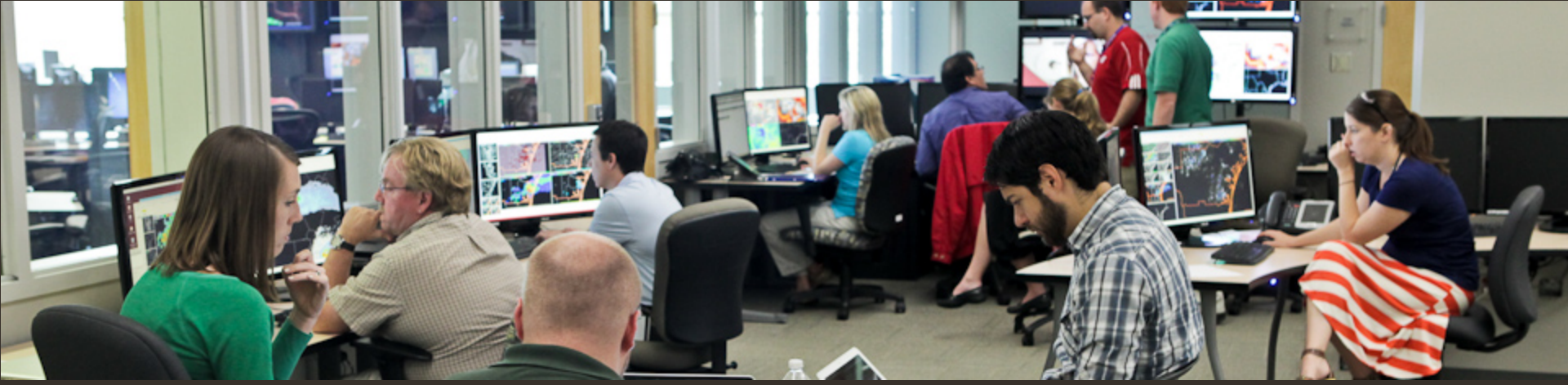


The GOESR Proving Ground in the Hazardous Weather Testbed

Participating organizations:

NOAA/NESDIS, NOAA/NSSL, NOAA/NWS

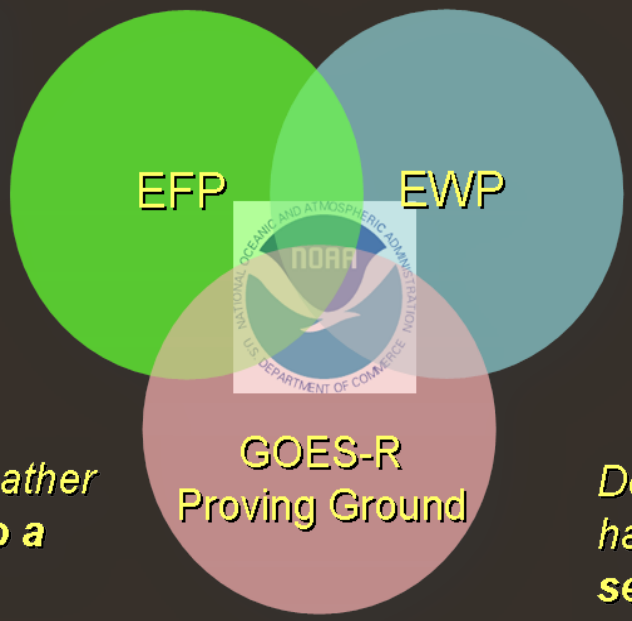
NASA-SPoRT, UW-CIMSS, UAH, CIRA, OU-CIMMS

Kristin M. Calhoun

NOAA Satellite Science Week

19 March 2013

What are the Hazardous Weather Testbed (HWT) & Spring Experiment?



Experimental
Forecast
Program

*Prediction of hazardous weather events from **a few hours to a week in advance***

Experimental
Warning
Program

*Detection and prediction of hazardous weather events **up to several hours in advance***

NWS Forecasters in an Operational Environment

- 10 AWIPS2 machines
- Ability to replicate service from any WFO in the country (multiple at one time)
- Early focus on mesoscale environment (e.g., high res-NWP & CI) followed by transition to warning operations

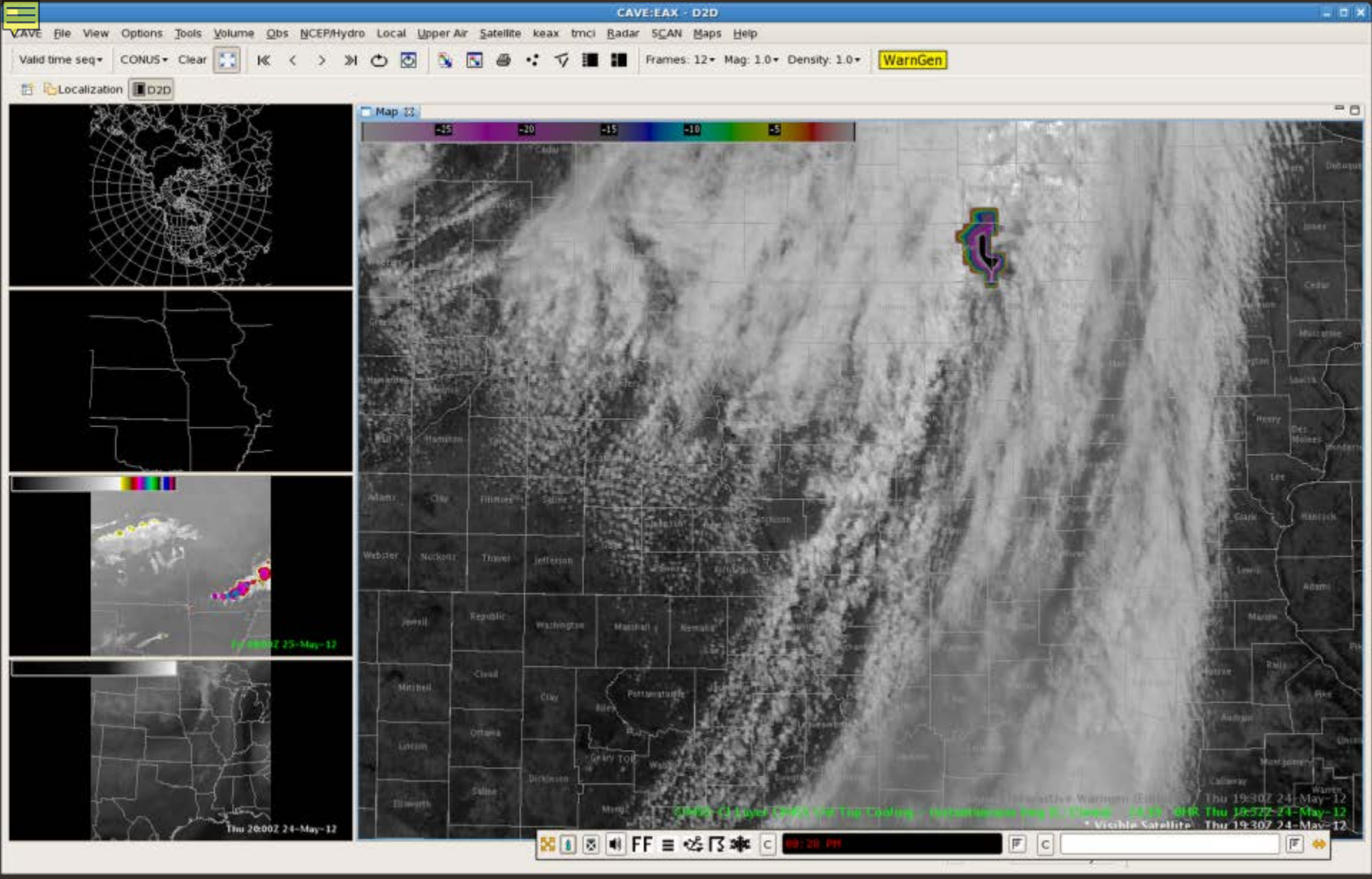
NWS Forecasters in an Operational Environment

- Active discussions with project scientists (during & post-event)
- Product / storm evaluation discussion using blog with embedded screenshots
- Daily forecaster surveys
- “Tales from the Testbed” webinar w/WDTB by forecasters

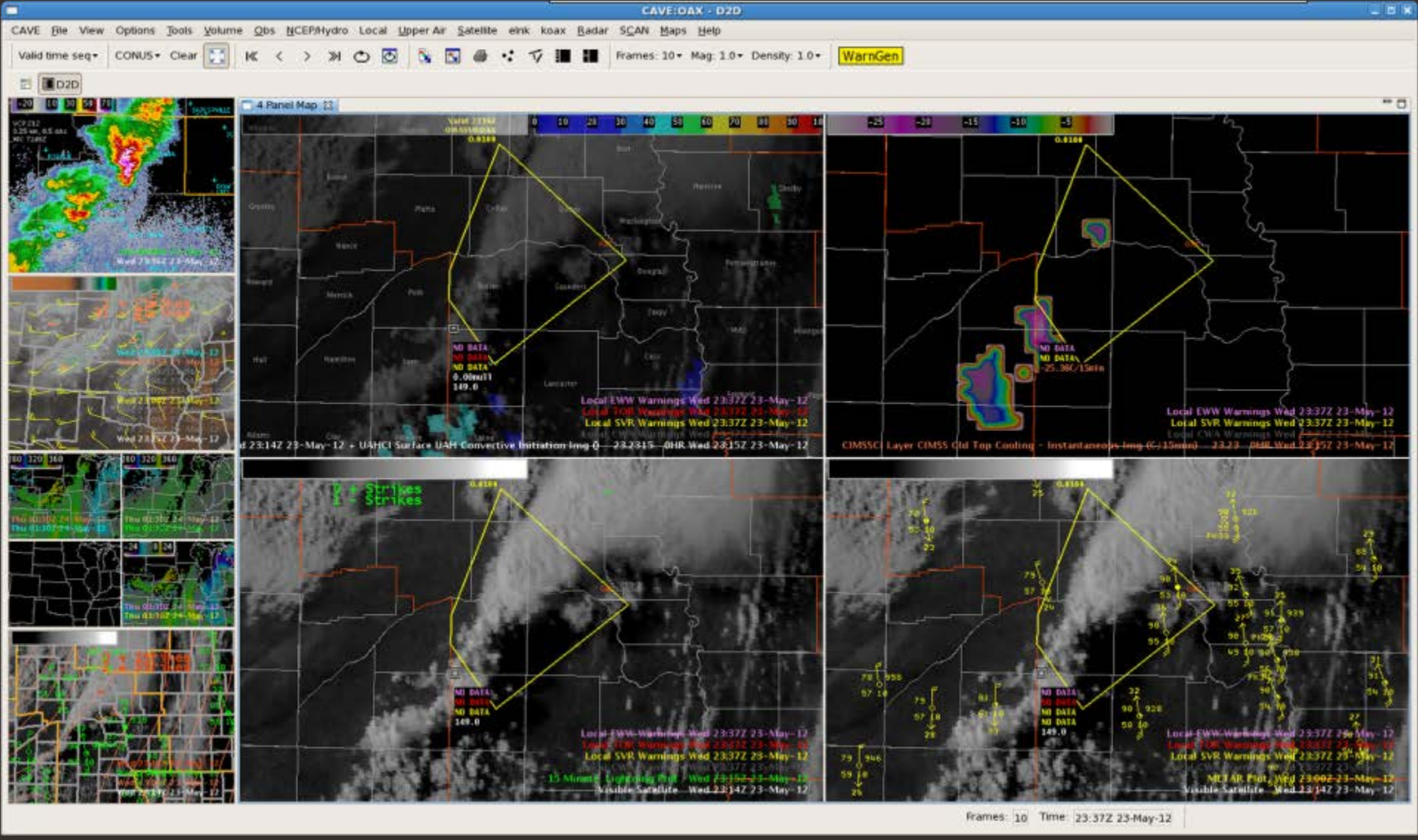
2012 Products:

CLOUD-TOP COOLING RATE

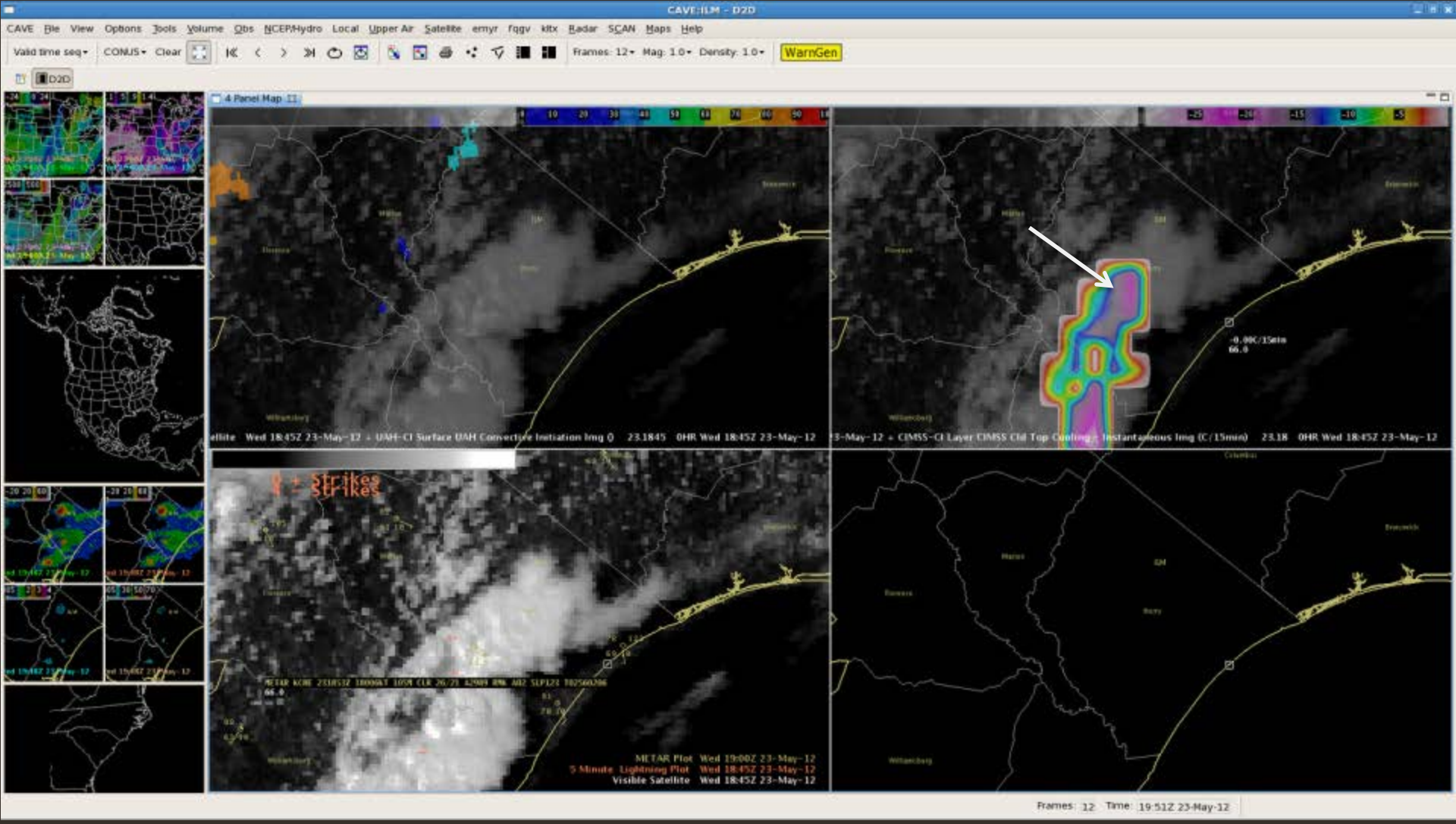
Univ. of Wisconsin-Coop. Inst. Metr. Sat. Studies (UW-CIMSS)



"The cloud top cooling product in central Iowa indicated nearly 40 C/15 km of cloud top cooling for a storm in Boone and Story counties. This product preceded intense radar reflectivity in the area by nearly an hour." –NWS Forecaster, Week 3

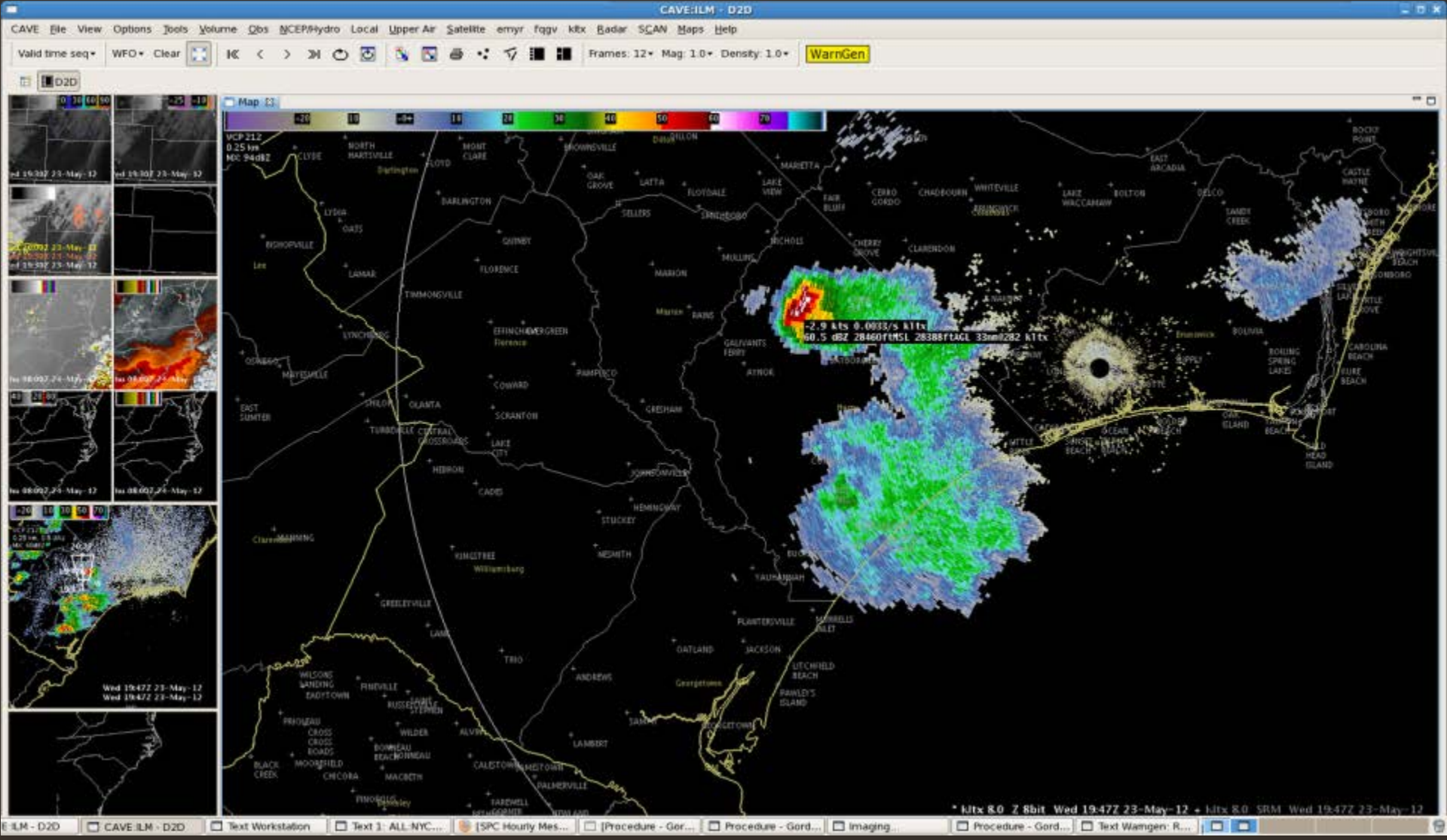


The scan at 2315 UTC had the UW-CTC product exhibiting a strong cooling rate of ~-25K/15 min. This information combined with what the forecasters have learned/noticed about our product in other situations prompted the forecaster to issue the warning with high confidence that the growing convective element would eventually become severe.



Horry County, SC; 1845 UTC, 23 May 2012

Cloud Top Cooling product at 1845Z (Top Right panel): cooling rates of -21C/15minutes



Horry County, SC; 1947 UTC, 23 May 2012

KLTX radar: 60dbz echos up over 28,000ft, which is above the -30C level from the 1200 UTC CHS sounding (~25,000ft).

Verification of > quarter size hail in NW Horry County by 2000 UTC.

More research (providing solid statistics) should be done to determine the appropriate cooling rate values that are associated with the occurrence of severe weather.

"Strong CTC signals off the terrain in NM with little or no convective development… Take home point — this is a great product, however forecasters need to know their environment to use this product in enhanced warning ops and beware of times that the convection is being forced by the terrain… the sfc dwpts were in the teens and lower 20s. Almost no way convection could develop with this dry air."

NWS Forecaster, "ABQ: CTC + Situational Awareness = Great Fcst", Realtime-Blog

"Based on the environment and the ongoing supercell activity, I issued the warning as soon as I saw the CTC... Without the CTC product, I may have issued the warning a scan or two later..."

