

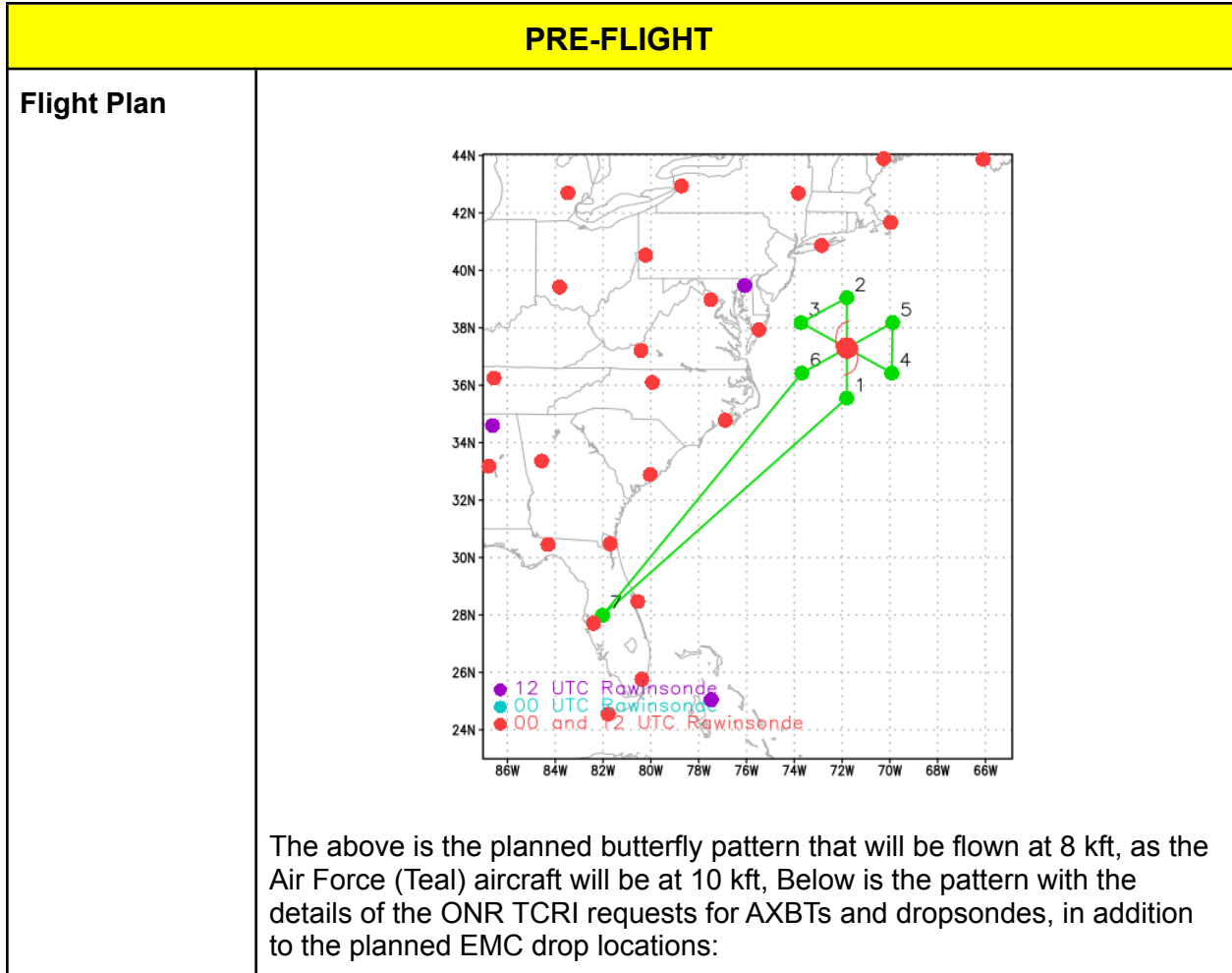
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Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H2**

MISSION PLAN			
FLIGHT ID	20210821H2	STORM	AL08 / HENRI
MISSION ID	1208A	TAIL NUMBER	NOAA42
TASKING	EMC	PLANNED PATTERN	Butterfly
MISSION SUMMARY			
TAKEOFF [UTC]	1942	LANDING [UTC]	0452
TAKEOFF LOCATION	Lakeland	LANDING LOCATION	Lakeland
FLIGHT TIME	9.2	BLOCK TIME	9.4
TOTAL REAL-TIME RADAR ANALYSES (Transmitted)	3 (3)	TOTAL DROPSONDES (Good/Transmitted)	21 (21/21)
OCEAN EXPENDABLES (Type)	7 AXBTs (ONR, all good)	sUAS (Type)	None
APHEX EXPERIMENTS / MODULES	Early Stage Experiment: AIPEX; Gravity Wave Module		
HRD CREW MANIFEST			
LPS ONBOARD	None	LPS GROUND	Zawislak
TDR ONBOARD	None	TDR GROUND	Alvey/Gamache
ASPEN ONBOARD	None	ASPEN GROUND	Sellwood
NESDIS SCIENTISTS	None		
GUESTS (Affiliation)	None		
AOC CREW MANIFEST			
PILOTS	Mitchell, Doremus, Copare, Legidakes		
NAVIGATOR	Hough, Freeman		
FLIGHT ENGINEERS	Darby, Green		
FLIGHT DIRECTOR	Carpenter		
DATA TECHNICIAN	Mascaro		
AVAPS	Underwood		

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Advancing the Prediction of Hurricanes Experiment (APHEX)

FLIGHT LOG - 20210821H2



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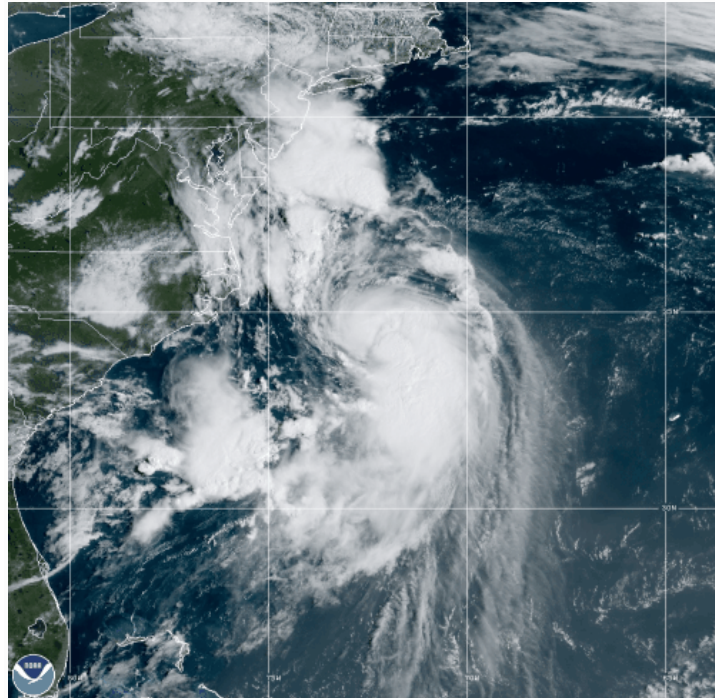
**FLIGHT LOG - 20210821H2**

	<p style="text-align: center;"><b>N42 flight into Henri: 21 August, 2021 (PM takeoff)</b></p> <p><b>Legend:</b>  <span style="color: green;">●</span> Flight track  <span style="color: green;">●</span> Regular drop  <span style="color: blue; border: 1px solid black; border-radius: 50%; width: 10px; height: 10px; display: inline-block; vertical-align: middle;"></span> Combo drop (Regular + AXBT)  <span style="border: 1px solid black; border-radius: 50%; width: 10px; height: 10px; display: inline-block; vertical-align: middle;"></span> Conditional Combo drop</p> <p><b>Dropsonde payload: 27 total</b>          6 turn point drops (EMC)          6 endpoint to center midpoint drops (EMC)          3 center drops (EMC)*          12 eyewall/RMW drops (ONR)**</p> <p><b>AXBT payload: 7 total</b></p> <p>* <b>center drop guidance:</b> Regular drops in the center on each of the 3 center passes, one with AXBT combo drop if eye is clear and calm.          ** <b>inner drop guidance:</b> if RMW is detectable and less than 50 km, release ONR drop at both 50 km and RMW. Otherwise, just one ONR drop at 50 km.</p> <p><b>GW Module 10kft, 60 nm out (maintain outbound heading) and back to pt. 6</b></p> <p><b>ONR inner drop radius: RMW and/or 50km**</b></p>
<p><b>Expendable Distribution</b></p>	<p>EMC-planned releases will be at the endpoints (EP), midpoints (MP), and centers (CTR); ONR TCRI will supplement sondes at locations at the RMW or 50 km, which is about the “quarterpoint” (QTRPNT) of the leg. AXBTs for ONR will be released in combo with dropsondes at the endpoints and once in the center (targeting the 2nd pass).</p>
<p><b>Preflight Weather Briefing</b></p>	<p>At the 11 AM EDT NHC advisory, Henri was upgraded to a Category 1 hurricane. At the 2 PM EDT NHC advisory, Hurricane Henri was located near 35.4N / 71.8W, with an MSLP of 991 mb, maximum sustained winds of 65 kt, and is moving north-northeast at 15 kt. While it appears the storm has gained some inner core symmetry, the convection has also not been particularly impressive over the past several hours, as seen in the satellite imagery below. There is, however, quite a bit of intense convection (based on the IR brightness temperatures and lightning) in the outer bands surrounding the storm. The main question is, is the storm still intensifying? The lack of deep convection within the inner core suggests it isn't, but it's also in the diurnal convective minimum. The storm still has another 12-18 hours over warm waters, so intensification is still possible before it moves over cooler waters. As for the shear, which was the main factor limiting intensification earlier, it does not appear that vertical wind shear is having as much effect on the storm structure, though there was still some tilt to the west above 6 km seen in the earlier P-3 mission and the forward</p>

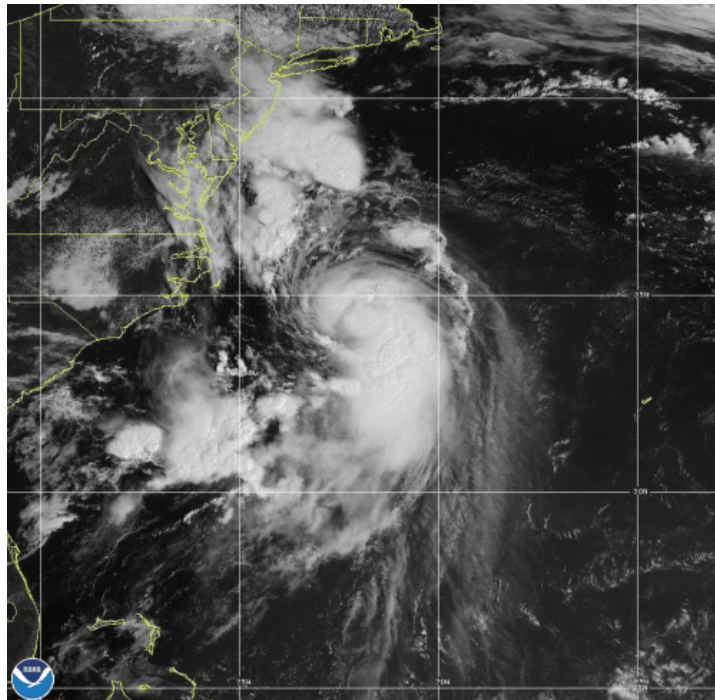
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FLIGHT LOG - 20210821H2

speed may be imparting some effects on the structure.



