Localized Aviation Model Output Statistics Program (LAMP): Improvements to convective forecasts in response to user feedback

Judy E. Ghirardelli

National Weather Service
Meteorological Development Laboratory

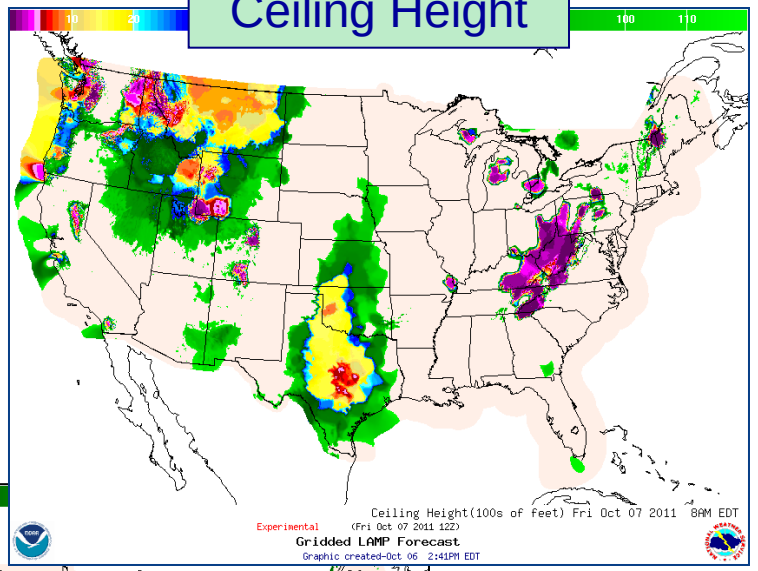
October 11, 2011

“Friends/Partners in Aviation Weather” Forum
NBAA Convention
Las Vegas, NV

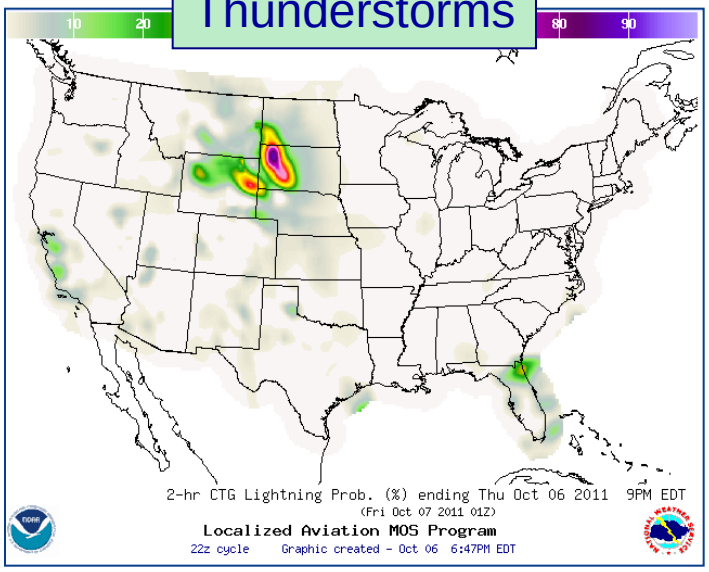
LAMP Background

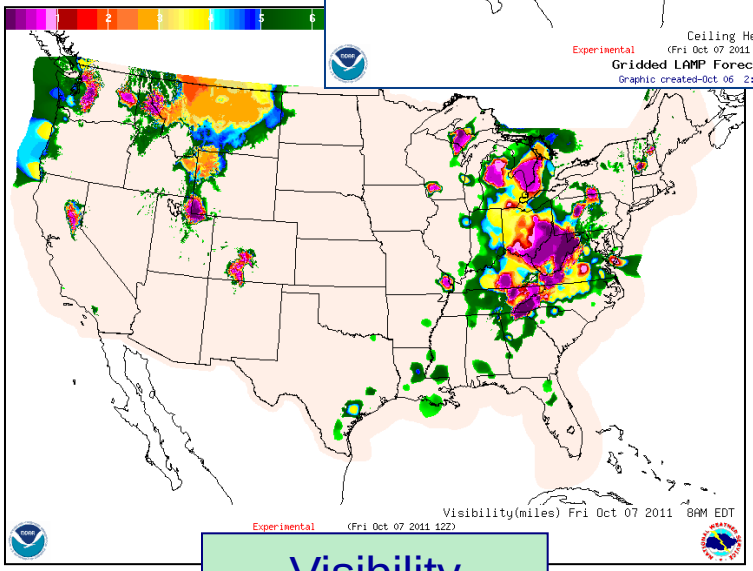
- Statistical Guidance of sensible weather
  - Produced hourly, 25-h forecast period
  - Valid at stations (airports) and on a grid
- Elements of interest to Aviation:
  - Winds (at stations)
  - Ceiling height (at stations and gridded)
  - Visibility (at stations and gridded)
  - Thunderstorms (at stations and gridded)

Ceiling Height



Thunderstorms





Visibility

How Did New LAMP Convection Guidance Evolve ?

- Existing Product: LAMP Lightning (LAMP ltg)
  - Predictand: ≥ 1 Cloud-to-Ground (CTG) lightning strike
- Review of existing practices to verify convection products (ESRL) indicates radar refl. of ≥ 40 dBZ used as indicator of "convection"
  - Problem: the verifying "truth" is not consistent with what LAMP lightning was intended to forecast
- FAA evaluation of operational LAMP ltg probabilities
  - Lacks spatial detail, skill, and sharpness especially beyond 6 hours
- MDL decisions (June 2010)
  - Define convection predictand:
    - radar ≥ 40 dBZ and/or ≥ 1 CTG lightning strikes
  - Add NAM MOS (to GFS MOS) convection probabilities as additional model input

New LAMP Convective Guidance

Thunderstorm (current)

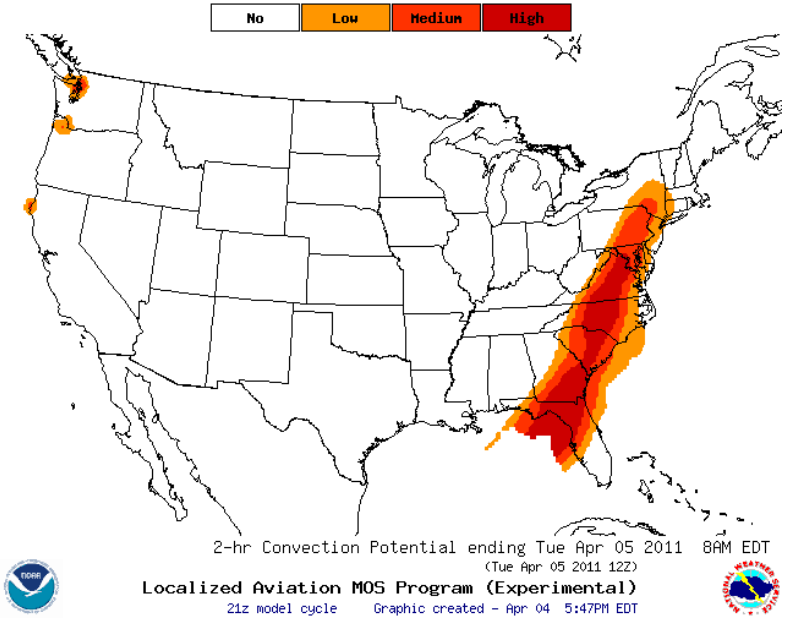
- Features:
  - Defined from Cloud-to-Ground (CTG) ltg
  - GFS MOS 3-h thunderstorm probability predictors
  - 2-h period / 20-km gridboxes
  - 1-h cycle; 3 – 25 h projections
  - Other predictors
- Criticisms:
  - Convection can occur without CTG lightning
  - Thunderstorm probabilities lack sharpness

Convection (future)

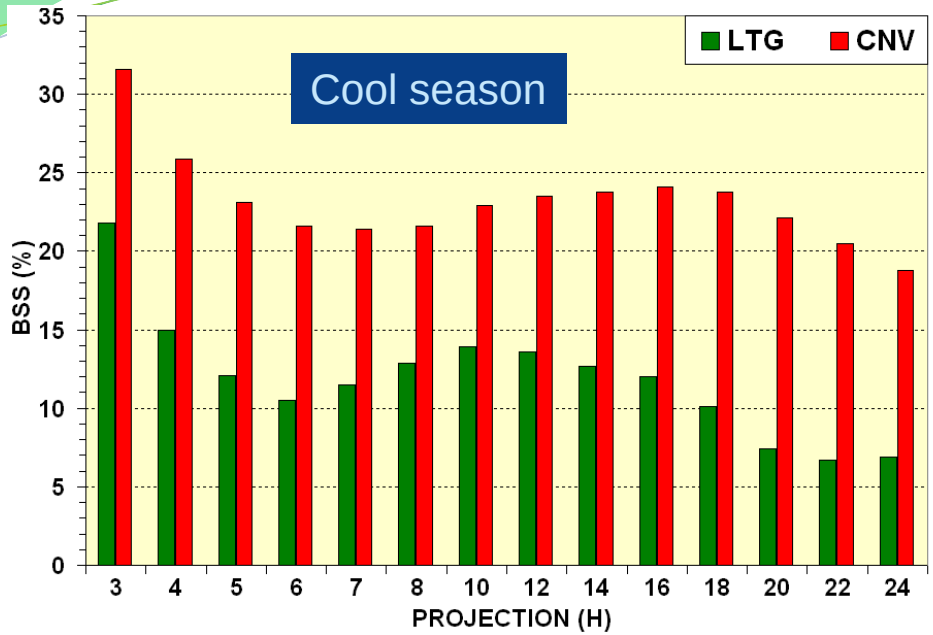
- Features:
  - Defined from CTG ltg / ≥ 40 dBZ radar reflectivity
  - GFS & NAM MOS 2-h convective probability predictors
  - 2-h period / 20-km gridboxes
  - 1-h cycle; 3 – 25 h projections
  - Other predictors
- Solution:
  - Convection can be indicated when there is little or no lightning
  - Convection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

