Probabilities in Aviation Weather Support

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Professional Background

- COMET/UCAR - Meteorologist / Project Leader: 2018 - Present
- Booz Allen Hamilton - Aviation Operations SME: 2018-2021
- NWS forecaster then manager, multiple locations: 1977 - 2014
- MIC of NWS National Aviation Meteorologists (NAMs): 2014-2017

  - Embedded within FAA Command Center / ATCSCC
- MIC of NWS Spaceflight Meteorology Group (SMG): 1991-2014

  - Embedded within NASA/JSC Mission Control Center

** Presentation represents my opinions – not those of UCAR/COMET

Quick Takes

- Historically, most human based aviation weather support has been *deterministic*
- Some probabilistic tools/elements are in place, e.g. LAMP, SREF, HREF, CIP/FIP, other (?)
- Experience with integrated/embedded NWS decision support:
  - Customers/users in FAA Centers prefer mostly deterministic information
  - Eyeball to eyeball briefings convey a form of probabilistic information:
    - Confidence levels explicitly briefed
    - Confidence mannerisms of briefer
    - Body language of briefer
    - Conflicting, inconsistent, or rapidly changing forecasts yield impression of “lower probabilities”

Additional Expert Inputs

ATM and ATC Operations SME Interview

- Air Traffic Controllers and Air Traffic Managers are "visual creatures" with - *by design* - very short attention spans due to data saturation
- Level of trust between ATC/ATM person and forecaster is paramount – and possibly the most important factor in decision support
- Each audience has a different capability of understanding a probability forecast. E.g. ATC vs ATM
- Customers will "tune out" if probabilities are injected into briefings
- Boomerang effect – "only as good as your last forecast" – e.g. if a thunderstorm occurs that had a 5 pct probability, credibility is shot
- Lack of training on probabilities could yield a poor deterministic (go/no-go) decision

CWSU Meteorologist Interview

- Mostly "nowcasting" timeframes – which is primarily deterministic
- Many decisions being made require yes/no deterministic inputs
- Probabilities are typically expressed as confidence levels
- Adding probabilities to clearcut situations (e.g. 20 pct or 80 pct prob) would not be feasible currently
- Very situational about explicit use of confidence levels
- Infusion of probabilities could potentially be in the "beyond-nowcast" timeframe (2+ hour projections)

Training Considerations and Summary

Training

Significant training would be needed:

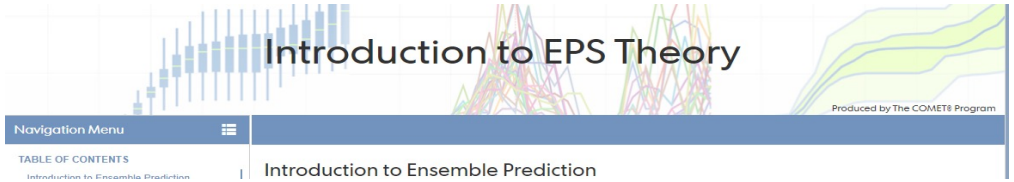
- All Forecasters
- Forecasters' management / corporate leadership
- Air Traffic Control personnel
- Air Traffic Management personnel
- ATC and ATM leadership including highest echelons
- NAS-wide integration including FAA, Airlines, DoD, others

Summary

- Most aviation weather support is deterministic
- Aviation weather customers respond favorably to deterministic with confidence levels added / implied
- Some tools/elements contain probabilistic aspects
- Transitioning to increased probabilistic forecasts would be a huge challenge due to enormity of NAS-wide and NWS-wide training
- Probabilistic weather support would NOT serve well those customers with a short (0-2 hour) decision horizon

