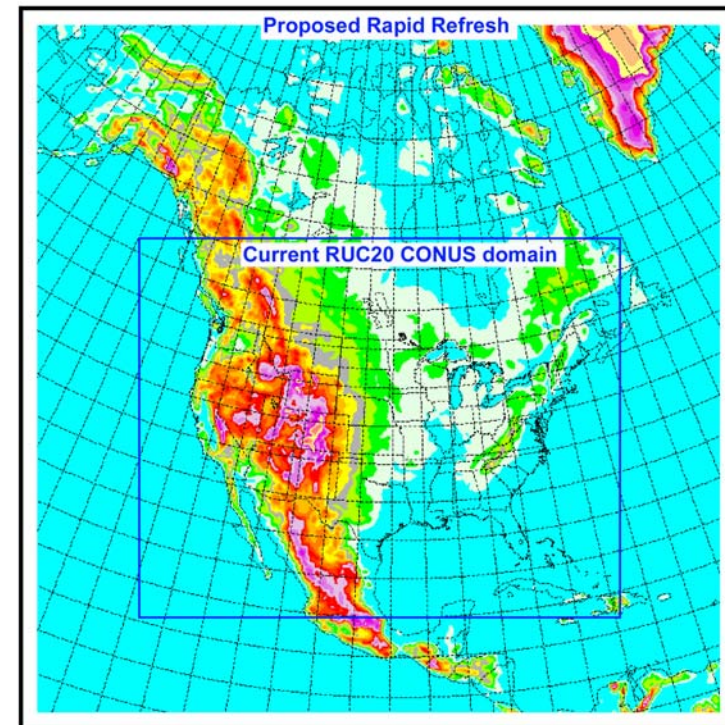


Aviation model/assimilation improvements for improved icing guidance (RUC, Rapid Refresh)

**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



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

RUC Conv Prob Fcst

1500 Z + 6-h forecast RCPF

2100 Z verification

Planned Rapid Refresh (RR) domain – 2009

13km resolution

Current RUC-13 CONUS domain

Maximum turbulence potential (FL200-FL450)

Turbulence - GTG

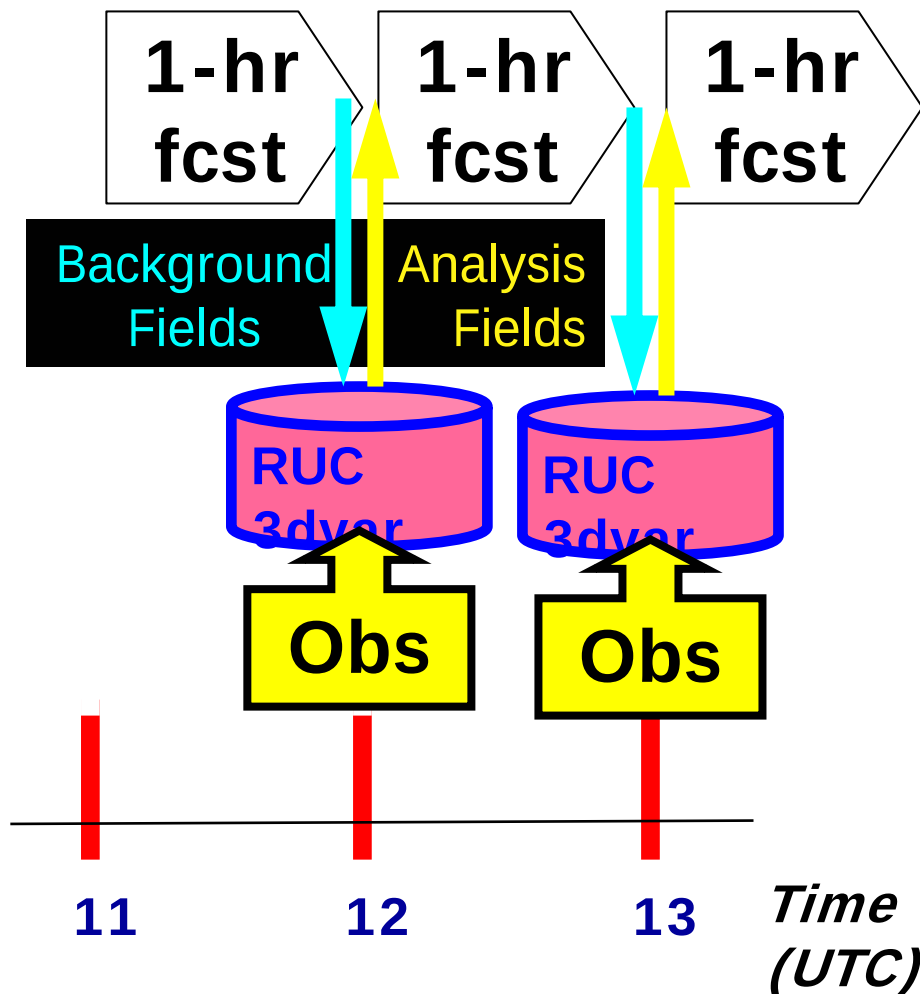
Maximum icing potential (FL010-FL300)

