19980829I1 LPS

E.2 Lead Project Scientist (On-Board)

E.2.1 Preflight

JM 1. Participate in general mission briefing.

JM 2. Determine specific mission and flight requirements for assigned aircraft.

JM 3. Determine from CARCAH or field program director whether aircraft has operational fix responsibility and discuss with AOC flight director/meteorologist and CARCAH unless briefed otherwise by field program director.

JM 4. Contact HRD members of crew to:

   a. Assure availability for mission.
   b. Arrange ground transportation schedule when deployed.
   c. Determine equipment status.

JM 5. Meet with AOC flight crew at least 90 minutes before takeoff, provide copies of flight requirements, and provide a formal briefing for the flight director, navigator, and pilots.

JM 6. Report status of aircraft, systems, necessary on-board supplies and crews to appropriate HRD operations center (MGOC in Miami or FGOC at remote recovery location).

E.2.2 In-Flight

JM 1. Confirm from AOC flight director that satellite data link is operative (information).

JM 2. Confirm camera mode of operation.

JM 3. Confirm data recording rate.

JM 4. Complete Form E-2.

E.2.3 Postflight

JM 1. Debrief scientific crew.

____ 2. Report landing time, aircraft, crew, and mission status along with supplies (tapes, *etc.*) remaining aboard the aircraft to the appropriate HRD operations center (MGOC or FGOC).

____ 3. Gather completed forms for mission and turn in at the appropriate operations center. [Note: all data removed from the aircraft by HRD personnel should be cleared with the AOC flight director.]

____ 4. Obtain a copy of the 10-s flight listing from the AOC flight director. Turn in with completed forms.

____ 5. Determine next mission status, if any, and brief crews as necessary.

____ 6. Notify the appropriate operations center (FGOC or MGOC) as to where you can be contacted and arrange for any further coordination required.

____ 7. Prepare written mission summary.

On-Board Lead Project Scientist Check List

Date 29 August 1998 Aircraft 43RF Flight ID 980829I

A. Participants:

HRD		AOC	
Function	Participant	Function	Participant
Lead Project Scientist	Marks	Flight Director	Parrish
Cloud Physics /Dropsonde	Landsea	Pilots McKim	Kemul/Taggert
Radar	Dorst	Navigator	Kozak
Workstation	Leighton	Systems Engineer	Goldstein
Photographer/Observer		Data Technician	Lynch
Omegasonde	Alverson	Electronics Technician	Dale Carpenter
AXBT/AXCP/Guest	Hildebrand	Other	

Take-Off: KOPF Location: 25°54.6 80°16.5"

Landing: KOPF Location: " "

Number of Eye Penetrations: 6

B. Past and Forecast Storm Locations:

Date/Time	Latitude	Longitude	MSLP	Maximum Wind
29/00Z	25.5	71.0	980	85 Kts

C. Mission Briefing:

VME p. ~~19~~ HFP 43RF is the high plane.

D. Equipment Status (Up, Down, Not Available, Not Used)

Equipment	Pre-Flight	In-Flight	Post-Flight	# used
Aircraft	✓	✓	✓	
Radar/LF	✓	✓		2 Dats
Radar/TA (Doppler)	✓	✓		
Cloud Physics	✓	✓		2 Dats
Data System	✓	✓		1 Dat
drop Omegasondes	✓	✓		38/37 ok
AXBT/AXCP	✓	✓		15/13 ok
Workstation	✓	✓		
Videography	✓	✓		4 video tapes

REMARKS:
- 2D-P was crapped out most of flight
- 2D-C was very noisy.
- Radar system had one crash N of G 160 nm out with no loss of data needed for analysis.
- 2 failed AXBT's; one # signal, 1 no launch
- 1 Total failure on GPS sondes 3-4 partial winds

E. (I) **Proposed Flight Pattern** (sketch or designate by number)

see attached flight plan

E. (II) **Actual Flight Pattern**

as briefed

start leg #1
202900 - 2054
start leg #2 2107 - 2130

1

Lead Project Scientist Event Log

Date 29 August 1998 Flight 980829I LPS Marks

Time	Event	Position	Comments
182014	TO	KOPF	
1858		25°4.2" 77°34'	radio check with John
1946		23°57" 73°59"	ER-2 abort
1956		23°31' 72°54'	pass 42RF est. 25°30" 70°50"
2003	IP	23°13.8" 72°20"	orbit wait for 42RF
2008	42RF at IP		
200845	Drop #1	23°17" 72°11."	start pattern AXBT #1 SST 28.2°
201244	Drop #2	23°35" 72°1.3"	Drop #2
201835	Drop #3	24°03 71°48.1	Drop #3 AXBT #2 27.0°
202500	Drop #4	24°28" 71°33.6	
202920	Drop #5 2		descend to 16 kft PATA cont. AXBT #3 SST 27.2°
204238	9	25°41" 70°53'	42 2044z 25°44" 70°52"
205426	Drop #6	26°26' 70°29.6"	TK 240 to pt 4 IA F/AST
210720	Drop #7	26°06.2" 71°41.8"	TK 120
211820	9 Drop	25°42" 71°W	eye drop 25.71 70.93 180/40 990mb
212230		25°25" 70°31.6"	heavy heavy rain !!!
213020	Drop #8 5	25°9.5" 70°42.6"	AXBT #4 SST 27.3°C
213855	Drop #9	24°38" 70°0.1"	
214630	Drop #10	24°10" 69°56"	AXBT #5 SST 27.2°C
215307	Drop #11	23°34" 69°52.8"	
215950	Drop #12 6	23°12" 69°50.1"	AXBT #6 SST 25.7°C EVTD looks

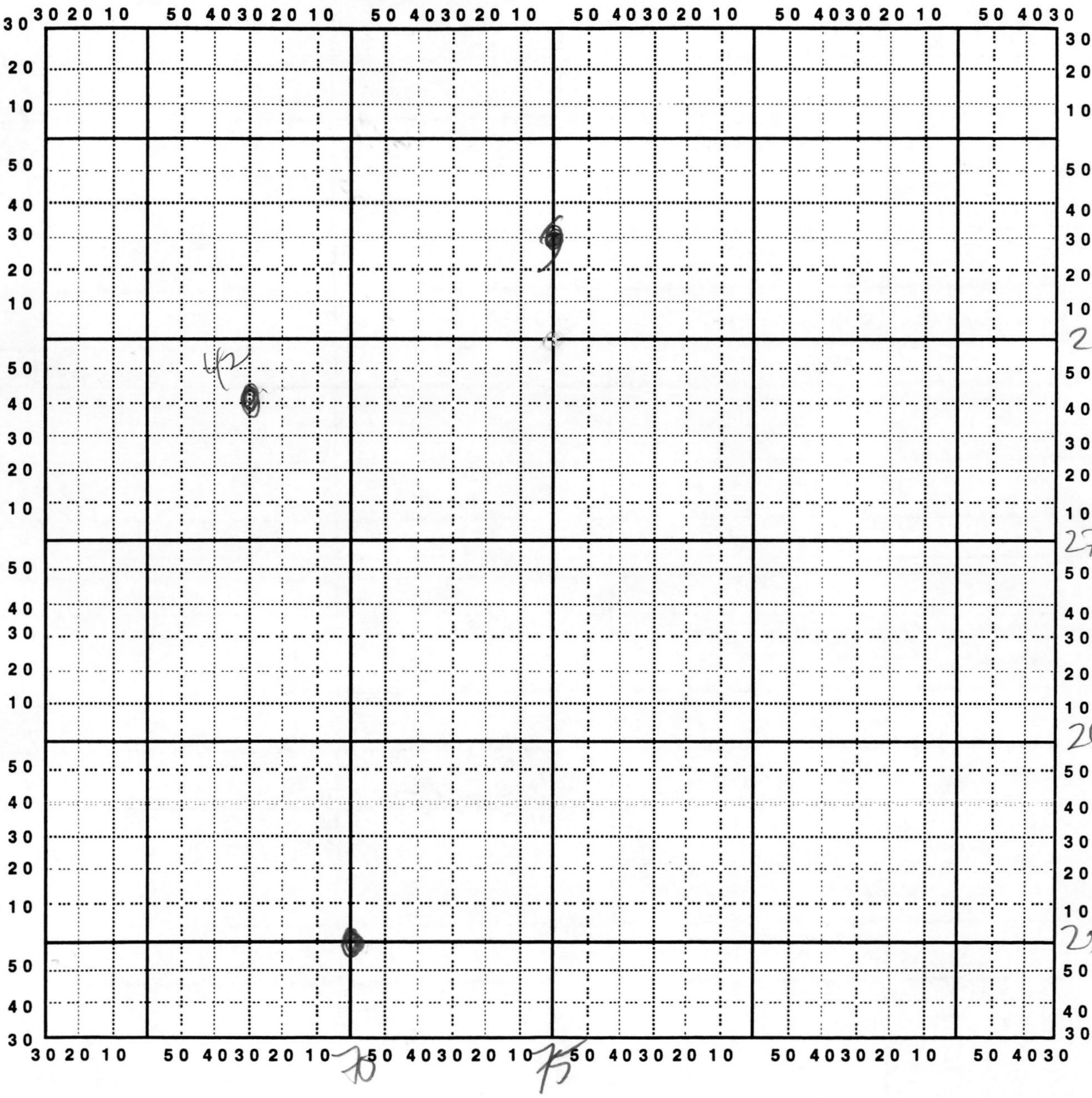
real interesting
good verti coverage but no
strong winds above 1km

1

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date 29 August 1998 Flight ID 980829I LPS Marks.



Note : Label full degrees according to location of the flight area.

precip probe is crapped out

red diamond is 1km on hodo

25° 45"
71 05" 42RF (2)
2219

Lead Project Scientist Event Log

Date 980824I **Flight** 29August 1998 **LPS** Marks

start leg#3 2252 — 2310 leg#4 2325-

Time	Event	Position	Comments
222955	P47 Drop# 13	25° 44.1" 68° 34.9"	AXBT #7 SST 28.3°
223645	Drop#14	25° 44.5" 69° 06.2"	
224320	Drop#15	25° 45" 69° 35"	AXBT #8 bad
badsonde 224738	Drop#16	25° 45.4" 70° 01"	descend to 16kft PA
225112			AXBT#9 → 26.3° SST
225149	(8) Drop#17	25° 45.8" 70° 27.8"	at 16kft TK FAST 270 TO dual PRF 1600/1066
230125	G	25° 47" 71° 13"	42RF 2258 25°31" 71°12"
231232	(9) Drop#18	25° 40 72° 05"	going downwind along
		(2318 cross band)	big band on W of G
232245	(10) Drop#19	25° 1.0" 71° 19.4"	precip probe dropped out
2334	G	25° 49" 71° 18"	pass E of G
234415	(11) Drop#20	26° 37.5 71° 15.1"	AXBT#10 → SST 26.2C 2337 25°57" N42G 71°19"
235317	Drop 21	27° 11.5" 70° 47.7	
235730	Drop 22	27° 28.6" 70° 34.3"	AXBT #11 → 28.2 SST
000558	Drop 23	27° 59.4" 70° 06"	
001137	(12) Drop 24	28° 19.8" 69° 58"	AXBT #12 → 28.5 SST
004315	(13) Drop 25	28° 16.7" 72° 59.3"	0011 radar down Terry resetting TK down
			radar up 0035 AXBT #13 → 26.1°C
004830	Drop 26	27° 44" 72° 47.4"	
005415	Drop 27	27° 19.4" 72° 31.6"	AXBT #14 → 26.9° SST
010040	Drop 28	26° 51" 72° 14"	descend to 16kft just inside convective line

Teal 29 G 2323Z 25°51" 71°17" 986 ext. 68kt.

