

**NOAA / AOML / Hurricane Research Division  
2021 Hurricane Field Program  
Advancing the Prediction of Hurricanes Experiment (APHEX)**

**FLIGHT LOG -- 2021081411**

MISSION PLAN			
FLIGHT ID	2021081411	STORM	AL07 / GRACE
MISSION ID	0107A	TAIL NUMBER	NOAA43
TASKING	NHC	PLANNED PATTERN	Alpha
MISSION SUMMARY			
TAKEOFF [UTC]	1442	LANDING [UTC]	2108
TAKEOFF LOCATION	Aruba	LANDING LOCATION	Aruba
FLIGHT TIME	6.5	BLOCK TIME	6.7
TOTAL REAL-TIME RADAR ANALYSES (Transmitted)	2 (2)	TOTAL DROPSONDES (Good/Transmitted)	7 (7/7)
OCEAN EXPENDABLES (Type)	None	sUAS (Type)	None
APHEX EXPERIMENTS / MODULES	Genesis Experiment: PREFORM		
HRD CREW MANIFEST			
LPS ONBOARD	Zawislak	LPS GROUND	None
TDR ONBOARD	Zawislak	TDR GROUND	Reasor
ASPEN ONBOARD	Sellwood	ASPEN GROUND	None
NESDIS SCIENTISTS	None		
GUESTS (Affiliation)	None		
AOC CREW MANIFEST			
PILOTS	Mitchell, Rannenber, Copare, Legidakes		
NAVIGATOR	Freeman		
FLIGHT ENGINEERS	Darby, Wysinger		
FLIGHT DIRECTOR	Carpenter		
DATA TECHNICIAN	Mascaro		
AVAPS	Underwood		

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**FLIGHT LOG -- 20210814I1**

<b>PRE-FLIGHT</b>	
<b>Flight Plan</b>	Alpha pattern in support of the NHC-tasks 1730Z fix requirement; flight at 5000 ft; planned legs are for NW to SE, and NE to SW
<b>Expendable Distribution</b>	Dropsondes at endpoints of each leg and the center
<b>Preflight Weather Briefing</b>	Overnight NHC upgraded TD7 to Tropical Storm Grace; 1007 mb with a peak intensity of 35 kt. Precipitation appears to be organized around a center, but it's difficult to discern as to whether there is a clear low-level circulation; at least in the midlevels, and determined from satellite imagery, the storm appears to have a robust circulation in the midtroposphere.
<b>Instrument Notes</b>	TDR angle correction module completed on the ferry down to Aruba; appeared to be successful and 2020 angle corrections were applied and updated prior to this mission. All instruments operational besides IWRAP.

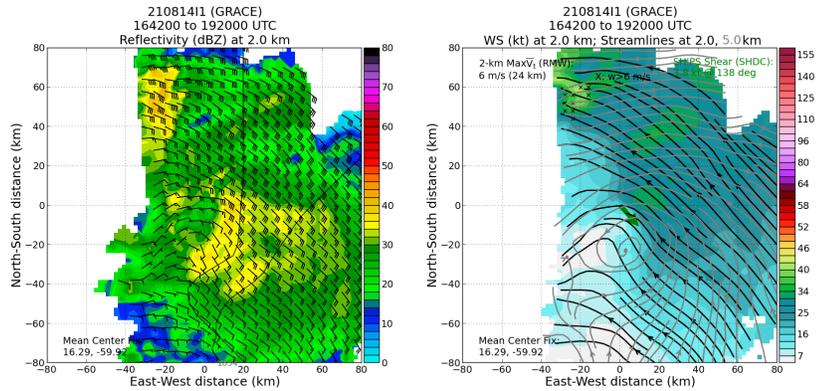
<b>IN-FLIGHT</b>	
Time [UTC]	Event

<b>POST-FLIGHT</b>	
<b>Mission Summary</b>	Perhaps the most interesting observation from this mission was that Tropical Storm Grace hasn't really completed its formation process (i.e., underwent genesis). As a collective, the observations from the flight indicated that while a coherent midlevel circulation was present, at low levels the storm did not show a robust circulation; rather flow appeared to have the structure of an open easterly wave trough. Critical to an evaluation of this structure was the tail Doppler radar analyses, which showed very well the co-location of the midlevel circulation (e.g., at 5 km) within the peak of the low-level easterly wave trough (e.g., 2 km, image below). Tropical storm winds were observed, but by definition without the

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presence of a surface circulation, the storm has not completed genesis.