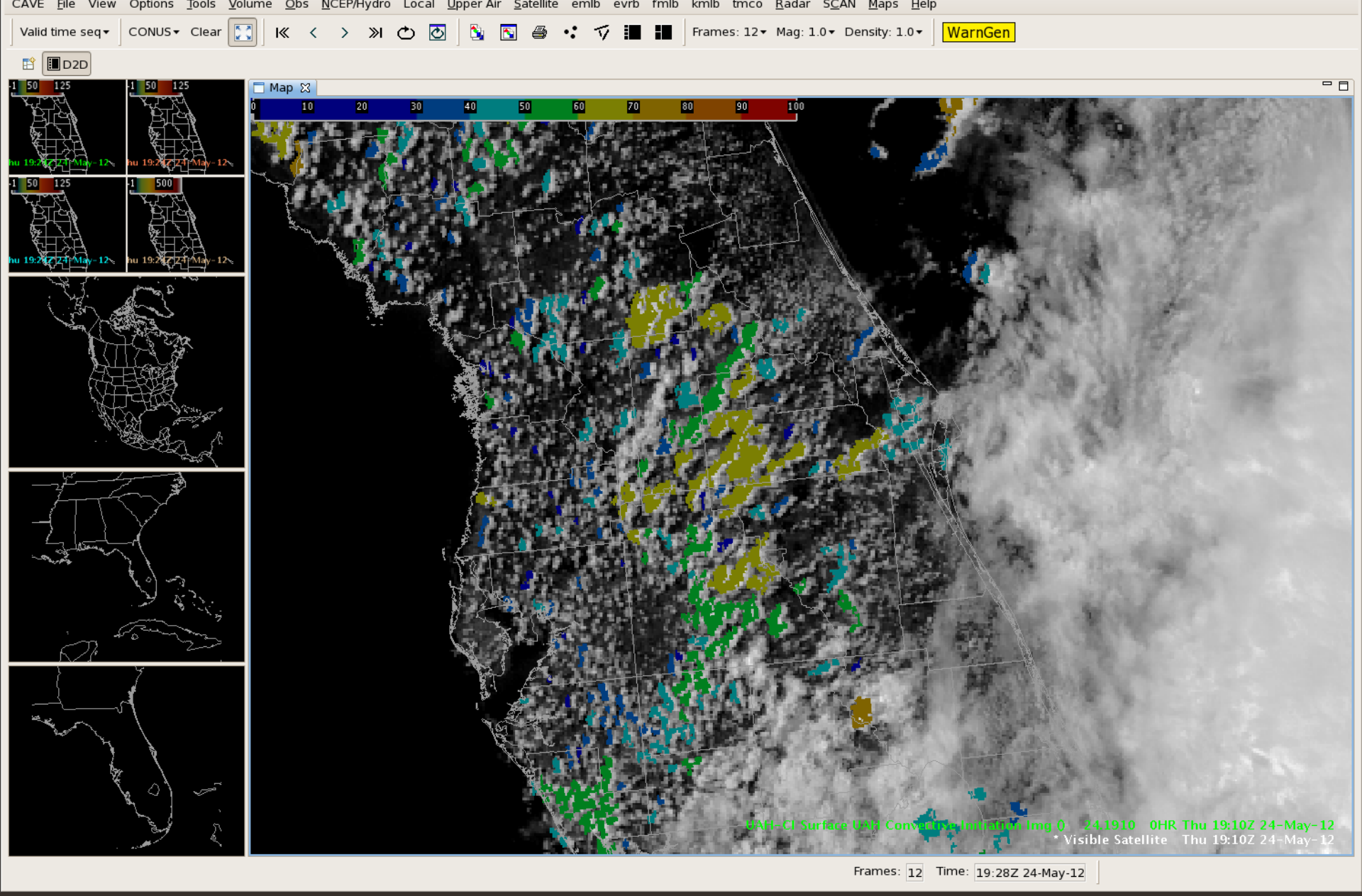
NWS Forecaster, "Tales from the Testbed" Webinar, 11 May 2012

2012 Products:

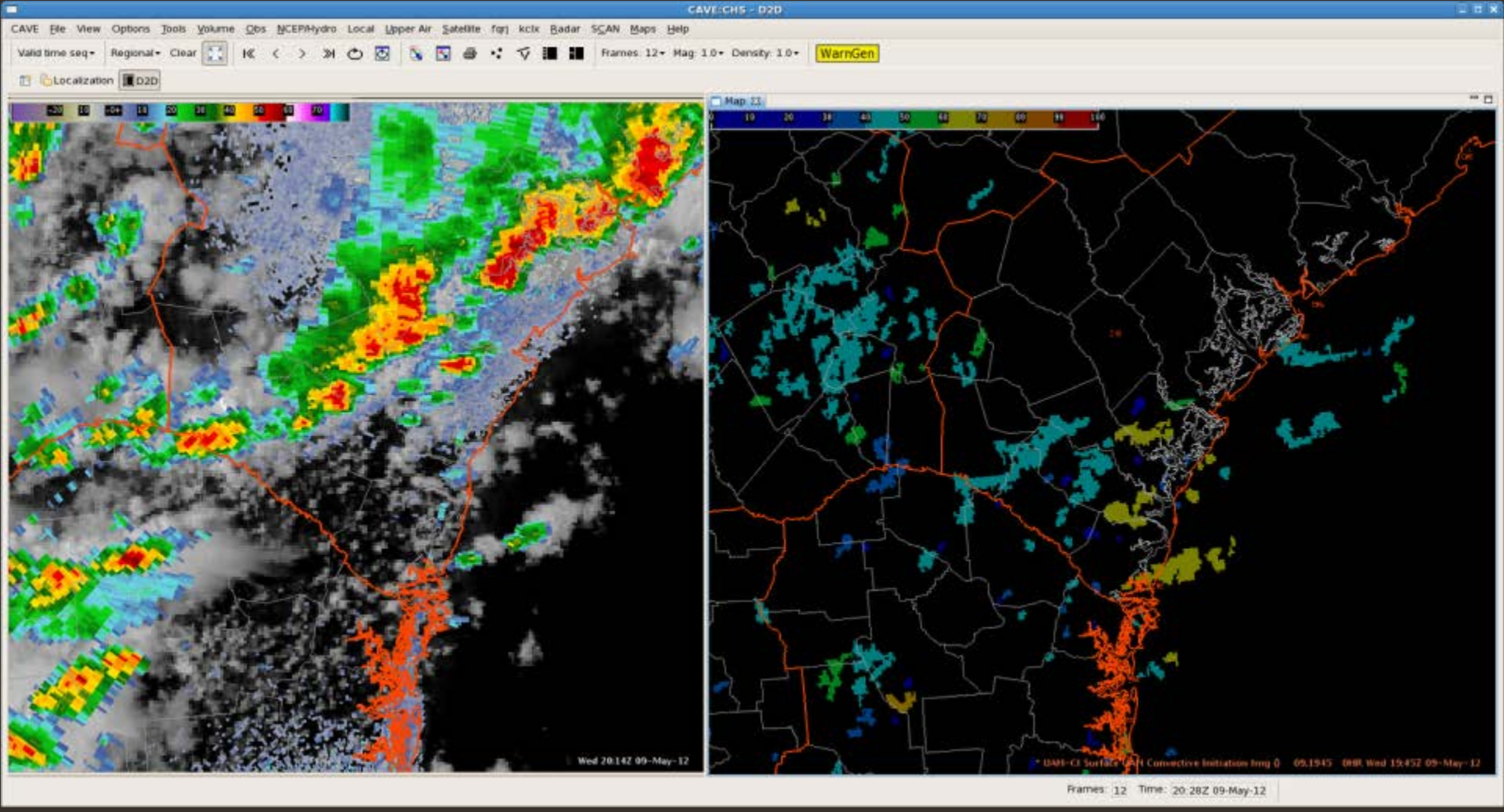
CONVECTION INITIATION

SATCAST – SATELLITE BASED CONVECTION ANALYSIS AND TRACKING

Univ. of AL- Huntsville

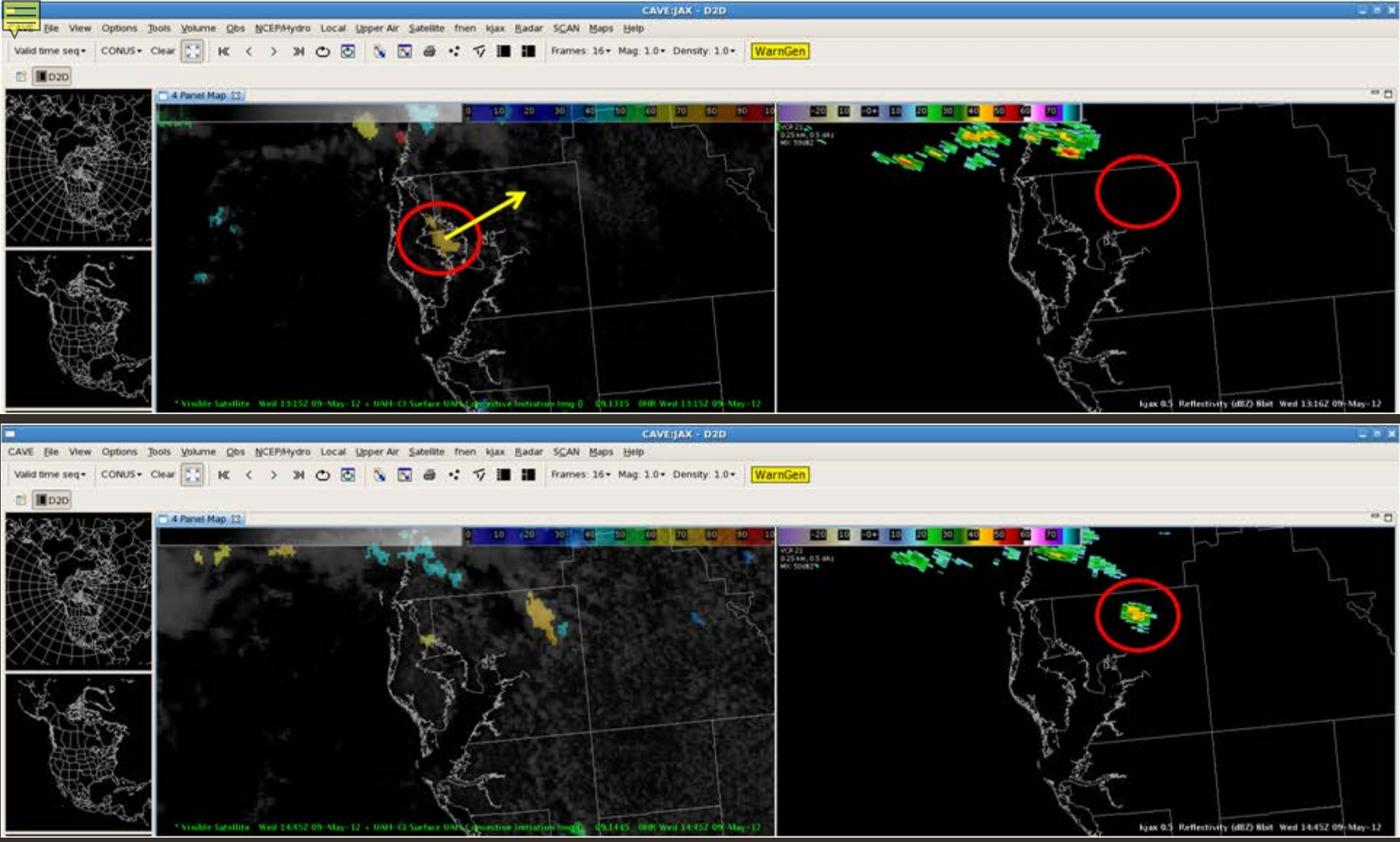


Moderately high probabilities for CI (60-70%) along ahead of the westward moving sea-breeze boundary. Best chance for thunderstorms appears to be from the interior counties towards the west coast. Some initiation is possible across Northern Brevard County…



A line of storms extends along the South Carolina coast and into portions of southern Georgia at 2014Z (9 May 2012) (left panel).

Earlier at 1945Z (right panel), the UAH Convective Initiation product showed 3 areas > 60%. Initiation was predicted along and just ahead of an outflow boundary, and just off the coast oriented west southwest to east northeast. The product performed very well, with around 30 minutes of lead time for the updrafts that exhibited +35dBZ.



