CoSPA
0 to 8 Hour Storm Prediction for Aviation

Update

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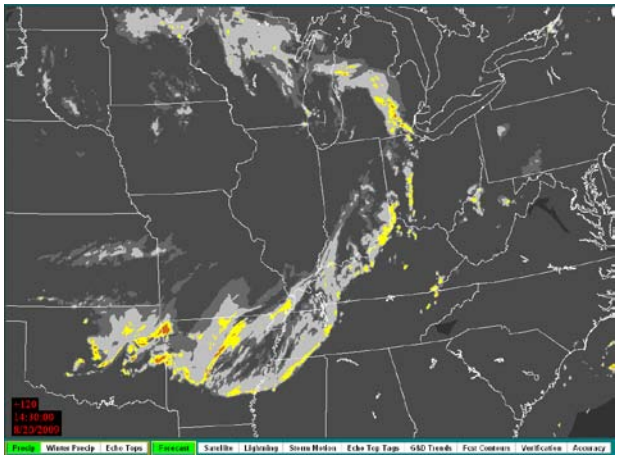
This research is in response to requirements and funding by the Federal Aviation Administration (FAA). The views expressed are those of the authors and do not necessarily represent the official policy or position of the FAA.

Overview

- CoSPA Overview
- Situation Display
- Ongoing Research
- Summary

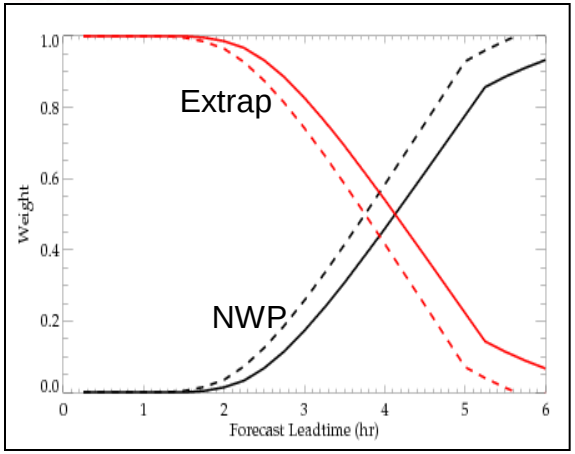
CoSPA 0-8 Hour Forecast
Main Components

Corridor Integrated Weather System (CIWS)

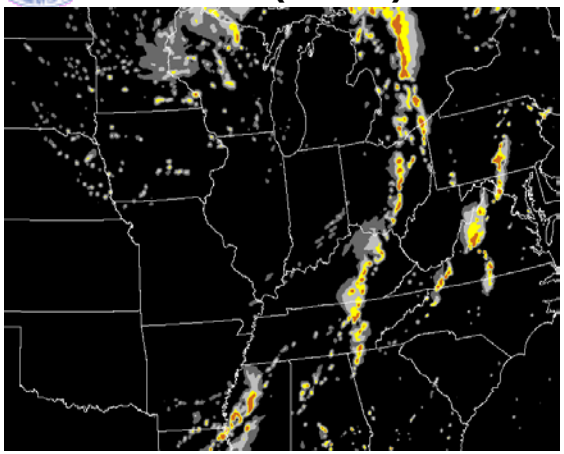


Extrapolation

Blending Module



High Resolution Rapid Refresh (HRRR)



Numerical Weather Prediction

0 Hour **2 Hour** **6 Hour** **8 Hour**

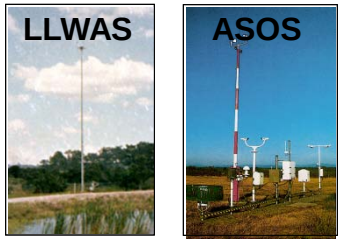
Forecast Lead

Air Traffic Management (ATM) Planning

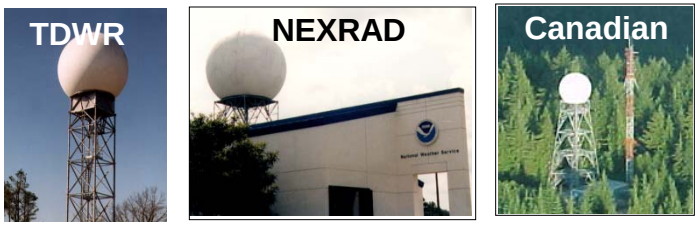
- **'Tactical' Planning (0-2hr)**
- **'Strategic' Planning (2-8hr)**

CoSPA 0-2 Hr Extrapolation Component

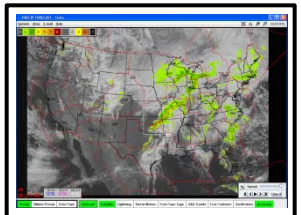
Corridor Integrated Weather System (CIWS)



