Localized Aviation MOS Program (LAMP): A Statistical Post-processing System for the Past, Present, and Future

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Harry R. Glahn Symposium

95th AMS Annual Meeting
Phoenix, AZ

January 6, 2015

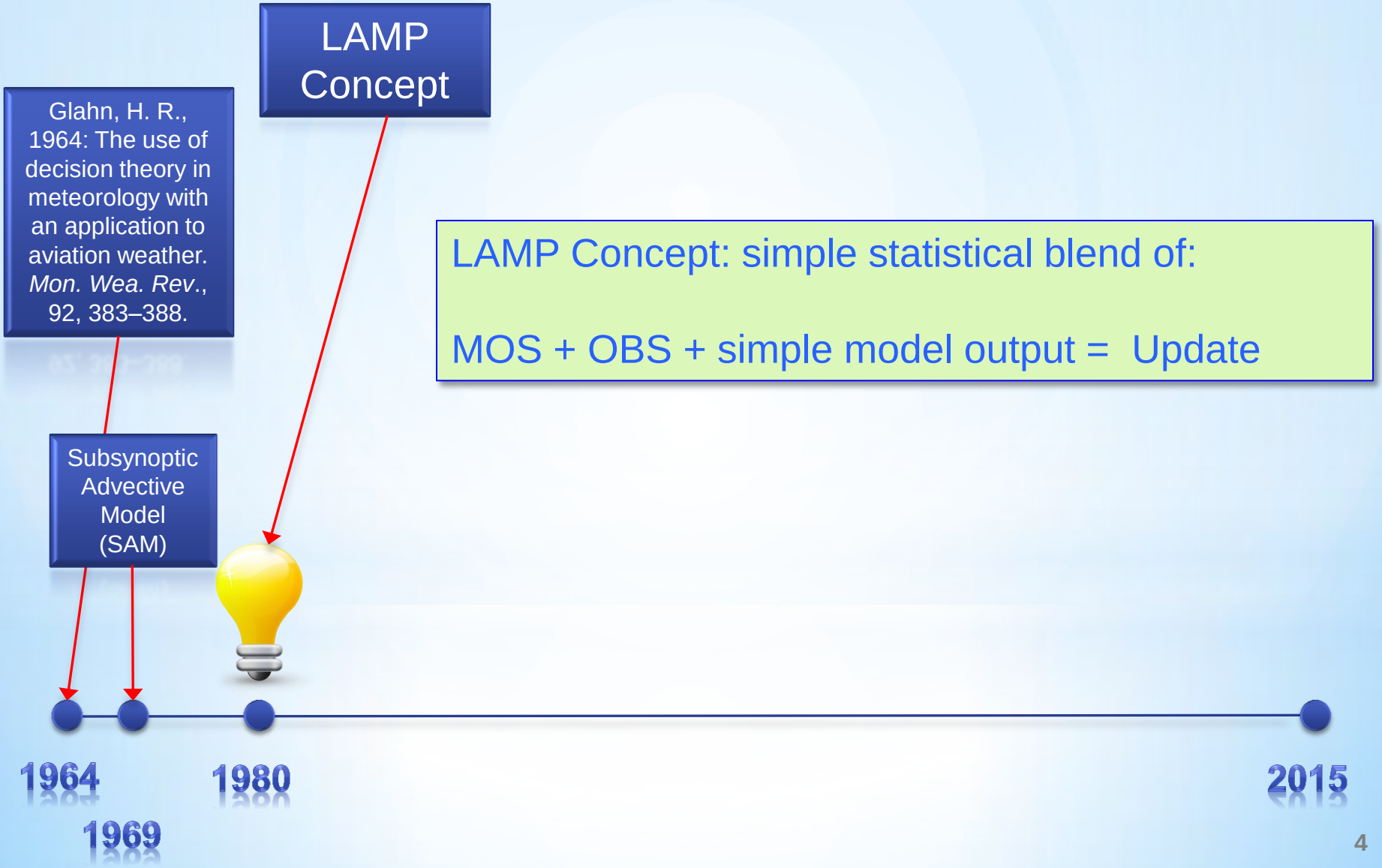
Or…

The History of LAMP: 35 years in 12 minutes

Background

- For decades, aviation forecasters have been providing forecasts to assist with the movement of aircraft through the National Air Space
- Aviation forecasters have had, and continue to have, a requirement for good quality guidance to help provide required aviation forecasts
- NWS forecasters need station-based guidance for the Terminal Aerodrome Forecast (TAF) and gridded guidance for Digital Aviation Services
- Aviation forecast products include forecasts of some of the most challenging sensible weather to forecast, such as thunderstorms, ceiling height, and visibility
- Historically, direct model output from Numerical Weather Prediction models has either not directly provided such forecasts or provided output that could be improved on when statistically post-processed

