

# Localized Aviation MOS Program (LAMP) for Aviation Forecasting

Judy E. Ghirardelli

National Weather Service  
Meteorological Development Laboratory

Chicago Aviation Workshop

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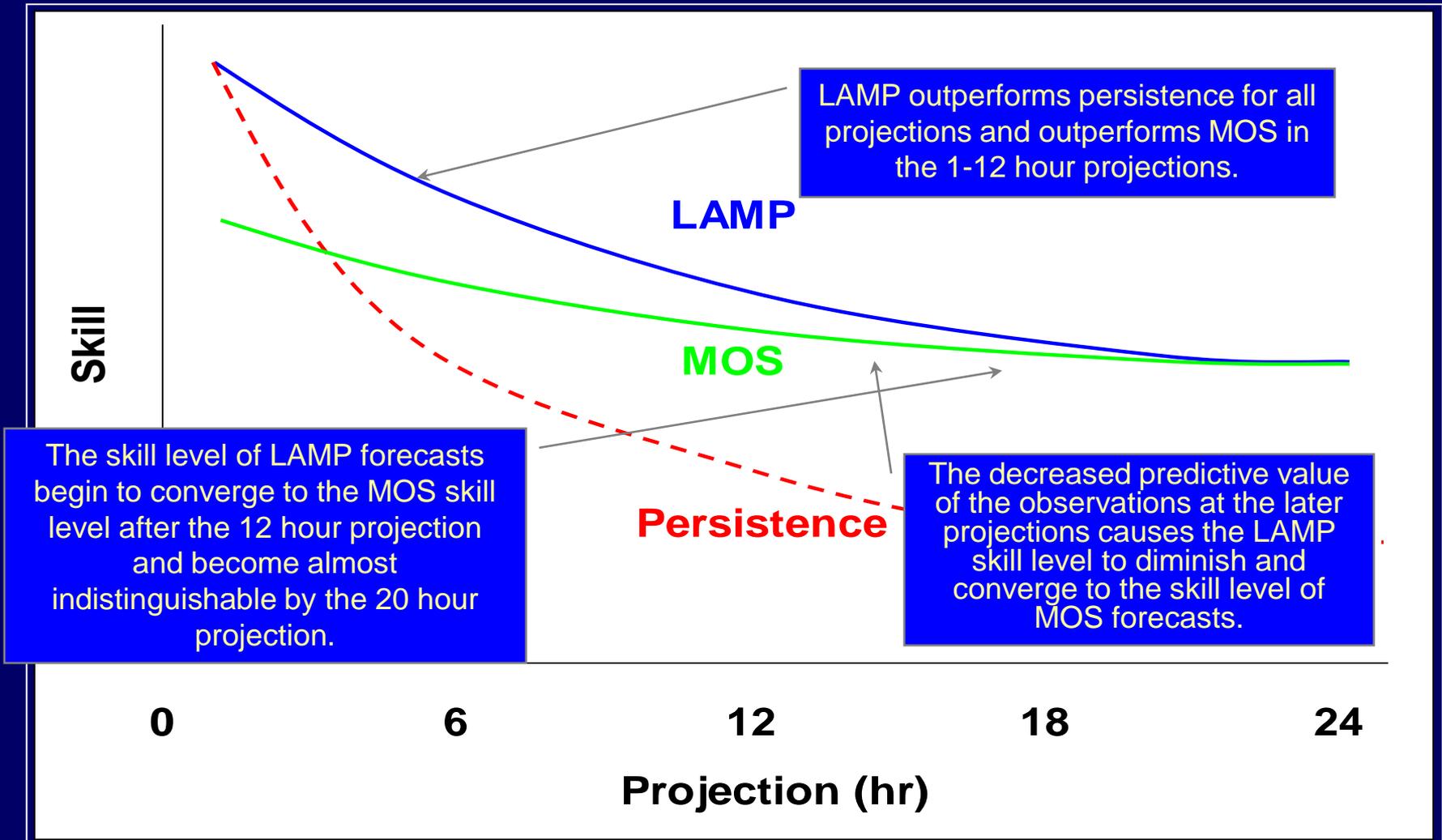
# Outline

- LAMP background
- Example of LAMP blending
- Current status and products
- Verification
- Gridded LAMP
- New LAMP Convection Product
- Future work and plans

# Localized Aviation MOS Program (LAMP) Background

- LAMP is a system of objective analyses, simple models, regression equations, and related thresholds which together provide guidance for sensible weather forecasts
- LAMP acts as an update to GFS MOS guidance
- Guidance is both probabilistic and non-probabilistic
- LAMP provides guidance for aviation elements
- LAMP bridges the gap between the observations and the MOS forecast
- 2006-2008: Implemented LAMP at stations and gridded thunderstorm guidance
- 2010: Implemented experimental version of Gridded LAMP centrally at NCEP

# Theoretical Concept of LAMP



# LAMP Guidance Details

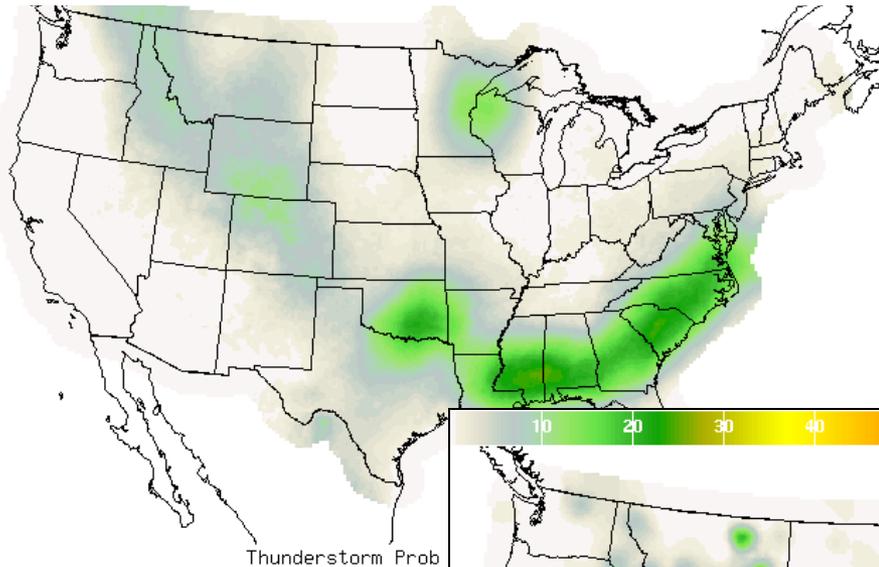
- LAMP guidance is in the range of 1- 25 hours in 1 hour projections
  - Runs 24 times a day (every hour) in NWS operations
  - **Types of Predictors:**
    - Station observations (METAR)
    - Gridded observations (radar, lightning)
    - MOS output
    - Model Output
  - **LAMP provides station-oriented guidance for:**
    - all LAMP forecast elements
    - ~1600 stations
    - CONUS, Alaska, Hawaii, Puerto Rico
  - **LAMP provides grid-oriented guidance for:**
    - Thunderstorms:
      - Probability of thunderstorm occurrence/best category of an occurrence (yes/no) in a 2 hour period in a 20-km grid box
    - Temperature
    - Dewpoint
    - Ceiling Height
    - Visibility
- New “Gridded LAMP” elements
  - Analyses of observations and LAMP forecasts

# Example of a GFS LAMP Text Bulletin

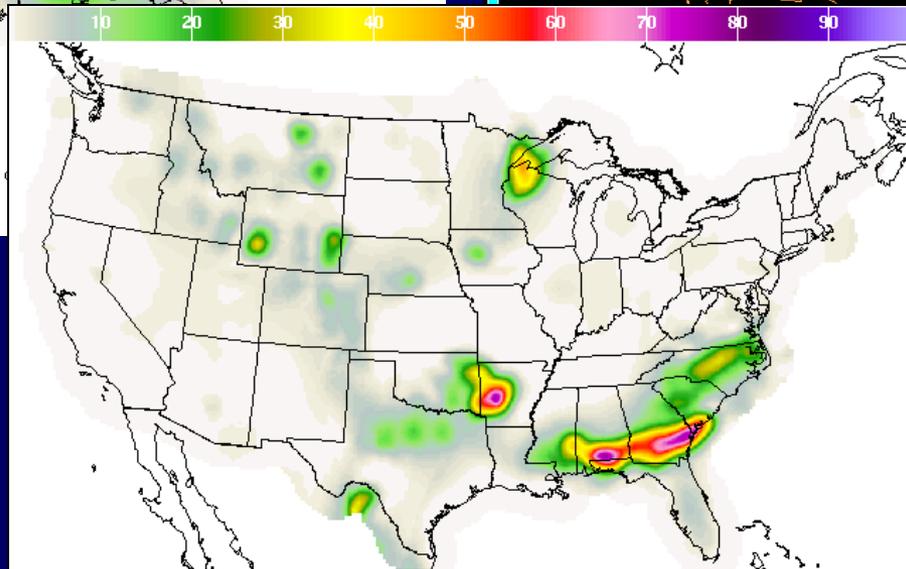
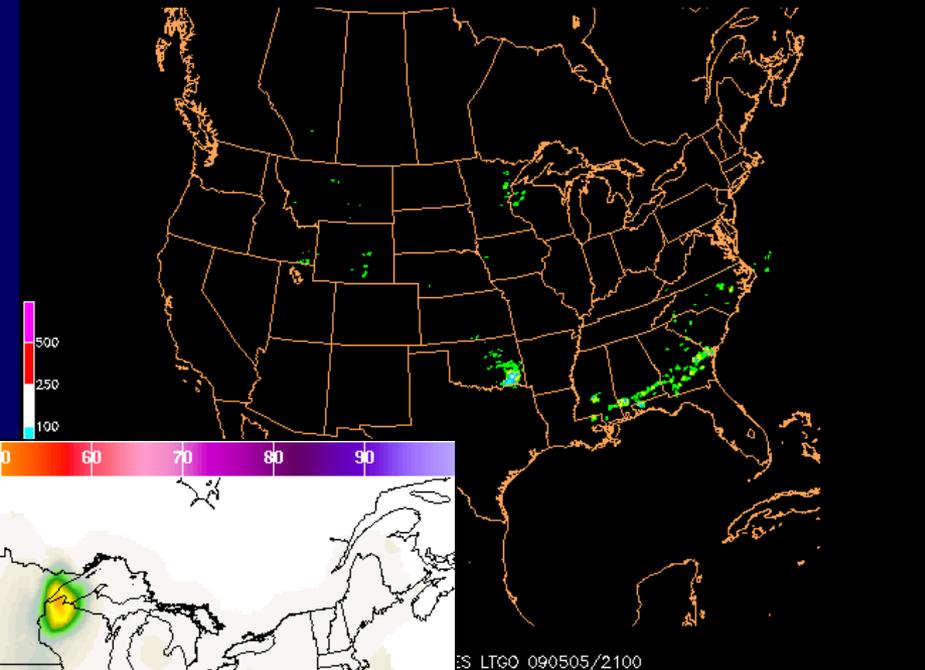
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# Example of blending Obs and MOS: 1-3 hr LAMP Thunderstorm forecast

