NOAA HFIP Use of TACC

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GOAL:
1. Make progress on establishing operational value of higher resolution modeling (global and hurricane, including ensembles) to improving forecast performance.
2. Demonstrate potential of on-demand computing to hurricane forecast operations.
3. Inform future R&D needs for HFIP goals and objectives toward the development and implementation of next-generation HFS.
4. Focus research to provide tangible benefit within 3 - 5 years.

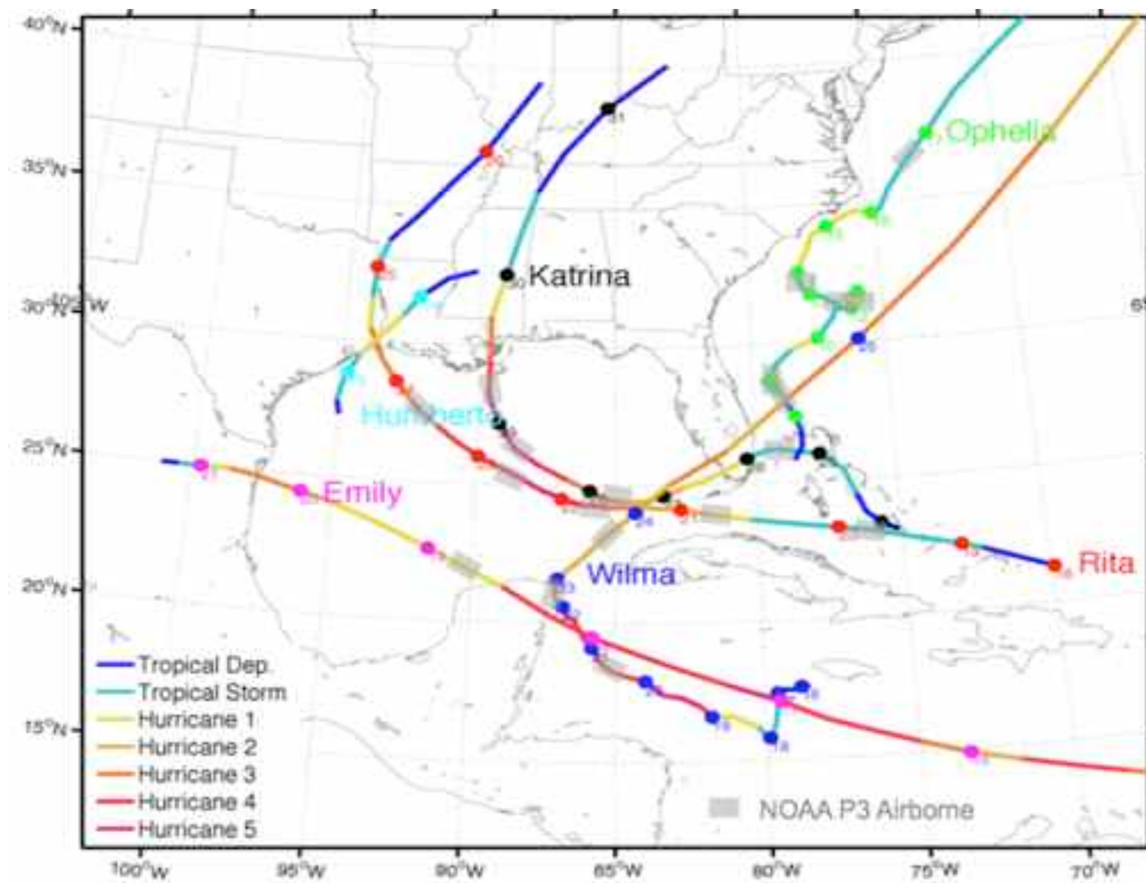
System Name:	Ranger
Operating System:	Linux
Number of Cores:	62,976
Total Memory:	123TB
Peak Performance:	579.4TFlops
Total Disk:	1.73PB (shared)
NOAA Allocation : (until 1 Jan 2009)	30M SUs

- Run up to 10 cases using ARW at 4 horizontal grid resolutions (40.5, 13.5, 4.5, and 1.5 km) with EnKF DA to use airborne Doppler radar data in inner core.
- Run 30-100 ensemble members for track and intensity with this configuration.
- Run similar configuration in real-time with GFS IC/BC and EnKF DA of airborne and ground-based Doppler radar data.
- Run FIM global model at 15-km horizontal resolution for 30 ensemble members.

