APPENDIX D:
July 24, 1996 Sierra Nevada Transect flights

I. Synoptic setting:

At 500 mb, a high pressure center was located just south and east of the sample area throughout the period, with very weak height field gradients. Similarly, the 850 mb height fields were quite flat. At the surface there was a weak west to east pressure gradient force with weak low pressure centers both to the north and to the south of the sample area. Winds aloft from the NMC analyses were light, and less than about 20 knots from the northwest at 850 mb at 0400 PST (12 Z) turning to westerly by 1600 PST (00Z). Surface winds plotted on the maps were light and variable. This was a stagnant situation which was in at least its second day. In the absence of significant synoptic forcing, we would expect local terrain induced thermal winds to dominate, i.e. a weak extended sea breeze and well developed mountain-valley winds.

II. Surface observations:

Winds at MCC were about seven knots throughout the sampling day, from the south-southeast until about 1000 PST then shifted to west-southwest about noon then slowly shifted back to the south-southeast by 2100 PST. High temperature at MCC was about 38 C (100 F) between 1400 and 1700 PST. Winds at BLU were light (less than 5 knots). The limited directional data show winds from the west in the afternoon hours.

At Placerville, wind speeds were light (less than 4 knots) all day, switched from downslope (west-northwest) at 0900 PST to westerly at 1300, then turned slowly back to downslope by 2300 PST. At Rocklin and Roseville, the wind speeds were also light but from the south-southeast until about noon, then turned to the west-southwest until about 1800 PST when they slowly shifted back to southeast. The maximum temperature at Roseville was higher than at Placerville, also reaching 38 C in the late afternoon.

Hourly averaged surface ozone concentrations were low through mid morning, increased following the wind shifts and peaked at between 120 and 130 ppbv at the three foothills sites.

III. Vertical Cross sections:

Flight 1, S1 data show a fairly stable atmosphere up to at least 1500 m with a very strong near surface nocturnal inversion. Using the relative humidity and ozone data, it appears the top of the residual layer was about 1300 m. As is typical of an urban environment, ozone was nearly depleted near the ground but was high in the residual layer (greater than 90 ppbv). Further to the northeast, at S2, there is evidence of a thin surface nocturnal inversion with a residual layer up to about 1300 m. Peak ozone values in the residual layer exceeded 100 ppbv. For the S3 traverse, the aircraft did penetrate a near surface inversion (cf. vertical potential temperature gradient in the lower reaches of the central sounding). Above the air was nearly neutral with a weak static stability and well mixed ozone and

relative humidity. The relatively simple pattern in the east-west section is mostly due to the lack of data at S1 and S2. Even so, the mixed layer height can be seen in the temperature and concentration fields.

Flight 2 encountered several data logging difficulties with S1 data essentially lost. At S2, it appears that the lower atmosphere was becoming more neutral with the top of the mixed layer still at 1300 m. In the lower reaches of the northwestern third of the S2 transect, a small pocket of ozone exceeding 120 ppbv was encountered. At S3, the convective boundary appears to have reached altitudes of about 2200 m by this time (1100 PST).

Flight 3, S1 data are also missing. At S2, the mixed layer had grown up to about 1500 m, being exactly neutral below 1300 m. The relative humidity was low and fairly well mixed. Ozone was also very well mixed below 1300 m with concentrations greater than 110 ppbv over nearly the whole of the lower cross section and peaked in excess of 120 ppbv. Farther upslope (S3), we see evidence of strong vertical mixing and convection (i.e. the high spatial variability at small scales). It appears that upslope flow had brought ozone or its precursors to this traverse area with ozone in the low altitudes exceeding 100 ppbv. A stair-step pattern is again obvious in the analysis. Ozone concentrations at the higher elevations were relatively high but significantly less than at the lower elevation just east of the city.

Flight 4, S1 data show a well mixed layer capped at about 700 m. High ozone concentrations (exceeding 160 ppbv) were found near the center of the traverse, with values about 120 ppbv at the traverse end points. At S2, the mixed layer was capped at about 1300 m with high ozone concentrations found across the width of the region, peaking in excess of 140 ppbv just northwest of Placerville.

IV. Synopsis:

The stagnant conditions that persisted through the observing period allowed aged pollutants to remain overnight in a residual layer and caused the new emissions to disperse slowly. The high pressure aloft presumably induced sufficient sinking to maintain a relatively low subsidence inversion and a fairly stable atmosphere above the PBL. This combination of events led to high surface temperatures, strong ozone production and weak but well defined upslope transport of the pollutants. The aircraft data are consistent with the surface ozone observations near Placerville where the 1800 PST concentrations were about 130 ppbv.

Table D-1

7-24-96
Averaged Aircraft Data

	Time (PST)	Location	Altitude (m MSL)	Direction	Speed (knots)	H_m (m MSL)	D_m (m AGL)
Flight 1	0600	S1	600	170	18	305	155
		S1	1500	205	18		
	0700	S2	1500	204	18	800	250
	0800	S3	1850	220	17	1650	400
			2500	200	18		
Flight 2	0900	S1	1400	221	18	425	270
	1000	S2	1500	200	16	1220	670
	1100	S3	1850	250	17	2135	885
			2500	245	20		
Flight 3	1300	S1	700	210	18	850	695
			1450	220	18		
	1400	S2	1500	220	16	1585	1035
			2100	170	18		
	1500	S3	1800	230	16	2250	1000
			2400	250	19		
Flight 4	1700	S1	750	200	15	1160	1005
			1600	200	22		
	1800	S2	1500	190	17	1465	945

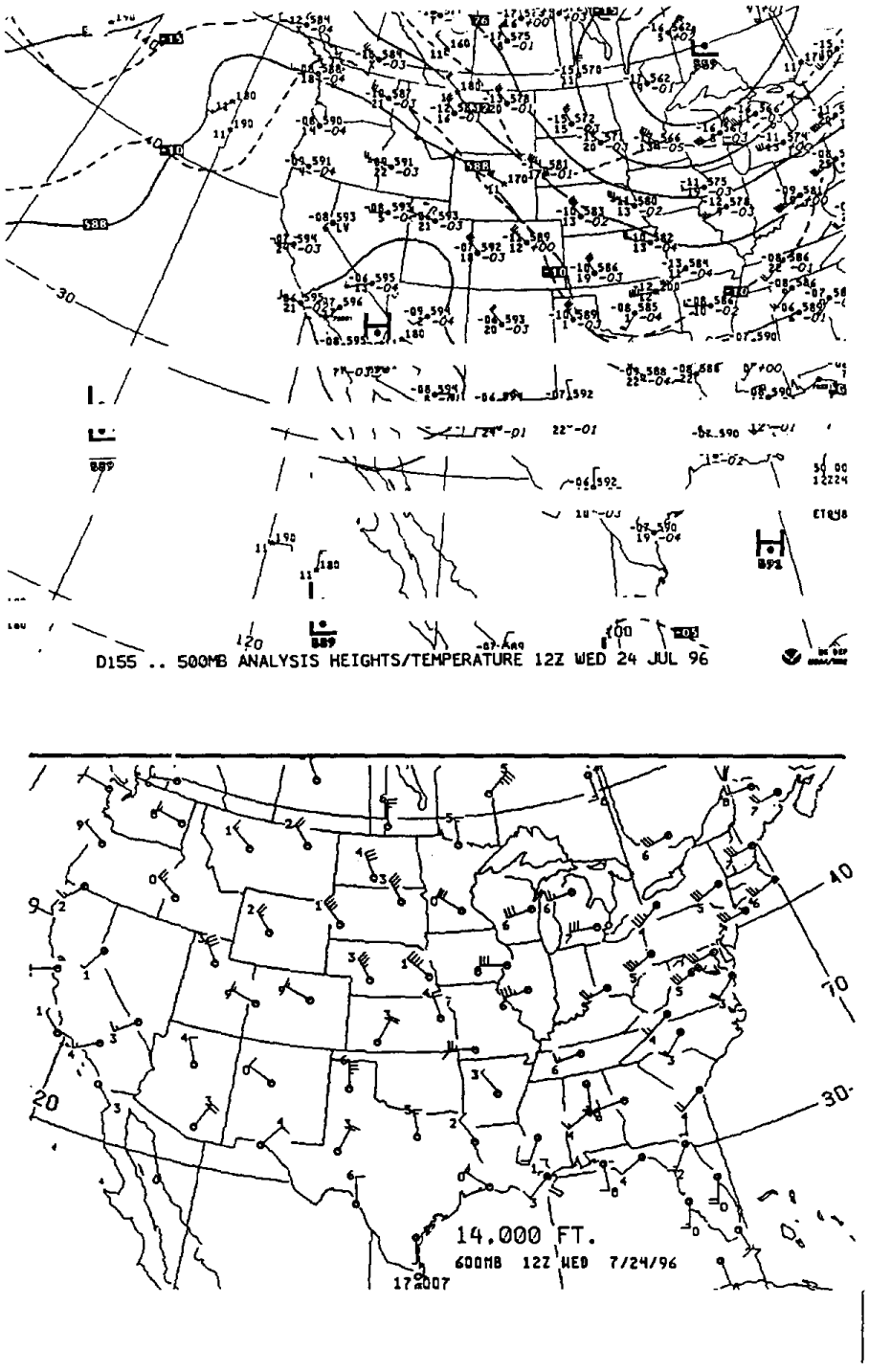


Figure D-1a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 0400 PST 7-24-96 (12Z).

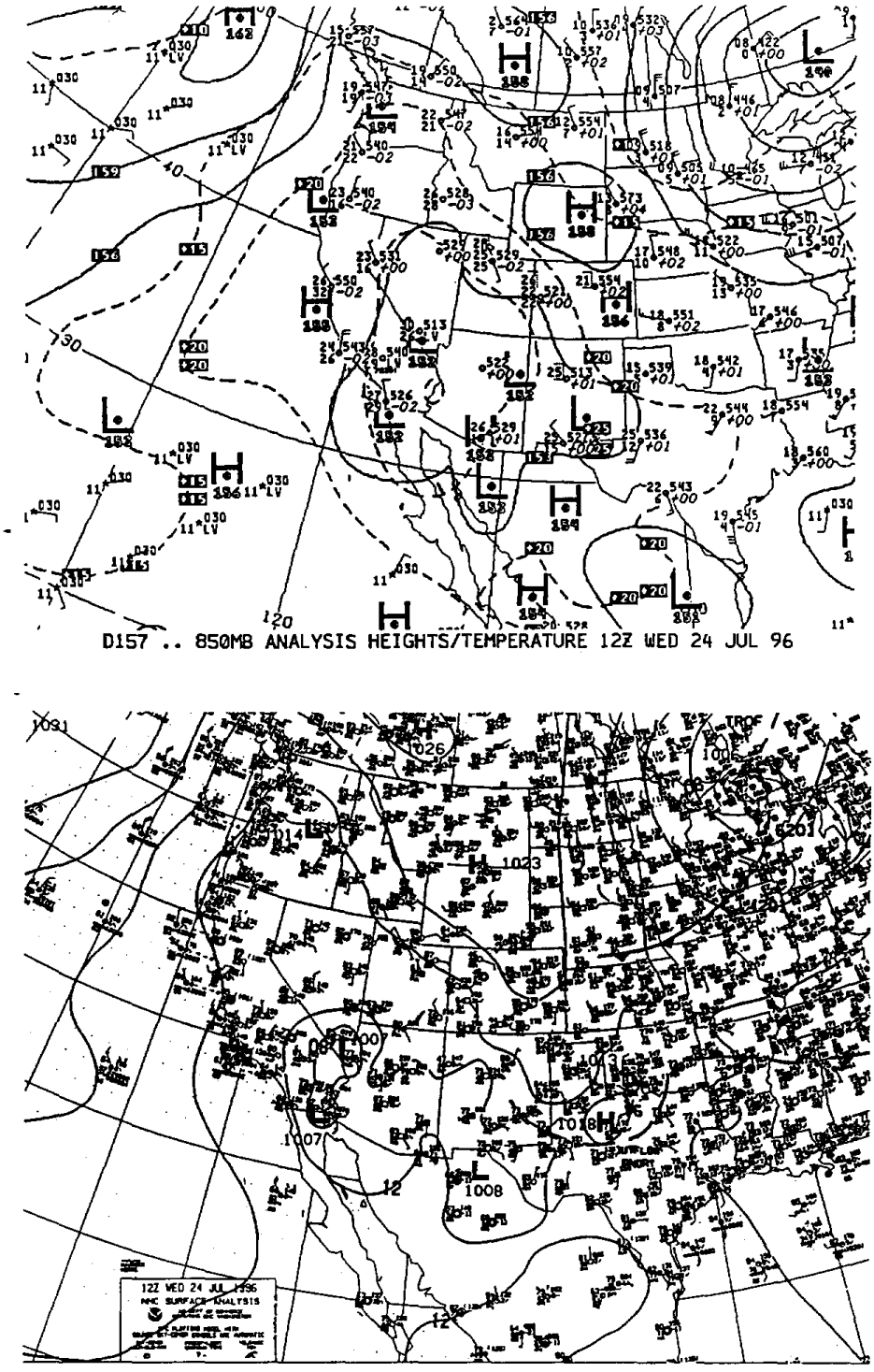


Figure D-1b: 850 mb height field (upper) and surface analysis map (lower) for 0400 PST 7-24-96 (12Z).

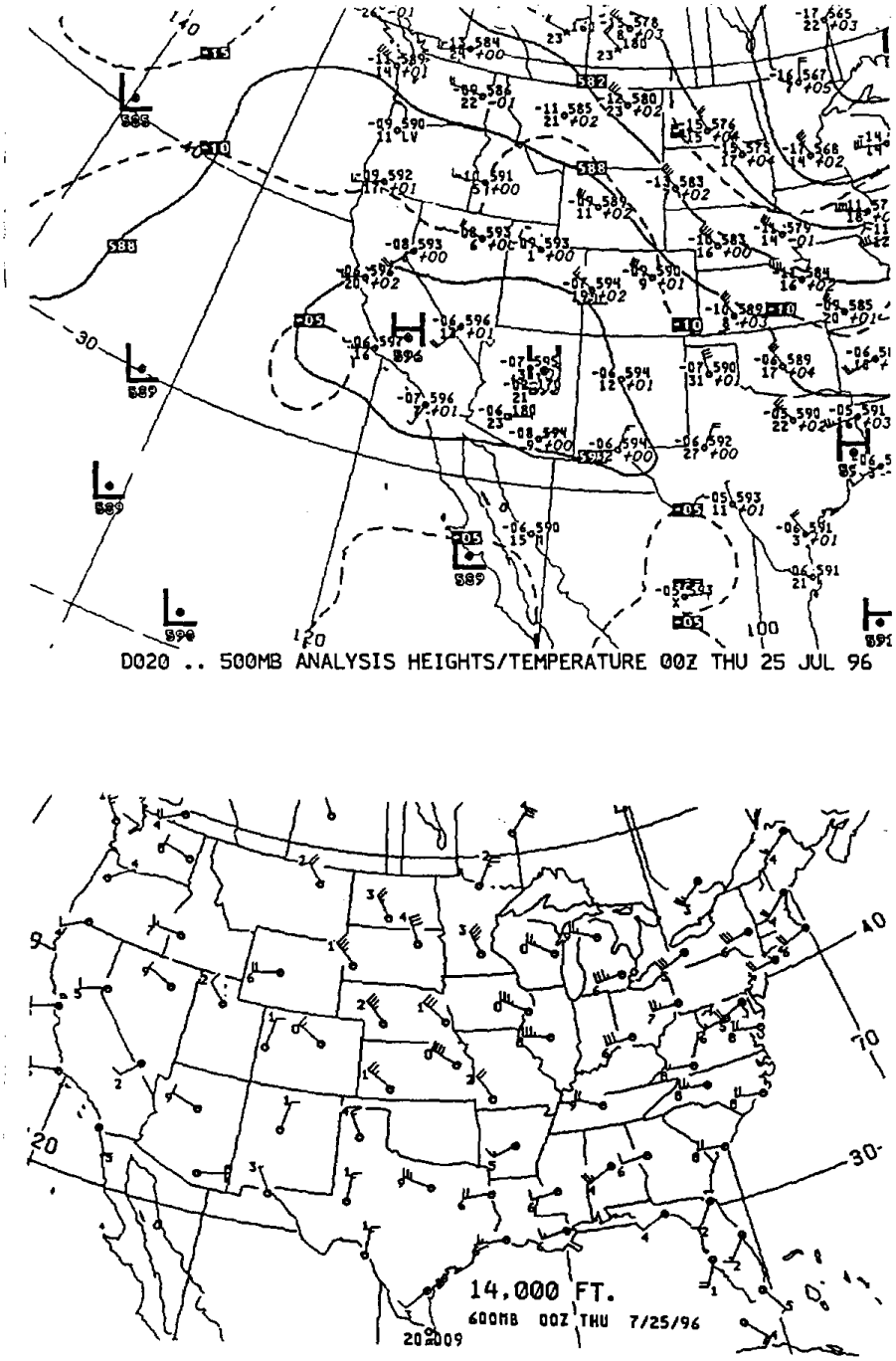


Figure D-2a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 1600 PST 7-24-96 (00Z).

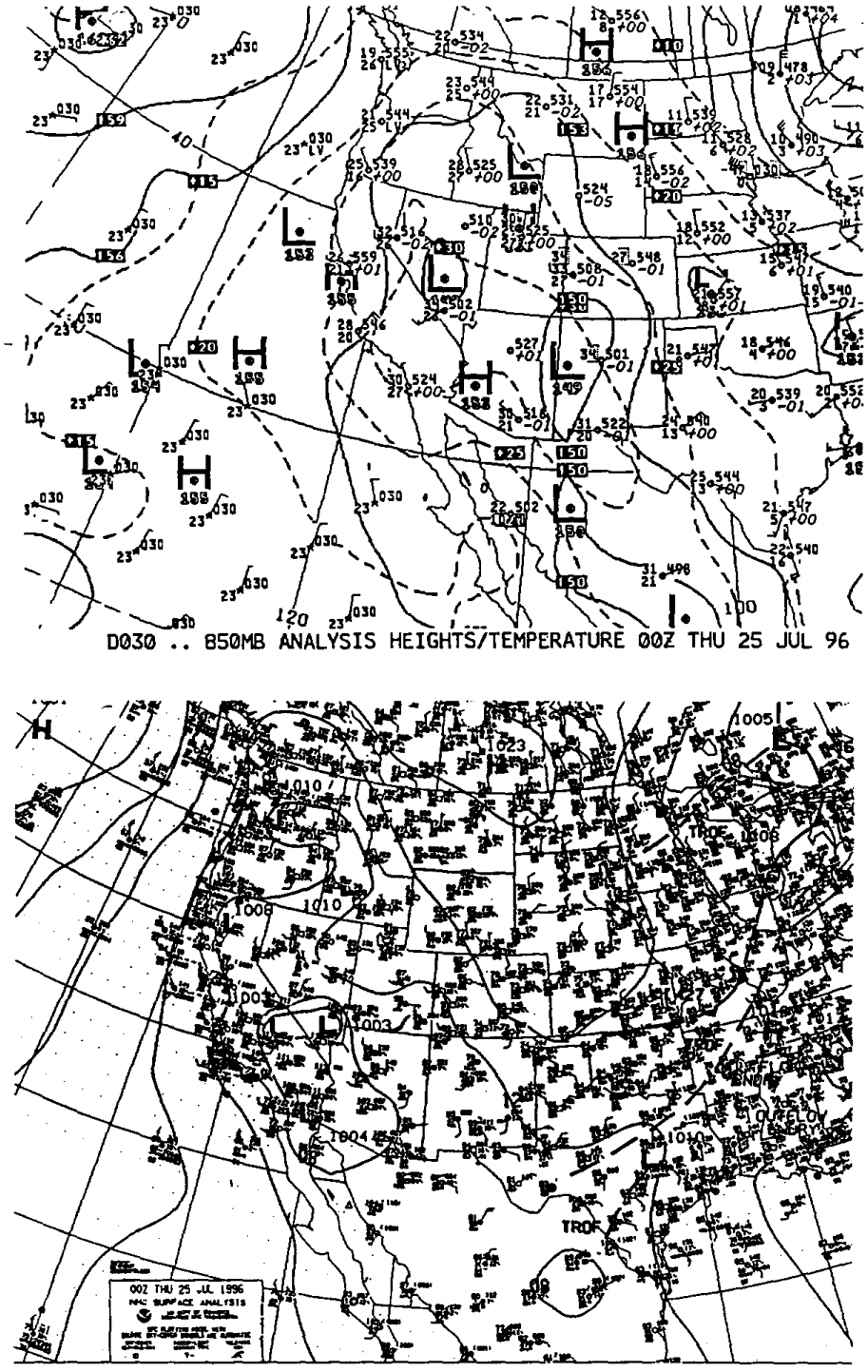


Figure D-2b: 850 mb height field (upper) and surface analysis map (lower) for 1600 PST 7-24-96 (00Z).

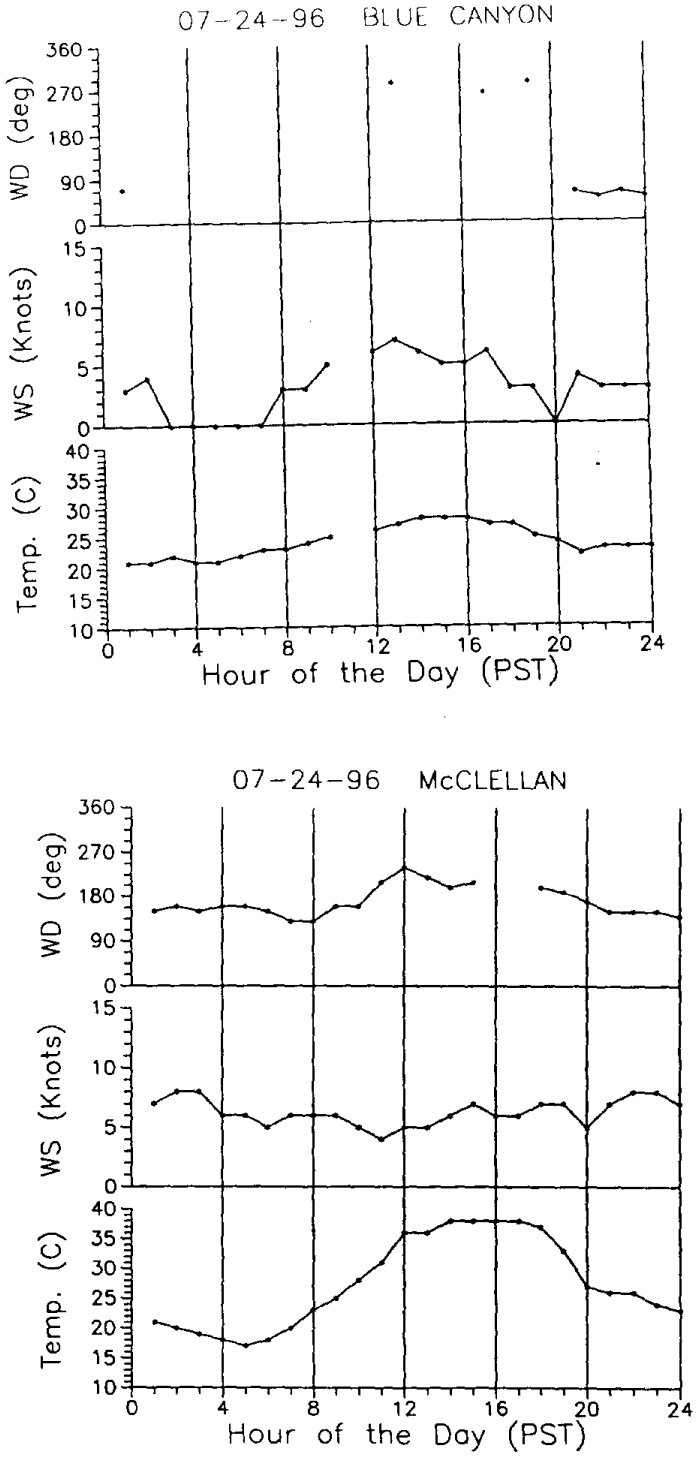


Figure D-3: Plot of wind and temperature data observed on the hour at Blue Canyon (upper) and McClellan (lower) on 7-24-96.

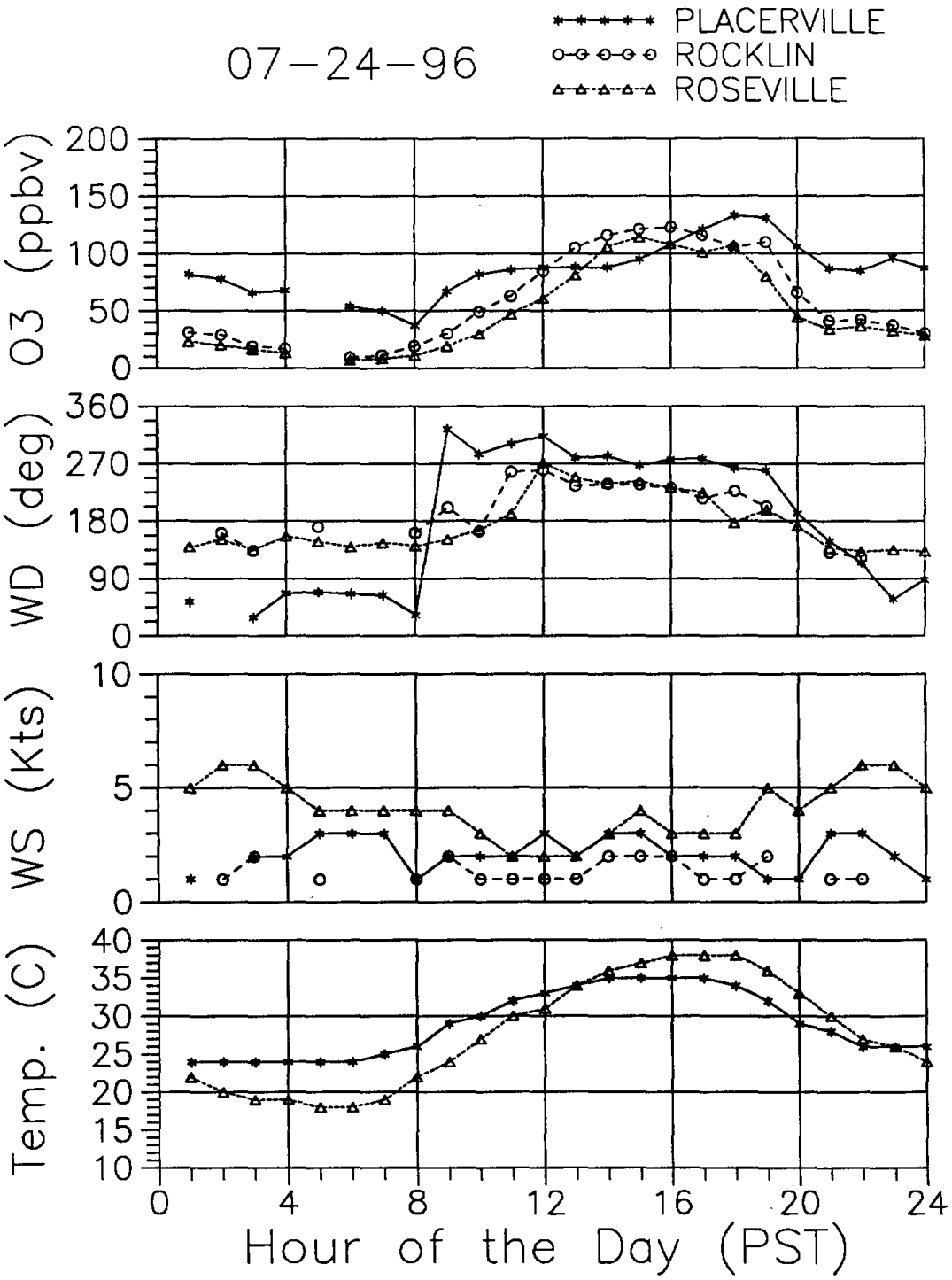
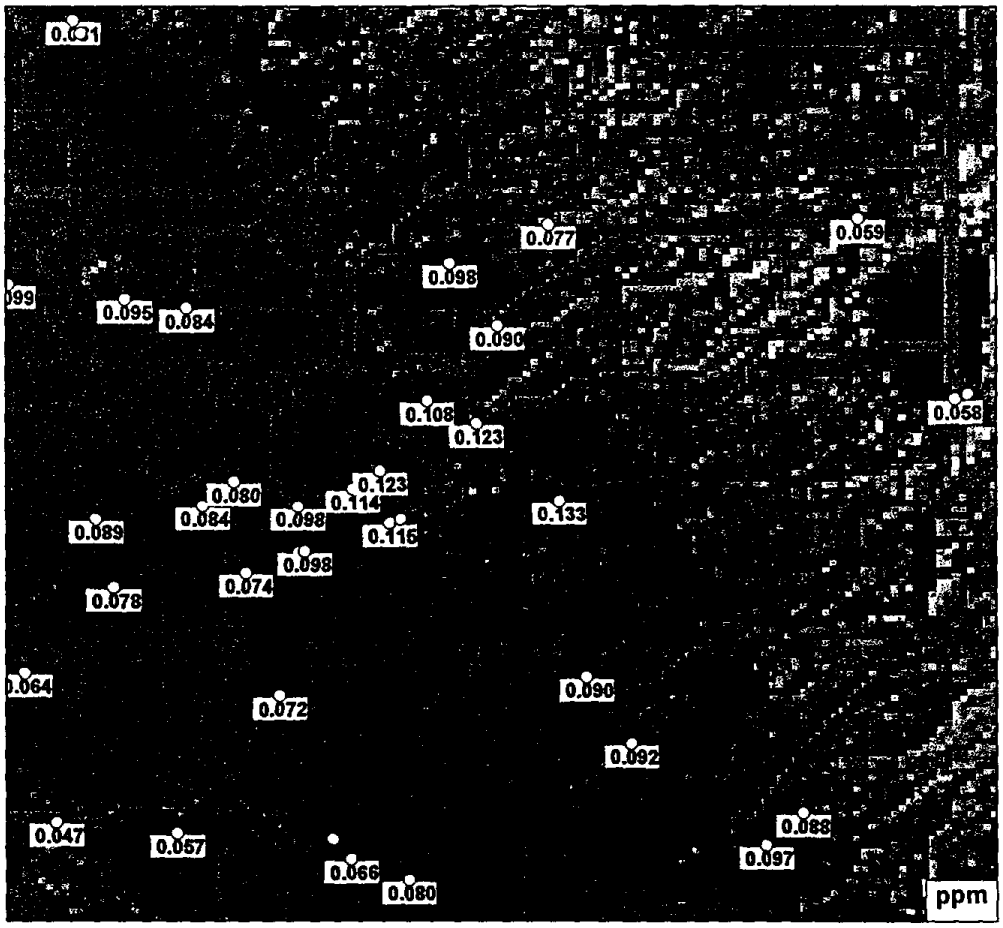


Figure D-4: Plot of hourly averaged data for the three foothill ground stations versus time of day (PST) for 7-24-96.

Figure D-5: Maximum hourly averaged ozone concentrations in central California on 7-24-96.



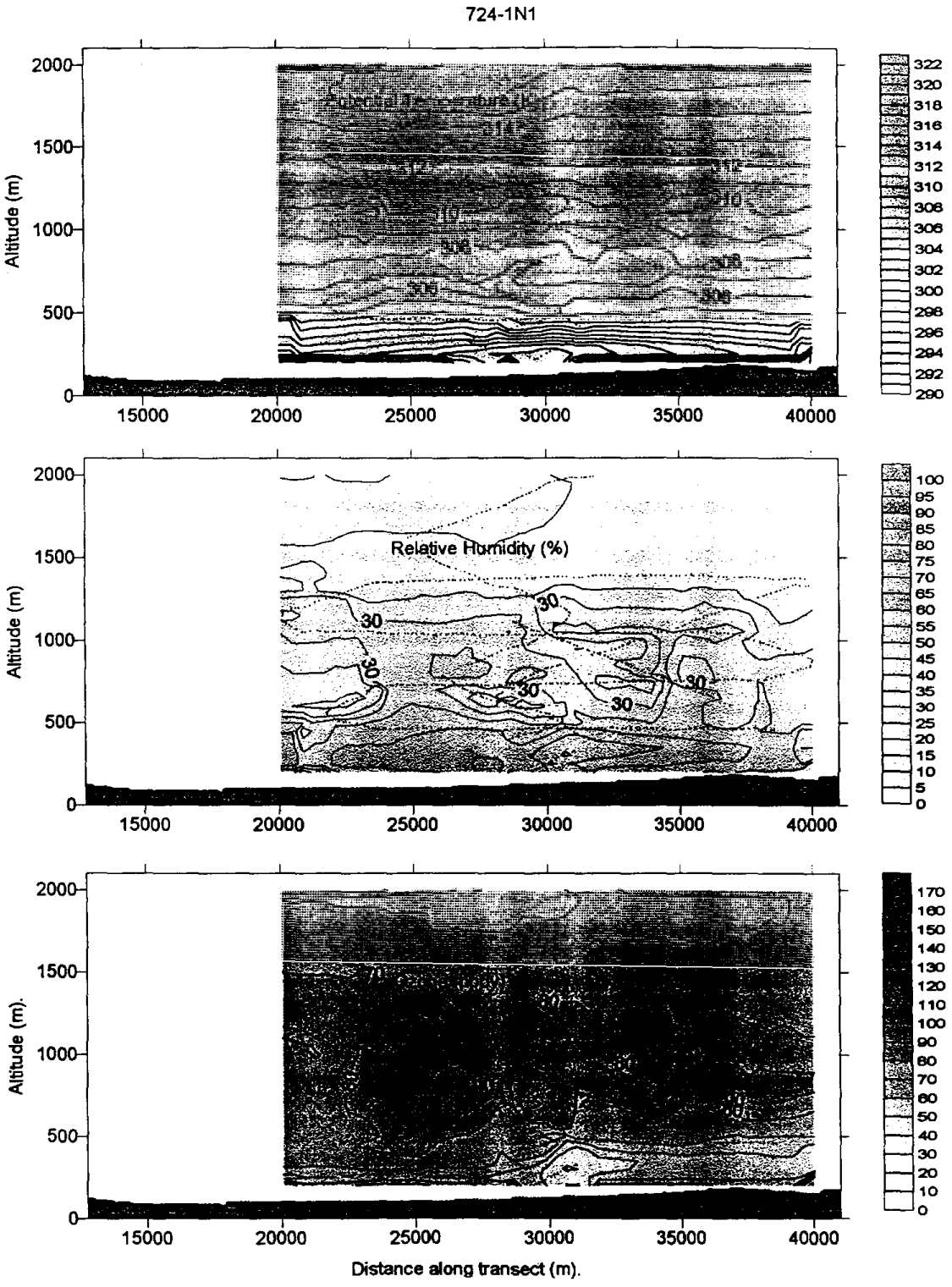


Figure D-6a: Vertical cross sections for flight 1 at S1 on 7-24-96.

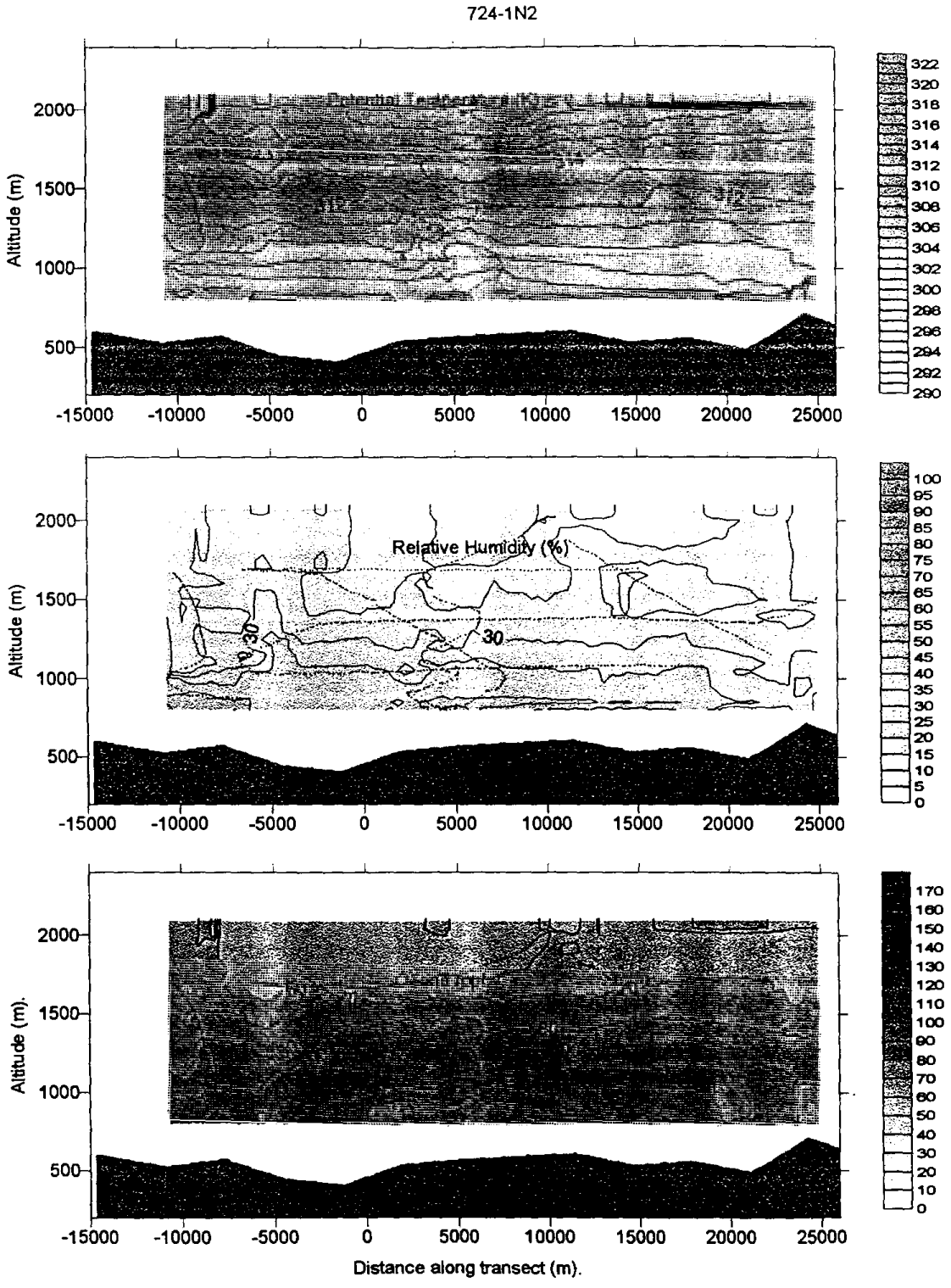


Figure D-6b: Vertical cross sections for flight 1 at S2 on 7-24-96.

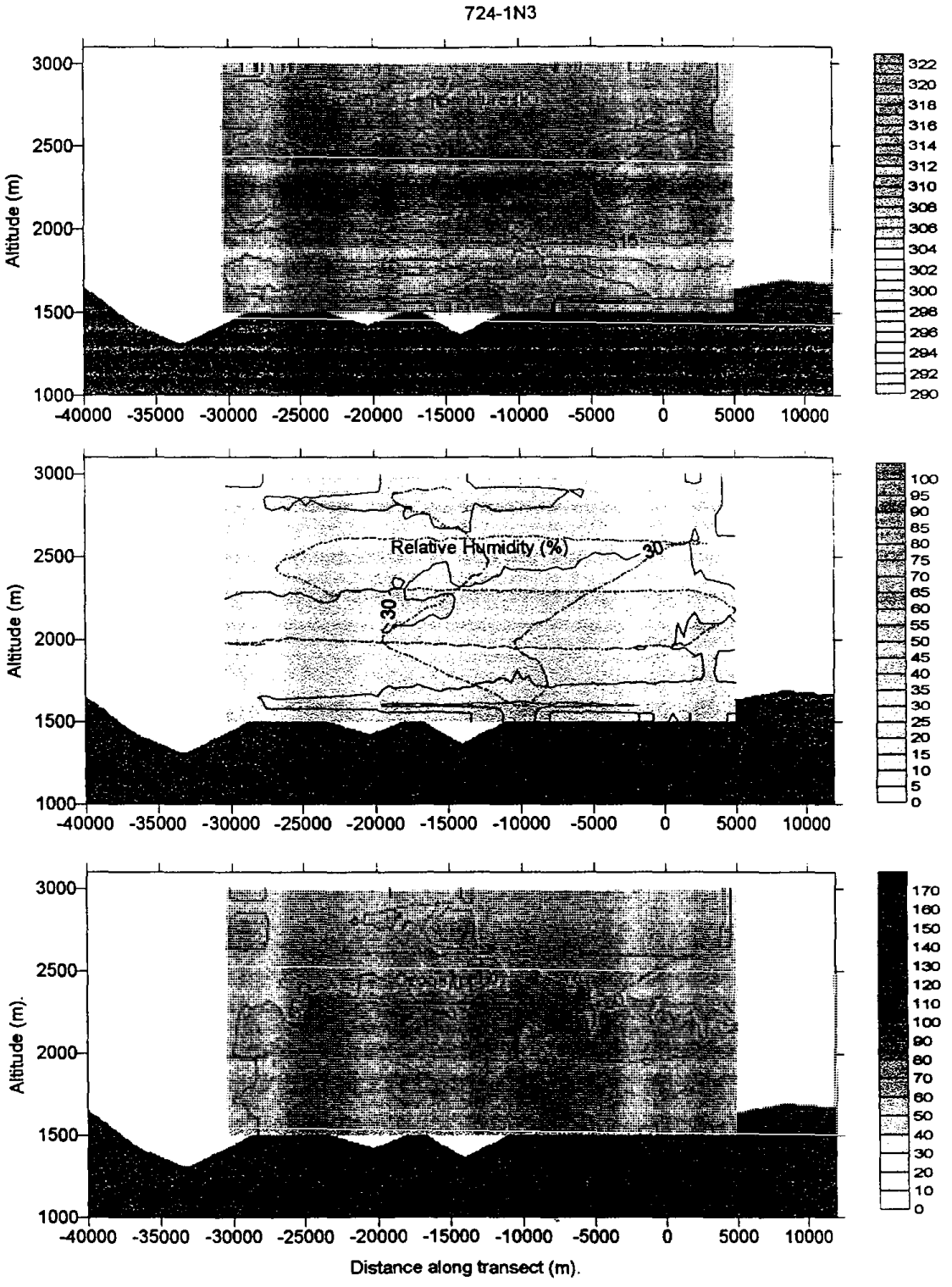


Figure D-6c: Vertical cross sections for flight 1 at S3 on 7-24-96.

