Federal Aviation Administration

FAA Weather Research Plans

Presented to: “Friends /Partners in Aviation Weather” Vision Forum

By: Ray Moy
FAA Aviation Weather Office

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Aviation Weather Research Program (AWRP)

Purpose: Applied Research to Minimize the Impact of Weather on the NAS

Motivation

– NextGen weather operational improvements

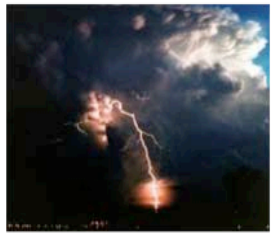
– FAA Flight Plan goals of greater capacity and increased safety

Goals

–Timely & accurate deterministic & probabilistic aviation weather information

AWRP Research Areas

Wx Hazard **Wx Information**



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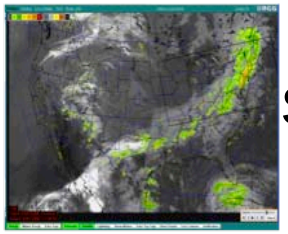

Storms

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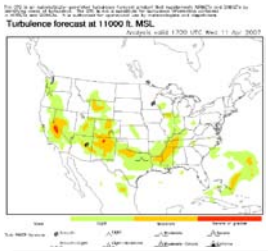

Turbulence

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Icing

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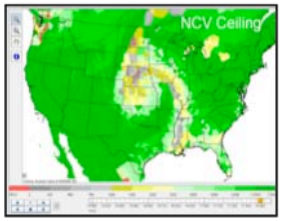
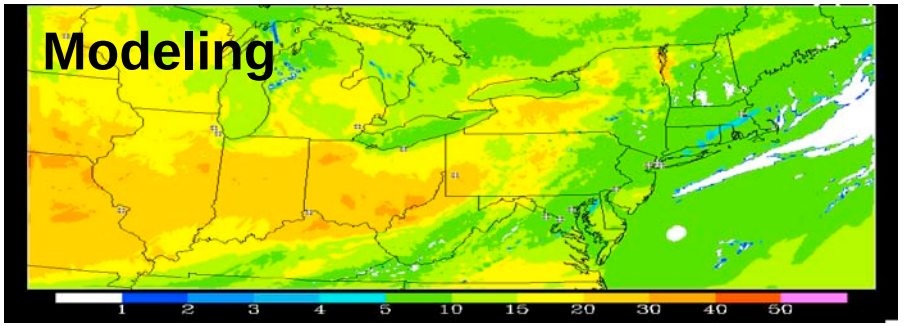
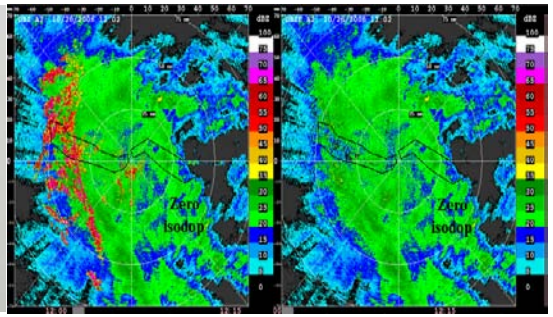


