 00	0.1	20.4
12/13 1230	1.8	90	12.7	13.0	160	0.057	0.007	14.8	-5.40E-01	0.1	20.8
12/13 1300	3.7	92	12.6	13.1	160	0.120	0.019	26.4	-2.18E-01	0.2	11.6
12/13 1330	5.0	98	11.8	13.0	180	0.169	0.040	46.3	-1.93E-01	0.3	8.7
12/13 1400	5.0	96	12.3	12.9	120	0.166	0.016	20.5	-8.85E-02	0.2	9.1
12/13 1430	5.5	97	11.9	12.9	60	0.184	0.032	37.1	-1.30E-01	0.2	4.4
12/13 1500	6.4	98	12.2	12.9	60	0.217	0.019	22.8	-5.75E-02	0.2	4.9
12/13 1530	6.8	96	12.3	12.8	60	0.233	0.013	17.6	-3.85E-02	0.2	5.4
12/13 1600	7.1	92	12.7	12.7	60	0.240	-0.003	1.4	-2.61E-03	0.1	8.5
12/13 1630	7.0	91	13.1	12.7	60	0.234	-0.013	-9.0	1.98E-02	0.0	0.0
12/13 1700	6.4	93	13.1	12.7	60	0.208	-0.015	-11.0	3.08E-02	0.0	0.0
12/13 1730	5.4	89	13.3	12.7	60	0.166	-0.022	-18.1	7.85E-02	0.0	0.0
12/13 1800	5.5	90	13.3	12.7	60	0.172	-0.021	-17.1	6.95E-02	0.0	0.0
12/13 1830	6.0	90	13.3	12.7	60	0.192	-0.023	-19.2	6.24E-02	0.0	0.0

BLM 3 81
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10^3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/13 1900	4.9	89	13.3	12.7	60	0.150	-0.024	-19.6	1.04E-01	0.0	0.0
12/13 1930	2.9	90	13.3	12.7	60	0.074	-0.020	-16.4	3.55E-01	0.0	0.0
12/13 2000	2.2	84	13.9	12.7	60	0.039	-0.022	-18.7	1.49E 00	0.0	0.0
12/13 2030	1.2	83	13.7	12.7	60	0.000	-0.000	-0.0	9.99E 02	0.0	0.0
12/13 2103	0.9	87	12.7	12.7	60	0.029	-0.006	1.4	-1.71E-01	0.1	14.6
12/13 2130	1.4	87	12.6	12.6	60	0.044	-0.002	6.2	-3.60E-01	0.1	19.2
12/13 2200	1.1	87	12.7	12.6	60	0.035	-0.003	5.3	-4.85E-01	0.1	17.0
12/13 2230	1.2	87	12.7	12.6	60	0.038	-0.003	4.2	-3.26E-01	0.1	15.5
12/13 2300	1.1	88	12.7	12.6	60	0.035	-0.001	6.2	-5.78E-01	0.0	22.3
12/13 2330	0.9	88	12.6	12.6	60	0.031	0.009	17.0	-2.06E 00	0.1	12.1
12/14 0000	0.7	87	12.5	12.6	60	0.026	0.010	19.0	-3.36E 00	0.1	12.4
12/14 0029	1.0	90	12.0	12.6	60	0.036	0.023	31.8	-2.94E 00	0.1	8.4
12/14 0058	1.1	88	12.2	12.6	60	0.039	0.016	25.9	-1.96E 00	0.1	9.2
12/14 0127	1.6	85	12.3	12.6	60	0.053	0.010	20.6	-8.45E-01	0.1	9.8
12/14 0156	3.0	81	13.0	12.6	60	0.089	-0.008	1.7	-2.17E-02	0.1	8.9
12/14 0225	3.1	85	12.4	12.6	60	0.098	0.007	16.3	-2.00E-01	0.1	9.0
12/14 0254	3.2	88	12.2	12.6	60	0.099	0.013	21.6	-2.57E-01	0.1	7.3
12/14 0323	2.3	91	12.4	12.6	60	0.071	0.008	14.3	-3.29E-01	0.1	9.6
12/14 0352	4.0	94	12.2	12.6	60	0.128	0.011	16.3	-1.18E-01	0.1	7.0
12/14 0421	4.1	94	12.3	12.6	60	0.131	0.006	11.0	-7.53E-02	0.1	8.5
12/14 0450	3.0	91	12.4	12.6	60	0.094	0.004	10.4	-1.39E-01	0.1	10.6
12/14 0519	1.3	87	12.0	12.6	60	0.044	0.021	32.6	-1.95E 00	0.1	8.1
12/14 0548	1.2	82	11.9	12.6	60	0.043	0.027	42.2	-2.71E 00	0.1	7.5
12/14 0617	0.8	81	11.8	12.6	60	0.033	0.032	48.3	-5.22E 00	0.1	7.8
12/14 0646	0.8	83	11.9	12.6	60	0.030	0.027	42.2	-5.39E 00	0.1	8.4
12/14 0728	1.4	87	11.8	12.6	60	0.049	0.033	45.2	-2.23E 00	0.1	6.7
12/14 0800	2.0	79	11.9	12.6	60	0.064	0.025	39.4	-1.11E 00	0.1	6.8
12/14 0830	1.7	78	12.3	12.6	60	0.056	0.013	27.5	-1.02E 00	0.1	8.8
12/14 0900	1.4	72	13.4	12.6	60	0.038	-0.016	-2.1	2.04E-01	0.0	0.0
12/14 0930	1.4	72	13.2	12.6	60	0.042	-0.015	0.1	2.38E-02	0.0	0.0
12/14 1000	1.0	79	13.0	12.7	60	0.032	-0.010	1.6	-1.49E-01	0.1	11.5
12/14 1100	4.2	77	13.9	12.8	60	0.118	-0.031	-22.0	1.90E-01	0.0	0.0
12/14 1130	5.1	76	14.3	12.7	60	0.149	-0.044	-35.7	1.94E-01	0.0	0.0
12/14 1200	5.8	75	14.5	12.7	60	0.176	-0.051	-43.2	1.66E-01	0.0	0.0
12/14 1230	6.5	79	13.9	12.7	60	0.206	-0.041	-33.2	9.35E-02	0.0	0.0
12/14 1300	6.3	84	13.7	12.7	60	0.201	-0.032	-26.2	7.77E-02	0.0	0.0

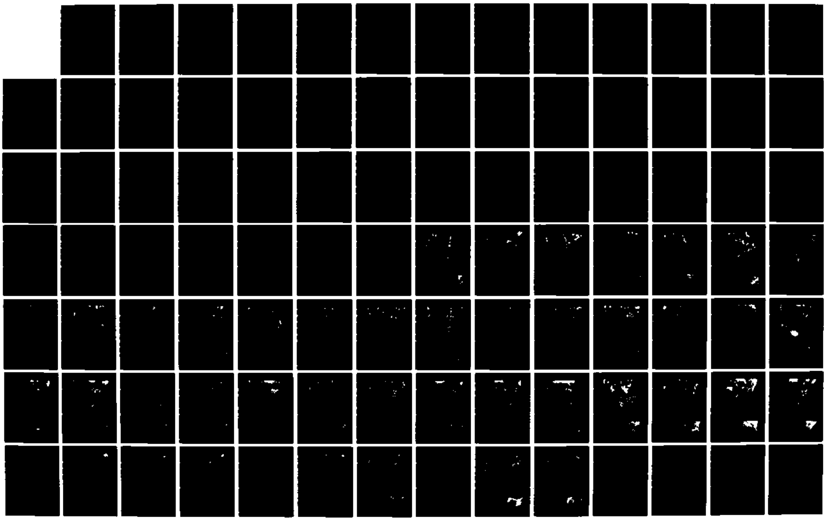
BLM 3 81
All Data

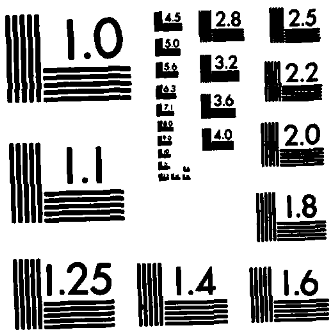
Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/14 1330	7.1	87	13.5	12.7	60	0.235	-0.026	-20.8	4.51E-02	0.0	0.0
12/14 1400	8.7	88	13.4	12.7	60	0.314	-0.024	-18.6	2.26E-02	0.0	0.0
12/14 1430	9.7	90	13.1	12.7	60	0.354	-0.018	-12.9	1.24E-02	0.0	0.0
12/14 1500	9.8	91	13.0	12.7	60	0.358	-0.010	-5.1	4.84E-03	0.0	0.0
12/14 1530	9.5	91	13.1	12.7	60	0.348	-0.018	-13.3	1.32E-02	0.0	0.0
12/14 1559	7.7	84	14.3	12.7	60	0.249	-0.054	-49.8	9.55E-02	0.0	0.0
12/14 1612	7.5	85	14.1	12.7	60	0.243	-0.047	-42.7	8.61E-02	0.0	0.0
12/14 1625	7.5	88	13.5	12.7	60	0.249	-0.027	-23.3	4.51E-02	0.0	0.0
12/14 1638	7.6	90	13.2	12.7	60	0.255	-0.021	-16.3	3.02E-02	0.0	0.0
12/14 1651	7.8	91	13.2	12.7	60	0.264	-0.020	-15.8	2.71E-02	0.0	0.0
12/14 1704	7.8	91	13.2	12.7	60	0.263	-0.020	-16.2	2.81E-02	0.0	0.0
12/14 1717	6.8	90	13.3	12.7	60	0.223	-0.024	-20.1	4.82E-02	0.0	0.0
12/14 1730	6.7	87	13.7	12.7	60	0.215	-0.035	-31.5	8.18E-02	0.0	0.0
12/14 1743	6.6	85	14.1	12.7	60	0.206	-0.047	-43.4	1.22E-01	0.0	0.0
12/14 1756	6.1	86	13.9	12.6	60	0.190	-0.040	-35.7	1.18E-01	0.0	0.0
12/14 1809	5.9	87	13.6	12.6	60	0.183	-0.031	-27.3	9.74E-02	0.0	0.0
12/14 1822	5.1	88	13.4	12.6	60	0.153	-0.025	-20.8	1.06E-01	0.0	0.0
12/14 1835	4.9	89	13.1	12.6	60	0.150	-0.017	-12.5	6.70E-02	0.0	0.0
12/14 1848	6.9	93	12.7	12.6	60	0.233	-0.004	0.3	-4.05E-04	0.1	8.2
12/14 1901	5.6	92	12.5	12.6	60	0.183	0.001	5.8	-2.03E-02	0.1	15.6
12/14 1929	5.6	92	12.7	12.6	60	0.181	-0.004	0.2	-1.62E-04	0.1	8.5
12/14 1958	7.7	96	12.2	12.6	60	0.267	0.013	17.4	-2.89E-02	0.2	5.2
12/14 2030	9.4	97	11.7	12.6	60	0.352	0.032	37.3	-3.56E-02	0.3	3.5
12/14 2100	10.1	98	11.9	12.6	60	0.379	0.022	26.6	-2.20E-02	0.3	3.9
12/14 2300	4.2	93	11.8	12.6	60	0.137	0.030	35.9	-2.25E-01	0.2	4.9
12/14 2330	5.3	96	11.5	12.6	60	0.177	0.040	46.5	-1.76E-01	0.2	4.1
12/15 0000	3.5	95	12.0	12.6	60	0.113	0.021	25.7	-2.40E-01	0.2	5.9
12/15 0030	4.3	93	10.8	12.6	60	0.145	0.070	79.5	-4.46E-01	0.3	3.6
12/15 0100	4.2	95	9.8	12.6	60	0.143	0.108	120.2	-6.95E-01	0.3	3.2
12/15 0130	3.8	96	9.8	12.6	60	0.128	0.111	123.4	-8.91E-01	0.3	3.3
12/15 0200	4.1	97	9.5	12.6	60	0.141	0.117	130.3	-7.78E-01	0.3	3.1
12/15 0230	4.0	96	9.8	12.6	60	0.135	0.108	119.9	-7.81E-01	0.3	3.2
12/15 0300	3.4	95	9.7	12.5	60	0.115	0.111	123.9	-1.12E 00	0.3	3.4
12/15 0330	2.2	95	9.3	12.5	60	0.075	0.138	153.1	-3.20E 00	0.3	3.6
12/15 0400	2.1	95	9.7	12.5	60	0.073	0.119	132.8	-2.96E 00	0.3	3.8
12/15 0430	1.3	90	10.1	12.5	60	0.049	0.110	126.0	-6.26E 00	0.2	4.5

BLM 3 81
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/15 0500	2.4	90	10.7	12.5	60	0.078	0.074	86.2	-1.69E 00	0.2	4.4
12/15 0530	4.0	97	11.2	12.6	60	0.132	0.051	57.6	-3.95E-01	0.2	4.2
12/15 0600	7.9	95	11.6	12.6	60	0.280	0.033	37.7	-5.69E-02	0.3	3.8
12/15 0630	5.0	92	11.3	12.5	60	0.168	0.045	53.0	-2.23E-01	0.2	4.0
12/15 0700	2.2	96	10.5	12.5	60	0.073	0.084	94.0	-2.06E 00	0.2	4.3
12/15 0730	1.9	94	10.6	12.5	60	0.065	0.078	88.8	-2.46E 00	0.2	4.6
12/15 1007	1.9	91	10.9	12.6	60	0.064	0.073	83.6	-2.42E 00	0.2	4.7
12/15 1023	1.7	95	10.8	12.6	60	0.059	0.079	88.4	-3.00E 00	0.2	4.7
12/15 1043	2.2	95	10.8	12.7	60	0.073	0.075	84.5	-1.90E 00	0.2	4.5
12/15 1118	4.0	86	12.9	12.6	60	0.120	-0.012	-6.0	5.12E-02	0.0	0.0
12/15 1203	3.6	84	13.1	12.6	60	0.103	-0.018	-11.3	1.30E-01	0.0	0.0
12/15 1228	2.2	88	12.6	12.7	60	0.067	0.001	7.2	-1.83E-01	0.0	20.5
12/15 1248	6.8	91	12.9	12.7	60	0.225	-0.009	-4.9	1.18E-02	0.0	0.0
12/15 1308	8.3	90	13.2	12.[illegible]	60	0.284	-0.020	-15.6	2.31E-02	0.0	0.0
12/15 1323	6.8	88	13.6	12.7	60	0.220	-0.031	-27.5	6.78E-02	0.0	0.0
12/15 1348	4.3	77	14.6	12.7	60	0.113	-0.049	-43.3	4.03E-01	0.0	0.0
12/15 1408	4.3	68	16.9	12.8	60	0.081	-0.081	-77.6	1.40E 00	0.0	0.0
12/15 1428	2.5	63	17.0	12.8	60	0.002	-0.003	-2.6	9.99E 02	0.0	0.0
12/15 1448	2.8	60	17.7	12.9	60	0.003	-0.005	-5.1	5.88E 01	0.0	0.0
[illegible] 1530	6.2	77	14.4	12.9	60	0.192	-0.047	-40.8	1.32E-01	0.0	0.0
[illegible] 1600	6.7	77	15.2	12.9	60	0.206	-0.066	-61.2	1.71E-01	0.0	0.0
[illegible]	7.7	78	14.9	12.8	60	0.248	-0.064	-59.1	1.15E-01	0.0	0.0
[illegible]	7.4	77	15.1	12.8	60	0.234	-0.068	-63.3	1.38E-01	0.0	0.0
[illegible]	6.2	79	14.9	12.8	60	0.187	-0.062	-58.0	1.99E-01	0.0	0.0
[illegible]	3.0	75	15.5	12.8	60	0.048	-0.041	-38.8	2.02E 00	0.0	0.0
[illegible]	1.6	68	16.[illegible]	12.8	60	0.001	-0.002	-1.9	9.99E 02	0.0	0.0
[illegible]	[illegible]	63	16.5	12.8	60	0.024	-0.030	-28.5	5.69E 00	0.0	0.0
[illegible]	[illegible]	[illegible]	14.2	12.8	50	0.182	-0.042	-37.5	1.35E-01	0.0	0.0
[illegible]	[illegible]	[illegible]	16.6	12.8	60	0.104	-0.068	-63.0	6.93E-01	0.0	0.0
[illegible]	[illegible]	[illegible]	13.0	12.5	60	0.179	-0.017	-14.3	5.36E-02	0.0	0.0
[illegible]	[illegible]	[illegible]	13.0	12.5	60	0.186	-0.017	-13.0	4.52E-02	0.0	0.0
[illegible]	[illegible]	[illegible]	[illegible]	12.6	60	0.187	-0.013	-9.5	3.26E-02	0.0	0.0
[illegible]	[illegible]	[illegible]	[illegible]	12.6	60	0.139	-0.013	-3.6	5.39E-02	0.0	0.0
[illegible]	[illegible]	[illegible]	13.1	12.6	60	0.056	-0.014	-10.5	4.06E-01	0.0	0.0
[illegible]	[illegible]	[illegible]	14.[illegible]	12.6	60	0.026	-0.018	-14.1	2.48E 00	0.0	0.0
[illegible]	[illegible]	[illegible]	14.8	12.5	60	0.063	-0.046	-39.1	1.17E 00	0.0	0.0

AD-A123 582 CALIFORNIA COASTAL OFFSHORE TRANSPORT AND DIFFUSION - 4/5
EXPERIMENTS - METEORO..(U) NAVAL POSTGRADUATE SCHOOL
MONTEREY CA G E SCHACHER ET AL. 06 DEC 82
UNCLASSIFIED NPS-61-82-007 F/G 4/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

BLM 3 81
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/16 0230	2.1	72	14.4	12.5	60	0.022	-0.020	-17.3	4.10E 00	0.0	0.0
12/16 0251	2.6	72	14.4	12.5	60	0.043	-0.033	-28.5	1.81E 00	0.0	0.0
12/16 0313	4.2	73	14.5	12.5	60	0.032	-0.029	-25.1	2.87E 00	0.0	0.0
12/16 0326	2.9	73	14.6	12.5	60	0.073	-0.048	-42.5	9.50E-01	0.0	0.0
12/16 0401	1.0	75	14.2	12.6	60	0.000	-0.001	-0.6	9.99E 02	0.0	0.0
12/16 0421	1.1	74	14.5	12.6	60	0.001	-0.001	-1.0	9.99E 02	0.0	0.0
12/16 0441	1.4	72	14.7	12.5	60	0.001	-0.001	-0.9	9.99E 02	0.0	0.0
12/14 1929	5.6	92	12.7	12.6	60	0.181	-0.004	0.2	-1.62E-04	0.1	8.5
12/14 1958	7.7	96	12.2	12.6	60	0.267	0.013	17.4	-2.89E-02	0.2	5.2
12/14 2030	9.4	97	11.7	12.6	60	0.352	0.032	37.3	-3.56E-02	0.3	3.5
12/14 2100	10.1	98	11.9	12.6	60	0.379	0.022	26.6	-2.20E-02	0.3	3.9
12/16 0501	2.2	72	14.4	12.5	60	0.024	-0.022	-19.3	4.05E 00	0.0	0.0
12/16 0521	2.4	74	14.2	12.5	60	0.038	-0.028	-23.3	1.92E 00	0.0	0.0
12/16 0541	2.4	72	14.5	12.6	60	0.041	-0.029	-23.8	1.73E 00	0.0	0.0
12/16 0601	2.0	75	13.9	12.6	60	0.036	-0.022	-16.6	1.54E 00	0.0	0.0
12/16 0621	2.7	72	13.9	12.6	60	0.059	-0.031	-22.7	7.73E-01	0.0	0.0
12/16 0641	3.6	68	14.0	12.6	60	0.095	-0.037	-25.6	3.44E-01	0.0	0.0
12/16 0701	3.4	67	13.9	12.6	60	0.087	-0.036	-24.5	3.89E-01	0.0	0.0
12/16 0721	4.7	63	14.5	12.6	60	0.132	-0.052	-38.4	2.63E-01	0.0	0.0
12/16 0741	8.0	66	14.2	12.5	60	0.139	-0.050	-37.7	2.35E-01	0.0	0.0
12/16 0801	8.9	66	14.3	12.6	60	0.171	-0.049	-35.5	1.46E-01	0.0	0.0
12/16 0841	4.1	62	14.1	12.6	60	0.114	-0.042	-28.2	2.64E-01	0.0	0.0
12/16 0901	4.6	61	14.6	12.6	60	0.128	-0.051	-36.9	2.73E-01	0.0	0.0
12/16 0921	4.1	62	14.5	12.6	60	0.112	-0.047	-33.8	3.27E-01	0.0	0.0
12/16 0941	4.6	58	15.5	12.6	60	0.121	-0.065	-52.0	4.23E-01	0.0	0.0
12/16 1001	4.5	54	15.8	12.6	60	0.115	-0.072	-58.5	5.32E-01	0.0	0.0
12/16 1021	4.5	50	16.4	12.7	60	0.104	-0.081	-67.4	7.39E-01	0.0	0.0
12/16 1041	3.6	56	15.3	12.7	60	0.081	-0.053	-41.2	7.47E-01	0.0	0.0
12/16 1101	3.7	59	14.8	12.8	60	0.092	-0.045	-32.6	4.64E-01	0.0	0.0
12/16 1129	6.5	55	15.2	12.7	60	0.124	-0.055	-41.9	3.25E-01	0.0	0.0
12/16 1144	6.2	51	15.9	12.8	60	0.106	-0.059	-45.9	4.88E-01	0.0	0.0
12/16 1159	5.6	48	15.9	12.8	60	0.058	-0.045	-34.9	1.25E 00	0.0	0.0
12/16 1214	5.3	60	14.7	12.9	60	0.058	-0.032	-21.7	7.72E-01	0.0	0.0
12/16 1229	5.6	63	14.4	12.8	60	0.070	-0.032	-22.5	5.55E-01	0.0	0.0
12/16 1244	6.1	66	14.7	12.9	60	0.090	-0.041	-32.1	4.72E-01	0.0	0.0
12/16 1259	6.7	73	14.5	13.0	60	0.113	-0.042	-33.4	3.11E-01	0.0	0.0

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All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/15 1314	9.0	76	14.5	13.1	60	0.204	-0.045	-35.7	1.03E-01	0.0	0.0
12/16 1329	10.6	77	14.4	13.1	60	0.261	-0.045	-36.4	6.40E-02	0.0	0.0
12/16 1400	10.0	80	13.8	13.2	60	0.240	-0.024	-15.5	3.25E-02	0.0	0.0
12/16 1430	9.6	81	13.8	13.3	60	0.226	-0.020	-11.2	2.69E-02	0.0	0.0
12/16 1500	8.9	83	13.7	13.3	60	0.211	-0.018	-10.0	2.72E-02	0.0	0.0
12/16 1530	8.4	84	13.7	13.3	60	0.201	-0.017	-10.1	3.04E-02	0.0	0.0
12/16 1600	8.3	86	13.6	13.2	60	0.200	-0.016	-9.6	2.89E-02	0.0	0.0
12/16 1700	6.0	85	13.6	13.2	60	0.214	-0.017	-10.2	2.69E-02	0.0	0.0
12/16 1730	5.8	84	13.7	13.2	60	0.213	-0.020	-12.9	3.44E-02	0.0	0.0
12/16 1800	6.7	83	13.8	13.4	60	0.239	-0.016	-7.8	1.67E-02	0.0	0.0
12/16 1830	7.2	81	14.0	13.4	60	0.253	-0.023	-14.6	2.76E-02	0.0	0.0
12/16 1900	9.4	79	14.2	13.3	60	0.329	-0.034	-25.4	2.81E-02	0.0	0.0
12/16 1930	6.9	76	14.2	13.2	60	0.224	-0.036	-25.5	6.12E-02	0.0	0.0
12/16 2000	6.1	71	14.4	13.2	60	0.191	-0.040	-27.3	9.01E-02	0.0	0.0
12/16 2030	4.7	70	14.0	13.2	60	0.141	-0.030	-17.1	1.05E-01	0.0	0.0
12/17 0830	3.6	66	13.1	13.2	60	0.105	0.001	21.6	-2.28E-01	0.1	16.4
12/17 0900	3.3	72	13.1	13.6	60	0.245	0.014	31.5	-6.13E-02	0.2	5.3
12/17 0930	2.8	75	13.2	13.6	60	0.064	0.012	30.3	-8.52E-01	0.1	8.5
12/17 1000	2.2	77	13.4	13.4	60	0.083	-0.001	13.0	-2.18E-01	0.1	19.2
12/17 1030	2.1	75	13.5	13.5	60	0.101	-0.004	10.6	-1.19E-01	0.1	10.8
12/17 1100	1.9	77	13.6	13.4	60	0.082	-0.009	3.7	-6.03E-02	0.1	8.9
12/17 1130	2.2	79	13.6	13.5	100	0.080	-0.006	6.3	-1.11E-01	0.1	14.5
12/17 1200	2.8	82	13.6	13.7	120	0.074	0.001	12.8	-2.74E-01	0.1	27.8
12/17 1230	4.4	82	13.6	13.8	170	0.027	0.004	17.8	-2.90E 00	0.1	32.9
12/17 1300	5.0	84	13.4	13.9	220	0.050	0.016	28.8	-1.37E 00	0.2	20.1
12/17 1330	4.7	82	13.4	14.0	220	0.067	0.021	35.5	-9.31E-01	0.2	16.9
12/17 1400	3.3	80	13.5	14.2	230	0.112	0.023	38.9	-3.68E-01	0.3	14.1
12/17 1430	6.6	83	13.5	14.0	180	0.095	0.014	26.5	-3.43E-01	0.2	15.0
12/17 1500	6.1	85	13.5	13.8	180	0.090	0.007	17.9	-2.61E-01	0.2	18.8
12/17 1530	5.3	76	13.8	13.6	180	0.056	-0.009	4.3	-1.51E-01	0.1	20.7
12/17 1600	5.1	76	14.0	13.7	60	0.048	-0.011	1.1	-4.05E-02	0.1	9.7
12/17 1630	4.9	82	13.7	13.5	80	0.082	-0.005	3.9	-6.50E-02	0.1	13.0
12/17 1700	4.6	84	13.6	13.6	90	0.072	0.001	9.4	-2.12E-01	0.1	26.4
12/17 1730	4.8	89	13.4	13.6	120	0.032	0.008	15.1	-1.73E 00	0.1	20.1
12/17 1800	4.8	91	13.2	13.4	120	0.040	0.008	14.0	-1.01E 00	0.1	18.4
12/17 1830	3.9	88	13.3	13.4	160	0.038	0.001	7.6	-6.08E-01	0.1	50.1

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All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
12/17 1900	4.7	85	13.5	13.5	240	0.027	0.003	12.0	-1.98E 00	0.1	47.1
12/17 1930	1.8	83	13.4	12.7	280	0.040	-0.014	-9.8	7.25E-01	0.0	0.0
12/17 2000	1.0	77	13.6	12.9	200	0.024	-0.010	-3.0	6.83E-01	0.0	0.0
12/17 2030	1.5	75	13.8	12.7	160	0.025	-0.015	-9.6	1.78E 00	0.0	0.0
12/17 2100	4.3	78	13.8	13.0	140	0.126	-0.023	-13.4	1.03E-01	0.0	0.0
12/17 2130	5.2	77	14.0	13.1	140	0.159	-0.028	-18.6	8.84E-02	0.0	0.0
12/17 2200	6.2	80	13.9	13.1	60	0.197	-0.027	-18.6	5.76E-02	0.0	0.0
12/17 2230	6.5	84	13.6	13.1	200	0.213	-0.017	-9.7	2.60E-02	0.0	0.0
12/17 2300	7.0	89	13.3	13.1	300	0.233	-0.010	-4.5	1.02E-02	0.0	0.0
12/17 2330	8.8	92	12.5	13.1	170	0.327	0.017	22.4	-2.48E-02	0.3	9.0
12/18 0000	8.6	93	11.9	13.0	170	0.306	0.036	43.8	-5.52E-02	0.4	7.1
12/18 0030	9.4	94	11.7	13.0	170	0.352	0.041	49.0	-4.66E-02	0.4	6.5
12/18 0100	11.1	97	11.6	13.0	150	0.379	0.045	51.6	-4.25E-02	0.4	5.7
12/18 0130	10.1	95	11.5	12.8	150	0.343	0.046	53.0	-5.35E-02	0.4	5.8
12/18 0200	9.2	95	11.6	13.0	250	0.279	0.045	52.4	-7.97E-02	0.5	8.8
12/18 0230	8.7	95	11.6	13.4	250	0.261	0.060	69.7	-1.22E-01	0.5	8.1
12/18 0300	8.8	94	11.6	13.5	250	0.267	0.064	74.4	-1.23E-01	0.5	7.9
12/18 0330	2.2	93	11.7	13.4	250	0.228	0.056	65.4	-1.49E-01	0.5	8.8
12/18 0400	1.9	92	11.9	12.8	250	0.234	0.027	34.0	-7.35E-02	0.4	11.1
12/18 0430	2.3	92	12.0	12.8	250	0.250	0.025	31.3	-5.91E-02	0.4	11.1
12/18 0500	2.7	91	12.1	13.2	250	0.228	0.034	42.9	-9.74E-02	0.4	10.3
12/18 0530	2.2	89	12.4	13.1	250	0.243	0.018	26.3	-5.26E-02	0.3	12.4
12/18 0600	3.4	90	12.4	12.8	250	0.250	0.012	18.6	-3.49E-02	0.3	14.3
12/18 0630	7.0	89	12.5	13.1	250	0.202	0.019	27.3	-7.86E-02	0.3	13.1
12/18 0700	7.1	87	12.5	13.1	250	0.213	0.020	29.3	-7.62E-02	0.3	12.7

Table 8d. Measured and calculated meteorological paramenters for BLM-4.

BLM-4 1982
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10^3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
06/21 0000	2.4	92	12.7	11.4	750	0.033	-0.021	-21.1	2.24E 00	0.0	0.0
06/21 0030	1.5	90	12.8	11.2	750	0.105	-0.043	-42.7	4.60E-01	0.0	0.0
06/21 0100	3.0	91	12.8	11.6	750	0.150	-0.036	-34.7	1.83E-01	0.0	0.0
06/21 0130	3.2	89	12.9	12.6	750	0.145	-0.005	0.7	-3.16E-03	0.3	46.1
06/21 0200	5.2	88	12.9	12.6	750	0.209	-0.008	-1.7	5.10E-03	0.0	0.0
06/21 0230	3.9	88	12.8	12.0	750	0.112	-0.024	-19.6	1.88E-01	0.0	0.0
06/21 0300	3.8	90	12.5	12.0	750	0.109	-0.017	-12.7	1.28E-01	0.0	0.0
06/21 0330	4.2	91	12.4	12.1	750	0.129	-0.011	-6.2	4.58E-02	0.0	0.0
06/21 0400	3.8	91	12.3	12.4	700	0.119	0.001	6.8	-5.56E-02	0.2	75.9
06/21 0430	3.2	92	12.2	12.5	700	0.101	0.009	14.9	-1.72E-01	0.3	42.4
06/21 0500	4.5	93	12.1	12.4	700	0.144	0.007	12.6	-7.15E-02	0.3	40.0
06/21 0530	3.1	92	12.2	11.8	700	0.088	-0.013	-9.4	1.47E-01	0.0	0.0
06/21 0600	2.2	92	12.2	11.9	700	0.058	-0.010	-6.9	2.45E-01	0.0	0.0
06/21 0630	1.8	92	12.2	11.9	700	0.048	-0.009	-5.3	2.79E-01	0.0	0.0
06/21 0700	1.8	91	12.2	12.1	650	0.051	-0.006	-1.4	7.16E-02	0.0	0.0
06/21 0730	2.1	92	12.3	12.2	700	0.063	-0.003	1.3	-3.40E-02	0.2	69.2
06/21 0800	2.6	92	12.2	12.3	700	0.080	0.001	5.7	-1.04E-01	0.1	105.8
06/21 0830	2.1	93	12.2	12.8	750	0.067	0.023	30.9	-8.16E-01	0.3	36.6
06/21 0935	3.9	93	12.3	13.3	750	0.128	0.036	44.6	-3.25E-01	0.5	25.5
06/21 1030	2.7	89	13.1	12.3	850	0.065	-0.016	-15.6	4.36E-01	0.0	0.0
06/21 1100	3.4	66	13.6	12.4	820	0.085	-0.028	-25.3	4.15E-01	0.0	0.0
06/21 1130	1.9	64	14.2	12.2	850	0.006	-0.066	-6.1	1.82E 01	0.0	0.0
06/21 1200	2.1	81	14.9	12.3	810	0.010	-0.010	-9.9	1.27E 01	0.0	0.0
06/21 1230	2.7	83	14.5	12.5	840	0.047	-0.031	-29.4	1.59E 00	0.0	0.0
06/21 1300	3.3	82	14.7	12.4	840	0.066	-0.043	-41.6	1.15E 00	0.0	0.0
06/21 1330	4.2	83	14.5	12.5	860	0.105	-0.054	-51.7	5.63E-01	0.0	0.0
06/21 1400	4.5	84	14.4	12.8	850	0.121	-0.050	-46.2	3.77E-01	0.0	0.0
06/21 1430	5.0	84	14.4	12.9	800	0.141	-0.051	-46.9	2.83E-01	0.0	0.0
06/21 1500	5.1	85	14.2	12.8	850	0.145	-0.049	-45.3	2.57E-01	0.0	0.0
06/21 1530	4.6	86	14.1	12.7	862	0.128	-0.046	-42.6	3.12E-01	0.0	0.0
06/21 1600	4.2	87	14.1	12.6	870	0.108	-0.044	-42.0	4.26E-01	0.0	0.0
06/21 1630	3.6	87	14.1	12.6	870	0.085	-0.040	-37.8	6.30E-01	0.0	0.0
06/21 1700	3.2	88	14.0	12.5	870	0.072	-0.036	-34.7	8.06E-01	0.0	0.0
06/21 1730	3.3	89	13.7	12.6	860	0.080	-0.031	-25.4	5.52E-01	0.0	0.0
06/21 1830	2.6	90	13.6	12.5	800	0.055	-0.025	-23.2	9.04E-01	0.0	0.0
06/21 2030	3.9	94	12.9	12.5	800	0.113	-0.016	-13.8	1.29E-01	0.0	0.0

BLM-4 1982
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10^3*Qo (m/seck)	z/L	w* (m/sec)	t (min)
06/21 2100	4.8	95	12.8	12.4	800	0.145	-0.016	-14.4	8.17E-02	0.0	0.0
06/21 2130	5.5	95	12.8	12.3	800	0.175	-0.017	-15.8	6.15E-02	0.0	0.0
06/21 2200	4.9	95	12.8	12.2	800	0.151	-0.016	-16.4	8.63E-02	0.0	0.0
06/21 2230	6.1	94	12.7	12.2	800	0.197	-0.017	-15.7	4.84E-02	0.0	0.0
06/21 2300	5.5	92	12.7	12.1	800	0.171	-0.020	-17.1	7.01E-02	0.0	0.0
06/21 2330	5.2	91	12.7	12.1	800	0.160	-0.021	-18.1	8.42E-02	0.0	0.0
06/22 0000	5.1	90	12.8	12.1	800	0.156	-0.024	-21.3	1.05E-01	0.0	0.0
06/22 0030	4.7	90	12.8	12.1	800	0.139	-0.024	-20.9	1.29E-01	0.0	0.0
06/22 0100	3.7	91	12.7	12.1	800	0.161	-0.021	-17.9	2.08E-01	0.0	0.0
06/22 0130	3.1	90	12.7	12.0	800	0.083	-0.020	-16.8	2.94E-01	0.0	0.0
06/22 0200	3.2	91	12.7	12.0	800	0.084	-0.021	-18.9	3.17E-01	0.0	0.0
06/22 0230	2.1	91	12.6	11.9	800	0.045	-0.017	-15.4	8.94E-01	0.0	0.0
06/22 0300	2.2	91	12.5	11.9	750	0.047	-0.017	-14.6	7.73E-01	0.0	0.0
06/22 0330	2.0	92	12.4	12.0	750	0.050	-0.011	-8.5	4.11E-01	0.0	0.0
06/22 0400	1.8	93	12.3	12.0	700	0.048	-0.008	-5.1	2.70E-01	0.0	0.0
06/22 0430	1.7	93	12.2	12.2	700	0.050	-0.002	1.8	-7.81E-02	0.1	66.3
06/22 0500	2.1	94	12.2	12.2	680	0.063	-0.002	1.2	-3.33E-02	0.1	79.8
06/22 0530	2.3	94	12.3	12.3	680	0.066	0.000	3.6	-9.09E-02	0.1	149.6
06/22 0600	2.9	94	12.3	12.2	670	0.086	-0.002	1.4	-2.10E-02	0.1	75.8
06/22 0630	3.1	94	12.4	12.2	660	0.092	-0.004	-0.9	1.42E-02	0.0	0.0
06/22 0700	3.1	94	12.4	12.0	660	0.086	-0.011	-8.6	1.39E-01	0.0	0.0
06/22 0800	2.9	84	13.1	12.0	650	0.066	-0.027	-23.0	6.29E-01	0.0	0.0
06/22 0830	1.9	82	13.6	11.9	700	0.016	-0.014	-12.3	5.69E 00	0.0	0.0
06/22 0900	1.0	82	14.2	11.9	720	0.000	-0.001	-0.8	9.99E 02	0.0	0.0
06/22 0930	1.8	73	15.8	12.0	720	0.001	-0.002	-1.8	9.99E 02	0.0	0.0
06/22 1000	1.6	71	15.9	11.8	700	0.001	-0.001	-1.4	9.99E 02	0.0	0.0
06/22 1030	2.5	72	16.0	12.0	700	0.002	-0.003	-2.5	9.99E 02	0.0	0.0
06/22 1100	2.7	76	15.3	12.5	720	0.028	-0.031	-29.2	4.39E 00	0.0	0.0
06/22 1130	1.6	76	15.4	13.6	720	0.004	-0.004	-3.3	2.68E 01	0.0	0.0
06/22 1200	1.6	74	15.9	13.8	720	0.001	-0.001	-1.0	9.72E 01	0.0	0.0
06/22 1230	1.6	74	16.0	14.0	650	0.004	-0.004	-3.6	2.26E 01	0.0	0.0
06/22 1300	2.5	76	15.7	13.9	650	0.047	-0.031	-24.7	1.31E 00	0.0	0.0
06/22 1400	4.0	80	15.2	13.8	650	0.104	-0.041	-34.7	3.80E-01	0.0	0.0
06/22 1430	4.0	80	15.4	13.9	600	0.104	-0.044	-36.9	4.11E-01	0.0	0.0
06/22 1500	5.0	79	15.6	13.6	600	0.137	-0.060	-54.2	3.47E-01	0.0	0.0
06/22 1530	6.5	78	15.6	13.7	600	0.200	-0.060	-53.1	1.58E-01	0.0	0.0

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Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/seck)	z/L	w* (m/sec)	t (min)
06/22 1600	6.2	77	15.6	13.3	600	0.183	-0.071	-64.8	2.31E-01	0.0	0.0
06/22 1630	5.1	77	15.6	13.1	600	0.136	-0.072	-67.8	4.39E-01	0.0	0.0
06/22 1700	4.9	78	15.4	12.9	600	0.128	-0.068	-64.1	4.66E-01	0.0	0.0
06/22 1730	4.8	82	14.7	12.8	600	0.130	-0.058	-54.5	3.87E-01	0.0	0.0
06/22 1800	4.4	82	14.3	12.7	600	0.117	-0.046	-42.1	3.64E-01	0.0	0.0
06/22 1830	3.7	85	13.9	12.6	600	0.092	-0.036	-32.2	4.50E-01	0.0	0.0
06/22 1900	3.8	86	13.7	12.7	600	0.103	-0.030	-25.4	2.85E-01	0.0	0.0
06/22 1930	3.4	87	13.4	12.6	575	0.090	-0.024	-19.6	2.87E-01	0.0	0.0
06/22 2000	2.6	88	13.1	12.5	560	0.063	-0.019	-15.1	4.54E-01	0.0	0.0
06/22 2030	2.6	89	13.0	12.5	620	0.065	-0.017	-12.7	3.58E-01	0.0	0.0
06/22 2100	2.6	89	12.8	12.5	580	0.076	-0.014	-9.7	2.01E-01	0.0	0.0
06/22 2130	1.9	90	12.8	12.5	620	0.047	-0.012	-7.6	4.09E-01	0.0	0.0
06/22 2200	2.1	90	12.8	12.4	630	0.054	-0.013	-8.9	3.68E-01	0.0	0.0
06/22 2230	2.0	90	12.8	12.5	630	0.048	-0.013	-9.1	4.71E-01	0.0	0.0
06/22 2300	2.2	91	12.8	12.7	630	0.063	-0.007	-2.2	7.04E-02	0.0	0.0
06/22 2330	2.5	93	12.5	12.8	620	0.076	0.007	13.2	-2.71E-01	0.2	45.4
06/23 0030	6.7	91	12.7	13.5	590	0.066	0.032	41.5	-1.14E 00	0.3	28.3
06/23 0830	1.1	94	12.1	12.2	550	0.036	0.004	8.0	-7.14E-01	0.1	67.7
06/23 0900	1.5	93	12.2	12.4	550	0.050	0.010	15.7	-7.43E-01	0.2	43.3
06/23 1020	1.6	88	13.1	13.3	600	0.052	0.010	18.8	-8.31E-01	0.2	45.6
06/23 1050	1.3	88	13.4	13.6	620	0.043	0.009	18.5	-1.15E 00	0.2	50.9
06/23 1204	4.4	86	13.5	13.7	550	0.143	0.007	16.7	-9.59E-02	0.3	35.1
06/23 1234	3.3	80	14.4	13.9	550	0.099	-0.013	-2.1	2.90E-02	0.0	0.0
06/23 1444	2.4	74	15.8	12.4	460	0.006	-0.008	-7.8	2.58E 01	0.0	0.0
06/23 1524	3.6	73	16.1	12.6	450	0.060	-0.059	-56.5	1.90E 00	0.0	0.0
06/23 2034	7.8	89	13.2	12.8	510	0.232	-0.017	-11.6	2.61E-02	0.0	0.0
06/23 2140	5.9	89	13.2	13.5	400	0.175	0.007	15.3	-5.86E-02	0.3	25.8
06/23 2210	5.7	89	13.2	13.5	350	0.160	0.007	15.8	-7.25E-02	0.2	24.1
06/23 2337	3.8	89	13.1	13.3	300	0.096	0.005	13.0	-1.64E-01	0.2	29.2
06/24 0007	6.4	91	12.9	13.3	260	0.188	0.013	20.4	-6.75E-02	0.3	15.7
06/24 0158	7.0	92	13.0	13.3	420	0.190	0.011	17.6	-5.75E-02	0.3	22.7
06/24 0228	7.2	91	12.9	13.4	500	0.195	0.016	23.2	-7.22E-02	0.4	22.3
06/24 0401	7.2	96	12.5	13.0	600	0.198	0.017	21.5	-6.48E-02	0.4	24.5
06/24 0431	6.0	97	12.3	12.9	550	0.154	0.019	23.2	-1.15E-01	0.4	24.2
06/24 0526	5.5	97	12.4	13.2	400	0.138	0.028	33.4	-2.09E-01	0.4	17.8
06/24 0648	5.1	94	12.7	13.2	550	0.130	0.018	23.6	-1.65E-01	0.4	26.2

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Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10*3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
06/24 0748	3.6	91	13.1	13.5	500	0.116	0.014	22.3	-1.95E-01	0.3	27.2
06/24 0830	2.3	91	13.1	12.7	450	0.061	-0.011	-7.2	2.34E-01	0.0	0.0
06/24 0858	2.4	90	13.2	12.8	460	0.060	-0.013	-9.7	3.23E-01	0.0	0.0
06/24 0927	3.2	90	13.4	12.8	460	0.086	-0.017	-13.6	2.20E-01	0.0	0.0
06/24 1000	2.7	89	13.4	12.9	500	0.072	-0.015	-11.1	2.58E-01	0.0	0.0
06/24 1030	2.7	89	13.5	13.1	500	0.075	-0.010	-5.1	1.11E-01	0.0	0.0
06/24 1130	3.4	90	13.6	13.0	500	0.095	-0.018	-14.4	1.92E-01	0.0	0.0
06/24 1230	5.4	82	14.9	14.0	500	0.169	-0.021	-12.6	5.36E-02	0.0	0.0
06/24 1300	4.7	81	15.1	14.1	500	0.140	-0.029	-20.9	1.29E-01	0.0	0.0
06/24 1330	3.9	83	15.0	14.4	500	0.118	-0.015	-5.8	5.10E-02	0.0	0.0
06/24 1400	4.9	84	14.9	14.4	500	0.156	-0.007	1.6	-6.79E-03	0.3	31.0
06/24 1430	6.2	86	14.7	14.3	500	0.206	-0.007	1.0	-2.26E-03	0.3	29.5
06/24 1500	6.5	83	15.2	14.4	550	0.214	-0.016	-7.9	2.11E-02	0.0	0.0
06/24 1530	6.3	83	15.2	14.3	550	0.204	-0.016	-8.4	2.46E-02	0.0	0.0
06/24 1600	5.9	84	15.1	14.4	550	0.192	-0.012	-4.4	1.48E-02	0.0	0.0
06/24 1630	5.9	83	15.3	14.3	550	0.191	-0.016	-7.7	2.57E-02	0.0	0.0
06/24 1700	6.1	83	15.3	14.3	550	0.197	-0.020	-12.4	3.86E-02	0.0	0.0
06/24 1730	6.1	84	15.3	14.3	550	0.198	-0.020	-13.4	4.09E-02	0.0	0.0
06/24 1800	6.6	85	15.1	14.2	550	0.217	-0.020	-13.8	3.53E-02	0.0	0.0
06/24 1830	7.2	87	14.9	14.1	550	0.240	-0.023	-17.8	3.70E-02	0.0	0.0
06/24 1900	8.4	88	14.5	13.5	550	0.284	-0.033	-29.6	4.37E-02	0.0	0.0
06/24 1930	7.6	88	14.1	13.1	550	0.253	-0.036	-32.5	6.07E-02	0.0	0.0
06/24 2000	6.9	90	13.9	13.0	600	0.223	-0.032	-28.9	6.94E-02	0.0	0.0
06/24 2030	5.9	93	13.4	13.1	600	0.191	-0.014	-10.5	3.47E-02	0.0	0.0
06/24 2100	6.2	94	13.2	13.1	600	0.205	-0.004	-0.7	2.16E-03	0.0	0.0
06/24 2130	6.1	94	13.1	12.6	600	0.197	-0.018	-16.0	4.90E-02	0.0	0.0
06/24 2200	4.9	93	13.1	12.1	600	0.142	-0.033	-32.8	1.94E-01	0.0	0.0
06/24 2230	4.0	94	13.0	12.0	700	0.107	-0.030	-29.9	3.12E-01	0.0	0.0
06/24 2300	4.5	89	13.4	12.0	700	0.127	-0.037	-36.1	2.68E-01	0.0	0.0
06/24 2330	3.4	87	13.6	12.0	750	0.076	-0.038	-36.9	7.61E-01	0.0	0.0
06/25 0000	2.7	85	14.0	11.9	800	0.040	-0.032	-31.3	2.31E 00	0.0	0.0
06/25 0030	2.7	87	13.9	11.9	800	0.041	-0.032	-31.8	2.24E 00	0.0	0.0
06/25 0100	2.1	89	13.5	11.8	800	0.022	-0.018	-17.3	4.43E 00	0.0	0.0
06/25 0130	1.0	89	13.8	11.8	820	0.001	-0.001	-1.2	9.99E 02	0.0	0.0
06/25 0200	0.5	88	14.0	12.3	820	0.000	-0.000	-0.4	9.99E 02	0.0	0.0
06/25 0230	0.9	87	13.9	13.0	820	0.000	-0.000	-0.3	9.99E 02	0.0	0.0

