

Mission Summary

20060915N Aircraft 49RF

SALEX Flight 2006

Scientific Crew (49RF)

Lead Scientist	Jason Dunion
Dropsonde Scientist	Peter Black
Visiting Scientist	Chidong Zhang

Aircraft Crew (49RF)

Aircraft Commander	Michele Finn
Pilots	John Longenecker Will Odell
Project Manager	Jack Parrish
Flight Meteorologist	Barry Damiano
Equipment Specialist	Gordon Kitson
Electronics Technician	John Hill
Electronics Technician	Bobby Peek
Electronics Technician	Mark Rogers

Mission Plan:

NOAA 49RF will fly a Saharan Air Layer Experiment (SALEX) around Tropical Storm Helene as part of IFEX. The G-IV will leave Barbados at 1500 UTC and will recover back at Barbados at 2145 UTC. The flight track will take the G-IV on a clockwise circumnavigation of the TC and is shown in Fig. 1, along with the 25 GPS dropwindsonde points.

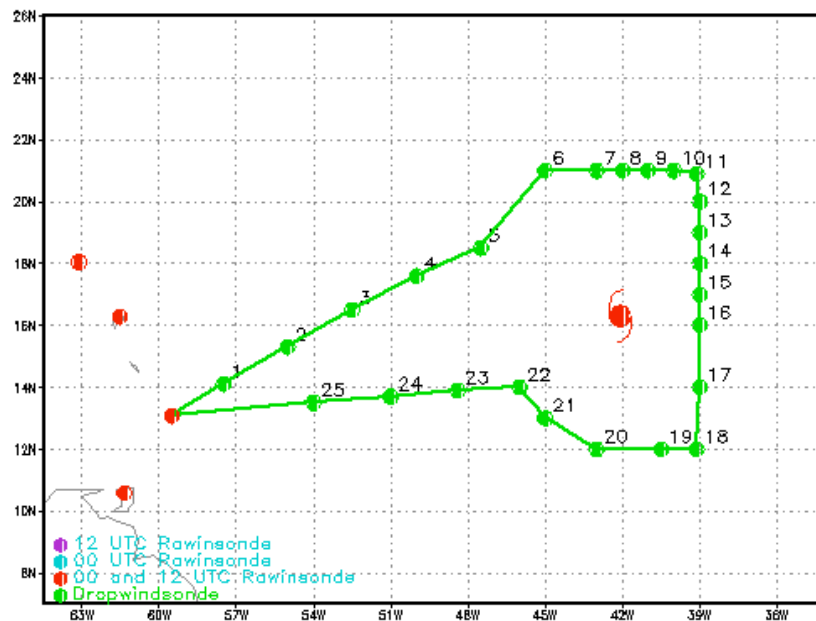


Fig. 1: Flight track (green line) for SALEX mission 060915n. The GPS dropsonde points (25 total) are indicated by green circles.

Mission Summary:

a) Synoptic Situation

Pre-Hurricane

Helene emerged from the coast of North Africa as a vigorous AEW on 12 September (Fig. 2). Figure 2 also shows that a very large Saharan Air Layer (SAL) outbreak was located to the north and west of this system at this time. The NASA

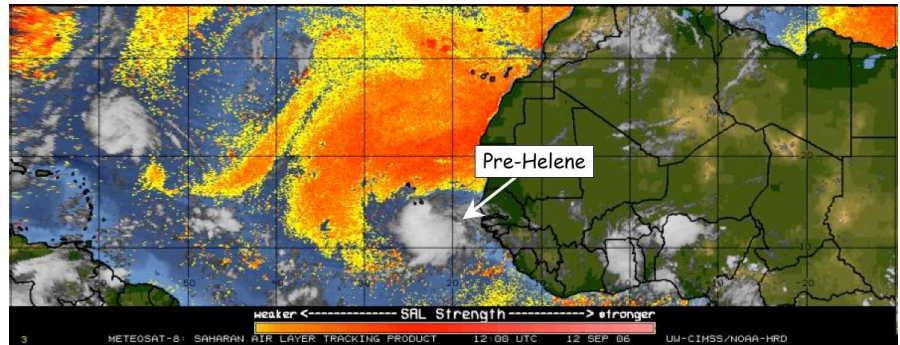


Fig. 2: SAL imagery (12 September 1200 UTC) showing a large SAL outbreak (yellow to red shading) north and west of the AEW that eventually developed into Hurricane Helene.

