



Progress in Aviation Weather Forecasting for ATM Decision Making

FPAW 2010

Jim Evans

Marilyn Wolfson

21 October 2010

MIT Lincoln Laboratory



Overview



- **CoSPA**

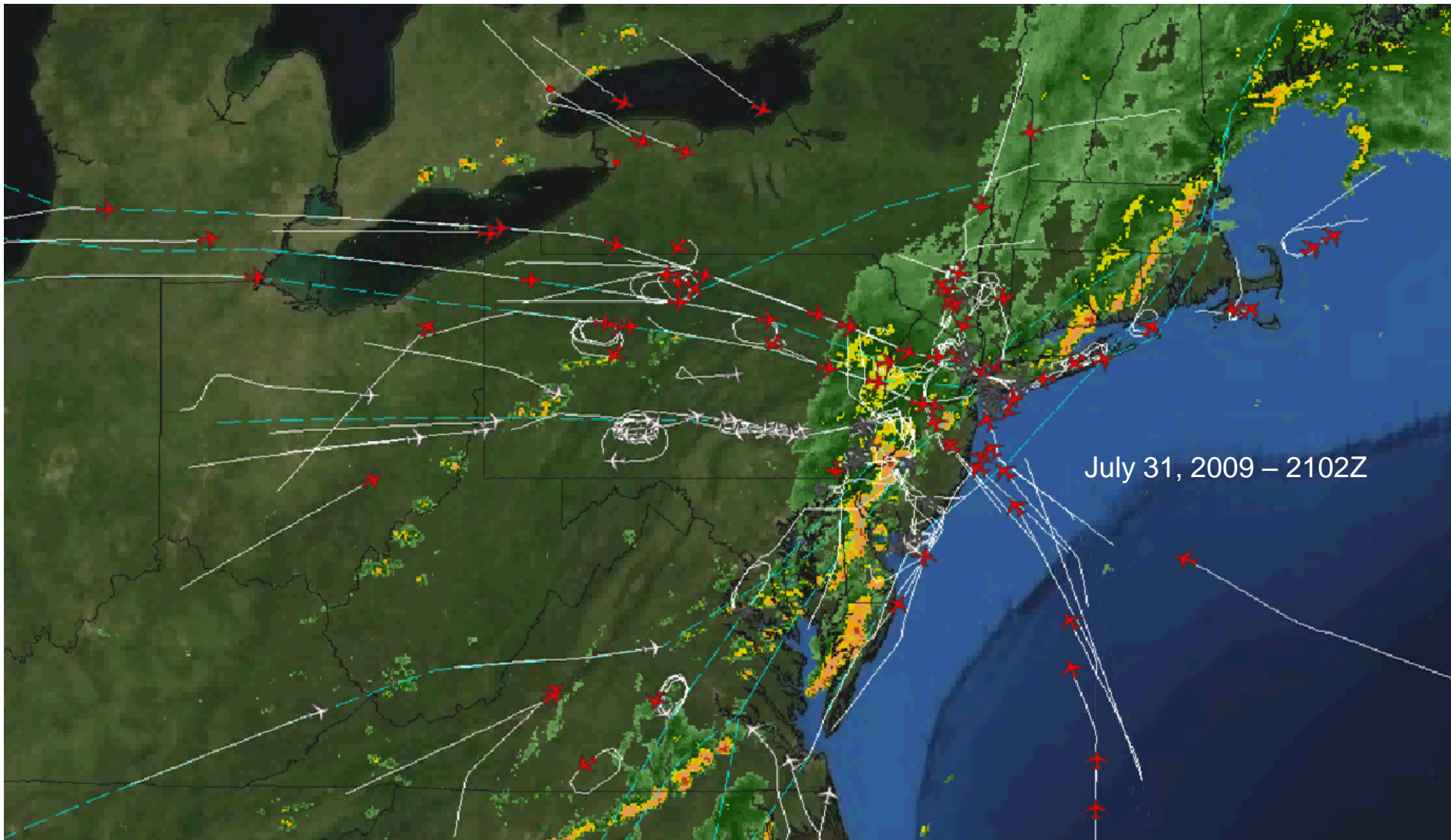
- (1) Integration with storm avoidance models and ATC route usage models

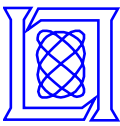
- (2) 0-8 hour winter precipitation forecasts

- **Improved runway winds forecasts**



Over Delivery of Traffic During a Severe Weather Event





CoSPA System

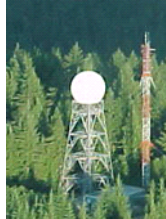
Observations



TDWR



NEXRAD



Canadian Radars



Surface Obs.



