Corridor Integrated Weather System

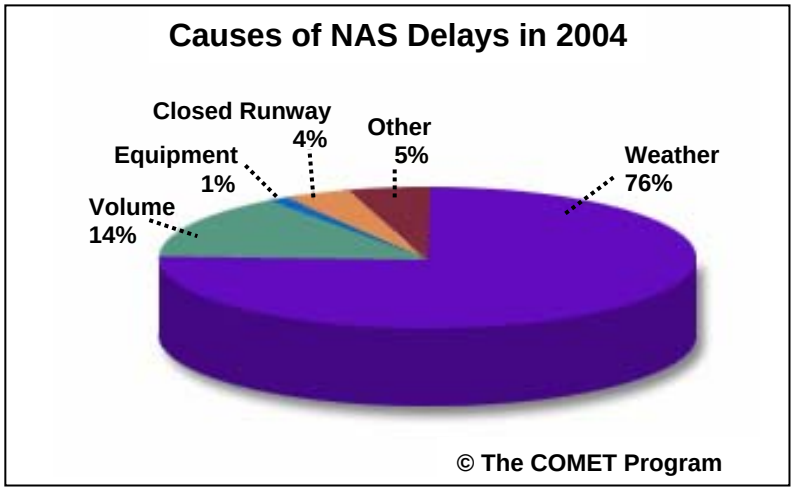
(CIWS)

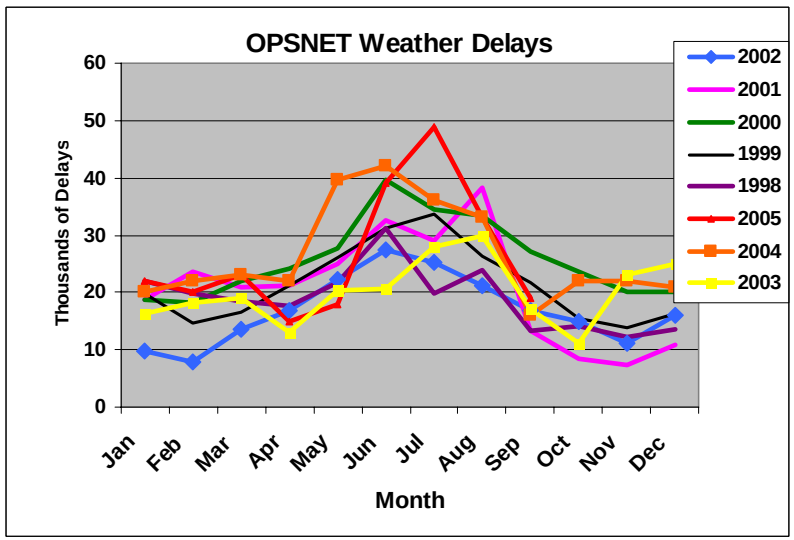
Outline

- **Example of Weather Impacting Air traffic**
  - **Impacts on worst delay day**
- **Ways to reduce delay**
  - **Improve forecasts**
  - **Aid traffic flow management**