DC-8 flew a single mission into Tropical Depression 8 (pre-Hurricane Helene) on 12 August from Sal, Cape Verde. This mission was part of the NAMMA field program and the main objectives included cyclogenesis, Saharan Air Layer/dust, and microphysics studies. The disturbance tracked to the west-northwest around the southeast periphery of a deep layer ridge [Fig. 3 (left)] over the next several days, which brought it into the suppressive influence of SAL and within range of the NOAA G-IV. The G-IV was deployed to Barbados on 14 September for a set of back-to-back SALEX missions on 15 and 16 September.

At 1800 UTC during the day of the mission, Tropical Storm Helene was located at $\sim 16.3^\circ\text{N}$ 42.1°W . A large deep layer ridge was located to its northwest [Fig. 3 (left)] and Hurricane Gordon was located on the northern edge of this ridge (~ 2000 km NW of Helene, Fig. 3). Tropical Storm Helene was located in a region of warm SSTs and low shear (<10 kt). Shear tendency analyses from UW/CIMSS showed that vertical wind shear in the region around Helene had been decreasing by ~ 5 - 10 kt. The dry air and strong winds associated with the SAL appear to have been the only negative environmental factors impacting the storm at this time.

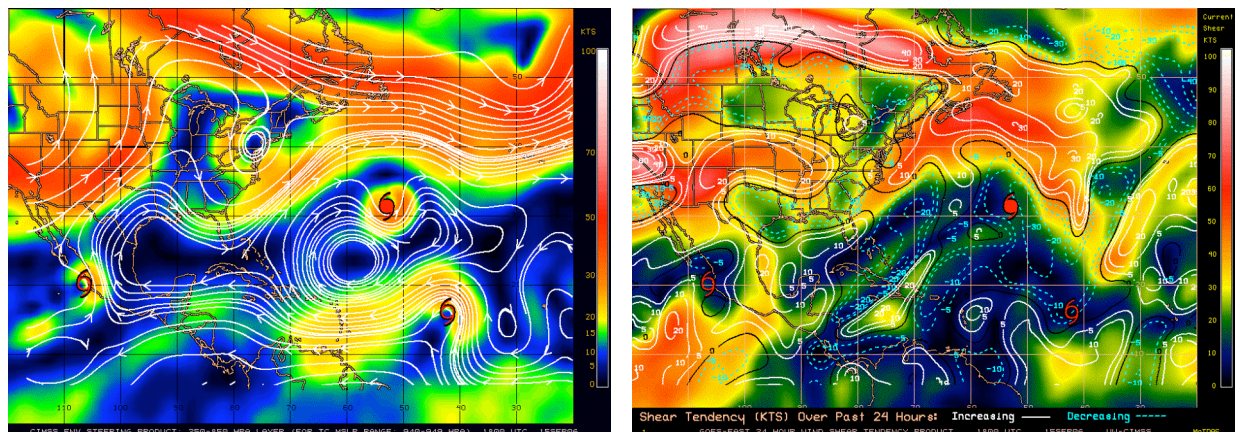


Fig. 3: Plots of (left) 250-850 hPa deep layer mean steering [magnitude (direction) of the steering flow is indicated by colored shading (white streamlines)] and (right) 24-hr wind shear tendency for 15 September 1800 UTC. Helene was located at $\sim 16.3^\circ\text{N}$ 42.1°W at this time. Hurricane Gordon is also indicated on the images ~ 2000 km northwest of Tropical Storm Helene. Images courtesy of UW/CIMSS.

b) Mission Specifics

The flight plan was designed to investigate a large SAL outbreak that was positioned west and north of Tropical Storm Helene (Fig. 4, *SAL 1*) and the moist tropical environment immediately surrounding the storm [Figs. 4 & 5 (TPW >45 mm; yellow to red shading)]. The flight plan called for initial sampling west and north of the storm at an optimal flight level of 41,000-45,000 ft. Subsequent north-south (Figs. 4 & 5, drops 11-18) and east-west (Figs. 4 & 5, drops 18-20) legs were made to sample a dry SAL intrusion that was wrapping in around the southwest quadrant of the storm. All GPS dropwindsondes were transmitted in real-time, so that data from the sondes could be assimilated into the NOAA GFS model.

