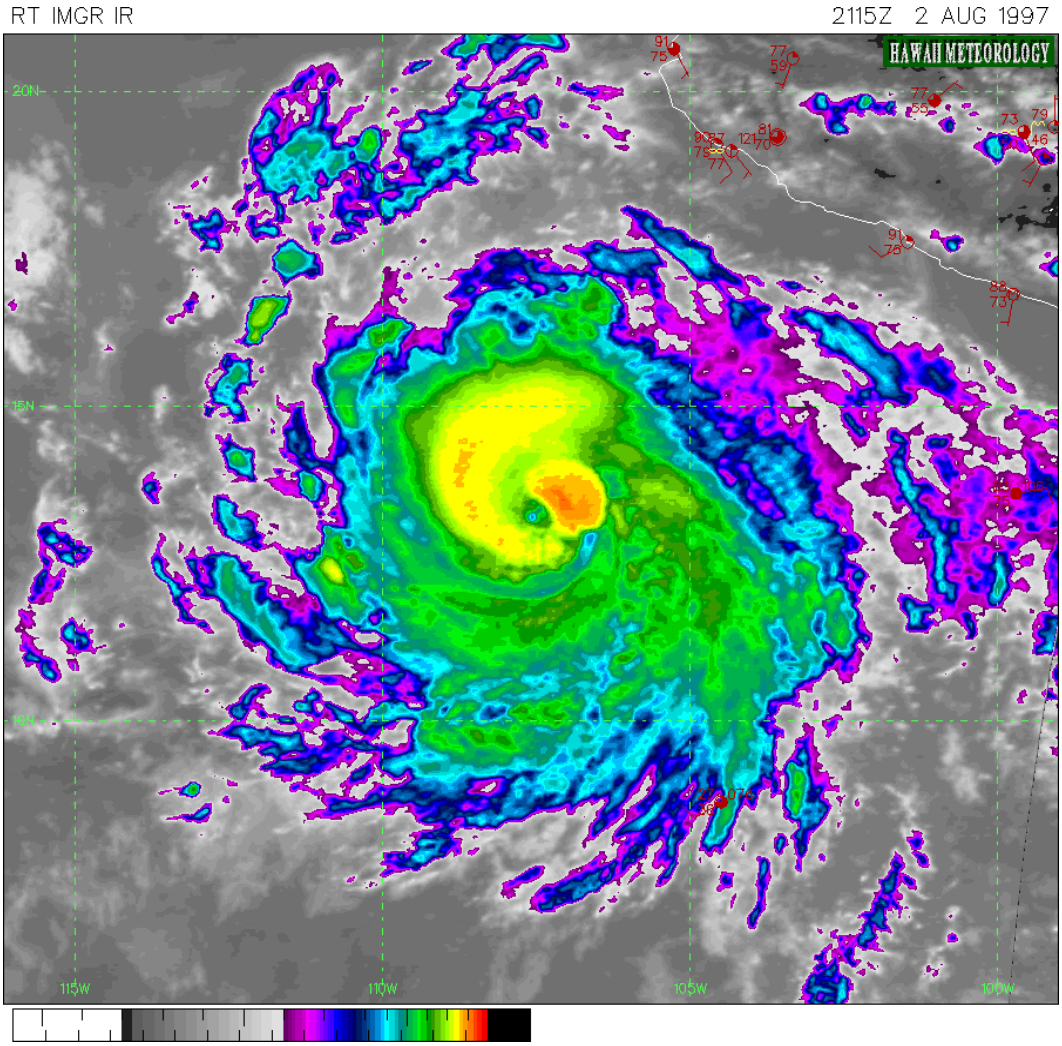
Hurricane Guillermo

On 2 and 3 August 1997 scientists from the Hurricane Research Division of AOML and aircraft crews from the Aircraft Operations Center flew both of NOAA's WP-3D research aircraft into Eastern-Pacific Hurricane Guillermo. The storm, classified in category 5 based upon 80 m s^{-1} surface winds measured by dropsonde, was nearly an ideal candidate for the Vortex Motion and Evolution Experiment conducted. It had a large central dense overcast that covered the 300 km diameter observational domain with broadly distributed light rain in addition to more intense embedded convection (see satellite picture). The "stratiform" rain provided targets for airborne Doppler radars so that the meteorologists could measure winds throughout the domain from near the surface to above 10 km. The aircraft deployed nearly 100 of the newly developed GPS dropsondes in Guillermo with a satisfactory success rate. The NOAA ship Ron Brown, as part of the PACS Tropical Eastern Pacific Process Study Cruise, took periodic soundings south of the center. In addition to the in situ data, collaborating scientists at CIRA, NRL West, and the University of Wisconsin orchestrated acquisition of rapid-scan GOES imagery, 85 GHz SSMI data, and water vapor winds respectively over a larger domain around Guillermo. Together, the radars, dropsondes, flight level instruments, shipborne measurements and satellites produced the most complete and detailed portrait of a hurricane obtained to date.

H. E. Willoughby



Mission Summary

970802H (N42RF)

Vortex Motion and Evolution Experiment (VME)

Lead Project Scientist:	John Gamache
Radar Scientists:	Mike Black, Neal Dorst
Observer:	Sam Houston
Workstation:	Paul Leighton

Mission Briefing:

At the time of mission briefing, Hurricane Guillermo was estimated by Peter Black to have a central pressure of 960 mb and winds of approximately 110 kts. The official estimate for the time of our arrival (1830 UTC) was 85 kts. Strong convection was noted near the center of the storm, and it was thought that Guillermo might have a 6-nm radius eye. A strong band was seen in the satellite imagery starting from the NW side of the eye and then extending NE of the storm center. Motion was estimated to be to be toward 285° at approximately 10 kts. The decision was made to fly N42RF to the east side of the hurricane, and N43RF to the north side, and locate our IP's along those azimuths.

Mission Description and Synopsis:

N42RF took off from Puerto Vallarta airport at 1640 UTC and flew SSE to the IP 130 nm E of the center. It descended to the mission flight level of 10,000 ft pressure altitude (PA) at 1816 UTC (13.9N, 105.2W) and reached the IP at 1826 (13.3N, 105.1W), to begin the pattern that would result in 10 eye penetrations. The coordinated Doppler pattern began 45 nm from the estimated center at 1836 UTC (13.3N, 105.9W). Maximum flight level winds on the east side were 110 kts. The eye was approximately 40 nm across and elliptical in shape, and since this was the first attempt at a fix, and "hunting" was not to be done at the expense of Doppler data, a good fix was not found. The aircraft continued westward to point **3** in the pattern, 45 nm to the W of the center. Maximum winds on the west side were 95 kts. Echo tops were highest on the eastern portion of this leg and appeared to reach to 16 km (Fig. 1). Fig. 2 shows a single sweep of the lower fuselage radar at 1854 UTC. At 1907 UTC (13.4N, 108.1W) N42RF turned SE to begin the downwind leg of the first "figure 4," reaching a point 45 nm south of the center at 1922 UTC (12.6N, 107.2W). N42RF then preceded northward, finding a 90-kt maximum flight-level wind on the S side, and a center at 1933 UTC (13.3N, 107.25W). Extrapolated minimum sea-level pressure (MSLP) was 956 mb. The first coordinated figure 4 was completed by flying a 45-nm leg to the north of the center, during which a 125 kt maximum flight level wind was found. Tail radar data were collected in planes perpendicular to the flight track (also known as "continuous" scans) while in radial penetrations, and in conical scans oriented 22-23° fore and aft of the plane perpendicular to the aircraft fuselage (Fore/aft scanning or FAST) during downwind legs.

The next two passes were not coordinated with N43RF, as it was farther from storm center executing the dropsonde pattern. The Tail radar was operated continuously in FAST mode during this time, to permit a Doppler analysis to be performed for each pass through storm center, and thus maintaining a fairly consistent interval between analyses. N42RF executed a second figure 4 from 1943 UTC—14.1N, 107.2W to 2106 UTC—12.7N 107.2W, plus another 90° downwind leg after the figure 4, ending up at a heading 150° azimuth, 45 nm from storm center. During this period two more centers were found. The first was at 2001 UTC (13.3N, 107.4W, and 954 mb extrapolated MSLP), and the second was at 2042 UTC (13.3N, 107.5W, and 955 mb extrapolated MSLP). Some of the best sunlight was seen during these passes (although Hurricane Guillermo was intense and still intensifying, it did not present a clear visible eye). Maximum winds during this period were 108 kts on the NE side, 95 kts on the NW side, and 105 kts on the SE side.