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Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10**3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
06/25 0300	2.4	86	13.9	13.0	820	0.056	-0.018	-13.6	5.24E-01	0.0	0.0
06/25 0330	4.3	87	14.0	13.0	820	0.126	-0.025	-20.8	1.58E-01	0.0	0.0
06/25 0400	3.6	89	14.0	13.0	750	0.095	-0.025	-22.2	2.92E-01	0.0	0.0
06/25 0430	3.0	89	14.0	13.2	700	0.076	-0.023	-17.4	3.58E-01	0.0	0.0
06/25 0500	1.8	87	14.0	13.3	700	0.035	-0.015	-11.5	1.15E 00	0.0	0.0
06/25 0530	1.9	84	14.2	13.3	740	0.037	-0.018	-13.0	1.15E 00	0.0	0.0
06/25 0600	2.1	82	14.4	12.9	740	0.027	-0.020	-16.1	3.02E 00	0.0	0.0
06/25 0630	2.8	82	14.4	12.6	730	0.052	-0.035	-31.8	1.43E 00	0.0	0.0
06/25 0700	4.2	81	14.4	13.0	740	0.112	-0.040	-34.3	3.28E-01	0.0	0.0
06/25 0730	5.1	80	14.4	13.1	740	0.152	-0.040	-32.1	1.66E-01	0.0	0.0
06/25 0800	5.5	80	14.5	12.9	650	0.165	-0.047	-40.0	1.76E-01	0.0	0.0
06/25 0830	3.8	77	15.0	12.9	500	0.090	-0.052	-46.5	6.81E-01	0.0	0.0
06/25 0900	2.4	70	16.3	12.8	450	0.009	-0.012	-10.7	1.66E 01	0.0	0.0
06/25 0930	1.4	64	17.5	12.8	450	0.001	-0.002	-2.0	9.99E 02	0.0	0.0
06/25 1000	2.9	64	17.8	12.9	450	0.004	-0.007	-6.8	4.49E 01	0.0	0.0
06/25 1030	4.2	70	16.6	12.8	400	0.075	-0.079	-75.4	1.59E 00	0.0	0.0
06/25 1100	6.2	74	15.8	12.4	380	0.175	-0.099	-95.3	3.72E-01	0.0	0.0
06/25 1130	6.6	76	15.7	12.6	320	0.196	-0.089	-85.2	2.64E-01	0.0	0.0
06/25 1200	6.9	78	15.5	12.6	300	0.210	-0.082	-78.8	2.12E-01	0.0	0.0
06/25 1230	7.5	80	15.3	12.8	200	0.239	-0.070	-66.5	1.39E-01	0.0	0.0
06/25 1300	8.4	82	15.1	12.8	250	0.278	-0.065	-62.5	9.65E-02	0.0	0.0
06/25 1330	9.3	83	15.0	12.7	210	0.328	-0.065	-62.0	6.86E-02	0.0	0.0
06/25 1400	10.8	82	15.0	12.6	220	0.388	-0.071	-68.4	5.40E-02	0.0	0.0
06/25 1430	10.8	82	15.1	12.4	180	0.388	-0.080	-78.3	6.18E-02	0.0	0.0
06/25 1500	11.4	83	15.1	12.3	150	0.412	-0.082	-81.3	5.70E-02	0.0	0.0
06/25 1530	10.4	82	15.1	12.2	150	0.372	-0.085	-84.8	7.29E-02	0.0	0.0
06/25 1600	10.6	82	15.1	12.1	150	0.376	-0.091	-91.0	7.67E-02	0.0	0.0
06/25 1630	11.1	82	15.2	12.0	150	0.396	-0.098	-98.9	7.50E-02	0.0	0.0
06/25 1700	12.2	80	15.3	11.9	250	0.445	-0.104	-104.5	6.28E-02	0.0	0.0
06/25 1730	12.5	77	15.6	11.8	320	0.452	-0.119	-116.0	6.87E-02	0.0	0.0
06/25 1800	12.4	76	16.0	11.7	330	0.448	-0.134	-134.4	7.99E-02	0.0	0.0
06/25 1830	10.8	77	15.9	11.6	400	0.379	-0.133	-133.5	1.10E-01	0.0	0.0
06/25 1913	11.0	81	15.2	12.0	320	0.393	-0.100	-99.5	7.66E-02	0.0	0.0
06/27 1130	11.0	94	13.7	10.8	100	0.391	-0.094	-101.0	7.84E-02	0.0	0.0
06/27 1200	12.0	94	13.7	10.7	100	0.427	-0.130	-137.7	8.97E-02	0.0	0.0
06/27 1230	14.9	95	13.7	10.6	100	0.559	-0.103	-111.3	4.23E-02	0.0	0.0

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Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10**3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
06/27 1300	14.3	85	15.4	10.5	100	0.530	-0.134	-142.0	6.02E-02	0.0	0.0
06/27 1330	14.2	95	13.6	10.5	100	0.529	-0.103	-111.0	4.72E-02	0.0	0.0
06/27 1400	13.9	95	13.6	10.5	100	0.517	-0.101	-109.8	4.88E-02	0.0	0.0
06/27 1430	14.3	95	13.5	10.6	90	0.531	-0.098	-106.3	4.46E-02	0.0	0.0
06/27 1500	14.8	94	13.6	10.6	90	0.554	-0.100	-108.1	4.19E-02	0.0	0.0
06/27 1530	14.7	93	14.0	10.5	90	0.549	-0.113	-121.0	4.78E-02	0.0	0.0
06/27 1600	15.6	93	14.1	10.5	90	0.585	-0.118	-127.0	4.41E-02	0.0	0.0
06/27 1630	15.6	93	14.3	10.5	90	0.585	-0.125	-135.4	4.70E-02	0.0	0.0
06/27 1700	13.0	93	14.5	10.5	100	0.471	-0.130	-140.5	7.52E-02	0.0	0.0
06/27 1730	12.5	94	14.5	10.9	100	0.453	-0.111	-120.6	6.98E-02	0.0	0.0
06/27 2000	10.1	97	13.4	11.0	200	0.360	-0.077	-84.4	7.73E-02	0.0	0.0
06/27 2030	9.1	99	12.8	11.0	250	0.321	-0.062	-68.3	7.88E-02	0.0	0.0
06/27 2100	8.0	100	12.5	11.1	250	0.264	-0.052	-57.3	9.79E-02	0.0	0.0
06/27 2130	8.1	99	12.4	11.1	250	0.267	-0.048	-53.0	8.82E-02	0.0	0.0
06/27 2200	8.1	99	12.4	11.0	400	0.270	-0.047	-51.1	8.35E-02	0.0	0.0
06/27 2230	7.5	99	12.3	11.0	400	0.245	-0.045	-48.8	9.69E-02	0.0	0.0
06/27 2300	6.6	99	12.2	11.0	360	0.206	-0.041	-45.3	1.26E-01	0.0	0.0
06/28 0000	6.2	99	12.0	11.0	400	0.192	-0.035	-37.8	1.22E-01	0.0	0.0
06/28 0030	5.6	98	12.2	11.0	400	0.170	-0.034	-36.7	1.51E-01	0.0	0.0
06/28 0100	4.2	98	12.4	11.0	500	0.109	-0.037	-40.1	4.01E-01	0.0	0.0
06/28 0130	4.3	99	12.2	11.0	600	0.116	-0.034	-37.6	3.33E-01	0.0	0.0
06/28 0200	4.4	98	12.6	11.1	750	0.114	-0.043	-47.0	4.28E-01	0.0	0.0
06/28 0230	4.1	96	12.8	11.1	750	0.101	-0.044	-46.9	5.47E-01	0.0	0.0
06/28 0300	2.6	96	12.8	11.1	850	0.040	-0.026	-27.8	2.03E 00	0.0	0.0
06/28 0330	2.3	98	12.7	11.2	800	0.026	-0.019	-20.5	3.63E 00	0.0	0.0
06/28 0400	1.1	98	12.8	11.7	800	0.001	-0.001	-0.6	9.99E 02	0.0	0.0
06/28 0430	1.8	98	12.8	11.7	750	0.020	-0.012	-13.2	3.90E 00	0.0	0.0
06/28 0500	1.5	98	12.9	11.8	680	0.002	-0.001	-1.4	5.81E 01	0.0	0.0
06/28 0526	1.7	99	12.9	11.7	700	0.011	-0.008	-8.8	8.54E 00	0.0	0.0
06/28 0600	1.7	98	12.8	11.8	700	0.015	-0.009	-10.2	5.52E 00	0.0	0.0
06/28 0630	2.6	98	12.8	11.7	730	0.049	-0.024	-25.8	1.30E 00	0.0	0.0
06/28 0700	5.4	97	13.1	11.7	680	0.159	-0.043	-46.2	2.17E-01	0.0	0.0
06/28 0730	4.2	95	13.3	11.4	680	0.103	-0.047	-50.5	5.63E-01	0.0	0.0
06/28 0800	3.8	95	13.3	11.4	680	0.087	-0.046	-49.0	7.63E-01	0.0	0.0
06/28 0830	3.0	96	13.2	11.5	600	0.059	-0.033	-35.5	1.21E 00	0.0	0.0
06/28 0900	3.5	93	13.9	11.7	660	0.071	-0.044	-46.8	1.11E 00	0.0	0.0

BLM-4 1982
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10↑3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
06/28 0930	3.9	94	13.7	11.6	660	0.090	-0.047	-50.0	7.36E-01	0.0	0.0
06/28 1000	5.3	93	13.6	11.7	660	0.150	-0.052	-54.5	2.89E-01	0.0	0.0
06/28 1030	7.5	92	13.9	11.2	660	0.234	-0.078	-63.7	1.82E-01	0.0	0.0
06/28 1100	6.4	94	14.0	11.4	660	0.188	-0.073	-78.1	2.63E-01	0.0	0.0
06/28 1130	4.5	94	14.3	11.7	700	0.110	-0.061	-66.1	6.50E-01	0.0	0.0
06/28 1300	5.8	92	14.9	11.9	800	0.159	-0.078	-84.0	3.96E-01	0.0	0.0
06/28 1330	6.5	93	15.1	11.9	800	0.191	-0.082	-88.9	2.85E-01	0.0	0.0
06/28 1400	6.3	93	15.1	11.8	800	0.178	-0.084	-90.9	3.39E-01	0.0	0.0
06/28 1430	6.5	92	15.4	11.8	850	0.183	-0.092	-100.1	3.54E-01	0.0	0.0
06/28 1500	6.3	92	15.4	11.9	850	0.175	-0.090	-97.7	3.77E-01	0.0	0.0
06/28 1530	7.0	92	15.6	11.9	850	0.206	-0.096	-104.8	2.93E-01	0.0	0.0
06/28 1600	8.2	92	15.5	11.8	850	0.259	-0.104	-112.9	1.99E-01	0.0	0.0
06/28 1630	8.1	92	15.6	11.8	850	0.251	-0.108	-116.6	2.20E-01	0.0	0.0
06/28 1700	7.7	94	15.2	11.7	850	0.237	-0.099	-107.9	2.29E-01	0.0	0.0
06/28 1730	7.0	94	14.8	11.6	820	0.210	-0.089	-97.3	2.63E-01	0.0	0.0
06/28 1800	7.8	95	14.5	11.6	850	0.243	-0.087	-94.7	1.91E-01	0.0	0.0
06/28 1830	8.2	94	14.5	11.4	850	0.261	-0.091	-99.0	1.73E-01	0.0	0.0
06/28 1900	8.3	94	14.5	11.3	850	0.263	-0.092	-99.6	1.71E-01	0.0	0.0
06/29 0800	3.3	94	13.4	11.5	3000	0.068	-0.037	-39.2	1.01E 00	0.0	0.0
06/29 0830	3.8	96	13.2	11.6	3000	0.093	-0.040	-42.8	5.94E-01	0.0	0.0
06/29 0900	3.1	95	13.3	11.5	3000	0.060	-0.035	-37.5	1.24E 00	0.0	0.0
06/29 0930	3.0	96	13.2	11.5	3000	0.056	-0.033	-35.8	1.36E 00	0.0	0.0
06/29 1000	2.7	94	13.7	11.6	3000	0.038	-0.030	-31.9	2.57E 00	0.0	0.0
06/29 1030	4.3	92	14.6	11.7	3000	0.097	-0.064	-68.6	8.59E-01	0.0	0.0
06/29 1200	4.0	92	15.3	12.1	3000	0.080	-0.060	-64.8	1.19E 00	0.0	0.0
06/29 1230	3.9	91	15.6	12.1	3000	0.068	-0.061	-65.2	1.68E 00	0.0	0.0
06/29 1300	4.0	90	15.9	12.2	3000	0.068	-0.066	-70.7	1.81E 00	0.0	0.0
06/29 1330	4.3	95	15.0	12.3	3000	0.100	-0.059	-64.6	7.66E-01	0.0	0.0
06/29 1400	3.9	94	15.1	12.6	3000	0.084	-0.053	-57.0	9.71E-01	0.0	0.0
06/29 1430	4.0	93	15.7	12.5	3000	0.079	-0.059	-64.2	1.23E 00	0.0	0.0
06/29 1500	3.7	93	15.9	12.5	3000	0.062	-0.054	-59.2	1.82E 00	0.0	0.0
06/29 1530	3.7	97	14.9	12.3	3000	0.071	-0.052	-57.0	1.34E 00	0.0	0.0
06/29 1600	4.4	98	14.5	12.2	3000	0.102	-0.059	-64.7	7.44E-01	0.0	0.0
06/29 1630	5.2	100	13.6	11.7	3000	0.142	-0.059	-65.2	3.82E-01	0.0	0.0
06/29 1700	4.0	99	13.5	11.5	3000	0.091	-0.051	-56.5	8.08E-01	0.0	0.0
06/29 1730	3.0	97	13.8	11.5	3000	0.044	-0.036	-39.2	2.44E 00	0.0	0.0

BLM-4 1982
All Data

Date/Time	U (m/sec)	RH (%)	T (C)	Ts (C)	Zi (m)	U* (m/sec)	T* (C)	10**3*Qo (m/secK)	z/L	w* (m/sec)	t (min)
06/29 1800	2.5	97	13.7	11.7	3000	0.026	-0.023	-24.7	4.42E 00	0.0	0.0
06/30 0652	8.6	98	14.4	15.0	3000	0.264	0.023	26.5	-4.52E-02	0.8	59.0
06/30 0722	8.6	95	15.1	15.0	600	0.257	-0.003	-0.0	1.40E-04	0.0	0.0
06/30 0926	6.8	92	15.3	13.3	600	0.168	-0.061	-63.3	2.66E-01	0.0	0.0
06/30 1008	6.3	89	15.6	13.8	880	0.147	-0.058	-58.1	3.20E-01	0.0	0.0
06/30 1038	6.5	90	15.5	13.9	880	0.156	-0.054	-53.8	2.62E-01	0.0	0.0
06/30 1248	4.0	92	16.6	14.9	880	0.061	-0.032	-33.1	1.07E 00	0.0	0.0
06/30 1318	7.5	93	15.4	13.0	880	0.192	-0.077	-81.6	2.64E-01	0.0	0.0
06/30 1348	7.5	92	15.5	12.9	880	0.191	-0.078	-82.9	2.70E-01	0.0	0.0
06/30 1504	7.7	92	15.7	12.8	880	0.198	-0.086	-91.7	2.79E-01	0.0	0.0
06/30 1543	8.4	91	15.8	12.7	900	0.222	-0.095	-101.6	2.45E-01	0.0	0.0
06/30 1613	9.5	91	15.9	12.5	900	0.270	-0.108	-115.4	1.88E-01	0.0	0.0
06/30 1725	10.3	94	15.4	12.6	900	0.322	-0.091	-98.6	1.13E-01	0.0	0.0
06/30 1755	9.5	94	15.3	12.3	900	0.272	-0.098	-105.0	1.69E-01	0.0	0.0
06/30 1825	8.3	94	15.3	11.9	900	0.217	-0.106	-114.4	2.88E-01	0.0	0.0
06/30 2012	7.5	100	14.4	14.0	750	0.209	-0.016	-17.1	4.68E-02	0.0	0.0
06/30 2042	8.1	0	14.1	13.8	750	0.233	-0.013	-14.7	3.20E-02	0.0	0.0
06/30 2233	8.3	0	14.3	15.0	700	0.254	0.017	19.6	-3.63E-02	0.5	24.7
06/30 2303	8.5	0	14.3	15.0	700	0.259	0.024	26.1	-4.61E-02	0.5	22.2
07/01 0545	7.1	100	12.7	11.7	780	0.187	-0.035	-38.3	1.30E-01	0.0	0.0
07/01 0833	2.3	89	15.7	11.9	780	0.000	-0.001	-1.1	9.99E 02	0.0	0.0
07/01 0833	2.3	89	15.7	11.9	580	0.001	-0.002	-2.1	9.99E 02	0.0	0.0
07/01 0953	8.6	91	15.0	12.3	440	0.236	-0.087	-92.0	1.97E-01	0.0	0.0
07/01 1023	9.7	92	14.9	12.6	590	0.299	-0.080	-83.9	1.12E-01	0.0	0.0
07/01 1131	10.9	93	15.2	14.0	400	0.367	-0.038	-37.9	3.34E-02	0.0	0.0
07/01 1312	11.0	95	15.3	15.3	400	0.382	0.003	7.2	-5.80E-03	0.3	25.8
07/01 1342	10.8	95	15.4	15.1	500	0.369	-0.010	-8.1	7.09E-03	0.0	0.0
07/01 1452	11.2	93	15.7	15.0	500	0.384	-0.023	-21.4	1.73E-02	0.0	0.0
07/01 1522	14.4	94	15.5	15.7	400	0.527	0.010	14.8	-6.31E-03	0.4	16.2

IV-5. Wind Direction Variance

Transport of material in the atmosphere is mainly accomplished by wind advection. The mean wind, averaged over some suitably long time, determines the centerline trajectory of a plume. The fluctuation of the wind about the mean determines the spread of a plume about the centerline.

It is not obvious what averaging periods should be used to determine mean wind. The division between what is considered average behavior and what is considered to be fluctuation is not clear, and in fact depends on the application for which a particular data set is to be used. The basic purpose of the data gathered in these experiments is to parameterize a one-hour average Gaussian model. Thus, the data presented in this section is one-hour average wind direction, and the variance about that average for the one-hour period. These data are presented in Table 9.

Table 9a. One-hour average wind directions, wind direction variances and the number of 10 sec. wind averages for BLM-1.

BLM-1: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
09/23/80	1612-1717	257.4	9.5	228
09/24/80	1109-1205	231.1	13.3	192
09/24/80	1206-1301	230.6	12.9	190
09/24/80	1303-1357	252.4	11.5	189
09/24/80	1358-1453	261.5	7.7	189
09/24/80	1455-1549	253.7	8.0	186
09/24/80	1551-1645	262.0	7.1	187
09/24/80	1743-1837	274.6	6.0	164
09/27/80	0647-0743	43.0	6.3	186
09/27/80	0917-1013	278.5	10.2	207
09/27/80	1110-1206	270.4	6.6	208
09/27/80	1207-1302	274.3	5.6	201
09/27/80	1303-1358	273.0	4.7	200
09/27/80	1359-1454	272.1	4.0	200
09/27/80	1456-1550	274.5	2.4	198
09/27/80	1551-1646	273.2	2.9	200
09/27/80	1647-1742	268.3	2.8	199
09/27/80	1744-1838	268.7	3.6	196
09/28/80	1239-1335	231.0	10.3	207
09/28/80	1340-1436	247.1	7.8	208
09/28/80	1437-1532	256.6	7.4	200
09/28/80	1534-1628	253.4	4.9	198
09/28/80	1712-1808	260.4	4.4	207
09/28/80	1809-1904	256.7	4.5	198
09/29/80	1149-1245	229.3	5.1	219
09/29/80	1251-1347	252.7	5.0	216
09/29/80	1349-1443	262.4	3.3	212
09/29/80	1444-1540	261.4	3.9	162
09/29/80	1558-1654	266.0	2.4	218
09/29/80	1656-1750	268.4	5.2	211
09/29/80	1751-1846	285.0	3.8	211

Table 9b. One-hour average wind directions, wind direction variances and the and the number of 10 sec. wind averages for BLM-2.

BLM-2: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
01/06/81	1125-1225	289.3	13.7	217
01/06/81	1325-1425	296.9	11.6	224
01/06/81	1425-1542	291.8	22.6	223
01/06/81	1542-1642	301.2	13.3	221
01/06/81	1642-1742	279.0	9.5	220
01/06/81	1742-1842	280.7	17.1	220
01/06/81	1842-1942	341.6	50.7	220
01/07/81	1132-1232	158.3	5.0	220
01/07/81	1250-1350	221.5	19.5	222
01/07/81	1350-1450	232.8	30.1	220
01/09/81	1119-1221	278.0	10.6	221
01/09/81	1239-1339	273.1	6.7	220
01/09/81	1339-1439	281.4	3.4	220
01/09/81	1440-1539	278.9	4.8	218
01/09/81	1540-1639	276.0	9.2	218
01/09/81	1640-1739	271.8	3.1	216
01/13/81	0822-0948	11.0	21.1	253
01/13/81	1019-1119	299.3	11.2	251
01/13/81	1209-1309	298.2	5.6	255
01/13/81	1310-1409	287.0	5.9	252
01/13/81	1409-1509	271.0	11.8	253
01/13/81	1509-1559	254.6	7.4	177
01/13/81	1559-1659	239.8	8.6	252
01/14/81	1100-1200	180.7	46.5	255
01/14/81	1200-1300	212.8	23.6	253
01/14/81	1300-1400	194.2	15.6	253
01/14/81	1400-1500	245.6	22.6	252
01/15/81	1411-1500	203.6	17.3	210
01/15/81	1522-1622	282.1	32.7	257
01/15/81	1622-1722	289.1	6.5	252
01/16/81	0908-1008	344.3	12.7	249
01/16/81	1020-1120	323.5	5.6	254
01/16/81	1120-1220	335.8	6.2	253
01/16/81	1220-1320	334.6	8.9	252
01/16/81	1320-1420	319.1	17.7	251
01/16/81	1420-1520	297.5	4.6	141
01/16/81	1520-1620	294.9	4.3	250
01/16/81	1621-1720	294.8	4.8	250
01/16/81	1721-1820	294.1	8.0	251
01/16/81	1821-1920	298.8	6.8	251
01/16/81	1921-2020	270.7	53.2	250
01/16/81	2021-2120	194.9	44.3	250
01/16/81	2121-2220	276.6	8.8	252

Table 9c. One-hour average wind directions, wind direction variances and the number of 10 sec. wind averages for BLM-3.

BLM- 3: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
12/08/81	1222-1322	283.6	51.7	250
12/08/81	1323-1422	263.4	8.1	261
12/08/81	1422-1522	264.8	9.3	263
12/08/81	1522-1622	279.7	42.0	264
12/08/81	1623-1722	279.6	42.1	260
12/08/81	1723-1822	196.6	41.3	261
12/08/81	1826-1922	122.9	23.9	243
12/08/81	1923-2022	110.7	6.4	262
12/08/81	2023-2122	82.2	20.3	262
12/08/81	2123-2222	176.3	40.2	262
12/08/81	2223-2322	214.0	27.7	262
12/08/81	2323-0022	208.8	33.1	262
12/09/81	0023-0122	275.1	37.1	262
12/09/81	0123-0222	48.6	70.1	262
12/09/81	0223-0322	159.1	41.2	261
12/09/81	0323-0422	120.6	18.5	261
12/09/81	0423-0522	147.0	32.9	261
12/09/81	0523-0622	197.1	49.7	261
12/09/81	0623-0722	209.7	36.1	261
12/09/81	0723-0822	129.5	26.0	260
12/09/81	0823-0922	172.4	16.4	262
12/09/81	0923-1022	182.3	35.3	259
12/09/81	1023-1122	205.3	11.5	261
12/09/81	1123-1222	199.5	11.3	263
12/09/81	1222-1322	173.8	9.8	264
12/09/81	1322-1422	151.6	12.8	262
12/09/81	1422-1522	94.8	35.0	263
12/09/81	1522-1622	64.9	10.1	263
12/09/81	1622-1722	80.3	9.5	263
12/09/81	1722-1822	114.8	15.6	262
12/09/81	1822-1922	113.1	12.7	263
12/09/81	1922-2022	105.4	26.3	263
12/09/81	2022-2122	252.3	40.6	264
12/09/81	2122-2222	350.4	25.3	264
12/09/81	2222-2322	55.6	11.6	262
12/09/81	2322-0022	24.4	16.8	262
12/10/81	0023-0122	51.4	10.3	262
12/10/81	0123-0222	55.5	11.5	262
12/10/81	0223-0322	35.3	29.3	262
12/10/81	0323-0422	33.2	18.9	262
12/10/81	0423-0522	315.9	19.5	262
12/10/81	0523-0622	312.5	6.0	262
12/10/81	0623-0722	312.6	7.1	262
12/10/81	0723-0822	303.0	5.2	262
12/10/81	0823-0922	90.6	51.5	249
12/10/81	0923-1022	113.1	26.2	261

BLM- 3: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
12/10/81	1023-1122	143.2	14.5	262
12/10/81	1123-1222	157.3	4.8	166
12/10/81	1223-1322	158.6	37.1	262
12/10/81	1323-1422	23.8	46.5	261
12/10/81	1423-1522	312.6	18.9	261
12/10/81	1523-1622	28.4	44.5	260
12/10/81	1623-1722	16.9	25.9	260
12/10/81	1916-2016	20.0	19.2	263
12/10/81	1946-2046	15.7	16.5	262
12/10/81	2100-2200	42.3	9.0	268
12/10/81	2201-2300	7.2	20.7	261
12/10/81	2300-0000	345.7	11.6	265
12/11/81	0000-0100	358.3	16.2	265
12/11/81	0100-0200	13.0	18.1	264
12/11/81	0200-0300	49.0	12.0	264
12/11/81	0300-0400	52.0	15.5	263
12/11/81	0400-0500	11.4	24.8	263
12/11/81	0500-0600	350.0	12.0	264
12/11/81	0600-0700	346.4	5.6	265
12/11/81	0700-0800	17.9	24.2	263
12/11/81	0800-0900	56.6	11.9	263
12/11/81	0901-1000	65.0	39.6	255
12/11/81	1001-1100	120.4	38.9	248
12/11/81	1101-1200	240.6	16.6	249
12/11/81	1201-1300	256.8	16.1	249
12/11/81	1301-1400	272.5	7.9	248
12/11/81	1400-1500	285.0	5.1	249
12/11/81	1501-1600	282.6	3.2	248
12/11/81	1603-1657	285.7	2.9	226
12/11/81	1657-1751	291.9	2.3	224
12/11/81	1752-1845	295.7	2.9	223
12/11/81	1846-1939	325.6	46.1	223
12/11/81	1913-2006	39.5	68.0	223
12/13/81	0731-0831	71.3	22.3	247
12/13/81	0832-0928	59.5	12.1	232
12/13/81	0901-1000	70.8	13.2	243
12/13/81	1001-1100	67.3	66.3	230
12/13/81	1100-1200	239.3	61.2	270
12/13/81	1200-1300	274.0	8.4	254
12/13/81	1300-1400	285.7	3.3	248
12/13/81	1400-1500	282.9	3.0	255
12/13/81	1500-1600	288.4	3.3	269
12/13/81	1600-1700	292.2	2.9	248
12/13/81	1700-1800	292.2	3.0	249
12/13/81	1800-1900	304.2	5.2	249
12/13/81	1900-2000	324.5	22.0	250

BLM- 3: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
12/15/81	1901-2000	310.8	14.0	255
12/15/81	2230-2330	309.2	4.1	261
12/15/81	2331-0030	315.2	3.0	257
12/16/81	0031-0130	17.8	21.8	258
12/16/81	0131-0230	29.3	5.2	258
12/16/81	0231-0326	41.0	14.0	233
12/16/81	0341-0441	4.1	12.4	256
12/16/81	0442-0541	17.6	10.3	253
12/16/81	0541-0641	45.2	7.1	254
12/16/81	0641-0741	32.2	9.1	252
12/16/81	0741-0841	22.1	9.6	251
12/16/81	0841-0941	18.4	7.4	253
12/16/81	0942-1041	339.3	18.2	254
12/16/81	1042-1144	299.0	7.8	211
12/16/81	1145-1244	278.0	9.5	250
12/16/81	1230-1329	296.2	5.3	248
12/16/81	1330-1430	297.6	3.0	262
12/16/81	1431-1530	316.8	5.7	258
12/16/81	1501-1600	322.2	4.1	258
12/16/81	1630-1730	315.2	3.0	262
12/16/81	1731-1830	320.6	5.2	257
12/16/81	1831-1930	318.2	7.0	257
12/16/81	1931-2030	328.4	12.7	257
12/17/81	0800-0900	78.4	18.1	259
12/17/81	0900-1000	87.9	8.5	260
12/17/81	1000-1100	92.4	13.5	260
12/17/81	1100-1200	117.9	6.1	259
12/17/81	1200-1300	39.0	31.9	261
12/17/81	1300-1400	51.2	17.8	260
12/17/81	1401-1500	75.6	13.7	258
12/17/81	1500-1600	179.4	82.7	260
12/17/81	1600-1700	252.2	10.3	257
12/17/81	1700-1800	238.9	99.8	259
12/17/81	1800-1900	201.0	53.3	259
12/17/81	1900-2000	41.6	37.7	259
12/17/81	2000-2100	116.8	21.7	259
12/17/81	2101-2200	135.4	3.1	259
12/17/81	2201-2300	132.8	4.1	259
12/17/81	2301-0000	139.7	4.5	259
12/18/81	0001-0100	135.6	4.0	259
12/18/81	0101-0200	144.0	8.0	259
12/18/81	0200-0300	138.9	6.5	259
12/18/81	0301-0400	161.4	10.5	257
12/18/81	0401-0500	183.7	12.7	257
12/18/81	0501-0600	178.1	7.9	226
12/18/81	0601-0700	169.8	23.2	257

BLM- 3: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
12/13/81	2104-2200	118.7	11.2	226
12/13/81	2200-2300	107.3	18.6	249
12/13/81	2304-0000	66.1	30.4	232
12/14/81	0001-0058	54.9	21.4	240
12/14/81	0059-0156	22.1	10.7	240
12/14/81	0157-0254	16.0	11.7	241
12/14/81	0255-0352	317.7	17.4	240
12/14/81	0353-0450	341.7	32.6	240
12/14/81	0451-0548	33.3	19.3	239
12/14/81	0549-0646	350.2	30.6	239
12/14/81	0708-0800	31.9	11.7	212
12/14/81	0801-0900	13.0	20.5	249
12/14/81	0901-1000	313.0	17.3	249
12/14/81	1001-1100	300.7	20.4	247
12/14/81	1101-1200	292.7	2.9	249
12/14/81	1201-1300	292.9	2.6	248
12/14/81	1301-1400	292.6	2.2	247
12/14/81	1401-1500	292.2	2.4	257
12/14/81	1430-1530	292.7	2.0	268
2/14/81	1546-1638	295.2	2.2	225
12/14/81	1638-1730	300.0	4.7	224
12/14/81	1730-1822	308.5	6.0	224
12/14/81	1822-1929	306.9	14.0	290
12/14/81	1935-2030	300.4	2.3	244
12/14/81	2000-2100	298.5	2.5	273
12/14/81	2230-2330	298.6	5.2	263
12/14/81	2330-0030	36.8	57.2	261
12/15/81	0030-0130	114.9	6.5	259
12/15/81	0130-0230	105.4	9.3	259
12/15/81	0230-0330	90.9	5.3	259
12/15/81	0330-0430	62.4	49.5	259
12/15/81	0430-0530	278.3	12.5	259
12/15/81	0530-0630	311.5	26.6	259
12/15/81	0630-0730	61.0	36.0	257
12/15/81	0700-0800	46.1	63.3	256
12/15/81	0900-1007	167.0	32.8	263
12/15/81	1008-1103	241.7	33.5	255
12/15/81	1108-1208	293.3	7.7	255
12/15/81	1209-1303	306.3	12.5	253
12/15/81	1308-1403	348.5	23.2	254
12/15/81	1349-1448	359.4	9.5	253
12/15/81	1500-1600	296.0	10.1	262
12/15/81	1600-1700	299.4	3.6	259
12/15/81	1701-1800	303.3	4.8	259
12/15/81	1801-1900	315.5	50.7	257

Table 9d. One-hour average wind directions, wind direction variances and the number of 10 sec. wind averages for BLM-4.

BLM-4: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
06/21/82	0002-0100	277.7	6.1	240
06/21/82	0100-0200	284.3	11.9	261
06/21/82	0200-0300	310.3	7.8	262
06/21/82	0300-0400	298.7	3.8	263
06/21/82	0400-0500	308.0	17.4	262
06/21/82	0500-0600	336.2	22.8	262
06/21/82	0601-0700	285.3	19.5	262
06/21/82	0700-0800	262.9	18.2	261
06/21/82	0730-0830	261.1	28.1	261
06/21/82	1000-1100	274.0	5.1	262
06/21/82	1101-1200	271.2	8.6	259
06/21/82	1201-1300	273.9	6.7	216
06/21/82	1301-1400	280.5	3.8	260
06/21/82	1400-1500	278.1	3.0	263
06/21/82	1501-1600	272.9	4.2	261
06/21/82	1600-1700	273.9	6.0	261
06/21/82	1631-1730	273.3	5.9	260
06/21/82	2000-2100	281.5	2.3	263
06/21/82	2101-2200	288.7	3.5	260
06/21/82	2201-2300	297.2	3.6	260
06/21/82	2301-0000	289.2	3.1	260
06/22/82	0001-0100	302.0	5.4	259
06/22/82	0101-0200	302.9	8.2	259
06/22/82	0201-0300	344.0	11.9	259
06/22/82	0301-0400	331.4	11.3	259
06/22/82	0401-0500	323.6	9.5	261
06/22/82	0500-0600	313.4	9.9	259
06/22/82	0601-0700	294.1	5.7	259
06/22/82	0730-0830	342.2	28.9	266
06/22/82	0830-0930	295.0	63.6	261
06/22/82	0930-1030	213.9	8.2	263
06/22/82	1030-1130	201.5	6.4	224
06/22/82	1130-1230	222.8	10.6	260
06/22/82	1231-1330	232.1	7.5	217
06/22/82	1331-1430	254.2	10.8	258
06/22/82	1431-1530	262.7	3.6	259
06/22/82	1531-1630	267.4	3.3	260
06/22/82	1631-1730	273.3	5.6	259
06/22/82	1730-1830	279.8	8.5	261
06/22/82	1831-1930	277.0	12.1	258
06/22/82	1931-2030	277.6	12.4	260
06/22/82	2031-2130	280.4	20.9	259
06/22/82	2130-2230	301.9	15.9	261
06/22/82	2231-2330	291.3	30.2	261
06/22/82	2331-0030	277.7	52.5	260
06/23/82	0031-0130	307.6	11.2	261
06/23/82	0131-0230	333.2	23.3	251
06/23/82	0231-0330	7.9	31.9	260
06/23/82	0331-0430	38.7	13.1	260

BLM-4: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
06/23/82	0431-0530	337.0	33.1	260
06/23/82	0531-0630	331.1	18.9	256
06/23/82	0601-0700	334.6	26.4	253
06/23/82	0800-0900	180.1	28.9	265
06/23/82	0950-1050	343.1	11.3	264
06/23/82	1134-1234	290.4	6.6	263
06/23/82	1414-1524	241.5	9.0	267
06/23/82	2110-2210	328.6	20.0	265
06/23/82	2307-0007	16.5	18.2	266
06/24/82	0128-0228	288.9	4.7	262
06/24/82	0331-0431	296.8	8.3	263
06/24/82	0810-0858	327.5	25.7	211
06/24/82	0902-1000	253.9	19.4	244
06/24/82	1001-1100	294.0	22.8	259
06/24/82	1030-1130	305.8	19.8	260
06/24/82	1200-1300	39.8	14.7	265
06/24/82	1301-1400	266.5	12.1	261
06/24/82	1400-1500	274.0	6.2	261
06/24/82	1501-1600	271.7	2.7	261
06/24/82	1600-1700	266.9	3.3	262
06/24/82	1701-1800	263.0	3.4	260
06/24/82	1801-1900	277.0	7.3	260
06/24/82	1901-2000	283.8	2.5	260
06/24/82	2002-2100	289.6	4.4	254
06/24/82	2101-2200	297.1	7.0	173
06/24/82	2201-2300	305.9	9.5	261
06/24/82	2301-0000	330.4	15.1	261
06/25/82	0001-0100	350.2	34.1	260
06/25/82	0101-0200	40.2	66.5	262
06/25/82	0201-0300	289.7	23.5	260
06/25/82	0301-0400	313.0	7.7	259
06/25/82	0401-0500	323.2	9.5	260
06/25/82	0501-0600	311.9	13.8	258
06/25/82	0601-0700	310.6	8.8	258
06/25/82	0701-0800	316.7	10.3	260
06/25/82	0800-0900	2.4	18.3	256
06/25/82	0900-1000	307.3	22.0	262
06/25/82	1000-1100	289.4	6.7	261
06/25/82	1101-1200	282.7	2.3	260
06/25/82	1200-1300	276.3	1.7	261
06/25/82	1300-1400	278.5	2.6	260
06/25/82	1402-1500	282.8	3.1	253
06/25/82	1500-1600	285.1	1.3	263
06/25/82	1600-1700	286.1	2.8	261
06/25/82	1700-1800	294.3	2.9	261
06/25/82	1731-1830	294.3	2.2	261
06/25/82	1925-2025	293.5	9.0	265
06/25/82	1956-2055	305.7	5.2	260
06/27/82	1100-1200	290.2	3.7	263
06/27/82	1200-1300	284.0	2.0	263

BLM-4: HOURLY AVERAGE WIND DIRECTIONS & SIGMAS

DATE	TIME PERIOD	<DIR>	SIGMA	N
06/27/82	1300-1400	284.5	2.3	222
06/27/82	1400-1500	283.6	2.9	263
06/27/82	1501-1600	284.8	2.4	263
06/27/82	1601-1700	284.9	2.4	263
06/27/82	1930-2030	291.8	3.1	267
06/27/82	2031-2130	293.1	3.4	263
06/27/82	2132-2230	302.4	4.3	257
06/27/82	2200-2300	306.6	4.5	264
06/27/82	2330-0030	299.2	7.5	269
06/28/82	0031-0130	307.5	13.2	262
06/28/82	0131-0230	309.1	6.8	262
06/28/82	0231-0330	320.9	29.1	263
06/28/82	0331-0430	294.4	75.3	263
06/28/82	0401-0500	305.9	56.7	262
06/28/82	0530-0630	298.9	19.7	269
06/28/82	0631-0730	272.0	15.8	265
06/28/82	0730-0830	290.5	17.2	265
06/28/82	0831-0930	304.5	21.4	264
06/28/82	0931-1030	283.6	6.8	262
06/28/82	1031-1130	275.2	12.9	263
06/28/82	1100-1200	282.0	8.8	249
06/28/82	1230-1330	267.9	7.8	267
06/28/82	1330-1430	272.9	5.6	265
06/28/82	1430-1530	272.0	2.8	265
06/28/82	1530-1630	276.4	2.3	264
06/28/82	1630-1730	278.5	3.2	264
06/28/82	1730-1830	280.9	4.7	264
06/28/82	1801-1900	286.6	3.5	262
06/29/82	0730-0830	171.7	10.6	267
06/29/82	0831-0930	171.5	8.1	260
06/29/82	0931-1030	193.6	5.8	264
06/29/82	1130-1230	180.2	11.2	267
06/29/82	1231-1330	219.0	13.2	263
06/29/82	1331-1430	225.4	8.4	202
06/29/82	1431-1530	234.6	6.9	263
06/29/82	1531-1630	271.7	13.1	262
06/29/82	1631-1730	297.3	25.8	263
06/29/82	1701-1800	8.5	56.1	263
06/30/82	0622-0722	302.5	3.4	263
06/30/82	0938-1038	321.4	3.0	265
06/30/82	1218-1318	246.2	27.1	269
06/30/82	1249-1348	270.3	6.4	264
06/30/82	1434-1543	260.8	4.4	270
06/30/82	1513-1613	268.6	5.2	267
06/30/82	1655-1755	278.4	3.8	266
06/30/82	1726-1825	283.8	3.4	258
06/30/82	1942-2042	310.2	3.4	270
06/30/82	2203-2303	306.4	3.9	190
07/01/82	0853-0953	292.3	7.0	266
07/01/82	0923-1023	297.8	2.3	265
07/01/82	1242-1342	309.1	3.4	268
07/01/82	1422-1522	309.2	3.7	263

IV-6. Ship Movements and Relative Wind

Since the data reported here were gathered in the coastal region where there can be large spatial inhomogeneities, it is important to know the ship's location. During the tracer gas releases, the ship was anchored at the appropriate distance from shore. At other times, it would be drifting, steaming slow or full ahead, taking data further at sea for homogeneity studies, etc.

The quality of the data depends on the direction of the relative wind over the ship. When the wind is from the stern, heat from the ship's exhaust can cause false temperature readings if the wind speed is low. When the direction is more than about 45° off the bow the turbulence sensors are affected, while the upper level mean sensors give valid data. Normal procedure when taking data is to keep the ship into the wind. This is not always possible, such as when a 24 hour operation is in progress and the ship must follow a prescribed track.

In this section we give both ship location and movement and relative wind data. These data can be used to assess the quality of meteorological data and determine the locations where data were obtained. Note that we do not attempt here to give exact ship locations throughout the cruises (that would be too voluminous). Exact locations can be obtained from NPS if they are needed. Here we give appropriate locations so that the scenarios under which data were gathered are known. The relative wind directions appear in table 10.

