NASA Technical Memorandum

NASA TM- 100376

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-29) LAUNCH

By G.L. Jasper and G.W. Batts

Space Science Laboratory

July 1989

National Aeronautics and Space Administration

George C. Marshall Space Flight Center

ACKNOWLEDGMENTS

The authors wish to thank the personnel of NASA Kennedy Space Center, along with those at the Cape Canaveral Air Force Station and their Computer Sciences Raytheon contractors, for the acquisition and distribution of all related KSC atmospheric data received at MSFC.

Thanks are due to Paul Meyer and Deanna Skow of the Earth Science and Applications Division, MSFC, for their help in extracting atmospheric data and satellite cloud photographs that are used in this report. Also, special thanks to Karen Gilliam and Bill Jeffries of Computer Sciences Corporation for their assistance in processing all the upper air data used in producing the STS-29 final atmospheric data tapes. Finally, appreciation is expressed to Rhonda Blocker of Boeing Computer Support Services for the GRA model, and to Ray Sparks and Kimberly Wilkie of NTI for the computer support in attaining pad measurements.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

TECHNICAL MEMORANDUM

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-29) LAUNCH

I. INTRODUCTION

This report presents an evaluation of the atmospheric environmental data taken during the launch of the Space Shuttle/STS-29 vehicle. This Space Shuttle vehicle was launched from Pad 39B at Kennedy Space Center (KSC), Florida, on a reference bearing of 90-degrees east of North, at 1457 u.t. (957 EST) on March 13, 1989.

This report presents a summary of the atmospheric environment at launch time (L+0) of the STS-29, together with the sequence of prelaunch Jimsphere-measured winds aloft profiles from L-3.83 hr through liftoff. The general atmospheric situation for the launch and flight area is described, and surface and upper level wind/thermodynamic observations near launch time are given. Since the ship Redstone was unavailable for STS-29 duty, the SRB descent/impact atmospheric data were not taken. However, one can use the STS-29 ascent data for SRB studies as the best substitute.

Previous MSFC-related launch vehicle atmospheric environmental conditions have been published as Appendix A of individual MSFC Saturn Flight Evaluation Working Group reports [1]. Office memorandums have been issued for previous flights giving launch pad wind information. A report has also been published [2] which summarizes most launch atmospheric conditions observed for the past 155 MSFC/ABMA-related vehicle launches through SA-208 (Skylab 4). Reports summarizing ASTP, STS-1 through STS-27 launch conditions are presented in References 3 through 23, respectively. Table 1 gives the atmospheric L+0 launch conditions for all the Space Shuttle missions.

II. SOURCES OF DATA

Atmospheric observational data used in this report were taken from synoptic maps made by the National Weather Service, plus all available surface observations and measurements from around the launch area. Upper air observations were taken from balloon-released instruments sent aloft from Cape Canaveral Air Force Station (CCAFS). High-altitude winds and thermodynamic data were generated from the global reference atmospheric model (GRAM) since there was no reliable Super-Loki rocketsonde data available. Table 2 presents a listing of systems used to obtain the upper level wind profiles used in compiling the final ascent atmospheric data tape. Data cutoff altitudes are also given in Table 2.

III. GENERAL SYNOPTIC SITUATION AT LAUNCH TIME

An area of weak high pressure dominated the weather over southern Florida during the launch of STS-29. Southerly winds prevailed over KSC during the countdown. Figure 1 depicts the surface map at 2 hr and 57 min before launch of STS-29. The flow of the wind aloft was from the northwest. Figure 2 shows the winds aloft condition at the 500-mb level 2 hr and 57 min before launch.

Skies were mostly clear over the KSC area prior to the launch of STS-29. Figure 3 shows the GOES-7 visible satellite picture at 1501 u.t. (4 min after launch) with the 500-mb heights and wind barbs superimposed. Figure 4 presents an up-close visible view of the Florida peninsula as recorded by GOES-7, taken also at 1501 u.t. (the exhaust cloud from STS-29 can be seen on this photograph).

The STS-29 mission was delayed 2 hours due to fog and strong winds aloft.

IV. SURFACE OBSERVATIONS AT LAUNCH TIME

Surface observations at launch time for selected KSC locations are given in Table 3. Included are pad 39B, Shuttle runway, and CCAFS balloon release station observations. Neither precipitation nor lightning was observed at launch time.

Table 4 presents pad 39B wind data along with other standard hourly atmospheric measurements and sky observations for the 6-hr period prior to launch of STS-29. Values for wind speed and direction are given for the 18-m (60-ft) pad light pole level.

V. UPPER AIR MEASUREMENTS DURING LAUNCH

The FPS-16 Jimsphere (1512 u.t.) and the MSS Rawinsonde (1500 u.t.) systems were used to measure the upper level wind and thermodynamic parameters for STS-29 launch. The Super-Loki Rocketsonde and Super-Loki Robin were not available for launch of STS-29. At altitudes above the measured data, the GRAM [24] parameters for March KSC conditions were used. A tabulation of the STS-29 final atmospheric data for ascent is presented in Table 5 which lists the wind and thermodynamic parameters versus altitude. A brief summary of parameters is given in the following paragraphs.

A. Wind Speed

At launch time, wind speeds were 16.9 ft/s (10.0 kn) at 60 ft and increased to a maximum of 104.7 ft/s (61.9 kn) at 45,200 ft (13,777 m). The winds remained below this maximum through the 84,000-ft (25,603-m) level which was the altitude of the last measurable wind speed. The left side of Figure 5 shows a plot of wind speed versus altitude.

B. Wind Direction

The 60-ft wind direction was from west-southwest (242 degrees) at launch time and shifted to a consistent northerly component around 10,000 ft (3,048 m). The winds fluctuated from the north to northwest to around the 40,800-ft (12,436-m) level. Above this level winds had a westerly component and became southwesterly near 69,000 ft (21,031 m). Winds remained southwesterly throughout 84,000 ft (25,603 m), which was the last measurable directional height. Figure 5 depicts the complete wind versus altitude profile specifying wind direction on the right side.

C. Prelaunch/Launch Wind Profiles

Prelaunch/launch wind profiles given in Figures 6 through 9 were measured by the Jimsphere FPS-16 system. Data is shown for four measurement periods beginning at L–3.83 hr and extending through L + 15 min.

The wind speed and direction profiles for the L–3.83 hr period prior to and including L + 15 min are shown in Figures 6 and 7. The in-plane and out-of-plane profiles are shown in Figures 8 and 9. The in-plane component wind speeds were mostly less than the March mean wind values. The out-of-plane wind speeds were generally greater than the March mean values but well within the 95-percent profile envelope.

D. Thermodynamic Data

The thermodynamic data, taken at STS-29 launch time, consisted of atmospheric temperature, dew-point temperature, pressure, and density. These data have been compiled as the STS-29 ascent atmospheric data and are presented in Table 5. The vertical structure of temperature and dew-point temperature for STS-29 ascent are shown graphically versus altitude in Figure 10.

E. SRB Upper Air and Surface Measurements

As has been mentioned in the introduction, since there was no ship available, an SRB descent atmospheric data tape has not been constructed. The tabular values for the ascent atmospheric tape, as presented in Table 5, should be used for SRB descent/impact studies since it is the closest measured data source.

TABLE 1. SELECTED ATMOSPHERIC OBSERVATIONS FOR THE FLIGHTS OF THE SPACE SHUTTLE VEHICLES

Vehicle Data				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			Count Down and Launch Comments of Meteorological Significance
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	
1	STS-1 Columbia	4/12/81	0700	10.234[d]	21	82	11.8 15.2	125 120	44,300	98	250	
2	STS-2 Columbia	11/12/81	1010	10.166	23	61	27.0 27.0	345 355	36,300	158	286	
3	STS-3 Columbia	3/22/82	1100	10.160	24	71	7.0[e] 8.0[e]	50[e] 145[e]	45,000	119	250	Wind directional change observed at Pad just prior to L+0. Onset of sea breeze.
4	STS-4 Columbia	6/27/82	1100[f]	10.200	29	70	5.8[g] 4.9[g]	133[g] 141[g]	47,900	37	329	
5	STS-5 Columbia	11/11/82	0719	10.227	22	68	22.0 35.0	90 90	40,600	146	336	
6	STS-6 Challenger	4/4/83	1330	10.183	23	55	12.7 16.4	63 55	46,100	155	277	
7	STS-7 Challenger	6/18/83	0733[f]	10.146	25	80	5.9[e] 10.3[e]	10[e] 350[e]	45,900	76	278	
8	STS-8 Challenger	8/30/83	0232[f]	10.111	24	97	8.8 14.0	269 268	45,100	30	349	17 min countdown delay due to adverse weather conditions.
9	STS-9 (SL-1) Columbia	11/28/83	1100	10.153	24	83	19.1 32.0	183 190	47,100	117	252	
10	STS-11 (41-B) Challenger	2/3/84	0800	10.173	17	75	0.0 NA	0 NA	38,200	143	288	
11	STS-13 (41-C) Challenger	4/6/84	0858	10.149	16	56	21.5 18.6	320 275	37,700	176	289	
12	STS-41D Discovery	8/30/84	0842[f]	10.172	26	81	3.0 3.6	106 39	40,300	44	270	
13	STS-41G Challenger	10/5/84	0703[f]	10.210	23	60	16.5 14.8	73 58	40,600	78	303	
14	STS-51A Discovery	11/8/84	0715	10.227	20	59	23.0 31.1	24 10	33,100	131	272	1 day delay due to excessive wind loads, calculated at high altitudes.

TABLE 1. (Concluded)

Vehicle Data[h]				Surface Observations					Inflight Conditions Max. Wind Below 60,000 ft			Count Down and Launch Comments of Meteorological Significance
				Thermodynamic[a]			Wind[b]					
Seq. No.	Vehicle No.	Launch Date	Time (EST) Nearest Minute	Press.[c] N/cm^2	Temp. (°C)	Rel. Hum. (%)	Speed (ft/sec)	Dir. (deg)	Alt. (ft)	Speed (ft/sec)	Dir. (deg)	
15	STS-51C Discovery	1/24/85	1450	10.173	18	46	17.1 15.5	228 253	42,900	199	265	1 day delay due to extreme cold surface temperatures.
16	STS-51D Discovery	4/12/85	1359	10.257	21	55	19.9 22.3	82 82	42,600	134	265	55-min delay due to a ship in the SRB impact area, and concerns over potential weather related impacts (cloud cover).
17	STS-51B Challenger	4/29/85	1202[f]	10.128	27	65	11.5 18.4	005 337	32,900 40,700	68 68	320 297	
18	STS-51G Discovery	6/17/85	0733[f]	10.201	23	91	2.9 11.8	201 206	40,100 46,700	55 55	298 302	
19	STS-51F Challenger	7/29/85	1700[f]	10.174	28	72	14.9 13.4	101 113	48,000	53	035	(20) 8/24 launch scrub due to unexceptable weather in launch area. Rain during countdown.
20	STS-51I Discovery	8/27/85	0658[f]	10.225	24	86	14.2 16.6	073 070	41,000	43	123	
21	STS-51J Atlantis	10/3/85	1115[f]	10.185	28	79	17.0 13.7	213 171	48,000	48	283	(24) 1/7 launch scrub due to unexceptable weather at TAL sites. 1/10 launch scrub due to heavy rain in launch area.
22	STS-61A Challenger	10/30/85	1200	10.059	28	72	12.7 14.1	217 174	43,000	81	218	
23	STS-61B Atlantis	11/26/85	1929	10.202	23	81	10.1 10.4	165 112	49,300	75	270	(25) 1/26 launch scrub due in-part to potential bad weather associated with frontal passage. 1/27 launch scrub due in-part to strong cross winds at X68. 1/28 2-hr delay due in-part to cold early morning temperatures.
24	STS-61C Columbia	1/12/86	0655	10.208	12	84	15.4 18.6	323 342	40,000	221	263	
25[i,j]	STS-51L[i] Challenger	1/28/86	1138	10.253	3	27	20.1 15.3	331 262	42,000	174	264	
26[j]	STS-26 Discovery	9/29/88	1137[f]	10.182	29	56	13.7 13.5	058 047	53,100	44	304	(26) 1 hr and 37 min delay due to light winds.
27[j]	STS-27 Atlantis	12/2/88	930	10.270	14	50	25.5 22.0	314 352	40,200	187	245	(27) 1 day delay due to excessive wind loads, calculated at high altitudes.
28[j]	STS-29 Discovery	3/13/89	957	10.190	18	78	16.9	242	45,200	105	283	(29) 2 hr delay due to fog and strong winds aloft.

a. Pad 39A thermodynamic measurements taken at approximately 1.2 m (4 ft) above natural grade at camera site No. 3.
b. 1 min average prior to L+0 of 60 ft PLP winds measured above natural grade. FSS wind measurement was not available.
c. Pressure measurement applicable to 21 ft above MSL unless otherwise indicated.
d. Pressure measurement applicable to 14 ft above MSL.
e. 10 sec average prior to L+0.
f. Eastern Daylight Time.
g. 30 sec average prior to L+0.
h. All vehicles launched from LC 39A except where noted.
i. Shuttle exploded in flight.
j. Vehicle launched from 39B.

TABLE 2. SYSTEMS USED TO MEASURE UPPER AIR WIND DATA FOR STS-29 ASCENT

	Date: March 13, 1989		Portion of Data Used			
	Release Time		Start		End	
Type of Data	Time (u.t.) (hr:min)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)	Altitude m (ft)	Time After L+0 (min)
FPS-16 Jimsphere	15:12	15	6 (21)	15	16,154 (53,000)	68
MSS Rawinsonde	15:00	3	16,459 (54,000)	57	25,603 (84,000)	87

TABLE 3. SURFACE OBSERVATIONS AT STS-29 LAUNCH TIME

Location[a]	Time After L+0 (min)	Pressure (MSL) N/cm^2 (psia)	Temperature K (°F)	Dew Point K (°F)	Relative Humidity (%)	Visibility km (miles)	Sky Cover			Wind	
							Cloud Amount	Cloud Type	Height of Base Meters (ft)	Speed ft/sec (kt)	Direction (deg)
NASA Space Shuttle Runway X68[d] Winds Measured at 10.4 m (34 ft)	0	10.193 (14.784)	293.2 (68.0)	288.7 (60.0)	75	13 (8)	0	Clear		11.8 (7.0)	250
CCAFS XMR[b] Surface Measurements	-1	10.191	292.0 (66.0)	288.7 (60.0)	81	13 (8)	0	Clear		8.4 (5.0)	240
Pad 39B[c] Lightpole NW 18.3 m (60.0 ft)	0	10.190	290.9 (64.0)	287.1 (57.0)	78	-	-	-	-	16.9 (10.0)	242

a. Altitudes of measurements are above natural grade, except where noted.

b. Balloon release site.

c. Pad 39B thermodynamic measurements are taken at camera site No. 3, approximately 6.4 m (21 ft) above MSL.

d. Official STS-29 sky observational site.

TABLE 4. STS-29 PRE-LAUNCH THROUGH LAUNCH KSC PAD 39B ATMOSPHERIC MEASUREMENTS[a]

Hourly Atmospheric Measurements						Sky Condition[b]			
2 December 1988 Time u.t.	Temperature (°F)	Dew Point (°F)	Relative Humidity (%)	60' Level (SE) WS Kt	60' Level (SE) WD°	Clouds	Total Sky Cover	Vis. (mi.)	Other Remarks
0900	58	57	98	9	253	Clear	0	7	
1000	58	57	99	10	251	Clear	0	7	
1100	58	58	100	10	251	Clear	0	4	Vision obstructed by fog
1200	56	56	100	11	252	Overcast at 200 ft	10/10	3/4	Vision obstructed by fog
1300	58	58	100	8	271	Scattered at 400 and 22,000 ft	5/10	2-1/2	Vision obstructed by fog
1400	61	60	97	11	260	Scattered at 800 ft	4/10	6	Vision obstructed by fog
L+0[c] 1457	64	57	78	10	242	Clear	0	8	

a. Hourly pad observations (obtained via MSFC/HOSC) averaged over 5 min, centered on the hour.

b. Sky observations taken at the Shuttle runway site X68.

c. L+0 PAD wind and thermodynamic parameters obtained from HOSC strip charts. The NW anemometer was used at 60 ft for L+0 wind conditions approximately 5 min average prior to L+0. Pad 39B L+0 sea level pressure was 10.190 N/cm^2.

