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Offshore transport and dispersion in the California Coastal Region-BLM III NPS data summary

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NAVAL POSTGRADUATE SCHOOL

Monterey, California

OFFSHORE TRANSPORT AND DISPERSION IN THE CALIFORNIA COASTAL REGION — BLM III

NPS DATA SUMMARY

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Environmental Physics Group

Naval Postgraduate School

Monterey, California

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The third in a series of tracer measurements of overwater transport and diffusion has been completed. This report includes the meteorological data obtained aboard the RV/Acania. Analyses of radiosonde data to yield mixed layer parameters for mixed layer assessment is also included.

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Table of Contents

List of Tables

List of Figures

I. Introduction

During December of 1981 the Environmental Physics Group of the Naval Postgraduate School (NPS) and Stanford Research International, (SRI), supported by the Bureau of Land Management (BLM), conducted the third of a series of transport and dispersion experiments in the California coastal region. The first two experiments were in the Santa Barbara Channel. The third and fourth experiments are being conducted near Pismo Beach, CA, which is representative of an open coastal location. The purpose of these operations is to perform offshore tracer experiments in order to parameterize dispersion models for the offshore regime and to build a data base for future model development. The purpose of this and previous data reports is to present the pertinent meteorological and source data for use by those who will be involved in the modeling effort.

Although the data gathered in these experiments have much wider application, they were collected for the specific purpose of parameterizing models that will be used to assess the onshore impact of offshore oil exploration and production sites. Such impact currently has great importance since many coastal areas are near the legal air pollution limit and any significant additional loading could push them over the limit. Air pollution models in current use have not been adequately validated for the overwater regime. Thus, BLM has undertaken this series of experiments to provide the data base needed for coastal overwater modeling.

During the tracer experiments, SF_6 gas was released from the ship RV/Acania and tracked by an aircraft and mobile and fixed stations on shore. Meteorological data was gathered on the ship and on the shore. This report contains shipboard meteorological data and gas source strength. Shore meteorological data and tracer results can be found in a report by SRI.

II. Operations Outline

The California coastal region experiences a strong land-sea breeze cycle during December. If the gradient wind is weak the cycle controls the local wind and the wind will be highly variable in the morning and evening hours. This means that care is required to place the ship in order to correctly target the tracer gas on the shoreline measurement network.

Beginning at 0800 of each day, the shipboard measured value of the wind was radioed to the shore command post every half-hour. These winds were compared to those on shore and when the wind began to come around to westerly the ship was moved to the proposed release location, usually about 1100. Wind reporting then occurred on a more frequent schedule, usually every 10 min. When the sea-breeze was established the ship was moved the short distance required to be at the proper position and the tracer gas release began as soon as the anchor was down.

Approximately one-half hour after the release began the aircrft arrived at the ship's position and made a sounding, spiraling upward. When the spiral was complete, smoke would be released at the ship to aid the initial positioning of the aircraft for plume transects.

Once the gas release began there was no way to reposition the ship if the wind changed. Pulling the anchor, moving, and reanchoring require approximately one hour. The loss of time, the need to restart shoreline one-hour average samples, and the definite possibility that the wind direction would change again in a variable wind situation preclude moving the ship.

There were times when shipboard operations interfered with collecting meteorological data. In order to indicate when such periods occurred, a list of shipboard events is presented below: (Times are $\pm$5 min)

12/6	0830	Underway from Monterey, sea-surface temperature sensor failed shortly after
12/8	1100	Finish repair of sea-surface temperature sensor
	1200	Start SF_6 release
	1700	Stop SF_6 release, remain at anchor
12/10	0915	Move ship to new location
	1400	Release scrubbed, drift, ship perpendicular to wind
	1645	Move ship and anchor
12/11	1200	Raise anchor, move ship to release position
	1225	Drop anchor
	1230	Start SF_6 release
	1850	Stop SF_6 release
	2010	Turn off all equipment
12/12	0900	Go to shore
12/13	0730	Back on station near release point, drift
	1135	Move ship to release point
	1150	Drop anchor
	1155	Start SF_6 release
	1855	Stop SF_6 release

12/15	1010	Move ship all over the place
	1040	Drop anchor and start SF_6 release
	1800	Stop SF_6 release
12/15	0735	Go to shore to get radiosonde balloons
	0855	Underway to release position area
	1055	Move ship to release position
	1115	Drop anchor and start SF_6 release
	1905	Stop SF_6 release
	2000	Go to shore
	2230	Begin obtaining background meteorological data, drift
12/16	0250	Move ship farther to sea, obtain data on wind structure
12/17	1400	Turn ship north
	1920	Stop ship off Pt. Sur to wait for fog, drift
12/18	0035	Turn ship into wind
	0310	Full speed to Monterey Bay
	0610	Turn ship into wind
	0700	All equipment off, head for home

III. Meteorological Measurements and Calculations

Extensive meteorological measurements were made on the RV/Acania in order to obtain as complete a characterizaation of the boundary layer as possible. Detailed descriptions of the equipment and calibration procedures can be obtained from NPS.

A mast on the bow held a measurement station at 7 m above mean sea level; a second station at 20.5 m was on a mast placed 5 behind the bow. The lower level experiences some ship influence m while the upper is relatively uninfluenced. For this reason only data from the upper station is used, lower station data being used only in the event of the failure of a sensor on the upper. At each station the following parameters were measured:

relative wind speed

relative wind direction (upper level only)

air temperature (T)

dew point temperature (T_D)

wind speed fluctuation

Other parameters which were measured or observed were:

sea surface temperature (T_S)

ship roll

ship pitch

ship location

inversion height (Z_i)

temperature and humidity profiles to 500 mb

sky cloud cover

The temperature and humidity profiles were obtained by shipboard radiosonde launch and were taken every 12 hours. The temperature inversion height was determined by an acoustic sounder which gave a continuous strip chart record. Most data listed above was averaged for one half hour intervals. The exceptions were relative wind speed and direction and ship's pitch and roll, for which 10 sec averages were obtained and recorded for the full period of a gas release.

Data acquisition is computer controlled, and the computer calculates a number of boundary layer properties at the end of each one-half hour period. These parameters are:

Friction velocity ($U*$)

Scaling temperature ($T*$)

Scaling water vapor mixing ration ($q*$)

Stability parameter (Z/L)

Virtual potential temperature flux (Q_o)

Convective mixing velocity ($w*$)

Convective mixing time (t)

Relative humidity (RH)

True wind speed and direction (U, WD)

Horizontal wind direction standard deviation (σ_θ)

Turbulence kinetic energy dissipation rate (ε)

All of these parameters are one-half hour averages. Shorter term averages of the wind speed and direction and their variances are obtained by calculations that are made subsequent to the experiment.

IV Tracer Release Data

In all cases, the tracer gas was released at ambient temperature from a height of 13m above mean sea level. Three SF_6 bottles were attached to a heated manifold and gas from two of the bottles was released simultaneously. Releasing from two bottles decreases the expansion rate and prevents the cylinders from icing. The output of the manifold went to a rotometer and a valve which was used for flow setting and coarse monitoring. A calibrated mass flow meter which was supplied and monitored by SRI was used to accurately determine the flow rate.

The dates, times, and locations of the tracer experiments are found in Table 1. Bottle weights and weights of gas used are found in Table 2. Flow rates are found in Table 3.

Release	Date	Latitude	Longitude	Start Time	End Time
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

Table 1. Location and start and end times for tracer gas releases. Times are Pacific Standard.

Bottle Number	Initial Weight	Weight (lbs) after release Number #1	#2	#3	#4	#5
3	255	161				
11	252.5			147.5		
12	259	166				
13	260		164.5			
14	254	144				
15	259				137	
16	258					143
17	252			148		
18	256		161			
19	256					143.5
20	254	____	____	____	134	____
Total Weight Released		297	190.5	209	242	227.5

Table 2. SF_6 bottle weights before and after the releases and total weight used. Weights are accurate to ± 0.5 lbs.

Release Number	Weight Used (lbs)	Total Time (hrs)	Flow Rate (lbs/hr)
1	297	5.00	59.40
2	190.5	6.33	30.09
3	209	7.00	29.88
4	242	8.33	29.05
5	227.5	7.75	29.25

Table 3. Average flow rates (lbs/hr) for the five tracer gas releases. Rates are determined from total weight used and elapsed time.

V. Wind Histories

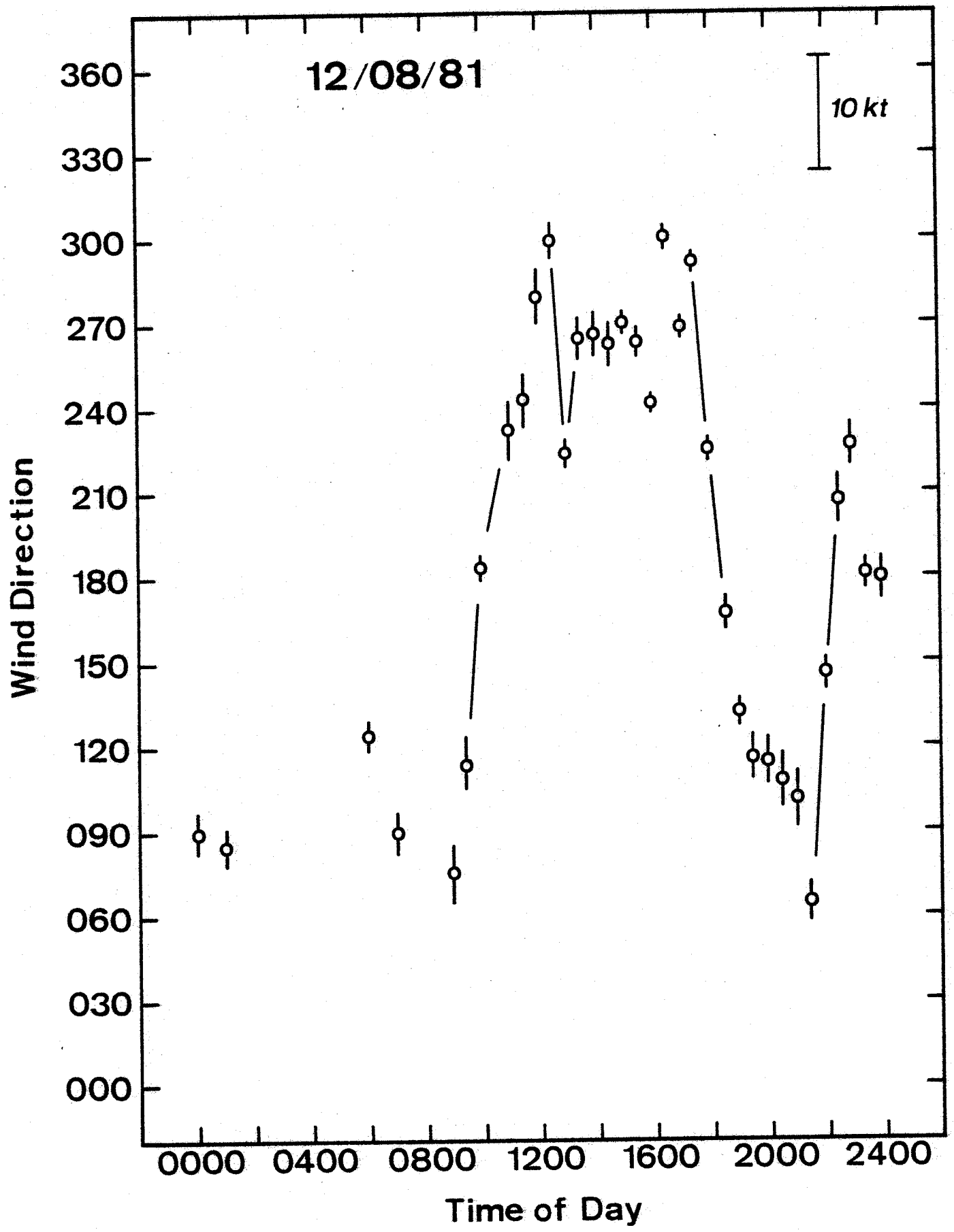
Winds were recorded on the RV/Acania in two ways: 1) Before and during each tracer release, instantaneous wind readings were obtained and reported every 10 min. These were recorded every hour on the weather observation log; 2) Average winds, usually over one-half hour periods, were acquired by the data acquisition computer. The instantaneous determinations were plotted on shipboard and used to aid in the go/no-go decisions for a tracer release.

The wind histories are plotted in Figures 1. The wind directions are plotted on the figures and the speed is indicated by the length of the bar. These data are mainly one-half hour computer averages, supplemented by instantaneous observations when the averages were not available (such as when moving the ship to the release point).

The figures show clearly the land/sea-breeze changeover that occurred during the late morning. On days when the change occurred the window for testing (during times of westerly winds) was from approximately 1200 to 2000. Note that the wind direction axis is not the same on all graphs. This was done so that each graph could be a continuous plot.

Following Pages

Figures 1 - Wind histories: true wind direction versus time, wind speed indicated by length of the vertical bars. Data is mainly one-half hour averages.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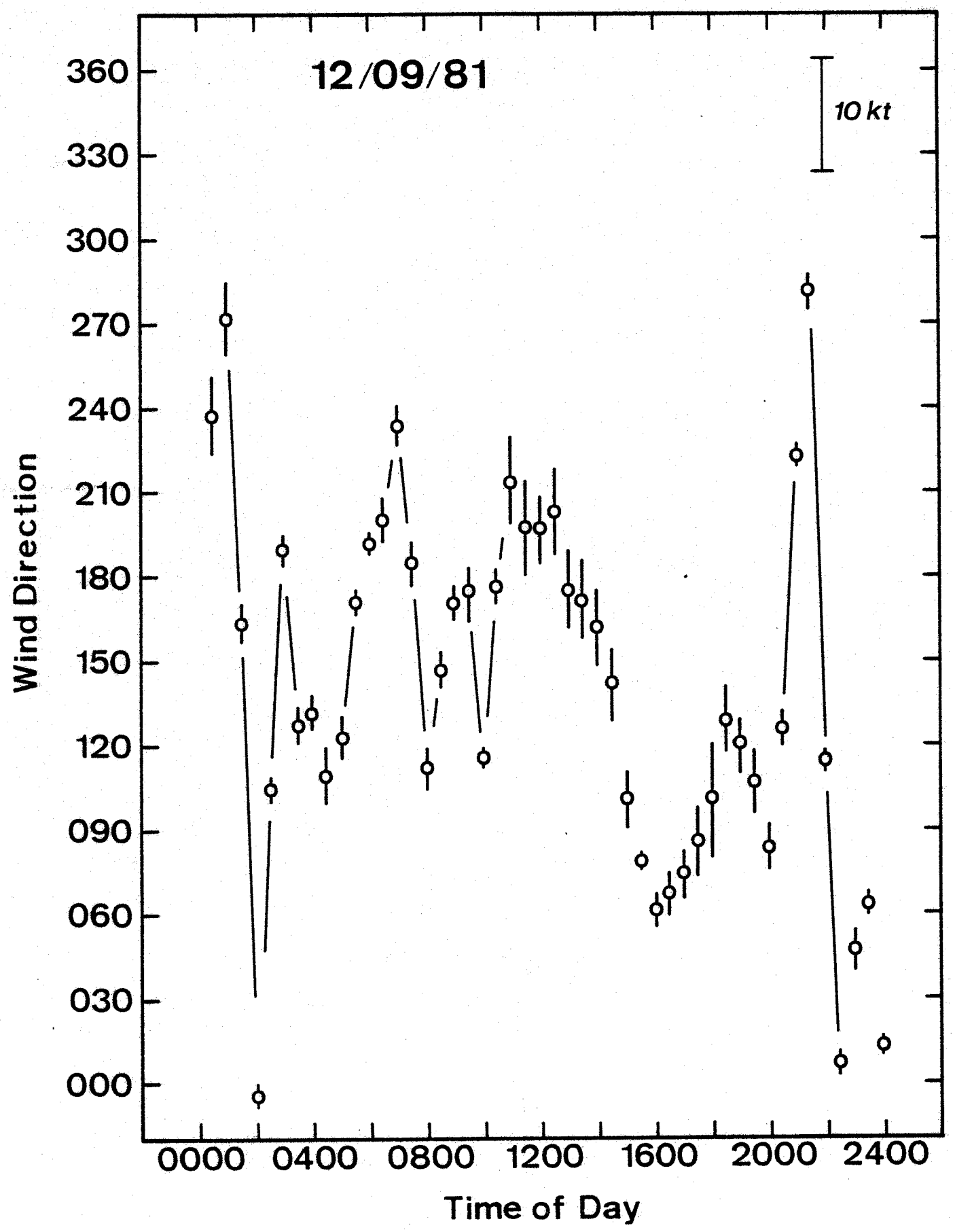
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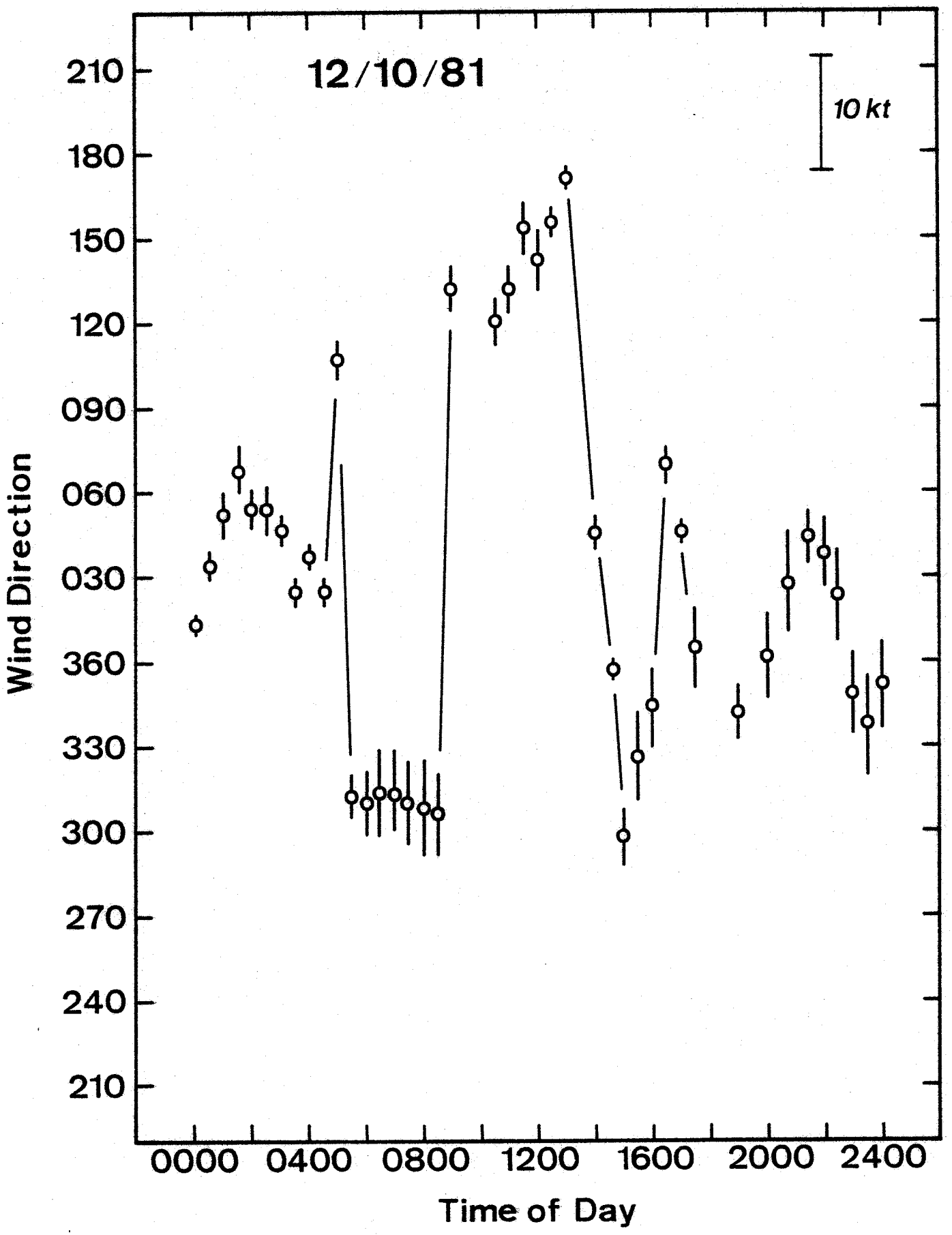
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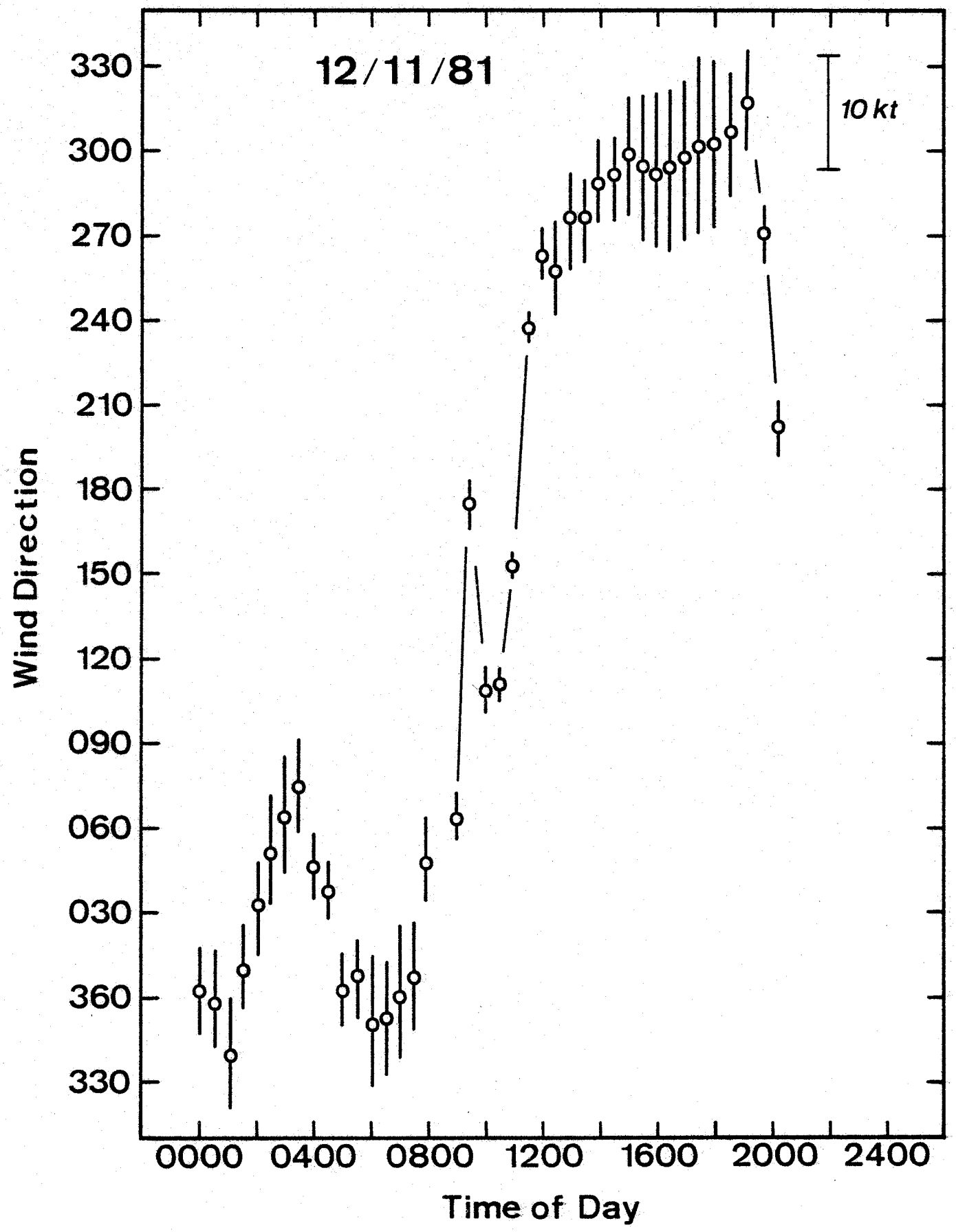
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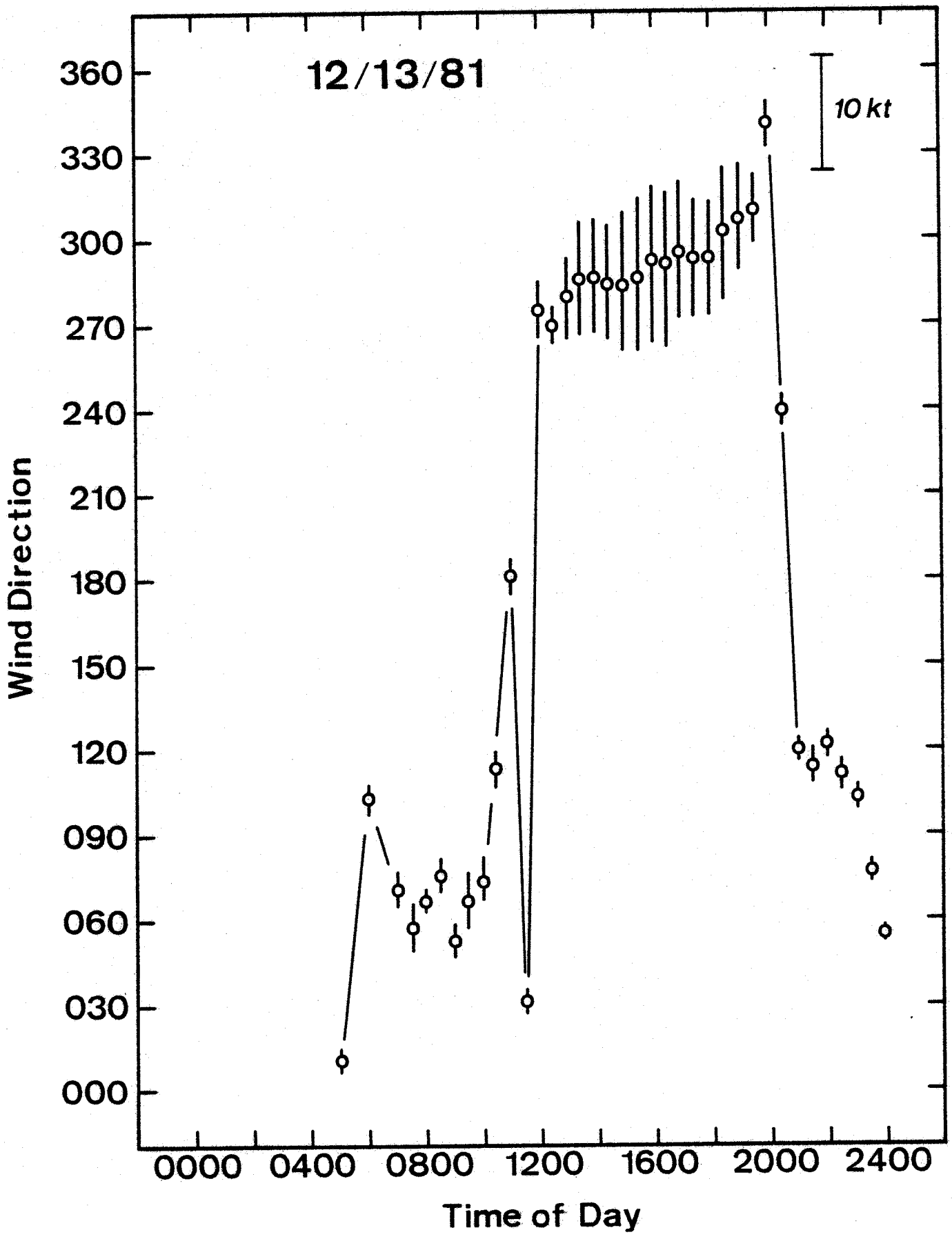
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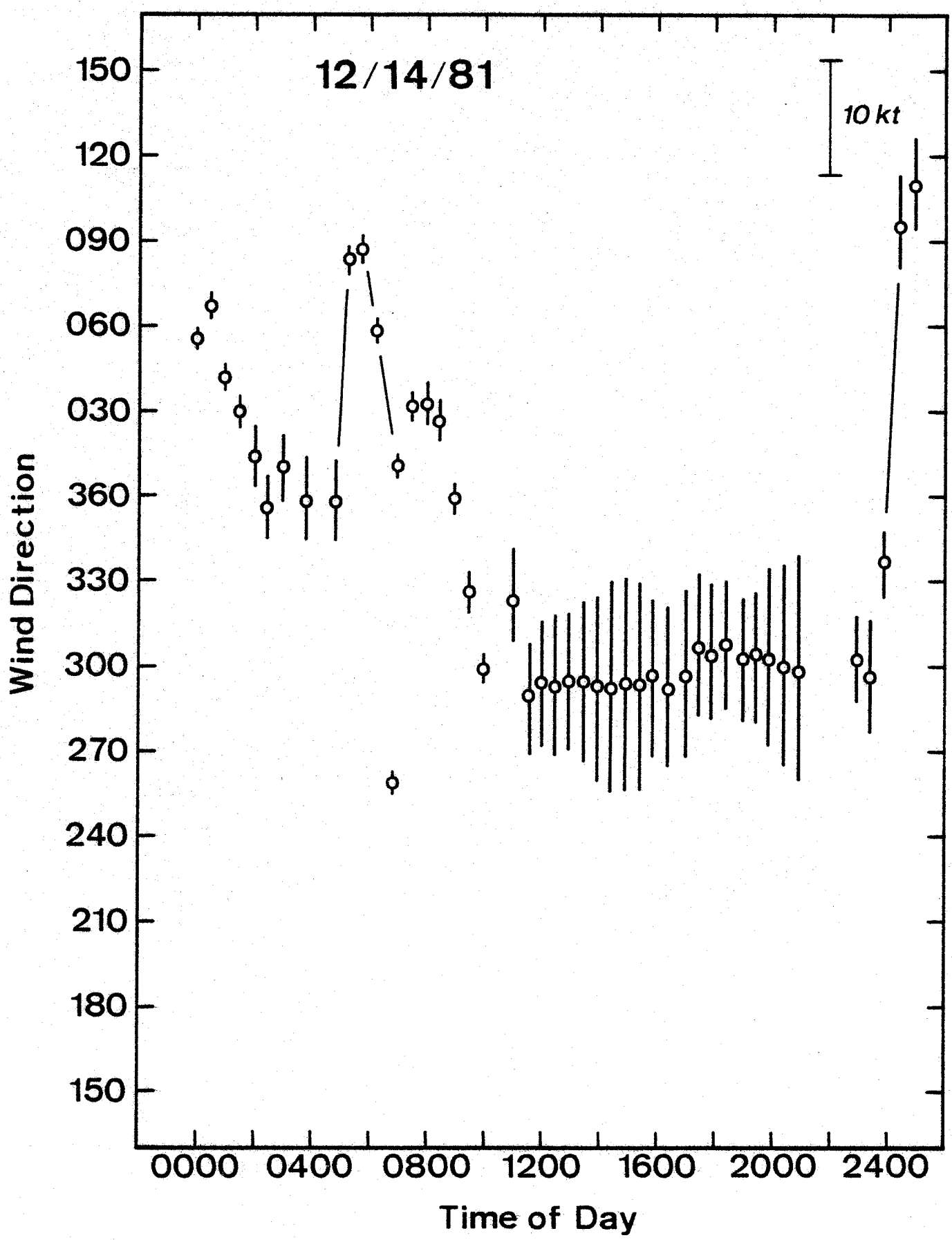
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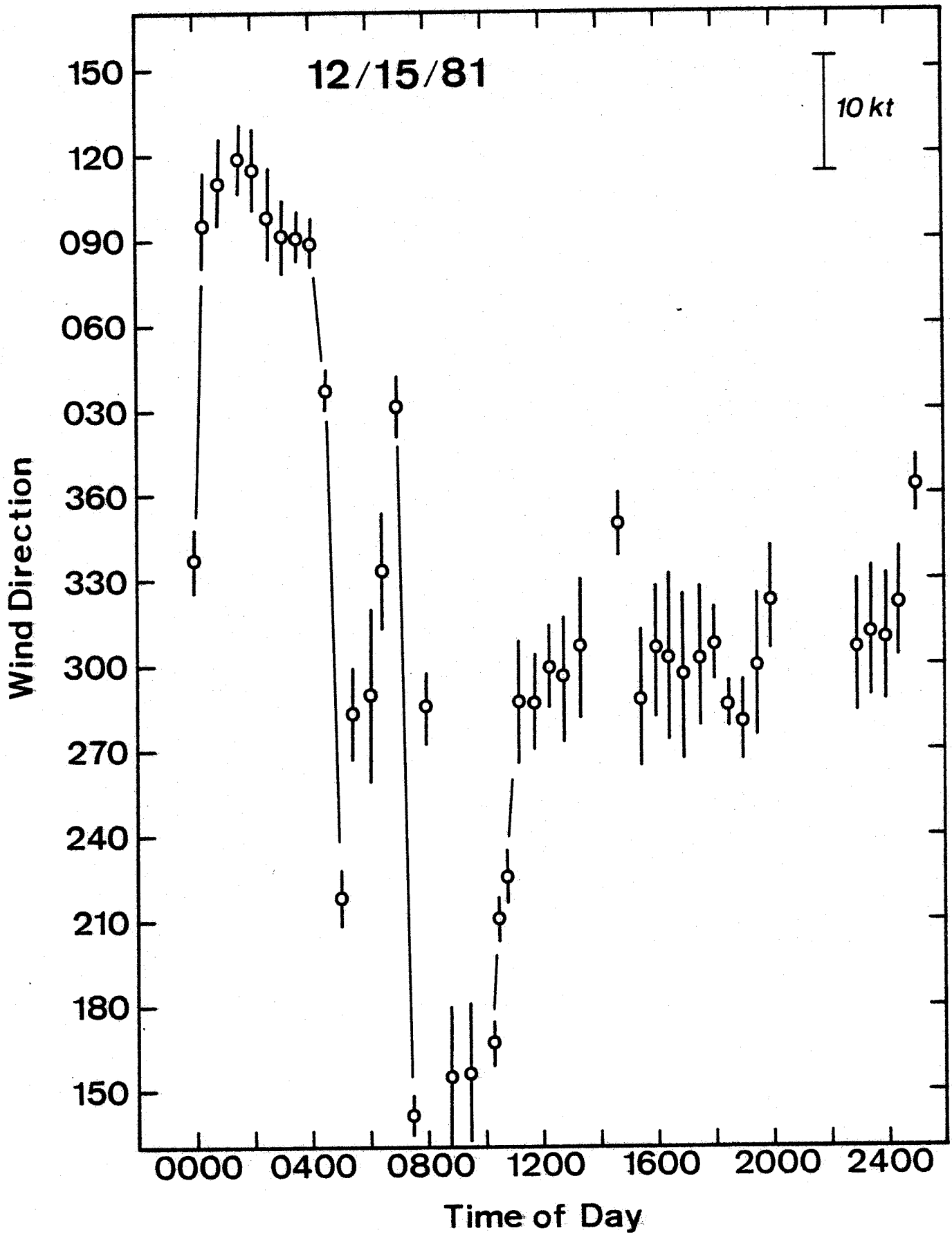
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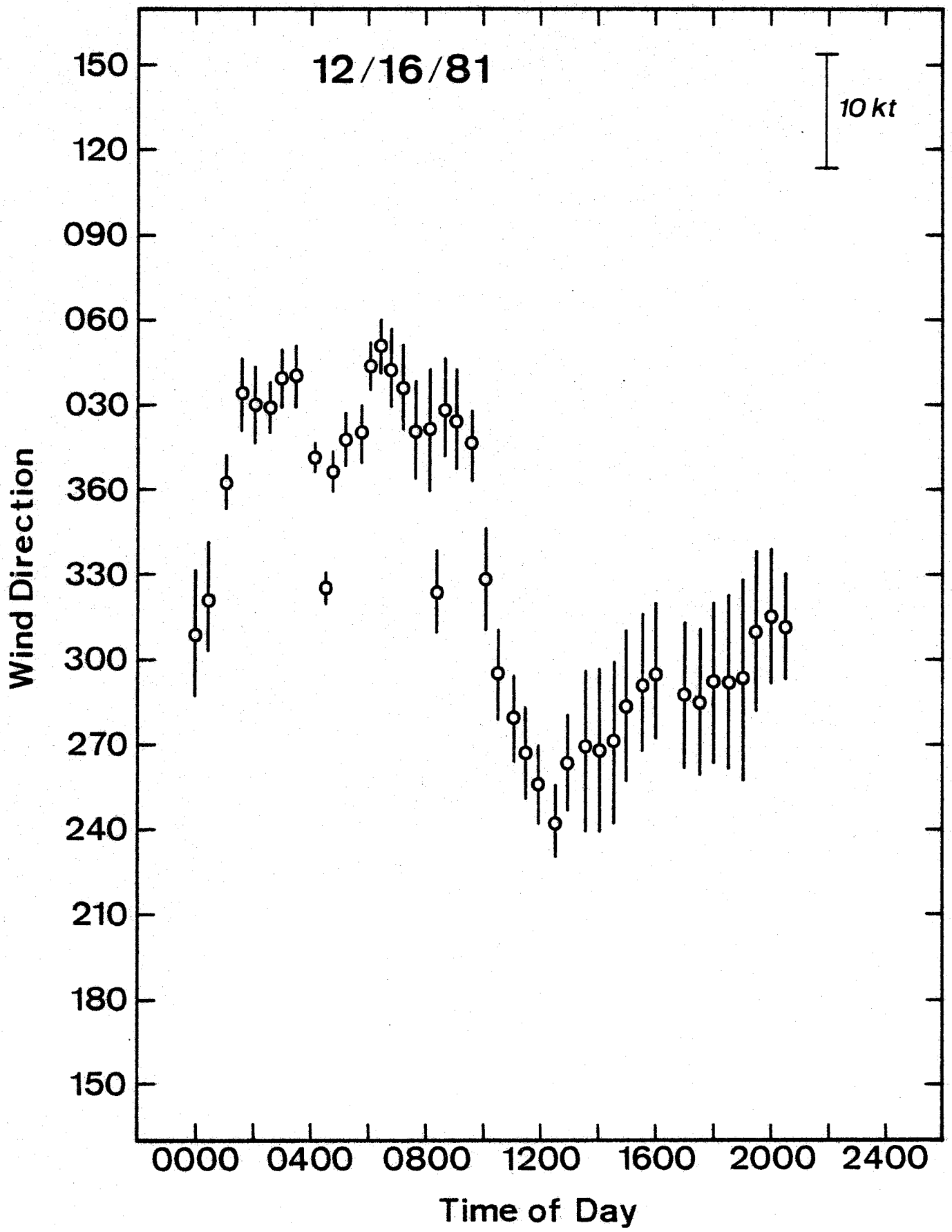
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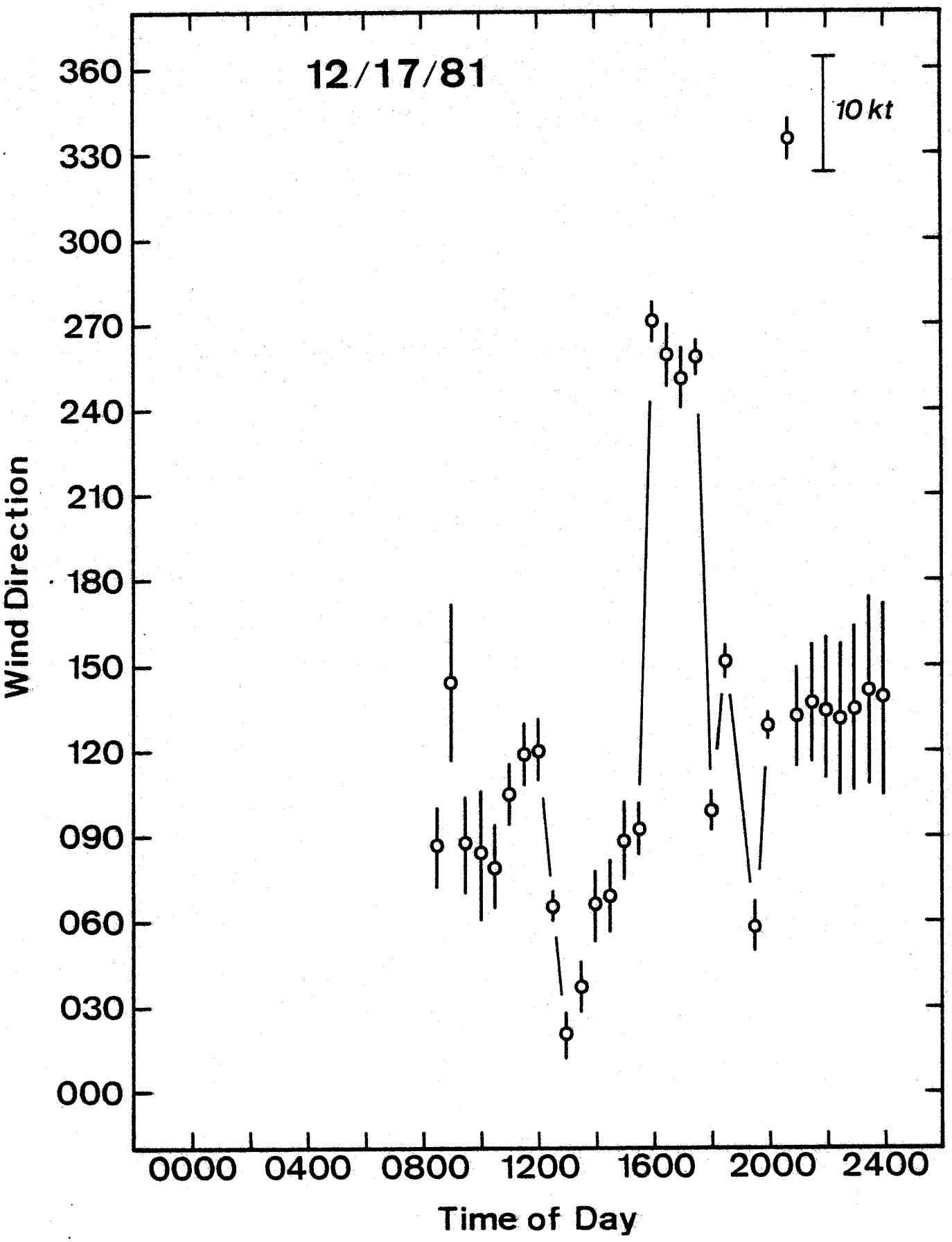
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Time of Day

