Upcoming Enhancements to the National Weather Service's Localized Aviation Model Output Statistics Program

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Meteorological Development Laboratory

Intermountain West Aviation Weather Safety (IWAWS) Workshop
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Portions of this research are in response to requirements and funding by the Federal Aviation Administration (FAA). The views expressed are those of the authors and do not necessarily represent the official policy or position of the FAA.

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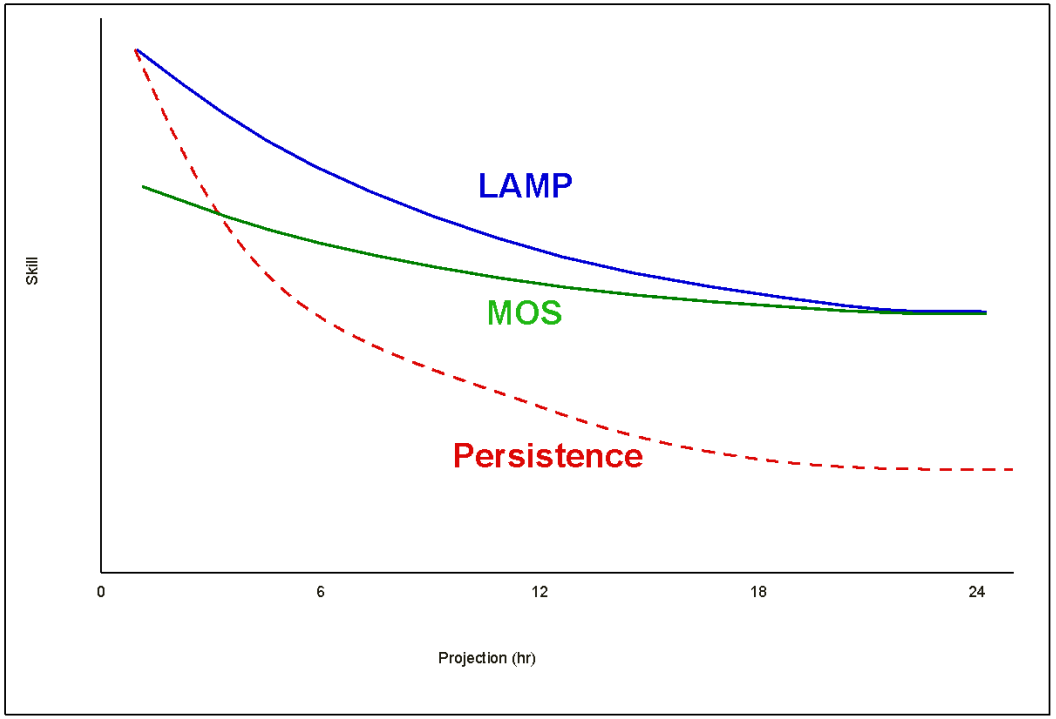
Outline

1. LAMP Background
2. Tour of LAMP Web Products
3. Current Work
4. Future work

1. LAMP Background

LAMP Background

- LAMP is a statistical system that uses observations, MOS output, and model output to provide guidance for aviation forecasting.
- LAMP acts as an update to MOS guidance.
- LAMP bridges the gap between the observations and the MOS forecast.
- LAMP outperforms persistence in the early period and trends towards MOS at the end of the period.
- LAMP guidance covers the short-range period of 1-38 hours
- Runs every hour in NWS operations at HH:30 (every 15 mins for ceiling and visibility out to 3 hours HH:00, HH:15, HH:45)



LAMP Guidance Details

- LAMP provides station-oriented guidance for:
  - All LAMP forecast elements, 2011 stations
  - CONUS, Alaska, Hawaii, Puerto Rico

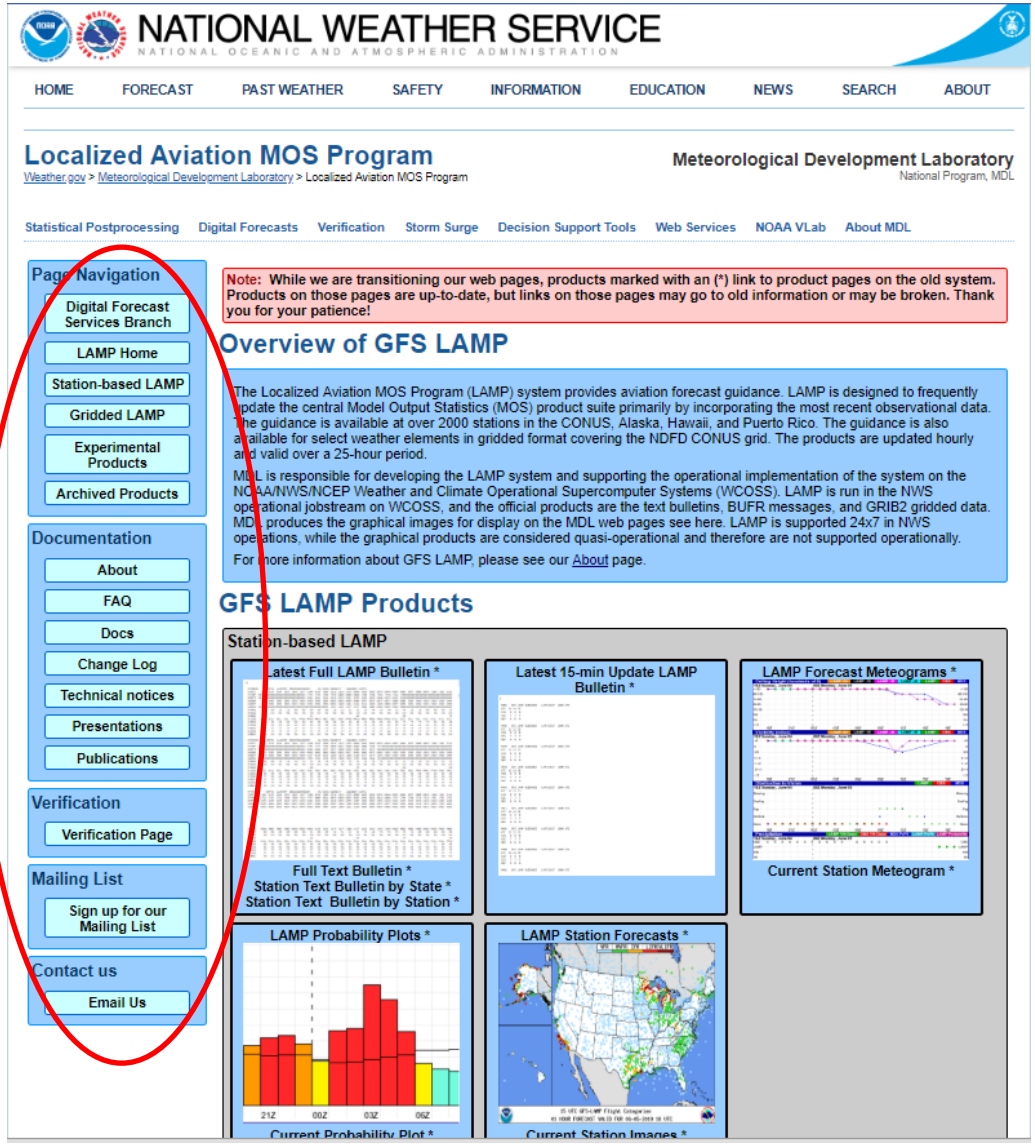
- Gridded LAMP provides grid-oriented guidance for:
  - Lightning & Convection
  - Temperature & Dewpoint
  - Wind Speed & Direction
  - Ceiling Height & Visibility
  - Sky Cover
  - Probability of Precipitation (**Coming in LAMP v2.3**)

- Temperature and dewpoint
- Wind speed, direction, and gusts
- Probability of precipitation (on hr)
- Probability of measurable precipitation (6- and 12-h)
- Precipitation type
- Precipitation characteristics
- Lightning/Convection
- Ceiling height
- Conditional ceiling height
- Opaque sky cover
- Visibility
- Conditional visibility
- Obstruction to vision

- Available:
  - At NWS WFOs in AWIPS
  - Via FTP, in the National Digital Guidance Database
  - Via NCEP Web services
  - Via website: http://weather.gov/mdl/lamp_home

2. Tour of LAMP Web Products

LAMP Web Page



https://www.weather.gov/mdl/lamp_home

LAMP Web Page

Page Navigation
- Digital Forecast Services Branch
- LAMP Home
- Station-based LAMP
- Gridded LAMP
- Experimental Products
- Archived Products

Documentation
- About
- FAQ
- Docs
- Change Log
- Technical notices
- Presentations
- Publications

Verification
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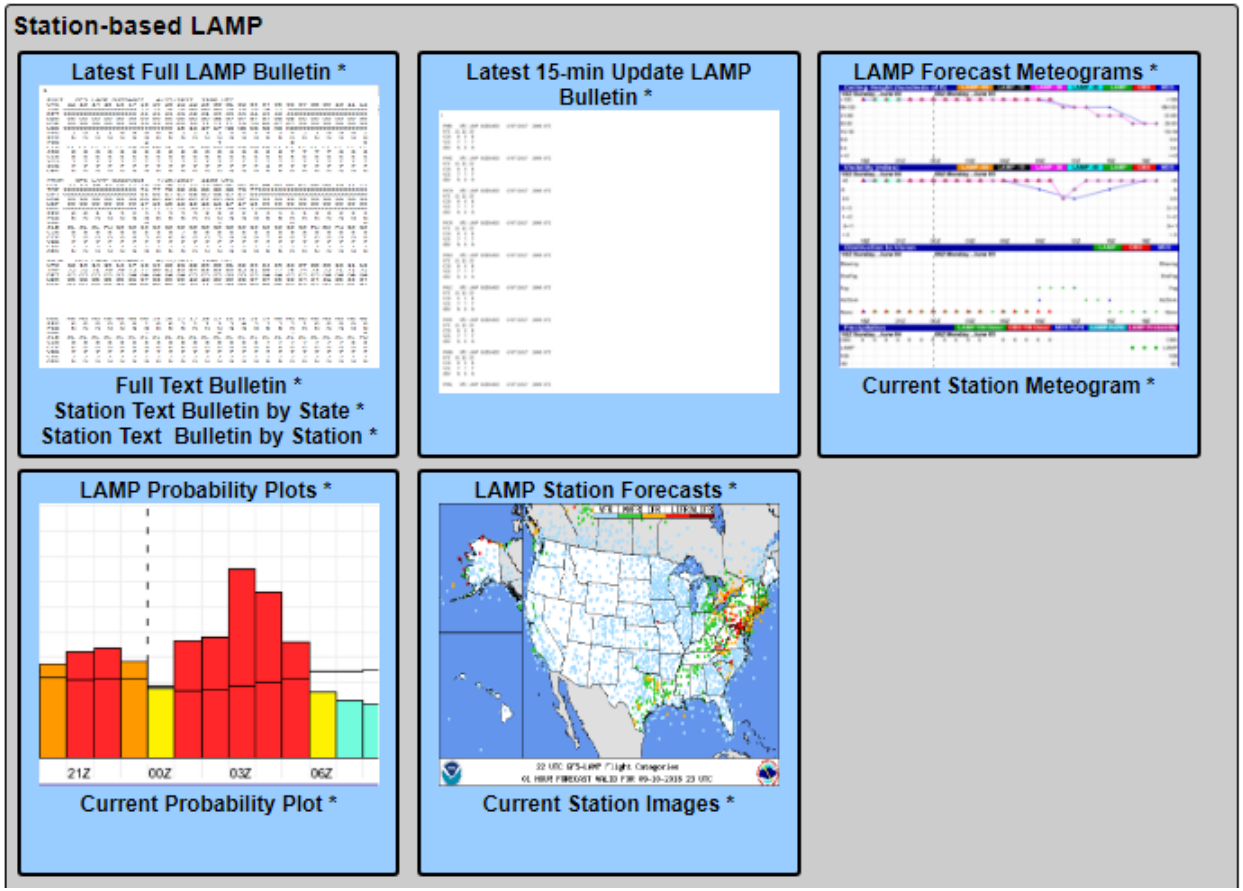
Click here to find real-time station-based forecast guidance

