D. Wolfe

Boulder Upslope Cloud Observation Experiment

Earl E. Gossard, Editor
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U.S. Department of Commerce
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NOTICE

(B)oulder (U)pslope (C)loud (O)bservation (E)xperiment

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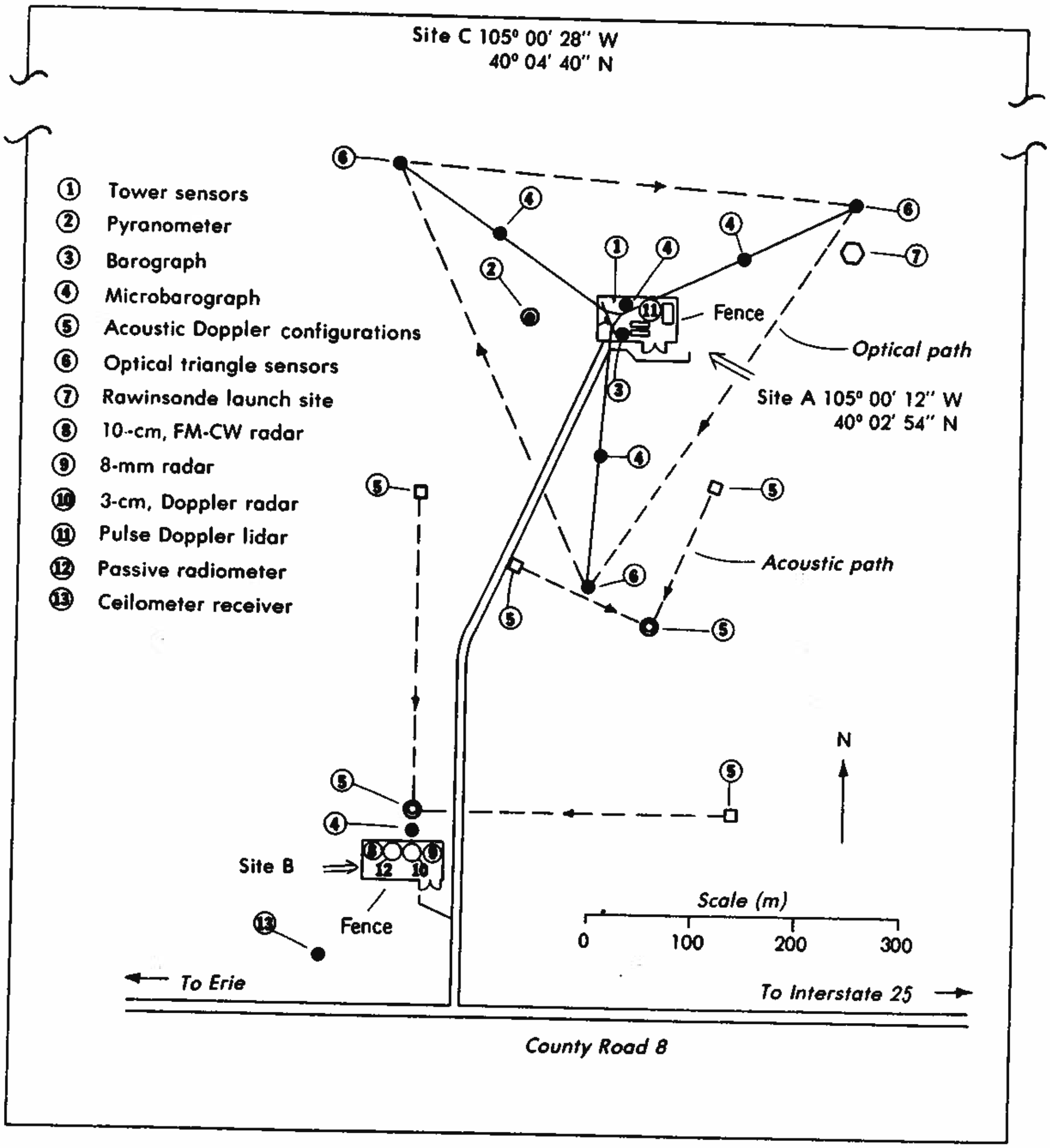
CONTENTS

I. Introduction - E. Gossard and H. Riehl

A well defined synoptic situation that leads to most of the winter and spring precipitation in the U.S. High Plains is commonly referred to as an "upslope" condition. Under this condition an easterly flow causes an orographic lifting of air over a broad area, creating a horizontally uniform and homogeneous cloud mass over a large area. Therefore, the upslope condition is of particular interest because it not only provides most of the winter precipitation to the area, but because it also provides an exceptionally stationary and homogeneous situation in which to carry out cloud observations for research purposes, including changing aerosol population, drop-size growth, and ice crystal formation and growth.

In the literature and textbooks upslope motion east of the Rocky Mountains often is defined as a long trek of air from the Mississippi westward with ascent of about 1300 m before reaching the Colorado mountains. Condensation always occurs when the long upslope motion happens. Broad areas of eastern Colorado then are covered by fog and ice formation on the ground. There is a question whether this broad ascending mass could be modified through conversion of supercooled water to snow alleviating the very severe problems caused by the ice fogs. The occurrence of such cases depends on the deviations of the general circulation from average. Some years ago there were persistent upslope fogs of this type, but none has happened in the last two years or more and none occurred during BUCOE. The question concerning this type of weather situation therefore could not even be broached and must await another experimental period, perhaps under more suitable conditions.

In other situations with upslope motion--i.e., NE to SE low level winds--much closer to Colorado, some very heavy snows have occurred, for instance on Thanksgiving 1979, and on December 28 of the same year. On that occasion winds were from the SE; observations and calculations made by H. Riehl and R. Reinking (see NOAA Tech. Memo ERL WMPO-44) showed that no more than one-tenth of the measured precipitation could be attributed to the 600 m rise of land from Amarillo, Texas, to Denver. Virtually all precipitation originated from dynamically produced upslope motion due to a cold low pressure center moving eastward across southern Colorado, rather like the situation of 12-13 May, 1982, in the present experiment.


Site C 105° 00' 28" W
40° 04' 40" N
① Tower sensors
② Pyranometer
③ Barograph
④ Microbarograph
⑤ Acoustic Doppler configurations
⑥ Optical triangle sensors
⑦ Rawinsonde launch site
⑧ 10-cm, FM-CW radar
⑨ 8-mm radar
⑩ 3-cm, Doppler radar
⑪ Pulse Doppler lidar
⑫ Passive radiometer
⑬ Ceilometer receiver
Fence
Optical path
Site A 105° 00' 12" W
40° 02' 54" N
Acoustic path
N
Site B
Fence
Scale (m)
0
100
200
300
To Erie
To Interstate 25
County Road 8

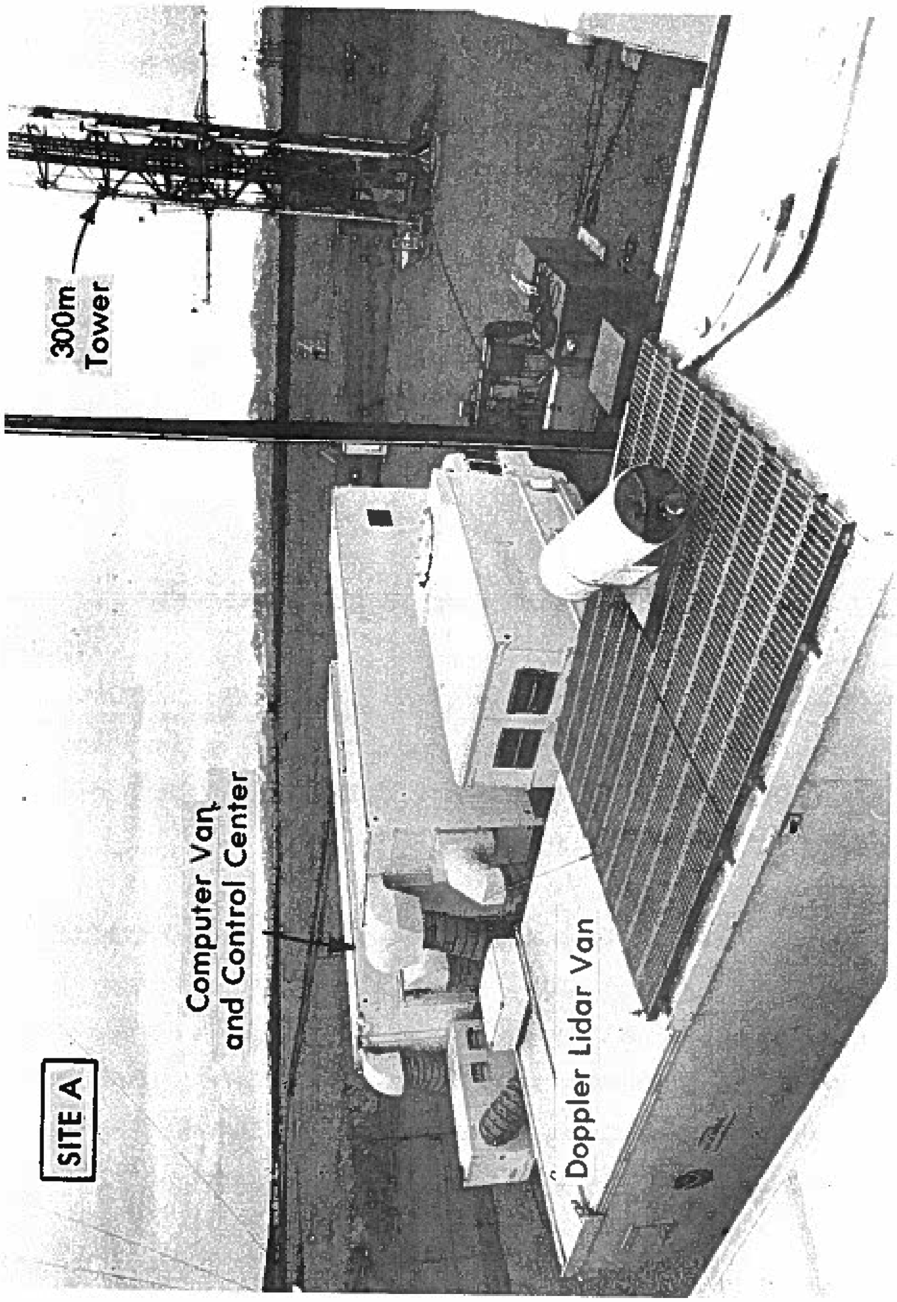
The area around the Boulder Atmospheric Observatory (BAO) was well suited to carry out this kind of experiment because the site was already densely instrumented with many of the in situ devices needed. (See BAO Report No. 1 on the PHOENIX experiment of 1978.) The experiment was designed to partially overlap an observational testing phase of PROFS and the Joint Airport Wind Shear (JAWS) experiment in order to make optimum joint use of facilities such as the CP-2 radar of the National Center for Atmospheric Research (NCAR). A map of the area with site locations is shown in Figure I-1. Site A is at the base of the 300-m instrumented BAO tower. The chemistry measurements and the particle measurements were made at this site, and it was also the location of the Doppler lidar. Figure I-2 is a photograph of this site. Site B, shown in Figure I-3, was the location of the radars and the microwave radiometer. The optical path precipitation sensor and all-sky camera were also at Site B, and the rotating beam ceilometer was closer to Site B than to Sites A or C. Site C, shown in Figure I-4, was the location of the dual-polarization lidar. The experiment was conducted from mid-March to 17 May when the radiometer was moved to Stapleton Field.

There were 3 basic plans followed in the data collection.

Plan A: This was used as a default mode. Most facilities, except the lidars, were left on automatic recording. All radars and the microwave radiometer were pointed vertically and data was recorded on tape and strip charts.

Plan B: Line Plan A, but all sites were manned. The Doppler lidar and 3-cm Doppler radar did VAD's (velocity azimuth displays from a conical scan about zenith) every hour and RAWIN balloon soundings (called GMD's in most of the logs) were made every four hours. The dual-polarization lidar operated vertically when precipitation was not so heavy that it was forced to close down.

Plan C: Like Plans A and B, but in addition special coordinated scans were made by the 3-cm Doppler radar, the FM-CW radar, the radiometer, and the dual-polarization lidar. When available, the aircraft flew 7-1/2 degree slant descents on radials toward the radiometer site and spiral ascents above the site.


SITE A
Computer Van and Control Center
Doppler Lidar Van
300m Tower

14 May

The radars operated continuously through the night and during the mornings. At about 0930 the lidars and radiometer were brought up. Intercomparisons of ceiling height were made between the ceilometer, the lidar and the three radars. The radars ran RHI's toward the southwest and the 3-cm radar made synchronous sky scans with the radiometer. Cross-polarization measurements of the bright band were made with the FM-CW radar.

VI. Aircraft Data Collection - B. Trotter

The organization of the instrumented aircraft program was very difficult for a number of reasons. First was the short notification time that an aircraft would be funded. Second was the amount of funds provided for the type of instrumentation and flight hours required for the program. Last was the establishment of a usage criteria that would benefit the maximum number of program participants per flight.

The aircraft, a Cessna Citation II, was contracted for and available for program use from March 15 thru May 15, 1982. Each project participant was asked to provide the aircraft requirement for that part of the experiment under his control. After all inputs had been received, flight patterns were drawn that would benefit the maximum number of users under specified weather conditions. There were five basic patterns, see Figures VI-2 and VI-7, that could be flown by the aircraft.

The operation procedures for aircraft use were somewhat cumbersome. The program itself had several independent experimenters. Weather conditions that were unsatisfactory to one could be satisfactory to another, so attention had to be given to each in relation to the weather forecast. The aircraft was based in Grand Forks, North Dakota, and deployed to the Boulder area only when suitable weather was in the forecast. The normal operational procedure was as follows:

A) Each morning a twenty-four hour forecast was made. Emphasis was placed on the potential for upslope conditions and the people affected.

B) Based on the forecast the aircraft crew was alerted to the possibility of a flight, the approximate time of the flight, and the flight patterns to be flown.

C) The forecast was updated in the afternoon and all program participants were alerted for the operational time period.

D) Once the aircraft was in the Boulder area, it was held on the approval for an optimum take-off time.

E) If the event developed, the aircraft would take off at a predetermined time. If the weather system failed to develop as expected either alternative flight plans were used or the plane was sent back to its base.

F) Once airborne, the flight track and data acquisition was coordinated with the ground station at the Boulder Atmospheric Observatory.

G) The flights continued on a prescheduled basis as long as the upslope system existed in the Boulder area.

Objective:

Collect microphysical data during upslope events in support of meteorological programs in BUCOE using flight patterns described in Parts 1-4 under Data Summary.

Data Summary:

During the period of March 15, 1982, to May 15, 1982, the Citation II was deployed to Boulder, Colorado, from Grand Forks, North Dakota, six times. A tabular summary of the deployment times is given in Table VI-1. The parameters that were sampled is shown in Table VI-2. From the sampled parameters a number of other parameters can be calculated. An example of the sampled plus calculated data is given in Table VI-3. The raw data tapes will have only the sampled data on them. Separate tapes will exist for the FSSP and 2D cloud sampling systems. Access to the University of North Dakota's software has been acquired. The computer used by the Boundary Layer Dynamics people (OWRM) is compatible with the software. We can process the data at the University of North Dakota or in-house.

Table VI-1

Summary of Flight Times

BUCOE CITATION MISSIONS

Date	Time (GMT)	Mission Type
3/25	1845-2215	4
4/09	2330-0010	2
4/16	0200-0315	2
4/16	0515-0700	2
4/16	1945-2030	2
4/20	1115-1135	1
4/21	1730-1815	Spiral Ascent
4/27	1645-1930	1, 2
5/11	1800-2100	1
5/12	1800-2030	1

Table VI-2

UND CITATION - SAMPLED PARAMETERS

Date

Time

VOR/DME Position

Latitude/Longitude Position

Ground Speed

True Heading

Track Angle

Drift Angle

Pitch Angle

Roll Angle

Vertical Acceleration

Total Temperature

Reverse Flow Temperature

Dew Point Temperature

J-W Liquid Water Content

Pitot-Static Differential Pressure

Static Pressure

FSSP

2-D Cloud

Part One: Flights for Microphysical Measurements for Upslope Modeling Program and Regional Variability

1) On the take-off from Jeffco airport climb up to just below cloud base and take a one minute level flight sounding. Increase altitude to just into the cloud base and take another one minute level flight sounding. Increase altitude to cloud top and take a third one minute level flight sounding. Decrease the aircraft altitude to just below the cloud top and take another level flight sounding. Refer to Figure Number VI-2.

2) Set the aircraft heading to 45 degrees off the Erie tower. Fly at minimum altitude for 100 miles. At the end of the 100 mile leg, began a step ascent to 20,000 feet. The first steps to 10,000 feet are to be in 1000 feet increments. The remaining steps to 20,000 feet are to be in 2,000 feet increments. Refer to Figure Number VI-3.

3) At 20,000 feet altitude establish an aircraft heading of 180 degrees. Fly at this heading for 100 miles. At this end point begin a box step descent. Reverse the ascent pattern. Steps down to 10,000 feet are to be in 2,000 feet increments and the remaining steps to minimum altitude are to be in 1,000 feet steps.

4) Establish a heading to the Erie tower. Fly at the minimum altitude to the tower.

5) Go to Part Number Two.

Part Two: Flights for Microphysical Measurements for Ground Based Remote Sensor Calibration and Comparison

1) At the Erie tower (BAO) spiral CCW around the tower while ascending to 10,000 feet MSL. See Figure VI-4.

2) On the westerly heading at 10,000 feet turn into a heading of 120 degrees. Descend to minimum altitude at the tower at a descent angle of 7.5 degrees. (NOTE: The aircraft must be at least 6.8 miles west of the tower location for this descent. A compromise was often made between aircraft heading, the altitude at which descent began, and the location of the dense clouds.

3) At the minimum altitude begin a CW spiral ascent to 10,000 feet. See Figure VI-5.

4) Again on a westerly heading, turn into a heading of 30 degrees. Descend to the minimum altitude at the tower at a descent angle of 7.5 degrees. See the NOTE in Step two.

5) Repeat Steps one through four.

Part Three: Flights for microphysical measurements for precipitation efficiency studies

1) Depart Jeffco airport on a heading parallel to the prevailing surface winds. Fly a zig-zag pattern near cloud top. Penetrate into the cloud tops in a slow roller coaster motion. See Figure VI-6. The zig-zag pattern should be lines 45 degrees off a line parallel to the prevailing winds but should not extend more than 20 miles off the prevailing wind/heading reference. The roller coaster (propoise) motions need not have more than a 1000 foot change from minimum to maximum altitudes.

2) Continue the pattern in Step one to the end of the cloud or to the Colorado border, whichever comes first.

3) Return to the Erie tower area at the minimum permissible altitude. The heading should be the out bound heading +/-180 degrees. Climb to <u>safe</u> altitude over the continental divide. Observe visually and photographically the limit of the upslope cloud forms above in

the westerlies. While making the observations fly from Estes Park, Colorado, to Georgetown, Colorado.

Part Four: Flights for microphysical measurements for regional variability in winds

1) This flight is to be made at the minimum flight altitude available for both upslope conditions and clear air flights.

2) From Jeffco airport take a heading of 60 degrees. At the Colorade border change aircraft heading to 180 degrees. (The distance to the border should be approximately 150 miles.) Fly south for a distance of 130 miles. Turn into a heading of 330 degrees. Fly on this heading for 150 miles. Turn into a 180 degree heading and return to Jeffco. See Figure VI-7.

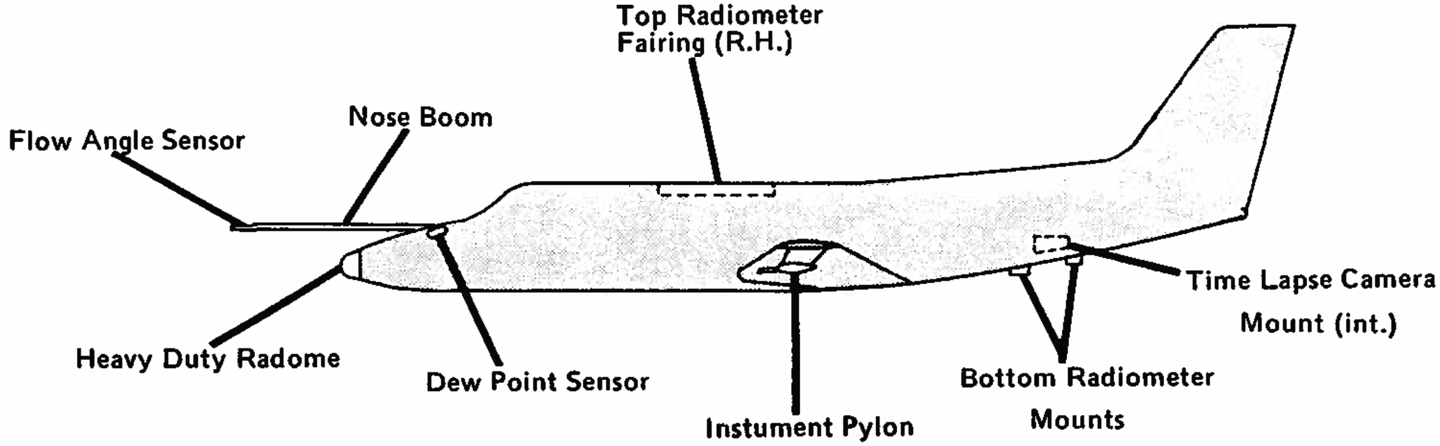
TABLE VI-3 (Page 1)

4/09/82 TIME	PRESS ALT	INS ALT	VOR	DME	LATITUDE		LONGITUDE		MACH NO	IAS	TAS	GND SPD	HEADINGS TRUE	MAG	INS	TRK	DRIFT	PITCH	ROLL	ACC
23:39:35	11265	13879	324	14.5	40	0.96	105	0.56	0.32	170.0	200.5	219.3	100.5	141	104	105	0.4	8.43	-15.37	-0.01
23:39:40	11437	13271	325	14.3	40	0.92	105	0.18	0.31	168.0	198.6	216.1	93.2	141	98	97	1.1	8.94	-17.2[illegible]	0.00
23:39:45	11611	12471	326	14.2	40	0.92	104	59.80	0.31	165.6	196.2	213.8	85.8	141	89	89	0.5	7.97	-17.32	-0.05
23:39:50	11756	11792	327	14.1	40	0.96	104	59.41	0.31	165.2	196.1	213.3	76.7	34	81	82	1.0	7.34	-18.13	-0.06
23:39:55	11871	11204	328	14.0	40	1.05	104	59.02	0.31	164.5	193.6	213.5	67.9	39	71	74	1.7	6.31	-17.29	-0.02
23:40:00	11956	10738	329	14.1	40	1.16	104	58.69	0.31	166.2	197.8	214.4	60.0	48	64	66	2.5	5.92	-17.89	0.03
23:40:05	12055	10369	331	14.1	40	1.32	104	58.36	0.32	168.9	201.2	215.2	50.9	53	55	57	2.2	6.02	-19.73	0.02
23:40:10	12179	10131	332	14.2	40	1.51	104	58.07	0.32	171.1	204.2	215.0	41.9	64	46	48	2.6	6.42	-17.96	0.03
23:40:15	12325	9959	333	14.4	40	1.74	104	57.82	0.32	169.8	203.1	214.1	33.5	76	37	40	2.3	6.48	-18.47	-0.02
23:40:20	12462	9847	334	14.6	40	1.99	104	57.61	0.32	169.0	202.5	213.9	25.4	85	29	32	3.2	6.00	-17.19	-0.02
23:40:25	12575	10008	335	14.8	40	2.26	104	57.45	0.32	169.4	203.3	214.3	17.6	94	22	24	3.3	5.82	-15.77	0.00
23:40:30	12705	10535	335	15.0	40	2.54	104	57.33	0.33	170.8	205.3	214.6	10.5	97	14	17	3.1	6.15	-16.41	0.01
23:40:35	12831	11019	336	15.3	40	2.83	104	57.27	0.33	170.8	205.7	213.5	1.9	102	5	9	3.6	7.17	-17.44	0.00
23:40:40	12971	11465	336	15.6	40	3.13	104	57.26	0.33	169.8	204.9	210.6	352.8	107	357	180	3.7	6.83	-20.61	0.01
23:40:45	13104	11871	336	15.9	40	3.41	104	57.32	0.33	169.9	205.3	209.3	342.9	115	347	350	3.0	6.74	-21.32	-0.03
23:40:50	13231	12217	336	16.2	40	3.69	104	57.44	0.33	169.5	205.3	208.0	332.8	122	336	340	3.3	6.42	-20.56	-0.02
23:40:55	13325	12523	336	16.5	40	3.96	104	57.64	0.33	169.6	205.5	207.6	323.3	126	326	331	3.5	5.92	-18.57	-0.03
23:41:00	13405	12766	336	16.8	40	4.17	104	57.84	0.33	172.7	209.5	207.6	316.4	128	321	322	3.4	5.87	-16.74	-0.00
23:41:05	13472	12973	335	17.0	40	4.50	104	58.31	0.34	174.1	211.3	206.4	303.7	134	308	316	2.8	7.39	-15.28	0.04
23:41:10	13584	13165	335	17.2	40	4.55	104	58.39	0.34	172.8	210.2	204.3	301.2	135	304	308	2.1	6.52	-17.65	-0.03
23:41:15	13657	13365	334	17.5	40	4.69	104	58.71	0.33	171.6	208.9	204.2	294.8	137	298	300	2.8	5.62	-16.14	-0.04
23:41:20	13702	13503	333	17.6	40	4.80	104	59.05	0.33	171.2	208.5	206.1	287.6	138	292	292	2.0	4.44	-13.87	0.02
23:41:25	13752	13626	333	17.8	40	4.89	104	59.41	0.34	172.4	210.0	209.6	282.6	144	287	286	1.9	4.35	-12.91	0.02
23:41:30	13814	13745	332	17.9	40	4.94	104	59.79	0.34	174.6	212.8	212.1	275.8	146	280	280	1.4	5.09	-14.03	0.04
23:41:35	13909	13682	331	18.0	40	4.95	105	0.17	0.35	177.2	216.2	213.2	268.6	153	272	273	1.2	5.77	-15.92	0.08
23:41:40	14054	14064	330	18.1	40	4.93	105	0.55	0.36	181.8	222.4	212.0	260.8	153	265	265	0.9	7.15	-15.81	0.08
23:41:45	14266	14296	329	18.1	40	4.87	105	0.92	0.35	179.0	219.7	207.1	254.8	153	259	257	0.3	9.16	-15.64	-0.01
23:41:50	14470	14532	328	18.2	40	4.78	105	1.26	0.35	177.6	218.6	203.0	248.6	153	253	250	-1.2	8.54	-15.15	-0.03
23:41:55	14671	14734	327	18.2	40	4.63	105	1.63	0.35	177.1	218.7	200.5	241.0	153	245	243	-1.8	7.54	-14.29	-0.02
23:42:00	14831	14916	326	18.1	40	4.50	105	1.88	0.35	173.8	215.1	199.7	233.9	153	238	235	-1.6	7.08	-17.32	-0.02
23:42:05	14953	15058	325	18.0	40	4.31	105	2.15	0.35	173.2	214.7	200.5	227.4	153	231	227	-2.4	6.50	-17.73	-0.05
23:42:10	15073	15276	325	18.0	40	4.10	105	2.39	0.35	173.7	215.6	203.2	217.6	153	222	219	-3.5	5.07	-19.25	0.00
23:42:15	15178	15926	324	17.8	40	3.85	105	2.57	0.35	175.8	218.5	209.0	210.0	153	213	209	-4.4	4.07	-19.06	-0.02
23:42:20	15284	16531	323	17.6	40	3.57	105	2.71	0.36	177.3	220.7	214.7	201.3	153	205	201	-4.4	4.35	-19.17	0.02
23:42:25	15400	17055	322	17.4	40	3.27	105	2.80	0.36	180.3	224.7	220.2	192.3	153	195	192	-4.4	4.71	-18.83	0.01
23:42:30	15518	17512	322	17.1	40	2.96	105	2.83	0.37	181.8	226.9	223.6	184.4	153	188	183	-4.1	5.60	-20.16	0.03
23:42:35	15655	17925	321	16.9	40	2.65	105	2.79	0.37	181.9	227.5	226.3	175.2	153	179	174	-5.2	5.97	-21.00	0.01
23:42:40	15796	18285	321	16.5	40	2.35	105	2.68	0.37	181.0	226.9	229.6	166.0	153	169	165	-4.7	5.53	-20.92	-0.02
23:42:45	15914	18585	321	16.2	40	2.05	105	2.52	0.37	181.2	227.4	232.8	157.9	153	162	156	-4.5	5.59	-19.70	-0.01
23:42:50	16024	18841	321	15.9	40	1.77	105	2.30	0.37	180.8	227.4	235.3	149.1	153	154	148	-4.4	6.26	-18.74	0.05
23:42:55	16184	19106	321	15.5	40	1.47	105	1.98	0.37	179.6	226.5	236.7	139.9	153	144	140	-4.4	6.47	-17.29	-0.00
23:43:00	16325	19021	321	15.2	40	1.29	105	1.72	0.37	179.7	227.1	238.1	133.5	153	137	132	-3.9	6.30	-19.41	-0.03
23:43:05	16448	18167	322	15.0	40	1.09	105	1.37	0.37	180.0	227.8	239.3	123.9	153	127	125	-2.7	6.52	-19.42	0.03
23:43:10	16606	17365	323	14.7	40	0.95	105	0.99	0.37	178.4	226.3	239.4	114.4	153	119	116	-1.5	6.34	-22.53	-0.05
23:43:15	16729	16689	323	14.4	40	0.84	105	0.58	0.37	177.9	226.1	241.3	105.0	153	109	108	-1.8	4.99	-23.09	-0.06
23:43:20	16776	16091	325	14.3	40	0.79	105	0.14	0.37	178.5	226.9	244.8	94.6	153	98	99	-1.0	4.41	-22.69	-0.01
23:43:25	16845	15599	326	14.1	40	0.79	104	59.70	0.37	180.1	229.3	247.7	84.3	41	88	89	-0.6	5.33	-25.98	0.06
23:43:30	16936	15254	327	14.0	40	0.87	104	59.26	0.37	180.0	229.6	249.5	71.9	51	75	77	-1.0	7.87	-28.13	0.10
23:43:35	17126	15054	329	14.0	40	1.01	104	58.86	0.37	176.1	225.3	247.8	59.5	58	62	65	-0.2	9.36	-26.58	0.04
23:43:40	17345	14958	330	14.1	40	1.20	104	58.49	0.37	175.1	224.8	245.7	48.6	65	52	54	0.6	8.77	-24.65	-0.04
23:43:45	17547	14962	331	14.2	40	1.44	104	58.17	0.37	175.4	225.8	245.0	40.1	77	44	45	1.5	7.95	-20.97	-0.04
23:43:50	17709	15443	332	14.4	40	1.71	104	57.90	0.37	175.1	225.9	244.5	31.8	85	36	38	2.3	7.76	-19.38	-0.02
23:43:55	17875	16006	334	14.7	40	2.06	104	57.64	0.37	176.0	227.8	243.9	21.1	91	25	30	3.8	7.28	-17.46	-0.00
23:44:00	18033	16503	335	15.0	40	2.37	104	57.47	0.37	175.5	227.7	242.4	14.5	95	19	22	4.8	8.18	-16.32	0.05
23:44:05	18213	16930	335	15.3	40	2.68	104	57.35	0.37	174.1	226.5	239.1	8.0	99	12	16	4.9	8.83	-15.81	-0.00
23:44:10	18388	17333	336	15.5	40	3.00	104	57.28	0.37	173.0	225.7	235.4	358.6	105	2	9	6.2	8.64	-18.80	-0.01
23:44:15	18565	17696	336	15.8	40	3.32	104	57.27	0.37	171.0	223.7	231.5	349.2	112	352	113	7.2	8.81	-19.22	0.02
23:44:20	18766	18045	336	16.2	40	3.63	104	57.32	0.37	173.4	227.3	224.9	341.4	114	345	352	6.7	10.74	-21.21	0.03
23:44:25	18975	18393	336	16.5	40	3.92	104	57.44	0.37	170.7	224.6	216.1	330.8	121	335	342	6.9	10.43	-21.95	-0.01
23:44:30	19186	18711	336	16.8	40	4.17	104	57.61	0.37	170.2	224.5	210.0	321.5	125	326	333	7.0	9.25	-21.34	-0.03
23:44:35	19360	18990	336	17.1	40	4.41	104	57.83	0.37	170.3	225.2	204.8	311.9	129	315	323	6.6	9.14	-21.53	0.01

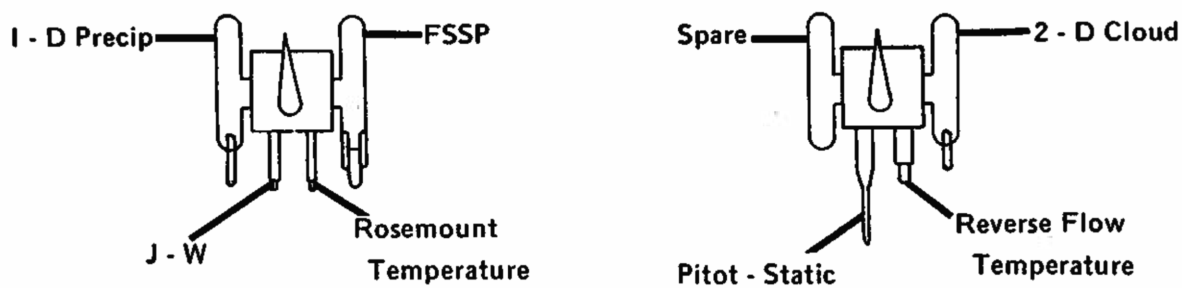
TABLE VI-3 (Page 2)

4/09/82 TIME	TOTAL ROSMT	AIR ROSMT	TOTAL RFT	AIR RFT	DEW POINT	JW LWC	VAPOR PRESS	MIX RATIO	POT TEMP	EQUIV TEMP	ATTCK	SIDSL	PITO NOSE	PITO WING	STAT WING	STAT FSLG	INS WINDS SPD	INS WINDS DIR	CAL WINDS SPD	CAL WINDS DIR	TIME	E
23:39:35	-3.4	-8.7	-5.2	-5.2	-20.7	1.050	1.18	1.11	297.3	300.4	0.4	0.0	54.1	47.7	663.2	663.2	18.6	295	0.	0	005152	0
23:39:40	-4.0	-9.2	-5.7	-5.7	-20.8	1.049	1.17	1.11	297.3	300.5	0.4	0.0	52.6	46.5	658.7	658.7	16.7	288	0.	0	005157	0
23:39:45	-4.7	-9.8	-6.3	-6.3	-20.8	1.049	1.17	1.11	297.3	300.5	0.4	0.0	51.1	45.2	654.3	654.3	17.0	270	0.	0	005202	0
23:39:50	-5.2	-10.3	-6.7	-6.7	-20.8	1.047	1.17	1.11	297.2	300.4	0.4	0.0	50.8	45.0	650.5	650.5	17.1	275	0.	0	005207	0
23:39:55	-5.6	-10.6	-7.1	-7.1	-20.9	1.048	1.16	1.11	297.2	300.4	0.4	-0.0	50.4	44.6	647.6	647.6	18.6	273	0.	0	005213	0
23:40:00	-5.9	-11.0	-7.3	-7.3	-20.9	1.047	1.16	1.11	297.1	300.2	0.4	0.0	51.2	45.5	645.4	645.4	19.5	265	0.	0	005218	0
23:40:05	-6.1	-11.4	-7.6	-7.6	-21.0	1.049	1.15	1.12	297.0	300.1	0.4	0.0	52.7	47.1	642.9	642.9	17.7	260	0.	0	005223	0
23:40:10	-6.2	-11.7	-7.9	-7.9	-21.0	1.050	1.15	1.12	297.0	300.2	0.4	0.0	54.1	48.3	639.8	639.8	15.2	266	0.	0	005228	0
23:40:15	-6.6	-12.0	-8.3	-8.3	-21.0	1.050	1.15	1.12	297.2	300.4	0.4	0.0	53.0	47.5	636.1	636.1	13.2	255	0.	0	005233	0
23:40:20	-7.0	-12.4	-8.7	-8.7	-21.1	1.050	1.14	1.12	297.2	300.4	0.4	0.0	52.5	47.1	632.7	632.7	16.3	249	0.	0	005237	0
23:40:25	-7.4	-12.8	-9.1	-9.1	-21.1	1.050	1.14	1.13	297.1	300.3	0.4	0.0	52.5	47.3	629.8	629.8	16.4	249	0.	0	005242	0
23:40:30	-7.6	-13.2	-9.3	-9.3	-21.1	1.050	1.14	1.14	297.1	300.4	0.4	-0.0	53.6	48.1	626.6	626.6	15.8	243	0.	0	005247	0
23:40:35	-7.9	-13.5	-9.7	-9.7	-21.1	1.050	1.14	1.13	297.2	300.4	0.4	0.0	53.5	48.1	623.5	623.5	15.6	241	0.	0	005252	0
23:40:40	-8.4	-13.9	-10.3	-10.3	-21.2	1.050	1.13	1.14	297.2	300.4	0.4	0.0	52.8	47.5	620.0	620.0	14.6	230	0.	0	005257	0
23:40:45	-8.9	-14.4	-10.8	-10.8	-21.2	1.050	1.13	1.14	297.0	300.3	0.4	0.0	52.7	47.6	616.8	616.8	11.9	236	0.	0	005302	0
23:40:50	-9.3	-14.8	-11.7	-11.7	-21.2	1.050	1.13	1.14	297.0	300.3	0.4	0.0	52.5	47.4	613.7	613.7	12.4	233	0.	0	005307	0
23:40:55	-9.6	-15.2	-12.0	-12.0	-21.2	1.050	1.13	1.15	296.9	300.2	0.4	0.0	52.3	47.4	611.4	611.4	12.7	222	0.	0	005313	0
23:41:00	-9.7	-15.5	-11.4	-11.4	-21.3	1.050	1.12	1.15	296.8	300.1	0.4	0.0	54.1	49.2	609.4	609.4	12.2	227	0.	0	005317	0
23:41:05	-9.8	-15.7	-11.5	-11.5	-21.3	1.051	1.12	1.14	296.8	300.1	0.4	0.0	54.9	50.1	607.8	607.8	10.6	258	0.	0	005326	0
23:41:10	-10.2	-16.0	-11.9	-11.9	-21.3	1.051	1.12	1.15	296.9	300.2	0.4	-0.0	53.6	49.3	605.1	605.1	9.8	252	0.	0	005327	0
23:41:15	-10.6	-16.3	-12.2	-12.2	-21.3	1.050	1.12	1.15	296.7	300.1	0.4	0.0	52.8	48.6	603.3	603.3	11.1	250	0.	0	005332	0
23:41:20	-10.9	-16.5	-12.4	-12.4	-21.3	1.050	1.12	1.15	296.6	299.9	0.4	0.0	52.4	48.4	602.3	602.3	7.6	194	0.	0	005337	0
23:41:25	-11.0	-16.8	-12.6	-12.6	-21.4	1.050	1.11	1.15	296.5	299.8	0.4	0.0	52.9	49.1	601.0	601.0	7.3	183	0.	0	005342	0
23:41:30	-11.1	-17.0	-12.9	-12.9	-21.4	1.051	1.11	1.15	296.5	299.8	0.4	0.0	54.3	50.3	599.6	599.6	5.1	177	0.	0	005347	0
23:41:35	-11.1	-17.2	-13.1	-13.1	-21.4	1.050	1.11	1.16	296.5	299.9	0.4	-0.0	56.3	51.9	597.3	597.3	5.2	229	0.	0	005352	0
23:41:40	-11.0	-17.5	-12.9	-12.9	-21.4	1.051	1.11	1.16	296.7	300.1	0.4	-0.0	59.0	54.7	593.8	593.8	8.8	250	0.	0	005357	0
23:41:45	-11.4	-17.7	-13.4	-13.4	-21.5	1.055	1.10	1.17	297.2	300.6	0.4	-0.0	56.9	53.0	588.8	588.8	14.6	263	0.	0	005402	0
23:41:50	-12.1	-18.4	-13.9	-13.9	-21.5	1.052	1.10	1.17	297.1	300.5	0.4	0.0	55.7	52.1	584.0	584.0	15.8	265	0.	0	005407	0
23:41:55	-12.7	-18.9	-14.5	-14.5	-21.5	1.052	1.10	1.18	297.1	300.6	0.4	0.0	55.4	51.8	579.3	579.3	18.7	259	0.	0	005413	0
23:42:00	-13.3	-19.3	-15.2	-15.2	-21.5	1.051	1.10	1.19	297.2	300.7	0.4	0.0	53.2	49.9	575.6	575.6	18.1	257	0.	0	005417	0
23:42:05	-13.8	-19.8	-15.7	-15.7	-21.6	1.051	1.09	1.19	297.0	300.5	0.4	0.0	52.7	49.5	572.8	572.8	16.7	273	0.	0	005422	0
23:42:10	-14.1	-20.2	-16.1	-16.1	-21.5	1.050	1.10	1.20	297.0	300.5	0.4	0.0	53.1	49.8	570.0	570.0	16.8	269	0.	0	005427	0
23:42:15	-14.3	-20.6	-16.1	-16.1	-21.6	1.052	1.09	1.19	297.0	300.5	0.4	0.0	54.3	51.1	567.6	567.6	18.6	278	0.	0	005431	0
23:42:20	-14.5	-20.9	-16.3	-16.3	-21.7	1.051	1.08	1.19	297.0	300.5	0.4	0.0	55.3	51.9	565.2	565.2	17.6	278	0.	0	005436	0
23:42:25	-14.6	-21.2	-16.3	-16.3	-21.7	1.051	1.08	1.19	296.9	300.5	0.4	0.0	57.2	53.7	562.5	562.5	16.9	274	0.	0	005442	0
23:42:30	-14.8	-21.5	-16.6	-16.6	-21.7	1.052	1.08	1.20	297.0	300.6	0.4	0.0	58.2	54.7	559.9	559.9	16.2	265	0.	0	005447	0
23:42:35	-15.1	-21.8	-17.1	-17.1	-21.8	1.055	1.07	1.20	297.1	300.7	0.4	-0.0	58.1	54.7	556.8	556.8	20.7	267	0.	0	005452	0
23:42:40	-15.5	-22.2	-17.7	-17.7	-21.9	1.053	1.07	1.20	297.1	300.7	0.4	0.0	57.4	54.2	553.6	553.6	18.5	269	0.	0	005457	0
23:42:45	-15.9	-22.6	-17.9	-17.9	-21.9	1.053	1.06	1.20	297.1	300.6	0.4	0.0	57.4	54.3	551.0	551.0	18.9	266	0.	0	005502	0
23:42:50	-16.0	-22.8	-17.9	-17.9	-21.8	1.053	1.07	1.21	297.2	300.9	0.4	0.0	57.3	54.1	548.5	548.5	19.7	263	0.	0	005507	0
23:42:55	-16.3	-23.0	-18.2	-18.2	-22.0	1.052	1.06	1.21	297.5	301.1	0.4	0.0	56.2	53.3	544.9	544.9	20.8	268	0.	0	005513	0
23:43:00	-16.7	-23.4	-18.2	-18.2	-22.0	1.051	1.06	1.21	297.6	301.2	0.4	0.0	56.3	53.4	541.8	541.8	19.8	261	0.	0	005517	0
23:43:05	-17.1	-23.9	-18.7	-18.7	-22.1	1.052	1.05	1.21	297.4	301.0	0.4	0.0	56.6	53.6	539.1	539.1	16.7	262	0.	0	005522	0
23:43:10	-17.8	-24.4	-19.4	-19.4	-22.2	1.057	1.04	1.20	297.3	300.9	0.4	0.0	55.3	52.6	535.6	535.6	13.8	267	0.	0	005527	0
23:43:15	-18.1	-24.7	-19.7	-19.7	-22.3	1.059	1.03	1.20	297.4	301.0	0.4	0.0	54.9	52.3	533.0	533.0	17.2	269	0.	0	005531	0
23:43:20	-18.2	-24.9	-19.8	-19.8	-22.3	1.055	1.02	1.19	297.3	300.9	0.4	0.0	55.2	52.6	532.0	532.0	20.2	268	0.	0	005536	0
23:43:25	-18.0	-24.8	-19.6	-19.6	-22.4	1.053	1.01	1.19	297.7	301.2	0.4	0.0	56.4	53.7	530.5	530.5	19.7	258	0.	0	005541	0
23:43:30	-17.9	-24.8	-19.7	-19.7	-22.6	1.056	1.00	1.17	298.0	301.5	0.4	-0.0	56.3	53.6	528.5	528.5	19.1	242	0.	0	005547	0
23:43:35	-18.5	-25.1	-20.2	-20.2	-22.7	1.058	0.99	1.17	298.3	301.9	0.4	0.0	53.7	51.2	524.4	524.4	21.4	241	0.	0	005551	0
23:43:40	-19.1	-25.7	-20.8	-20.8	-22.9	1.060	0.97	1.16	298.3	301.8	0.4	-0.0	53.0	50.6	519.7	519.7	20.9	246	0.	0	005557	0
23:43:45	-19.8	-26.4	-21.2	-21.2	-23.1	1.061	0.96	1.16	298.2	301.7	0.4	-0.0	53.0	50.8	515.4	515.4	21.7	243	0.	0	005602	0
23:43:50	-20.2	-26.8	-21.7	-21.7	-23.2	1.064	0.95	1.15	298.2	301.7	0.4	0.0	52.7	50.6	512.0	512.0	21.0	243	0.	0	005607	0
23:43:55	-20.2	-27.0	-21.6	-21.6	-23.5	1.064	0.93	1.13	298.6	302.1	0.4	0.0	53.3	51.2	508.5	508.5	23.4	255	0.	0	005613	0
23:44:00	-20.5	-27.2	-21.7	-21.7	-23.7	1.062	0.91	1.12	298.9	302.3	0.4	0.0	53.0	50.9	505.2	505.2	24.2	252	0.	0	005618	0
23:44:05	-21.1	-27.7	-22.3	-22.3	-23.9	1.062	0.89	1.10	298.9	302.3	0.4	0.0	52.1	50.0	501.4	501.4	23.5	249	0.	0	005623	0
23:44:10	-21.6	-28.2	-22.9	-22.9	-24.2	1.063	0.87	1.08	298.9	302.2	0.4	0.0	51.3	49.4	497.8	497.8	26.5	254	0.	0	005627	0
23:44:15	-22.3	-28.8	-23.5	-23.5	-24.5	1.063	0.84	1.06	298.9	302.2	0.4	0.0	50.1	48.3	494.2	494.2	29.6	254	0.	0	005632	0
23:44:20	-22.9	-29.5	-23.9	-23.9	-24.8	1.060	0.82	1.04	298.7	301.9	0.4	0.0	51.5	49.6	490.1	490.1	26.5	267	0.	0	005637	0
23:44:25	-23.4	-30.0	-24.5	-24.5	-25.1	1.061	0.80	1.02	298.9	302.0	0.4	0.0	49.8	48.1	485.9	485.9	28.6	266	0.	0	005642	0
23:44:30	-24.2	-30.7	-25.2	-25.2	-25.4	1.060	0.78	1.00	298.8	301.8	0.4	0.0	49.4	47.8	481.6	481.6	30.3	269	0.	0	005647	0
23:44:35	-24.7	-31.3	-25.9	-25.9	-25.7	1.060	0.75	0.98	298.6	301.7	0.4	0.0	49.7	47.9	478.1	478.1	31.1	270	0.	0	005652	0

Fig. VI-1



Cross Section of UND Citation Showing Sensor Mounting Points.



Top View of Wing Tip Pylon Instrumentation.

Citation II Equipment Sensor Locations

Fig. VI-2

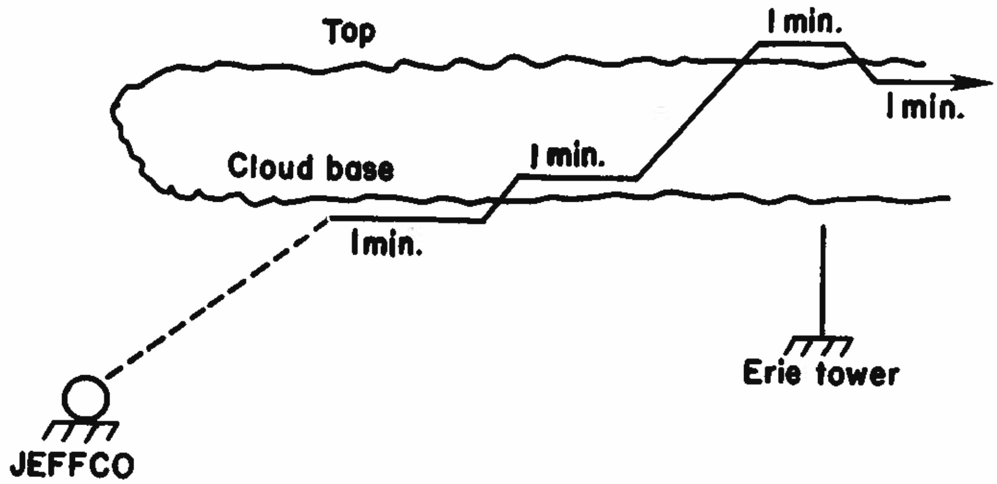


Fig. VI-3

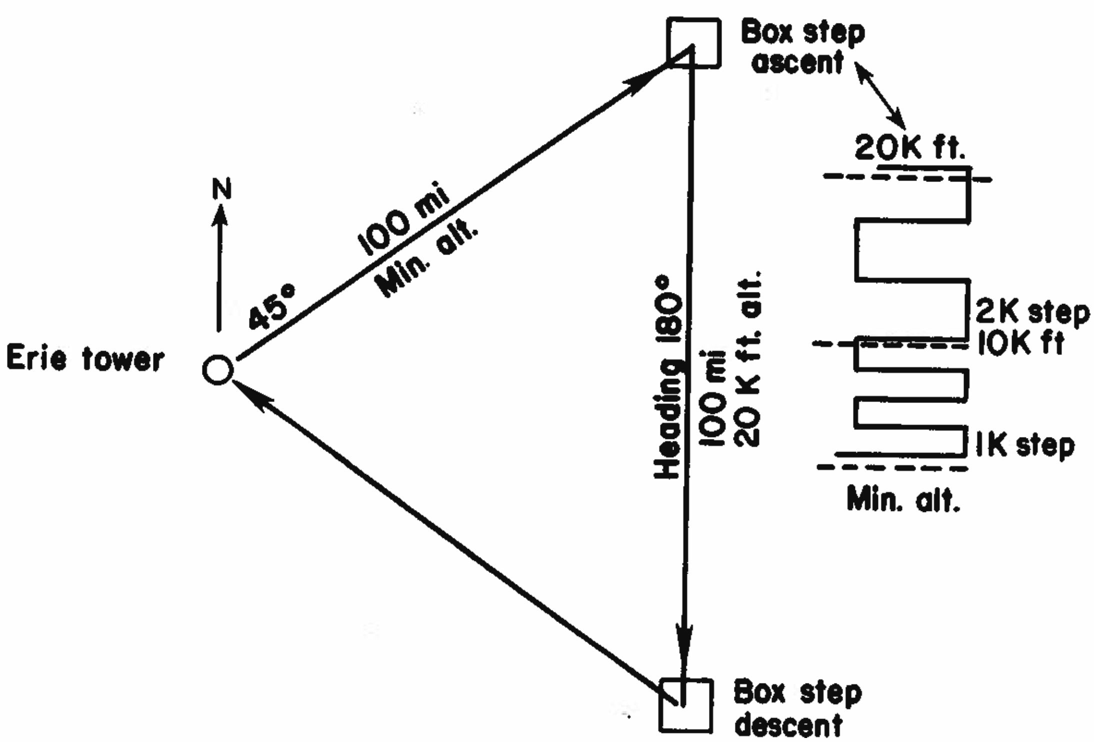


Fig. VI-4

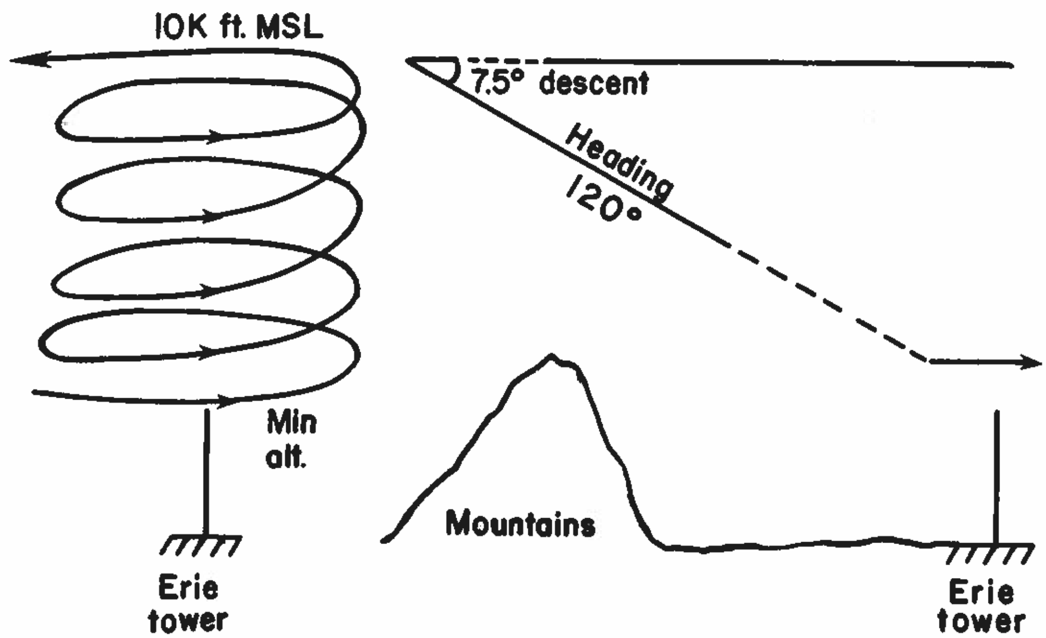


Fig. VI-5

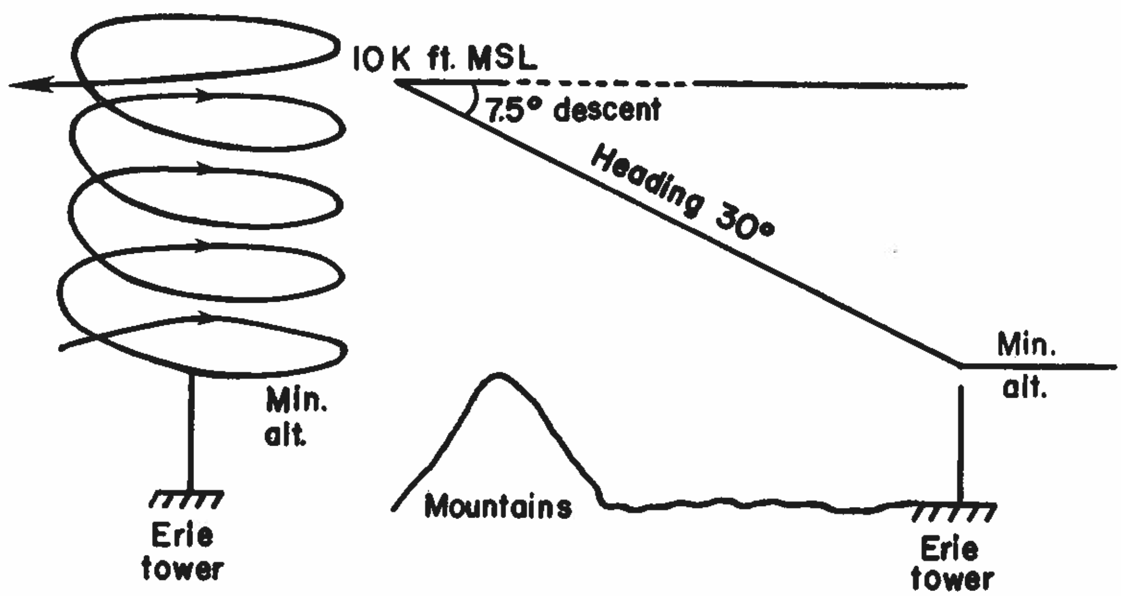


Fig. VI - 6

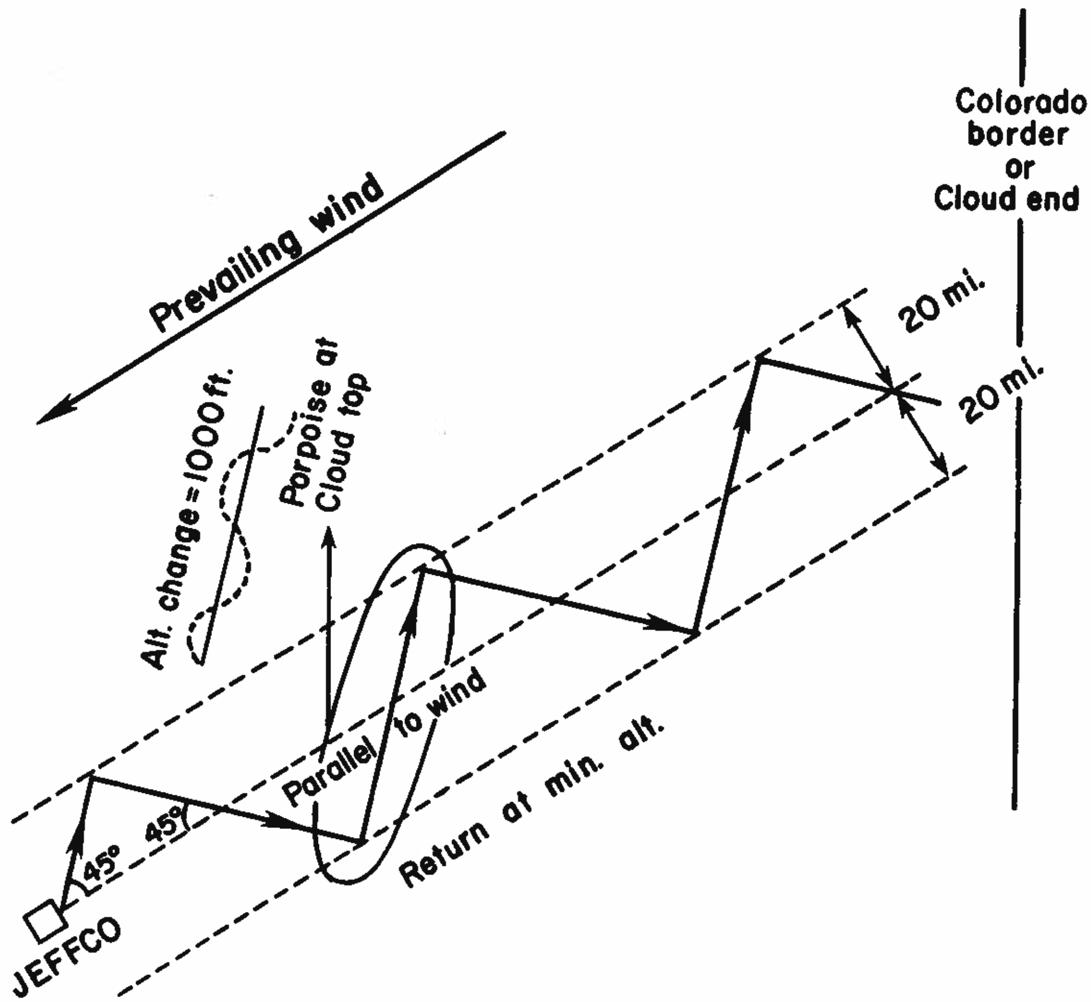
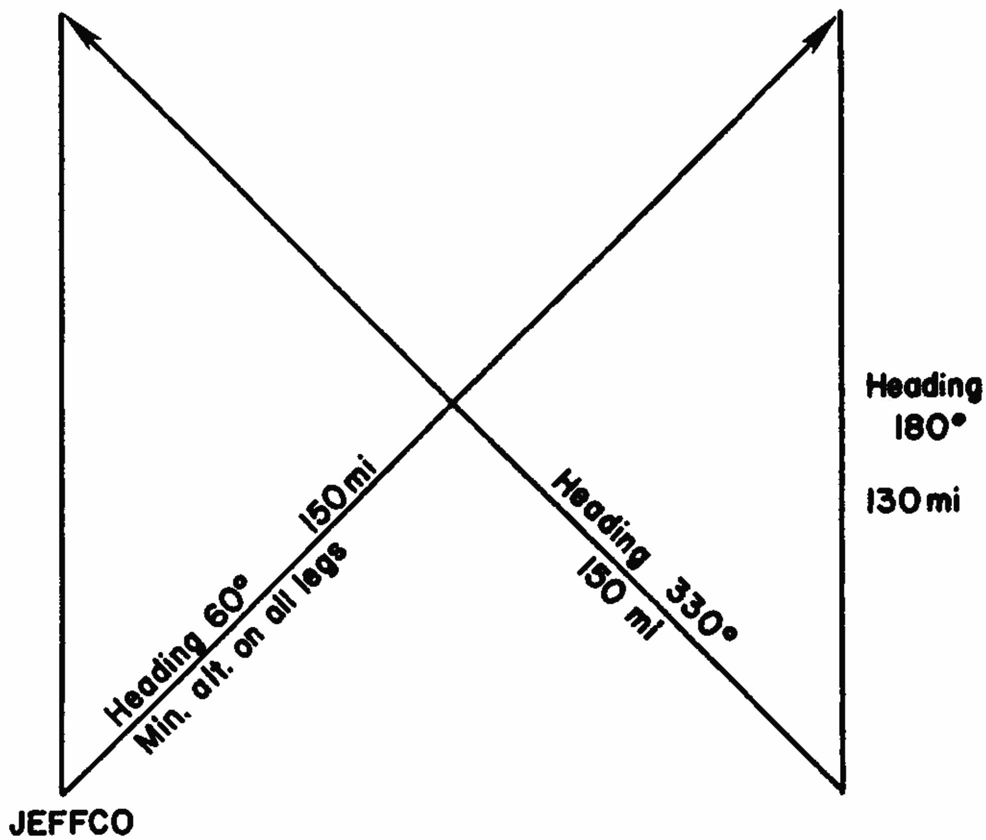

Colorado
border
or
Cloud end
Prevailing wind
20 mi.
20 mi.
Alt. change = 1000 ft.
Porpoise at
Cloud top
Parallel to wind
Return at min. alt.
45°
45°
JEFFCO

Fig. VI-7


Heading 180°
130 mi
150 mi
Heading 60°
Min. alt. on all legs
Heading 330°
150 mi
JEFFCO

VII. Surface Sampling of Snow and Ice Crystals - H. Weickmann

Snow crystal data were taken from January 82 to May 82. The data taken were essentially a detailed snow crystal record of the rate of precipitation and a photographic record of the snow crystals which precipitated.