VI. Meteorological Data and Calculated Parameters

The mean meteorological data and calculated boundary layer parameters are listed in Table 4. The symbols used are defined in Section II.

Wind speed, relative humidity, and air temperature values are those measured at the upper level (20.5 m). All calculated parameters were determined using the bulk aerodynamic method. Most of the data is one-half hour averages. Shorter averaging times are readily apparent where they occur in the data; longer times were not used. All times are the end of an averaging period.

The boundary layer depth, Z_i, was very difficult to determine during much of the experiment. Zeroes in the table show those times where no well defined boundary layer existed. The heights were determined using both radiosonde and acoustic sounder results. The acoustic sounder was often of limited use because of multiple echos.

The stability parameter, Z/L, and the scaling parameters, U_* and T_*, were determined using the bulk aerodynamic method. For a stable surface layer, the iterative method used to perform the calculation will not converge if Z/L is too large. For these cases Z/L is arbitrarily set to 999 in the table.

The method used to calculate the convective mixing velocity, W_*, and the mixing time, t, are valid only for an unstable surface layer. For the stable case, these parameters are set to zero.

The data presented in Table 4 are of two types. The first is the data obtained during the tracer gas releases. The second is the complete data set from the cruise.

Following Page

Table 4 - Meteorological data and calculated boundary layer parameters.

BLM III-81
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)
12/08 1159	2.8	34	17.4	12.7	80	0.005	-0.010	-8.2	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

BLM III-81
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)
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
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	6.8	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

BLM III-81
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)
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
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

BLM III-81
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)
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
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

BLM III-81
Release #5

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 1048	2.2	95	10.8	12.7	60	0.073	0.075	84.5	-1.90E 00	0.2	4.5
12/15 1148	4.0	86	12.9	12.6	60	0.120	-0.012	-6.0	5.12E-02	0.0	0.0
12/15 1208	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	12.7	60	0.284	-0.020	-15.6	2.31E-02	0.0	0.0
12/15 1328	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
12/15 1530	6.2	77	14.4	12.9	60	0.192	-0.047	-40.8	1.32E-01	0.0	0.0
12/15 1600	6.7	77	15.2	12.9	60	0.206	-0.066	-61.2	1.71E-01	0.0	0.0
12/15 1630	7.7	78	14.9	12.8	60	0.248	-0.064	-59.1	1.15E-01	0.0	0.0
12/15 1700	7.4	77	15.1	12.8	60	0.234	-0.068	-63.3	1.38E-01	0.0	0.0
12/15 1730	6.2	79	14.9	12.8	60	0.187	-0.062	-58.0	1.99E-01	0.0	0.0
12/15 1800	3.0	75	15.5	12.8	60	0.048	-0.041	-38.8	2.02E 00	0.0	0.0
12/15 1830	1.6	68	16.5	12.8	60	0.001	-0.002	-1.9	9.99E 02	0.0	0.0
12/15 1900	2.8	68	16.5	12.8	60	0.024	-0.030	-28.5	5.69E 00	0.0	0.0
12/15 1930	5.9	82	14.2	12.8	60	0.182	-0.042	-37.5	1.35E-01	0.0	0.0

BLM III-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	-8.2	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

BLM III-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)
12/09 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	2.4	94	9.8	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	0.088	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	0.088	-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	0.8	86	12.5	12.4	0	0.020	-0.007	-1.8	5.82E-01	0.0	0.0

BLM III-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)
12/09 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

BLM III-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)
12/10 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

BLM III-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)
12/11 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	6.8	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 III-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 III-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 III-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	94	10.9	12.6	60	0.064	0.073	83.6	-2.42E 00	0.2	4.7
12/15 1028	1.7	95	10.8	12.6	60	0.059	0.078	88.4	-3.00E 00	0.2	4.7
12/15 1048	2.2	95	10.8	12.7	60	0.073	0.075	84.5	-1.90E 00	0.2	4.5
12/15 1148	4.0	86	12.9	12.6	60	0.120	-0.012	-6.0	5.12E-02	0.0	0.0
12/15 1208	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	12.7	60	0.284	-0.020	-15.6	2.31E-02	0.0	0.0
12/15 1328	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
12/15 1530	6.2	77	14.4	12.9	60	0.192	-0.047	-40.8	1.32E-01	0.0	0.0
12/15 1600	6.7	77	15.2	12.9	60	0.206	-0.066	-61.2	1.71E-01	0.0	0.0
12/15 1630	7.7	78	14.9	12.8	60	0.248	-0.064	-59.1	1.15E-01	0.0	0.0
12/15 1700	7.4	77	15.1	12.8	60	0.234	-0.068	-63.3	1.38E-01	0.0	0.0
12/15 1730	6.2	79	14.9	12.8	60	0.187	-0.062	-58.0	1.99E-01	0.0	0.0
12/15 1800	3.0	75	15.5	12.8	60	0.048	-0.041	-38.8	2.02E 00	0.0	0.0
12/15 1830	1.6	68	16.5	12.8	60	0.001	-0.002	-1.9	9.99E 02	0.0	0.0
12/15 1900	2.8	68	16.5	12.8	60	0.024	-0.030	-28.5	5.69E 00	0.0	0.0
12/15 1930	5.9	82	14.2	12.8	60	0.182	-0.042	-37.5	1.35E-01	0.0	0.0
12/15 2000	4.4	67	16.6	12.8	60	0.104	-0.068	-63.0	6.98E-01	0.0	0.0
12/15 2300	5.6	92	13.0	12.5	60	0.179	-0.017	-14.3	5.36E-02	0.0	0.0
12/15 2330	5.8	90	13.0	12.5	60	0.186	-0.017	-13.0	4.52E-02	0.0	0.0
12/16 0000	5.8	90	12.9	12.6	60	0.187	-0.013	-9.5	3.26E-02	0.0	0.0
12/16 0030	4.5	89	12.9	12.6	60	0.139	-0.013	-8.6	5.39E-02	0.0	0.0
12/16 0100	2.3	87	13.1	12.6	60	0.056	-0.014	-10.5	4.06E-01	0.0	0.0
12/16 0130	1.8	75	14.0	12.6	60	0.026	-0.018	-14.1	2.48E 00	0.0	0.0
12/16 0200	3.2	69	14.8	12.5	60	0.063	-0.046	-39.1	1.17E 00	0.0	0.0

BLM III-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

BLM III-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 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

BLM III-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)
12/17 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	-4.68E-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

VII. Radiosonde Results

Radiosondes were released from the ship twice in each 24-hour period, generally at 0500 and 1700 PST. Releases were made and interpreted by a Navy radiosonde team. Temperature and humidity were determined by them at standard levels and significant points. Since we are interested in the detailed structure of the boundary layer such a treatment is too coarse. Thus, the original strip chart output and the met team determined calibration points were used to construct finer scale graphs, which are presented in Figures 2.

There are two apparent sources of error in these radiosonde results. The lowest height reading, which is obtained at the ship, is subject to ships influence and should not be used. Thus, it is not possible to use the radiosonde to determine properties of the surface layer. The radiosonde humidity system was not capable of measuring a relative humidity below 20%.

It is very important in understanding transport and dispersion to determine whether the boundary layer is well mixed. We do this by examining the potential temperature and specific humidity. These parameters will be well mixed, constant with height, in a well-mixed boundary layer. The two parameters have been determined from the radiosonde results and are also shown in Figures 2. Again, note that the lowest point for each sounding is not reliable.

The specific humidity and potential temperature plots have been processed to obtain information needed for boundary layer modeling. The well-mixed values, jump in the values at the

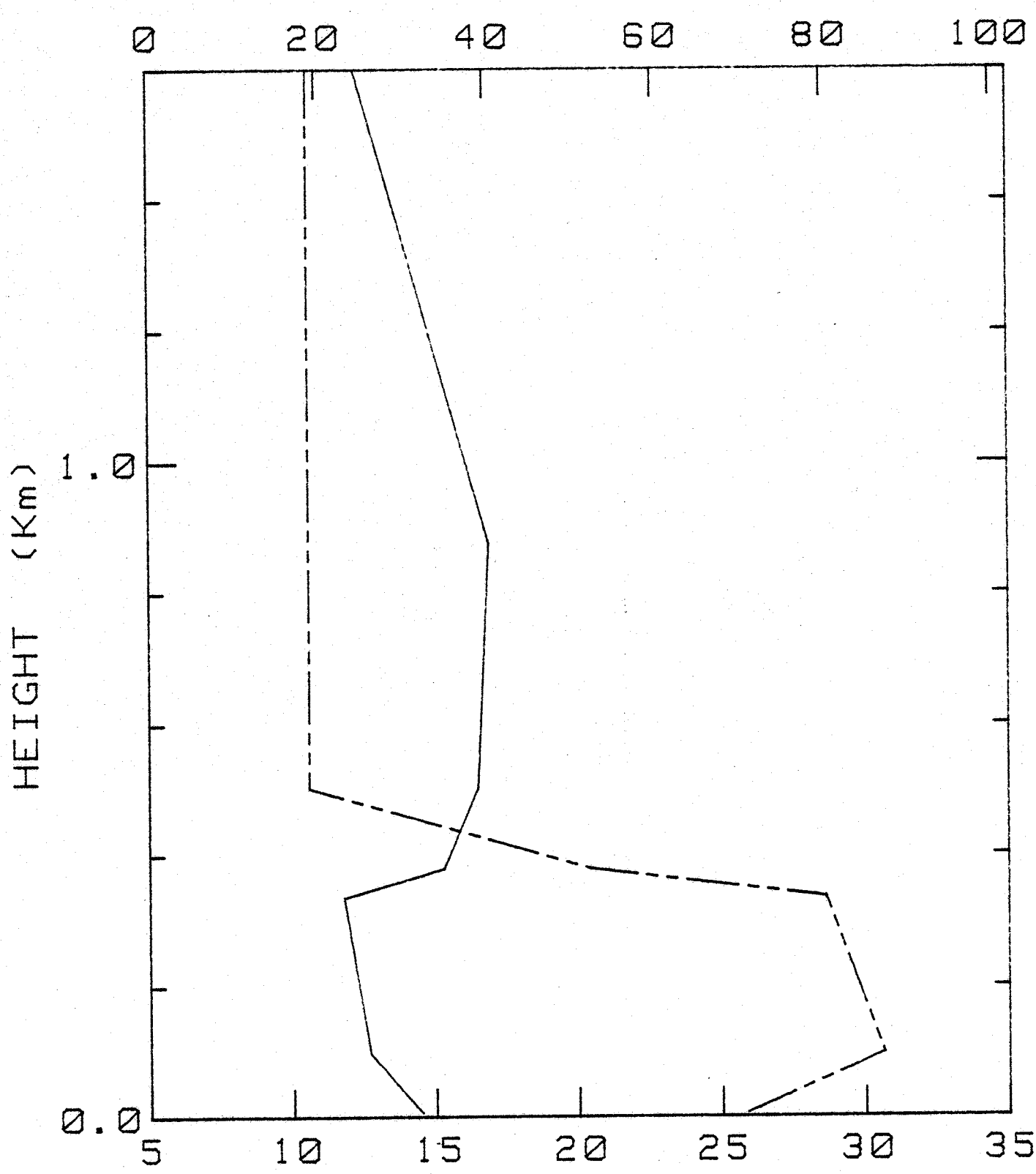
inversion (for a zeroth-order jump) and the gradient above the inversion are all given. These have been obtained by digitizing the plots; the digitizing is shown by the broken lines in the figures. It is readily apparent that the boundary layer was not well mixed, nor its height well defined for many days of these experiments.