Icing FIP

NOAA/ESRL/GSD, NCEP, NCAR, U. Okla, others

RUC Hourly Assimilation Cycle

Cycle hydrometeor, soil temp/moisture/snow plus atmosphere state variables



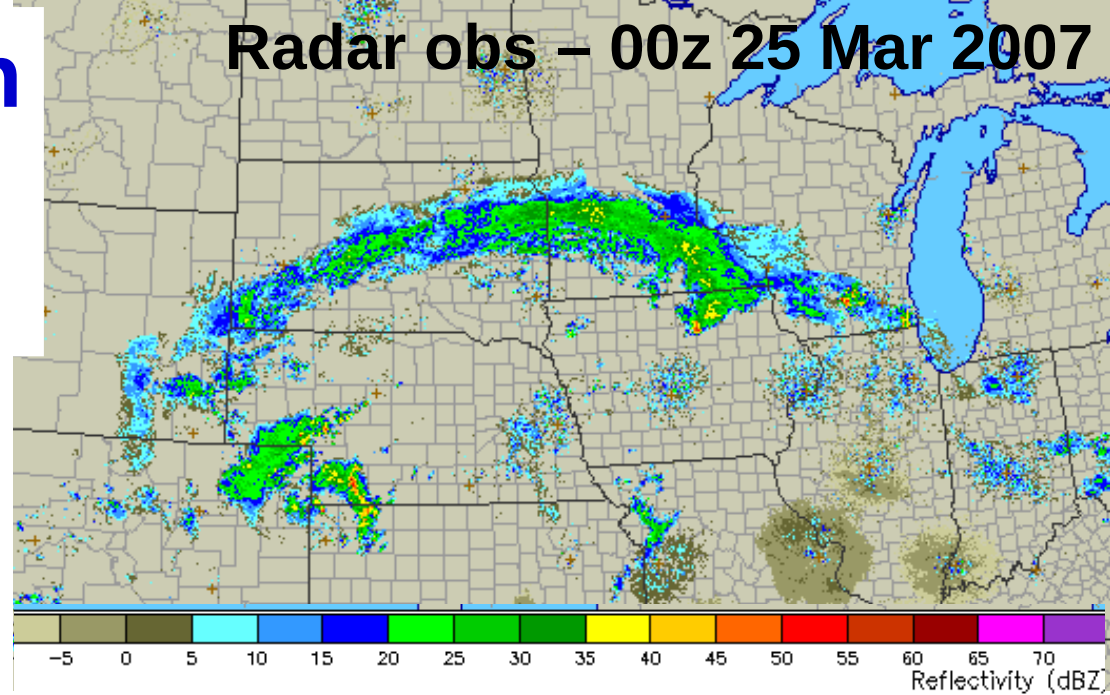
Hourly obs in 2008 RUC

<u>Data Type</u>	<u>~ Number</u>
Rawinsonde (12h)	80
NOAA profilers	30
VAD winds	110-130
PBL – prof/RASS	~25
Aircraft (V,temp)	1400-4500
TAMDAR (V,T,RH)	0-1000
Surface/METAR	1500-1700
Buoy/ship	100-150
GOES cloud winds	1000-2500
GOES cloud-top pres	10 km res
GPS precip water	~300
Mesonet (temp, dpt)	~7000
Mesonet (wind)	~ 600
METAR-cloud-vis-wx	~1500
Radar / lightning	2km