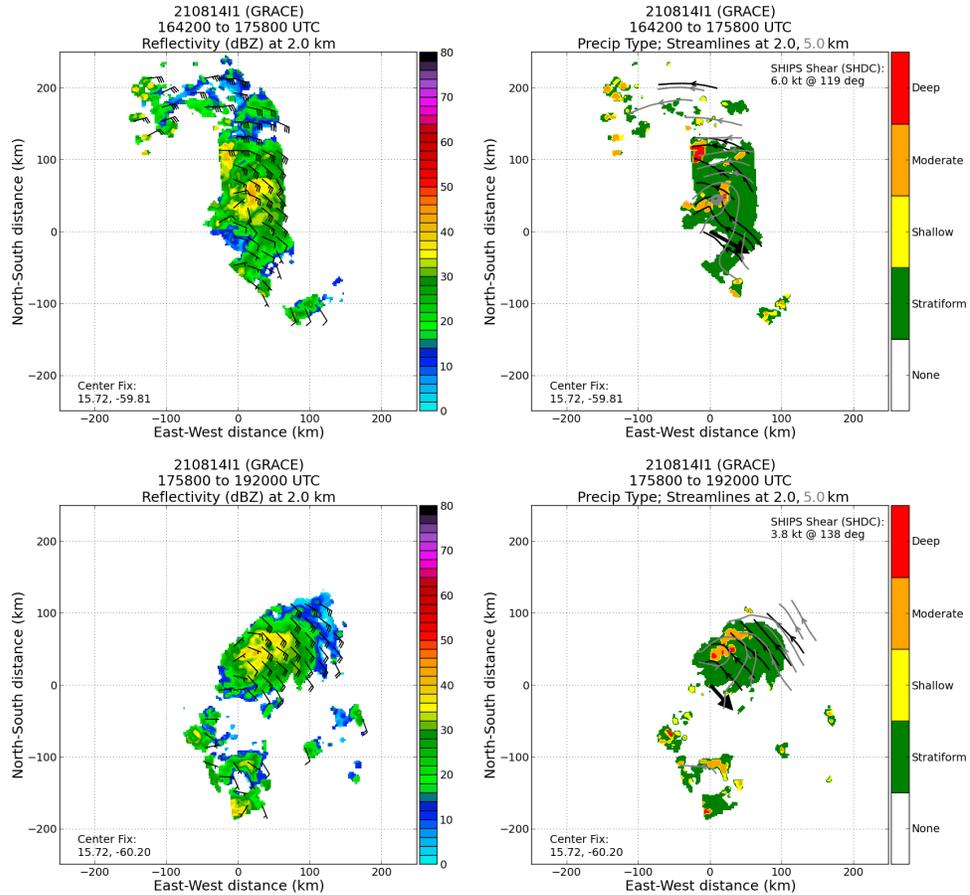


*Zoom into the center of the storm for 2.0 km reflectivity and winds (left image) and 2.0 and 5.0 km streamlines with 2.0 km winds shaded (right image).*

As the PREFORM experiment in the Genesis Stage of APHEX is concerned with identifying the precipitation modes (e.g., stratiform v. convective) during the genesis stage, the tail Doppler radar analyses were quite revealing about the dominant precipitation mode during the flight (see the two images below): stratiform rain. While some isolated areas of (deep) convection were observed, much of the region, at the time of the flight, was stratiform precipitation, which would support the robust midlevel circulation (MCV) observed in the wind structure.

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*The precipitation mode classified from the tail Doppler radar from the two passes of the storm.*

One final interesting observation from this flight was that the disturbance appeared to exhibit multiple vorticity centers at low-levels (see 2 km vorticity below) and a distinct “pouch” (closed circulation in storm relative flow) in low and midlevels that was tilted from NW to SE with height (see image below). The “southern” low-level vorticity center was actually aligned with the midlevel center.

