

RAP / HRRR weather guidance for Air Traffic Flow Management: Progress and Challenges

Stephen S. Weygandt Curtis Alexander, Stan Benjamin, Geoff Manikin*, Tanya Smirnova, Ming Hu NOAA Earth System Research Laboratory *NOAA National Centers for Environmental Prediction

> Friends and Partners of Aviation Weather NBAA Convention, October 23-24, 2014



Rapid Refresh and **HRRR** NOAA hourly updated models

13km Rapid **Refresh (RAP)** Version 2 -- NCEP implement 25 Feb 2014 Version 3 – GSD Planned NCEP -- 2015 **3km High Resolution Rapid Refresh (HRRR) Initial - NCEP** implement 30 Sept 2014 Version 2 – GSD Planned NCEP -- 2015

GSD → NCEP HRRR: MORE RELIABLE (now 99+%) AVAILABLE SOONER (1h fcst by +50 min, 15h fcst by +1:30

Accurate prediction of hazardous weather What are the key requirements?

Higher resolution models



Use of all Observations (Data assimilation)



Rawins Satellite Aircraft Radar Surface Profiler

Rapid updating

-- Fresher forecasts -- Time-lagged ensembles

Wind Errors





High-Impact Prediction Needs: Higher Resolution Models



NBAA

Friends and Partners Aviation Weather • 22 Oct 2014

4

Data assimilation: using all the observations including radar data



Improved 0-3 hr Convective Fcsts





Model prediction skill is moving toward nowcast skill Radar data assimilation is key part of this



HRRR deterministic and probabilistic forecasts











HRRR deterministic and probabilistic forecasts









21z 14 July 2014 09z + 12h fcst



Evolution of hourly updated NOAA modeling

Feb 2014 – Rapid Refresh v2 – oper at NCEP → Improved surface forecasts, convective environment fields Hybrid ensemble-variational GSI assimilation Model – improved cloud / PBL / LSM / soil, updated version of WRF ARW Sept 2014 – HRRR (3km) – oper at NCEP Hourly updated storm-scale forecasts, greater accuracy (timing, location, structure) for thunderstorms and many other features 3-km / 15 min radar reflectivity assimilation

North American Rapid Refresh Ensemble (NARRE)

- 2 cores (ARW, NMMB), 6 members
- Hourly updating with GSI-hybrid EnKF
- Hourly forecasts to 24-h, 84-h 4x / day



Future oper @ NCEP

2015 – RAPv3/HRRRv2

~2017 – NARRE

➔ with hybrid 4d-ens/var DA

~2019 – HRRR Ensemble (HRRRE) – eventually with ~3km ensemble DA