Surface Weather



Weather Radar

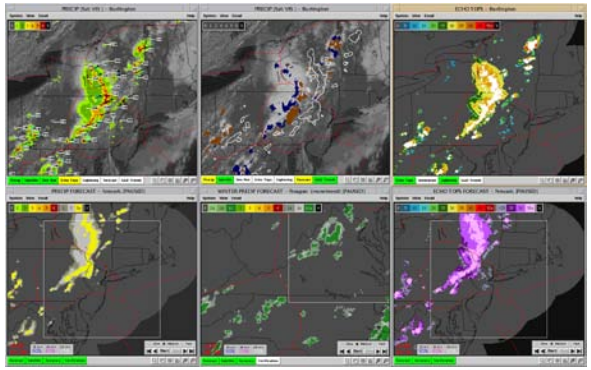


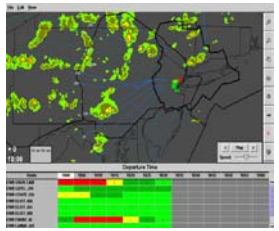
Web-based Tools

Lightning

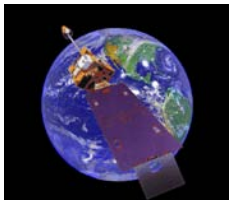
Real-time Weather Product Generator

CIWS Situation Display

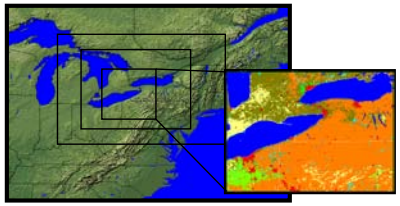




Decision Support Tools



Satellite



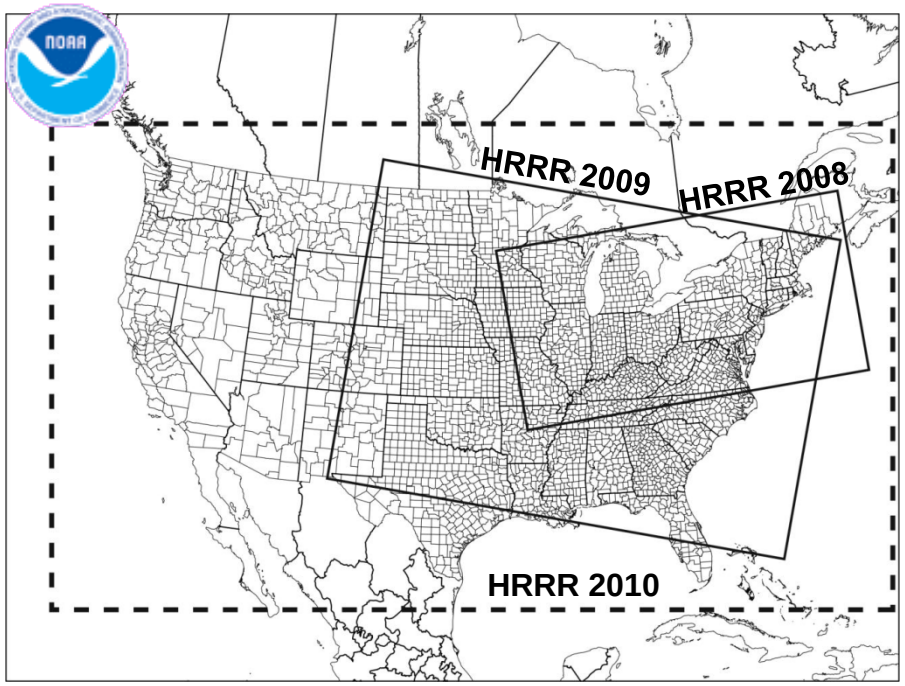
NWP Models

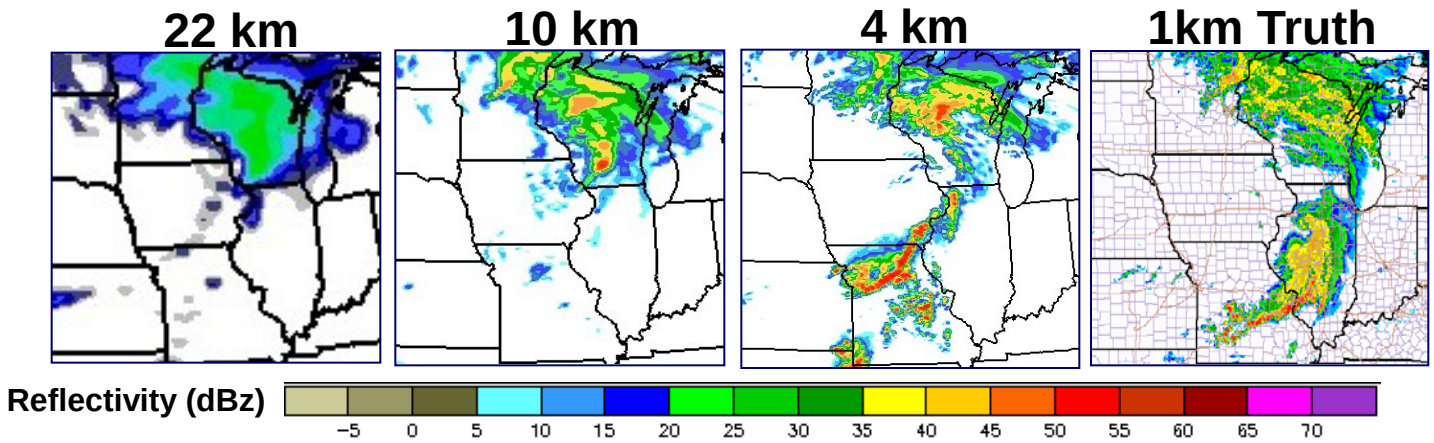
Air Traffic Managers

Airline Dispatch

CoSPA Numerical Model Component
HRRR

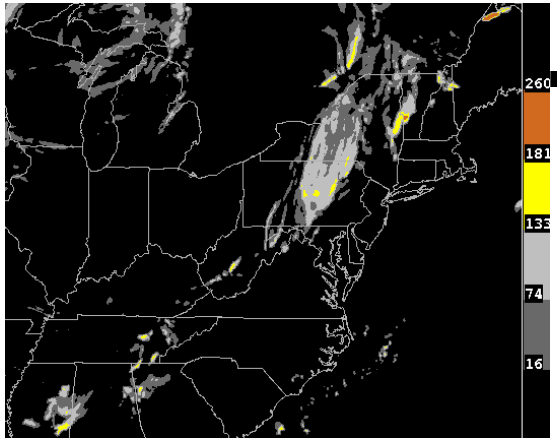
- **Experimental, High-Resolution, Rapid Refresh (HRRR)**
- **Updates every 60 min using latest radar data and surface obs**
- **Storm-resolving (3km) model**
- **Initialize 3 km model from 13 km RUC model with radar reflectivity assimilation**





