Hourly Updated NOAA NWP Models

RUC – current NCEP operational model -13km

Radar assimilation since Nov. 2008

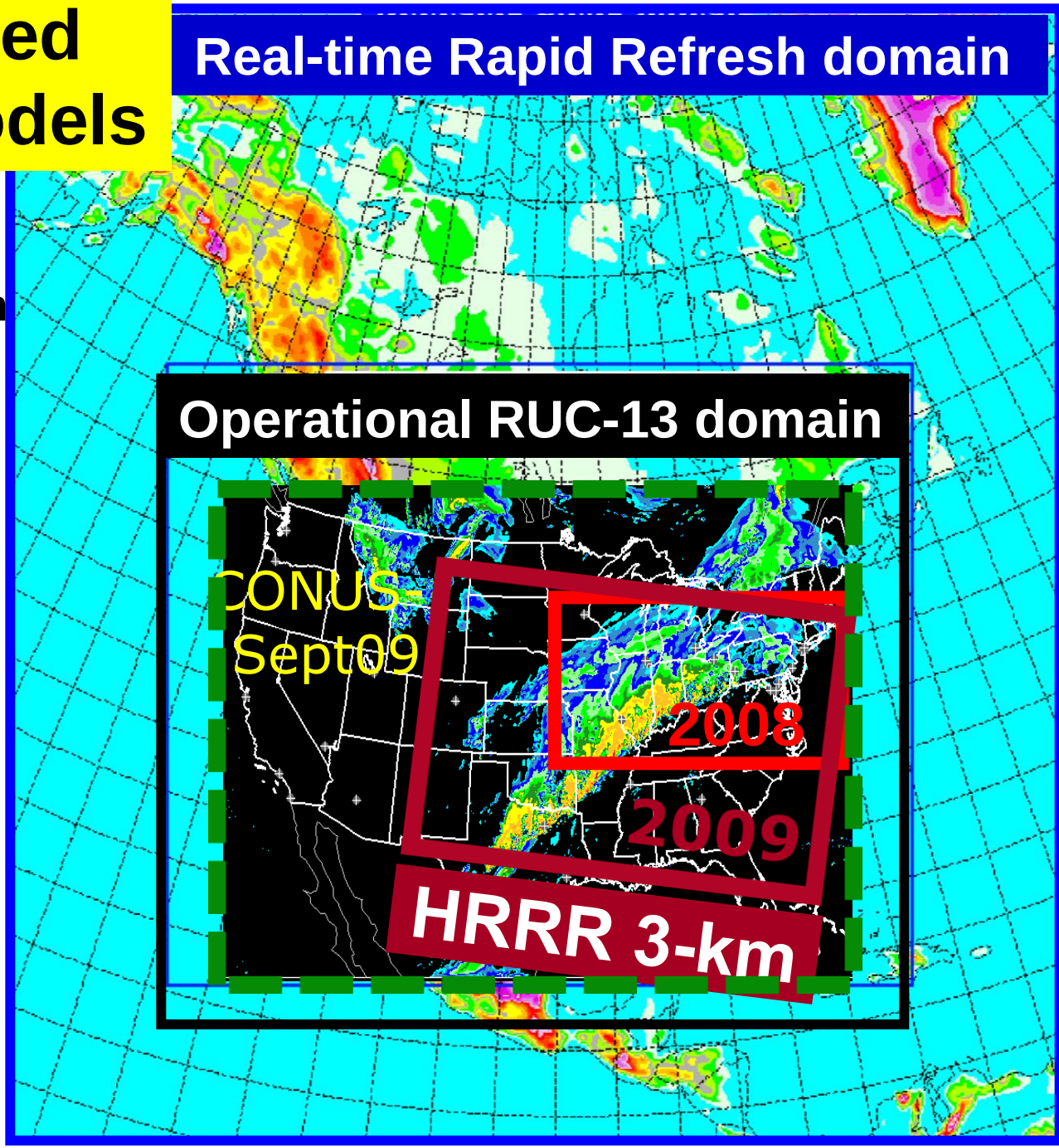
- 18h extension- Dec09

Rapid Refresh (RR) – will replace RUC at NCEP in 2010 – WRF-ARW, GSI w/ RUC-based enhancements

HRRR – Hi-Res Rapid Refresh

-Experimental 3km run -

- Initialized by RUC/RR



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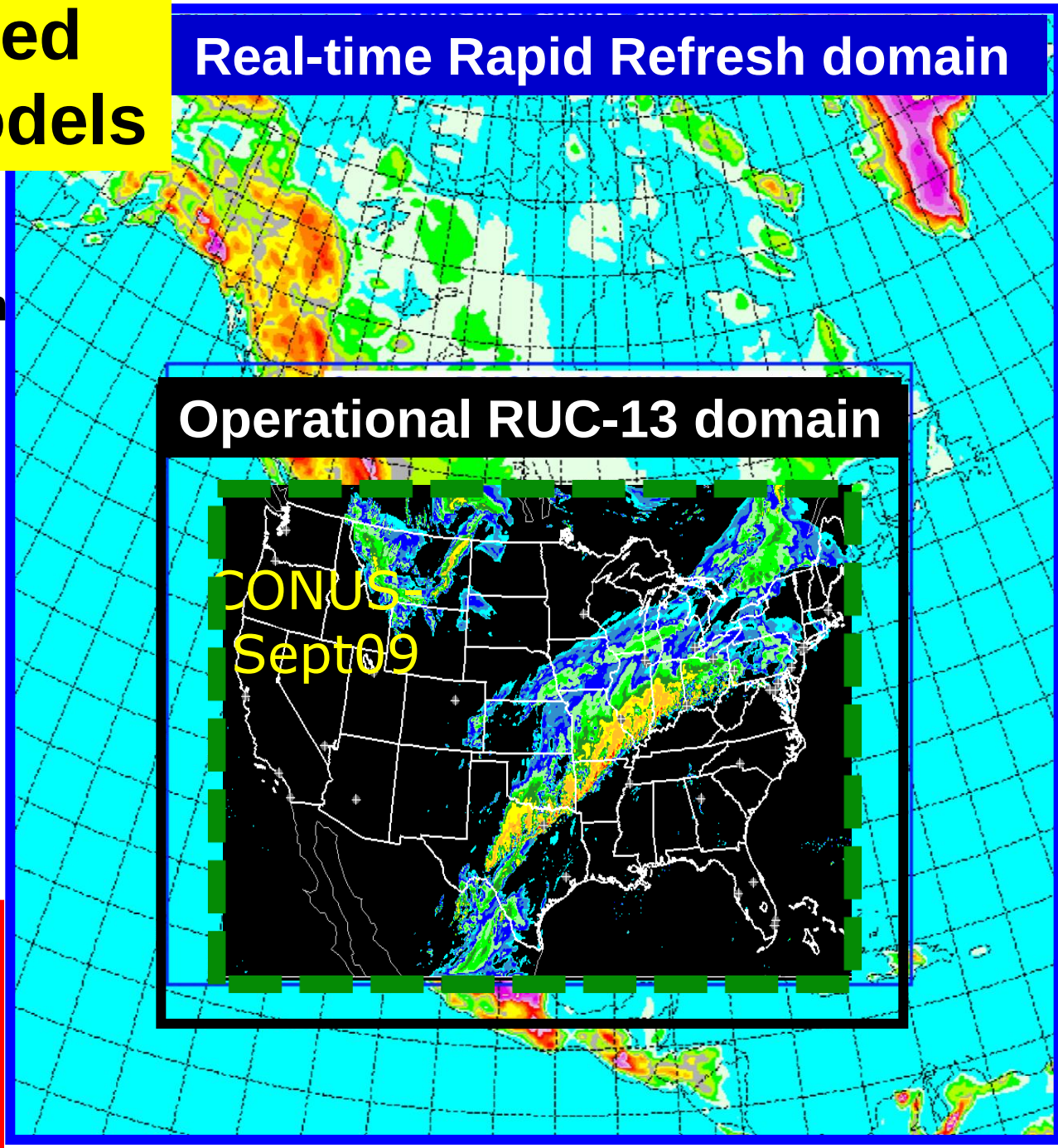
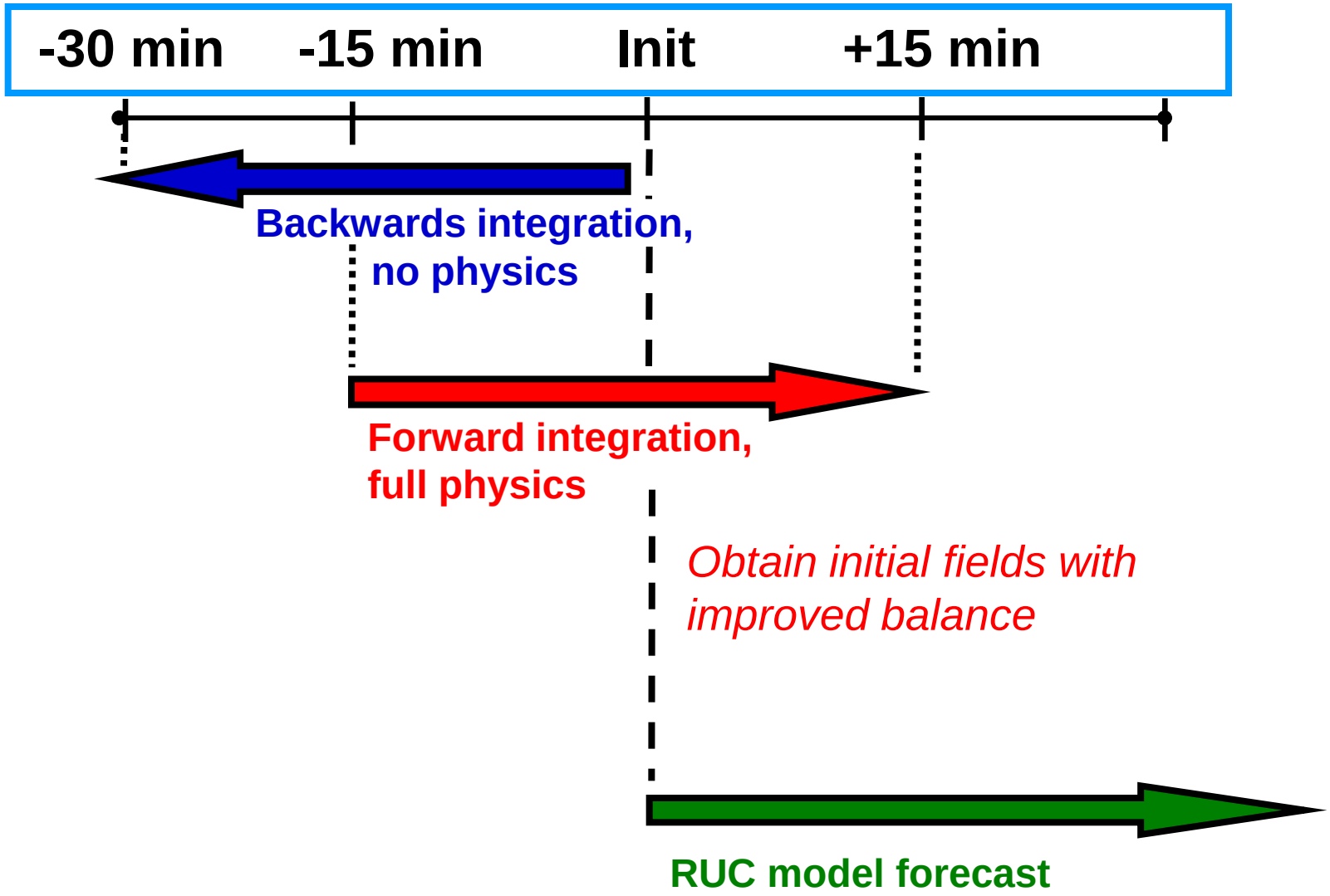
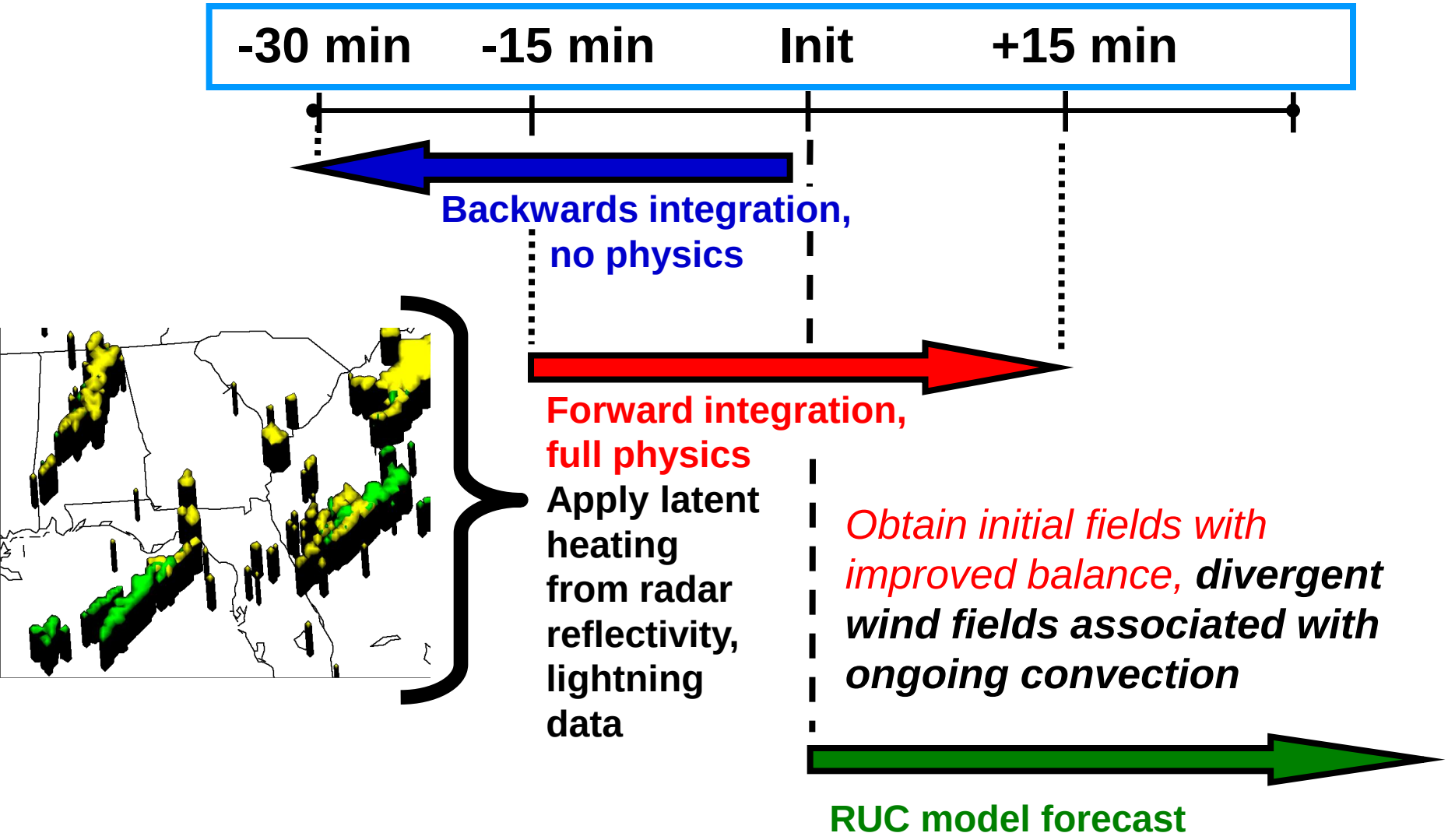