Lightning



Satellite



Profilers



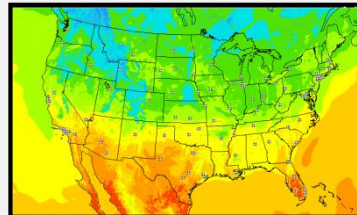
Aircraft

Product Generator

CIWS products are "blended" with HRRR forecasts

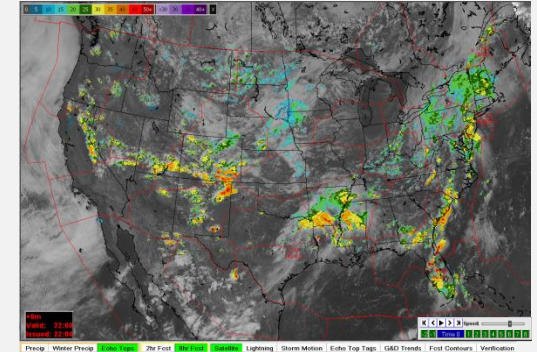


Numerical Weather Prediction (NWP)



High resolution rapid refresh (HRRR)

Situation Display

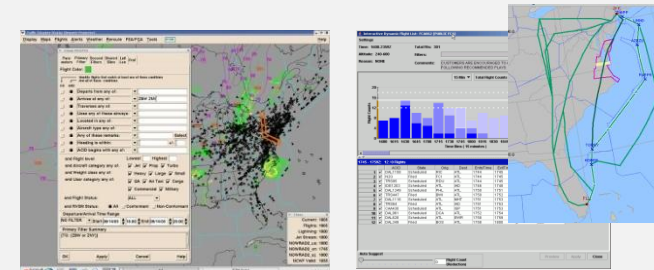


Echo Tops

Users



Air Traffic Managers Airline Dispatch



Decision Support Tools



CoSPA Operational Evaluation Status

- Providing 0-8 hr forecasts of VIL and Echo Tops to select facilities
- Collaboration between MIT LL, NCAR and NOAA
- **Objective:** Evaluate suitability and quantitative benefits of CoSPA for ATM operations
- **Duration:** June – Oct.



- Very positive response from users
- Improves situational awareness and strategic planning coordination
- High resolution is useful in assessing weather impacts
- Observed decisions in:
 - Airspace flow programs (AFP)
 - Ground delay programs (GDP)
 - “Playbook” reroute initiatives
 - Setting staffing needs

Benefits Collection

13-14 June

16 June

6-8 July

19-21 July

3 Aug.

4-5 Aug.

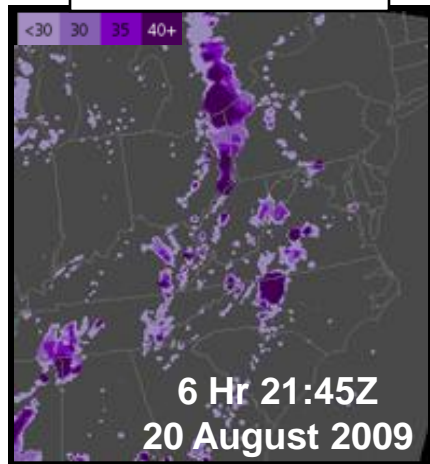
1-2 Sept.

16 Sept.

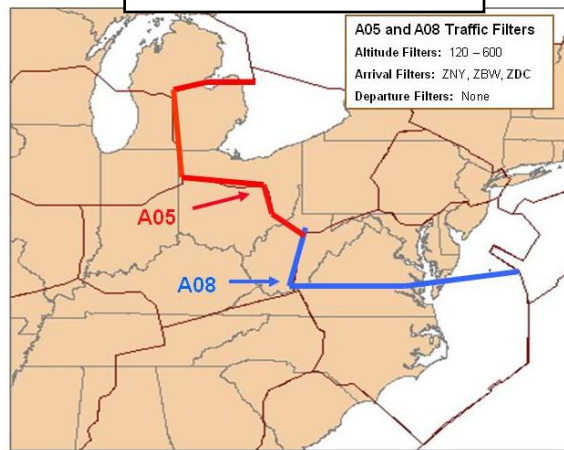


CoSPA Offers Straightforward Translation into 2-8 Hour Capacity Constraint Forecasts

