OCONUS Proving Ground

Steve Goodman

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http://www.goes-r.gov

PG OCONUS
Anchorage, Alaska
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Outline

- NOAT Guidance
- Recent PG Demonstrations
- OCONUS Products & Demonstrations
- Role of AWG
- Training
- Questions & Recommendations
- Summary

NWS Operational Advisory Team (NOAT) Yearly Guidance Memorandum for the Science and Demonstration Executive Board (SDEB) – FY13

- **Overarching NWS Science and Technology Themes**
  - Convective initiation/Warn on Forecast
  - Best state of the Atmosphere (e.g., 3-d analysis)
  - Next Generation Forecast System
  - Decision Support Information Systems
  - Integration of Social Science into the forecast process
  - Risk Reduction as a core validation activity
- **NWS Weather Ready Nation (WRN)**

*NOAT Priorities for GOES-R Future Capabilities

- 1. Convective Initiation
- 2. Fog and Low Stratus
- 3. Icing Threat plus Cloud Properties (cloud ice water path, cloud layers heights, cloud liquid water, cloud type). Note: these are all interrelated – cloud properties integral to this and other efforts. Also, specific guidance to pursue integrated NWP-centric approaches.
- 4. SO_2 Detection
- 5. Land Surface Model Related (emissivity, vegetation index, vegetation fraction)
- 6. **Precipitation: probability of rainfall, rainfall potential, QPE (Rain Rate)**
- 7. Ice Cover
- 8. Flood and Standing Water (at full resolution)
- 9. Other Priority 2 Products not specifically noted (includes tropopause folding turbulence prediction, enhanced V overshooting top detection, visibility, and all others not covered above).

Although demonstration of products should meet these priorities, NOAT accepts the demonstration of non-baseline products as acceptable if short-term value to operations is expected.

*NOAT- NWS Ops Advisory Team

Further Guidance from the NOAT – FY13

- Five Recommendations on:
  - Training
    - All proposed projects should include end to end training plan
  - Path to Operations
  - Integration or fusion with data from other sources
    - Special interest in using synthesized imagery in the PGs
  - Strategic Vision
    - Focus on future…. not on current forecast operations
  - Understand the Forecast Process
    - Develop vision on how completed project will assist forecast ops

*IAC Recommendation Science Week March 2013

… Utilization of the LEO high spectral resolution data rendering of moisture vertical and horizontal distributions needs to be encouraged.

Recommendation: Regional forecasts and nowcasts necessary for a Weather Ready Nation will have to make better use of the information content from AIRS, CrIS, and IASI data; GPS data should also be included. Between LEO sounding coverage, GOES-R data should be used to monitor temporal profile changes (atmospheric stability, dq/dt, $V \bullet \nabla q$, $\nabla \bullet q$, etc).

*IAC- GOES-R Independent Advisory Committee

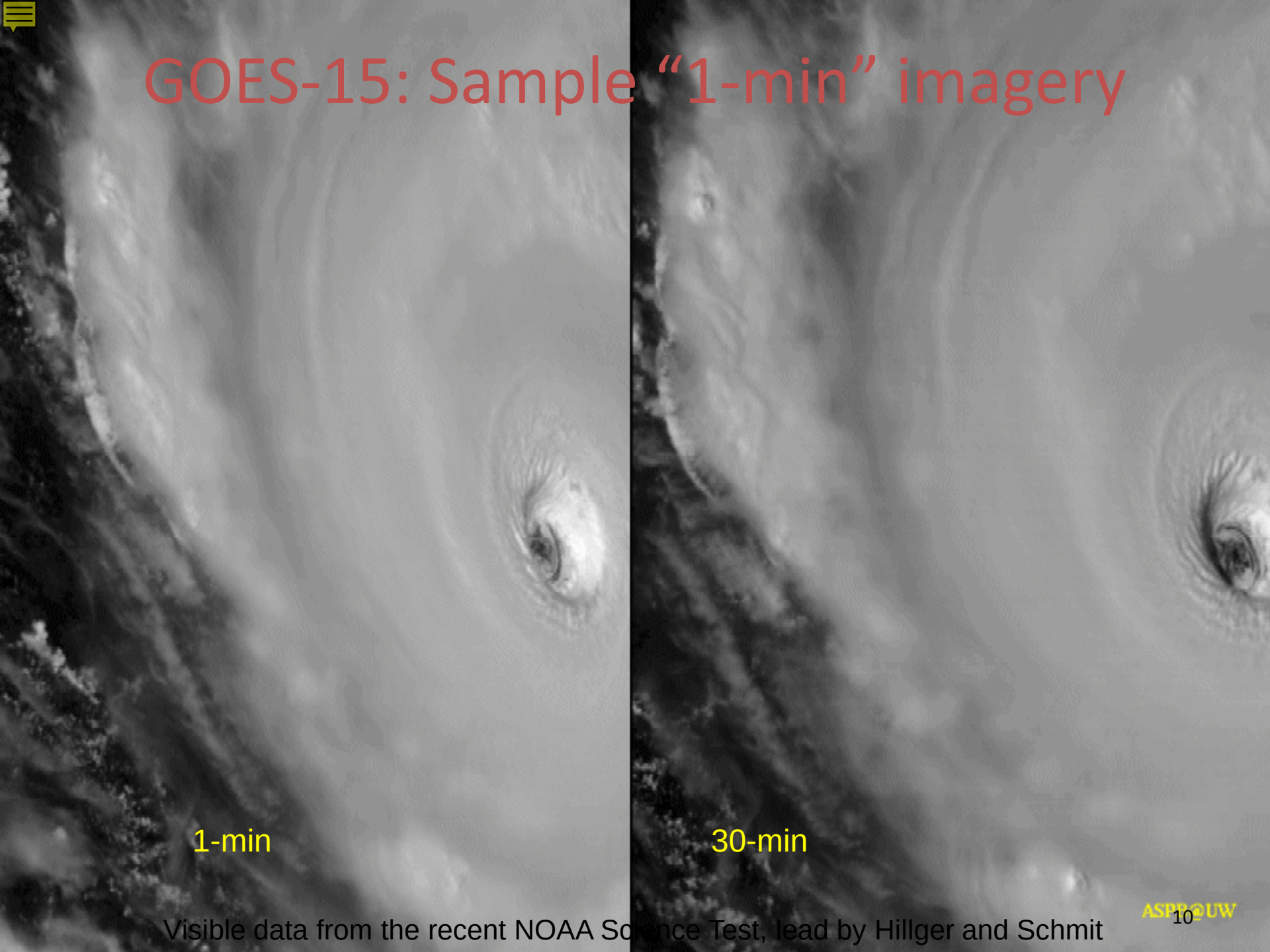
Proving Ground Demonstrations

- Hazardous Weather Testbed
  - Focus on Severe Storms
- NHC/Joint Hurricane Testbed
  - Focus on tropical cyclones/hurricane intensity and track
- Aviation Weather Testbed
  - Focus on High Impact Convective Weather
- OPC and SAB (Camp Springs MD)
  - Focus on offshore thunderstorms
- High Latitude and Arctic Experiment (Alaska Region)
  - Focus on precipitation/snow/cloud/ash/aviation
- WPC and SAB (Camp Springs MD)
  - Focus on precipitation/QPF
- Air Quality (UMBC)
  - Focus on aerosol detection
- Pacific Region (Hawaii)
  - Focus on tropical cyclones/heavy rainfall/aviation
- Space Weather (NWS SWPC: Boulder CO)
  - Focus on GOES-R like level 2 products

NHC Highlights

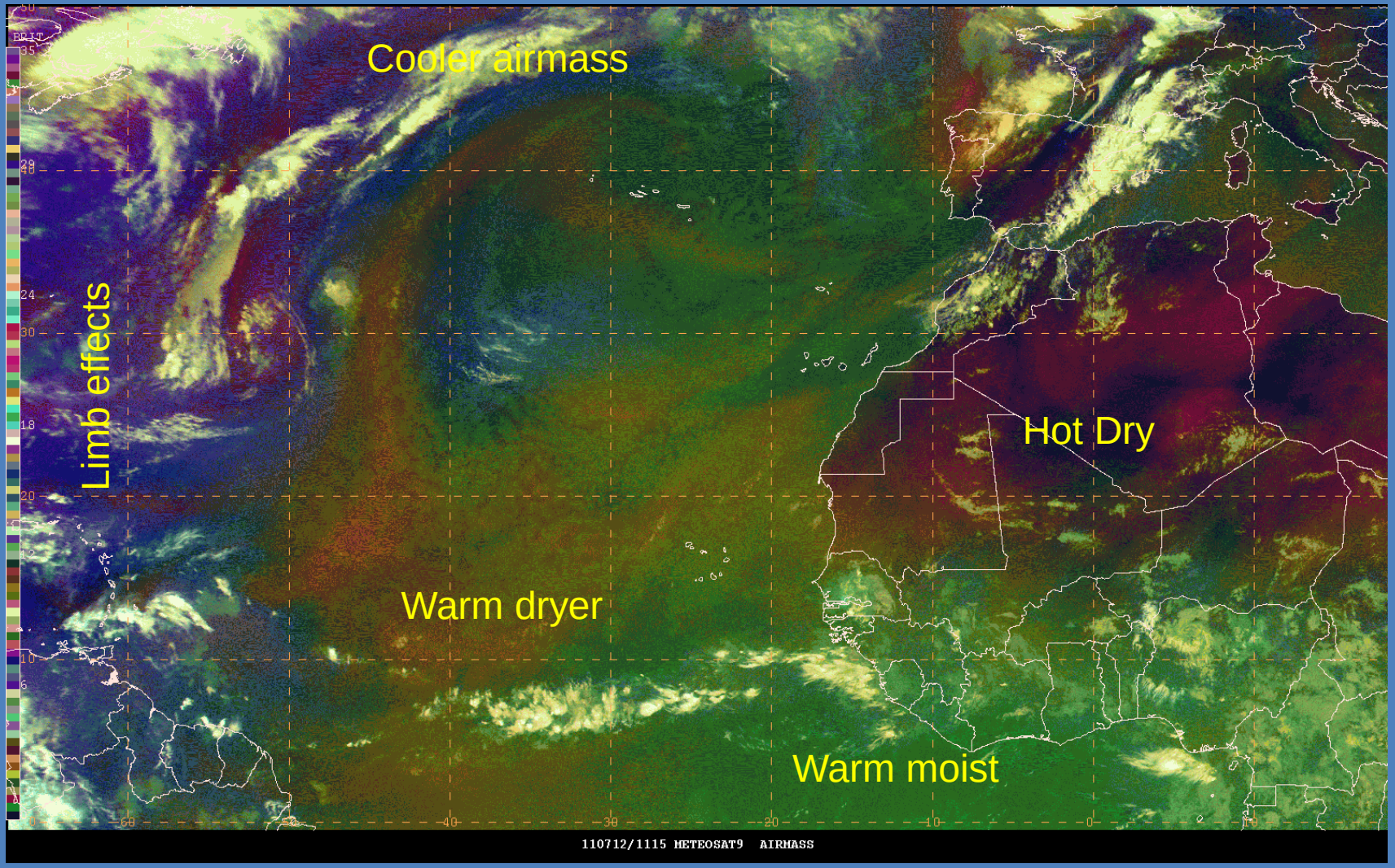
- 9 Prototype GOES-R Products Demonstrated
  - Demonstration period: Aug. 1 – Nov. 30 2012
- HIE, TOT, and Natural Color being improved based on forecaster feedback
- SRSO data being used to test and improve AMVs
- Based on forecaster feedback…multispectral imagery now routinely used in NHC ops
- Lightning input improved threat score of the RII by 5 to 7%
- Plans to include Suomi-NPP products in 2013