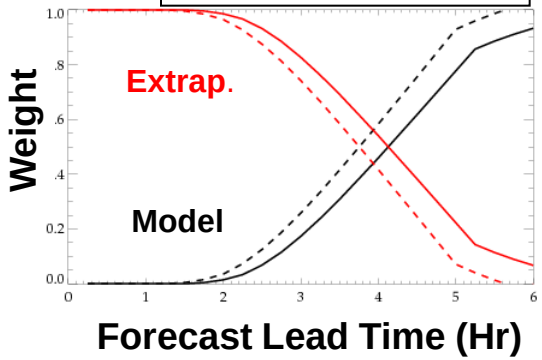
CoSPA Blending Component

Extrapolation Forecast

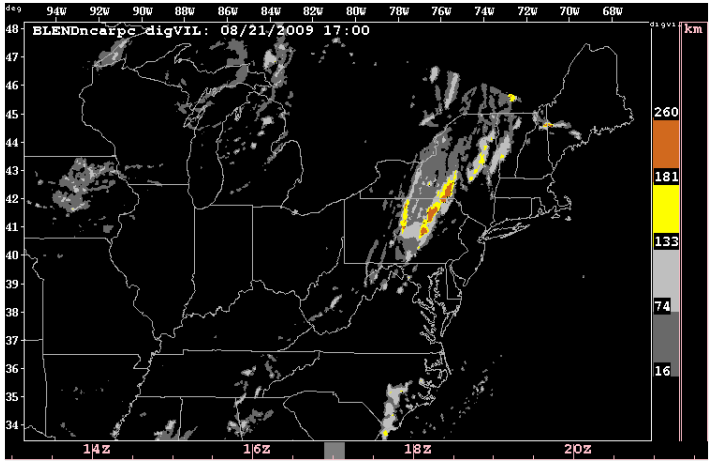


Blending

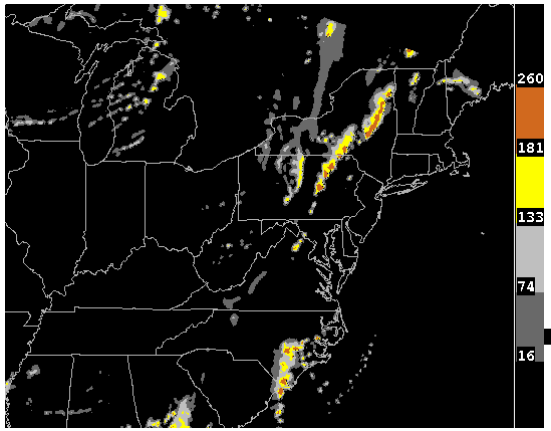
Dashed : 15 to 00 Z
Solid : 00 to15



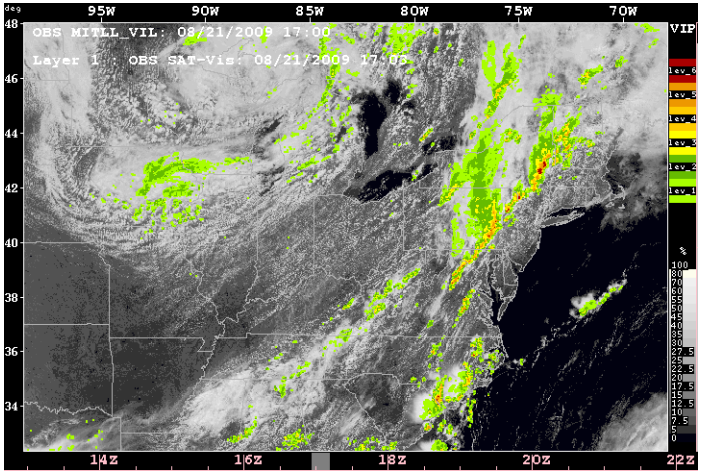
Blended Forecast



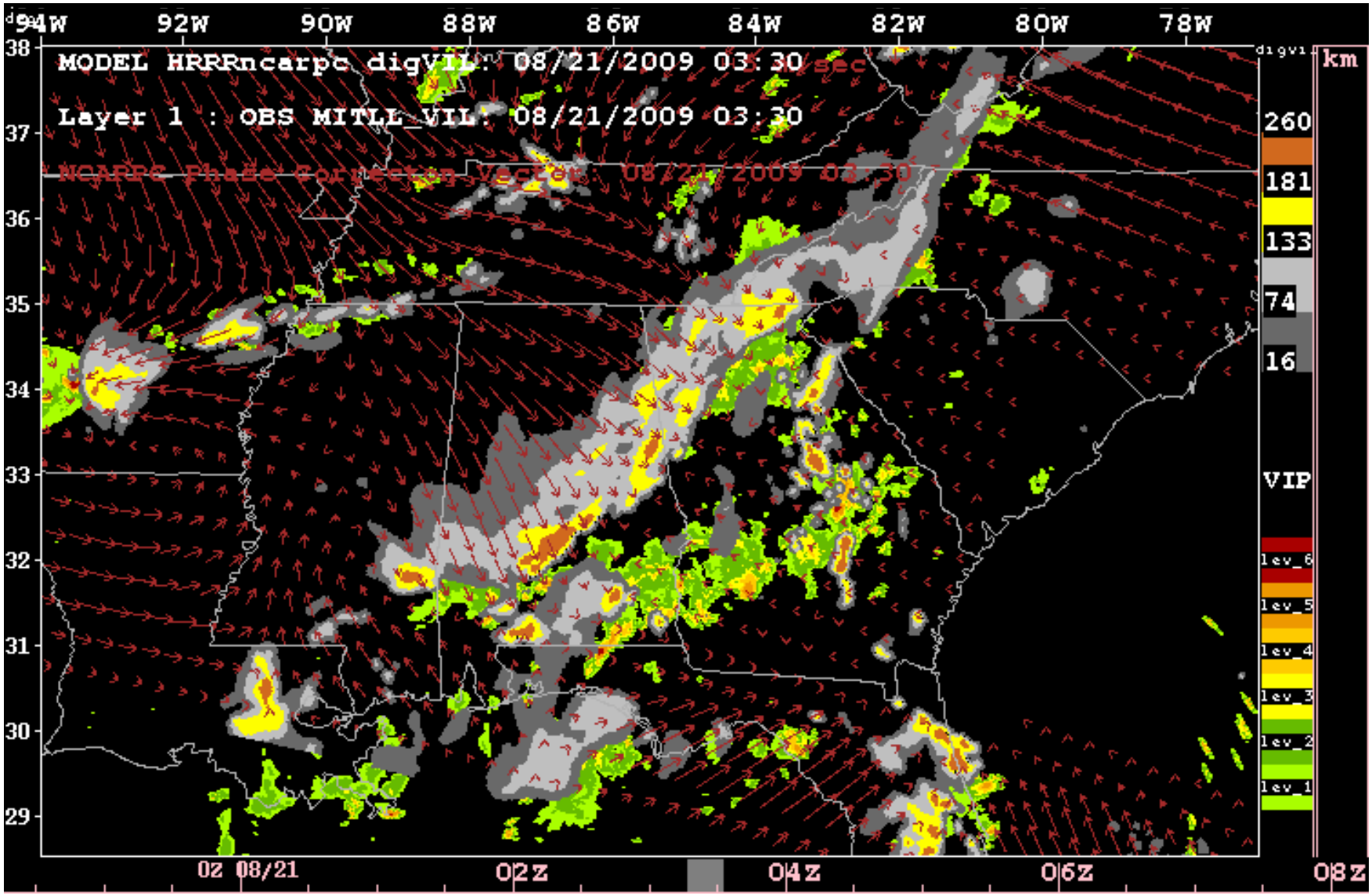
Location Adjusted Model



Truth 17Z



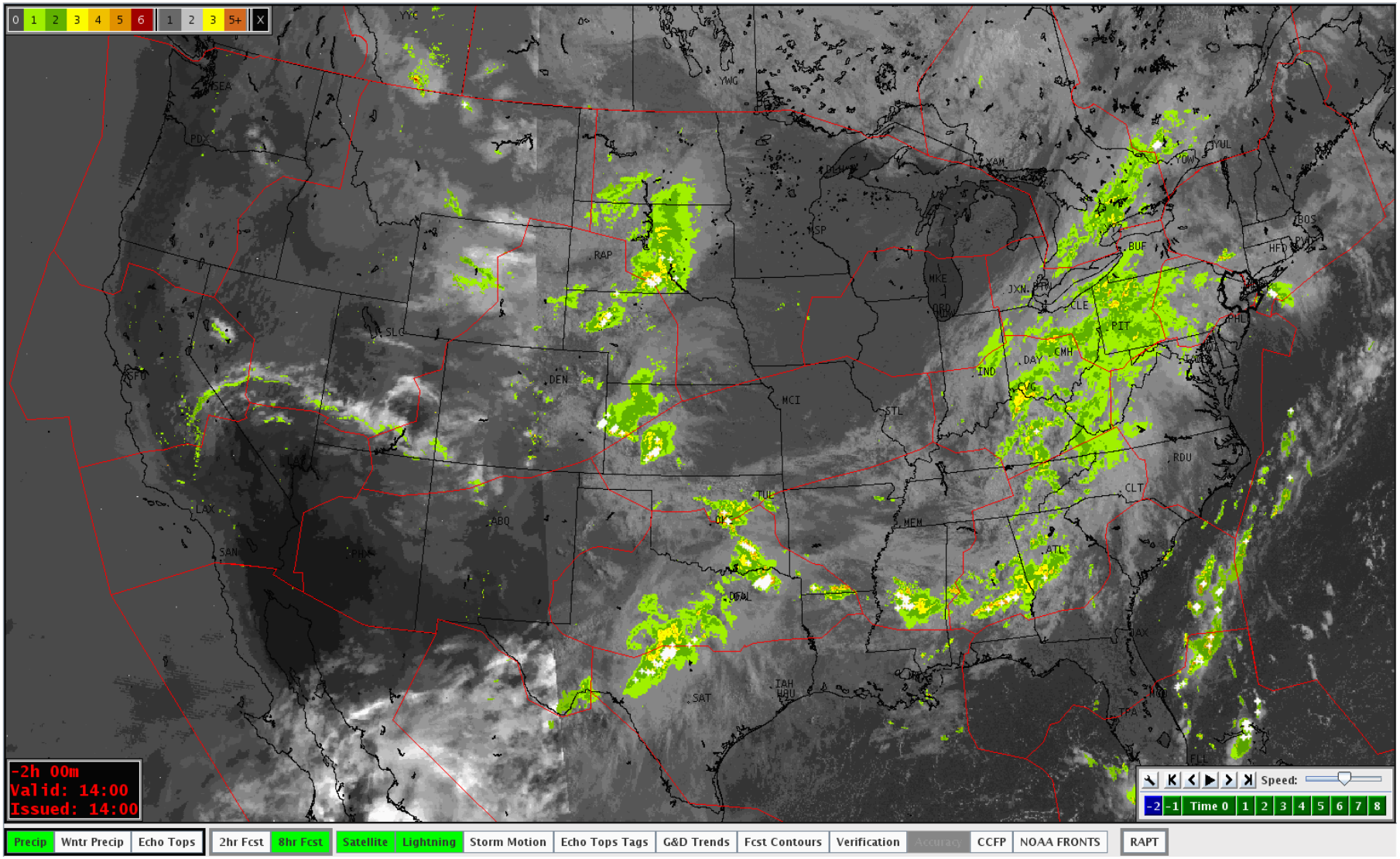
Blending
Phase Adjustment



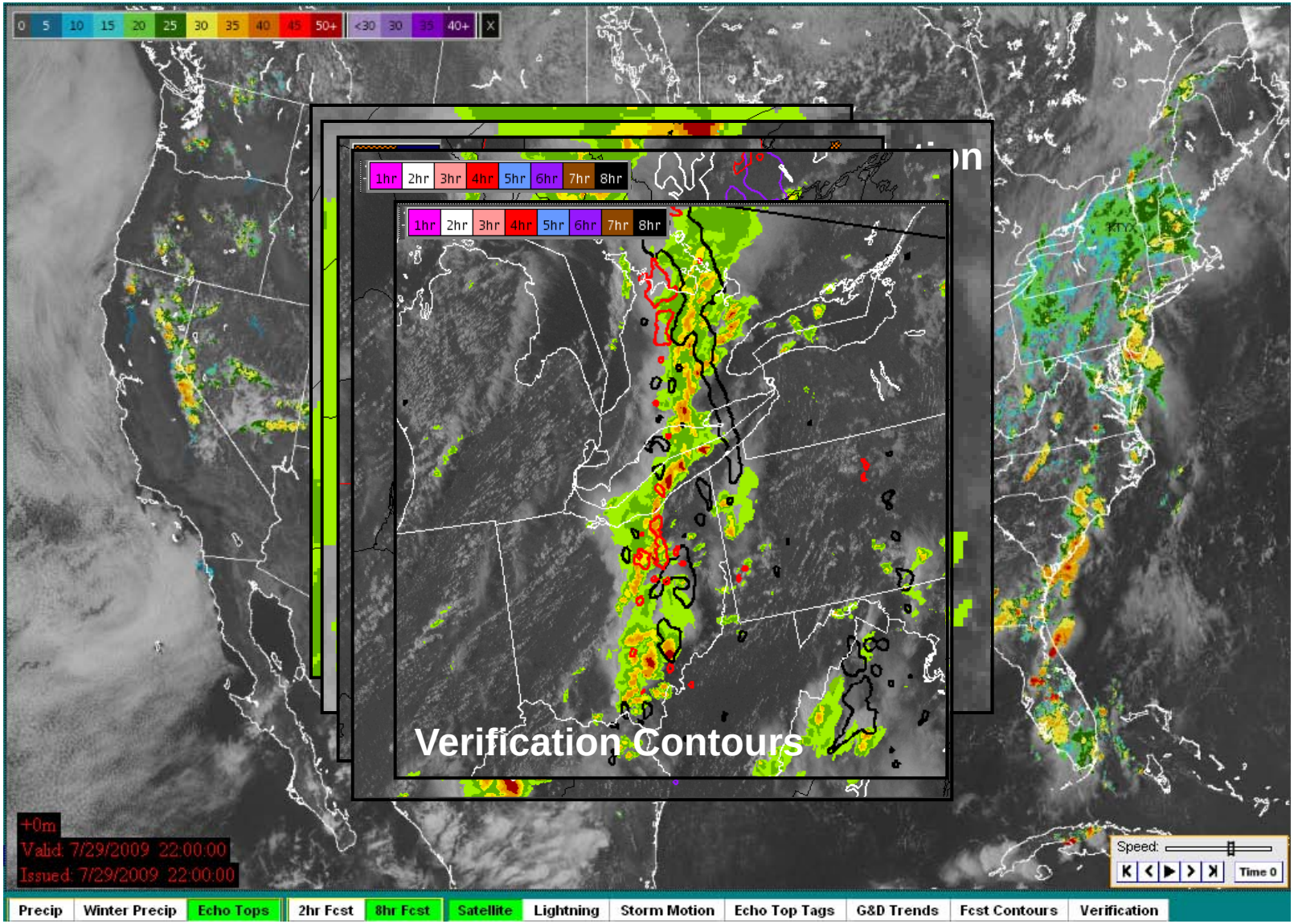
Overview

- CoSPA Overview
- **Situation Display**
- Ongoing Research
- Summary