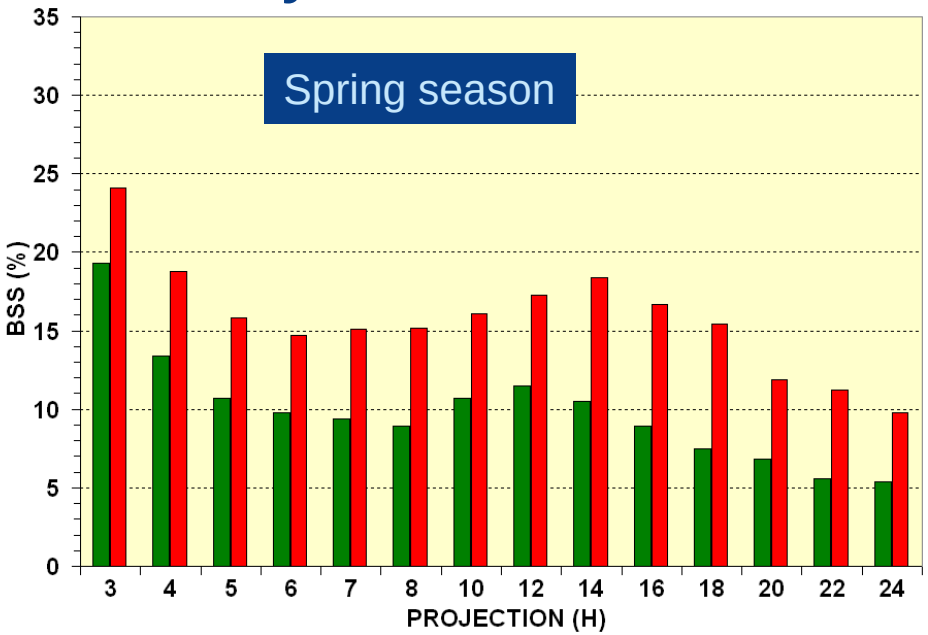
Convection Potential

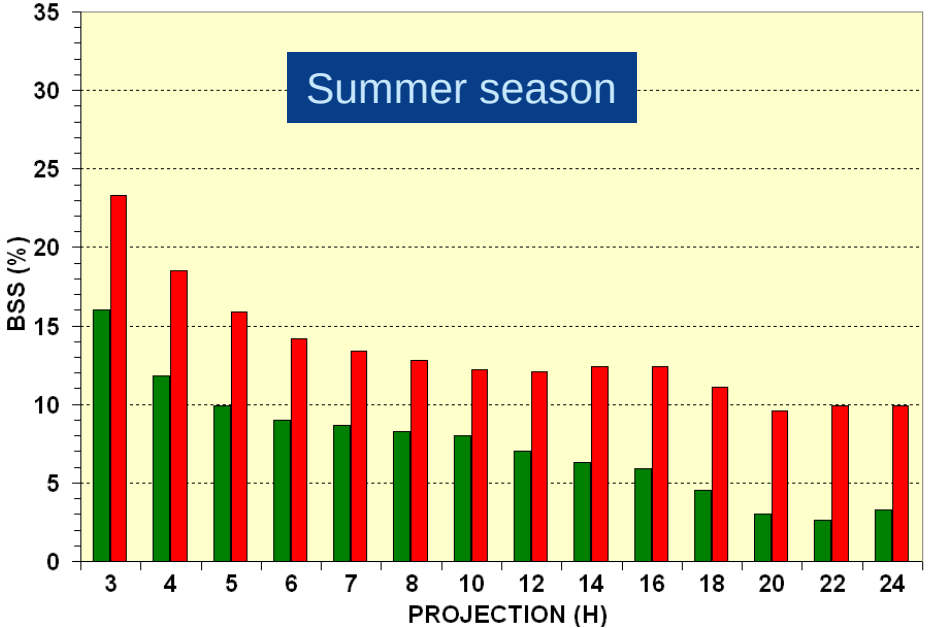
- Four convection potential categories
  - No, low, medium, and high
  - Each category is defined objectively from a pre-determined probability threshold
  - Each probability threshold corresponds to a prescribed bias criterion, where bias is
    - ~ 2.7 = low potential
    - ~ 1.1 = medium potential (lightning ~ 1.2)
    - ~ 0.4 = high potential
- Convection potential aids interpretation of probabilities with peak values < 100%