Assimilation of Doppler Radar OBS for Hurricanes: Tests with some HFIP cases

Plus Dolly and Fay (2008, tracks not shown in map)

- TC initialization is intrinsically multiscale; initial vortex and convective details can both be important for intensity, structure and precipitation forecasts
- Abundant WSR-88D observations for TCs near coasts
- HRD collects NOAA P3 aircraft Doppler radar data sets and process them on most tropical cyclones since 1994.
- NOAA airborne Doppler missions to expand for TCs



Light-shaded bands denote periods with NOAA P3 airborne Doppler observations

Airborne Doppler Radar Scanning Geometry

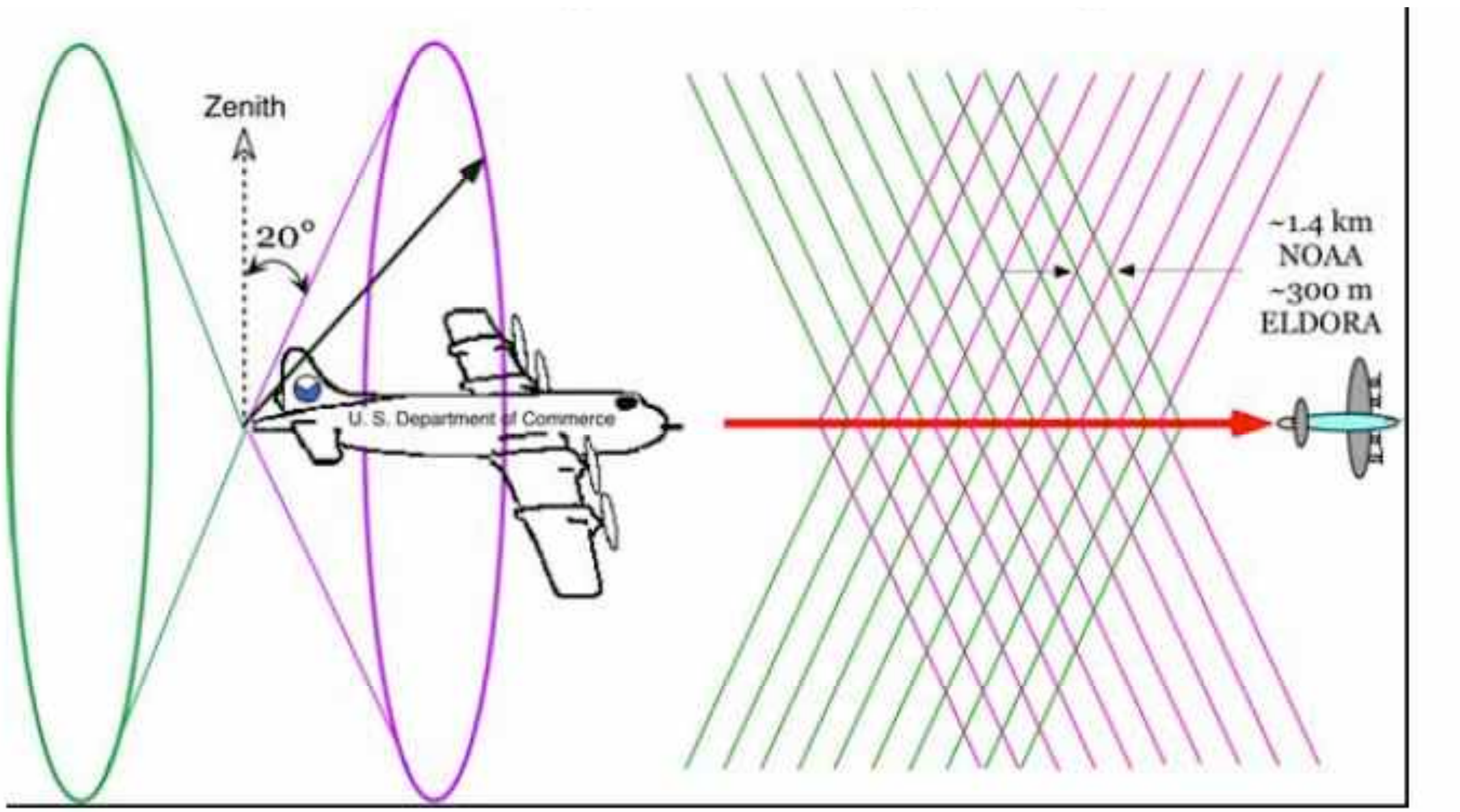
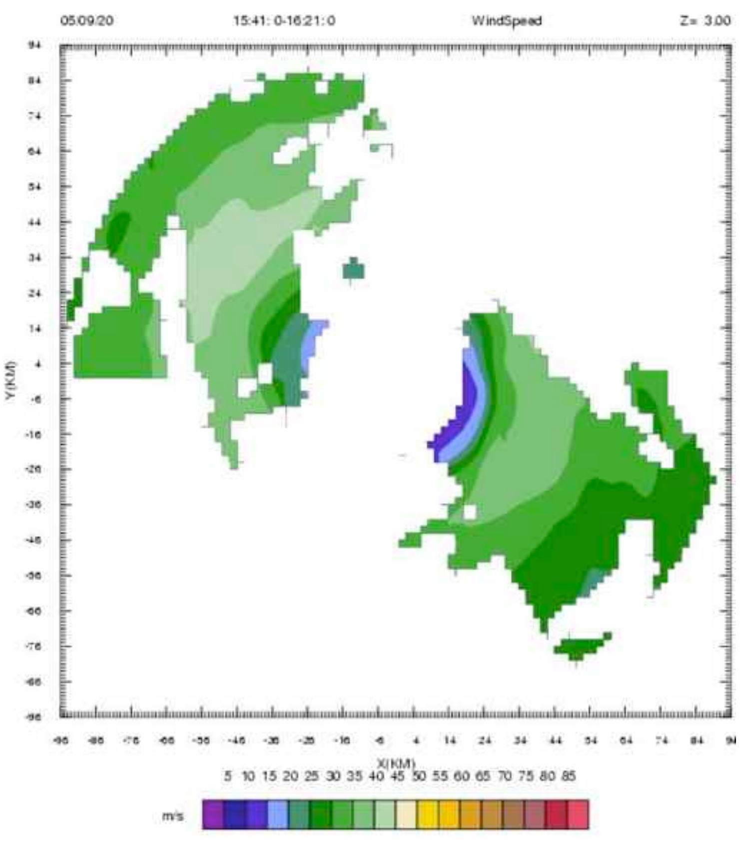
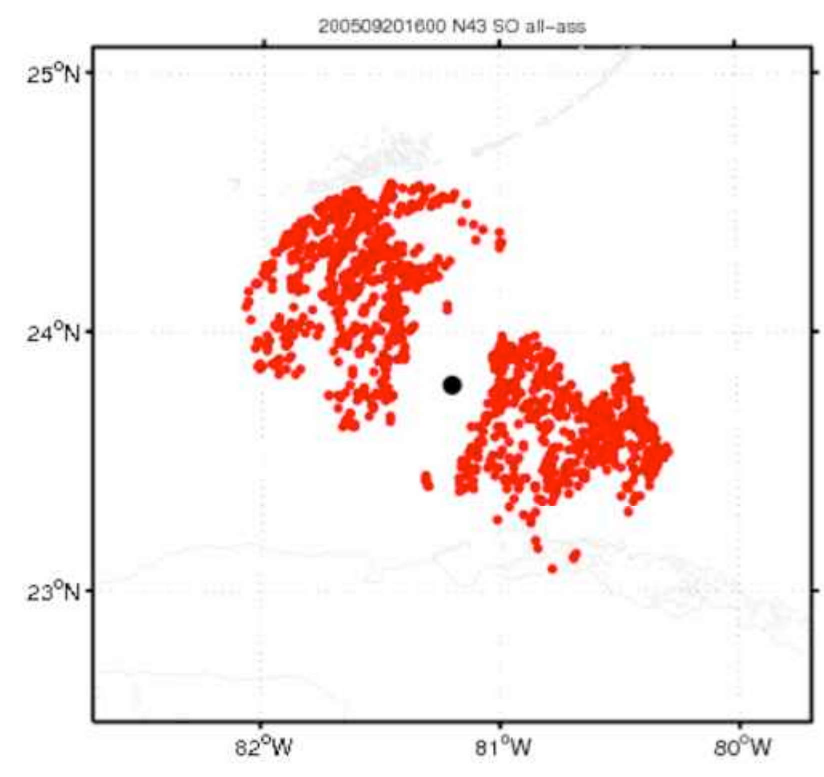