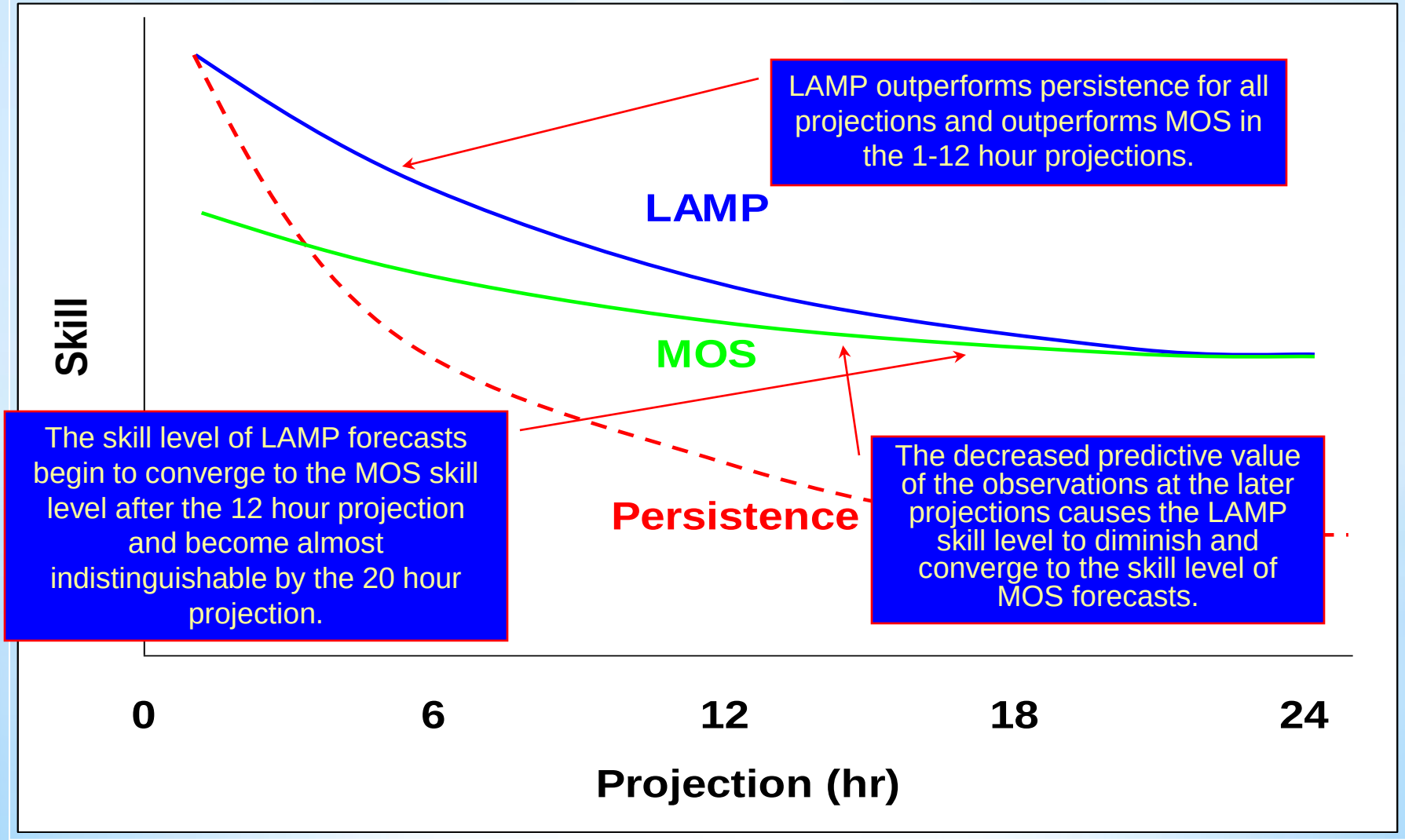
Time Line



LAMP Concept: simple statistical blend of:

MOS + OBS + simple model output = Update

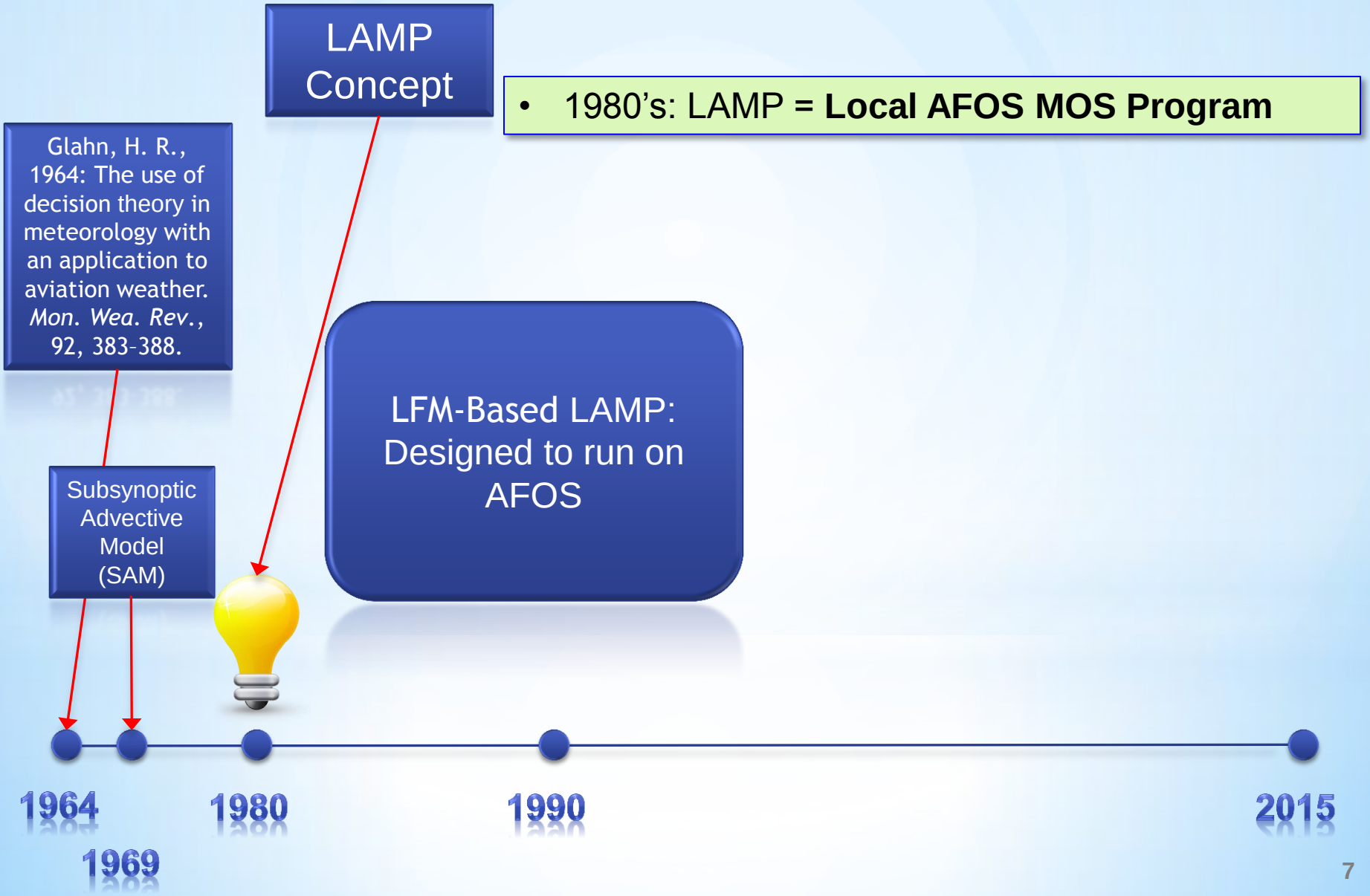
Theoretical Model Forecast Performance of LAMP, MOS, and Persistence



LAMP was developed

- LAMP: a system of objective analyses, simple models, regression equations, and related thresholds which together provided guidance for sensible weather forecasts. The same definition applies today.
- LAMP acted as an update to Limited-Fine Mesh (LFM) MOS guidance
- Guidance was both probabilistic and non-probabilistic
- LAMP bridged the gap between the observations and the MOS forecasts
- Designed to run on Automation of Field Operations and Services (AFOS)
- LAMP = **Local AFOS MOS Program**