GOES-15: Sample “1-min” imagery

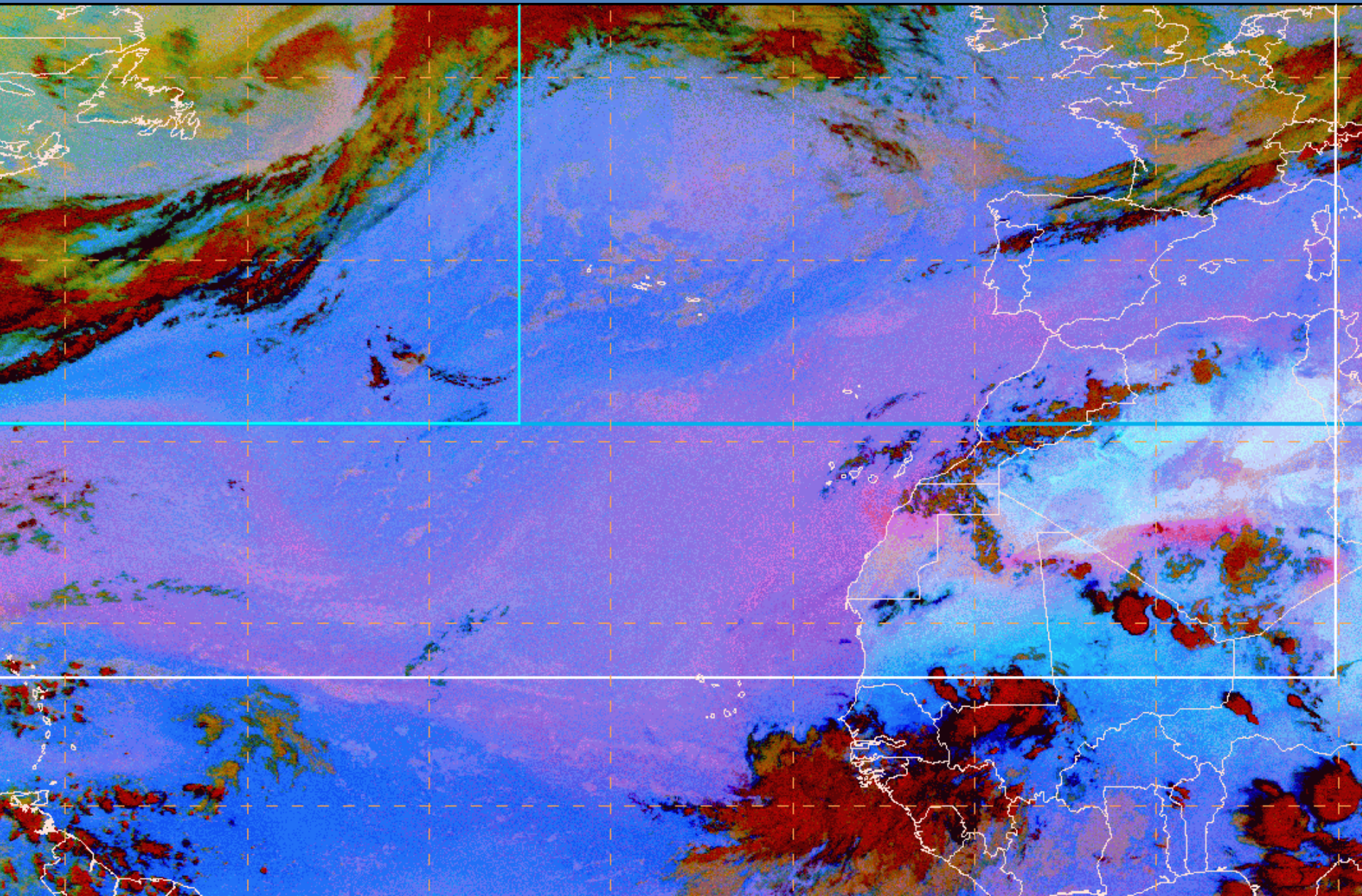


Visible data from the recent NOAA Science Test, lead by Hillger and Schmit

RGB Air Mass Product from SEVIRI



Saharan Air Layer



Plans for 2013

- Add new RGB products
  - Information on cloud top structure
  - Improved RGB dust product
  - Combined LEO – GEO products
- Work towards direct generation of RGB products on NHC AWIPS-2 systems
- Add NPP Products
  - High resolution Vis, IR, Day-Night Band
  - Direct readout from CIMSS for CONUS
  - Larger domain from NESDIS + other sources
- ATMS/CrIS
  - Temperature/moisture soundings
  - Intensity/size retrievals
  - Maximum potential intensity estimates

Winter Weather Experiment at the Aviation Weather Testbed

Dates: February 11-22

- Simulated Cloud and Moisture Imagery
- Flight Icing Threat
- Fog and Low Stratus

Spring Experiment at the Hazardous Weather Testbed

Dates: May 6-24

- Cloud and Moisture Imagery
- Lightning Detection
- Convective Nearcasting Model
- WRF-based Lightning Threat Forecast
- UWCI-Cloud Top Cooling Rates
- Sounder RGB Airmass

Winter Weather Experiment at the Aviation Weather Testbed

Participants:

- 18 AWC forecasters
- 3 WFO forecasters
- Lockheed Martin
- NTSB
- NCAR
- NASA LaRC
- Air Force Weather Agency

Five Forecast Desks:

- World Area Forecast- 24 hr forecast for icing, turbulence, jets, tropopause heights
- 3 Forecast Area Desks- icing, turbulence, wind shear, freezing level, ceiling, visibility
- National Aviation Meteorologist- updating air traffic flow managers of short-term weather hazards focused on the busy Golden Triangle

Simulated Cloud and Moisture Imagery

The simulated imagery was praised for picking up not only the intense shear zone over the southern Mississippi Valley, but also the ‘notches and bumpiness’ in the building ridge over the Mid-Atlantic, both of which are features typically associated with moderate or great turbulence events.

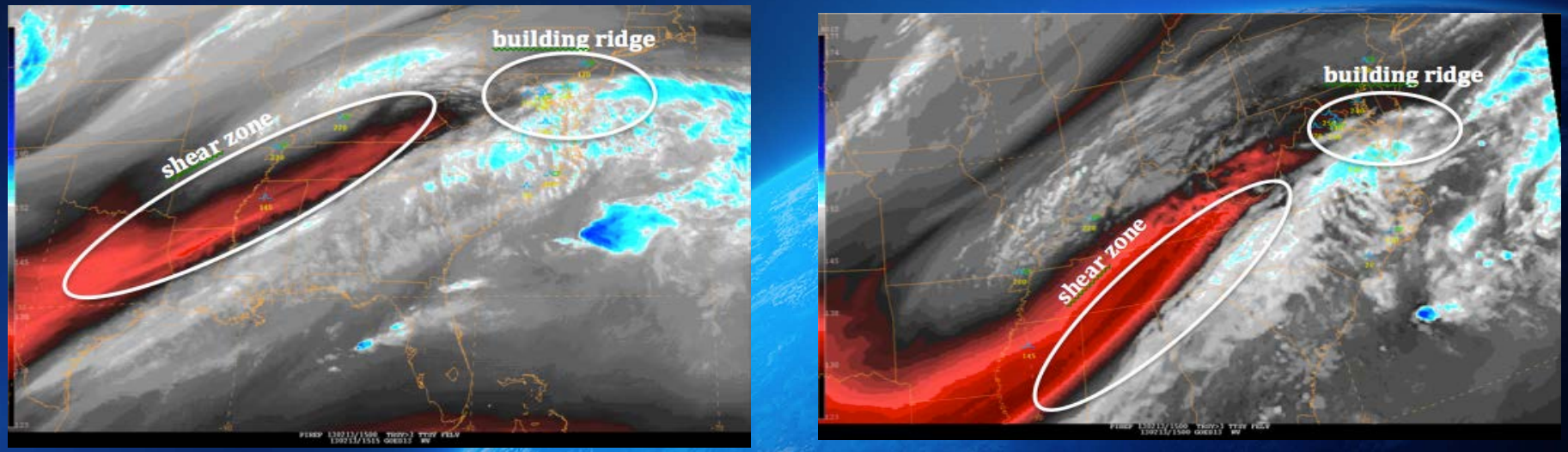


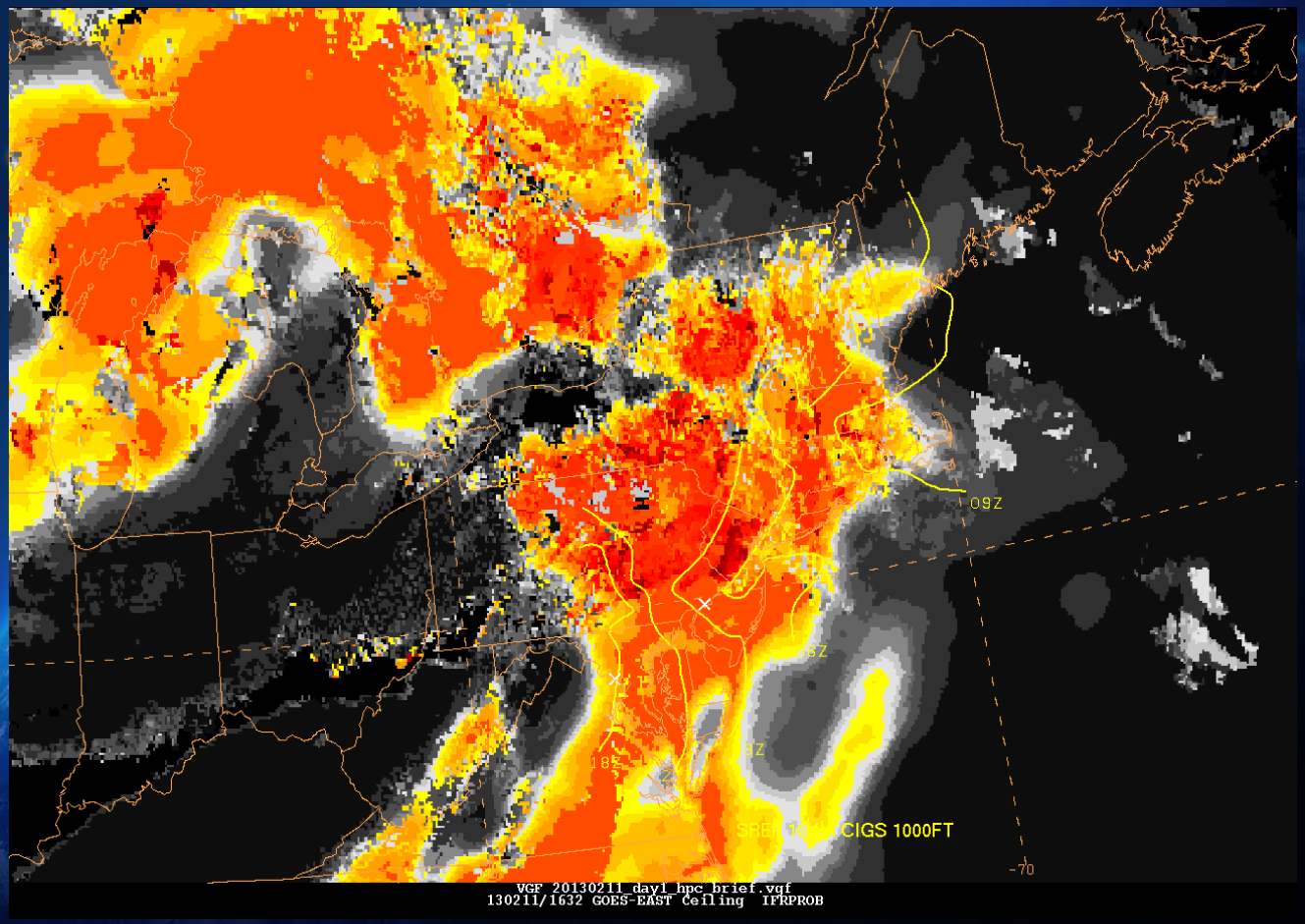
Figure 1. 20130213 1515 UTC. Strong jet with core winds > 150 kts, (left) GOES-13 water vapor and 1500 UTC MOG turbulence PIREPs, (right) 1500 UTC NSSL-WRF simulated water vapor

“It was very helpful in determining the signatures associated with moderate or greater turbulence events.”

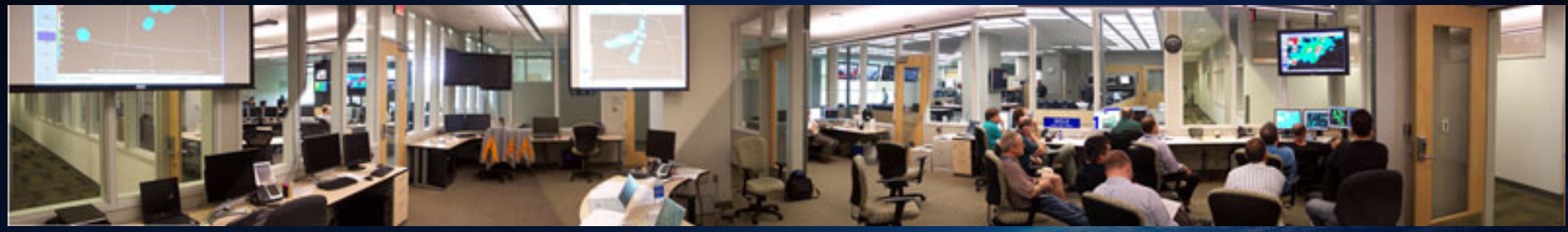
Fog and Low Stratus

In this case, the FLS was used to get an idea of the dissipation rate of the fog over Philadelphia (PHL) and Reagan National (DCA). With this information they could give the traffic flow managers an estimation of when the ceilings would lift enough for operations to resume and also when they could safely release inbound flights.

