



HEMS-related Aviation Weather R&D

Steve Abelman

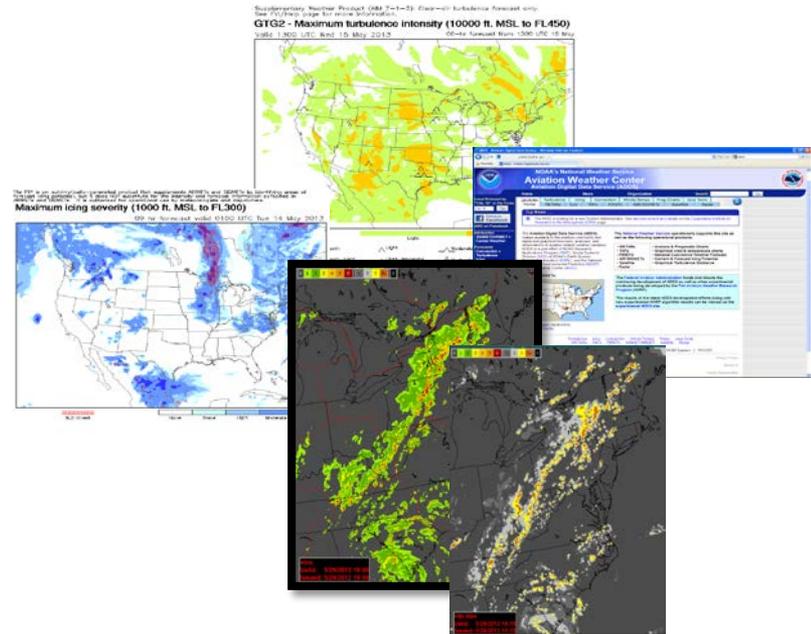
Dec 18, 2013



FAA

Aviation Weather Research Program

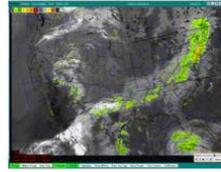
- Applied research to minimize NAS weather impacts by:
 - Meeting specific NextGen Operational Improvements
 - Mitigating weather-related safety and/or efficiency issues
 - Evolving weather information contained in today's legacy capabilities to meet emerging NextGen requirements, often in collaboration with the NWS