TABLE 5. STS-29 ASCENT ATMOSPHERIC DATA TAPE

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
21.	16.90	242.00	17.77	0.1019E+04	0.1213E+04	13.91
100.	13.45	260.00	17.72	0.1016E+04	0.1210E+04	13.58
200.	13.45	260.00	17.67	0.1012E+04	0.1206E+04	13.16
300.	13.78	260.00	17.61	0.1009E+04	0.1202E+04	12.74
400.	13.78	260.00	17.55	0.1005E+04	0.1198E+04	12.32
500.	13.78	260.00	17.50	0.1002E+04	0.1194E+04	11.90
600.	16.08	258.00	17.44	0.9980E+03	0.1190E+04	11.49
700.	13.78	277.00	17.38	0.9945E+03	0.1186E+04	11.07
800.	11.48	266.00	17.32	0.9909E+03	0.1183E+04	10.65
900.	15.42	262.00	17.27	0.9873E+03	0.1179E+04	10.23
1000.	18.04	253.00	17.21	0.9838E+03	0.1175E+04	9.81
1100.	21.98	263.00	17.44	0.9803E+03	0.1170E+04	9.13
1200.	22.97	280.00	17.67	0.9769E+03	0.1165E+04	8.45
1300.	23.95	296.00	17.90	0.9734E+03	0.1160E+04	7.77
1400.	24.93	310.00	18.13	0.9700E+03	0.1156E+04	7.09
1500.	25.26	297.00	18.36	0.9666E+03	0.1151E+04	6.41
1600.	21.65	291.00	18.59	0.9632E+03	0.1146E+04	5.73
1700.	21.98	286.00	18.82	0.9598E+03	0.1141E+04	5.05
1800.	19.03	293.00	19.05	0.9564E+03	0.1137E+04	4.37
1900.	21.65	298.00	19.28	0.9531E+03	0.1132E+04	3.69
2000.	19.03	295.00	19.51	0.9497E+03	0.1127E+04	3.01
2100.	14.76	284.00	19.30	0.9463E+03	0.1124E+04	2.93
2200.	13.78	296.00	19.09	0.9430E+03	0.1121E+04	2.85
2300.	13.78	303.00	18.88	0.9396E+03	0.1118E+04	2.77
2400.	13.12	292.00	18.67	0.9363E+03	0.1114E+04	2.69
2500.	9.19	273.00	18.46	0.9330E+03	0.1111E+04	2.61
2600.	4.27	293.00	18.25	0.9296E+03	0.1108E+04	2.53
2700.	7.55	303.00	18.04	0.9263E+03	0.1105E+04	2.45
2800.	6.23	267.00	17.83	0.9230E+03	0.1102E+04	2.37
2900.	6.23	243.00	17.62	0.9198E+03	0.1099E+04	2.29
3000.	3.61	258.00	17.41	0.9165E+03	0.1096E+04	2.21
3100.	5.58	259.00	17.10	0.9132E+03	0.1093E+04	2.16
3200.	8.53	248.00	16.79	0.9100E+03	0.1090E+04	2.11
3300.	8.53	210.00	16.48	0.9067E+03	0.1087E+04	2.06
3400.	7.22	216.00	16.17	0.9035E+03	0.1085E+04	2.01
3500.	6.23	223.00	15.86	0.9003E+03	0.1082E+04	1.96
3600.	10.50	233.00	15.55	0.8970E+03	0.1079E+04	1.91
3700.	12.14	219.00	15.24	0.8938E+03	0.1077E+04	1.86
3800.	10.50	202.00	14.93	0.8906E+03	0.1074E+04	1.81
3900.	8.86	217.00	14.62	0.8875E+03	0.1071E+04	1.76
4000.	10.17	220.00	14.31	0.8843E+03	0.1068E+04	1.71
4100.	13.78	215.00	14.13	0.8811E+03	0.1065E+04	1.54
4200.	14.11	205.00	13.95	0.8779E+03	0.1062E+04	1.37
4300.	12.47	202.00	13.77	0.8748E+03	0.1059E+04	1.20
4400.	10.83	218.00	13.59	0.8716E+03	0.1056E+04	1.03
4500.	14.76	216.00	13.41	0.8685E+03	0.1053E+04	0.86
4600.	16.40	205.00	13.23	0.8653E+03	0.1050E+04	0.69
4700.	15.75	191.00	13.05	0.8622E+03	0.1047E+04	0.52
4800.	11.81	200.00	12.87	0.8591E+03	0.1043E+04	0.35
4900.	11.15	200.00	12.69	0.8560E+03	0.1040E+04	0.18

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
5000.	12.80	203.00	12.51	0.8529E+03	0.1037E+04	0.01
5100.	12.80	183.00	12.42	0.8498E+03	0.1034E+04	-0.37
5200.	9.51	177.00	12.33	0.8467E+03	0.1031E+04	-0.75
5300.	8.86	177.00	12.24	0.8436E+03	0.1027E+04	-1.13
5400.	10.50	205.00	12.15	0.8406E+03	0.1024E+04	-1.51
5500.	12.80	186.00	12.06	0.8375E+03	0.1021E+04	-1.89
5600.	13.12	188.00	11.97	0.8345E+03	0.1017E+04	-2.27
5700.	10.83	204.00	11.88	0.8314E+03	0.1014E+04	-2.65
5800.	11.11	218.00	11.79	0.8284E+03	0.1011E+04	-3.03
5900.	16.73	209.00	11.70	0.8254E+03	0.1007E+04	-3.41
6000.	16.40	205.00	11.61	0.8224E+03	0.1004E+04	-3.79
6100.	19.69	220.00	11.50	0.8194E+03	0.1001E+04	-3.80
6200.	20.67	222.00	11.39	0.8164E+03	0.9974E+03	-3.81
6300.	24.28	222.00	11.28	0.8135E+03	0.9942E+03	-3.82
6400.	21.00	224.00	11.17	0.8105E+03	0.9910E+03	-3.83
6500.	19.69	236.00	11.06	0.8076E+03	0.9877E+03	-3.84
6600.	22.97	242.00	10.95	0.8046E+03	0.9845E+03	-3.85
6700.	23.62	247.00	10.84	0.8017E+03	0.9813E+03	-3.86
6800.	21.98	255.00	10.73	0.7988E+03	0.9781E+03	-3.87
6900.	22.64	265.00	10.62	0.7959E+03	0.9749E+03	-3.88
7000.	22.64	263.00	10.51	0.7930E+03	0.9718E+03	-3.89
7100.	21.65	262.00	10.35	0.7901E+03	0.9688E+03	-4.13
7200.	18.70	273.00	10.19	0.7872E+03	0.9658E+03	-4.37
7300.	20.34	281.00	10.03	0.7843E+03	0.9628E+03	-4.61
7400.	19.36	275.00	9.87	0.7814E+03	0.9599E+03	-4.85
7500.	16.73	283.00	9.71	0.7786E+03	0.9569E+03	-5.09
7600.	19.69	286.00	9.55	0.7757E+03	0.9540E+03	-5.33
7700.	20.01	281.00	9.39	0.7729E+03	0.9511E+03	-5.57
7800.	15.75	278.00	9.23	0.7700E+03	0.9481E+03	-5.81
7900.	15.42	286.00	9.07	0.7672E+03	0.9452E+03	-6.05
8000.	16.73	298.00	8.91	0.7644E+03	0.9423E+03	-6.29
8100.	17.72	297.00	8.79	0.7616E+03	0.9393E+03	-6.75
8200.	15.09	299.00	8.67	0.7588E+03	0.9363E+03	-7.21
8300.	12.47	305.00	8.55	0.7560E+03	0.9333E+03	-7.67
8400.	17.39	294.00	8.43	0.7532E+03	0.9303E+03	-8.13
8500.	16.08	276.00	8.31	0.7505E+03	0.9274E+03	-8.59
8600.	15.09	261.00	8.19	0.7477E+03	0.9244E+03	-9.05
8700.	12.14	276.00	8.07	0.7450E+03	0.9215E+03	-9.51
8800.	15.75	284.00	7.95	0.7422E+03	0.9185E+03	-9.97
8900.	17.39	280.00	7.83	0.7395E+03	0.9156E+03	-10.43
9000.	17.06	284.00	7.71	0.7368E+03	0.9126E+03	-10.89
9100.	15.75	299.00	7.53	0.7341E+03	0.9099E+03	-10.90
9200.	17.06	298.00	7.35	0.7314E+03	0.9071E+03	-10.91
9300.	18.37	293.00	7.17	0.7287E+03	0.9043E+03	-10.92
9400.	15.75	302.00	6.99	0.7260E+03	0.9015E+03	-10.93
9500.	14.44	321.00	6.81	0.7233E+03	0.8988E+03	-10.94
9600.	14.76	319.00	6.63	0.7206E+03	0.8960E+03	-10.95
9700.	14.11	301.00	6.45	0.7179E+03	0.8933E+03	-10.96
9800.	8.53	301.00	6.27	0.7153E+03	0.8905E+03	-10.97
9900.	8.53	331.00	6.09	0.7126E+03	0.8878E+03	-10.98

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
10000.	10.50	340.00	5.91	0.7100E+03	0.8851E+03	-10.99
10100.	11.15	321.00	5.60	0.7074E+03	0.8828E+03	-10.97
10200.	8.53	324.00	5.29	0.7047E+03	0.8805E+03	-10.95
10300.	9.51	338.00	4.98	0.7021E+03	0.8781E+03	-10.93
10400.	12.80	345.00	4.67	0.6995E+03	0.8758E+03	-10.91
10500.	11.48	339.00	4.36	0.6969E+03	0.8735E+03	-10.89
10600.	8.53	336.00	4.05	0.6943E+03	0.8713E+03	-10.87
10700.	9.51	339.00	3.74	0.6917E+03	0.8690E+03	-10.85
10800.	11.81	353.00	3.43	0.6891E+03	0.8667E+03	-10.83
10900.	12.80	334.00	3.12	0.6866E+03	0.8644E+03	-10.81
11000.	10.17	340.00	2.81	0.6840E+03	0.8622E+03	-10.79
11100.	12.47	354.00	2.57	0.6814E+03	0.8597E+03	-11.15
11200.	14.44	342.00	2.33	0.6788E+03	0.8572E+03	-11.51
11300.	12.80	345.00	2.09	0.6763E+03	0.8548E+03	-11.87
11400.	11.15	6.00	1.85	0.6737E+03	0.8523E+03	-12.23
11500.	14.11	349.00	1.61	0.6712E+03	0.8499E+03	-12.59
11600.	15.09	345.00	1.37	0.6686E+03	0.8474E+03	-12.95
11700.	13.78	348.00	1.13	0.6661E+03	0.8450E+03	-13.31
11800.	16.08	356.00	0.89	0.6636E+03	0.8426E+03	-13.67
11900.	18.70	357.00	0.65	0.6611E+03	0.8401E+03	-14.03
12000.	17.06	350.00	0.41	0.6586E+03	0.8377E+03	-14.39
12100.	14.11	1.00	0.18	0.6561E+03	0.8353E+03	-14.42
12200.	14.44	357.00	-0.05	0.6536E+03	0.8328E+03	-14.45
12300.	14.76	350.00	-0.28	0.6512E+03	0.8304E+03	-14.48
12400.	12.80	349.00	-0.51	0.6487E+03	0.8279E+03	-14.51
12500.	16.08	0.00	-0.74	0.6462E+03	0.8255E+03	-14.54
12600.	18.04	358.00	-0.97	0.6438E+03	0.8230E+03	-14.57
12700.	15.42	342.00	-1.20	0.6414E+03	0.8206E+03	-14.60
12800.	13.12	348.00	-1.43	0.6389E+03	0.8182E+03	-14.63
12900.	13.78	356.00	-1.66	0.6365E+03	0.8158E+03	-14.66
13000.	18.04	348.00	-1.89	0.6341E+03	0.8134E+03	-14.69
13100.	19.69	338.00	-2.12	0.6317E+03	0.8110E+03	-14.73
13200.	17.39	335.00	-2.35	0.6292E+03	0.8085E+03	-14.77
13300.	19.03	348.00	-2.58	0.6268E+03	0.8061E+03	-14.81
13400.	21.98	342.00	-2.81	0.6244E+03	0.8037E+03	-14.85
13500.	24.61	337.00	-3.04	0.6220E+03	0.8013E+03	-14.89
13600.	22.31	338.00	-3.27	0.6196E+03	0.7989E+03	-14.93
13700.	21.65	340.00	-3.50	0.6173E+03	0.7965E+03	-14.97
13800.	24.28	343.00	-3.73	0.6149E+03	0.7942E+03	-15.01
13900.	24.93	338.00	-3.96	0.6125E+03	0.7918E+03	-15.05
14000.	24.28	334.00	-4.19	0.6102E+03	0.7894E+03	-15.09
14100.	23.95	336.00	-4.46	0.6078E+03	0.7872E+03	-15.22
14200.	26.57	334.00	-4.73	0.6055E+03	0.7849E+03	-15.35
14300.	25.26	330.00	-5.00	0.6031E+03	0.7827E+03	-15.48
14400.	23.62	328.00	-5.27	0.6008E+03	0.7804E+03	-15.61
14500.	24.93	333.00	-5.54	0.5985E+03	0.7782E+03	-15.74
14600.	26.90	327.00	-5.81	0.5962E+03	0.7760E+03	-15.87
14700.	25.59	321.00	-6.08	0.5939E+03	0.7738E+03	-16.00
14800.	23.62	323.00	-6.35	0.5916E+03	0.7716E+03	-16.13
14900.	24.93	328.00	-6.62	0.5893E+03	0.7694E+03	-16.26