TOMORROW

43 IP 27.7N 76.5°W

42 IP 25 76°W

TO ~~1730Z~~ 19Z

5

Lead Project Scientist Event Log

Date 29 August 1998 Flight 980824I LPS Marks

Time	Event	Position	Comments

0115 NOAA 42 in eye 25 58 71 30
011529 NOAA 43 in eye 25 54 71 25
0114 NASA 817 in eye
0112 TEAL29 in eye 25°57" 71°30" 988 mb

38
25
36

Lead Project Scientist Event Log

Date 29 August 1998 **Flight** 980829I **LPS** Marks

Leg 5 0105—012430 Leg 6 0141 – 0201

Time	Event	Position	Comments
010500	Drop 29 (14)	26° 32.9 72° 32"	at 16 kft TKSE to eye
011529	eye	25° 54" 71° 25"	4-plane stack in eye
			0118 enter SE eyewall
012639	Drop 30 (15)	25° 19" 70° 54"	TK015 in SE rainbands
014022	Drop 31 (16)	26° 23" 70° 47"	lots of scatterers
015026	eye	26° 03.6 71° 30.9"	eye 0147 (42) 26° 04" 71° 33"
			eye forming up
020218	Drop 32 (17)		50 nm WSW of eye depart climb to 23 kft.
020838	Drop 33	25° 41" 72° 56.1"	
021545	Drop 34	25° 46.8" 73° 31.6"	(AXBT #15 failed) no launch; in big band
022145	Drop 35	25° 51.7" 74° 03.6"	lots of scatterers 022050
022735	Drop 36 (18)	25° 56.7 74° 34.7"	end pattern; lots of cowtetel growth on TA
032926	land KOPF		

28.5 150 nm
75.0 circle

38 Drops
36 pattern + 2 eye
(1 failure)
4 partial failure

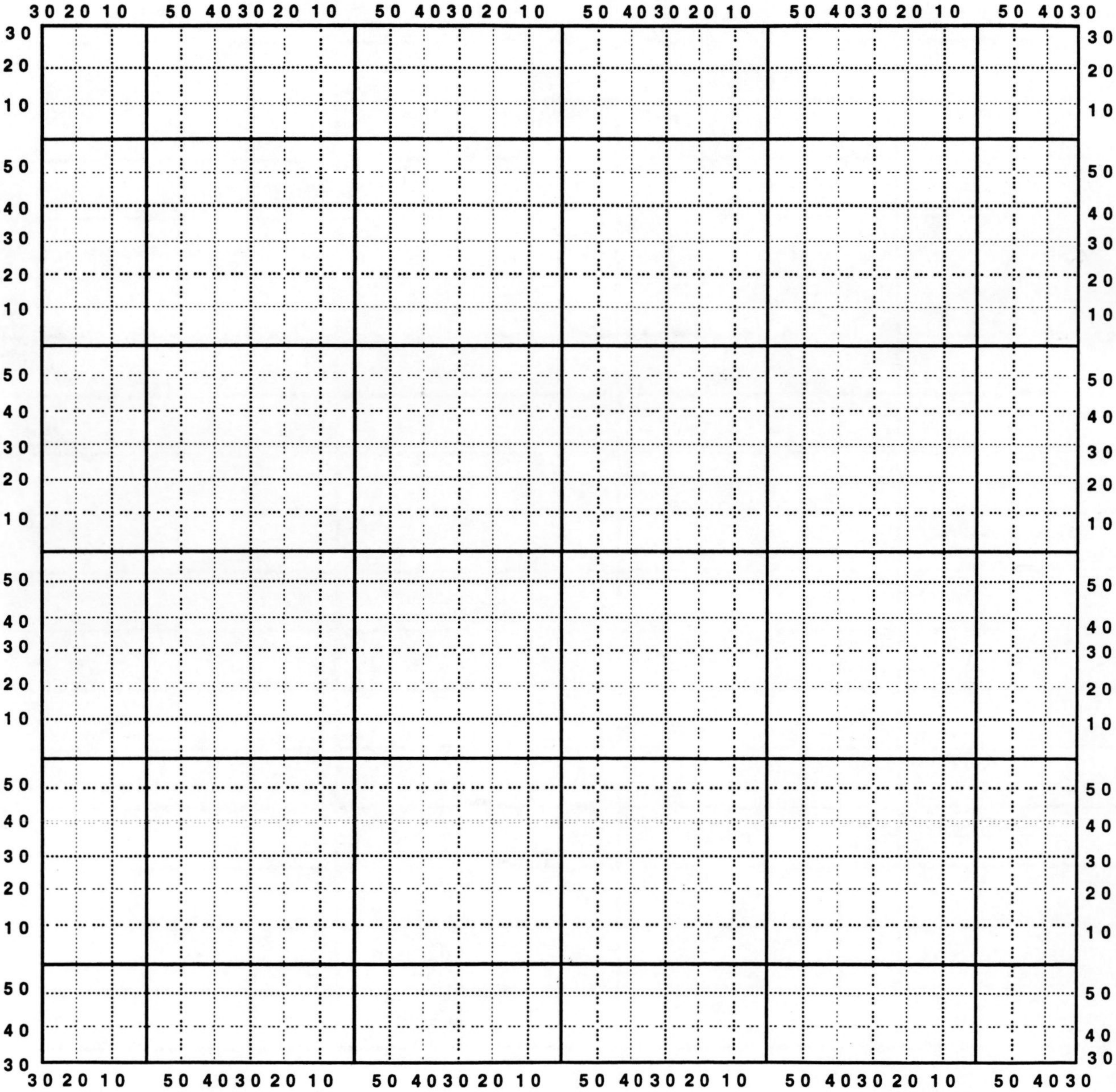
15 AXBT's (2 failed)

1

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date 29 August 1998 Flight ID 980829I LPS Marks.



Note : Label full degrees according to location of the flight area.

Mission Summary
<u>Danielle</u>
980829I Aircraft 43RF

<u>Scientific Crew (43RF)</u>

Lead Project Scientist	Frank Marks
Radar Scientist	Neal Dorst
Cloud Physics Scientist	Chris Landsea
Dropwindsonde Scientist	Sim Aberson
WARDS Scientist	Peter Hildebrand
Workstation Scientist	Paul Leighton

Mission Briefing:

At 2000 UTC on 29 August Hurricane Danielle was projected to be a 25.5 N and 71 W, moving WNW at 11 kts. We briefed the N43RF crew for the Vortex Motion and Evolution Experiment (p. 19 in HFP) with a take off at 1800 UTC from Opa Locka in Miami. The initial point (IP) in the pattern was 160 nm SSW of the center. Flight-level was planned to start at 18,000 ft outside 50 nm radius from the center, climbing as high as possible throughout the mission. Inside 50 nm radius flight level would be 16,000 ft to avoid p-static effecting the GPS-sonde antenna.

Mission Synopsis::

Take off occurred at 1820 UTC and we proceeded to the IP (2005 UTC). Radar revealed that Danielle was trying to form an eyewall with a radius of 25 nm. The developing eyewall was on the SE corner of a large hook shaped principal rainband curving around the center from 200 nm SE of the center through 150 nm N of the center to 50 nm NW of the center. The principal band contained active convective cells all along its length. Initially, the eyewall was characterized by an opening to the NW, with a large anvil over the inner 50 nm radius. Scatterers were confined to the convection SW, S, SE, and E of the center at all levels and at low and high levels to the NW. During the mission the NE corner of the developing eyewall slowly wrapped around the center, and by the last pass through the center convection was growing all around the center.

The first coordinated dual-Doppler pattern was from 2029-2130 UTC. N43RF ran the Doppler radar with single PRF (1600) scanning perpendicular to the track on all of the radial legs to produce an EVTD analysis, while N42RF ran the Doppler radar in dual-PRF (2100/1400) and F/AST on all legs. The EVTD was completed showing over 80 kt winds at 1 km in the NW side of the storm and transmitted for the first time back to NHC (it was received and given to the hurricane specialist). The center at 1 km altitude was found WNW of the flight level center at 16,000 ft. Peak winds of 70 kts were found at flight level in the SE quadrant. The EVTD-derived hodograph showed the storm was embedded in a flow with a low-level (600-850 mb) E jet with mean winds of 10 kts. The hodograph showed the winds dropped off both above and below these levels.

The second coordinated dual-Doppler pattern was from 2252-2344 UTC. On this Fig-4 N42RF ran their Doppler radar with single PRF (1600) scanning perpendicular to the track on all of the radial legs to produce an EVTD analysis, while N43RF ran the Doppler radar in dual-PRF (1600/1050) and F/AST on all legs. N42RF ran an EVTD and successfully transmitted their first analysis to NHC. Again the center at the surface was found WNW of the flight-level center at 16,000 ft. Peak winds of 70 kts were found at flight level in the SE quadrant. At the end of the outbound leg 160 nm N of the storm the radar system crashed taking 9 min to be restarted. Fortunately, very little scatterers were present in this part of the pattern and no data was lost.

The third coordinated dual-Doppler pattern was from 0105-0201 UTC. As on the last coordinated Fig-4 N42RF ran their Doppler radar with single PRF (1600) scanning perpendicular to the track on all of the radial legs to produce an EVTD analysis, while N43RF ran the Doppler radar in dual-PRF (1600/1050) and F/AST on all legs. The first leg was very well coordinated with both planes passing through the eye at the same time (visual confirmation), and 3-min after the AFRES WC-130 and 1-min after the NASA DC-8. The second leg was not as well coordinated as N42RF cut their downwind leg short to avoid intense convection, thereby getting to the center 5 min ahead of us.

AXBTs on the first leg showed peak SST 160 nm WSW of the center of 28.2°, remaining above 27° through the center to 50 nm NE of the center. The coldest SST was 25.7° 160 nm SSE of the center in the wake of both Bonnie and Danielle. SSTs in the precipitation within 100 nm E of the center were typically hovering near 26-26.5°, while SSTs 160 nm N of the center were over 28°.

We had one GPS-sonde failure out of 38 total drops on the 75 nm ring E of the center inbound to the second coordinated Fig-4. We also had one bad AXBT at the 100 nm ring on the same leg and another at the 100 nm ring W of the center.

We had 6 penetrations.

Evaluation:

Overall the experiment went very well as we completed the whole pattern as planned. With the addition of the DC-8 dropsondes from 35,000 ft in the core and the presence of the G-IV dropsondes surrounding the storm, this data set should provide an unprecedented data set to match the inner vortex onto it environment for use in studies of vortex interaction. The presence of the DC-8 dropsonde thermodynamic data will provide an excellent opportunity to derive the potential vorticity structure of the vortex. The evolution of the eyewall as it formed during the mission, combined with the missions the next day should provide an excellent opportunity to study the vortex evolution.

The coordination with N42RF was pretty good during the coordinated dual-Doppler legs in the core. We typically passed through the center within 1 min of N42RF. On the next to last leg we passed though the eye at the same time as N42RF, 2 min after the AFRES WC-130 and 1 min after the NASA DC-8. The worst coordination occurred on the last leg when N42RF crossed the eye 5 min ahead of us. The GPS sondes performed very well, with only one complete sonde failure out of 38 total drops. 3-4 other dropsondes had partial failures. The radar data system also performed well, with only one outage along the downwind leg 160 nm N of the center, where we had no scatterers. The AXBTs also worked real well with 13 good sondes out of 15 total.