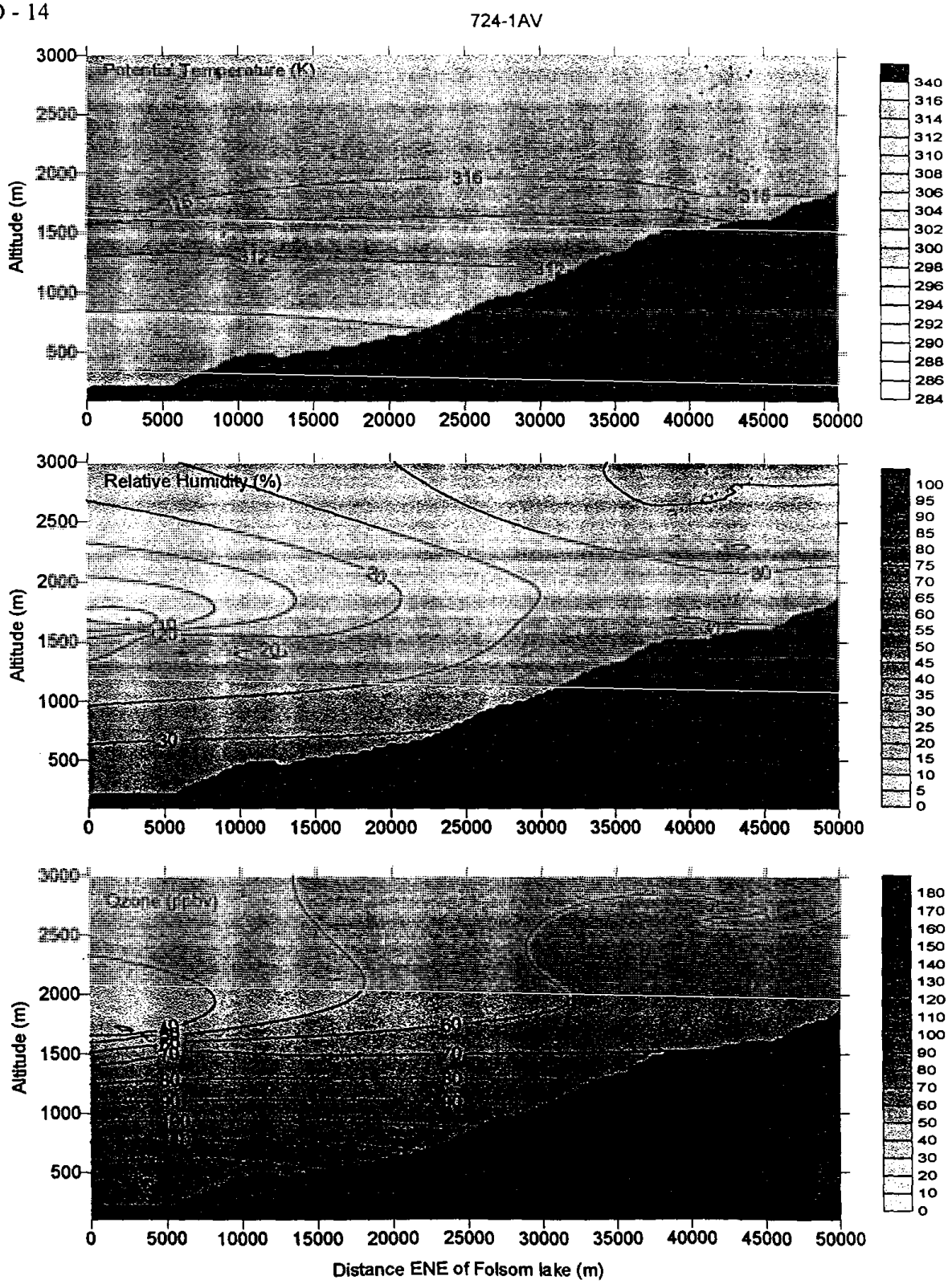


Figure D-6d: Vertical east-west cross sections for flight 1 on 7-24-96.

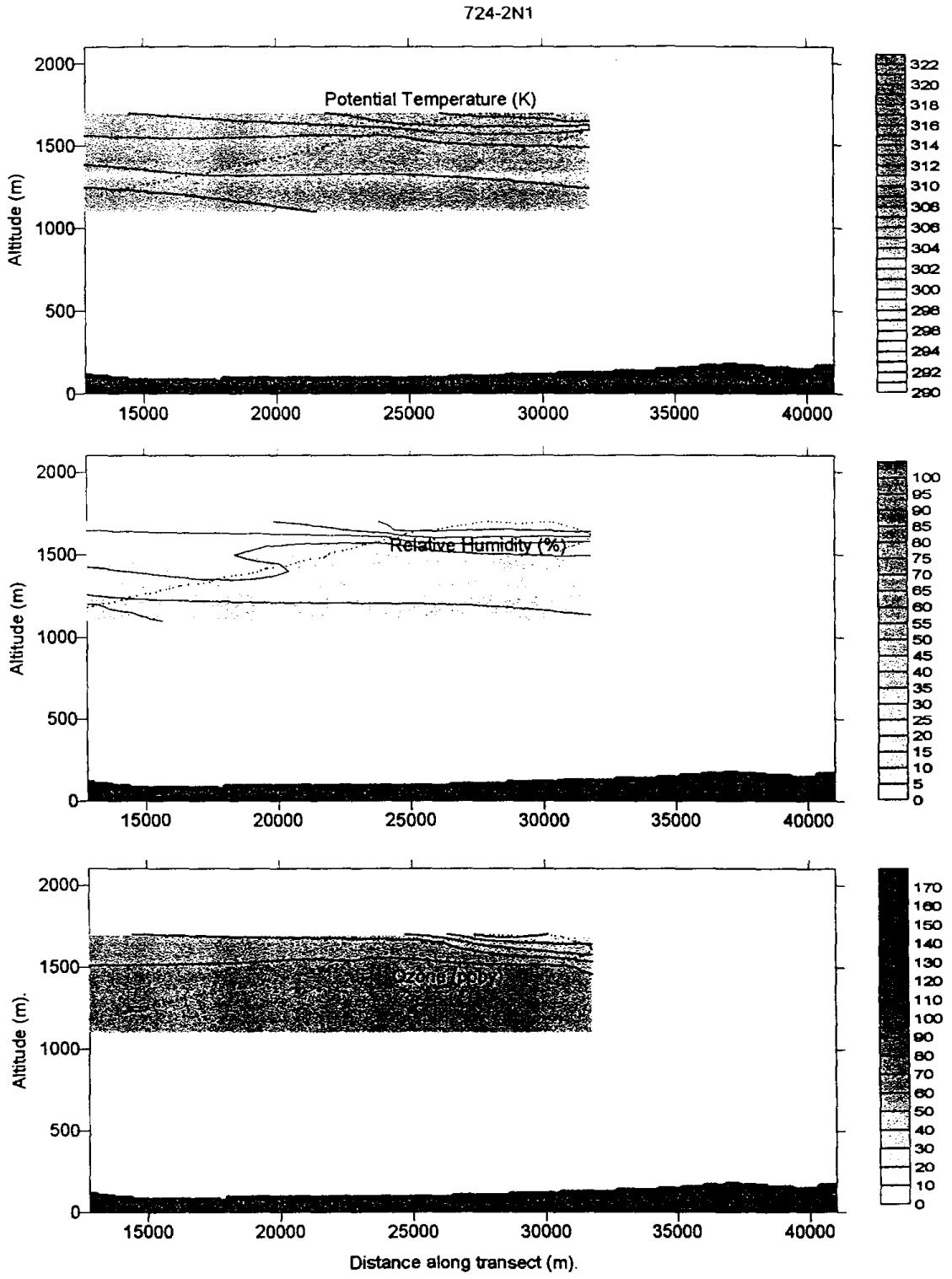


Figure D-7a: Vertical cross sections for flight 2 at S1 on 7-24-96.

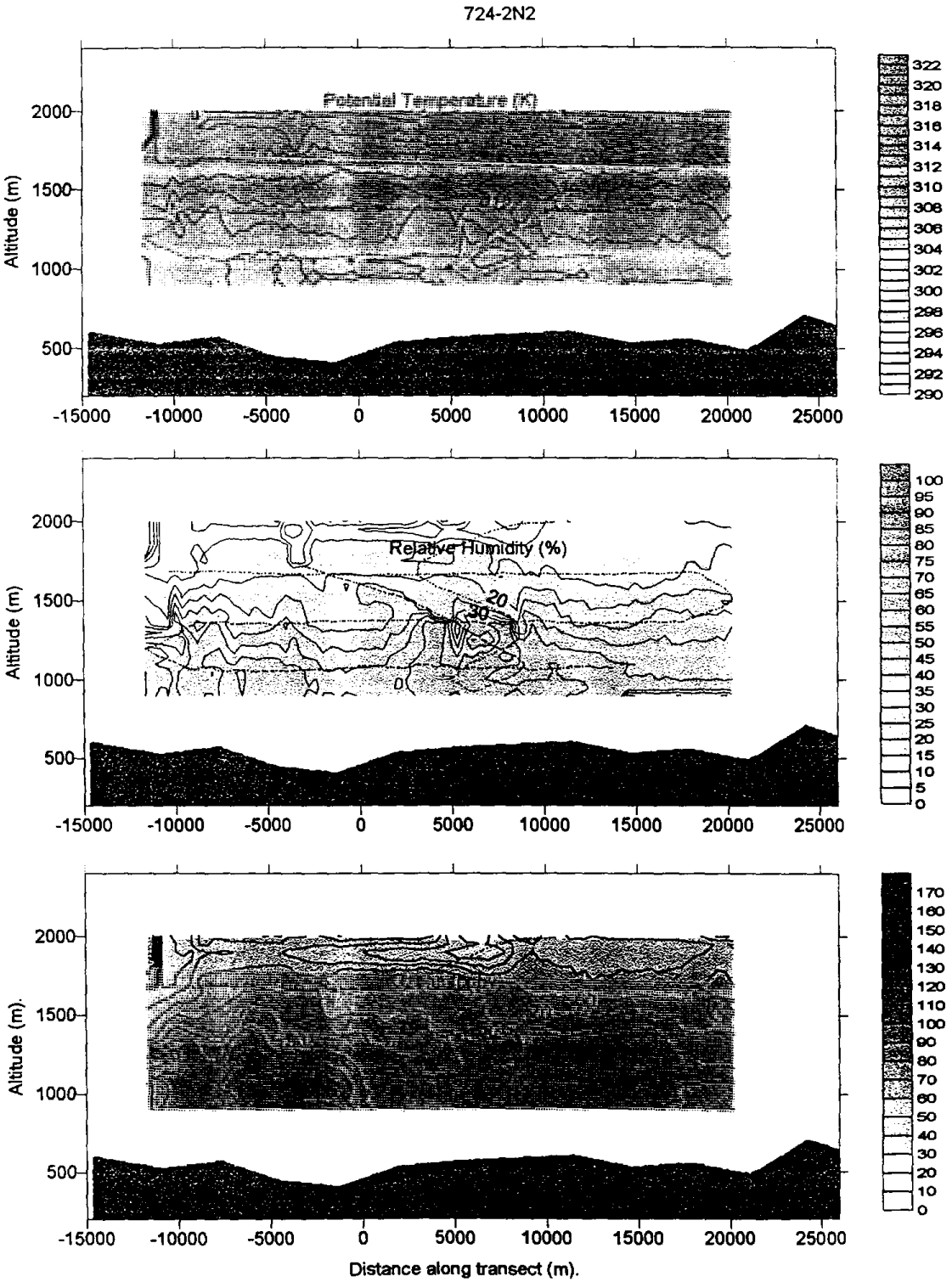


Figure D-7b: Vertical cross sections for flight 2 at S2 on 7-24-96.

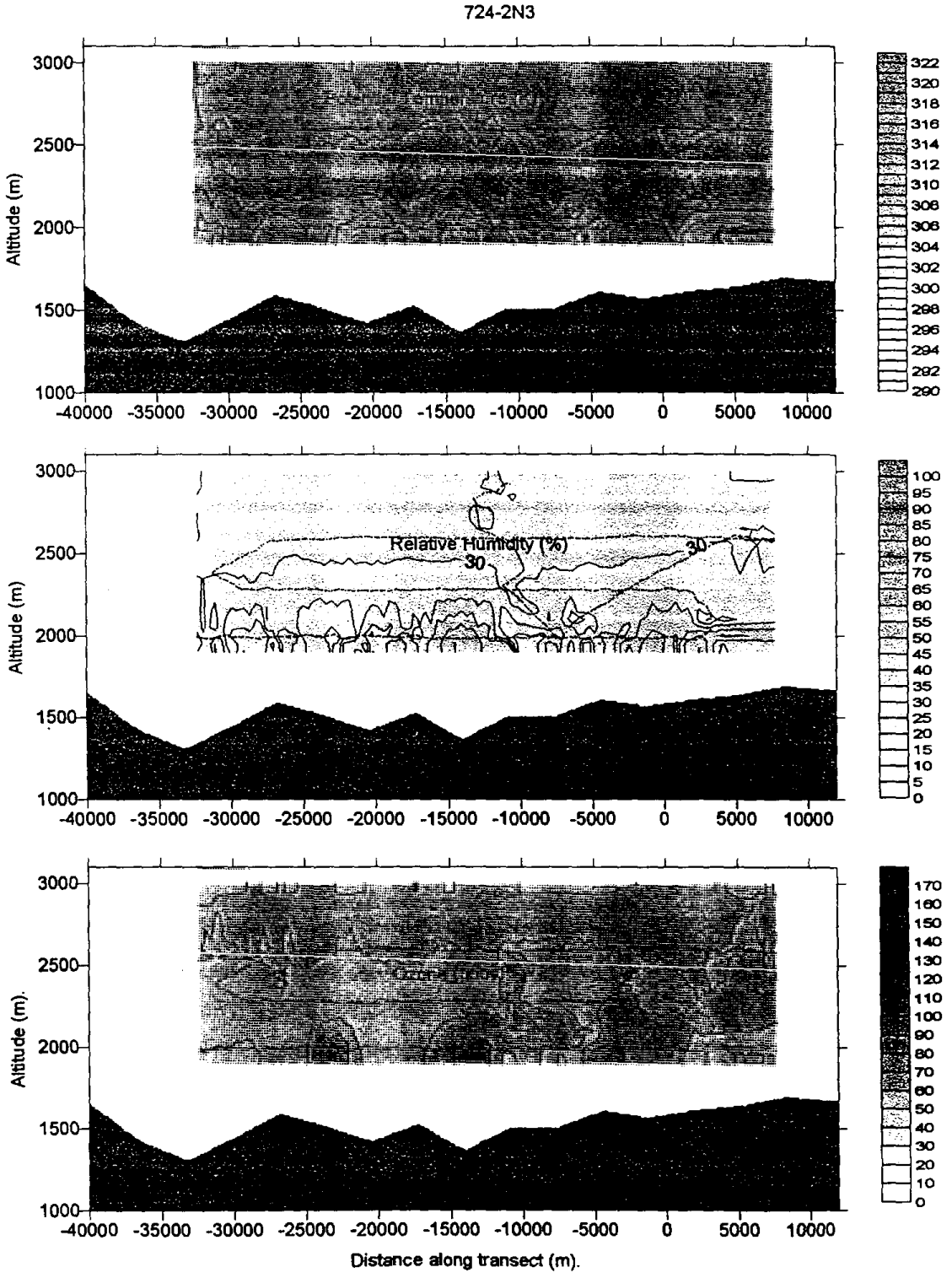


Figure D-7c: Vertical cross sections for flight 2 at S3 on 7-24-96.

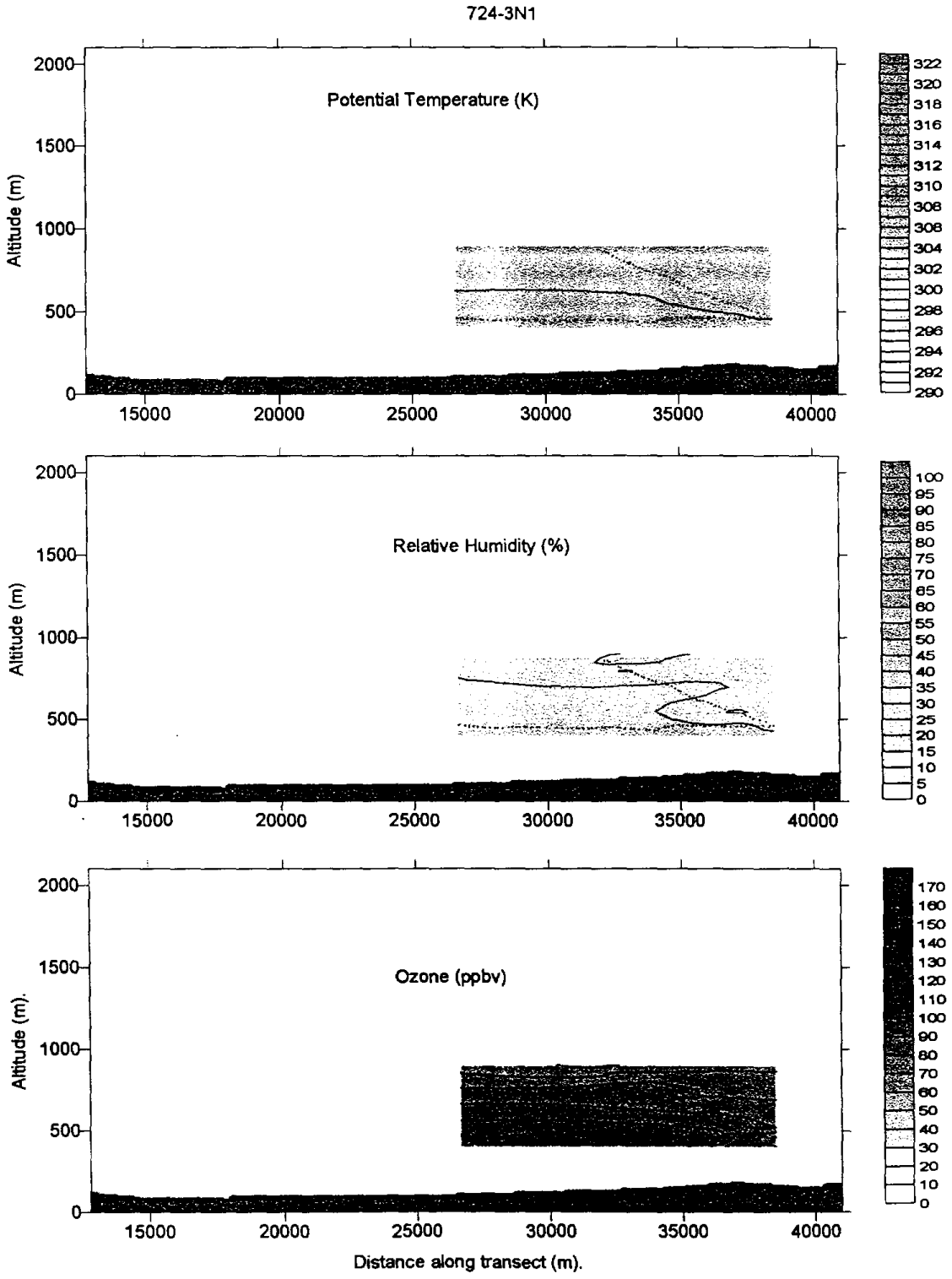


Figure D-8a: Vertical cross sections for flight 3 at S1 on 7-24-96.

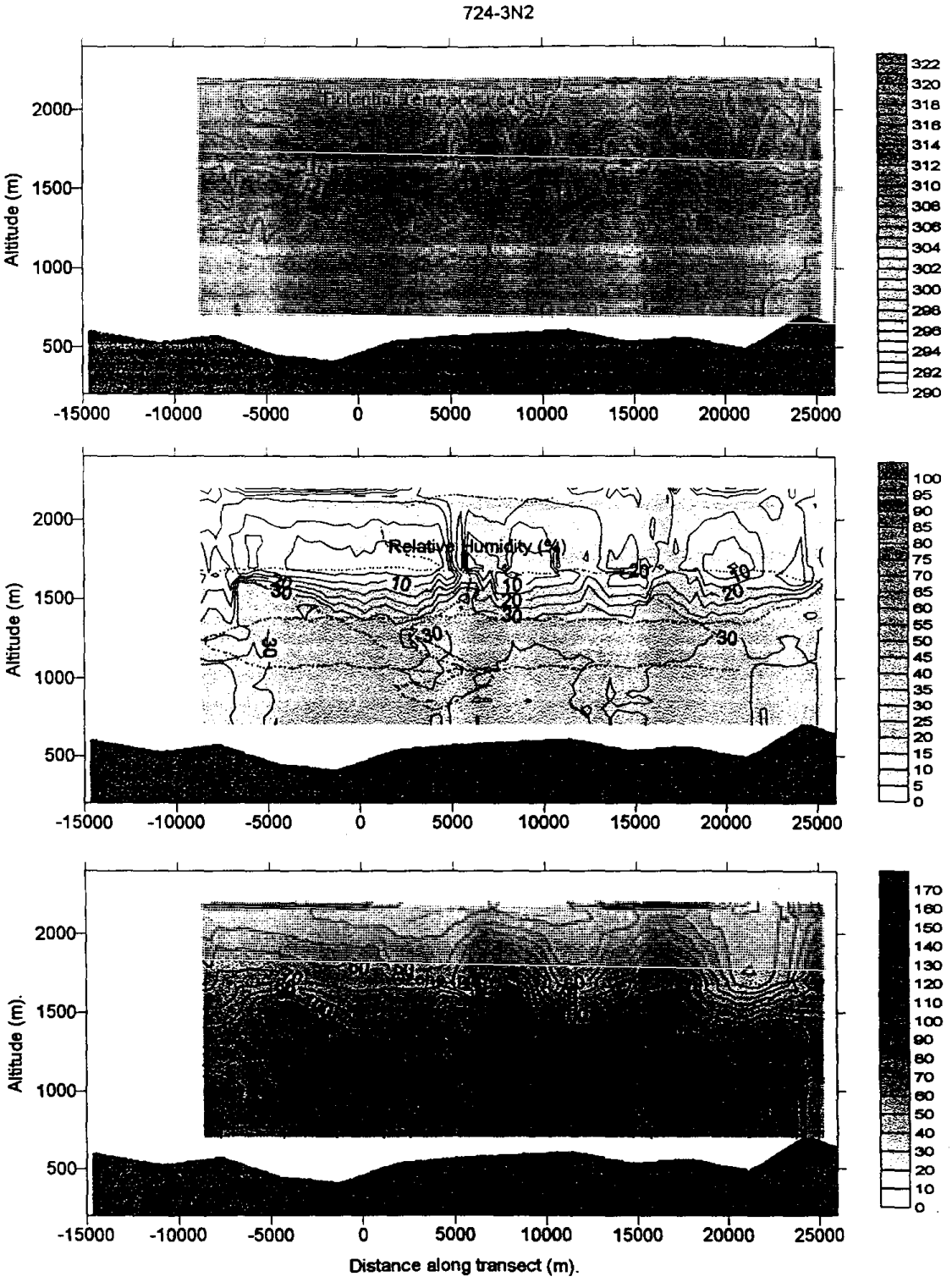


Figure D-8b: Vertical cross sections for flight 3 at S2 on 7-24-96.

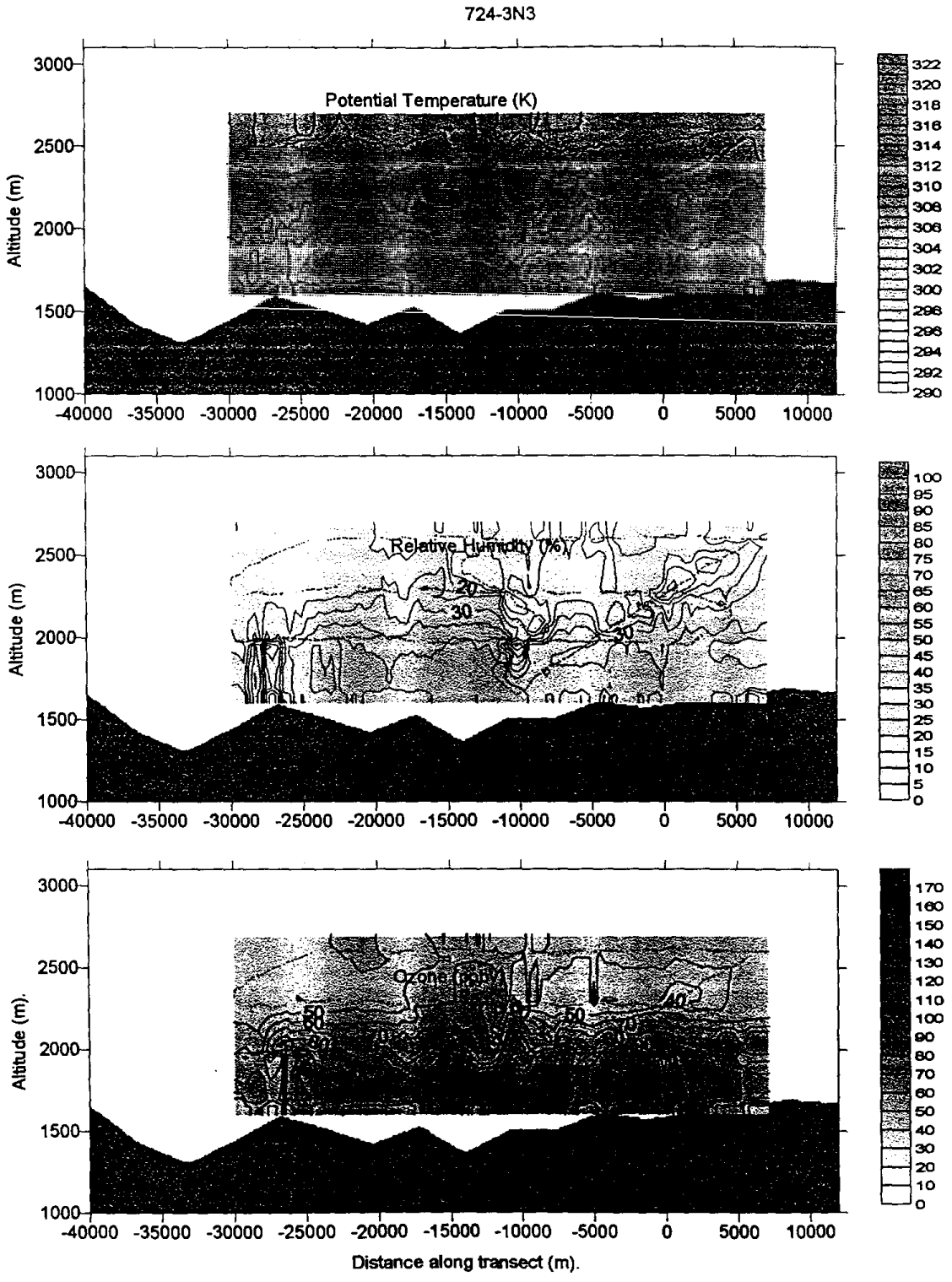


Figure D-8c: Vertical cross sections for flight 3 at S3 on 7-24-96.

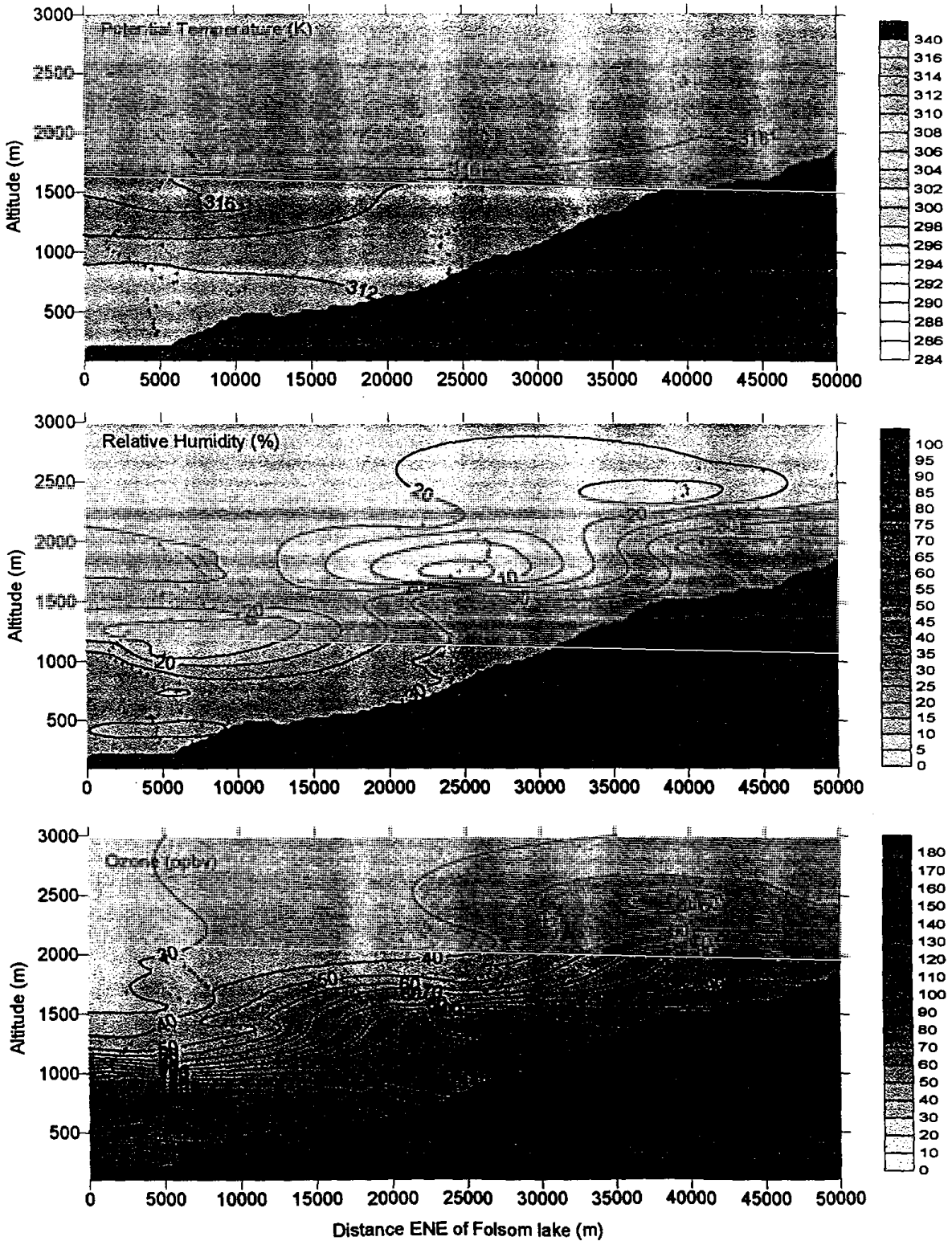


Figure D-8d: Vertical east-west cross sections for flight 3 on 7-24-96.

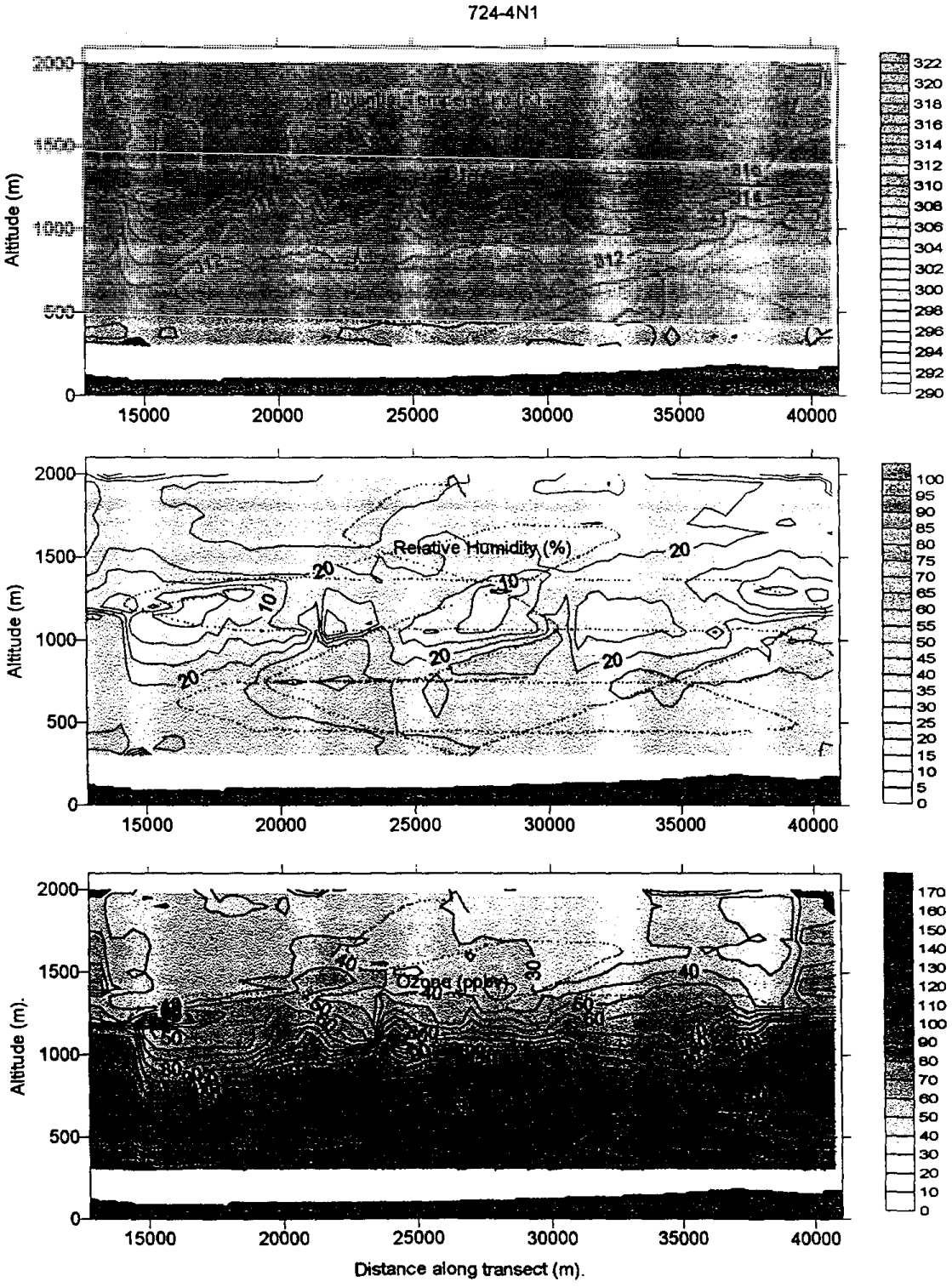


Figure D-9a: Vertical cross sections for flight 4 at S1 on 7-24-96.

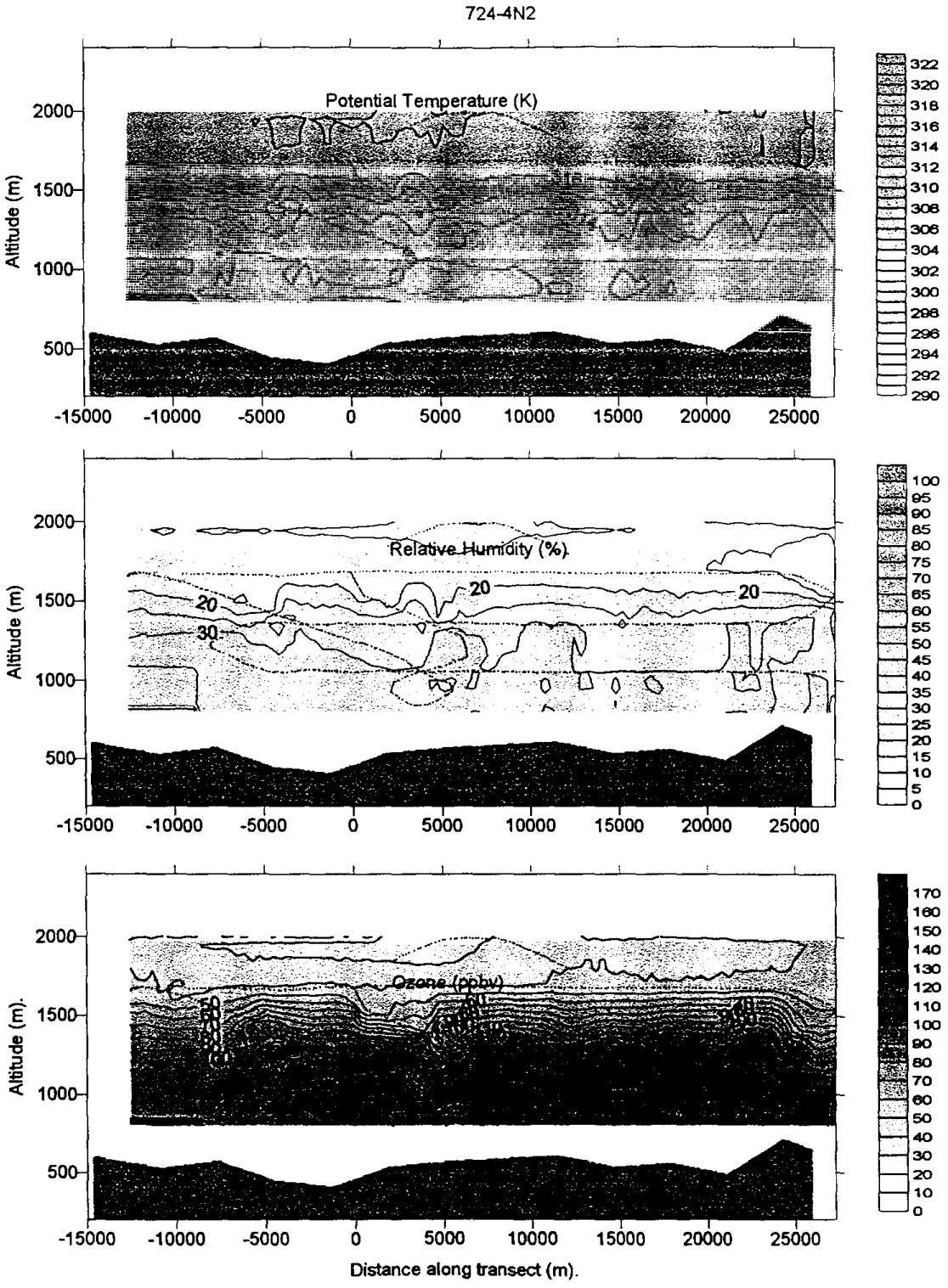


Figure D-9b: Vertical cross sections for flight 4 at S2 on 7-24-96.

APPENDIX E:
July 31, 1996 Sierra Nevada Transect Flights

I. Synoptic setting:

At 0400 PST (12Z), the 500 mb height field was quite flat with winds from the southwest at 20-25 knots. At 850 mb, the fields were also very flat with a weak low pressure center located off the northwest coast of California and one over the south eastern part of the state. Winds at 850 mb were light and variable. At the surface, a trough of low pressure lay along the Central Valley with light and variable surface winds. There was a well defined west to east (on shore) surface pressure force along the coast.

At 1600 PST (00Z), a weak trough was approaching the coast at 500 mb, with high pressure over southern Nevada. Winds at 500 mb were still from the southwest and a bit stronger, 20-30 knots. At 850 mb, the height field was still relatively flat with low pressure over southern Nevada and high pressure building off the northwest coast. Winds at 850 mb were from the west at Oakland and calm at Reno. At the surface, a thermal low persisted in the Central Valley and the onshore pressure gradient force increased. Surface winds indicate a strong sea breeze intrusion with winds of 15 to 20 knots in the Bay Area and over the Sacramento River delta.

II. Surface observations:

At MCC, surface winds were less than 5 knots until noon with highly variable direction but a preponderance of winds between south and east. Afternoon wind speeds increased to 5 to 8 knots, essentially westerly between 1000 and 1500 PST, west-southwest from 1600 to 2000 PST, then shifting slowly to southeasterly. High temperatures at MCC reached about 42 C (108 F). Winds at Blue Canyon were light through the morning hours, from east-northeast (downslope) at least between 0300 and 0500. Between 1000 and 1500 PST, several periods of strong north winds (15 knots) were recorded, followed by upslope flow between 1500 and 2000 PST at about 5 knots.

At the foothill sites, downslope flow was evident through 0800 PST followed by westerly flows between 1000 and 2000 PST with speeds less than 5 knots. Temperatures were high, 40 C at Roseville between 1400 and 1800 PST. Ozone concentrations remained fairly constant at Roseville (50-70 ppbv) throughout the day. At the other two sites, ozone was low until 0800 then varied between 40 and 70 ppbv until 1900 and then decayed back to about 20 ppbv after 2000 PST.

III. Vertical Cross sections:

Flight 1 shows near-ground stable layers at both S1 and S2 with very weak static stability aloft. At S3, the atmosphere above the surface was also near neutral. For the S1 and S2 transects, relative humidity and ozone were low. S3 showed the highest concentrations of ozone (60 - 70 ppbv) for this early morning period, with the highest concentrations found above 2800 m. As with the other clean day, a pocket of higher ozone concentrations was found aloft at S3.

Flight 2, S1 showed the remnants of the surface nocturnal inversion in all fields, especially the thin layer of ozone reaching concentrations of 90 ppbv at 500 m altitude. At S2, the right half of the sampled area remained well mixed but the left (northwest) part showed growth of a mixed layer and increases in ozone concentrations. At S3, the sampled atmosphere was neutrally stratified with ozone values about 50 ±5 ppbv.

