Reconnaissance Data Forecast Impacts at NCEP

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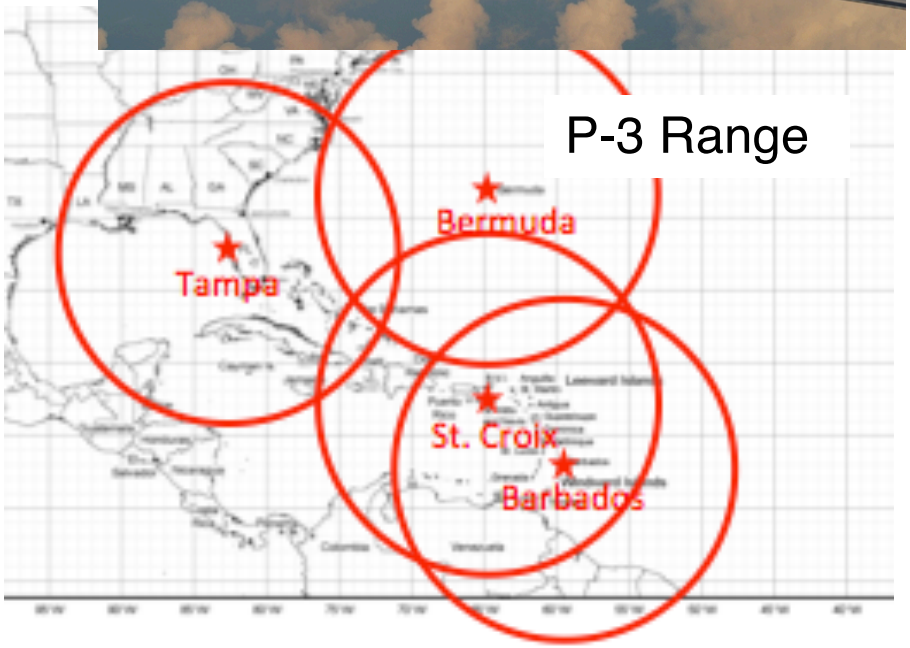
Outline

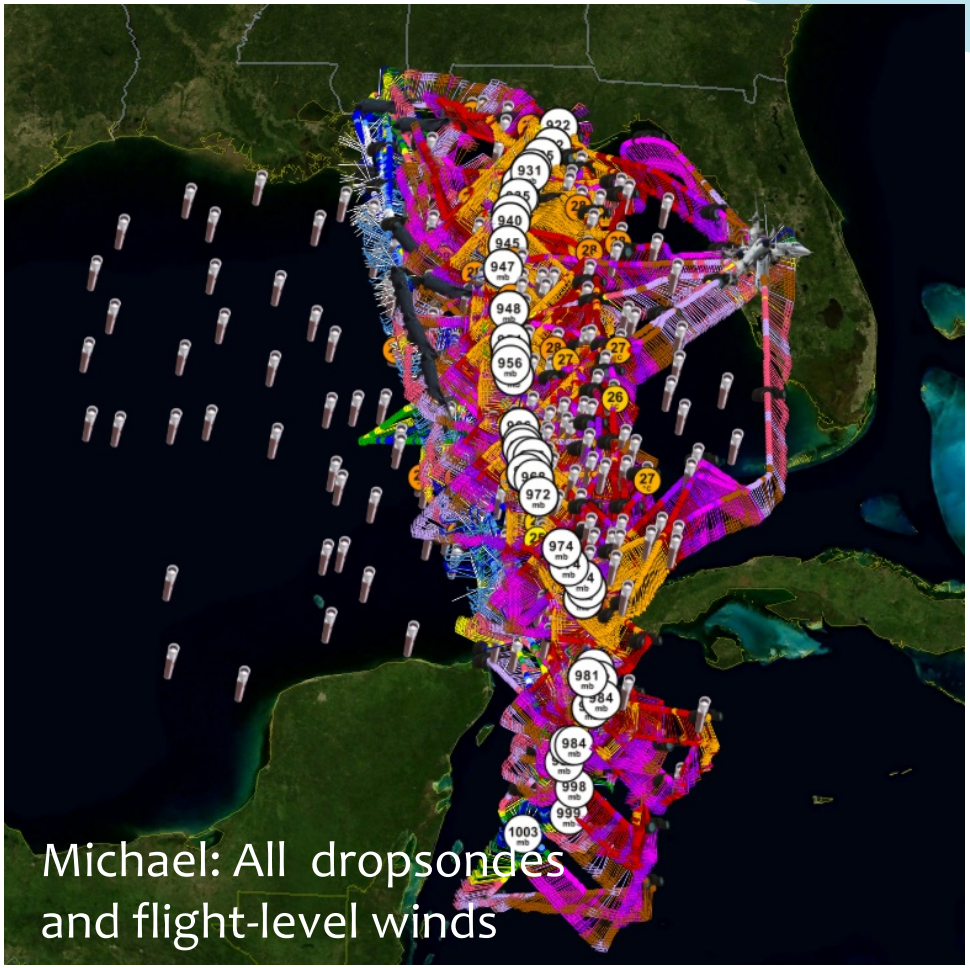
- Overview of data and usage
- Recon impact in HWRF
- Changes in 2018
- Future direction