GFS Station-based LAMP Products



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Documentation

- About
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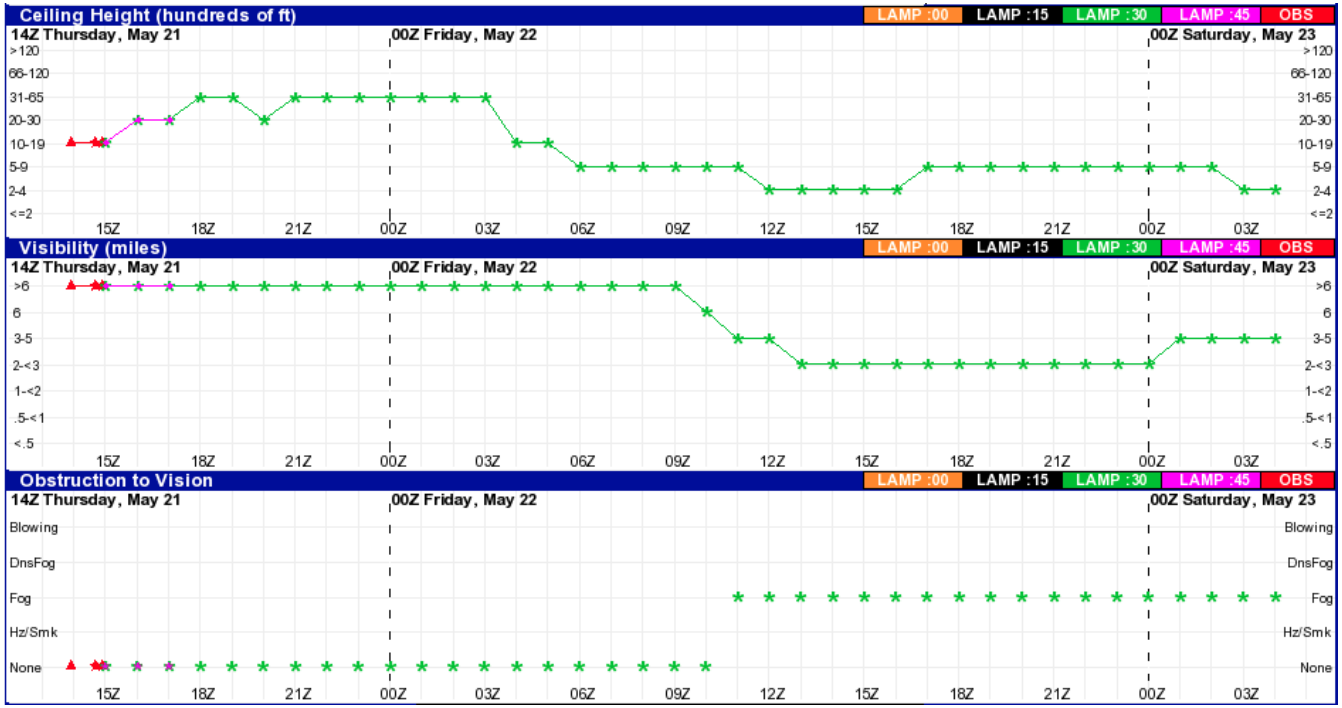
Click here for LAMP Meteograms showing the future guidance



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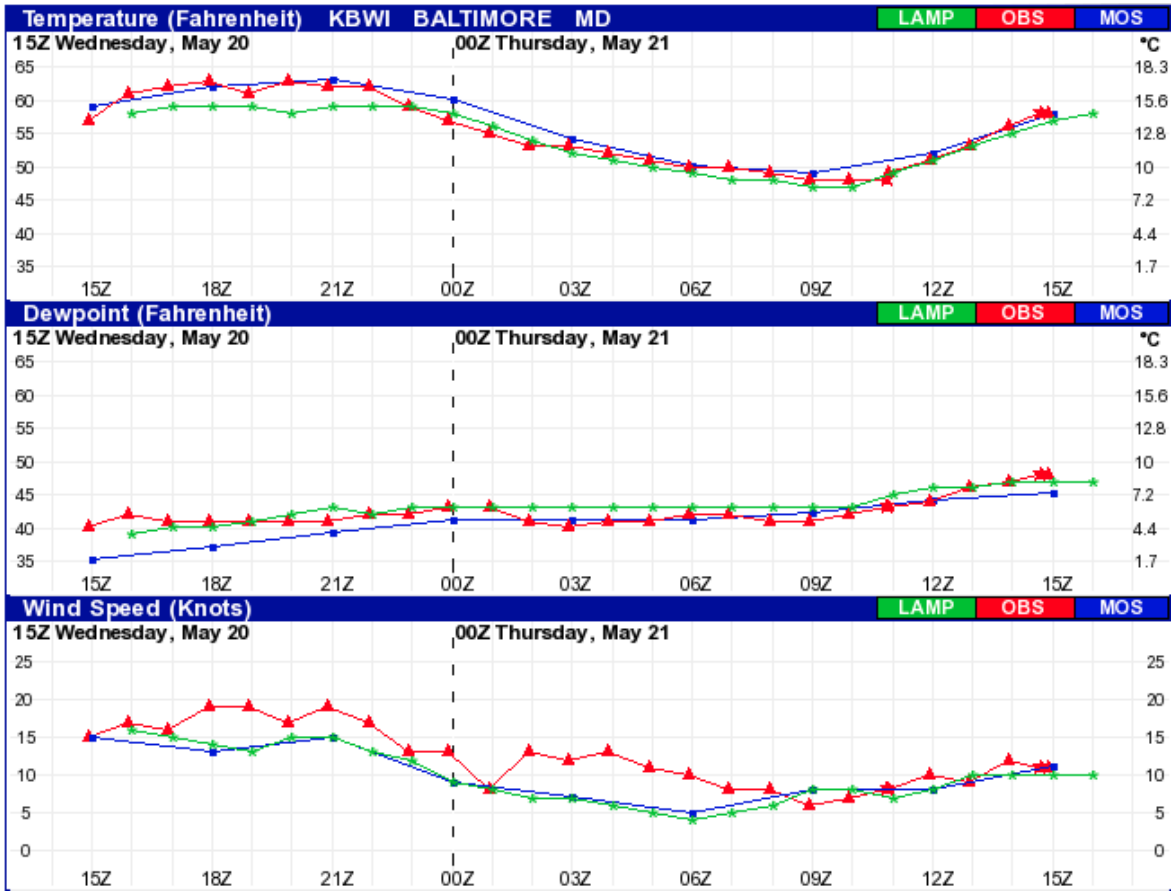
Click here for LAMP Meteograms showing the past guidance



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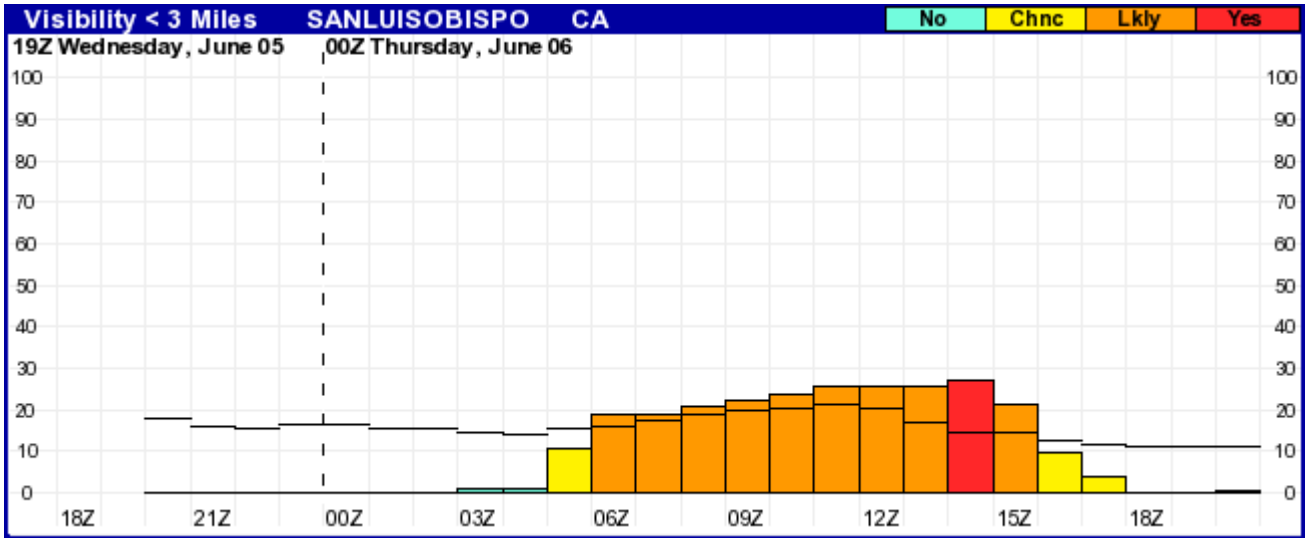
Click here for LAMP Probability and Threshold Plots



Probabilities (bars) and thresholds (lines)
KSBP
Visibility < 3 mi

https://www.weather.gov/mdl/lamp_home

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Documentation
- About
- FAQ
- Docs
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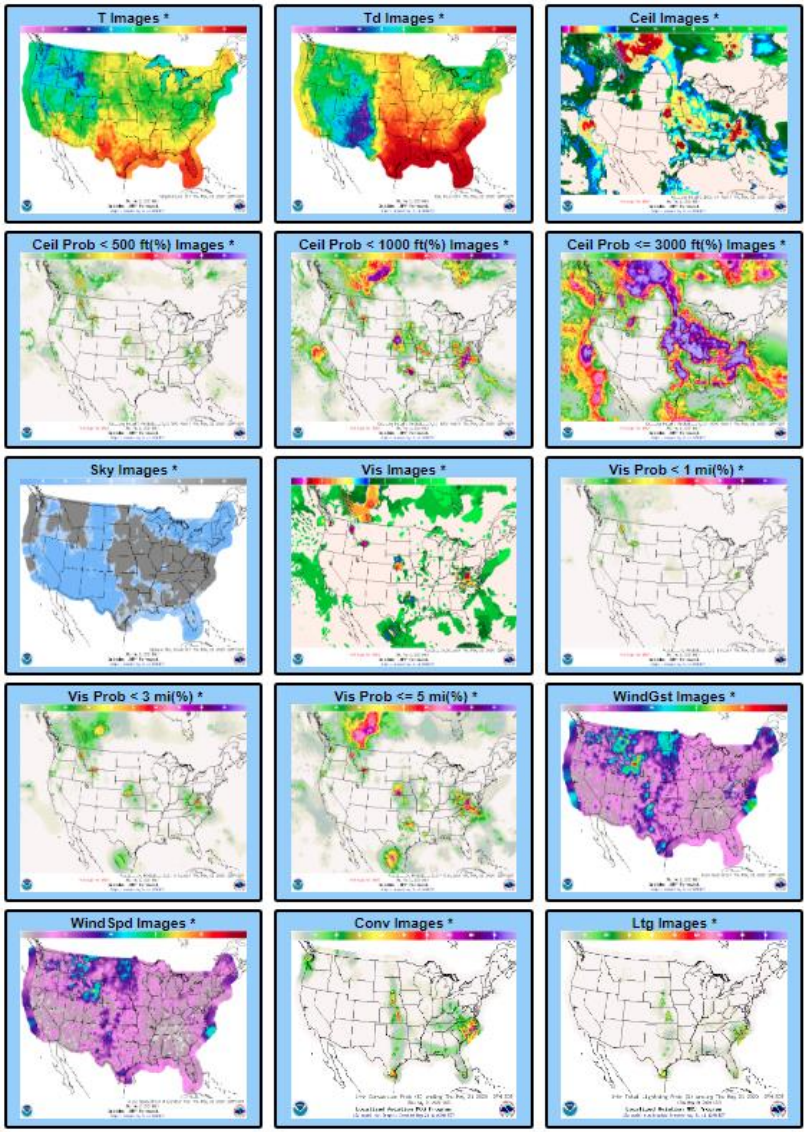
Click here to find real-time gridded forecast guidance