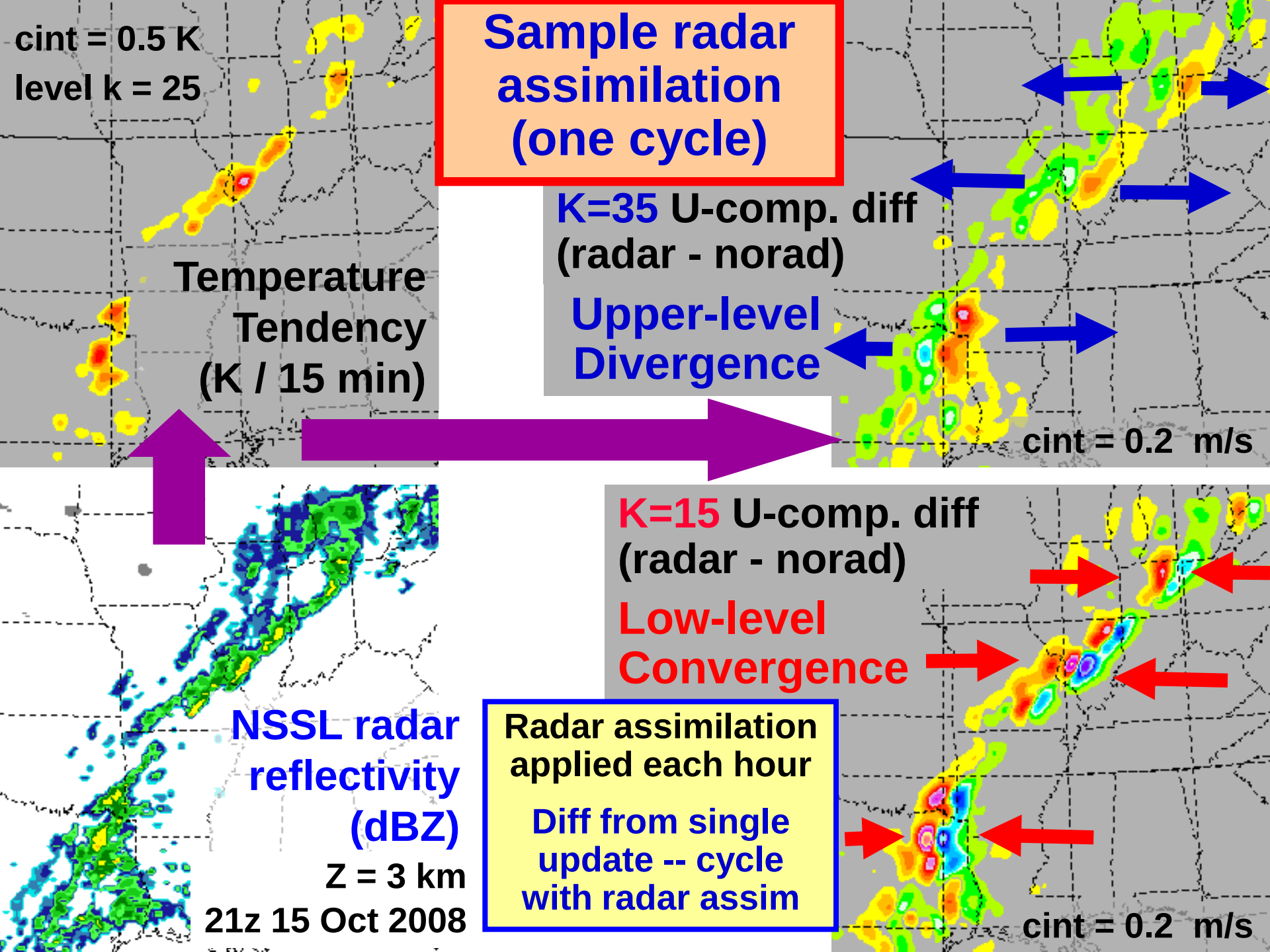
RUC / RR Diabatic Digital Filter Initialization (DDFI)

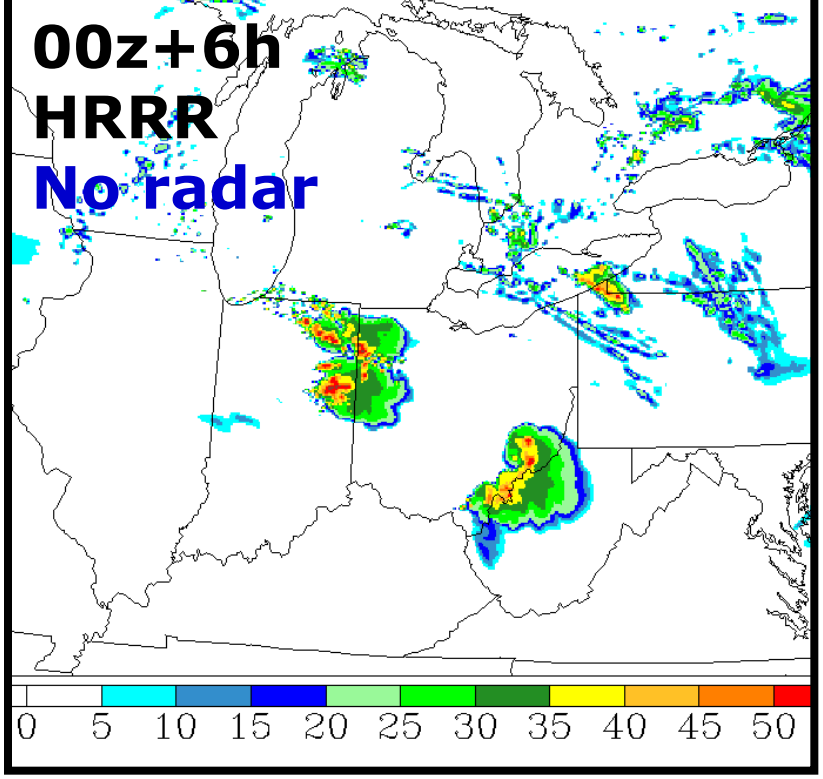


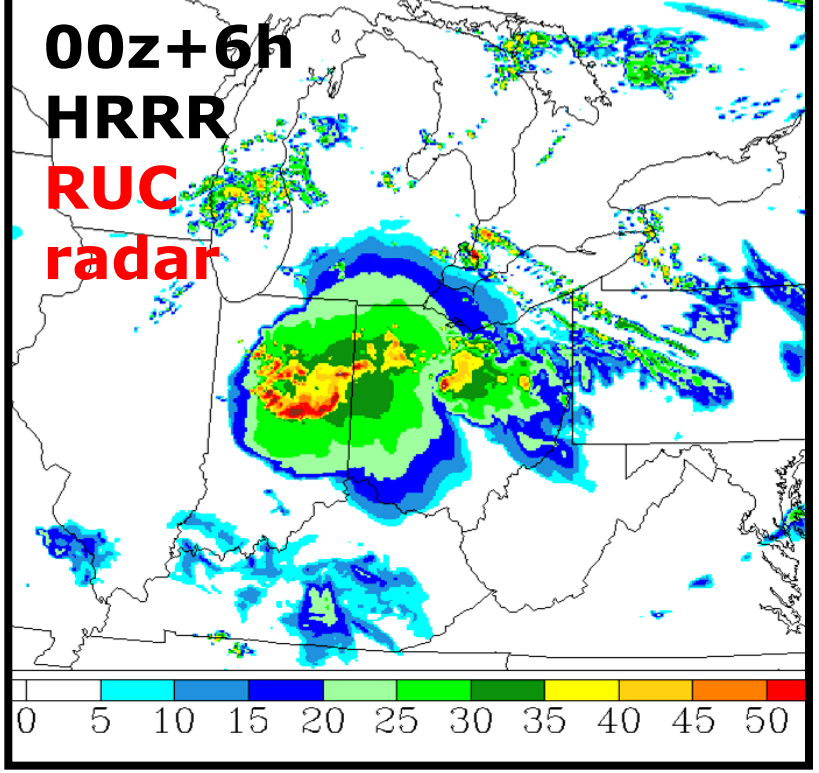
RUC / RR Diabatic Digital Filter Initialization (DDFI)