Aviation Weather Research Program

Wx Hazard

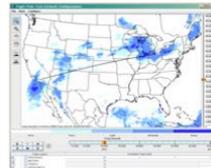
Wx Information



Conv.
Storms



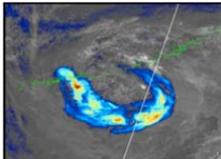
Turbulence



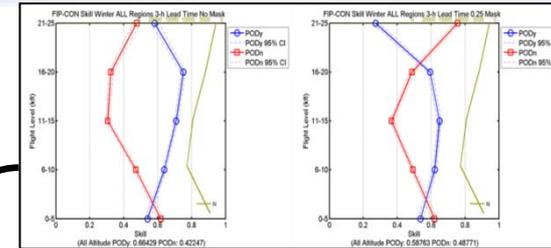
In-Flight
Icing



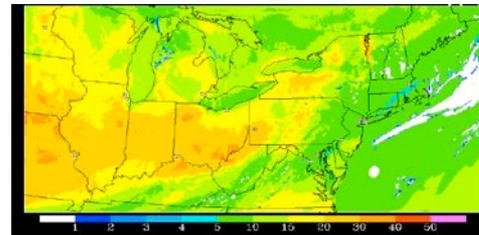
Ceiling &
Visibility



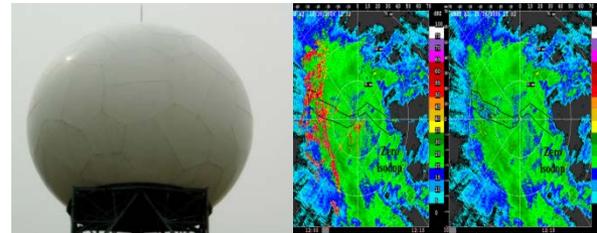
Volcanic
Ash



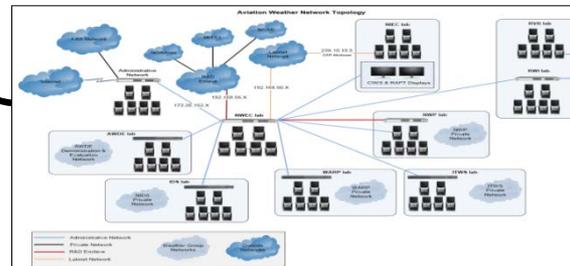
Quality
Assessment



Modeling



Radar
Techniques

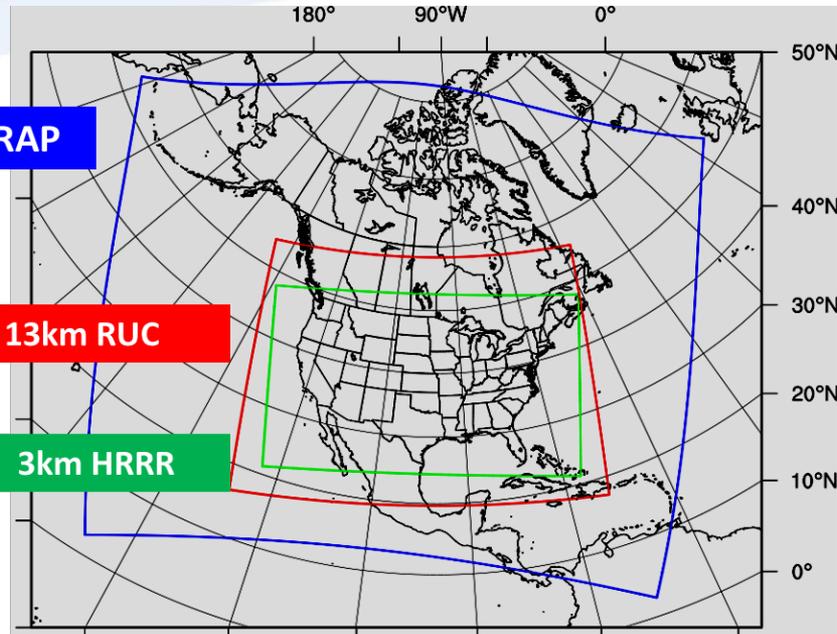


Evaluation

Numerical Modeling

Why?

Improve operationally available (at NWS) model resolution and refresh rates to enhance nowcasts and forecasts of aviation hazards including in-flight icing, turbulence, convective storms, and ceiling & visibility



What Has Been Accomplished?

- 3km, High Resolution Rapid Refresh (HRRR) model running at NOAA ESRL
- Implementation of WRF-RAP (13km hourly forecast including AK,) operational at the National Weather Service (NWS)

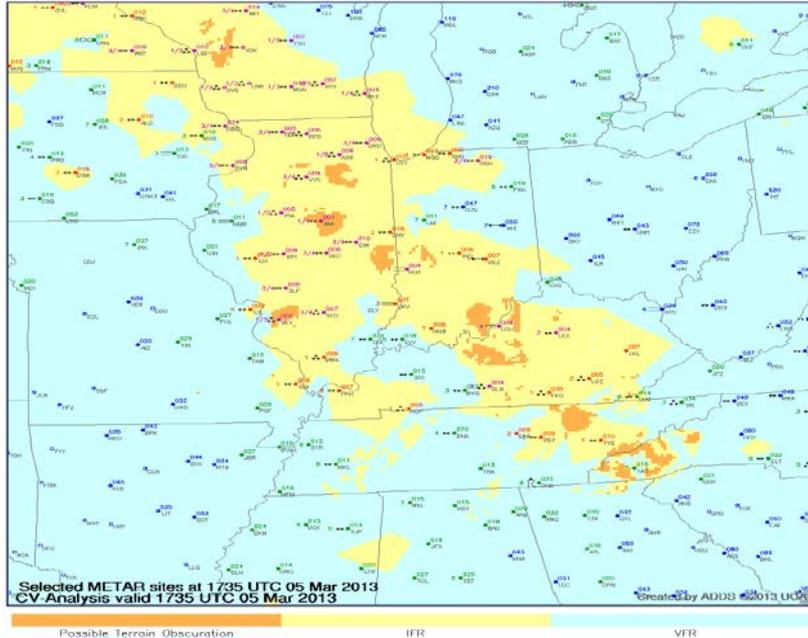
MD&E: What's Coming?