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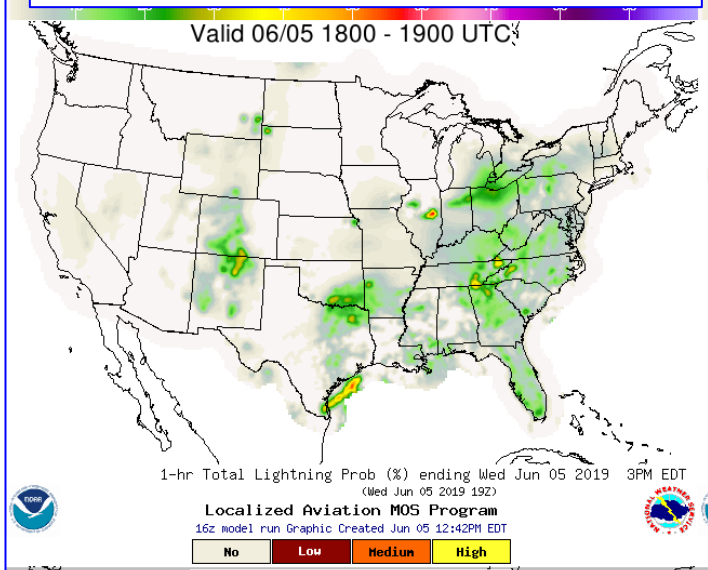
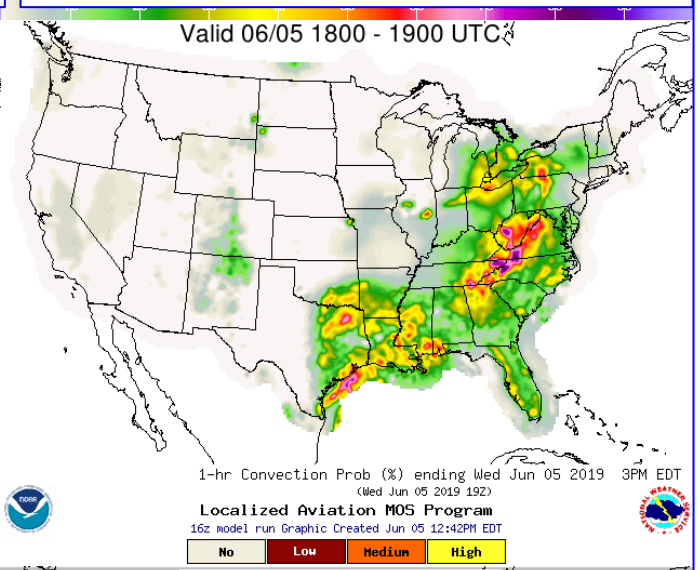
LAMP Web Page

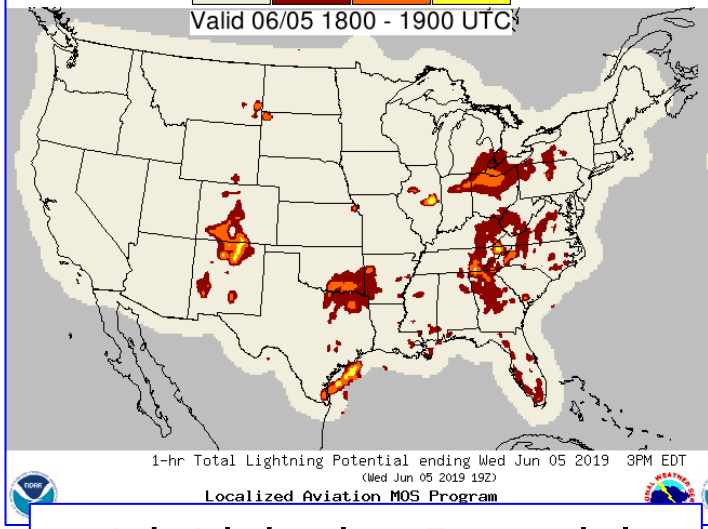
1-h Lightning Probability



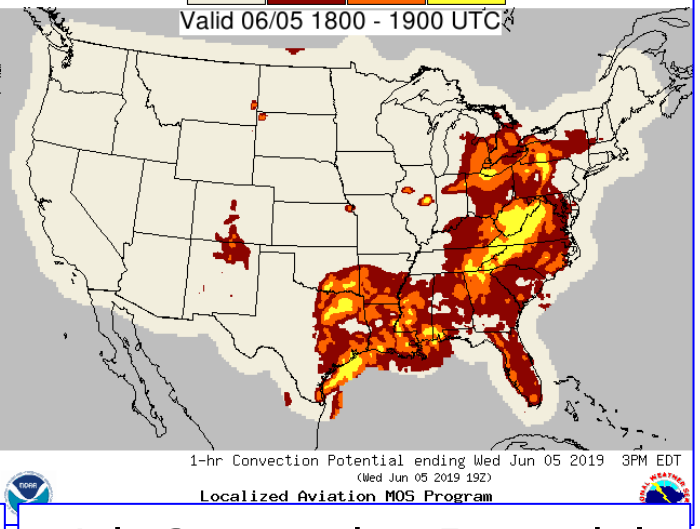
1-h Convection Probability



1-h Lightning Potential



1-h Convection Potential



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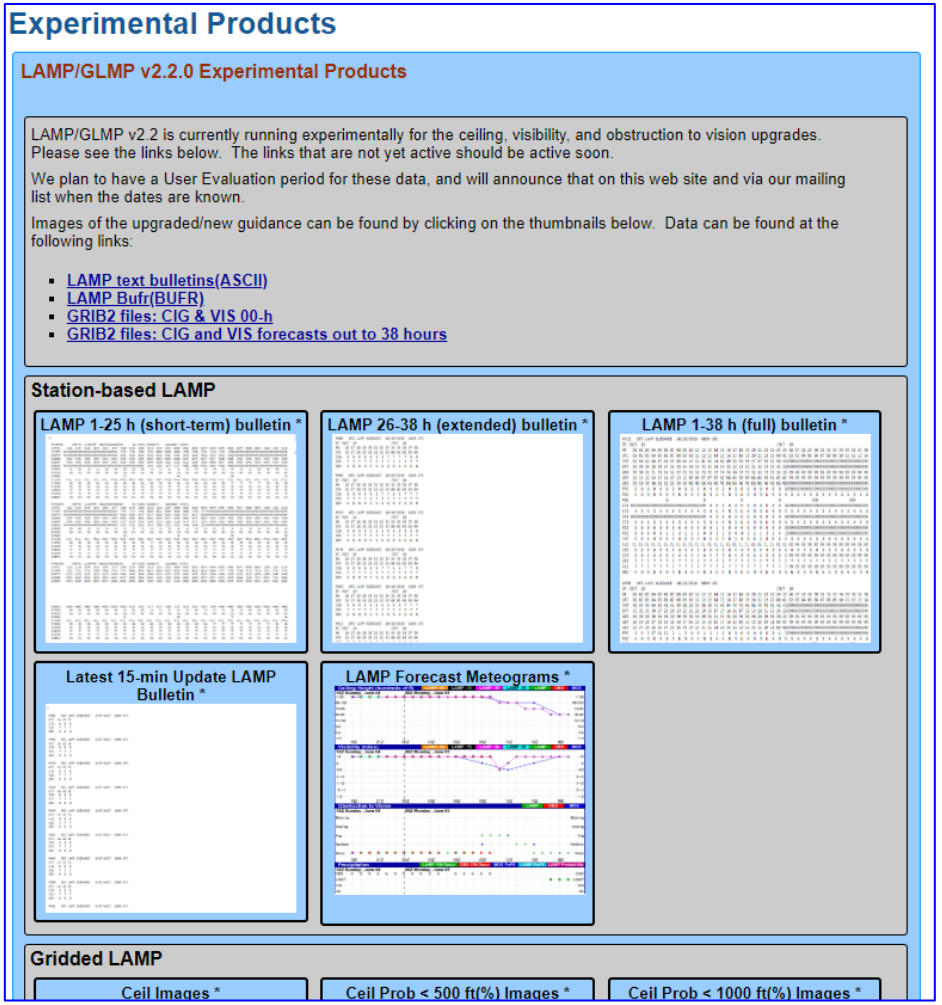
Click here to find experimental guidance that we are currently working on implementing



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- Archived Products

Documentation
- About
- FAQ
- Docs
- Change Log
- Technical notices
- Presentations
- Publications

Verification
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Click here to sign up for our mailing list to receive information about:

- Current known outages
- Future anticipated outages
- News about upcoming changes

Instructions for joining LAMP Mail List Server

The purpose of this list is to notify users of changes to LAMP webpages or other LAMP products. In order to subscribe to the LAMP users mailing list, send email to: lyris@infolist.nws.noaa.gov. No subject is necessary.

The body of the message should contain the following:

subscribe lamp_mailing_list pw=your_password

Where your_password is the password you determine. Please use a combination of at least 6 characters/numbers/special characters. Make note of this password as it will be needed to access any previous messages sent to the list server.

After the above process is completed, your request to join the mailing list will need to be approved. Upon approval you will receive an automated welcome message, and thereafter you will receive any emails that are sent to the list. Approved members can read previous messages by going to http://infolist.nws.noaa.gov/read/login.

In order to enter the site, you will be asked to enter the email address where you receive your subscription, and also the password that you determined to use.

If you have any questions or problems please feel free to Email Us.

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- Archived Products

Documentation
- About
- FAQ
- Docs
- Change Log
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- Presentations
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Click here to contact the LAMP team

Thank you for contacting MDL!

Please send us an email using the form below

For the fastest response, please do the following:

- Select the best fit for your question type in the drop-down menu
- Include the name of the product or project in the subject line
- If you have a question or comment about the webpage design or contents, include the url of the page in the email body

Thank you!

Contact Form

If you want a response, you MUST include your contact information in the Contact Email or inside your message. We cannot reply to you if you do not provide the information.

