Mission Summary
Tropical Storm Chantal
20010820H Aircraft: N42RF

Scientific Crew:

Lead Project Scientist	Mike Black
Radar Scientist	John Gamache
Workstation Scientist	Peter Dodge
Dropsonde Scientist	Gary Barnes (U Hawaii)
AXBT Scientist	Frank Marks
CCN Counter	Jim Hudson (DRI)
SFMR Scientist	Tony Castells (UMASS)

Aircraft Crew:

Pilots	CAPT Brian Taggert, LT Randall TeBeest
Flight Engineer	Greg Bast
Navigators	LT Carl Newman
Flight Directors	Tom Shepherd
Engineers	Sean McMillan, Jorge Delgado, Jim Barr

Mission Brief:

Tropical Storm Chantal was forecast to make landfall near the Belize-Mexico border on the Yucatan Peninsula in the late hours of August 20. The intensity was not forecast to change much from a 55-60 kt T.S. before making landfall. Visible and infrared (Fig. 1) satellite imagery showed an exposed low-level center with vigorous convection displaced on the east and north portions of the storm. HRD and NASA planned a quantitative precipitation experiment (QPE) with NOAA's N42RF and NASA's DC-8 and ER2 aircraft. The aircraft would fly coordinated legs in an asymmetric figure-4 pattern (Fig. 2) to sample the vortex and high precipitation regions. The leg lengths of the NOAA WP-3D would be shorter (max. 100 nmi) than those of the DC-8 and ER-2 (max. 165 nmi) to account for the differences in ground speed. The tail radar on the WP-3D would be operated in the F/AST mode, except on the SW to NE and E to W passes, where continuous mode would be employed to collect vertical incidence Doppler data. The WP-3D would deploy up to 18 AXBTs and 24 GPS dropsondes in the storm environment, primarily in the inner core.

Sometime during the execution of the figure-4, a rainband would be identified by HRD scientists with the LF radar on the WP-3D that would be studied by both the NOAA and NASA aircraft after completion of the survey pattern. Information on the location and orientation of the rainband would be conveyed from the WP-3D crew to the crew on the DC-8 and ER2 for coordination. The WP-3D planned on flying a series of box patterns around convectively-active portions of the band while the DC-8 and ER2 would fly across the band. N42RF would take off at 1630 UTC from MacDill AFB and the NASA aircraft at 1700 UTC from Jacksonville to rendezvous at the initial point north of Chantal's Center.

Mission Synopsis:

N42RF departed MacDill AFB at 1722 UTC, almost an hour later than planned due to a takeoff delay of the NASA aircraft. The aircrew of N42RF tried to contact the NASA aircraft on the ferry down to Chantal but were unable to communicate with them until nearing the IP. Once we realized that the NASA planes were about a half hour behind N42RF, it was decided to fly closer to the center of Chantal to get a better look on the LF radar (Fig. 3). The radar showed an asymmetric precipitation pattern with all of the convection on the north and east sides of the storm. The coastlines of Cozumel, the Yucatan Peninsula, and Belize are also evident in Fig. 3). A well-defined radar center was not obvious on the radar screen. The WP-3D turned back to the north to arrive at our IP and coordinate with the NASA aircraft. The actual flight of N42RF is in Figure 4.

The storm was somewhat further west than anticipated, so we adjusted our north-to-south pass through Chantal to end up about 50 miles south of the center. N42RF fixed the center of Chantal at about 18.4 ° N, 86.8 ° W. We dropped 4 GPS sondes along with AXBTs on the north side of the storm (Table 1). N42RF tracked NE, dropping a sonde and AXBT at the midpoint of the downwind leg, We arrived at a point 100 nmi east of the center, releasing a sonde and AXBT before heading inbound at 2100 UTC. During this pass, the WP-3D encountered a series of convective rainbands and adjacent stratiform precipitation regions.

An overall view of the precipitation pattern of Chantal, along with N42RF's track, sonde, and AXBT locations is in Figure 5. A dropsonde was released just south of the center of Chantal at 3126 UTC with a location of 18.1 ° N, 87.2° W. The leg lengths on the west and southwest sides of Chantal were truncated to maintain coordination with the NASA aircraft. N42RF then made a SW to NE pass through the storm ending up at a point 100 nmi NE of Chantal at 2210 UTC. GPS sondes and AXBTs were dropped at the midpoints and end of the legs. Plots from the dropsondes at 700, 850, Surface, and layer-mean (700-SFC) are shown in Figures 7-10. The sondes highlighted by boxes in Fig. 10 are 4 representative observations, depicted in the Skew-T plots in Figures 13-16.

The NOAA WP-3D aircraft was then finished with the survey portion of the flight and we found out that the NASA DC-8 aircraft was having instrumentation problems associated with severe icing and would probably have to return to base. The WP-3D crew decided to continue on and fly an abbreviated box pattern around a convective rainband about 60 nmi east of Chantal's center (Fig. 17). The tail radar collected Doppler wind and reflectivity data as we passed close to the band. A particularly intense cell, embedded in strong shear is evident in Fig. 18. At 2350 UTC, N42RF headed back to MacDill after tracking NW along the inner portion of the rainband. The remaining 8 AXBTs loaded into the tubes on the belly of the WP-3D were deployed in the eastern Gulf of Mexico during 0051 and 0123 UTC at evenly-spaced locations between 24° and 26.7° N, 84° and 85° W. N42RF landed at 0056 UTC, having completed an 8.5-hour mission. Overall this was a successful mission, both from a scientific viewpoint and for testing the instrumentation and coordination with NASA. Valuable flight-level, radar reflectivity, Doppler velocity, GPS sonde, and AXBT data were collected in a sheared, asymmetric tropical storm that had large areas of deep convection (Fig. 20). A total of 21 GPS dropsondes and 18 AXBTs were releases in the inner core and nearby environment of Chantal. Data collected from the aircraft were uses in the HRD real-time wind analyses (Fig. 19) and by the NHC forecaster on duty.

PROBLEMS:

Although this mission was designed to collect data for a quantitative precipitation study, the SFMR and cloud physics systems were not operating. The reflectivity data seemed about 8 dBZ too high while the tail reflectivity data appeared about the same amount too low. Hopefully, these can be corrected in post-flight calibrations. One GPS sonde had a launch failure and another contained no wind data. Otherwise, the GPS sondes worked extremely well, including the fix by AOC to the temperature and humidity sensor arms; there were no failures of these sensors. The AXBTS all recorded data, with only a few that contained questionable data. The NOAA and NASA aircraft had communication problems that hindered the effectiveness of the coordination. These problems will, hopefully, be resolved before the next flight with the NOAA and NASA aircraft.

Mike Black
9/4/01

TS Chantal Sondes 20 Aug 2001 N42RF

#	Sonde_ID	TIME (UTC)	Lat	Lon	WL150	DLM WND	MBL WND	Comments
1	003115095	1938	19.71	85.51	10039	11538	09542	RAINBAND
2	003475034	2005	19.82	86.09	10035	11539	09535	SST 290
3	003475031	2020	18.85	86.48	08045	10050	07547	LSTWND 011 SST 294
4	003248007	2027	18.50	86.82	07552	11522	08062	
5	003475026	2047	18.16	86.03	13545	14546	13546	
6	003475088	2100	18.37	85.02	-99	-99	-99	No winds not transmitted
7	003475048	2106	18.43	85.45	08034	12535	08036	
8	003515122	2111	18.41	85.84	10541	13042	10543	SST 298 RAINBAND
9	003475089	2136	18.07	87.26	09510	25001	10508	LSTWND 032 SST 299 EYE
10	003475097	2158	19.03	86.10		11543	-99	LSTWND 470
11	003475038	2207	19.49	85.57	08032	11034	08036	
12	003115089	2234	18.53	87.07	09553	11543	09557	LSTWND 012
13	003115094	2247	18.30	86.22	08542	12537	08545	
14	011245417	2258	19.11	86.52	07544	10545	08046	
15	003515086	2320	18.30	87.49	09018	11517	09517	
16	003515073	2323	18.33	87.31	12032	13534	12034	
17	003475036	2326	18.36	87.10	12043	13043	11045	
18	003248008	2329	18.39	86.88	09057	11550	09062	
19	003475039	2334	18.43	86.51	08551	11546	09053	LSTWND 013
20	003475033	2338	18.48	86.19	08543	11542	09044	
21	003825281	2349	19.10	86.37	08043	10543	08043	