The snow crystal photos show a great variety of shapes and forms, but only a few show the traditional variety of six-sided stars. They frequently show needles and very small particles which could be either debris or little snow grains. They are present in May 12, 1982 #15 and 16 but are missing for instance in the entire sequence of pictures on March 3, 1982. Whether this is true or an artifact is difficult to determine since these little snow grains occur also with wind. Certainly, they would contribute a source for crystal multiplication.

Objectives:

A) Measure crystal flux at the surface. The crystal flux is the mechanism by which the rate of precipitation functions. The crystals may ascend or descend, or be partly ascending and partly descending. They may form flakes, for which a number of mechanisms work, such as: aggregation (crystal to crystal by interlocking or by cohesion) droplet to droplet by accretion, droplet to crystal by riming.

B) Make microphotographic pictures of the crystals in order to document the type of crystals that form under certain conditions throughout the precipitating cloud. The problem in microphysics is whether the crystals which precipitate have formed near the cloud top in so-called generating cells, (the snow crystals then belong to the type which is characteristic for the temperature range of the generating cell) or whether snow crystals form throughout the entire cloud layer without special generating cells. This mechanism would cause the development of crystals along the entire vertical temperature range of the cloud.

Data Summary:

6 Jan. 1982	08.00 - 13.35	Very light precipitation.
11 Jan. 1982	22.03 - 23.43	Diminishing precipitation. Difficulties with photographic record causes termination of observation.
3 Feb. 1982	07.30 - 10.56	Light precipitation, very low density snow, wind begins to interfere with snow crystal record.
8 Feb. 1982	13.30 - 16.30	Snow crystal record in Formvar slides; no rate of precipitation measurements.
3 Mar. 1982	07.24 - 10.55	Rate of precipitation with Dew Scale but have trouble with Polaroid cassette.
	11.50 - 16.30	Snow surveillance drive with H. Riehl: Boulder, Eldora, Peak to Peak Highway, Ward, Left-Hand Canyon, office.
5 Mar. 1982	07.39 - 09.40	Snow flurries.
24 Mar. 1982	18.31 - 22.29	Very light precipitation from dendrites and irregular snow particles.
19 Apr.		Snow surveillance Boulder to Nederland along Boulder Canyon.
20 Apr. 1982	10.15 - 16.37	Snow surveillance with two stations: 1) Along Boulder Canyon to Nederland, then selection of observation site 9-1/2 miles up Canyon. Several snow showers passed by and were studied. Difficulties with Polaroid

Data Summary cont'd.

		film cassette. 2) The second station was in RL-3 during the time period 10.48 - 15.31.
27 Apr. 1982	10.18 - 11.46	Snow surveillance along Boulder Canyon to ramp of Eldora Ski area.
	12.00 - 13.18	Study of several snow showers. Terminate observations due to snow melting before photos can be obtained.
11 May 1982	10.25 - 14.30	Snow surveillance from RL-3 up Boulder Canyon to Eldora Ski Area and return.
12 May 1982	10.49 - 11.34	Snow surveillance up Boulder Canyon to Eldora Ski Area. Temperatures at Boulder were too warm for snow crystal photography.
	12.00 - 14.33	Continuous snow precipitation, photographic record of snow crystals.
13 May 1982		Snow surveillance Boulder Canyon to Caribou Ranch. Tail end of extended snow fall, air is quickly warming up and crystals melt before their pictures can be taken.

VIII. Snow Crystal and Cloud Drop Collection by Formvar Replicator - F. Parungo

Hydrometeors (snow crystal and cloud drops) were collected with Formvar replicators on Erie Tower and on the roof of the six story building in Boulder, CO., at the corner of 30th and Arapahoe. The permanent replicas will be examined with scanning electron microscope to determine the hydrometeors' structure, size distribution and concentrations. An example is shown in Figure XVIII - 1.

Objectives:

Analyze hydrometeors' structure, size distribution, and concentration.

Data Summary:

Date	Time	Records
4 Mar. 1982	14.00 - 14.15	Photograph of hailstone
5 Mar. 1982	08.27 - 09.05	Replicas of snow crystals
20 Mar. 1982	10.25 - 11.40	Replicas of mixed hydrometeors

IX. An Experiment on the Energy of Upslope Motions During BUCOE - H. Riehl

The BUCOE experiment with its various facets offered the opportunity to obtain observations from the plains to the high mountains. Often the top of overcasts can be observed at 8,000 - 9,000 feet. A sea of stratocumulus lies below and, upon entering from above, a sharp temperature drop is experienced. Based on numerous experiences of this kind, one could form the hypothesis that the observed top represented the height to which a pressure gradient on the upper plains would be able to force the cold air up the slope. On a profile up the canyon roads one should find constant static energy appearing on a thermodynamic diagram as a moist adiabatic lapse rate. Temperatures should be lower than measured at, say, the BAO tower if absolute thermal stability prevailed there, making it possible to calculate the pressure head. Further, from the decrease of humidity along the path up the mountainside, one should be able to calculate the precipitation rate given the wind field. Connection with the eastern plains would be established by the general station network of the NWS and the special observations at BAO and Greeley plus the aircraft flight routines.

Instrumentation for this part of the program was simple; there was need only for a good barometer, a hygro-thermometer, and a wind direction and velocity indicator. Due to the shortage of cases only three missions were made: two in Dr. Weickmann's vehicle and one in mine. Since the cases were light there was no problem due to snow on the highways, but there could be on more intense cases in the future. It was hoped to have some measurements some distance above the roads in the mountain region, but these did not materialize.

Objective:

> Test the hypothesis that the top of the easterly low-level flow against the mountains is the height to which the pressure gradient over the upper plains is able to force the cold air upslope.

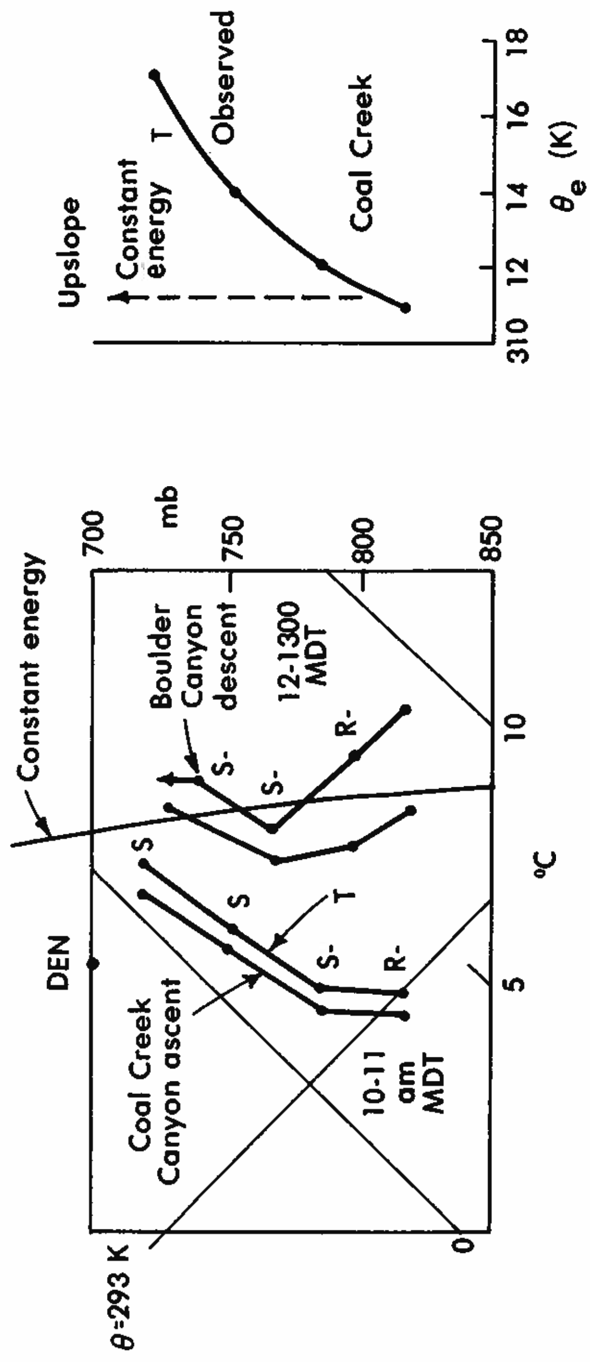
Data Summary:

While further analysis with the sondes east of the mountains and the airplane information must and will be carried out, the immediate result from the profile data alone indicated failure of the model as outlined. In all three cases the top of the cloud was found near 8,000 - 9,000 feet with thickness of about 2,000 feet or 600 m, but the sounding prepared by numerous measurements up several canyons in no way indicated constant energy, i.e., the air could not have risen from low to high levels. Winds, moreover, were very light easterly for the most part; at times the air was calm. Temperature decreased only very slowly with height, closer to isothermal than to adiabatic; thus, neither pressure head nor precipitation could be computed.

After these experiences there is a puzzle as to just what is meant by "upslope;" it would seem a very frutiful idea to repeat the experiment in the 1982-83 seasons, as one of the major weather factors of the whole Colorado foothills area is involved.

An example of a tephigram drawn for the last ascent made on 13 May is shown in Figure IX-1.

IX-1



Constant energy
Boulder Canyon descent
12-1300 MDT
Coal Creek Canyon ascent
10-11 am MDT
DEN
S
S
T
S-
R-
S-
S-
R-
θ=293 K
700
750
800
850
mb
0
5
10
°C
Upslope
Constant energy
T
Observed
Coal Creek
310
12
14
16
18
θe (K)

X. Tower Particle Sampling Measurements - C.C. Van Valin, D.L. Wellman, E.W. Barrett and L.P. Stearns

Objectives:

The Air Quality Group of OWRM measured several aerosol parameters during upslope events beginning 24 March and ending 14 May 1982. The objectives of the Air Quality Group study were to provide an assessment of the variability of the size and concentration of aerosol particles and drops, the net radiation, and some physical and chemical characteristics of the aerosol and drop population. Periods of particular interest were during the formation of clouds or when the cloud bases were descending.

Data Summary:

Measurements at the BAO were done on the Carriage, mostly at 296 m. Measurements included light scattering (b_{scat}) at visible wavelengths, the Aitken nuclei (AN) concentration, aerosol and drop size distributions over the range 0.1-1600 μm diameter (PMS, Inc. probes of the diameter ranges 0.1 - 2.6 μm (ASASP-X), 0.5-47 μm (FSSP), and 50-1600 μm (2-D)), and earth surface-atmosphere and cloud drop-atmosphere interface IR temperatures. The b_{scat}, AN concentrations, and IR temperatures, plus air temperature, dew point, and Carriage height were recorded on strip charts; all measurements were recorded on magnetic tape. The inclusive times of the measurement periods are listed in Table X-1; analog (strip chart) recordings were being made during these periods.

Table X-1

Begin	End
1622 MST, 24 March	1428 MST, 25 March
1123 MST, 9 April	1724 MST, 9 April
1442 MST, 15 April	1351 MST, 16 April
2348 MST, 18 April	1437 MST, 21 April
1132 MDT, 26 April	0800 MDT, 28 April
1212 MDT, 29 April	1335 MDT, 30 April
1818 MDT, 4 May	1533 MDT, 5 May
1752 MDT, 10 May	0950 MDT, 14 May

The magnetic tape recordings, except for the 2-D, were done during the times listed in Table X-2. No data were obtained from the FSSP probe from 20 April to 29 April due to a power supply failure.

Table X-2

Magnetic tape data record at the BAO (except 2-D).

Begin	End
163709 MST, 24 March	210219 MST, 24 March
222534 MST, 24 March	045034 MST, 25 March
075359 MST, 25 March	122304 MST, 25 March
122959 MST, 25 March	142919 MST, 25 March
141004 MST, 9 April	172649 MST, 9 April
190105 MST, 15 April	010535 MST, 16 April
065234 MST, 16 April	132254 MST, 16 April
000014 MST, 19 April	062444 MST, 19 April
101004 MST, 19 April	163904 MST, 19 April
165034 MST, 19 April	231524 MST, 19 April
000759 MST, 20 April	063039 MST, 20 April
070059 MST, 20 April	131244 MST, 20 April
132009 MST, 20 April	194939 MST, 20 April
084359 MST, 21 April	143429 MST, 21 April
113159 MDT, 26 April	153929 MDT, 26 April
154529 MDT, 26 April	220459 MDT, 26 April
221704 MDT, 26 April	234339 MDT, 26 April
082409 MDT, 27 April	123104 MDT, 27 April
123939 MDT, 27 April	190604 MDT, 27 April
191659 MDT, 27 April	194001 MDT, 27 April
122208 MDT, 29 April	224118 MDT, 29 April

224758 MDT, 29 April	112448 MDT, 30 April
190318 MDT, 4 May	074548 MDT, 5 May
081008 MDT, 5 May	154048 MDT, 5 May
180315 MDT, 10 May	070125 MDT, 11 May
144505 MDT, 11 May	034455 MDT, 12 May
093655 MDT, 12 May	161425 MDT, 12 May
162455 MDT, 12 May	225615 MDT, 12 May
094058 MDT, 13 May	223848 MDT, 13 May

The magnetic tape recordings from the PMS, Inc., 2-D probes covered the times listed in Table X-3

Table X-3

Time periods for magnetic tape record of the PMS, Inc., 2-D probe.

Begin	End
0810 MST, 16 April	1350 MST, 16 April
0000 MST, 19 April	0655 MST, 20 April
0924 MST, 20 April	1200 (est) MST, 20 April
1330 MST, 20 April	0700 (est) MST, 21 April
0826 MDT, 27 April	1910 MDT, 27 April
1230 MDT, 29 April	1320 MDT, 30 April
1903 MDT, 4 May	1535 MDT, 5 May
1804 MDT, 10 May	1340 MDT, 11 May

The analysis of the ASASP-X and FSSP data is under way. Examples of the output are presented in Figures X-1-4 that include size distributions from four times during the 24 March 1982 upslope episode. Tables X-4-7 contain the particle number, surface and mass distributions derived from the same parameters from which the figures were derived. In each figure the ordinate values are in terms of log (dN/dlog R) cm^{-3}; the abscissa is log R, μm. The crosses are the actual data points; the solid curves are modified gamma distributions (Deirmendjian, 1969) least-square fitted to the data points by the method of peak stripping (Barrett et al., 1979). Figure X-1 is the product of data averaging over a 35-minute period ending at 17:59:54 MST; this was before snowfall began and before low level clouds appeared. It is reasonably representative of the "normal," fairly clean atmosphere. The data collection was done at the tower's 295 m level. Figure X-2 is a 13-minute average ending at 18:30:04 MST, in the presence of a thin cloud and after snowfall had begun. The particle size distribution is the same in Figure X-1 from the lower radius cut-off to about 1 μm. There is some increase, by approximately a factor of two, in the size interval from ca. 2-5 μm radius, but in the larger size range, from 10-23.5 μm, the particle number increase is close to two orders of magnitude. This probably represents the presence of ice crystals, and is the small size end of the snowflake spectrum. Figure X-3, a 3-minute average ending at 18:48:54 MST, indicates what is probably a water cloud with a droplet number modal radius of 2.8 μm and a number increase by nearly two orders of magnitude at the modal radius. The large particle population, representing ice crystals, is unchanged from the previous example. Figure X-4, a 9.6-minute average ending at 21:01:59 MST, shows the densest water cloud measured during this episode. Here the droplet modal

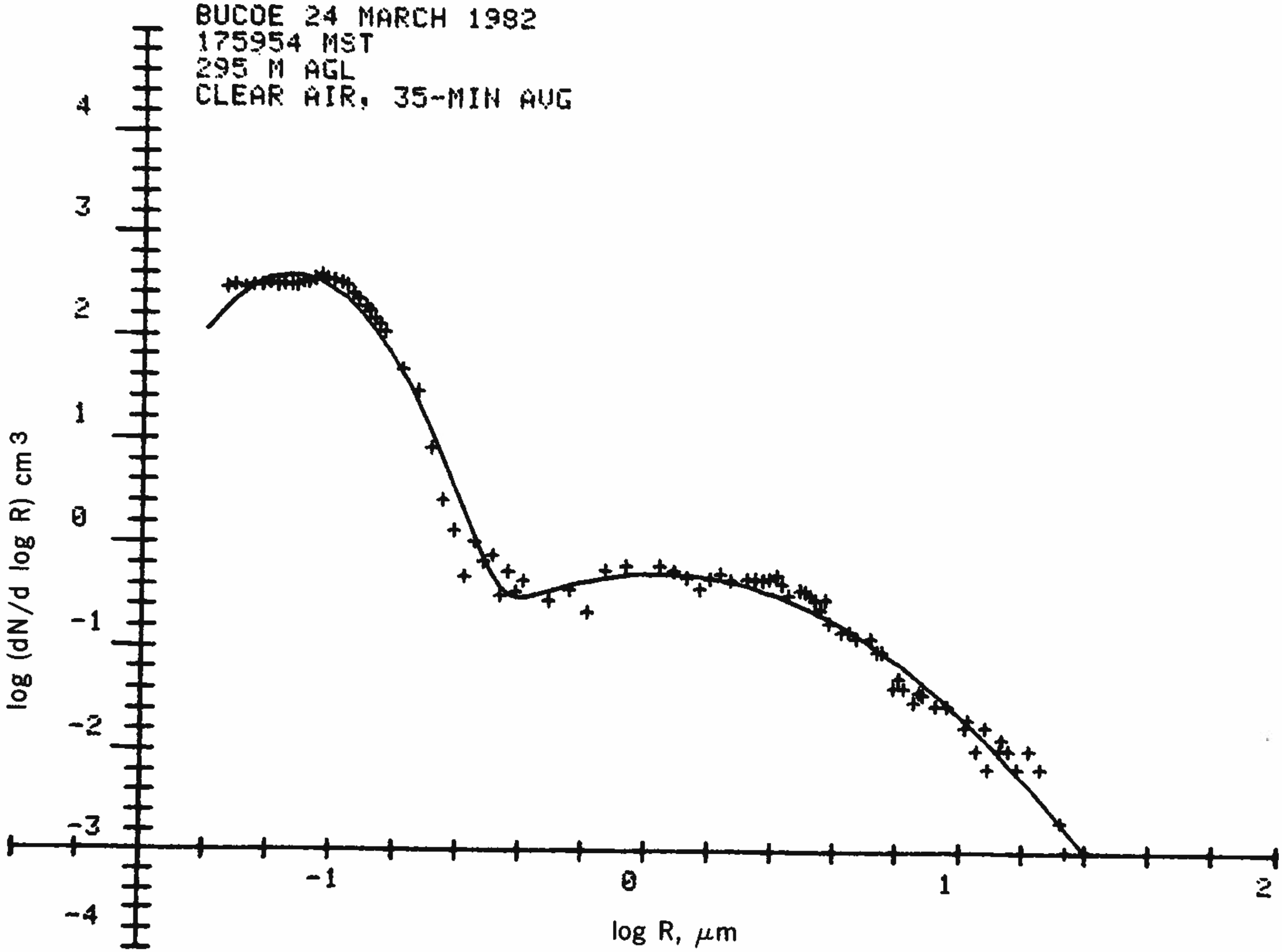


Figure X-1. Particle size distribution for a 35-minute averaging period ending at 17:59:54 MST at the 295 m level of BAO. This is typical of a fairly clean atmosphere.

Table X-4a

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.047 TO 0.51 MICROMETERS
DATE 820324 TIME 175954

MEAN RADIUS = 7.929E-002 MICROMETERS
MODAL RADIUS = 7.350E-002 MICROMETERS
MEDIAN RADIUS = 7.349E-002 MICROMETERS
STANDARD DEVIATION = 3.213E-002 MICROMETERS
SKEWNESS PARAMETER = 1.086E+000
MODAL ORDINATE = 3.854E+002 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 1.637E+002 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 1.075E-001 MICROMETERS
MODAL RADIUS = 9.963E-002 MICROMETERS
MEDIAN RADIUS = 9.961E-002 MICROMETERS
STANDARD DEVIATION = 4.352E-002 MICROMETERS
SKEWNESS PARAMETER = 1.086E+000
MODAL ORDINATE = 3.547E-007 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 1.505E-007 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION FOR A DRY AEROSOL

MEAN RADIUS = 1.251E-001 MICROMETERS
MODAL RADIUS = 1.160E-001 MICROMETERS
MEDIAN RADIUS = 1.160E-001 MICROMETERS
STANDARD DEVIATION = 5.064E-002 MICROMETERS
SKEWNESS PARAMETER = 1.085E+000
MODAL ORDINATE = 2.542E+000 MICROGRAMS/CUBIC METER
MASS CONCENTRATION = 1.078E+000 MICROGRAMS/CUBIC METER

Table X-4b

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.415 TO 21.25 MICROMETERS
DATE 820324 TIME 175954

MEAN RADIUS = 1.616E+000 MICROMETERS
MODAL RADIUS = 1.090E+000 MICROMETERS
MEDIAN RADIUS = 1.090E+000 MICROMETERS
STANDARD DEVIATION = 1.770E+000 MICROMETERS
SKEWNESS PARAMETER = 1.662E+000
MODAL ORDINATE = 5.228E-001 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 5.057E-001 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 7.810E+000 MICROMETERS
MODAL RADIUS = 5.275E+000 MICROMETERS
MEDIAN RADIUS = 5.272E+000 MICROMETERS
STANDARD DEVIATION = 8.535E+000 MICROMETERS
SKEWNESS PARAMETER = 1.660E+000
MODAL ORDINATE = 3.782E-007 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 3.652E-007 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 1.714E+001 MICROMETERS
MODAL RADIUS = 1.158E+001 MICROMETERS
MEDIAN RADIUS = 1.157E+001 MICROMETERS
STANDARD DEVIATION = 1.871E+001 MICROMETERS
SKEWNESS PARAMETER = 1.659E+000
MODAL ORDINATE = 9.853E-005 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 9.508E-005 GRAMS/CUBIC METER

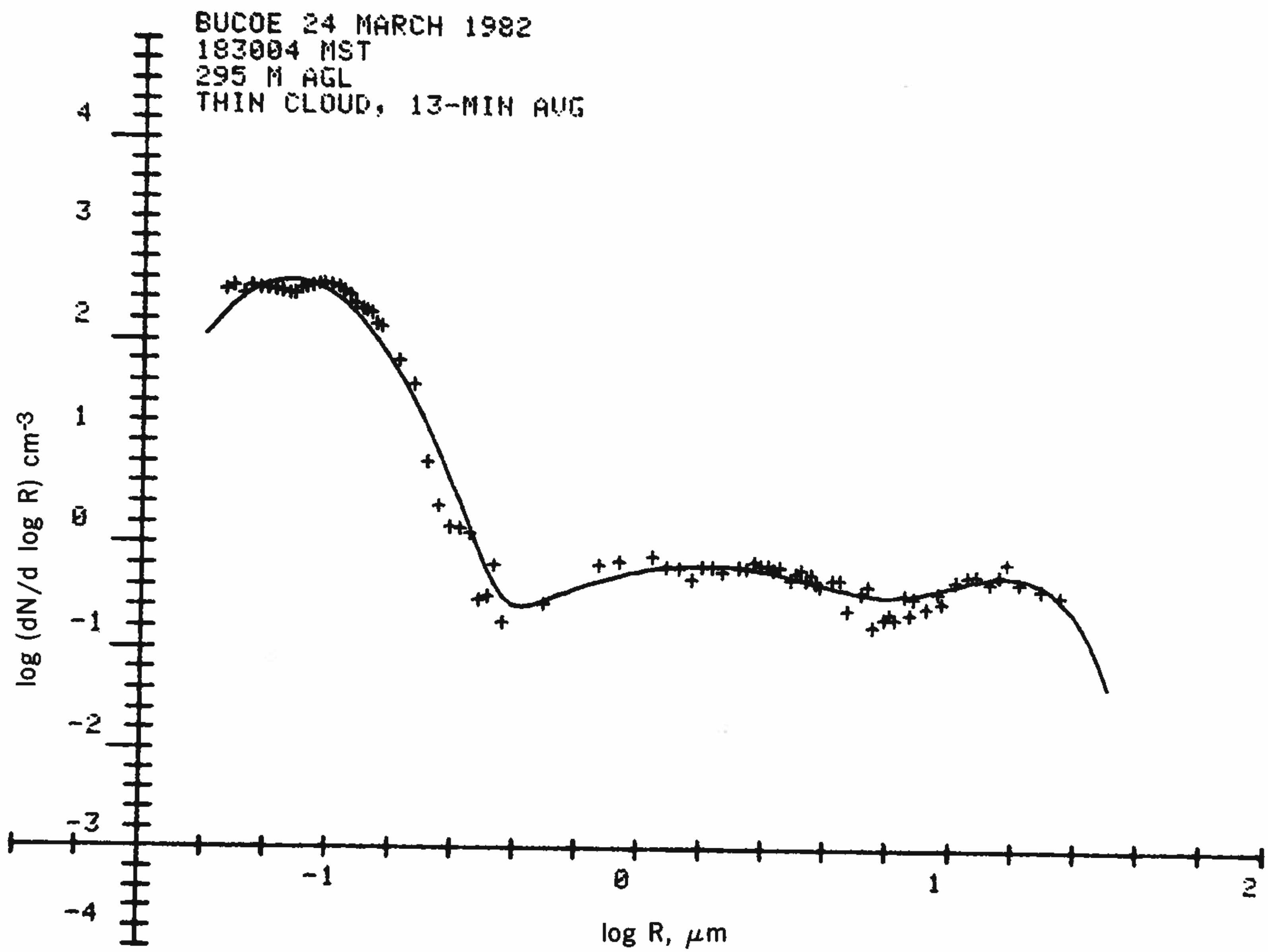


Figure X-2. Particle size distribution for a 13-minute averaging period ending at 18:30:04 MST at the 295 m level of BAO. Compared to Figure X-1, this shows added particles at model radii of 1.55 μm and 15.3 μm that are believed to represent a thin water cloud and "diamond dust" snow crystals.

Table X-5a

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.047 TO 0.37 MICROMETERS
DATE 820324 TIME 183004

MEAN RADIUS = 8.017E-002 MICROMETERS
MODAL RADIUS = 7.412E-002 MICROMETERS
MEDIAN RADIUS = 7.411E-002 MICROMETERS
STANDARD DEVIATION = 3.311E-002 MICROMETERS
SKEWNESS PARAMETER = 1.093E+000
MODAL ORDINATE = 3.846E+002 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 1.662E+002 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 1.098E-001 MICROMETERS
MODAL RADIUS = 1.016E-001 MICROMETERS
MEDIAN RADIUS = 1.015E-001 MICROMETERS
STANDARD DEVIATION = 4.533E-002 MICROMETERS
SKEWNESS PARAMETER = 1.093E+000
MODAL ORDINATE = 3.638E-007 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 1.571E-007 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION FOR A DRY AEROSOL

MEAN RADIUS = 1.285E-001 MICROMETERS
MODAL RADIUS = 1.189E-001 MICROMETERS
MEDIAN RADIUS = 1.188E-001 MICROMETERS
STANDARD DEVIATION = 5.303E-002 MICROMETERS
SKEWNESS PARAMETER = 1.093E+000
MODAL ORDINATE = 2.665E+000 MICROGRAMS/CUBIC METER
MASS CONCENTRATION = 1.150E+000 MICROGRAMS/CUBIC METER

Table X-5b

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.345 TO 5.5 MICROMETERS
DATE 820324 TIME 183004

MEAN RADIUS = 2.012E+000 MICROMETERS
MODAL RADIUS = 1.548E+000 MICROMETERS
MEDIAN RADIUS = 1.450E+000 MICROMETERS
STANDARD DEVIATION = 1.909E+000 MICROMETERS
SKEWNESS PARAMETER = 1.441E+000
MODAL ORDINATE = 6.237E-001 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 5.894E-001 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 6.627E+000 MICROMETERS
MODAL RADIUS = 5.472E+000 MICROMETERS
MEDIAN RADIUS = 5.222E+000 MICROMETERS
STANDARD DEVIATION = 5.209E+000 MICROMETERS
SKEWNESS PARAMETER = 1.337E+000
MODAL ORDINATE = 7.112E-007 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 5.697E-007 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 1.072E+001 MICROMETERS
MODAL RADIUS = 9.056E+000 MICROMETERS
MEDIAN RADIUS = 8.692E+000 MICROMETERS
STANDARD DEVIATION = 7.830E+000 MICROMETERS
SKEWNESS PARAMETER = 1.299E+000
MODAL ORDINATE = 1.678E-004 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 1.259E-004 GRAMS/CUBIC METER

Table X-5c

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 5.75 TO 22.75 MICROMETERS
DATE 820324 TIME 183004

MEAN RADIUS = 1.312E+001 MICROMETERS
MODAL RADIUS = 1.527E+001 MICROMETERS
MEDIAN RADIUS = 1.250E+001 MICROMETERS
STANDARD DEVIATION = 6.696E+000 MICROMETERS
SKEWNESS PARAMETER = 7.965E-001
MODAL ORDINATE = 4.962E-001 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 2.837E-001 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 1.924E+001 MICROMETERS
MODAL RADIUS = 2.074E+001 MICROMETERS
MEDIAN RADIUS = 1.893E+001 MICROMETERS
STANDARD DEVIATION = 6.626E+000 MICROMETERS
SKEWNESS PARAMETER = 6.582E-001
MODAL ORDINATE = 2.049E-005 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 7.739E-006 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 2.153E+001 MICROMETERS
MODAL RADIUS = 2.285E+001 MICROMETERS
MEDIAN RADIUS = 2.126E+001 MICROMETERS
STANDARD DEVIATION = 6.559E+000 MICROMETERS
SKEWNESS PARAMETER = 6.219E-001
MODAL ORDINATE = 1.489E-002 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 4.964E-003 GRAMS/CUBIC METER

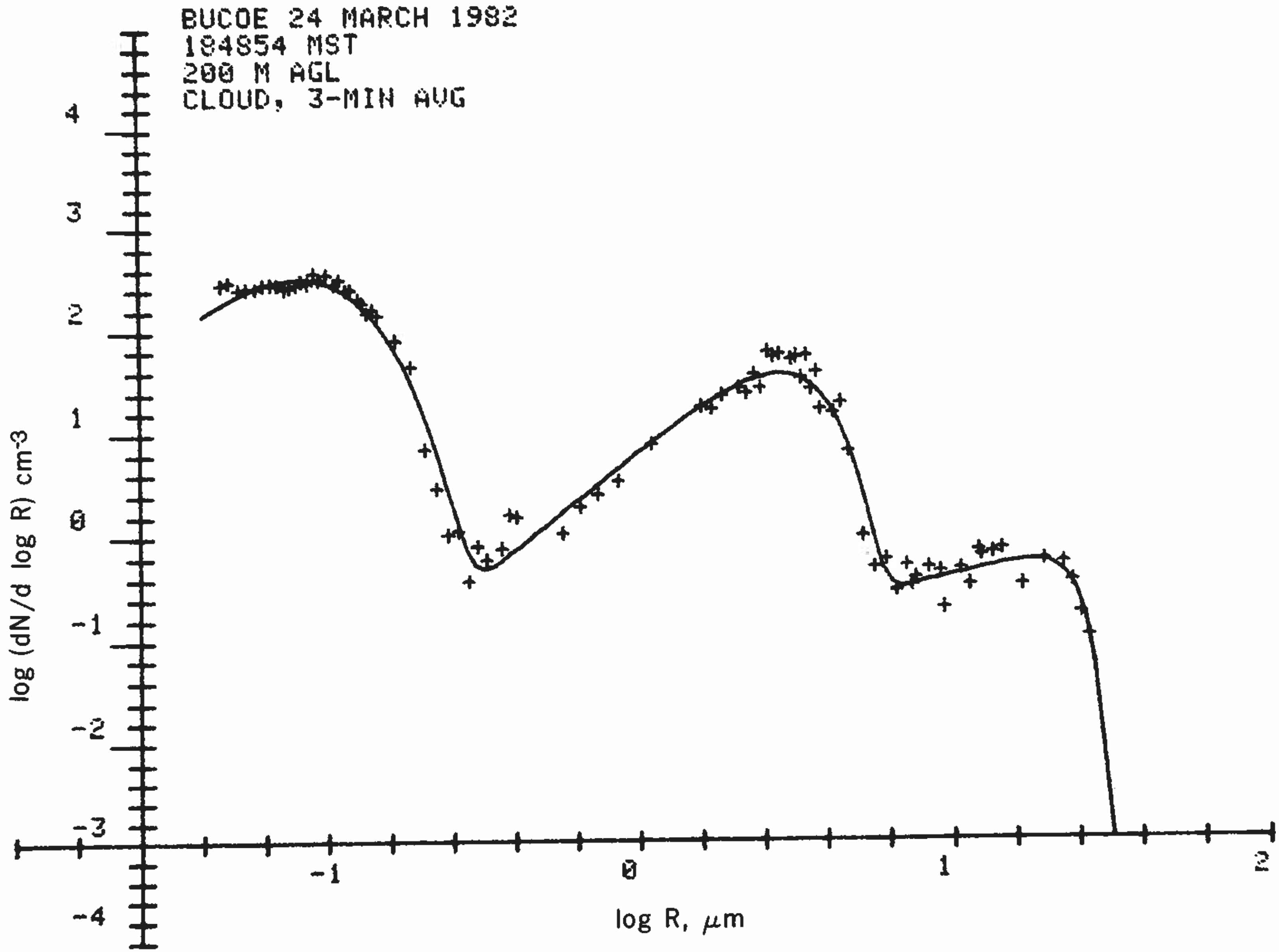


Figure X-3. Particle size distribution for a 3-minute averaging period ending at 18:48:54 MST at the 200 m level of BAO. Compared to Figure X-2, this shows about 60 times more droplets in the water cloud, but a similar concentration of snow crystals.

Table X-6a

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.047 TO 0.29 MICROMETERS
DATE 820324 TIME 184854

MEAN RADIUS = 7.748E-002 MICROMETERS
MODAL RADIUS = 8.127E-002 MICROMETERS
MEDIAN RADIUS = 7.253E-002 MICROMETERS
STANDARD DEVIATION = 3.719E-002 MICROMETERS
SKEWNESS PARAMETER = 9.154E-001
MODAL ORDINATE = 3.289E+002 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 1.771E+002 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 1.118E-001 MICROMETERS
MODAL RADIUS = 1.152E-001 MICROMETERS
MEDIAN RADIUS = 1.076E-001 MICROMETERS
STANDARD DEVIATION = 4.165E-002 MICROMETERS
SKEWNESS PARAMETER = 8.389E-001
MODAL ORDINATE = 3.983E-007 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 1.644E-007 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION FOR A DRY AEROSOL

MEAN RADIUS = 1.273E-001 MICROMETERS
MODAL RADIUS = 1.305E-001 MICROMETERS
MEDIAN RADIUS = 1.234E-001 MICROMETERS
STANDARD DEVIATION = 4.330E-002 MICROMETERS
SKEWNESS PARAMETER = 8.132E-001
MODAL ORDINATE = 3.262E+000 MICROGRAMS/CUBIC METER
MASS CONCENTRATION = 1.225E+000 MICROGRAMS/CUBIC METER

Table X-6b

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.27 TO 3.375 MICROMETERS
DATE 820324 TIME 184854

MEAN RADIUS = 2.470E+000 MICROMETERS
MODAL RADIUS = 2.839E+000 MICROMETERS
MEDIAN RADIUS = 2.436E+000 MICROMETERS
STANDARD DEVIATION = 1.007E+000 MICROMETERS
SKEWNESS PARAMETER = 6.024E-001
MODAL ORDINATE = 3.770E+001 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 1.670E+001 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 3.206E+000 MICROMETERS
MODAL RADIUS = 3.462E+000 MICROMETERS
MEDIAN RADIUS = 3.195E+000 MICROMETERS
STANDARD DEVIATION = 9.341E-001 MICROMETERS
SKEWNESS PARAMETER = 4.487E-001
MODAL ORDINATE = 4.749E-005 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 1.493E-005 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 3.478E+000 MICROMETERS
MODAL RADIUS = 3.703E+000 MICROMETERS
MEDIAN RADIUS = 3.470E+000 MICROMETERS
STANDARD DEVIATION = 9.063E-001 MICROMETERS
SKEWNESS PARAMETER = 4.029E-001
MODAL ORDINATE = 5.674E-003 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 1.596E-003 GRAMS/CUBIC METER

Table X-6c

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 7.75 TO 22.75 MICROMETERS
DATE 820324 TIME 184854

MEAN RADIUS = 9.749E+000 MICROMETERS
MODAL RADIUS = 1.820E+001 MICROMETERS
MEDIAN RADIUS = 9.850E+000 MICROMETERS
STANDARD DEVIATION = 7.287E+000 MICROMETERS
SKEWNESS PARAMETER = 7.676E-001
MODAL ORDINATE = 5.656E-001 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 4.537E-001 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 1.792E+001 MICROMETERS
MODAL RADIUS = 2.159E+001 MICROMETERS
MEDIAN RADIUS = 1.851E+001 MICROMETERS
STANDARD DEVIATION = 5.539E+000 MICROMETERS
SKEWNESS PARAMETER = -7.409E-001
MODAL ORDINATE = 2.898E-005 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 8.445E-006 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 1.963E+001 MICROMETERS
MODAL RADIUS = 2.247E+001 MICROMETERS
MEDIAN RADIUS = 2.018E+001 MICROMETERS
STANDARD DEVIATION = 4.888E+000 MICROMETERS
SKEWNESS PARAMETER = -7.923E-001
MODAL ORDINATE = 2.130E-002 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 5.044E-003 GRAMS/CUBIC METER

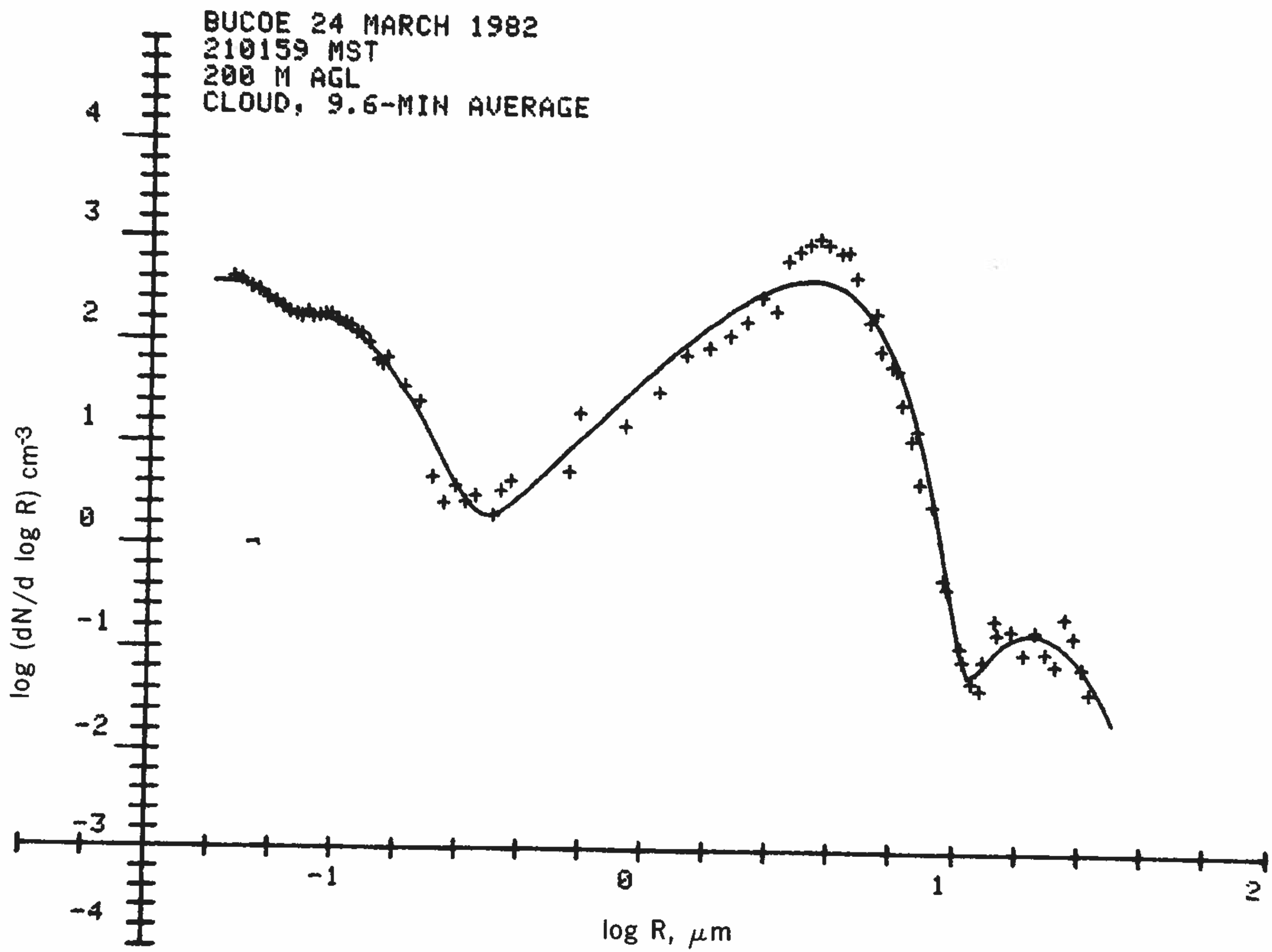


Figure X-4. Particle size distribution for a 9.6-minute averaging period ending at 21:01:59 MST at the 200 m level of BAO. Concentration of the water droplet mode is much greater than in the previous examples; the smoothed curve indicates approximately 420 cm^{-3}, while the raw data points indicate a more narrowly distributed mode at a maximum concentration of about 1000 cm^{-3}. The snow crystal mode was less populous by a factor of 4-5.

Table X-7a

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.047 TO 0.071 MICROMETERS
DATE 820324 TIME 210159

MEAN RADIUS = 1.174E-002 MICROMETERS
MODAL RADIUS = 3.611E-002 MICROMETERS
MEDIAN RADIUS = 2.474E-002 MICROMETERS
STANDARD DEVIATION = 1.532E-002 MICROMETERS
SKEWNESS PARAMETER = 1.127E+000
MODAL ORDINATE = 3.321E+002 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 6.183E+002 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 4.036E-002 MICROMETERS
MODAL RADIUS = 4.979E-002 MICROMETERS
MEDIAN RADIUS = 4.148E-002 MICROMETERS
STANDARD DEVIATION = 1.439E-002 MICROMETERS
SKEWNESS PARAMETER = -6.344E-001
MODAL ORDINATE = 8.343E-008 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 2.895E-008 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION FOR A DRY AEROSOL

MEAN RADIUS = 4.549E-002 MICROMETERS
MODAL RADIUS = 5.261E-002 MICROMETERS
MEDIAN RADIUS = 4.663E-002 MICROMETERS
STANDARD DEVIATION = 1.272E-002 MICROMETERS
SKEWNESS PARAMETER = -7.195E-001
MODAL ORDINATE = 2.851E-001 MICROGRAMS/CUBIC METER
MASS CONCENTRATION = 7.789E-002 MICROGRAMS/CUBIC METER

Table X-7b

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.078 TO 0.27 MICROMETERS
DATE 820324 TIME 210159

MEAN RADIUS = 8.671E-002 MICROMETERS
MODAL RADIUS = 8.019E-002 MICROMETERS
MEDIAN RADIUS = 8.017E-002 MICROMETERS
STANDARD DEVIATION = 3.578E-002 MICROMETERS
SKEWNESS PARAMETER = 1.093E+000
MODAL ORDINATE = 1.724E+002 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 7.445E+001 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 1.187E-001 MICROMETERS
MODAL RADIUS = 1.098E-001 MICROMETERS
MEDIAN RADIUS = 1.098E-001 MICROMETERS
STANDARD DEVIATION = 4.895E-002 MICROMETERS
SKEWNESS PARAMETER = 1.093E+000
MODAL ORDINATE = 1.908E-007 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 8.232E-008 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION FOR A DRY AEROSOL

MEAN RADIUS = 1.389E-001 MICROMETERS
MODAL RADIUS = 1.285E-001 MICROMETERS
MEDIAN RADIUS = 1.285E-001 MICROMETERS
STANDARD DEVIATION = 5.725E-002 MICROMETERS
SKEWNESS PARAMETER = 1.092E+000
MODAL ORDINATE = 1.511E+000 MICROGRAMS/CUBIC METER
MASS CONCENTRATION = 6.516E-001 MICROGRAMS/CUBIC METER

Table X-7c

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 0.25 TO 10.75 MICROMETERS
DATE 820324 TIME 210159

MEAN RADIUS = 3.114E+000 MICROMETERS
MODAL RADIUS = 3.369E+000 MICROMETERS
MEDIAN RADIUS = 2.995E+000 MICROMETERS
STANDARD DEVIATION = 1.325E+000 MICROMETERS
SKEWNESS PARAMETER = 7.983E-001
MODAL ORDINATE = 4.199E+002 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 1.991E+002 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 4.173E+000 MICROMETERS
MODAL RADIUS = 4.377E+000 MICROMETERS
MEDIAN RADIUS = 4.085E+000 MICROMETERS
STANDARD DEVIATION = 1.364E+000 MICROMETERS
SKEWNESS PARAMETER = 7.209E-001
MODAL ORDINATE = 7.955E-004 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 2.865E-004 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 4.618E+000 MICROMETERS
MODAL RADIUS = 4.807E+000 MICROMETERS
MEDIAN RADIUS = 4.539E+000 MICROMETERS
STANDARD DEVIATION = 1.374E+000 MICROMETERS
SKEWNESS PARAMETER = 6.959E-001
MODAL ORDINATE = 1.218E-001 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 3.985E-002 GRAMS/CUBIC METER

Table X-7d

STATISTICS OF PARTICLE NUMBER DISTRIBUTION
PARTICLE SIZE RANGE FROM 12.25 TO 22.75 MICROMETERS
DATE 820324 TIME 210159

MEAN RADIUS = 1.844E+001 MICROMETERS
MODAL RADIUS = 1.762E+001 MICROMETERS
MEDIAN RADIUS = 1.762E+001 MICROMETERS
STANDARD DEVIATION = 5.713E+000 MICROMETERS
SKEWNESS PARAMETER = 9.852E-001
MODAL ORDINATE = 1.538E-001 PER CUBIC CENTIMETER
NUMBER CONCENTRATION = 5.069E-002 PER CUBIC CENTIMETER

STATISTICS OF SURFACE DISTRIBUTION

MEAN RADIUS = 2.215E+001 MICROMETERS
MODAL RADIUS = 2.117E+001 MICROMETERS
MEDIAN RADIUS = 2.116E+001 MICROMETERS
STANDARD DEVIATION = 6.856E+000 MICROMETERS
SKEWNESS PARAMETER = 9.850E-001
MODAL ORDINATE = 7.210E-006 SQUARE CM/CUBIC CM
TOTAL SURFACE AREA = 2.375E-006 SQUARE CM/CUBIC CM

STATISTICS OF MASS DISTRIBUTION, CLOUD OR WET HAZE

MEAN RADIUS = 2.427E+001 MICROMETERS
MODAL RADIUS = 2.320E+001 MICROMETERS
MEDIAN RADIUS = 2.319E+001 MICROMETERS
STANDARD DEVIATION = 7.510E+000 MICROMETERS
SKEWNESS PARAMETER = 9.848E-001
MODAL ORDINATE = 5.326E-003 GRAMS/CUBIC METER
LIQUID WATER CONTENT = 1.753E-003 GRAMS/CUBIC METER

radius was ca. 3.4 μm and the maximum ordinate value (based on raw data points) was ca. 1000 cm^{-3}. The ice crystal mode (R > 10 μm) was much less populous than in the example of Figure. X-3.

At the present time, the capability exists to provide imaging output for the 2-D probe. Software is being developed to provide ice and liquid water discrimination, from which the water content of both the liquid and solid phases will be derived, and the size distributions, from which number concentration, surface area, and mass concentration will be derived. Additional functions will be developed as the need arises.

Figure X-5 is a sample of the imaging output from the 2-D probe. The number code at the top left of each image row is, in order, the year, month, day, hour, minute, and second (MST) of the beginning of the image row. The following numbers, 799 and 0, are relevant only to internal electronic options. The length of the vertical bars is 800 μm, and they constitute a linearly proportional scale for estimation of dimensions shorter than 800 μm; the horizontal dimension is of the same scale. The theoretical lower size limit is based on the dimension of the individual sensing elements, i.e., 25 μm; in practice, the lower limit is near 50 μm. The images shown represent the real two-dimensional shape of each particle that passes the sensing array, and in this sample it is apparent that graupel was being sensed. Each vertical bar also represents an indeterminate amount of time when no particles were present in the sensing array.