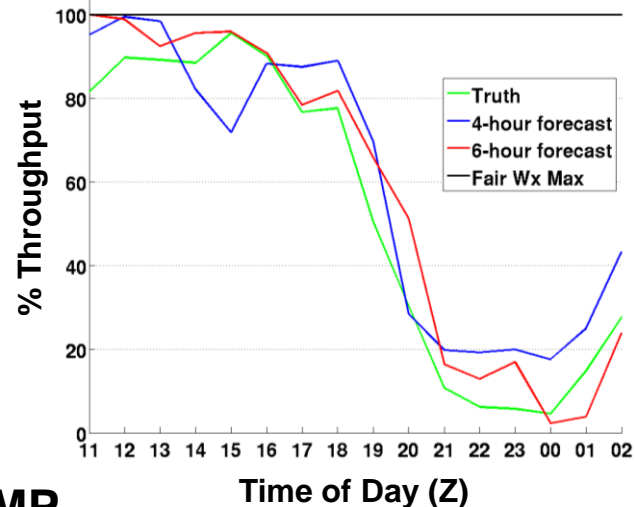
CoSPA 2 – 8 Hour Forecast



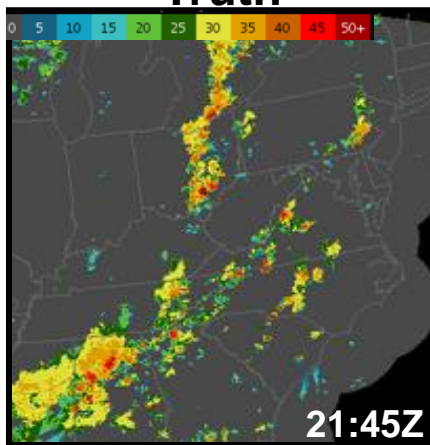
AFP Capacity Impact Assessment



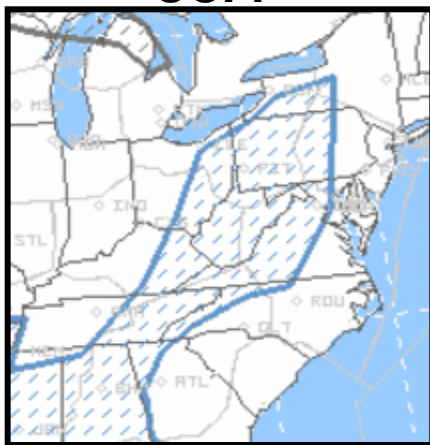
AFP Throughput Assessment and Response Strategy



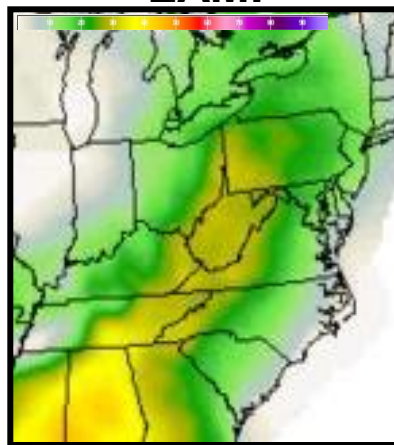
Truth



CCFP



LAMP



AFP = Airspace Flow Program

- CoSPA forecasts can be easily translated into weather avoidance field (WAF) forecasts

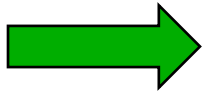
- RAPT route blockage algorithms are used to estimate AFP throughput