The next figure 4, coordinated with N43RF, was oriented 60° clockwise from the first one. The first radial leg was flown along a nominal track of 330° and the second along a nominal track of 60°, with a downwind leg between the two radial legs. During these penetrations it appeared that the eye was being pinched off and thus was shrinking. Figure 3 shows the horizontal reflectivity structure at 2119 UTC, when several high reflectivity features formed on the SE side of the eyewall, and a small hook seemed to form in the NW eyewall. The center estimate at 2154 UTC was 13.4N, 107.6W, with an extrapolated MSLP of 949 mb (an N43RF eye dropsonde estimate MSLP at 953 mb, and had winds less than 5 m s^{-1} all the way to the surface). Peak winds were 100 kts on the NW and SW sides, and 115 kts on the NE side. N43RF experienced some down time during this figure 4, and thus for portions of the N42RF radial flight legs the tail radar was operated in FAST mode, to improve the single-pass resolutions of the wind field.

The second "uncoordinated" figure 4 was then flown by N42RF, as N43RF returned to the region beyond 50 nm from storm center. Two radial penetrations along nominal tracks of 210° and 300° were flown, and two estimates of storm center were made. The first was at 2225 UTC (13.3N, 107.7W, MSLP 948 mb), and the second was at 2257 UTC (13.4N, 107.8W, 947 mb MSLP). During the penetration along track 210° a maximum wind was found in a rainband of 110 kts, and then a second maximum was found in the eyewall of 125 kts. Both of these were on the NE side of the center. Peak winds on the SE side were 105 kts, on the NW side were 98 kts, and on the SW side were 92 kts.

The third and final coordinated figure 4 was flown 60° clockwise from the second one, with radial penetrations along tracks of 30° and 120°. Two centers were estimated at 2332 UTC (13.4N, 107.8W, MSLP 946 mb), and at 0003 UTC (13.4N, 108.0W, MSLP 944 mb). A single sweep of reflectivity at 0003 UTC is shown in Fig. 4. Maximum winds on the NE, NW, and SE sides were 122 kts, 112 kts, and 105 kts, respectively. N42RF landed at Puerto Vallarta airport at 0204 UTC.

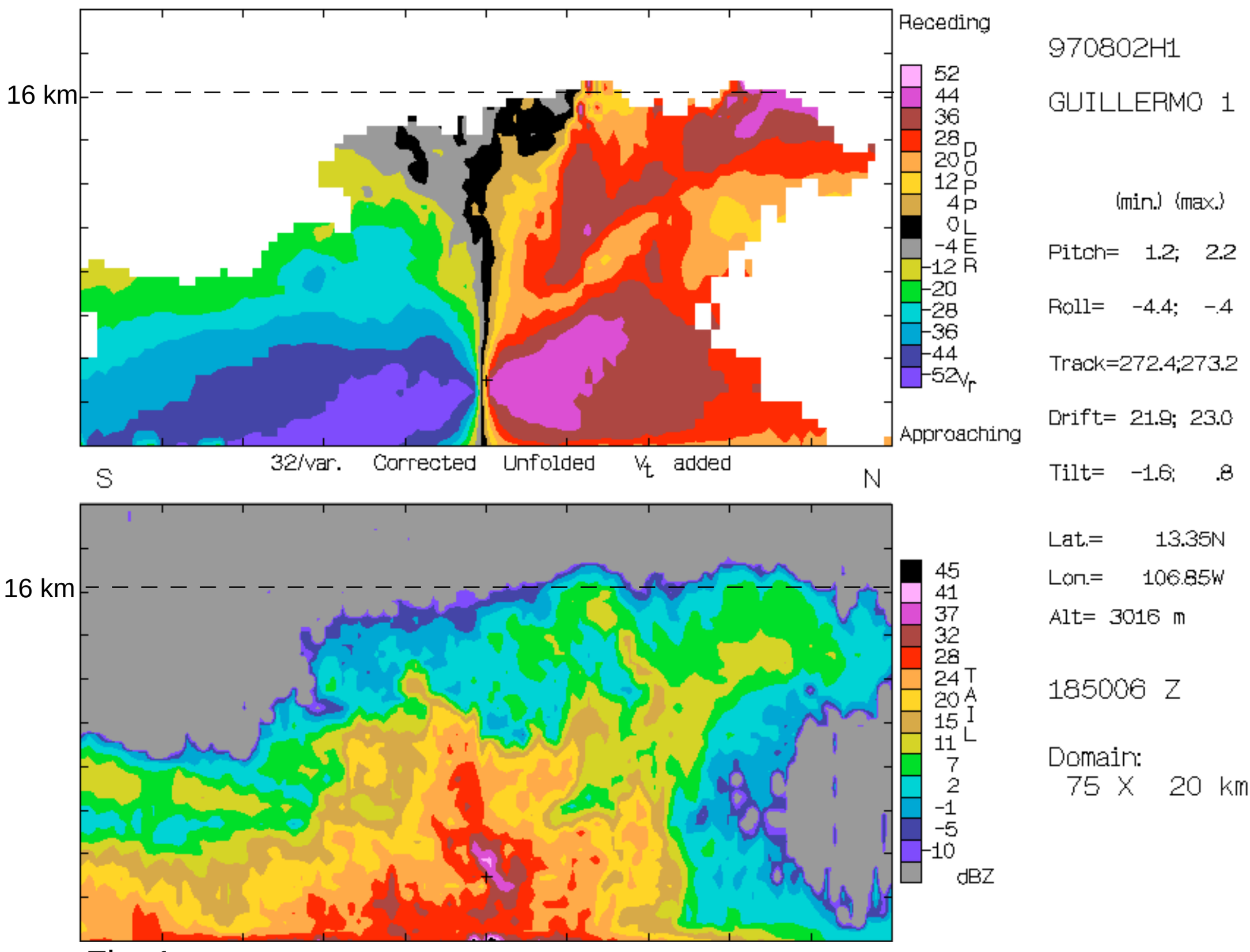
The days motion computed from our center estimates was 285° at 9 kts. Deepening may have been as much as 2 mb h^{-1}.

Mission Evaluation:

The mission was a **great** success, achieving for the first time, good coverage of the eyewall region and that immediately beyond it with Doppler data, as well as, by far the most complete coverage of the region from 50 nm to 160 nm with dropsonde data. Although there were a few failures of N43RF's GPS sonde drops, these regions should be covered well by airborne Doppler data. The observations described here occurred in a storm that appeared to be intensifying rapidly (2 mb h^{-1}), while undergoing rapid changes in eyewall shape and orientation. The data set promises to help our understanding of the interaction of the eyewall region with its immediate environment, and may help us understand storm motion and intensity change better.

Fix	Time (UTC)	Location (Lat., Lon.)	MSLP (mb)	comments
1	~1854	N/A	N/A	coordinated with N43RF
2	1933	13.3N, 107.25W	956	coordinated with N43RF
3	2001	13.3N, 107.4W	954	
4	2042	13.3N, 107.5W	955	
5	2119	13.3N, 107.55W	952	coordinated with N43RF
6	2154	13.4N, 107.6W	949	coordinated with N43RF
7	2225	13.3N, 107.7W	948	
8	2257	13.4N, 107.8W	947	
9	2332	13.4N, 107.8W	946	coordinated with N43RF
10	0003	13.4N, 108.0W	944	coordinated with N43RF