Predictor: 12 UTC MOS Thunderstorm  
Prob Valid 22 – 00 UTC



Predictor: 21 UTC lightning strike data

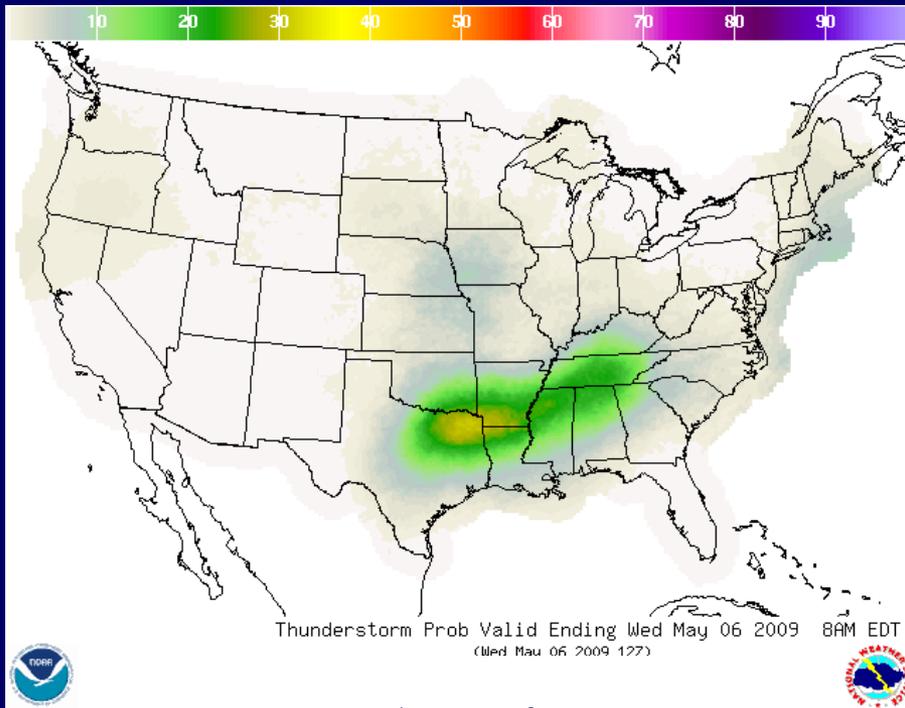


21 UTC LAMP Thunderstorm  
Probability Valid 22-00 UTC

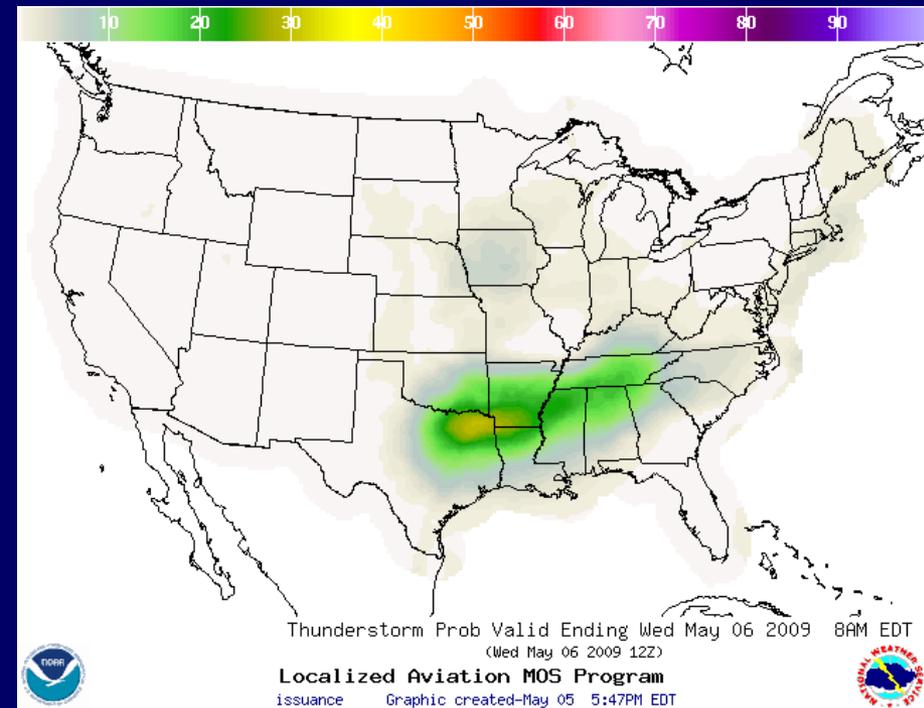


# 13-15 hr LAMP Thunderstorm forecast

12 UTC MOS Thunderstorm Probability  
– Valid 10 – 12 UTC (next day)



21 UTC LAMP Thunderstorm Probability  
– Valid 10 – 12 UTC (next day)

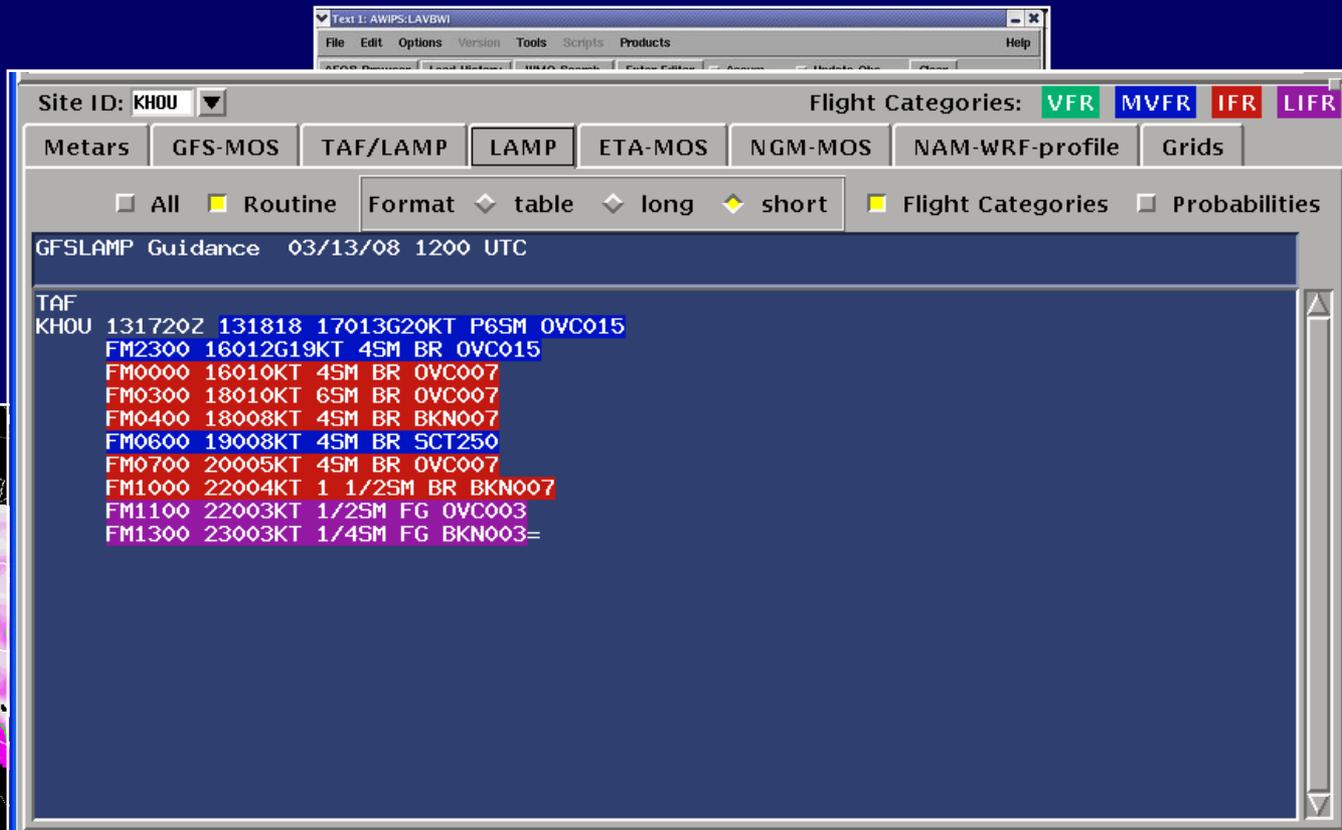


# LAMP Current Status: Available Products

- At NWS WFOs:
  - Currently operational guidance viewable at WFOs
  - Experimental Gridded LAMP grids can be brought into GFE via the LDM data feed
- Website products:
  - Text bulletins
  - Station plots
  - Meteograms
  - Probability/Threshold images
  - Gridded Thunderstorm images
  - Experimental Gridded LAMP images
- Via FTP, in the National Digital Guidance Database:
  - Station-based LAMP bulletins (ASCII)
  - Station-based LAMP forecasts (BUFR)
  - Gridded LAMP thunderstorm guidance (GRIB2)
  - Experimental Gridded LAMP products (GRIB2)

# Overview of Available Products

- Available to NWS forecasters via AWIPS
  - Guidance is viewed as text or graphically by forecasters
  - Guidance is input into software for preparing TAFs



