

SHOUT Research Flight 1 – 20160824 - Gaston

Shift 1 Mission Scientists: Gary Wick, Jason Dunion

Shift 2 Mission Scientists: Scott Braun, John Walker, Alan Brammer

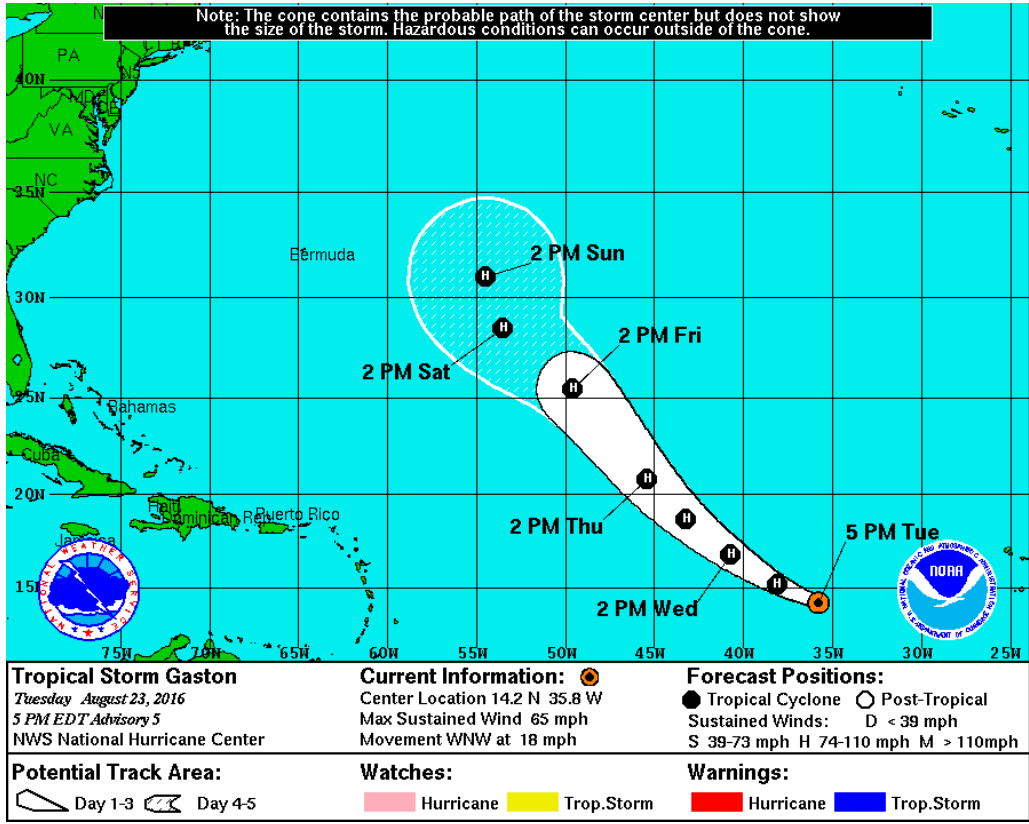
Shift 3 Mission Scientists: Rosimar Rios-Berrios, Will Komaromi, Greg Tripoli

Log initiated by G. Wick

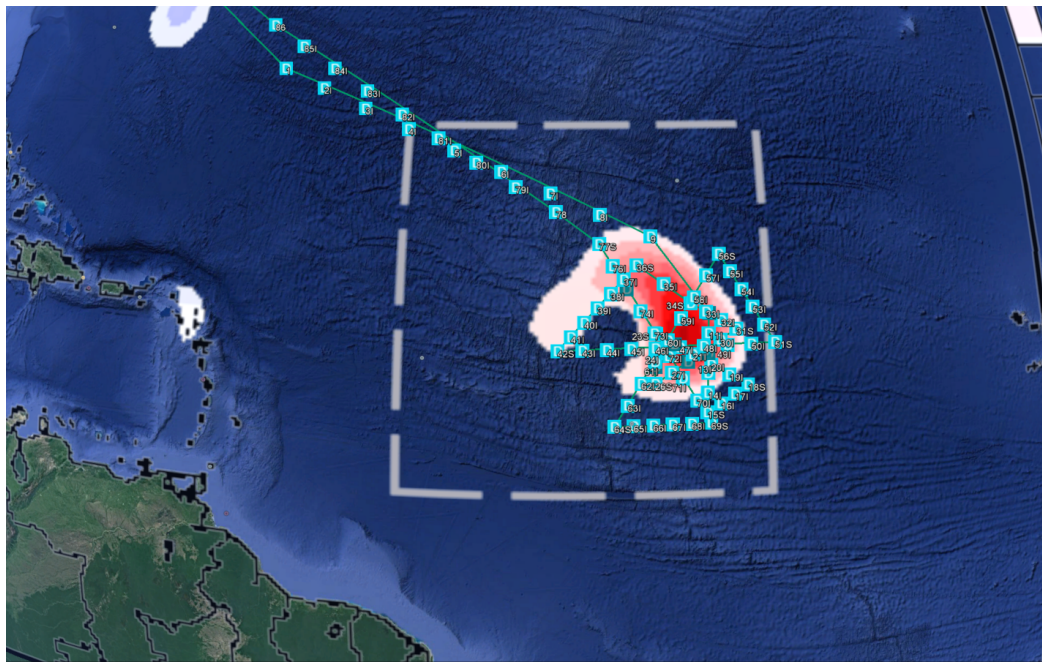
The objective of this first flight is to sample the region over and around Tropical Storm Gaston as well as an upstream trough region requested by NHC for the purpose of improving forecast accuracy. Gaston had been declared a tropical storm by Tuesday morning (the 23rd) and was forecast to further intensify to hurricane strength over the next couple of days. Initial model agreement is quite good in the near term, but uncertainty grows a bit later about the time of potential recurvature. The lack of initial uncertainty is a bit of a concern, but the desire is to get sampling over multiple model cycles. The system is forecast to remain out in the open ocean but has the potential for notable strengthening. The flight plan includes large and small butterfly elements centered over the storm as well as legs over the trough to be sampled both inbound and outbound. A sequence has been set up to support back-to-back-to-back flights with Wednesday-Thursday, Friday-Saturday, and Sunday-Monday flights. A flight plan has already been submitted for a possible Friday-Saturday flight. AL 99 remains a concern and a potential threat to the US later in its life cycle, so we will continue to monitor its progress as making decisions to continue sampling of Gaston.

Payloads are AVAPS, HAMSRS, and HIWRAP. 90 dropsondes are loaded on the aircraft.

NHC forecast track Tuesday (day prior)

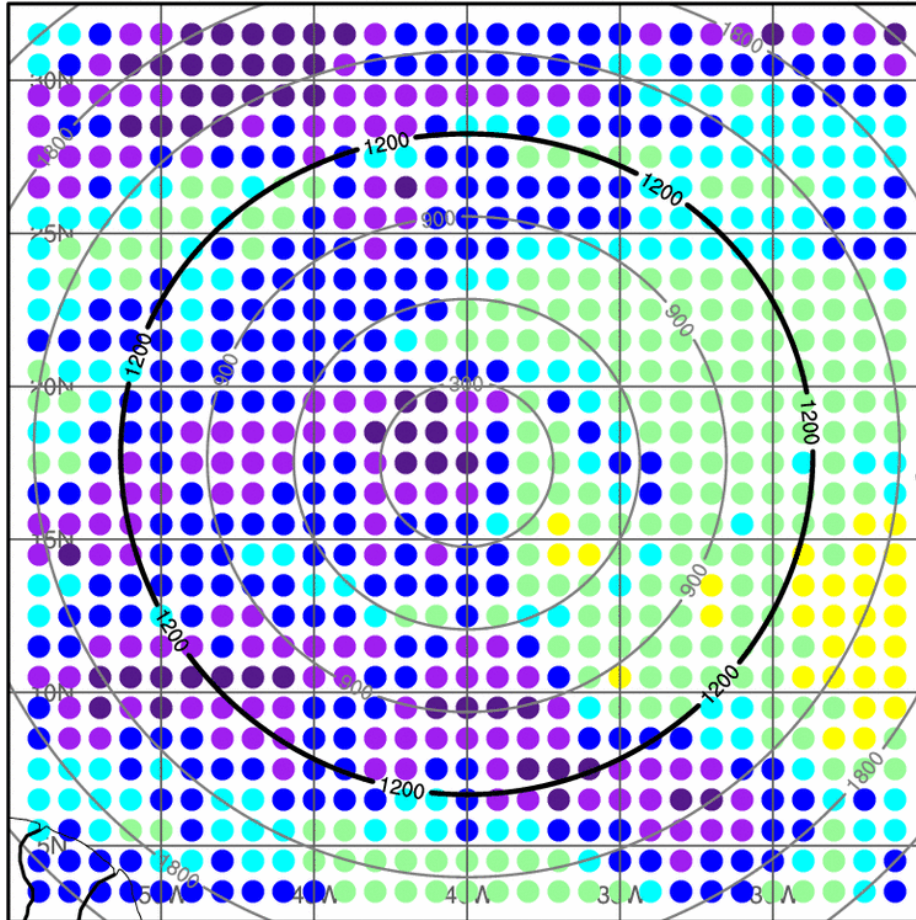


Sensitivity image provided by Jim Doyle showing that our pattern covers the COAMPS-TC sensitivities very well.



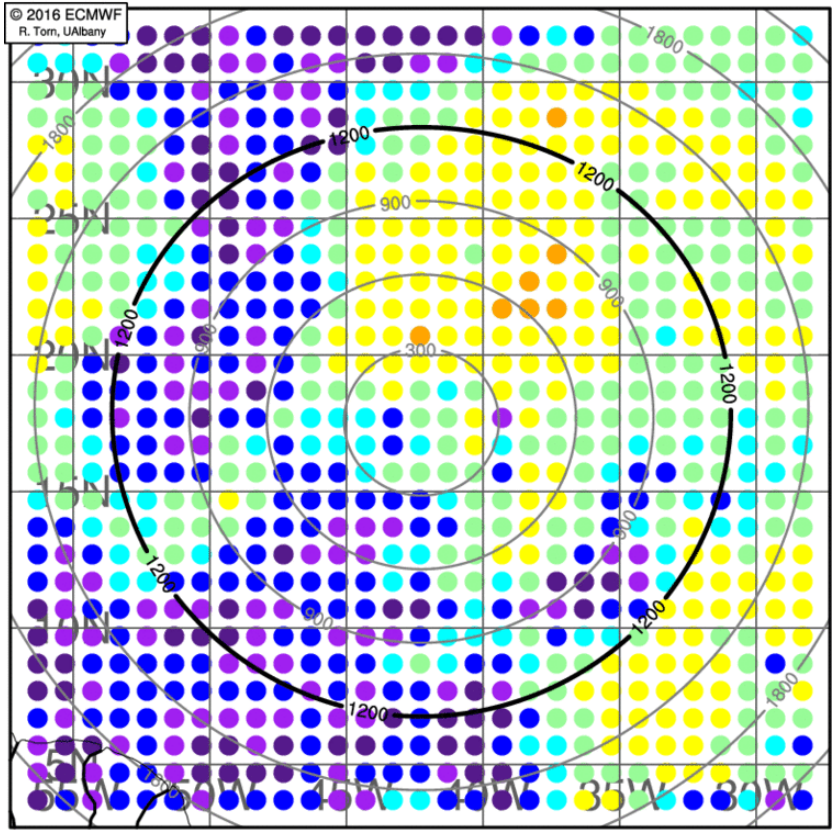
Below are the sensitivity graphics from Ryan Torn on Tuesday. The first is the track impact from HWRP. Ryan warns up front that projected impact is smaller than normal. The largest impact is about 1500 km to the east and west.

Drosonde impact at 2016082500 (F072)



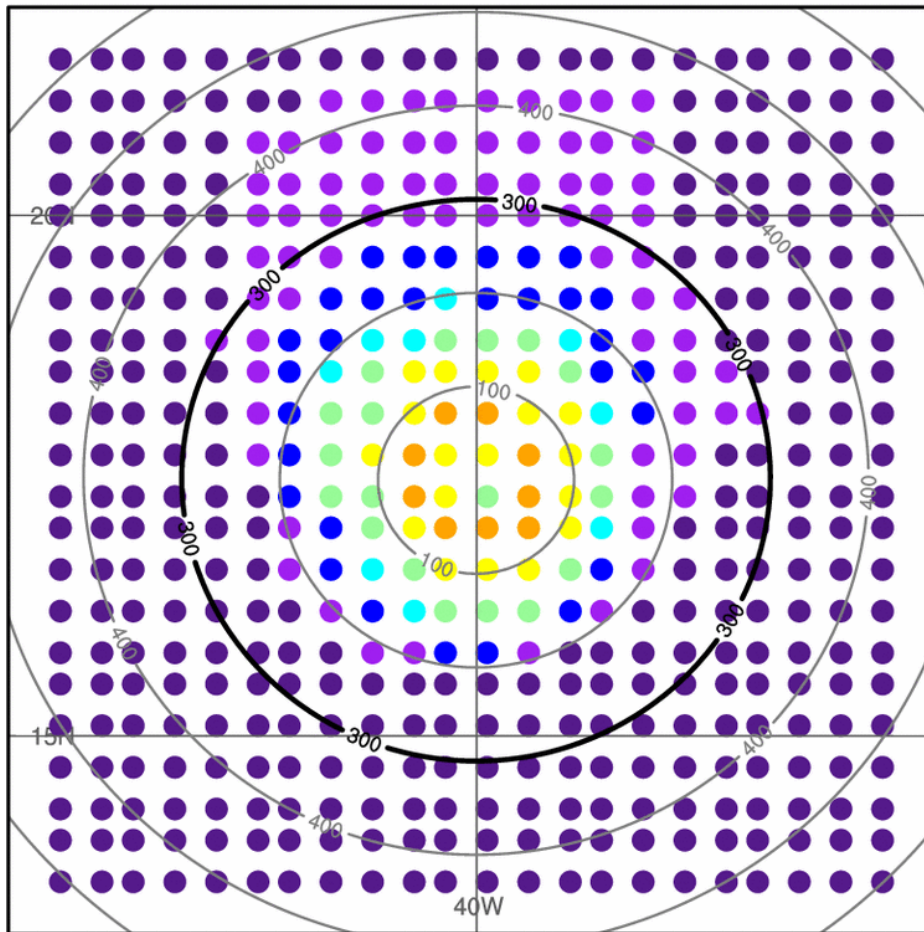
The following is the corresponding graphic from the EC ensembles. Similar in highlighting east, but also identifies the north.

Dropsonde impact at 2016082500 (F048)



From Ryan: “As for intensity, neither model's ensemble prediction system shows much variability in the intensity of Gaston beyond 1200 UTC 25 August. Most of the uncertainty is between now and then in MSLP, so the only metric that might make sense is the 10 m kinetic energy, which suggests taking observations within 300 km of the center of the wave with no particular preference for one quadrant or another; however, that impact is fairly short-lived as there are no real targets for improving the 0000 UTC 27 August forecast.”

Dropsonde impact at 2016082500 (F072)



From NHC Gaston Discussion 5: Some reference to upcoming forecast uncertainty after about 3 days...

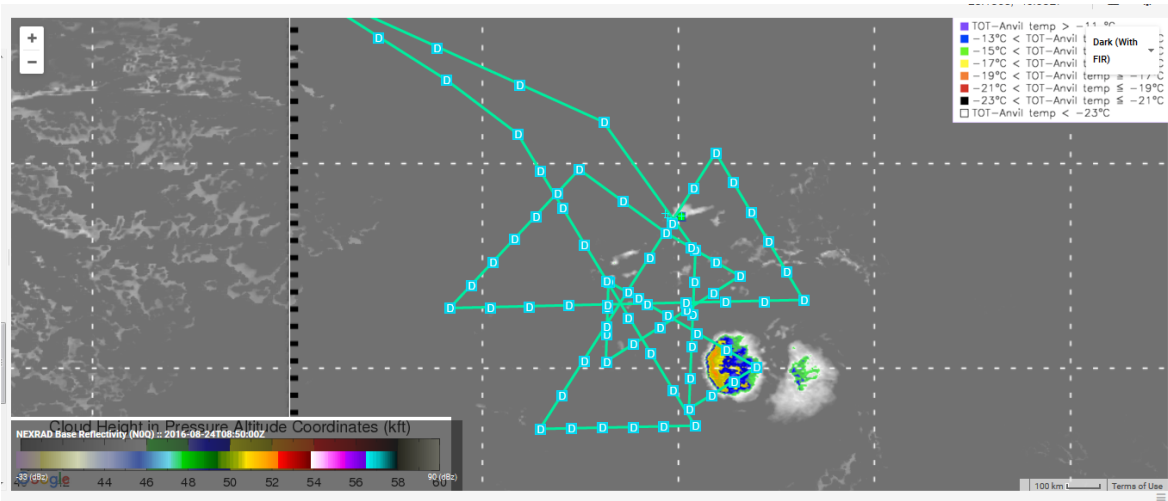
The initial motion estimate is 290/16. Gaston should gradually turn northwestward during the next couple of days as it moves around the subtropical ridge. Guidance is in very good agreement on the forecast during that time, and little change is made to the previous NHC track in the shorter term. Beyond 3 days, a break in the subtropical ridge is forecast, although the models are not in great agreement on exactly what longitude Gaston reaches before its likely recurvature.

T-0 Meeting at 0430 EDT (0830 UTC)

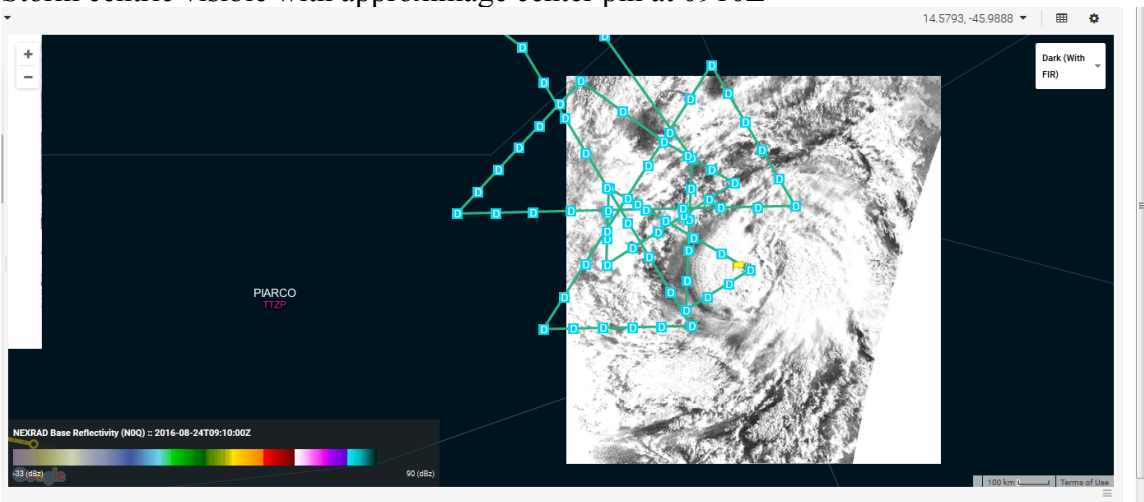
Takeoff will be runway 4

John asked that any flight plan changes come after leaving W-386. Land no earlier than 0600 EDT for airspace. Would have to work any early return today (due to payload issues) in real time for space and chase.

First cloud top height grab with flight track on staffing GHOC at 0854Z. Highest cloud tops reaching up to ~52kft on west side of system. No lightning indications at this time.



Storm centric visible with approximate center pin at 0910Z



In 0500 NHC discussion, they report Gaston still as a tropical storm, but expect likely strengthening to a hurricane today.

TROPICAL STORM GASTON DISCUSSION NUMBER 7
NWS NATIONAL HURRICANE CENTER MIAMI FL AL072016
500 AM AST WED AUG 24 2016

A 0414 UTC AMSR2 microwave image revealed that Gaston's structure has improved with the development of a well-defined low-level cloud ring and a mid-level microwave eye. However, the mid-level center

is displaced about 25 n mi to the northeast of the low-level center. Dvorak intensity estimates from TAFB and SAB are both T4.0/65 kt, but objective numbers are still between 55-60 kt. Given the tilted structure of the cyclone, the initial intensity is only raised to 60 kt on this advisory.

University of Wisconsin CIMSS shear analyses indicate that 10 kt of southwesterly shear is affecting Gaston, which could explain the cyclone's tilted structure. The shear is expected to remain low enough during the next 24 hours to allow Gaston to strengthen to a hurricane later today. However, the intensification trend should be interrupted after 24 hours, continuing through day 3, when Gaston moves into a higher shear zone to the east of a mid-/upper-level low. Some strengthening is then probable on days 4 and 5 when Gaston moves north of the upper low into a lower-shear environment. The intensity models are in very good agreement on this general scenario, and the official NHC forecast was only lowered a bit at 36 and 48 hours to be more in line with the IVCN consensus.

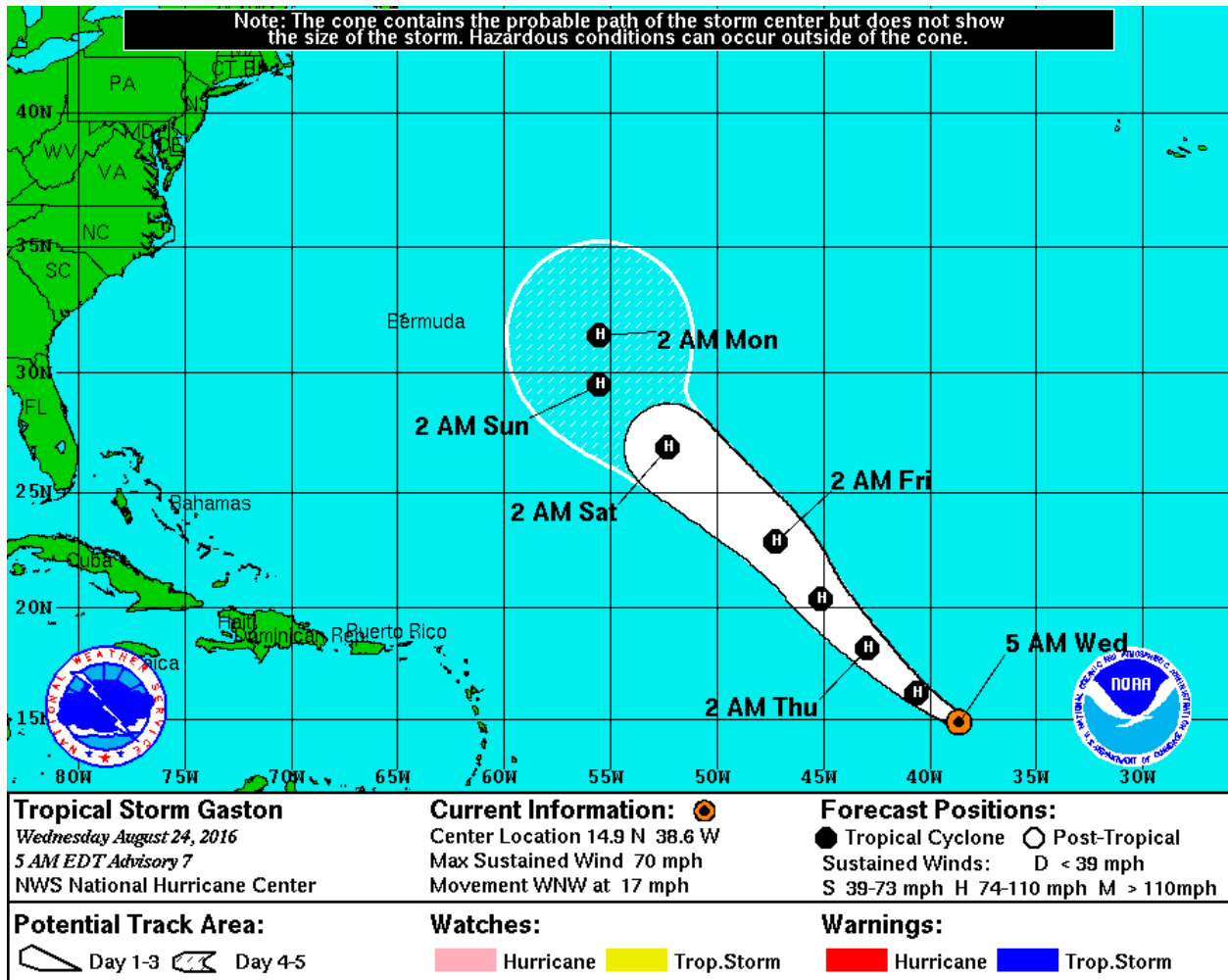
Tracking the low-level center observed in microwave data yields a motion of 290/15 kt. Gaston is approaching a break in the subtropical ridge caused by the aforementioned mid-/upper-level low, and the steering currents should cause the motion to become northwestward later today and continue along that heading for the next four days. By day 5, Gaston is expected to slow down and turn northward to the west of a mid-level high. There is lower-than-normal spread among the track guidance for the entire five-day forecast period, and the NHC forecast continues to closely follow the TVCN multi-model consensus.

