

19980902I1-LPS

On-Board Lead Project Scientist Check List

Date 02 Sept '98 Aircraft 43RF Flight ID 980902I1

A. Participants:

HRD		AOC	
Function	Participant	Function	Participant
Lead Project Scientist	<u>Peter Dodge</u>	Flight Director	<u>Stan Czyzck</u>
Cloud Physics	<u>Bob Black</u>	Pilots	<u>Tennessee</u> <u>M Kim</u>
Radar	<u>John Gamache</u>	Navigator	<u>Dave Rathbun</u>
Workstation	<u>Mike Black</u>	Systems Engineer	<u>Sean McManus</u> <u>Rock</u>
Photographer/Observer	<u>Rob Rogers</u>	Data Technician	<u>Sean McManus</u> <u>illan</u>
GPS Omegasonde	<u>JAMES Franklin</u>	Electronics Technician	<u>Tim Barr</u>
AXBT/AXCP/Guest	<u>ED WALSH</u>	Other	<u>Richard Anthony</u>

BLOCK OUT: 191330

BLOCK IN:

Take-Off: 192551 Location: Tampa Mas Dill

Landing: 0317 Location: u

Number of Eye Penetrations: ||||

B. Past and Forecast Storm Locations:

Date/Time	Latitude	Longitude	MSLP	Maximum Wind
<u>02/15Z</u>	<u>28.88</u>	<u>87.9</u>	<u>990</u>	
<u>02/17Z</u>	<u>"</u>	<u>"</u>	<u>"</u>	
<u>02/21Z</u>	<u>29</u>	<u>87.2</u>		

C. Mission Briefing: Fly over buoys to center, fig 4, then up and back to EVX, then Rainband module, then go to Kerton Beach, descend to 8'000', fly along coast. Drop many sondes, BT's.

E.2 Lead Project Scientist (On-Board)

E.2.1 Preflight

- ☒ 1. Participate in general mission briefing.
- ☒ 2. Determine specific mission and flight requirements for assigned aircraft.
- ☐ 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.
- ☐ 4. Contact HRD members of crew to:
 - a. Assure availability for mission.
 - b. Arrange ground transportation schedule when deployed.
 - c. Determine equipment status.
- ☒ 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.
- ☒ 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

- ☐ 1. Confirm from AOC flight director that satellite data link is operative (information).
- ☐ 2. Confirm camera mode of operation.
- ☐ 3. Confirm data recording rate.
- ☐ 4. Complete Form E-2.

E.2.3 Postflight

- ☐ 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.

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

see attached

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

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

Equipment	Pre-Flight	In-Flight	Post-Flight
Aircraft			
Radar/LF			
Radar/TA (Doppler)			
Cloud Physics			
Data System			
Omegasondes			
AXBT/AXCP			
Workstation			
Videography			

REMARKS:

Lead Project Scientist Event Log

Date 1998-2 Sept

Flight 980902II

LPS P. Dodge

BT S
#1 #1
#2
#2 #3
#3 #4
#4 #5
#5
#6
#7
#8
#9
#10
#6
#11

Time	Event	Position	Comments
192551	Take off		
1954	heard Citation	Going up to 20 k'	
200207	28°36' 84°32'	first ^{SIRAT} band	42036 drop, BT
200731	28°35' 84°56'	Drop in W	no MAX/BAND
2022	28°47' 86°03'	42039 drop,	BT
2027 2022	Turn to 6	28°53' 86°11'	
2037	29°04.7	87°09.1	STAN'S FIX
2041	29°04'	87°33'	
205057	29°10	88°17'	Sonde, BT at 42040
210129	28°32' 87°35'	Turn	
2102	28°34' 87°29'		Sonde BT
2110	29°04' 87°08.5	Center	and into the shift
211657	29°26' 86°47'		BT in RB NG
212032 212032	29°39' 86°37'	DROP	NO WINDS
212130	29°43' 86°34'	"	GOOD
212910 212910	30°16' 86°14'	TURN AT 20 ASX	BOUNCY 50 KT
2132	30°15' 86°23'	Sonde	Wind Good
214353	29°32' 86°49'	Bouncy	Sonde Good
214430	29°29' 86°52'		" Good
214535	29°25' 86°55'		BT 29.25°
215017	29°28' 87°08'	DROP	A BIT SOUTH of center ✓

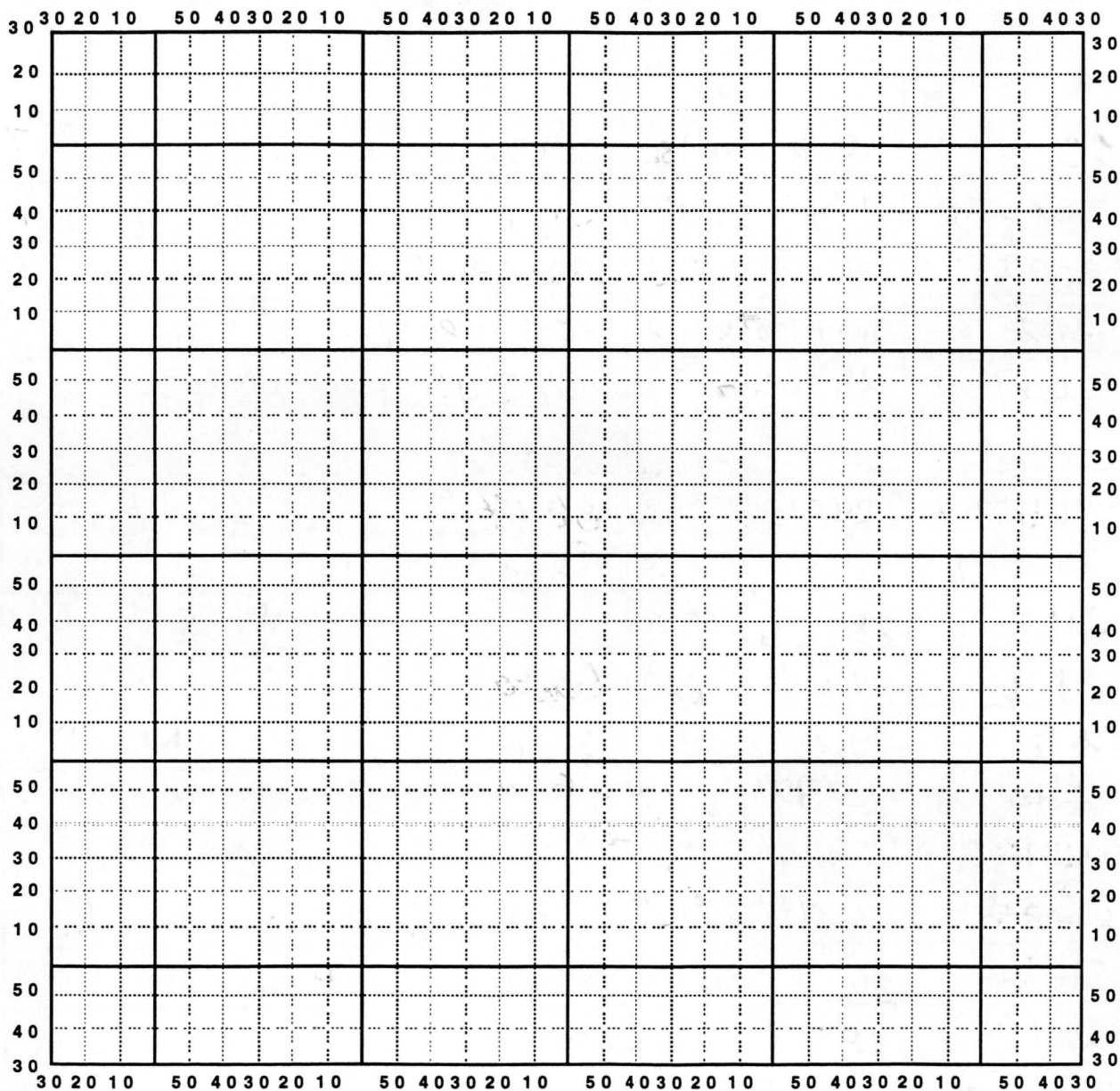
APPROX Center

next
PT 26°30' 87°10'

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date _____ Flight ID _____ LPS _____



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

Lead Project Scientist Event Log

Date 1998 2 Sept

Flight

98090271

LPS

P. Dodge

BT S

#7 #12

#8 #14

#15

#9 #16

#17

#10 #18

#19

#20

#21

Time	Event	Position	Comments
2217		27°15' 87°00	TURN for Rainband Sawtooth
2229	27°15' 85°00	49	Sonde, BT 30 m/s GOOD
2230	27°16' 85°42'		TRK left 45° 27°
223418	27°29' 85°25'	9	Sonde 31 m/s GOOD
223829	27°45' 85°08'		Turn to 315
22408	27°52' 85°09'		Sonde BT
224440	28°02' 85°27'		DROP NO GOOD
2248	28°10' 85°40'		TURN to 45°
225409	28°36' 85°21'		Sonde BT GOOD
2256	28°42' 85°11'		Sonde NO WINDS late winds
2304	28°31' 84°31'	TURN at 42036	
2305	28°35' 84°26'		Sonde, BT
2311	29°05' 84°08'	Descent Start	
2319	29°36' 83°42'	at 8000	
2321	29°46' 83°36'	Turn	
2322	29°44' 83°36'	DROP KTYFI	
2315	29°55' 83°50'	TURN	
2327			
2330	30°04' 84°10'	SONDE	NO #2
2331	30°03' 84°13'	SONDE	GOOD Sonde

Lead Project Scientist Event Log

Date 1998 02 SeptFlight 98090211

LPS _____

Time	Event	Position	Comments
22 2334	29°57' 84°24'	SONDE	23 m/s
23 2337	29°51' 84°34'	SONDE	
2342	29°38' 84°42'	Turn to head	
24 2351	29°16' 85°02'	SONDE	90 KTS ! ^{LEV} LEV 37 m/s
2355	29°09' 85°15'	We	
2356	Good visual	sea state	
25 0013		SONDE AT 42039	NO WINDS
26 0013 ⁴³	28°57' 86°20'	2 nd sonde	at
0024	29°19' 86°44'		FIX by STAN
0034	29°20' 87°32'		
0039	28°56' 87°15'	SHAPE	TO OUR LEFT 20 NM
12 0042	28°52' 87°07'	TURN, BT RELEASE	head back to 6
0052	86°43' 29°20' 3	CENTER (STAN)	
0056	we were JUST EAST OF SOME GOOD CELLS		
13 101	29°51' 86°23'	BT DROP	
10225	GOOD BUMPS AS WE HEAD TO COAST		
10523	30°07' 86°14'	TURN (SLOW) to HEAD W	
27 10745	30°14' 86°19'	SONDE near KEVX	
0112	30°15' 86°43'	Winds 11 the coast	
28 0125	30°12' 87°50' 8'	MOBILE BAY DROP	

0126 can see the oil platforms, ED & JERRY flying!