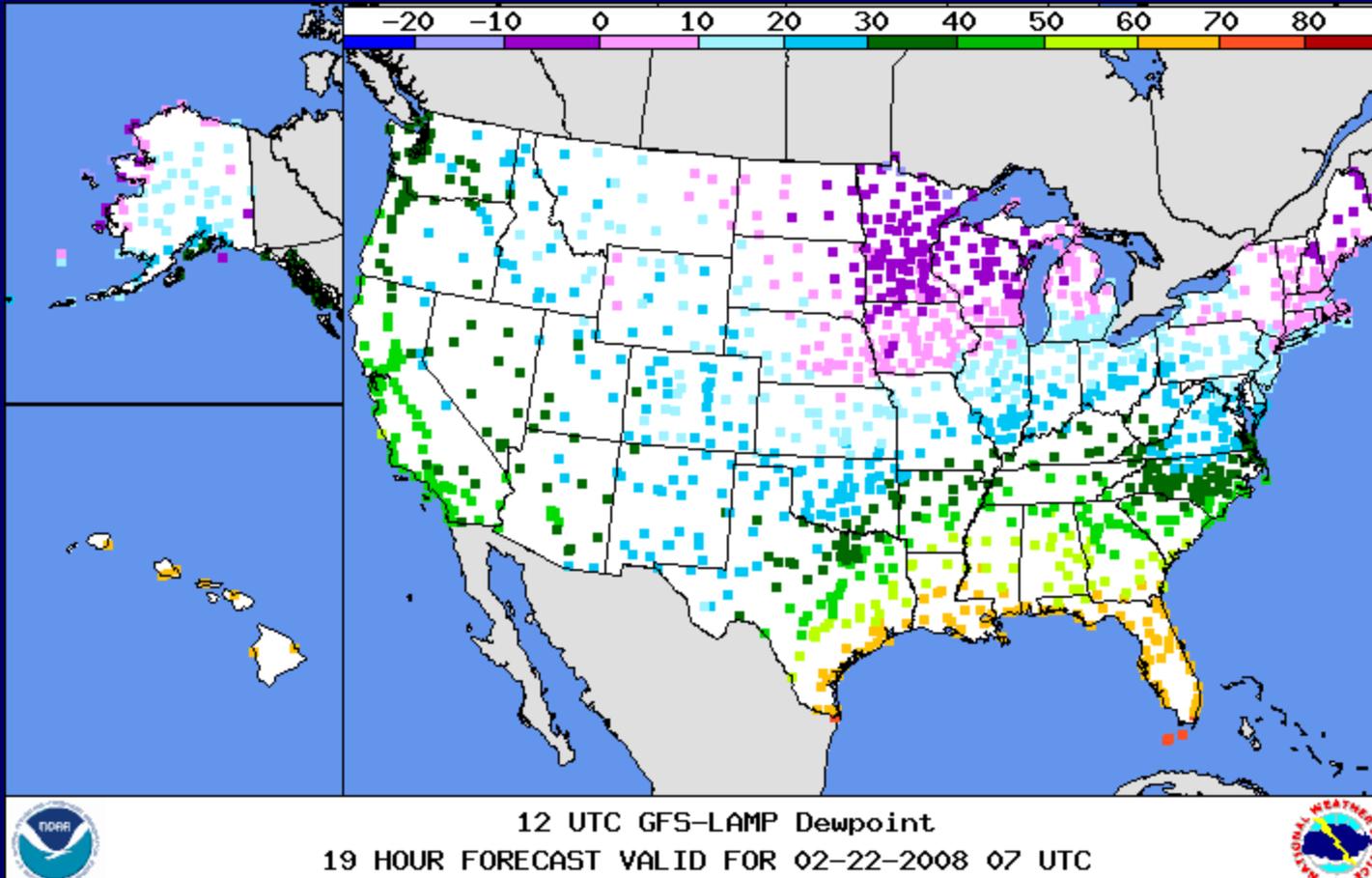
The screenshot displays the AWIPS software interface. At the top, a window titled 'Text 1: AWIPS:LAVBWI' is visible. Below it, the main application window shows 'Site ID: KHOU' and 'Flight Categories: VFR MVFR IFR LIFR'. The 'TAF/LAMP' tab is selected, and the 'Format' dropdown is set to 'short'. The main display area shows 'GFSLAMP Guidance 03/13/08 1200 UTC' and a TAF for KHOU with the following forecast data:

```
TAF
KHOU 131720Z 131818 17013G20KT P6SM OVC015
FM2300 16012G19KT 4SM BR OVC015
FM0000 16010KT 4SM BR OVC007
FM0300 18010KT 6SM BR OVC007
FM0400 18008KT 4SM BR BKN007
FM0600 19008KT 4SM BR SCT250
FM0700 20005KT 4SM BR OVC007
FM1000 22004KT 1 1/2SM BR BKN007
FM1100 22003KT 1/2SM FG OVC003
FM1300 23003KT 1/4SM FG BKN003=
```

# Website: LAMP Station Plots

## Elements

- Flight Category
- Ceiling Height
- Visibility
- Obstruction to Vision
- Total Sky Cover
- Precipitation Type
- Probability of Precipitation
- Wind Speed
- Wind Gust
- Wind Direction
- Temperature
- Dewpoint



[Click an element name on this slide to see its plot](#)



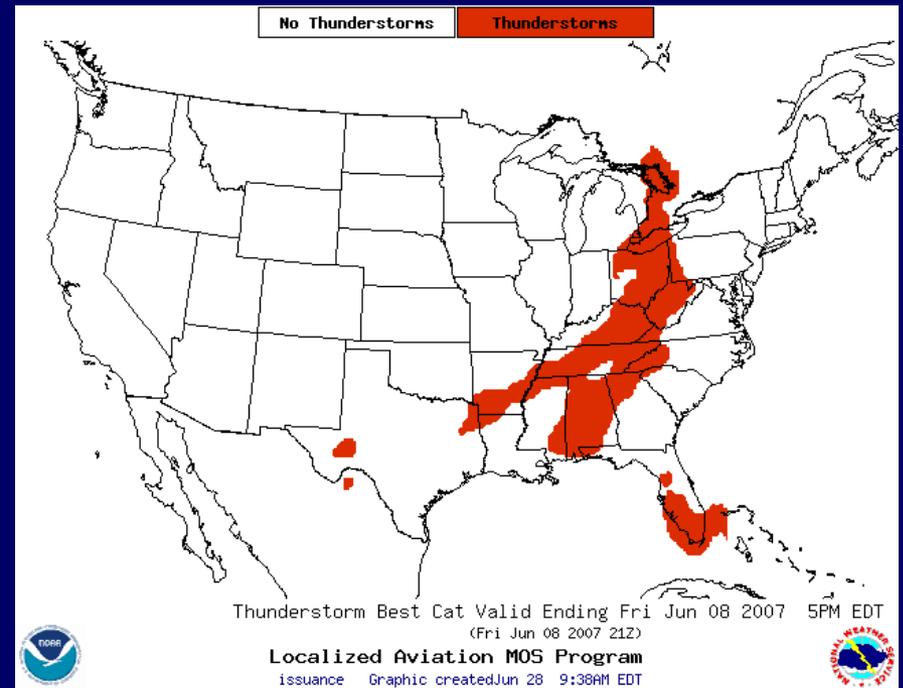
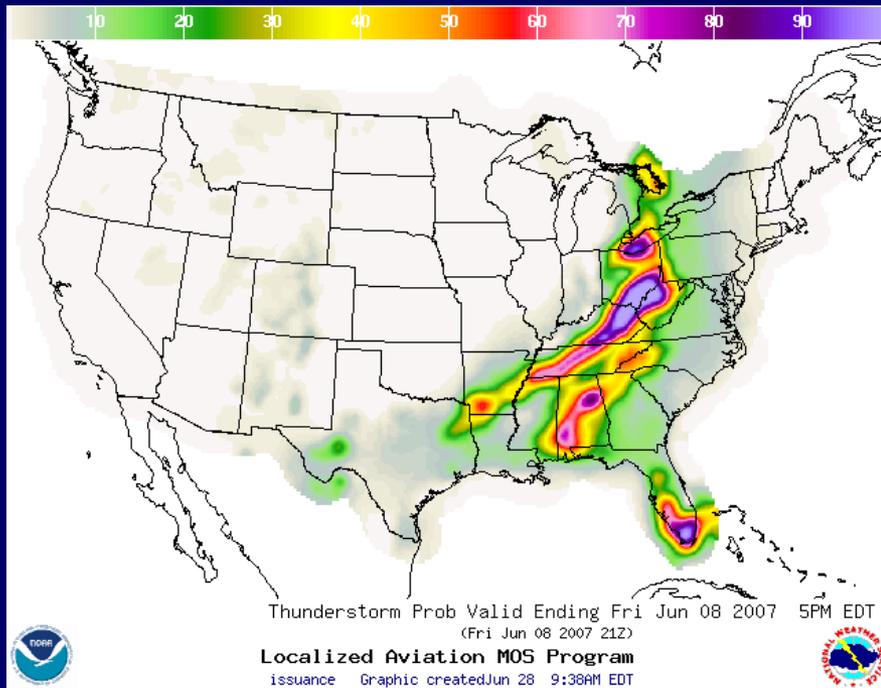
# Website: LAMP Station Meteograms



## Features

- Up to 12 displayable LAMP forecast elements
- Real-time verification of current and past cycles
- Verification of completed past cycles including the corresponding GFS MOS forecast