- Feb. 11th, 2013 1632 - 1902 UTC FLS and the Feb. 11th NAM desk forecast (EXP)



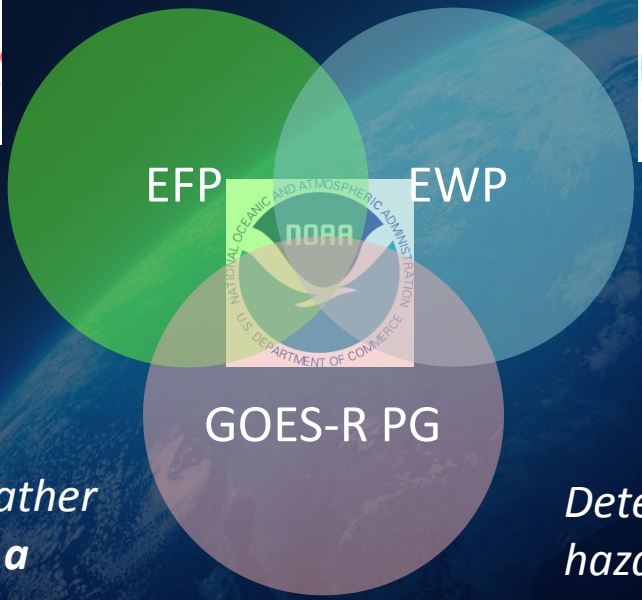
NOAA's Hazardous Weather Testbed



Storm Prediction Center
Norman, Oklahoma

Experimental
Forecast
Program

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



National Severe Storms Laboratory

Experimental
Warning
Program

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

Some Feedback Gathered EWP

- In answer to question "if you could have only one product which would it be?"
  - All products mentioned: CI, Nearcast, CTC, Simulated imagery, PGLM, and RGB
- "The product that stood out for me was the WRF simulated IR imagery….great way to see how the models are doing"
- "CTC is useful. 18 deg. per 15 min gave 1 hr lead time for large hail."
- PGLM: "biggest benefit is where lightning itself is the main concern (large outdoor events)". "For warning decisions, could be good for marginal airmass type storms."
- "Love the theta E difference on Nearcast"

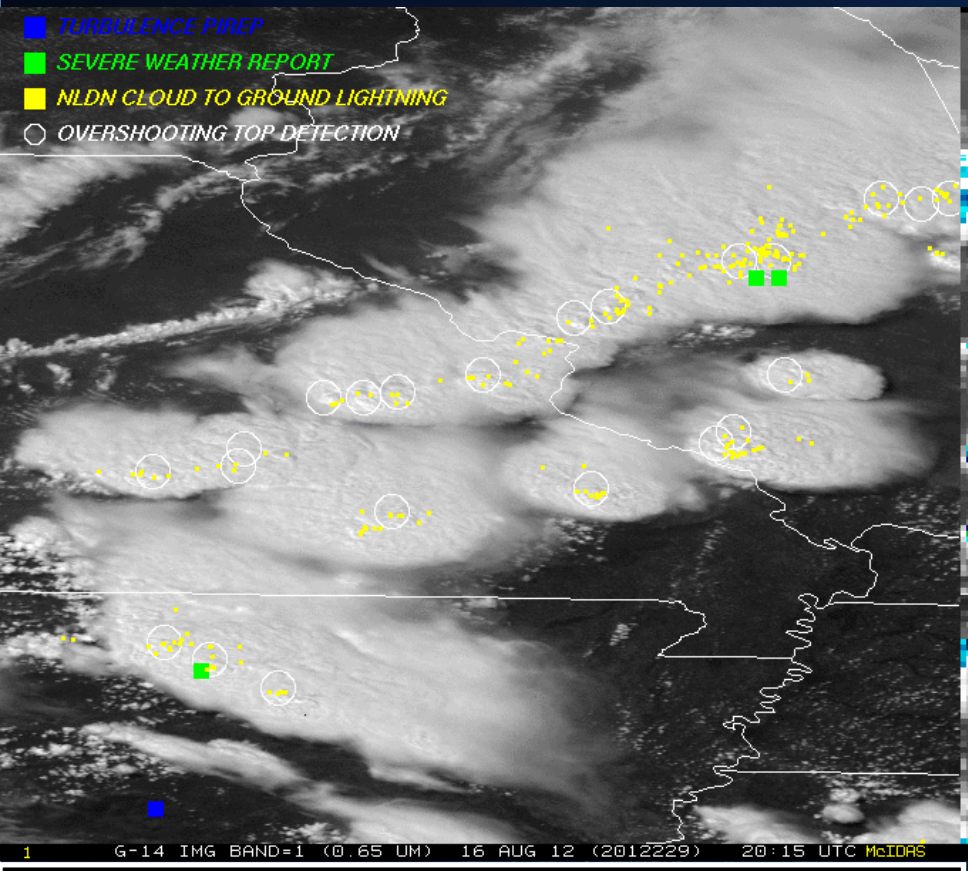
Proving Ground Forecaster Feedback

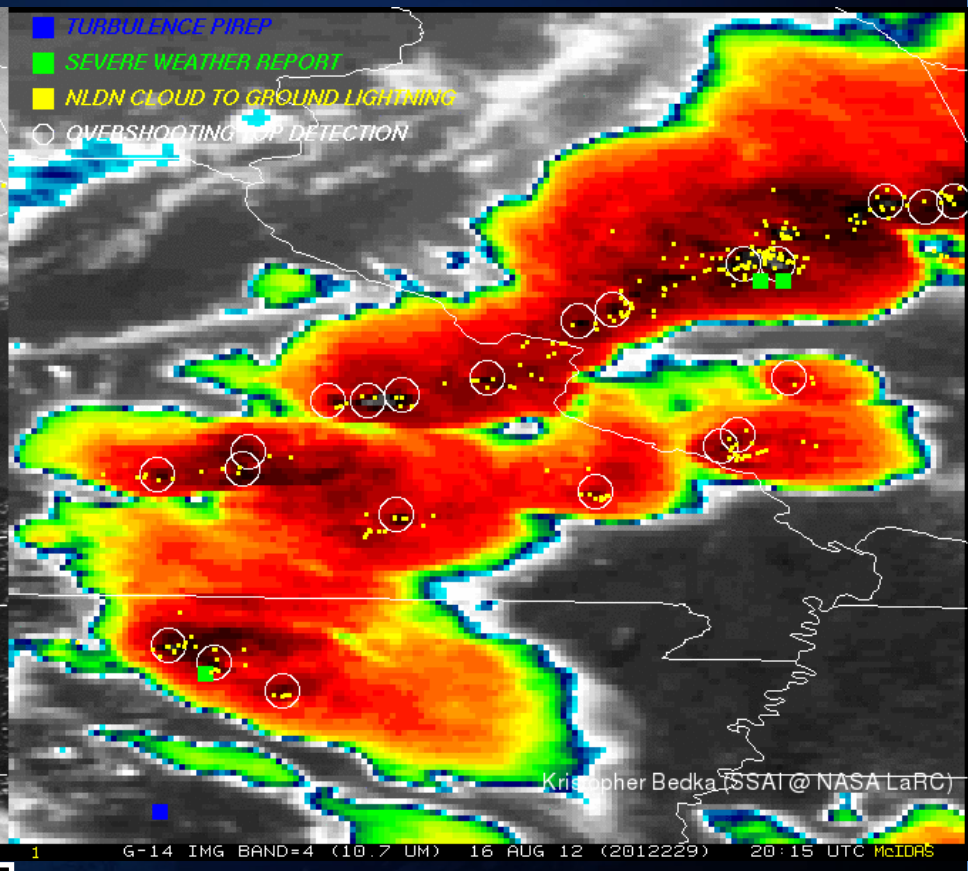
- **“The total lightning data is an excellent tool for monitoring convection…”**
- **“I utilized it as a situational awareness product …the data gave me more confidence in my warning.”**

“We saw several instances where the total lightning was picking up on storms before the AWIPS lightning [NLDN] program picked up on them. One could see the utility of this in the future, bringing with it a potential for lightning statements and potentially lightning based warnings.”

-Pat Spoden (SOO, NWSFO Paducah, KY)

GOES-R Super Rapid Scan
Moving towards data fusion





Courtesy, Kris Bedka

Proving Ground Demonstration at AWC Testbed

User comment: 'Cloud Top Cooling product is an excellent source of enhancing the situational awareness for future convective initiation, particularly in rapid scan mode'. *(AWC Testbed forecaster, June 2012)*

Why NWS needs this?

- Situational Awareness
- Warning confidence
- Decision Support (venues)

GOES-R Proving Ground HWT Spring Experiment: Moore Oklahoma EF 5 Tornado, May 20, 2013

NWS Norman Briefing

Headlines

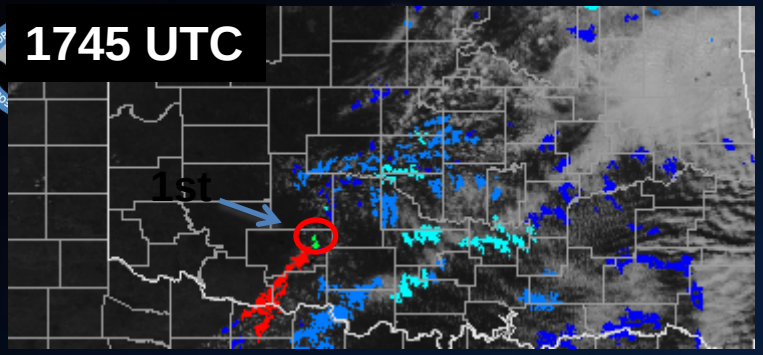
- Significant severe weather expected today!
- Highest impacts expected along and south of I-44
- Tornadoes and giant hail likely
- Concern for schools and afternoon rush hour

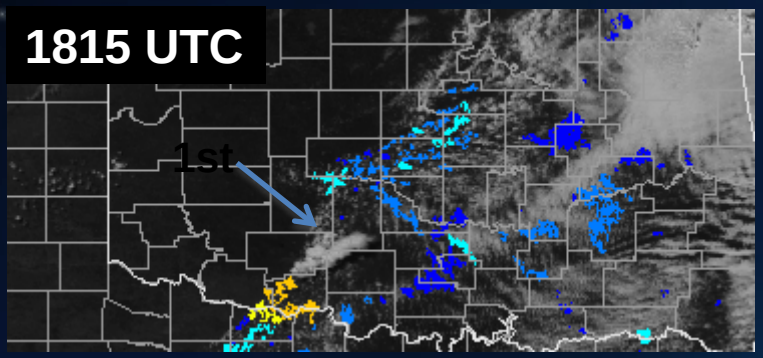
NWS Norman Briefing

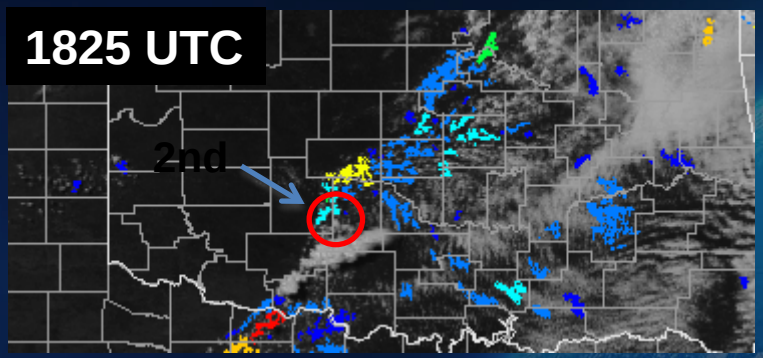
Based on the computer model projections and observational evidence, weather forecasters in Norman issued a video briefing at 11 a.m. Monday, warning that any storms that formed could quickly become supercells, and could rapidly form tornadoes as well.

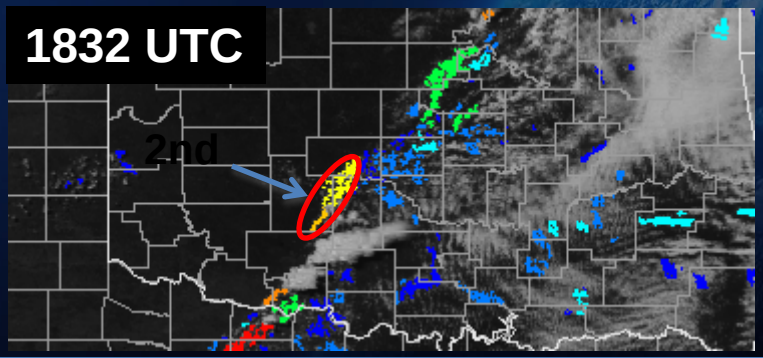
NWS Norman Briefing

The tornado that struck Moore was spawned by a supercell that had formed only about 45 minutes earlier, southwest of Newcastle.