I have Questions / Comments about:

Choose Topic: LAMP

Your Name:

Affiliation (optional):

Contact Email (your email):

Subject:

Message:

Captcha Image: km2fc5

Type Captcha Here:

Refresh Captcha

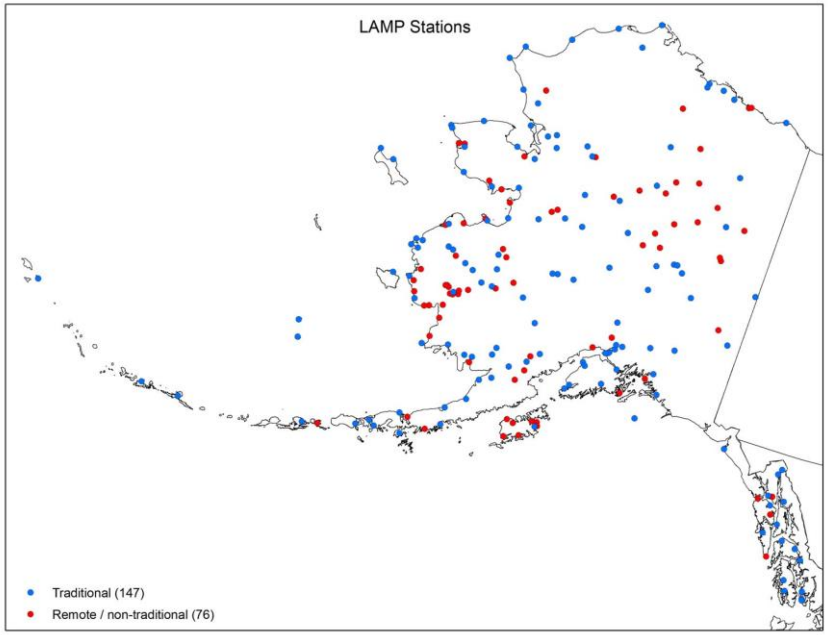
Submit Form

https://www.weather.gov/mdl/lamp_home

3. Current Work

LMP/GLMP V2.3 Upgrade

- LAMP supports the National Blend of Models:
  - The National Blend of Models (NBM) provides a skillful and spatially consistent gridded starting point for making National Digital Forecast Database (NDFD) forecasts.
  - NBM is key component to NWS efforts to evolve and build a Weather Ready Nation.
- V2.3.0 upgrade highlights:
  - Alaska “Meld” ceiling and visibility guidance on NBM domain to 38 hours.
  - Alaska “Meld” 1-h convection and lightning probability and potential guidance on NBM domain to 38 hours.
  - Adding ceiling, visibility, convection, and lightning guidance at 76 remote locations in AK.
  - CONUS “Meld” sky cover guidance on NBM domain to 38 hours.
  - CONUS 1-h Probability of precipitation on NBM domain out to 38 hours.



Alaska Gridded LAMP Ceiling and Visibility (LAMP/GLMP V2.3)

Alaska LAMP Meld for C&V (V2.3)

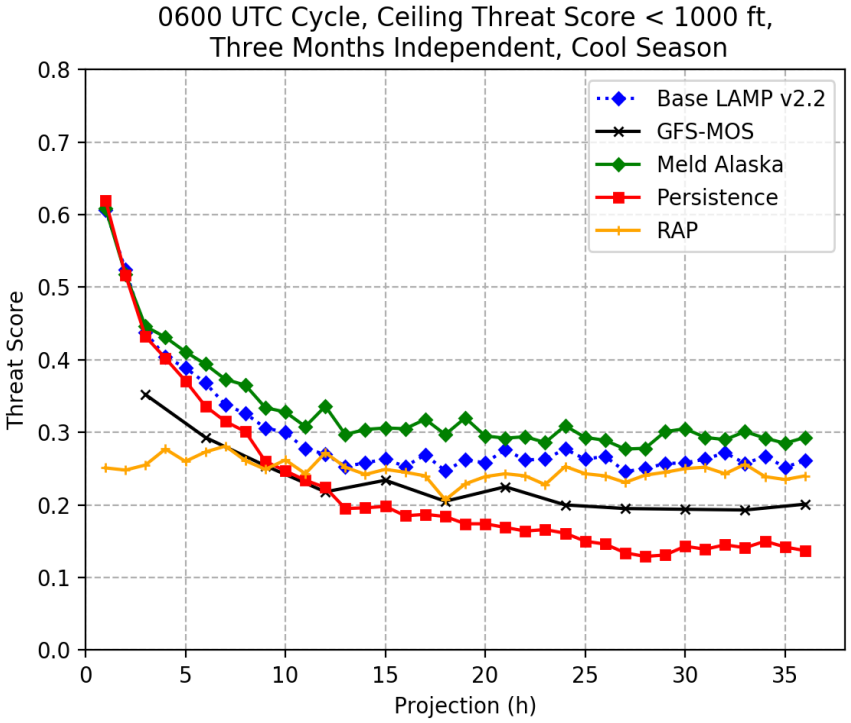
- JTTI-funded work
- Challenges and Decisions:
  - Very different observation/station density in AK vs CONUS
  - Created additional “MOS/LAMP” stations in remotest parts of domain
  - HRRR AK available only every 3 hours
  - Decided to leverage RAP in AK instead of HRRR AK until such a time as HRRR is available hourly; Also RAP covers NBM domain
  - No observations over water
  - Decided to use RAP-only over water
  - AK GLMP C&V Land = blending of Base LAMP (which includes GFS MOS, Obs, simple models) + RAP

Alaska LAMP Meld for C&V (V2.3)

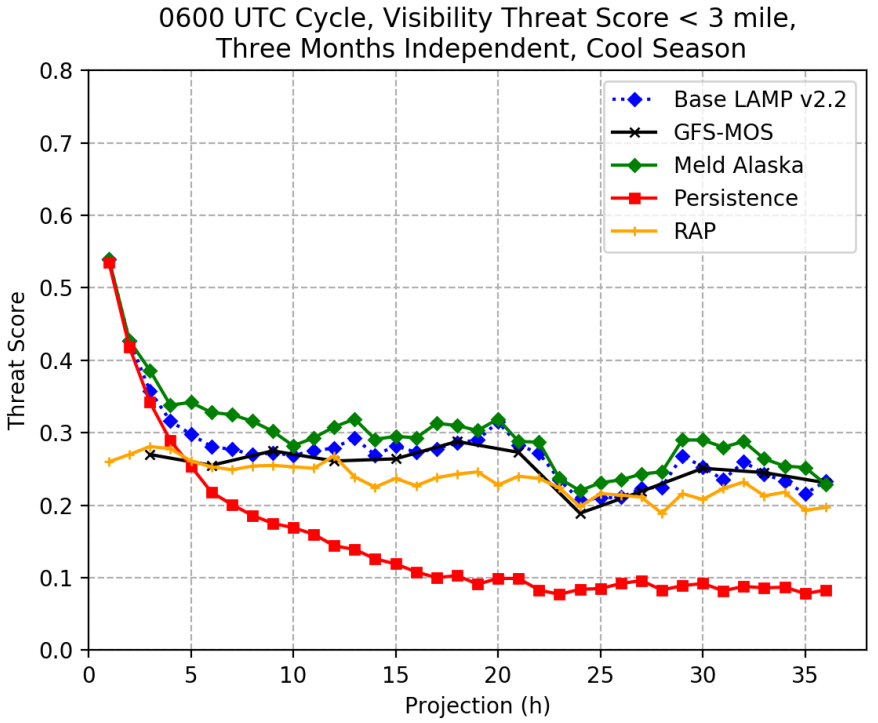
- Verification details
  - Development period:
    - 4 years of warm season data (warm seasons 2015-2018)
    - 3 years of cool season data (cool seasons 2015-2016, 2016-2017, 2017-2018)
  - Independent data period for verification
    - 4 months of warm season verification (June – Sep 2018)
    - 3 month of cool season verification (Jan – Mar 2018)
- All AK stations verified

LAMP Meld (V2.3) Verification
Alaska 1-38 h guidance Cool Season

Ceiling < 1,000 feet



Visibility < 3 miles

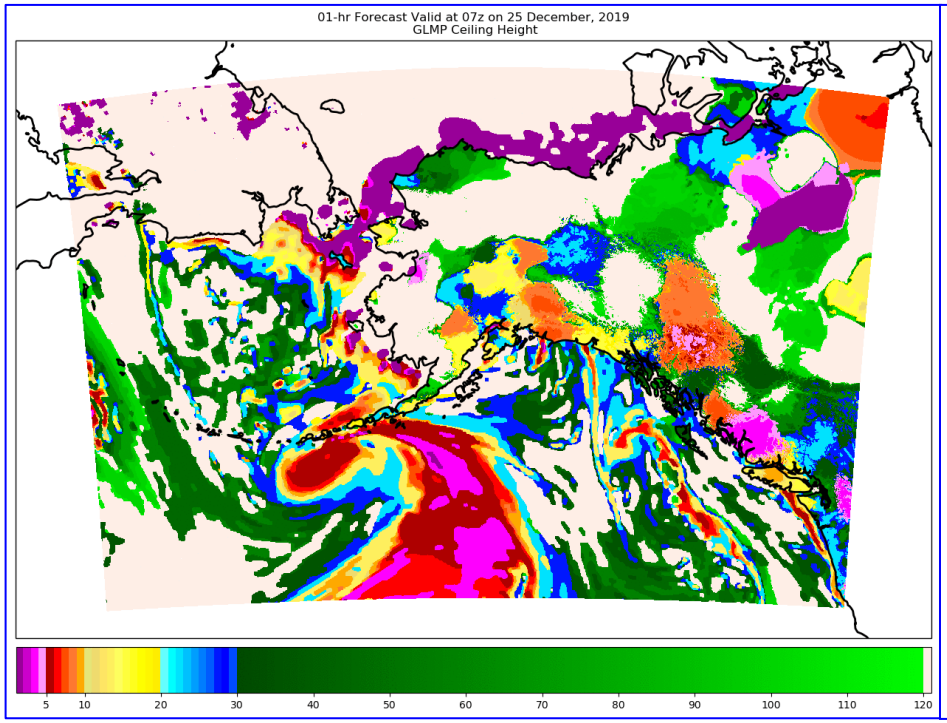


LAMP Meld (green) shows improvement over Base LAMP (blue) and RAP (yellow) and GFS MOS (black)

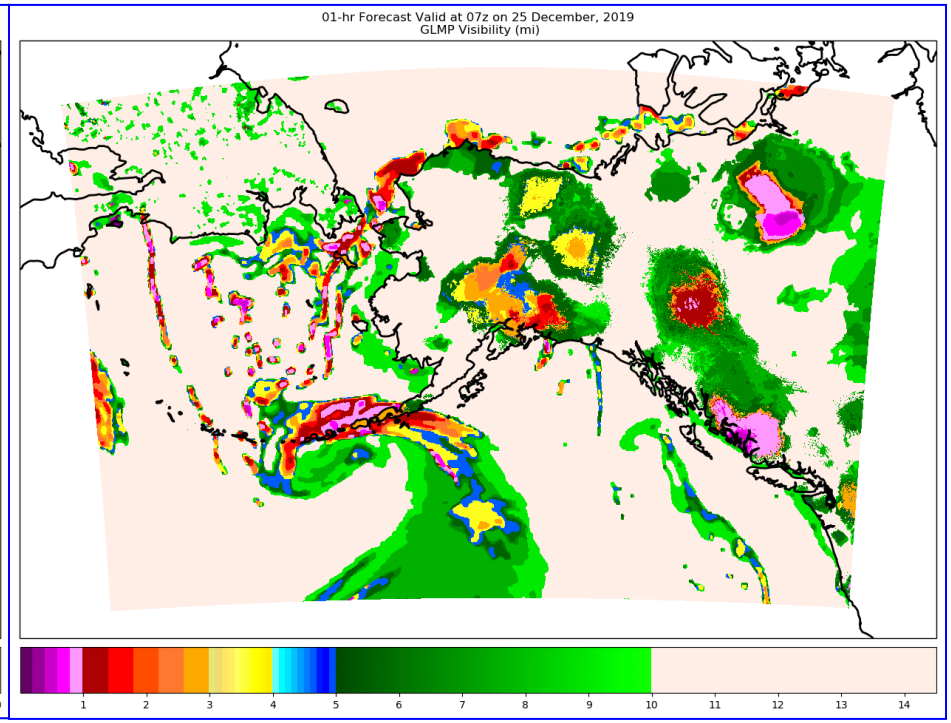
Alaska LAMP Meld for C&V (V2.3)

