

# THE FORECASTING AND MONITORING OF CONVECTION ASSOCIATED WITH FLASH FLOOD THREATS

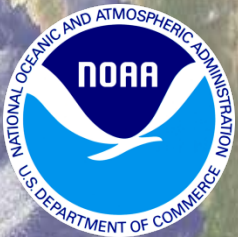
**Michael J. Folmer  
(UMCP/ESSIC/CICS)**

**Satellite Liaison at WPC/OPC/TAFB/SAB**

**Contributions from:**

**Andrew Orrison (WPC), David Novak (WPC), Jamie Kibler (SAB),  
Steve Goodman (GOES-R), and Mitch Goldberg (JPSS)**

**3<sup>rd</sup> Annual CICS-MD Science Meeting  
11/13/14**



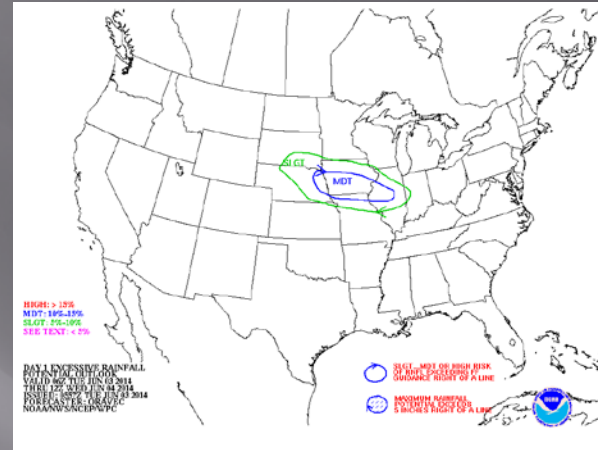


# NCEP Weather Prediction Center (WPC) Excessive Rainfall Outlook

- Highlight regions where rainfall may *exceed flash flood guidance at a point*

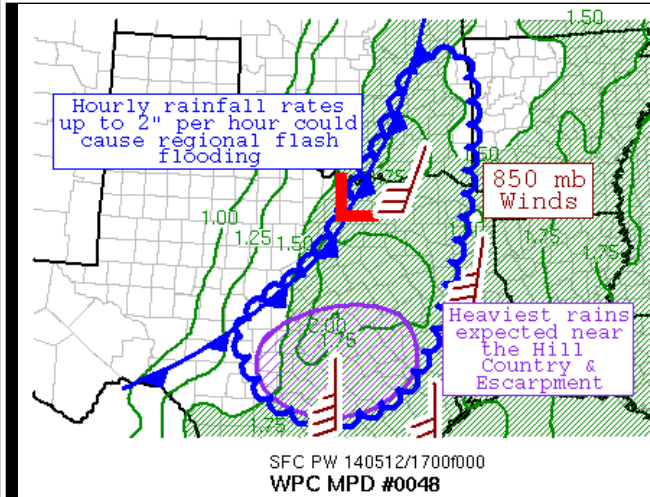
- Day 1 – 3 forecasts

- Probabilistic
  - Slight (5-10%)
  - Moderate (10-15%)
  - High (>15%)



# WPC MetWatch Desk

- Short-term, event-driven forecasts that highlight regions where heavy rainfall may *lead to flash flooding over the next 1-6 hours*
- Goal – enhance near-term situational awareness among local NWS Offices, emergency managers, and the media



MESOSCALE PRECIPITATION DISCUSSION 0048  
NWS WEATHER PREDICTION CENTER COLLEGE PARK MD  
247 PM EDT MON MAY 12 2014

AREAS AFFECTED...EASTERN OK...NORTHEAST AND CENTRAL TX

CONCERNING...HEAVY RAINFALL...FLASH FLOODING POSSIBLE

VALID 121846Z - 130046Z

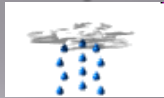
SUMMARY...ORGANIZED THUNDERSTORMS WITH HEAVY RAINFALL ARE EXPECTED TO MOVE ACROSS EASTERN OK, NORTHEAST TX, AND THE TX HILL COUNTRY OVER THE NEXT SEVERAL HOURS. REGIONAL FLASH FLOODING IS CONSIDERED POSSIBLE IN THESE AREAS.

DISCUSSION...THE COMBINATION OF A SLOWLY PROGRESSIVE COLD FRONT, PRECIPITABLE WATER VALUES OF 1.75-2 INCHES (BETWEEN THE 90TH AND 99TH PERCENTILES FOR MID-MAY), 0-3 KM WIND SHEAR OF OVER 25 KNOTS, AND CAPE VALUES OF 2000-4000 J/KG HAS ORGANIZED A NARROW BAND OF THUNDERSTORMS ACROSS PORTIONS OF TX AND OK, WITH A CLUSTER CURRENTLY FORMING ACROSS SOUTHEAST OK. WITH 850 HPA INFLOW EXCEEDING THE 850-400 HPA MEAN WINDS ACROSS TX AND OK, HEAVY RAINS ARE LIKELY WITH THIS ACTIVITY, ON THE ORDER OF 2" AN HOUR WITHIN STRONGER CONVECTION.