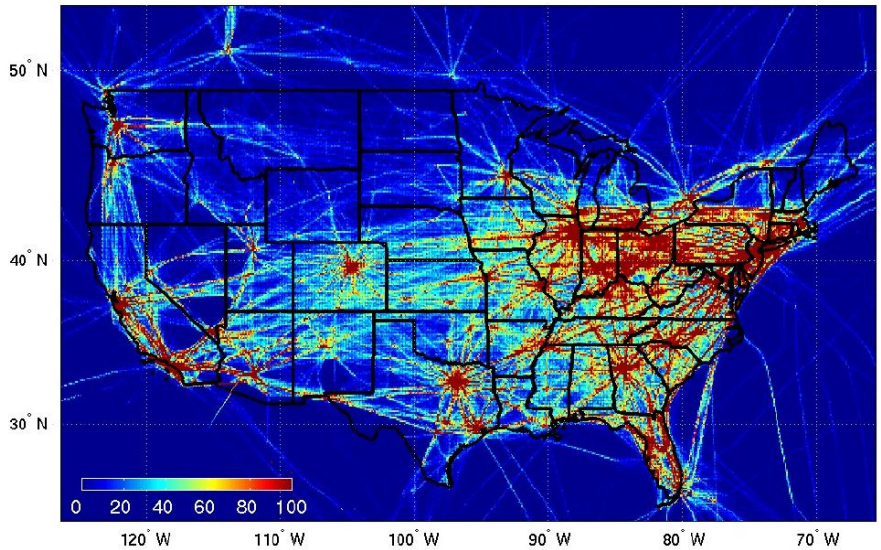
Aviation Delay Problem

Aviation Weather Delays





US Air Traffic Density



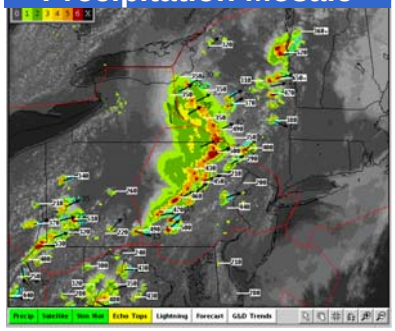
Thunderstorm Impacts

- Thunderstorms cause fatalities and severe injuries at a cost of $8.1M/yr
- Convection responsible for 40% of delay costs: $840 – 920 M/yr
- Approximately 40% of thunderstorm delay possibly avoidable ($336-368 M/yr)