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
15000.	27.56	320.00	-6.89	0.5870E+03	0.7672E+03	-16.39
15100.	25.59	316.00	-7.10	0.5847E+03	0.7648E+03	-16.53
15200.	23.95	317.00	-7.31	0.5824E+03	0.7624E+03	-16.67
15300.	24.93	323.00	-7.52	0.5802E+03	0.7601E+03	-16.81
15400.	25.26	319.00	-7.73	0.5779E+03	0.7577E+03	-16.95
15500.	23.62	311.00	-7.94	0.5756E+03	0.7553E+03	-17.09
15600.	21.33	316.00	-8.15	0.5734E+03	0.7530E+03	-17.23
15700.	22.64	320.00	-8.36	0.5712E+03	0.7507E+03	-17.37
15800.	23.62	314.00	-8.57	0.5689E+03	0.7483E+03	-17.51
15900.	19.69	307.00	-8.78	0.5667E+03	0.7460E+03	-17.65
16000.	18.70	315.00	-8.99	0.5645E+03	0.7437E+03	-17.79
16100.	20.34	313.00	-9.11	0.5623E+03	0.7411E+03	-18.46
16200.	19.69	310.00	-9.23	0.5601E+03	0.7386E+03	-19.13
16300.	19.36	311.00	-9.35	0.5579E+03	0.7361E+03	-19.80
16400.	21.98	307.00	-9.47	0.5557E+03	0.7335E+03	-20.47
16500.	23.62	306.00	-9.59	0.5535E+03	0.7310E+03	-21.14
16600.	24.28	298.00	-9.71	0.5513E+03	0.7285E+03	-21.81
16700.	25.59	306.00	-9.83	0.5491E+03	0.7260E+03	-22.48
16800.	28.54	305.00	-9.95	0.5470E+03	0.7235E+03	-23.15
16900.	28.87	299.00	-10.07	0.5448E+03	0.7210E+03	-23.82
17000.	29.20	297.00	-10.19	0.5427E+03	0.7185E+03	-24.49
17100.	31.82	302.00	-10.41	0.5406E+03	0.7163E+03	-24.57
17200.	36.09	295.00	-10.63	0.5384E+03	0.7141E+03	-24.65
17300.	34.45	294.00	-10.85	0.5363E+03	0.7118E+03	-24.73
17400.	37.73	297.00	-11.07	0.5342E+03	0.7096E+03	-24.81
17500.	41.99	295.00	-11.29	0.5320E+03	0.7074E+03	-24.89
17600.	41.67	298.00	-11.51	0.5299E+03	0.7052E+03	-24.97
17700.	40.35	301.00	-11.73	0.5278E+03	0.7030E+03	-25.05
17800.	42.65	301.00	-11.95	0.5258E+03	0.7008E+03	-25.13
17900.	41.99	298.00	-12.17	0.5237E+03	0.6986E+03	-25.21
18000.	40.03	299.00	-12.39	0.5216E+03	0.6964E+03	-25.29
18100.	41.34	297.00	-12.57	0.5195E+03	0.6941E+03	-24.95
18200.	41.01	295.00	-12.75	0.5175E+03	0.6918E+03	-24.61
18300.	38.06	296.00	-12.93	0.5154E+03	0.6895E+03	-24.27
18400.	38.06	300.00	-13.11	0.5133E+03	0.6873E+03	-23.93
18500.	41.67	301.00	-13.29	0.5113E+03	0.6850E+03	-23.59
18600.	38.71	302.00	-13.47	0.5093E+03	0.6827E+03	-23.25
18700.	38.71	307.00	-13.65	0.5072E+03	0.6805E+03	-22.91
18800.	42.65	305.00	-13.83	0.5052E+03	0.6782E+03	-22.57
18900.	39.04	306.00	-14.01	0.5032E+03	0.6759E+03	-22.23
19000.	40.03	308.00	-14.19	0.5012E+03	0.6737E+03	-21.89
19100.	44.62	310.00	-14.22	0.4992E+03	0.6711E+03	-22.21
19200.	43.31	310.00	-14.25	0.4972E+03	0.6685E+03	-22.53
19300.	42.65	316.00	-14.28	0.4952E+03	0.6660E+03	-22.85
19400.	48.56	309.00	-14.31	0.4933E+03	0.6634E+03	-23.17
19500.	49.54	310.00	-14.34	0.4913E+03	0.6608E+03	-23.49
19600.	51.18	313.00	-14.37	0.4893E+03	0.6583E+03	-23.81
19700.	53.48	310.00	-14.40	0.4874E+03	0.6558E+03	-24.13
19800.	55.12	307.00	-14.43	0.4855E+03	0.6532E+03	-24.45
19900.	53.48	307.00	-14.46	0.4835E+03	0.6507E+03	-24.77

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
20000.	56.76	309.00	-14.49	0.4816E+03	0.6482E+03	-25.09
20100.	56.76	309.00	-14.61	0.4797E+03	0.6459E+03	-25.48
20200.	55.45	310.00	-14.73	0.4777E+03	0.6436E+03	-25.87
20300.	58.07	312.00	-14.85	0.4758E+03	0.6414E+03	-26.26
20400.	55.45	311.00	-14.97	0.4739E+03	0.6391E+03	-26.65
20500.	53.81	312.00	-15.09	0.4720E+03	0.6368E+03	-27.04
20600.	56.76	314.00	-15.21	0.4701E+03	0.6346E+03	-27.43
20700.	57.74	313.00	-15.33	0.4682E+03	0.6323E+03	-27.82
20800.	54.13	315.00	-15.45	0.4663E+03	0.6301E+03	-28.21
20900.	54.13	317.00	-15.57	0.4645E+03	0.6279E+03	-28.60
21000.	52.49	312.00	-15.69	0.4626E+03	0.6257E+03	-28.99
21100.	51.18	312.00	-15.95	0.4607E+03	0.6238E+03	-29.16
21200.	49.21	315.00	-16.21	0.4589E+03	0.6219E+03	-29.33
21300.	53.15	312.00	-16.47	0.4570E+03	0.6200E+03	-29.50
21400.	51.18	313.00	-16.73	0.4552E+03	0.6181E+03	-29.67
21500.	53.48	315.00	-16.99	0.4534E+03	0.6163E+03	-29.84
21600.	53.81	311.00	-17.25	0.4515E+03	0.6144E+03	-30.01
21700.	53.15	312.00	-17.51	0.4497E+03	0.6126E+03	-30.18
21800.	54.79	315.00	-17.77	0.4479E+03	0.6107E+03	-30.35
21900.	53.48	314.00	-18.03	0.4461E+03	0.6089E+03	-30.52
22000.	53.81	314.00	-18.29	0.4443E+03	0.6071E+03	-30.69
22100.	56.43	315.00	-18.52	0.4425E+03	0.6051E+03	-30.95
22200.	57.41	315.00	-18.75	0.4407E+03	0.6032E+03	-31.21
22300.	54.13	316.00	-18.98	0.4389E+03	0.6013E+03	-31.47
22400.	57.74	316.00	-19.21	0.4371E+03	0.5994E+03	-31.73
22500.	57.74	316.00	-19.44	0.4353E+03	0.5975E+03	-31.99
22600.	55.45	316.00	-19.67	0.4335E+03	0.5956E+03	-32.25
22700.	56.76	315.00	-19.90	0.4318E+03	0.5937E+03	-32.51
22800.	53.81	314.00	-20.13	0.4300E+03	0.5918E+03	-32.77
22900.	54.46	316.00	-20.36	0.4282E+03	0.5900E+03	-33.03
23000.	54.46	315.00	-20.59	0.4265E+03	0.5881E+03	-33.29
23100.	52.17	311.00	-20.83	0.4247E+03	0.5862E+03	-33.55
23200.	55.12	314.00	-21.07	0.4230E+03	0.5844E+03	-33.81
23300.	56.10	311.00	-21.31	0.4213E+03	0.5826E+03	-34.07
23400.	51.84	310.00	-21.55	0.4195E+03	0.5807E+03	-34.33
23500.	54.13	311.00	-21.79	0.4178E+03	0.5789E+03	-34.59
23600.	52.49	310.00	-22.03	0.4161E+03	0.5771E+03	-34.85
23700.	53.48	310.00	-22.27	0.4144E+03	0.5752E+03	-35.11
23800.	53.81	310.00	-22.51	0.4127E+03	0.5734E+03	-35.37
23900.	53.81	306.00	-22.75	0.4110E+03	0.5716E+03	-35.63
24000.	55.12	307.00	-22.99	0.4093E+03	0.5698E+03	-35.89
24100.	56.43	306.00	-23.25	0.4076E+03	0.5681E+03	-36.06
24200.	56.10	307.00	-23.51	0.4059E+03	0.5663E+03	-36.23
24300.	55.77	306.00	-23.77	0.4042E+03	0.5645E+03	-36.40
24400.	54.46	307.00	-24.03	0.4025E+03	0.5628E+03	-36.57
24500.	55.45	306.00	-24.29	0.4009E+03	0.5610E+03	-36.74
24600.	54.13	306.00	-24.55	0.3992E+03	0.5593E+03	-36.91
24700.	58.07	305.00	-24.81	0.3975E+03	0.5575E+03	-37.08
24800.	58.07	301.00	-25.07	0.3959E+03	0.5558E+03	-37.25
24900.	56.76	305.00	-25.33	0.3942E+03	0.5541E+03	-37.42

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
25000.	57.74	304.00	-25.59	0.3926E+03	0.5523E+03	-37.59
25100.	57.09	302.00	-25.85	0.3909E+03	0.5506E+03	-37.84
25200.	57.41	303.00	-26.11	0.3893E+03	0.5489E+03	-38.09
25300.	57.74	301.00	-26.37	0.3877E+03	0.5471E+03	-38.34
25400.	55.45	305.00	-26.63	0.3860E+03	0.5454E+03	-38.59
25500.	56.10	305.00	-26.89	0.3844E+03	0.5437E+03	-38.84
25600.	54.46	303.00	-27.15	0.3828E+03	0.5420E+03	-39.09
25700.	55.12	308.00	-27.41	0.3812E+03	0.5403E+03	-39.34
25800.	57.09	308.00	-27.67	0.3796E+03	0.5386E+03	-39.59
25900.	55.45	311.00	-27.93	0.3780E+03	0.5369E+03	-39.84
26000.	56.76	311.00	-28.19	0.3764E+03	0.5352E+03	-40.09
26100.	55.12	311.00	-28.46	0.3748E+03	0.5335E+03	-40.33
26200.	54.13	312.00	-28.73	0.3732E+03	0.5318E+03	-40.57
26300.	54.13	311.00	-29.00	0.3716E+03	0.5302E+03	-40.81
26400.	52.49	309.00	-29.27	0.3700E+03	0.5285E+03	-41.05
26500.	56.10	310.00	-29.54	0.3685E+03	0.5268E+03	-41.29
26600.	54.46	309.00	-29.81	0.3669E+03	0.5252E+03	-41.53
26700.	54.13	308.00	-30.08	0.3653E+03	0.5235E+03	-41.77
26800.	55.12	309.00	-30.35	0.3638E+03	0.5219E+03	-42.01
26900.	55.77	310.00	-30.62	0.3622E+03	0.5202E+03	-42.25
27000.	56.10	312.00	-30.89	0.3607E+03	0.5186E+03	-42.49
27100.	58.40	311.00	-31.16	0.3592E+03	0.5170E+03	-42.70
27200.	59.06	312.00	-31.43	0.3576E+03	0.5153E+03	-42.91
27300.	59.71	313.00	-31.70	0.3561E+03	0.5137E+03	-43.12
27400.	59.71	310.00	-31.97	0.3545E+03	0.5120E+03	-43.33
27500.	60.37	310.00	-32.24	0.3530E+03	0.5104E+03	-43.54
27600.	60.70	312.00	-32.51	0.3515E+03	0.5088E+03	-43.75
27700.	58.07	309.00	-32.78	0.3500E+03	0.5072E+03	-43.96
27800.	57.74	313.00	-33.05	0.3485E+03	0.5056E+03	-44.17
27900.	55.45	314.00	-33.32	0.3470E+03	0.5040E+03	-44.38
28000.	54.13	314.00	-33.59	0.3455E+03	0.5024E+03	-44.59
28100.	56.10	313.00	-33.81	0.3440E+03	0.5006E+03	-44.84
28200.	55.12	312.00	-34.03	0.3425E+03	0.4989E+03	-45.09
28300.	54.46	316.00	-34.25	0.3410E+03	0.4972E+03	-45.34
28400.	56.76	316.00	-34.47	0.3395E+03	0.4955E+03	-45.59
28500.	55.45	314.00	-34.69	0.3381E+03	0.4938E+03	-45.84
28600.	56.76	320.00	-34.91	0.3366E+03	0.4921E+03	-46.09
28700.	60.37	318.00	-35.13	0.3351E+03	0.4905E+03	-46.34
28800.	57.41	319.00	-35.35	0.3337E+03	0.4888E+03	-46.59
28900.	58.40	322.00	-35.57	0.3322E+03	0.4871E+03	-46.84
29000.	62.34	313.00	-35.79	0.3308E+03	0.4855E+03	-47.09
29100.	59.71	318.00	-36.07	0.3294E+03	0.4839E+03	-47.44
29200.	62.01	318.00	-36.35	0.3279E+03	0.4824E+03	-47.79
29300.	59.71	317.00	-36.63	0.3265E+03	0.4808E+03	-48.14
29400.	60.70	316.00	-36.91	0.3250E+03	0.4793E+03	-48.49
29500.	58.73	316.00	-37.19	0.3236E+03	0.4778E+03	-48.84
29600.	58.07	317.00	-37.47	0.3222E+03	0.4762E+03	-49.19
29700.	57.09	319.00	-37.75	0.3208E+03	0.4747E+03	-49.54
29800.	57.74	321.00	-38.03	0.3194E+03	0.4732E+03	-49.89
29900.	55.77	316.00	-38.31	0.3180E+03	0.4717E+03	-50.24

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
30000.	57.74	316.00	-38.59	0.3166E+03	0.4702E+03	-50.59
30100.	56.10	317.00	-38.86	0.3152E+03	0.4686E+03	-50.82
30200.	56.00	317.00	-39.13	0.3138E+03	0.4671E+03	-51.05
30300.	56.00	317.00	-39.40	0.3124E+03	0.4655E+03	-51.28
30400.	55.88	318.00	-39.67	0.3110E+03	0.4640E+03	-51.51
30500.	55.77	318.00	-39.94	0.3096E+03	0.4625E+03	-51.74
30600.	55.77	316.00	-40.21	0.3082E+03	0.4610E+03	-51.97
30700.	56.43	312.00	-40.48	0.3069E+03	0.4594E+03	-52.20
30800.	55.45	314.00	-40.75	0.3055E+03	0.4579E+03	-52.43
30900.	57.41	313.00	-41.02	0.3042E+03	0.4564E+03	-52.66
31000.	53.81	316.00	-41.29	0.3028E+03	0.4549E+03	-52.89
31100.	56.10	314.00	-41.58	0.3014E+03	0.4535E+03	-53.13
31200.	55.77	315.00	-41.87	0.3001E+03	0.4520E+03	-53.37
31300.	56.10	313.00	-42.16	0.2987E+03	0.4505E+03	-53.61
31400.	55.77	311.00	-42.45	0.2974E+03	0.4491E+03	-53.85
31500.	58.07	313.00	-42.74	0.2961E+03	0.4476E+03	-54.09
31600.	55.45	313.00	-43.03	0.2947E+03	0.4462E+03	-54.33
31700.	57.74	313.00	-43.32	0.2934E+03	0.4447E+03	-54.57
31800.	60.04	313.00	-43.61	0.2921E+03	0.4433E+03	-54.81
31900.	58.07	312.00	-43.90	0.2908E+03	0.4419E+03	-55.05
32000.	60.37	310.00	-44.19	0.2895E+03	0.4405E+03	-55.29
32100.	61.68	310.00	-44.42	0.2882E+03	0.4389E+03	-55.49
32200.	60.04	309.00	-44.65	0.2869E+03	0.4374E+03	-55.69
32300.	63.65	311.00	-44.88	0.2856E+03	0.4358E+03	-55.89
32400.	61.35	312.00	-45.11	0.2843E+03	0.4343E+03	-56.09
32500.	63.32	312.00	-45.34	0.2830E+03	0.4328E+03	-56.29
32600.	63.98	311.00	-45.57	0.2818E+03	0.4313E+03	-56.49
32700.	63.65	313.00	-45.80	0.2805E+03	0.4298E+03	-56.69
32800.	67.26	312.00	-46.03	0.2792E+03	0.4283E+03	-56.89
32900.	63.98	314.00	-46.26	0.2780E+03	0.4268E+03	-57.09
33000.	65.62	314.00	-46.49	0.2767E+03	0.4253E+03	-57.29
33100.	65.62	310.00	-46.79	0.2754E+03	0.4239E+03	-57.54
33200.	63.32	312.00	-47.09	0.2742E+03	0.4225E+03	-57.79
33300.	64.30	312.00	-47.39	0.2729E+03	0.4211E+03	-58.04
33400.	65.29	311.00	-47.69	0.2716E+03	0.4197E+03	-58.29
33500.	65.62	313.00	-47.99	0.2704E+03	0.4183E+03	-58.54
33600.	63.98	314.00	-48.29	0.2691E+03	0.4169E+03	-58.79
33700.	63.65	311.00	-48.59	0.2679E+03	0.4156E+03	-59.04
33800.	64.30	309.00	-48.89	0.2667E+03	0.4142E+03	-59.29
33900.	67.59	310.00	-49.19	0.2654E+03	0.4129E+03	-59.54
34000.	67.91	310.00	-49.49	0.2642E+03	0.4115E+03	-59.79
34100.	66.93	309.00	-49.76	0.2630E+03	0.4101E+03	-60.03
34200.	66.27	316.00	-50.03	0.2618E+03	0.4087E+03	-60.27
34300.	67.59	310.00	-50.30	0.2605E+03	0.4073E+03	-60.51
34400.	68.24	313.00	-50.57	0.2593E+03	0.4059E+03	-60.75
34500.	69.55	312.00	-50.84	0.2581E+03	0.4045E+03	-60.99
34600.	69.55	312.00	-51.11	0.2569E+03	0.4031E+03	-61.23
34700.	71.19	313.00	-51.38	0.2557E+03	0.4017E+03	-61.47
34800.	71.19	313.00	-51.65	0.2546E+03	0.4003E+03	-61.71
34900.	70.87	314.00	-51.92	0.2534E+03	0.3990E+03	-61.95