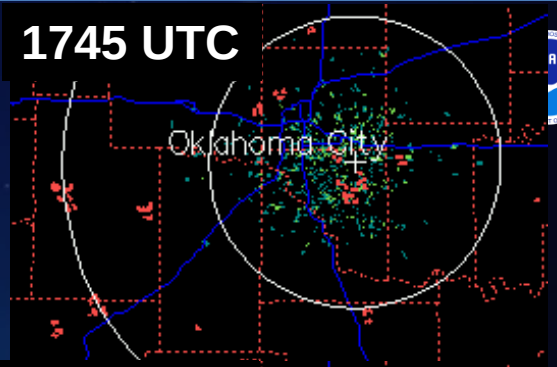


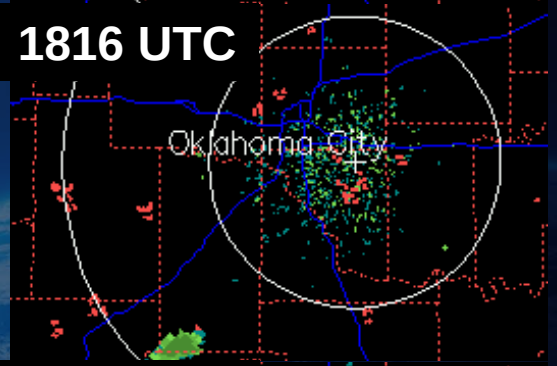


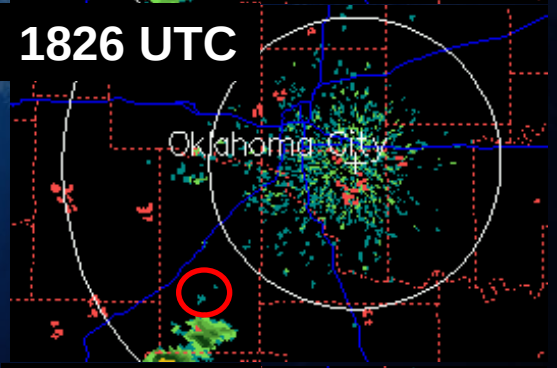
Cumulus clouds forming southwest of Oklahoma City. ≥90% probabilities for CI in SW Oklahoma. Cell on north side of this region becomes part of Moore storm, the 1st cell.

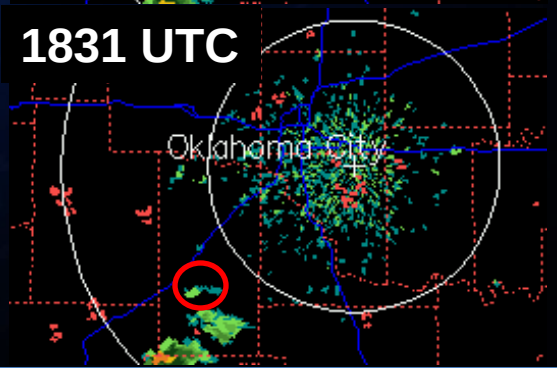
Additional development in advance of CI for Moore supercell with a few echoes present in radar. **~60 min CI lead-time for 1st cell.**

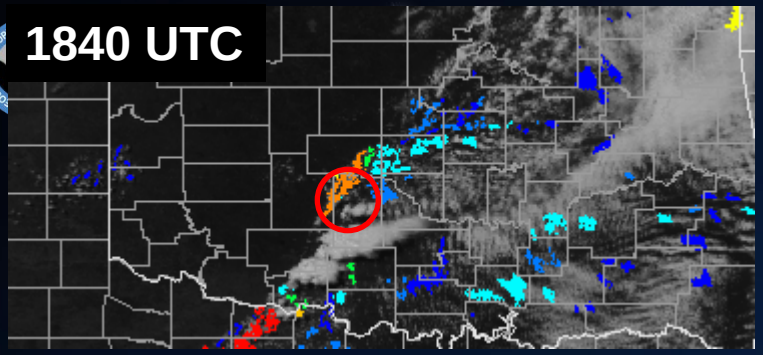
≥60% probability for CI for 2nd object just west of 1st cell, with no echoes present in radar

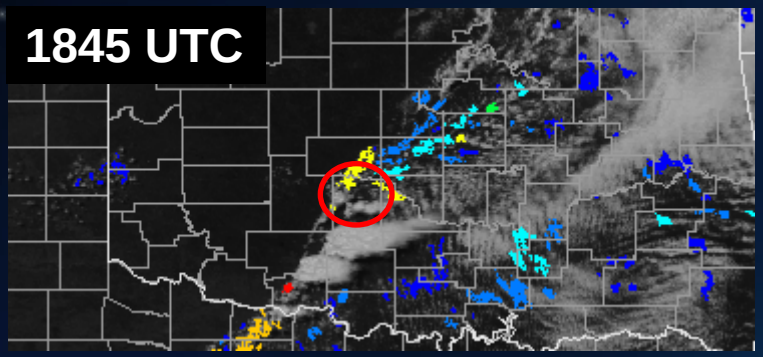


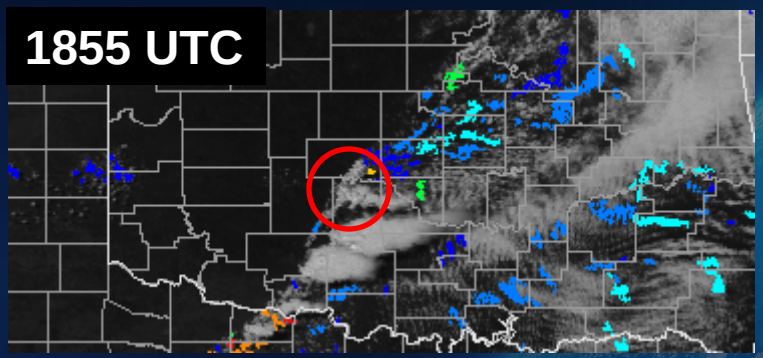






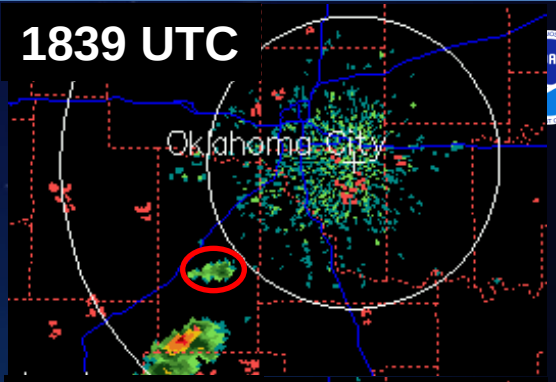


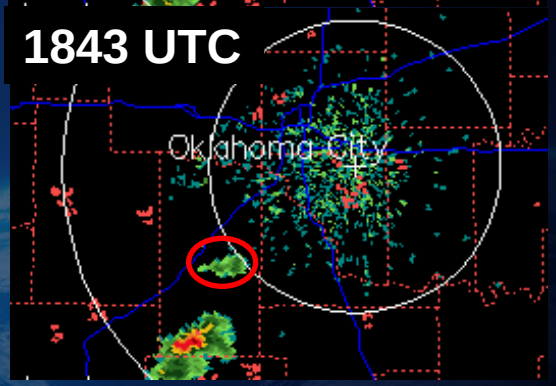


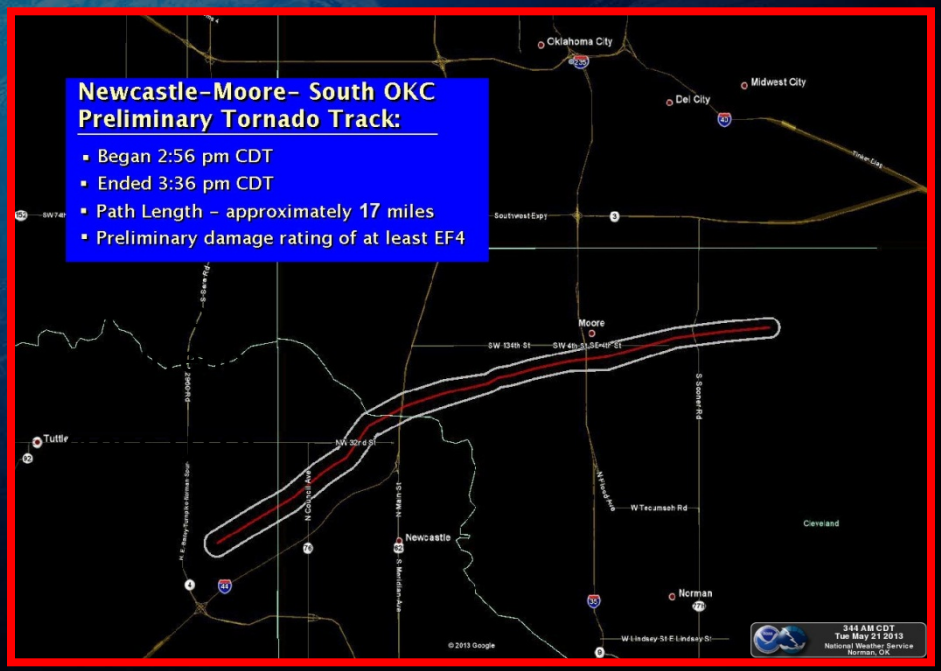


CI probability jumps to ≥80%; radar echoes first appear for Moore supercell.

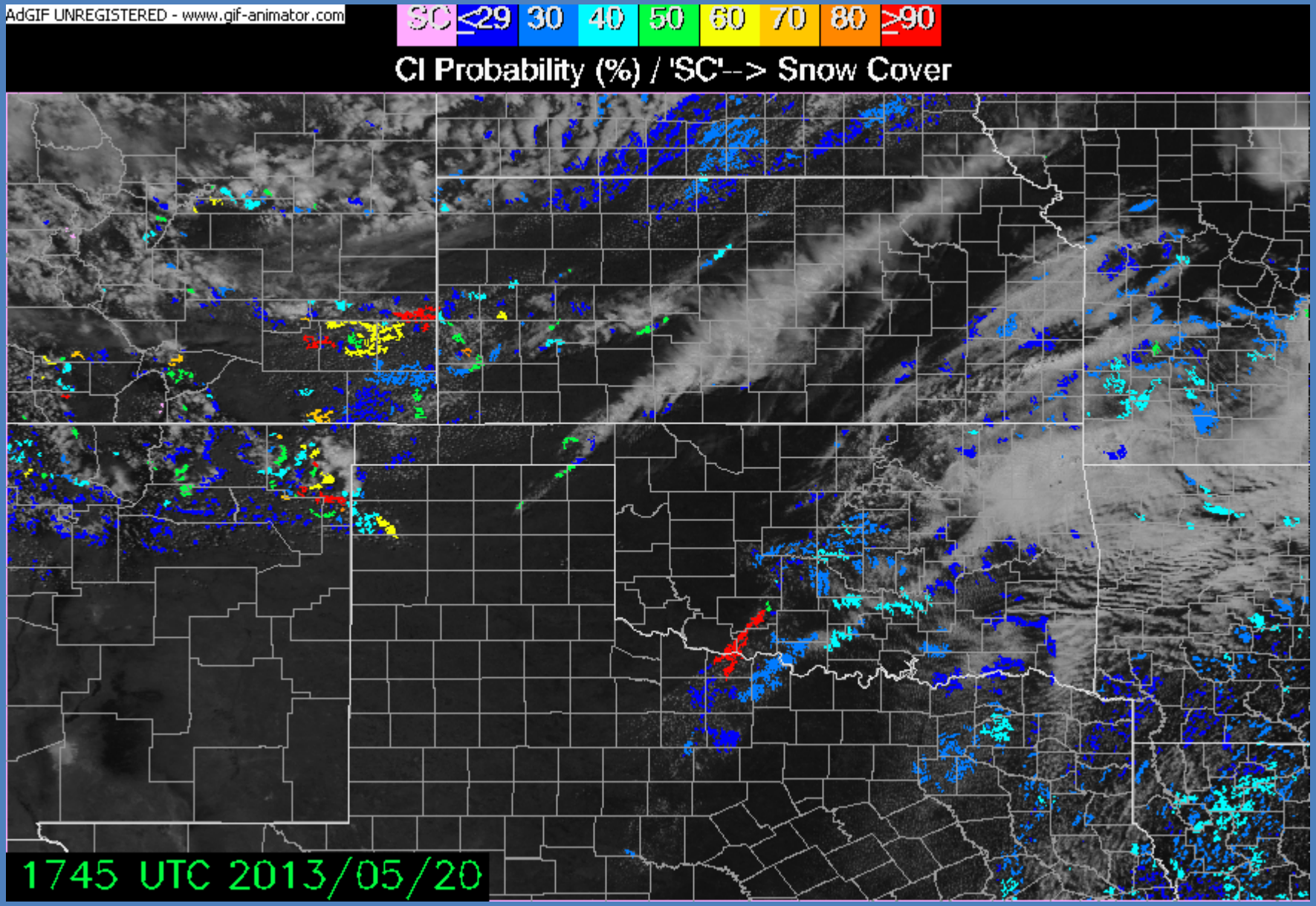
CI lead time >15 min for 2nd cell.







GOES-R CI provided a 15 min to 1 hour advanced notice to convective cloud development in an environment prone to supercell formation.