Prototype Forecasts

Gridded LAMP Ceiling Forecasts



Gridded LAMP Visibiliy Forecasts

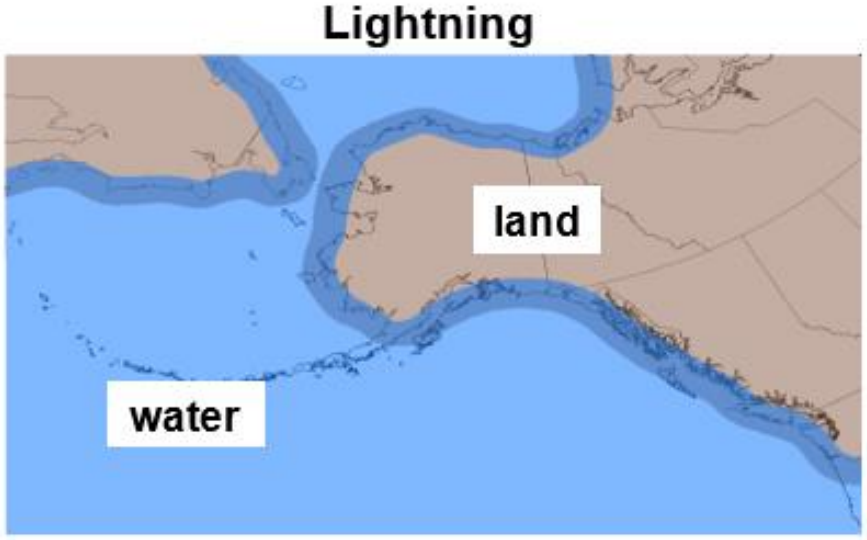


Alaska Gridded LAMP 1-h Convection & Lightning (LAMP/GLMP V2.3)

Alaska LAMP Conv & Ltg (V2.3)

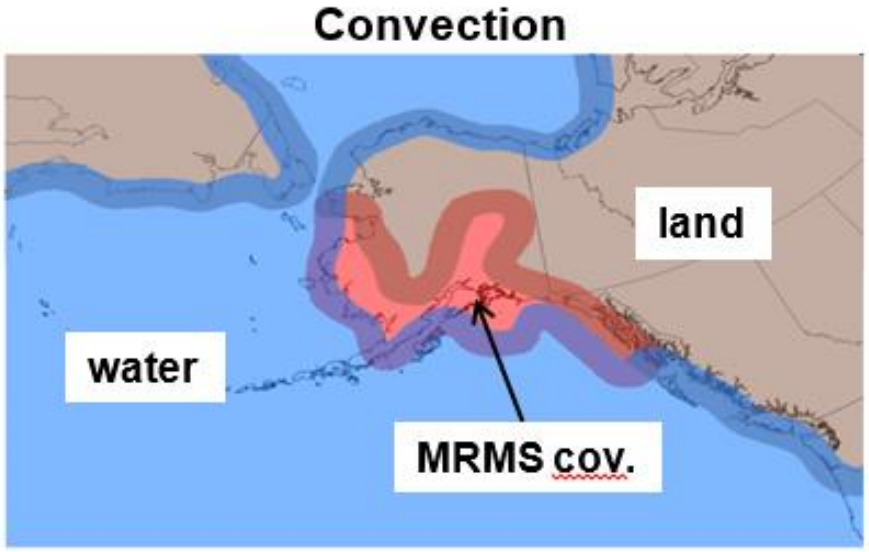
- JTTI-funded work
- Extension of CONUS convection and lightning (C&L) to Alaska NBM domain.
- Convection occurrence defined as 1 or more CG lightning strikes and/or composite reflectivity >= 35 dBZ
- Base LAMP = NAM MOS + obs
- Meld = Base LAMP + RAP MOS
- 1-h conv/ltg probability and potentials

Alaska LAMP Conv & Ltg (V2.3)



Two regions for lightning:

1. Land
2. Water

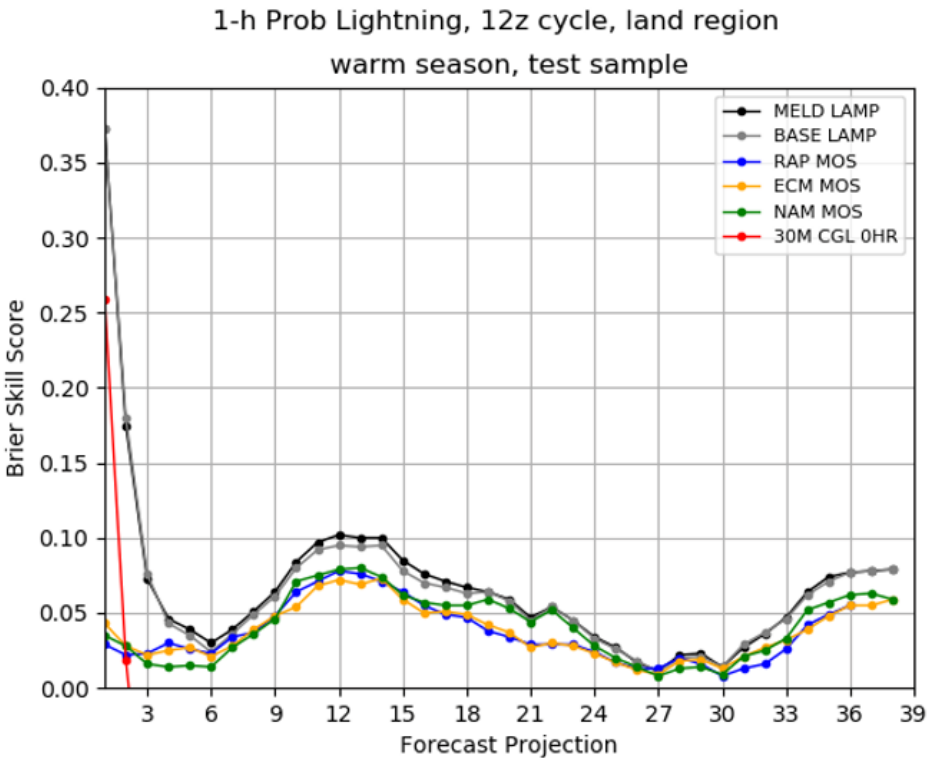


Three regions for conv:

1. MRMS
2. Land
3. Water

Alaska LAMP Conv & Ltg (V2.3)

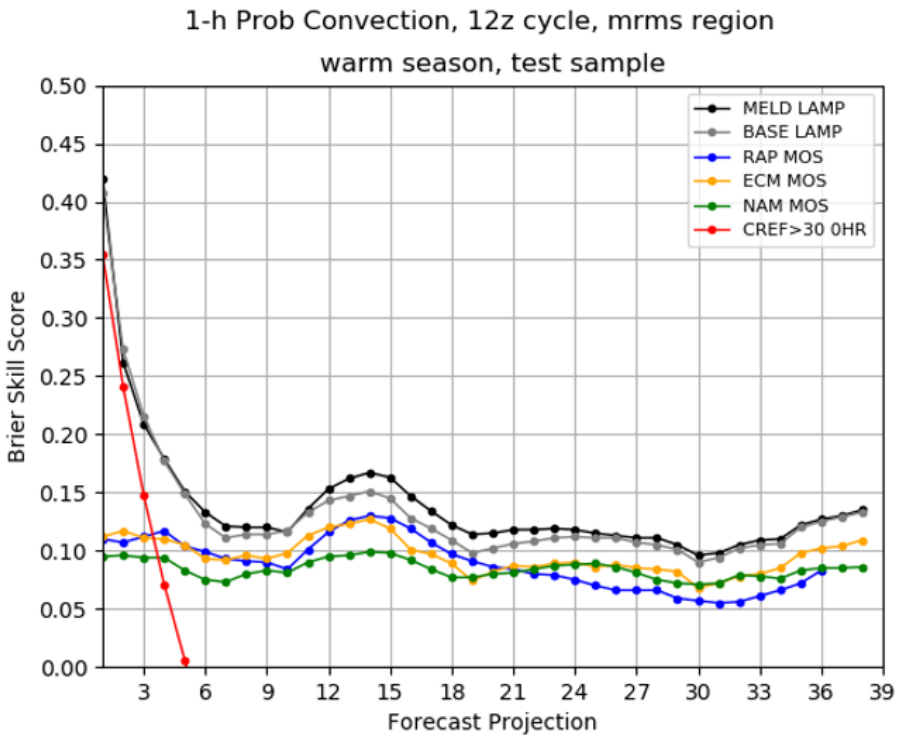
Lightning, 12z, land region
June-July 2017



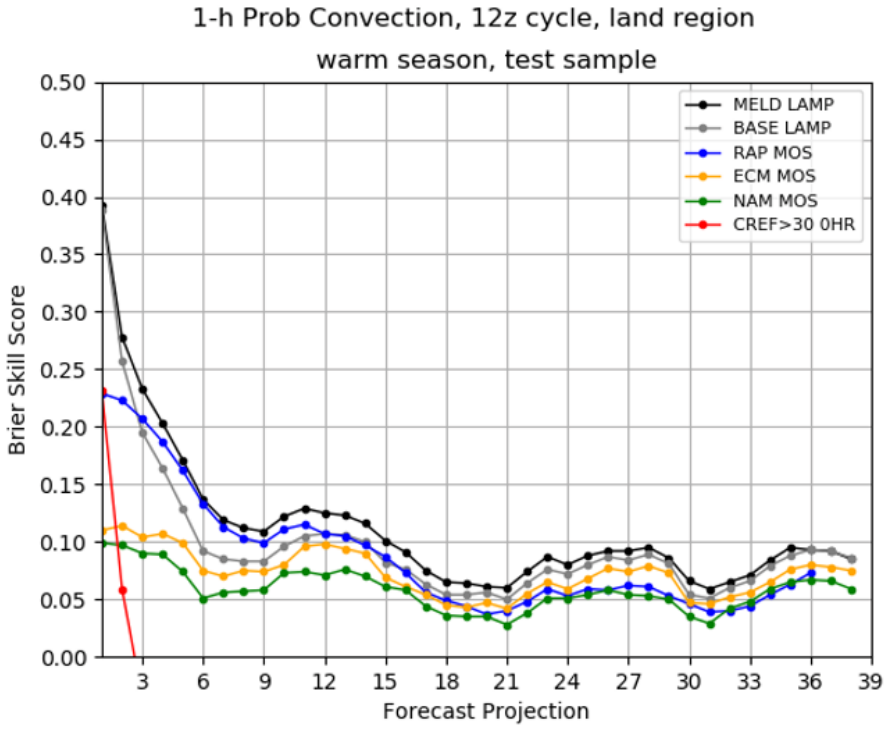
LAMP Meld (black) shows improvement over Base LAMP (grey) and all MOS components