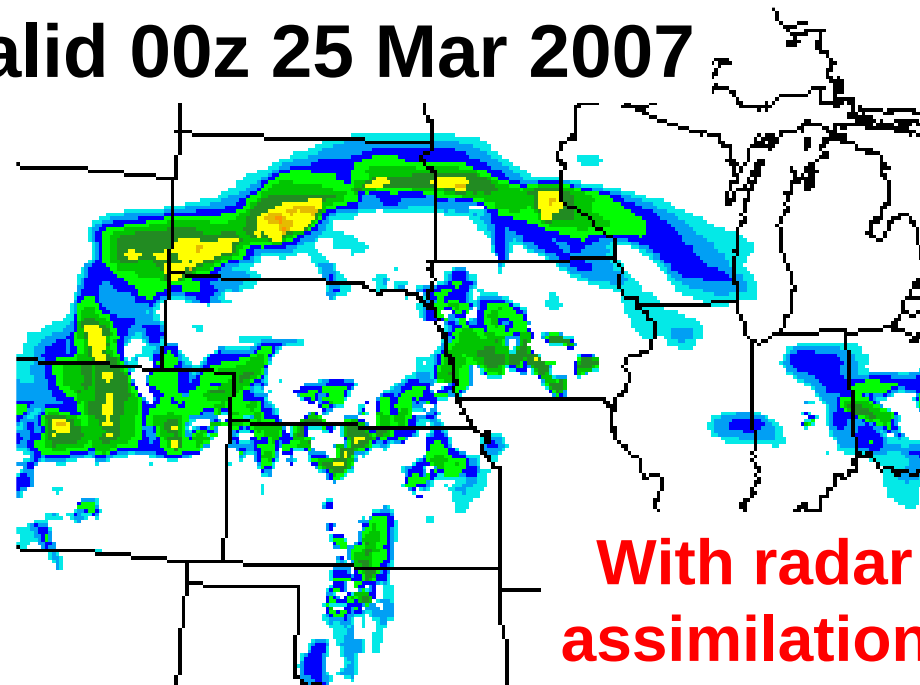
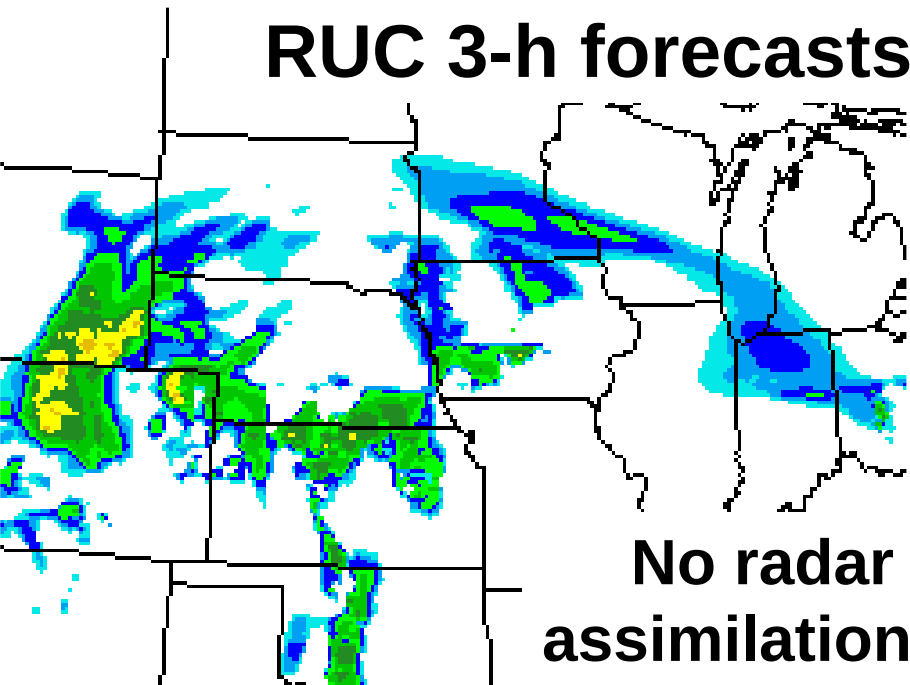
Radar assimilation in RUC - winter storm example