AdGIF UNREGISTERED - www.gif-animator.com
SC ≤29 30 40 50 60 70 80 ≥90
CI Probability (%) / 'SC'--> Snow Cover
1745 UTC 2013/05/20

GOES-R Proving Ground HWT Spring Experiment: Moore Oklahoma EF 5 Tornado, May 20, 2013

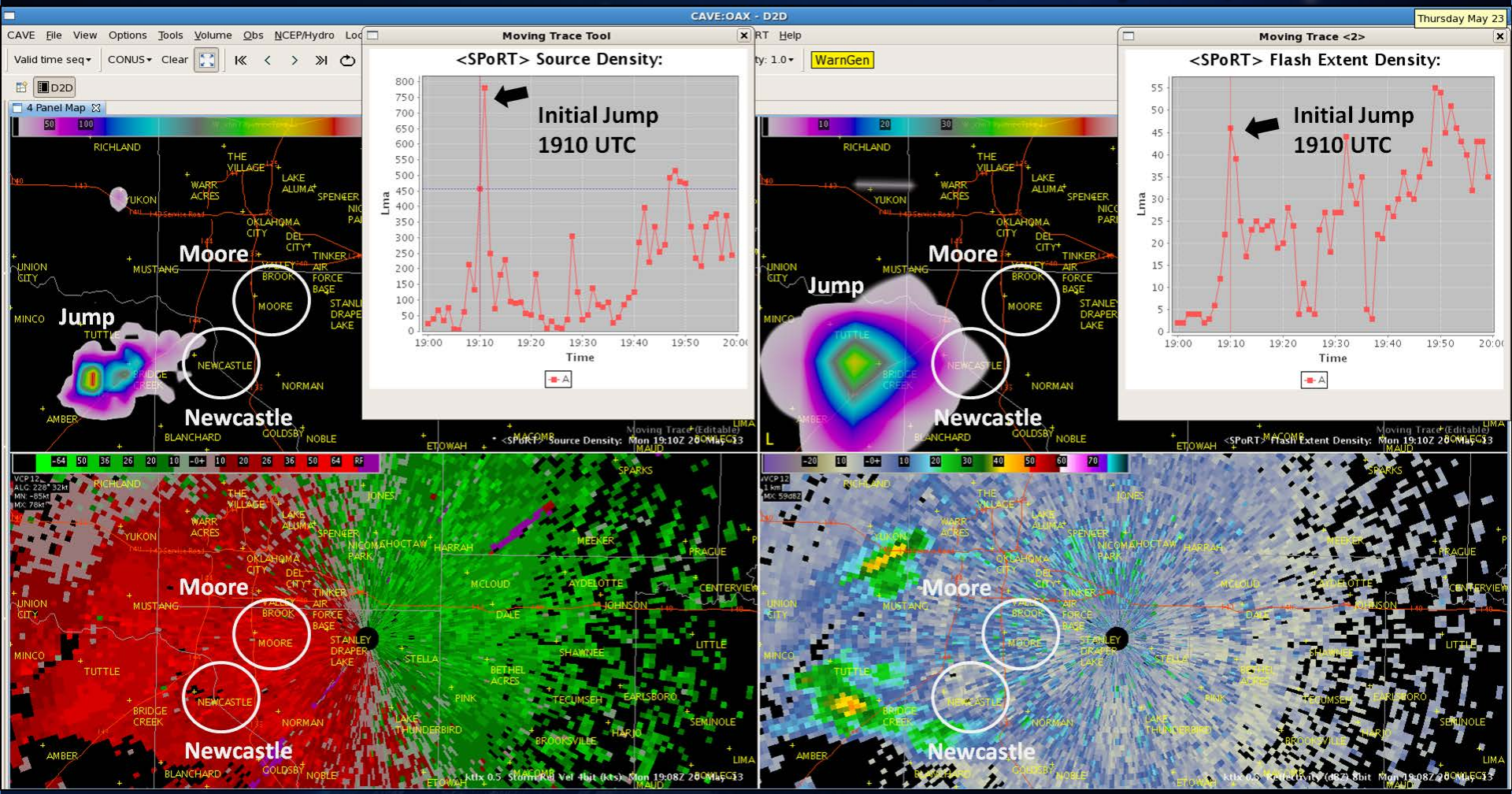


Figure 1: AWIPS II four panel display from 1910 UTC that shows the total lightning source density (upper left), and pseudo geostationary lightning mapper flash extent density (PGLM – upper right), along with the radar storm relative velocity (lower left), and radar reflectivity (lower right). The pop-up windows show the total lightning tracking tool's time series plot for the source densities (left) and PGLM flash extent density (right).

GOES-R Proving Ground HWT Spring Experiment: Moore Oklahoma EF 5 Tornado, May 20, 2013

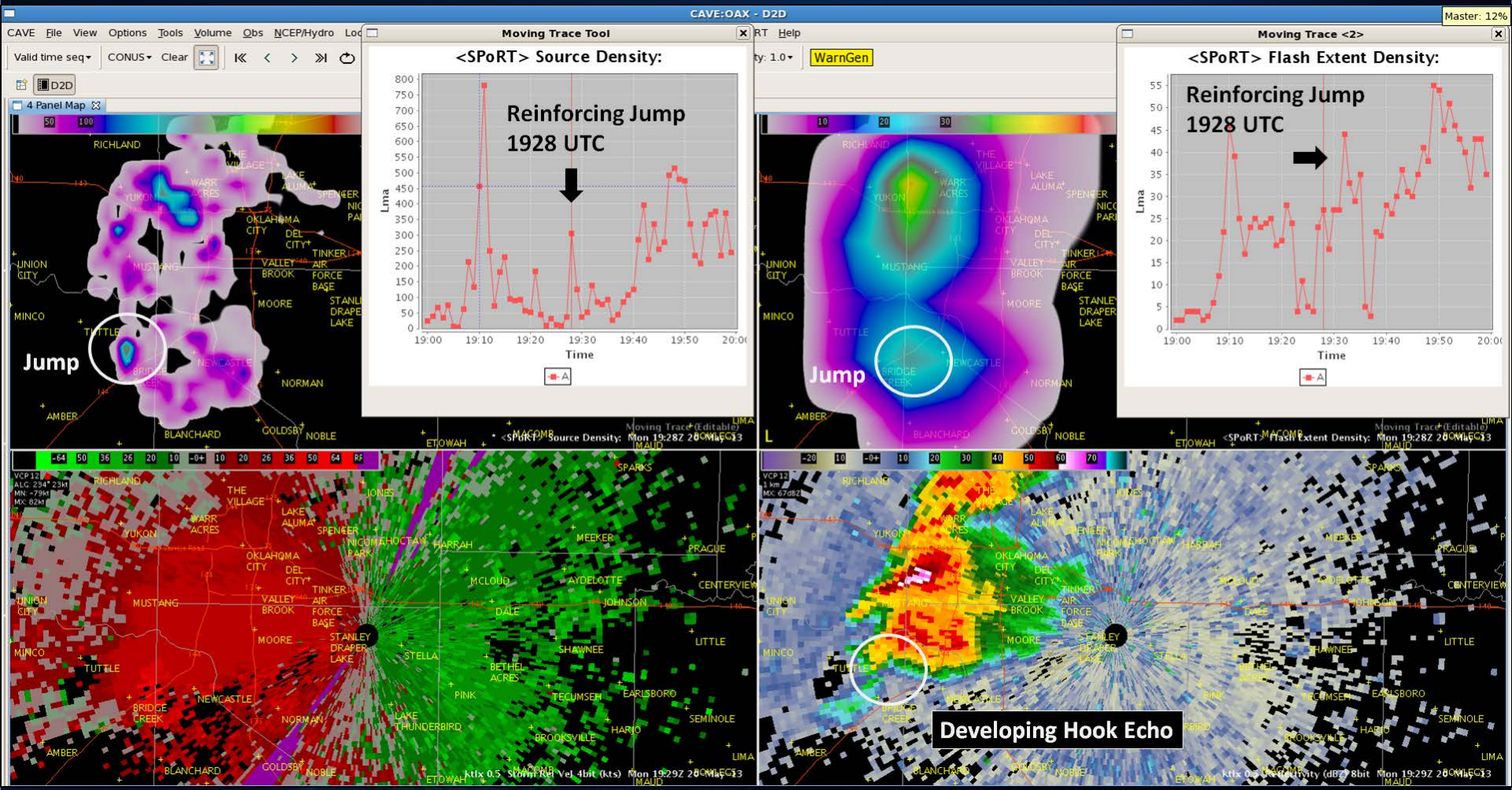


Figure 2: The total lightning observations begin to undergo a second, reinforcing lightning jump at 1928 UTC. At this point, this is 12 minutes before the official tornado warning at 1940 UTC and 28 minutes prior to the reported touchdown time of 1956 UTC, near Newcastle, Oklahoma.

GOES-R Proving Ground HWT Spring Experiment: Moore Oklahoma EF 5 Tornado, May 20, 2013

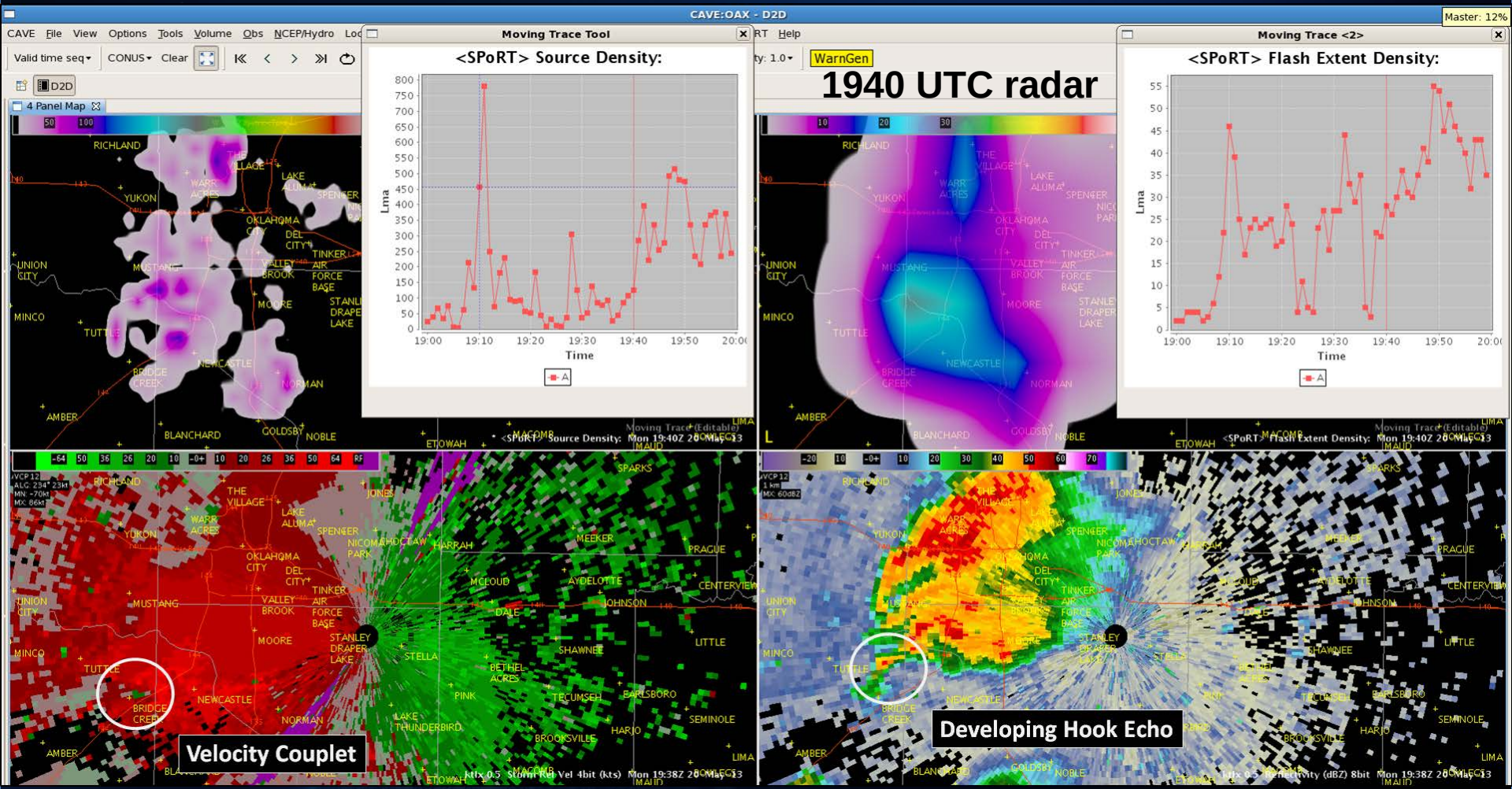


Figure 3: At 1940 UTC, the lightning activity has decreased following the initial jump at 1910 UTC and the reinforcing jump at 1928 UTC. Radar continues to show intensification, particularly with the radar velocity couplet clearly evident to the west-southwest of Newcastle, Oklahoma.