Following Pages

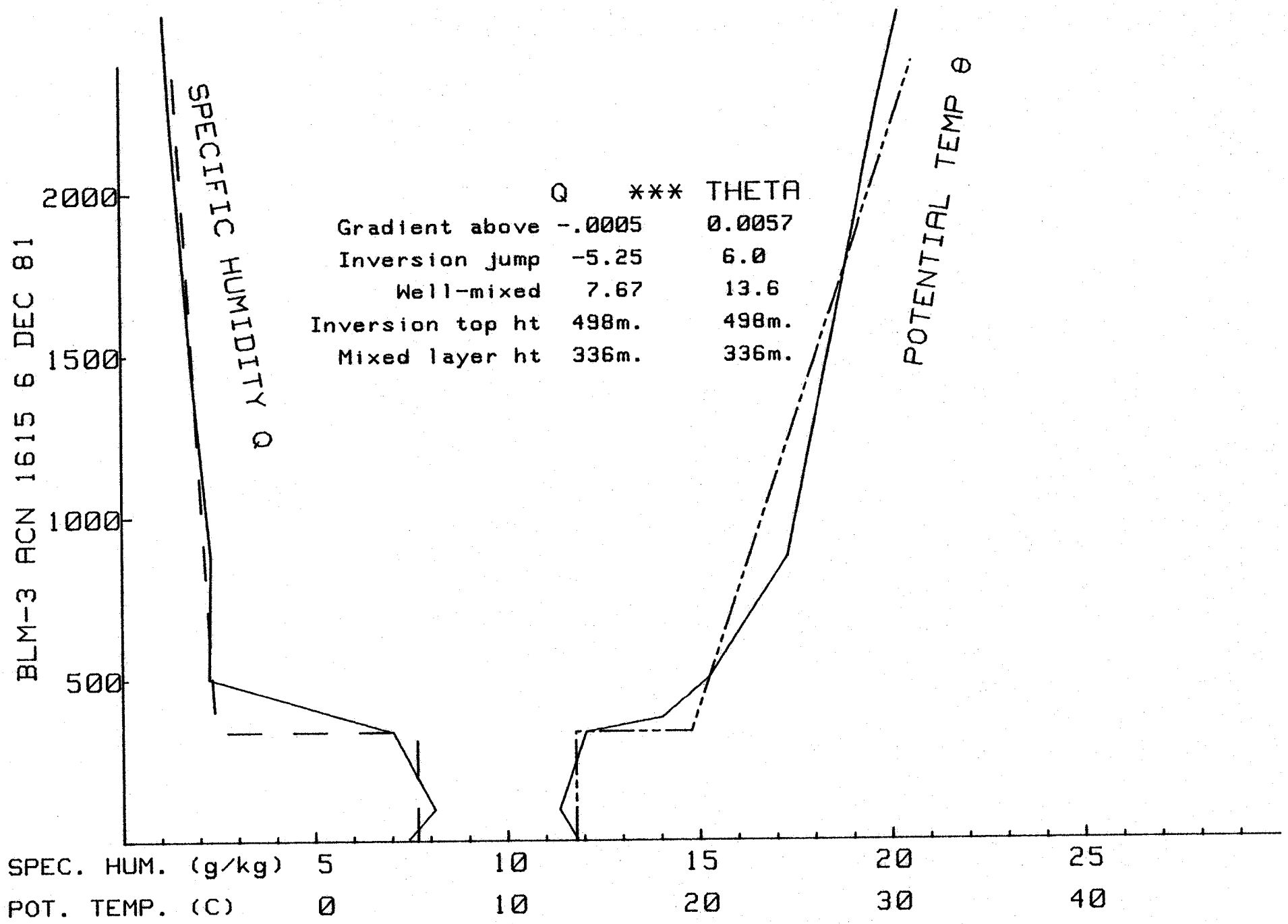
Figures 2 - There are two groups of figures

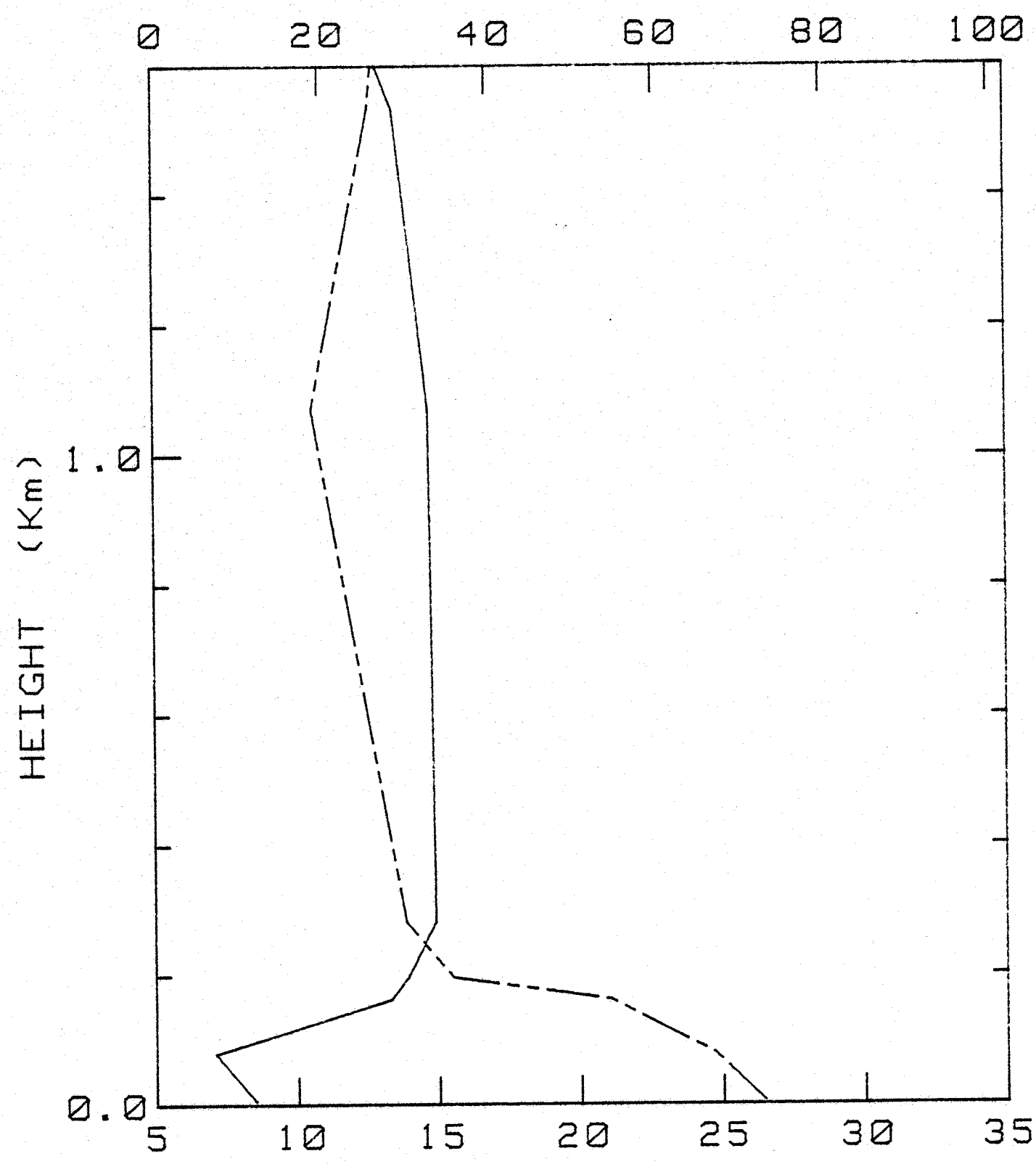
a) Temperature (solid line) and relative humidity profiles (broken line) determined from each radiosonde release.

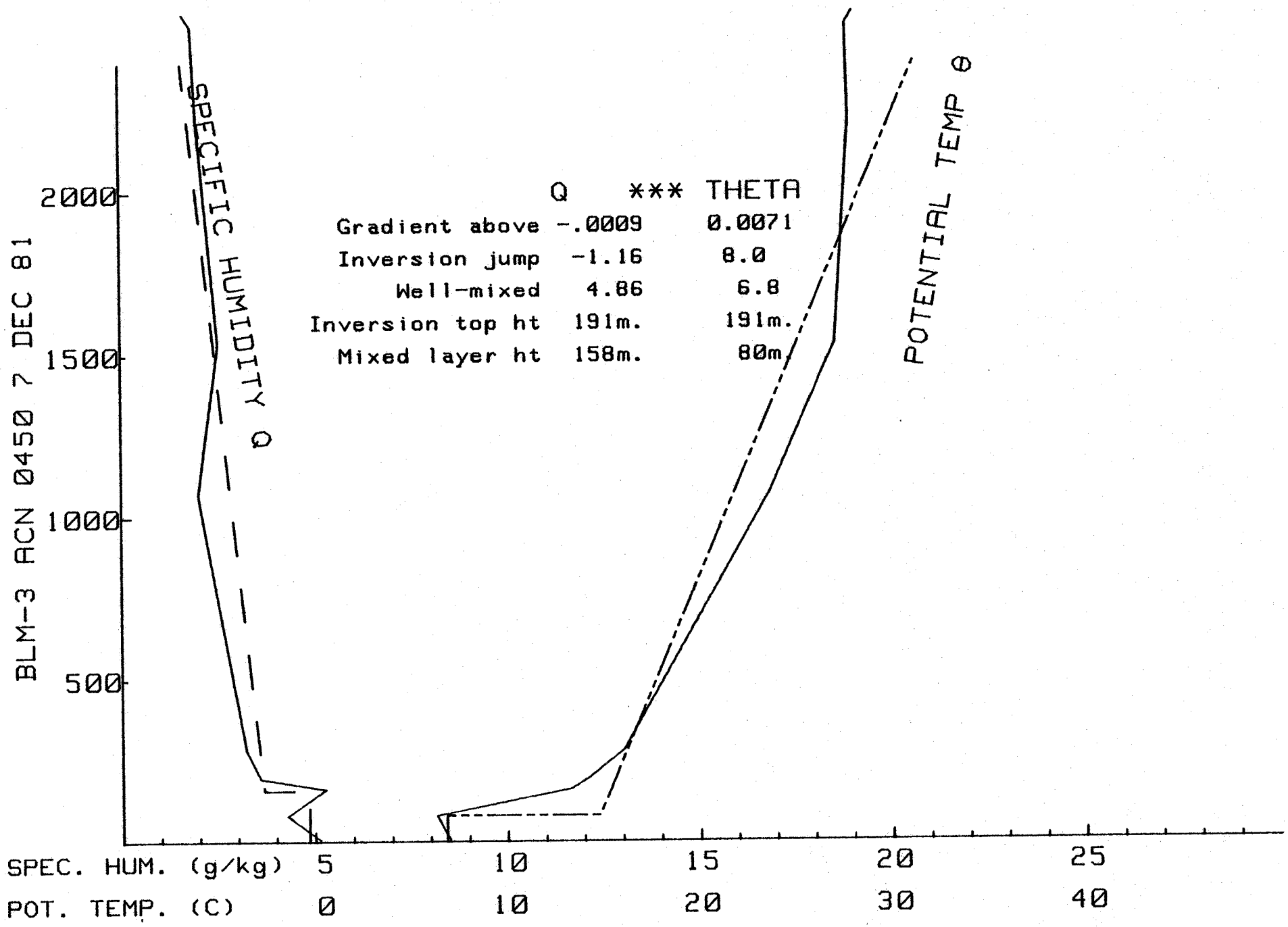
b) Mixed layer parameters: potential temperature and specific humidity. Plots for a given day are on facing pages.

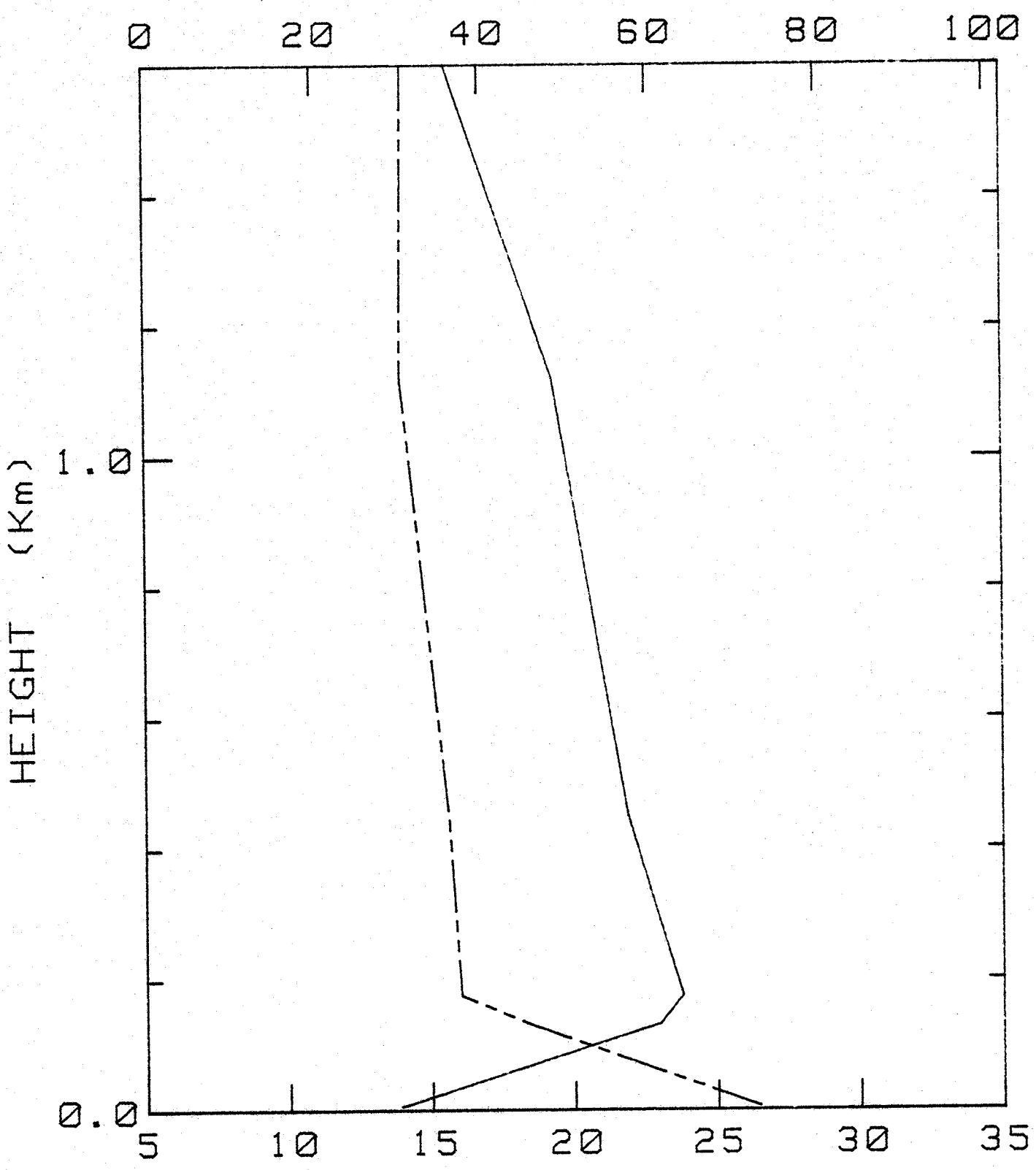


BLM-3 6 DEC 81 1615

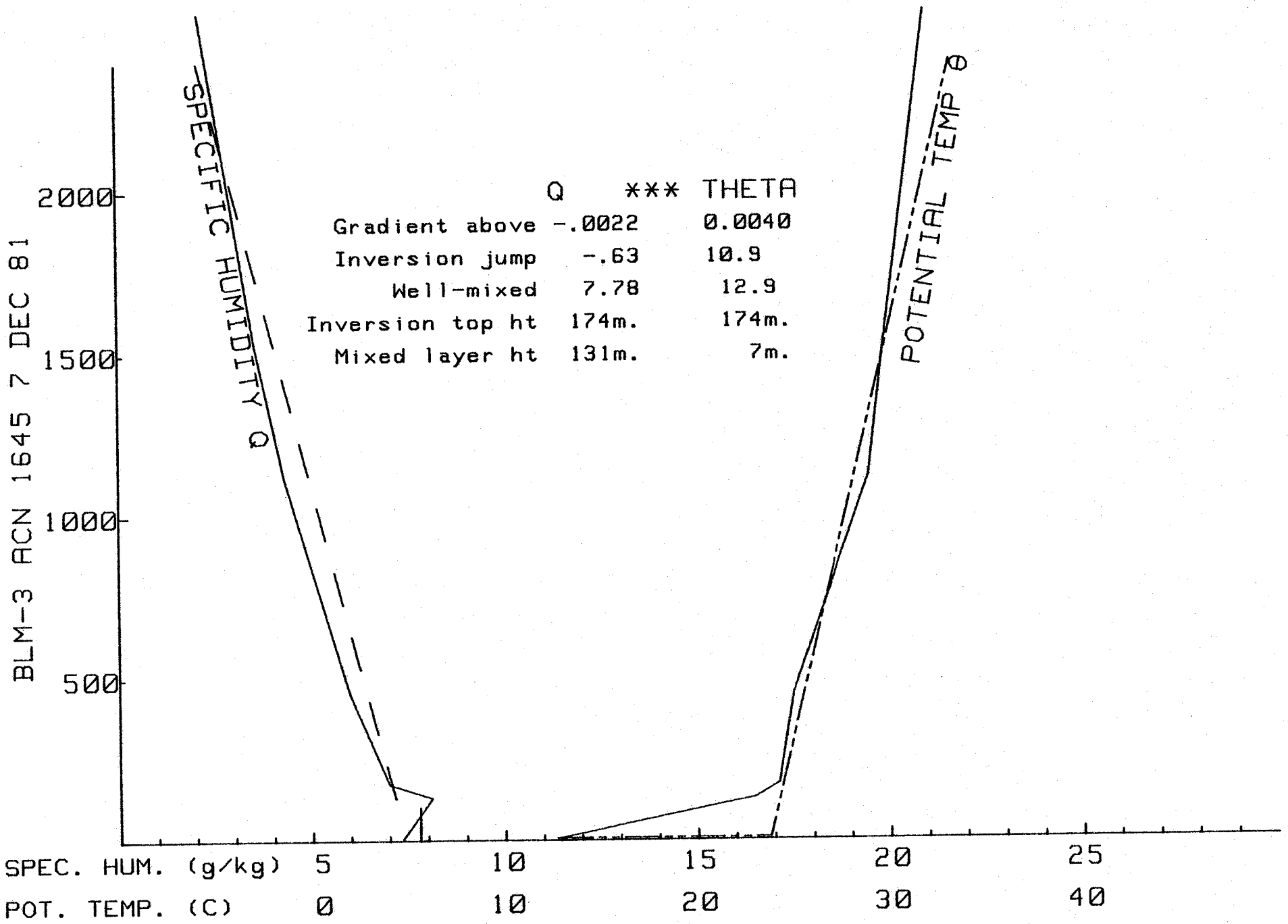

BLM-3 ACN 1615 6 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
2000
1500
1000
500
Q *** THETA
Gradient above -.0005 0.0057
Inversion jump -5.25 6.0
Well-mixed 7.67 13.6
Inversion top ht 498m. 498m.
Mixed layer ht 336m. 336m.
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

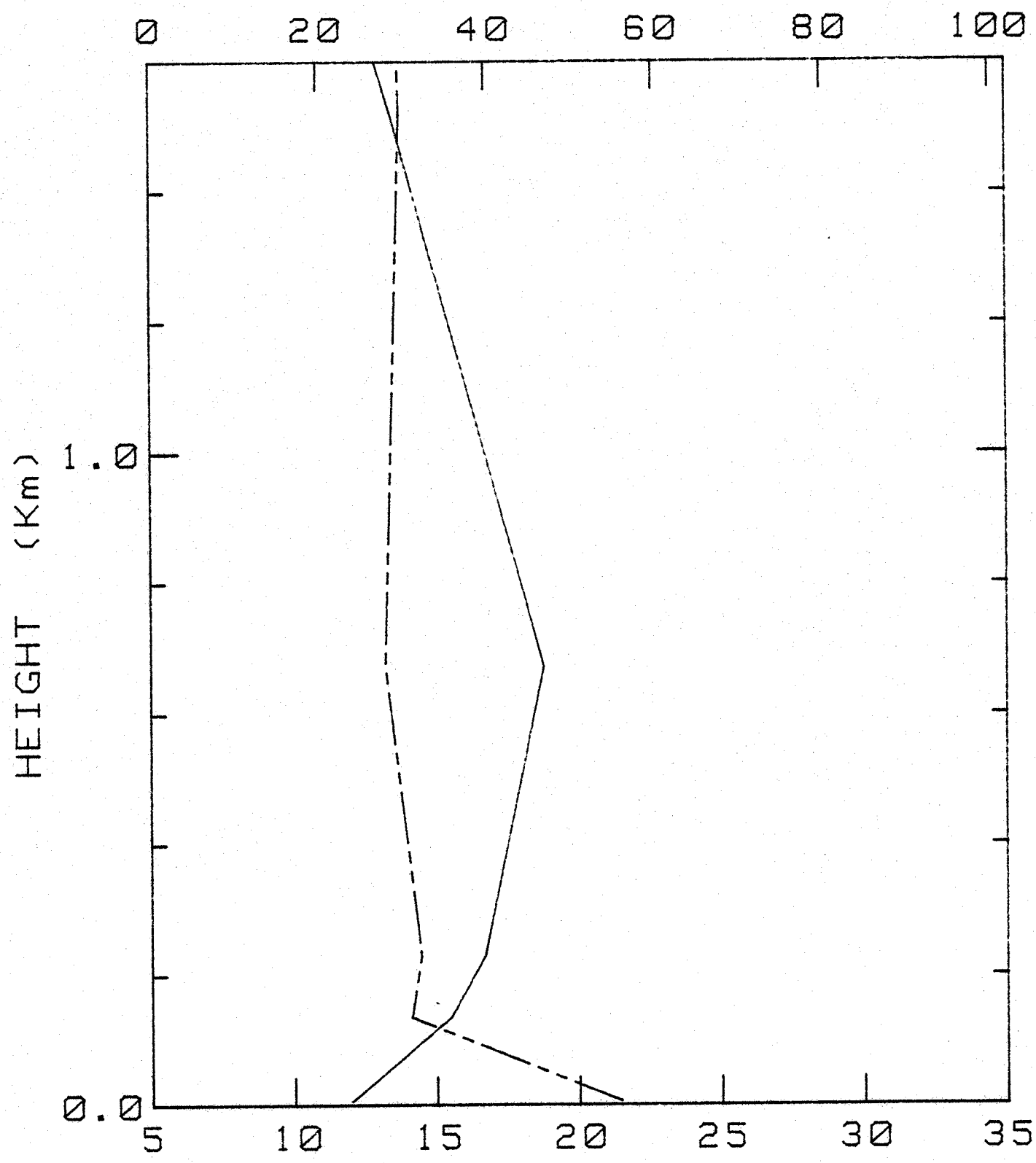

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 7 DEC 81 450

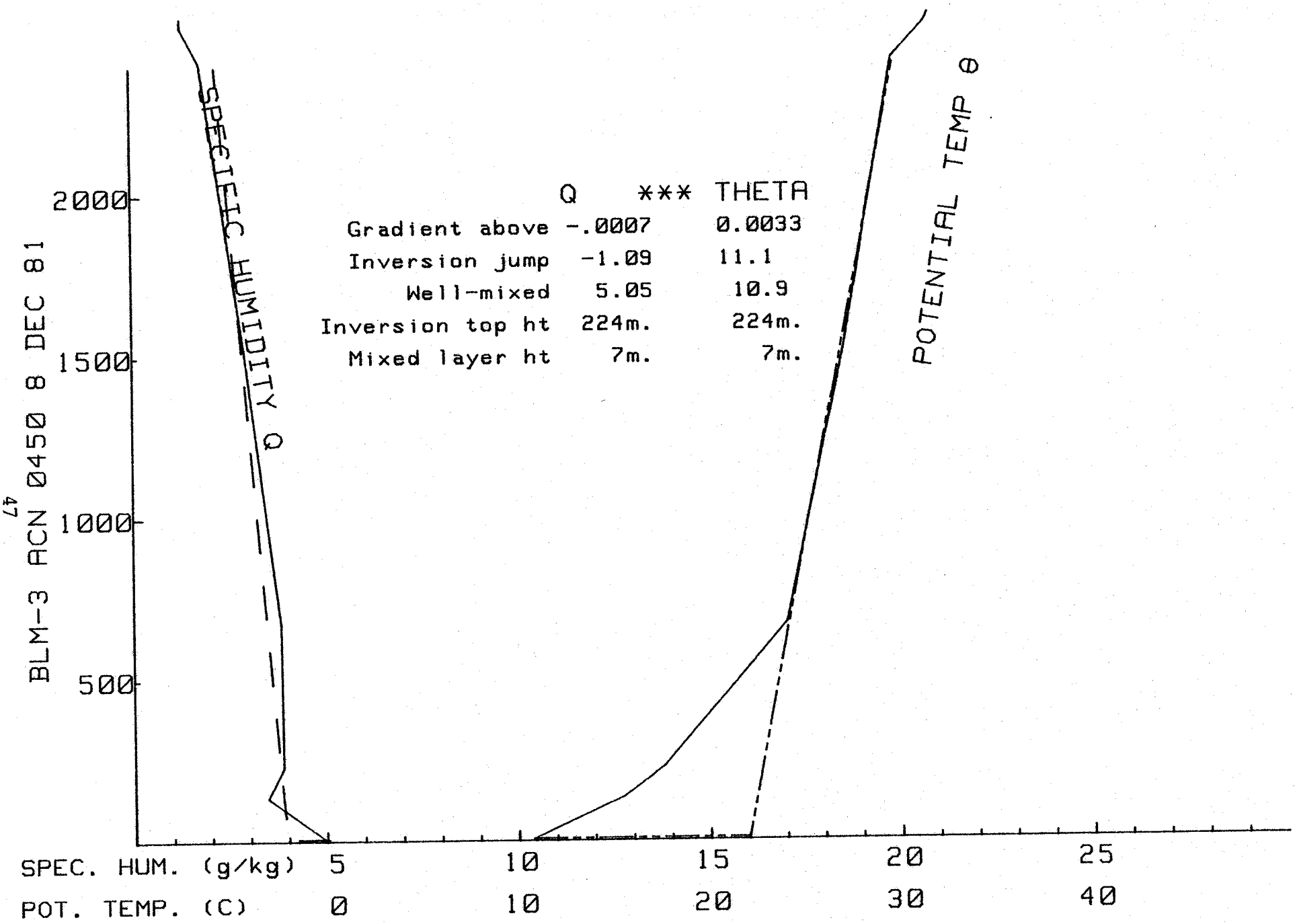

BLM-3 ACN 0450 7 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
2000
1500
1000
500
Q *** THETA
Gradient above -.0009 0.0071
Inversion jump -1.16 8.0
Well-mixed 4.86 6.8
Inversion top ht 191m. 191m.
Mixed layer ht 158m. 80m
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

