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# **NOAA Research and Development Supporting NextGen**

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# FAA/NOAA Coordination



- Developing an integrated science roadmap (NOAA, FAA, NASA, DOD)
  - Mapping current research to FOC requirements,
  - Identify redundancies
  - Identify gaps
  - Plan for RTO (Research To Operations)



# NOAA NextGen Research



- FY09/10
  - IOC driven
- FY11
  - HRRR transition
    - Risk with High Performance Computing bandwidth
- FY12 and beyond
  - Testbed
  - Applicable Research, development, RTO



# ESRL R&D FY09-10



- ESRL R&D Roles
  - Establish evaluation process to identify where forecasters add value
  - Determine Best Approach for WIDB Data Architecture
  - Evaluate Technologies, Web Services and standards
- ESRL R&D Activities
  - Baseline forecast technologies
  - Prototype WIDB and SAS
  - Research, Design and Develop Prototype Joint Meteorological and Oceanographic (METOC) Broker Language (JMBL) Server
  - Develop Net Enabled Verification Service

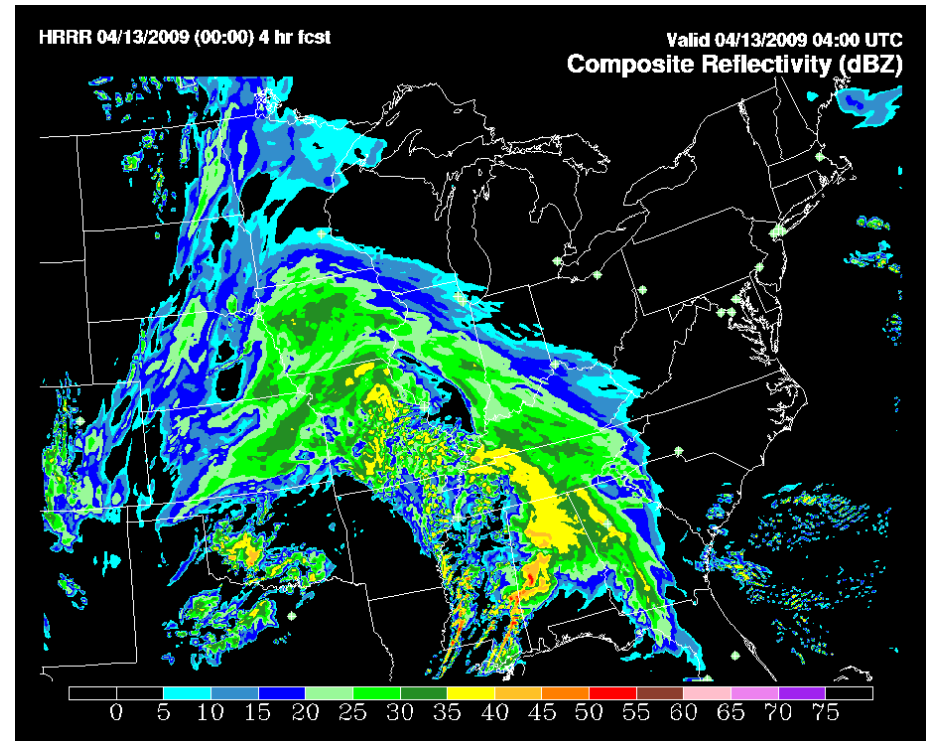


Figure: High Resolution Rapid Refresh Composite Reflectivity

# MDL R&D FY09-10

- MDL R&D Roles
  - Explore Extension of National Digital Forecast Database (NDFD) Server Architecture
  - Probabilistic Techniques
- MDL R&D Activities
  - Prototype new product generation capabilities on AWIPS
  - Prototype WIDB
  - Build Aviation Weather Center Test Bed
  - Develop tools for forecast consistency

