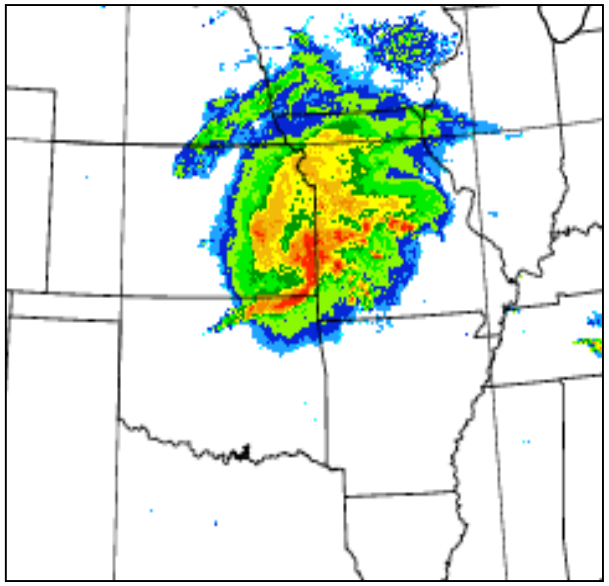
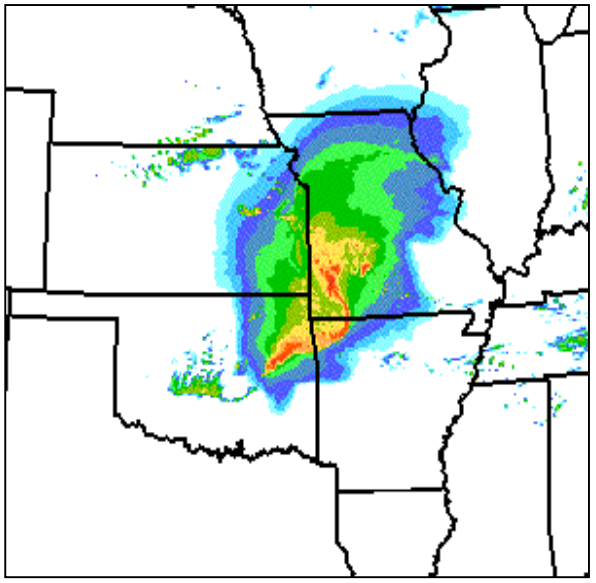
The Use of the RUC DFI Initialization for the 2009 WRF-ARW 3 km Explicit Convective Forecasts:

Radar
12 UTC
05/08/09



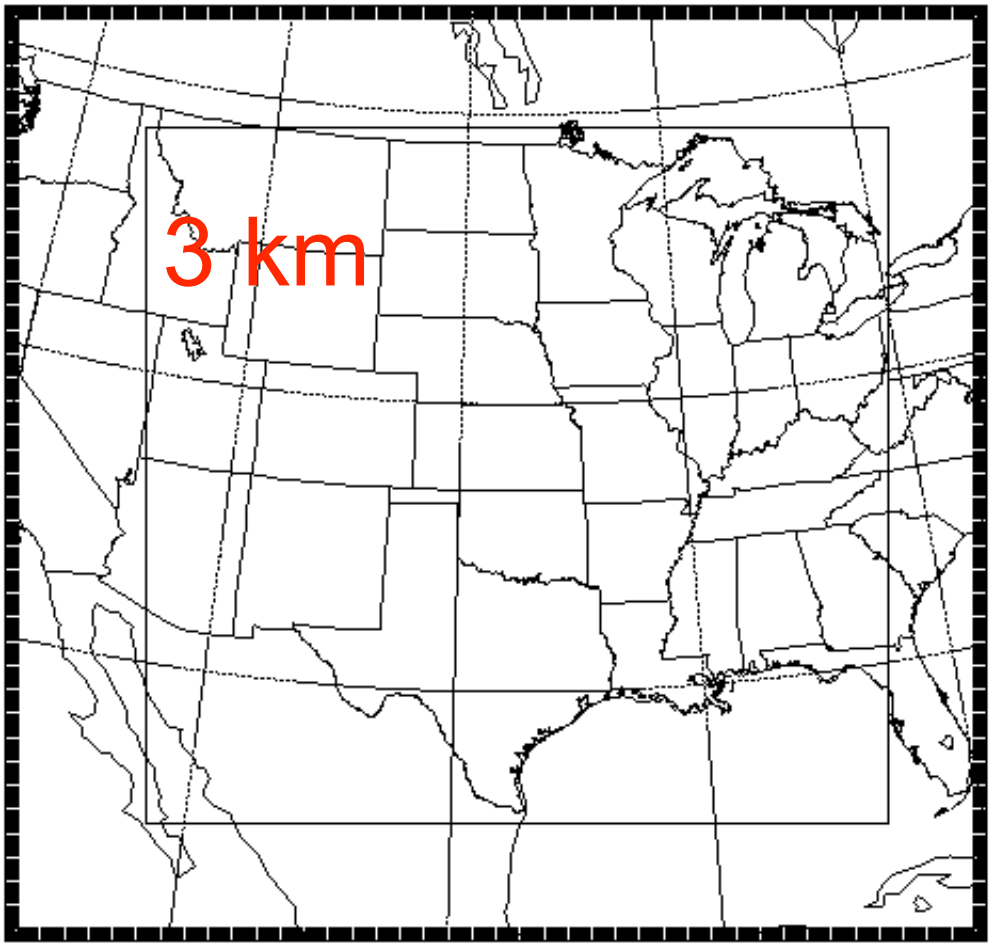


3 km ARW
24 h
Forecast:

Morris Weisman, Wei Wang, Kevin Manning,
Ming Chen; NCAR/MMM

(10th WRF User's Workshop: June-23-26 2009)

2009 Domain: 3 km (1 May - 30 June)



3 km domain:

….initialized at 00,12 UTC

….48 h

….MYJ PBL

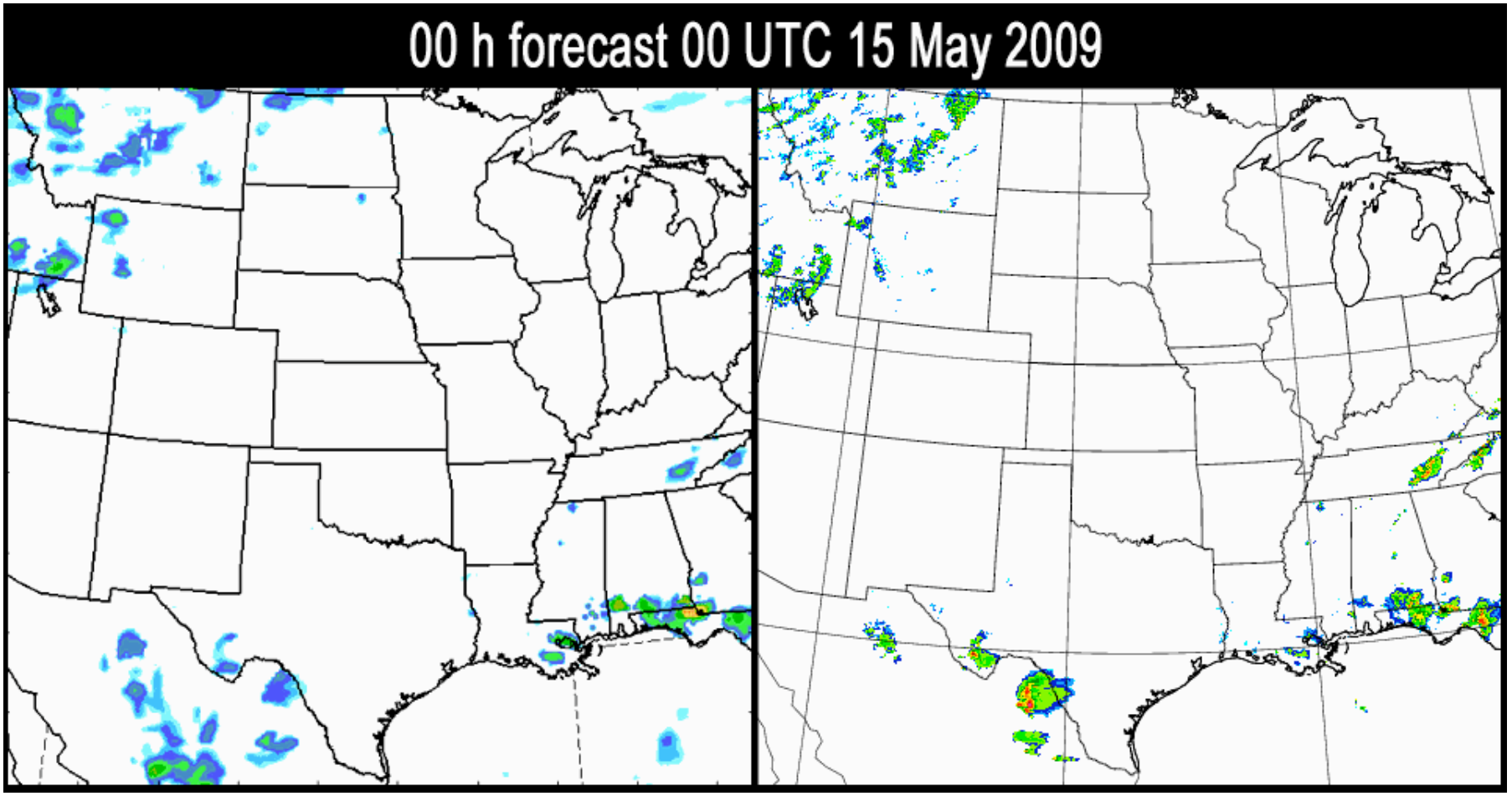
….Thompson Microphysics

…. RUC 13 km DFI analysis

…. GFS BC

2008: The use of WRF-3DVAR and 12 h of cycling at 9 km grid resolution produced spurious convection at times