John Gamache


16 km
Receding
52
44
36
28
20
12
4
0
-4
-12
-20
-28
-36
-44
-52
DOPPLER
V_r
Approaching
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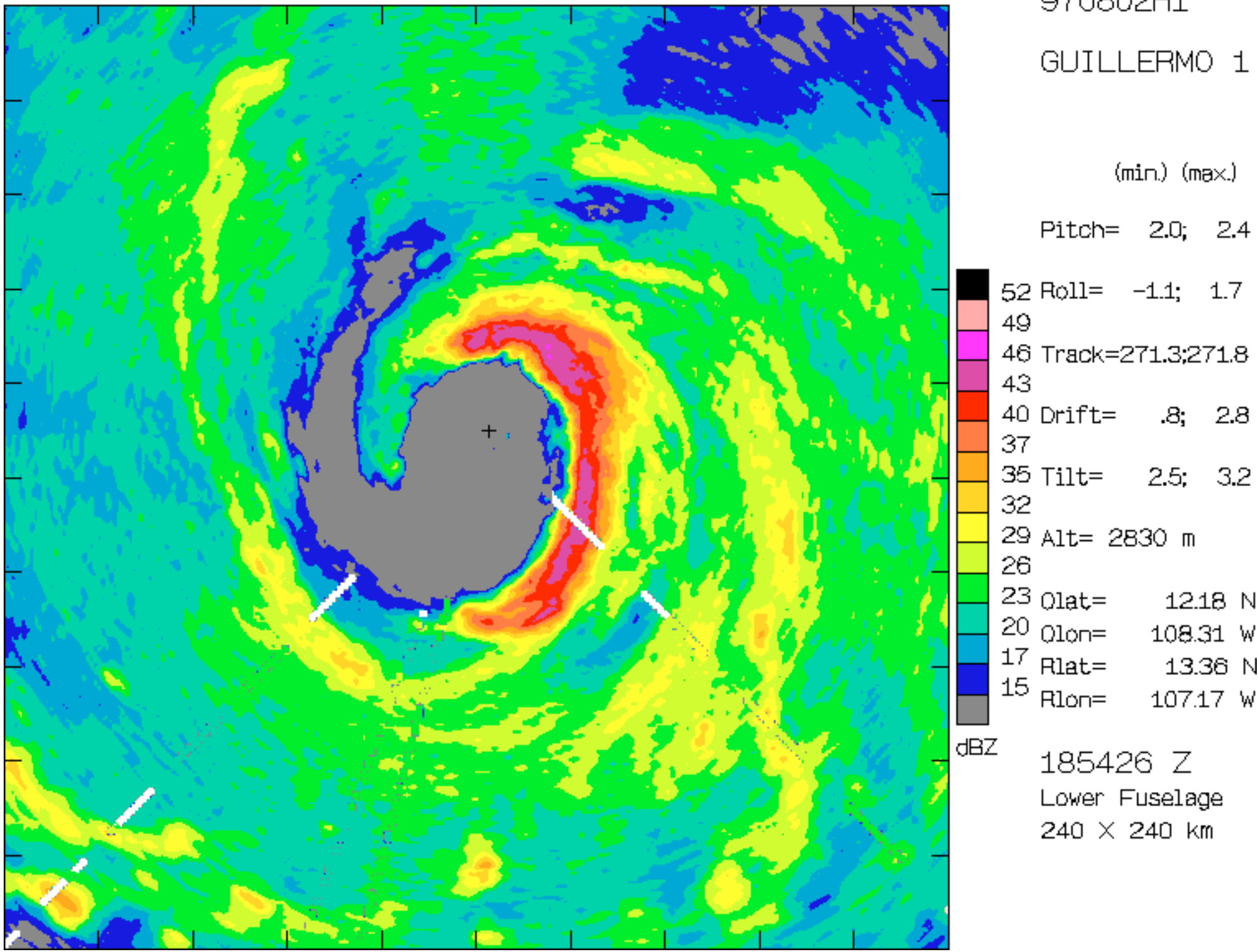
S
32/var. Corrected Unfolded V_t added
N
16 km
45
41
37
32
28
24
20
15
11
7
2
-1
-5
-10
dBZ
TAIL
Lat.= 13.35N
Lon.= 106.85W
Alt= 3016 m
185006 Z
Domain:
75 X 20 km

Fig. 1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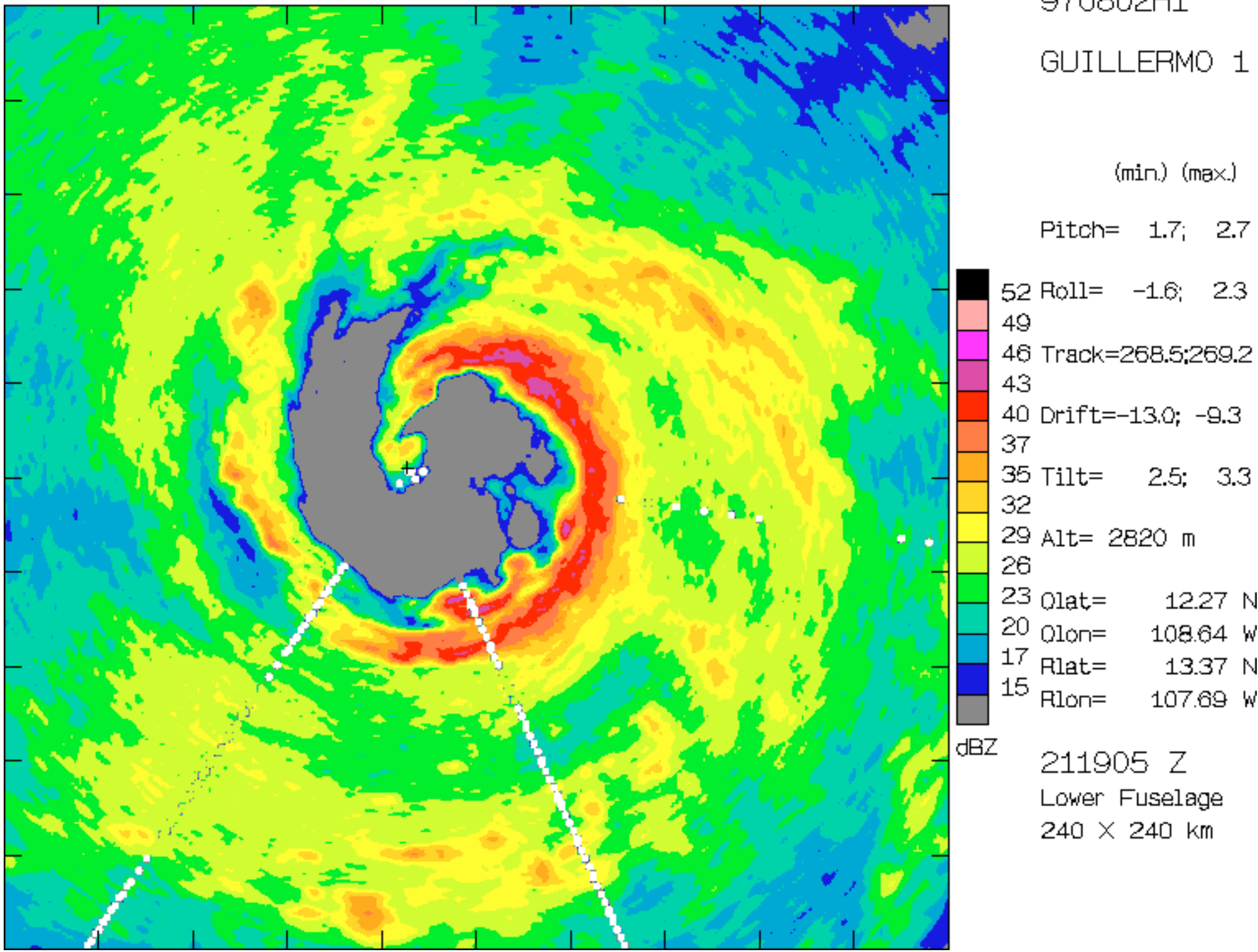
52
49
46
43
40
37
35
32
29
26
23
20
17
15
dBZ
185426 Z
Lower Fuselage
240 X 240 km