- Research targeting 0-24 hour high-resolution, rapid refresh ensembles to support probabilistic forecast products as well as a global model with 1-2km resolution and 5-10 minute refresh rate
- Improvements in model forecasts (resolution, accuracy, coverage, probabilistic) of aviation specific weather hazards

C&V

Flight category

Caution: This product is intended to aid flight planning and is best used along with other weather products such as METARs, AIRMETs, TAFs and Area Forecasts.



Why?

To produce advanced C&V detection and forecast algorithms that can mitigate the safety, capacity and efficiency impacts of low ceilings and visibility in the NAS

What Has Been Accomplished?

- Operational implementation of CVA on ADDS in 2012
- New focus on exploitation of “non-traditional” data sources to improve gridded C&V analyses over data sparse regions

C&V: What's Coming?

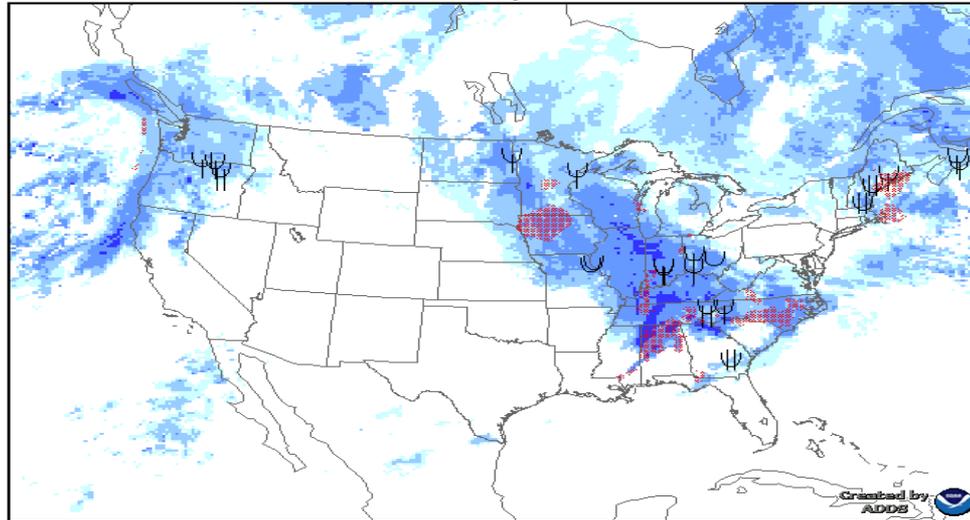
- AK-CVA Feasibility Assessment and Concept of Operations leading to an experimental prototype
- Display enhancements to the HEMS Tool
- HEMS Tool migration to operational ADDS

In-Flight Icing

By FAA policy CIP is a Supplementary Weather Product for enhanced situational awareness only and must be used with one or more primary products (safety decision) such as an AIRMET or SIGMET (see AIM 7-1-3).

Maximum icing severity (1000 ft. MSL to FL300)

Analysis valid 1900 UTC Tue 05 Mar 2013



SLD threat

None Trace Light Moderate Heavy

Icing PIREP Symbols

Trace

Trace-Light

Light-Moderate

Moderate-Severe

Light

Moderate

Severe

What Has Been Accomplished?

- Enhancement to operational CIP and FIP on ADDS to enable use of WRF-RAP delivered to AWC and implemented operationally
- CIP-FIP high-resolution algorithms to AWC for operational testing & validation
- Using Alaska HRRR model data and polar-orbiting satellite to enhance development of Icing Product Alaska