A. Ship Movements

BLM-1 (1980)

9/21	0905	Underway from Monterey
	0955	Proceed south $\sim$5 miles offshore
	1700	4 nmi off Piedras Blancas light
	1900	Off Pt Buchon
9/22	0300	Round Pt Conception
	0325	Proceed east in Santa Barbara Channel
	1040	Drift near Ventura $\sim$5 nmi from shore
	1300	Underway for Anacapa to do sea surface temperature work
	1400	Go through Anacapa passage
	1415	5 nmi off Santa Cruz Island, in lee
	1700	Move ship out of lee of island
	1813	Underway to release area
	1930	On station 8 nmi from shore off Ventura.
		Drift overnight
9/23		Drift all day in general Ventura area
9/24	0645	Underway for release position
	0730	On station $\sim$4 nmi from coast near Ventura
	1045	Reposition ship to release position
	1055	Anchor ship for SF_6 release
		Remain at anchor overnight
9/25	1000	Underway for Port Hueneme
	1115	In Port Hueneme
9/27	0500	Underway from Port Hueneme
	0640	On station off Ventura, drifting
	1030	Move ship to SF_6 release position
	1103	Anchored on station
		Remain for the day

9/28	0915	Pull anchor, move to new position
	0930	At SF_6 release position
	0945	Anchor on station
	1915	Pull anchor and head for Port Hueneme
	2030	Dock at Port Hueneme
9/29	0500	Underway from Port Hueneme
	0615	Drift at approximate position of Ventura
	1135	Drop anchor at SF_6 release position
	1930	Underway for Port Hueneme
	2030	Dock at Port Hueneme
9/30	1015	Underway from Port Hueneme
		Proceed to area south of Channel Islands to work oceanic cold fronts
10/1	1630	Depart for Monterey

BLM-2 (1981)

1/5	0950	Underway from Monterey
	1010	Proceed south ~5 miles off shore
	1800	Off Piedras Blancas Pt.
1/6	0525	Off Pt. Conception
	1320	Anchor at SF_6 release position off Ventura
		Remain at anchor overnight
1/7	1125	Move ship to proposed release position
	1142	Drift at position
	1530	Move to proposed release position for tomorrow
	1550	Anchor, remain overnight
1/8		Remain at anchor off Ventura

1/9	1110	Move to new SF_6 release position
	1125	Anchor at new position
	1825	Pull anchor and underway for Port Hueneme
	1955	Dock at Port Hueneme
1/13	0500	Underway from Port Hueneme
	0615	Drift at approximate SF_6 release position
	1000	Move ship back to release position
	1020	Drift at position
	1110	Move ship back to position
	1135	Drop anchor at SF_6 release position
		Remain at anchor through night
1/14	1215	Pull anchor and move to proposed release position
	1445	Anchor for the night near Ventura
1/15	1240	Pull anchor and move ship to proposed SF_6 release position
	1355	Anchor at release position
	1715	Pull anchor and underway to Port Hueneme
	1820	Put personnel ashore at Port Hueneme
		Leave for San Diego area at ~10 miles off shore
1/16	0900	Turn into wind, ~ 20 miles off San Diego, take data
	2300	Stop taking data, head for San Diego

BLM-3	(1981)	
12/6	0830	Underway from Monterey
	0900	Turn to south, sail at ~ 5 miles from shore
	1748	Off Pt. Buchon
	2100	On station off Pismo Beach ~ 5 miles from shore, drift for the night

12/7		Drift for the day and repair equipment
	1715	Reposition ship
	1823	Back at position for drifting
12/8	0652	Head for Avila to pick up personnel and equipment
	0755	Leave Avila Beach
	0919	Drifting at release position
	1153	Anchor at SF_6 release position
		Remain at anchor overnight
12/9		Remain at anchor throughout the day
12/10	0915	Pull anchor and move ship to proposed position
	0940	Drifting, waiting for wind
	1300	Move ship back to release position
	1700	Reposition ship, anchor and remain overnight
12/11	1155	Pull anchor and move to SF_6 release position
	1224	Anchor at position
		Remain at anchor overnight
12/12	0925	Pull anchor and head for Avila Beach
	1040	Anchor at Avila Beach, shore leave
	2240	Pull anchor and go back to SF_6 release position off Pismo Beach
	2330	Drift at release position
12/13	1120	Move ship into position
	1146	Anchor at release position
		Remain at anchor overnight
12/14	1015	Move ship to proposed SF_6 release position
	1030	Anchor ship at release position
		Remain at anchor overnight

12/15	0730	Pull anchor, go in to pick up radiosondes
	0843	Leave Avila, go back to station
	0939	On station, drift
	1055	Move ship to new proposed SF_5 release position
	1115	Drop anchor at new position
	2000	Pull anchor and go to Avila Beach
	2100	Put personnel ashore, sail to Pt Buchon
	2215	Drift at ~ 5 nmi off Pt Buchon
12/16	0250	Move ship to 10 nmi offshore
	0325	At 10 nmi, check wind, proceed to 15 nmi offshore
	0338	Stop ship and drift at ~ 12 nmi to look for land-sea breeze extent
	0720	Underway back to SF_6 release area, 3 nmi offshore
	0810	Stop at release area, drift
	1105	2/3 ahead to W
	1615	Change course to N toward Pt Buchon
	1900	Stop at ~ 3 nmi off Pt Buchon and drift overnight, waiting for fog
12/17	0738	Move 1/2-ahead to north
	0855	Full ahead to west
	1130	Still sailing west, at 50 nmi offshore
	1345	At 70 nmi offshore
	1400	Turn ship and head north
	1920	Stop ship off Pt Sur, drift and wait for fog
12/18	0033	Slow ahead into wind (145°)
	0310	Full speed ahead for Monterey Bay
	0610	Slow ahead into wind at ~ 5 nmi off Monterey (160°)
	0702	End experiment, head for Monterey

BLM-4 (1982)

6/20	1038	Underway from Monterey
	1242	Head south at ~5 nmi off shore
	2100	Off Moro Bay
6/21	0000	1/2-ahead from Pt Buchon toward release area
	0207	Stop ship and drift at SF_6 release area, 3 nmi off Pismo Beach
	0830	Move ship to place marker buoys
	1050	Back at release area, drift
	1206	Move ship to SF_6 release position
	1218	Anchor at release position
		Remain at anchor overnight
6/22	1055	Pull anchor and move ship to new SF_6 release position
	1115	Drifting at the new position
	1312	Underway to redesignated SF_6 release position
	1338	Drop anchor at release position
	2340	Pull anchor and head toward Pt Buchon
6/23	0140	2 nmi off Pt Buchon, turn towards Moro Bay
	0223	3 nmi off Moro Bay, turn to due N
	0303	At northernmost point of Moro Bay, 1 nmi off shore, turn to due S
	0528	Due W of SF_6 release area at 15 nmi off shore, turn to due E to return to release area
	0707	Back at release area, 5 nmi out, drift
	0725	Slow ahead into the wind
	0906	Move ship to 10 nmi from shore

	0945	Slow ahead into the wind at 10 nmi
	1056	Move ship to 15 nmi from shore
	1130	Slow ahead into the wind at 15 nmi
	1237	Return to 5 nmi from shore
	1400	Slow ahead into the wind at 5 nmi
	1527	Drift at ~ 7 nmi from shore
	2003	Slow ahead into the wind at 5 nmi
	2035	Move to 10 nmi from shore
	2109	Slow ahead into the wind at 10 nmi
	2212	Move to 15 nmi from shore
	2305	Slow ahead into the wind at 15 nmi
6/24	0008	Move to 10 nmi from shore
	0122	Slow ahead into the wind at 10 nmi
	0230	Move to 5 nmi from shore
	0335	Slow ahead into the wind at 5 nmi
	0433	Move to 10 nmi from shore
	0456	Slow ahead into the wind at 10 nmi
	0530	Move to 5 nmi from shore
	0615	Slow ahead into the wind at 5 nmi
	0649	Move to 2 nmi from shore
	0715	Slow ahead into the wind at 2 nmi
	0754	Move ship to proposed SF_6 release position at 3 nmi from shore
	0808	Drift at release position
	0900	Make small corrections of ship position while waiting for release
	1147	Anchor at release position, remain at anchor overnight

6/25		Remain anchored at this position for the next SF_6 release
	1900	Pull anchor and move to tend buoys
	1920	Move to Moro Bay area and work there overnight
6/26	0500	Depart Moro Bay for Avila Beach
	0810	Anchor at Avila Beach
6/27	0630	Depart Avila Beach, proceed to repair buoys
	0800	Repair buoy
	0905	Move to projected SF_6 release position
	1026	Anchor at release position, remain at anchor overnight
6/28	1025	Pull anchor and move to SF_6 release position at 5 nmi from shore
	1045	Drift at release position
	1150	Move to corrected release position
	1210	Anchor at release position
	1938	Move ship to work Moro Bay area overnight
6/29	0500	Head back to release area
	0720	Back at 5 nmi SF_6 release position, drift
	1110	Move back to release position
	1206	Rotate the ship into the wind
	1339	Move to new SF_6 release position
	1349	Anchor at release position
	1335	Pull anchor and proceed to remove buoys
	2000	Move to 20 nmi from shore and drift
6/30	0724	Move to 10 nmi from shore
	0845	Slow ahead into the wind at 10 nmi
	1042	Move to 1/2 nmi from shore
	1217	Slow ahead into the wind at 1/2 nmi

	1352	Move back to 1/2 nmi from shore
	1430	Slow ahead into the wind at 1/2 mile
	1619	Return to 1/2 nmi from shore
	1650	Slow ahead into the wind at 1/2 nmi
	1830	Move to 10 nmi from shore
	1938	Slow ahead into the wind at 10 nmi
	2045	Move ship to 18 nmi from shore
	2200	Slow ahead into the wind at 18 nmi
	2300	Move ship to 3 nmi from shore and drift overnight
7/1	0518	Slow ahead into the wind at 3 nmi
	0551	Move to 1/2 nmi from shore
	0631	Stop at 1/2 nmi
	0758	Hold ship into the wind at 3 nmi
	0840	Move to 5 nmi from shore
	0850	Slow ahead into the wind at 5 nmi
	1027	Move to 10 nmi from shore
	1055	Slow ahead into the wind at 10 nmi
	1140	Move to 20 nmi from shore
	1243	Slow ahead into the wind at 20 nmi
	1454	End of operation, leave for Monterey

Table 10a. One-half hour average relative wind directions for BLM-1.

date	time	WD(rel)
09/23	1642	357
09/23	1717	353
09/23	1749	354
09/24	1137	55
09/24	1205	209
09/24	1233	36
09/24	1301	18
09/24	1329	25
09/24	1357	17
09/24	1425	4
09/24	1453	358
09/24	1521	345
09/24	1549	339
09/24	1617	342
09/24	1645	342
09/24	1713	348
09/24	1741	336
09/24	1837	345
09/24	1905	353
09/27	0715	61
09/27	0743	64
09/27	0859	282
09/27	0945	276
09/27	1013	283
09/27	1041	281
09/27	1138	23
09/27	1206	21
09/27	1234	17
09/27	1302	11
09/27	1330	3
09/27	1358	1
09/27	1426	356
09/27	1454	355
09/27	1522	351
09/27	1550	351
09/27	1618	351
09/27	1646	347
09/27	1714	342
09/27	1742	342
09/27	1810	344
09/27	1838	340
09/27	1906	343
09/28	1307	25
09/28	1335	15
09/28	1408	14
09/28	1436	21
09/28	1504	11
09/28	1532	7
09/28	1600	352
09/28	1628	347
09/28	1740	342
09/28	1808	335
09/28	1836	332
09/28	1904	325
09/29	1217	32
09/29	1245	35
09/29	1319	45
09/29	1347	33
09/29	1415	32
09/29	1443	28
09/29	1511	21
09/29	1540	6
09/29	1626	343
09/29	1654	333
09/29	1722	327
09/29	1750	326
09/29	1818	331
09/29	1846	327
09/29	1902	322

Table 10b. One-half hour average relative wind directions for BLM-2

date	time	wD(rel)
01/06	1355	5
01/06	1425	3
01/06	1455	12
01/06	1542	342
01/06	1612	6
01/06	1642	350
01/06	1712	344
01/06	1742	341
01/06	1812	343
01/06	1842	354
01/06	1912	356
01/06	1942	77
01/07	1202	25
01/07	1232	67
01/07	1320	83
01/07	1350	81
01/07	1420	56
01/07	1450	200
01/09	1149	276
01/09	1221	352
01/09	1309	340
01/09	1339	348
01/09	1409	352
01/09	1439	353
01/09	1509	351
01/09	1539	348
01/09	1609	346
01/09	1639	347
01/09	1709	338
01/09	1739	338
01/09	1809	345
01/13	0852	79
01/13	0948	74
01/13	1049	243
01/13	1119	236
01/13	1239	345
01/13	1309	348
01/13	1339	346
01/13	1409	350
01/13	1439	346
01/13	1509	349
01/13	1521	356
01/13	1559	346
01/13	1629	338
01/13	1659	336
01/13	1729	349
01/14	1130	343
01/14	1200	271
01/14	1230	360
01/14	1300	316
01/14	1330	269
01/14	1400	282
01/14	1430	283
01/14	1500	347
01/15	1441	11
01/15	1500	19
01/15	1552	55
01/15	1622	49
01/15	1652	29
01/15	1722	46
01/16	0938	346
01/16	1008	335
01/16	1050	354
01/16	1120	10
01/16	1150	13
01/16	1220	16
01/16	1250	9
01/16	1320	360
01/16	1350	1
01/16	1420	342
01/16	1450	333
01/16	1520	346
01/16	1550	345
01/16	1620	346
01/16	1650	348
01/16	1720	343
01/16	1750	342
01/16	1820	356
01/16	1850	352

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date	time	WD(rel)
01/16	1920	0
01/16	1950	340
01/16	2020	355
01/16	2050	263
01/16	2120	351
01/16	2150	14
01/16	2220	8
01/16	2250	13

date	time	WD(rel)

Table 10c. One-half hour average relative wind directions for BLM-3.

date time	WD(rel)
12/08 1109	70
12/08 1119	70
12/08 1129	68
12/08 1139	22
12/08 1149	24
12/08 1159	63
12/08 1209	72
12/08 1219	40
12/08 1252	343
12/08 1352	13
12/08 1422	10
12/08 1452	17
12/08 1522	10
12/08 1552	344
12/08 1622	24
12/08 1652	344
12/08 1722	10
12/08 1752	303
12/08 1822	264
12/08 1852	279
12/08 1922	315
12/08 1952	338
12/08 2022	350
12/08 2052	334
12/08 2122	295
12/08 2152	354
12/08 2222	44
12/08 2252	60
12/08 2322	22
12/08 2352	20
12/09 0022	50
12/09 0052	48
12/09 0122	311
12/09 0152	163
12/09 0222	266
12/09 0252	339
12/09 0322	283
12/09 0352	292
12/09 0422	290

date time	WD(rel)
12/09 0452	313
12/09 0522	332
12/09 0552	342
12/09 0622	342
12/09 0652	17
12/09 0722	345
12/09 0752	331
12/09 0822	354
12/09 0852	7
12/09 0922	8
12/09 0952	311
12/09 1022	347
12/09 1052	7
12/09 1122	352
12/09 1152	355
12/09 1222	359
12/09 1252	336
12/09 1322	333
12/09 1352	327
12/09 1422	319
12/09 1452	297
12/09 1522	236
12/09 1552	225
12/09 1622	260
12/09 1652	261
12/09 1722	281
12/09 1752	327
12/09 1822	336
12/09 1852	319
12/09 1922	316
12/09 1952	290
12/09 2022	322
12/09 2052	25
12/09 2122	35
12/09 2152	277
12/09 2222	173
12/09 2252	227
12/09 2322	233
12/09 2352	166
12/10 0022	188

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date	time	WD(rel)	date	time	WD(rel)
12/10	0052	224	12/11	0100	40
12/10	0122	247	12/11	0130	31
12/10	0152	216	12/11	0200	29
12/10	0222	227	12/11	0230	1
12/10	0252	199	12/11	0300	7
12/10	0322	156	12/11	0330	353
12/10	0352	172	12/11	0400	333
12/10	0422	155	12/11	0430	77
12/10	0452	231	12/11	0500	72
12/10	0522	73	12/11	0530	40
12/10	0552	70	12/11	0600	19
12/10	0622	61	12/11	0630	23
12/10	0652	58	12/11	0700	18
12/10	0722	48	12/11	0730	27
12/10	0752	41	12/11	0800	61
12/10	0822	42	12/11	0330	333
12/10	0852	253	12/11	0900	112
12/10	1022	249	12/11	0930	221
12/10	1052	235	12/11	1000	130
12/10	1122	52	12/11	1030	215
12/10	1152	106	12/11	1100	261
12/10	1222	184	12/11	1130	342
12/10	1252	178	12/11	1200	357
12/10	1352	216	12/11	1300	348
12/10	1422	169	12/11	1330	356
12/10	1452	107	12/11	1400	359
12/10	1522	123	12/11	1430	358
12/10	1552	132	12/11	1500	0
12/10	1622	246	12/11	1530	357
12/10	1857	49	12/11	1600	355
12/10	1946	173	12/11	1630	356
12/10	2016	305	12/11	1657	1
12/10	2046	340	12/11	1724	357
12/10	2130	327	12/11	1751	2
12/10	2200	302	12/11	1818	1
12/10	2230	322	12/11	1845	3
12/10	2300	308	12/11	1912	10
12/10	2330	9	12/11	1939	334
12/11	0000	60	12/11	2006	135
12/11	0030	6	12/13	1030	290

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date	time	WD(rel)
12/13	1100	211
12/13	1230	336
12/13	1300	345
12/13	1330	346
12/13	1400	341
12/13	1430	335
12/13	1500	337
12/13	1530	342
12/13	1600	341
12/13	1630	338
12/13	1700	339
12/13	1730	339
12/13	1800	339
12/13	1830	350
12/13	1900	349
12/13	1930	351
12/13	2000	21
12/13	2030	275
12/13	2103	160
12/13	2130	148
12/13	2200	155
12/13	2230	160
12/13	2300	149
12/13	2330	215
12/14	0000	205
12/14	0029	217
12/14	0058	206
12/14	0127	133
12/14	0156	90
12/14	0225	353
12/14	0254	13
12/14	0323	30
12/14	0352	23
12/14	0421	23
12/14	0450	57
12/14	0519	162
12/14	0548	167
12/14	0617	137
12/14	0646	338
12/14	0723	98

date	time	WD(rel)
12/14	0800	86
12/14	0830	79
12/14	0900	58
12/14	0930	29
12/14	1000	5
12/14	1100	349
12/14	1130	353
12/14	1200	352
12/14	1230	351
12/14	1300	349
12/14	1330	349
12/14	1400	343
12/14	1430	344
12/14	1500	344
12/14	1530	344
12/14	1559	349
12/14	1612	340
12/14	1625	345
12/14	1638	341
12/14	1651	344
12/14	1704	341
12/14	1717	350
12/14	1730	346
12/14	1743	351
12/14	1756	347
12/14	1809	346
12/14	1822	353
12/14	1335	352
12/14	1848	349
12/14	1901	337
12/14	1929	347
12/14	1958	349
12/14	2030	345
12/14	2100	344
12/14	2300	348
12/14	2330	348
12/15	0000	17
12/15	0030	90
12/15	0100	53
12/15	0130	13

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date time	WD(rel)	date time	WD(rel)
12/15 0200	327	12/16 0130	12
12/15 0230	318	12/16 0200	351
12/15 0300	315	12/16 0230	4
12/15 0330	296	12/16 0251	14
12/15 0400	279	12/16 0313	32
12/15 0430	208	12/16 0326	48
12/15 0500	3	12/16 0401	359
12/15 0530	27	12/16 0421	334
12/15 0600	6	12/16 0441	337
12/15 0630	29	12/16 0501	337
12/15 0700	100	12/16 0521	330
12/15 0730	215	12/16 0541	332
12/15 1007	334	12/16 0601	11
12/15 1028	20	12/16 0621	24
12/15 1048	41	12/16 0641	332
12/15 1148	349	12/16 0701	318
12/15 1208	15	12/16 0721	309
12/15 1228	23	12/16 0741	327
12/15 1248	4	12/16 0801	327
12/15 1308	355	12/16 0841	289
12/15 1328	5	12/16 0901	297
12/15 1348	49	12/16 0921	294
12/15 1408	36	12/16 0941	293
12/15 1428	46	12/16 1001	293
12/15 1448	37	12/16 1021	291
12/15 1530	341	12/16 1041	281
12/15 1600	352	12/16 1101	280
12/15 1630	351	12/16 1129	15
12/15 1700	347	12/16 1144	13
12/15 1730	350	12/16 1159	3
12/15 1800	355	12/16 1214	359
12/15 1830	331	12/16 1229	1
12/15 1900	323	12/16 1244	13
12/15 1930	344	12/16 1259	14
12/15 2000	359	12/16 1314	25
12/15 2300	274	12/16 1329	20
12/15 2330	273	12/16 1400	17
12/16 0000	279	12/16 1430	19
12/16 0030	291	12/16 1500	28
12/16 0100	337	12/16 1530	33

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date	time	WD(rel)
12/16	1600	35
12/16	1700	274
12/16	1730	270
12/16	1800	273
12/16	1830	275
12/16	1900	285
12/16	1930	278
12/16	2000	275
12/16	2030	282
12/17	0830	53
12/17	0900	173
12/17	0930	13
12/17	1000	23
12/17	1030	38
12/17	1100	355
12/17	1130	339
12/17	1200	344
12/17	1230	5
12/17	1300	17
12/17	1330	25
12/17	1400	44
12/17	1430	25
12/17	1500	28
12/17	1530	20
12/17	1600	342
12/17	1630	328
12/17	1700	331
12/17	1730	350
12/17	1800	14
12/17	1830	7
12/17	1900	352
12/17	1930	60
12/17	2000	247
12/17	2030	5
12/17	2100	86
12/17	2130	75
12/17	2200	76
12/17	2230	75
12/17	2300	73
12/17	2330	79

date	time	WD(rel)
12/18	0000	80
12/18	0030	81
12/18	0100	358
12/18	0130	6
12/18	0200	8
12/18	0230	4
12/18	0300	9
12/18	0330	227
12/18	0400	173
12/18	0430	177
12/18	0500	242
12/18	0530	172
12/18	0600	120
12/18	0630	343
12/18	0700	323

Table 10d. One-half hour average relative wind directions for BLM-4.

BLM-4 1982

date	time	WD(rel)
06/21	0000	314
06/21	0030	235
06/21	0100	247
06/21	0130	95
06/21	0200	96
06/21	0230	66
06/21	0300	90
06/21	0330	89
06/21	0400	87
06/21	0430	93
06/21	0500	11
06/21	0530	303
06/21	0600	308
06/21	0630	88
06/21	0700	93
06/21	0730	85
06/21	0800	74
06/21	0830	81
06/21	0935	337
06/21	1030	81
06/21	1100	18
06/21	1130	327
06/21	1200	266
06/21	1230	328
06/21	1300	25
06/21	1330	12
06/21	1400	2
06/21	1430	358
06/21	1500	354
06/21	1530	349
06/21	1600	336
06/21	1630	332
06/21	1700	327
06/21	1730	320
06/21	1800	318
06/21	1830	321
06/21	2030	316
06/21	2100	321
06/21	2130	325
06/21	2200	325
06/21	2230	329
06/21	2300	316
06/21	2330	296
06/22	0000	289
06/22	0030	299
06/22	0100	311
06/22	0130	301
06/22	0200	306
06/22	0230	321
06/22	0300	331
06/22	0330	313
06/22	0400	298
06/22	0430	297
06/22	0500	310
06/22	0530	304
06/22	0600	314
06/22	0630	315
06/22	0700	333
06/22	0800	7
06/22	0830	38
06/22	0900	18
06/22	0930	335
06/22	1000	6
06/22	1030	355
06/22	1100	336
06/22	1130	40
06/22	1200	71
06/22	1230	75
06/22	1300	71
06/22	1400	7
06/22	1430	4
06/22	1500	358
06/22	1530	349
06/22	1600	340
06/22	1630	337
06/22	1700	330
06/22	1730	329
06/22	1800	318
06/22	1830	321

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date	time	WD(rel)
06/22	1900	304
06/22	1930	317
06/22	2000	303
06/22	2030	296
06/22	2100	287
06/22	2130	291
06/22	2200	297
06/22	2230	288
06/22	2300	298
06/22	2330	265
06/23	0000	324
06/23	0030	358
06/23	0100	351
06/23	0130	357
06/23	0200	6
06/23	0230	358
06/23	0300	354
06/23	0330	336
06/23	0400	339
06/23	0430	343
06/23	0500	358
06/23	0530	39
06/23	0600	306
06/23	0630	316
06/23	0700	342
06/23	0830	315
06/23	0900	17
06/23	1020	356
06/23	1030	357
06/23	1204	357
06/23	1234	1
06/23	1444	15
06/23	1524	349
06/23	2034	358
06/23	2140	42
06/23	2210	14
06/23	2337	16
06/24	0007	13
06/24	0158	344
06/24	0228	357
06/24	0401	354
06/24	0431	2
06/24	0526	5
06/24	0648	357
06/24	0748	276
06/24	0830	64
06/24	0858	15
06/24	0927	68
06/24	1000	79
06/24	1030	102
06/24	1130	99
06/24	1230	338
06/24	1300	339
06/24	1330	315
06/24	1400	319
06/24	1430	324
06/24	1500	323
06/24	1530	321
06/24	1600	316
06/24	1630	317
06/24	1700	319
06/24	1730	316
06/24	1800	322
06/24	1830	328
06/24	1900	342
06/24	1930	339
06/24	2000	340
06/24	2030	342
06/24	2100	344
06/24	2130	347
06/24	2200	344
06/24	2230	331
06/24	2300	336
06/24	2330	351
06/25	0000	343
06/25	0030	329
06/25	0100	18
06/25	0130	63
06/25	0200	64
06/25	0230	250

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date	time	WD(rel)
06/25	0300	259
06/25	0330	307
06/25	0400	309
06/25	0430	314
06/25	0500	291
06/25	0530	272
06/25	0600	285
06/25	0630	318
06/25	0700	337
06/25	0730	351
06/25	0800	0
06/25	0830	17
06/25	0900	43
06/25	0930	22
06/25	1000	353
06/25	1030	357
06/25	1100	329
06/25	1130	326
06/25	1200	321
06/25	1230	315
06/25	1300	315
06/25	1330	317
06/25	1400	319
06/25	1430	320
06/25	1500	324
06/25	1530	322
06/25	1600	322
06/25	1630	320
06/25	1700	324
06/25	1730	327
06/25	1800	325
06/25	1830	325
06/25	1913	274
06/25	1955	343
06/25	2025	356
06/25	2055	353
06/27	1130	350
06/27	1200	348
06/27	1230	346
06/27	1300	345
06/27	1330	345
06/27	1400	346
06/27	1430	342
06/27	1500	340
06/27	1530	340
06/27	1600	339
06/27	1630	340
06/27	1700	337
06/27	1730	330
06/27	1916	331
06/27	2000	331
06/27	2030	331
06/27	2100	329
06/27	2130	333
06/27	2200	337
06/27	2230	340
06/27	2300	343
06/27	2326	338
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06/28	0200	11
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06/28	0330	52
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06/28	0500	257
06/28	0526	94
06/28	0600	175
06/28	0630	50
06/28	0700	11
06/28	0730	23
06/28	0800	25
06/28	0830	38
06/28	0900	17
06/28	0930	33
06/28	1000	2
06/28	1030	339

BLM-4 1982

date	time	WD(rel)
06/28	1100	331
06/28	1130	268
06/28	1300	323
06/28	1330	315
06/28	1400	320
06/28	1430	324
06/28	1500	320
06/28	1530	322
06/28	1600	325
06/28	1630	326
06/28	1700	327
06/28	1730	323
06/28	1800	321
06/28	1830	326
06/28	1900	327
06/29	0800	33
06/29	0830	42
06/29	0900	34
06/29	0930	52
06/29	1000	32
06/29	1030	53
06/29	1200	246
06/29	1230	325
06/29	1300	9
06/29	1330	260
06/29	1400	287
06/29	1430	300
06/29	1500	293
06/29	1530	300
06/29	1600	309
06/29	1630	327
06/29	1700	333
06/29	1730	14
06/29	1800	121
06/30	0652	352
06/30	0722	349
06/30	0926	359
06/30	1008	7
06/30	1038	3
06/30	1243	359

date	time	WD(rel)
06/30	1318	4
06/30	1348	356
06/30	1504	356
06/30	1543	2
06/30	1613	5
06/30	1725	350
06/30	1755	1
06/30	1825	3
06/30	2012	6
06/30	2042	1
06/30	2233	350
06/30	2303	10
07/01	0545	2
07/01	0833	351
07/01	0923	12
07/01	0953	9
07/01	1023	3
07/01	1131	7
07/01	1312	8
07/01	1342	5
07/01	1452	8
07/01	1522	340

APPENDIX A CALIBRATION PROCEEDURES

The results of laboratory calibrations of meteorological sensors that are used for field measurements can be misleading. For example, platinum resistance temperature sensors can be calibrated to $\pm$ 0.001°C, or with the leads used in the field calibrated to $\pm$ 0.01°C. Such a calibration is repeatable and represents the basic capabilities of the sensors and of the calibration facility. When these sensors are used in the field, with the required aspiration, recognizing that at times the aspirator will be shaded and at times in direct sunlight, measurement accuracy of $\pm$ 0.1°C is doing well.

Measuring wind speed produces another problem because of ship influence. No matter how accurately the cups are calibrated, using them on, or near, the RV/Acania reduces the accuracy to $\pm$ 0.5 m/sec. The results on larger ships are worse. The attainable accuracies in the field are sufficient for this work, especially when one considers the use of the results. Meteorological parameters measured at a point are being used to predict plume behavior over a spatially large region, near the coast, where spatial inhomogeneities are great. Great measurement accuracy is not required but, of course, the sensors should be moderately well calibrated so that systematic errors are not introduced. The following are the calibration procedures used to insure the validity of the meteorological data obtained aboard the R/V ACANIA.

Air, Sea, and Dewpoint Temperatures:

All temperature sensors are calibrated together in an insulated chamber. The air and sea temperature probes and a HP2801A quartz thermometer standard are mounted in an aluminum cylinder which effectively eliminates the temperature differences between these sensors. The differences are less than 0.01°C. The dewpoint thermometers cannot be mounted in the same block because they are permanently mounted to the mirror in the sensor. In the calibration chamber, the temperature difference between these sensors and the cylinder can be as much as 0.1°C.

The temperature measured by a sensor is found from its resistance by inverting the standard equation

$$R = R_o(1 + \alpha T),$$

where T is in °C, R_o the resistance at the ice point, and α is the temperature coefficient. For the air temperature sensors $\alpha = 0.003921$; for the dewpoint sensors $\alpha = 0.003895$. The calibration procedure is to determine the values of R_o for each sensor from the known calibration chamber temperature and the measured resistances. This is done at several temperatures to eliminate errors which can be introduced by temperature inhomogeneities in the chamber. Calibration accuracy is ± 0.01°C for the air and sea surface temperature sensors and ± 0.1°C for the dew point sensors.

Wind Speed:

Calibrations are performed in one of the NPS wind tunnels using a calibrated hot wire sensor as the standard. We do not attempt to perform the calibration to an accuracy any greater than

± 0.5 m/sec. We have not found any errors or differences between sensors to be greater than ±0.5 m/sec. When the cups are used in the field, salt loading of the bearings can cause it to be outside of this range, but this is easily detected long before the calibration is affected by observing the decay rate of the shaft rotation when no cup is in place. Affected sensors are never used.

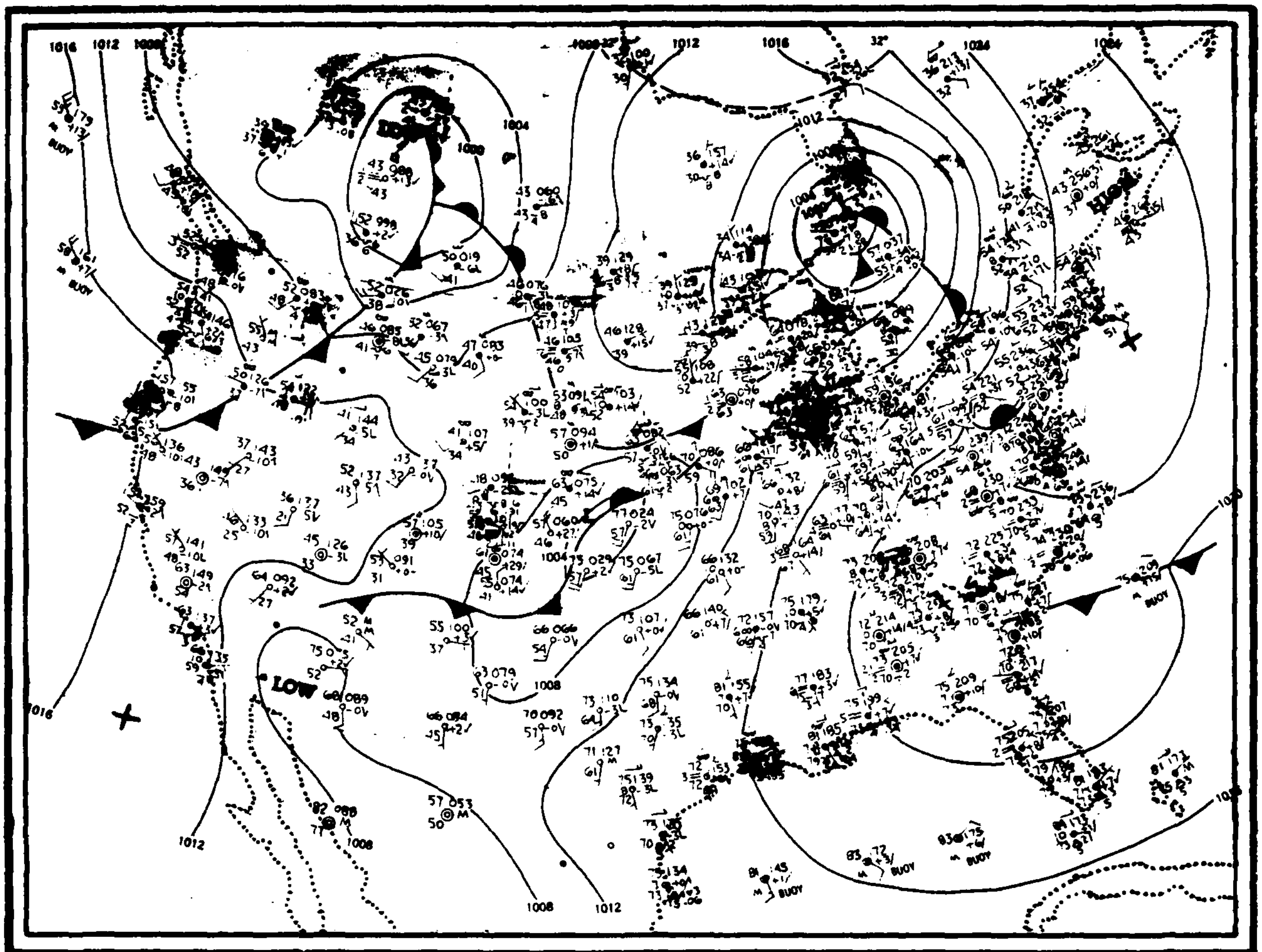
Inversion Height:

The acoustic sounder records are calibrated with radiosondes every 12 hours during most shipboard operations. It is misleading, however, to consider this to be a good calibration of the sounder, it is only semi-quantitative. The acoustic return which the sounder senses comes from reflection from small scale temperature inhomogeneities. The inhomogeneities are caused by a combination of the temperature gradient and mechanical turbulence at the inversion. The return, thus, is not necessarily from the height where the temperature break occurs, which is the inversion height deterined from the radiosonde. Normally, radiosonde and sounder determinations of boundary layer depth agree to within 40m.

Wind Speed Turbulence:

No laboratory calibration of the hot film sensors is made. The films are calibrated, in-situ, by comparing their output to that of the immediatly adjacent cup. Film calibration parameters are derived by comparing the one-half hour average mean and variance of the wind speed as determined by the two sensors.

APPENDIX B SYNOPTIC CHARTS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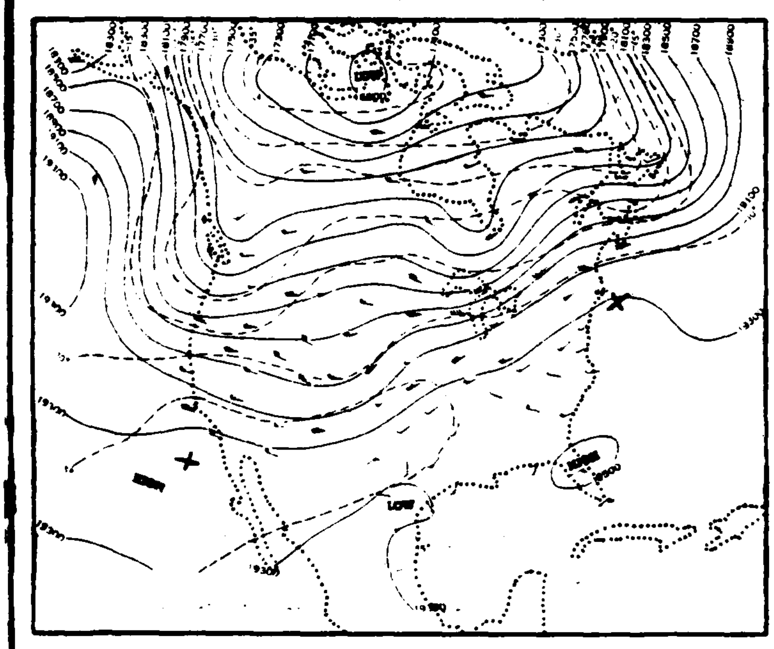

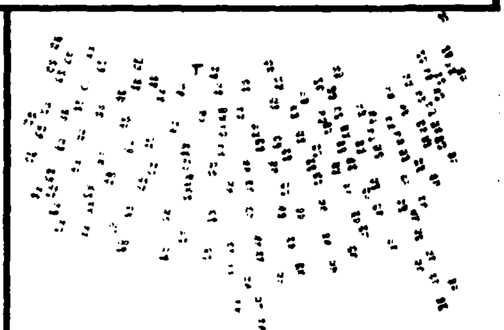

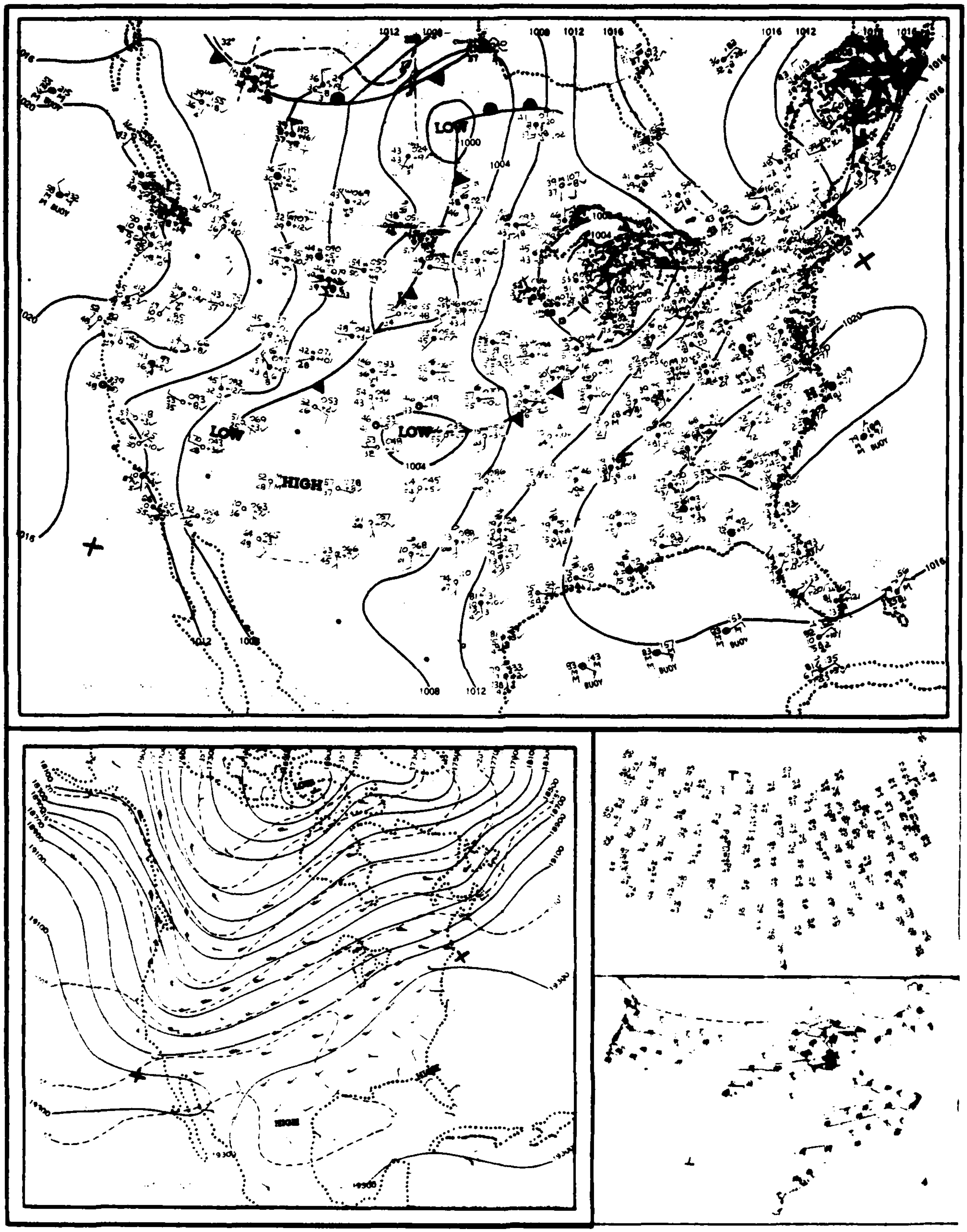
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HIGH
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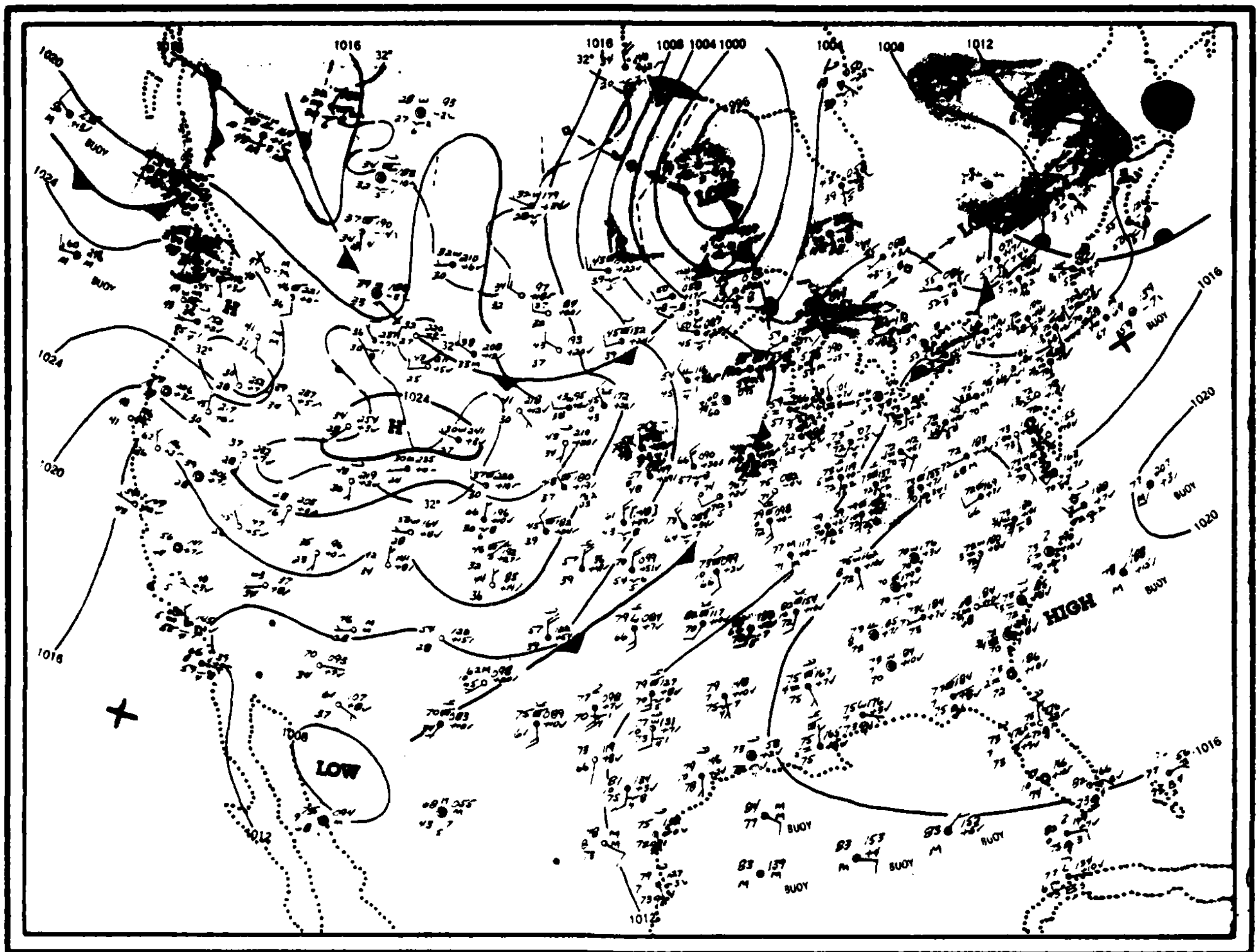
1016
1008 1004 1000
1012
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LOW
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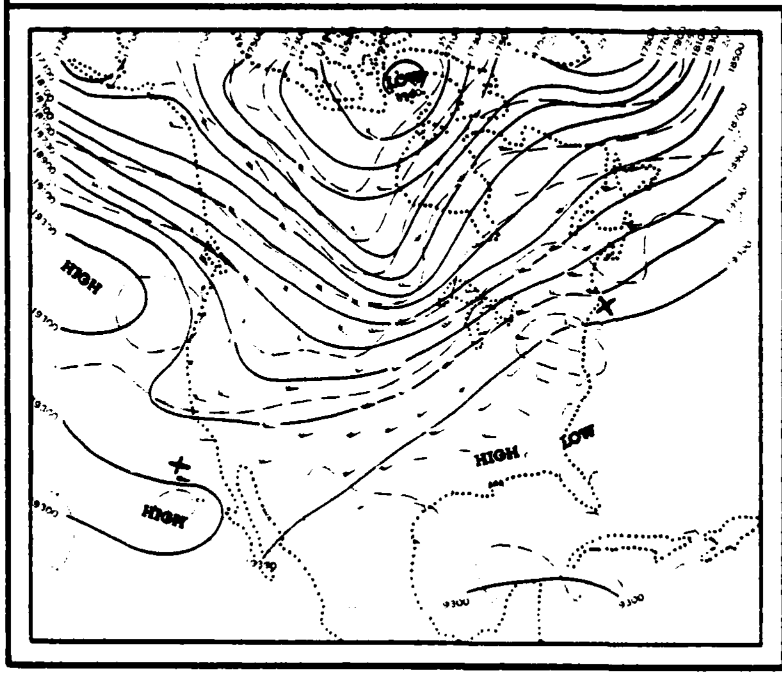
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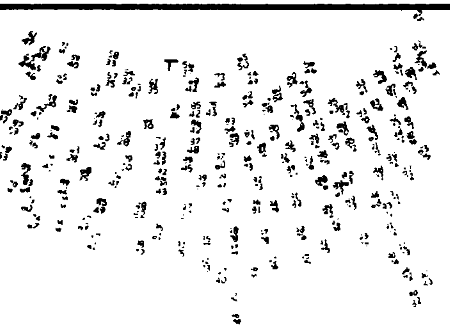

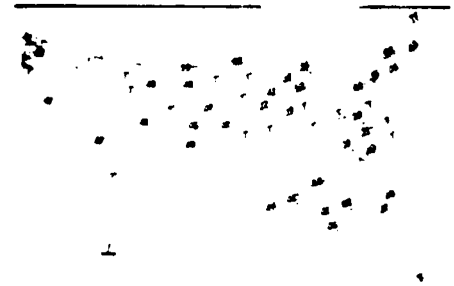

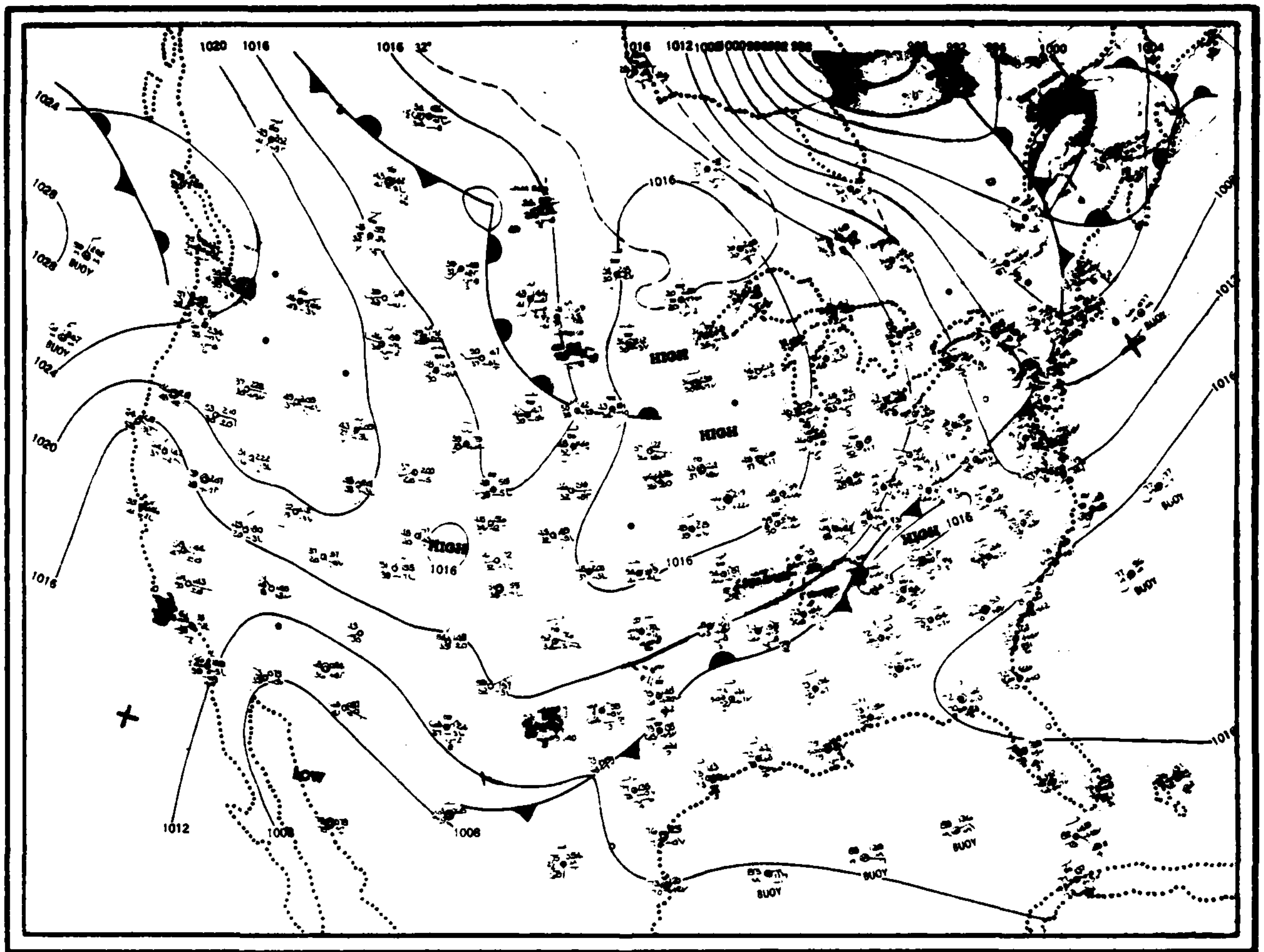
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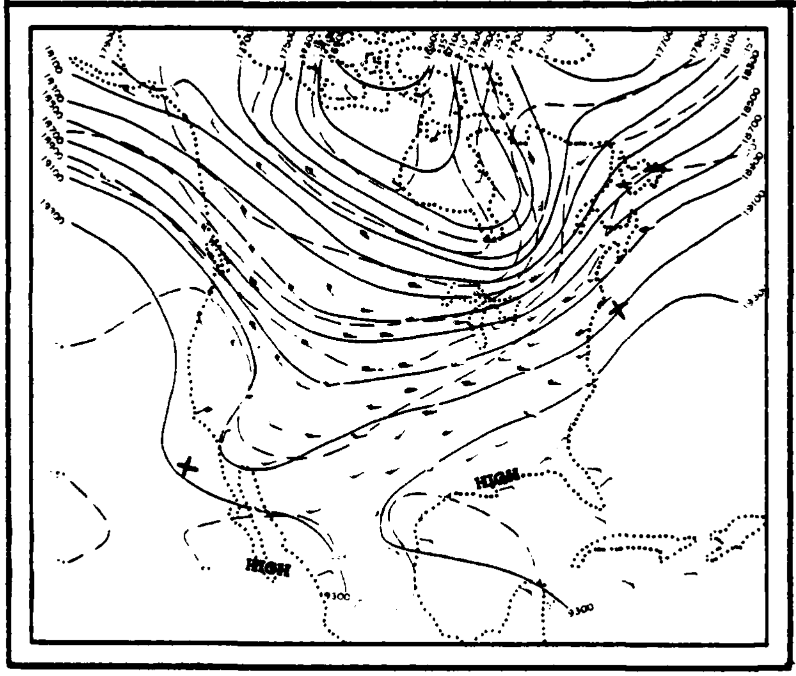
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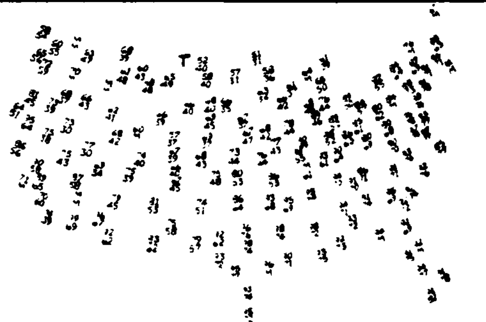