TS Chantal
20010820H

NOAA-42

HRD Flight Summary

Mike Black

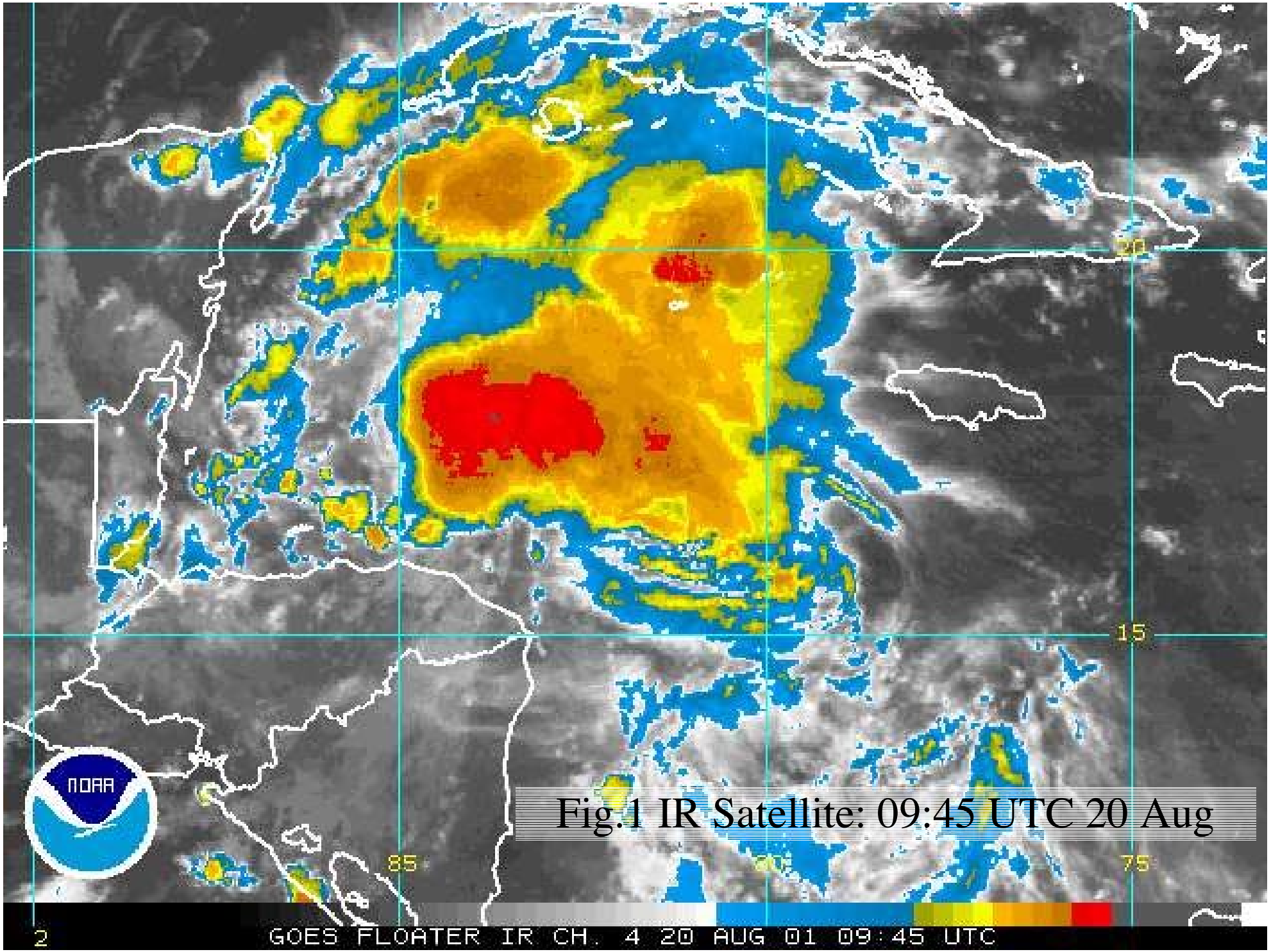
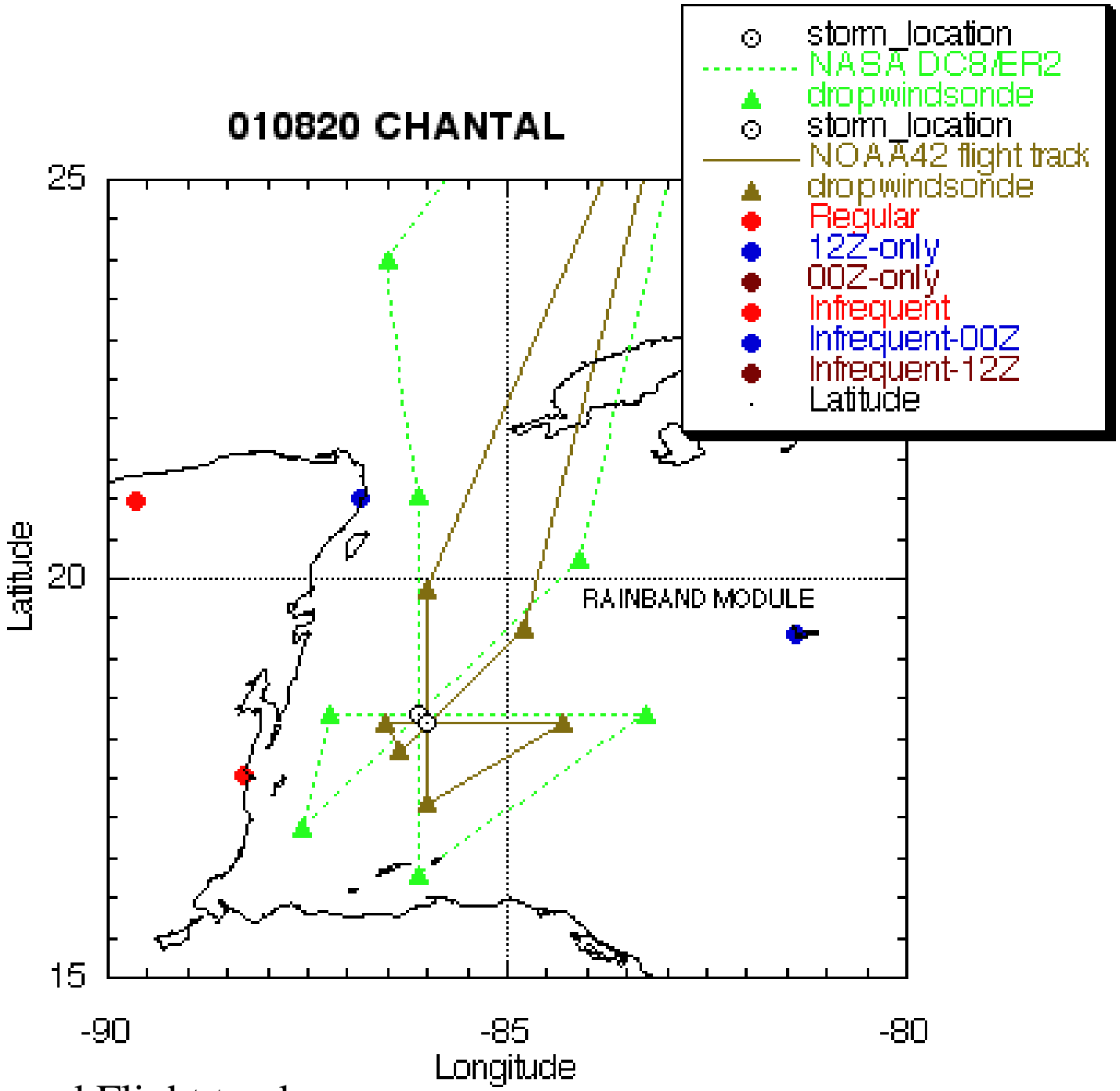