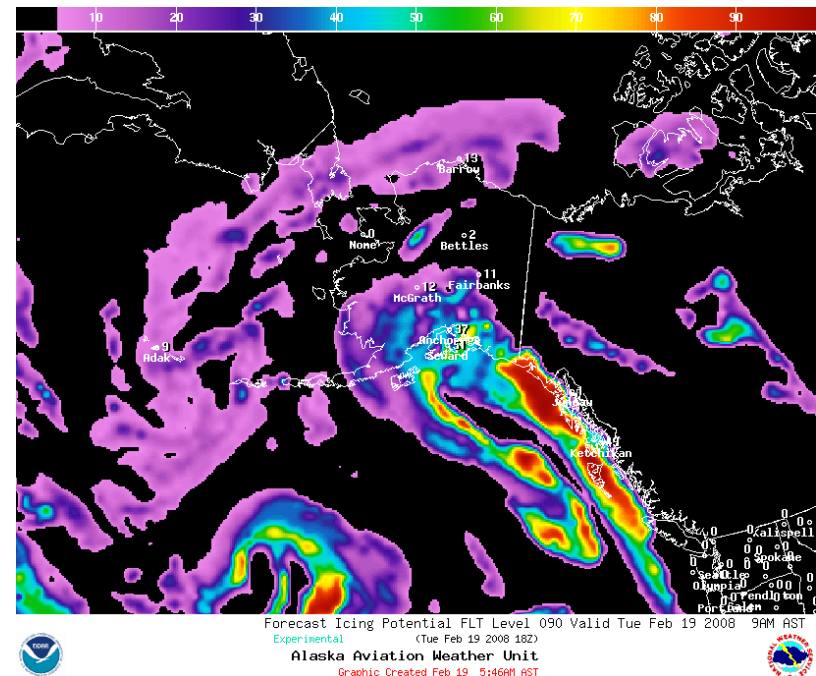


Figure: Interactive Collaboration in 4 Dimensions (IC4D) Forecast Icing



# NCEP R&D FY10



- NCEP Roles
  - Develop analyses to be used for verification of Aviation impact variables
- NCEP Activities
  - Improve spatial resolution and quality of Real-Time Mesoscale Analysis (RTMA)
  - Prototype Analysis of Record Phase II
    - Develop Delayed Mesoscale Analysis for archive quality verification

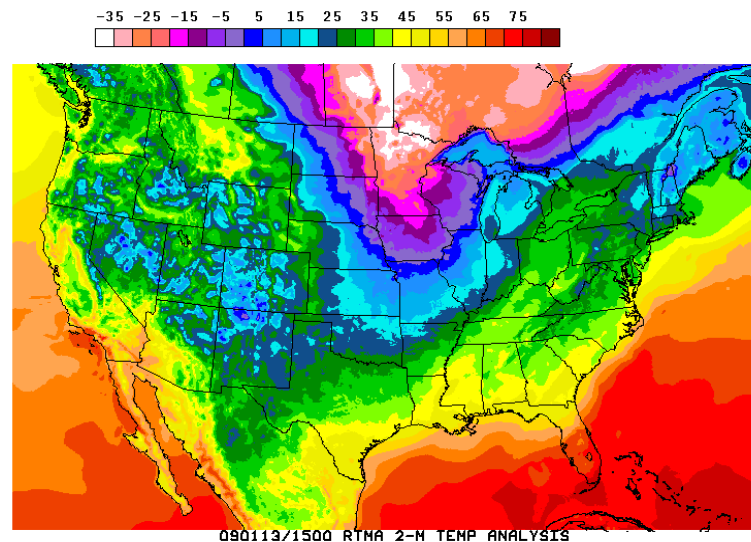


Figure: RTMA 2 meter Temperature Analysis

# NCAR R&D FY09-10

- RAL Roles
  - Transition Aviation impact variables Research to Operations
  - Model Microphysics
- RAL R&D Activities
  - Prototype AutoNowcaster
  - Evaluate Human-Over the Loop (HOTL) Decision Support Techniques
  - Evaluate Methodologies for probabilistic Aviation forecasts
  - Develop Capabilities for Hazard and Convective Product Generation