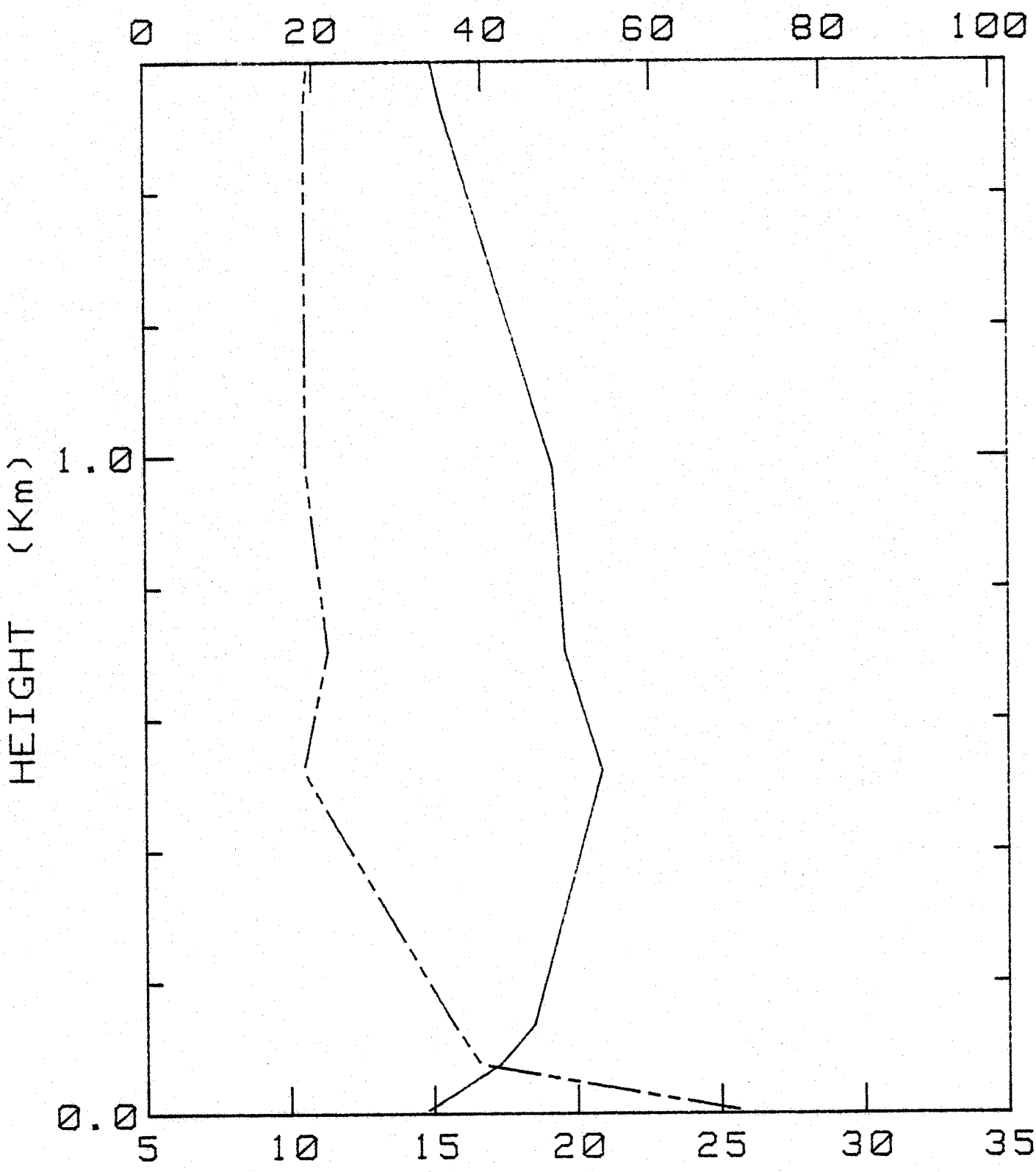


BLM-3 7 DEC 81 1645

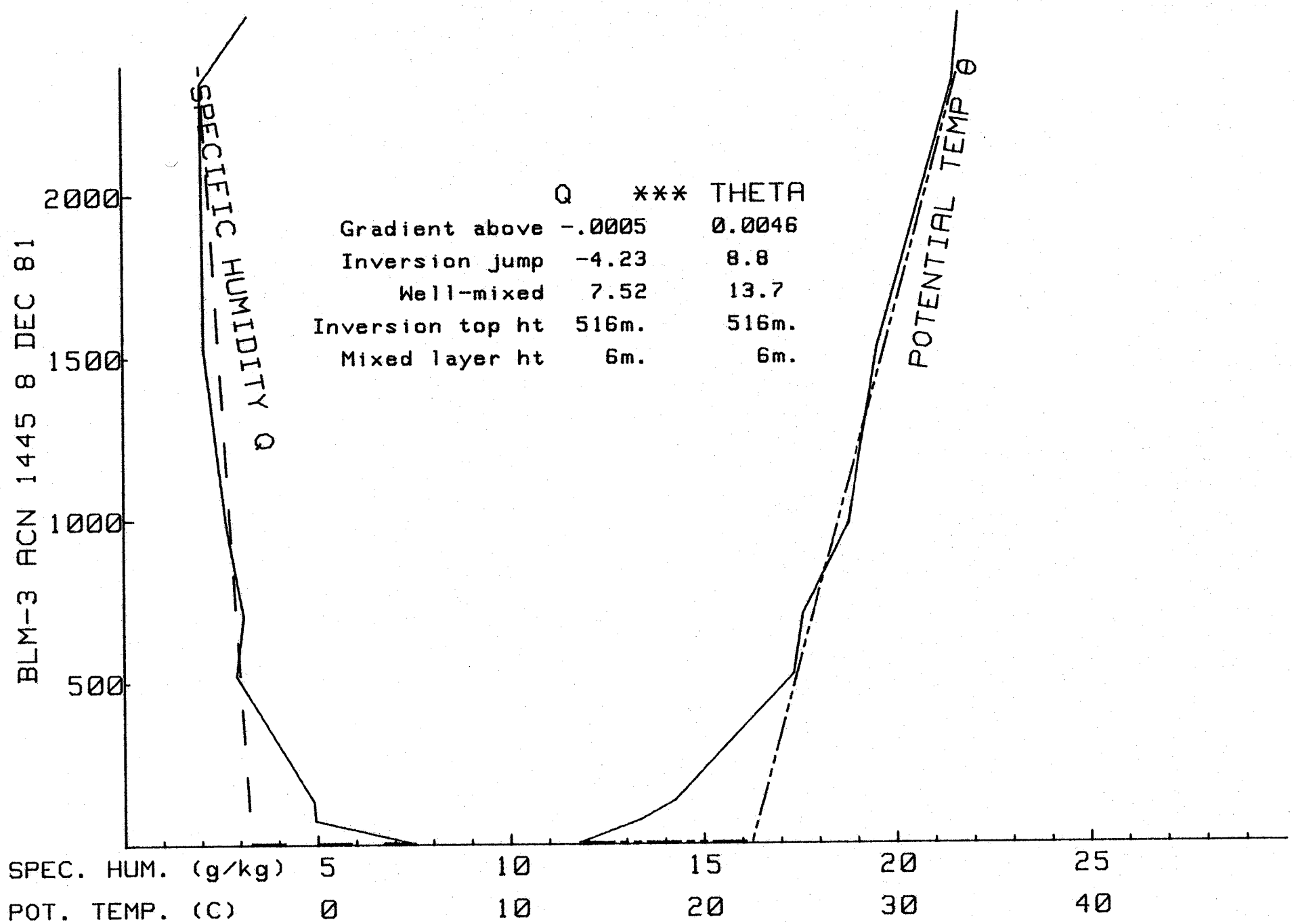

BLM-3 ACN 1645 7 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0022 0.0040
Inversion jump -.63 10.9
Well-mixed 7.78 12.9
Inversion top ht 174m. 174m.
Mixed layer ht 131m. 7m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

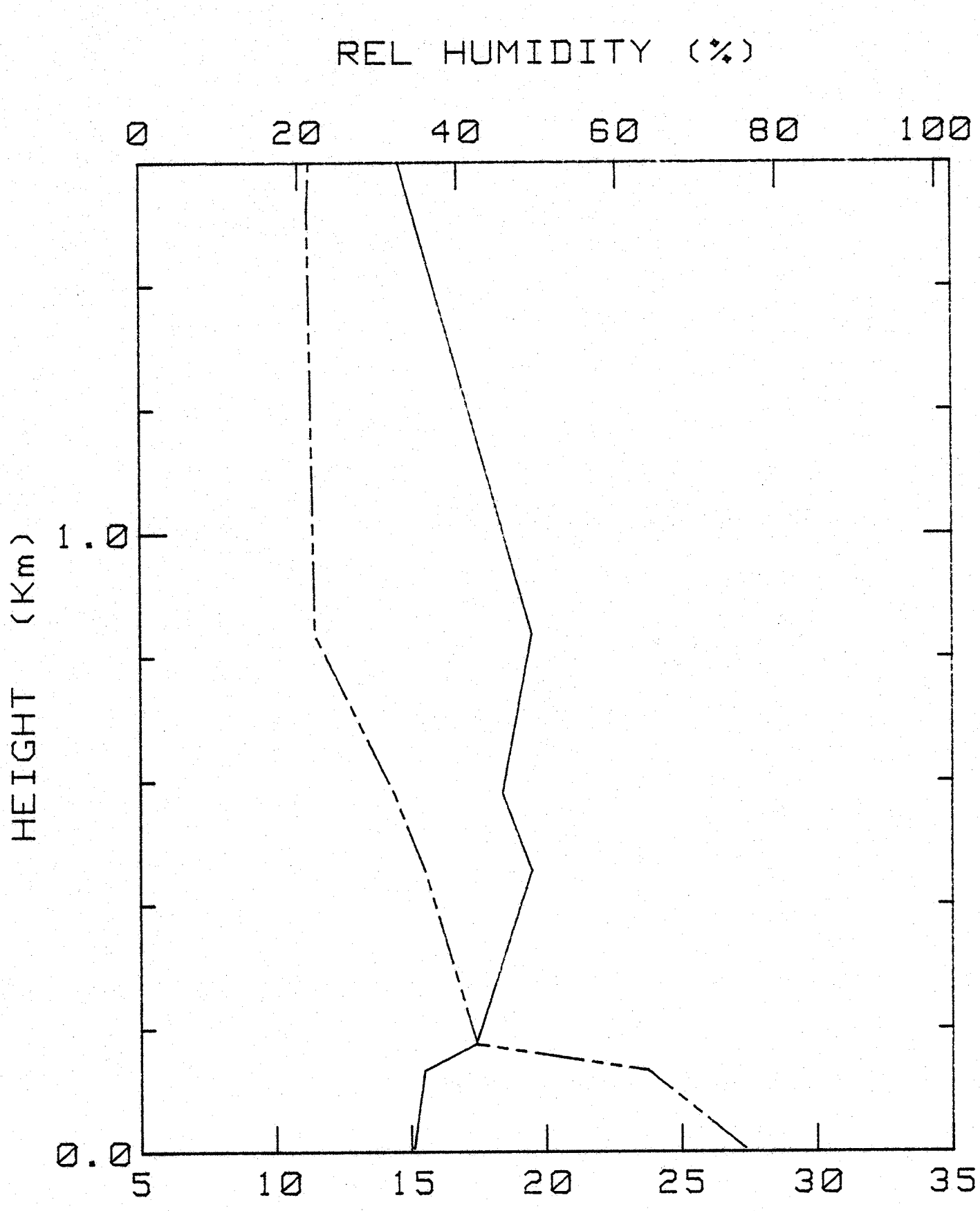

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 8 DEC 81 450

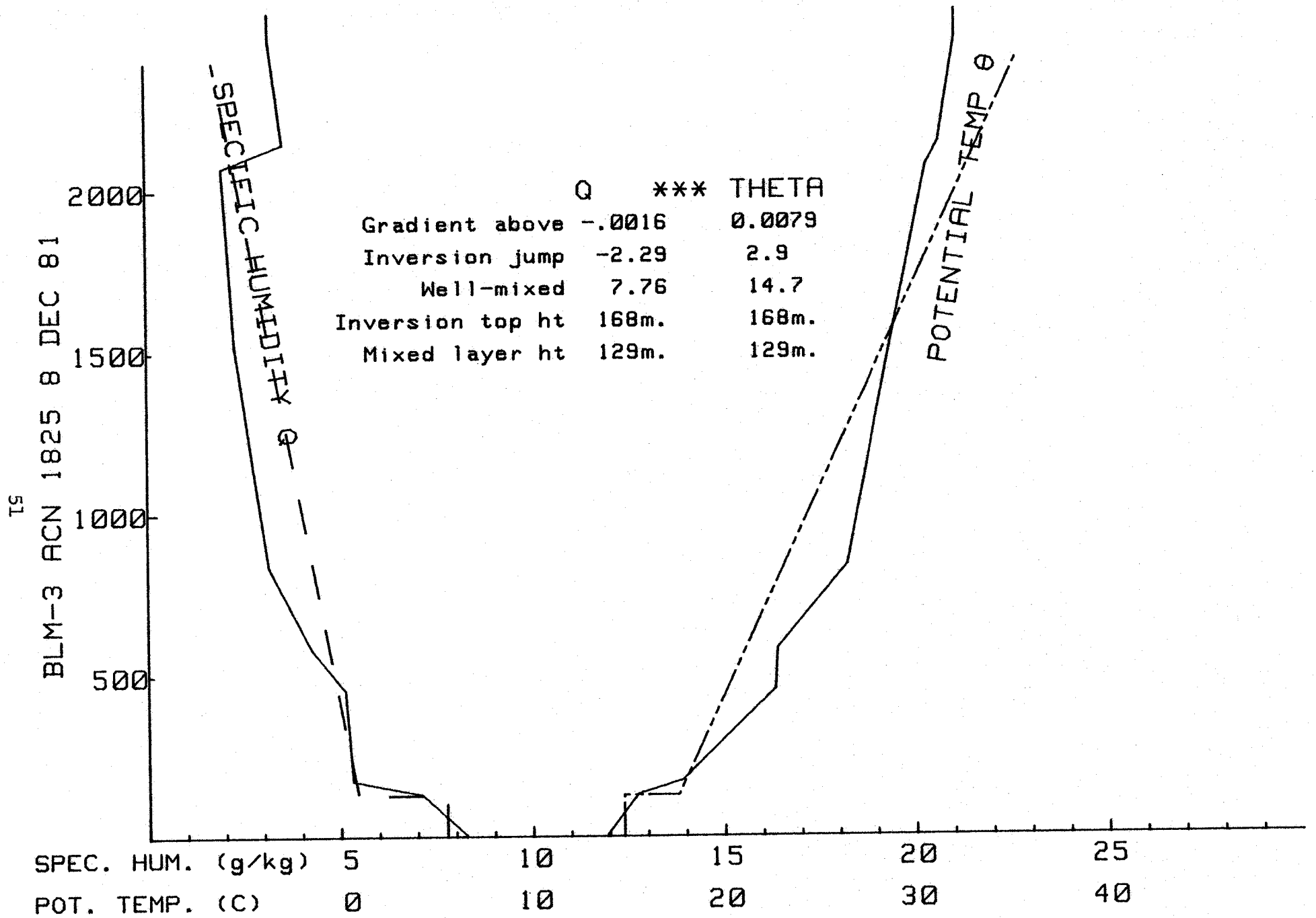

BLM-3 ACN 0450 8 DEC 81
47
SPECIFIC HUMIDITY Q
POTENTIAL TEMP Θ
Q *** THETA
Gradient above -.0007 0.0033
Inversion jump -1.09 11.1
Well-mixed 5.05 10.9
Inversion top ht 224m. 224m.
Mixed layer ht 7m. 7m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

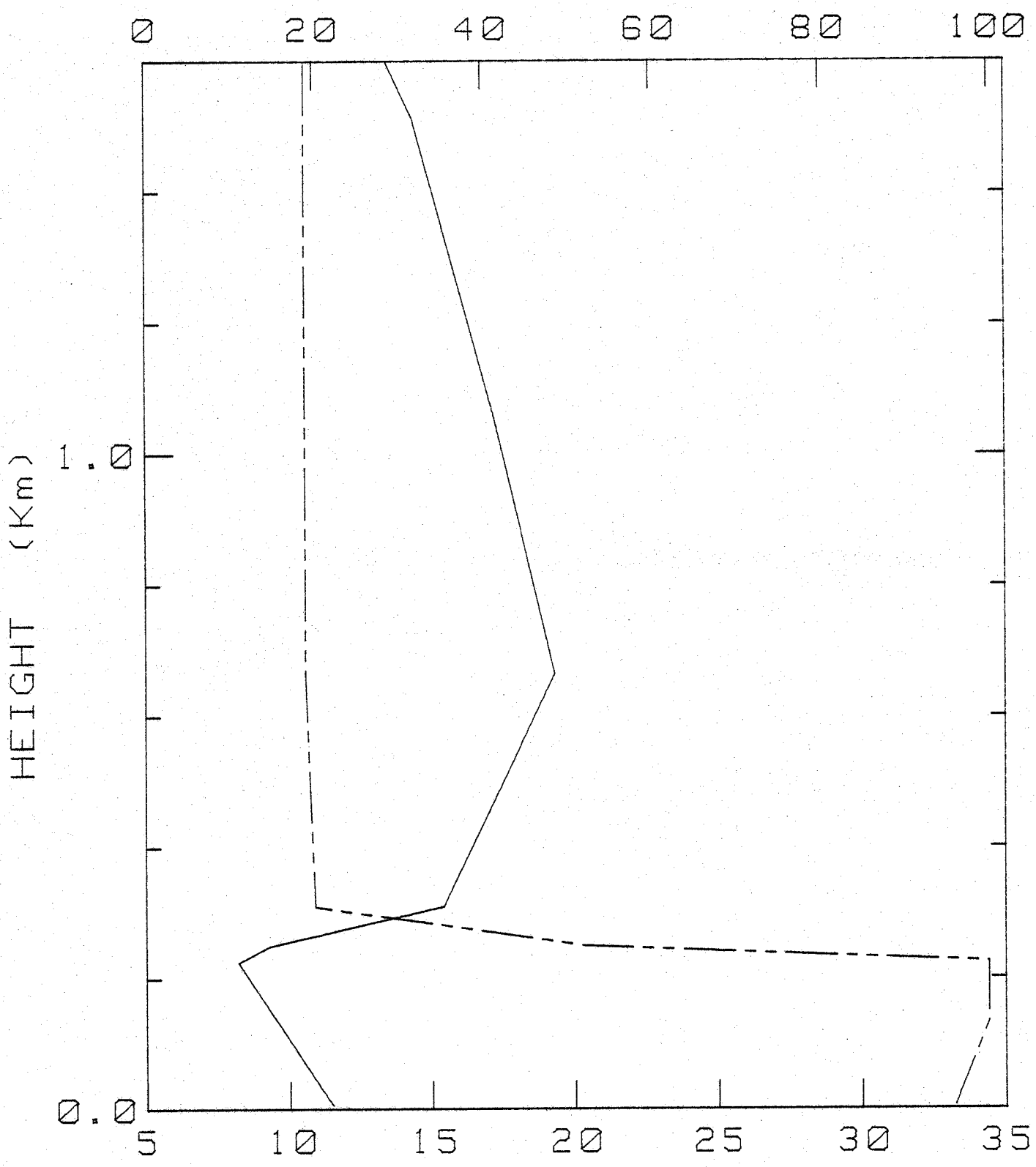


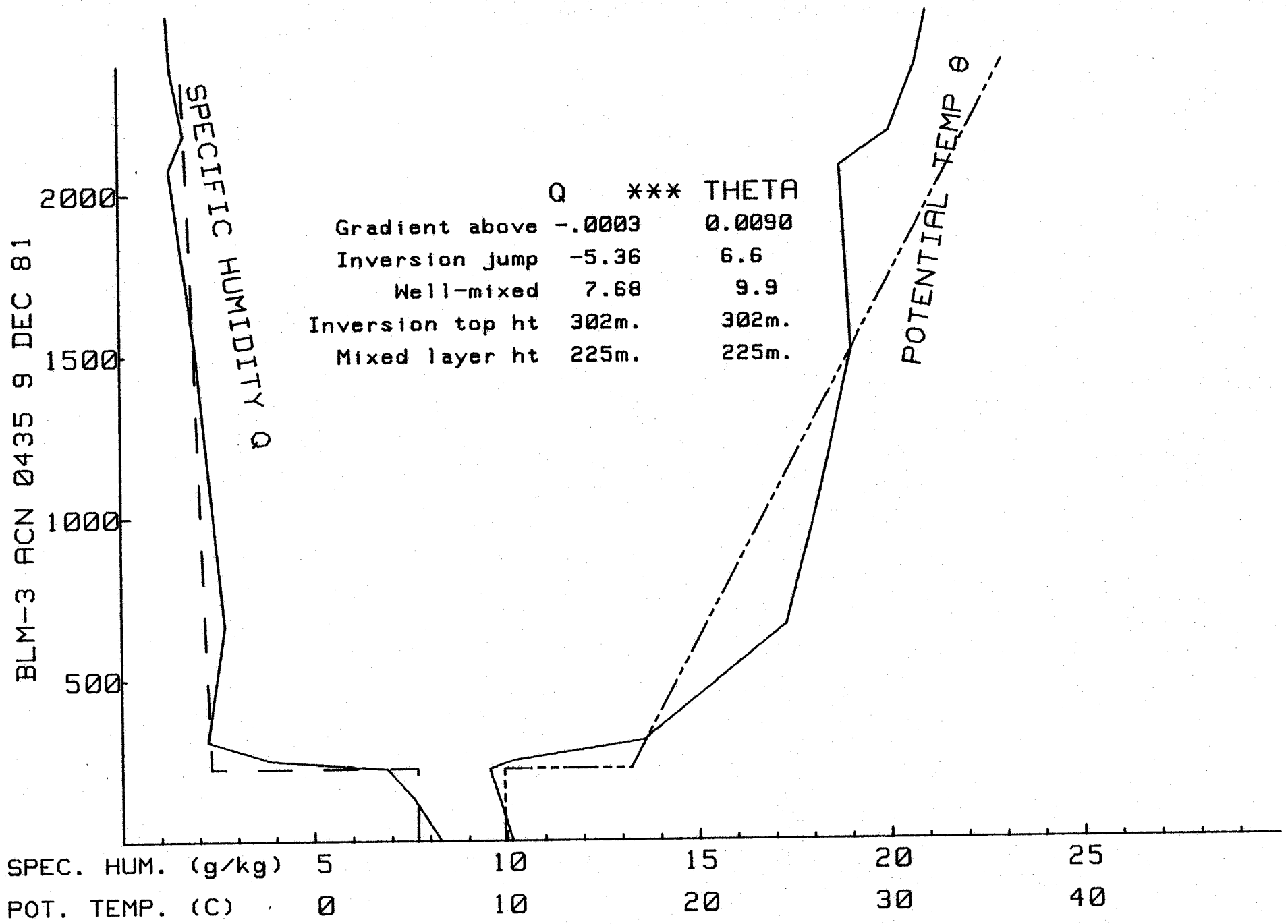
BLM-3 8 DEC 81 1445

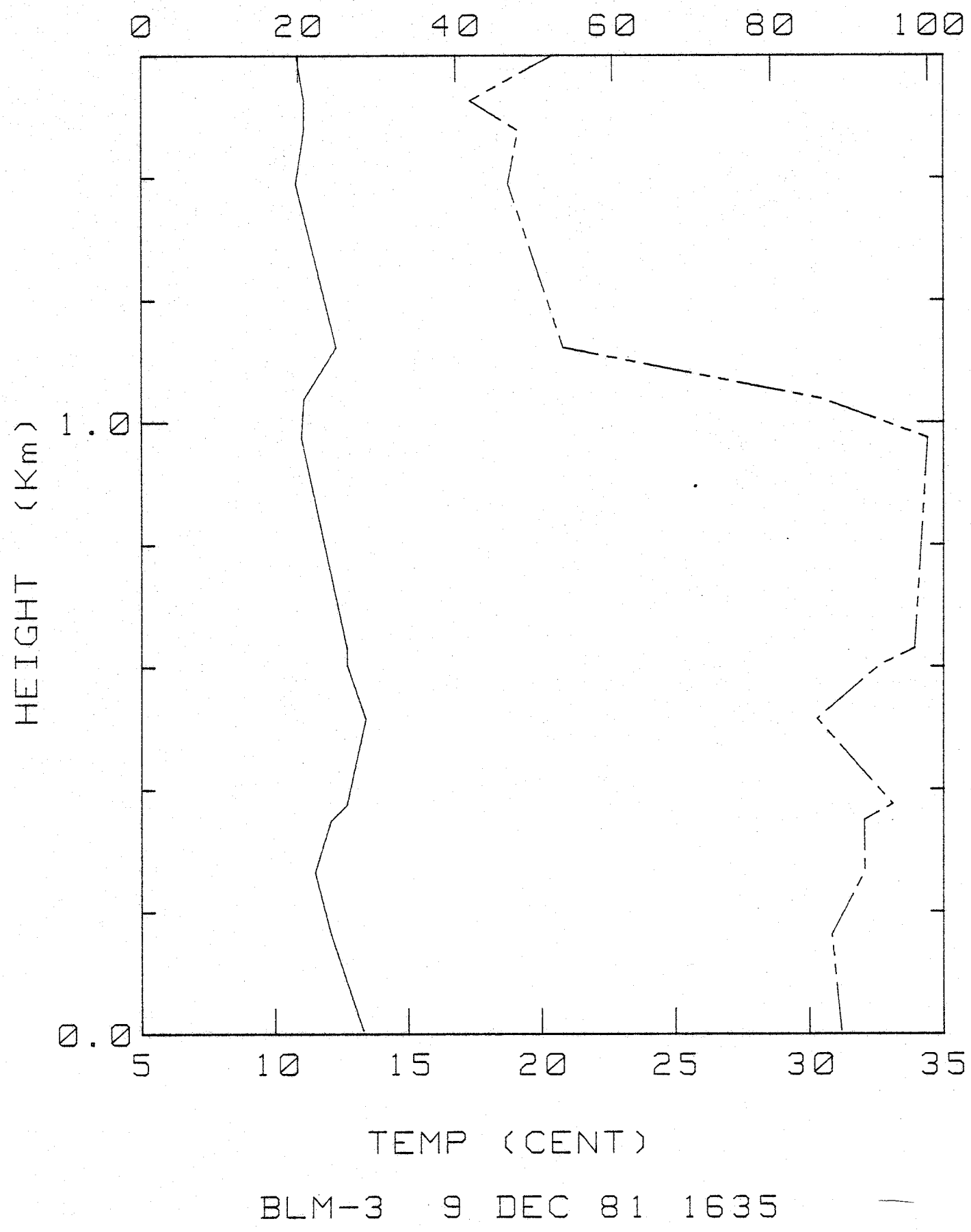

BLM-3 ACN 1445 8 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0005 0.0046
Inversion jump -4.23 8.8
Well-mixed 7.52 13.7
Inversion top ht 516m. 516m.
Mixed layer ht 6m. 6m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

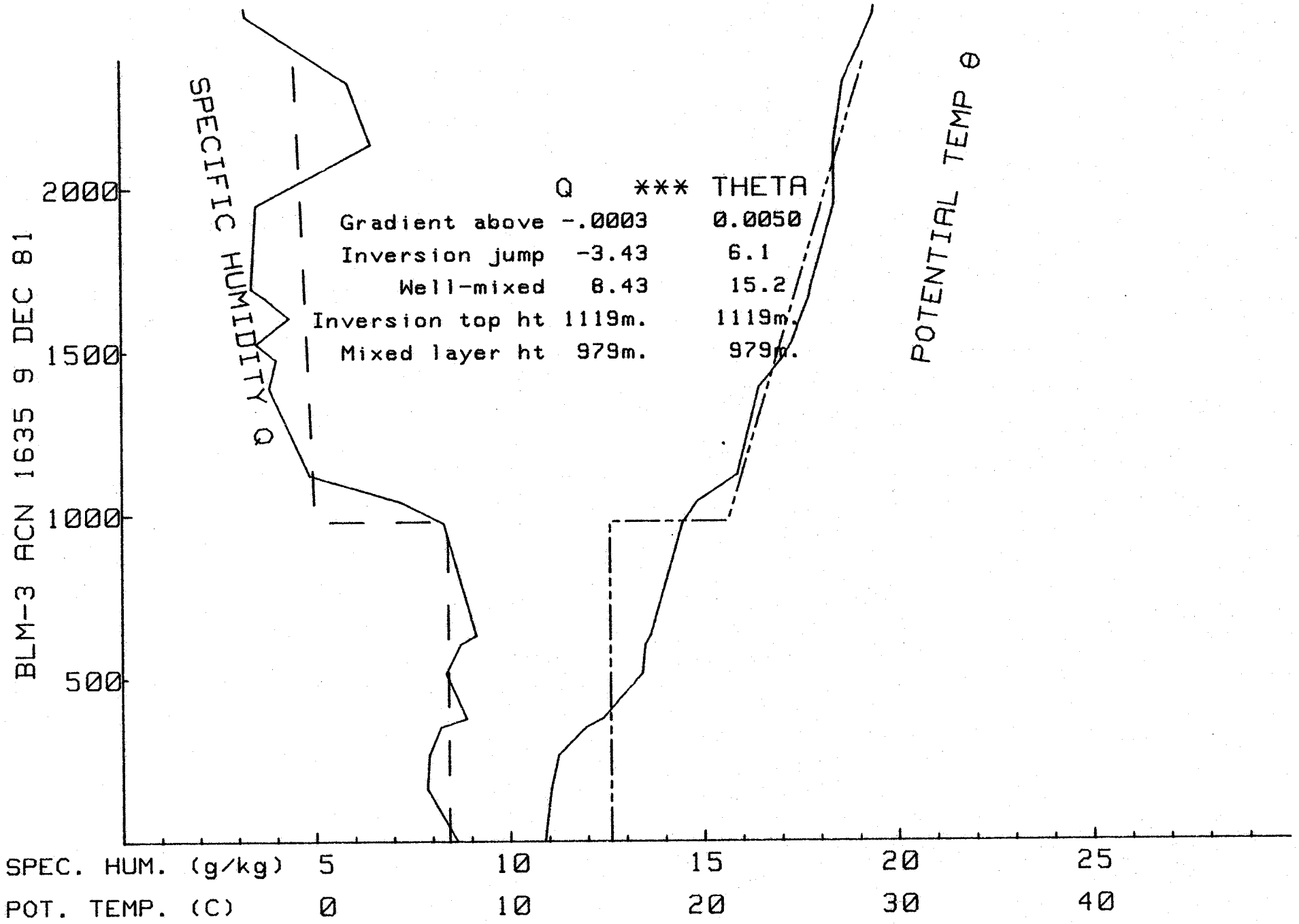

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 8 DEC 81 1825

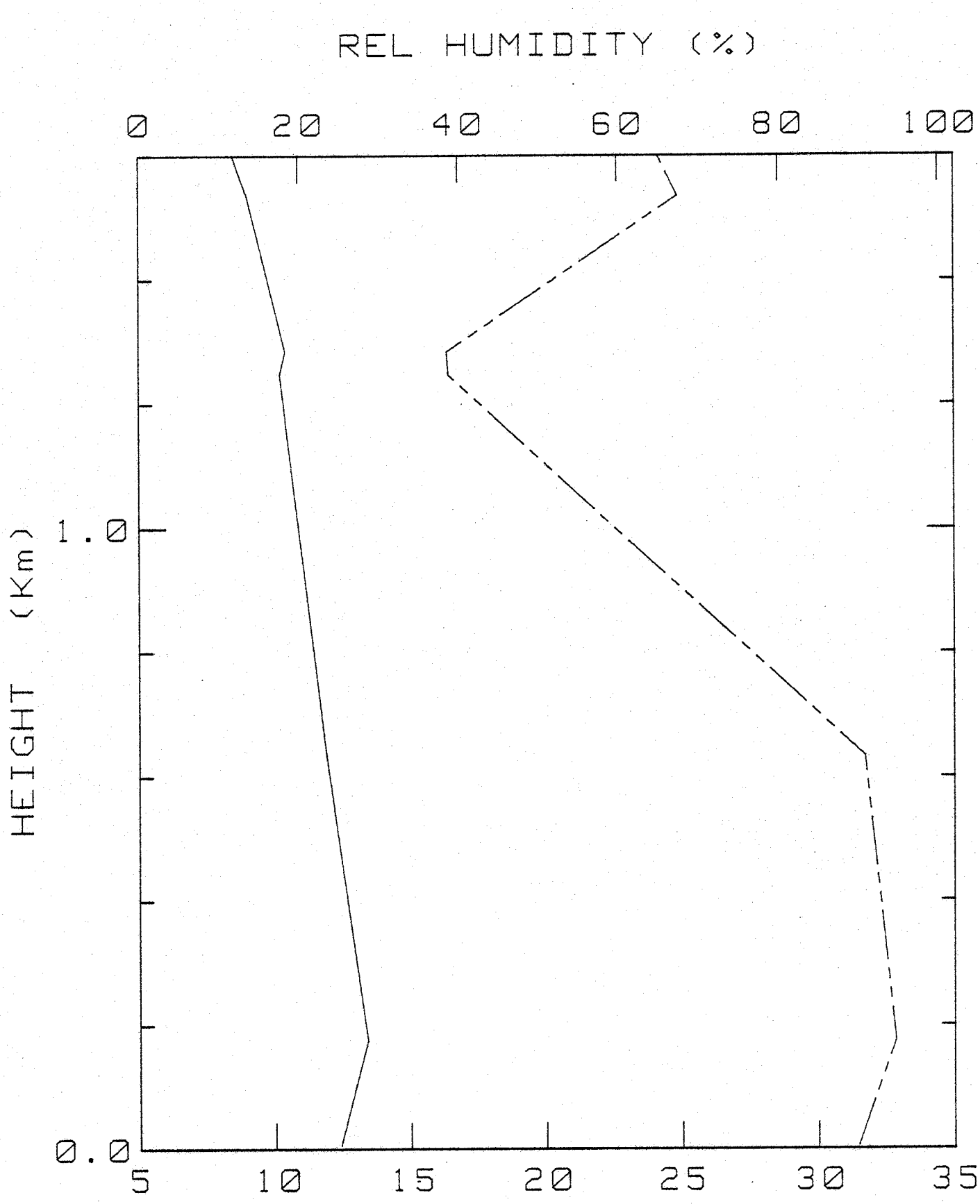

BLM-3 ACN 1825 8 DEC 81
SPECIFIC HUMIDITY Θ
POTENTIAL TEMP Θ
Q *** THETA
Gradient above -.0016 0.0079
Inversion jump -2.29 2.9
Well-mixed 7.76 14.7
Inversion top ht 168m. 168m.
Mixed layer ht 129m. 129m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

