

Doppler Wind Lidar on the Hurricane Reconnaissance Aircraft

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Lidar WG meeting

3 November 2015

Overview

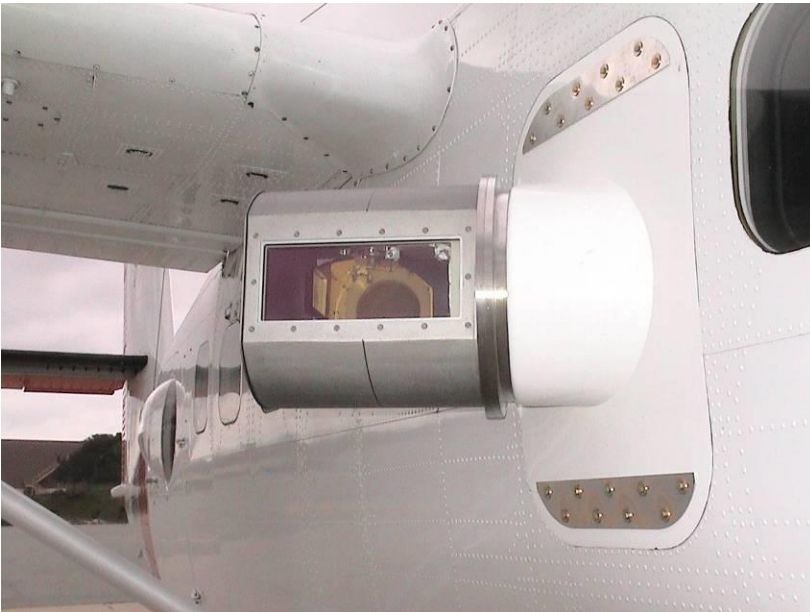
- Army's WTX system (Dave Ligon) "finally" installed and flown on NOAA N43.
 - Same system that flew on Navy's P3 during TPARC-08
- Trained three NOAA people to operate the system
- Conducted flight test on August 6, 2015
- System flew until August 28 when it was removed from N43 per schedule.
- While some useful data was collected, there were multiple problems
 - Scanner sticking
 - Operation faults...exception handling
- Profiles processed and provided to AOML for impact study



The TODWL system

A CIRPAS instrument

(Twin Otter Doppler Wind Lidar
primary funding by ONR and NPOESS)