THE MESOSCALE GUIDANCE IS IN GENERAL AGREEMENT THAT THUNDERSTORM ACTIVITY NEAR THE MOST EXTREME CAPE, COMBINED WITH DRY AIR ALOFT, SHOULD CAUSE A COLD POOL TO FORM IN ASSOCIATION WITH THE NORTH-CENTRAL TX, AND POSSIBLY SOUTHEAST OK, CONVECTION AND ALLOW IT TO BOW OUT SOMEWHAT TO THE SOUTHEAST ACROSS THE HILL COUNTRY INTO THIS EVENING. AS IT DOES SO, INFLOW INTO THE BAND WILL INCREASE AND RAINFALL EFFICIENCY SHOULD INCREASE AT THE EXPENSE OF THUNDERSTORM ACTIVITY FARTHER TO THE NORTHEAST. HIGH FLASH FLOOD GUIDANCE VALUES ACROSS THE REGION, ON THE ORDER OF 3-

# NOAA/NESDIS Satellite Analysis Branch

## Precipitation Program



24x7x365 monitoring of precipitation with emphasis on satellite analysis, short term trends and rainfall estimates

### Supporting NWS WFOs/RFCs

#### Priorities

- heavy rainfall / flash flooding
- moderate to heavy winter precipitation
  - West Coast winter storms
  - Great Lakes snows
- Consultation on satellite issues



Satellite (SPENES) discussion messages

12-planet & NWSchat messages

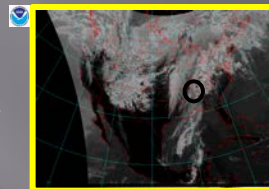
graphical analysis

satellite rain and snowfall estimates

### Supporting NWS NCEP WPC

#### Priorities

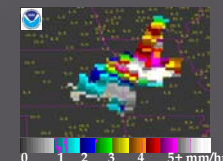
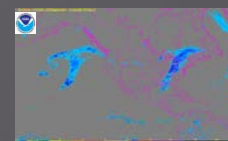
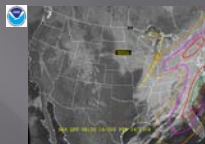
- excessive rainfall area
- 0-6 hr rainfall guidance
- satellite precipitation trends



• tropical rainfall



• rainfall and snowfall estimates



<http://www.ssd.noaa.gov/PS/PCPN/>



# New Products Introduced in the Satellite Proving Ground at WPC and SAB

- ▣ Overshooting Top Detection/Magnitude
  - CIMSS
- ▣ GLD-360 Lightning Density
  - OPC/NESDIS/CICS
- ▣ Convective Initiation
  - UAH/NASA SPoRT
- ▣ GOES-14 Super Rapid Scan Operations for GOES-R (SRSOR)
  - CIMSS & CIRA
- ▣ Nearcast
  - CIMSS