Fig. 2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52
49
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43
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37
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32
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26
23
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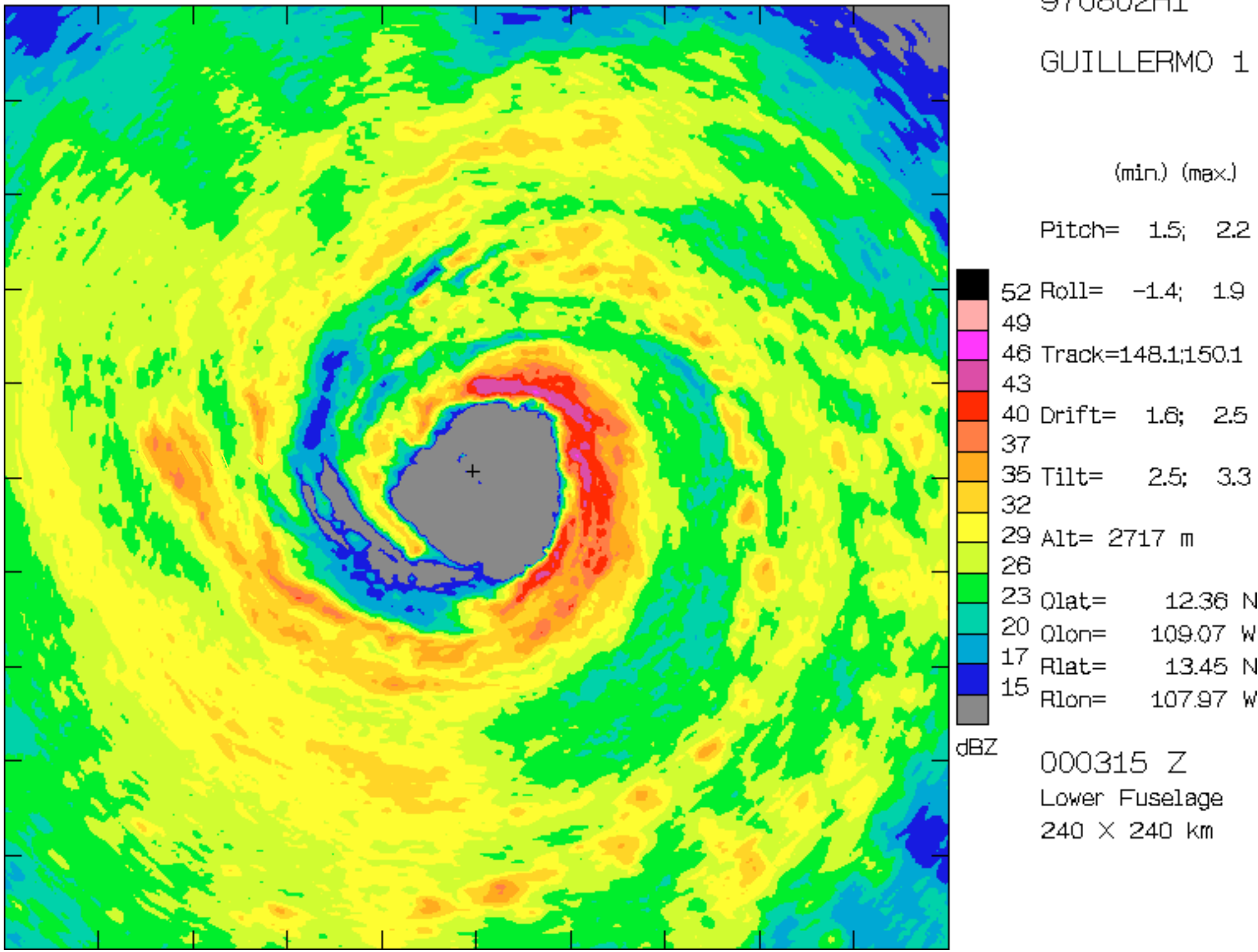
17
15
dBZ
211905 Z
Lower Fuselage
240 X 240 km

Fig. 3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52
49
46
43
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37
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32
29
26
23
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17
15
dBZ
000315 Z
Lower Fuselage
240 X 240 km

Fig. 4

Mission Summary

970802I (N43RF)

Vortex Motion and Evolution Experiment (VME)

Scientific Crew:

Lead Project Scientist	Franklin
Radar Scientist	Marks
Dropwindsonde Scientists	Goldenberg, Willoughby
Workstation	Dodge

Mission Briefing:

At 1500 UTC on 02 August, Hurricane Guillermo was located at 13.5N, 106.5W, moving towards 280 degrees at 11 kt, with maximum estimated sustained winds of 80 kt. The short term forecast was for continued westward motion.

The VME mission called for both NOAA aircraft to fly coordinated, pre-determined flight patterns, collecting flight-level, Doppler radar, and GPS dropwindsonde data within 160 nm of the center of Guillermo. Planned takeoff times were 1700 UTC for N43RF, and 1630 UTC for N42RF, to allow both aircraft to reach their respective initial positions (IPs) near 1830 UTC. The VME pattern was to be rotated relative to the pattern in the HRD Field Program Plan, such that N43's IP would be north of the center, and N42's IP would be located east of the center. Three eye drops from N43RF were planned, on the second pass of each coordinated figure 4. Altitude was 17-18 kft, depending on icing conditions.

Most or all of the sondes had their RH sensors preheated to remove contaminants within 48 h of the mission. Several sondes had one of the two RH sensor heaters disabled to examine the effectiveness of the heaters.

N43RF was to run its radar in FAST mode, while N42RF scanned in planes during the coordinated parts of the pattern.

Mission Synopsis:

The mission began with N43RF's takeoff from Puerto Vallarta at 1701 UTC. The IP (160 nm N of the center: 15 55.7N 107 17.4W) was reached at 1826 UTC. Drop/leg times in the pattern are summarized in the attached figure. Drop times in green, tan, and red indicate drops that were good, partial, and fail, respectively. The final position was reached at 0042 UTC, for a total pattern time of 6:16. N43RF recovered in Puerto Vallarta at 0156 UTC.

Mission Evaluation and Problems:

Overall: Outstanding. This represents the best VME data set to date. All essential aspects of the mission were fully successful.

Aircraft coordination: Very good. All coordinated legs were run within about 1-2 min of each other.

Radar: Very good. There was only one signifcant failure. The radars went down from 2158-2202 UTC, during the second half of the second figure 4. N42RF switched to FAST mode at this point. Ample scatterers over nearly the entire pattern will enable the Doppler to fill in a gap in the dropsonde coverage (see below).

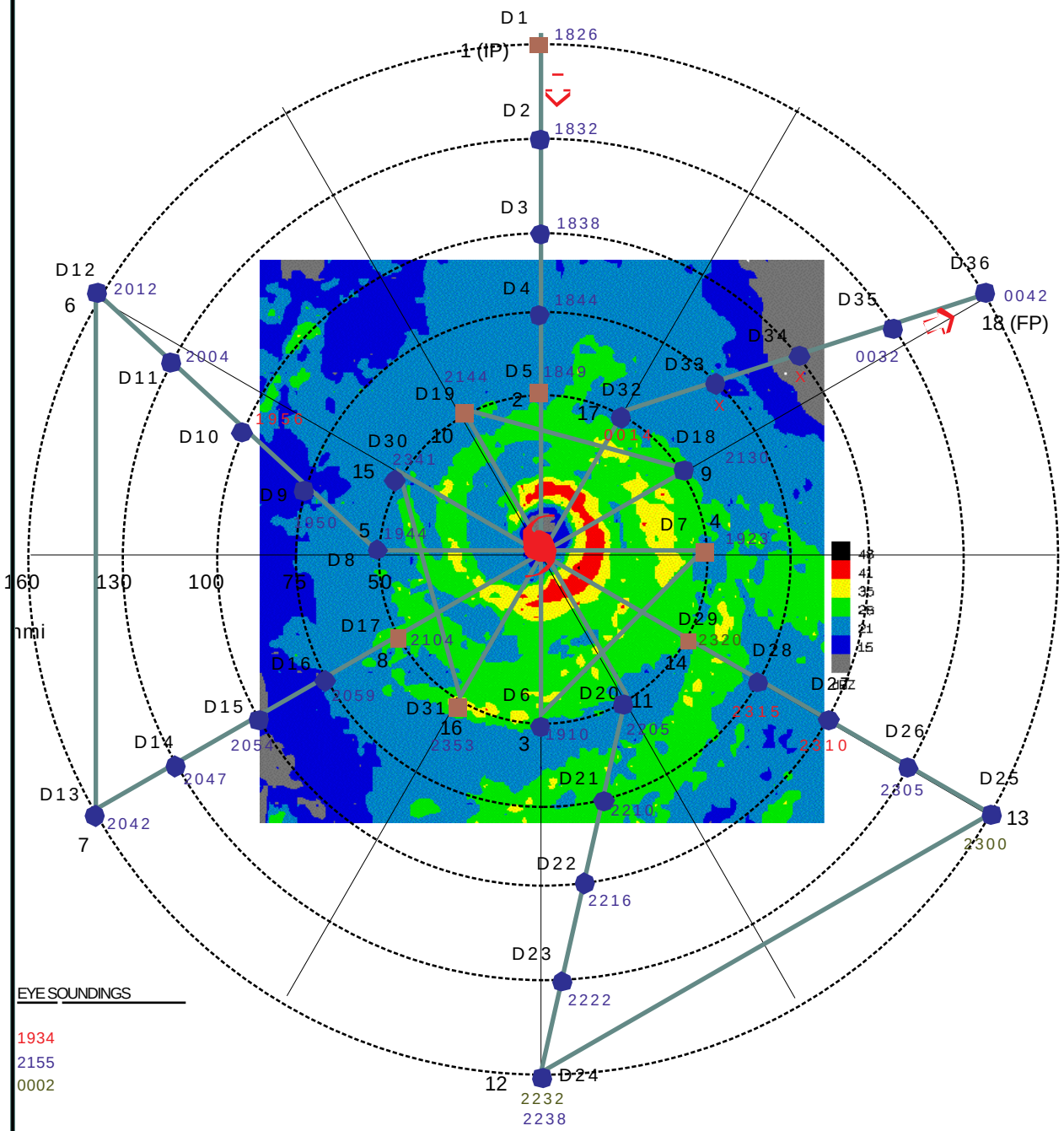
Dropsondes: Performance was very good, although a bit more altitude for the drops would have been nice. 30 of 39 sondes had good winds, 4 more were partial. There was an interior area on the east side of the storm where failures were concentrated. Most failures appear to be related to p-

static. The legs at 300, 360, and 060 degrees were flown at 505 mb, the leg at 240 was flown at 485 mb, and the legs at 180 and 120 were flown at 465 mb. There was 1 successful eye drop.

