Vortex-Scale Hurricane Data Assimilation:

Overview of NOAA/AOML/HRD's *Hurricane Ensemble Data Assimilation System (HEDAS)* and Its Performance for the 2010 Hurricane Season

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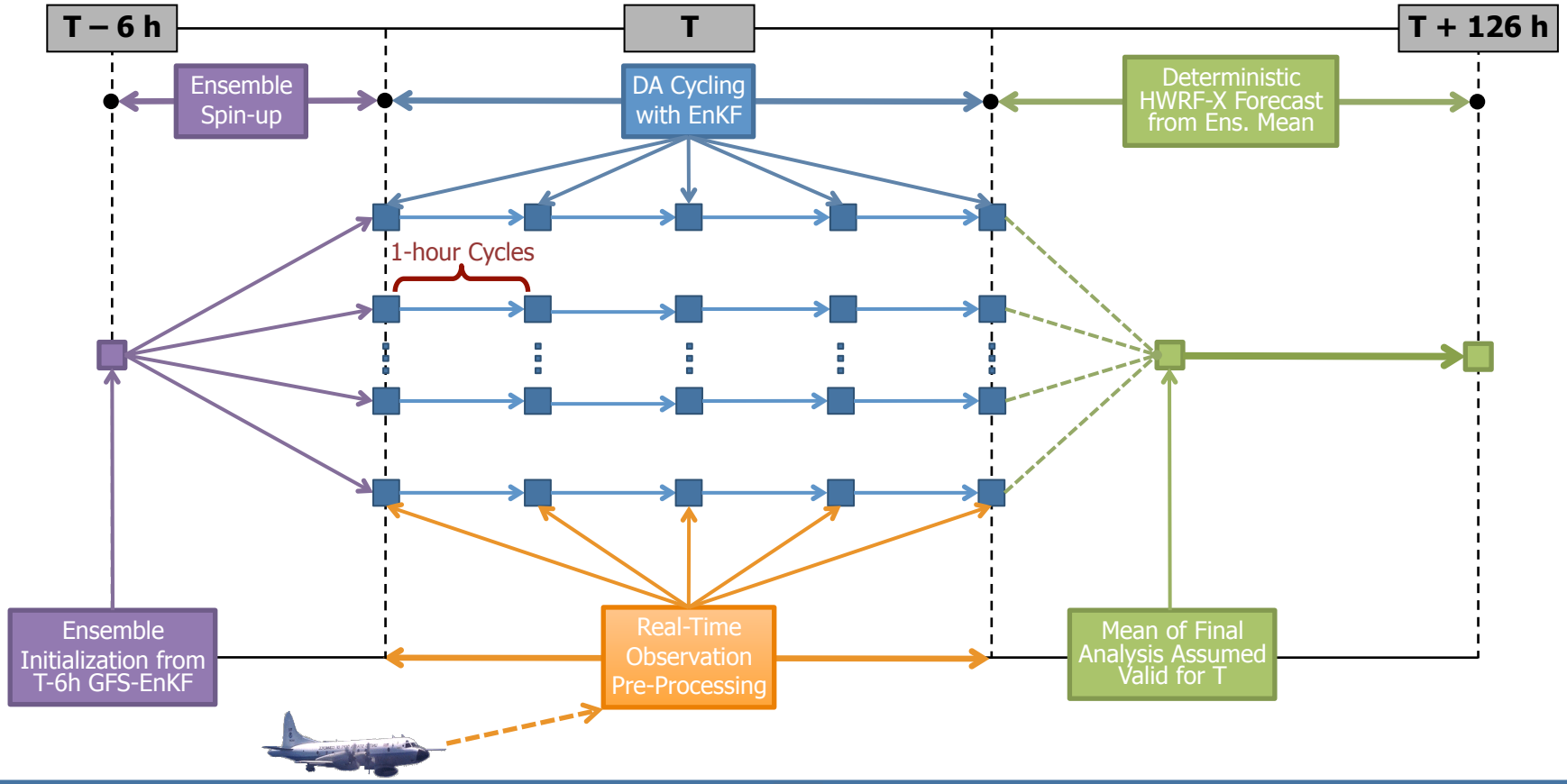
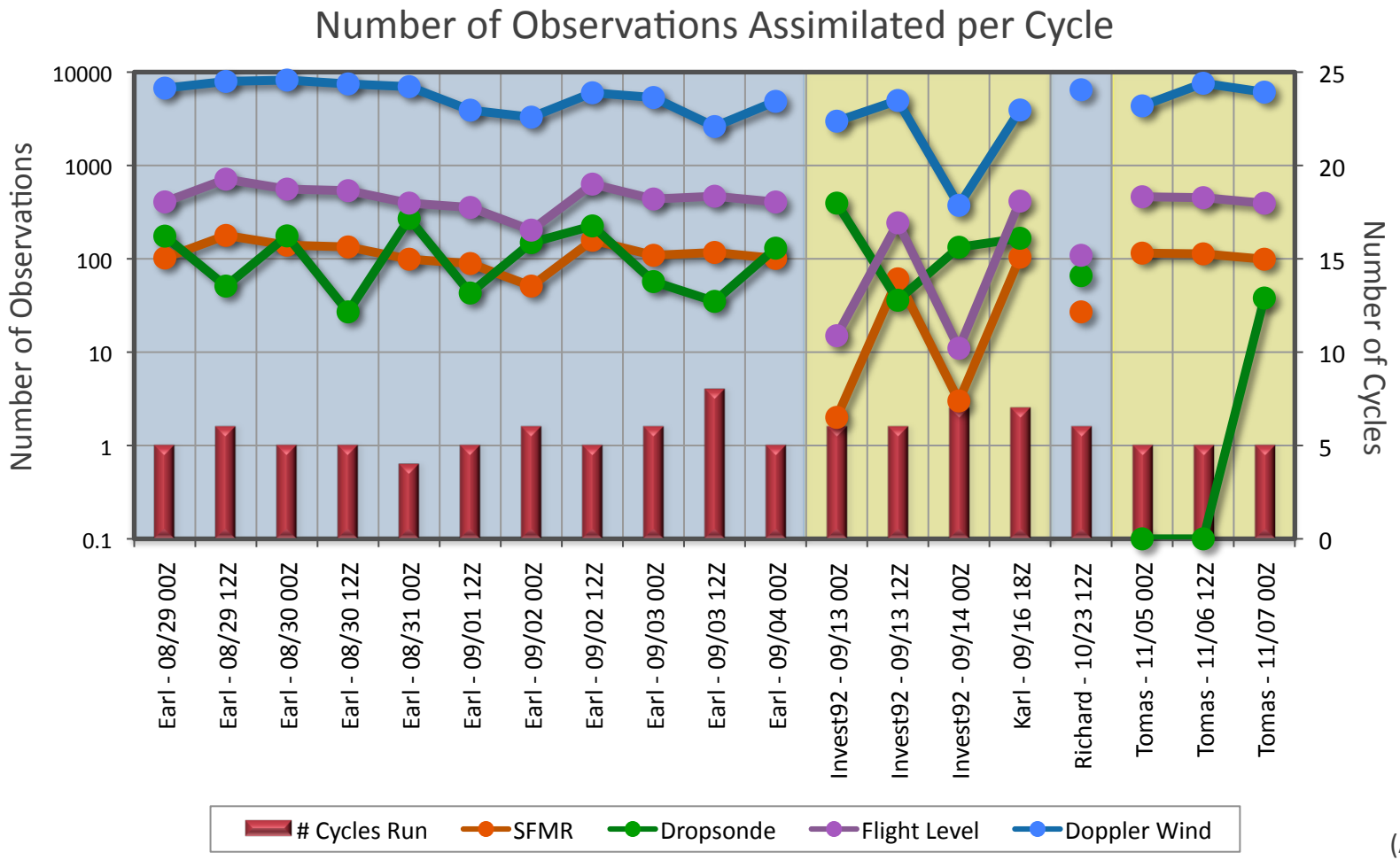
2010 HEDAS Semi-Real-Time Runs for HFIP: DA Cycling Workflow

