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Use of Convective Initiation Information Derived from GOES Satellite Data in the High Resolution Rapid Refresh (HRRR) Forecast System

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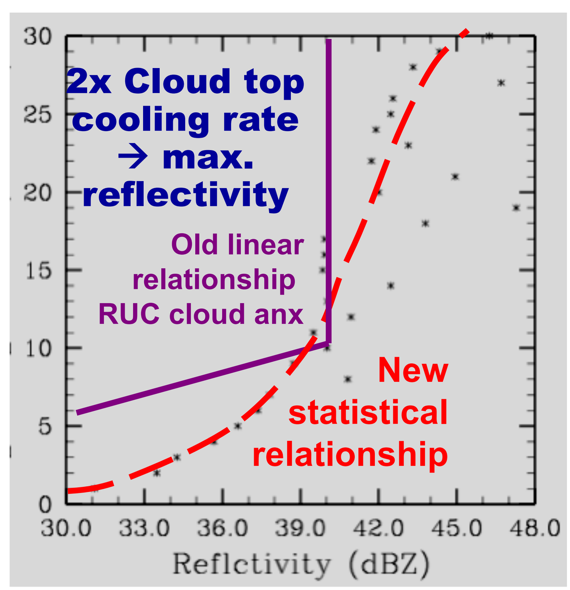
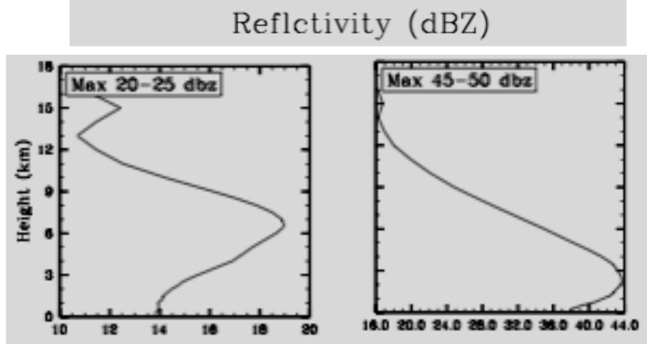
OVERVIEW

Evaluation of impact from assimilation of convection indicators into the HRRR
GOES-R CI algorithm 10.7 µm T/B cloud top cooling rate (CTCR) data from University of Alabama Huntsville (UAH)
Helpful for avoiding model delay in storm development
Used lower bound of CTCR of -4K/15 min
Using current versions of HRRR similar to operational
GOES-R CI algorithm fields are available during daylight hours and over the Eastern U. S.
Real time use of the CTCR in GSD experimental HRRR began mid October 2016

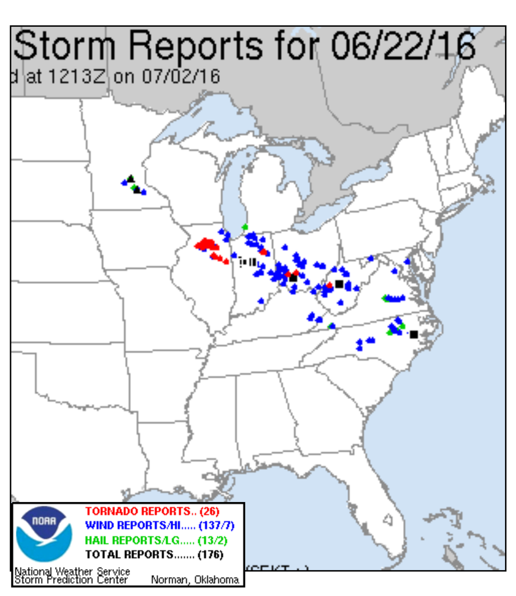
HRRR GOES-R CTCR Assimilation Algorithm

- Compute cloud top cooling rate (CTCR, deg. K/15 min) per HRRR grid box
- Seasonally varying statistical relationship between CTCR field and proxy column max reflectivity
- This replaced old empirical linear relationship first used in RUC
- Seasonally varying relationship between proxy column max refl. and vertical profile of reflectivity
- Use this proxy 3D reflectivity to obtain LH based temperature tendency for use in radar DFI
- Radar DFI induces storm-scale convergent / divergent winds