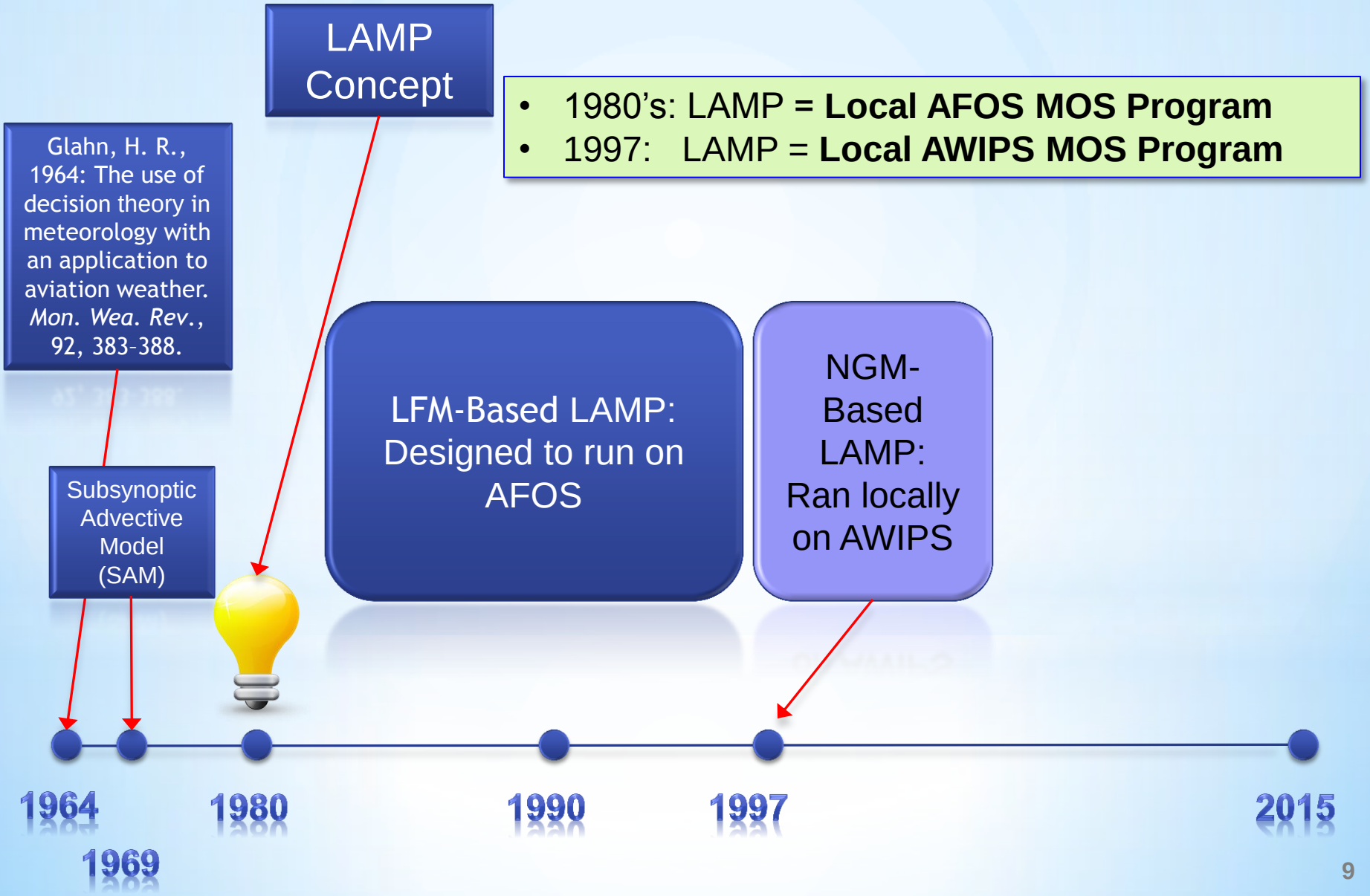
Time Line


LAMP Concept
• 1980's: LAMP = **Local AFOS MOS Program**
Glahn, H. R., 1964: The use of decision theory in meteorology with an application to aviation weather. *Mon. Wea. Rev.*, 92, 383-388.
Subsynoptic Advective Model (SAM)
LFM-Based LAMP: Designed to run on AFOS
1964
1969
1980
1990
2015

LFM- to NGM-based LAMP

- LFM-Based LAMP Concerns:
  - NWS modernization: AFOS was being phased out and AWIPS was being developed and implemented at NWS Forecast Offices
  - Nested-Grid Model (NGM) became operational, and was an improvement over LFM. LFM was to be discontinued.
- → NGM-Based LAMP was developed.
- Designed to run on Advanced Weather Interactive Processing System (AWIPS)
- LAMP = **Local AWIPS MOS Program**

Time Line



- 1980's: LAMP = **Local AFOS MOS Program**
- 1997: LAMP = **Local AWIPS MOS Program**