Problems:

Most of the data systems worked very well. We did have a few problems:

1) 2D-P was not working for almost the whole flight. 2D-C was very noisy for most of the flight, but did seem to be getting some good images.

2) Radar system crashed at 0011 UTC and was down for 22 min while we were traversing downwind 160 nm N of the storm. However, no significant data was lost as there were few scatterers.

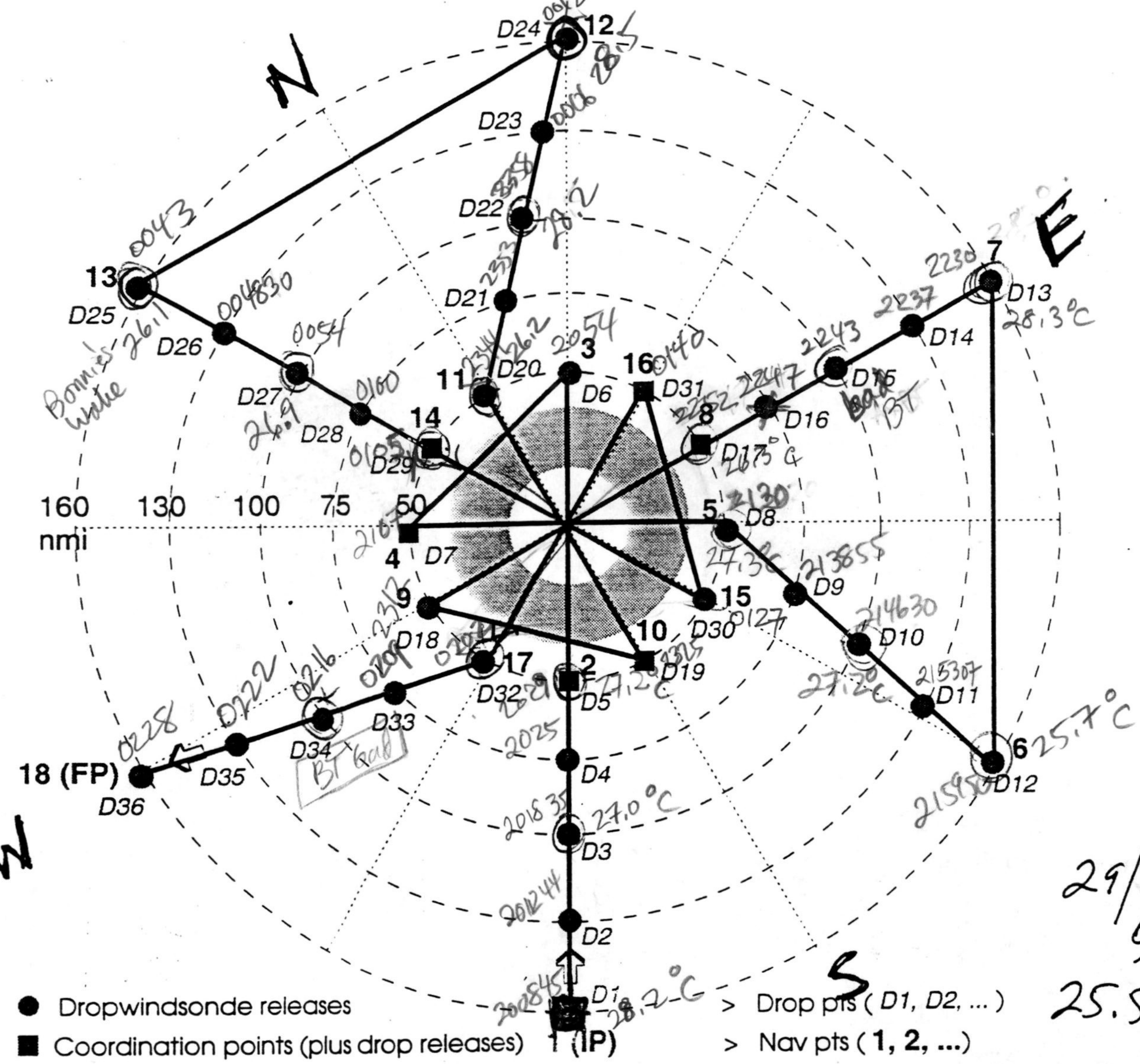
3) Two AXBTs failed: one had no launch signal and the second had no data.

4) One total failure of the GPS sondes (D16). 3-4 had partial winds in the boundary layer.

Frank Marks
3 September 1998

N43RF 15-23 Kft

VORTEX MOTION AND EVOLUTION EXPERIMENT



OAXBT

29/20Z

6

25.5, 71.c

Fig. 9. **Sample Upper Aircraft Flight Pattern**

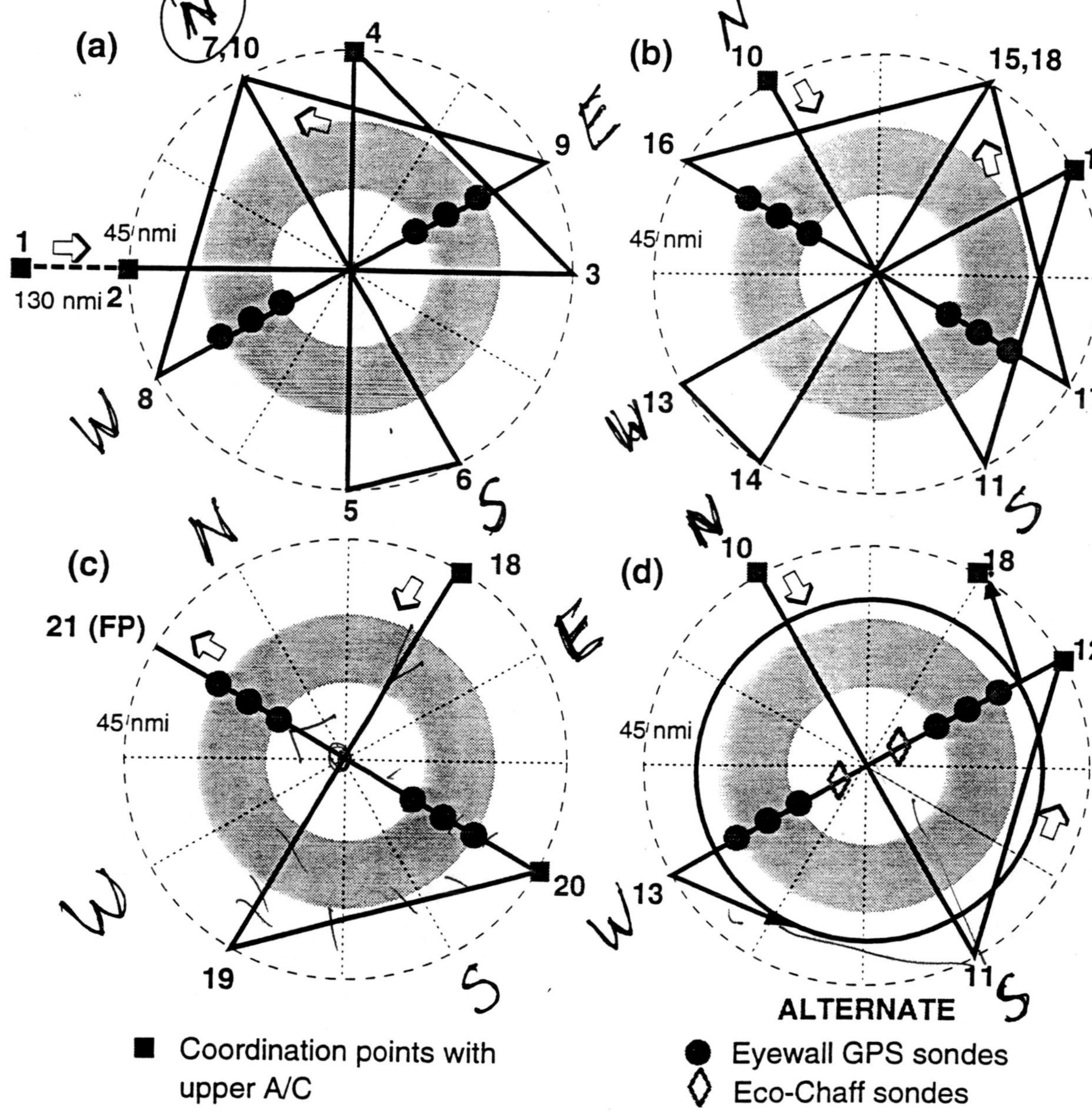
- Note 1. True airspeed calibration is required.
- Note 2. During the ferry to the **IP**, aircraft will climb to the 500 mb level (about FL 180). The 400 mb level (about FL 250) should be reached as soon as possible and maintained throughout the remainder of the pattern, unless icing or electrical conditions require a lower altitude.
- Note 3. The pattern may be entered along any compass heading. The **IP** and coordinating points (**CP**) must be reached simultaneously with the lower aircraft. The lower aircraft is responsible for ensuring that these points are reached simultaneously.
- Note 4. There are **no** scheduled drops in the eye. It may be desirable to make a drop during the second pass of each figure-4, assuming clearance from the lower aircraft and USAF reconnaissance aircraft. GPS-sonde frequencies should be coordinated with USAF aircraft. All drops are to be made after turns.
- Note 5. Airborne Doppler radar scans continuously perpendicular to the track on radial penetrations at radii<50 nmi (95 km) , and F/AST during the rest of the pattern.
- Note 6. Aircraft should not deviate from the pattern to find the wind center in the eye.

3 of 4

Teal 47 (18Z) Teal 21 (00Z)