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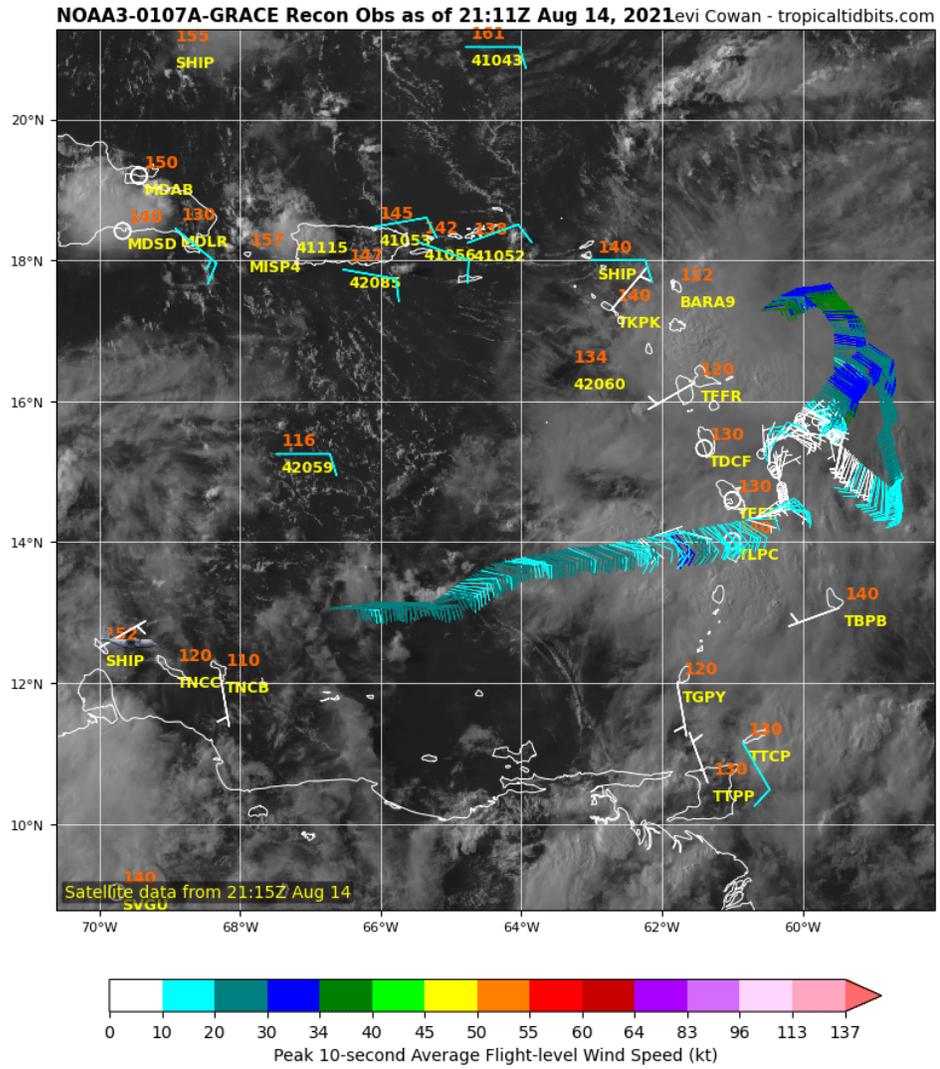
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	<div style="text-align: center;"> </div> <p style="text-align: center;"><i>Relative vorticity and storm-relative streamlines at 2 (left) and 5 (right) km.</i></p> <p>7 total dropsondes were released, all charged to NWS</p>
<b>Actual Standard Pattern Flown</b>	Alpha pattern at 5000 ft
<b>APHEX Experiments / Modules Flown</b>	Data will be useful to the <i>Genesis Experiment: PREFORM</i> since the storm appears to not yet have a clear low-level circulation; therefore, of interest could be the location and development of the surface center in relation to the midlevel circulation observed (and the precipitation).
<b>Plain Language Summary</b>	<ul style="list-style-type: none"> <li>• While NHC upgraded TD7 to a tropical storm, it was apparent from the aircraft data from this flight that Grace had not completed its formation stage as there was a clear circulation higher up (~15000 ft), but no robust, clear circulation in the low levels or at the surface.</li> <li>• A classic structure was observed of an “open” easterly wave trough in low-levels with a circulation superimposed on that in the middle troposphere, likely originating from the extensive stratiform rain that was also observed within the wave trough from the tail Doppler radar on the P-3.</li> </ul>
<b>Instrument Notes</b>	All instruments performed nominally

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Final Mission  
Track



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