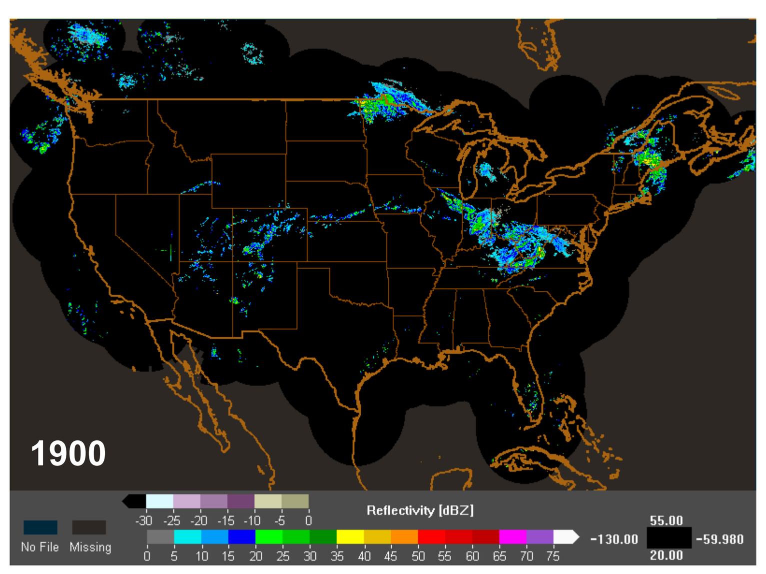




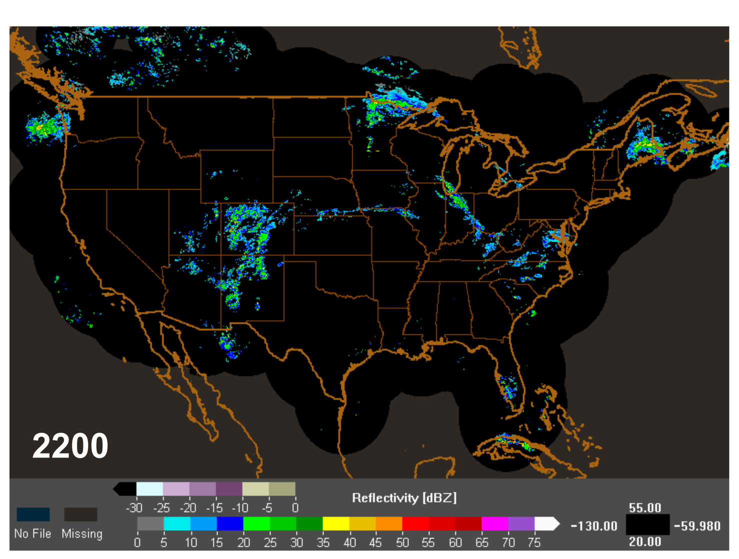
Focus case: 22 June 2016



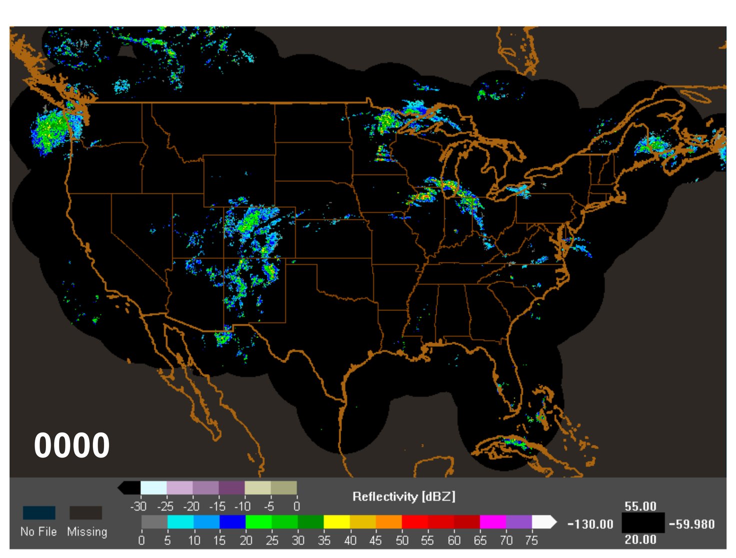
SPC Storm Reports for 22 June 2016