Workstation: 38 TEMPDROP messages were transmitted. None were received at NCEP because they weren't looking for the UZPN13 KWBC header. The dropwindsonde scientists were able to keep up with the high data rate, but there was no time for any radar transmissions. A bug in the TEMPDROP decoder caused the synoptic map routine to fail towards the end of the flight.

James Franklin

VORTEX MOTION AND EVOLUTION EXPERIMENT
GUILLERMO 970802I



Dropwindsonde releases

Coordination points (plus drop releases)

> Drop pts (D1, D2, ...) Nav pts (1, 2, ...)

Mission Summary

970803H (N42RF)

Vortex Motion and Evolution Experiment (VME)

Lead Project Scientist:	John Gamache
Radar Scientists:	Mike Black, Neal Dorst
Observer:	Sam Houston
Workstation:	Paul Leighton

Mission Briefing:

At the time of mission briefing on 3 August 1997, it was apparent from satellite imagery that Hurricane Guillermo had intensified since the missions of 2 August. Actually, satellite analysis at the Tropical Prediction Center suggested that measurements made in Hurricane Guillermo might constitute a record for Eastern Pacific hurricanes. Thus TPC requested that we document the intensity carefully. They were estimating pressures as low as 905-910 mb, and maximum winds of 145 kts. At the suggestion of Michael Black, it was decided that three sets of three GPS dropsondes would be made to document the eyewall. These drops have already proven to be quite interesting. The decision was made to fly the pattern with the same orientations as on 2 August 1997.

Mission Description and Synopsis:

N42RF took off from Puerto Vallarta airport at 164910 UTC, ferrying at 16,000 ft to the initial point (IP). At 1829 UTC (14.4N 109.0W), the aircraft descended to the flight level of 10,000 ft pressure altitude (PA), and reached the initial point (IP), 130 nm directly east of the estimated storm center. As on 2 August 1997, the mission began with a "figure 4" coordinated between N42RF and N43RF. The point 45 nm east of storm center (13.9N 111.4W) was reached at 1905 UTC, and the maximum flight level winds on the east side were 125 kts. Echo tops on this side were estimated to reach 17 km. The center was found at time 1910 UTC (13.9N, 111.7W, estimated minimum sea-level pressure (MSLP) 923 mb). Fig. 1 shows the reflectivity structure at 1910 UTC. The aircraft proceeded westward to the point 45 nm W of the storm center, and arrived at 1922 UTC (13.8N 112.5 W). On the west side reflectivities were quite low with low echo tops, except for a 3-4 km thick band of upper-level reflectivity (outflow?). N42RF then proceeded to a point 45 nm directly S of the storm center, reaching there at 1936 (13.2N, 111.8 W). The aircraft turned northward, finding maximum south side winds of 105 kts, and estimating the eye at 1945 UTC (13.8N, 111.8W, estimated MSLP 930 mb). As N42RF exited the storm the first set of three drops were made, one at 194829 UTC (14.1N 111.8W, inside the eyewall), the second at 195027 UTC (14.2N 111.8W, in the eyewall), and the third at 195315 UTC (14.4N 111.8W, just outside the eyewall). The second dropsonde reported a low-level wind maximum of 145 kts. Maximum flight level winds on the north side were 140 kts. The end of the coordinated figure 4 was at 195725 UTC (14.6N 111.7W).

The uncoordinated figure 4 followed. Two more center positions were estimated at 2018 UTC (13.8N, 111.9W, estimated MSLP 931 mb), and 2054 UTC (13.9N, 112.0W, estimated MSLP 930 mb). Maximum flight-level winds of 140, 135, 120, and 115 kts were found on the NW, NE, SE, and SW sides of the storm, respectively.

The second coordinated figure 4 began at 2115 UTC (13.2N, 111.7W) to the SE of the storm center. N42RF proceeded along nominal track 330°, passing near the center; however, it was not possible to estimate the center position accurately on this pass. The N43RF estimate was 13.8N, 112.1W at 2124 UTC. Maximum flight level winds on the SE side were 110 kts on the SE side, and 140 kts on the NW side. Three drops were made during this flight leg, bracketing the SE eyewall. The drops were at 212030 UTC (13.5N 111.8W), 212307 UTC (13.7N, 111.9W), and 212516 UTC (13.8N, 112.0W). The last two had good winds, and all three had thermodynamic

data. The NW end of the flight leg was reached at 2135 UTC (14.5N, 112.4W). A downwind leg was then flown to the next point at 2153 UTC (13.5, 112.7W), where N42RF turned inward, and tracked along 60° through the storm center. The storm center was found at 2202 UTC (13.8N, 112.6W, MSLP 929 mb), and the maximum flight-level winds on the SW and NE sides were 115 and 133 kts, respectively.

Then the second "uncoordinated" figure 4 for N42RF began, going from 2153 UTC (13.5N, 112.7W) and ending at 2328 UTC (13.4N, 112.9W). The aircraft waited there executing maneuvers, and began the next coordinated figure 4 at 2333 UTC (13.2N 112.9W). During the uncoordinated 4, two centers were estimated, one at 2231 UTC (13.9N, 112.3W, estimated MSLP 932 mb), and the second at 2306 UTC (13.9N, 112.4W, estimated MSLP around 923 mb, winds less than 3 kts). Maximum flight-level winds were 140, 105, 128, and 125 kts on the NE, SW, SE, and NW sides, respectively.

The third coordinated figure 4 began at 2333 UTC (13.2N 112.9W) to the SW of the storm center. N42RF flew a nominal track of 030, finding maximum flight level winds of 110 and 142 kts on the SW and NE sides, respectively, and a storm center at 2345 UTC (13.9N, 112.5W, estimated MSLP 926 mb). The reflectivity structure at 2346 UTC is shown in Fig. 2. Four drops were made along this flight leg. The first was in the SW eyewall at 234219. The other three bracketed the NE eyewall and were made at 234840 UTC, 235140 UTC (14.2N, 112.4W), and 235416 UTC (14.4N, 112.3W). The end of the flight leg was reached at 2357 UTC (14.6N, 112.2W), and N42RF then proceeded downwind to the next flight leg. That leg began at 0011 UTC (14.4N, 113.4W), along a nominal track of 120, and ended at 0036 UTC (13.6N, 111.9W). The center along that leg was estimated at 0025 UTC to be at 13.9N, 112.6W (Fig. 3). Maximum flight-level winds on NW and SE sides on this flight leg were 120 kts. As in several previous passes through the SE eyewall, lightning was seen, and maximum echo tops were about 17-18 km (Fig. 4). At 0036 UTC (13.6N, 111.9W) N42RF ended its mission and began its return to Puerto Vallarta, where it landed at 0243 UTC.

Mission Evaluation:

This was yet again an excellent mission. On this day we observed a hurricane in more or less steady state, to complement the intensifying hurricane the day before. We should also be able to document the convection on the SE side of the storm, which was quite deep for hurricanes (17-18 km). **The drops from N42RF in the eyewall are the first of their kind to work so well.**

Ten drops were made to observe the winds and thermodynamics in and near the hurricane eyewall. During each bracketing two out of three sondes reported winds, while all sondes reported thermodynamics. These drops should help use understand the vertical profiles of radial and tangential flow, as well as θ_e, in the hurricane eyewall. Vertical structure of the thermodynamic and wind field suggest that the boundary layer is very thin under the eyewall. The vertical resolution of these sondes is much greater than for the Omega Dropwindsondes used in previous hurricane seasons.

During this flight FAST (fore/aft scanning) mode was employed on the N42RF tail radar, except during radial penetrations in the coordinated figure 4's. Tail radars worked well on both aircraft, enabling us to follow the tail radar scanning schemes to the letter.