Aerosols and droplets were collected for individual analysis with both

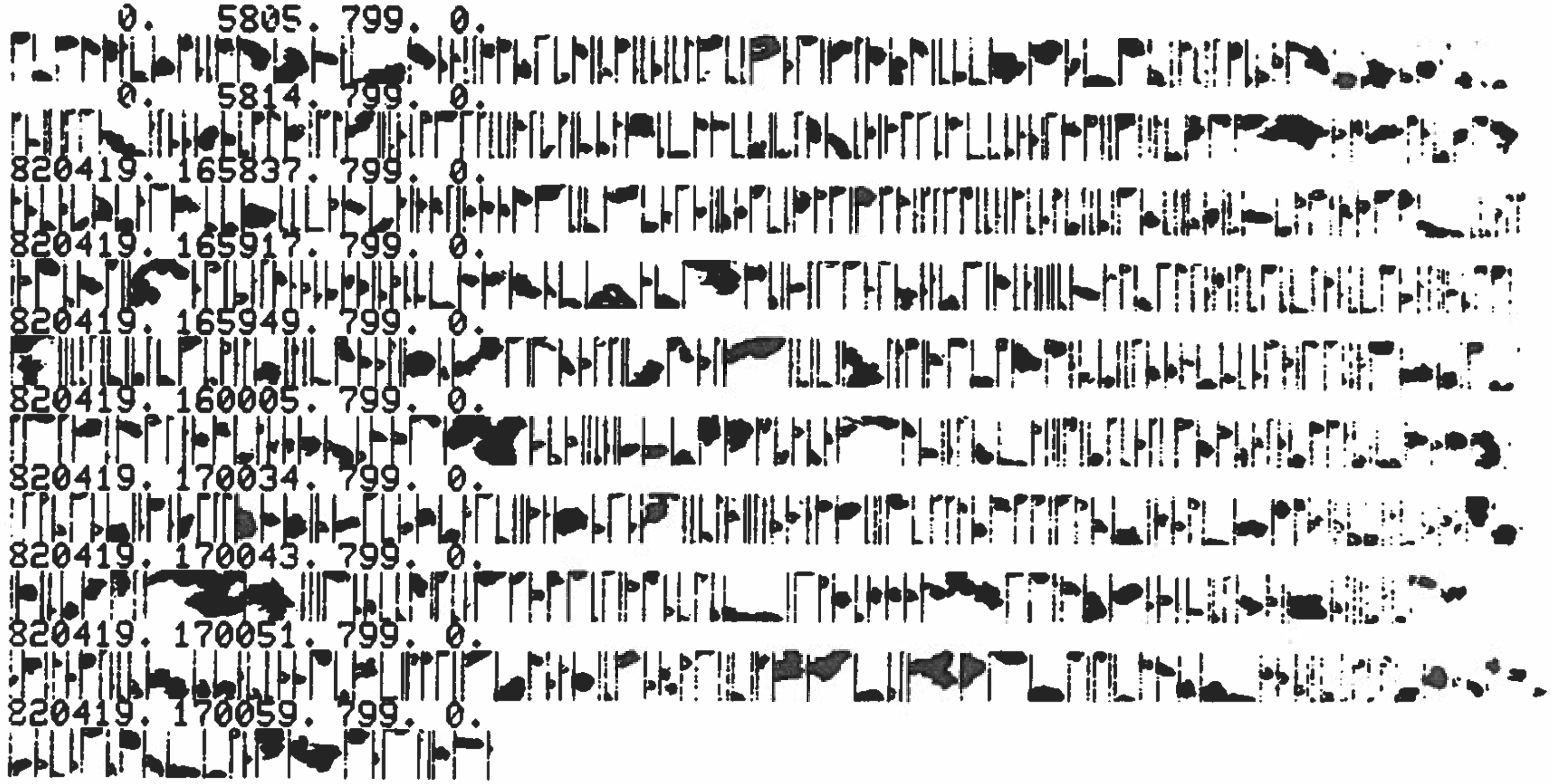


Figure X-5. Imaging output from the PMS, Inc., 2-D probe indicating graupel and snow. This example is from 19 April 1982 at the BAO at 2 m above ground. Each vertical bar represents an 800 μm length scale.

transmission and scanning electron microscopes. The analysis is for partical size, shapes, and the presence of sulfate and nitrate (transmission), and for particle morphology and elemental content (atomic number greater than 11, scanning electron microscope with energy dispersive X-ray analysis). The particle samples were collected at the 300 m BAO tower level using the Cassella cascade impactor. Analysis of the April 27, 1143-1205 MDT sample showed that only liquid droplets of modal diameter 0.25-0.30 μm, range 0.1-3.0 μm, were collected, and all contained sulfate. During sample collection the atmosphere being sampled appeared to be cloud free; however, cloud base was a short distance above the tower. Analysis of the other samples is continuing. The sample collection times are listed in Table X-8.

Table X-8

BAO cascade impactor sample collection times.

1105-1148 MST, 16 April	during snowfall
1059-1136 MST, 19 April	after upslope
0919-0939 MST, 20 April	during snow
1042-1120 MST, 21 April	after upslope
1613-1628 MDT, 26 April	before upslope
1143-1205 MDT, 27 April	hazy, close to cloud base. Droplets containing sulfate, no dry aerosol.

1217–1236 MDT, 5 May	cloud above the tower
1340–1345 MDT, 8 May	In cloud
1405–1419 MDT, 8 May	In cloud
1022–1101 MDT, 9 May	In cloud

In addition to the measurements at the BAO, a continuous record of AN concentration, atmospheric electrical conductivity, wind direction and velocity, and temperature was made at the Gunbarrel Hill field site and is available in support of the BUCOE analysis. Also, the Thermo-Systems, Inc., Model 3030 Electrical Aerosol Analyzer (EAA) was operated for spot measurements of size distribution during upslope events. The EAA particle size range is approximately 0.015 to 0.9 μm diameter. Sampling time per EAA size distribution determination is ca. 2 minutes. The sample beginning times are listed in Table X-9.

Table X-9

0932 MST, 24 March

1644 MST, 24 March

2030 MST, 24 March

0834 MST, 25 March

0930 MST, 25 March

1502 MST, 25 March

1036 MST, 19 April

1500 MST, 19 April

1600 MST, 19 April

1700 MST, 19 April

1856 MST, 19 April

2000 MST, 19 April

0800 MST, 20 April

0940 MST, 20 April

1022 MST, 20 April

1100 MST, 20 April

0916 MST, 26 April

0828 MST, 27 April

1400 MST, 29 April

1500 MST, 29 April

1900 MST, 29 April

2000 MST, 29 April

0630 MST, 30 April

0700 MST, 30 April

0730 MST, 30 April

0800 MST, 30 April

0846 MST, 4 May

0600 MST, 5 May

0652 MST, 5 May

0730 MST, 5 May

0800 MST, 5 May

0830 MST, 5 May

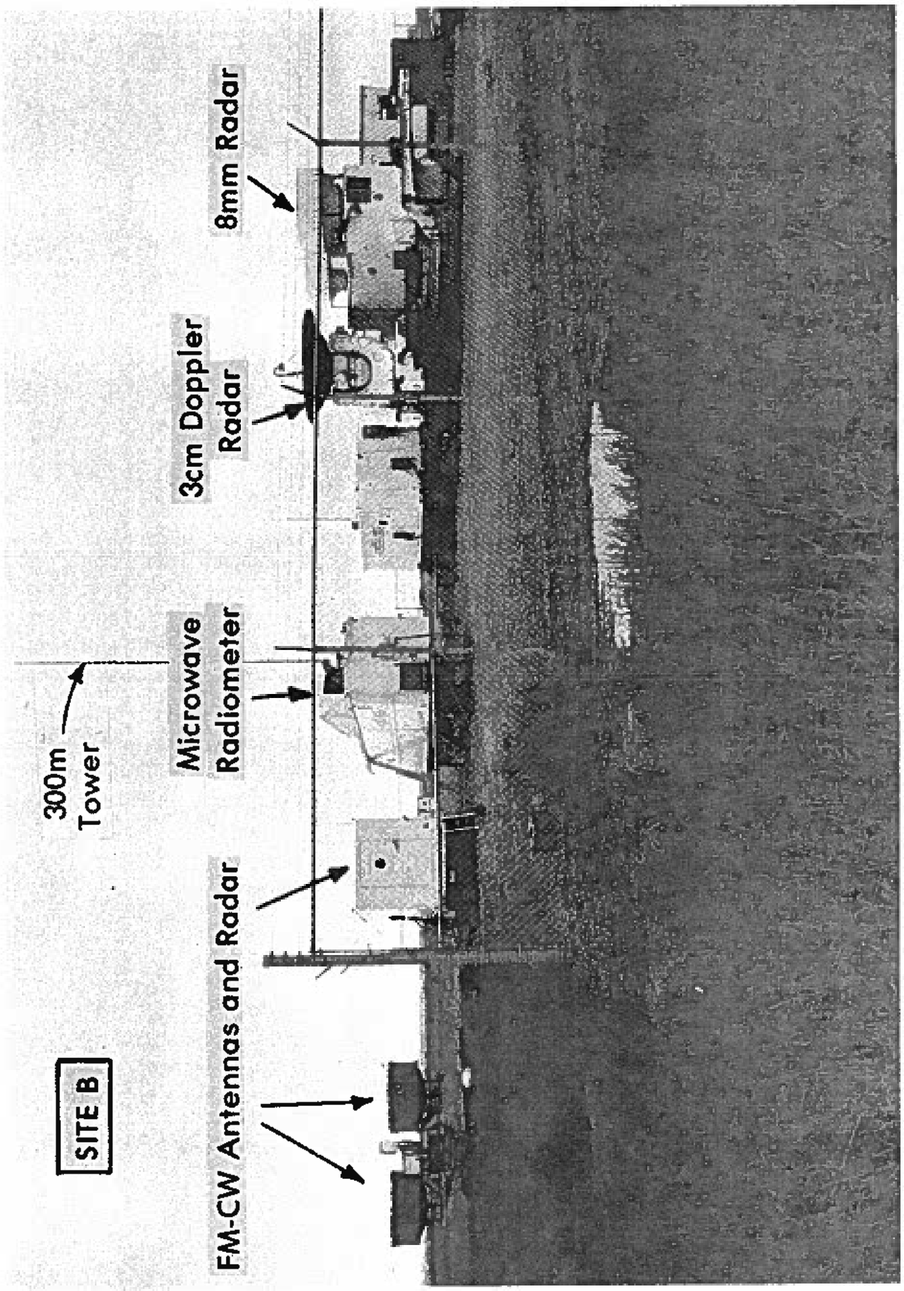
0900 MST, 5 May

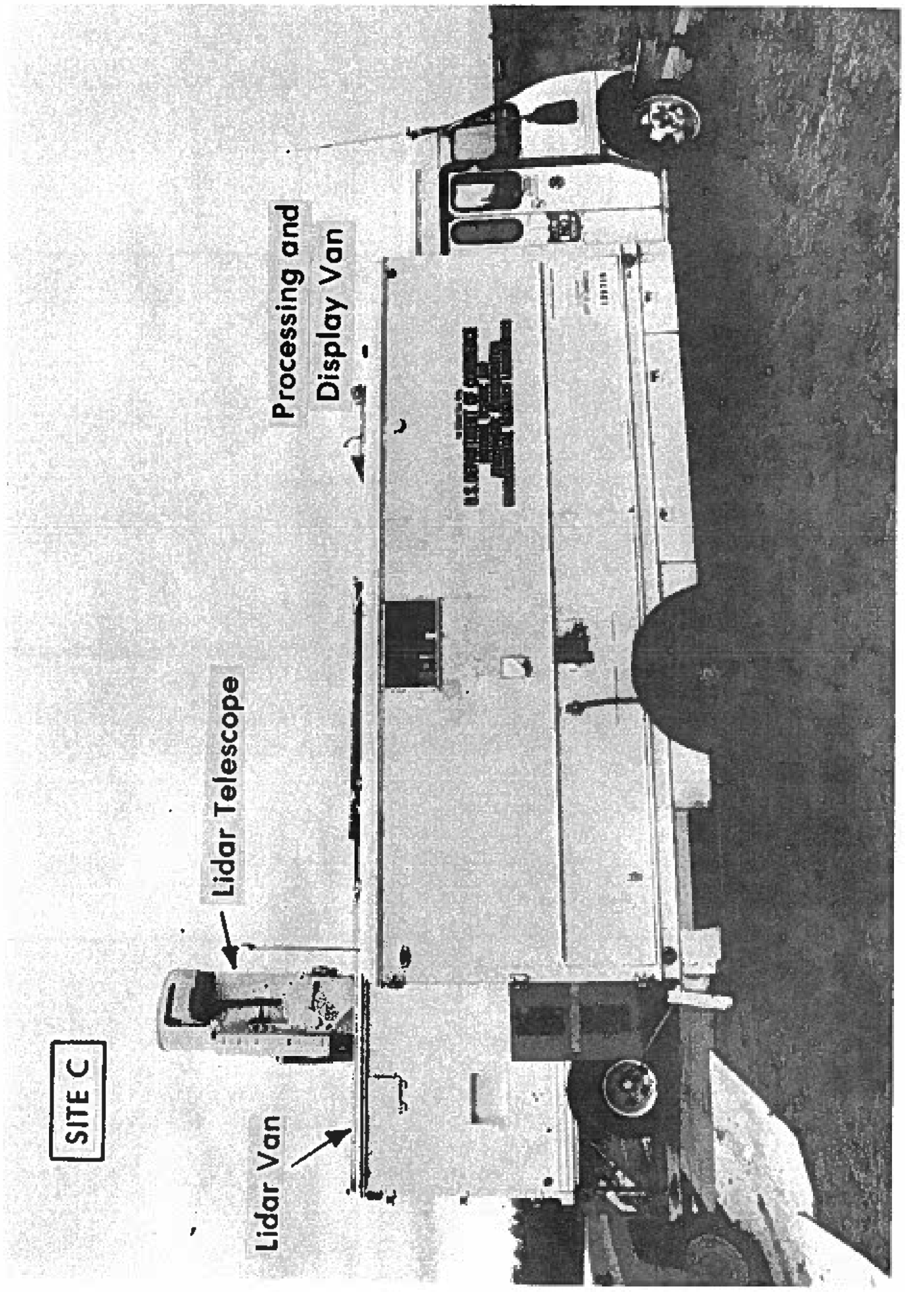
0824 MST, 6 May

References

Barrett, E. W., F. P. Parungo, and R. F. Pueschel, Cloud modification by urban pollution: a physical demonstration, Meteorol. Rdsch., 32, 136-149, 1979.

Deirmendjian, D., Electromagnetic Scattering on Spherical Polydispersions, Elsevier, New York, 1969.


SITE B
FM-CW Antennas and Radar
300m Tower
Microwave Radiometer
3cm Doppler Radar
8mm Radar


SITE C
Lidar Telescope
Lidar Van
Processing and
Display Van

II. Goals and Objectives

The goals of this observational program were to provide the data base to:

A) Learn more about the role of ice crystals in the formation of clouds and precipitation under upslope conditions.

B) Calibrate the various remote sensing systems against reliable in situ devices in a steady, homogeneous cloud environment, and to evaluate their practical applicability for observing the role of ice crystals and cloud microphysics in the evolution of upslope precipitation.

III. Facilities in the Experiment

A) In situ measurements

Aircraft (University of N. Dakota's Citation)
Boulder Atmospheric Observatory (BAO)
Tower particle measurements
Surface chemistry sampling
All-sky camera
Rotating beam ceilometer

B) Ground-based remote sensing

Dual-channel microwave radiometer
3-cm wavelength Doppler radar
8.6 millimeter, vertically pointing radar
10-cm frequency modulated, continuous wave (FM-CW) radar
Doppler lidar
Dual-polarization lidar

C) Local supporting observations and facilities

WPL's Boulder Surface Wind Network (BWN)
PROFS Surface Network
NCAR 10- and 3-cm wavelength Doppler radar (CP-2)
RAWINS from the BAO
RAWINS from Greeley
Continuous wind soundings by radar from Platteville
Continuous radiometric soundings at Stapleton Airport

IV. Participating Organizations

The experiment was a cooperative program including several laboratories and offices within NOAA as well as organizations outside NOAA:

A) NOAA laboratories and offices

Aeronomy Laboratory
Office of Weather Research and Modification
Wave Propagation Laboratory
Weather Modification Program Office

B) National Center for Atmospheric Research

Field Observation Facilities

C) Cooperative Institute for Research in the Environmental Services

In addition to the above, an aircraft operated by the University of North Dakota was a key element in the observation program. Lease of the aircraft and aircraft insurance were provided by the Bureau at Reclamation, so that it was only necessary that NOAA pay for aircraft hours, flight crew salaries and per diem.

V. Operational Summary of the Principal Weather Events

24 March

A frontal passage was forecast for 1500, then moved up to 1430. Most stations were manned by 1400. By 1410 the front was dramatically visible to the northeast by the dust storm it was producing. Pictures were taken at 1410 and 1420. The carriage was down by 1425 when the wind struck. The T' sensor at level 4 was destroyed. Both the Doppler radar (3-cm) and the Doppler lidar were recording VAD data. A successful GMD launch was made at 1636. Snow began at Fort Collins at 1619. Winds were from the NE at 1700. TPQ-11 had continuous echo to the ground at 1735 and snow began at 1749. At 1855 the Doppler lidar quit for the night. The optical precipitation sensor was turned on at 1605. GMD launches at 1903, 1945, and 2042. Small graupel particles at 2052, light snow at 2137. Aircraft take-off from Jeffco at 2155, but unable to retract landing gear. Returned to Jeffco and did not fly again that night. At 2300 all units were placed in automatic recording, unmanned mode for the night. GMD launch at 2251.

25 March

Joint Doppler lidar-aircraft soundings at 1300 accompanied by GMD launch. Aircraft did spiral ascent to 35,000 ft. MSL and descent in clear air, then headed for North Dakota.

9 April

Operation started at about 1430. Aircraft had been called; by the time it had arrived clouds had largely disappeared. Aircraft arrived at 1640, climbed to 37,000 ft. MSL, then returned to North Dakota. GMD launches at 1650 and 1710.

15 April

Operation began at 1700. GMD launch at 1718. At 1725 there was a middle cloud layer at about 10,000 ft. AGL accompanied by low fracto cumulus with virga. At 1745 pictures were taken around the tower. At 1821 there was light rain and a gust front arrived from the west. VAD's by FM-CW radar and Doppler lidar were taken at 1831. Aircraft arrived at 1910 and started spiral climb from 6000 ft. MSL, at 200 ft./min. for first 1000 ft.--faster above 7000 ft. The aircraft entered clouds at 15,700 ft. MSL. It ascended to 20,000 ft., and began its descent at 2004. VAD's by pulse Doppler radar at 2105, FM-CW at 2137. GMD launch at 2157. The aircraft started a climb at 2224. It cleared cloud top at 23,000 ft. MSL and started its decent at 2309. Started ascent at 2330, reached 23,000 ft. at 2341 and headed west. Started slant descent at 2354; headed for Jeffco at 0001 on 16th. Back to Plan A at 0007.

19-20 April

Mode of operation during the night of 19-20 April was basic Plan A (without the lidars) and with the pulse Doppler radar doing very slow VAD's instead of pointing vertically. There was a light snow falling in area from about 1800 on. From 2300-2400 it was fairly heavy. The aircraft was ordered down and arrived at around 0300 for an 0400 take-off. Gossard talked to them at 0330. Trotter and Abshire arrived to fly with them at 0350. There were GMD launches from tower at 1203, 0408, and 0820. Aircraft took off at 0400, but 40 miles into the flight pattern word came that the co-pilot's (the scientist co-pilot's father) had a coronary and was in intensive care. Therefore, the plane returned to Jeffco to phone North Dakota and try to locate another test pilot. GMD manned all night, FM-CW radar manned at 0600 and all facilities up and manned by 0700. Light snow started at 0714. Ganor went up the tower collecting snow samples at 0906. At 0925 small hail or graupel was falling (~1 mm diameter) and continued to fall intermittently. By 0945 it was sticking to the ground. FM-CW radar recorded fall velocity spectra. At 1002 it was snowing harder. By 1000 a co-pilot was found in Kansas City, but his aircraft could not land at Jeffco and so was sent to Stapleton. Level 4 T' went out at 1020. At 1024 it was snowing more heavily. Level 3 T' lost at 1040. Temperature at tower top -6.3°C and -3.1°C at bottom in and out of cloud. Snow stopped at 1400. Experiment terminated at 1530.

26-27 April (Times are Daylight Time)

Late on Monday, 26 April, it was decided to bring the aircraft down from North Dakota either that night or the following morning and schedule a take-off at 0830. This was cancelled after the 2200 weather maps were examined. However, the aircraft was already on it's way. Operations began at 0930 the next morning (27 April).

There was extensive low cloud and fog and very little liquid precipitation in the form of sparse, large drops. The first test of the cloud drop replicator was made at the tower top, but the timer failed. The aircraft took off at 1030 and flew a pattern over the plains for verifying the Nickerson model. However, the clouds were broken up out over the plains, and the event was largely confined to the area near the mountains. A RAWIN was launched at 1044. The aircraft did a spiral ascent and slant descent beginning at 1045, then went into Pattern 3 which was completed at 1310. Ganor went up the tower collecting cloud water samples at 1120. Operations were terminated at 1330.

29 April (Times are Daylight Time)

Operations began at 1300. The aircraft was not called down from North Dakota. Stations were manned at 1300 except the Doppler lidar which was manned at 1400. The CP-2 radar came up about 1730. A 403 MHz RAOB was launched at 1930. The experiment went back to Mode A (unmanned) at 2000. A fair amount of liquid water precipitation occurred from 1500-1700, but it was not a widespread case (largely confined to the region in close to the mountains).

In this event the CP-2 radar, located near I-25 and Baseline, joined the experiment for the first time. Unfortunately, by 2000 it had lost nearly all its echoes as had most of the other radars in the experiment. The 8 mm TPQ-11 was still seeing some return from middle cloud levels. The clear-air return on the FM-CW radar had virtually disappeared also. The experiment went to the automatic recording mode at about 1900.

11 May (Times are Daylight Time)

At 0700 it was found that one phase of the three-phase power had gone out so both the tower and the 3-cm radar were down. The TPQ-11 and FM radars were still up. Disk problems existed in both the BAO computer and the 3-cm radar computer. The disk at the tower was repaired by DEC at 1420 so the BAO system came up at that time. The aircraft arrived at Jeffco between 0945 and 1000 MDT. The clouds were low, often down across the top of the tower. Since it looked like the event might last some time, it was decided to get one flight early in the event, and one the following day. Therefore, the aircraft took off at 1200 to fly Pattern No. 1. It returned about 1500 at a time when there were so few clouds around the BAO that it was decided to not do the slant descent toward the radiometer. The carriage was stuck at the top of the tower during a crucial period of low clouds and by the time it was lowered and sent back up with the tapes changed and the system recalibrated, the clouds had lifted. Some data were collected, using the elevator, by Ganor and Nagamoto, i.e., they collected liquid water samples and replicator samples. After the return of the aircraft at 1500, the facilities were returned to automatic and the experiment went into an unmanned mode, because there were only thin clouds and no precipitation. The aircraft was put on standby for a 0900 take-off the following day. Bartram worked on 3-cm radar disk most of the afternoon. It was repaired about 1630 and the radars were left in an automatic, operational mode through the night.

12 May

The dual-polarization lidar site was manned at 0740 MDT. GMD launch at 0753. Radars were up at 0740. The weather was heavy overcast with some clearing to the west. The CP-2 radar came up at 0845 but did not see much, so it was decided to hold the aircraft. Light precipitation began about 0918, increased more-or-less continuously to 0930 and continued to 1000, so dual-polarization lidar was closed down at about 0920-0930. At about 1100, dual-Doppler work began between CP-2 and CP-3. The aircraft took off at 1155. It flew Pattern No. 1. CP-2 reported widespread precipitation over the area and deepening of the easterly flow. The FM-CW radar, the 3-cm radar, and the microwave radiometer did RHI's together and the two radars did a synchronous VAD at 1500 MDT. The possibility of two more hours of aircraft time was discussed with Williams to get in another flight. There was heavy icing on the balloons launched around 1600 and 2200. One balloon returned to the ground because of ice. Another rose to a level where it remained until it blew out of the area.

13 May

Mixed snow and liquid precipitation was too heavy for lidar operation, so only the radars, radiometer, BAO facilities and the optical weather identifier were operated. There were multiple power glitches during the night, so the radar data acquisition systems were down. Heavy icing occurred on the tower with large chunks falling in a radius of 100 feet around the tower base. The radars did RHI's in toward the mountains to observe the flow patterns against the hills. The 3-cm radar did VAD's continously except when in RHI mode. Intercomparisons of ceiling height were made between the lidar, the ceilometers, and the three radars. The weather began to clear by 1300 and manned operations terminated at 1400.

XI. Surface Sampling of Chemical Content of Precipitation - R. Norton

At Site A, near the BAO tower, gas phase nitric acid, aerosols, and precipitation were collected during spring upslope storms. A high volume (200 liter/min) air sampling system was used with teflon filters for aerosols and nylon filters for nitric acid. Special "microclean" plastic bags supported by four-liter beakers were used to collect the precipitation. Nitrate and sulfate were extracted from the filters using a buffered solution and quantified with a Dionex 10 ion chromatograph. The major anions in the precipitation were also determined with the ion chromatograph. Precipitation Ph, conductivity, and NH_4^+ concentration were measured if an adequate liquid sample was available. Insufficient precipitation fell during this experiment to reliably estimate wash out efficiencies. However, the data that were taken are summarized in Table XI - 1.

Objective:

The purpose of this experiment was to estimate the efficiency with which various kinds of precipitation removes nitrate or sulfate from the atmosphere.

DATA SUMMARY FOR UPSLOPE EVENTS

DATE	TIME (MST)	AEROSOLS		GAS	PRECIPITATION					COMMENTS
		NO_3^-	$SO_4^=$	HNO_3	NO_3^-	$SO_4^=$	Ph.	Cond.	NH_4^+	
09 April 1982	1750-1950	X	X	X						No precipitation
	2000-2120	X	X	X						No precipitation
15 April 1982	1527-1737	X	X							HNO_3 filter broke
	1750-1950	X	X	X						No precipitation
	2001-2302	X	X	X						No precipitation
19 April 1982	1800-2142	X	X	X	X	X				Not enough precipitation for complete analysis
19-20 April 1982	2157-0135	X	X	X						No precipitation
	0146-0518	X	X	X						No precipitation
	0527-0930	X	X	X						No precipitation
	0939-1039	X	X	X	X	X	X	X	X	
	1052-1214	X	X	X	X	X	X	X	X	
	1224-1610	X	X	X						No precipitation
	1620-1955	X	X	X						No precipitation
27-28 April 1982	1323-1007	X	X	X						No precipitation
29 April 1982	1440-1800	X	X	X						No precipitation
	1810-2110	X	X	X						No precipitation
12 May 1982	0100-1300				X	X	X	X	X	Air sampler being removed no filters exposed
12-13 May 1982	1400-1400				X	X	X	X	X	

XII. BAO Tower Data and Tower Operations for BUCOE - J. Gaynor

Detailed descriptions of the BAO tower data and supporting data are presented elsewhere (Kaimal and Wolfe, 1979) so they will not be repeated here. The following outlines the data provided during the experiment.

Objective:

The objective of the BAO tower facility was to support the remote sensor measurements during BUCOE.

Data Summary:

A) Pertinent Standard BAO Data:

1) Dry bulb temperature at 8 levels and dewpoint temperatures at 6 levels, 10-s and 20-min. averages. Dewpoint hygrometers were missing from the 22-m and 50-m tower levels because they were needed on the instrument carriage. The 50-m dewpoint was replaced on May 4, 1981.

2) Wind speeds and directions (SSE boom) 8 levels, 10-s and 20-min. averages.

3) Fast response temperature (T') and wind components (u, v, and w; NNW boom) 8 levels, 10-s and 20-min. averages, 20-min. variances and fluxes and inertial subrange spectra of w and T', and cospectra of wT' recorded every 20-min.

4) Absolute ground pressure and solar radiation at the ground, 10-s and 20-min. averages.

5) Triangle cross-winds (3), optical C_n^2 (3), and optical triangle divergence for 20-min. intervals.

B) Pertinent Special BAO Data:

1) Movable carriage data:

	Special Channel No.:
a) Sonic u, v, w.	1, 2, 3 respectively
b) Fast response temperature (T').	4
c) Slow response dewpoint.	8
d) Propeller vane speeds and direction.	17 & 19 respectively
e) Slow response temperature.	22 with the sign in 33
2) Absolute pressure into a special channel for σ_p^2 recordings every 20-min.	10

All of the data analysis and display programs which are documented for use on the regular channels can also be used on the special channels. These programs reside on a PDP 11/70 minicomputer located in the Wave Propagation Laboratory. The data may be accessed by anyone and help is provided by the computer operators and BAO scientists. Any period of data available on tape can be put back on the 11/70 disk for analysis on request.

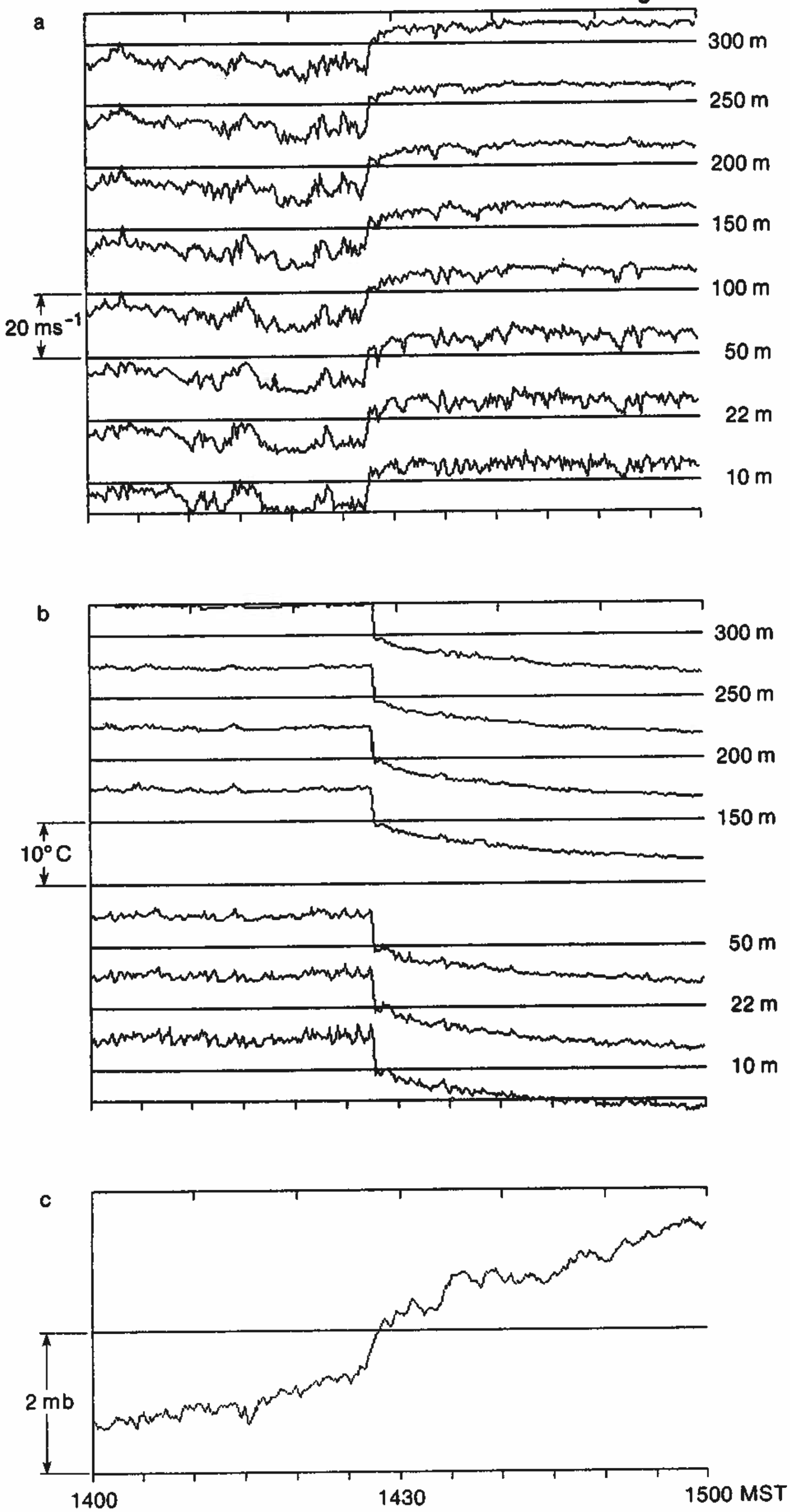
The following list presents some of the limitations of the BAO tower data in a precipitating and/or saturated environment.

A) The dewpointers are accurate to within 0.5°C and must be operated on a 10-min. cleaning cycle everyday.

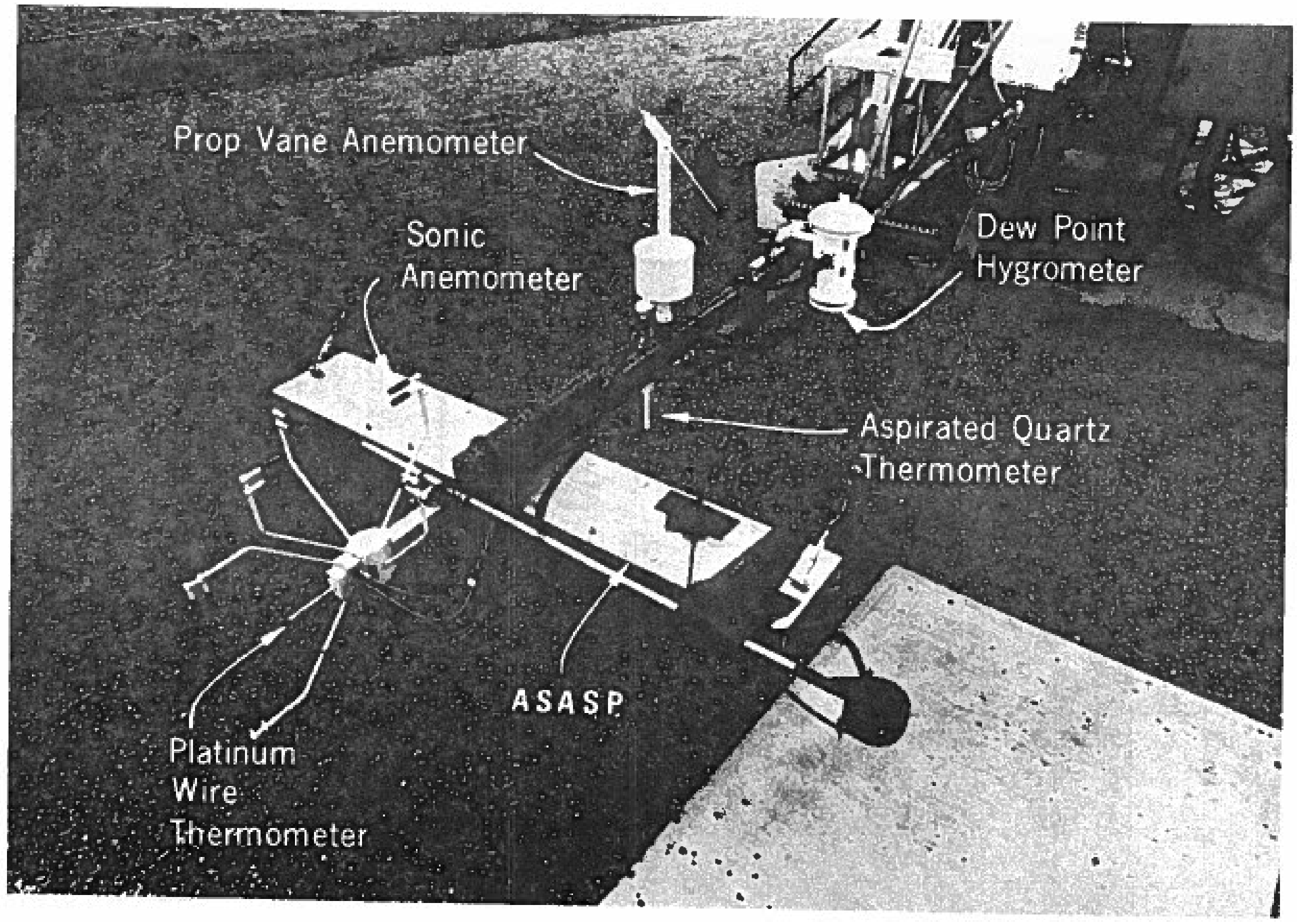
B) The accuracy of the dewpointers is in question in a saturated environment, particularly at ice-point temperatures. Large oscillations in apparent dewpoint have been noted previously. Precisely when and how these occur needs to be studied.

C) The platinum wires for the fast response temperatures may get coated with moisture when in a cloud or in a precipitating environment, severely dampening the response of the T' sensors. The time of coating is usually well-marked by a sudden decrease in T' variance. A coating of ice with some wind will break the wires causing zero variance.

Fig. XII-1


a
300 m
250 m
200 m
150 m
100 m
50 m
22 m
10 m
20 ms⁻¹
b
300 m
250 m
200 m
150 m
50 m
22 m
10 m
10° C
c
2 mb
1400
1430
1500 MST

XII-2



Prop Vane Anemometer
Sonic Anemometer
Dew Point Hygrometer
Aspirated Quartz Thermometer
ASASP
Platinum Wire Thermometer

Partial wire detachment creates large data spikes, leading to an unrealistically large variance. Large rain drops may also break the platinum wires.

D) The sonic anemometers will survive in a precipitating environment longer than the other fast response sensors. In fact, the sonics will not begin to have problems until ice coats the transducers at which time unrealistic fluctuations occur. Also, heavy rain may significantly coat the sonic transducers with water, leading to the same effect.

E) The response of the propeller vanes will be affected by extremely cold and damp weather (below -10°C) or very heavy wet snow.

F) The slow response temperatures should have no problems.

The computer programs available to display and analyze the data are many and varied. Figure XII-1 shows sample plots of the time series of fast response wind speed and temperature at the 8 tower levels (the temperature at level 4 is missing) and the pressure at the ground. The time series for all data is from the 10-s averaged data set during the abrupt frontal passage on March 24, 1982. The period is one hour in duration starting at 1400 MST. The wind speed shows that this event appeared as a gust front. Each parameter is plotted relative to its own mean. The fast temperatures are not calibrated absolutely, but Figure 1 shows a 5° to 8°C temperature drop, depending on level, in a few minute period. Also, note the "temperature waves" of about 3°C amplitudes on the lower tower levels prior to frontal passage.

Because during the March 2-5, 1982, event many key supporting sensors were either unmanned or unavailable (including the aircraft), we consider this event a "shakedown" and will not include it in the following summaries of tower operations. The summaries begin with a chronological list of significant events including weather observations at tower base, carriage operations and BAO computer on tower data problems. With the use of the Knollenberg probes on the instrument carriage, documenting the carriage operations is critical. Figure XII-2 is a photograph of the carriage and its instruments. Useful observations also include a visual estimate of whether the tower top is in cloud to supplement the ceilometer readings. Following this chronological list are general comments and observations for each event.

Of the five cases summarized below, three can probably be considered major events--March 24, April 19-20, and May 12-14.

A) March 24

1) Events sequence (times in MST):

1425	Level 4 T" went out at frontal passage.
1542	Temperatures dropped below freezing on tower.
1724:30	Carriage at 300m. Hold at surface because of strong winds and to allow time for start-up of PMS probes.
1831:15-1832	Carriage descents to 250m.
1847	Carriage at 200m.
1900	Level 1 T' out.
1900-1904	Carriage ascends to 300m.
1900-1933	Carriage descends to 200m.
After 2000	Level 7 T' failed.
2000-2002	Carriage ascends to 300m.
2030-2032	Carriage descends to 250m.
2045-2048	Carriage descends to 200m.
2101-2104	Carriage ascends to 300m.
2130-2132	Carriage descends to 250m.
2145-2147	Carriage descends to 200m.
2202-2218	Carriage descends to surface.

2) General comments and observations:

After frontal passage, the carriage was in the tower wind shadow, nullifying the carriage wind measurements. Also because of the strong winds and, later, the icing due to the snowfall, all the sonic anemometer winds were not reliable. For directions less than 90°C, the propeller vane winds were good.

After the carrage was on the surface, a brief inspection indicated that the T' element was covered with ice crystals and the screen on the aspirator to the unheated T_d was clogged with crystals. The effect of the crystals on T_d is unclear. However, $T = T_d$ after snow began. Ice on the T' instruments severely effects the response characteristics.

One additional interesting note: Five to ten minutes prior to frontal passage, large amplitude temperature variation (~ 3°C) with about a 50 to 60 s period occurred at the lower tower levels (Figure 1). We have not correlated these with pressure or w but these may be an interesting sidelight for study.

B) April 19-20

1) Events sequence (times in MST):

Mornings of 19 April -0642 20 April, carriage at tower top. 2220 19 April -0620 20 April, no tower data due to 11/34 computer failure.

April 20:

0642-0652	Carriage descending to surface.
0707-0720	Carriage ascending to tower top.
0714	Light snow begins.
0805	Radiosonde launch showing weak inversion at 4 km and cloud layer 2.5 km thick.
0906	Eli Ganor ascending in elevator to collect snow samples.
0925	Graupel falling.
0945	Fairly heavy snowfall. Eli Ganor descends tower.

0959	Tower top in clouds.
1020	Level 4 T' out.
1024	Carriage at surface. Snowing heavily.
1040	Level 2 and 3 T' out.
1052	Carriage at top. Tower top in and out of clouds during past hour.
1128-1138	Carriage descending to surface.
1152-1202	Carriage ascending to tower top.
1303-1313	Carriage descending to surface.
1334-1344	Carriage ascending to tower top. (Remains at top through aircraft flight 1000-1100 on April 21.
1400	Level 2 w out after intermittent operation all day.

2) General comments and observations:

The snowfall on 20 April was generally convective and spotty, with a total of 0.12" of moisture at the BAO. Essentially, all of the fast response temperatures (T') were out and the sonic winds were very suspect because of the wet, sticky snow.

C) 27 April

1) Events sequence (times in MDT):

Carriage at top of tower by afternoon of 26 April

2340, 26 April - 0640, 27 April	Tower data lost due to power failure.
0630, 27 April	Tower top in clouds.
0649-0659	Carriage descending to surface.
0800-0820 and 1020-1100	Tower data lost due to printer malfunctions.

0930	Carriage at tower top.
1058-1106	Carriage descends to surface.
1120	Eli Ganor and Charlie VanValin up elevator to take cloud samples.
1125-1134	Carriage ascending to tower top.
1150	Pulse Doppler reported rain, but none at tower.
1216-1224	Carriage descending to surface.
1249-1257	Carriage ascending to tower top.
1315	Sprinkle, large drops.
1330	Mode A begins. Carriage remains at tower top until morning of 28 April.

2) General comments and observations:

The temperatures were above freezing (3°C - 6°C) during the entire event. Most of the rain (0.10") fell before 2400 on 26 April with only 0.01 after 2400. No measurable rain occurred during the experiment. Of significance was the occurrence of low clouds very often obscuring the top of the tower through most of the morning. All of the tower instruments were operating properly, but some of the data periods were totally lost because of power failures and printer malfunctions.

D) 29 April

1) Events sequence (times in MDT):

The carriage was at the top of the tower in the morning.

1423	Dual-polarization lidar reported structure near the top of the tower, but nothing noticeable in the tower data.

1430	Strong winds (14-16 m/s out on NNE) and a temperature drop signals the frontal passage.
1455	Winds rise up to 27 m/s.
1604	Light rain.
1630-1800	Intermittent light rain.
1855	Gradual clearing.

2) General comments and observations:

The event was characterized by quite strong winds, generally 10-20 m/s from the N becoming more NE after the frontal passage. The winds calmed by 1800. The rain was light and only measured a trace. The top of the tower was never in cloud. All tower instruments functioned properly except the sonic anemometers which can be noisy in wind higher than about 12 m/s.

E) 11-14 May

1) Events sequence (times in MDT):

Afternoon of 10 May, carriage up to 300 m with probes running. After 2040 10 May, power out at the BAO so no data. However, Knollenberg probes kept running all night. 2-D probes out due to burned out aspirator motor.

11 May, 0930 - Power back on. However, disk problems on 11/34 means no data until 1500.

1056	Tower in tenuous clouds above level 6. Very light drizzle. Carriage stuck at 300m.
1115	0.03" of rain since 0800 when rain began.
1132	Winds from NE at 5 m/s. Fairly constant in time and with height.

1156	Carriage at surface.
1229	Little change in weather conditions. Winds 3-4 m/s out of NE.
1307	Eli Ganor going up elevator to take drop samples.
1357	Clouds breaking up.
1500	Starting regular data on 11/34.
	Plan A begins for the night.
0758, 12 May	0.34" of rain during night.
0800	Winds very light.
0808	Tower top clear of clouds. Carriage at 286 m with FSSP running.
0828	Heavy cloud cover with little or no rain.
0837	Carriage at surface.
0941	Eli Ganor ascending elevator for rain drop samples.
0938-0946	Carriage ascends to 250 m. 2-D and IR both down on carriage. Rain getting heavier. Tower top still clear on clouds.
0948	Tower winds remain light but more northerly.
1018	Rain has decreased considerably.
1117	Eli Ganor down from tower.
1122	Carriage at 292 m.
1142	Last tower output shows 3-4 m/s winds from 330° to 340°.
1225	During 1200-1220 data period, most dewpoint hydrometers are in their cleaning cycle.
1328	Winds on tower are 4-6 m/s out of N. Sprinkles at tower.

1346	Rain has stopped. Top of tower in tenuous cloud. Accumulated about 0.03" of rain since 0800.
1410	Moderate rain with large drops.
1423	Sonic V component on level 8 looks bad on 1400 output.
1500	0.14" of rain the past hour.
1523	From 1420 on, sonic w levels 7 and 8 and sonic u & v level 8 are out because of water on the transducers.
1530	Rain has tapered off.
1535	Go to Plan A.
1537-1545	Carriage descending to surface to change tapes.
1651	Carriage back at 290 m.
1640-1720	No BAO data because of disk fault.
1800	N winds at 10 m/s.
2240, 12 May - 0940, 13 May	No tower data because of power problems.
0930, 13 May	Light to moderate rain through the morning. Snow was falling during the night at tower top.
0940	Signal cable broke on carriage on its way down.
0940-1120	Very intermittent tower data.
1140	Tower data system back on, but no carriage data from this time through 14 May.
1400	Switch to Plan A.

2) General comments and observations:

This event, nearly four days in duration, was certainly the wettest and best developed upslope case of all occurring during the experimental period. A total of 3.42" of rain accumulated, with the heaviest precipitation period from the afternoon of 12 May until the morning of 13 May, when the rain was mixed with snow at tower base. During the night of 12-13 May, heavy snow fell at the top of the tower covering the carriage with 8" to 9" of snow and ice.

During the night of 12-13 May, the rain and snow became heavy enough to break all of the platinum wires. eliminating all T' data. Also, through 13 May, most of the sonic anemometer wind components were quite intermittent because of water and ice coating on the transducers. In mid-morning on 13 May, the level 6 propeller broke when it was struck by a chunk of ice falling from above. By the morning of 14 May, all the sonics except level 6, appeared to be working properly.

References

Kaimal, J. C., and D. E. Wolfe, BAO site, tower instrumentation, and PHOENIX operations, Chapter 2, in Project PHOENIX: The September 1978 Field Operation, William H. Hooke, Ed., NOAA/NCAR Boulder Atmospheric Observatory Rept. No. 1, available from NOAA/ERL, Boulder, Colo., and from NCAR Publications Office, Boulder, Colo. (1979).

XIII. Observations by the Microwave Radiometer - J. Snider

The microwave radiometer employed in the 1982 Boulder Upslope Cloud Observation Experiment (BUCOE 82) is an instrument that simultaneously measures liquid water contained in clouds and atmospheric water vapor. The system is completely passive, depending upon the natural emission of microwave energy which is proportional to the amounts of water vapor and liquid water that are present in the atmosphere. Therefore, the measured quantities are the total liquid water (in mm) and water vapor (in cm) integrated over the entire path through the atmosphere that is being observed by the radiometer (Snider et al., 1980, Guiraud et al., 1979).

Two independent radiometers comprise the system: the first operates at 20.6 GHz which is sensitive primarily to water vapor, while the second operates at 31.65 GHz which is most sensitive to liquid water. The two radiometers are coupled into a single antenna system which uses a design that produces equal beamwidths at each frequency. As a result, equal filling factors are obtained at each operating frequency. A steerable antenna is employed so that the system may be used to study both spatial and temporal variability of liquid water in clouds and water vapor in the atmosphere. However, as the radiometer is passive, it does not provide any information about the variation of liquid and water vapor as a function of distance from the radiometer.

Three operating modes are employed for the microwave system:

A) Fixed azimuth and elevation angles (fixed mode).

B) Continuous azimuth scans at a fixed elevation angle (azscan mode).

C) Elevation scans at a fixed azimuth angle (RHI mode).

In general, the fixed mode was employed continuously during clear weather while the other two modes were employed for special studies during times when liquid-bearing clouds were present. However, the fixed mode was also used during descents of the aircraft along the radiometer antenna beam (discussed below).

The radiometer was co-located with the FM/CW radar, the 3 cm and 8 mm radars about 500 yards south of the BAO tower (see Figures I-1 and I-3). The various systems were located as close to each other as practicable so that the instruments could make observations along nearly common paths. Because different antenna sizes are used by the different instruments, it was not possible to employ common volumes. Figure XIII-1 shows the dual-channel radiometer installed at BAO and Figure XIII-2 shows the interior of the radiometer van.

Objectives:

The following experimental objectives were established for the microwave radiometer during BUCOE 82:

A) To make continuous measurements of integrated water vapor and liquid water throughout the (BUCOE) test period with fixed and scanning modes being used as appropriate.

B) To acquire specific data sets for comparison with reflectivity measurements made by the 10 cm FM-CW and 3.2 cm Doppler radars.

C) To acquire specific data sets for comparison with optical measurements of ice and liquid in clouds by the dual-polarization lidar.

D) To acquire data on cloud liquid content for comparison with simultaneous in situ measurements of microphysical characteristics and cloud liquid water by probes mounted on an aircraft. These measurements, to be performed preferably in relatively uniform cloud types, were to be made along a common path through the clouds at a 7.5 degree elevation angle.

These experiments were designed to support the following studies in atmospheric science:

A) Investigate the temporal and spatial variability of liquid water in Colorado upslope cloud systems as they evolve and produce precipitation.

B) Study the ability of the microwave radiometer to detect changes of state in clouds.

C) Further demonstrate and document the capability of the microwave radiometer to detect supercooled liquid in stratoform clouds.

D) Evaluate the advantages resulting from simultaneous observations of clouds by the microwave radiometer, 8.6 mm, 3.2 cm and 10 cm radars, i.e., is the total information content increased over that from the solitary measurements?

Data Summary:

The microwave radiometer operated essentially continuously during BUCOE 82 from 1430 MST, March 1, until 1200 MST, May 17. Data are missing for about 6 percent of the time primarily due to power outages which resulted in a loss of computer processing. The radiometer proper operated without failure of any kind for the entire period.

Output data from the microwave radiometer are available as computer plots on microfilm or in tabulated form. Liquid and water vapor data are presented as a function of time for the fixed mode and versus angle for the two scanning modes. Examples of the plots are given in Figures XIII-3 and XIII-4. A summary of system operation throughout the BUCOE 82 operating period is listed in Table XIII-1. The elevation angle was 90° in the fixed mode unless otherwise listed in the table.

TABLE XIII-1

SUMMARY OF MICROWAVE RADIOMETER DATA AVAILABLE FOR BUCOE 82

Date	Time Period (MST)	Operating Mode	Remarks
03/01/82	1430-1600 1600-2400	Azscan Fixed	Various elevation angles
03/02/82	0000-2400	Fixed	
03/03/82	" "	"	
03/04/82	" "	"	
03/05/82	" "	"	
03/06/82	" "	"	
03/07/82	" "	"	
03/08/82	" "	"	
03/09/82	" "	"	
03/10/82	" "	"	
03/11/82	0000-1710 1723-1800 1800-2400	Calibration Fixed "	
03/12/82	0000-2400	"	
03/13/82	" "	"	
03/14/82	" "	"	
03/15/82	0000-0946 0946-1059 1108-2400	" Azscan Fixed	 el. = 15°
03/16/82	0000-1400 1404-1450 1517-2400	" Calibration Fixed	
03/17/82	0000-2400	"	
03/18/82	" "	"	
03/19/82	" "	"	
03/20/82	" "	"	

(TABLE XIII-1 - Cont.)

Date	Time Period (MST)	Operating Mode	Remarks
03/21/82	0000-2400	Fixed	
03/22/82	" "	"	
03/23/82	" "	"	
03/24/82	0000-1800	"	
	1800-2007	Azscan	Coordinated scans with 3 cm radar
	2017-2220	Fixed	el. = 7.5°
	2225-2310	Azscan	
	2313-2400	Fixed	el. = 7.5° until 2325
03/25/82	0000-1433	Fixed	
	1433-1537	Calibration	
	1550-2400	Fixed	
03/26/82	0000-2400	Fixed	
03/27/82	0000-2400	"	
03/28/82	0000-2400	"	
03/29/82	0000-1350	"	
	1354-1412	Azscan	el. = 7.5°
	1413-1447	Fixed	el. = 7.5°
	1447-2400	"	
03/30/82	0000-2400	"	
03/31/82	" "	"	
04/01/82	0000-1412	Azscan	el. = 7.5°
	1511-1533	Fixed	
	1538-2400	"	
04/02/82	0000-2400	"	
04/03/82	" "	"	
04/04/82	" "	"	
04/05/82	0000-1008	"	
	1010-1122	Calibration	
	1122-2400	Fixed	
04/06/82	0000-2400	"	

(TABLE XIII-1 - Cont.)

Date	Time Period (MST)	Operating Mode	Remarks
04/07/82	0000-1353	Fixed	
	1358-1709	Azscan	el. = 7.5°
	1720-2400	Fixed	
04/08/82	0000-1445	"	
	1452-1638	Azscan	el. = 7.5°
	1650-2400	Fixed	
04/09/82	0000-1450	"	
	1455-1529	Azscan	el. = 7.5°
	1540-1614	Fixed	Aircraft climbing vertically over tower
	1630-1642	"	
	1643-1652	"	el. = 7.5°
	1653-1745	"	
	1746-1750	"	el. = 7.5°
	1751-2400	"	
04/10/82	0000-1800	"	
	1800		Antenna position indicator failed causing less of computer processed data until 1345, 04/12/82
04/12/82	1345-2400	"	
04/13/82	0000-2400	"	
04/14/82	" "	"	
04/15/82	0000-1641	"	
	1645-1741	Azscan	el. = 7.5°
	1746-1800	Fixed	
	1801-2015	"	el. = 7.5°, az. = 312° for aircraft descent from 2002-2008
	2016-2150	Azscan	Coordinated scans with 3 cm radar
	2150-2400	Fixed	el. = 7.5° for aircraft descents which occurred from 2310-2315 and 2354-2358
04/16/82	0000-0005	"	el. = 7.5°
	0011-0900	"	el. = 90°
	0906-1208	Azscan	Continuous scans at el. = 7.5° while awaiting aircraft
	1210-1332	Fixed	el. = 7.5°. Aircraft descent from 1324-1327
	1353-2400	"	

(TABLE XIII-1 - Cont.)

Date	Time Period (MST)	Operating Mode	Remarks
04/17/82	0000-2400	Fixed	
04/18/82	" "	"	
04/19/82	" "	"	
04/20/82	0000-0637	"	
	0640-0700	Azscan	el. = 7.5°
	0705-0730	Fixed	
	0730-0754	RHI	
	0755-0854	Fixed	
	0858-1000	Azscan	Coordinated scans with 3 cm radar, el. = 7.5°
	1000-1130	Fixed	
	1133-1248	Azscan	el. = 7.5°
	1248-1325	"	Coordinated scans with 3 cm radar
	1335-1418	Fixed	
	1421-1453	RHI	Coordinated RHI scan with FM-CW and 3 cm radars
	1455-1514	Fixed	el. = 15°, looking along same path with FM-CW radar
	1523-1606	RHI	Coordinated scan with FM-CW and 3 cm radars, and dual-polarization lidar
	1609-1650	Azscan	el. = 7.5°
	1655-2400	Fixed	
04/21/82	0000-2400	"	
04/22/82	" "	"	
04/23/82	" "	"	
04/24/82	" "	"	
04/25/82	" "	"	
04/26/82	0000-0620	"	
	0620-2400	"	Power failures caused loss of data from: 0620-0733 0830-1530 1750-2346

(TABLE XIII-1 - Cont.)

Date	Time Period (MST)	Operating Mode	Remarks
04/27/82	0000-0050	Fixed	
	0050-0815	"	No data-power failure
	0841-1017	Azscan	el. = 10°
	1018-1045	Fixed	With 3 cm radar
	1048-1120	Azscan	el. = 10°
	1122-1148	RHI	az. = 270°
	1148-1219	Fixed	el. = 7.5°, az. = 270° for aircraft descent from 1215-19
	1229-1237	RHI	az. = 270°
	1245-1259	RHI	Coordinated with FM-CW radar
	1303-1330	Fixed	el. = 90°
	1331-2400	"	el. = 17°, az. = 267° for overnight run with FM-CW radar
04/28/82	0000-0850	"	el. = 17°
	0850-0921	RHI	
	0925-1039	Azscan	Various elevation angles
	1045-2400	Fixed	
04/29/82	0000-1218	"	
	1220-1321	Azscan	el. = 12.5°
	1324-1406	RHI	Coordinated with FM-CW radar. Max. liquid at el. = 20°
	1419-1435	Azscan	Scan terminated due to high wind
	1439-1500	Fixed	el. = 10°, az. = 270°
	1503-1534	RHI	Coordinated with FM-CW and 3 cm radars
	1535-1613	Fixed	
	1614-1630	Azscan	el. = 10°
	1630-1722	"	Coordinated with 3 cm radar, el. = 10°
	1722-1757	Fixed	el. = 10°, operating on fixed paths with 3 cm radar
	1800-2400	"	
04/30/82	0000-1305	"	
	1312-1600	Azscan	Various elevation angles
	1600-2400	Fixed	
05/01/82	0000-2400	"	
05/02/82	" "	"	
05/03/82	" "	"	Calibration from 0845-1100
05/04/82	" "	"	
05/05/82	" "	"	

(TABLE XIII-1 - Cont.)