LAMP Lightning (LTG) vs Convection(CNV) Prob. Skill for 1800 UTC Cycle



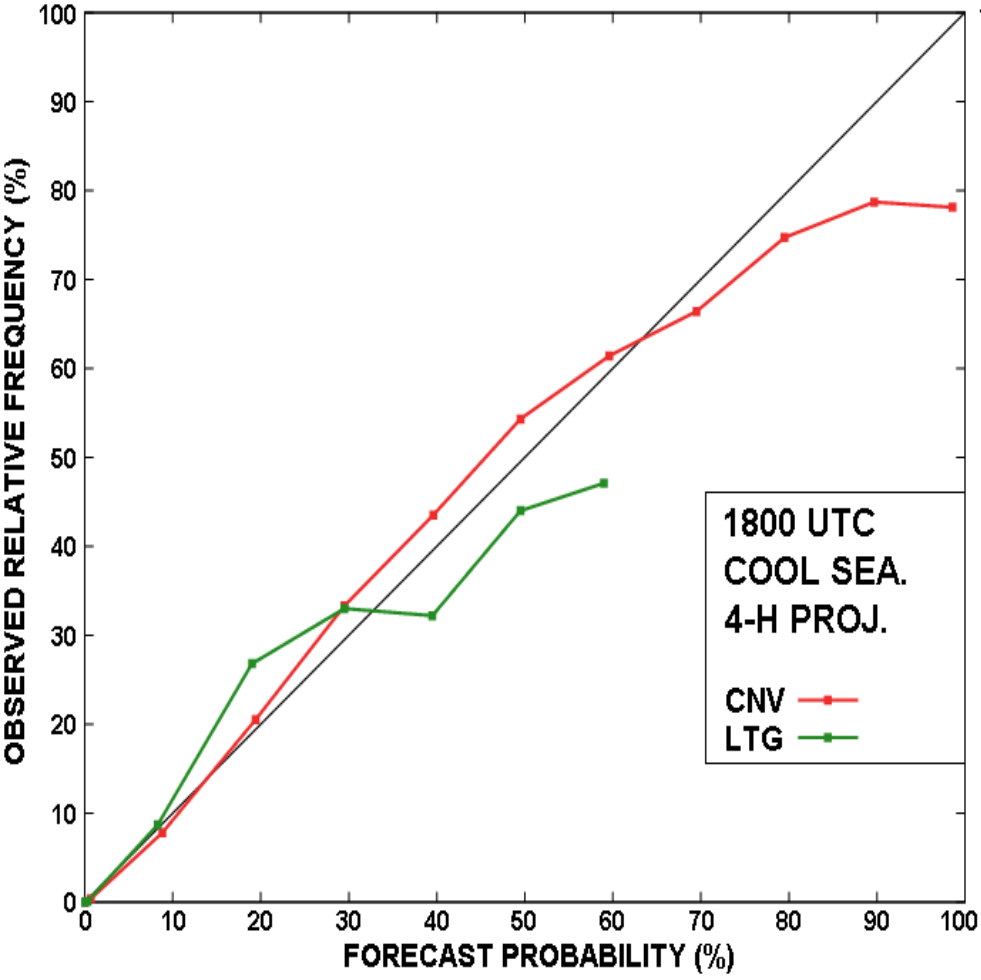


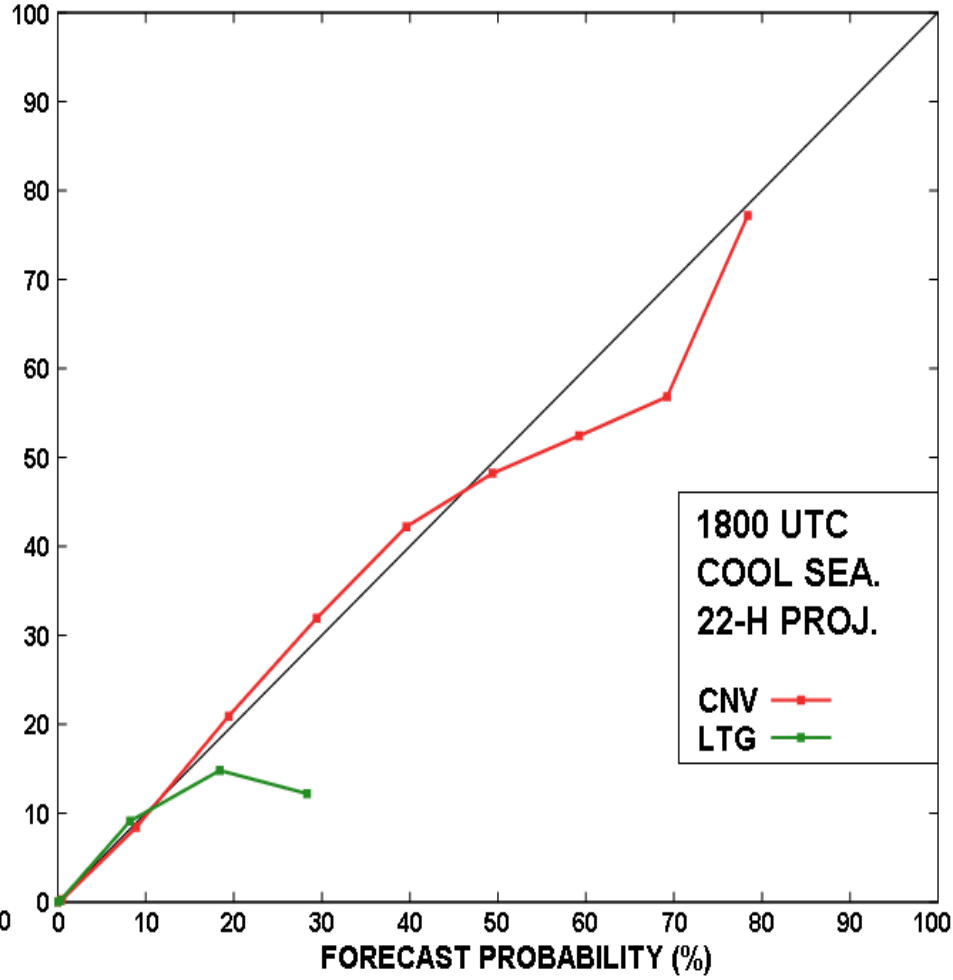


Independent sample

Oct 2009 – Oct 2010

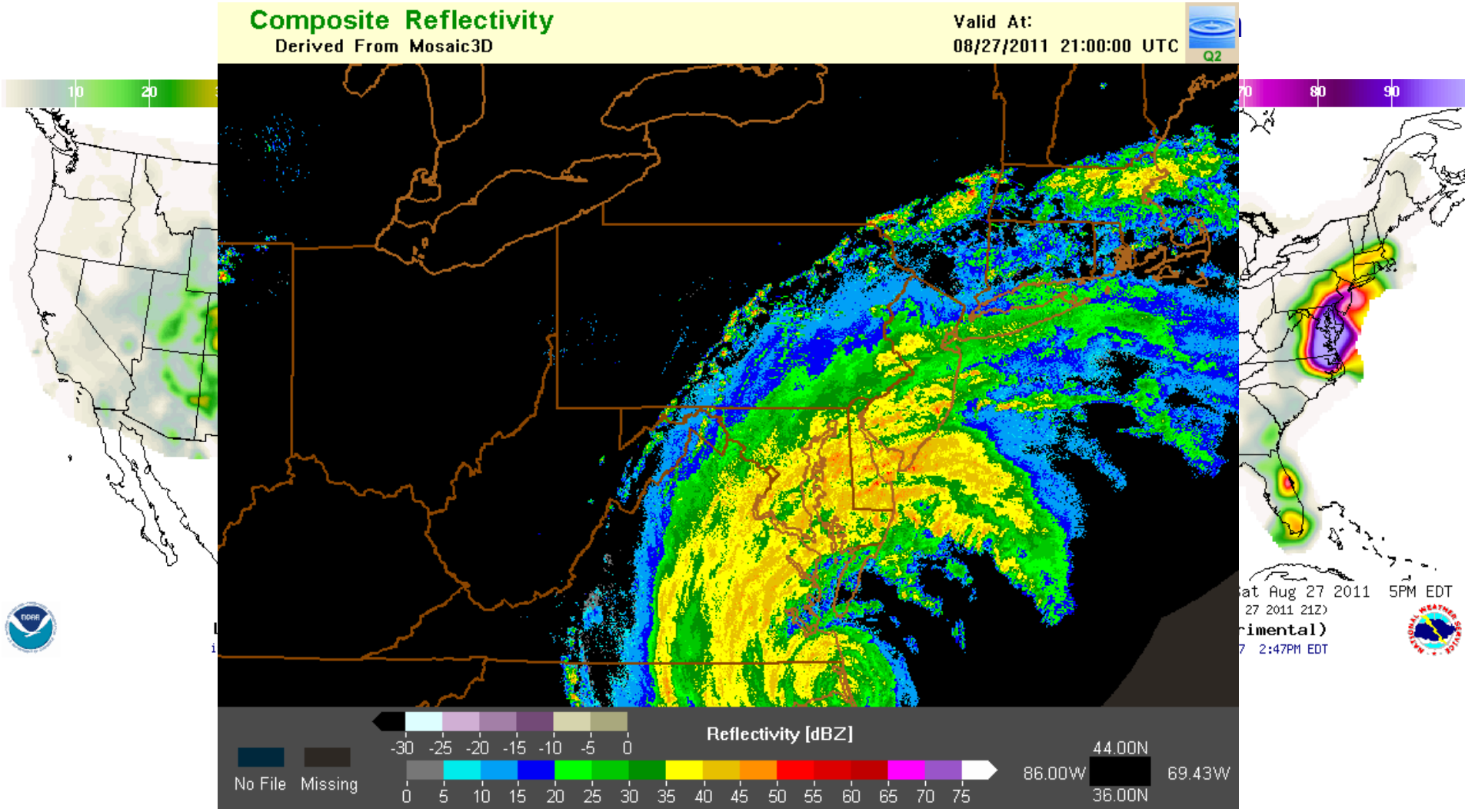
LAMP Lightning vs Convection Probability Reliability and Sharpness





New LAMP Convective Guidance

August 27, 2011: 1800 UTC cycle, Hurricane Irene

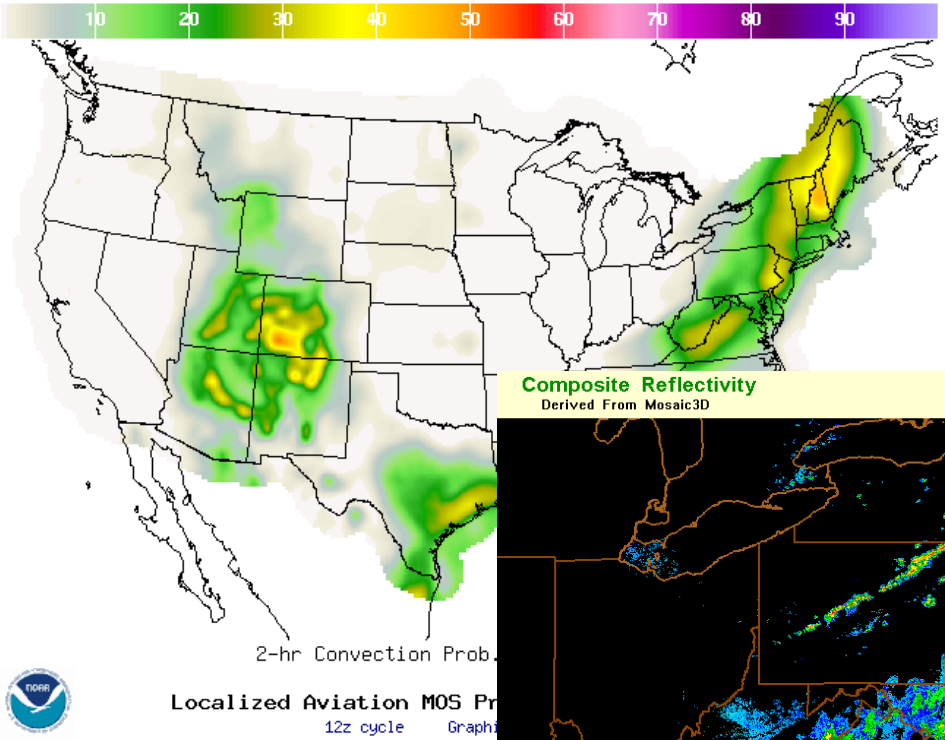


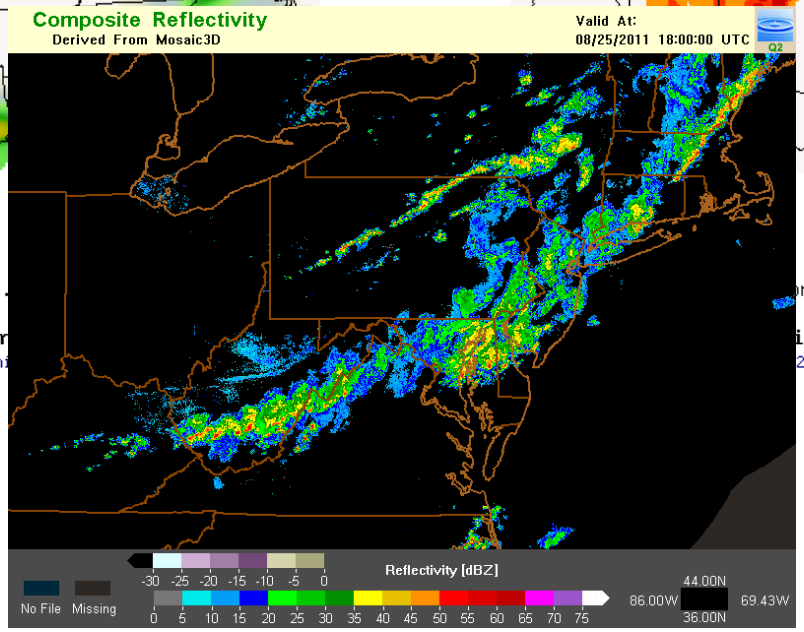
New LAMP Convective Guidance

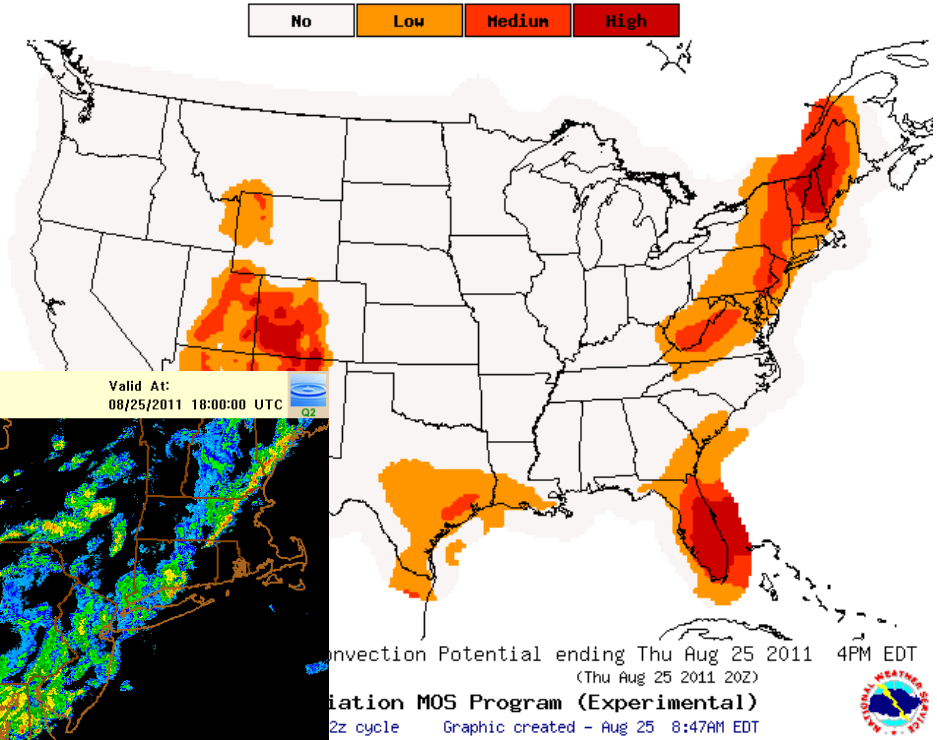
August 25, 2011: 1200 UTC cycle, 6-8 hour projection