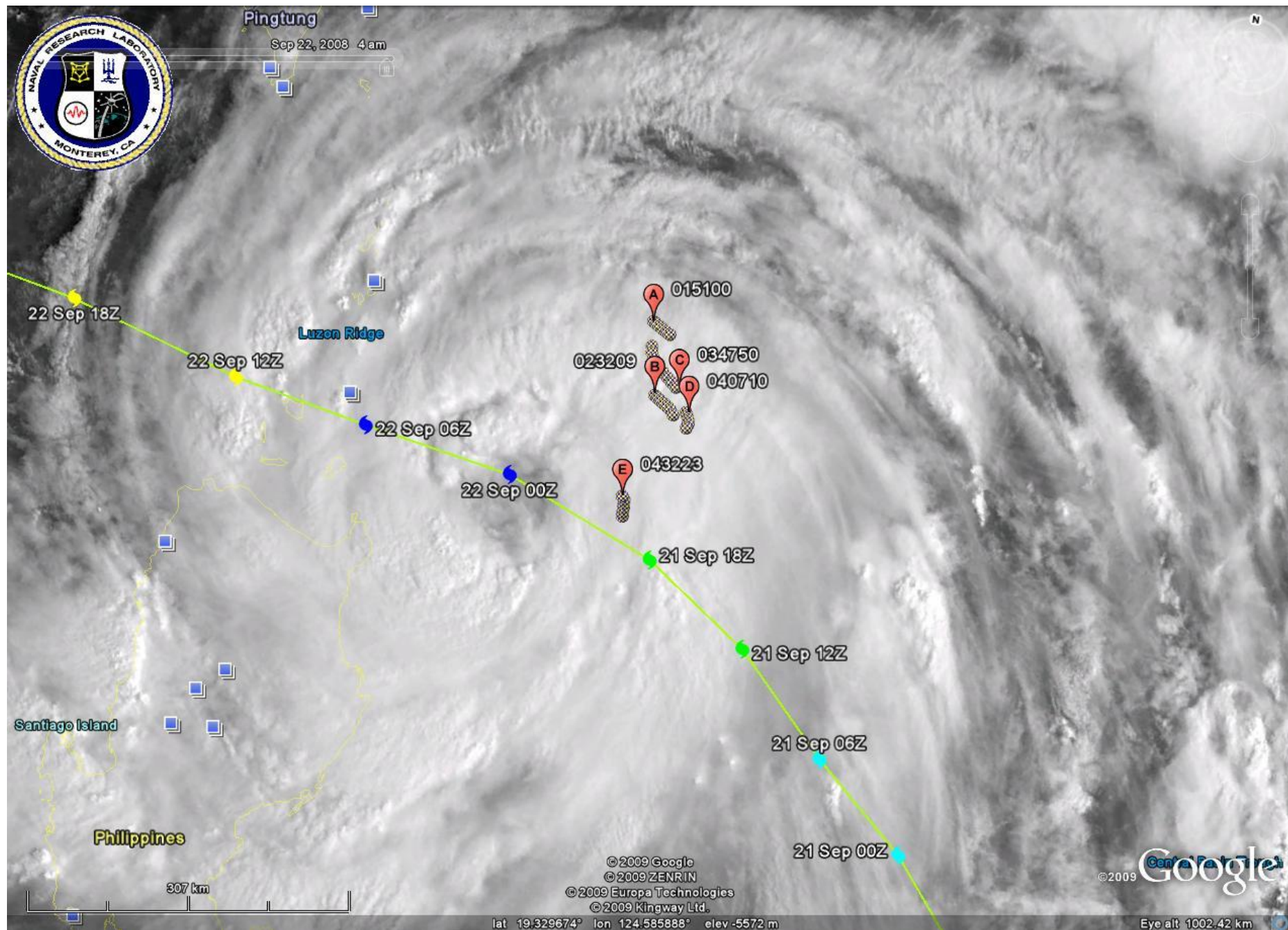


P3DWL for ONR TPARC and NOAA HFIP



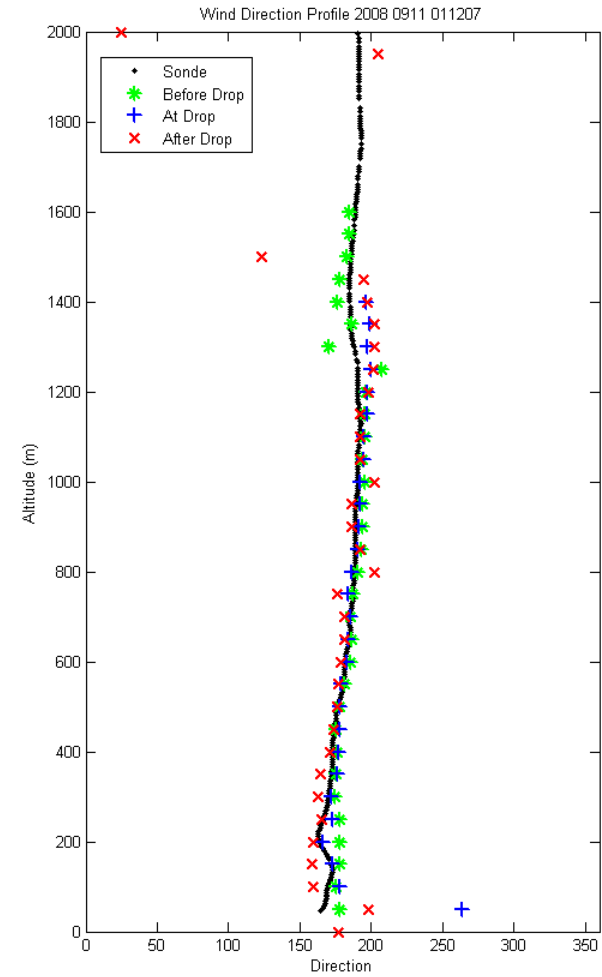
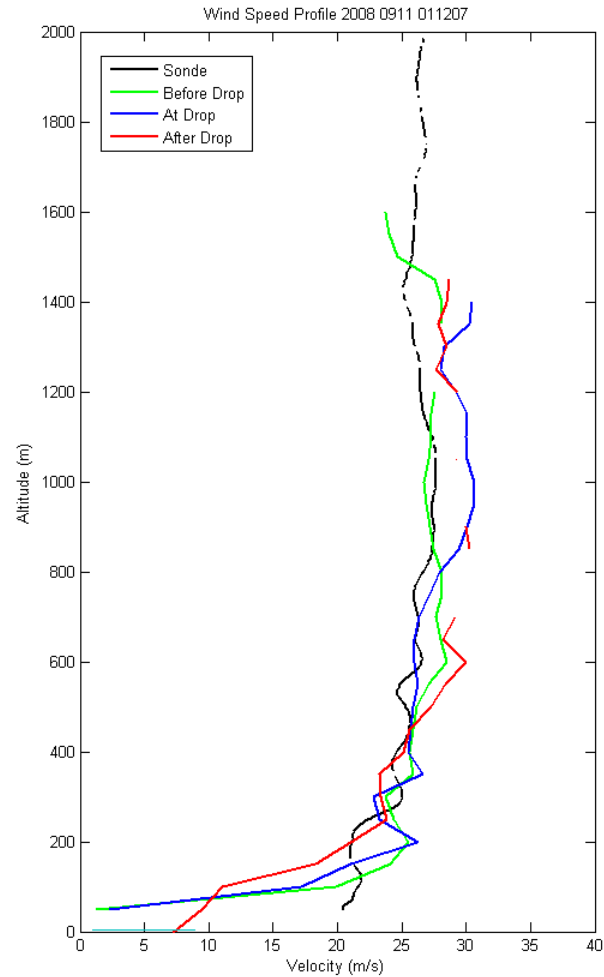
1.6 μm coherent WTX (ARL/LMCT)
10 cm bi-axis scanner (NASA)
P3 and other parts (NRL)
Analyses software (SWA/CIRPAS)



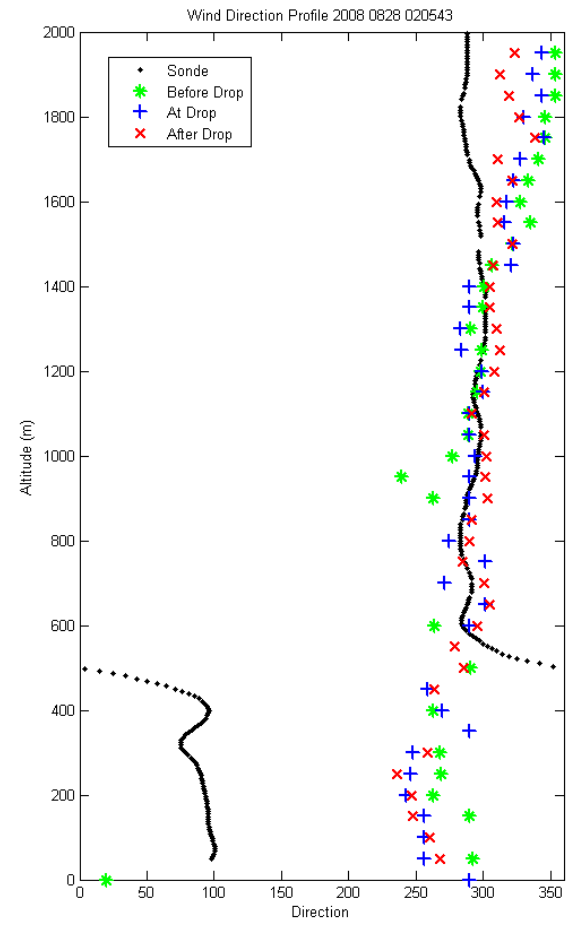
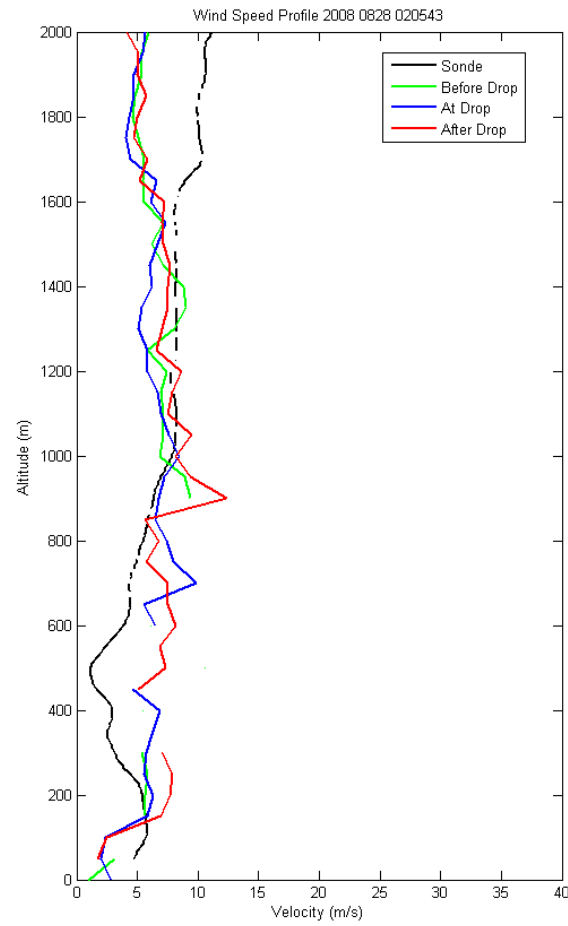


DWL vs. Dropsonde

(high wind speed near eye, no clouds below FL)



DWL vs. Dropsondes (low wind speed, no clouds)



Impact of Airborne Doppler Wind Lidar Profiles on Numerical Simulation of Tropical cyclones: First snapshot with Typhoon Nuri (2008)

Zhaoxia Pu and Lei Zhang, *Department of Atmospheric Sciences, University of Utah*
G. David Emmitt, *Simpson Weather Associates, Inc.*

Model: Mesoscale community Weather Research and Forecasting (WRF) model

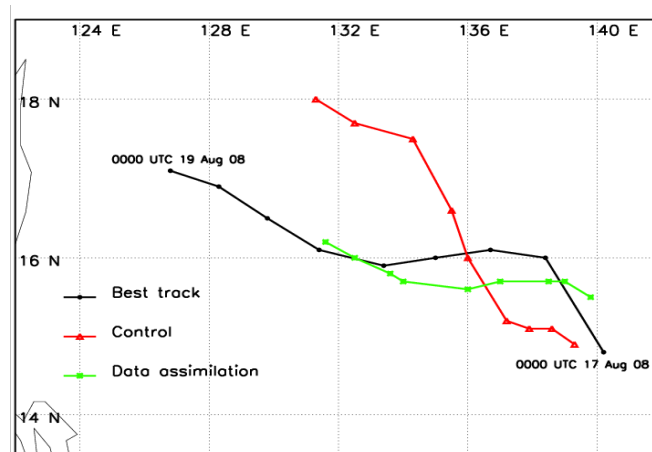
Data: Doppler wind Lidar (DWL) profiles during T-PARC for the period of 0000UTC –0200 UTC 17 August 2008

Forecast Period: 48-h forecast from 0000UTC 17 August 2008 to 0000UTC 19 August 2008

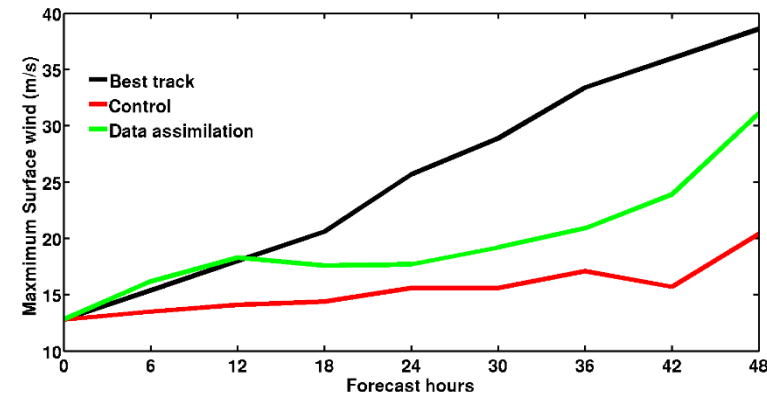
Control: without DWL data assimilated into the WRF model.