Date	Time Period (MST)	Operating Mode	Remarks
05/06/82	0000-2400	Fixed	
05/07/82	" "	"	
05/08/82	" "	"	
05/09/82	0000-1400	"	
	1400		Power failure--no reliable data until 0845, 05/11/82
05/11/82	0845-1142	"	
	1142-1200	RHI	
	1210-1300	Azscan	el. = 7.5°
	1330-1425	Fixed	el. = 7.5°, az. = 270° for aircraft descent which was cancelled
	1427-1500	RHI	Coordinated with FM-CW radar
	1500-2400	Fixed	
05/12/82	0000-0735	"	
	0735-0753	RHI	az. = 270°
	0754-0808	Fixed	
	0810-0926	Azscan	el. = 10°, coordinated with 3 cm radar
	0935-1008	RHI	Coordinated with FM-CW and 3 cm radars
	1010-1248	Fixed	
	1250-1350	RHI	Coordinated with FM-CW and 3 cm radars
	1352-1438	Fixed	
	1439-2156	"	el. = 60° with FM-CW radar. Power failure at 2156--no processed data until 0730, 05/13/82
05/13/82	0730-0757	"	
	0758-0821	RHI	
	0822-0918	Fixed	
	0920-0945	RHI	
	0948-1007	Azscan	el. = 15°
	1010-1130	Fixed	
	1130-1147	"	el. = 8°
	1149-1253	RHI	Coordinated with FM-CW radar
	1254-1512	Azscan	Various elevation angles
	1520-2400	Fixed	

(TABLE XIII-1 - Cont.)

Date	Time Period (MST)	Operating Mode	Remarks
05/14/82	0000-0840	Fixed	
	0842-0920	RHI	Coordinated with 3 cm and FM-CW radars
	0920-1030	Fixed	
	1030-1053	RHI	
	1054-1124	Fixed	
	1125-1221	RHI	Coordinated with FM-CW and 3 cm radars and dual-polarization radar.
	1122-1344	Azscan	Various elevation angles.
	1354-2400	Fixed	
05/15/82	0000-2400	"	
05/16/82	" "	"	
05/17/82	0000-0749	"	
	0750-1000	Calibration	
	1025-1200	Azscan	el. = 10°
	1200		BUCOE 82 operation terminated

References

Guiraud, F. O., J. Howard, and D. C. Hogg (1979), A dual-channel microwave radiometer for measurement of precipitable water vapor and liquid, IEEE Trans. Geosci. Electron., GE 17(4), 129-136.

Snider, J. B., F. O. Guiraud, and D. C. Hogg (1980), Comparison of cloud liquid content measured by two independent ground-based systems, J. Appl. Meteorol., 19(5), 577-579.

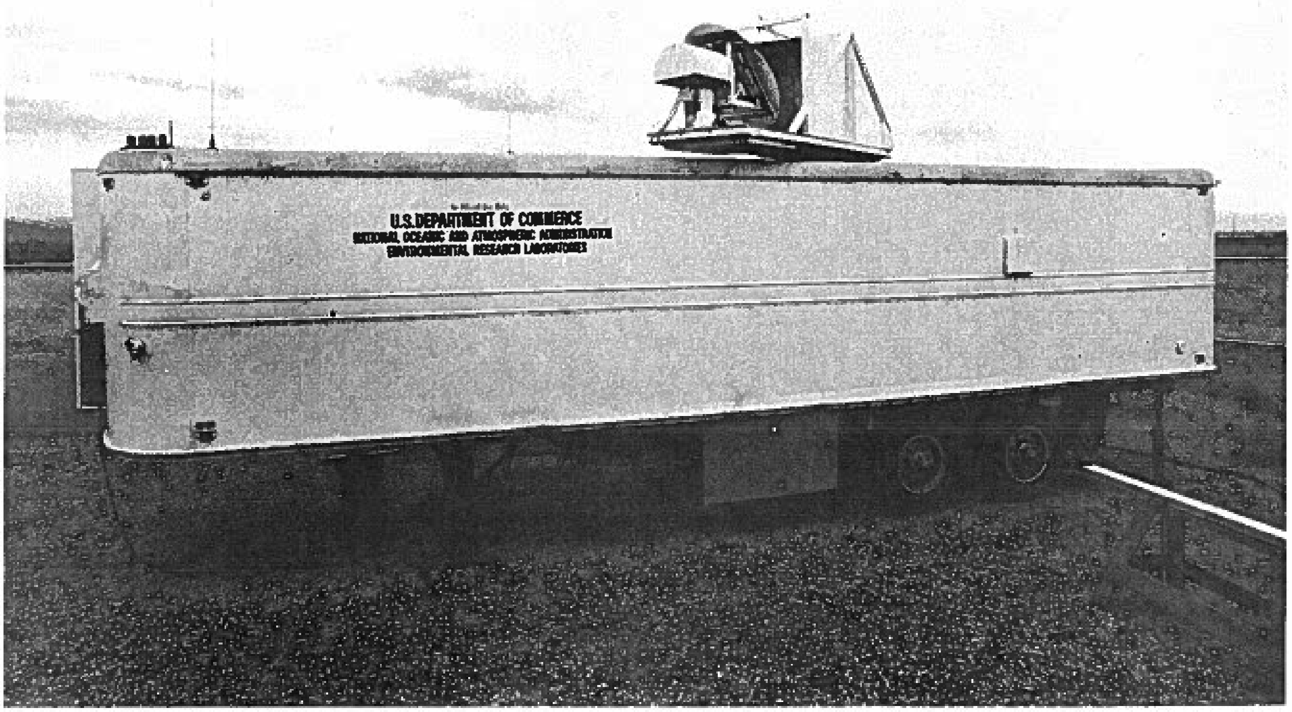


Fig. XIII-1 Dual-channel microwave radiometer installed at Site B near the BAO tower.

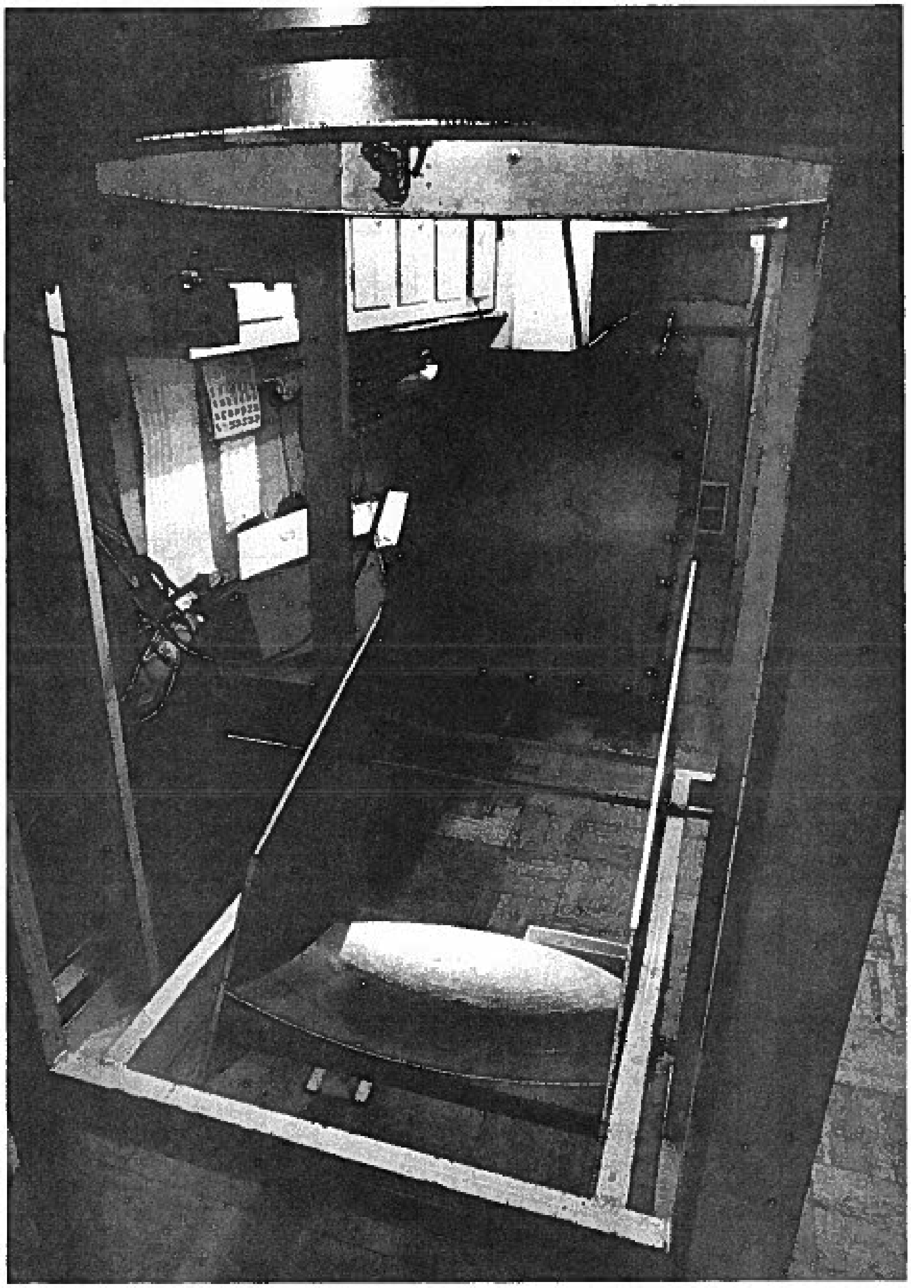


Fig. XIII-2 Interior of dual-channel radiometer van showing primary antenna reflector and electronics package (black enclosure).

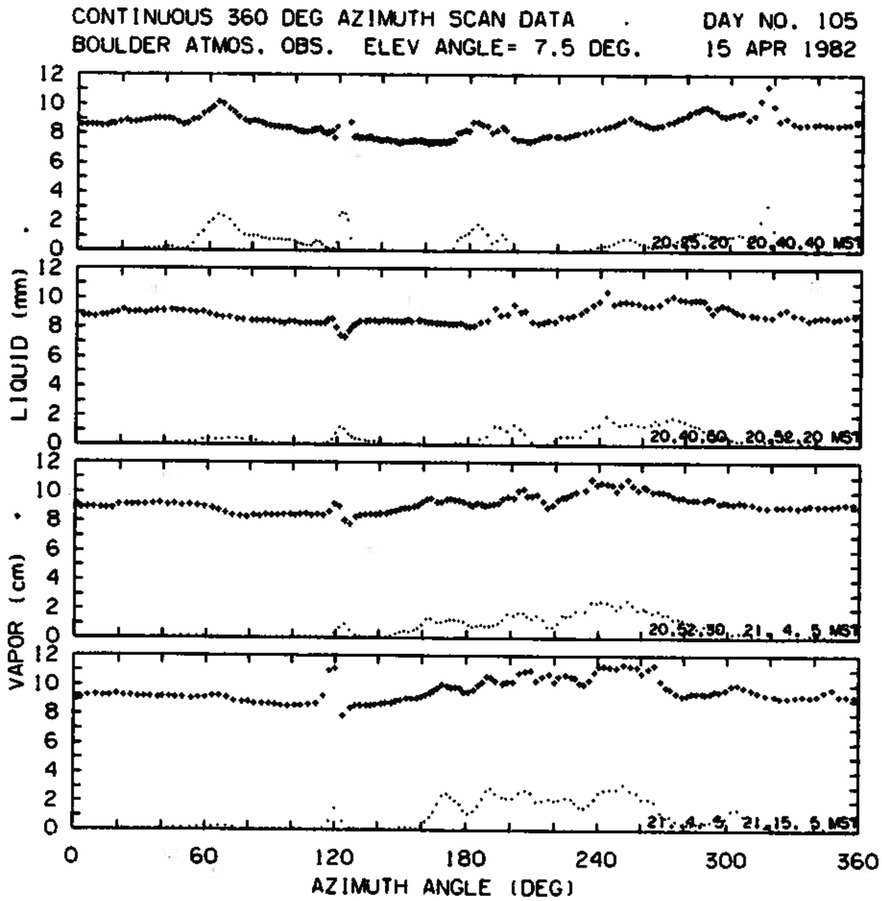


Fig. XIII-3 Example of water vapor and liquid water measured by the radiometer during an azimuth scan at 7.5 degrees elevation angle.

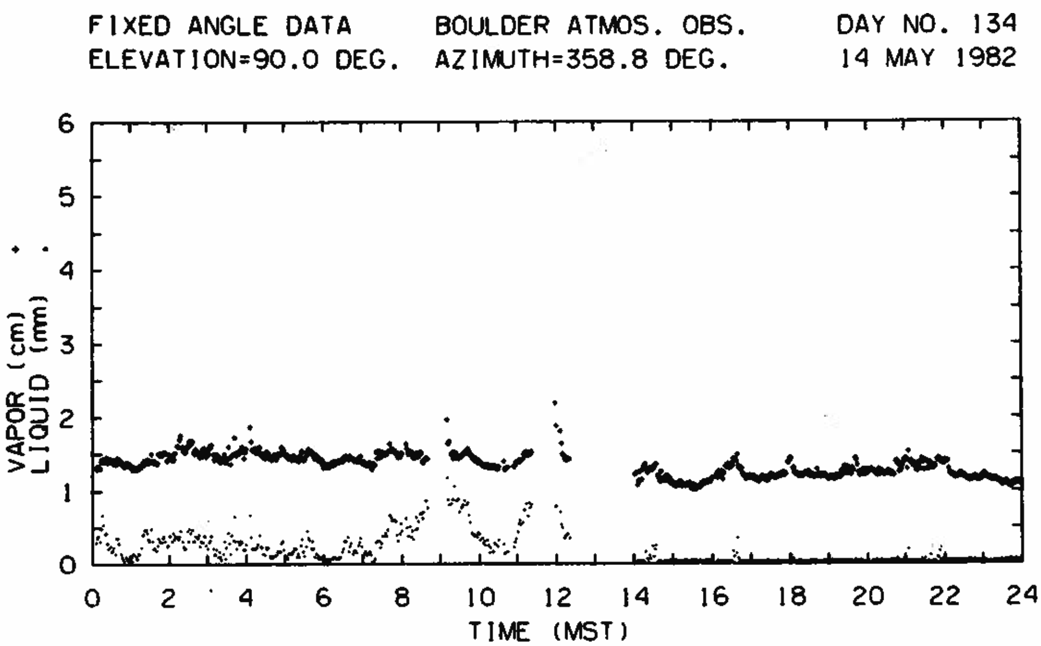


Fig. XIII-4 Example of water vapor and liquid water recorded in the zenith direction by the microwave radiometer.

XIV. Observations by the NCAR CP-2 Radar System - J. Wilson

Objective:

Collect radar weather information in upslope weather events in support of other tasks in the BUCOE experiment.

Data Summary for Upslope Events:

The following data were collected during upslope storm periods from CP-2. On 12 May coordinated dual-Doppler was collected by CP-2 and CP-3. The radars were separated by a distance of approximately 18 km.

Typically both reflectivity and Doppler velocity were collected in 360° scans at ~ 1 deg steps in elevation to 20 deg elevation. Then roughly 2 min. of vertically pointing data were collected and several RHI's. This took about 15 min. and then the process was repeated.

April 19	1755-2009	
April 20	0925-1248	
April 29	1727-1951	
May 4	1608-2008	
May 11	1114-1311	
May 12	0936-1825	Dual-Doppler
May 13	0837-0930	

XV. FM-CW Doppler Radar Observations - T. Detman

The 10 cm FM-CW radar was co-located with the microwave radiometer, the 3.2 cm and 8.6 mm pulse Doppler radars and the optical weather identifier at the sight of the former temporary building at the BAO. Figure XV-1 shows the FM-CW radar antennas (transmit on the right, receive on the left); the equipment van is at the far left. Figure XV-2 shows one of the authors inside the equipment van. This radar has two basic modes of operation: backscattered power and Doppler velocity. In the Doppler mode a velocity distribution of the scattering elements in each range cell is obtained; in backscattered power mode the velocity information is sacrificed for increased range resolution of the reflectivity. During most unmanned periods of operation the radar alternated between measurement of backscattered power and Doppler velocity taking one record of each type each minute, pointing vertically, as shown in Figure XV-3.

When the radar was scanned, records of only one type were recorded, typically every five seconds. Two types of scans were used: RHI, in which the antenna moved in elevation at a fixed azimuth, and VAD where the antenna moved in azimuth with elevation fixed.

Objectives:

A) Measure the profile of radar reflectivity factor and its temporal variability in combination with the microwave radiometer to obtain the spatial distribution of liquid water density in upslope storm systems. The vertical structure will typically be observed with a resolution of about 4 meters.

B) Monitor the melting level (bright band) to delineate the height domain of liquid water phase in the cloud systems.

C) Using the Doppler capability, measure drop fall speed spectra and total precipitation rate and compare with rain gauge for verification.

D) Determine the temporal and spatial distribution of liquid water in different cloud events.

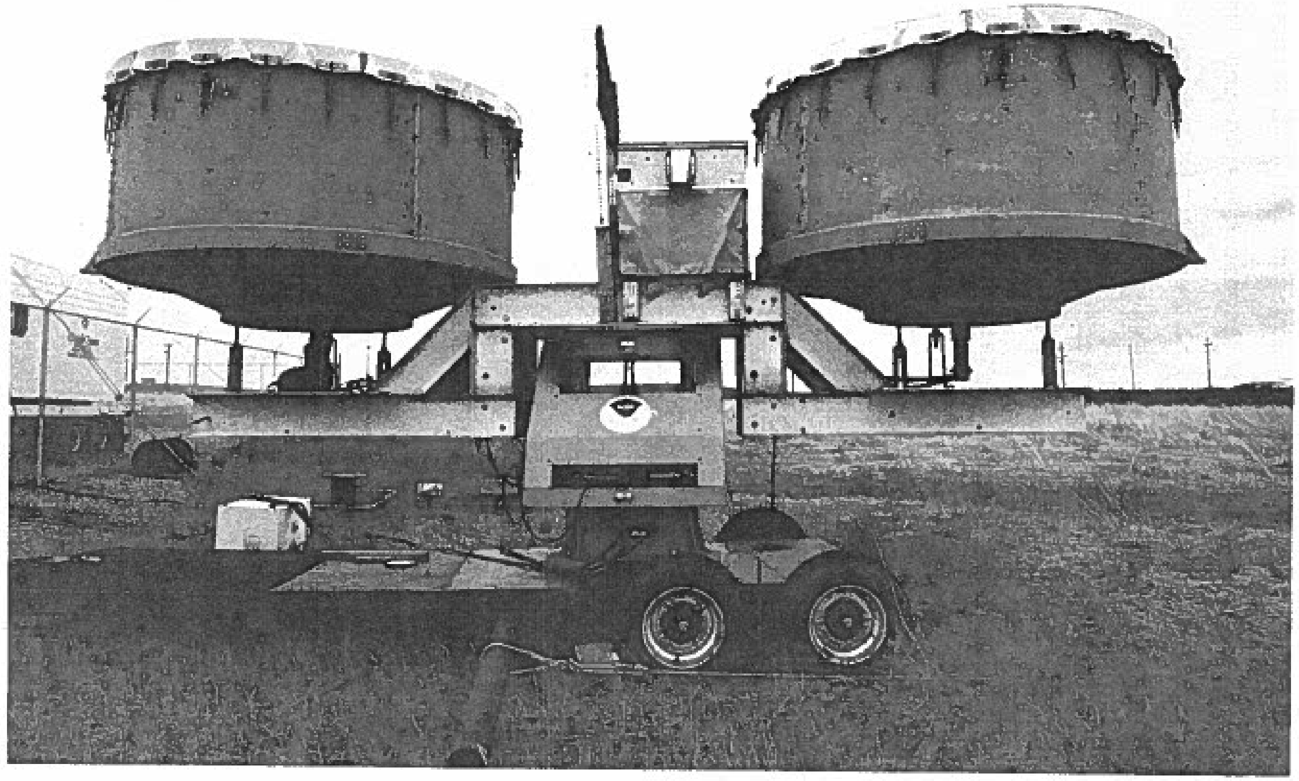


Figure XV-1. The FM-CW radar antennas, transmit on the right, receive on the left.

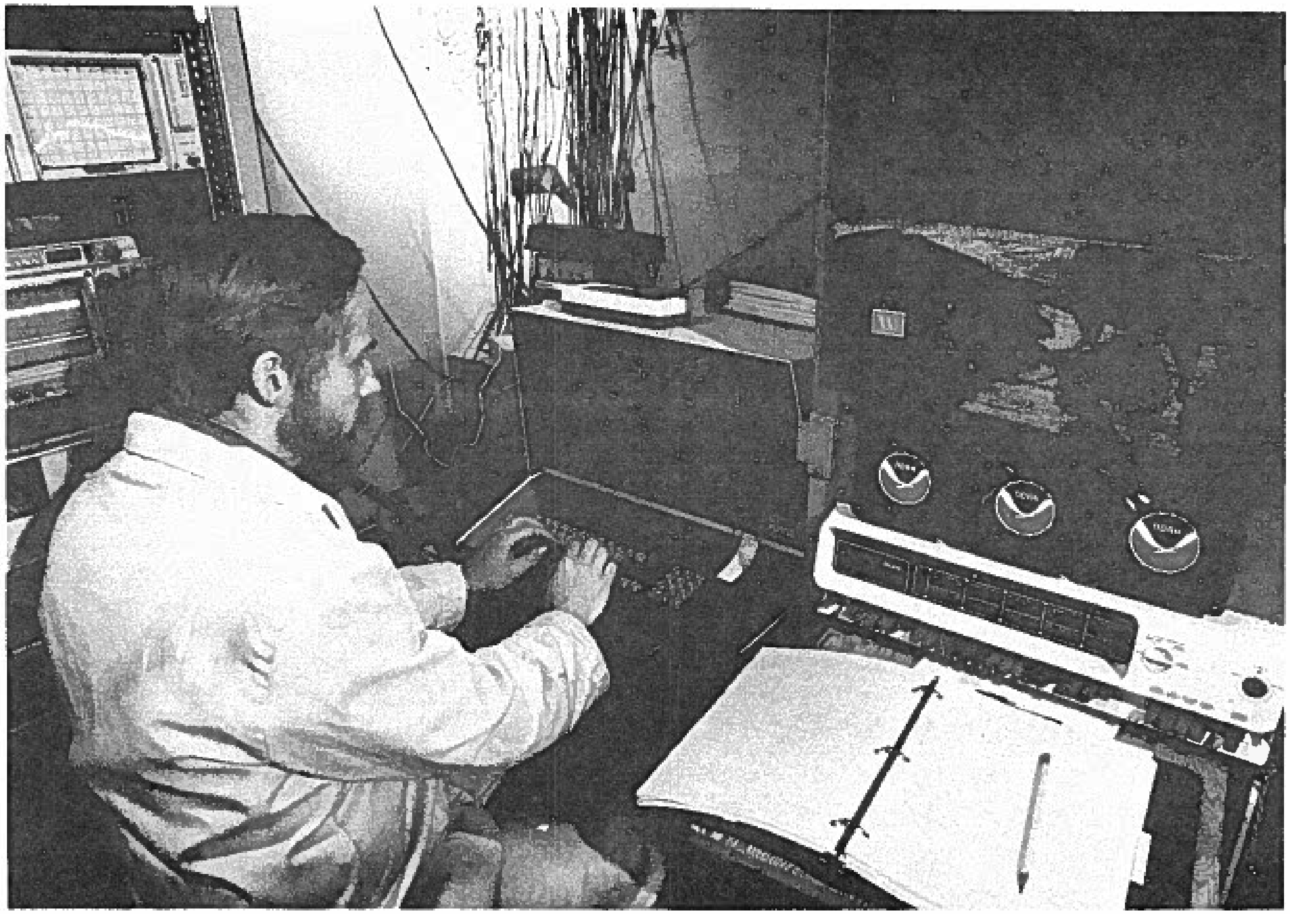
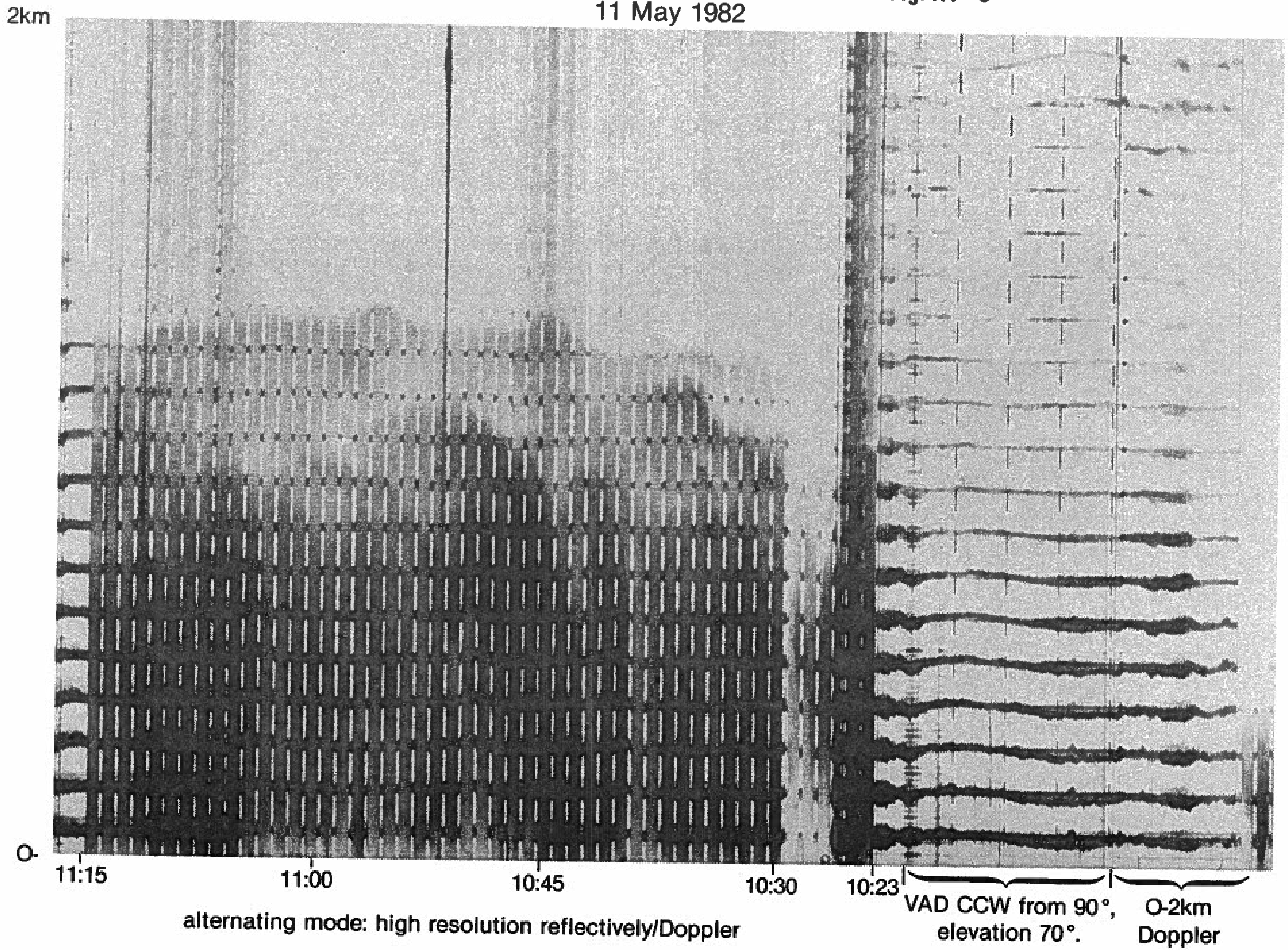


Figure XV-2. The FM-CW radar control center.

Fig. XV-3


11 May 1982
2km
O-
11:15
11:00
10:45
10:30
10:23
alternating mode: high resolution reflectively/Doppler
VAD CCW from 90°, elevation 70°.
O-2km Doppler

E) Determine the horizontal spatial spectra of cloud density and liquid water.

F) Measure drop-size spectra and how it varies as the storm evolves.

Data Summary for Upslope Events:

March 24

Time (MST)	
14:22:	Recording started: 0-2 km alt. mode.
14:30:	Frontal passage.
17:44:	Change to 0-4 km alt. mode.
18:00:	Snowing at surface.
18:23 - 18:53:	Cross-polarization measurements.
18:55 - 19:10:	High resolution (30 m) fall speed spectra.
19:21 - 19:34:	0-2 km alt. mode.
19:34 - 19:43:	Cross-polarization measurements, 0-2 km.
19:43 - 20:02:	Normal polarization, 0-2 km alt. mode.
20:02 - 20:40:	0-4 km alt. mode.
21:01 - 22:13:	Fall velocity spectra.
22:13:	0-2 km alt. mode.

April 9

Time (MST)	
15:29:	Recording started.

April 15

Time (MST)	
16:54 - 17:25:	0-4 km alt. mode.
17:35 - 17:47:	Two RHI scans at az. = 300° and 210°.
17:50 - 17:58:	VAD at el. = 60°.
18:03 - 18:28:	0-4 km alt. mode.
18:30 - 18:36:	VAD at el. = 60°, "no return."
18:38 - 18:46:	VAD.
18:53 - 19:46:	0-4 km alt. mode.
19:50 - 20:01:	VAD.
20:04 - 20:07:	0-4 km alt. mode.
20:11 - 20:18:	Fixed beam data, az. = 312°, el. = 7.5°.
20:21 - 20:30:	0-4 km alt. mode.
20:30 - 20:45:	VAD.
21:11 - 21:34:	0-4 km alt. mode.
21:37 - 21:58:	Two VAD's at el. = 70°.
22:01:	0-4 km alt. mode.
23:08 - 23:29:	Two VAD's, el. = 70°.
23:29:	0-4 km alt. mode, el. = 70°.

April 16

Time (MST)

00:02: 0-4 km alt. mode, vertical.

April 19

Time (MST)

16:19: 0-4 km alt. mode.

April 20

Time (MST)

06:09: 0-4 km alt. mode.

06:19 - 09:07: 0-4 km alt. mode.

09:07 - 09:10: 0-2 km alt. mode.

09:11 - 09:44: 0-4 km alt. mode.

09:44 - 10:15: Fall speed spectra, "heavy snow."

10:18 - 13:50: 0-4 km alt. mode.

13:51 - 14:01: 0-4 km Doppler alternating with 0-22 km range only.

14:23 - 15:59: Fixed beam sequence coordinated with radiometer, 0-22 km range only.

16:32: 0-4 km alt. mode.

April 27

Time (MST)

08:35 - 09:26: 0-2 km alt. mode.

09:26 - 09:43: 0-4 km alt. mode.

09:44 - 10:49:	0-22 km range only.
10:49 - 12:15:	0-4 km alt. mode.
12:19 - 13:10:	Four RHI's, 0-22 km range only.

April 29

Time (MST)	
11:57 - 12:13:	0-22 km alt. mode.
12:13 - 12:27:	RHI, 0-22 km alt. mode.
12:50 - 12:56:	VAD, 0-2 km, Doppler.
12:58 - 13:05:	VAD, 0-2 km, Doppler.
13:13 - 13:28:	RHI, 0-22 km alt. mode.
13:36 - 14:06:	Fixed beam sequence, quasi RHI, 0-22 km alt. mode.
14:08 - 14:45:	Three RHI's, 0-22 km.
14:54 - 15:04:	0-22 km alt. mode el. = 10°.
15:05 - 15:35:	RHI coordinated with radiometer, 0-22 km alt. mode, 2 minutes at each elevation.
16:15 - 16:28:	0-4 km alt. mode.
16:30 - 16:36:	0-2 km alt. mode.
16:40 - 17:06:	Fall speed spectra.
17:14 - 17:23:	0-2 km alt. mode.
17:23 - 18:01:	0-4 km alt. mode.
18:03:	0-2 km alt. mode.

May 11

Time (MST)	
08:35 - 09:46:	0-2 km alt. mode.
09:46 - 09:59:	0-4 km alt. mode.
10:07 - 10:20:	VAD, el. = 70°.
10:23 - 11:13:	0-2 km alt. mode.
11:15 - 11:31:	VAD el. = 60°.
11:36 - 11:49:	VAD el. = 70°.
11:52 - 13:59:	0-2 km alt. mode.
14:29 - 14:59:	RHI coordinated with radiometer, 0-44 km.
15:07 - May 12, 06:58:	0-2 km alt. mode.

May 12

Time (MST)	
06:58 - 07:33:	0-4 km alt. mode.
08:11 - 09:03:	0-4 km alt. mode.
09:34 - 10:08:	RHI coordinated with radiometer and 3.2 cm radar.
10:12:	0-2 km alt. mode.
11:01:	0-4 km alt. mode.
11:10 - 12:57:	0-22 km alt. mode.
13:06 - 13:48:	RHI coordianted with radiometer.

14:03 - 14:15:	VAD, el. = 70°, "heavy rain".
14:21 - 14:33:	VAD, "light rain".
14:42:	0-22 km alt. mode, el. = 60°.

May 13

Time (MST)	
07:27 - 09:43:	Twelve RHI's.
09:49 - 10:14:	Fall speed spectra.
10:15 - 10:35:	0-1 km, Doppler, vertical.
10:38 - 11:32:	0-2 km alt. mode.
11:48 - 12:23:	RHI coordinated with radiometer, 0-4 km Doppler.
12:27 - 12:29:	Coordinated with radiometer, el. = 16°, az. = 270°.
12:36 - May 14, 07:39:	0-2 km alt. mode.

May 14

Time (MST)	
07:55 - 08:36:	Three VAD's, el. = 20°, 15°, 12.5°.
08:42 - 09:21:	RHI coordinated with radiometer, "possible bright band."
10:38 - 11:21:	0-4 km Doppler, "for ceiling comparisons."
11:28 - 11:30:	Fixed beam, el. = 8°, az. = 240°, 0-33 km.

11:31 - 11:33:	Fixed beam, el. = 10°, az. = 240°, 0-33 km.
11:34 - 12:14:	Fixed beam sequence, pseudo RHI, 0-22 km, coordinated with radiometer.
12:22:	0-4 km alt. mode.

XVI. Observations by the WPL 3 cm and 8 mm Radars - J. Hanchett

The 3 cm wavelength Doppler radar and the 8 mm radar normally operated in a vertical, or near vertical, pointing mode recording automatically. Because the 3 cm radar was scannable with Doppler capabilities, it was often used to do a conical scan about the zenith (VAD's) to take wind profiles once an hour. It frequently did coordinated scans with the radiometer and the FM-CW radar. In addition to VAD's, these scans were commonly "fixed beam" and RHI's (range, height indications). The 8 mm radar was not scannable and did not have Doppler capability. It pointed vertically measuring reflectivity. The siting of the radars is shown in Figures I-1 and I-3 and photographs of the radars are shown in Figures XVI-1, XVI-2, and XVI-3.

Objectives:

In support of other measurement programs, provide the depth and spatial extent of cloud layers and measure wind profiles through clouds and precipitation.

Data Summary for Upslope Events:

March 17

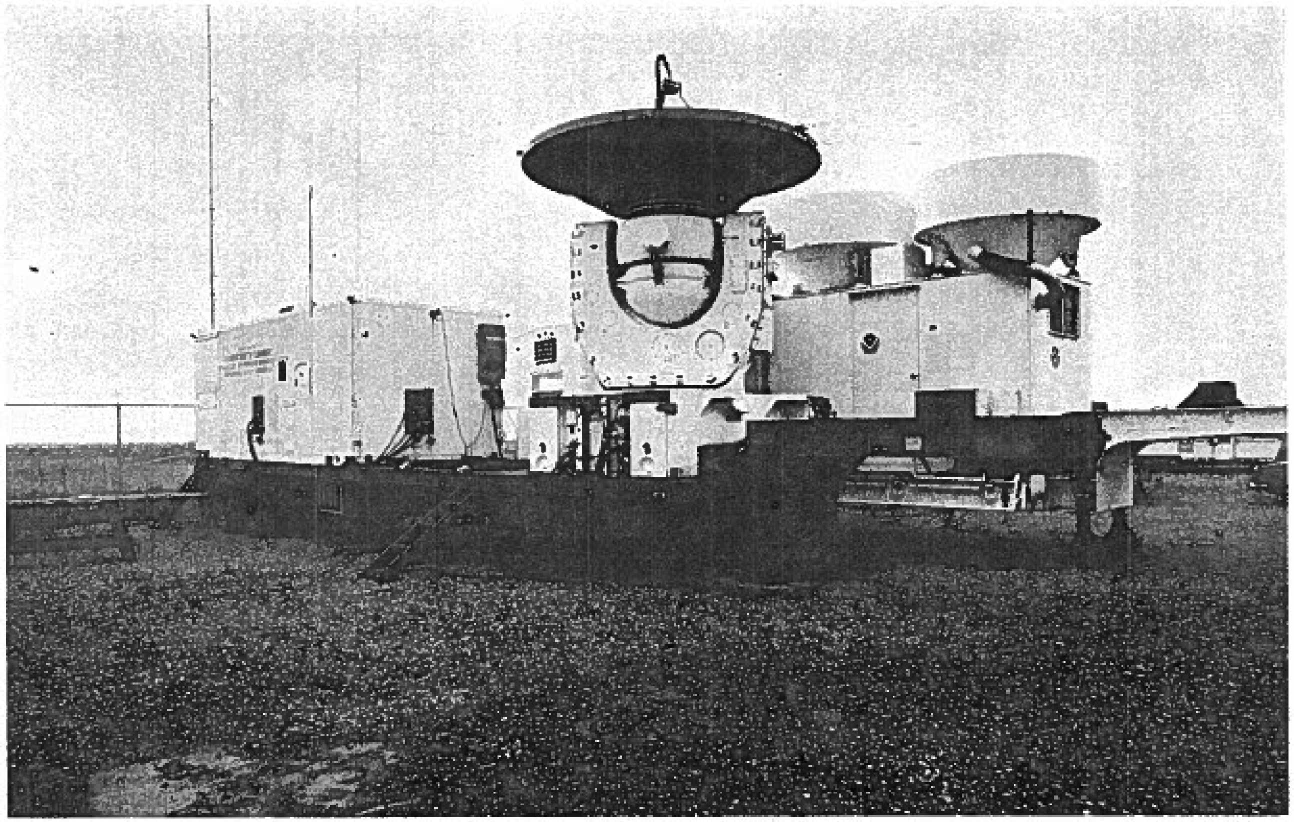
Time (MST)	
1345:	Tape 3--radars tested in unattended operation.

March 18

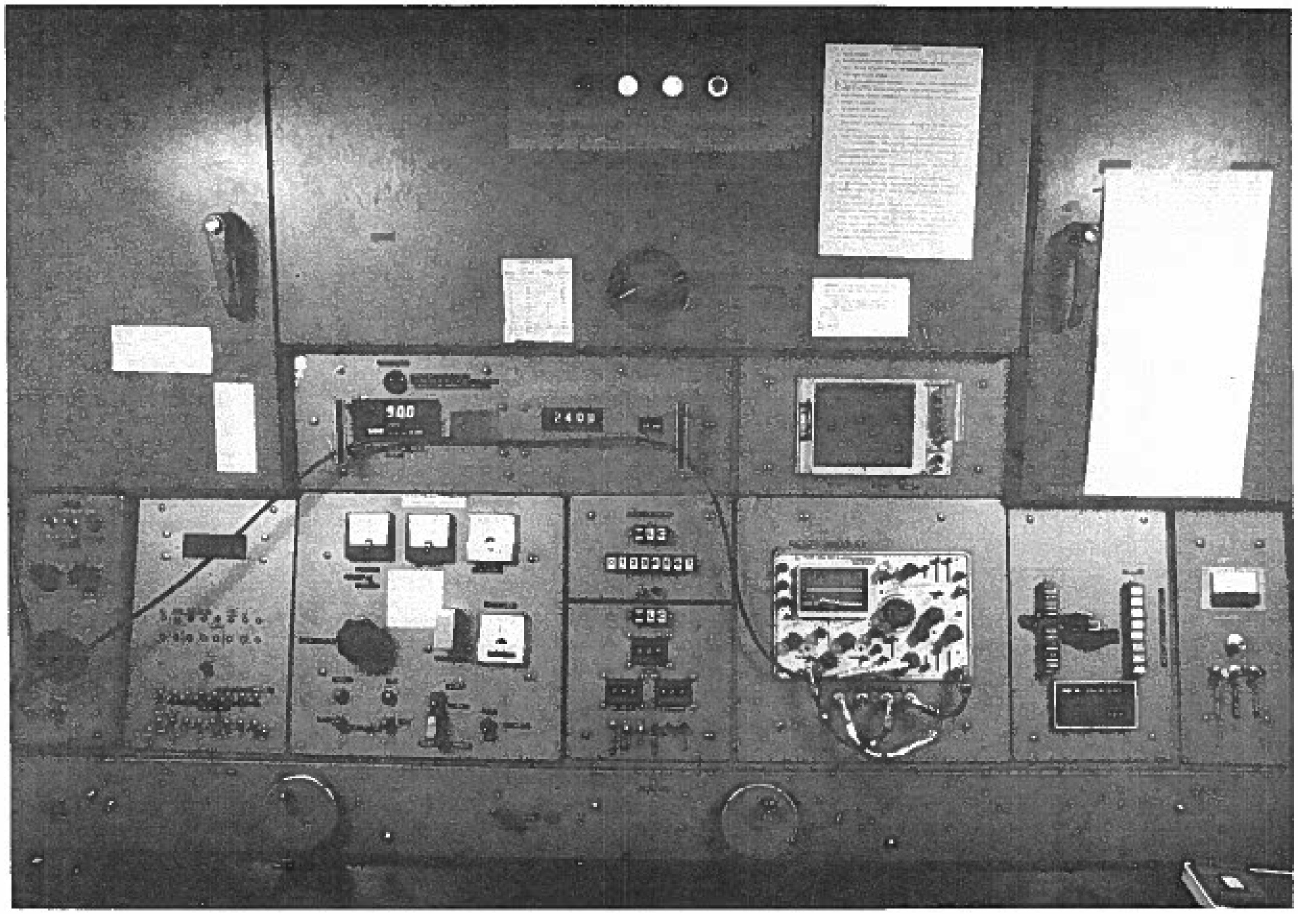
Time (MST)	
0730:	Tape 3--terminated. Test operation successful.

March 24

Time (MST)	
1420 - 1500:	Tape 4--Velocity Azimuth Display (VAD) scans very intense squall line. VAD scans done at 30°, 60°, and 90° elevation.
1500 - 1541:	Tape 5--VAD scans.



XVI-1 External view of 3 cm pulse Doppler radar (left) and 8 mm, vertically pointing radar (dual antennas on the right).



XVI-3 Interior of 3 cm radar van showing control console.

April 16

Time (MST)

0730: Tape 12--radars left in unattended operation (not much weather).

April 19

Time (MST)

1715: Tape 14--systems in automatic mode. 3 cm radar running slow, VAD scans at 60° el.

April 20

Time (MST)

0705: Tape 15--conical scan about zenith for VAD.

0900: VAD scans coordinated with radiometer.

1005: X-band and K-band radars showing cloud top at about 3 Km.

1047: Tape 16--vertical operation 30 second beams.

1246: VAD coordinated with radiometer.

1423: RHI scans along 270° az. coordinated with FM-CW radar and the radiometer.

1524: RHI scans along 240° az. coordinated with FM-CW radar and the radiometer.

1600: Tape 17--vertical 30 second beams. Both radars in automatic mode.

0745: Tape 17--terminated.

1500: 3 cm radar VAD at 60° el.

1504: RHI coordinated with FM-CW radar and radiometer.

1630: Fixed 290° az. at 10° el.; recording with radiometer. Slow VAD scan at 10° el., with radiometer.

1700: VAD done at high speed.

1708: Tape 21--slow VAD with radiometer.

1805: VAD done at high speed.

1900: Default mode in automatic, unattended operation.

April 30

Time (MST)

0738: VAD done at high speed.

0850: Radar left in automatic mode.

1620: Secured.

May 4

Time (MST)

1545: Tape 22--VAD done 60° el., 30 second beam time unattended.

May 5

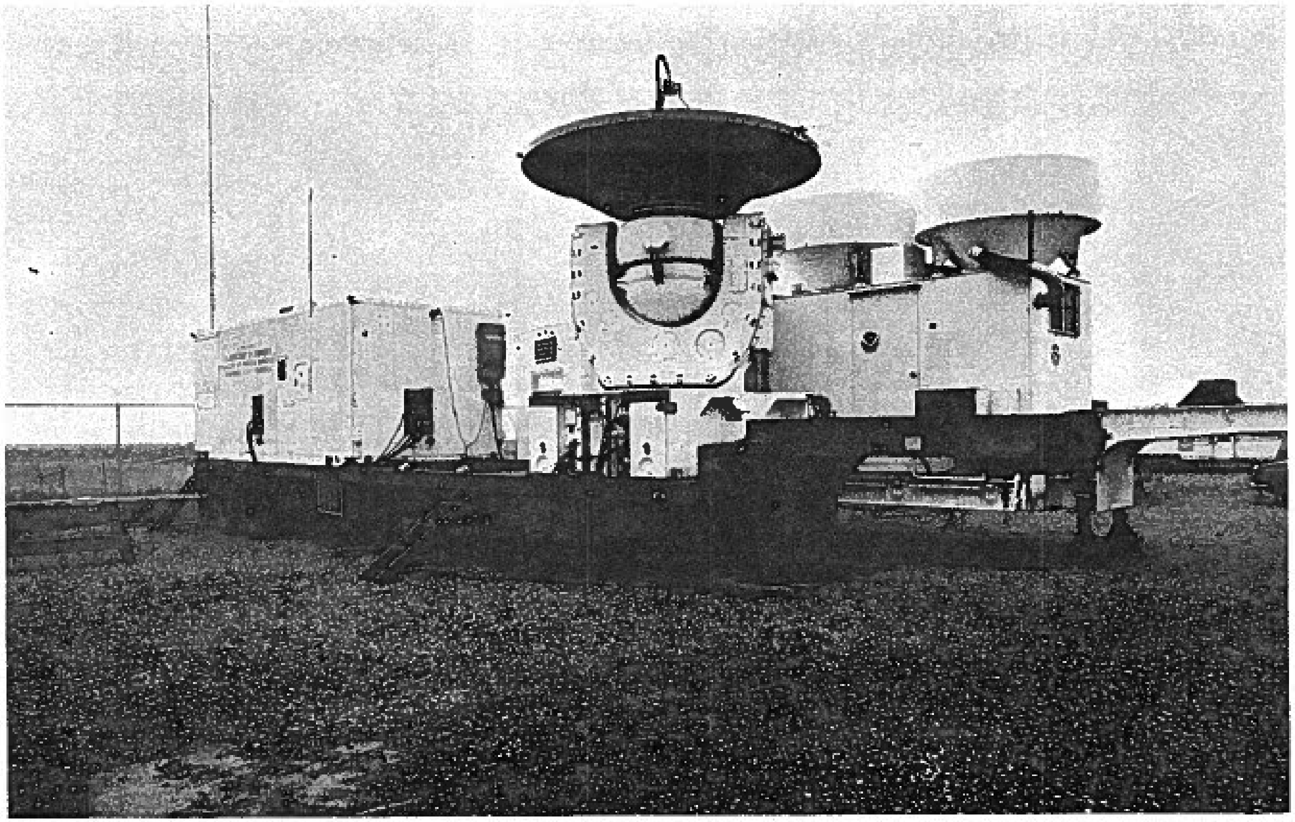
Time (MST)

0725: Tape 23--VAD done 60° el., 30 second beam time unattended.

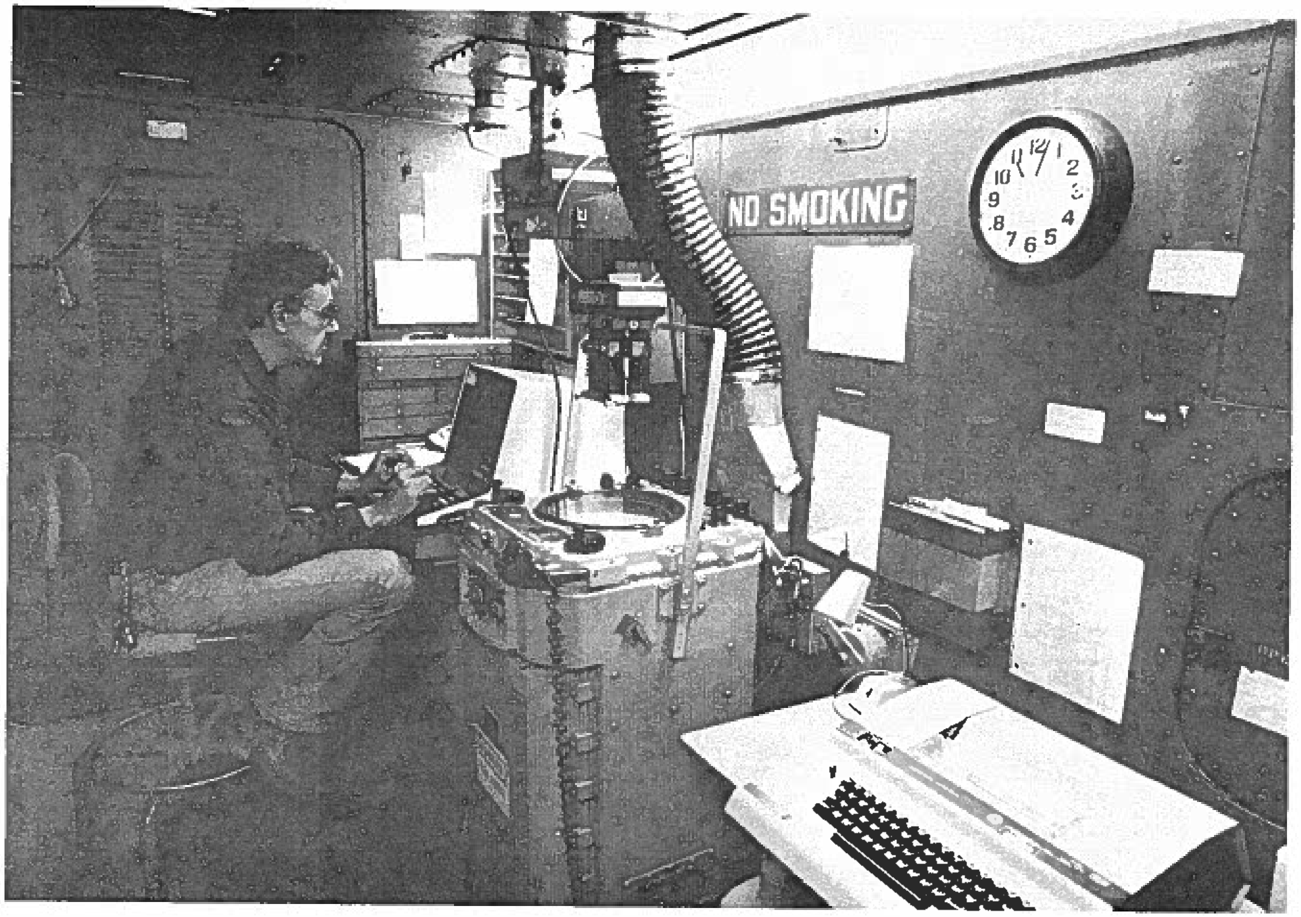
0805:	RHI with 270° az. and at the same elevation angles as at 0740.
0830:	Rain rate was about 0.2"/hr. since about 0600.
0900:	RHI's with 270° az. and the same elevation angles as at 0805.
0950:	Vertical mode with 30 second beams. FM-CW also in vertical mode to make comparison of spectral with weather identifier signature.
1000:	3 cm radar doing RHI scan at 210° az. for comparison with FM-CW radar radiometer and Doppler lidar.
1108:	3 cm radar doing RHI at 210° az.
1215:	8 mm radar return at 6.5 Km from layer 200 meters thick and very weak. There is no radar return visible on the 3 cm band radar.
1345:	Radars placed in unattended operation doing slow VAD's at 60° el. taking 30 second beams.

May 14

Time (MST)	
0630:	3 cm radar doing VAD at 60° el. with 30 second beams. Recording on Tape 26.
0845:	3 cm radar doing coordinated RHI's with the FM-CW radar and the radiometer at 270° az.
1002:	3 cm radar antenna pointing vertical for cloud base comparison between 3 cm, 8 mm, and FM-CW radars and the lidars.



XVI-1 External view of 3 cm pulse Doppler radar (left) and 8 mm, vertically pointing radar (dual antennas on the right).



XVI-2 Interior of 3 cm radar van showing display units and computer terminals.

April 16

Time (MST)	
0730:	Tape 12--radars left in unattended operation (not much weather).

April 19

Time (MST)	
1715:	Tape 14--systems in automatic mode. 3 cm radar running slow, VAD scans at 60° el.

April 20

Time (MST)	
0705:	Tape 15--conical scan about zenith for VAD.
0900:	VAD scans coordinated with radiometer.
1005:	X-band and K-band radars showing cloud top at about 3 Km.
1047:	Tape 16--vertical operation 30 second beams.
1246:	VAD coordinated with radiometer.
1423:	RHI scans along 270° az. coordinated with FM-CW radar and the radiometer.
1524:	RHI scans along 240° az. coordinated with FM-CW radar and the radiometer.
1600:	Tape 17--vertical 30 second beams. Both radars in automatic mode.
0745:	Tape 17--terminated.

April 26

Time (MST)

0844: Tape 18--vertical pointing mode 30 second beams.

1030: 3 cm radar doing VAD at 60° el.

1045: 3 cm VAD at 60° el.

1125: 3 cm radar doing fixed beam scan with radiometer at 10° az.

1336: 3 cm radar doing vertical 30 second beams. Radars left in automatic unattended mode (little weather).

2350: Tape 19--mounted.

April 27

Time (MST)

0954: System shut down.

April 29

Time (MST)

1204: Tape 30--3 cm radar doing slow VAD scans at 60° el. angle and 2.5 second beam time.

1220: 3 cm radar in vertical operation with 30 second beams.

1300: 3 cm radar VAD at 60° el., then back to vertical.

1345: 3 cm radar VAD with Doppler lidar.

1407: 3 cm radar VAD at 60° el.

1500: 3 cm radar VAD at 60° el.

1504: RHI coordinated with FM-CW radar and radiometer.

1630: Fixed 290° az. at 10° el.; recording with radiometer. Slow VAD scan at 10° el., with radiometer.

1700: VAD done at high speed.

1708: Tape 21--slow VAD with radiometer.

1805: VAD done at high speed.

1900: Default mode in automatic, unattended operation.

April 30

Time (MST)

0738: VAD done at high speed.

0850: Radar left in automatic mode.

1620: Secured.

May 4

Time (MST)

1545: Tape 22--VAD done 60° el., 30 second beam time unattended.

May 5

Time (MST)

0725: Tape 23--VAD done 60° el., 30 second beam time unattended.

May 11

Time (MST)

2020:	Tape 24--radars powered up and placed in automatic, continuous recording of 3 cm radar doing VAD scans at 30° el. angle.

May 12

Time (MST)

0730:	3 cm radar doing slow VAD scans at 30° el.
0759:	Both radars recording vertically.
0820 - 0837:	3 cm radar VAD scan with radiometer.
0840:	3 cm radar fixed at 270° az. and 10° el. with radiometer.
0935:	3 cm radar doing RHI's coordinated with radiometer.
1303:	3 cm VAD scans at 30°, 60°, and 90° el.
1357:	Tape 25--VAD scans at 30° el. angle.
1440:	VAD at 60° el. with 30 second beams.

May 13

Time (MST)

0730:	Tape 26--VAD at 60° el. with 30 second beams.
0740:	RHI at 270° az. and elevation angles of 5°, 10°, 15°, 20°, 25°, 30°, 45°, 60°, 75°, and 90°, with 30 second beams.

0805:	RHI with 270° az. and at the same elevation angles as at 0740.
0830:	Rain rate was about 0.2"/hr. since about 0600.
0900:	RHI's with 270° az. and the same elevation angles as at 0805.
0950:	Vertical mode with 30 second beams. FM-CW also in vertical mode to make comparison of spectral with weather identifier signature.
1000:	3 cm radar doing RHI scan at 210° az. for comparison with FM-CW radar radiometer and Doppler lidar.
1108:	3 cm radar doing RHI at 210° az.
1215:	8 mm radar return at 6.5 Km from layer 200 meters thick and very weak. There is no radar return visible on the 3 cm band radar.
1345:	Radars placed in unattended operation doing slow VAD's at 60° el. taking 30 second beams.

May 14

Time (MST)	
0630:	3 cm radar doing VAD at 60° el. with 30 second beams. Recording on Tape 26.
0845:	3 cm radar doing coordinated RHI's with the FM-CW radar and the radiometer at 270° az.
1002:	3 cm radar antenna pointing vertical for cloud base comparison between 3 cm, 8 mm, and FM-CW radars and the lidars.

1111: Tape 27--mounted.