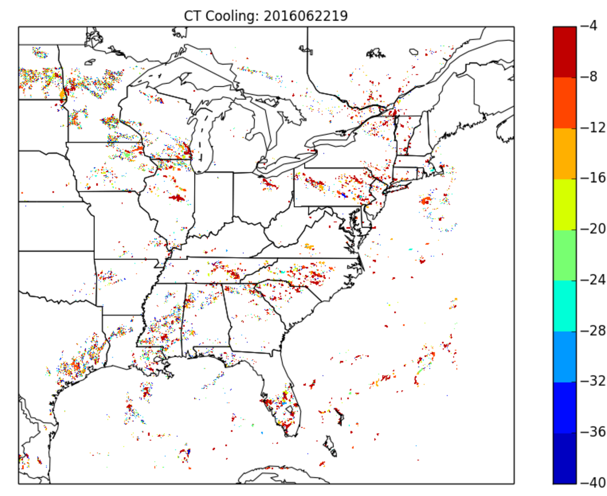
MRMS radar at 1900 UTC



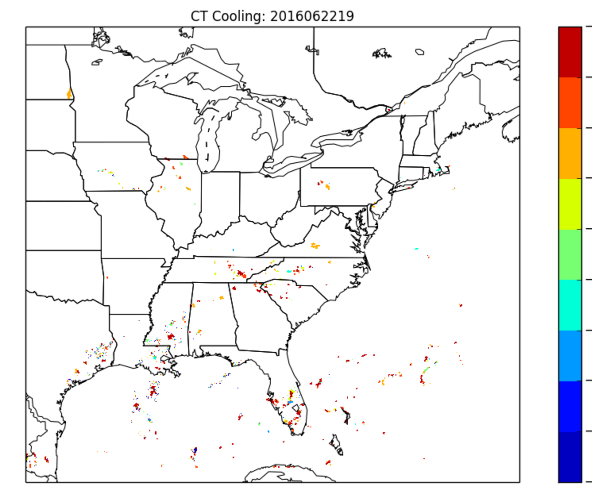
MRMS radar at 2200 UTC



MRMS radar at 0000 UTC 23 June