Lead Project Scientist Event Log

(4)

Date 2 Sept 98

Flight 980902I

LPS Dodge

13 BT 28 S

14

14

Time	Event	Position	Comments
012756	TURN	30°14' 88°03'	TURN over MOBILE BAY
0139	70 KTS	29°49' 87°26'	
0140	29°48' 87°22'	BT	
	Stan mentioned ripples in weak rainband.		
0200	STANS LAST CENTER ORBITING, LOOKING FOR LAST CENTER		
0204	29°33' 86°17' 9"	STANS LAST FIX	
0207	AFR remarks that center seems to be stretched out on N-S AXIS		
0208	EW Wave >	30' 29°34' 86°03'	
0217	29°36' 85°54'	BT	
0230	28°56' 84°55'	BT West of Rainband	
023806	28°38' 84°32'	SONDE	still have 71 KTS AT FLIGHT LVL
24020	28°34' 84°24'	BT, TURN	to head TAMPA
0242	28°32' 84°15'	66 KTS yet	climbing to
0311	RADAR ALTIMETER CALL		7,000'
	CAL PASS OVER RUNWAY		

15

1617*

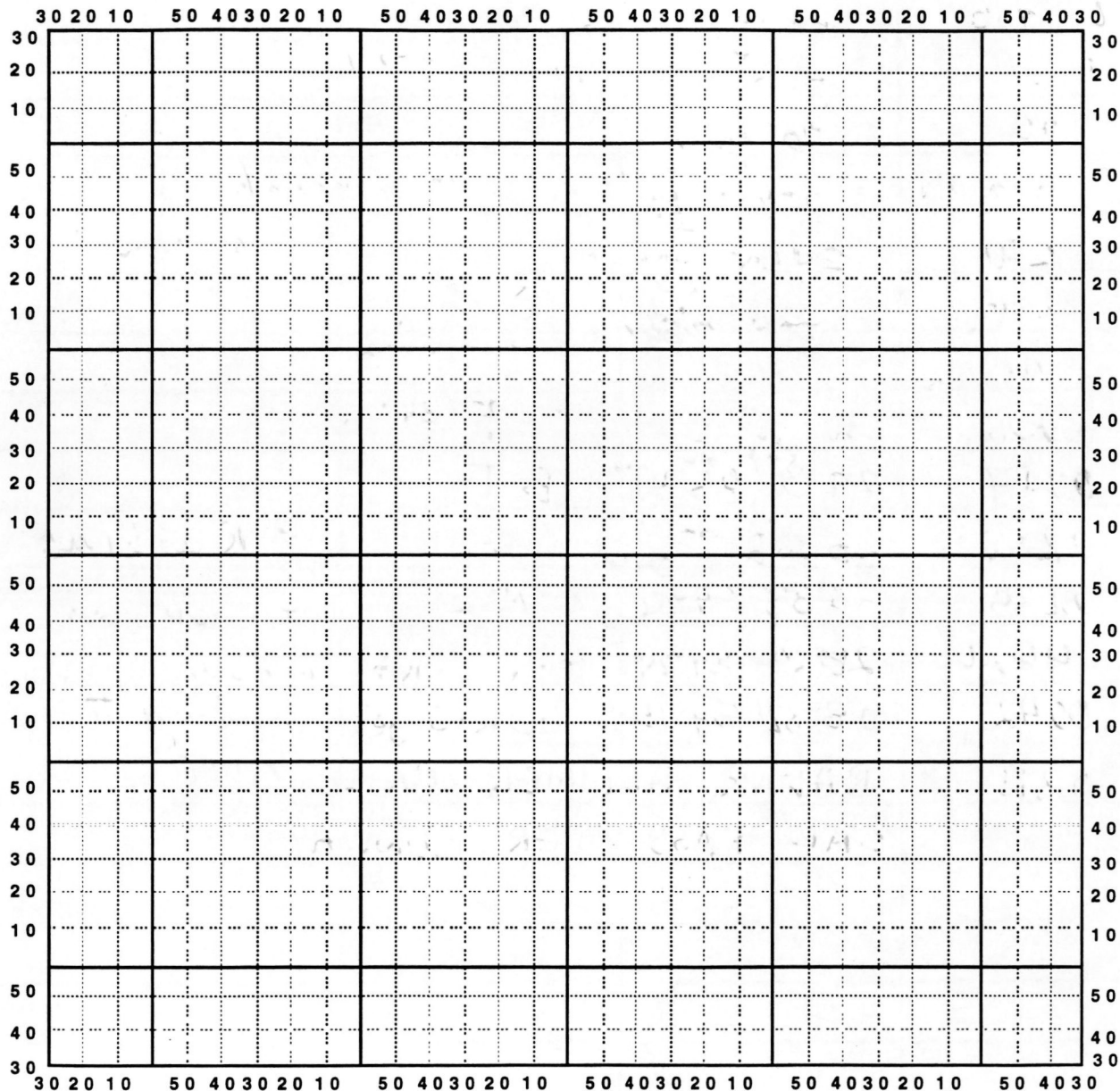
29

* I missed one BT drop, don't know when LAST SONDE died before launch

Hurricane Recco Plotting Chart

True at 25° Latitude, in Degrees and Minutes

Date _____ Flight ID _____ LPS _____



Note : Label full degrees according^{*} to location of the flight area.

Mission Summary
Hurricane Earl
Landfall
98090211 Aircraft: 43RF

Scientific Crew:

Chief Scientist	Peter Dodge
Doppler Scientist	John Gamache
Cloud Physics	Bob Black
Dropsonde Scientist	James Franklin
Workstation/AXBT:	Mike Black
Observer	Rob Rogers
SRA	Ed Walsh

Aircraft Crew:

Cockpit:	CAPT Jerry McKim
	LCDR Tim O'Mara
	CAPT Dave Tennesen
	Roc Torrey
Navigator:	LCDR Dave Rathbun
Flight Director:	Stan Czyzyk
Engineers:	Sean McMillan, Jim Barr, Richard McNamara
Radio:	Damon SansSouci

Mission Briefing:

At 1 pm EDT, 2 September 1998, we briefed the AOC flight crew for a Tropical Cyclone Windfields at Landfall research flight in Tropical Storm Earl, which at that time was forecast to reach hurricane strength and make landfall between Mobile, Alabama, and Panama City Florida. The goal of the flight was to collect flight-level, radar and GPS dropsonde data to capture the structure of the windfield in a landfalling hurricane. We were especially interested in the onshore flow because of the possible storm surge in the Florida Panhandle.

Pete Black started the briefing by cautioning the flight crew that there could be severe weather associated with Earl, because of the higher wind shear and the interaction with the coast. I explained our initial pattern, a figure 4 through the storm to be followed by some radial legs toward the Eglin Air Force Base WSR-88D (KEVX). Then we planned, tentatively, to fly a saw-tooth pattern through the main rainband east of the center and then to descend to 8000' to fly along the coast, to measure the storm surge in Apalachee Bay with Ed Walsh's surface radar. We planned to drop numerous GPS Sondes and Airborne Expendable BathyThermographs (AXBT's) to map out the onshore and offshore flow, the eye, and the main rainband and/or wind maximum. The AOC crew agreed to this flexible plan. It helped that both Stan Czyzyk and Jerry McKim had been on the Fran and Danny landfall missions in previous years.

Mission Synopsis:

We left MacDill at 1925 UTC, and reached our initial altitude of 14 000' by 1945. This flight was separated into three modules:

a. **The initial pattern:** By 2007 we had reached the wind max in the main rainband, ~200 km east of the center of the storm. Sondes and AXBT's were deployed in the band and at buoy 42039. At 2037 Stan fixed the center at 29°04.7'N, 87°09.1'W, and we proceeded west to buoy 42040 where we also dropped sonde and AXBT at 2050. We passed through the center for the second time at 2110 and headed NE to KEVX. This leg was bouncy as we flew through rainbands near the coast. John Gamache reset the LF color scale so we could more easily pick out the 50 dBZ cores; there were several and we managed to avoid them all. At 2129 we turned at the coast dropped some more sondes and AXBT's and passed through the center again at 2150, where we dropped a center sonde. As we headed the south the bouncing subsided and we were in clearer air for a while.

b. **The rainband sawtooth:** After we had finished the outbound leg from KEVX at 2200 UTC, Mike and Rob designed a sawtooth pattern to measure the inflow into the main convection of the storm. The goal was to drop sondes on either side of the band, as well as in the middle. We had successful sonde + BT drops at 2240, 2254 and 2305.

c. **The coastal survey:** We began our descent to 8000' at 2311 as we headed for Keaton Beach (KTNF1).

At 2320 we started running along the coast. We dropped sondes at KTNF1 at 2320, two sondes near St. Marks at 2330, and one at 2334 near Panacea. We had planned to follow the coast on around St. Georges Island to sample the coast near Port St. Joe and Panama City, but there was some rather strong echo near Cape San Blas (CSBF1), so we headed southeast. In fact, the TLH WSR-88D detected a Tornado Vortex Signature at 2350 in this same area. Mike suggested that we head out to buoy 42039, repeat the figure 4 through the storm and then head for EVX one more time. So that's what we did. Just southeast of Cape San Blas the aircraft flew upwind into the wind max, just inside the rainband. Mike remarked to Jerry that this was probably the first time he had flown upwind in an "eyewall". The flight crew did an excellent job of steering us around the convection that seemed to be increasing. At 0107 we dropped a sonde just offshore of KEVX, west of Panama City. We paralleled the coast for awhile, about 10-20 km offshore, and then we flew right over Gulf Shores into the mouth of Mobile Bay. After dropping a sonde in Mobile Bay, we turned at the Dauphin Island C-Man (DPIA1) and headed SE for our last pass through Earl. At 0204 Stan fixed the center at 29°33.5'N, 86°17.9'W, well east of our previous center. The Air Force remarked that the center seemed stretched out on a N-S axis. Ed Walsh noted 30' waves at 0208. We dropped the last sonde and AXBT at 0238, in the main rainband, and 0242 we climbed and headed back to Tampa. At 0311 we did a radar altimeter calibration pass over the runway for Ed Walsh, and then landed at 0317 UTC.

Evaluation:

The flight went very well. The sonde and AXBT coverage provide good coverage of a rather unusual hurricane. James Franklin noted that the sondes did not find a surface wind > 50 kts, yet at 7000' the flight-level winds were > 70 kts for much of the latter part of the flight. Mark Powell incorporated some of that flight level data in an analysis centered at 0130 that estimated the maximum surface wind to be 79 kts, 91 nmi east of the center. A preliminary surface analysis of the GPS sonde data shows similarities to a cold front! The portion of the data set that was collected in Apalachee Bay will be supplemented by wind profiler data collected by Kevin Knupp's group from the University of Alabama-Huntsville, and the WSR-88D data collected by the Eglin AFB and Tallahassee WSR-88D radars.

We now have four data sets collected over land in weak to moderate hurricanes. I still think we must be very cautious about flying in stronger hurricanes overland. It is difficult to interpret the LF display when at 14,000' because strong echo can be caused either by convection or bright band echo. The Dopplerized nose radar may help in discriminating the nasty places from the merely bumpy.

Acknowledgements:

The AOC crew were great. Stan Czyzyk and Dave Rathbun agreed to every change in the flight patterns that we requested, and Jerry McKim, Dave Tennesen, and Tim O'Mara moved us through some bumpy flying with a minimum of surprises. Jim Barr kept the radar running, and Sean McMillan and Richard McNamara managed to keep with our evolving plans for GPS sonde and AXBT drops.

Mike Black acted as co-LPS on this mission; he called most of the Sonde and AXBT drops, and also helped design the rainband and second figure-4 patterns. Rob Rogers also helped plan the rainband pattern. James Franklin processed and transmitted most of the GPS data. Bob Black collected some more big raindrop data; NASA will probably be interested in our cloud physics data because they did not fly below 14,000'. Pete Black helped plan the flight, and reminded us to be careful on this hurricane flight after 2 1/2 weeks of continuous operation. Steve Feuer and Mark Powell's analyses and comments helped set up the first part of the flight for the briefing.

Problems:

I forgot to request that we record WARDS data, so the WARDS system did not collect Dopplerized Nose radar data. There was a brief problem with the ASDL system at the beginning of the flight. There may be a problem with the way spectral width is recorded on the data system. We did not send out our LF composites until late in the flight; we should have sent them in a more timely manner. The radar tape has numerous parity errors, which may result in significant data gaps.

Tables:

Table 1. Centers determined by AOC Flight Director and Navigator

Time	Lat	Lon	Comments
2037	29° 04'	87° 09'	
2110	29° 04'	87° 08'	
2150	29° 08'	87° 08'	maybe a bit south of center. Sonde dropped here.
0024	29° 19'	86° 45'	
0052	29° 20'	86° 43'	
0204	29° 33'	86° 17'	

Table 2. GPS Sondes

	Serial #	Time	Lat	Lon	Comments
1	974940036	200206	28.5	84.5	With BT
2	974510099	200730	28.6	84.9	Rainband, signal loss
3	974530042	202222	28.8	86.0	with BT
4	981950004	205100	29.2	88.3	"
5	982630002	210243	28.6	87.5	"
6	974740026	212032	29.7	86.6	rainband, no winds
7	974510001	212130	29.7	86.6	rainband
8	973730034	213207	30.3	86.4	rainband
9	974740043	214357	29.5	86.8	rainband
10	981950051	214431	29.5	86.9	rainband
11	981810026	215018	29.1	87.1	eye
12	973730037	222918	27.3	85.8	with BT, sst = 27
13	973840061	223420	27.5	85.4	rainband edge
14	982640245	224005	27.9	85.2	with BT, clipped, 10% diff
15	982710012	224438	28.1	85.4	rainband
16	982630012	225409	28.6	85.4	with BT, no data (late winds?)
17	973840042	225607	28.7	85.2	rainband
18	973730042	230527	28.6	84.5	with BT, over buoy 42036
19	980410074	232205	29.8	83.6	
20	973250047	233020	30.1	84.2	No LD, rainband
21	981750067	233110	30.1	84.2	rainband
22	975020002	233430	29.9	84.4	rainband
23	974530061	233715	29.9	84.6	over land, rapid ws falloff
24	974510040	235130	29.3	85.0	eyewall
25	982630004	001046	28.8	86.0	no winds
26	973730045	001343	28.9	86.2	
27	981810011	010738	30.2	86.3	rainband offshore
28	982430005	012515	30.2	87.8	
29	982010104	023806	28.6	84.5	rainband, failed early