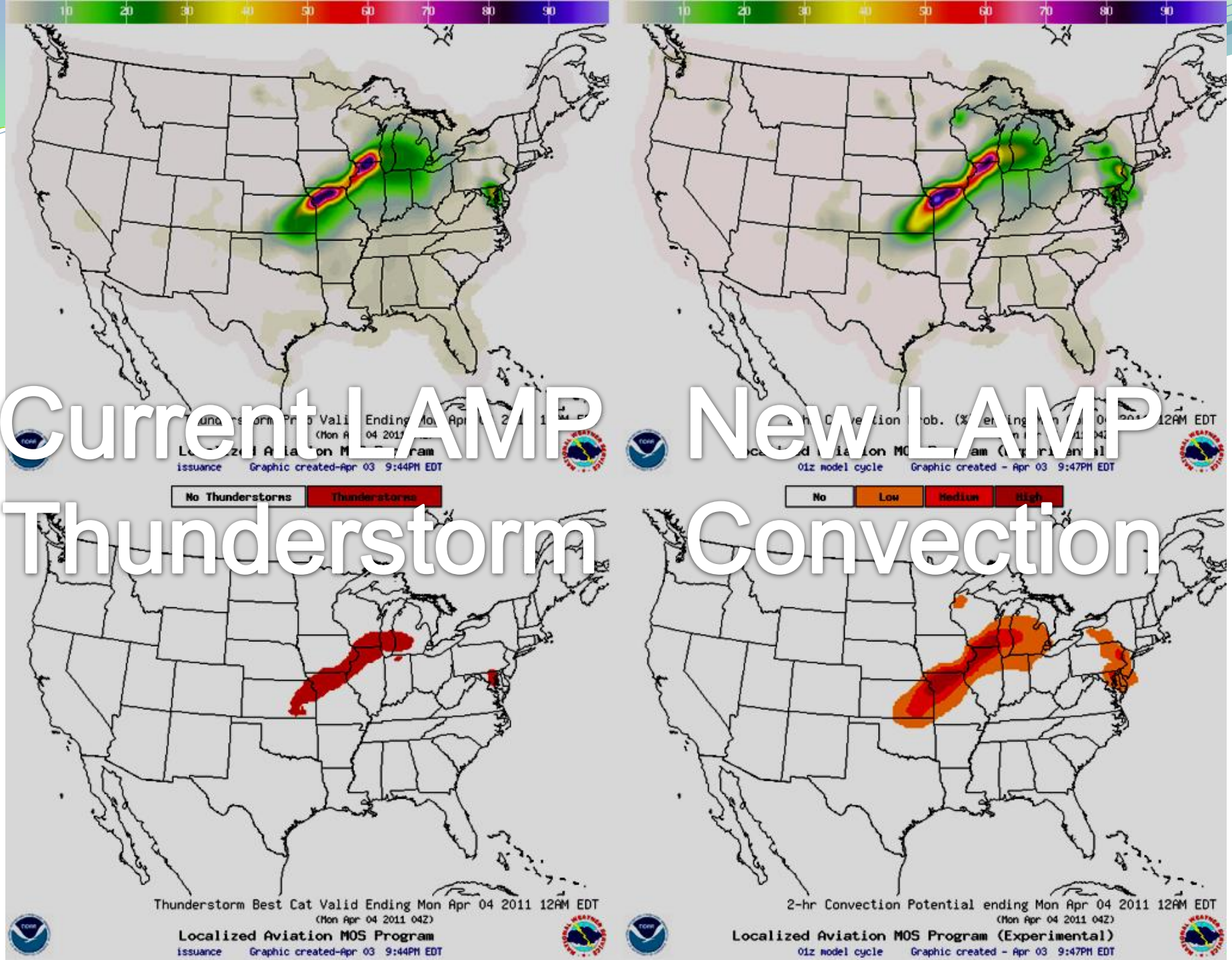
Convection Probabilities

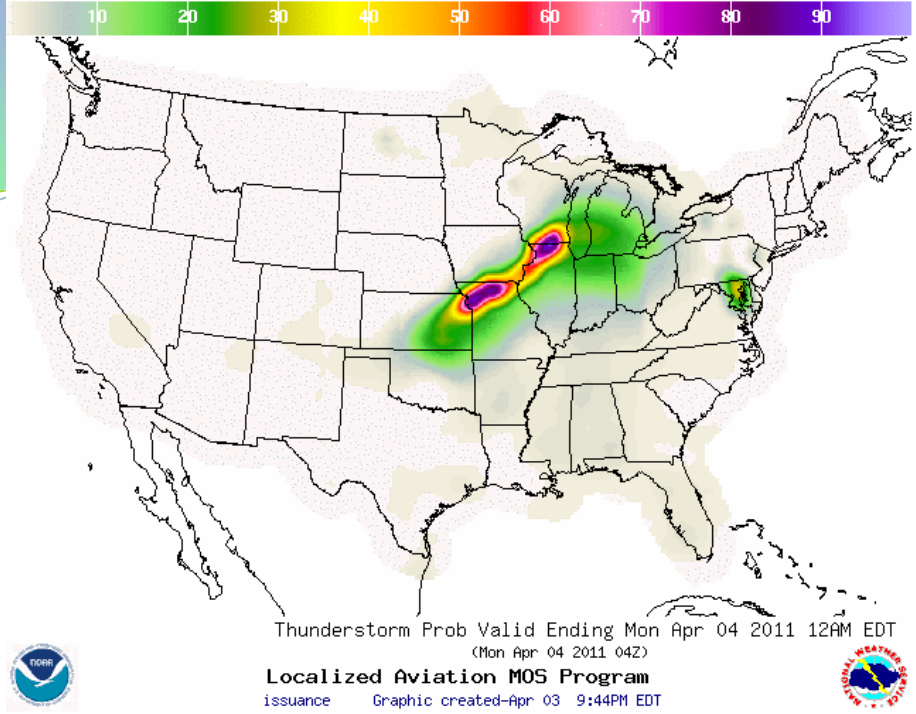
Convection Potential

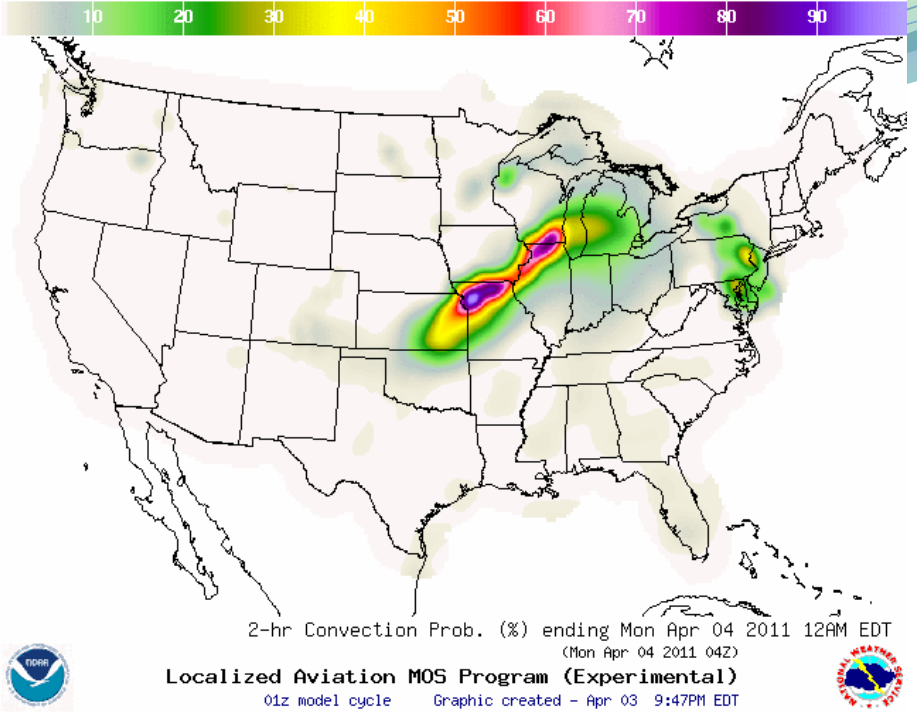


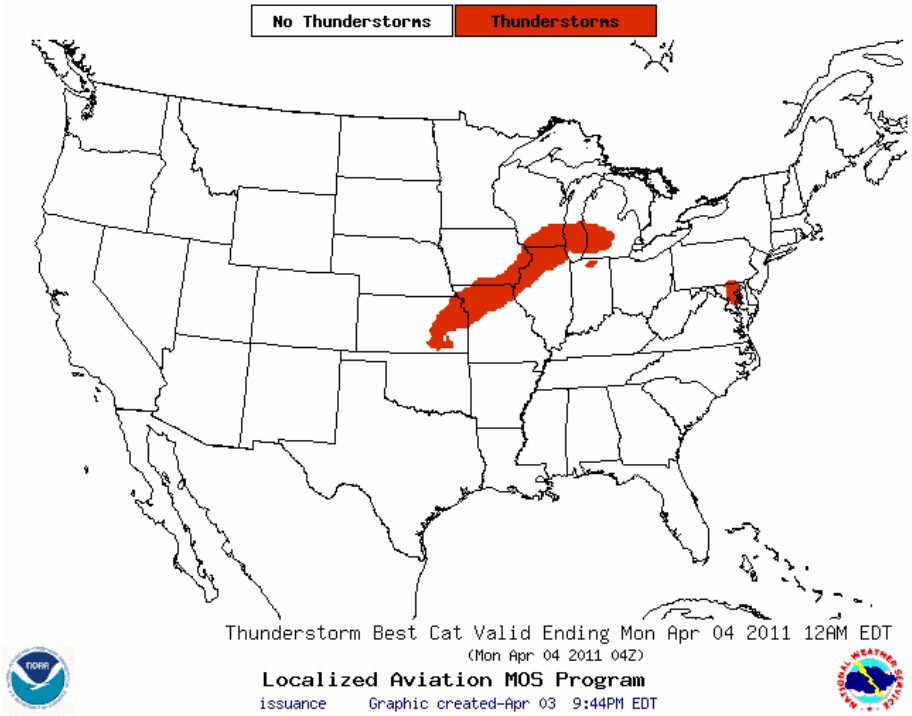


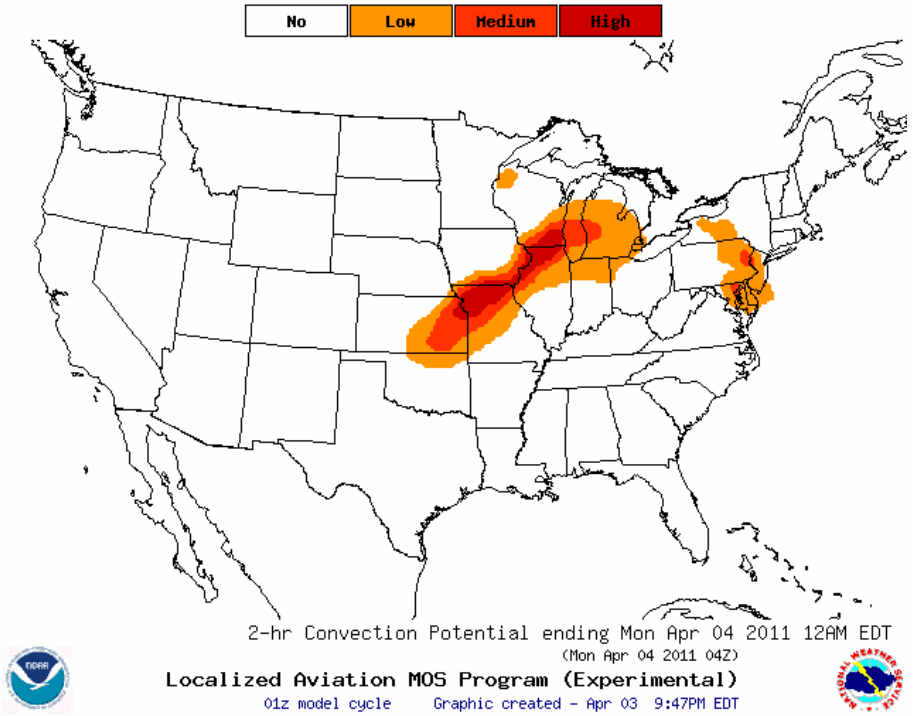


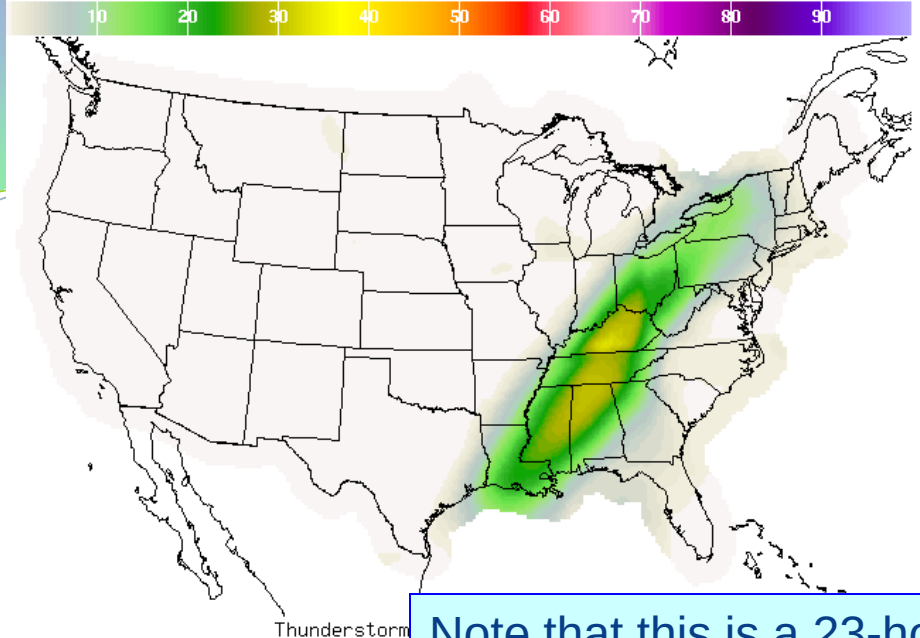

Current LAMP
New LAMP
Thunderstorm
Convection
No Thunderstorms
Thunderstorms
No
Low
Medium
High
Thunderstorm Best Cat Valid Ending Mon Apr 04 2011 12AM EDT
(Mon Apr 04 2011 04Z)
Localized Aviation MOS Program
issuance
Graphic created-Apr 03 9:44PM EDT
2-hr Convection Potential ending Mon Apr 04 2011 12AM EDT
(Mon Apr 04 2011 04Z)
Localized Aviation MOS Program (Experimental)
01z model cycle
Graphic created - Apr 03 9:47PM EDT

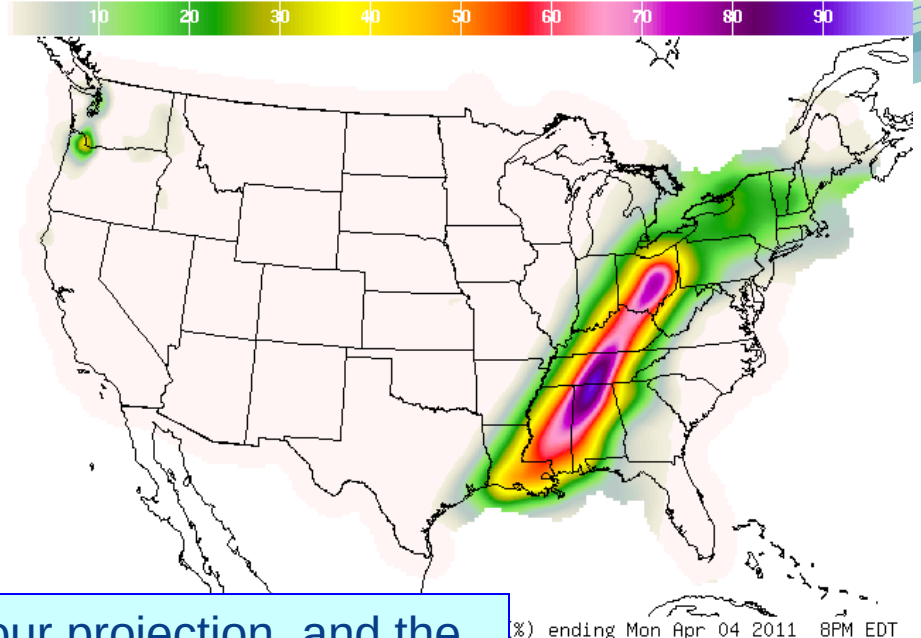

10 20 30 40 50 60 70 80 90