- Only ran when Doppler radar wind data was available from NOAA P-3 flights (➔ 19 cases)
- Used 1452 processors on NOAA's tJet cluster (supported by HFIP)



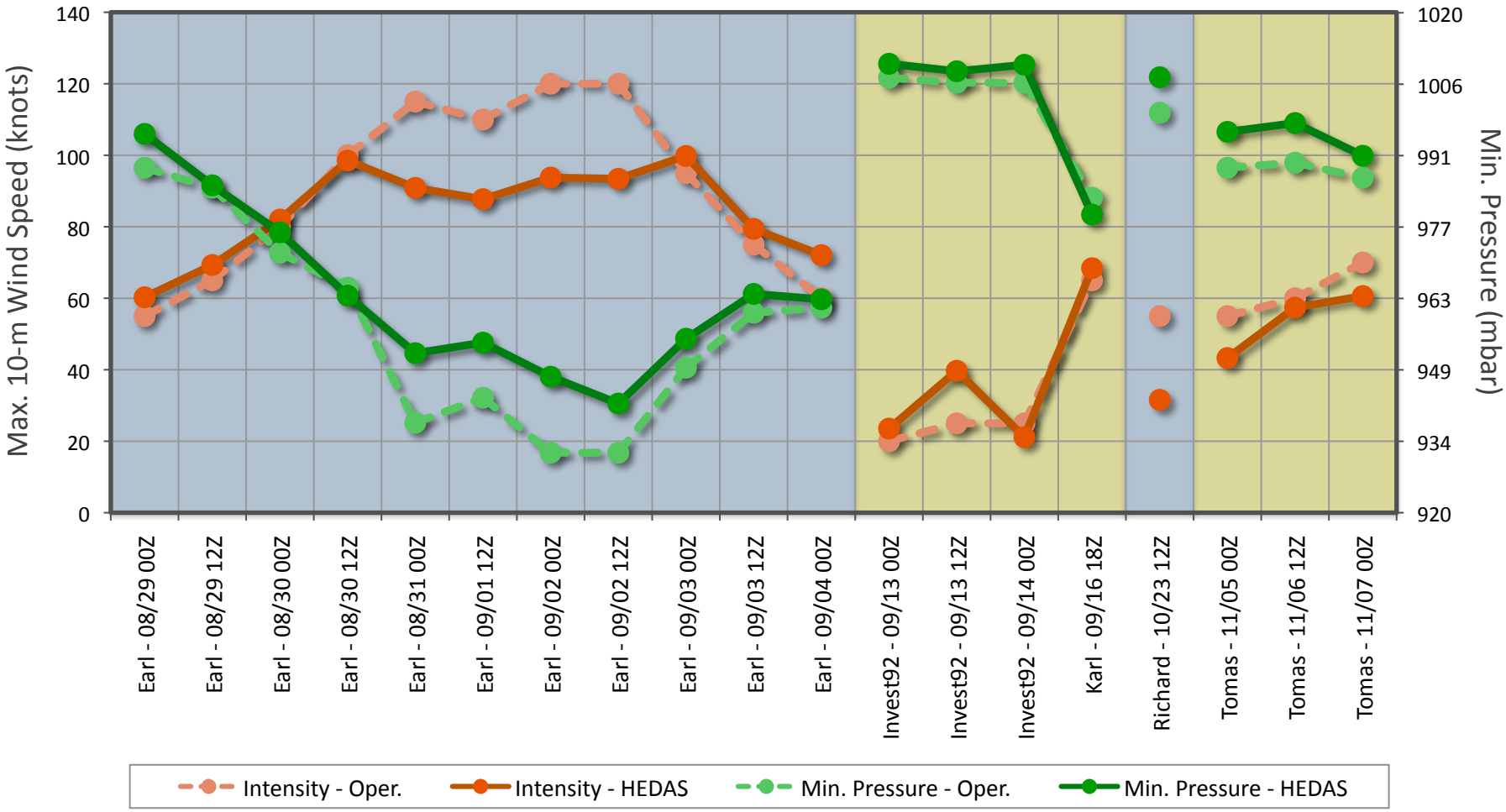
2010 HEDAS Semi-Real-Time Runs for HFIP: Summary of Cases