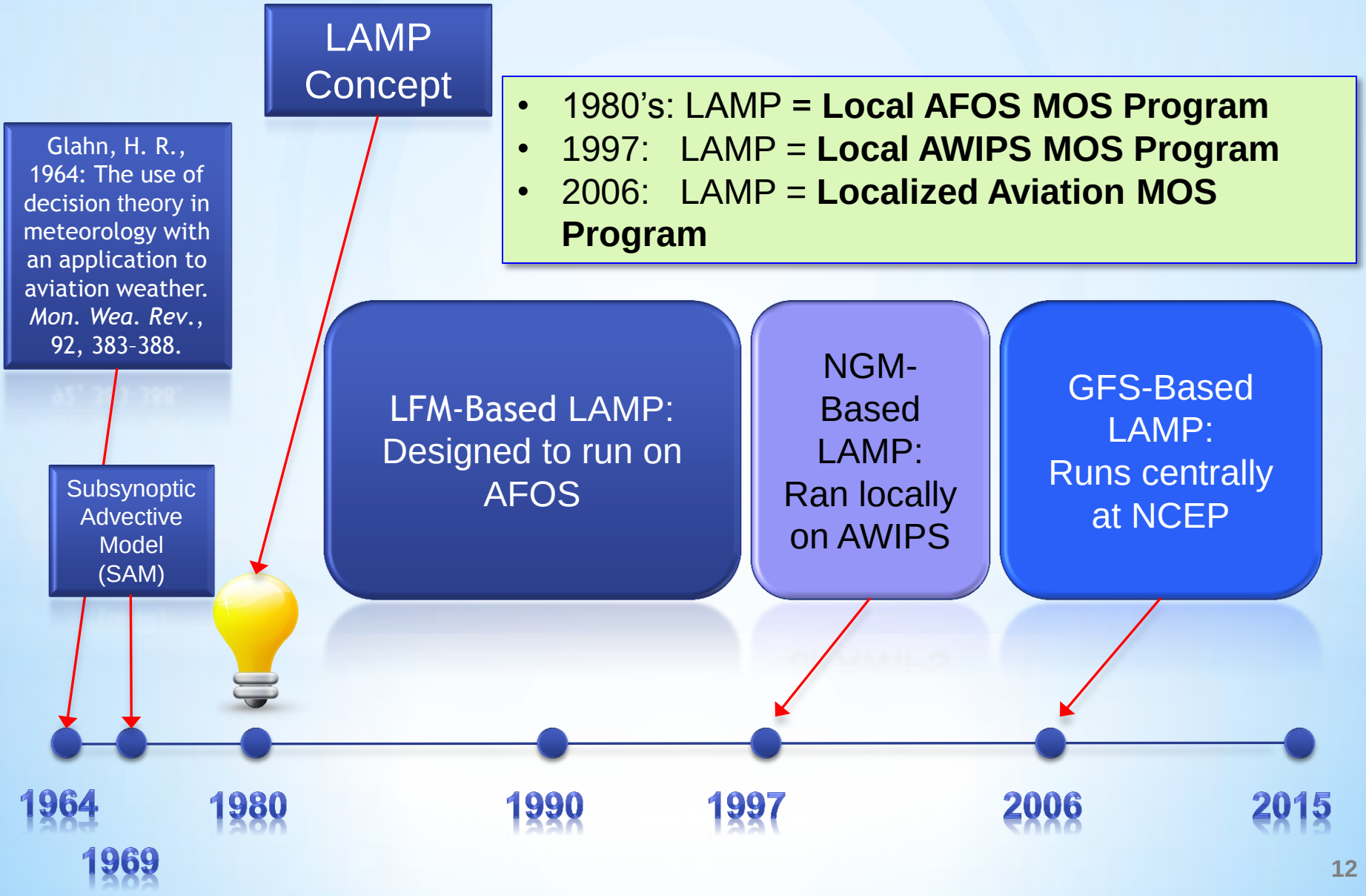
NGM- to GFS-based LAMP

- NGM-based LAMP Concerns:
  - Difficultly maintaining the system running in AWIPS
  - NGM model was frozen
  - GFS model implemented
  - GFS MOS more skillful; provided guidance for more stations
  - Hourly statistical guidance was needed for aviation forecasting, and to provide guidance for the 24-hour period for the TAF
- → GFS-Based LAMP was developed and designed to run centrally at the National Centers for Environmental Prediction (NCEP)
- LAMP = **Localized Aviation MOS Program**

GFS-Based LAMP

System	NGM-based LAMP	GFS-based LAMP
Updates	NGM MOS	GFS MOS
Runs	Locally in AWIPS	Centrally on NCEP computers
Cycles	Every 3 hours	Every hour
Projections	Hourly out 20 hours	Hourly out 25 hours
Coverage	CONUS	CONUS, Alaska, Hawaii, Puerto Rico
Stations	~ 1000 stations	> 1500 Stations