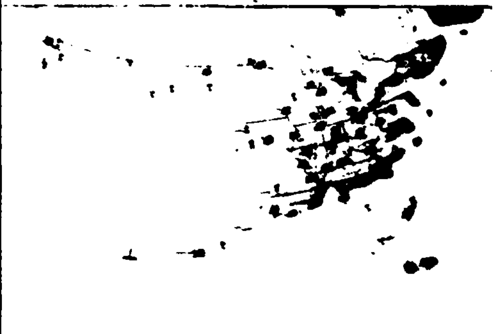

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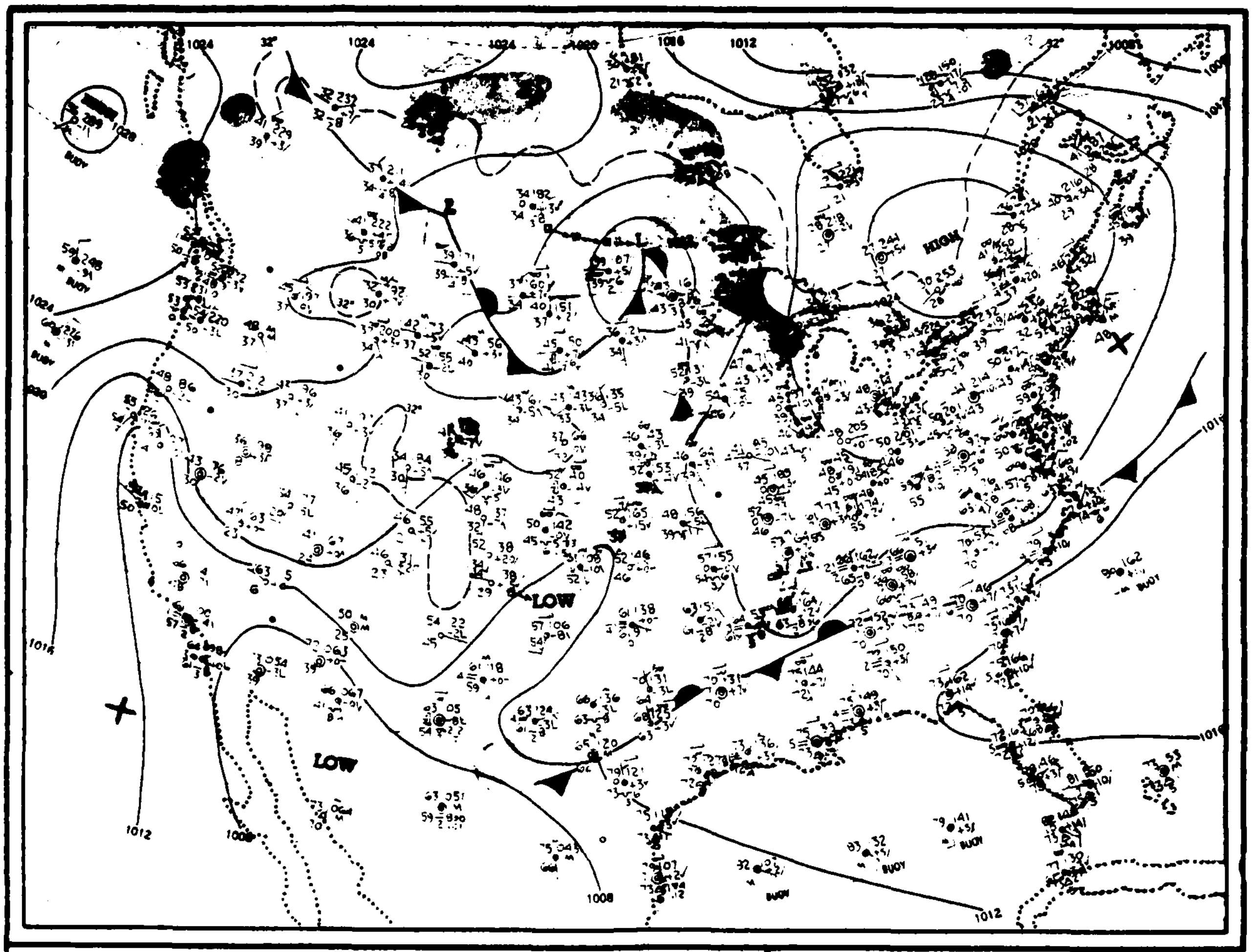

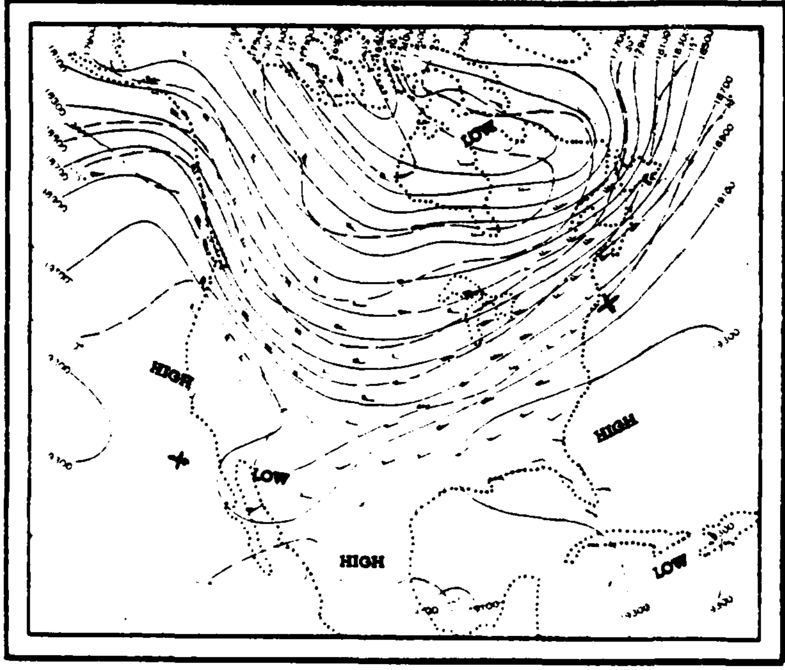

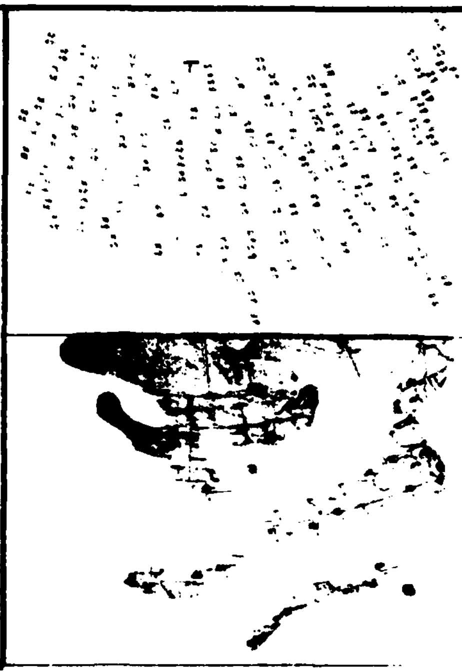

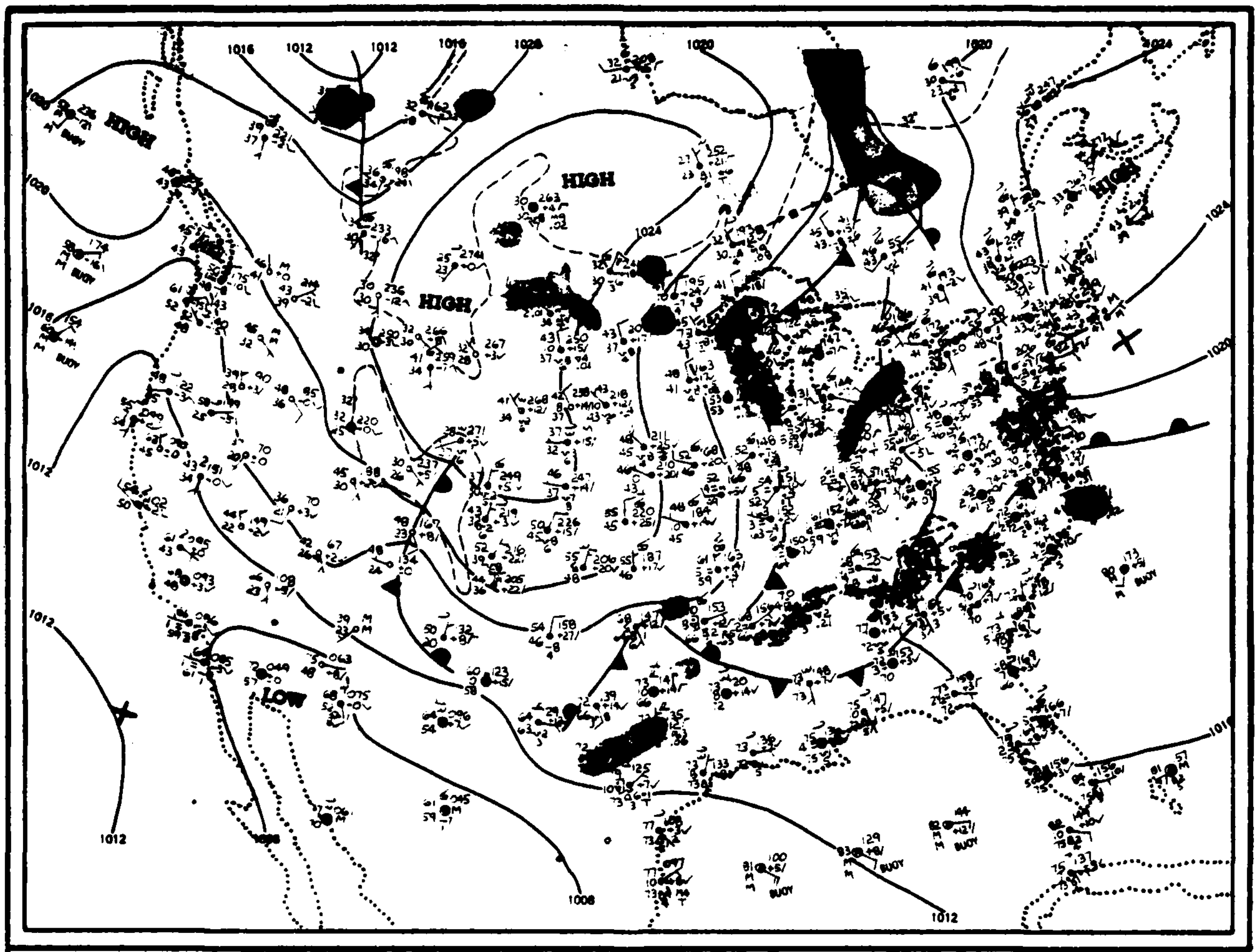
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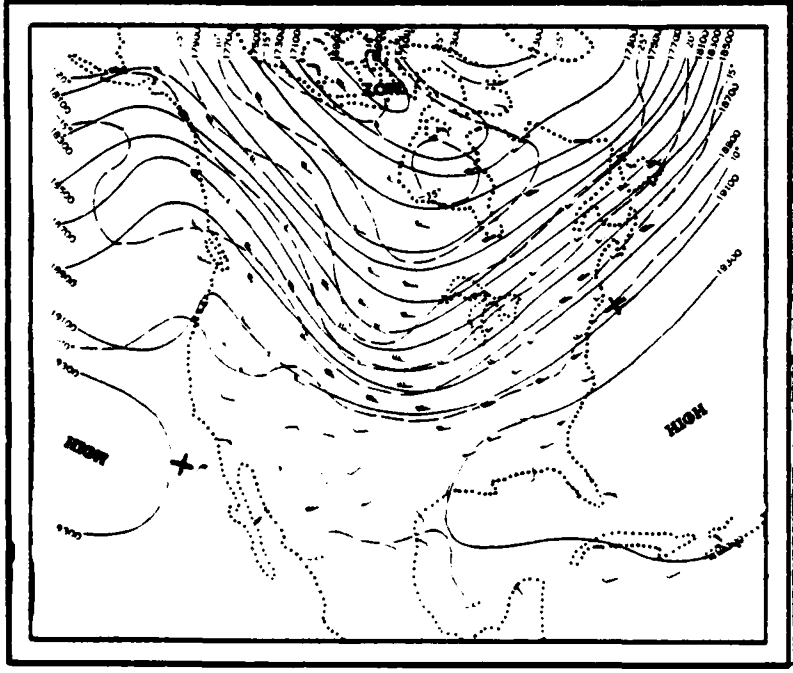
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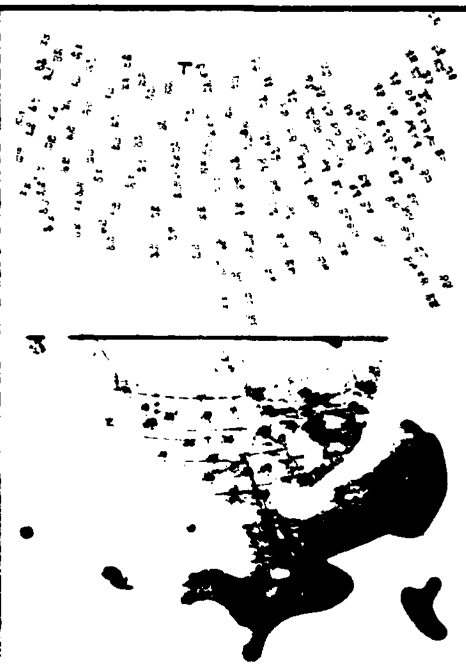

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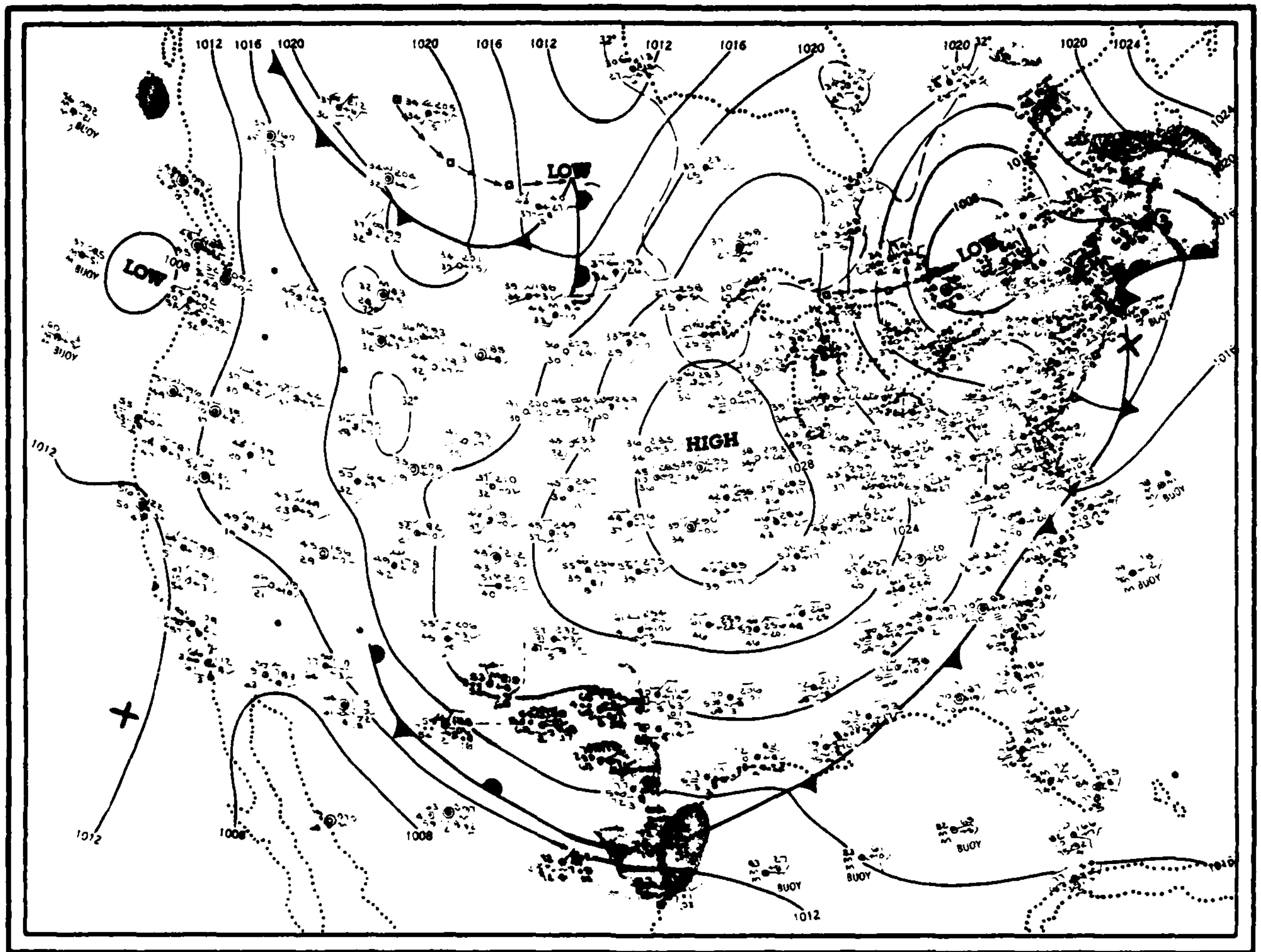

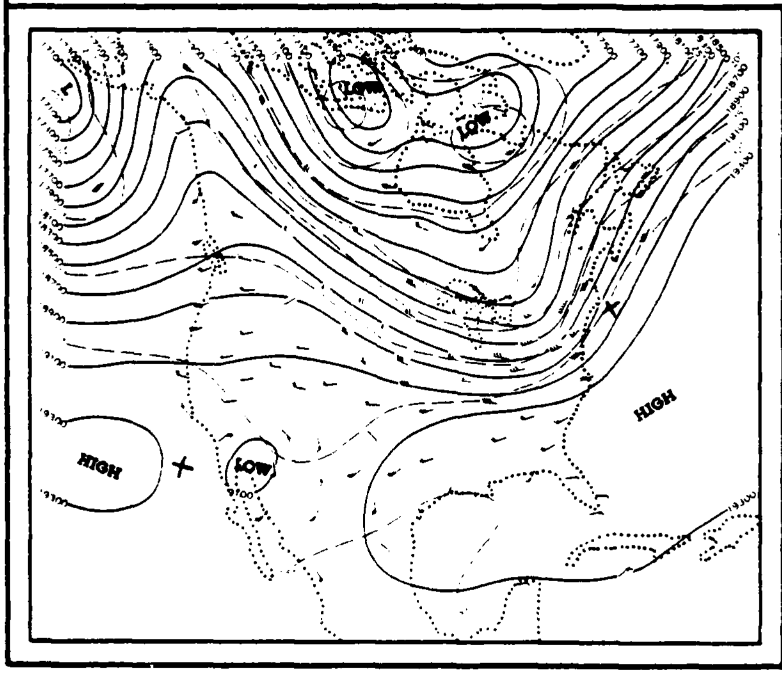

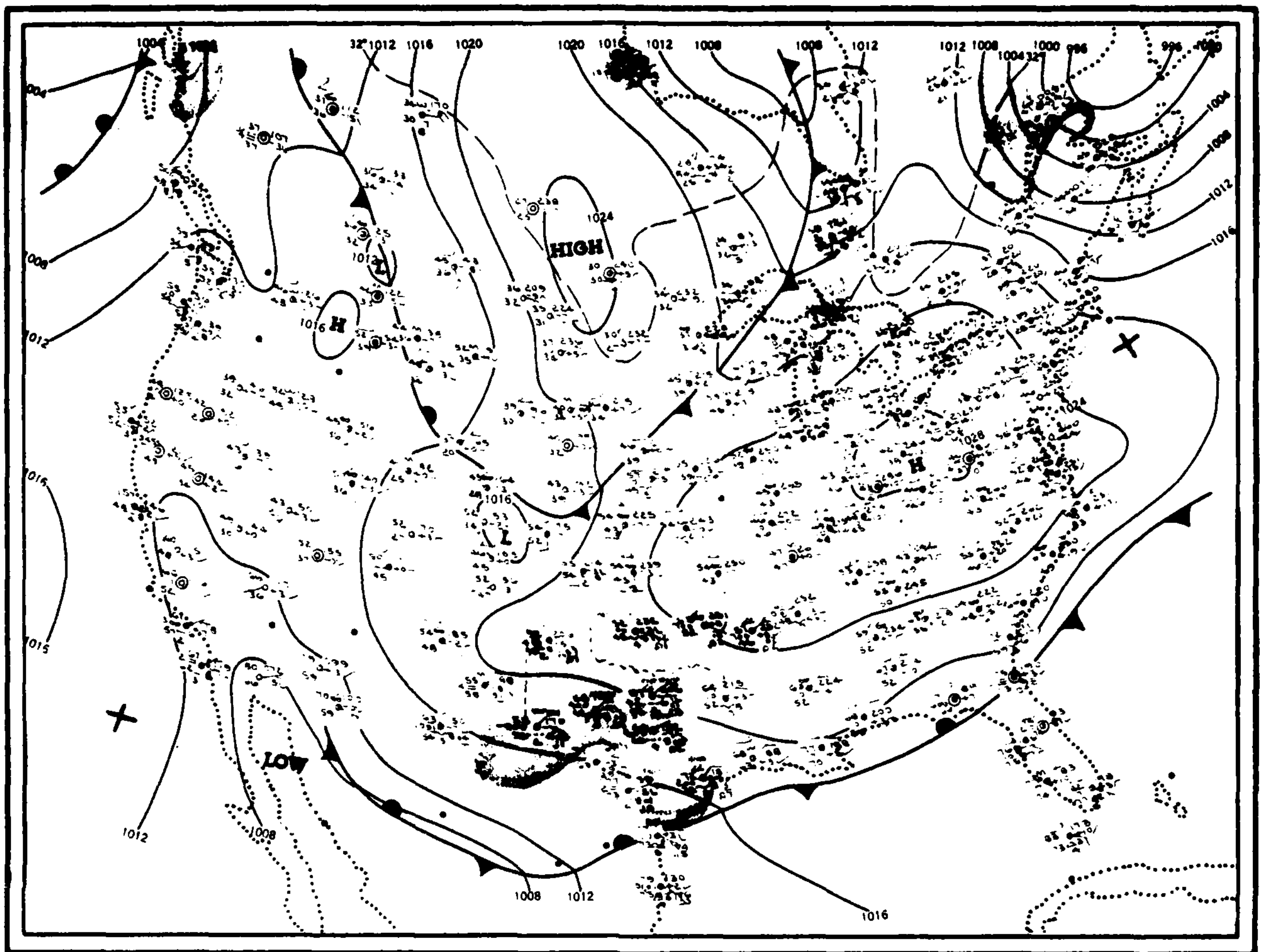
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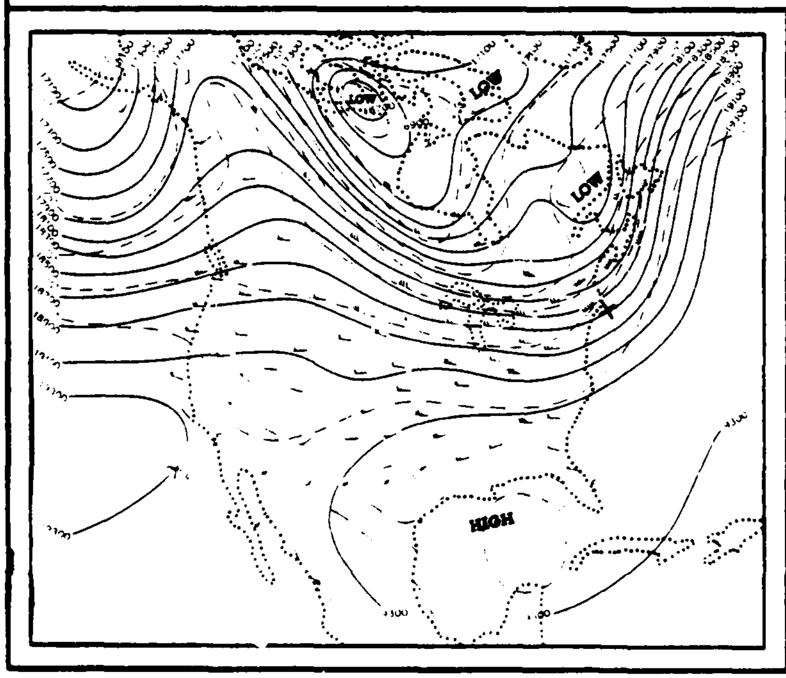
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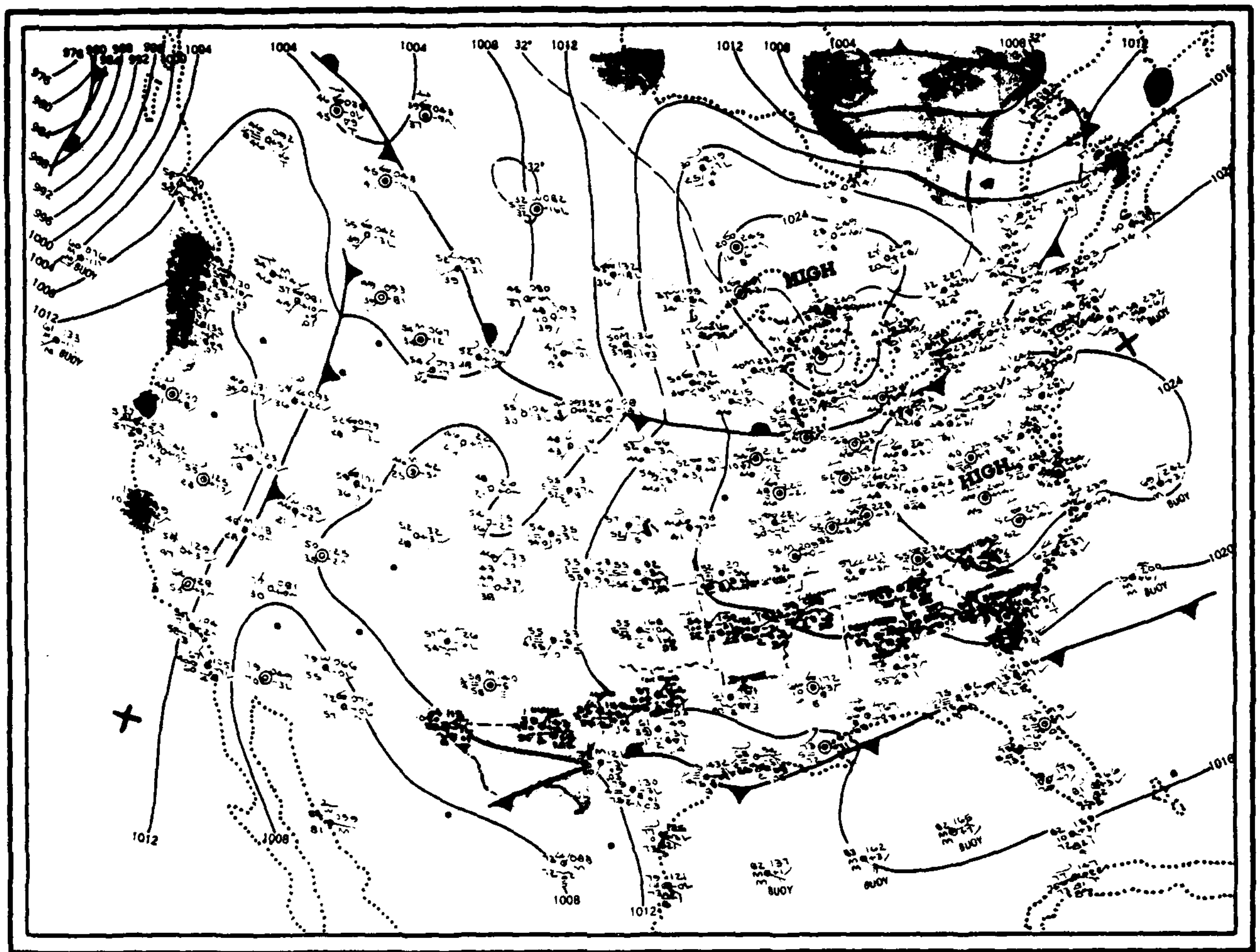

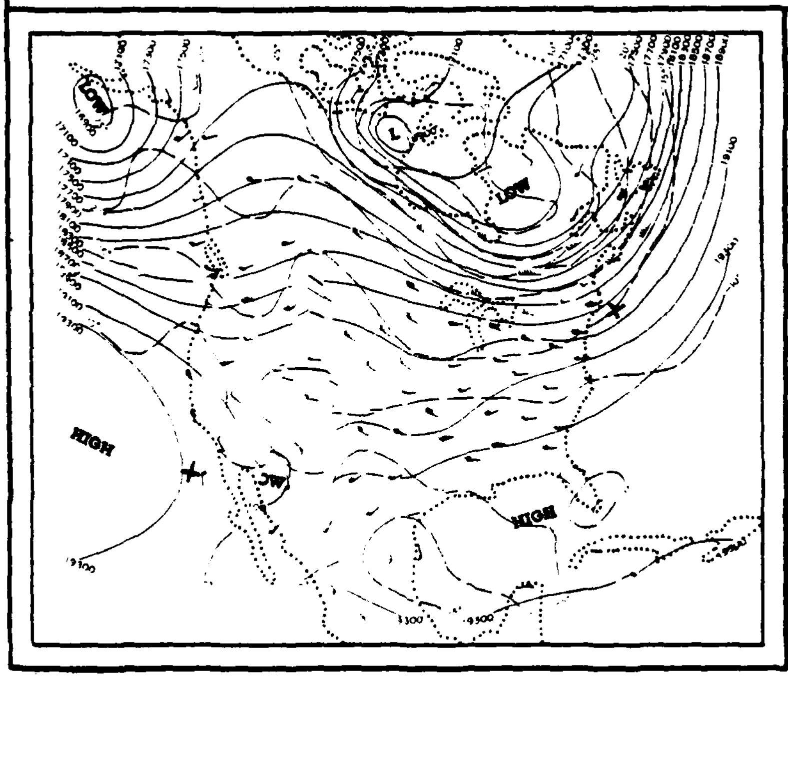

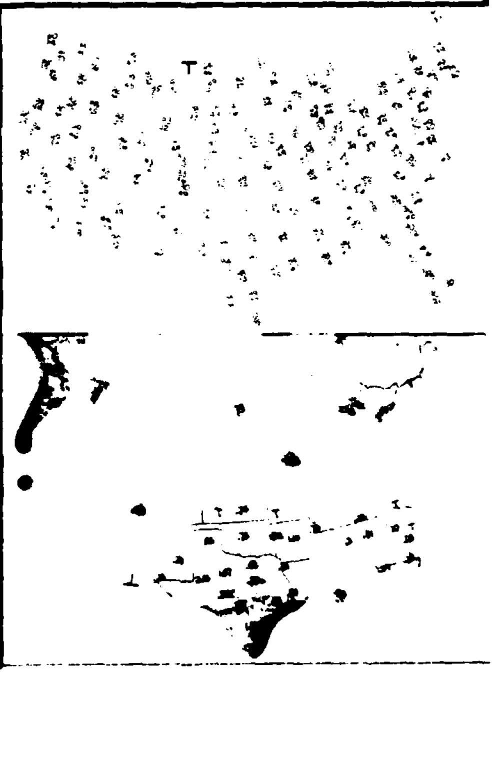

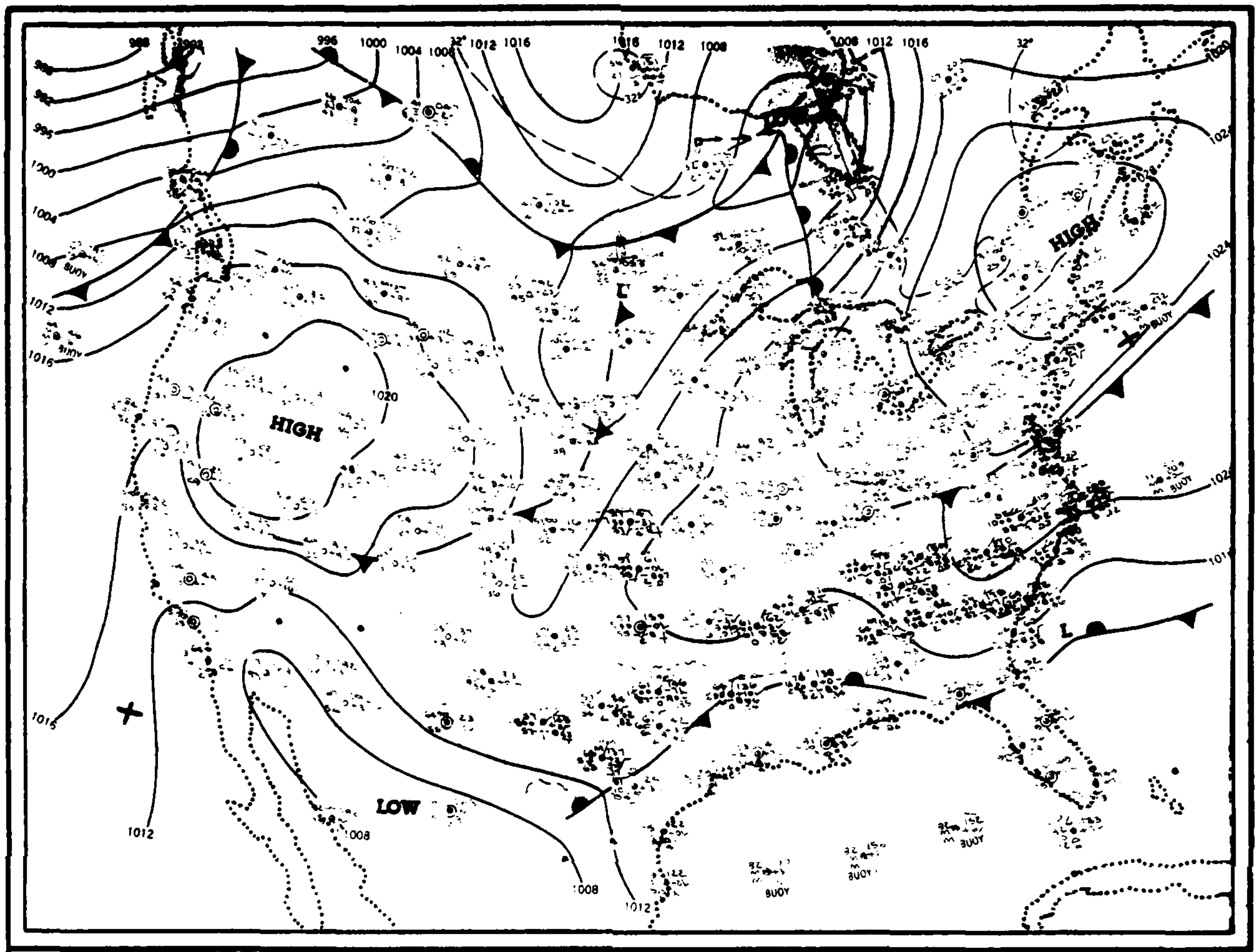
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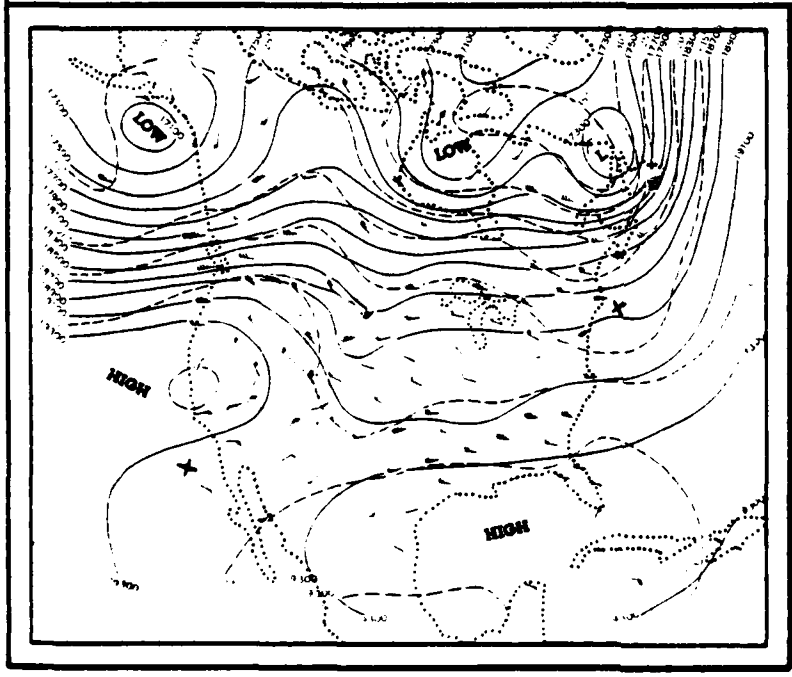
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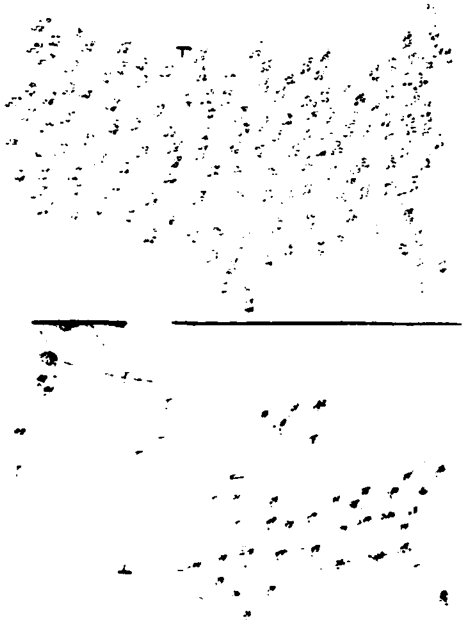

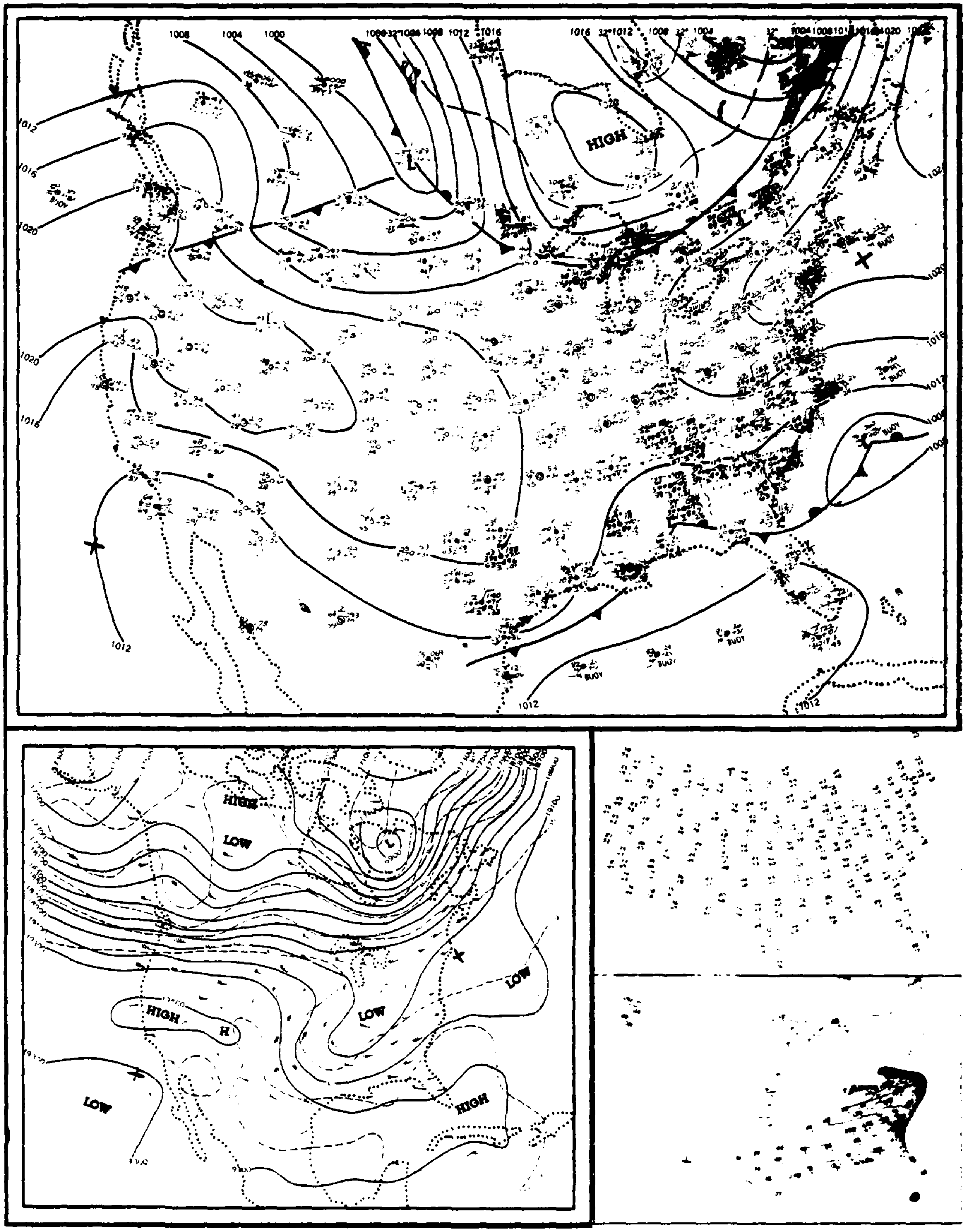
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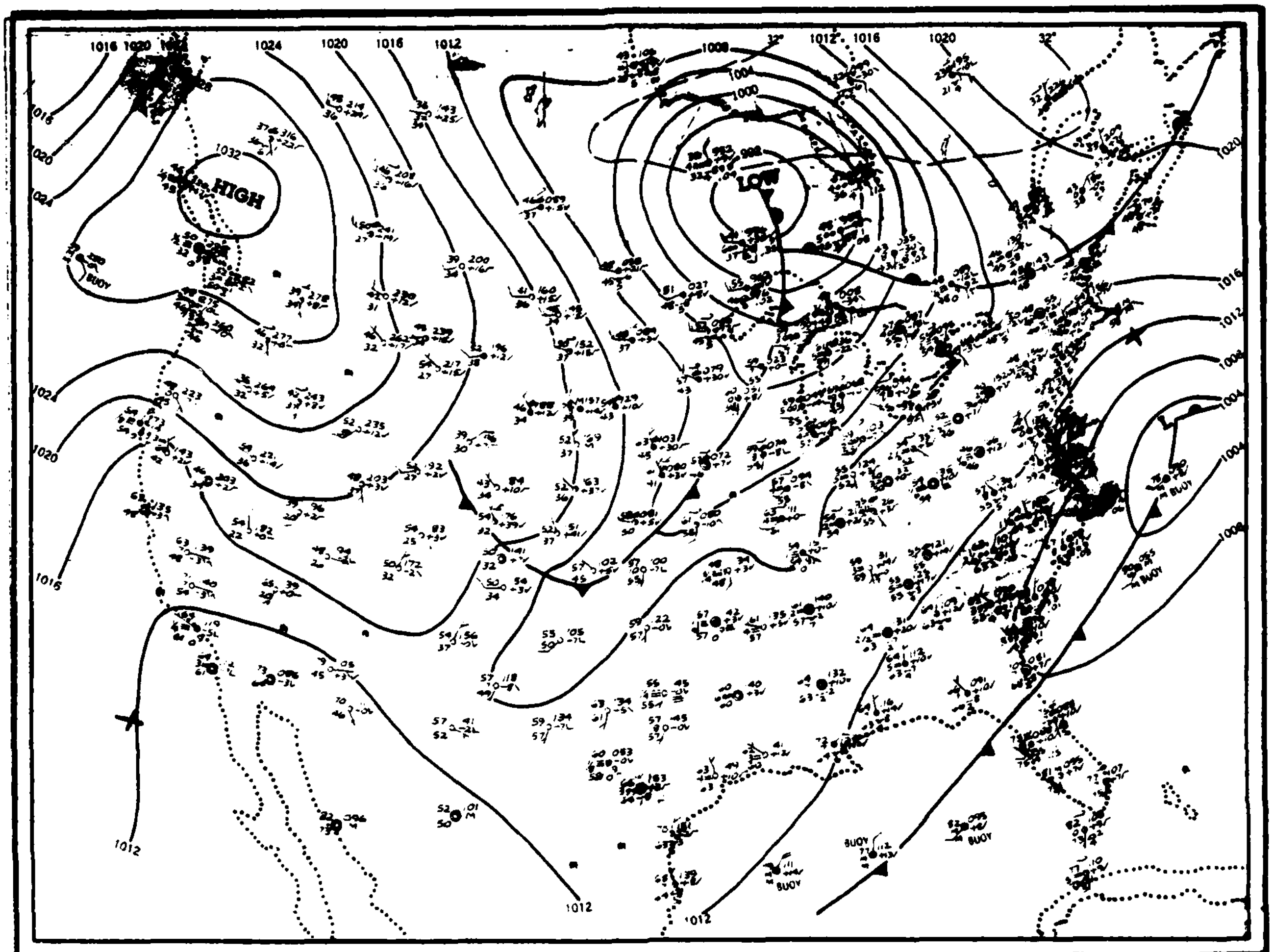