Relevant COMET/METED Lessons

→ *New in 2022*



→ *New in 2022*

Backup

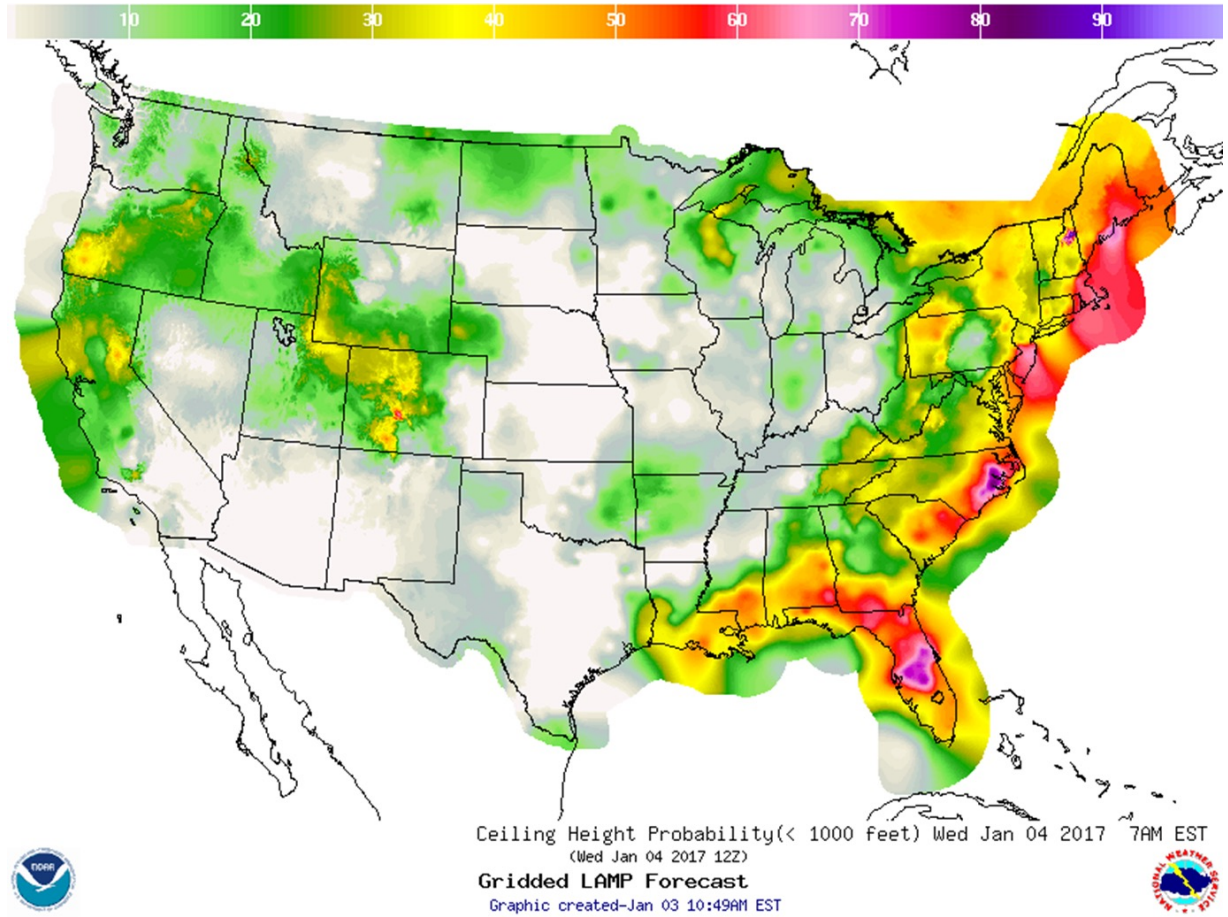
A Thought

If the 8 C's of Decision Support are done well, less need to introduce probabilities (?)

The 8 C's of Decision Support *

- Coordination
- Collaboration
- Consistency
- Customization
- Confidence
- Consultation
- Clarity
- Creativity

* Created by NWS AWC/NAMs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Ceiling Height Probability(< 1000 feet) Wed Jan 04 2017 7AM EST
(Wed Jan 04 2017 12Z)
Gridded LAMP Forecast
Graphic created-Jan 03 10:49AM EST

Overview

- Quick Takes
- ATC / ATM Input / Comments
- CWSU Meteorologist Input / Comments
- Transition to probabilistic forecasts
- Summary

Example from Hurricane Ian

- Evac order for Sanibel Island came less than 24 hours
- NHC disclaimer stated impacts could occur on either side
- EMs looked at cone of uncertainty and line of track
- Ems made a deterministic decision made on probabilistic information