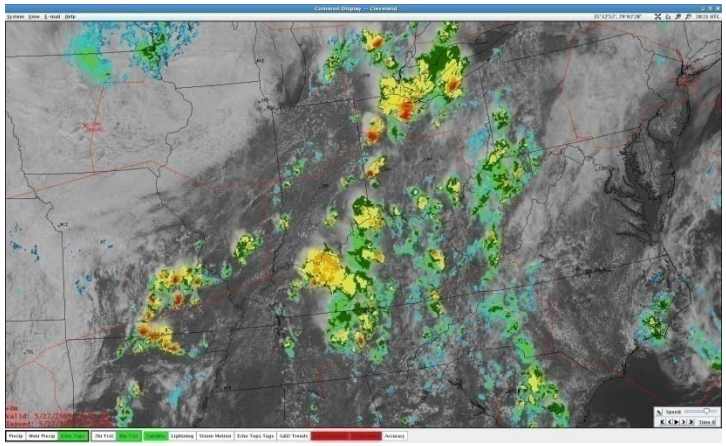
Ceiling & Visibility





Research Area: Storms

Advanced Storm Prediction Algorithm



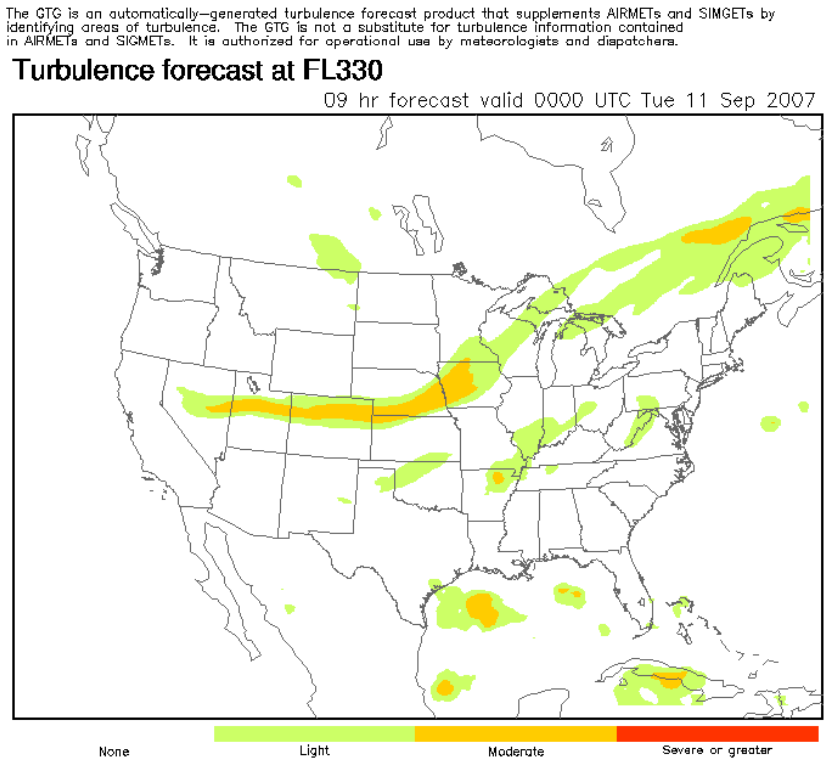
2009 Demo Capabilities

- 0-2hr 1km/2-6hr 3km
- Precip & storm height forecasts
- 5 min update rate/15 min forecast
- Forecast & verification contours

NextGen Near Term Capability

- CONUS
- Probabilistic forecast and weather avoidance fields
- Automated Front detection
- Precipitation & storm height