Data Assimilation: With DWL data assimilated into the WRF model

Data impact: Control vs. Data assimilation

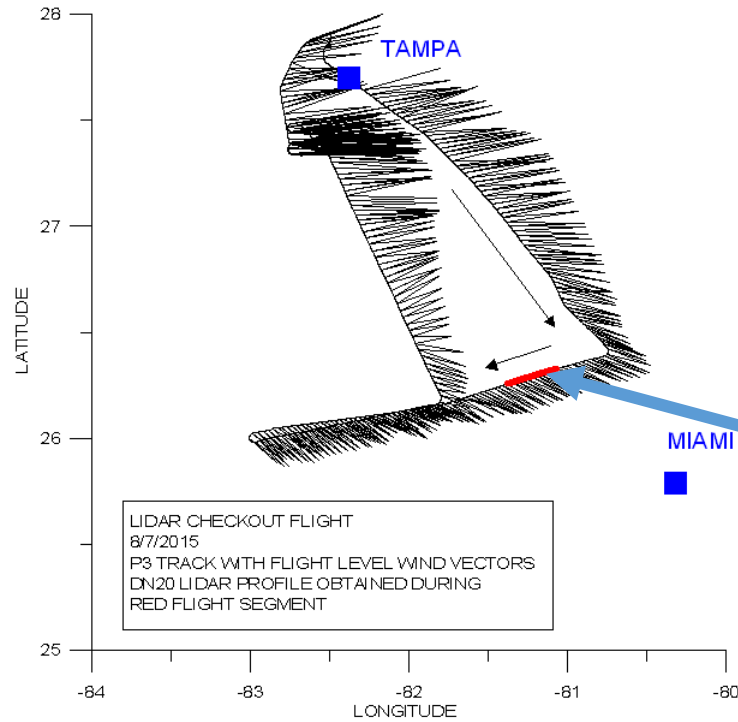


- Assimilation of DWL profiles eliminated the northern bias of the simulated storm track .

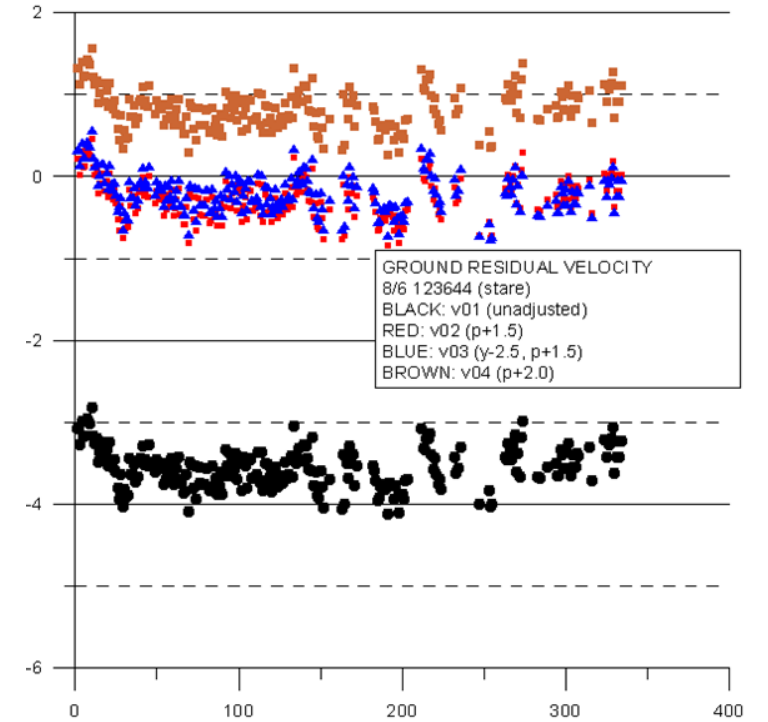
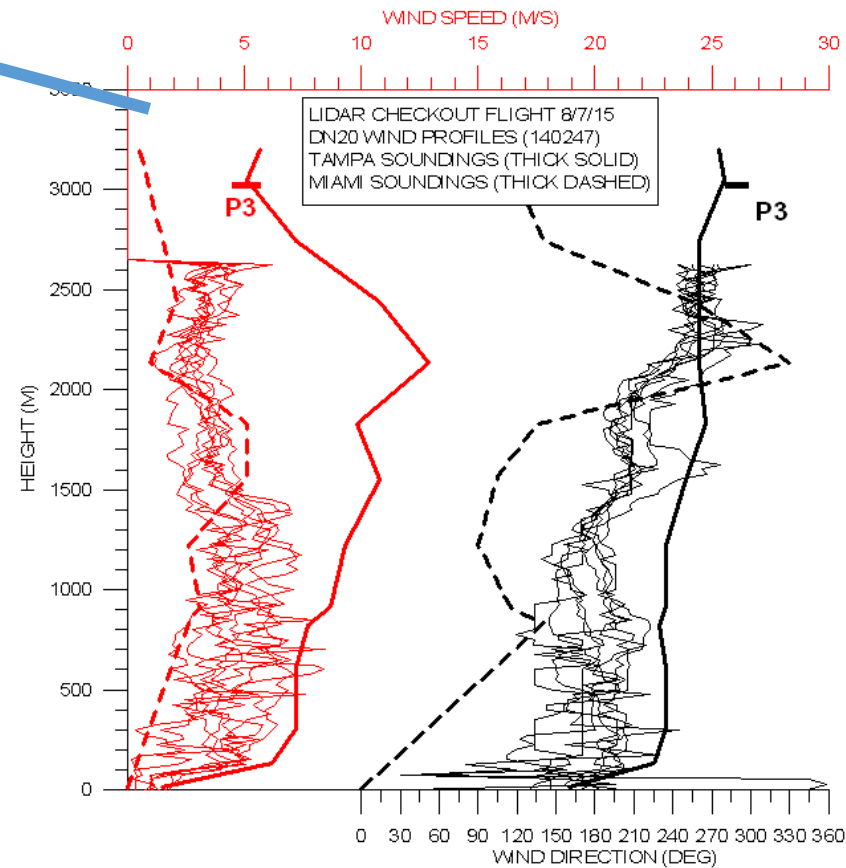


- Assimilation of DWL profiles resulted in a stronger storm that is more close to the observed intensity of the storm.

Checkout flight August 6, 2015



5 minutes of P3DWL
wind profiles compared
to Tampa and Miami
rawinsonde soundings