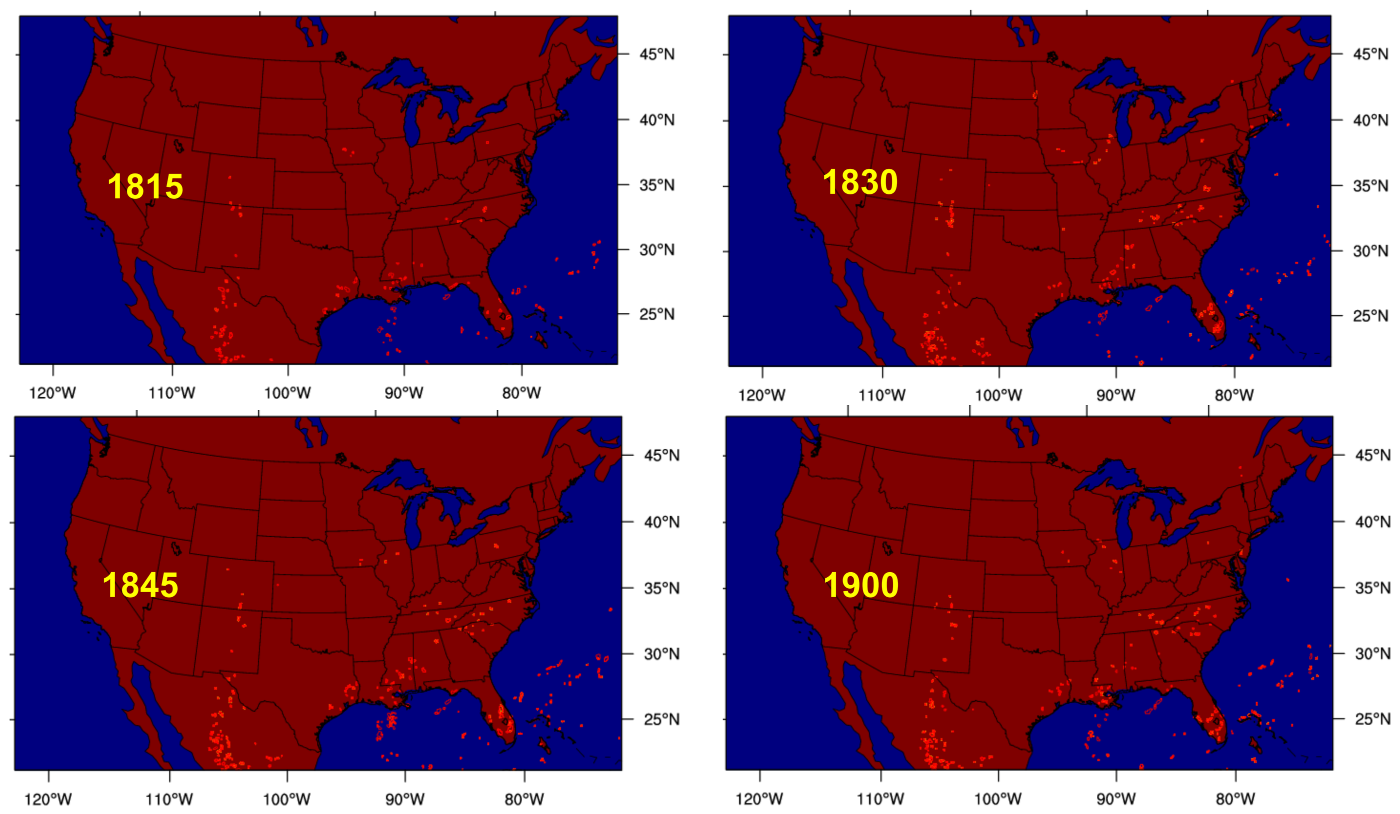


All CTCR for 1900 UTC run (composite of 4 15 min files)



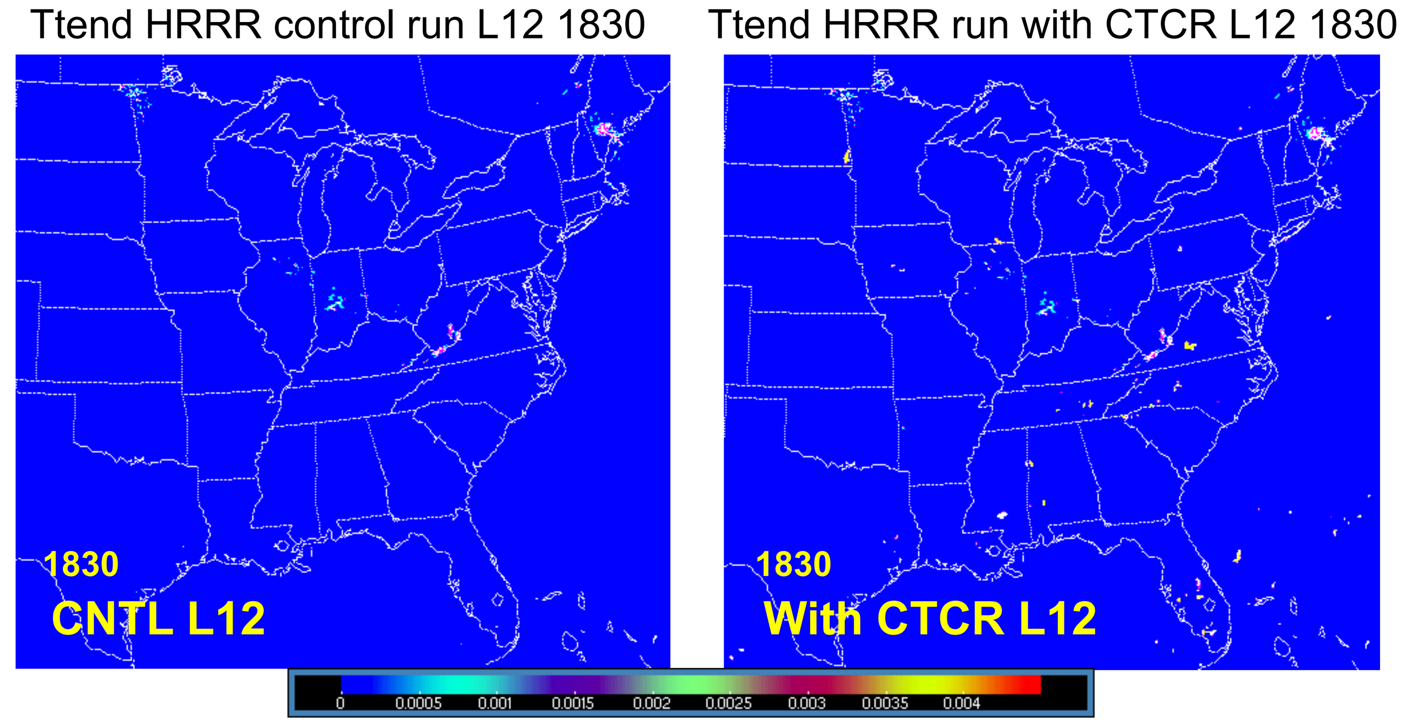
All CTCR for 1900 UTC run filtered by SOS ge 60

