STATISTICAL GUIDANCE FOR TERMINAL AERODROME FORECASTS FROM THE LOCALIZED AVIATION MOS PROGRAM

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Introduction

To provide aviation guidance for Terminal Aerodrome Forecast (TAF) preparation, the NWS's Meteorological Development Laboratory (MDL) developed a short-term statistically-based forecast guidance system called the **Localized Aviation MOS Program (LAMP)**. LAMP is designed to update the Global Forecast System (GFS) MOS forecast guidance on an hourly basis with hourly forecasts extending out to 25 hours in advance.

LAMP generates both categorical and probabilistic guidance for a variety of weather elements with special emphasis on those affecting the aviation community. The guidance includes, but is not limited to, probabilistic and categorical forecasts of ceiling height and horizontal visibility.

Previous verification of the LAMP forecast guidance has shown improvements over the GFS MOS forecasts of ceiling height and visibility during the 1- though 9-h projections. **This study compares and contrasts statistically-based LAMP ceiling height and visibility forecasts with forecasts produced by the Global Systems Division's (GSD) Rapid Update Cycle model (RUC20), the National Centers for Environmental Prediction's (NCEP) Weather Research and Forecasting (WRF) Nonhydrostatic Mesoscale Model (NMM) (WRF-NMM), and the Short-Range Ensemble Forecasting (SREF) system.**

Model Data and Methodology

Data

- LAMP – multiple linear regression forecasting model that updates the GFS MOS guidance and produces station-based categorical and probabilistic ceiling height and visibility forecasts
- RUC20 – dynamical model that generates continuous ceiling height and visibility forecasts through post-processing algorithms on a 20-km Lambert Conformal grid
- WRF-NMM - dynamical model that generates continuous ceiling height and visibility forecasts through post-processing algorithms on a 12-km Lambert Conformal grid
- SREF - ensemble-based system that produces probabilistic forecasts which are interpolated to a 40-km Lambert Conformal grid

Interpolation to Station

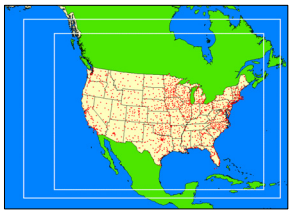
- LAMP categories and probabilities - valid at stations
- RUC20 and WRF-NMM continuous forecasts - nearest neighbor interpolation
- SREF probabilities - bilinear interpolation

Verification

Verification Details

- 1462 METAR stations in the CONUS
- Verification Periods
  - Cool season (October 2006 - March 2007)
  - Warm season (April 2007 - September 2007)

Events Verified	
Ceiling Height	**Visibility**
< 500 feet	< ½ mile
< 1000 feet	< 1 mile
< 3000 feet	< 3 miles

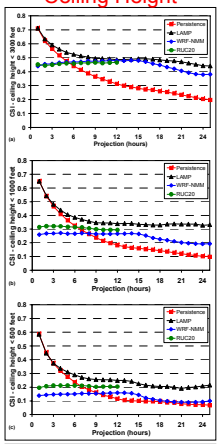


✦Rectangles show model domains

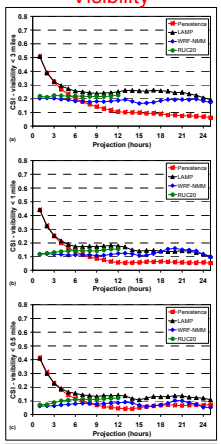
✦Red dots show LAMP station points used for verification

Categorical Verification Results

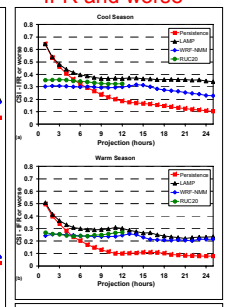
Ceiling Height | Visibility | IFR and worse[1]



CSI for ceiling height (a) < 3000 feet, (b) < 1000 feet, and (c) < 500 feet for the 0000 UTC cool season. Shown are **persistence (red squares)**, **LAMP (black triangles)**, **WRF-NMM (blue diamonds)**, and **RUC20 (green circles)**.



CSI for visibility (a) < 3 miles, (b) < 1 mile, and (c) < 1/2 mile for the 0000 UTC cool season. Shown are **persistence (red squares)**, **LAMP (black triangles)**, **WRF-NMM (blue diamonds)**, and **RUC20 (green circles)**.