Overview: Recon Data

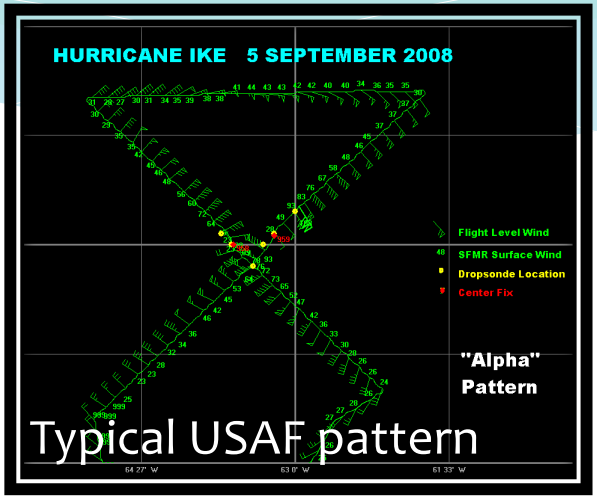
- Flight level winds, temperature, moisture
- Surface wind speeds (SFMR)
- Dropsonde winds, temperature, moisture
- Doppler winds



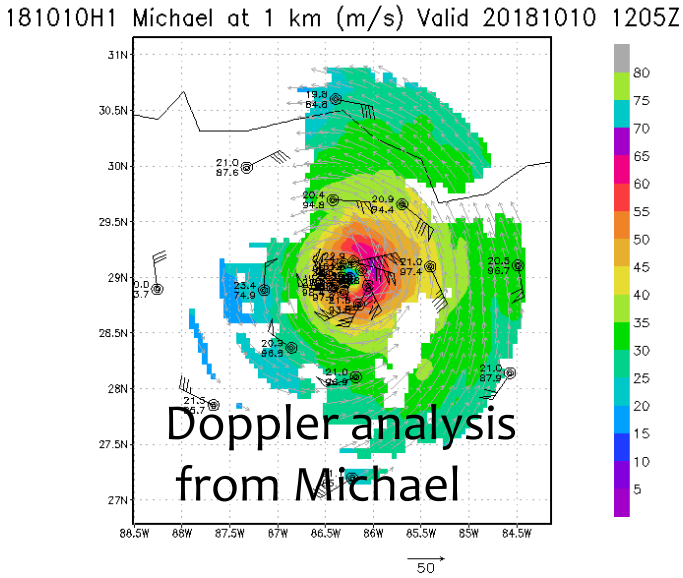
Overview: Recon Data



Michael: All dropsondes and flight-level winds



Typical USAF pattern

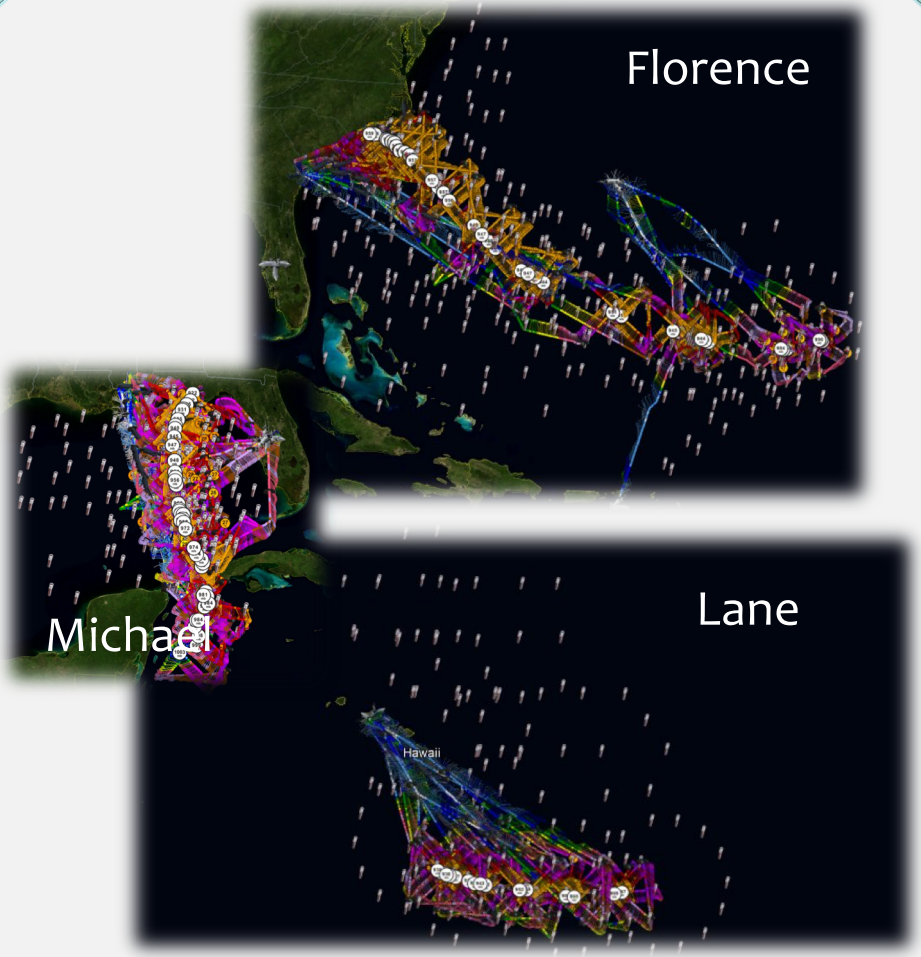