Also, added simulated
radar reflectivity field to
RUC output

Radar obs – 00z 25 Mar 2007



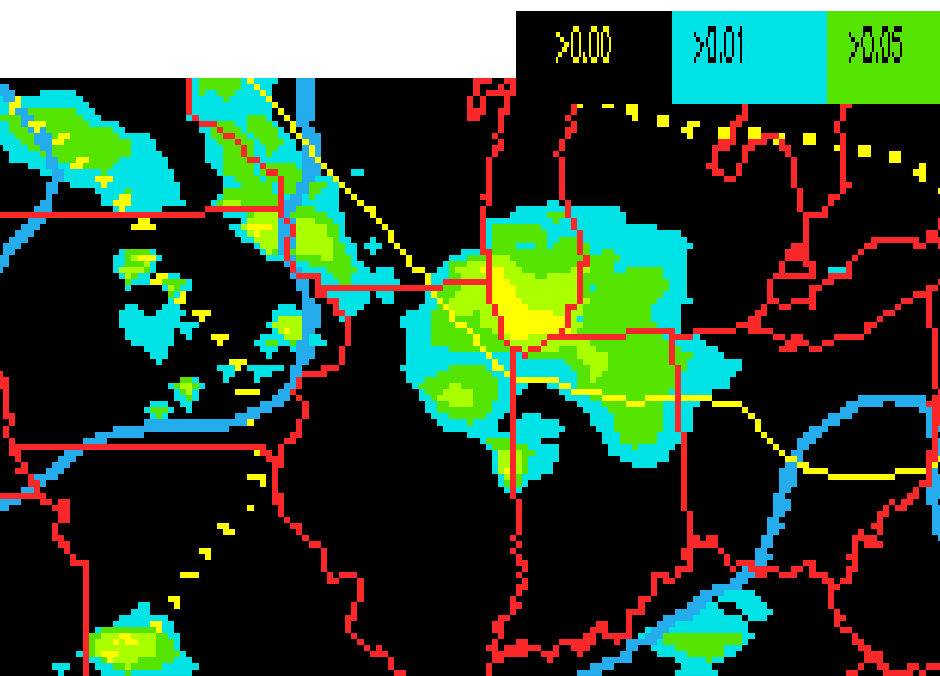
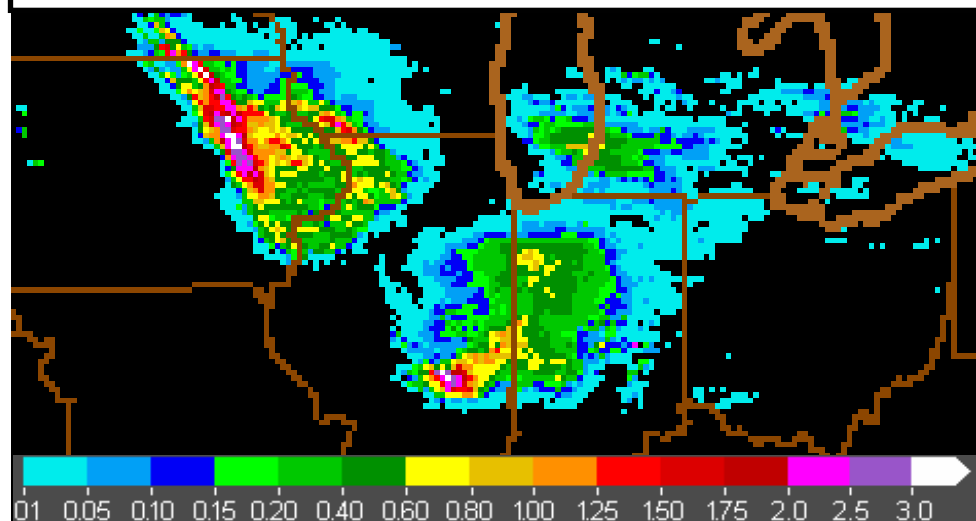
RUC 3-h forecasts valid 00z 25 Mar 2007