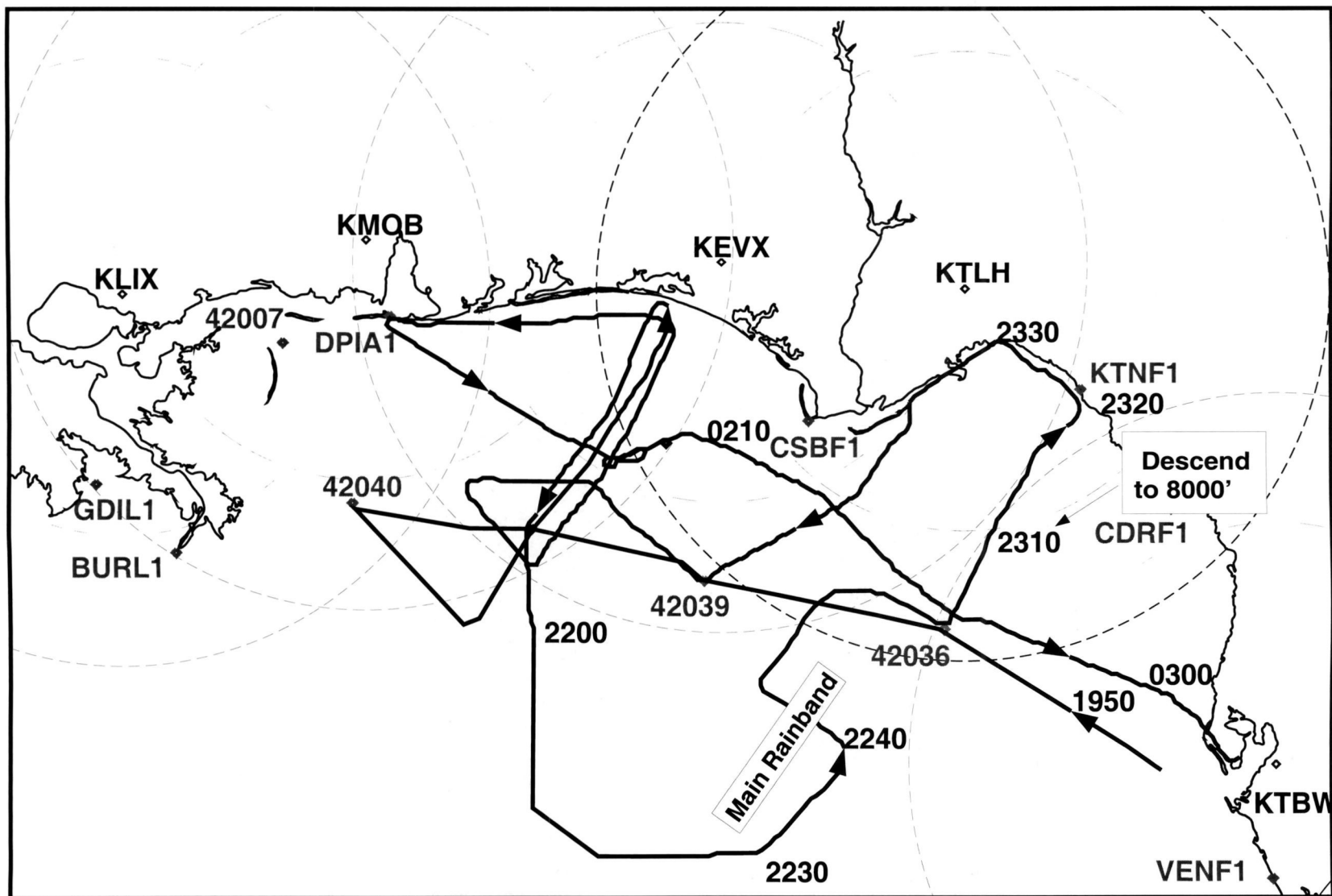
Table 3. AXBT's

#	Time	Lat	Lon	Comments
1	200219	28° 30'	84° 32'	
2	202300	28° 47'	86° 03'	
3	205100	29° 10'	88° 17'	
4	210248	28° 34'	87° 29'	
5	211657	29° 26'	86° 47'	in rainband, maybe no good
6	214534	29° 25'	86° 55'	
7	222920	27° 15'	85° 49'	
8	224006	27° 52'	85° 09'	
9	225409	28° 36'	85° 21'	
10	230528	28° 35'	84° 26'	
11	001100	28° 47'	86° 01'	near Buoy 42039
12	002400	28° 18'	86° 45'	Dropped in eye
13	004320	28° 52'	87° 07'	
14	010057	29° 51'	86° 23'	
15	014042	29° 48'	87° 22'	
16	021732	29° 36'	85° 54'	
17	023025	28° 56'	84° 55'	
18	024018	28° 34'	84° 24'	

Figures:

1. NOAA 43RF flight track. (on thor in /users/peter/earl_stuff.d/earl_flight_map.draw, *.ps)
2. Surface map from GPS drops. (on thor in /users/peter/earl_stuff.d/ sond_srf_map.ps)

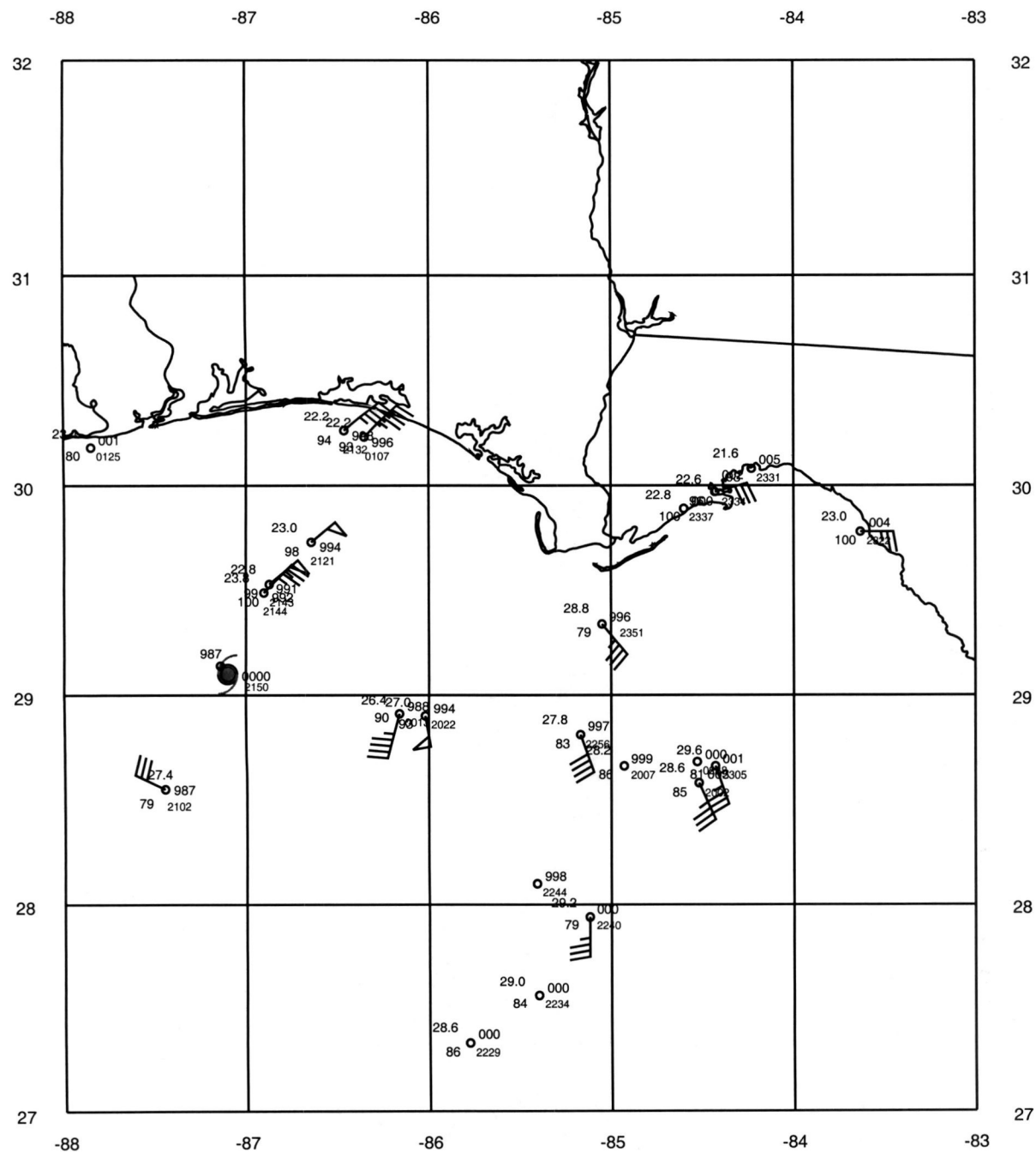
Hurricane Earl NOAA 43RF flight track 2 September 1998



0 50 100 km

230 km range

150 km "purple haze"