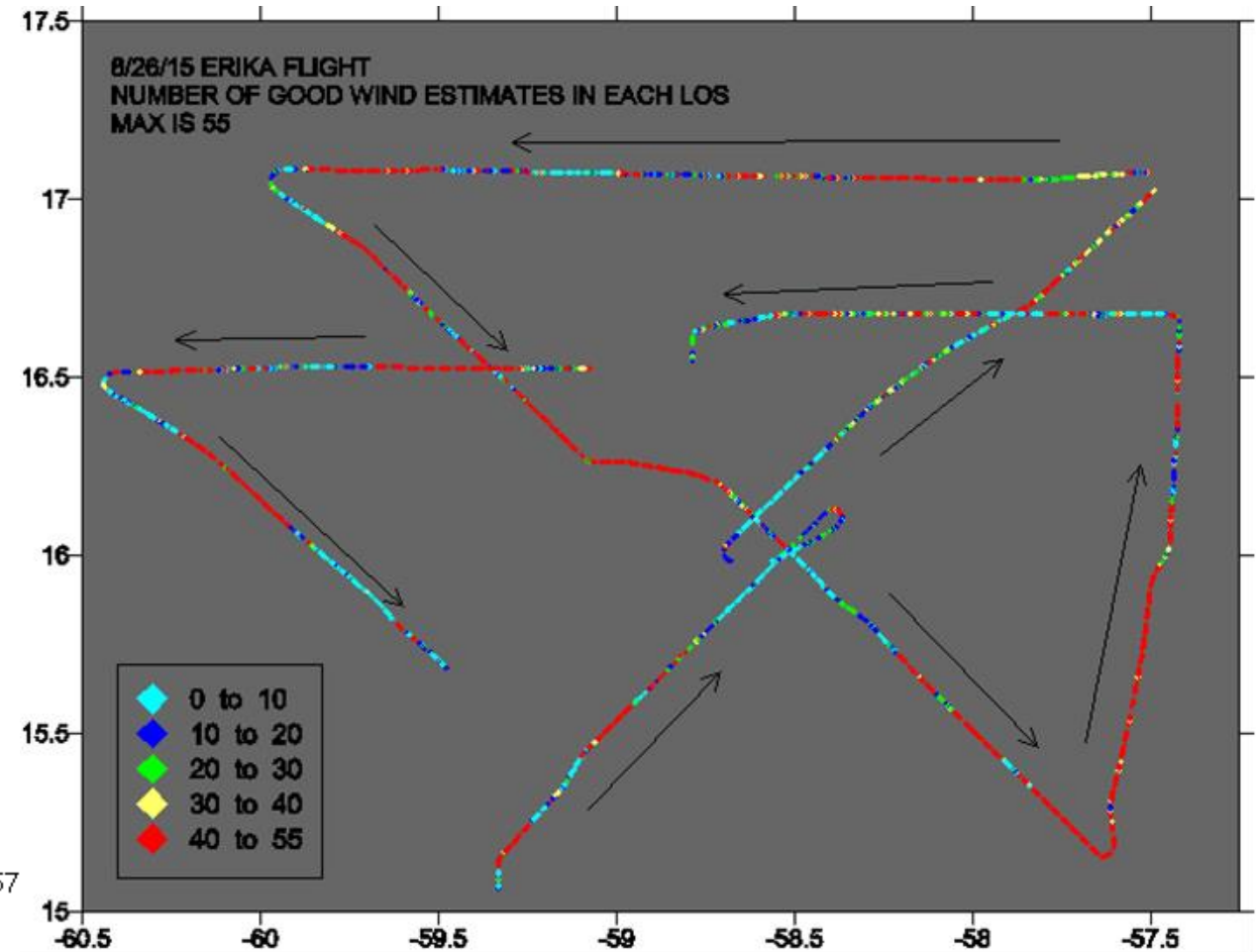
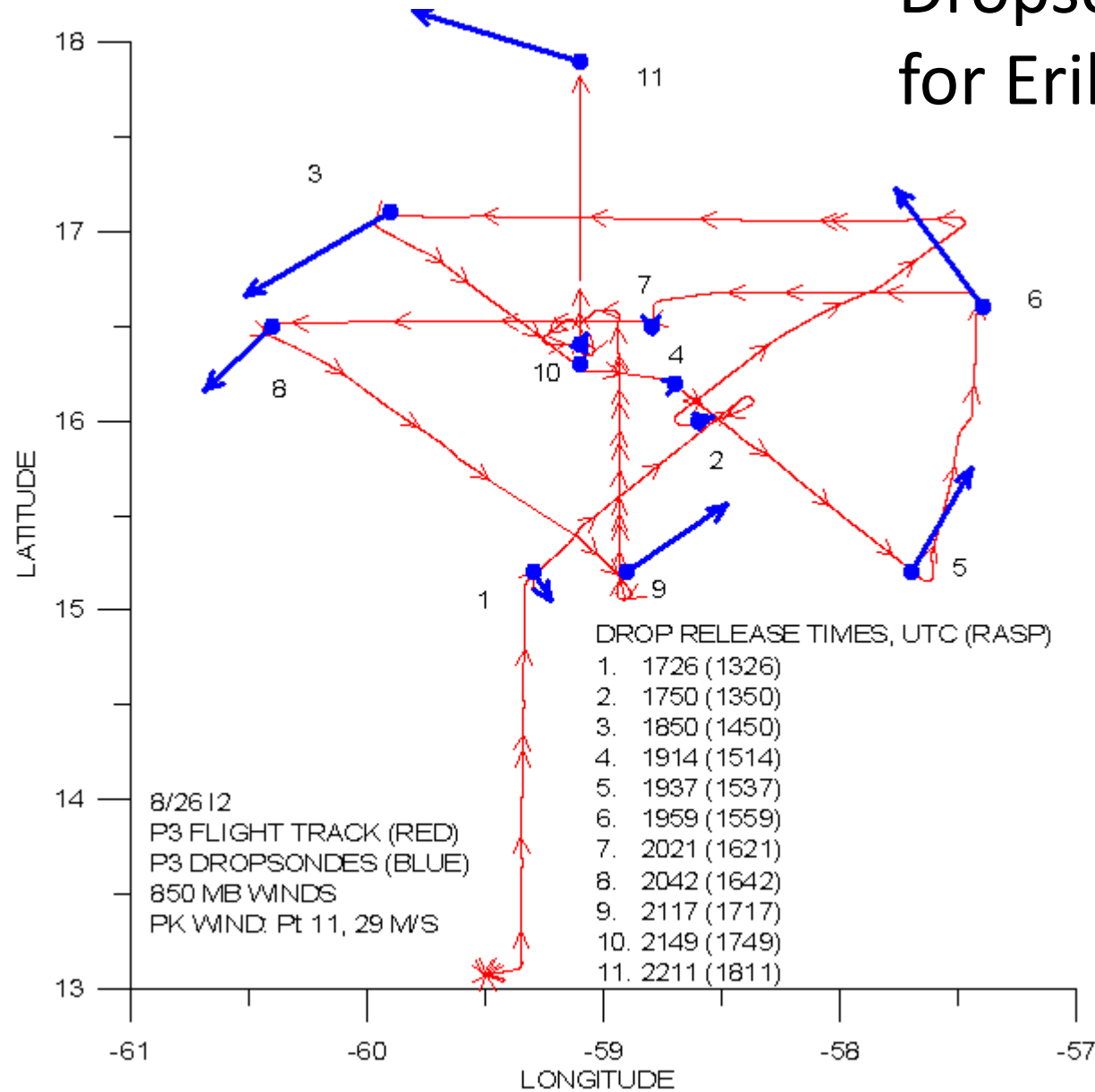
Residual LOS speeds in
ground returns