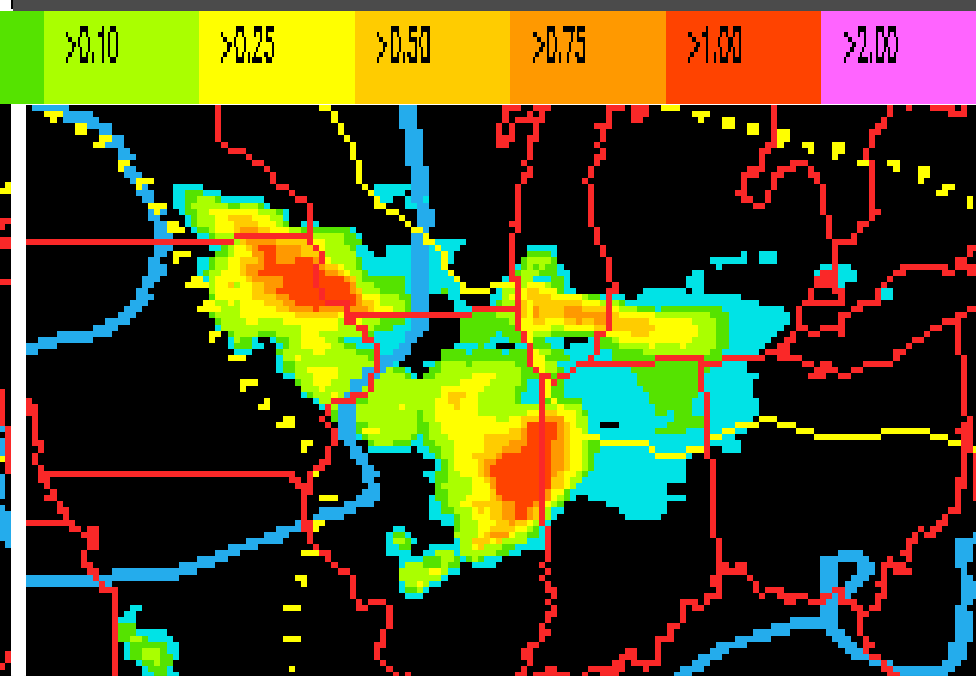
Overnight convection example

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

NSSL 12z 3-h accum. Precip.