SATCAST Strength of Signal CI product produces forecast output of 70+ index value (on scale from 0-100), valid from 1315 UTC (Left). The storm motion is to the ENE. Note the lack of any radar echoes at the time.

By 1445 UTC (1.5 hours after the above CI forecast in Figure 1), the first 35+ dBZ echo is finally detected by the radar (Right).

100% of the forecasters responded “yes” in the survey when asked if they preferred a probabilistic approach to a binary yes/no approach.

“The SATCAST strength of signal is a huge improvement.”

NWS Forecaster,EWP end of week 2 debrief

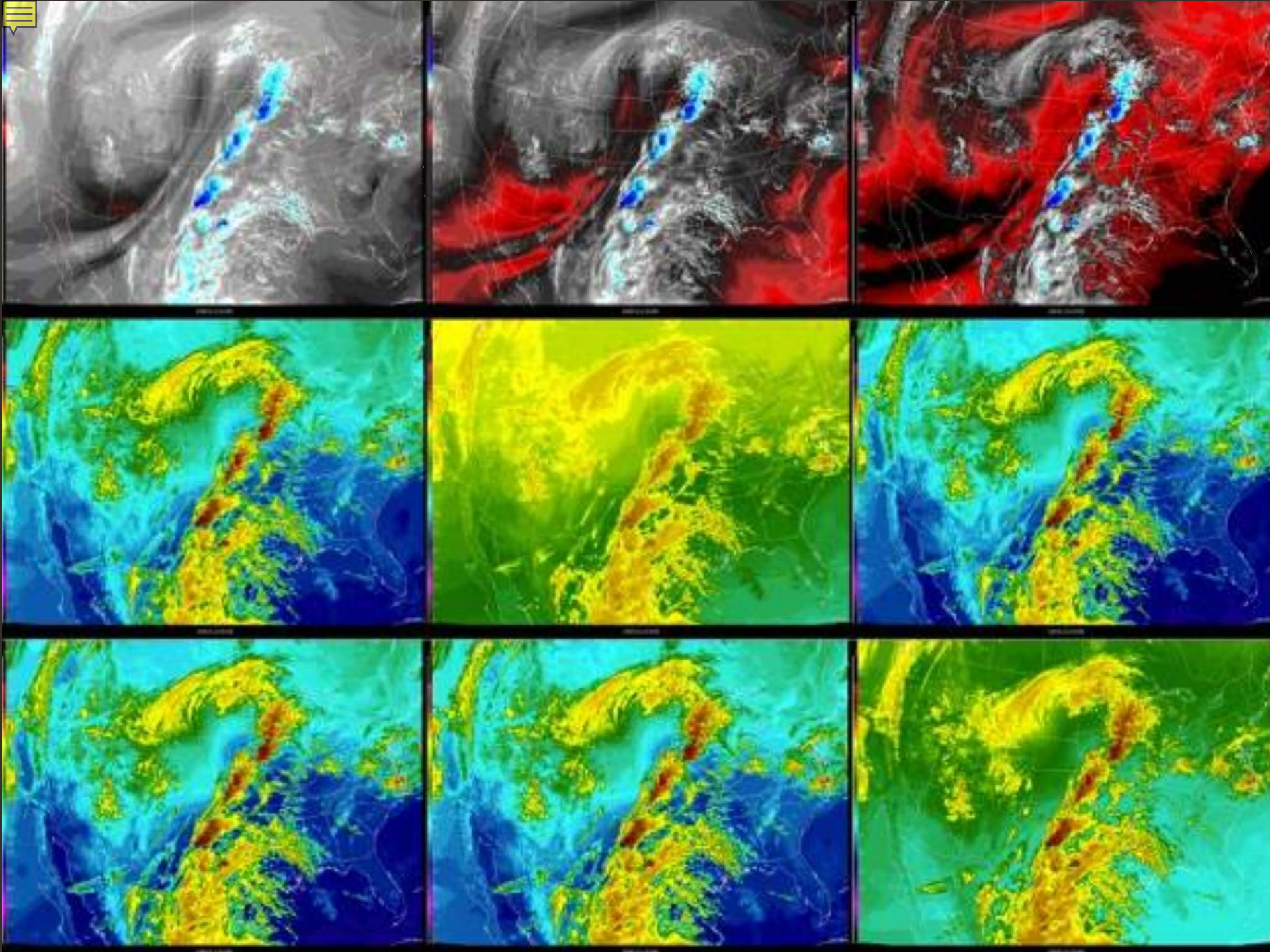
“The probabilistic CI will be really useful for aviation purposes since we're not looking at just severe convection.”

NWS ForecasterEWP end of week 3 debrief

2012 Products:

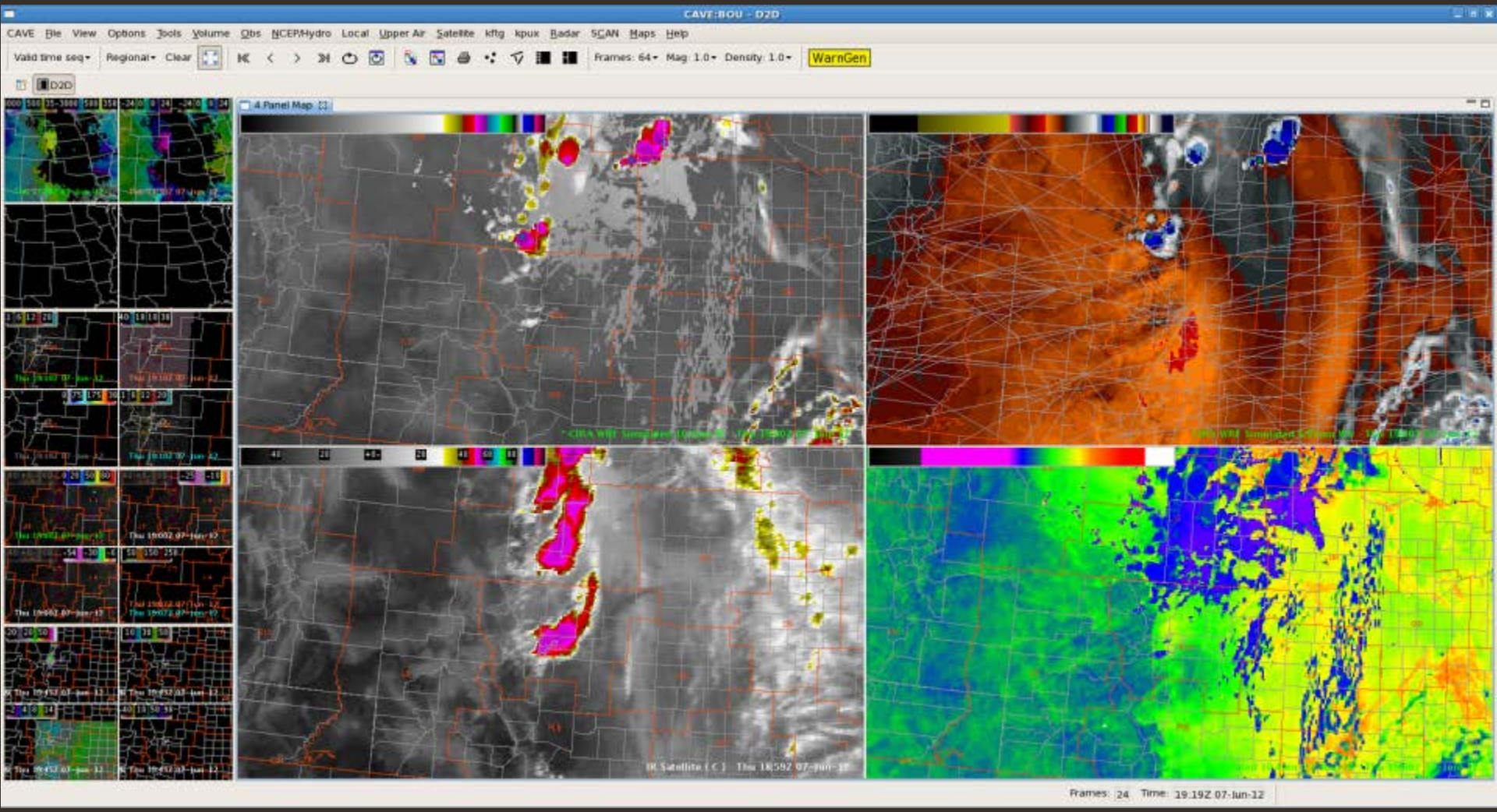
SIMULATED SATELLITE (CLOUD AND MOISTURE IMAGERY)

UW-CIMSS & Coop. Inst. For Res. in the Atmos. (CIRA)