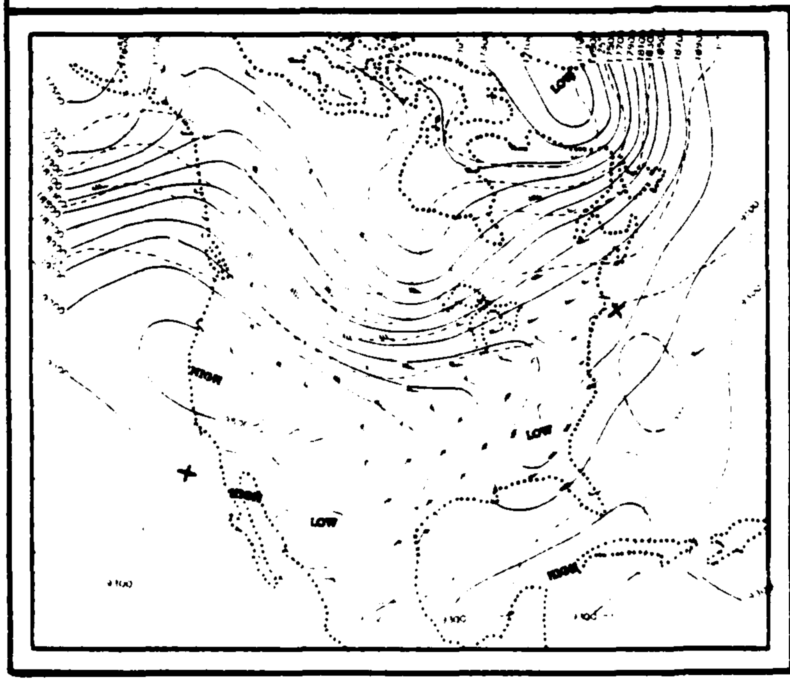

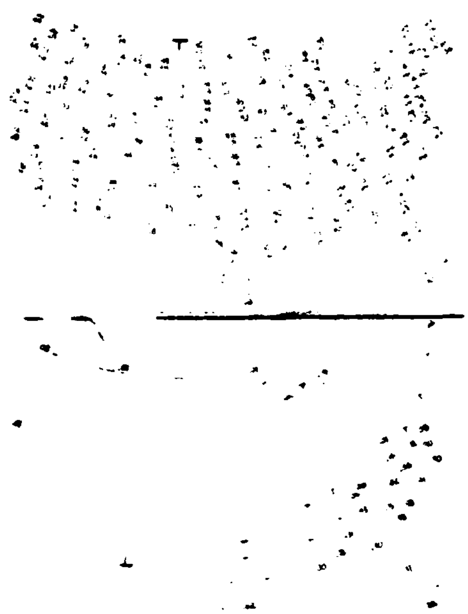

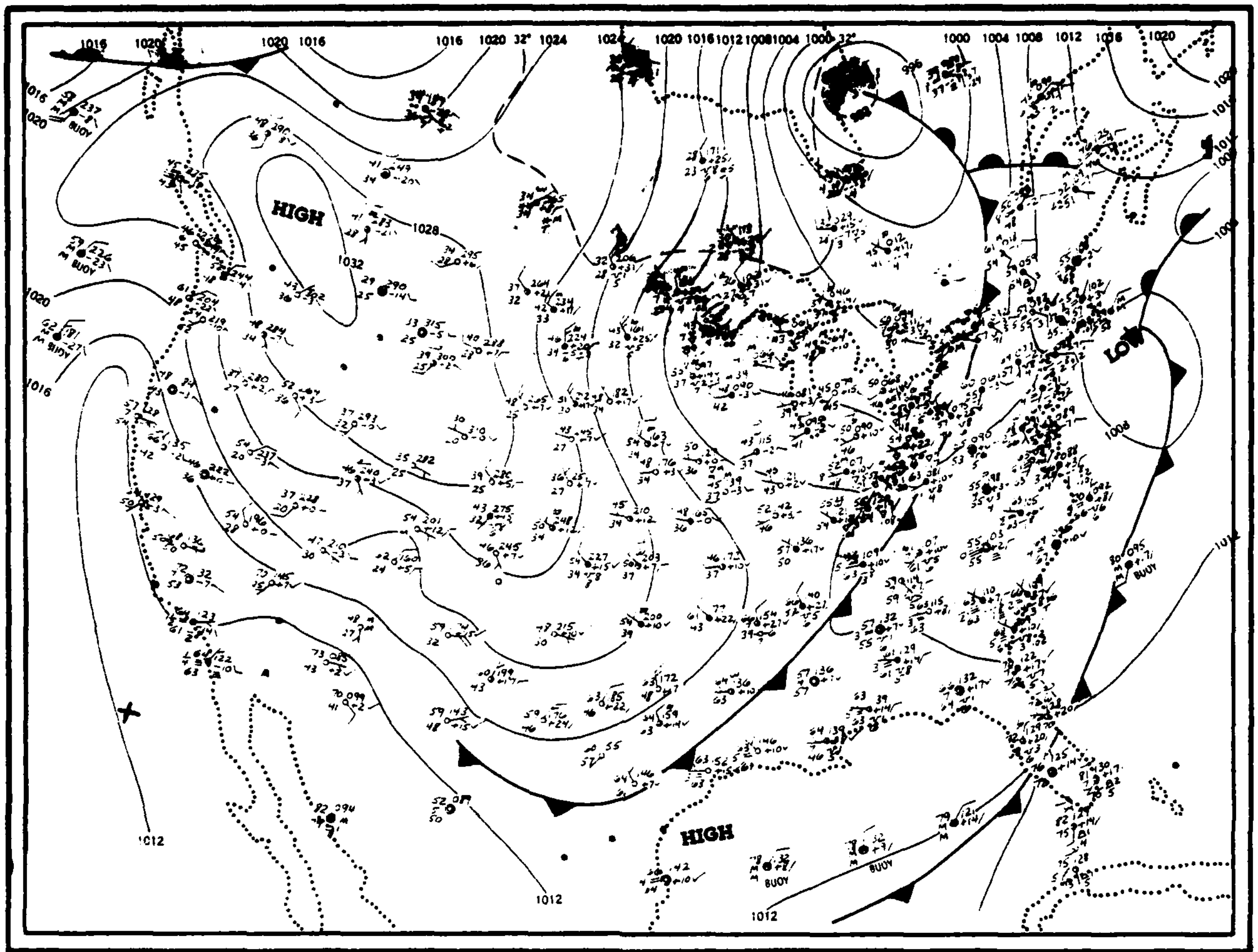
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1012
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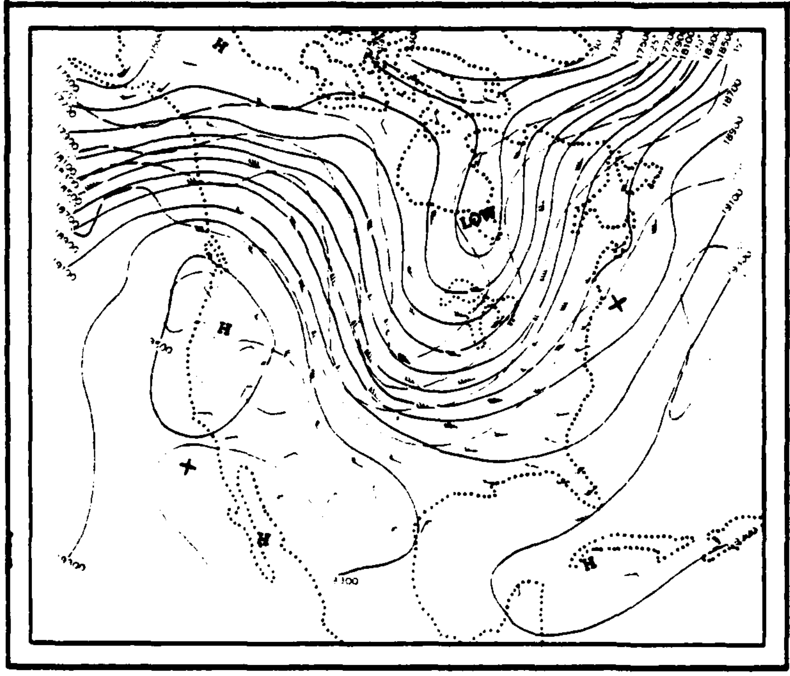
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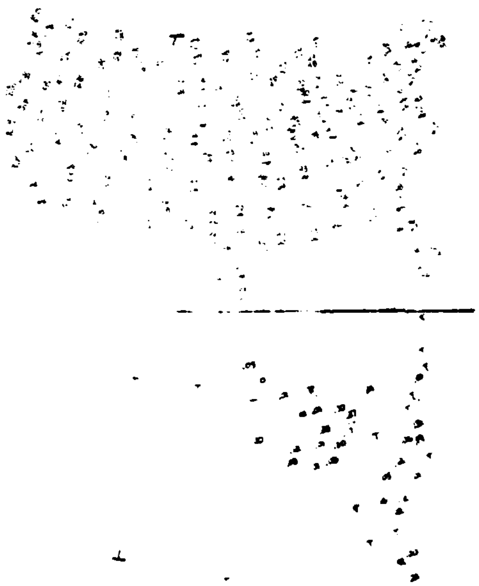

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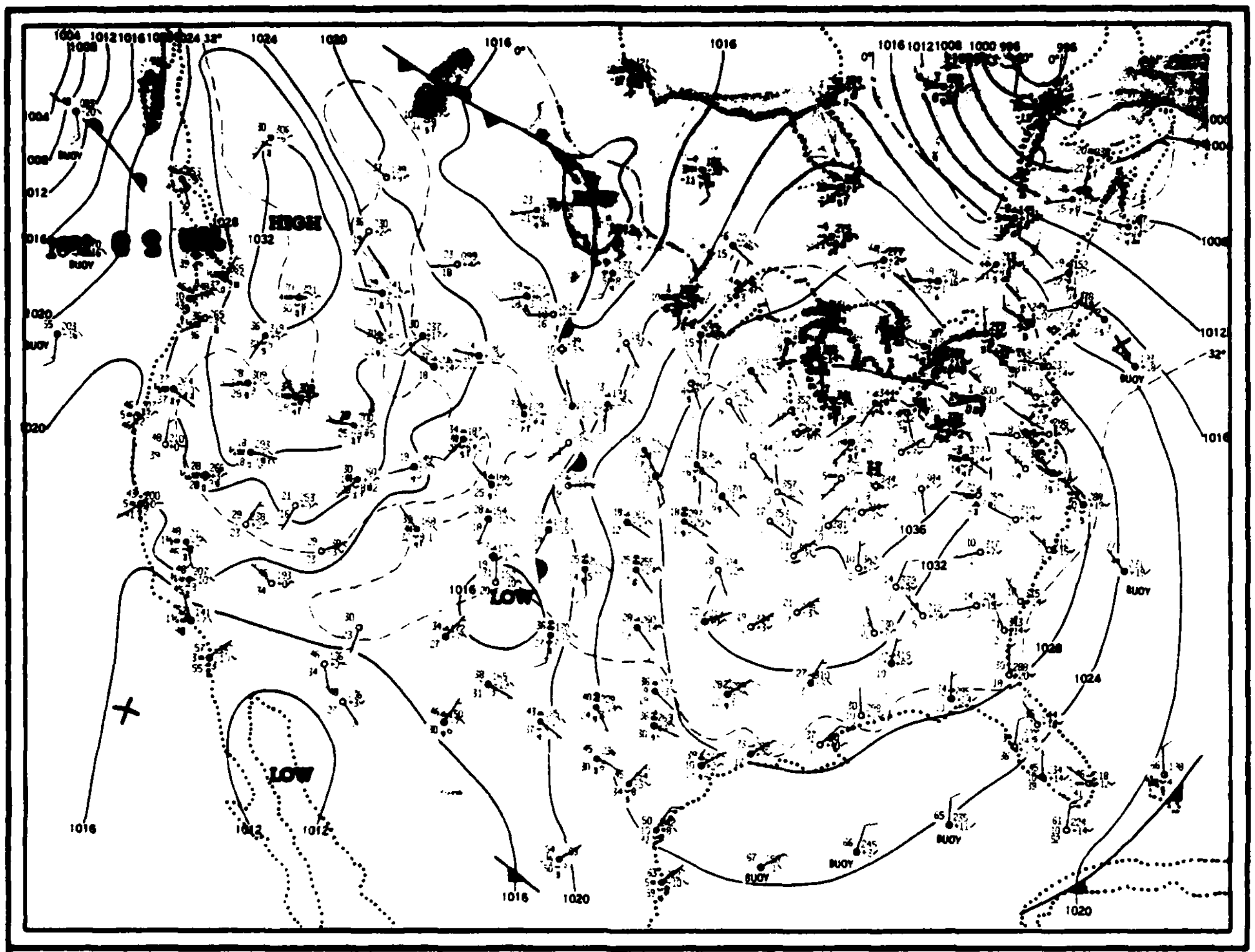

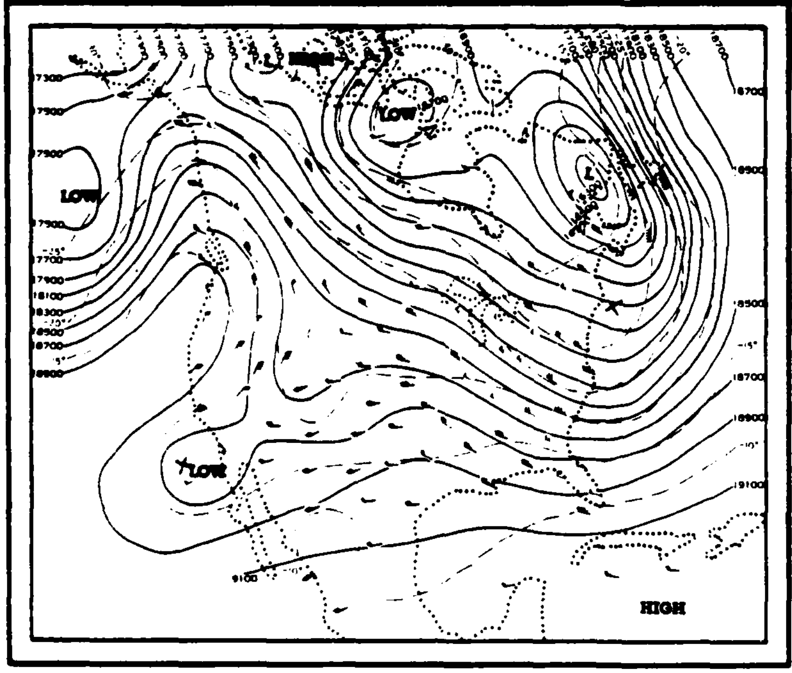

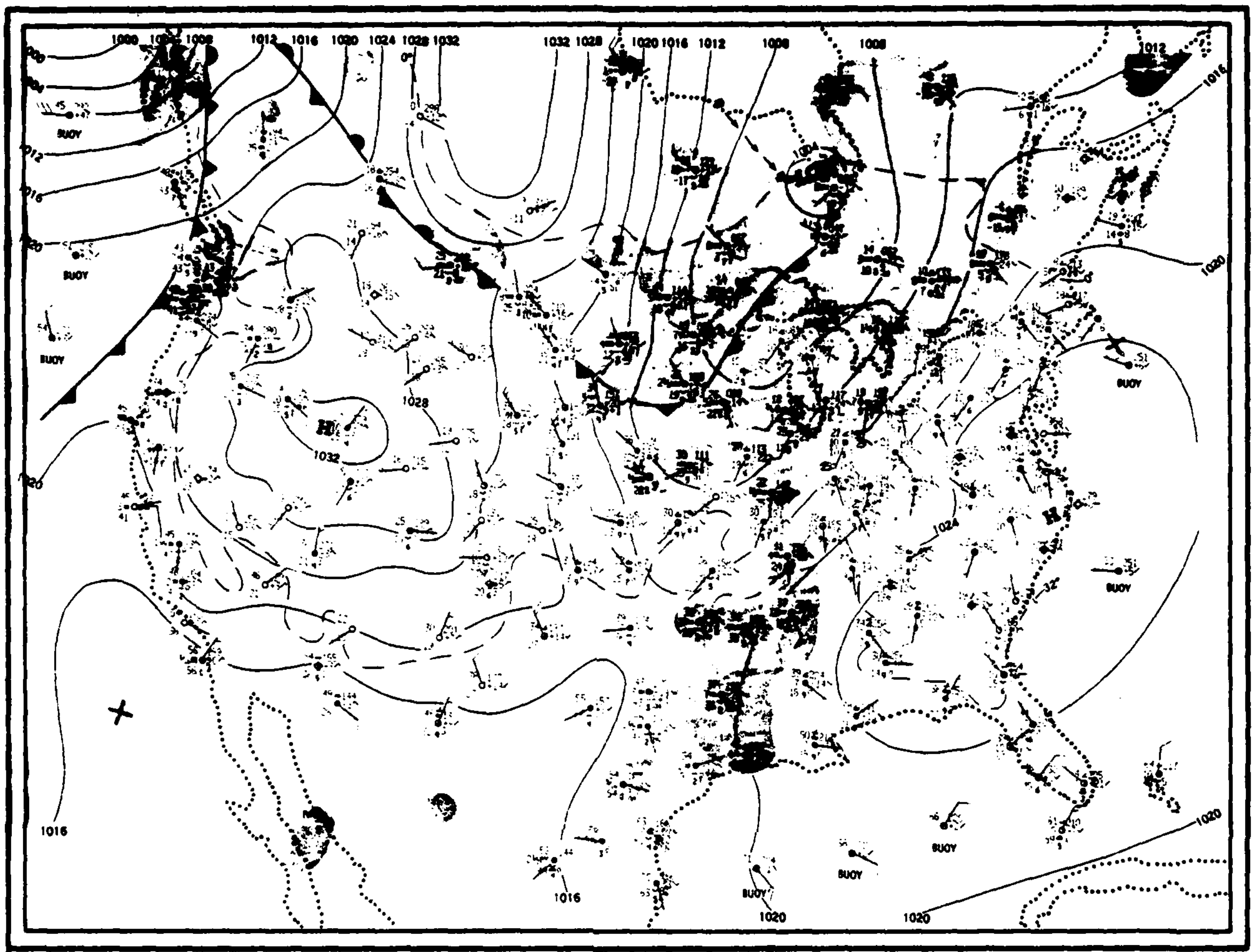
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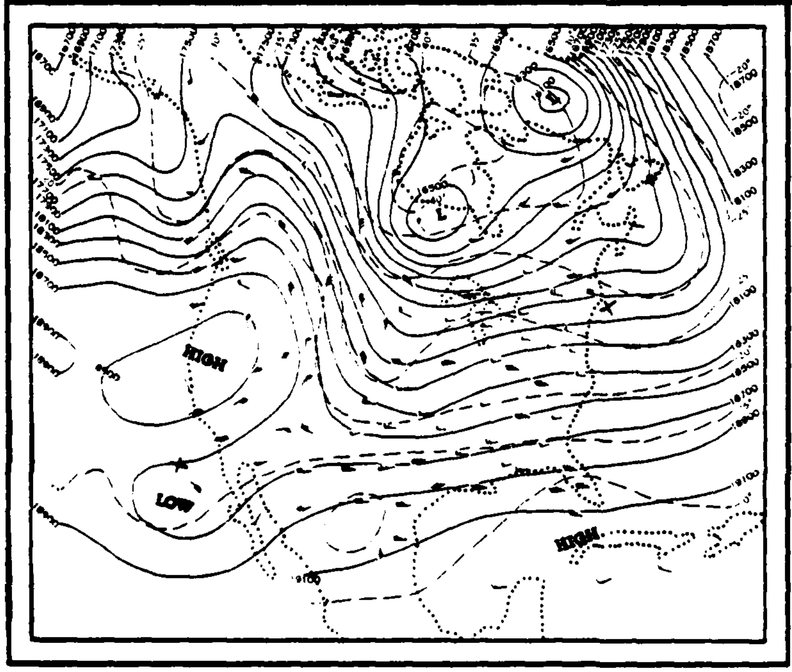
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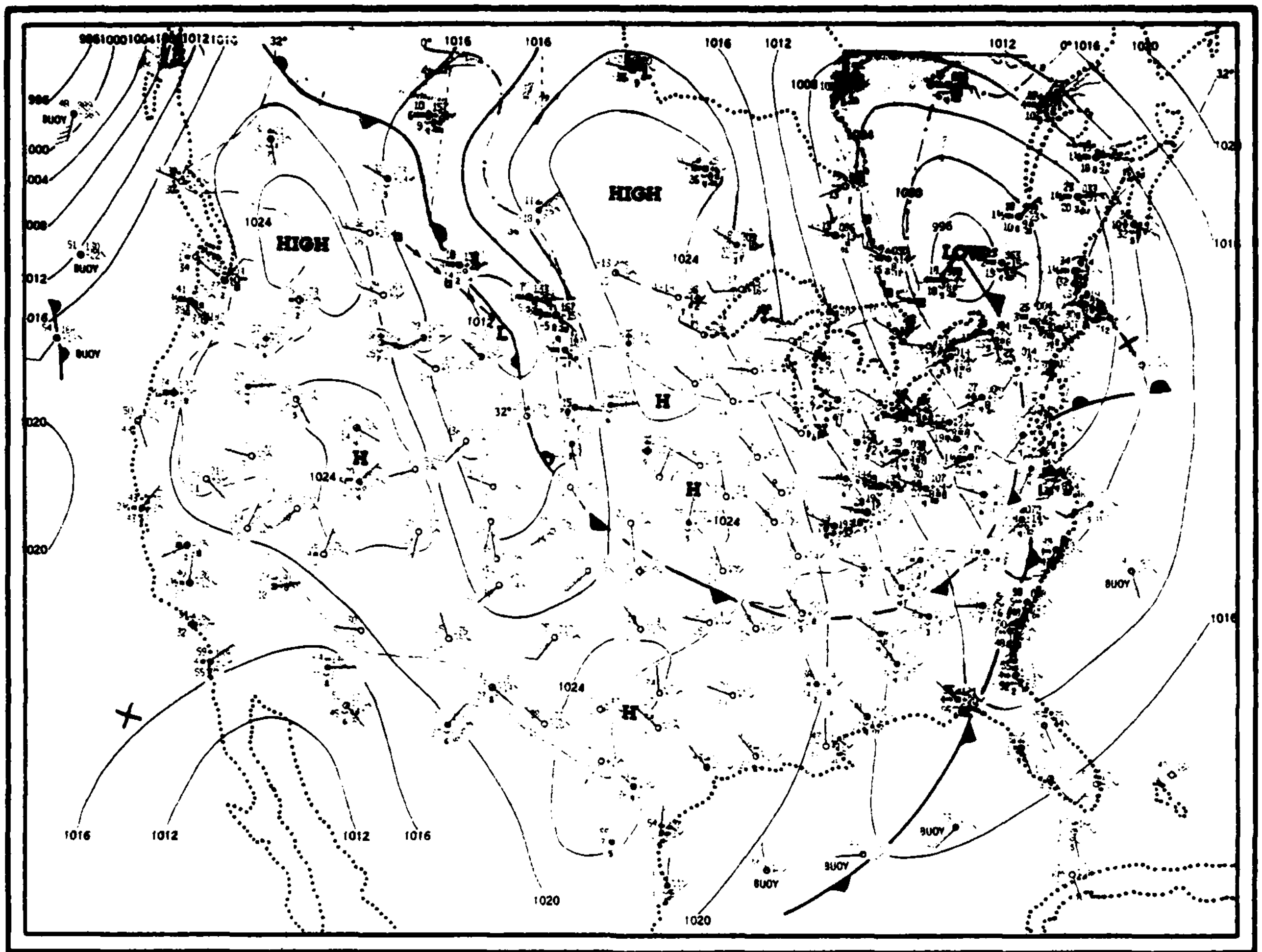

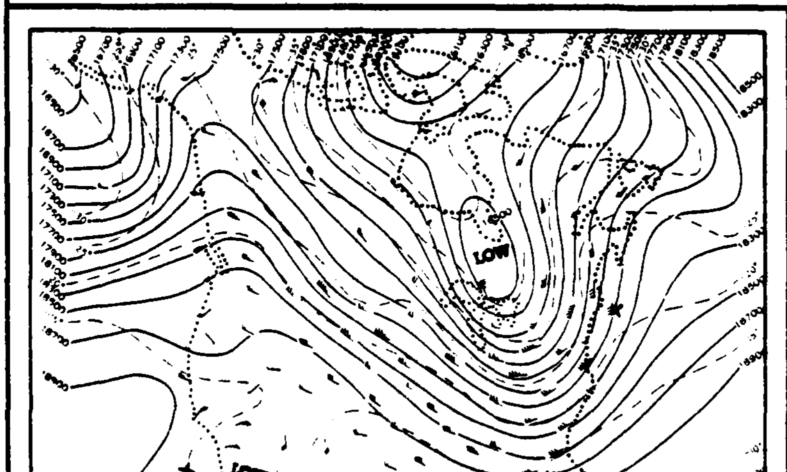

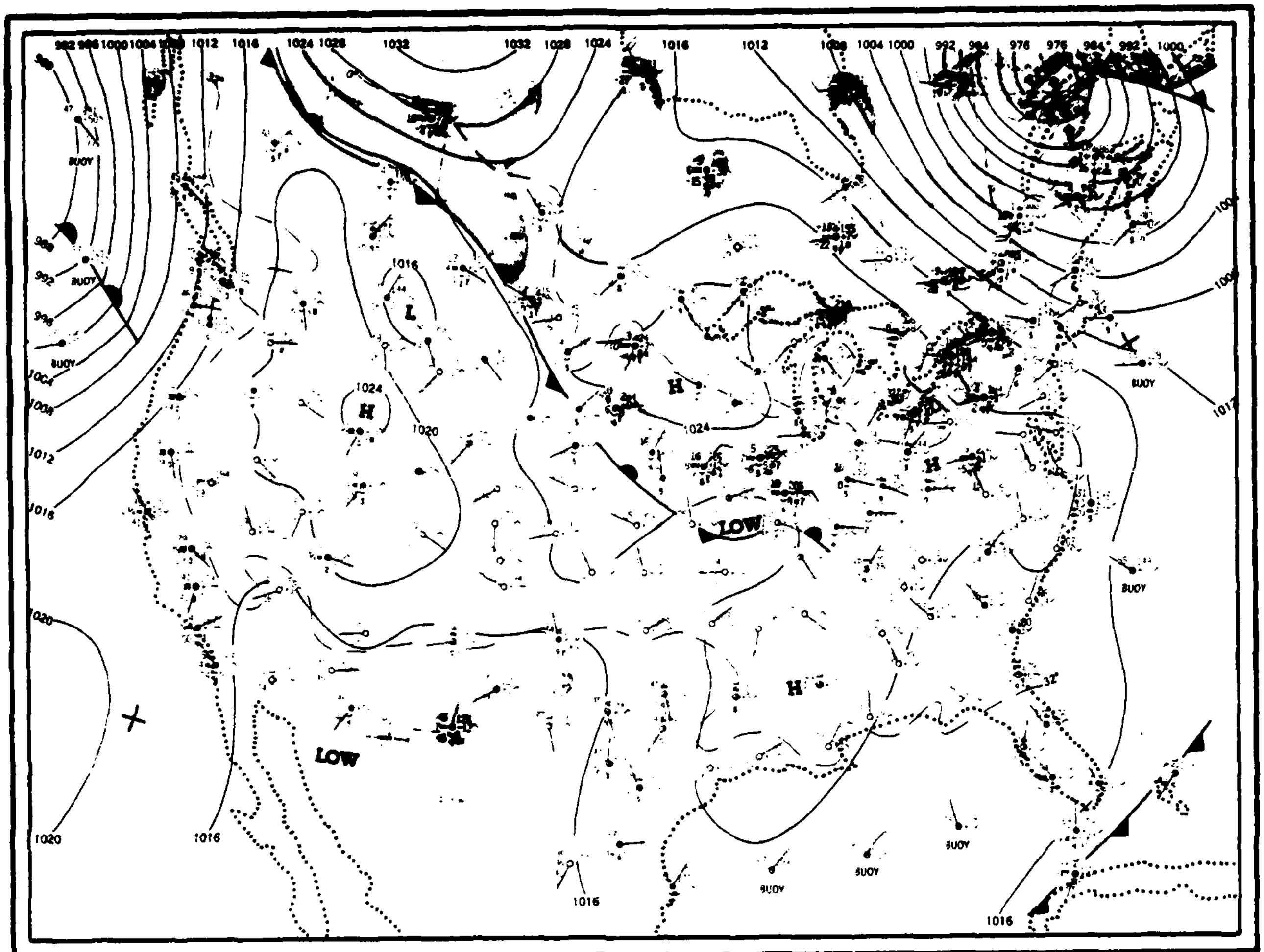
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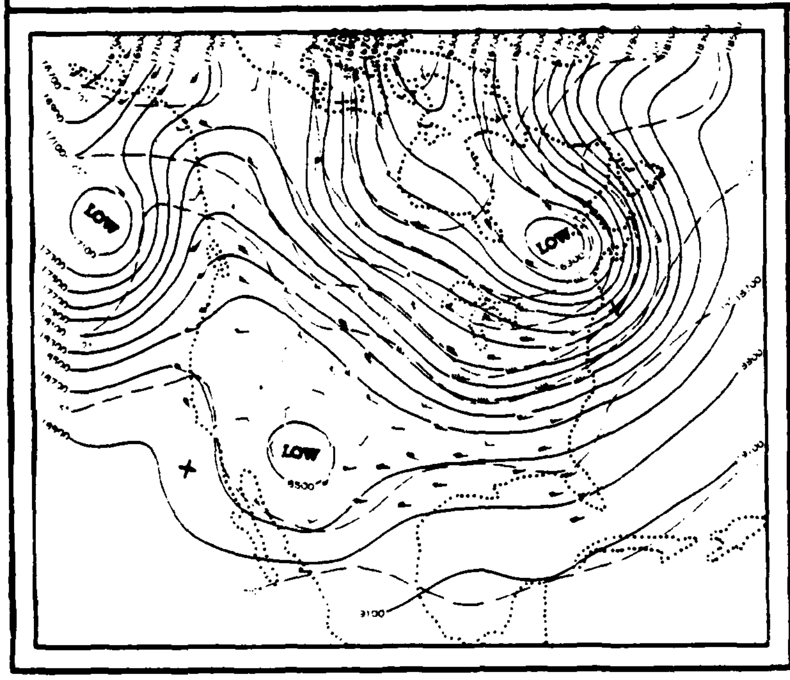
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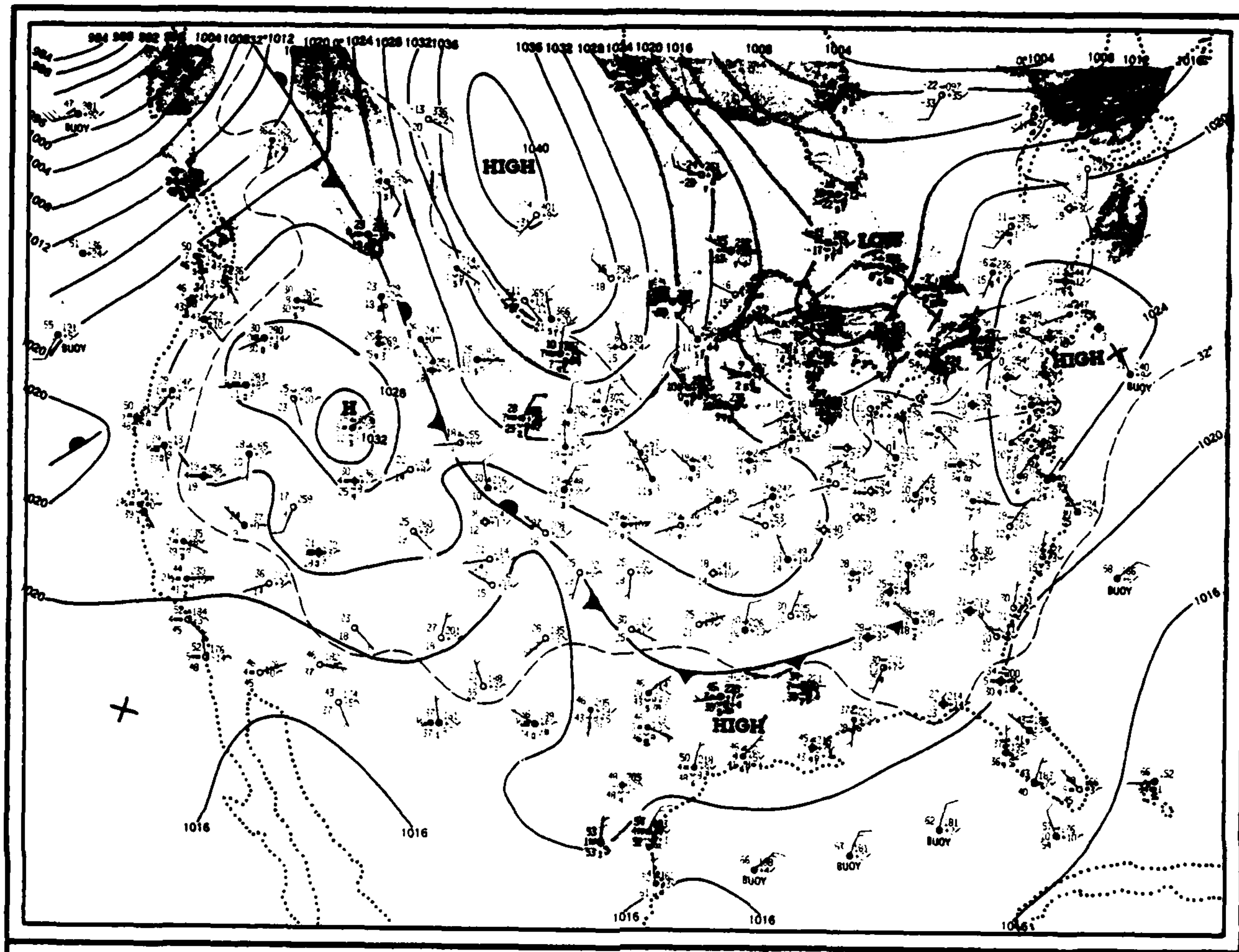

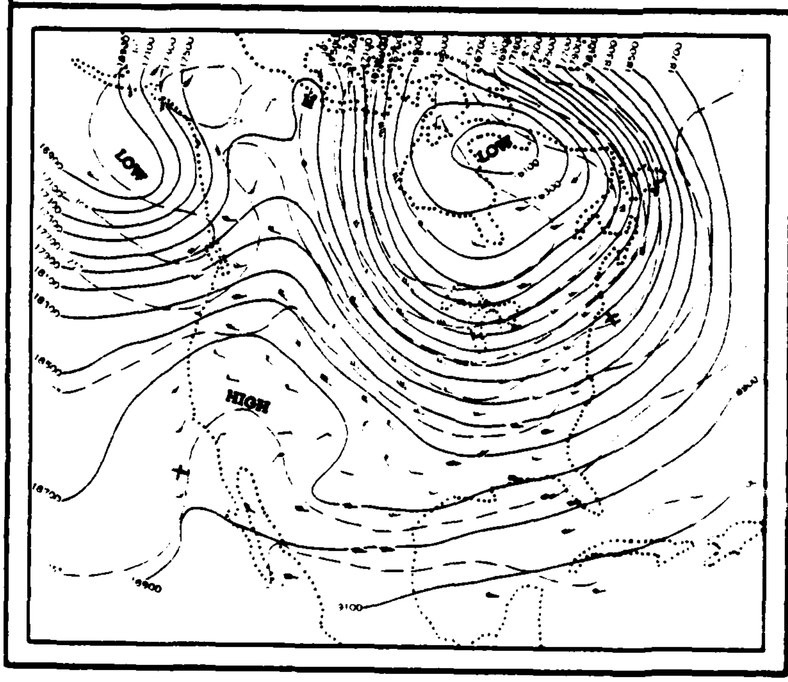

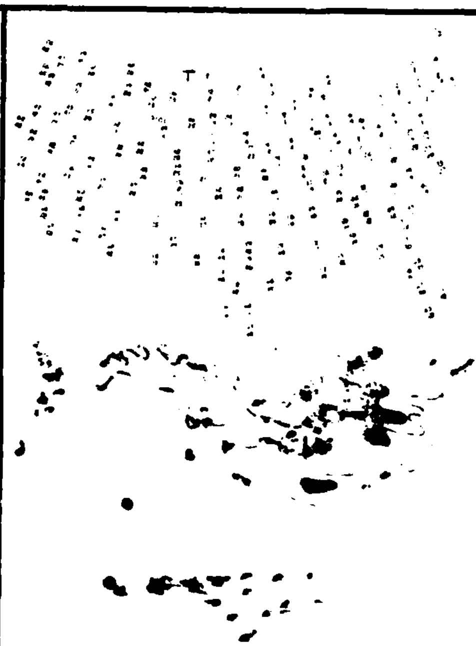

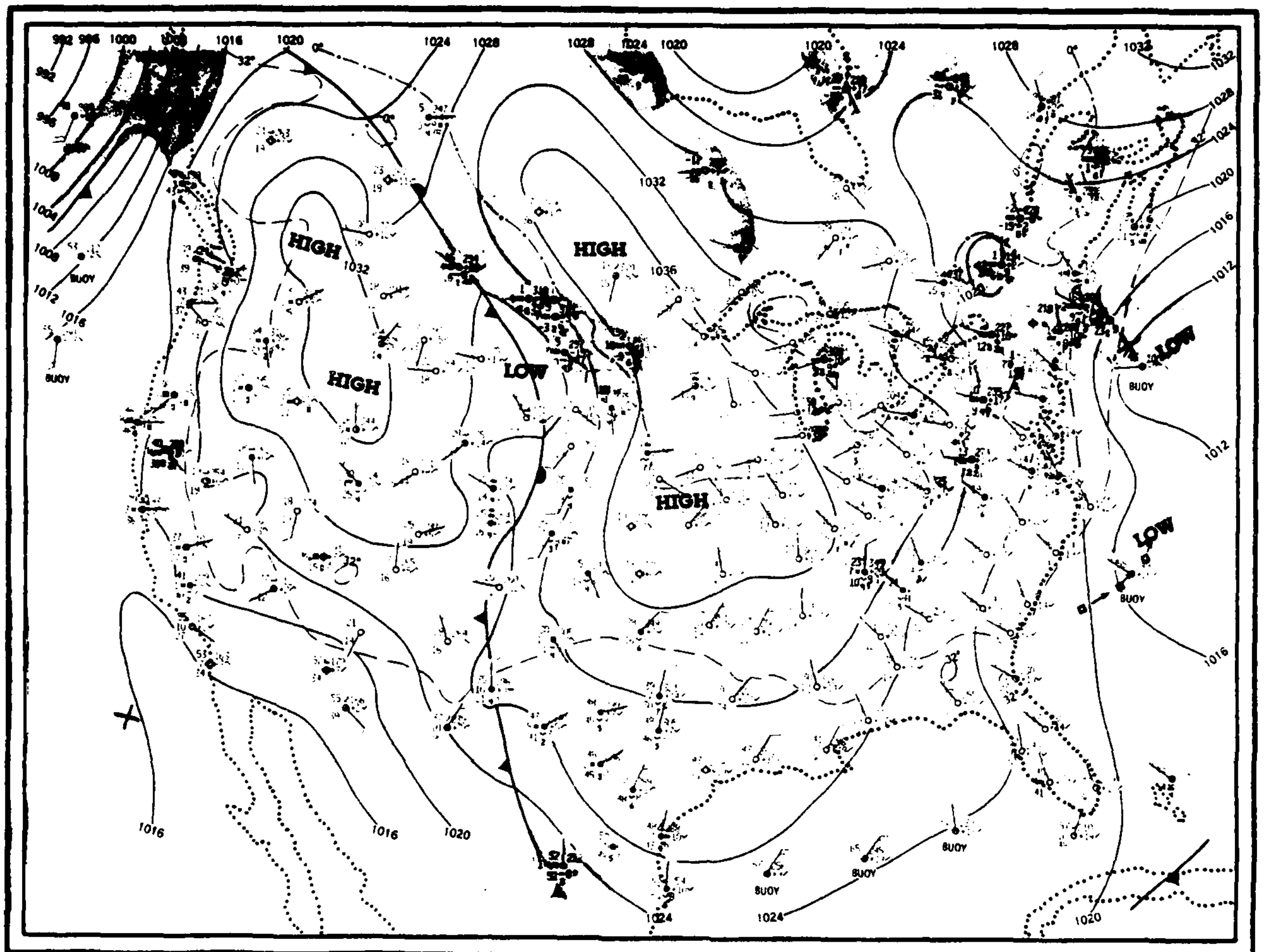
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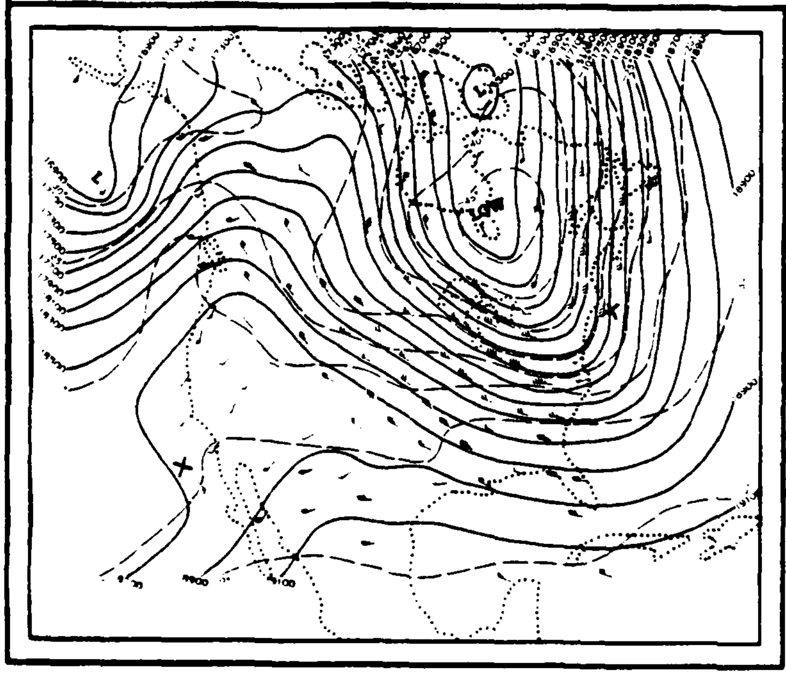
BUOY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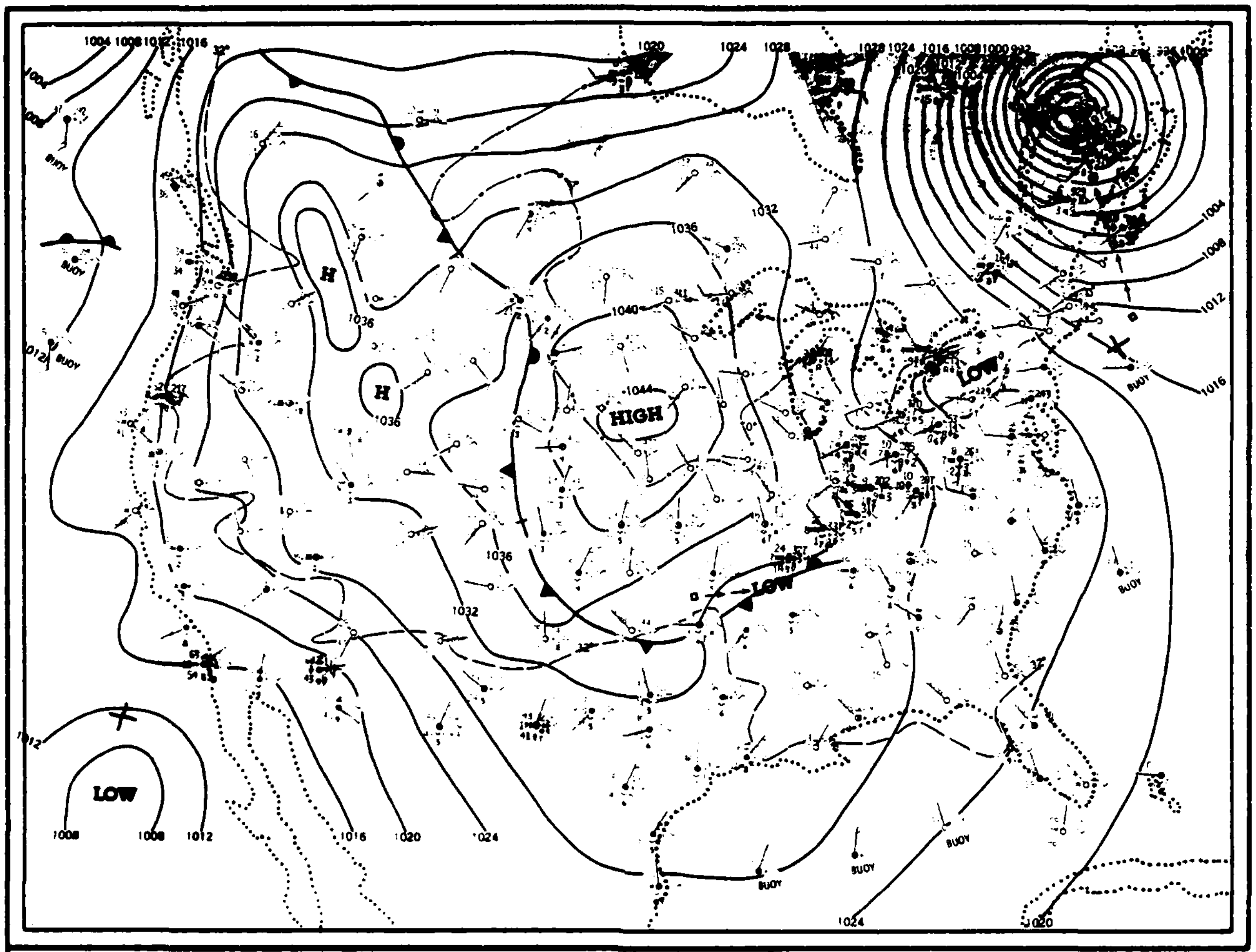
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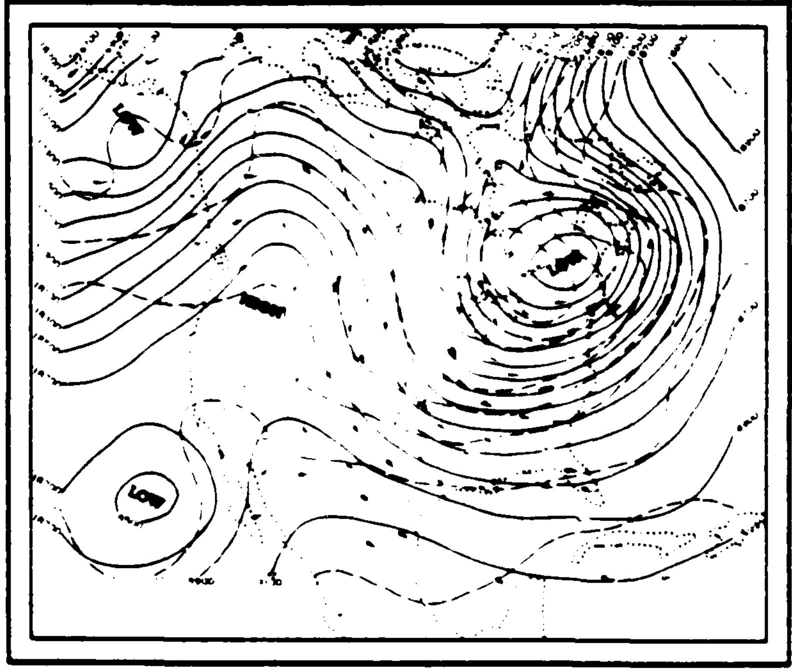
BUOY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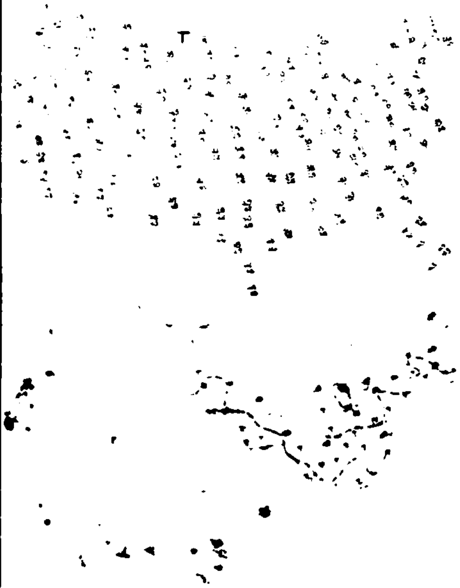

