

Improving Weather Information Storm Prediction for Aviation



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NBAA Friends and Partners in Aviation Weather
21 October 2010 in Atlanta, GA

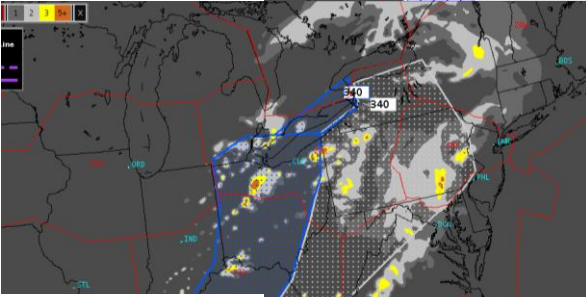
Types of Convective Weather Forecasts

Forecast	Type	Coverage	Generated	Outlook / Updates
Terminal Aerodrome Forecast (TAF)	Text	Terminal	Human	0 – 24 h updated every 6 h
Convective Outlooks	Graphic & text	CONUS	Human	1, 2, 3, & 4 - 8 days updated as needed
Mesoscale Discussion	Graphic & text	Regional	Human	few hours issued as needed
CCFP	Graphic	CONUS	Human	2, 4 & 6 h updated every 2 h
CIWS	Graphic	CONUS 1 km	Automatic	0 – 2 h 5 min updates
CoSPA	Graphic	CONUS 3 km	Automatic	2 – 8 h 15 min updates
LAMP	Graphic	CONUS 20 km	Automatic	0 – 24 h hourly updates

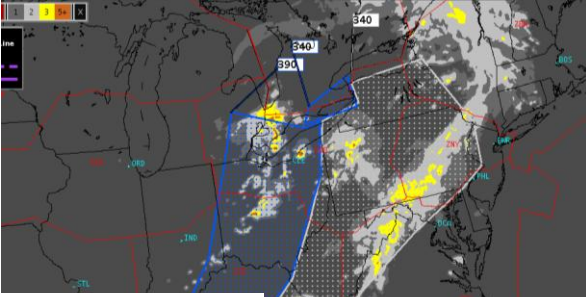
2009 & 2010 Additions

CoSPA & CCFP

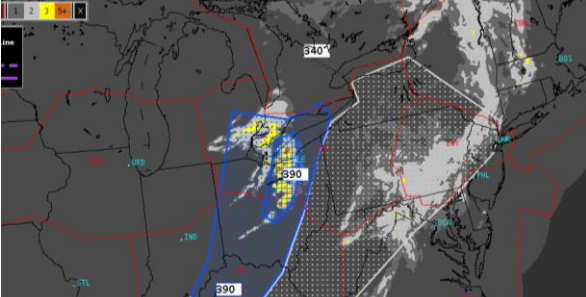
8 h Forecast



6 h Forecast



4 h Forecast

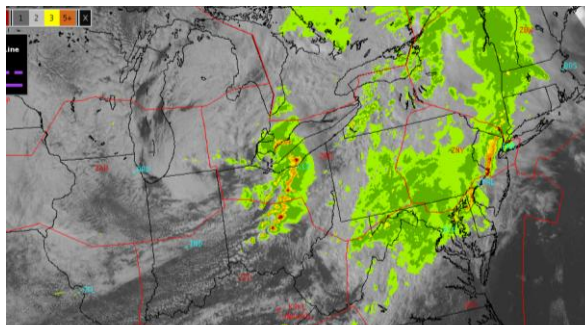


2 h Forecast



16 September 2010

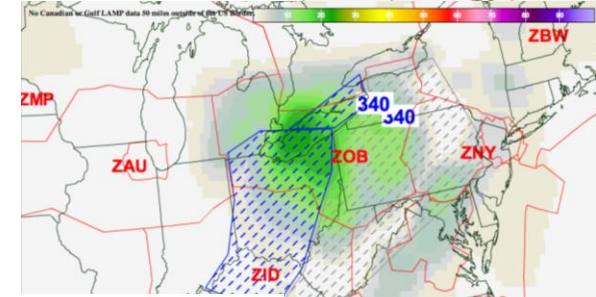
- CCFP & LAMP show highest confidence on 2nd wave of storms, & confidence is increasing with decreasing lead time
- CoSPA indicating two significant waves, but intensity of 1st wave weakens for short-term forecast (related to blending transition)
- Intensity of storms that affected NY area airports was not really grasped by any forecast until they impacted!



