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

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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)
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
    - \( \sim 2.7 = \) low potential
    - \( \sim 1.1 = \) medium potential
      (lightning \( \sim 1.2 \))
    - \( \sim 0.4 = \) high potential

- Convection potential aids interpretation of probabilities with peak values < 100%
LAMP Lightning (LTG) vs Convection (CNV) Prob. Skill for 1800 UTC Cycle

Cool season

Spring season

Summer season

Independent sample
Oct 2009 – Oct 2010
LAMP Lightning vs Convection Probability
Reliability and Sharpness

Diagram showing the observed relative frequency vs forecast probability for two scenarios:
- 1800 UTC COOL SEA 4-H PROJ.
- 1800 UTC COOL SEA 22-H PROJ.

Legend:
- CNV
- LTG
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

Composite Reflectivity

Valid At: 08/25/2011 18:00:00 UTC

Localized Aviation MOS Program (Experimental)
12z cycle Graphic created - Aug 25 0:49AM EDT
Current LAMP Thunderstorm

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

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

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

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