Fig.1 IR Satellite: 09:45 UTC 20 Aug



- Figure 2 Planned Flight tracks

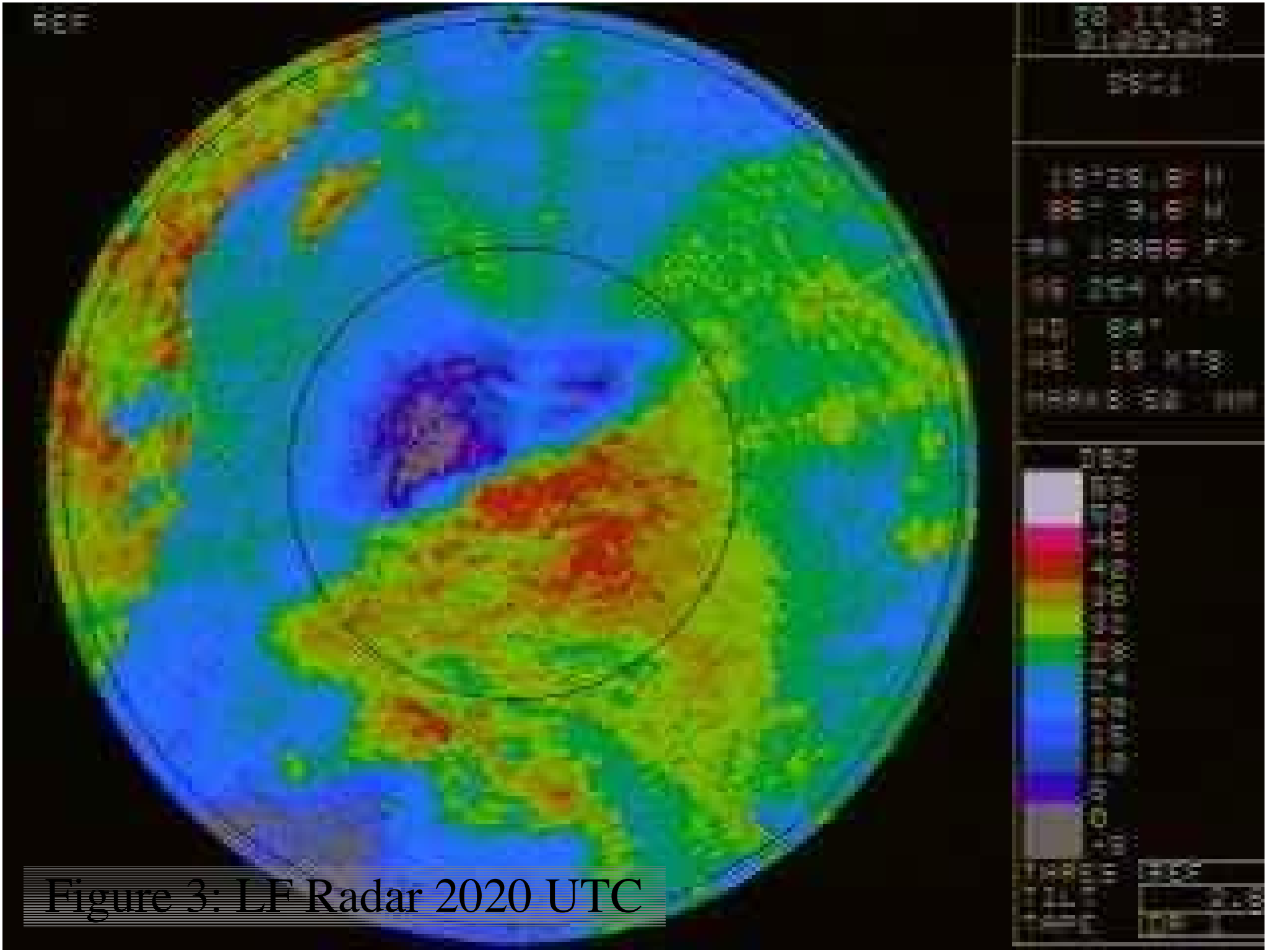


Figure 3: LF Radar 2020 UTC

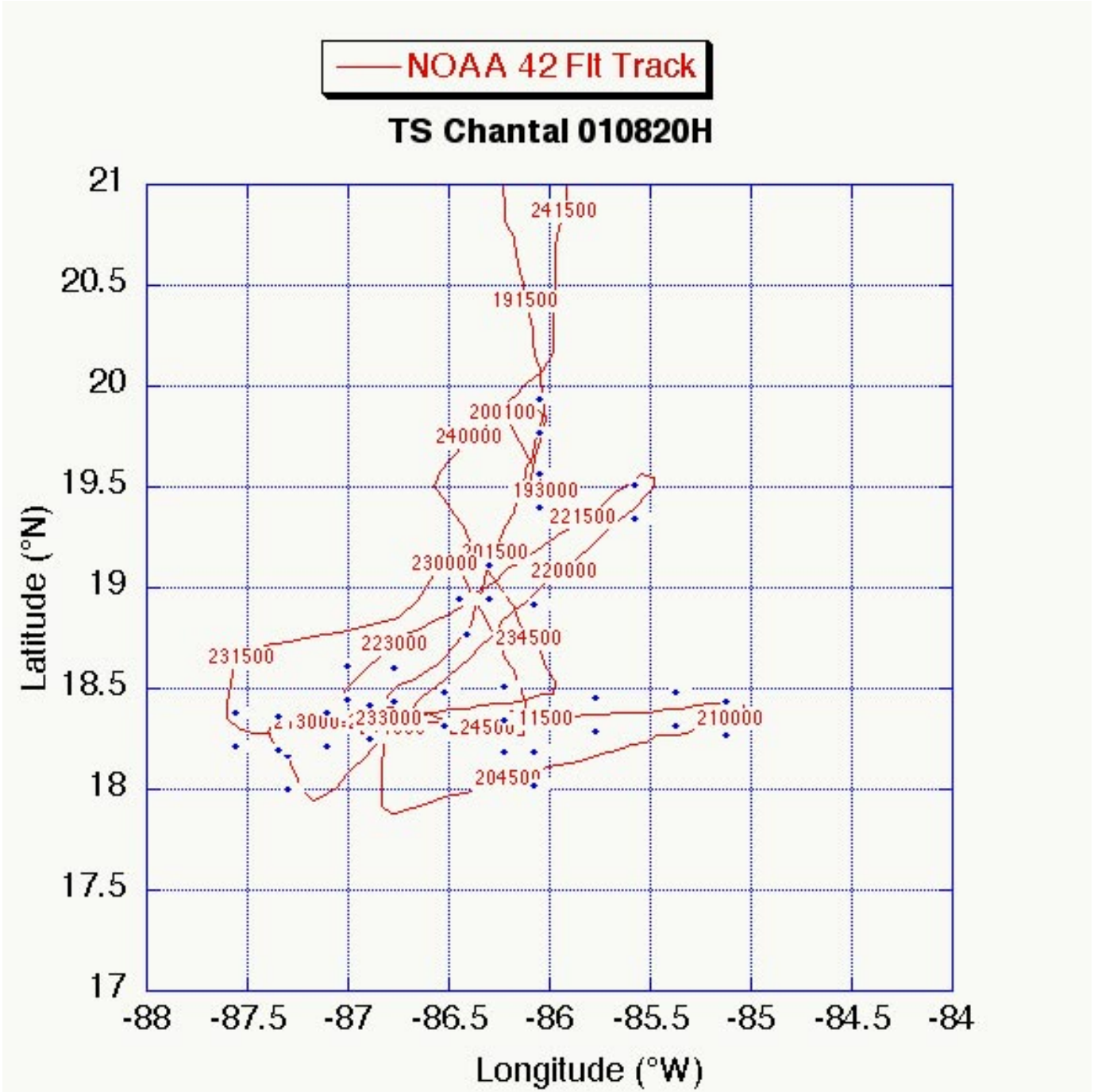


Figure 4: N42RF flight track with times (UTC) every 15 minutes and GPS-sonde locations (•)

Table 1: GPS-sondes- N42RF

TS Chantal Sondes 20 Aug 2001 NOAA 42

		Time	Splash Loc		WL150		DLM WND	MBL WND		COMMENTS
	Sonde ID	UTC	lat	lon						
1	003115095	1938	19.71	85.51	10039	085	11538	012586	09542	RAINBAND
2	003475034	2005	19.82	86.09	10035	085	11539	012616	09535	SST 290
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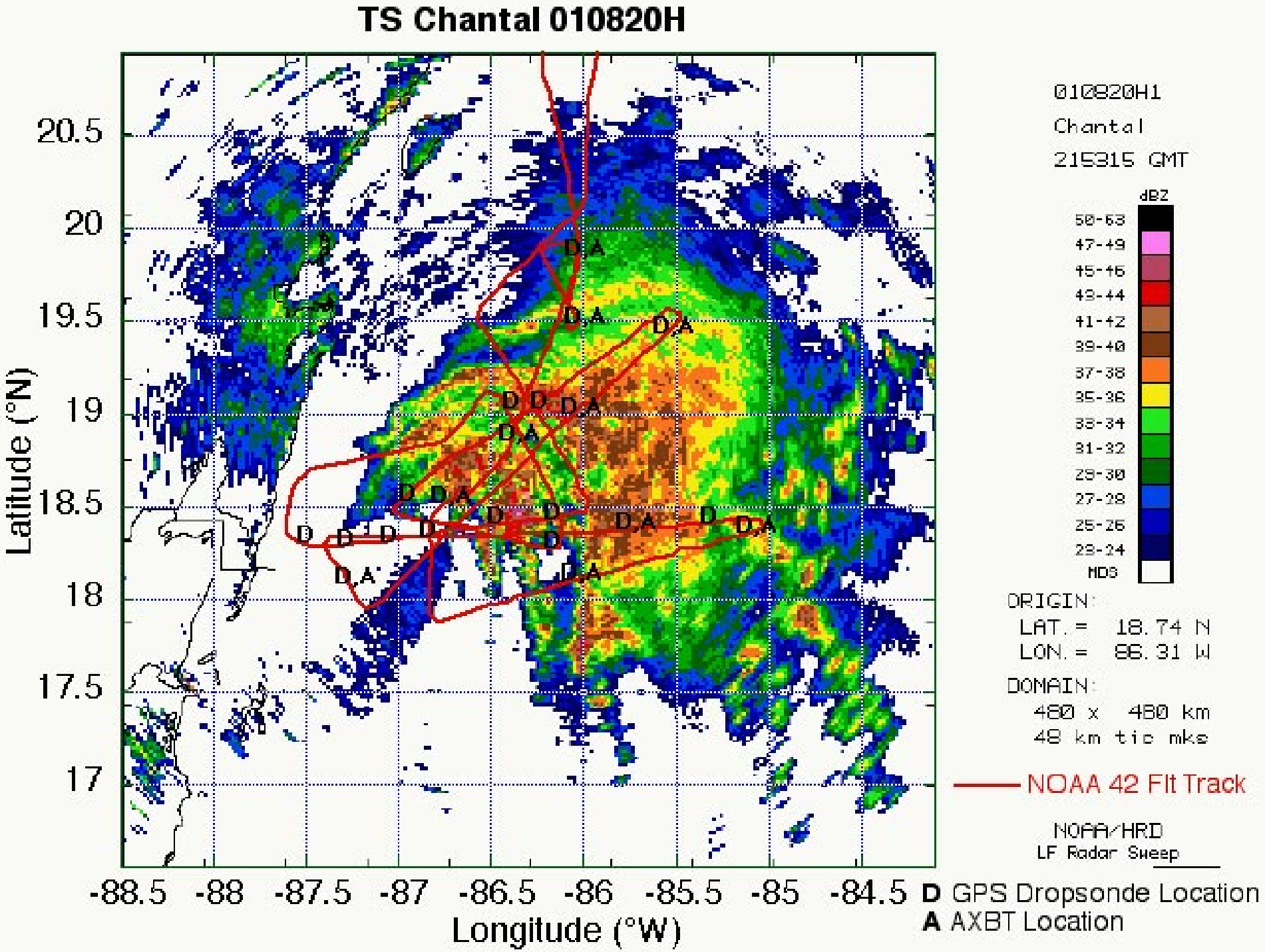
4	003248007	2027	18.50	86.82	07552	085	11522	006613	08062	
5	003475026	2047	18.16	86.03	13545	085	14546	008684	13546	
6	003475088	2100	18.35	85.02						NO WINDS
7	003475048	2106	18.43	85.45	08034	085	12535	011615	08036	
8	003515122	2111	18.41	85.84	10541	085	13042	010615	10543	SST 298 RAINBAND
9	003475089	2136	18.07	87.26	09510	107	25001	001613	10508	LST WND 032 SST 299 EYE
10	003475097	2158	19.03	86.10			11543	958615		LST WND 470
11	003475038	2207	19.49	85.57	08032	085	11034	012615	08036	
12	003115089	2234	18.53	87.07	09553	087	11543	005615	09557	LST WND 012
13	003115094	2247	18.30	86.22	08542	085	12537	009614	08545	
14	011245417	2258	19.11	86.52	07544	085	10545	010614	08046	
15	003515086	2320	18.30	87.49	09018	085	11517	003683	09517	
16	003515073	2323	18.33	87.31	12032	085	13534	004614	12034	
17	003475036	2326	18.36	87.10	12043	085	13043	006614	11045	
18	003248008	2329	18.39	86.88	09057	085	11550	005693	09062	
19	003475039	2334	18.43	86.51	08551	088	11546	007613	09053	LST WND 013 LAST REPORT TO KWBC
20	003475033	2338	18.48	86.19	08543	085	11542	010613	09044	
21	003825281	2349	19.10	86.37	08043	085	10543	012614	08043	

Last two GPS-sondes were not transmitted.