# LAKE CHARLES, LA

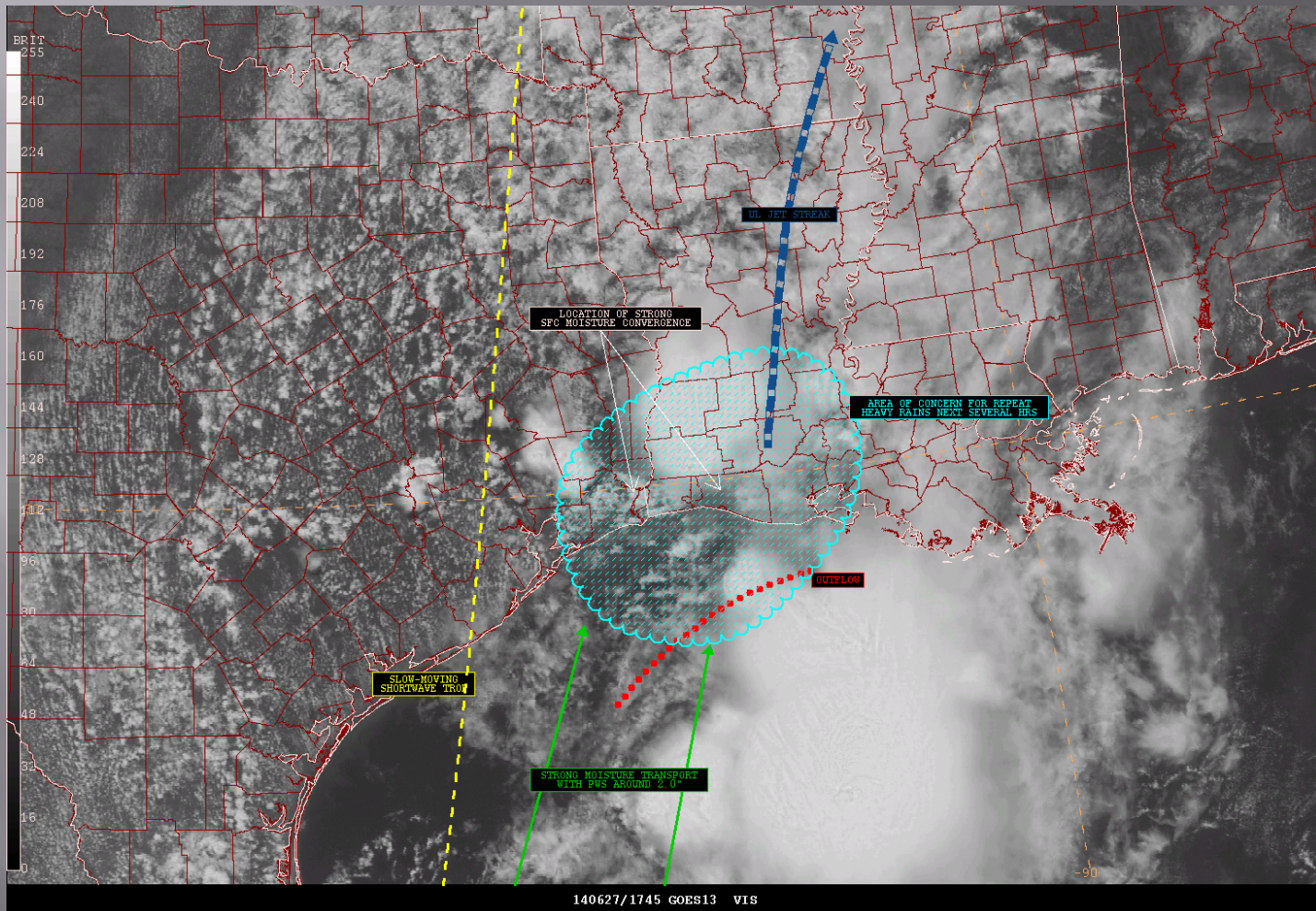
Localized Flash Flood

06/27/14

Convective Initiation

# Satellite Analysis Branch

## Satellite Precipitation Estimates (SPENES)

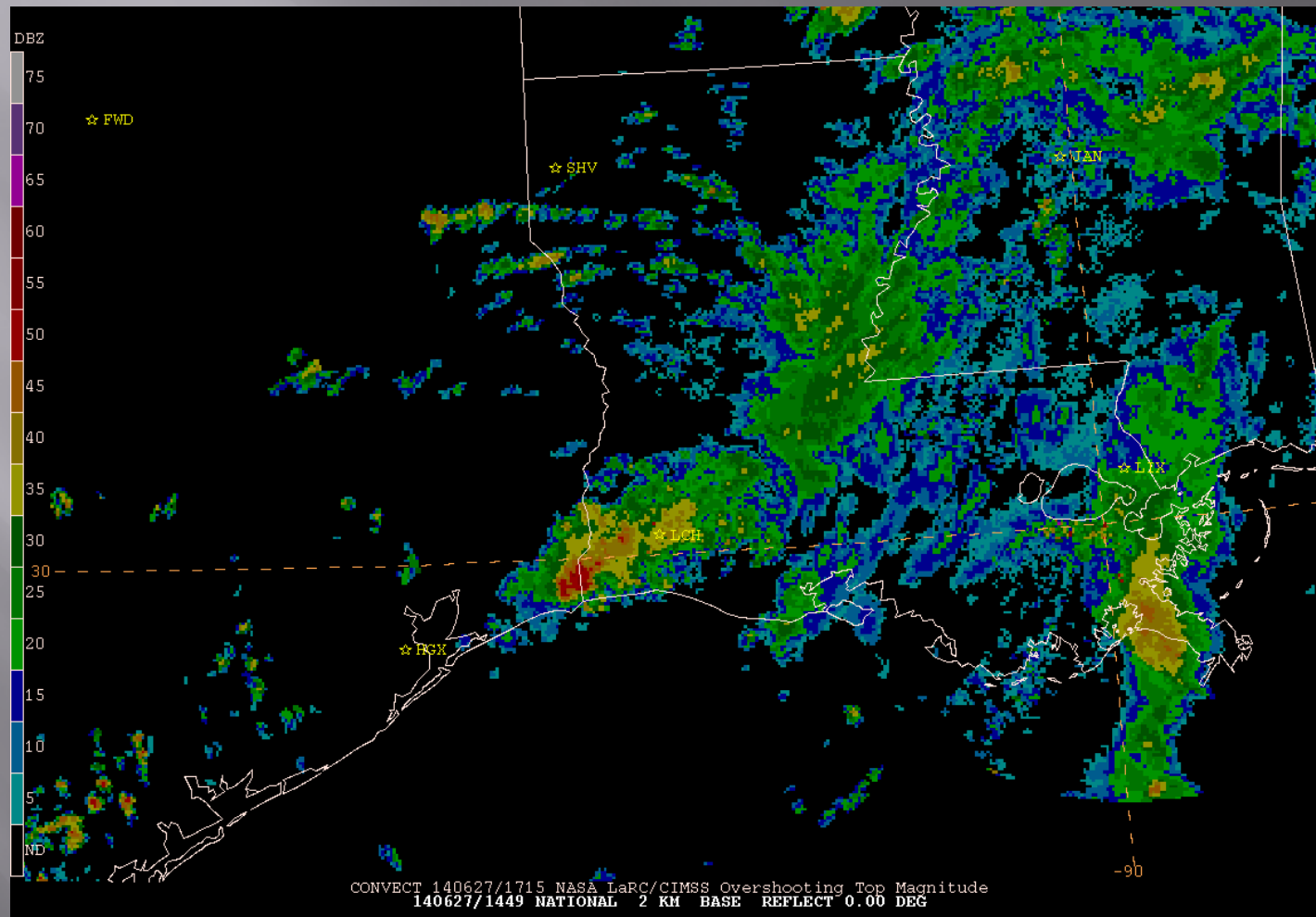


Analyst Warren



# 06/27/14 Flash Flood

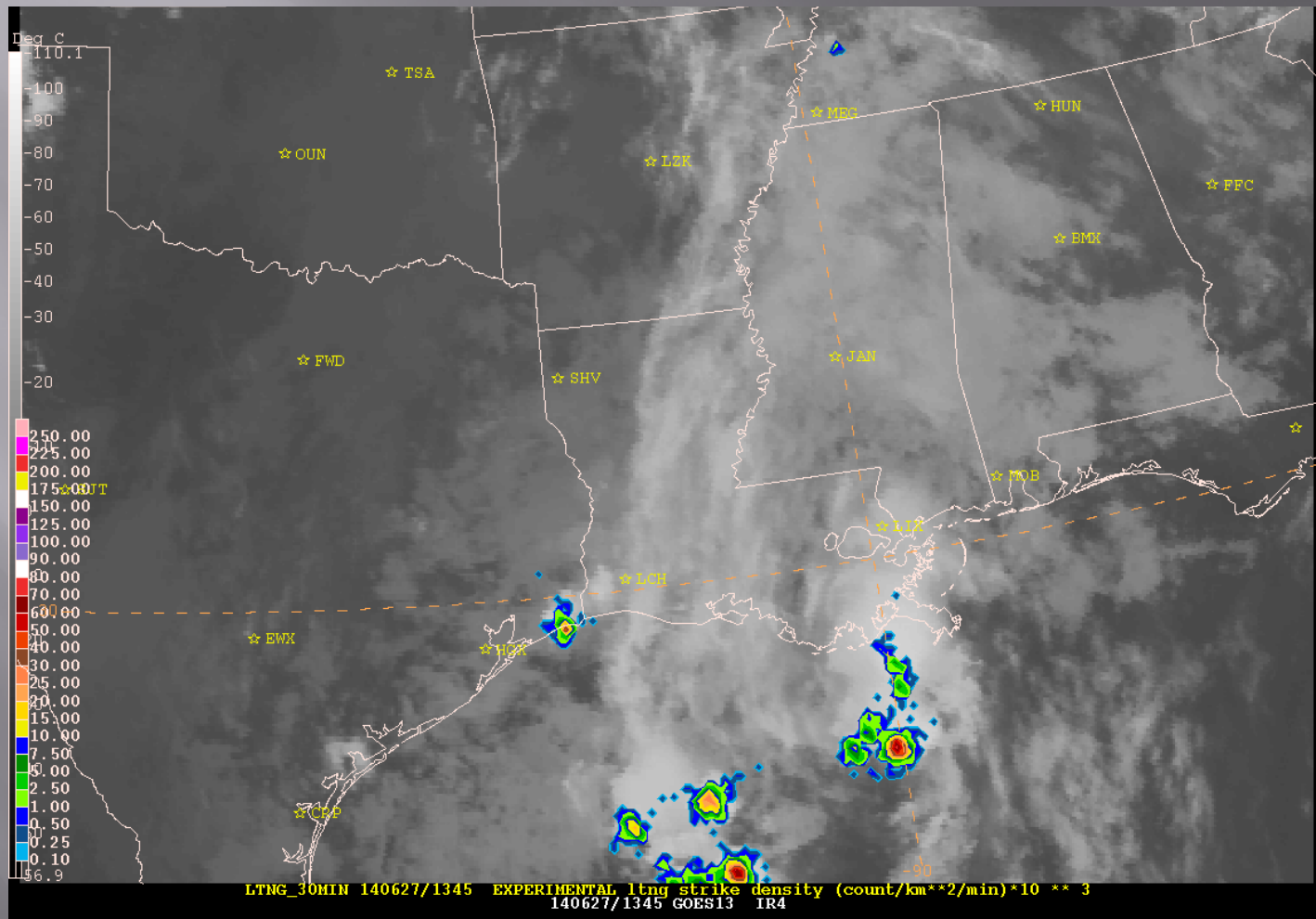
## Base Reflectivity with Overshooting Top Magnitude



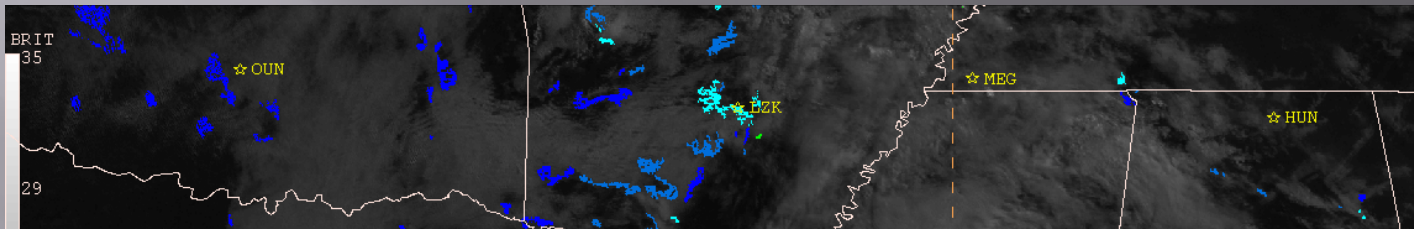


# 06/27/14 Flash Flood

## GOES-13 Infrared with GLD-360 Lightning Density



# 06/27/14 Flash Flood