Fig. 2.5 Tail radar scanning geometry for both the NOAA P-3s and the NRL P-3. The left plot shows a schematic of the antenna scanning methodology. A horizontal projection of the beams is shown on the right.

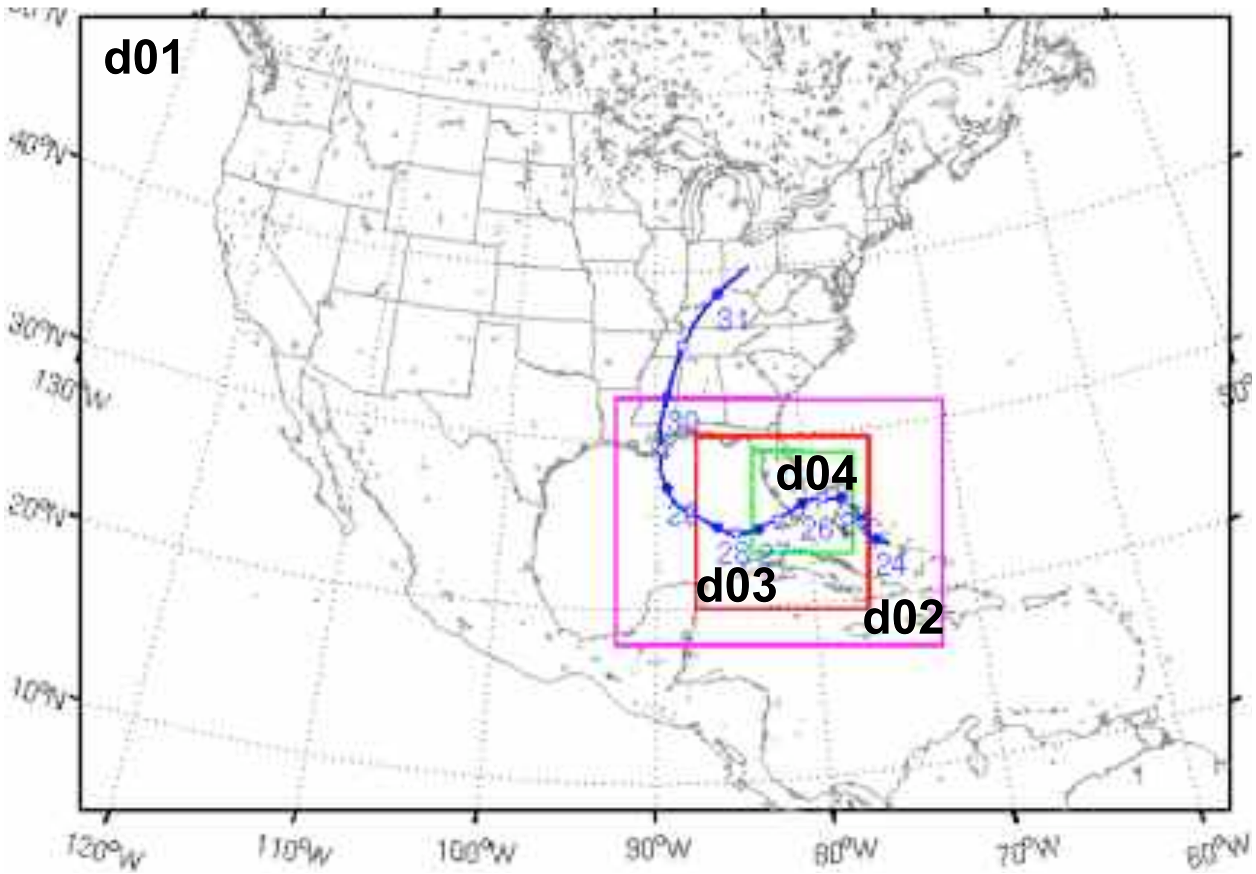
Airborne V_r Super-Observations (SOs): Similar to NEXRAD data but w/ more QCs



