Jobsheet

UAH GOES-R CI, Numerical Weather Prediction-Satellite Convection Analysis & Tracking (NWP-SATCAST) Product

Objective:

- Observe and evaluate UAH GOES-R CI output from the 24 May 2011 case dataset.

Product Overview:

The purpose of the UAH GOES-R CI algorithm is to track and diagnose the cloud-top characteristics of convective-form clouds by using the IR component of geostationary satellite data fused with environmental information provided by the Rapid Refresh (RAP) Model to produce a forecast probability of CI for each individually tracked cloud by assessing these characteristics for signals of vertical growth/development/favorable environment. The diagnoses (and resultant forecasts) are based on hourly analysis from the RAP combined with the two most recent GOES scans and are constantly updated with each newly available set of images for both inputs.

There are 7 steps performed every time a new GOES scan is available (including Rapid Scan Operations and Full Disk scans) in order to generate each UAH GOES-R CI output product:

1. Download latest available GOES (East) data.
2. Create Convective Cloud Mask (CCM), used to define "cloud objects".
3. Derive Mesoscale Atmospheric Motion Vectors (MAMVs) from 3 consecutive sets of images.
4. Combine CCM and MAMVs to perform "cloud object-tracking".
5. Perform spectral/temporal differencing tests for each tracked cloud object to diagnose potential characteristics of vertical cloud growth and determine forecasts for CI.
6. Match the location of each cloud object to the most recent hourly analysis (from RAP) and query for environmental data.
7. Process 9 satellite fields with 15 model environmental fields to produce a CI probability value, depicted by the colored objects in the DSS display.

NOTE: Steps 2 and 3 are run simultaneously to decrease processing time. The RAP data required for Step 6 is processed hourly outside of the main algorithm script and made available for the top of the hour forecast.

Job sheet Overview:

This job sheet contains a sequential set of procedures that you will follow to view and observe CI output in the AWIPS environment.

Case Synopsis:

This day features a vigorous upper level shortwave trough that begins over the Four Corners region in the morning and propagates to the northeast throughout the day, transitioning into a negatively tilted orientation over the OK/TX-panhandle borders by 00 UTC (Figures 1 and 2). At the surface a dry line develops over the TX panhandle in the morning and mixes eastward into western and central OK (Figures 3 and 4), providing the focus for convergence and super-cellular development later in the day across western OK. With abundant instability present ahead of the dry line and strong dynamics aloft, this day was forecast to become a High Risk event for severe weather with increased probabilities of large hail and strong, long-lived tornadoes. On such a day, when almost any convective development could inevitably lead to future tornado genesis or the production of large, damaging hail downstream, a reliable convective initiation (CI) product could provide useful information in a situational awareness framework, which can give forecasters a heads up and has the potential to increase warning lead times.