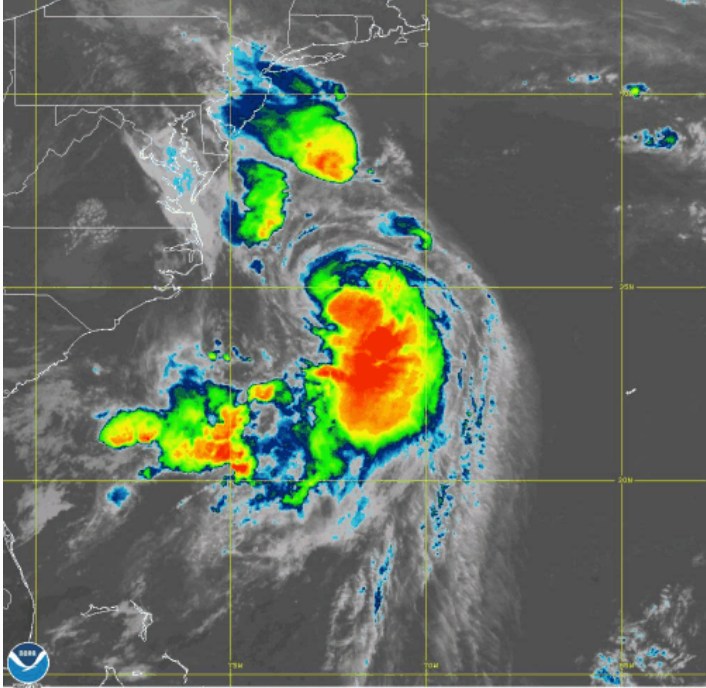
21 Aug 2021 14:00Z NOAA/NESDIS/STAR GOES-East GEOCOLOR



21 Aug 2021 14:30Z NOAA/NESDIS/STAR GOES-East Band 02 TS Henri

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**FLIGHT LOG - 20210821H2**

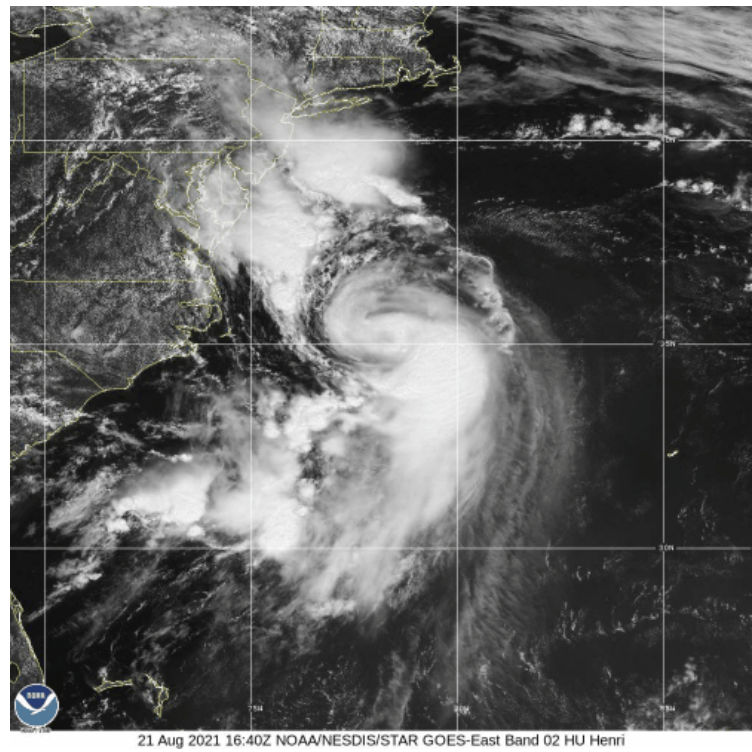
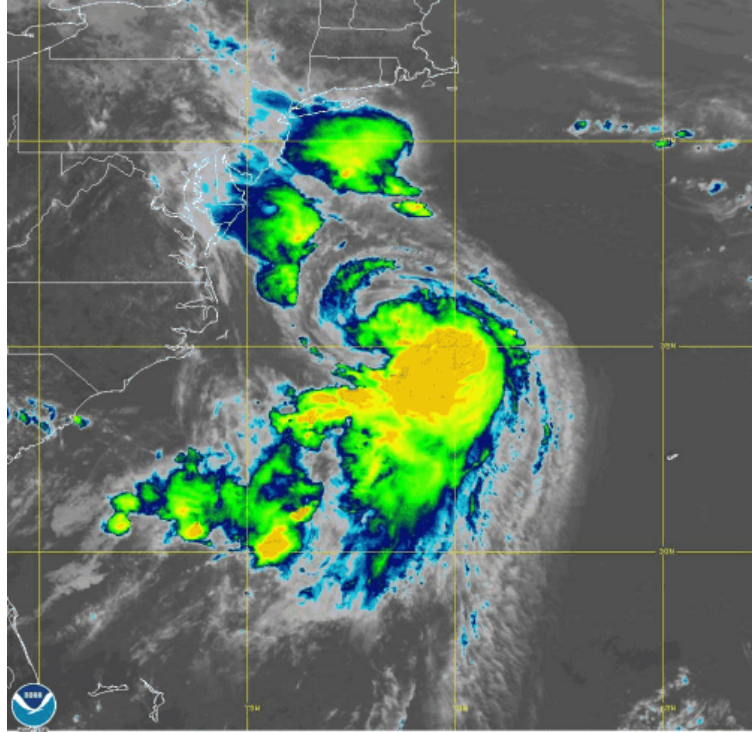
	 <p style="font-size: small; text-align: center;">21 Aug 2021 14:50Z NOAA/NESDIS/STAR GOES-East Band 13 TS Henri</p>
<b>Instrument Notes</b>	Instruments operating nominally; THOR is still not operational

IN-FLIGHT	
Time [UTC]	Event
1942	Takeoff from Lakeland
2035	The AF mission 1108A just as they were getting into the storm had to return to base (RTB) due to an issue. So now this mission will have to pick up the 2330Z fix (on our 2nd pass), and perhaps even the 0230Z fix. Flight altitude will now be 10 kft. Potentially no change in the butterfly pattern, if NHC approves. If they have to do the 0230Z fix, then a delay may be needed to get on time, and that delay could be used for the Gravity Wave Module past the SE endpoint after the 2nd pass before repositioning to the NE to do the final NE to SW pass.

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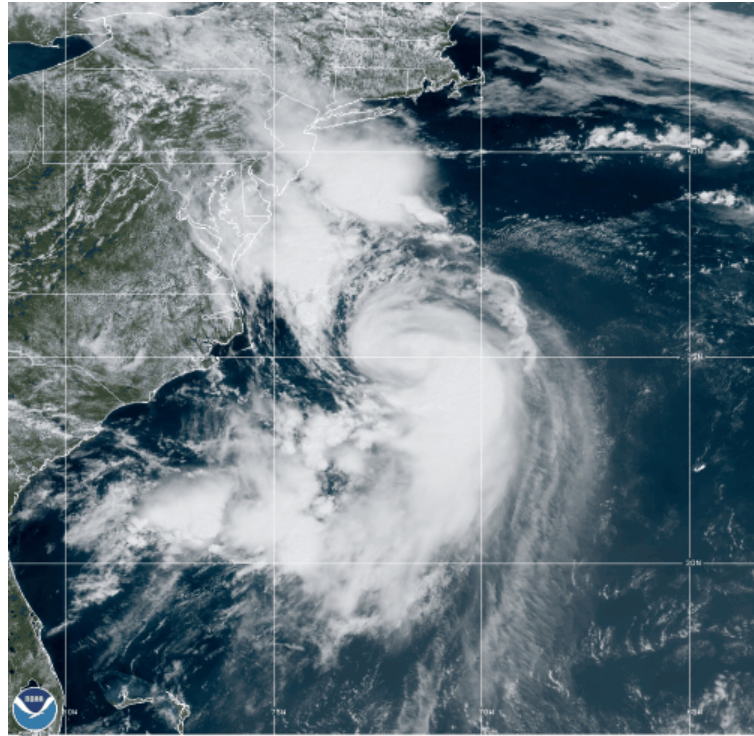
FLIGHT LOG - 20210821H2

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FLIGHT LOG - 20210821H2

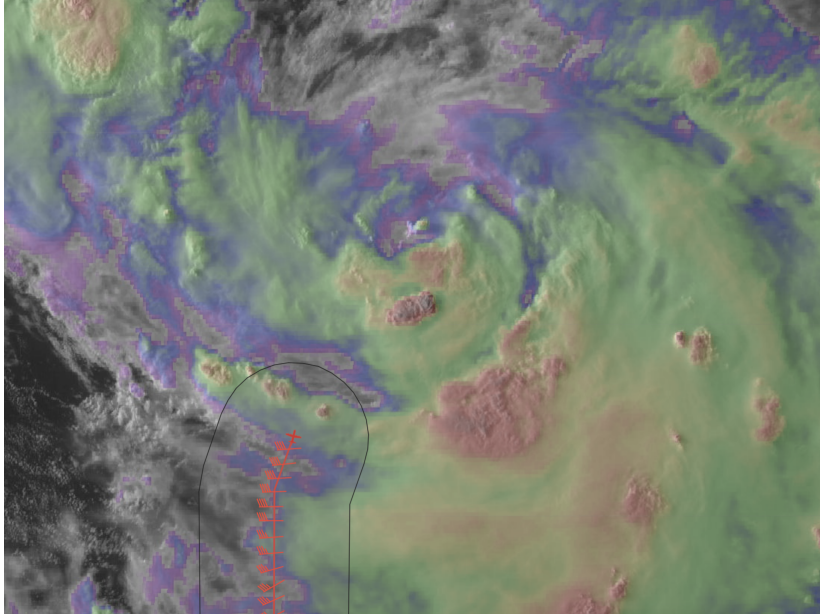


Nearing the initial point (IP) of the pattern, the above satellite imagery has indicated some new convective development on the southern part of the storm, continued inner core symmetry, and perhaps even some eye clearing in the visible (maybe triggered by the convection on the southern side of the eyewall).