Thunderstorm Prob Valid Ending Mon Apr 04 2011 12AM EDT
(Mon Apr 04 2011 04Z)
Localized Aviation MOS Program
issuance Graphic created-Apr 03 9:44PM EDT


10 20 30 40 50 60 70 80 90
2-hr Convection Prob. (%) ending Mon Apr 04 2011 12AM EDT
(Mon Apr 04 2011 04Z)
Localized Aviation MOS Program (Experimental)
01z model cycle Graphic created - Apr 03 9:47PM EDT

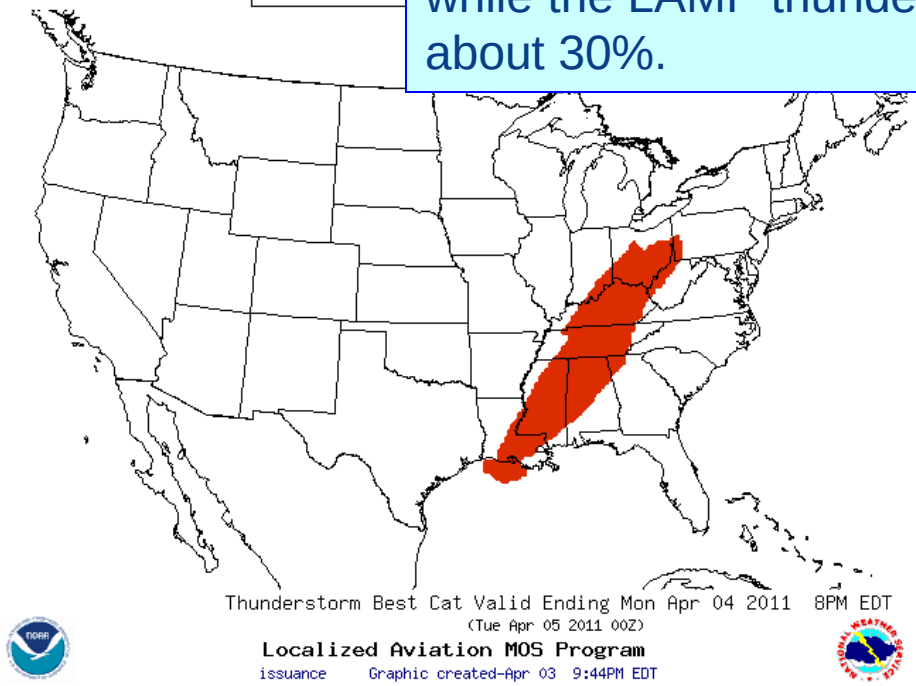

No Thunderstorms
Thunderstorms
Thunderstorm Best Cat Valid Ending Mon Apr 04 2011 12AM EDT
(Mon Apr 04 2011 04Z)
Localized Aviation MOS Program
issuance Graphic created-Apr 03 9:44PM EDT

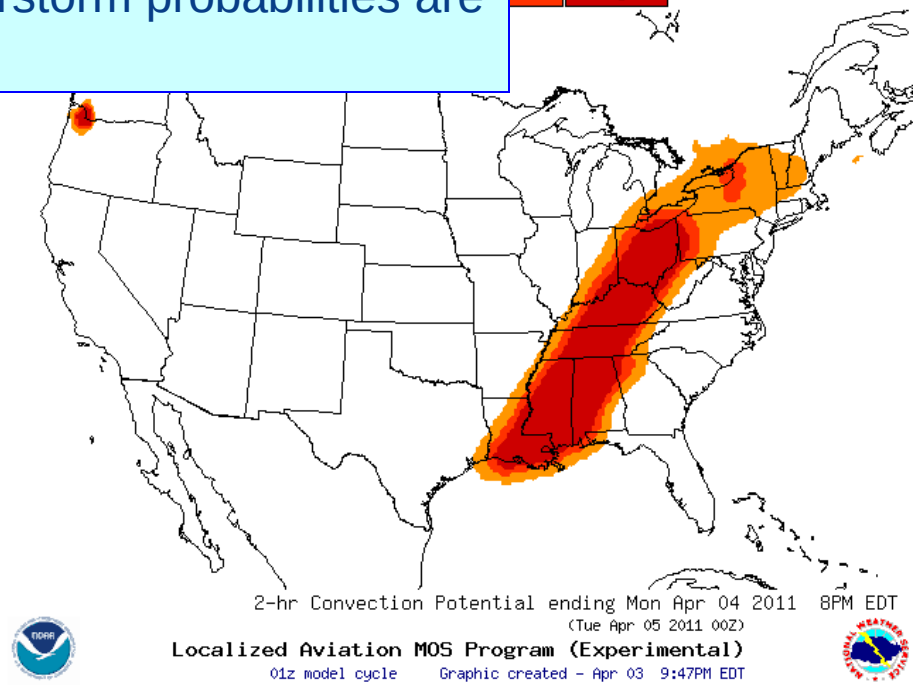

No
Low
Medium
High
2-hr Convection Potential ending Mon Apr 04 2011 12AM EDT
(Mon Apr 04 2011 04Z)
Localized Aviation MOS Program (Experimental)
01z model cycle Graphic created - Apr 03 9:47PM EDT