- Figure 5: LF radar, track, AXBT and GPS-sonde locations

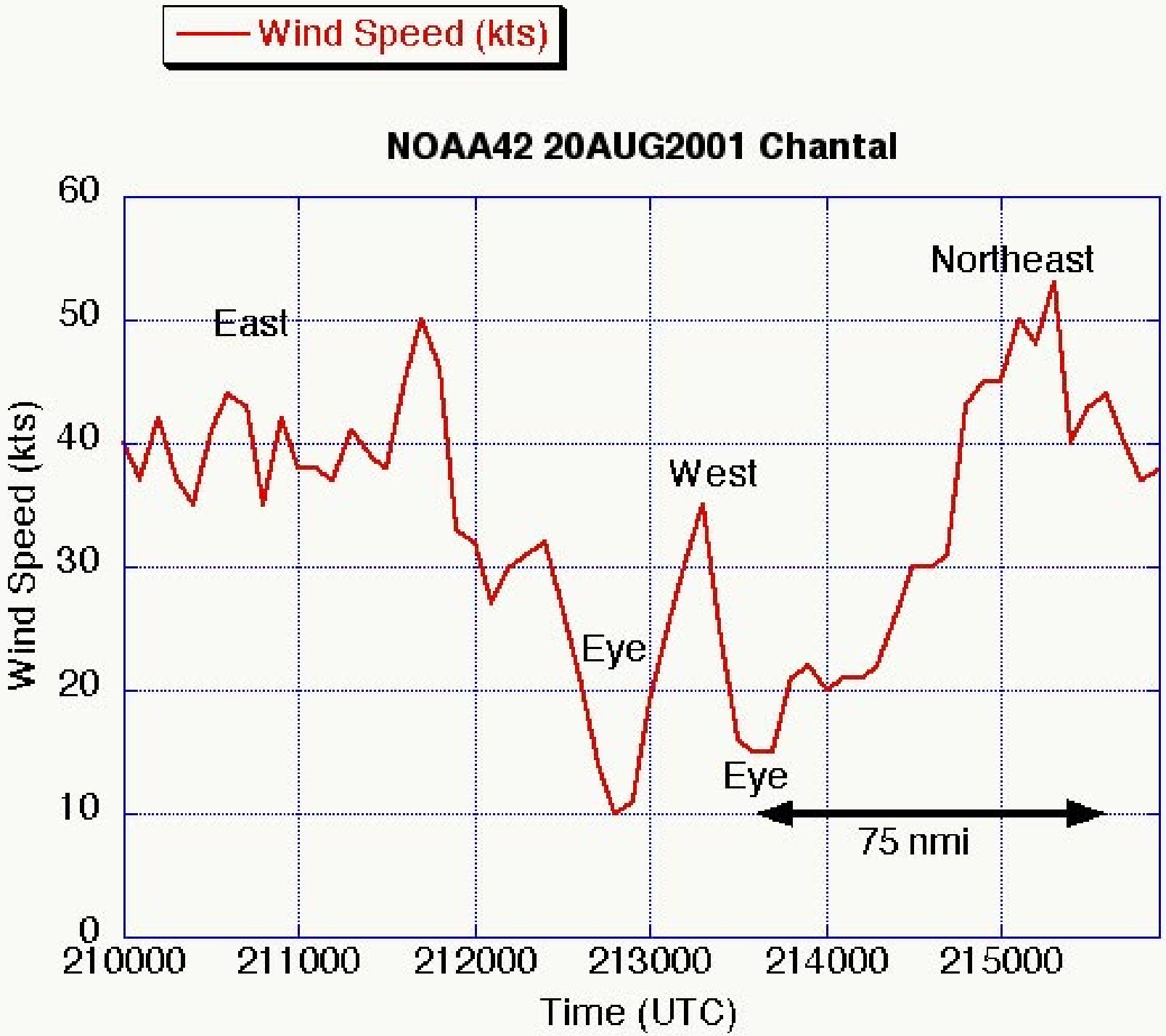


Fig. 6: N42R
flight-level
wind speed

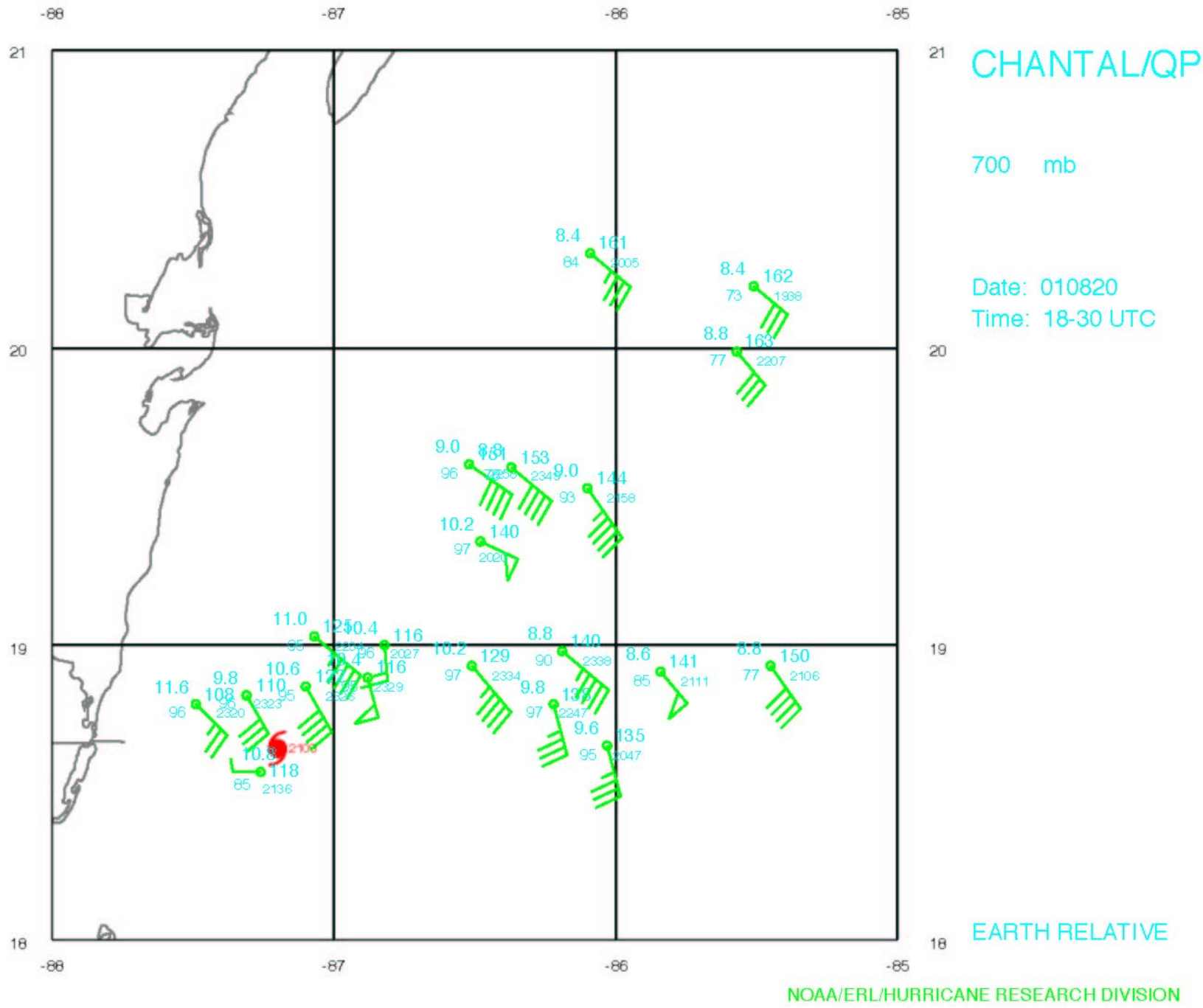


Fig. 7: 700 mb GPS-sondes