# Website: LAMP Thunderstorms Probabilities and Best Category (Y/N) All Projections

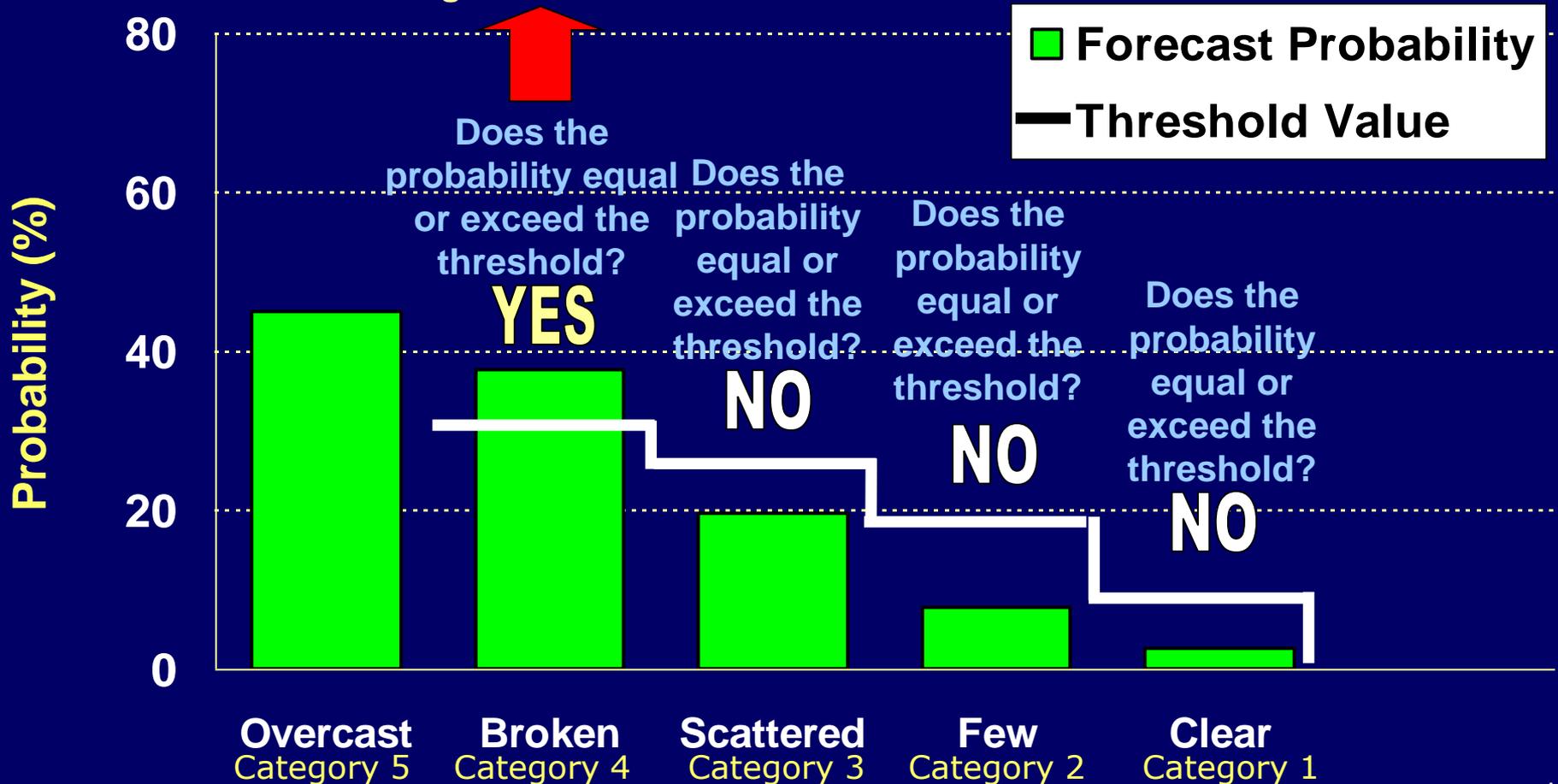


# LAMP probability/threshold used to make Categorical Forecasts

- LAMP regression equations output:
  - Continuous value forecasts (e.g., temperature, dewpoint, wind speed) or
  - Probabilities of events (e.g., ceiling < 1000 feet, visibility < 1/2 mile, sky cover of broken).
- To make categorical forecasts, LAMP uses:
  - Probabilities from the regression equations and
  - Thresholds
- Thresholds are derived to either:
  - Maximize the threat score within a certain bias range, or
  - Achieve Unit Bias

# LAMP Categorical Forecast Selection Process

The probability of “broken” exceeds the threshold value for “broken” – therefore LAMP categorical forecast is “broken”

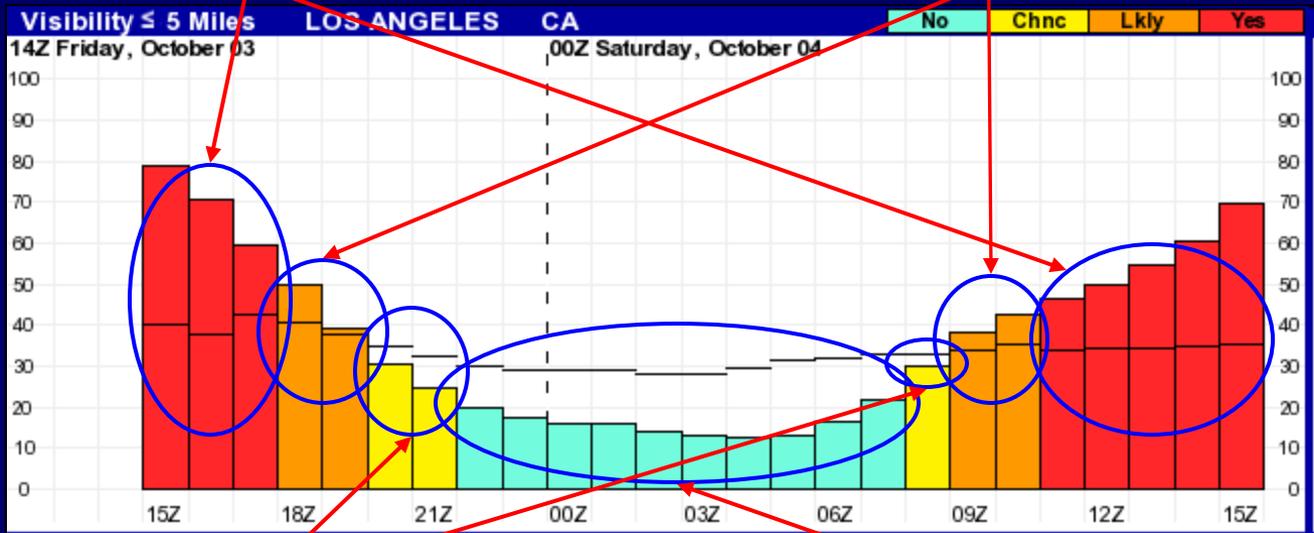


# LAMP Probabilities and Thresholds for Flight Categories

## Uncertainty Plot Tab – looking at vis ≤ 5 miles

Red=Yes  
Probability exceeds threshold by more than 10%

Orange=Likely  
Probability exceeds threshold but NOT by more than 10%



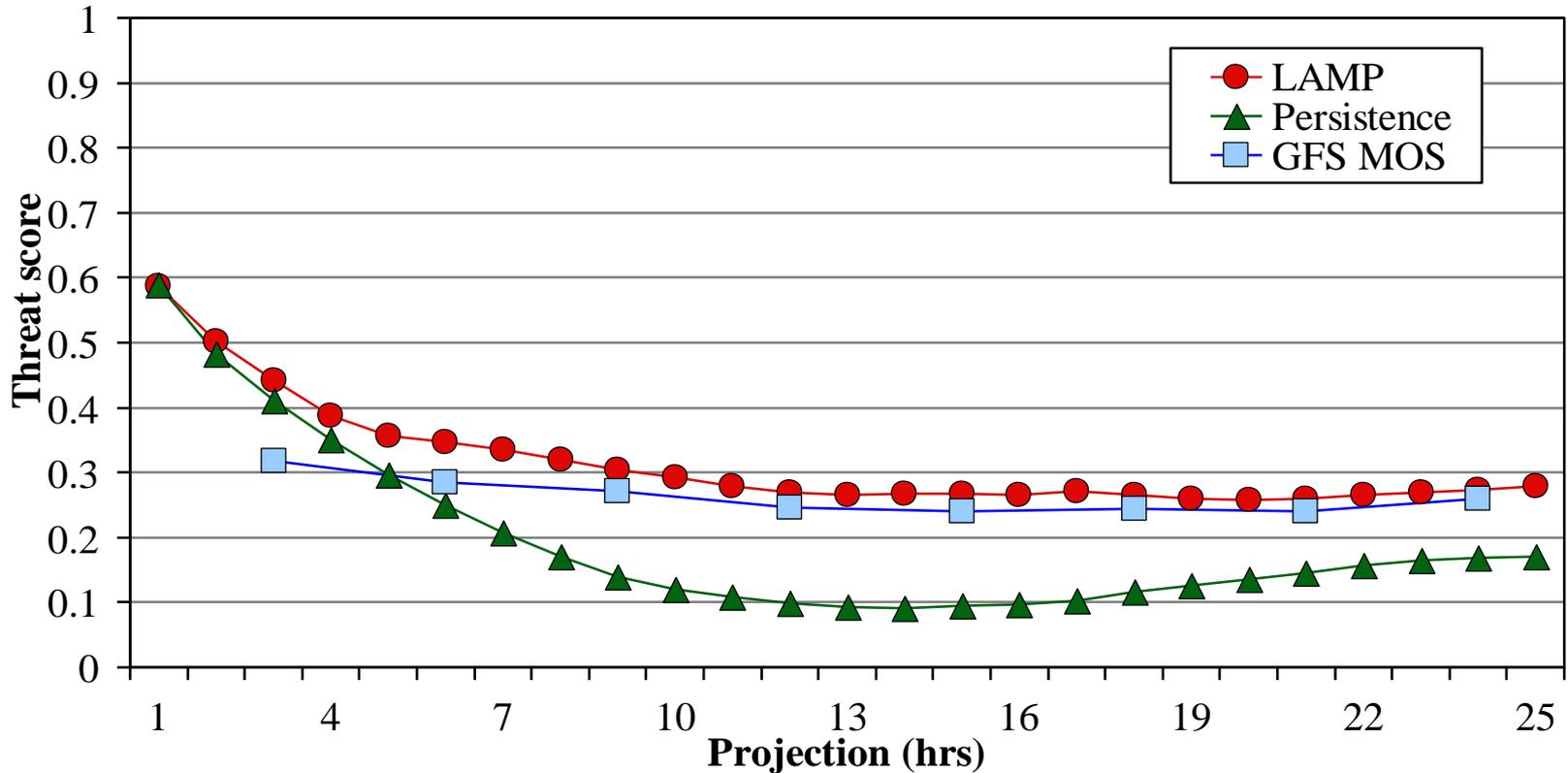
Yellow = Chance  
Probability is less than threshold

Cyan = No  
Probability is less than threshold

Note that this shows you one condition (e.g., vis ≤ 5 miles). To determine the most likely condition, you should consider rarer conditions first.