add assimilation of radar data

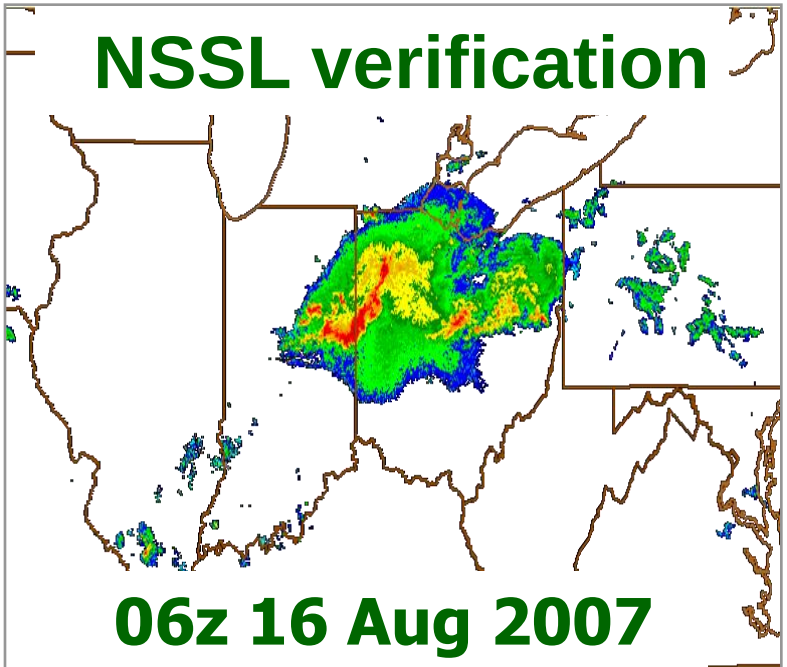



cint = 0.5 K
level k = 25
Sample radar assimilation (one cycle)
K=35 U-comp. diff (radar - norad)
Upper-level Divergence
Temperature Tendency (K / 15 min)
cint = 0.2 m/s
K=15 U-comp. diff (radar - norad)
Low-level Convergence
NSSL radar reflectivity (dBZ)
Z = 3 km
21z 15 Oct 2008
Radar assimilation applied each hour
Diff from single update -- cycle with radar assim
cint = 0.2 m/s

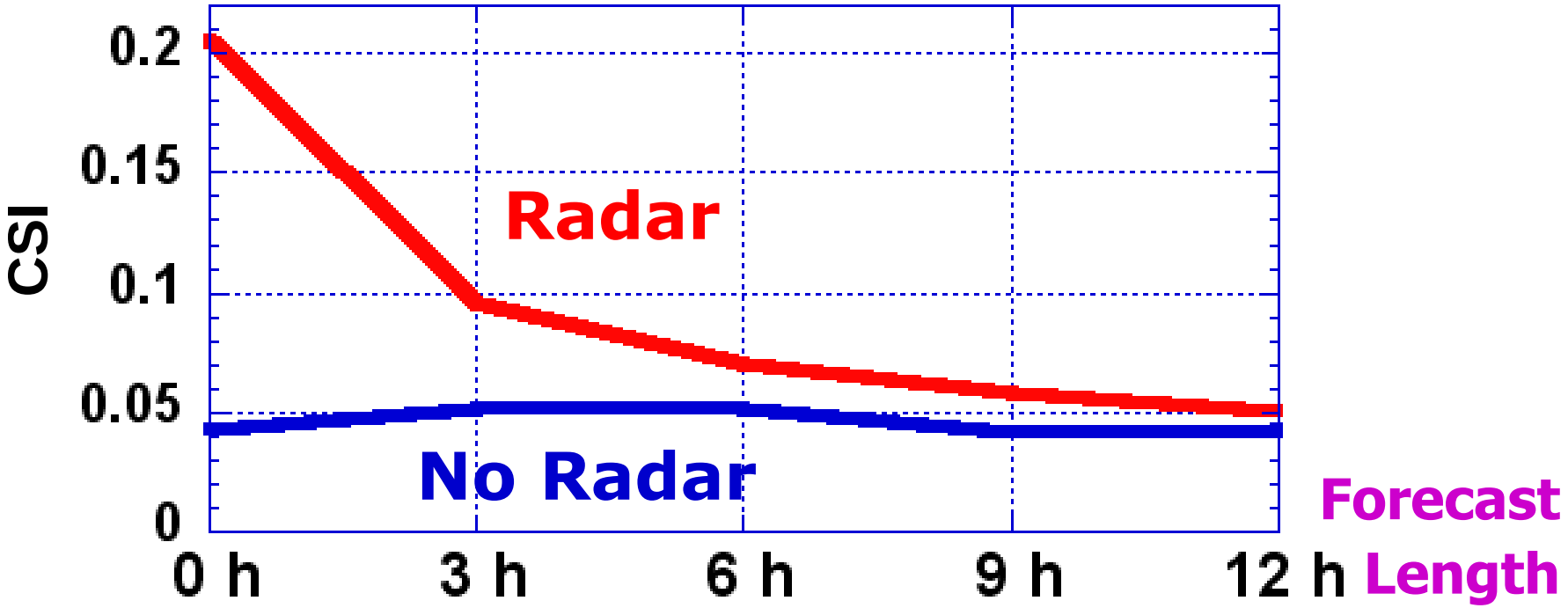




RUC radar assimilation on 13-km grid improves HRRR 3-km forecast



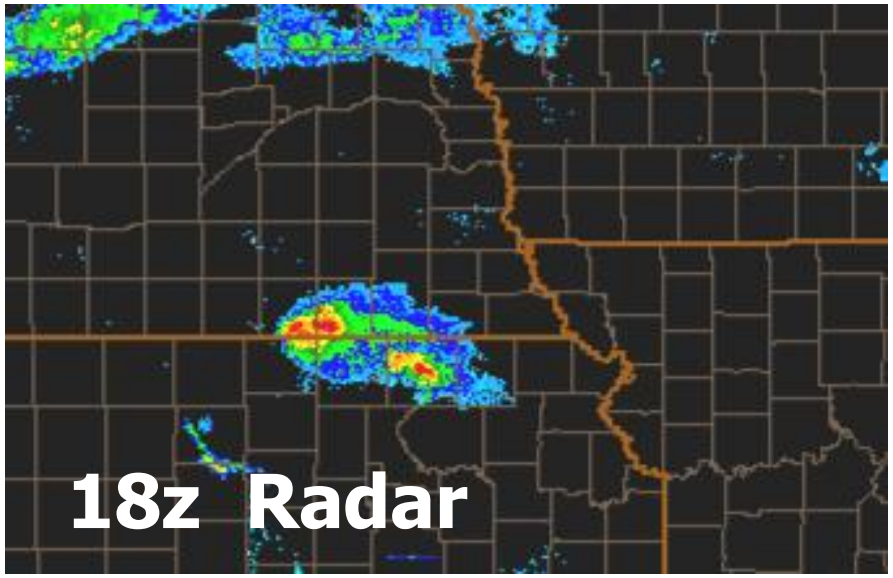
2008 HRRR reflectivity verification
Skill vs. forecast length

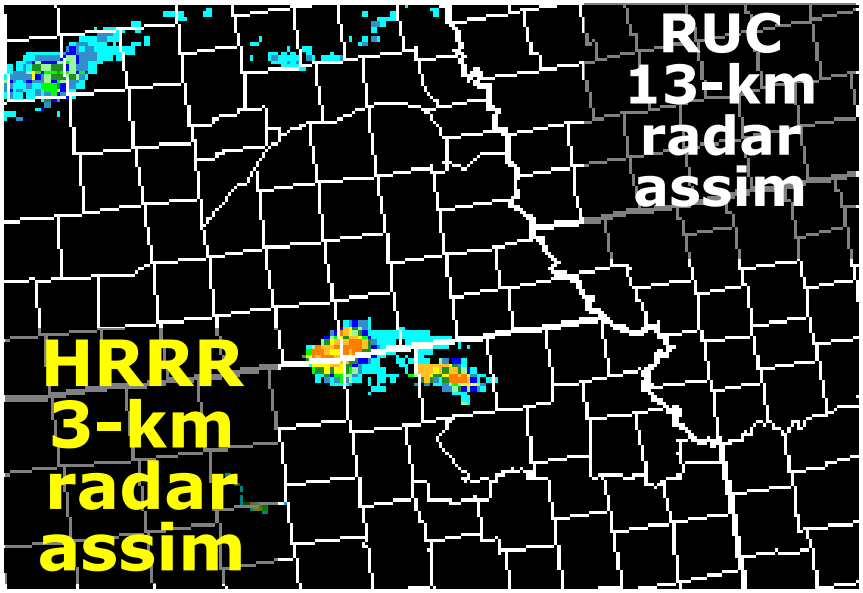


30 dBZ reflectivity
on HRRR 3-km grid

Verification period
23 June – 25 Aug 2008

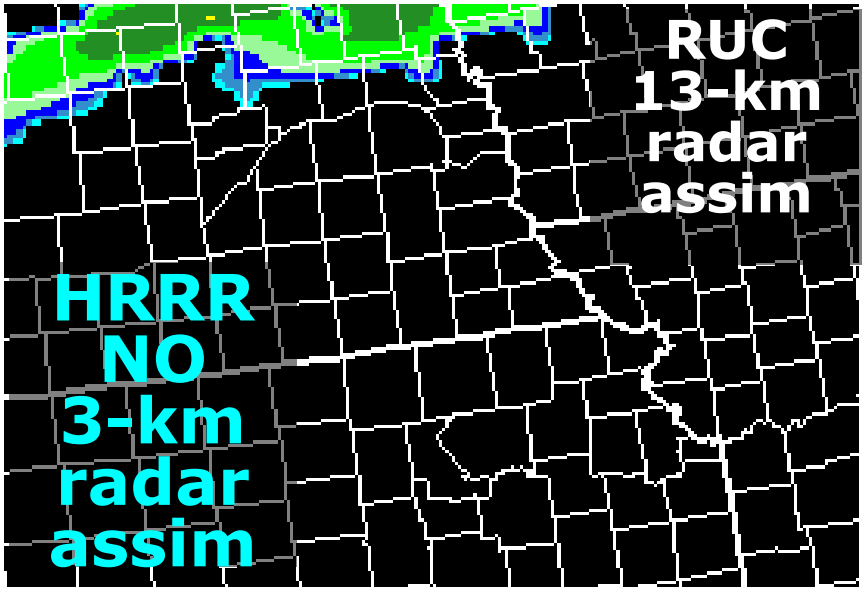
HRRR with 2nd pass radar assimilation on 3-km domain