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
35000.	69.55	312.00	-52.19	0.2522E+03	0.3976E+03	-62.19
35100.	67.59	313.00	-52.45	0.2510E+03	0.3962E+03	-62.41
35200.	66.93	313.00	-52.71	0.2498E+03	0.3948E+03	-62.63
35300.	62.34	314.00	-52.97	0.2487E+03	0.3934E+03	-62.85
35400.	62.99	311.00	-53.23	0.2475E+03	0.3920E+03	-63.07
35500.	62.34	308.00	-53.49	0.2463E+03	0.3907E+03	-63.29
35600.	61.35	308.00	-53.75	0.2452E+03	0.3893E+03	-63.51
35700.	61.02	313.00	-54.01	0.2440E+03	0.3879E+03	-63.73
35800.	60.04	308.00	-54.27	0.2429E+03	0.3866E+03	-63.95
35900.	59.06	310.00	-54.53	0.2417E+03	0.3852E+03	-64.17
36000.	60.37	308.00	-54.79	0.2406E+03	0.3838E+03	-64.39
36100.	57.74	308.00	-55.03	0.2395E+03	0.3824E+03	-64.60
36200.	59.38	305.00	-55.27	0.2383E+03	0.3810E+03	-64.81
36300.	57.41	309.00	-55.51	0.2372E+03	0.3796E+03	-65.02
36400.	57.74	307.00	-55.75	0.2361E+03	0.3783E+03	-65.23
36500.	59.71	307.00	-55.99	0.2349E+03	0.3769E+03	-65.44
36600.	59.38	304.00	-56.23	0.2338E+03	0.3755E+03	-65.65
36700.	58.73	303.00	-56.47	0.2327E+03	0.3741E+03	-65.86
36800.	59.38	306.00	-56.71	0.2316E+03	0.3728E+03	-66.07
36900.	61.02	304.00	-56.95	0.2305E+03	0.3714E+03	-66.28
37000.	60.70	306.00	-57.19	0.2294E+03	0.3700E+03	-66.49
37100.	61.02	302.00	-57.36	0.2283E+03	0.3686E+03	-66.63
37200.	60.04	303.00	-57.53	0.2272E+03	0.3671E+03	-66.77
37300.	57.09	305.00	-57.70	0.2261E+03	0.3656E+03	-66.91
37400.	62.66	302.00	-57.87	0.2250E+03	0.3641E+03	-67.05
37500.	59.71	307.00	-58.04	0.2239E+03	0.3627E+03	-67.19
37600.	61.35	302.00	-58.21	0.2229E+03	0.3612E+03	-67.33
37700.	62.99	305.00	-58.38	0.2218E+03	0.3597E+03	-67.47
37800.	62.66	299.00	-58.55	0.2207E+03	0.3583E+03	-67.61
37900.	62.66	300.00	-58.72	0.2197E+03	0.3569E+03	-67.75
38000.	66.27	299.00	-58.89	0.2186E+03	0.3554E+03	-67.89
38100.	68.24	296.00	-58.83	0.2175E+03	0.3536E+03	-67.84
38200.	65.62	298.00	-58.77	0.2165E+03	0.3518E+03	-67.79
38300.	67.59	301.00	-58.71	0.2155E+03	0.3500E+03	-67.74
38400.	68.57	297.00	-58.65	0.2144E+03	0.3482E+03	-67.69
38500.	70.87	304.00	-58.59	0.2134E+03	0.3465E+03	-67.64
38600.	71.85	304.00	-58.53	0.2124E+03	0.3447E+03	-67.59
38700.	75.13	307.00	-58.47	0.2113E+03	0.3429E+03	-67.54
38800.	77.43	305.00	-58.41	0.2103E+03	0.3412E+03	-67.49
38900.	78.41	307.00	-58.35	0.2093E+03	0.3395E+03	-67.44
39000.	79.72	309.00	-58.29	0.2083E+03	0.3377E+03	-67.39
39100.	79.07	308.00	-58.22	0.2073E+03	0.3360E+03	-67.33
39200.	77.43	310.00	-58.15	0.2063E+03	0.3343E+03	-67.27
39300.	78.08	310.00	-58.08	0.2053E+03	0.3326E+03	-67.21
39400.	78.74	309.00	-58.01	0.2043E+03	0.3308E+03	-67.15
39500.	79.07	309.00	-57.94	0.2033E+03	0.3292E+03	-67.09
39600.	81.04	305.00	-57.87	0.2024E+03	0.3275E+03	-67.03
39700.	84.65	304.00	-57.80	0.2014E+03	0.3258E+03	-66.97
39800.	82.35	303.00	-57.73	0.2004E+03	0.3241E+03	-66.91
39900.	80.05	308.00	-57.66	0.1995E+03	0.3224E+03	-66.85

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
40000.	81.36	302.00	-57.59	0.1985E+03	0.3208E+03	-66.79
40100.	77.43	304.00	-57.75	0.1975E+03	0.3195E+03	-66.94
40200.	76.44	300.00	-57.91	0.1966E+03	0.3182E+03	-67.09
40300.	75.46	295.00	-58.07	0.1956E+03	0.3169E+03	-67.24
40400.	74.80	295.00	-58.23	0.1947E+03	0.3156E+03	-67.39
40500.	75.46	293.00	-58.39	0.1937E+03	0.3143E+03	-67.54
40600.	75.13	292.00	-58.55	0.1928E+03	0.3130E+03	-67.69
40700.	74.15	292.00	-58.71	0.1919E+03	0.3117E+03	-67.84
40800.	76.44	285.00	-58.87	0.1909E+03	0.3104E+03	-67.99
40900.	73.16	287.00	-59.03	0.1900E+03	0.3092E+03	-68.14
41000.	75.46	287.00	-59.19	0.1891E+03	0.3079E+03	-68.29
41100.	76.44	285.00	-59.41	0.1882E+03	0.3067E+03	-9999.00
41200.	78.74	280.00	-59.63	0.1873E+03	0.3056E+03	-9999.00
41300.	79.72	278.00	-59.85	0.1864E+03	0.3044E+03	-9999.00
41400.	80.71	277.00	-60.07	0.1855E+03	0.3033E+03	-9999.00
41500.	83.01	273.00	-60.29	0.1846E+03	0.3021E+03	-9999.00
41600.	83.99	274.00	-60.51	0.1837E+03	0.3010E+03	-9999.00
41700.	85.30	275.00	-60.73	0.1828E+03	0.2998E+03	-9999.00
41800.	86.61	275.00	-60.95	0.1819E+03	0.2987E+03	-9999.00
41900.	86.94	274.00	-61.17	0.1811E+03	0.2976E+03	-9999.00
42000.	84.97	277.00	-61.39	0.1802E+03	0.2964E+03	-9999.00
42100.	87.60	276.00	-61.49	0.1793E+03	0.2951E+03	-9999.00
42200.	88.58	275.00	-61.59	0.1784E+03	0.2938E+03	-9999.00
42300.	90.88	277.00	-61.69	0.1776E+03	0.2925E+03	-9999.00
42400.	91.21	279.00	-61.79	0.1767E+03	0.2913E+03	-9999.00
42500.	92.52	281.00	-61.89	0.1758E+03	0.2900E+03	-9999.00
42600.	94.82	282.00	-61.99	0.1750E+03	0.2887E+03	-9999.00
42700.	93.50	280.00	-62.09	0.1741E+03	0.2874E+03	-9999.00
42800.	95.14	283.00	-62.19	0.1733E+03	0.2862E+03	-9999.00
42900.	98.43	281.00	-62.29	0.1724E+03	0.2849E+03	-9999.00
43000.	91.86	285.00	-62.39	0.1716E+03	0.2836E+03	-9999.00
43100.	92.52	286.00	-62.51	0.1708E+03	0.2824E+03	-9999.00
43200.	92.52	285.00	-62.63	0.1699E+03	0.2812E+03	-9999.00
43300.	90.22	285.00	-62.75	0.1691E+03	0.2799E+03	-9999.00
43400.	84.32	289.00	-62.87	0.1682E+03	0.2787E+03	-9999.00
43500.	87.27	284.00	-62.99	0.1674E+03	0.2775E+03	-9999.00
43600.	90.22	280.00	-63.11	0.1666E+03	0.2763E+03	-9999.00
43700.	90.55	280.00	-63.23	0.1657E+03	0.2751E+03	-9999.00
43800.	91.86	279.00	-63.35	0.1649E+03	0.2739E+03	-9999.00
43900.	94.16	276.00	-63.47	0.1641E+03	0.2727E+03	-9999.00
44000.	92.19	278.00	-63.59	0.1633E+03	0.2715E+03	-9999.00
44100.	91.21	279.00	-63.71	0.1625E+03	0.2703E+03	-9999.00
44200.	91.86	277.00	-63.83	0.1617E+03	0.2691E+03	-9999.00
44300.	94.49	279.00	-63.95	0.1609E+03	0.2679E+03	-9999.00
44400.	96.78	278.00	-64.07	0.1601E+03	0.2667E+03	-9999.00
44500.	96.13	278.00	-64.19	0.1593E+03	0.2656E+03	-9999.00
44600.	95.47	280.00	-64.31	0.1585E+03	0.2644E+03	-9999.00
44700.	96.46	281.00	-64.43	0.1577E+03	0.2633E+03	-9999.00
44800.	96.78	281.00	-64.55	0.1569E+03	0.2621E+03	-9999.00
44900.	94.16	284.00	-64.67	0.1562E+03	0.2610E+03	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
45000.	96.13	284.00	-64.79	0.1554E+03	0.2598E+03	-9999.00
45100.	97.11	286.00	-64.86	0.1546E+03	0.2586E+03	-9999.00
45200.	104.66	283.00	-64.93	0.1539E+03	0.2574E+03	-9999.00
45300.	101.71	287.00	-65.00	0.1531E+03	0.2563E+03	-9999.00
45400.	101.05	292.00	-65.07	0.1524E+03	0.2551E+03	-9999.00
45500.	101.71	293.00	-65.14	0.1516E+03	0.2539E+03	-9999.00
45600.	97.77	292.00	-65.21	0.1509E+03	0.2527E+03	-9999.00
45700.	95.47	291.00	-65.28	0.1501E+03	0.2516E+03	-9999.00
45800.	88.58	292.00	-65.35	0.1494E+03	0.2504E+03	-9999.00
45900.	90.88	284.00	-65.42	0.1486E+03	0.2493E+03	-9999.00
46000.	86.94	285.00	-65.49	0.1479E+03	0.2481E+03	-9999.00
46100.	91.86	280.00	-65.51	0.1472E+03	0.2469E+03	-9999.00
46200.	92.85	279.00	-65.53	0.1464E+03	0.2457E+03	-9999.00
46300.	86.29	281.00	-65.55	0.1457E+03	0.2445E+03	-9999.00
46400.	91.54	279.00	-65.57	0.1450E+03	0.2433E+03	-9999.00
46500.	89.24	284.00	-65.59	0.1443E+03	0.2421E+03	-9999.00
46600.	92.85	283.00	-65.61	0.1435E+03	0.2409E+03	-9999.00
46700.	96.46	282.00	-65.63	0.1428E+03	0.2398E+03	-9999.00
46800.	97.77	283.00	-65.65	0.1421E+03	0.2386E+03	-9999.00
46900.	99.41	282.00	-65.67	0.1414E+03	0.2374E+03	-9999.00
47000.	99.08	284.00	-65.69	0.1407E+03	0.2363E+03	-9999.00
47100.	103.35	284.00	-65.66	0.1400E+03	0.2351E+03	-9999.00
47200.	100.39	284.00	-65.63	0.1393E+03	0.2339E+03	-9999.00
47300.	99.41	285.00	-65.60	0.1386E+03	0.2327E+03	-9999.00
47400.	100.39	288.00	-65.57	0.1379E+03	0.2315E+03	-9999.00
47500.	99.08	291.00	-65.54	0.1373E+03	0.2303E+03	-9999.00
47600.	100.72	289.00	-65.51	0.1366E+03	0.2291E+03	-9999.00
47700.	99.08	296.00	-65.48	0.1359E+03	0.2280E+03	-9999.00
47800.	96.46	294.00	-65.45	0.1352E+03	0.2268E+03	-9999.00
47900.	95.80	290.00	-65.42	0.1346E+03	0.2257E+03	-9999.00
48000.	91.54	294.00	-65.39	0.1339E+03	0.2245E+03	-9999.00
48100.	83.01	294.00	-65.53	0.1332E+03	0.2235E+03	-9999.00
48200.	83.01	287.00	-65.67	0.1326E+03	0.2226E+03	-9999.00
48300.	80.71	286.00	-65.81	0.1319E+03	0.2216E+03	-9999.00
48400.	78.41	288.00	-65.95	0.1312E+03	0.2206E+03	-9999.00
48500.	74.15	286.00	-66.09	0.1306E+03	0.2197E+03	-9999.00
48600.	79.07	279.00	-66.23	0.1299E+03	0.2187E+03	-9999.00
48700.	77.10	279.00	-66.37	0.1292E+03	0.2177E+03	-9999.00
48800.	77.43	274.00	-66.51	0.1286E+03	0.2168E+03	-9999.00
48900.	74.80	275.00	-66.65	0.1279E+03	0.2158E+03	-9999.00
49000.	72.51	280.00	-66.79	0.1273E+03	0.2149E+03	-9999.00
49100.	74.48	275.00	-66.87	0.1267E+03	0.2139E+03	-9999.00
49200.	75.13	273.00	-66.95	0.1260E+03	0.2129E+03	-9999.00
49300.	79.07	272.00	-67.03	0.1254E+03	0.2120E+03	-9999.00
49400.	82.68	271.00	-67.11	0.1248E+03	0.2110E+03	-9999.00
49500.	84.65	272.00	-67.19	0.1242E+03	0.2100E+03	-9999.00
49600.	81.69	274.00	-67.27	0.1235E+03	0.2090E+03	-9999.00
49700.	83.99	274.00	-67.35	0.1229E+03	0.2081E+03	-9999.00
49800.	85.30	276.00	-67.43	0.1223E+03	0.2071E+03	-9999.00
49900.	83.66	279.00	-67.51	0.1217E+03	0.2062E+03	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
50000.	81.69	279.00	-67.59	0.1211E+03	0.2052E+03	-9999.00
50100.	84.97	277.00	-67.62	0.1205E+03	0.2042E+03	-9999.00
50200.	79.40	281.00	-67.65	0.1199E+03	0.2032E+03	-9999.00
50300.	76.77	280.00	-67.68	0.1193E+03	0.2022E+03	-9999.00
50400.	76.12	278.00	-67.71	0.1187E+03	0.2012E+03	-9999.00
50500.	72.83	284.00	-67.74	0.1181E+03	0.2002E+03	-9999.00
50600.	73.82	280.00	-67.77	0.1175E+03	0.1992E+03	-9999.00
50700.	74.15	280.00	-67.80	0.1169E+03	0.1983E+03	-9999.00
50800.	80.38	272.00	-67.83	0.1163E+03	0.1973E+03	-9999.00
50900.	81.04	271.00	-67.86	0.1157E+03	0.1963E+03	-9999.00
51000.	77.43	278.00	-67.89	0.1151E+03	0.1953E+03	-9999.00
51100.	81.04	280.00	-68.06	0.1145E+03	0.1945E+03	-9999.00
51200.	82.68	278.00	-68.23	0.1140E+03	0.1937E+03	-9999.00
51300.	83.01	282.00	-68.40	0.1134E+03	0.1929E+03	-9999.00
51400.	82.68	283.00	-68.57	0.1128E+03	0.1921E+03	-9999.00
51500.	83.66	285.00	-68.74	0.1123E+03	0.1913E+03	-9999.00
51600.	87.60	282.00	-68.91	0.1117E+03	0.1905E+03	-9999.00
51700.	81.04	288.00	-69.08	0.1112E+03	0.1897E+03	-9999.00
51800.	81.69	287.00	-69.25	0.1106E+03	0.1890E+03	-9999.00
51900.	87.27	285.00	-69.42	0.1100E+03	0.1882E+03	-9999.00
52000.	86.61	284.00	-69.59	0.1095E+03	0.1874E+03	-9999.00
52100.	80.38	291.00	-69.68	0.1089E+03	0.1865E+03	-9999.00
52200.	80.05	294.00	-69.77	0.1084E+03	0.1856E+03	-9999.00
52300.	76.12	303.00	-69.86	0.1078E+03	0.1848E+03	-9999.00
52400.	82.02	294.00	-69.95	0.1073E+03	0.1839E+03	-9999.00
52500.	74.48	299.00	-70.04	0.1067E+03	0.1830E+03	-9999.00
52600.	73.16	294.00	-70.13	0.1062E+03	0.1822E+03	-9999.00
52700.	70.21	305.00	-70.22	0.1056E+03	0.1813E+03	-9999.00
52800.	66.27	305.00	-70.31	0.1051E+03	0.1805E+03	-9999.00
52900.	61.68	300.00	-70.40	0.1045E+03	0.1796E+03	-9999.00
53000.	61.35	290.00	-70.49	0.1040E+03	0.1788E+03	-9999.00
53500.	62.47	283.00	-70.19	0.1014E+03	0.1740E+03	-9999.00
54000.	62.30	283.00	-69.49	0.9887E+02	0.1691E+03	-9999.00
54500.	62.27	283.00	-69.29	0.9639E+02	0.1647E+03	-9999.00
55000.	58.07	282.00	-69.69	0.9397E+02	0.1609E+03	-9999.00
55500.	52.13	282.00	-69.89	0.9162E+02	0.1570E+03	-9999.00
56000.	46.06	282.00	-70.39	0.8931E+02	0.1534E+03	-9999.00
56500.	40.52	282.00	-71.09	0.8706E+02	0.1501E+03	-9999.00
57000.	37.80	281.00	-72.09	0.8486E+02	0.1470E+03	-9999.00
57500.	36.61	280.00	-72.29	0.8270E+02	0.1434E+03	-9999.00
58000.	36.61	278.00	-72.09	0.8060E+02	0.1397E+03	-9999.00
58500.	37.63	276.00	-71.19	0.7856E+02	0.1355E+03	-9999.00
59000.	38.65	274.00	-69.49	0.7659E+02	0.1310E+03	-9999.00
59500.	38.81	273.00	-68.49	0.7467E+02	0.1271E+03	-9999.00
60000.	38.48	274.00	-68.39	0.7281E+02	0.1239E+03	-9999.00
60500.	37.96	276.00	-68.49	0.7100E+02	0.1209E+03	-9999.00
61000.	36.98	280.00	-68.39	0.6923E+02	0.1178E+03	-9999.00
61500.	36.12	282.00	-68.19	0.6750E+02	0.1147E+03	-9999.00
62000.	34.94	283.00	-67.99	0.6582E+02	0.1118E+03	-9999.00
62500.	33.43	284.00	-67.69	0.6419E+02	0.1088E+03	-9999.00