FORECAST POSITIONS AND MAX WINDS

INIT	24/0900Z	14.9N	38.6W	60 KT	70 MPH
12H	24/1800Z	16.2N	40.6W	65 KT	75 MPH
24H	25/0600Z	18.2N	42.9W	70 KT	80 MPH
36H	25/1800Z	20.4N	45.1W	70 KT	80 MPH
48H	26/0600Z	22.9N	47.2W	70 KT	80 MPH
72H	27/0600Z	26.9N	52.3W	70 KT	80 MPH
96H	28/0600Z	29.5N	55.5W	80 KT	90 MPH
120H	29/0600Z	31.5N	55.5W	85 KT	100 MPH

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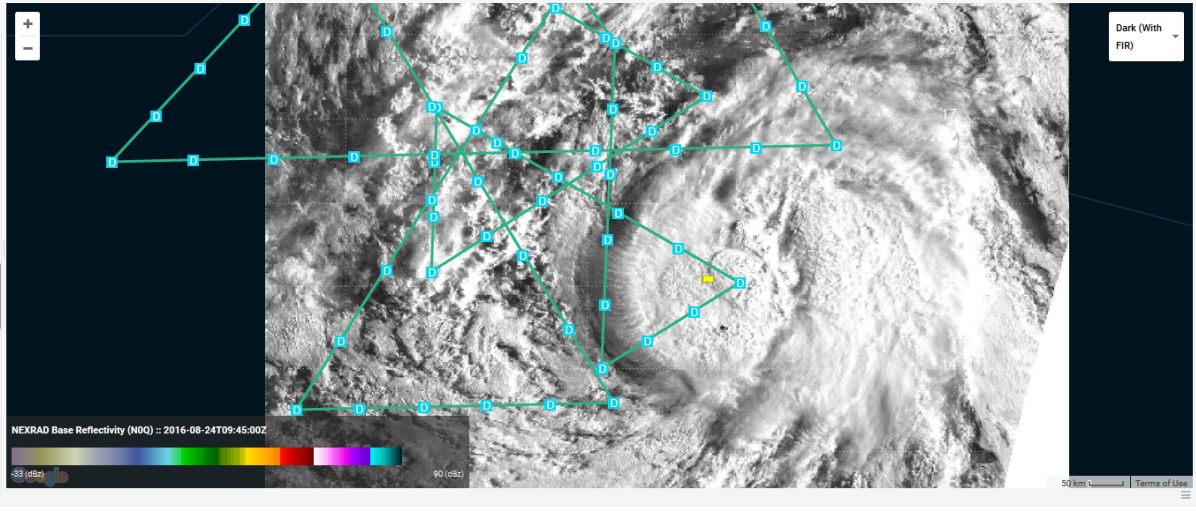
Forecaster Berg



0927Z: Clear for engine start
 0929Z: Engine start

Jason has draft plan update in N42 plan 2

~0930Z: Updated CIMMS storm centric visible image:



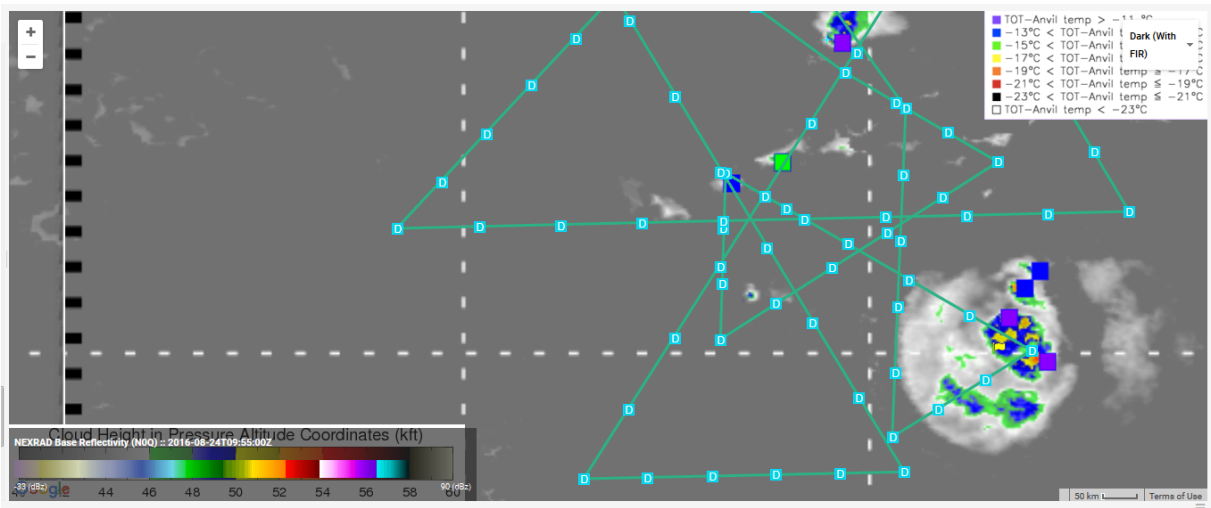
0944Z: Starting power up of systems (SMA)

0945Z: Payload power coming up

0950Z: Ready for pin pull

0952Z pin pulled

0958Z: CTH product with TOTs and lightning. Couple of TOTs, no lightning. Convection most active on eastern side. Jason noted Saharan air entering on north side. Could pose problems for system as develops.



1001Z: Taxi

1006Z: Rolling

1007Z: Takeoff

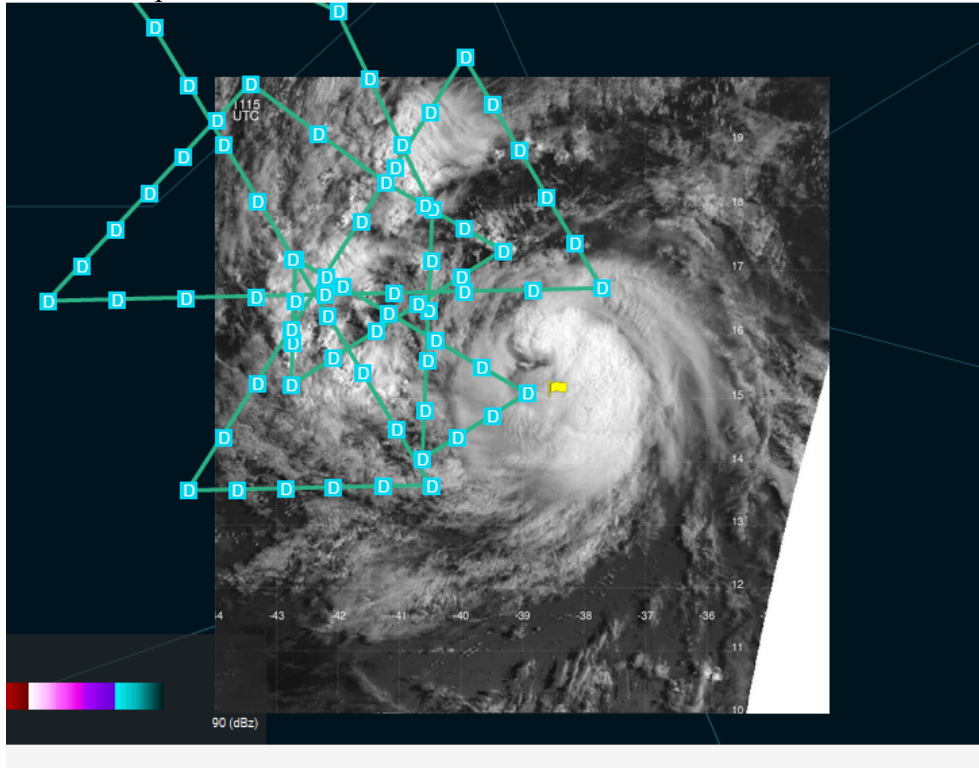
1042Z: Leaving test track and heading out of W386

1057Z: Update 1 to flight track submitted by Jason

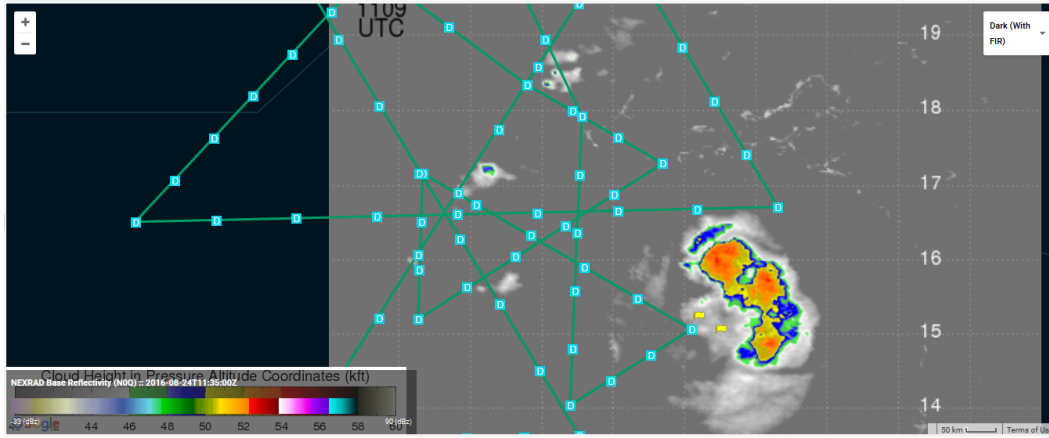
Changes:

1. the storm centered pattern was shifted to reflect the latest NHC track for Gaston.
2. drops were repositioned along the initial NW-SE leg (new MTS points 1-10)
3. 2 drops were added along the inbound NW-SE leg (new MTS points 10-13S)

~1130Z: Updated storm centered vis:

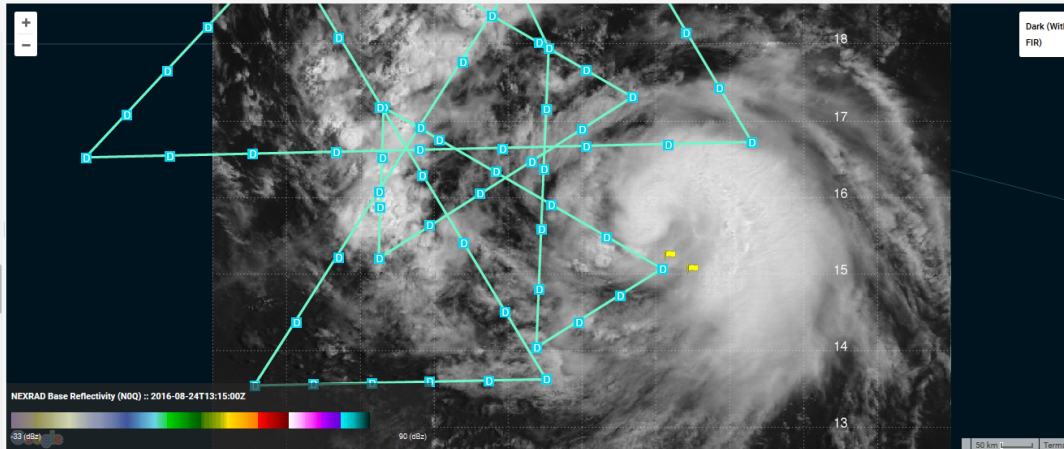


Corresponding cloud top height image. Note satellite image time reported as 1109Z. Convection still strongest on eastern side. Had been some lightning earlier in smaller cell to the north, but none visible over main storm area.

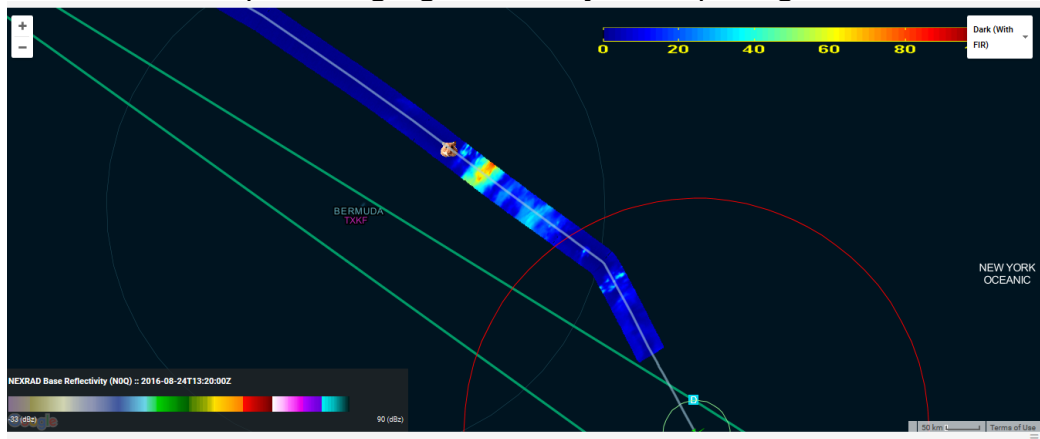


1259Z Departing Bermuda airspace and turning towards first drop point

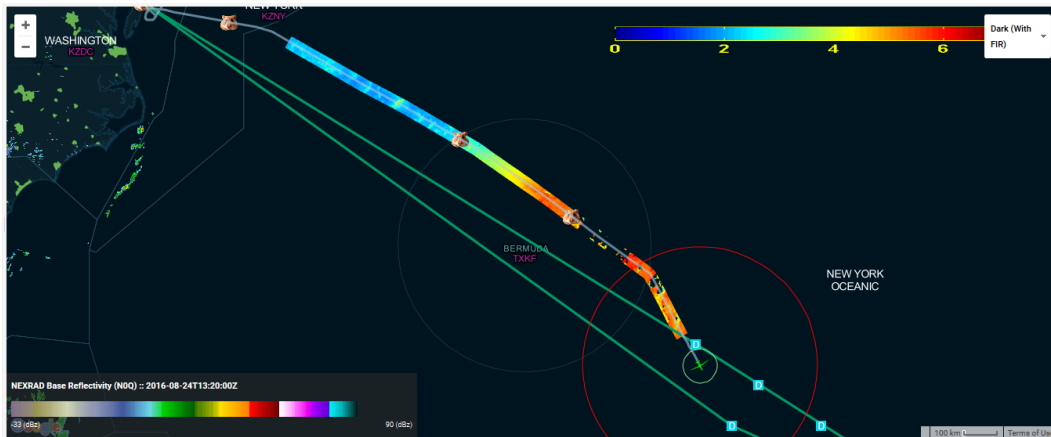
~1300Z - latest storm centered vis



1322Z HAMSRS report seeing high reflectivity values passing over remnants of Fiona:



Corresponding TPW during transit in:



1330Z Have internet access failure to MS computers in POR. Don Sullivan working but up temporarily on laptop

1337Z: loaded first sonde. Waiting for ATC clearance to enable interlock

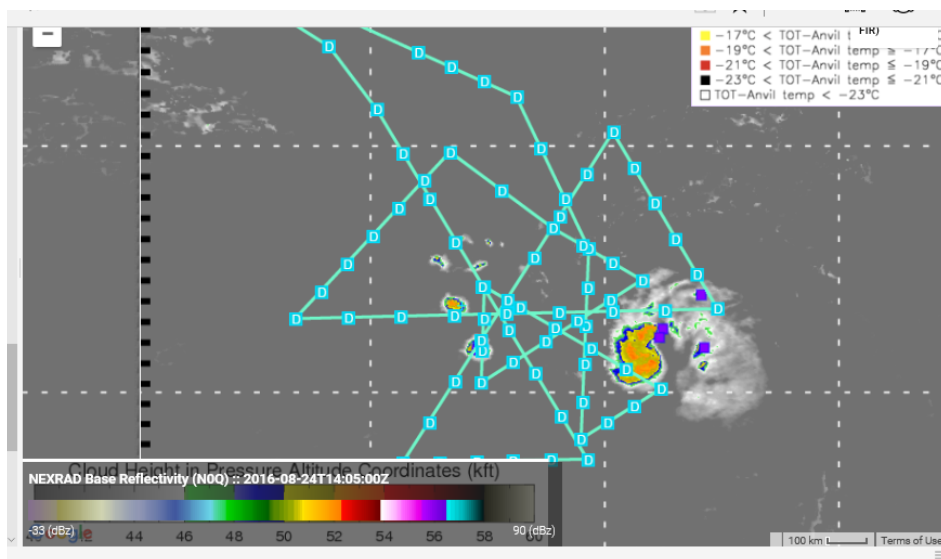
1340Z: interlock enabled

1342Z: Sonde 1 launched at location 1.
About 20 minutes to next drop

1354Z: Don still working internet issues. Says related to some firewall changes they are implementing to support HIWRAP data transfer.

1401Z: loading sonde 2. Had problem with load - exploring

1406Z: Crude cloud top screen grab from laptop

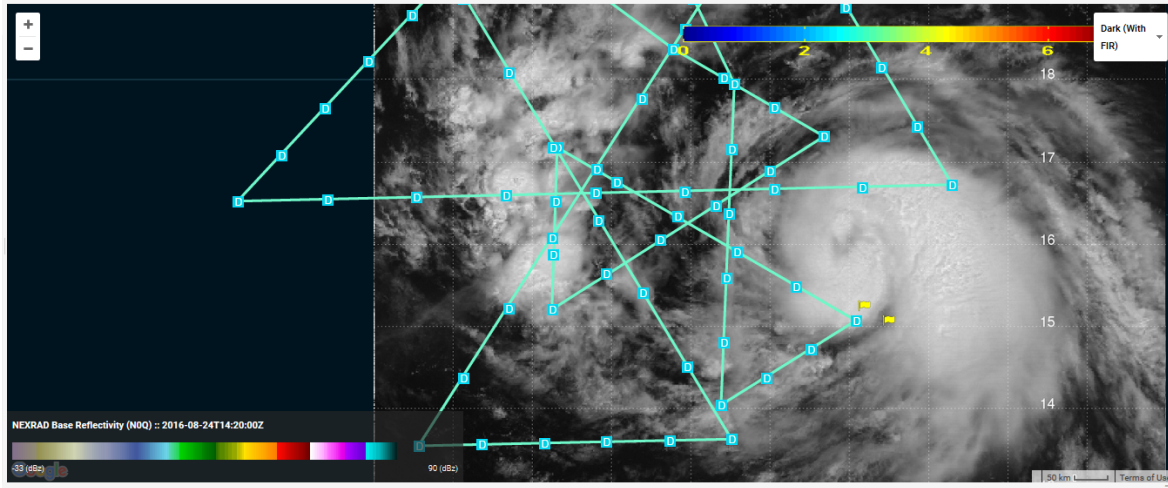


1408Z: Had to miss drop location 2 due to problem with sonde load.

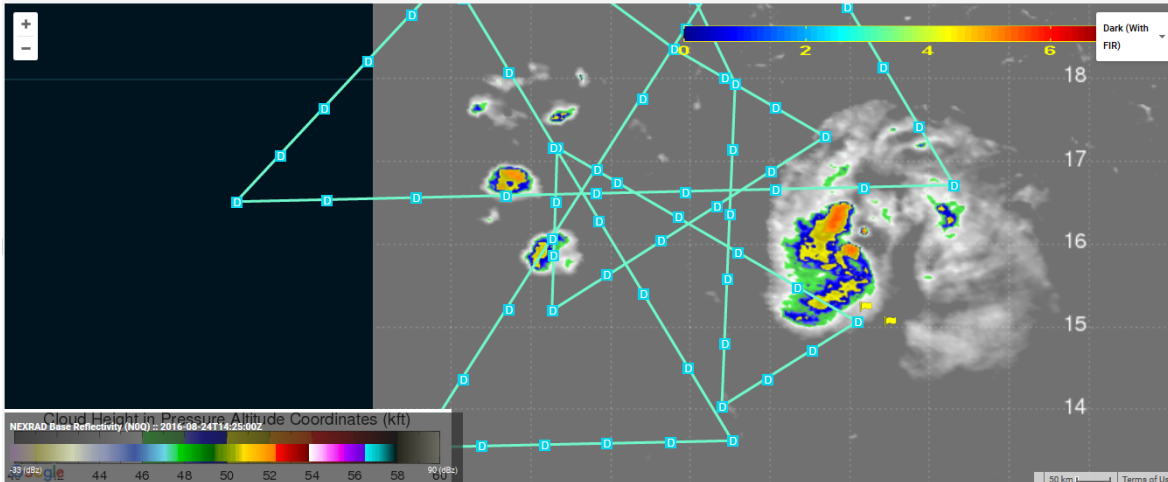
Terry was able to manually load sonde but couldn't initialize to do sounding. May likely be a dummy sounding

1416Z: Looks like internet is back up on MS1. Still not active on MS2 or 3. Jason rebooted MS2 but did not clear problem there. Problem part complicated by pilot handover going on now.

~1415Z: Storm centric visible image - some active convection nearer to center



Corresponding cloud top height image: image time 1409Z



1433Z: Sonde 2 deployed at location 3. Will be no sounding since load was manual and did not initialize

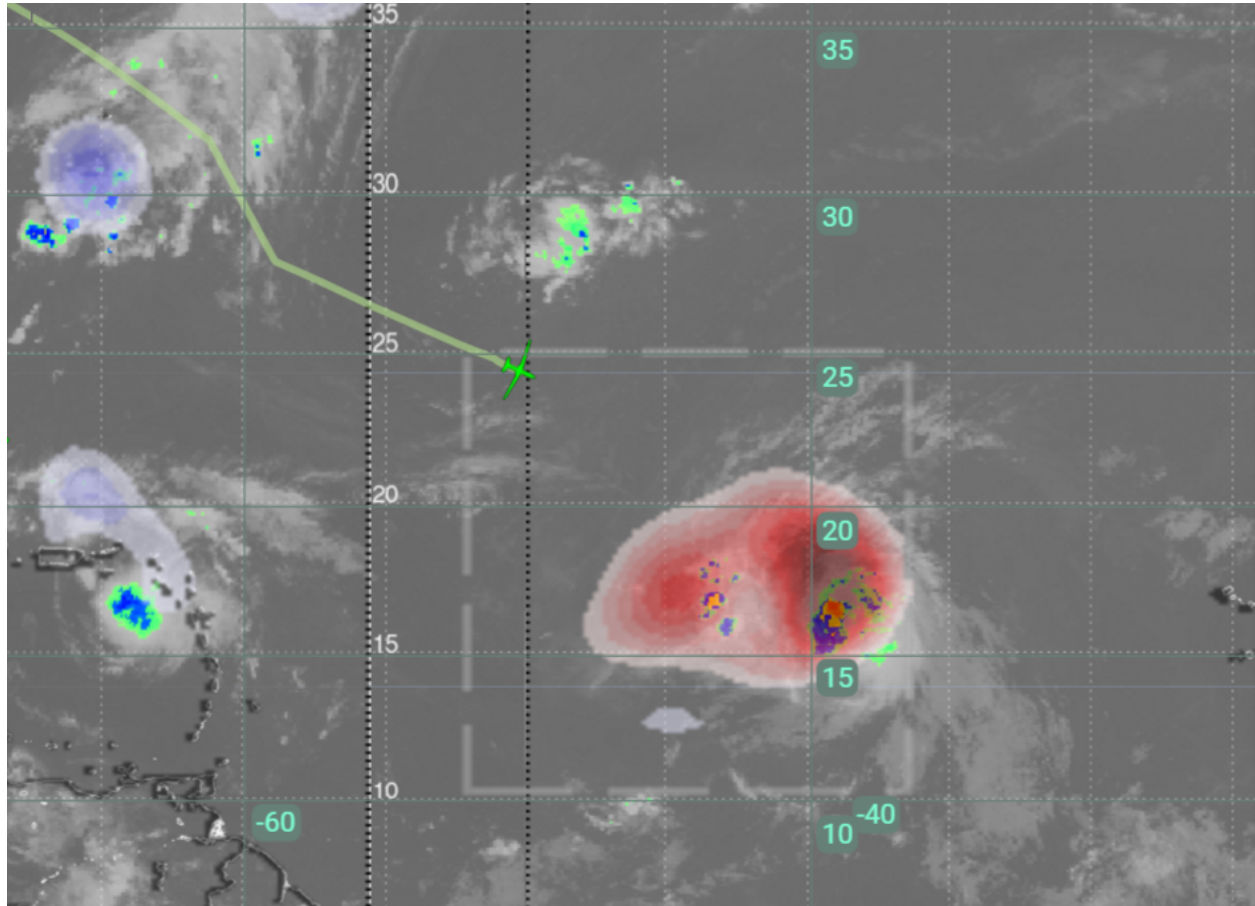
Loaded next sonde immediately and auto load did succeed.

Had to debug issues with automated transfer of sounding data. Password on WFF link server had timed out and had to be reset. Needed key from asp-interface-2 going in to be reset as well. Manual rsync worked with known password, but Pat is reworking key

As GH inbound, received e-mail from Jim Doyle on his adjoint sensitivity results for today's flight:

Just wanted to pass along this interesting sensitivity from COAMPS-TC for today's flight. Below is the 850 mb water vapor sensitivity overplotted on the brightness temperature. Main sensitivity near Gaston and the deep convection associated with it. Secondary max near the convection to the west. Also negative sensitivities to AL99 and Fiona (make these weaker and Gaston gets stronger). Probably only interesting to adjoint nerds like me, but wanted to pass it along.