GOES-R Proving Ground HWT Spring Experiment: Moore Oklahoma EF 5 Tornado, May 20, 2013

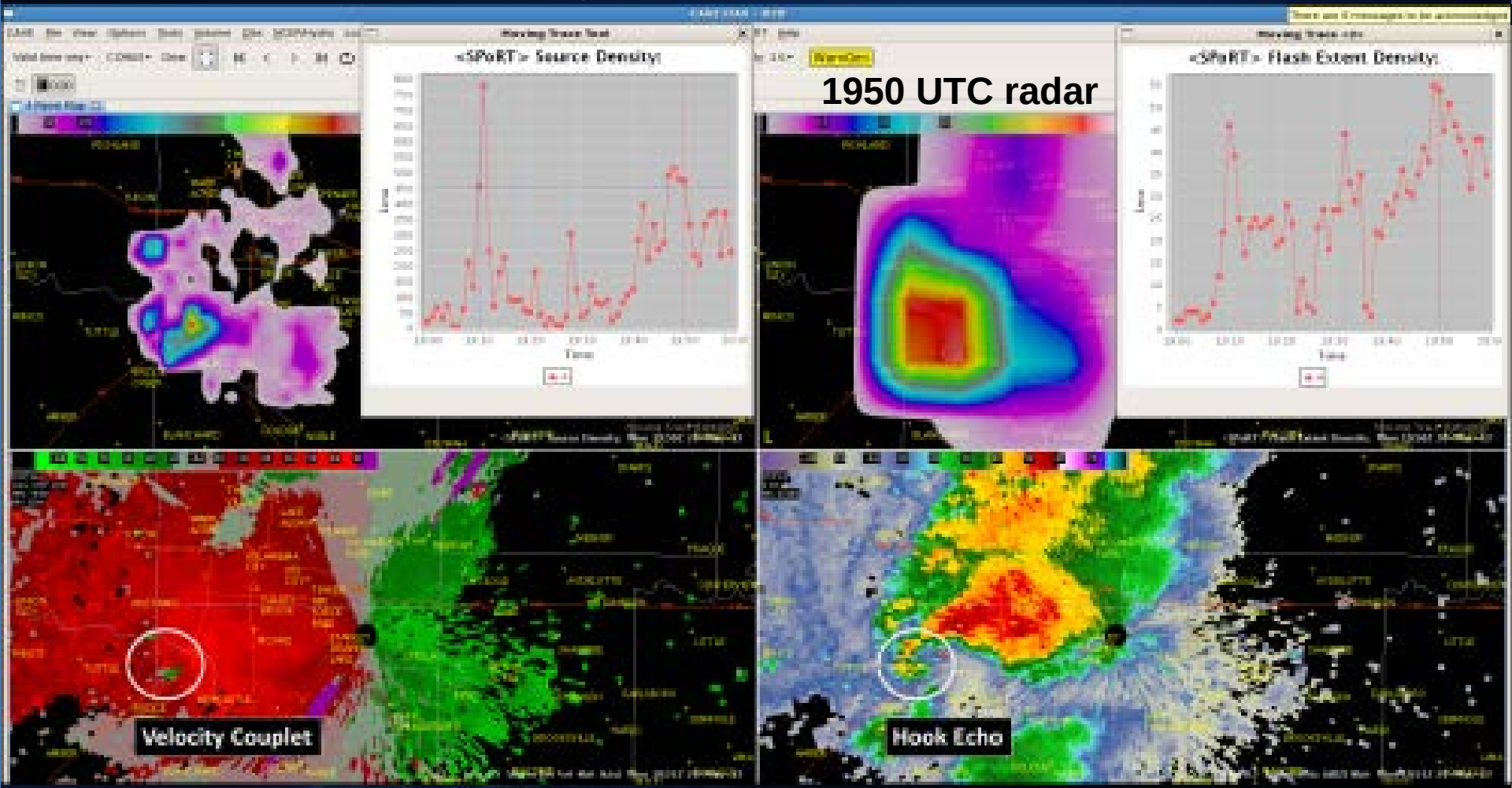
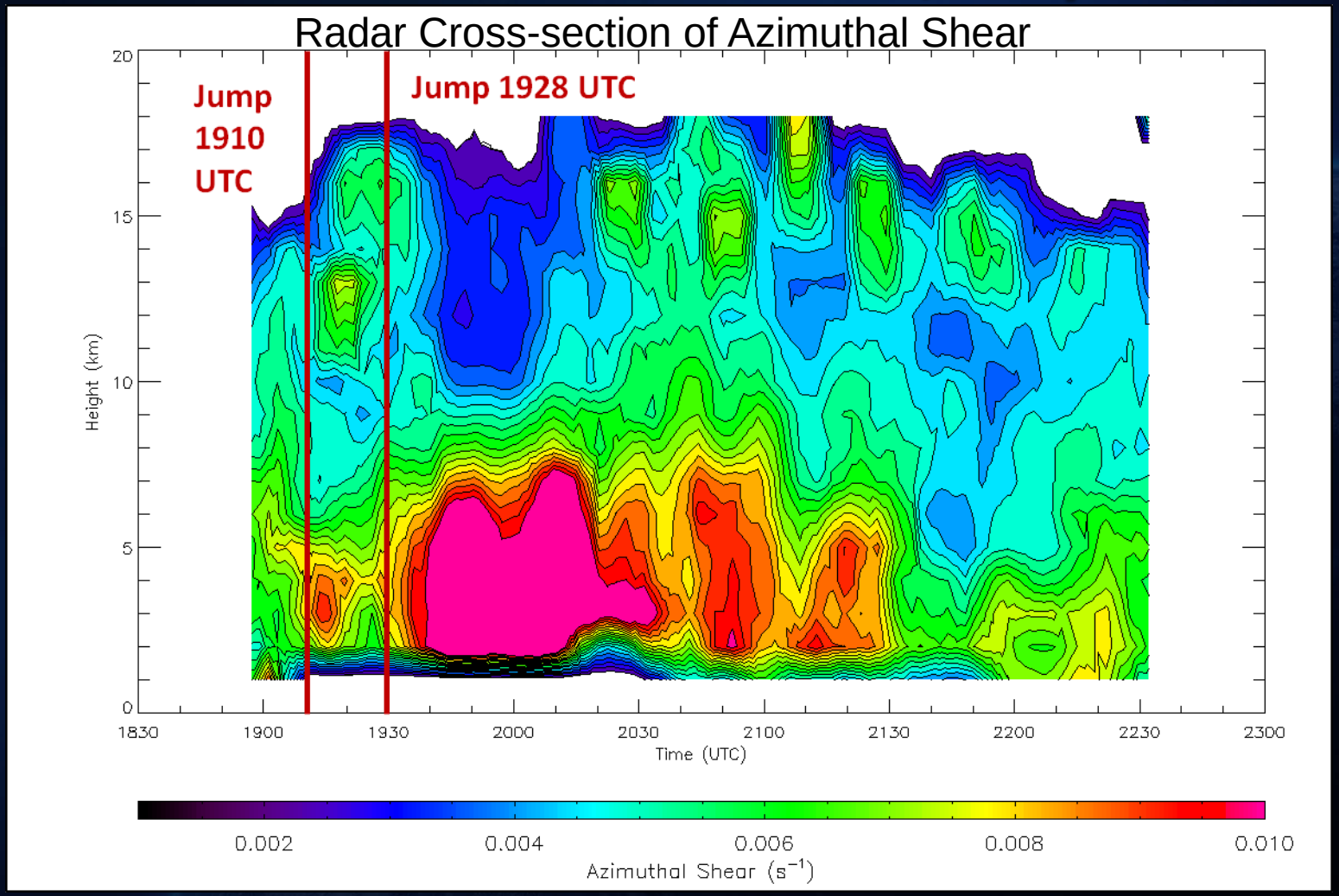


Figure 4: At 1950 UTC, the tornado warning has been active for 10 minutes with the classic hook echo and velocity couplet signatures. Both total lightning products show one final increase in activity, but given the high values for the past few minutes, this is not a third lightning jump. The tornado would touchdown 6 minutes later just outside of Newcastle, Oklahoma before further intensifying and moving through Moore, Oklahoma.

Courtesy SPoRT -http://nasasport.wordpress.com/2013/05/24/total-lightning-perspective-of-the-moore-oklahoma-supercell/

GOES-R Proving Ground HWT Spring Experiment: Moore Oklahoma EF 5 Tornado, May 20, 2013



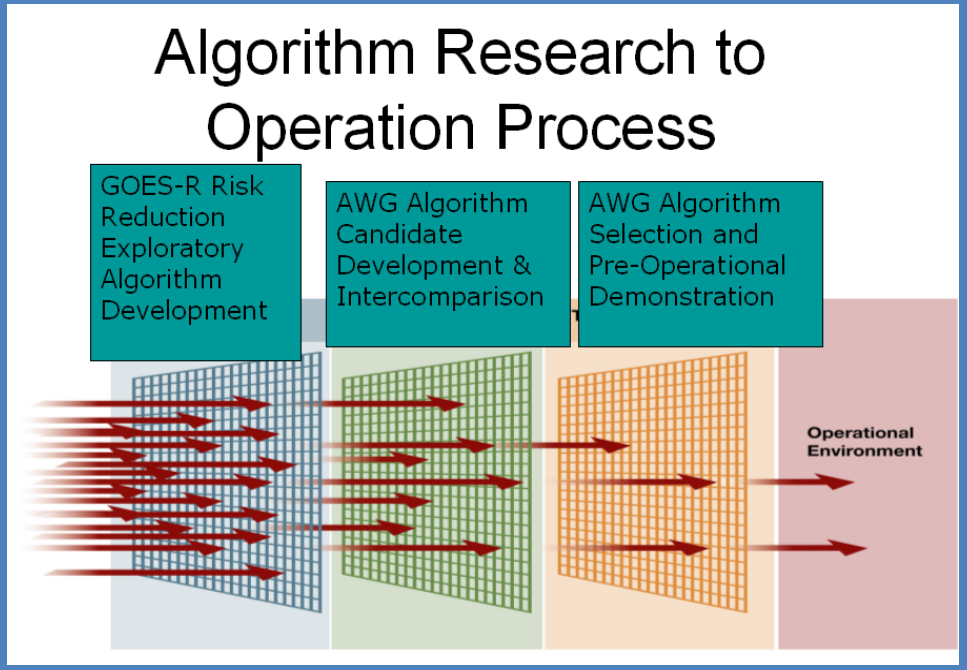
Chris Schultz / UAH-NASA

Figure 5:Radar cross section of azimuthal shear (a measure of the storm's rotation). Red vertical bars show the occurrence of the original and reinforcing lightning jump at 1910 and 1928 UTC, respectively. Note the large increase in azimuthal shear after each lightning jump.

GOES-R Algorithm Working Group

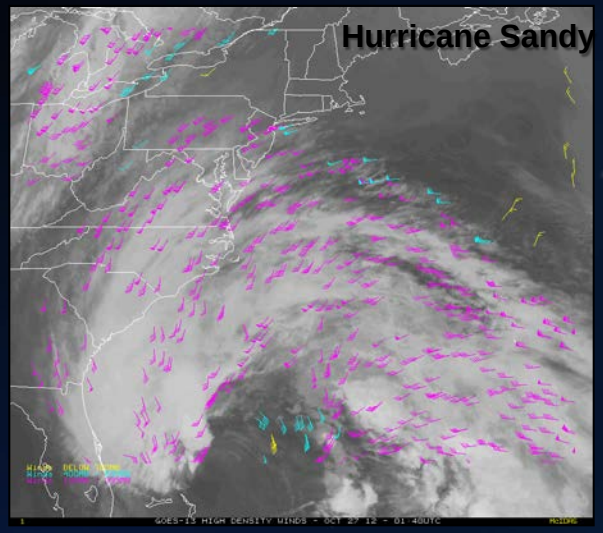
- **Mission:**
  - **To select, develop, test, validate, and demonstrate Level-2 algorithms meet the GOES-R requirements and provide them to the GOES-R Ground Segment.**
  - **Provide sustained life cycle validation and Level-2 product enhancements**

- **End-to-End Capabilities**
  - Instrument Trade Studies
  - **Proxy Dataset Development**
  - **Algorithm Development and Testing**
  - **Product Demonstration Systems**
  - **Development of Cal/Val Tools**
  - Integrated Cal/Val Enterprise System
  - Radiance and **Product Validation**
  - Algorithm and application improvements
  - **User Readiness** and Education