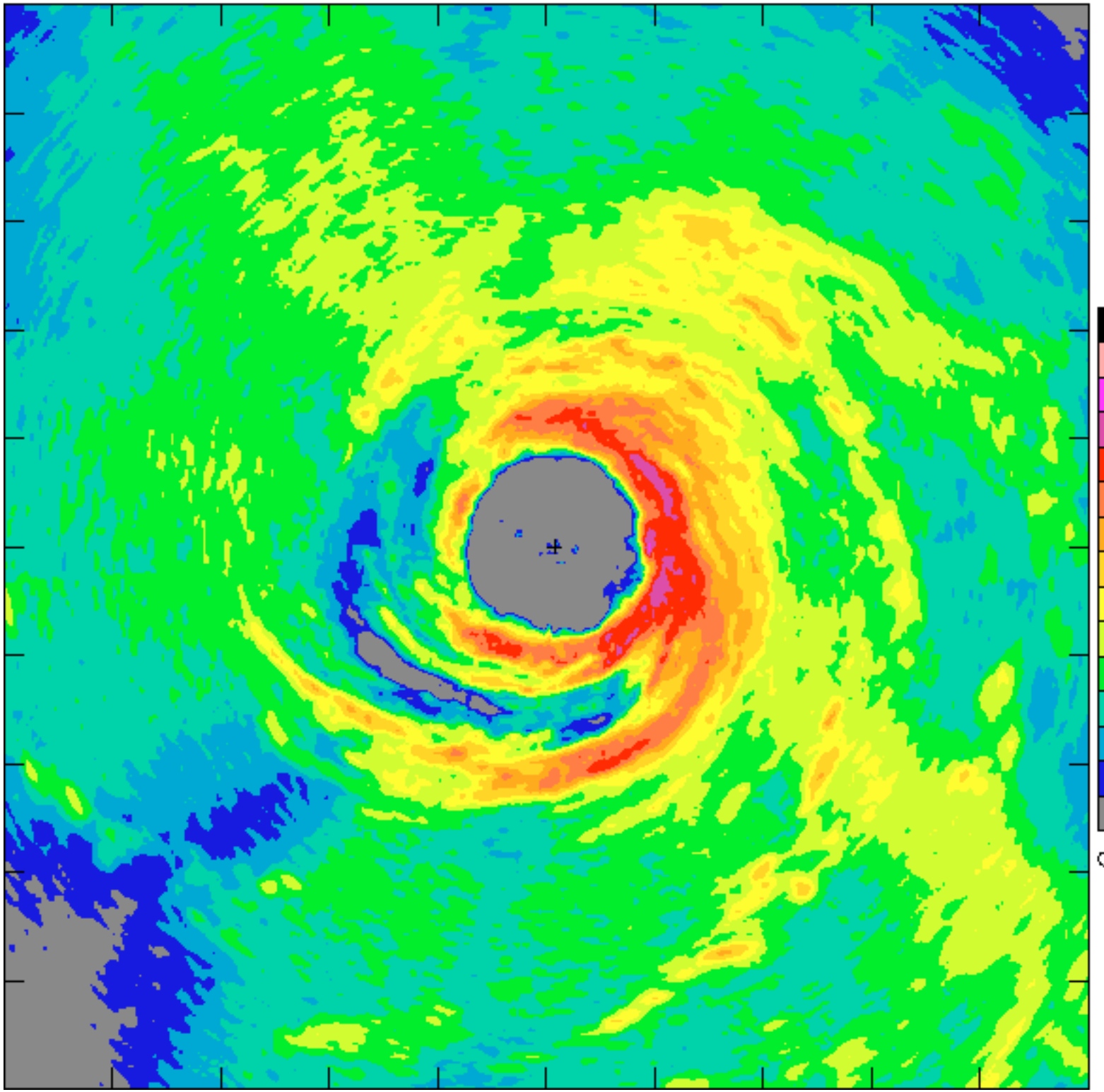
Acknowledgments:

Very special thanks go to the AOC (NOAA Aircraft Operations Center) piloting, maintenance and scientific crews of N42RF and N43RF. They exhibited not only high ability and competence, but also a great willingness to do whatever could be done safely to enhance the quality of the final research data set.

Fix	Time (UTC)	Location (Lat., Lon.)	MSLP (mb)	comments
1	1910	13.9N, 111.7W	923	coordinated with N43RF
2	1945	13.8N, 111.8W	930	coordinated with N43RF
3	2018	13.8N, 111.9W	931	
4	2054	13.9N, 112.0W	930	
5	~2124	N/A	N/A	coordinated with N43RF
6	2202	13.8N, 112.6W	929	coordinated with N43RF
7	2231	13.9N, 112.3W	932	
8	2306	13.9N, 112.4W	923	
9	2345	13.9N, 112.5W	926	coordinated with N43RF
10	0025	13.9N, 112.6W		coordinated with N43RF

Drop	Time (UTC)	Location (Lat., Lon.)	comments
1	194830	14.035N, 111.790W	inside the N eyewall
2	195030	14.161N, 111.769W	in the N eyewall
3	195315	14.4N, 111.8W	just outside the N eyewall, NO WINDS, good PTH
4	212030	13.5N, 111.8W	inside the SE eyewall, NO WINDS, good PTH
5	212303	13.694N, 111.896W	in the SE eyewall
6	212503	13.821N, 111.989W	just outside the SE eyewall
7	234221	13.689N, 112.666W	in the SW eyewall
8	234838	14.073N, 112.451W	inside the NE eyewall
9	235142	14.244N, 112.363W	in the NE eyewall
10	235416	14.4N, 112.3W	just outside the NE eyewall, NO WINDS, good PTH

John Gamache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52
49
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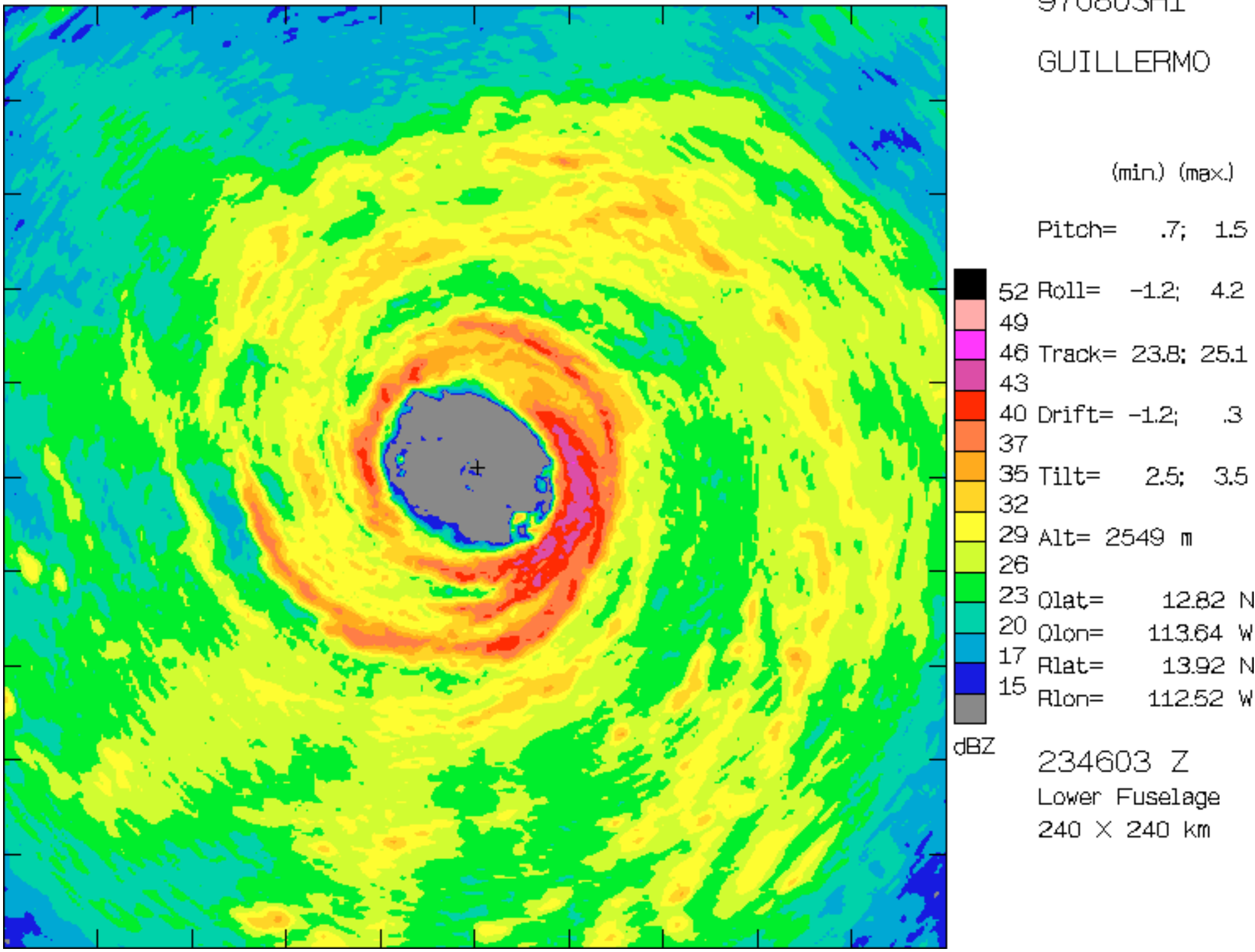
dBZ
191016 Z
Lower Fuselage
240 X 240 km