15 May 2009 00 UTC

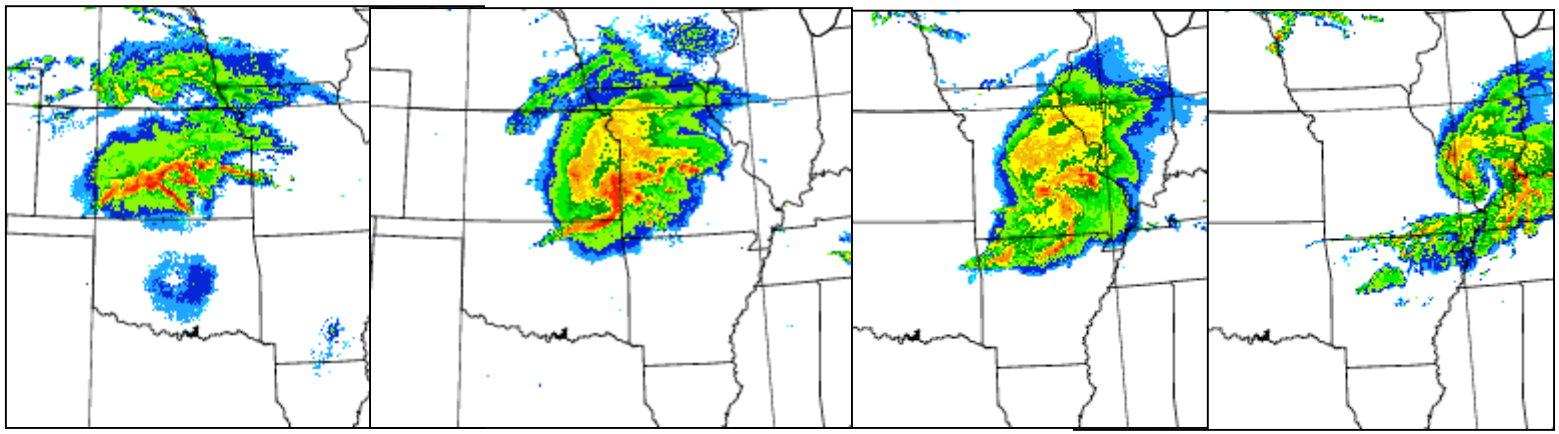


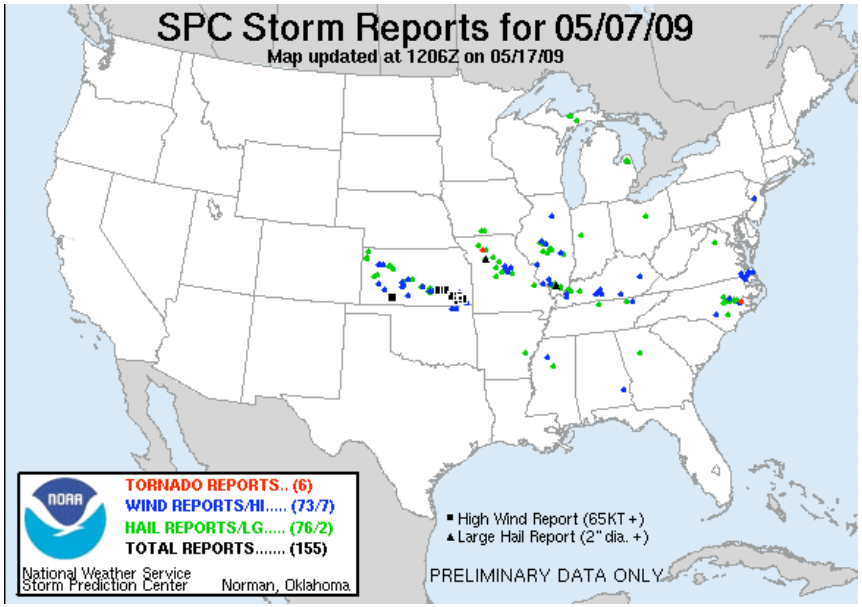
WRF-ARW Reflectivity

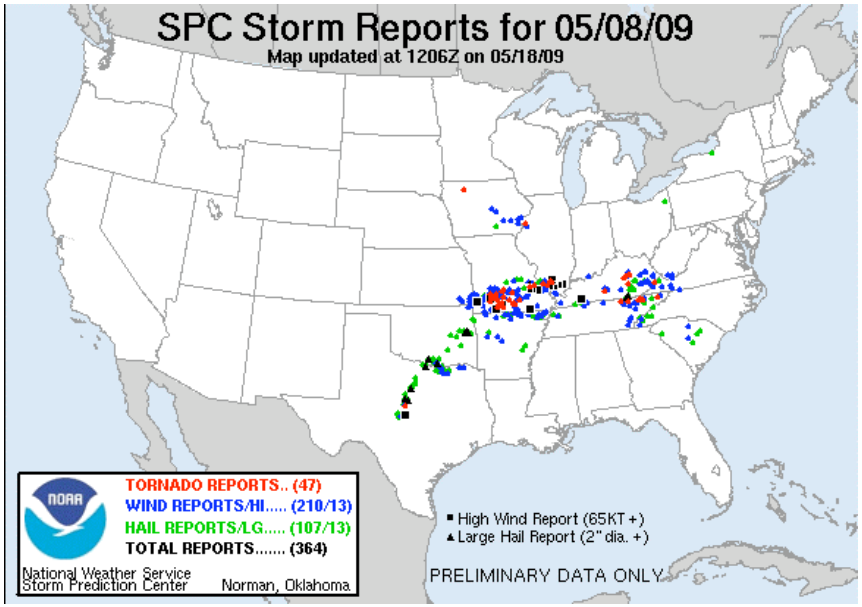
Composite Radar

08 May 2009

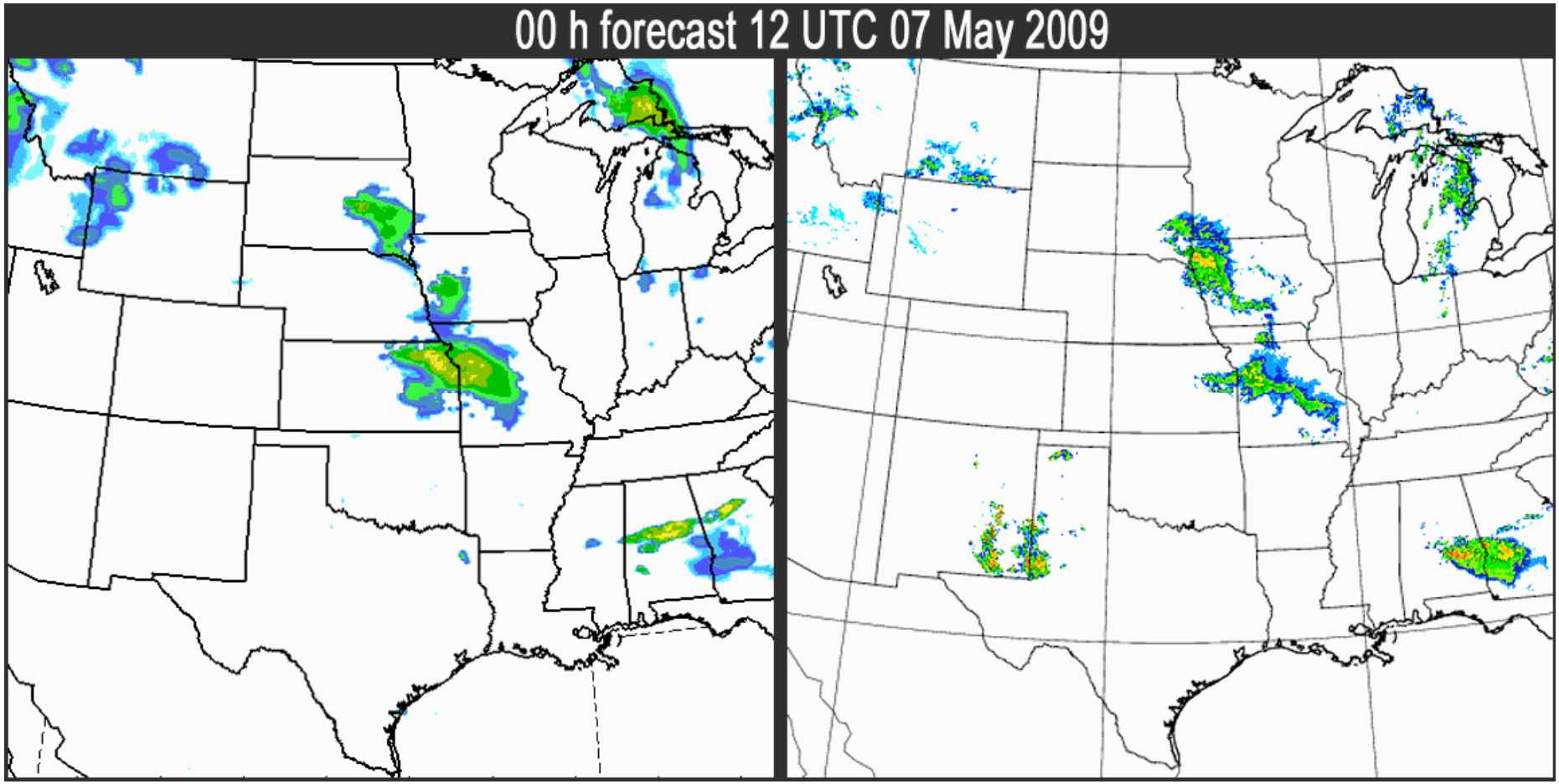
09 UTC 12 UTC 15 UTC 18 UTC







07 May 2009 12 UTC

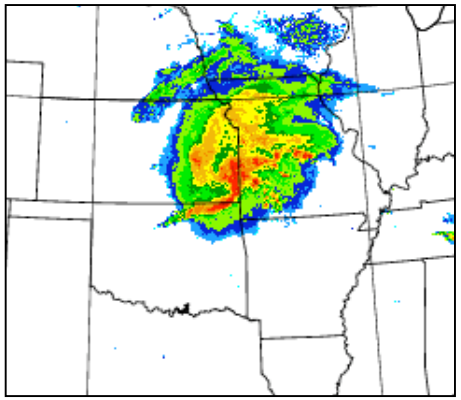


WRF-ARW Reflectivity

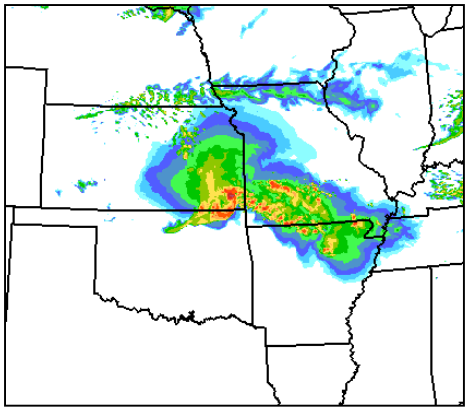
Composite Radar

Thompson / MYJ

RADAR



NAM

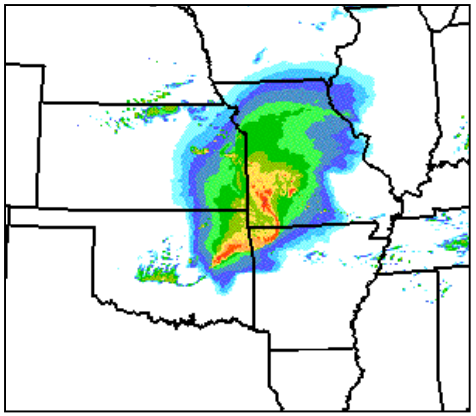


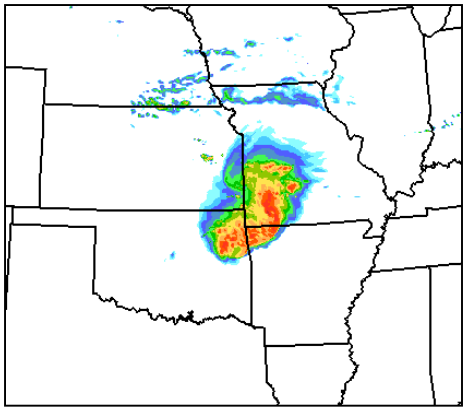
24 h Forecasts
Valid 12 UTC