CTCR filtered by SOS on the HRRR grid for each 15 min file used in the 1900 UTC 22 June 2016 run of the HRRR



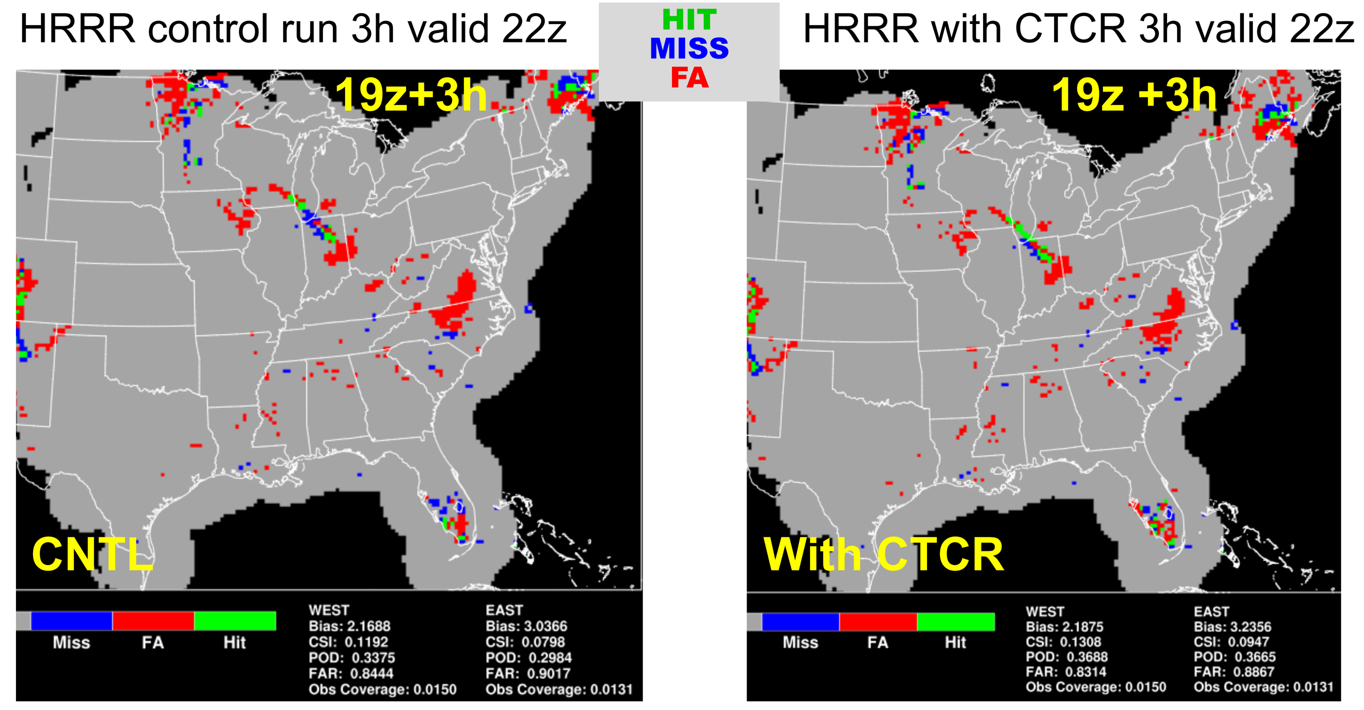
Runs of the HRRR with and without the satellite derived CTCR show a response to the CTCR brought in via the temperature tendency (K/s). Model level 12, 1830 UTC.