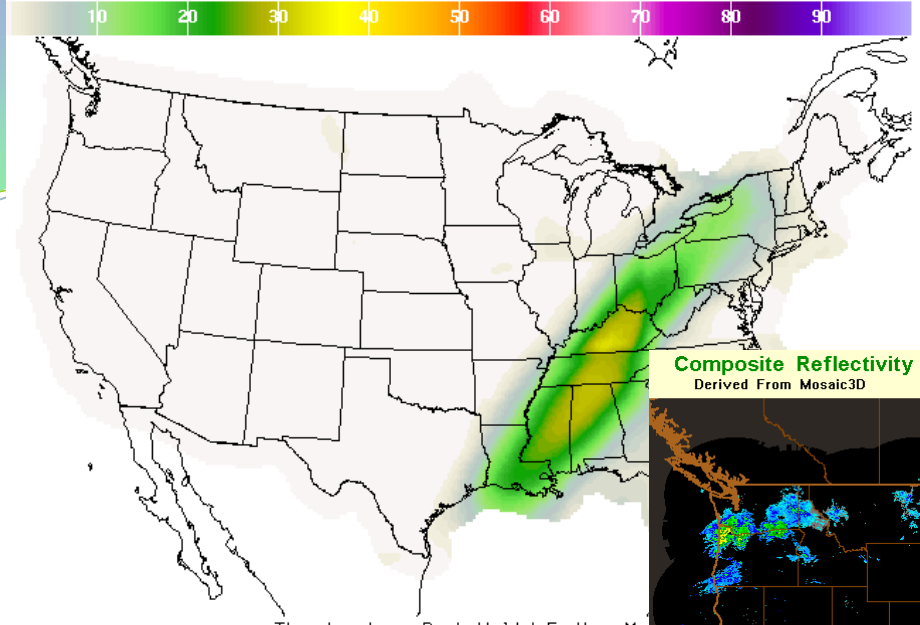


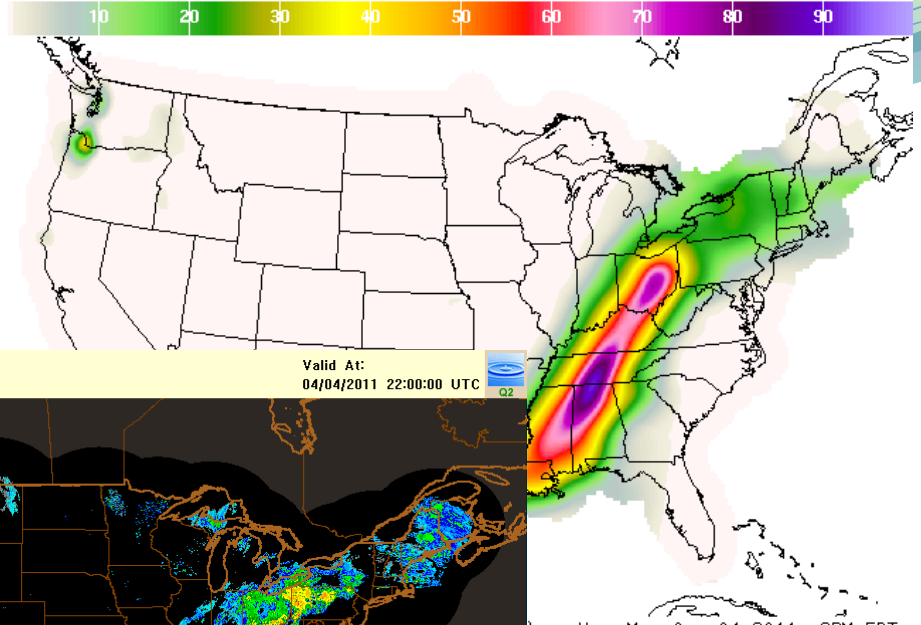


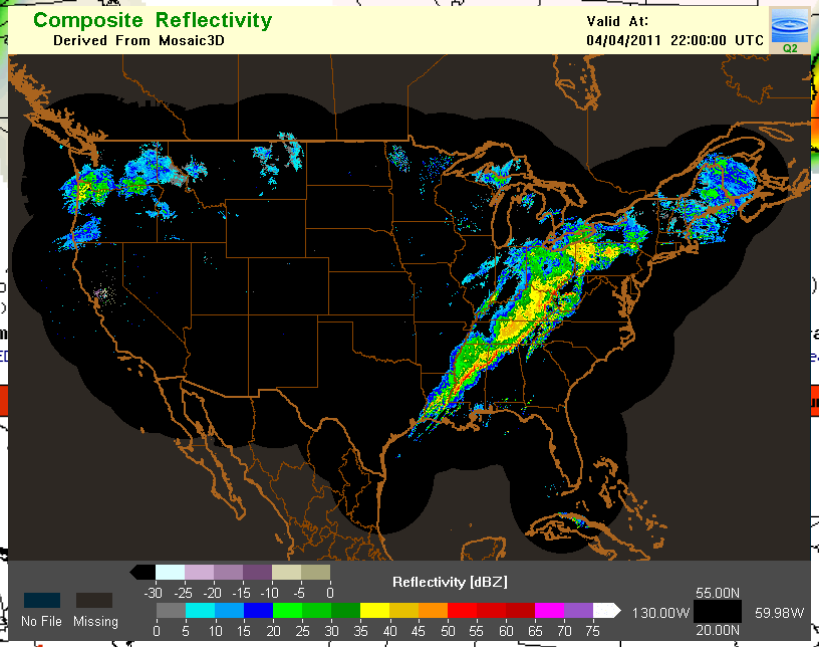
Note that this is a 23-hour projection, and the LAMP convective probabilities are about 90% while the LAMP thunderstorm probabilities are about 30%.

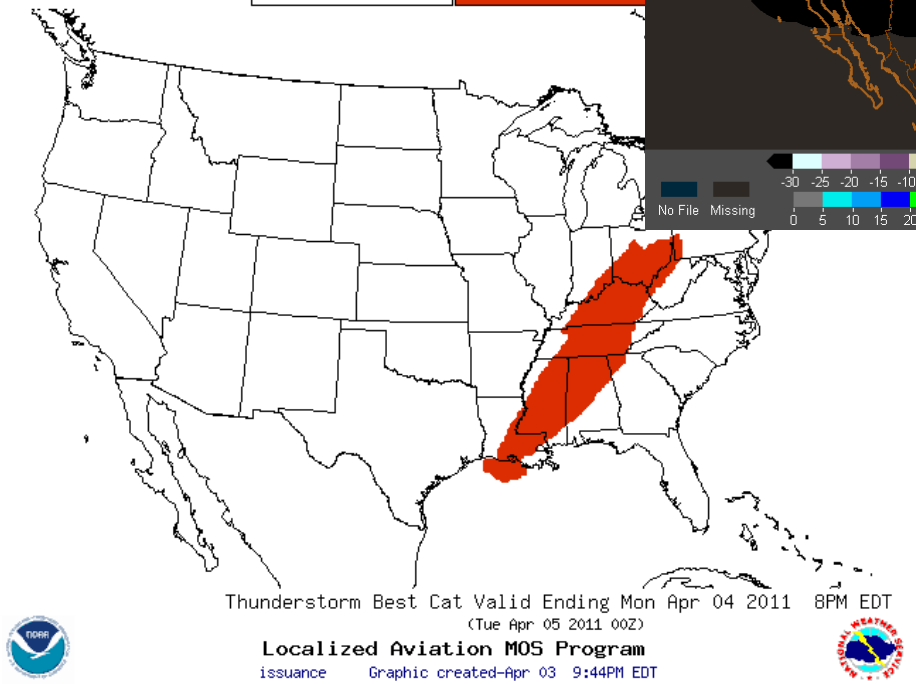


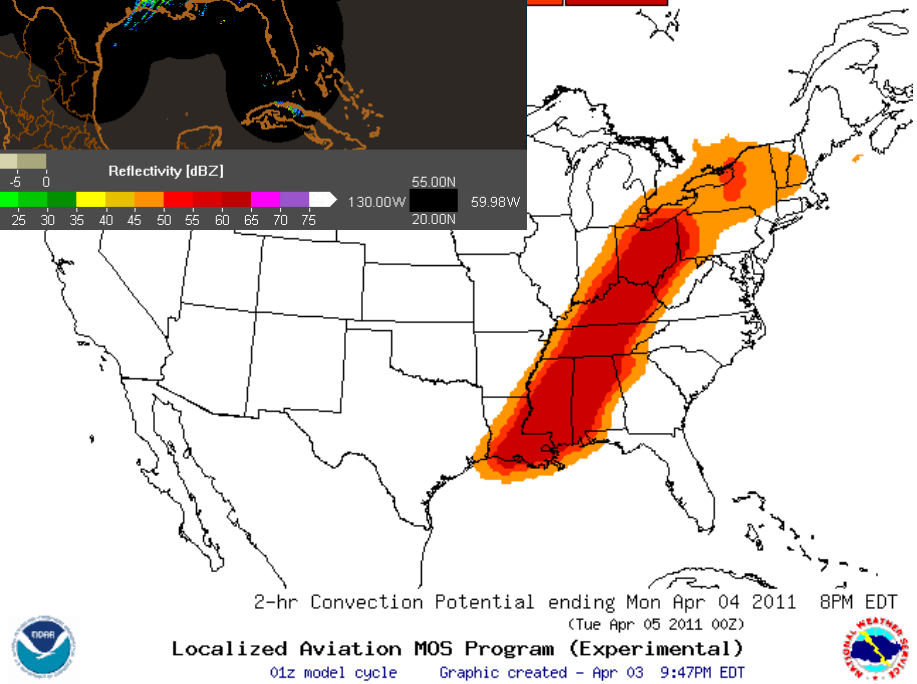



10 20 30 40 50 60 70 80 90
Thunderstorm Prob Valid Ending Mo
(Tue Apr 05 2011 00Z)
Localized Aviation MOS Program
issuance Graphic created-Apr 03 9:44PM ED
No Thunderstorms
Thunderstorms


10 20 30 40 50 60 70 80 90
ending Mon Apr 04 2011 8PM EDT
(Tue Apr 05 2011 00Z)
am (Experimental)
eated - Apr 03 9:47PM EDT
un
High

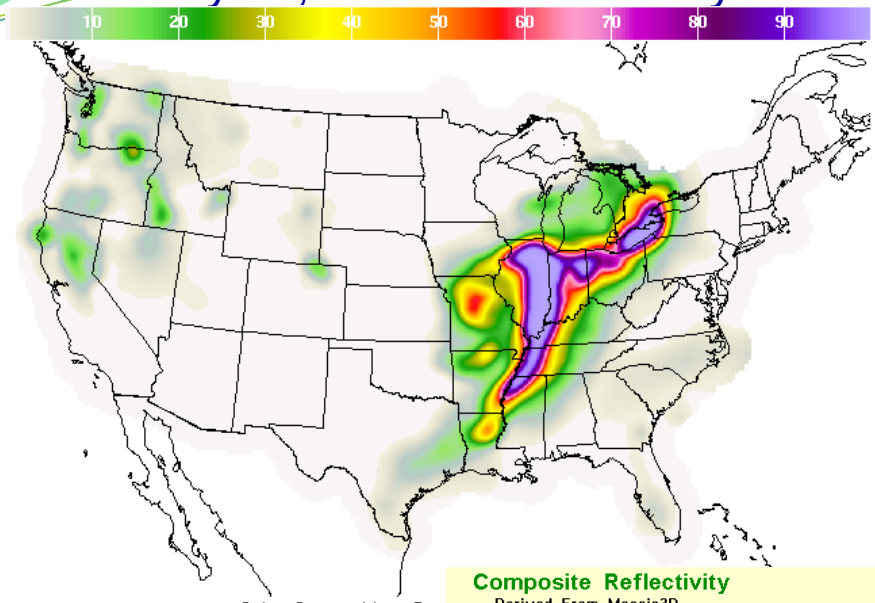

Composite Reflectivity
Derived From Mosaic3D
Valid At:
04/04/2011 22:00:00 UTC
Q2
Reflectivity [dBZ]
-30 -25 -20 -15 -10 -5 0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75
No File
Missing
55.00N
130.00W
59.98W
20.00N