# Verification

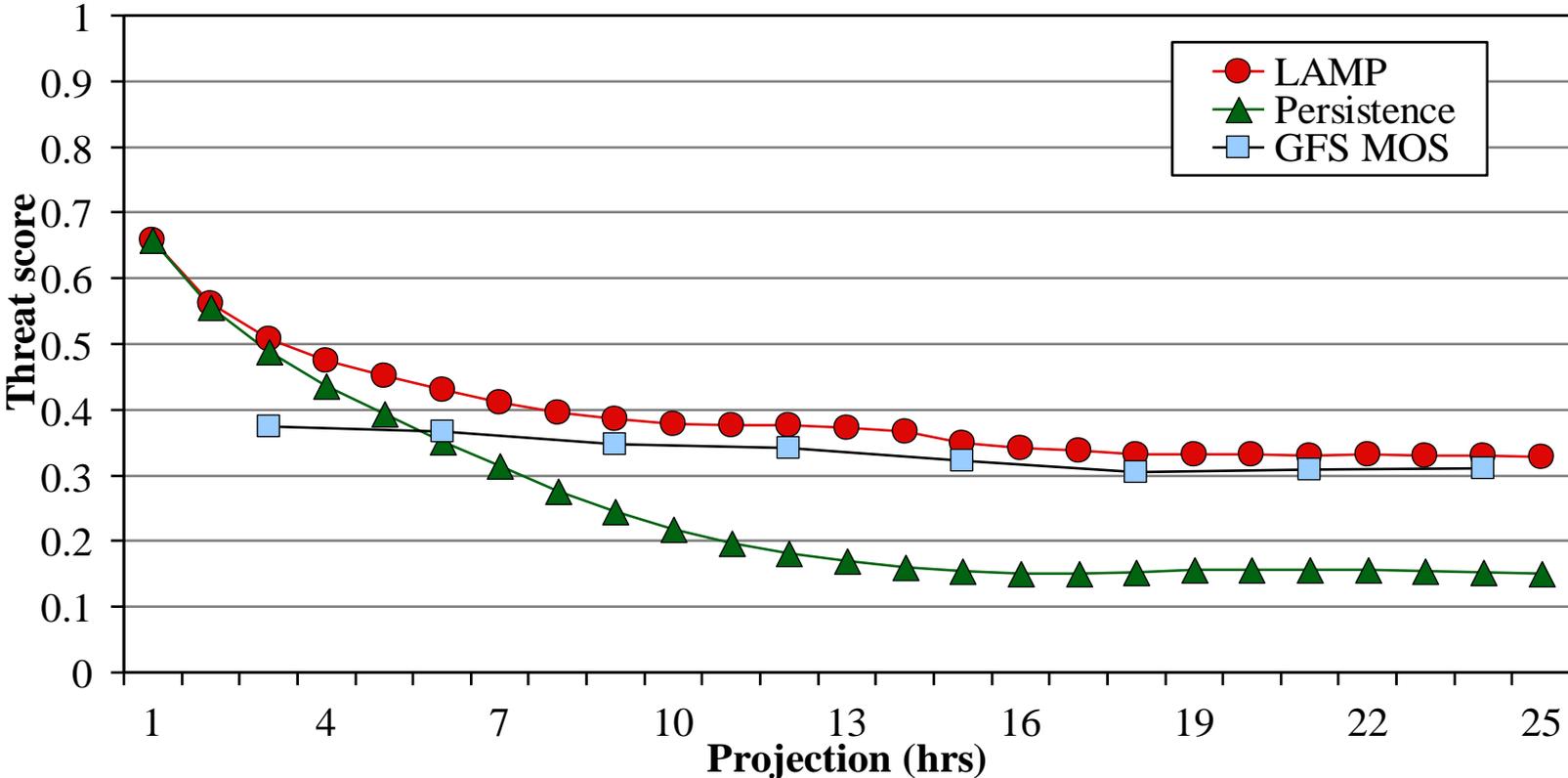
## IFR Conditions or lower - Warm Season



1522 stations, 0900 UTC LAMP, 0000 UTC GFS MOS  
verification period: Apr – Sep 2007

# Verification

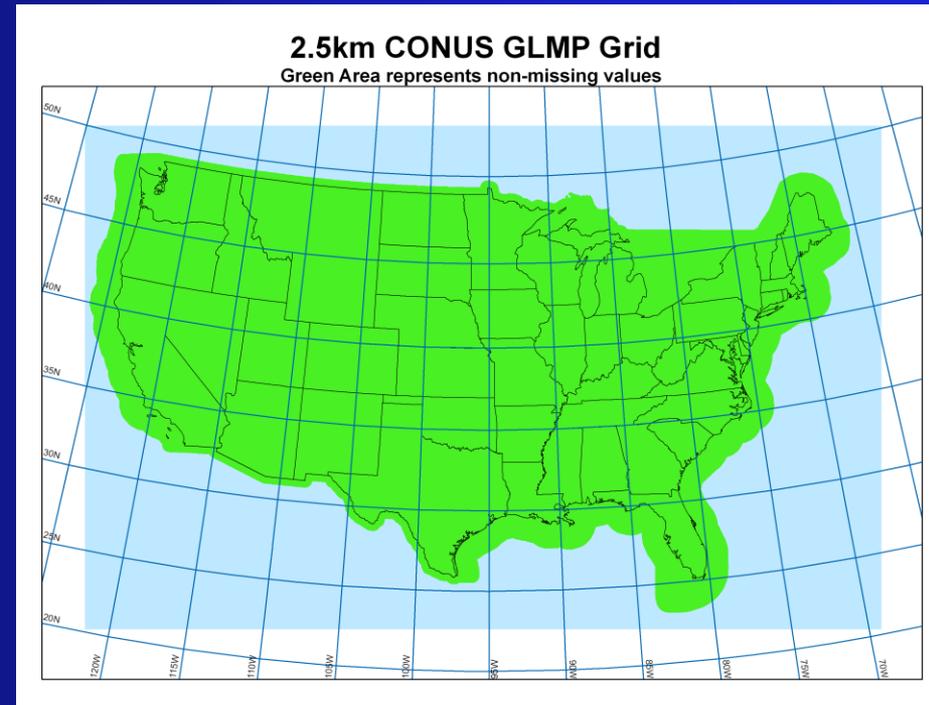
IFR Conditions or lower - Cool Season



1522 stations, 0900 UTC LAMP, 0000 UTC GFS MOS  
verification period: Oct 2007 – Mar 2008

# Gridded LAMP Work

- Gridded observations and LAMP forecasts of:
  - Temperature
  - Dewpoint
  - Ceiling Height (100's of ft)
  - Visibility (miles)
  - Other elements later
- Will be available via the NextGen 4-D Data Cube
- Status:
  - Running experimentally at NCEP as of 9/28/2010
  - Available in Experimental NDGD
  - Images available on MDL/LAMP web page



# Gridded LAMP Work

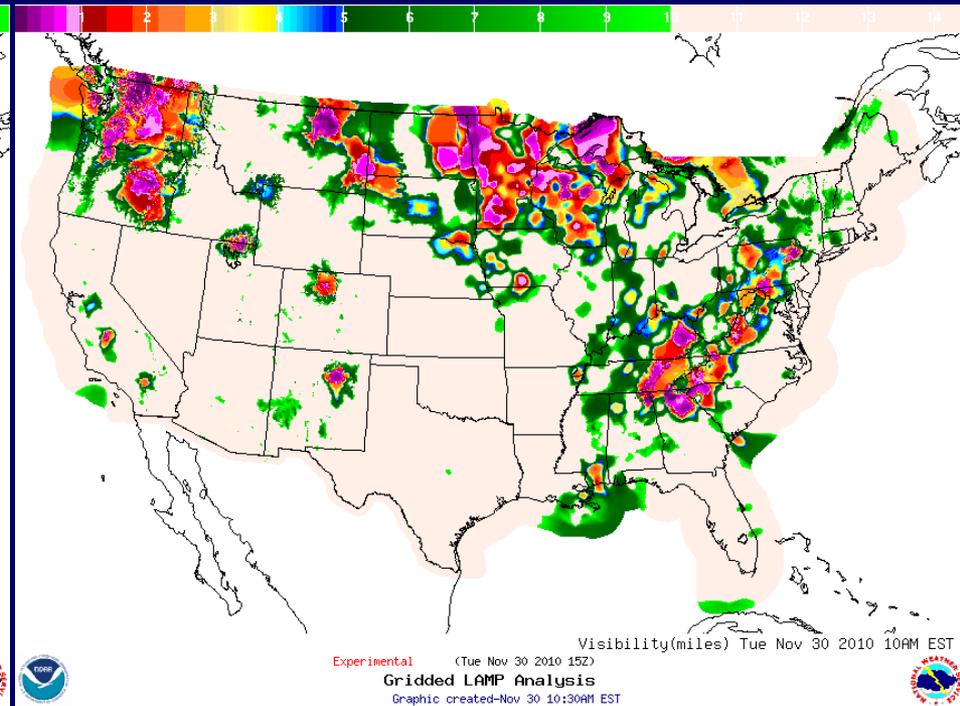
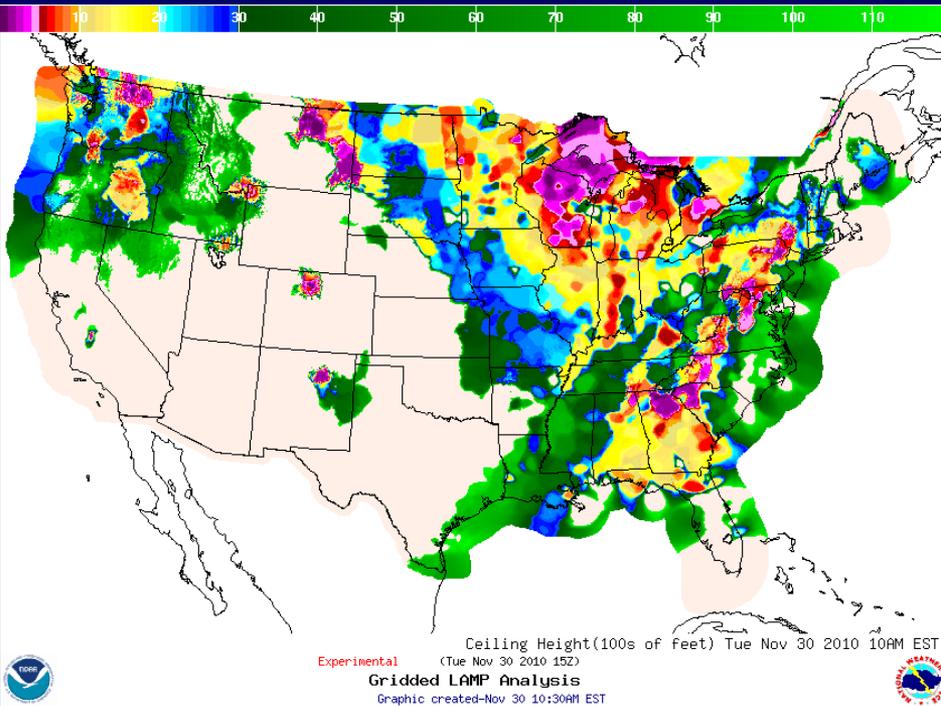
- Gridded LAMP analyses of **observations** – for checkout and verification
  - Temperature and Dewpoint:
    - Observations from METAR, Mesonet, synoptic stations, C-MAN, tide gauges, and moored buoys (Roughly 10,000 – 12,000 observations per hour)
  - Ceiling and Visibility:
    - Observations from METAR
- Analysis of LAMP **forecasts**
  - Temperature and dewpoint: continuous values are analyzed
  - Ceiling Ht and Vis: categorical values are converted to continuous values