TABLE 5. (Continued)

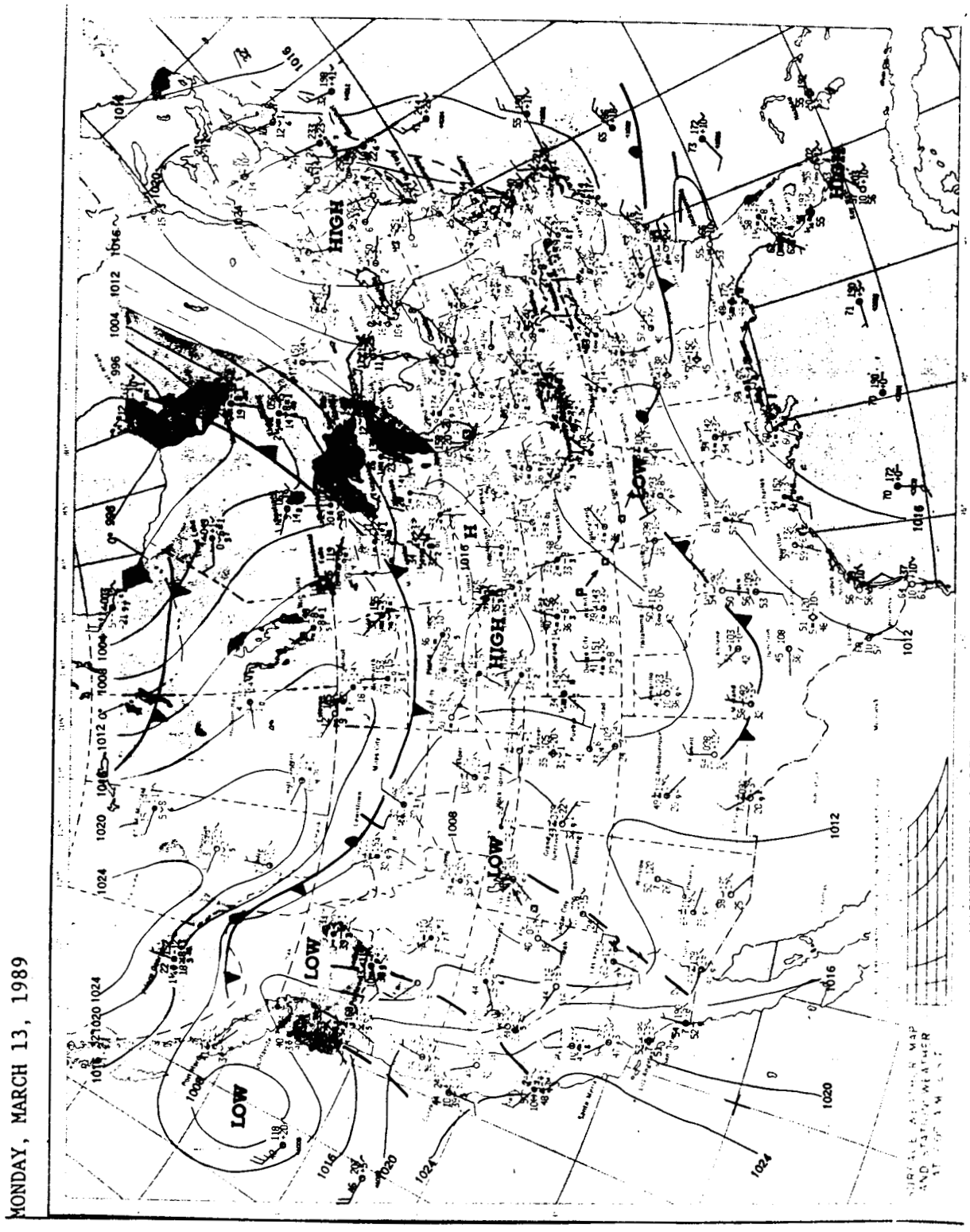
ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
63000.	30.87	283.00	-67.39	0.6260E+02	0.1060E+03	-9999.00
63500.	28.51	279.00	-66.79	0.6105E+02	0.1031E+03	-9999.00
64000.	27.00	275.00	-66.69	0.5954E+02	0.1005E+03	-9999.00
64500.	26.15	271.00	-66.59	0.5807E+02	0.9794E+02	-9999.00
65000.	25.98	266.00	-66.29	0.5664E+02	0.9539E+02	-9999.00
65500.	26.31	263.00	-66.29	0.5524E+02	0.9303E+02	-9999.00
66000.	26.51	261.00	-66.39	0.5388E+02	0.9078E+02	-9999.00
66500.	26.15	260.00	-65.89	0.5255E+02	0.8833E+02	-9999.00
67000.	25.33	258.00	-65.19	0.5126E+02	0.8587E+02	-9999.00
67500.	24.31	253.00	-64.69	0.5000E+02	0.8356E+02	-9999.00
68000.	23.29	244.00	-64.39	0.4878E+02	0.8140E+02	-9999.00
68500.	23.13	237.00	-63.79	0.4759E+02	0.7919E+02	-9999.00
69000.	23.79	230.00	-63.49	0.4643E+02	0.7715E+02	-9999.00
69500.	24.64	227.00	-62.59	0.4531E+02	0.7496E+02	-9999.00
70000.	25.66	227.00	-61.69	0.4421E+02	0.7283E+02	-9999.00
70500.	26.51	230.00	-61.49	0.4315E+02	0.7102E+02	-9999.00
71000.	27.69	233.00	-62.29	0.4211E+02	0.6957E+02	-9999.00
71500.	28.35	236.00	-62.59	0.4109E+02	0.6798E+02	-9999.00
72000.	28.18	240.00	-62.79	0.4009E+02	0.6639E+02	-9999.00
72500.	27.49	244.00	-62.79	0.3912E+02	0.6478E+02	-9999.00
73000.	25.98	249.00	-62.29	0.3817E+02	0.6306E+02	-9999.00
73500.	24.31	251.00	-61.19	0.3725E+02	0.6122E+02	-9999.00
74000.	22.28	250.00	-60.19	0.3636E+02	0.5948E+02	-9999.00
74500.	20.77	248.00	-59.79	0.3549E+02	0.5795E+02	-9999.00
75000.	19.75	244.00	-59.49	0.3464E+02	0.5648E+02	-9999.00
75500.	19.06	239.00	-58.49	0.3382E+02	0.5489E+02	-9999.00
76000.	18.24	238.00	-57.99	0.3302E+02	0.5346E+02	-9999.00
76500.	16.54	239.00	-57.49	0.3223E+02	0.5206E+02	-9999.00
77000.	14.70	243.00	-56.69	0.3147E+02	0.5065E+02	-9999.00
77500.	12.99	249.00	-55.69	0.3073E+02	0.4923E+02	-9999.00
78000.	11.48	252.00	-56.09	0.3001E+02	0.4816E+02	-9999.00
78500.	10.47	249.00	-56.19	0.2931E+02	0.4706E+02	-9999.00
79000.	10.63	242.00	-56.49	0.2862E+02	0.4602E+02	-9999.00
79500.	12.14	235.00	-56.99	0.2795E+02	0.4504E+02	-9999.00
80000.	14.34	229.00	-57.39	0.2729E+02	0.4406E+02	-9999.00
80500.	17.06	228.00	-56.59	0.2664E+02	0.4285E+02	-9999.00
81000.	19.75	229.00	-55.99	0.2602E+02	0.4174E+02	-9999.00
81500.	22.44	229.00	-55.69	0.2541E+02	0.4071E+02	-9999.00
82000.	24.48	229.00	-55.39	0.2481E+02	0.3969E+02	-9999.00
82500.	26.67	227.00	-54.79	0.2423E+02	0.3866E+02	-9999.00
83000.	28.67	227.00	-53.39	0.2367E+02	0.3752E+02	-9999.00
83500.	30.22	227.00	-52.09	0.2312E+02	0.3643E+02	-9999.00
84000.	31.23	228.00	-51.39	0.2259E+02	0.3549E+02	-9999.00
85000.	28.80	229.53	-50.55	0.2118E+02	0.3315E+02	-9999.00
88000.	21.69	236.14	-48.04	0.1747E+02	0.2704E+02	-9999.00
91000.	15.15	248.80	-45.53	0.1441E+02	0.2205E+02	-9999.00
94000.	10.29	276.32	-43.02	0.1188E+02	0.1799E+02	-9999.00
97000.	10.00	320.72	-40.51	0.9800E+01	0.1468E+02	-9999.00
100000.	12.68	308.38	-38.70	0.8630E+01	0.1282E+02	-9999.00
103000.	15.77	300.51	-36.89	0.7610E+01	0.1122E+02	-9999.00

TABLE 5. (Continued)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
106000.	19.05	295.29	-35.08	0.6700E+01	0.9804E+01	-9999.00
109000.	22.46	291.69	-33.27	0.5900E+01	0.8568E+01	-9999.00
112000.	24.88	289.01	-31.13	0.5220E+01	0.7514E+01	-9999.00
115000.	26.50	286.84	-28.71	0.4630E+01	0.6599E+01	-9999.00
118000.	28.18	284.91	-26.30	0.4100E+01	0.5786E+01	-9999.00
121000.	29.88	283.14	-23.89	0.3640E+01	0.5087E+01	-9999.00
124000.	31.59	281.62	-21.49	0.3220E+01	0.4457E+01	-9999.00
127000.	33.34	280.26	-19.08	0.2860E+01	0.3921E+01	-9999.00
130000.	38.19	276.36	-16.83	0.2550E+01	0.3466E+01	-9999.00
133000.	43.18	273.35	-14.57	0.2270E+01	0.3058E+01	-9999.00
136000.	48.30	270.93	-12.31	0.2020E+01	0.2698E+01	-9999.00
139000.	53.45	269.02	-10.05	0.1800E+01	0.2383E+01	-9999.00
142000.	58.65	267.44	-8.22	0.1600E+01	0.2104E+01	-9999.00
145000.	63.38	266.35	-6.64	0.1430E+01	0.1869E+01	-9999.00
148000.	67.45	265.68	-5.97	0.1280E+01	0.1669E+01	-9999.00
151000.	71.49	265.05	-5.30	0.1150E+01	0.1496E+01	-9999.00
154000.	75.58	264.52	-4.64	0.1030E+01	0.1336E+01	-9999.00
157000.	79.66	264.04	-3.97	0.9190E+00	0.1189E+01	-9999.00
160000.	83.76	263.59	-3.29	0.8220E+00	0.1061E+01	-9999.00
163000.	86.03	262.88	-4.41	0.7360E+00	0.9541E+00	-9999.00
166000.	88.13	262.15	-5.75	0.6580E+00	0.8572E+00	-9999.00
169000.	90.20	261.47	-7.01	0.5880E+00	0.7697E+00	-9999.00
172000.	92.29	260.82	-8.24	0.5260E+00	0.6917E+00	-9999.00
175000.	94.40	260.17	-9.47	0.4700E+00	0.6210E+00	-9999.00
178000.	96.34	259.46	-11.20	0.4190E+00	0.5572E+00	-9999.00
181000.	97.94	258.56	-13.94	0.3720E+00	0.5000E+00	-9999.00
184000.	99.60	257.69	-16.69	0.3310E+00	0.4496E+00	-9999.00
187000.	101.28	256.85	-19.45	0.2940E+00	0.4037E+00	-9999.00
190000.	102.95	256.02	-22.21	0.2610E+00	0.3623E+00	-9999.00
193000.	104.67	255.24	-24.97	0.2310E+00	0.3243E+00	-9999.00
196000.	105.55	256.63	-27.94	0.2040E+00	0.2898E+00	-9999.00
199000.	106.35	258.63	-30.96	0.1800E+00	0.2589E+00	-9999.00
202000.	107.25	260.58	-33.97	0.1590E+00	0.2316E+00	-9999.00
205000.	108.27	262.51	-36.98	0.1400E+00	0.2065E+00	-9999.00
208000.	109.41	264.41	-39.99	0.1240E+00	0.1853E+00	-9999.00
211000.	108.73	266.25	-42.82	0.1090E+00	0.1649E+00	-9999.00
214000.	101.30	268.16	-45.09	0.9520E-01	0.1454E+00	-9999.00
217000.	94.03	270.40	-47.36	0.8330E-01	0.1285E+00	-9999.00
220000.	86.90	272.99	-49.62	0.7290E-01	0.1136E+00	-9999.00
223000.	79.97	276.05	-51.79	0.6370E-01	0.1002E+00	-9999.00
226000.	73.32	279.69	-53.96	0.5570E-01	0.8853E-01	-9999.00
229000.	64.82	279.44	-55.80	0.4850E-01	0.7774E-01	-9999.00
232000.	55.39	276.33	-57.49	0.4210E-01	0.6801E-01	-9999.00
235000.	46.19	271.95	-59.17	0.3660E-01	0.5959E-01	-9999.00
238000.	37.38	265.52	-60.86	0.3180E-01	0.5218E-01	-9999.00
241000.	29.34	255.30	-62.54	0.2760E-01	0.4565E-01	-9999.00
244000.	23.20	240.61	-64.20	0.2400E-01	0.4001E-01	-9999.00
247000.	21.00	239.39	-65.70	0.2070E-01	0.3476E-01	-9999.00
250000.	18.84	237.80	-66.95	0.1790E-01	0.3024E-01	-9999.00
253000.	16.68	235.90	-68.21	0.1550E-01	0.2635E-01	-9999.00