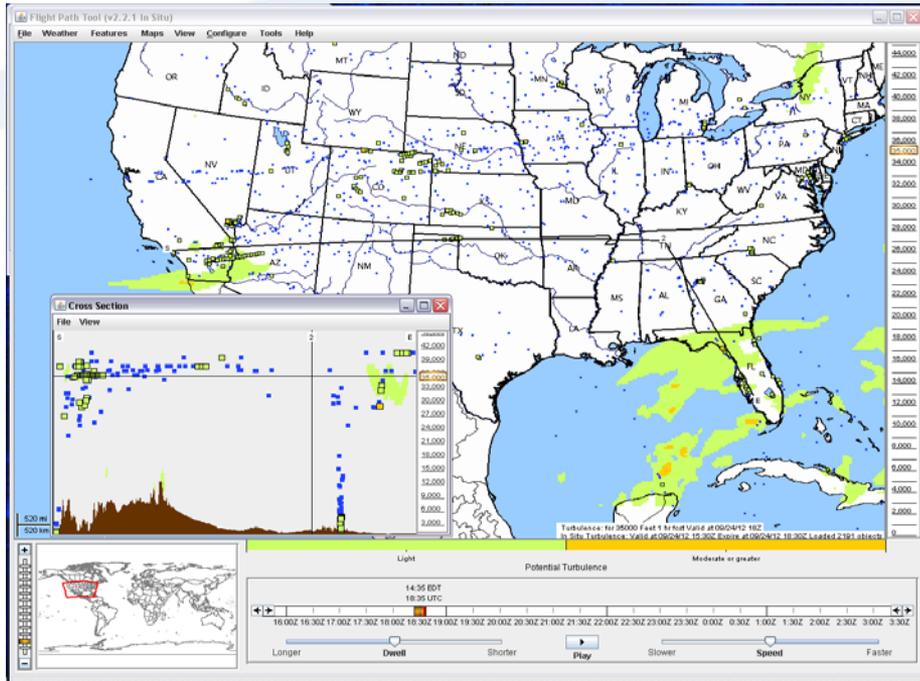
Why?

To produce advanced in-flight icing detection and forecast algorithms that can mitigate the safety, capacity and efficiency impact of aircraft icing on the NAS

In-Flight Icing: What's Coming?

- Aircraft-specific icing severity estimates (MICRO)
 - ✦ Hi-res, in-flight icing diagnosis and forecast that contains frequently-updated fields of liquid water content, drop size distribution, and temperature
- Icing Product Alaska (IPA); forecast and a diagnosis of icing over Alaska
- Bug fixes, upgrades, and minor logic fixes to CIP/FIP Hi-Res required after testing and validation by AWC
- Evaluation NEXRAD dual-polarization and assessment of the feasibility of its use for icing diagnoses and forecasts

Turbulence



Why?

To produce advanced turbulence detection and forecast algorithms that can mitigate the safety, capacity and efficiency impact of turbulence on the NAS

What Has Been Accomplished?

- Graphical Turbulence Guidance (GTG) in operational use on ADDS
- Deployment of in situ Eddy Dissipation Rate (EDR) turbulence detection algorithm
- In response to an NTSB recommendation, completed study simulating results of DIA wind gust event using higher resolution numerical weather prediction models

Turbulence: What's Coming?

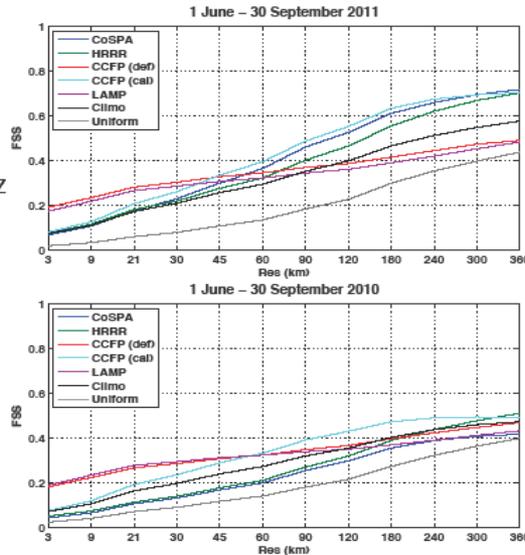
- Improved turbulence observation capabilities for strategic and tactical use
- Expanded GTG nowcast/forecast capabilities to include mountain wave and convectively induced turbulence for all flight levels surface to FL 450
- Development of an operational capability to remotely sense turbulence (i.e., with satellites and radar)

Quality Assessment (QA)

CoSPA VIP-level 3 FSS in (SE)

Why?