NSSL-WRF FORECAST (SIM) IR FOR 1900 UTC

SIM WV (6.95 um) AT 1900 UTC

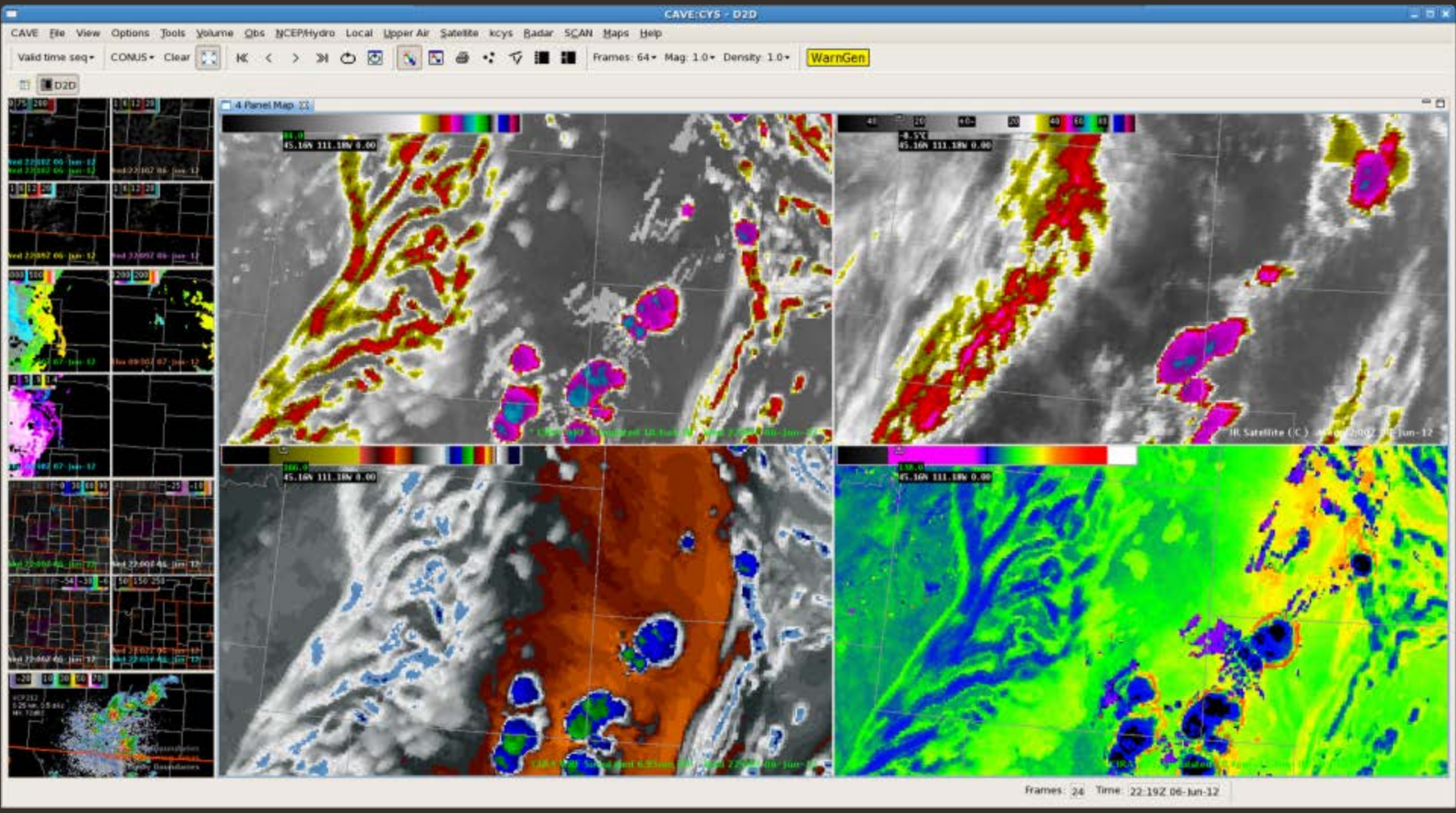


ACTUAL IR SAT AT 1900 UTC

SIM BAND DIFFERENCE (10.35-12.30 um) IR AT 1900 UTC

NSSL-WRF FORECAST (SIM) IR FOR 2200 UTC

ACTUAL IR SAT AT 2200 UTC

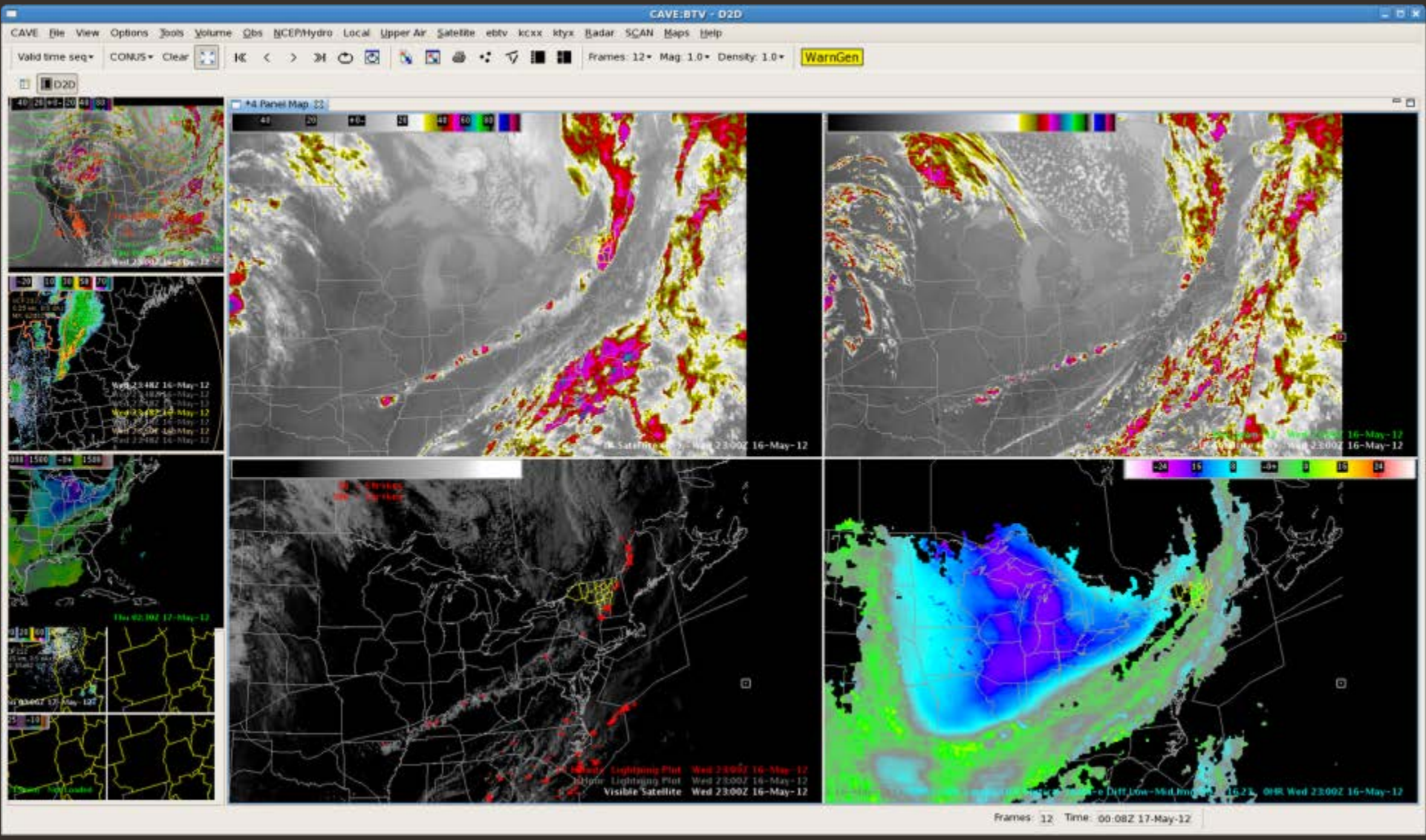


SIM WV (6.95 um) AT 2200 UTC

SIM BAND DIFFERENCE (10.35-12.30 um) IR AT 2200 UTC

ACTUAL IR SAT AT 2300 UTC

NSSL-WRF FORECAST (SIM) IR FOR 2300 UTC



VIS SAT & NLDN Lightning at 2300 UTC

NEARCAST (theta-e diff)

Forecasters were very excited about the simulated satellite imagery and would like to have it provided within their operations.

"I was really impressed on how well it picked up on the whole pattern, convective initiation and location... the purpose is to get a whole 3D representation and I liked that aspect."

NWS Forecaster, "EWP daily debrief 5/9

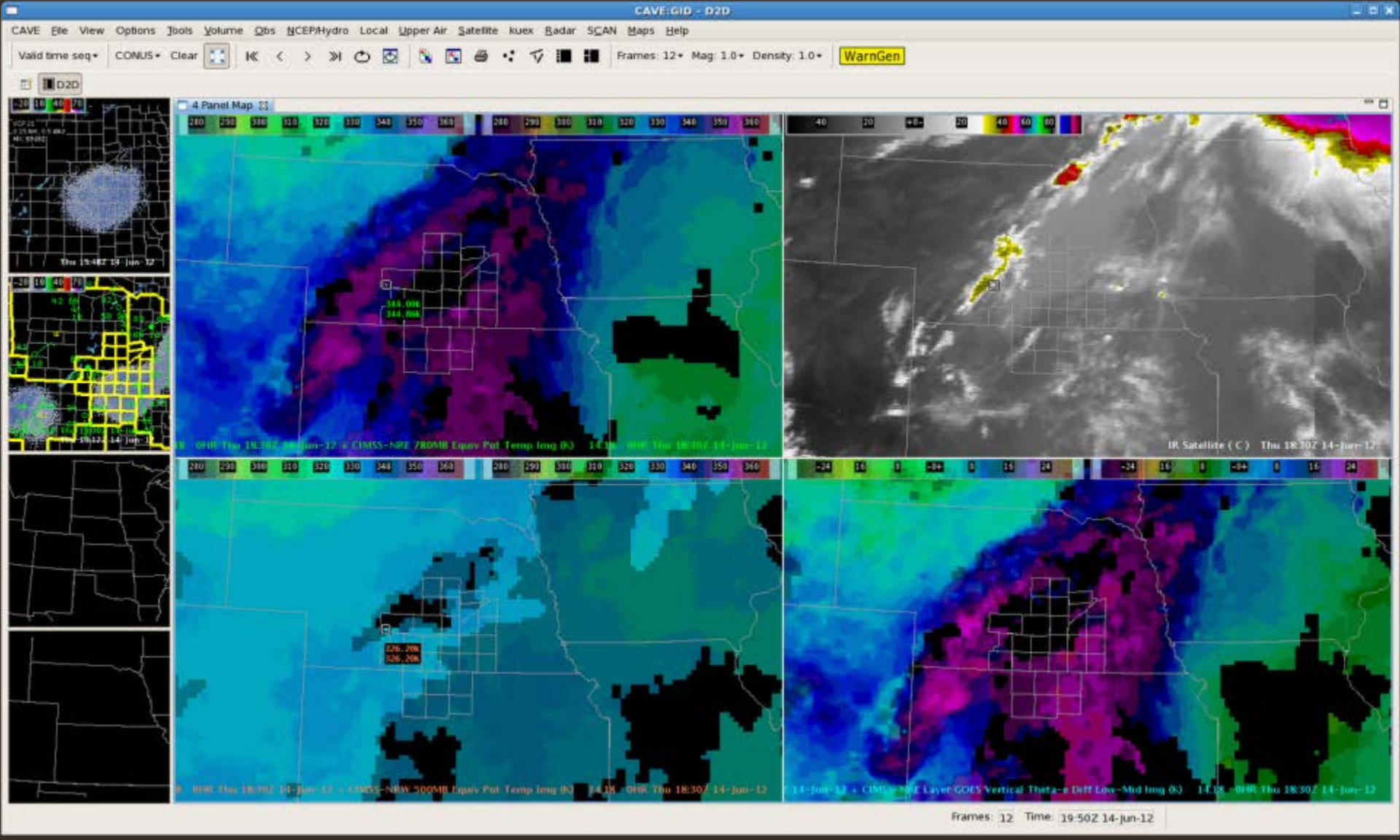
"Synthetic WRF imagery can enhance forecasts by providing model data in a familiar satellite format which makes model analysis, model comparison to obs and model forecast projections easier to visualize and understand."