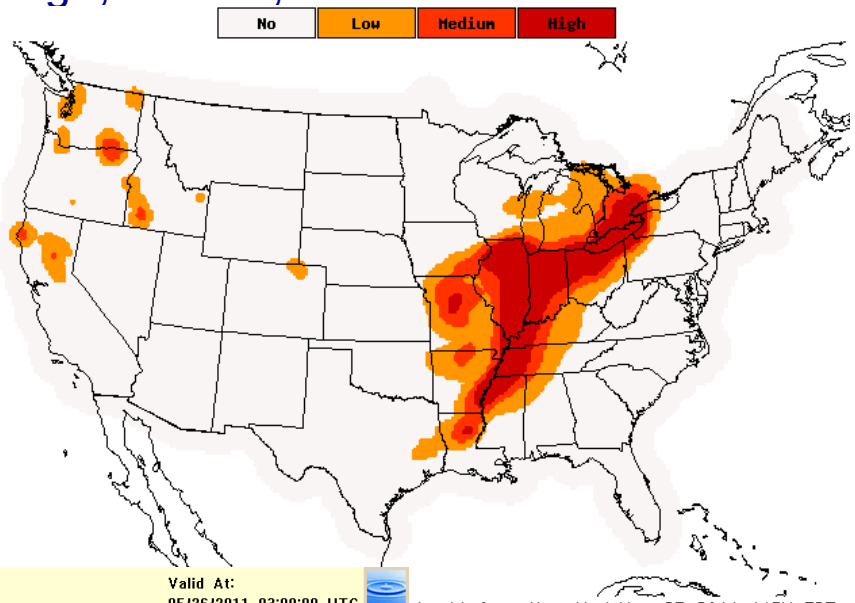

Thunderstorm Best Cat Valid Ending Mon Apr 04 2011 8PM EDT
(Tue Apr 05 2011 00Z)
Localized Aviation MOS Program
issuance Graphic created-Apr 03 9:44PM EDT

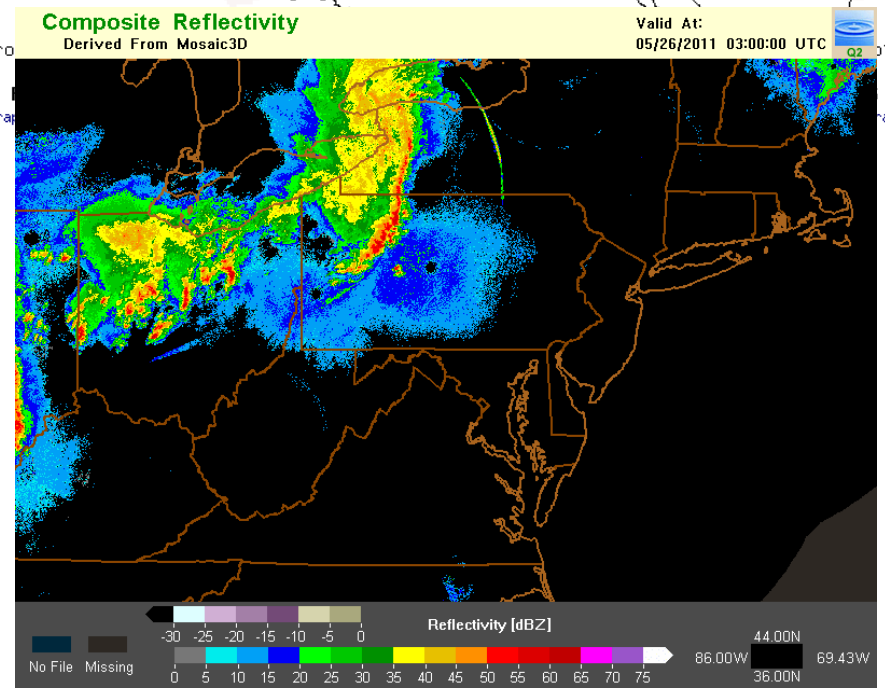

2-hr Convection Potential ending Mon Apr 04 2011 8PM EDT
(Tue Apr 05 2011 00Z)
Localized Aviation MOS Program (Experimental)
01z model cycle Graphic created - Apr 03 9:47PM EDT