Scan pattern was a
12 point step stare
with 20 degree off nadir angle

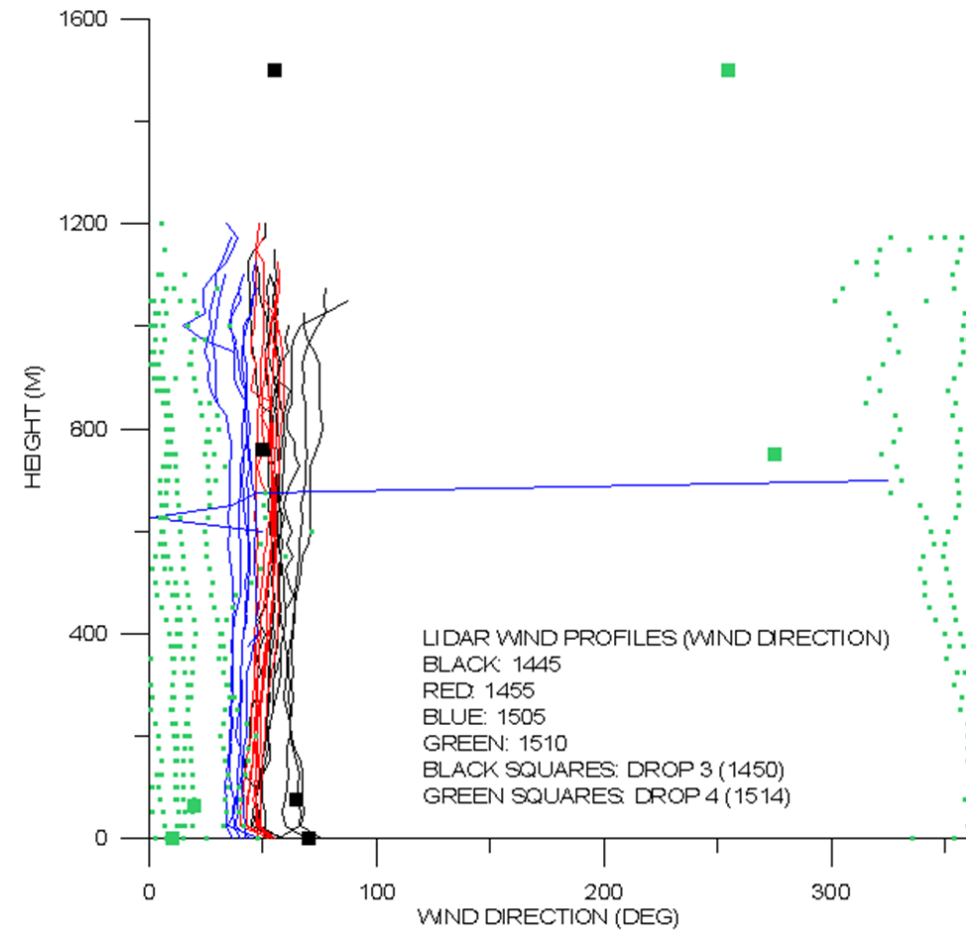
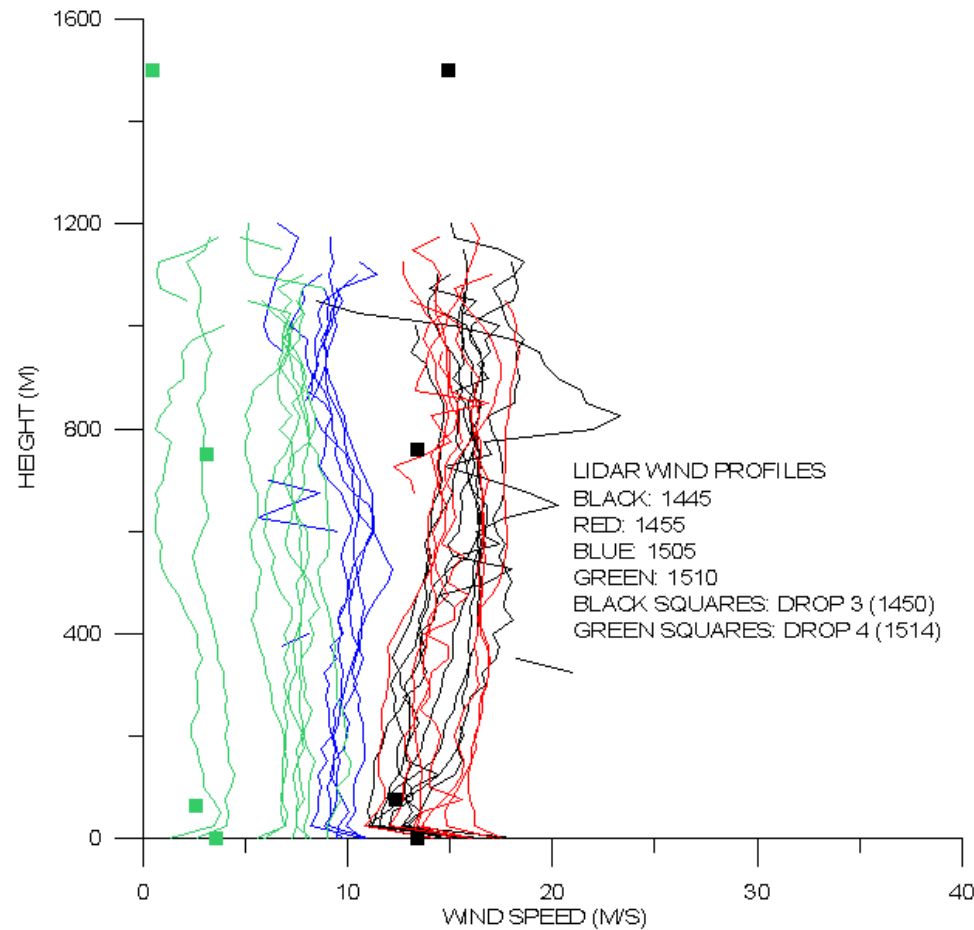
Scanner issue workaround

- Scanner would work properly in the hanger and for the first 1 hour or so after takeoff. The scanner elevation stage would then begin sticking then become unmovable. This problem was more evident at ferry altitudes above 25Kft.
- A workaround was coded and sent down to the P3DWL team. The elevation stage was positioned at 30 degrees forward of nadir and the azimuth stage was swept +/- 30 degrees in 5 degree increments. Two second dwells at each 5 degree step plus the slew time between stares provided 13 perspectives every 30 seconds.