N42RF 12Kft

VORTEX MOTION AND EVOLUTION EXPERIMENT



29/20Z

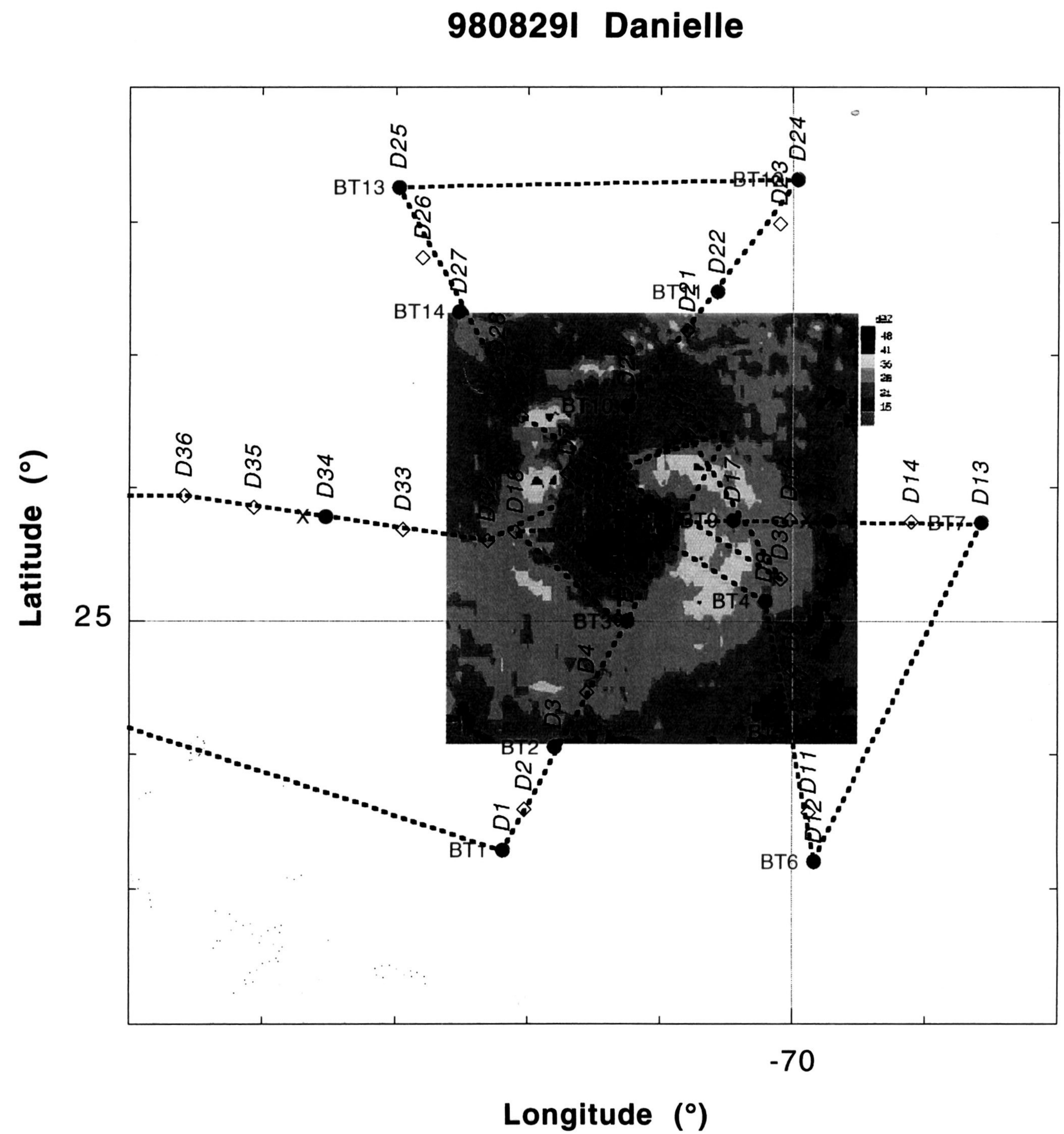
6

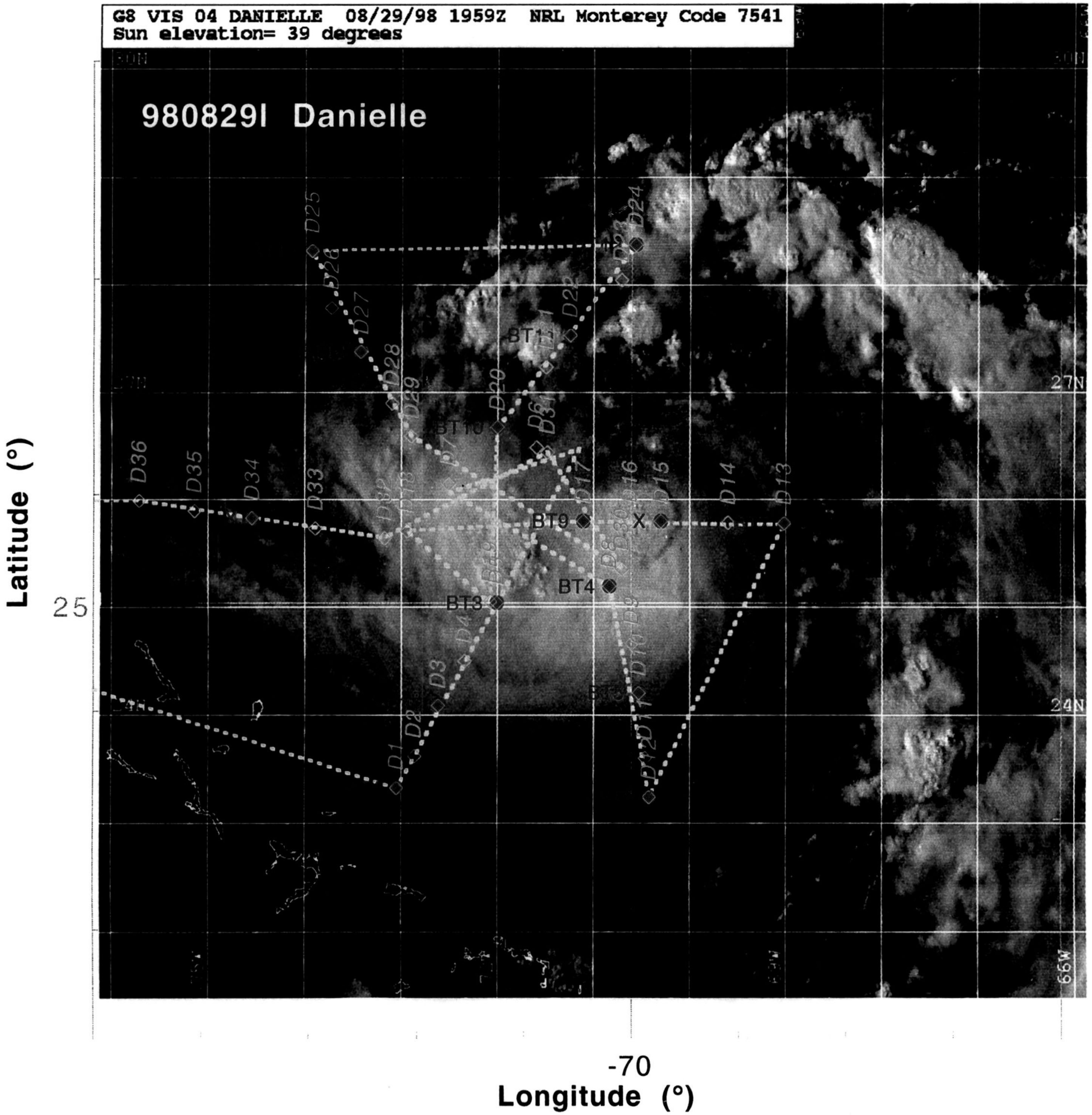
25.5 71.C

Fig. 10. Sample Lower Aircraft Flight Pattern

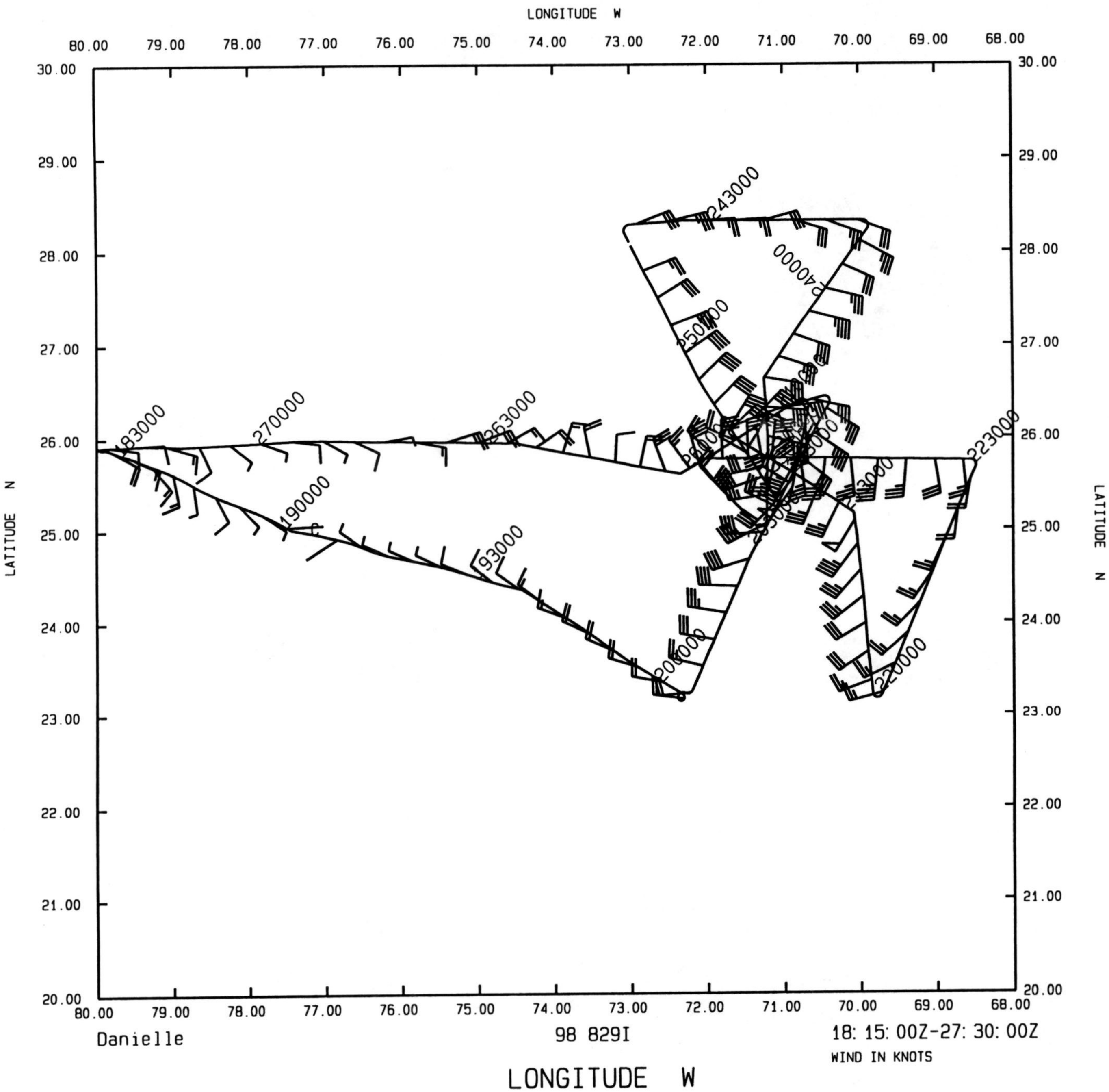
• Note 1.	True airspeed calibration is required.
• Note 2.	Unless there is a conflict with the USAF aircraft, the lower NOAA aircraft will operate at FL 100 (10,000 ft or 3 km). Eyewall drops may be required at the discretion of the lead mission scientist. As many as 3 drops per penetration, with spacing of 10-30 km, may be requested.
• Note 3.	The **IP** is at 130 nmi (240 km) radius from the storm center. The pattern may be entered at any compass heading, but will always be 90° upwind of the entry point of the upper aircraft. Radial legs are 45 nmi (83 km) long.
• Note 4.	The **IP** and coordinating points (**CP**) must be reached simultaneously with the lower aircraft. The lower aircraft is responsible for ensuring that these points are reached simultaneously.
• Note 5.	Airborne Doppler radar scans continuously perpendicular to the track on radial penetrations at radii<50 nmi (95 km) , and F/AST during the rest of the pattern.
• Note 6.	Aircraft should not deviate from the pattern to find the wind center in the eye.