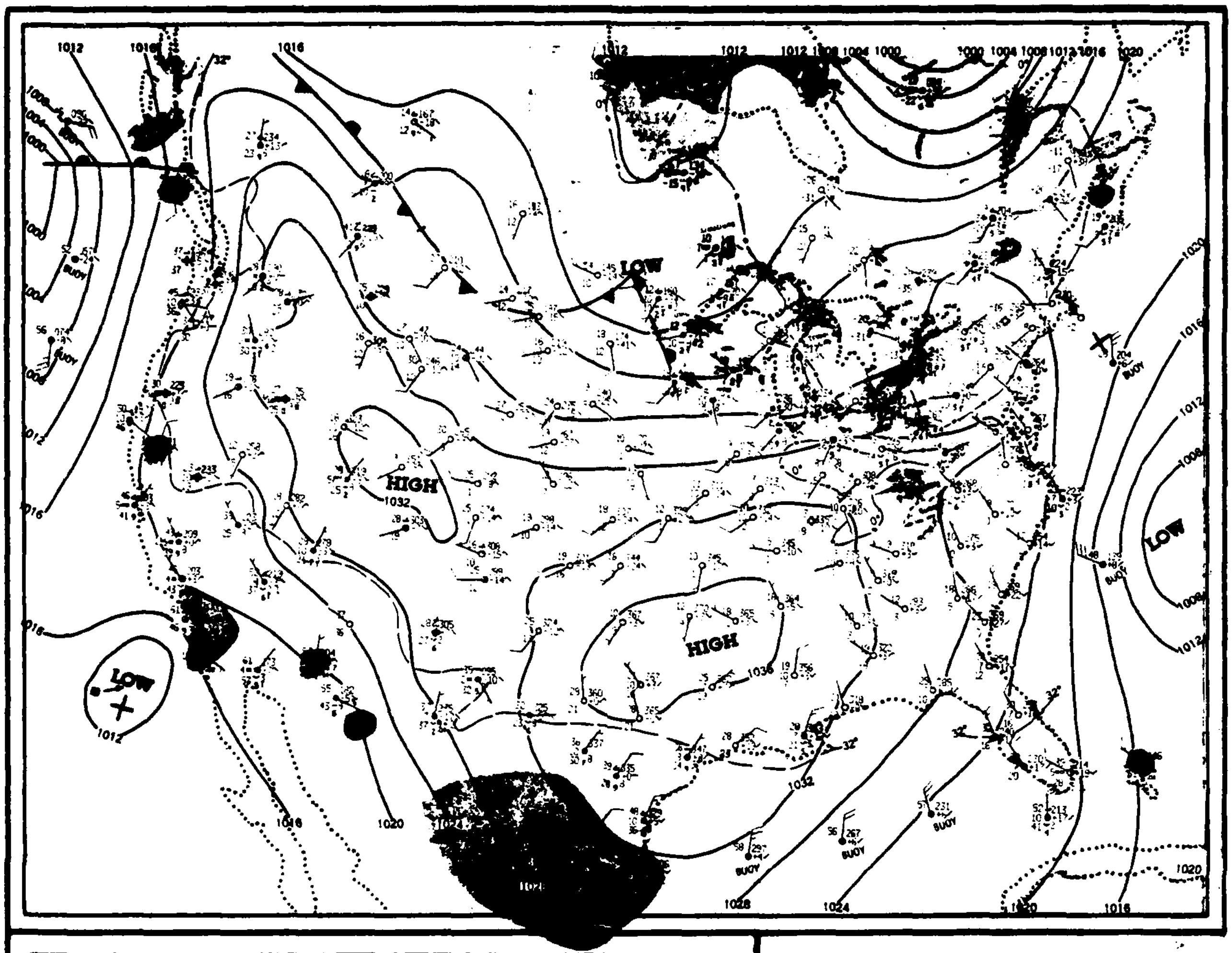
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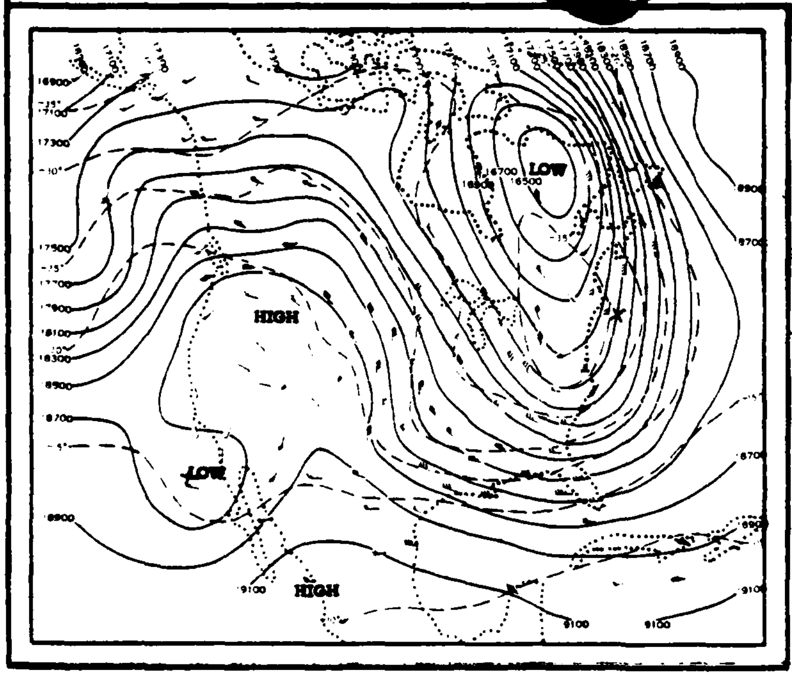
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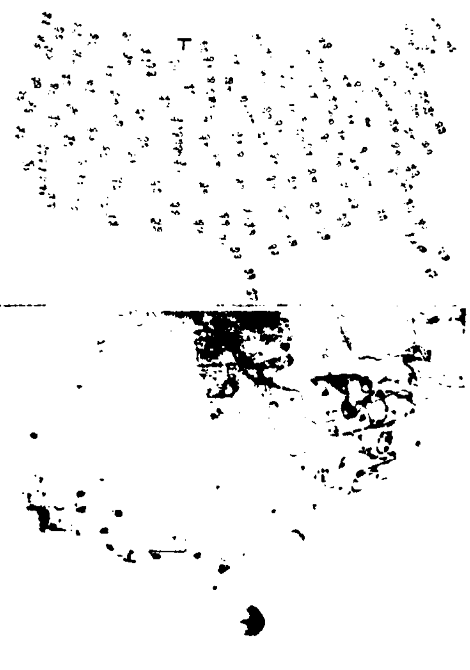

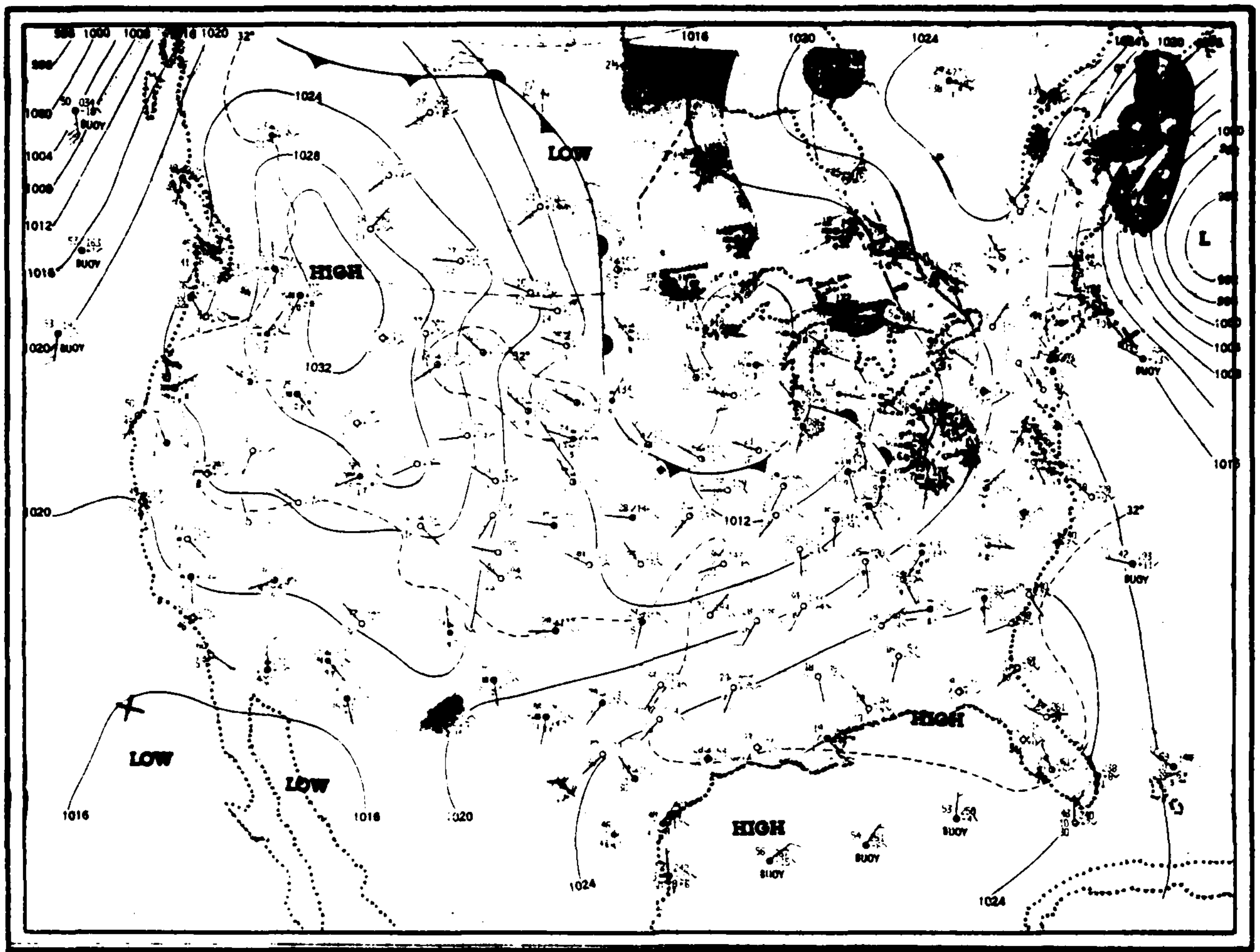
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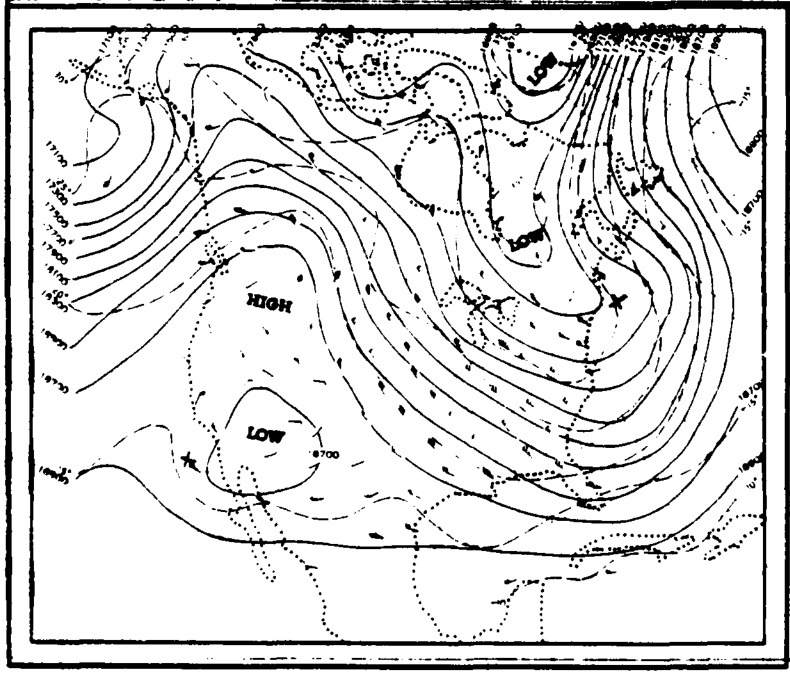
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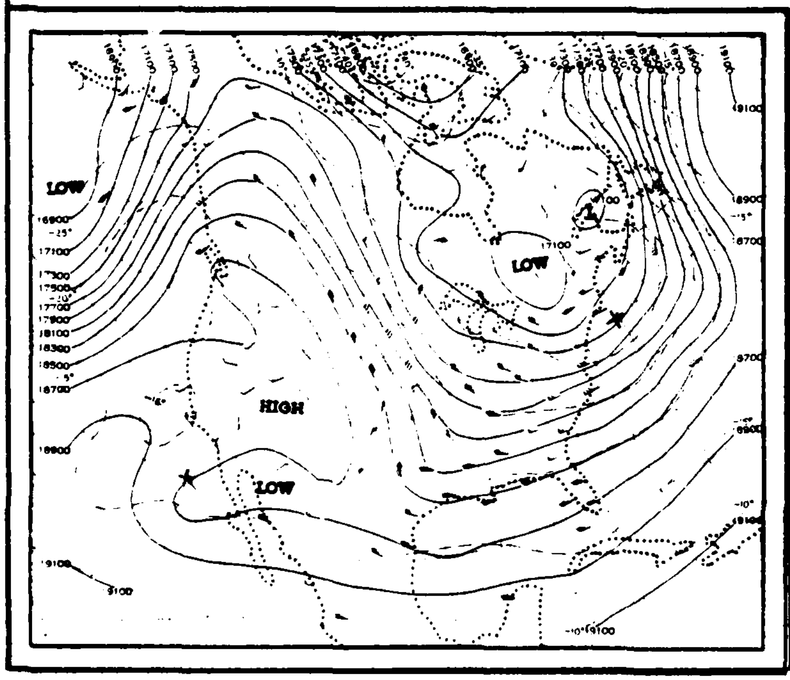
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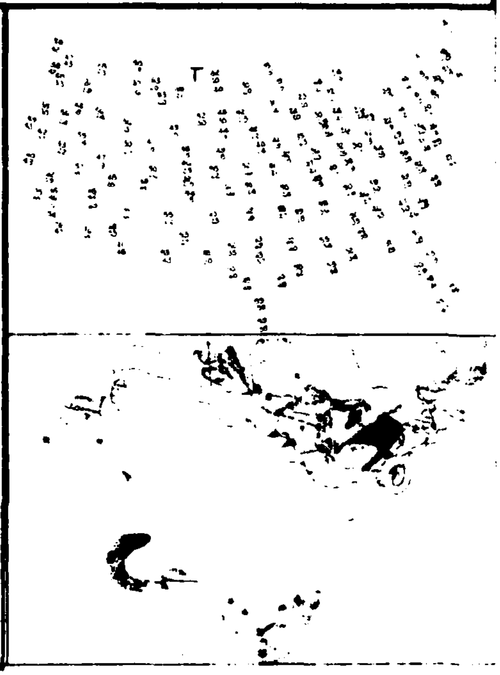

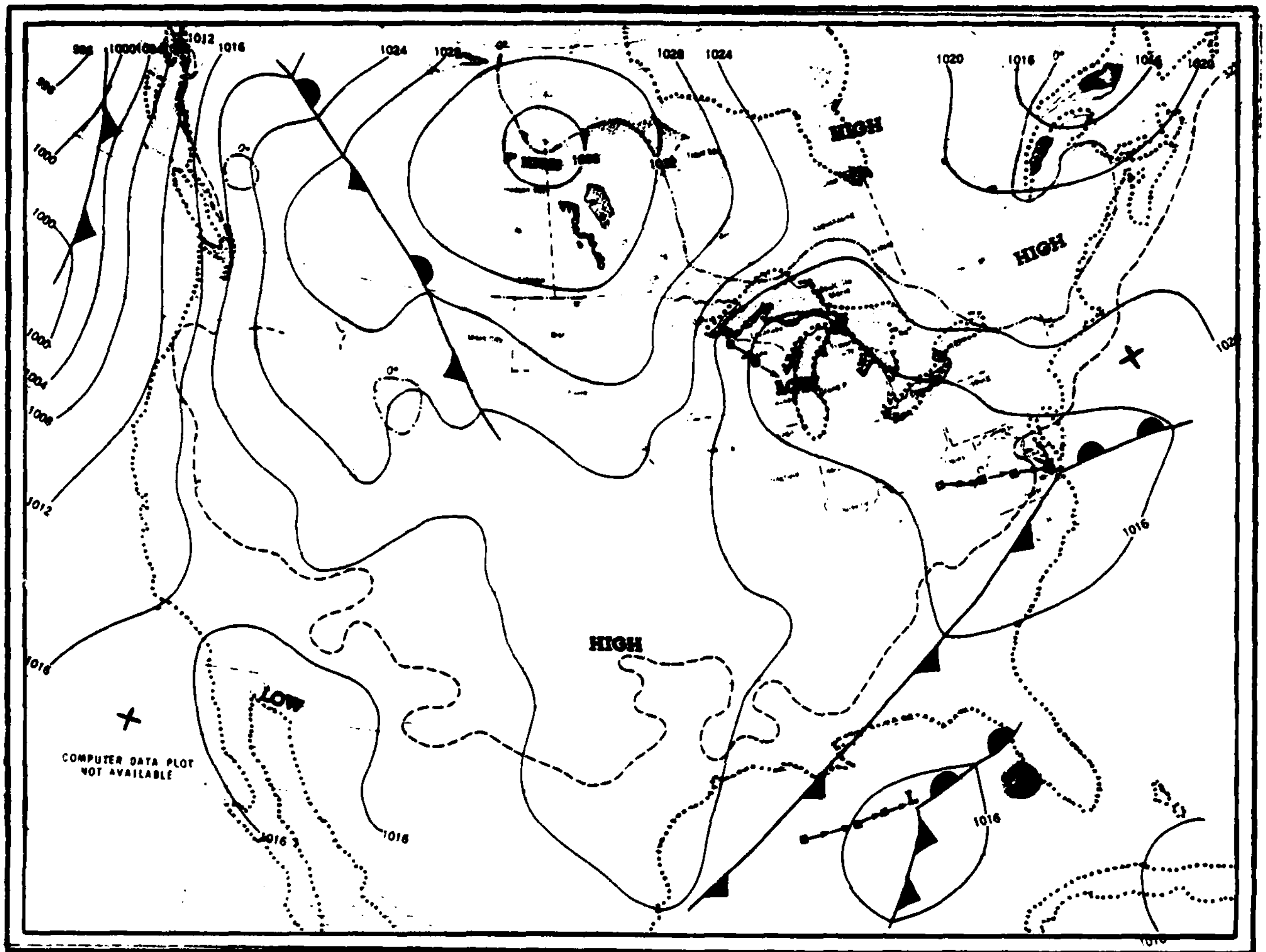
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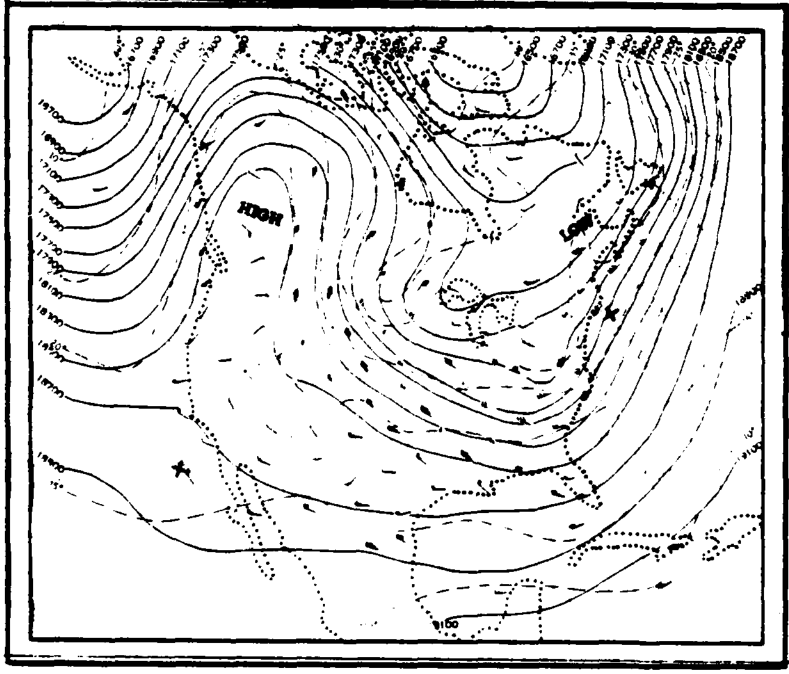
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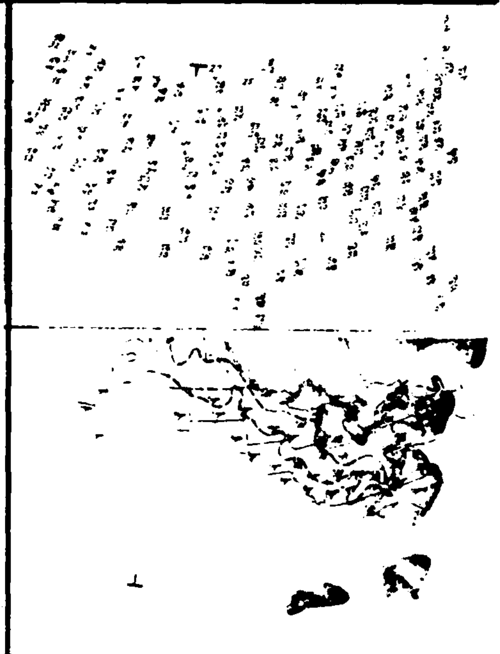
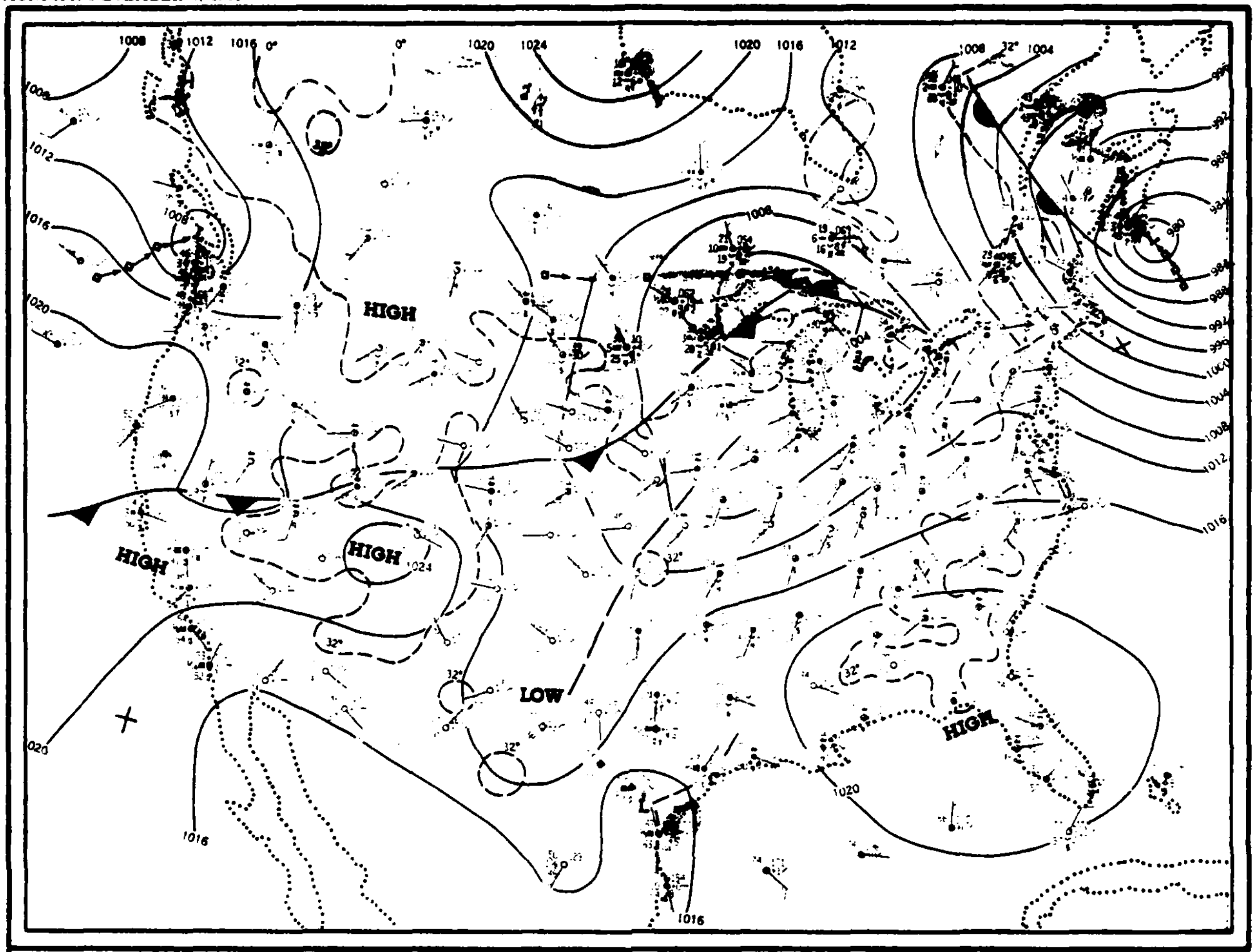
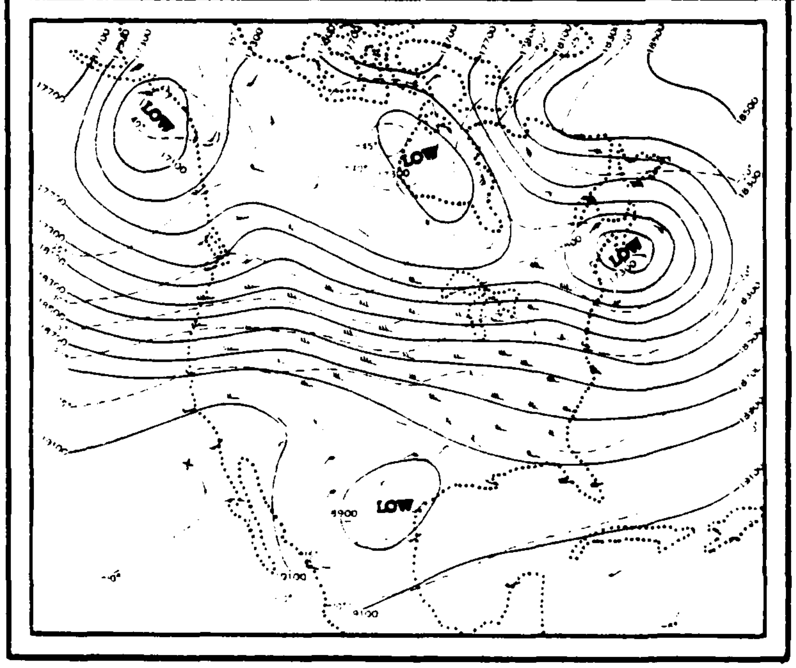
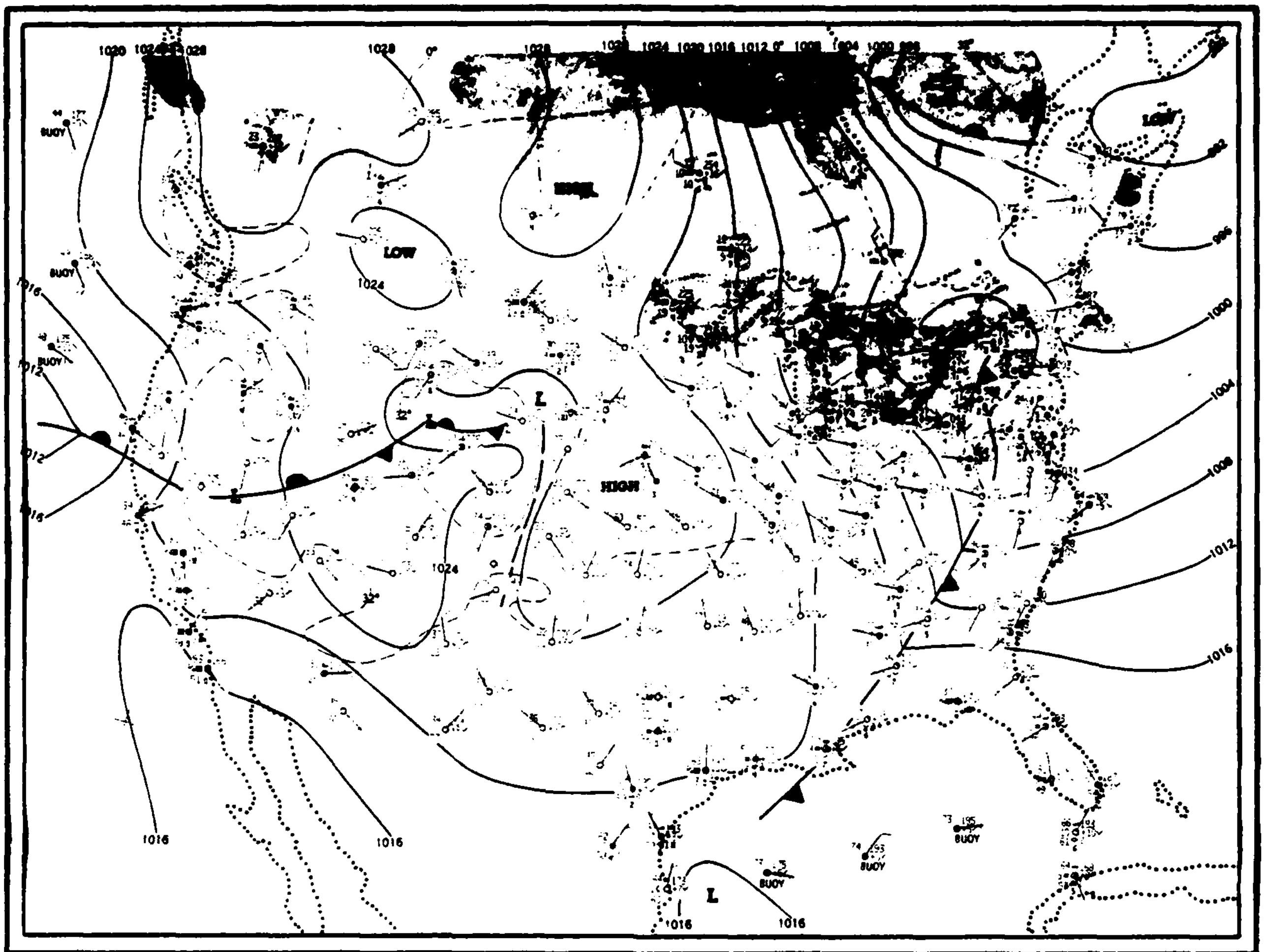


MONDAY, DECEMBER 7, 1981



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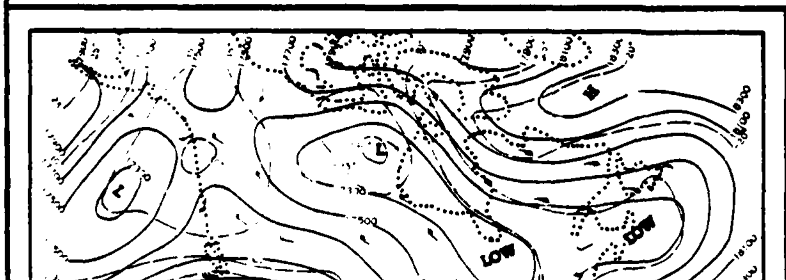
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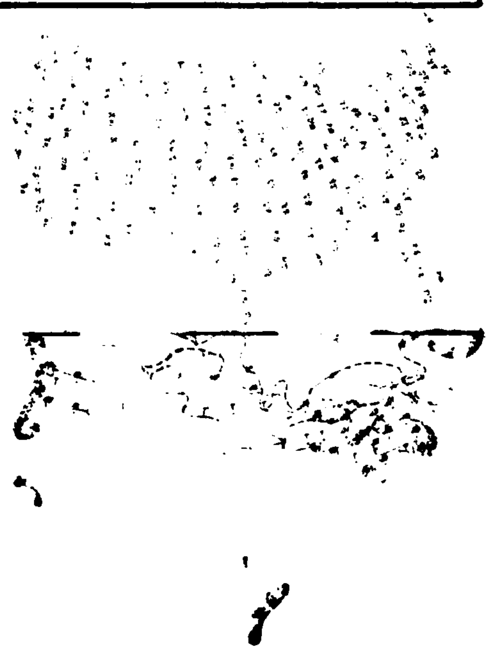

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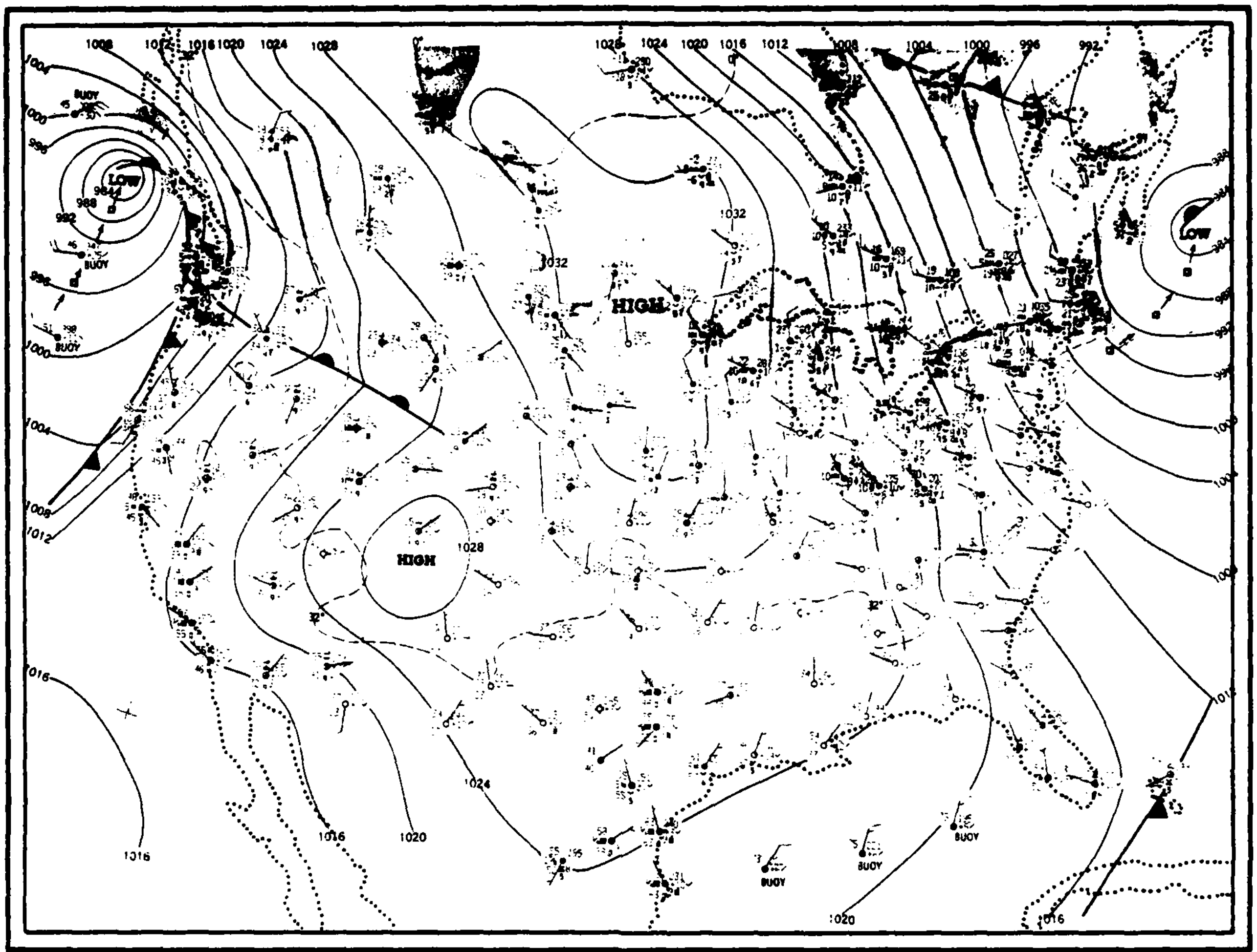

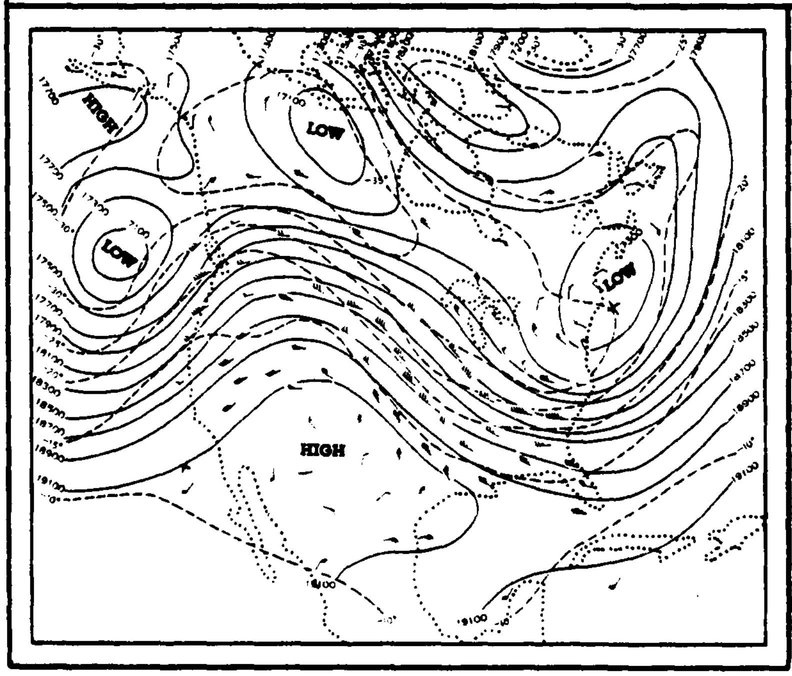

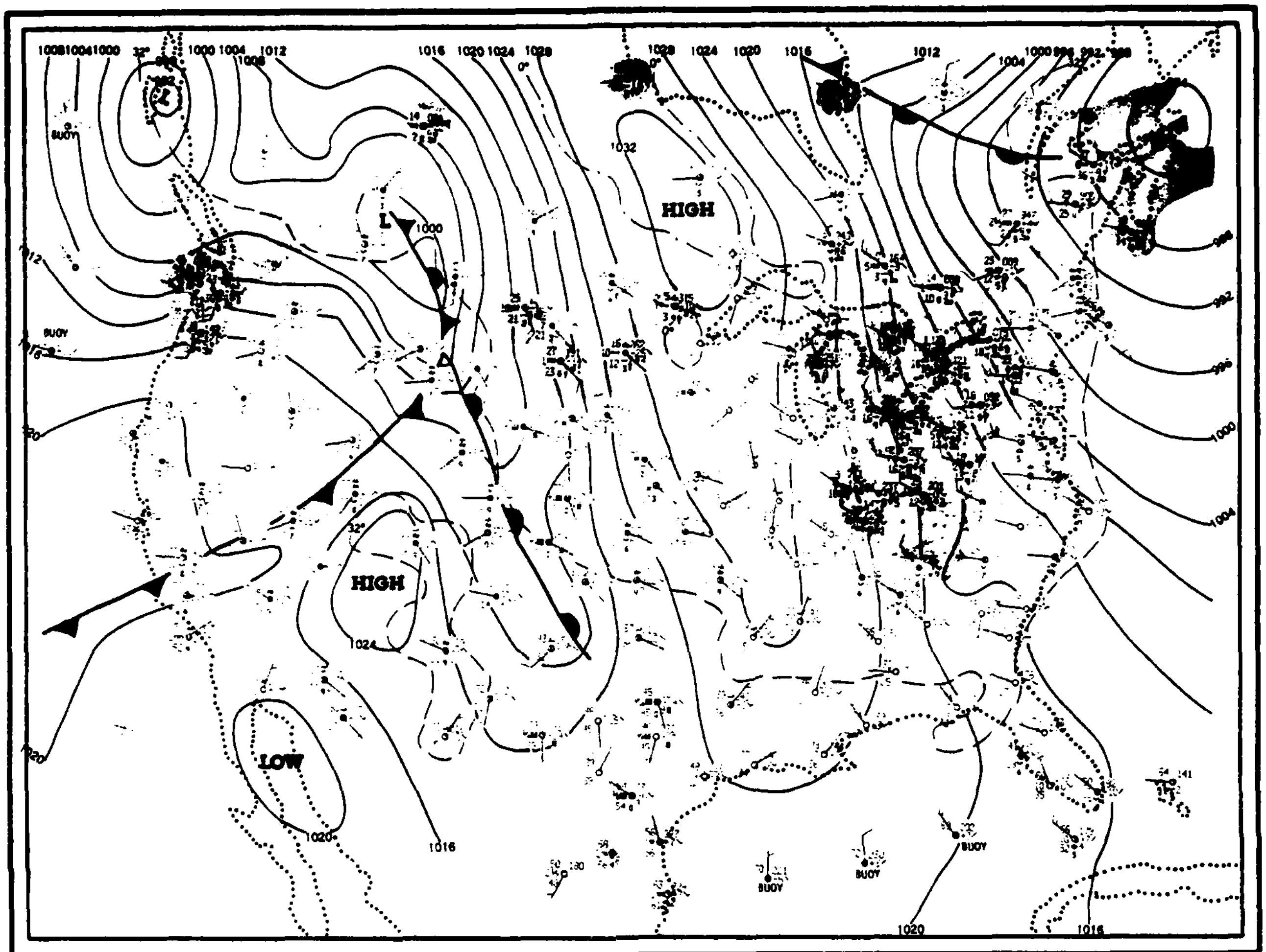
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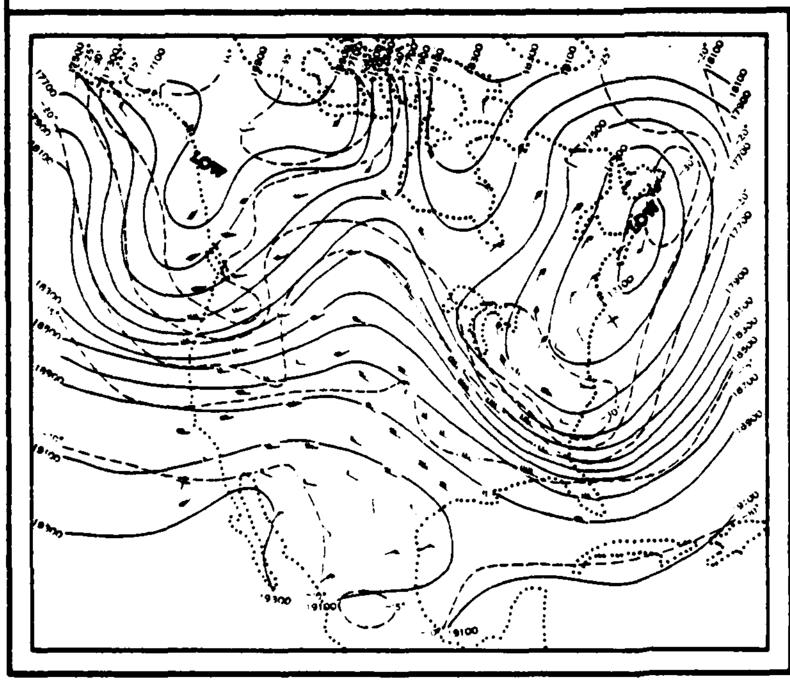
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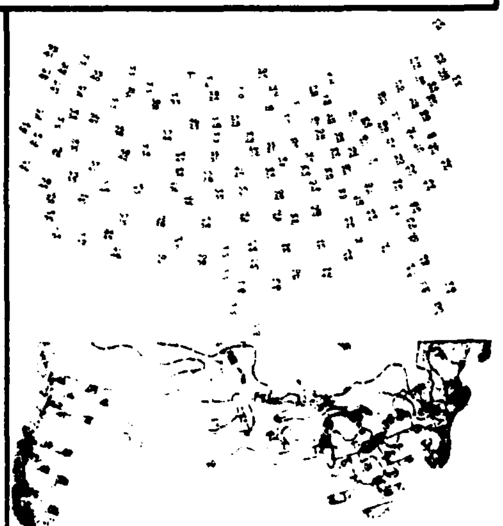

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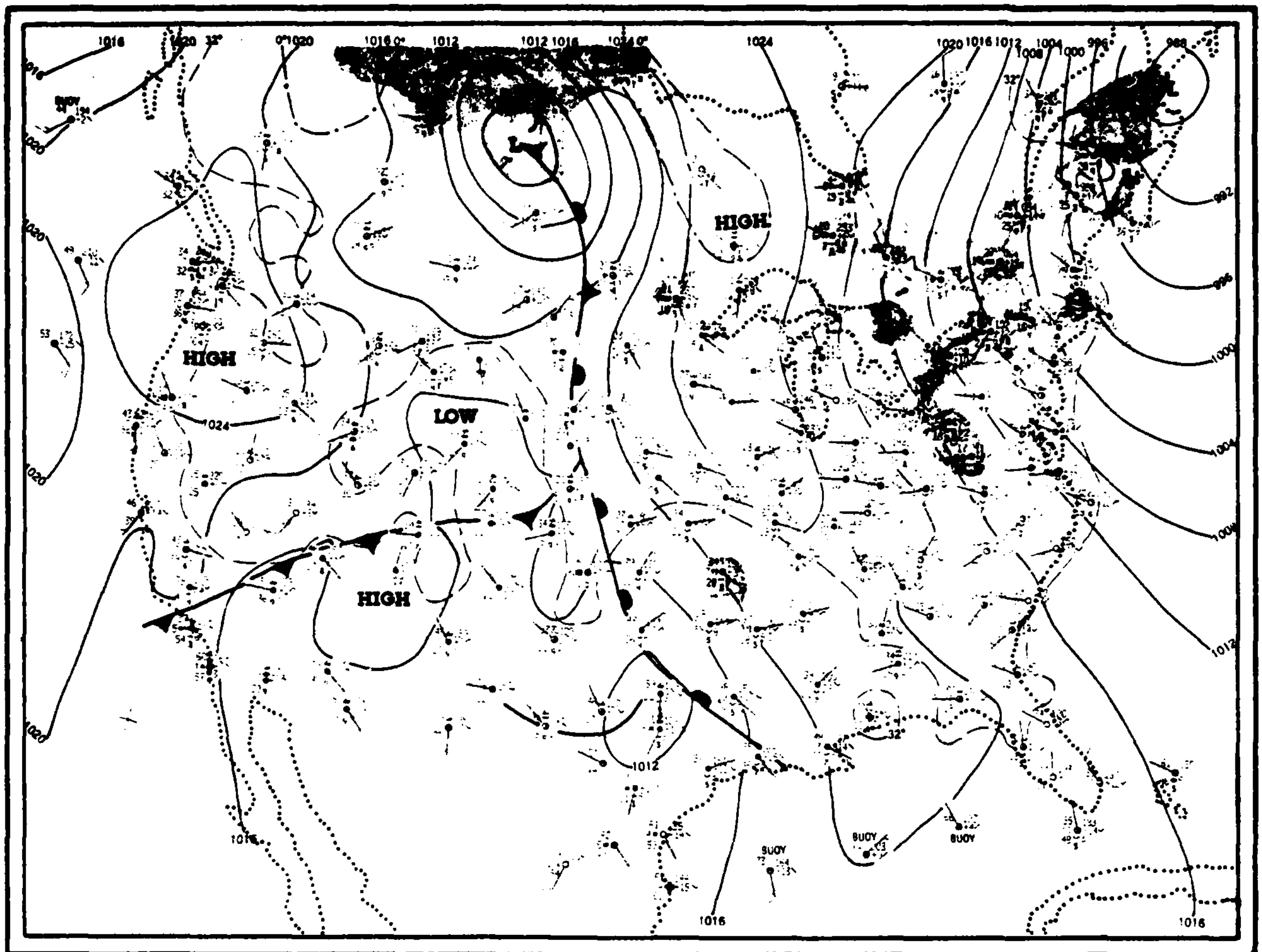