Jim

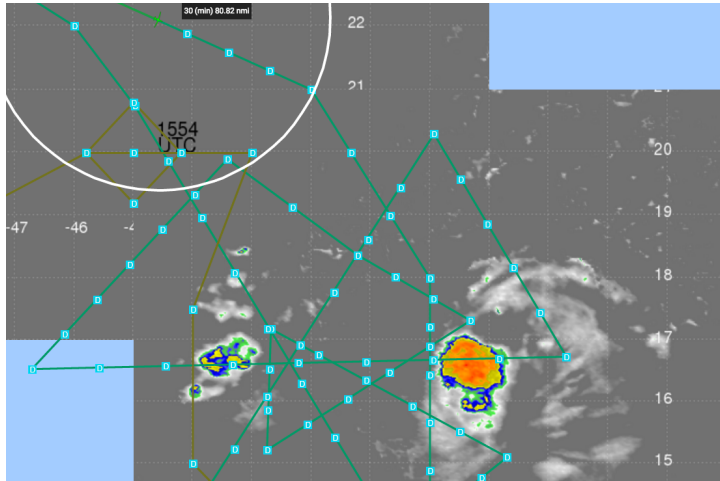


1459Z: Sonde 3 deployed at location 4. Successful sounding

1527Z: Sonde 4 deployed at location 5. Good drop

1555Z: Sonde 5 deployed at location 6. Good drop

Drop 5 (D20160824_155500) got a nice profile through the tongue of dry air wrapping around the system. Relatively dry down to ~925 hPa, temp inversion and drier air upwards of 800 hPa.



1618Z: Taking over crude screen shot duty. Cloud top heights as we approach storm. Image time: 1554z

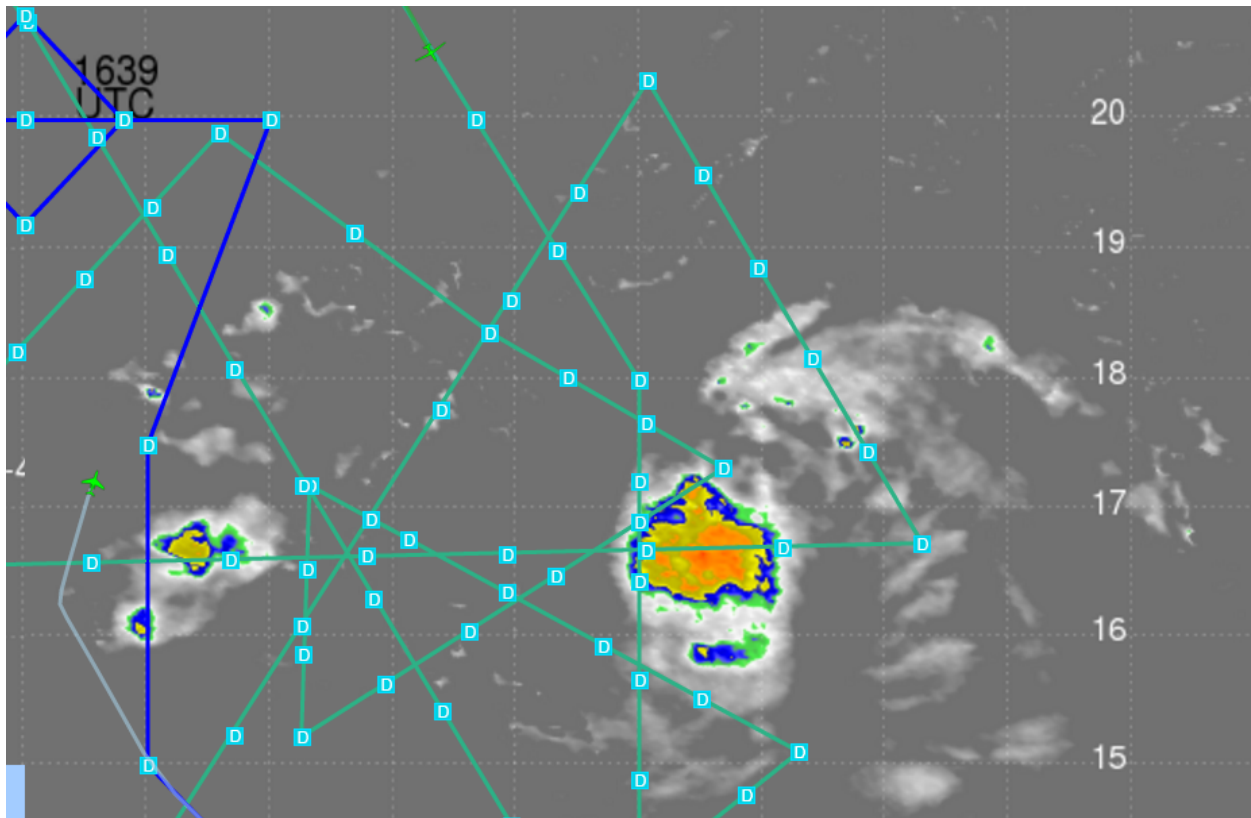
1622Z: Sonde 6 deployed at location 7. Good drop.

1630Z: Sonde 7 deployed at location 8. Good drop.

1638Z: Sonde 8 deployed at location 9. Good drop.

1647Z: Sonde 9 deployed at location 10. Good drop.

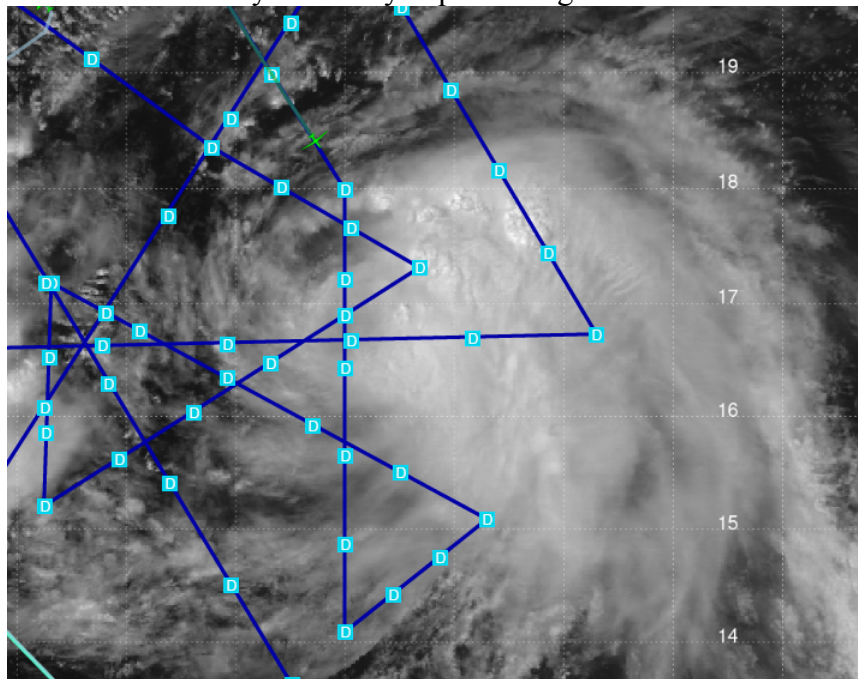
1653Z: Cloud tops have continued to slowly collapse since the 1500z flair up. No TOTs or lightning over the central region since 1528Z. Average top now around 51-52 kft, peaks between 52-54 kft.

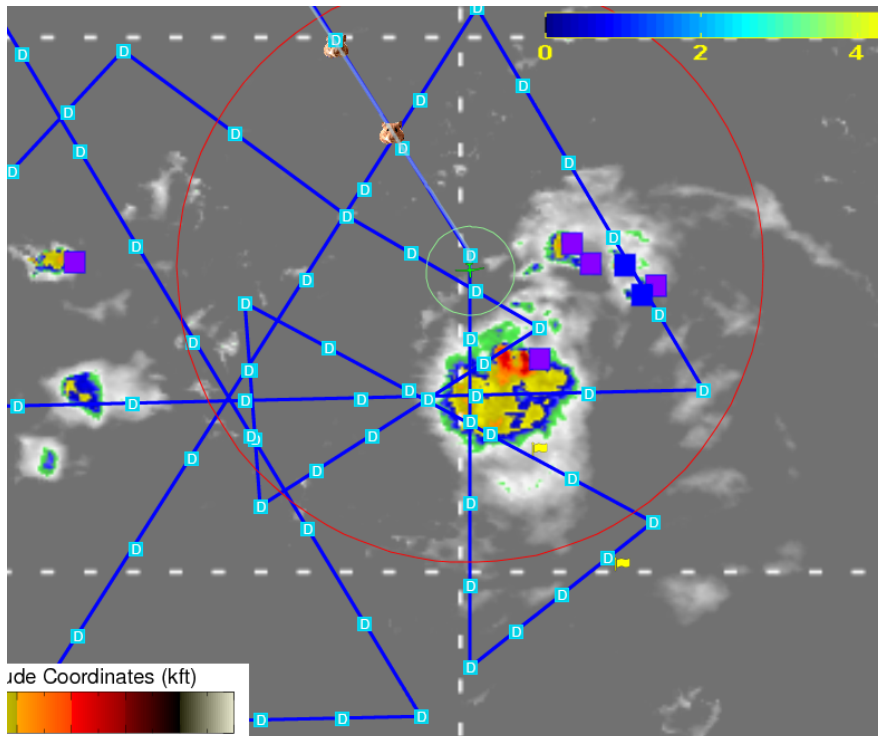


1700Z: Sonde 10 deployed at location 11. Good drop.

1713Z: Sonde 11 deployed at location 12. Good drop.

1720Z: Visible satellite from 1645z. Deep convection focussed on the eastern half of the circulation currently. Possibly experiencing some of the shear to the north of the system.





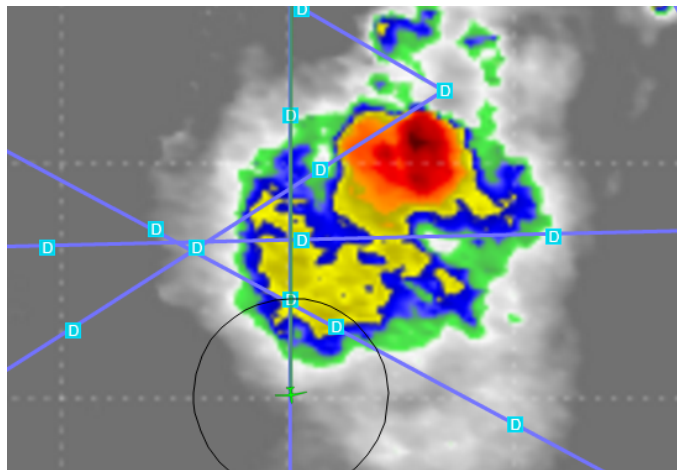
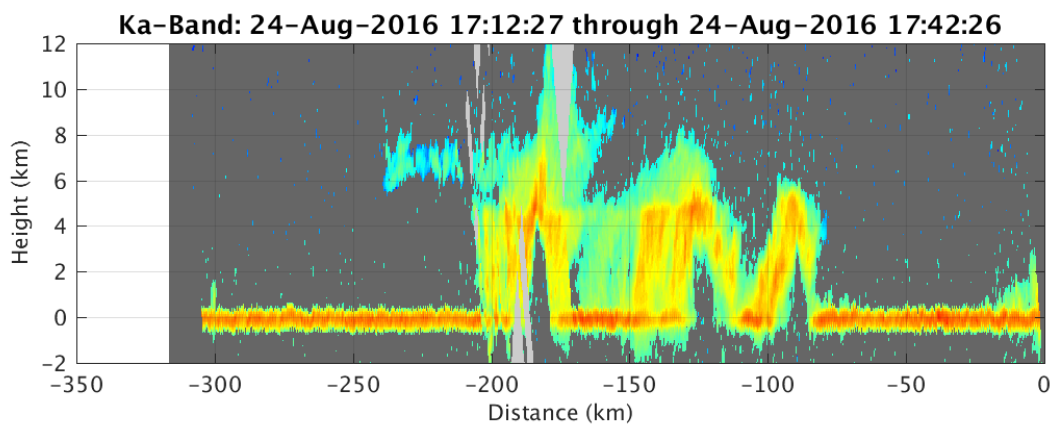
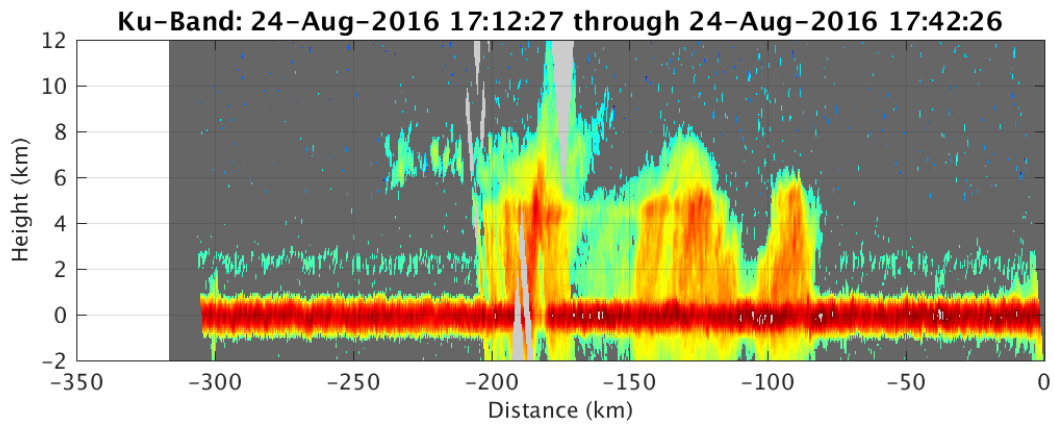
1700 UTC image showing very intense convection to the left of southbound track. Tops near 54-56 kft. Track after southbound leg has been changed (update #3) to extend leg to the NE to shift the SE-NW leg and the following one northeastward a bit to get closer to the expected center location.

1726Z: Sonde 12 deployed at location 13. Good drop.

1735Z: Sonde 13 deployed at location 14. Good drop.

1743Z: Sonde 14 deployed at location 15. Good drop.

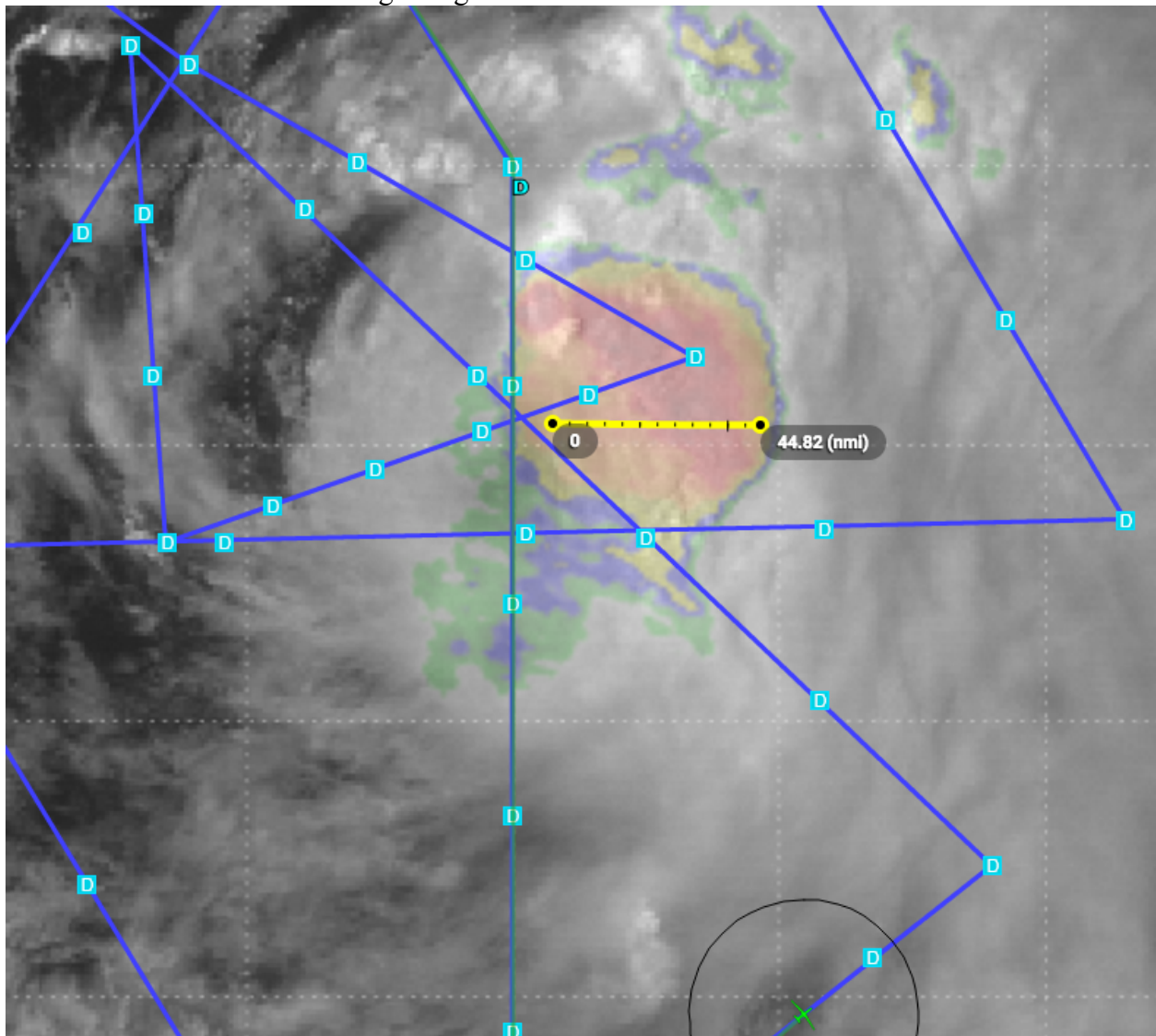
1745Z: Real-time HIWRAP image of first overpass.



Corresponding cloud top image:

- 1751Z: Sonde 15 deployed at location 16. Good drop.
- 1759Z: Sonde 16 deployed at location 17. Good drop.
- 1808Z: Sonde 17 deployed at location 18. Good drop.
- 1817Z: Sonde 18 deployed at location 19. Lost Ku so can't confirm good drop.
- 1824Z: Sonde 19 deployed at location 20. Good drop.

1827Z: Small area of intense convection at 1700z expanded over the hour. Storm now has large area (50 nmi diameter) with cloud tops between 53-55 kft. Vis and cloud tops overlaid. Image times 1809z. No detection of lightning around the area.



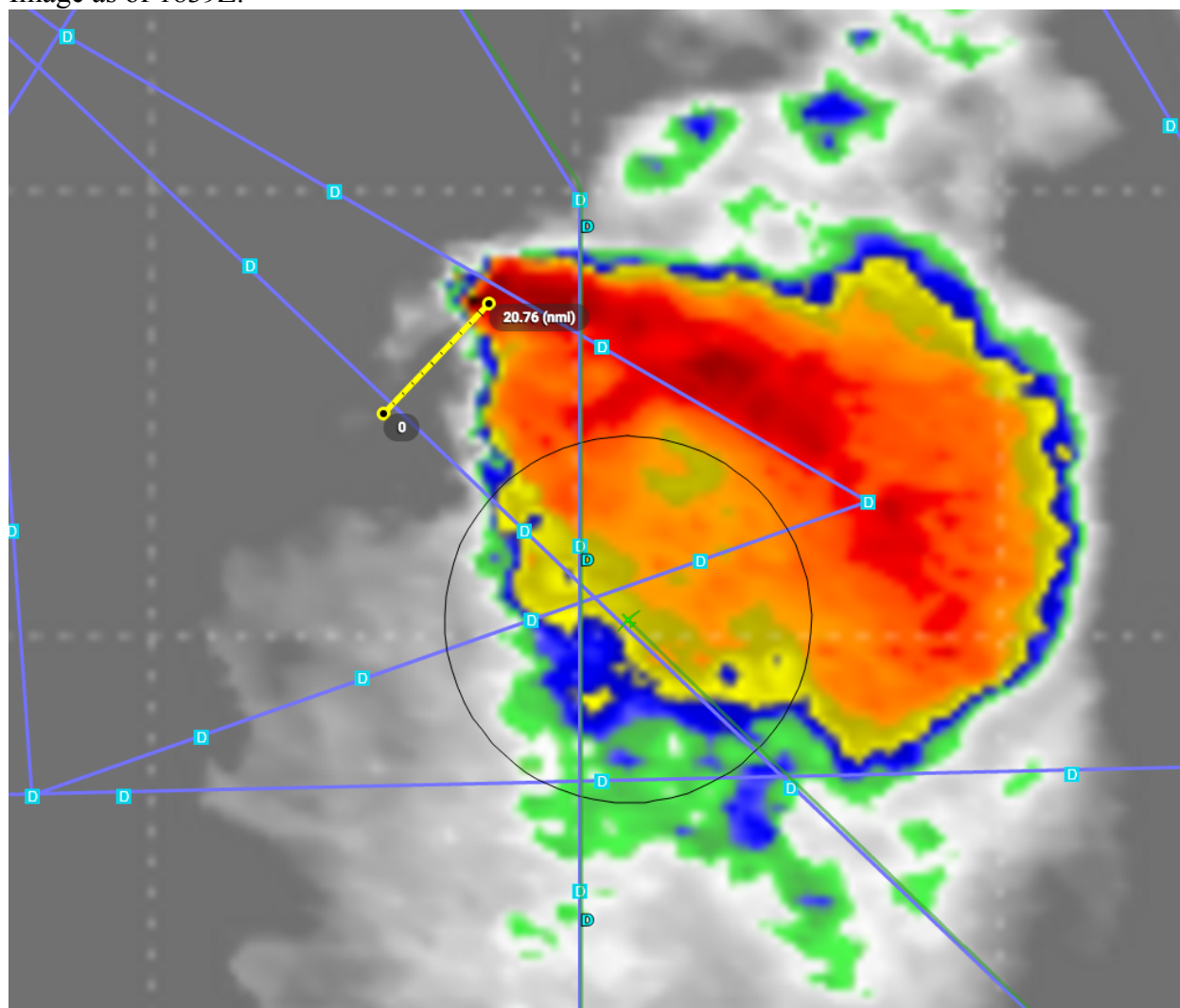
1830Z: Sonde 20 deployed at new location 21 in revised track. Good drop.

1837Z: Sonde 21 deployed at new location 22. Good drop. Now heading northwest to do second near-center crossing.

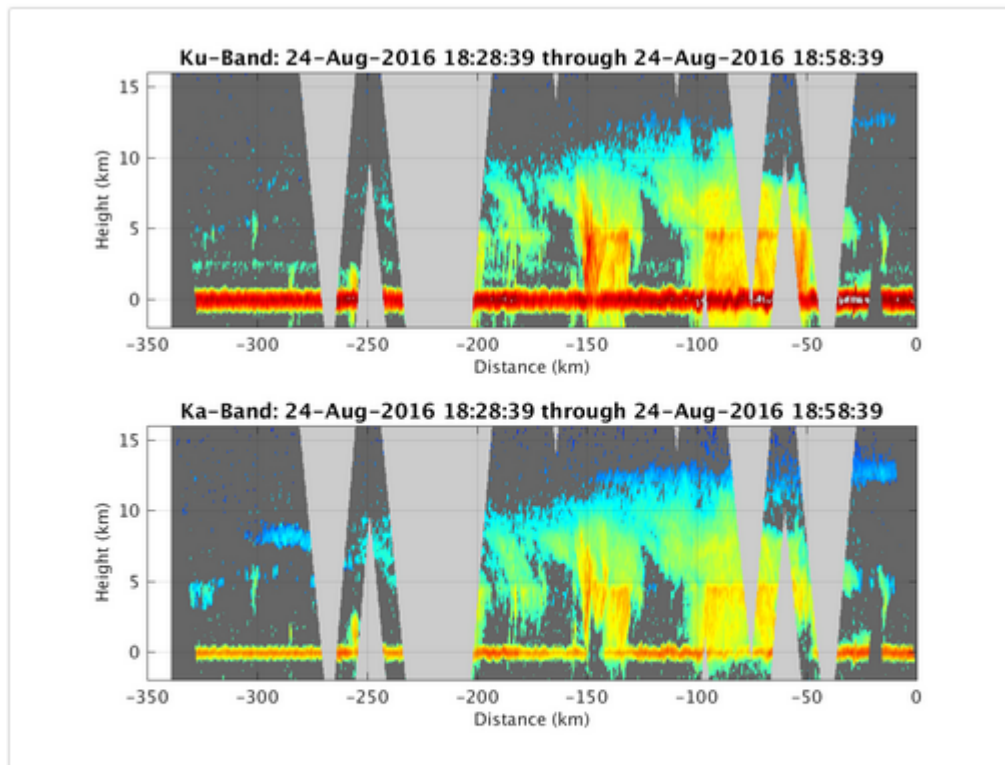
1844Z: Sonde 22 deployed at new location 23. Good drop.

1852Z: Sonde 23 deployed at new location 24. Good drop.

1855Z: Small intense area of convection on the north side of the storm. TOT detected of >10K. Image as of 1839Z.



1901Z: Sonde 24 deployed at new location 25. Good drop.



HIWRAP_RealTimeVerticalPlot

Image last fetched at 2016-08-24T19:04:03.543Z

HIWRAP image from the second crossing of the storm from SE to NW.

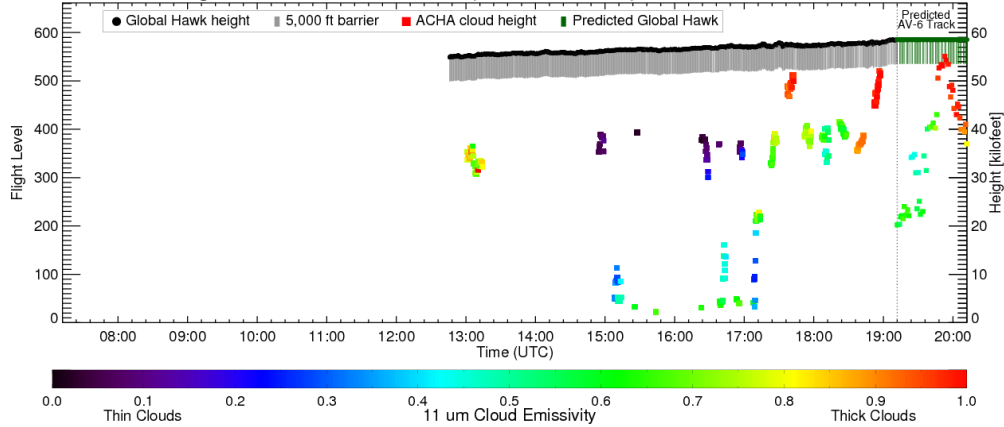
1909Z: Sonde 25 deployed at new location 26. Good drop.