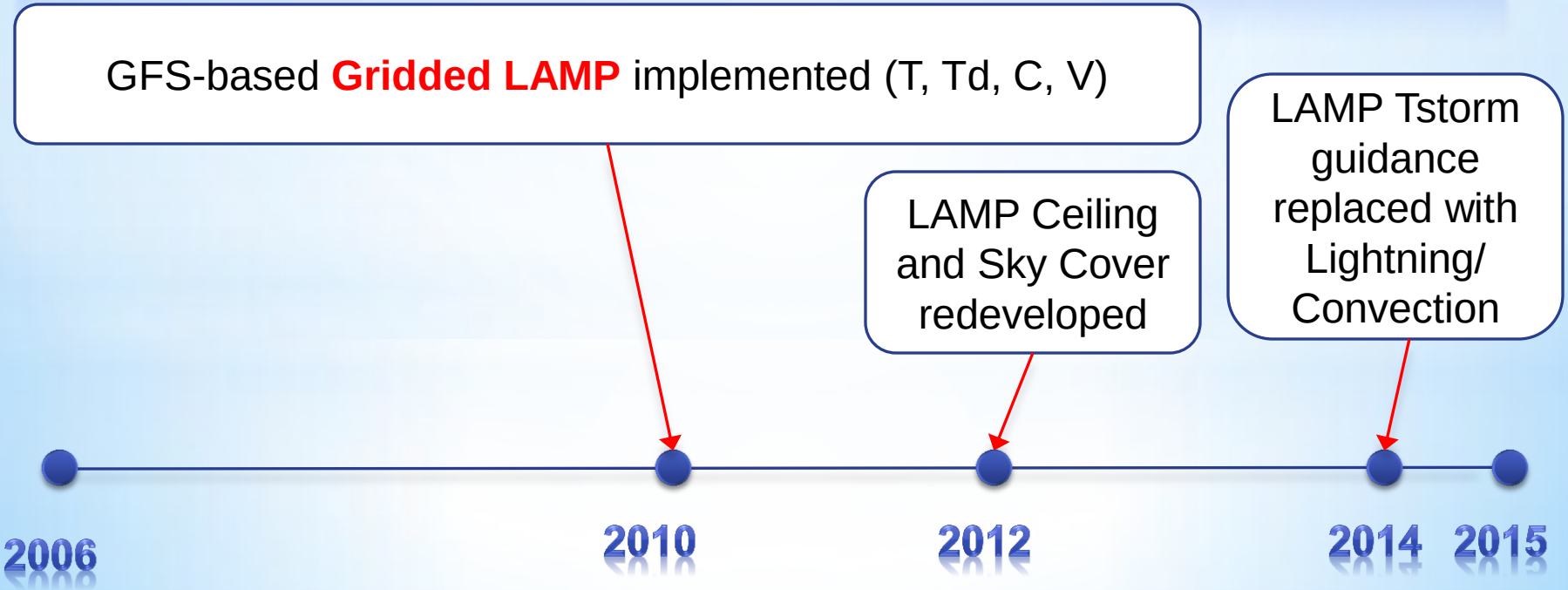
Time Line



- 1980's: LAMP = **Local AFOS MOS Program**
- 1997: LAMP = **Local AWIPS MOS Program**
- 2006: LAMP = **Localized Aviation MOS Program**