In 2011, the HRRR is no longer outperforming the blended CoSPA product valid at 19Z for a 6-h lead-time



- To provide an independent assessment of weather product quality in an operational context w/comparison to other forecasts and to provide verification and validation of transitioning AWRP products
- To conduct ongoing R&D on enhanced verification methodologies and tools

38 **FIQAS**

What Has Been Accomplished?

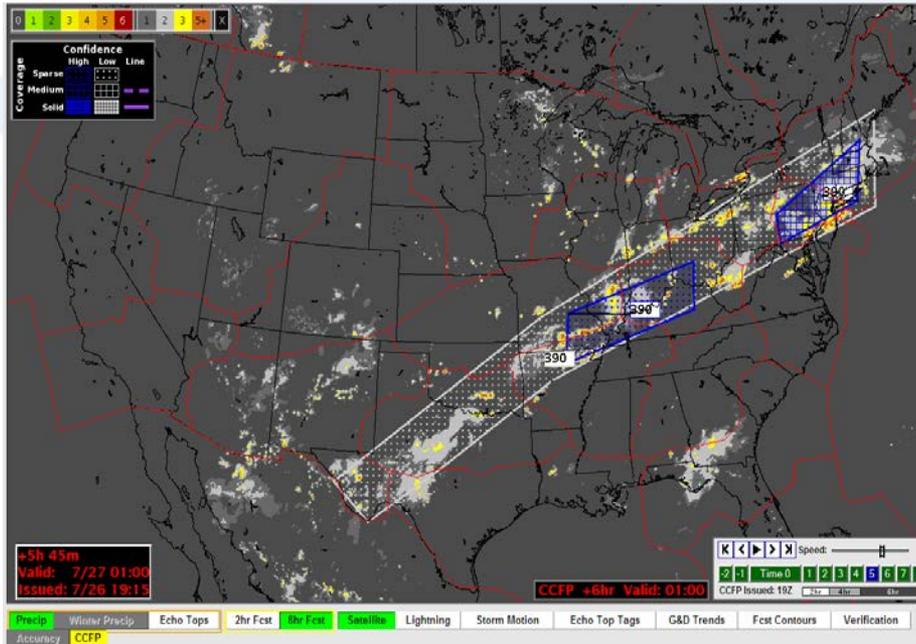
- CoSPA 2011 Evaluation
- Further VRMC development w/turbulence
- Study on alternate turbulence observation data sets for GTG3 evaluation
- Validated CALIPSO satellite data for CIP/FIP evaluations
- Completed FCI enhancements paper and further VRMC development w/turbulence
- Completed CIP/FIP Hi-Res Evaluation



QA: What's Coming?

- GTG3 Evaluation in progress
- CIP/FIP MICRO Evaluation – 02/2014
- CoSPA Uncertainty Measures Evaluation – 02/2014
- Alaska Icing Diagnosis Algorithm – 08/2014

Wx Uncertainty



Why?

- To determine NAS users' and operators' understanding of uncertainty inherent in all weather information and to understand how they apply that understanding to decision making

What Has Been Accomplished?

- MIT Lincoln Labs, NWS Aviation Services Branch and NASA Ames coordination to evaluate how they incorporate uncertainty into weather products
- Survey of TRACON, ARTCC, tower and ATCSCC personnel to understand their comprehension of weather uncertainty and current use of probabilities
- Completed FAA-funded research study on “Understanding Convective Weather Forecast Uncertainty Needs of ATM”

Wx Uncertainty: What's Coming?

- Baseline for future weather products that will create a common understanding of weather uncertainty and establish best practices for the application of uncertainty information to operational decisions and decision-making processes

In addition:

- AVS receives a portion of AWRP funding and prioritizes it's own activities (in collaboration with AWRP). Initiatives include:
 - ✦ High Ice Water Content
 - ✦ TAIWIS
- AWRP will continue to work collaboratively with NWS on ADDS enhancements and improvements
- The Research, Engineering, & Development Advisory Committee (REDAC) has tasked AWRP and WTIC to review accident and incident statistics to evaluate AWRP initiatives

Questions?



FAA

Next**GEN**