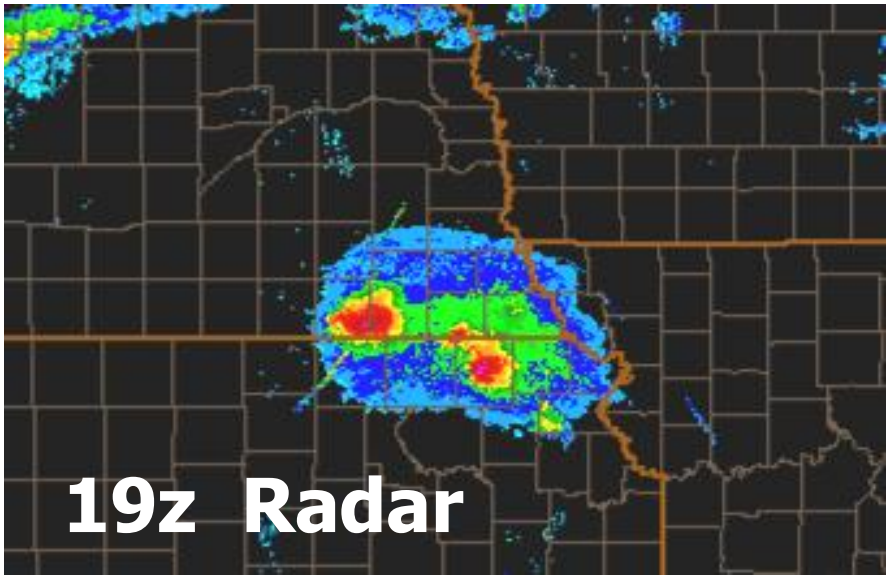
27 June 2009

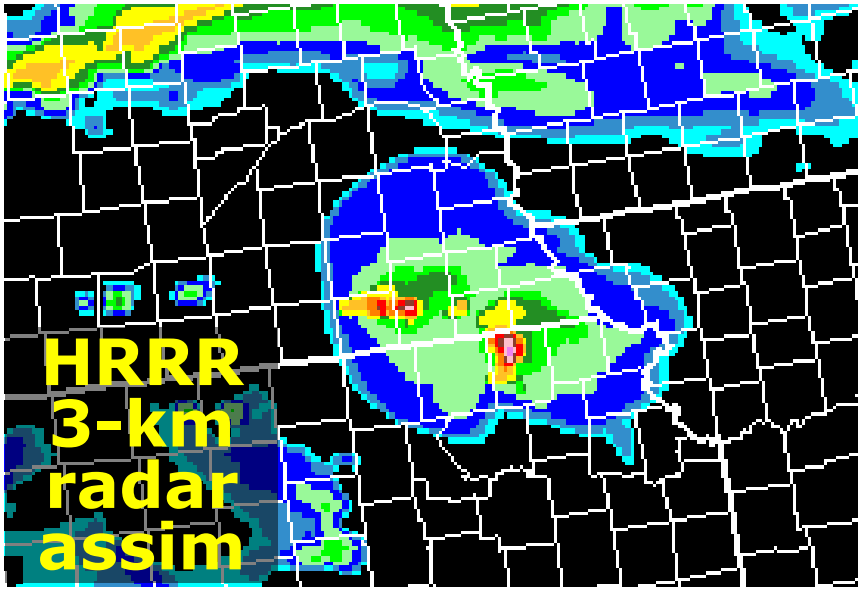
+ 0h fcsts



- Both forecsts have RUC 13-km DFI reflectivity assim.
- 2nd pass (3-km DFI radar DA) greatly reduces initial spin-up

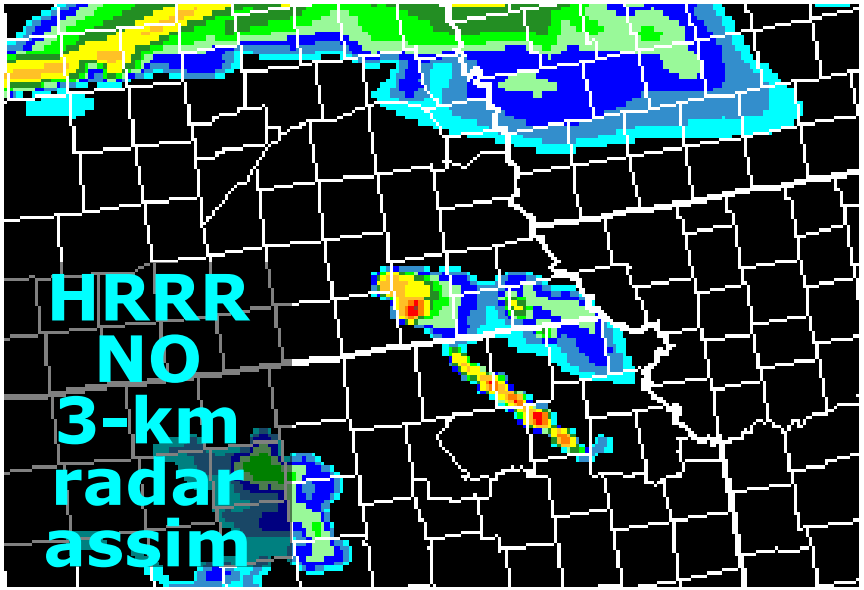
HRRR with 2nd pass radar DA on 3-km domain





27 June 2009

+ 1h fcsts



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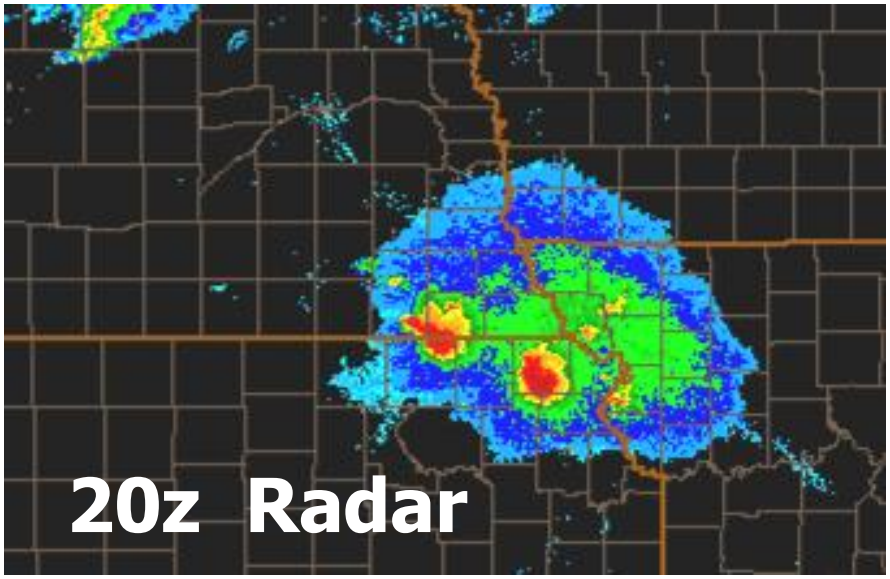
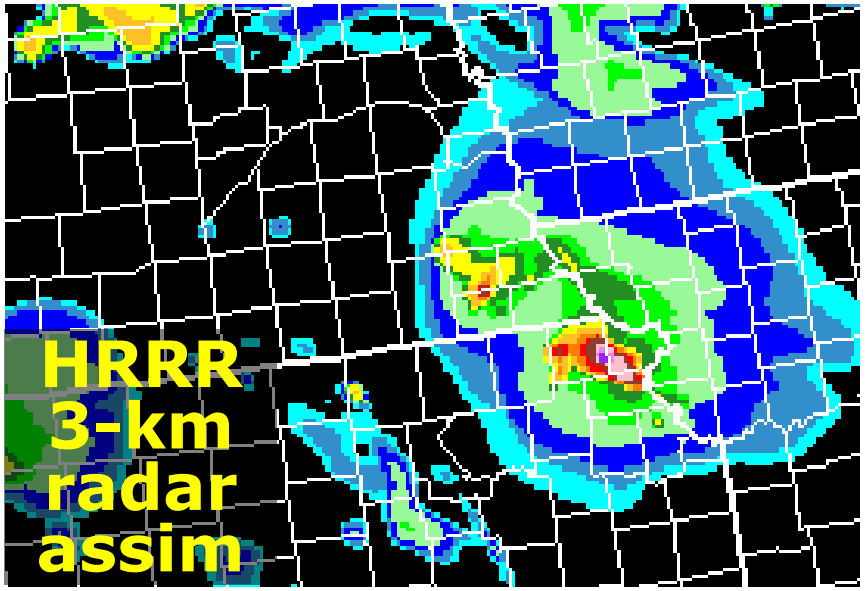
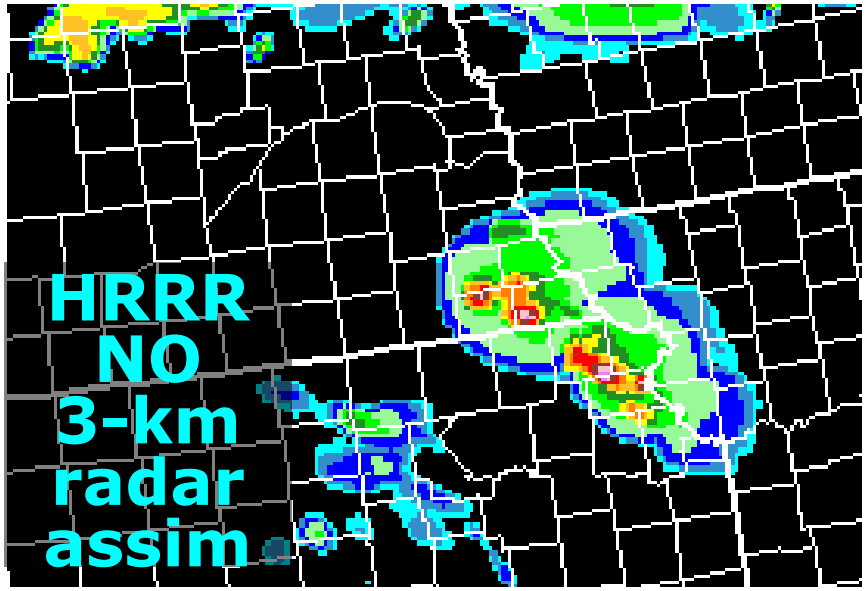