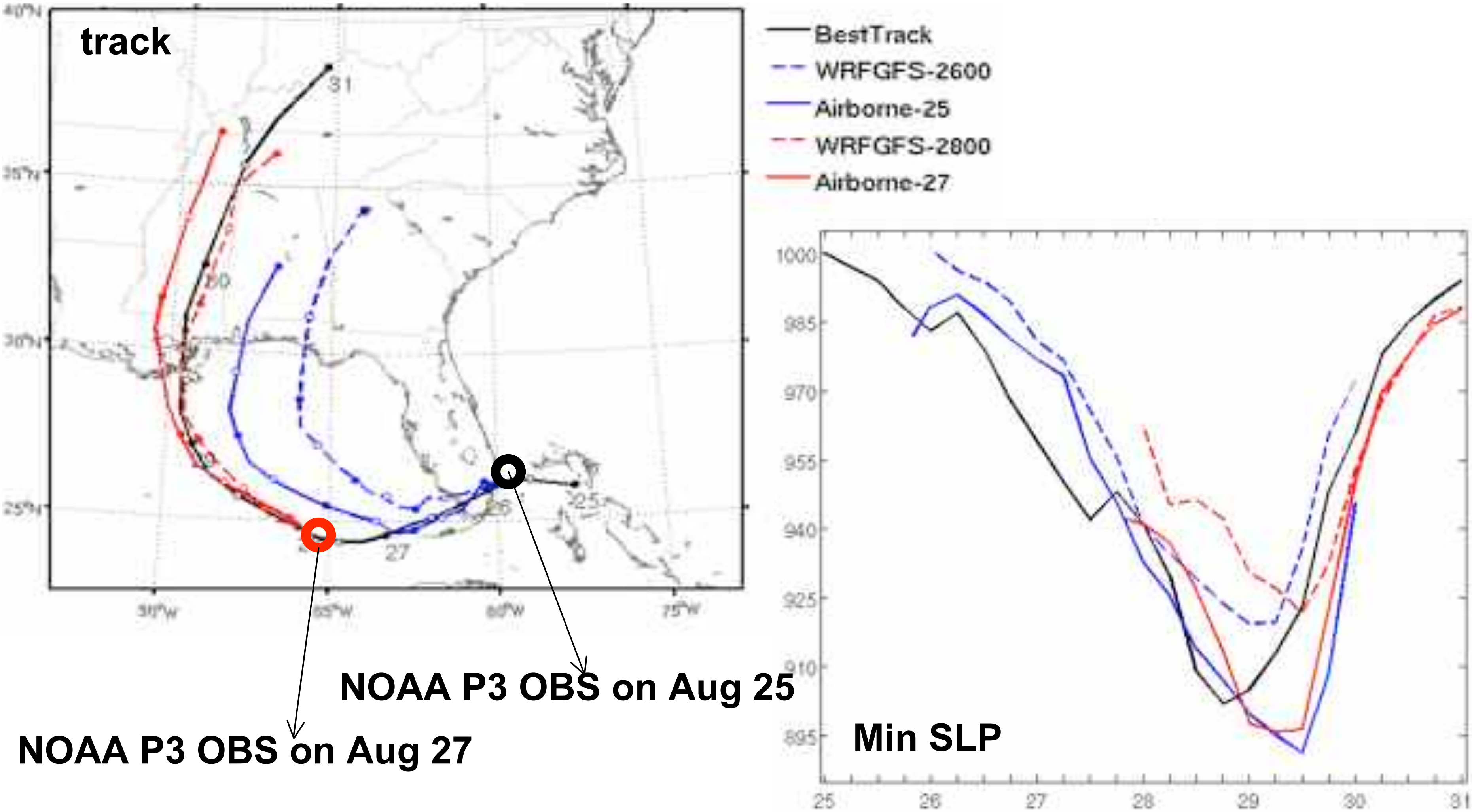


Radial velocity from NOAA P3 at 3km **Corresponding SOs**

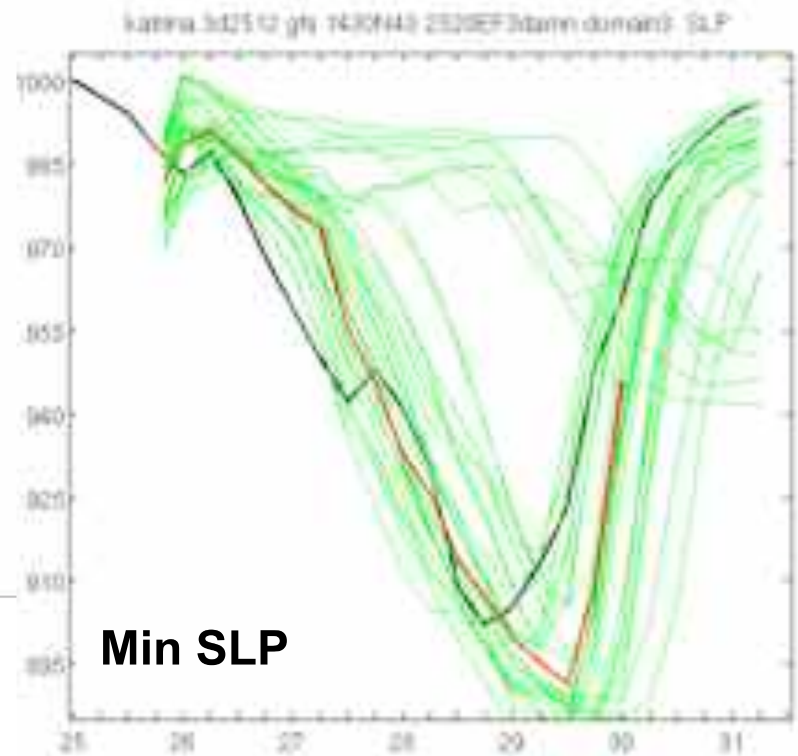
Impacts of Assimilating Airborne Doppler Radar for Katrina (2008)



Performance of Airborne Doppler V_r Assimilation for Katrina (2005)



HFIP/TACC Track and Intensity Uncertainty Forecast from WRF/ARW Ensemble with EnKF Doppler V_r Assimilation on 25 Aug.



Towards Real-time Assimilation of Airborne Radar Observations with EnKF: Same *Experimental Design as Test Cases*

WRF/ARW triply-nested domains for both EnKF analyses and free forecasts:

D1: 121x160x40.5km x 35 levels (similar to GFDL coarse domain)

D2: 121x160x13.5km x 35 levels

D3: 253x253x 4.5km x 35 levels (moving nest in forecast mode)

Time performance of standard real-time WRF/ARW forecast initialized with GFS

Waiting time for GFS completion: 4.5 h

Transfer GFS analysis and forecasts from NCEP to TACC: 0.3 h

Initialization of WRF/ARW with GFS using WPS: 0.4 h

126-h WRF free forecast with 512 processors: 2.7 h

Total time lapse: 7.9 h (3.4 h after GFS completion, 1.5 km is 7 h after)