05/08/09

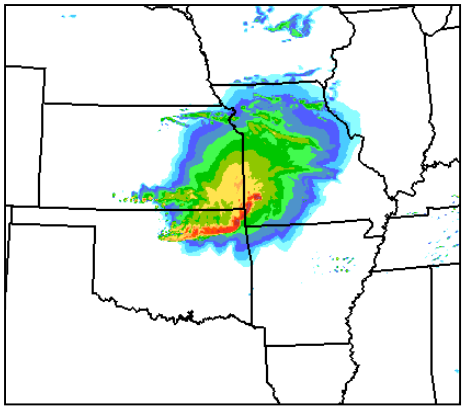
WSM6 / MYJ

Thompson / YSU

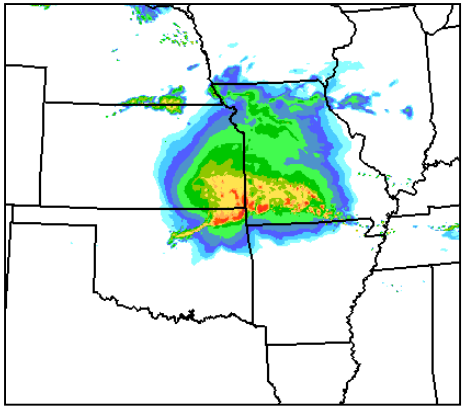
RUC-DFI

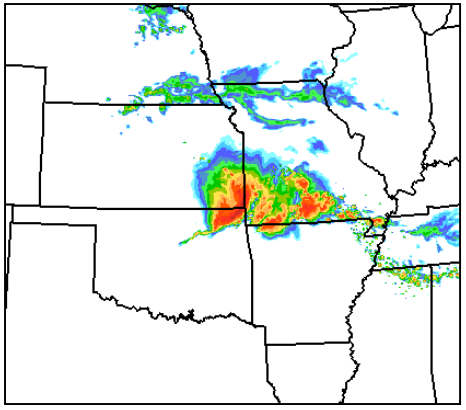


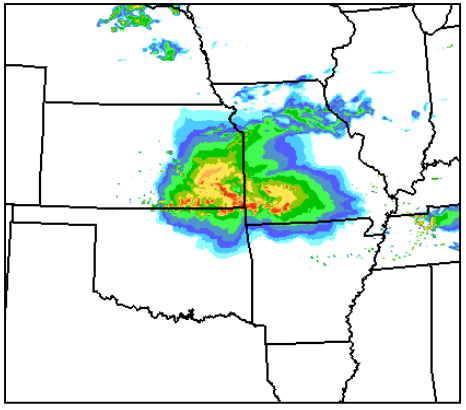




GFS

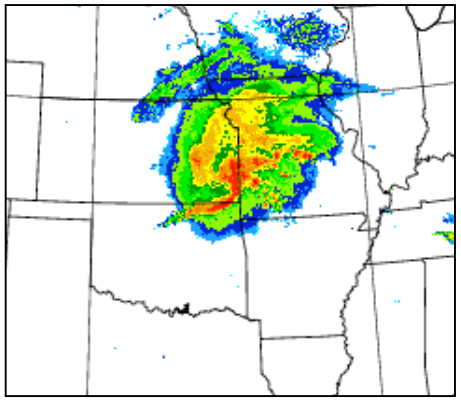




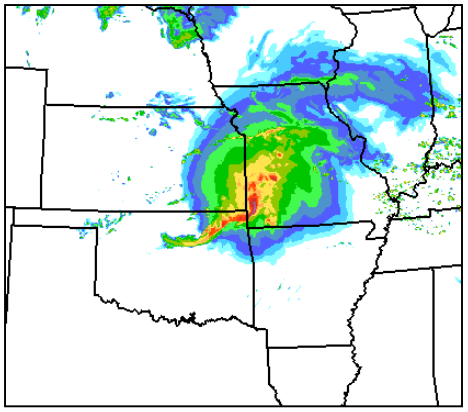


Thompson / MYJ

RADAR



NAM

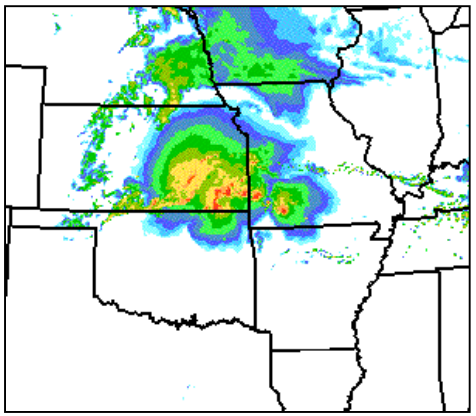


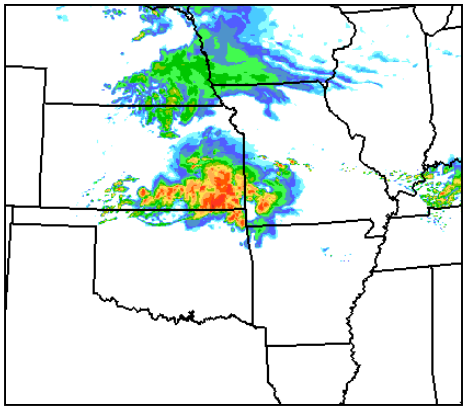
12 h Forecasts
Valid 12 UTC
05/08/09

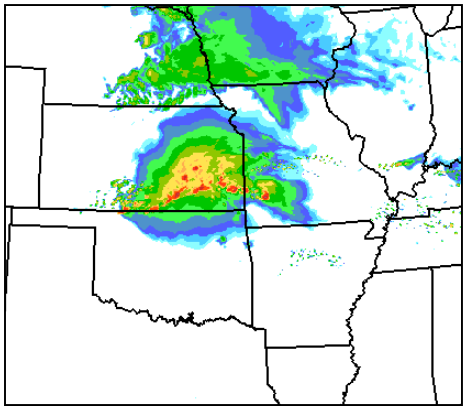
WSM6 / MYJ

Thompson / YSU