Overview

- **CoSPA**

- (1) Integration with storm avoidance models and ATC route usage models



- (2) 0-8 hour winter precipitation forecasts

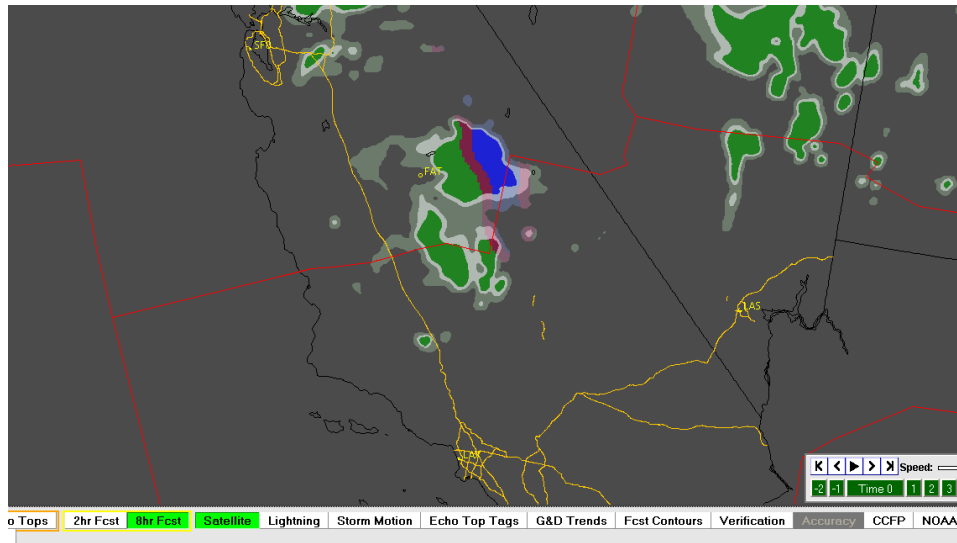
- **Improved runway winds forecasts**



CoSPA Winter Precipitation Forecast

“Validation” of CoSPA Winter Forecast by Use of Mammoth Mountain Web
Cam data (6 Oct 2010)

McCoy Cam



Winter Precip. Colors With Phase

CoSPA has an 0-8 hour winter precipitation forecast, but a decision has not yet been made to conduct an operational evaluation similar to the 2010 convective weather evaluation



Overview

- **CoSPA**

- (1) Integration with storm avoidance models and ATC route usage models

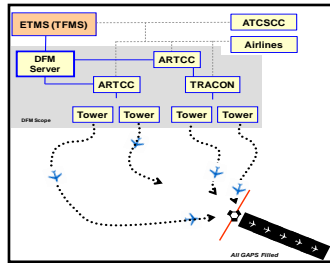
- (2) 0-8 hour winter precipitation forecasts



- **Improved runway winds forecasts**



An Emerging ATM DST Motivating Improvements in Surface Wind Forecasts

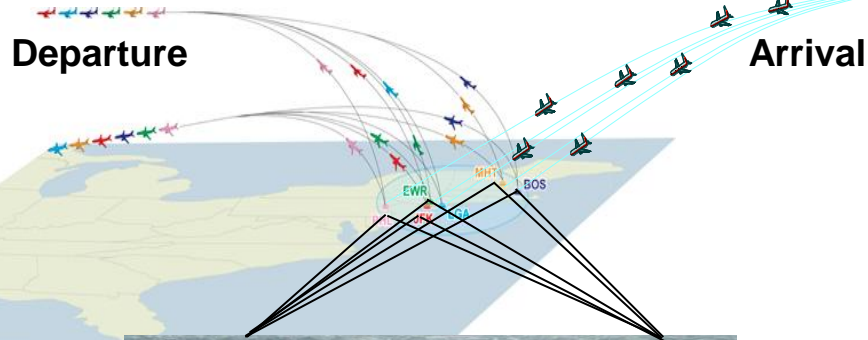


TFM Constraints

Integrated arrival, surface and departure management decision support tool (ADMT)

Departure

Arrival



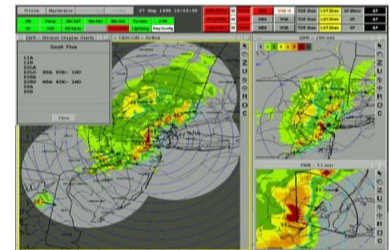
Surface



Arrival/Departure Demand



Integrated Tower Display Suite (TFDM)



Airport Weather-winds are especially important

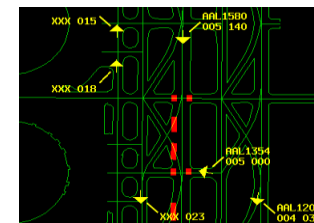
Electronic Flight Data Management (TFDM)

Operational Users

- ATCT Controllers and TMC
- TRACON, ARTCC, TFM
- Airline and Dispatch
- Airport

Decisions

- Pushback control
- Taxi control
- Departure sequencing
- Departure route assurance
- Runway configuration and load-balancing