1917Z: Sonde 26 deployed at new location 27. Good drop.

1918Z: Gaston cloud top height vs GHawk flight level. Storm seems to be going through semi consistent 60-90min convective burst cycle for the past 3-4hrs. Cloud tops gradually increasing each time. GH remains 2-3 kft (vertically) and 25 nmi (horizontally) clear of tops so far.

I (ABrammer) misinterpreted the below plot. Cloud heights are along GH track, cycle is therefore our overpasses over the system. Cloud tops still gradually increasing over time, but less periodic than plot suggests.

ACHA cloud height and AV-6 altitude comparison: Last updated at 1912 UTC on 20160824

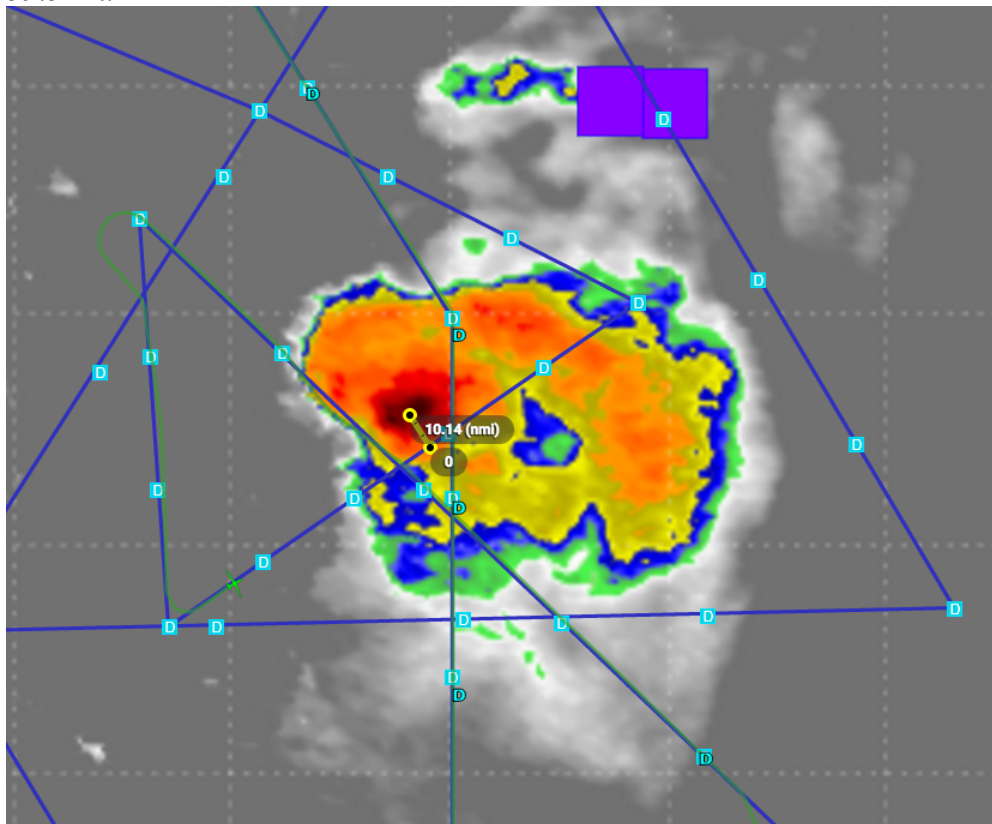


1926Z: Sonde 27 deployed at new location 28. Good drop.

1933Z: Sonde 28 deployed at new location 29. Good drop.

1941Z: Sonde 29 deployed at new location 30. Good drop.

1942Z: Another flair up, continuing the same area from previous bursts. Slowly moving around the storm, now on the western side. Image time 1924Z, tops reaching 56+kft. GH currently at 59.5 kft.

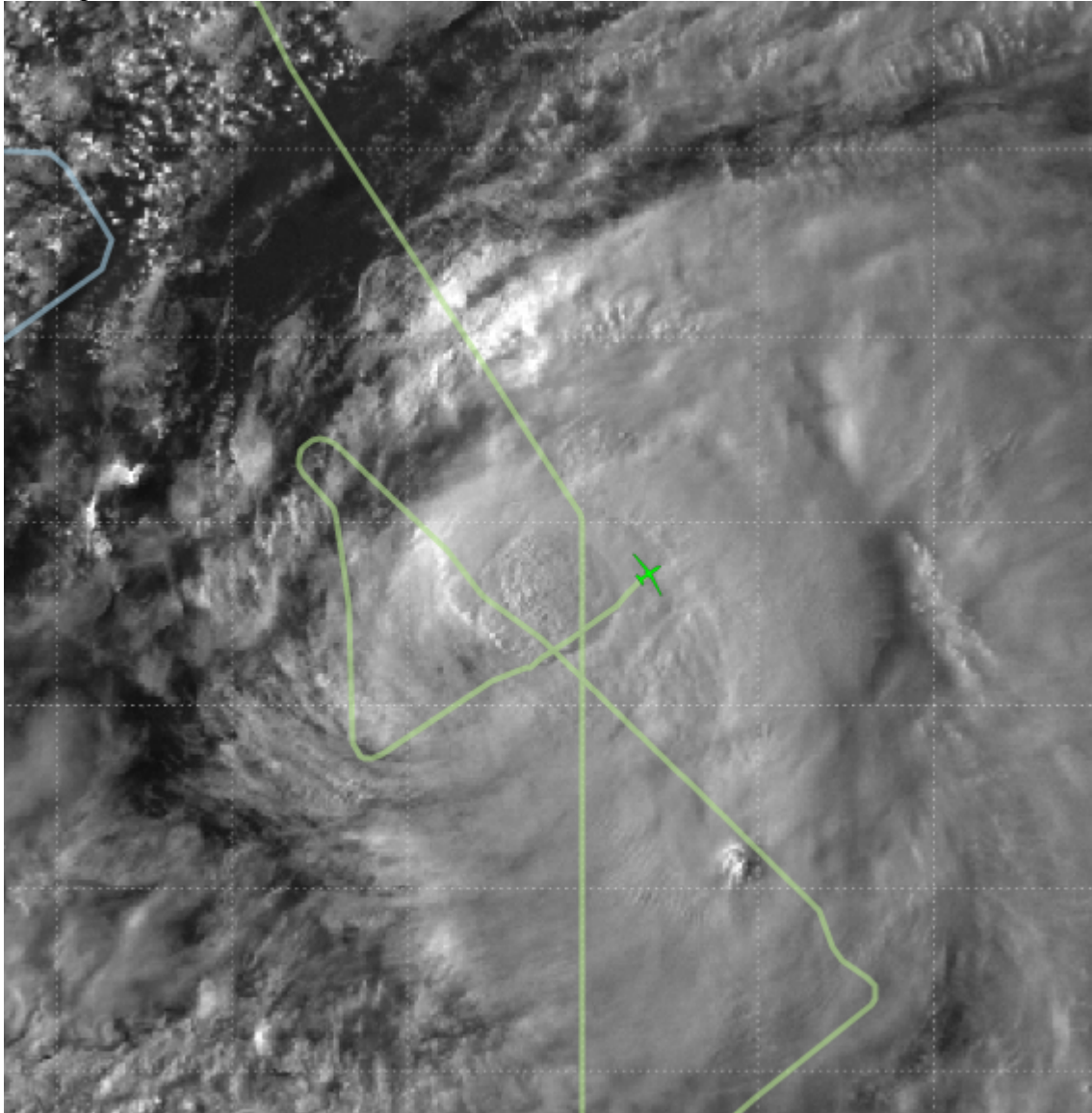


1944Z: Sonde 30 deployed at new location 31. Good drop.

1950Z: Sonde 31 deployed at new location 32. Good drop.

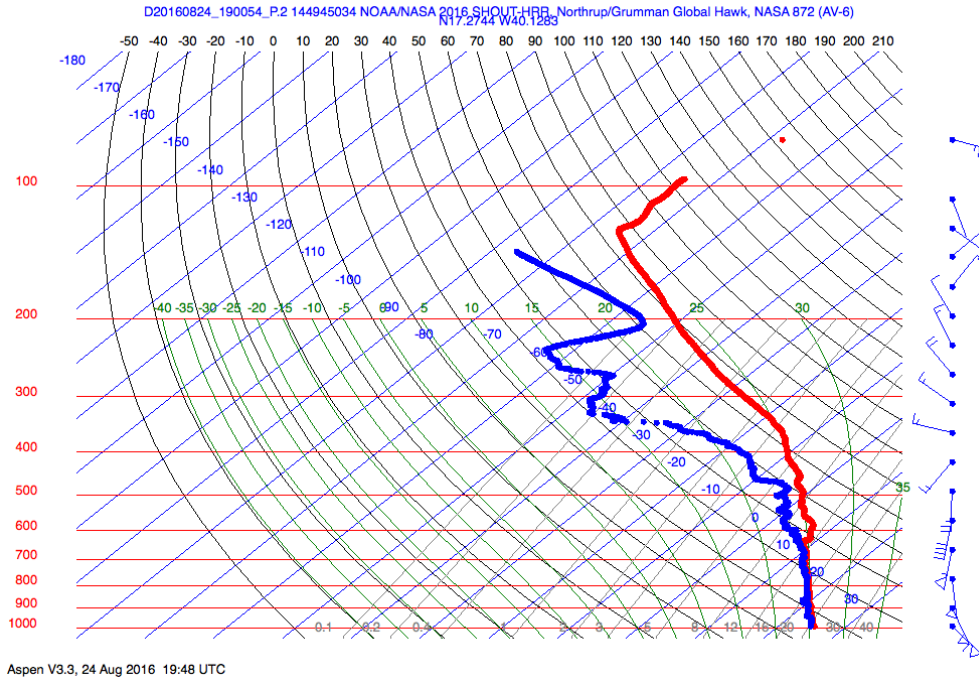
1955Z: Sonde 32 deployed at new location 33. Good drop.

2000z: Visible satellite from 1945Z. Just completing 2nd overpass of center. Skirting the fringe of deep convection near the center of the storm .

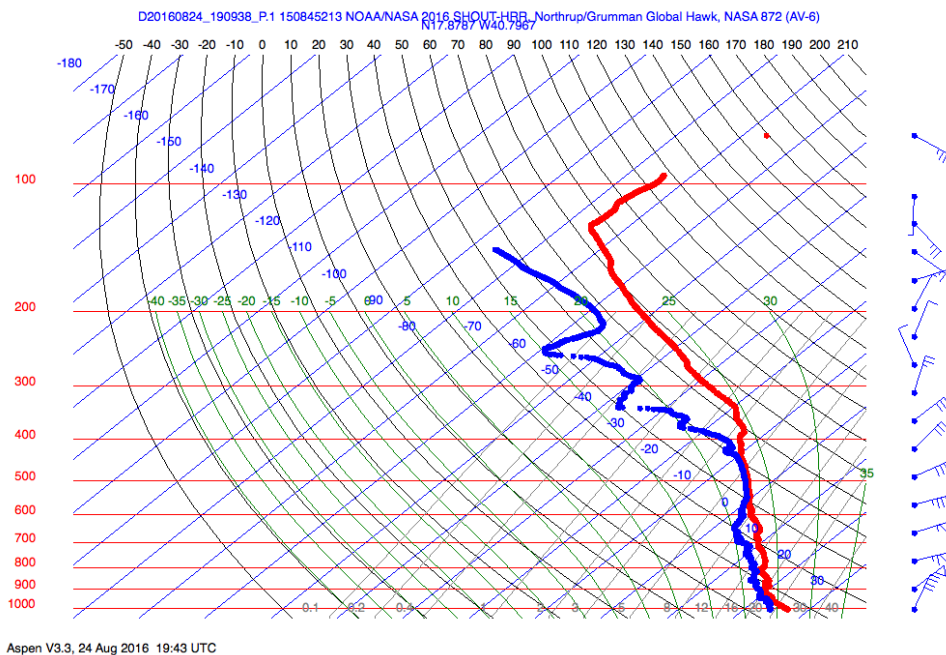


2001Z: Sonde 33 deployed at new location 34. Good drop.

2007Z: Sonde 34 deployed at new location 35. Good drop.

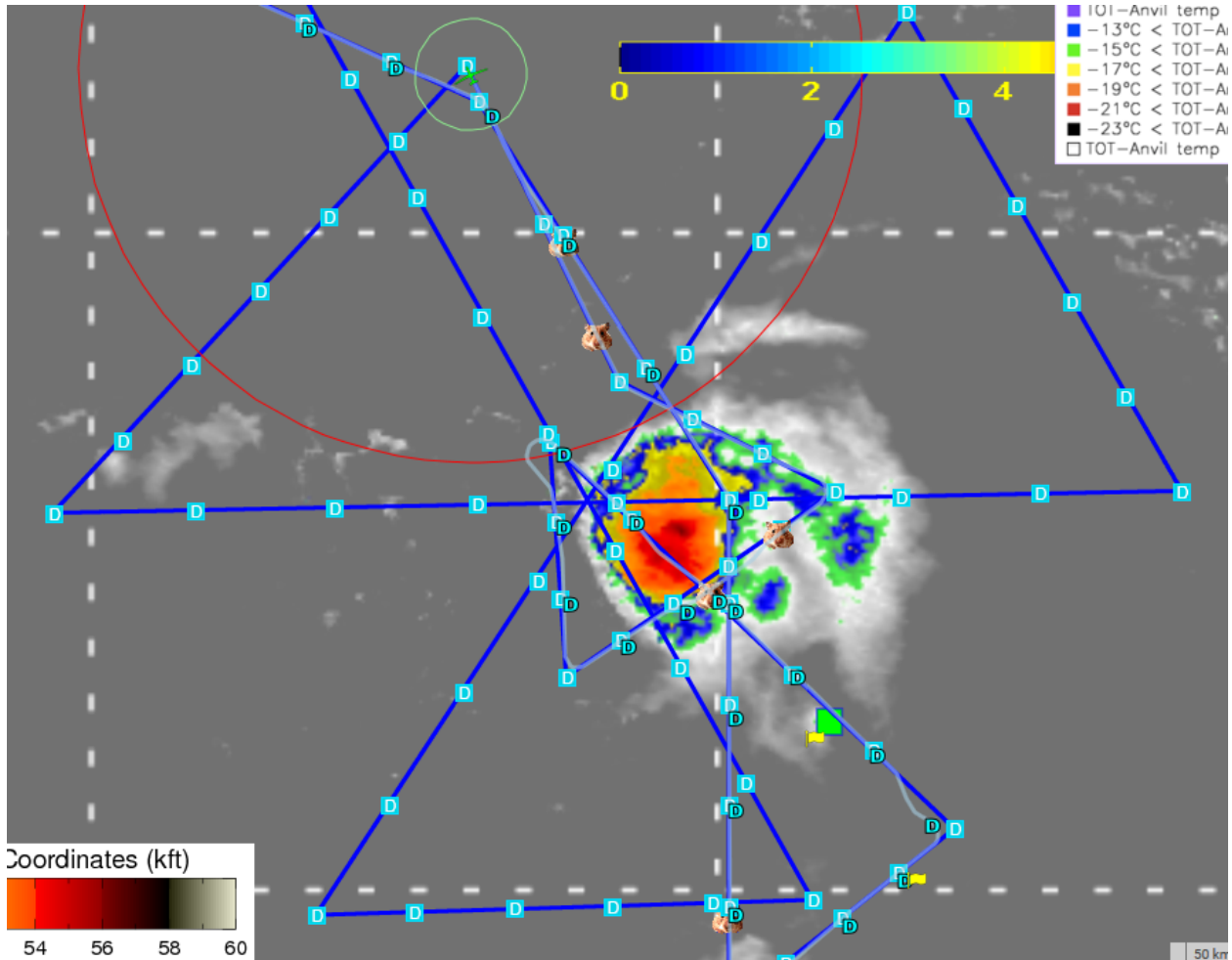


The Skew-T above was for the second center overpass, shows moist conditions up to 600 mb. Winds suggest release on southern side of eye, reaching surface on NE side of eye.



Subsequent drop after the above appears to have stayed on the north-northwest side of the storm. Moist conditions up to 400hPa. Surface winds around 40kts. Center slightly SW of center point between drop locations 25-26?

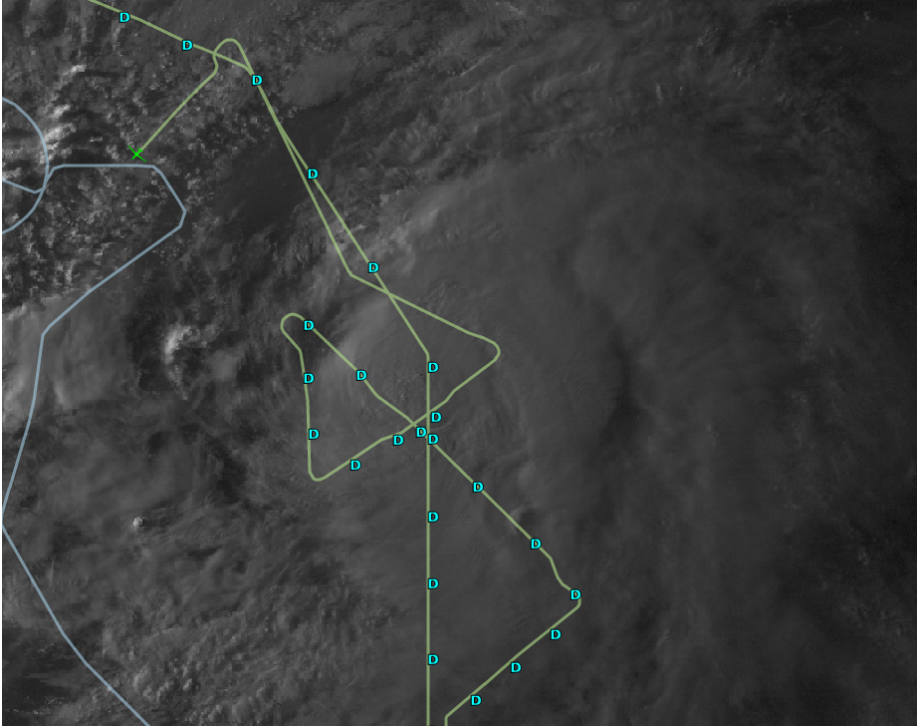
2012Z: Sonde 35 deployed at new location 36. Good drop.
 2018Z: Sonde 36 deployed at new location 37. Good drop.
 2025Z: Sonde 37 deployed at new location 38. Good drop.
 2040Z: Sonde 38 deployed at new location 39. K. Sellwood reports that this was a bad sonde based on post processing.



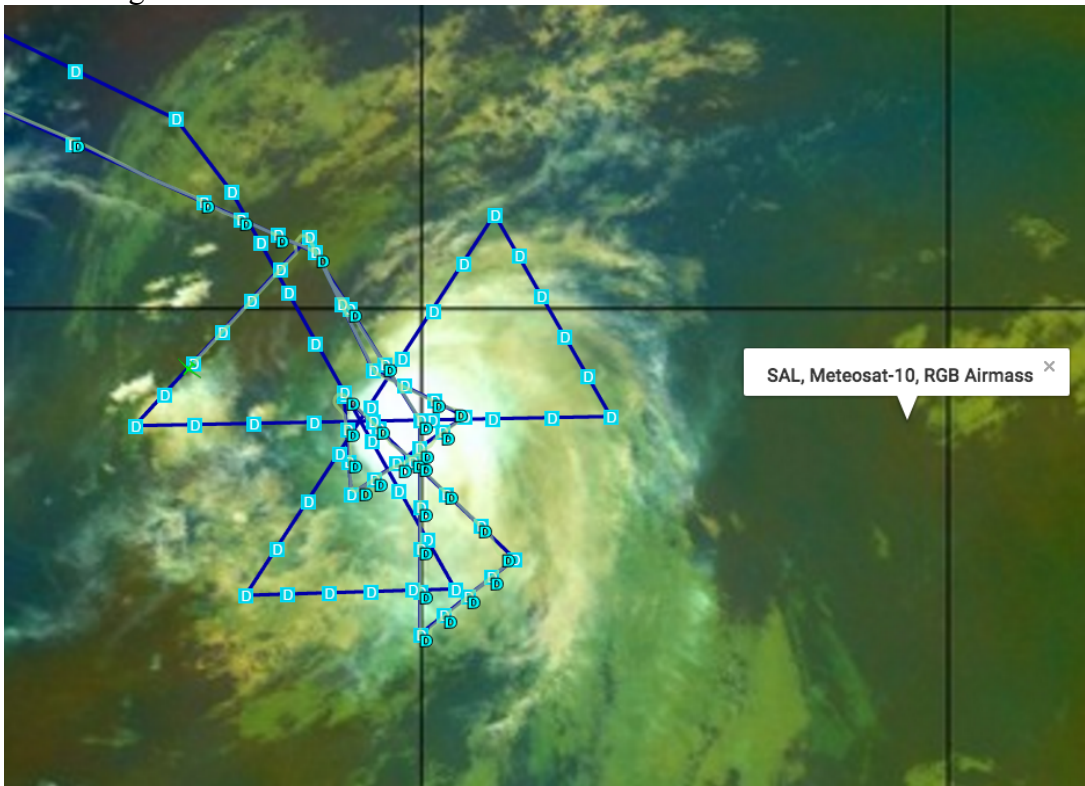
CTH image for 2015 UTC. GH is far to the NW of deep convection, beginning turn to the southwest.

2053Z: Sonde 39 deployed at new location 40. Good drop.
 2101Z: Sonde 40 deployed at new location 41. Good drop.
 2109Z: Sonde 41 deployed at new location 42. Good drop.
 2117Z: Sonde 42 deployed at new location 43. Good drop.
 2125Z: Sonde 43 deployed at new location 44. Good drop.

2110Z: Visible satellite from 2030-2045z. Storm is looking pretty healthy in the evening hours. Large circular CDO around center.

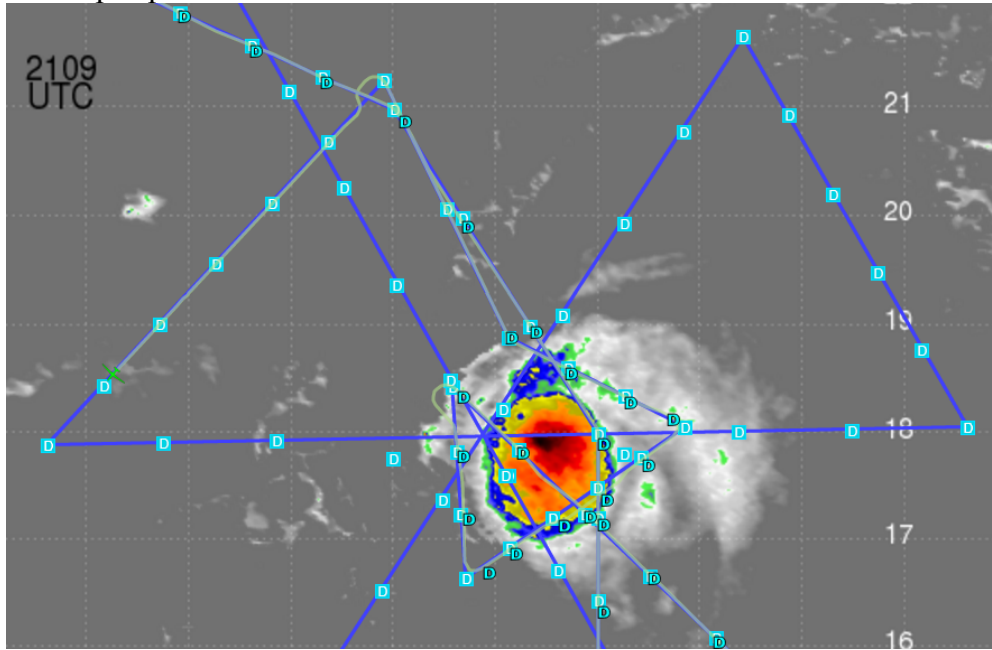


2127Z: RGB airmass product suggests dry mid-level air along transect to NW of storm, Drops 39-45. Image also 2045z.



Follow up to above post: Drops along this leg, show decent wedge of dry air above 400 hPa and also a slight reduction in RH down to around 800 hPa. Two small 2 K inversions at the base of the dry layer between 700 and 800 hPa.

2132Z: CTH (2109Z image) around storm center maintaining average heights around 53 kft with tops up to 57-58 kft.