By mid afternoon (flight 3) through early evening (flight 4), there were few changes at the transects: neutral stratification, well mixed relative humidity fields and pockets of relatively high ozone concentrations of 60 to 80 ppbv, especially at S1. For both flights 2 and 3, the east-west section shows the well-mixed nature of the lower atmosphere.

IV. Synopsis:

Given the weak circulation aloft, the light winds near the surface, and the high afternoon temperatures reached near the ground, one would expect much higher ozone concentrations. In fact, they remained low over the foothills and throughout most of the sample area. The persistence of the initially unstratified atmosphere clearly fostered both the absence of aged pollutants in the residual layer at the start of the day and the deep vertical mixing of the pollutants, both of which would favor relatively low concentrations of ozone, in the afternoon.

Table E-1

7-31-96
Averaged Aircraft Data

	Time (PST)	Location	Altitude (m MSL)	Direction	Speed (knots)	H_m (m MSL)	D_m (m AGL)
Flight 1	0600	S1	600	190	15	245	95
		S1	1500	230	21		
	0700	S2	850	205	14	790	240
			1500	200	16		
			2200	180	17		
	0800	S3	1850	200	15	<1585	335
			2500	220	18		
Flight 2	0900	S1	650	225	15	425	275
			1350	235	15		
	1000	S2	1500	200	16	1070	520
	1100	S3	1900	220	17	2075	825
			2500	220	16		
Flight 3	1300	S1	600	245	18	670	520
			1400	230	15		
	1400	S2	1500	200	17		
	1500	S3	1800	235	16		
			2350	220	19		
Flight 4	1600	S1	650	230	16		
			1500	215	18		
	1700	S2	1500	230	16		

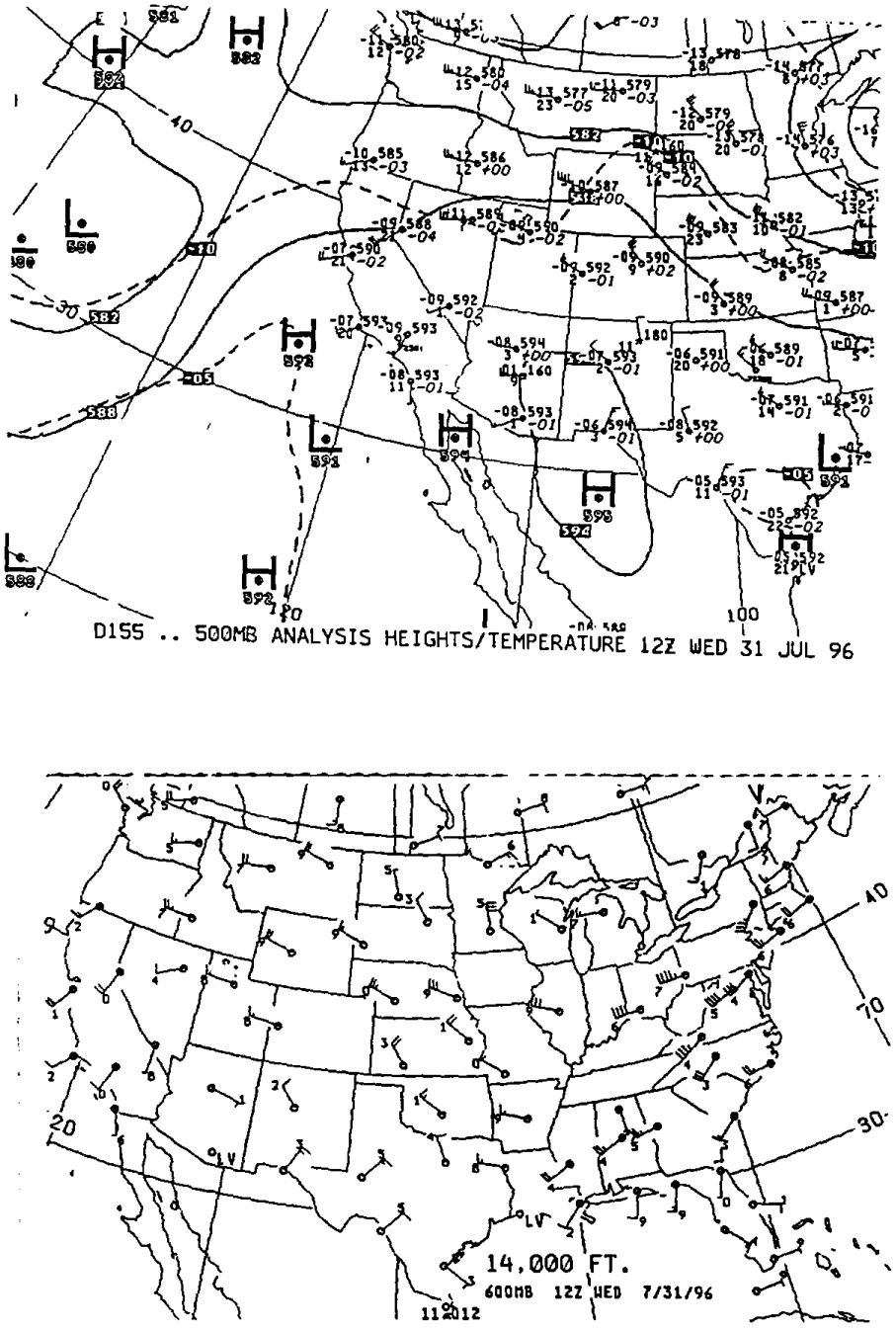


Figure E-1a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 0400 PST 7-31-96 (12Z).

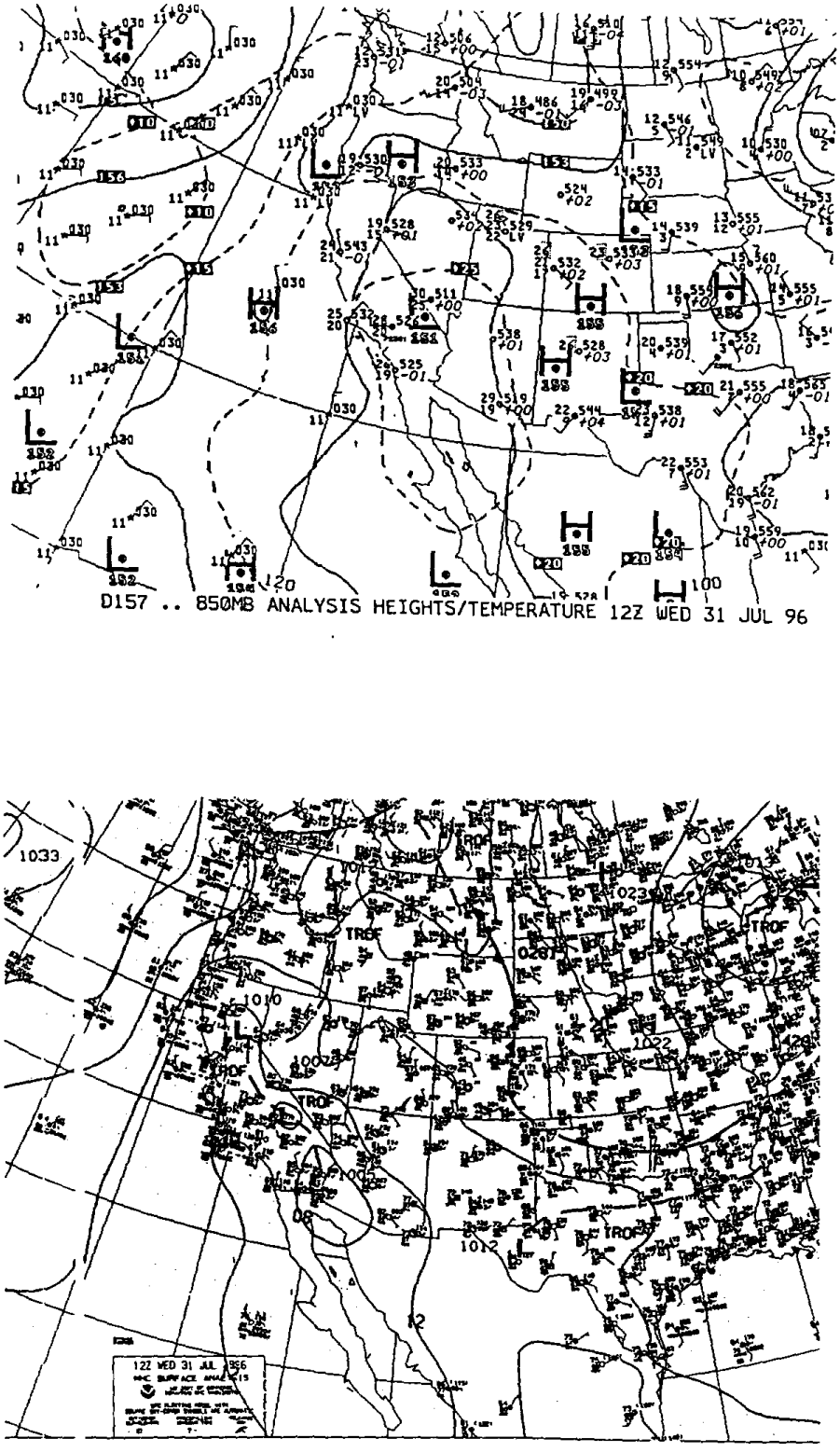
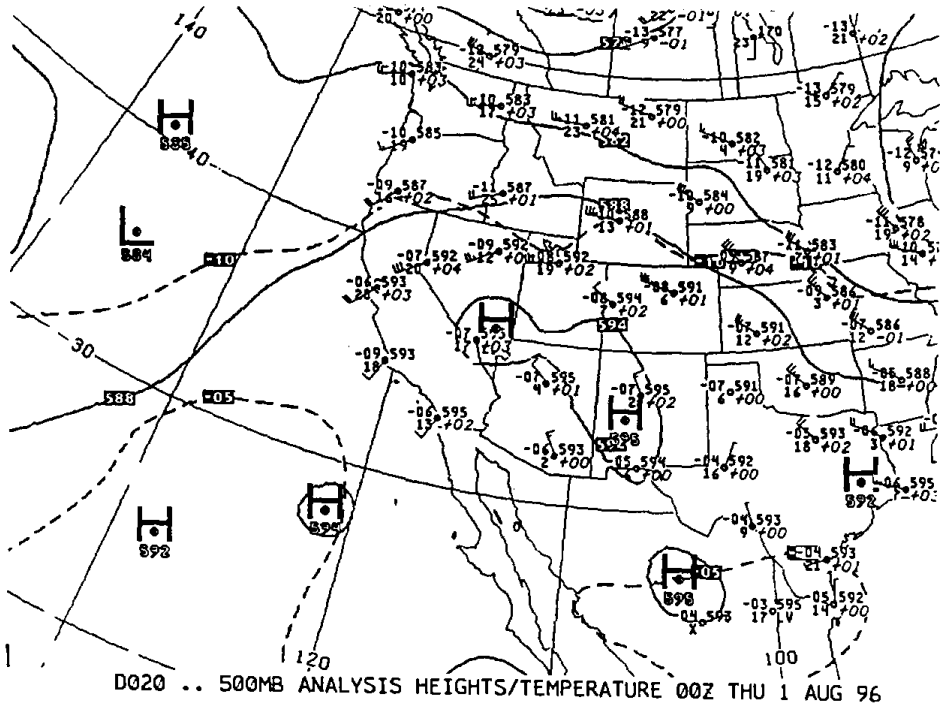


Figure E-1b: 850 mb height field (upper) and surface analysis map (lower) for 0400 PST 7-31-96 (12Z).



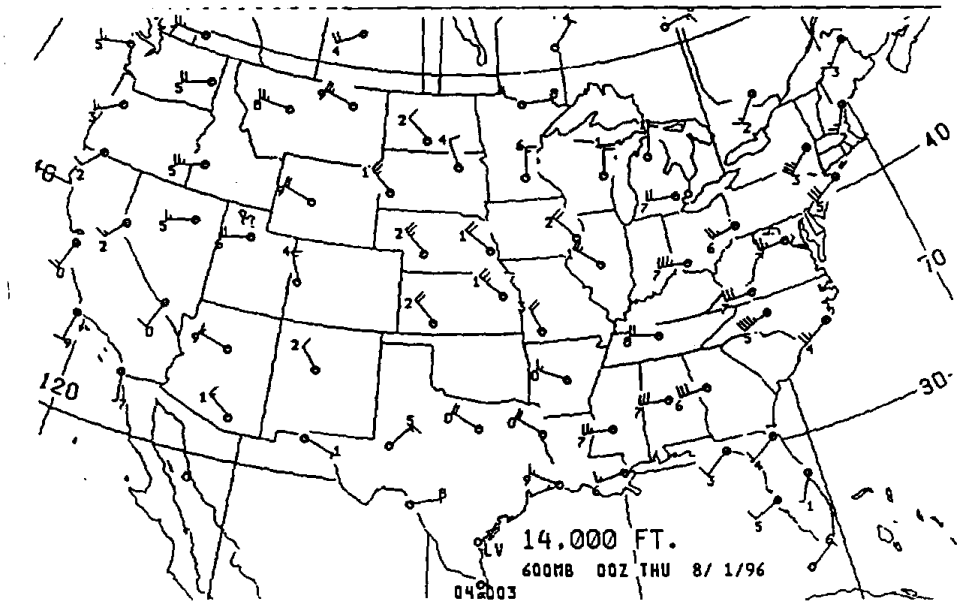


Figure E-2a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 1600 PST 7-31-96 (00Z)

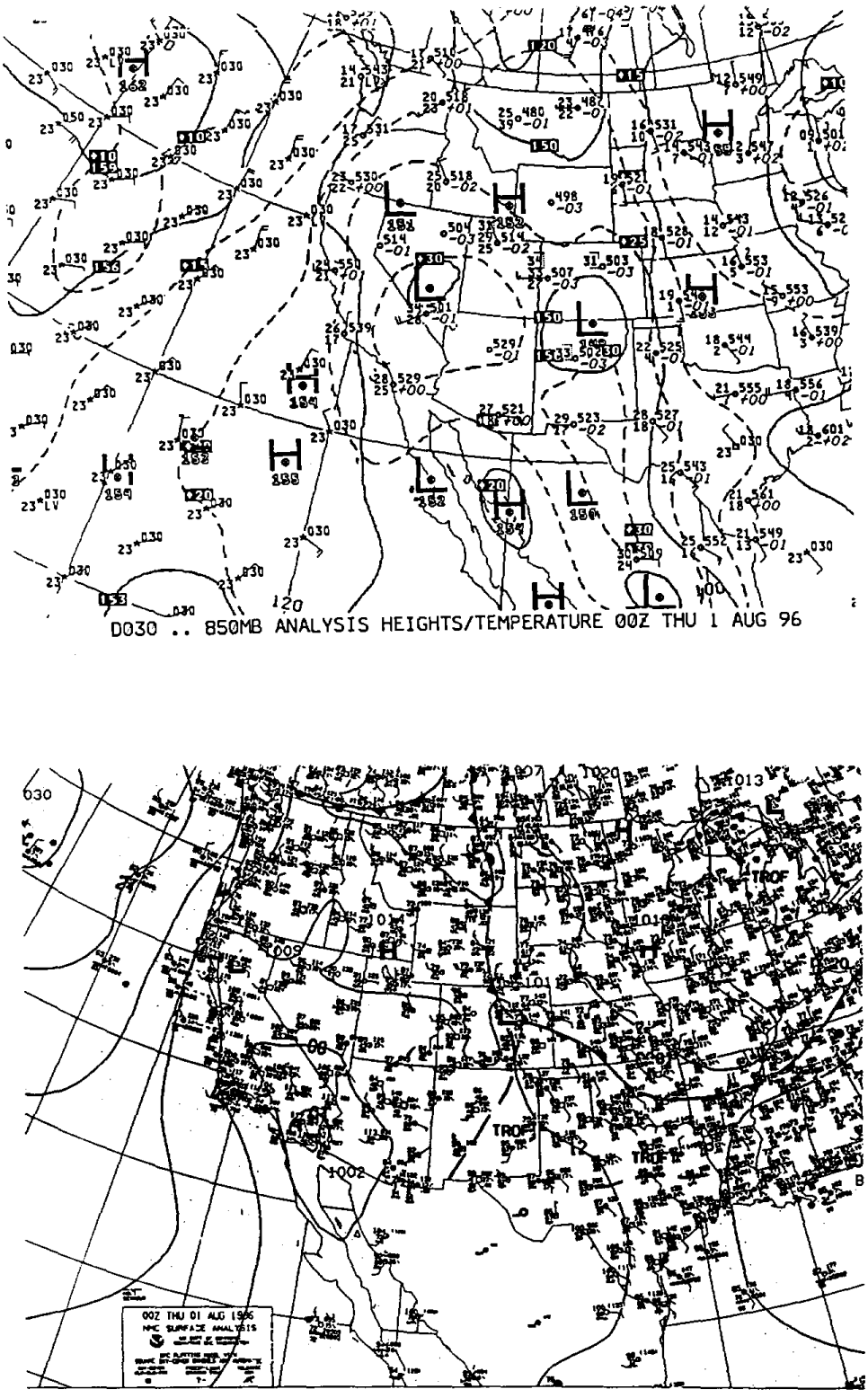


Figure E-2b: 850 mb height field (upper) and surface analysis map (lower) for 1600 PST 7-31-96 (00Z).

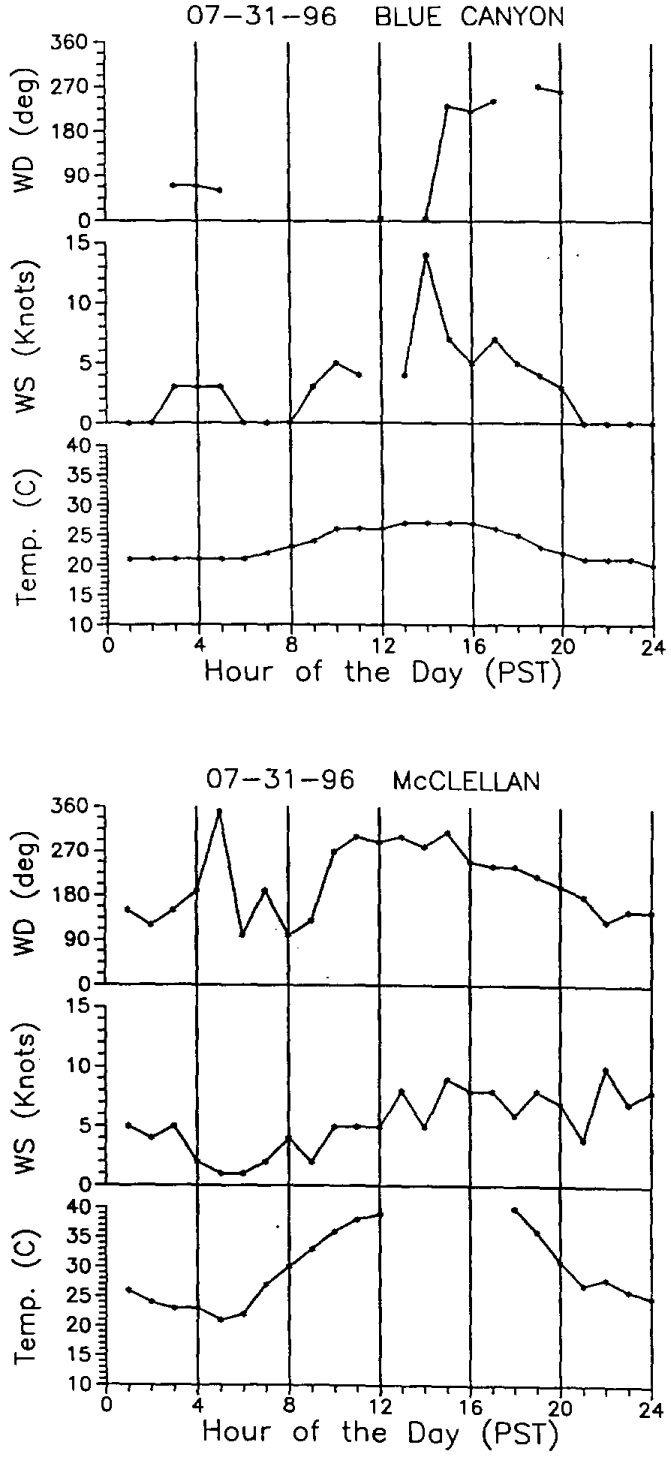


Figure E-3: Plot of wind and temperature data observed on the hour at Blue Canyon (upper) and McClellan (lower) on 7-31-96.

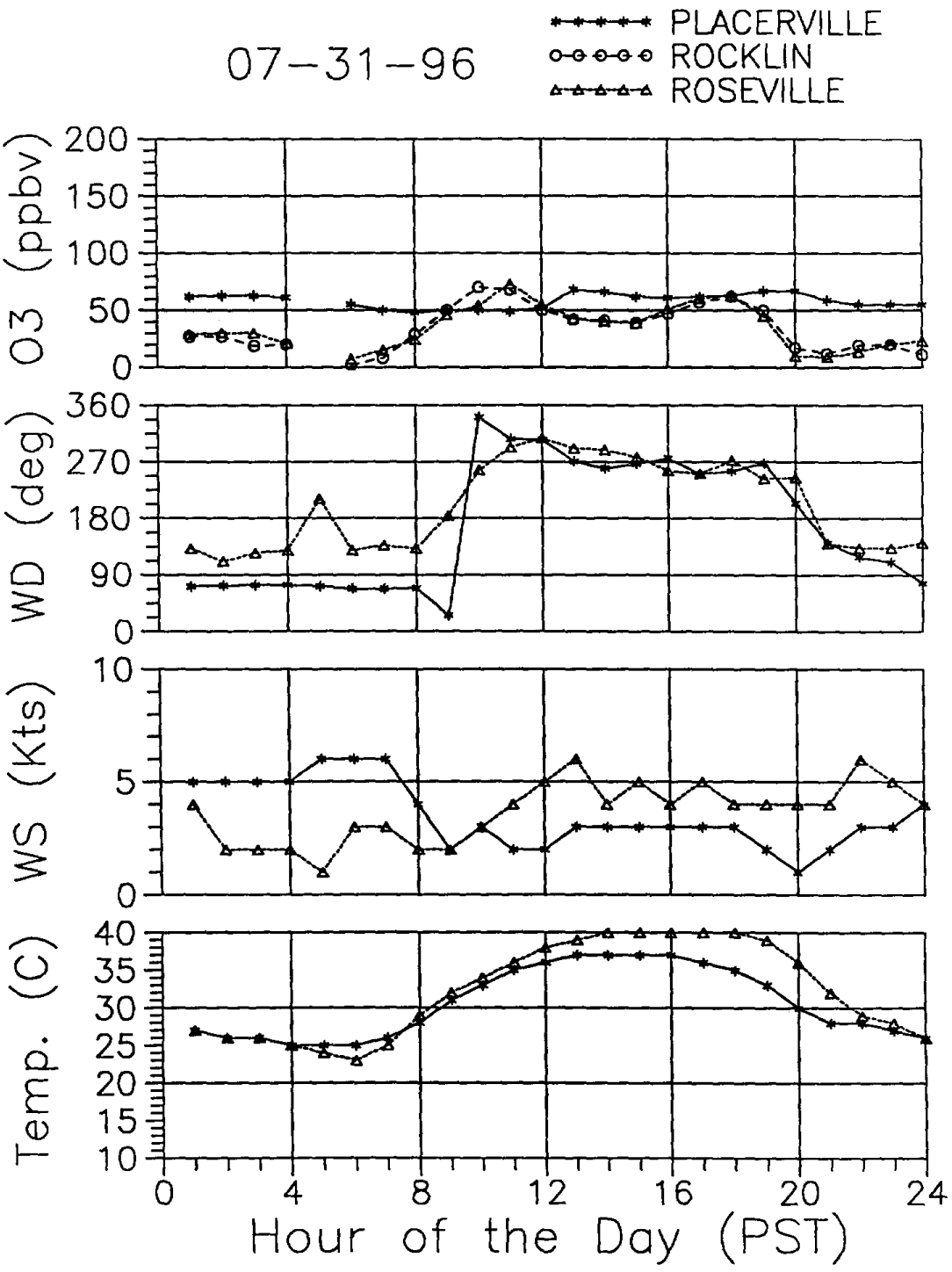
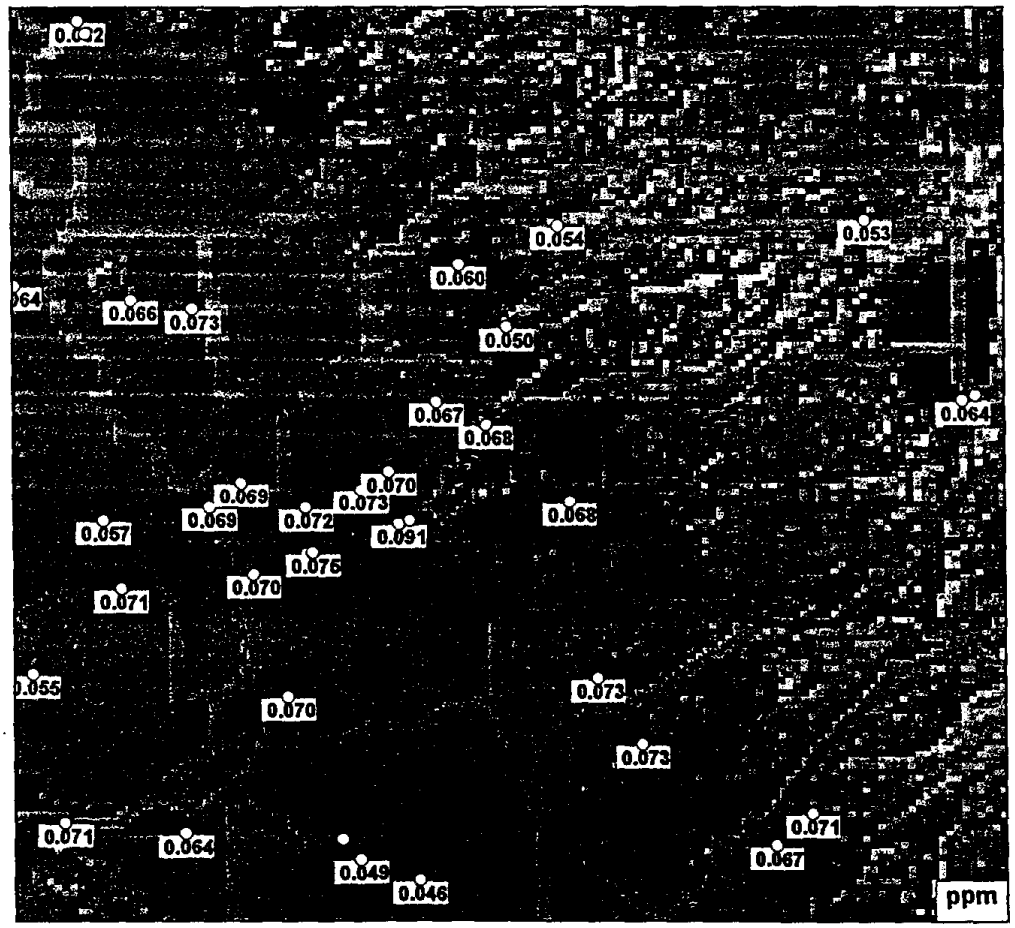


Figure E-4: Plot of hourly averaged data for the three foothill ground stations versus time of day (PST) for 7-31-96.

Figure E-5: Maximum hourly averaged ozone concentrations in central California on 7-31-96.



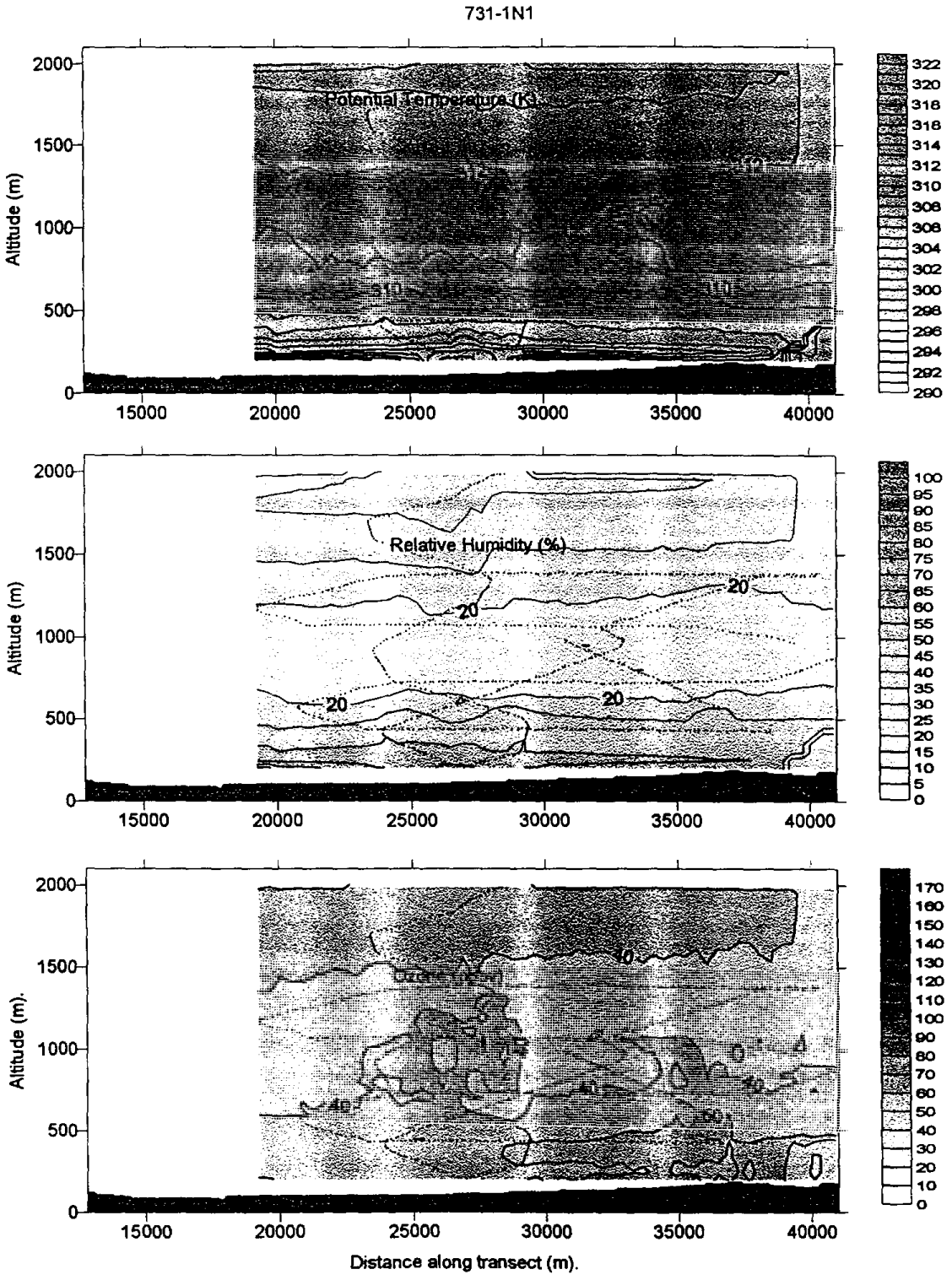


Figure E-6a: Vertical cross sections for flight 1 at S1 on 7-31-96.

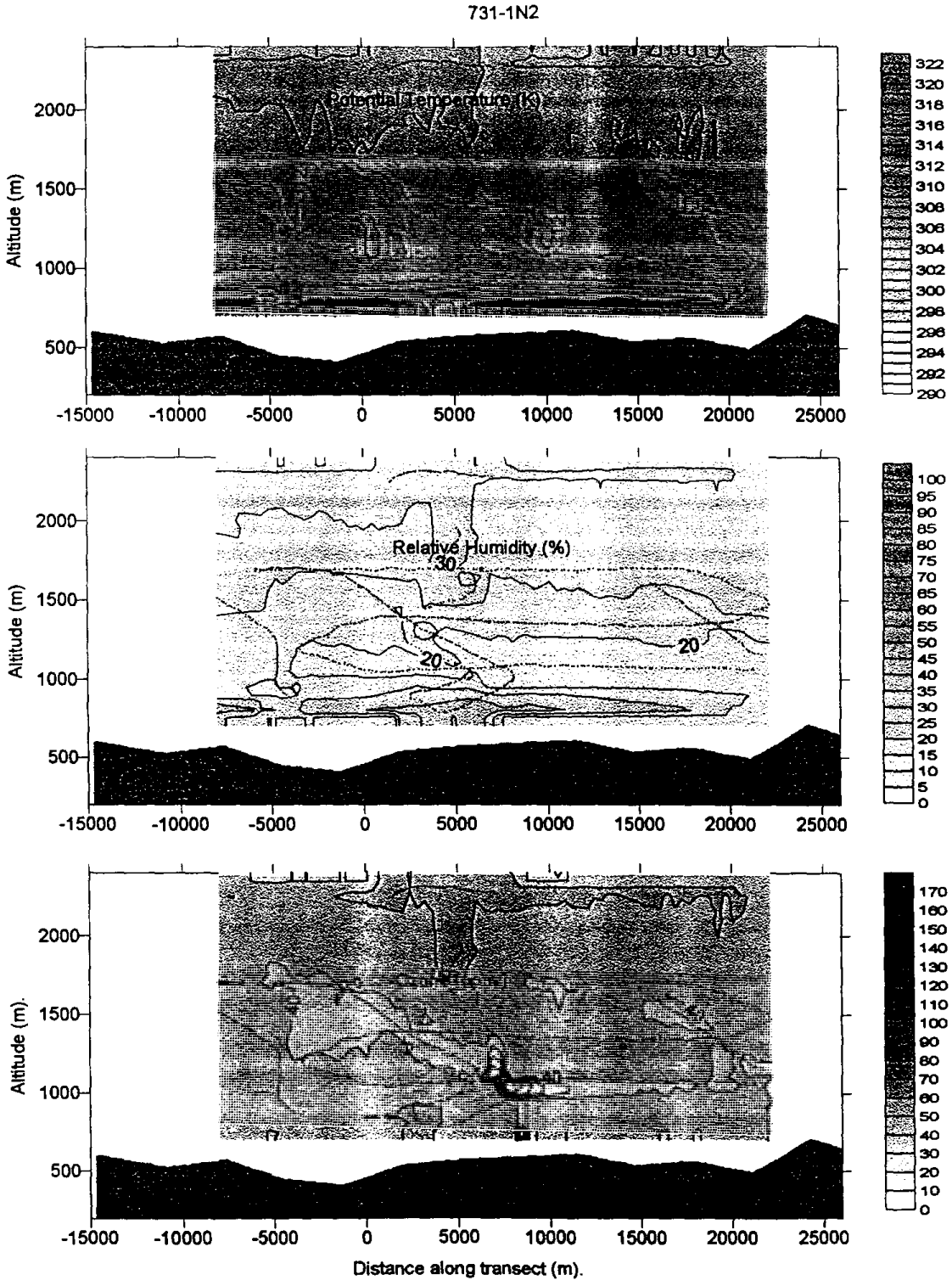


Figure E-6b: Vertical cross sections for flight 1 at S2 on 7-31-96.

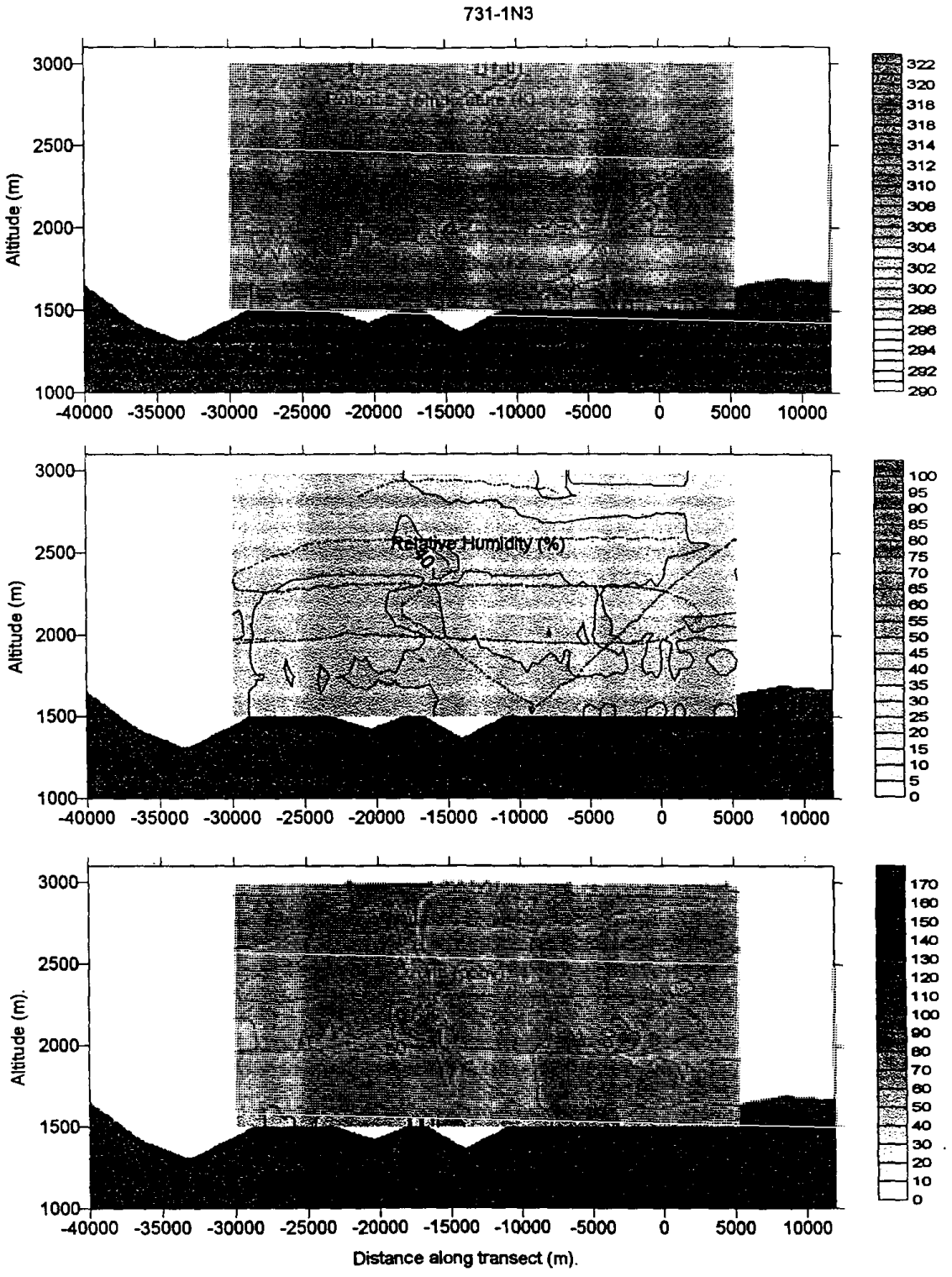


Figure E-6c: Vertical cross sections for flight 1 at S3 on 7-31-96.

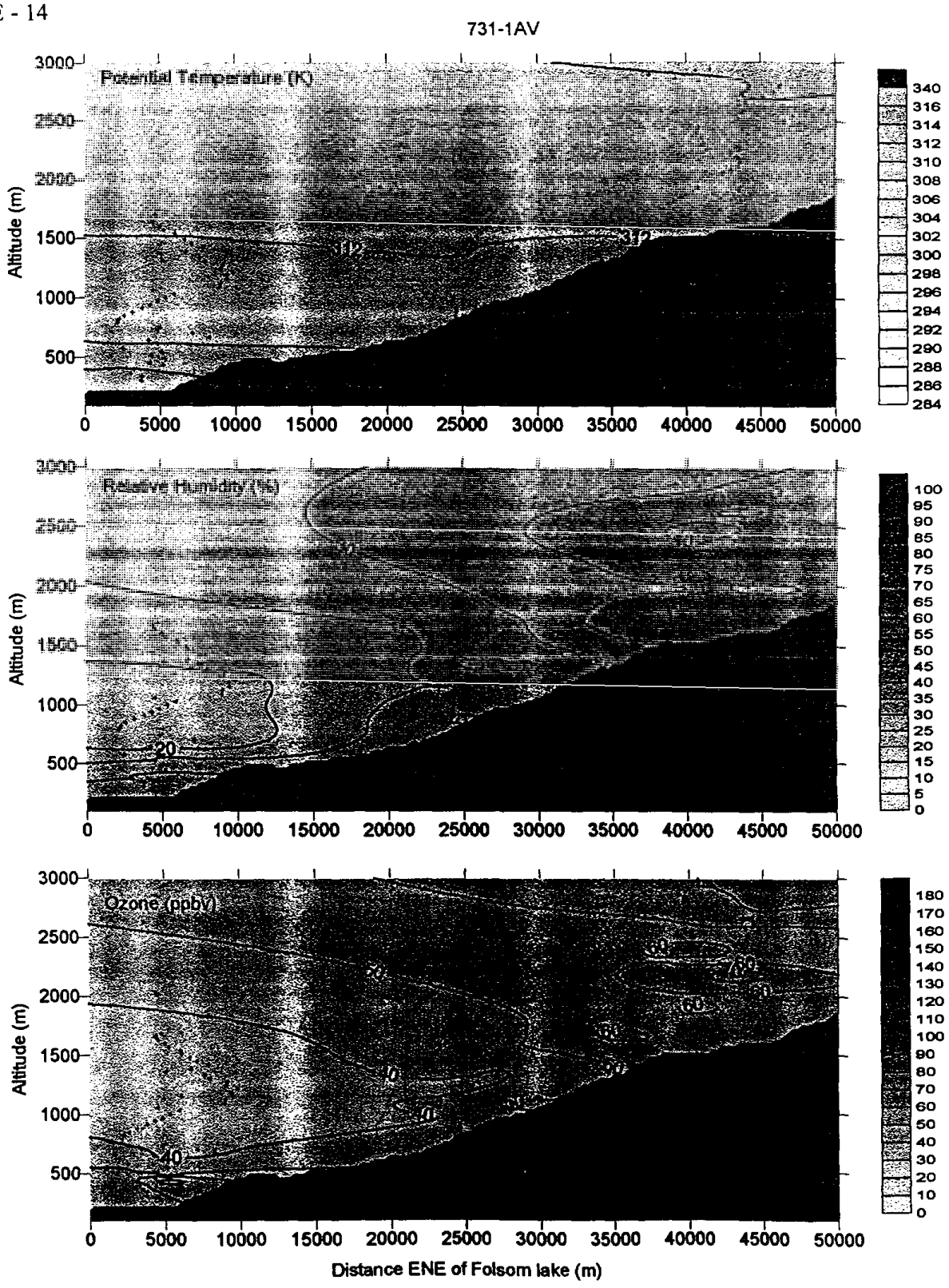


Figure E-6d: Vertical east-west cross sections for flight 1 on 7-31-96.