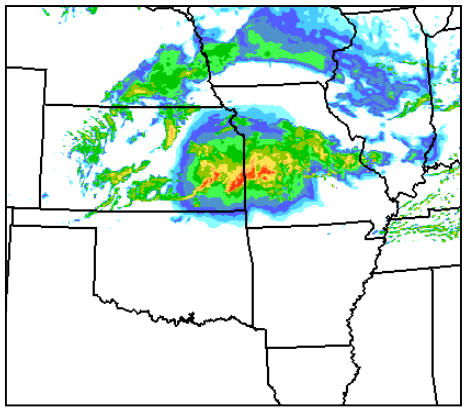
RUC-DFI

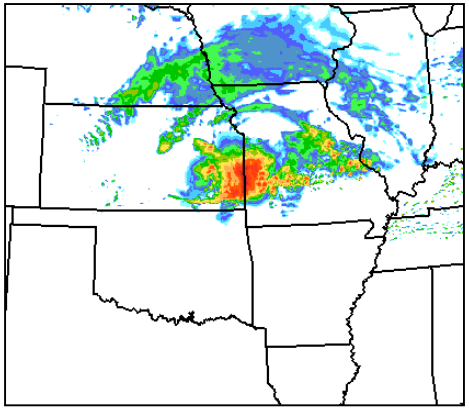


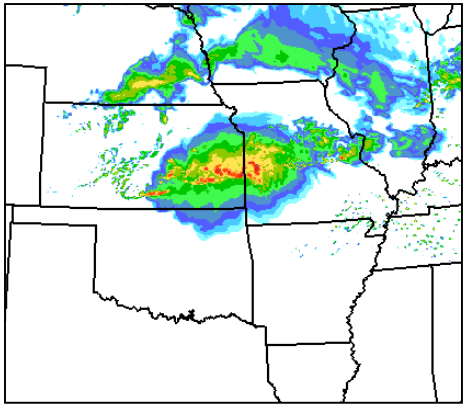




GFS







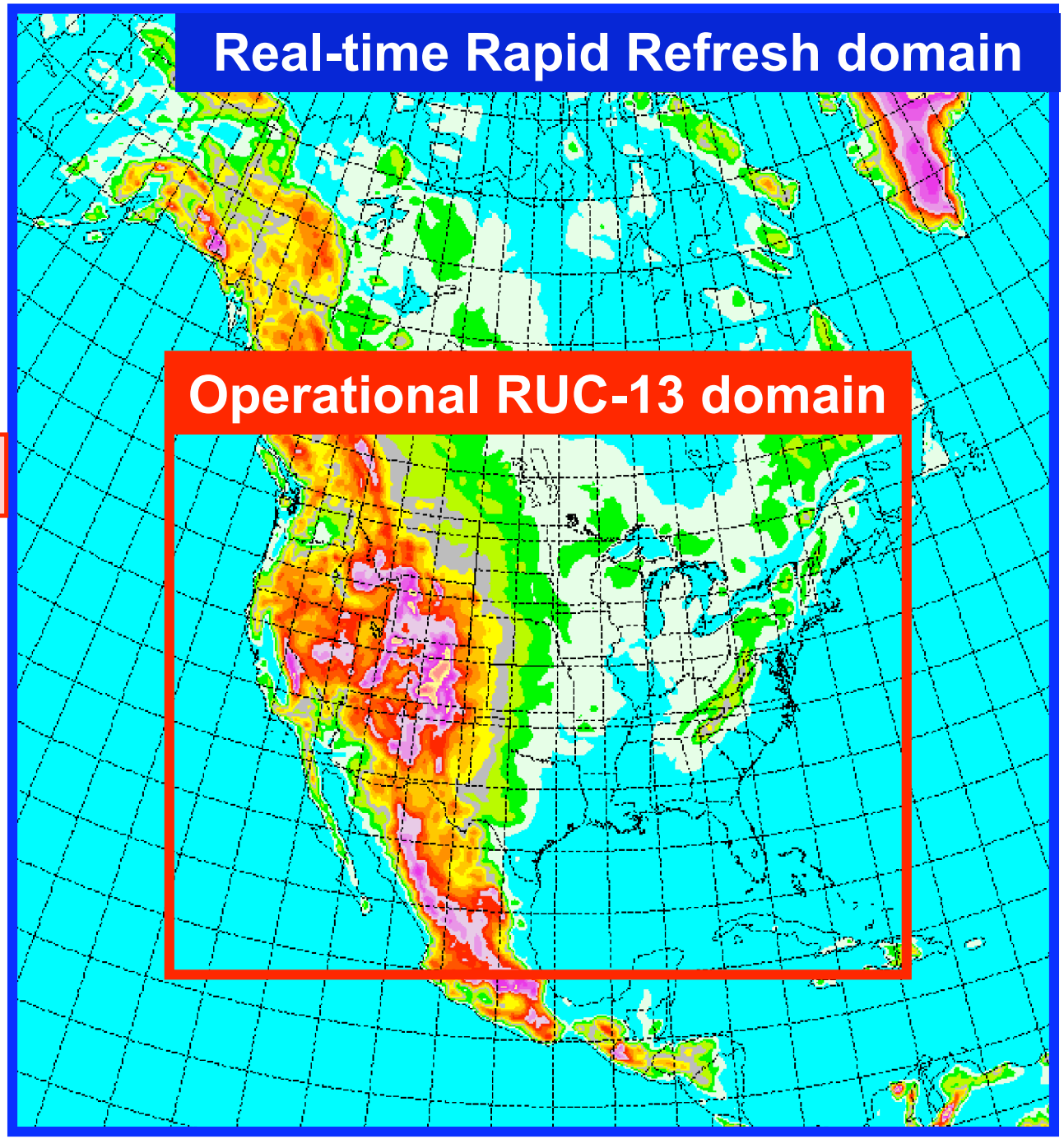
RUC and Rapid Refresh

RUC – Major NCEP upgrade 17 Nov 2008

- Radar refl assim
- TAMDAR RH

RR – Planned to replace RUC at NCEP in 2010, has radar assim

12-h fcst each hour for RUC and RR

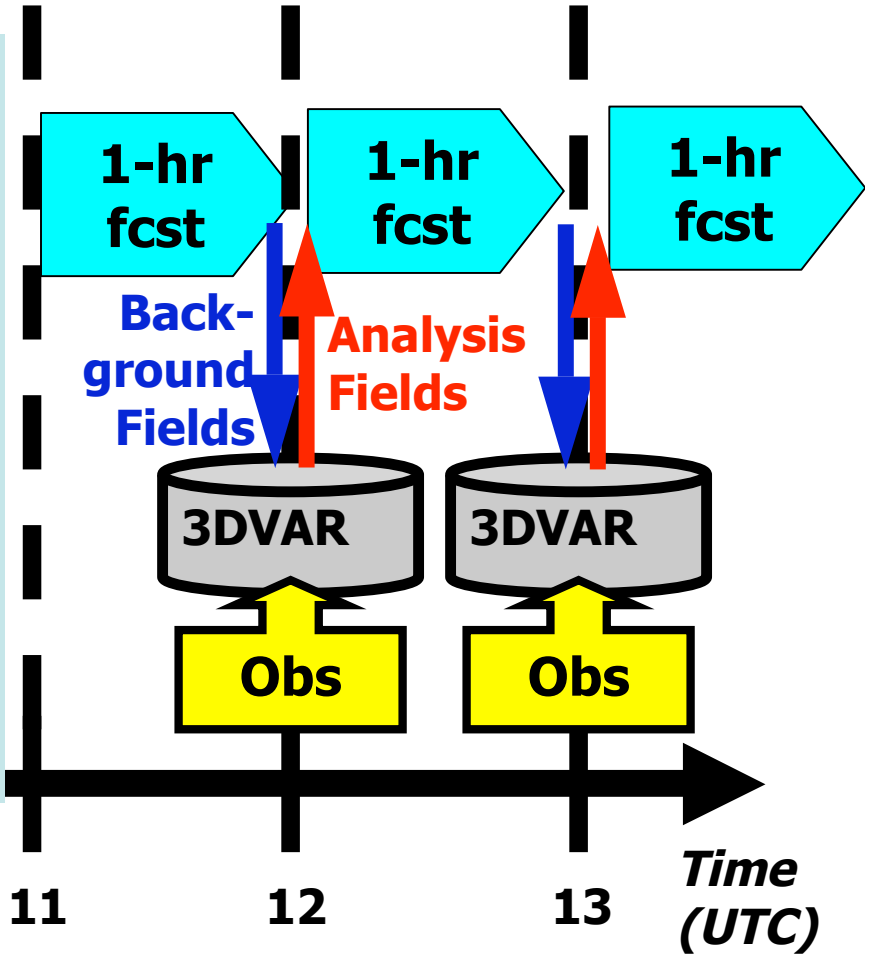


RUC / RR hourly updating

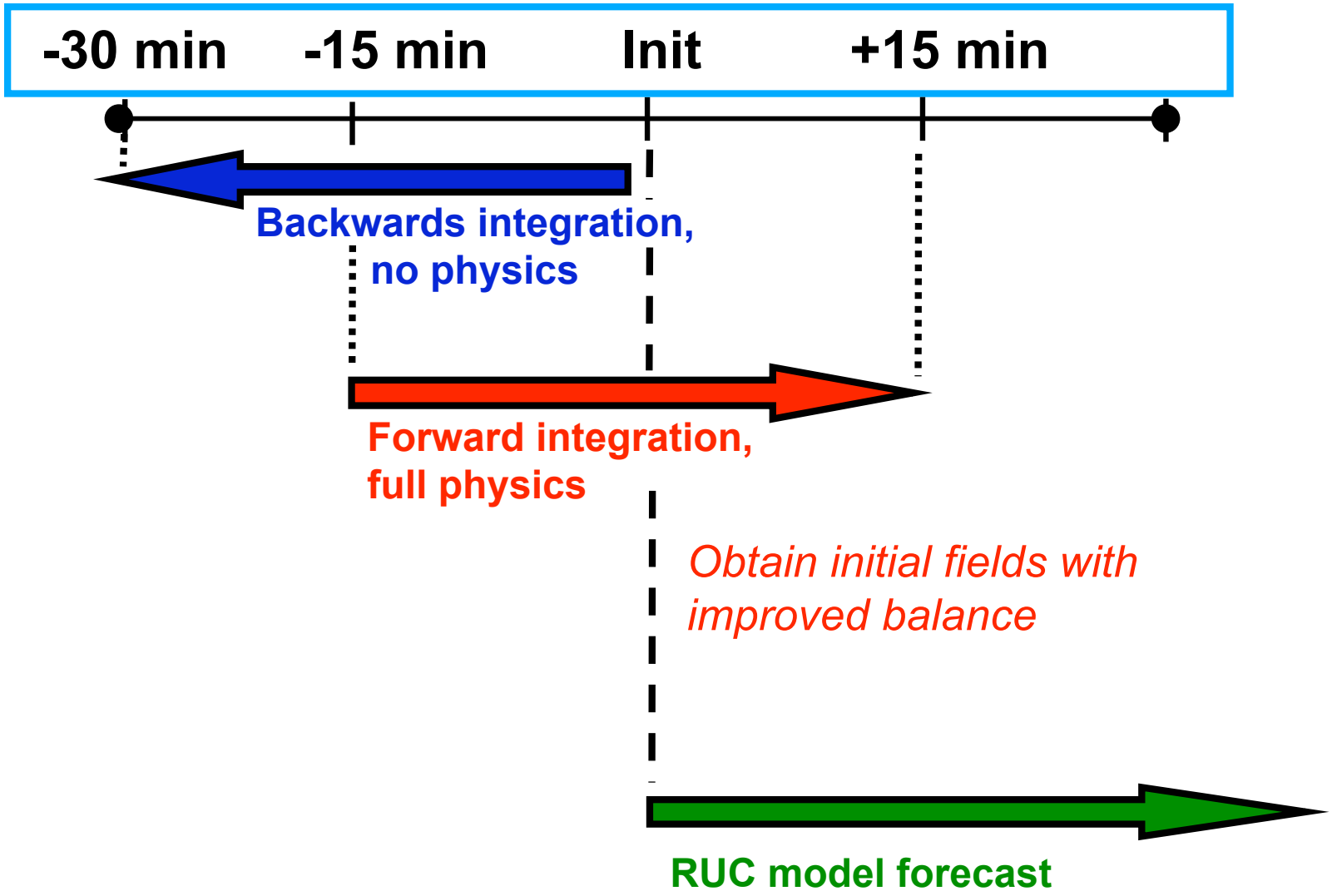
Use latest observations to obtain the freshest analysis and forecasts for aviation, severe weather, and general forecast applications