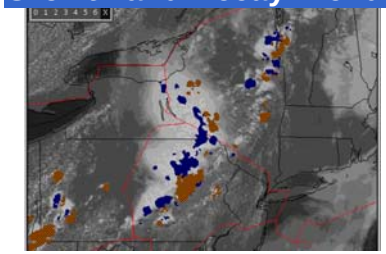
FAA Corridor Integrated Weather System

Improving Tactical Convective Weather Forecasts for Aviation

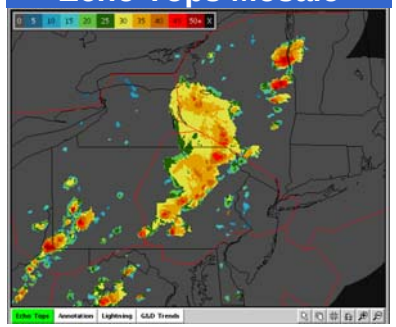
Precipitation Mosaic



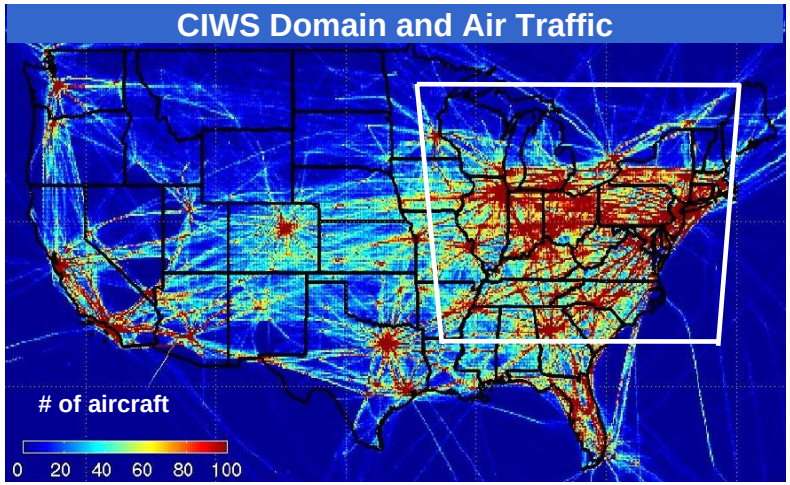
Growth and Decay Trends



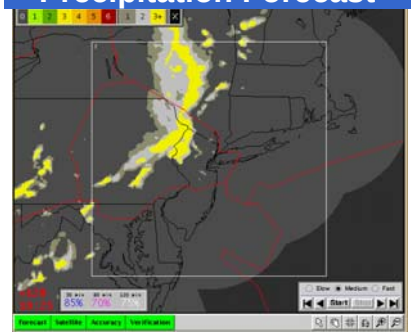
Echo Tops Mosaic



CIWS Domain and Air Traffic



0-2 hour Precipitation Forecast



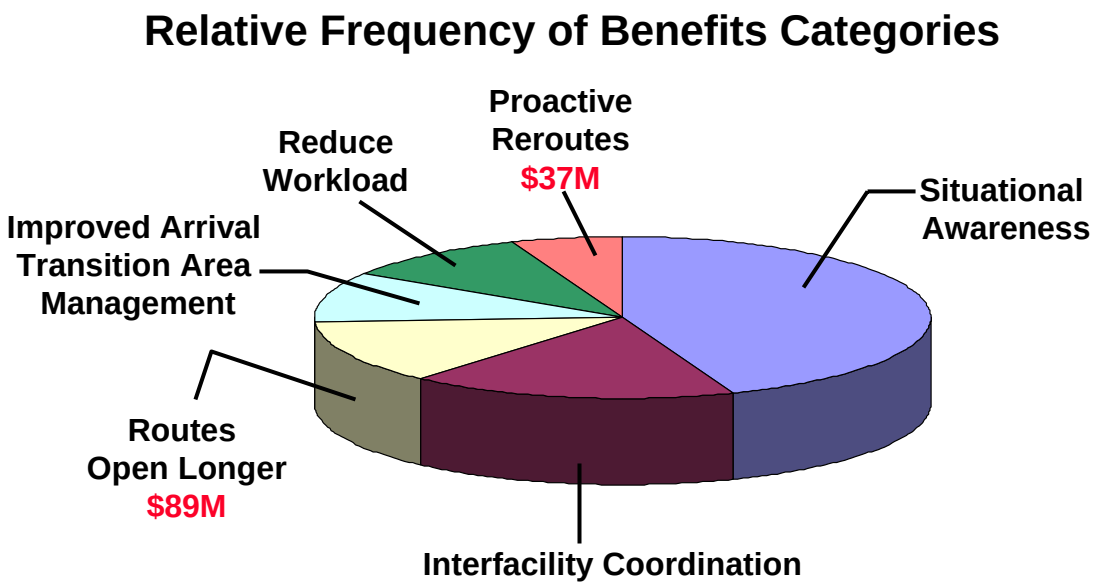
0-2 hour Echo Tops Forecast

Winter Precipitation Forecast

Plan CIWS capability across CONUS by 2007

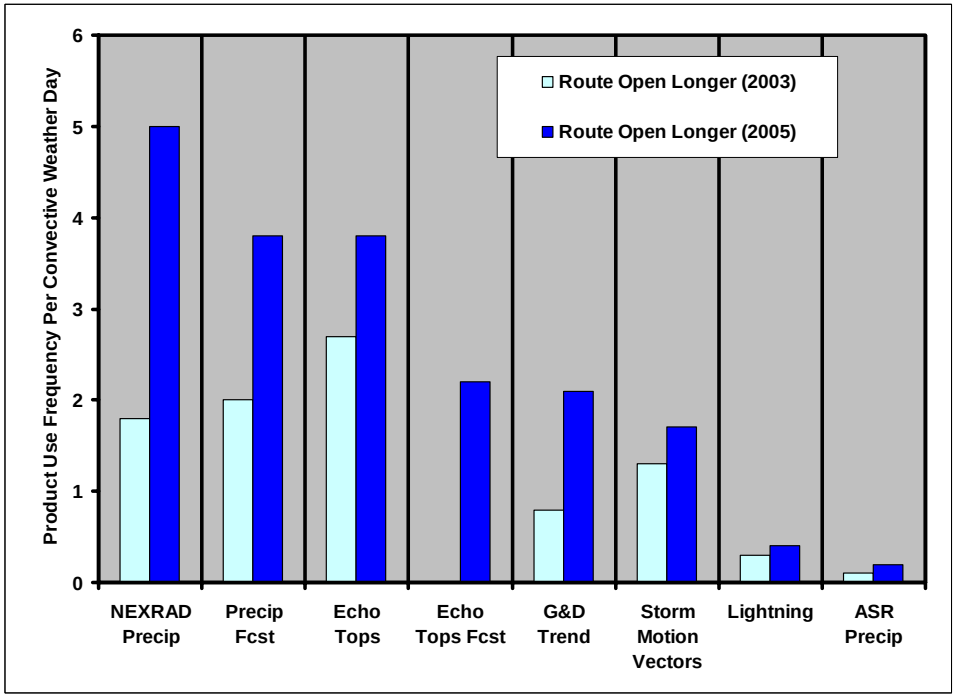
Identified CIWS Benefits in 2003

- **Intensive benefits analyses in 2003 & 2005**
  - **Annual benefits estimates are from ’03**
  - **Increase expected based on ’05 analyses**

