P 1

Assimilation of convective initiation information derived from GOES satellite data into the Rapid Refresh and HRRR forecast systems

Tracy Lorraine Smith[1,2], S. S. Weygandt[1], C. R. Alexander[1,3], M. Hu[1,3], H. Lin[1,2], J. R. Mecikalski[4]

[1]*NOAA/ESRL/GSD Assimilation and Modeling Branch*

[2]*Cooperative Institute for Research in the Atmosphere, Colorado State University*

[3]*Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder* [4]*University of Alabama in Huntsville*

OVERVIEW

Evaluation of impact from assimilation of convection indicators into the RAP and 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

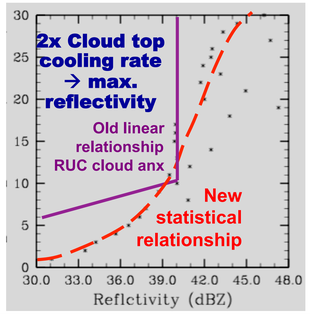
Used lower bound of CTCR of -3K/15 min

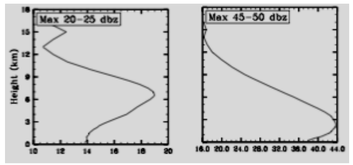
Using current versions of RAP/HRRR similar to operational GOES-R CI algorithm fields are available during daylight hours and over the Eastern U. S.

Qualitative assessment encouraging, additional refinement and assessment ongoing

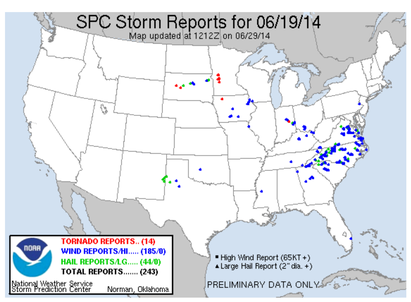
RAP GOES-R CTCR Assimilation Algorithm

- Compute cloud top cooling rate (deg. K / 15 min) per RAP 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

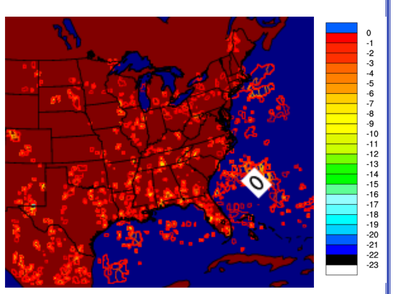




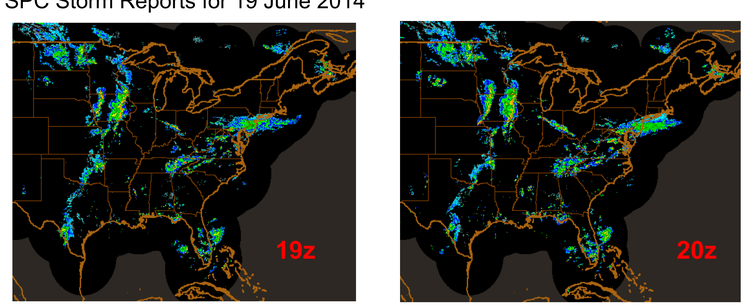
Focus case: 19 UTC 19 June 2014



SPC Storm Reports for 19 June 2014

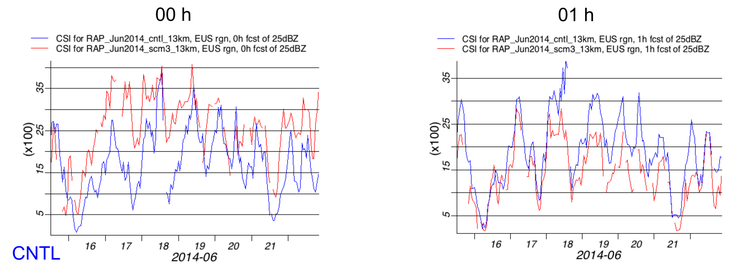


CTCR (K) from GOES



MRMS composite reflectivity from 1900 and 2000 UTC 19 June 2014

RAP CSI for 25 dBz 15-22 June 2014

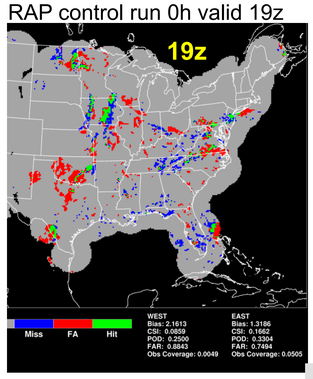


CNTL
CTCR-3

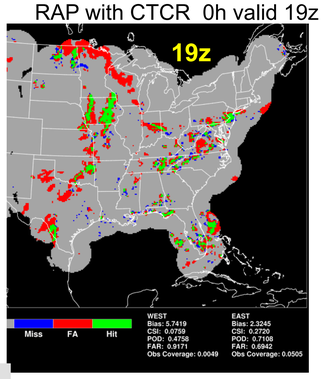
Analysis CSI better with CTCR, 01 forecast worse