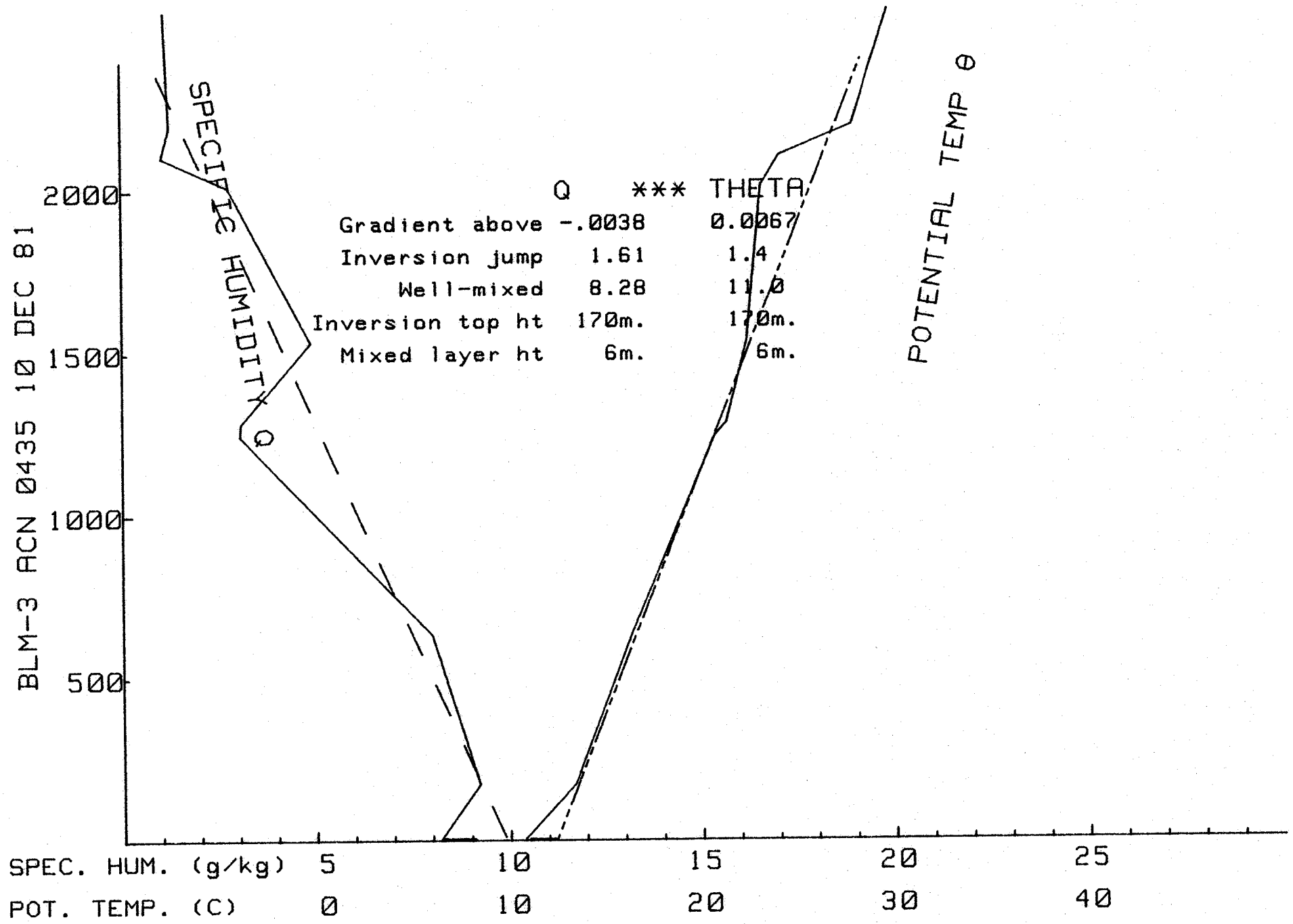

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 9 DEC 81 435

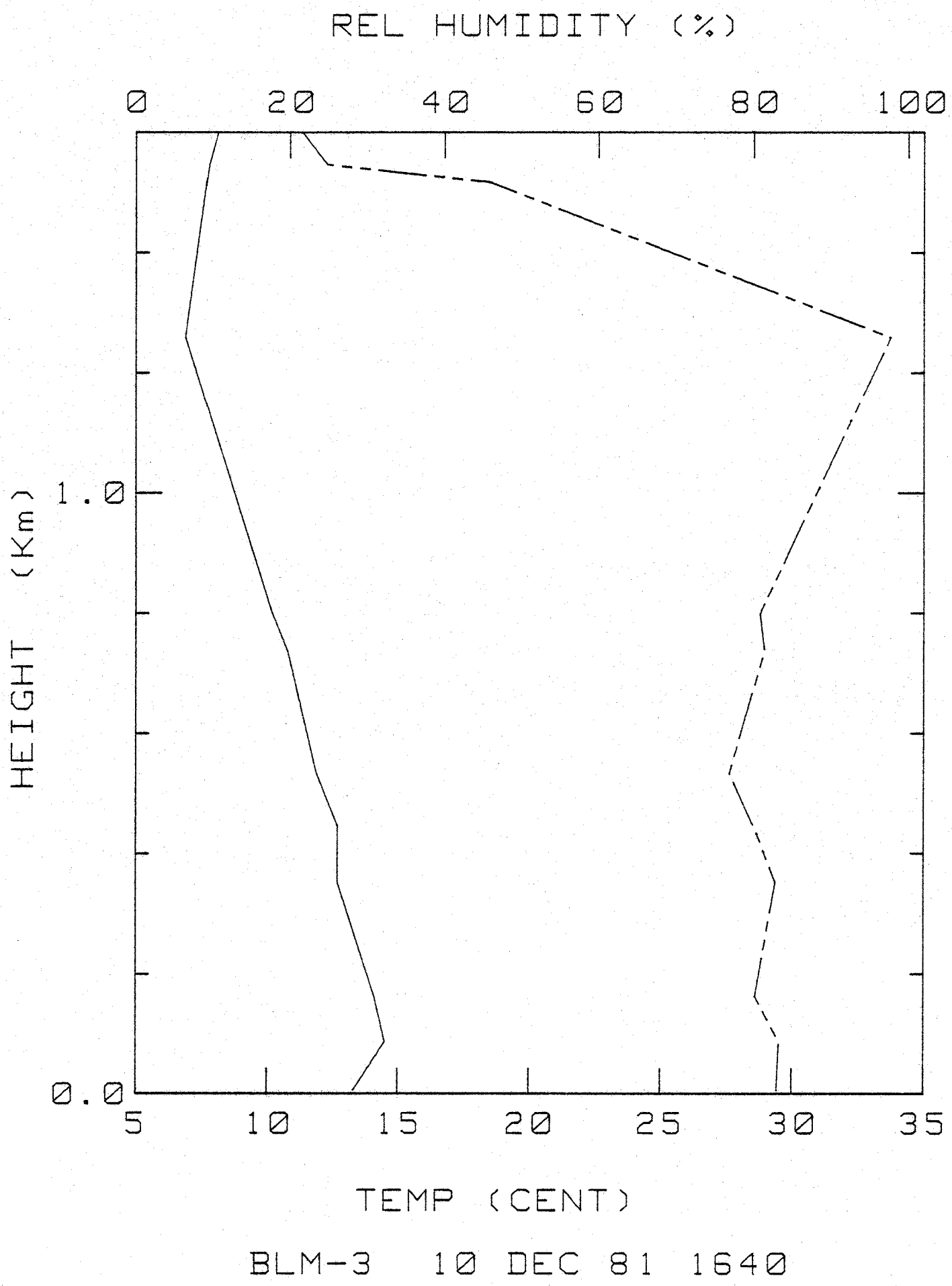

BLM-3 ACN 0435 9 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0003 0.0090
Inversion jump -5.36 6.6
Well-mixed 7.68 9.9
Inversion top ht 302m. 302m.
Mixed layer ht 225m. 225m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

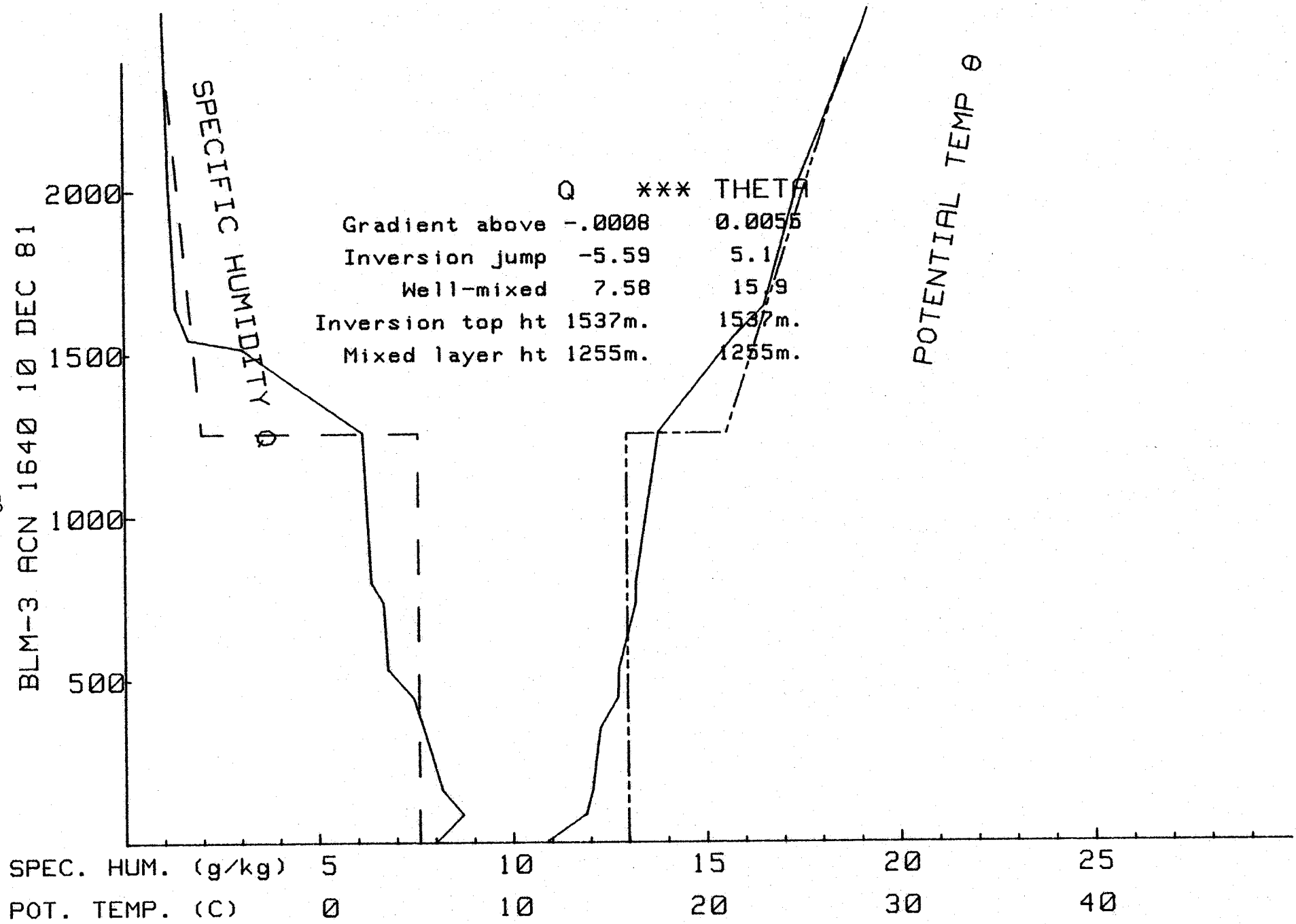

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 9 DEC 81 1635

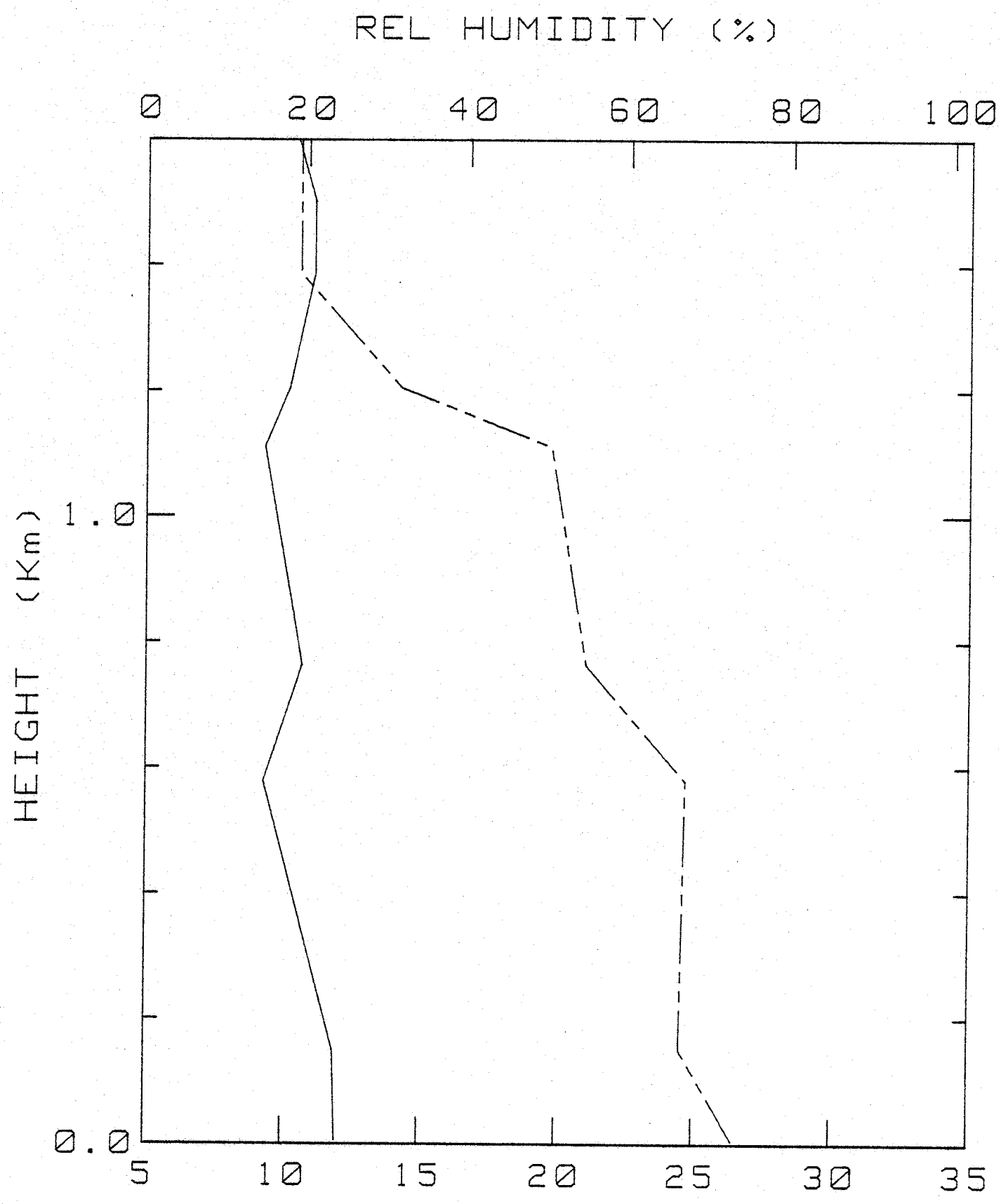

BLM-3 ACN 1635 9 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0003 0.0050
Inversion jump -3.43 6.1
Well-mixed 8.43 15.2
Inversion top ht 1119m. 1119m.
Mixed layer ht 979m. 979m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

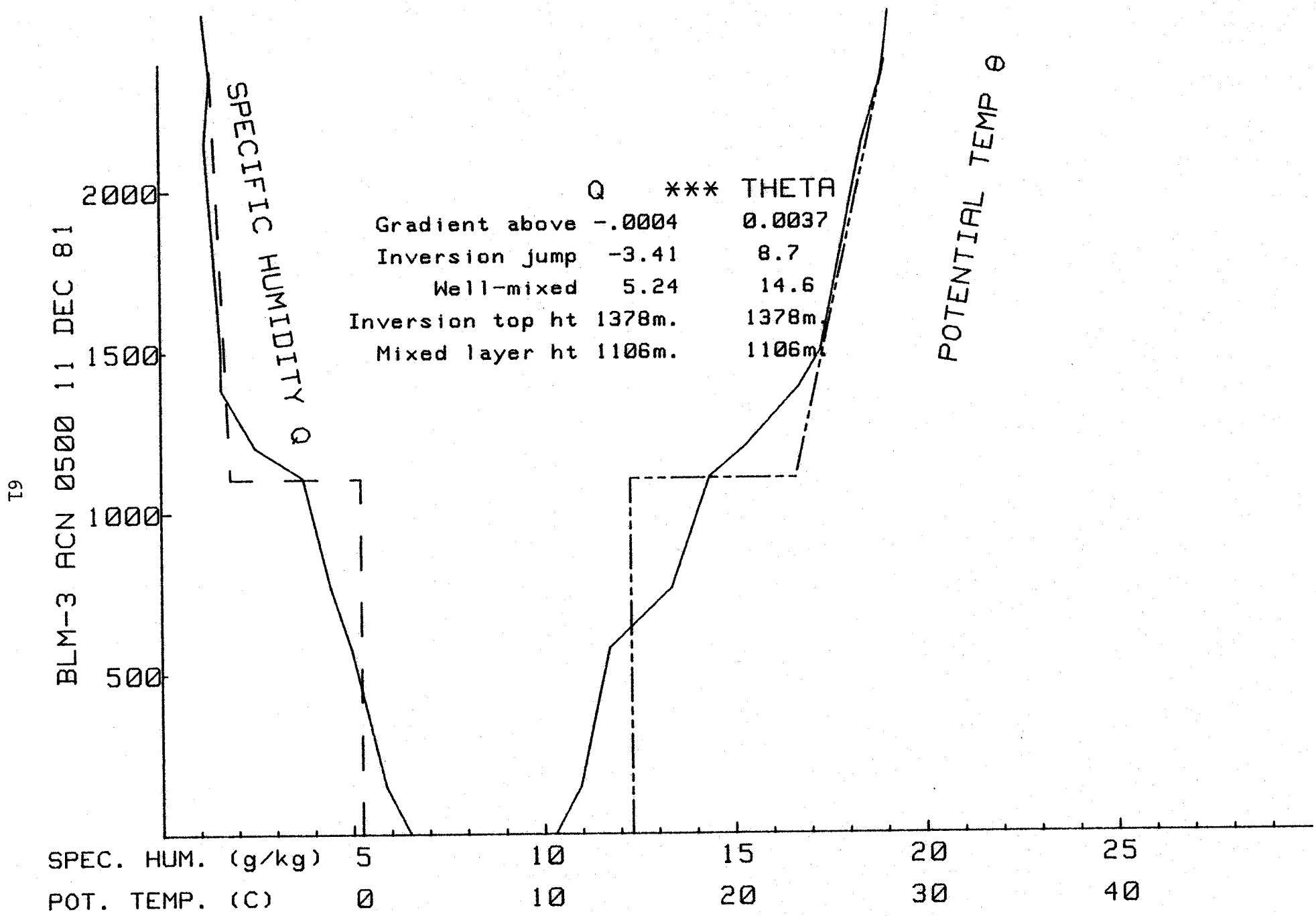

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 10 DEC 81 435

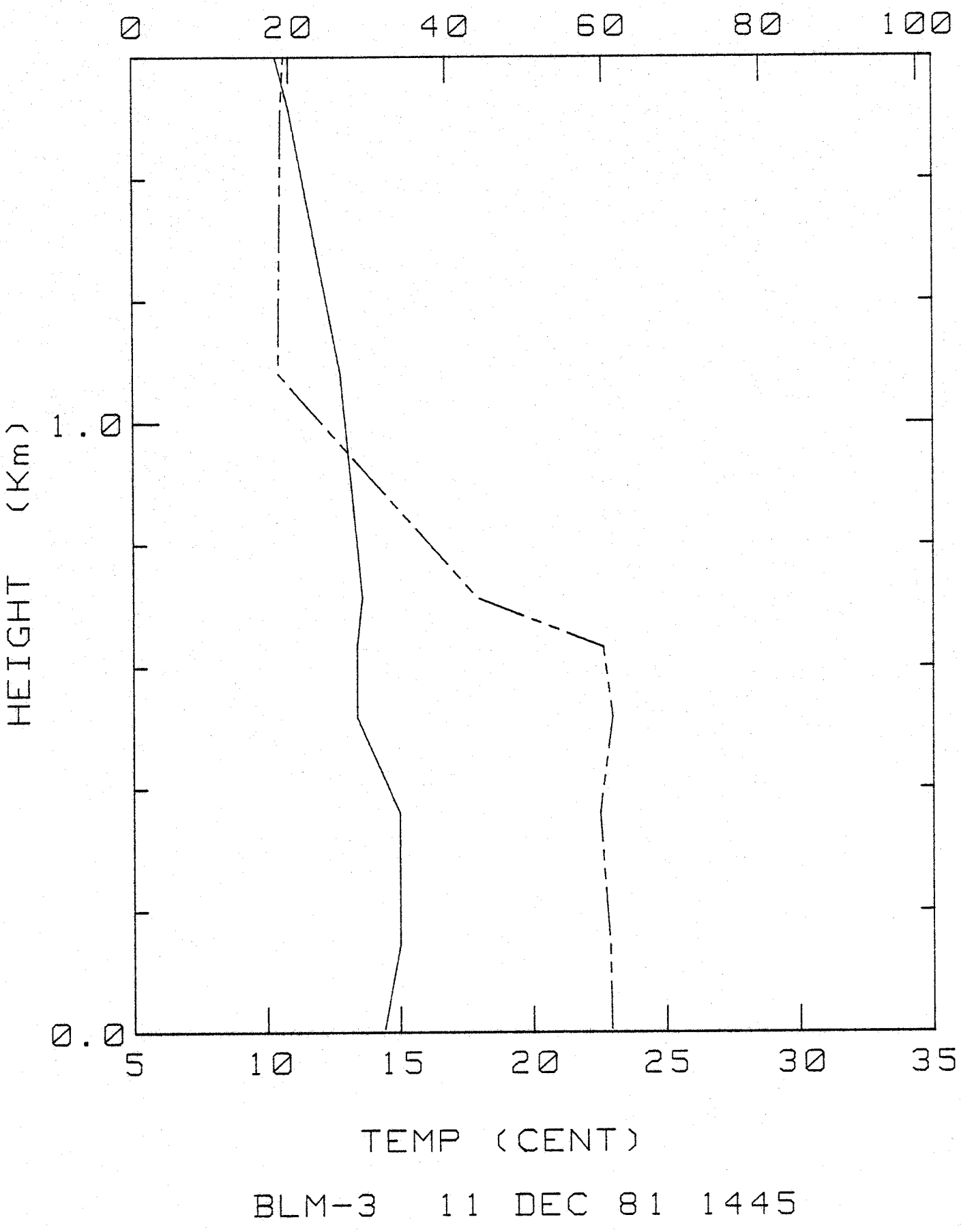

BLM-3 ACN 0435 10 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0038 0.0067
Inversion jump 1.61 1.4
Well-mixed 8.28 11.0
Inversion top ht 170m. 170m.
Mixed layer ht 6m. 6m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