EARL

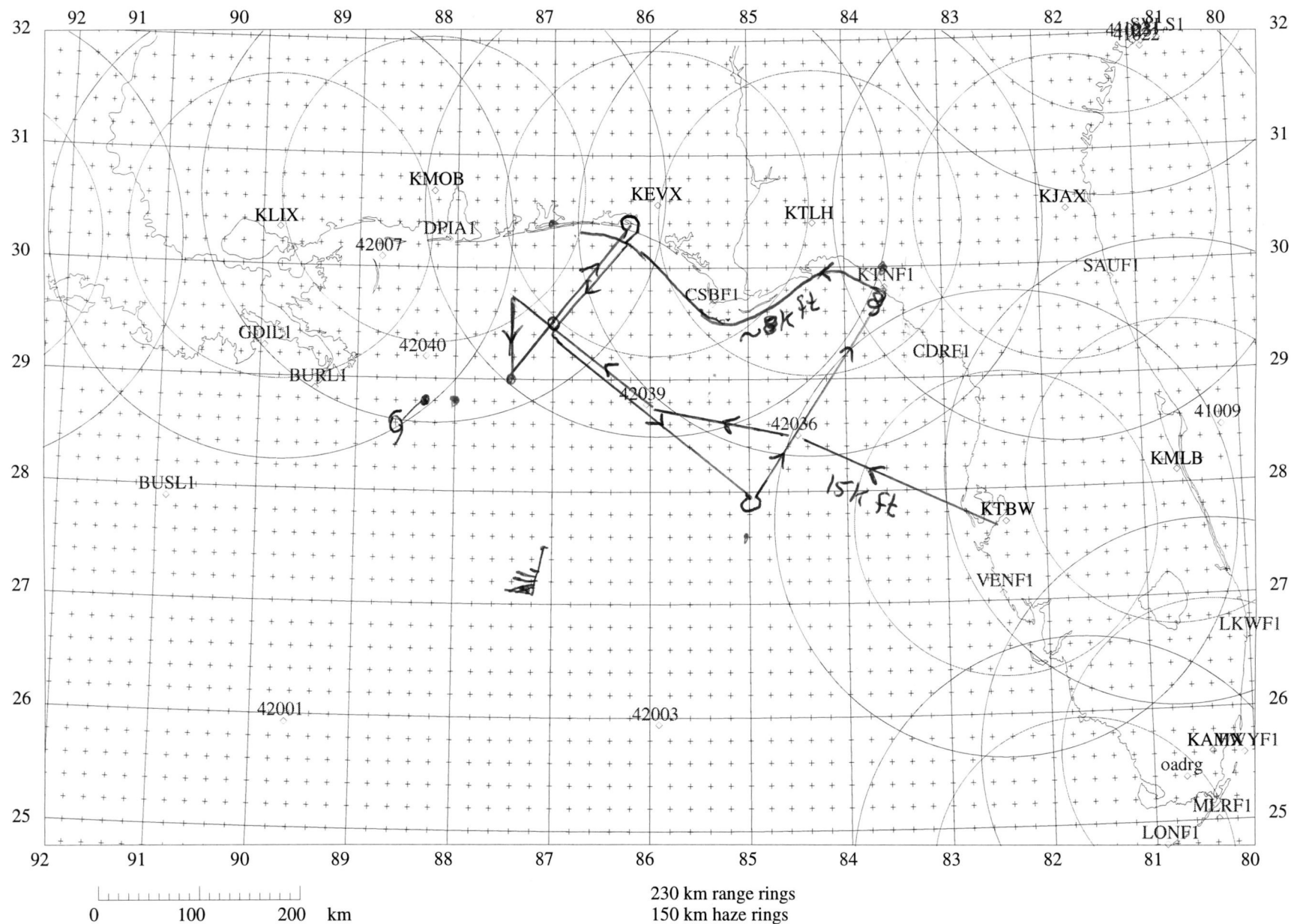
Surface

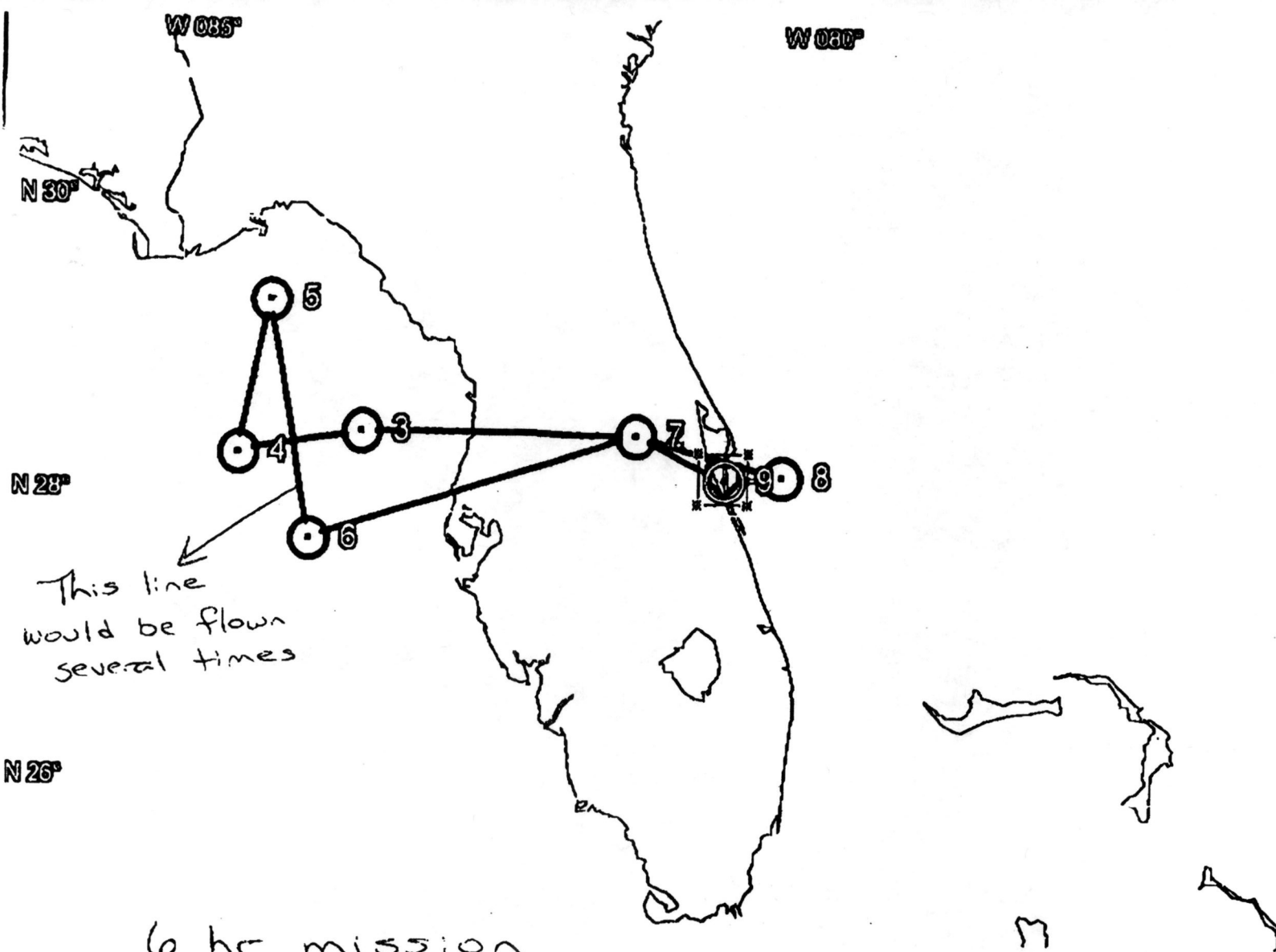
Date: 980902

Time: 18-30 UTC

EARTH RELATIVE

Center Lat: 28.50 Lon: -86.00





6 hr mission
 1800 UTC takeoff
 Rainfall study for Sept. 2
 NASA Mission



2358
500BZ

LF
we at 1996 m
75 KT

Teal 1959
2 h ago 28° 26' 87° 50' they at 5'000
187

2010 Teal hunting

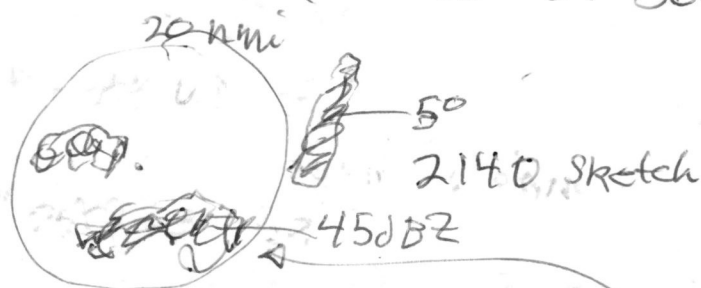
2025 ASDL ~~Drop~~ Sys Problem

2031 Citation has 30 minutes left

2032 TEAL: 28° 58' 87° 23'

2103 Ship (Freighter)

2138 50 dBZ cores in Band 20 nmi E of
US (29°40' 86°36' is us)



2142 Thru part of this

FOR RAINBAND PART

Go S to 26°30, 87°10, do sawtooths,
Along strat band, then to 42036

2239 NASA DC-8 went down to 14,000',
will re-ascend because of R... not sure where they are

2320 quite near coast at 8000' @ 186° 55.9 KTS

2341 Too Much shit By CBF1 - so we will
head S to 42039, then to G (Thanks MB!)

2351

BUOY / C-MAN LOCATIONS

~~43~~ 42036 28° 30' 22" 84° 30' 37" (28.51°, 84.51°)
 42039 28° 47' 05" 86° 02' 16" (28.78°, 86.04°)

KTNF1 29.82° 83.59° Keaton Beach

CSBF1 29.67° 85.36° Cape San Blas

Apalachicola Bay 29.72 85.00

Panama City
 Tide Stn 30.20 85.87

CDRF1 29.14° 83.03° Cedar Key

DP1A1 30.25° 88.07°

42007 30.09° 88.77°

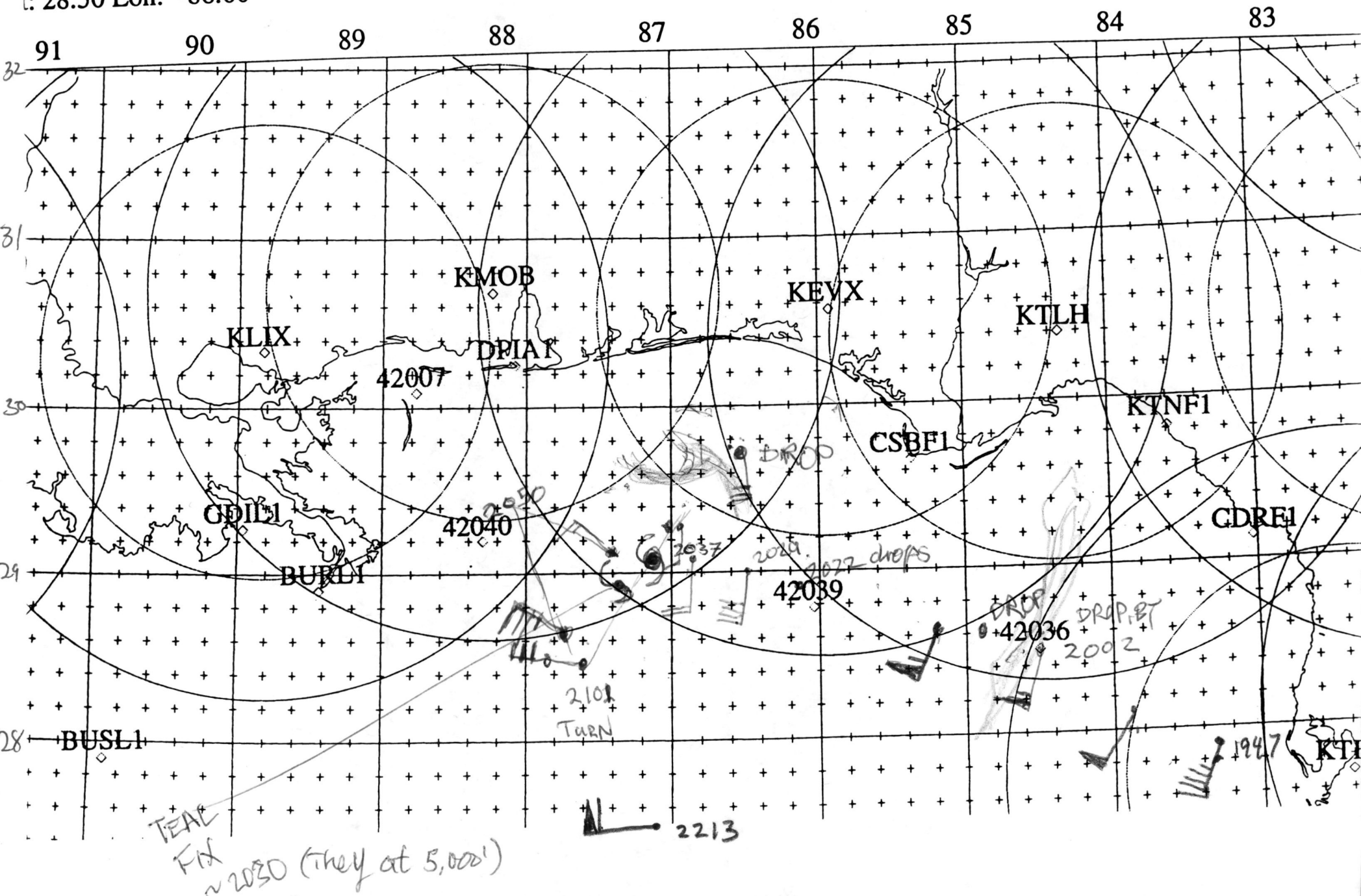
~~42004~~
 42040 29.20° 88.25°

WSR - 88D's

MOB	30.6794°	88.2397°	Mobile
EVX	30.5644°	85.9214°	Eglin
TLH	30.3975°	84.3289°	Tallahassee
TBW	27.7056	82.4022°	Tampa
	27.2717	89.0756	Alachua County