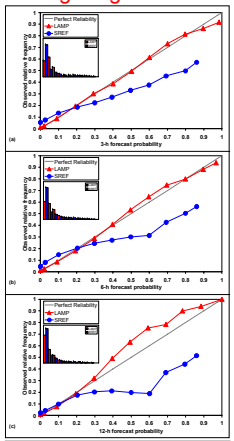


CSI for IFR or worse conditions for 0000 UTC for the (a) cool season and (b) warm season. Shown are **persistence (red squares)**, **LAMP (black triangles)**, **WRF-NMM (blue diamonds)**, and **RUC20 (green circles)**.

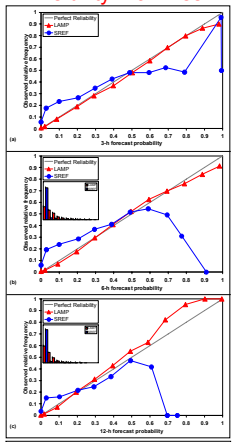
[1] "IFR or Worse" indicates Instrument Flight Rules conditions or worse. IFR or worse conditions occur when the lowest ceiling height is < 1000 feet and/or the visibility is < 3 miles.

Probabilistic Verification Results

Ceiling Height < 1000 ft | Visibility < 3 miles



Reliability diagrams and histograms (inset) for probabilities of ceiling height < 1000 feet for the (a) 3-h, (b) 6-h, and (c) 12-h projections for the 0900 UTC cycle cool season for **LAMP (red diamonds and bars)** and **SREF (blue circles bars)**.



Reliability diagrams and histograms (inset) for probabilities of visibility < 3 miles for the (a) 3-h, (b) 6-h, and (c) 12-h projections for the 0900 UTC cycle cool season for **LAMP (red diamonds and bars)** and **SREF (blue circles and bars)**.

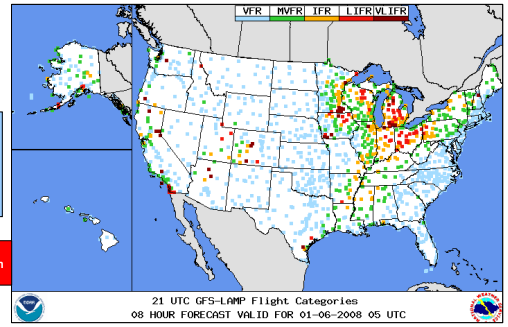
Verification Summary

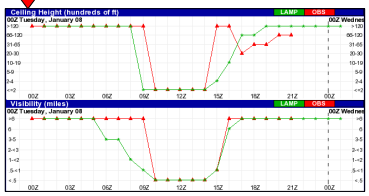
- This study shows that station-based 0000 UTC LAMP categorical forecasts of ceiling height and visibility are more accurate than RUC20 and WRF-NMM post-processed, categorized forecasts of ceiling height and visibility interpolated to stations for ceilings < 3000, < 1000, and < 500 feet, and visibilities < 3, < 1, and < ½ miles.
- For the 0900 UTC cycle and periods studied here, LAMP ceiling height and visibility probabilities exhibit better reliability than those from the SREF system.

LAMP Aviation Images on the Web
http://weather.gov/mdl/lamp

Flight category station plot

Click to zoom
Click on station for meteogram





Station meteogram showing LAMP forecasts and verifying observations

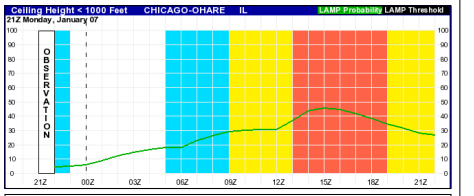
Prototype LAMP Probabilistic Aviation Graphic

Prototype LAMP ceiling probabilities

Cyan = MVFR

Yellow = IFR

Orange = LIFR



The green line is the LAMP probability of ceiling height < 1000 feet. The colored bars represent the flight categories indicated by LAMP for that time period. White bars indicate conditions better than Marginal Visual Flight Rules (MVFR), blue bars indicate MVFR, yellow bars indicate Instrument Flight Rules, and orange bars indicate Low Instrument Flight Rules.

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