Estimated real-time WRF/ARW forecast initialized assimilating airborne Vr data

EnKF ensemble initialized with most recent available GFS: no waiting time

Quality control and super-observation (SO) of Airborne data per hour: 0.3 h

Transfer airborne ~3000 SOs from P3 to TACC: 0.2 h

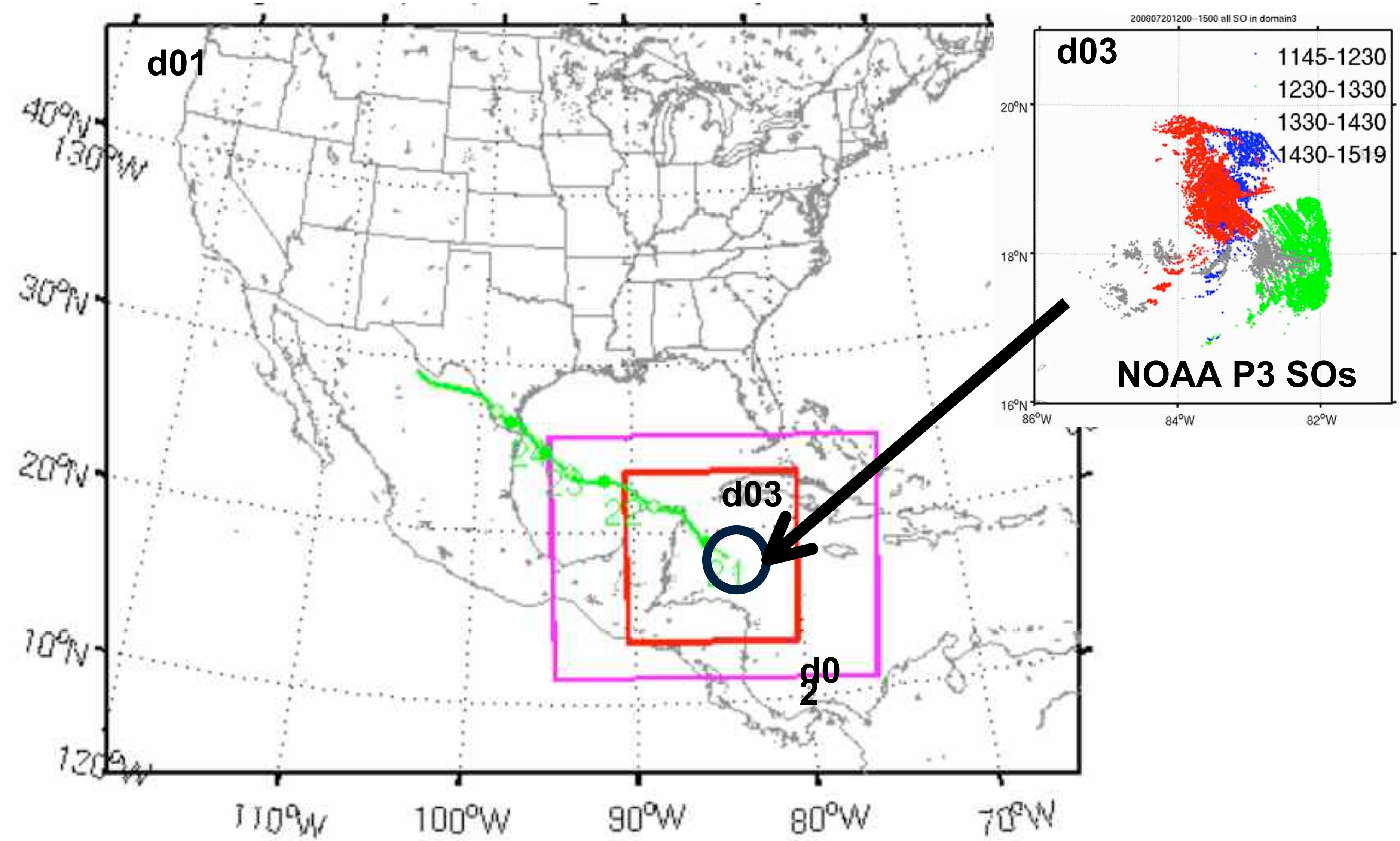
EnKF assimilation of 1-h SOs: 0.5 h

126-h WRF free forecast with 512 processors: 2.7 h

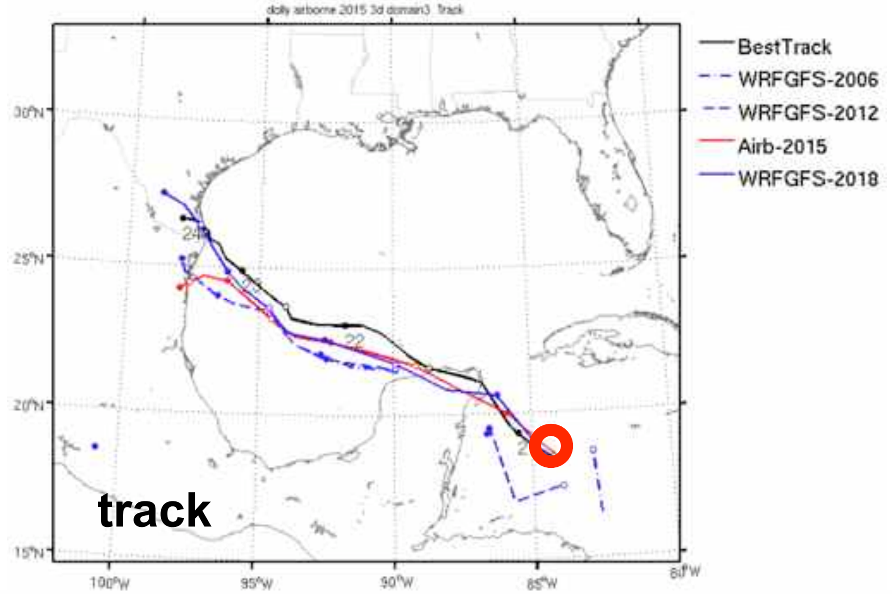
Total time lapse: 3.7 h (1.5 km is 7 h) after Doppler observations taken