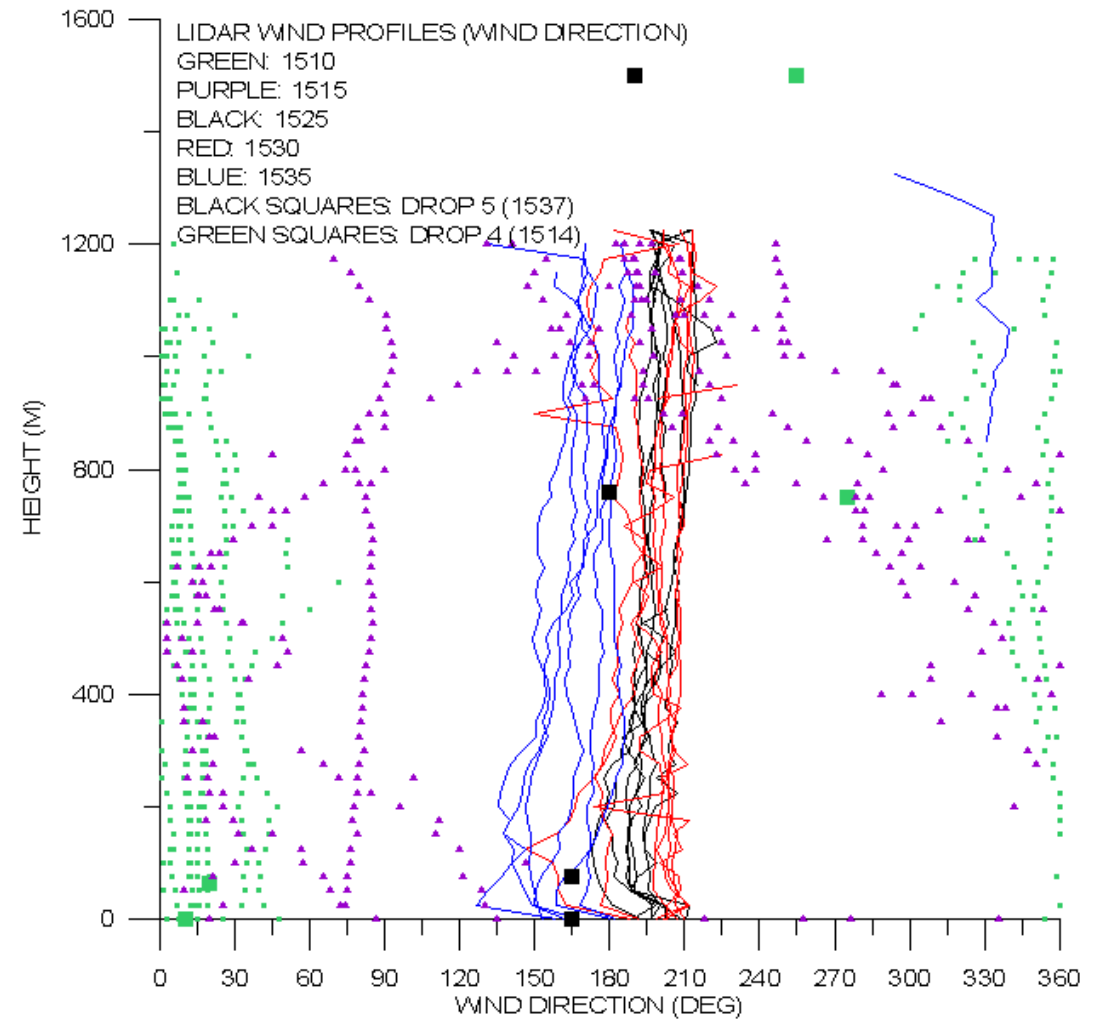
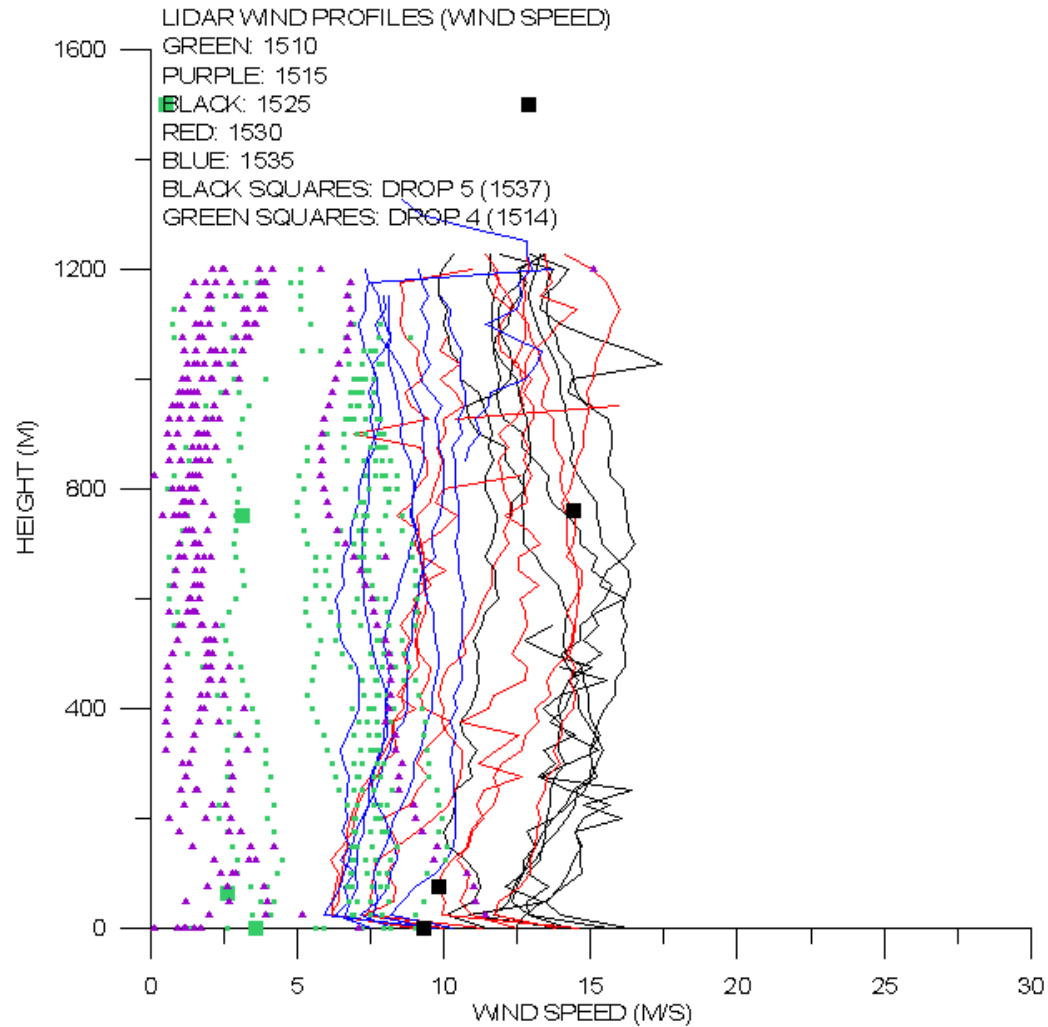
Dropsonde locations and P3DWL coverage for Erika reconnaissance flight 8/26/15



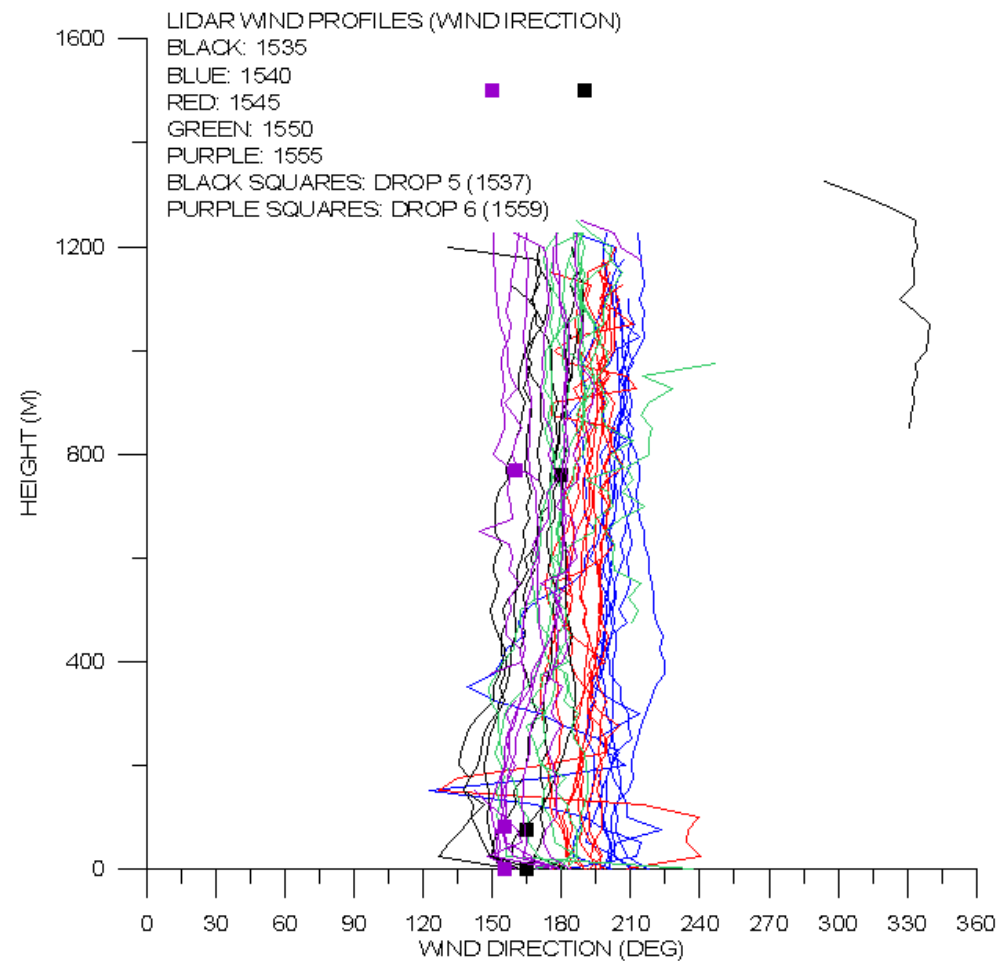
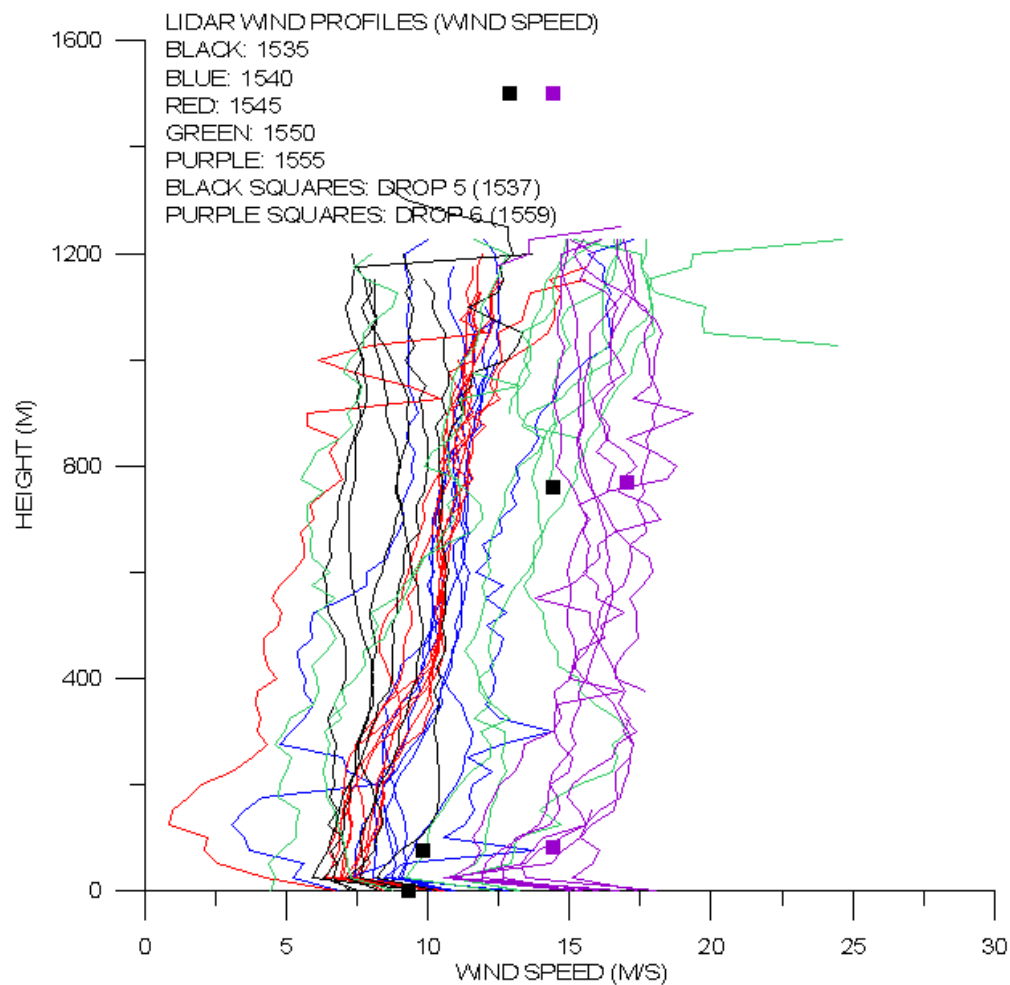
Series of P3DWL profiles and dropsonde data between drop 3 and 4 in Erika