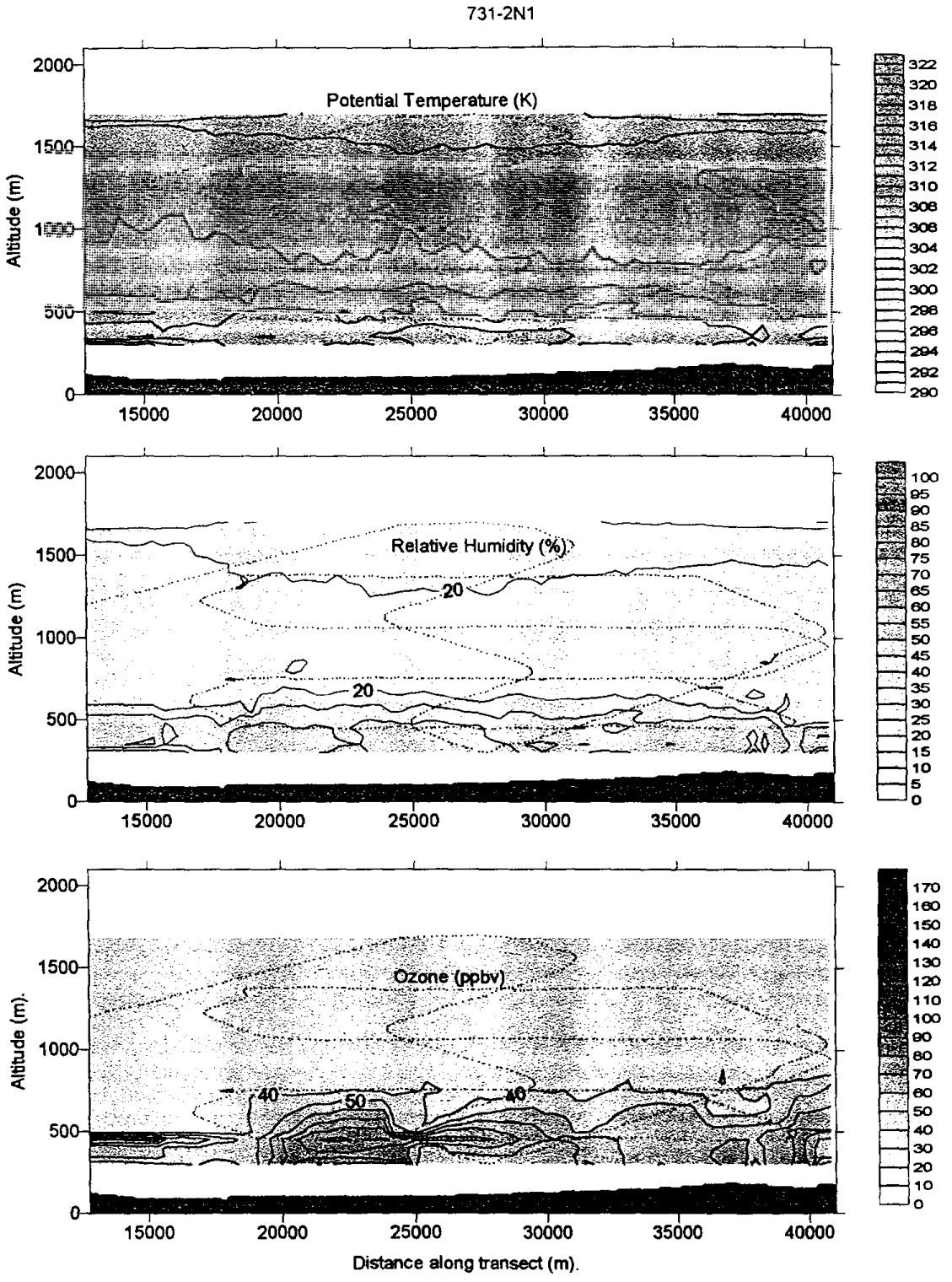


Figure E-7a: Vertical cross sections for flight 2 at S1 on 7-31-96.

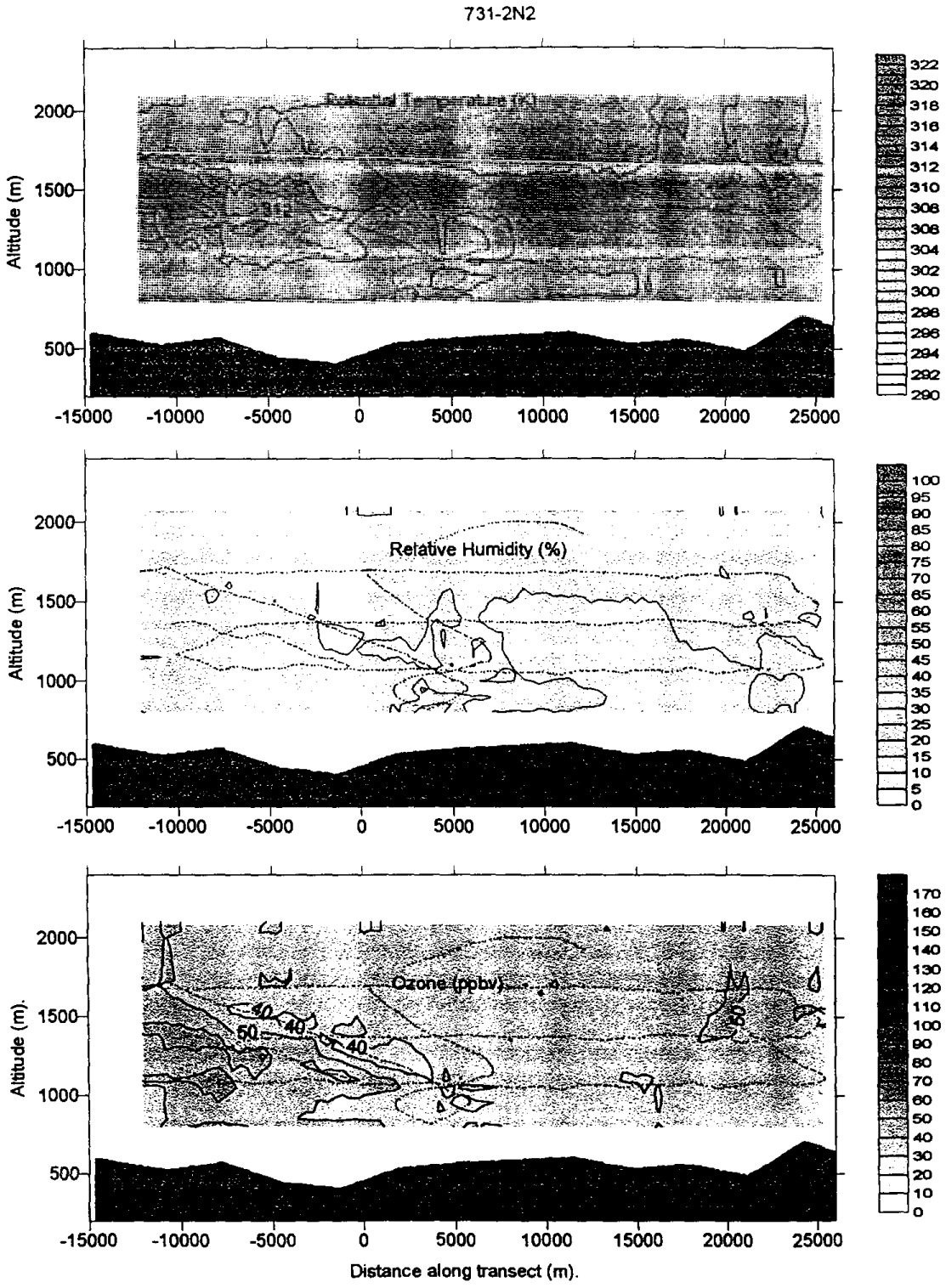


Figure E-7b: Vertical cross sections for flight 2 at S2 on 7-31-96.

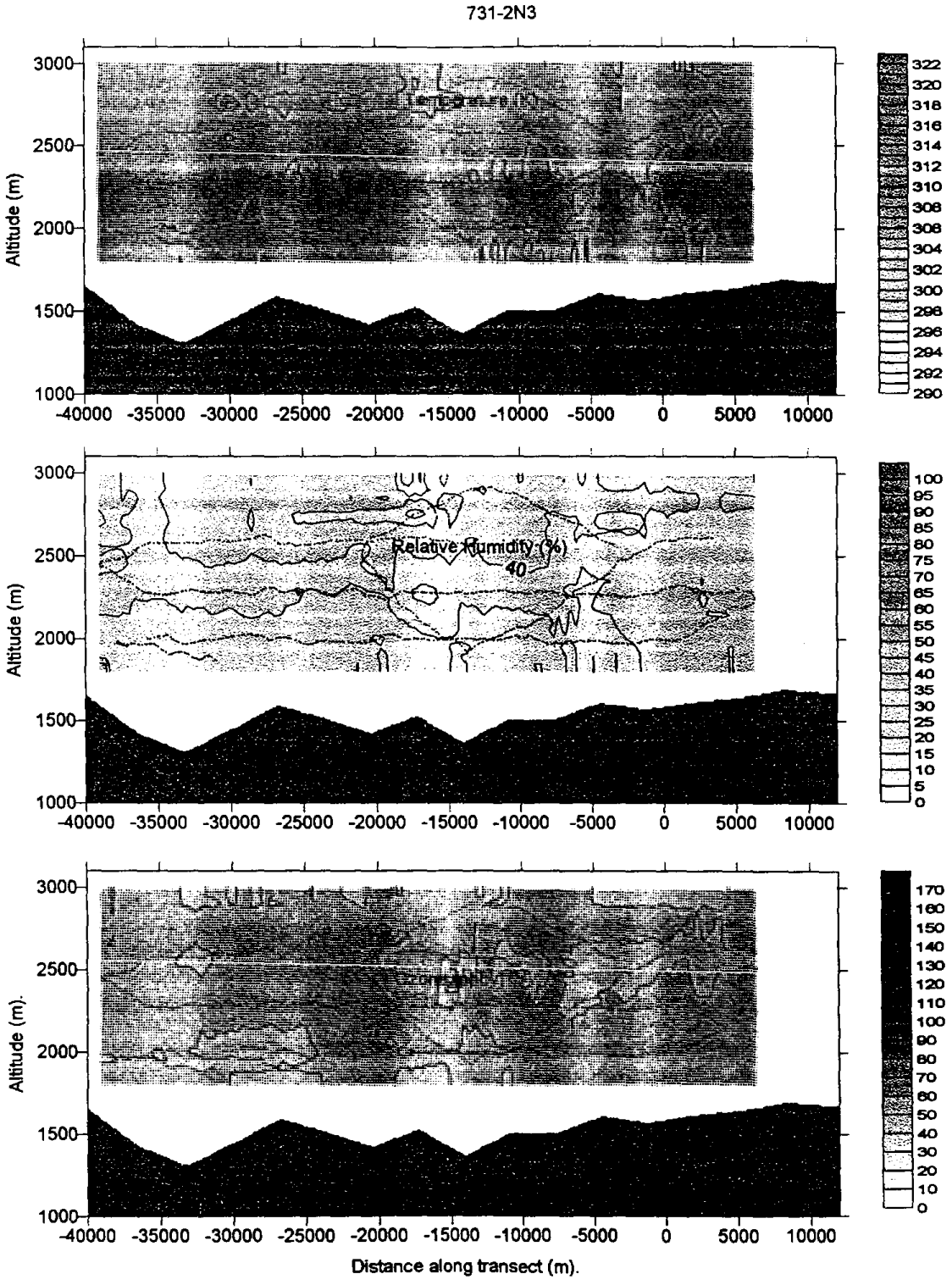


Figure E-7c: Vertical cross sections for flight 2 at S3 on 7-31-96.

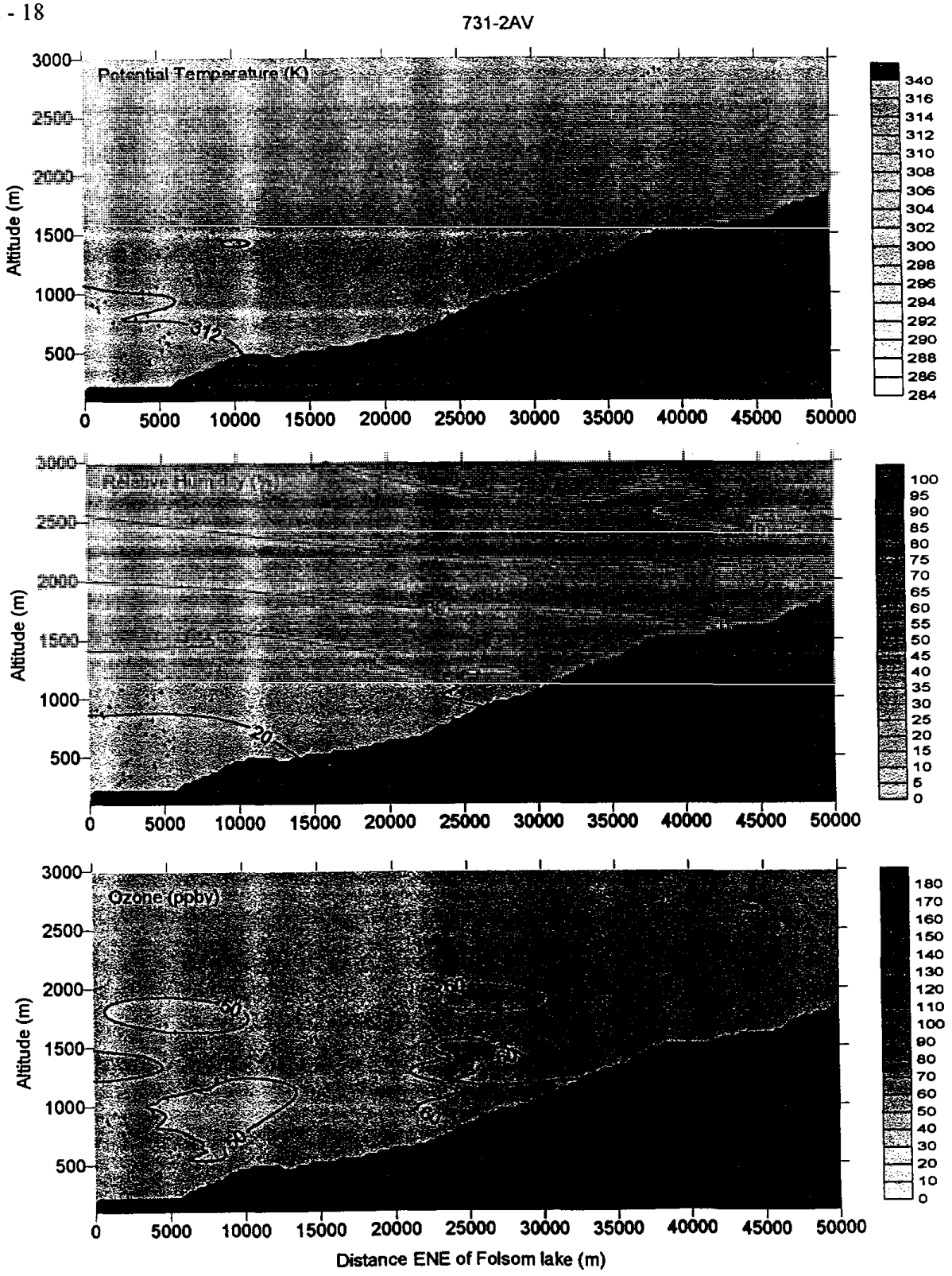


Figure E-7d: Vertical east-west cross sections for flight 2 on 7-31-96.

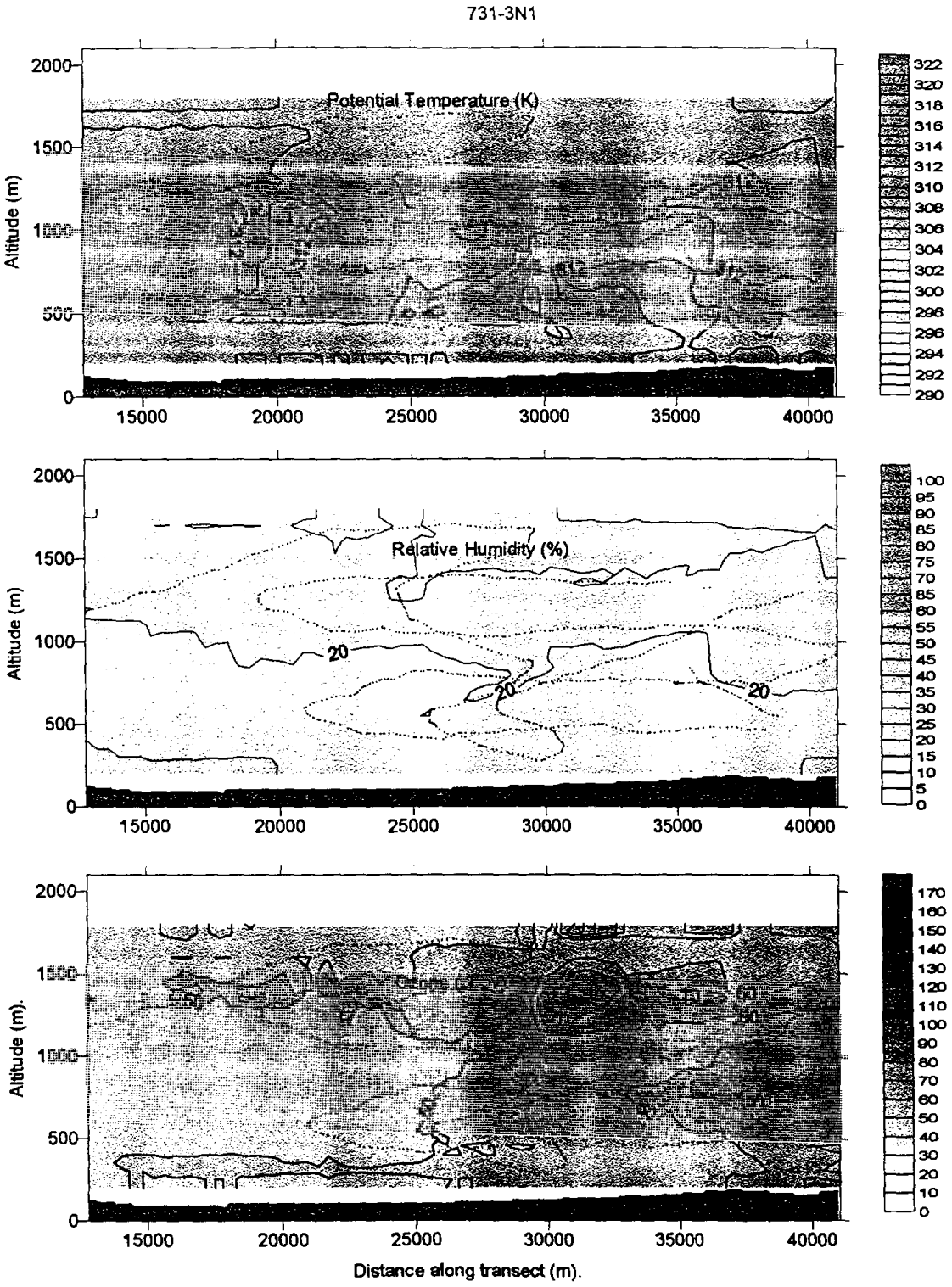


Figure E-8a: Vertical cross sections for flight 3 at S1 on 7-31-96.

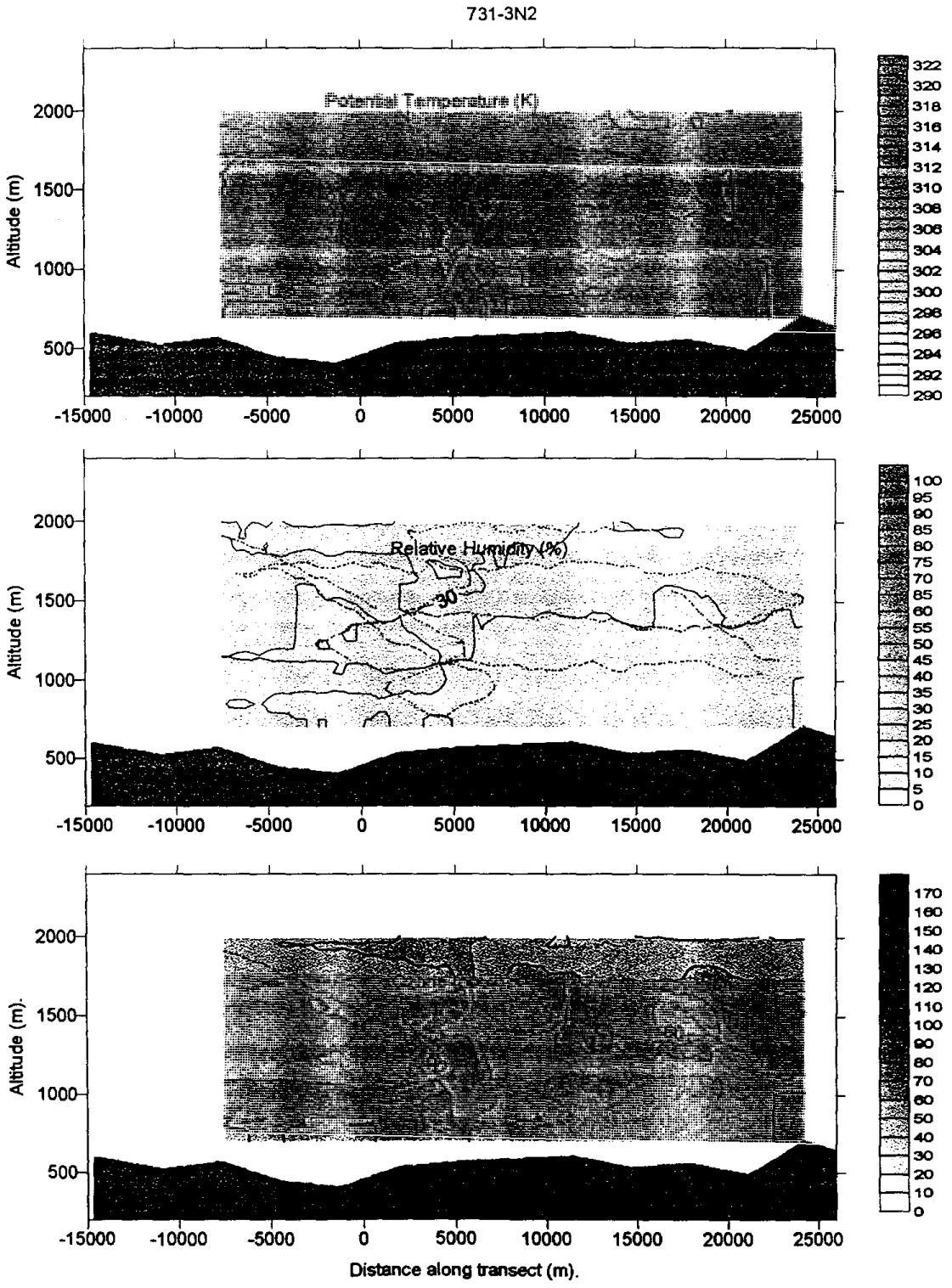


Figure E-8b: Vertical cross sections for flight 3 at S2 on 7-31-96.

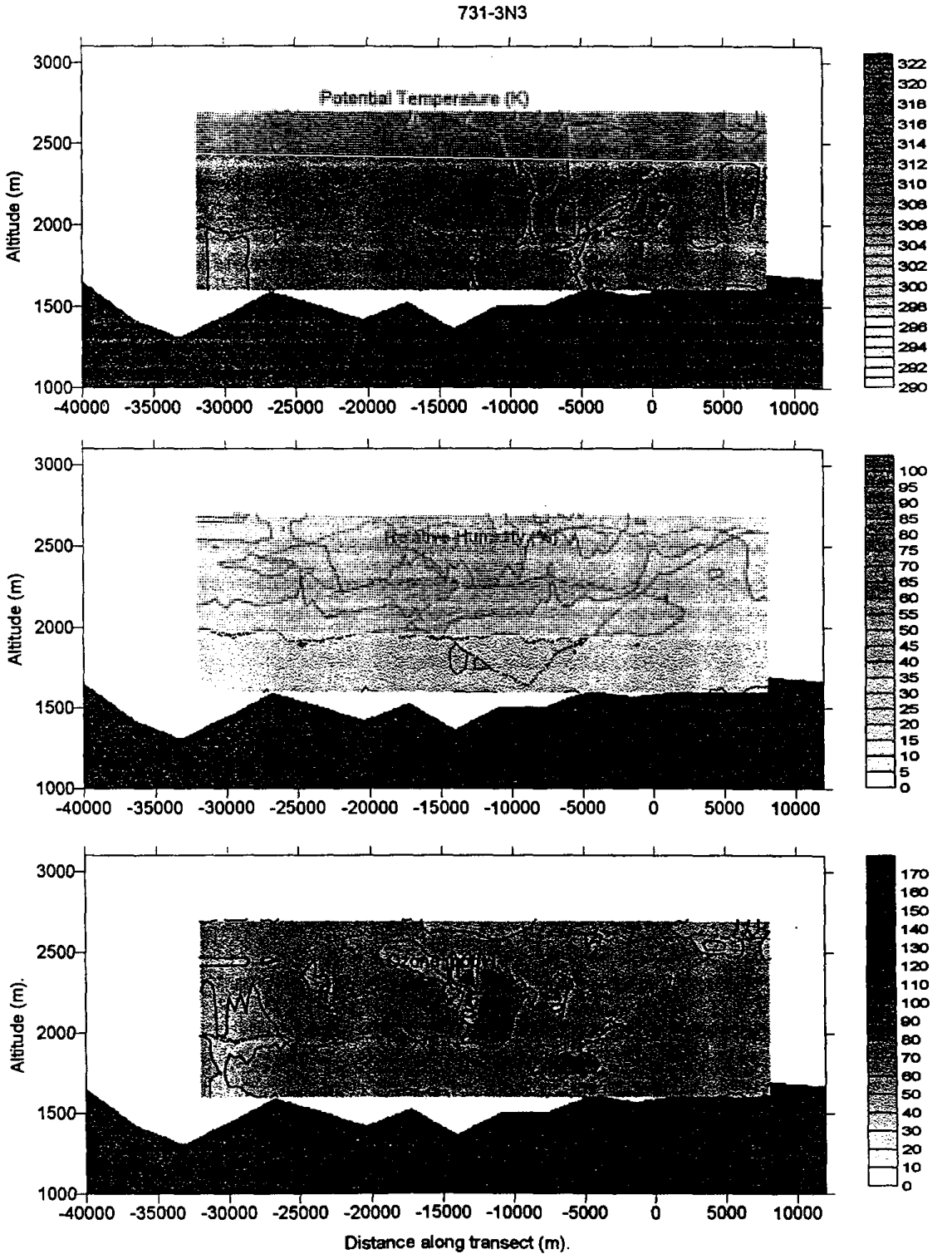


Figure E-8c: Vertical cross sections for flight 3 at S3 on 7-31-96.

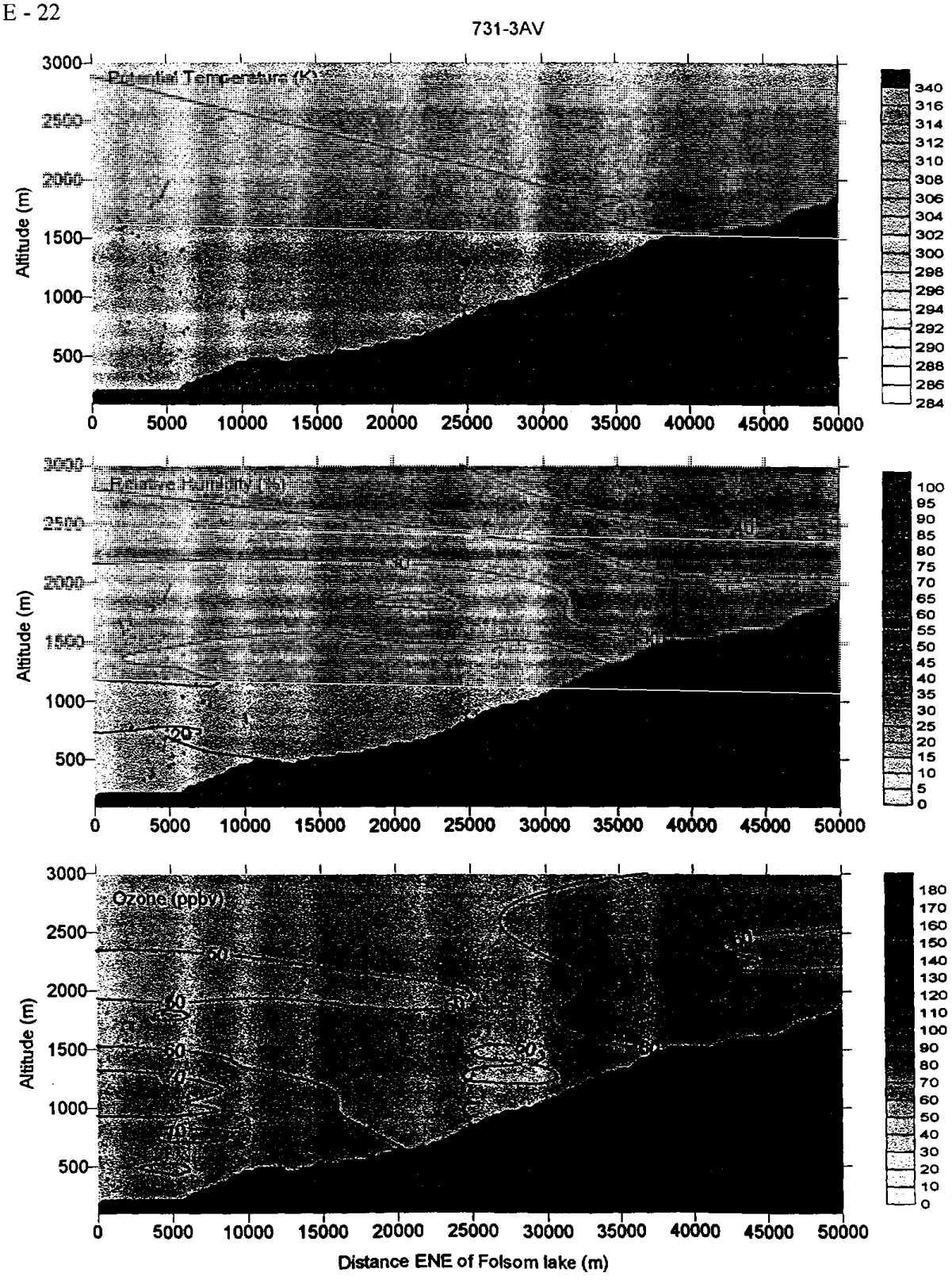


Figure E-8d: Vertical east-west cross sections for flight 3 on 7-31-96.

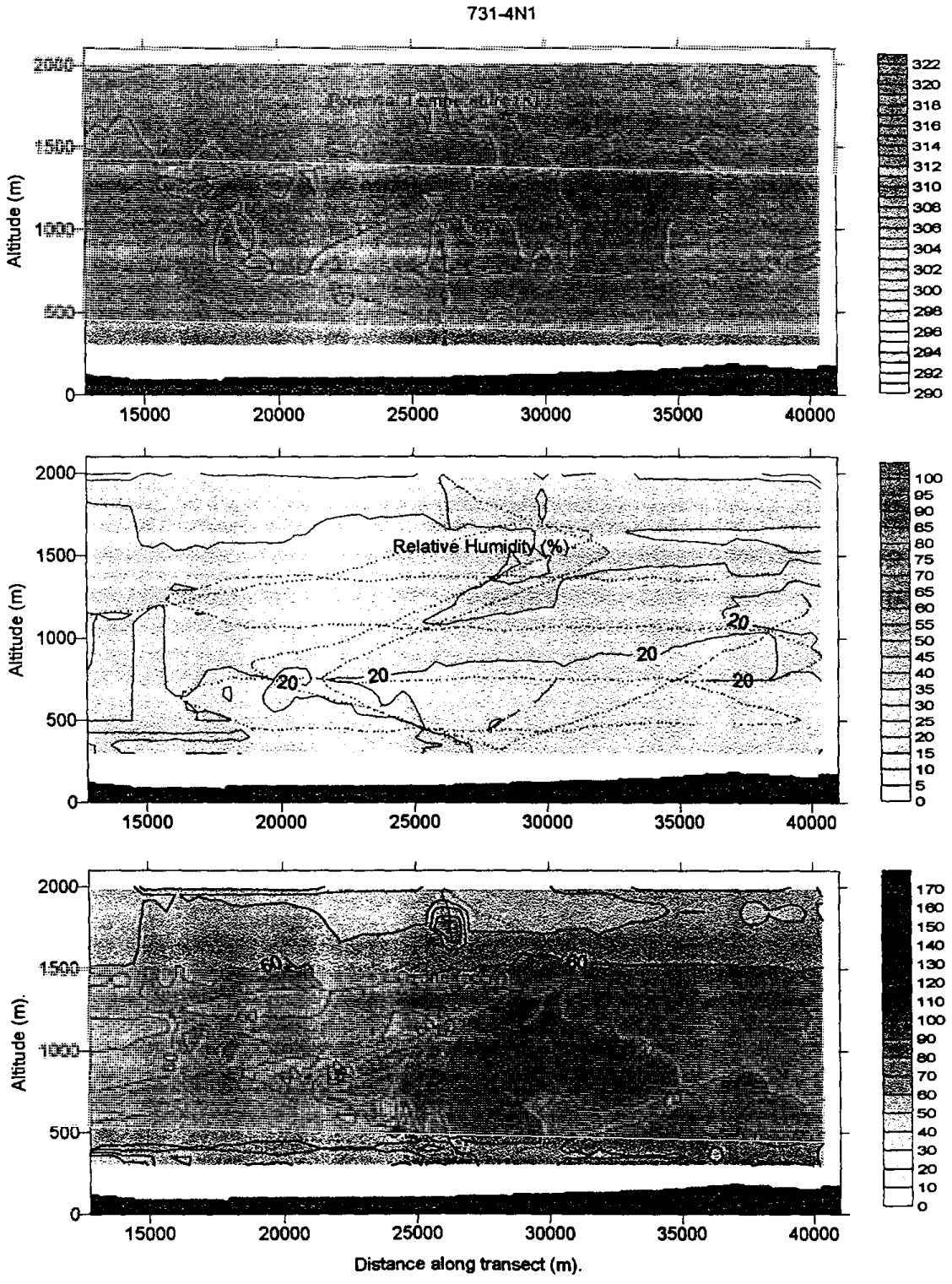


Figure E-9a: Vertical cross sections for flight 4 at S1 on 7-31-96.

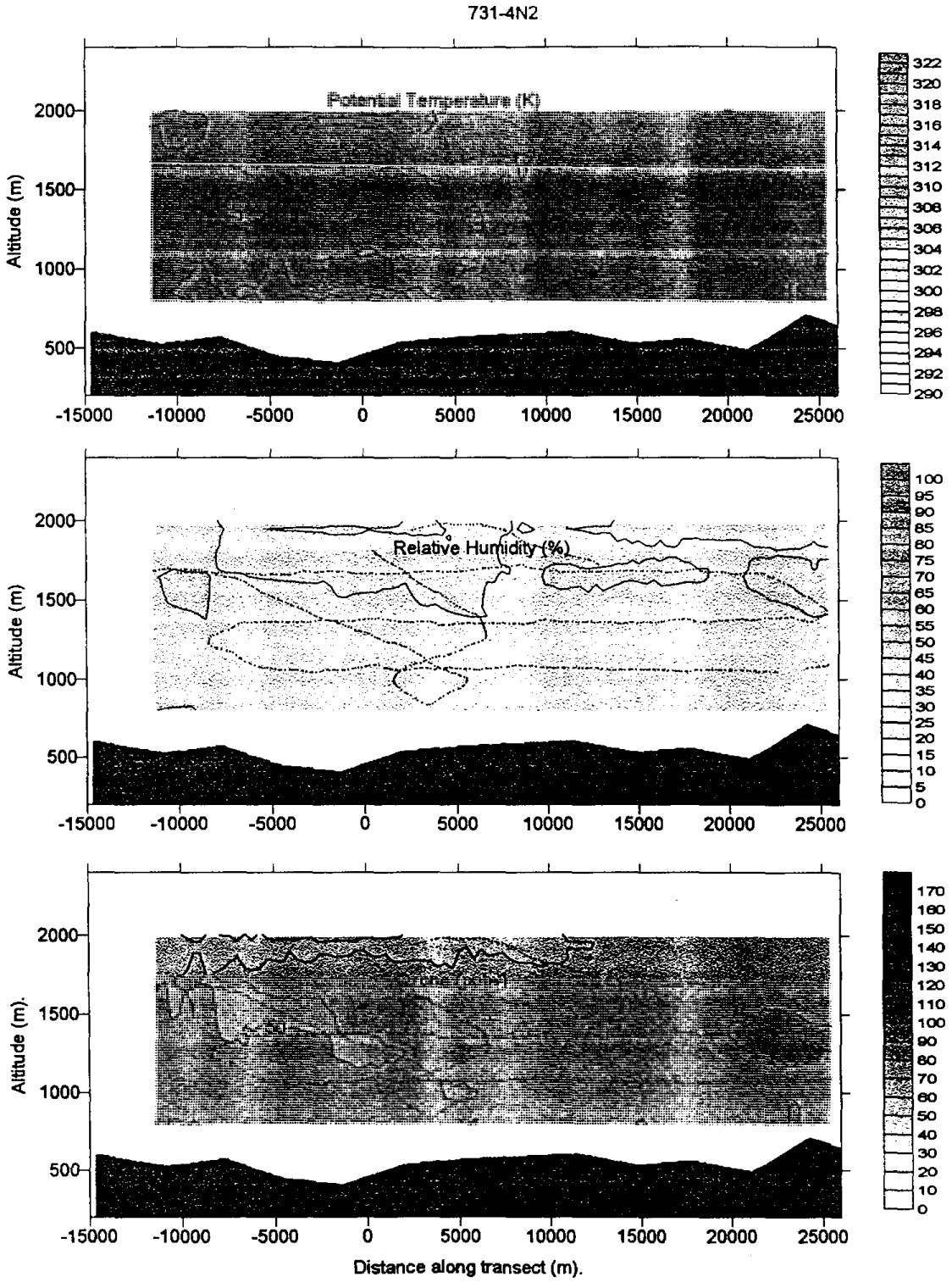


Figure E-9b: Vertical cross sections for flight 4 at S2 on 7-31-96.

APPENDIX F:
August 7, 1996 Sierra Nevada Transect Flights

I. Synoptic setting:

At 0400 PST (12Z), the 500 mb map shows a weak low pressure center over southern California with weak winds from the northeast. At 600 mb, the winds were southeast to south and also weak. At 850 mb, the height field was very flat, with slight troughing along the California coast and weak southeast to east winds over the area of interest. At the surface, a weak trough was found from west-central Oregon to southeast California. By 1600 PST (00Z), there were few changes, except that the winds aloft had more westerly components and the surface on-shore pressure gradient increased, with more pronounced low pressure centers located in the north and south state.

II. Surface observations:

At MCC, the wind directions were south-southeast through 0900 PST, shifting to northwest by 1100, then being from west to southwest through 2000 PST. The south-southeast winds had speeds decreasing with time from about 9 to 4 knots by 1000, the afternoon winds were 5 to 7 knots. The high temperature for the day at MCC was 35 C. At BLU, wind speeds decreased after midnight to calm at 0600. During the afternoon when data are available, the winds were upslope (southwest to west) at about 5 knots at BLU.

At Placerville, the wind shifted from southeast to east-northeast between midnight and 0800, with speeds about 3-4 knots. At 0900, the winds shifted to north-northeast, rotating back to westerly by noon, and remained westerly through 2000. Wind speeds throughout most of the day were 2 to 4 knots. Ozone concentrations were fairly steady in the early morning hours at 60 ppbv increasing to a maximum of 105 ppbv by 1600 and decreasing slowly thereafter to 60 ppbv.

At Rocklin and Roseville, wind directions were steady from the southeast though 0800, shifting to westerly by 1100, and shifting back to southeast after 1900 PST. Speeds at Roseville decreased steadily from 7 knots at 0100 to 1 knot at 1100, then picked up again at 1400 and remained about 5 knots for the rest of the day. Ozone concentrations remained at or below 40 ppbv through 1000, rose to 80 ppbv for the afternoon and decayed back to about 30 ppbv after 2000 PST.