2 of 4

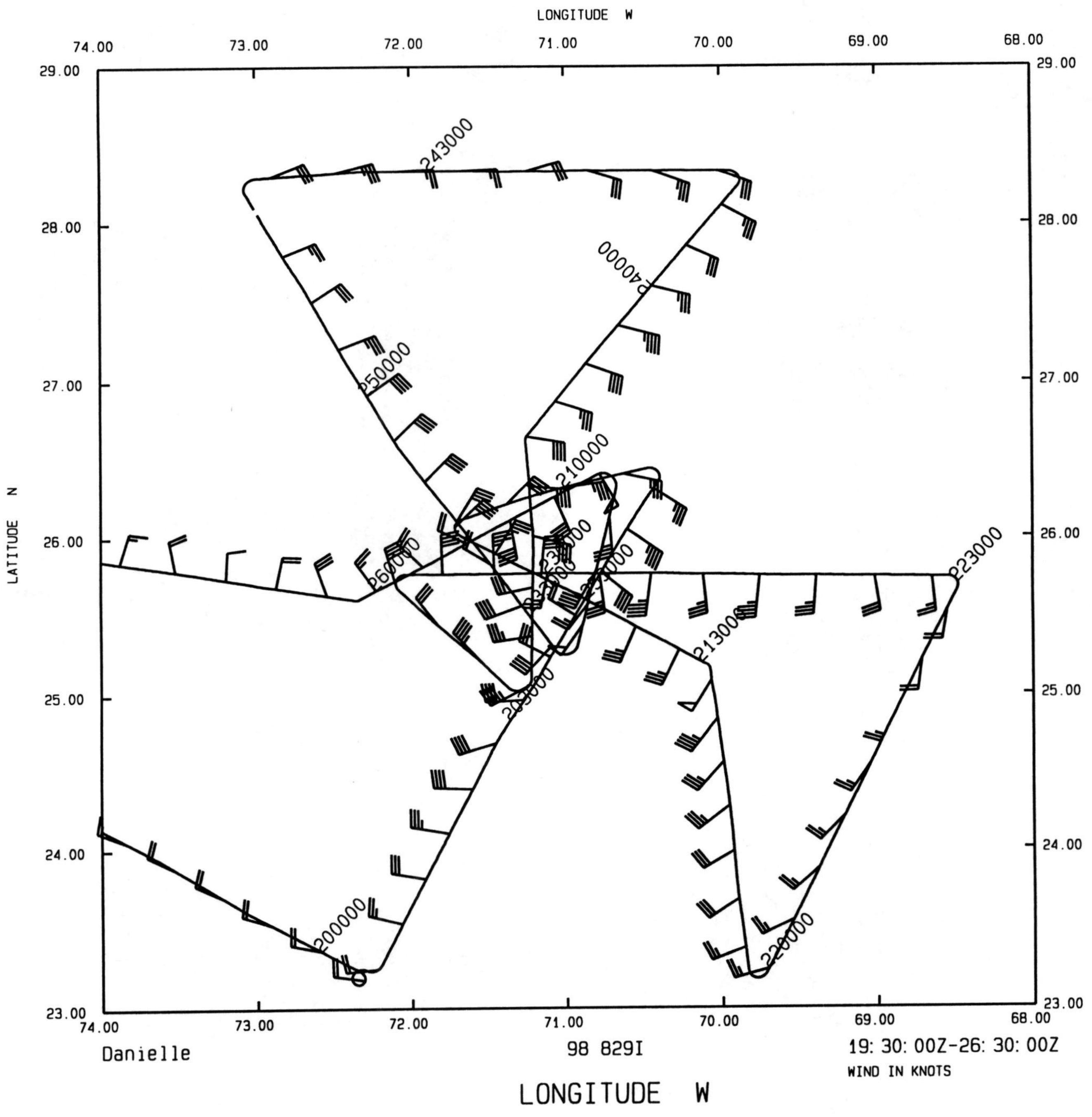

980829I Danielle
Latitude (°)
25
Longitude (°)
-70
D1
D2
D3
D4
D13
D14
D17
D22
D24
D25
D26
D27
D33
D34
D35
D36
BT1
BT2
BT4
BT6
BT7
BT13
BT14

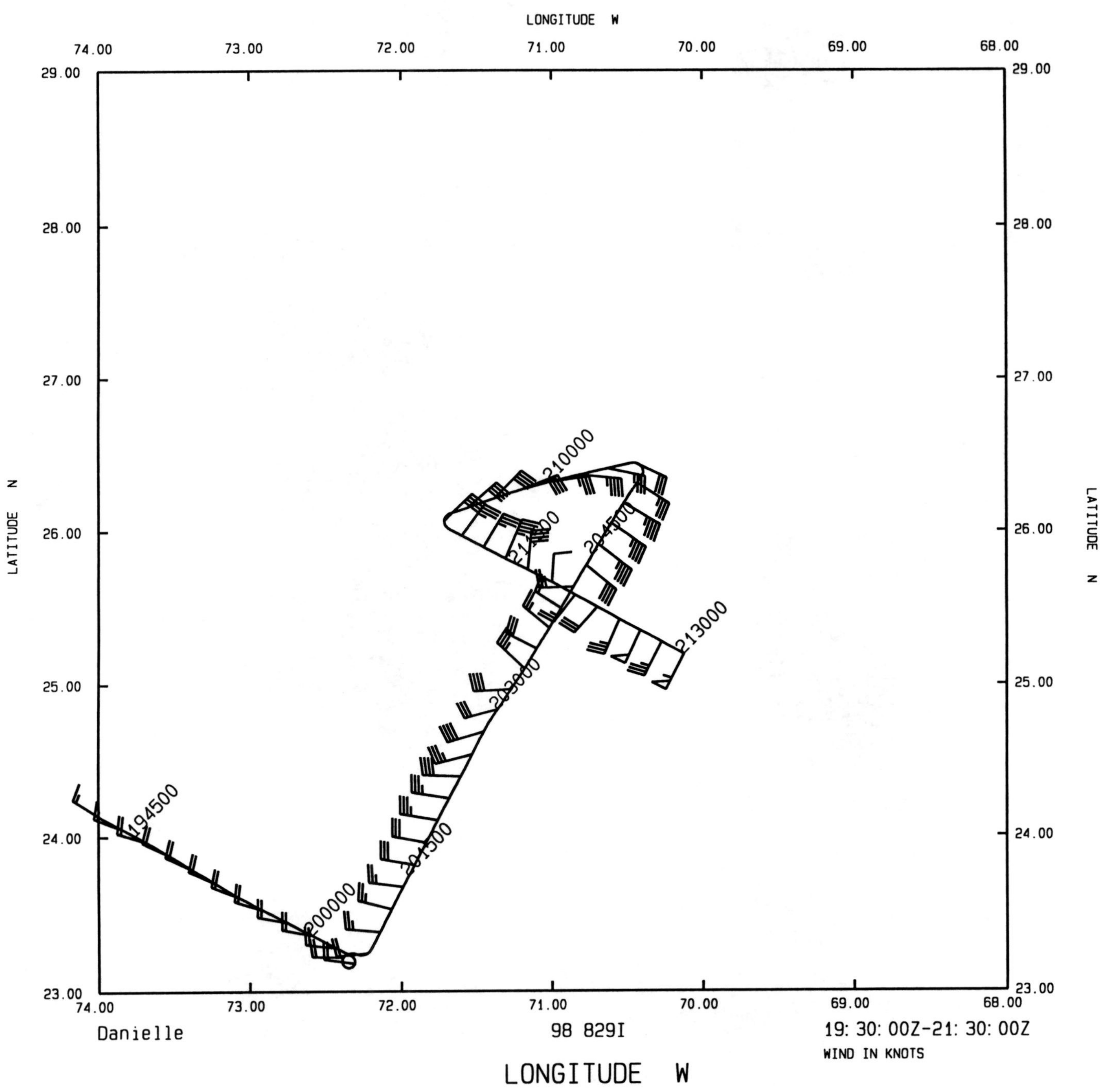


G8 VIS 04 DANIELLE 08/29/98 1959Z NRL Monterey Code 7541
Sun elevation= 39 degrees
980829I Danielle
BT11
BT10
BT9
X
BT4
BT3
27N
24N
66W
Latitude (°)
25
-70
Longitude (°)



LONGITUDE W
80.00
79.00
78.00
77.00
76.00
75.00
74.00
73.00
72.00
71.00
70.00
69.00
68.00
30.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
22.00
21.00
20.00
LATITUDE N
243000
240000
250000
183000
270000
263000
190000
93000
200000
220000
223000
Danielle
98 829I
18: 15: 00Z-27: 30: 00Z
WIND IN KNOTS
LONGITUDE W


LONGITUDE W
74.00
73.00
72.00
71.00
70.00
69.00
68.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
LATITUDE N
243000
240000
250000
210000
260000
223000
213000
203000
200000
220000
Danielle
98 829I
19: 30: 00Z-26: 30: 00Z
WIND IN KNOTS
LONGITUDE W


LONGITUDE W
74.00
73.00
72.00
71.00
70.00
69.00
68.00
29.00
28.00
27.00
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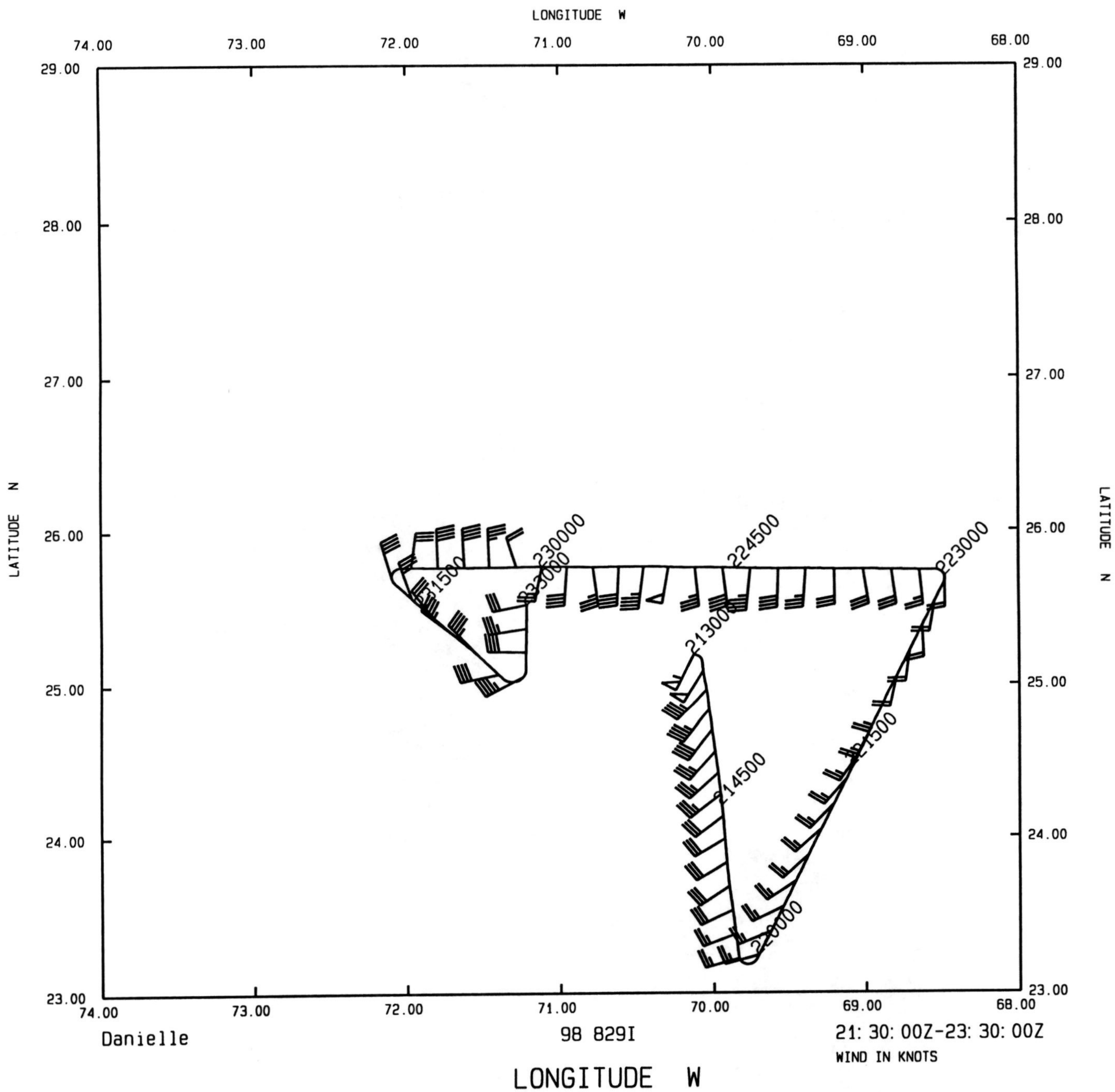
25.00
24.00
23.00
LATITUDE N
194500
200000
201500
203000
204500
210000
211500
213000
Danielle
98 829I
19: 30: 00Z-21: 30: 00Z
WIND IN KNOTS
LONGITUDE W