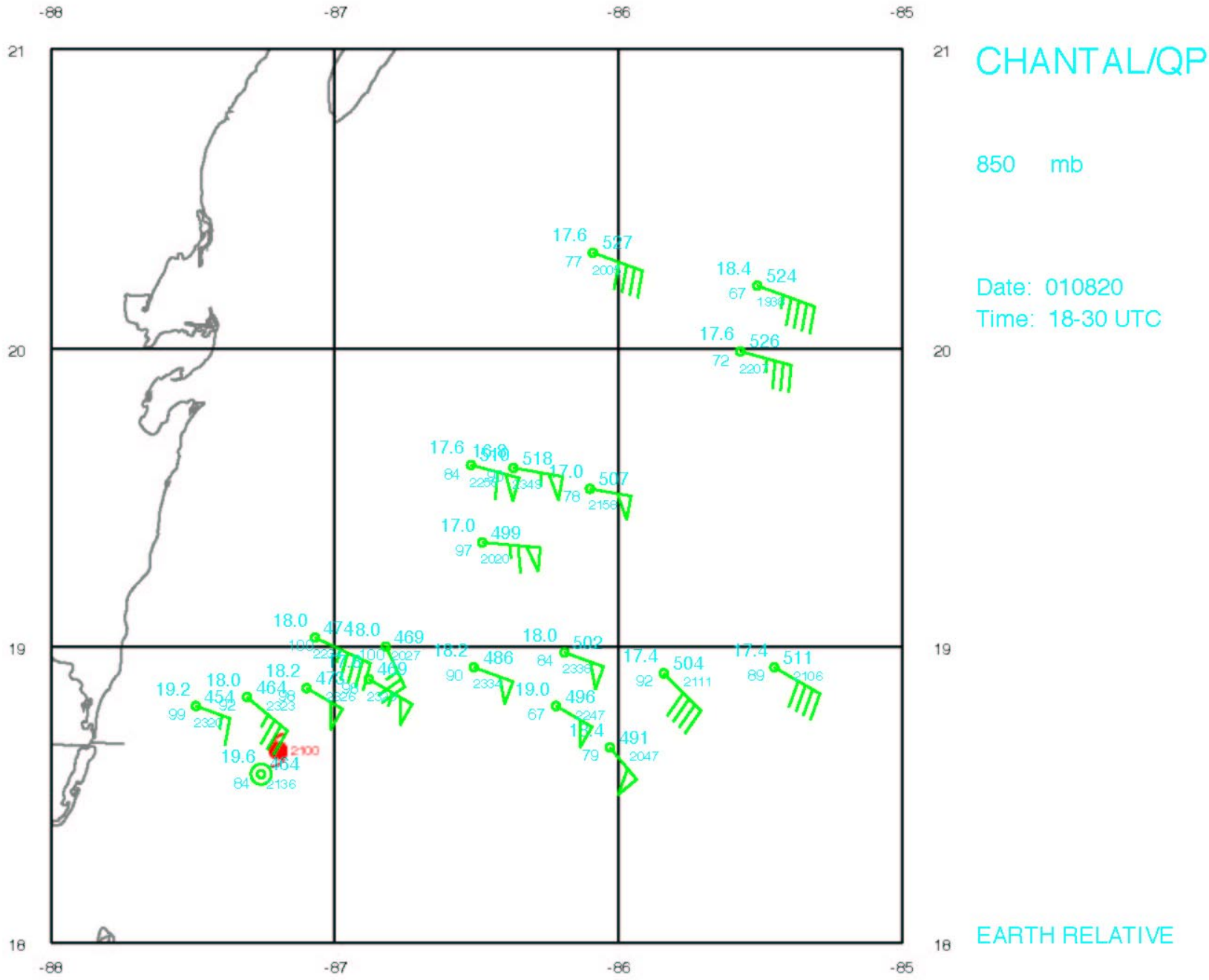


Fig. 8: 850 mb GPS-sondes

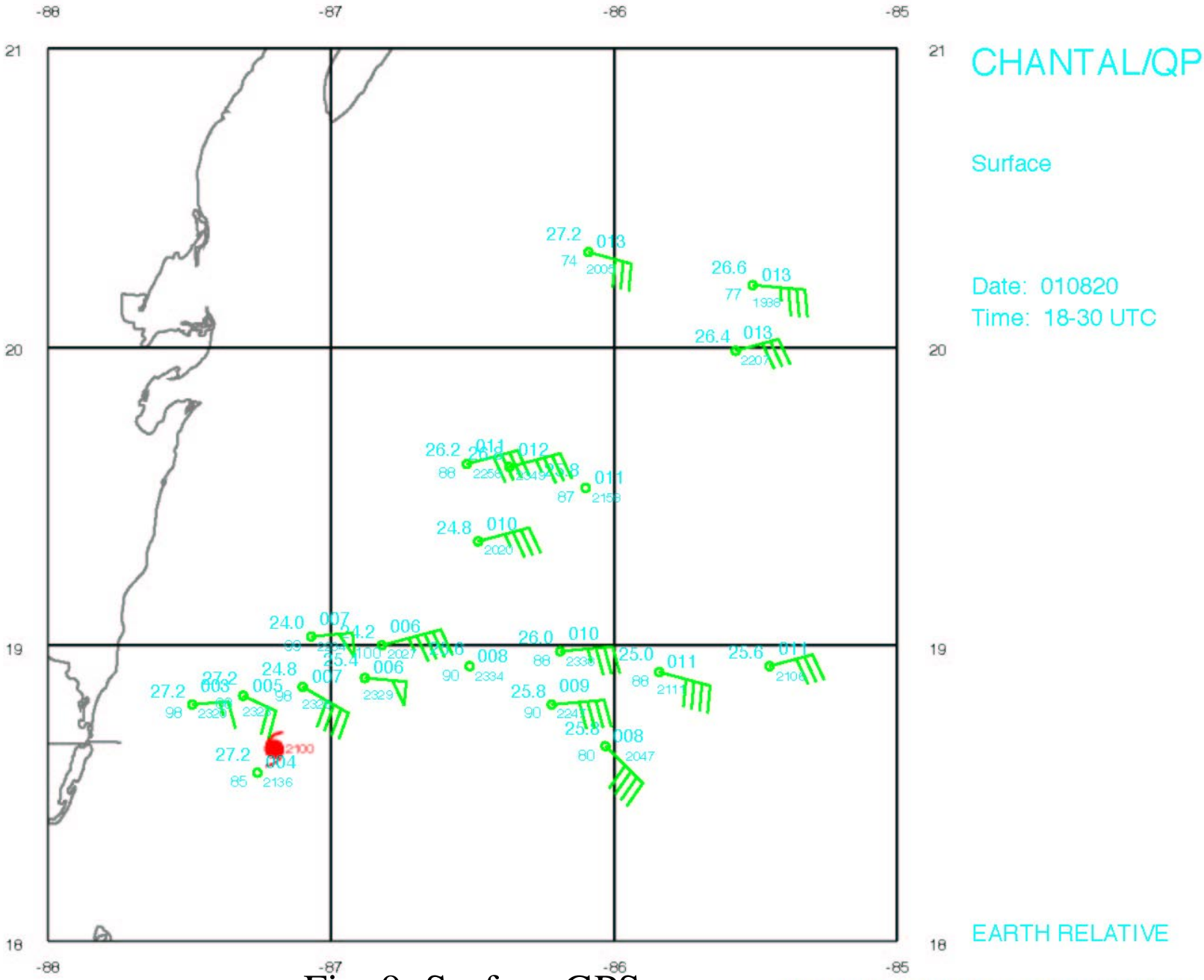


Fig. 9: Surface GPS-sondes

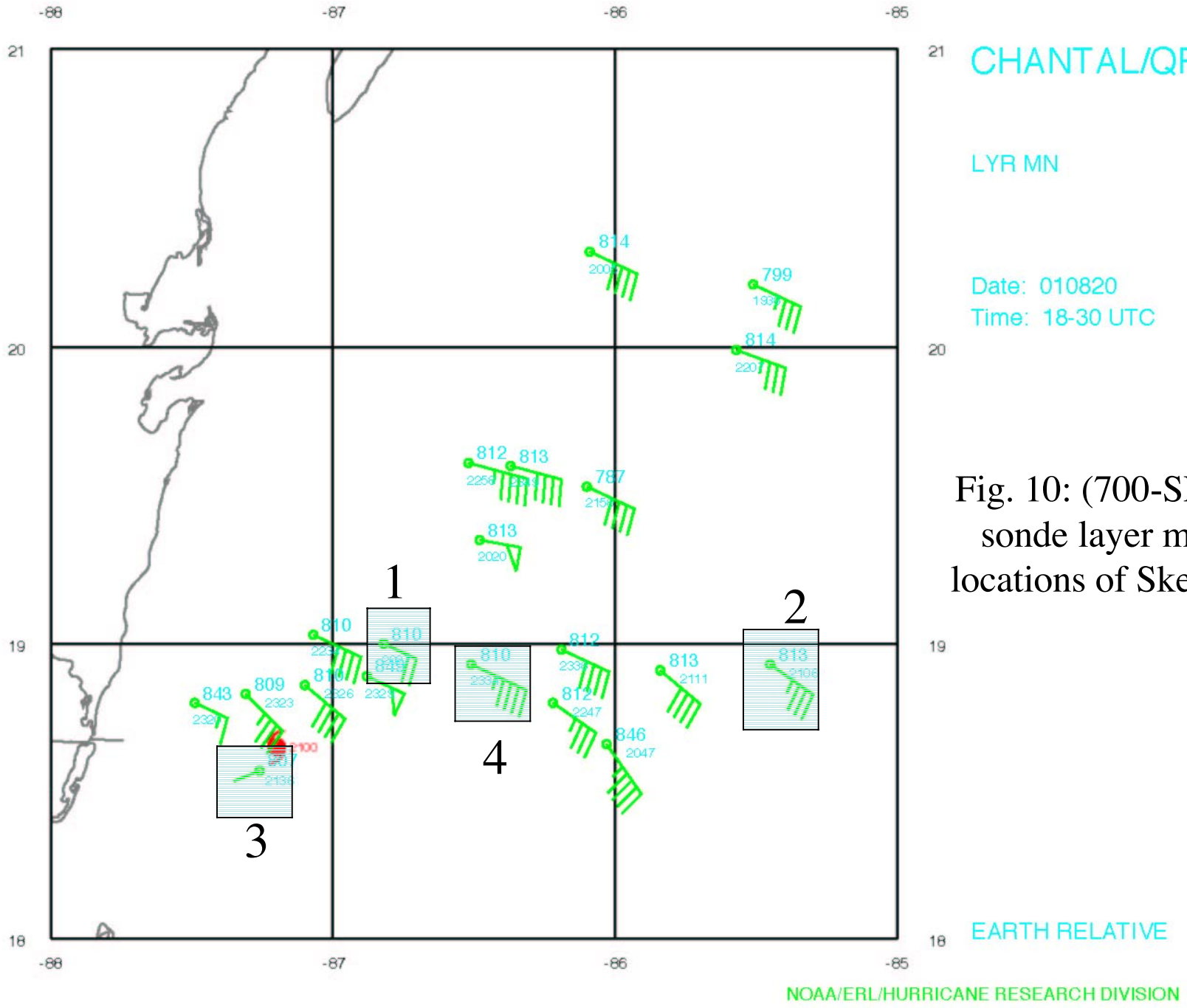
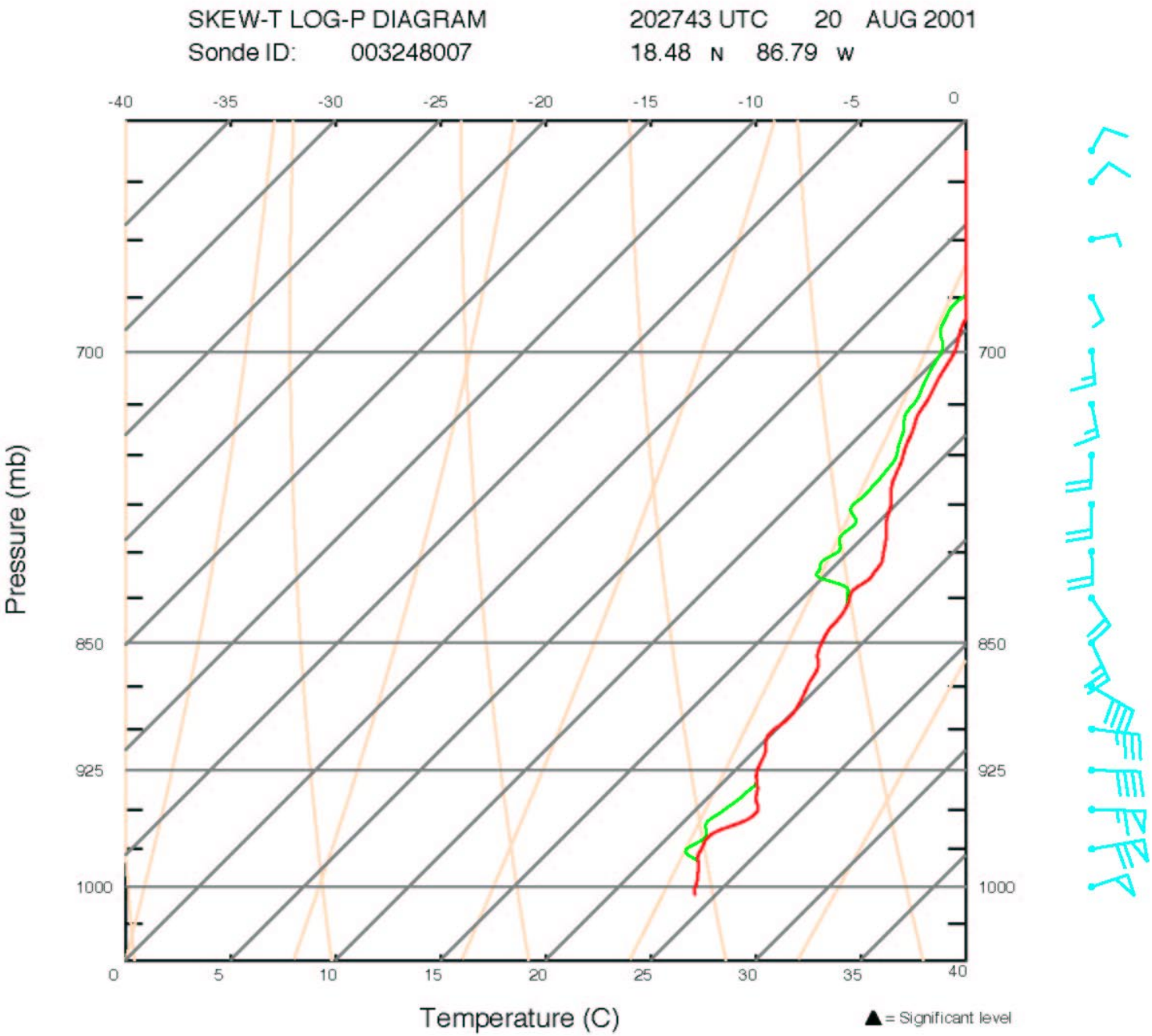