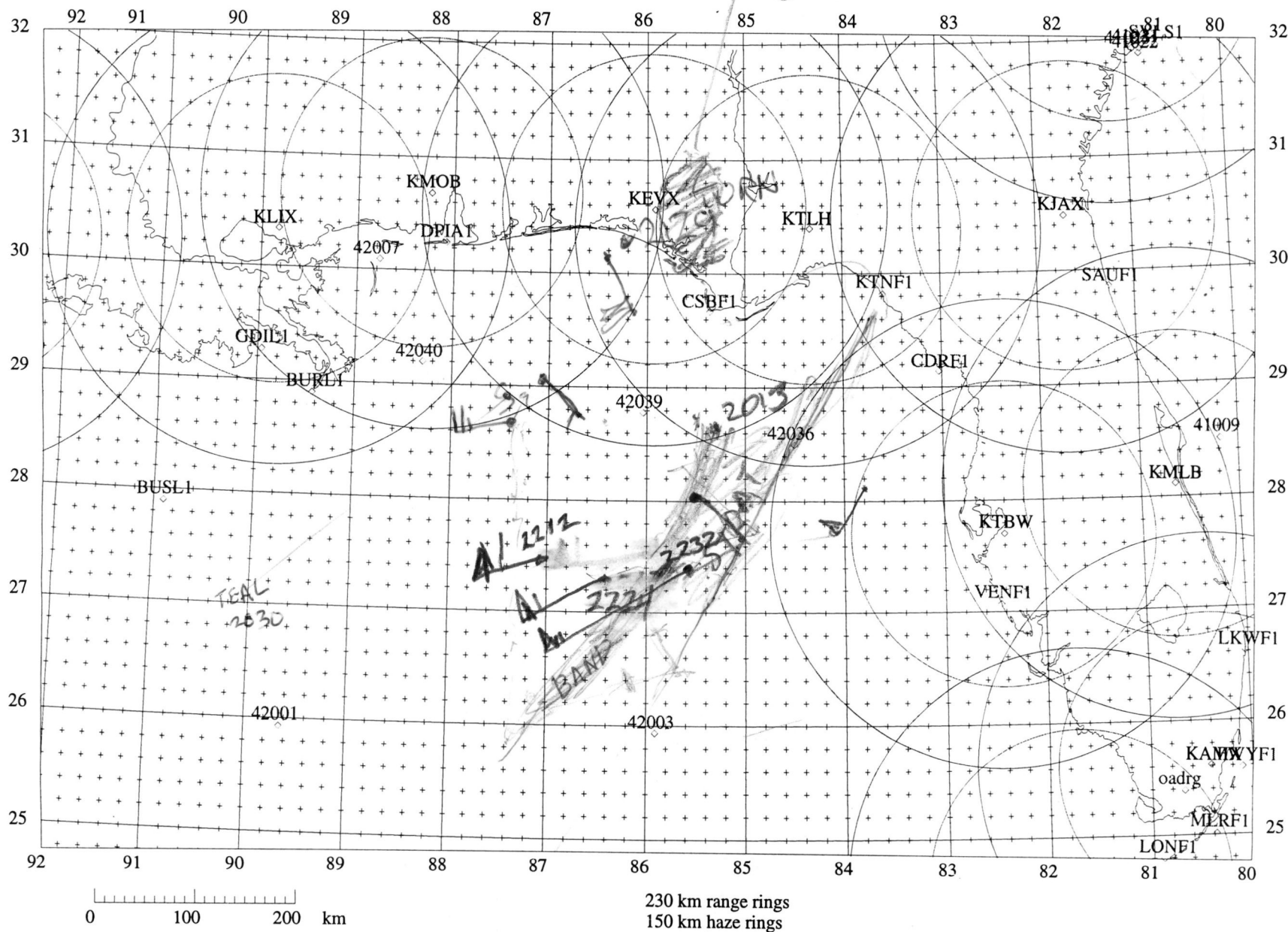


t: 28.50 Lon: -86.00



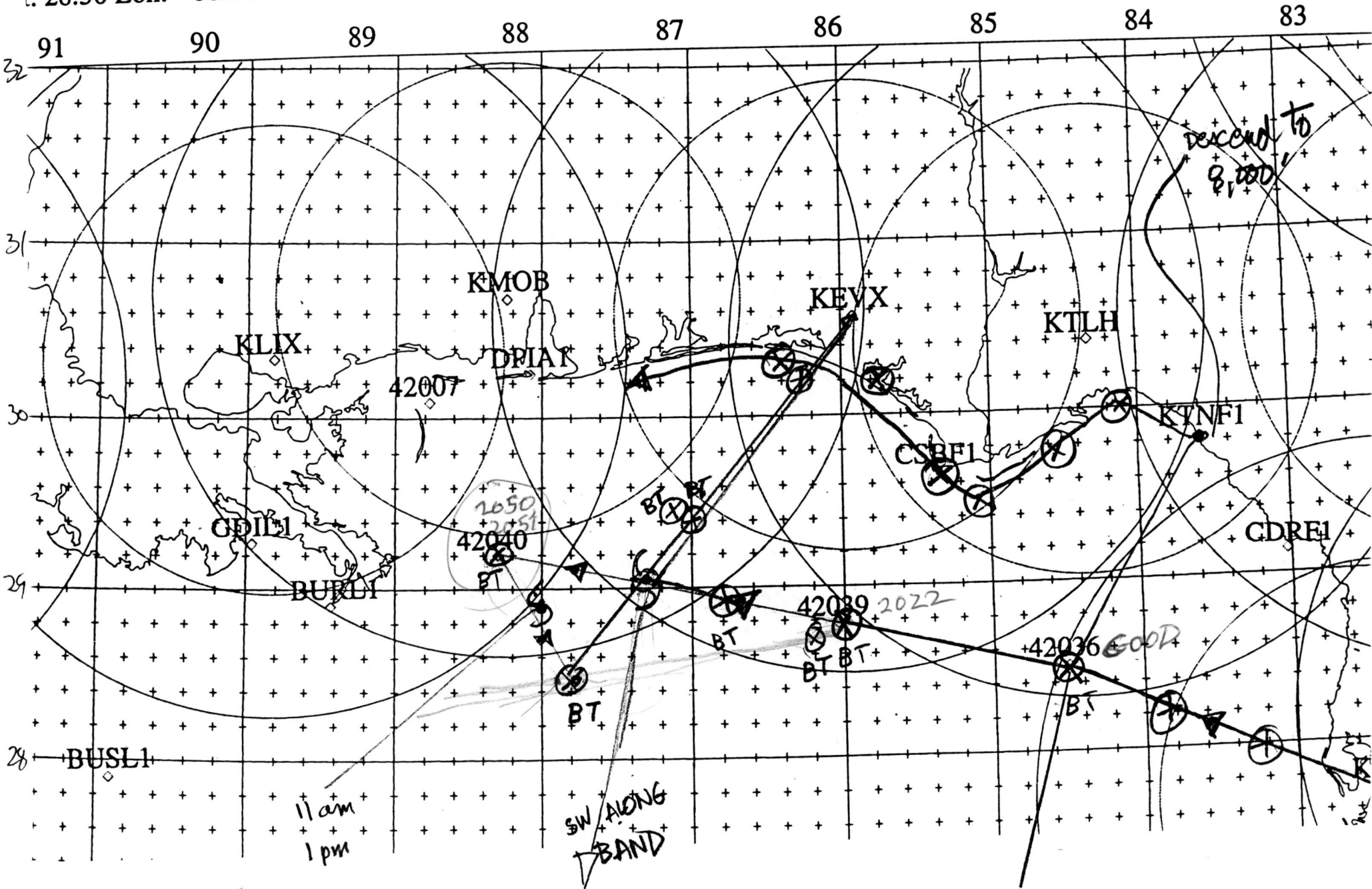
Center Lat: 28.50 Lon: -86.00

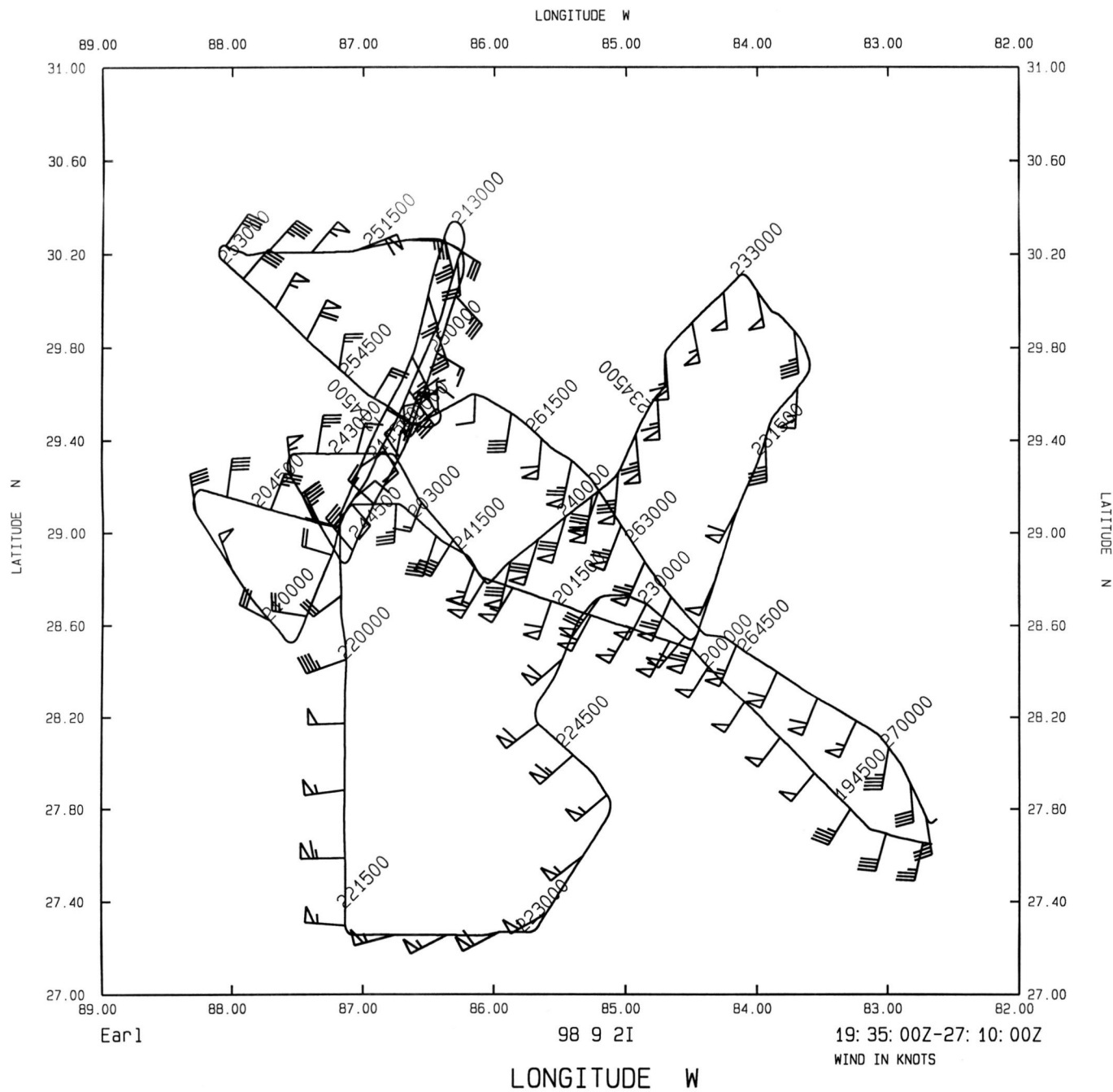
Pretty Vig
Convection to our Left