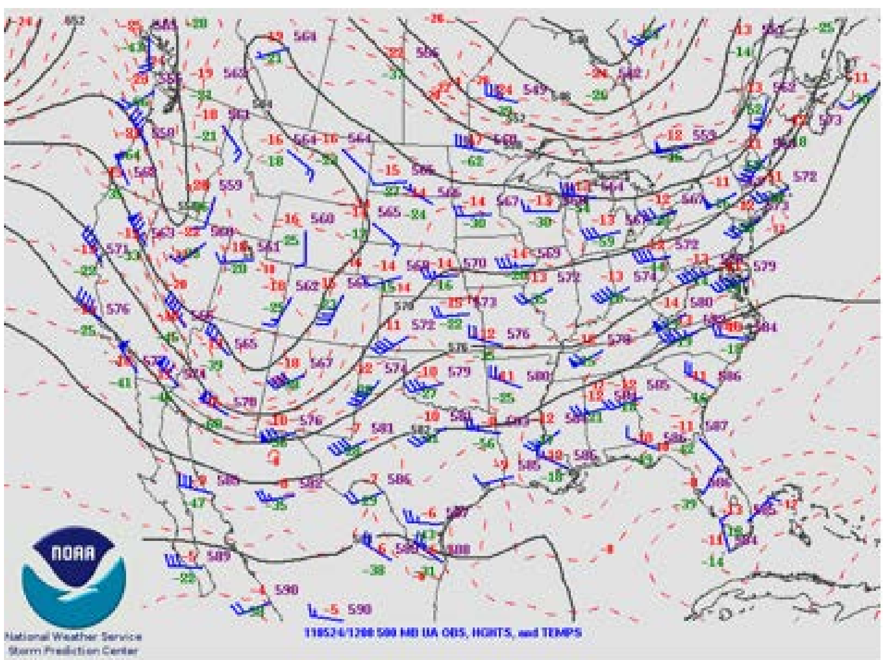

Figure 1: 500 mb chart at 12 UTC on 24 May 2011

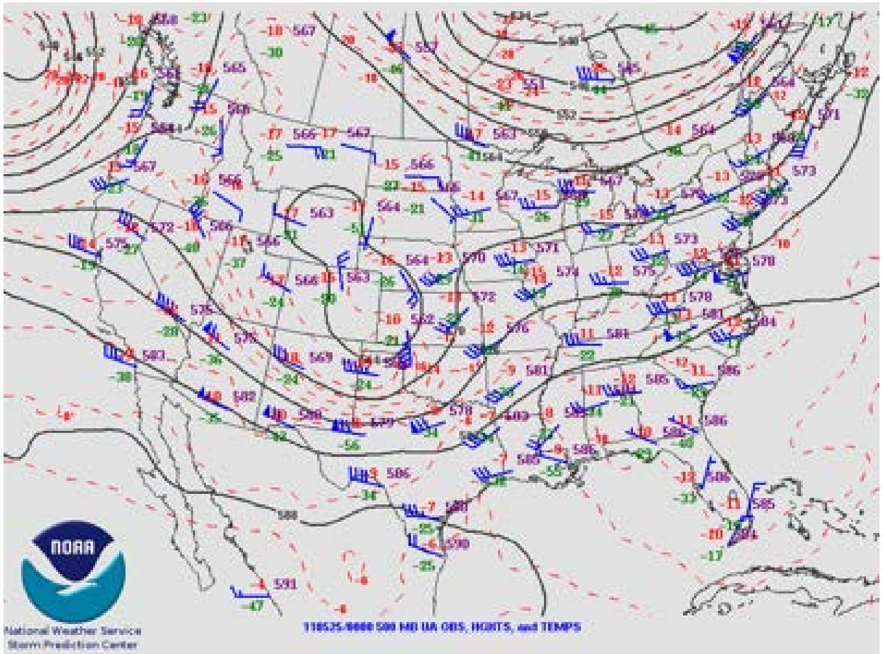

Figure 2: 500 mb chart at 00 UTC on 25 May 2011

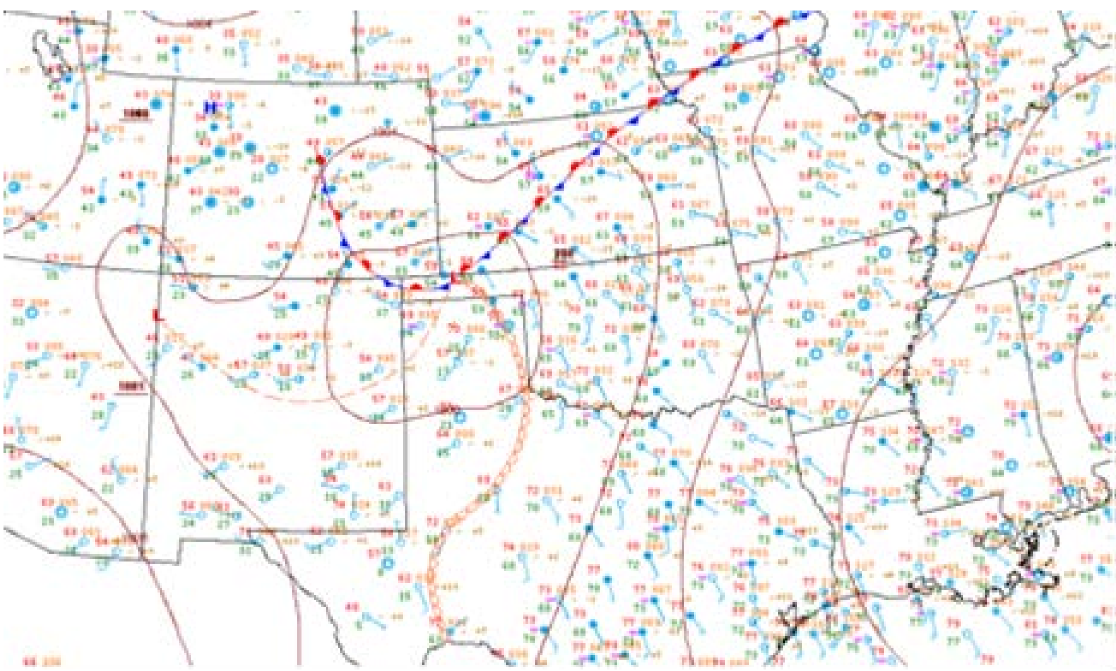

Figure 3: Surface map at 12 UTC on 24 May 2011

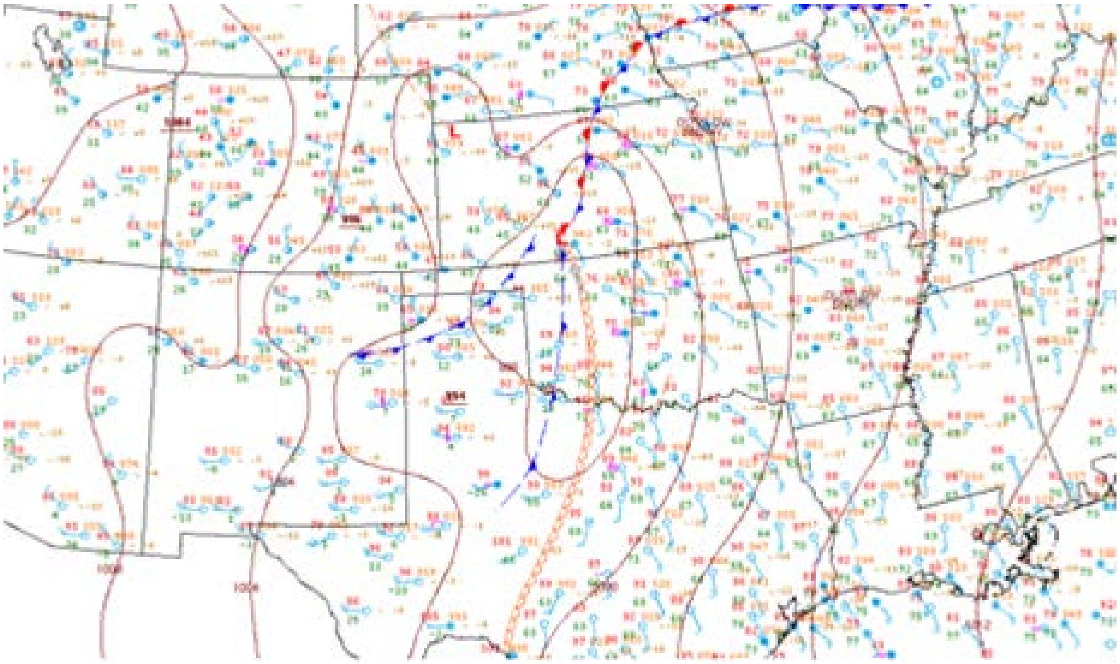

Figure 4: Surface map at 00 UTC on 25 May 2011

WES Case Instructions

1. If AWIPS D2D is not currently open, double-click on the Launch AWIPS D2D icon to start up an AWIPS D2D session.

2. Left click on the D2D clock in the lower-right corner of D2D.

3. Inside the “Set Time” window, set the D2D clock to **2011 May 24 22:00** UTC (don’t bother changing the seconds) and check the “Freeze Time at This Position” box.