Convective Initiation



SHORT TERM OUTLOOK VALID 1750-2250Z...HIGH CONFIDENCE FACTOR IN SHORT TERM OUTLOOK...ALREADY CONVECTION HAS DEVELOPED ACROSS PORTIONS OF SE TX/SW LA THIS AFTERNOON WITH SOME LOCATIONS RECEIVING A QUICK 2-3" IN AN HR. INCREASING CONCERN OF ADDITIONAL CONVECTION DEVELOPING/EXPANDING N FROM GULF OF MEXICO AHEAD OF SHORTWAVE TROF THAT IS GRADUALLY LIFTING NWD ACROSS ERN TX/WRN GULF OF MEXICO. **WITHIN THE LAST HR AN OUTFLOW BOUNDARY HAS BEGUN TO PROPAGATE NWD TOWARDS TO COASTLINES OF SE TX/SW LA WITH NEW CONVECTION ALREADY BEGINNING TO INITIATE. GOES CI ALGORITHM DOES SUGGEST POSSIBLE TO LIKELY ADDITIONAL CONVECTIVE TO DEVELOP AHEAD/ALONG OUTFLOW BOUNDARY IN THE NEXT COUPLE OF HRS.** ATTM OBJECTIVE SFC MOISTURE CONVERGENCE MOISTURE HAS A STRONG MAX LOCATED ALONG THE SW LA COAST. GIVEN THE STRONG SRLY 85H MOISTURE TRANSPORT OF 2.0"+ PWS AND SLOW-MOVING NATURE OF THE SHORTWAVE...THINKING THIS STRONG MOISTURE FLUX SHOULD ONLY GRADUALLY SHIFT NWD OVER THE NEXT 2-4 HRS...FAVORING REPEAT CELL ACTIVITY. ~Warren