- A total of 19 cases are run (when NOAA P-3's collected Doppler radar data):



(Aksoy)

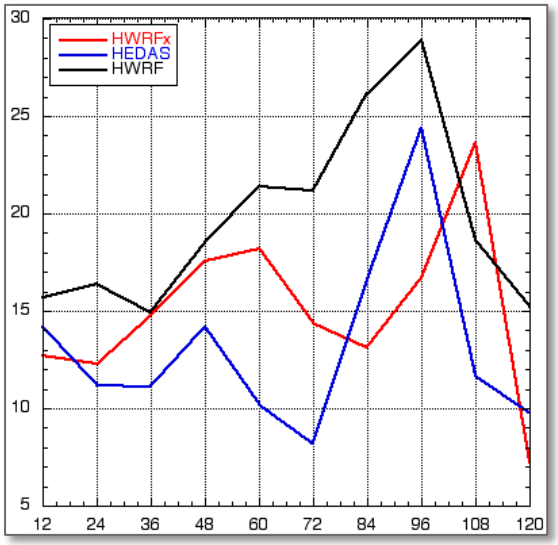
2010 HEDAS Semi-Real-Time Runs for HFIP: Summary of Final Mean Analysis Intensity



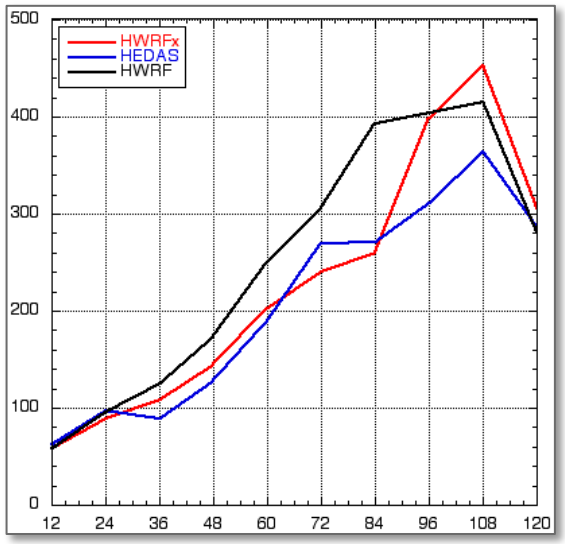
(Aksoy)

2010 HEDAS Semi-Real-Time Runs for HFIP: Summary of Forecast Performance (Absolute)

Intensity Error (kt)

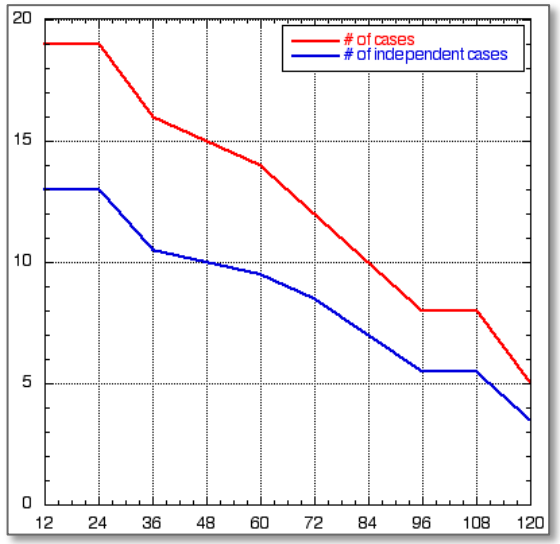


Track Error (km)



Forecast Time (hour)