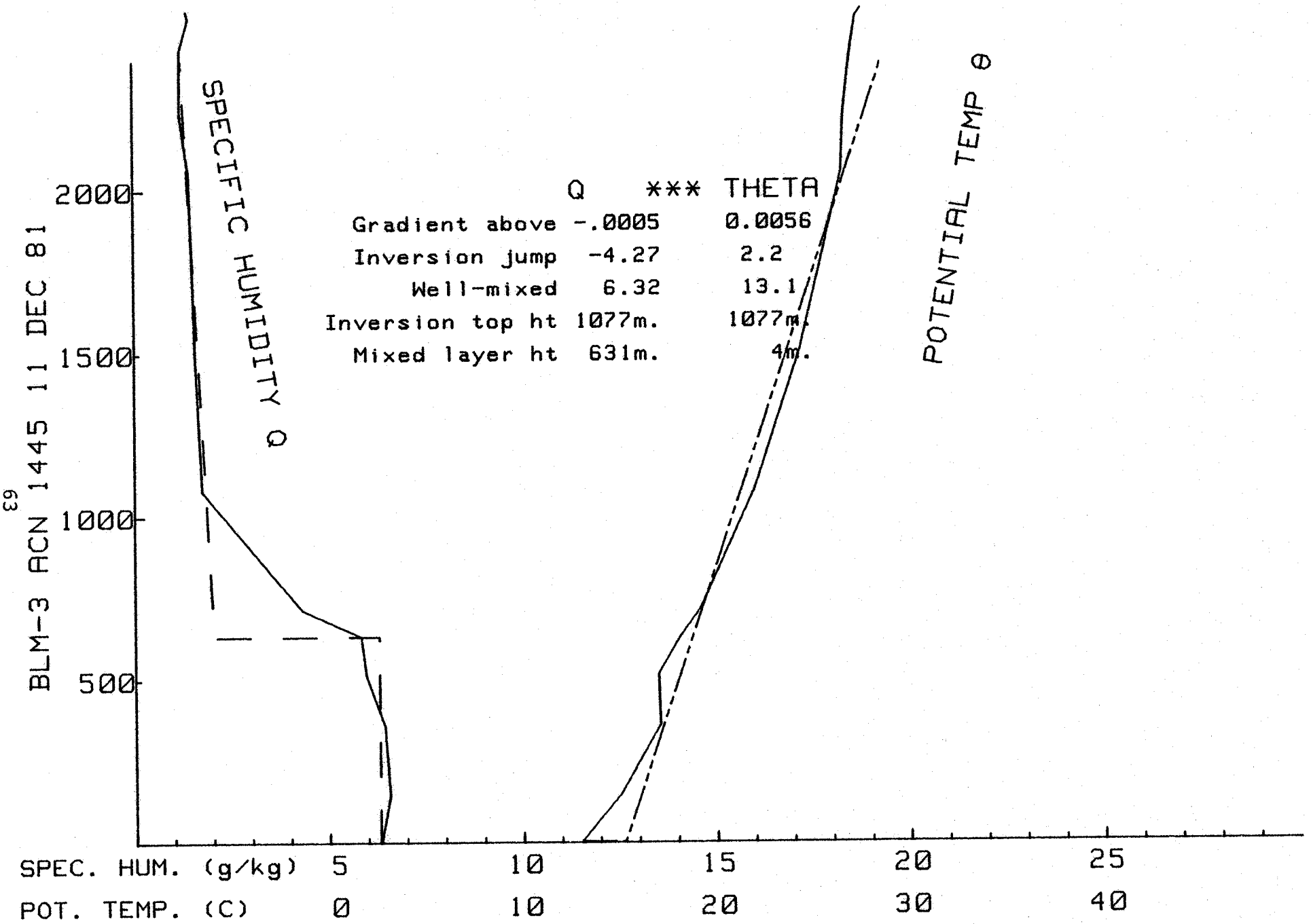

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 10 DEC 81 1640

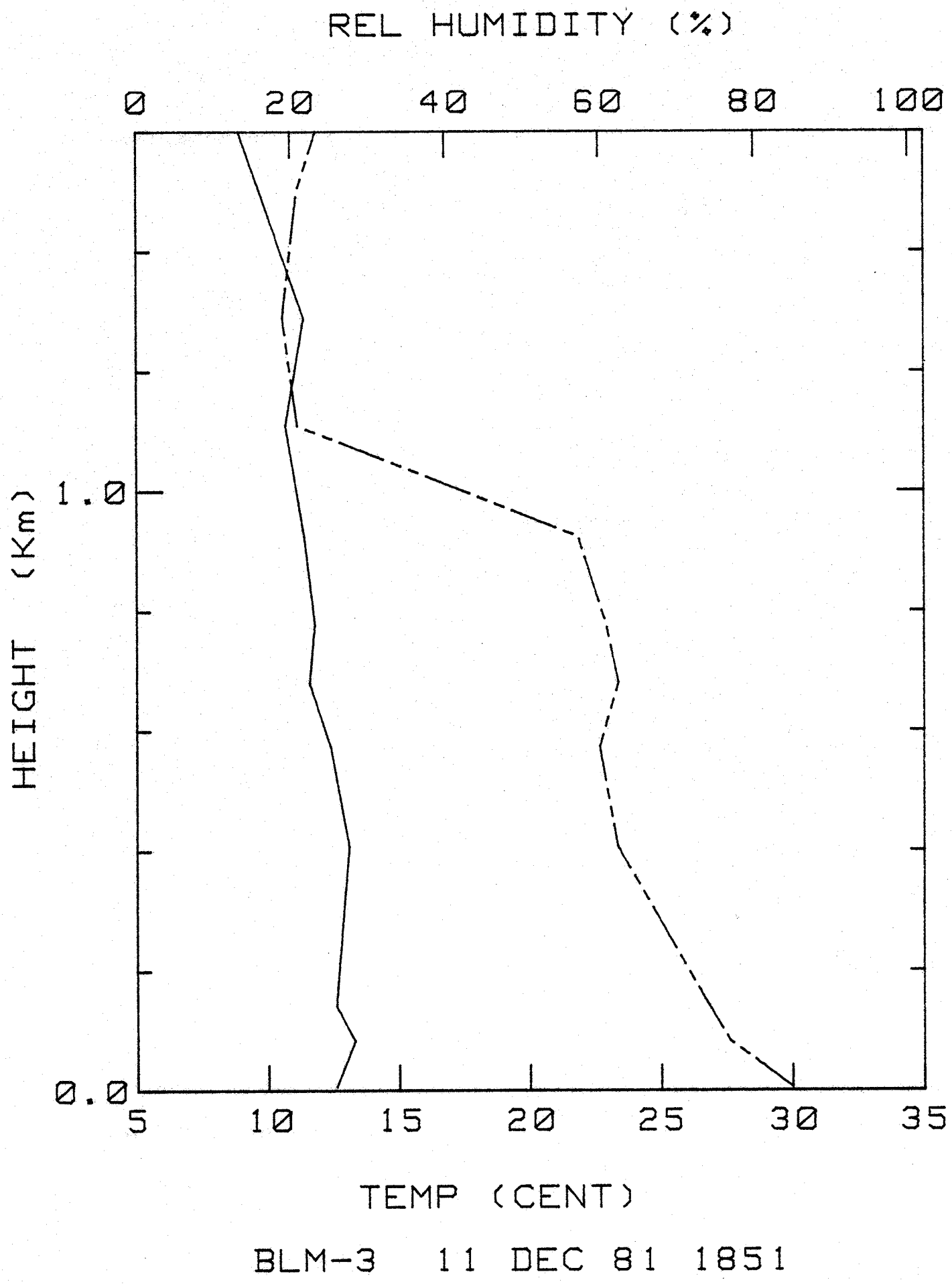

BLM-3 ACN 1640 10 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0008 0.0056
Inversion jump -5.59 5.1
Well-mixed 7.58 15.9
Inversion top ht 1537m. 1537m.
Mixed layer ht 1255m. 1255m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

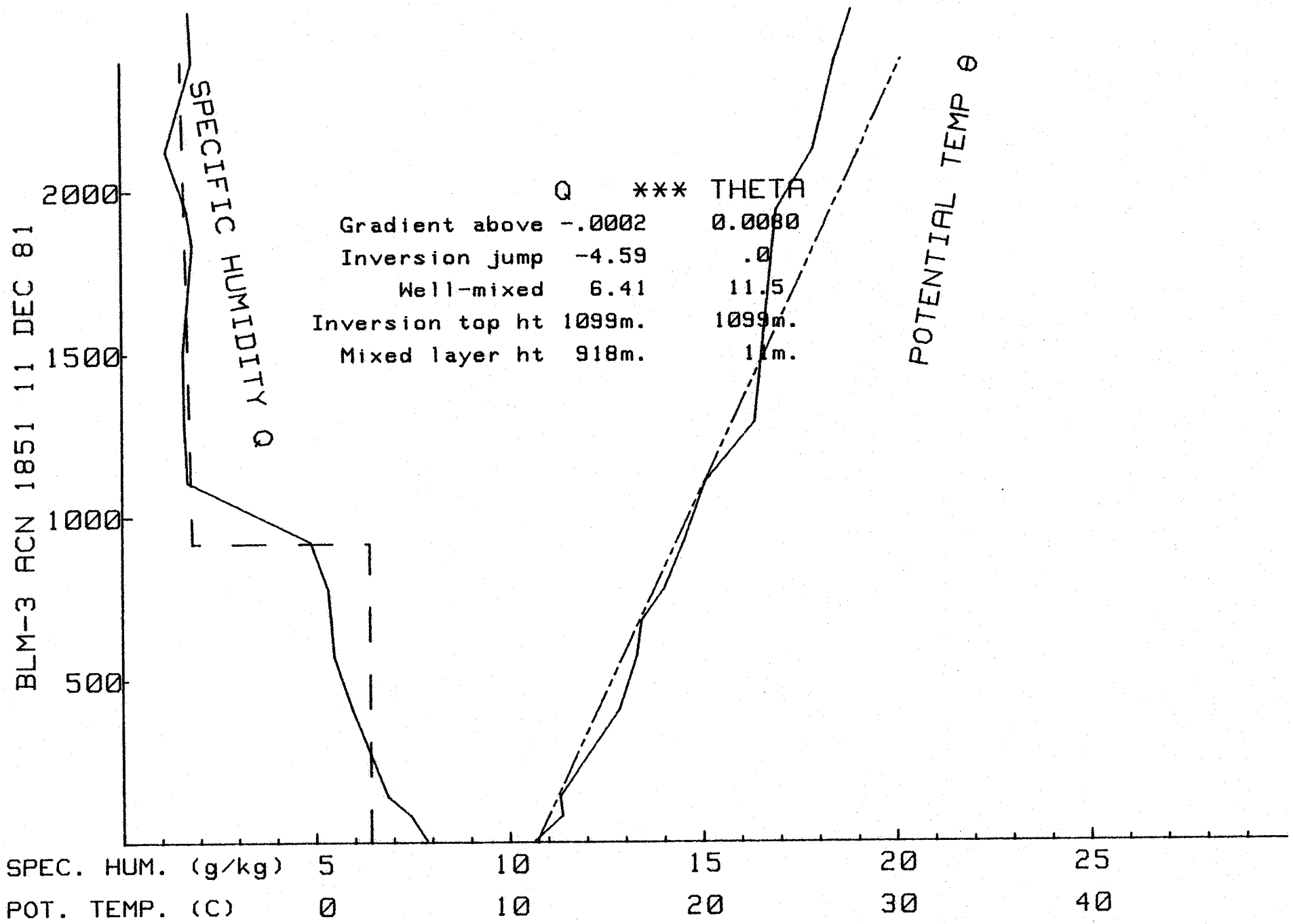

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 11 DEC 81 500

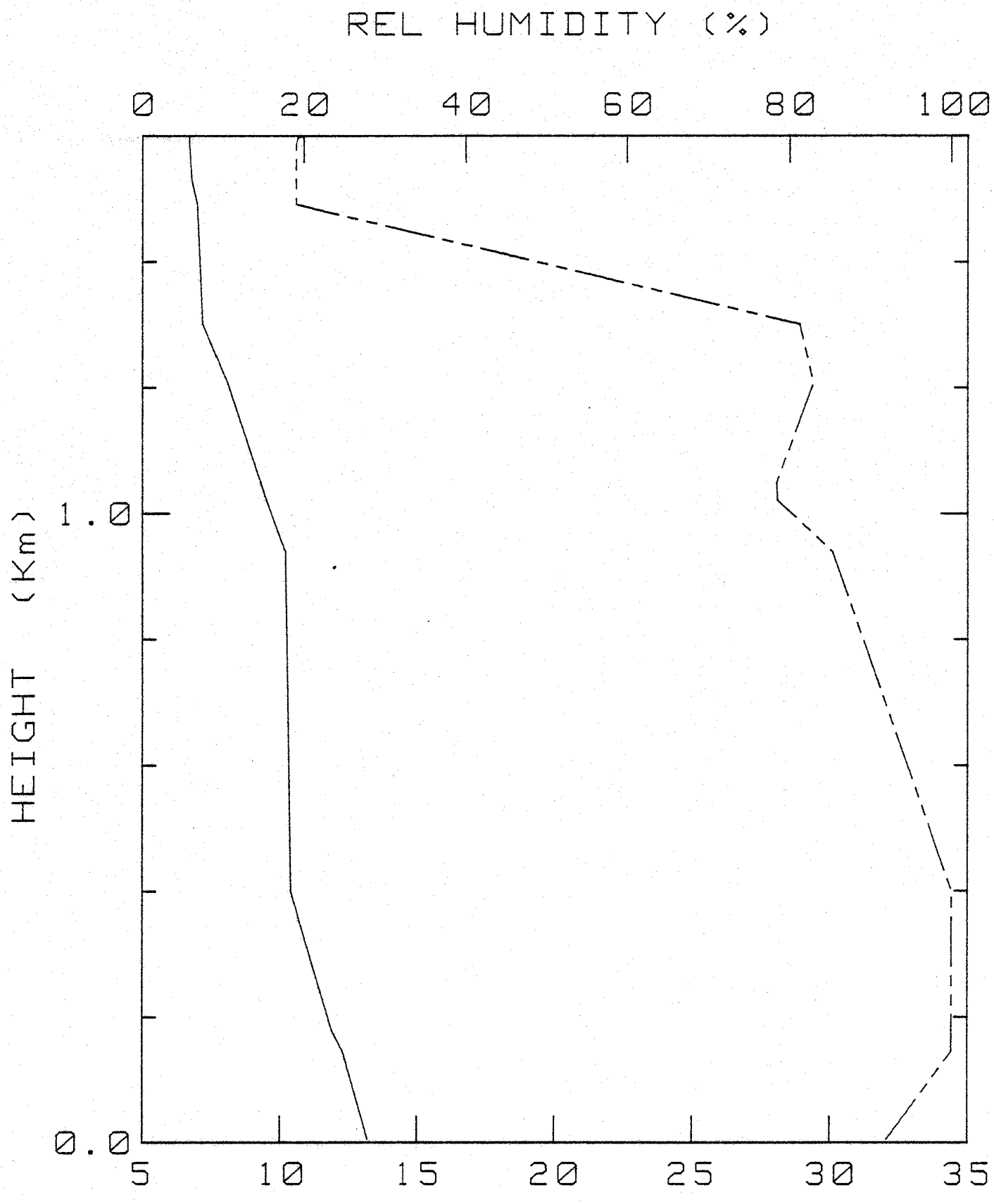

BLM-3 ACN 0500 11 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP Θ
Q *** THETA
Gradient above -.0004 0.0037
Inversion jump -3.41 8.7
Well-mixed 5.24 14.6
Inversion top ht 1378m. 1378m.
Mixed layer ht 1106m. 1106m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

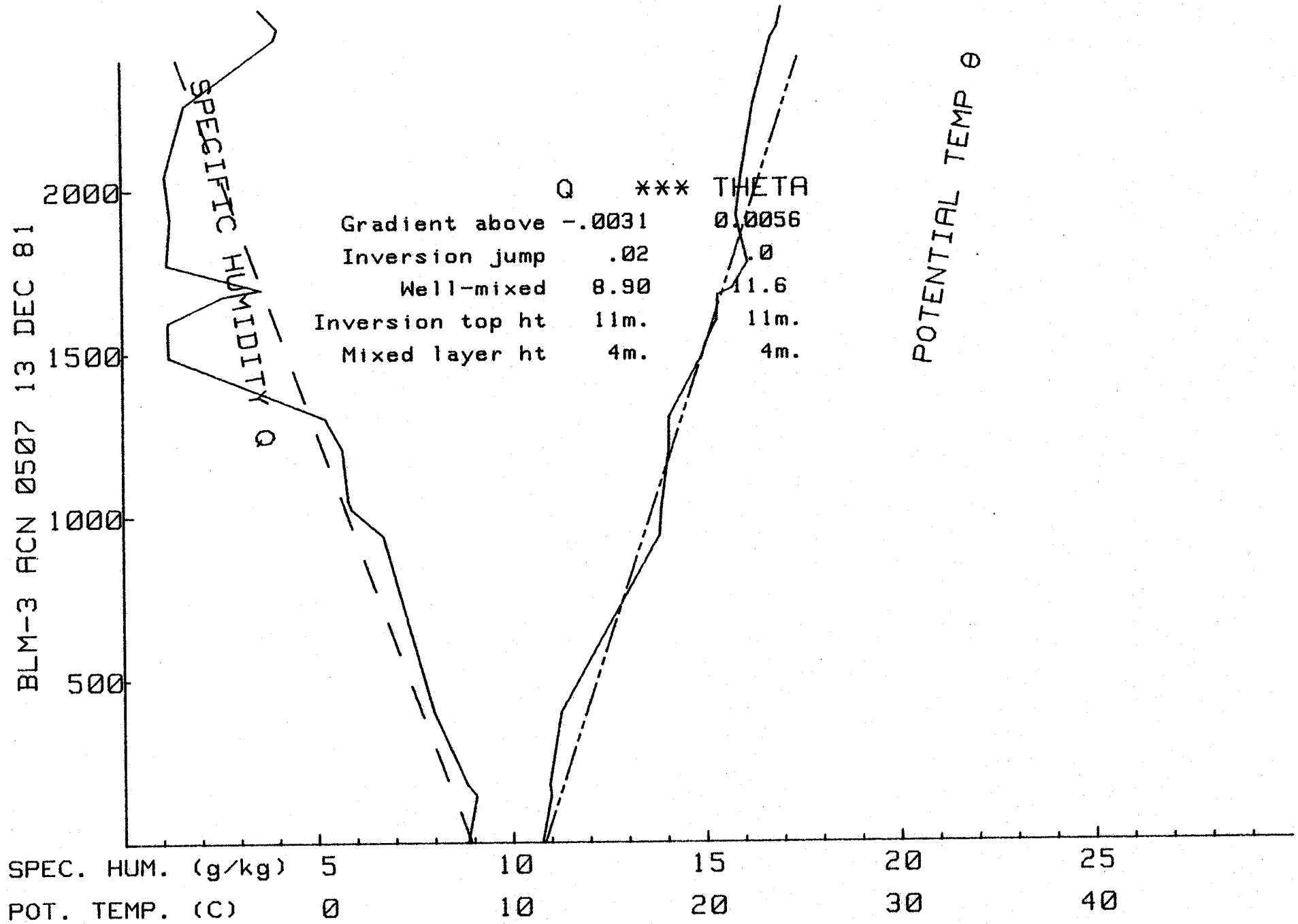

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 11 DEC 81 1445

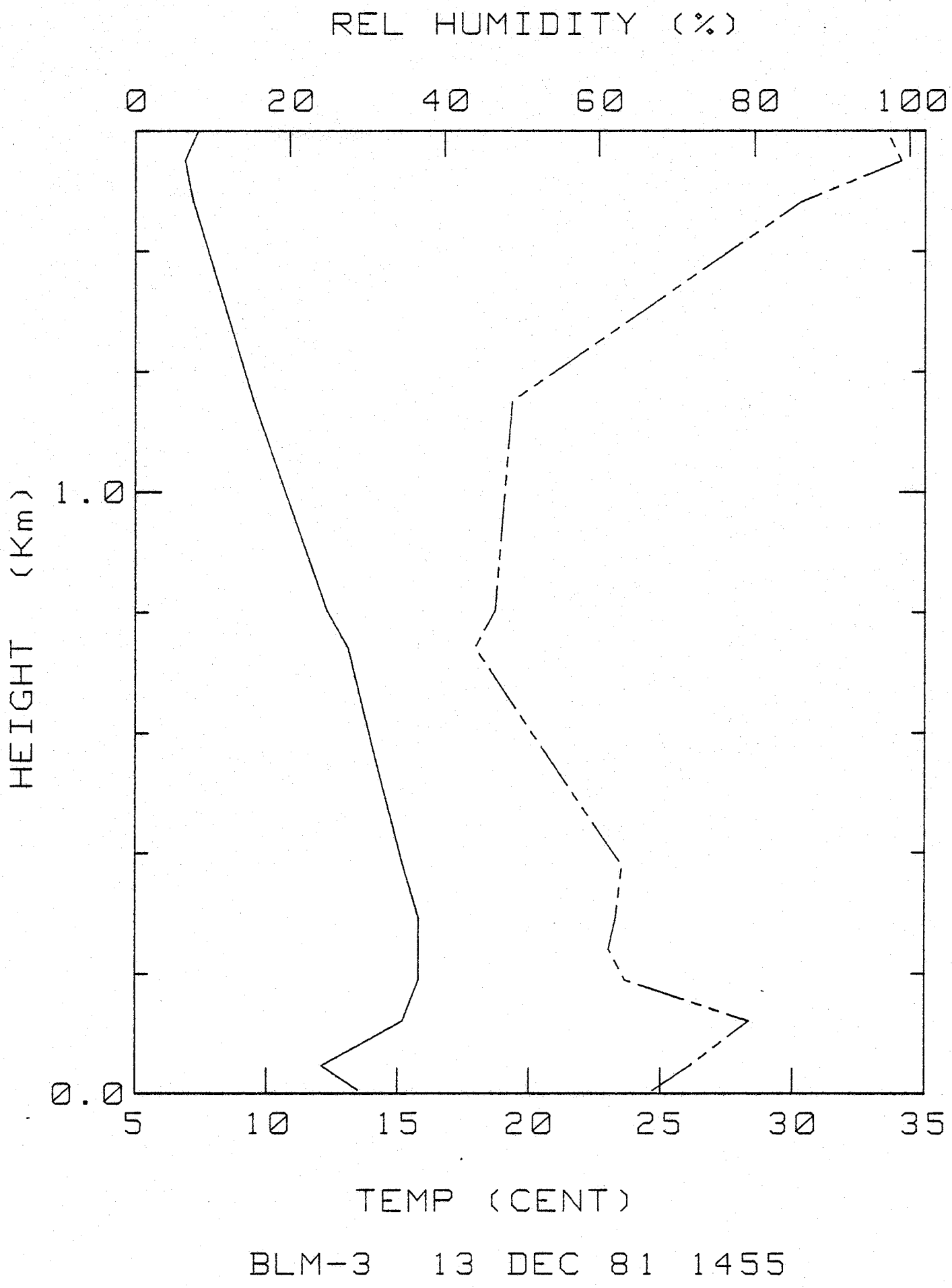

BLM-3 ACN 1445 11 DEC 81
63
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0005 0.0056
Inversion jump -4.27 2.2
Well-mixed 6.32 13.1
Inversion top ht 1077m. 1077m.
Mixed layer ht 631m. 4m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

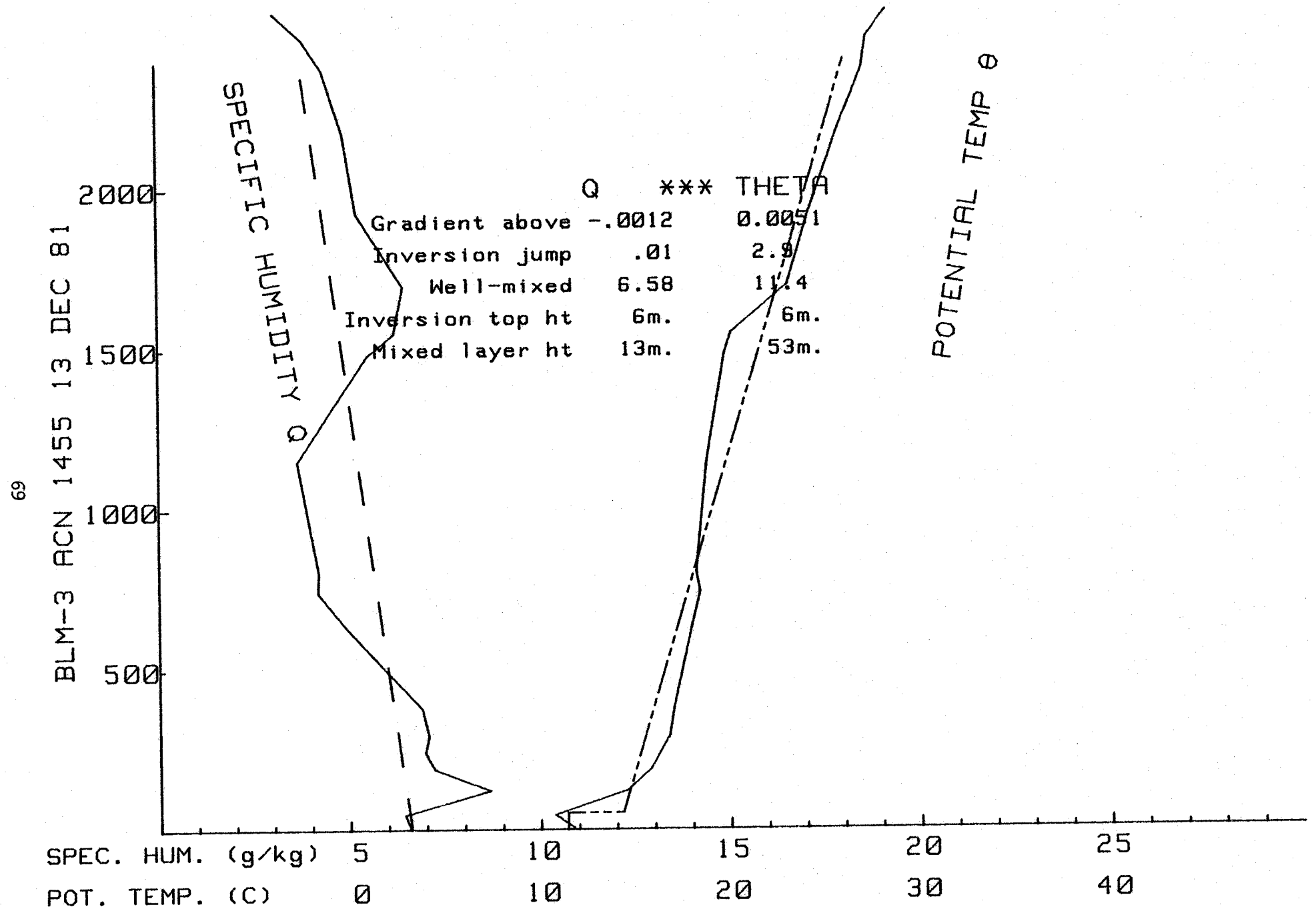

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 11 DEC 81 1851

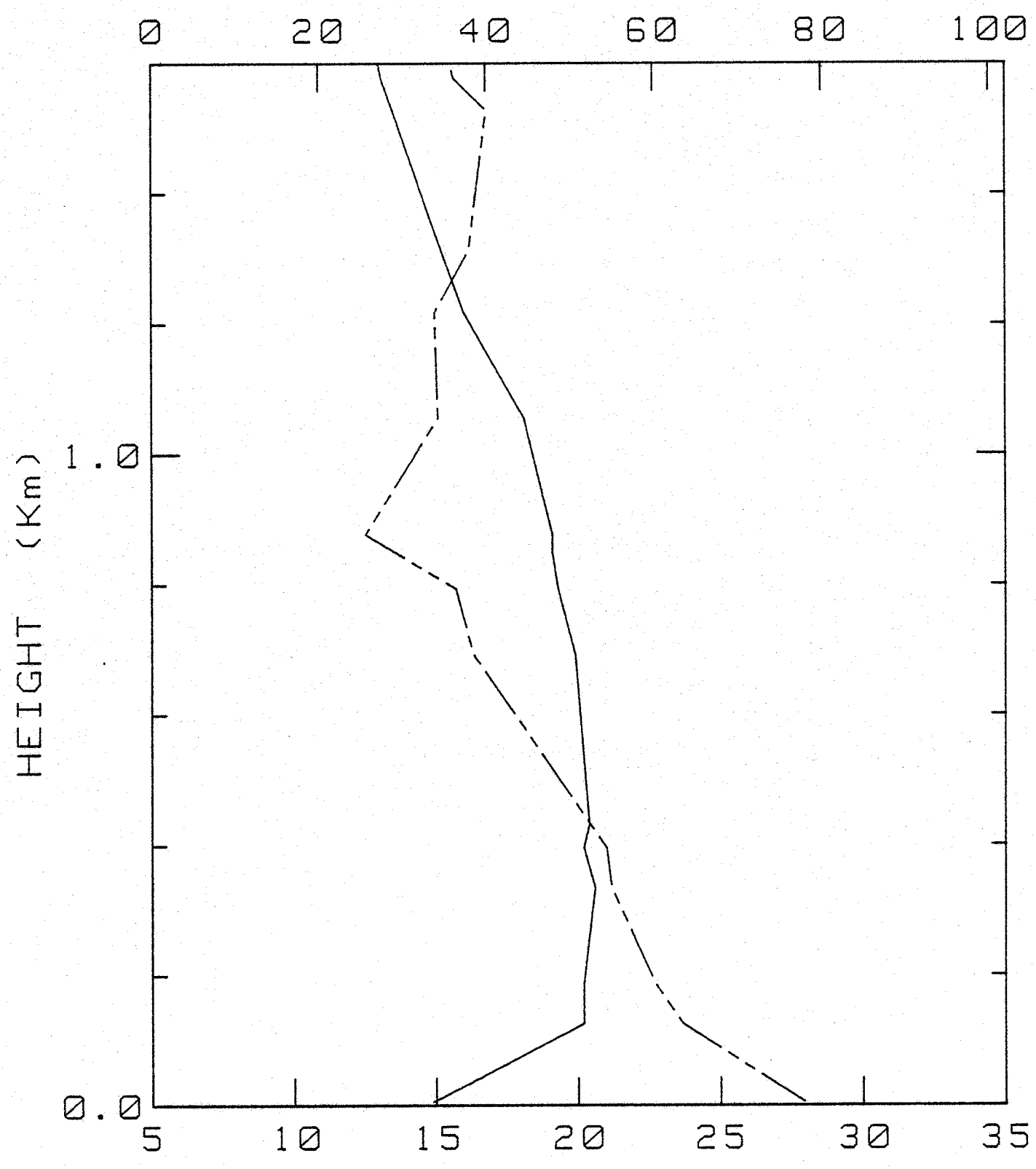

BLM-3 RCN 1851 11 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP Θ
Q *** THETA
Gradient above -.0002 0.0080
Inversion jump -4.59 .0
Well-mixed 6.41 11.5
Inversion top ht 1099m. 1099m.
Mixed layer ht 918m. 11m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