# TENNESSEE VALLEY

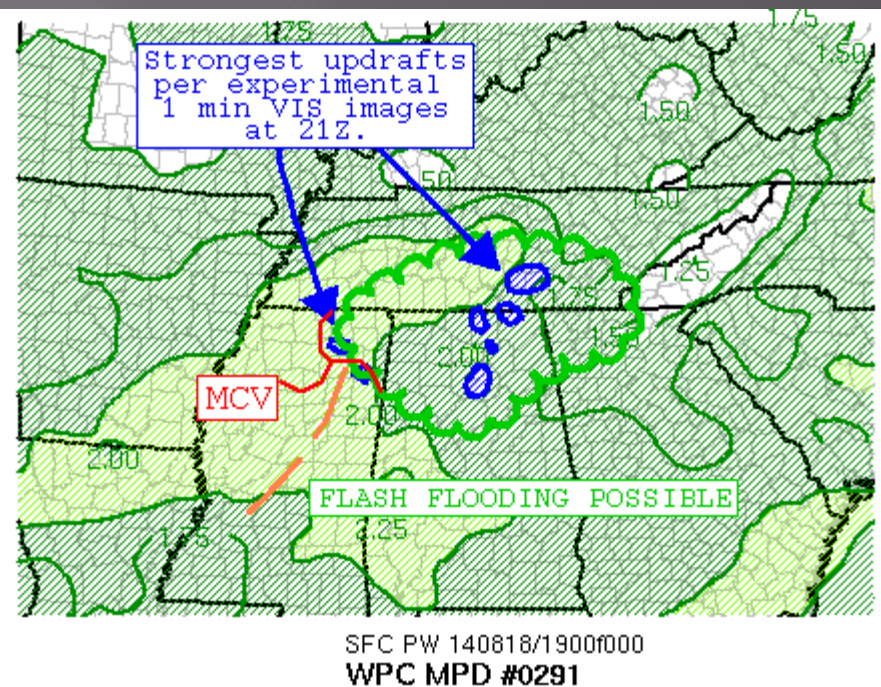
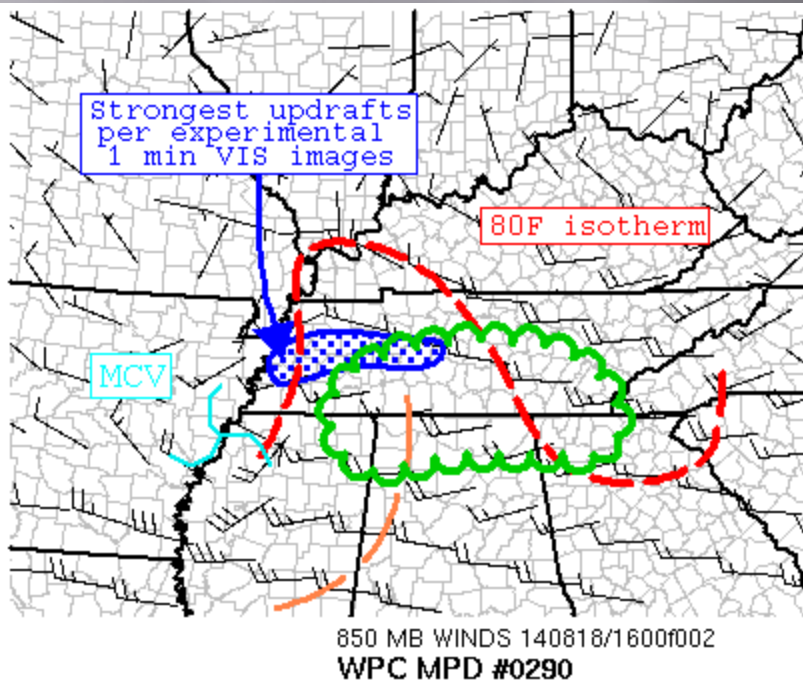
Heavy Rain Event

08/18/14

GOES-14 SRSOR

# Weather Prediction Center

## Mesoscale Precipitation Discussion



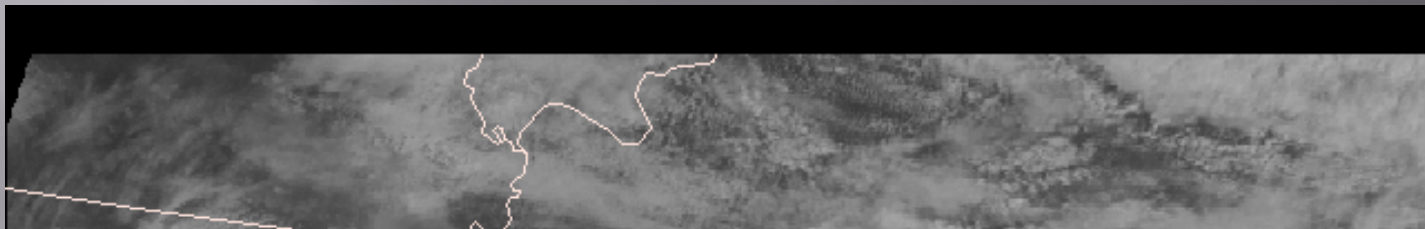
Forecaster Rubin-Oster

Forecaster Bann



# 08/18/14 Heavy Rain Event

## GOES-14 Super Rapid Scan Operations for GOES-R



ADDITIONALLY A MORE EXPANSIVE AXIS OF CONVECTION HAS DEVELOPED ALONG A WEST-EAST LINE WITH THE UPDRAFTS GROWING RAPIDLY PER THE **EXPERIMENTAL 1 MINUTE RAPID SCAN VISIBLE IMAGERY**. THE MEAN STEERING FLOW REMAINS WEST TO EAST WHICH SUGGESTS THE ACTIVITY WILL SLIDE EASTWARD INTO CENTRAL TN DURING THE NEXT COUPLE OF HOURS. ~Rubin-Oster