III. Vertical Cross sections:

Flight 1, S1 data show a well defined surface based nocturnal inversion layer, a secondary stable layer between 500 and 600 m and a third stable layer based at 1500 m. Between 700 and 1500 meters, the stability was weak but ozone concentrations were high (maximum more than 90 ppbv), suggesting this was a residual layer from the day before. Farther east at S2, the stable layer based near 1500 m was also evident with some hint of a shallow near ground surface inversion. As was the case at S1, the relative humidity was very low above this stable layer and moderate in the mixed layer below. Ozone concentrations in the residual layer were well mixed at 60 - 70 ppbv with a small pocket

exceeding 80 ppbv. At S3, the atmosphere was near neutral except for a slightly more stable layer between 2300 and 2500 m. Here the higher relative humidities were found aloft and low values near the surface. The ozone concentrations were well mixed being between 50 and 60 ppbv throughout the cross section.

Flight 2, S1 data are very similar to those of flight one, except for the modest thickening of the surface stable layer and a low level horizontal gradient in ozone being greater than 90 ppbv at the northwest end but less than 80 at the southeast end of the section. At S2, the stable layer between 1200 and 1500 m seems to have lowered, and concentrations of ozone have increased to more than 100 ppbv at the northwest end. At S3, the fields changed little from flight 1.

Flight 3, S1 data show a stable layer persisting between 700 and 1100 m but with the relative humidity field well mixed. Peak ozone concentrations were over the southeast half of the section but remained greater than 100 ppbv. At S2, evidence of a convective boundary layer with a mixing depth of about 1400 m was seen (i.e. the small scale fluctuations at and above 1400 m, the wavy flight path and isothermal potential temperature below 1400 m). Peak values of ozone, in excess of 110 ppbv, were seen in the lower altitudes near the section center. At S3, there was also evidence of strong convective mixing up to about 2500 m as all fields show a high spatial variability at small scales. Maximum ozone concentrations are about 80 ppbv. The east-west section shows the confinement of the more highly polluted layer to elevations below 1500 meters.

Flight 4, S1 data show a well mixed layer below about 1000 m with ozone exceeding 80 ppbv on the northwest edge of the section, exceeding 90 ppbv within the lower southeast half and a small pocket of ozone more than 100 ppbv at about 750 m altitude. At S2, the well mixed layer was again capped at 1400 m with ozone concentrations in excess of 100 ppbv through out most of the PBL.

IV. Synopsis:

The synoptic scale flow did not appear to favor strong vertical motions in either direction. A well defined residual layer was present in the early morning containing moderately high ozone concentrations. As the day progressed, upslope flow and vertical mixing produced a wide, deep plume of ozone (maximum more than 120 ppbv) by mid-afternoon. Over the upper slopes, deep vertical mixing appears to have limited high concentrations to small pockets, scattered throughout the measurement area of S3.

Table F-1

8-07-96
Averaged Aircraft Data

	Time (PST)	Location	Altitude (m MSL)	Direction	Speed (knots)	H_m (m MSL)	D_m (m AGL)
Flight 1	0600	S1	600	190	15	490	340
		S1	1750	210	14		
	0700		1500	195	16	730	180
	0800	S3	1850	130	18	2200	950
			2500	200	19		
Flight 2	0900	S1	650	190	16	610	460
			1400	205	16		
	1000	S2	1500	195	16	1280	730
	1100	S3	1950	170	16	2135	885
			2500	200	19		
Flight 3	1300	S1	650	210	16	975	825
			1450	225	14		
	1400	S2	1500	195	16	1700	1150
	1500	S3	1850	200	14	2440	1190
			2450	210	20		
Flight 4	1600	S1	650	225	16	1585	1435
			1500	205	14		
	1700	S2	1500	190	16	1650	1100

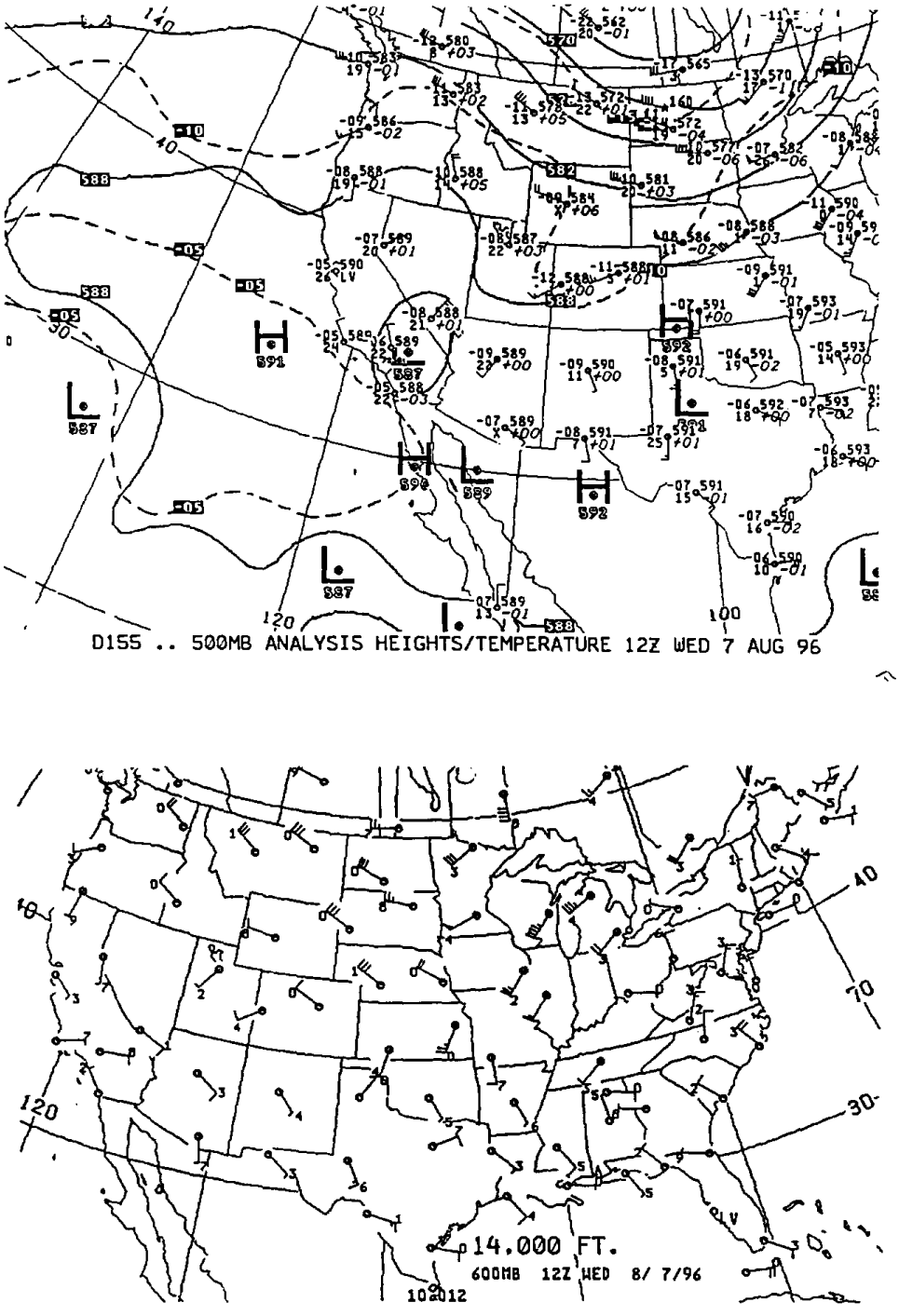


Figure F-1a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 0400 PST 8-07-96 (12Z).

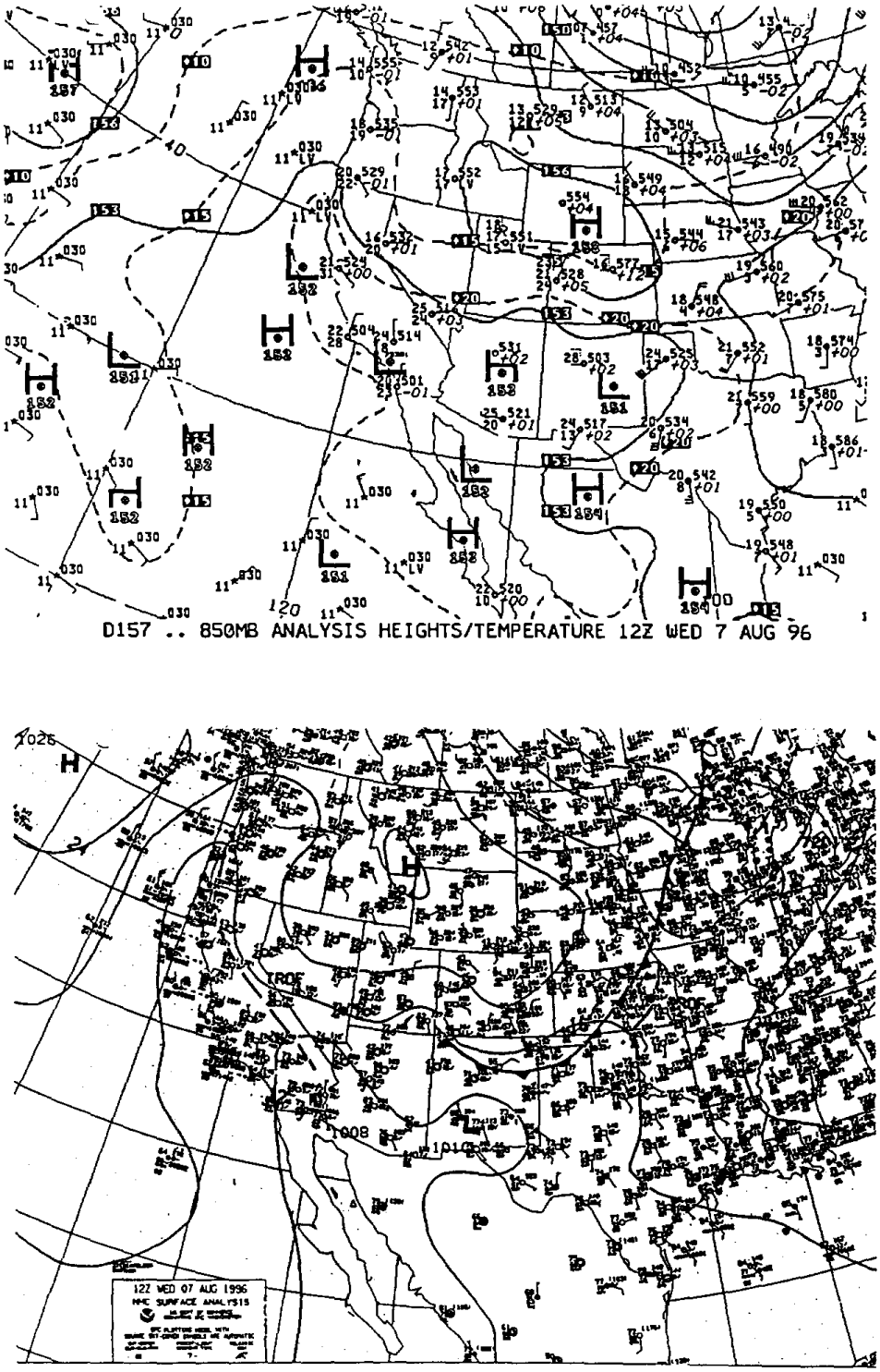


Figure F-1b: 850 mb height field (upper) and surface analysis map (lower) for 0400 PST 8-07-96 (12Z).

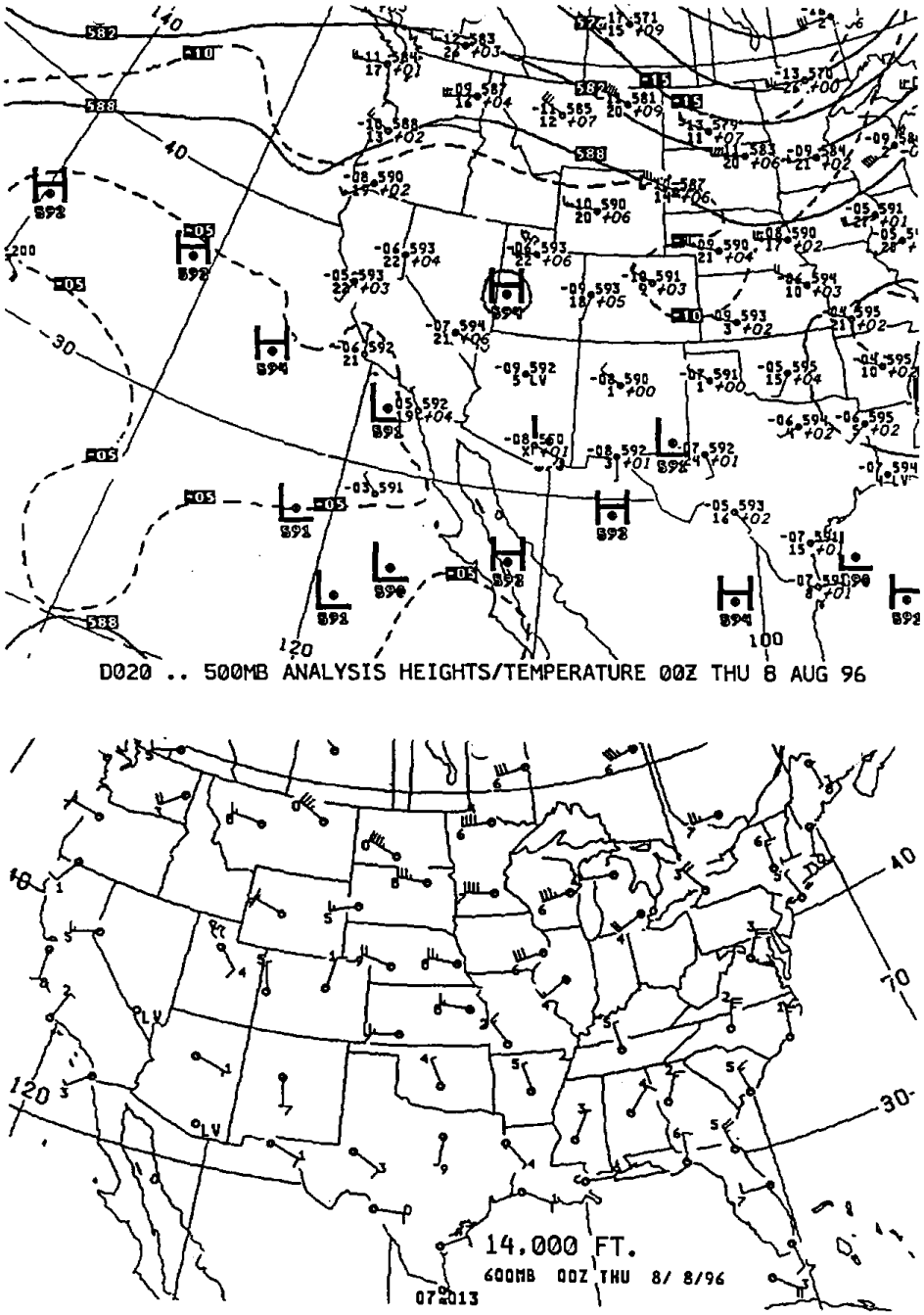


Figure F-2a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 1600 PST 8-07-96 (00Z).

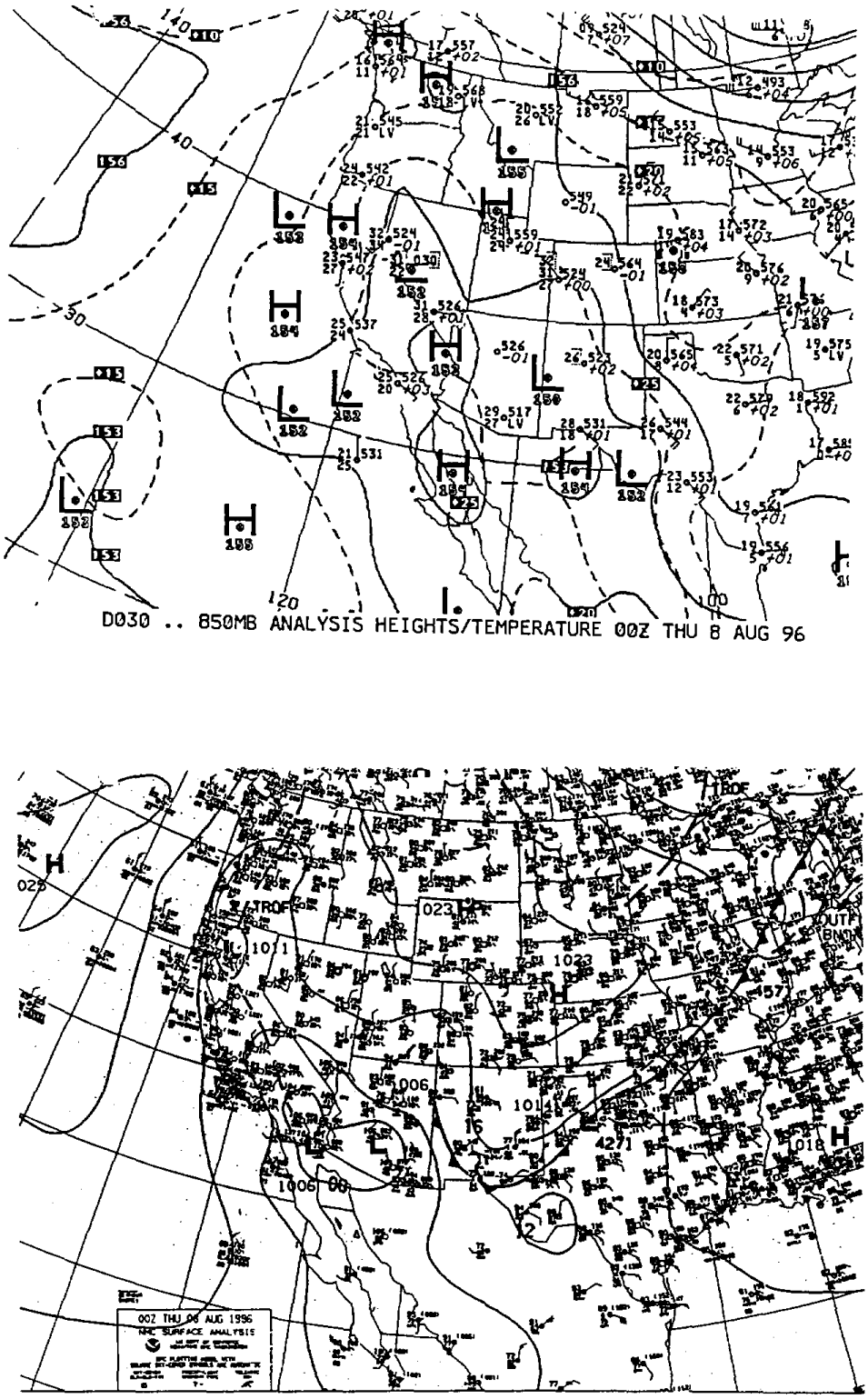


Figure F-2b: 850 mb height field (upper) and surface analysis map (lower) for 1600 PST 8-07-96 (00Z).

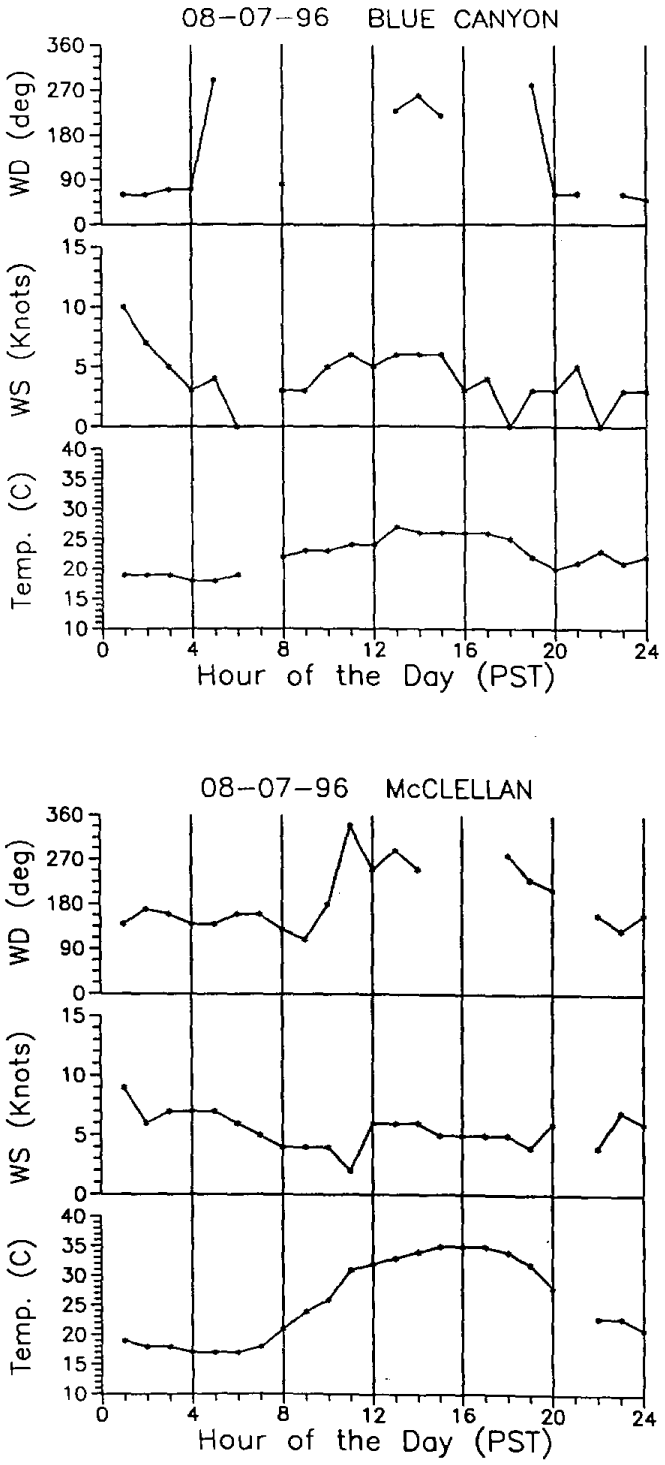


Figure F-3: Plot of wind and temperature data observed on the hour at Blue Canyon (upper) and McClellan (lower) on 8-07-96.

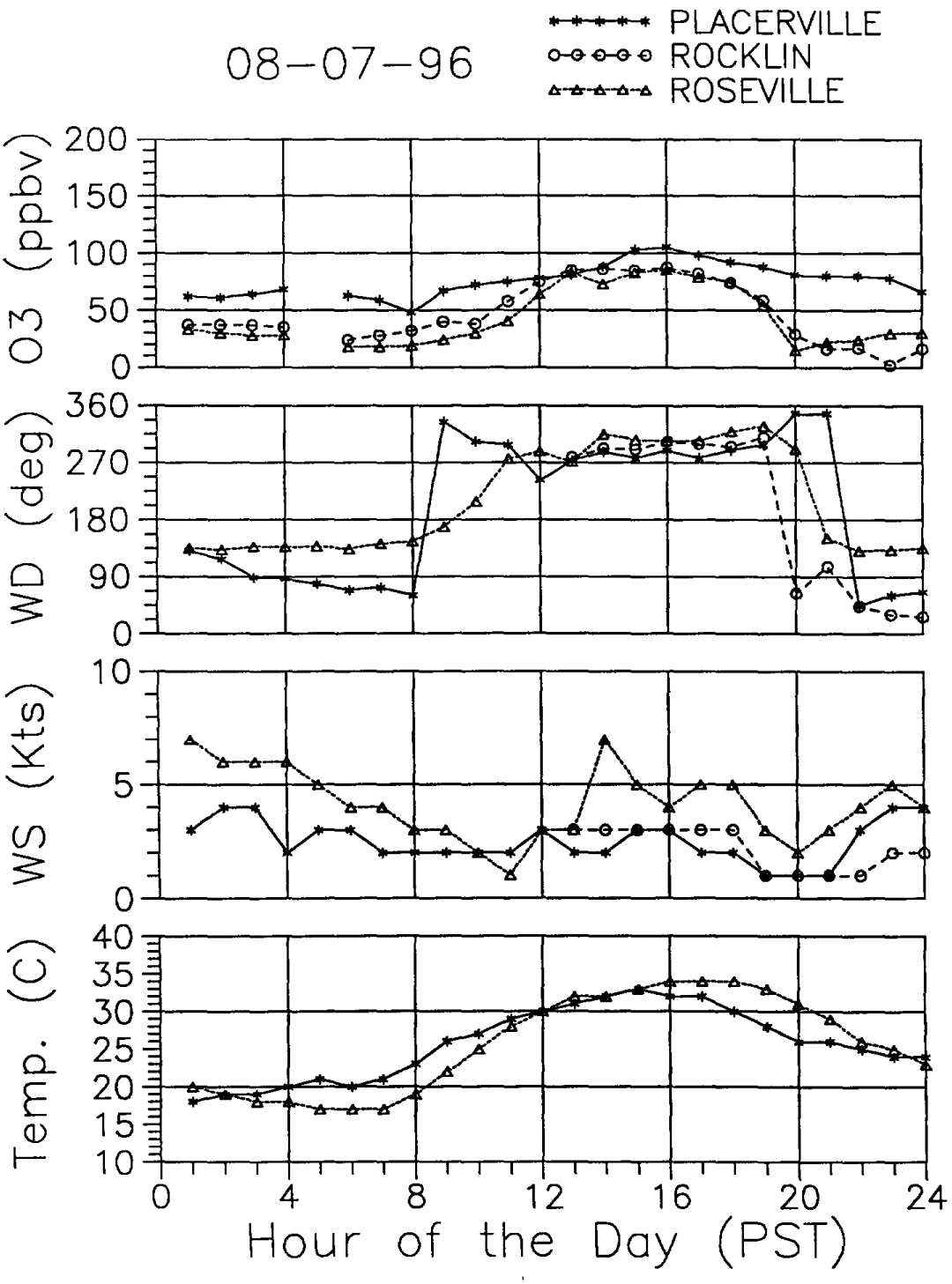
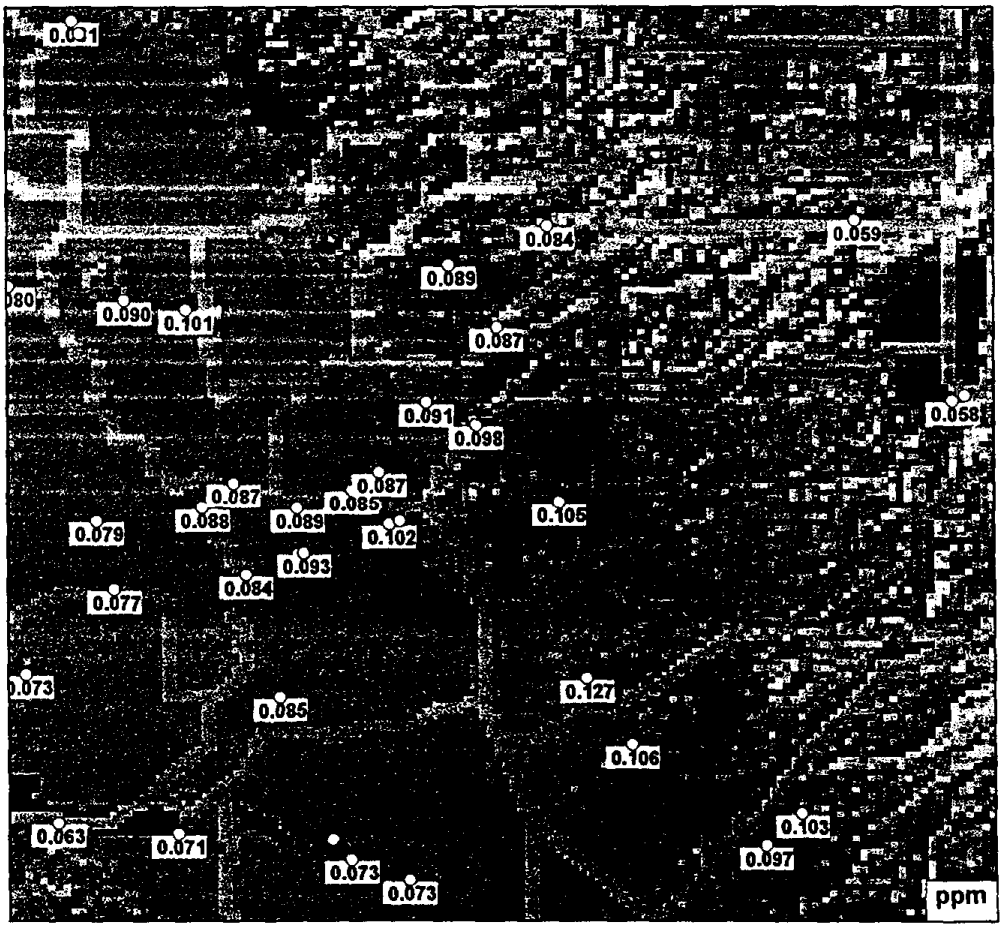


Figure F-4: Plot of hourly averaged data for the three foothill ground stations versus time of day (PST) for 8-07-96.

Figure F-5: Maximum hourly averaged ozone concentrations in central California on 8-07-96.



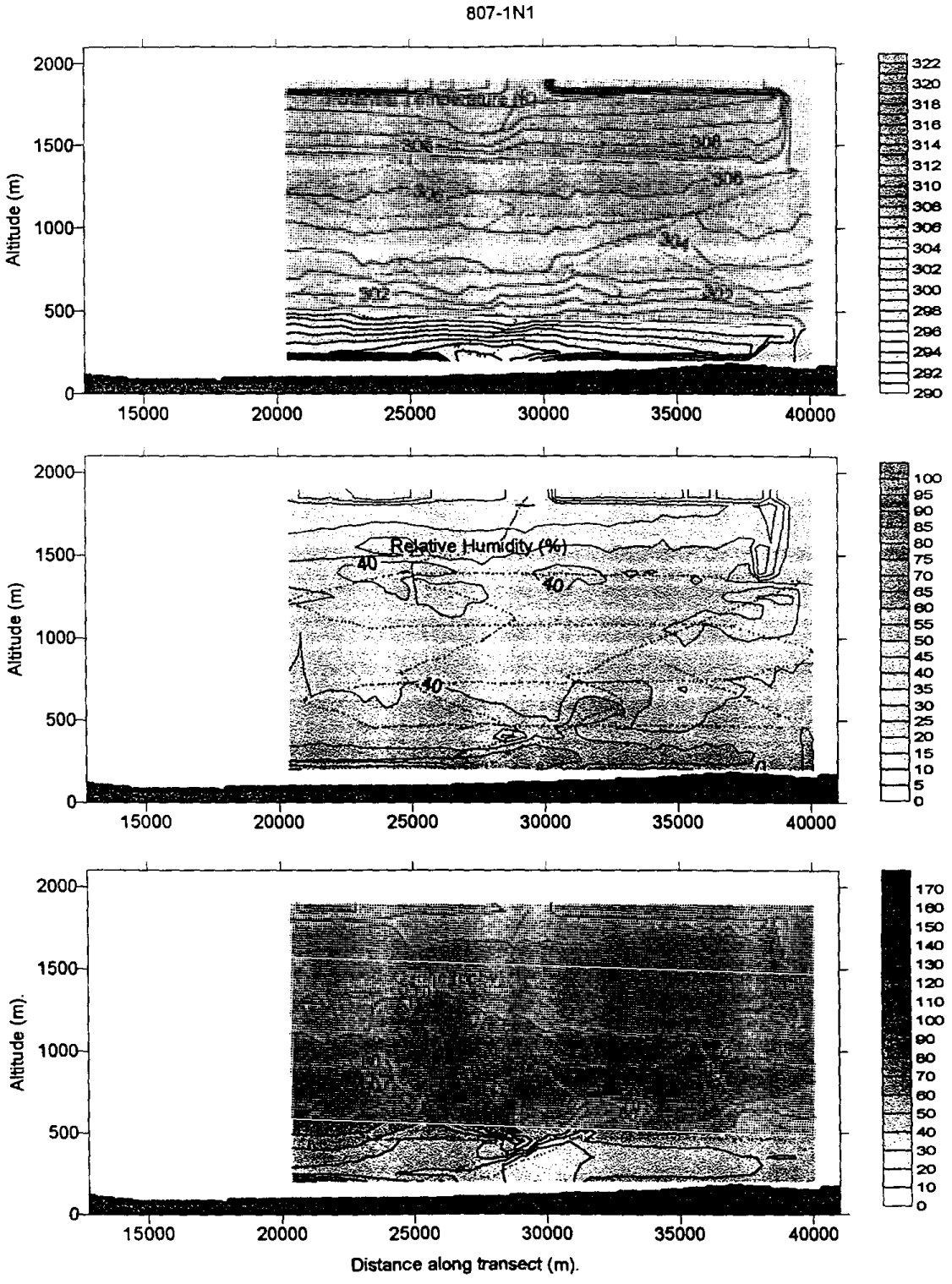


Figure F-6a: Vertical cross sections for flight 1 at S1 on 8-07-96.

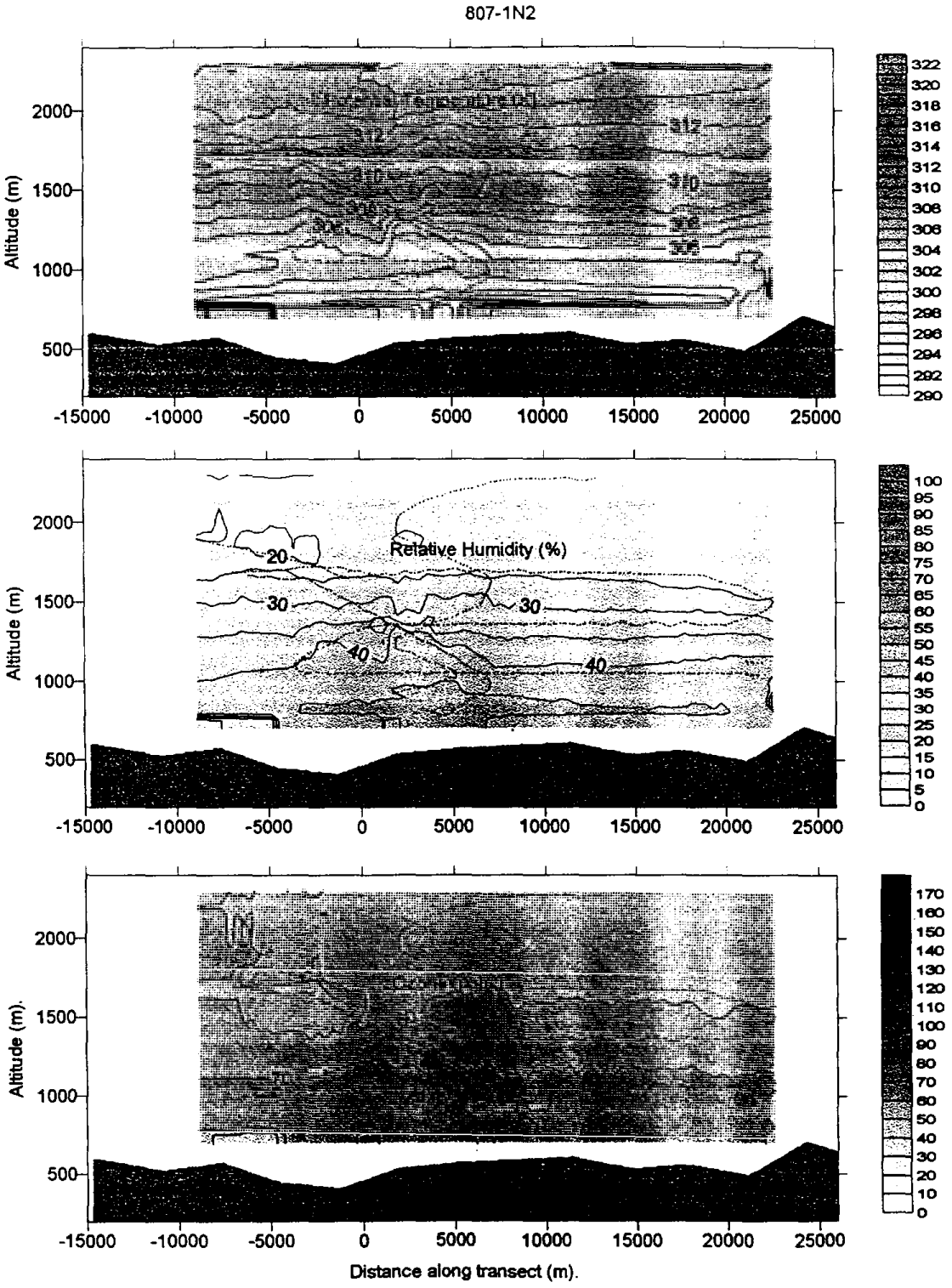


Figure F-6b: Vertical cross sections for flight 1 at S2 on 8-07-96.

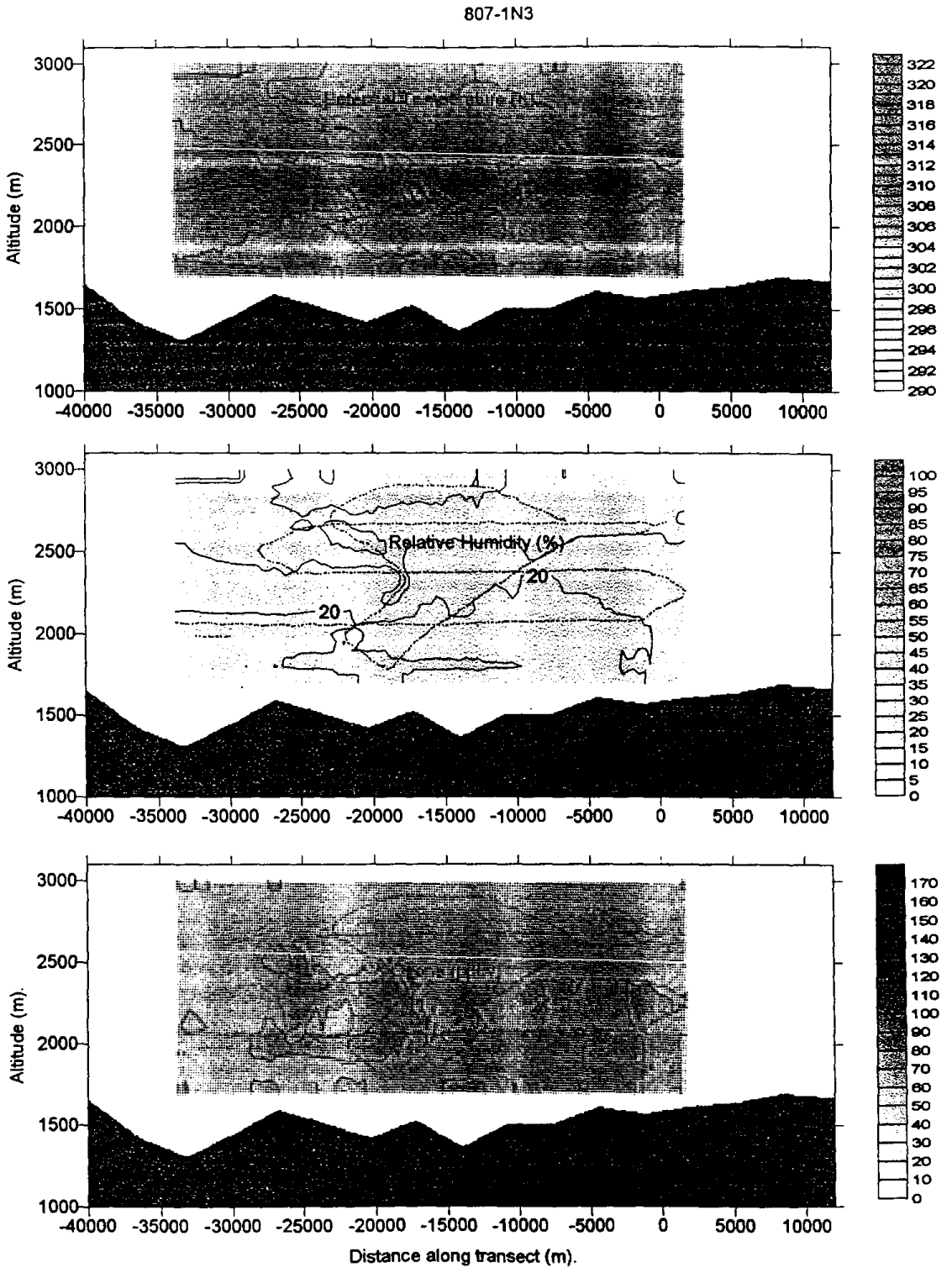


Figure F-6c: Vertical cross sections for flight 1 at S3 on 8-07-96.