Alaska LAMP Conv & Ltg (V2.3)

Convection, 12z, MRMS region
June-July 2017

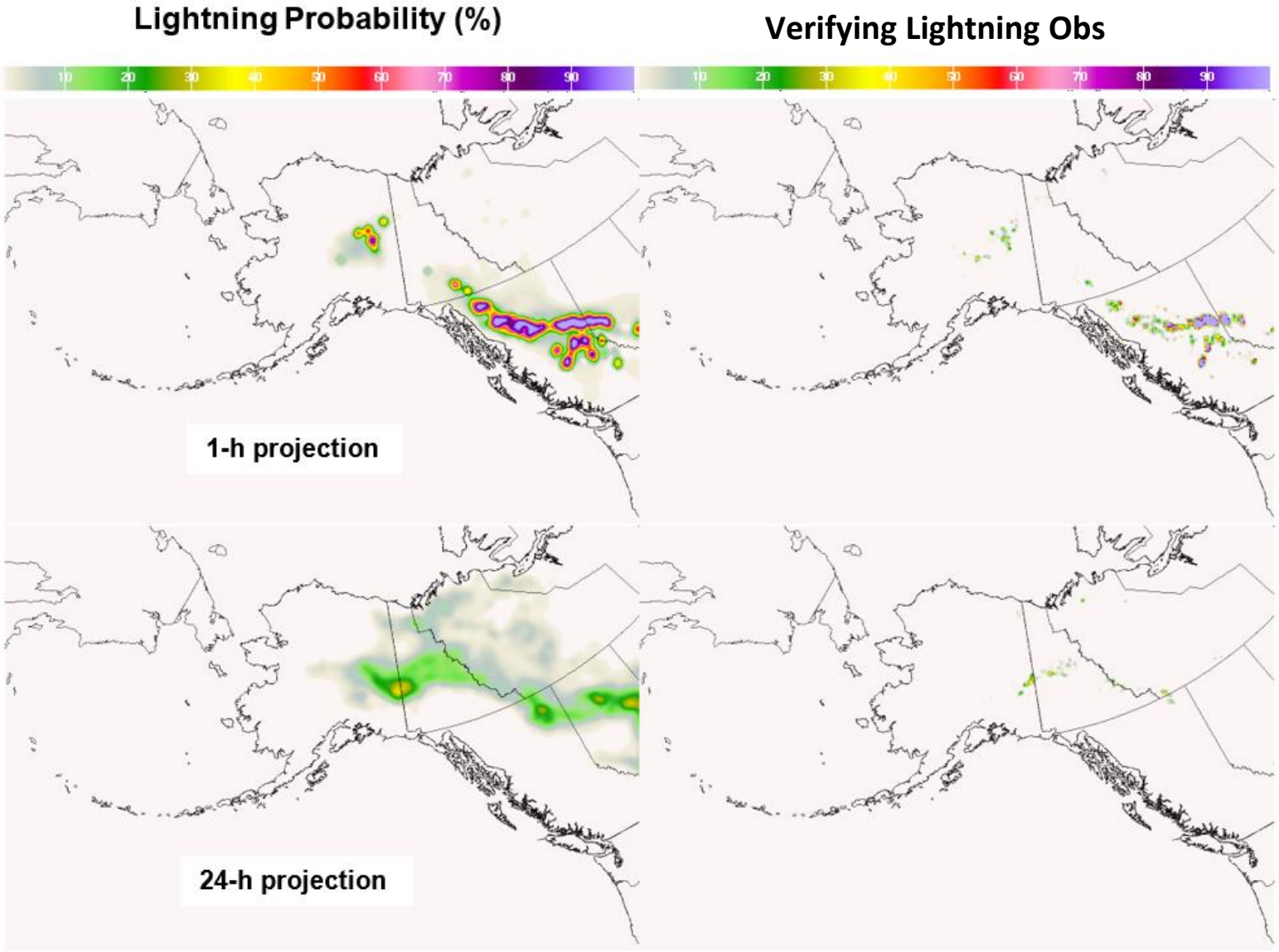


Convection, 12z, land region
June-July 2017

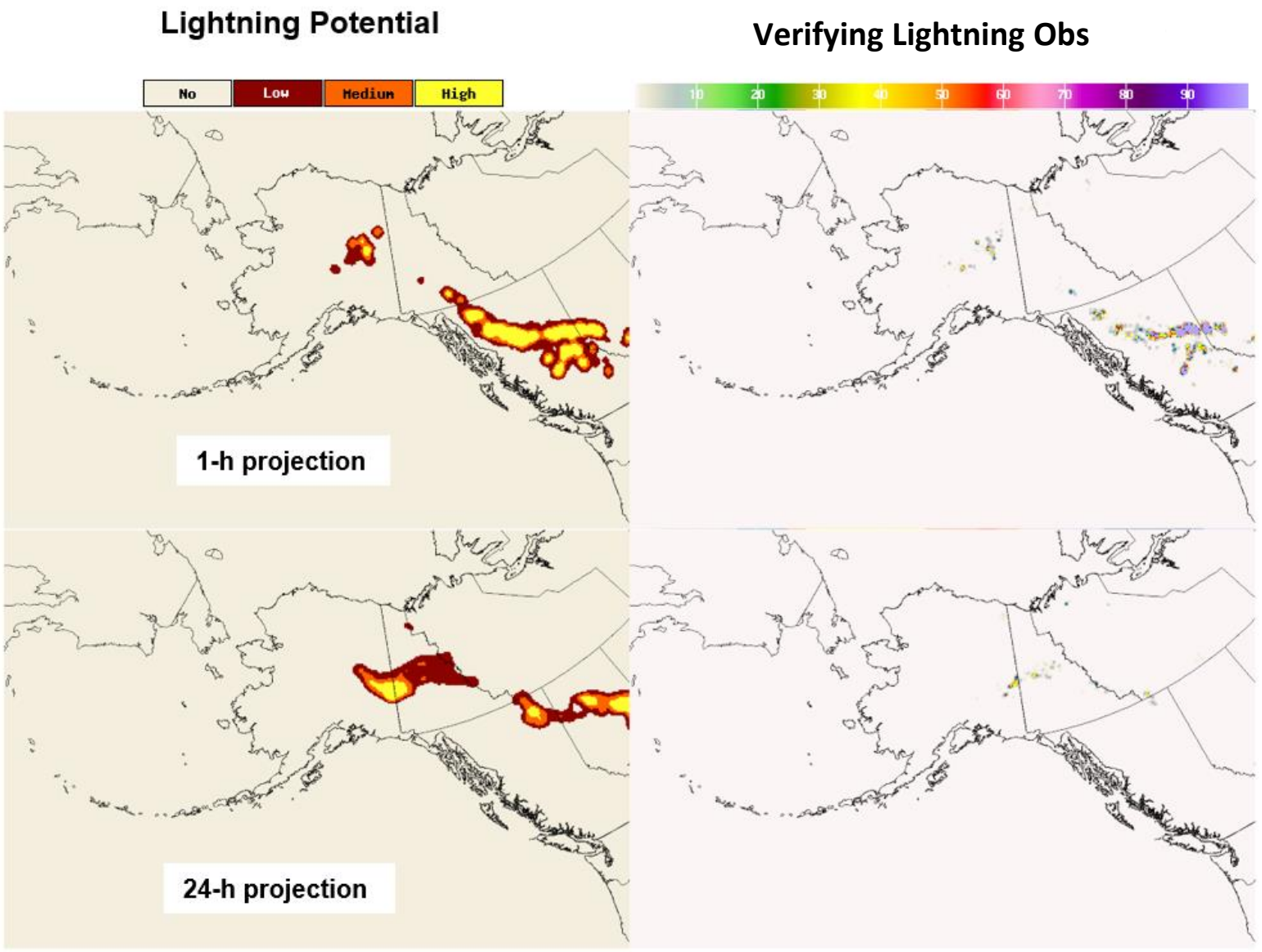


LAMP Meld (black) shows improvement over Base LAMP (grey) and all MOS components

Alaska LAMP Conv & Ltg (V2.3)



Alaska LAMP Conv & Ltg (V2.3)