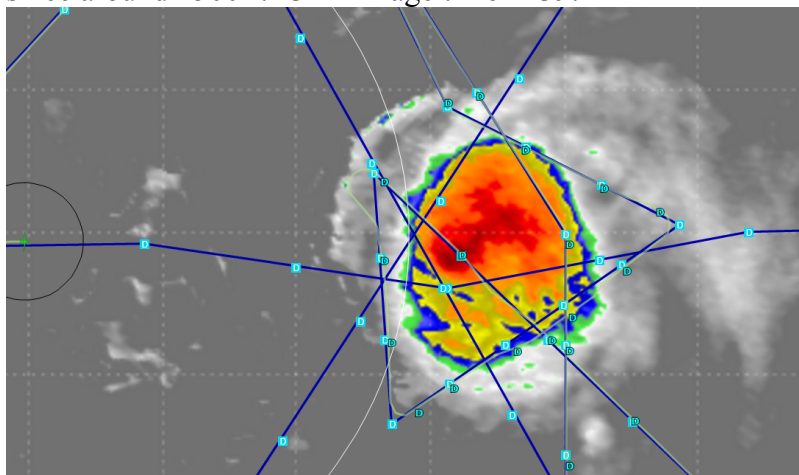
2124Z image shows slightly lower peaks in deepest region. Now north of expected track.

2134Z: Sonde 44 deployed at new location 45. Good drop.

2142Z: Sonde 45 deployed at new location 46. Good drop.

2151Z: Sonde 46 deployed at new location 47. Good drop.

2154Z: Intense convection over the past hour has subsided slightly. Peak CTH now around 54 kft, GH now flying at 59 kft. Not TOTs over center for a while now. No lightning near center since around 1500Z. CTH image time 2139.



NHC Discussion below mentions GH sondes. Lesson learned: Get mentioned in the discussion, get free pizza!

TROPICAL STORM GASTON DISCUSSION NUMBER 9
NWS NATIONAL HURRICANE CENTER MIAMI FL AL072016
500 PM AST WED AUG 24 2016

Gaston is being affected by southwesterly vertical shear associated with a strong mid- to upper-level trough and cut-off low seen in water vapor imagery near 26n 51w. The shear has caused the low-level center to become partially exposed while much of the deep convection has been shunted to eastern half of the circulation.

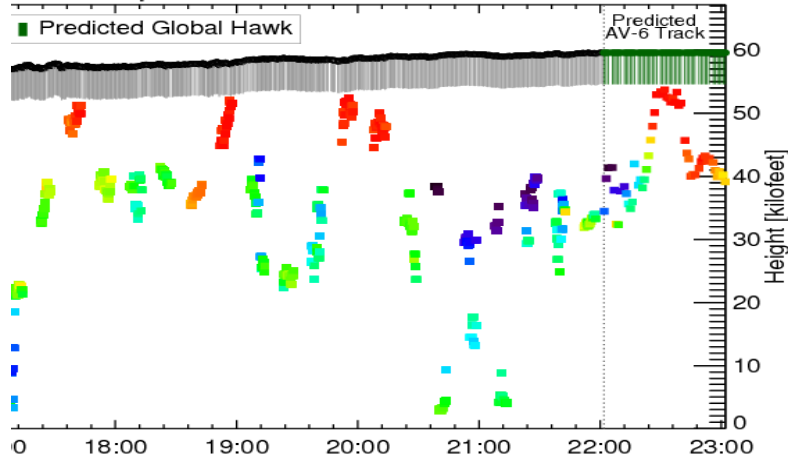
In spite of the degraded satellite presentation, dropsonde data from the unmanned NASA Global Hawk aircraft investigating Gaston support keeping the intensity at 60 kt. In fact, additional observations from the ongoing mission might reveal that the system is even a little stronger than this estimate.

Gaston is in for a prolonged period of strong southwesterly shear for the next 36 to 48 hours, with the shear possibly peaking around 30 kt during that time. The considerable shear is expected to induce weakening, and it is possible that more weakening could occur than indicated in the forecast despite the cyclone's moving over warmer waters. Once Gaston's interaction with the trough lessens in about 2 days, the cyclone should reach 29 deg C water when the shear diminishes. This should give Gaston an opportunity to re-intensify for at least a couple of days before the models indicate an increase in shear at the end of the forecast period. The intensity forecast is reduced relative to the previous one and is a little below the multi-model consensus through 48 hours, but then reverses and is above the consensus aids from 72-120 hours.

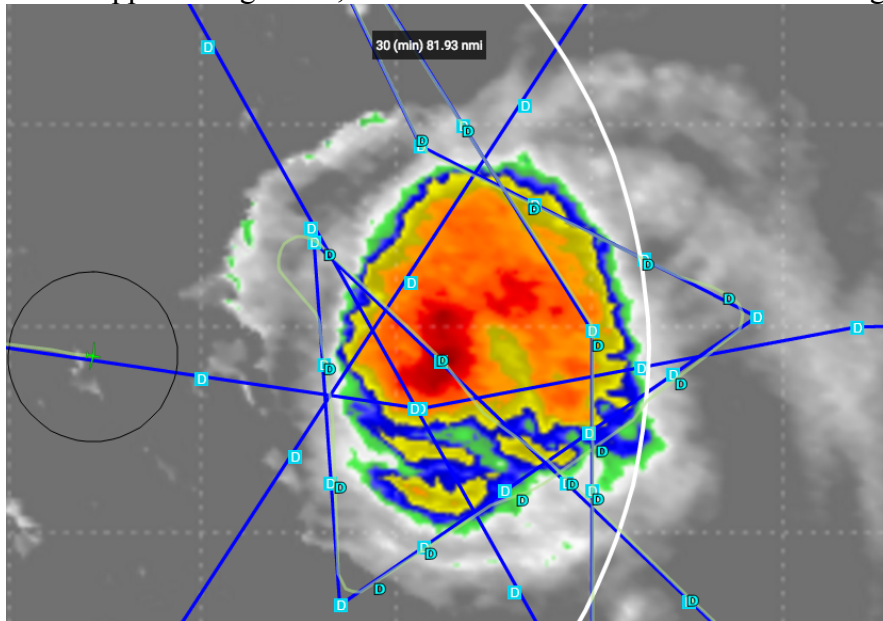
Gaston's heading is now definitively northwestward, and the initial motion estimate is 315/14. A continued northwestward motion is likely for the next few days as Gaston moves between one cell of the subtropical ridge centered over the eastern Atlantic and the cut-off low to the northwest. After 72 hours, Gaston should approach a more significant weakness in the Atlantic subtropical ridge around 60w and slow while turning north-northwestward to northward. There are substantial model differences again this cycle, with the ECMWF indicating a weaker subtropical ridge. The weaker ridge makes Gaston more vulnerable to the mid-latitude westerly flow over the North Atlantic, which results in an earlier recurvature. However, the bulk of the guidance has a stronger ridge, and thus have solutions that go much farther west. No major changes have been made to the previous forecast in the short term but the track has been adjusted much farther to the left after 72 hours, in the direction of but not as far left as the multi-model consensus.
2203Z: Sonde 47 deployed at new location 48. Good drop.

2206Z: Cloud tops are currently below our 5kft clearance with no TOTs or lightning near by. GH track over current tops keeps us sufficiently clear.

Last updated at 2202 UTC on 20160824



2207Z approaching storm, CTH below thresholds. 2154Z CTH image:

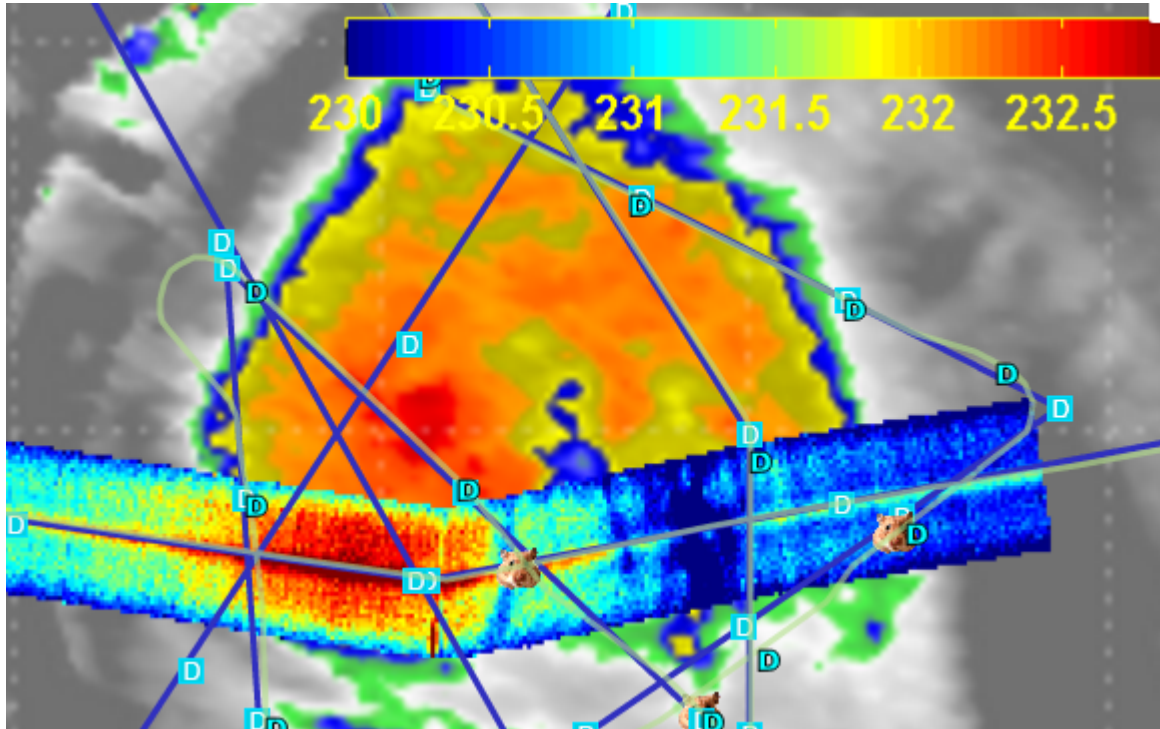


2215Z: Sonde 48 deployed at new location 49. Good drop.

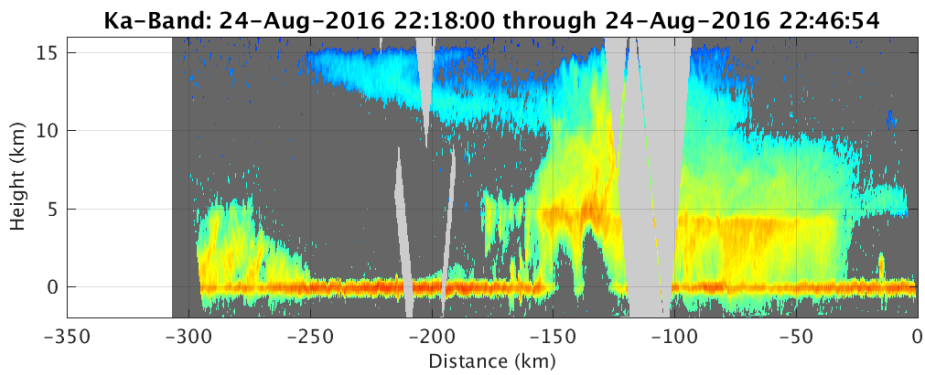
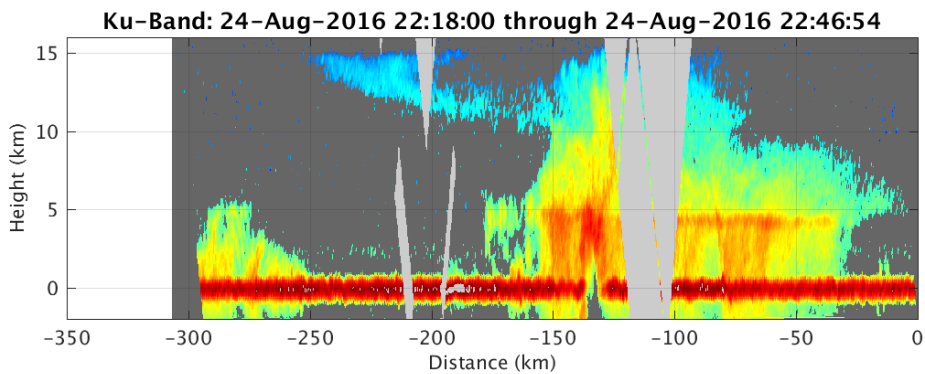
2227Z: Sonde 49 deployed at new location 50. Good drop.

2239Z: Sonde 50 deployed at new location 51. Good drop.

2241Z: W-E transect over system observed 2-3 deg warm anomaly at 250mb (stbrown1-chat)

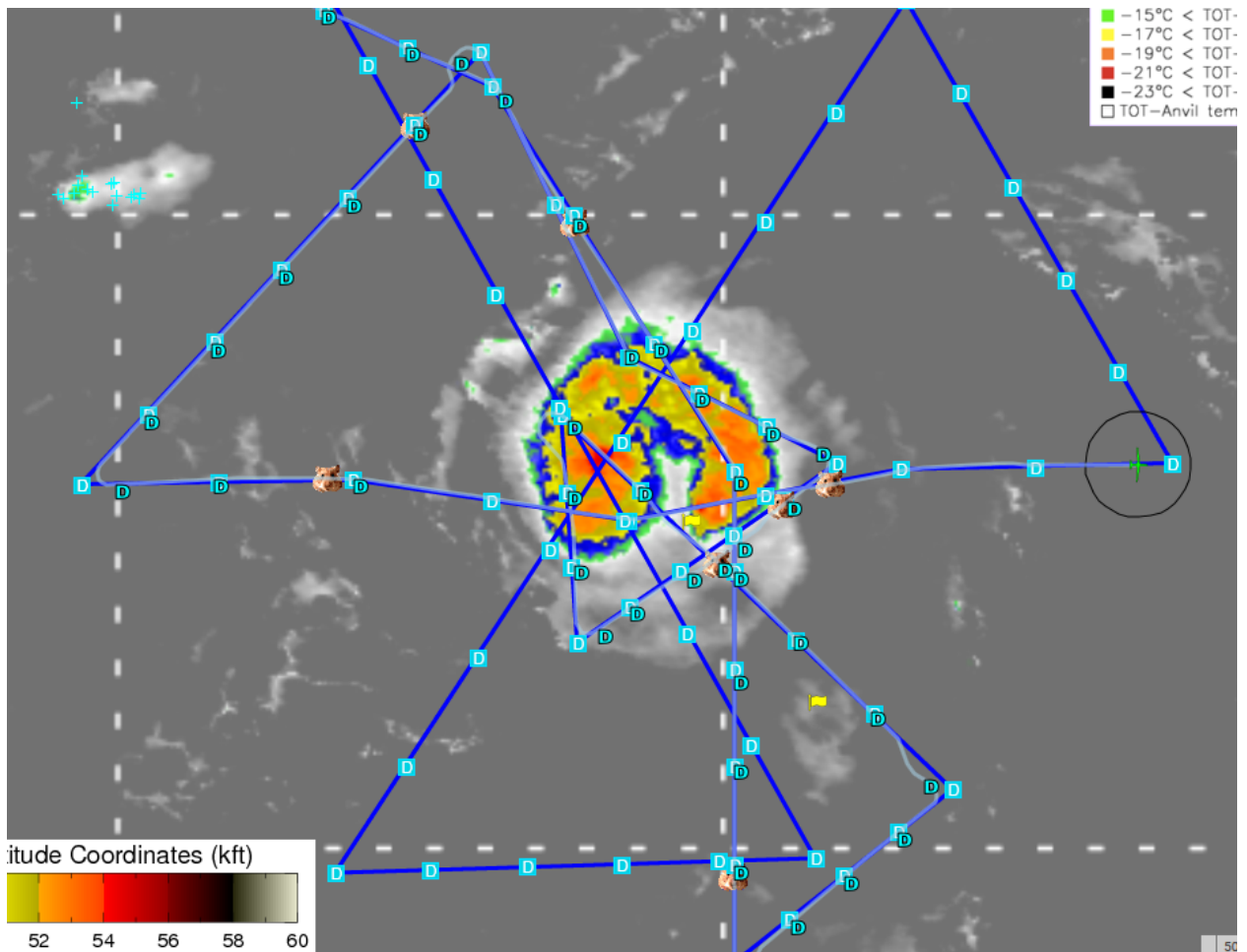


2249Z: HiWrap vertical-time plot from W-E Transect.



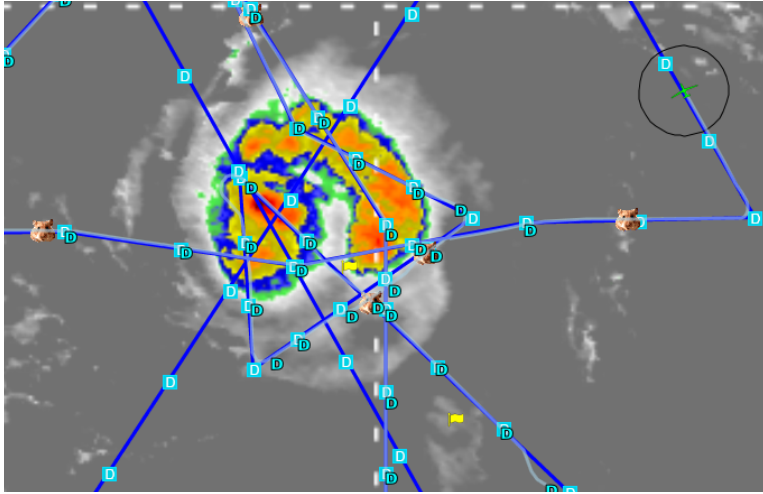
HIWRAP shows cloud tops around 15km (49 kft) though missing the likely highest section
 CIMSS CTH product suggests 52-54 kft

2251Z: Sonde 51 deployed at new location 52. Good drop.
2303Z: Sonde 52 deployed at new location 53. Good drop.

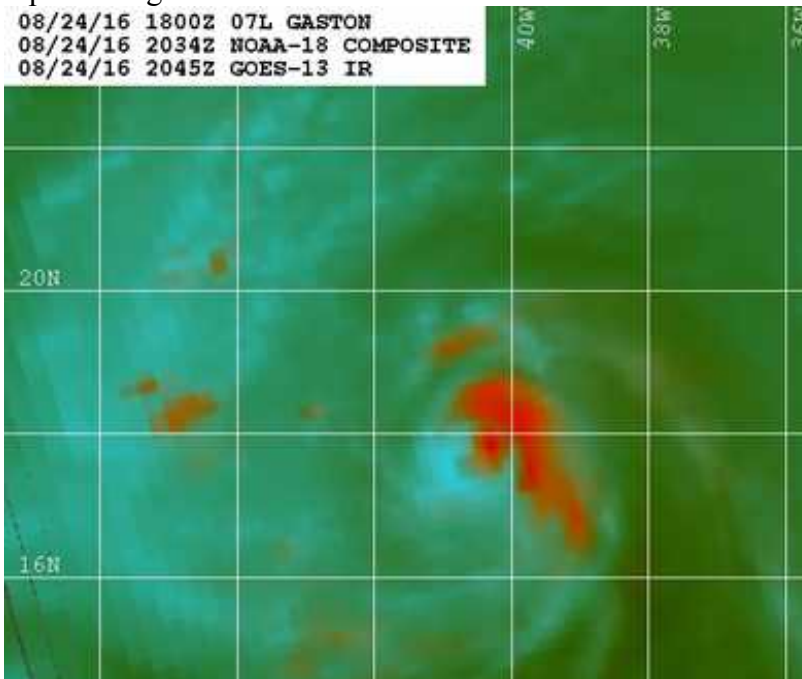


2245Z CTH image. Nearly completed first crossing of storm in large butterfly.
CTHs suggest that there is still persistent convection NE of the center as well as perhaps an outer band forming farther NE.

2316Z: Sonde 53 deployed at new location 54. Good drop.
2323Z: Sonde 54 deployed at new location 55. Good drop.

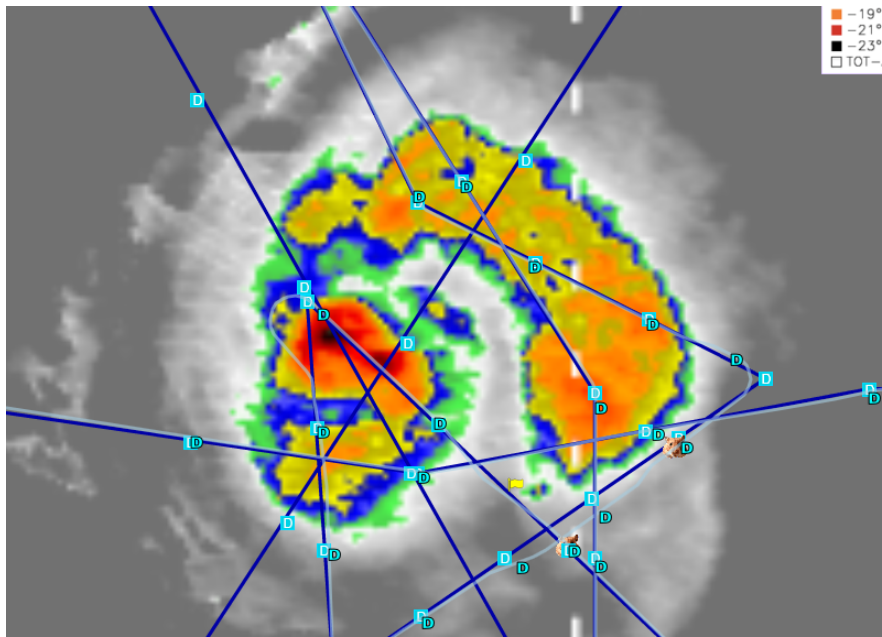


CTH image at 2300 UTC. Suspect that center is SW of deep convection. Another round of deep tops has begun.



AMSU image shows heavy precip in red and cyan ring, suggesting a center SW of the deep convection.

2331Z: Sonde 55 deployed at new location 56. Good drop.



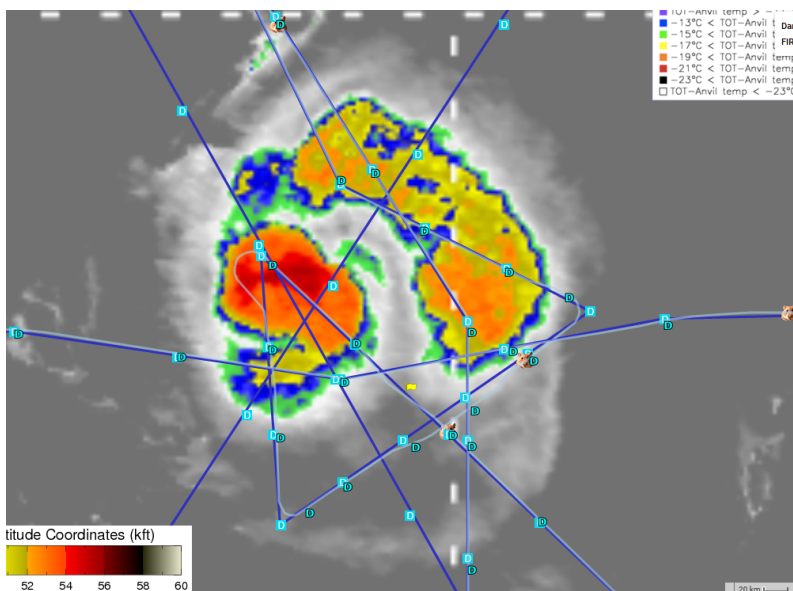
CTH image at 2315Z.

2339Z: Sonde 56 deployed at new location 57. Good drop.

2348Z: Sonde 57 deployed at new location 58. Good drop.

2355Z: Discussion on chat about impact of drops on HWRF forecast. 12z to 18z initialization has seen a 20 hPa increase in central pressure at the 108/102 fhr . New run including GH drops keeps storm notably weaker and also further SW of previous track.

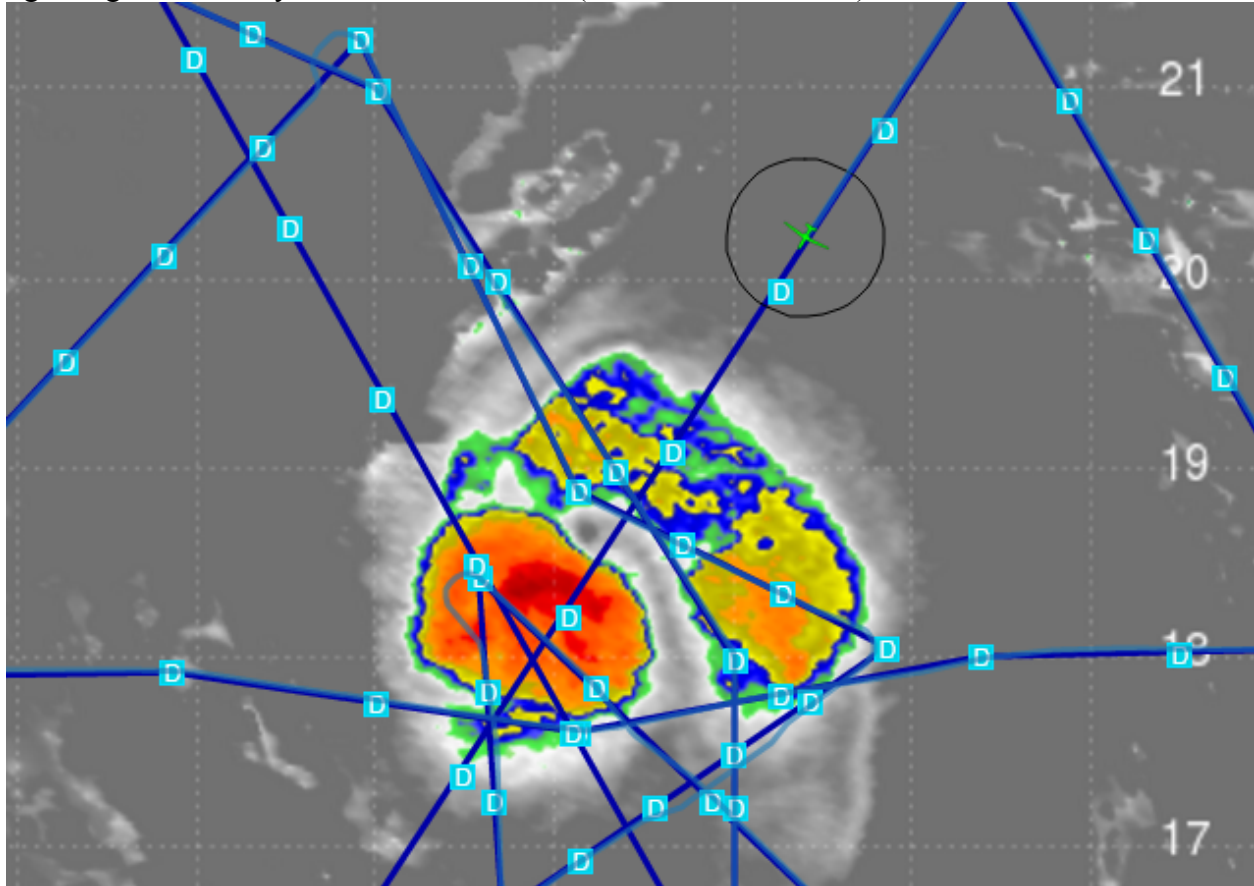
2357Z: Sonde 58 deployed at new location 59. Good drop.