No radar assimilation



Radar assimilation

Convective suppression example

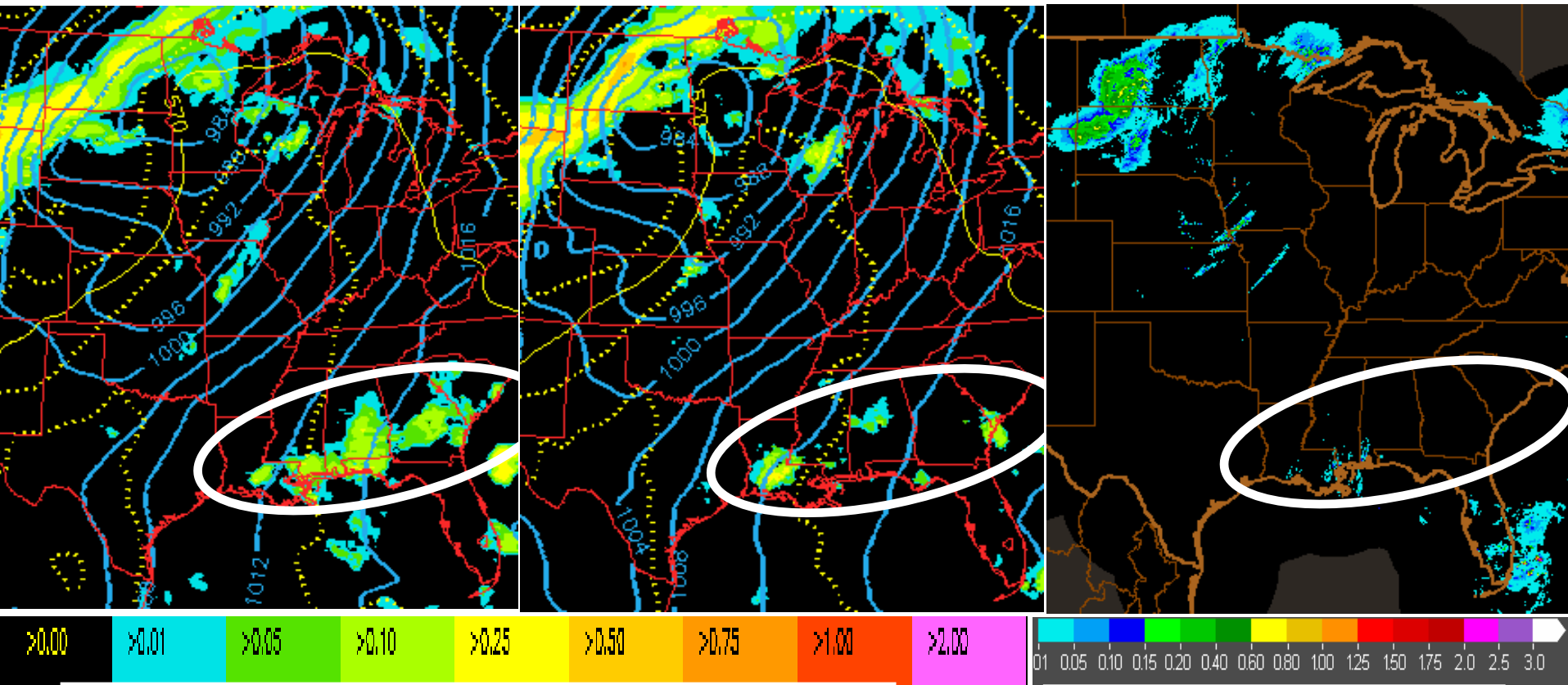
Radar

NSSL 3-h

Control

Assimilation

precipitation



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

Valid 15z 7 June 2007

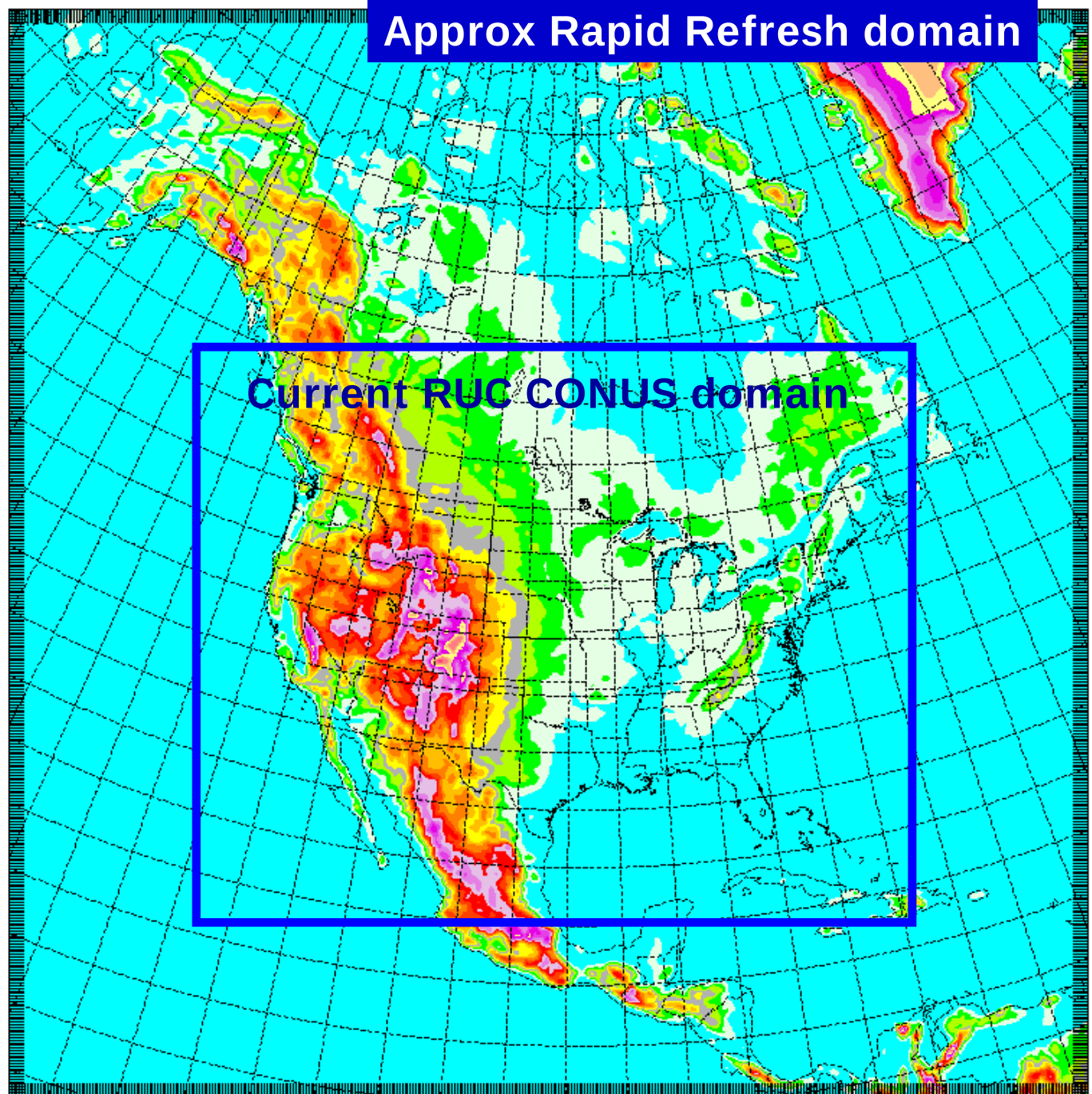
Impact from convective suppression

RUC ↓ Rapid- Refresh (2009)

*Continental
situational
awareness
model*

Hourly NWP
Update for:

- CONUS
- AK/Can
- Pac/Atl
- Caribbean

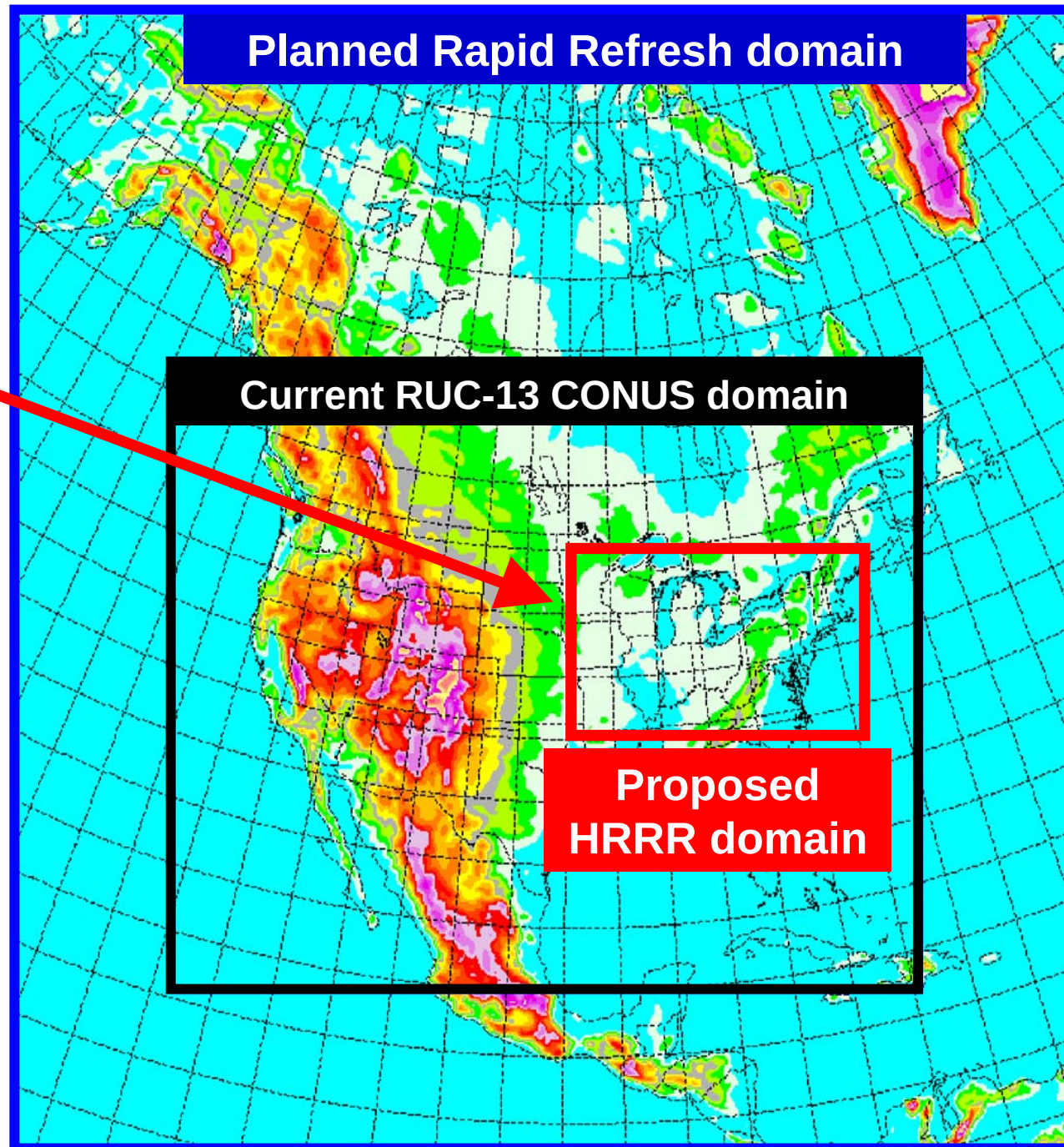


RUC to Rapid Refresh

- CONUS domain (13km)  • North American domain (13km)
- RUC model  • WRF model (ARW dynamic core)
- RUC 3DVAR  • GSI (Gridpoint Statistical Interpolation)