Data types used

Rawinsonde (balloons)
Wind Profilers (405 MHz, 915 MHz) RASS virtual temperatures
VAD winds (WSR-88D radars)
Aircraft (ACARS, TAMDAR)
Surface (METAR , Buoy, Mesonet
Precipitable water (GPS, GOES, SSM/I)
GOES cloud-drift winds
GOES cloud-top pressure/temp
Radar reflectivity, lightning
Ship reports/dropsondes
Satellite radiances (Rapid Refresh)

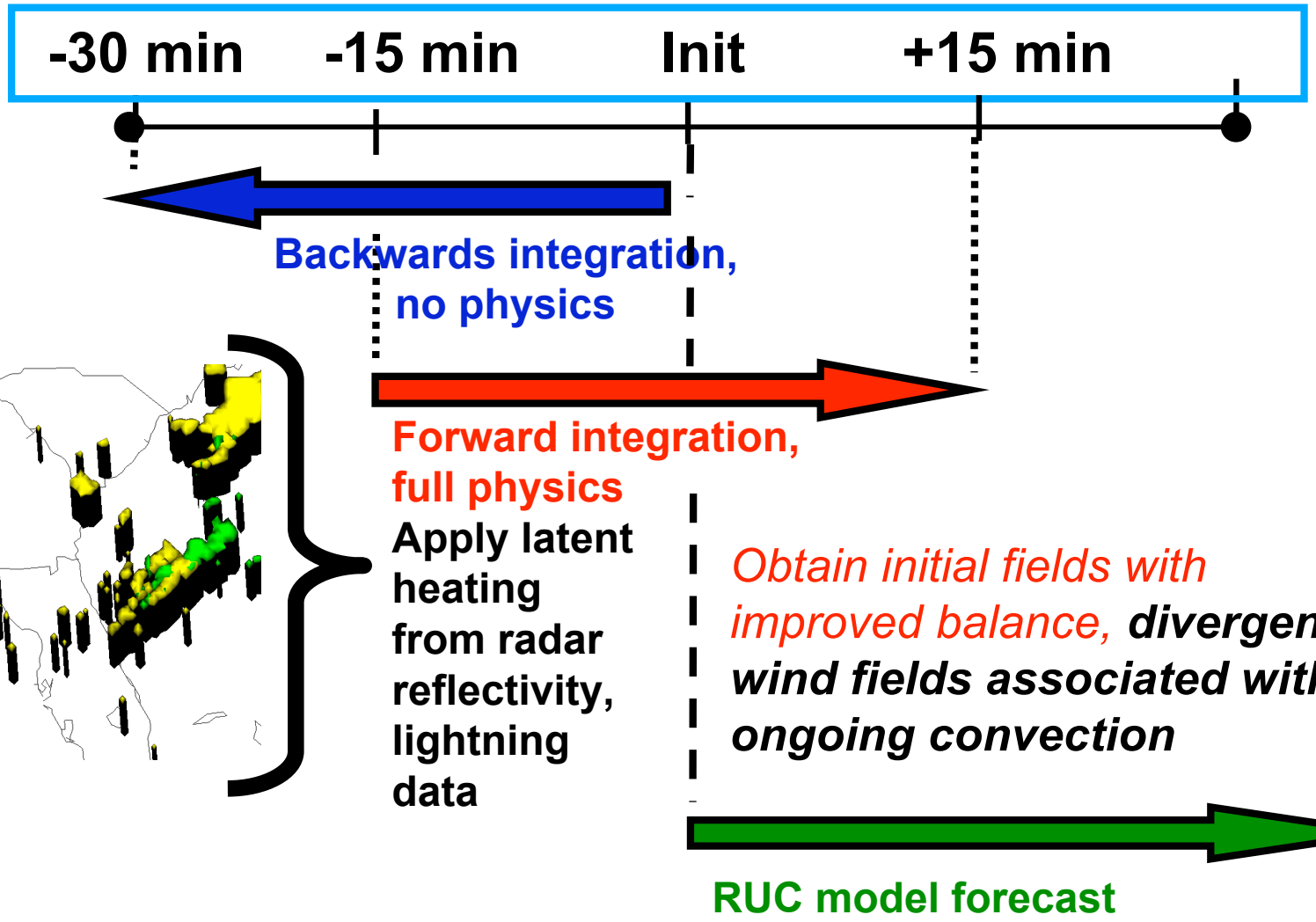


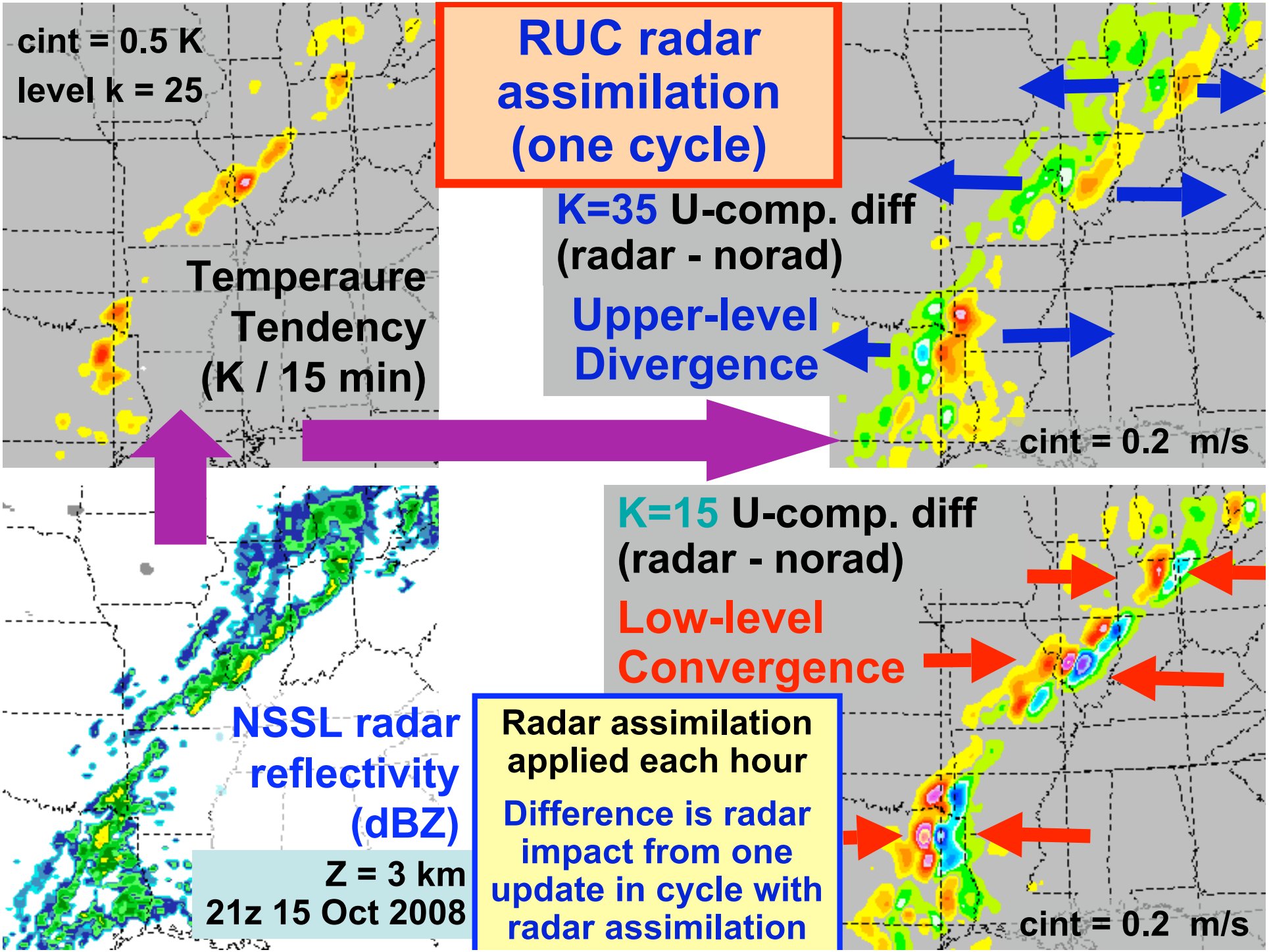
Diabatic Digital Filter Initialization (DDFI)



