NASA Airborne Platforms and Instrumentation Relevant to Tropical Cyclones

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**NASA Earth Science Research Capable Aircraft (2016)**

**WB-57:** Aging aircraft, but *great* performance in TCI 2015

**ER-2:** Overflies almost any weather; satellite simulator

**DC-8:** Upper-level microphysics and remote sensing

**Global Hawk:** ~24-h duration. Moving to Block 10 from the initial prototypes.
Hurricane Imaging Radiometer (HIRAD) 2015 Science Flights (ONR TCI project on WB-57)

Surface Wind Speed Retrievals in Hurricanes Marty, Joaquin, and Patricia
High-Altitude Imaging Wind and Rain Airborne Profiler (HIWRAP)

MEASUREMENTS:
Map the 3-dimensional winds and precipitation within hurricanes and other severe weather events.

Map ocean surface winds in clear to light rain regions using scatterometry.

NASA Global Hawk:
19 km altitude, 24 hours

HIWRAP Characteristics:
• Conically scanning.
• Simultaneous Ku/Ka-band & two beams @30 and 40 deg
• Winds using precipitation & clouds as tracers.
• Ocean vector wind scatterometry similar to QuikScat.
HIWRAP made 20 crossings of Hurricane Karl on September 17, 2010 during GRIP over 14 hours.

Doppler line of sight wind measurements are continually profiled during the conical scans.

Horizontal winds are calculated from Doppler winds from multi look angles as the Global Hawk passes across the storm.

Horizontal winds (m/s) and reflectivity (dBZ) derived from one pass across Hurricane Karl’s eye/eyewall region.

Grid is at 1.5 km x 1.5 km x 0.150 km intervals.
Wide swath from NASA MSFC’s HIRAD (left panels) quickly maps the wind structure of the hurricane.

Narrow sampling from operational instruments (right panels) requires several passes by the aircraft.

Assimilation graphics courtesy Jason Sippel
ER-2 over Hurricane Emily (2005)

EDOP

AMPR Precipitation Index
Based on 10, 19, 37, 85 GHz

GOES IR