Time Line

GFS-Based LAMP:
Runs centrally at NCEP



Current LAMP Guidance Details

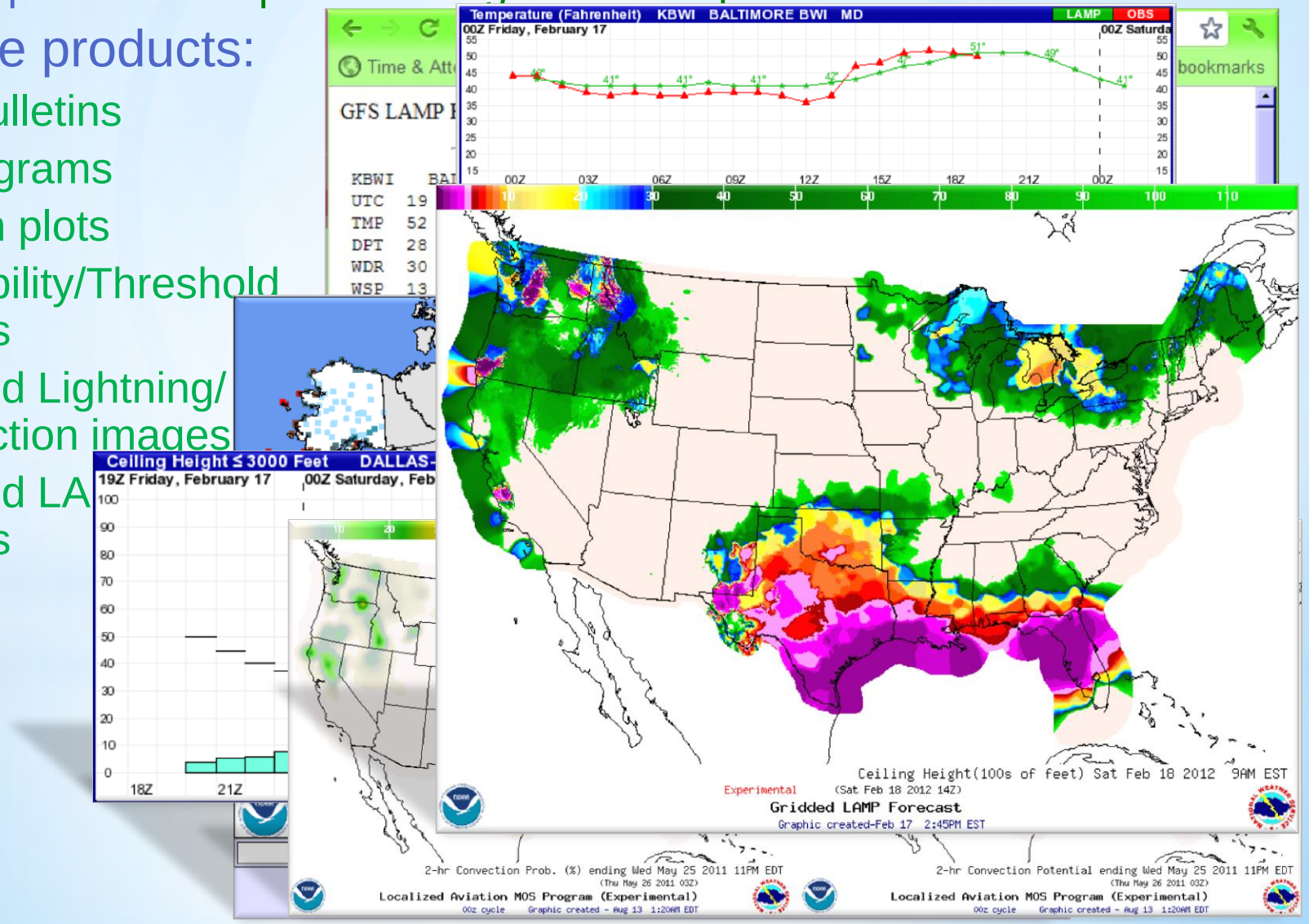
- LAMP guidance is in the range of 1- 25 hours in 1 hour projections
- Runs 24 times a day (every hour) in NWS operations

- LAMP provides station guidance for:
  - all LAMP forecast elements, 1692 stations
  - CONUS, Alaska, Hawaii, Puerto Rico
- LAMP provides gridded guidance over the CONUS for:
  - Lightning: at least one CG ltg strike
  - Convection: at least one CG ltg strike and/or radar ≥ 40 dBZ (New April 2014)
  - Temperature and Dewpoint
  - Ceiling Height and Visibility

- 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 and Convection
- Ceiling height
- Conditional ceiling height
- Sky cover
- Visibility
- Conditional visibility
- Obstruction to vision