**SUPER RAPID SCAN IMAGERY** CONTINUES TO SHOW THAT MOST OF THE MOST ACTIVE UPDRAFTS WERE LOCATED FROM SOUTH CENTRAL TN INTO NORTHERN AL...A REGION WHERE THE MEAN MID LEVEL FLOW WAS ROUGHLY THE SAME AS LOW LEVEL INFLOW. ~Bann



# UPPER MISSISSIPPI VALLEY

Heavy Rain Event

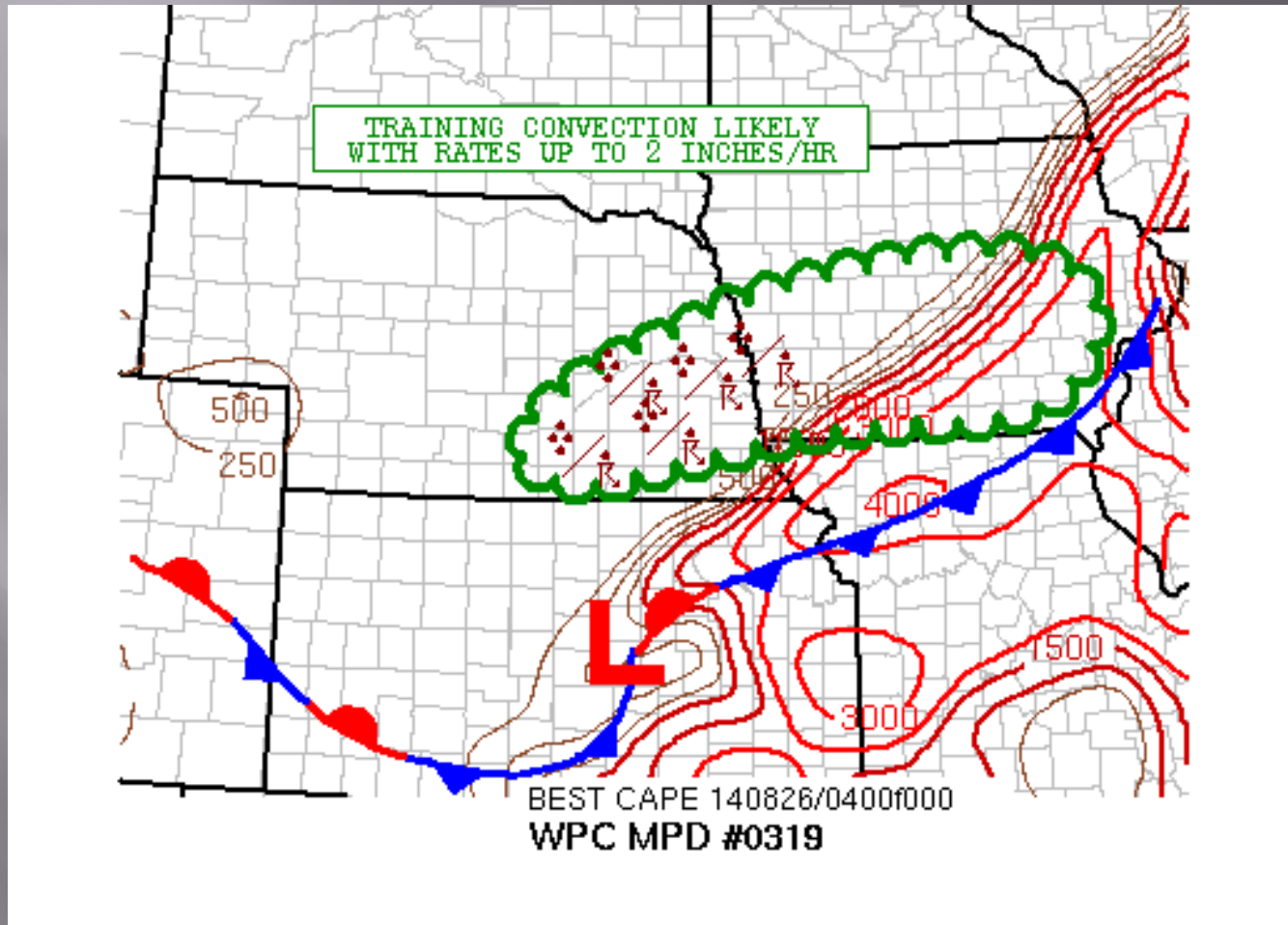
08/26/14

Nearcast Model



# Weather Prediction Center

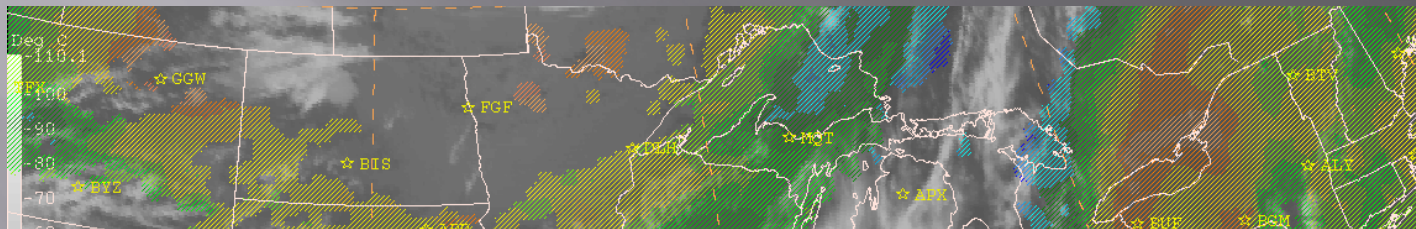
## Mesoscale Precipitation Discussion



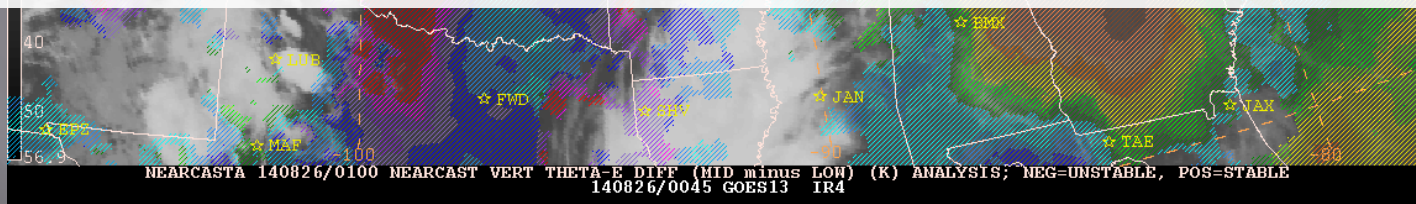
Forecaster Orrison

# 08/26/14 Heavy Rain Event

## GOES-13 Infrared and Nearcast Theta-E Difference



THE 00Z NAM-CONEST AND 00Z NSSL-WRF INDICATE A FORMIDABLE W/E OR WSW/ENE AXIS OF STRONG CONVECTION SETTING UP THROUGH 06Z AND TWO THE PREDAWN HOURS INVOLVING SERN NEB AND CNTRL AND SWRN IA. ADDITIONALLY...**THE EXPERIMENTAL NEARCAST PRODUCT INDICATES AN AXIS OF DIFFERENTIAL THETA-E THAT SUPPORTS AN INSTABILITY AXIS ACROSS SERN NEB AND THROUGH A LARGE PART OF CNTRL AND SRN IA. THIS IS ALREADY WITHIN THE INSTABILITY GRADIENT AS SEEN BY THE LATEST RAP ANALYSIS...BUT THE NEARCAST PRODUCT INDICATES THIS PERSISTING THROUGH 12Z. THEREFORE...CONFIDENCE IS RATHER HIGH** THAT CONVECTION WILL CONTINUE TO ORGANIZE AND EXPAND IN A GENERAL WSW/ENE FASHION OVERNIGHT AND ADVANCE INTO OR DEVELOP ACROSS CNTRL/SWRN IA IN PARTICULAR. ~Orrison