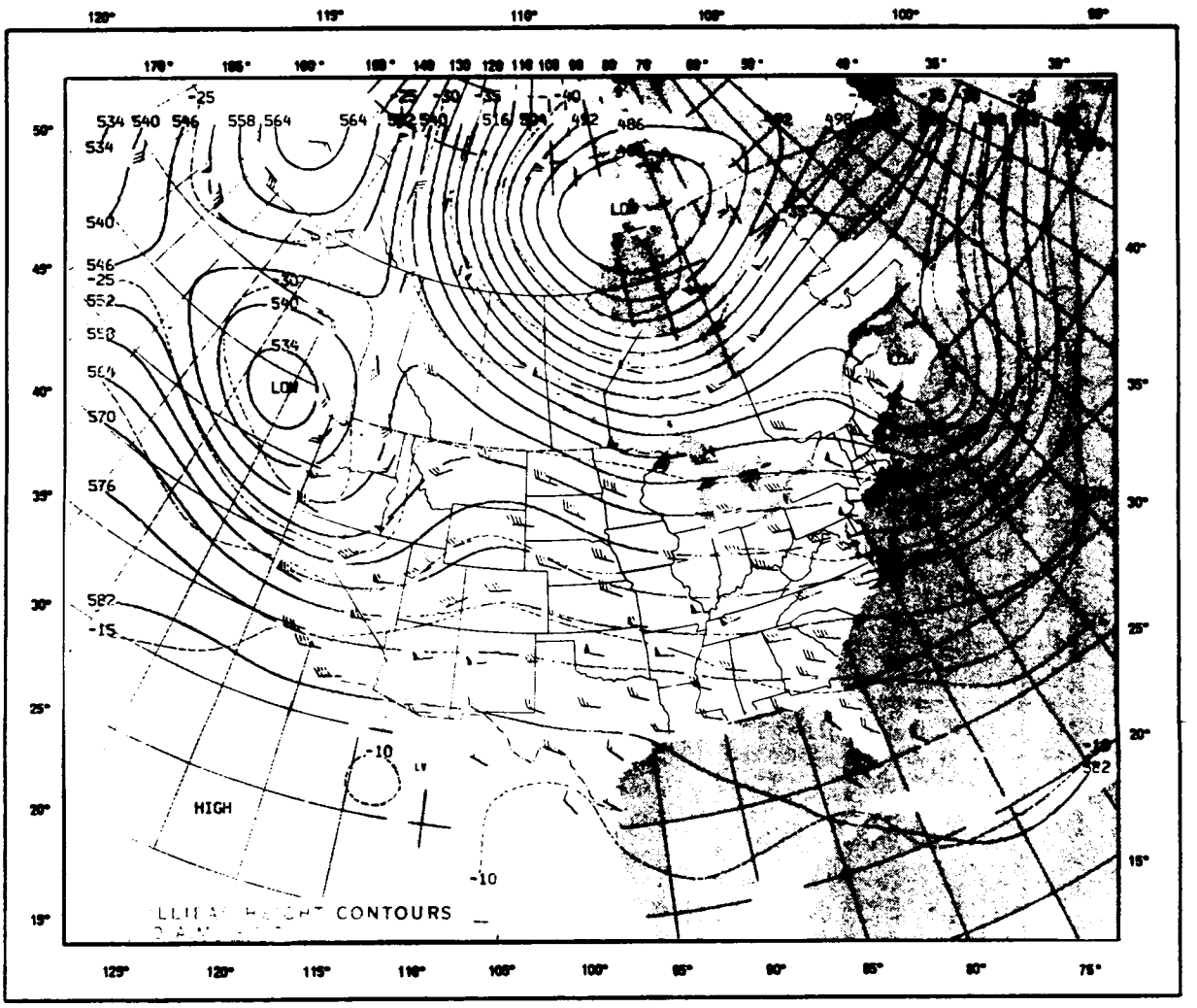
TABLE 5. (Concluded)

ALTITUDE (FT)	WIND SPEED (FT/SEC)	WIND DIRECTION (DEG)	TEMPERATURE (DEG C)	PRESSURE (MILLIBARS)	DENSITY (GRAM/M3)	DEW POINT (DEG C)
256000.	14.56	233.34	-69.48	0.1340E-01	0.2292E-01	-9999.00
259000.	12.46	230.02	-70.74	0.1160E-01	0.1996E-01	-9999.00
262000.	12.91	216.84	-71.90	0.9990E-02	0.1729E-01	-9999.00
265000.	16.27	202.53	-72.99	0.8600E-02	0.1497E-01	-9999.00
268000.	20.27	193.38	-74.08	0.7390E-02	0.1293E-01	-9999.00
271000.	24.62	187.43	-75.16	0.6360E-02	0.1119E-01	-9999.00
274000.	29.15	183.23	-76.21	0.5470E-02	0.9677E-02	-9999.00
277000.	33.79	180.17	-77.20	0.4710E-02	0.8374E-02	-9999.00
280000.	26.44	177.23	-78.01	0.4030E-02	0.7194E-02	-9999.00
283000.	19.21	172.05	-78.82	0.3460E-02	0.6203E-02	-9999.00
286000.	12.31	160.70	-79.64	0.2960E-02	0.5329E-02	-9999.00
289000.	6.90	127.85	-80.45	0.2540E-02	0.4592E-02	-9999.00
292000.	7.56	65.10	-81.27	0.2180E-02	0.3958E-02	-9999.00
295000.	6.84	83.39	-81.34	0.1860E-02	0.3378E-02	-9999.00
298000.	15.43	161.53	-80.45	0.1590E-02	0.2874E-02	-9999.00
301000.	30.69	174.48	-79.57	0.1360E-02	0.2447E-02	-9999.00
304000.	45.91	178.69	-78.68	0.1160E-02	0.2078E-02	-9999.00
307000.	59.13	180.73	-77.79	0.9900E-03	0.1765E-02	-9999.00
310000.	67.99	182.02	-76.91	0.8450E-03	0.1500E-02	-9999.00
313000.	70.84	182.55	-75.12	0.7260E-03	0.1277E-02	-9999.00
316000.	72.19	183.15	-73.23	0.6230E-03	0.1086E-02	-9999.00
319000.	71.82	183.96	-71.33	0.5350E-03	0.9235E-03	-9999.00
322000.	69.01	185.16	-69.43	0.4600E-03	0.7866E-03	-9999.00
325000.	62.94	187.04	-67.54	0.3950E-03	0.6693E-03	-9999.00
328000.	57.01	189.27	-65.03	0.3400E-03	0.5691E-03	-9999.00
331000.	58.11	189.88	-61.29	0.2950E-03	0.4851E-03	-9999.00
334000.	57.77	190.74	-57.55	0.2550E-03	0.4120E-03	-9999.00
337000.	55.53	191.93	-53.82	0.2210E-03	0.3510E-03	-9999.00
340000.	50.70	193.89	-50.08	0.1910E-03	0.2983E-03	-9999.00
343000.	42.53	197.41	-46.34	0.1650E-03	0.2534E-03	-9999.00
346000.	39.27	199.68	-39.90	0.1460E-03	0.2181E-03	-9999.00
349000.	39.43	200.20	-32.68	0.1290E-03	0.1869E-03	-9999.00
352000.	38.50	200.92	-25.47	0.1140E-03	0.1603E-03	-9999.00
355000.	36.15	201.96	-18.25	0.1010E-03	0.1380E-03	-9999.00
358000.	31.95	203.67	-11.04	0.8870E-04	0.1179E-03	-9999.00
361000.	21.94	211.86	-3.17	0.7870E-04	0.1016E-03	-9999.00
364000.	22.47	205.70	7.00	0.7150E-04	0.8891E-04	-9999.00
367000.	23.04	198.00	17.17	0.6490E-04	0.7788E-04	-9999.00
370000.	23.92	188.52	27.34	0.5880E-04	0.6817E-04	-9999.00
373000.	25.49	177.27	37.51	0.5330E-04	0.5977E-04	-9999.00
376000.	28.29	164.80	47.68	0.4820E-04	0.5234E-04	-9999.00
379000.	17.87	148.21	58.81	0.4400E-04	0.4617E-04	-9999.00
382000.	19.06	152.42	70.73	0.4060E-04	0.4113E-04	-9999.00
385000.	20.41	156.40	83.02	0.3750E-04	0.3668E-04	-9999.00
388000.	21.93	159.97	95.65	0.3480E-04	0.3287E-04	-9999.00
391000.	23.63	163.05	108.59	0.3240E-04	0.2957E-04	-9999.00
394000.	25.47	165.91	121.81	0.3020E-04	0.2664E-04	-9999.00
397000.	27.46	168.49	135.26	0.2820E-04	0.2405E-04	-9999.00
400000.	29.59	170.68	148.91	0.2640E-04	0.2179E-04	-9999.00



Surface Synoptic Map at 1200 u.t. March 13, 1989 — Isobaric, Frontal, and Precipitation Patterns Are Shown in Standard Symbolic Form.

Figure 1. Surface synoptic chart 2 hr 57 min before launch of STS-29.



500 Millibar Height
Contours at 1200 u.t.
March 13, 1989.
Continuous Lines Indicate Height Contours in Feet Above Sea Level.
Dashed Lines Are Isotherms in Degrees Centigrade. Arrows Show Wind
Direction and Speed at the 500-mb Level.

Figure 2. 500 mb map 2 hr 57 min before launch of STS-29.

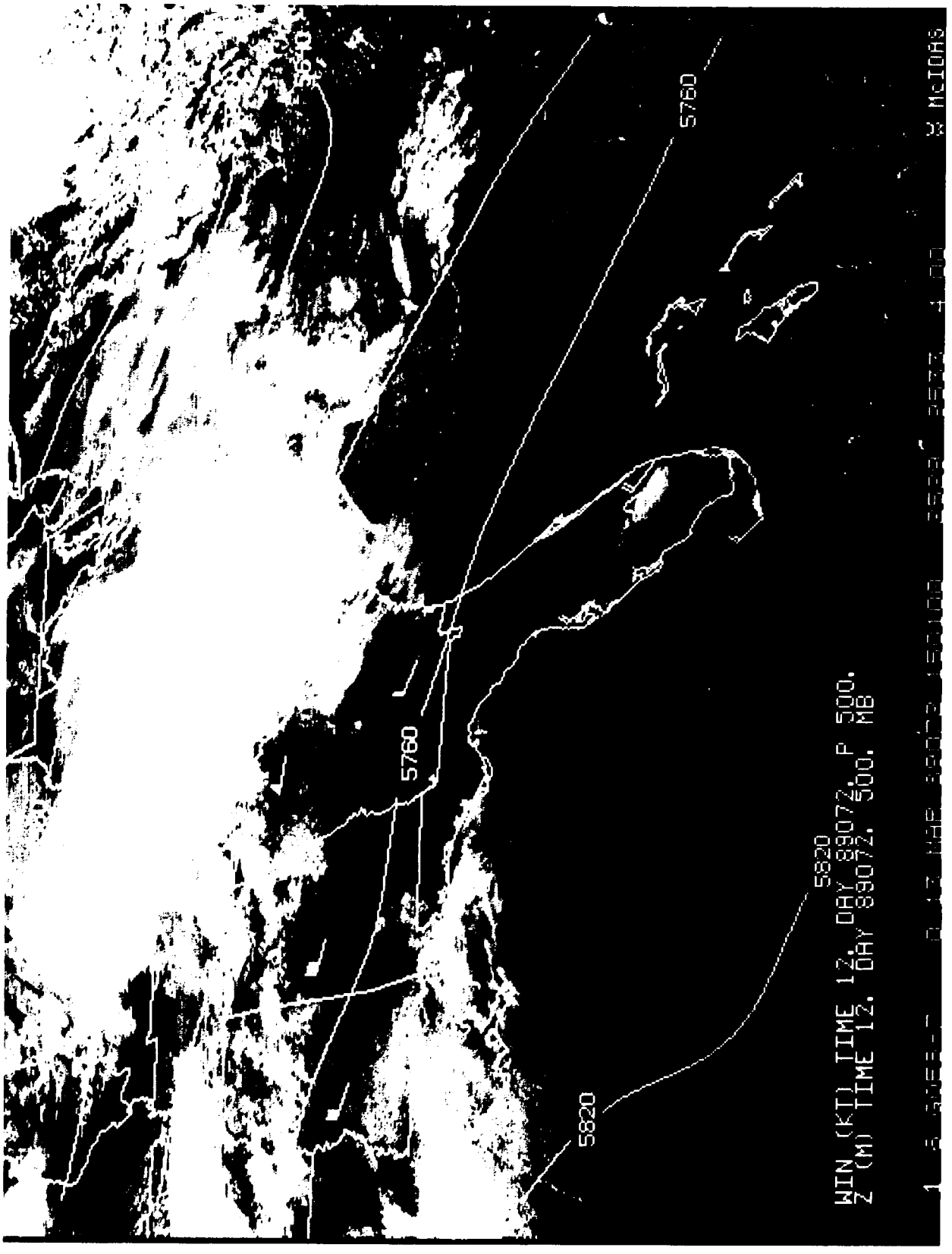


Figure 3. GOES-7 visible imagery of cloud cover at the launch of STS-29 (1501 u.t., March 13, 1989). 500-mb heights (meters) and wind barbs are also included for 1200 u.t.