2157	Sonde #1, inbound SSW, IP (NWS 1); the inbound will be more along the lines of a 210 degree radial inbound; ONR AXBT #1
2209	Sonde #2, inbound SSW, MP (NWS 2)

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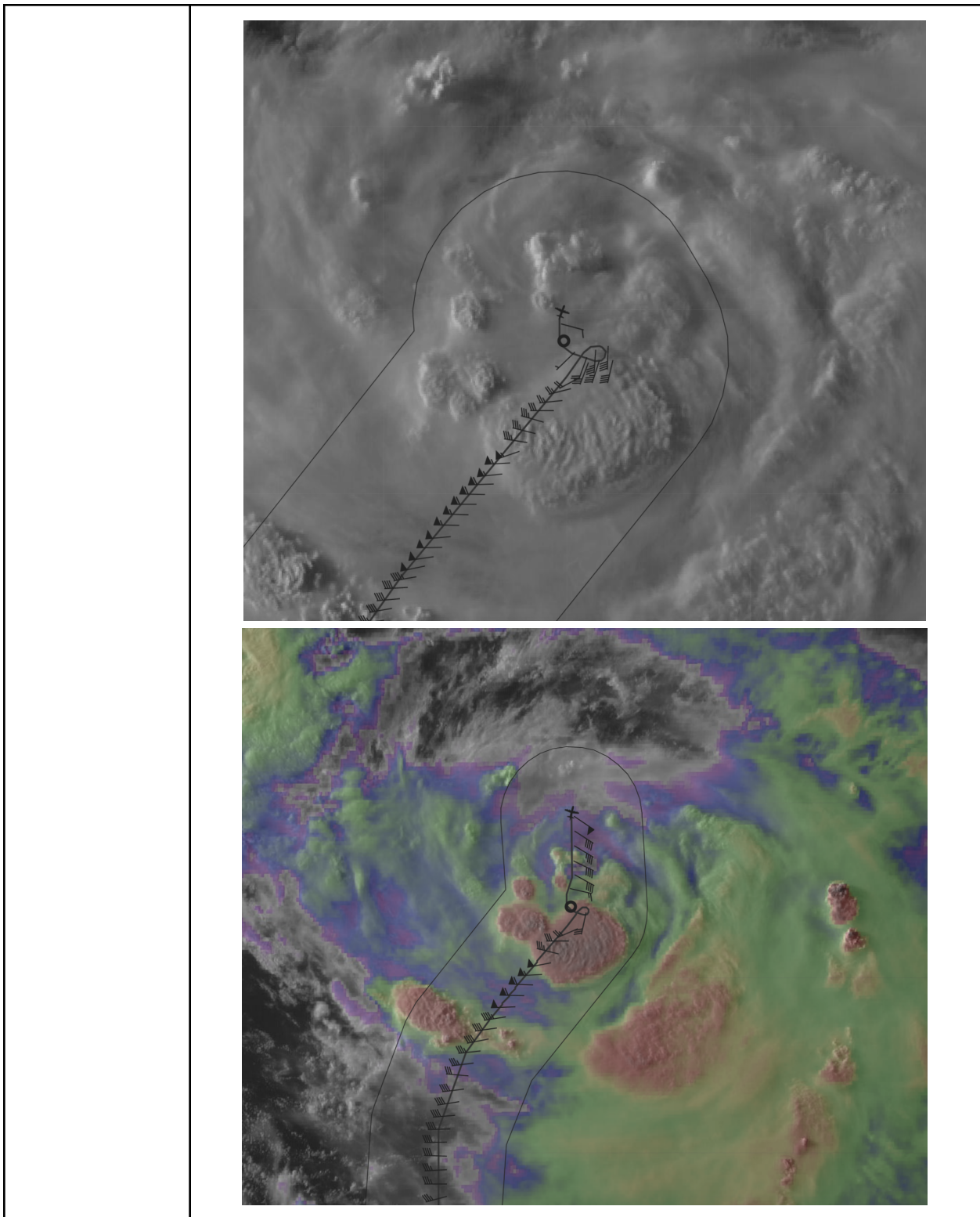
**FLIGHT LOG - 20210821H2**

	
2219	Sonde #3, inbound SSW, QTRPNT (ONR 1)
2226	Approaching the center; they will orbit in the eye in order to meet the 2330Z fix time requirement.
2235	<p>Marked the center for the 2330Z fix time, right at the 1 hour early window. Now will go outbound to the north. From the satellite image below, it appears the new convective development continues in the southern eyewall, and perhaps even near the very center itself.</p> <p>Sonde #4, Center #1 (NWS 3); ONR AXBT #2</p> <p>Center sonde info: 988 mb splash, 285/6 kt (10m) -- so between this and the extrapolated MSLP of 986 mb, it appears the storm (at least from the MSLP) is somewhat more intense than when the previous reconnaissance was in the storm. NHC had the MSLP at 991 mb at 5 PM EDT advisory (also 65 kt, located at 36.3N / 71.4W, moving north-northeast at 16 kt).</p>



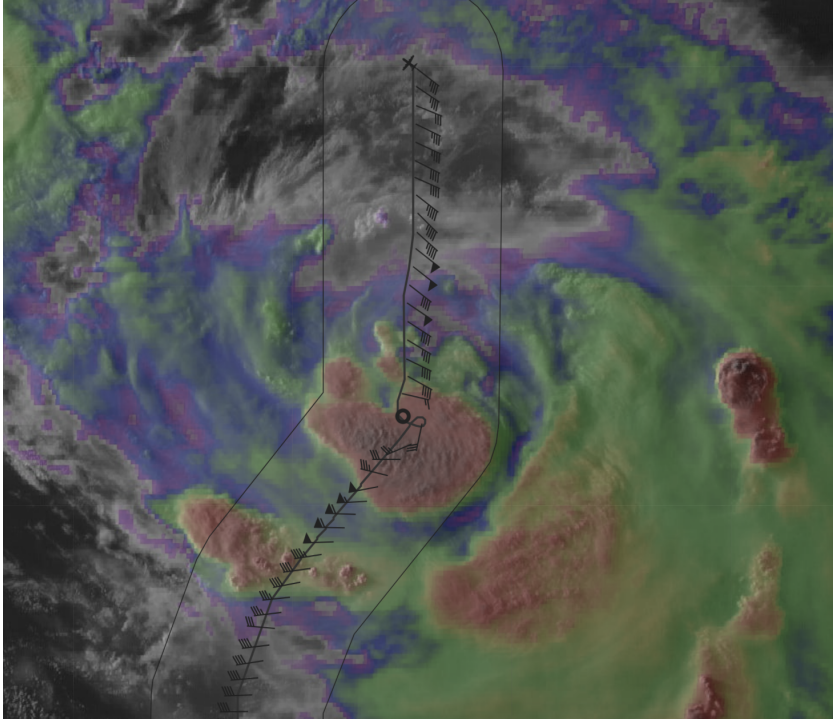
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FLIGHT LOG - 20210821H2



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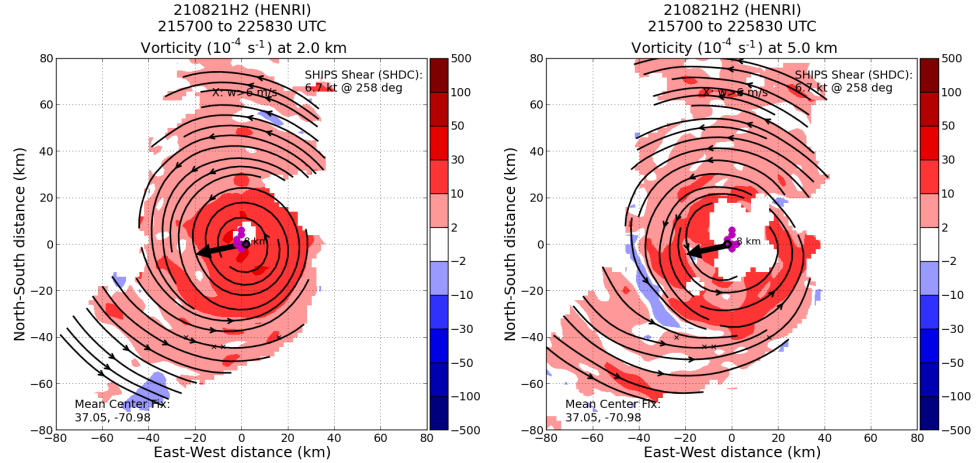
**FLIGHT LOG - 20210821H2**

2244	Sonde #5, outbound N, QTRPNT (ONR 2)
2249	Sonde #6, outbound N, MP (NWS 4)
2300	<p>Convection continues to develop and broaden on the south side of the surface circulation. P-3 is now turning downwind to position itself to the NW for the next inbound.</p> 
2258	Sonde #7, outbound N, endpoint (NWS 5)
2321	Sonde #8, inbound NW, IP (NWS 6); ONR AXBT #3
2332	Sonde #9, inbound NW, MP (NWS 7)