# KANSAS, OKLAHOMA, MISSOURI

Heavy Rain Event

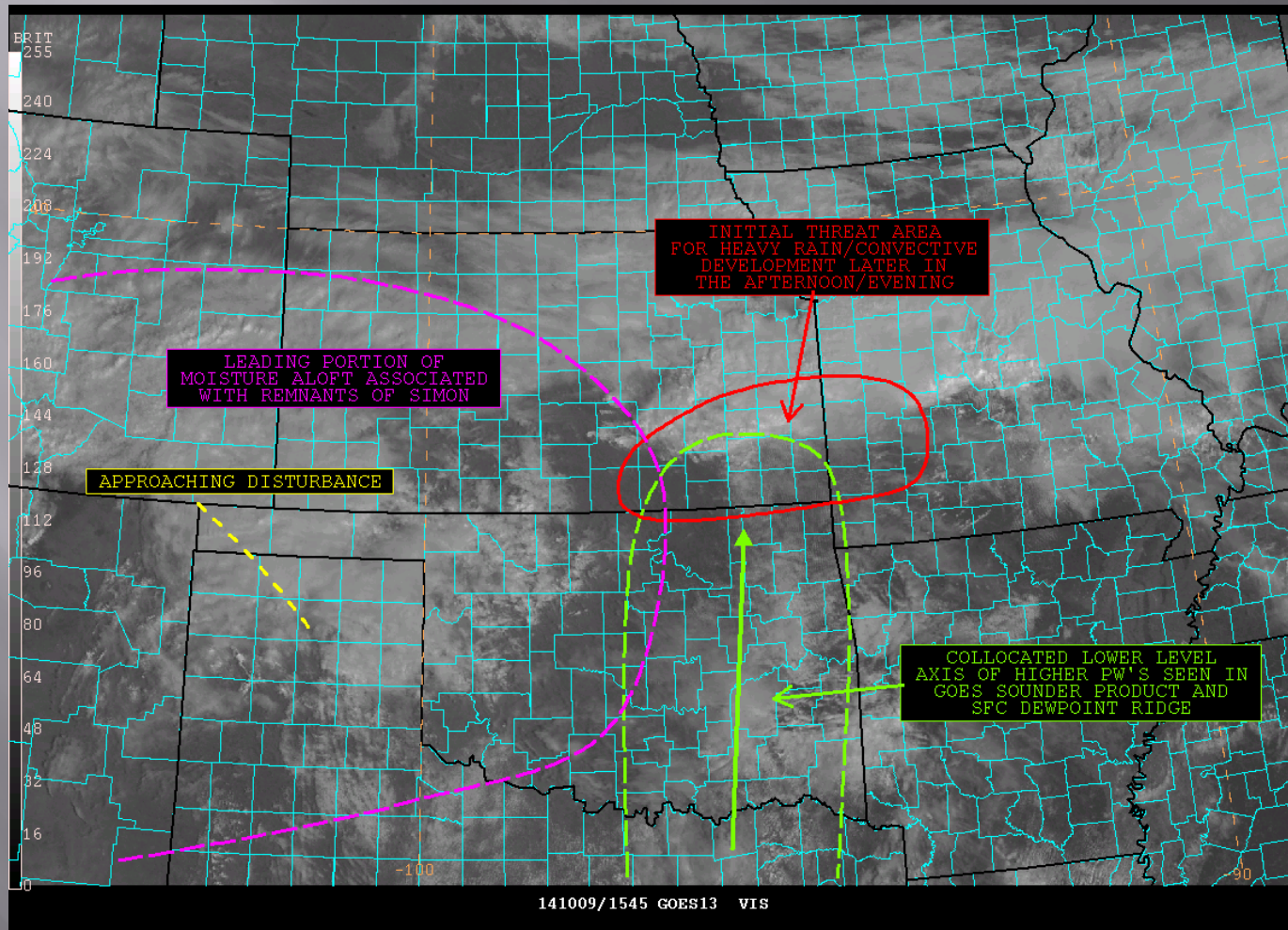
10/09/14

Nearcast Model



# Weather Prediction Center

## Mesoscale Precipitation Discussion

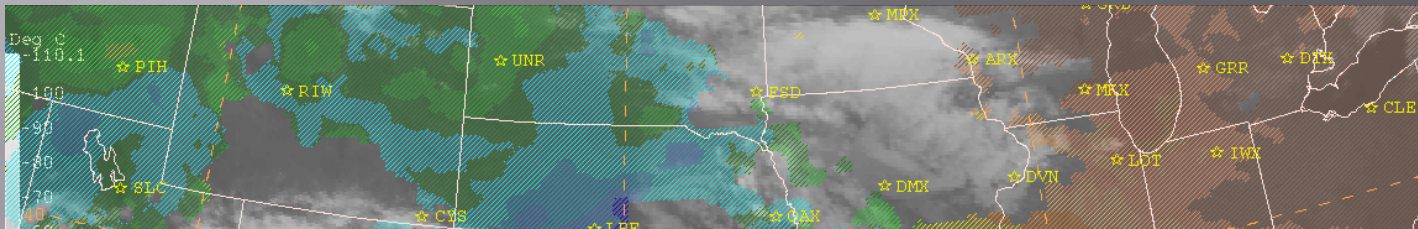


Analyst Simko

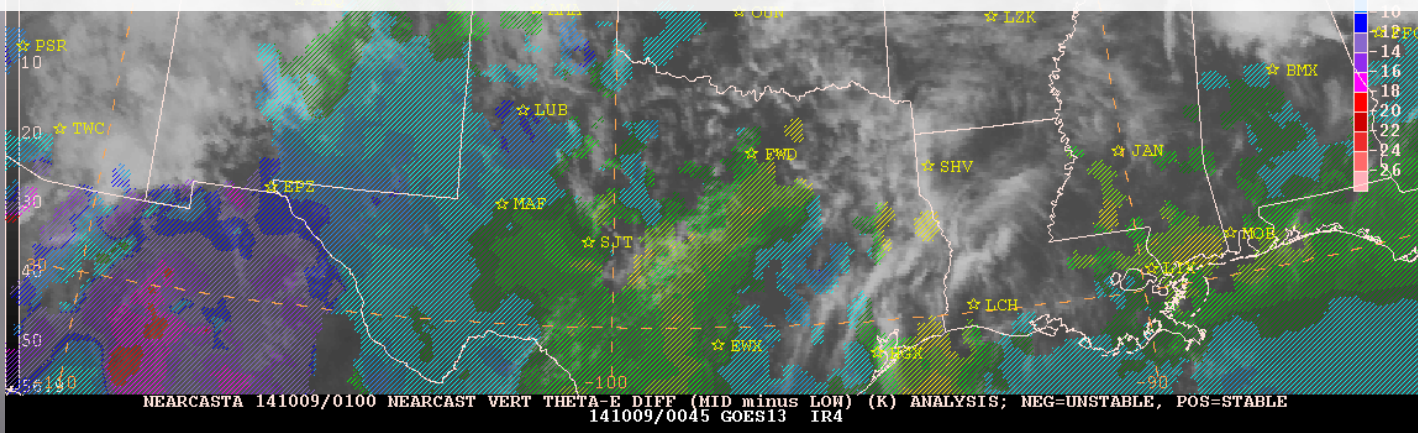


# 10/09/14 Heavy Rain Event

## GOES-13 Infrared and Nearcast Theta-E Difference



BEYOND THE SHORT TERM (LIKELY CLOSER TO 00Z AND BEYOND), EXPECT UPSTREAM SHORTWAVE ENERGY LIFTING NE FROM THE SW US EMBEDDED WITHIN SW-NE AXIS CURRENTLY ACROSS E NM EXTENDING INTO THE NW TX/OK PANHANDLE REGION AND SW KS DEPICTED IN WATER VAPOR IMAGERY AND IN **CIMSS-GOES-R PROVING GROUND NEARCAST VERTICAL THETA-E DIFFERENCE PRODUCT** TO COINCIDE WITH SUBTLE BACKING OF LLJ TO A MORE SOUTHERLY DIRECTION AND FOCUS ASCENT ALONG W-E ORIENTED LOW LEVEL BOUNDARY DRAPED ACROSS KS/MO. ~Simko



# Conclusion

- ❑ The WPC and SAB are finding great utility in using new satellite products to assist in diagnosing the threat for heavy rain and potential flash flood events.
- ❑ The Overshooting Top Detection and GLD-360 Lightning Density products have been in operations (experimental mode) for 1.5 years.
- ❑ The Convective Initiation product was introduced in May-June and has already proven to be useful in diagnosing areas to focus on for heavy rain.
- ❑ The Nearcast product is the newest product, but forecasters are already finding it to be quite useful in analyzing observed Theta-E or layered PW.
- ❑ More research into the uses of these products in combination with one another will be done prior to GOES-R launch (March 2016) to give forecasters a working “toolbox” of heavy rain monitoring satellite products.



# Questions?

michael.folmer@noaa.gov