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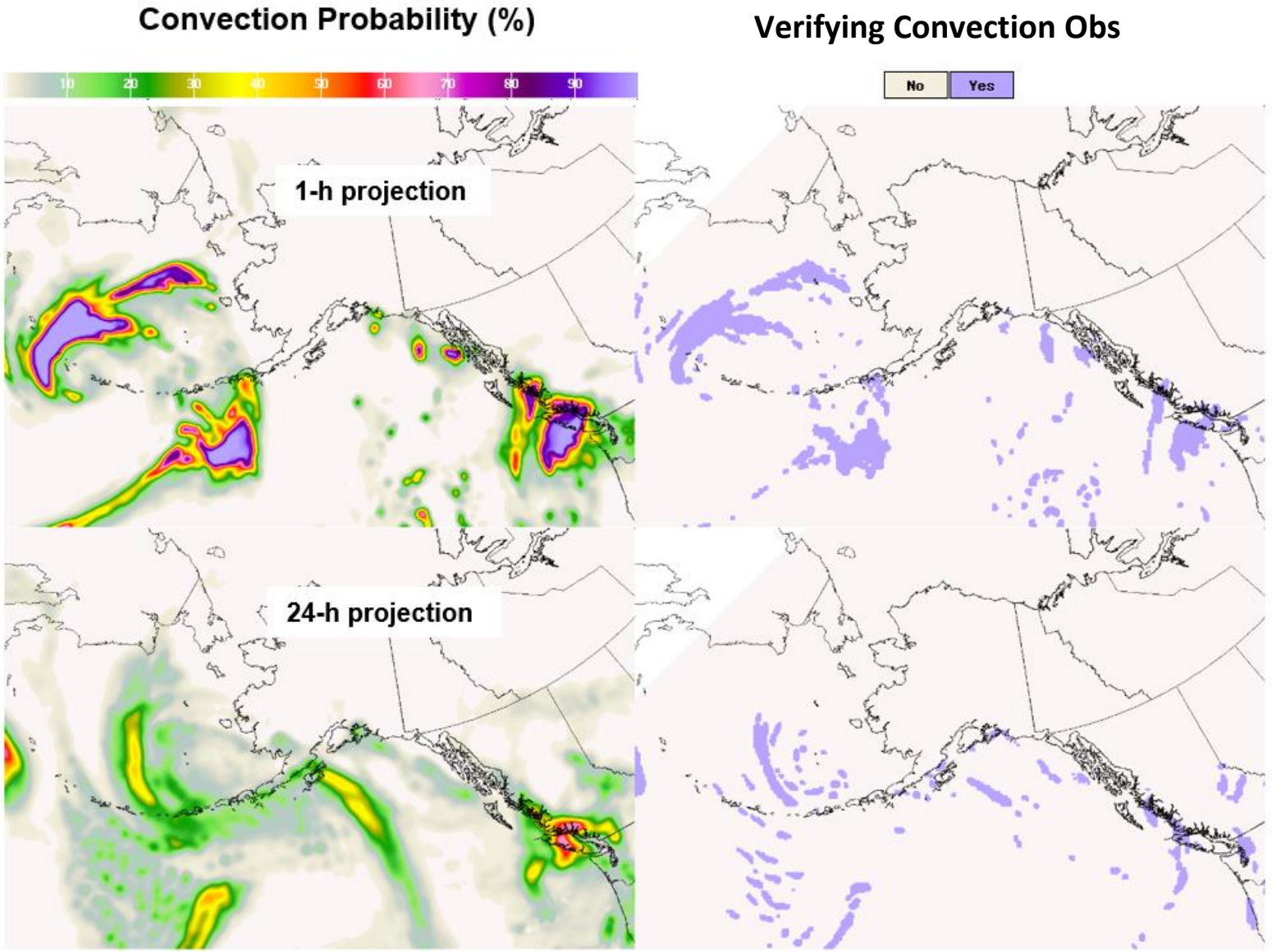
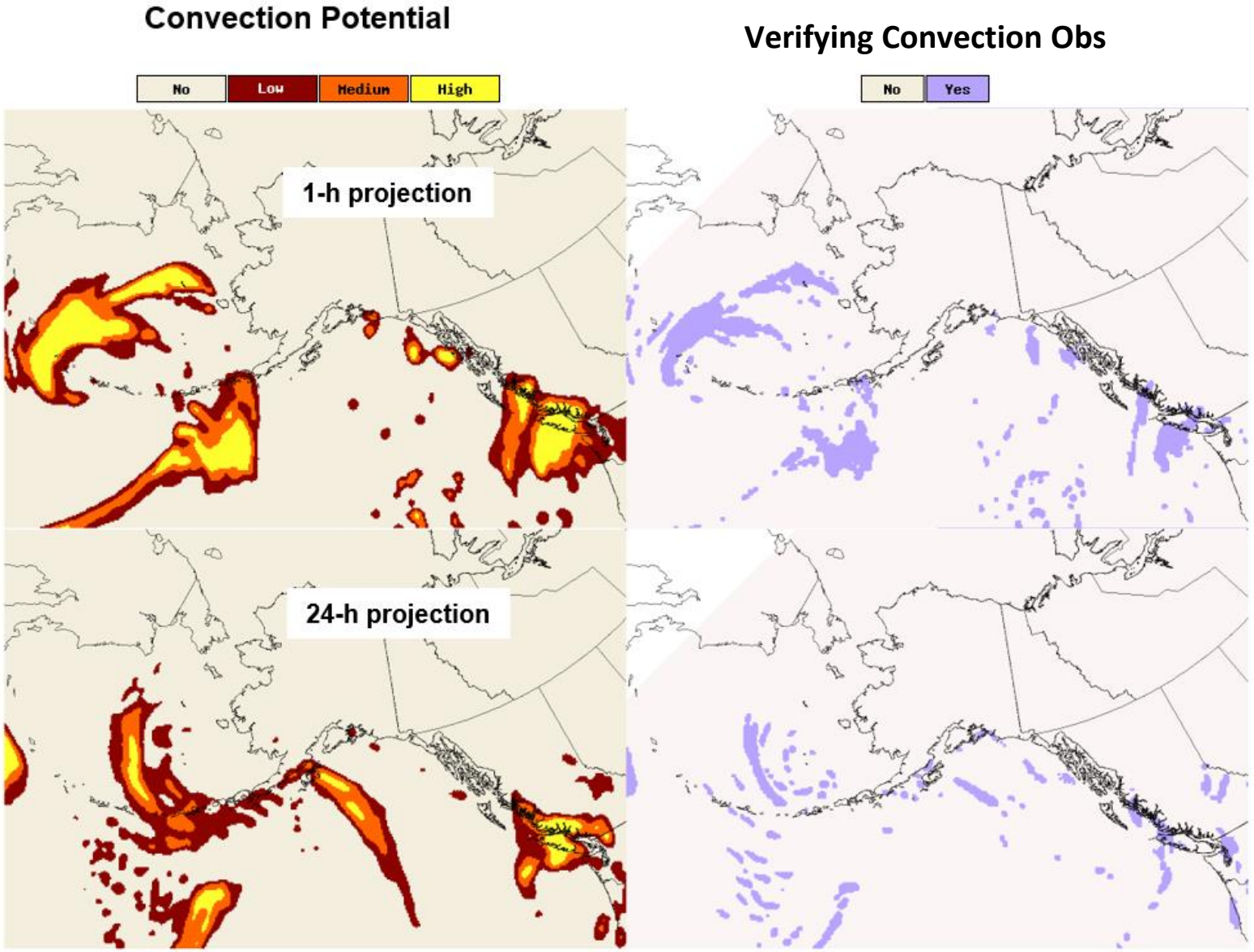


Alaska LAMP Conv & Ltg (V2.3)



CONUS Gridded LAMP Meld Sky Cover (LAMP/GLMP V2.3)

CONUS GLMP Sky Cover (V2.3)

- Work funded by FAA AWRP
- Expansion of GLMP sky cover guidance to full NBM CONUS domain and extension to 38 hours.
- Base LAMP = GFS MOS (new) + obs
- Meld = Base LAMP + HRRR MOS

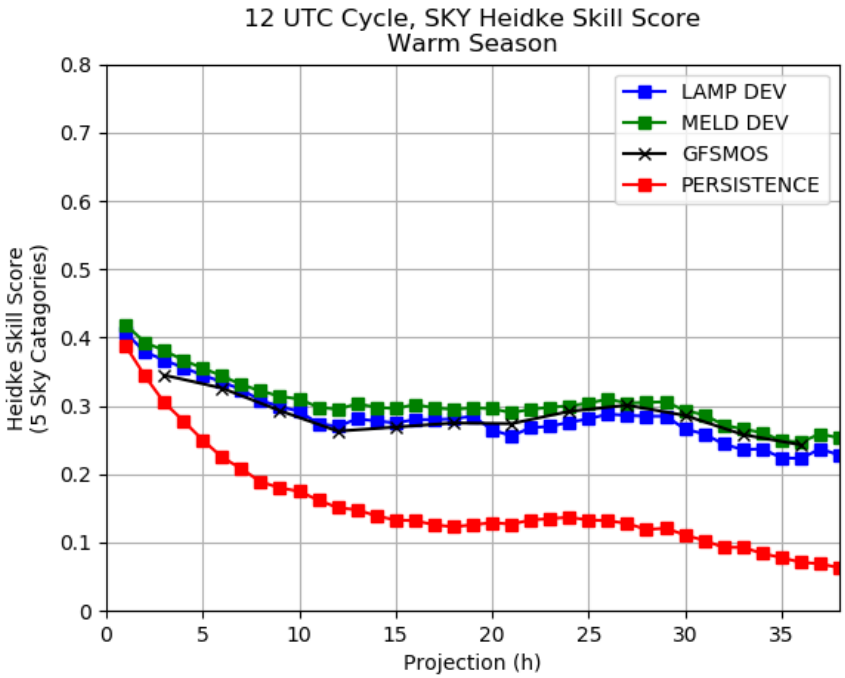
CONUS GLMP Sky Cover (V2.3)

- Development:
  - Cumulative probabilities of sky cover
    < few, < scattered, < broken, < overcast
  - Regional equations out to 38 hours.
  - Thresholds computed for making discrete categorical forecasts (clr, few, sct, bkn, ovc).

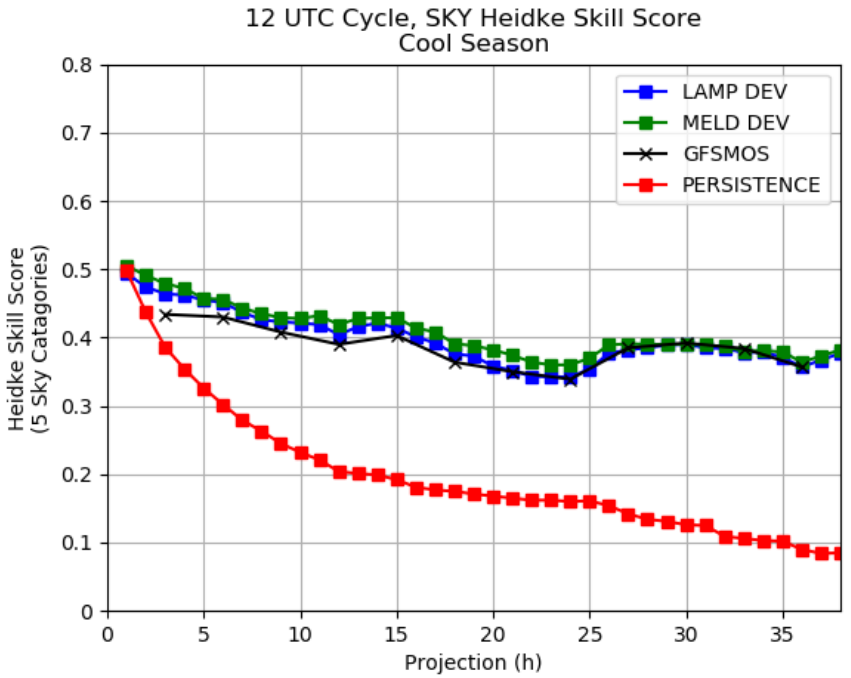
- Verification:
  - Heidke Skill Scores computed for Meld, Base LAMP, GFS MOS, and persistence.
  - Includes ~1550 stations that report sky cover.
  - Cool season independent period: Feb-March 2017, Oct-Dec 2017
  - Warm season independent period: Apr-Sept 2017

CONUS GLMP Sky Cover (V2.3)

12z, Warm Season



12z, Cool Season



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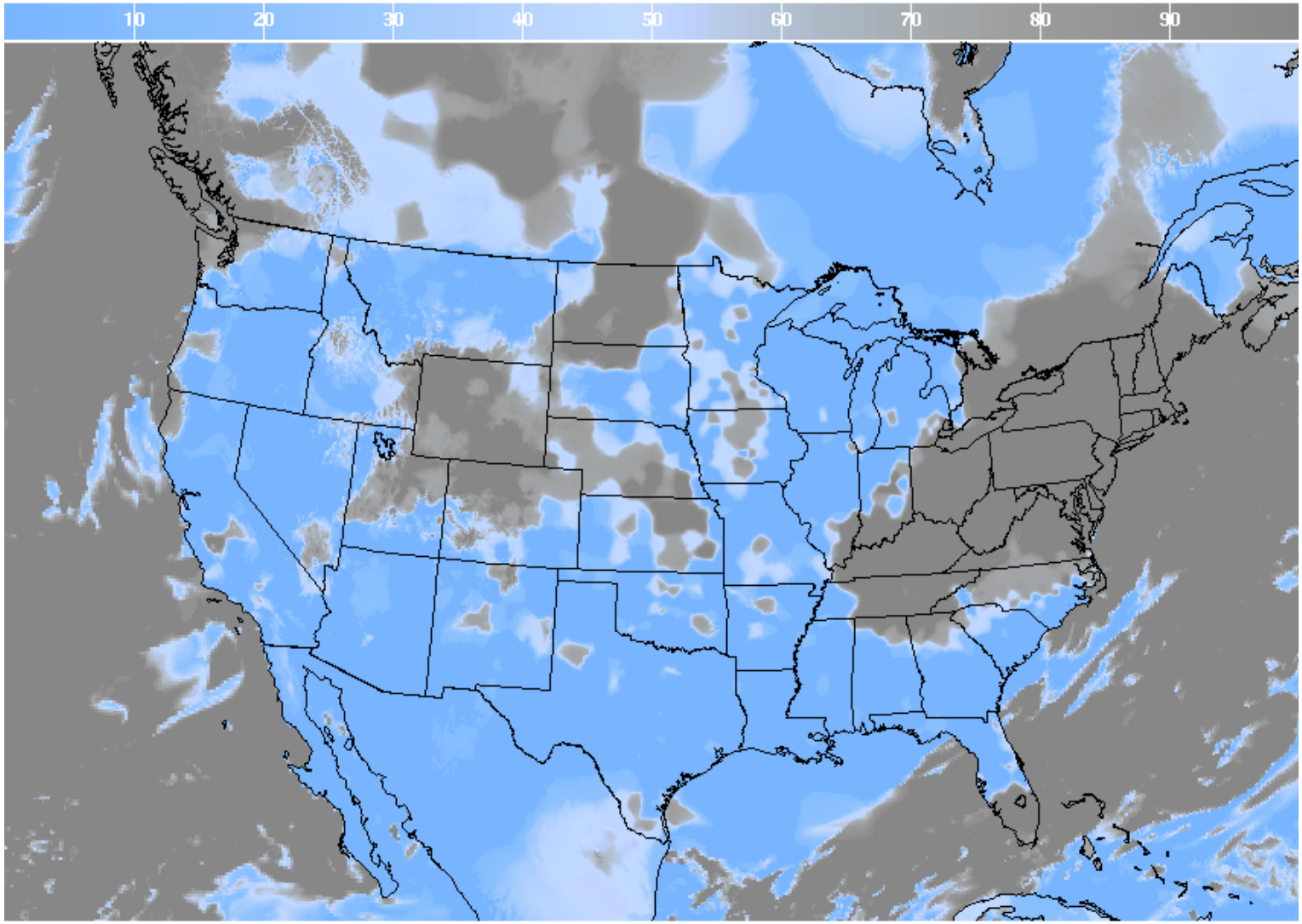
CONUS GLMP Sky Cover (V2.3)