2330 UTC CTH image. Tops in deepest cell dropping a bit. Planning to keep next flight leg from NE to SW as is. Should cross storm on east side of deep convection.

Predicted track over center keeps GH with more than 5 kft vertical clearance.

2211Z: Latest CTH image shows a consistent structure. Broad circular area around center of storm with tops around 54 kft. Relatively uniform without any evidence of TOTs and still no lightning detected anywhere near the storm. (2354 CTH data time)



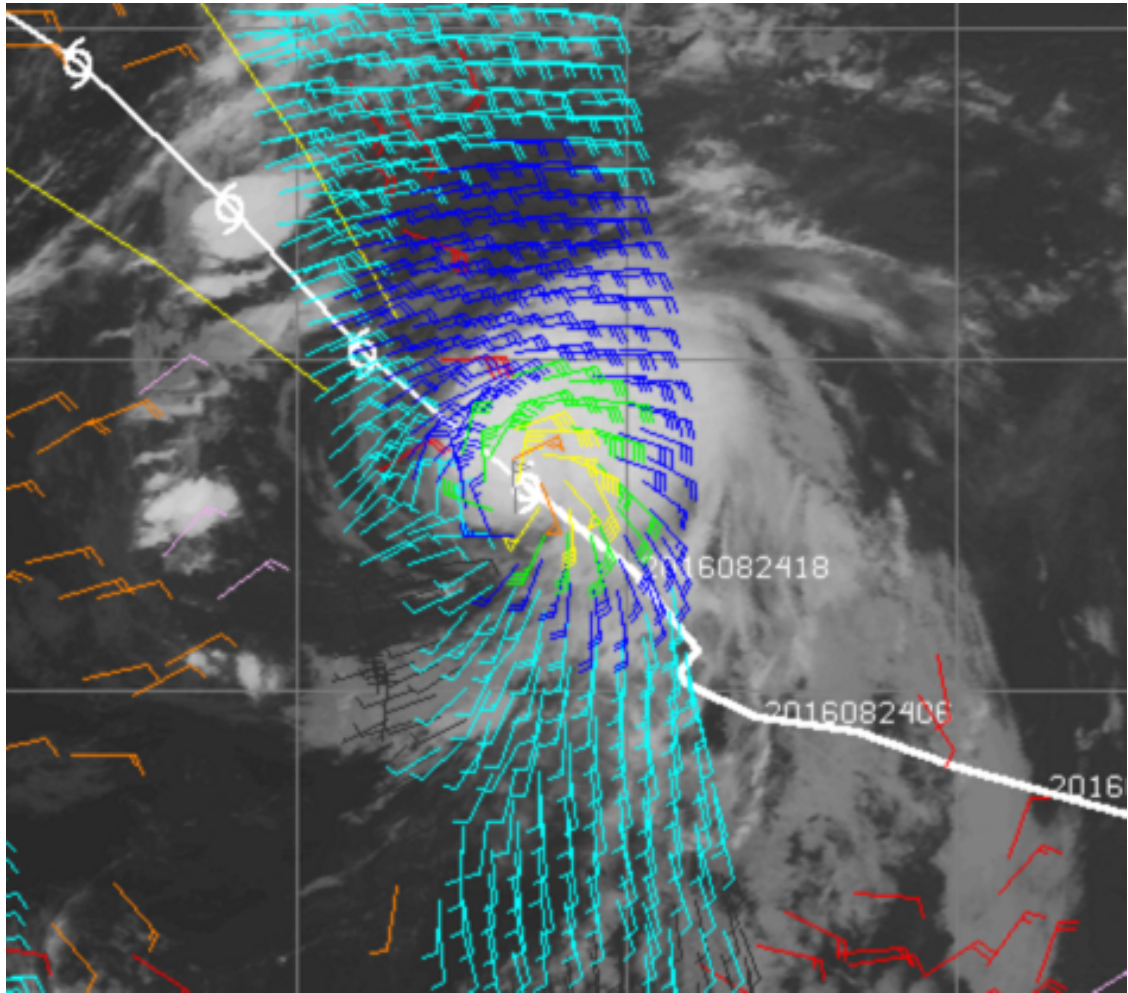
0005Z: Sonde 59 deployed at new location 60. Good drop.

0017Z: Sonde 60 deployed at new location 61. Good drop. Winds had to be removed in QC.

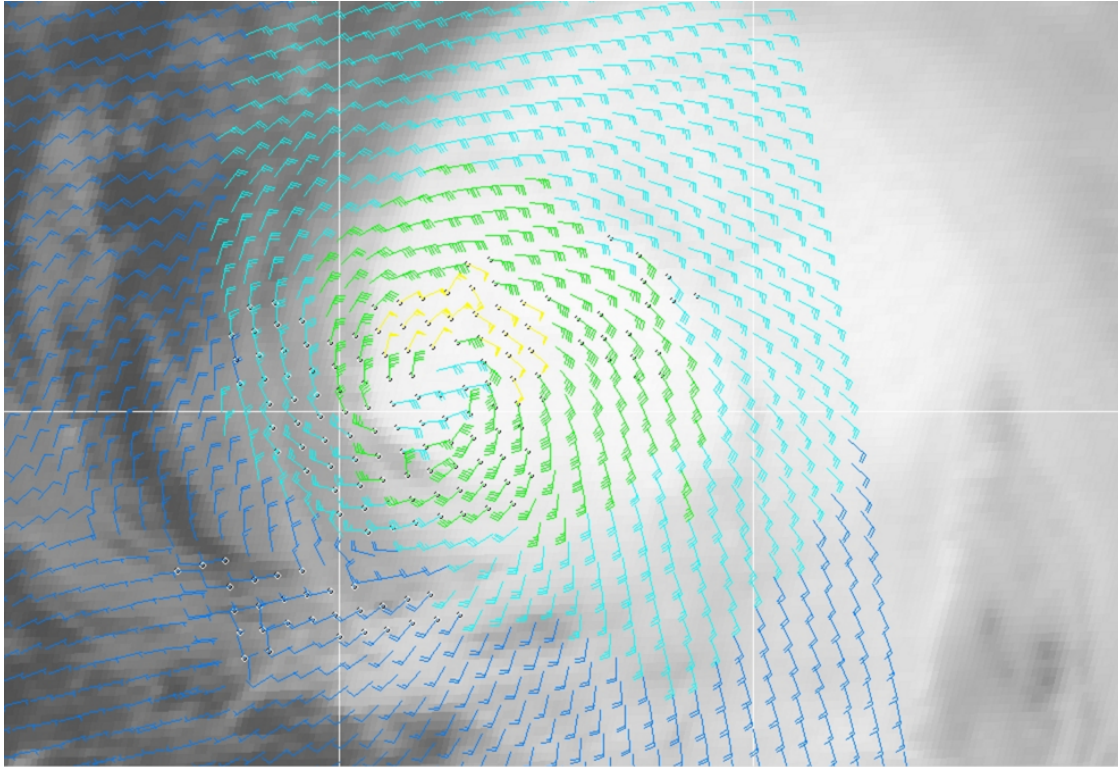
0026Z: Sonde 61 deployed at new location 62. Good drop.

0037Z: Sonde 62 deployed at new location 63. Good drop.

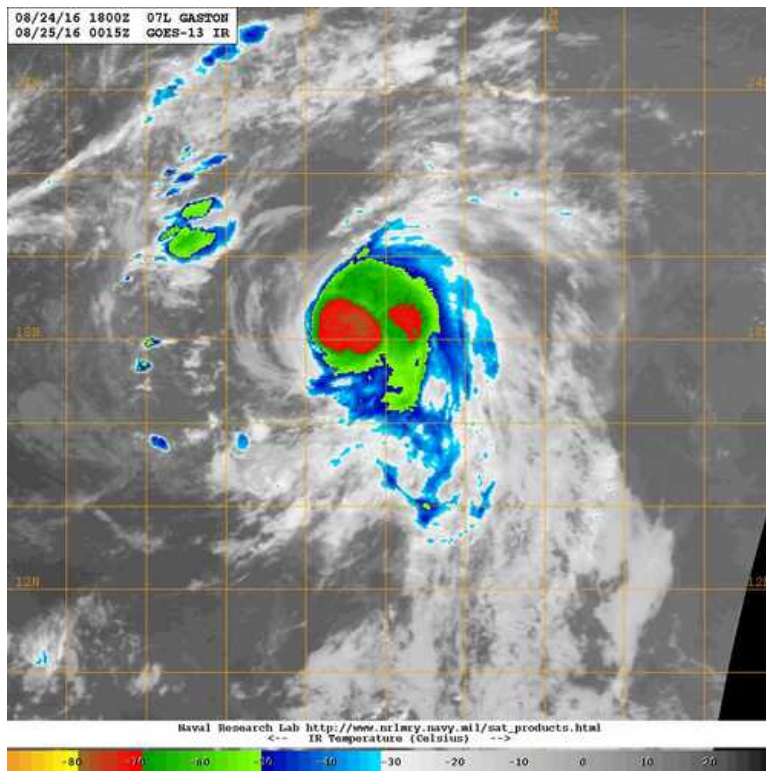
0041Z: IR satellite image around time of overpass for NE-SW transect. Storm still feeling vertical shear with most of the convection to the east of the center. Satellite time (0015z).



ASCAT pass, 25 Aug 0030 GMT CIMSS

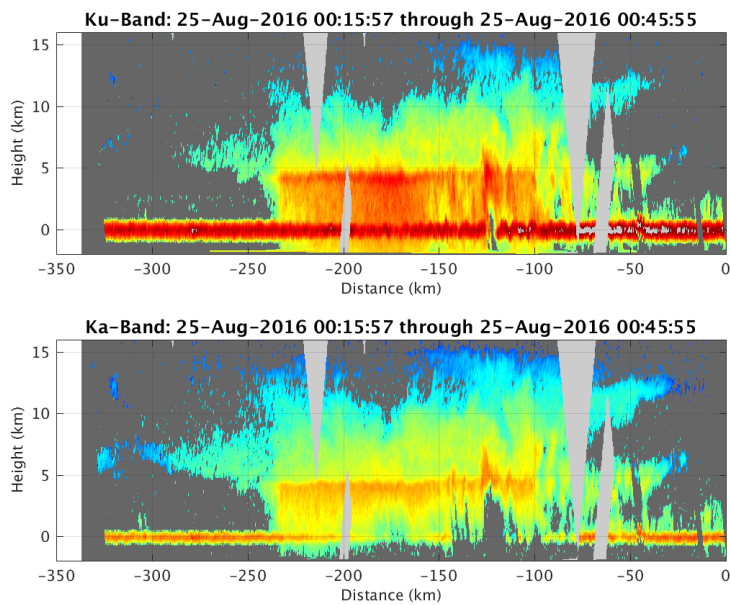


ASCAT pass, 25 Aug 0030 GMT NRL



0047Z: Sonde 63 deployed at new location 64. Good drop.

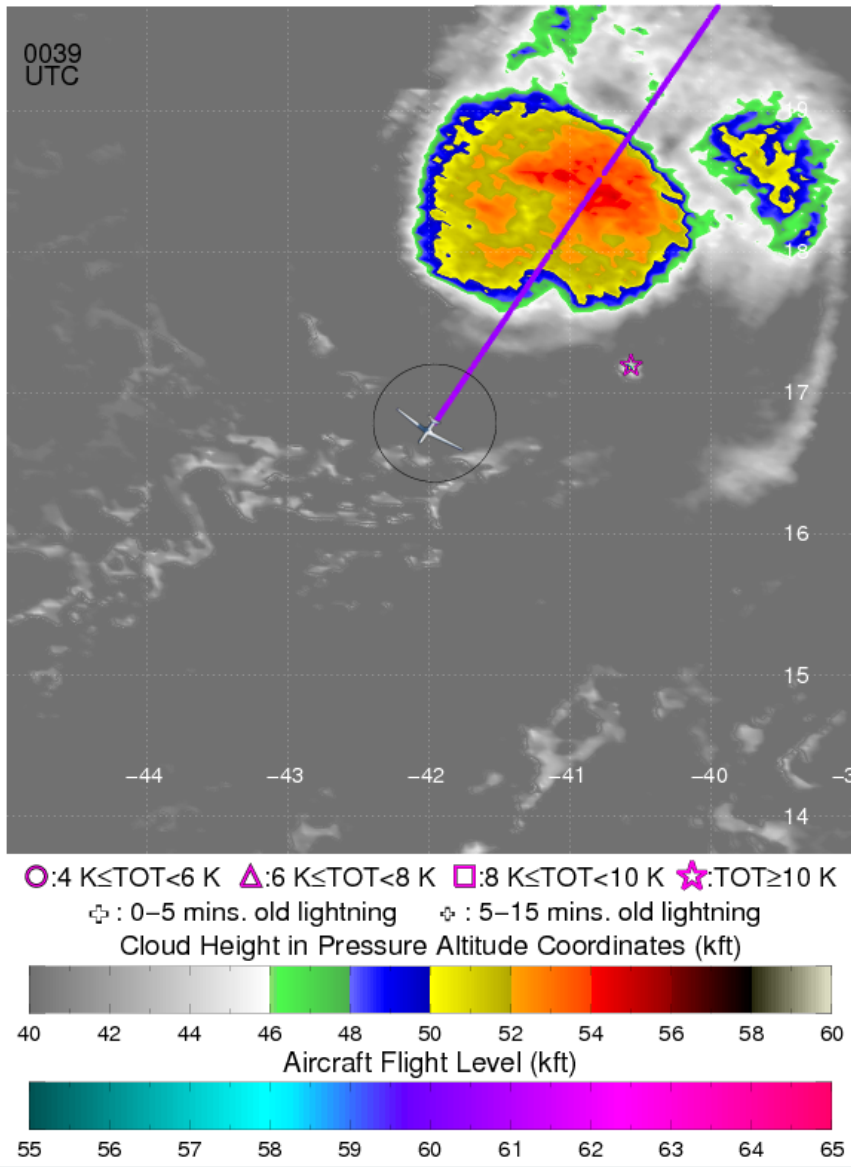
0048Z: Leaving storm for this transect. HIWRAP showing CTH at around 15 km. Still a



potential 3-4 kft disagreement between CIMSS CTH and HIWRAP. CIMSS seems to be on the highside so far.

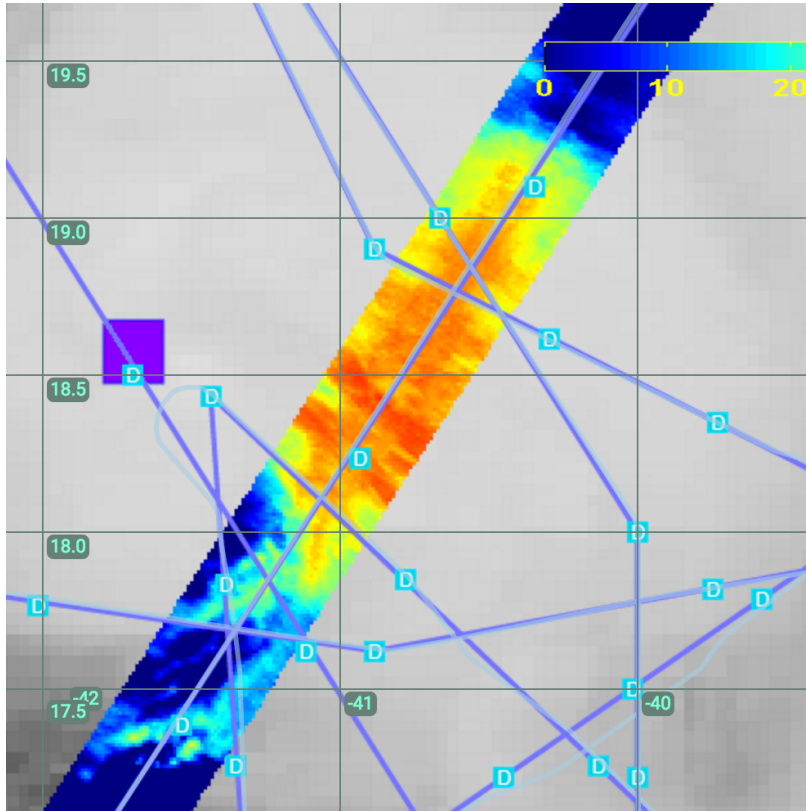
0054Z: CTH and TOTs right after 5th center pass. GH passed directly over deepest convection, with drop 62 (003716) in 54 kft cloud tops.

Lightning and AV-6 on 20160825 at 0054 UTC
 ACHA CTH & TOTs at time listed

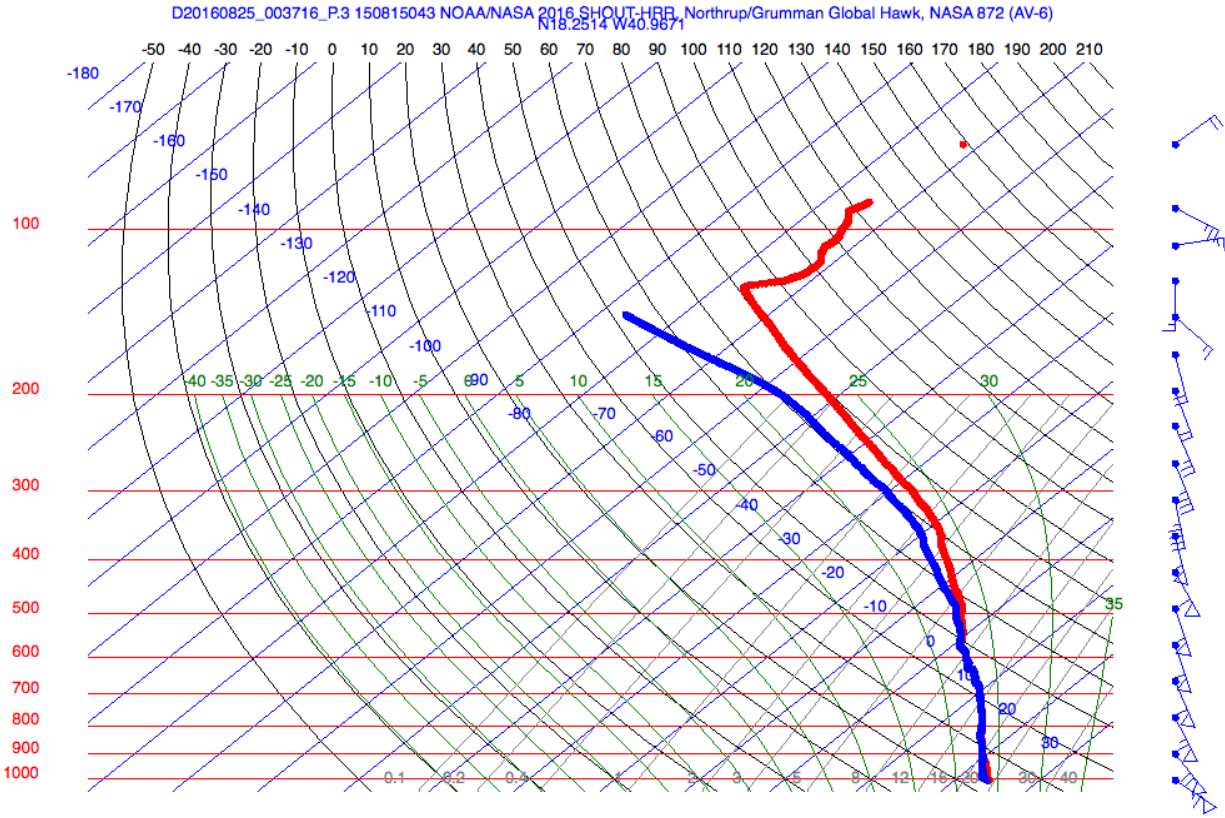


Per HAMSRS, center was at 18.09N, 41.44W

Figure showing 6-km reflectivity from HAMSRS scan:



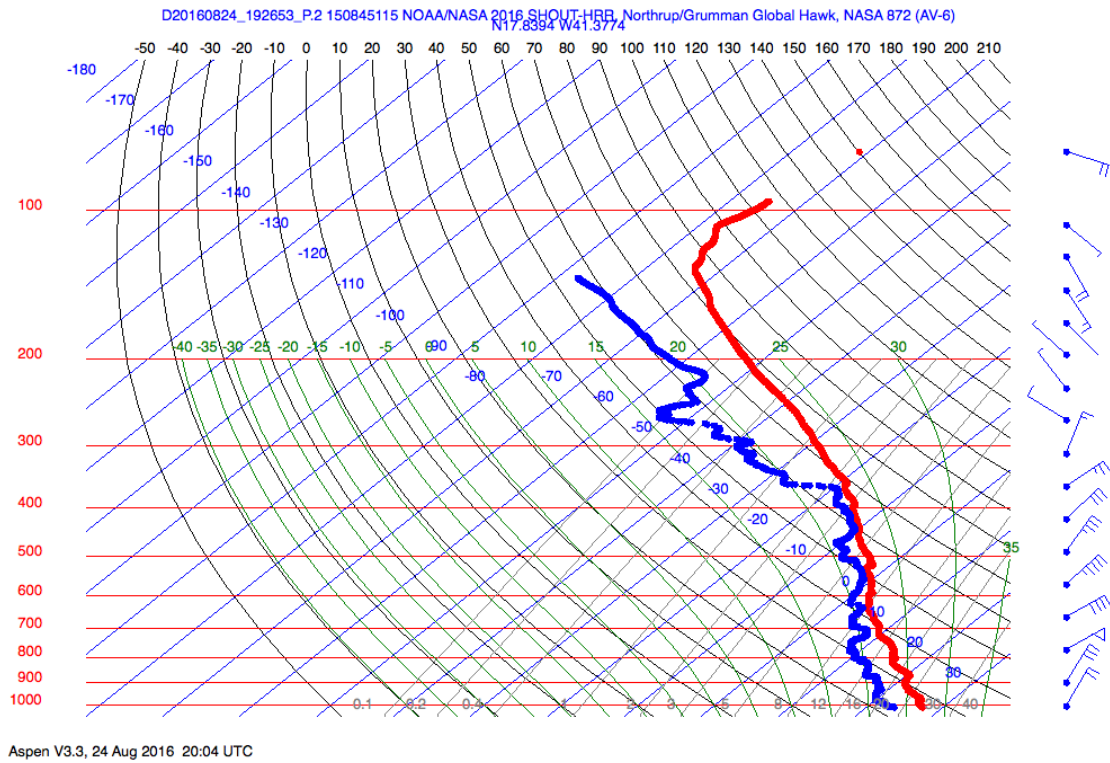
Drop #63 shows 60-kt near-surface winds and moist conditions up to 450 mb.