27 June 2009

+ 2h fcsts



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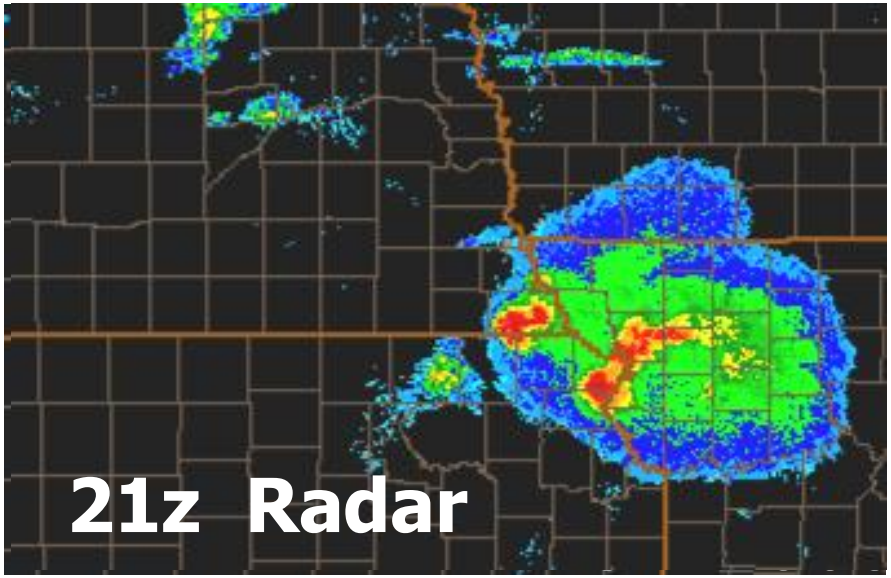
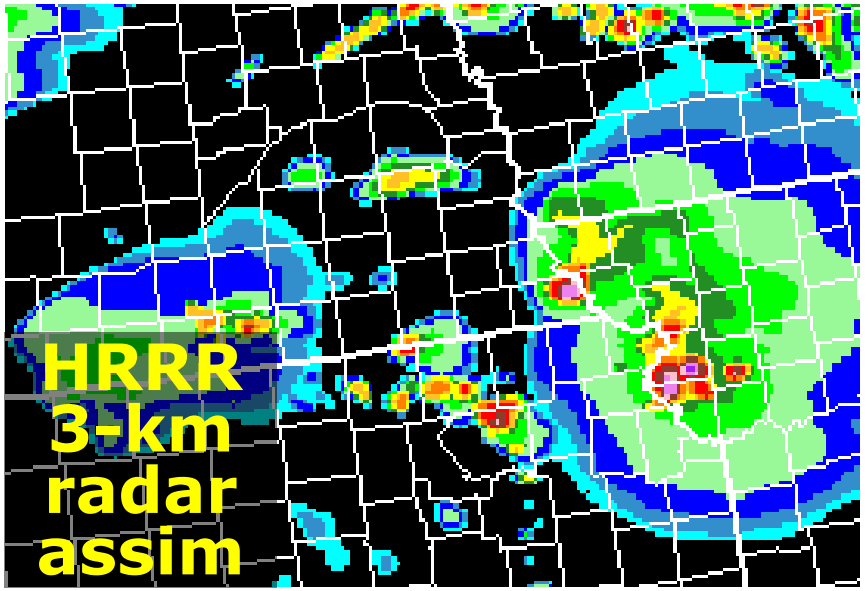
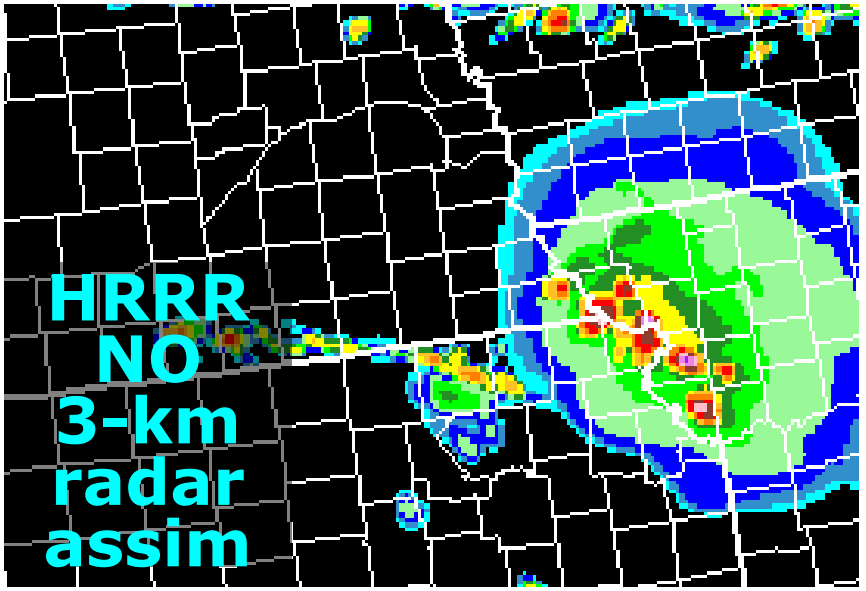
HRRR with 2nd pass radar DA on 3-km domain





27 June 2009

+ 3h fcsts



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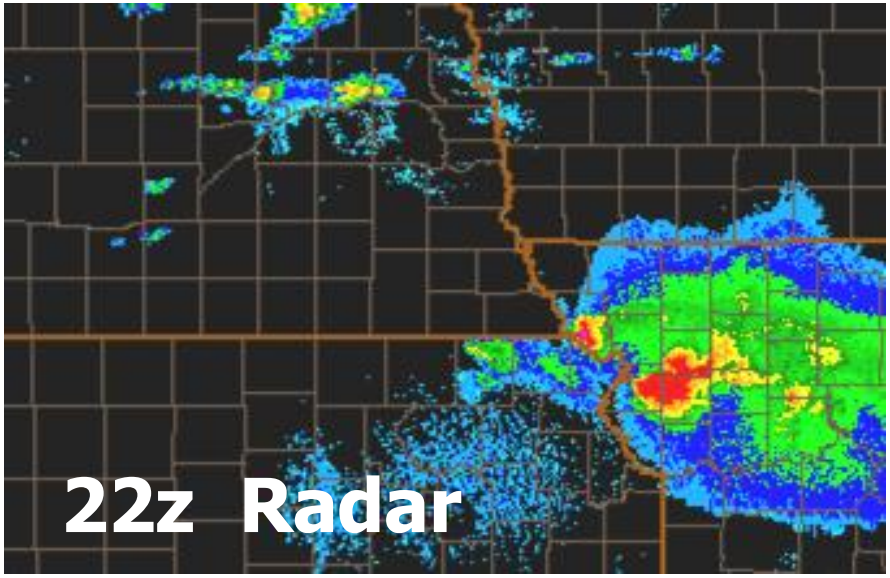
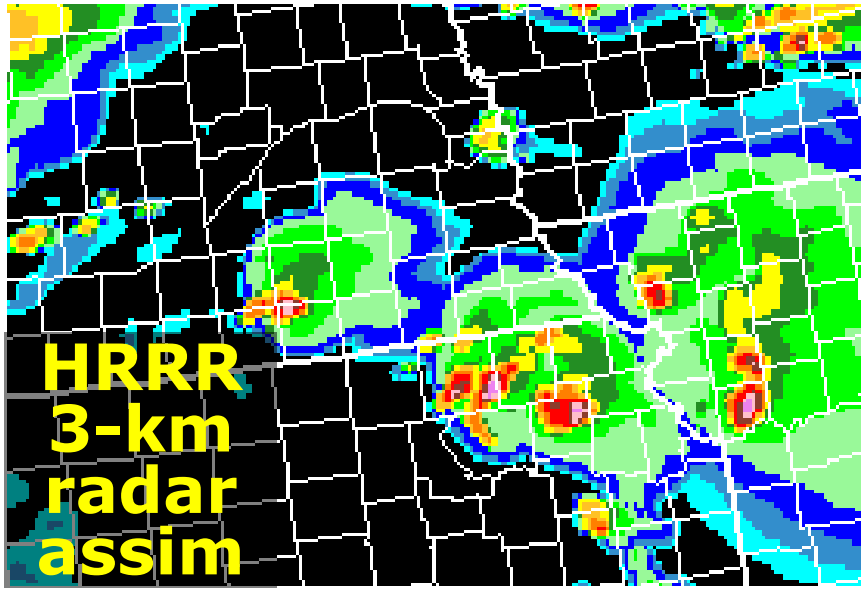
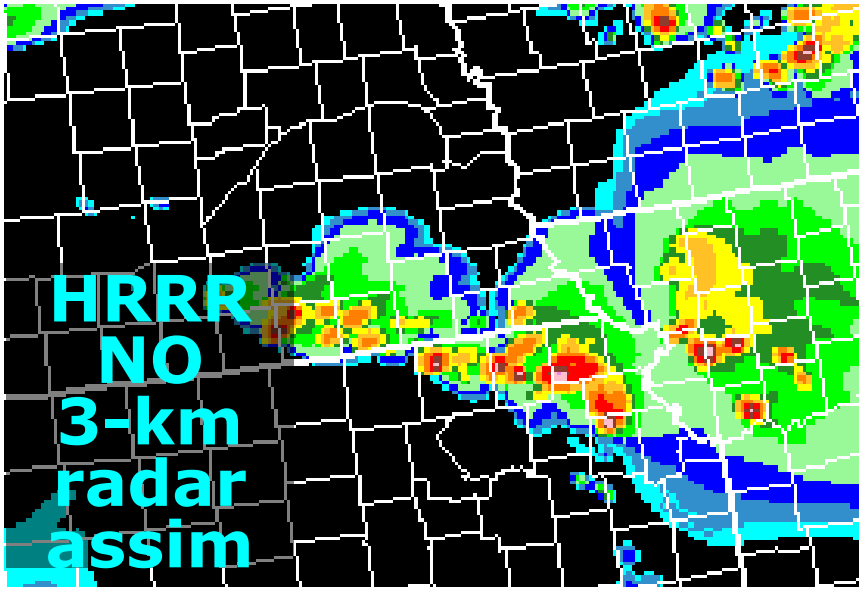