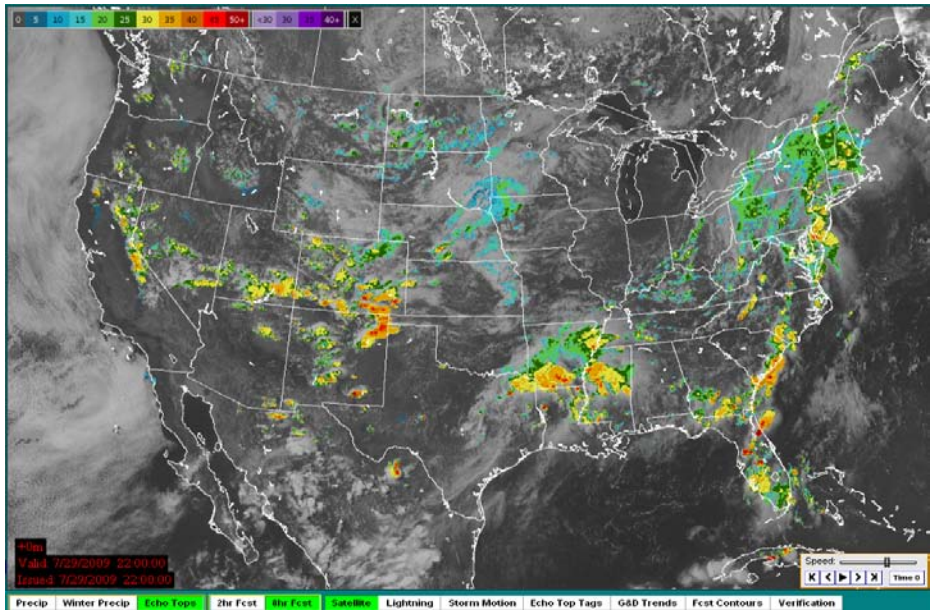
CoSPA Situation Display



CoSPA Situation Display



CoSPA Current Capabilities

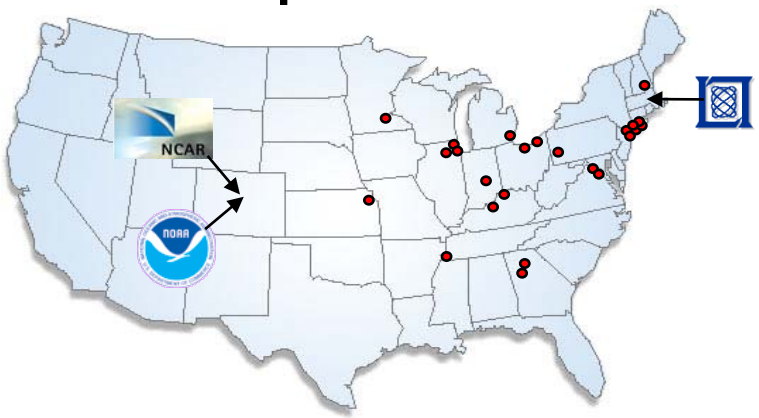


- Horizontal resolution:1 km (0-2 hour), 3 km (2-8 hr)
- CONUS coverage
- Display 2D VIL and ET
- Forecast out to 8 hours
- Time steps: 5 min (0-2 hr), 15 min (2-8 hr)
- Latency: Extrapolation (10 min), Blending (20 min), HRRR (2 hrs)
- Deterministic forecast (Probabilistic forecast under development)

Live Real-time Evaluation in 2010

- **Forecast Operational Evaluation**
  - **1 June 2010 through 30 Sept 2010**
  - **Air Traffic Management Users**
  - **ATCSCC, ARTCCs, TRACONs, CWSUs**
  - **Quality Assessment**
  - **Live 24/7 operations**
- **Goal: CoSPA Operational in 2013**

CoSPA Operational Sites



Overview

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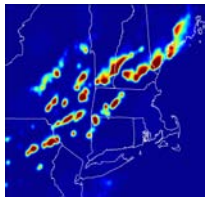
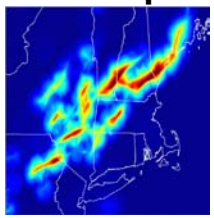
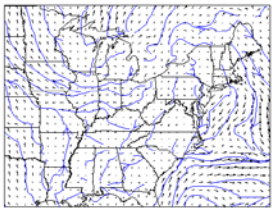
CoSPA Research
Motion Estimation

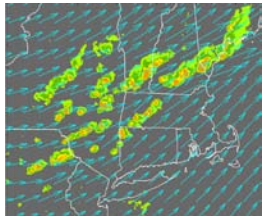
Multiscale Approach

Temporal	Spatial	
0-30 min	13 km	Cell 
1-2 hr	69x13 km	Envelope 
2-8 hr	201x101 km	Synoptic