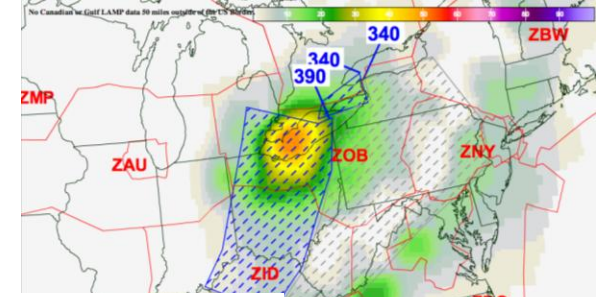
Observation at 21Z

LAMP & CCFP

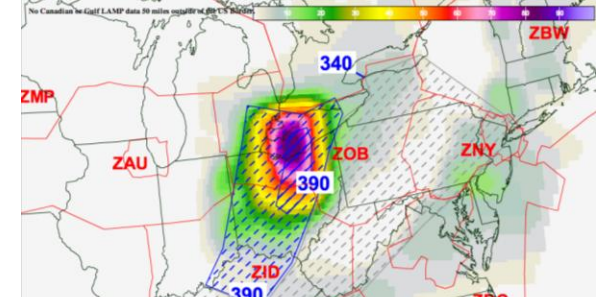
8 h Forecast



6 h Forecast



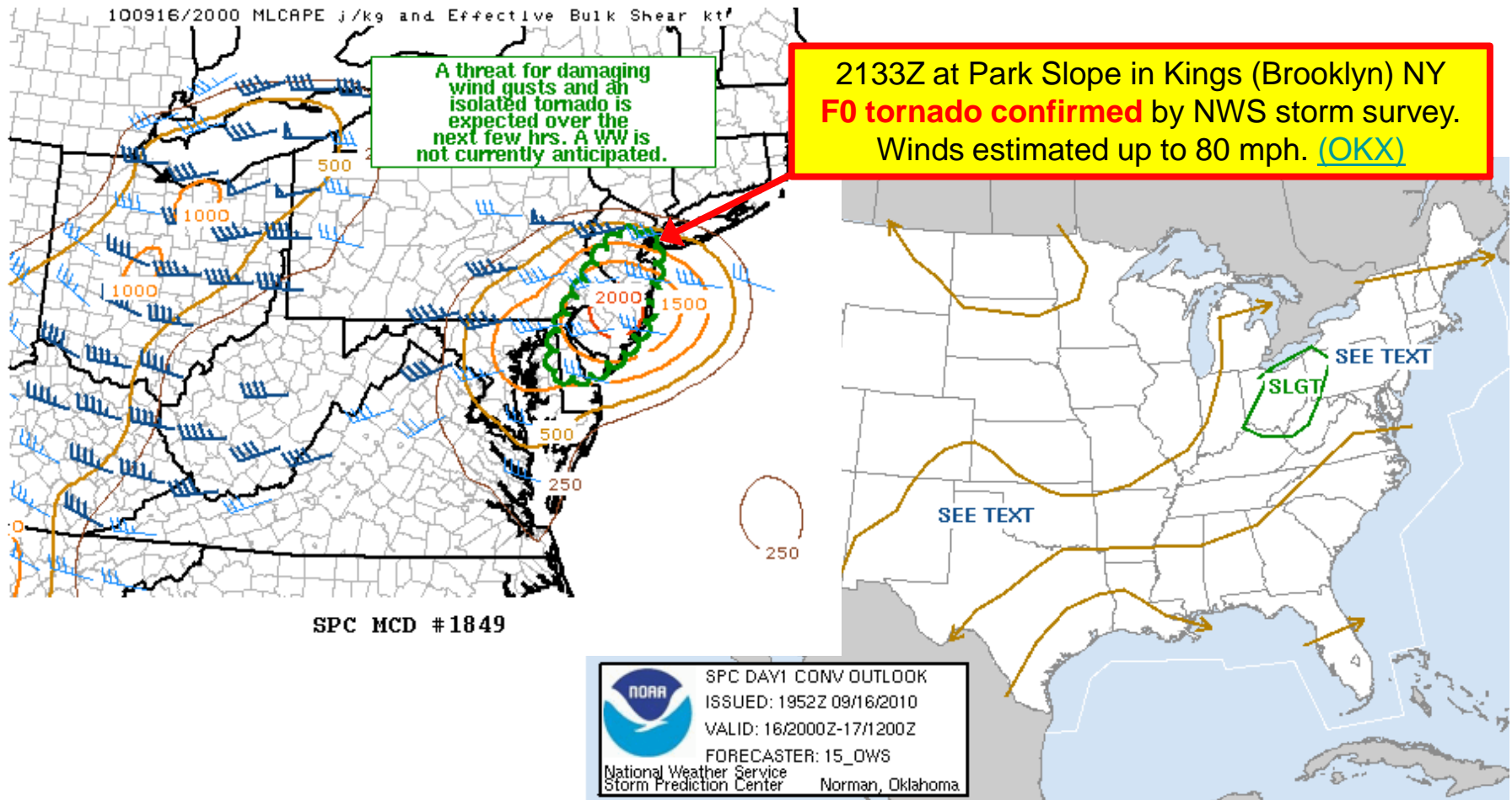
4 h Forecast



2 h Forecast



Mesoscale discussion for greater NJ area **issued at 2037Z** & valid 2037Z until 2130Z . . . includes isolated strong to marginally severe thunderstorms . . . primary threat will likely be strong gusty winds . . . potential for isolated tornado



1 day convective outlook **updated at 1952Z** & valid 9/16 20Z until 9/17 12Z . . . suggest a risk of storm intensification . . . includes a 2% chance for tornado & 5% risk of damaging winds in NY area

Grappling with Uncertainties & Risks

. . . true for both weather & ATM prediction

•Forecast Uncertainties

- observations (limited coverage & measurement errors)
- numerical weather prediction (non-linear dynamic system, initialization)
- incomplete process understanding
- calibration

•Quantification of Uncertainty

- human subjectivity (local weather expertise, experience with models)
- statistical procedures (MOS processing, trends, similar past situations)
- ensemble techniques (multi-model, time-lagging, spatial or diagnostic)
- combination thereof

•Uncertainty Communication

- no forecast is complete without description of uncertainty
- what do we communicate: confidence, uncertainty, or probability?
- ambiguity in definition of event, timing & location
- choice of words & graphics
- do forecast providers understand what aviation users need (impact & risk)?
- how do aviation users interpret a weather forecast & its limitations?

Some Food for Thought . . .

•Action in Response to Probabilistic Forecast

- “5% chance of damaging winds”: maybe 95 times out of 100 similar situations a “wait & see” strategy may be best approach . . .
- where is that “human threshold” that triggers proactive steps? (may depend on context or yesterday’s experience)
- how would fully-automated system deal with low probabilities?

•How Good is Good Enough?

- how accurate can forecasts become (predictability limit)?
- how accurate do forecasts need to be in order to be useful & valuable?
- finding answer to last question **requires weather integration** into decision making process

•What Information are Aviation Users Looking for?

- presence or absence of weather hazards in space & time (key locations)
- weather hazards exceeding critical thresholds (intensity or organization)
- high impacts for safety & efficiency of air traffic
- last point **requires translation of weather to impact & capacity estimation**