27 June 2009

+ 4h fcsts



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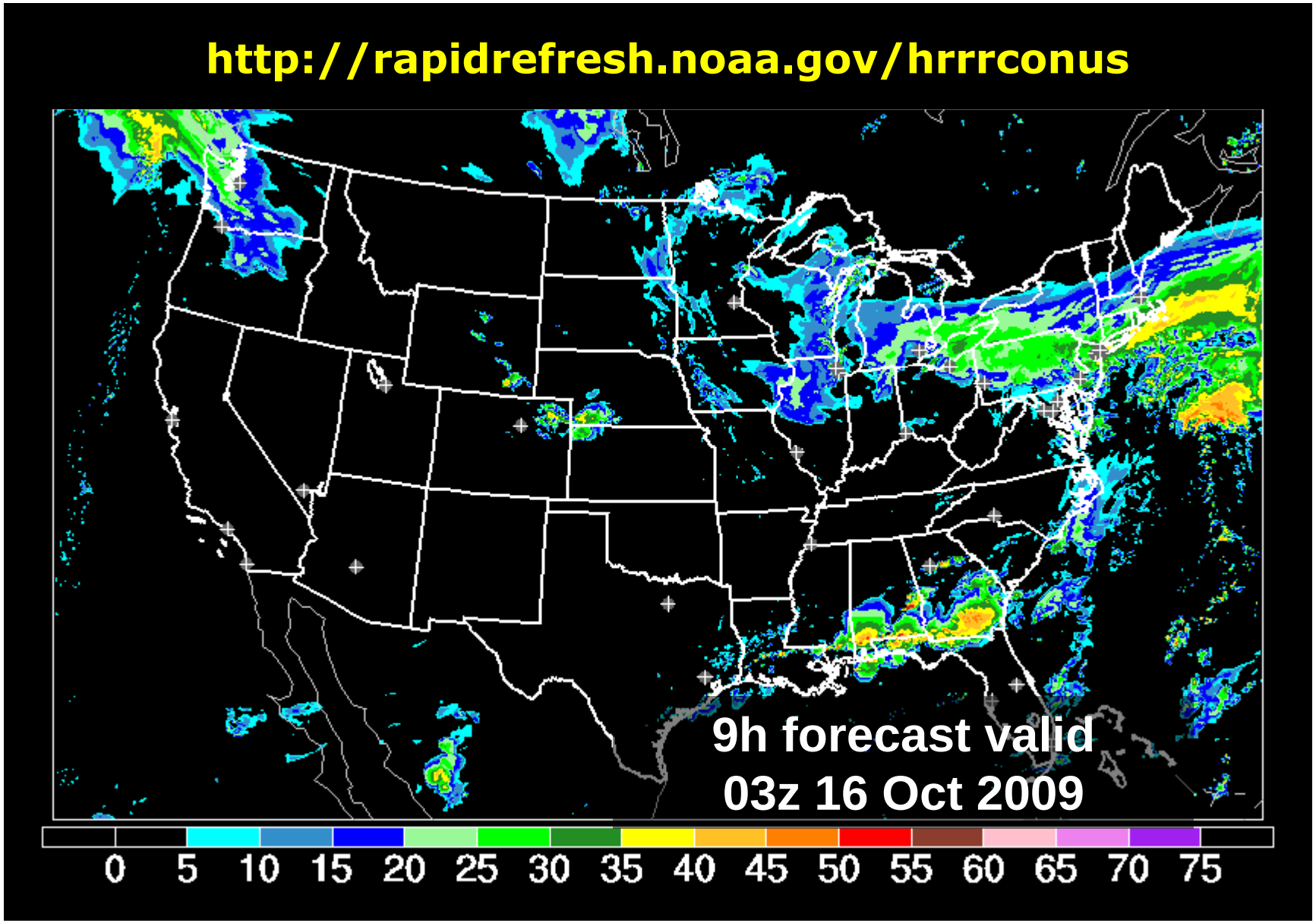
Real-time CONUS HRRR runs at ESRL



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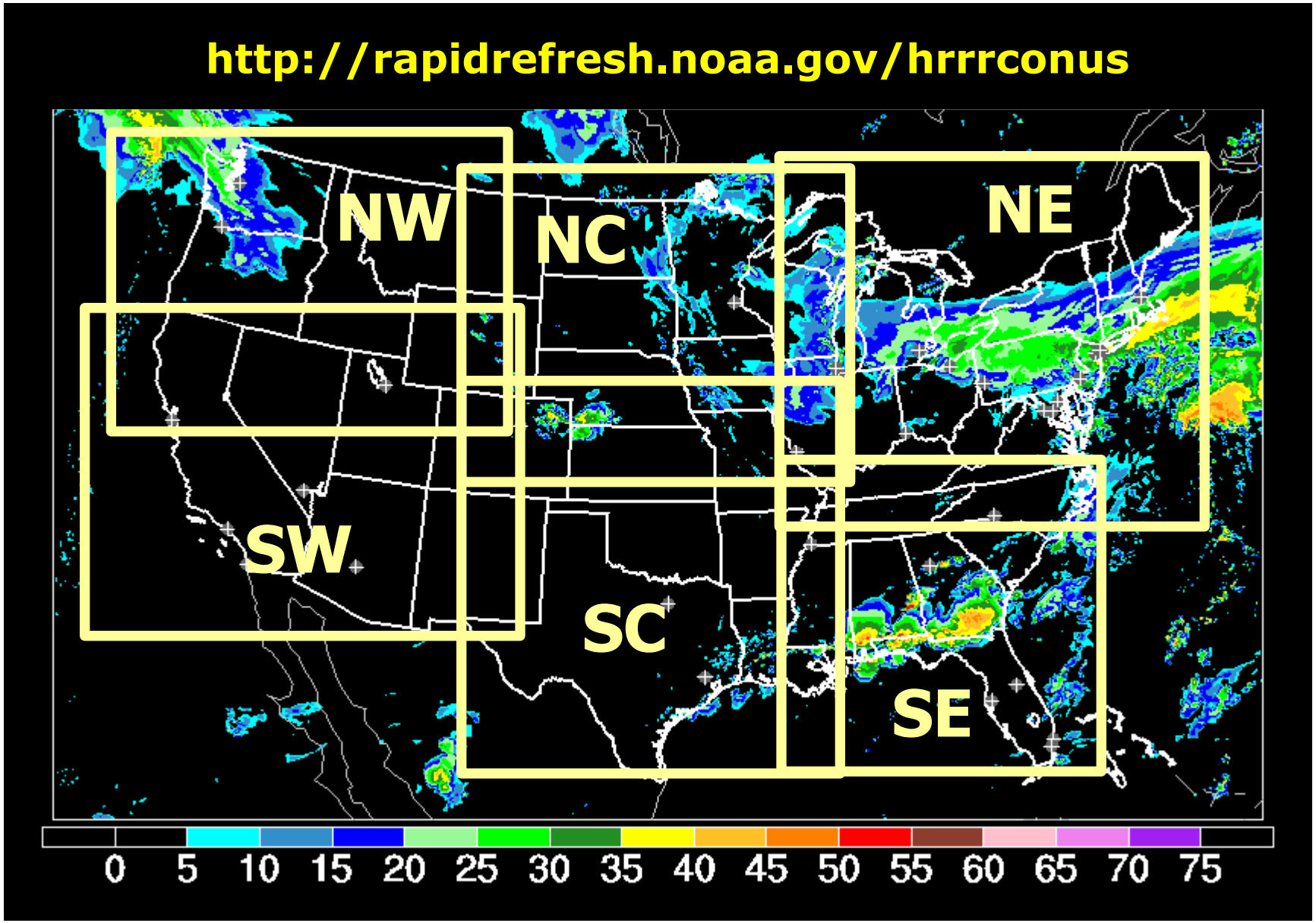
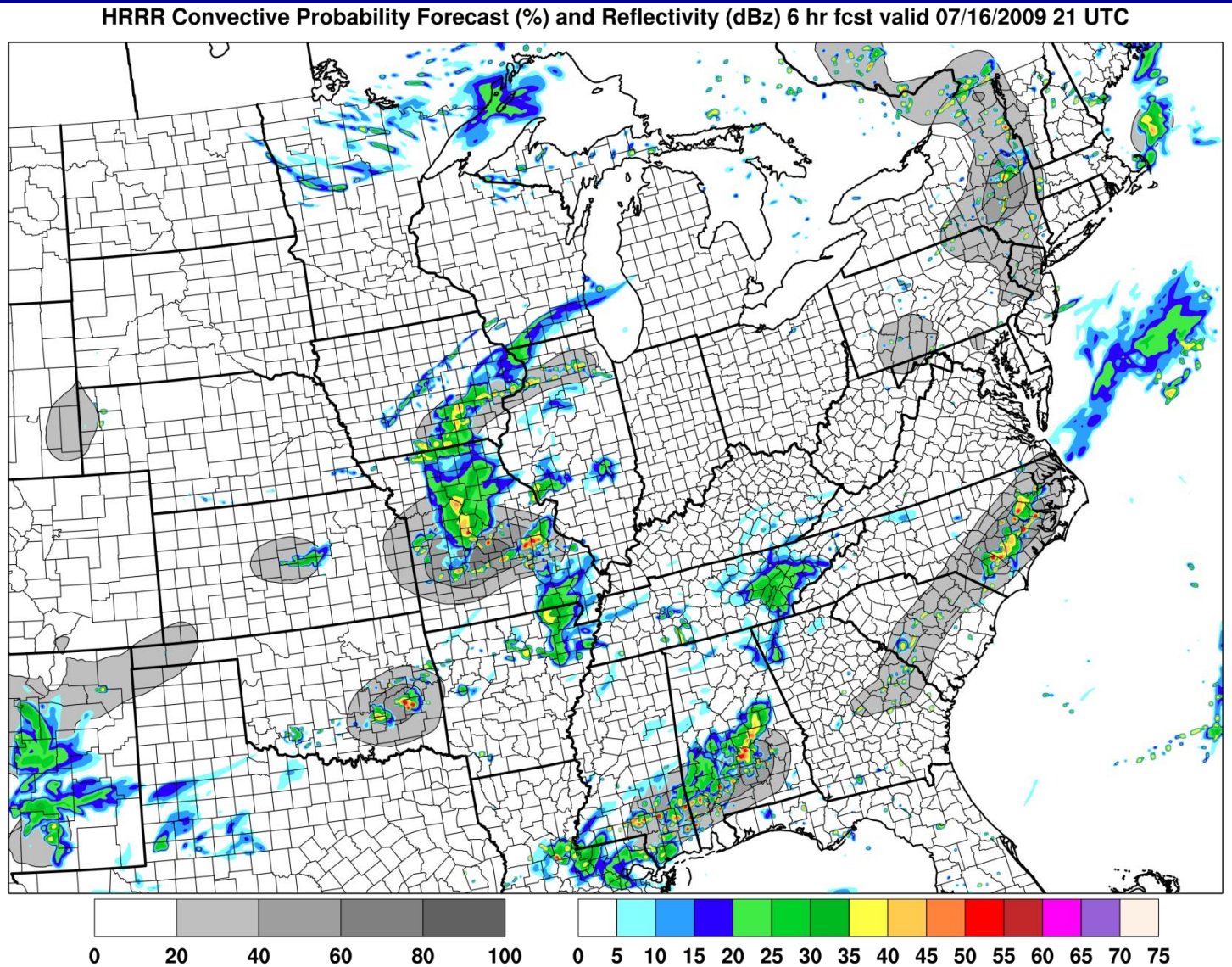


HCPF (probabilistic) and HRRR (deterministic)