RAP 25 dBz CREF verification for 19-20 UTC 19 June 2014

RAP control run 0h valid 19z

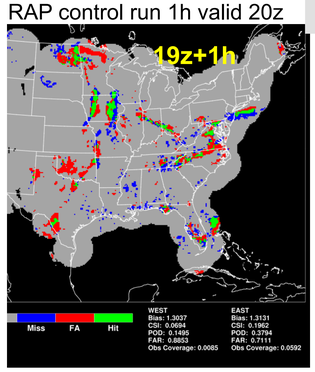


RAP with CTCR 0h valid 19z

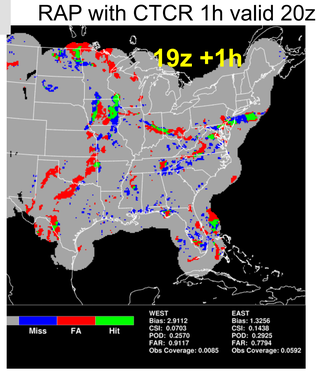


HIT
MISS
FA

RAP control run 1h valid 20z



RAP with CTCR 1h valid 20z

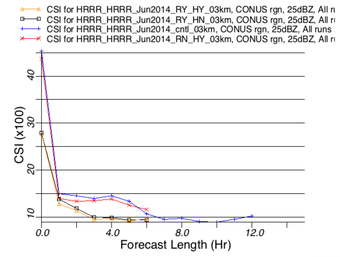


Case study example for 19 June 2014, 1900-2000 UTC. As in the overall statistics, the analysis with CTCR data verifies better than the control run without the data, but at 1h the number of hits drops, the misses and false alarms go up.

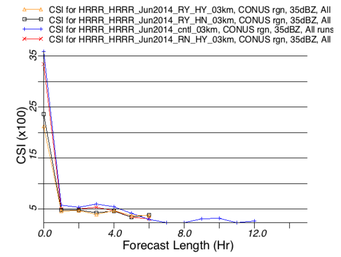
RAP

HRRR runs 18-20 UTC 19 June 2014

CSI for all forecasts 25 dBZ



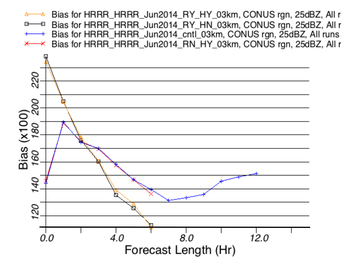
CSI for all forecasts 35 dBZ



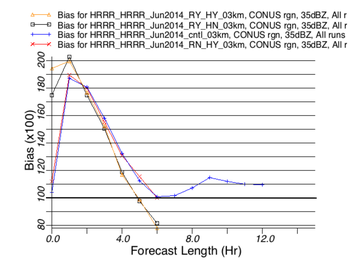
CTCR Assimilation

RAPno-HRRRno	RAPno-HRRRyes
RAPyes-HRRRno	RAPyes-HRRRyes

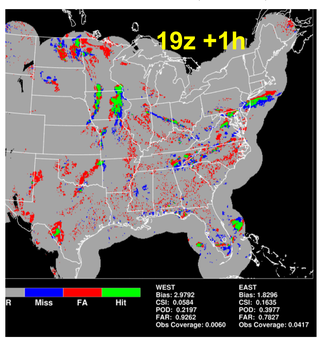
bias for all forecasts 25dBz



bias for all forecasts 35dBz



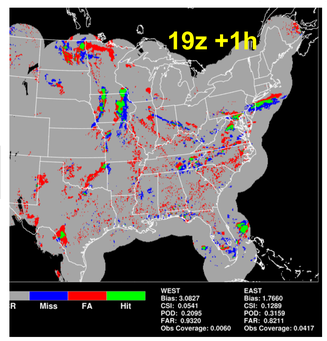
HRRR control run (RNHN)



25 dBz

HIT
MISS
FA

HRRR run with CTCR (RNHY)



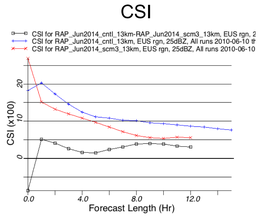
Initial runs of the HRRR with and without the satellite derived CTCR in both the RAP background field and the HRRR itself show a larger sensitivity to the background field than the data. We will work on improving the RAP background field as well as how we apply the CTCR in the HRRR.

HRRR

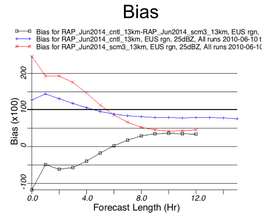
RAP scores by forecast length 25 dBz 15-22 June 2014

CNTL
CTCR -3
DIFF

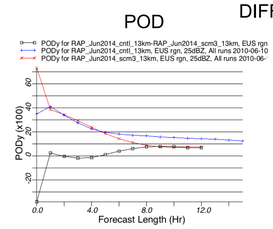
CSI



Bias



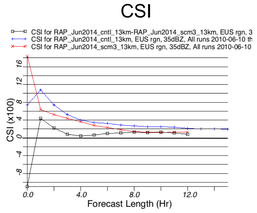
POD



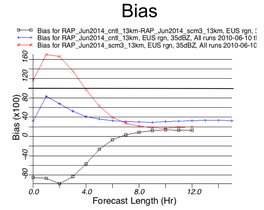
CTCR has a definite positive impact on the analyses, however this is lost in the early forecasts. We think it might be a case of too much too fast.

RAP scores by forecast length 35 dBz

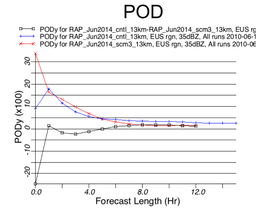
CSI



Bias



POD



SUMMARY and FUTURE WORK

Evaluation of impact from assimilation in both the updated RAP and the HRRR show sensitivity to the CTCR values

Looking at additional CI indicator fields from UAH for assimilation to improve CI detection and reduce noise

Also investigating methods of insertion of the data into the RAP/HRRR systems

Planned implementation into parallel test versions of the RAP and HRRR at ESRL as resources allow. Retrospective runs of interesting cases are ongoing.