Doppler analysis from Michael

Overview: Recon Data

2018 Operations:

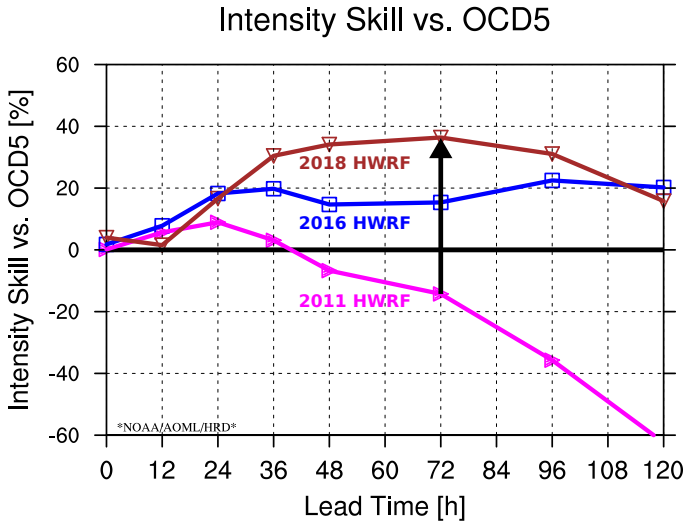
- Nearly 120 missions into 15 tropical systems
- Nearly 1700 dropsondes deployed
- At one point, simultaneous operations from Hawaii, Caribbean, and US East Coast



Dropsonde locations and flight-level winds from all missions into Florence, Michael, and Lane