LONGITUDE W
74.00
73.00
72.00
71.00
70.00
69.00
68.00
29.00
28.00
27.00
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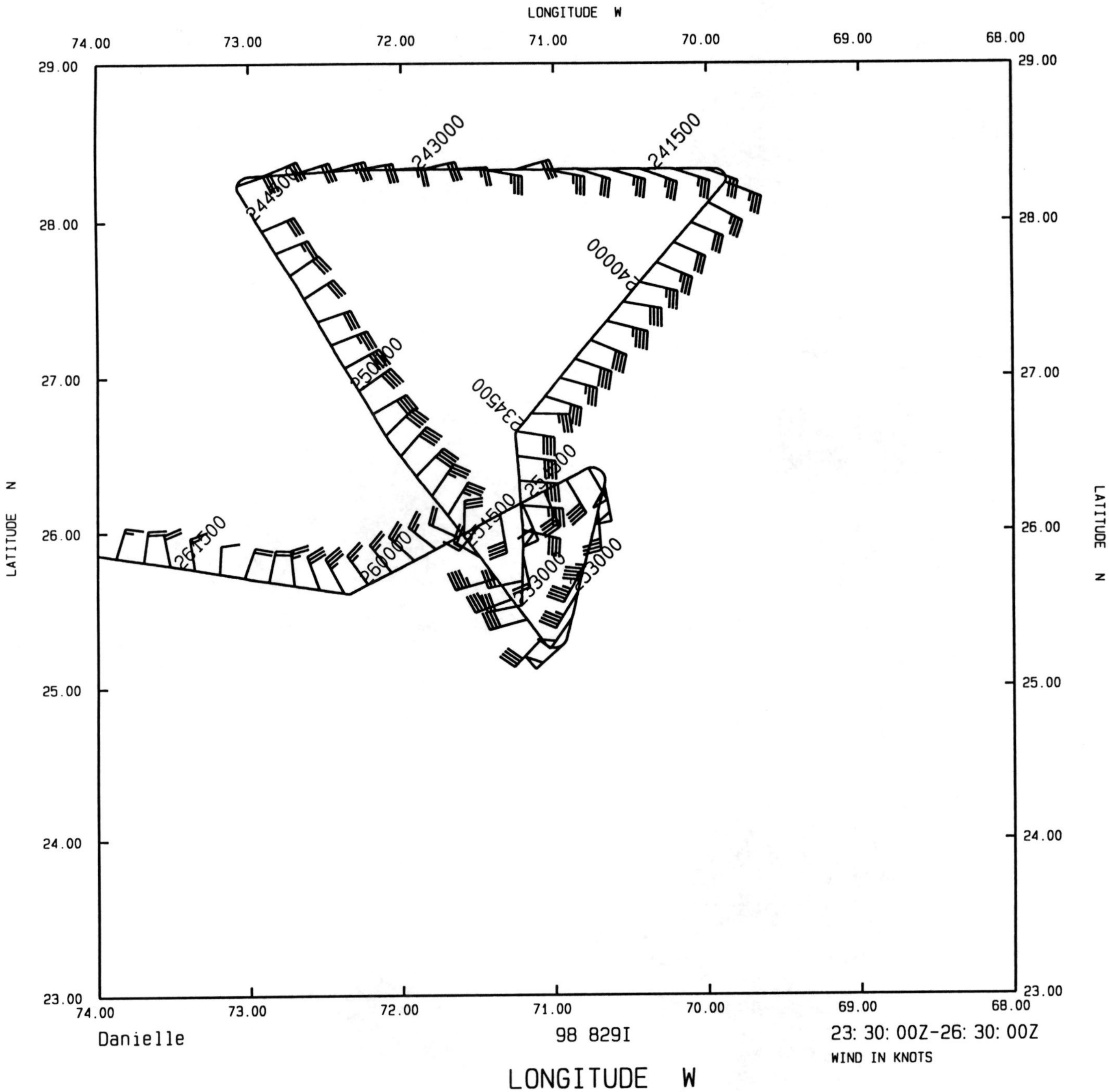
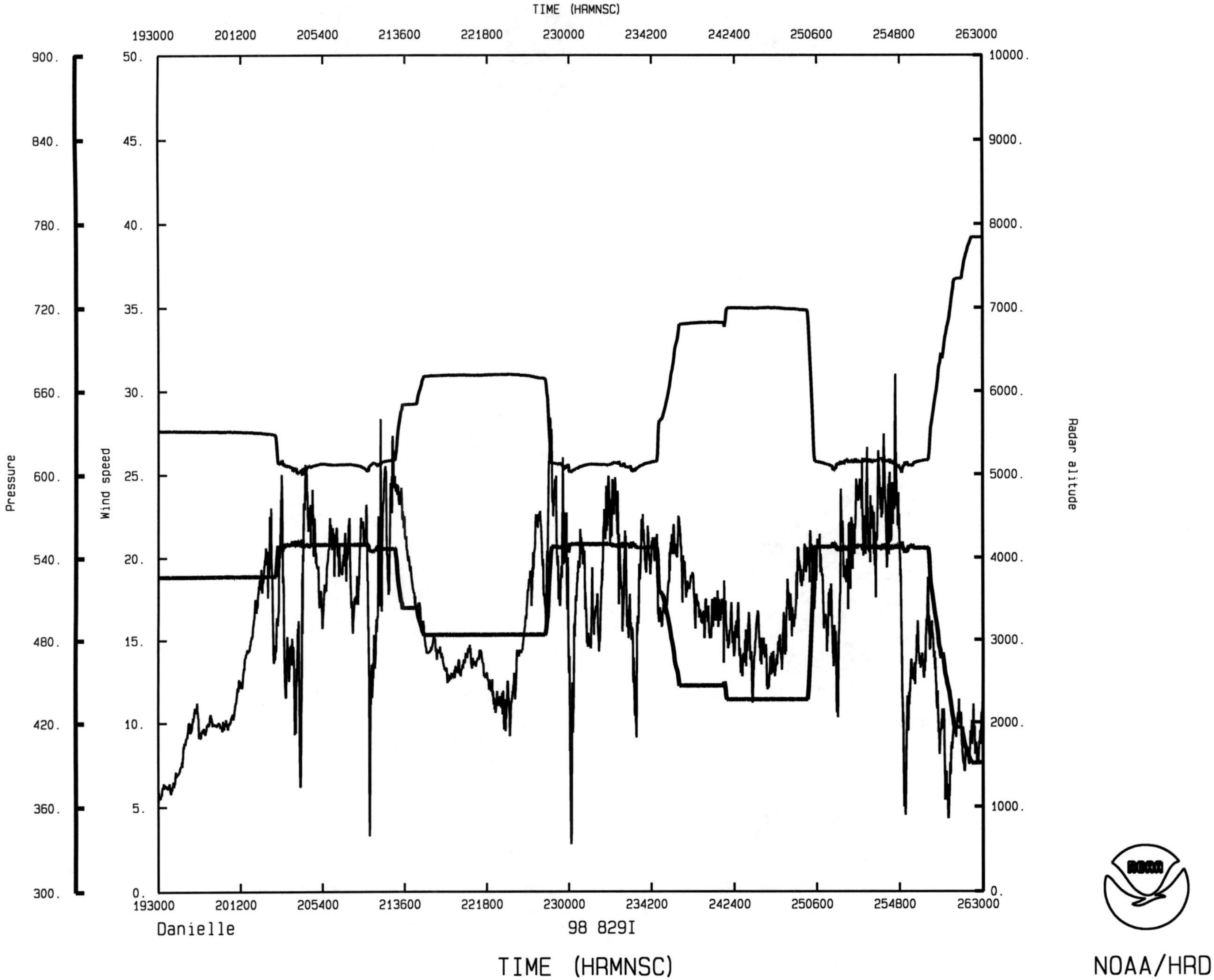
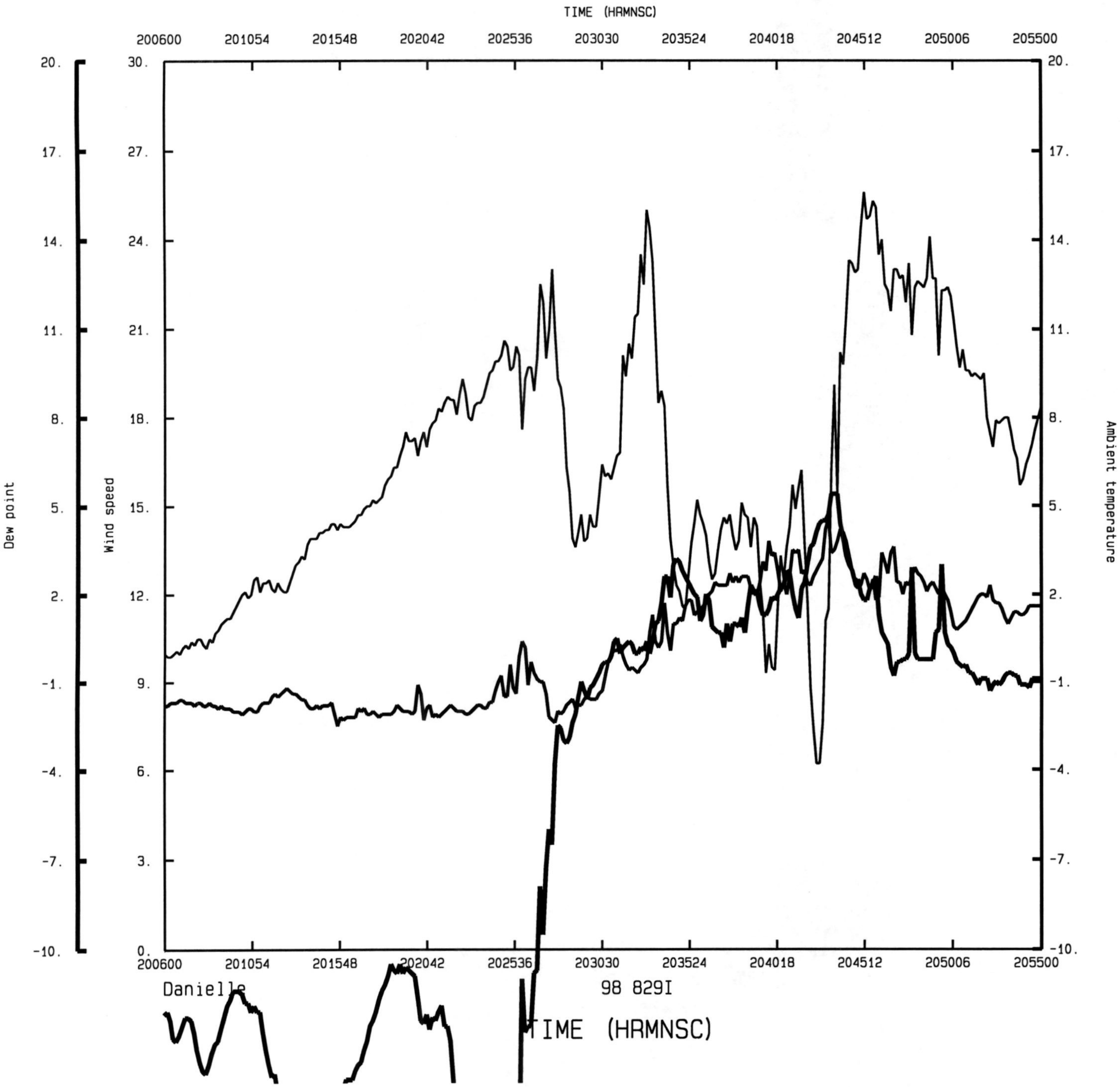
25.00
24.00
23.00
LATITUDE N
230000
224500
223000
213000
214500
220000
Danielle
98 829I
21: 30: 00Z-23: 30: 00Z
WIND IN KNOTS
LONGITUDE W