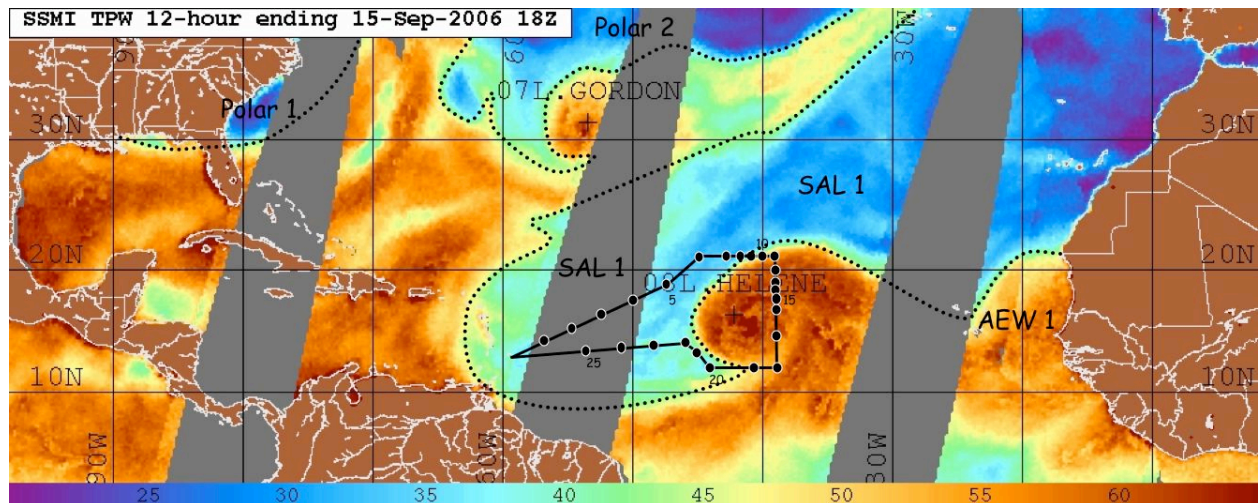


Fig. 4: Mosaic of total precipitable water (TPW) from the constellation of SSM/I satellites (1800 UTC 15 September 2006). Regions where TPW values of <45 mm (dotted lines) indicate dry air in the low to mid-levels of the atmosphere (~600-925 hPa). One distinct area of dry SAL air (*SAL 1*), two areas of dry polar air (*Polar 1* & *2*), an African easterly wave (*AEW 1*), Hurricane Gordon, and Tropical Storm Helene are indicated in the imagery. The G-IV flight track (black curve) and dropsonde points (black circles) are overlaid on the imagery. Imagery courtesy of NRL-Monterey.

Takeoff was at 1500 UTC from Barbados. A large SAL outbreak was stretched from the eastern Caribbean to North Africa and already overspread the West Indies region the day before the 060915n mission (Fig. 4, *SAL 1*). Additionally, zoomed SSMIS TPW imagery from 1104 UTC suggested that dry SAL air (<45 mm TPW; green to blue shading) was likely being advected toward the inner core region of Helene (Fig. 5). Figure 6 shows the 060915n flight track overlaid on the 15 September 1800 UTC GFS model analysis of 700 hPa relative humidity. Although the GFS model analysis appeared to accurately depict the spatial extent of the SAL that was surrounding Helene (Fig. 4, *SAL 1*; Fig. 6, 700 hPa RH of <50%), preliminary data from GPS dropwindsondes launched during the mission suggests that the model was significantly overestimating the mid-level moisture in regions of the SAL. Figure 6 shows that the GFS analyzed the SAL's 700 hPa RH along the flight track to be no lower than ~30%. In fact, the GFS analyzed most of the SAL west of Helene to contain ~40% RH at 700 hPa. However, GPS dropwindsondes showed several regions in the SAL where mid level moisture was ~5-20% RH.