Fig. 10: (700-SFC) GPS-sonde layer mean and locations of Skew-T plots



- Fig. 11: GPS-sonde NE of center (1)

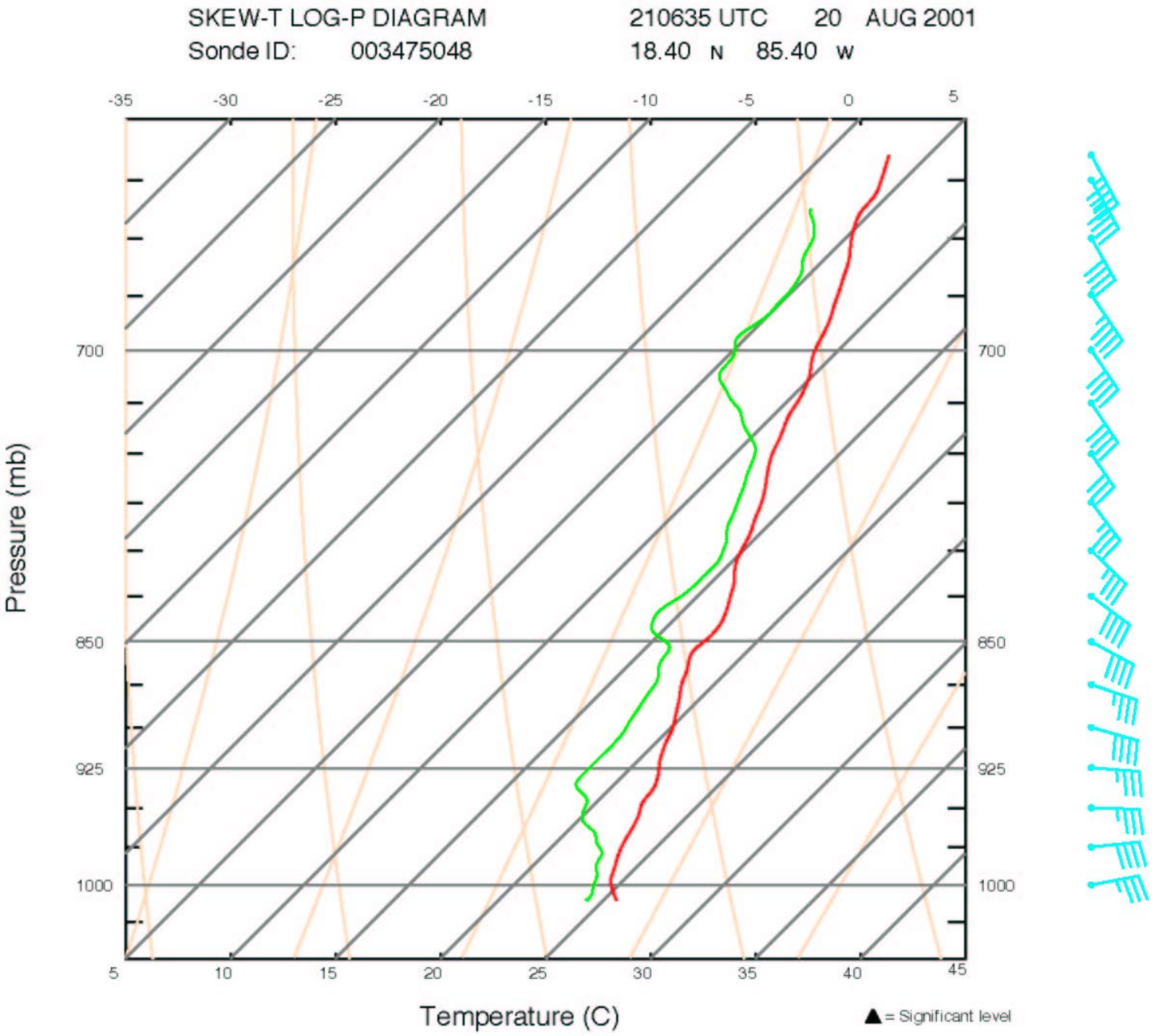
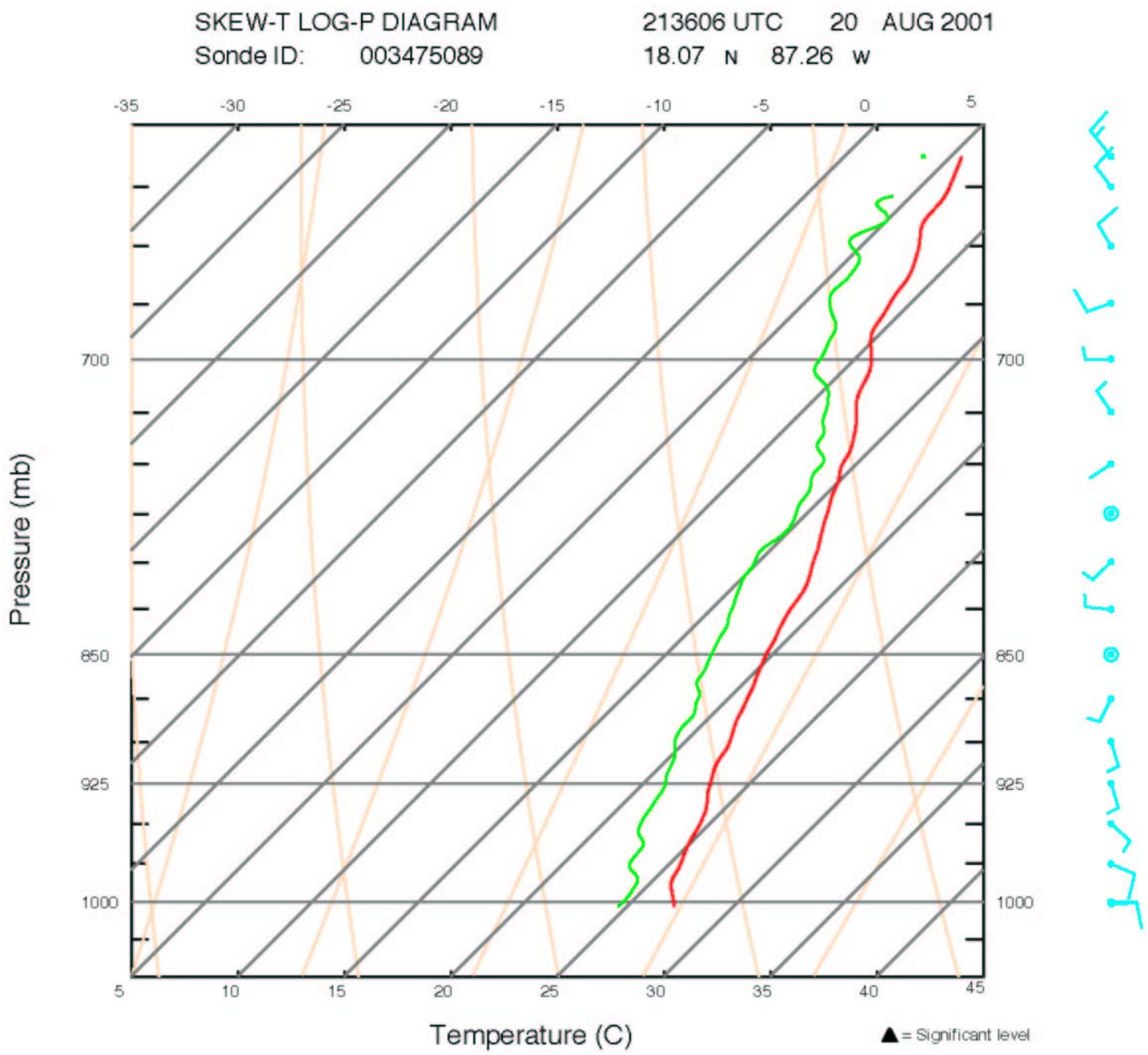
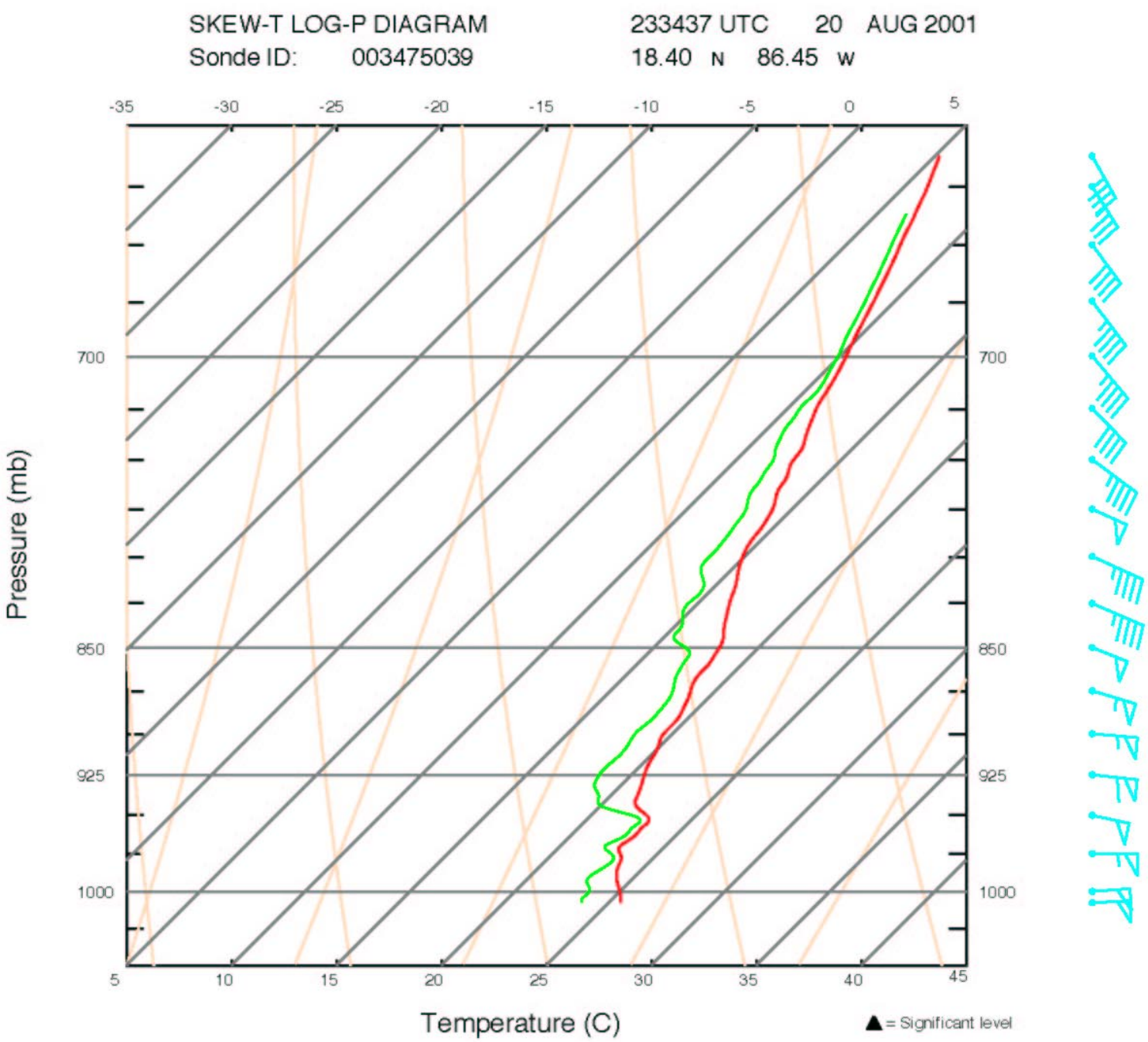