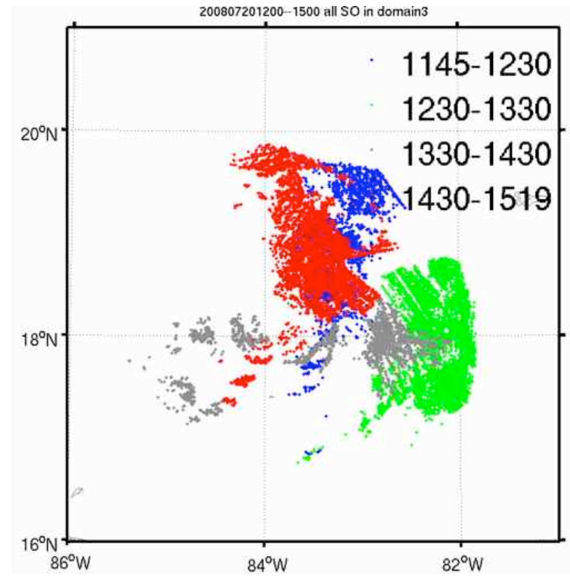
Tests on Hurricane Dolly (2008)

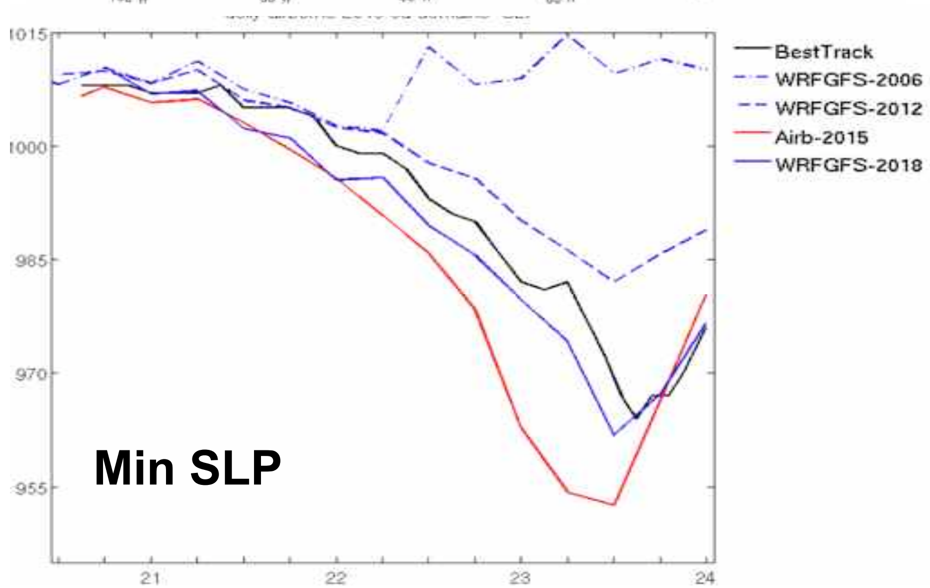
Towards Potential Real-time Applications