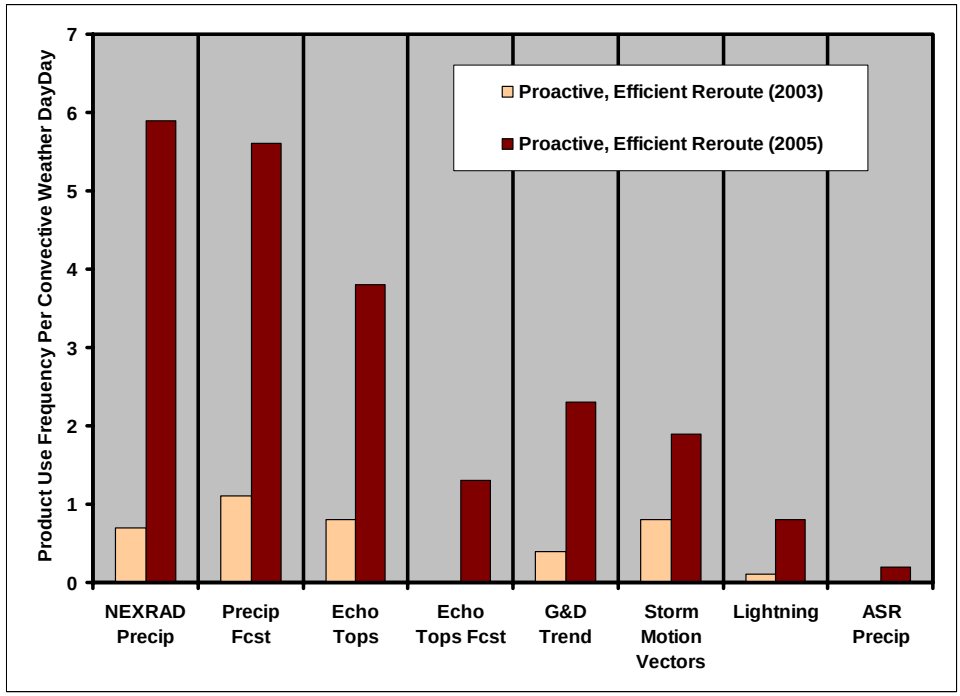


CIWS Benefits Are Increasing …

Comparison of CIWS Product Usage in 2003 and 2005



Keeping Routes Open Longer



Proactive, Efficient Reroutes

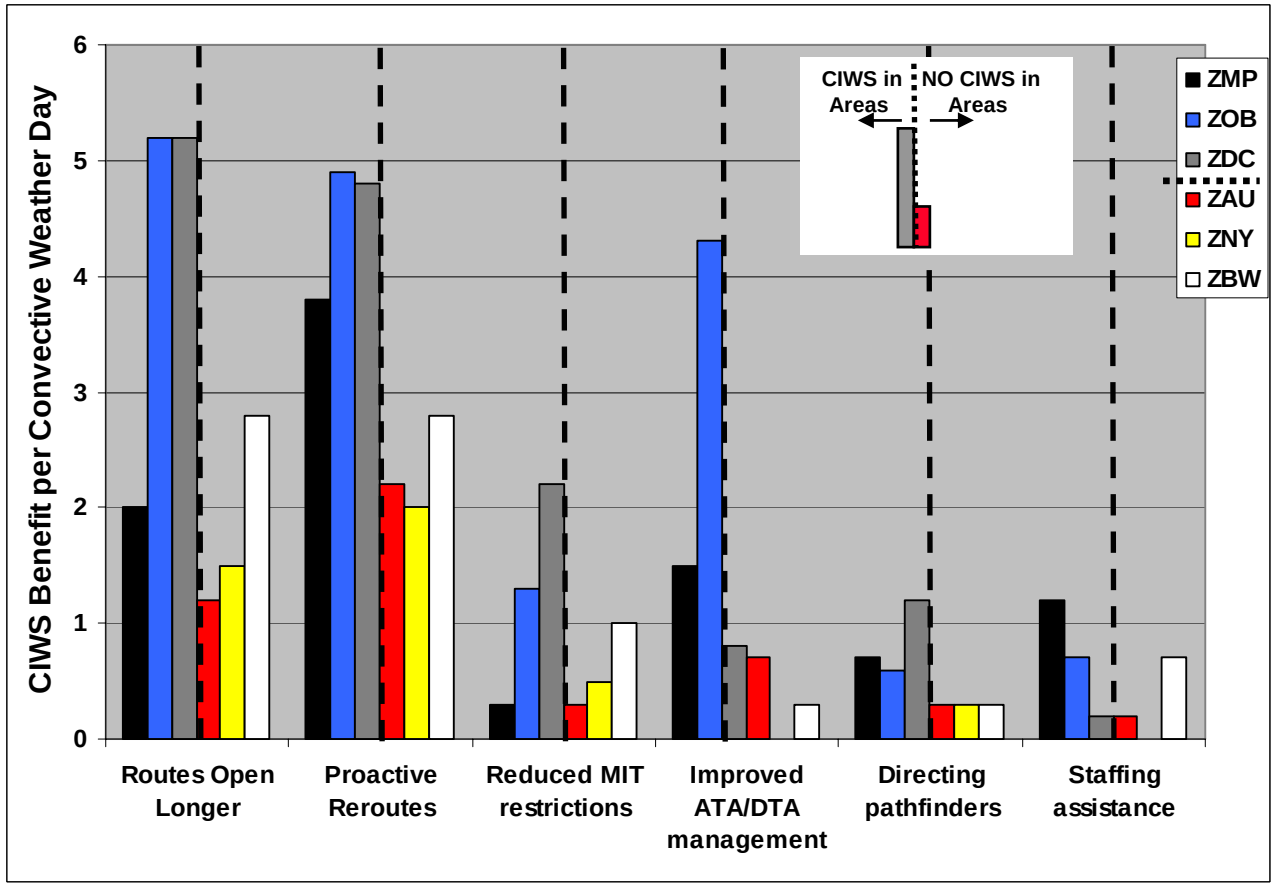
- Note increased use of Precip Forecast and importance of Echo Tops information
- Initial use of Echo Tops Forecast in 2005 surpasses use of Precip Forecast in 2003