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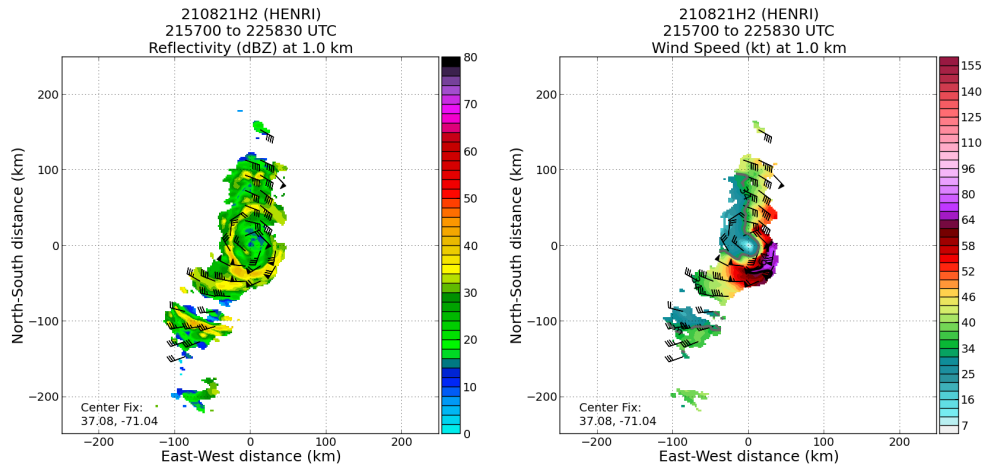
**FLIGHT LOG - 20210821H2**

2344



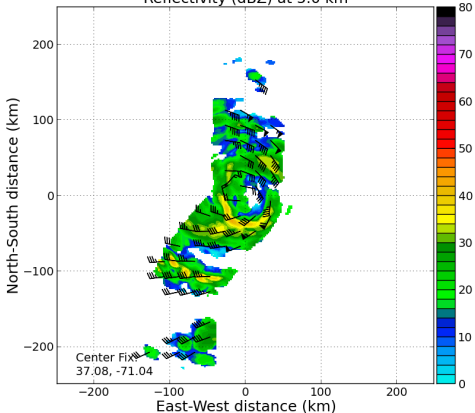
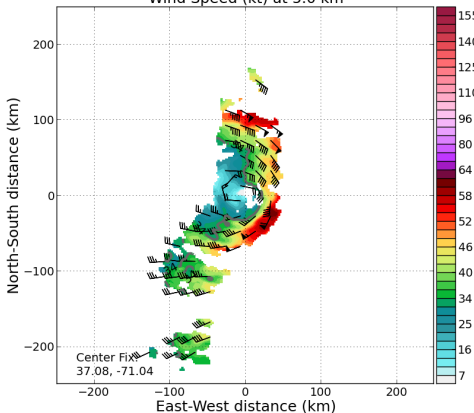
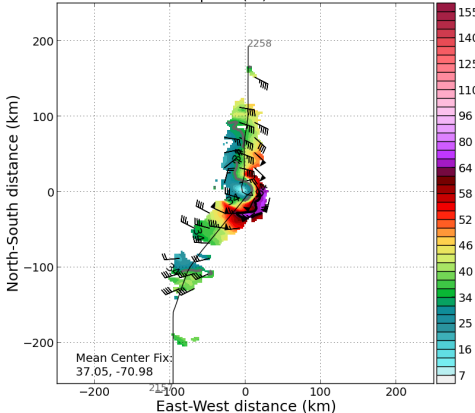
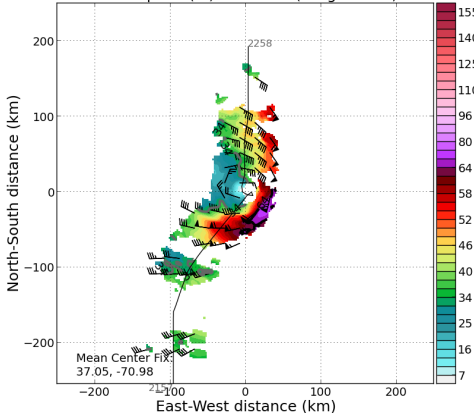
The above image shows the relative vorticity at 2.0 and 5.0 km, as well as the tilt with height; the image shows that the storm is essentially aligned between the low and midlevels.

Here's a look at the full 1 and 5 km swaths, which actually show that the RMW has decreased significantly from the earlier P-3. Hurricane-force winds now exist in the eyewall to the south and east at 0.5 and 1.0 km.



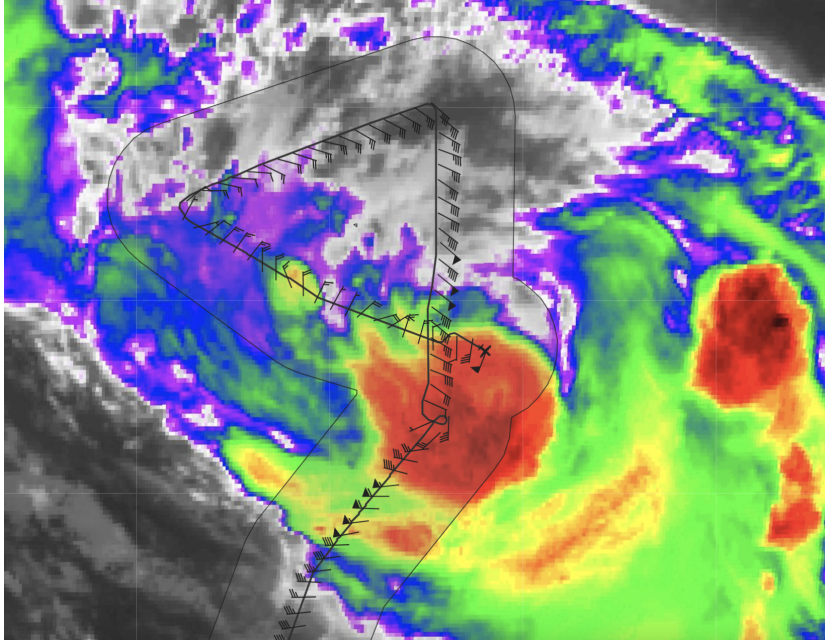
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Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H2**

	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>210821H2 (HENRI) 215700 to 225830 UTC Reflectivity (dBZ) at 5.0 km</p>  </div> <div style="text-align: center;"> <p>210821H2 (HENRI) 215700 to 225830 UTC Wind Speed (kt) at 5.0 km</p>  </div> </div> <p>And now the winds at 0.5 km:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>210821H2 (HENRI) 215700 to 225830 UTC Wind Speed (kt) at 0.5 km</p>  </div> <div style="text-align: center;"> <p>210821H2 (HENRI) 215700 to 225830 UTC Wind Speed (kt) at 3.0 km (~flight level)</p>  </div> </div>
2342	Sonde #10, inbound NW, QTRPNT (ONR 3)
2345	<p>Sonde #11, Center #2 (NWS 8)</p> <p>Sonde info: 988 mb, winds 206/10 kt</p> <p>Marked the center on the 2nd pass. The image from the pass below shows that the convective burst on the south side continues to expand in coverage. So far, it appears the storm has strengthened and has been reinvigorated convectively near the center after a lull for most of the afternoon.</p>

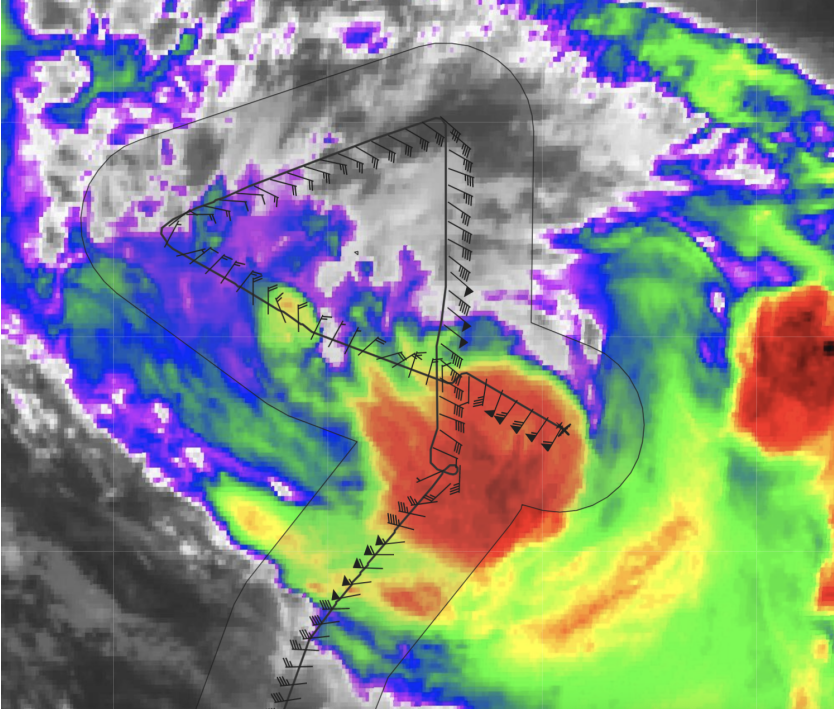
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FLIGHT LOG - 20210821H2

	
2350	<p>Sonde #12, outbound SE, RMW (ONR 4)</p> <p>The Flight Director was able to detect a clearer RMW on the pass through the SE eyewall (image below, and based on the TDR images from the first pass, that checks), and instead dropped the ONR sonde at that RMW instead of the QTRPNT</p>

