

Verification for Terminal Forecasts and Traffic Flow Management Decisions

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Sponsors: FAA, AWRP, ESRL/GSD, NWS, NextGen

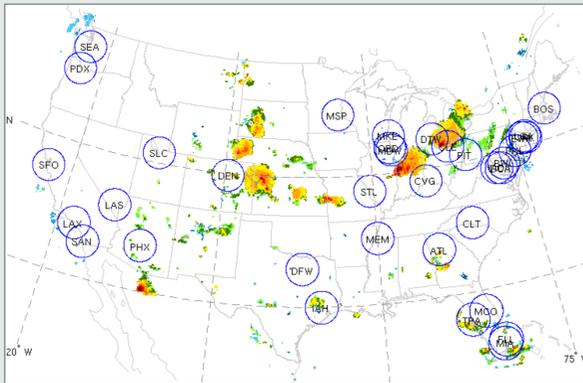
1. Purpose

Assess the NDFD derived thunderstorm product in the context of Traffic Flow Management (TFM) to support near-term convective forecast requirements

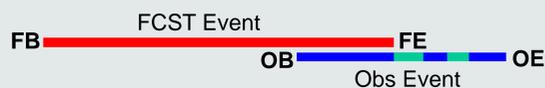
- Incorporate operational context
 - Terminal (OEP 35 airports)
 - FCA-bounded regions in the Northeast
- Support the requirements provided by the FAA and tracked by NWS
 - Metrics for *onset* and *cessation* of convection
 - Spatial displacement

2. Verification Approach

A. OEP 35 Airports and CIWS Obs



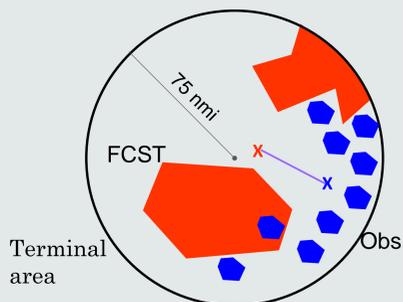
B. Computation of Timing Error for Onset and Cessation



$$\text{Onset timing error} = \text{FB} - \text{OB}$$

$$\text{Cessation timing error} = \text{FE} - \text{OE}$$

C. Spatial Displacement

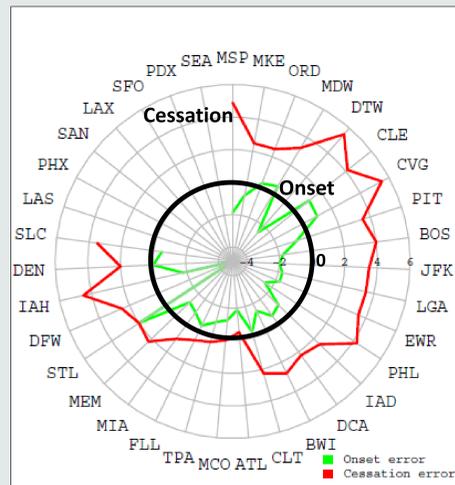


Compute the center of mass (CM) for both the forecast (X) and the obs (X), each at their own onset or cessation time.

The spatial displacement is the distance between the CMs (purple line).

3. Results

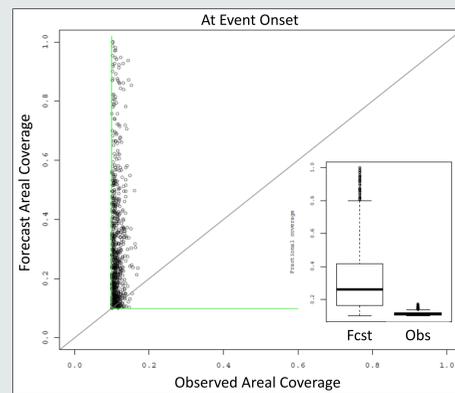
Forecast Timing Error (h), 4 h lead



Onset:
Forecasts are generally too *early* (inside black circle), by 1-2 h.

Cessation:
Forecasts are too *late* (outside black circle). Timing error is largest in the Northeast (~4 h) and smallest in the Southeast (0-2 h).

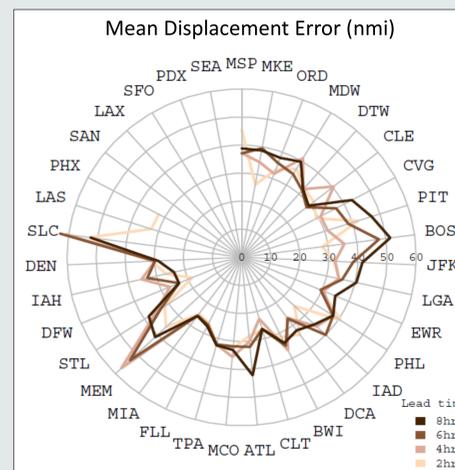
Forecast Coverage Much Larger Than Obs Coverage



Forecasts frequently saturate terminal area, while obs rarely cover more than 20% of the terminal area.

Obs coverage larger at cessation, but still much less than forecast.

Large Displacement Errors



Slight increase with lead time

Fairly consistent across the country, except larger errors for PIT, BOS, MEM, SLC

Forecast Performance at Onset and Cessation

Onset (hit = |forecast- obs| < 3h)

Lead Time (h)	POD	CSI	FARatio	Timing Err (h)	Location Err (nmi)
2	0.34	0.22	0.61	1.48	34.16
4	0.30	0.19	0.65	1.46	34.98
6	0.28	0.18	0.65	1.44	35.43
8	0.26	0.17	0.66	1.39	36.45

Cessation

Lead Time (h)	POD	CSI	FARatio	Timing Err (h)	Location Err (nmi)
2	0.30	0.19	0.66	1.54	42.54
4	0.27	0.17	0.68	1.53	44.06
6	0.24	0.15	0.70	1.43	44.23
8	0.22	0.15	0.70	1.35	44.42

Better at onset than cessation.

Slow degradation with lead time

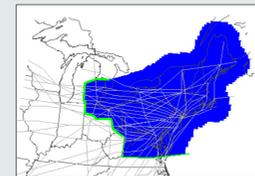
4. Summary

- NDFD forecast was found to be unable to discriminate convection at the proper spatial and temporal scales needed for TFM weather support.
- NDFD forecast characteristics do not capture attributes of convection such as growth, decay, and advection.

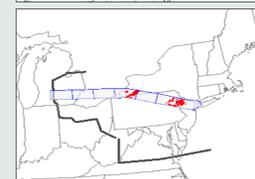
Details:

- Forecast onset too early, cessation too late
- Temporal and spatial accuracy of NDFD better for onset than for cessation
- Displacement error greater for cessation than for onset (median displacement > 30 nmi)
- For ± 3h temporal precision, skill decreases with increasing lead time over all regions
- Skill by region does vary, and displacement errors are larger in the Northeast and smaller in the Southeast

5. Future Work: More Forecasts and En-route



- NE Jetways oriented N-S and E-W
- 20 nmi buffer applied around jetway
- Thunderstorm echo tops (30,000 ft or greater) at least 20 nmi in size that intersect the jetway



- Apply the Flow Constraint Index (a measure of restriction through a corridor)
- Include additional forecasts: HRRR, RAP, LAMP, SREF

More Information

For links to other projects and additional information, see the FIQAS homepage: <http://esrl.noaa.gov/fiqas>