CIWS Benefits Comparisons

ARTCCs With and Without CIWS Displays in Areas

- **Much higher benefits at ARTCCs with CIWS displays in TMU and Areas**
- **ZMP ARTCC new CIWS 'user' in 2005**
  - **Benefits lagged other ARTCCs with CIWS in TMU and Areas as 2005 was first SWAP season with CIWS and user "burn-in" period was expected**
- **For ARTCCs with no CIWS in Areas, significantly more benefits realized at ZBW**
  - **Compensated for lack of CIWS in Areas through increased use in TMU**
  - **ZBW operational benefits still lagged benefits at ZDC and ZOB (ARTCCs with similar TMU CIWS experience, but CIWS also in Areas)**

CIWS Operational Benefits per ARTCC **



** *Includes most significant CIWS en route delay reduction benefits categories + FAA staffing assistance category*

Recipe for Bad NAS Delay Day

1. Impact NY TRACON directly
2. Disrupt E-W flow in Corridor
3. Impact DC and Atlanta simultaneously
4. Make the weather impact last for hours

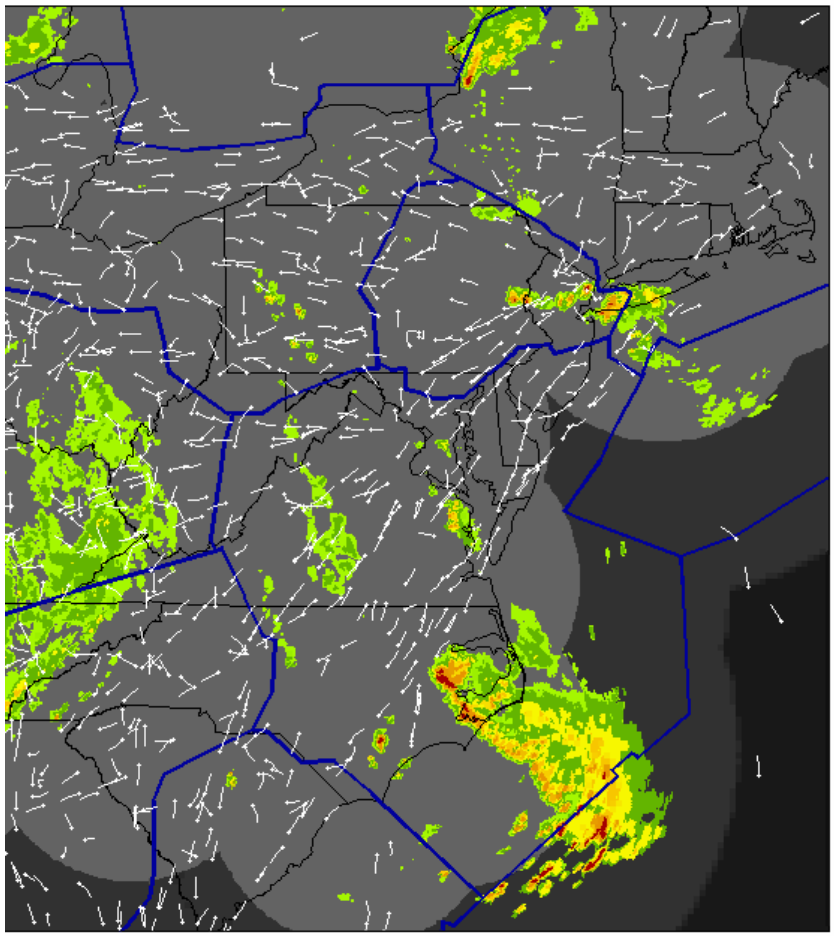
- 13 July 2005 had all these ingredients!
  - Worst single day delay in FAA history
    - For 35 OEP pacing airports
      - 1624 delays recorded
      - 2017 total hours of delay
      - Average delay of 74 min per flight
  - Hurricane Dennis remnant in central US
  - Convective weather along east coast