Technique: MDL Gridding Technique used in Gridded MOS, with modifications

# Gridded LAMP Work: Gridded Observations

## Ceiling Height Observations

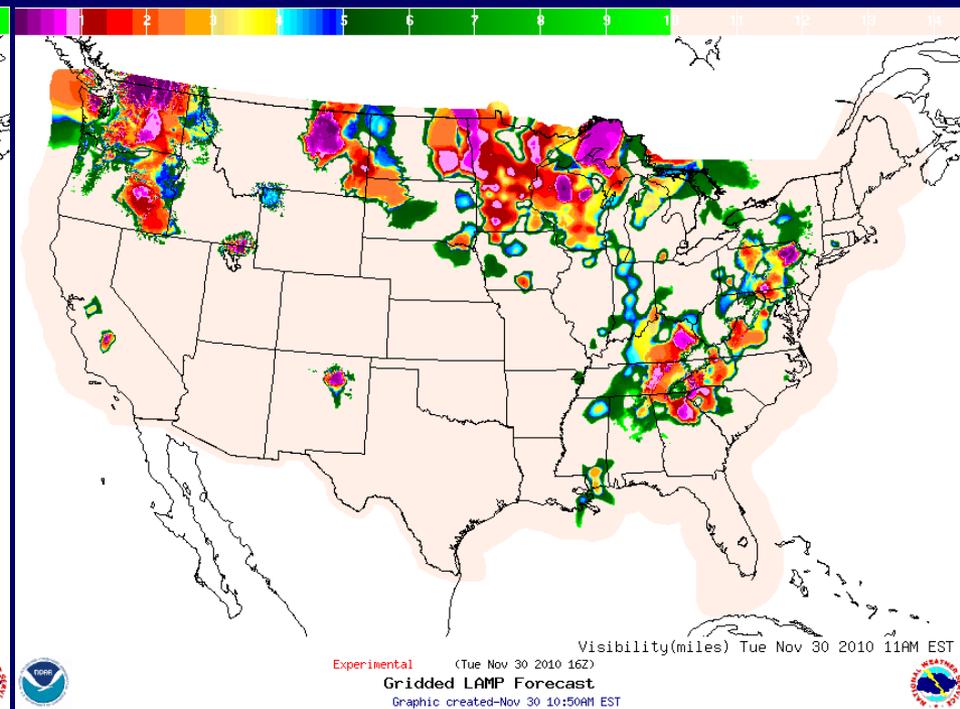
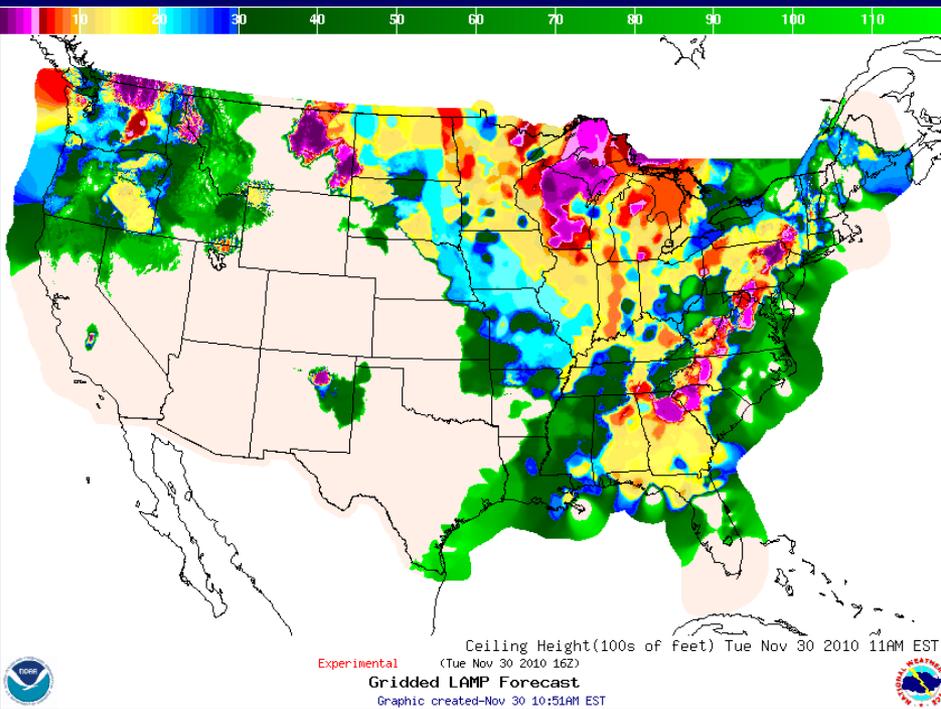
## Visibility Observations



# Gridded LAMP Work: Gridded Forecasts

Ceiling Ht Forecasts 1-25 hours

Visibility Forecasts 1-25 hours

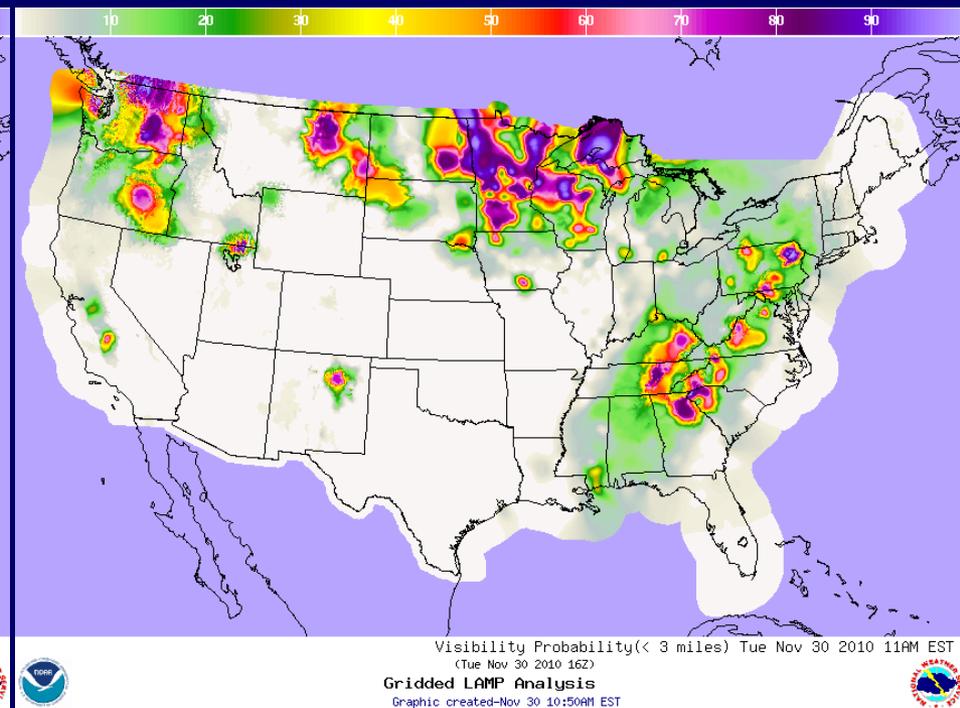
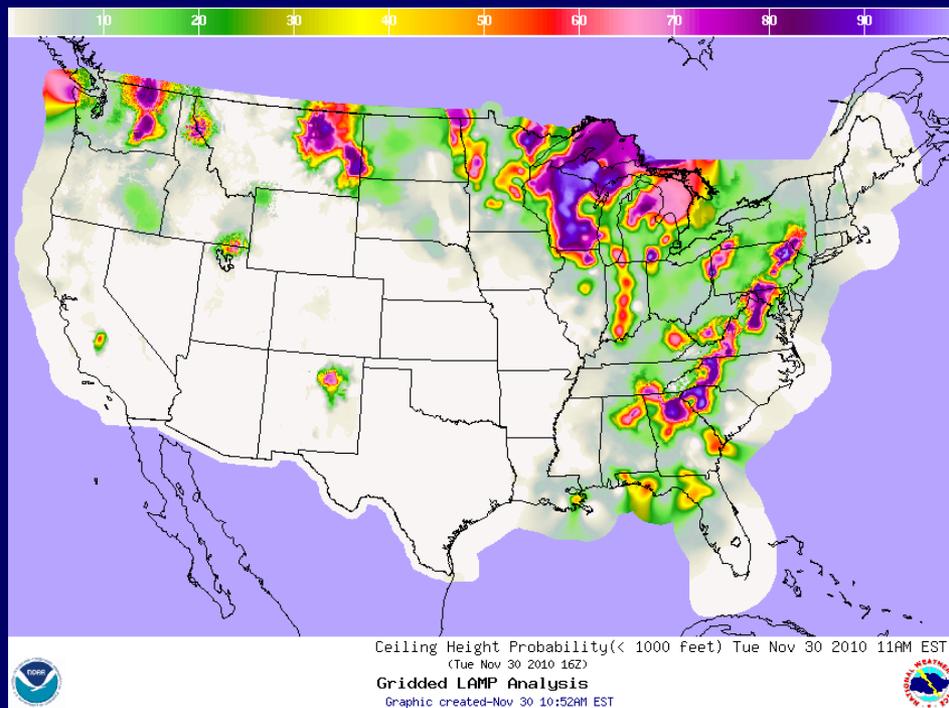


# Gridded LAMP Work: Gridded Probability Forecasts

Not yet implemented

Ceiling Ht Prob. Forecasts 1-25 hrs

Visibility Prob. Forecasts 1-25 hrs



# Future Work: New LAMP Convective Guidance

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## Thunderstorm (current)