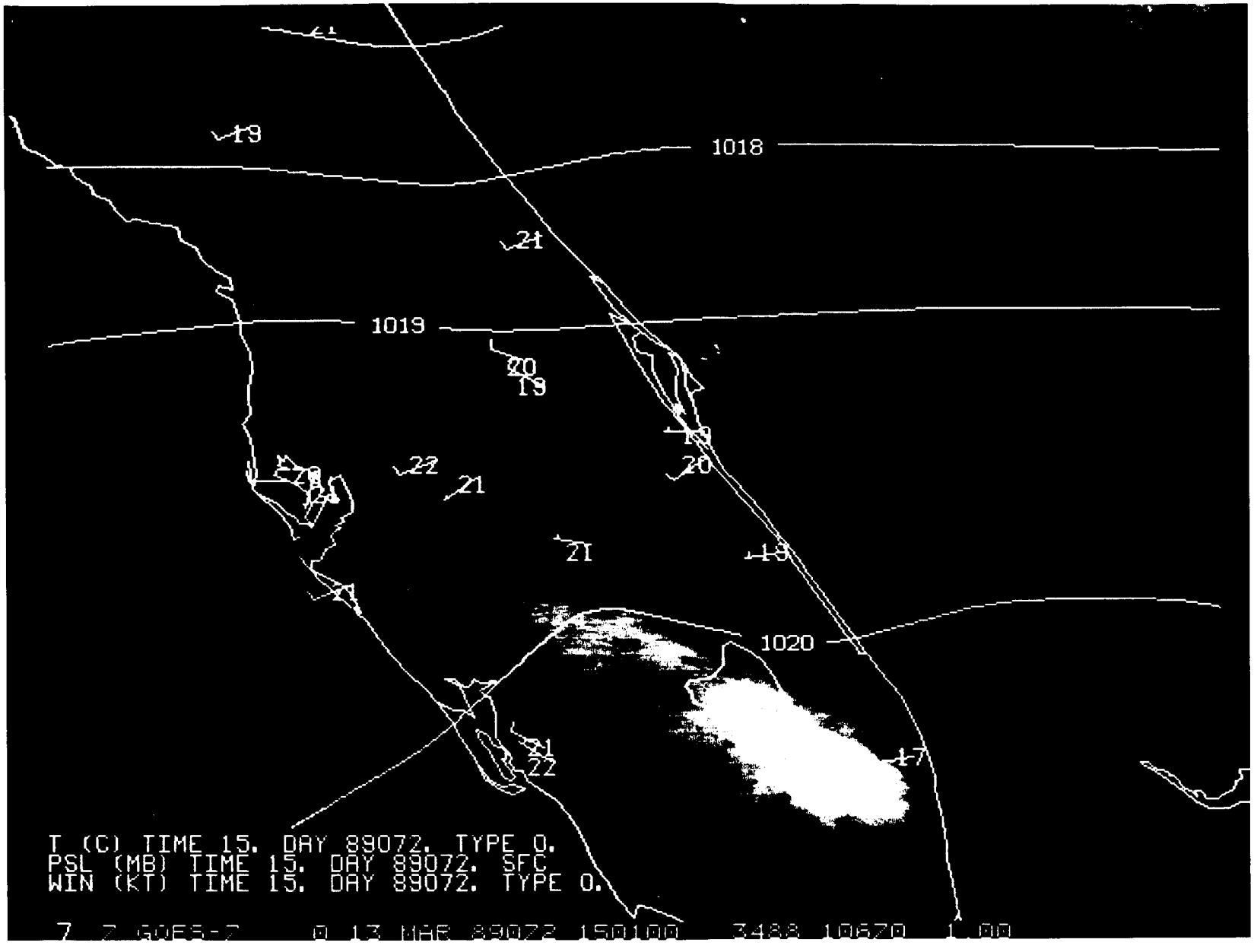


Figure 4. Enlarged view of GOES-7 visible imagery of cloud cover taken at the launch of STS-29 (1501 u.t., March 13, 1989). Surface temperatures, isobaric parameters, and wind barbs for 1500 u.t. are also included.

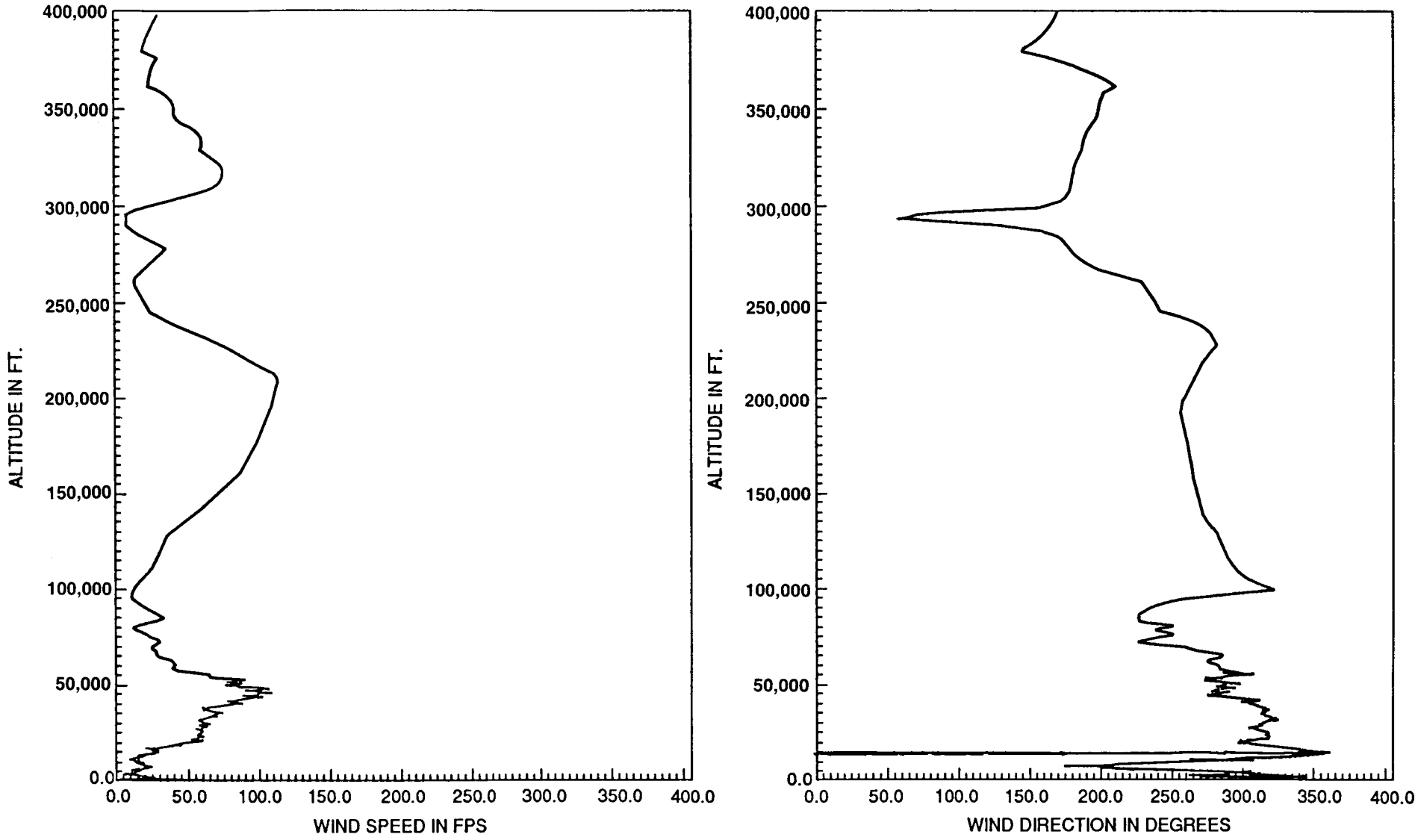


Figure 5. Scalar wind speed and direction at launch time of STS-29.

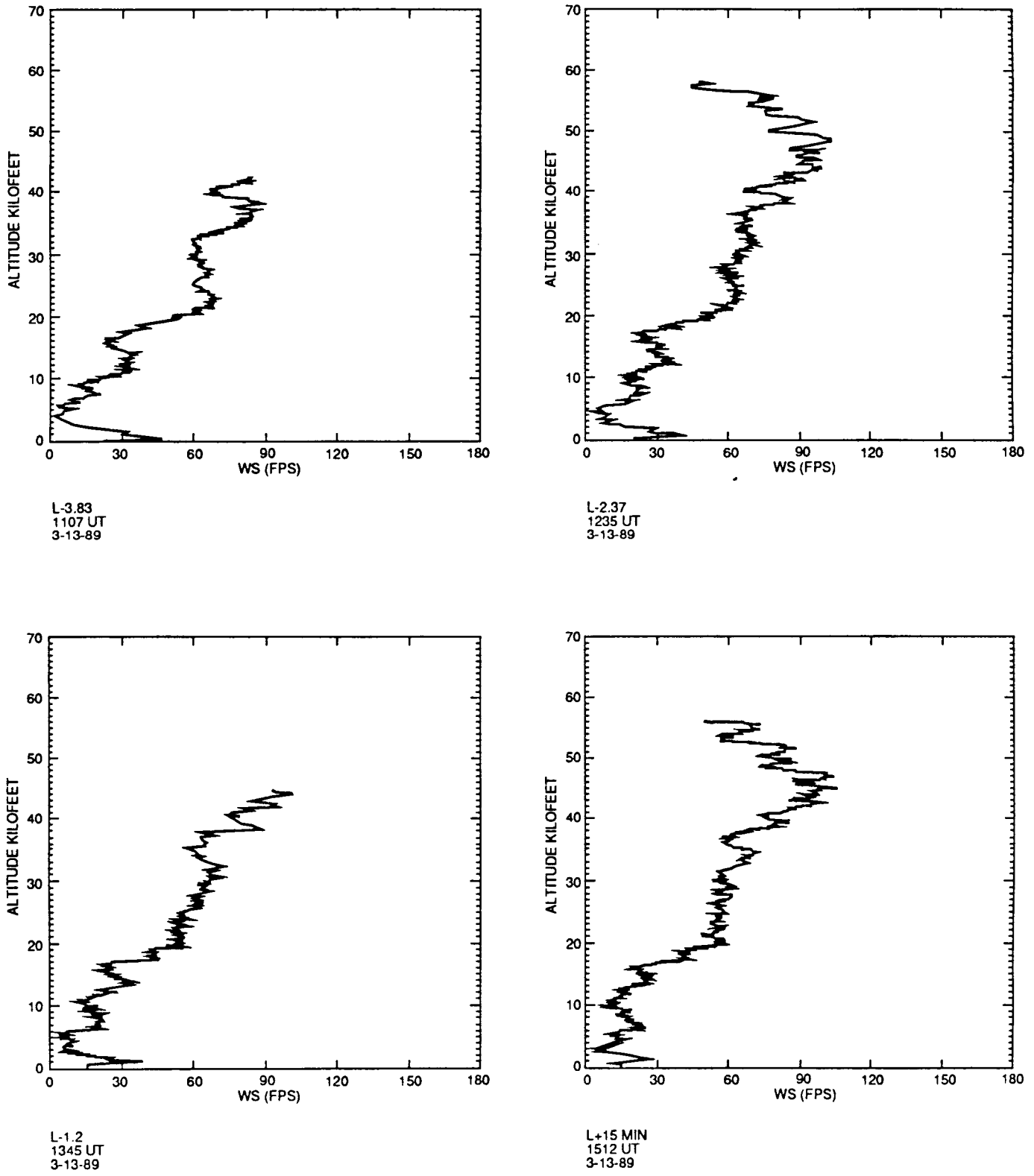


Figure 6. STS-29 prelaunch/launch Jimsphere-measured wind speeds (FPS).

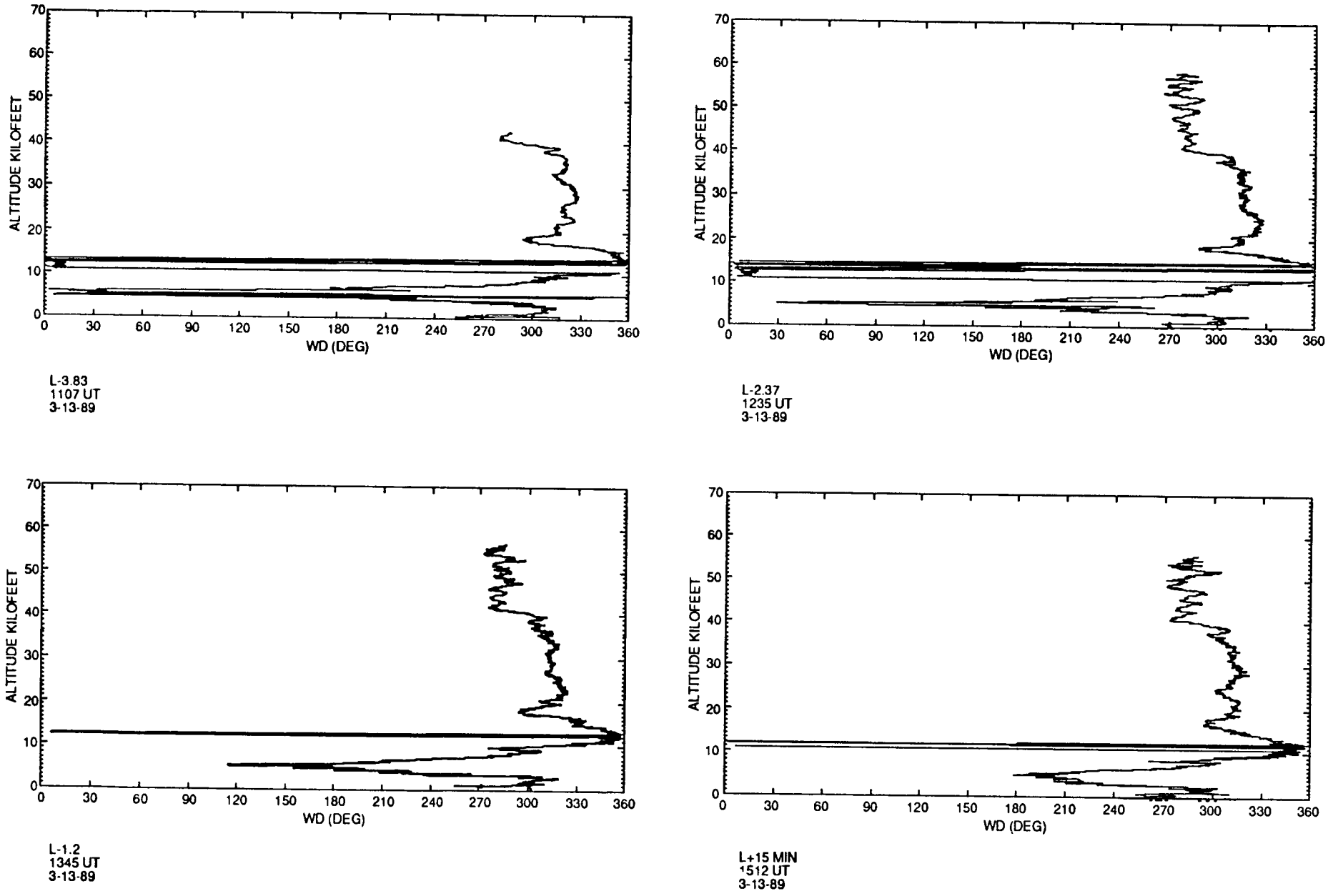


Figure 7. STS-29 prelaunch/launch Jimsphere-measured wind directions (degrees).