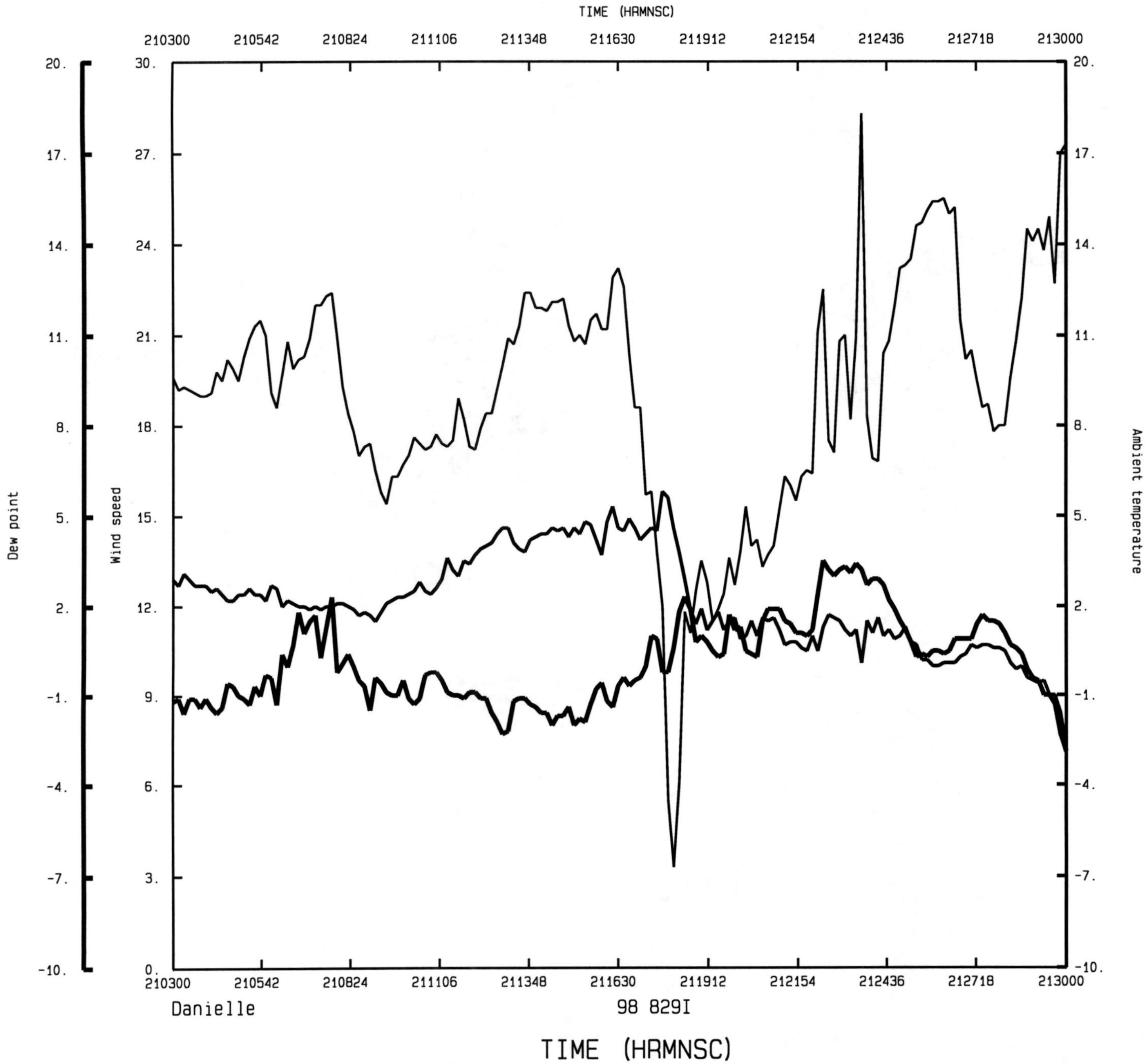
LONGITUDE W
74.00
73.00
72.00
71.00
70.00
69.00
68.00
29.00
28.00
27.00
26.00
25.00
24.00
23.00
LATITUDE N
243000
241500
244500
240000
250000
234500
235000
251500
261500
260000
233000
253000
Danielle
98 829I
23: 30: 00Z-26: 30: 00Z
WIND IN KNOTS
LONGITUDE W



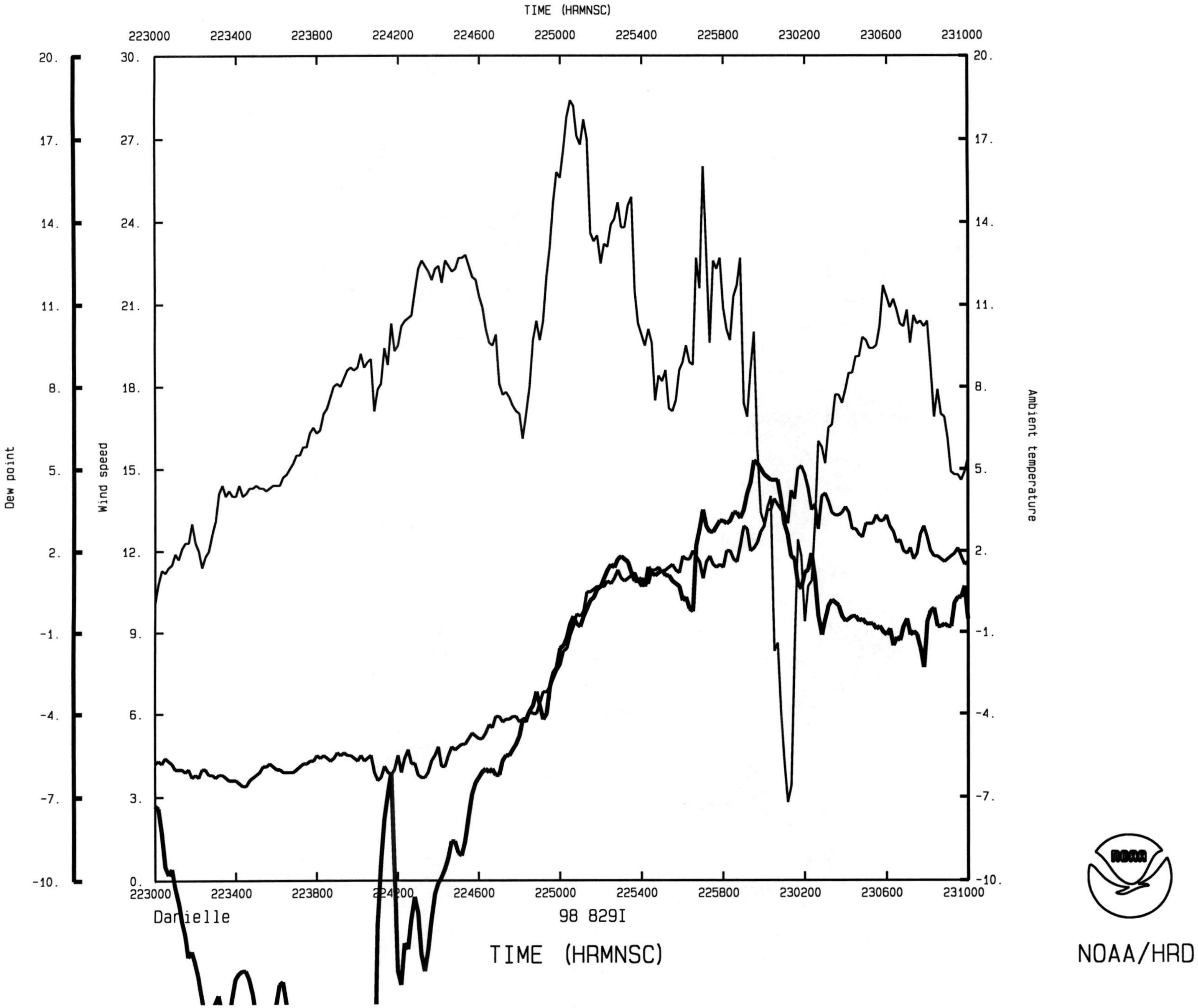
TIME (HRMNSC)
193000
201200
205400
213600
221800
230000
234200
242400
250600
254800
263000
Pressure
900.
840.
780.
720.
660.
600.
540.
480.
420.
360.
300.
Wind speed
50.
45.
40.
35.
30.
25.
20.
15.
10.
5.
0.
Radar alitude
10000.
9000.
8000.
7000.
6000.
5000.
4000.
3000.
2000.
1000.
0.
Danielle
98 829I
TIME (HRMNSC)
NOAA/HRD


TIME (HRMNSC)
200600
201054
201548
202042
202536
203030
203524
204018
204512
205006
205500
Dew point
Wind speed
Ambient temperature
20.
17.
14.
11.
8.
5.
2.
-1.
-4.
-7.
-10.
30.
27.
24.
21.
18.
15.
12.
9.
6.
3.
0.
Danielle
98 829I
TIME (HRMNSC)

