UW-CTC Fusion Capabilities in Convective Storm Nowcasting

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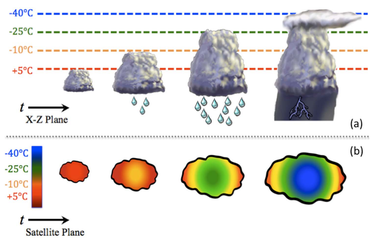
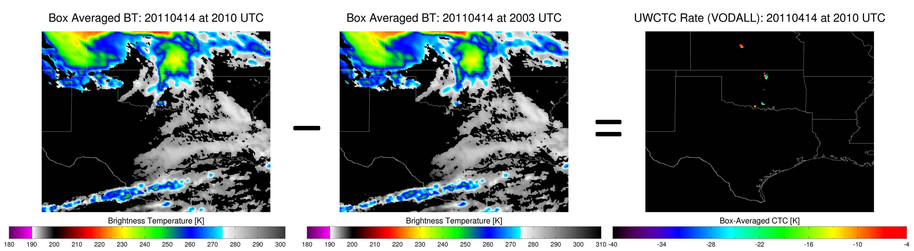
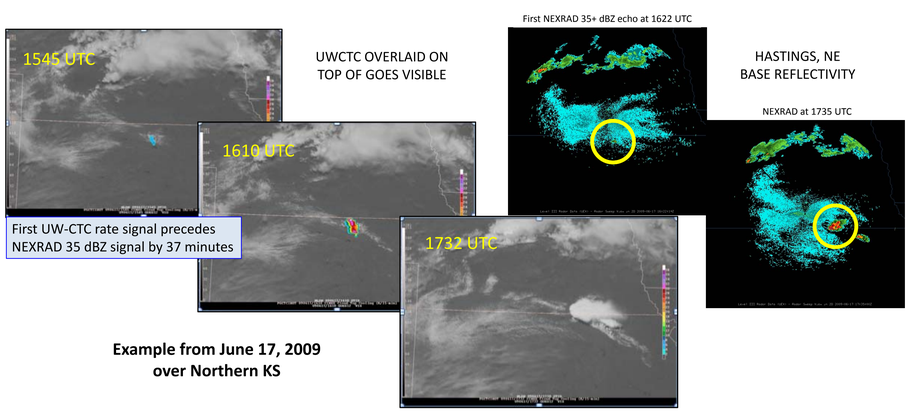
UW-Cloud Top Cooling (CTC) Rate

• Quantitatively diagnose vertical convective cloud growth by observing cooling of the cloud top in geostationary satellite 11 µm brightness temperature (BT) field



• Computes box-averaged 11 µm BT for current and previous time using several GOES-R-ready derived fields such as Cloud Mask, Cloud Type, and Cloud Optical Depth as focusing tools
• The current and previous BT fields are then differenced and various tests are performed to deduce location and magnitude of cloud top cooling