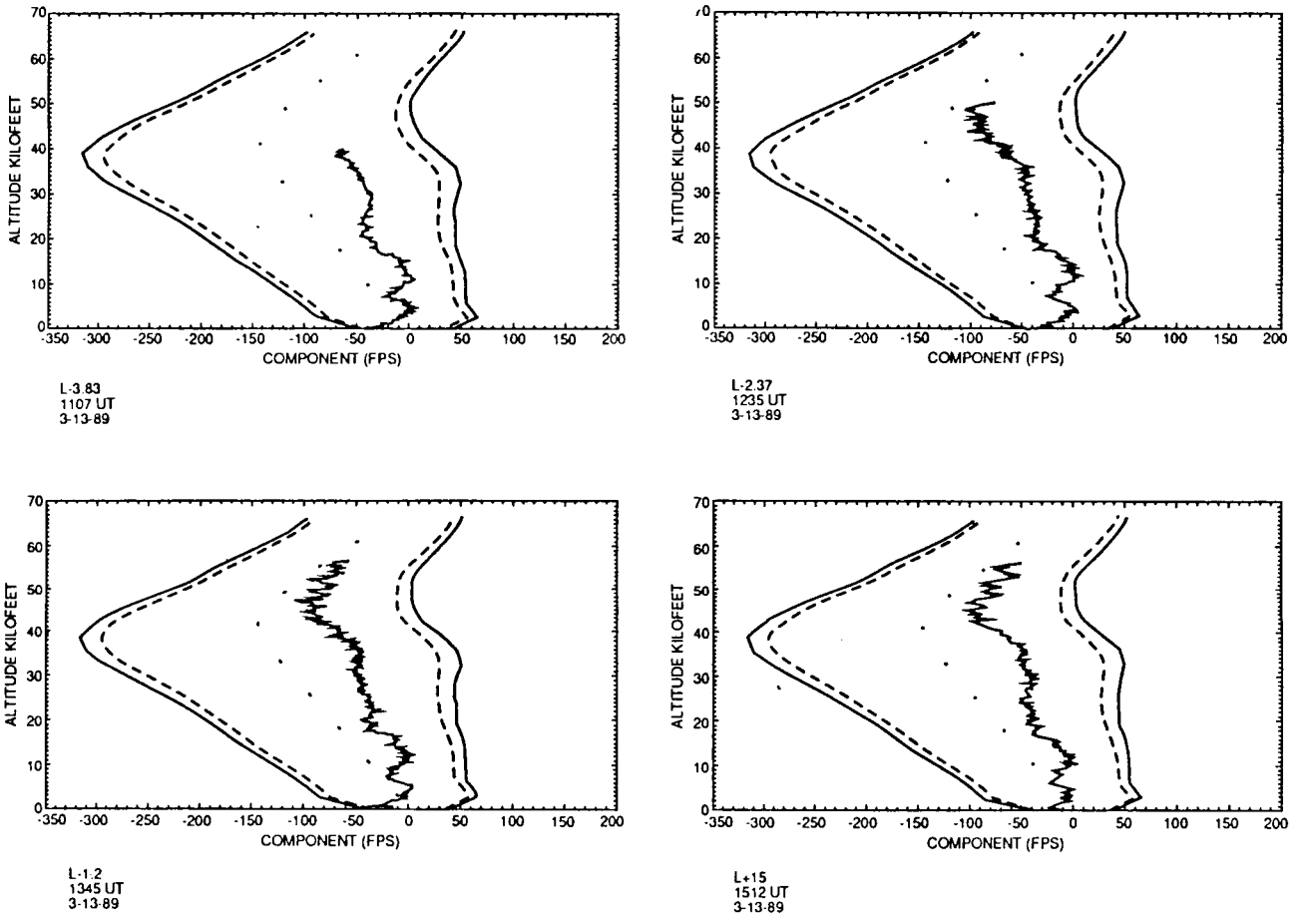


Figure 8. STS-29 prelaunch/launch Jimsphere-measured in-plane component winds (FPS). Flight azimuth = 90 deg.

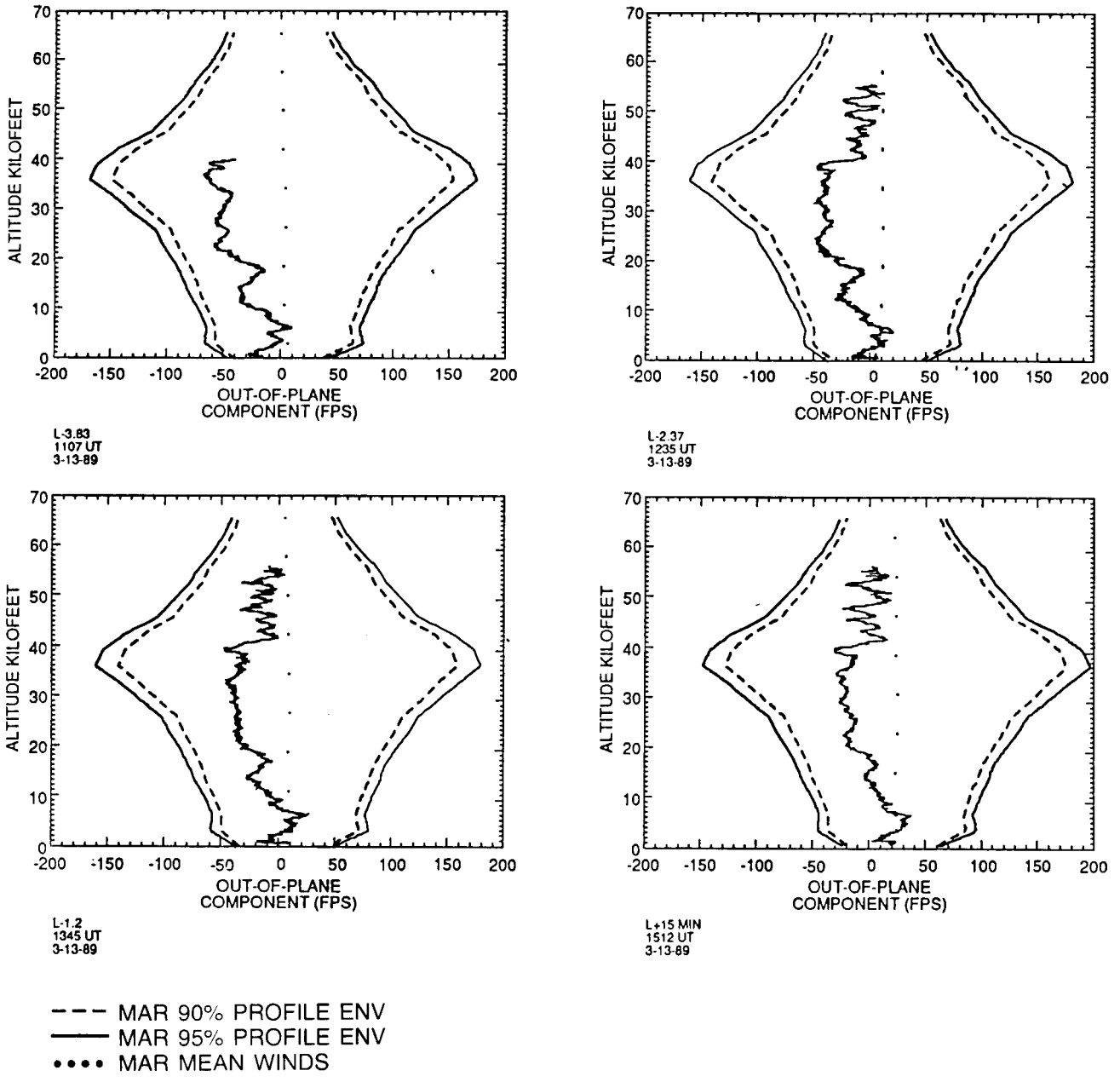


Figure 9. STS-29 prelaunch/launch Jimsphere-measured out-of-plane component winds (FPS). Reference flight azimuth = 90 deg.

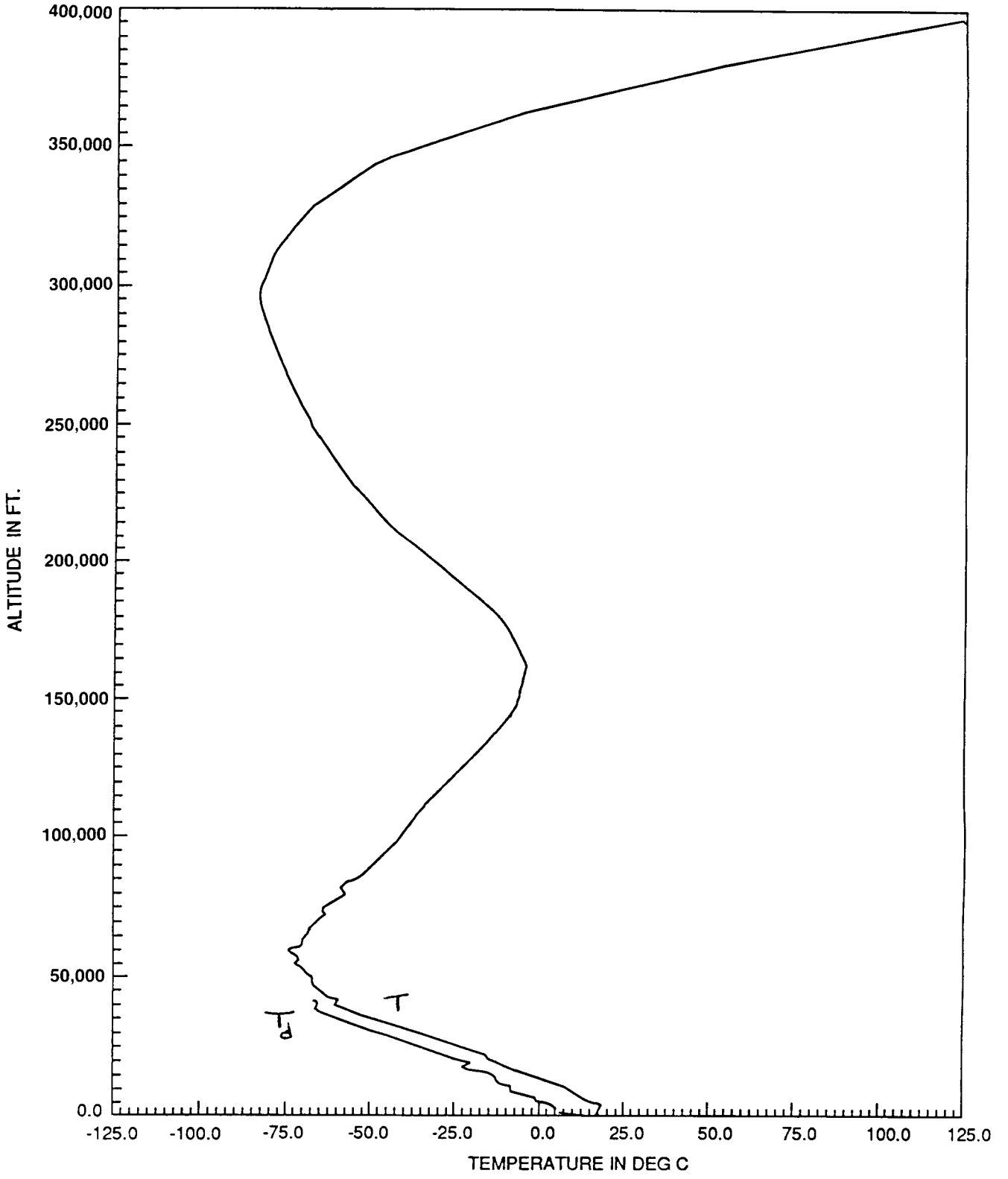


Figure 10. STS-29 temperature profiles versus altitude for launch (ascent).

REFERENCES

1. Saturn Flight Evaluation Working Group: Saturn Launch Vehicle Flight Evaluation Report – Appendix A – Atmosphere (A separate report is prepared for each Saturn vehicle launch operation). George C. Marshall Space Flight Center, Alabama.

2. Johnson, D.L.: Summary of Atmospheric Data Observations for 155 Flights of MSFC/ABMA Related Aerospace Vehicles. NASA TM X-64796, December 5, 1973.

3. Johnson, D.L.: Atmospheric Environment for ASTP (SA-210) Launch. NASA TM X-64990, February 1976.

4. Johnson, D.L., Jasper, G., and Brown, S.C.: Atmospheric Environment for Space Shuttle (STS-1) Launch. NASA TM 82436, July 1981.

5. Johnson, D.L. and Brown, S.C.: Atmospheric Environment for Space Shuttle (STS-2) Launch. NASA TM 82463, December 1981.

6. Johnson, D.L., Brown, S.C., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-3) Launch. NASA TM 82480, April 1982.

7. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-4) Launch. NASA TM 82498, July 1982.

8. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-5) Launch. NASA TM 82515, March 1983.

9. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-6) Launch. NASA TM 82529, May 1983.

10. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-7) Launch. NASA TM 82542, July 1983.

11. Johnson, D.L., Hill, C.K., Turner, R.E., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-8) Launch. NASA TM 82560, October 1983.

12. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-9) Launch. NASA TM 82572, January 1984.

13. Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-11) Launch. NASA TM 82580, March 1984.

14. Johnson, D.L., Hill, C.K., Jasper, G., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-13) Launch. NASA TM 82588, May 1984.

15. Johnson, D.L., Hill, C.K., Jasper, G., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-41D) Launch. NASA TM 86484, October 1984.

16. Johnson, D.L., Hill, C.K., Jasper, G., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-41G) Launch. NASA TM 86486, November 1984.

17. Johnson, D.L., Jasper, G., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51A) Launch. NASA TM 84697, December 1984.

18. Jasper, G.L., Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51C) Launch. NASA TM 86508, April 1985.

19. Jasper, G.L., Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51D) Launch. NASA TM 86524, June 1985.

20. Jasper, G.L., Johnson, D.L., Hill, C.K., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51B) Launch. NASA TM 86525, July 1985.

21. Jasper, G.L., Johnson, D.L., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-51L) Launch. NASA TM 86577, December 1986.

22. Jasper, G.L., Johnson, D.L., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-26) Launch. NASA TM 100359, March 1989.

23. Jasper, G.L., Johnson, D.L., and Batts, G.W.: Atmospheric Environment for Space Shuttle (STS-27) Launch. NASA TM-100370, July 1989.

24. Justus, C.G., et al.: The NASA/MSFC Global Reference Atmosphere Model – Mod 3 (with Spherical Harmonic Wind Model). NASA CR-3256, March 1980.

APPROVAL

ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE (STS-29) LAUNCH

By G.L. Jasper and G.W. Batts

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassified.

E. TANDBERG-HANSSEN
Director, Space Science Laboratory

☆ U.S. GOVERNMENT PRINTING OFFICE 1989–731-061/00183

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
NASA TM-100376		

4. TITLE AND SUBTITLE	5. REPORT DATE
Atmospheric Environment for Space Shuttle (STS-29) Launch	July 1989
	6. PERFORMING ORGANIZATION CODE ES44

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT #
G.L. Jasper and G.W. Batts*	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. WORK UNIT NO.
George C. Marshall Space Flight Center Marshall Space Flight Center, Alabama 35812	11. CONTRACT OR GRANT NO.
	13. TYPE OF REPORT & PERIOD COVERED
12. SPONSORING AGENCY NAME AND ADDRESS	Technical Memorandum
National Aeronautics and Space Administration Washington, D.C. 20546	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared by Space Science Laboratory, Science and Engineering Directorate.

*Computer Sciences Corporation, Huntsville, Alabama.

16. ABSTRACT

This report presents a summary of selected atmospheric conditions observed near Space Shuttle STS-29 launch time on March 13, 1989, at Kennedy Space Center, Florida. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of pre-launch Jimsphere-measured vertical wind profiles is given in this report. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-29 vehicle ascent has been constructed. The STS-29 ascent atmospheric data tape has been constructed by Marshall Space Flight Center's Earth Science and Applications Division to provide an internally consistent data set for use in post-flight performance assessments.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
STS-29 Launch Atmospheric Summary Pressure Temperature Relative Humidity Winds, Winds Aloft, Clouds Space Shuttle	Unclassified – Unlimited

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified	40	NTIS