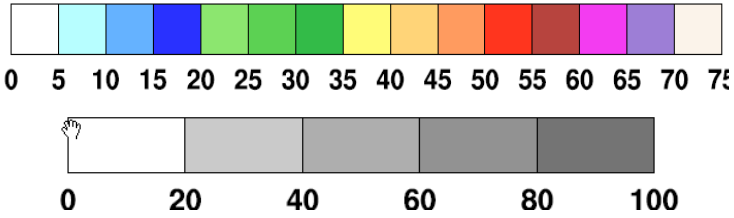
HCPF is based on time-lagged HRRR forecasts

Development – GSD (Curtis Alexander, Doug Koch, Steve Weygandt)

HCPF is basis for CoSPA probability forecast

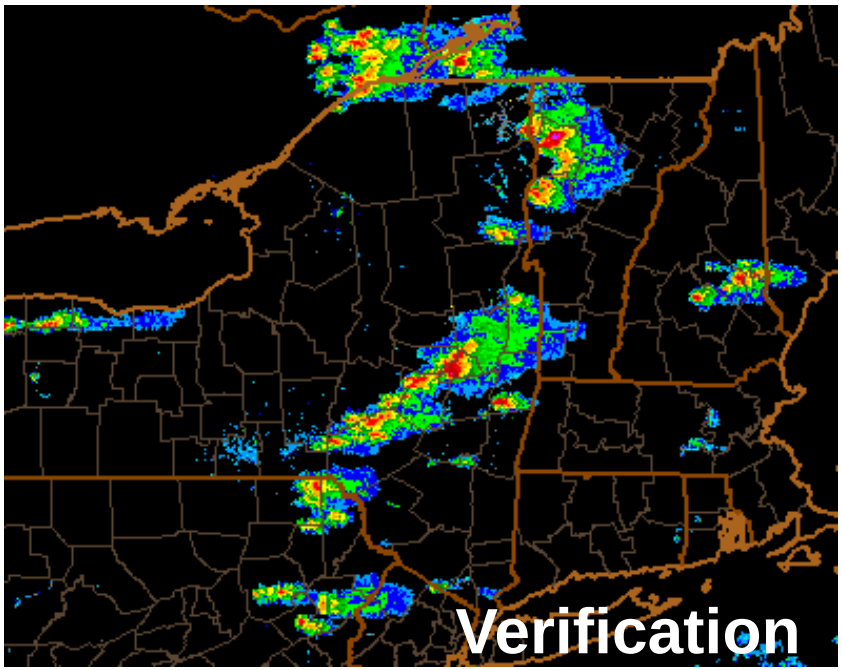


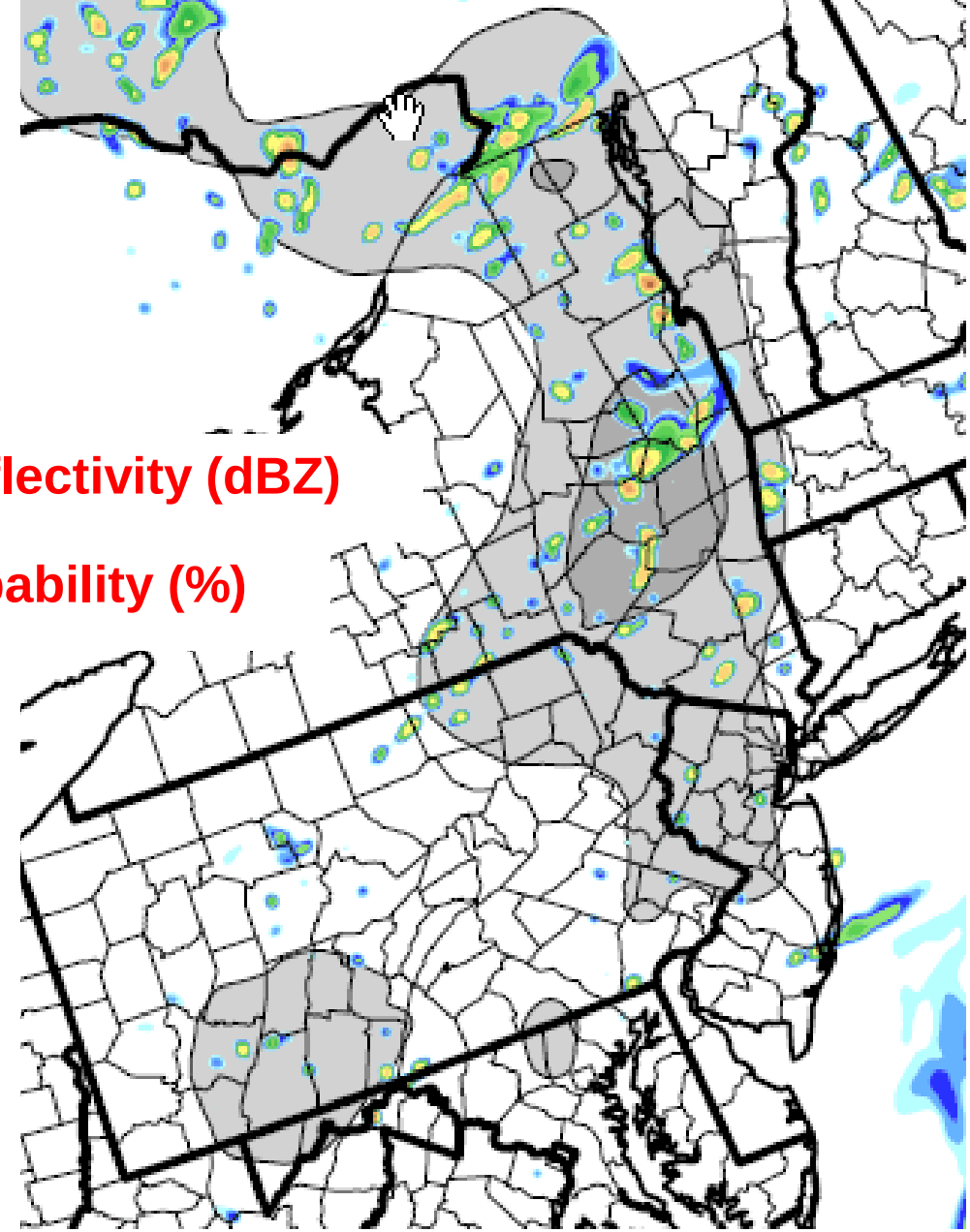
July 16, 2009 HCPF / HRRR overlay



Reflectivity (dBZ)

Probability (%)





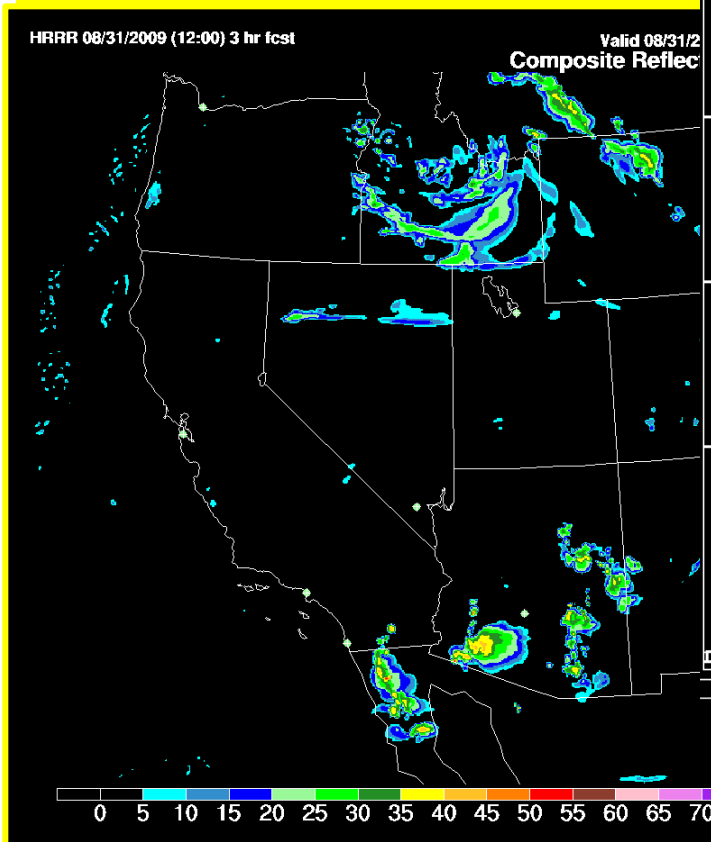
15z + 6h HRRR and HCPF

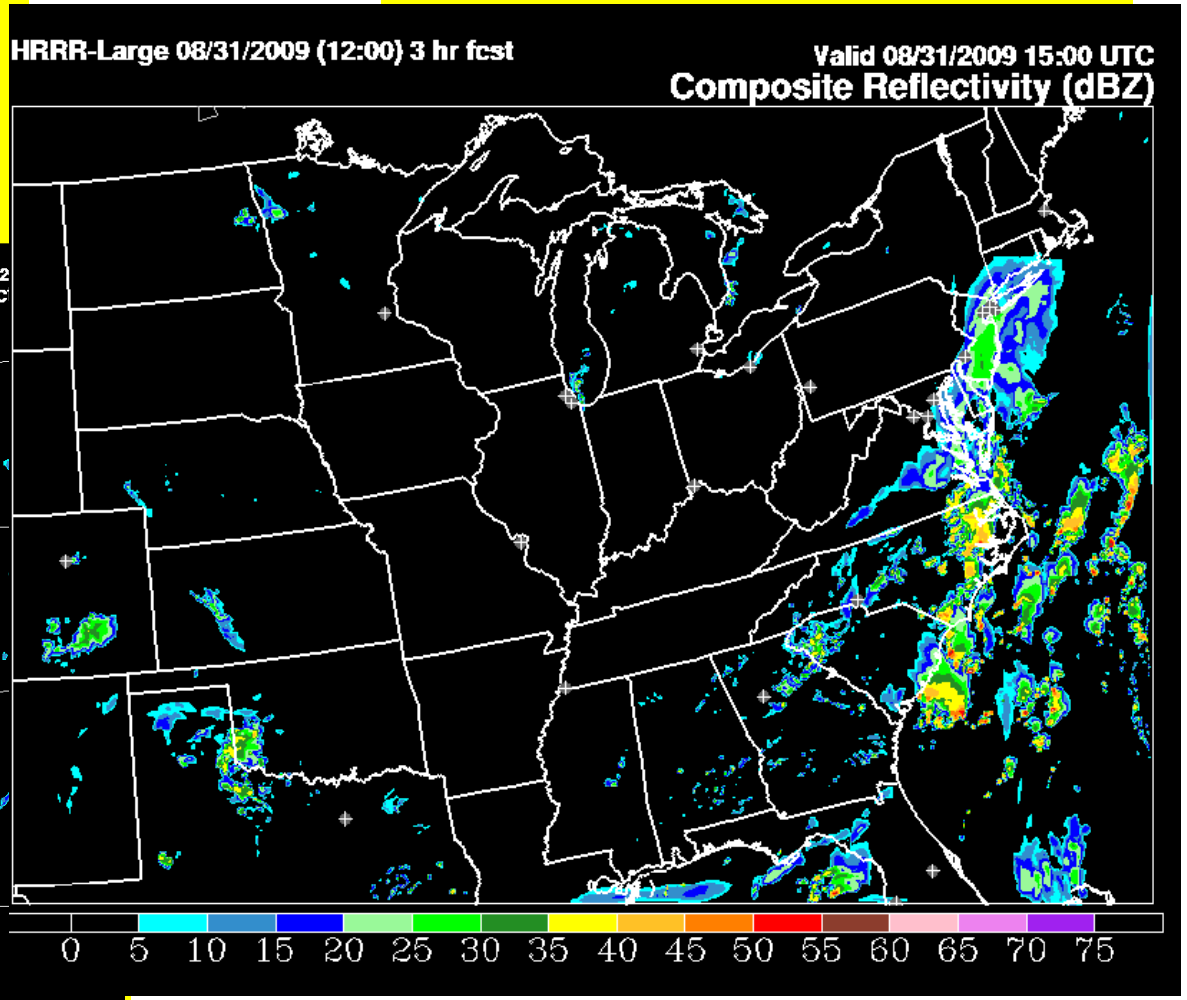
Chem addition to hourly updated NWP

3h forecast
Valid 15z Mon 31 Aug 2009

HRRR-chem-fire
-Western US, WRF-chem
-Init=RUC, same as HRRR
- Run every 6h
-Uses real-time GOES ABBA hourly fire data