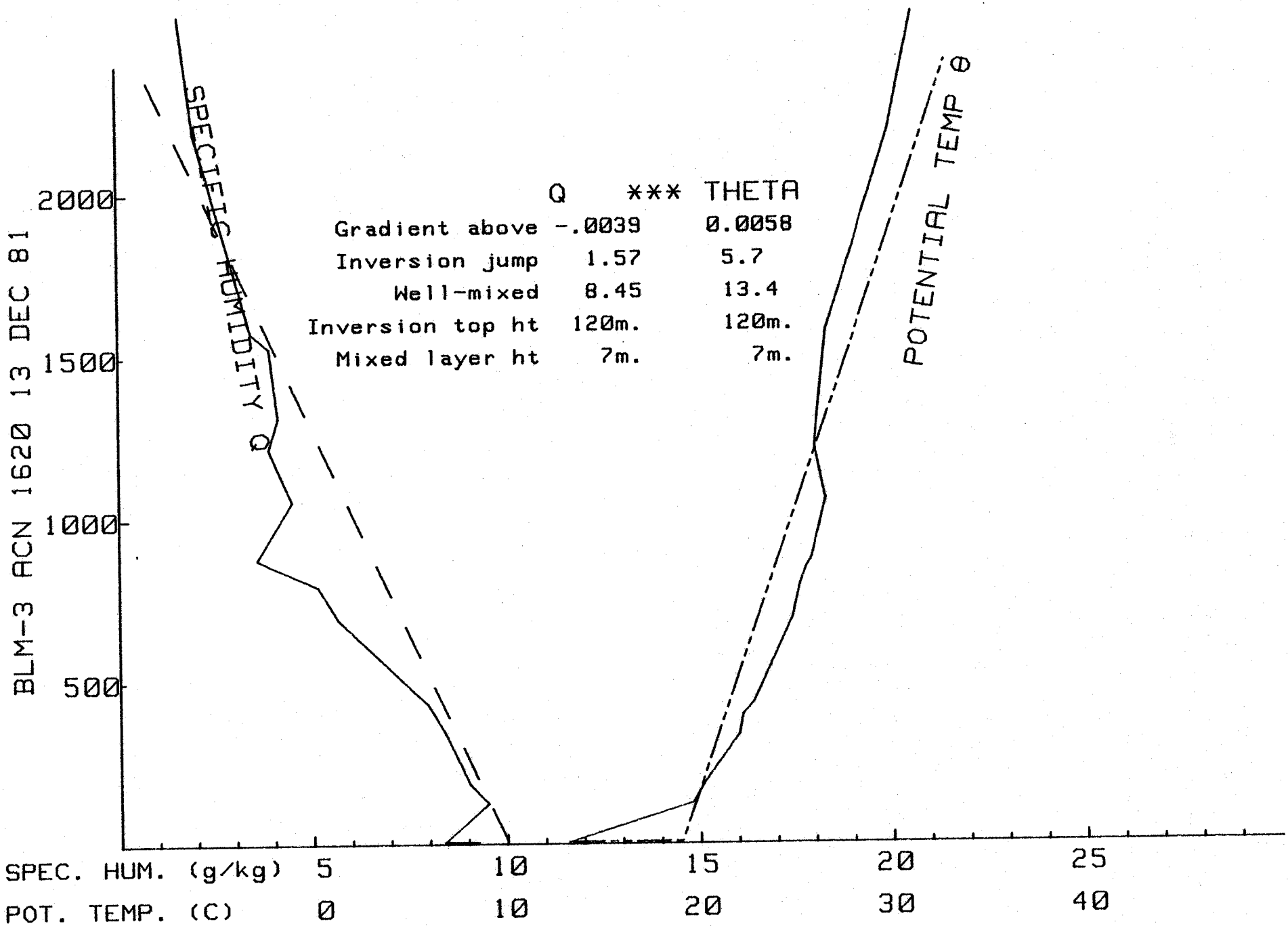

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 13 DEC 81 507

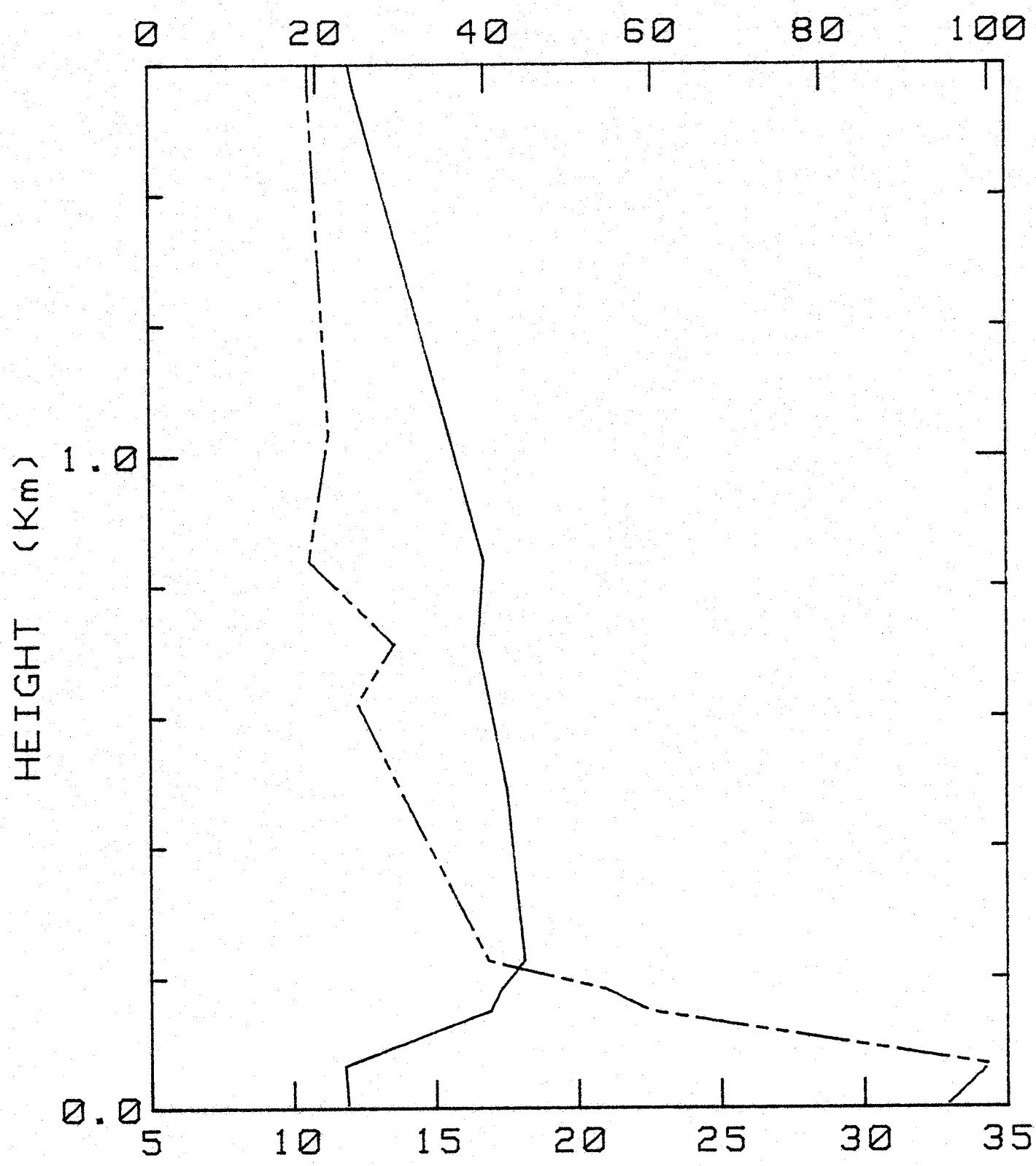

BLM-3 ACN 0507 13 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0031 0.0056
Inversion jump .02 .0
Well-mixed 8.90 11.6
Inversion top ht 11m. 11m.
Mixed layer ht 4m. 4m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

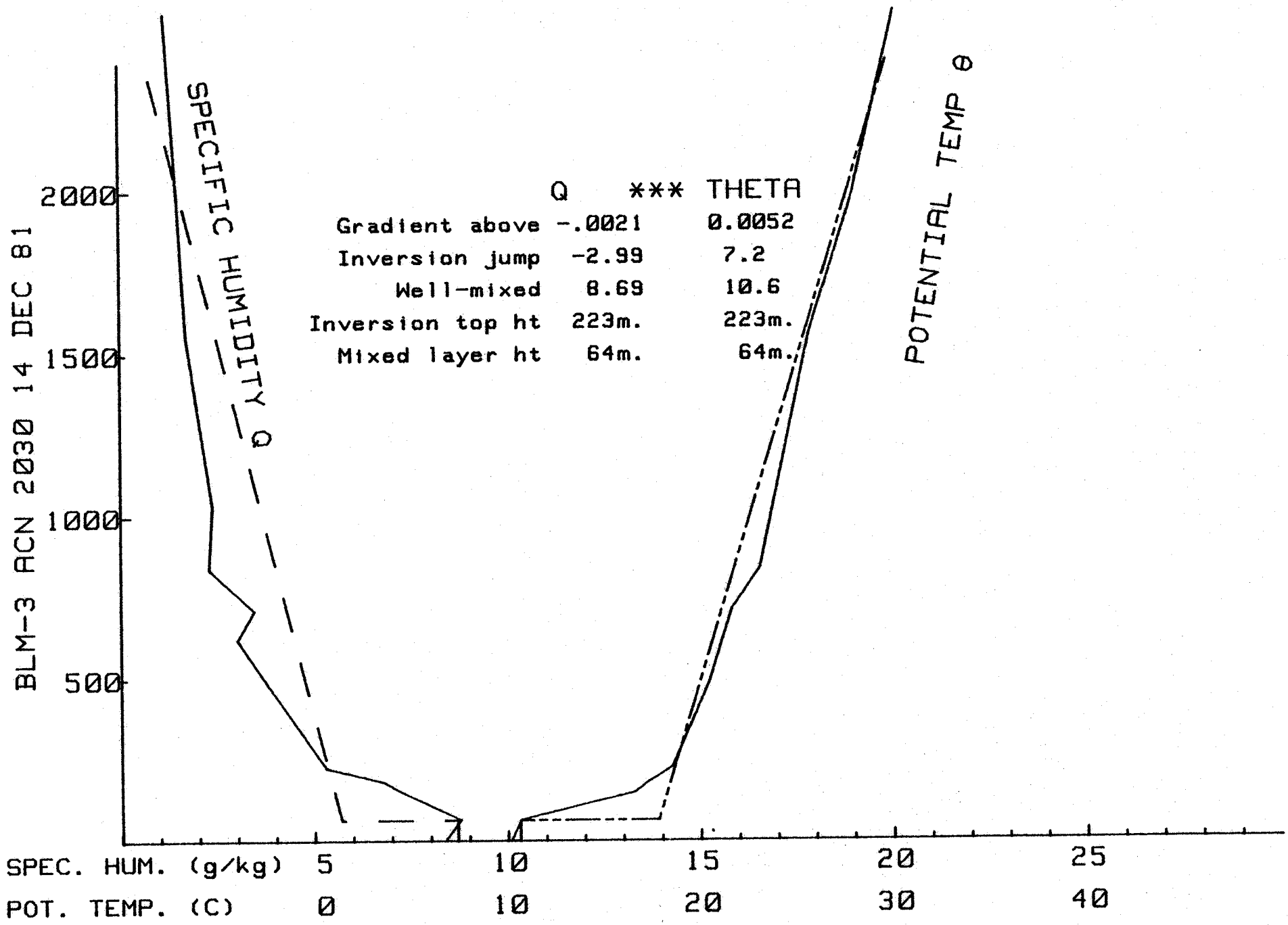

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 13 DEC 81 1455

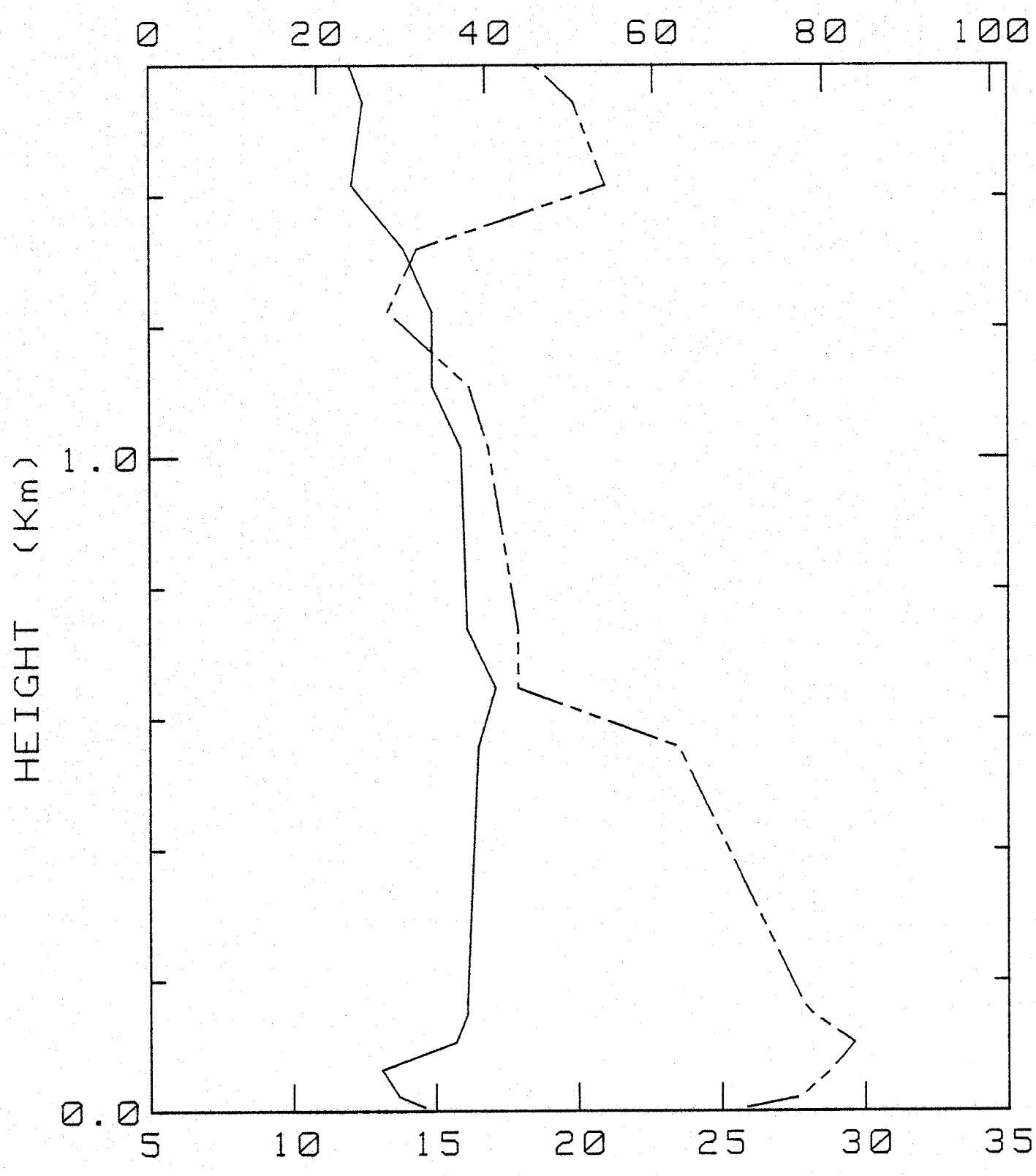

BLM-3 ACN 1455 13 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0012 0.0051
Inversion jump .01 2.9
Well-mixed 6.58 11.4
Inversion top ht 6m. 6m.
Mixed layer ht 13m. 53m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

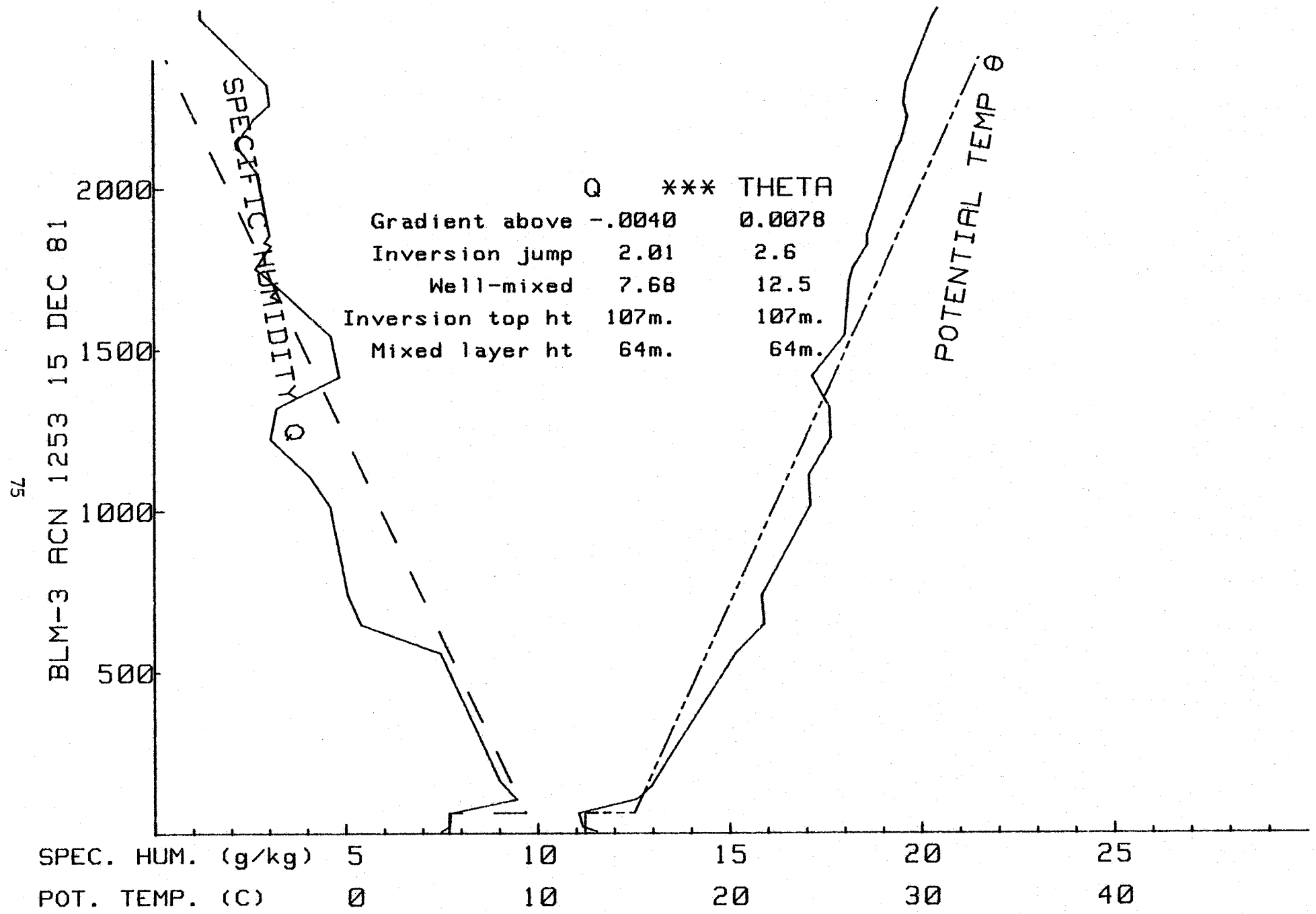

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 13 DEC 81 1620

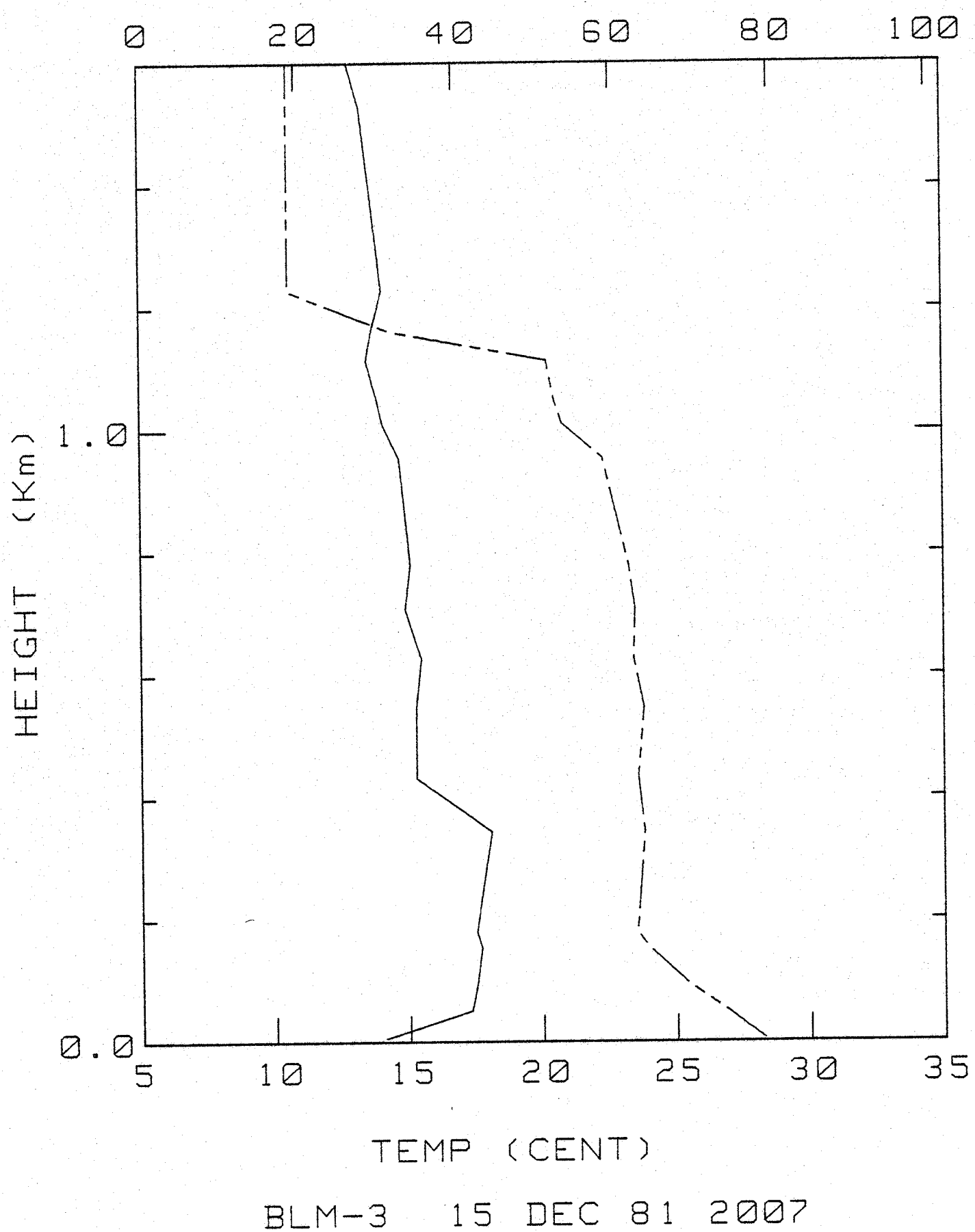

BLM-3 ACN 1620 13 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0039 0.0058
Inversion jump 1.57 5.7
Well-mixed 8.45 13.4
Inversion top ht 120m. 120m.
Mixed layer ht 7m. 7m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