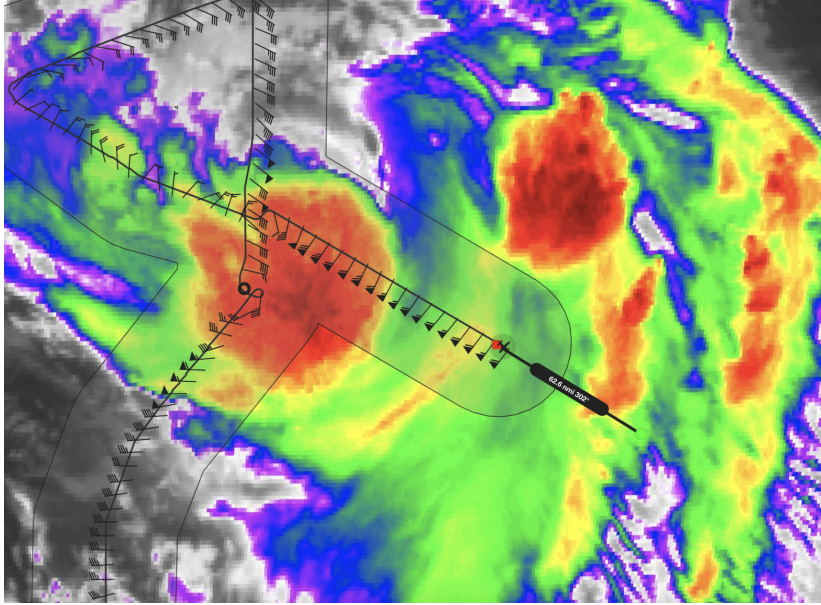
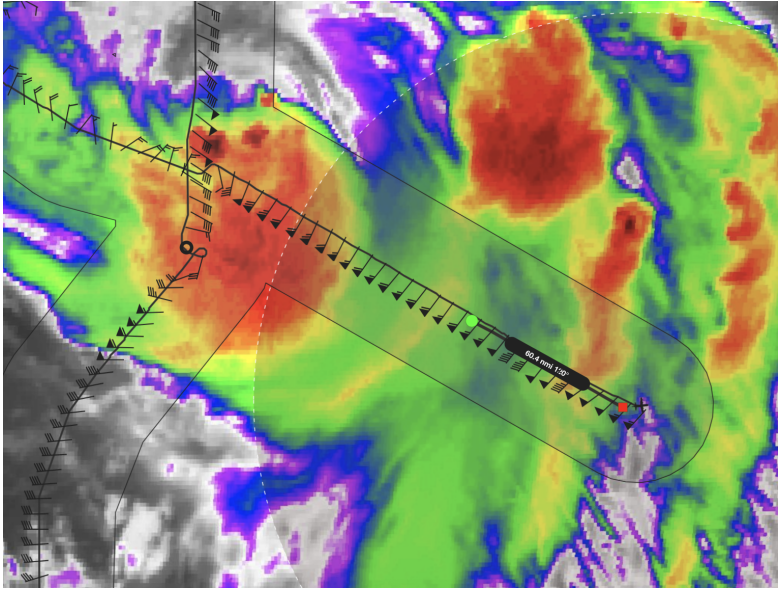
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FLIGHT LOG - 20210821H2

	
2358	Sonde #13, outbound SE, MP (NWS 9)
0010	So in order to delay enough to be on time for the 0230Z fix (likely 1 hour early), they will execute the Gravity Wave Module past the SE endpoint. So that will be 60 n mi past the endpoint, straight and level, and reverse on the same track back 60 n mi to the SE endpoint.

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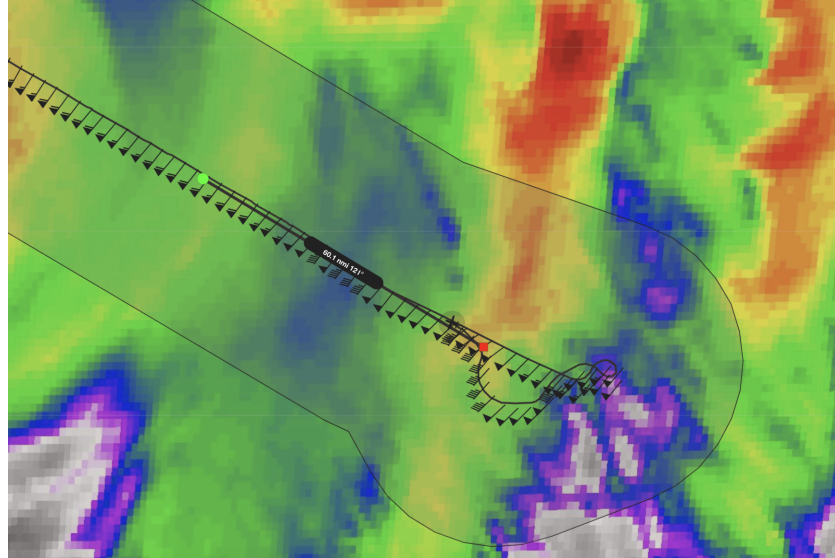
**FLIGHT LOG - 20210821H2**

	
0012	Sonde #14, outbound SE, endpoint (NWS 10); ONR AXBT #5
0016	Doing the Gravity Wave Module now; just one cell could interrupt it.
0027	<p>Completed outbound leg of the Gravity Wave Module:</p> 
0039	They're now heading back on track towards the endpoint for the inbound leg of the Gravity Wave Module. They had to loop SW to avoid a cell to get back on line, but now that they are – just requested to go 60 n mi from the

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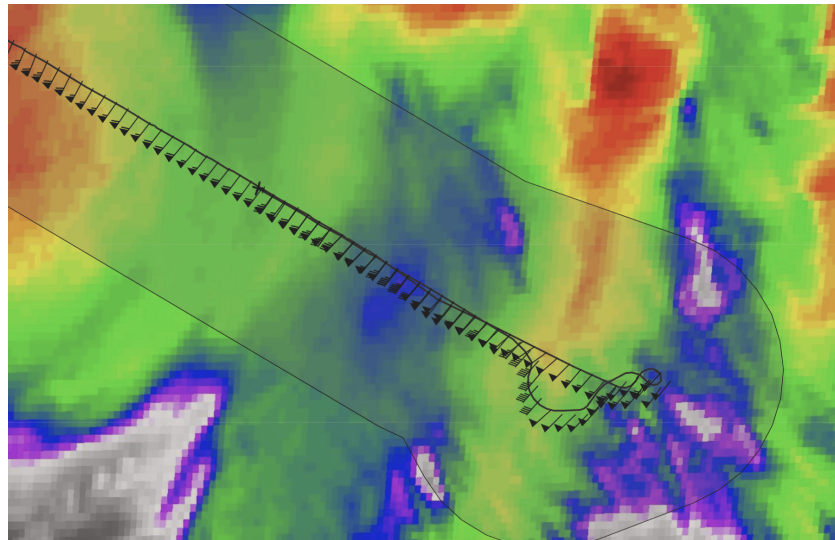
FLIGHT LOG - 20210821H2

point they intersected on the track to complete a full 60 n mi out and back on the same track to complete a successful module.



0054

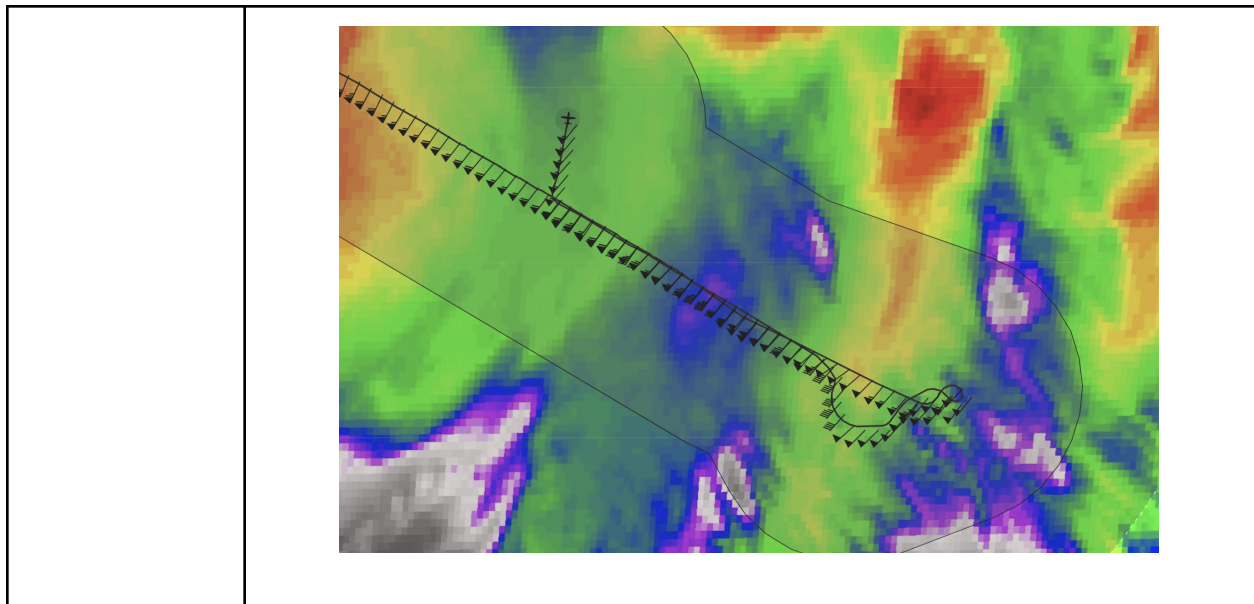
End of the inbound leg -- Gravity Wave Module completed -- 60 nmi outbound, then a return on track a bit inbound of the end of the outbound leg, but continued inbound radially inward of the original SE endpoint to make it a full 60 n mi out and back.





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Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

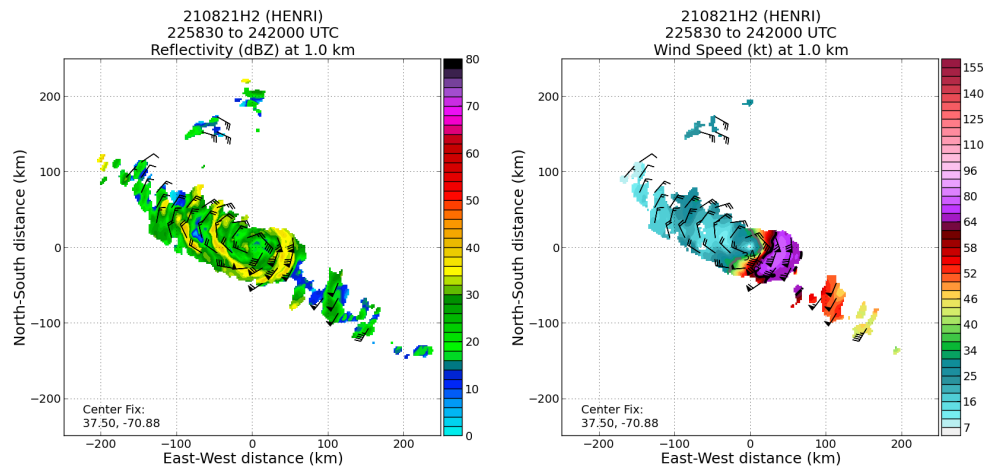
**FLIGHT LOG - 20210821H2**



0109

The 2nd TDR analyses for the first downwind and second pass are in. The 1 km and 5 km are shown below, and also the vertical tilt, which shows the storm is well aligned through 12 km. Although, the circulation may be getting elongated NW to SE some now. Fast forward motion also continues.