Number of Cases



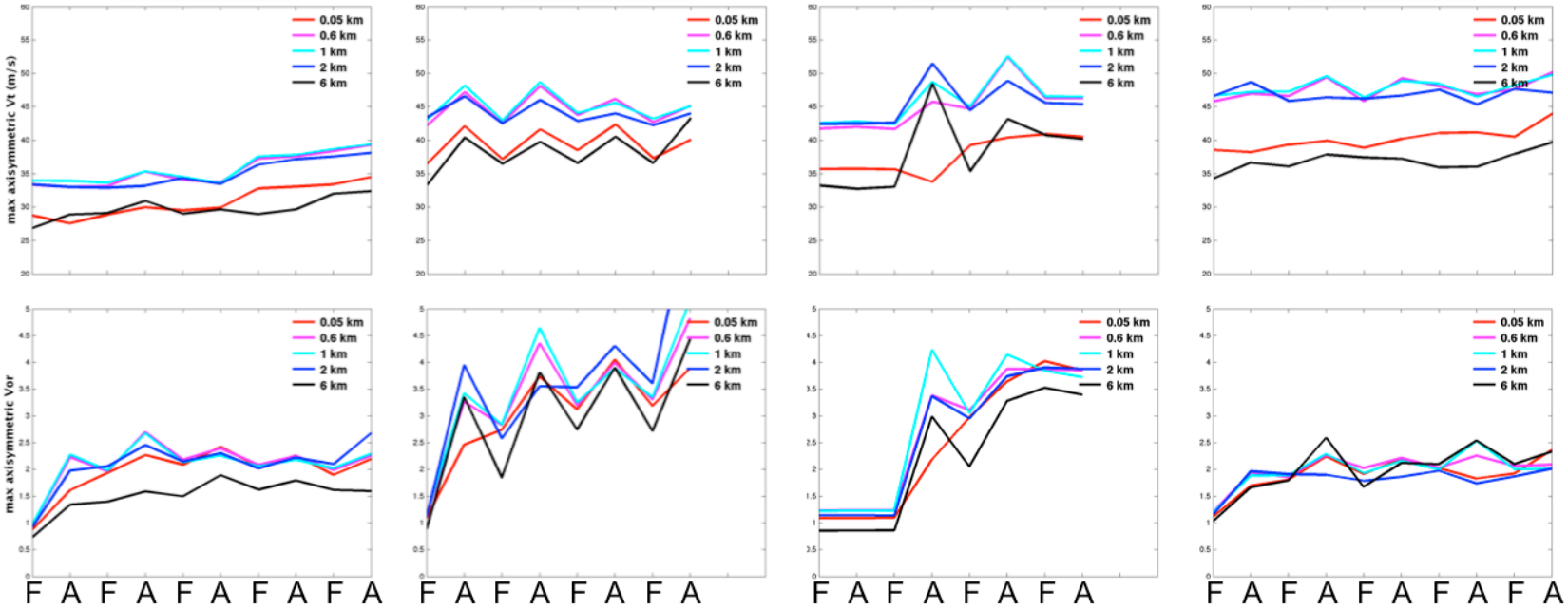
HEDAS (in blue) performs better in intensity and comparably in track (to HWRF and HWRFx)

(Aberson)

Evolution of Vortex Dynamical Properties During EnKF Cycling (Examples from Earl)

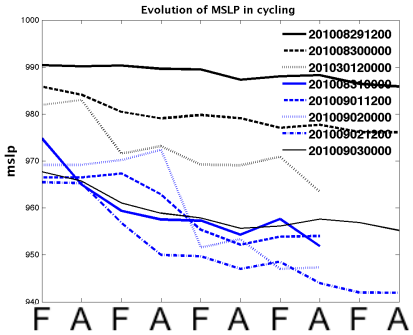
08/30 00Z | 08/31 00Z | 09/02 00Z | 09/03 00Z

Max. Tangential Velocity (m/s)



Max. Vorticity (s^{-1})

Min. Pressure (mbar)



1. Systematic reduction of vortex strength during short-term forecasts after increase at analysis update times
2. Systematic decrease in pressure indicates that wind-pressure coupling is not balanced during spin up (down)