Fig. 1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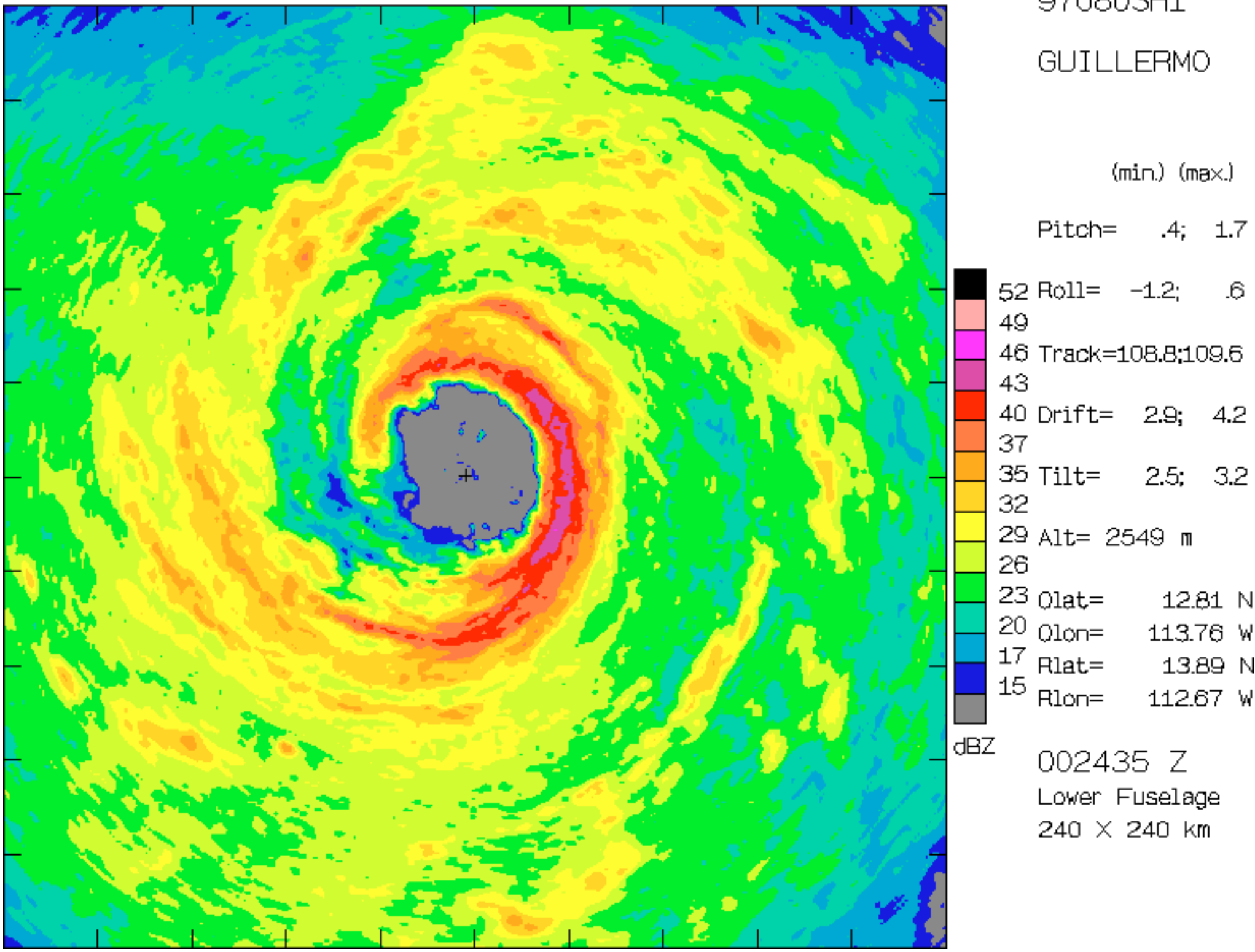
Lower Fuselage
240 X 240 km

Fig. 2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Roll= -1.2; .6
Track=108.8;109.6
Drift= 2.9; 4.2
Tilt= 2.5; 3.2
Alt= 2549 m
Olat= 12.81 N
Olon= 113.76 W
Rlat= 13.89 N
Rlon= 112.67 W
52
49
46
43
40
37
35
32
29
26
23
20
17
15
dBZ
002435 Z
Lower Fuselage
240 X 240 km

Fig. 3

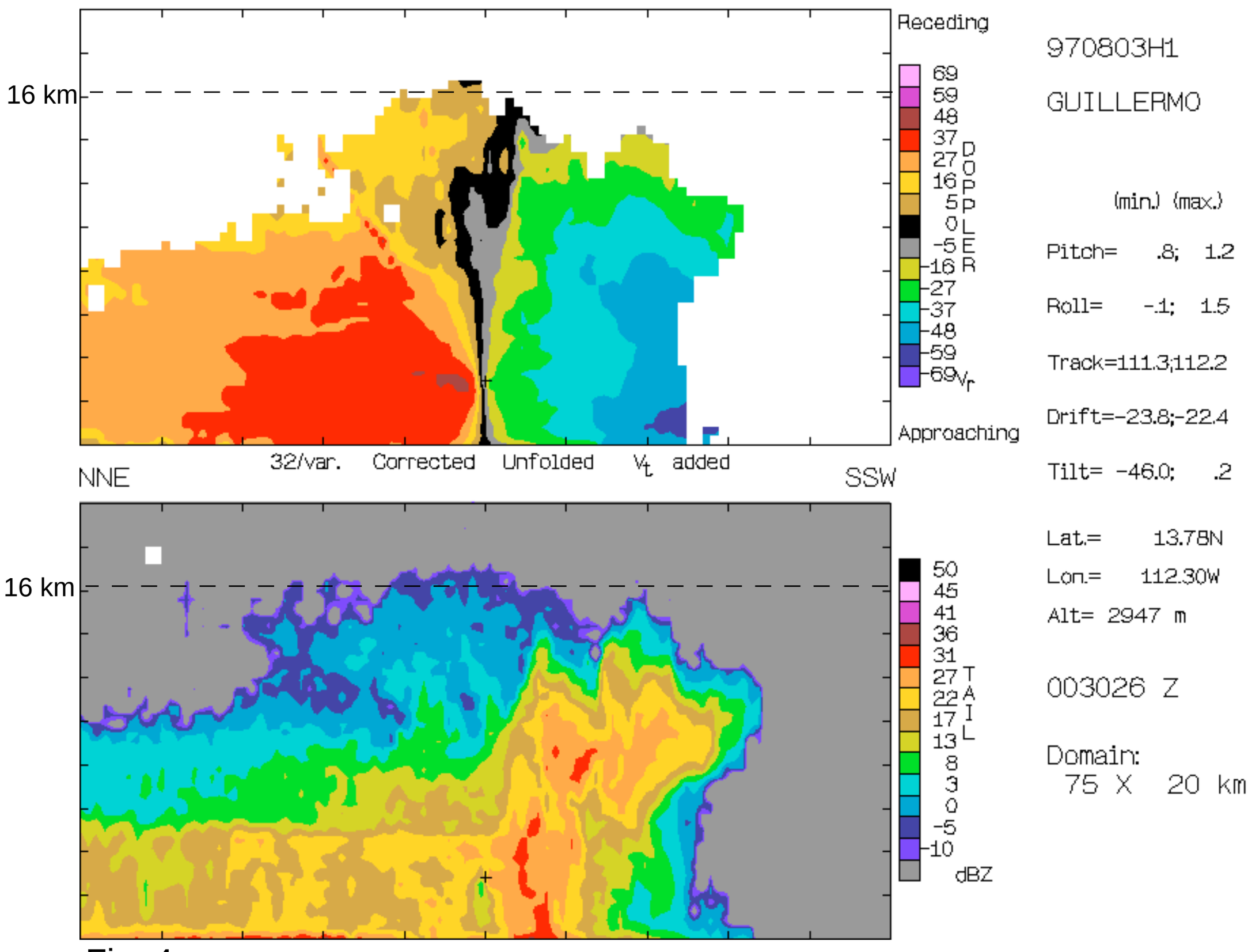

16 km
Receding
69
59
48
37
27
16
5
0
-5
-16
-27
-37
-48
-59
-69
DOPPLER
V_r
Approaching
970803H1
GUILLERMO
(min.) (max.)
Pitch= .8; 1.2
Roll= -.1; 1.5
Track=111.3;112.2
Drift=-23.8;-22.4
Tilt= -46.0; .2
Lat.= 13.78N
Lon.= 112.30W
Alt= 2947 m
003026 Z
Domain:
75 X 20 km
NNE
32/var. Corrected Unfolded V_t added
SSW
16 km
50
45
41
36
31
27
22
17
13
8
3
0
-5
-10
TAIL
dBZ