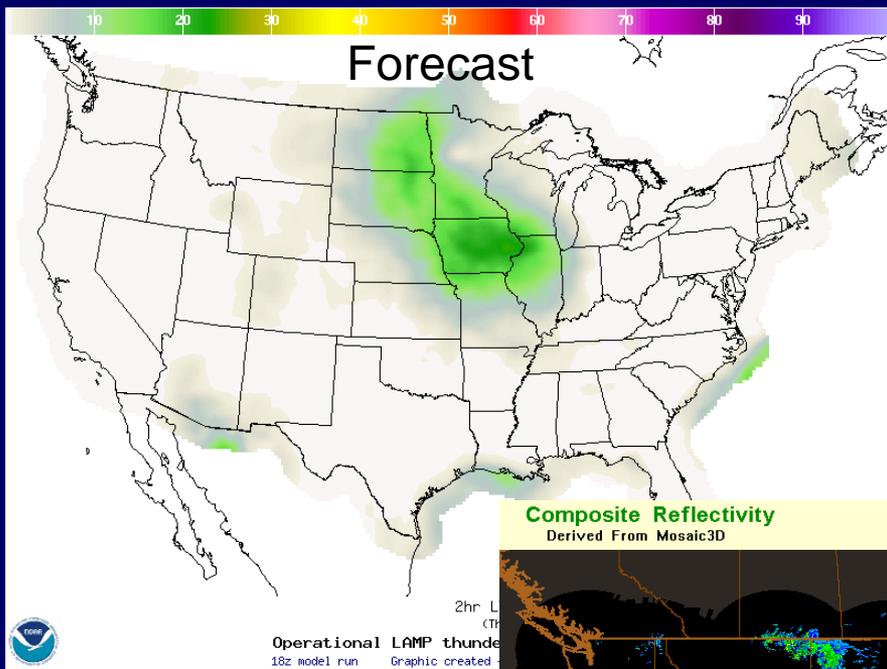
- Features:
  - Defined from Cloud-to-Ground (CTG) Itg
  - GFS MOS 3-h thunderstorm probability predictors
  - 2-h period / 20-km gridboxes
  - 1-h cycle; 3 – 25 h projections
  - Other predictors
- Criticisms:
  - Convection can occur without lightning
  - Thunderstorm probabilities lack sharpness

## Convection (future)

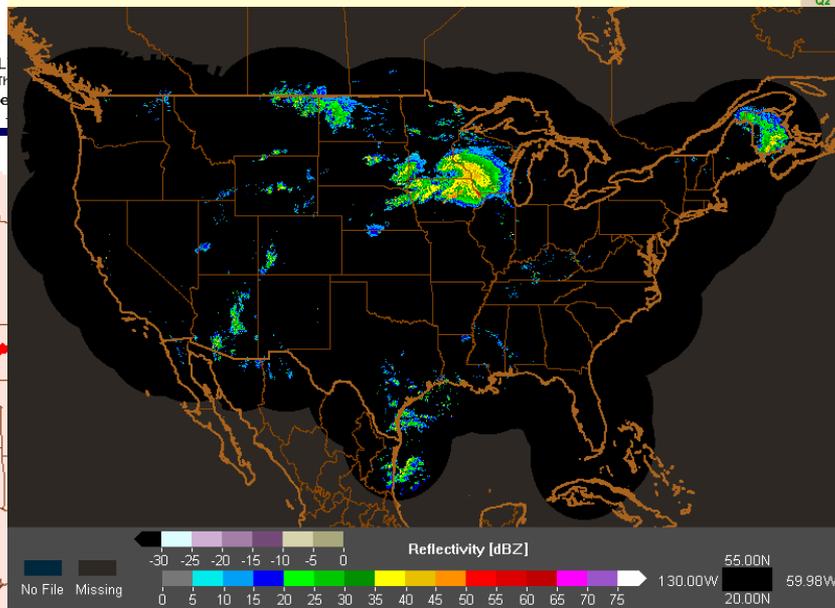
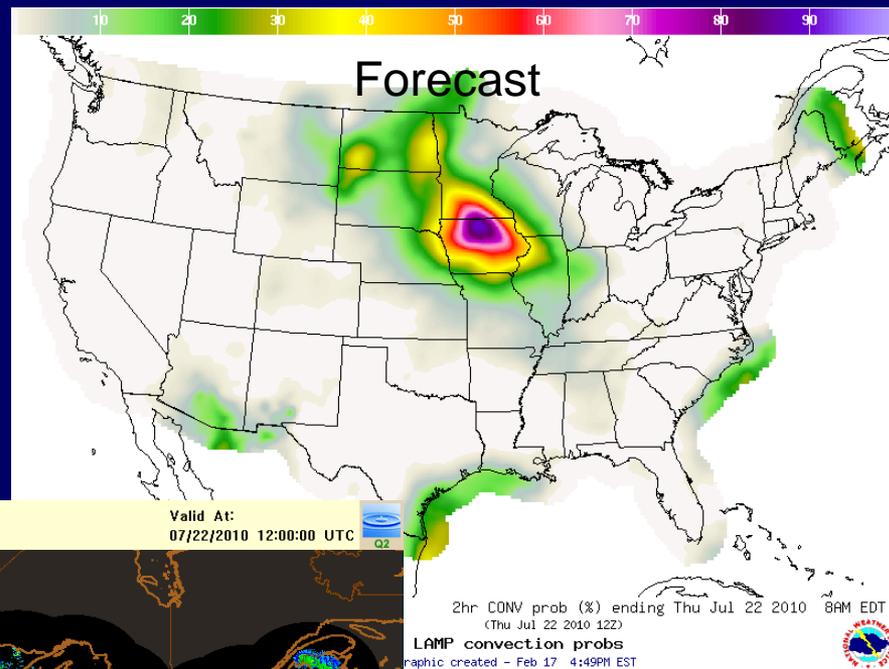
- Features:
  - Defined from CTG Itg /  $\geq 40$  dBZ radar reflectivity
  - GFS & NAM MOS 2-h convective probability predictors
  - 2-h period / 20-km gridboxes
  - 1-h cycle; 3 – 25 h projections
  - Other predictors
- Solution:
  - Convection can be indicated when there is little or no lightning
  - Convection probabilities exhibit good sharpness

# 18-h LAMP probabilities and verification from 1800 UTC 21 Jul 2010

## LAMP Lightning Product



## LAMP Convection Product

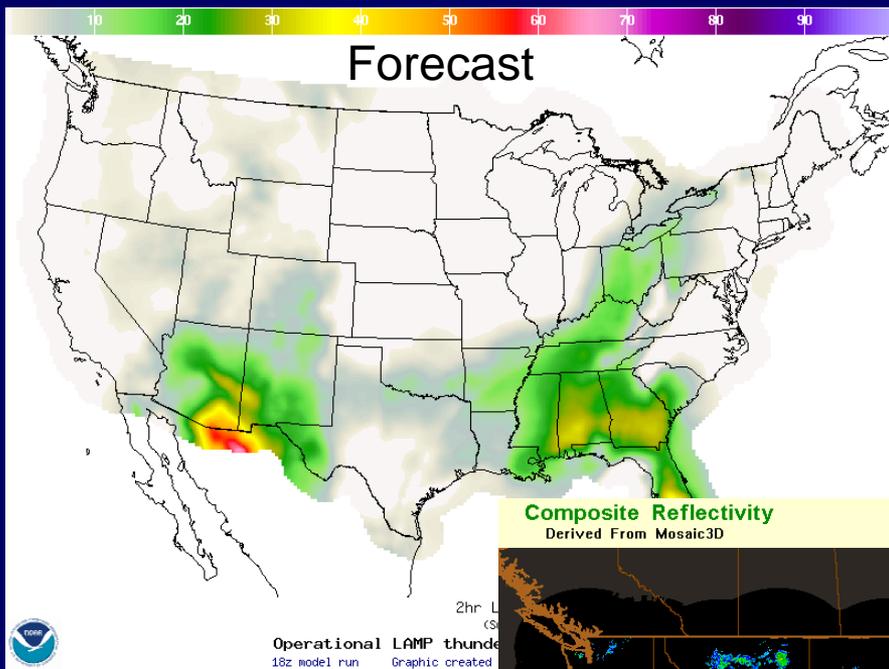


Verifying Lightning

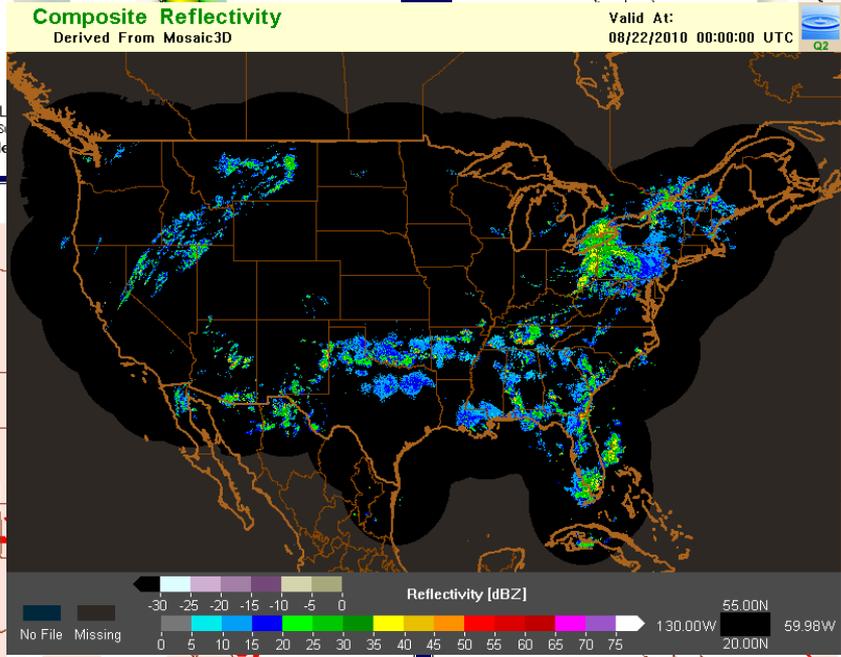
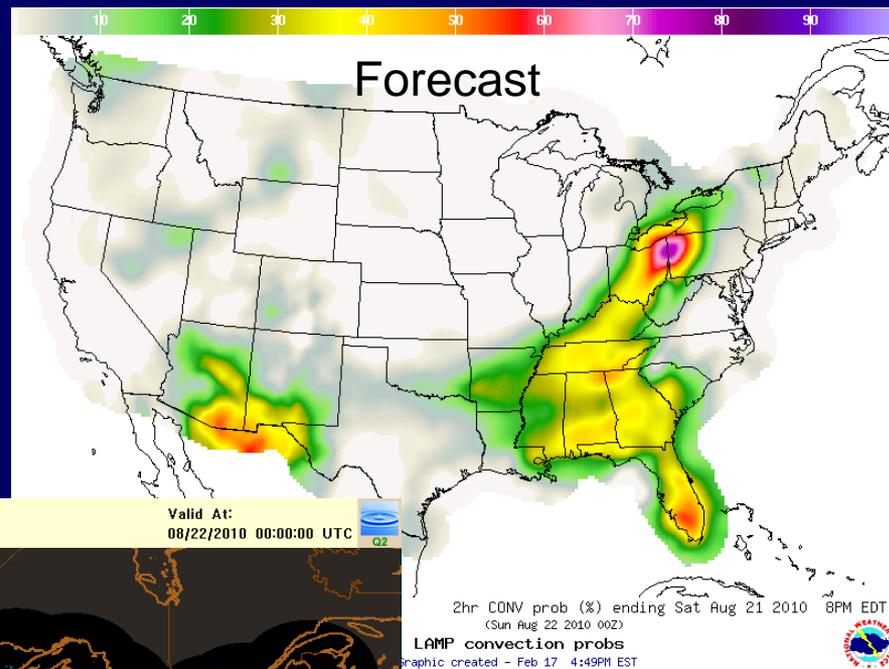
Verifying Lightning/Radar