HRRR
-Eastern 2/3 US
-Init=RUC, WRF-non-chem
- Run every 1h





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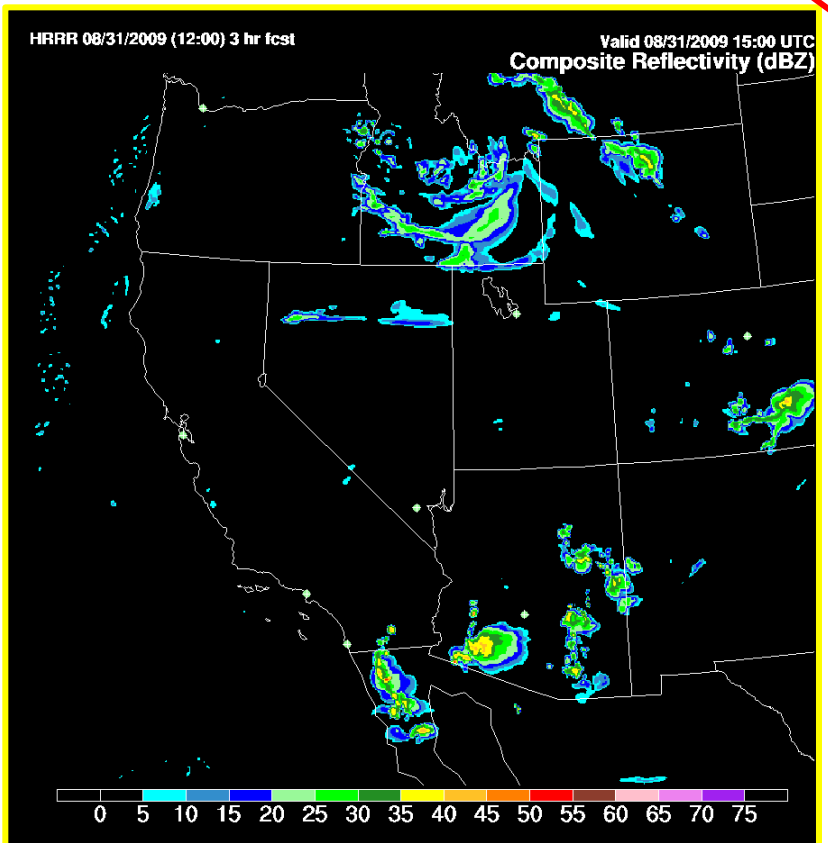
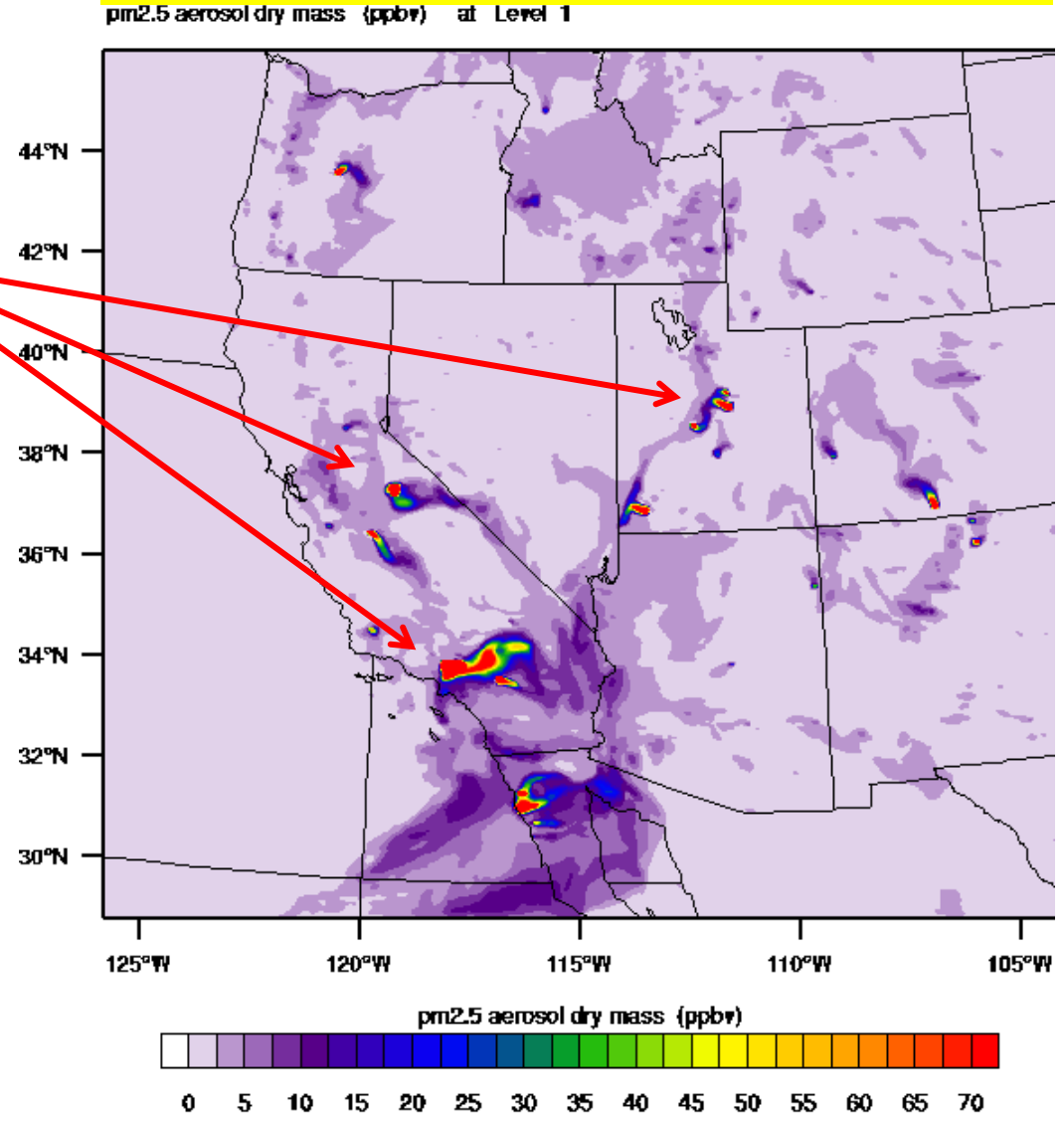


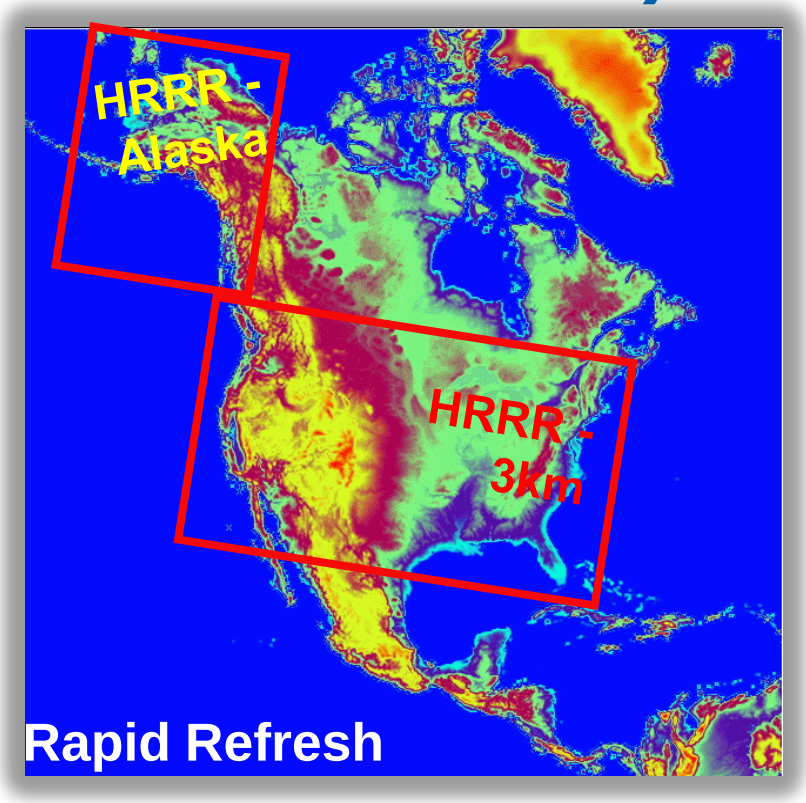
2.5 micron particulate matter
- At lowest level (~8m above ground



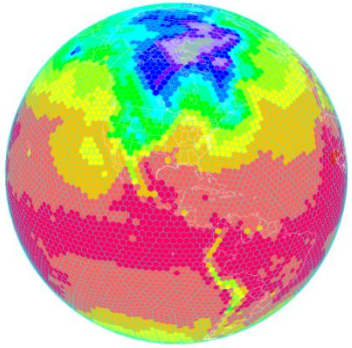
Future plans in collaboration with NCEP, FAA partners (NCAR, MIT/LL, others)

2010 – Rapid Refresh operational at NCEP
2012 – Operational (NCEP)
CONUS-wide High Resolution Rapid Refresh nested inside RR
2013 – Ensemble RR (~6 members, ARW, NMM cores) - NRRE
2014 – Add operational Alaska HRRR
2015 – Ensemble HRRR -HRRRE
2017 – Global Rapid Refresh (GRR)

Incorporation of inline chemistry – 2012-15



• Assimilation of radial wind, new satellite, phased-array radar, CASA, new regional aircraft, chemistry obs…
• Frequency from 60min➔30➔15min
• Improved nowcast/blend/NWP



Applications:
Aviation, severe wx, hydrology, energy, air quality, fire wx, volcanoes/hazards, etc.