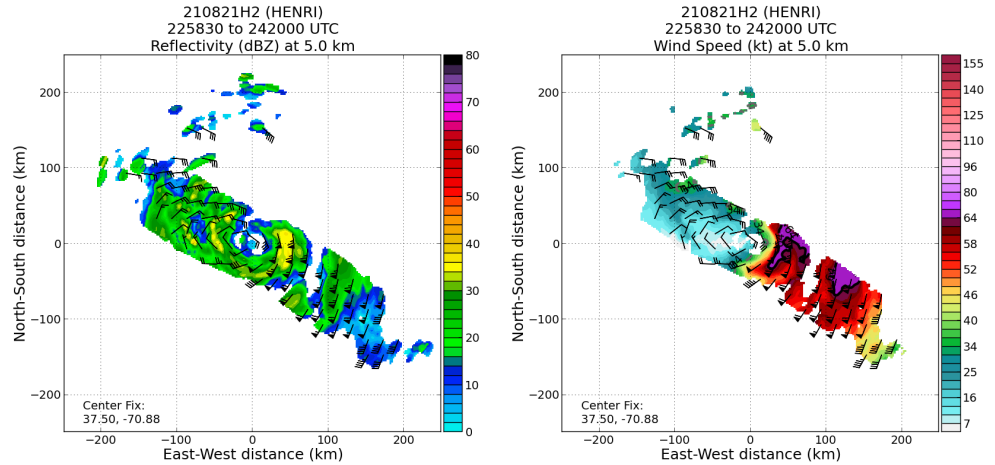
The 1 km swath analysis:



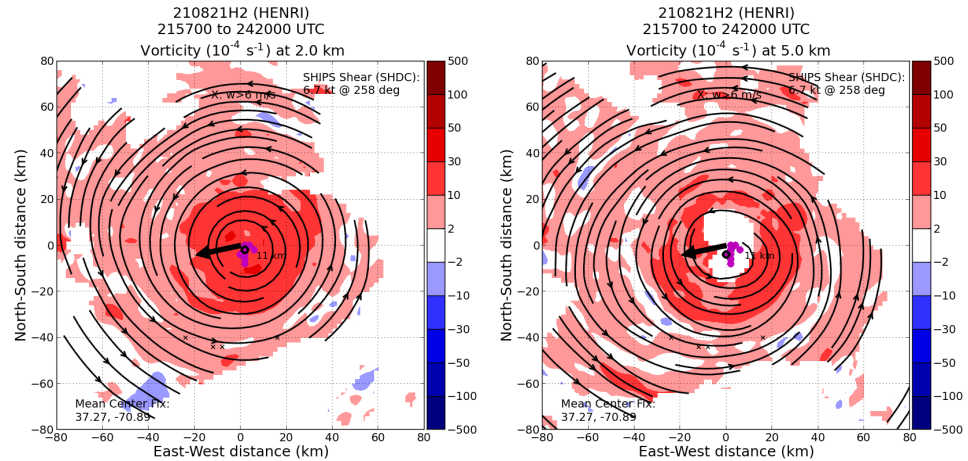
The 5 km swath analysis:

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Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H2**



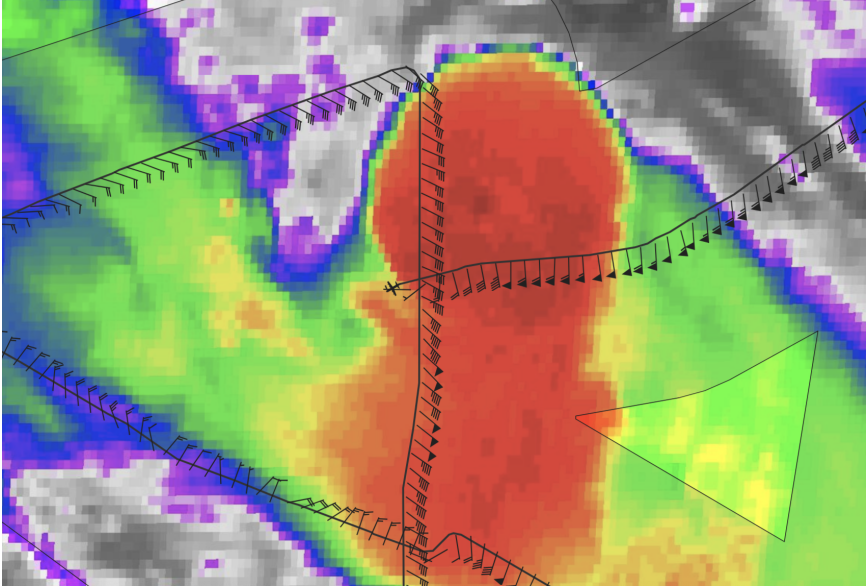
And the relative vorticity and tilt diagram:



0125	Sonde #15, inbound NE, IP (NWS 11); ONR AXBT #6
0139	Sonde #16, inbound NE, MP (NWS 12)
0157	Just made their 3rd and final fix of the flight. Convection has developed on the east side now after being primarily on the south side.

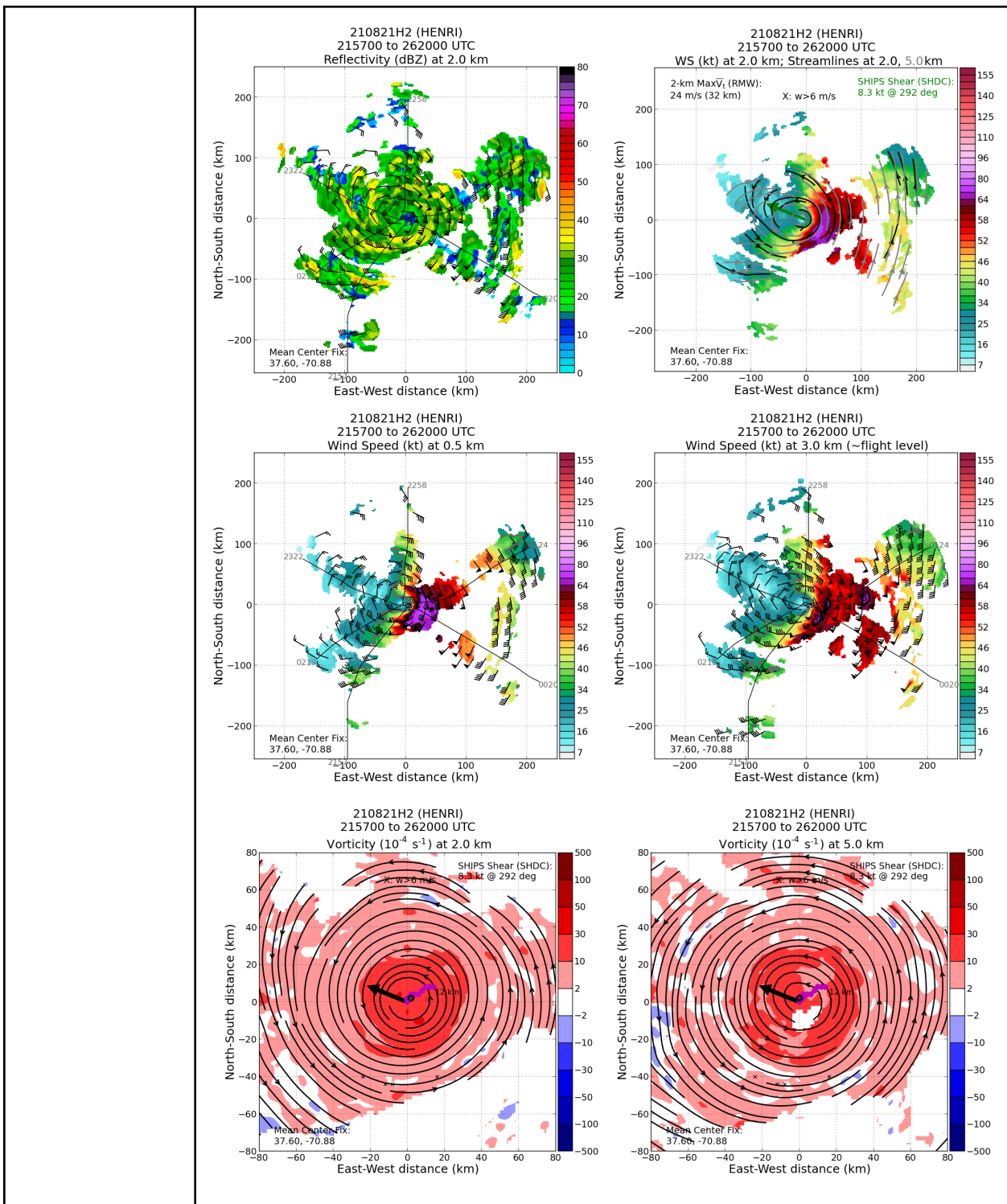
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Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H2**

	
0147	Sonde #17, inbound NE, QTRPNT (ONR 5)
0157	Sonde #18, Center #3 (NWS 13) Sonde info: 989 mb, winds 290 at 14 kts
0203	Sonde #19, outbound SW, QTRPNT (ONR 6)
0208	Sonde #20, outbound SW, MP (NWS 14)
0221	Sonde #21, outbound SW, endpoint (NWS 15); ONR AXBT #7
	Science Complete
	The final TDR analyses: below is the composite analyses from the three passes:

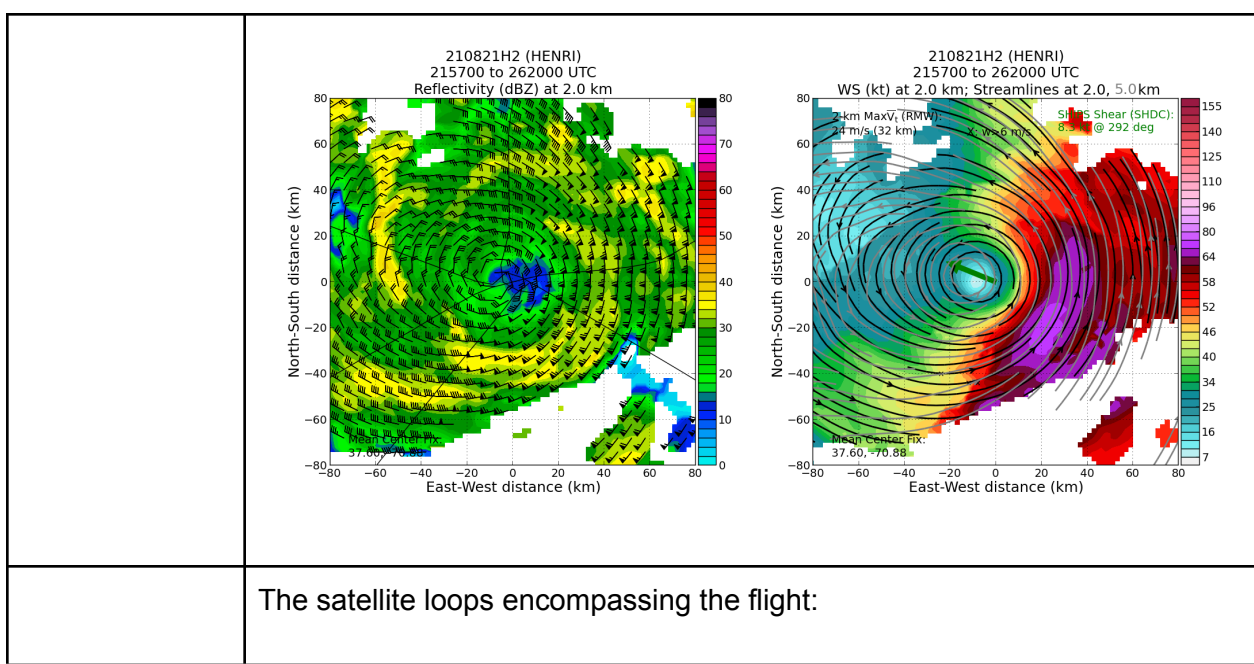
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**Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG - 20210821H2**



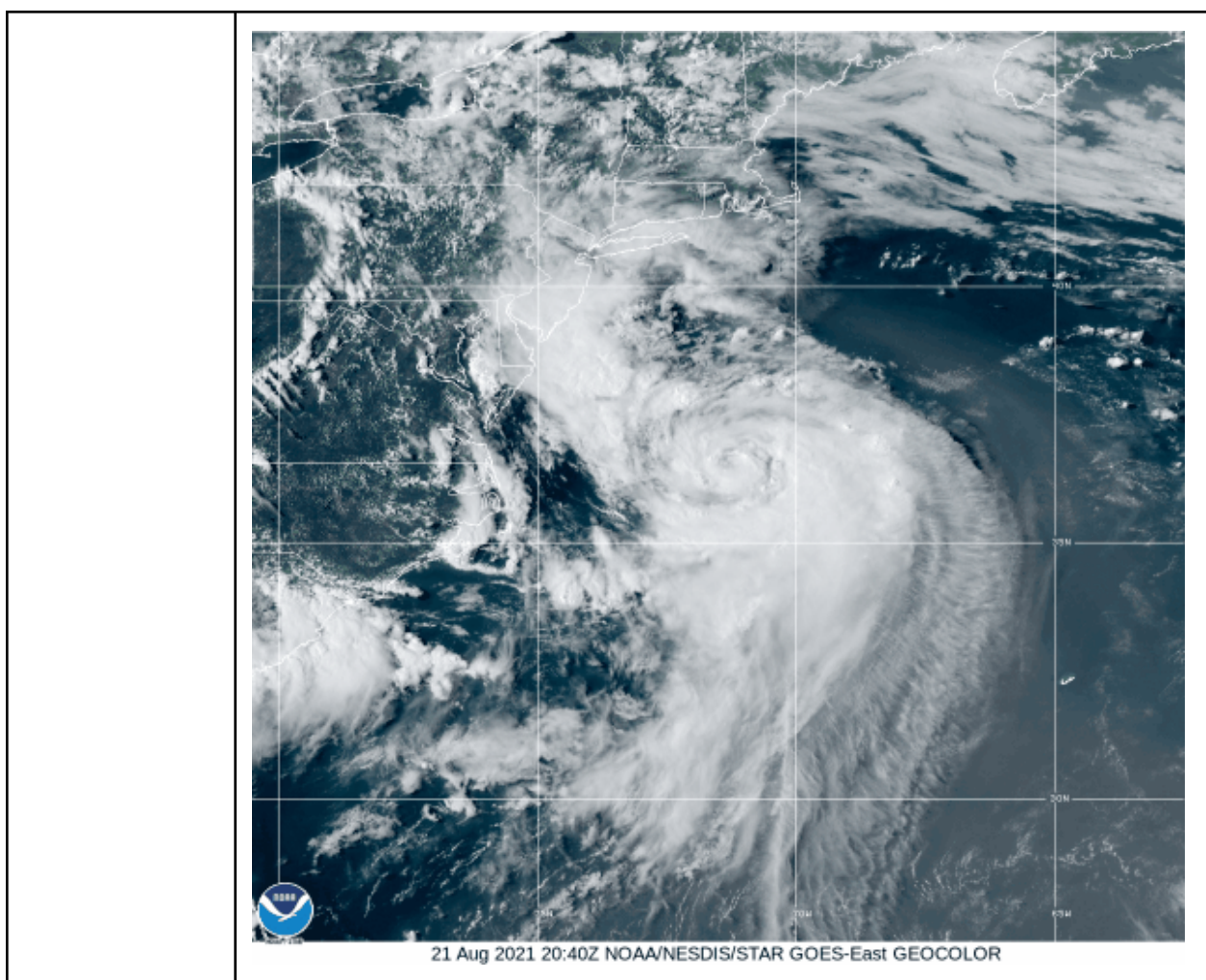
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FLIGHT LOG - 20210821H2



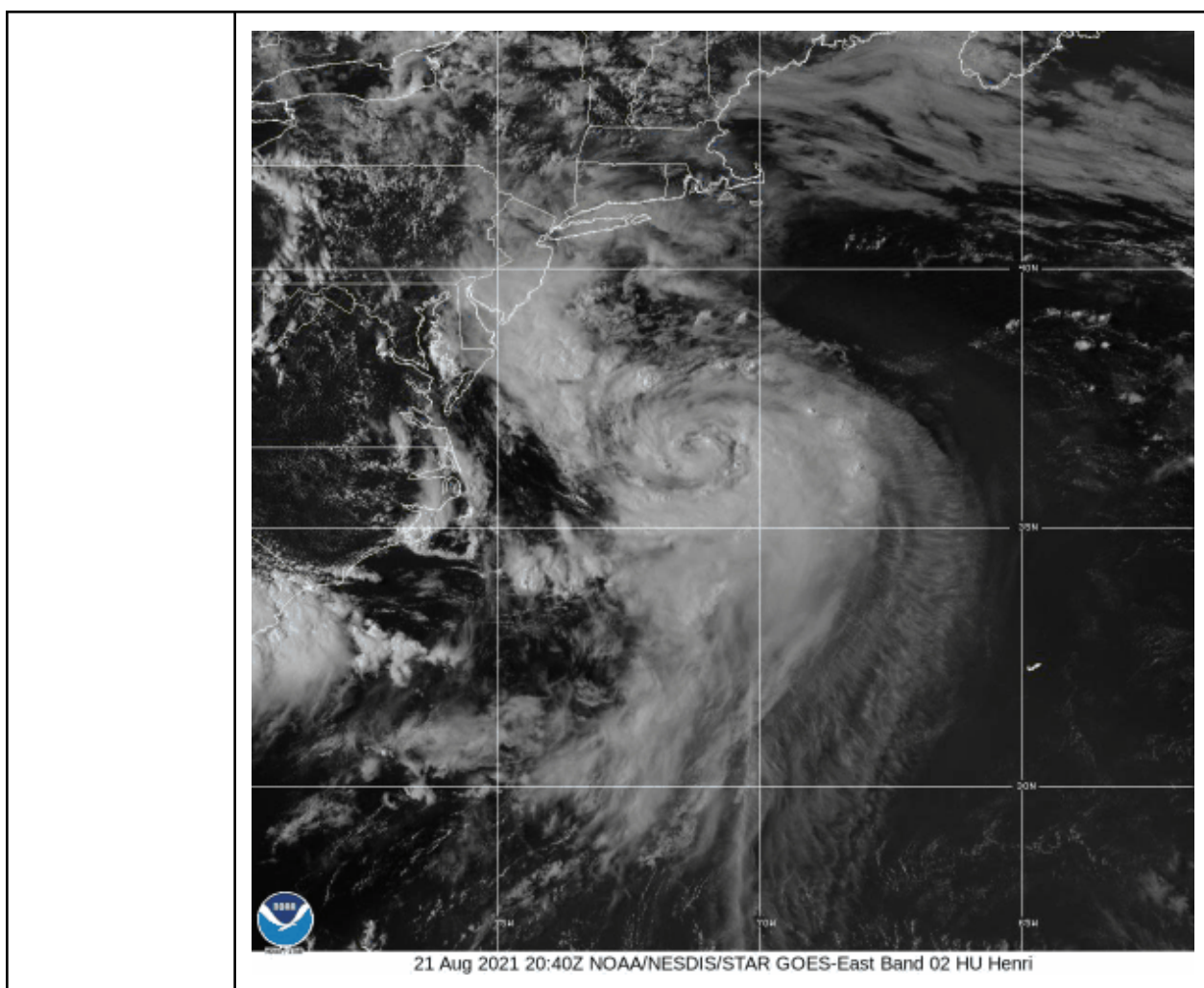
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Hurricane Field Program  
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FLIGHT LOG - 20210821H2