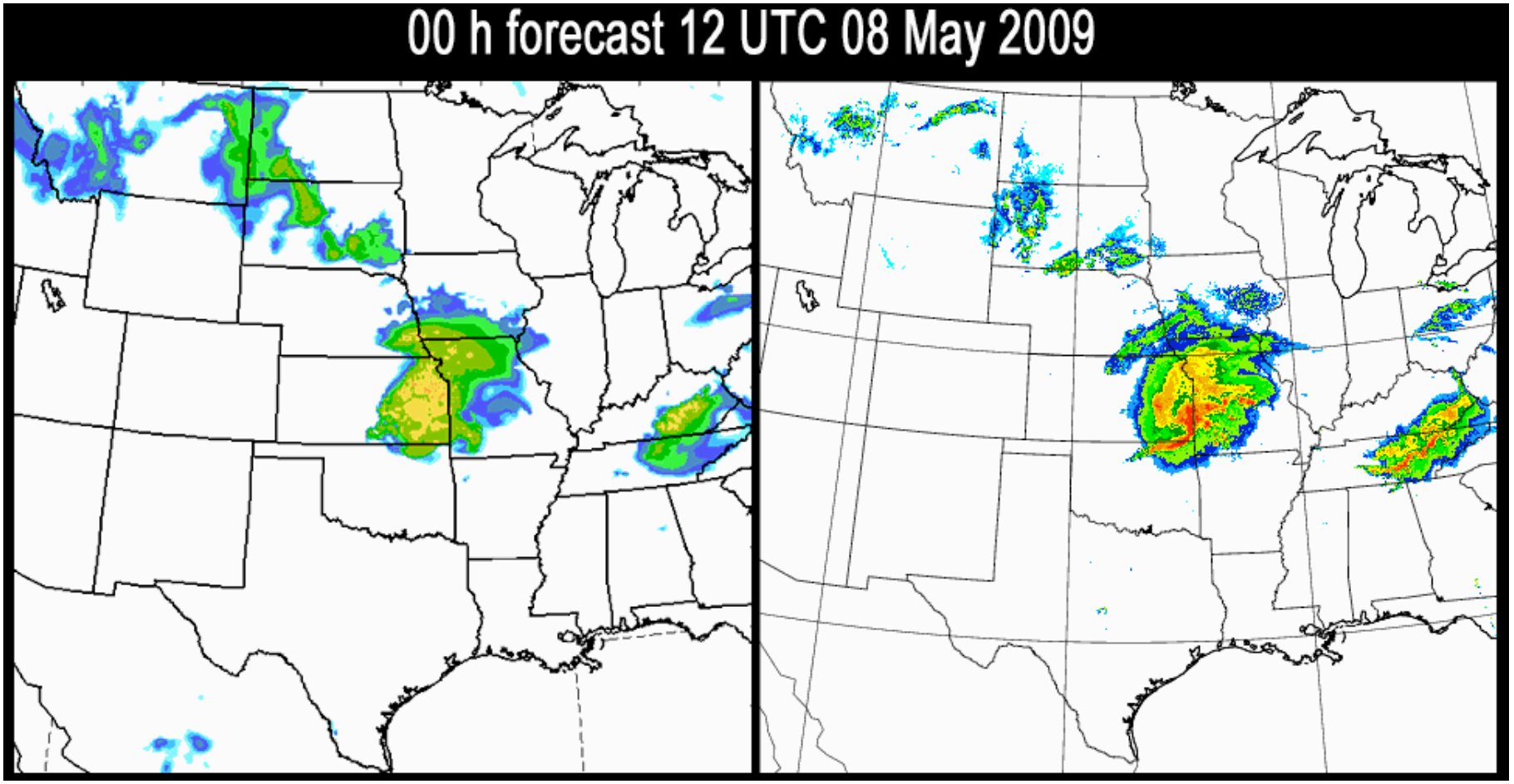
Diabatic Digital Filter Initialization (DDFI)

add assimilation of radar data




cint = 0.5 K
level k = 25
RUC radar assimilation (one cycle)
K=35 U-comp. diff (radar - norad)
Upper-level Divergence
Temperaure 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
Difference is radar impact from one update in cycle with radar assimilation
cint = 0.2 m/s