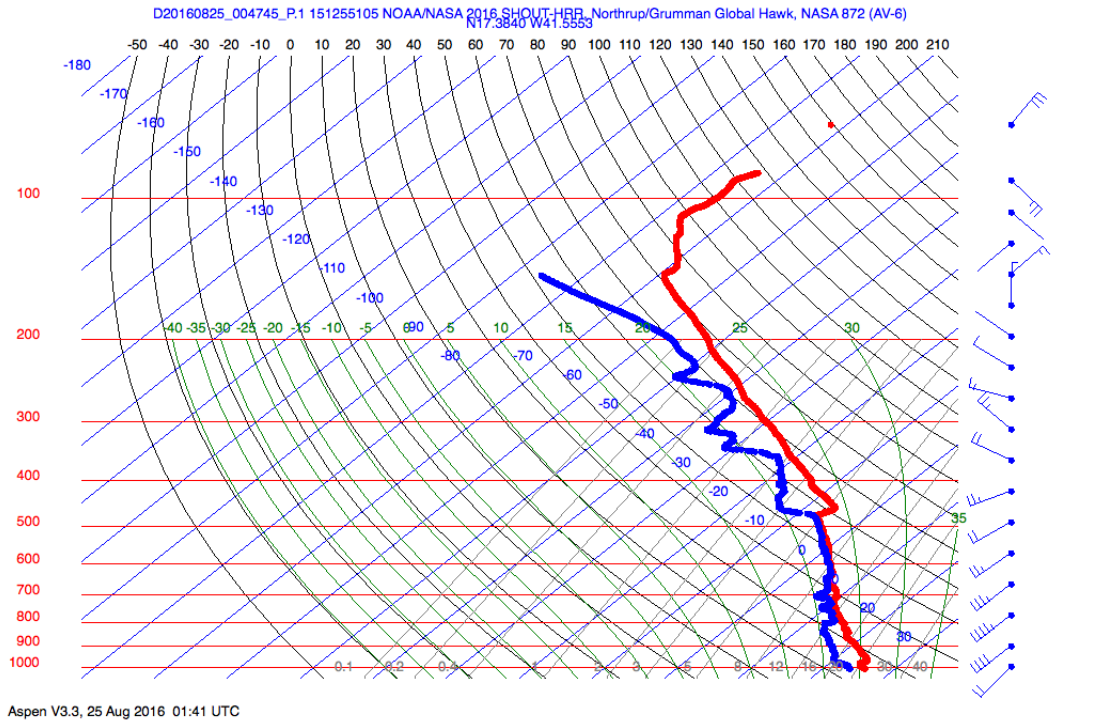
0058Z: Sonde 64 deployed at new location 65. Good drop.
 0108Z: Sonde 65 deployed at new location 66. Good drop.
 0120Z: Sonde 66 deployed at new location 67. Good drop.

Drops #64 and #65 were released just SW of the most active convection. Drop #64 shows northeasterly winds and drop #65 shows southwesterly winds. Both sondes show dry air between 1000 and 700 mb. Suggests low-level center was between both drops, and SW of the convection.

Corresponding image to drop #64:



Corresponding image to drop #65



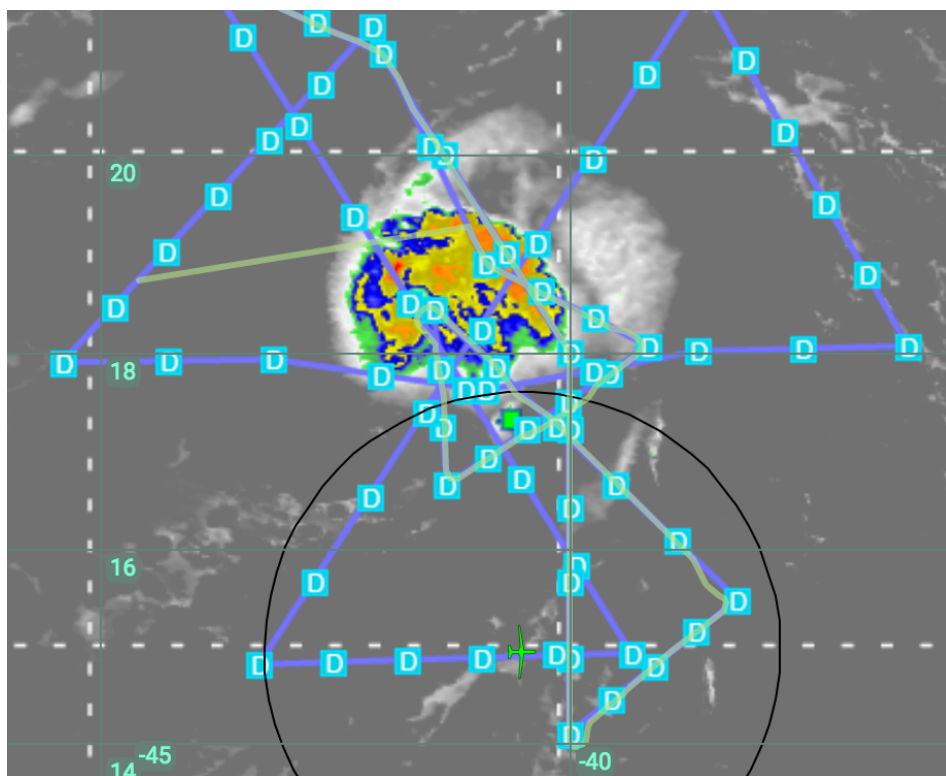
0122Z: Flight track update #8. Adjusted the last butterfly leg (drops 72 to 80) to get a closer center pass. Adjusted drop 80 about 10 km to west of original position, keeping drop 72 at the originally planned location.

0126Z: Sonde 67 deployed at new location 68. Good drop.

0134Z: Sonde 68 deployed at new location 69. Good drop.

0143Z: Sonde 69 deployed at new location 70. Good drop.

0150Z: Some TOTs have showed up close to projected path, but seems to be transient. Cloud top heights < 50 kft.



0152Z: Sonde 70 deployed at new location 71. Good drop.

0201Z: Sonde 71 deployed at new location 72. Good drop.

0210Z: Sonde 72 deployed at new location 73. Good drop.

0221Z: Sonde 73 deployed at new location 74. Good drop.

0232Z: Sonde 74 deployed at new location 75. Good drop.

0235Z: NHC's 11 PM discussion (Advisory #10) mentions the value of dropsondes from Global Hawk in keeping the intensity at 60 kt:

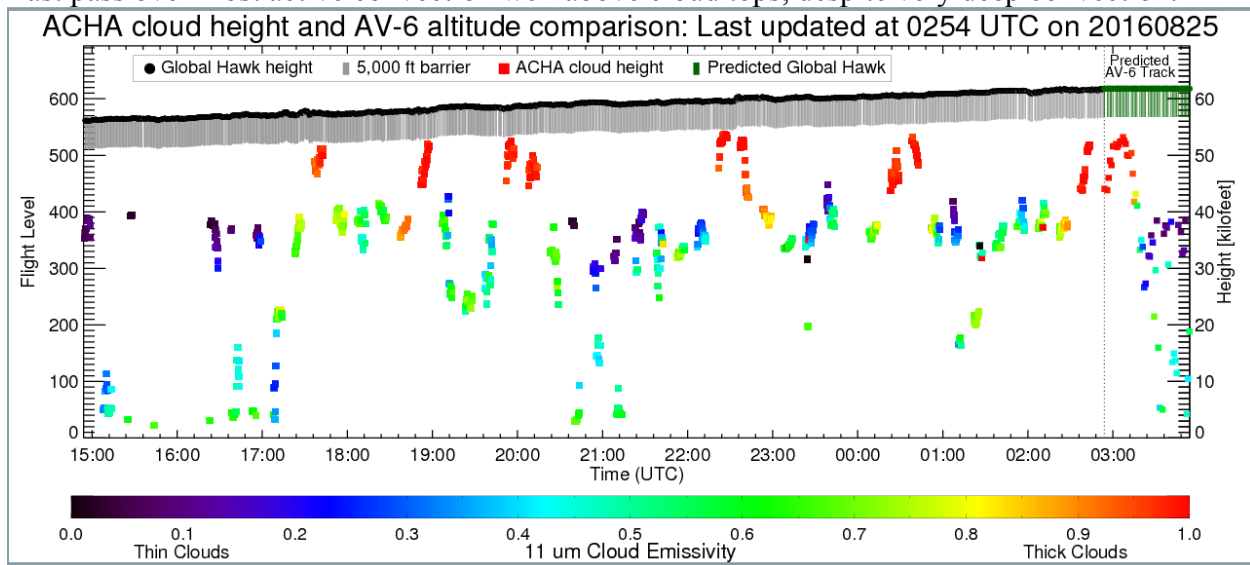
TROPICAL STORM GASTON DISCUSSION NUMBER 10
NWS NATIONAL HURRICANE CENTER MIAMI FL AL072016
1100 PM AST WED AUG 24 2016

Satellite intensity estimates from all agencies, recent ASCAT measurements, **and numerous dropsondes from the unmanned NASA Global Hawk aircraft indicate that the initial intensity of Gaston remains at 60 kt.** Strong upper-level westerlies blowing around the base of an upper low to the northwest of Gaston are already affecting the symmetry of the cyclone, and the low-level center is on the western edge of the convection. This strong westerly shear is expected to last for about 36 hours, resulting in some weakening. Most of the global models move the upper low toward the southwest, and in about 2 days, Gaston will again be in a favorable environment for intensification. On this basin, the NHC forecast weakens the cyclone during the next 24 to 36 hours, and then calls for Gaston to intensify and reach hurricane strength over the warm waters of the central Atlantic. The forecast follows closely the SHIPS model and the intensity consensus.

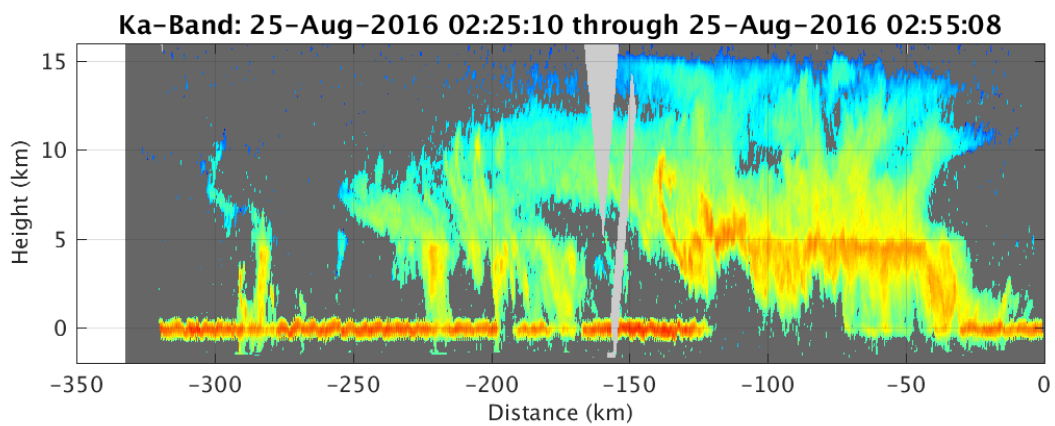
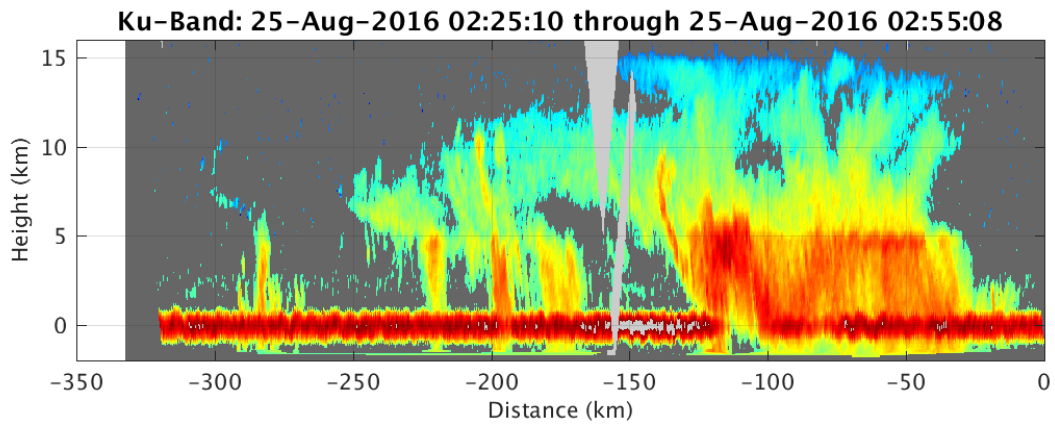
Gaston is moving toward the northwest or 310 degrees at 15 kt steered by the flow between the subtropical high and the same low that is causing the shear. As the low moves southwestward and the ridge to the north of the cyclone amplifies, Gaston should turn a little more toward the west-northwest with a decrease in forward speed. The NHC forecast is the middle of the guidance envelope and is basically on top of the latest multi-model consensus. No significant changes were made to the previous track forecast.

0243Z: Sonde 75 deployed at new location 76. Good drop.

Last pass over most active convection well above cloud tops, despite very deep convection:



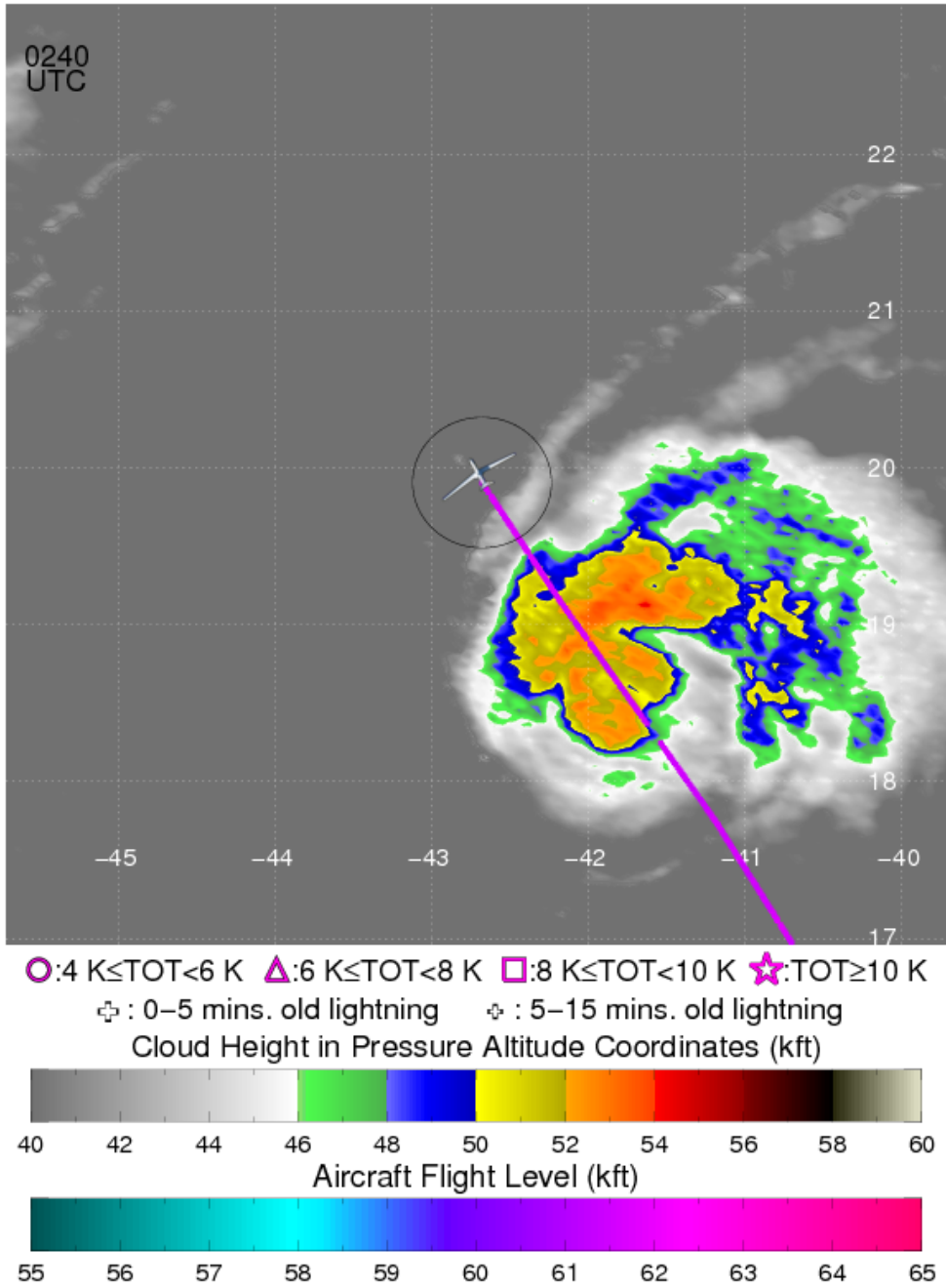
Corresponding HIWRAP scan shows very deep convection with nice anvil structure



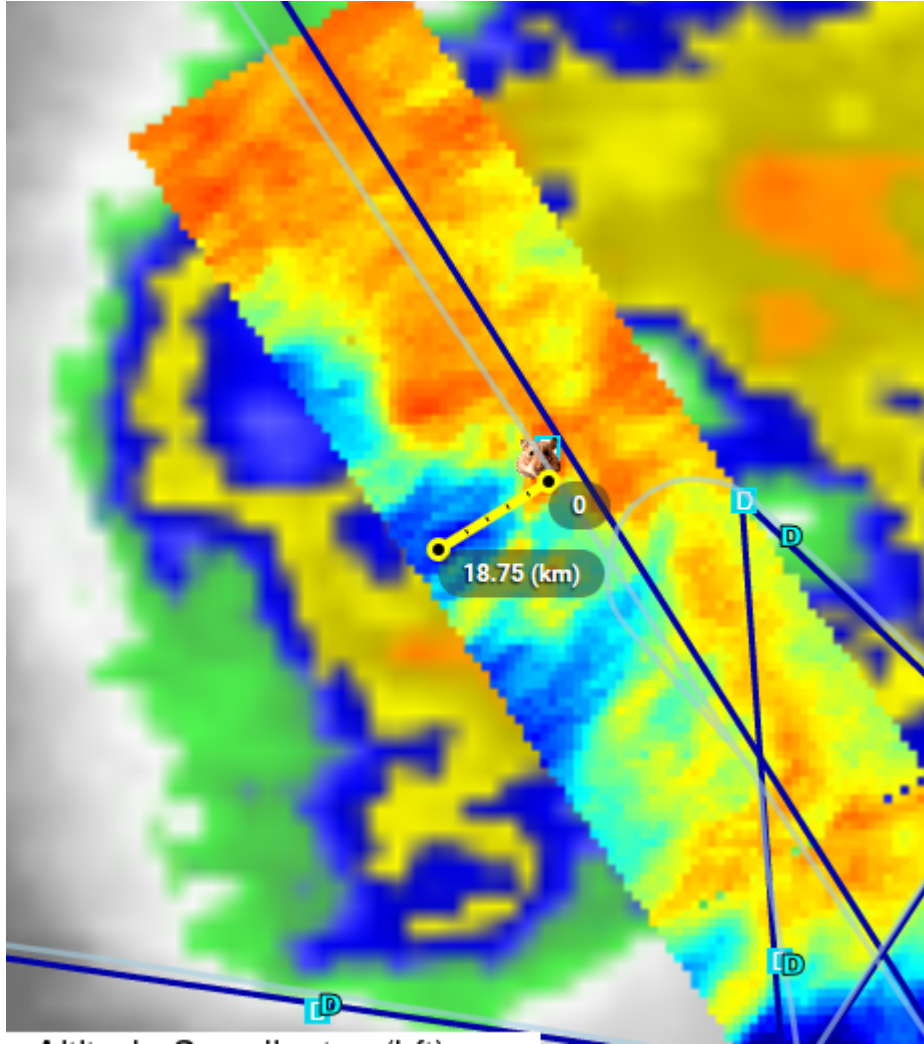
0254Z: Sonde 76 deployed at new location 77. Good drop.

0054Z: CTH and TOTs following 6th and final center pass. GH again passed directly over deepest convection. Cloud tops suggested we were very close to center but HAMSRS suggests that center was 15-20 km further west.

Lightning and AV-6 on 20160825 at 0300 UTC ACHA CTH & TOTs at time listed

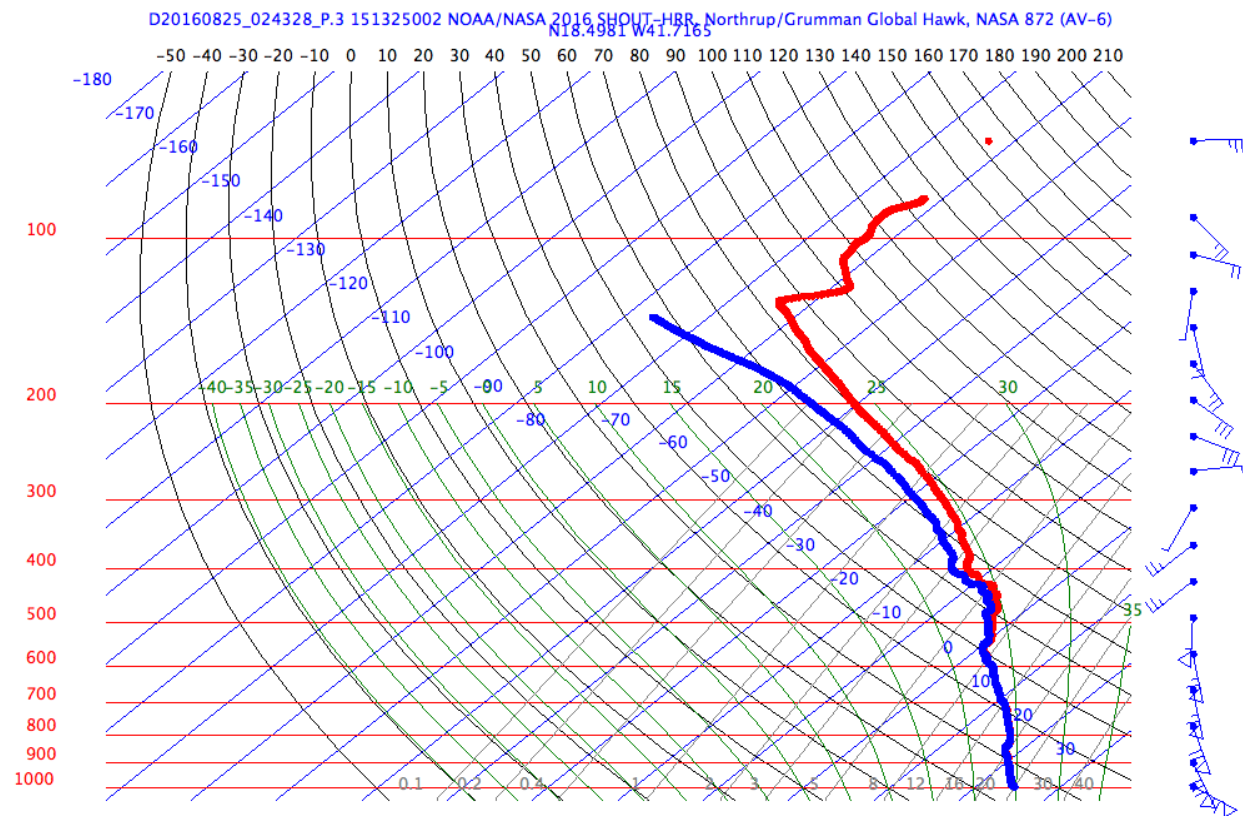


HAMSR center at ~0245Z, approximately 18.37N, 41.85W based upon reflectivity at 6km:



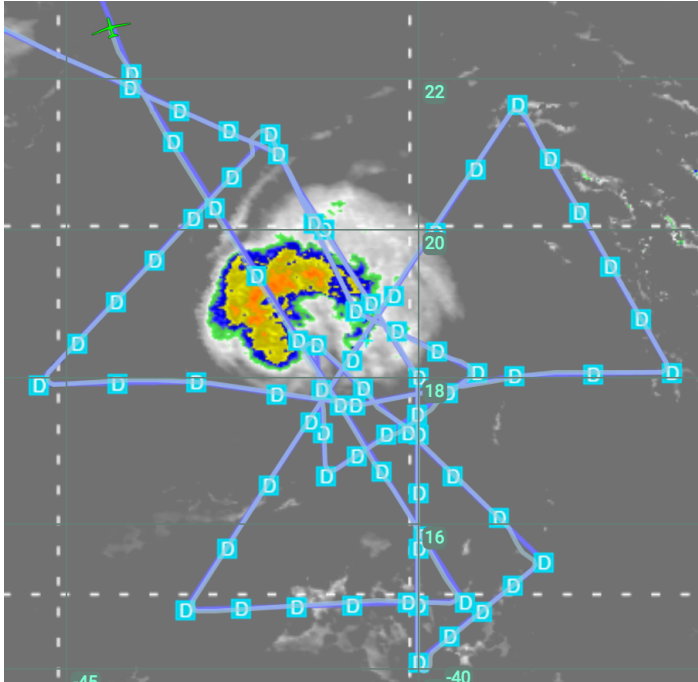
HAMSRS warm anomaly puts center at 18.66N, 41.85W.

Drop 75 at 024328 reveals nearly saturated profile through 450mb, with 65 kts at the surface and 80 kts at 900 mb:



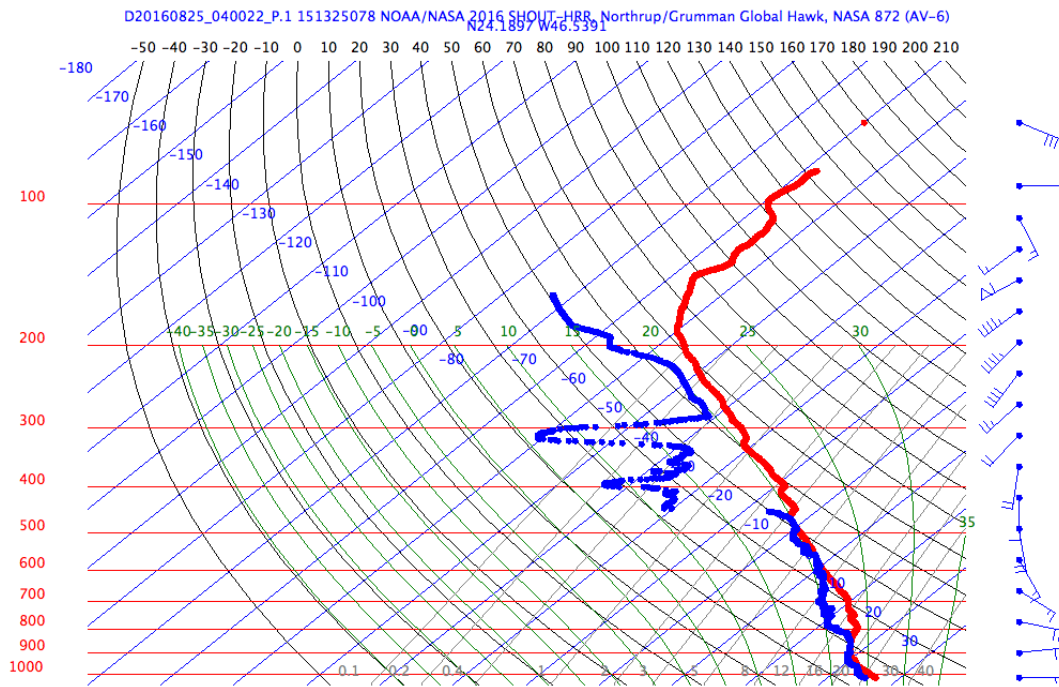
0305Z: Sonde 77 deployed at new location 78. Good drop.
 0316Z: Sonde 78 deployed at new location 79. Good drop.
 0326Z: Sonde 79 deployed at new location 80. Good drop.