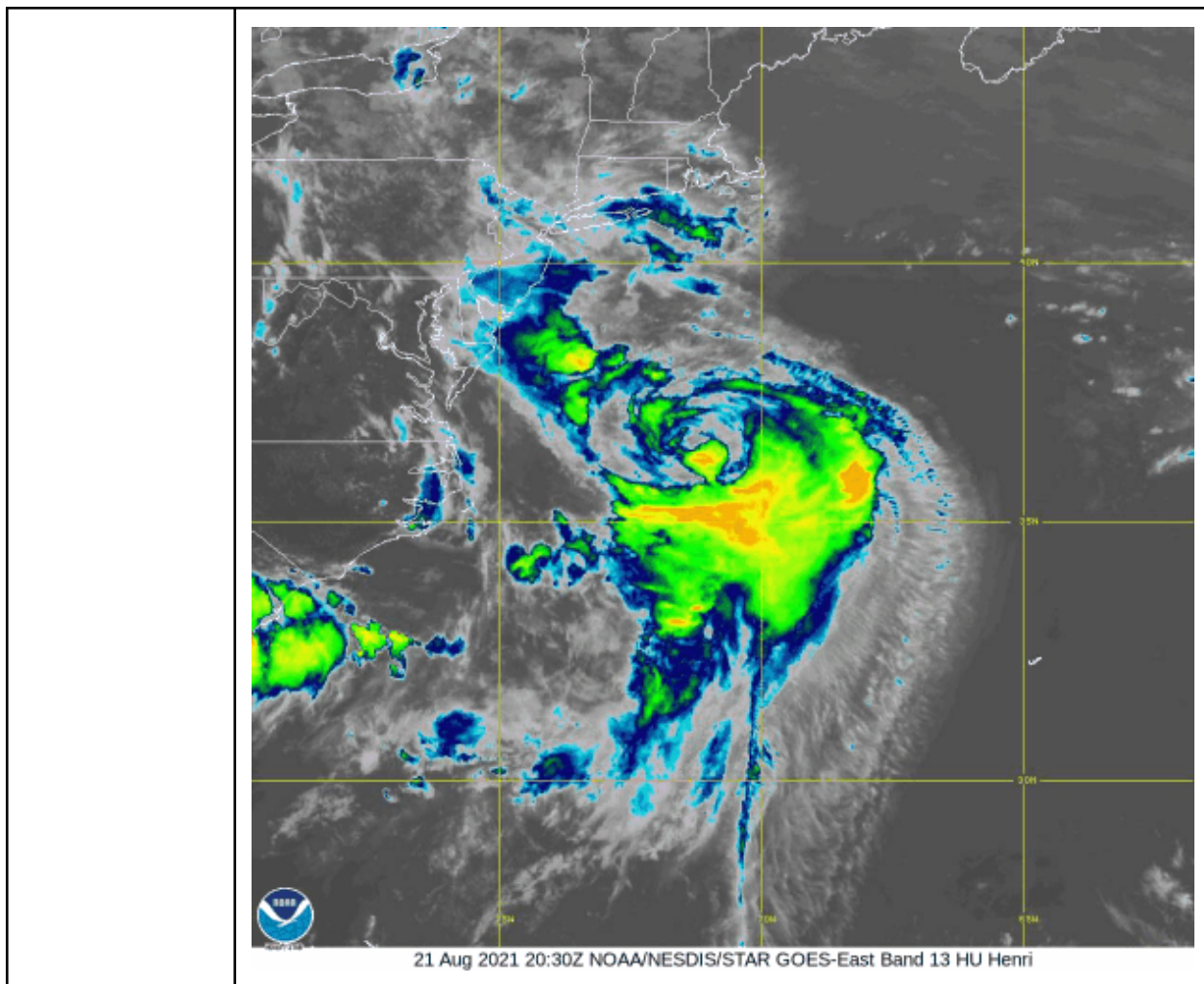
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Hurricane Field Program  
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FLIGHT LOG - 20210821H2



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 Hurricane Field Program  
 Advancing the Prediction of Hurricanes Experiment (APHEX)

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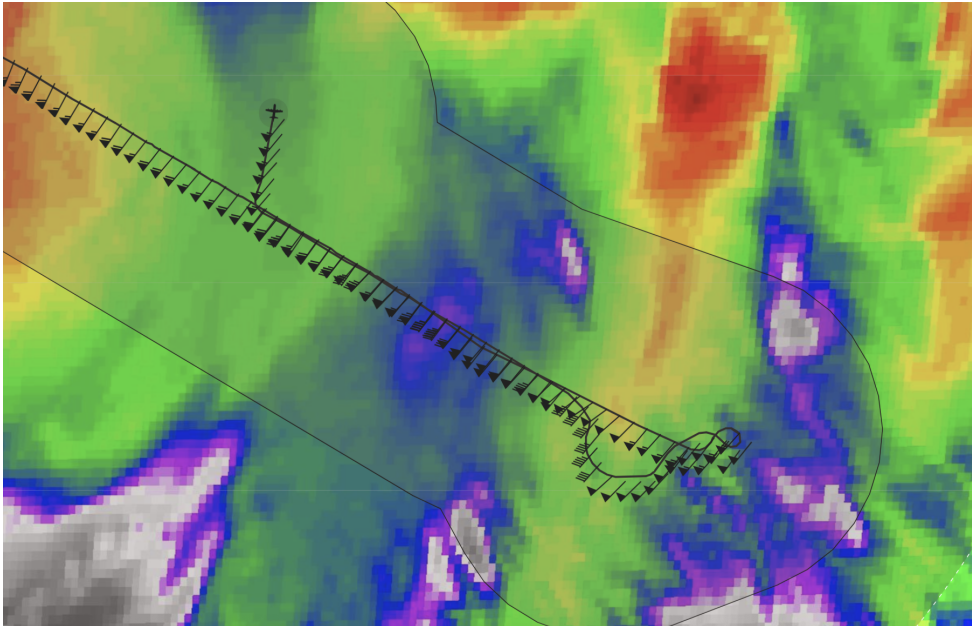
**POST-FLIGHT**

<b>Mission Summary</b>	<p>This mission successfully flew a complete butterfly pattern in support of EMC tasking into Hurricane Henri as it moves up the US coastline off the Mid-Atlantic. Because the Air Force (Teal) aircraft had to return to base, the mission was also tasked with the 2330 UTC NHC fix requirements (and also accomplished the 0230 UTC, as well, though the next Teal mission will return in time to complete that fix too). The storm lacked convection prior to the mission, but increased in convective coverage within the eyewall during the mission (even becoming fairly symmetric early on) and expanded on each pass (as seen in the satellite loops encompassing the mission above). Towards the end of the mission,</p>
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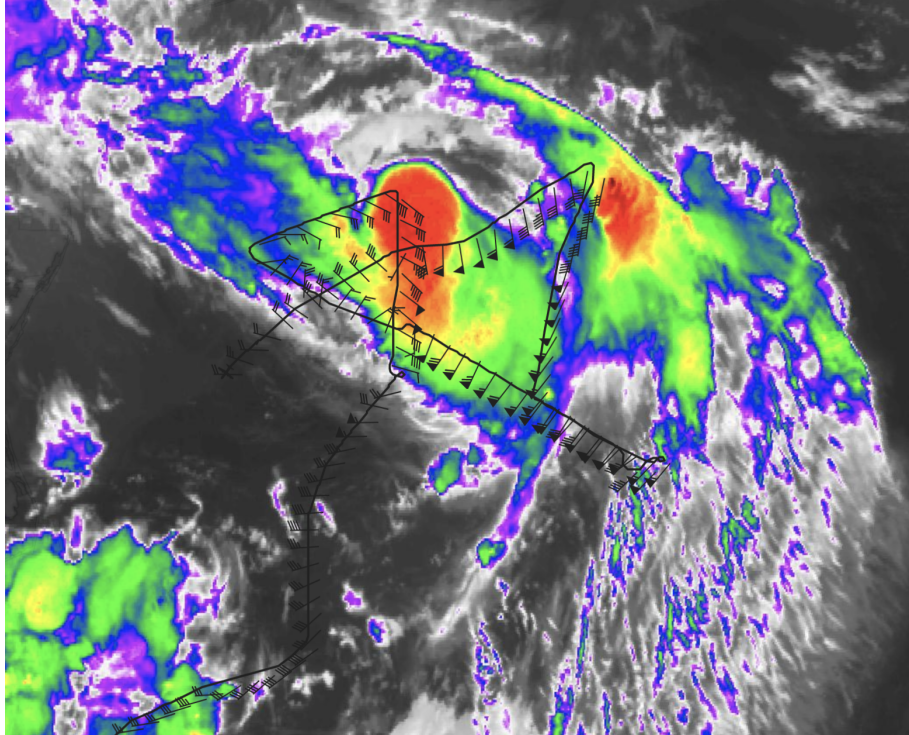
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Hurricane Field Program  
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**FLIGHT LOG - 20210821H2**

	<p>though, the storm took on a more elongated appearance, and that was seen in the TDR analysis winds, as well.</p> <p>Overall, the storm had a lower MSLP than the 1800 UTC NHC advisory before the mission, but did not necessarily have higher peak winds. What was observed to be different from the earlier P-3 mission was that the peak winds were within the eyewall (maximum to the south through northeast quadrants), rather than just at farther radii observed earlier. So the storm likely intensified somewhat, but is also now accelerating northward and getting caught up in the north-northwestward steering flow.</p> <p>As part of the ONR TCRI collaboration with APHEX, the data collected supports research for the <i>Early Stage Experiment: AIPEX</i>, while a successful <i>Gravity Wave Module</i> was flown in the SE quadrant of the storm (see screenshot below). AXBTs were also released at all endpoints and once in the center to measure the ocean conditions that the storm is encountering.</p> <p>21 Dropsondes (all good; 15 NWS, 6 ONR); 7 ONR AXBTs (all good)</p> 
<p><b>Actual Standard Pattern Flown</b></p>	<p>Butterfly as planned; 10 kft</p>

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Hurricane Field Program  
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**FLIGHT LOG - 20210821H2**

<b>APHEX Experiments / Modules Flown</b>	The data collected will be useful to the <i>Early Stage Experiment: AIPEX</i> , and a <i>Gravity Wave Module</i> was flown; the flight was in collaboration with ONR TCRI.
<b>Plain Language Summary</b>	<ul style="list-style-type: none"> <li>• This mission collected data to be included in the hurricane forecast models as the storm approaches a landfall in the northeast United States.</li> <li>• Data from the mission showed that the storm was slightly more intense than earlier in the day, but also that the hurricane-force winds were closer to the center (in the eyewall) than earlier observations from the P-3, as well. The circulation was aligned with increasing altitude, and the precipitation intensified and became more symmetric around the center during the mission. Despite this increase in precipitation, the storm's wind field appeared to become elongated from northwest to southeast.</li> </ul>
<b>Instrument Notes</b>	Instruments onboard functioned nominally; THOR was still not operational, though, nor for this entire sequence of Henri missions on NOAA42.
<b>Final Mission Track</b>	

NOAA / AOML / Hurricane Research Division  
Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)

FLIGHT LOG - 20210821H2