08 May 2009 12 UTC



WRF-ARW Reflectivity

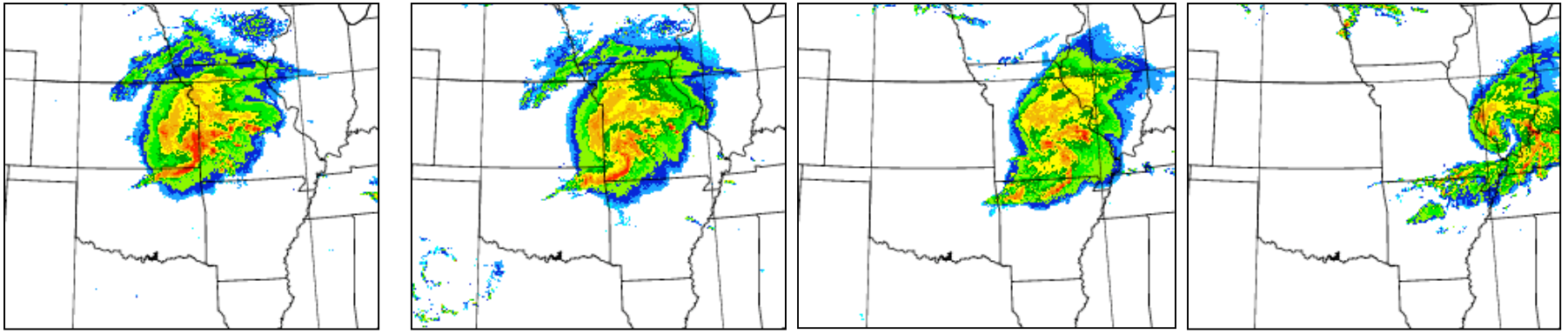
Composite Radar

05/08/09 12 UTC

13 UTC

15 UTC

18 UTC

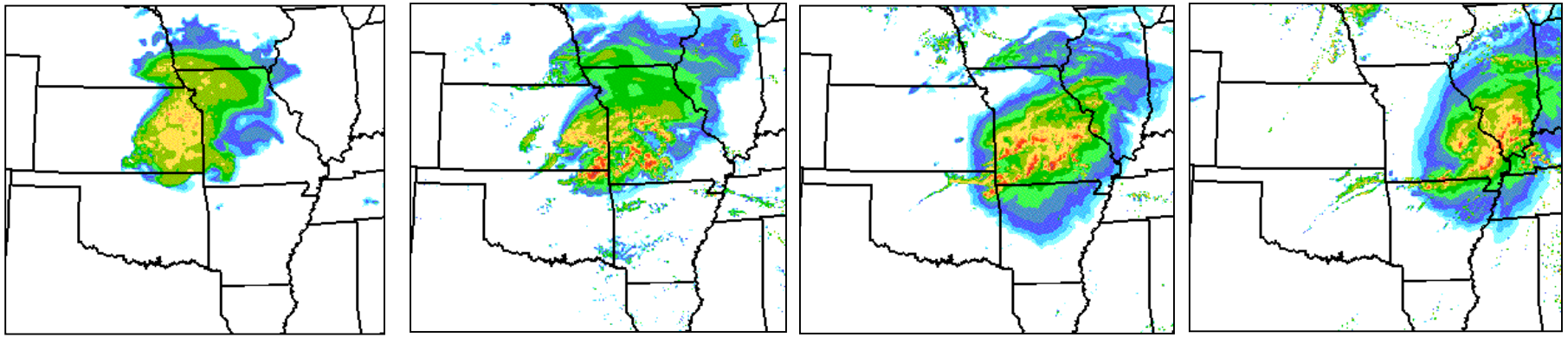


RUC/DFI 00h

RUC/DFI 1h

RUC/DFI 3h

RUC/DFI 6h

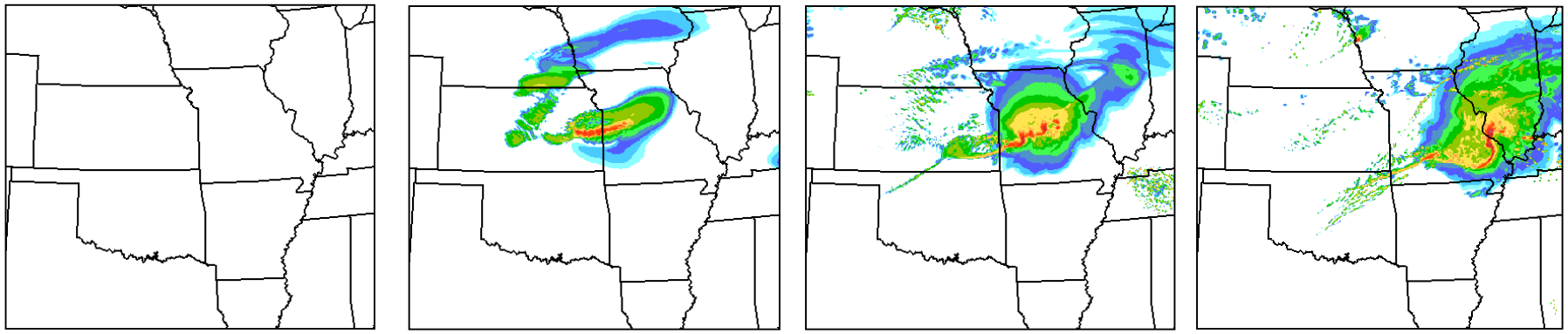


GFS-COLD 00h

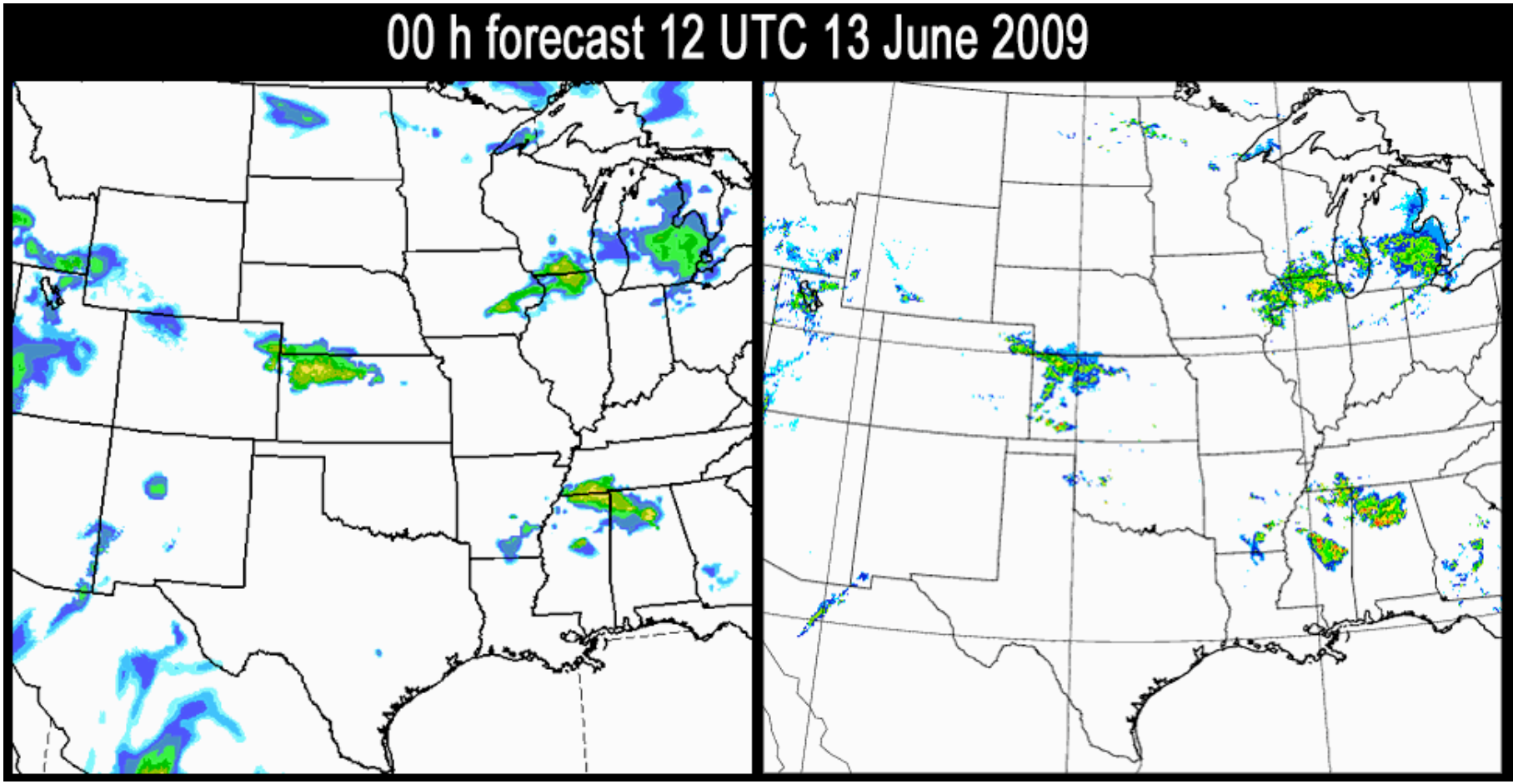
GFS-COLD 1h

GFS-COLD 3h

GFS-COLD 6h



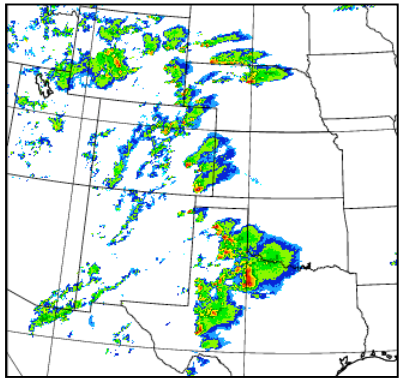
13 June 2009 12 UTC

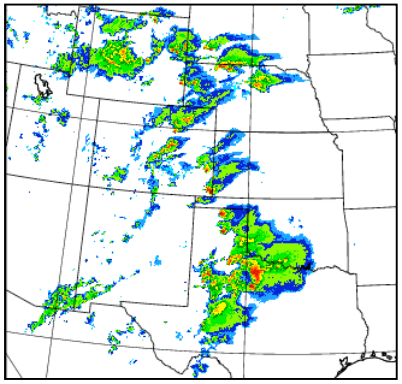


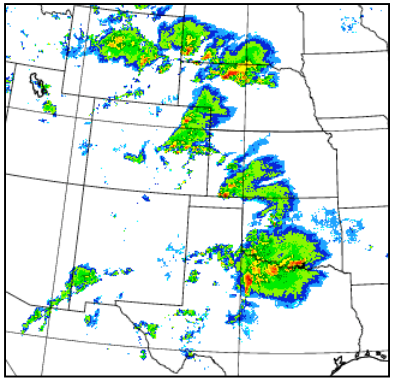
WRF-ARW Reflectivity

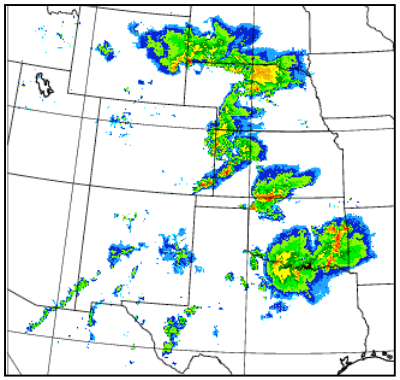
Composite Radar

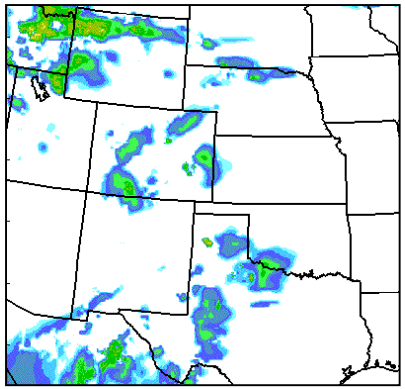
06/14/09 00 UTC | 01 UTC | 03 UTC | 06 UTC