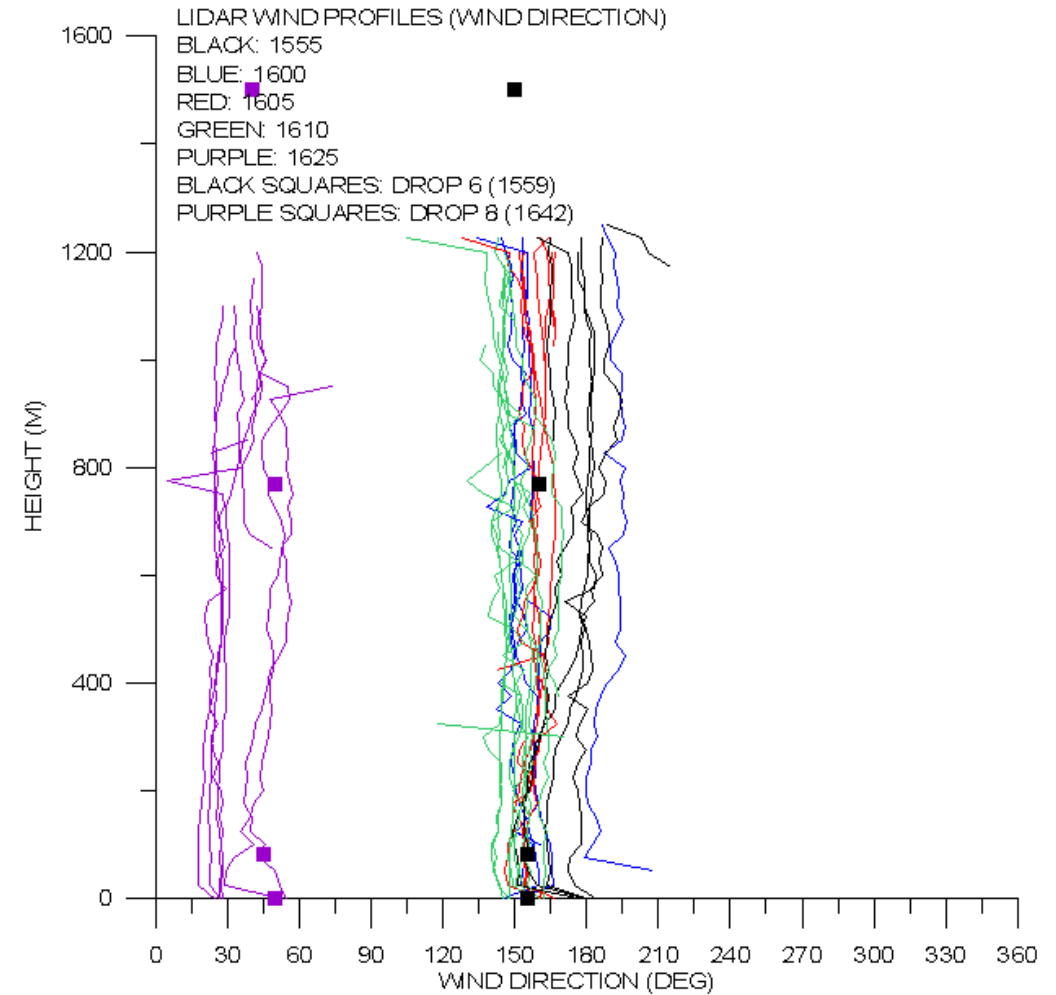
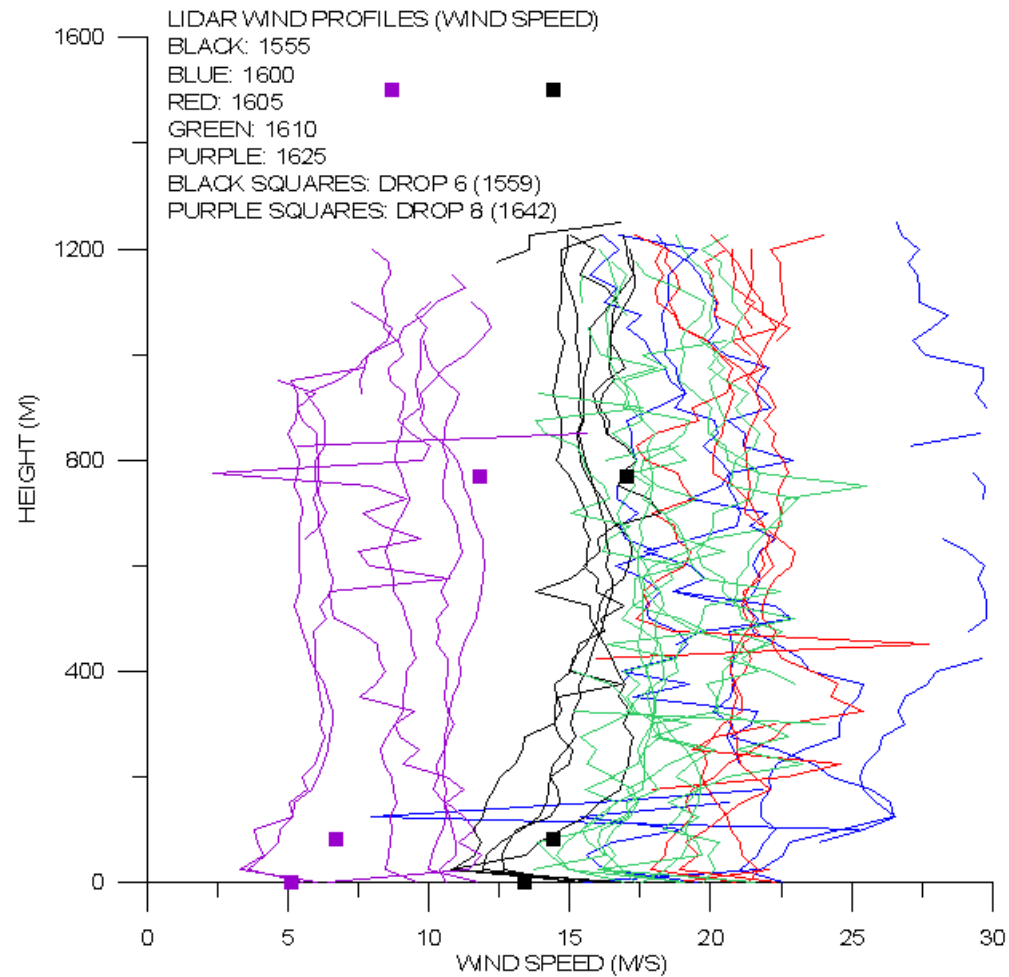
Series of P3DWL profiles and dropsonde data between drop 4 and 5 in Erika