Fig. 12: GPS-sonde easternmost point (2)



- Fig. 13: GPS-sonde near center (3)



- Fig. 14: GPS-sonde rainband, east of center

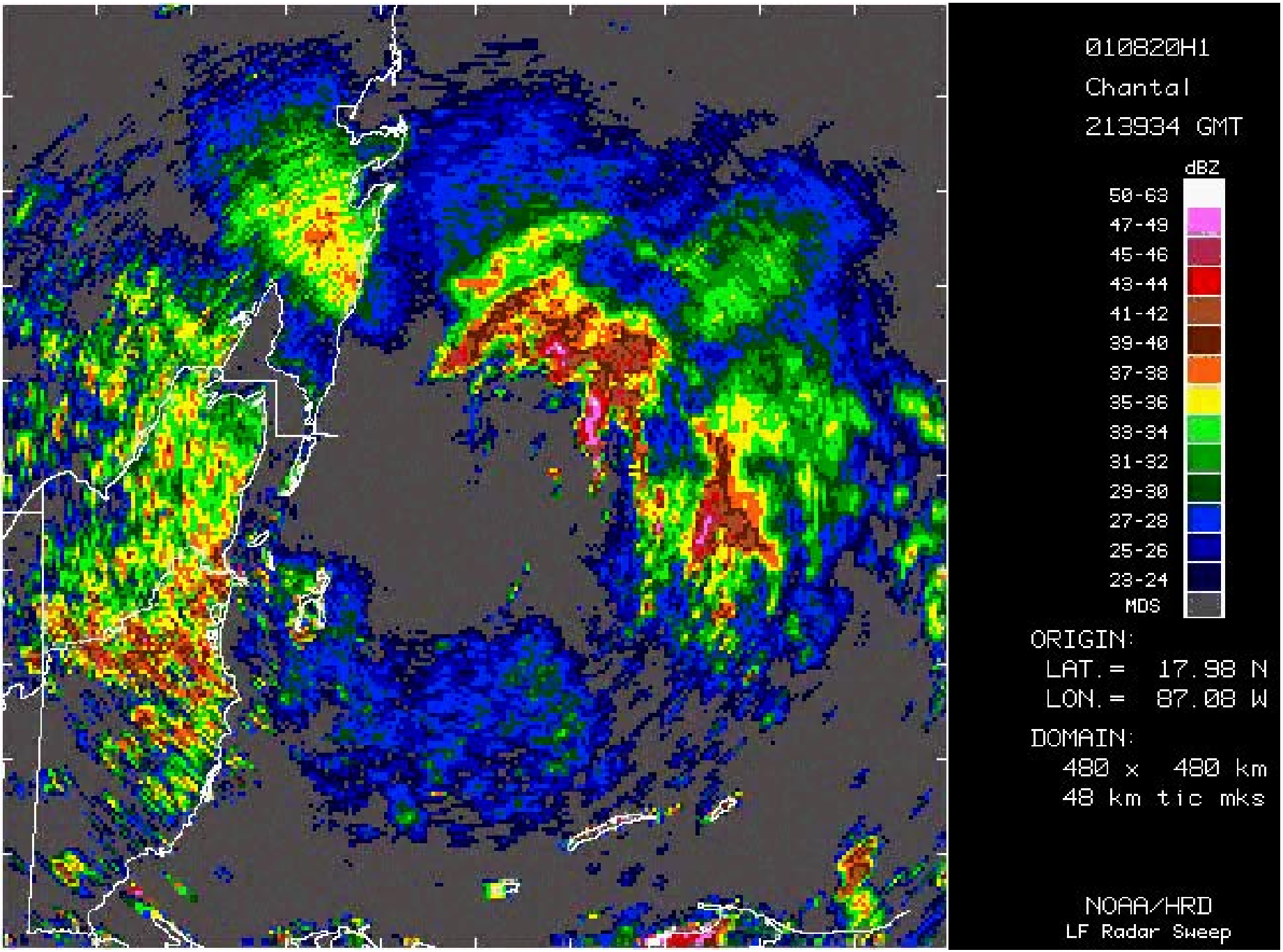


Fig. 15: LF radar animation of rainbands

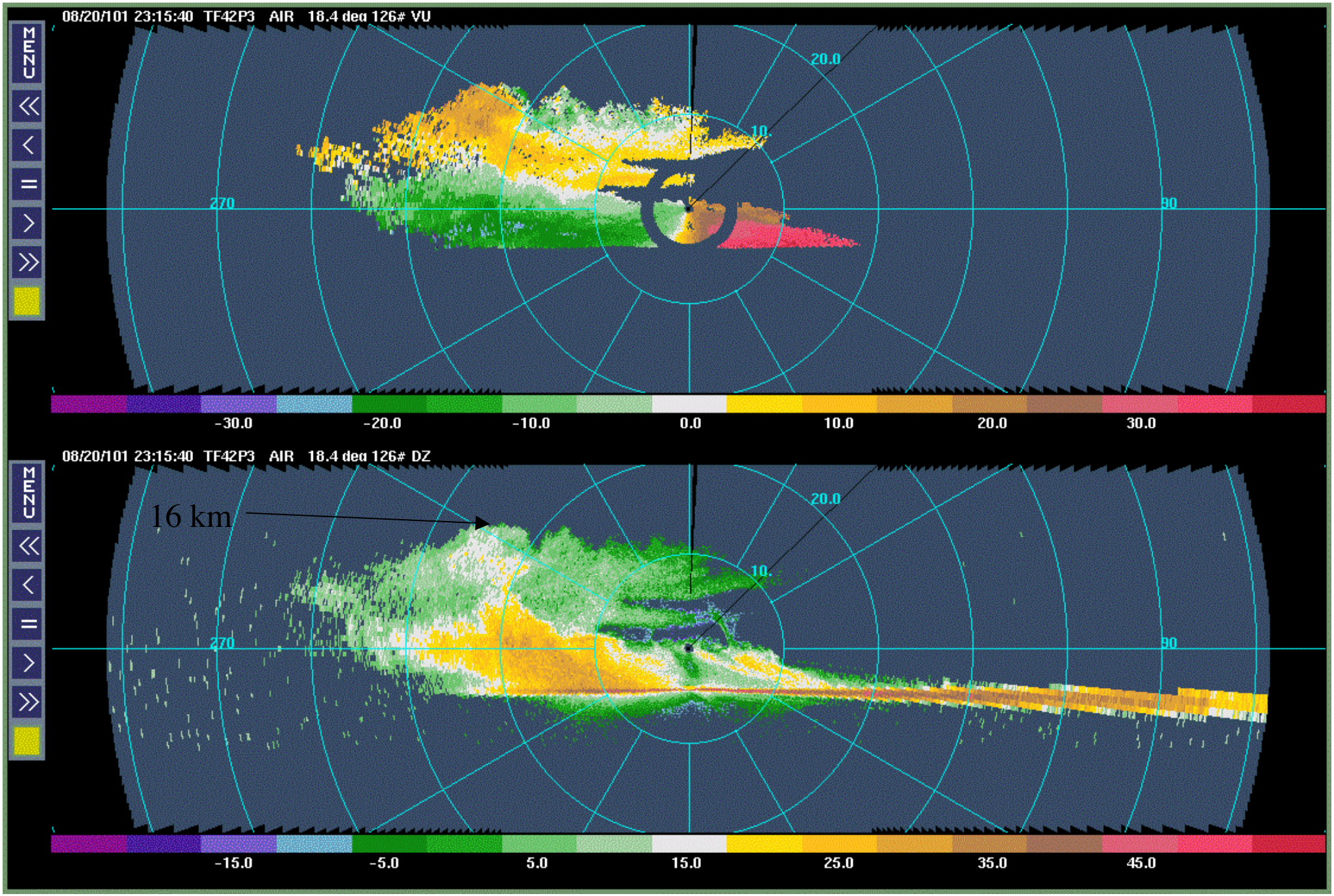