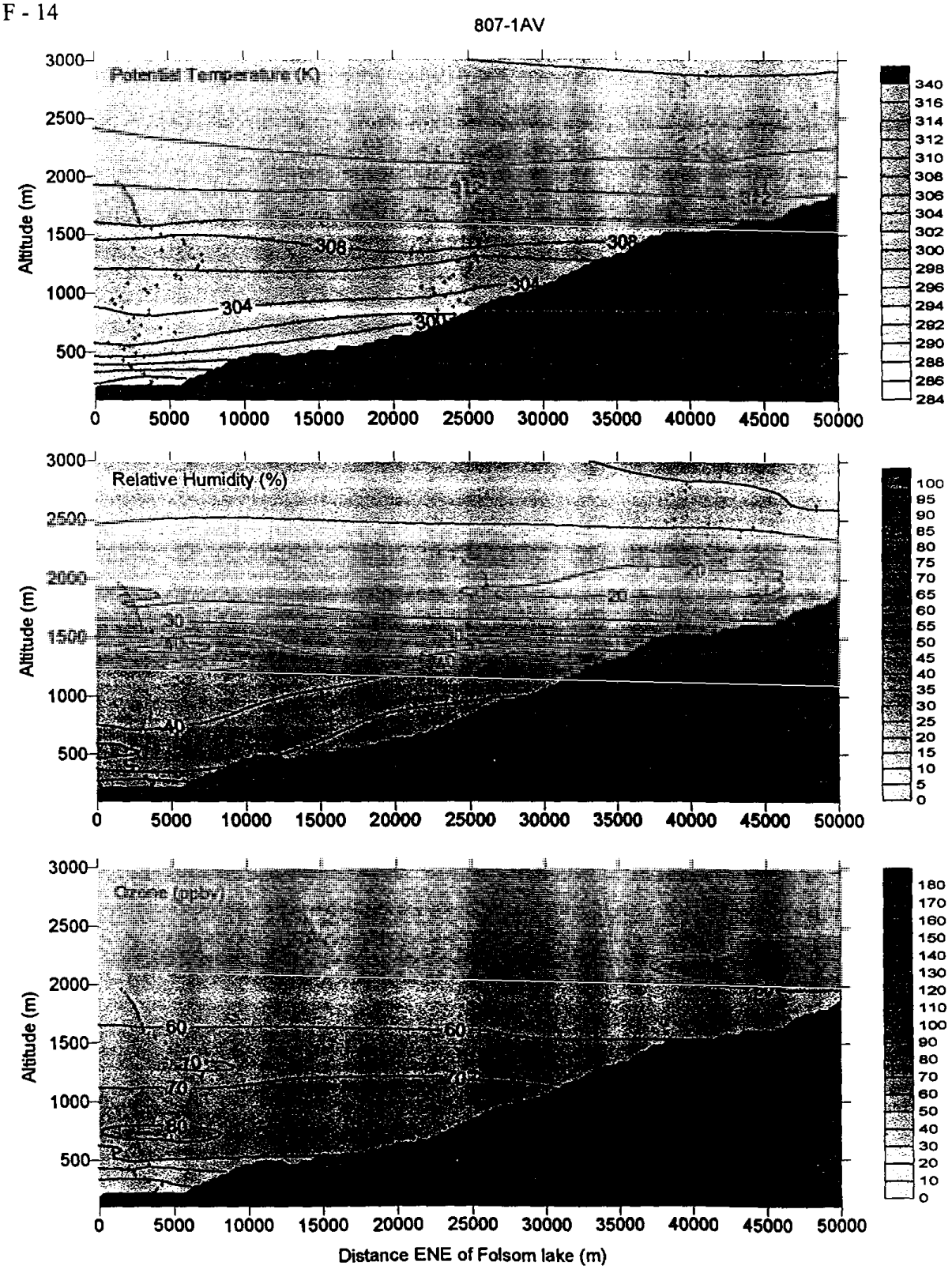


Figure F-6d: Vertical east-west cross sections for flight 1 on 8-07-96.

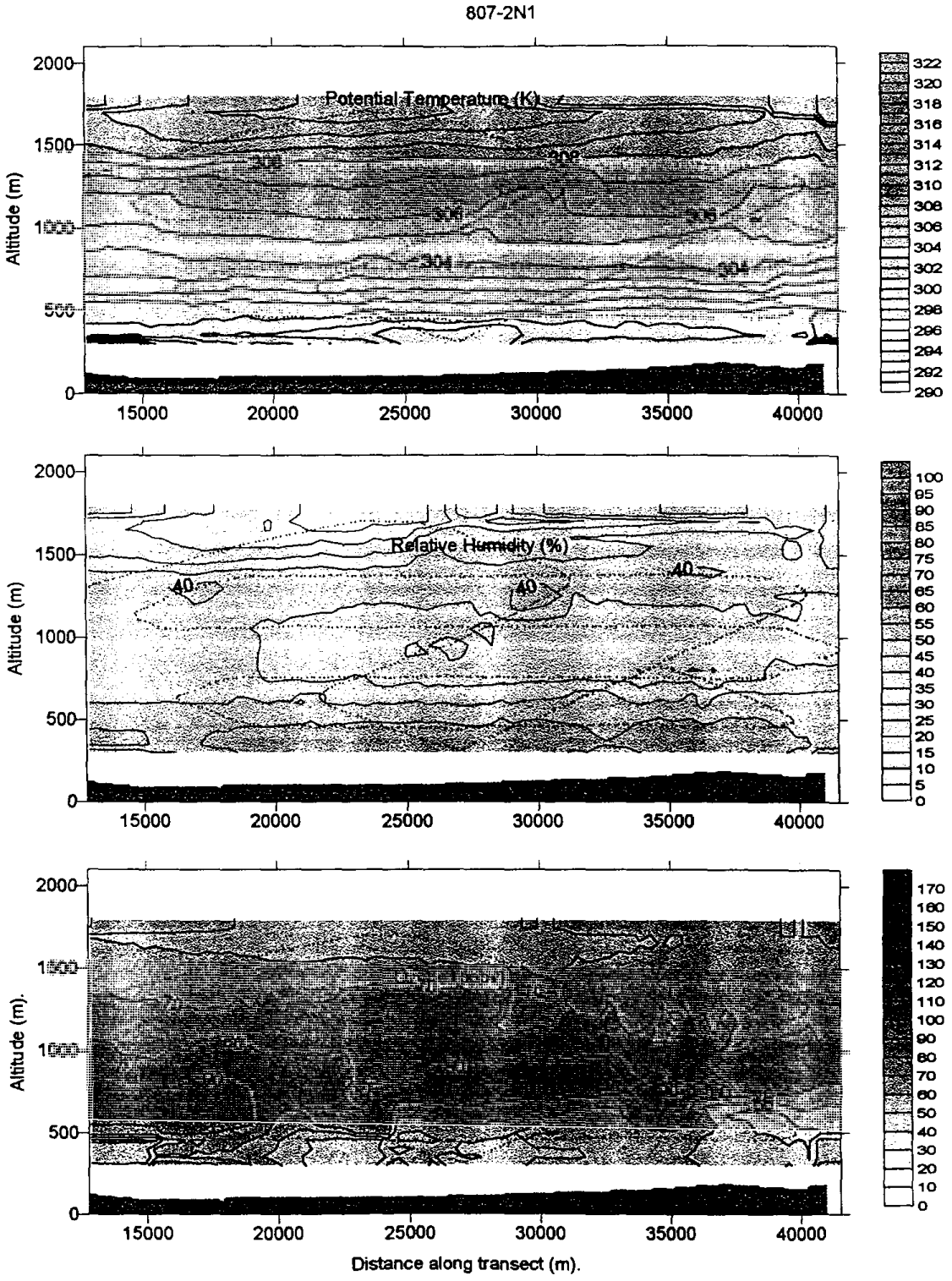


Figure F-7a: Vertical cross sections for flight 2 at S1 on 8-07-96.

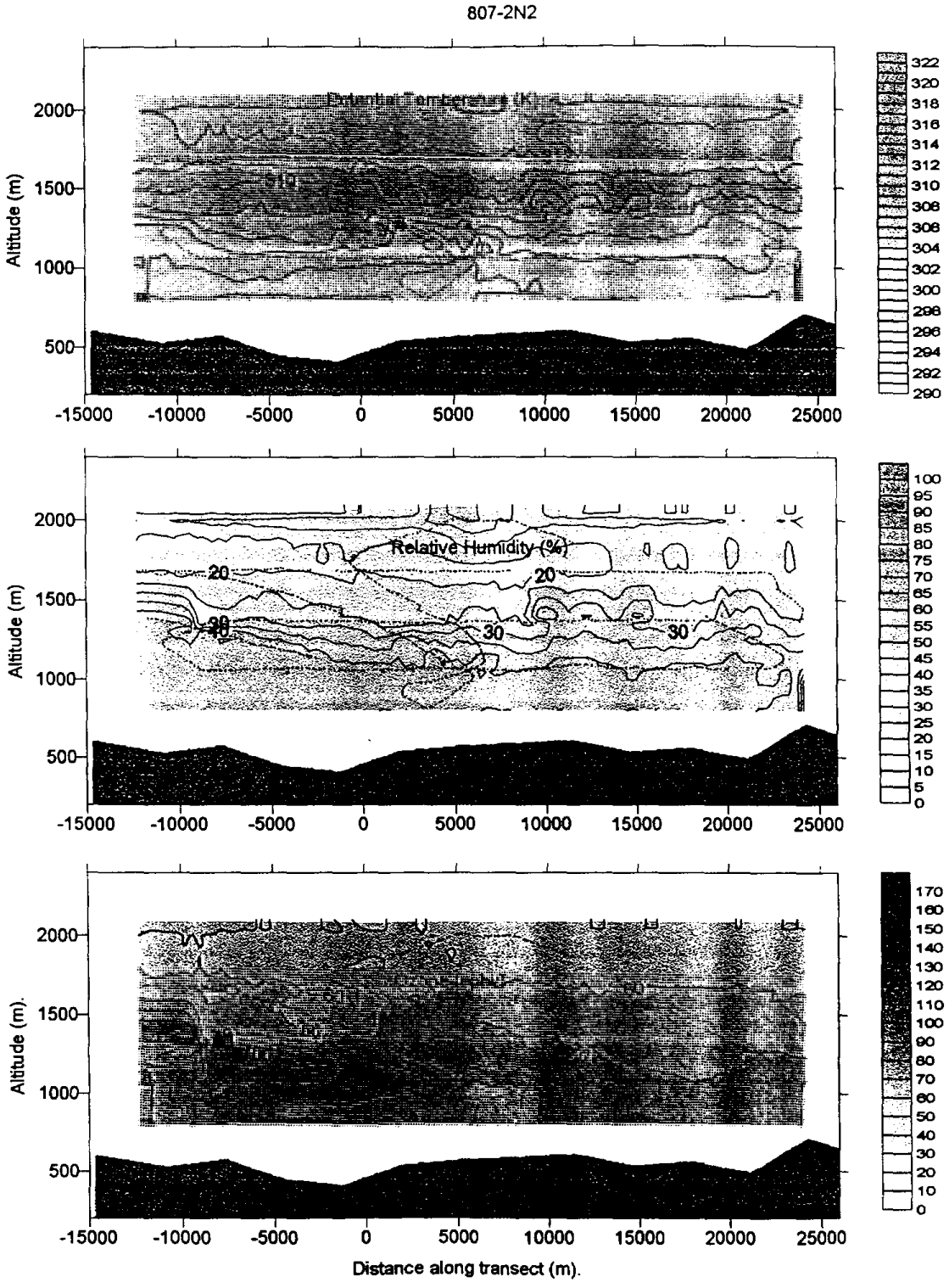


Figure F-7b: Vertical cross sections for flight 2 at S2 on 8-07-96.

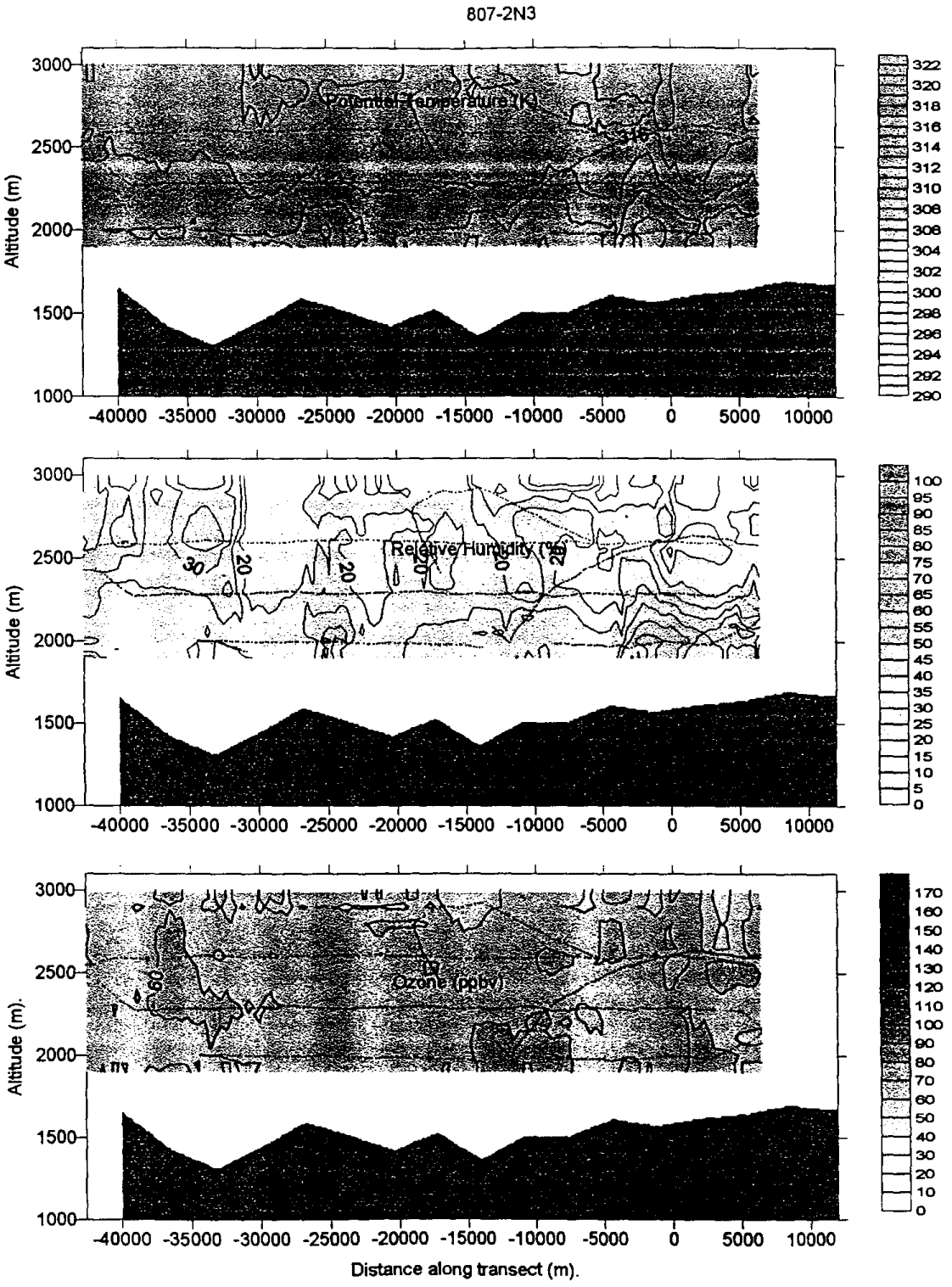


Figure F-7c: Vertical cross sections for flight 2 at S3 on 8-07-96.

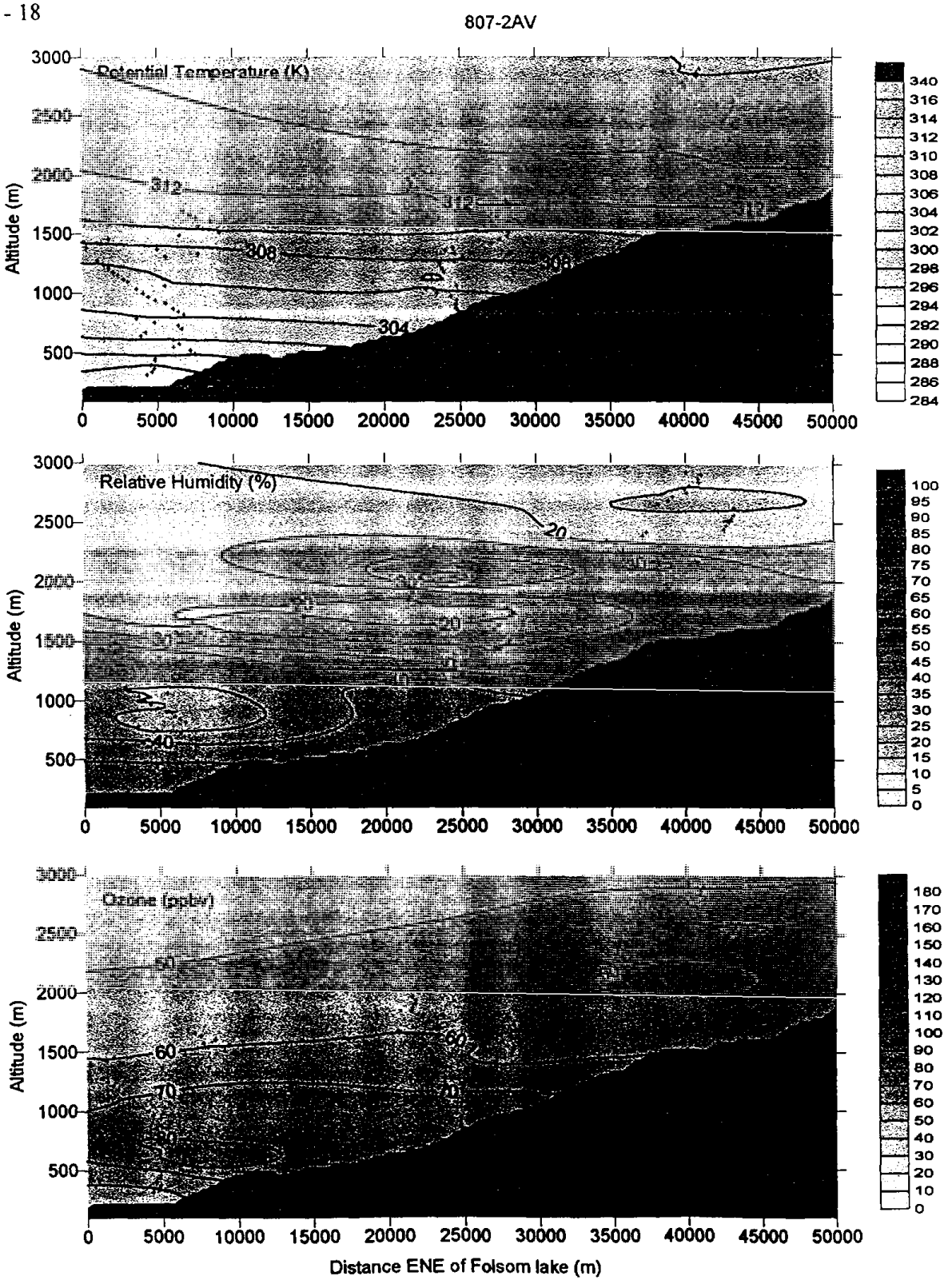


Figure F-7d: Vertical east-west cross sections for flight 2 on 8-07-96.

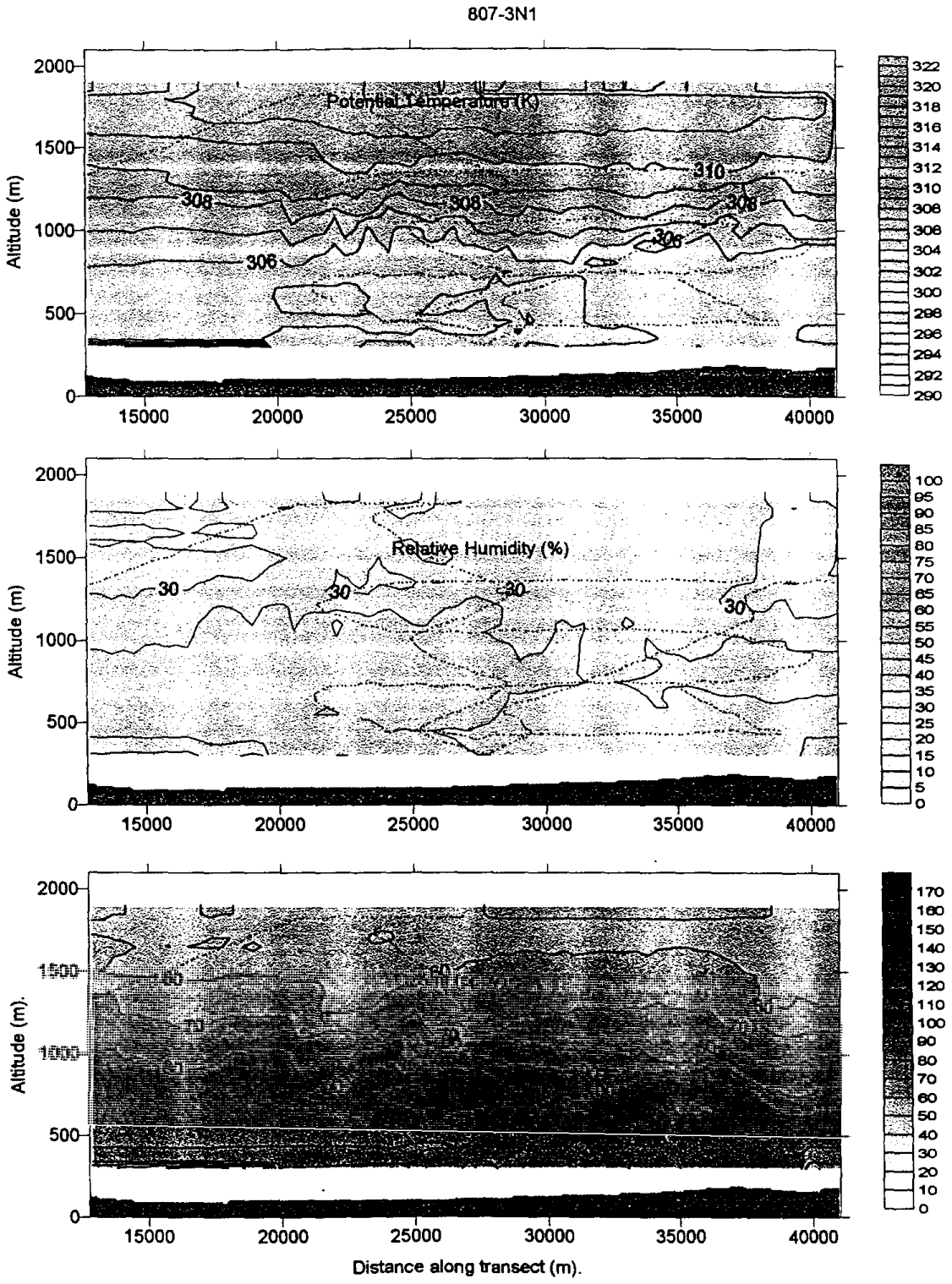


Figure F-8a: Vertical cross sections for flight 3 at S1 on 8-07-96.

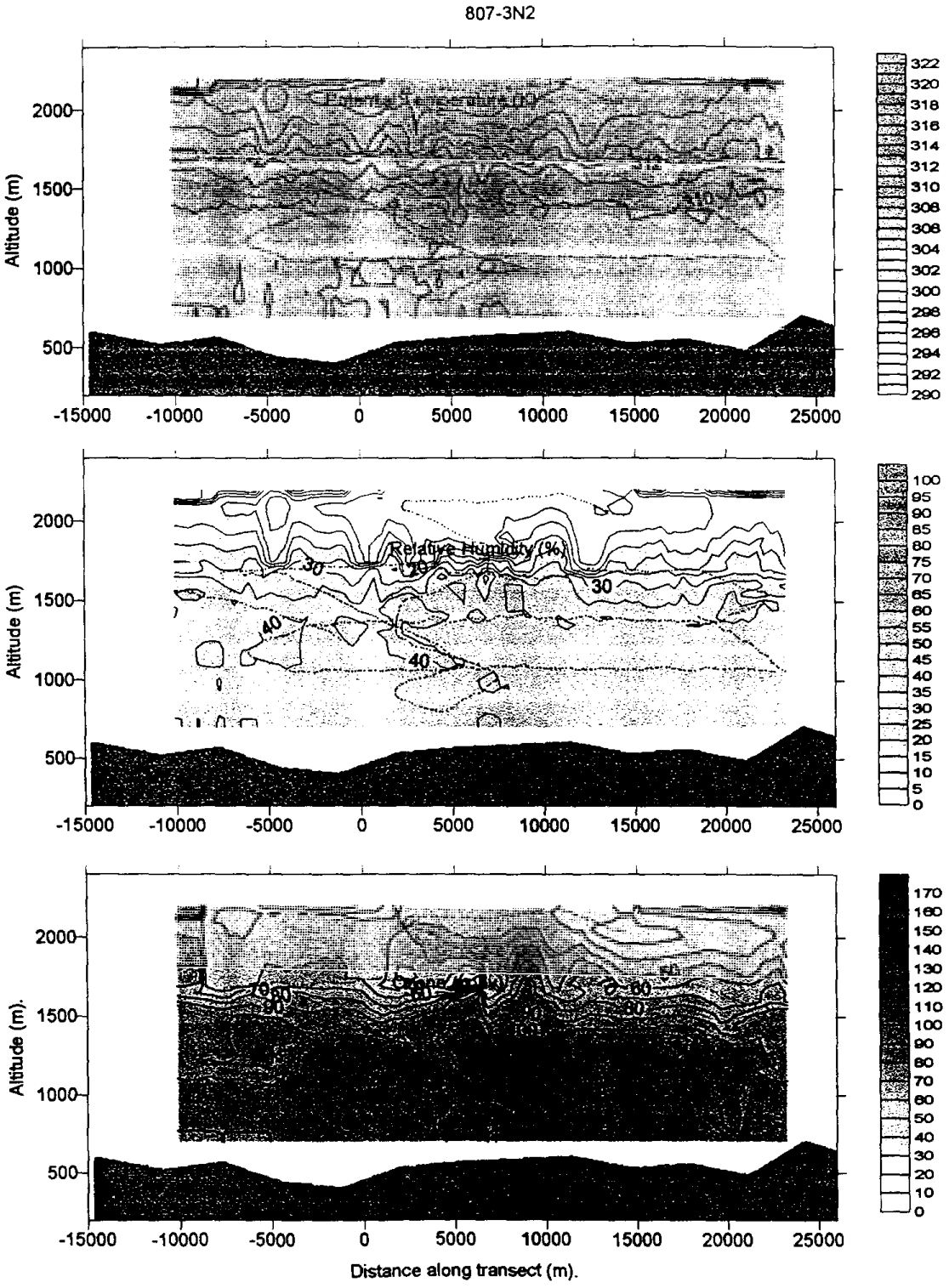


Figure F-8b: Vertical cross sections for flight 3 at S2 on 8-07-96.

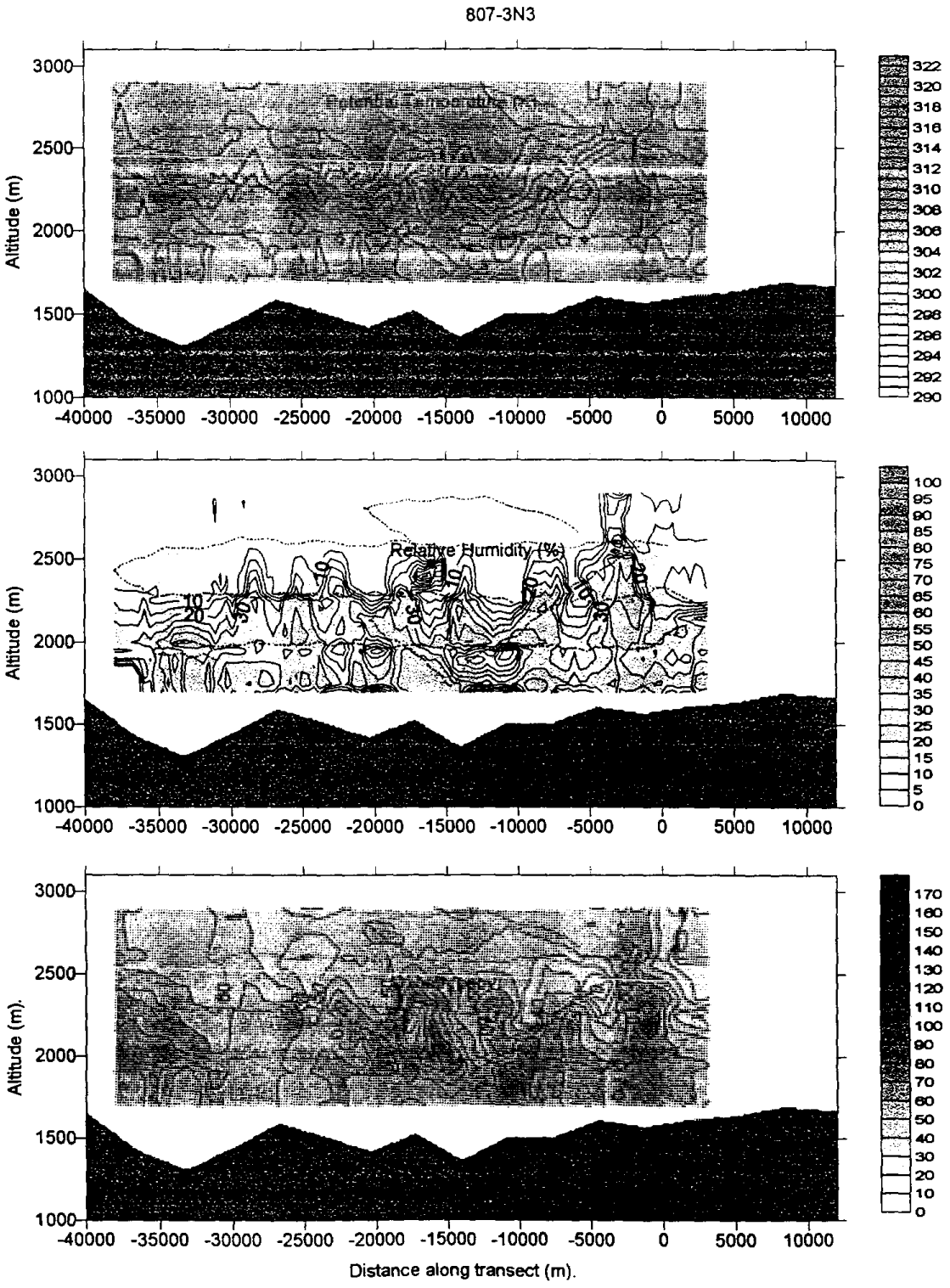


Figure F-8c: Vertical cross sections for flight 3 at S3 on 8-07-96.

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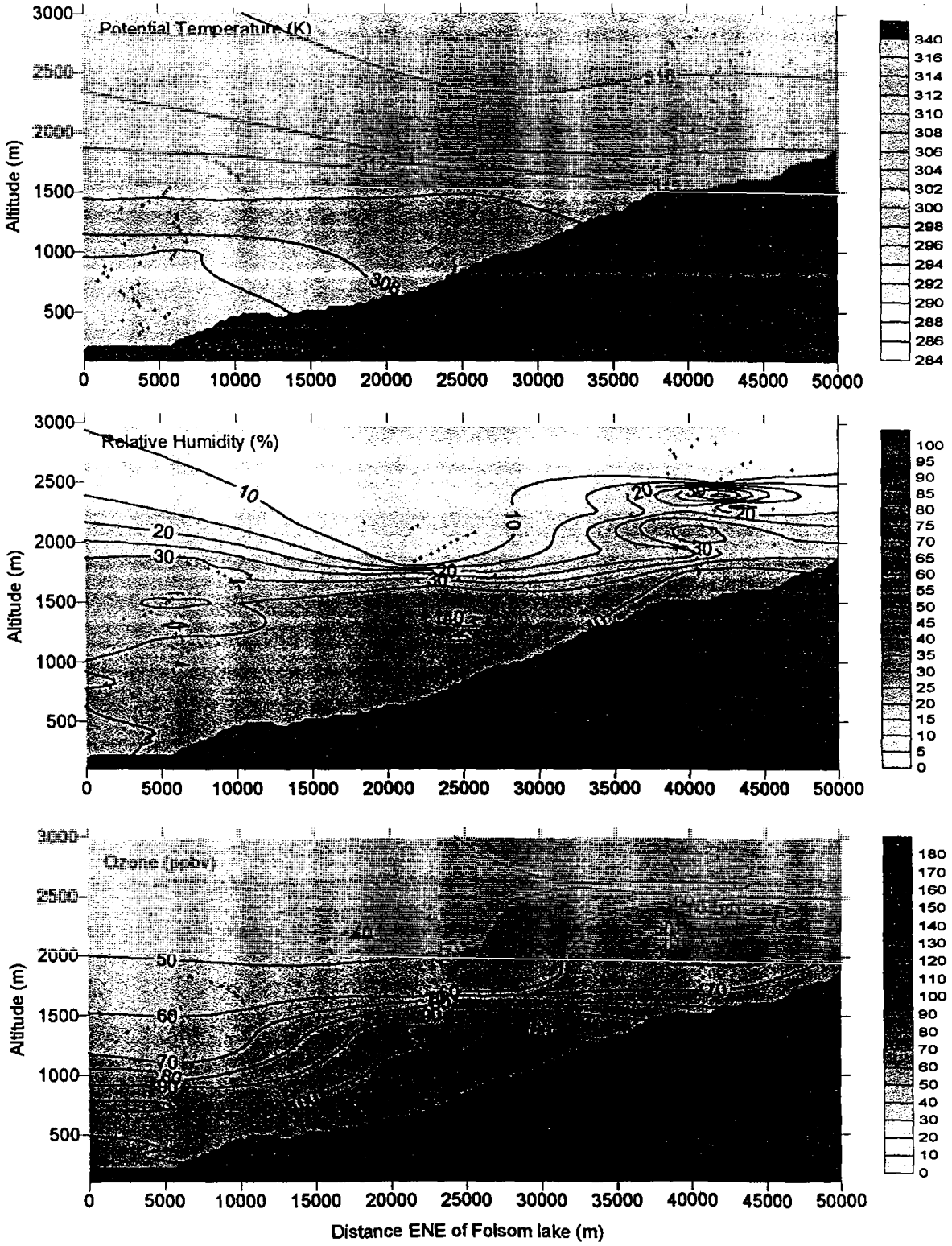


Figure F-8d: Vertical east-west cross sections for flight 3 on 8-07-96.

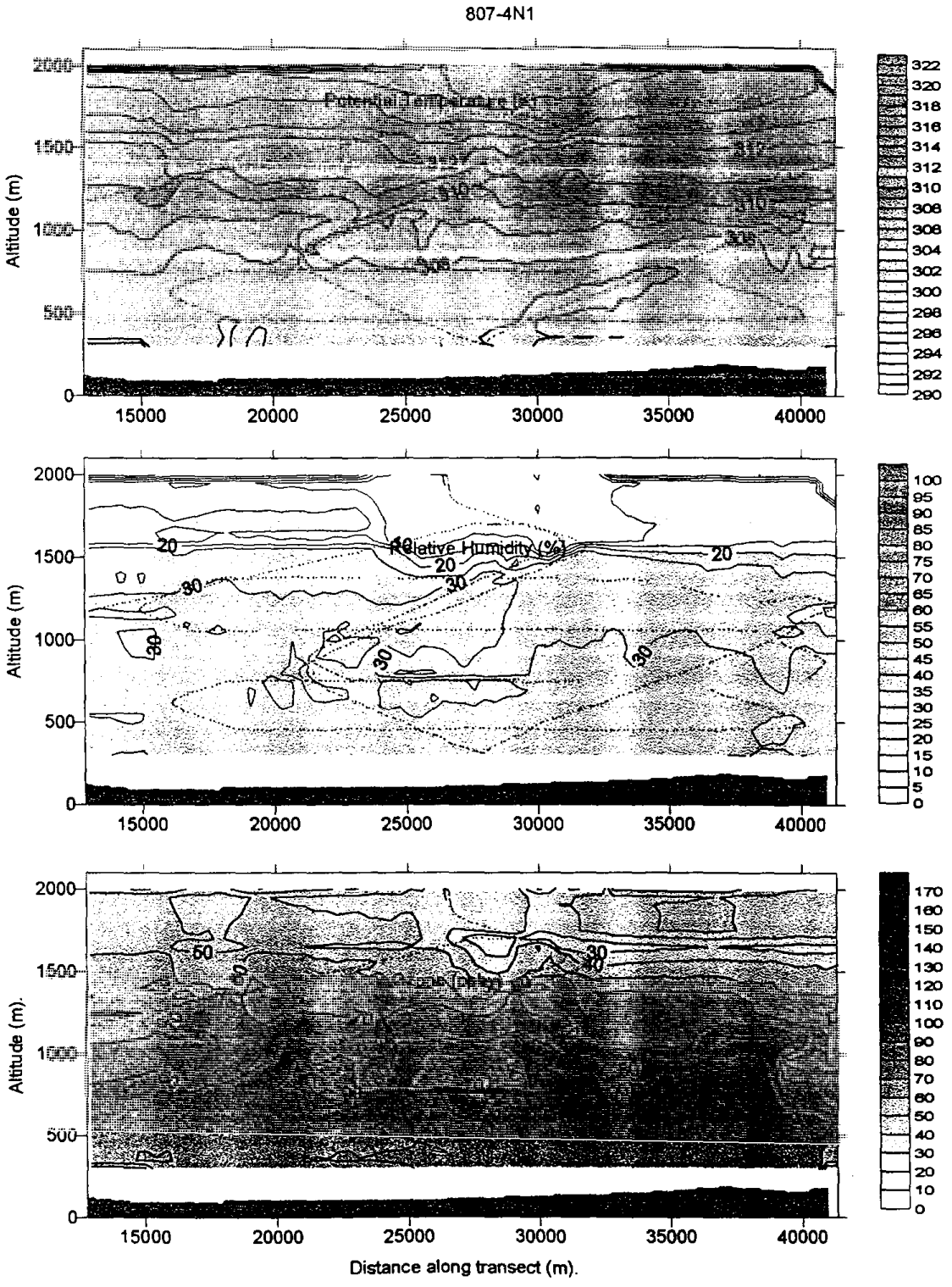


Figure F-9a: Vertical cross sections for flight 4 at S1 on 8-07-96.

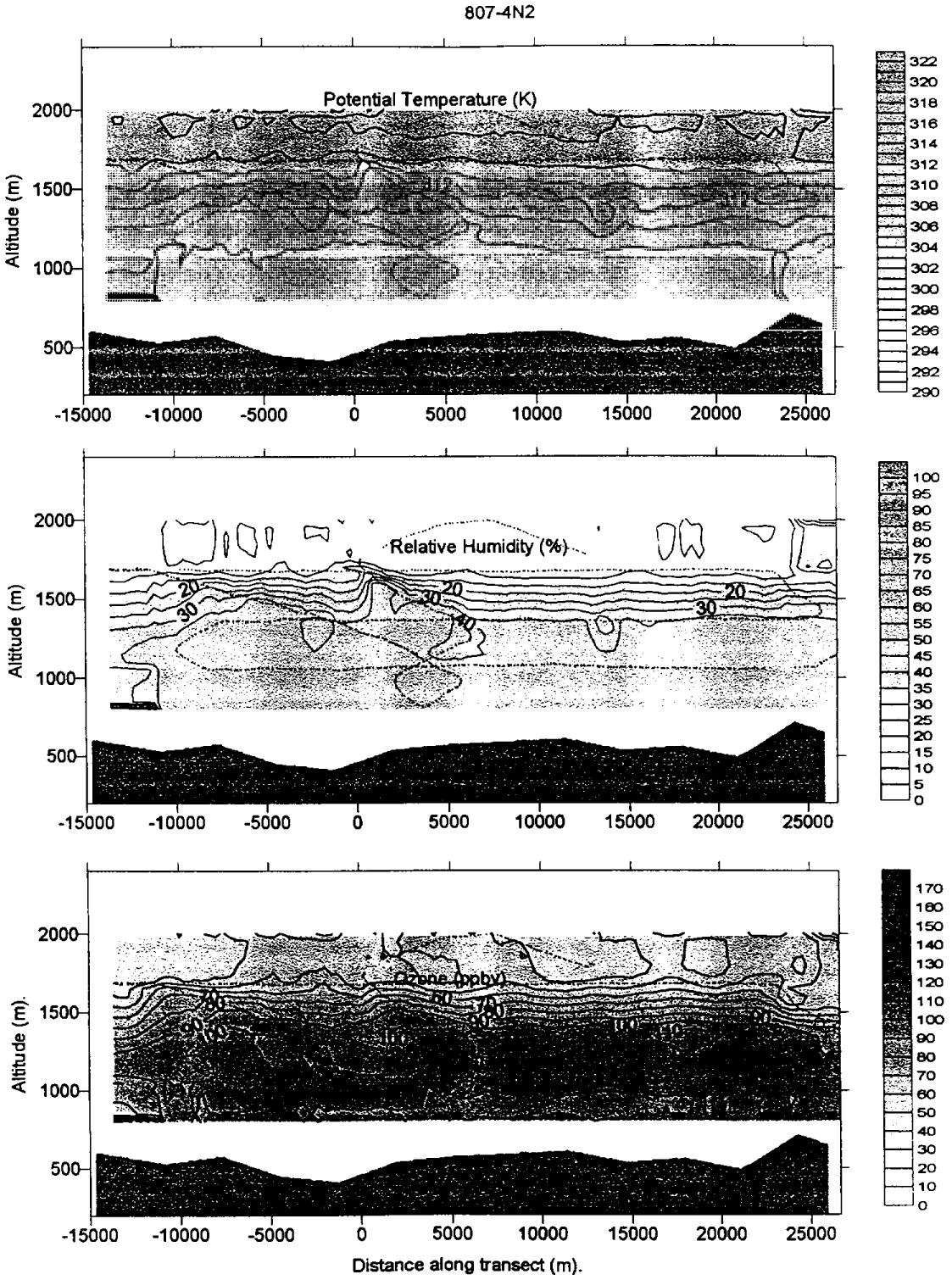


Figure F-9b: Vertical cross sections for flight 4 at S2 on 8-07-96.

APPENDIX G:
August 15, 1996 Sierra Nevada Transect Flights

I. Synoptic setting:

0400 PST (12Z): A very flat 500 mb height field was present over the sample area with divergent flow near a hyperbolic point in the flow. At 600 mb (4200 m), weak flow from the southwest was over the area. The 850 mb height field was also quite flat, with west wind at Oakland and north-northwest at Reno. A weak surface trough was over western California with a moderate onshore pressure gradient along the northern California coast.

1600 PST (00Z): Very little changed at all altitudes. The surface trough was better defined within the Central Valley and the onshore pressure gradient strengthened and extended further southward.

II. Surface observations:

At MCC, the wind speeds were between 4 and 8 knots with the higher speeds being the most prevalent. Wind directions were from the south-southeast until 0800 PST, are missing for most of the daytime hours and were west-southwest at 1700 PST, shifting back to south-southeast by 2200 PST. The high temperature at MCC reached 40 C. At BLU, wind speeds were light (less than 5 knots), from the east in the pre dawn hours and missing nearly the whole day. At the foothill stations, wind directions were between east and southeast most of the morning hours, shifted to between west and southwest by 1100 PST, and shifted back to downslope after sunset. Maximum temperatures were between 35 and 38 C. Ozone concentrations measured at these sites were less than 60 ppbv most of the day, with late afternoon maxima of about 80 ppbv.