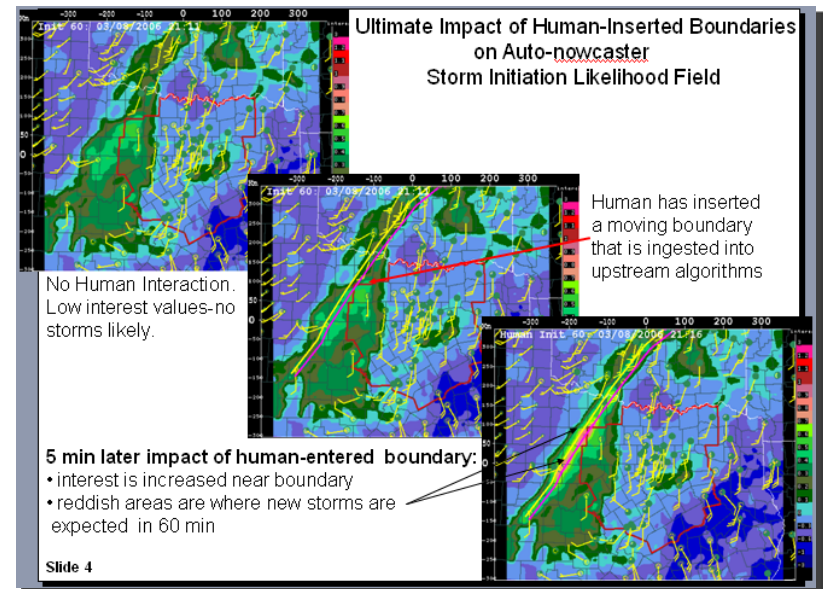


Figure: AutoNowcaster Storm Initiation Probability



# Leverage OAR Research: Observations and Forecasts



- **ARL**
  - Hysplit model for smoke, volcanic ash, and dust forecasts
  - CMAQ model for aerosols forecasts
- **ESRL**
  - LIDAR observations for wake vortex, water vapor
  - GMD monitoring of radiation, water vapor observations
  - HRRR forecast model, FIM, NIM, Chem-WRF, GPS-met, MADIS
  - Sodar, Profiler observations for terminal requirements
- **NSSL**
  - Warn-on-Forecast for short-range probabilistic convective weather forecasts
  - Quality-controlled 3-D Radar mosaic data
  - Weather hazard identifier from radar signatures
  - Dual-Pol research on echo classification, quality control, and automatic identification of high-impact rain, rain/snow and icing aloft
  - MPAR research
- **AOML**
  - Hurricane landfall, intensity changes observations and forecasts
- **GLERL**
  - Wave, swell height observations and forecasts



# Beyond IOC Observation R&D

- LIDAR demo CHK
- GRIDS icing detection
- SODAR
- GPSmet
- Dual Pol Radar
- MPAR
- GOES R/NPOESS