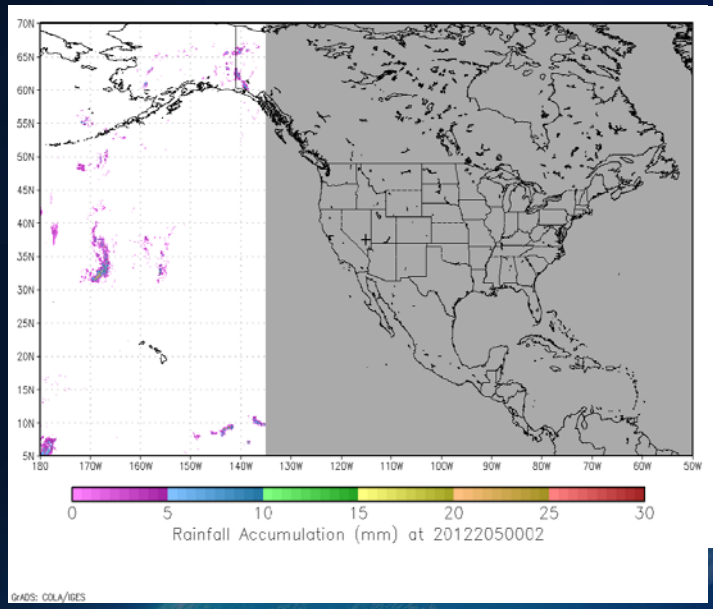


Demonstrations of ABI Proxy Products

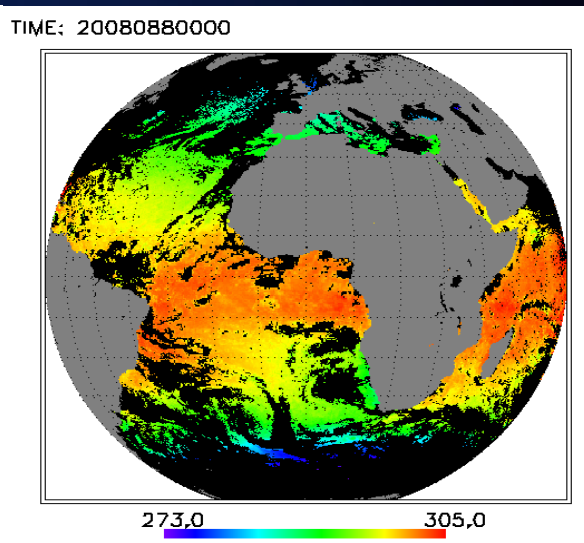
Derived Motion Winds from GOES-13



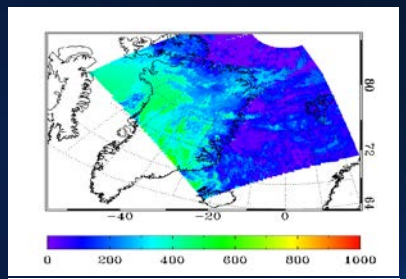
Rainfall Rate from GOES-13 and GOES-15



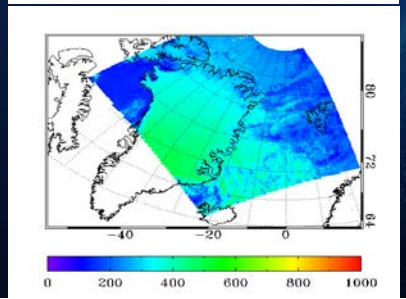
SST from MSG/SEVIRI



Terra MODIS 1500 UTC on 16 May 2006

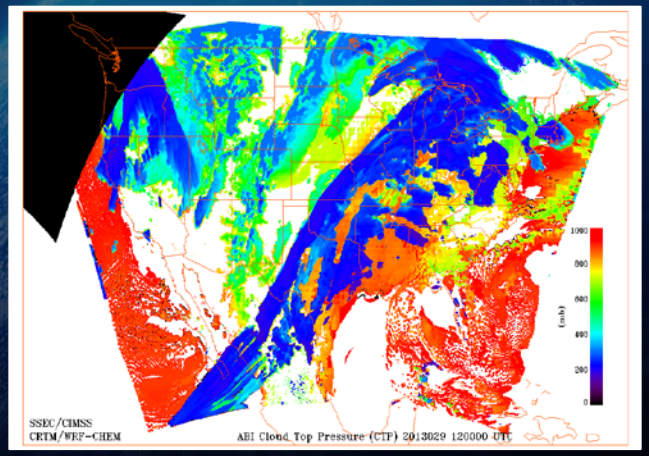


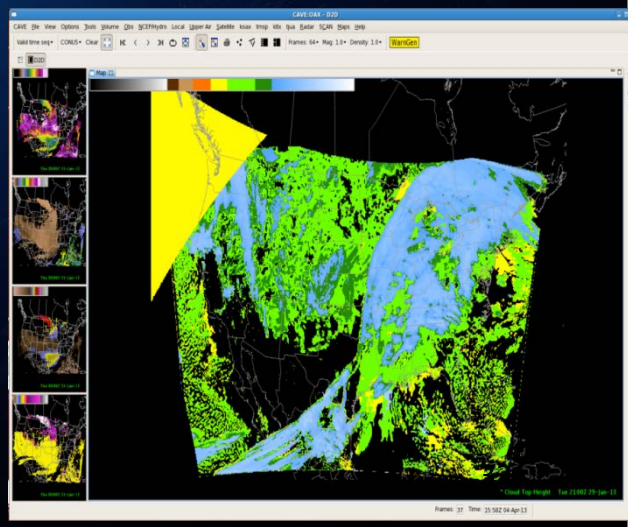
Downward Shortwave Radiation (SFC)



Reflected Shortwave Radiation (TOA)

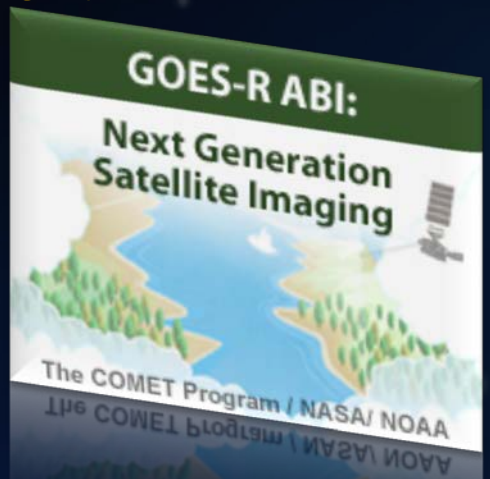
Cloud-top pressure & TPW from Simulated ABI Imagery





Training and User Education Update

New!



Updated!

Online Training Modules

- GOES-R ABI: Next Generation Satellite Imaging (COMET)
- GOES-R: Benefits of Next-Generation Environmental Monitoring (COMET)
- GOES-R 101
- Satellite Hydrology and Meteorology for Forecasters (SHyMet)
- SPoRT product training modules
- VISIT Training Resources
- Commerce Learning Center

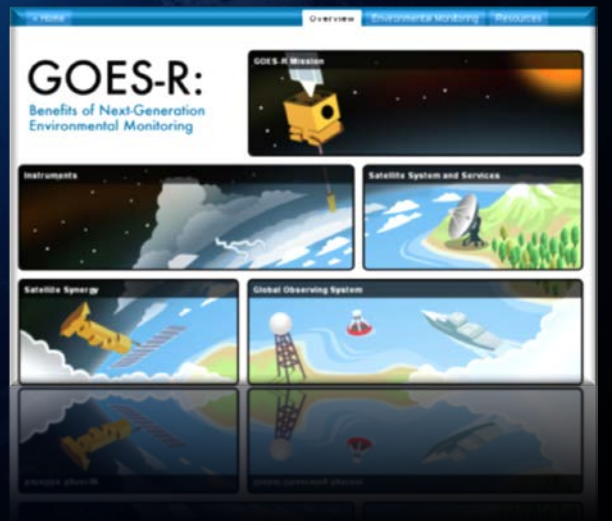
Printed Materials

- GOES-R Fact Sheets (18)
- GOES-R Tri-fold
- User Readiness Plan
- GRB Downlink Specifications and Product Users Guide

GRB Simulators

- Available mid-late 2013

New!



VISIT

Virtual Institute for Satellite Integration Training

FY11-12 Live Training Sessions

Synthetic Imagery in Forecasting Orographic Cirrus (January 2011)

Synthetic Imagery in Forecasting Severe Weather (February 2011)

Objective Satellite-Based Overshooting Top and Enhanced-V Anvil Thermal Couplet Signature Detection (February 2011)

Volcanoes and Volcanic Ash Part 2 (March 2011)

GOES-15 Becomes GOES-West (December 2011)

VISIT Satellite Chats (short, interactive discussions, Q&A, monthly since February 2012)

Topics:

- Fog and Low-Cloud Detection from Satellite (2-22-2012)
- Water Vapor Imagery (3-21-2012)
- Satellite Related Severe Weather Products (4-25-2012)
- Fire Weather Imagery and Products (5-23-2012)
- Mesoscale Convective Vortices (6-27-2012)

Synthetic Imagery in Forecasting Low Clouds and Fog (April 2012)

Pseudo GOES Lightning Mapper (May 2012)

Tropical Cyclone Intensity Model Guidance Used by NHC (June 2012, updated)

Tropical Cyclone Track Model Guidance Used by NHC (June 2012, updated)

Convective Cloud Top Cooling, UW Convective Initiation Algorithm (July 2012)

OCONUS Products

- Pacific Region Products:
  - Convective Initiation
  - Lightning based RII
  - Orographic Rainfall Index
  - Rainfall Rate and QPE
  - SO2 detection
  - Statistical Tropical Cyclone Intensity Models
  - TPW
  - Volcanic Ash Detection and Height

OCONUS Products

- Alaska Region Products:
  - Snow extent and depth
  - Cloud properties
  - Aviation applications
    - Volcanic ash
    - FLS
    - Convective toolkit
    - Aircraft icing
    - Turbulence

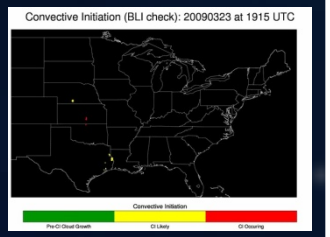
OCONUS Questions

- What CONUS Feedback on Demonstration Products is Applicable to Pacific Region and High Latitudes?
  - CI/OT/CTC/PGLM/ Nearcasting of value to Alaska and Pacific Islands?
  - Value of 30 sec and 1min interval imagery?
  - Basic imagery (especially with GOES-R resolution) has demonstrated value to 70N. How far north are other level 2 products useful?
  - If products lose value with latitude, can fusion with polar products mitigate loss and still maintain advantage of temporal refresh rate?

NWS Vision to Integrate ABI and GLM Products with Other Data and Models

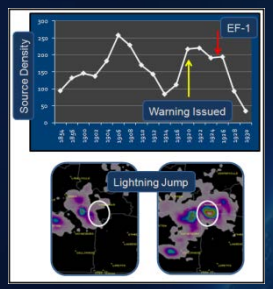
A Potential Operational Example: Convective Initiation/Severe Wx
How can we integrate the information in future tools?

CI

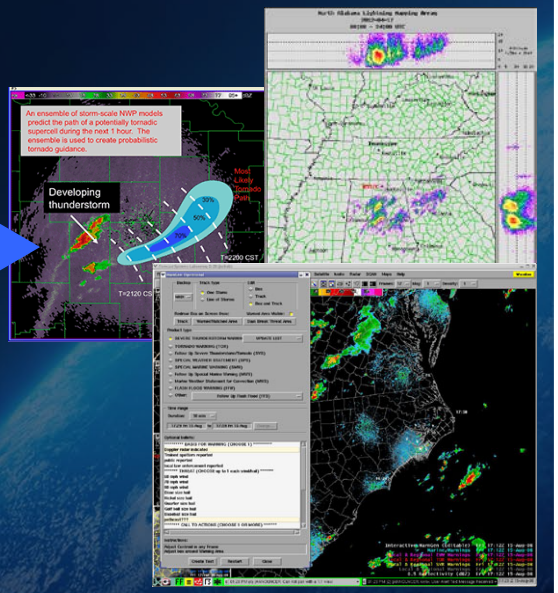


Over-shooting tops

Lightning Jumps



Next Generation Warning System



Why NWS needs this?

Situational Awareness
Warning confidence
Decision Support (venues)

Situational Awareness:

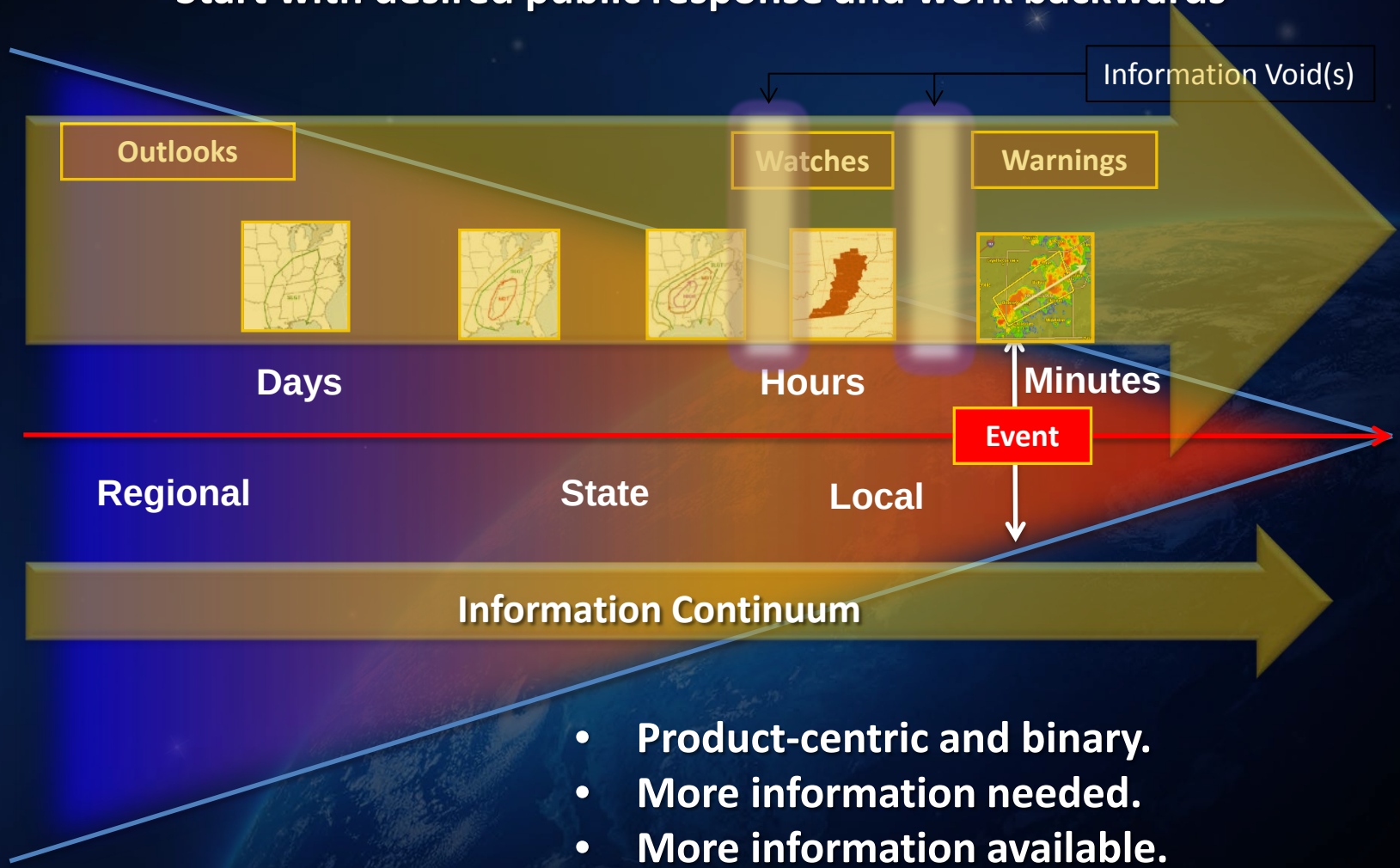
User comment: 'Cloud Top Cooling product is an excellent source of enhancing the situational awareness for future convective initiation, particularly in rapid scan mode'.