Example of Air Traffic Impacts by Weather

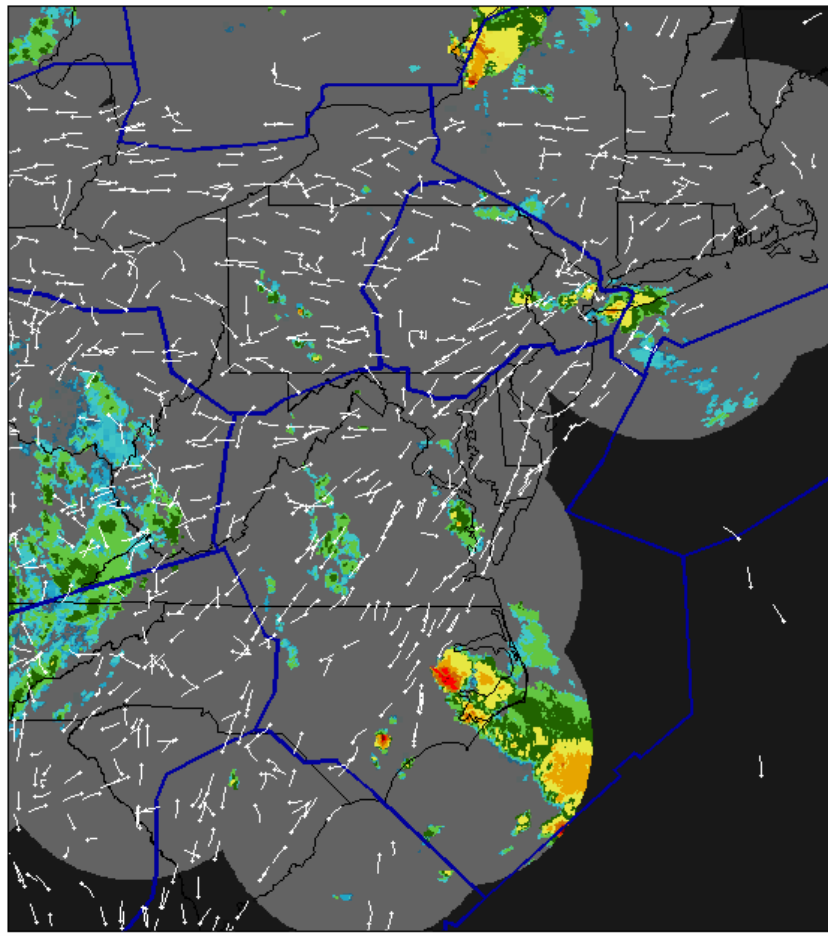
Worst Delay – day in FAA history – 13 July 2005