1122: 3 cm radar doing RHI at 240° with radiometer, FM-CW radar, and the dual-polarization lidar.

1215: 3 cm radar placed in unattended mode doing slow VAD's at 60° el. angle.

May 15

Time (MST)

0915: Tape 28--started automatically during the early morning hours. Systems shut down because of no radar return.

XVII. Doppler Lidar Observations - F. Hall

The Doppler lidar was located at Complex A near the tower base (see Figure I-2). It was operated only during conditions of meteorological interest--mainly upslope situations, without heavy clouds or precipitation, obtaining a few sets of VAD scans per hour. A photograph of the interior of the lidar van is shown in Figure XVII-1 and a sample of its wind profiles is shown in Figure XVII-2.

Objectives:

A) Gather atmospheric backscatter coefficient data under a variety of meteorological conditions.

B) Study the variation in cloud scattering as a function of zenith angle, especially for glaciated or cirrus clouds.

C) Test capability of measuring convergence and cloud entrainment.

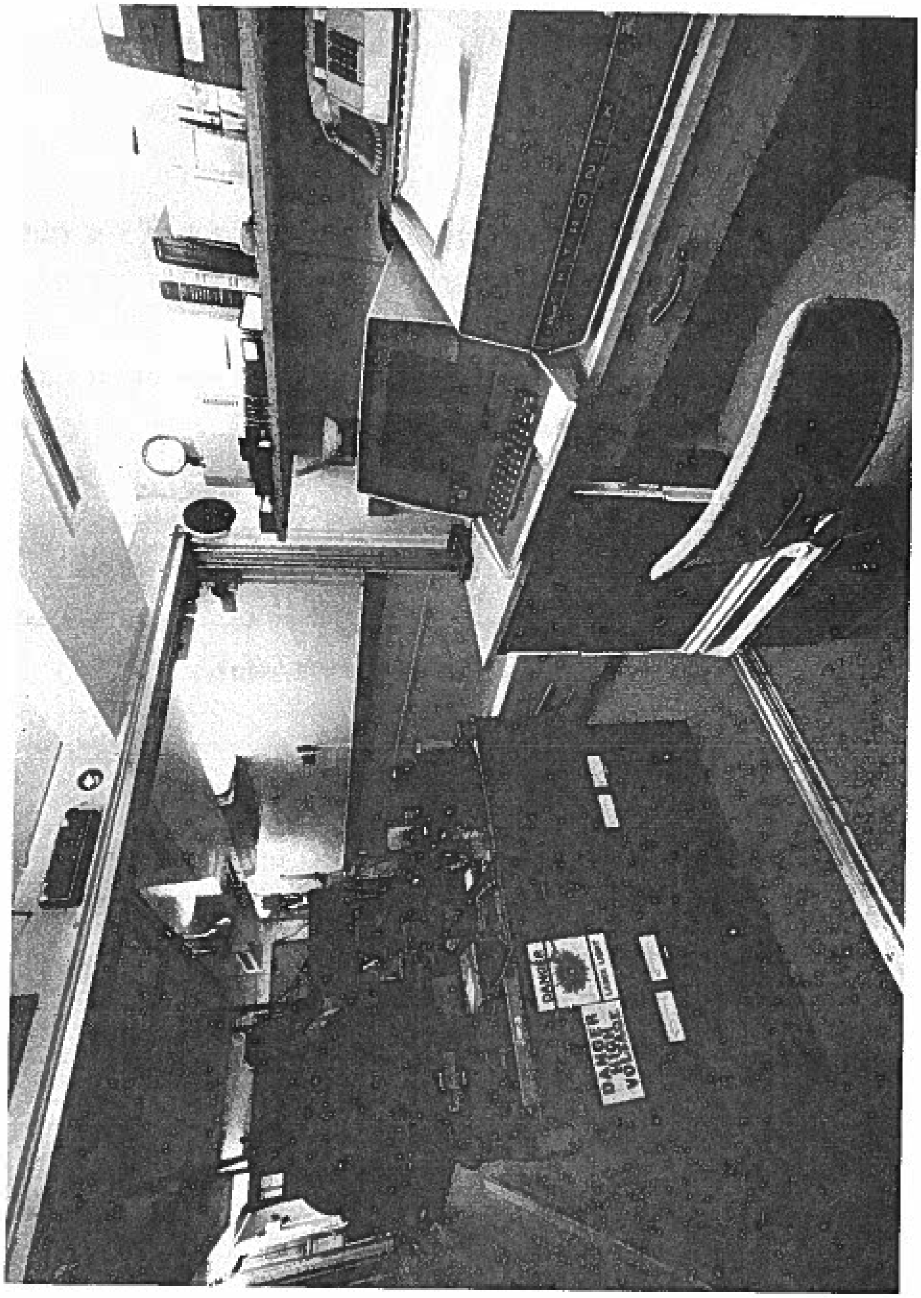
E) Study upper-level and low-level convergence and cloud entrainment by performing VAD scans at 30° and 85° zenith angles.

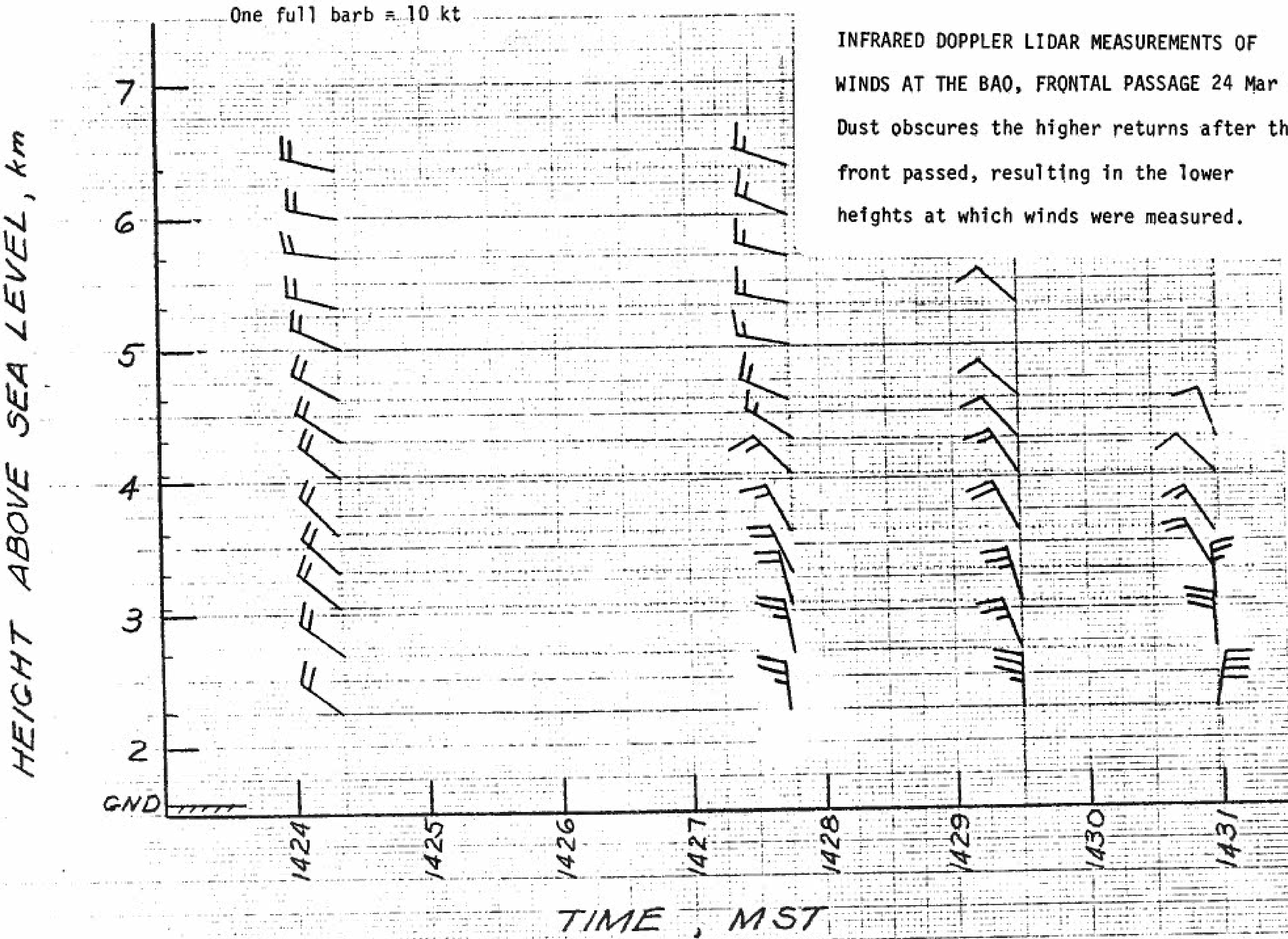
Data Summary:

The Doppler lidar was operated during the BUCOE experiment as follows:

26 February	Arrival at BAO
1 March	Powered up
2 March	0930-0950, 1502-1523
3 March	1010-1025
4 March	1424-1526
5 March	1203-1400
8 March	1349-1400
9 March	1106-1236, 1309-1313
10 March	1527-1545

XVII-1





INFRARED DOPPLER LIDAR MEASUREMENTS OF WINDS AT THE BAO, FRONTAL PASSAGE 24 Mar 82 Dust obscures the higher returns after the front passed, resulting in the lower heights at which winds were measured.

11 March	1038-1114	
12 March	1046-1100	
15 March	1513-1527	GMD
16 March	1400-1511	
17 March	1140-1230	
18 March	0952-1015	
19 March	1000-1020	
24 March	1416-1745	GMD
25 March	1049-1509	GMD, Aircraft
26 March	1540-1600	
29 March	1430-1600	
30 March	≃ 1500	
31 March	1200-1235	
5 April	1530-1547	
7 April	1121-1136	
9 April	1645-1702	
19 April	1407-1415	
20 April	0917-0920	
21 April	0940-1052	Aircraft
22 April	1516-1542	
23 April	1103-1143	
27 April	0909-1304	GMD
28 April	1034-1114	
29 April	1409-1528	
30 April	1202-1214	
6 May	1120-1122	
7 May	1433-1458	

10 May	1122-1140		
11 May	1103-1427	GMD	FM-CW
12 May	1036-1140	GMD	
17 May	1156-1307		
18 May	1340-1426		
20 May	1220-1227	GMD	
21 May	1154-1248	GMD	
25 May	1039-1122	GMD	
26 May	1342-1414	GMD	

XVIII. Dual-Polarization, Multi-Wavelength Lidar - T. McNice

The WPL dual-polarization, multi-wavelength lidar system was located 1.3 km NNW of the BAO tower, at 40° 04' 40" N latitude and 105° 00' 28" W longitude (see Figure I-4). This location was a compromise between the requirements of BUCOE and those of a concurrent smoke diffusion program. This lidar was operated mainly at the primary ruby wavelength of .6943 microns in the dual-polarization mode; that is, a linear polarization was transmitted and two polarizations were detected--one parallel and the other perpendicular to the transmitted polarization. The perpendicular-to-parallel ratio, or depolarization ratio, provided a measure of non-sphericity--thus, an indication of the degree of glaciation--of clouds and precipitation. Occasionally, a second wavelength at .3472 microns was transmitted and its signal returns were detected in a third channel simultaneously with the two .6943 polarizations. The laser was typically operated at 2 joules at .6943 microns and .3 joules at .3472 microns with a pulse occurring every 5 to 10 seconds. Output beamwidth was 1 milliradian and pulsewidth was 30 nanoseconds. Light scattered from the laser beam by the atmosphere was collected in a 75 cm, f/3 Newtonian telescope, which could be positioned over the entire vertical hemisphere. After collection, the optical signal was split into two channels according to polarization. Scattered sunlight was removed by narrow-band interference filters. The three optical signals were detected by photomultipliers and digitized simultaneously in three Biomation 8100 transient recorders, which sampled the signal as fast as a sample every 10 nanoseconds and stored 2048 8-bit samples for each laser shot. The stored data was then passed to a Data General Eclipse S/200 computer, examined for quality, combined with the other data required for processing (laser power, telescope position, time, etc.) and written to magnetic tape to await further processing. A photograph of the interior of the data processing and display van is shown in Figure XVIII-1.

Objectives:

The objectives were the following:

A) Measure cloud-base height and precipitation position.

B) Separate glaciated from unglaciated clouds by depolarization measurements.

C) Evaluate the effectiveness of the dual-polarization technique in mixed-phase conditions by comparison with the 2-D spectrometer probes.

D) Measure the degree of orientation of ice platelets in cloud and use dual-wavelength data to evaluate the contribution of diffraction error in flutter-angle calculations.

E) Investigate the possibility of using lidar extinction-to-backscatter profiles to determine glaciation conditions in optically thin clouds.

Data Summary:

Lidar data was recorded using the following four types of scan patterns:

A) Scan V1. This was a vertical sounding. The lidar was fired vertically throughout the file, and maximum range was set to include any clouds visible. In clear air situations maximum range was sequenced between 3 and 15 km to provide coverage of the troposphere. When the aircraft was in the vicinity maximum range was set to provide best signal-to-noise ratio at the aircraft's altitude. The lidar was typically fired at a shot every 10 seconds, except when the aircraft was operating, when a shot every 5 seconds was used. Each file usually contained about 100 shots.

B) Scan V2. This was also a vertical sounding, with the elevation angle rocked back and forth between 88.5 and 91.0 degrees to detect specular returns from oriented ice platelets. When present, these returns showed up as strong spikes in the parallel polarization channel emerging from the broader return when the lidar was directed within .5 degrees of the zenith.

C) Scan V3. This was a type V2 scan with the .3472 micron wavelength also used to separate diffraction from flutter-angle effects when oriented ice crystals were observed.

D) Scan T. Here the lidar was directed approximately 7 meters west of the particle spectrometers mounted on the BAO instrument carriage, with the signal-to-noise ratio optimized for that specific range.

E) Scan R. This was an RHI scan, usually between the zenith and 13.5 degrees above horizontal. Occasionally the scan was directed from a point just above the WPL radars to the zenith.

The following is a catalog of lidar data which will be available when processing is complete. Each data set is listed by date (and day number) and file number, with starting and ending times (mountain standard time) scan type and maximum range also listed. The time code errors noted are recoverable, as system time was recorded independently of the time code generator. It is intended that this catalog be used by other investigators in planning the inclusion of the lidar data in their analysis.

All of the data listed will be reduced in such a way as to present cloud or precipitation backscatter intensities and depolarization ratios as a function of space and time. Extinction corrections will be applied only to a few files of special interest, in response to specific requests.

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA

SCAN TYPES

V1=VERTICAL SOUNDING
V2=ELEVATION ANGLE SCANNED BETWEEN 88.5 AND 91.0 DEGREES
V3=VERTICAL SOUNDING, SINGLE-CHANNEL UV AND
DUAL-POLARIZATION RED
T=LIDAR BEAMED NEXT TO BAO CARRAIGE
R=RHI SCAN

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
		****** 3 MAR 82(DAY 62) ******			
4	14:54	14:59	V1	3	
5	15: 2	15: 7	V1	6	
6	15: 7	15:13	V1	6	
7	15:13	15:20	V1	6	
8	15:20	15:29	V1	6	
9	15:30	15:42	V1	6	
10	15:43	15:54	V1	6	
		****** 4 MAR 82(DAY 63) ******			
4	14:33	14:45	V1	3	
5	14:54	15: 2	T	6	OPERATION SUSPENDED - SNOW
6	15:37	15:49	V1	3	
7	15:51	15:53	T	6	OPERATION TERMINATED - SNOW
		****** 5 MAR 82(DAY 64) ******			
4	10:55	11: 8	V1	3	
7	11:17	11:30	V1	3	
8	11:32	11:45	V1	3	
10	11:49	12: 1	V1	3	
11	12: 2	12:13	V1	3	
13	12:21	12:34	V1	3	
14	12:35	12:47	V1	3	
15	12:47	12:59	V1	3	
		****** 18 MAR 82(DAY 77) ******			
4	4:41	4:41	V1	3	
5	4:43	4:44	V1	6	
6	4:47	4:47	V1	15	
7	14:16	14:17	V1	3	
8	14:20	14:21	V1	6	
9	14:22	14:23	V1	15	
10	14:26	14:28	V1	3	
11	14:28	14:30	V1	6	
12	14:31	14:32	V1	15	

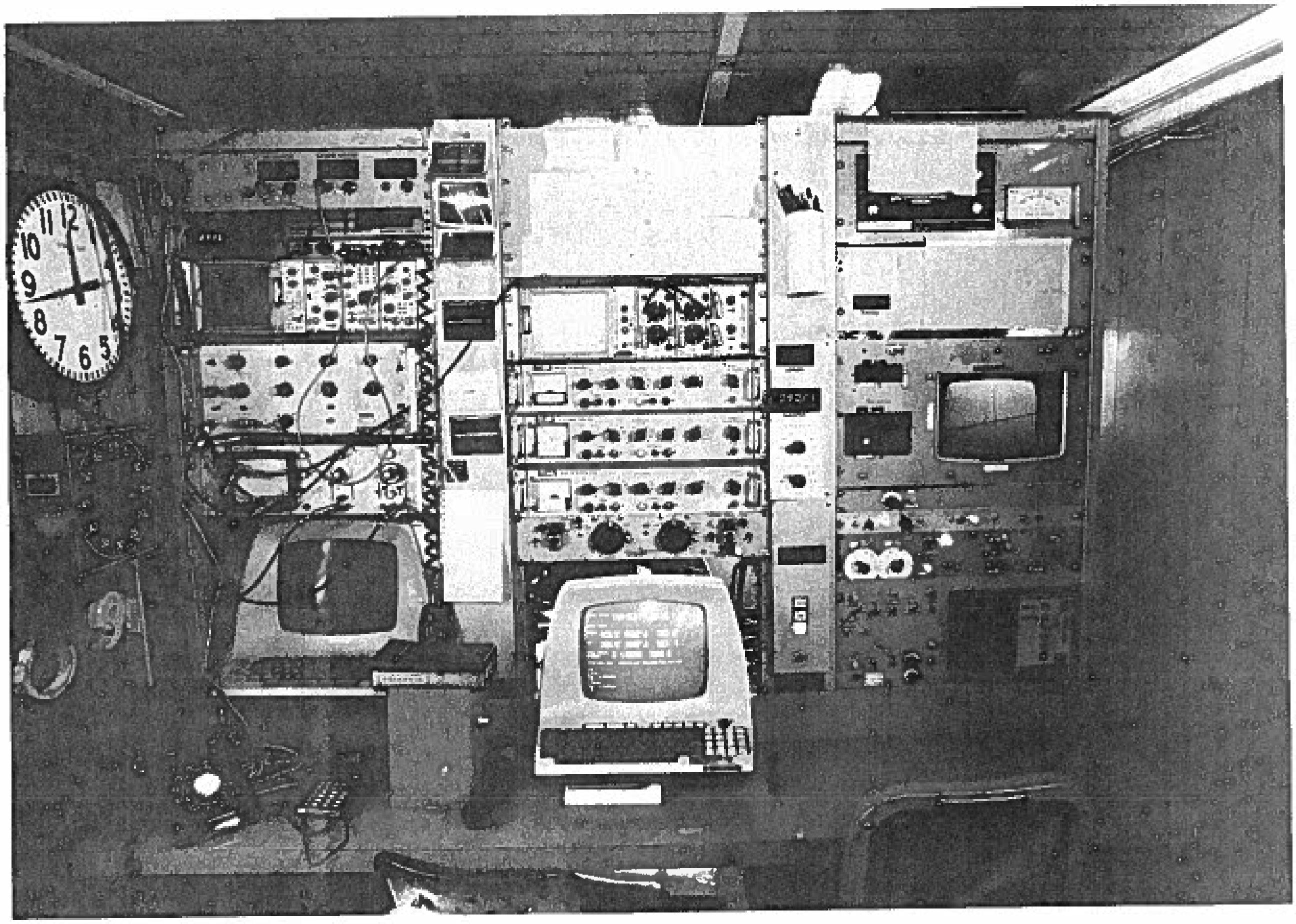


Figure XVIII. Interior of Lidar Processing and Display Van.

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
			****** 24 MAR 82(DAY 83) ******		
5	14:22	14:23	V1	3	
6	14:24	14:29	V1	6	OPERATION SUSPENDED - WIND
7	16:14	16:16	V1	6	
8	16:18	16:19	V1	15	
9	16:20	16:36	V1	6	
10	16:36	0: 8	V1	6	TIME CODE ERROR
11	0: 9	0:21	V1	3	TIME CODE ERROR
12	0:21	17:14	V1	3	TIME CODE ERROR
13	17:21	17:33	V1	3	
15	17:42	17:50	R	6	
16	17:52	18: 4	V1	3	
17	18: 6	18:14	R	6	
18	18:16	18:17	V1	3	OPERATION TERMINATED - SNOW
			****** 25 MAR 82(DAY 84) ******		
4	10:24	10:37	V1	3	
5	10:42	10:54	V1	3	
7	11: 6	11: 7	T	3	
8	11: 8	11:20	T	3	
9	11:23	11:24	V1	3	
10	11:25	11:26	V1	3	
11	11:27	11:29	V1	15	
12	11:31	11:42	V1	3	
14	11:50	12: 2	V1	3	
15	12: 3	12: 4	V1	3	
16	12: 5	12:12	V1	15	
17	12:17	12:29	V1	3	
18	13:18	13:31	V1	3	
19	13:32	13:34	V1	6	
20	13:35	13:53	V1	15	
21	13:53	13:58	V1	15	
22	13:59	14: 3	V1	6	
23	14: 4	14: 9	V1	3	
24	14:15	14:19	T	3	

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
		****** 26 MAR 82(DAY 85) ******			
27	11:32	11:33	T	3	LASER POLARIZATION ERROR
28	11:46	11:52	V2	6	ORIENTED ICE CRYSTALS
29	11:53	12: 0	V2	6	ORIENTED ICE CRYSTALS
31	12:22	12:27	V3	6	ORIENTED ICE CRYSTALS
32	12:27	12:35	V3	6	ORIENTED ICE CRYSTALS
33	12:37	12:38	V3	6	ORIENTED ICE CRYSTALS
		****** 9 APR 82(DAY 99) ******			
5	15:21	15:22	V1	3	
6	15:24	15:24	V1	6	
7	15:26	15:31	V1	15	ELEVATION READOUT ERROR
8	16:45	16:47	T	3	
9	16:58	17: 1	V1	3	
10	17: 2	17: 9	V1	6	
11	17:10	17:20	V1	15	
12	17:20	17:27	V1	15	
13	17:30	17:31	T	3	

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
		****** 15 APR 82(DAY 105) ******			
4	1:42	1:43	V1	3	TIME CODE ERROR
5	1:45	1:46	V1	6	TIME CODE ERROR
8	1:49	1:52	V1	6	TIME CODE ERROR
9	1:54	2: 8	V1	6	TIME CODE ERROR
10	2:10	2:23	V1	6	TIME CODE ERROR
11	15:33	15:36	T	3	
12	15:38	15:52	V1	6	
13	15:54	16: 7	V1	15	
14	16: 9	16:13	T	3	
15	16:17	16:31	V1	15	
16	16:33	16:39	T	3	
17	16:42	16:56	V1	6	
18	16:57	16:58	V1	3	
19	17: 9	17:12	T	3	
20	17:30	17:43	V1	6	
21	17:46	17:50	T	3	
22	17:51	17:57	R	3	
23	17:58	18:12	V1	6	
24	18:13	18:27	V1	6	
25	18:28	18:37	V1	6	
26	18:38	18:52	V1	15	
27	18:56	19: 9	V1	6	
28	19: 9	19:36	V1	6	
29	19:36	19:50	V1	6	
30	19:51	20:10	V1	6	
31	20:13	20:16	T	3	
32	20:21	20:35	V1	6	
33	20:36	20:50	V1	6	
34	20:55	21: 9	V1	6	
35	21:10	21:24	V1	6	
36	21:27	21:41	V1	6	
37	21:42	21:50	V1	6	
39	22: 1	22:14	V1	6	TIME CODE ERROR
40	22:16	22:30	V1	6	
41	22:30	22:41	V1	6	
42	22:43	22:57	V1	6	
43	22:57	23:11	V1	6	
44	23:11	23:25	V1	6	
45	23:25	23:40	V1	6	
46	23:40	23:53	V1	6	
47	23:54	0: 8	V1	6	

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	TIME(MST) START	TIME(MST) STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
****** 16 APR 82(DAY 106) ******					
DAY 106					
1	10: 4	10:19	V1	6	
2	10:23	10:27	T	3	
3	10:31	10:46	V1	6	
4	11: 4	11:18	V1	6	
5	11:27	11:31	T	3	
6	11:33	11:46	V1	6	
7	11:46	12: 2	V1	6	
8	12: 5	12: 9	T	3	
9	12:11	12:16	V1	6	
11	12:18	12:32	V1	6	
12	12:33	12:39	V1	6	
13	12:40	12:45	V2	6	ORIENTED ICE CRYSTALS
14	12:46	12:49	V1	6	
15	12:49	12:55	V2	6	ORIENTED ICE CRYSTALS
16	12:56	13: 4	V1	6	
17	13: 5	13:12	V2	6	ORIENTED ICE CRYSTALS
18	13:12	13:20	V2	6	ORIENTED ICE CRYSTALS
19	13:20	13:32	V2	6	ORIENTED ICE CRYSTALS

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
			****** 20 APR 82(DAY 110) ******		
5	7:14	7:23	V2	3	
6	7:26	7:35	T	3	
7	7:36	7:41	R	3	
8	7:42	7:51	V2	3	
10	7:55	8: 4	R	3	
11	8: 6	8:14	T	3	
12	8:22	8:26	R	3	
13	8:28	8:37	V1	3	
14	8:37	8:46	R	3	
15	8:47	8:57	T	3	
16	8:57	9: 0	R	3	
17	9: 2	9:12	V2	3	
18	9:14	9:20	R	3	
19	9:23	9:33	V2	3	
20	9:35	9:41	R	3	SUSPENDED OPERATION - SNOW
21	13:49	14: 0	V2	3	
22	14: 2	14: 8	R	3	
23	14: 9	14:20	T	3	
24	14:22	14:27	R	3	
25	14:30	14:40	V2	3	
26	14:44	14:54	T	3	
27	15: 9	15:19	V1	3	
28	15:23	15:48	R	15	COORDINATED WITH RADARS
30	15:48	15:50	R	15	COORDINATED WITH RADARS
31	15:50	16: 0	R	6	COORDINATED WITH RADARS
32	16: 3	16:13	T	3	
33	16:16	16:25	V2	3	
			****** 21 APR 82(DAY 111) ******		
4	9:28	9:42	T	3	
5	10: 9	10:10	V1	3	
6	10:47	11: 1	V1	3	
7	11: 1	11: 9	V1	6	
8	11:10	11:16	V1	6	
9	11:17	11:26	V1	15	
10	11:28	11:37	T	3	
24	19:22	19:23	V1	3	
25	19:24	19:25	V1	6	
26	19:26	19:35	V1	15	
27	19:36	19:45	V1	30	

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
		****** 27 APR 82(DAY 117) ******			
4	6:56	7:10	V1	3	
5	7:11	7:27	V1	3	
6	7:27	7:40	V1	3	
7	7:41	7:55	V1	3	
8	7:55	8: 4	R	3	
10	8:10	8:17	V1	3	
11	8:18	8:26	T	3	
12	8:29	8:35	V1	3	
13	8:36	8:50	T	3	
15	8:53	8:59	R	3	
16	9: 0	9:13	V1	3	
17	9:16	9:18	V1	3	
18	9:22	9:37	T	3	
19	9:38	9:45	R	3	
20	9:46	10: 1	V1	3	
21	10: 4	10:18	V1	3	
22	10:18	10:25	R	3	
23	10:29	10:42	V1	3	
24	10:43	10:54	V1	3	
25	10:54	10:58	V1	3	
26	11: 3	11:19	V1	3	
27	11:21	11:34	V1	3	
28	11:36	11:37	V1	3	
29	11:39	11:45	R	3	
30	11:46	11:49	V1	6	
31	11:49	11:51	V1	3	
32	11:52	12: 0	V1	3	
33	12: 0	12:10	V1	3	
34	12:11	12:16	V1	6	
36	12:17	12:23	V1	3	

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
			****** 29 APR 82(DAY 119) ******		
4	10:40	10:41	V1	3	
5	10:44	10:45	V1	6	
6	10:46	10:47	V1	15	
7	11: 7	11: 8	V1	3	
8	11: 9	11:10	V1	6	
9	11:17	11:18	V1	3	
10	11:19	11:20	V1	6	
12	11:30	11:47	V1	6	
13	11:47	12: 4	V1	6	
14	12: 6	12:15	T	3	
15	12:18	12:24	R	6	
16	12:24	12:41	V1	6	
17	12:45	12:53	T	3	
18	12:54	13: 2	R	15	
19	13: 3	13:19	V1	6	
20	13:21	13:29	T	3	
21	13:30	13:36	R	15	
22	13:37	13:55	V1	6	
23	13:59	14: 7	T	3	
24	14: 8	14:14	R	15	
25	14:14	14:31	V1	6	
26	14:34	14:43	T	3	
27	14:45	14:51	R	15	
28	14:52	14:59	V1	6	
29	15: 0	15: 1	V1	3	
30	15: 2	15: 4	R	3	
31	15: 5	15: 6	T	3	
32	15: 7	15:17	V1	3	
33	15:19	15:28	T	3	
34	15:29	15:35	R	6	
35	15:41	15:59	V1	6	
37	16: 4	16:12	T	3	
39	16:14	16:20	R	6	
40	16:21	16:38	V1	3	
41	16:40	16:48	T	3	
42	16:49	16:56	R	6	
43	16:57	17:16	V1	3	
44	17:18	17:27	T	3	
45	17:28	17:35	R	6	
47	17:38	17:54	V1	6	
48	17:56	18: 4	T	3	
49	18: 5	18:13	R	15	
50	18:13	18:29	V1	3	
51	18:33	18:41	T	3	
52	18:42	18:49	R	15	

BUCOE 1982
DUAL-POLARIZATION, MULTI-WAVELENGTH LIDAR DATA
(CONTINUED)

FILE	--TIME(MST)-- START	STOP	TYPE SCAN	MAX RANGE (KM)	COMMENTS
		** 11,12 MAY 82(DAYS 131,132) **			
1	10: 9	10:12	V1	3	
2	10:18	10:31	V1	3	
3	10:39	10:56	V1	3	
4	11: 9	11:10	V1	3	
5	11:11	11:21	V1	3	
6	11:29	11:32	V1	3	
10	7: 1	7:17	V1	3	
11	7:30	7:47	V1	3	
12	7:59	8:17	V1	3	
13	8:18	8:25	R	3	
14	10:37	10:59	T	3	
15	11: 1	11:18	V1	3	
16	11:19	11:35	V1	3	
17	11:38	11:55	T	3	
18	11:57	12: 4	R	3	
19	12: 5	12:19	V1	3	
20	12:20	12:37	T	3	
21	12:39	12:44	R	3	
22	12:45	13: 1	V1	3	
23	13: 3	13: 9	T	3	OPERATION TERMINATED - RAIN
		****** 14 MAY 82(DAY 134) ******			
4	10: 0	10: 8	V1	3	
5	10:20	10:26	R	3	ABOVE THE RADARS
6	10:45	10:52	R	3	ABOVE THE RADARS
7	11: 0	11: 9	R	3	ABOVE THE RADARS
8	11:11	11:20	R	6	ABOVE THE RADARS
9	11:28	11:30	R	3	COORDINATED WITH RADARS
10	11:31	11:33	R	3	COORDINATED WITH RADARS
11	11:33	11:35	R	3	COORDINATED WITH RADARS
12	11:36	11:38	R	15	COORDINATED WITH RADARS
13	11:38	11:40	R	15	COORDINATED WITH RADARS
14	11:40	11:43	R	15	COORDINATED WITH RADARS
15	11:43	11:45	R	15	COORDINATED WITH RADARS
16	11:45	11:48	R	15	COORDINATED WITH RADARS
17	11:48	11:50	R	15	COORDINATED WITH RADARS
18	11:50	11:53	R	6	COORDINATED WITH RADARS
19	11:53	11:55	R	6	COORDINATED WITH RADARS
20	11:55	11:58	R	6	COORDINATED WITH RADARS
21	11:58	12: 1	R	6	COORDINATED WITH RADARS
22	12: 6	12: 8	R	6	COORDINATED WITH RADARS
23	12: 8	12:11	R	6	COORDINATED WITH RADARS
24	12:11	12:13	R	6	COORDINATED WITH RADARS

XIX. Continuous Wind Soundings by Radar Profiling at Platteville and Continuous Radiometric Soundings at Stapleton Airport - D. Van de Kamp

This system is designed to provide continuous profiles through the atmosphere from the surface up to 16-18 km ($\simeq$ 100 mB). The Profiler consists of active (radar) and passive (radiometric) equipment. The atmospheric parameters measured include wind speed and direction, temperature, precipitable water vapor, integrated cloud liquid, surface parameters, 500 mb height, and tropopause height.

The Platteville VHF wind-profiling radar is located 30 km northeast of the BAO tower; it is fixed-beam, Doppler radar operating at 6 meter wavelength. This system uses three separate radars; components of the horizontal wind are measured using two of the radar beams that are directed 15° from the zenith; one points toward the north and the other toward the east. The third radar, measuring vertical air motion and determining the tropopause height, is pointed at the zenith.

The rest of the Profiler system, including all the passive radiometric equipment, is located near Stapleton International Airport, next to the National Weather Service Forecast office.

The upper-level wind patterns near the experimental area are recorded at Platteville. Each volume sampled by the radar for wind speed and direction is nearly 1500 meters thick. The center of the first volume, or height, is located 2461 meters AGL (4072 meters MSL). The second height is centered near the 500 mb level. Table XIX-1 lists the heights and pressure levels that the radar samples.

Four additional heights above the 9th level, up to 21 km (a pressure height of less than 50 mb), are also sampled. These higher levels rarely produce good data because of poor signal-to-noise ratios.

Radiosondes were released regularly during operational periods of the experiment; these ascend through the upslope flow into the westerly winds aloft and generally travel over Platteville. Good correlation between the radiosondes wind measurements and the remotely-measured winds profiled by Platteville is therefore to be expected.

An interesting event occurred in the upper atmosphere on April 2nd. The eastern slope of the Rocky Mountains was experiencing chinook winds with surface winds estimated between 30 and 40 mph at Platteville. Figure XIX-1 shows a plot of winds at the 3rd and 5th sampling heights. Both levels show a general flow from the southwest at the beginning of Figure 1. By 1430 GMT the winds at both heights have tended to shift to the south. From this point in time, the lower level continues backing toward the east with a reduction of wind speed to 3 ms^{-1} until 1620 GMT. The upper level winds have veered back to the southwest, holding the same 8 ms^{-1} speed, in the same time period. Within the next hour, the lower level wind direction is from the north with an increase in speed to 7 ms^{-1}, and at the same time the upper level speed decreased to 5 ms^{-1}. This behavior appears to be caused by the passage of an upper-level rotor more than 5 km above Platteville, near the 400 mb level. The return to a more normal wind pattern is observed several hours later. Further investigation of this event is planned.

On March 24th a dramatic surface frontal passage occurred with gusty northeast winds and a significant drop in temperature. In Figure XIX-2, the temperature profiles as measured by radiometric equipment located at Stapleton Airport are plotted. Each profile is a 20 minute average of temperatures. The first profile of the time sequence ends at 2140z, with a surface temperature of 14°C. The second profile, ending at 2200z shows the passage of the gust front in the lowest layer with a temperature reduction of 8°C. A corresponding 2°C reduction is seen above the gust front at the 810, 750, and 695 mb level, a volume approximately 1 km thick. Surface visibility was reduced to 1/2 mile in blowing dust at the time of the frontal passage. It is speculated that the dust and cool temperatures at the surface causes a sharp reduction of radiation heating of the lower atmosphere; this caused the initial equal lowering of the temperature in the 1 km section of the atmosphere above the gust front. Following the passage of the cold front, the surface temperature dropped a total of 14°C in 1 hour and 40 minutes.

The passage of the gust front was a shallow, but intense leading edge to a surface cold front. The lowest level that the Platteville radar samples is near 600 mb, well above the surface gust front. For this reason the dramatic boundary layer changes in wind direction and speed would not be detected by the radar.

A steerable dual-channel radiometer was located at the BAO tower during the experiment, and operated by J. B. Snider. Measurements of the total water vapor and liquid water were taken. Equivalent measurements are available from the fixed-beam, vertically pointing dual-channel radiometer of the Denver Profiler located at Stapleton Airport.

TABLE XIX-1

Heights of Platteville Wind Measurements

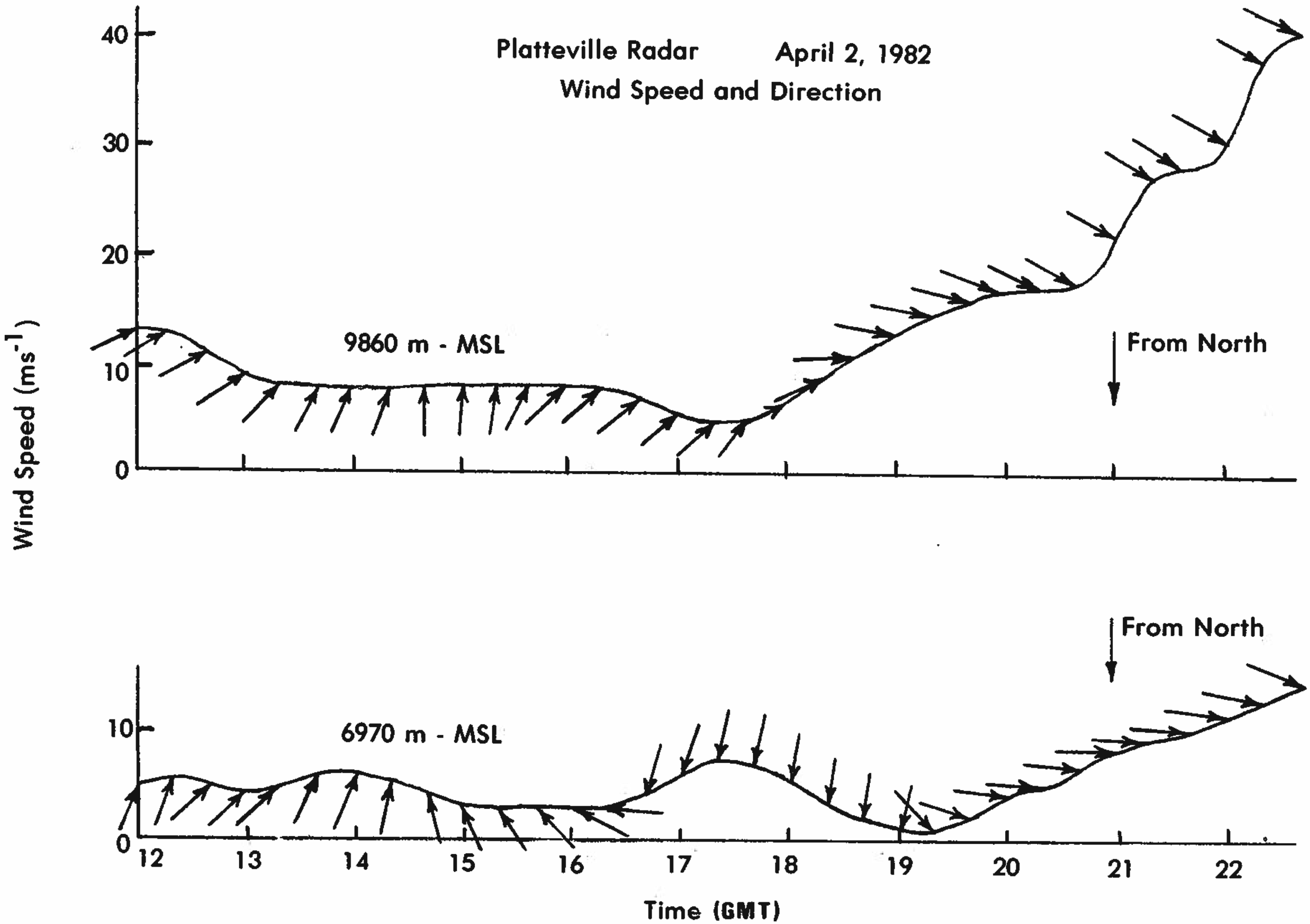
	Meters MSL	Standard Atmospheric Pressure mb
1st Height	4072	610
2nd	5520	500
3rd	6968	410
4th	8416	330
5th	9864	270
6th	11312	210
7th	12760	170
8th	14208	140
9th	15656	110

Objectives:

Obtain continuous soundings of wind, temperature and humidity (actually at 20 minute intervals) in the area of the BUCOE experiment in support of meteorological research elements in the program.

Data Summary:

The Platteville radar is operated continuously giving a real-time display of winds on the Profiler monitor at RB-3 in Boulder, and a recording on tape at Platteville. March and May were successful months for recording data. April's data was not continuous because of a number of problems caused by one transmitter and an intermittent fault in the receiver section. Good data were taken for the May 11th through the 13th BUCOE operation days. Table XIX-2 lists the data tapes available from Platteville.


Platteville Radar
April 2, 1982
Wind Speed and Direction
9860 m - MSL
6970 m - MSL
From North
From North
Wind Speed (ms⁻¹)
40
30
20
10
0
10
0
12
13
14
15
16
17
18
19
20
21
22
Time (GMT)

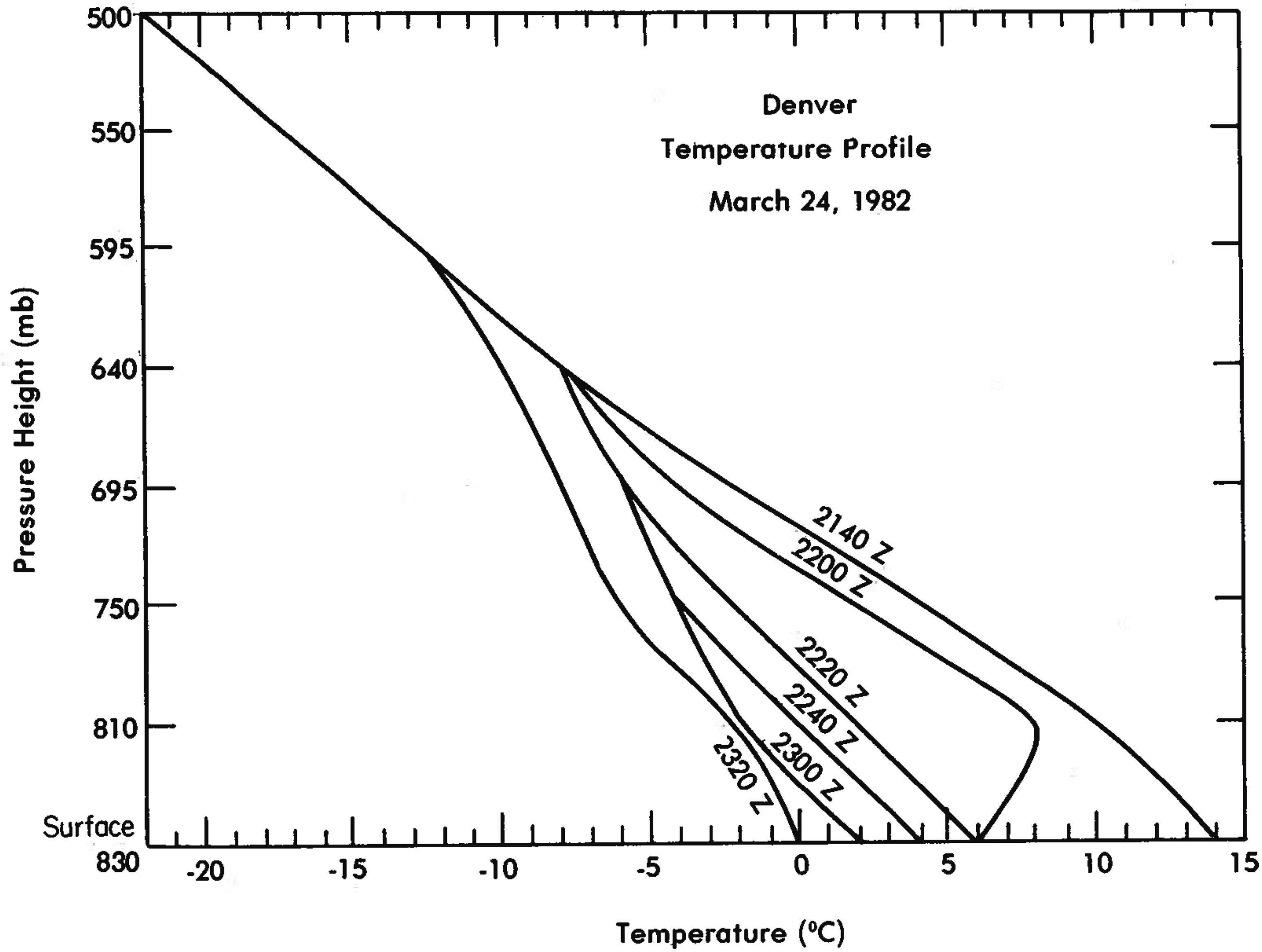

Denver
Temperature Profile
March 24, 1982
Pressure Height (mb)
500
550
595
640
695
750
810
Surface
830
-20
-15
-10
-5
0
5
10
15
Temperature (°C)
2140 Z
2200 Z
2220 Z
2240 Z
2300 Z
2320 Z

TABLE XIX-2

Platteville Data Tapes--Dates and Times are all Local (MST and MDT)

Platteville Tape Number	Beginning Date and Time	Ending Date and Time
PL82-068	9 March, 1210	15 March, 1230
PL82-074	15 March, 1230	23 March, 1015
PL82-082	23 March, 1015	1 April, 2330
PL82-092	2 April, 1250	8 April, 1100
Note: No data available 8 April, 1100 to 16 April, 1300		
PL82-106	16 April, 1300	23 April, 1300
Note: Transmitter failed for the north-south component on the 18th. East-west and zenith components continued to operate. North-south transmitter repaired 1015 the 20th. North-south transmitter failed again 1300 the 23rd. Complete system down following this failure. No data available 23 April, 1300 to 26 April, 1030		
PL82-116	26 April, 1030	4 May, 1115
Note: North-south transmitter failed 1400 the 26th complete system down again. System back up midmorning the 28th without the zenith component. Zenith component back up with all problems solved, mid-morning the 29th.		
PL82-124	4 May, 1115	11 May, 1200
PL82-131	11 May, 1200	18 May, 0900

APPENDIX A

BUCOE Rawinsonde Data - R. J. Zamora

In support of the BUCOE studies, Rawinsonde observations were taken at the Boulder Atmospheric Observatory (BAO) and at La Salle, Colorado, 5 miles S.E. of Greeley. The BAO site utilized a standard Ground Meteorological Device (GMD) owned and operated by NOAA's Wave Propagation Laboratory (WPL). The La Salle site operated a Weathermeasure RD-65 unit. Both sites used VIZ 1680 MHz radiosondes equipped with ACCU-LOK temperature and humidity sensors.

During the project a total of 23 flights were made at the BAO and 17 flights from the La Salle site. Table A1 lists the date and time for each flight at the BAO and Table A2 gives the date and times for the La Salle flights. All times here are mountain standard. The sounding data were reduced using software written by Seth Troxel and the author. The temperature humidity and wind data from the BAO site constitute the remainder of this appendix. Values of humidity are unreliable for dewpoints less than -55°C because of sensor limitations.

Acknowledgement

The author wishes to thank Mark Suehl and Seth Troxel, who assisted in all the BAO flights and Emmett Malone, who reduced the raw sounding data.

TABLE A1

BAO Rawinsonde

Launch Number	Date	Time (MST)
3	03/04/82	16:35
4	03/05/82	10:20
5	03/05/82	14:50
6	03/16/82	15:10
7	03/24/82	15:53
10	03/24/82	22:51
11	03/25/82	13:28
13	04/09/82	17:10
14	04/15/82	17:18
15	04/15/82	21:56
16	04/20/82	00:03
17	04/20/82	04:08
18	04/20/82	08:05
19	04/23/82	11:25
20	04/27/82	09:44
21	04/29/82	18:35
22	05/11/82	09:26
23	05/11/82	13:20
24	05/12/82	06:57
25	05/12/82	10:49
28	05/12/82	15:54
29	05/12/82	19:01 *
30	05/13/82	09:46
31	05/13/82	13:31
32	05/14/82	09:38

* Heavy icing forced down after ascent to 607.2 mb.