Research Area: Turbulence



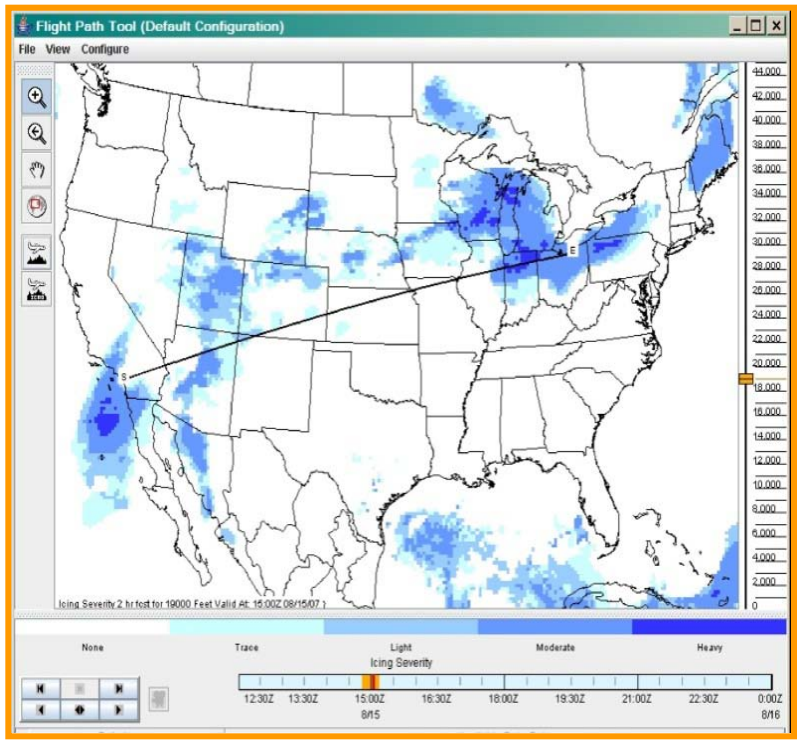
Current Capabilities

- Clear Air forecasts for FL200+ out to 12 hours
- Updated hourly
- Uses model inputs and pilot reports (PIREPs)

Near Term Capability

Forecasts to surface with hourly update to include clear air and mountain wave turbulence; inputs from satellite, radar, air & ground-based surface observation systems

Research Area: In-Flight Icing



Current Capabilities

Analysis Product

Severity, probability, Super-cooled Large Drop (SLD) potential, hourly update

Uses model, satellite, surface weather, and PIREPs

Forecast Product

12 hour icing potential, hourly update, uses model inputs

NextGen Near Term Capability

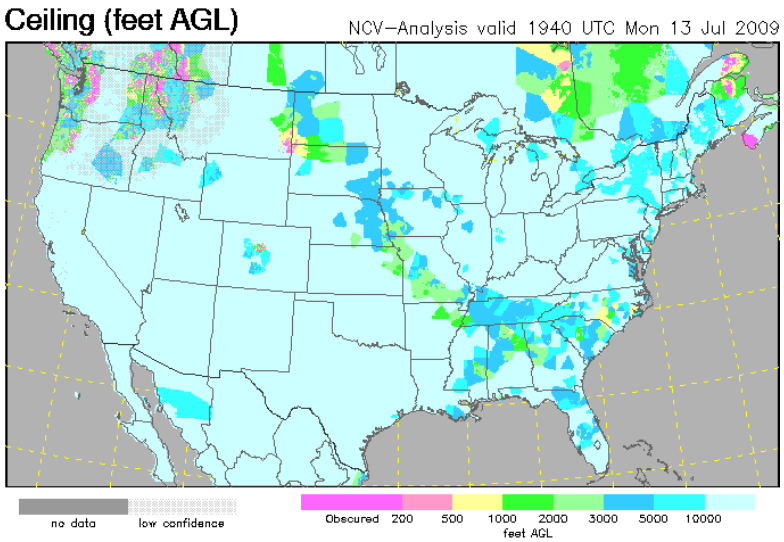
FIP severity, probability, super-cooled large droplets (SLD) forecasts 0-12hr CONUS-wide

Research Area: National Ceiling & Visibility

Current Activities

NCV Analysis

- NCVA algorithm an automated gridded analysis of ceiling, visibility and flight category
- Nearest-neighbor interpolation is used to populate grid points between METAR sites.
- Operational on ADDS -2010



NCV Forecast

- Development & initial test of CONUS product
- 0-12 h probabilistic nowcast/forecast product (updated hourly to 12 h at 5km)