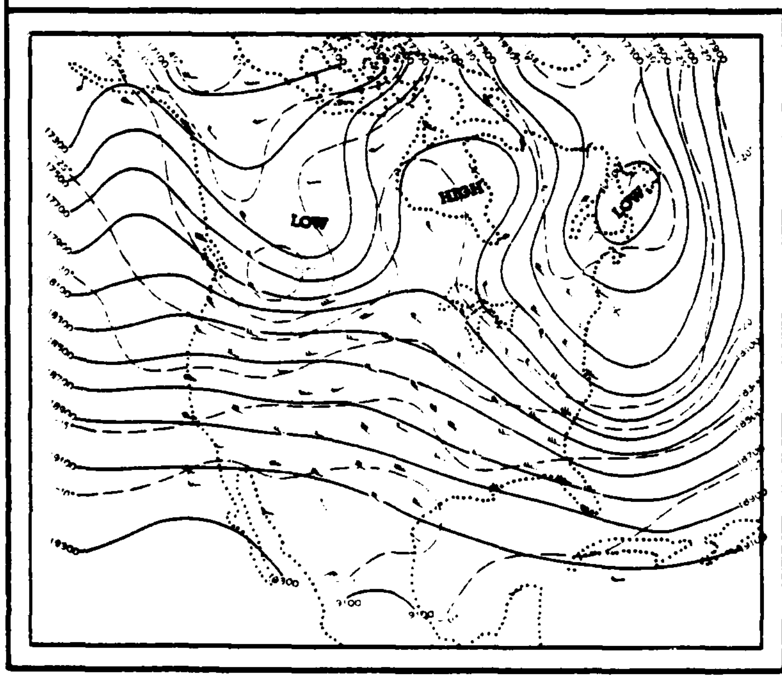

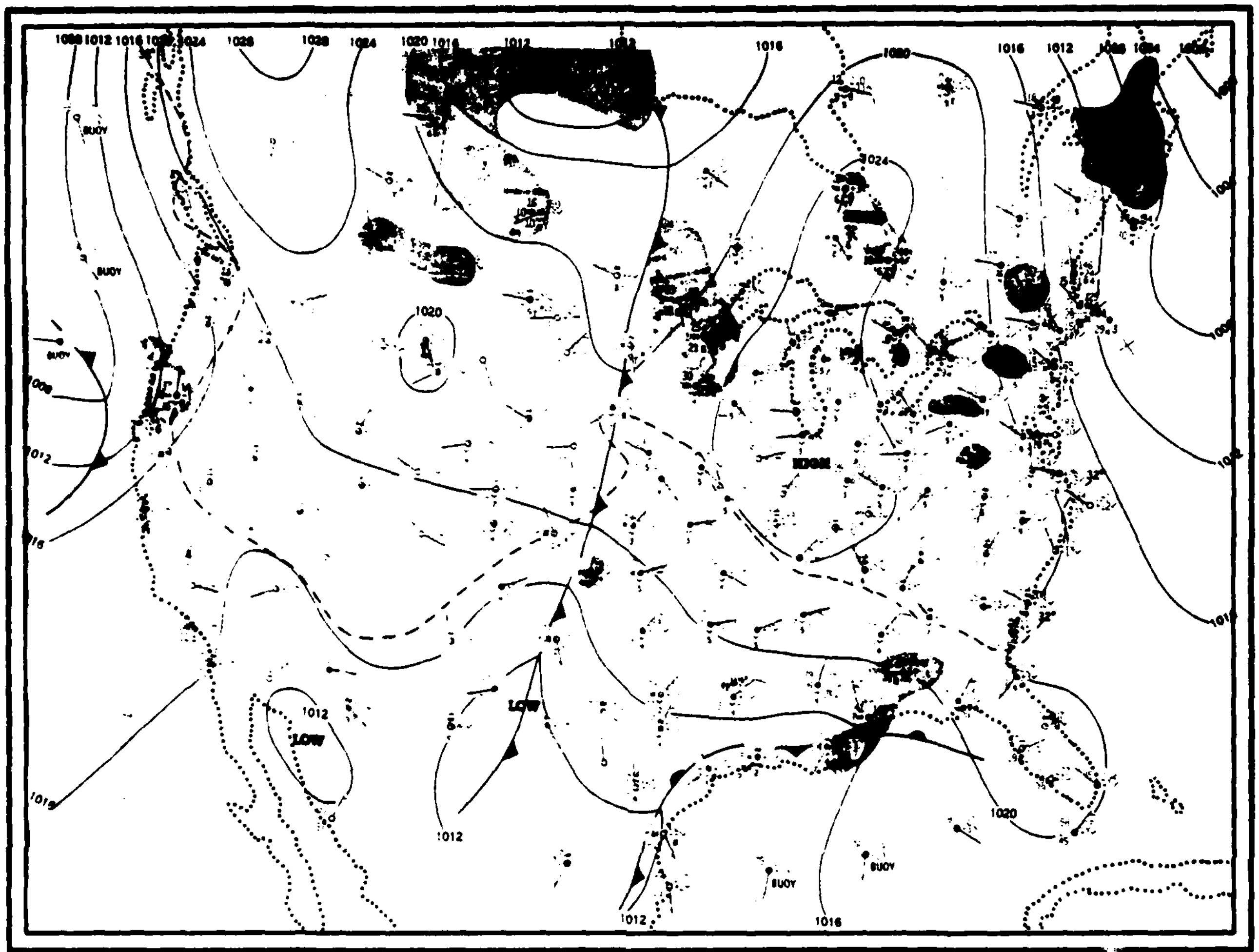
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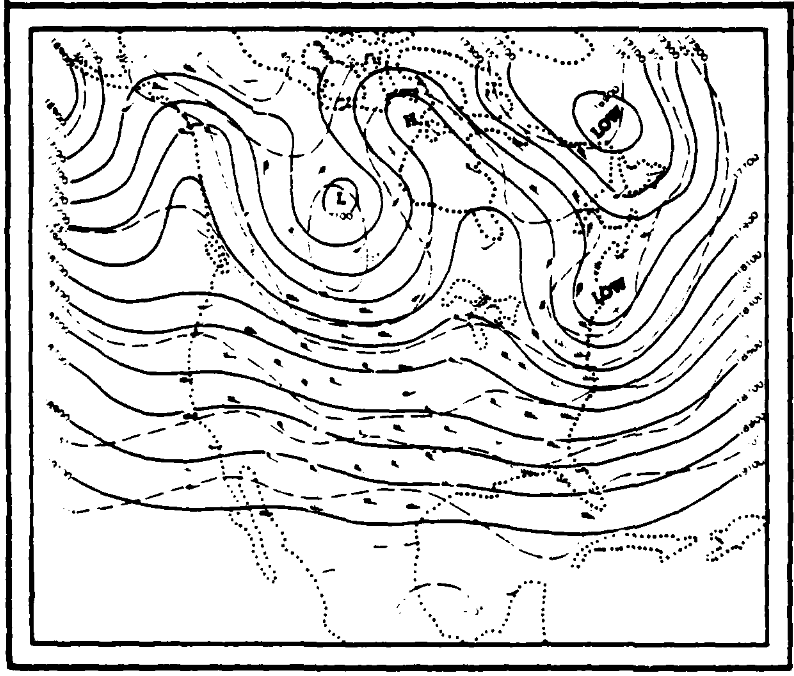
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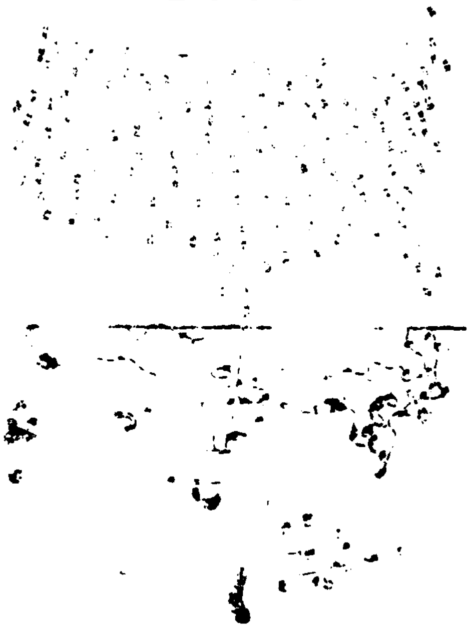

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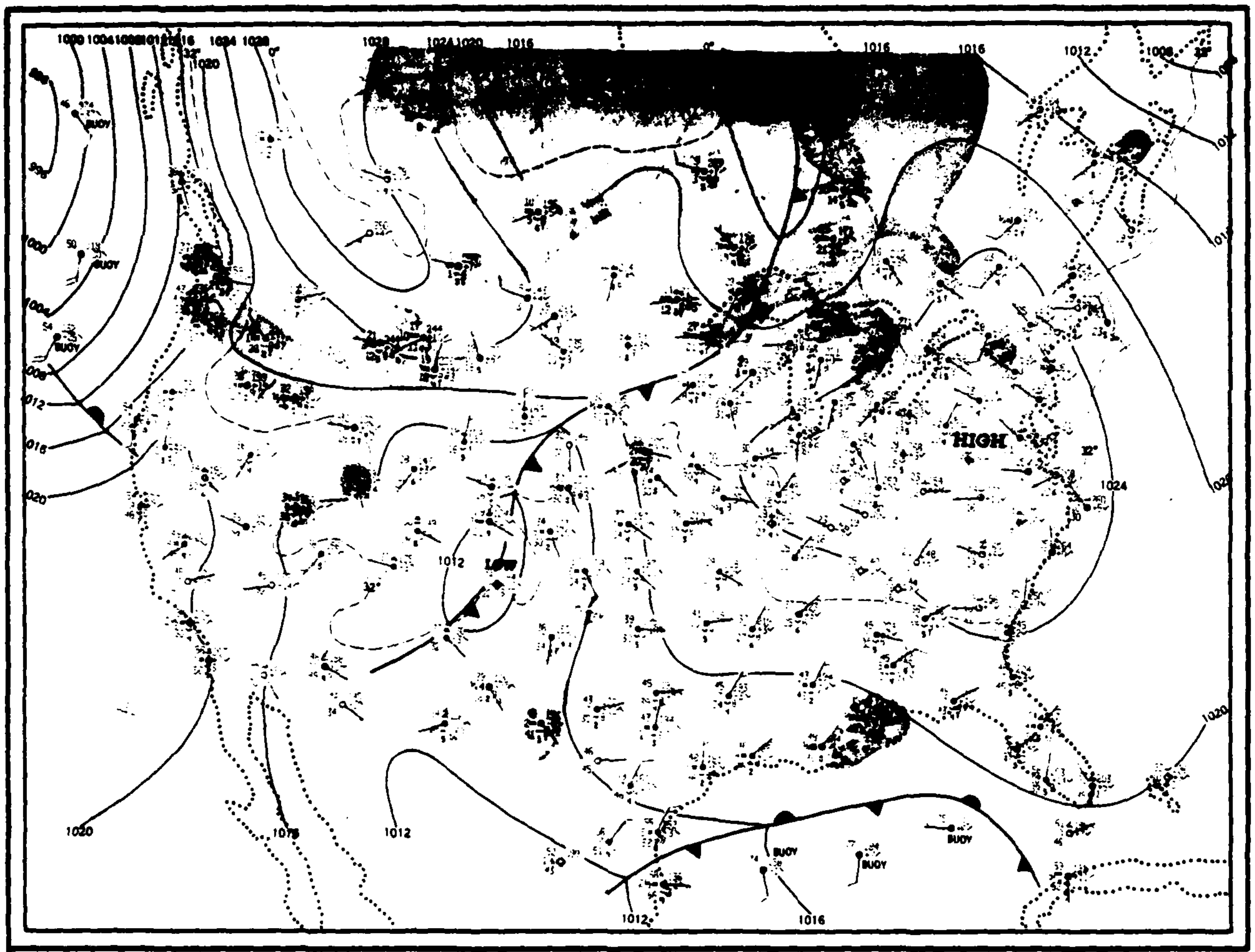

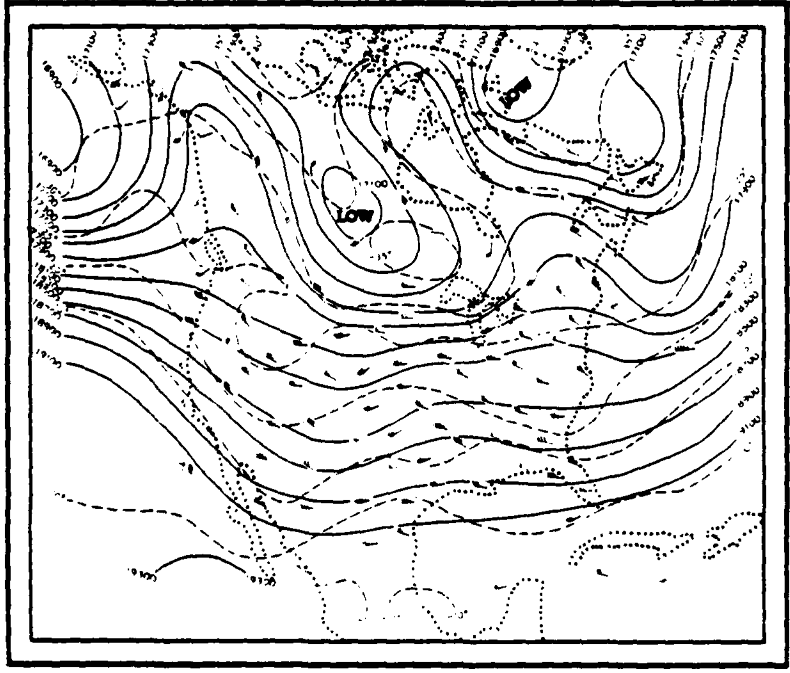

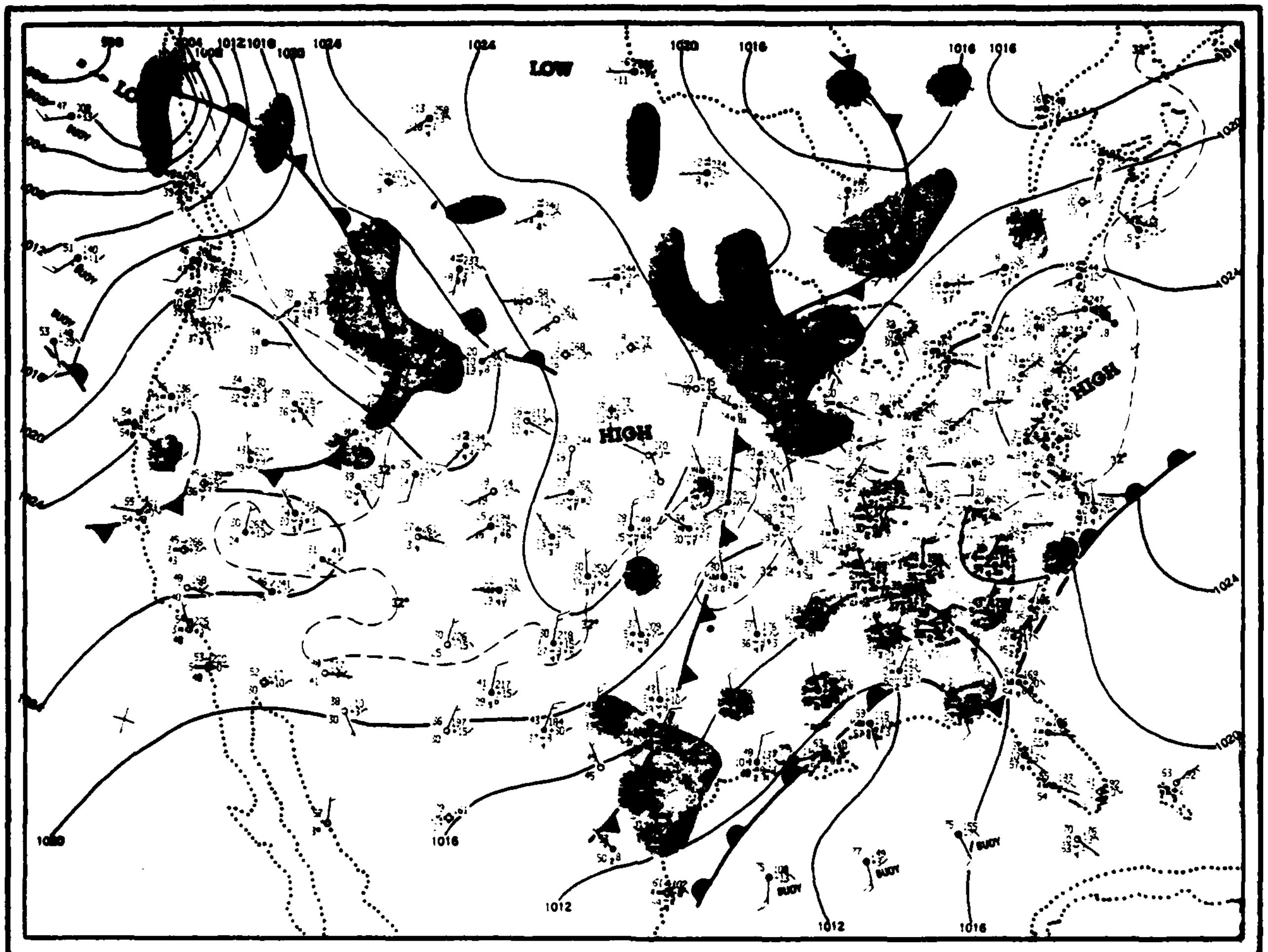
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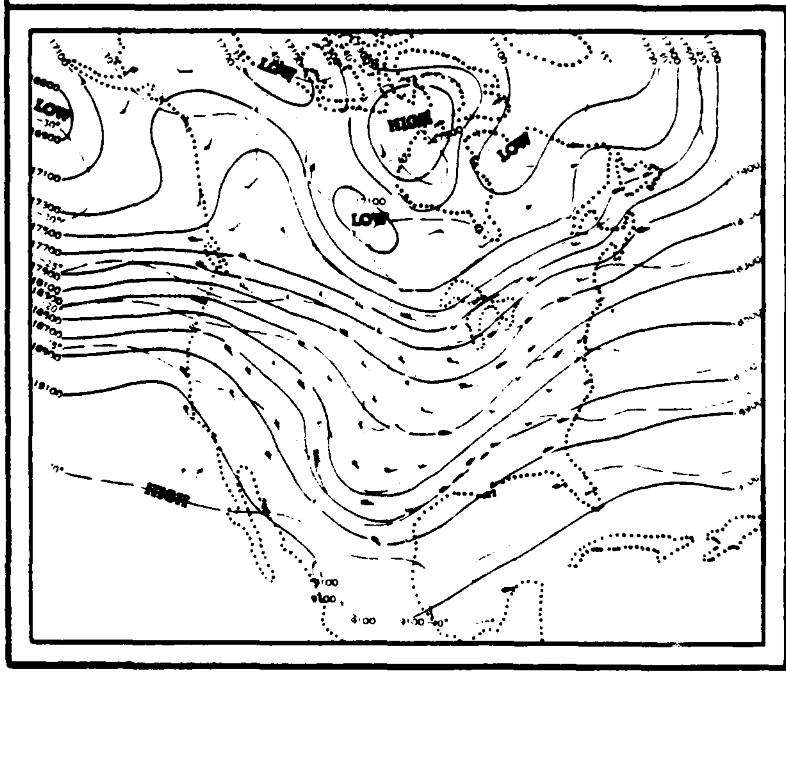
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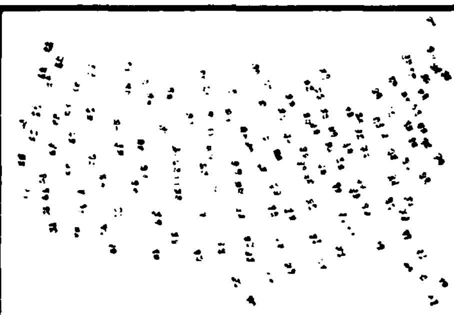

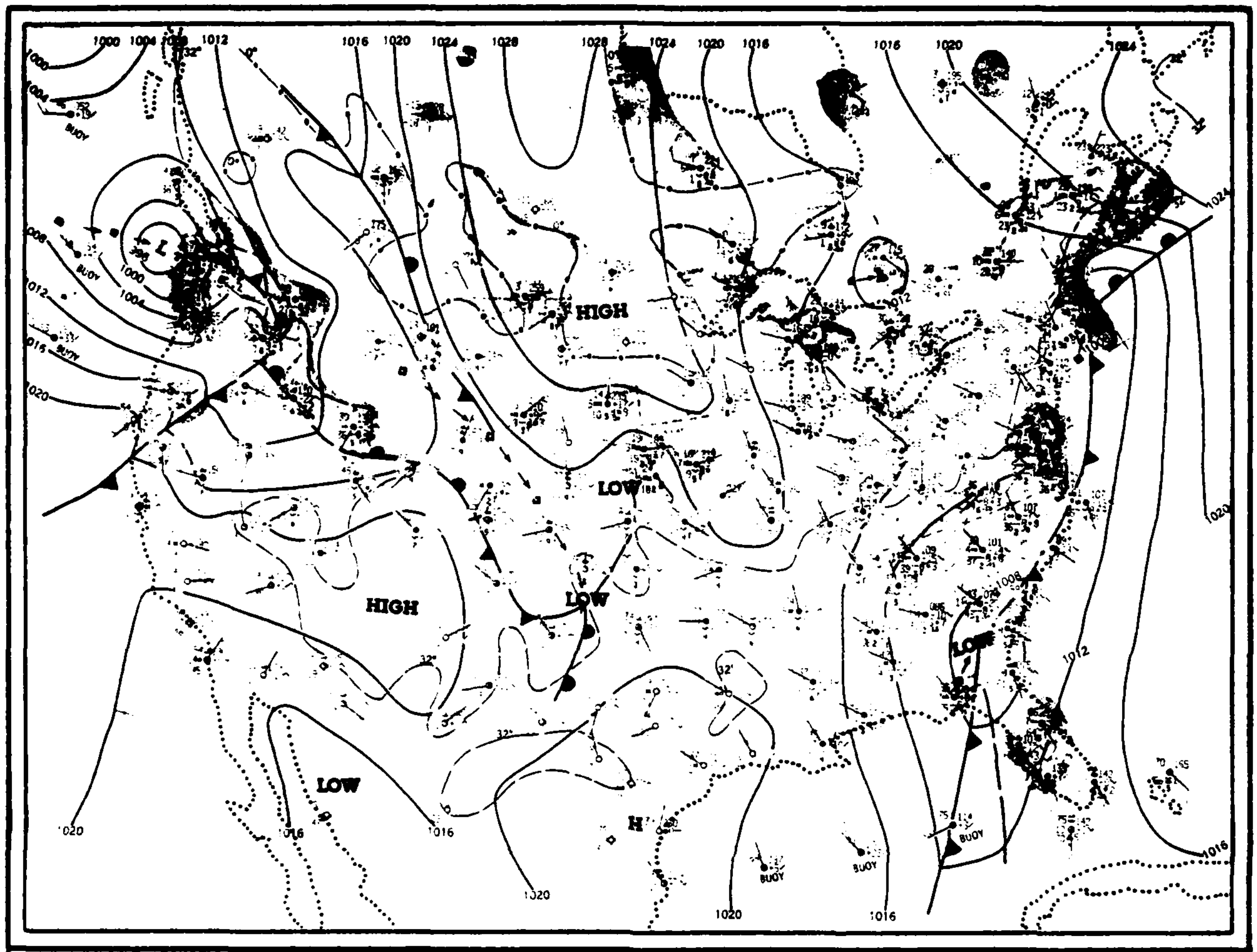
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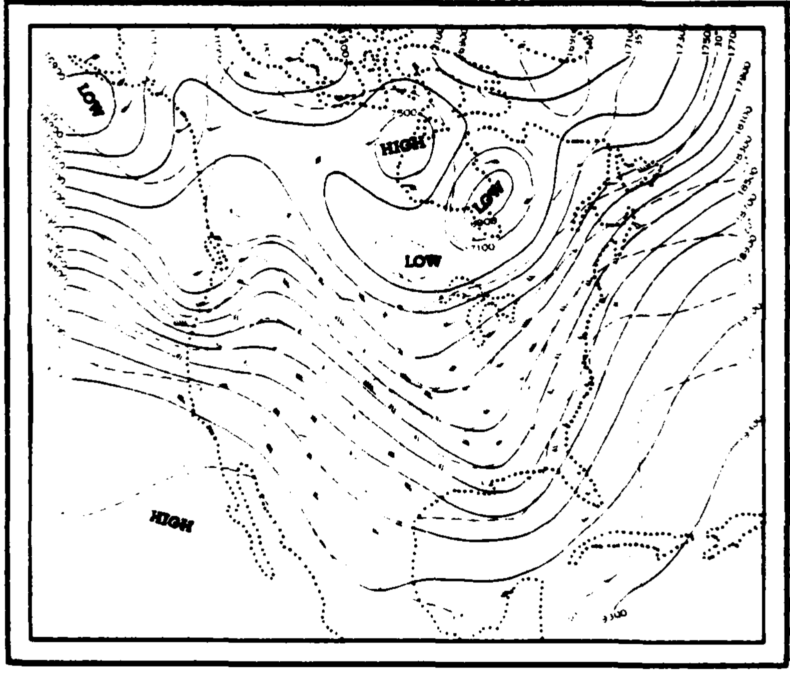
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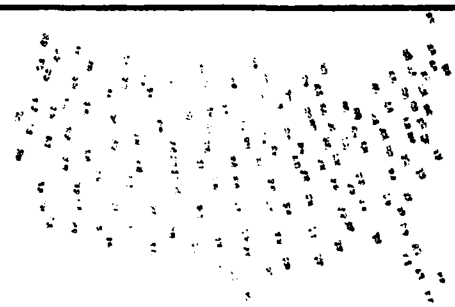


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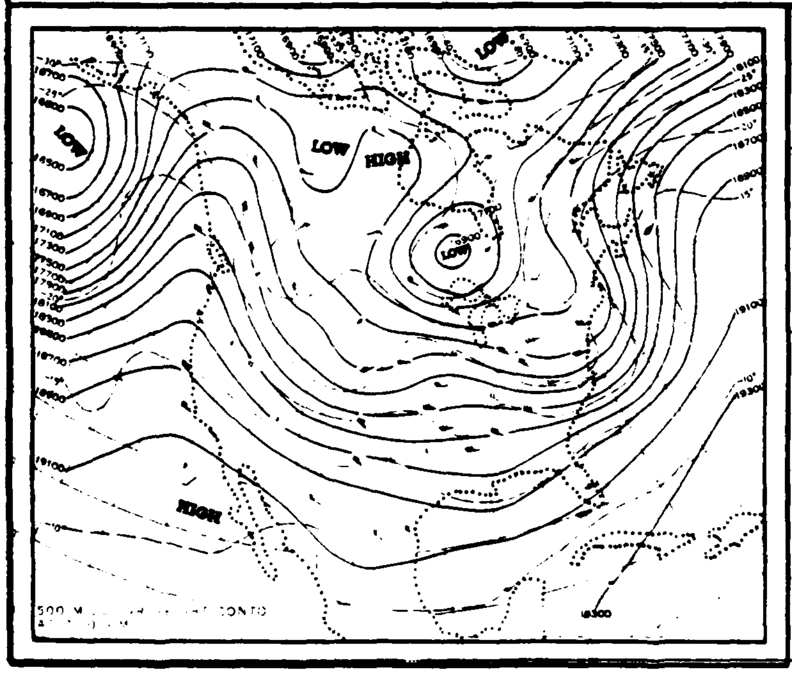
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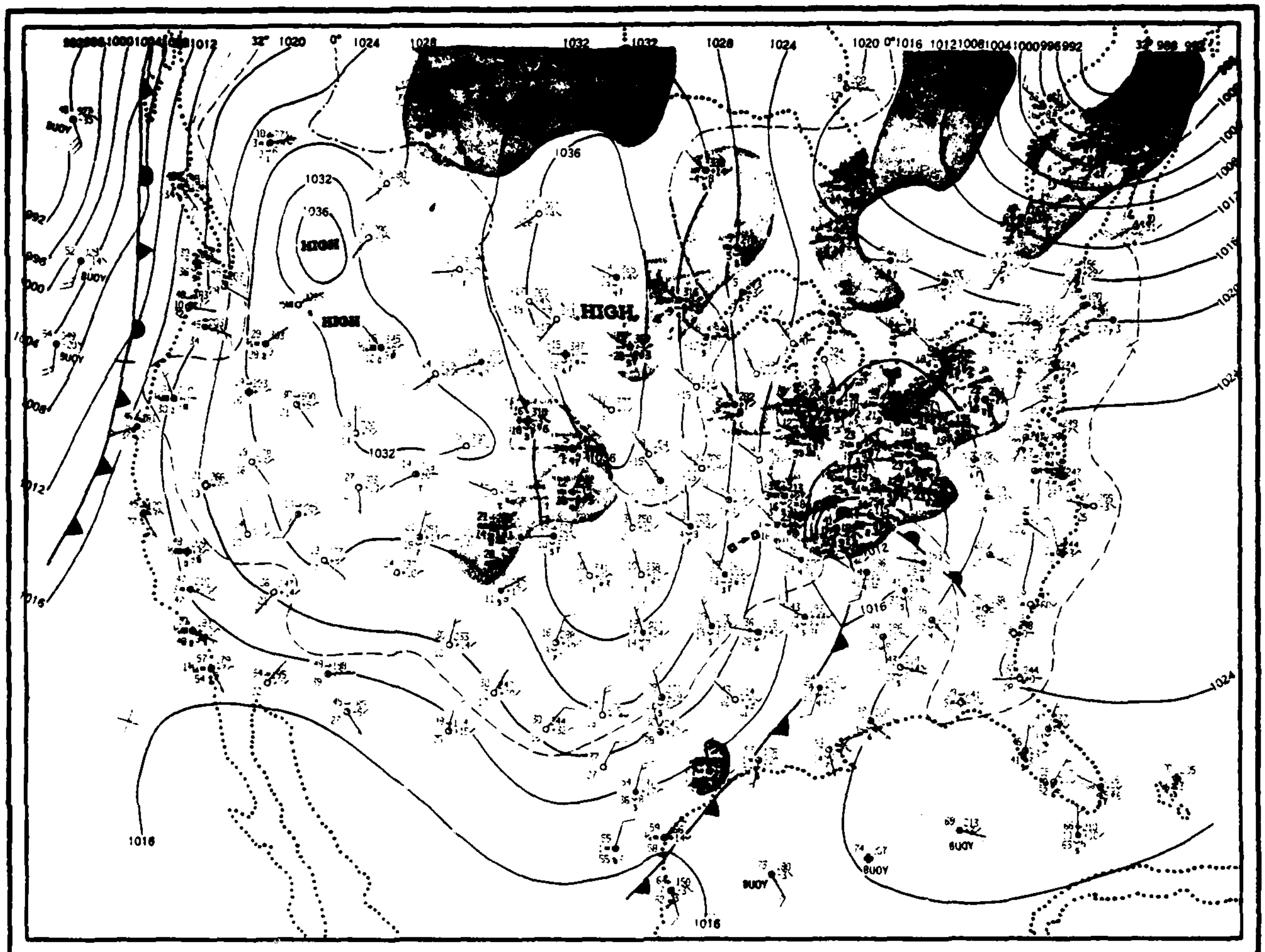
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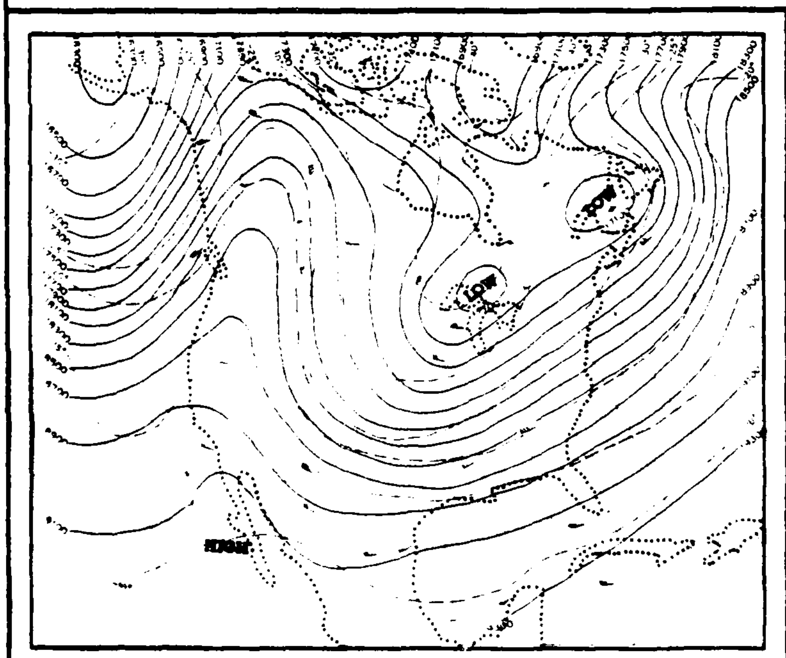
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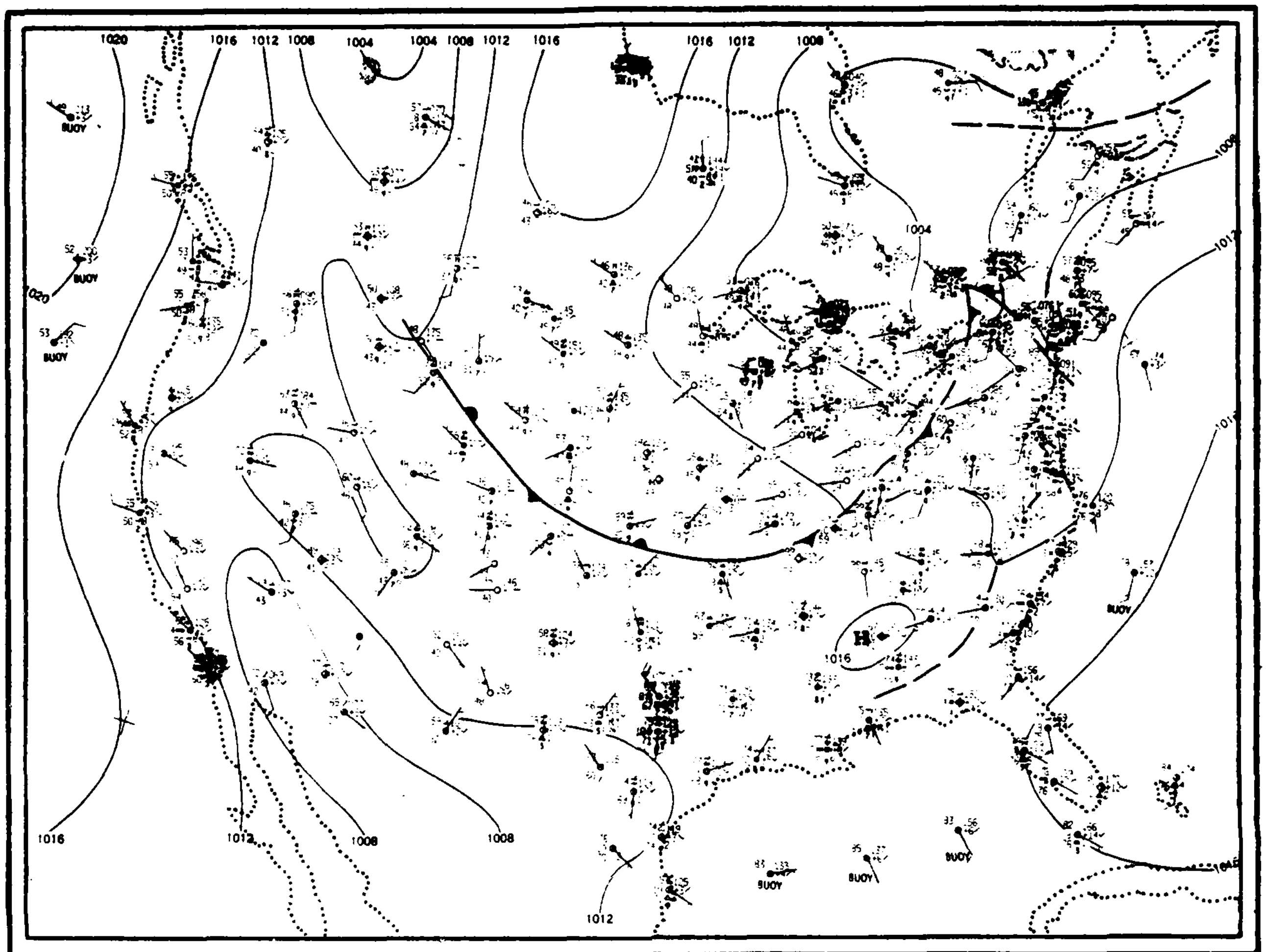
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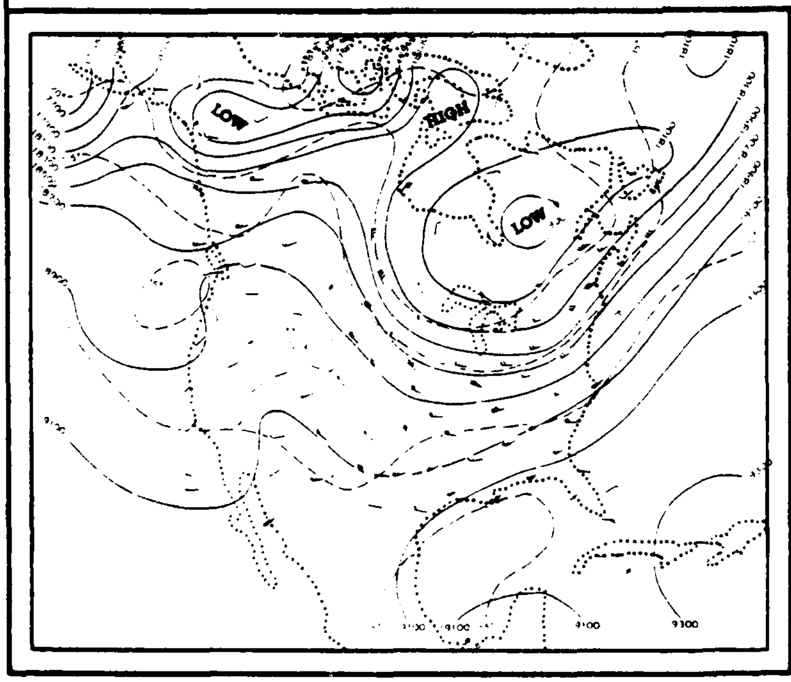
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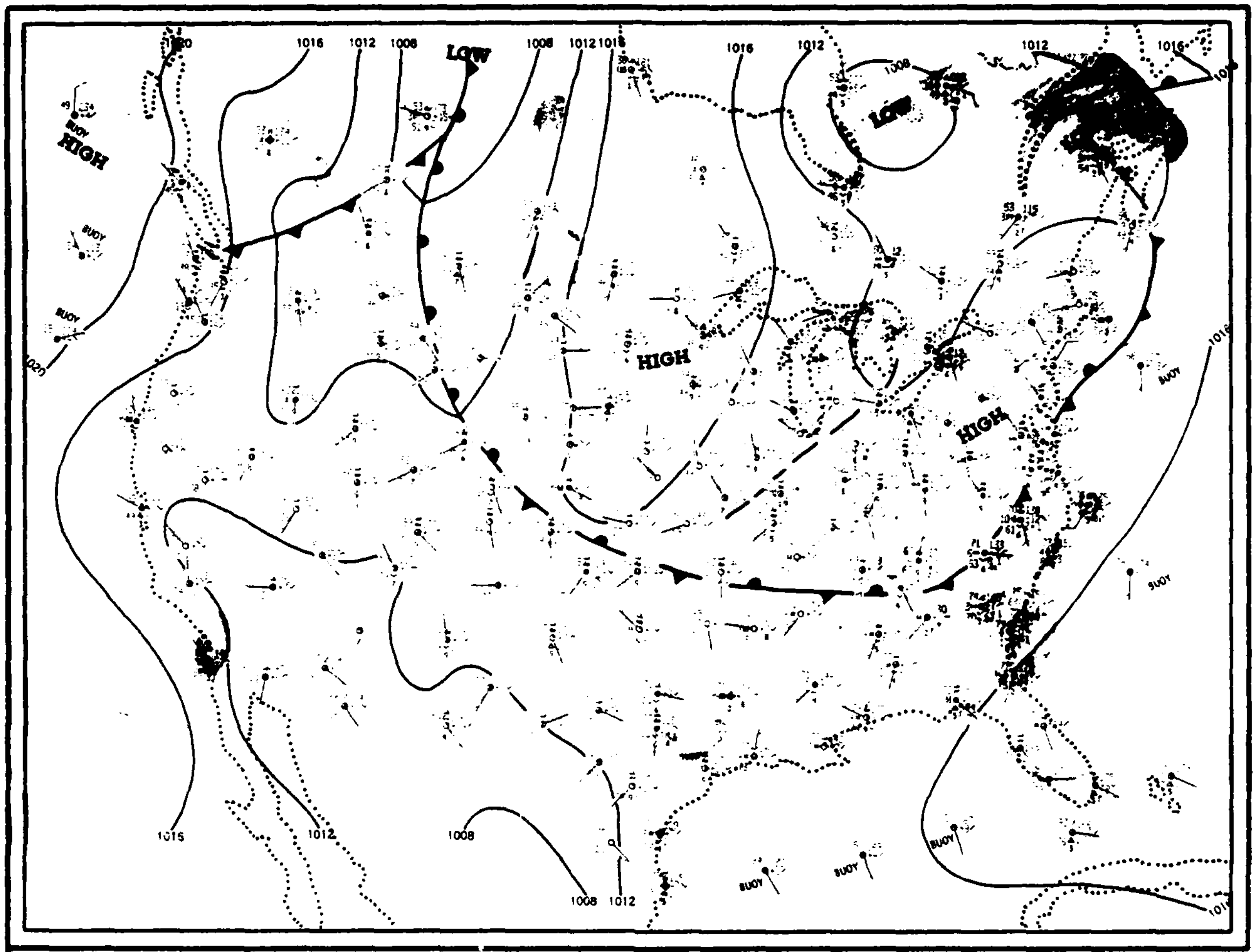
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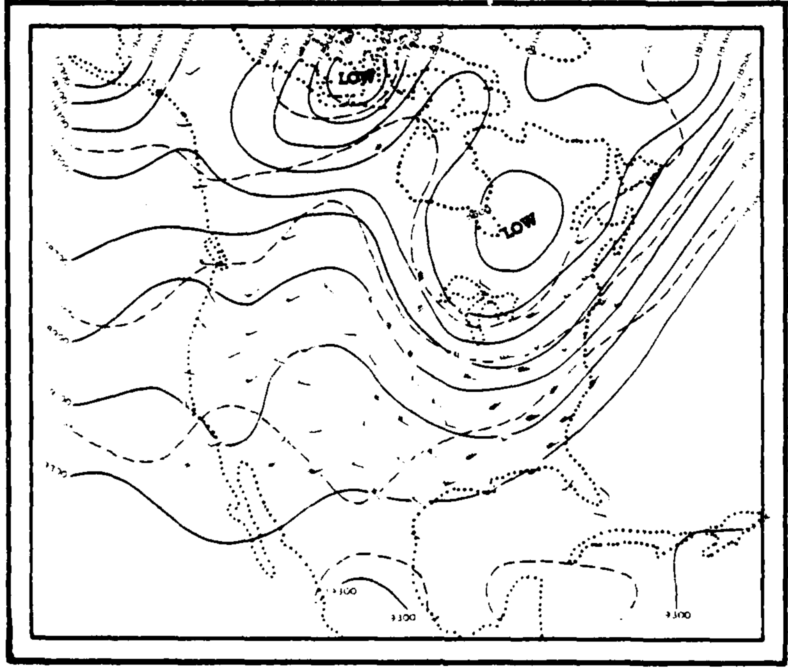
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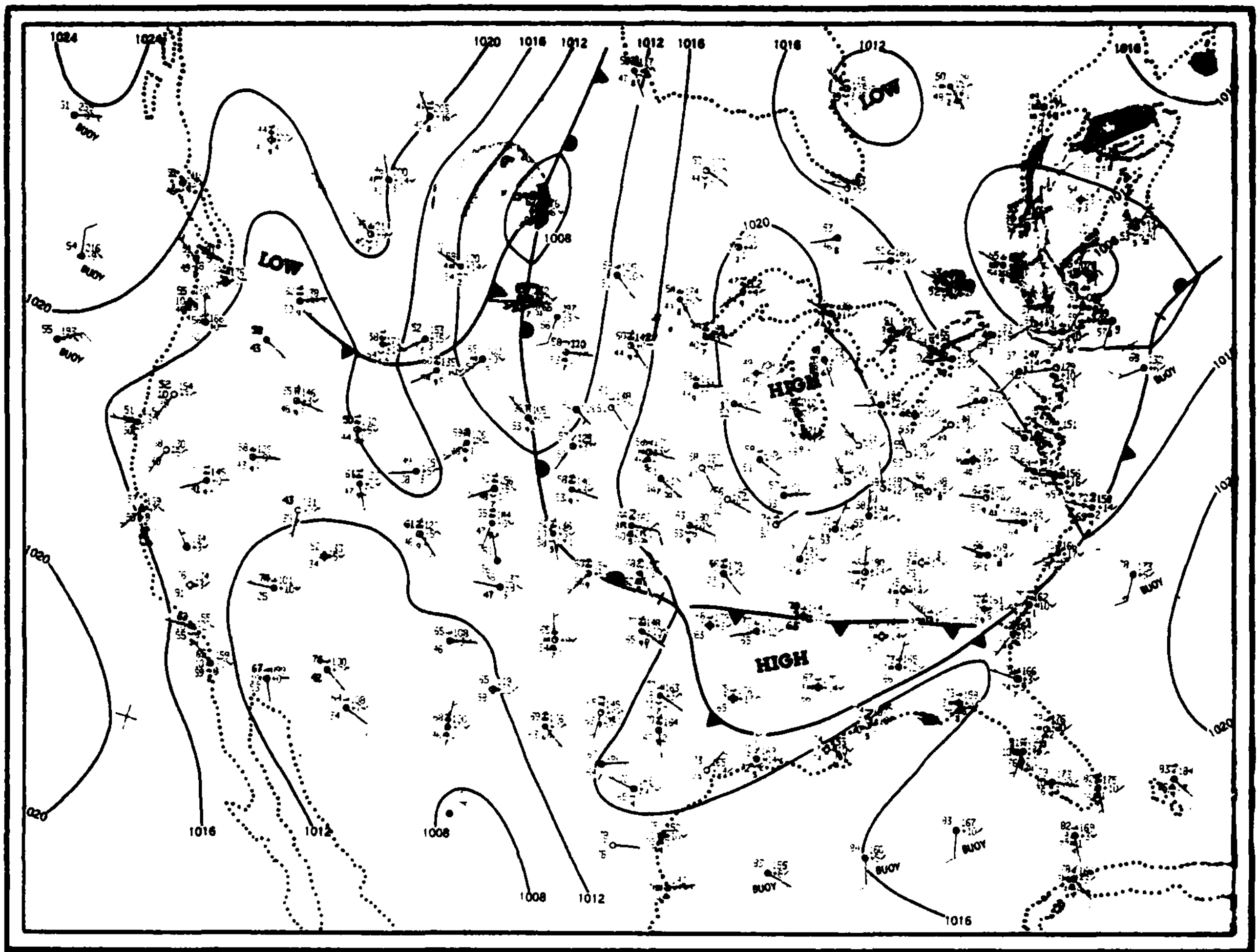
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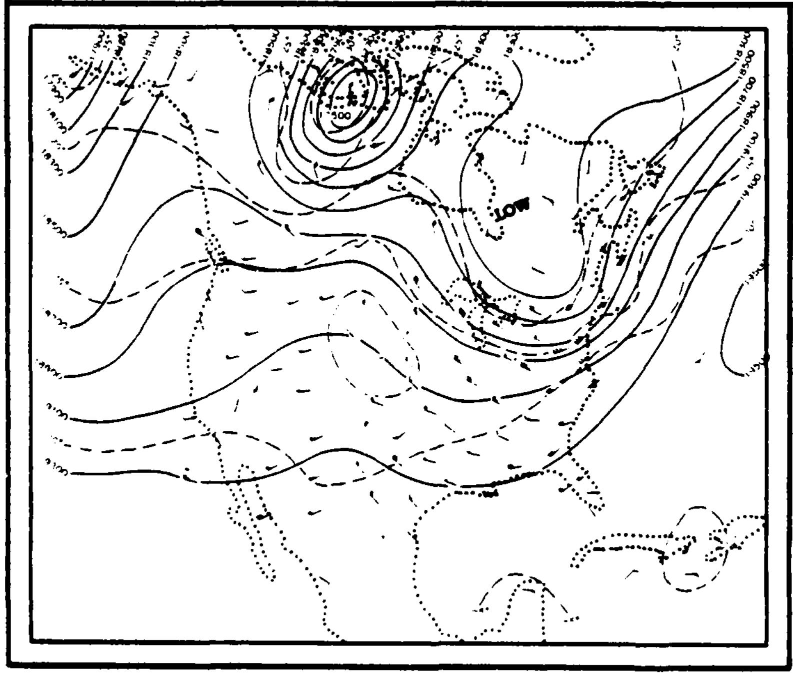
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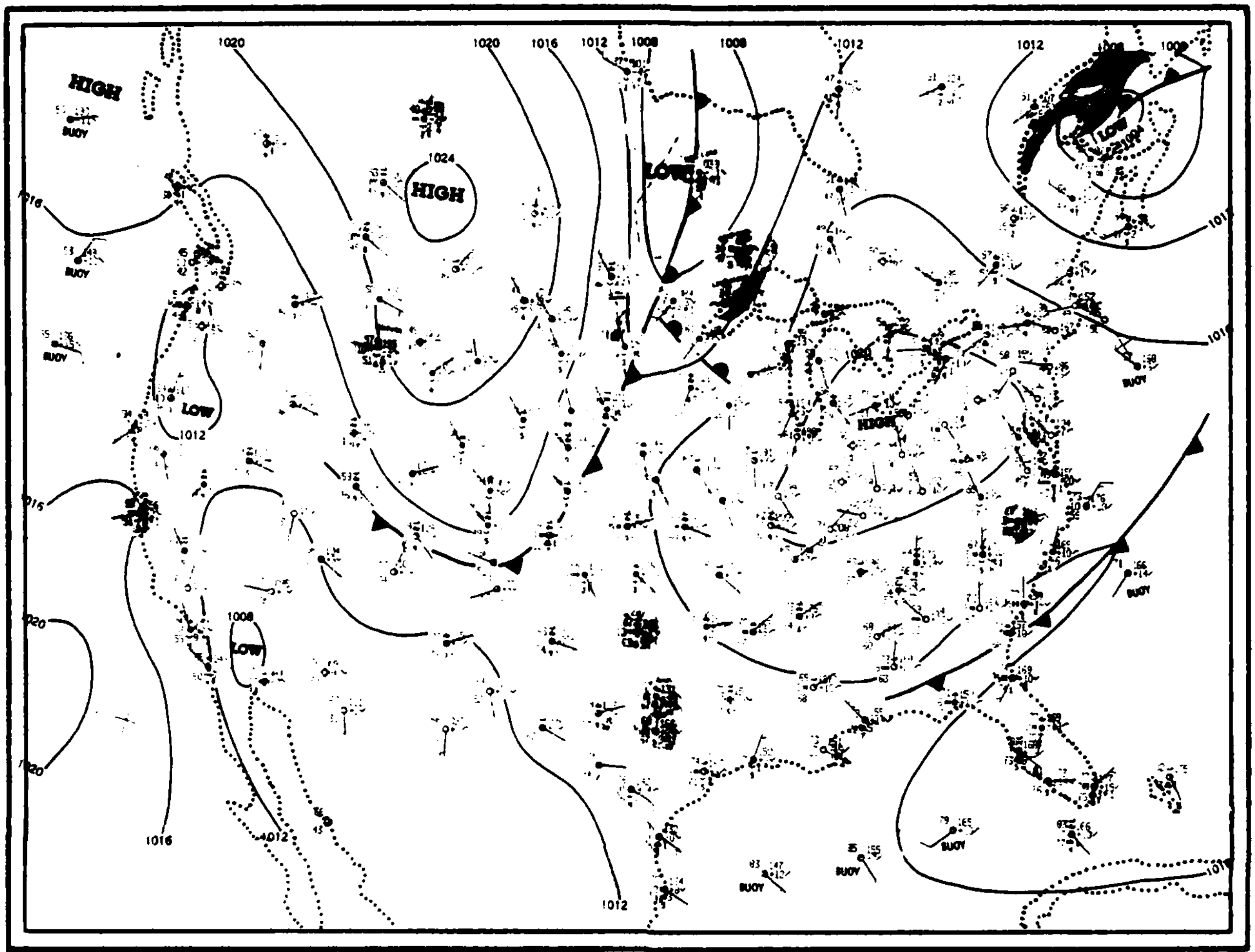
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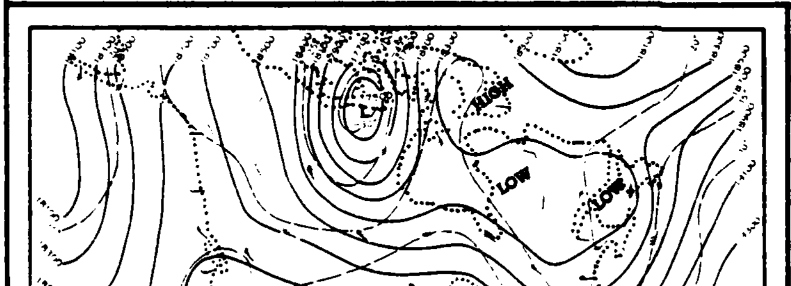
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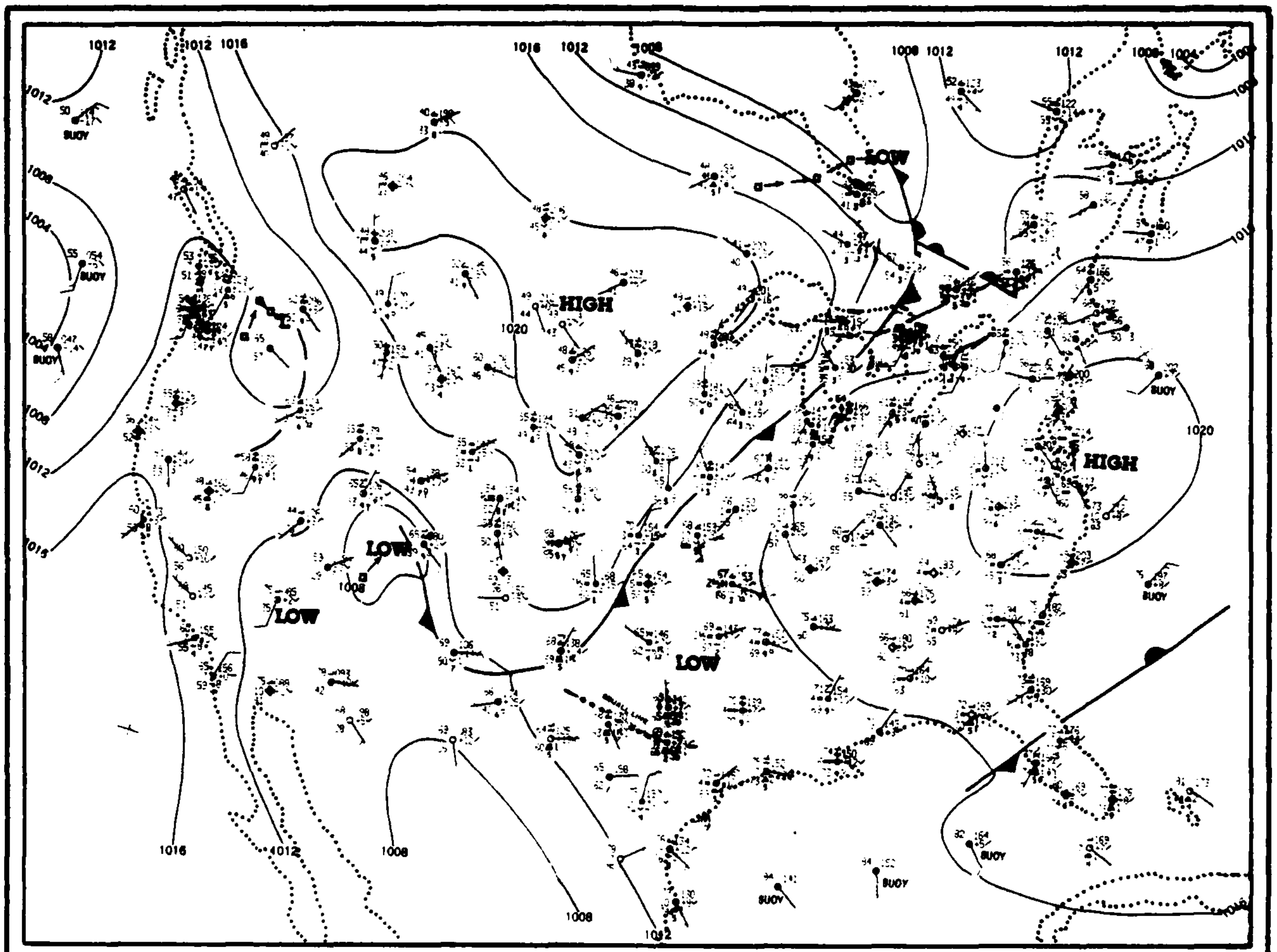
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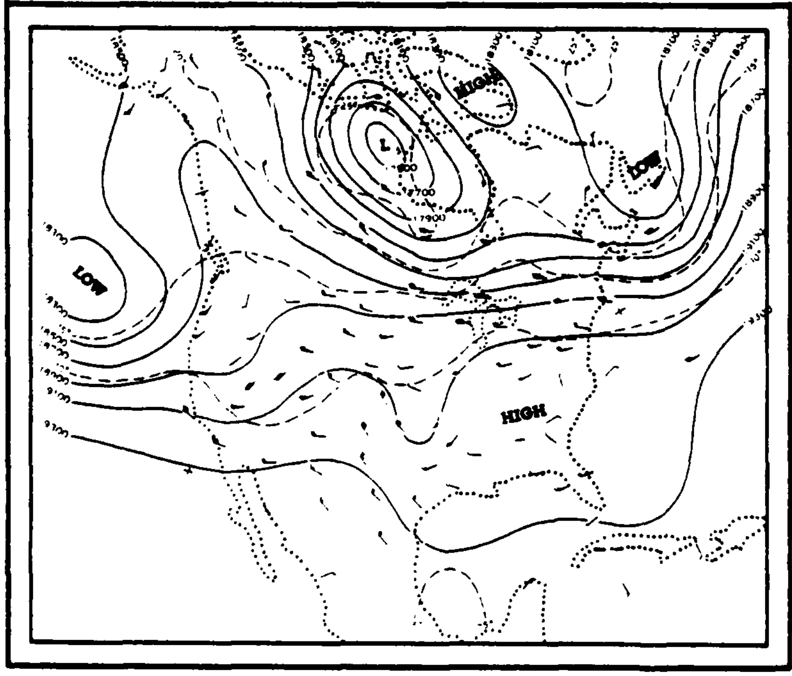
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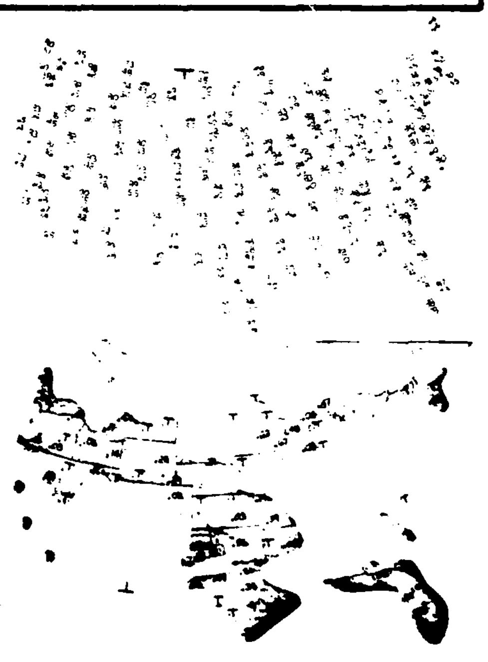