TABLE A2

La Salle Rawinsonde

Launch Number	Date	Time (MST)
1	03/24/82	19:10
2	03/25/82	07:40
3	04/20/82	01:05
4	04/20/82	08:45
5	04/20/82	12:00
6	04/29/82	14:15
7	04/29/82	18:15
8	04/29/82	10:05
9	05/11/82	05:45
10	05/11/82	13:16
11	05/11/82	06:57
12	05/12/82	07:33
13	05/12/82	12:25
14	05/12/82	18:55
15	05/12/82	19:40
16	05/13/82	07:51
17	05/13/82	12:48

STATION: BAO, ERIE
DATE: 3/4/82
TIME: 1635 MST
EXPERIMENT: BUCOE
LAUNCH NO: 3

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	834.2	1572.0	.0	-1.9	-2.2	96.7	271.9	285.7	297.7
.89	809.8	1807.2	235.2	-4.5	-5.0	95.6	269.2	285.4	295.2
2.00	777.2	2130.9	558.9	-4.9	-5.5	95.5	268.7	288.3	298.3
5.43	675.6	3220.4	1648.4	-11.1	-11.8	93.9	262.3	293.1	300.0
8.14	589.0	4259.0	2687.0	-18.6	-22.0	72.2	254.7	296.1	300.2
8.44	579.8	4375.8	2803.8	-21.6	-25.8	66.1	251.7	294.0	297.1
10.17	534.6	4969.6	3397.6	-25.3	-30.4	59.2	247.9	296.5	298.9
15.14	417.6	6710.2	5138.2	-39.9	-45.3	52.8	233.3	299.5	300.2
17.14	380.2	7343.8	5771.8	-45.4	-51.1	49.6	227.8	300.3	300.7
20.50	358.2	7734.9	6162.9	-52.9	-58.6	47.1	220.2	295.4	295.6
22.89	297.2	8938.3	7366.3	-53.2	-60.1	39.9	219.9	311.2	311.4
28.13	237.0	10410.9	8838.9	-48.8	-57.8	31.3	224.3	338.6	339.1
32.25	204.8	11375.2	9803.2	-46.5	-58.5	21.6	226.6	356.7	357.5

STATION: BAO, ERIE
DATE: 3/5/82
TIME: 1020 MST
EXPERIMENT: BUCOE
LAUNCH NO: 4

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	842.0	1572.0	.0	-5.4	-8.5	76.3	268.2	281.3	290.0
.71	820.4	1775.1	203.1	-8.0	-9.0	91.6	265.5	280.6	287.7
1.63	790.0	2067.1	495.1	-10.9	-11.3	96.5	262.5	280.5	286.3
4.07	711.0	2876.7	1304.7	-11.2	-13.3	82.8	262.2	288.8	295.2
7.00	624.8	3855.9	2283.9	-18.2	-20.5	80.1	255.1	291.7	295.7
12.30	488.2	5651.0	4079.0	-31.5	-39.6	41.0	241.7	296.7	298.1
16.21	395.8	7099.5	5527.5	-43.5	-52.8	31.9	229.7	299.4	299.9
20.24	329.6	8304.7	6732.7	-53.2	-61.2	34.4	219.9	302.1	302.3
20.61	323.2	8430.7	6858.7	-54.0	-61.9	34.4	219.2	302.7	302.9
21.51	310.6	8687.9	7115.9	-50.7	-59.4	31.9	222.4	310.7	311.0
26.67	252.0	10051.3	8479.3	-50.3	-61.2	23.6	222.9	330.6	330.9
29.62	224.6	10806.7	9234.7	-47.9	-60.5	19.3	225.2	345.3	345.9
44.43	144.2	13730.1	12158.1	-47.9	-61.5	16.8	225.3	391.9	393.0

STATION: BAO, ERIE
DATE: 3/5/82
TIME: 1020 MST
EXPERIMENT: BUCOE
LAUNCH NO: 4

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	842.0	1572.0	.0	-5.4	-8.5	76.3	268.2	281.3	290.0
4.18	700.0	3006.2	1434.2	-11.4	-13.5	82.0	262.1	289.9	296.4
11.80	500.0	5495.8	3923.8	-30.0	-37.9	42.5	243.2	296.5	298.1
15.93	400.0	7041.9	5469.9	-43.2	-52.0	34.2	230.0	298.9	297.4
22.61	300.0	8949.1	7377.1	-50.4	-59.9	28.7	222.7	314.3	314.6
26.85	250.0	10139.2	8567.2	-50.1	-61.1	23.6	223.0	331.5	331.9
32.55	200.0	11604.1	10032.1	-47.9	-61.4	17.1	225.2	356.9	357.6
43.50	150.0	13502.0	11930.0	-47.9	-61.5	16.8	225.3	387.5	388.5

STATION: BAO, ERIE
DATE: 3/5/82
TIME: 1456 MST
EXPERIMENT: BUCOE
LAUNCH NO: 5

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	841.5	1572.0	.0	-2.0	-7.8	60.5	271.6	284.9	296.6
1.73	784.6	2122.8	550.8	-7.9	-9.3	87.8	265.6	284.4	292.0
2.83	754.2	2428.7	856.7	-10.5	-11.1	95.0	263.0	284.7	291.1
3.30	743.8	2535.6	963.6	-10.9	-15.1	68.1	262.5	285.4	291.6
3.70	734.0	2637.8	1065.8	-9.8	-18.0	47.1	263.6	287.8	294.8
4.69	702.4	2976.1	1404.1	-11.8	-22.3	37.0	261.5	289.2	295.4
8.19	606.4	4084.0	2512.0	-20.0	-23.1	74.4	253.2	292.0	295.5
10.28	560.6	4662.2	3090.2	-23.7	-36.3	26.5	249.5	294.4	297.1
14.57	483.0	5730.6	4158.6	-33.0	-43.2	32.0	240.1	295.7	296.9
17.69	419.4	6705.8	5133.8	-41.7	-44.8	68.9	231.5	296.8	297.4
19.80	374.6	7460.7	5888.7	-48.4	-54.2	47.7	224.8	297.7	298.0
22.12	346.2	7978.4	6406.4	-49.6	-57.7	34.9	223.6	302.8	303.1
25.81	299.8	8915.0	7343.0	-52.3	-63.2	23.1	220.8	311.7	311.9
28.95	268.6	9626.3	8054.3	-52.0	-64.8	17.7	221.2	322.1	322.4
33.05	234.0	10525.1	8953.1	-49.3	-63.4	15.3	223.9	339.2	339.7
38.01	197.0	11656.4	10084.4	-48.2	-62.9	14.4	224.9	358.0	358.6
51.96	115.8	15135.9	13563.9	-50.9	-65.3	14.2	222.2	411.7	412.7
56.13	98.8	16166.1	14594.1	-52.3	-66.5	14.3	220.8	428.1	429.1

STATION: BAO, ERIE
DATE: 3/5/82
TIME: 1456 MST?
EXPERIMENT: BUCOE
LAUNCH NO: 5

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	841.5	1572.0	.0	-2.0	-7.8	60.5	271.6	284.9	296.6
4.69	700.0	3008.9	1436.9	-11.9	-22.5	37.0	261.4	289.3	295.5
13.62	500.0	5489.8	3917.8	-31.1	-41.9	29.9	242.1	295.2	296.6
18.53	400.0	7027.9	5455.9	-44.6	-49.4	56.1	228.6	297.0	297.4
25.78	300.0	8921.2	7349.2	-52.3	-63.1	23.5	220.8	311.6	311.9
31.17	250.0	10104.7	8532.7	-50.8	-64.4	16.0	222.4	330.6	331.0
37.60	200.0	11566.0	9993.9	-48.4	-63.0	14.4	224.8	356.2	356.8
45.14	150.0	13453.1	11881.1	-50.0	-64.5	14.4	223.1	383.9	384.7
55.80	100.0	16088.5	14516.5	-52.5	-66.6	14.4	220.7	426.4	427.3

STATION: BAO, ERIE
DATE: 3/15/82
TIME: 1510 MST
EXPERIMENT: BUCOE
LAUNCH NO: 6

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	822.2	1572.0	.0	14.9	-4.1	26.5	288.7	304.6	341.1
4.60	664.2	3317.2	1745.2	-3.8	-9.7	59.6	269.8	302.8	316.4
6.38	611.4	3964.6	2392.6	-9.6	-12.2	79.2	263.9	303.4	312.4
7.29	578.0	4395.7	2823.7	-13.3	-14.0	94.0	260.2	304.0	310.9
7.75	561.8	4612.3	3040.3	-13.4	-14.1	93.9	260.0	306.3	313.4
9.38	514.8	5269.7	3697.7	-19.5	-24.6	60.6	253.8	306.7	311.2
10.78	477.6	5822.5	4250.5	-23.8	-31.9	43.3	249.5	308.1	311.3
12.39	442.6	6373.1	4801.1	-28.7	-34.9	51.6	244.6	308.7	310.9
13.79	415.8	6816.7	5244.7	-32.7	-40.3	43.4	240.4	309.0	310.5
15.39	390.0	7264.2	5692.2	-36.6	-42.3	52.5	236.6	309.7	310.8
18.35	347.8	8046.4	6474.4	-43.3	-51.4	37.3	229.9	310.9	311.5
20.00	325.0	8499.2	6927.2	-47.0	-54.9	36.7	226.2	311.9	312.3

STATION: BAO, ERIE
DATE: 3/15/82
TIME: 1510 MST
EXPERIMENT: BUCOE
LAUNCH NO: 6

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	822.2	1572.0	.0	14.9	-4.1	26.5	288.7	304.6	341.1
3.52	700.0	2898.4	1326.4	.6	-8.9	48.8	274.2	303.2	319.4
9.90	500.0	5491.5	3919.5	-21.2	-29.4	43.8	252.0	307.2	311.1
14.74	400.0	7092.9	5520.9	-35.1	-42.1	45.8	238.0	309.3	310.6

STATION: BAO, ERIE
DATE: 3/15/82
TIME: 1510 MST
EXPERIMENT: BUCOE
LAUNCH NO: 6

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC							5.0	5.0	10.0	330.0
1.	135.1	35.3	379.4	536.	378.	-380.	10.5	-10.1	14.6	314.0
2.	134.0	40.1	758.8	901.	648.	-626.	8.5	-9.2	12.5	317.5
3.	136.5	41.0	1138.2	1309.	901.	-950.	6.9	-10.5	12.6	326.5
4.	139.8	42.3	1517.5	1668.	1076.	-1274.	5.1	-8.1	9.5	327.8
5.	140.0	45.0	1890.7	1891.	1215.	-1448.	8.7	-1.7	8.9	281.1
6.	130.5	46.7	2254.4	2124.	1615.	-1380.	12.7	3.6	13.2	254.0
7.	121.5	48.9	2686.3	2343.	1998.	-1224.	14.4	3.9	14.9	254.9
8.	114.5	48.8	3141.1	2750.	2502.	-1140.	18.8	1.7	18.9	264.8
9.	109.5	46.6	3544.4	3352.	3160.	-1119.	24.3	.5	24.3	268.9
10.	105.5	43.5	3942.5	4155.	4003.	-1110.	28.1	2.1	28.2	265.7
11.	101.4	40.9	4325.7	4994.	4895.	-987.	27.4	1.7	27.5	266.4
12.	100.0	38.9	4667.7	5785.	5697.	-1005.	25.0	-1.7	25.1	273.8
13.	99.6	37.4	4994.4	6532.	6441.	-1089.	22.1	-3.5	22.4	279.0
14.	99.8	36.5	5303.4	7167.	7063.	-1220.	21.0	-4.2	21.5	281.4
15.	99.9	35.4	5583.1	7856.	7739.	-1351.	22.9	-4.9	23.4	282.2
16.	100.2	34.2	5853.4	8613.	8477.	-1525.	22.1	-4.1	22.5	280.6
17.	100.0	33.5	6117.7	9243.	9102.	-1605.	20.4	-1.1	20.4	273.1
18.	99.3	32.9	6381.9	9865.	9735.	-1594.	22.7	2.4	22.8	264.0
19.	97.9	32.1	6652.8	10605.	10505.	-1458.	25.6	4.3	26.0	260.5
20.	96.7	31.3	6927.2	11393.	11315.	-1329.	26.3	4.2	26.6	261.0

STATION: BAO,ERIE
DATE: 3/15/82
TIME: 1510 MST
EXPERIMENT: BUCOE
LAUNCH NO: 6

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1349.7	5.9	-9.2	10.9	327.2
500.0	3917.6	27.9	2.0	28.0	265.9
400.0	5518.7	22.5	-4.8	23.0	282.0

STATION: BAO, ERIE
DATE: 3/24/82
TIME: 1536 MST
EXPERIMENT: BUCOE
LAUNCH NO: 7

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	836.9	1572.0	.0	.6	-7.8	53.2	274.2	288.1	300.9
1.28	768.4	2250.0	678.0	-5.6	-8.3	79.3	267.9	288.5	298.1
1.78	749.3	2448.2	876.2	-3.8	-8.6	65.8	269.8	292.5	304.2
2.31	730.6	2649.1	1077.1	-.3	-10.8	40.7	273.2	298.4	314.6
4.12	676.5	3260.7	1688.7	-3.8	-15.6	35.0	269.6	301.2	314.5
5.25	641.6	3675.4	2103.4	-8.3	-17.8	42.1	265.1	300.7	310.3
7.43	575.1	4512.4	2940.4	-16.1	-19.9	69.4	257.3	301.2	306.5
9.97	502.6	5515.9	3943.9	-21.9	-34.5	27.3	251.3	305.9	309.6
13.25	420.2	6807.1	5235.1	-32.1	-45.0	23.3	241.1	308.9	310.5
17.63	347.4	8120.9	6548.9	-42.7	-53.7	25.9	230.4	311.8	312.4
21.81	272.2	9731.5	8159.5	-52.7	-62.7	26.2	220.4	319.8	320.1

STATION: BAO, ERIE
DATE: 3/24/82
TIME: 1536 MST
EXPERIMENT: BUCOE
LAUNCH NO: 7

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	836.9	1572.0	.0	.6	-7.8	53.2	274.2	288.1	300.9
3.40	700.0	2999.5	1427.5	-1.9	-14.3	33.8	271.5	300.4	315.3
12.00	500.0	5575.5	4003.5	-21.9	-35.2	25.2	251.3	306.4	310.0
21.00	400.0	7175.9	5603.9	-34.7	-47.3	23.4	238.4	309.7	311.2
25.00	300.0	9124.5	7552.5	-49.1	-60.0	24.0	224.1	316.2	316.6

STATION: BAO, ERIE
DATE: 3/24/82
TIME: 1536 MST
EXPERIMENT: BUCOE
LAUNCH NO: 7

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								-22.7	-22.7	25.0	65.0
2.	209.0	24.9	2531.6	959.6	2067.	-1002.	-1808.	3.4	-19.1	19.4	350.0
4.	170.0	34.5	3220.1	1648.1	2398.	416.	-2362.	30.4	-8.2	31.4	285.0
6.	135.7	31.3	3963.3	2391.3	3933.	2747.	-2815.	39.2	-6.5	39.7	279.5
8.	121.1	27.3	4737.6	3165.6	6133.	5252.	-3168.	42.8	-11.8	44.4	285.4
10.	118.0	23.5	5527.7	3955.7	9098.	8033.	-4271.	43.5	-18.2	47.1	292.7
12.	117.0	21.7	6315.1	4743.1	11919.	10620.	-5411.	53.7	-28.6	60.8	298.0
14.	118.0	18.2	7032.1	5460.1	16607.	14663.	-7797.	63.2	-35.5	72.4	299.3
16.	118.0	16.2	7632.0	6060.0	20859.	18417.	-9793.	62.7	-29.3	69.2	295.1
18.	117.0	14.9	8263.4	6691.4	25148.	22407.	-11417.	63.6	-29.1	70.0	294.6
20.	117.0	14.2	9034.1	7462.1	29490.	26276.	-13388.	60.6	-25.6	65.8	292.9
22.	116.0	13.9	9802.6	8230.6	33258.	29892.	-14580.	58.6	-19.3	61.7	288.2

STATION: BAO, ERIE
DATE: 3/24/82
TIME: 1536 MST
EXPERIMENT: BUCOE
LAUNCH NO: 7

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTMSL M.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	2995.0	1423.0	22.2	-16.3	27.5	306.3
500.0	5556.7	3984.7	43.9	-18.5	47.6	292.9
400.0	7171.7	5599.7	63.1	-34.0	71.7	298.3
300.0	9136.1	7564.1	60.4	-24.7	65.3	292.3

STATION: BAO, ERIE
DATE: 3/24/82
TIME: 2251 MST
EXPERIMENT: BUCOE
LAUNCH NO: 10

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	846.5	1572.0	.0	-6.2	-6.9	94.6	267.3	280.0	287.9
1.48	799.0	2021.3	449.3	-9.5	-10.6	90.5	264.0	281.2	287.6
2.47	766.6	2340.6	768.6	-10.8	-11.6	92.9	262.7	283.1	289.2
3.45	736.0	2652.8	1080.8	-12.8	-13.9	90.0	260.6	284.3	289.6
4.41	706.0	2969.2	1397.2	-14.9	-16.0	89.7	258.5	285.3	290.0
5.48	676.4	3292.8	1720.8	-16.0	-16.7	93.1	257.4	287.6	292.0
6.10	657.0	3513.7	1941.7	-12.5	-13.0	95.1	261.0	294.0	300.3
6.81	637.4	3745.9	2173.9	-10.9	-11.4	95.5	262.6	298.3	305.9
9.60	563.4	4681.8	3109.8	-18.0	-25.8	46.8	255.2	300.6	305.3
11.32	519.2	5288.5	3716.5	-21.4	-36.1	21.8	251.8	303.7	307.4
11.98	502.2	5533.7	3961.7	-22.1	-37.4	20.0	251.1	305.8	309.4
13.80	458.6	6194.8	4622.8	-27.2	-41.3	21.6	246.0	307.4	309.8
14.52	450.5	6322.9	4750.9	-28.4	-42.9	20.3	244.8	307.4	309.6
18.15	366.3	7777.6	6205.6	-37.8	-50.9	21.2	235.3	313.6	314.6
20.70	313.4	8833.2	7261.2	-46.3	-57.6	23.9	226.8	316.1	316.6
22.48	281.2	9545.9	7973.9	-51.1	-61.8	24.1	222.1	319.2	319.5
24.01	263.0	9979.0	8407.0	-53.3	-63.6	24.6	219.9	322.2	322.4
26.35	228.4	10877.3	9305.3	-58.2	-68.0	24.8	215.0	328.0	328.1
28.31	201.8	11653.2	10081.2	-60.3	-69.8	25.3	212.9	336.5	336.6
29.10	186.8	12131.2	10559.2	-63.4	-72.4	26.2	209.8	338.9	339.0
30.14	181.8	12300.0	10728.0	-58.2	-67.9	25.2	215.0	350.1	350.3
32.07	163.2	12978.5	11406..5	-58.9	-68.7	24.4	214.3	359.9	360.1
33.80	154.4	13330.2	11758.2	-54.2	-64.6	24.2	219.0	373.6	374.0
37.49	131.6	14359.3	12787.3	-52.3	-63.0	23.7	220.8	394.4	395.1
39.10	121.8	14858.0	13286.0	-53.9	-64.4	23.8	219.3	400.4	401.0

STATION: BAO, ERIE
DATE: 2251 MST
TIME: 3/24/82
EXPERIMENT: BUCOE
LAUNCH NO: 10

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	846.5	1572.0	.0	-6.2	-6.9	94.6	267.3	280.0	287.9
4.77	700.0	3035.0	1463.0	-15.0	-15.5	95.5	258.4	285.9	290.5
12.10	500.0	5544.4	3972.4	-22.3	-37.5	20.5	250.9	305.8	309.4
16.89	400.0	7143.2	5571.2	-34.8	-48.0	21.5	238.4	309.8	311.1
20.41	300.0	9096.5	7524.5	-47.9	-59.0	24.0	225.2	317.8	318.2
24.89	250.0	10281.2	8709.2	-54.7	-65.0	24.3	218.5	324.8	325.0
28.34	200.0	11689.6	10117.6	-60.6	-70.0	25.7	212.5	336.8	336.9
34.45	150.0	13508.1	11936.1	-54.0	-64.4	24.2	219.1	377.0	377.4

STATION: BAO,ERIE
DATE: 3/24/82
TIME: 2251 MST
EXPERIMENT: BUCOE
LAUNCH NO: 10

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	184.7	1.2	.0	0.	0.	0.	-3.1	-2.6	4.0	50.0
1.	204.7	43.3	302.7	321.	-134.	-292.	-4.0	-9.2	10.0	23.7
2.	203.7	44.8	615.3	620.	-249.	-567.	-3.1	-7.2	7.8	23.4
3.	203.9	49.3	935.1	804.	-326.	-735.	-3.2	-7.8	8.5	22.4
4.	203.1	47.8	1259.3	1142.	-448.	-1050.	-1.7	-9.4	9.6	10.2
5.	198.1	48.6	1572.5	1386.	-431.	-1318.	6.5	-3.4	7.3	298.0
6.	182.2	56.4	1902.4	1264.	-49.	-1263.	29.4	-14.0	32.5	295.6
7.	147.7	40.5	2207.8	2585.	1381.	-2185.	36.9	-10.3	38.3	285.5
8.	130.4	41.1	2552.8	2926.	2229.	-1897.	36.6	-1.0	36.6	271.6
9.	121.7	34.1	2897.9	4280.	3642.	-2249.	47.9	-14.9	50.2	287.3
10.	118.5	28.8	3245.8	5904.	5189.	-2817.	47.6	-21.0	52.0	293.8
11.	118.3	25.7	3597.9	7476.	6582.	-3544.	43.7	-31.1	53.7	305.5
12.	121.0	23.3	3962.5	9201.	7887.	-4739.	42.6	-41.0	59.1	313.9
13.	123.4	21.4	4325.0	11036.	9214.	-6075.	44.2	-40.5	59.9	312.5
14.	124.3	19.9	4650.5	12847.	10613.	-7240.	44.2	-37.0	57.7	310.0
15.	125.0	18.7	4934.6	14579.	11942.	-8362.	45.3	-41.7	61.5	312.6
16.	126.2	17.8	5334.4	16615.	13408.	-9813.	46.4	-47.9	66.7	315.9
17.	127.4	17.1	5734.3	18640.	14808.	-11321.	45.0	-50.3	67.5	318.2
18.	128.6	16.5	6134.1	20709.	16184.	-12920.	42.5	-47.8	63.9	318.3
19.	129.3	16.2	6545.1	22528.	17433.	-14269.	41.4	-44.5	60.8	317.1
20.	129.9	15.9	6958.1	24427.	18739.	-15668.	42.3	-42.3	59.9	315.0
21.	130.1	15.7	7367.0	26209.	20048.	-16882.	46.3	-39.8	61.1	310.6
22.	130.0	15.4	7766.6	28197.	21600.	-18124.	51.8	-34.7	62.4	303.8
23.	129.3	15.1	8105.3	30040.	23246.	-19026.	53.7	-30.9	62.0	299.9
24.	128.8	14.7	8387.7	31972.	24917.	-20034.	57.6	-34.7	67.2	301.0
25.	128.3	14.4	8769.0	34153.	26802.	-21167.	57.1	-30.3	64.7	297.9
26.	127.6	14.3	9151.2	35902.	28444.	-21905.	54.3	-23.9	59.3	293.7

27.	126.9	14.2	9541.2	37706.	30153.	-22640.	48.5	-26.2	55.1	298.3
28.	126.8	14.2	9935.3	39264.	31440.	-23520.	56.0	-24.5	61.2	293.6
29.	125.7	14.2	10473.4	41390.	33612.	-24153.	51.4	-10.1	52.4	281.2
30.	124.9	14.2	10679.1	42203.	34613.	-24147.	36.7	-6.7	37.3	280.4
31.	124.4	14.2	11003.2	43484.	35879.	-24567.	46.3	-18.3	49.8	271.6
32.	124.0	14.1	11353.7	45201.	37473.	-25276.	47.2	-24.3	53.1	297.3
33.	123.9	13.9	11566.7	46739.	38794.	-26068.	38.8	-22.9	45.1	300.5
34.	123.8	13.8	11784.4	47978.	39869.	-26690.	40.0	-20.1	44.7	296.7
35.	123.5	13.7	12062.2	49481.	41262.	-27311.	40.3	-16.7	43.6	292.4
36.	123.2	13.7	12339.9	50620.	42357.	-27718.	41.0	-16.5	44.2	291.9
37.	122.9	13.6	12617.7	52155.	43791.	-28329.	42.2	-16.8	45.4	291.7
38.	122.6	13.6	12911.4	53369.	44961.	-28754.	43.0	-20.4	47.6	295.4
39.	122.5	13.5	13220.4	55067.	46443.	-29587.	48.0	-27.0	55.1	299.4

STATION: BAO, ERIE
DATE: 3/24/82
TIME: 2251 MST
EXPERIMENT: BUCOE
LAUNCH NO: 10

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1459.7	2.0	7.9	8.1	194.4
500.0	3988.6	42.7	-41.0	59.2	313.8
400.0	5613.2	45.4	-49.6	67.3	317.5
300.0	7543.1	48.8	-37.7	61.6	307.7
250.0	8726.6	57.2	-30.8	65.0	298.3
200.0	10114.6	54.9	-19.4	58.2	289.5
150.0	11926.7	40.2	-18.3	44.2	294.5

STATION: BAO, ERIE
DATE: 3/25/82
TIME: 1328 MST
EXPERIMENT: BUCOE
LAUNCH NO: 11

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	844.0	1572.0	.0	6.0	-3.1	51.9	279.8	293.0	311.8
.29	834.6	1663.7	91.7	5.6	-2.1	57.5	279.5	293.6	312.2
.65	824.4	1763.6	191.6	1.3	-6.3	57.0	274.9	290.0	303.7
2.20	775.6	2251.3	679.3	-2.7	-7.7	65.1	270.9	290.8	303.0
2.85	742.3	2597.7	1025.7	-5.3	-9.1	71.9	268.2	291.7	302.0
3.90	724.0	2796.0	1224.0	.6	-15.3	29.0	274.0	300.3	315.8
4.40	710.0	2952.4	1380.4	-.3	-15.4	26.9	273.0	300.9	317.7
6.00	656.8	3569.5	1997.5	-5.3	-19.7	27.0	268.0	302.1	314.1
7.80	606.4	4190.5	2618.5	-10.2	-25.1	24.4	263.1	303.4	312.1
11.30	512.8	5462.7	3890.7	-18.1	-31.7	25.5	255.1	308.7	313.9
14.55	442.6	6543.0	4971.0	-27.2	-37.6	32.8	246.0	310.5	313.1
18.70	361.0	7978.3	6406.3	-38.2	-47.2	34.8	235.0	314.4	315.4
27.90	241.0	10646.4	9074.4	-57.2	-65.0	34.2	215.9	324.4	324.5
29.30	227.4	11012.1	9440.1	-59.1	-66.7	34.1	214.0	326.9	327.0
32.50	197.2	11906.0	10334.0	-58.8	-66.4	34.1	214.4	341.1	341.2
33.90	184.8	12317.6	10745.6	-54.8	-62.8	33.8	218.4	353.7	354.3

STATION: BAO, ERIE
DATE: 3/25/82
TIME: 1328 MST
EXPERIMENT: BUCOE
LAUNCH NO: 11

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	844.0	1572.0	.0	6.0	-3.4	51.0	279.8	293.0	311.8
1.00	700.0	3086.2	1514.2	-.4	-16.7	23.8	273.0	302.1	319.1
2.00	500.0	5681.4	4109.4	-19.5	-33.3	24.6	253.7	309.3	313.9
3.00	400.0	7296.3	5724.3	-32.7	-42.7	32.5	240.5	312.5	314.1
4.00	300.0	9258.5	7686.5	-47.9	-56.7	32.5	225.3	317.9	318.3
5.00	250.0	10438.7	8866.7	-56.4	-64.6	32.2	216.8	322.2	322.4
6.00	200.0	11846.9	10274.9	-59.0	-67.0	32.1	214.2	339.3	339.5

STATION: BAO, ERIE
DATE: 3/25/82
TIME: 1328 MST
EXPERIMENT: BUCOE
LAUNCH NO: 11

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	KT.		
SFC								2.7	2.7	8.0	340.0
1.	151.0	62.0	1873.7	301.7	160.	78.	-140.	-.2	-1.9	1.9	7.0
2.	187.0	79.0	2168.3	616.3	120.	-15.	-119.	-5.5	2.1	5.9	111.1
3.	268.0	76.0	2626.0	1054.0	263.	-263.	-9.	-3.7	4.6	5.8	141.2
4.	304.0	77.0	2827.2	1255.2	290.	-240.	162.	7.2	1.4	7.3	259.0
5.	67.0	83.0	3183.8	1611.8	198.	182.	77.	17.0	-2.4	17.1	278.0
6.	89.0	68.0	3569.5	1997.5	807.	807.	14.	18.1	-2.0	18.2	276.3
7.	92.0	61.0	3914.5	2342.5	1298.	1298.	-45.	18.0	-6.3	19.1	289.2
8.	101.0	54.0	4263.2	2691.2	1955.	1919.	-373.	19.1	-14.7	24.1	307.5
9.	111.0	49.0	4626.7	3054.7	2655.	2479.	-952.	21.8	-20.9	30.2	313.8
10.	117.0	43.0	4990.2	3418.2	3666.	3266.	-1664.	23.1	-21.1	31.3	312.4
11.	120.0	40.0	5353.7	3781.7	4507.	3903.	-2253.	26.7	-19.0	32.8	305.4
12.	120.0	36.0	5695.4	4123.4	5675.	4915.	-2838.	29.4	-17.0	34.0	300.0
13.	120.0	34.0	6027.8	4455.8	6606.	5721.	-3303.	30.0	-12.3	32.4	292.3
14.	118.0	32.0	6360.2	4788.2	7663.	6766.	-3597.	30.5	-14.7	33.8	295.8
15.	119.0	30.5	6691.5	5119.5	8691.	7602.	-4214.	29.7	-18.9	35.2	302.5
16.	119.0	29.0	7021.5	5449.5	9831.	8598.	-4766.	28.3	-15.7	32.4	299.0
17.	119.0	28.4	7351.4	5779.4	10689.	9349.	-5182.	30.6	-17.0	35.0	299.0
18.	119.0	27.0	7681.4	6109.4	11990.	10487.	-5813.	33.1	-18.3	37.8	299.0
19.	119.0	26.3	8008.0	6436.0	13022.	11390.	-6313.	34.7	-19.2	39.6	299.0
20.	119.0	25.0	8304.4	6732.4	14438.	12628.	-7000.	31.9	-22.7	39.1	305.4
21.	120.0	24.5	8600.9	7028.9	15423.	13357.	-7712.	28.6	-15.8	32.6	299.0
22.	119.0	24.0	8897.3	7325.3	16453.	14390.	-7977.	38.0	-16.1	41.3	292.9
23.	119.0	23.0	9193.8	7621.8	17956.	15704.	-8705.	44.6	-24.7	50.9	299.0
24.	119.0	22.0	9490.2	7918.2	19598.	17141.	-9501.	33.7	-18.7	38.5	299.0
25.	119.0	22.0	9786.7	8214.7	20332.	17783.	-9857.	23.6	-6.3	24.5	284.9
26.	118.0	22.0	10083.1	8511.1	21066.	18600.	-9890.	43.1	-9.1	44.0	281.9
27.	117.0	21.0	10379.6	8807.6	22944.	20444.	-10417.	62.7	-17.3	65.1	285.5
28.	116.0	20.0	10672.5	9100.5	25003.	22473.	-10961.	64.7	-24.3	69.1	290.6
29.	116.0	19.0	10933.7	9361.7	27188.	24437.	-11919.	43.4	-21.2	48.3	296.0
30.	116.0	19.0	11207.6	9635.6	27984.	25152.	-12267.	23.2	-11.3	25.8	[illegible]

STATION: BAO, ERIE
DATE: 4/9/82
TIME: 1710 MST
EXPERIMENT: BUCOE
LAUNCH NO: 13

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC							-9.4	-9.4	10.0	110.0
1.	234.5	35.8	293.0	406.	-331.	-236.	-7.9	-2.2	8.2	74.7
2.	254.7	49.2	586.1	506.	-488.	-133.	-7.1	3.5	7.9	116.2
3.	268.5	48.8	879.1	770.	-769.	-20.	-7.0	5.2	8.7	126.9
4.	281.6	52.8	1233.3	936.	-917.	188.	.5	9.0	9.0	183.0
5.	305.8	59.5	1549.2	913.	-740.	534.	9.0	9.3	12.9	224.2
6.	334.7	64.9	1797.2	842.	-360.	761.	11.9	7.0	13.8	239.5
7.	359.6	63.6	1946.1	966.	-7.	966.	12.0	4.6	12.9	248.9
8.	20.0	62.0	2095.0	1114.	381.	1047.	13.8	2.3	14.0	260.7
9.	37.4	58.2	2243.9	1391.	845.	1105.	15.0	1.5	15.1	264.2
10.	48.9	54.3	2414.8	1735.	1308.	1141.	17.0	2.2	17.1	262.5
11.	56.7	50.1	2709.8	2266.	1894.	1244.	15.7	3.0	16.0	259.3
12.	59.8	48.8	3006.9	2632.	2275.	1324.	13.4	2.9	13.7	257.8
13.	62.4	48.0	3410.4	3071.	2721.	1423.	15.7	4.1	16.2	255.5
14.	64.1	46.6	3813.8	3607.	3244.	1575.	17.6	4.0	18.1	257.1
15.	66.3	45.4	4217.3	4159.	3808.	1672.	20.4	.9	20.4	267.5
16.	70.1	44.0	4626.4	4791.	4505.	1631.	27.1	-1.6	27.1	273.4
17.	74.0	41.5	5044.1	5701.	5481.	1572.	37.3	.5	37.3	269.3
18.	76.3	37.7	5415.8	7007.	6808.	1660.	47.5	5.7	47.8	263.1
19.	77.1	33.7	5754.0	8628.	8410.	1926.	53.5	7.6	54.0	261.9
20.	78.1	30.5	6084.7	10330.	10108.	2130.	62.8	5.3	63.0	265.2
21.	79.6	27.0	6363.6	12489.	12284.	2255.	60.7	3.9	60.8	266.4
22.	80.3	25.0	6554.3	14056.	13855.	2368.	58.5	7.5	59.0	262.7
23.	80.3	22.7	6745.1	16125.	15894.	2717.	68.8	12.3	69.9	259.9
24.	80.2	20.8	6977.5	18369.	18100.	3127.	74.8	14.0	76.1	259.4
25.	80.1	19.2	7251.6	20824.	20514.	3580.	81.7	9.4	82.3	263.4
26.	80.9	17.8	7525.7	23440.	23145.	3707.	79.7	-3.8	79.8	272.7

27.	82.5	17.0	7843.3	25654.	25435.	3349.	70.5	-10.9	71.4	278.8
28.	83.7	16.4	8142.7	27667.	27500.	3036.	63.6	-7.6	64.0	276.8
29.	84.4	15.8	8347.4	29499.	29358.	2879.	63.8	-3.7	63.9	273.3
30.	84.9	15.2	8576.0	31565.	31440.	2806.	60.7	-4.4	60.9	274.2
31.	85.5	14.9	8836.0	33208.	33106.	2606.	52.9	-10.1	53.8	280.8
32.	86.4	14.7	9122.4	34773.	34704.	2183.	46.6	-16.8	49.5	289.8
33.	87.5	14.6	9381.9	36018.	35983.	1571.	40.0	-17.5	43.7	293.6
34.	88.3	14.5	9618.6	37192.	37176.	1103.	38.8	-13.5	41.1	289.2
35.	88.9	14.4	9855.3	38384.	38377.	737.	39.1	-11.2	40.7	285.9
36.	89.4	14.3	10091.9	39592.	39590.	415.	39.5	-9.6	40.7	283.7
37.	89.8	14.2	10328.6	40818.	40818.	143.	40.0	-9.1	41.1	282.8
38.	90.2	14.1	10565.3	42062.	42062.	-147.	35.3	-14.5	38.2	292.3
39.	91.0	14.1	10802.0	43004.	42998.	-751.	30.1	-21.2	36.9	305.2
40.	91.9	14.1	11038.6	43947.	43923.	-1457.	27.1	-18.2	32.6	303.8
41.	92.4	14.1	11230.5	44710.	44671.	-1872.	23.1	-11.0	25.6	295.6
42.	92.7	14.1	11403.0	45397.	45347.	-2139.	21.8	-10.0	24.0	294.7
43.	93.1	14.1	11575.6	46084.	46017.	-2492.	22.2	-11.6	25.1	297.7
44.	93.5	14.1	11756.4	46804.	46717.	-2857.	24.3	-12.1	27.2	296.5
45.	93.9	14.1	11963.3	47628.	47517.	-3240.	25.8	-13.9	29.3	298.4
46.	94.4	14.1	12170.6	48453.	48310.	-3717.	27.1	-15.8	31.4	300.3
47.	94.9	14.1	12400.5	49368.	49188.	-4217.	28.4	-16.4	32.8	300.1
48.	95.4	14.1	12630.4	50284.	50061.	-4732.	29.9	-20.0	36.0	303.8
49.	96.1	14.1	12892.0	51325.	51035.	-5454.	32.9	-12.0	35.1	290.1
50.	96.0	14.1	13157.2	52381.	52094.	-5475.	32.3	-18.6	37.3	300.0
51.	97.1	14.1	13422.3	53436.	53027.	-6605.	30.2	-36.6	47.5	320.5

STATION: BAO, ERIE
DATE: 3/25/82
TIME: 1328 MST
EXPERIMENT: BUCOE
LAUNCH NO: 11

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTMSL M.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	3068.4	1496.4	14.0	-.5	14.0	271.9
500.0	5659.7	4087.7	29.2	-17.2	33.9	300.6
400.0	7292.3	5720.3	30.2	-16.7	34.5	299.0
300.0	9334.6	7762.6	39.4	-21.8	45.0	299.0
250.0	10446.3	8874.3	63.2	-18.9	66.0	286.6

STATION: BAO, ERIE
DATE: 4/9/82
TIME: 1710 MST
EXPERIMENT: BUCOE
LAUNCH NO: 13

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	836.1	1572.0	.0	7.8	-14.2	19.3	281.2	295.7	317.3
3.15	746.2	2495.0	923.0	-.5	-17.1	23.0	272.9	296.5	312.0
4.28	708.4	2907.5	1335.5	-4.4	-18.7	27.4	269.0	296.6	308.5
5.67	672.0	3320.0	1748.0	-8.3	-19.8	34.7	265.1	296.8	305.8
9.85	619.8	3942.5	2370.5	-12.7	-21.0	45.9	260.6	298.6	305.3
11.98	570.2	4570.9	2998.9	-19.5	-22.9	71.5	253.8	297.9	301.9
15.60	466.4	6031.3	4459.3	-30.7	-32.9	79.4	242.5	301.5	303.1
17.39	419.2	6779.1	5207.1	-37.1	-39.9	72.8	236.1	302.7	303.6
18.65	393.8	7210.3	5638.3	-38.2	-41.2	71.3	235.0	306.7	307.6
20.63	357.6	7865.0	6293.0	-44.5	-48.2	63.8	228.6	306.8	307.3
23.50	329.4	8412.5	6840.5	-46.7	-52.0	51.7	226.5	311.2	311.6
26.00	296.8	9097.7	7525.7	-50.7	-55.6	53.1	222.5	314.9	315.2
27.84	271.4	9682.0	8110.0	-49.8	-56.9	39.6	223.4	324.4	324.8
29.57	257.2	10036.2	8464.2	-46.5	-55.2	33.4	226.6	334.2	334.8
31.50	238.4	10538.1	8966.1	-48.3	-59.3	24.0	224.9	338.9	339.4
32.30	229.6	10788.3	9216.3	-43.8	-56.4	20.6	229.3	349.3	350.3
40.30	172.4	12681.6	11109.6	-51.3	-64.4	16.9	221.9	366.9	367.4
43.76	157.2	13278.8	11706.8	-53.3	-66.2	17.0	219.9	373.2	373.7
45.98	146.4	13738.0	12166.0	-52.5	-65.5	17.0	220.7	382.3	382.9
48.10	135.8	14225.4	12653.4	-51.0	-64.2	16.9	222.2	393.3	394.1
51.43	118.4	15108.3	13536.3	-55.7	-67.2	20.0	217.5	400.3	400.8

STATION: BAO, ERIE
DATE: 4/9/82
TIME: 1710 MST
EXPERIMENT: BUCOE
LAUNCH NO: 13

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	836.1	1572.0	.0	7.8	-14.2	19.3	281.2	295.7	317.3
4.60	700.0	3001.4	1429.4	-5.1	-19.3	27.8	268.2	296.8	308.1
14.32	500.0	5536.0	3964.0	-27.0	-29.1	80.7	246.2	300.1	302.3
18.32	400.0	7109.3	5537.3	-37.9	-41.1	69.6	235.3	305.7	306.6
25.83	300.0	9039.8	7467.8	-50.2	-54.8	55.3	223.0	314.6	314.9
30.34	250.0	10238.3	8666.3	-47.2	-57.2	27.9	225.9	335.8	336.4
36.50	200.0	11713.8	10141.8	-47.5	-61.2	16.8	225.6	357.5	358.2
45.20	150.0	13595.3	12023.3	-52.2	-65.2	17.0	221.0	380.2	380.7

STATION: BAO, ERIE
DATE: 4/9/82
TIME: 1710 MST
EXPERIMENT: BUCOE
LAUNCH NO: 13

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1430.7	5.5	10.0	11.5	208.8
500.0	3986.6	18.9	2.8	19.1	261.5
400.0	5533.0	49.5	6.4	49.9	262.7
300.0	7458.5	80.4	-.6	80.4	270.4
250.0	8656.4	58.3	-6.4	58.7	276.2
200.0	10196.0	39.8	-9.4	40.9	283.3
150.0	12012.9	26.1	-14.4	29.8	298.8

STATION: BAO, ERIE
DATE: 4/15/82
TIME: 1718 MST
EXPERIMENT: BUCOE
LAUNCH NO: 14

TIME MIN	PRES MB	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	828.2	1572.0	.0	17.1	-7.6	17.7	290.7	306.3	340.3
8.80	626.6	3855.5	2283.5	-5.2	-12.7	51.7	268.3	306.3	319.3
12.95	543.6	4949.7	3377.7	-15.8	-16.8	91.6	257.6	306.3	312.3
13.69	535.0	5070.0	3498.0	-15.8	-17.2	87.9	257.6	307.7	312.5
16.48	484.6	5807.6	4235.6	-21.8	-23.5	84.3	251.5	309.2	313.1
19.90	422.8	6796.0	5224.0	-30.0	-32.3	78.7	243.2	311.0	313.0
24.02	352.0	8072.3	6500.3	-40.8	-44.4	65.9	232.3	313.2	313.9
26.72	326.2	8534.7	7012.7	-45.9	-50.2	59.0	227.3	313.1	313.6
30.18	301.0	9115.8	7543.8	-49.4	-54.9	49.7	223.8	315.4	315.8
33.89	265.8	9919.8	8347.8	-55.5	-61.0	47.5	217.7	318.0	318.2
35.07	254.7	10191.7	8619.7	-55.6	-61.3	46.5	217.5	321.7	321.9

STATION: BAO, ERIE
DATE: 4/15/82
TIME: 1718 MST
EXPERIMENT: BUCOE
LAUNCH NO: 14

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	828.2	1572.0	.0	17.1	-7.6	17.7	290.7	306.3	348.3
3.91	700.0	2975.4	1403.4	5.6	-11.3	28.4	279.1	308.7	332.1
15.77	500.0	5596.8	4024.8	-20.5	-22.7	80.2	252.8	308.1	312.3
21.72	400.0	7204.4	5632.4	-34.1	-36.5	76.7	239.1	310.7	312.1
30.28	300.0	9281.2	7709.2	-19.5	-23.8	65.8	253.9	357.9	366.9

STATION: BAO, ERIE
DATE: 4/15/82
TIME: MST
EXPERIMENT: BUCOE
LAUNCH NO: 14

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								2.0	2.0	2.0	270.0
1.	172.1	44.3	1831.5	259.5	266.	37.	-263.	2.6	-8.7	9.0	343.1
2.	163.1	42.9	2091.0	519.0	558.	162.	-534.	4.2	-8.8	9.8	334.3
3.	159.7	42.1	2350.4	778.4	862.	299.	-808.	4.3	-7.7	8.8	331.0
4.	157.1	43.4	2609.9	1037.9	1098.	427.	-1011.	4.0	-2.9	4.9	305.7
5.	151.0	49.0	2869.4	1297.4	1128.	547.	-986.	3.6	-.0	3.6	270.7
6.	147.4	52.3	3128.9	1556.9	1203.	648.	-1014.	2.3	.3	2.3	261.3
7.	144.6	56.9	3388.4	1816.4	1184.	686.	-965.	-1.1	1.8	2.1	148.2
8.	147.3	62.7	3647.9	2075.9	1071.	579.	-902.	-5.7	3.0	6.6	116.9
9.	157.5	70.1	3908.2	2336.2	846.	324.	-781.	-9.0	5.6	10.6	121.8
10.	177.6	77.9	4171.9	2599.9	557.	23.	-557.	-9.9	7.8	12.6	128.4
11.	224.0	81.8	4435.5	2863.5	413.	-287.	-297.	-8.7	10.9	13.9	141.2
12.	232.4	80.4	4699.2	3127.2	529.	-517.	114.	-4.2	12.4	13.1	161.1
13.	310.4	78.0	4957.8	3385.8	720.	-548.	466.	.7	13.5	13.6	183.1
14.	333.6	73.5	5152.0	3580.0	1060.	-472.	950.	4.6	16.8	17.5	195.2
15.	350.0	68.3	5416.3	3844.3	1530.	-266.	1507.	7.5	18.7	20.1	201.8
16.	359.7	62.9	5680.7	4108.7	2103.	-11.	2103.	9.6	17.8	20.2	208.3
17.	7.1	59.1	5957.9	4385.9	2625.	324.	2605.	10.8	15.9	19.2	214.2
18.	12.0	56.0	6246.9	4674.9	3153.	656.	3084.	10.9	15.3	18.8	215.5
19.	15.7	53.4	6535.9	4963.9	3687.	998.	3549.	11.2	13.9	17.8	219.0
20.	18.9	51.6	6827.0	5255.0	4165.	1349.	3940.	11.9	12.7	17.5	223.1
21.	21.8	50.0	7136.8	5564.8	4669.	1734.	4335.	13.5	11.6	17.8	229.3
22.	25.1	48.8	7446.5	5874.5	5143.	2182.	4657.	14.0	9.6	16.9	235.6
23.	27.8	48.0	7756.3	6184.3	5568.	2597.	4926.	15.6	8.0	17.5	242.8
24.	31.4	47.1	8066.1	6494.1	6035.	3144.	5151.	21.2	5.8	22.0	254.8
25.	36.5	45.5	8258.3	6686.3	6571.	3908.	5282.	25.2	5.4	25.8	258.0
26.	40.6	43.6	8448.0	6876.0	7221.	4699.	5482.	25.7	5.0	26.1	259.0

27.	44.5	42.0	8627.6	7055.6	7836.	5492.	5589.	28.4	4.6	28.7	260.8
28.	48.2	39.8	8781.1	7209.1	8653.	6450.	5767.	31.1	6.4	31.8	258.4
29.	51.1	37.7	8934.6	7362.6	9526.	7414.	5982.	31.3	4.8	31.6	261.2
30.	54.1	36.0	9088.1	7516.1	10345.	8380.	6066.	32.8	3.1	32.9	264.6
31.	56.8	34.4	9293.5	7721.5	11277.	9436.	6175.	34.0	3.7	34.2	263.8
32.	59.0	33.0	9510.2	7938.2	12224.	10478.	6296.	33.9	4.3	34.1	262.7
33.	60.8	31.7	9726.9	8154.9	13204.	11526.	6442.	34.8	5.8	35.3	260.5
34.	62.2	30.4	9945.1	8373.1	14272	12624.	6656.	35.0	5.2	35.4	261.5
35.	63.7	29.4	10175.6	8603.6	15269.	13688.	6765.	34.5	3.5	34.6	264.1

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0003 MST
EXPERIMENT: BUCOE
LAUNCH NO: 16

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	848.1	1572.0	.0	-2.2	-12.9	39.3	271.2	284.0	295.3
2.60	761.8	2412.5	840.5	-9.7	-18.0	46.7	263.6	284.8	291.5
4.40	704.0	3015.4	1443.4	-15.1	-24.1	42.1	258.2	285.3	289.9
7.00	621.4	3945.9	2373.9	-22.3	-28.7	52.6	250.9	287.4	290.1
8.10	587.4	4355.5	2783.5	-27.0	-30.4	70.8	246.2	286.6	288.3
8.80	570.8	4561.9	2989.9	-27.8	-30.4	76.7	245.4	288.0	289.7
11.50	507.2	5399.9	3827.9	-34.2	-36.8	74.7	239.0	290.2	291.2
13.60	456.0	6140.2	4568.2	-37.1	-40.0	72.0	236.1	295.5	296.3
16.70	382.2	7336.6	5764.6	-46.5	-50.7	59.6	226.6	298.4	298.8
17.20	375.8	7448.8	5876.8	-45.8	-51.6	49.1	227.4	300.8	301.2
20.50	305.8	8823.2	7251.2	-45.2	-53.8	34.2	227.9	319.9	320.4
25.00	284.2	9310.7	7738.7	-46.7	-56.7	27.9	226.5	324.6	325.1
30.00	234.8	10568.3	8996.3	-49.9	-60.1	26.1	223.3	337.9	338.3
31.90	221.0	10964.9	9392.9	-49.3	-60.1	24.5	223.9	344.7	345.2
35.40	192.5	11870.8	10298.8	-49.0	-59.9	24.0	224.2	359.1	359.7
36.80	182.0	12238.6	10666.6	-49.5	-60.3	24.0	223.7	364.2	364.8
41.80	150.2	13496.9	11924.9	-49.5	-60.3	24.0	223.7	384.7	385.5
44.50	135.2	14188.1	12616.1	-48.3	-59.7	22.7	224.9	398.6	399.7
45.30	131.4	14375,4	12803.4	-49.5	-60.7	22.7	223.7	399.7	400.7
47.30	120.8	14922.8	13350.8	-52.5	-63.3	23.3	220.7	403.9	404.6
51.10	99.8	16148.1	14576.1	-55.7	-67.2	20.0	217.5	420.4	421.0

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0003 MST
EXPERIMENT: BUCOE
LAUNCH NO: 16

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	848.1	1572.0	.0	-2.2	-12.9	39.3	271.2	284.0	295.3
4.50	700.0	3058.6	1486.6	-15.5	-24.5	42.0	257.7	285.3	289.7
12.40	500.0	5493.5	3926.5	-35.8	-38.6	72.7	237.4	289.4	290.3
15.90	400.0	7018.7	5446.7	-45.4	-49.2	62.5	227.8	296.0	296.4
23.41	300.0	8933.8	7361.8	-46.4	-56.4	28.3	226.8	320.0	320.5
28.20	250.0	10139.8	8567.8	-48.3	-58.7	26.0	224.9	334.3	334.8
34.40	200.0	11607.6	10035.6	-48.9	-59.8	24.0	224.3	355.4	356.0
41.81	150.0	13495.1	11923.1	-49.5	-60.3	24.0	223.7	384.9	385.7
51.05	100.0	16114.8	14542.8	-55.7	-67.2	20.0	217.5	420.2	420.8

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0003 MST
EXPERIMENT: BUCOE
LAUNCH NO: 16

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								.0	.0	12.0	.0
1.	179.5	31.9	1895.3	323.3	519.	5.	-519.	-.6	-18.3	18.3	2.0
2.	182.0	29.8	2218.5	646.5	1129.	-39.	-1128.	-1.4	-21.1	21.2	3.8
3.	182.6	28.1	2546.4	974.4	1825.	-83.	-1823.	-2.5	-22.9	23.0	6.3
4.	184.4	27.2	2881.4	1309.4	2548.	-195.	-2540.	-4.0	-26.0	26.3	8.8
5.	185.5	25.7	3230.1	1658.1	3445.	-330.	-3429.	-4.0	-27.9	28.2	8.1
6.	185.9	25.2	3588.0	2016.0	4284.	-440.	-4262.	-1.5	-24.8	24.8	3.6
7.	184.9	25.5	3945.9	2373.9	4977.	-425.	-4959.	1.2	-20.0	20.0	356.5
8.	183.8	26.5	4318.3	2746.3	5508.	-365.	-5496.	3.7	-16.2	16.6	347.2
9.	181.9	27.1	4623.9	3051.9	5964.	-198.	-5961.	8.6	-13.4	15.9	327.3
10.	178.5	28.0	4934.3	3362.3	6324.	166.	-6321.	14.5	-9.3	17.2	302.6
11.	173.9	29.2	5244.7	3672.7	6571.	698.	-6534.	18.3	-4.8	19.0	284.7
12.	168.9	30.7	5576.1	4004.1	6744.	1298.	-6618.	22.6	2.2	22.7	264.5
13.	161.9	32.9	5928.7	4356.7	6734.	2092.	-6401.	31.5	12.3	33.9	248.6
14.	151.0	35.2	6294.6	4722.6	6695.	3246.	-5855.	42.4	18.0	46.1	247.0
15.	138.3	35.8	6680.5	5108.5	7083.	4712.	-5289.	47.9	18.6	51.4	248.8
16.	127.2	35.2	7066.4	5494.4	7789.	6204.	-4709.	51.4	17.2	54.2	251.5
17.	118.2	33.1	7403.9	5831.9	8946.	7884.	-4228.	63.9	12.5	65.1	258.9
18.	111.2	29.7	7782.0	6210.0	10887.	10150.	-3937.	68.8	9.1	69.4	262.4
19.	106.8	27.6	8198.5	6626.5	12675.	12134.	-3664.	87.1	8.9	87.6	264.1
20.	102.3	23.9	8614.9	7042.9	15893.	15528.	-3386.	95.2	10.0	95.7	264.0
21.	99.6	21.8	8877.3	7305.3	18265.	18009.	-3046.	75.4	10.1	76.0	262.4
22.	97.8	20.0	8985.7	7413.7	20369.	20180.	-2764.	68.1	9.0	68.7	262.5
23.	96.4	18.6	9094.0	7522.0	22351.	22212.	-2491.	65.9	9.0	66.5	262.2
24.	95.2	17.4	9202.3	7630.3	24348.	24248.	-2207.	64.9	8.4	65.5	262.6
25.	94.3	16.4	9310.7	7738.7	26294.	26220.	-1972.	66.6	4.4	66.8	266.2
26.	93.9	15.7	9562.2	7990.2	28426.	28360.	-1933.	72.5	-.2	72.5	270.2

27.	93.7	15.0	9813.7	8241.7	30759.	30694.	-1985.	67.7	-1.8	67.8	271.6
28.	93.6	14.6	10065.3	8493.2	32606.	32542.	-2047.	57.4	-3.7	57.5	273.7
29.	93.7	14.3	10316.8	8744.8	34307.	34236.	-2214.	60.3	-7.9	60.8	277.5
30.	94.0	13.9	10568.3	8996.3	36352.	36264.	-2536.	60.0	-11.4	61.0	280.8
31.	94.4	13.6	10777.1	9205.0	38049.	37937.	-2919.	50.8	-11.4	52.1	282.6
32.	94.7	13.4	10990.8	9418.8	39536.	39403.	-3240.	51.3	-11.0	52.5	282.1
33.	95.0	13.2	11249.6	9677.6	41261.	41104.	-3596.	50.7	-9.0	51.4	280.1
34.	95.1	13.1	11508.4	9936.4	42699.	42530.	-3796.	46.5	-7.8	47.1	279.6
35.	95.3	13.0	11767.2	10195.2	44160.	43972.	-4079.	47.3	-8.1	48.0	279.7
36.	95.4	12.9	12028.4	10456.4	45655.	45452.	-4297.	48.8	-1.8	48.8	272.2
37.	95.1	12.8	12289.0	10717.0	47171.	46984.	-4193.	42.8	1.4	42.8	268.1
38.	95.0	12.8	12540.6	10968.6	48279.	48095.	-4208.	42.6	.4	42.6	269.4
39.	94.8	12.7	12792.3	11220.3	49788.	49614.	-4166.	49.6	1.5	49.6	268.3
40.	94.6	12.6	13043.9	11471.9	51322.	51157.	-4116.	43.2	-.7	43.2	270.9
41.	94.6	12.6	13295.6	11723.6	52448.	52279.	-4206.	43.6	-3.5	43.7	274.6
42.	94.6	12.5	13548.1	11976.1	54021.	53847.	-4333.	44.0	-3.5	44.2	274.6
43.	94.6	12.5	13804.1	12232.1	55176.	54998.	-4425.	44.9	-3.6	45.0	274.6
44.	94.6	12.4	14060.1	12488.1	56799.	56616.	-4555.	44.5	-.3	44.5	270.4
45.	94.4	12.4	14305.2	12733.2	57914.	57743.	-4443.	37.1	-4.7	37.4	277.2
46.	94.7	12.4	14567.0	12995.0	59105.	58906.	-4843.	39.8	3.8	40.0	264.6
47.	94.0	12.4	14840.7	13268.7	60349.	60202.	-4210.	44.1	15.6	46.8	250.5
48.	93.6	12.4	15148.5	13576.5	61749.	61628.	-3877.	47.2	11.0	48.5	256.9
49.	93.2	12.4	15470.9	13898.9	63216.	63117.	-3529.	48.4	15.3	50.8	252.5
50.	92.6	12.4	15793.4	14221.4	64683.	64616.	-2934.	48.2	12.3	49.7	255.7
51.	92.4	12.4	16115.8	14543.8	66149.	66091.	-2770.	47.8	5.3	48.1	263.7

STATION: BAO,ERIE
DATE: 4/20/82
TIME: 0003 MST
EXPERIMENT: BUCOE
LAUNCH NO: 16

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTMSL M.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	3060.4	1488.4	-4.0	-27.0	27.3	8.4
500.0	5504.0	3932.0	21.9	.4	21.9	268.9
400.0	7048.0	5476.0	51.2	17.3	54.1	251.4
300.0	8954.1	7382.1	70.2	9.3	70.8	262.5
250.0	10181.3	8609.3	58.8	-5.6	59.0	275.4
200.0	11632.4	10060.4	46.9	-8.0	47.5	279.6
150.0	13506.1	11934.1	44.0	-3.5	44.1	274.6
100.0	16136.4	14564.4	47.9	5.0	48.2	264.0

STATION: BAO, ERIE

DATE: 4/20/82
TIME: 0408 MST
EXPERIMENT: BUCOE
LAUNCH NO: 17

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								6.0	6.0	6.0	270.0
1.	183.3	29.8	1835.1	263.1	459.	-26.	-459.	.0	-18.2	18.2	360.0
2.	180.0	27.7	2160.3	588.3	1121.	0.	-1121.	.7	-22.2	22.3	358.1
3.	179.4	26.5	2485.5	913.5	1832.	19.	-1832.	.5	-23.0	23.0	358.7
4.	179.3	25.7	2793.9	1221.9	2539.	31.	-2539.	-1.1	-22.7	22.7	2.9
5.	180.9	25.3	3100.5	1528.5	3233.	-51.	-3233.	-5.5	-22.1	22.8	13.9
6.	184.5	25.1	3407.0	1835.0	3917.	-307.	-3905.	-5.1	-18.0	18.7	15.8
7.	184.8	25.9	3689.9	2117.9	4362.	-365.	-4346.	-.2	-14.5	14.5	.7
8.	183.8	26.0	3917.7	2345.7	4809.	-319.	-4799.	3.8	-16.4	16.8	347.0
9.	181.4	25.7	4151.6	2579.6	5360.	-131.	-5358.	4.3	-16.7	17.3	345.5
10.	180.5	25.8	4391.4	2819.4	5832.	-51.	-5832.	2.7	-16.2	16.4	350.7
11.	179.7	25.7	4631.1	3059.1	6356.	33.	-6356.	1.2	-13.1	13.1	356.1
12.	179.8	25.4	4870.9	3298.9	6947.	24.	-6947.	4.3	-16.6	17.2	345.6
13.	177.7	25.6	5112.7	3540.7	7390.	297.	-7384.	12.5	-12.7	17.8	315.3
14.	174.1	26.1	5378.6	3806.6	7770.	799.	-7729.	18.8	-5.5	19.6	286.3
15.	169.3	27.6	5681.3	4109.3	7860.	1459.	-7724.	25.5	4.0	25.8	261.1
16.	162.4	29.0	5923.7	4351.7	7851.	2374.	-7483.	32.5	7.5	33.3	257.0
17.	154.5	29.5	6124.0	4552.0	8046.	3464.	-7262.	34.1	6.1	34.6	259.9
18.	147.8	29.5	6324.4	4752.4	8400.	4476.	-7108.	35.5	4.9	35.9	262.2
19.	140.9	29.0	6543.8	4971.8	8969.	5657.	-6961.	38.5	3.0	38.6	265.6
20.	135.3	28.1	6772.6	5200.6	9740.	6851.	-6923.	44.2	1.2	44.2	268.4
21.	129.4	26.5	6981.4	5409.4	10850.	8384.	-6887.	51.9	-2.4	52.0	272.6
22.	125.1	24.8	7252.4	5680.4	12293.	10058.	-7069.	59.1	-.1	59.1	270.1
23.	119.8	23.1	7486.9	5914.9	13867.	12034.	-6892.	70.0	4.9	70.2	266.0
24.	115.2	21.1	7704.5	6132.5	15893.	14380.	-6767.	78.5	4.5	78.7	266.7
25.	111.4	19.3	7922.0	6350.0	18133.	16383.	-6616.	82.4	7.8	82.7	264.6
26.	107.9	17.8	8139.5	6567.5	20455.	19465.	-6287.	80.6	13.0	81.6	[illegible]

27.	104.9	16.7	8357.1	6785.1	22616.	21855.	-5815.	84.1	15.5	85.5	257.6
28.	102.2	15.8	8710.5	7138.5	25227.	24657.	-5331.	87.5	14.8	88.7	260.4
29.	100.2	15.1	9044.5	7472.5	27694.	27256.	-4904.	86.1	17.3	87.9	258.7
30.	98.1	14.3	9289.5	7717.5	30277.	29975.	-4268.	91.0	7.4	91.3	265.3
31.	97.7	13.5	9536.2	7964.2	33173.	32874.	-4445.	95.7	-2.3	95.8	271.4
32.	97.0	12.8	9786.2	8214.2	36155.	35885.	-4406.	85.8	-1.7	85.6	271.2
33.	96.8	12.4	10023.7	8451.7	38441.	38170.	-4552.	80.6	-6.4	80.8	274.5
34.	96.7	11.9	10241.8	8669.8	41141.	40860.	-4800.	90.9	-9.6	91.4	276.0
35.	96.7	11.4	10460.1	8888.1	44080.	43779.	-5143.	78.6	-9.2	79.2	276.7
36.	96.7	11.2	10685.7	9113.7	46027.	45713.	-5370.	56.5	-8.0	57.1	278.1
37.	96.8	11.1	10911.3	9339.2	47603.	47268.	-5636.	50.6	-10.2	51.7	281.3
38.	97.0	11.0	11136.8	9564.8	49207.	48840.	-5997.	44.0	-9.5	45.0	282.3
39.	97.1	11.0	11362.4	9790.4	50367.	49981.	-6226.	37.0	-7.5	37.7	281.4
40.	97.2	11.0	11588.0	10016.0	51528.	51121.	-6458.	37.1	-6.1	37.6	279.4
41.	97.2	11.0	11813.5	10241.5	52688.	52273.	-6604.	37.9	-.2	37.9	270.3
42.	96.9	11.0	12039.1	10467.1	53849.	53459.	-6469.	38.2	3.0	38.4	265.5
43.	96.7	11.0	12264.7	10692.7	55009.	54633.	-6418.	37.7	-1.4	37.7	272.1
44.	96.7	11.0	12490.2	10918.2	56169.	55786.	-6553.	37.9	.4	37.9	269.3
45.	96.4	11.0	12715.8	11143.8	57330.	56973.	-6391.	38.0	2.2	38.1	266.7
46.	96.3	11.0	12940.6	11368.6	58486.	58133.	-6418.	37.7	.9	37.7	268.7
47	96.1	11.0	13164.6	11592.6	59639.	59301.	-6338.	37.7	1.0	37.7	268.4
48.	96.0	11.0	13388.6	11816.6	60791.	60458.	-6354.	37.8	3.0	38.0	265.5
49.	95.7	11.0	13612.6	12040.6	61944.	61637.	-6152.	37.9	3.2	38.0	265.2
50.	95.6	11.0	13836.6	12264.6	63096.	62795.	-6157.	37.3	-1.9	37.4	272.9
51.	95.6	11.0	14060.6	12488.6	64248.	63942.	-6270.	37.3	-1.8	37.4	272.8
52.	95.5	11.0	14284.6	12712.6	65401.	65100.	-6268.	37.3	-1.8	37.4	272.7
53.	95.5	11.0	14508.6	12936.6	66553.	66247.	-6379.	37.2	-3.6	37.3	275.5