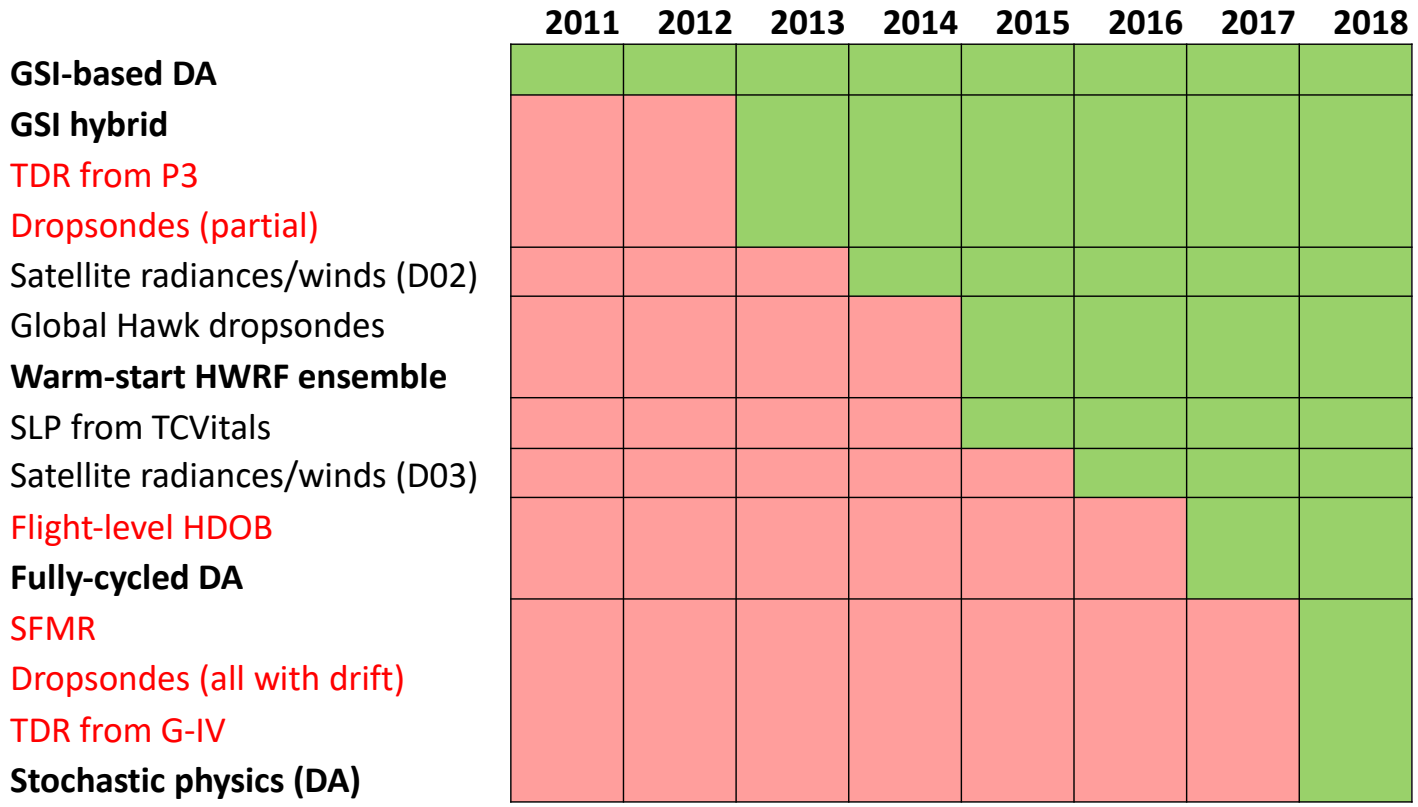
Overview: Recon Usage at NCEP

- Dropsonde data for radii > 1 degree has been operationally assimilated since 1997 into the AVN/GFS global model
- Assimilation of inner-core reconnaissance data did not begin until 2013 (HWRF)
- HWRF is the only operational model worldwide to use all reconnaissance data



Improvement in HWRF intensity forecasts since 2011 as compared with OCD5 (climatology/persistence)