III. Vertical cross sections:

Flight 1: At S1, a layer of strong stability was found at about 500 m which appears to be separate from a near ground nocturnal inversion. Above about 700 meters, the atmosphere was near neutral. The relative humidity and ozone values were low (less than 30 % and less than 60 ppbv, respectively) and well mixed. At S2, a strong surface inversion was found close to the ground, which may be a combination of surface cooling and the stable layer found between 500 and 700 meters at S1. Above about 800 m, the atmosphere was also near neutral, with well mixed relative humidity and a few pockets of ozone greater than 60 ppbv right near the surface and also aloft (higher than 1300 m). At S3, the atmospheric stability increased above 2200 m forming a cap to the more neutral layer below. The relative humidity droped off to nearly zero through this layer suggesting this was a subsidence inversion. Pockets of relatively high ozone were found just below this layer having concentrations greater than 70 and 90 ppbv.

Flight 2: At S1, the potential temperature fields show a near neutral layer below 500 m, a stable layer at 500 to 700 m and near neutral conditions up to at least 1700 m. Relative humidity remained low and well mixed, while below the stable layer ozone was increasing (greater than 70 ppbv). At S2, the surface based stable layer disappeared, and the atmosphere was neutral up to at least 2000 m. Relative

humidity and ozone were well mixed with ozone concentrations being about 50 ± 5 ppbv throughout the sampled section. At S3, we see the signature of deep thermal convection, with no obvious capping inversion.

Flight 3: At S1, the atmosphere was essentially neutral from the surface to 1800 m, relative humidity was low and well mixed and ozone was moderately well mixed except for a low altitude maximum of about 90 ppbv over the southeastern third of the section. At S2, the humidity was very low, the stability neutral and ozone well mixed at about 70 ±5 ppbv over most of the sampled section. At S3, the whole sampled section was neutrally stratified, and all fields well mixed. Ozone concentrations were about 60 ±5 ppbv everywhere.

Flight 4: There is some evidence of increasing stability above 1700 m. Ozone concentrations were moderately high below 1200 m with a small pocket of 100 ppbv at 750 m near the traverse midpoint. At S2, an increase in stability at about 1500 m was evident in all fields. Ozone concentrations exceeded 90 ppbv over most of the section below 1500 m, with two pockets greater than 100 ppbv.

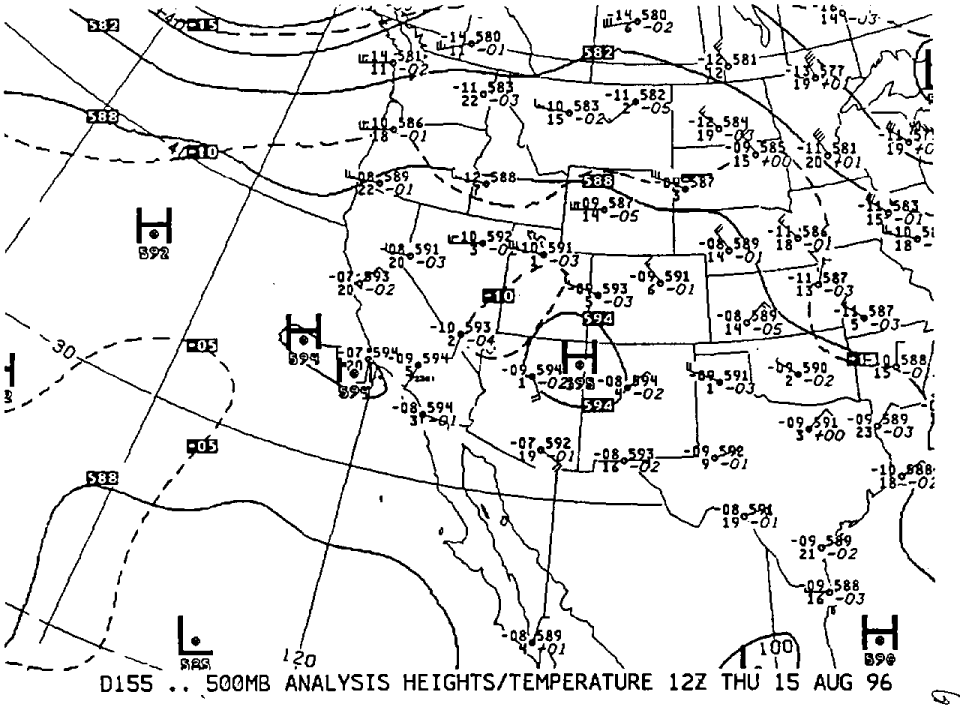
IV. Synopsis:

With the weak flows aloft and high surface temperatures, one would expect high ozone concentrations. However the day begins with a well mixed outer layer and relatively low ozone aloft, especially at S1. In fact the early morning ozone maxima were at relatively high altitudes and at S3. This suggests either the previous days plume stopped in the vicinity of S3, or that the previous day's plume was folded back into the upper part of the S3 section. As the day progressed, up slope transport brought ozone and its precursors into the sample area but the deep mixed layer kept maxima less than or equal to 100 ppbv. The high concentrations appear to be near the center of the sample sections with lower values near the end points. This is consistent with the maximum concentrations of near 80 ppbv observed at the surface stations.

Table G-1

8-15-96
Averaged Aircraft Data

	Time (PST)	Location	Altitude (m MSL)	Direction	Speed (knots)	H_m (m MSL)	D_m (m AGL)
Flight 1	0600	S1	600	205	16	460	310
			1500	200	16		
	0700	S2	1500	193	16	730	180
	0800	S3	1850	180	22	1675	425
			2400	200	20		
Flight 2	1000	S1	650	200	16	610	460
			1350	190	16		
	1100	S2	1500	200	18		
	1200	S3	1850	200	20	2200	950
			2500	210	20		
Flight 3	1300	S1	600	210	18		
			1400	195	16		
	1400	S2	1500	190	16	1800	1250
	1500	S3	1950	210	16	2500	1250
			2500	215	18		
Flight 4	1700	S1	650	205	16	1280	1130
			1500	200	16		
	1800	S2	1500	205	17	1710	1160



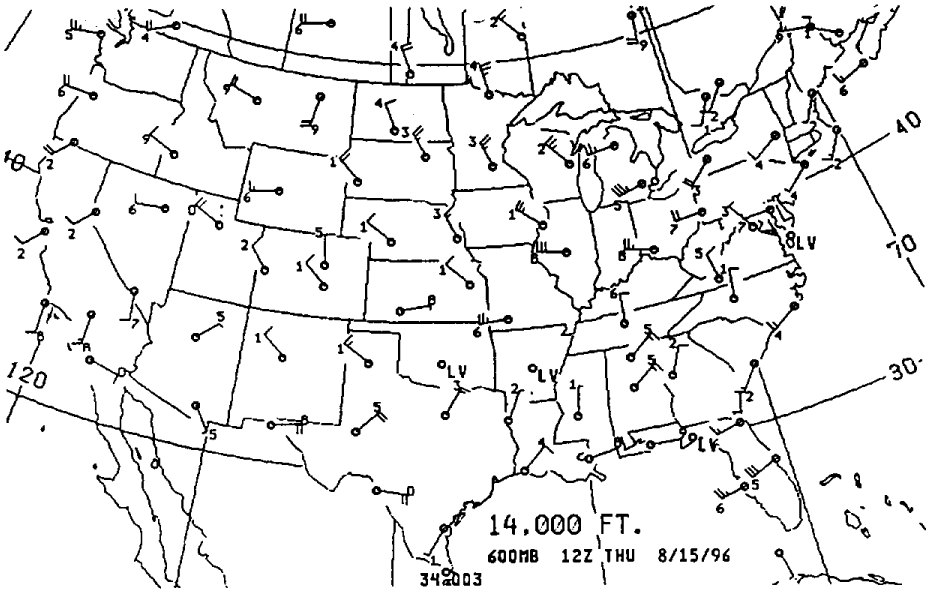


Figure G-1a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 0400 PST 8-15-96 (12Z).

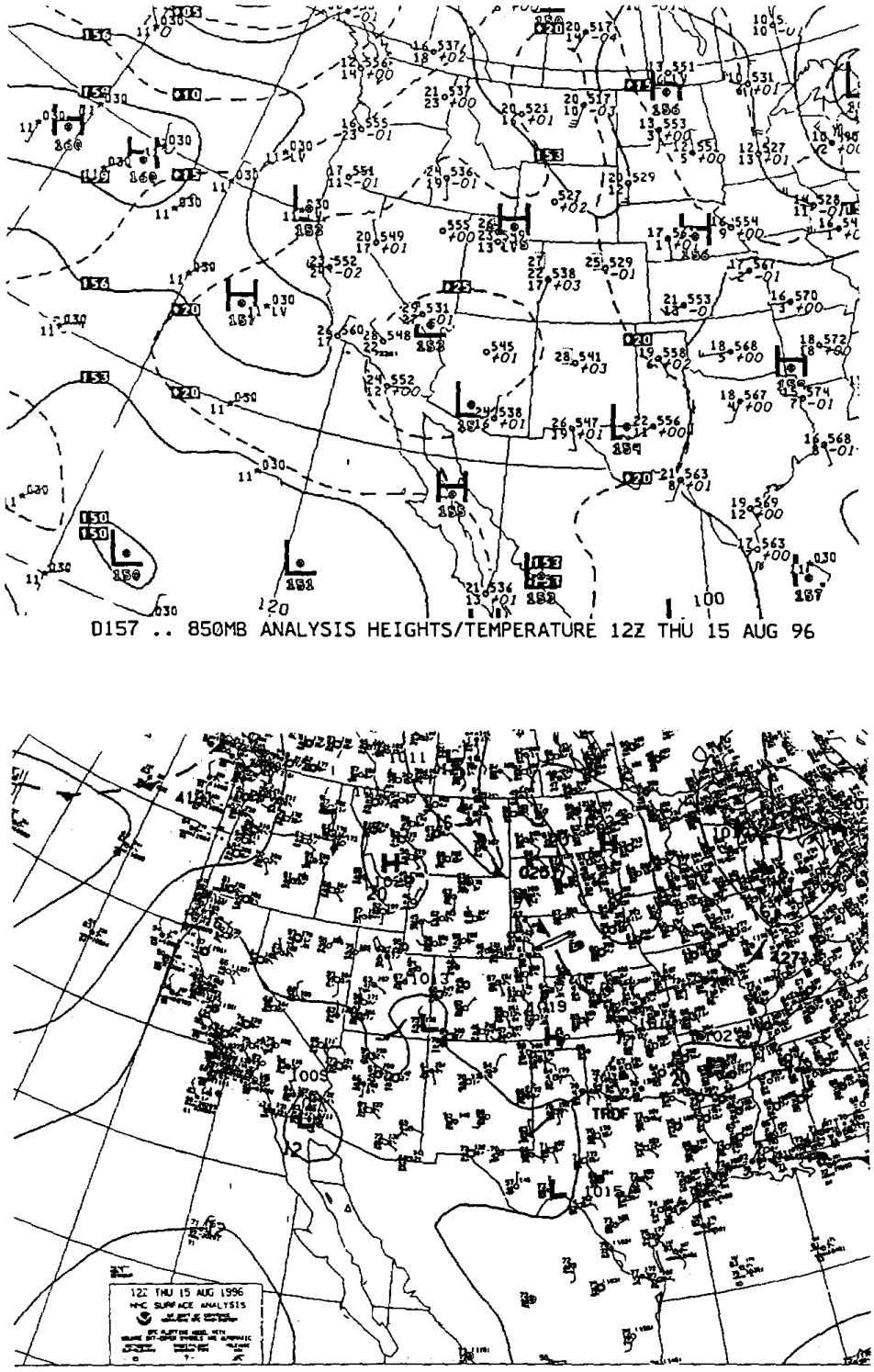


Figure G-1b: 850 mb height field (upper) and surface analysis map (lower) for 0400 PST 8-15-96 (12Z).

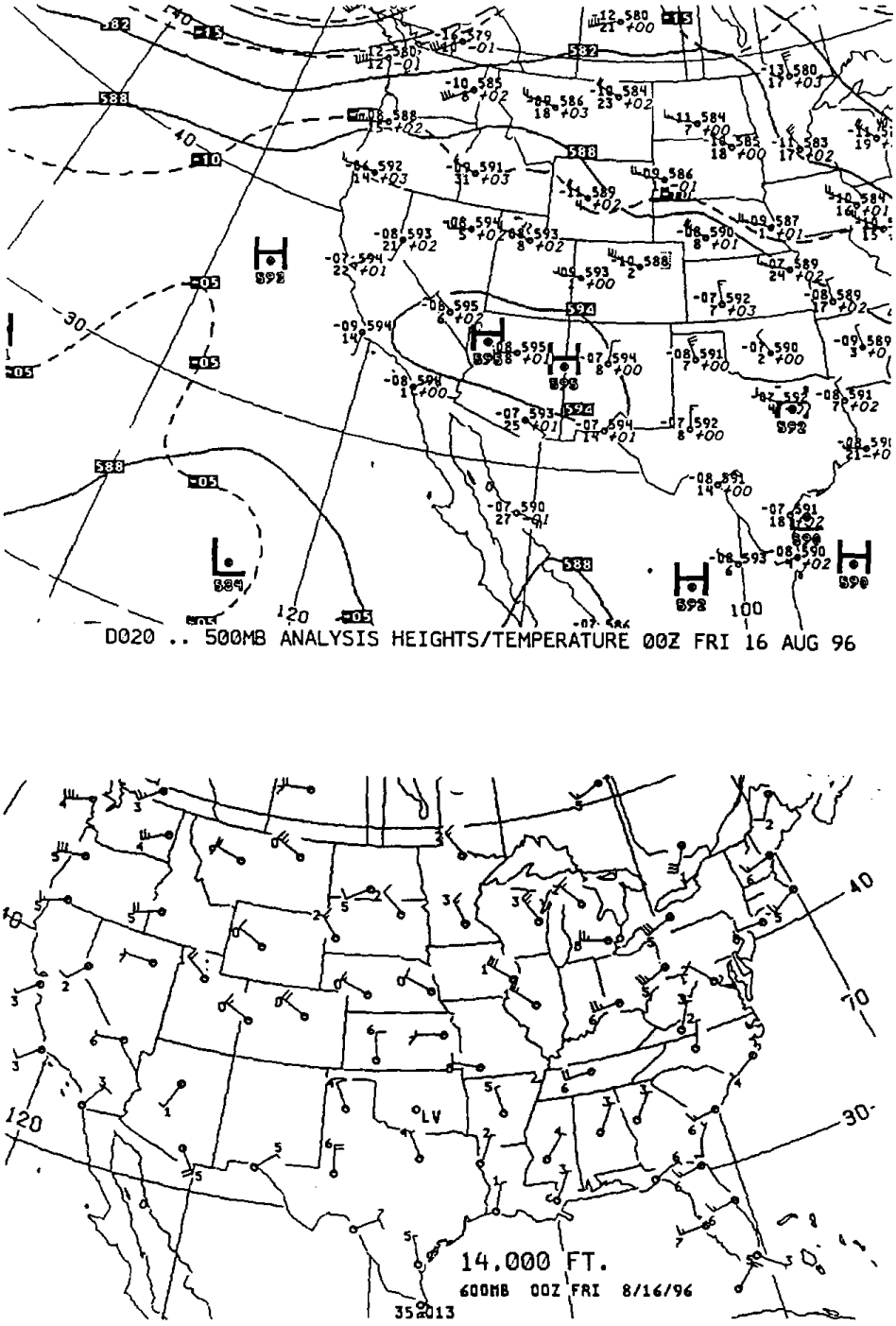


Figure G-2a: 500 mb height field (upper) and 600 mb winds aloft analysis (lower) for 1600 PST 8-15-96 (00Z)

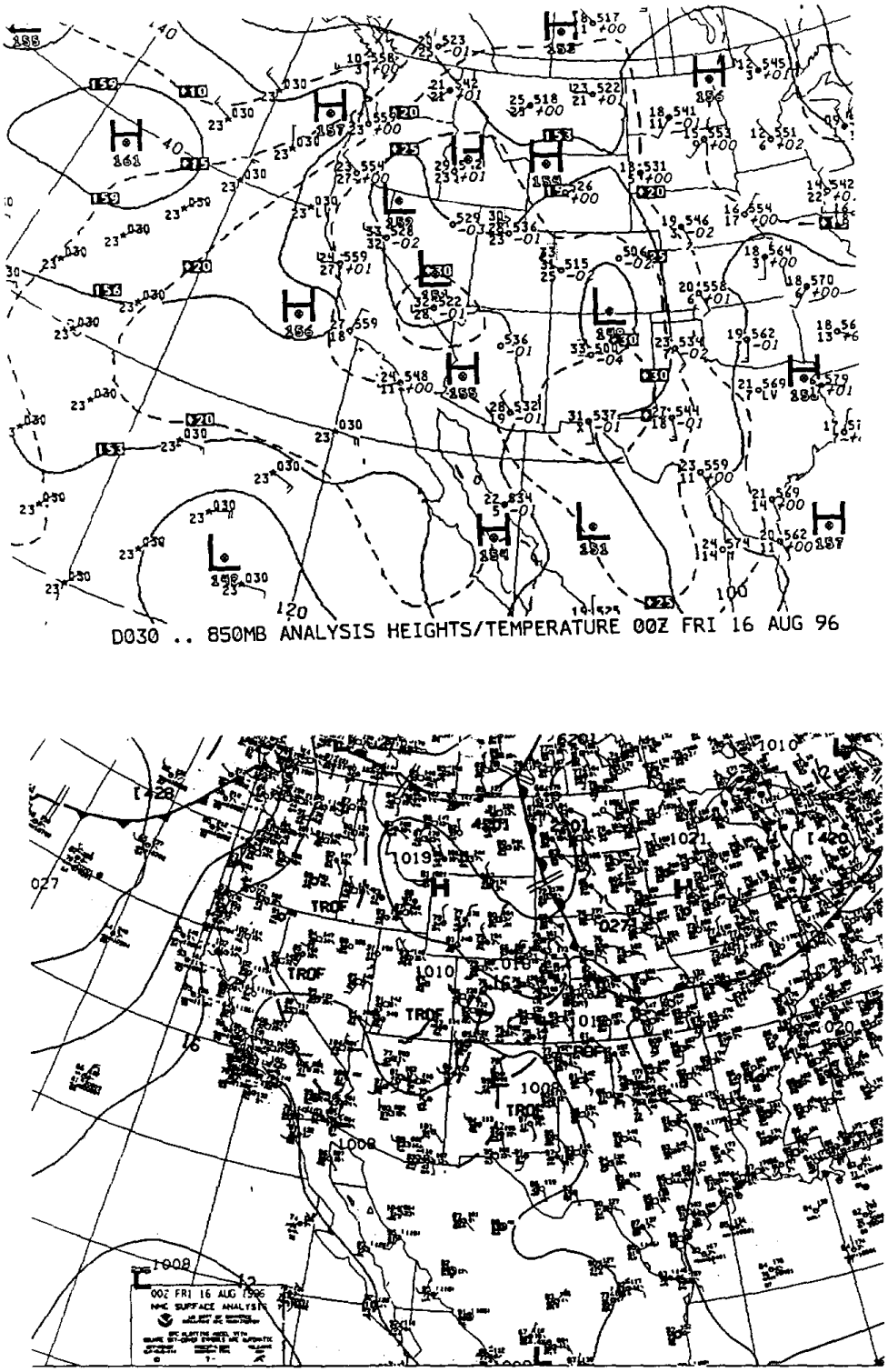


Figure G-2b: 850 mb height field (upper) and surface analysis map (lower) for 1600 PST 8-15-96 (00Z).

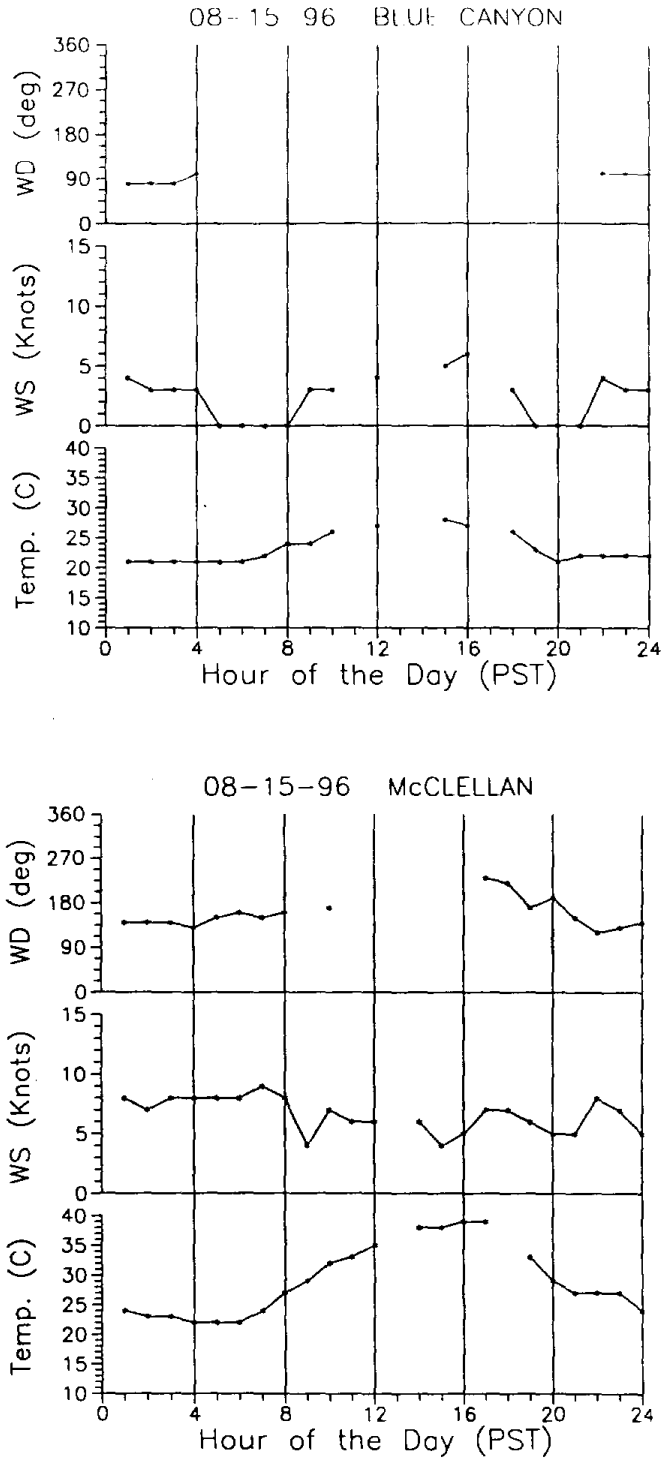


Figure G-3: Plot of wind and temperature data observed on the hour at Blue Canyon (upper) and McClellan (lower) on 8-15-96.

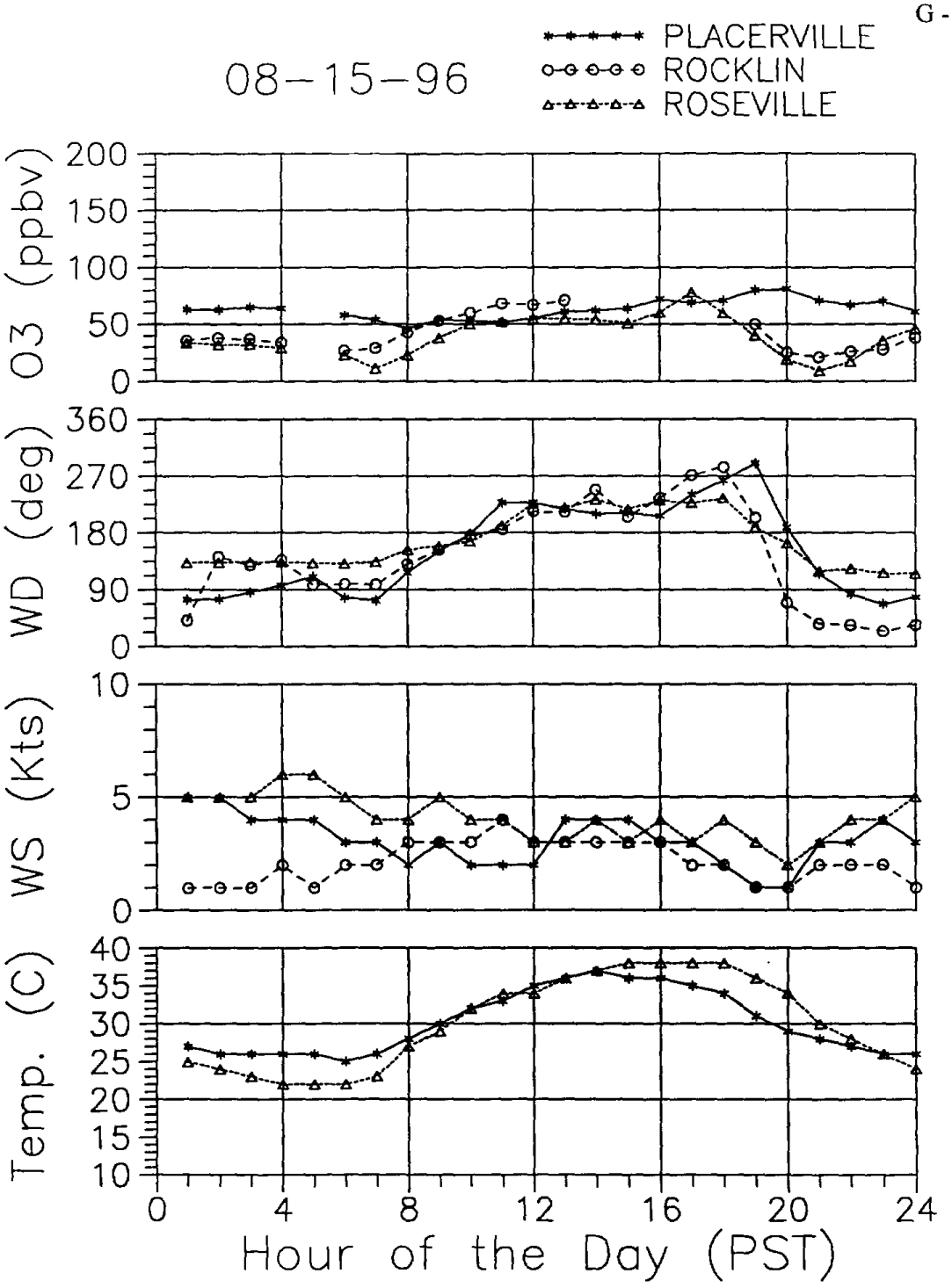
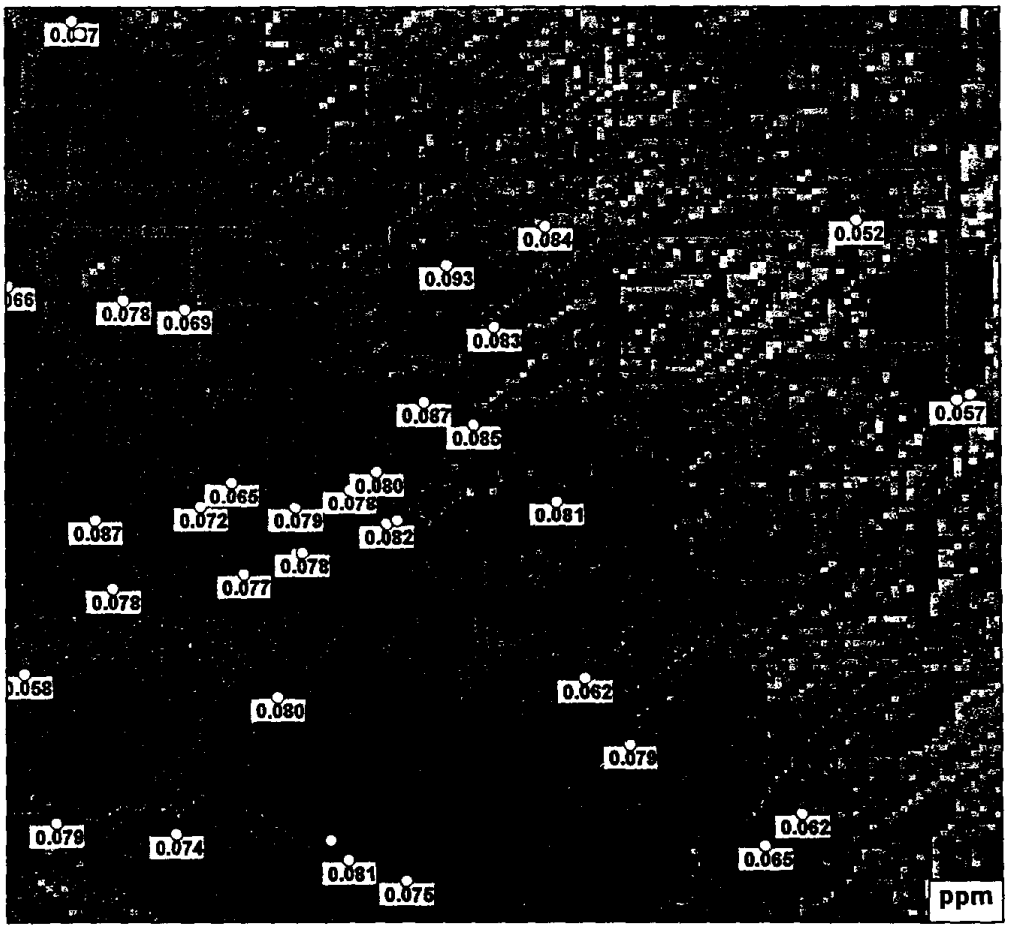


Figure G-4: Plot of hourly averaged data for the three foothill ground stations versus time of day (PST) for 8-15-96.

Figure G-5: Maximum hourly averaged ozone concentrations in central California on 8-15-96.



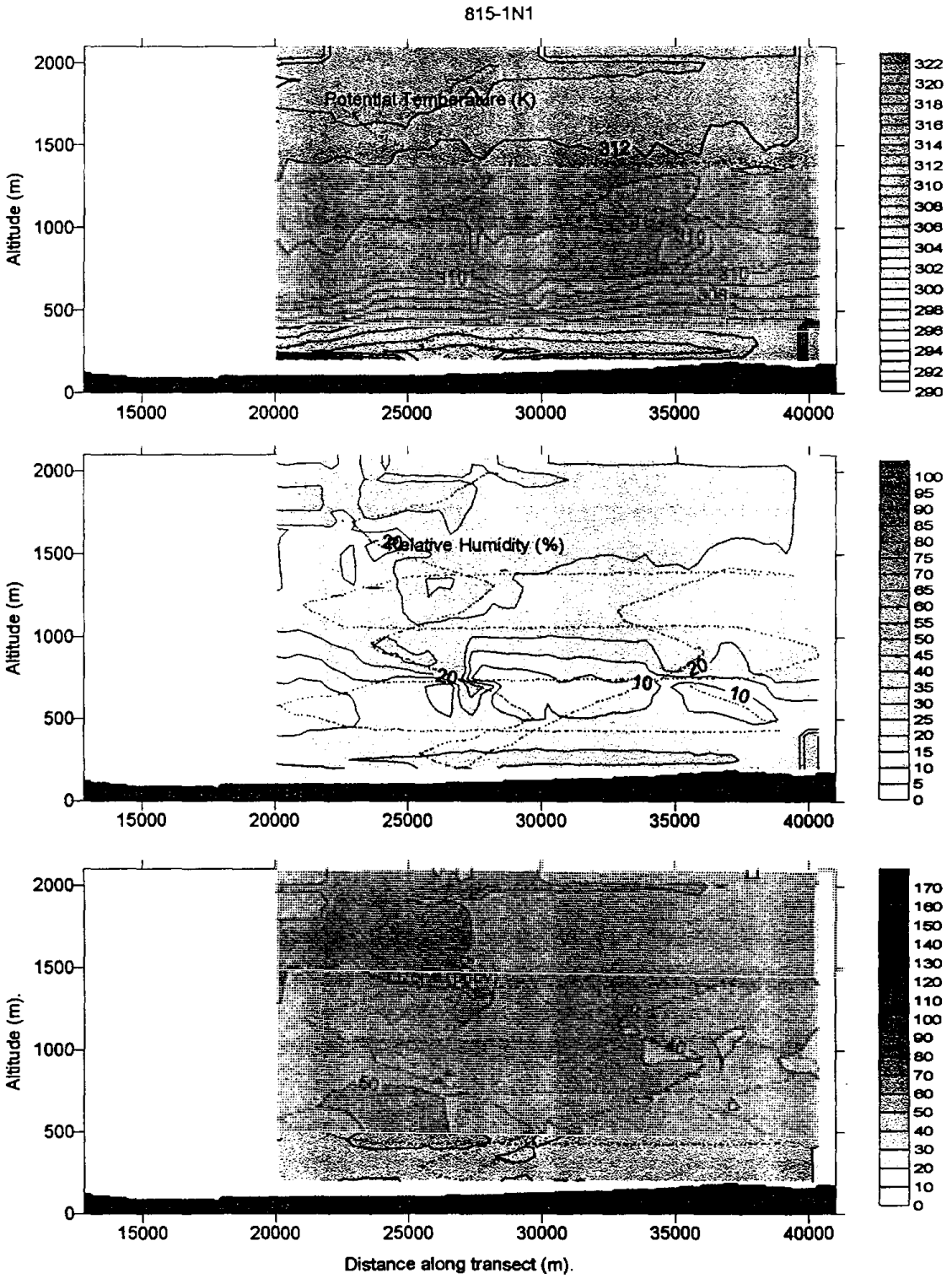


Figure G-6a: Vertical cross sections for flight 1 at S1 on 8-15-96.

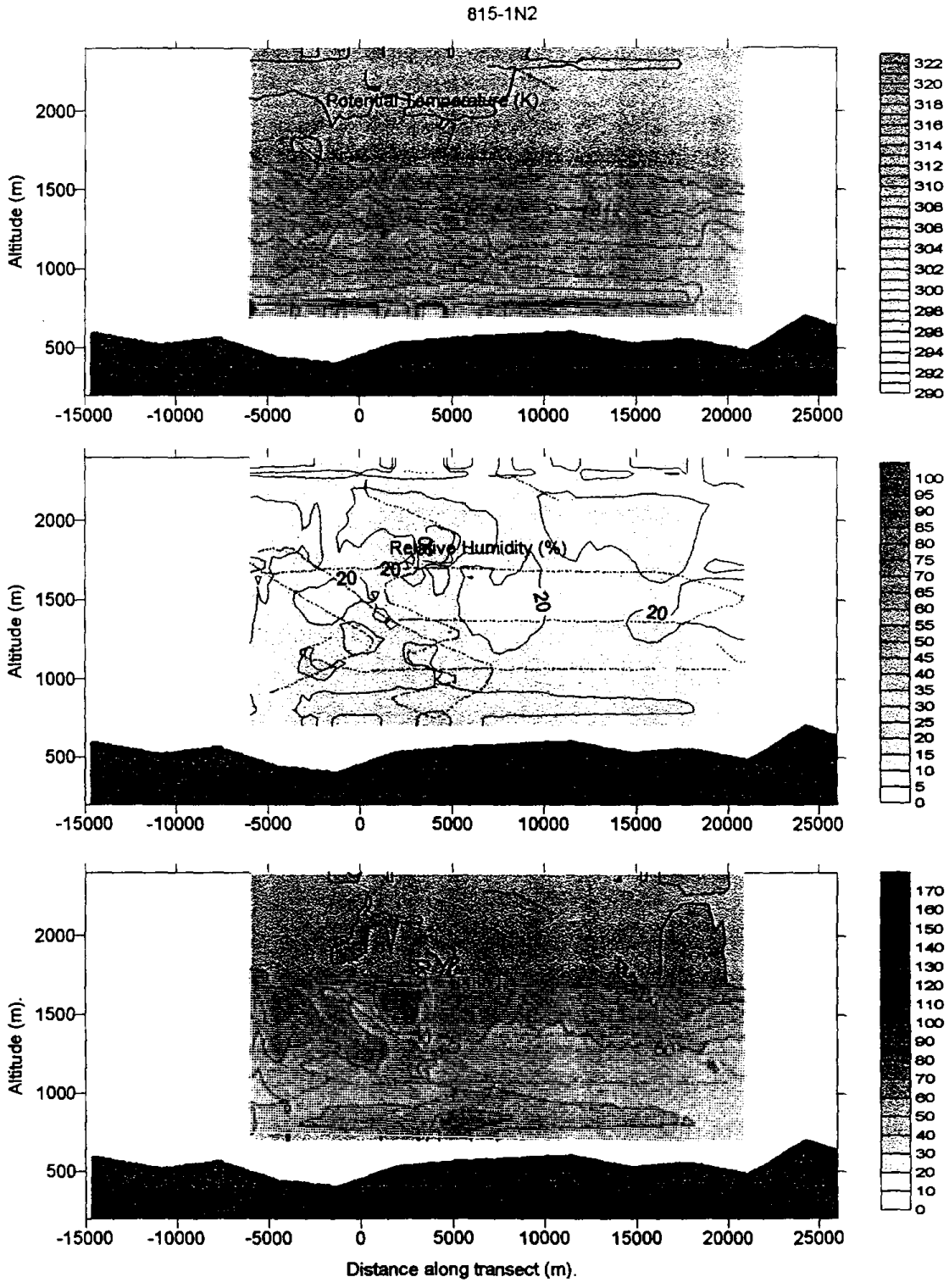


Figure G-6b: Vertical cross sections for flight 1 at S2 on 8-15-96.

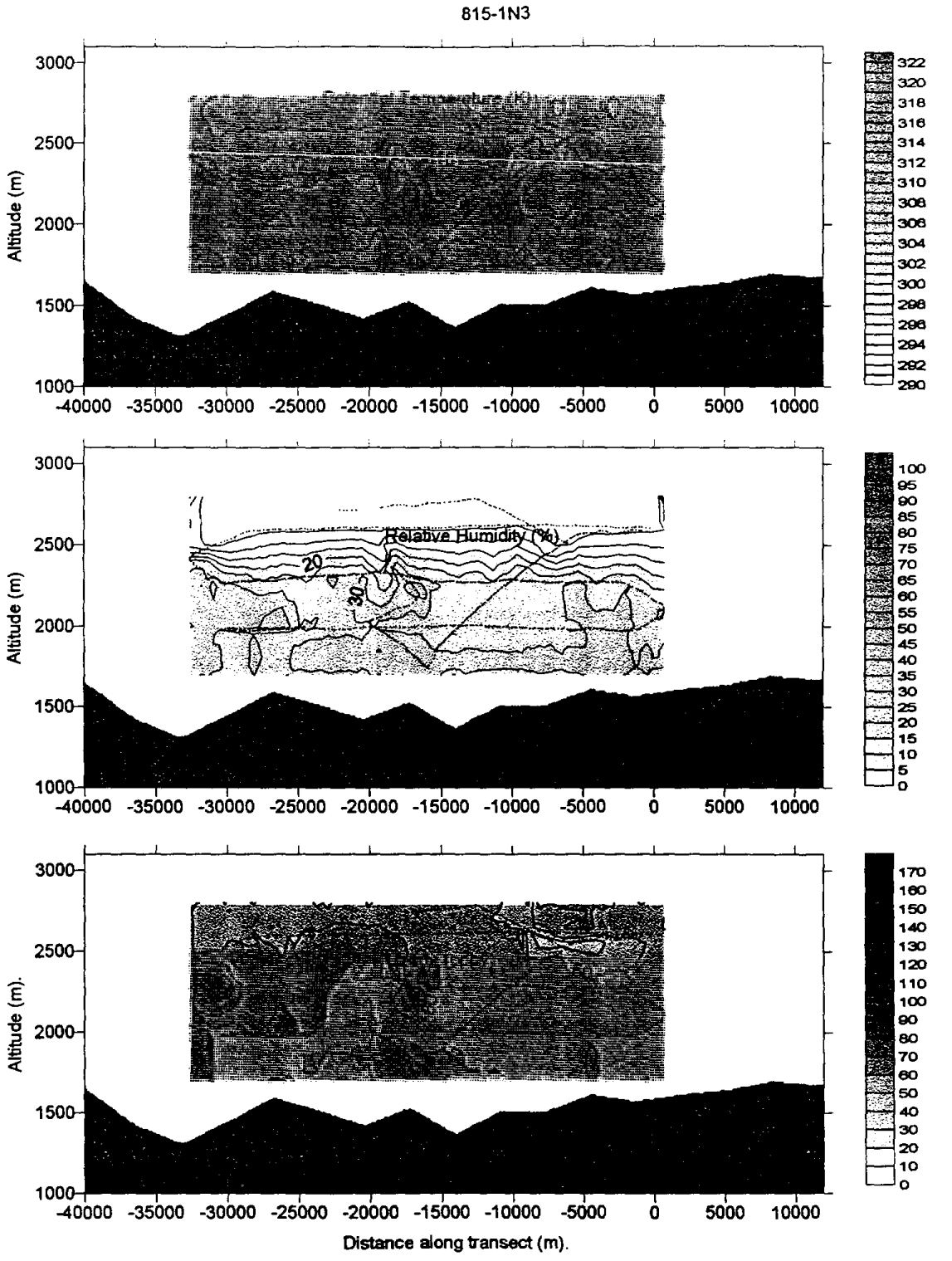


Figure G-6c: Vertical cross sections for flight 1 at S3 on 8-15-96.