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0408 MST
EXPERIMENT: BUCOE
LAUNCH NO: 17

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	849.2	1572.0	.0	-3.9	-13.2	44.1	269.5	282.1	291.9
.67	832.6	1727.8	155.8	-4.1	-12.5	47.8	269.3	283.6	293.4
3.10	752.2	2518.0	946.0	-11.3	-16.9	59.8	262.0	284.1	290.0
6.70	649.8	3621.6	2049.6	-20.4	-20.7	97.1	252.9	285.9	289.0
8.49	614.8	4029.3	2457.3	-23.2	-29.0	55.5	250.0	287.3	289.7
12.92	530.4	5091.4	3519.4	-32.1	-38.2	51.3	241.1	289.0	290.2
14.00	509.2	5378.6	3806.6	-33.5	-39.1	53.9	239.7	290.7	291.8
15.41	479.0	5805.4	4233.4	-36.2	-41.4	55.3	237.0	292.5	293.4
18.62	436.2	6448.7	4876.7	-40.9	-46.0	55.2	232.3	294.4	295.0
19.48	422.6	6664.1	5092.1	-41.0	-49.1	38.3	232.1	297.0	297.5
21.08	402.4	6998.1	5426.1	-39.5	-51.3	24.5	233.6	303.1	303.8
22.29	383.2	7332.5	5760.5	-39.8	-52.1	22.7	233.4	307.0	307.8
27.10	328.4	8378.8	6806.8	-43.5	-55.4	22.9	229.6	315.7	316.3
28.72	300.2	8975.8	7403.8	-48.7	-59.8	23.6	224.4	316.6	317.0
30.69	278.8	9456.2	7884.2	-54.1	-64.4	24.2	219.1	315.7	315.9
32.61	258.6	9938.6	8366.6	-54.2	-64.6	24.2	218.9	322.3	322.5
34.96	238.8	10451.1	8879.1	-52.8	-63.3	24.2	220.4	331.9	332.2
45.51	165.2	12830.8	11258.8	-52.5	-63.7	22.0	220.7	369.3	369.8
53.00	127.6	14508.6	12936.6	-50.2	-61.7	21.8	223.0	401.7	402.7

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0408 MST
EXPERIMENT: BUCOE
LAUNCH NO: 17

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTMSL M.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	3080.6	1508.6	-5.2	-22.2	22.8	13.2
500.0	5508.6	3936.6	22.2	-2.1	22.3	275.5
400.0	7039.9	5467.9	53.5	-1.9	53.5	272.1
300.0	8980.3	7408.3	86.4	16.8	88.0	259.0
250.0	10161.2	8589.2	87.1	-8.3	87.5	275.5
200.0	11705.6	10133.6	37.6	-3.0	37.7	274.6
150.0	13509.1	11937.1	37.8	3.1	38.0	265.3

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0805 MST
EXPERIMENT: BUCOE
LAUNCH NO: 18

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	851.4	1572.0	.0	-1.0	-6.0	65.5	272.6	285.0	297.5
2.07	798.4	2078.4	506.4	-8.1	-9.6	88.0	265.4	282.6	287.9
4.89	714.0	2936.7	1364.7	-14.1	-14.9	93.0	259.2	285.2	290.1
8.38	618.6	4008.6	2436.6	-22.2	-24.3	81.1	251.1	288.0	290.7
9.37	594.2	4304.0	2732.0	-23.1	-31.4	43.0	250.1	290.2	292.8
13.45	495.6	5603.3	4031.3	-34.3	-41.2	46.2	238.8	291.9	292.9
14.27	481.0	5812.0	4240.0	-35.4	-40.6	55.5	237.8	293.1	294.1
14.89	467.0	6017.1	4445.1	-36.7	-41.7	56.6	236.4	293.9	294.8
15.30	460.0	6121.7	4549.7	-36.6	-43.7	44.4	236.6	295.4	296.3
16.19	439.8	6431.8	4859.8	-38.2	-47.6	33.4	234.9	297.2	297.9
18.85	388.6	7278.3	5706.3	-41.1	-51.9	27.0	232.1	304.1	304.8
20.60	358.8	7820.7	6248.7	-41.1	-52.1	26.2	232.1	311.1	311.9
23.88	314.4	8705.7	7133.7	-47.7	-57.7	27.9	225.4	313.8	314.2
25.08	298.6	9045.0	7473.0	-49.2	-59.0	28.0	224.0	316.4	316.8
28.32	268.6	9737.4	8165.4	-50.6	-60.2	28.0	222.6	324.2	324.5
38.04	188.8	12048.2	10476.2	-48.2	-58.6	26.0	225.0	362.4	363.1
40.39	173.0	12624.1	11052.1	-48.2	-58.9	24.8	225.0	371.6	372.4
41.59	165.4	12919.5	11347.5	-49.2	-59.9	24.9	224.0	374.7	375.4
42.20	161.4	13080.6	11508.6	-47.7	-58.6	24.8	225.4	379.8	380.7
44.69	146.2	13731.3	12159.3	-49.4	-60.1	24.5	223.8	387.9	388.7
49.29	122.0	14917.1	13345.1	-49.5	-61.7	20.0	223.7	408.2	409.3
54.35	98.6	16308.3	14736.3	-50.7	-62.8	20.0	222.4	431.5	432.7

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0805 MST
EXPERIMENT: BUCOE
LAUNCH NO: 18

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	851.4	1572.0	.0	-1.0	-6.0	65.5	272.6	285.0	297.5
5.39	700.0	3093.5	1521.5	-15.4	-16.1	93.3	258.0	285.5	287.9
13.20	500.0	5542.8	3970.8	-34.1	-41.2	44.9	239.1	291.5	292.6
18.27	400.0	7084.4	5512.4	-40.5	-51.2	27.8	232.6	302.3	303.0
24.92	300.0	9008.0	7436.0	-49.2	-59.0	28.0	224.0	316.0	316.3
30.20	250.0	10202.3	8630.3	-49.8	-59.6	28.0	223.4	332.0	332.4
36.55	200.0	11665.9	10093.9	-48.6	-59.0	26.1	224.5	355.8	356.4
44.10	150.0	13557.9	11985.9	-48.6	-59.5	24.4	224.5	386.3	387.2
53.92	100.0	16211.2	14639.2	-50.9	-62.9	20.0	222.3	429.5	430.6

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0805 MST
EXPERIMENT: BUCOE
LAUNCH NO: 18

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								12.3	12.3	16.0	310.0
1.	179.9	20.0	1816.6	244.6	672.	1.	-672.	.7	-17.1	17.1	358.0
2.	178.0	22.5	2061.2	489.2	1181.	41.	-1180.	-1.5	-16.7	16.8	5.2
3.	183.1	24.8	2361.4	789.4	1709.	-92.	-1706.	-5.7	-16.5	17.5	19.0
4.	188.0	26.2	2665.8	1093.8	2223.	-309.	-2201.	-9.5	-13.3	16.4	35.4
5.	195.0	28.1	2970.5	1398.5	2619.	-678.	-2530.	-9.5	-9.1	13.2	46.3
6.	198.0	30.4	3277.6	1705.6	2907.	-898.	-2765.	-4.6	-7.0	8.3	33.5
7.	198.0	32.9	3584.8	2012.8	3111.	-961.	-2959.	-3.4	-7.3	8.0	24.9
8.	199.0	34.3	3891.9	2319.9	3401.	-1107.	-3216.	-2.8	-5.5	6.2	27.1
9.	199.0	36.9	4193.6	2621.6	3492.	-1137.	-3301.	-4.3	-2.9	5.2	56.0
10.	202.0	38.7	4504.6	2932.6	3661.	-1371.	-3394.	-7.6	-4.9	9.0	57.2
11.	204.0	39.5	4823.1	3251.1	3944.	-1604.	-3603.	-3.8	-6.3	7.3	31.1
12.	203.0	41.0	5141.5	3569.5	4106.	-1604.	-3780.	-.1	-3.2	3.2	2.3
13.	203.0	43.3	5460.0	3888.0	4126.	-1612.	-3798.	4.0	.8	4.1	259.1
14.	200.0	46.4	5743.3	4171.3	3972.	-1359.	-3733.	11.0	.8	11.0	265.7
15.	194.0	49.2	6045.2	4473.2	3861.	-934.	-3746.	17.9	1.0	17.9	266.7
16.	184.0	52.5	6365.6	4793.6	3678.	-257.	-3669.	20.1	4.1	20.5	258.3
17.	175.0	55.6	6689.6	5117.6	3504.	305.	-3491.	22.6	8.7	24.2	248.9
18.	160.0	58.5	7007.8	5435.8	3331.	1139.	-3130.	31.8	14.3	34.9	245.8
19.	139.0	59.0	7324.8	5752.8	3457.	2268.	-2609.	49.8	13.8	51.7	254.5
20.	118.4	51.7	7634.7	6062.7	4788.	4212.	-2277.	72.0	15.4	73.6	258.0
21.	103.9	42.6	7928.6	6356.6	6913.	6710.	-1661.	79.3	17.5	81.2	257.6
22.	97.5	35.8	8198.4	6626.4	9188.	9109.	-1199.	80.7	16.3	82.3	258.6
23.	93.2	30.5	8468.3	6896.3	11708.	11689.	-654.	86.3	15.3	87.7	259.9
24.	91.0	26.4	8739.6	7167.6	14439.	14437.	-252.	89.5	10.6	90.2	263.3
25.	90.0	23.4	9022.4	7450.4	17217.	17217.	0.	88.1	7.5	88.4	265.2
26.	89.4	21.1	9241.6	7669.6	19876.	19875.	208.	85.7	4.5	85.8	267.0

27.	89.3	19.3	9455.3	7883.3	22511.	22510.	275.	79.3	.1	79.3	269.9
28.	89.5	18.1	9669.1	8097.1	24773.	24772.	216.	71.1	-2.2	71.2	271.8
29.	89.7	17.2	9899.1	8327.1	26901.	26900.	141.	70.1	-3.5	70.2	272.9
30.	90.0	16.4	10136.8	8564.8	29101.	29101.	0.	61.5	-5.8	61.8	275.3
31.	90.4	16.0	10374.6	8802.6	30698.	30697.	-214.	49.6	-5.5	49.9	276.3
32.	90.6	15.7	10612.3	9040.3	32162.	32160.	-337.	52.1	-3.2	52.2	273.6
33.	90.7	15.3	10850.0	9278.0	33915.	33912.	-414.	50.3	-1.5	50.3	271.7
34.	90.7	15.1	11087.8	9515.8	35267.	35264.	-431.	40.2	-1.5	40.3	272.2
35.	90.8	15.0	11325.5	9753.5	36401.	36397.	-508.	41.3	.6	41.3	269.2
36.	90.6	14.8	11563.2	9991.2	37815.	37813.	-396.	42.0	2.7	42.1	266.3
37.	90.5	14.7	11801.0	10229.0	38990.	38989.	-340.	38.4	1.9	38.4	267.2
38.	90.4	14.6	12038.7	10466.7	40182.	40181.	-281.	34.5	.9	34.5	268.6
39.	90.4	14.6	12283.5	10711.5	41122.	41121.	-287.	35.4	3.3	35.5	264.6
40.	90.1	14.5	12528.5	10956.5	42366.	42366.	-74.	35.6	7.1	36.3	258.7
41.	89.8	14.5	12774.3	11202.3	43316.	43316.	151.	36.5	6.2	37.0	260.3
42.	89.6	14.4	13027.8	11455.8	44617.	44616.	312.	37.6	5.3	37.9	262.0
43.	89.4	14.4	13289.7	11717.7	45637.	45635.	478.	38.5	4.3	38.7	263.7
44.	89.3	14.3	13551.0	11979.0	46995.	46992.	574.	44.2	4.6	44.4	264.1
45.	89.1	14.2	13811.2	12239.2	48369.	48363.	760.	38.6	7.5	39.3	259.1
46.	88.8	14.2	14069.0	12497.0	49388.	49377.	1034.	32.9	6.2	33.5	259.3
47.	88.7	14.2	14326.8	12754.8	50406.	50393.	1144.	33.0	2.1	33.0	266.3
48.	88.7	14.2	14584.5	13012.5	51425.	51412.	1167.	33.0	.7	33.0	268.7
49.	88.7	14.2	14842.3	13270.3	52444.	52430.	1190.	33.8	.8	33.8	268.7
50.	88.7	14.2	15112.3	13540.3	53511.	53497.	1214.	34.8	3.9	35.0	263.6
51.	88.5	14.2	15387.2	13815.2	54597.	54578.	1429.	35.1	5.5	35.5	261.1
52.	88.4	14.2	15662.1	14090.1	55684.	55662.	1555.	35.1	2.5	35.2	265.9
53.	88.4	14.2	15937.1	14365.1	56770.	56748.	1585.	35.2	-.7	35.2	271.1
54.	88.5	14.2	16212.0	14640.0	57857.	57837.	1515.	35.3	-2.3	35.3	273.7

STATION: BAO, ERIE
DATE: 4/20/82
TIME: 0805 MST
EXPERIMENT: BUCOE
LAUNCH NO: 18

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTMSL M.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	3094.0	1522.0	-7.4	-8.5	11.2	41.1
500.0	5545.3	3973.3	6.1	1.0	6.2	261.1
400.0	7089.8	5517.8	36.4	14.7	39.2	248.0
300.0	9015.0	7443.0	88.1	7.5	88.5	265.1
250.0	10276.0	8704.0	54.5	-5.6	54.8	275.9
200.0	11723.9	10151.9	39.5	2.1	39.6	266.9
150.0	13568.6	11996.6	43.8	4.8	44.1	263.8
100.0	16225.0	14653.0	35.3	-2.4	35.4	274.0

STATION: ERIE, BAO
DATE: 4/23/82
TIME: 1125 MST
EXPERIMENT: BUCOE
LAUNCH NO: 19

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	840.9	1572.0	.0	18.6	-5.7	18.6	292.3	306.6	352.3
2.50	778.0	2228.5	656.5	10.8	-12.1	18.5	284.3	305.1	334.7
4.63	721.6	2849.4	1277.4	5.6	-16.1	19.1	279.0	306.0	328.5
9.11	604.2	4267.1	2695.1	-7.2	-16.9	41.6	266.2	307.2	318.6
11.19	561.2	4837.7	3265.7	-11.7	-22.1	37.6	261.6	308.4	316.8
14.82	495.4	5780.1	4208.1	-18.8	-34.0	21.3	254.4	311.0	316.0
15.31	487.4	5901.3	4329.3	-19.4	-34.6	21.4	253.8	311.6	316.4
16.42	471.0	6154.1	4582.1	-22.5	-37.2	21.5	250.7	310.9	314.6
17.15	455.6	6397.4	4825.4	-24.1	-36.9	26.2	249.1	311.8	315.2
17.88	440.4	6644.0	5072.0	-26.1	-38.6	26.2	247.1	312.4	315.2
18.65	425.0	6900.9	5328.9	-27.4	-40.5	24.1	245.8	313.9	316.5
21.19	381.6	7665.2	6093.2	-34.4	-46.7	24.4	238.8	314.5	316.0
23.37	353.0	8205.4	6633.4	-38.5	-50.3	24.5	234.7	316.0	317.0
26.41	313.4	9013.4	7441.4	-44.1	-54.7	26.7	229.0	319.2	319.8
28.19	294.4	9431.0	7859.0	-46.2	-56.8	26.0	226.9	321.9	322.4
31.30	257.6	10309.9	8737.9	-50.6	-60.6	26.9	222.5	328.0	328.3
34.15	229.2	11061.9	9489.9	-56.1	-65.5	27.1	217.1	330.8	331.0
38.76	188.0	12321.8	10749.8	-56.1	-65.5	27.1	217.1	350.1	350.4
42.32	160.2	13336.0	11764.0	-57.4	-66.8	26.7	215.8	364.3	364.5
53.41	98.8	16396.2	14824.2	-56.6	-66.4	25.2	216.6	419.9	420.4

STATION: BAO, ERIE
DATE: 4 23 82
TIME: 1125 MST
EXPERIMENT: BUCOE
LAUNCH NO: 19

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	840.9	1572.0	.0	18.6	-5.7	18.6	292.3	306.6	352.3
5.42	700.0	3100.8	1528.8	3.5	-18.2	18.4	276.9	306.4	326.5
14.42	500.0	5721.0	4149.0	-18.4	-31.8	26.0	254.9	310.7	315.9
20.17	400.0	7344.1	5772.1	-31.4	-43.3	26.4	241.8	314.3	316.1
27.62	300.0	9321.9	7749.9	-45.5	-56.1	26.4	227.6	321.2	321.7
32.00	250.0	10519.8	8947.8	-52.1	-62.0	26.6	221.0	328.6	328.9
37.18	200.0	11951.4	10379.4	-56.1	-65.5	27.1	217.1	344.0	344.2
43.27	150.0	13783.2	12211.2	-55.4	-65.1	26.3	217.7	374.6	375.0
53.19	100.0	16360.1	14788.1	-56.9	-66.5	26.0	216.3	417.8	418.3

STATION: BAO. ERIE
DATE: 4/23/82
TIME: 1125 MST
EXPERIMENT: BUCOE
LAUNCH NO: 19

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	182.2	.0	.0	0.	0.	0.	-7.3	2.7	7.8	110.0
1.	216.3	38.7	262.7	328.	-194.	-264.	-7.3	-7.0	10.1	46.3
2.	226.3	40.1	525.4	624.	-451.	-431.	-6.8	-3.4	7.6	63.2
3.	232.2	45.9	802.1	777.	-614.	-476.	-5.2	-2.8	5.9	62.0
4.	232.1	48.1	1092.6	980.	-774.	-602.	-5.4	-5.3	7.5	45.8
5.	229.8	48.3	1392.4	1241.	-948.	-801.	-5.6	-8.4	10.1	33.5
6.	224.9	47.2	1707.8	1581.	-1116.	-1120.	-4.4	-9.5	10.5	24.6
7.	221.2	47.6	2023.3	1848.	-1217.	-1390.	-1.0	-8.4	8.5	6.4
8.	215.6	49.2	2338.7	2019.	-1175.	-1641.	.9	-6.1	6.1	351.2
9.	213.3	51.5	2654.1	2111.	-1159.	-1765.	1.8	-1.7	2.5	313.5
10.	211.3	55.1	2932.3	2046.	-1063.	-1748.	3.3	2.9	4.4	229.1
11.	211.0	60.0	3205.9	1851.	-953.	-1587.	3.1	5.6	6.3	208.8
12.	211.9	64.5	3467.9	1654.	-874.	-1404.	3.7	4.6	5.9	219.2
13.	209.0	68.2	3727.1	1491.	-723.	-1304.	8.2	10.2	13.1	218.8
14.	205.4	77.9	3986.3	855.	-367.	-772.	10.7	19.2	22.0	209.2
15.	207.3	83.2	4243.2	133.	-61.	-119.	4.4	17.3	17.9	194.2
16.	342.0	86.0	4476.5	313.	-97.	298.	.6	13.4	13.5	182.5
17.	358.0	81.5	4764.9	712.	-25.	712.	.5	18.4	18.4	181.5
18.	357.3	74.3	5101.3	1434.	-68.	1432.	-2.0	22.5	22.5	174.8
19.	355.9	68.8	5422.8	2103.	-150.	2098.	-3.0	20.6	20.8	171.6
20.	354.6	64.6	5722.8	2717.	-256.	2705.	-3.8	20.2	20.5	169.3
21.	353.4	60.8	6022.8	3366.	-387.	3344.	-1.3	23.8	23.8	176.9
22.	355.4	56.3	6279.9	4188.	-336.	4175.	2.7	27.2	27.3	185.7
23.	357.5	52.4	6526.9	5026.	-219.	5022.	.3	30.2	30.2	180.6
24.	357.0	48.3	6785.5	6046.	-316.	6037.	-3.5	28.3	28.6	172.9
25.	356.3	46.1	7050.9	6785.	-438.	6771.	-5.3	28.4	28.9	169.5
26.	355.3	43.1	7316.3	7818.	-641.	7792.	-6.9	41.0	41.5	170.5

27.	354.7	39.0	7563.2	9340.	-863.	9300.	-5.7	34.6	35.1	170.7
28.	354.3	38.0	7797.4	9980.	-991.	9931.	-7.4	23.4	24.6	162.5
29.	353.0	36.7	8070.0	10827.	-1319.	10746.	-8.3	29.4	30.5	164.2
30.	352.7	35.2	8351.7	11839.	-1504.	11743.	-4.9	23.2	23.7	168.0
31.	352.4	35.1	8633.4	12284.	-1625.	12176.	-4.4	16.8	17.4	165.5
32.	352.1	34.6	8902.4	12905.	-1774.	12782.	-6.1	17.2	18.2	160.4
33.	351.4	34.4	9165.9	13386.	-2002.	13236.	-6.2	13.3	14.6	155.1
34.	351.0	34.4	9429.4	13771.	-2154.	13602.	-6.6	11.8	13.5	150.5
35.	350.2	34.4	9701.1	14168.	-2412.	13961.	-5.2	14.0	14.9	159.8
36.	350.3	34.2	9974.3	14677.	-2473.	14467.	.6	14.1	14.1	182.3
37.	350.9	34.3	10247.5	15022.	-2376.	14833.	1.7	13.5	13.6	187.2
38.	351.2	34.2	10520.7	15481.	-2368.	15299.	4.3	15.8	16.3	195.3
39.	352.4	34.1	10796.6	15946.	-2109.	15806.	10.5	16.8	19.9	212.1
40.	354.0	34.0	11080.9	16428.	-1717.	16338.	15.4	12.2	19.6	231.7
41.	356.0	34.4	11365.3	16599.	-1158.	16558.	17.5	4.6	18.1	255.1
42.	357.8	35.0	11649.7	16637.	-639.	16625.	17.8	3.7	18.2	258.4
43.	359.8	35.4	11927.7	16784.	-59.	16784.	19.0	7.7	20.5	248.0
44.	1.8	35.5	12202.8	17108.	537.	17099.	21.5	8.7	23.2	248.1
45.	4.2	35.7	12477.9	17365.	1272.	17318.	21.6	6.8	22.7	252.6
46.	6.1	35.9	12753.0	17618.	1872.	17518.	20.3	7.0	21.5	250.9
47.	8.1	36.0	13028.1	17932.	2527.	17753.	23.2	8.0	24.5	251.1
48.	10.4	36.0	13303.1	18310.	3305.	18009.	23.1	3.8	23.4	260.7
49.	12.4	36.4	13578.2	18417.	3955.	17987.	18.3	-1.6	18.3	275.0
50.	13.9	36.9	13853.3	18451.	4432.	17911.	16.6	1.4	16.7	265.1
51.	15.4	37.0	14128.4	18749.	4979.	18076.	21.5	7.5	22.7	250.8
52.	17.4	36.8	14403.5	19254.	5758.	18373.	25.8	7.9	27.0	253.0
53.	19.5	36.7	14678.6	19693.	6574.	18563.	26.4	4.6	26.8	260.2
54.	21.6	36.7	14954.7	20063.	7386.	18654.	26.3	3.0	26.5	263.6

STATION: BAO. ERIE
DATE: 4/23/82
TIME: 1125 MST
EXPERIMENT: BUCOE
LAUNCH NO: 19

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1535.7	-5.0	-8.9	10.3	29.4
500.0	4133.0	6.9	18.4	19.6	200.6
400.0	5756.7	-3.6	20.6	20.9	170.1
300.0	7719.0	-7.2	27.2	28.1	165.2
250.0	8918.9	-6.1	16.9	18.0	160.1
200.0	10361.5	2.7	14.5	14.7	190.6
150.0	12247.5	21.6	8.3	23.1	248.8
100.0	14731.7	26.4	4.3	26.7	260.8

STATION: BAO, ERIE
DATE: 4/27/82
TIME: 0944 MST
EXPERIMENT: BUCOE
LAUNCH NO: 20

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	842.8	1572.0	.0	7.0	5.8	92.2	281.3	294.2	314.4
.45	829.0	1707.6	135.6	5.4	3.9	90.2	279.6	293.9	312.4
2.01	781.4	2189.1	617.1	2.4	1.7	95.6	276.4	295.7	311.6
3.67	734.8	2685.0	1113.0	.2	-.4	95.6	274.2	298.6	313.3
4.31	716.6	2886.4	1314.4	.4	-3.5	75.1	274.2	300.9	316.3
4.69	698.2	3095.2	1523.2	.2	-7.4	56.5	273.9	303.0	318.8
6.87	644.4	3733.7	2161.7	-3.7	-10.9	53.3	269.8	305.5	319.8
11.39	558.0	4854.2	3282.2	-11.8	-13.6	85.4	261.6	308.8	317.1
15.05	493.2	5787.8	4215.8	-18.5	-22.5	68.2	254.8	311.7	316.9
15.98	477.4	6030.0	4458.0	-20.3	-23.3	74.3	253.1	312.5	317.1
18.97	431.4	6772.1	5200.1	-26.1	-31.9	54.8	247.1	314.2	317.1
20.05	409.4	7149.1	5577.1	-28.6	-35.2	49.4	244.6	315.7	318.2
25.91	307.0	9139.1	7567.1	-45.7	-52.8	41.5	227.5	318.9	319.4
27.11	294.4	9417.5	7845.5	-47.1	-53.5	45.1	226.1	320.7	321.2
33.19	235.2	10864.5	9292.5	-59.1	-65.4	41.5	214.1	323.8	324.0
35.45	213.6	11468.5	9896.5	-59.1	-66.2	36.4	214.1	332.9	333.0
38.01	193.8	12085.0	10513.0	-54.5	-64.9	23.9	218.7	349.6	350.0
42.58	161.2	13258.1	11686.1	-56.9	-70.3	14.9	216.3	364.5	364.8
51.40	140.0	14152.6	12580.6	-56.3	-70.0	14.2	216.9	380.6	381.0
52.15	136.2	14326.8	12754.8	-57.7	-71.3	14.2	215.4	381.0	381.3
55.08	121.2	15062.4	13490.4	-58.1	-71.8	13.7	215.1	393.3	393.7
57.05	110.2	15665.7	14093.7	-55.3	-69.5	13.4	217.9	409.4	410.0

STATION: BAO, ERIE
DATE: 4/27/82
TIME: 0944 MST
EXPERIMENT: BUCOE
LAUNCH NO: 20

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	842.8	1572.0	.0	7.0	5.8	92.2	281.3	294.2	314.4
4.80	700.0	3081.5	1509.5	.2	-7.2	57.2	273.9	302.7	318.5
14.70	500.0	5691.6	4119.6	-17.5	-21.3	69.9	255.8	311.7	317.3
20.06	400.0	7322.9	5750.9	-29.8	-36.4	49.1	243.4	316.3	318.5
26.54	300.0	9303.3	7731.3	-46.5	-53.6	41.4	226.6	319.8	320.3
31.72	250.0	10488.4	8916.4	-55.9	-62.0	43.6	217.2	322.9	323.1
37.30	200.0	11909.3	10337.3	-55.6	-64.1	31.0	217.6	344.7	345.0
49.60	150.0	13740.4	12168.4	-56.1	-69.6	14.9	217.1	373.5	373.8

STATION: BAO, ERIE
DATE: 4/27/82
TIME: 0944 MST
EXPERIMENT: BUCOE
LAUNCH NO: 20

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								-3.9	-3.9	6.0	40.0
1.	195.4	65.3	1877.4	305.4	140.	-37.	-135.	-.4	-3.5	3.5	7.0
2.	167.0	70.6	2186.1	614.1	216.	-26.	-215.	4.2	-4.1	5.9	314.1
3.	150.0	63.8	2484.9	912.9	449.	225.	-389.	8.9	-7.0	11.4	308.1
4.	140.9	55.6	2788.9	1216.9	833.	525.	-647.	7.4	-5.5	9.2	306.9
5.	137.1	57.4	3130.7	1558.7	997.	679.	-730.	5.0	-.8	5.1	279.2
6.	129.9	60.0	3453.2	1881.2	1086.	833.	-697.	3.7	5.7	6.8	213.5
7.	112.7	65.8	3765.9	2193.9	986.	910.	-381.	5.1	9.5	10.8	208.4
8.	95.6	64.7	4013.8	2441.8	1154.	1149.	-113.	9.8	7.9	12.6	230.9
9.	85.9	60.6	4261.7	2689.7	1516.	1512.	108.	12.6	6.7	14.3	242.2
10.	81.2	56.4	4509.6	2937.6	1952.	1929.	299.	14.2	5.8	15.4	247.9
11.	79.0	52.6	4757.5	3185.5	2435.	2391.	465.	14.8	5.8	15.9	248.6
12.	77.0	49.7	5009.8	3437.8	2915.	2841.	656.	17.0	7.6	18.6	245.9
13.	74.8	46.0	5264.9	3692.9	3566.	3441.	935.	16.9	9.2	19.3	241.4
14.	72.5	44.1	5519.9	3948.0	4074.	3885.	1225.	16.1	11.0	19.5	235.6
15.	70.0	41.7	5775.0	4203.0	4717.	4433.	1613.	19.9	10.0	22.2	243.4
16.	70.2	39.4	6034.9	4462.9	5433.	5112.	1840.	21.2	9.2	23.1	246.5
17.	69.2	37.5	6283.1	4711.1	6140.	5740.	2180.	16.2	9.8	18.9	238.8
18.	68.2	37.0	6531.4	4959.4	6561.	6111.	2444.	21.1	7.6	22.4	250.3
19.	69.4	34.7	6782.6	5210.6	7525.	7044.	2648.	29.5	3.6	29.7	263.0
20.	71.4	33.6	7131.6	5559.6	8368.	7931.	2669.	31.7	1.4	31.7	267.5
21.	73.1	32.1	7471.7	5899.7	9405.	8999.	2734.	33.0	1.5	33.0	267.3
22.	74.5	31.1	7811.3	6239.3	10343.	9967.	2764.	38.1	3.3	38.2	265.1
23.	75.5	29.3	8150.9	6578.9	11723.	11350.	2935.	30.5	.9	30.5	268.2
24.	76.6	29.6	8490.5	6918.5	12179.	11847.	2822.	22.5	-2.2	22.6	275.6
25.	77.6	29.1	8830.1	7258.1	13040.	12736.	2800.	33.8	-.6	33.8	271.0
26.	78.7	28.1	9160.0	7588.0	14211.	13936.	2785.	37.7	2.5	37.7	266.2

27.	78.9	27.0	9392.0	7820.0	15348.	15060.	2955.	35.0	3.7	35.2	264.0
28.	79.4	26.2	9629.3	8057.3	16375.	16095.	3012.	34.7	1.3	34.8	267.9
29.	80.0	25.4	9867.3	8295.3	17470.	17205.	3034.	45.7	1.4	45.7	268.3
30.	80.7	24.0	10105.3	8533.3	19166.	18914.	3097.	39.7	-.4	39.8	270.6
31.	81.3	23.8	10343.3	8771.3	19887.	19658.	3008.	32.3	-1.4	32.3	272.4
32.	81.8	23.1	10581.3	9009.3	21122.	20906.	3013.	38.0	.7	38.0	268.9
33.	82.1	22.6	10819.3	9247.3	22215.	22004.	3053.	39.1	2.9	39.2	265.7
34.	82.2	22.0	11061.0	9509.0	23536.	23318.	3194.	44.1	4.0	44.3	264.8
35.	82.4	21.4	11348.2	9776.2	24946.	24727.	3299.	44.9	-2.8	45.0	273.6
36.	83.4	20.9	11601.0	10029.0	26263.	26089.	3019.	39.7	-7.9	40.5	281.3
37.	84.1	20.6	11841.8	10269.8	27322.	27178.	2809.	32.9	-2.6	33.0	274.6
38.	84.2	20.4	12082.6	10510.6	28262.	28117.	2856.	32.4	-9.1	33.7	285.7
39.	85.6	20.2	12339.1	10767.1	29264.	29178.	2245.	36.9	-15.3	39.9	292.5
40.	86.4	19.9	12595.8	11023.8	30453.	30393.	1912.	34.3	-10.7	35.9	287.3
41.	87.1	19.8	12852.5	11280.5	31333.	31293.	1585.	32.1	-10.8	33.9	288.6
42.	87.8	19.6	13109.2	11537.2	32400.	32376.	1244.	32.3	-8.7	33.5	285.1
43.	88.2	19.4	13300.7	11728.7	33305.	33289.	1046.	32.1	-14.3	35.1	294.1
44.	89.4	19.0	13402.1	11830.1	34357.	34355.	360.	28.5	-15.0	32.2	297.7
45.	89.8	18.8	13503.5	11931.5	35049.	35048.	122.	22.6	-11.9	25.6	297.7
46.	90.6	18.6	13604.9	12032.9	35755.	35753.	-374.	19.6	-13.3	23.7	304.1
47.	91.1	18.5	13706.3	12134.3	36266.	36259.	-696.	16.4	-12.6	20.7	307.7
48.	91.8	18.4	13807.8	12235.8	36782.	36764.	-1155.	16.5	-11.9	20.3	305.9
49.	92.2	18.3	13909.2	12337.2	37304.	37277.	-1432.	16.5	-12.3	20.6	306.6
50.	92.9	18.2	14010.6	12438.6	37832.	37784.	-1914.	13.0	-12.4	17.9	313.6
51.	93.3	18.2	14112.0	12540.0	38141.	38077.	-2196.	13.4	-8.3	15.8	301.9
52.	93.6	18.2	14291.9	12719.9	38688.	38612.	-2429.	20.4	-11.2	23.3	298.8
53.	94.2	18.2	14540.2	12968.2	39443.	39337.	-2889.	24.0	-9.5	25.8	291.6
54.	94.3	18.2	14791.2	13219.2	40207.	40093.	-3015.	24.6	-3.0	24.8	276.9
55.	94.3	18.2	15042.3	13470.3	40970.	40855.	-3072.	27.2	-2.0	27.2	274.3
56.	94.3	18.2	15344.1	13772.1	41888.	41770.	-3141.	29.7	-2.2	29.7	274.3

STATION: BAO, ERIE
DATE: 4/27/82
TIME: 0944 MST
EXPERIMENT: BUCOE
LAUNCH NO: 20

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTMSL M.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	3074.8	1502.8	5.6	-1.4	5.7	283.8
500.0	5689.8	4117.8	18.6	10.4	21.3	240.8
400.0	7331.7	5759.7	32.4	1.5	32.5	267.4
300.0	9293.8	7721.8	36.1	3.2	36.3	264.9
250.0	10502.8	8930.8	36.1	-.0	36.1	270.1
200.0	11891.9	10319.9	32.9	-4.0	33.1	276.9
150.0	13730.6	12158.6	16.4	-12.5	20.6	307.3

STATION: BAO, ERIE
DATE: 4/29/82
TIME: 1835 MST
EXPERIMENT: BUCOE
LAUNCH NO: 21

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	843.5	1572.0	.0	10.0	-1.1	45.9	283.9	297.3	322.4
3.78	737.4	2672.0	1100.0	.9	-1.5	84.0	274.9	297.1	314.6
7.03	645.6	3733.2	2161.2	-3.6	-5.4	85.6	270.2	305.5	317.8
10.65	576.8	4615.8	3043.8	-8.8	-12.7	70.5	264.7	309.4	319.8
17.53	470.2	6169.2	4597.2	-18.8	-39.8	11.1	254.4	315.7	321.1
18.97	447.2	6541.8	4969.8	-20.3	-41.5	10.6	252.9	318.4	323.4
27.72	340.0	8508.3	6936.3	-36.1	-52.8	13.7	237.1	322.7	324.1
32.72	282.8	9761.0	8189.0	-45.9	-49.9	61.3	227.3	326.2	326.8
33.94	271.0	10043.1	8471.1	-48.4	-54.9	43.8	224.8	326.6	327.0
35.75	253.6	10476.8	8904.8	-51.7	-58.6	40.4	221.4	327.8	328.1
39.25	220.8	11359.2	9787.2	-59.5	-66.1	39.3	213.6	329.0	329.2
42.34	195.2	12121.8	10549.8	-64.2	-70.7	38.1	208.9	333.4	333.5
44.78	176.2	12746.6	11174.6	-65.4	-72.0	37.3	207.7	341.3	341.4

STATION: BAO, ERIE
DATE: 4/29/82
TIME: 1835 MST
EXPERIMENT: BUCOE
LAUNCH NO: 21

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	843.5	1572.0	.0	10.0	-1.1	45.9	283.9	297.3	322.4
5.07	700.0	3093.2	1521.2	-.8	-1.9	91.3	273.1	301.6	318.0
15.68	500.0	5710.8	4138.8	-15.1	-37.5	10.2	258.1	314.7	321.8
22.63	400.0	7359.9	5787.9	-26.7	-46.1	11.6	246.5	320.4	323.4
31.16	300.0	9368.7	7796.7	-42.9	-49.0	47.5	230.3	325.0	325.7
36.13	250.0	10572.8	9000.8	-52.5	-59.4	40.4	220.7	328.0	328.3
41.81	200.0	11977.9	10405.9	-63.8	-70.4	38.1	209.3	331.7	331.8

STATION: BAO, ERIE
DATE: 5 11 82
TIME: 0926 MST
EXPERIMENT: BUCOE
LAUNCH NO: 22

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	839.3	1572.0	.0	5.6	5.0	95.9	279.8	293.1	311.4
.70	808.2	1879.5	307.5	2.2	1.5	95.3	276.2	292.6	307.7
1.96	761.6	2357.3	785.3	-.7	-1.4	94.6	273.2	294.5	309.3
3.12	724.6	2755.3	1183.3	-1.4	-2.1	94.5	272.5	298.0	313.0
3.47	715.6	2854.9	1282.9	-2.0	-2.7	94.3	271.9	298.4	312.8
3.71	701.8	3010.0	1438.0	-1.8	-2.7	92.7	272.0	300.2	315.2
5.30	664.0	3449.1	1877.1	-4.2	-7.2	77.3	269.5	302.4	315.6
5.60	657.7	3524.8	1952.8	-1.1	-6.8	61.4	272.6	306.8	324.2
6.62	627.0	3903.1	2331.1	-5.7	-13.1	51.7	267.8	305.7	318.1
9.08	559.0	4792.9	3220.9	-11.8	-20.3	45.3	261.5	308.6	316.9
10.90	510.4	5483.3	3911.3	-16.4	-29.3	28.0	256.8	311.2	317.3
14.05	448.6	6442.6	4870.6	-22.5	-30.4	45.0	250.7	315.2	319.2
17.82	376.8	7696.3	6124.3	-33.1	-41.4	39.5	240.1	317.4	319.1
18.97	356.2	8089.0	6517.0	-36.4	-43.1	46.6	236.8	318.1	319.4
21.93	330.0	8612.0	7040.0	-42.5	-50.9	36.0	230.7	316.7	317.4
22.65	304.4	9155.0	7583.0	-44.7	-53.3	34.6	228.4	321.0	321.6
23.90	298.2	9292.5	7720.5	-45.3	-53.8	34.5	227.9	322.1	322.7
25.84	256.8	10272.2	8700.2	-53.5	-61.4	34.5	219.7	324.1	324.3
27.18	240.2	10699.0	9127.0	-56.7	-64.4	34.6	216.5	325.5	325.7
28.93	219.2	11280.2	9708.2	-55.9	-63.9	33.3	217.3	335.4	335.6
30.30	206.6	11655.4	10083.4	-57.7	-66.2	30.4	215.5	338.3	338.5
31.21	196.8	11963.3	10391.3	-56.0	-65.3	27.8	217.1	345.6	345.9
31.90	189.8	12193.3	10621.3	-56.5	-65.9	27.1	216.6	348.5	348.7
33.50	175.8	12683.0	11111.0	-53.5	-65.3	19.7	219.7	361.2	361.6
35.14	162.8	13176.4	11604.4	-54.3	-67.2	16.5	218.9	367.9	368.3
36.38	154.2	13525.5	11953.5	-52.8	-66.4	15.5	220.3	376.1	376.6
39.75	129.0	14666.9	13094.9	-56.7	-70.2	14.6	216.5	388.8	389.2
40.80	123.4	14949.9	13377.9	-54.3	-68.1	14.5	218.9	398.2	398.8
41.44	120.0	15128.7	13556.7	-55.1	-68.9	14.4	218.1	400.0	400.5
42.66	113.0	15513.4	13941.4	-54.3	-68.3	14.1	218.9	408.4	409.0
42.91	111.4	15605.3	14033.3	-51.8	-66.2	13.9	221.4	414.7	415.6
45.62	97.0	16496.3	14924.3	-55.1	-69.3	13.4	218.1	425.1	425.8

STATION: BAO,ERIE
DATE: 5/11/82
TIME: 0926 MST
EXPERIMENT: BUCOE
LAUNCH NO: 22

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	839.3	1572.0	.0	5.6	5.0	95.9	279.8	293.1	311.4
3.99	700.0	3038.4	1466.4	-1.8	-5.0	76.3	271.9	300.5	315.5
11.40	500.0	5641.6	4069.6	-16.8	-28.1	33.0	256.4	312.5	318.5
16.59	400.0	7277.2	5705.2	-29.1	-36.4	45.9	244.1	317.2	319.5
22.96	300.0	9265.6	7693.6	-45.3	-53.8	34.6	227.9	321.5	322.1
26.41	250.0	10458.1	8886.1	-54.4	-62.3	34.5	218.8	325.2	325.4
30.80	200.0	11879.8	10307.8	-56.8	-65.4	30.4	216.3	342.8	343.0
36.75	150.0	13716.7	12144.7	-53.5	-67.0	15.6	219.7	378.0	370.5
44.95	100.0	16319.2	14747.2	-54.6	-58.7	57.5	218.6	422.3	423.0

STATION: BAO, ERIE
DATE: 5/11/82
TIME: 0926 MST
EXPERIMENT: BUCOE
LAUNCH NO: 22

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	187.0	.0	.0	0.	0.	0.	-2.0	-3.5	4.0	30.0
1.	194.0	59.0	420.4	253.	-61.	-245.	-1.4	-6.7	6.9	12.0
2.	192.0	62.0	797.6	424.	-88.	-415.	-1.5	-4.3	4.5	19.7
3.	197.0	65.0	1139.9	532.	-155.	-508.	-.0	-.2	.2	12.0
4.	192.0	74.0	1515.3	434.	-90.	-425.	3.4	4.8	5.9	215.7
5.	165.0	83.0	1790.7	220.	57.	-212.	6.2	7.2	9.5	220.8
6.	86.0	82.0	2097.1	295.	294.	21.	7.8	10.8	13.3	216.0
7.	50.0	74.0	2464.0	707.	541.	454.	7.9	15.9	17.7	206.5
8.	38.0	65.8	2825.2	1270.	782.	1001.	10.1	20.6	23.0	206.1
9.	34.0	56.8	3186.3	2085.	1166.	1729.	12.9	26.4	29.3	206.1
10.	31.0	49.3	3563.5	3065.	1579.	2627.	15.5	31.6	35.2	206.2
11.	30.0	42.8	3934.5	4249.	2124.	3680.	18.4	36.8	41.2	206.6
12.	29.0	37.1	4238.2	5604.	2717.	4901.	18.0	38.9	42.9	204.8
13.	28.0	33.4	4541.9	6888.	3234.	6082.	18.3	37.8	42.0	205.8
14.	28.0	30.6	4845.6	8194.	3847.	7234.	17.4	38.5	42.3	204.4
15.	27.0	28.6	5176.3	9494.	4310.	8459.	14.8	40.9	43.5	199.9
16.	26.0	26.9	5508.3	10857.	4760.	9759.	16.4	39.7	42.9	202.4
17.	26.0	25.7	5840.3	12135.	5320.	10907.	15.2	39.9	42.7	200.9
18.	25.0	24.6	6174.0	13485.	5699.	12222.	11.1	41.7	43.2	194.9
19.	24.0	23.8	6509.9	14760.	6003.	13484.	13.5	39.7	41.9	198.8
20.	24.0	22.6	6686.0	16062.	6533.	14673.	12.5	40.0	41.9	197.3
21.	23.0	21.6	6862.2	17332.	6772.	15954.	12.1	40.2	42.0	196.8
22.	23.0	20.8	7078.6	18635.	7281.	17153.	15.7	52.0	54.4	196.8
23.	22.0	20.2	7606.0	20673.	7744.	19167.	14.9	51.1	53.2	196.3
24.	22.0	19.5	7755.1	21900.	8204.	20305.	19.3	47.7	51.4	202.0
25.	22.0	19.1	8258.3	23048.	8934.	22112.	31.3	58.0	65.9	208.4
26.	23.0	18.6	8731.8	25946.	10138.	23883.	23.3	57.7	62.2	202.0

27.	22.0	18.1	9049.5	27687.	10372.	25671.	14.1	54.5	56.3	194.5
28.	22.0	17.7	9378.5	29387.	11008.	27247.	23.4	58.0	62.6	202.0
29.	22.0	17.1	9705.9	31550.	11819.	29252.	33.6	57.8	66.8	210.1
30.	23.0	16.6	9979.3	33475.	13080.	30814.	40.6	47.3	62.3	220.6
31.	24.0	16.3	10297.8	35216.	14324.	32171.	30.7	45.8	55.2	213.9
32.	24.0	16.1	10628.9	36025.	14978.	33641.	20.9	46.9	51.3	204.0
33.	24.0	15.9	10934.0	38384.	15612.	35066.	20.8	46.6	51.0	204.0
34.	24.0	15.7	11236.4	39975.	16259.	36519.	19.3	43.4	47.5	204.0
35.	24.0	15.6	11536.2	41318.	16806.	37746.	19.3	43.4	47.6	204.0
36.	24.0	15.4	11819.6	42911.	17453.	39201.	20.1	45.0	49.3	204.0
37.	24.0	15.3	12135.9	44362.	18043.	40526.	25.2	25.3	35.7	224.8
38.	25.0	15.5	12474.0	44980.	19007.	40766.	21.9	17.2	27.8	231.8
39.	25.0	15.6	12812.1	45888.	19393.	41588.	14.1	30.2	33.3	205.0
40.	25.0	15.6	13132.8	47036.	19878.	42630.	24.5	20.6	32.0	229.9
41.	26.0	15.7	13403.5	47684.	20903.	42858.	19.6	9.8	21.9	243.4
42.	26.0	15.9	13702.3	48102.	21087.	43234.	18.9	7.4	20.3	248.7
43.	27.0	16.1	14031.1	48612.	22069.	43314.	14.9	-.7	14.9	272.5
44.	27.0	16.5	14359.5	48477.	22008.	43193.	-9.8	11.2	14.9	138.6
45.	26.0	16.7	14687.9	48957.	21461.	44002.	-17.7	26.2	31.6	146.0

STATION: BAO, ERIE
DATE: 5/11/82
TIME: 0926 MST
EXPERIMENT: BUCOE
LAUNCH NO: 22

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1456.2	.3	5.0	5.0	183.6
500.0	4065.2	18.2	37.7	41.9	205.8
400.0	5708.1	15.7	39.8	42.8	201.5
300.0	7664.9	16.7	49.8	52.5	198.6
250.0	8855.4	17.6	56.6	59.9	197.1
200.0	10268.4	31.6	46.0	55.8	214.5
150.0	12116.2	25.2	26.5	36.6	223.5
100.0	14706.1	-17.6	26.3	31.7	146.1

STATION: BAO,ERIE
DATE: 5/11/82
TIME: 1320 MST
EXPERIMENT: BUCOE
LAUNCH NO: 23

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	838.6	1572.0	.0	2.9	2.1	94.7	276.9	290.3	305.4
.25	833.6	1620.9	48.9	7.2	3.1	74.9	281.3	295.3	316.2
2.43	767.4	2295.4	723.4	1.2	.8	96.8	275.3	296.0	311.0
3.44	739.4	2594.3	1022.3	-.1	-.8	94.1	273.9	297.7	314.0
3.74	730.2	2694.9	1122.9	.7	-3.0	76.2	274.6	299.7	315.2
6.63	667.0	3418.2	1846.2	-2.8	-5.7	77.8	271.0	303.6	318.4
7.04	653.7	3578.3	2006.3	-2.0	-6.6	67.5	271.7	306.2	322.5
8.74	614.6	4064.9	2492.9	-6.6	-9.4	78.1	267.0	306.4	318.2
10.09	588.4	4405.0	2833.0	-7.5	-11.3	71.4	266.1	309.2	320.8
14.22	506.6	5552.7	3980.7	-15.9	-22.7	51.9	257.4	312.5	319.0
16.11	459.6	6278.0	4706.0	-22.0	-38.9	16.8	251.2	313.8	317.8
18.13	429.6	6771.4	5199.4	-25.3	-41.2	17.9	247.9	315.6	318.8
24.36	345.2	8319.4	6747.4	-37.8	-52.5	17.2	235.3	319.0	320.1
26.64	319.4	8849.4	7277.4	-42.6	-56.6	17.3	230.6	319.6	320.3
27.24	312.8	8990.4	7418.4	-42.7	-56.7	17.4	230.4	321.3	322.0
32.54	264.8	10095.8	8523.8	-50.5	-62.7	19.8	222.7	325.6	326.0
33.74	253.2	10387.3	8815.3	-51.4	-63.5	19.8	221.8	328.5	328.8
38.83	206.0	11700.8	10128.8	-60.2	-71.0	20.8	213.0	334.6	334.8
40.75	191.6	12157.3	10585.3	-56.0	-67.6	19.4	217.2	348.4	348.7
44.05	169.0	12964.5	11392.5	-51.2	-64.1	17.7	221.9	369.0	369.6
46.14	156.4	13467.9	11895.9	-51.4	-64.7	16.7	221.8	377.0	377.6
46.84	152.2	13644.2	12072.2	-52.8	-65.9	16.7	220.4	377.6	378.1
50.27	132.8	14522.8	12950.8	-53.6	-66.5	16.8	219.6	391.2	391.8
51.59	125.6	14879.7	13307.7	-55.5	-68.2	16.8	217.7	394.0	394.5
57.29	99.4	16372.5	14800.5	-55.1	-68.0	16.6	218.0	421.9	422.6
58.84	93.4	16772.6	15200.6	-52.5	-65.6	16.7	220.7	434.8	435.8

STATION: BAO, ERIE
DATE: 5/11/82
TIME: 1320 MST
EXPERIMENT: BUCOE
LAUNCH NO: 23

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	838.6	1572.0	.0	3.7	3.1	95.5	277.8	291.2	307.3
5.12	700.0	3032.6	1460.6	.4	-4.5	69.5	274.2	303.0	318.9
14.52	500.0	5650.3	4078.3	-16.3	-24.1	46.8	257.0	313.2	319.6
22.70	400.0	7287.4	5715.4	-29.2	-43.3	21.1	244.0	317.0	319.4
28.70	300.0	9277.7	7705.7	-44.7	-55.4	26.2	228.5	322.4	323.0
34.15	250.0	10477.5	8905.5	-52.3	-61.6	28.9	220.9	328.3	328.6
39.65	200.0	11897.5	10325.5	-59.5	-67.9	30.0	213.7	338.6	338.7
47.30	150.0	13726.2	12154.2	-52.8	-63.2	24.5	220.4	379.2	379.7
57.18	100.0	16329.4	14757.4	-55.1	-65.5	23.8	218.0	421.2	421.9

STATION: BAO, ERIE
DATE: 5/11/82
TIME: 1320 MST
EXPERIMENT: BUCOE
LAUNCH NO: 23

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC							-.5	-.5	1.6	160.0
1.	133.2	87.2	280.9	14.	10.	-9.	1.1	.3	1.1	251.8
2.	71.8	83.4	590.3	68.	65.	21.	2.4	.1	2.4	266.6
3.	90.2	79.8	892.1	161.	161.	-1.	3.0	1.3	3.3	246.2
4.	67.6	77.2	1187.9	270.	250.	103.	-.5	6.3	6.3	175.2
5.	18.3	74.2	1438.2	407.	128.	386.	-4.7	10.4	11.5	155.7
6.	356.8	66.1	1688.5	748.	-42.	747.	-4.9	12.9	13.8	159.3
7.	351.7	59.0	1990.6	1196.	-173.	1184.	-3.7	26.7	27.0	172.0
9.	353.5	46.7	2558.4	2411.	-273.	2395.	4.6	37.0	37.3	187.0
10.	1.8	39.0	2810.4	3471.	109.	3469.	10.4	28.0	29.9	200.3
11.	5.1	36.7	3085.9	4140.	368.	4124.	9.3	23.8	25.6	201.4
12.	7.9	34.0	3363.8	4987.	685.	4940.	12.2	26.6	29.3	204.6
13.	11.0	31.8	3641.7	5873.	1121.	5765.	15.4	26.3	30.4	210.4
14.	14.0	30.1	3919.5	6762.	1636.	6561.	18.0	28.0	33.3	212.8
15.	16.6	28.7	4280.0	7818.	2233.	7492.	23.8	32.5	40.3	216.1
16.	19.9	27.1	4663.8	9114.	3102.	8570.	31.5	44.5	54.5	215.3
17.	22.2	24.0	4923.4	11058.	4178.	10238.	27.4	41.4	49.7	213.5
18.	23.3	23.1	5167.7	12115.	4792.	11127.	23.8	35.9	43.1	213.6
19.	24.4	21.6	5415.6	13678.	5651.	12457.	27.8	42.8	51.0	213.0
20.	25.3	20.4	5664.0	15230.	6509.	13769.	27.7	42.7	50.9	213.0
21.	26.0	19.4	5912.5	16790.	7360.	15090.	26.4	42.6	50.1	211.8
22.	26.4	18.6	6161.0	18307.	8140.	16398.	24.9	40.8	47.7	211.4
23.	26.8	18.0	6409.5	19726.	8894.	17607.	26.4	42.4	49.9	212.0
24.	27.2	17.3	6657.9	21376.	9771.	19012.	25.6	43.6	50.5	210.5
25.	27.3	16.8	6896.2	22841.	10476.	20297.	22.8	42.9	48.6	208.0
26.	27.3	16.3	7128.6	24378.	11181.	21663.	23.6	42.6	48.7	209.0

27.	27. 5	15. 9	7362. 0	25844.	11934.	22924.	28. 1	42. 5	51. 0	213. 4
28.	28. 0	15. 4	7576. 9	27508.	12914.	24288.	34. 4	48. 1	59. 2	215. 6
29.	28. 5	14. 8	7785. 4	29467.	14060.	25896.	37. 9	50. 5	63. 1	216. 9
30.	29. 1	14. 3	7994. 0	31362.	15252.	27403.	39. 1	46. 4	60. 7	220. 1
31.	29. 8	13. 9	8202. 6	33145.	16472.	28762.	37. 9	41. 9	56. 5	222. 2
32.	30. 4	13. 6	8411. 2	34768.	17594.	29988.	38. 6	46. 4	60. 3	219. 7
33.	30. 8	13. 2	8635. 6	36818.	18852.	31625.	43. 1	55. 9	70. 6	217. 6
34.	31. 2	12. 8	8882. 4	39096.	20253.	33441.	44. 6	56. 6	72. 0	218. 2
35.	31. 6	12. 5	9140. 5	41230.	21604.	35117.	39. 9	51. 7	65. 3	217. 6
36.	31. 8	12. 3	9398. 5	43106.	22715.	36635.	33. 4	44. 7	55. 8	216. 8
37.	32. 0	12. 2	9656. 6	44663.	23668.	37877.	31. 3	48. 0	57. 3	213. 1
38.	31. 9	12. 0	9914. 6	46645.	24649.	39600.	27. 4	51. 5	58. 3	208. 0
39.	31. 7	11. 9	10169. 2	48257.	25357.	41057.	29. 7	50. 4	58. 5	210. 5
40.	31. 8	11. 7	10407. 0	50254.	26481.	42710.	39. 7	53. 0	66. 2	216. 8
41.	32. 1	11. 5	10646. 5	52329.	27808.	44329.	37. 6	57. 7	68. 9	213. 1
42.	31. 9	11. 3	10891. 1	54505.	28802.	46273.	31. 0	55. 3	63. 4	209. 2
43.	31. 9	11. 2	11135. 7	56239.	29719.	47746.	26. 8	40. 0	48. 1	213. 8
44.	32. 0	11. 2	11380. 3	57475.	30457.	48741.	23. 8	32. 0	39. 9	216. 7
45.	32. 1	11. 2	11621. 3	58692.	31189.	49719.	26. 6	29. 8	40. 0	221. 8
46.	32. 4	11. 2	11862. 2	59909.	32101.	50582.	20. 9	23. 7	31. 6	221. 4
47.	32. 4	11. 3	12113. 2	60621.	32482.	51184.	18. 8	26. 3	32. 3	215. 5
48.	32. 5	11. 3	12369. 3	61902.	33260.	52208.	20. 3	25. 4	32. 5	218. 7
49.	32. 6	11. 4	12625. 5	62615.	33735.	52751.	15. 3	17. 4	23. 2	221. 4
50.	32. 7	11. 5	12881. 6	63315.	34205.	53280.	17. 1	16. 7	23. 9	225. 7
51.	32. 9	11. 6	13148. 2	64053.	34792.	53780.	12. 8	20. 0	23. 7	212. 7
52.	32. 7	11. 7	13415. 1	64779.	34996.	54512.	5. 9	12. 5	13. 9	205. 3
53.	32. 8	11. 9	13677. 0	64902.	35158.	54555.	2. 1	3. 3	3. 9	212. 7
54.	32. 7	12. 1	13938. 9	65019.	35126.	54714.	2. 1	13. 6	13. 8	189. 0
55.	32. 5	12. 2	14200. 8	65681.	35291.	55395.	5. 2	21. 9	22. 5	193. 2
56.	32. 3	12. 3	14462. 7	66332.	35445.	56068.	6. 4	20. 7	21. 6	197. 3
57.	32. 2	12. 4	14724. 6	66971.	35687.	56671.	12. 5	26. 9	29. 7	204. 8
58.	32. 1	12. 4	14983. 8	68150.	36215.	57731.	17. 1	34. 4	38. 4	206. 4