# 6-h LAMP probabilities and verification from 1800 UTC 21 Aug 2010

## LAMP Lightning Product



## LAMP Convection Product

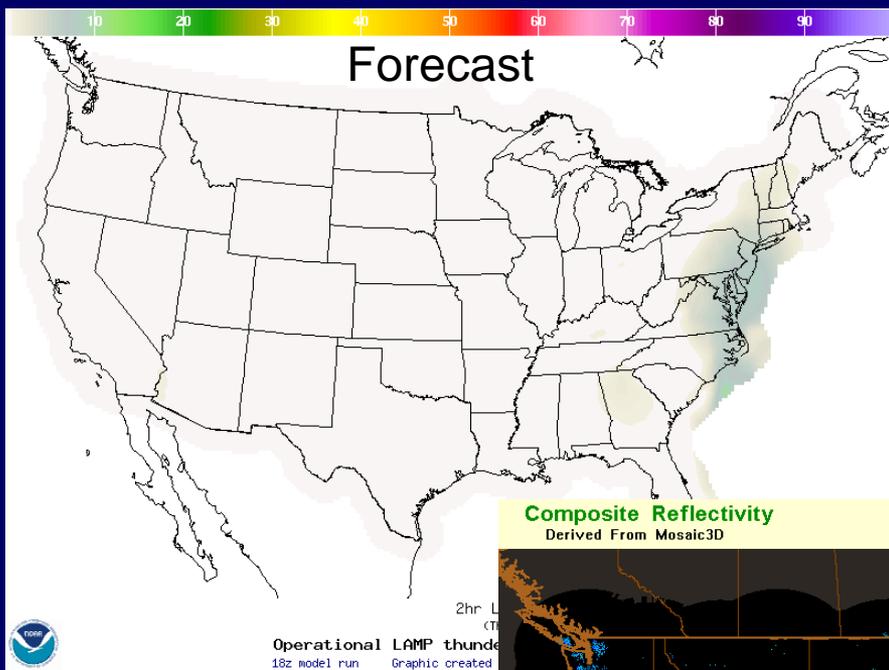


Verifying Lightning

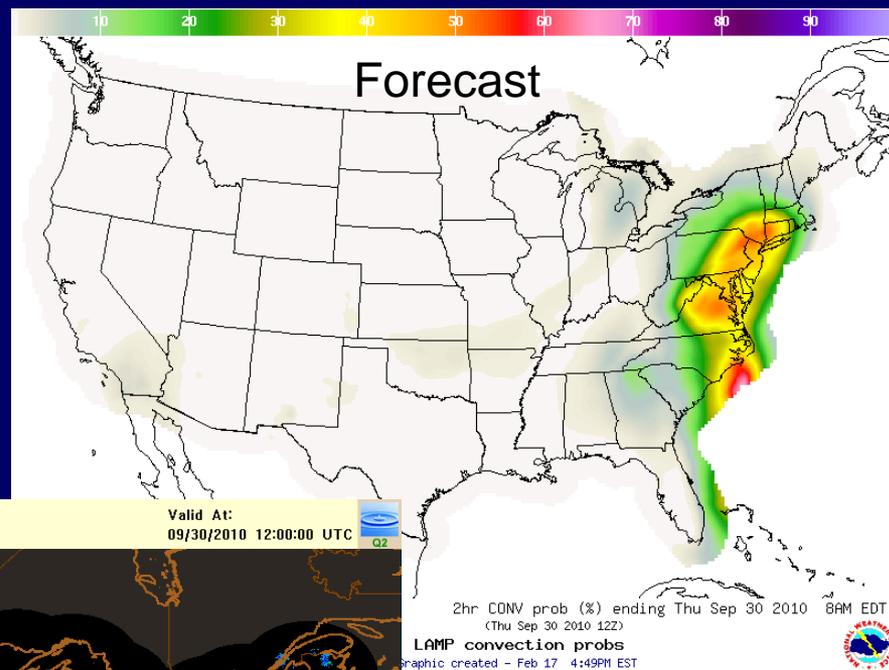
Verifying Lightning/Radar

# 18-h LAMP probabilities and verification from 1800 UTC 29 Sep 2010

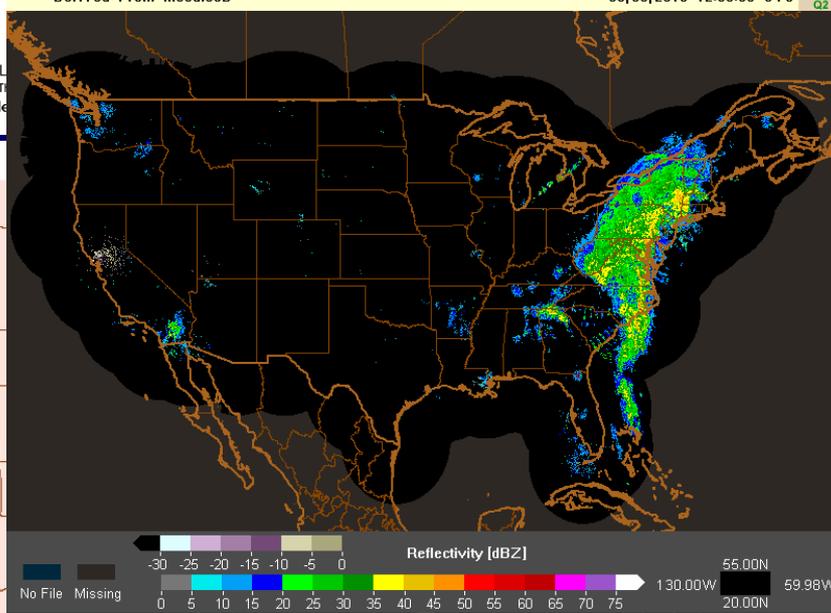
## LAMP Lightning Product



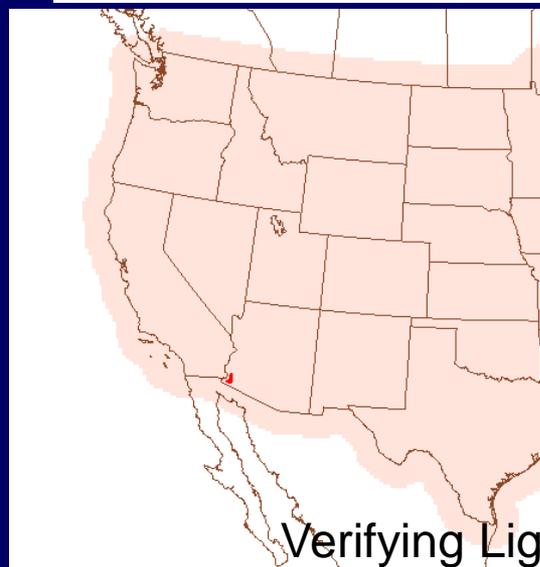
## LAMP Convection Product



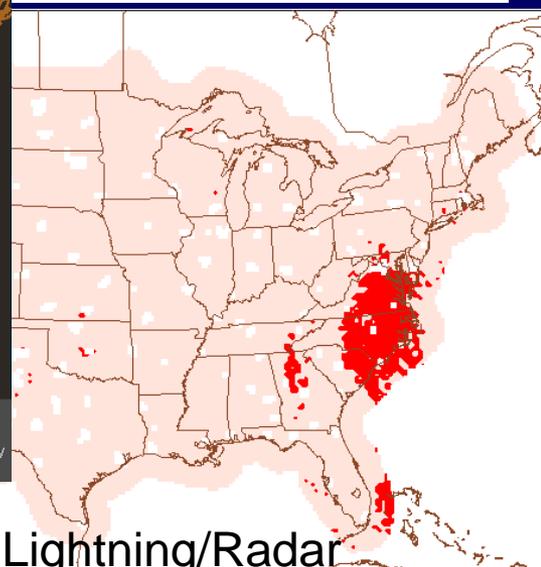
### Composite Reflectivity



## Verifying Lightning



## Verifying Lightning/Radar



# Future Plans

- **Station work:**
  - Add 119 stations to match those which were added to GFS MOS 03/2010
  - Test the effects of adding Canadian and marine stations to help Gridded LAMP products. (Additional stations should benefit Gridded LAMP products)
  - Redevelop LAMP station guidance of ceiling height and opaque sky cover
  - Forecast Consistency
    - Minimize temporal inconsistencies for aviation weather elements
    - Remove all inter-element inconsistencies
- **Gridded Work:**
  - Verify grids
  - Add ceiling height and visibility probabilities
  - Test/revise temperature and dewpoint GLMP scheme
  - Add sky cover, winds, obstruction to vision
- **New LAMP Convection product**

# Questions?

- LAMP Website:
  - <http://www.nws.noaa.gov/mdl/gfslamp/gfslamp.shtml>
- LAMP Mailing List for notification/announcements:
  - <http://www.nws.noaa.gov/mdl/lamp/joinlist.shtml>
- Training Materials:
  - <http://www.nws.noaa.gov/mdl/gfslamp/docs/presentations.shtml>
    - Training on LAMP Background: “An Introduction to The Localized Aviation MOS Program (LAMP)” by David Rudack.
    - Training on LAMP Products: “Accessing and Using GFS LAMP Products” by Scott Scallion.
- Contact:
  - [Judy.Ghirardelli@noaa.gov](mailto:Judy.Ghirardelli@noaa.gov)