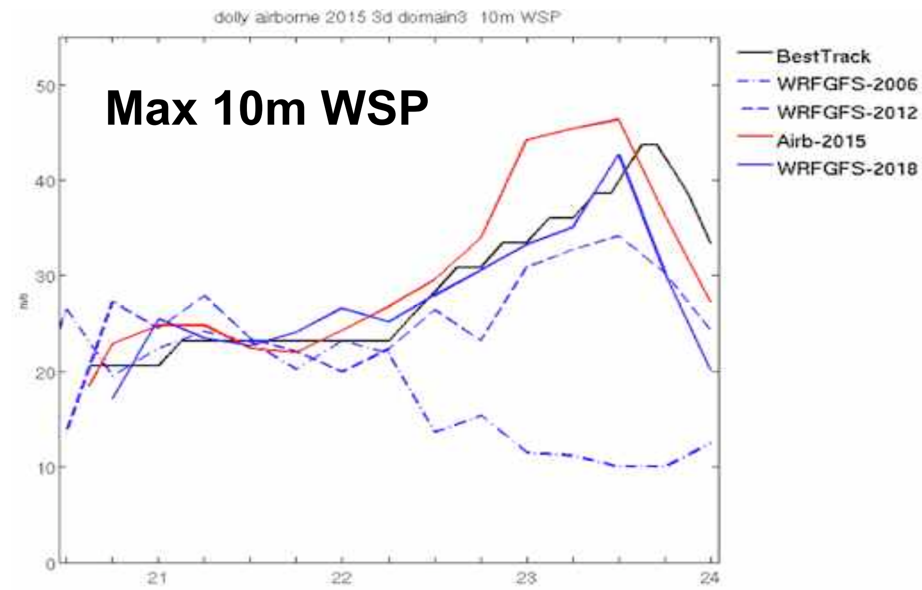


Performance of Airborne Vr Assimilation for Dolly (2008)



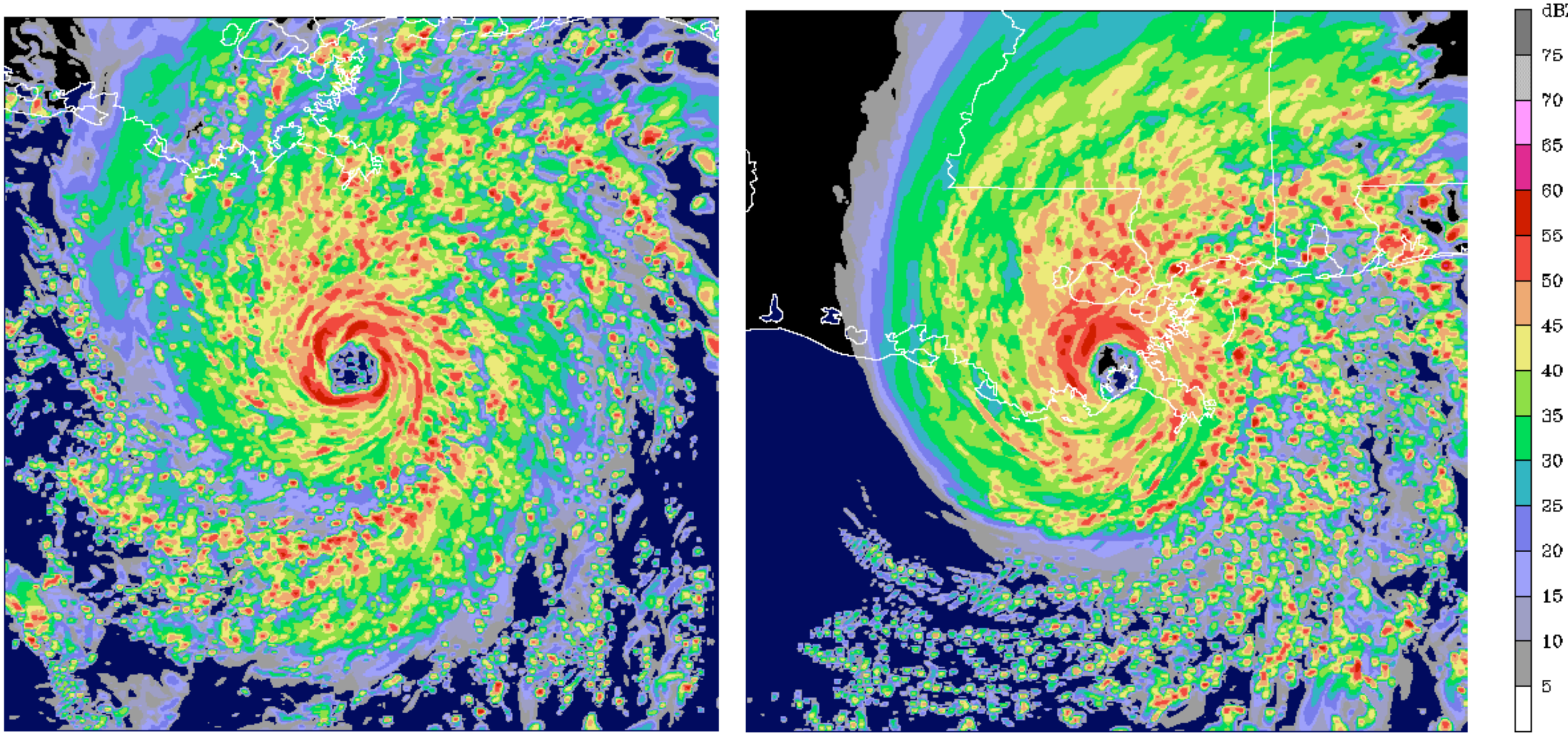






Extra

HFIP/TACC 1.5-km High-resolution FCST: WRF/ARW Simulated Reflectivity after V_r Assimilation on Aug 27th



00Z Aug 29, near peak intensity **12Z Aug 29, around landfall**