Overview: HWRF Data Assimilation



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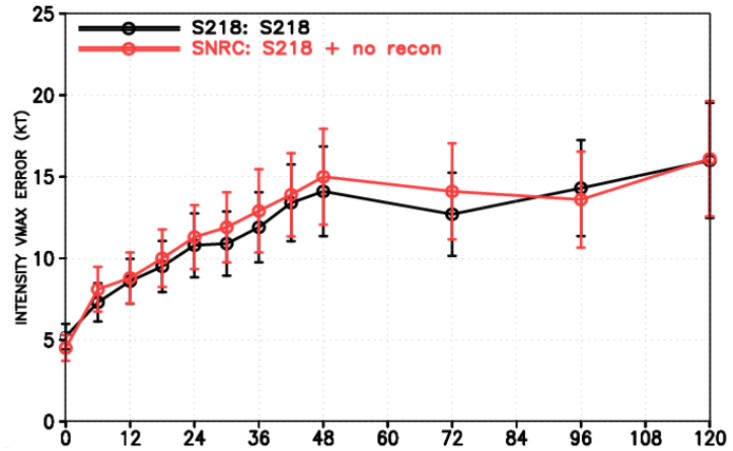
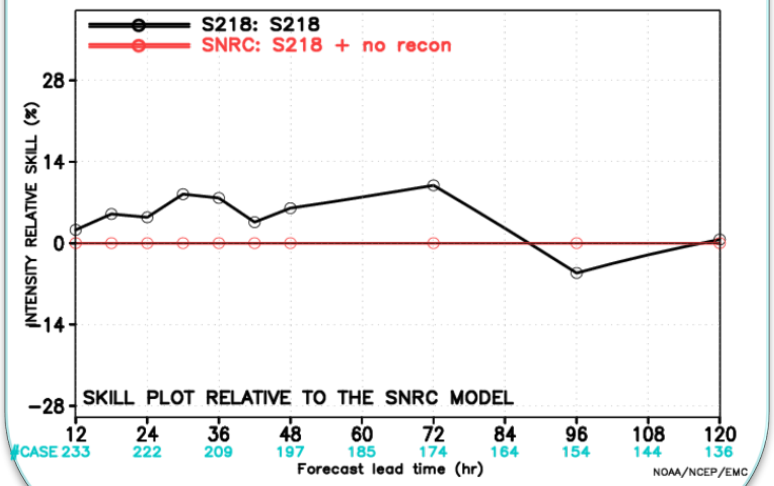
Recon Impact: 2019 HWRF

- Impact of recon in 2016-2018 high impact storms was examined for HWRF
- Many major hurricanes in this sample, which are the hardest to improve
- Recon has a clear positive impact on intensity, about 10% improvement through 72h
- This does not include impacts on FV3

Recon test Vmax error in HWRF



Recon test Vmax skill in HWRF



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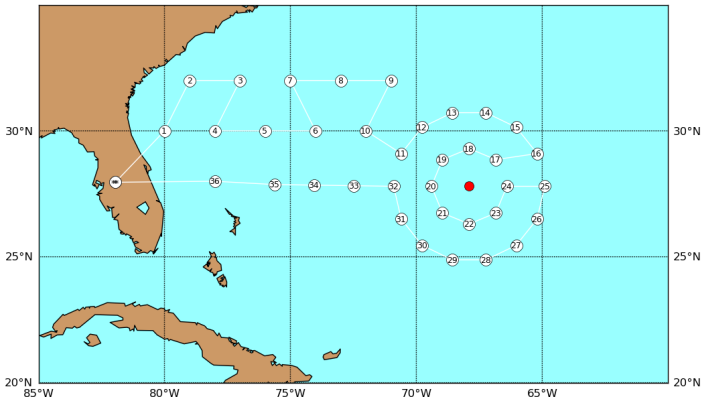
Changes in 2018: G-IV missions

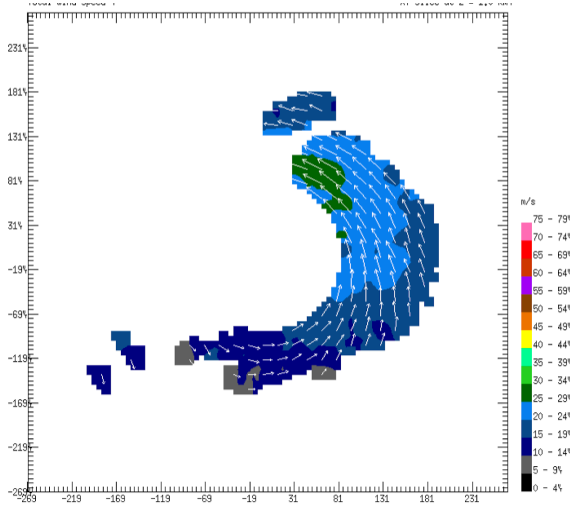
G-IV began two complete circumnavigations at ~90 and 180 nm

- Likely stronger impact on track than that from distant dropsondes
- Recent research also shows that near-vortex data helps constrain vortex structure with impacts on intensity
- G-IV Doppler velocity data more extensive closer to the vortex