Ttend HRRR control run L12 1830 | Ttend HRRR run with CTCR L12 1830



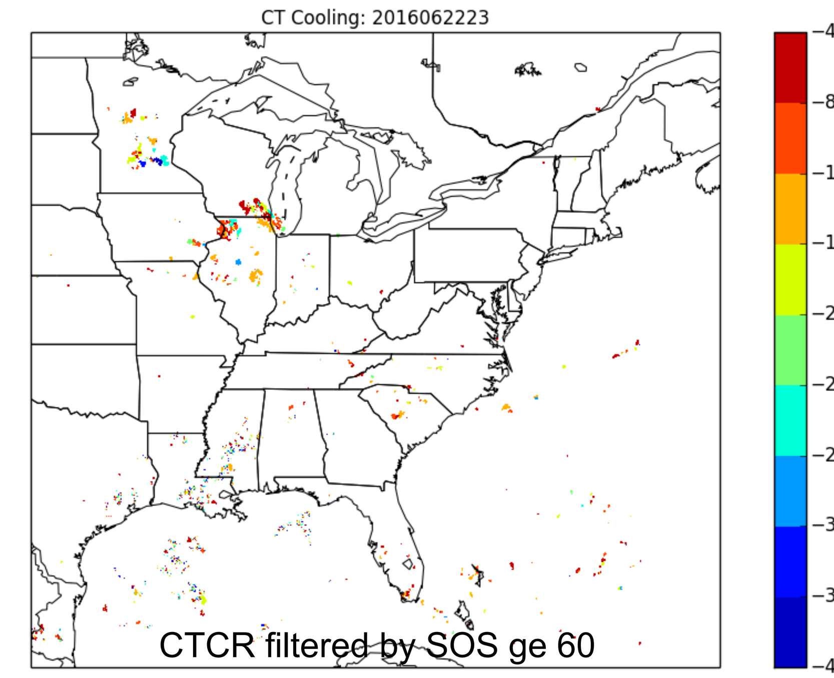
HRRR 25 dBZ CREF verification for 3h forecast valid 22 UTC 22 June 2016