Convective Guidance Examples

May 26, 2011: 0000 UTC cycle: Chicago, Atlanta, New York all affected

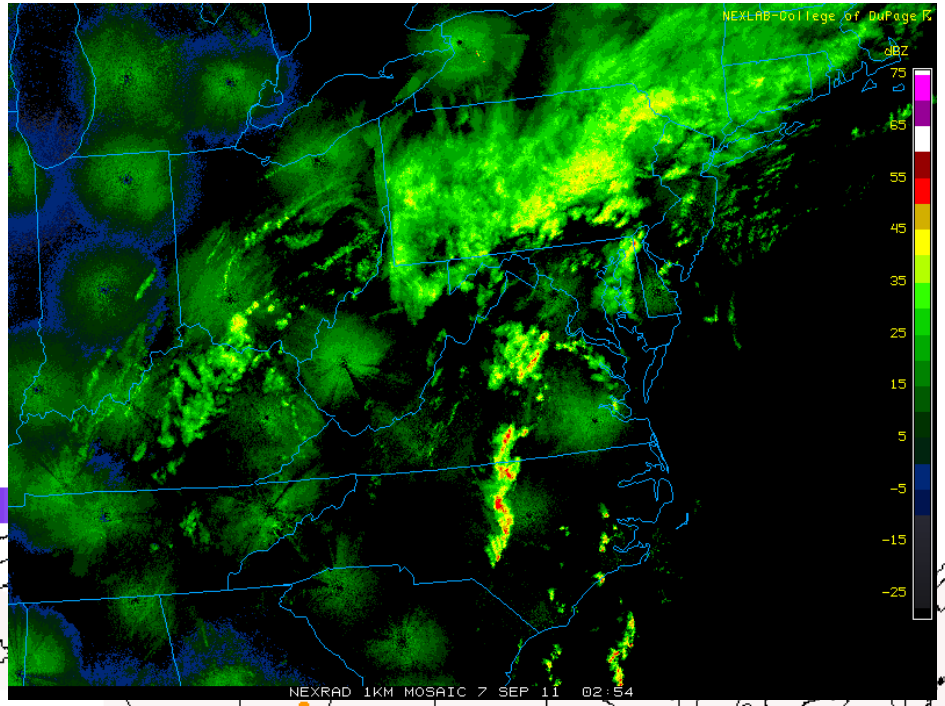


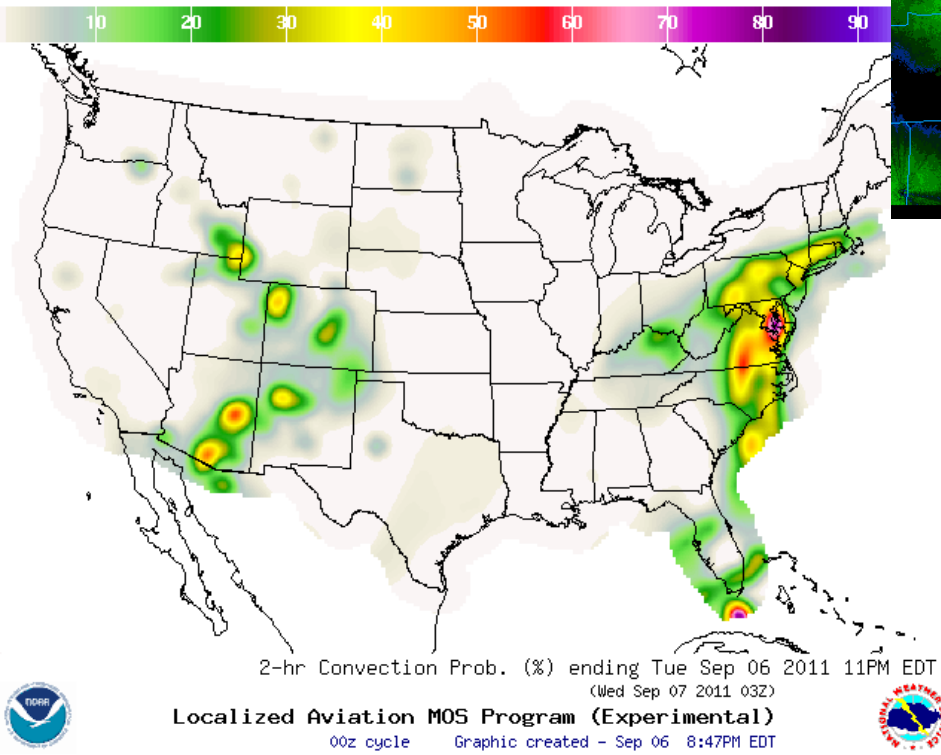


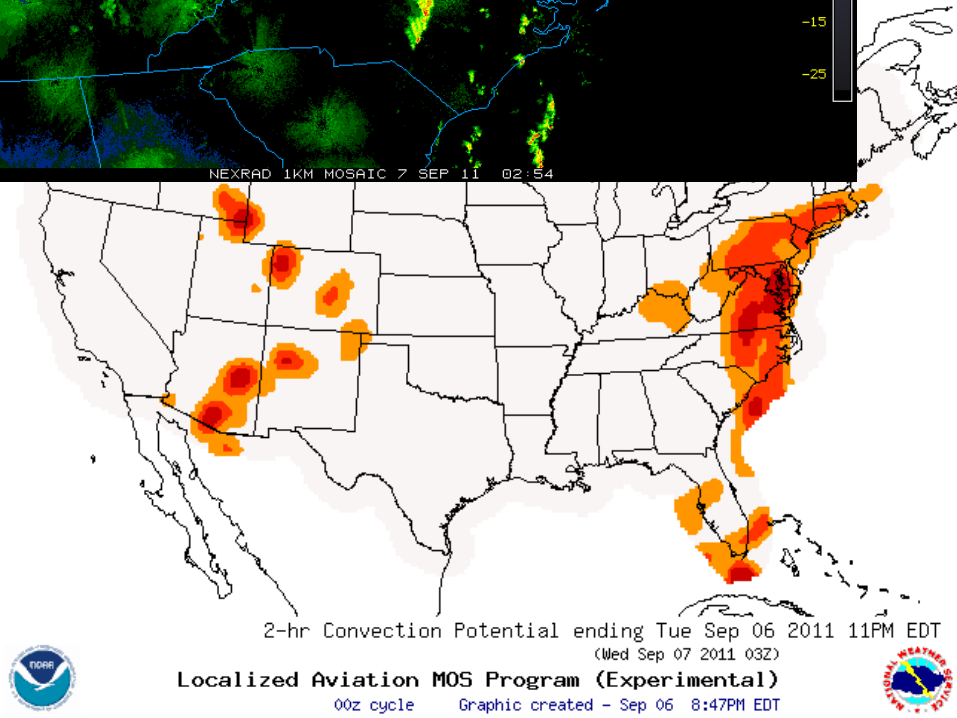


Convective Guidance Examples

September 07, 2011: 0000 UTC cycle

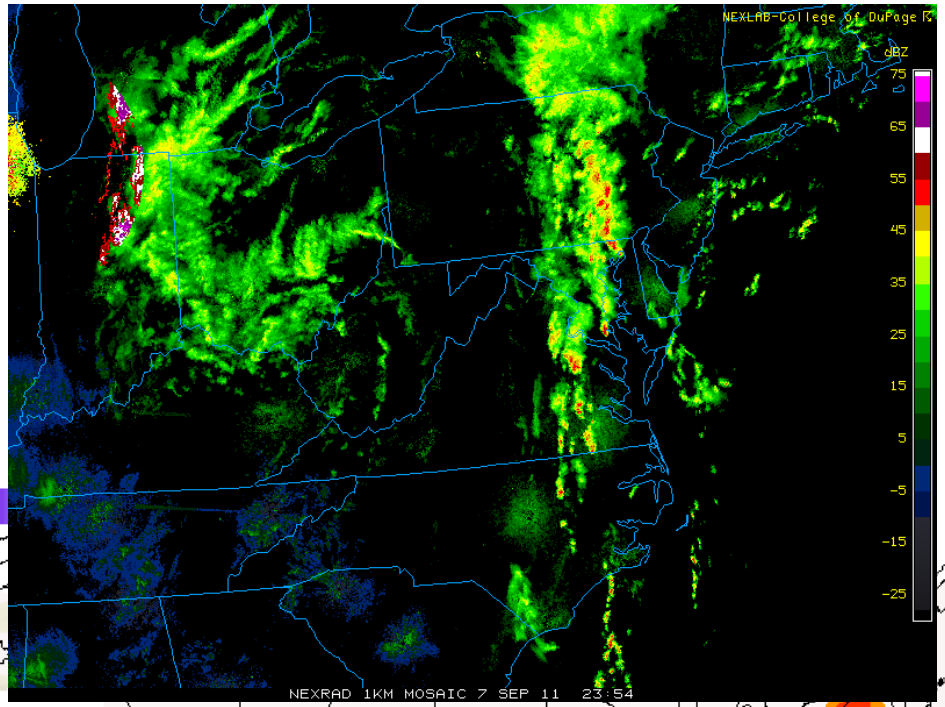


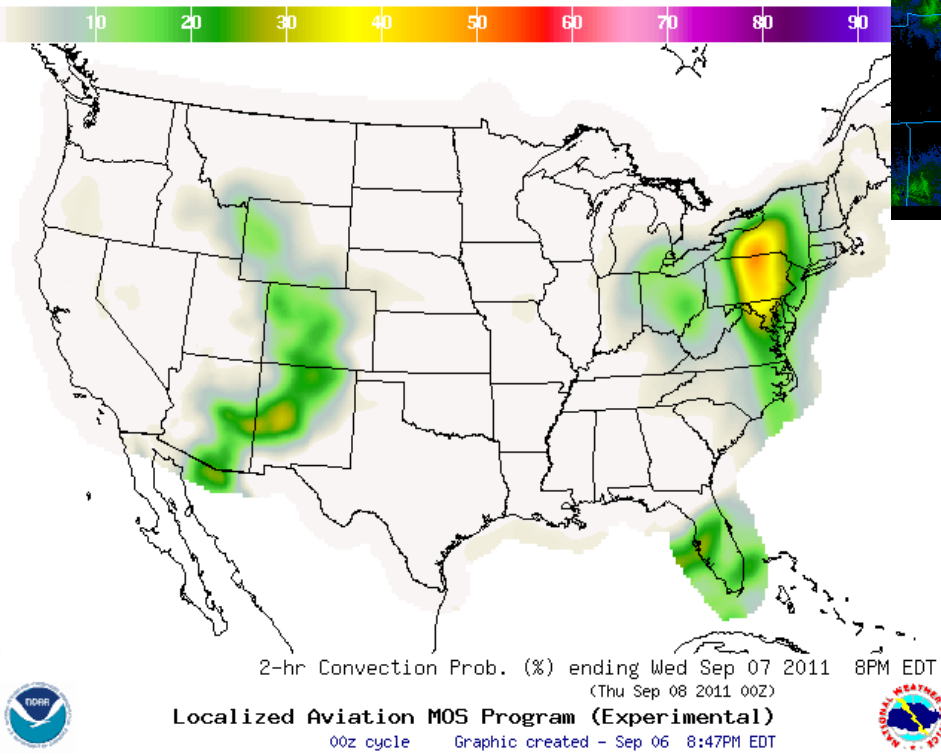


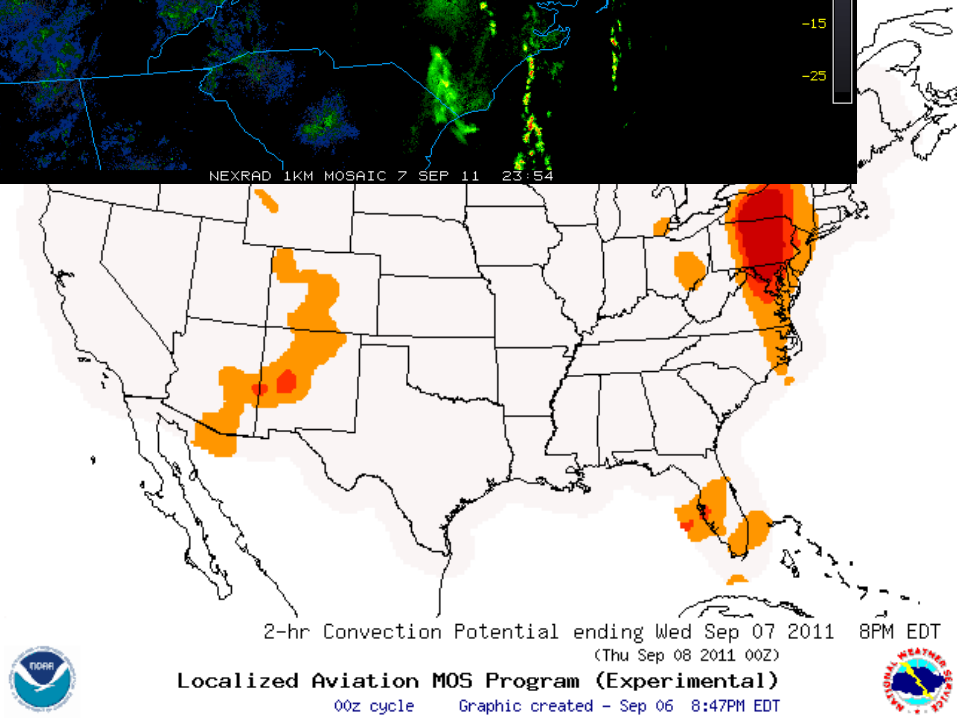


Convective Guidance Examples

September 07, 2011: 0000 UTC cycle: 22-24 hour projection

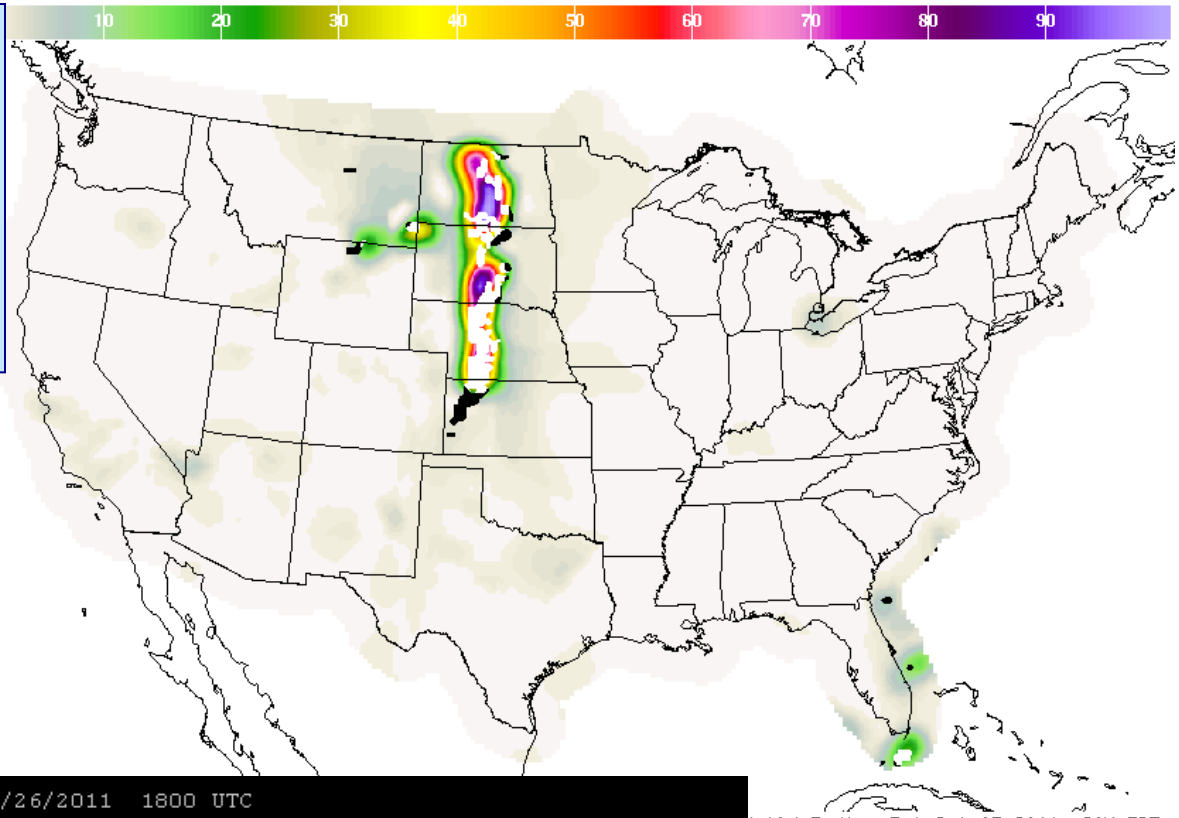






Future Work: Additional Products

Verification Graphics: overlay probabilities with marker indicating if convection was observed




```
KBVY   GFS LAMP GUIDANCE   9/26/2011  1800 UTC
UTC  19 20 21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
CP2        1  1  0  1  0  0     0     0     1     1     2     1     1     1
CC2        N  N  N  N  N  N     N     N     N     N     N     N     N     N

KBWI   GFS LAMP GUIDANCE   9/26/2011  1800 UTC
UTC  19 20 21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
CP2        0  0  0  0  0  0     0     0     0     3     4     6    10    19
CC2        N  N  N  N  N  N     N     N     N     N     N     N     N     L

KCAK   GFS LAMP GUIDANCE   9/26/2011  1800 UTC
UTC  19 20 21 22 23 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19
CP2       57 54 52 44 41 35    20     8     9     8     6     4     2     1
CC2        H  H  H  H  H  H     L     N     N     N     N     N     N     N
```

Text bulletins at stations: to support prototype Gate Forecasts

Implementation Plans

- Convection products produced in real time since March 2011
  - 24 cycles per day (not supported 24x7)
  - Web Graphics at:
    http://weather.gov/mdl/lamp/compare.php
    http://weather.gov/mdl/lamp/convection.php
  - GRIB2 files available at:
    http://www.mdl.nws.noaa.gov/~glmp/conv_grib/
- Implement on CCS parallel system before March 2012
- Available in experimental NDGD March 2012
- Transmit grids on SBN/NOAAPORT – planned FY12/13

- Contact: Judy.Ghirardelli@noaa.gov