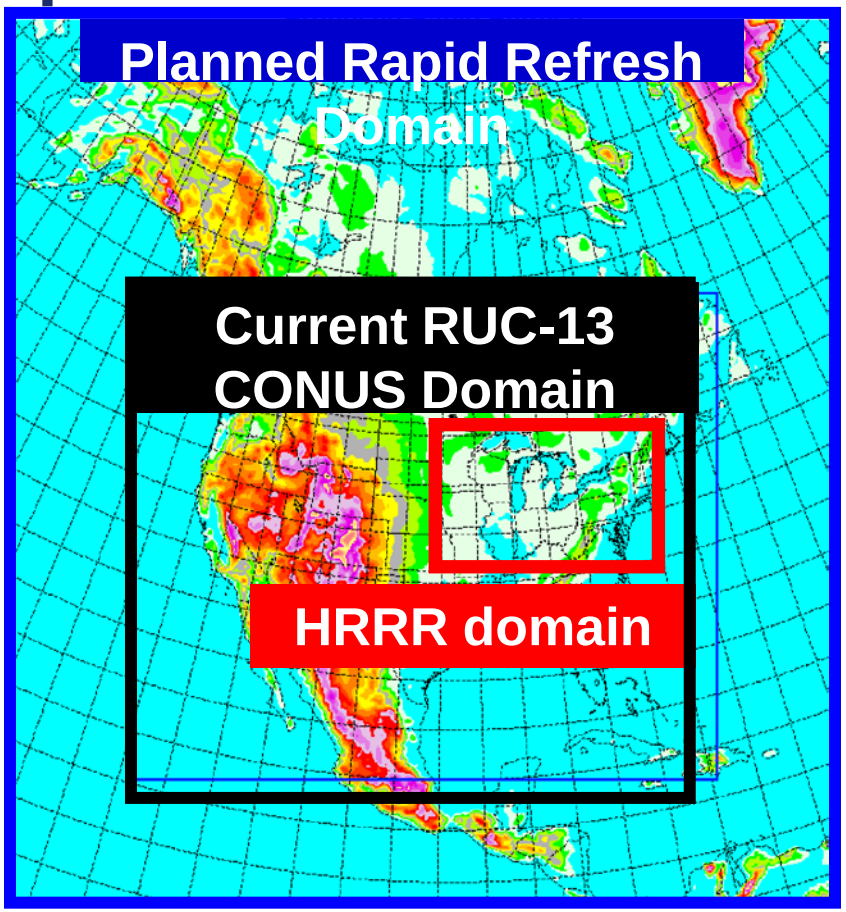
NextGen Near Term Capability

- NCV Analysis: 5-min update, 5-km resolution

Research Area: Model Development & Enhancement

Current Activities

- **Weather Research & Forecast (WRF) Model:** Develop an advanced mesoscale forecast & assimilation system to promote closer ties between research & operations
- **Rapid Update Cycle – 13Km (RUC-13)** Resolution improved from 20 to 13Km. Improved accuracy for jet-level winds, temperature, In-flight icing, convection, turbulence, and ceiling & visibility



NextGen Near Term Capability

- High-Resolution Rapid Refresh (HRRR) Storm-resolving (3km) model; updated every 30-60 min including latest radar data
- HR WRF-RR model with improved microphysics for enhanced CIP/FIP and convective forecast
- Improved cloud/hydrometer analysis for NCV

Research Area: Advanced Wx Radar Techniques

Development of techniques so that data from weather radars can be used to improve weather forecasting. Results of these efforts are used by other AWRP research areas to improve their forecast and nowcast capabilities