AWC Testbed forecaster

(June 2012)

Looking Ahead - Warning Challenges
Impact-Based Decision Support

Start with desired public response and work backwards



- **Product-centric and binary.**
- **More information needed.**
- **More information available.**

"Leo not just for NWP, Geo not just for imagery"
Louis Uccellini, Director NWS, Satellite Science Week, March 2013

Adapted from Dr. Heather Lazrus (SSWIM)
Lans Rothfusz NSSL

Recommendations & Path Forward

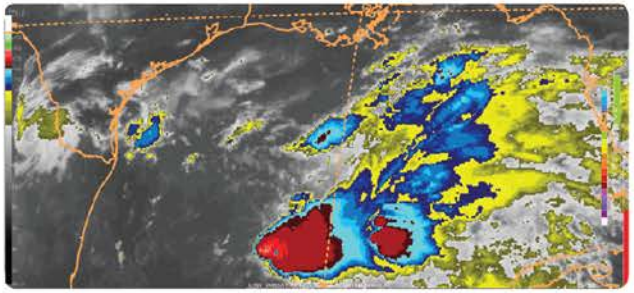
- Call for new start proposals in July will follow NOAT guidance in assigning priorities
- Look for opportunities to take advantage of blended productsWhat new blended products are needed?
- Keep thinking about how products could be improved and integrated into operations
- Think about need for decision aids (both for forecasters and emergency managers)
- Ensure that all PG participant feedback is recorded
  - Blogs have worked great
  - Tales from the testbed have proven very popular
- We need to evaluate value of SRSO in Pacific Region and Alaska

Summary

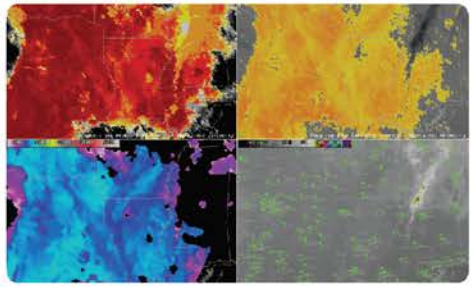
Pre-launch demonstrations with proxy data benefits users to prepare them to fully exploit all GOES-R instruments and capabilities

- Continue to apply lessons learned to incorporate new improvements each year.
- Demonstrate products and decision aids in NOAA Testbeds, NCEP Centers, WFOs, and the NWS Proving Ground at Training Center
- Transition of Future Capabilities, fused products, Impact-based Decision Aids, Decision Support Services
- Continue to develop, demonstrate, and test as part of decision support services
- Enhanced collaboration with JPSS, international, and private sector community

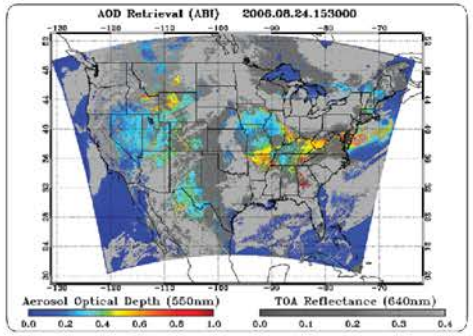
GOES-R Proving Ground Partners



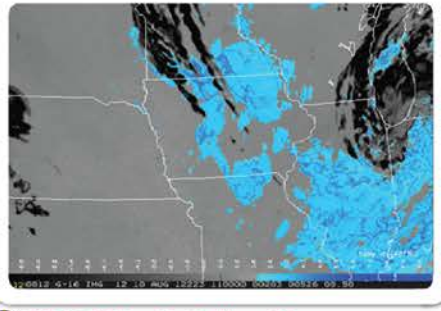
AWC – Kansas City, MO IR Imagery of Oceanic Storms



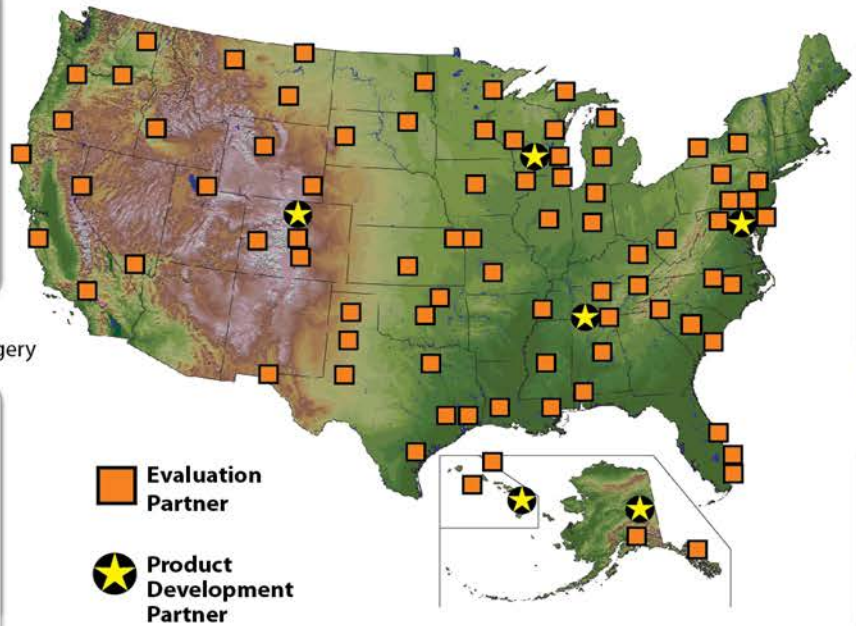
CIMSS/STAR – Madison, WI
Fog/Low Stratus Product

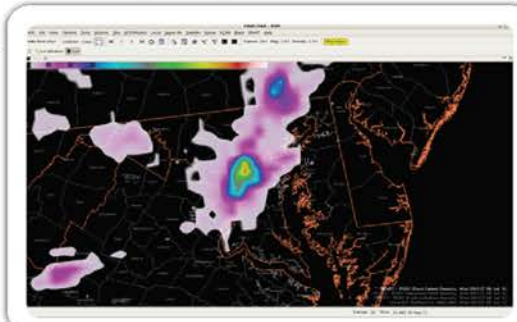


STAR/UMBC – College Park, MD
Aerosol Optical Depth

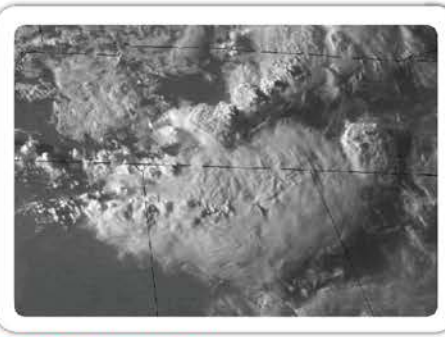


CIRA/STAR – Ft. Collins, CO
ABI Synthetic Low Cloud Enhancement Imagery

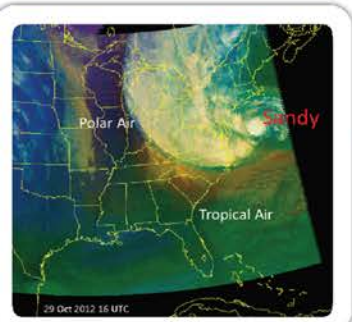




SPoRT/NASA – Huntsville, AL
GLM Lightning Density



SPC – Norman, OK
Severe Storms 1-Min Visible Imagery of Overshooting Tops

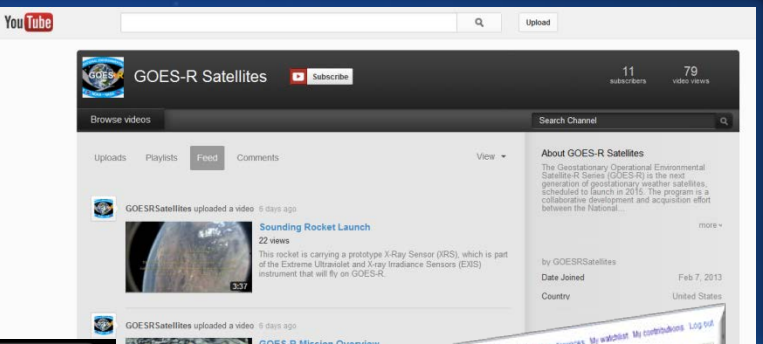


NHC – Miami, FL
RGB Air Mass for Hurricane Sandy

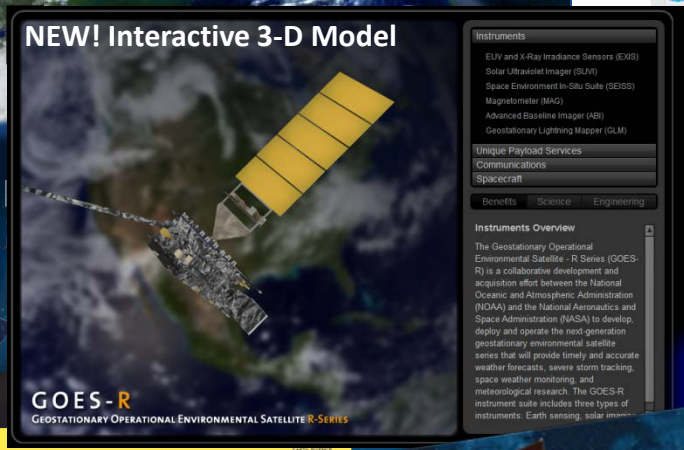
Education and Public Outreach Update

New look for goes-r.gov!

New YouTube page!

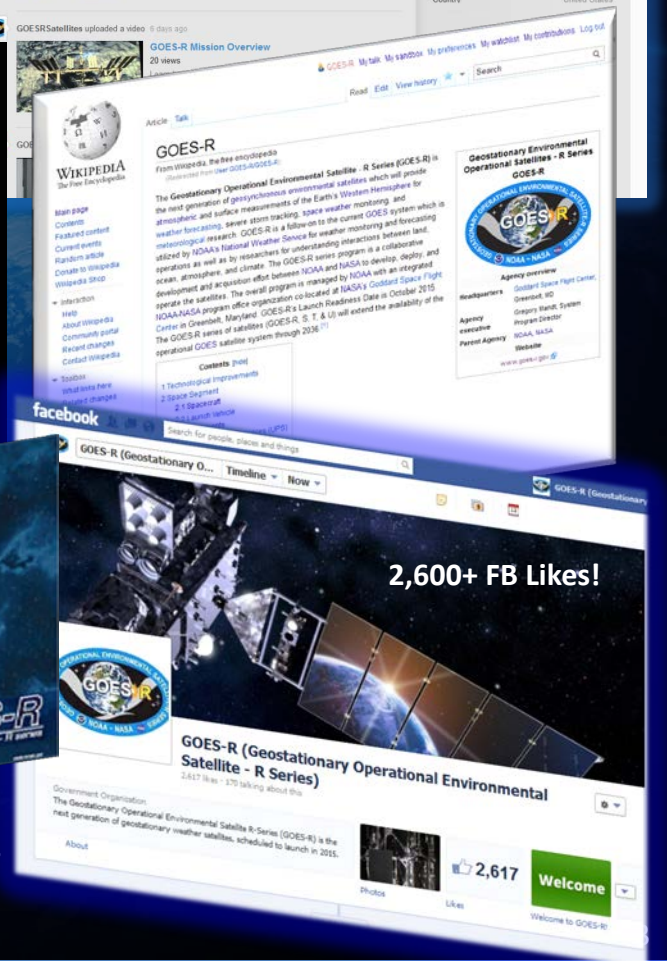


NEW! Interactive 3-D Model



Live Media Event
April 3, 2012,Goddard TV Studio

GOES-R article and poster in Winter 2012 issue of *The Earth Scientist*



2,600+ FB Likes!