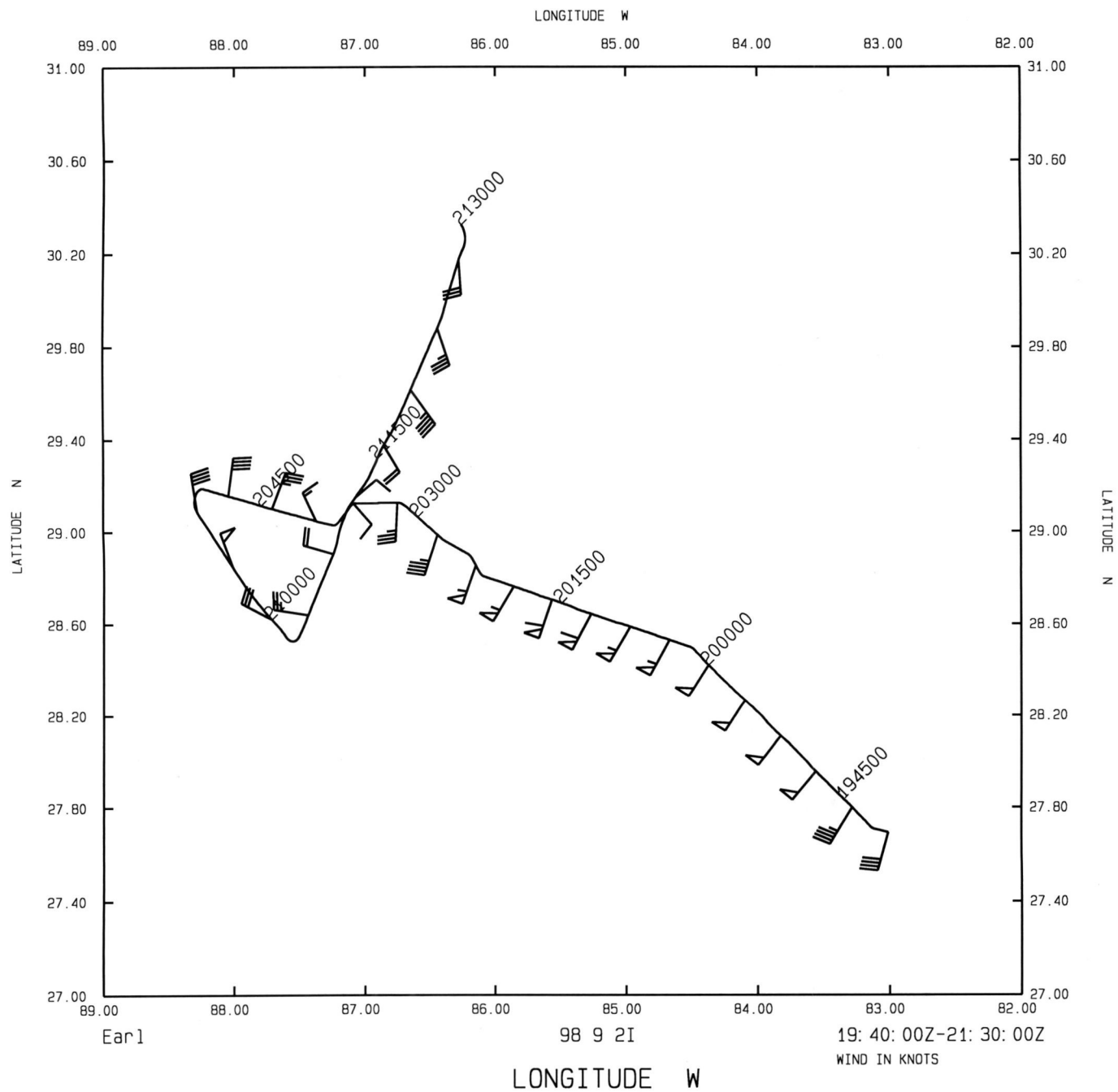


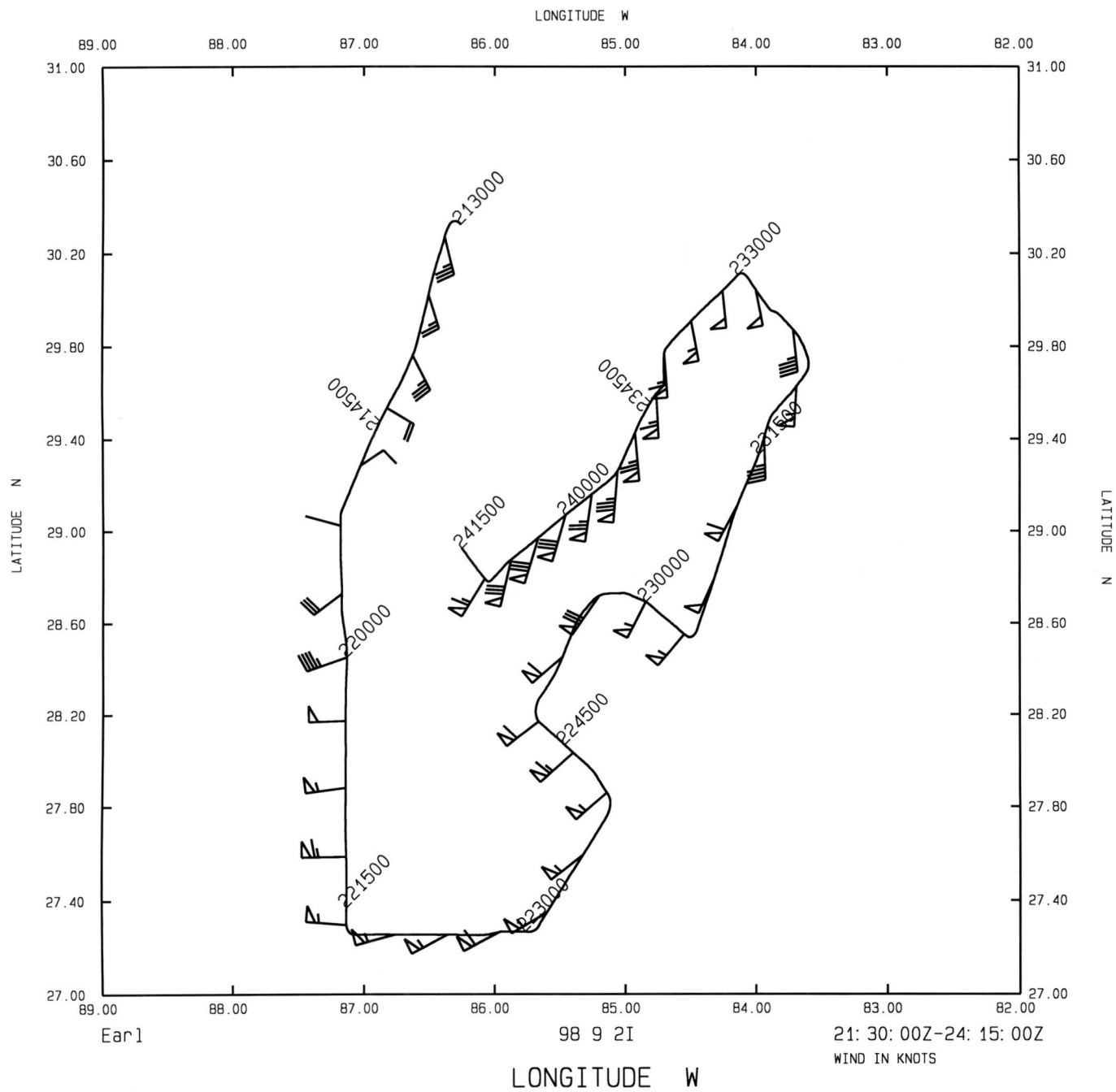
20

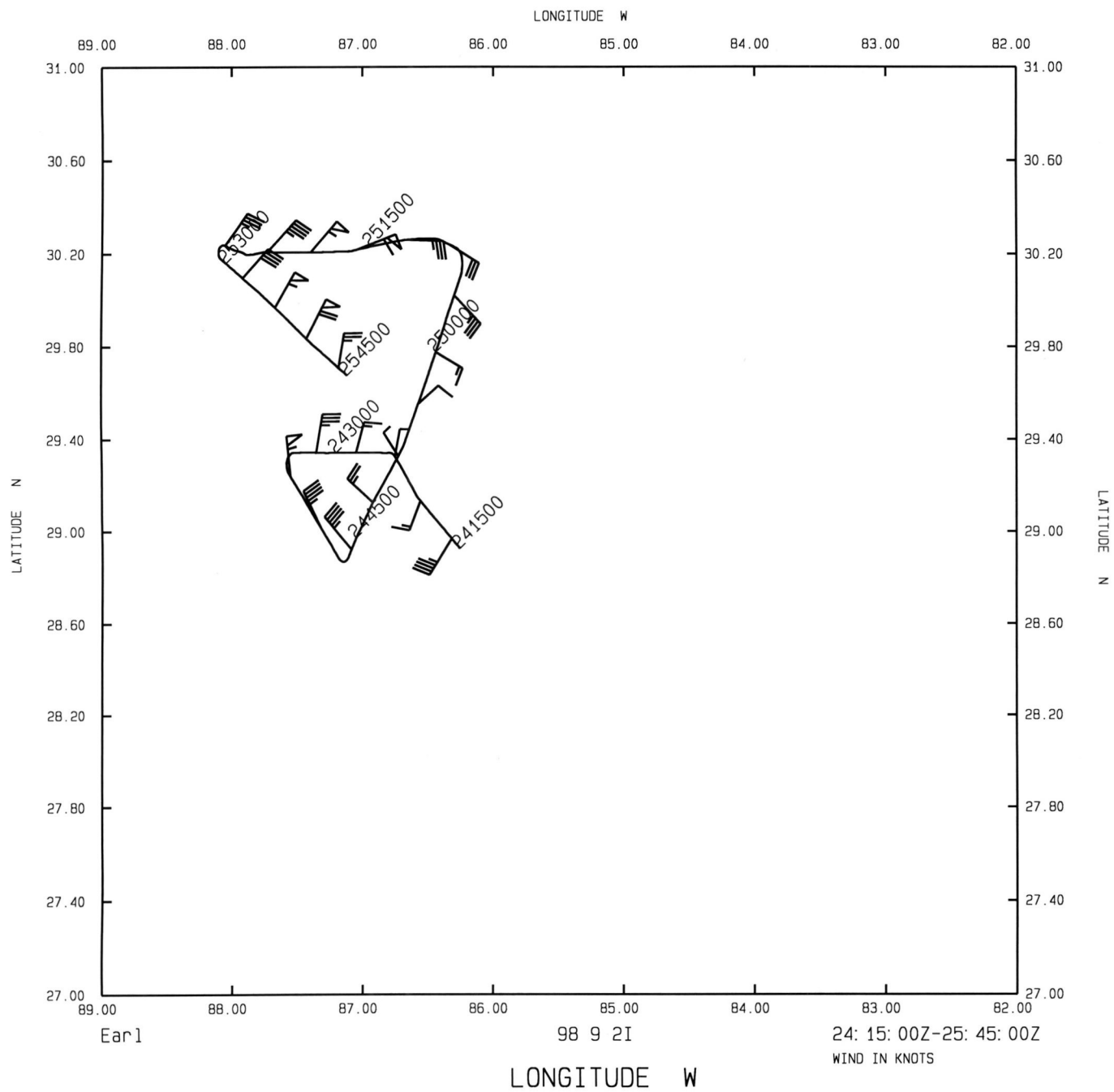
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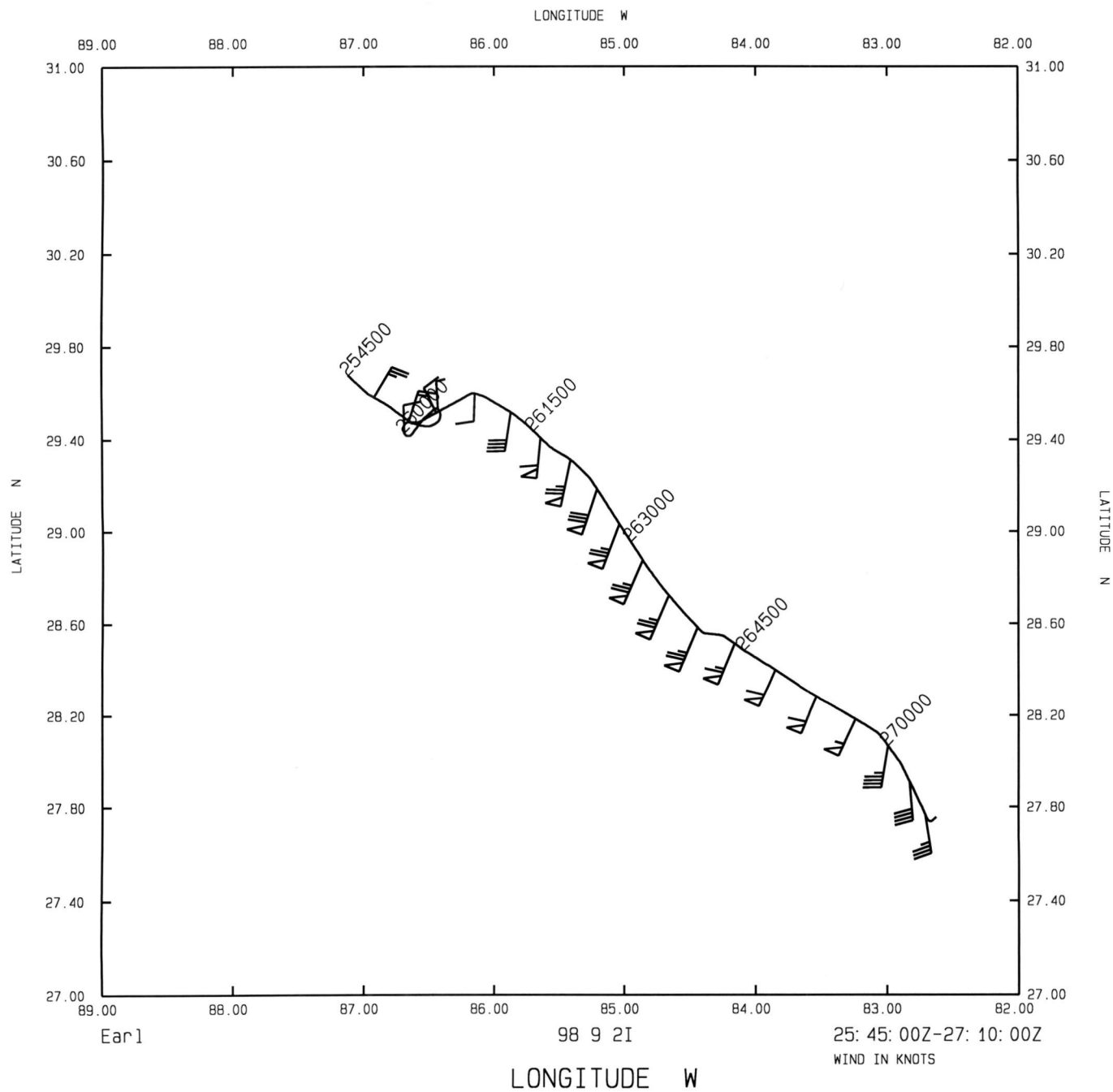