Fig. 16: Doppler (top) and reflectivity (bottom) from tail radar showing a cell in the rainband, east of Chantal's center

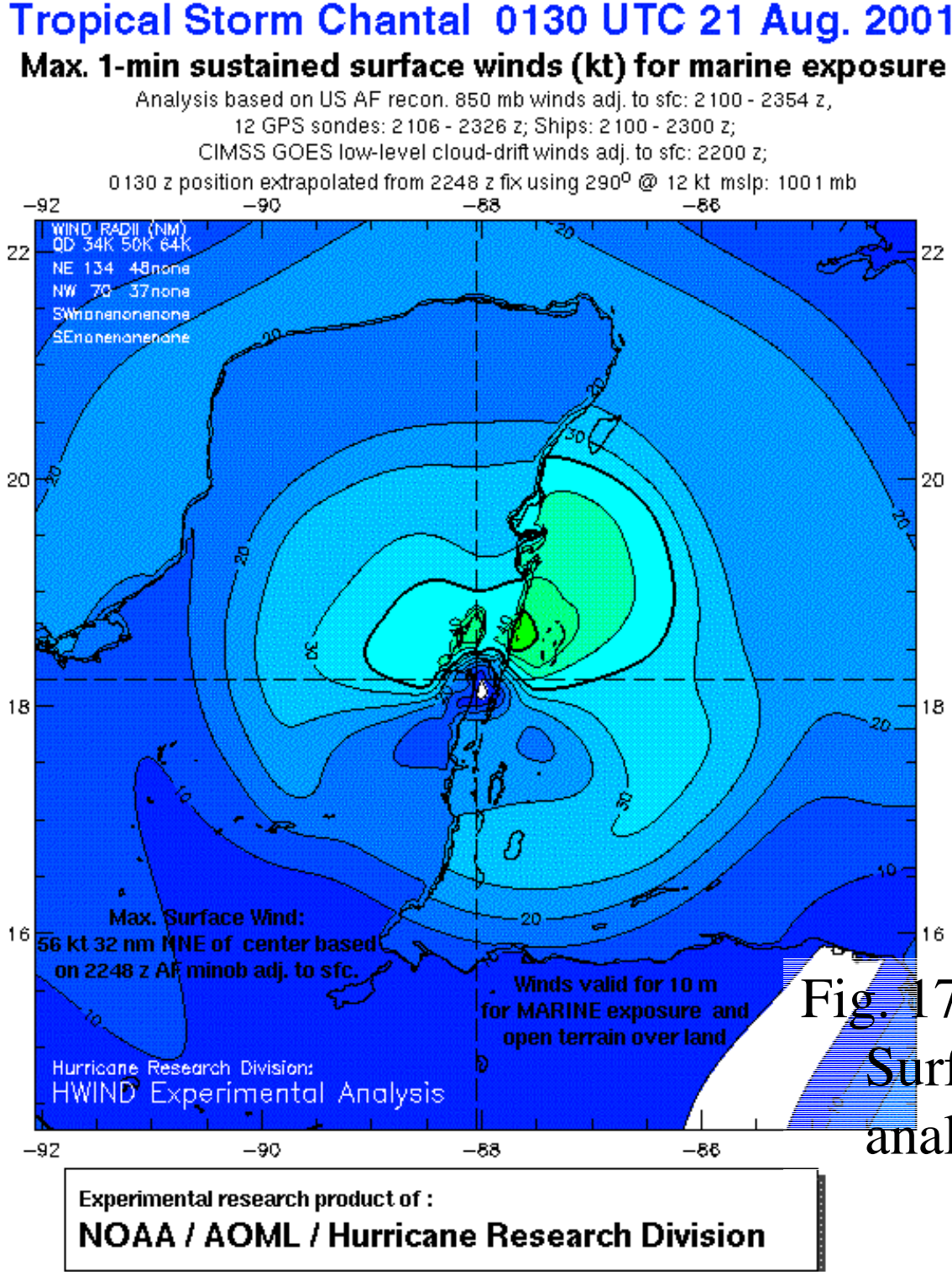


Fig. 17: HRD Surface wind analyses

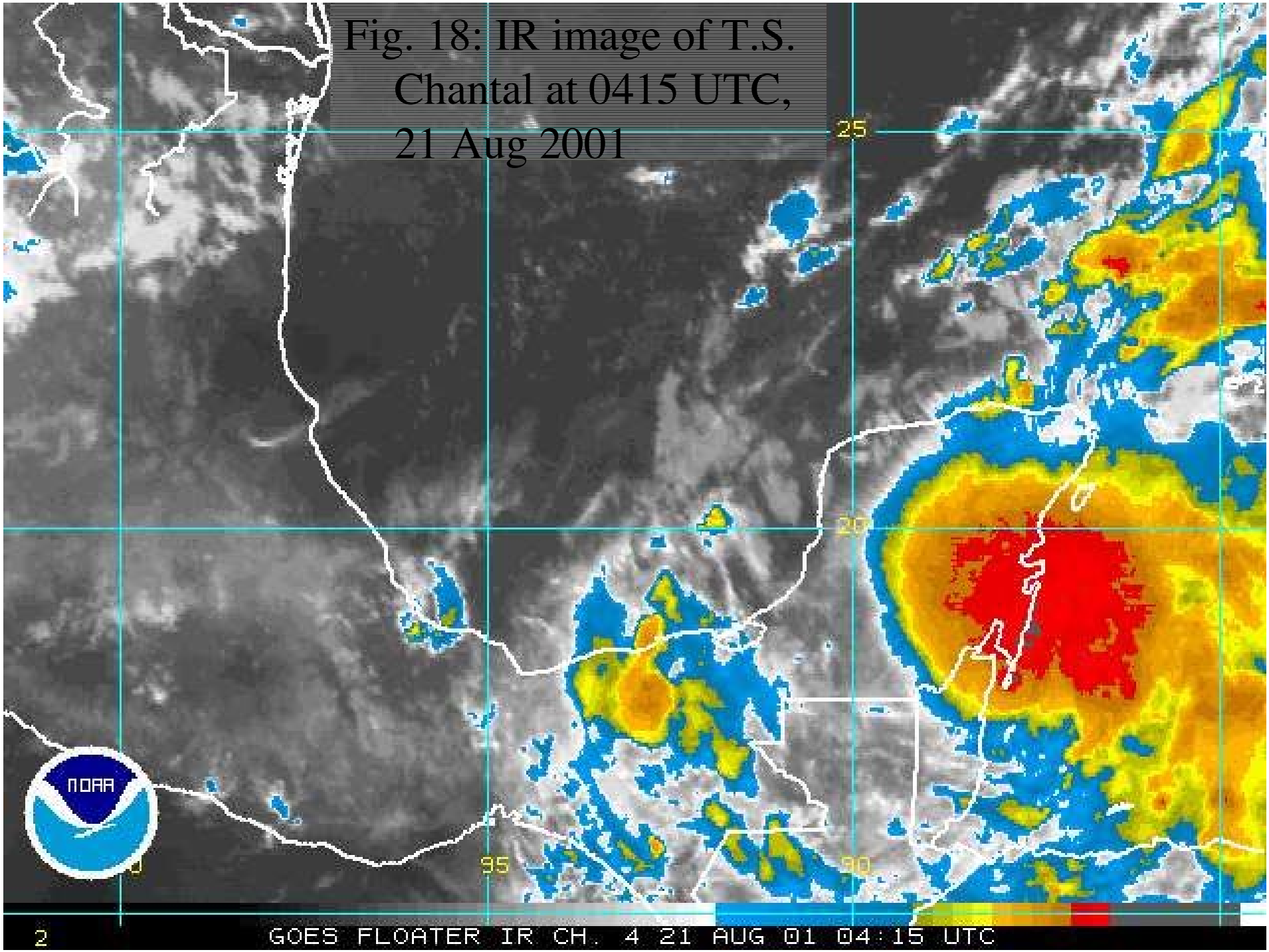


Fig. 18: IR image of T.S. Chantal at 0415 UTC, 21 Aug 2001