CIWS Precipitation 0 1 2 3 4 5 6

2005/07/13 15:02:59

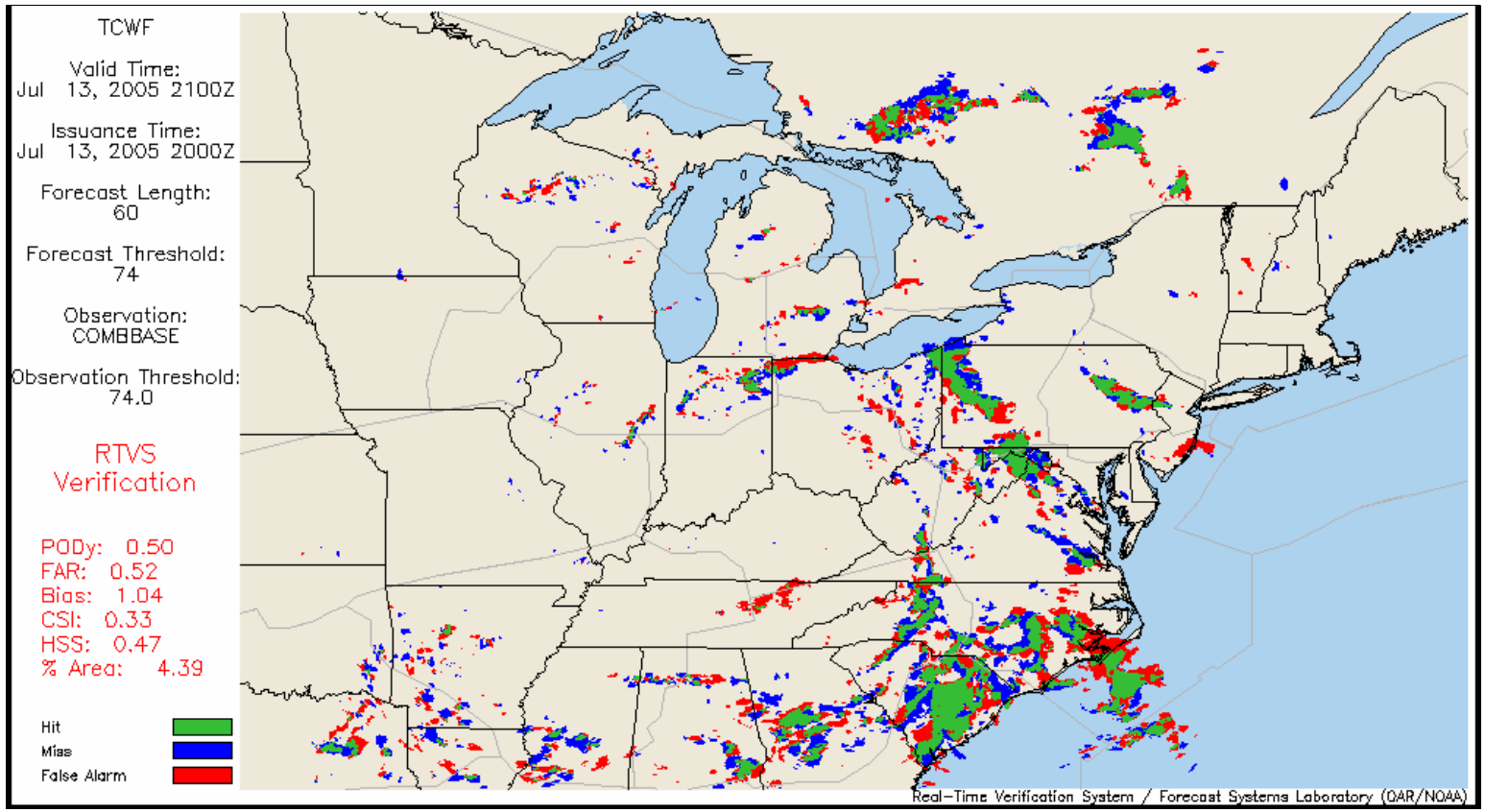


CIWS Echo Tops 0 5 10 15 20 25 30 35 40 45 50+ X



Flights at or above 16,000 Feet
Western weather caused by remnant of hurricane Dennis