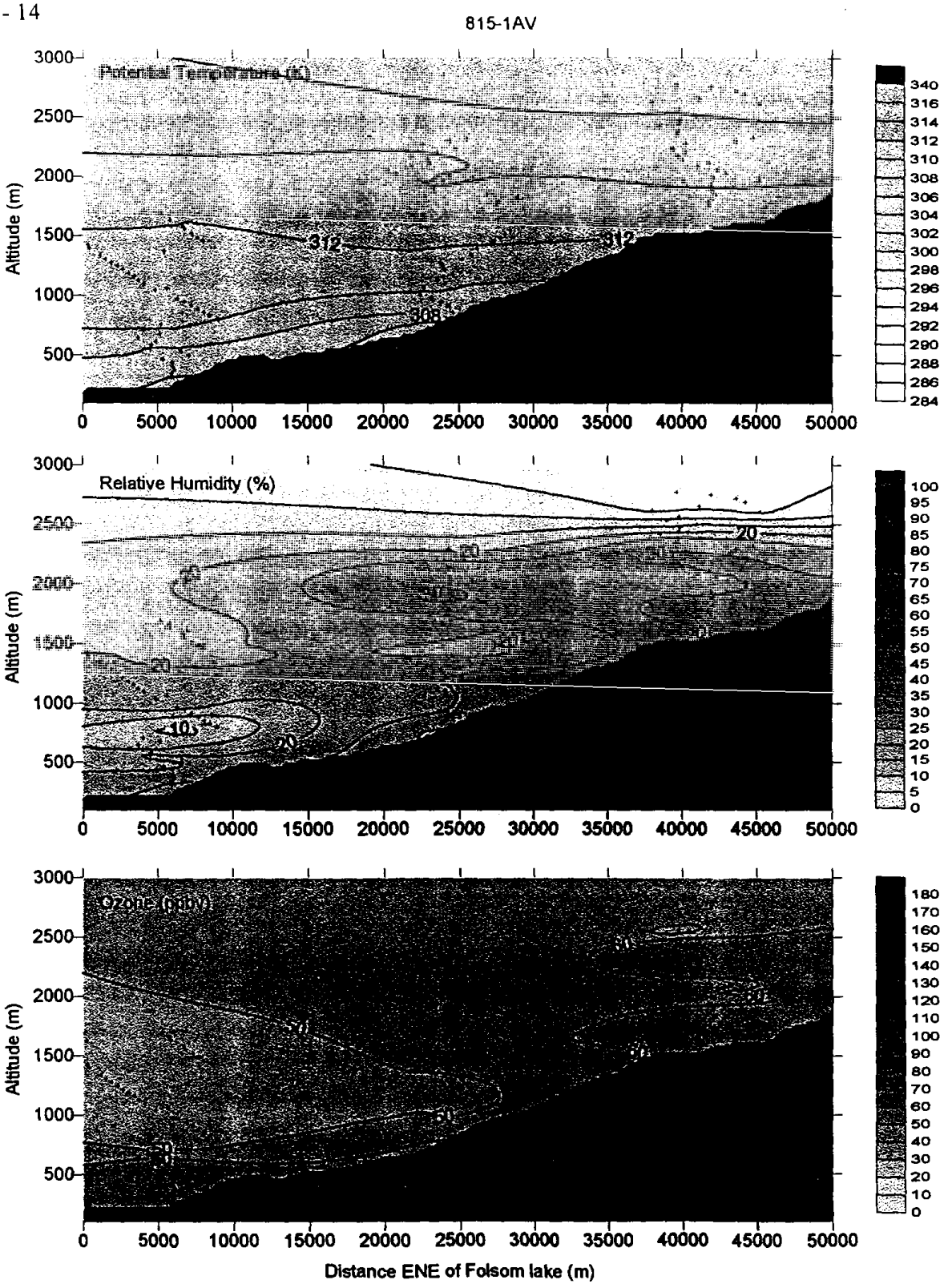


Figure G-6d: Vertical east-west cross sections for flight 1 on 8-15-96.

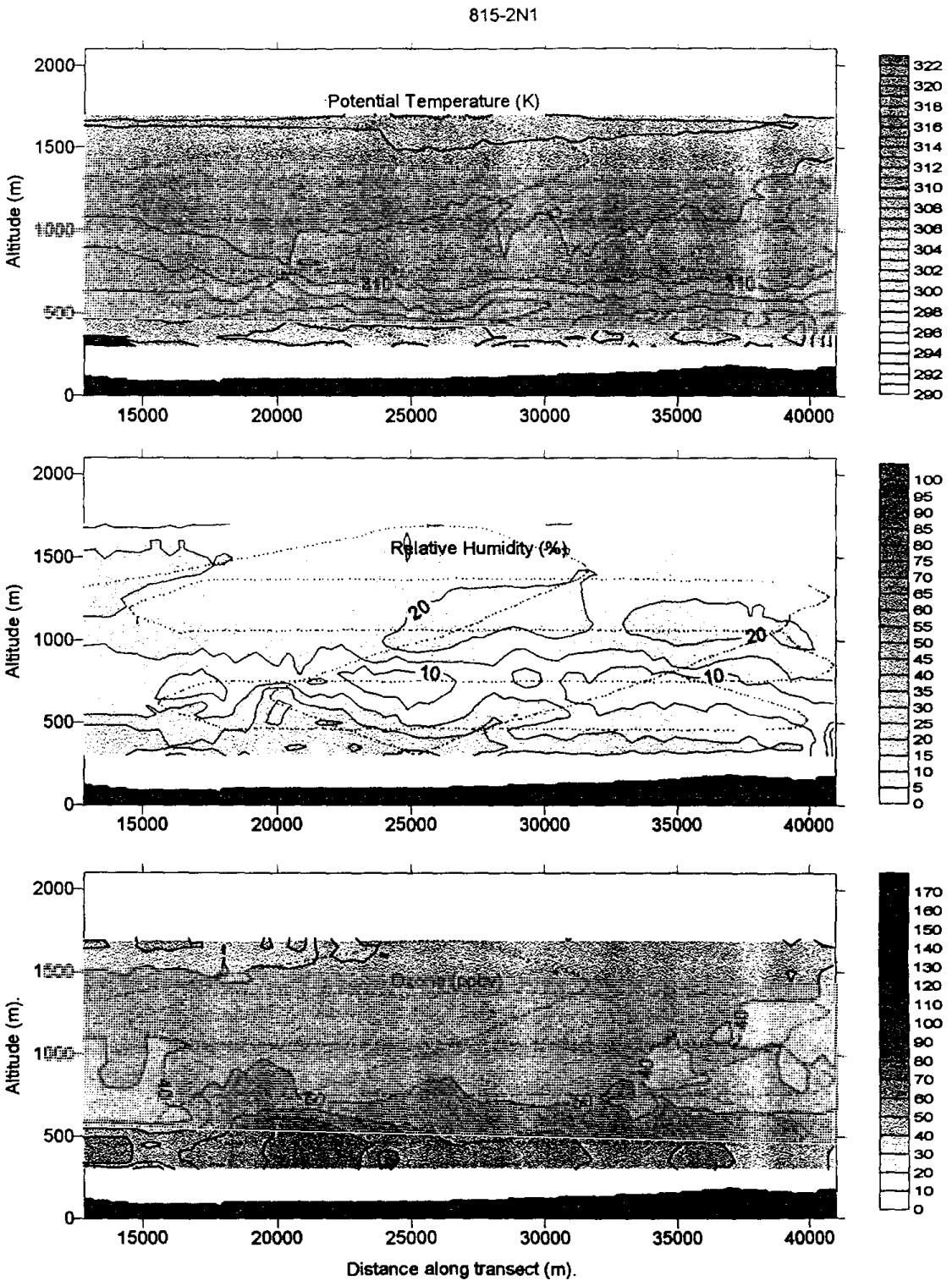


Figure G-7a: Vertical cross sections for flight 2 at S1 on 8-15-96.

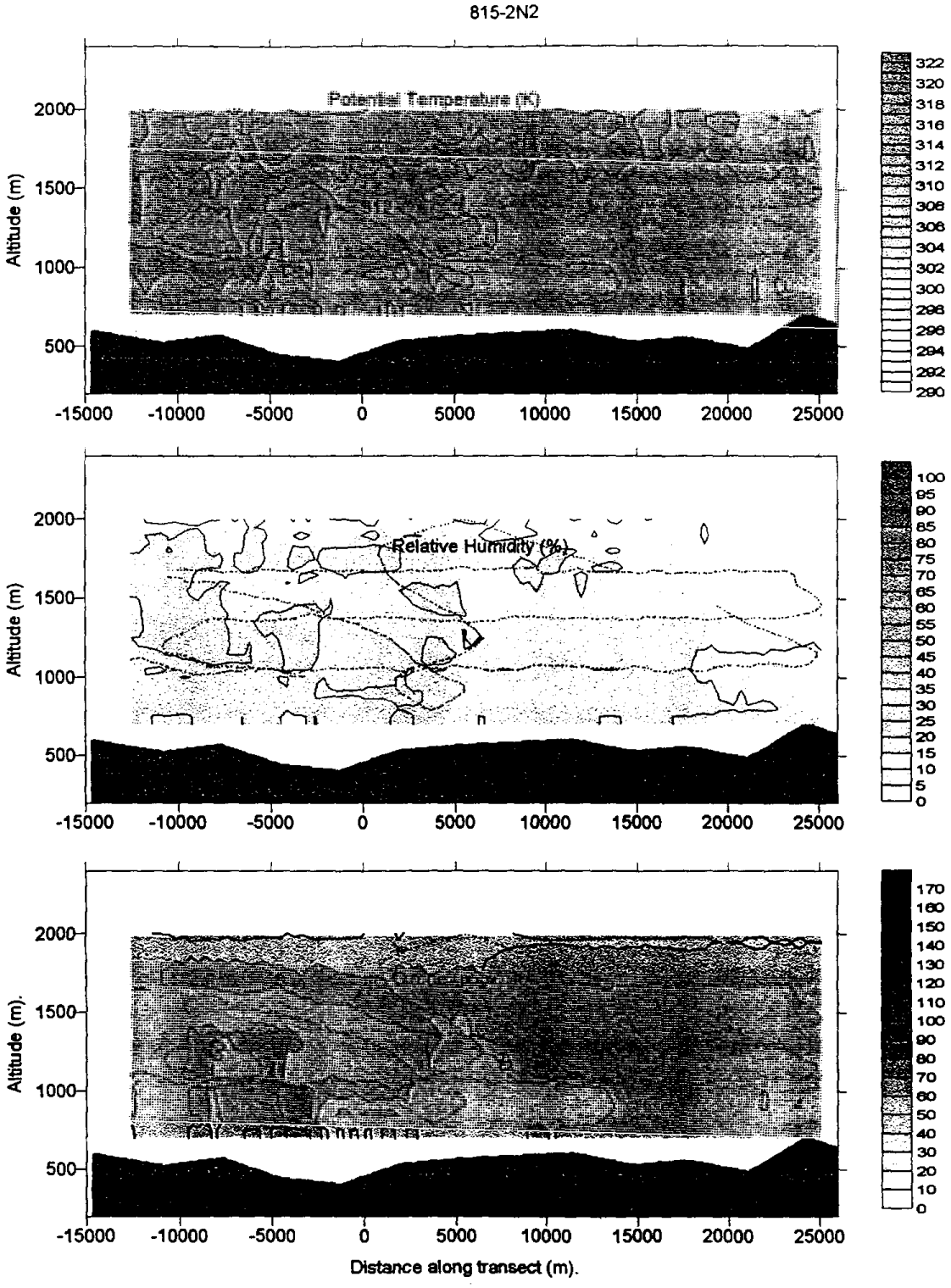


Figure G-7b: Vertical cross sections for flight 2 at S2 on 8-15-96.

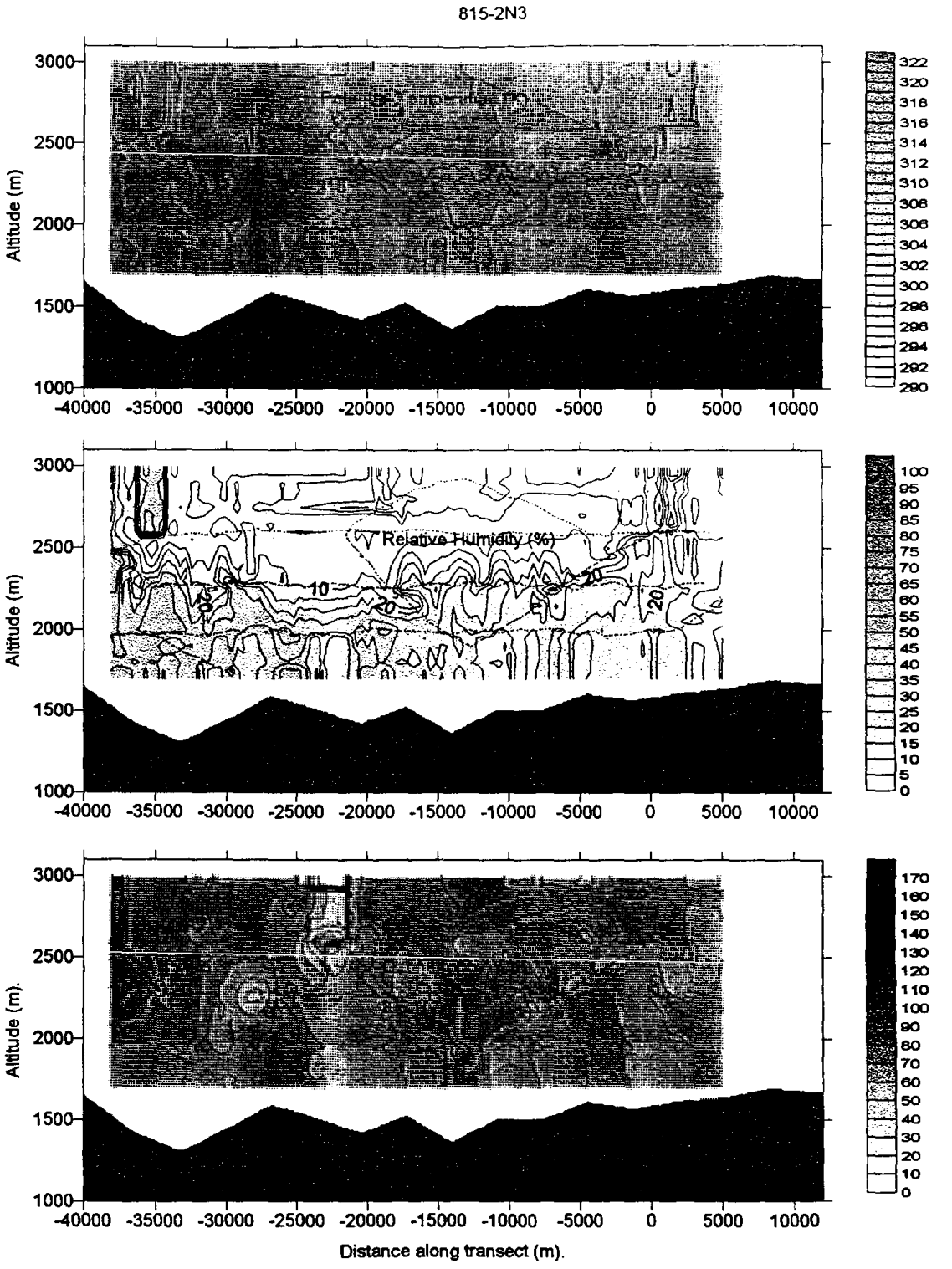


Figure G-7c: Vertical cross sections for flight 2 at S3 on 8-15-96.

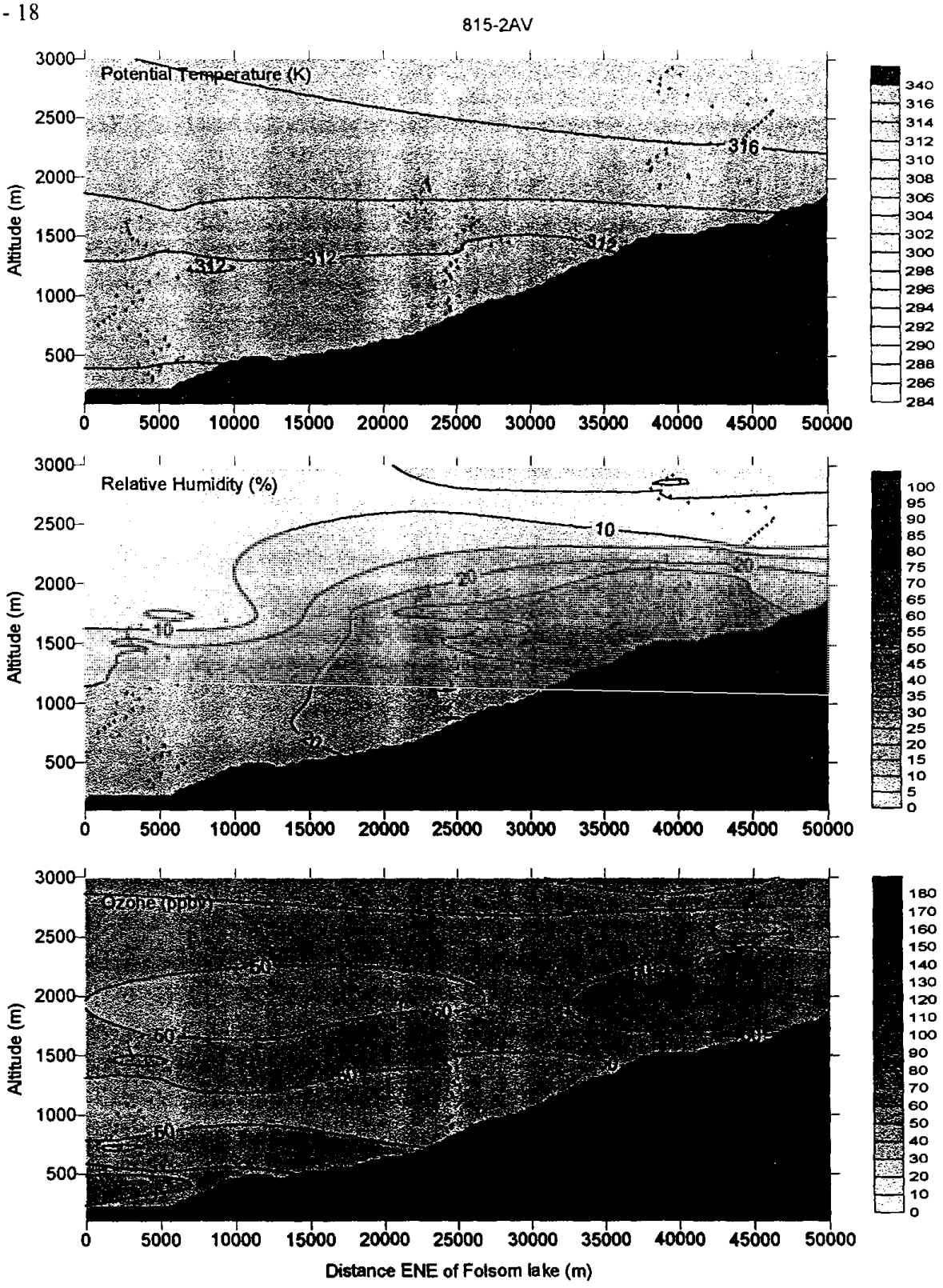


Figure G-7d: Vertical east-west cross sections for flight 2 on 8-15-96.

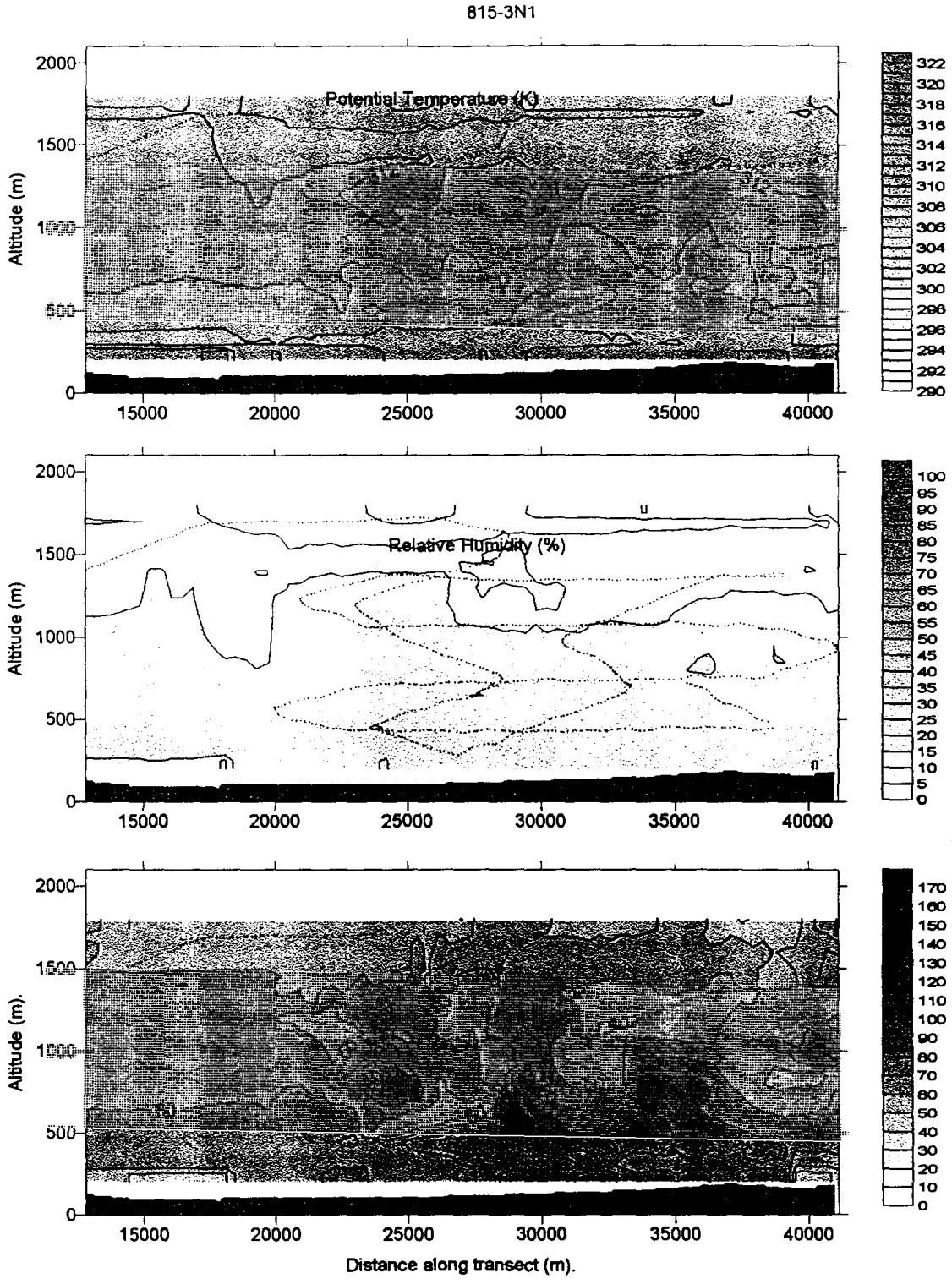


Figure G-8a: Vertical cross sections for flight 3 at S1 on 8-15-96.

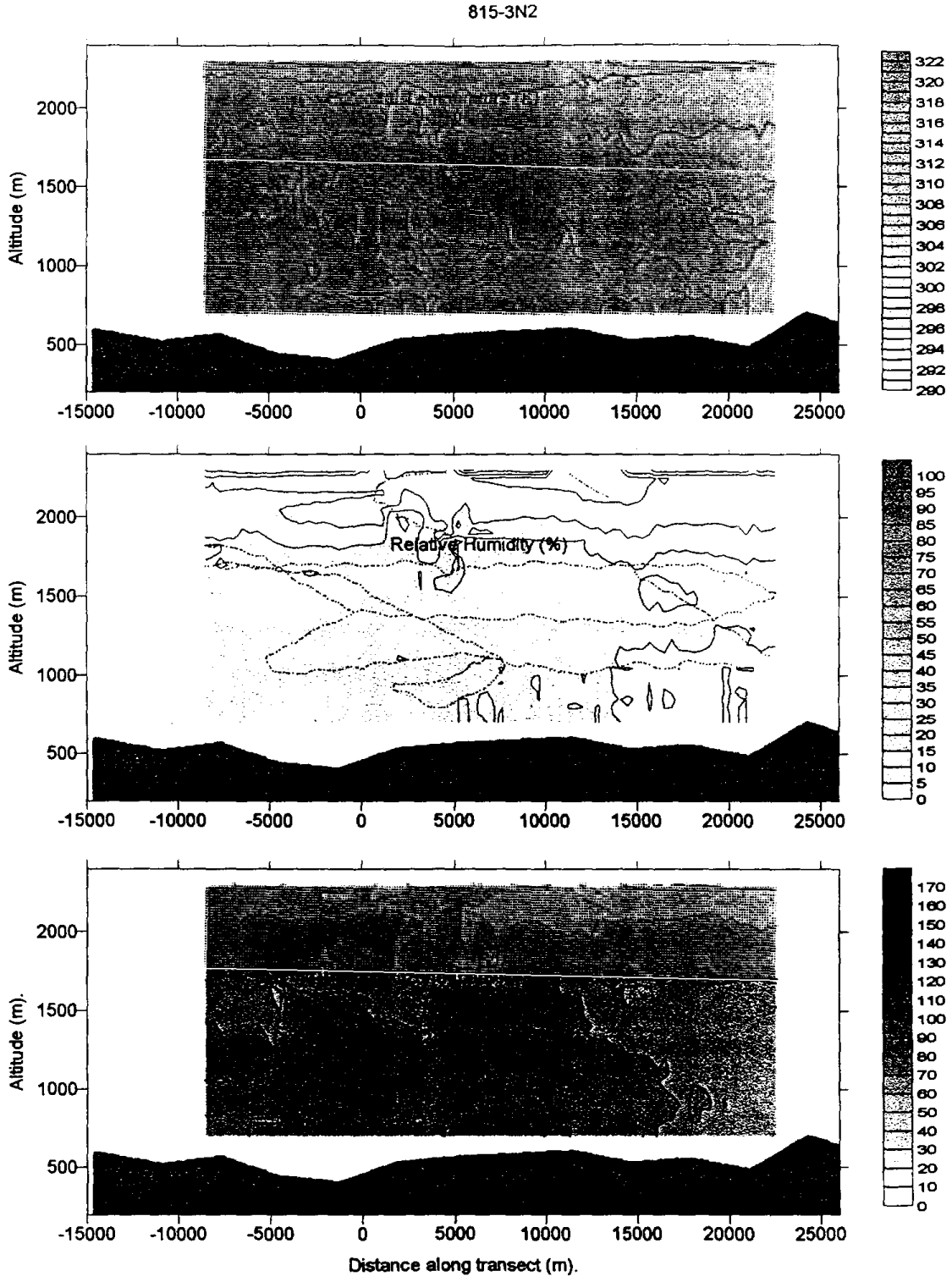


Figure G-8b: Vertical cross sections for flight 3 at S2 on 8-15-96.

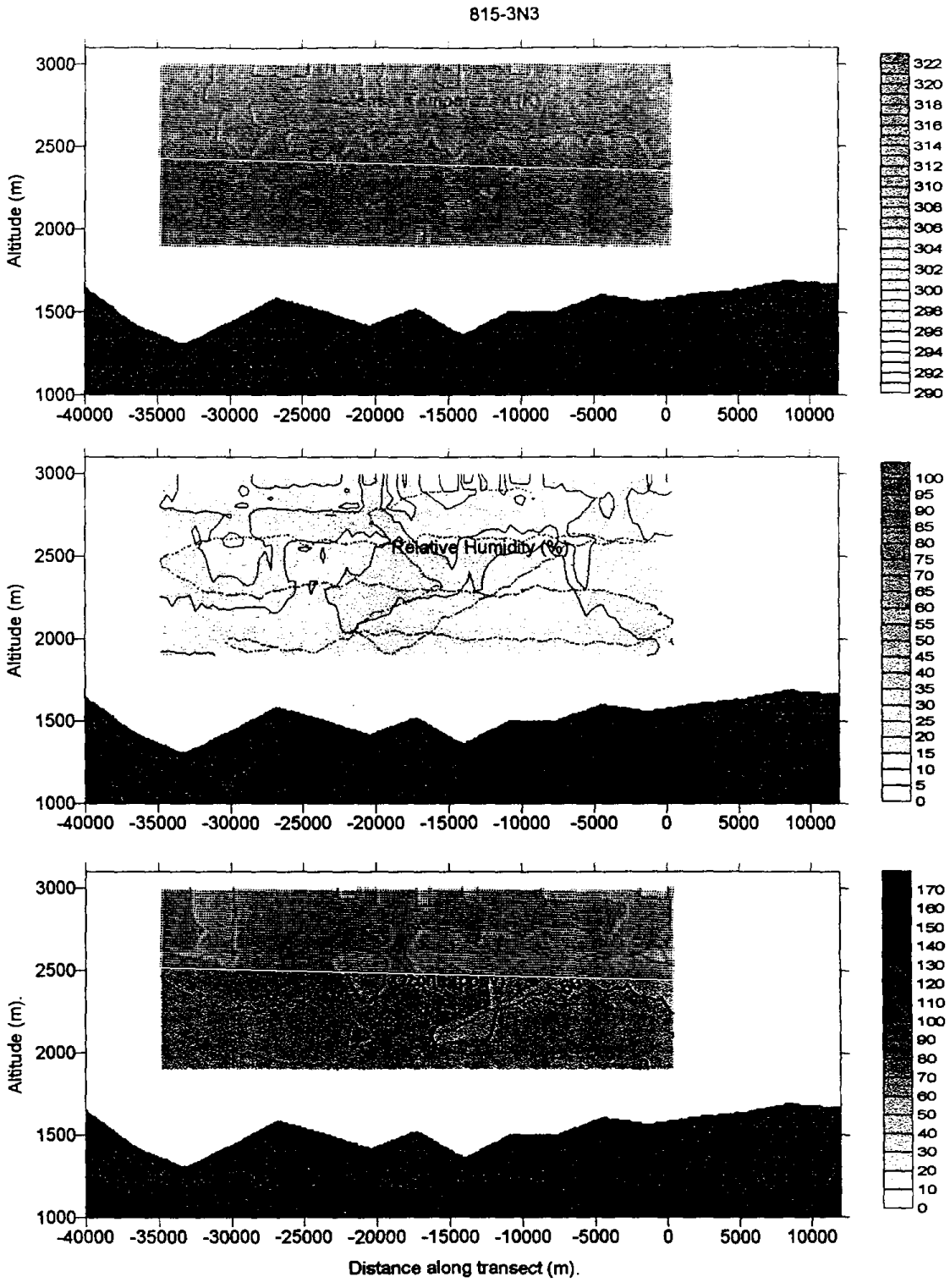


Figure G-8c: Vertical cross sections for flight 3 at S3 on 8-15-96.

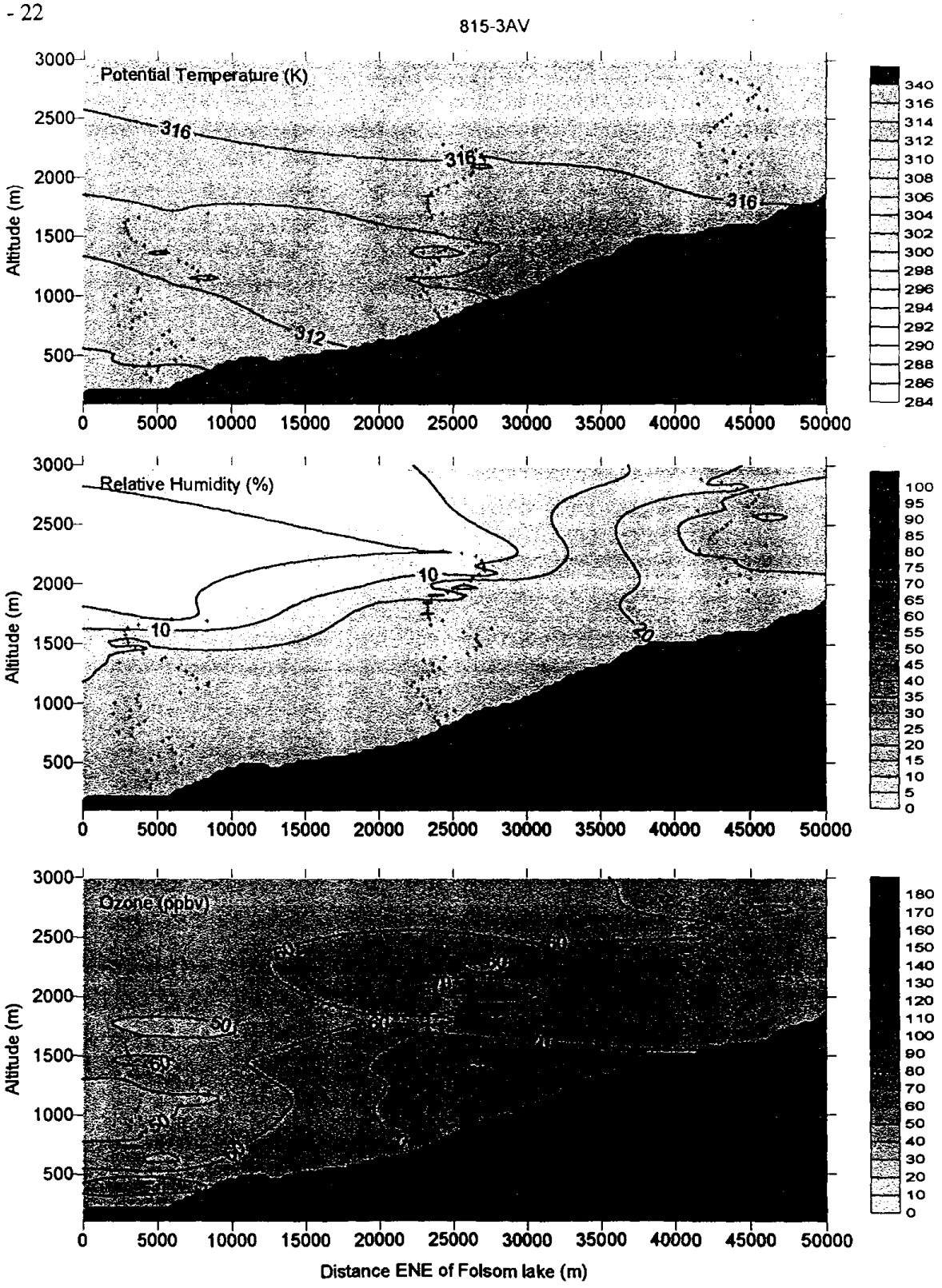


Figure G-8d: Vertical east-west cross sections for flight 3 on 8-15-96.

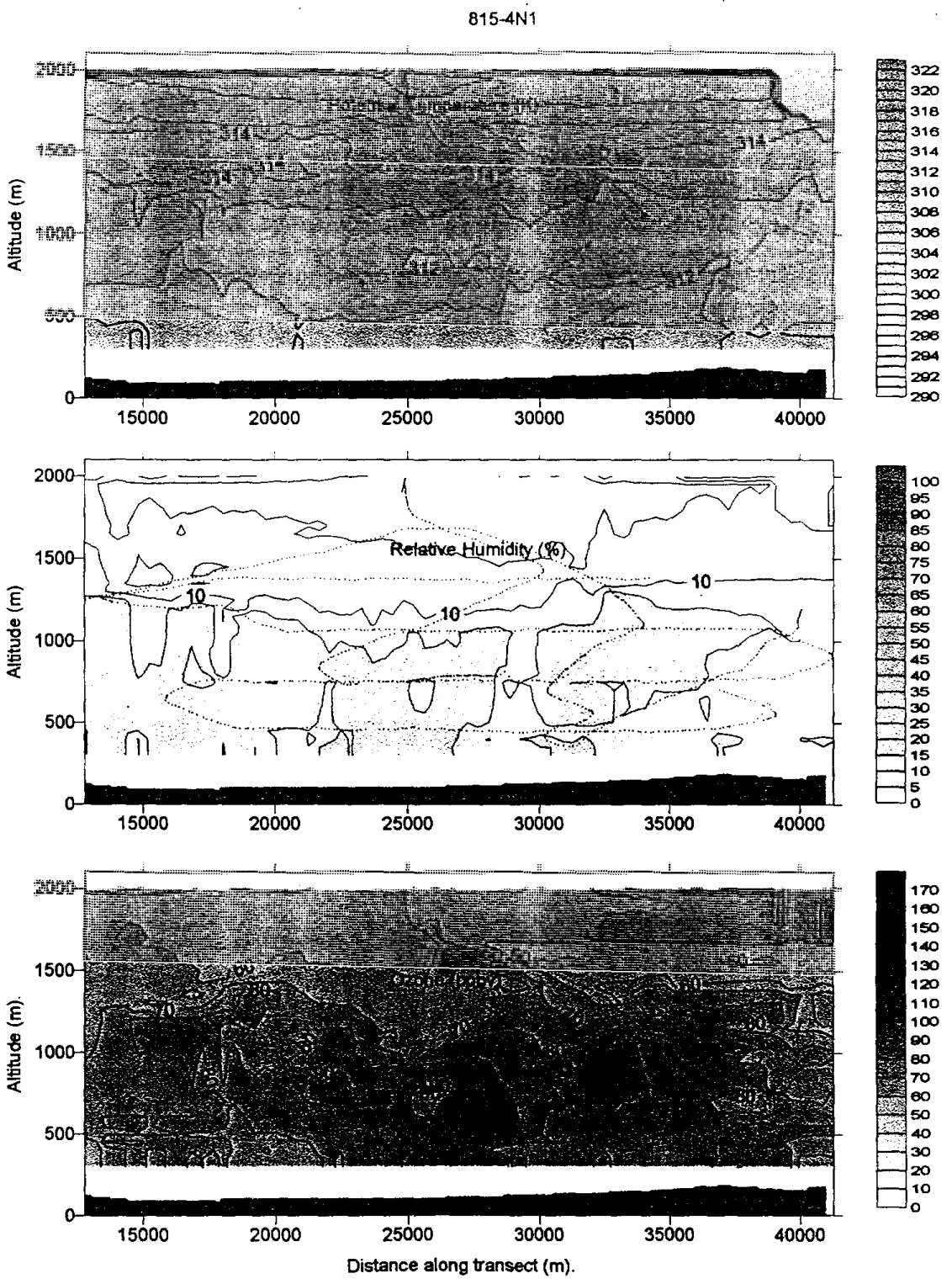


Figure G-9a: Vertical cross sections for flight 4 at S1 on 8-15-96.

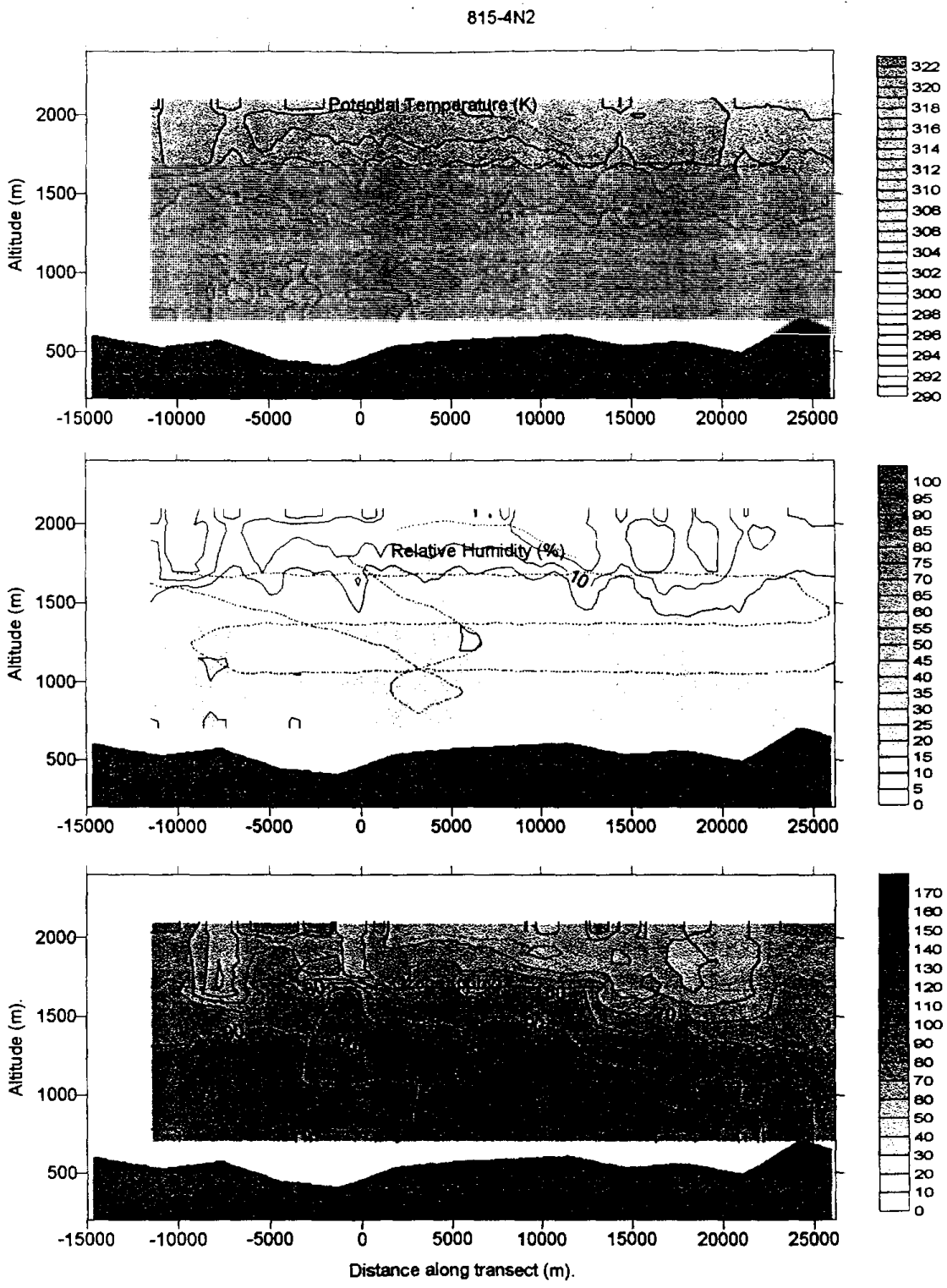


Figure G-9b: Vertical cross sections for flight 4 at S2 on 8-15-96.