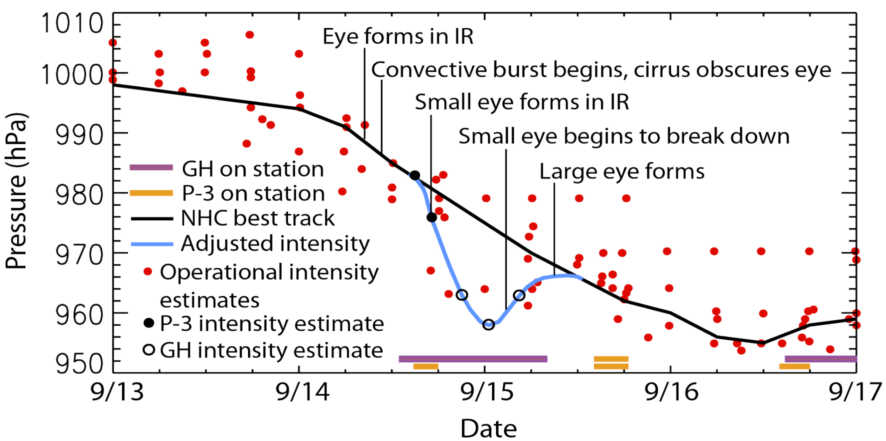
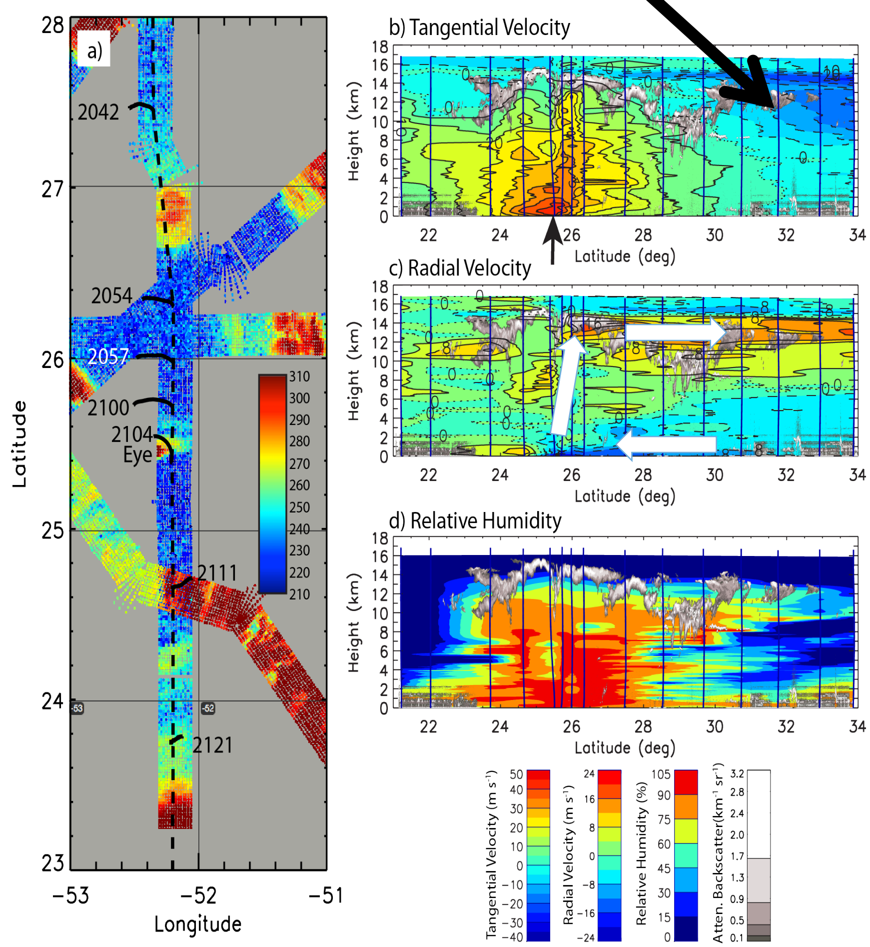
HS3 Observed Hurricane Edouard's Rapid Intensification (RI)

HS3 dropsondes detect RI episode missed by the National Hurricane Center



- RI onset (detected by dropsondes) coincident with large convective burst and formation of very small eye in GOES imagery
- RI also concurrent with decrease in environmental vertical wind shear, allowing convection and vortex to remain upright
- Although GOES cloud tops appeared to be symmetric about the storm center, the radial and tangential flows remained highly asymmetric, counter to expectations

Strong anticyclonic outflow



From Braun et al. (2015)

Name: Scott Braun, NASA/GSFC, Code 612
E-mail: scott.a.braun@nasa.gov
Phone: 301-614-6316

Publication: "NASA's Hurricane and Severe Storm Sentinel (HS3) Investigation" by Scott Braun, Paul Newman, and Gerald Heymsfield (NASA.GSFC). Bulletin of the American Meteorological Society, (submitted).

Data sources: Data from the HS3 2012-2014 field campaigns. The paper focuses on three topics: The rapid intensification of Hurricane Edouard (2014), the interaction of Hurricane Nadine (2012) with the Saharan Air Layer (not shown in this slide), and the characteristics of upper-level storm outflow. The paper also includes a sidebar on measurements of Hurricane Gonzalo from the High-altitude Wind and Rain Airborne Profiler (HIWRAP) Doppler radar. Data used in the paper includes dropsondes, Cloud Physics Lidar (CPL) attenuated backscatter, scanning high-resolution interferometer sounder (S-HIS) brightness temperatures and retrieved temperatures and relative humidity, and HIWRAP radar reflectivity.

Technical Description of Figures:

Top left: Summary of Edouard's intensity time series. Black line indicates the National Hurricane Center best-track intensity. Red circles represent operational satellite-derived intensity estimates. Black and open circles represent intensities from NOAA P-3 and NASA Global Hawk dropsondes, respectively. Dropsondes and operational satellite intensities suggest a period of RI, followed by rapid weakening. Key evolutionary features from GOES are indicated by text.

Right panels: (a) S-HIS brightness temperatures for the north-to-south flight segment corresponding to the vertical cross sections (b-d). Blue (red) colors indicate high (low) clouds. The location of the eye and times of dropsonde releases are indicated. Small black line segments indicate dropsonde trajectories relative to the flight track (dashed black line). (b) Tangential velocities showing strong cyclonic flow (yellow to red colors) beneath the CPL-detected cloud tops (gray shading) transitioning to anticyclonic flow (blue colors) above and radially outward from the clouds. (c) Radial velocity showing inflow (blue colors) primarily from the north (right side) and strong outflow (orange and red) at upper levels, also primarily to the north, leading to the strong anticyclonic flow well north of the storm in (b). South of the storm center [center at black vertical arrow under panel (b)], only weak inflow at outflow is present, showing the highly asymmetric structure of the radial flow. (d) Relative humidity, with dark blue colors showing very dry air. In (b-c), vertical lines show dropsonde profile locations. White arrows in (c) indicate the sense of the dominant radial circulation.

Scientific significance, societal relevance, relation to future missions: The Global Hawk provides a valuable capability for mapping out large regions of the storm and its environment. The study highlights key findings from HS3 related to rapid intensification, storm-SAL interactions, and outflow characteristics. Of particular note here is that RI occurs after a decease in environmental vertical shear, an intense convective burst, and formation of a very small eye. The RI is cut short and the storm weakens briefly as the small eye is replaced by a much larger eye. The paper will be the key reference for all other HS3 related papers to be submitted over the course of the next few years (~20 papers expected within the next year based upon feedback from HS3 related investigators).