Series of P3DWL profiles and dropsonde data between drop 5 and 6 in Erika



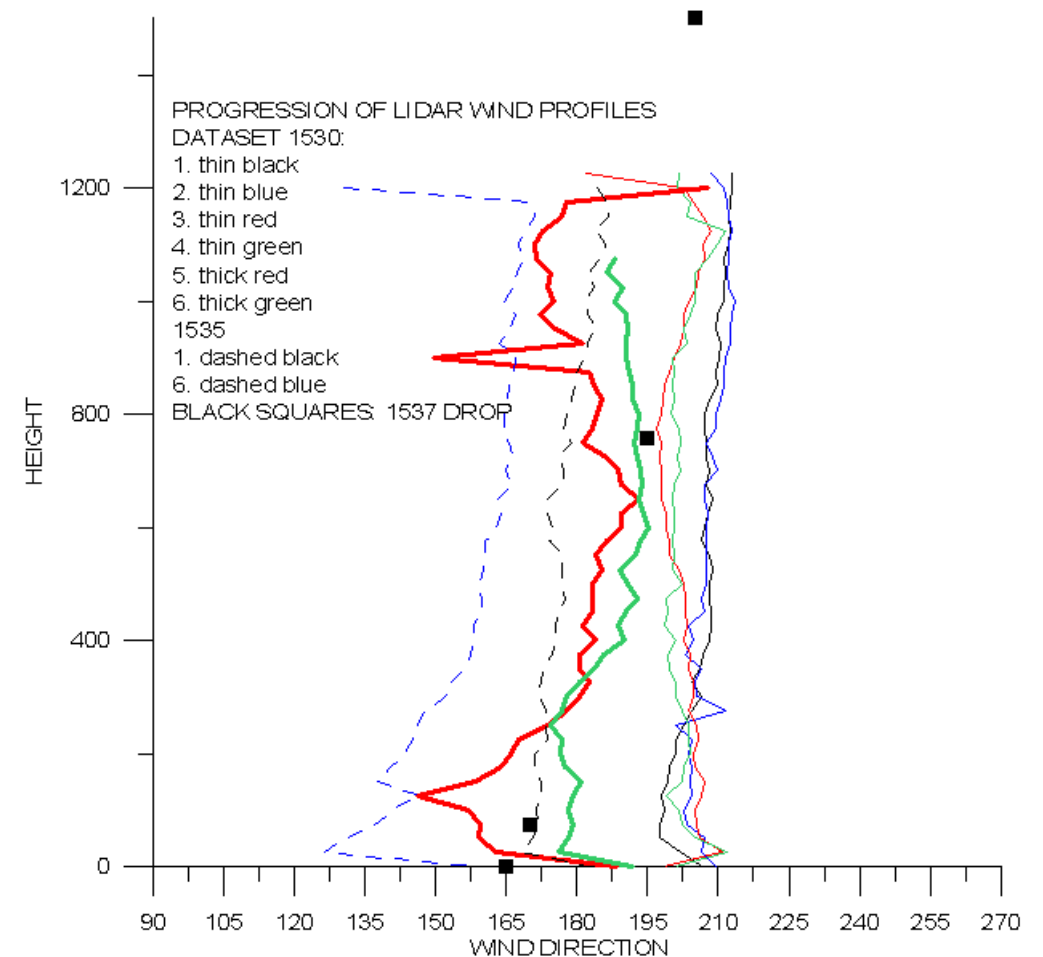
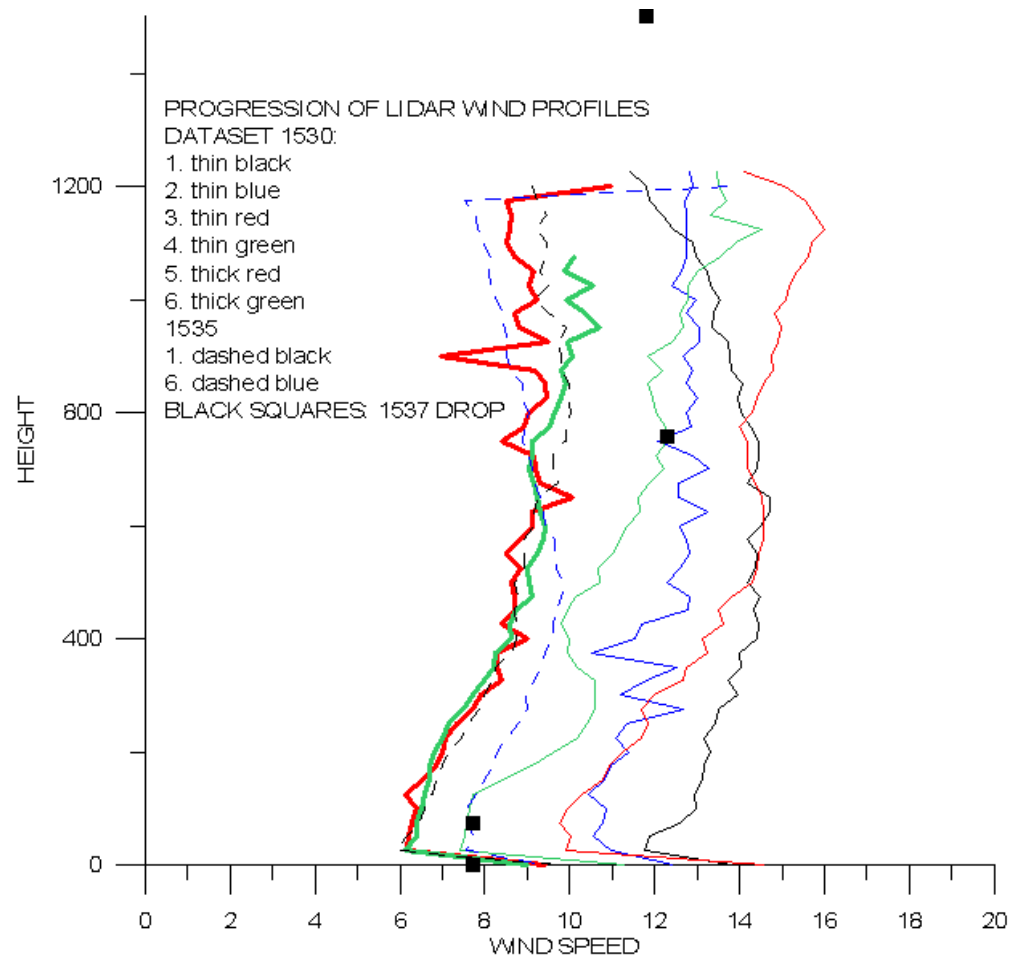
Series of P3DWL profiles and dropsonde data between drop 6 and 8 in Erika



Comments on sweep soundings

- Noisier in the vertical than complete VADs
- Profiles of wind speed and wind direction appear to be quite reasonable and show changes along the flight path that are consistent with the more coarse dropsonde soundings.
- One question is “ are the differences between sequential P3DWL sweep soundings random ?

Closer look at profile trends revealed by P3DWL



Plans for 2016

- Repair scanner
 - Spare parts for major components have been found
 - Planning to conduct temperature chamber tests at NOAA AOC to establish temperature cause of sticking and to checkout any modifications made during the repair.
- Add a UPS to guard against power spikes during transfer from APU to aircraft supply.
 - Assures that system remains stable after startup (~ 15 minutes) and is ready for data taking immediately after takeoff.
- Modify data system to capture 100% of data generated by the new WTX
 - Currently only capturing 20% of 500Hz data stream with old data system
- Conduct test flights in spring 2016 on the N43 before it gets new wings.
 - Transfer system to N42 for the 2016 hurricane season.