HRRR control run 3h valid 22z | HIT MISS FA | HRRR with CTCR 3h valid 22z

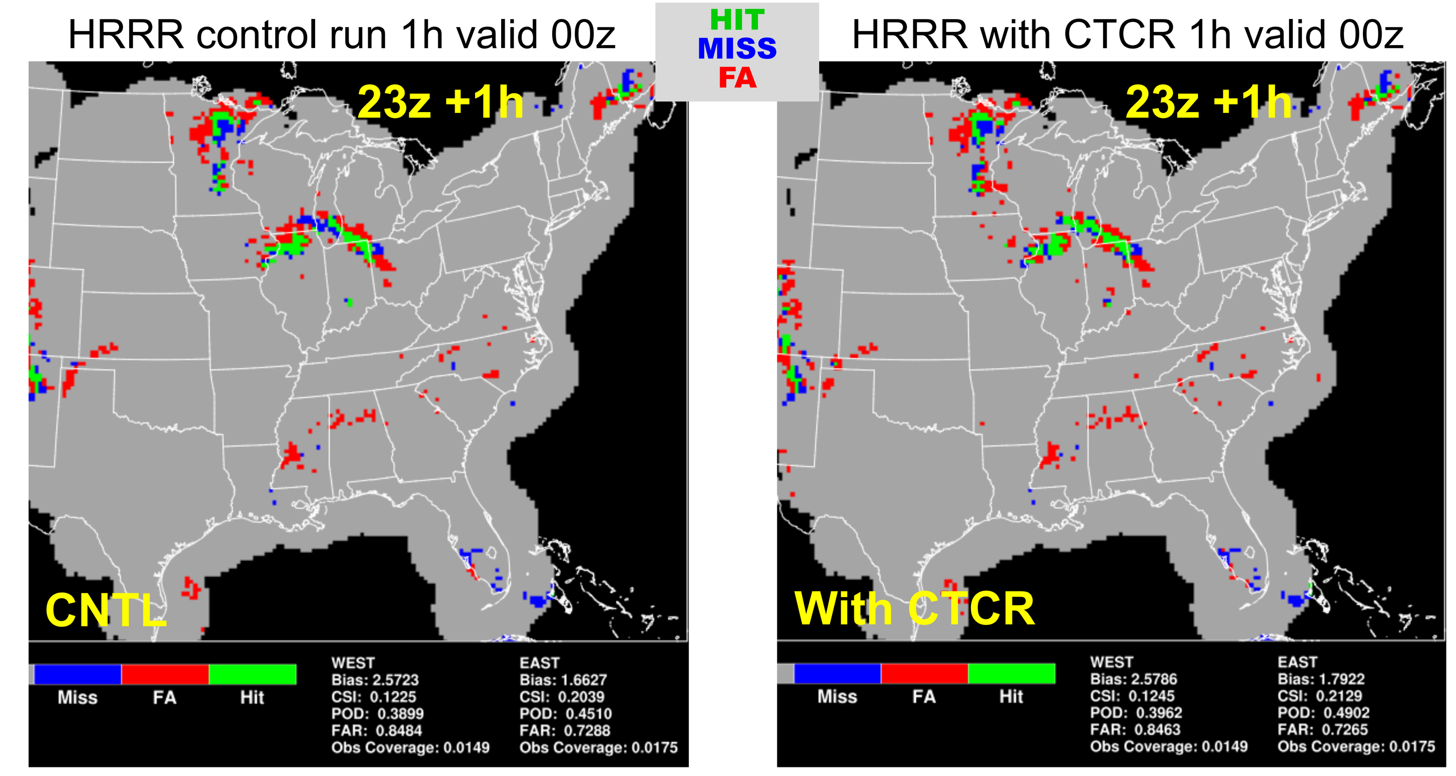


Case study verification for 22 June 2016, 1900 UTC 3h forecast valid 2200 UTC. There is an improved forecast of the composite reflectivity using CTCR data especially in WI/IL/IN.

The one hour forecast from 2300 UTC 22 June 2016 valid 0000 23 June, the height of the severe outbreak in IL/IN, also shows a marked improvement in the composite reflectivity forecast for 25 dBZ.

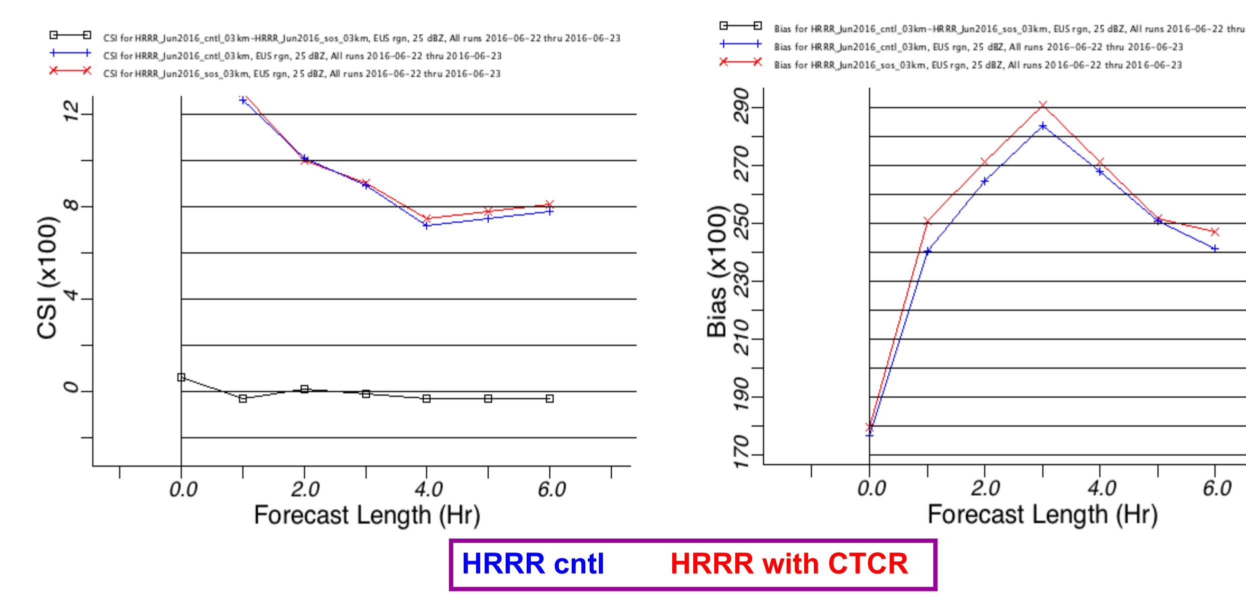


HRRR control run 1h valid 00z | HIT MISS FA | HRRR with CTCR 1h valid 00z



Verification for HRRR runs 18-00 UTC 22-23 June 2016

CSI for all forecasts 25 dBZ | bias for all forecasts 25 dBZ



POD and FAR slightly improved in the CTCR run (not shown)

SUMMARY and FUTURE WORK

Evaluation of impact from assimilation in the HRRR shows sensitivity to the CTCR values

Using additional strength of signal field from UAH for assimilation CI detection reduces noise

Investigating methods of insertion of the data into the HRRR assimilation system

Currently running in a REAL TIME experimental version of the HRRR at ESRL.