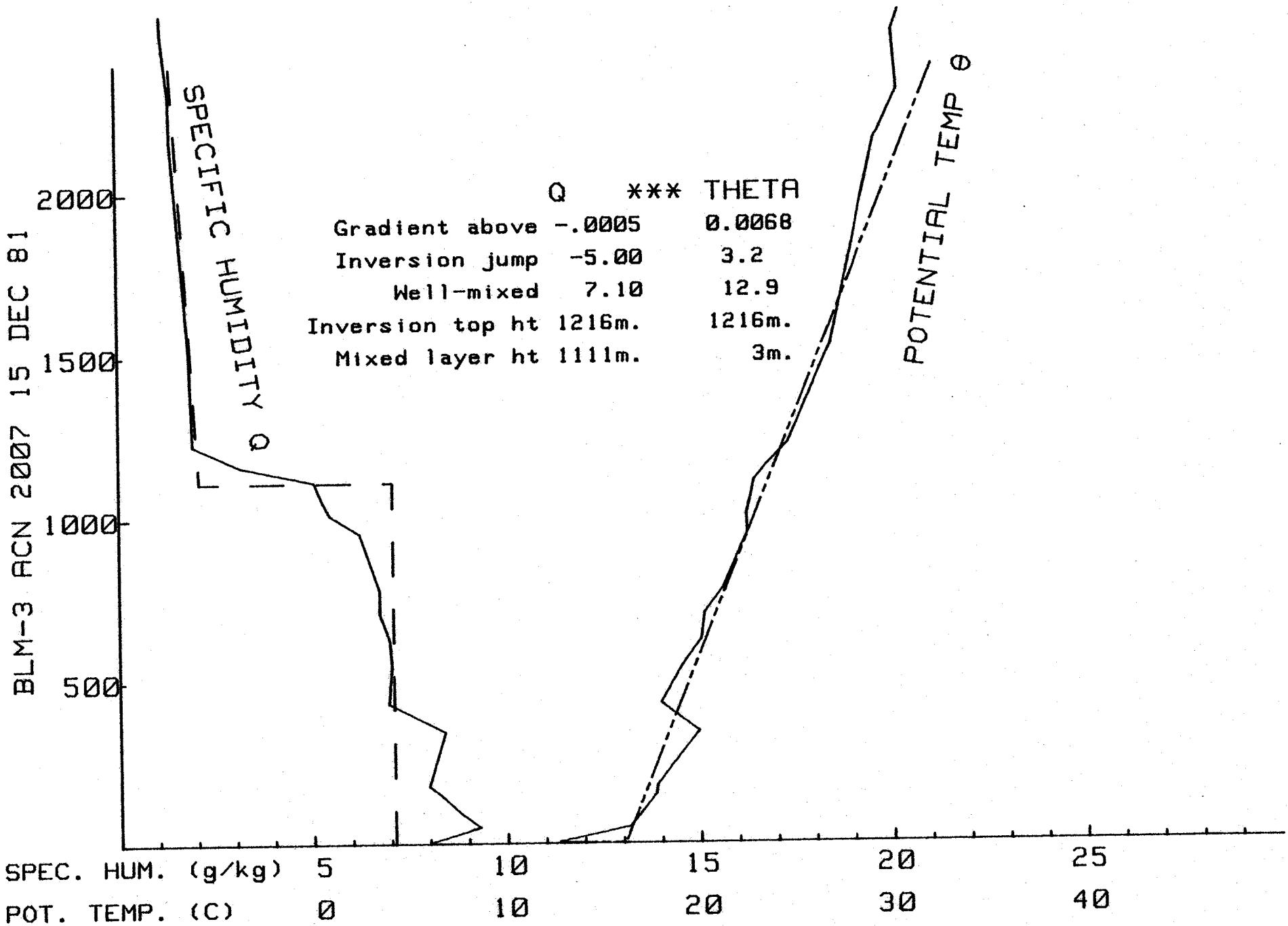

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 14 DEC 81 2030

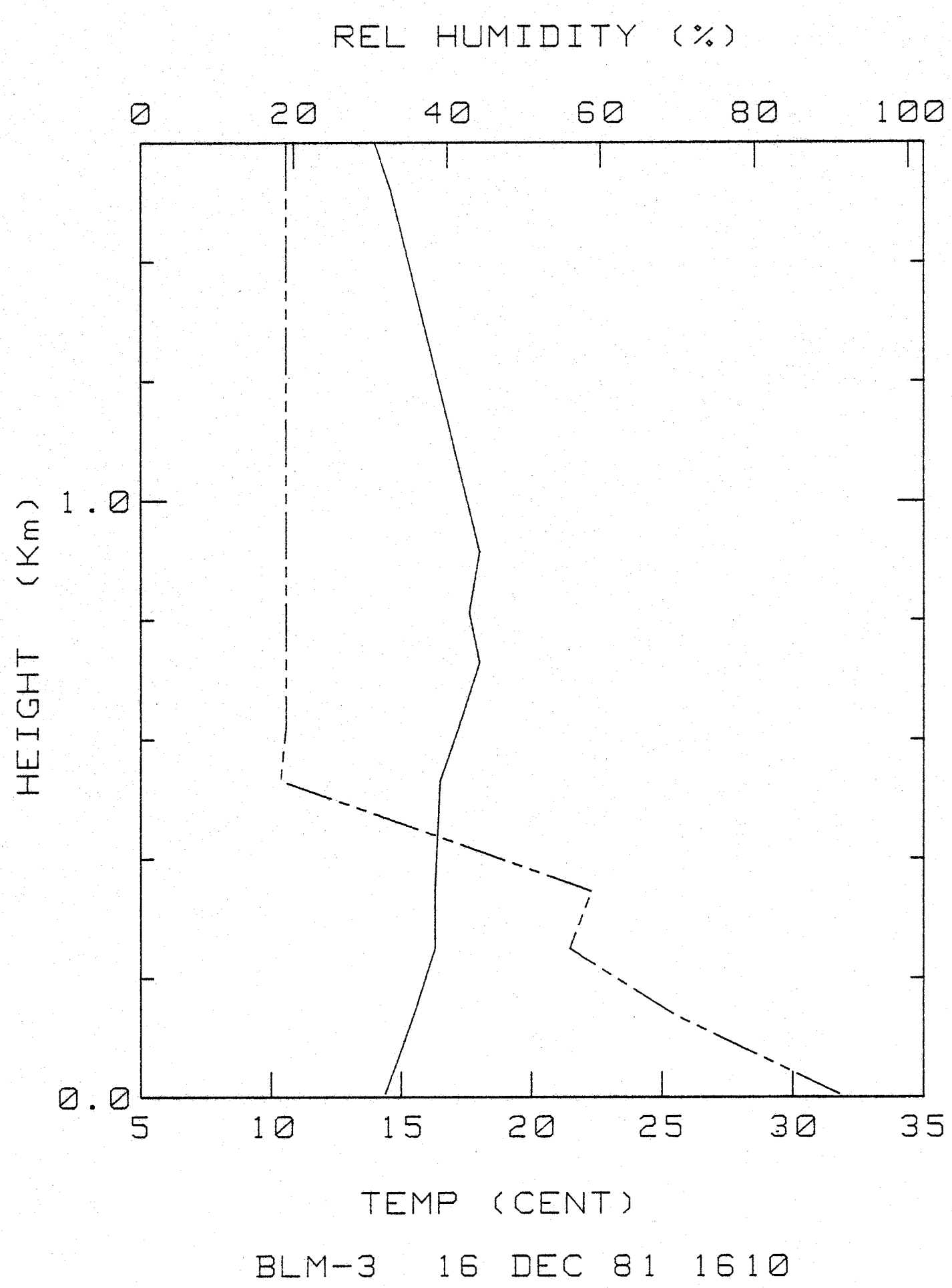

BLM-3 ACN 2030 14 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0021 0.0052
Inversion jump -2.99 7.2
Well-mixed 8.69 10.6
Inversion top ht 223m. 223m.
Mixed layer ht 64m. 64m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

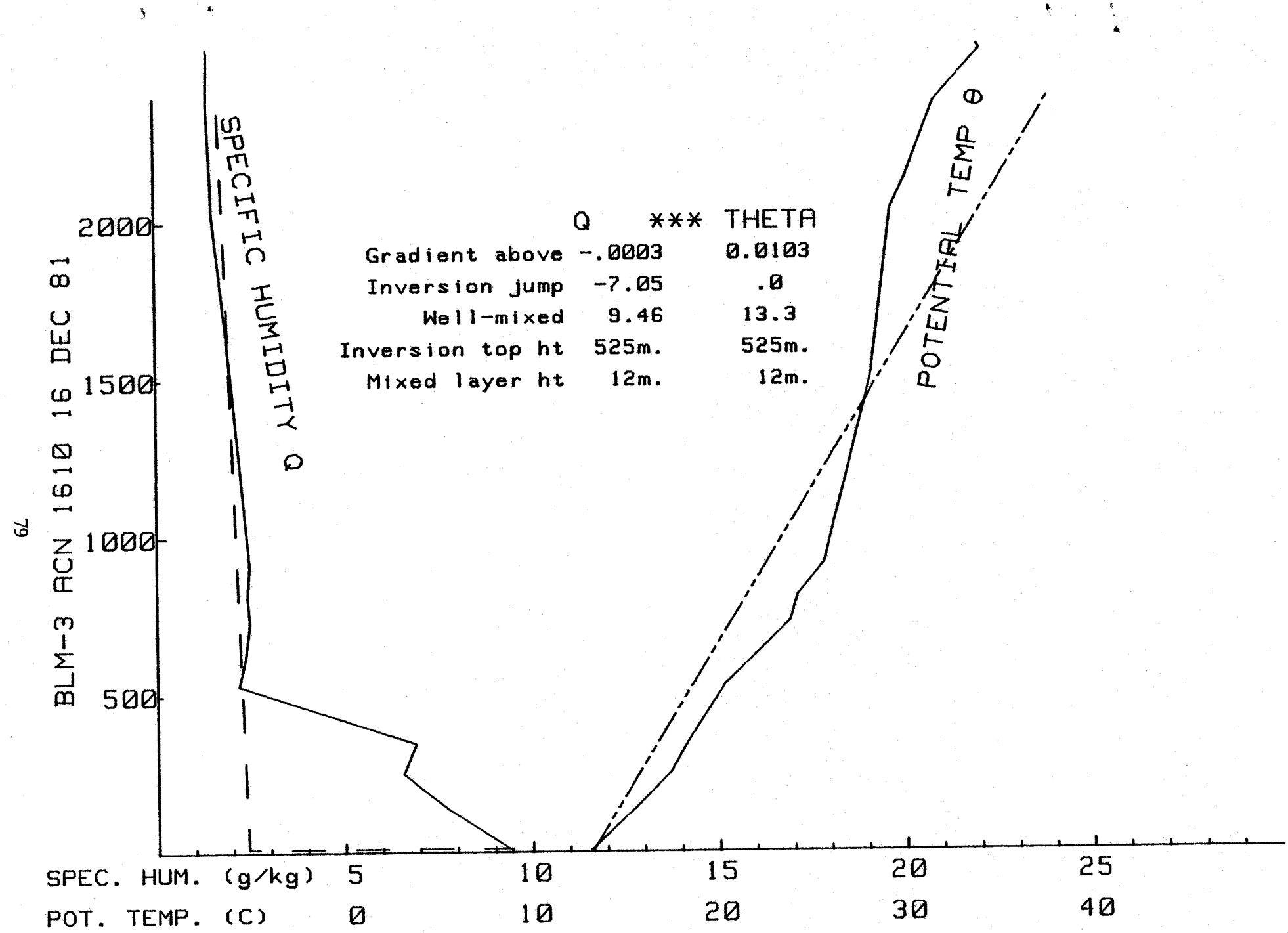

REL HUMIDITY (%)
0
20
40
60
80
100
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 15 DEC 81 1253


BLM-3 ACN 1253 15 DEC 81
2000
1500
1000
500
SPECIFIC HUMIDITY Q
POTENTIAL TEMP Θ
Q *** THETA
Gradient above -.0040 0.0078
Inversion jump 2.01 2.6
Well-mixed 7.68 12.5
Inversion top ht 107m. 107m.
Mixed layer ht 64m. 64m.
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
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 15 DEC 81 2007


BLM-3 ACN 2007 15 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0005 0.0068
Inversion jump -5.00 3.2
Well-mixed 7.10 12.9
Inversion top ht 1216m. 1216m.
Mixed layer ht 1111m. 3m.
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
HEIGHT (Km)
1.0
0.0
5
10
15
20
25
30
35
TEMP (CENT)
BLM-3 16 DEC 81 1610


BLM-3 ACN 1610 16 DEC 81
SPECIFIC HUMIDITY Q
POTENTIAL TEMP θ
Q *** THETA
Gradient above -.0003 0.0103
Inversion jump -7.05 .0
Well-mixed 9.46 13.3
Inversion top ht 525m. 525m.
Mixed layer ht 12m. 12m.
2000
1500
1000
500
SPEC. HUM. (g/kg) 5 10 15 20 25
POT. TEMP. (C) 0 10 20 30 40

VII. Acoustic Sounder Results

The acoustic sounder was operated continuously throughout the cruise. Figures 3 are photographs of the strip chart output. As can be seen there was seldom a well defined return that would allow one to easily determine the boundary layer depth. In Table 5 we list the heights of detectable acoustic returns for every half-hour. In many cases the returns were weak, in others there were multiple returns, so that it is not certain if they indicate the height of the base of the inversion.

The difficulty in determining the inversion height is confirmed by the radiosonde results. As discussed in the previous section, there was not a well defined mixed layer for much of the operation.

Table 5 - Heights of acoustic echo return from the acoustic sounder.

DATE	TIME	z_1	z_2	DATE	TIME	z_1	z_2
12-6-81	0900				1230	300	
	0930				1300	350	
	1000				1330	290	
	1030				1400	245	
	1100				1430	200	
	1130	480			1500	190	
	1200	420			1530	160	
	1230	360	70		1600		
	1300	350	90		1630		
	1330	320	100		1700		
	1400		100		1730		
	1430		110		1800		
	1500		110		1830	170	
	1530		100		1900	180	
	1600		120		1930	160	
	1630		130		2000	150	
	1700	360			2030	170	
	1730	320			2100	160	
	1800	330			2130	170	
	1830	360			2200	190	
	1900	380			2230	190	
	1930	350			2300	250	
	2000	240			2330		
	2030	180			2400		
	2100	140		12-8-81	0030	120	
	2130	250			0100	130	230
	2200	220			0130	110	170
	2230	180			0200	130	
	2300	150			0230	160	
	2330	140			0300	180	
12-7-81	0000	160			0330	150	
	0030	160			0400	130	
	0200	200			0430	150	
	0230	230			0500	160	
	0300	170			0530	150	
	0330	220			0600	120	
	0400	180			0630	150	
	0430	140			0700	130	
	0500				0730		
	0530	260			0800		
	0600	220			0830		
	0630	240			0900		
	0700	210			0930	340	
	0730	170			1000	350	
	0800	160			1030	330	
	0830	210			1100		
	0900	250			1130		
	0930	280			1200	300	
	1000	240			1230	260	
	1030	200			1300	210	
	1100				1330	220	
	1130	225			1400	220	
	1200	240			1430	230	

DATE	TIME	z_1	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
	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	

DATE	TIME	z_1	z_2
12-10-81	2000	490	
	2030	510	
	2100	490	
	2130	460	
	2200	430	
	2230	440	
	2300	380	
	2330	390	
	2400	340	
12-11-81	0030		
	0100		
	0130		
	0200		
	0230		
	0300		
	0330		
	0400		
	0430	510	
	0500	460	
	0530	460	
	0600	470	
	0630	490	
	0700	480	
	0730	460	
	0800	480	
	0830	420	
	0900	360	
	0930	420	
	1000	430	
	1030	370	
	1100	350	
	1130	340	
	1200		
	1230		
	1300		
	1330	100	
	1400	160	
	1430	140	
	1500		
	1530		
	1600		
	1630		
	1700		
	1730		
	1800		
	1830	180	
	1900		
	1930	200	
	2000	230	
	2030	210	
	2100	220	
	2130	260	
	2200	350	
	2230	400	
	2300	380	
	2330	320	
	2400	340	
12-12-81	0030	420	310
	0100	430	320
	0130	450	330
	0200	440	320
	0230	440	280
	0300	450	260
	0330	430	260
	0400	400	260
	0430	370	
	0500	350	
	0530	330	
	0600	300	
	0630	310	
	0700	320	
	0730	280	
	0800	250	
	0830	230	
	0900		
	0930	100	
	1000	120	
	1030	140	
	1100	100	
	1130		
	1200	450	
	1230	200	700
	1300	140	450
	1330	200	340
	1400		
	1430		
	1500		
	1530		
	1600		
	1630		
	1700		
	1730		
	1800		
	1830		
	1900		
	1930		
	2000	420	
	2030	500	
	2100		
	2130		
	2200	700	
	2230	650	
	2300	600	
	2330	580	
	2400	580	
12-13-81	0030	580	

DATE	TIME	z_1	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	250	

DATE	TIME	z_1	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	

DATE	TIME	z_1	z_2
12-15-81	0600	140	500
	0630	120	400
	0700		
	0730		
	0800		
	0830		90
	0900		120
	0930		160
	1000	300	140
	1030	340	100
	1100	360	150
	1130	390	200
	1200		
	1230		
	1300		
	1330		
	1400	400	
	1430		
	1500		
	1530		
	1600	380	
	1630		
	1700		
	1730	220	
	1800		
	1830		
	1900	320	
	1930	310	
	2000	320	
	2030		
	2100	210	
	2130		
	2200		
	2230		
	2300	250	
	2330		
	2400	140	
12-16-81	0030		
	0100		
	0130		
	0200	150	
	0230		
	0300		
	0330	170	
	0400		
	0430	160	
	0500		
	0530	230	
	0600		
	0630		
	0700		
	0730		
	0800	240	
	0830	240	
	0900		
	0930		
	1000		
	1030		
	1100		
	1130	80	
	1200	170	
	1230	270	
	1300		
	1330		
	1400	110	
	1430	150	
	1500	160	
	1530		
	1600		
	1630		
	1700	140	
	1730	130	
	1800	220	
	1830		
	1900	160	
	1930	100	
	2000		
	2030	140	
	2100		
	2130		
	2200	250	130
	2230	270	
	2300	290	
	2330		
	2400		
12-17-81	0030		
	0100		
	0130		
	0200	100	
	0230	120	
	0300	100	320
	0330		340
	0400		
	0430	140	280
	0500		
	0530		380
	0600	100	270
	0630	120	300
	0700		280
	0730		
	0800		
	0830		
	0900	180	
	0930		
	1000		
	1030		

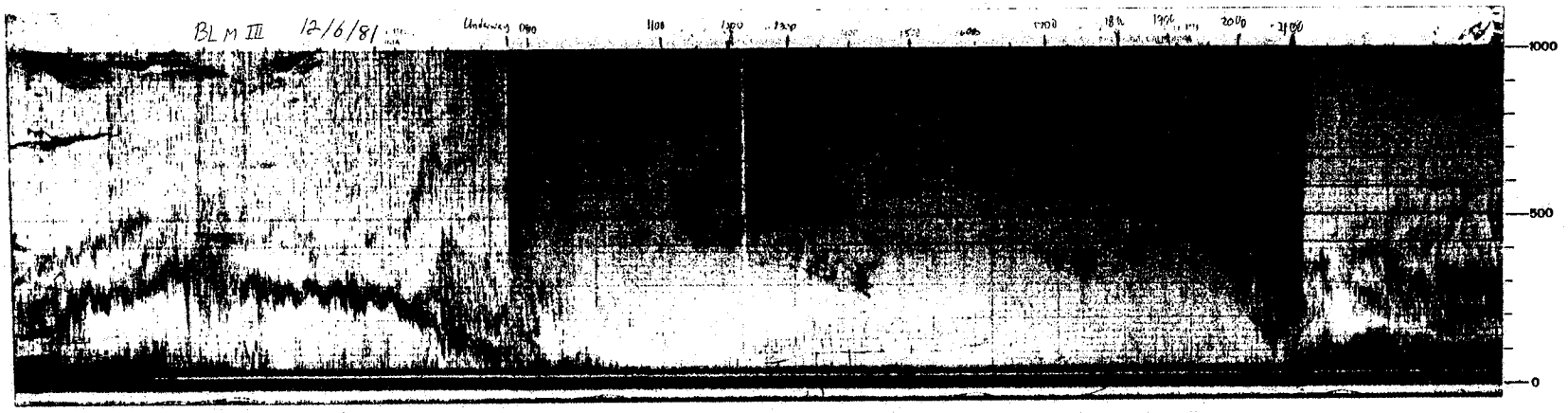
DATE	TIME	z_1	z_2	DATE	TIME	z_1	z_2
12-17-81	1100	80					
	1130	100					
	1200	120					
	1230	170					
	1300	230					
	1330	220					
	1400	230					
	1430	190					
	1500	180					
	1530	170					
	1600						
	1630	80					
	1700	90					
	1730	120					
	1800	120					
	1830	160					
	1900	240					
	1930	280					
	2000	200					
	2030	160					
	2100	130					
	2130	140					
	2200						
	2230	200					
	2300	170					
	2330	160					
	2400	170					

Following Pages

Figures 3 - Acoustic sounder strip charts.

The sounder was located on the RV/Acania.

12/6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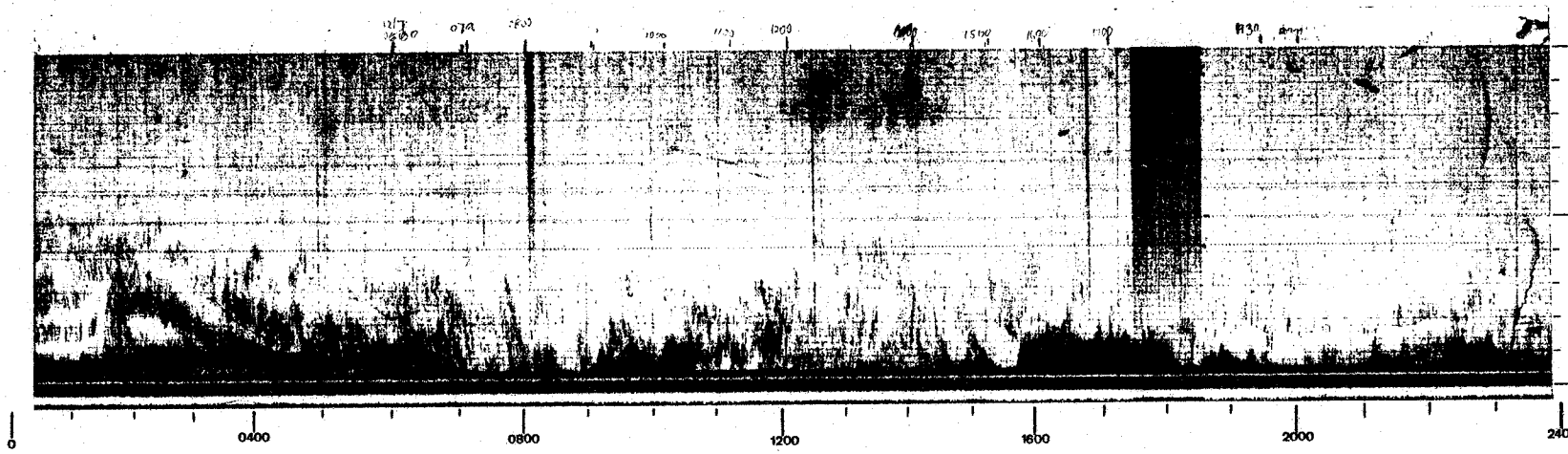
12/7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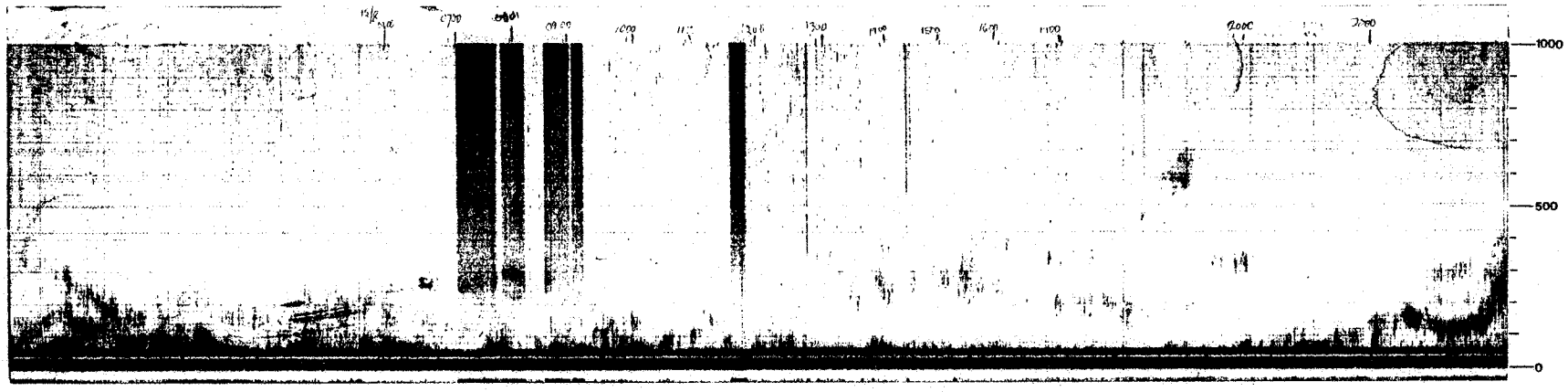
12/8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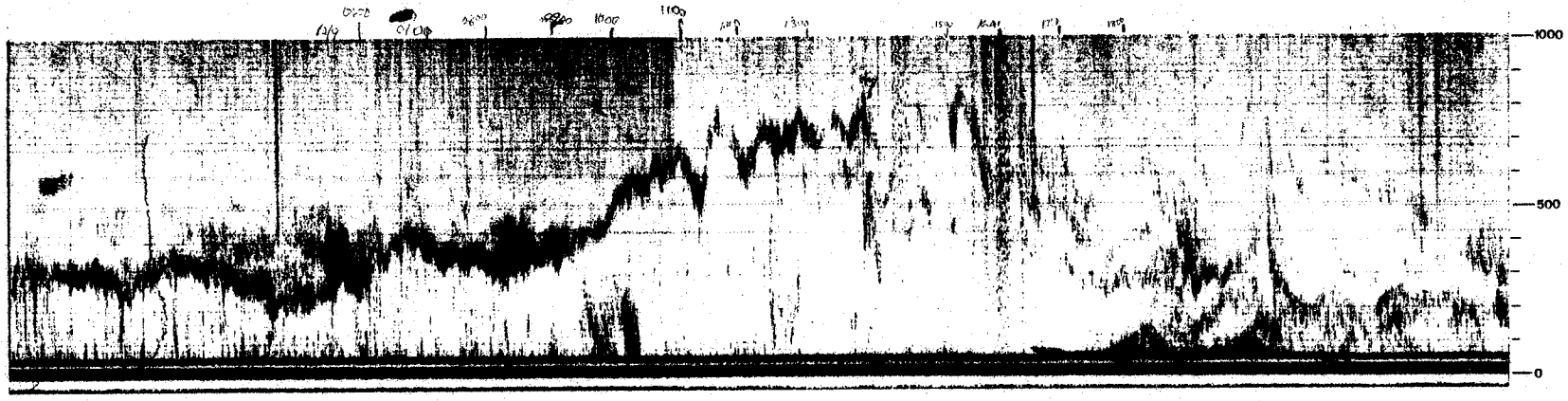
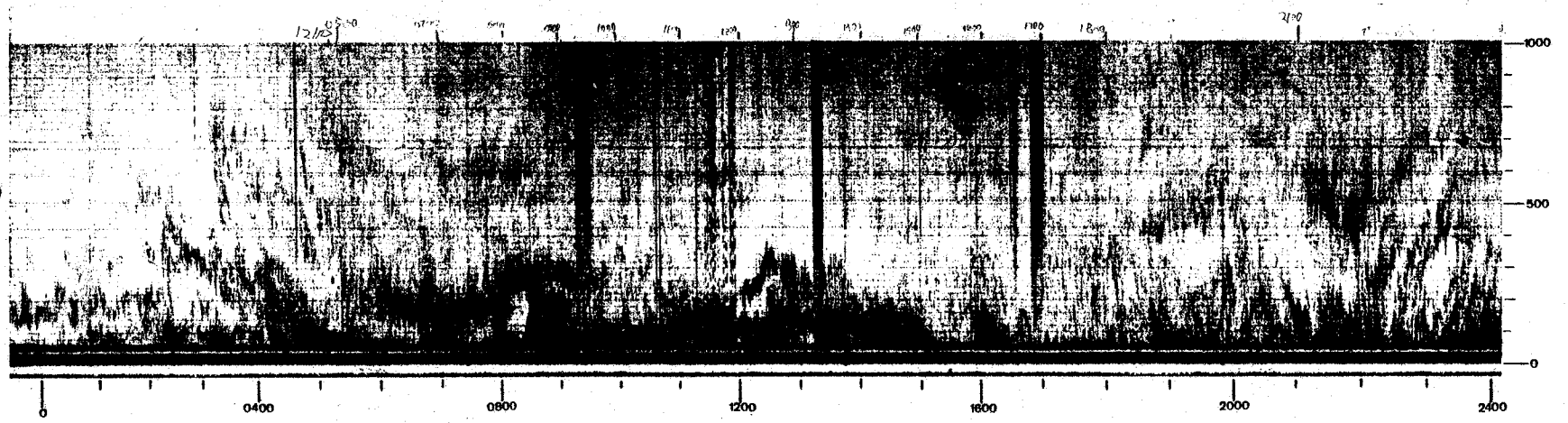
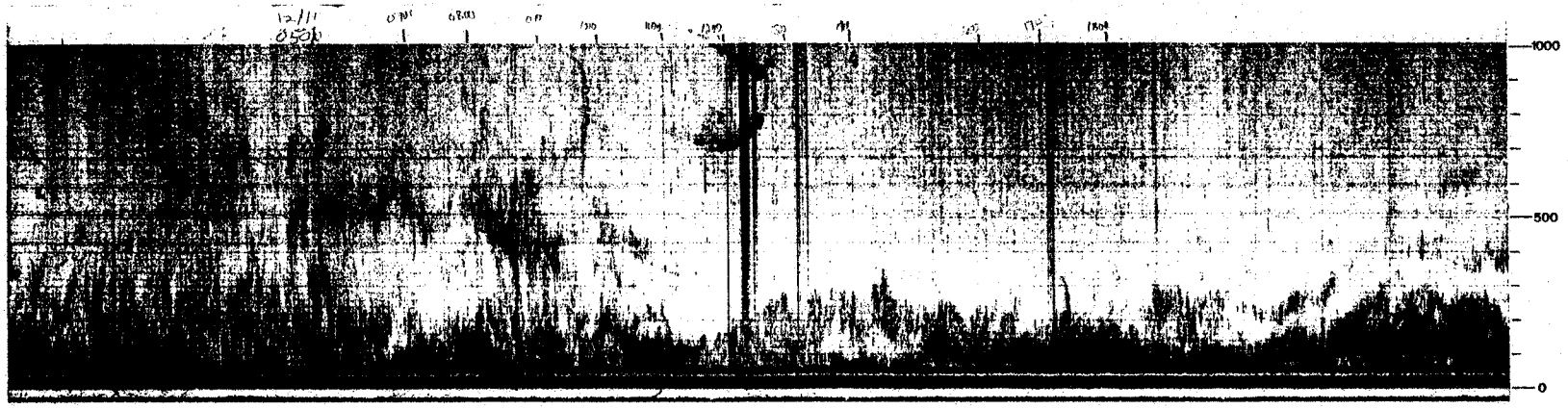
12/9



12/10



12/11



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12/13
12/12
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12/15
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2400
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0800
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1600

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