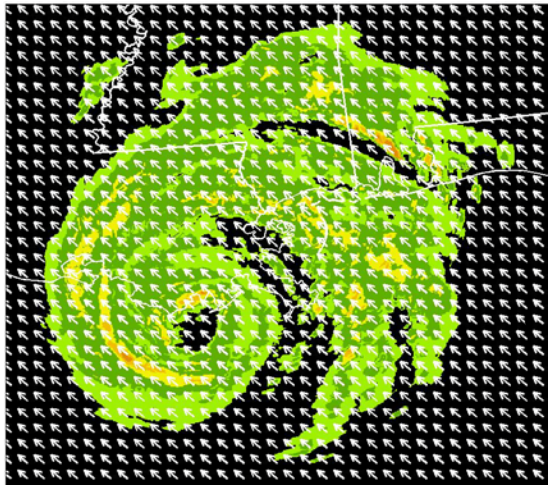
Model Winds

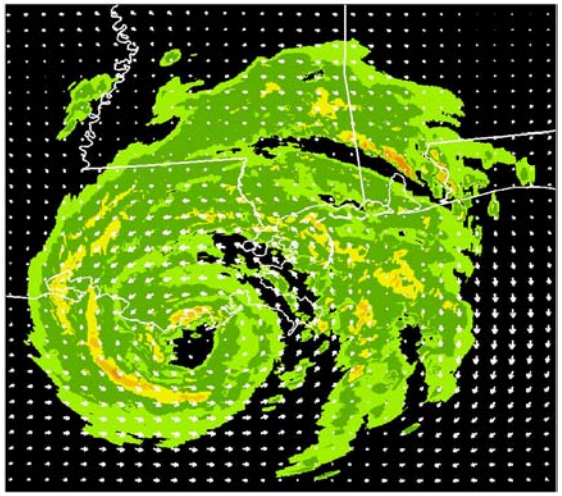


Motion Vectors



Wavelet Approach



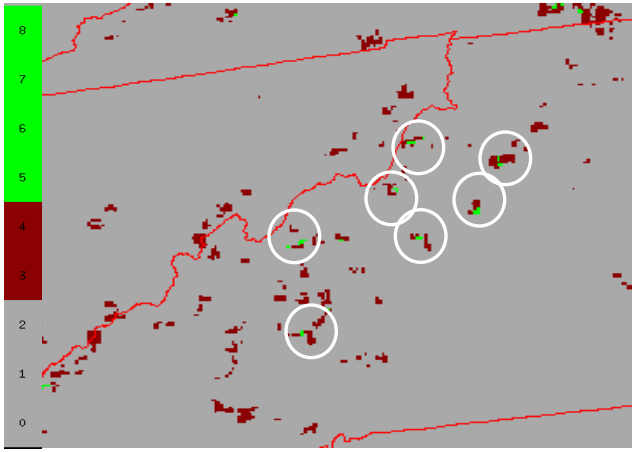


-Translation, rotation, and deformation based on wavelet decomposition

-Applies physical constraints

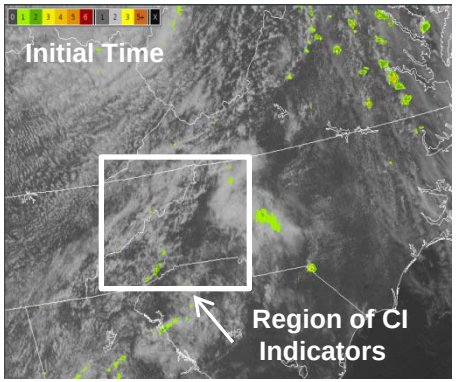
CoSPA Research
0-1 Hr Convective Initiation

Eight Satellite CI Indicators

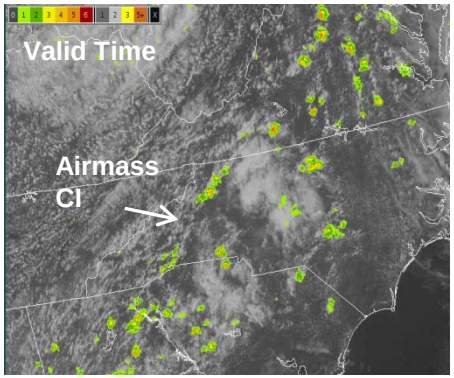


- SATCAST IR-based indicators depict cloud-top cooling, glaciation, and cloud height.
- SATCAST running in real-time CoSPA testing environment
- Algorithms exploit meteorological variables and image processing to test the use of SATCAST in CoSPA