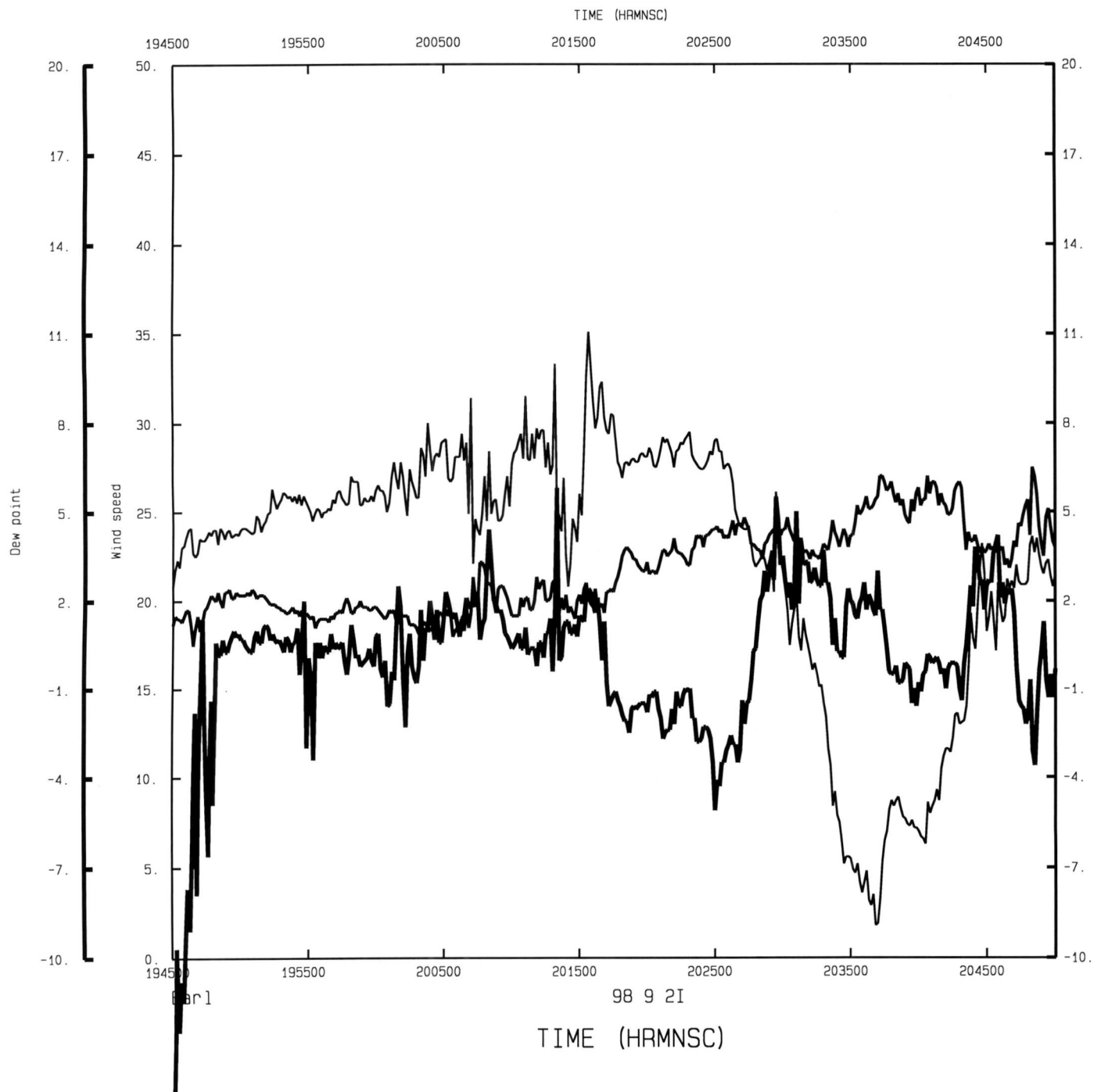


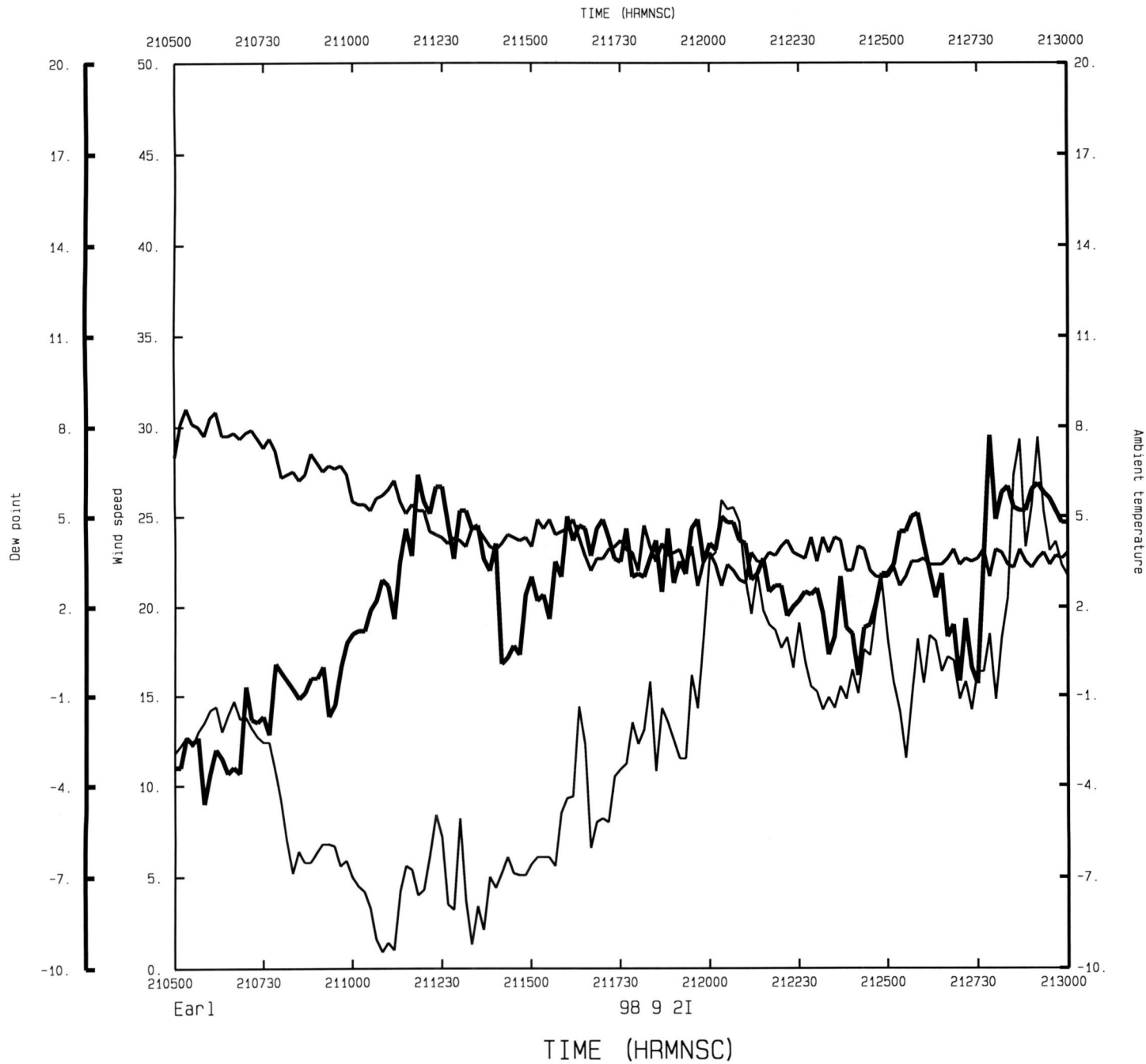




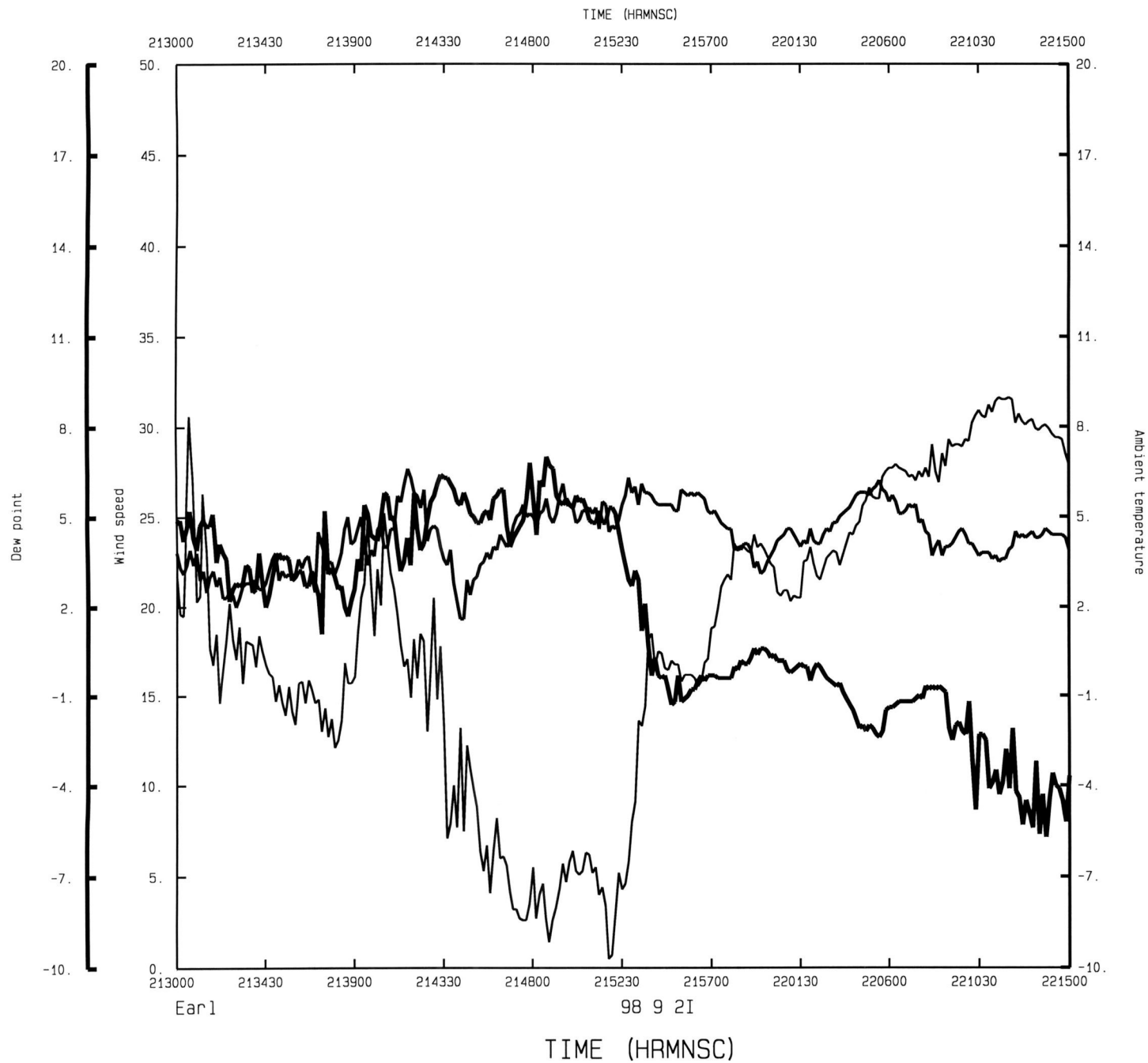




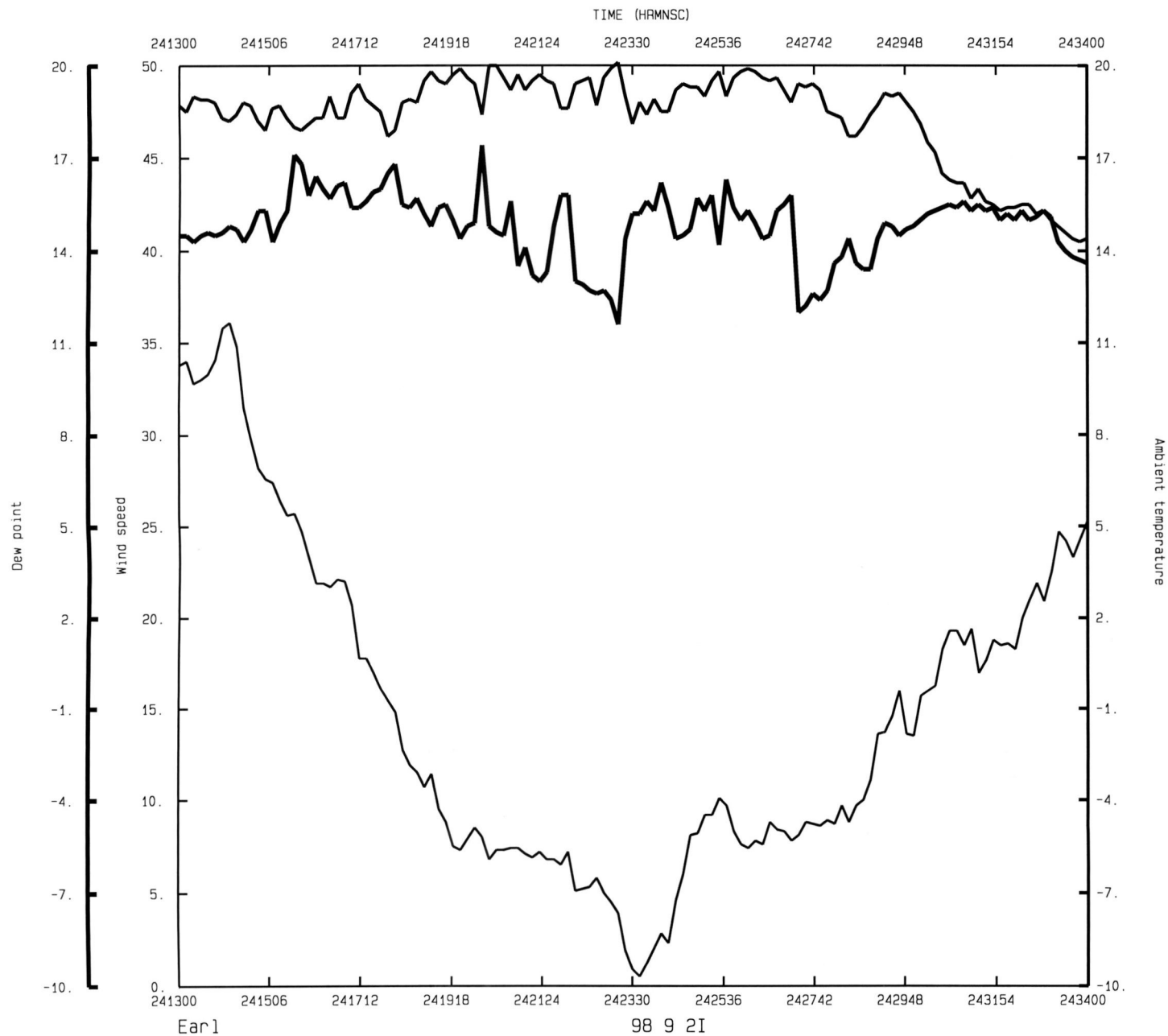