4. The product combinations for this jobsheet are located in an AWIPS procedure folder called **UAH_CI**. This can accessed from the D2D menu by selecting **File → Procedures → Open…**, selecting **UAH_CI** from the list, and clicking on the OK button. This will open up a new window called **Procedure – UAH_CI**

5. Select **UAHCI – 4 panel** from the procedure window and click on the **Load** button to open the products into D2D. This will load a four-panel display of time-matched GOES Visible Satellite (Upper-Left), UAH GOESR-CI (Upper-Right) KFDR 0.5º reflectivity (Lower-Left) and KTLX 0.5º reflectivity (Lower-Right). You can browse through these products in the 4-panel plot or rotate through them using the 1,2,3,4 keys at the top of the keyboard. You can return to the 4-panel layout by right-clicking on the D2D map and selecting *Four Panel Layout*.

6. Look at the CI product at 1815 UTC.

   We see that UAH GOESR-CI is forecasting CI in the western edge of the cloud field on the OK/TX border along the Red River and to the north of there in western OK. This signifies the first detected development of vertically growing clouds along the eastward propagating dryline. Note the 1815 image corresponds with the full disk scan, meaning a 30 min gap between images.

7. Cycle between images from 1815 UTC to 1832 UTC and focus on the CI product.

   You will notice certain CI detections will disappear. This is because once clouds develop into a mature cumuliform state; the algorithm will no longer track or provide forecasts for them. Notice at 1832, additional CI detections are plotted in Jackson County and in the TX/NM border.

8. Advance ahead to 1845 UTC and focus on the CI product.

   The algorithm shows a large area of CI along what will ultimately become a line of strong convective storms. This line is visible with objects as early as 1730. Notice as time moves forward to 1845, the objects transition in color values from the cooler blues, to the warmer yellows and oranges along the line.

9. Cycle through the imagery from 1832 UTC to 1855 UTC.

   Notice the radar echoes in the vicinity of the 1815 UTC CI forecast appear, with 35 dBZ echoes occurring at 1855 UTC onward.

10. Advance the loaded products to 2115 UTC.

    UAH GOES-R CI continues to indicate CI along the southern portion of the dry line. This is also confirmed through the areal extent and intensity of radar echoes seen from both the KTLX and KVNX radars (Figure 5).