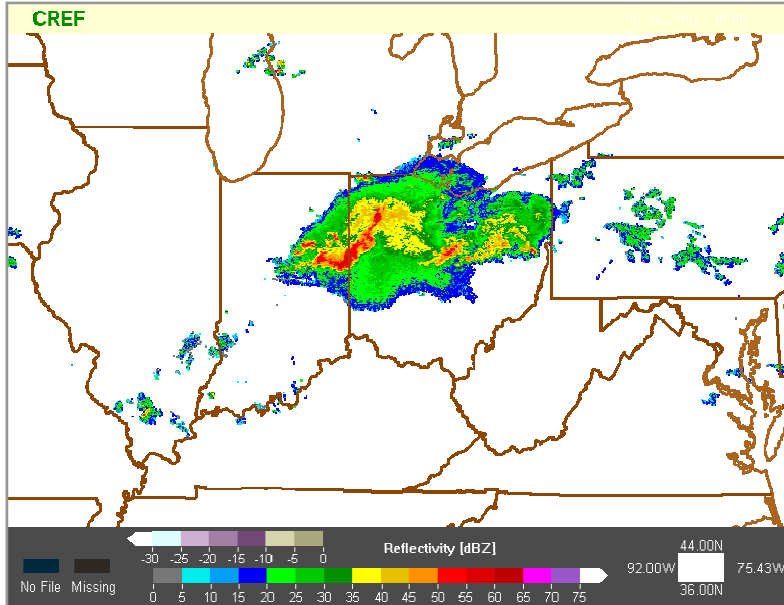
High-Resolution Rapid Refresh (HRRR)

- 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

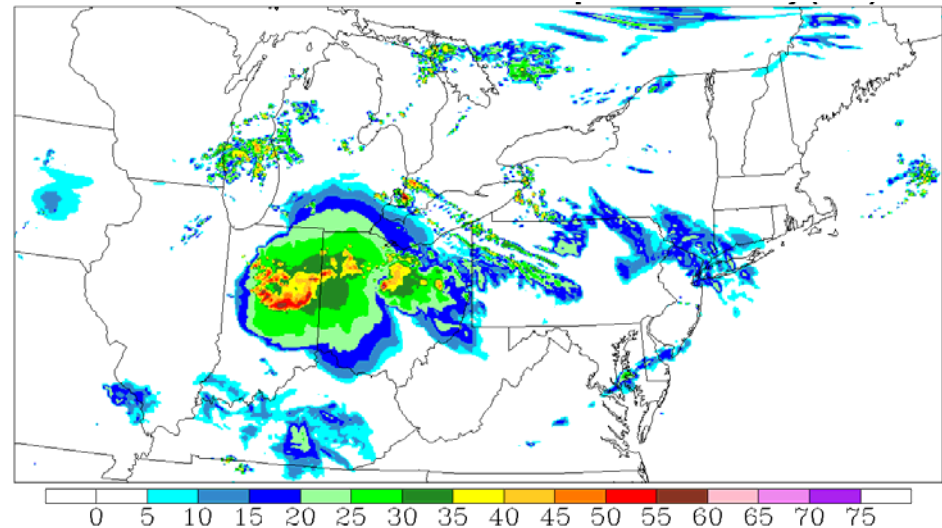


Sample HRRR from Radar-Enhanced RUC

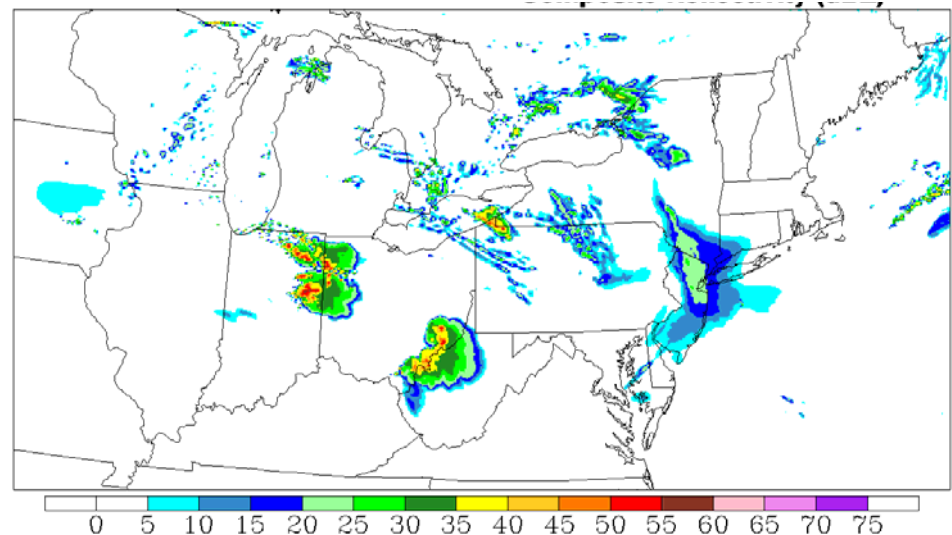
NSSL verification



HRRR 3-km run initialized From radar-enhanced RUC



No-radar init - 3-km run



**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