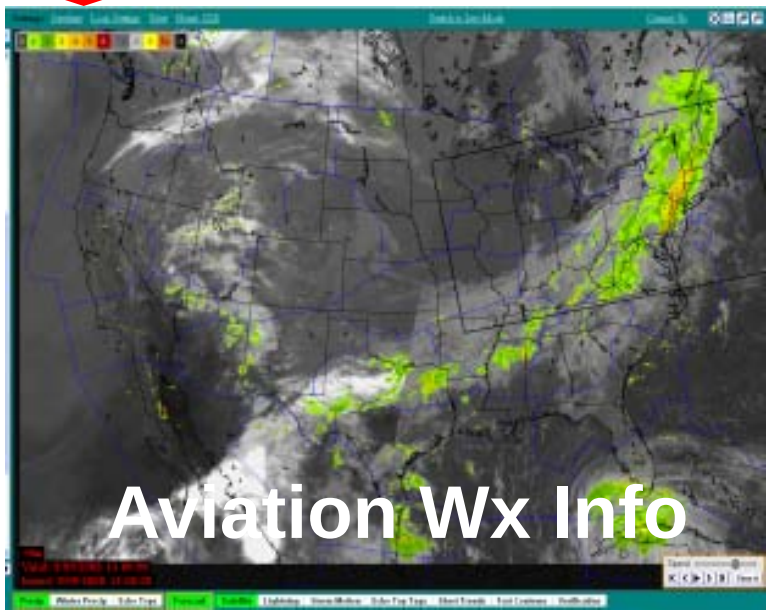
Current Activities

- Update national radar mosaic to handle super-resolution NEXRAD data
- Integrating Canadian radar data into real-time national 3D mosaic
- NEXRAD Turbulence Detection Algorithm (NTDA)
- Improve icing forecasts via enhanced polarimetric measurements in low-reflectivity clouds

NextGen Near Term Capability

- Polarimetric measurements as input into numerical models
- NTDA-based 3D EDR mosaic

AWRP – Building Towards NextGen



2009 **2013** **2018** **2025**

Deterministic **Probabilistic** **Increased Coverage**

Enhanced Accuracy and Longer Lead Times

Goals for Mid-Term Operational Capability

Convection

Summer & Winter Probabilistic fcsts for CONUS & Alaska beyond 12-hrs

Turbulence

Global CAT & MWT out to 36hrs updated every 6hrs; North America (NA) all phenomena including convection out to 18hrs updated every 15 minutes

In-Flight Icing

Diagnosis & probabilistic forecasts for CONUS & AK out to 12 hours

National Ceiling and Visibility

2D diagnosis & 3D probabilistic fcst 0-12hrs CONUS & AK every 5 minutes

Model Development and Enhancement

Ensemble-based 3-km HRRR forecasts initialized by all RRE members for probabilistic 3-km forecasts including reflectivity with NAM

Advance Weather Radar Technique

Use of Multi-Function Phased Array Radar Technology (MPAR) to achieve improved weather hazard detection and prediction

Goals for Final Operational Capability

Convection

Global summer & winter probabilistic forecasts out to 24-hours

Turbulence

Global Forecasts for all phenomena out to 36hrs & updated every 15 minutes except for the NA, NPAC & NLANT areas where forecasts out to 24hrs

In-Flight Icing

Global diagnosis probabilistic forecasts out to 12 hours

National Ceiling and Visibility

3D diagnosis & 4D probabilistic forecasts 0-12hrs, selected OCONUS areas every 5 minutes.

Model Development and Enhancement

Predictive HRRR global micro-physic based probabilistic models

Advanced Weather Radar Techniques

Wind shear solutions for Terminal

FAA/NOAA Collaboration

- **MODELING**
  - NOAA ESRL
  - NOAA NCEP/EMC
- **TURBULENCE**
  - NOAA ESRL
- **RADAR TECHNIQUES**
  - NOAA NSSL
- **STORMS**
  - NOAA ESRL
- **QUALITY ASSESSMENT**
  - NOAA ESRL
- **DISSEMINATION (ADDS)**
  - NOAA NCEP/AWC

Outreach

Government
•FAA Aircraft Safety
•NASA, Glenn
•NASA, Langley
•NASA, Ames
•NWS
•NOAA
•NTSB

Professional Societies
•AIAA
•SAE
•AMS

International
•Transport Canada
•Meteo France
•German National Airspace Agency
•Eurocontrol
•Met Services Canada

Universities
- University of Oklahoma
- University of Washington
- CSU
- University of Illinois
- PSU
- University of Chicoutimi, Canada
- University of Wisconsin
- University of Alabama
- Arizona State University
- Georgia Tech Research Institute
- UCLA
- University of New Hampshire
- University of Melbourne (Austr)
- Yenisei University (S. Korea)
- Norwegian Institute of Air Research

Defense
- Air Force Weather Agency
- Naval Research Lab

Questions