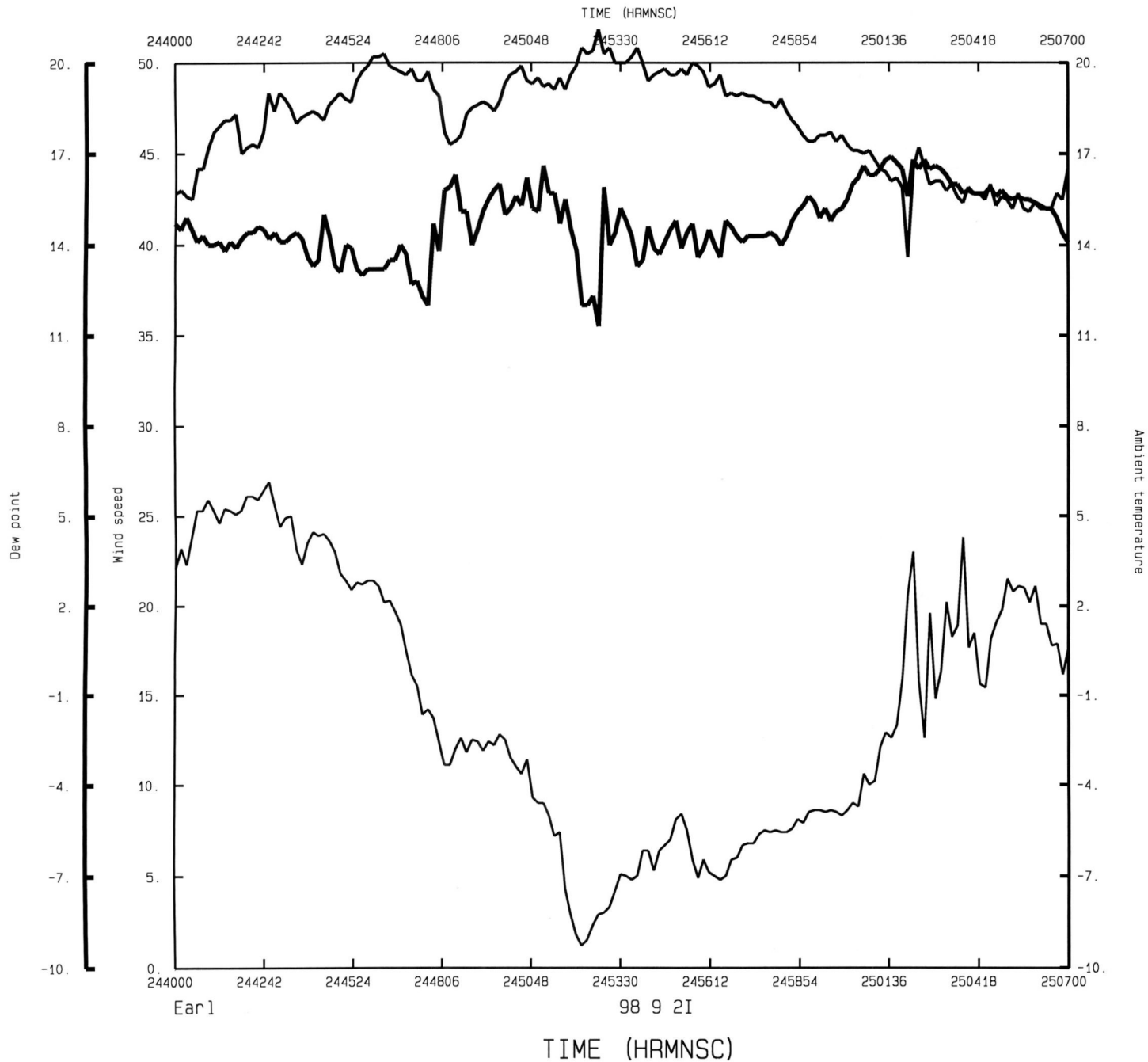
NOAA/HRD

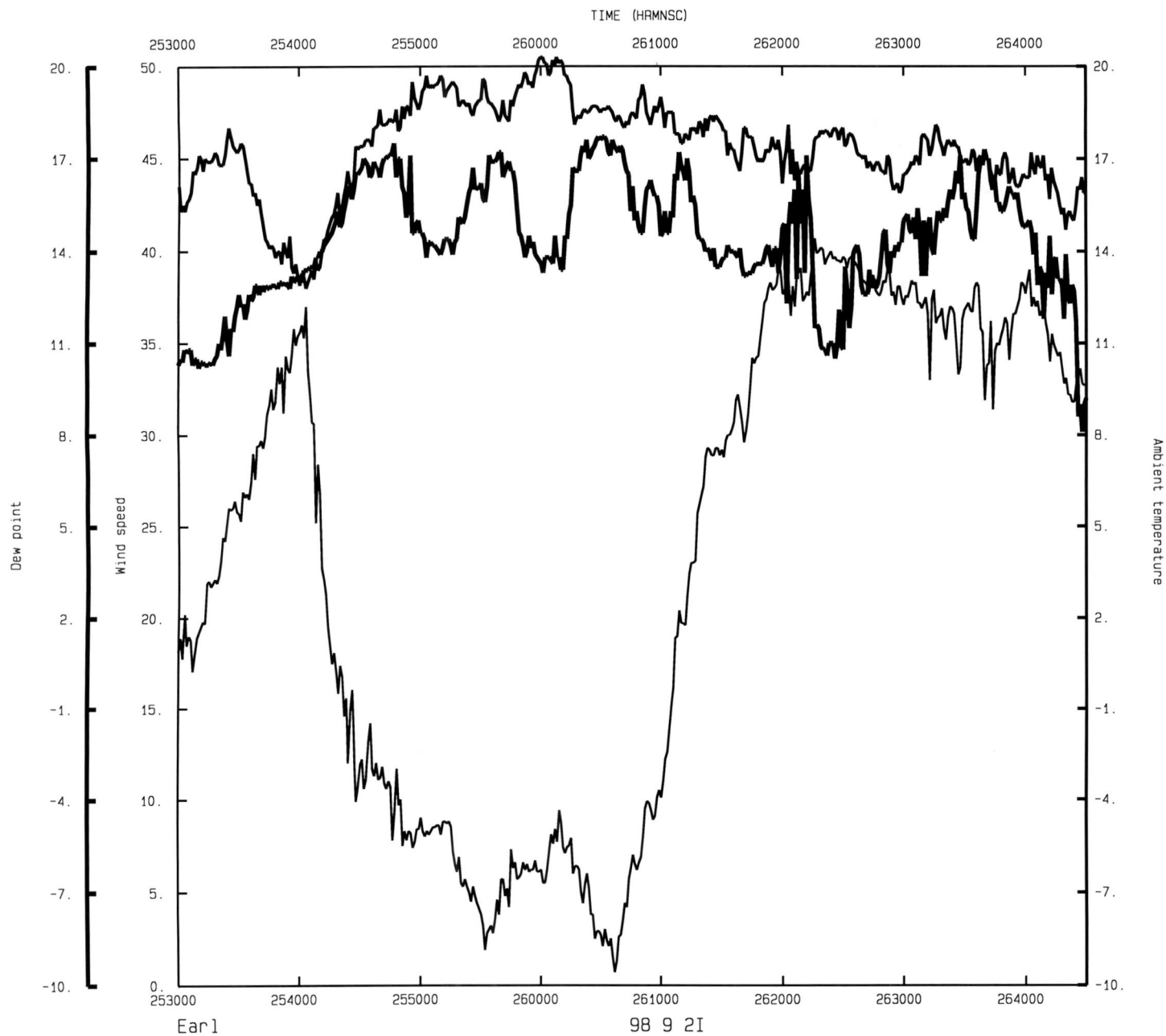


NOAA/HRD

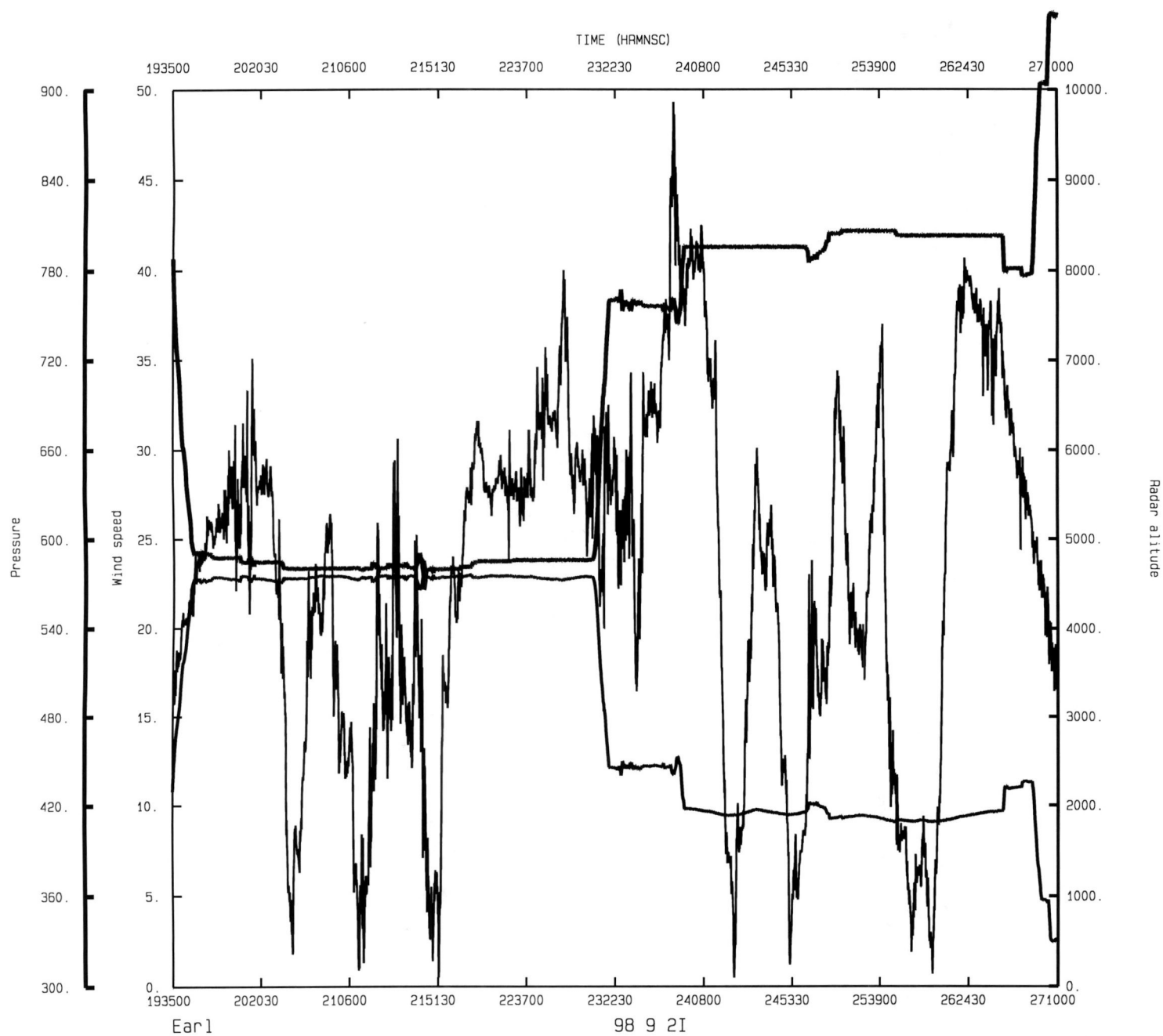


NOAA/HRD





NOAA/HRD



NOAA/HRD