Aviation model/assimilation improvements for improved icing guidance (RUC, Rapid Refresh)

Stan Benjamin - NOAA Research ESRL/Global Systems Division (GSD) Boulder, CO

- Assimilation of radar reflectivity, TAMDAR to be added to RUC Jan 2008
- Rapid Refresh over N. America - Fall 2009

NCEP  FAA  FPAW – 27 Sept 2007
RUC/RR - backbone for high-frequency aviation products

National Convective Weather Forecast (NCWF), Icing Potential (FIP), Graphical Turbulence Guidance (GTG), and the aviation weather products

Planned Rapid Refresh (RR) domain – 2009

13km resolution

RUC Conv Prob Fcst

1500 Z + 6-h forecast RCPF

Current RUC-13 CONUS domain

Turbulence - GTG

Icing FIP

NOAA/ESRL/GSD, NCEP, NCAR, U. Okla, others
Cycle hydrometeor, soil temp/moisture/snow plus atmosphere state variables

**Hourly obs in 2008 RUC**

<table>
<thead>
<tr>
<th>Data Type</th>
<th>~Number</th>
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<tr>
<td>Rawinsonde (12h)</td>
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<tr>
<td>NOAA profilers</td>
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<tr>
<td>VAD winds</td>
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<td>PBL – prof/RASS</td>
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<td>Aircraft (V,temp)</td>
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<td>TAMDAR (V,T,RH)</td>
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<td>Surface/METAR</td>
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<td>GOES cloud winds</td>
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<td>GOES cloud-top pres</td>
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<td>GPS precip water</td>
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<td>Radar / lightning</td>
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Radar assimilation in RUC - winter storm example

Also, added simulated radar reflectivity field to RUC output

RUC 3-h forecasts valid 00z 25 Mar 2007

No radar assimilation

With radar assimilation
Overnight convection example

Real-time 9z + 3-h forecasts valid 12z 17 July 2007

No radar assimilation

Radar assimilation
Convective suppression example

Radar Assimilation

Real-time 3-h forecasts valid 15z 7 June 2007

Impact from convective suppression
RUC
Rapid-Refresh (2009)

Continental situational awareness model

Hourly NWP Update for:
- CONUS
- AK/Can
- Pac/Atl
- Caribbean
RUC to Rapid Refresh

- CONUS domain (13km) -> North American domain (13km)
- RUC model -> WRF model (ARW dynamic core)
- RUC 3DVAR -> GSI (Gridpoint Statistical Interpolation)
High-Resolution Rapid Refresh (HRRR)

- Proposed initial domain for NOAA/NCEP
- Storm-resolving (3-km) model
- Updated every 30-60 min including latest radar data
- Would run as part of Rapid Refresh
- Expandable based on NOAA computing resources
Sample HRRR from Radar-Enhanced RUC

NSSL verification

HRRR 3-km run initialized
From radar-enhanced RUC

Radar-enhanced RUC essential for HRRR forecast success

6-h forecasts valid
00z 16 Aug 2007
RUC / Rapid Refresh plans for improved icing (and other) guidance

• Jan 2008 - RUC upgrade at NCEP
  - Assimilation of 3-d radar reflectivity, TAMDAR added
  - Significant improvement in winter storm and thunderstorm forecasting
  - Simulated reflectivity output products added

• Fall 2009
  - Rapid Refresh (RR) to replace RUC at NCEP
  - Hourly update (like RUC) for improved icing guidance to cover North America
  - Will include assimilation of radar reflectivity, improved satellite cloud data (e.g., NASA Langley), improved icing physics (via NCAR)

• 2012
  - 6-member Rapid Refresh ensemble
  - Possible addition of 3km HRRR over NE Corridor