0330Z: We just completed the last leg of the last butterfly. Cloud top pattern suggests convection is wrapping around the cyclone as we begin the transit back to Wallops.



0341Z: Sonde 80 deployed at new location 81. Good drop.
 0400Z: Sonde 81 deployed at new location 82. Good drop.

Sonde #81 shows 60-kt southwesterly winds just above 200 mb.



Aspen V3.3, 25 Aug 2016 05:05 UTC

0415Z: Gaston becomes the third hurricane of the Atlantic hurricane season. Intensity upgrade was based on dropsonde data from this mission!

HURRICANE GASTON TROPICAL CYCLONE UPDATE
NWS NATIONAL HURRICANE CENTER MIAMI FL AL072016
1215 AM AST THU AUG 25 2016

...GASTON BECOMES THE THIRD HURRICANE OF THE ATLANTIC SEASON...

Dropsonde data from a NASA/NOAA Global Hawk mission indicate that Gaston has strengthened to a hurricane. The maximum winds are estimated to be 75 mph (120 km/h) with higher gusts.

SUMMARY OF 1215 AM AST...0415 UTC...INFORMATION

LOCATION...18.7N 42.2W
ABOUT 1215 MI...1955 KM W OF THE CABO VERDE ISLANDS
MAXIMUM SUSTAINED WINDS...75 MPH...120 KM/H
PRESENT MOVEMENT...NW OR 310 DEGREES AT 17 MPH...28 KM/H
MINIMUM CENTRAL PRESSURE...988 MB...29.47 INCHES

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Forecaster Berg

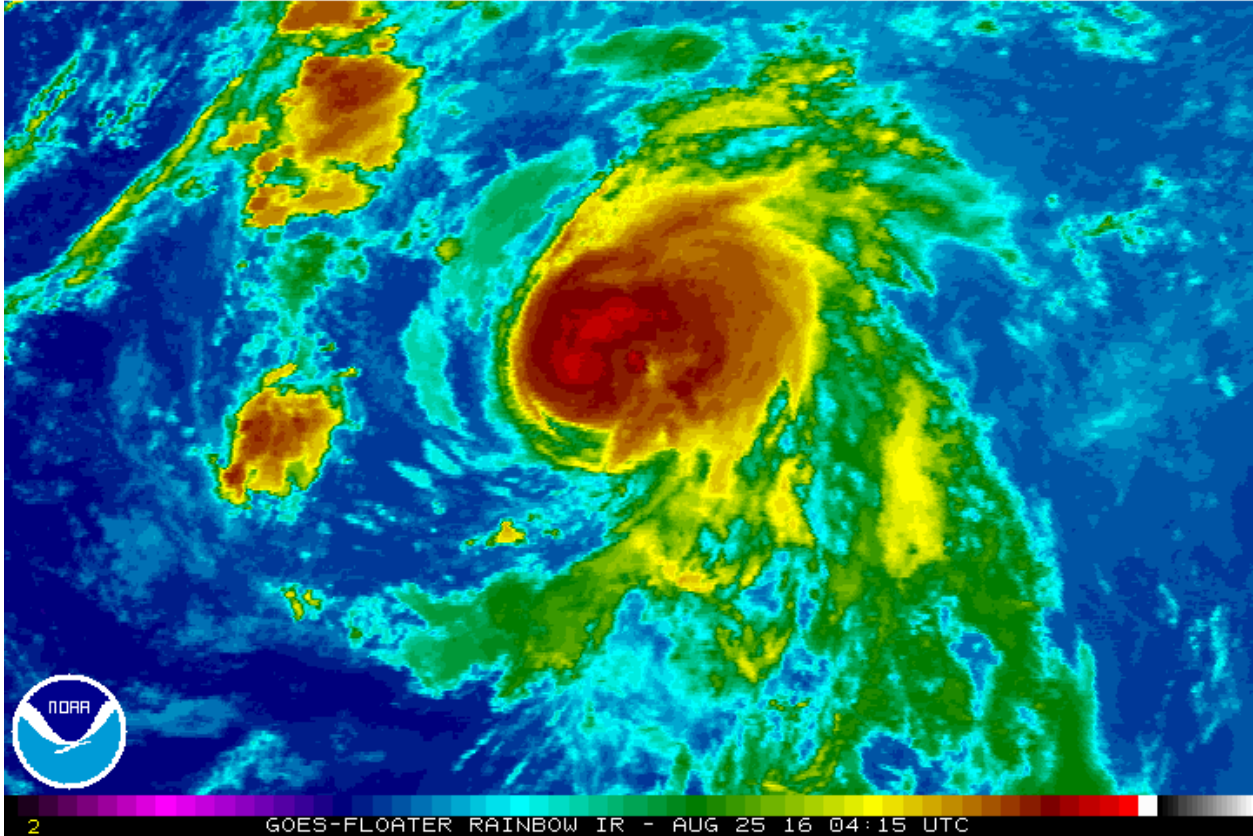
Added comments from Steve Feuer via e-mail:

Hi all,

I left NHC last night a couple of minutes after this dropsonde was apparently launched. I had been monitoring all the transmitted temp drop code messages from the GH during the afternoon and evening while at work. I was printing out significant messages and skew-T plots and creating synoptic map plots for the hurricane specialists as well. This included everything up until the last leg over Gaston. I let the hurricane specialists on duty know about that final penetration, and fortunately they were able to see the profile of this inner-core drop to upgrade Gaston to a hurricane, as I just verified on the phone with Jack Beven a half hour ago. The key elements for the upgrade was an MBL wind of 80 kt, which NHC reduces to an estimated surface wind of 64 kt (80%), and a WL150 wind of 77 kt, which reduces down to about 68 kt (the surface wind is not considered).

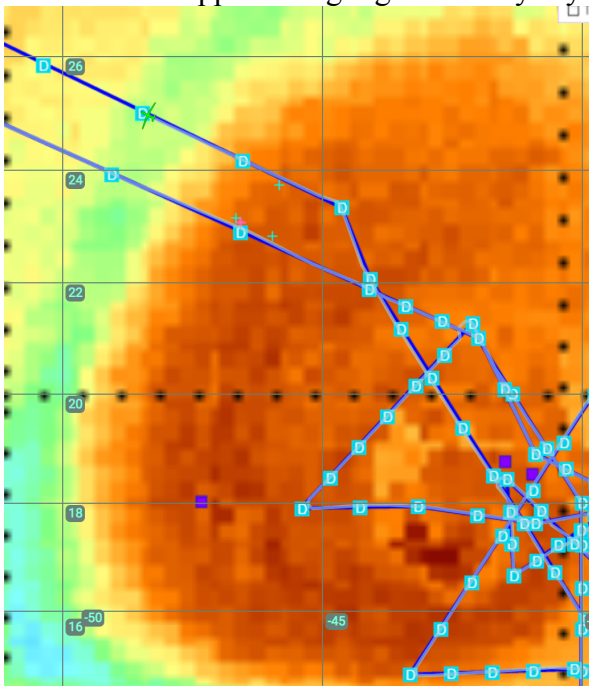
Steve Feuer
CARCAH/53 WRS
National Hurricane Center
[305-229-4474](tel:305-229-4474)

GOES IR image at the time Gaston was upgraded to hurricane:

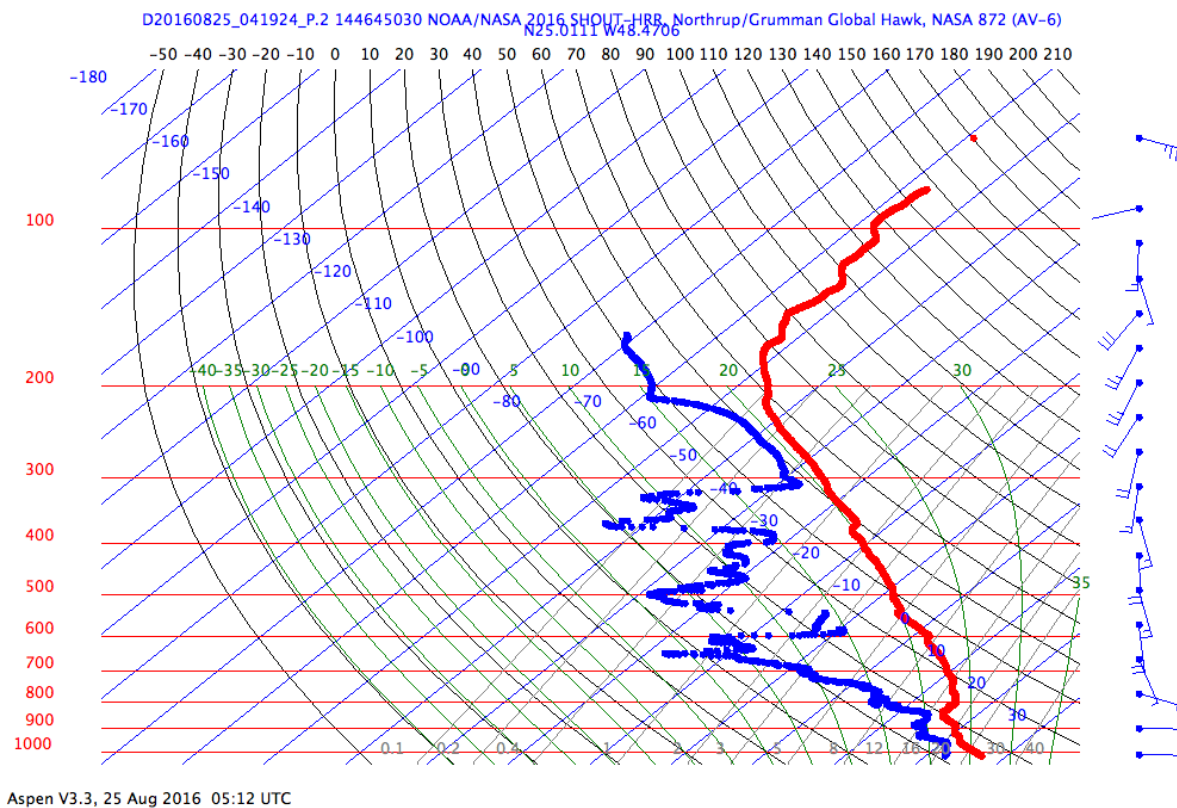


0419Z: Sonde 82 deployed at new location 83. Good drop.

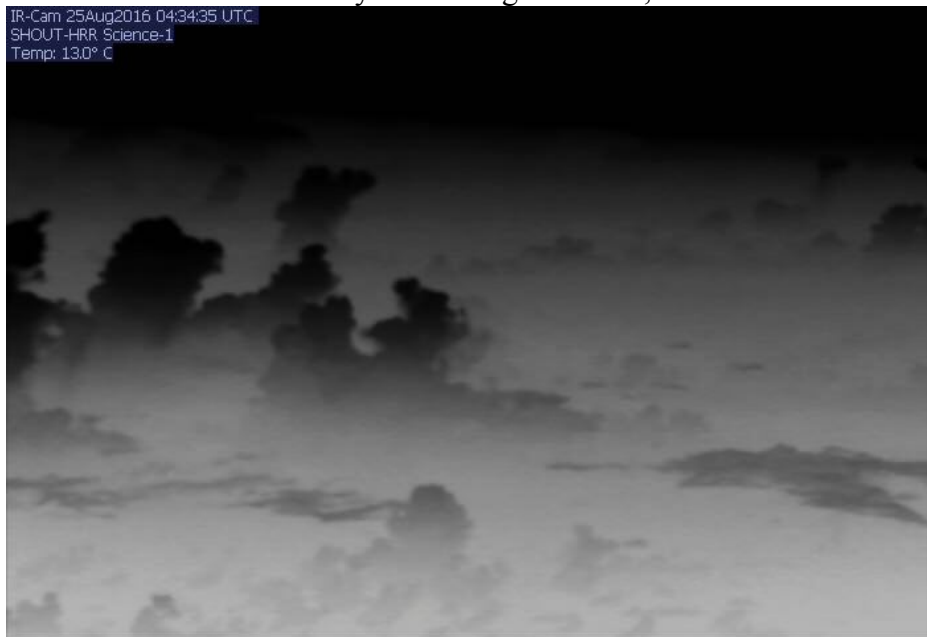
Global Hawk approaching region of very dry air. Sonde #82 will sample this region.



As suspected, very dry conditions sampled by this sonde:



Nice cloud structure seen by the low-light camera, with shallow convection:



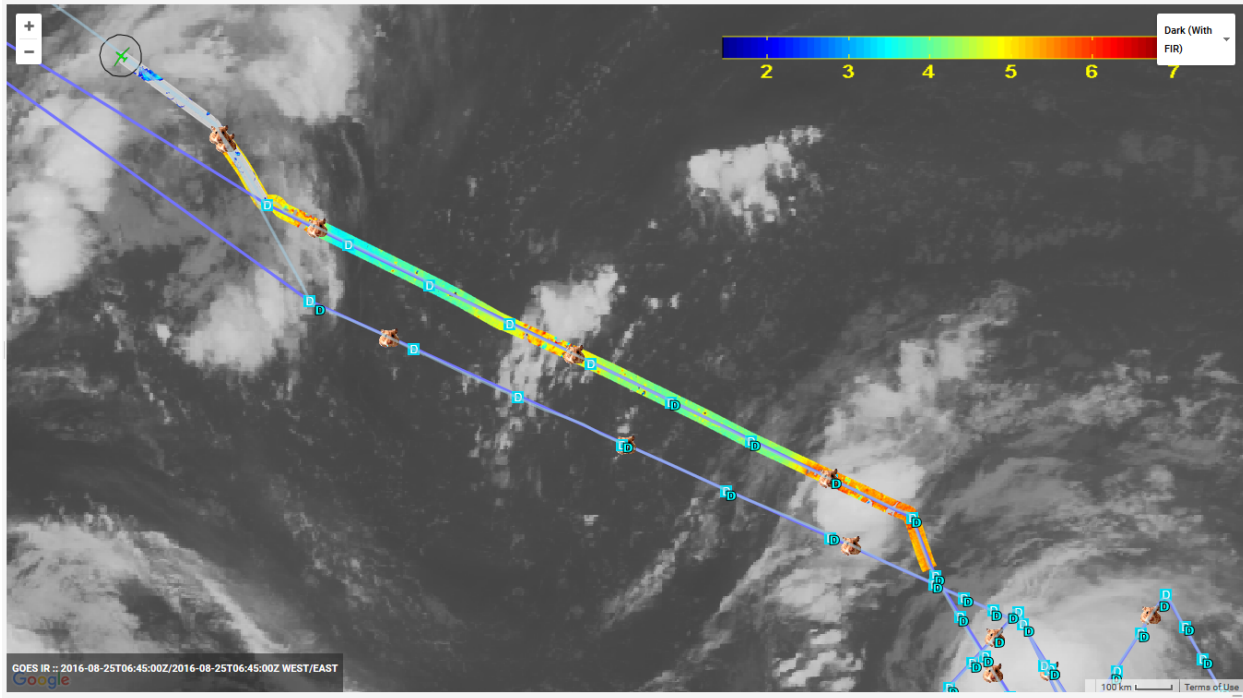
0438Z: Sonde 83 deployed at new location 84. Good drop.

0458Z: Sonde 84 deployed at new location 85. There will not be data from this sonde because the sonde cannot communicate with the aircraft. All remaining sondes are in the same bin and

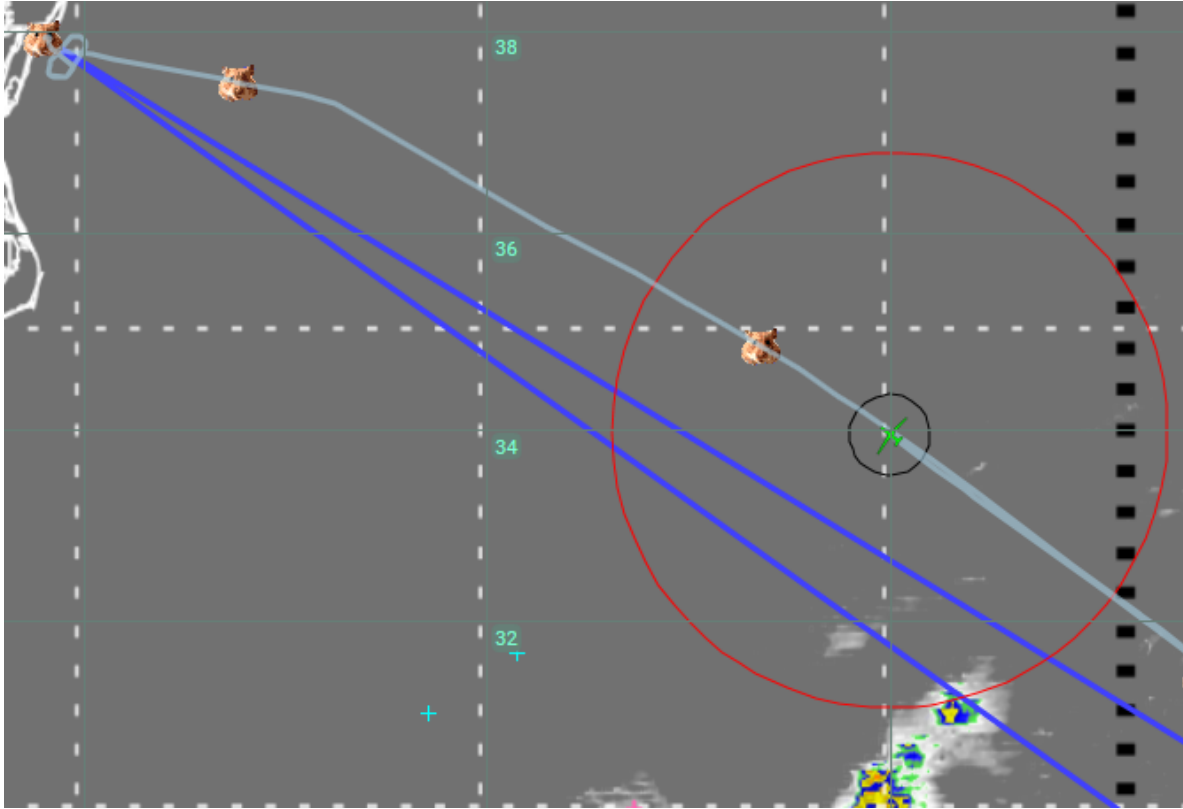
will not be released. Note: this is the same bin that had some issues during the transit flight from Armstrong to Wallops.

0556Z: All dropsondes with available data have been QC'ed and posted to the AVAPS quick looks on MTS.

0645Z: HAMSr TPW reveals greater moisture both ahead of and behind the trough (overlaid on GOES-east IR), with drier air within the trough itself. Slightly greater moisture values also appear directly beneath an upper-level low near the center of the trough axis.



0715Z: CTH/TOT/Lightning product shows excellent conditions for transit back to Wallops. Clear skies with a chance of isolated hamsters!



0730Z: Mission director indicates that we're an hour away from W-386. Payload will be turned off just before approach to that region.

0823Z: Beginning power down of payloads for descent after OKONU

0843Z: Engines stable - beginning to power back up payloads.

0905Z: Beginning further descent

0924Z: Beginning power down for final descent

0936Z: All off

Additional callouts from the NHC 0500 Gaston Discussion:

HURRICANE GASTON DISCUSSION NUMBER 11
 NWS NATIONAL HURRICANE CENTER MIAMI FL AL072016
 500 AM AST THU AUG 25 2016

For much of yesterday afternoon and evening, the NASA/NOAA Global Hawk unmanned aircraft flew a mission through Gaston. On the aircraft's last pass through the storm, it released a dropsonde at 0243 UTC that measured a mean boundary layer wind of 80 kt and an average wind of 77 kt in the lowest 150 m of the sounding near the center of the cyclone. These numbers both support an intensity of 65 kt, and consequently Gaston was upgraded to a hurricane. The

sonde reported a minimum pressure of 995 mb with a 69-kt surface wind, which equates to a central pressure of about 988 mb.

Despite Gaston becoming a hurricane, microwave data indicate that the cyclone is tilted due to 20-25 kt of west-southwesterly shear. The shear is expected to increase further during the next 12-24 hours when Gaston moves around the eastern side of an upper-level low, and as a result, the hurricane is forecast to weaken back to a tropical storm later today. The shear is then forecast to subside in about 48 hours, and with sea surface temperatures expected to increase, Gaston is likely to reintensify during the latter part of the forecast period. The updated NHC forecast is higher than the previous forecast during the first 48 hours primarily to account for the higher initial intensity. After 48 hours, the official forecast is unchanged and closely follows the SHIPS model and the ICON intensity consensus.

Gaston continues to move northwestward, or 310 degrees at 15 kt, along the southwestern edge of a mid-tropospheric high. A fairly quick northwestward motion should continue for the next 36 hours, with a turn toward the west-northwest expected by 48 hours when Gaston moves around the north side of the aforementioned mid- to upper-level low. Gaston is then expected to recurve toward the north-northeast by day 5 as it moves through a break in the ridge and toward the mid-latitude westerlies. The track models are in agreement on this general scenario, although the ECMWF model is a little bit slower and to the east of the other models, showing a sharper turn by day 5. The new NHC track forecast is therefore a little east of the previous forecast on days 4 and 5 and lies closest to the HWRF and the TVCN multi-model consensus.

FORECAST POSITIONS AND MAX WINDS

INIT	25/0900Z	19.5N	43.3W	65 KT	75 MPH
12H	25/1800Z	21.1N	44.8W	60 KT	70 MPH
24H	26/0600Z	23.4N	46.9W	55 KT	65 MPH
36H	26/1800Z	25.3N	49.4W	55 KT	65 MPH
48H	27/0600Z	26.7N	52.0W	60 KT	70 MPH
72H	28/0600Z	29.1N	56.0W	70 KT	80 MPH
96H	29/0600Z	31.0N	58.0W	80 KT	90 MPH
120H	30/0600Z	32.5N	57.5W	85 KT	100 MPH

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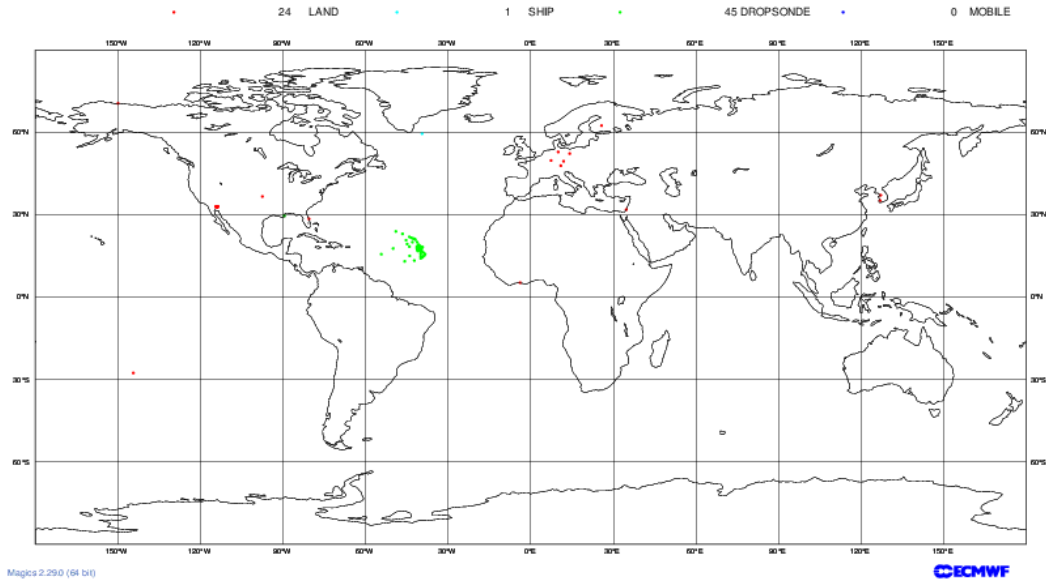
Forecaster Berg

0945Z: Chase has joined and proceeding inbound

0959Z: Landing

Next morning follow-up. ECMWF assimilation info for their 18z and 00z cycles. Showing the inclusion of the GH drops into both cycles. Gaston intensity increased ~20kts between 12z 12hr forecast and 00z analysis.

ECMWF Data Coverage (All obs DA) - Temp
24/Aug/2016; 18 UTC
Total number of obs = 70



ECMWF Data Coverage (All obs DA) - Temp
25/Aug/2016; 00 UTC
Total number of obs = 736