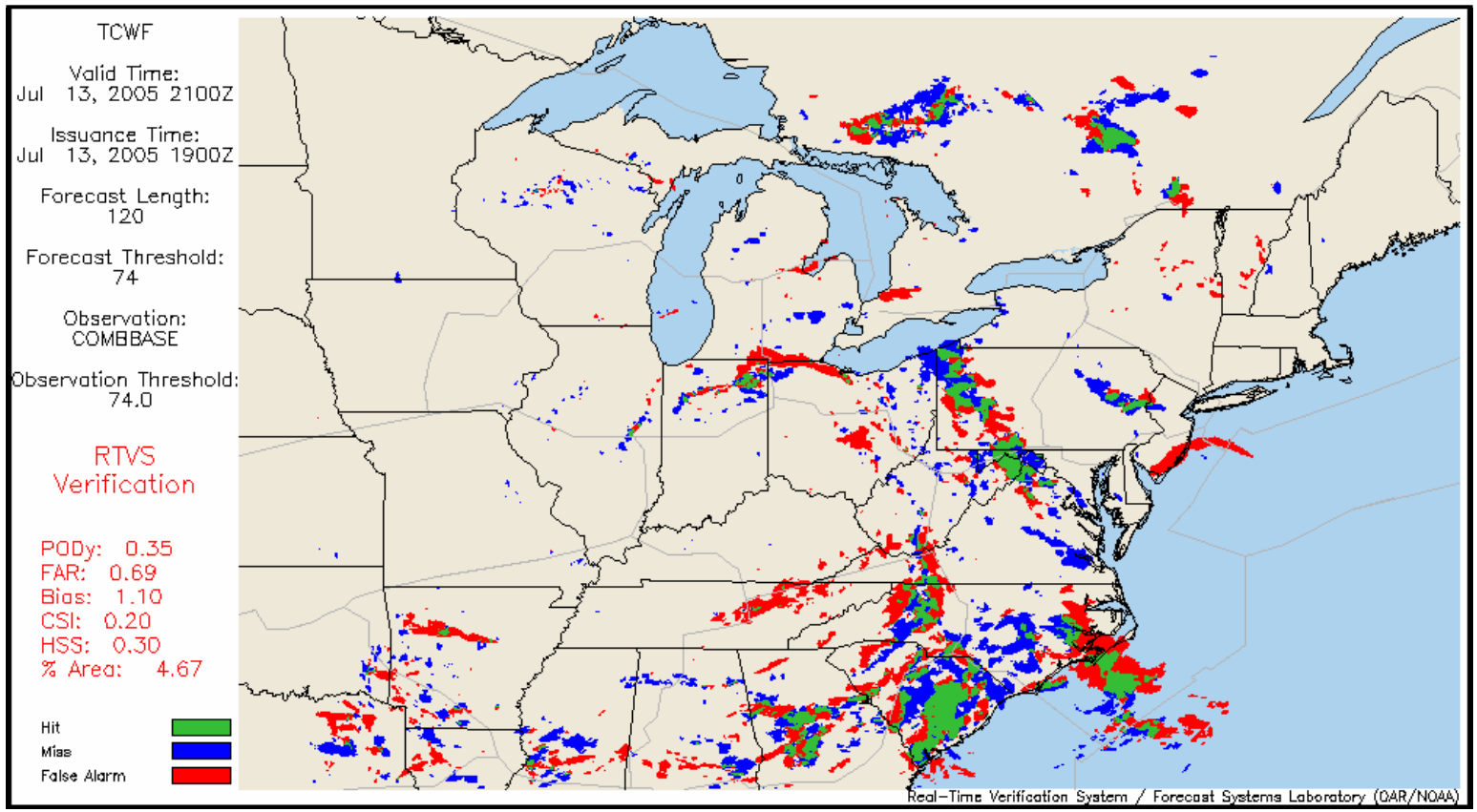
CIWS 1-hr Forecast Performance



Correct Forecasts **Failed to Forecast Decay** **Failed to Forecast Growth**

- All significant storm elements forecast very well

CIWS 2-hr Forecast Performance



Correct Forecasts **Failed to Forecast Decay** **Failed to Forecast Growth**

- Large storms forecast less well - more growth & decay missed

Reducing Weather Impact Delays

- **Recognize some delay is unavoidable**
  - **Develop model to calculate optimal routing given weather, traffic**
  - **Compare “actual” routing to “optimal” to fairly measure delay**

- **Improve forecast products**
  - **FAA Aviation Weather Research Program is**
    - **Improving storm growth & decay in 0-2 hr tactical forecasts**
    - **Developing automated 2-6 hr strategic forecasts**
  - **Research results directly improve CIWS products**

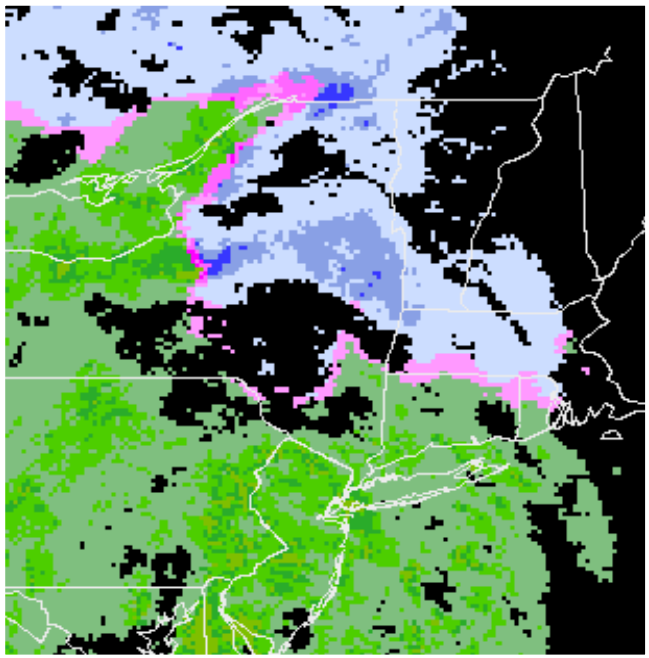
- **Aid traffic flow planning in complex weather scenarios**
  - **Provide common situational awareness**
  - **Couple forecasts with decision support tools**

Ongoing Research to Improved Forecasts

Enhanced Winter Forecast

0-2 hr Precipitation Phase Forecast

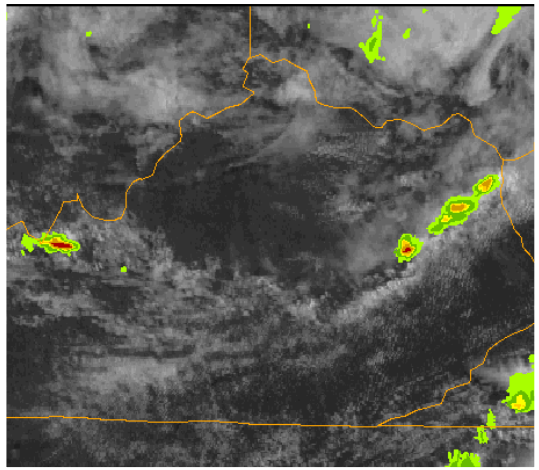
Snow Mix Rain



CIWS Winter Mode Forecast

Growth of New Storms

Use of Satellite Growth Evidence



Knowledge of Frontal Forcing