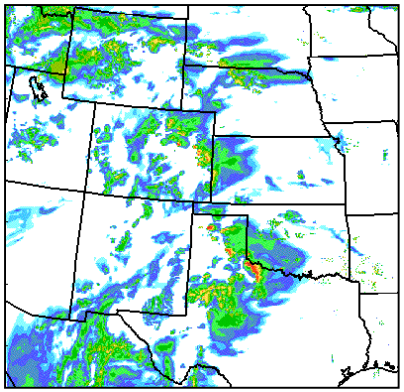

RUC/DFI 00h

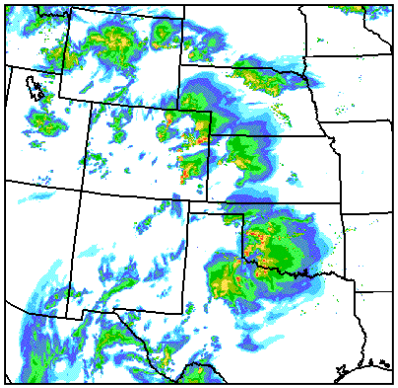

RUC/DFI 1h

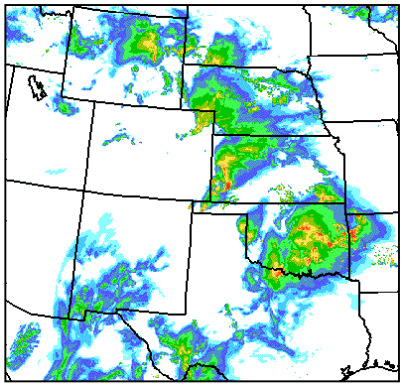

RUC/DFI 3h

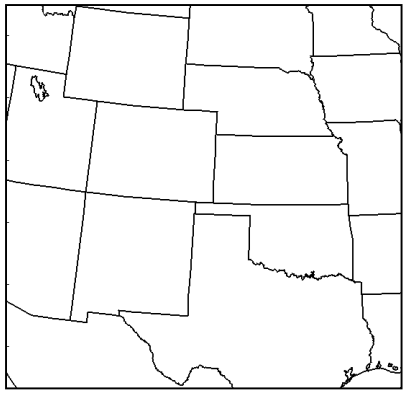

RUC/DFI 6h

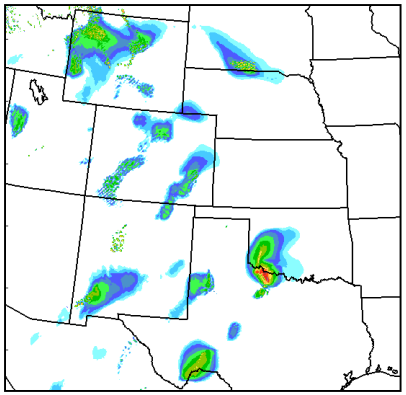

GFS-COLD 00h

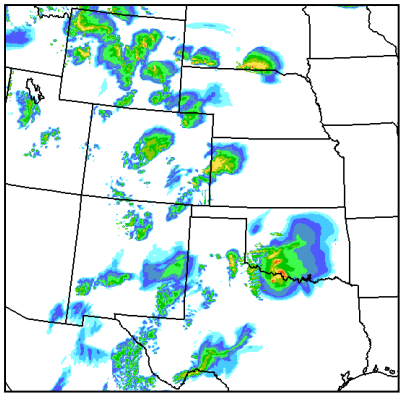

GFS-COLD 1h

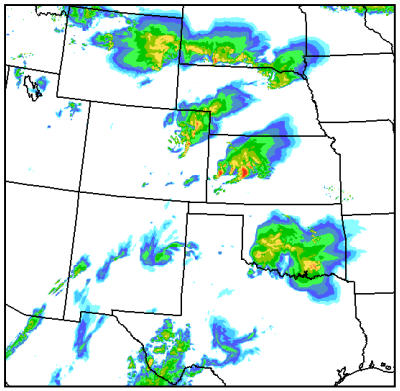

GFS-COLD 3h


GFS-COLD 6h

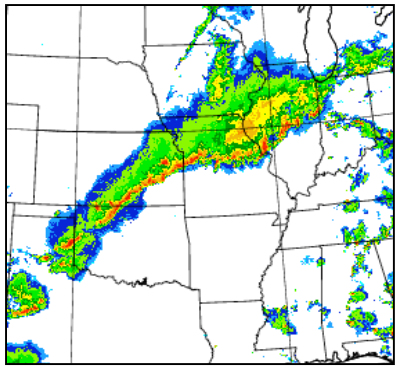
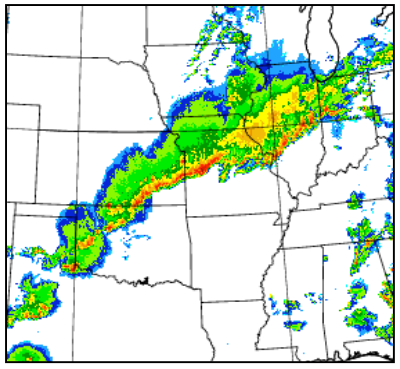
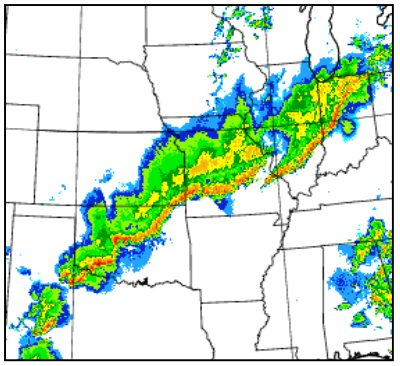
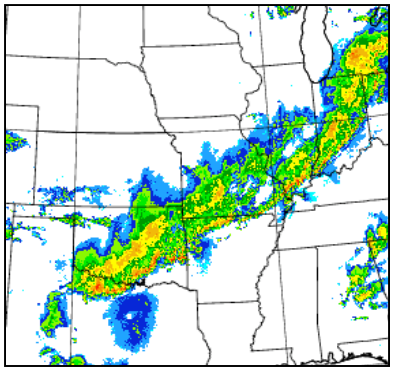




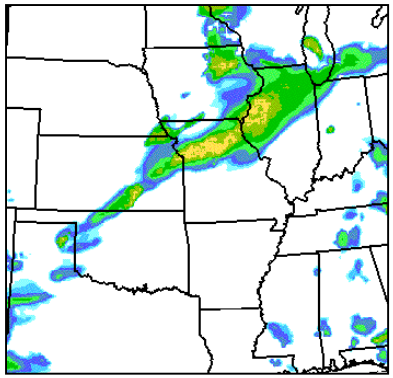
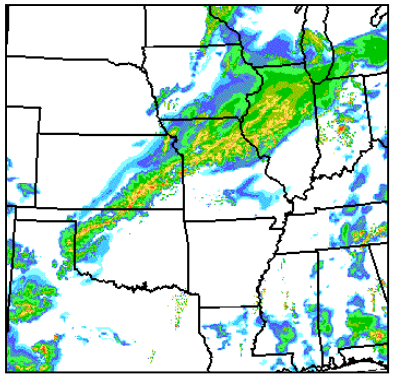
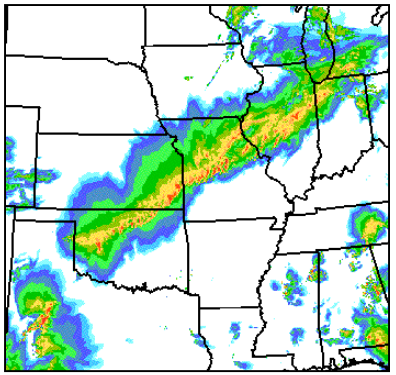
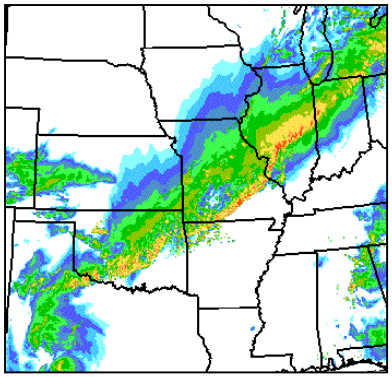




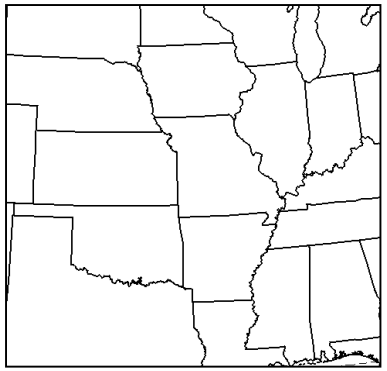
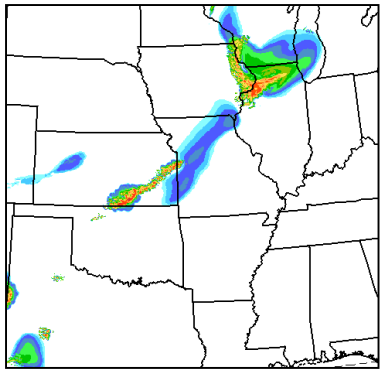
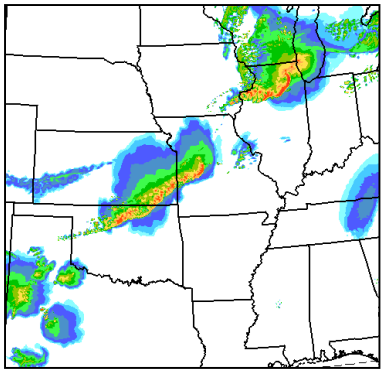
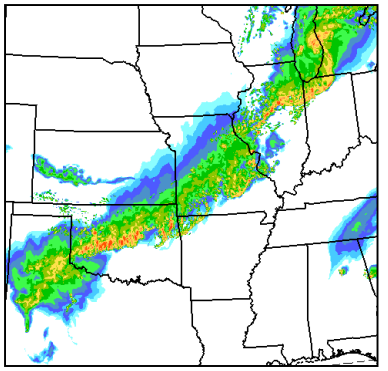
05/16/09 00 UTC 01 UTC 03 UTC 06 UTC

RUC/DFI 00h RUC/DFI 1h RUC/DFI 3h RUC/DFI 6h

GFS-COLD 00h GFS-COLD 1h GFS-COLD 3h GFS-COLD 6h

Summary:

…The use of the 13 km RUC analyses along with DFI and the simple radar assimilation technique significantly improves model spin-up while minimizing spurious effects.

….time period for spin-up of ongoing convection reduced from ~6h to 3h

….improvements beyond 6 h less clear

…Forecasts more sensitive to initial state than model physics

…12 UTC update does improve forecast over previous 00 UTC initialization