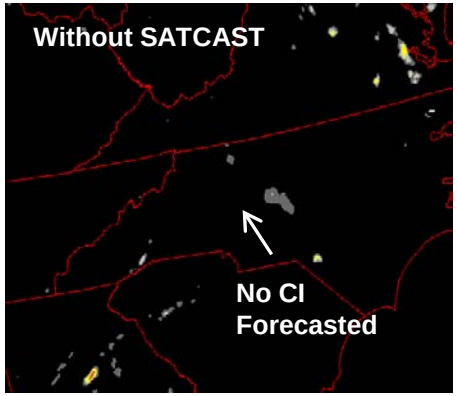
Radar Precipitation & Satellite



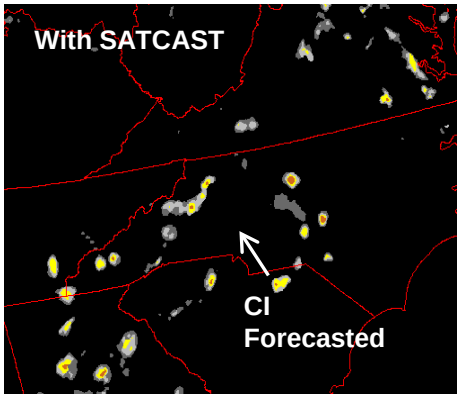
Radar Precipitation & Satellite



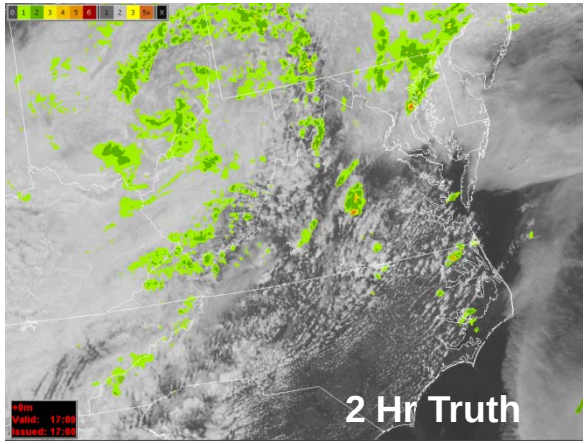
1 Hour Precipitation Forecast

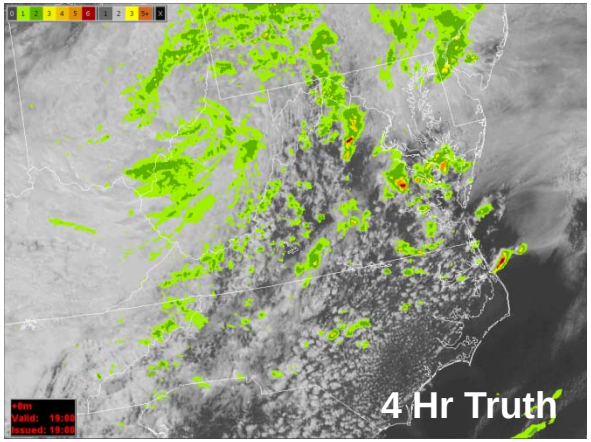


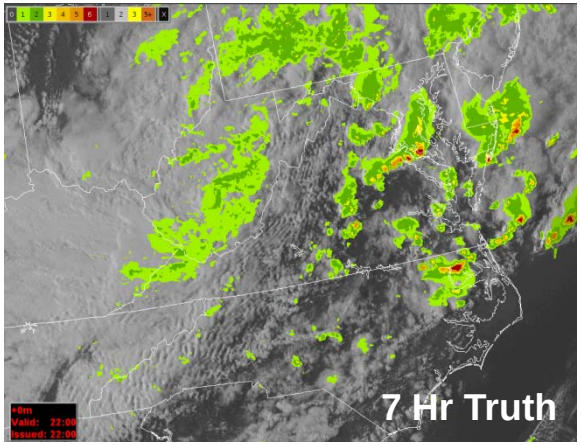
1 Hour Precipitation Forecast

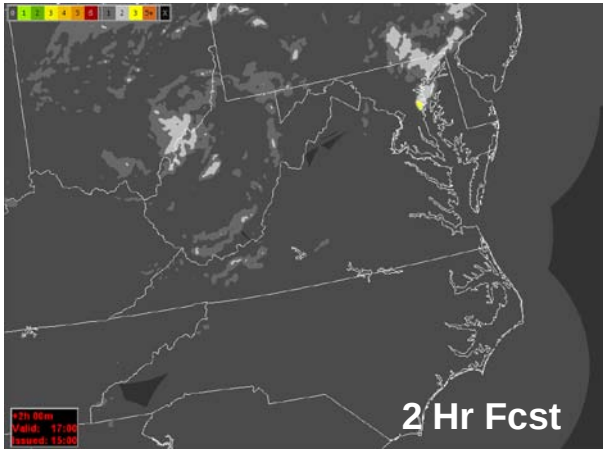


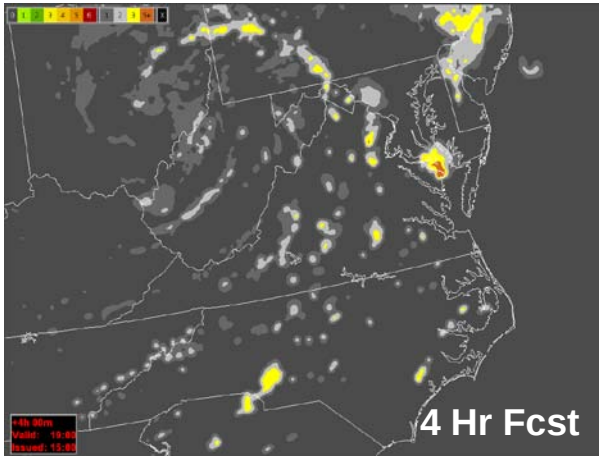
CoSPA Research
Long-lead Convective Initiation