STATION: BAO,ERIE
DATE: 5/11/82
TIME: 1320 MST
EXPERIMENT: BUCOE
LAUNCH NO: 23

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1468.5	-4.8	10.7	11.7	156.1
500.0	4082.5	20.5	30.1	36.4	214.3
400.0	5742.3	27.3	42.6	50.6	212.6
300.0	7713.1	36.7	49.7	61.7	216.4
250.0	8904.4	44.2	56.2	71.4	218.2
200.0	10319.0	35.9	52.2	63.4	214.5
150.0	12171.8	19.1	26.1	32.4	216.2
100.0	14766.4	13.2	28.2	31.1	205.1

STATION: BAO, ERIE
DATE: 5 12 82
TIME: 0657 MST
EXPERIMENT: BUCOE
LAUNCH NO: 24

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	836.6	1572.0	.0	5.2	4.2	93.2	279.4	293.0	310.9
.40	826.8	1668.2	96.2	3.9	2.7	91.9	278.0	292.5	309.0
1.44	799.0	1946.0	374.0	2.7	1.6	92.6	276.7	294.1	310.0
4.07	725.8	2719.4	1147.4	-1.1	-1.8	93.8	272.9	298.2	313.6
5.82	681.6	3220.0	1648.0	-2.6	-3.4	93.8	271.2	301.9	316.4
6.82	655.4	3530.3	1958.3	-4.3	-8.1	72.5	269.3	303.4	316.6
10.17	571.6	4595.3	3023.3	-11.3	-12.2	91.7	262.3	307.3	315.8
11.11	547.0	4931.4	3359.4	-14.1	-15.7	85.7	259.4	307.9	314.8
12.56	515.0	5386.3	3814.3	-17.3	-27.7	35.8	256.0	309.4	315.0
14.77	480.0	5910.6	4338.6	-20.5	-35.7	20.9	252.7	311.7	316.1
20.05	388.2	7442.5	5870.5	-33.1	-42.5	34.6	240.1	314.7	316.3
21.40	361.2	7945.3	6373.3	-37.0	-40.9	64.6	236.1	315.9	317.1
25.45	303.0	9136.7	7564.7	-46.3	-56.5	27.5	226.9	319.2	319.7
27.55	279.2	9679.7	8107.7	-46.7	-61.9	13.9	226.4	326.2	326.7
34.98	211.1	11495.3	9923.3	-56.2	-69.8	14.6	217.0	338.5	338.8
37.39	194.0	12036.3	10464.3	-52.8	-67.5	13.3	220.3	352.2	352.5
38.61	184.4	12363.3	10791.3	-53.5	-68.0	13.3	219.7	356.3	356.7
41.28	145.2	13895.6	12323.6	-55.1	-69.8	12.5	218.1	378.7	379.2
46.20	118.6	15195.3	13623.3	-52.7	-68.2	11.8	220.5	405.7	406.4
50.51	98.6	16381.6	14809.6	-55.1	-70.4	11.4	218.1	423.1	423.8

STATION: BAO, ERIE
DATE: 5 11 82
TIME: 0657 MST
EXPERIMENT: BUCOE
LAUNCH NO: 24

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	836.6	1572.0	.0	5.2	4.2	93.2	279.4	293.0	310.9
5.10	700.0	3011.7	1439.7	-1.8	-2.5	94.3	272.0	300.5	315.5
13.58	500.0	5606.7	4034.7	-18.6	-32.8	23.8	254.6	310.4	315.4
19.44	400.0	7229.8	5657.8	-31.1	-44.6	21.9	242.1	314.6	316.5
25.74	300.0	9203.7	7631.7	-46.7	-58.3	22.7	226.4	319.5	320.0
30.60	250.0	10401.9	8829.9	-50.8	-65.3	14.1	222.3	330.5	330.8
36.60	200.0	11846.4	10274.4	-53.5	-67.8	13.6	219.7	348.1	348.5
39.74	150.0	13693.5	12121.5	-54.4	-69.0	12.9	218.7	376.3	376.8
50.21	100.0	16287.5	14715.5	-55.1	-70.4	11.4	218.1	421.4	422.1

STATION: BAO, ERIE
DATE: 5/12/82
TIME: 0657 MST
EXPERIMENT: BUCOE
LAUNCH NO: 24

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	180.0	.0	.0	0.	0.	0.	-1.0	-1.7	2.0	30.0
1.	143.7	66.0	256.1	114.	68.	-92.	.6	-2.7	2.8	347.0
2.	167.0	72.3	537.8	172.	39.	-167.	.5	-1.6	1.6	342.1
3.	152.3	75.7	831.4	212.	99.	-188.	.9	-1.0	1.3	318.7
4.	157.9	77.6	1124.9	247.	93.	-229.	-3.4	1.5	3.7	113.5
5.	228.0	84.1	1411.1	146.	-108.	-98.	-6.1	4.6	7.7	126.9
6.	281.0	80.3	1701.1	291.	-285.	55.	-2.2	9.6	9.8	167.3
7.	333.9	74.7	2011.9	550.	-242.	494.	-.4	15.6	15.6	178.5
8.	343.1	65.4	2328.7	1066.	-310.	1020.	.3	16.3	16.3	181.0
9.	351.5	60.2	2645.6	1515.	-224.	1498.	3.7	12.5	13.0	196.3
10.	357.3	58.8	2962.4	1794.	-85.	1792.	6.6	15.9	17.2	202.7
11.	4.3	53.1	3312.4	2487.	186.	2480.	13.2	24.5	27.9	208.4
12.	12.5	47.0	3630.3	3385.	733.	3305.	18.8	29.1	34.6	212.9
13.	17.5	41.1	3909.8	4482.	1348.	4274.	21.6	32.6	39.1	213.4
14.	21.2	36.0	4146.3	5707.	2064.	5321.	22.7	34.2	41.0	213.6
15.	23.3	32.3	4395.0	6952.	2750.	6385.	24.4	43.0	49.4	209.5
16.	24.1	28.2	4684.7	8737.	3568.	7975.	20.5	39.2	44.3	207.6
17.	24.5	27.2	4974.4	9679.	4014.	8808.	16.8	30.7	35.0	208.6
18.	25.0	25.8	5264.1	10889.	4602.	9869.	17.5	36.7	40.6	205.5
19.	24.7	24.5	5553.8	12187.	5092.	11072.	13.4	40.4	42.6	198.3
20.	23.7	23.4	5843.5	13504.	5428.	12365.	13.1	49.3	51.0	194.9
21.	22.7	22.1	6211.6	15297.	5903.	14112.	8.0	50.8	51.4	188.9
22.	20.9	21.5	6536.7	16594.	5920.	15502.	2.6	48.9	48.9	183.1
23.	19.5	20.6	6830.2	18171.	6066.	17129.	8.2	67.4	67.9	187.0
24.	18.1	19.0	7123.7	20689.	6428.	19665.	.9	53.0	53.0	181.0
25.	16.7	19.2	7417.3	21300.	6121.	20401.	-2.7	39.7	39.8	176.1
26.	15.8	18.5	7691.2	22987.	6259.	22118.	12.7	72.9	74.0	189.9

27.	15.5	17.1	7949.0	25839.	6905.	24899.	16.9	68.4	70.4	193.9
28.	15.5	16.7	8200.4	27334.	7305.	26339.	16.4	56.1	58.5	196.3
29.	15.6	16.0	8444.0	29448.	7919.	28363.	19.1	69.0	71.6	195.5
30.	15.5	15.3	8687.6	31757.	8487.	30602.	17.2	72.5	74.5	193.4
31.	15.3	14.7	8931.2	34044.	8983.	32837.	15.5	71.4	73.0	192.3
32.	15.1	14.2	9174.8	36258.	9445.	35006.	16.5	72.6	74.4	192.8
33.	15.0	13.7	9418.4	38636.	10000.	37319.	17.2	72.8	74.8	193.3
34.	14.9	13.3	9661.9	40873.	10510.	39499.	6.2	69.8	70.1	135.0
35.	14.0	13.0	9905.1	42904.	10379.	41629.	15.7	64.1	66.0	193.8
36.	14.8	12.7	10128.9	44946.	11481.	43454.	23.8	57.3	62.1	202.6
37.	14.7	12.5	10352.7	46698.	11850.	45170.	17.9	57.0	59.7	197.4
38.	15.0	12.3	10603.1	48630.	12586.	46973.	25.3	62.5	67.4	202.0
39.	15.3	12.2	10989.7	50829.	13412.	49028.	30.5	73.1	79.2	202.7
40.	15.7	12.2	11562.5	53479.	14471.	51484.	33.9	87.7	94.0	201.2
41.	15.9	12.1	12135.4	56606.	15508.	54441.	32.6	79.3	85.8	202.4
42.	16.3	12.0	12485.7	58741.	16487.	56380.	24.7	49.7	55.6	206.5
43.	16.5	12.0	12749.5	59982.	17036.	57512.	16.3	37.1	40.5	203.7
44.	16.6	12.0	13013.3	61223.	17491.	58671.	10.7	29.8	31.6	199.7
45.	16.6	12.1	13277.2	61932.	17693.	59351.	7.3	30.6	31.5	193.3
46.	16.5	12.1	13541.0	63163.	17939.	60562.	9.8	39.4	40.6	194.0
47.	16.5	12.1	13813.6	64435.	18300.	61781.	14.5	29.5	32.8	206.2
48.	16.8	12.2	14088.5	65162.	18834.	62381.	17.3	19.2	25.8	222.1
49.	17.1	12.3	14363.3	65876.	19370.	62964.	13.8	19.8	24.1	215.0
50.	17.2	12.4	14638.2	66578.	19688.	63601.	10.3	20.6	23.1	206.5

STATION: BAO, ERIE
DATE: 5/12/82
TIME: 0657 MST
EXPERIMENT: BUCOE
LAUNCH NO: 24

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1437.3	-6.0	5.1	7.9	130.6
500.0	4029.7	22.1	33.4	40.1	213.5
400.0	5661.4	13.4	43.7	45.7	197.1
300.0	7617.6	7.0	64.4	64.8	186.2
250.0	8866.8	16.0	71.7	73.4	192.6
200.0	10250.8	20.6	57.2	60.8	199.8
150.0	12108.5	32.7	79.7	86.1	202.3
100.0	14695.5	10.6	20.6	23.1	207.3

STATION: BAO, ERIE
DATE: 5 12 82
TIME: 1049 MST
EXPERIMENT: BUCOE
LAUNCH NO: 25

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	835.9	1572.0	.0	7.3	5.1	85.8	281.5	295.2	316.0
1.00	810.4	1825.7	253.7	3.6	2.4	91.9	277.7	293.9	310.5
3.04	748.8	2464.1	892.1	-.2	-1.0	94.0	273.7	296.5	312.3
4.12	716.8	2813.3	1241.3	-1.6	-2.4	93.7	272.2	298.6	313.5
4.50	707.2	2921.0	1349.0	-.5	-1.3	94.0	273.4	301.0	317.6
6.04	667.2	3385.9	1813.9	-2.1	-2.7	95.0	271.8	304.3	319.9
9.75	582.6	4448.1	2876.1	-10.2	-18.2	47.8	263.2	306.9	316.0
14.58	467.8	6102.6	4530.6	-21.7	-26.5	61.7	251.6	312.5	316.7
19.86	352.8	8116.8	6544.8	-37.3	-47.2	31.7	235.9	317.7	318.9
20.95	339.0	8392.8	6820.8	-36.6	-55.3	10.5	236.5	322.3	323.6
27.51	272.8	9862.4	8290.4	-47.8	-64.1	11.5	225.4	326.8	327.2
28.50	260.8	10157.5	8585.5	-50.6	-66.4	11.7	222.5	326.8	327.2
35.41	200.0	11868.0	10296.0	-55.7	-70.4	12.3	217.5	344.6	344.9
36.12	195.2	12023.2	10451.2	-54.5	-69.8	11.7	218.6	348.3	349.2
38.07	180.4	12530.4	10958.4	-52.5	-68.2	11.4	220.7	360.2	360.6
39.30	170.8	12883.4	11311.4	-53.1	-69.1	10.7	220.1	364.8	365.2
40.49	161.6	13241.5	11669.5	-51.5	-68.1	10.3	221.6	373.2	373.8
43.70	140.6	14138.0	12566.0	-55.0	-70.8	10.6	218.1	382.3	382.8
48.75	113.8	15497.1	13925.1	-52.5	-69.3	9.6	220.7	410.9	411.7
49.60	110.4	15694.3	14122.3	-50.0	-67.6	9.1	223.1	419.1	420.2
50.35	107.0	15898.7	14326.7	-50.0	-67.6	9.1	223.1	422.8	424.0
52.55	97.2	16521.3	14949.3	-53.7	-70.7	9.1	219.4	427.4	428.2

STATION: BAO, ERIE
DATE: 5 12 82
TIME: 1049 MST
EXPERIMENT: BUCOE
LAUNCH NO: 25

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	835.9	1572.0	.0	7.3	5.1	85.8	281.5	295.2	316.0
4.74	700.0	3011.8	1439.8	-1.3	-2.1	93.8	272.6	301.0	316.7
12.98	500.0	5611.6	4039.6	-18.3	-23.5	60.1	255.0	310.8	316.0
17.65	400.0	7237.5	5665.5	-30.7	-35.9	56.8	242.5	315.2	317.2
24.85	300.0	9229.9	7657.9	-42.8	-60.2	11.0	230.4	325.1	325.8
29.85	250.0	10438.4	8866.4	-50.9	-66.8	11.5	222.2	330.4	330.7
35.41	200.0	11875.4	10303.4	-55.7	-70.4	12.3	217.5	344.6	344.9
42.25	150.0	13714.1	12142.1	-54.2	-70.7	9.7	219.0	376.7	377.1
51.80	100.0	16325.6	14753.6	-52.3	-69.6	9.0	220.8	426.7	427.6

STATION: BAO, ERIE
DATE: 5/12/82
TIME: 1049 MST
EXPERIMENT: BUCOE
LAUNCH NO: 25

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	178.0	.0	.0	0.	0.	0.	-1.6	-5.8	6.0	15.0
1.	169.0	56.4	253.2	168.	32.	-165.	-.2	-3.4	3.4	3.1
2.	183.1	69.7	565.1	209.	-11.	-209.	-2.9	-4.8	5.6	30.6
3.	197.3	61.1	877.0	484.	-144.	-462.	-4.1	-3.7	5.5	48.1
4.	211.3	66.9	1198.8	511.	-266.	-437.	-6.2	3.9	7.4	122.4
5.	247.5	69.1	1495.7	571.	-528.	-219.	-8.6	8.2	11.9	133.5
6.	274.8	66.0	1797.2	800.	-797.	67.	-9.4	11.1	14.5	139.7
7.	292.8	60.0	2083.6	1203.	-1109.	466.	-8.0	13.4	15.6	149.2
8.	304.7	56.5	2369.3	1568.	-1289.	893.	-8.7	16.6	18.7	152.2
9.	312.1	50.1	2655.1	2220.	-1647.	1488	-9.0	17.0	19.2	152.2
10.	316.5	47.8	2954.8	2679.	-1844.	1943.	-8.4	15.7	17.8	151.8
11.	318.6	45.2	3296.4	3273.	-2165.	2455.	-9.5	28.0	29.6	161.3
13.	326.5	42.1	3979.5	4404.	-2431.	3673.	-1.1	31.5	31.5	178.0
14.	333.1	41.2	4321.0	4936.	-2233.	4402.	1.0	25.9	25.9	182.2
15.	335.8	39.0	4678.9	5778.	-2368.	5270.	-2.8	29.8	29.9	174.6
16.	338.9	37.1	5059.3	6690.	-2408.	6241.	-12.5	26.7	29.5	155.0
17.	335.6	35.6	5439.7	7598.	-3139.	6919.	-15.6	21.4	26.5	144.1
18.	336.0	35.1	5820.1	8281.	-3368.	7565.	-8.8	37.8	38.9	166.9
19.	338.3	31.9	6200.5	9961.	-3683.	9256.	-2.2	48.0	48.1	177.4
20.	341.6	30.6	6563.0	11097.	-3503.	10530.	2.2	53.2	53.3	182.3
21.	344.2	27.6	6814.0	13034.	-3549.	12542.	-.8	57.0	57.0	179.1
22.	345.8	25.9	7037.6	14493.	-3555.	14051.	-8.5	80.4	80.8	174.0
23.	346.9	22.0	7261.2	17972.	-4073.	17504.	-9.0	72.9	73.5	172.9
24.	347.5	21.5	7484.8	19001.	-4113.	18551.	-4.6	48.4	48.6	174.6
25.	348.0	20.2	7708.4	20951.	-4356.	20493.	-8.0	63.0	63.5	172.8
26.	348.4	19.1	7932.0	22906.	-4606.	22438.	-8.9	61.9	62.6	171.9

27.	348.6	18.2	8155.6	24805.	-4903.	24316.	-7.6	63.7	64.1	173.2
28.	349.1	17.4	8415.4	26854.	-5078.	26369.	-1.5	65.1	65.2	178.7
29.	350.0	16.8	8687.6	28775.	-4997.	28337.	3.5	64.7	64.8	183.1
30.	350.9	16.2	8934.5	30753.	-4864.	30366.	5.5	64.7	64.9	184.8
31.	351.8	15.7	9181.5	32664.	-4659.	32330.	8.8	62.0	62.6	188.1
32.	352.8	15.3	9428.4	34465.	-4320.	34193.	9.7	53.4	54.3	190.3
33.	353.5	15.1	9675.4	35859.	-4059.	35628.	8.9	47.1	47.9	190.7
34.	354.2	14.9	9922.4	37291.	-3769.	37100.	8.0	57.2	57.8	188.0
35.	354.8	14.5	10169.3	39322.	-3564.	39160.	7.3	67.5	67.9	186.1
36.	355.4	14.1	10399.2	41401.	-3320.	41267.	9.1	61.3	62.0	188.4
37.	356.0	13.9	10653.6	43049.	-3003.	42944.	12.0	55.5	56.8	192.2
38.	356.7	13.7	10912.9	44767.	-2577.	44692.	14.9	47.7	49.9	197.3
39.	357.4	13.7	11197.5	45934.	-2084.	45887.	12.2	45.1	46.7	195.1
40.	357.8	13.6	11493.8	47510.	-1824.	47475.	10.5	39.3	40.7	195.0
41.	358.3	13.7	11783.2	48337.	-1434.	48315.	11.5	26.2	28.7	203.6
42.	358.7	13.8	12062.0	49108.	-1114.	49095.	7.7	25.0	26.1	197.2
43.	358.9	13.9	12340.8	49867.	-957.	49858.	8.0	30.5	31.5	194.6
44.	359.3	13.9	12616.5	50981.	-623.	50977.	12.6	29.5	32.1	203.1
45.	359.8	14.0	12885.2	51680.	-180.	51679.	17.5	27.2	32.4	212.8
47.	.5	14.3	13422.4	52658.	460.	52656.	12.0	32.9	35.0	200.1
48.	.6	14.3	13691.0	53712.	562.	53709.	1.8	33.5	33.6	183.1
49.	.6	14.3	13950.3	54729.	573.	54726.	1.8	25.7	25.7	184.1
50.	.7	14.4	14198.2	55298.	676.	55294.	1.8	20.2	20.3	185.1
51.	.7	14.5	14477.2	55979.	684.	55975.	.3	22.1	22.1	180.7
52.	.7	14.6	14759.9	56664.	692.	56660.	.3	22.2	22.2	180.7

STATION: BAO, ERIE
DATE: 5/12/82
TIME: 1049 MST
EXPERIMENT: BUCOE
LAUNCH NO: 25

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1428.5	-8.2	7.1	10.8	131.0
500.0	4056.4	-.6	30.3	30.3	178.9
400.0	5703.3	-12.1	32.9	35.1	159.9
300.0	7667.0	-7.3	60.3	60.7	173.1
250.0	8867.2	4.9	64.7	64.9	184.4
200.0	10270.6	8.1	64.8	65.3	187.1
150.0	12135.4	7.8	26.4	27.6	196.5
100.0	14737.7	.3	22.2	22.2	180.7

STATION: BAO, ERIE
DATE: 5 12 82
TIME: 1554 MST
EXPERIMENT: BUCOE
LAUNCH NO: 28

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	833.3	1572.0	.0	3.6	.1	78.0	277.5	291.5	307.5
1.35	799.6	1907.5	335.5	3.4	2.5	94.0	277.5	294.8	311.5
2.40	772.2	2190.0	618.0	1.6	.9	95.1	275.6	295.8	311.1
5.00	718.0	2775.8	1203.8	.1	-.6	94.8	274.1	300.4	315.5
11.00	605.6	4125.6	2553.6	-6.4	-7.1	94.0	267.3	307.9	320.0
16.20	515.8	5361.7	3789.7	-14.8	-16.4	86.1	258.7	312.2	319.3
20.20	447.0	6431.2	4859.2	-21.8	-24.5	77.0	251.5	316.4	320.7
28.92	309.8	9014.3	7442.3	-43.5	-48.7	53.4	229.6	321.1	321.7
32.70	256.4	10258.4	8686.4	-53.8	-59.4	47.5	219.4	323.8	324.0
33.90	249.5	10433.3	8861.3	-54.7	-60.6	45.5	218.4	324.9	325.1
35.10	229.2	10980.3	9408.2	-51.5	-57.8	43.5	221.7	337.8	338.2
36.63	213.4	11444.8	9872.8	-50.7	-57.6	41.0	222.4	346.0	346.4
39.52	188.4	12252.2	10680.2	-53.2	-60.3	38.7	220.0	354.6	355.0
47.30	140.0	14160.7	12588.7	-54.3	-61.9	35.9	218.9	384.1	384.6
55.00	103.0	16140.3	14568.3	-51.6	-59.7	34.3	221.5	424.4	425.4
57.08	93.0	16798.8	15226.8	-54.4	-66.1	20.0	218.7	431.5	432.3

STATION: BAO, ERIE
DATE: 5 12 82
TIME: 1554 MST
EXPERIMENT: BUCOE
LAUNCH NO: 28

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	833.3	1572.0	.0	3.6	.1	78.0	277.5	291.5	307.5
6.02	700.0	2975.8	1403.8	-1.5	-2.1	94.8	272.4	300.9	316.4
17.10	500.0	5585.1	4013.1	-16.3	-18.1	84.6	257.1	313.2	319.5
22.60	400.0	7227.8	5655.8	-27.7	-31.2	69.0	245.6	319.1	321.8
29.18	300.0	9228.1	7656.1	-43.9	-49.2	53.0	229.2	323.4	324.1
33.18	250.0	10424.2	8852.2	-54.4	-60.1	46.7	218.7	325.2	325.4
38.01	200.0	11863.0	10291.0	-51.6	-58.7	39.5	221.5	351.0	351.5
45.65	150.0	13726.5	12154.5	-52.4	-60.0	36.7	220.8	379.8	380.4
55.60	100.0	16347.4	14775.4	-52.5	-60.6	34.1	220.6	426.2	427.2

STATION: BAO/ERIE
DATE: 5/12/82
TIME: 1554 MST
EXPERIMENT: BUCOE
LAUNCH NO: 28

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	16.2	.0	.0	0.	0.	0.	-3.6	-13.5	14.0	15.0
1.	143.5	31.9	247.9	398.	237.	-320.	5.9	-11.9	13.3	333.9
2.	153.9	31.8	509.1	821.	361.	-737.	1.1	-14.3	14.3	355.5
3.	165.7	31.2	751.4	1241.	306.	-1202.	-4.1	-12.5	13.2	18.3
4.	176.0	32.8	976.3	1515.	106.	-1511.	-8.3	-13.3	15.7	32.2
5.	185.9	30.6	1201.2	2031.	-209.	-2020.	-12.7	-15.7	20.2	39.0
6.	195.3	29.0	1425.7	2572.	-679.	-2481.	-14.6	-13.1	19.6	48.0
7.	201.4	28.5	1650.2	3039.	-1109.	-2830.	-14.6	-10.1	17.7	55.4
8.	207.0	28.3	1874.8	3482.	-1581.	-3102.	-19.0	-9.8	21.3	62.8
9.	213.6	27.0	2099.3	4120.	-2280.	-3432.	-22.7	-3.6	23.0	81.1
10.	221.9	27.5	2323.8	4464.	-2981.	-3323.	-24.4	4.8	24.9	101.2
11.	230.4	27.4	2548.4	4916.	-3788.	-3134.	-24.4	9.3	26.1	110.9
12.	238.5	27.9	2785.6	5261.	-4486.	-2749.	-21.4	14.9	26.1	124.9
13.	246.6	28.5	3022.8	5567.	-5109.	-2211.	-17.9	16.2	24.1	132.1
14.	252.6	29.1	3260.0	5857.	-5589.	-1752.	-16.2	14.0	21.5	130.9
15.	257.6	29.2	3497.2	6257.	-6112.	-1344.	-15.4	13.9	20.7	132.0
16.	262.2	29.5	3734.4	6601.	-6539.	-896.	-12.4	14.8	19.3	139.9
17.	266.4	30.1	3995.4	6892.	-6879.	-433.	-11.8	15.5	19.5	142.9
18.	270.5	30.4	4262.4	7265.	-7265.	63.	-10.8	16.6	19.8	147.0
19.	274.5	30.9	4529.4	7568.	-7545.	594.	-8.7	17.9	19.9	154.0
20.	278.5	31.3	4796.4	7889.	-7802.	1166.	-9.8	18.7	21.1	152.4
21.	282.1	31.4	5086.3	8333.	-8148.	1747.	-12.4	17.0	21.1	143.8
22.	284.5	31.3	5381.9	8852.	-8570.	2216.	-14.2	15.0	20.7	136.6
23.	286.5	31.1	5677.6	9412.	-9024.	2673.	-14.0	14.9	20.5	136.9
24.	288.4	31.0	5973.2	9941.	-9433.	3138.	-11.9	18.3	21.9	147.0
25.	291.3	30.9	6268.9	10475.	-9759.	3805.	-11.8	19.7	23.0	149.1
26.	293.2	30.7	6564.5	11056.	-10162.	4355.	-16.6	21.0	26.8	141.6

STATION: BAO, ERIE
DATE: 5 13 82
TIME: 0946 MST
EXPERIMENT: BUCOE
LAUNCH NO: 30

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	834.8	1572.0	.0	3.7	3.1	95.6	277.9	291.6	307.7
.55	821.4	1703.4	131.4	2.6	1.9	95.3	276.6	291.7	306.8
2.62	784.4	2075.2	503.2	.3	-.4	95.6	274.2	293.1	306.6
5.05	729.0	2661.6	1089.6	-1.3	-2.0	94.5	272.5	297.5	312.4
9.10	648.8	3584.5	2012.5	-5.5	-6.6	91.4	268.2	302.9	314.9
11.46	604.4	4138.5	2566.5	-7.9	-18.0	39.8	265.4	306.3	317.0
14.03	570.8	4580.1	3008.1	-11.7	-16.7	63.3	261.7	307.0	315.1
18.58	489.0	5749.8	4177.8	-18.6	-22.8	66.6	254.7	312.3	317.6
19.40	474.2	5978.9	4406.9	-19.0	-23.4	65.5	254.3	314.6	319.8
25.33	364.6	7880.9	6308.9	-33.3	-40.0	47.7	239.9	320.1	321.8
26.55	344.4	8280.5	6708.5	-34.4	-41.3	46.0	238.8	323.9	325.6
27.88	324.6	8692.1	7120.1	-37.4	-45.1	41.3	235.8	325.2	326.5
28.21	318.0	8832.9	7260.9	-40.8	-48.3	40.8	232.4	322.5	323.4
30.10	292.8	9394.0	7822.0	-41.5	-57.0	14.4	231.7	329.2	330.1
31.05	280.8	9678.8	8106.8	-40.1	-56.6	13.0	233.1	335.1	336.3
32.80	257.0	10282.0	8710.0	-41.2	-58.0	12.3	232.0	342.1	343.2
35.21	229.0	11064.1	9492.1	-42.1	-58.9	12.1	231.0	352.1	353.3
35.65	223.6	11225.0	9653.0	-43.8	-60.3	12.2	229.4	352.0	353.0
39.05	187.6	12405.0	10833.0	-43.5	-60.2	12.0	229.6	370.6	371.9
39.64	183.0	12571.4	10999.4	-45.1	-61.5	12.0	228.1	370.7	371.8
40.10	178.2	12749.0	11177.0	-44.9	-61.3	12.0	228.2	373.8	374.9
40.31	176.8	12802.0	11230.0	-43.0	-59.7	11.9	230.2	377.8	379.3
40.63	174.4	12893.9	11321.9	-44.2	-60.4	12.6	228.9	377.3	378.5
41.81	164.2	13297.4	11725.4	-44.9	-60.8	13.0	228.2	382.6	383.9
42.45	159.6	13488.4	11916.4	-42.4	-58.7	12.9	230.7	390.0	391.8
44.14	146.6	14058.4	12486.4	-45.8	-61.5	13.1	227.4	393.8	395.1
54.90	87.2	17507.5	15935.5	-47.2	-62.7	13.1	226.0	454.0	456.2

STATION: BAO, ERIE
DATE: 5 13 82
TIME: 0946
EXPERIMENT: BUCOE
LAUNCH NO: 30

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	834.8	1572.0	.0	3.7	3.1	95.6	277.9	291.6	307.7
6.39	700.0	2987.6	1415.6	-2.8	-4.3	87.7	271.0	299.4	313.3
18.00	500.0	5583.4	4011.4	-17.5	-22.1	64.7	255.8	311.7	317.3
23.60	400.0	7219.2	5647.2	-28.4	-33.2	60.5	244.8	318.0	320.6
29.50	300.0	9229.4	7657.4	-40.8	-55.6	16.1	232.4	327.9	328.9
33.20	250.0	10467.8	8895.8	-41.7	-58.4	12.3	231.4	344.0	345.1
38.80	200.0	11975.4	10403.4	-43.2	-59.8	12.2	229.9	364.3	365.5
43.82	150.0	13907.4	12335.4	-44.5	-60.4	13.0	228.7	393.4	394.9
51.05	100.0	16609.5	15037.5	-46.8	-62.3	13.1	226.4	437.4	439.3

STATION: BAO, ERIE
DATE: 5/13/82
TIME: 0946 MST
EXPERIMENT: BUCOE
LAUNCH NO: 30

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
0.	126.0	21.3	.0	0.	0.	0.	9.7	2.6	10.0	255.0
1.	141.0	27.4	211.6	408.	257.	-317.	8.0	-16.0	17.9	333.5
2.	153.5	19.5	390.8	1104.	492.	-988.	6.2	-21.6	22.5	343.9
3.	158.8	18.5	593.5	1774.	641.	-1654.	2.7	-23.7	23.8	353.4
4.	164.9	18.2	834.2	2537.	661.	-2450.	-1.0	-23.8	23.8	2.4
5.	169.5	18.7	1075.0	3176.	579.	-3123.	-2.5	-18.4	18.5	7.9
6.	172.0	19.8	1302.9	3619.	504.	-3584.	-.7	-13.7	13.8	2.8
7.	172.3	20.9	1530.1	4007.	537.	-3971.	2.6	-8.5	8.9	342.8
8.	170.8	22.9	1757.4	4160.	665.	-4107.	4.1	6.8	7.9	211.0
9.	167.5	28.6	1984.6	3640.	788.	-3554.	4.2	7.1	8.3	210.7
10.	165.8	30.4	2218.2	3781.	927.	-3665.	-.6	1.3	1.4	155.1
11.	167.8	34.6	2452.5	3555.	751.	-3475.	-7.1	7.1	10.0	134.9
12.	171.4	39.1	2653.0	3265.	488.	-3228.	-8.9	11.8	14.7	142.9
13.	175.8	45.7	2824.6	2756.	202.	-2749.	-7.8	7.5	10.8	134.1
14.	179.8	47.3	2996.1	2765.	10.	-2765.	-6.1	.4	6.1	94.2
15.	183.7	50.0	3250.2	2727.	-176.	-2722.	-5.4	1.0	5.5	100.8
16.	186.9	52.2	3506.7	2720.	-327.	-2700.	-4.2	.7	4.2	99.3
17.	189.2	54.2	3763.3	2714.	-434.	-2679.	-2.6	-.1	2.6	86.9
18.	190.2	55.6	4019.9	2752.	-487.	-2709.	-2.4	-1.9	3.1	51.8
19.	191.8	56.3	4285.9	2858.	-585.	-2798.	-2.1	-7.2	7.5	16.5
20.	191.1	55.0	4589.5	3214.	-619.	-3154.	-.8	-10.9	10.9	4.5
21.	190.4	54.3	4909.6	3528.	-637.	-3470.	-1.9	-11.4	11.6	9.4
22.	190.8	53.1	5229.7	3927.	-736.	-3857.	-3.5	-14.0	14.4	13.9
23.	191.1	51.5	5549.9	4415.	-850.	-4332.	-1.8	-16.1	16.2	6.4
24.	189.9	50.0	5870.0	4925.	-847.	-4852.	-1.1	-17.6	17.6	3.5
25.	189.6	48.4	6190.1	5496.	-917.	-5419.	-1.5	-20.0	20.1	4.4
26.	188.8	46.6	6514.4	6160.	-942.	-6088.	.7	-25.6	25.6	358.4

27.	187.1	44.1	6832.7	7051.	-871.	-6997.	2.7	-29.9	30.1	354.9
28.	185.6	41.9	7155.1	7975.	-778.	-7936.	.6	-22.4	22.4	358.6
29.	185.7	41.6	7478.6	8423.	-837.	-8382.	-.1	-5.4	5.4	.6
30.	185.4	43.1	7774.8	8308.	-782.	-8271.	-3.4	5.6	6.5	149.2
31.	187.4	44.9	8073.8	8102.	-1044.	-8035.	-5.0	8.5	9.9	149.8
32.	188.0	47.1	8415.4	7820.	-1088.	-7744.	-2.9	10.6	11.0	164.9
33.	189.4	49.5	8755.3	7478.	-1221.	-7377.	-2.3	13.5	13.7	170.3
34.	190.1	52.3	9079.2	7017.	-1231.	-6908.	-1.8	15.5	15.6	173.5
35.	191.7	55.1	9403.0	6560.	-1330.	-6423.	-5.7	13.3	14.5	156.7
36.	194.6	57.2	9756.1	6287.	-1585.	-6084.	-7.3	13.7	15.5	152.0
37.	197.7	59.9	10101.4	5856.	-1780.	-5578.	-8.6	15.0	17.3	150.1
38.	202.3	61.9	10446.7	5578.	-2117.	-5161.	-8.6	12.5	15.2	145.4
39.	205.7	63.7	10792.0	5334.	-2313.	-4806.	-9.1	13.5	16.3	146.0
40.	211.8	65.4	11114.3	5089.	-2681.	-4325.	-6.7	15.7	17.1	156.8
41.	215.4	67.6	11423.6	4709.	-2728.	-3838.	-4.2	18.6	19.1	167.4
42.	222.8	69.8	11756.5	4326.	-2939.	-3174.	-9.9	22.6	24.7	156.4
43.	233.8	71.1	12075.5	4134.	-3336.	-2442.	-7.3	22.1	23.3	161.7
44.	241.9	72.8	12412.0	3842.	-3389.	-1810.	.9	20.4	20.5	182.7
45.	250.2	74.7	12734.0	3484.	-3278.	-1180.	6.0	19.2	20.1	197.3
46.	258.3	76.7	13053.6	3086.	-3022.	-626.	3.1	18.8	19.0	189.3
47.	269.6	77.0	13373.2	3087.	-3087.	-22.	3.2	21.7	21.9	188.5
48.	284.2	78.0	13692.7	2911.	-2822.	714.	6.0	21.1	21.9	195.9
49.	295.2	77.9	14012.3	3004.	-2718.	1279.	1.0	16.4	16.4	183.4
50.	302.0	77.2	14331.9	3256.	-2761.	1726.	2.3	21.3	21.4	186.3
51.	315.2	76.0	14651.5	3653.	-2574.	2592.	3.3	27.4	27.6	187.0
52.	323.2	74.1	14971.1	4265.	-2555.	3415.	9.8	16.7	19.4	210.4
53.	331.5	74.9	15290.7	4126.	-1969.	3626.	15.0	24.0	28.3	211.9
54.	341.6	71.7	15610.3	5163.	-1630.	4899.	11.0	41.2	42.7	194.9

STATION: BAO, ERIE
DATE: 5/13/82
TIME: 0946 MST
EXPERIMENT: BUCOE
LAUNCH NO: 30

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1419.8	-.4	11.2	11.2	177.8
500.0	4011.7	-2.5	-1.9	3.1	52.9
400.0	5682.6	-1.5	-16.7	16.8	5.2
300.0	7644.4	-6.0	-.7	6.1	83.8
250.0	8885.7	-2.1	14.3	14.5	171.6
200.0	10403.7	-8.6	12.8	15.5	146.0
150.0	12310.4	-1.4	21.3	21.3	176.3
100.0	15156.9	12.8	21.0	24.6	211.3

STATION: BAO, ERIE
DATE: 5/13/82
TIME: 1331 MST
EXPERIMENT: BUCOE
LAUNCH NO: 31

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	834.8	1572.0	.0	10.6	4.1	63.8	284.9	298.8	325.4
.20	831.6	1603.9	31.9	9.0	2.7	64.7	283.1	297.4	321.1
5.27	675.2	3289.1	1717.1	-4.5	-6.0	88.1	269.2	300.6	313.1
5.59	666.2	3394.8	1822.8	-4.8	-6.7	85.2	268.9	301.4	313.8
7.90	614.2	4030.2	2458.2	-8.5	-13.7	62.6	264.9	304.2	314.1
12.19	539.4	5026.1	3454.1	-14.5	-25.4	34.9	258.7	308.6	315.4
15.60	484.0	5836.5	4264.5	-21.3	-30.5	39.7	251.9	309.9	314.0
16.55	472.6	6011.4	4439.4	-24.1	-32.1	43.7	249.1	308.6	311.8
16.73	468.8	6070.3	4498.3	-24.3	-32.8	41.4	249.0	309.1	312.3
19.79	409.6	7042.9	5470.9	-30.2	-34.5	62.8	243.0	313.7	315.7
23.31	361.0	7928.8	6356.8	-37.3	-40.6	68.6	235.9	315.6	316.8
26.09	328.2	8579.5	7007.5	-42.6	-46.5	63.1	230.6	317.1	317.8
26.91	315.4	8846.9	7274.9	-44.7	-49.1	58.7	228.5	317.8	318.4
28.12	296.8	9254.2	7682.2	-44.1	-52.8	34.1	229.0	324.2	324.8
32.38	255.6	10256.7	8684.7	-44.1	-58.0	17.3	229.0	338.3	339.1
57.35	99.4	16477.3	14905.3	-52.5	-65.7	16.5	220.7	427.1	428.1

STATION: BAO, ERIE
DATE: 5/13/82
TIME: 1331 MST
EXPERIMENT: BUCOE
LAUNCH NO: 31

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	834.8	1572.0	.0	10.6	4.1	63.8	284.9	298.8	325.4
4.39	700.0	3008.3	1436.3	-1.7	-4.8	77.1	272.1	300.6	315.8
14.75	500.0	5602.2	4030.2	-18.9	-29.2	35.7	254.3	310.0	314.9
20.45	400.0	7224.1	5652.1	-31.2	-35.3	64.1	242.0	314.5	316.4
27.95	300.0	9208.6	7636.6	-44.1	-52.5	35.5	229.0	323.2	323.8
33.50	250.0	10431.0	8859.0	-44.4	-58.6	16.6	228.8	340.1	340.9
35.80	200.0	11917.7	10345.7	-47.0	-60.9	16.5	226.2	358.4	359.2
46.99	150.0	13811.4	12239.4	-49.9	-63.5	16.4	223.3	384.1	384.9
57.20	100.0	16447.8	14875.8	-52.5	-65.7	16.5	220.7	426.4	427.4

STATION: BAO, ERIE
DATE: 5/13/82
TIME: 1331 MST
EXPERIMENT: BUCOE
LAUNCH NO: 31

WINDS

TIME MIN	AZ	EL	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC							-5.5	-5.5	16.0	20.0
1.	174.7	26.3	297.8	603.	56.	-600.	3.0	-17.9	18.1	350.4
2.	170.4	29.4	630.2	1118.	187.	-1103.	3.0	-12.2	12.6	346.0
3.	169.8	35.0	962.6	1375.	243.	-1353.	-.1	-9.3	9.3	.4
4.	173.8	37.5	1295.0	1688.	182.	-1678.	-1.4	-9.3	9.4	8.4
5.	175.3	40.1	1627.4	1933.	158.	-1926.	-.8	-7.9	8.0	5.8
6.	176.5	41.7	1935.6	2172.	133.	-2168.	-2.0	-7.6	7.8	14.4
7.	179.1	42.7	2210.6	2396.	38.	-2395.	-2.9	-7.5	8.1	21.0
8.	181.0	43.3	2481.4	2633.	-46.	-2633.	-.9	-.4	1.0	67.8
9.	180.4	48.3	2713.5	2418.	-17.	-2418.	.9	5.6	5.7	188.8
10.	179.8	52.2	2945.7	2285.	8.	-2285.	.0	6.6	6.6	180.4
11.	180.4	57.7	3177.8	2009.	-14.	-2009.	-2.3	10.8	11.0	168.0
12.	184.7	64.5	3410.0	1626.	-133.	-1621.	-4.4	11.6	12.4	159.0
13.	192.5	70.0	3646.6	1327.	-287.	-1296.	-6.2	10.1	11.9	148.5
14.	207.5	73.9	3884.3	1121.	-518.	-994.	-6.2	12.1	13.6	152.7
15.	230.7	78.1	4121.9	869.	-672.	-550.	-5.4	11.2	12.4	154.0
16.	250.3	78.2	4338.2	906.	-853.	-306.	-7.3	7.2	10.2	134.6
17.	264.5	76.2	4584.1	1126.	-1121.	-108.	-7.9	4.3	9.0	118.4
18.	268.2	74.7	4902.0	1341.	-1340.	-42.	-4.9	-2.6	5.5	62.3
19.	259.4	74.5	5219.8	1448.	-1423.	-266.	.1	-8.9	8.9	359.5
20.	246.2	75.2	5523.8	1459.	-1335.	-589.	5.3	-11.1	12.3	334.4
21.	229.0	75.9	5775.5	1451.	-1095.	-952.	5.8	-16.0	17.0	340.2
22.	211.9	72.9	6027.1	1854.	-980.	-1574.	6.2	-20.6	21.5	343.2
23.	197.7	69.6	6278.8	2335.	-710.	-2225.	10.9	-22.8	25.3	334.5
24.	185.9	65.3	6518.3	2998.	-308.	-2982.	12.9	-31.0	33.6	337.4
25.	178.8	58.5	6752.3	4138.	87.	-4137.	13.9	-28.7	31.9	334.1
26.	173.4	55.6	6986.4	4784.	550.	-4752.	14.3	-25.1	28.9	330.3

27.	170.3	51.7	7305.2	5769.	972.	-5687.	10.3	-25.8	27.8	338.2
28.	169.4	49.8	7641.8	6458.	1188.	-6348.	1.1	-17.7	17.7	356.6
29.	171.3	49.0	7889.3	6858.	1037.	-6779.	-8.0	-6.2	10.1	51.9
30.	174.1	50.2	8124.6	6769.	696.	-6733.	-10.1	3.8	10.8	110.7
31.	176.4	51.9	8359.9	6555.	412.	-6542.	-10.3	14.8	18.0	145.2
32.	179.4	55.9	8595.3	5819.	61.	-5819.	-10.1	9.1	13.6	132.1
33.	182.0	55.9	8839.2	5985.	-209.	-5981.	-7.2	6.0	9.4	130.1
34.	184.0	59.0	9088.3	5461.	-381.	-5448.	-5.0	9.6	10.8	152.4
35.	185.5	59.9	9337.4	5413.	-519.	-5388.	-8.1	4.8	9.4	120.6
36.	189.7	61.4	9586.5	5227.	-881.	-5152.	-12.7	9.2	15.7	126.1
37.	195.1	63.1	9835.6	4990.	-1300.	-4818.	-14.2	13.9	19.9	134.4
38.	202.3	65.3	10084.8	4638.	-1760.	-4292.	-11.1	18.9	21.9	149.7
39.	208.5	68.1	10333.9	4154.	-1982.	-3651.	-10.2	20.6	23.0	153.6
40.	218.4	70.0	10583.0	3852.	-2393.	-3019.	-7.8	24.3	25.5	162.2
41.	228.9	73.2	10832.1	3270.	-2464.	-2150.	-5.7	25.1	25.7	167.2
42.	241.8	74.3	11081.3	3115.	-2745.	-1472.	-3.5	19.3	19.6	169.8
43.	250.3	75.9	11330.4	2846.	-2679.	-959.	5.5	15.6	16.5	199.4
44.	258.0	78.0	11579.5	2461.	-2408.	-512.	6.5	16.0	17.3	202.1
45.	270.7	79.1	11828.6	2278.	-2278.	28.	2.8	21.1	21.3	187.6
46.	289.5	78.9	12077.8	2370.	-2234.	791.	3.9	23.8	24.1	189.2
47.	306.3	78.4	12326.9	2530.	-2039.	1498.	1.9	24.7	24.8	184.5
48.	317.6	76.0	12576.0	3136.	-2114.	2315.	-3.6	26.2	26.4	172.2
49.	324.0	73.3	12825.1	3848.	-2262.	3113.	-2.2	23.2	23.3	174.5
50.	329.0	71.5	13074.3	4375.	-2253.	3750.	2.1	23.9	24.0	185.1
51.	335.1	69.2	13323.4	5061.	-2131.	4591.	5.4	28.2	28.7	190.7
52.	340.7	66.8	13572.5	5817.	-1923.	5490.	7.3	26.4	27.4	195.5
53.	344.9	65.0	13821.6	6445.	-1679.	6223.	11.6	23.0	25.8	206.8
54.	350.1	63.5	14070.7	7015.	-1206.	6911.	12.1	22.1	25.2	208.7
55.	353.0	61.9	14319.9	7646.	-932.	7589.	12.6	20.8	24.3	211.1
56.	357.0	60.6	14569.0	8209.	-430.	8198.	14.6	19.6	24.4	216.7
57.	359.8	59.3	14818.1	8798.	-31.	8798.	12.9	19.4	23.4	213.6

STATION: BAO, ERIE
DATE: 5/13/82
TIME: 1331 MST
EXPERIMENT: BUCOE
LAUNCH NO: 31

WINDS FOR MANDATORY OR SPECIFIED LEVELS

PRES MB.	HTAGL M.	U KTS	V KTS	SPEED KTS	DIR DEG
700.0	1449.9	-1.1	-8.7	8.7	7.2
500.0	4030.5	-5.7	11.5	12.9	153.5
400.0	5645.9	5.6	-13.4	14.6	337.2
300.0	7612.1	1.6	-18.5	18.6	355.0
250.0	8907.7	-6.8	7.0	9.8	136.2
200.0	10899.0	-5.1	23.5	24.1	167.9
150.0	12890.2	-1.1	23.5	23.5	177.2
100.0	14881.4	13.3	19.3	23.5	214.5

STATION: BAO, ERIE
DATE: 5/14/82
TIME: 0938 MST
EXPERIMENT: BUCOE
LAUNCH NO: 32

TIME MIN	PRES MB.	HEIGHT M	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	839.3	1572.0	.0	10.6	2.6	57.5	284.7	298.4	324.7
3.00	742.0	2583.1	1011.1	1.7	-2.1	75.9	275.6	299.3	315.6
3.41	724.2	2773.4	1206.4	-.3	-2.1	86.2	273.6	299.3	315.7
5.03	679.2	3288.5	1716.5	-4.5	-5.0	96.2	269.3	300.1	312.5
5.92	652.8	3601.0	2029.0	-4.8	-5.3	96.1	269.0	303.2	315.9
9.05	568.0	4684.4	3112.4	-10.8	-11.5	94.6	262.7	308.4	317.3
11.30	511.6	5480.4	3908.4	-16.3	-20.1	70.0	257.0	311.1	317.2
12.30	488.4	5827.0	4255.0	-20.3	-31.6	31.7	253.0	310.4	314.9
12.84	473.2	6060.5	4488.5	-21.9	-33.6	30.0	251.4	311.3	315.2
13.80	450.6	6420.1	4848.1	-22.8	-32.9	35.3	250.4	314.5	318.3
21.45	313.6	8970.4	7398.4	-43.1	-50.0	43.3	230.0	320.5	321.2
24.20	266.0	10060.7	8488.7	-50.9	-57.7	41.5	222.2	324.6	324.9
25.90	240.9	10709.0	9137.0	-48.7	-56.0	39.5	224.5	337.2	337.7
28.22	212.6	11531.7	9959.7	-48.1	-57.3	30.6	225.1	350.4	351.0
30.94	179.8	12634.8	11062.8	-48.7	-59.6	24.1	224.5	366.7	367.4
33.85	149.8	13829.7	12257.7	-50.6	-61.7	22.9	222.5	383.0	383.7
40.11	99.4	16493.9	14921.9	-52.1	-69.0	9.7	221.0	427.7	428.7

STATION: BAO, ERIE
DATE: 5/14/82
TIME: 0938 MST
EXPERIMENT: BUCOE
LAUNCH NO: 32

TIME MIN	PRES MB.	HEIGHT M.	HTAGL M.	T DEG C	TD DEG C	RH %	VIR T DEG K	THETA DEG K	THETAE DEG K
.00	839.3	1572.0	.0	10.6	2.6	57.5	284.7	298.4	324.7
4.30	700.0	3048.8	1476.8	-2.9	-3.4	96.5	270.9	299.2	312.9
11.82	500.0	5636.8	4064.8	-18.9	-28.9	37.2	254.3	310.0	314.9
17.01	400.0	7263.8	5691.8	-29.6	-37.4	43.1	243.6	316.5	318.7
22.50	300.0	9244.1	7672.1	-46.7	-52.9	46.0	226.5	319.6	320.1
25.70	250.0	10441.0	8869.0	-51.4	-58.2	41.2	221.8	329.7	330.0
29.20	200.0	11899.2	10327.2	-48.7	-58.6	27.6	224.5	355.7	356.3
33.80	150.0	13782.4	12210.4	-50.6	-61.7	22.9	222.5	382.9	383.6
40.08	100.0	16413.5	14841.5	-52.6	-67.3	13.3	220.6	426.1	427.0

STATION: BAO, ERIE
DATE: 5/14/82
TIME: 0938 MST
EXPERIMENT: BUCOE
LAUNCH NO: 32

WINDS

TIME MIN	AZ	EL	HTMSL M.	HTAGL M.	RANGE M.	X M.	Y M.	U KTS	V KTS	SPEED KTS	DIR DEG
SFC								-3.5	-3.5	20.0	10.0
1.	166.1	21.3	1909.0	337.0	864.	208.	-839.	7.4	-28.7	29.7	345.6
2.	165.6	20.2	2246.1	674.1	1832.	456.	-1775.	9.4	-34.6	35.8	344.8
3.	165.2	18.2	2583.1	1011.1	3075.	786.	-2973.	8.8	-33.2	34.4	345.2
4.	165.4	19.4	2964.2	1392.2	3953.	997.	-3826.	7.1	-30.6	31.4	347.0
5.	165.9	18.8	3279.0	1707.0	5014.	1222.	-4863.	6.0	-33.9	34.5	350.0
6.	167.0	18.7	3628.7	2056.7	6076.	1367.	-5920.	3.0	-29.4	29.5	354.2
7.	168.1	19.4	3974.8	2402.8	6823.	1407.	-6676.	4.1	-23.6	23.9	350.1
8.	167.6	20.0	4320.9	2749.0	7553.	1622.	-7377.	11.9	-21.4	24.5	330.9
9.	165.0	20.5	4667.1	3095.1	8278.	2143.	-7996.	13.6	-21.3	25.2	327.5
10.	164.2	20.9	5020.5	3448.5	9031.	2459.	-8690.	8.9	-21.5	23.2	337.5
11.	163.9	21.4	5374.3	3802.3	9702.	2691.	-9322.	7.0	-22.5	23.6	342.8
12.	164.0	21.6	5723.0	4151.0	10484.	2890.	-10078.	4.1	-23.1	23.5	350.1
13.	164.7	22.2	6120.4	4548.4	11146.	2941.	-10751.	.8	-21.0	21.0	357.7
14.	165.5	22.7	6486.8	4914.8	11749.	2942.	-11375.	-1.1	-16.7	16.8	3.8
15.	166.3	23.4	6820.1	5248.1	12128.	2872.	-11783.	-1.3	-8.7	8.8	8.8
16.	166.5	24.5	7153.5	5581.5	12248.	2859.	-11909.	-6.1	-5.9	8.5	46.1
17.	168.4	25.5	7486.9	5914.9	12401.	2494.	-12148.	-10.8	-8.8	13.9	50.8
18.	170.0	26.3	7820.2	6248.2	12642.	2195.	-12450.	-11.4	-9.5	14.9	50.1
19.	172.0	27.1	8153.6	6581.6	12862.	1790.	-12736.	-12.3	-8.6	15.0	55.1
20.	173.7	27.9	8487.0	6915.0	13060.	1433.	-12981.	-8.9	-10.8	14.0	39.3
21.	174.7	28.3	8820.3	7248.3	13462.	1243.	-13404.	-8.4	-7.3	11.1	49.0
22.	176.1	29.5	9188.4	7616.4	13462.	916.	-13431.	-14.3	-7.6	16.2	61.9
23.	178.5	30.0	9584.9	8012.9	13879.	363.	-13874.	-19.2	-10.0	21.7	62.5
24.	181.1	30.9	9981.4	8409.4	14051.	-270.	-14048.	-13.0	-2.2	13.2	80.3
25.	181.8	32.1	10365.8	8793.8	14019.	-440.	-14012.	3.2	-.4	3.2	276.4
26.	180.3	33.1	10744.5	9172.5	14071.	-74.	-14070.	7.9	-3.6	8.7	294.2

27.	179.8	33.8	11099.1	9527.1	14231.	50.	-14231.	2.4	-5.9	6.3	337.6
28.	179.7	34.4	11453.7	9881.7	14432.	76.	-14432.	-.4	-2.8	2.9	8.0
29.	179.9	35.5	11848.0	10276.0	14406.	25.	-14406.	2.0	2.5	3.2	218.7
30.	179.2	36.8	12253.6	10681.6	14278.	199.	-14277.	7.1	-4.9	8.6	304.5
31.	178.2	37.0	12659.4	11087.4	14714.	462.	-14706.	4.0	.6	4.1	262.1
32.	178.2	38.9	13070.1	11498.1	14250.	448.	-14243.	1.1	14.1	14.2	184.5
33.	177.8	40.7	13480.7	11908.7	13845.	531.	-13835.	3.3	7.7	8.4	202.9
34.	177.3	41.8	13893.6	12321.6	13781.	649.	-13766.	-.6	4.4	4.4	172.8
35.	177.9	43.2	14319.2	12747.2	13574.	497.	-13565.	-1.5	16.4	16.5	174.8
36.	177.5	45.9	14744.8	13172.8	12765.	557.	-12753.	-1.8	19.4	19.5	174.8
37.	178.2	47.7	15170.3	13598.3	12374.	389.	-12367.	-3.1	8.5	9.1	159.7
38.	178.3	48.9	15595.9	14023.9	12234.	363.	-12229.	1.3	2.7	3.0	205.8
39.	177.8	49.8	16021.5	14449.5	12211.	469.	-12202.	-2.9	7.1	7.7	158.0
40.	179.1	51.6	16447.1	14875.1	11790.	185.	-11788.	-9.2	13.4	16.2	145.6