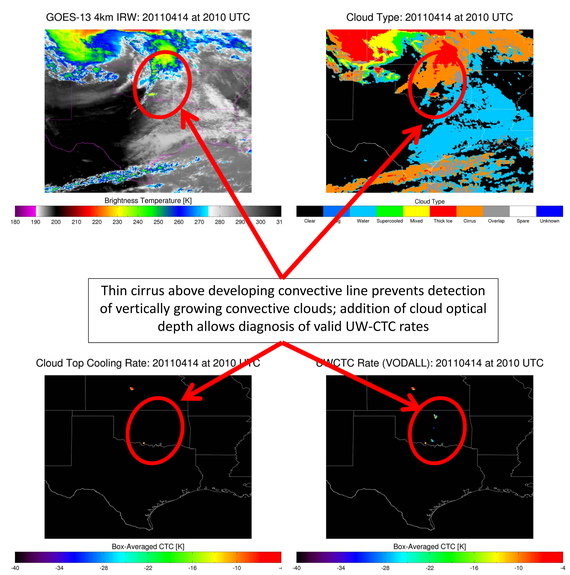




Example from June 17, 2009 over Northern KS

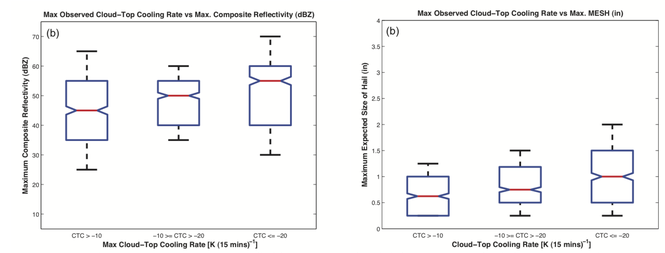
Detection in Thin Cirrus

• UW-CTC originally was not designed to operate in areas of ice clouds since cooling rates from areas where ice clouds are above lower water clouds can be ambiguous
• Forecasters continuously identified this as the largest deficiency of the algorithm at various testbed locations
• RESPONDING TO FORECASTER FEEDBACK: Inclusion of a daytime-only enhancement using Visible Cloud Optical Depth Retrievals allowing operation within areas of cirrus clouds
• Increase in cloud optical depth is related to rapidly-growing lower level clouds in these two cloud layer situations (cirrus has low optical depth values)



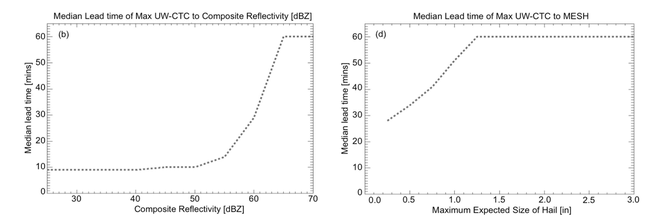
Relating UW-CTC to NEXRAD

• What is the prognostic value of UW-CTC? (Can the addition of UW-CTC increase severe thunderstorm warning lead-time?)
• FORECASTER HYPOTHESIS: The stronger the UW-CTC cooling rate, the stronger the resultant convection



Analysis is grouped into weak (left), moderate (middle), and strong (right) UW-CTC cooling rates. The red line indicates the median value of each bin with the blue boxes representing 25th (lower) and 75th (higher) percentiles of the data and the whiskers representing the respective 1σ bin value. A lack of overlap in the notches of the boxes indicates medians are statistically different to the 95% confidence level.

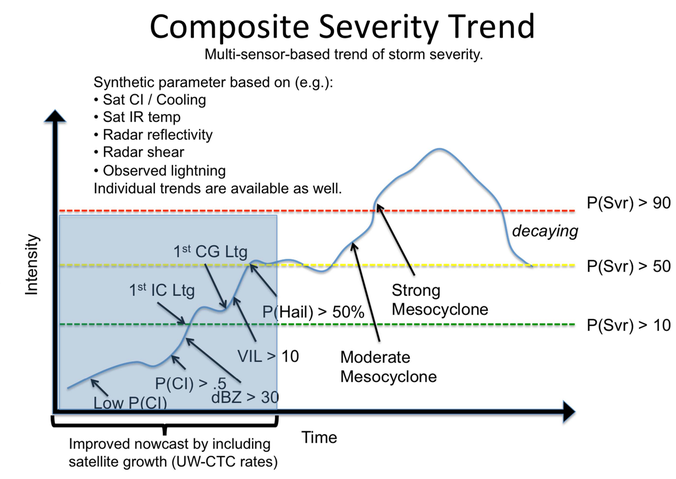
• HYPOTHESIS VERIFIED: Storms with stronger UW-CTC cooling rates exhibit more intense precipitation cores (including hail)



• For the above relationships to be useful in nowcasting, there must be sufficient lead-time. The above figures show median lead-time of maximum UW-CTC rate and various thresholds of composite reflectivity and MESH

UW-CTC and OU Probabilistic Hazards Information System

• OU Probabilistic Hazards Information System (OU-PHI) fuses a variety of data (radar, NWP, statistical studies, etc.) to determine the probability of significant weather from developing thunderstorms
• Given the promise of good lead-time of UW-CTC detection over strong thunderstorms, the integration of UW-CTC and its associated NEXRAD relationships within the OU-PHI system may improve OU-PHI's overall performance



FUTURE WORK

Future work will focus on the fusion of the UW-CTC product into the abovementioned OU-PHI System and integration of the UW-CIMSS Nearcast Field (which assimilates satellite and NWP data) into the UW-CTC framework for further improvement of performance statistics

Interested readers are encouraged to view the poster presentations of Mecikalski et al., Walker et al., and Petersen et al.

UW-CTC INFORMATIONAL LINKS

Product Quicklooks: http://cimss.ssec.wisc.edu/snaap/convinit/quicklooks/
Training/Instructions: http://cimss.ssec.wisc.edu/goes_r/proving-ground/SPC/SPC.html

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ACKNOWLEDGEMENTS: This research was funded by NOAA GOES Improved Measurement Product Assurance Plan (GIMPAP) grand number PRJ36XB and NOAA GOES-R Proving Ground participation.