NWS Forecaster, "Tales From the Testbed" Webinar, 11 May 2012

2012 Products:

NEARCAST

UW-CIMSS

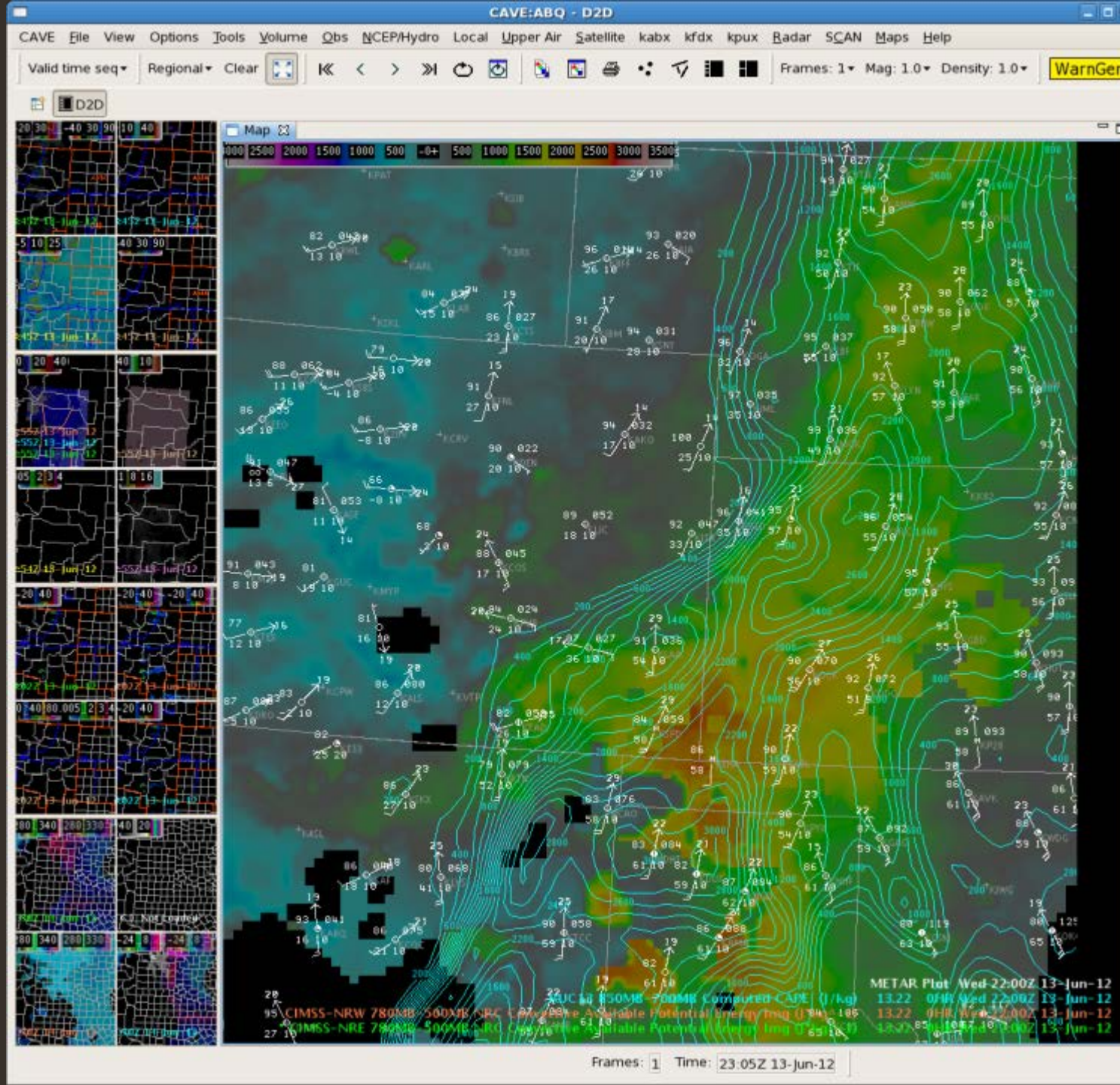


GOES-E and GOES-W Nearcast low-level theta-e (top left), GOES-E observed IR (top right), mid-level theta-e (bottom left) and theta-e difference (bottom right) at 1830 UTC on 14 June 2012.

"NRE theta-e products showing a fairly unstable airmass over the area…and with near full insolation on the Cu field southeast of the boundary we expect initiation in the next 2 hours across the forecast area…" –realtime blog

Nearcast 780-500 mb layer CAPE analysis overlaid with RAP 850-700 mb layer CAPE analysis in AWIPS II at 2200 UTC on 13 June 2012.

Forecasters found this product easier to understand conceptually than the theta-e and PW difference fields.



Forecasters found the NEARCAST products particularly useful in determining convective maintenance.

"It was telling us that the axis of instability was going all the way to the coast (and it did) and that would be a huge thing to know, whether the convection would continue or die."

NWS Forecaster, "EWP daily debrief 6/12",

"Instead of seeing the holes from cloud cover... maybe you could add in some model data to fill the gaps."

NWS Forecaster, EWP end of week 1 debrief

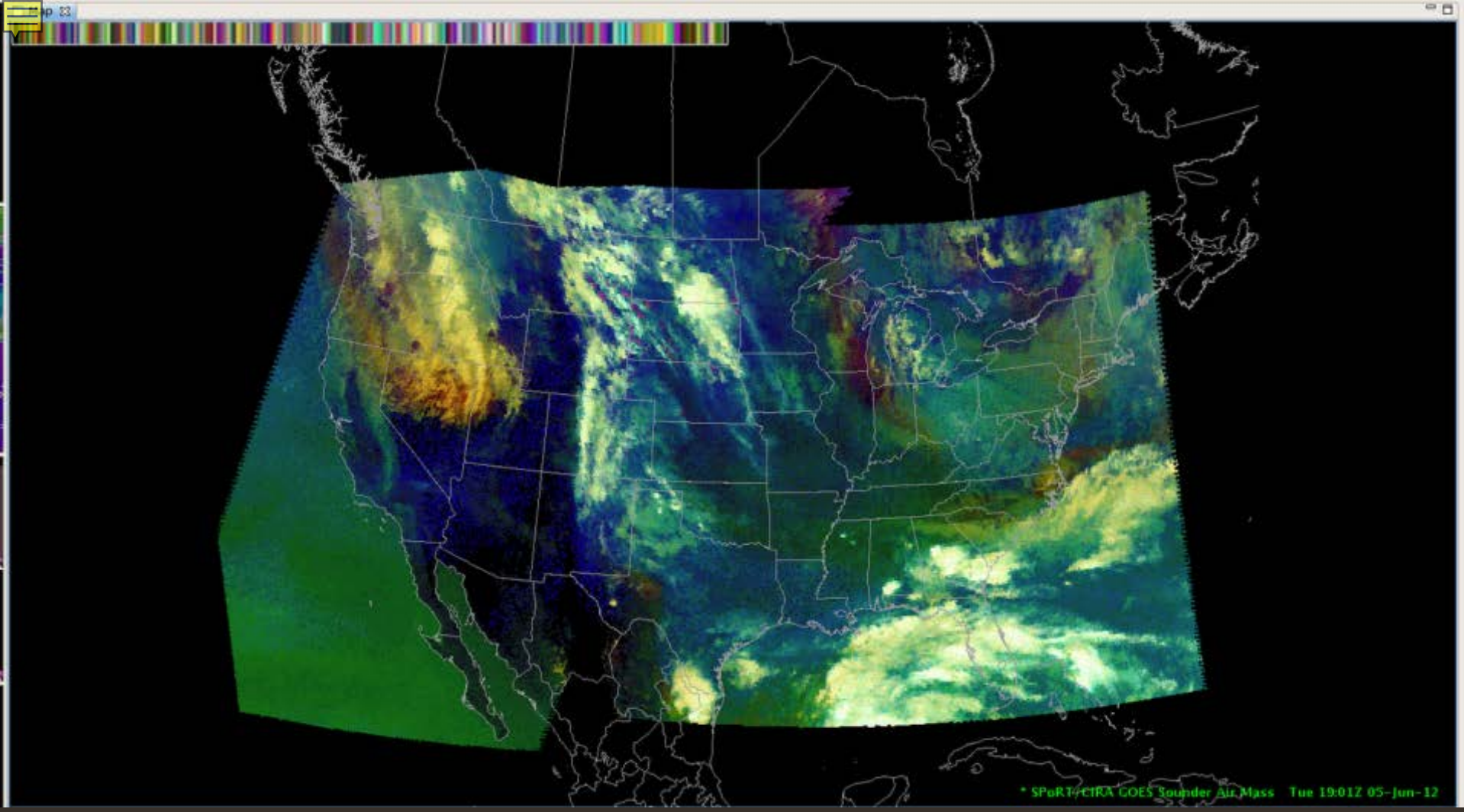
"On the boundary of the GOES-E and GOES-W domains, it would be nice to have some continuity from one product to the other."

NWS Forecaster, Final EWP weekly debrief

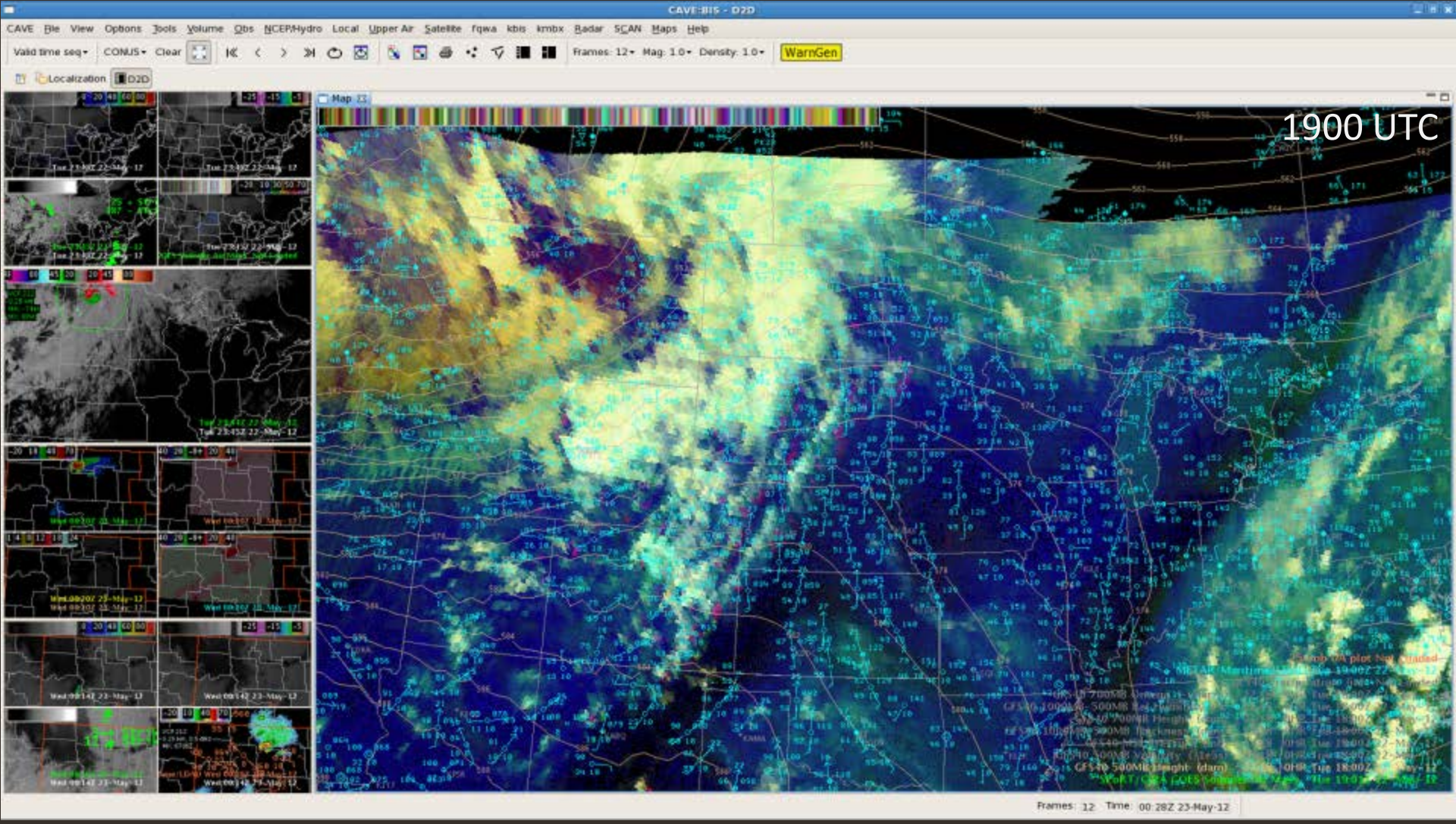
2012 Products:

GOES SOUNDER AIRMASS RGB

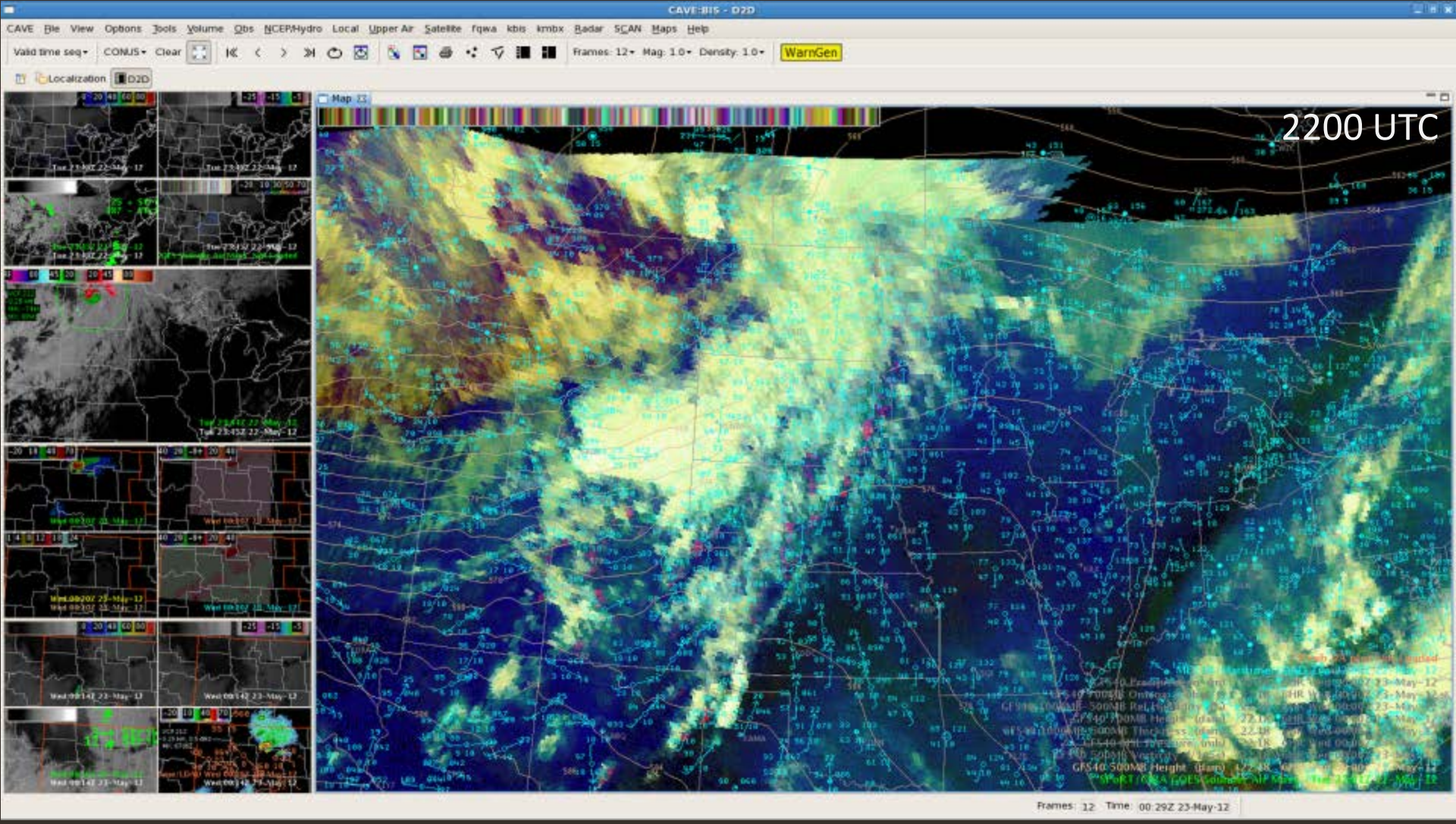
NASA-SPoRT & CIRA



GOES Sounder RGB Airmass product displayed on HWT AWIPS II workstation at 1901 UTC on 5 June 2012.



"The airmass composite image was helpful in pinpointing the position of the jet max as a sharp moisture gradient evolved (roughly extending from Oregon to Wyoming). Initiation over far NW Dakota also awaited the approach of the "ozone-rich" airmass (purple) as it overtook the eastward progressing dryline between 19-22Z, fostered by reports of surface dewpoints in the mid 50s beneath rapidly drying mid/upper levels."

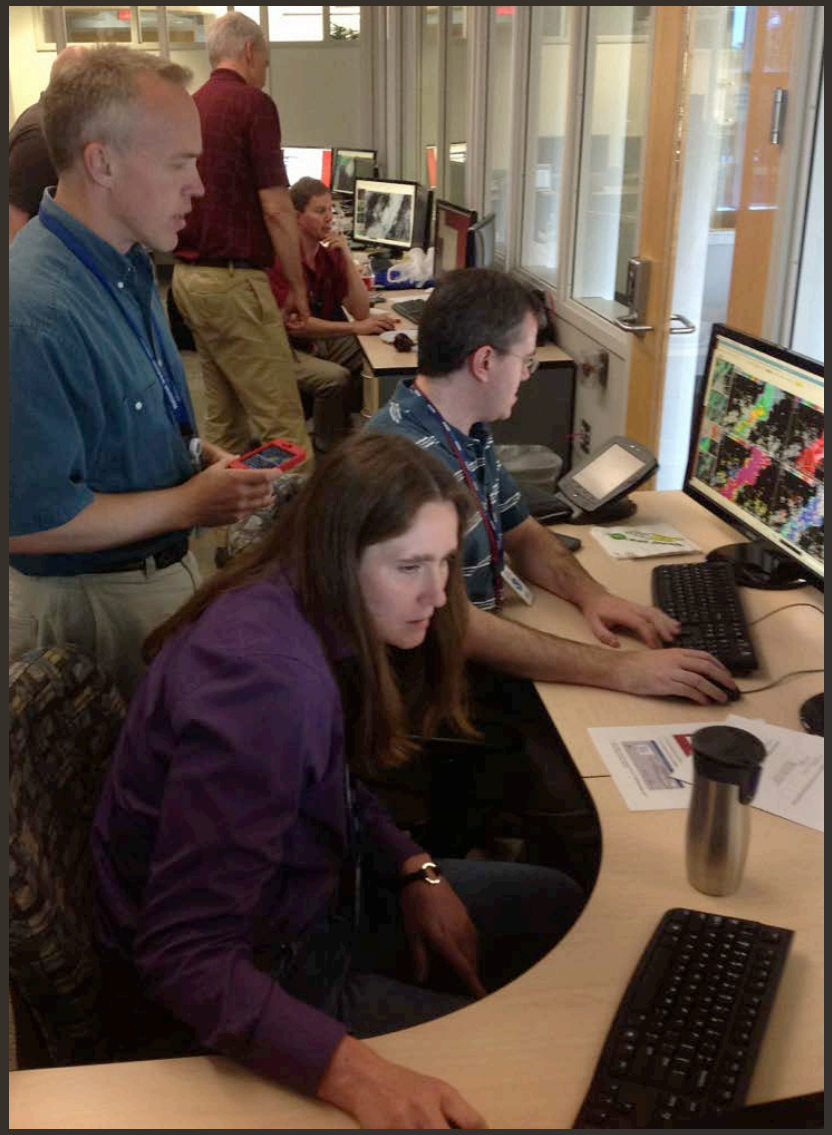


"The airmass composite image was helpful in pinpointing the position of the jet max as a sharp moisture gradient evolved (roughly extending from Oregon to Wyoming). Initiation over far NW Dakota also awaited the approach of the "ozone-rich" airmass (purple) as it overtook the eastward progressing dryline between 19-22Z, fostered by reports of surface dewpoints in the mid 50s beneath rapidly drying mid/upper levels."

Provides a quick look at the synoptic scale atmosphere, as well as an innovative way to display satellite imagery …

"It was interesting to see the initiation occurred along the sharp moisture gradients that were associated with the strong shortwave troughs... as well as being very useful for picking out the jet maximum... I really love this product."

NWS Forecaster, EWP end of week 3 debrief



2012 Products:

PSUEDO-**GEOSTATIONARY LIGHTNING MAPPER (PGLM)**

NSSL-CIMMS & NASA-SPoRT

Creation of the pGLM product

LMA detects VHF radiation emitted as lightning propagates

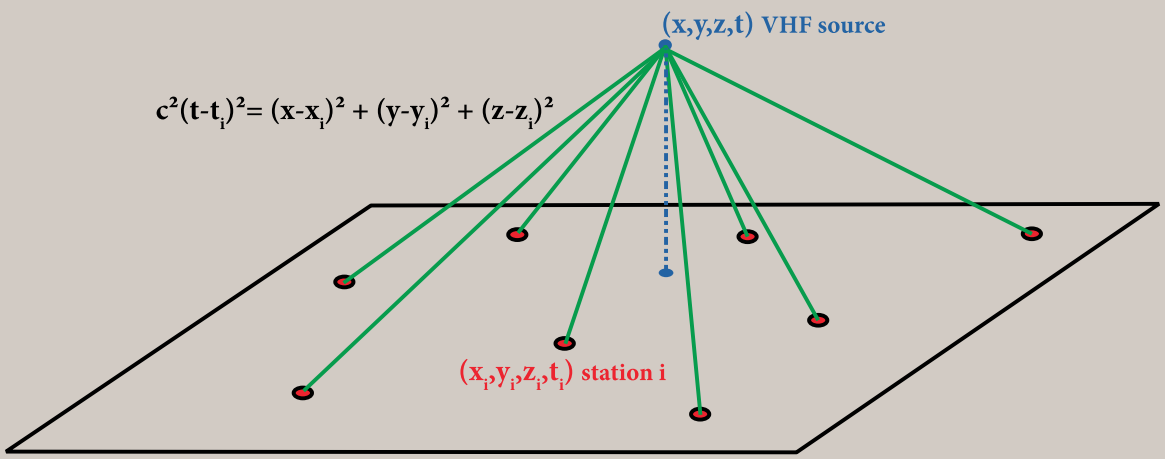
Quality Control:

- 7 stations, 10 VHF source points per flash

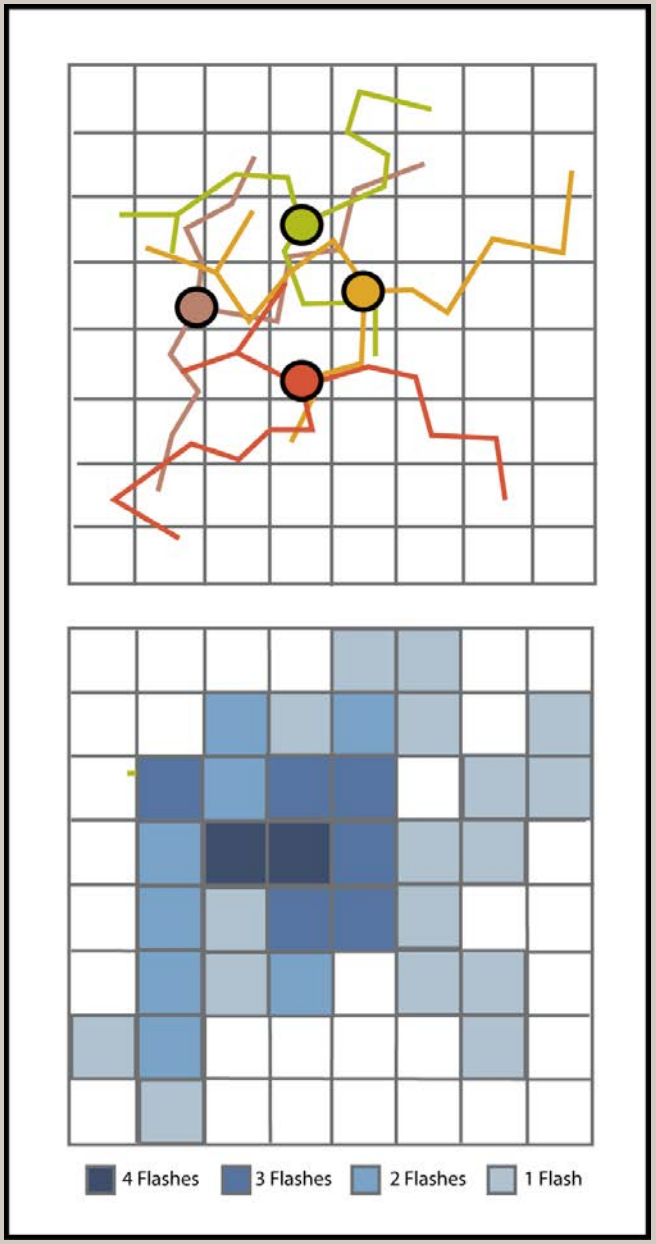
Flash sorting – real-time – from LMA data

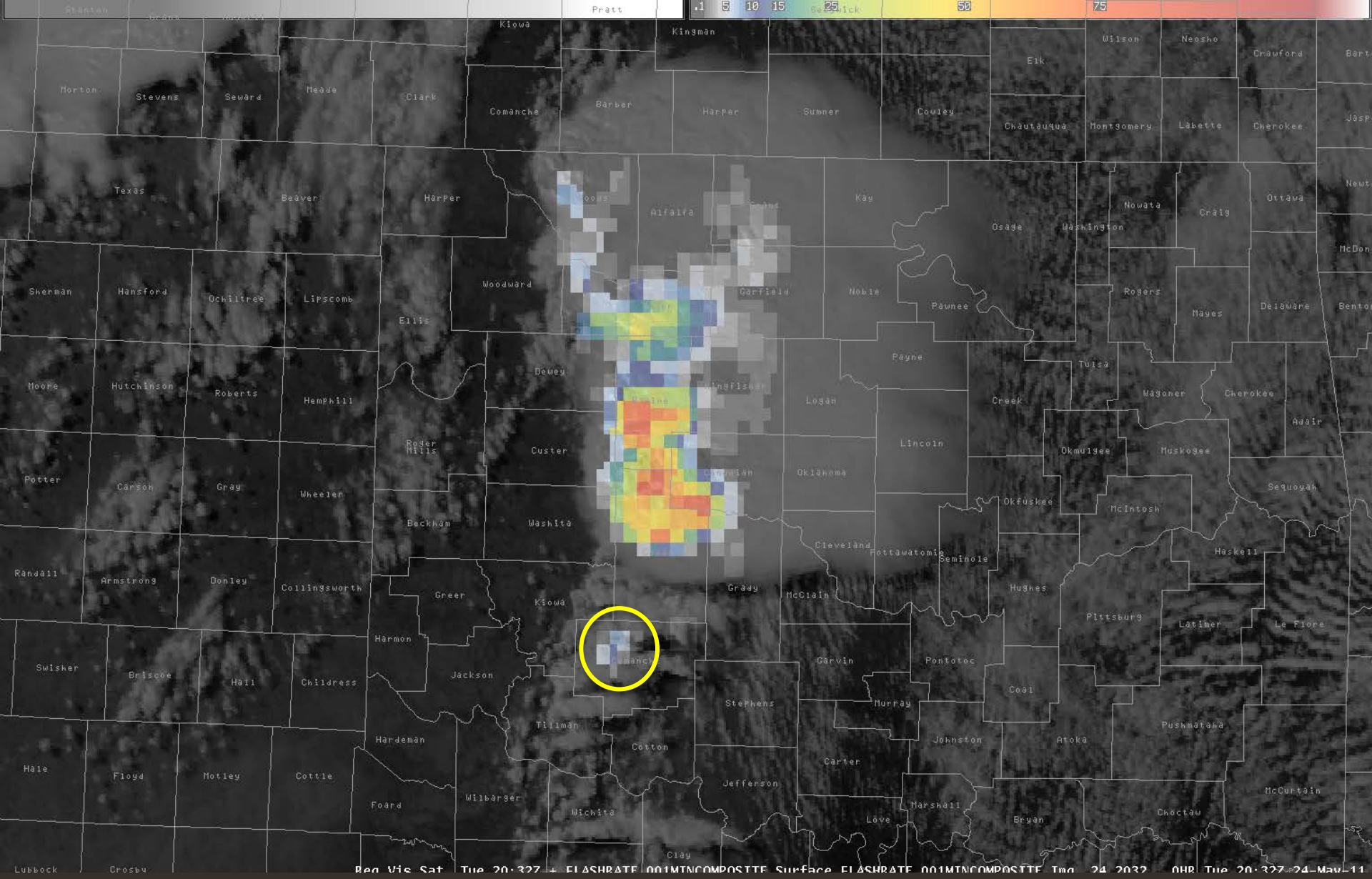
Flash Extent Density = Flash Footprint

Produced every min, real-time -> AWIPS2

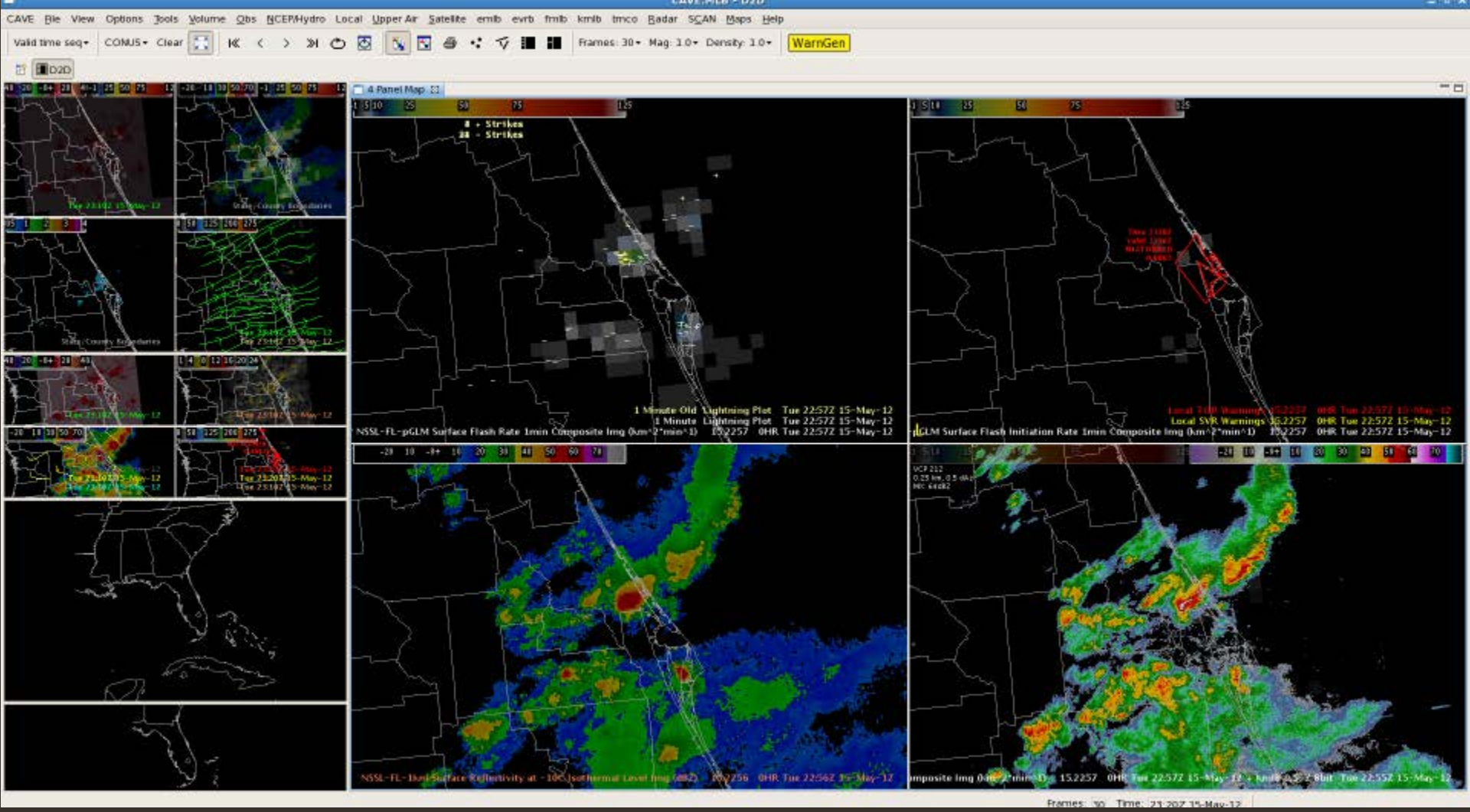


From Hamlin (2004)





Anvil Extent & convection initiation



Product integration: pGLM & NLDN; reflecitivity at -10 C; 0.5 deg reflectivity

pGLM is a great situational awareness tool and can provide more confidence in a warning decision.

"Total lightning data preceded the CG network anywhere from 10-40 minutes. I was able to quickly determine when flash rate was significantly increasing, and then compare with satellite and (3DVAR) updraft/downdraft parameters for a nice big picture."

NWS Forecaster, Post Event Survey

"Coming into the day, I wasn't quite sure when or where to or why to use the data, but after using it I really think it has a lot of functionality and is useful in warning operations. I look forward to it as a product from the GOES-R."

NWS Forecaster, Post Event Survey

"There were some good cases where the CI (SATCAST) would switch from 60% to 80% and then the CTC would flag the storm and we would get some good lead time on the first lightning flash... it was nice to have it all work in tandem."
-*NWS Forecaster* (week 3)

Thanks to all the project scientists and NWS participants!

GOESR Proving Ground Liaison (SPC/HWT):
Chris Siewert

UW-CIMSS:
Wayne Feltz, Justin Sieglaff, Bob Aune, Jordan Gerth, Lee Cronce

UAH:
John Mecikalski, Lori Schultz, John Walker, Chris Jewett

CIRA:
Dan Lindsay

NASA-SPORT:
Geoffrey Stano

NSSL & OU/CIMMS (HWT Support):
Kristin Calhoun, Greg Stumpf, Travis Smith, & Darrel Kingfield

GOES-R proving Ground: http://goesrhwt.blogspot.com/

Experimental Warning Program: http://ewp.nssl.noaa.gov/

2013 Experiment: May 6-May 24

Contact:
At the HWT: Kristin M. Calhoun, kristin.kuhlman@noaa.gov
Proving Ground Coordinator: Kathryn Mozer, kathryn.mozer@noaa.gov