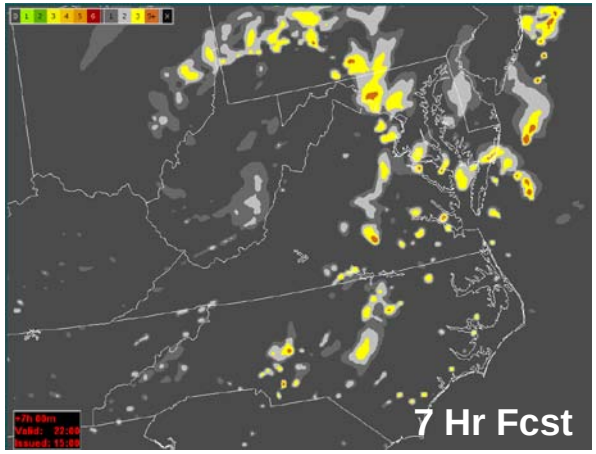






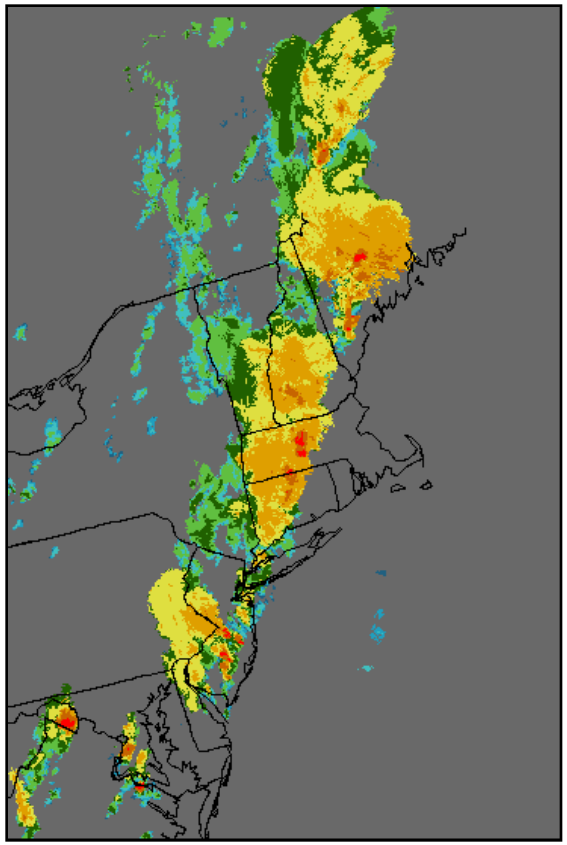




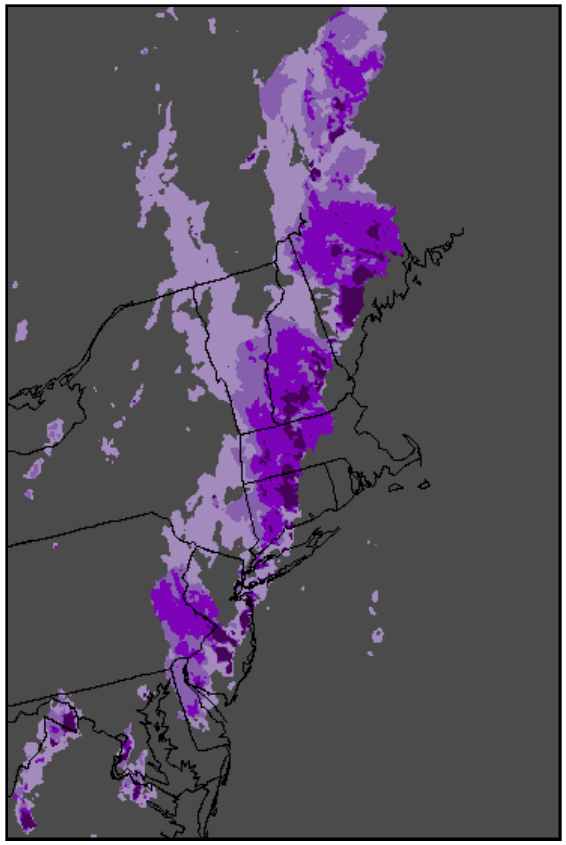


CI captured in HRRR

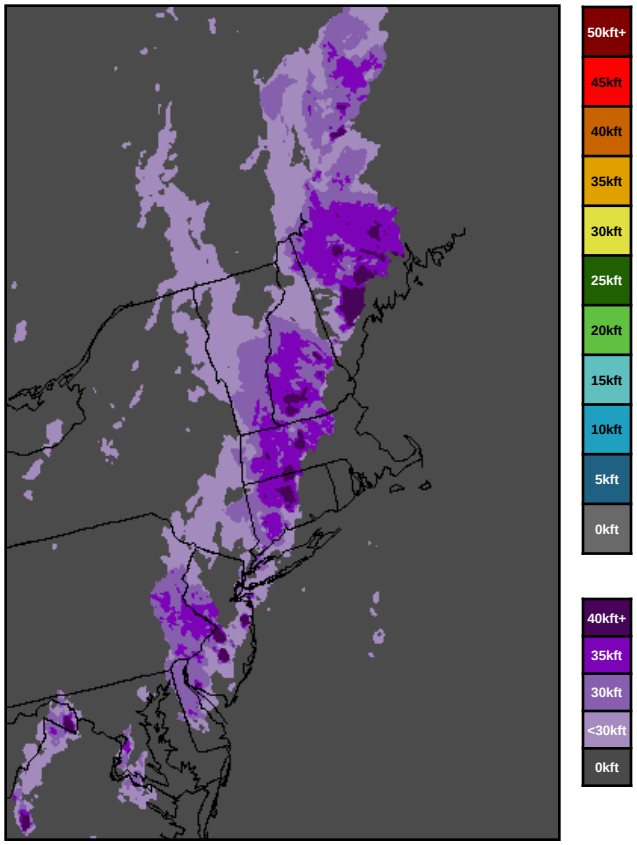
CoSPA Research
Storm Decay



Truth Echo Tops



Existing Echo Tops Forecast

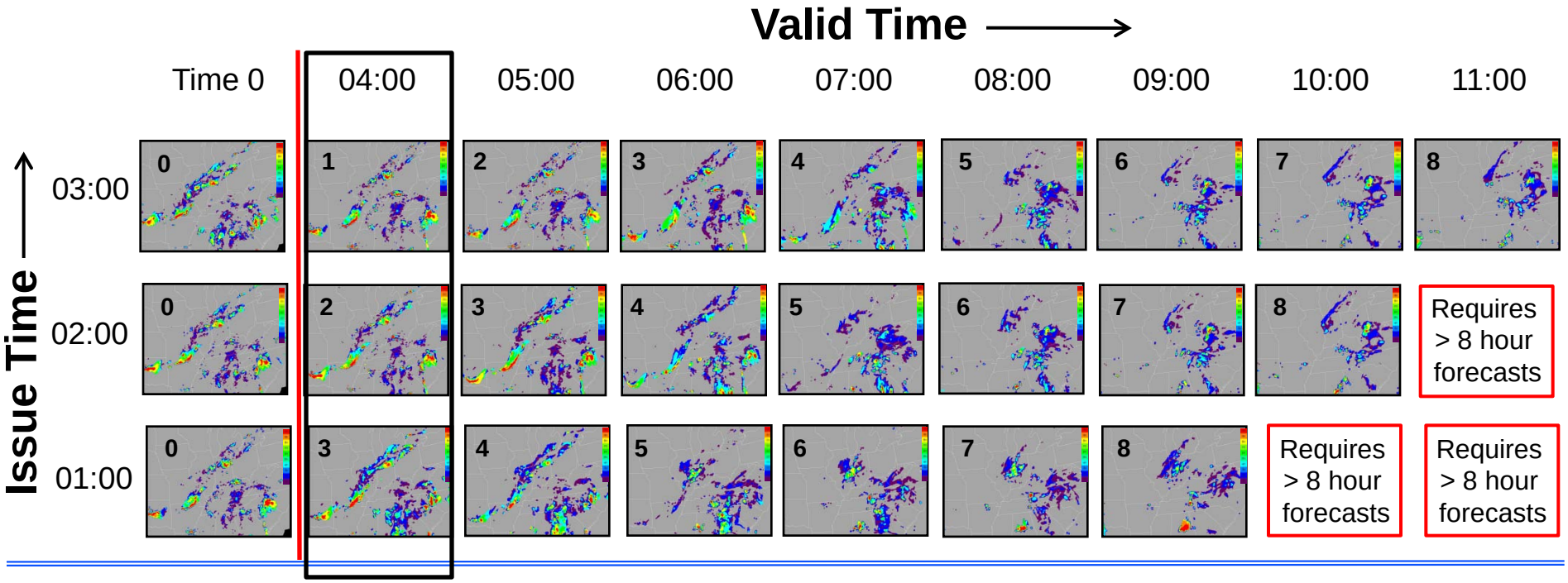


Echo Tops Forecast with Decay

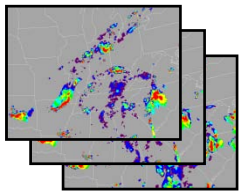
- Uses trends in CG lightning and ET
- Algorithm in testing

Probabilistic Forecasting
Time-Lagged Ensembles

Input: Weather Avoidance Field (Probability of pilot deviation)

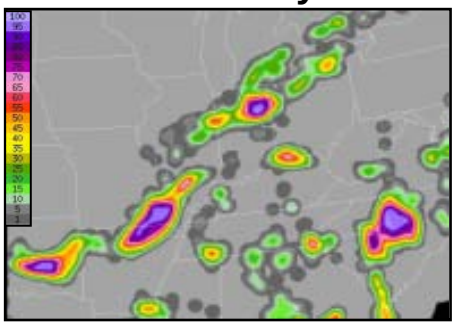


Example for 04:00 Valid Time

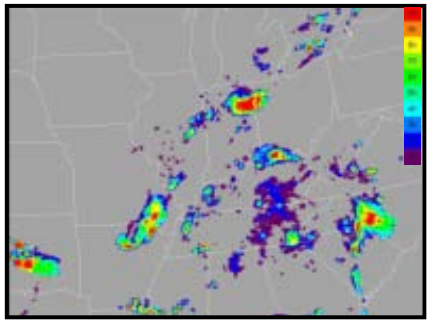


- Apply Threshold
- Count pixels in kernel above threshold

Probability



Truth



Summary

- **2010 FAA Operational Evaluation of 0-8 hr forecasts**
  - **Deterministic forecasts of VIL and Echo Tops**
  - **Shows storm character and scale**
  - **CONUS-wide domain**

- **Forecasts combine short-term heuristics with longer-term Numerical Weather Prediction modeling**

- **Current Research**
  - **Storm motion, convective initiation and decay, probabilistic forecasts, forecast blending, numerical modeling (HRRR)**

- **Future**
  - **Companion CoSPA probabilistic forecasts**
  - **Real-time accuracy estimates**