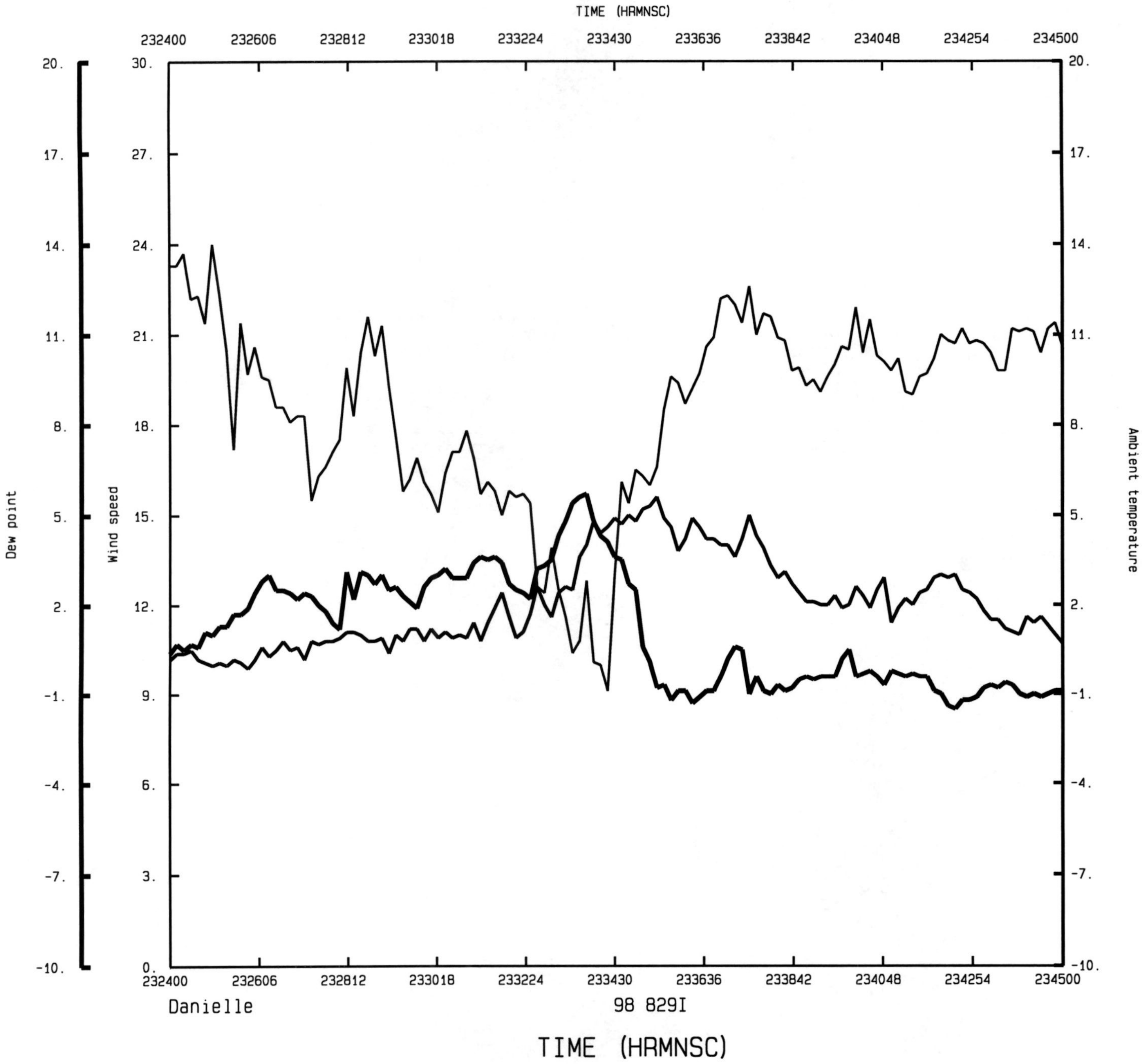
NOAA/HRD


TIME (HRMNSC)
210300
210542
210824
211106
211348
211630
211912
212154
212436
212718
213000
Dew point
Wind speed
Ambient temperature
Danielle
98 829I
TIME (HRMNSC)

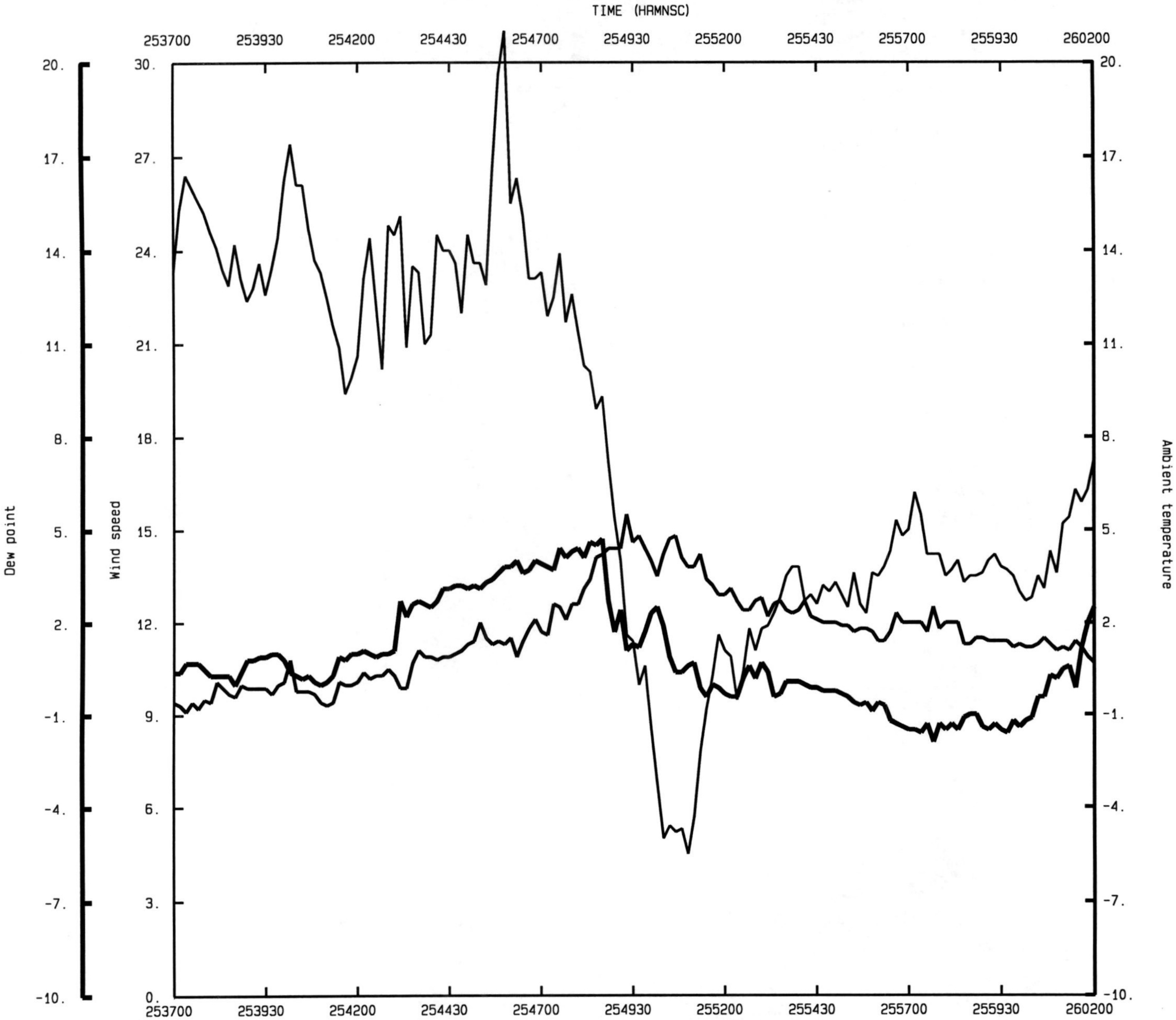
NOAA/HRD



TIME (HRMNSC)
223000
223400
223800
224200
224600
225000
225400
225800
230200
230600
231000
Dew point
20.
17.
14.
11.
8.
5.
2.
-1.
-4.
-7.
-10.
Wind speed
30.
27.
24.
21.
18.
15.
12.
9.
6.
3.
0.
Ambient temperature
Danielle
98 829I
TIME (HRMNSC)
NOAA/HRD


TIME (HRMNSC)
232400
232606
232812
233018
233224
233430
233636
233842
234048
234254
234500
Dew point
Wind speed
Ambient temperature
Danielle
98 829I
TIME (HRMNSC)

NOAA/HRD

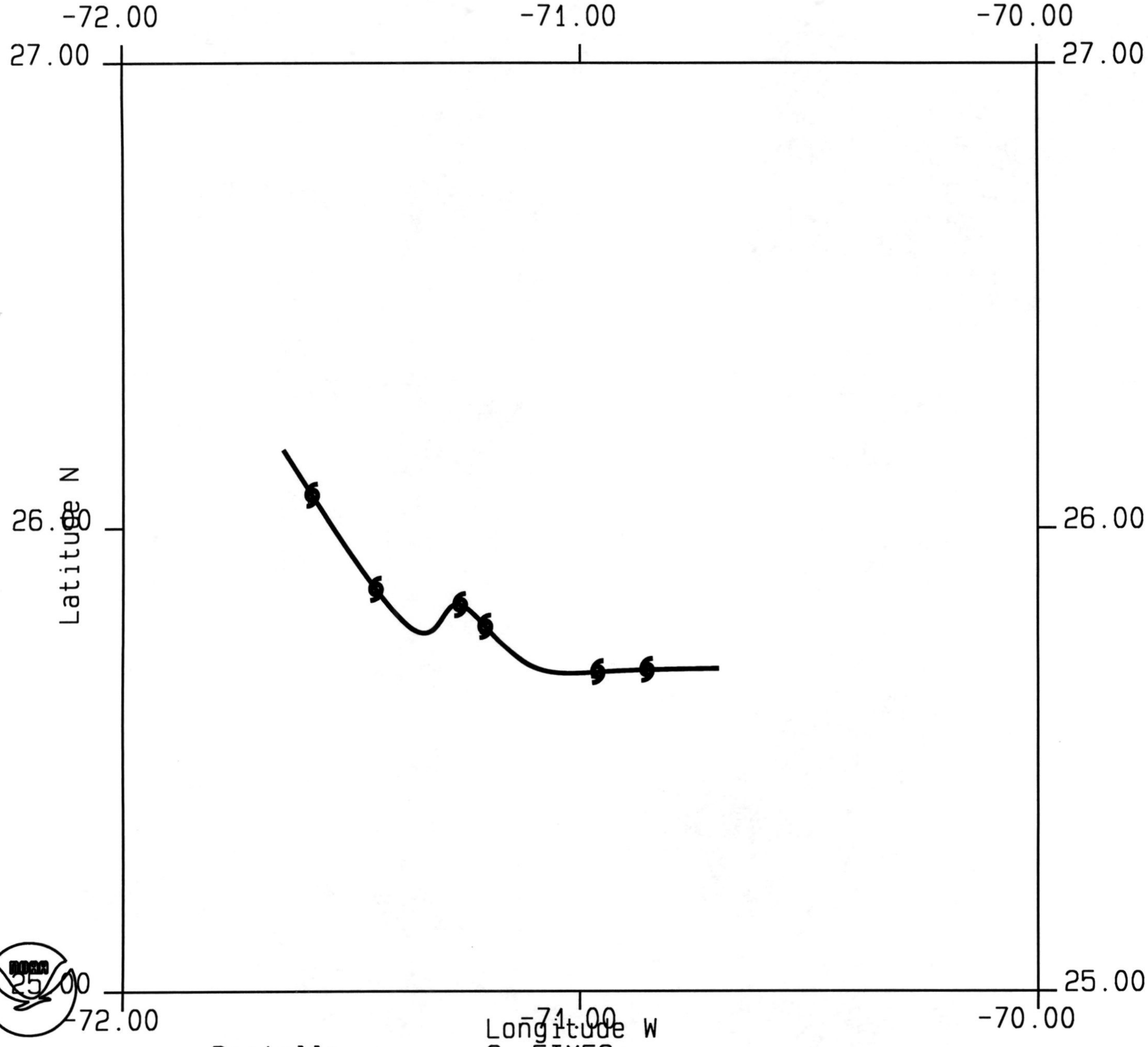


Danielle

98 829I

TIME (HRMNSC)

NOAA/HRD



Danielle

6 FIXES

NOAA/HRD

6 SPLINE
TRACK