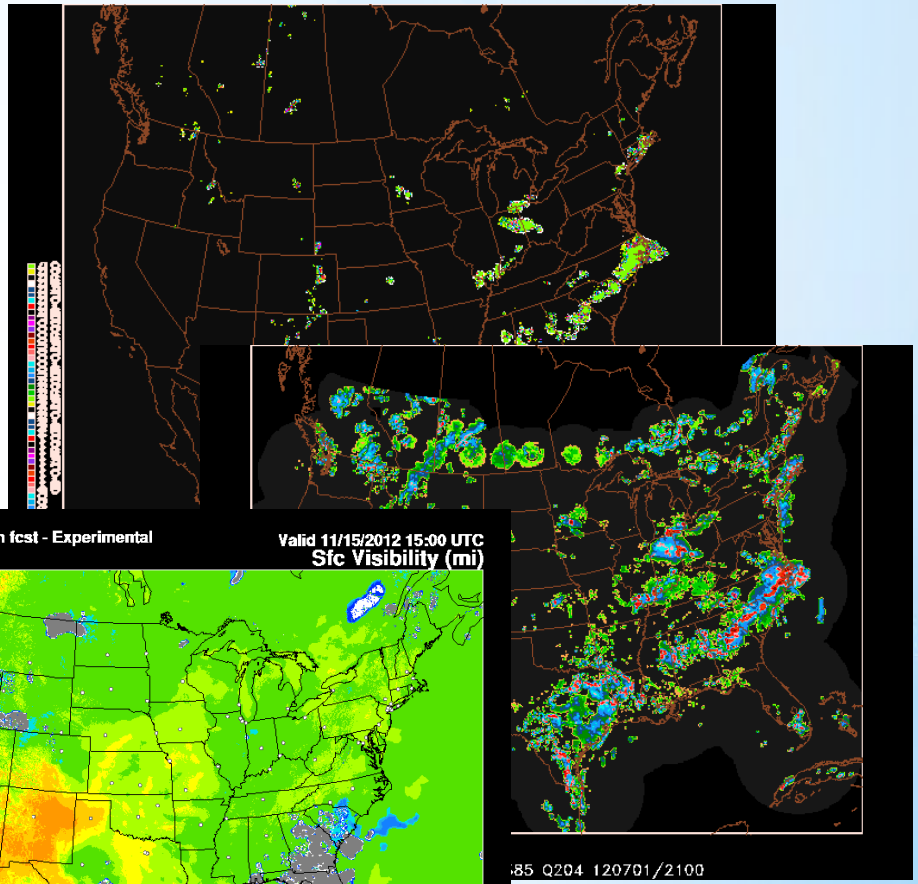
LAMP Current Status: Available Products

- Products are available on the SBN/NOAAPort, on the NWS ftp server, and in the National Digital Guidance Database (NDGD)
- Website products: http://weather.gov/mdl/lamp/index.shtml
- Website products:
  - Text bulletins
  - Meteograms
  - Station plots
  - Probability/Threshold images
  - Gridded Lightning/ convection images
  - Gridded LA images



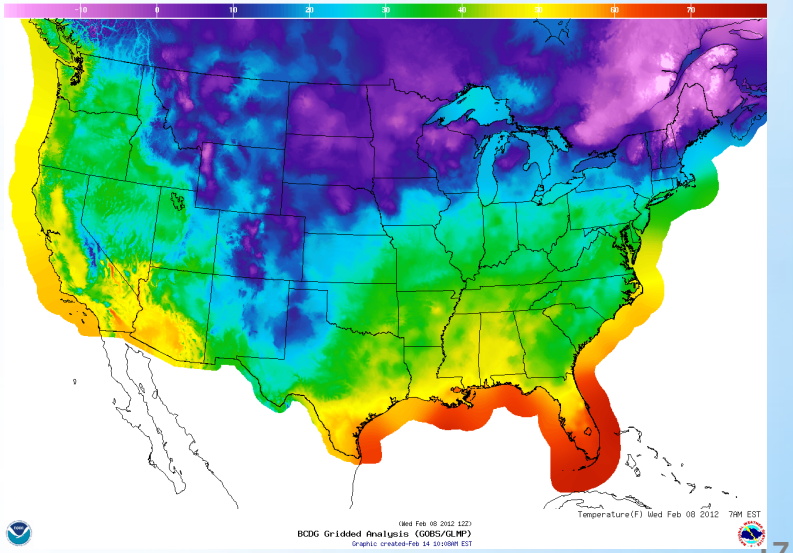
LAMP: Future Work FY15-FY16

- Updating Gridded LAMP Temperature, Dewpoint, Ceiling Height, Visibility, and adding Sky Cover and Wind Speed and Direction
- Using new datasets to further improve LAMP:
  - Total Lightning Data
  - Multi-Radar/Multi-Sensor System (MRMS) radar data
  - High Resolution Rapid Refresh (HRRR) model data
- Using the above, MDL plans to redevelop: Convection, Lightning, Ceiling Height, Visibility, add Gridded Storm Tops
- Preliminary results encouraging



Future work beyond 2016

- Additional forecast elements for Gridded LAMP:
  - Wind Gust
  - Obstruction to vision
  - POPs
  - Ptype
  - Flight categories?
  - Additional probabilities
- Redeveloping temperature, dewpoint, and wind LAMP guidance at stations to include additional stations
  - Including new TAF stations for which we have received numerous WFO requests.
  - This work will provide improved guidance at stations as well as improve Gridded LAMP for these elements.
- Additional areas (Alaska, Hawaii, PR)
- Eventual Extension to 36 hrs
- Extended grid into Canada



Summary

In summary, LAMP has changed a great deal in the last 35 years. With new datasets becoming available and the continued need for good quality aviation guidance, LAMP will no doubt change again, but Bob Glahn's original concept remains as a core component of LAMP, which is a valuable part of the NWS's suite of short-term statistical guidance.

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