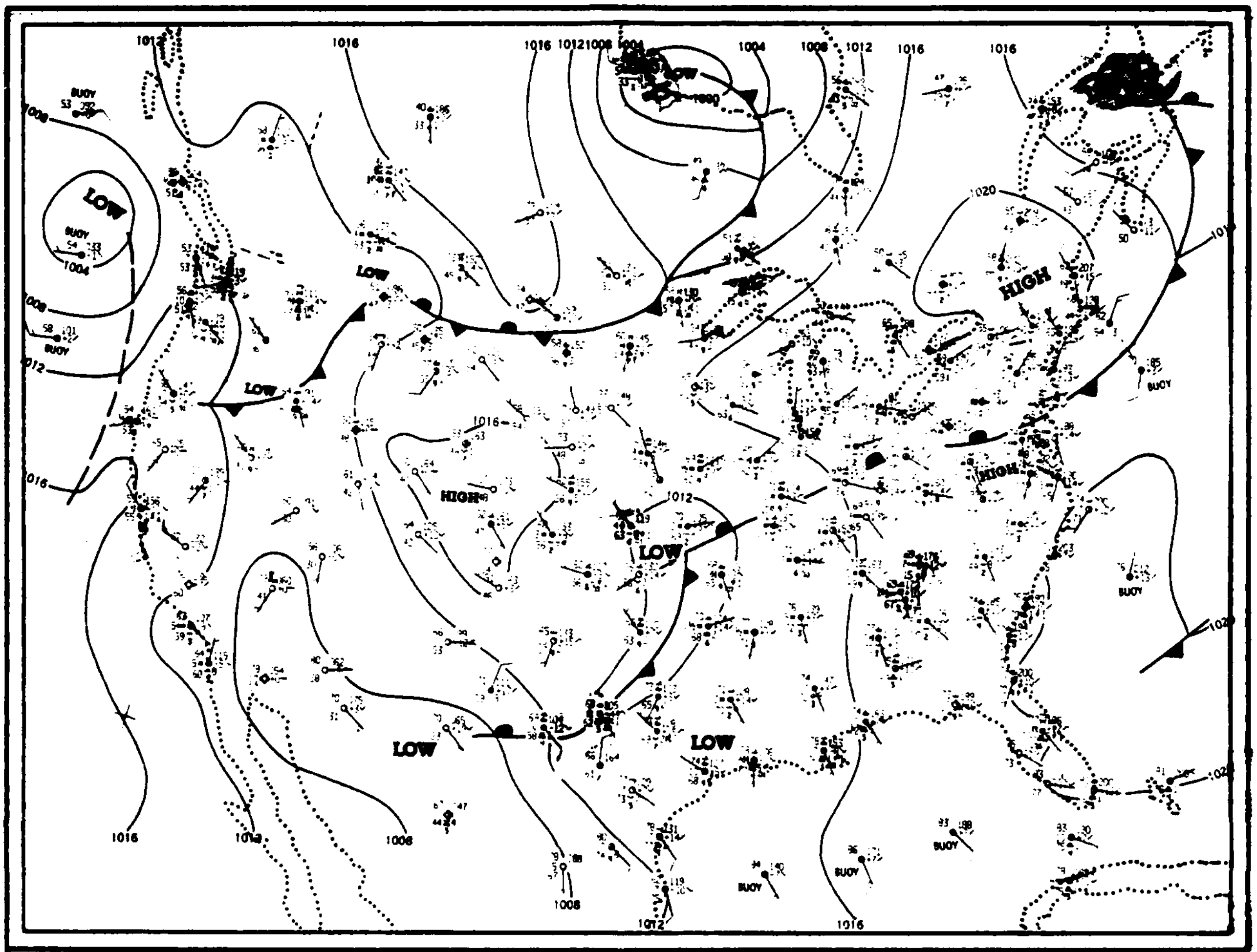
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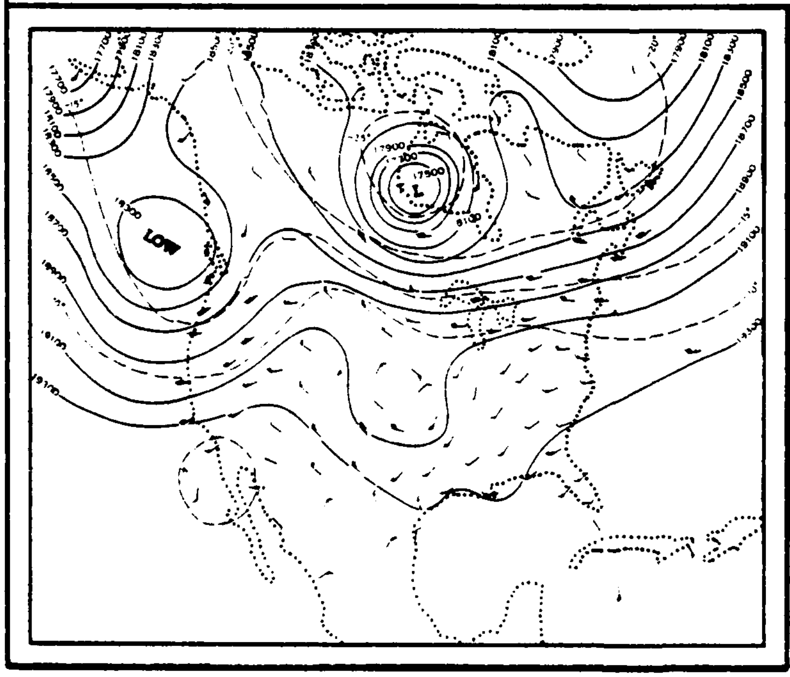
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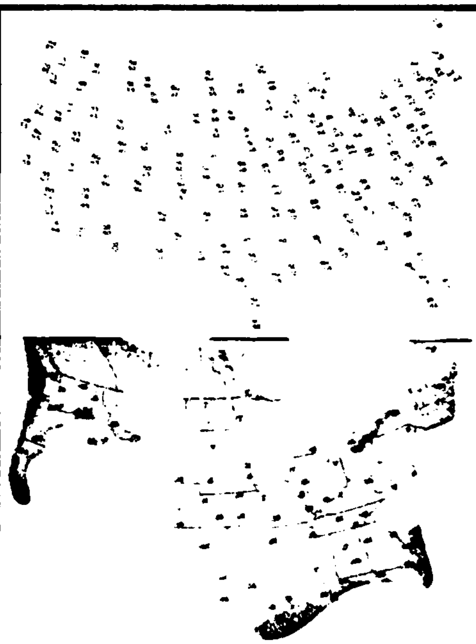

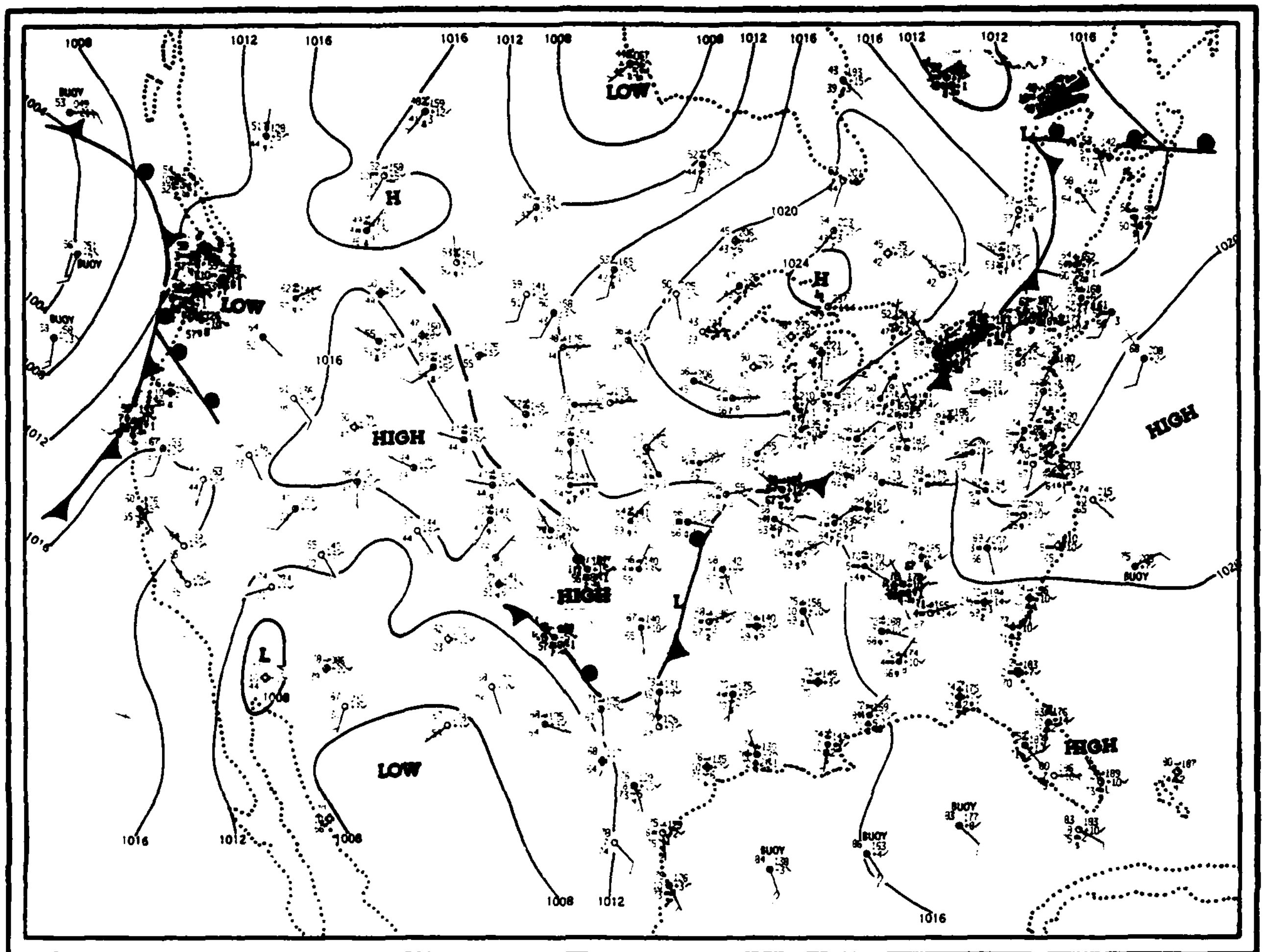
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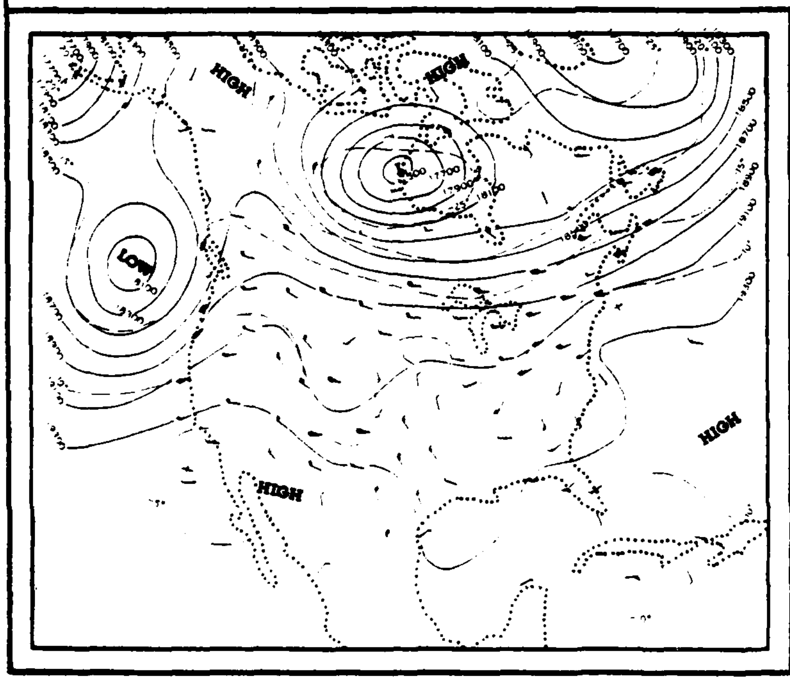
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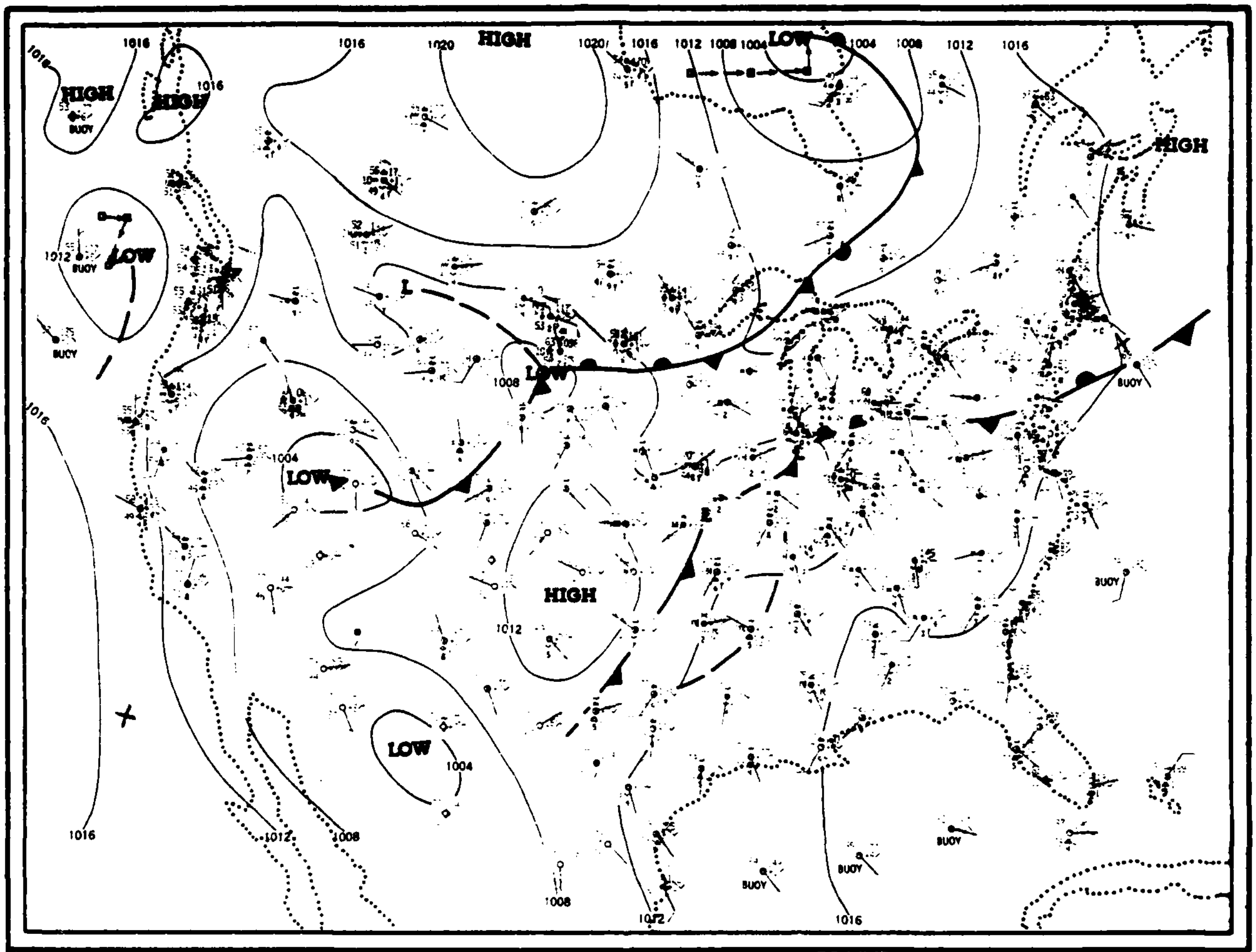
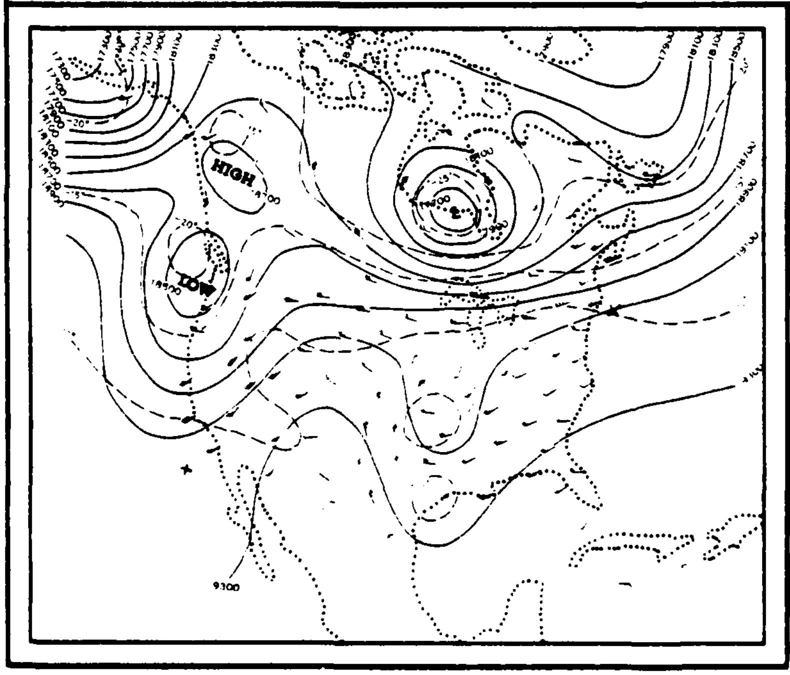
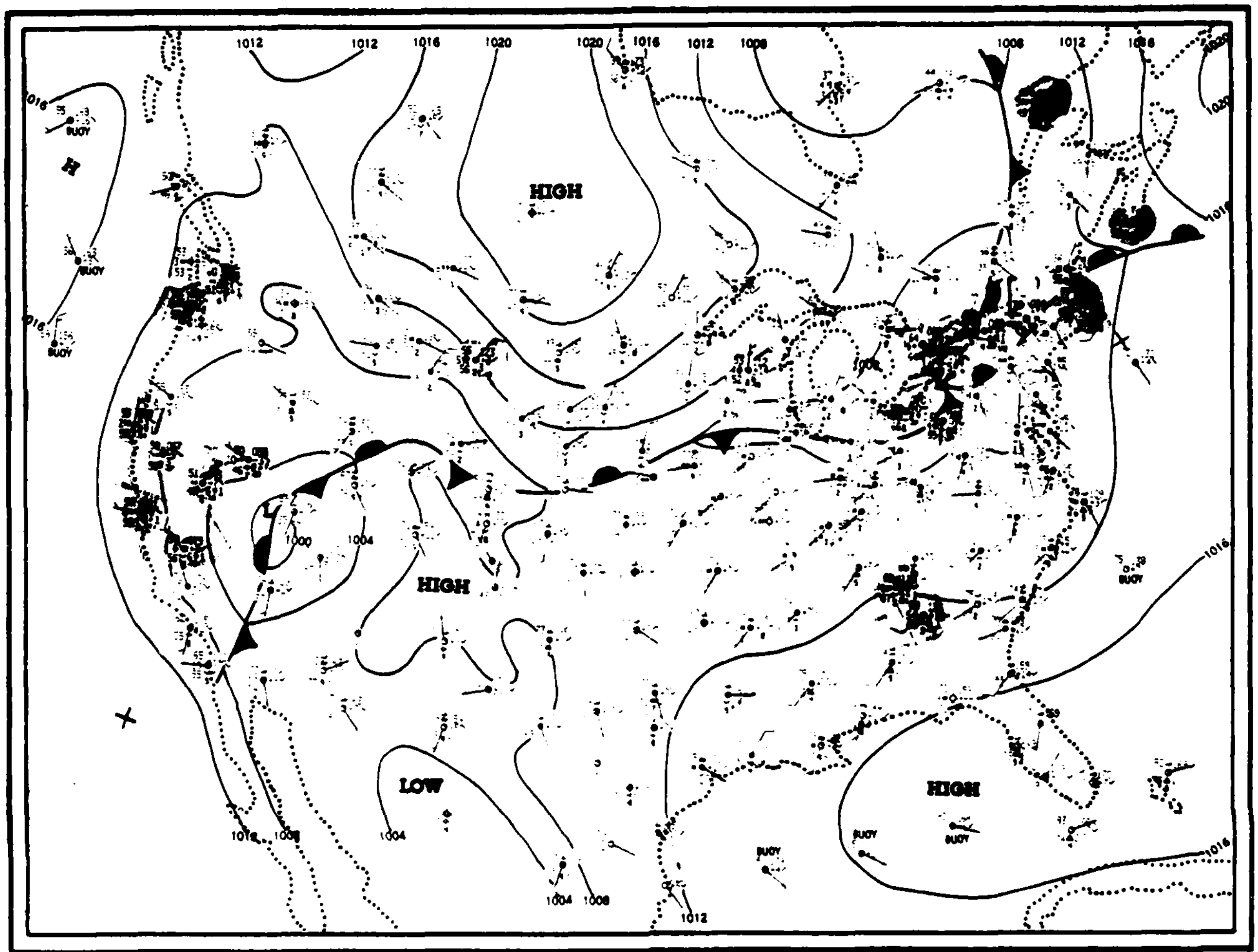
MONDAY, JUNE 28, 1982



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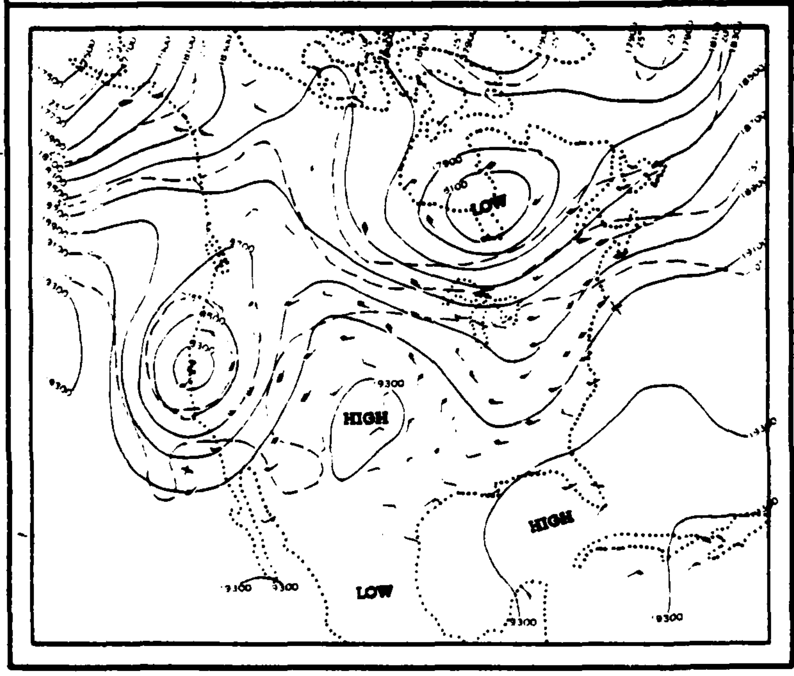
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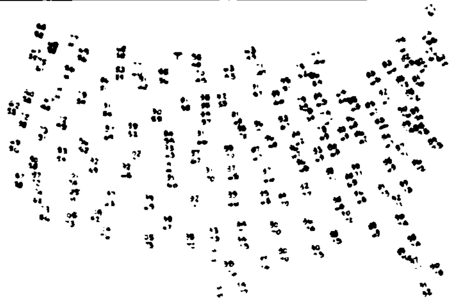

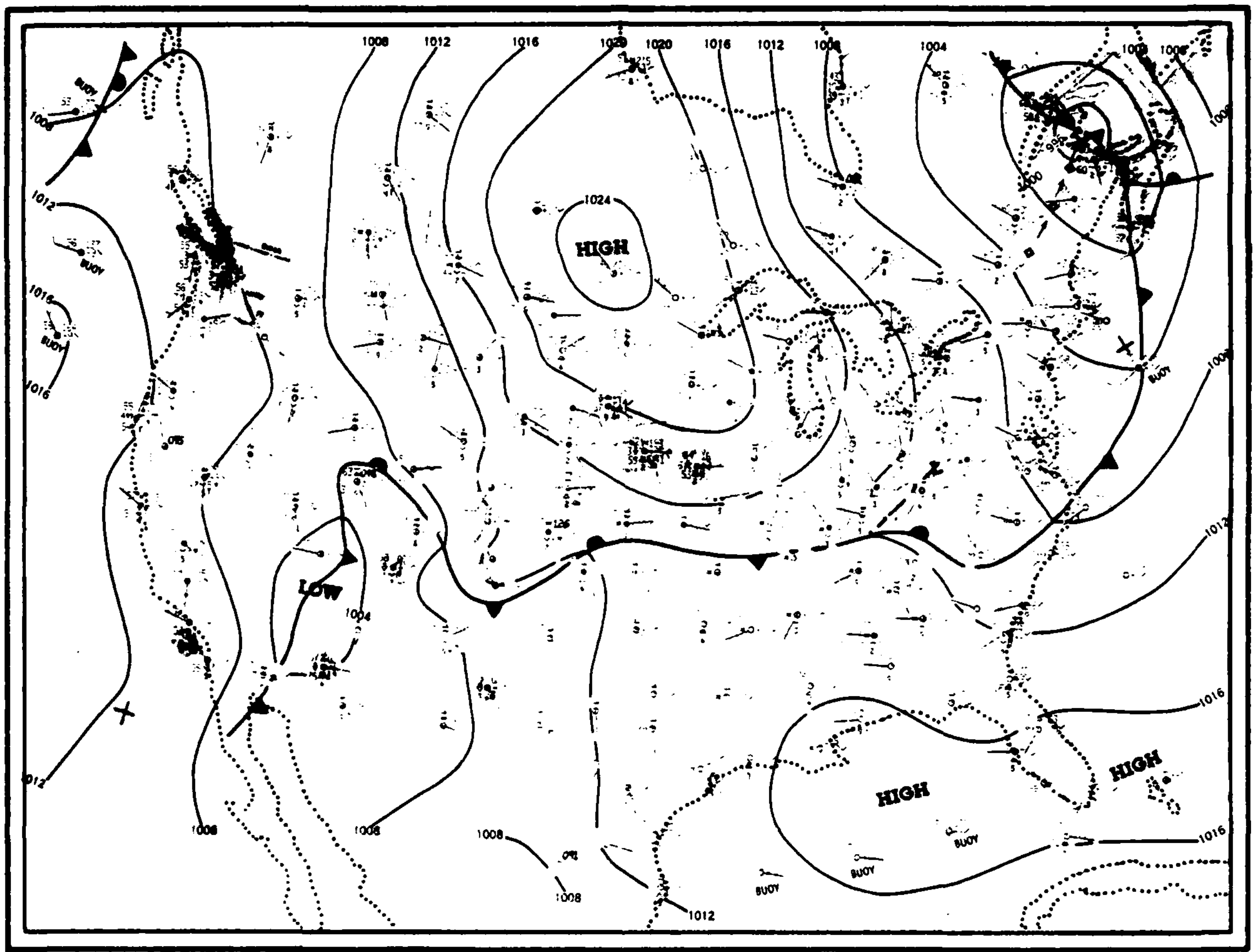
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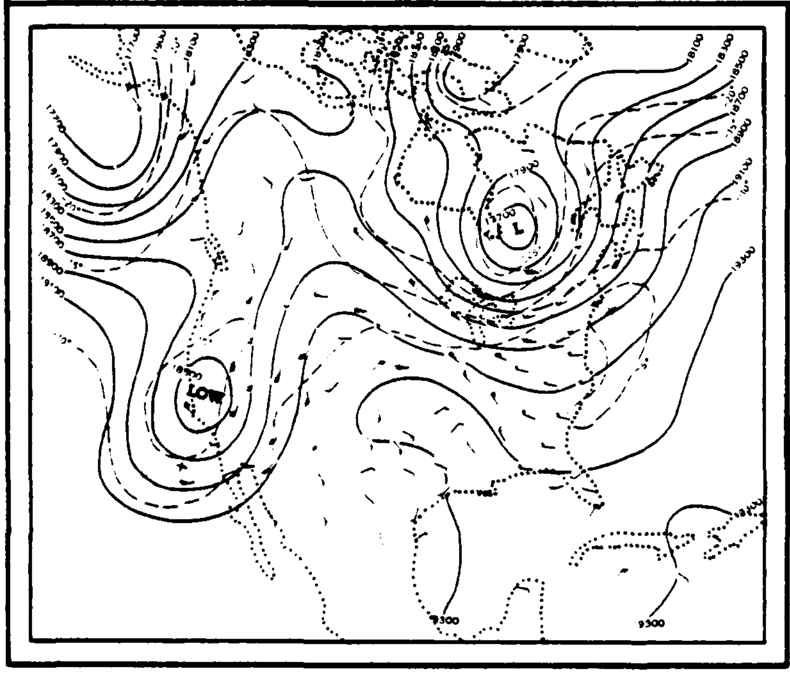
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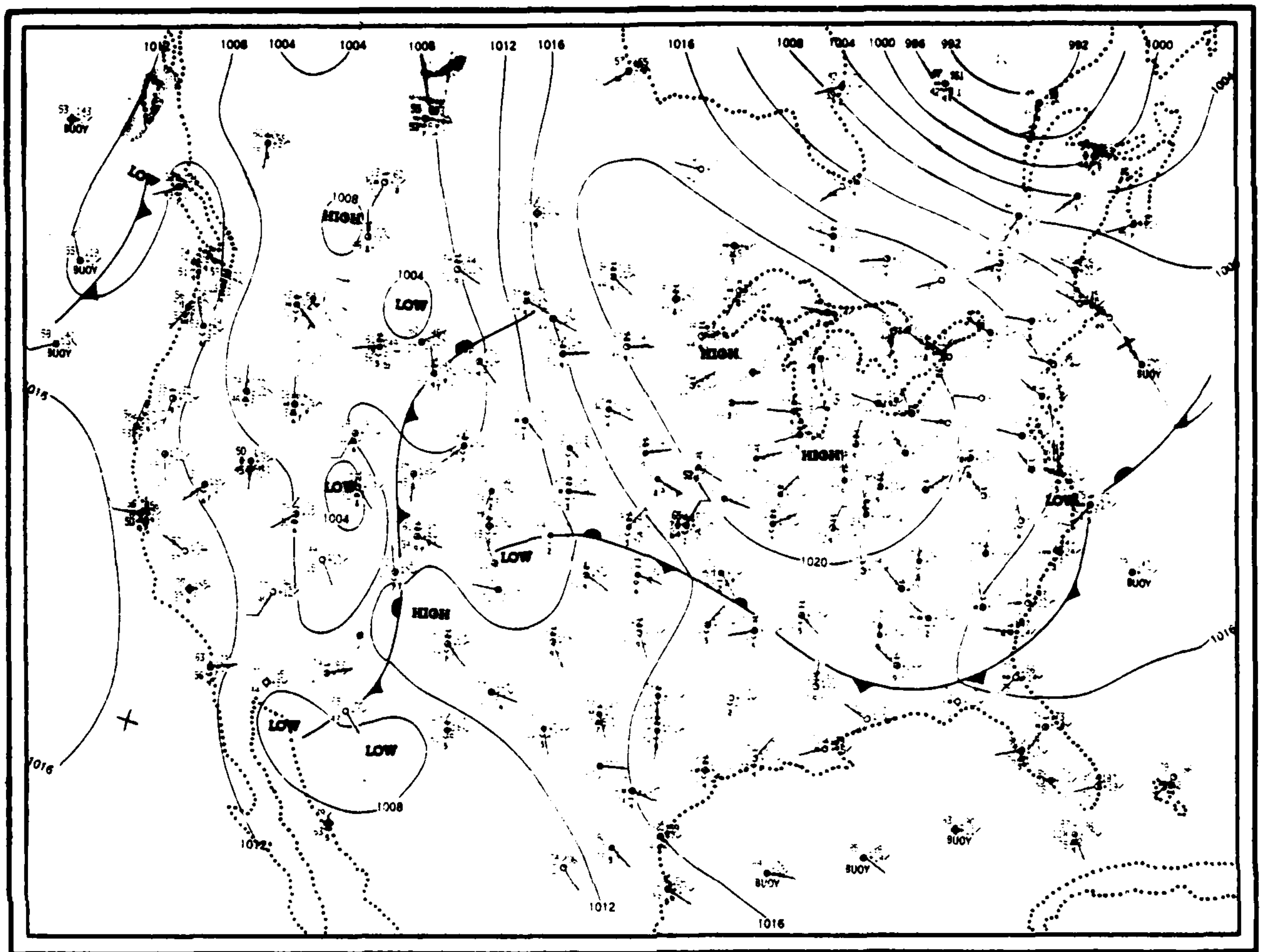
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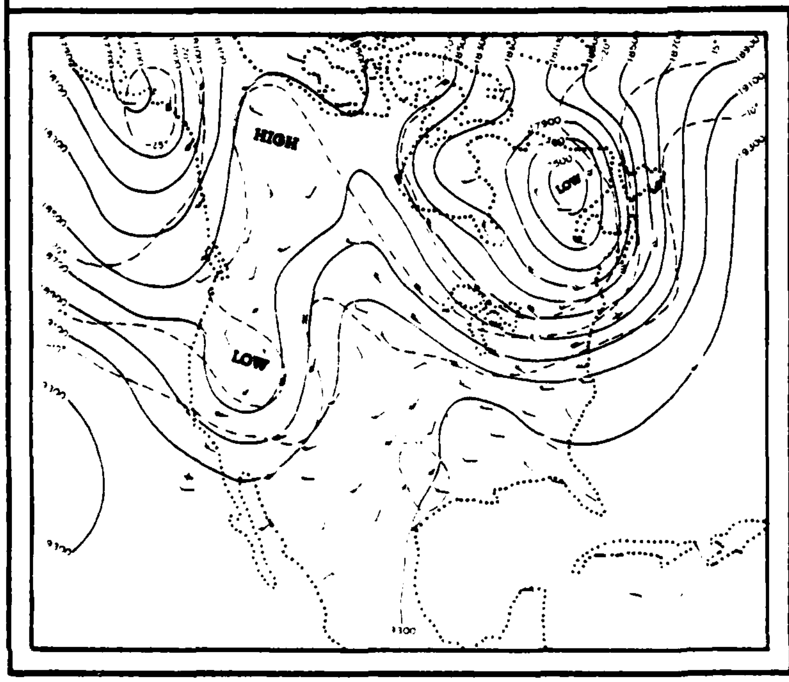
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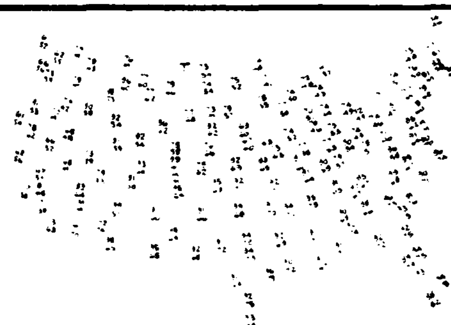

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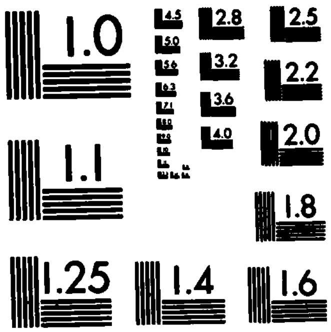
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