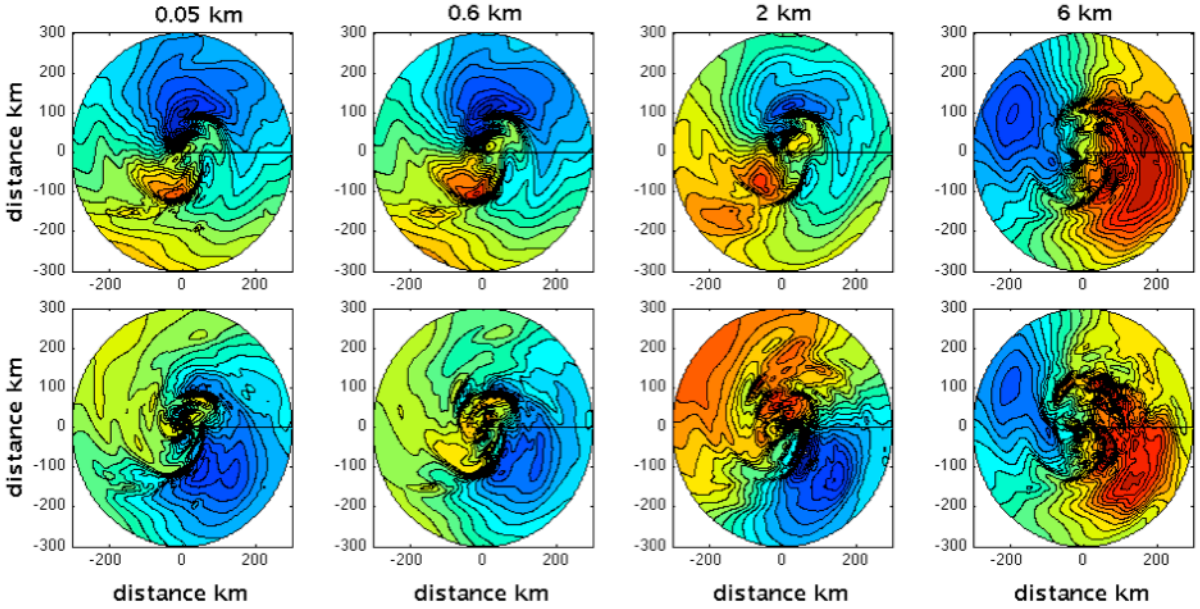
(Vukicevic)

Depth of the Inflow Layer: A Source of Model Error in Short-Range Forecasts

Earl 08/31 00Z - Final Cycle

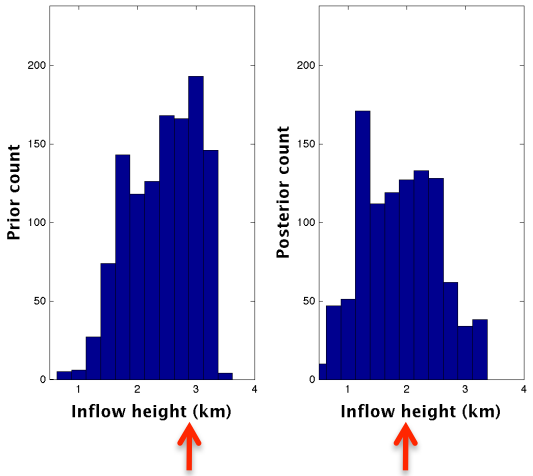
Prior

Posterior



Significant phase discrepancy from prior to posterior indicates large disagreement between model inflow structure and observed

All Earl Cases



Inflow layer in the forecast model is too deep, likely due to inadequate vertical resolution in the PBL and PBL parameterization

(Vukicevic)

Summary and Future Plans

- Across the 19 cases for which HEDAS has run during the 2010 season:
  - **Intensity error was better than HWRFx (initialized with HWRF vortex) and operational HWRF**
  - Track error was comparable
- Issues remain with respect to initial adjustment during forecast when initialized from HEDAS vortex (this is not unique to HEDAS)
  - ➔ Research underway at HRD to address these issues
- Planned updates before the 2011 season:
  - Satellite data assimilation in the core (Vukicevic)
  - Representation of model error in surface and PBL physics (Aksoy and J. Zhang)
  - Improved parallelization
- All of HEDAS forecast case results can be found at the following link: https://storm.aoml.noaa.gov/realtime