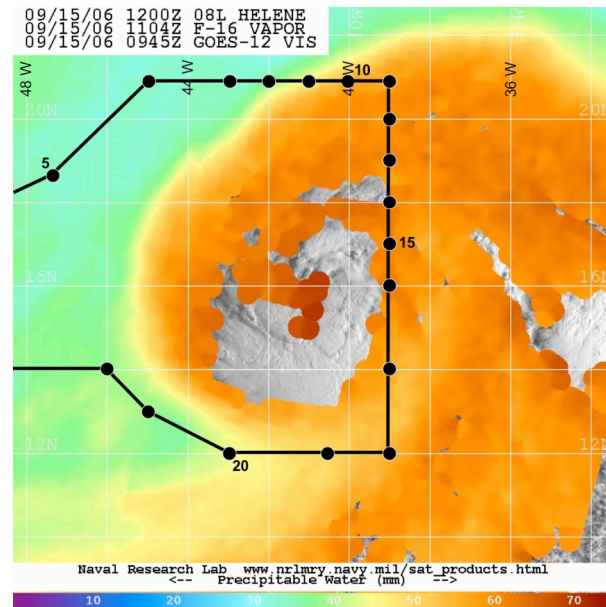


Fig. 5: SSMIS total precipitable water (TPW) imagery showing Tropical Storm Helene on 15 September 1104 UTC. The SAL's dry air is indicated by values of <45 mm (green to blue shading) in the TPW image. The G-IV flight track (black curve) and dropsonde points (black circles) are overlaid for reference. Imagery courtesy of NRL-Monterey.

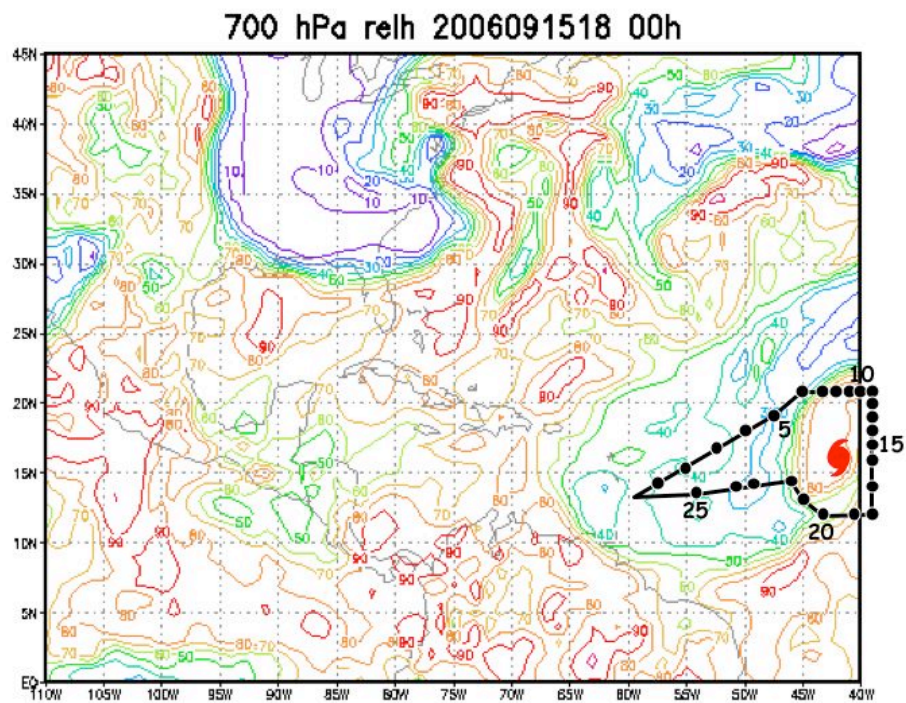


Fig. 6: Analysis of GFS 700 hPa relative humidity (%) for 15 September 1800 UTC. The G-IV flight track (black lines), GPS dropsonde points (black circles), and location of TS Helene are overlaid on the analysis.

Problems:

There were no major problems related to this flight. Although “codeless” GPS dropsondes mainly from 2000-2004 were used, only one dropsonde failed out of the 26 that were dropped.