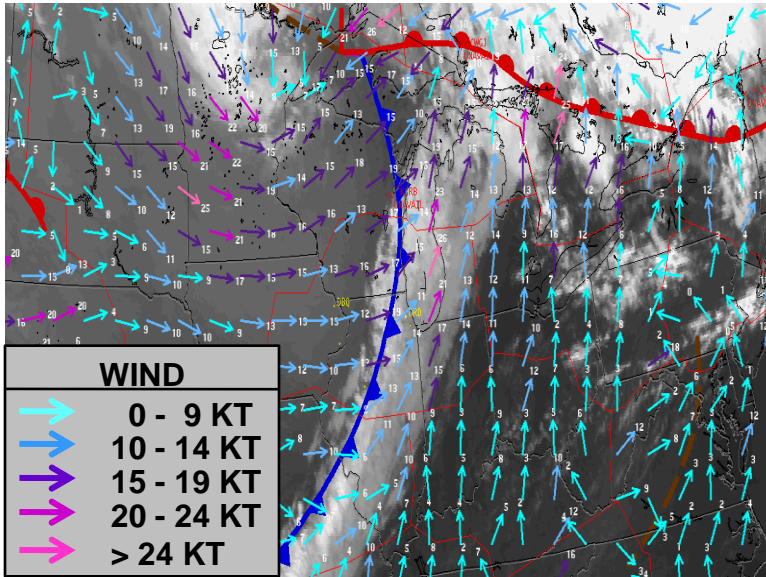


Terminal and Surface Surveillance

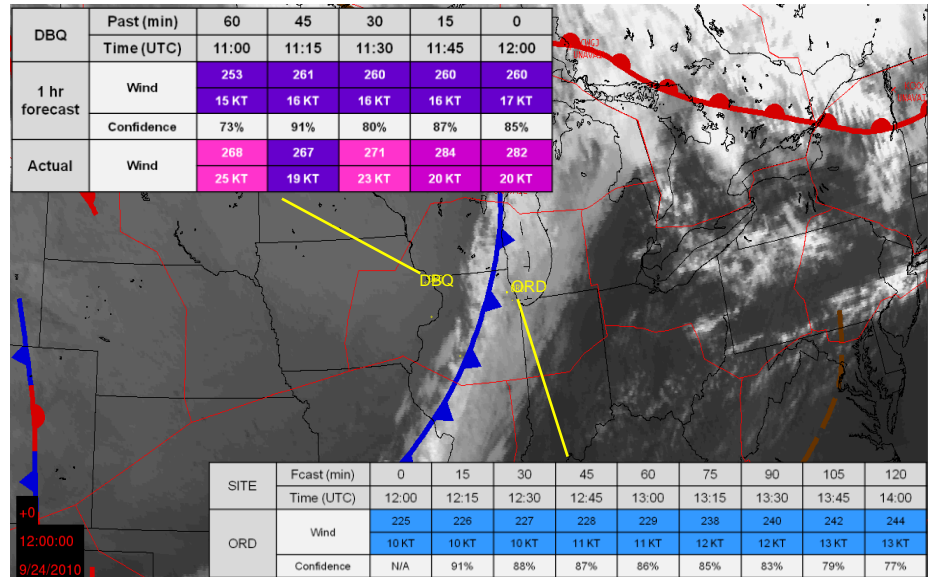


CoSPA Terminal Winds Forecast Display Concept

09/24/2010 12:00 GMT



Frontal Wind Vectors



Tabular Forecasts and Verification

Other components of improving terminal winds forecasts:

- Improved forecast accuracy and resolution made available by HRRR
- Wake turbulence mitigation for departures (WTMD) statistical ASOS and RUC algorithms
- Mosaic of MIGFA gust front detections (TDWR and NEXRAD)
- ITWS high resolution surface winds gridded analysis
- TAF wind forecasts



Summary

- **FAA 0-8 hr CoSPA forecast provides**
 - **Deterministic forecasts of precipitation and echo tops that are straightforward to translate into forecasts of capacity constraints (e.g., airspace and AFP throughput)**
 - **Winter precipitation forecasts analogous to CIWS**
- **CoSPA accuracy characterization research is underway; comparing forecasts at a fixed valid time provides a functional equivalent to time-lagged ensembles**
- **Improving surface winds forecasts are very important for improving surface traffic management for runway configuration changes as well as forecasting airport capacity**
 - **Work is underway to take advantage of HRRR wind forecasts and to use technology from a number of other FAA and NOAA programs (e.g., ITWS, WTMD, NEXRAD)**