

# Experimental LAMP Upgraded Lightning Objective Forecast Guidance: Technical Description

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## Part 1 – Mission Statement

### 1. Brief Product Description

Objectively-produced, experimental LAMP upgraded lightning forecast guidance consists of probability and categorical forecasts of one or more cloud-to-ground (CTG) lightning strikes in 20-km grid boxes for 2-h periods in the 3- to 25-h range over the CONUS. The probability of  $\geq 1$  CTG lightning strikes is the basic model forecast from which a multi-category “lightning potential” forecast is derived. The latter consists of four objectively defined lightning potential categories consisting of “no,” “low,” “medium,” and “high.” The forecasts are produced each hour year round, where the issue time for a given clock hour (H) is approximately H+40 min.

Note that the lightning predictand for the LAMP upgraded experimental guidance is identical to that for the operational LAMP CTG lightning guidance forecasts (see <http://www.nws.noaa.gov/mdl/gfslamp/tstorm.php>, termed “thunderstorm” guidance). However, the categorical forecast form of the guidance has changed from a two-category “yes/no” occurrence specification used operationally to a four-category “potential” specification in the experimental guidance. Note also that the experimental lightning guidance is similar to an experimental LAMP convection product (<http://www.nws.noaa.gov/mdl/lamp/convection.php>); the essential difference is the supplemental inclusion of radar reflectivity in the convection predictand.

### 2. Purpose/Intended Use

The LAMP lightning product has forecast guidance applications for airport operations, fire weather, and the public forecast enterprise.

### 3. Audience/Users

Targeted users of the LAMP lightning forecast guidance include the National Weather Service (NWS) National Centers for Environmental Prediction (NCEP) Storm Prediction Center (SPC) responsible for issuing fire weather outlooks and NWS Weather Forecast Offices (WFOs) who issue fire weather, agricultural, and general public forecasts. The products could also be used to assess the risk of lightning for airport operations. Together, these applications benefit the forestry, agricultural, aviation, and recreation industries, as well the general welfare of society.

### 4. Product availability

The LAMP lightning probability and potential grids are issued every hour for 14 forecast projections in the 3 - 25 hour range. The forecast projections are in hourly increments for the first seven or eight hours (depending on the LAMP model cycle) and in two hour increments thereafter. The geographical coverage spans the contiguous United States and slightly beyond. Graphical forecast maps are available at <http://www.weather.gov/mdl/lamp/lightning.php>, and gridded data in GRIB2 format are available for downloading at [http://www.nws.noaa.gov/mdl/lamp/cnvlqt\\_downloads.php](http://www.nws.noaa.gov/mdl/lamp/cnvlqt_downloads.php).

### 5. Feedback Method:

The upgraded LAMP lightning product is currently being produced experimentally on the NCEP Weather and Climate Operational Supercomputing System (WCOSS). In the near future (date to be determined), a Public Notification Statement will be issued to advise users of the availability of the experimental forecasts and to provide a mechanism for feedback during a public comment period. Also, opportunities for user feedback may be provided through workshops, interactive web presentations, etc. For further information please contact:

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## Part 2 – Technical Aspects

### 1. Science Basis

Objective scoring of the experimental, upgraded LAMP lightning probabilities reveals substantial forecast skill, which is better than for the operational LAMP lightning probabilities. The improved skill is due to supplemental MOS predictors from the NCEP North American Mesoscale (NAM) model, as both the operational and upgraded LAMP lightning models use MOS predictors from the (large scale) NCEP Global Forecast System (GFS). The NAM MOS predictors also provide enhanced spatial resolution in the upgraded lightning product.

The four-category lightning potential forecasts are derived from the probabilities through application of (three) previously-derived threshold probabilities. A given probability threshold is derived through an iterative process such that the associated threat score (same as Critical Success Index) is maximized within a narrow, prescribed bias range. With this procedure, the average bias is about 2.7 (27 forecast events for every 10 observed events) for low (L), medium (M), and high (H) potential combined, 1.1 (11 forecast events for every 10 observed events) for M and H potential combined, and 0.4 (4 forecast events for every 10 observed events) for H potential. Thus, the threshold probability for L potential is the lowest among the three, and it is highest for H. Finally, the three threshold probabilities vary by season of the year, geographical location, forecast projection, and LAMP cycle, but the average bias is fixed. Thus, the bias properties of the lightning potential (over a long sample) do not vary as a function of season, geographical location, time of the day, etc., which is an important attribute.

Objective scoring of the lightning potential shows a general improvement in threat score and bias over that for the operational categorical forecast.

Information on forecast skill for the lightning probabilities and accuracy of the potential forecasts (and other information about the LAMP lightning product) is available at

[http://www.nws.noaa.gov/mdl/gfslamp/docs/LAMP\\_convect\\_newltg.pptx](http://www.nws.noaa.gov/mdl/gfslamp/docs/LAMP_convect_newltg.pptx).

### 2. Training

Training in the guidance use of the LAMP lightning product may be provided through occasional workshops, webcasts, and web-based training modules.

### 3. Availability

Graphical LAMP lightning forecast maps at <http://www.nws.noaa.gov/mdl/lamp/lightning.php> are available experimentally 24/7 and updated each hour (H) at approximately H + 40 min. Downloadable GRIB2 files are available at [http://www.nws.noaa.gov/mdl/lamp/cnvtlg\\_downloads.php](http://www.nws.noaa.gov/mdl/lamp/cnvtlg_downloads.php).