Fig. 4

Mission Summary

970803I (N43RF)

Vortex Motion and Evolution Experiment (VME)

Scientific Crew:

Lead Project Scientist	Franklin
Radar Scientist	Marks
Dropwindsonde Scientists	Goldenberg, Willoughby
Workstation	Dodge

Mission Briefing:

At 1500 UTC on 03 August, Hurricane Guillermo was located at 13.7N, 110.8W, moving towards 275 degrees at 11 kt, with maximum estimated sustained winds of 135 kt. The short term forecast was for continued westward motion.

The VME mission called for both NOAA aircraft to fly coordinated, pre-determined flight patterns, collecting flight-level, Doppler radar, and GPS dropwindsonde data within 160 nm of the center of Guillermo. Planned takeoff times were 1700 UTC for N43RF, and 1640 UTC for N42RF, to allow both aircraft to reach their respective initial positions (IPs) near 1830 UTC. The VME pattern was to be rotated relative to the pattern in the HRD Field Program Plan, such that N43's IP would be north of the center, and N42's IP would be located east of the center. Six eye drops from N43RF were planned, on each pass of each coordinated figure 4. Altitude was 17-18.3 kft, depending on icing conditions.

Most or all of the sondes had their RH sensors preheated to remove contaminants within 48 h of the mission. Several sondes had one of the two RH sensor heaters disabled to examine the effectiveness of the heaters.

N43RF was to run its radar in FAST mode, while N42RF scanned in planes during the coordinated parts of the pattern.

Mission Synopsis:

The mission began with N43RF's takeoff from Puerto Vallarta at 1659 UTC. The IP (160 nm N of the center) was reached at 1839 UTC. Drop/leg times in the pattern are summarized in the attached figure. Drop times in green, tan, and red indicate drops that were good, partial, and fail, respectively. The final position was reached at 0106 UTC, for a total pattern time of 6:27. This total time includes some circling in the eye on the last pass to try to get a better eye drop (the radar was not working at this time). N43RF recovered in Puerto Vallarta at 0245 UTC.

Mission Evaluation and Problems:

Overall: Outstanding. This data set exceeds even the one from the day before in coverage and quality. Dropsonde failures were scattered, leaving no major gaps in coverage. There were enough scatterers that FAST wind sets will supplement the dropsonde failures, as well as provide winds above flight level.

Aircraft coordination: Very good. All coordinated legs were run within about 1-2 min of each other.

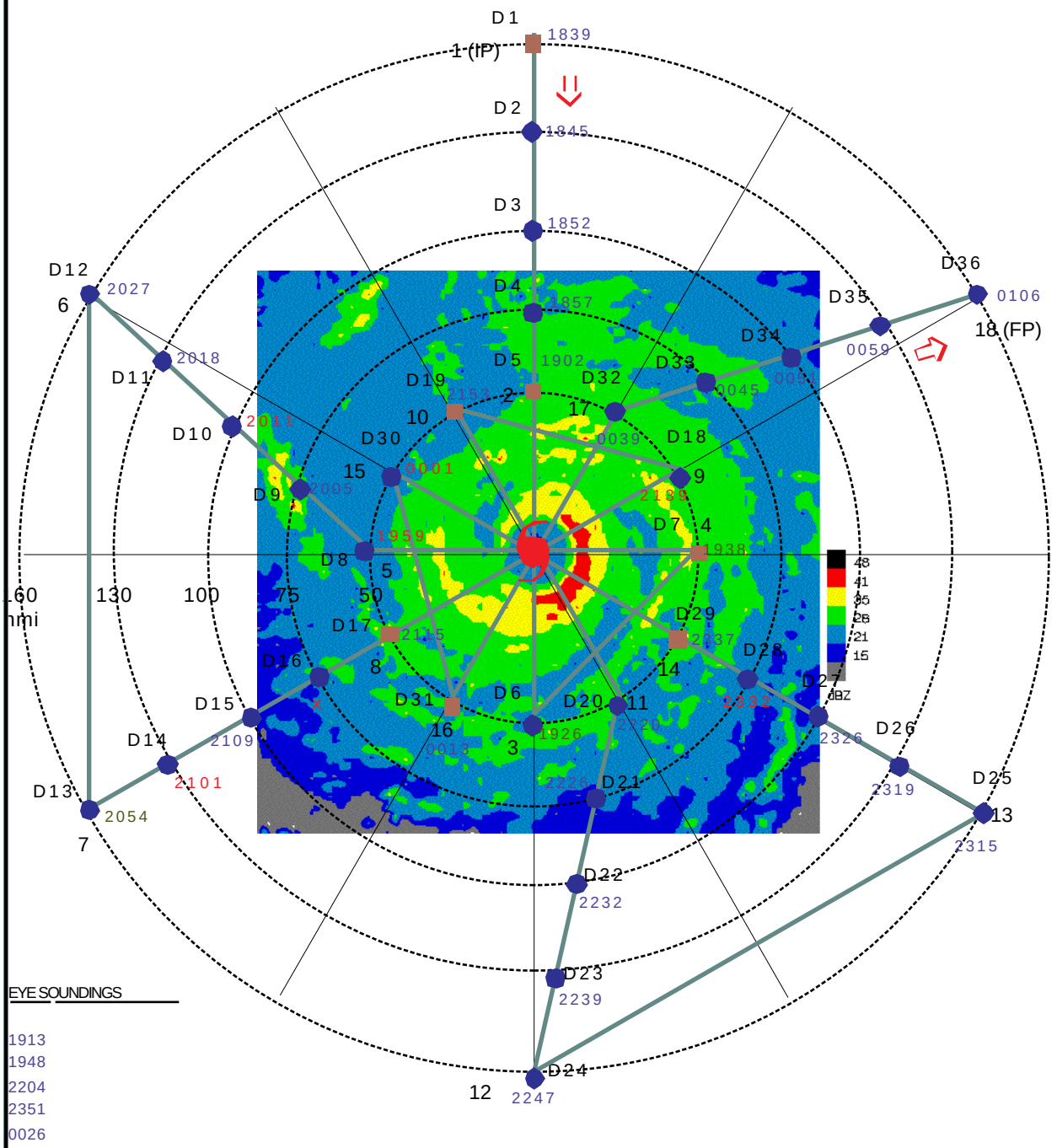
Radar: Very good. There was only one significant failure. The radars went down at 0015 UTC, during the second half of the last figure 4. N42RF may have switched to FAST mode at this point.

Dropsondes: Performance was very good, although a bit more altitude for the drops would have been nice. 31 of 40 sondes had good winds, 3 more were partial. There were 5 successful eye drops. It is now clear that p-static is a problem near and above the melting level.

Workstation: 31 TEMPDROP messages were transmitted. None were received at NCEP because they weren't looking for the UZPN13 KWBC header. Copies of 5 messages were converted to KNHC at OSO and were received at NCEP. The dropwindsonde scientists were able to keep up with the high data rate, but there was no time for any radar transmissions. During drop D6 communication between the AVAPS and workstation failed. It was restored for drop D9. Drops D6-D8 and E2 were retrieved from floppy from the AVAPS. Towards the end of the flight the ASDL system refused to accept any more messages. There may have been a backlog of data waiting to get off the airplane.

James Franklin

VORTEX MOTION AND EVOLUTION EXPERIMENT
GUILLERMO 970803I



EYE SOUNDINGS

1913
1948
2204
2351
0026

Dropwindsonde releases

Coordination points (plus drop releases)

> Drop pts (D1, D2, ...) Nav pts (1, 2, ...)