Planned G-IV flight track and dropsondes for Hurricane Florence



Analysis of horizontal winds from GIV TDR

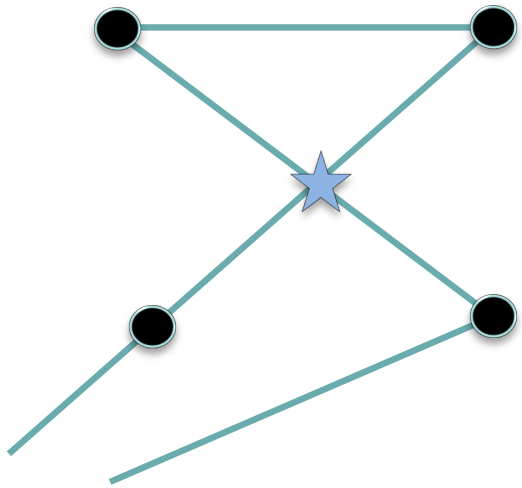


Changes in 2018: C-130 missions

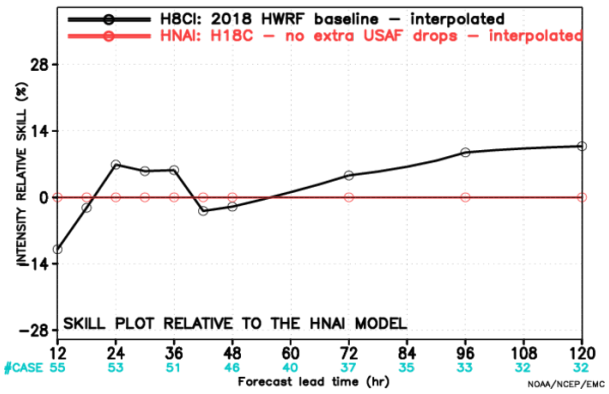
"End-point" dropsondes from USAF C-130 missions

- Dropsondes at end-points of "alpha" pattern from C-130 missions began experimentally in 2017
- Data denial tests suggested a 10% impact on intensity skill
- Based on these results, this practice was implemented operationally in 2018

Example of end-point drop positions



End-point dropsonde test intensity skill



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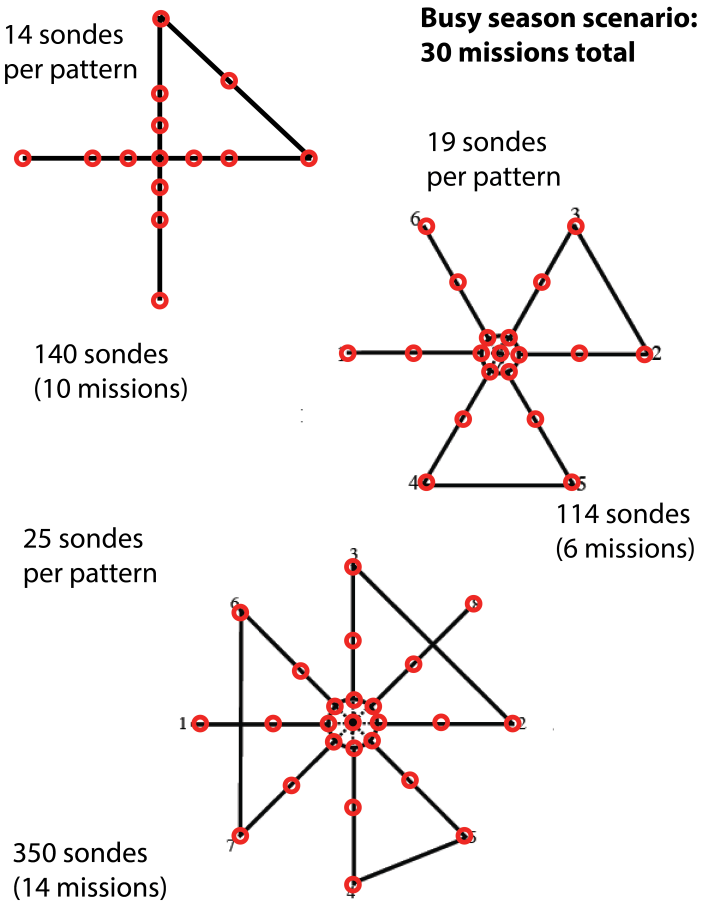
Future direction

- NOAA in process of acquiring another high-altitude jet to replace or supplement G-IV
- "Smarter" environmental targeting in the works for dropsondes
- Major cost-benefit assessment of recon practices underway (focused on dropsondes)



Idealized distribution of sondes to be tested in data denial experiments

Conclusions

- NOAA has an extensive TC reconnaissance program focused on forecast improvement for US threats
- Concurrent with improving dynamic guidance and data assimilation, reconnaissance missions are increasingly focused on gathering data from in and near the TC vortex
- A systematic evaluation of reconnaissance best practices is underway with results forthcoming in next several years