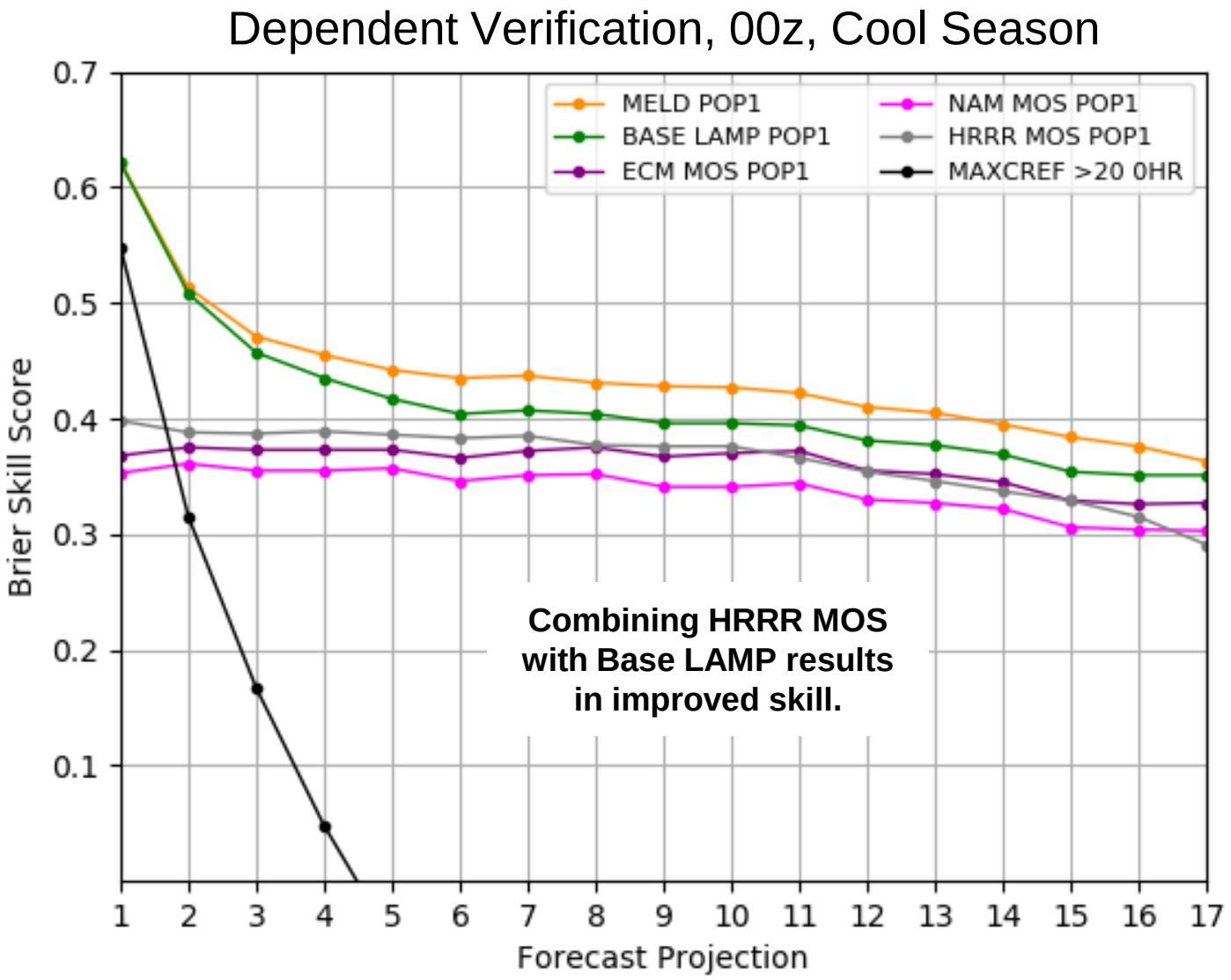


CONUS Gridded LAMP
1-h Probability of Precipitation
(LAMP/GLMP V2.3)

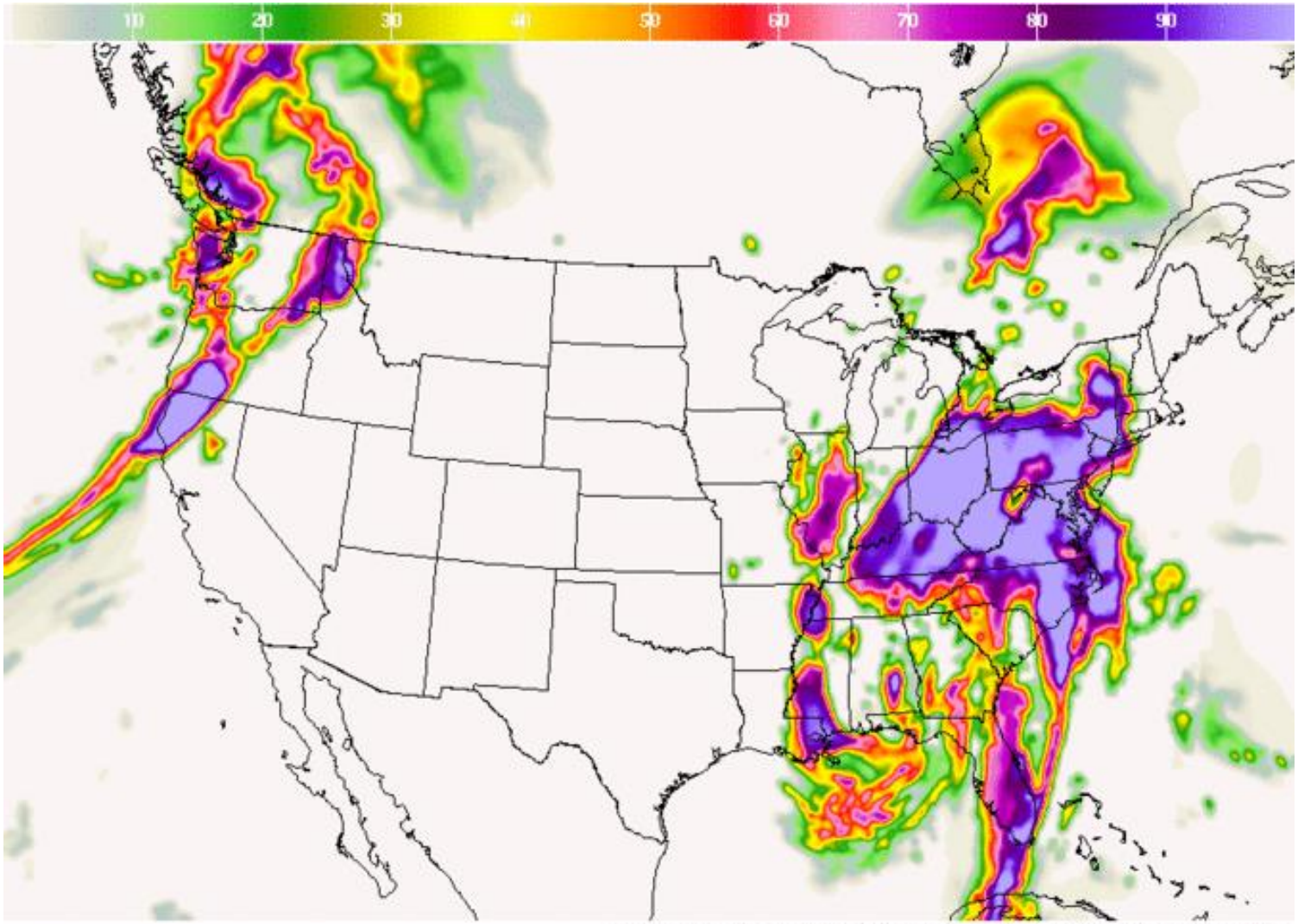
CONUS GLMP 1-h PoP (V2.3)

- Supports National Blend of Models
- MRMS gauge-corrected 1-h quantitative precipitation estimates used to define occurrence of measure precipitation.
- Predictand = areal coverage of measurable precipitation in a 5-km grid box during the hour
- Base LAMP = NAM MOS + obs
- Meld = Base LAMP + HRRR MOS
- 1-h/6-h/12-h PoP, 1-h categorical yes/no

CONUS GLMP 1-h PoP (V2.3)



CONUS GLMP 1-h PoP (V2.3)



12/21/2018, 00Z cycle, 1-38 hours

Summary

LAMP/GLMP v2.3 implementation:

- Alaska “Meld” ceiling and visibility guidance on NBM domain to 38 hours.
- Alaska “Meld” 1-h convection and lightning probability and potential guidance on NBM domain to 38 hours.
- CONUS “Meld” sky cover guidance on NBM domain to 38 hours.
- CONUS 1-h Probability of precipitation on NBM domain out to 38 hours.

Current schedule:

- Code handoff to NCEP Central Operations planned **September 2020**.
- Implementation on supercomputer planned **December 2020**.

4. Future Work

Future Work

Plans for remainder of FY20/21:

- Refresh of temperature, dewpoint, wind speed/direction/gust guidance at stations out to 38 hours to support NBM
- Refresh of precipitation type guidance at stations and extension to 38 hours (and possible gridded probability guidance for input to NBM)
- Create deterministic and probabilistic GLMP guidance for highest impact weather C&V and flight category conditions over 15-minute periods (funded by FAA).
- Investigate usability of satellite data to improve GLMP guidance between stations for ceiling height over CONUS (funded by FAA).
  - University of Wisconsin CIMSS and NASA Langley GOES-15/16

Additional Resources

Additional Resources:

- LAMP website: http://weather.gov/mdl/lamp_home
- LAMP Experimental website: http://www.weather.gov/mdl/lamp_experimental
- Contacts: Phil.Shafer@noaa.gov, Judy.Ghirardelli@noaa.gov

Thank you!