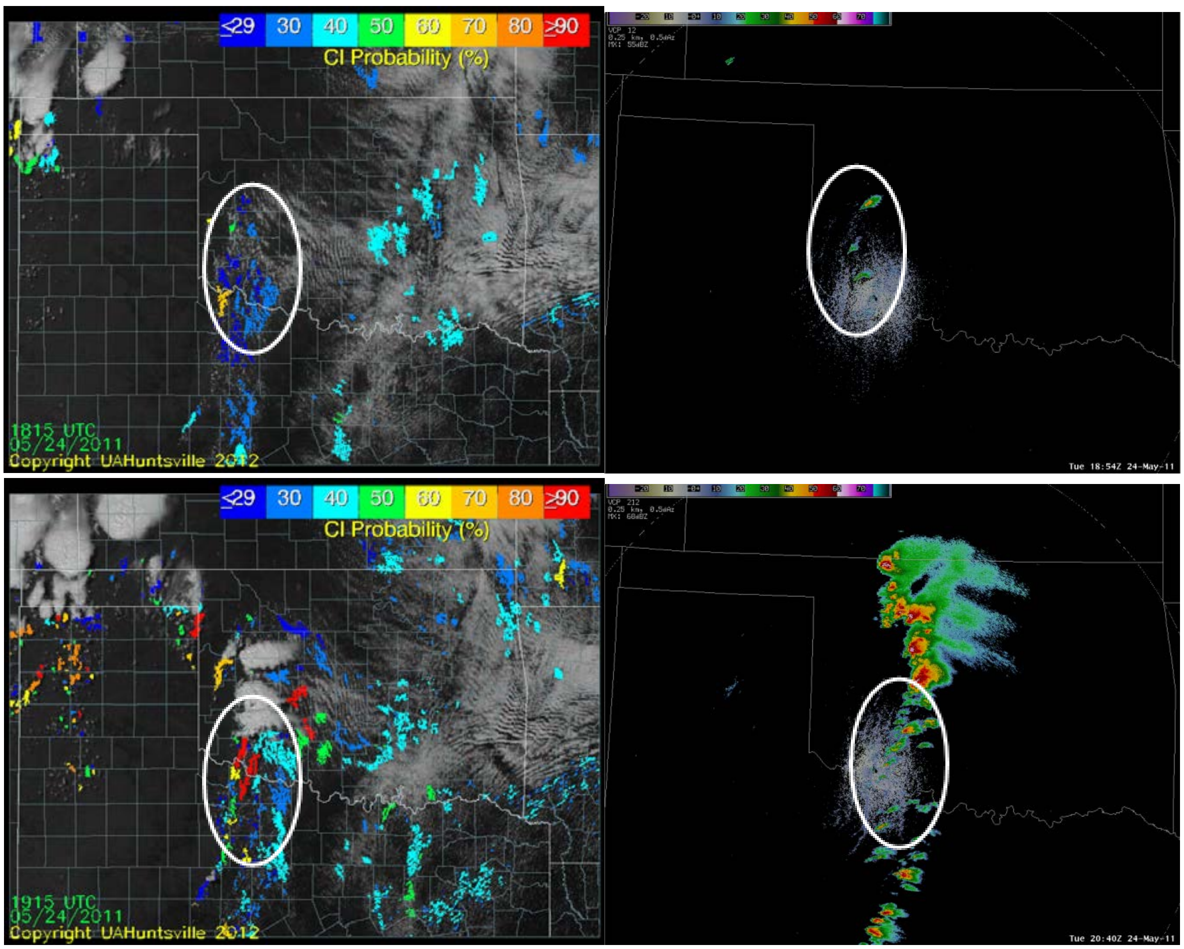

Figure 5: Examples of verified UAH GOES-R CI forecasts: Top row, UAH GOES-R CI forecast at 1815Z (left), with the radar image at 1854Z (right) showing the development of radar echoes of 35 dBZ. Bottom row, UAH GOES-R CI forecast at 1915Z (left), with the radar image from 2040Z (right).

What to Expect in the HWT:

Due to popular opinion from the 2011/2012 groups of visiting forecasters who were able to evaluate UAH GOES-R CI, changes have been made to the algorithm so that the output forecasts are no longer "null" or "positive" (2011 HWT). Further, the algorithm leverages NWP data to define the environment the cloud object is in. A logistic regression technique has been applied in such a way as to combine all of the information from nine satellite interest field tests (originally used to evaluate cloud top characteristics and produce the null/positive forecasts) and fifteen NWP (from the RAP) environmental fields to produce a probability score (previously known (2012 HWT) as the "Strength of Signal") type of forecast output. The latest version of the UAH GOES-R CI algorithm produces a diagnostic look at each tracked cloud object on a scale from 1 to 100, leveraging the additional information provided by the RAP about the environment where the object is located resulting in values where higher numbers indicate a cloud object that is exhibiting stronger characteristic signals of vertical cloud development, and lower numbers indicate weaker characteristic signals of vertical cloud development.