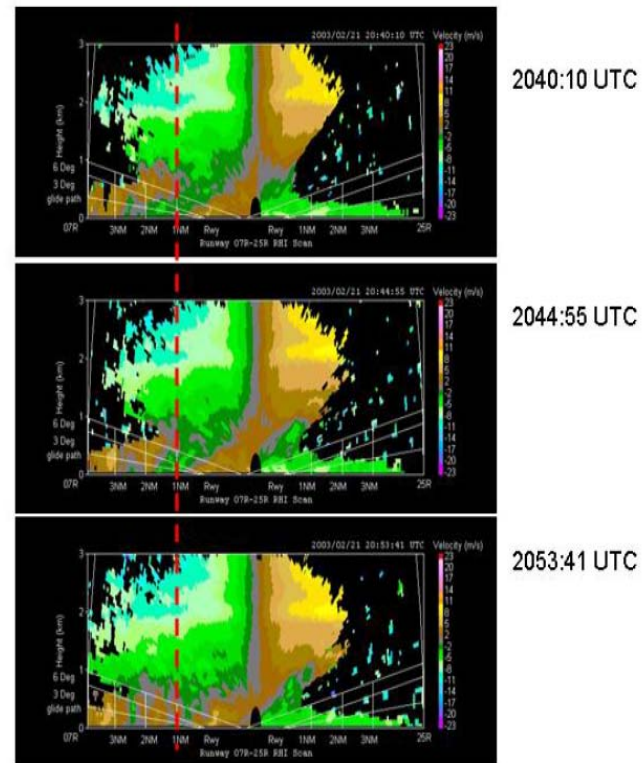


Figure 12. Sequence of west-east vertical slice scans as in Fig. 9, at 2040, 2044, and 2053 UTC, showing the transient and variable nature of the Sham Wat outflow, indicated by the vertical red dashed line.

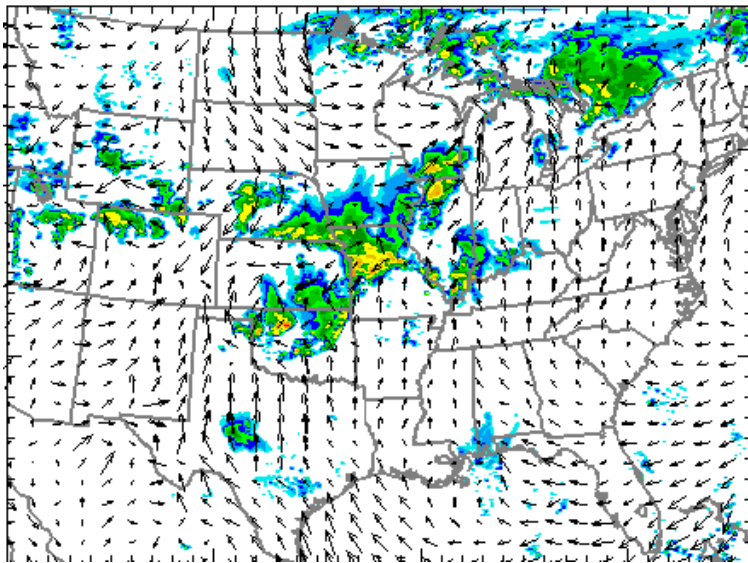


# Beyond IOC NWP

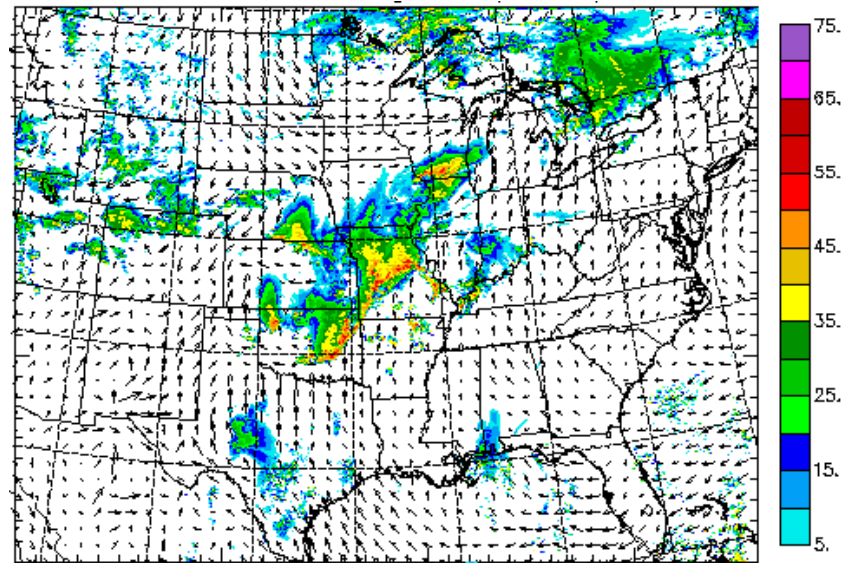


Hazardous Weather Testbed (CAPS OU)

Example: 9-h forecasts valid at 09 UTC, 5/26/2007



4 km fcst with radar



1 km fcst without radar

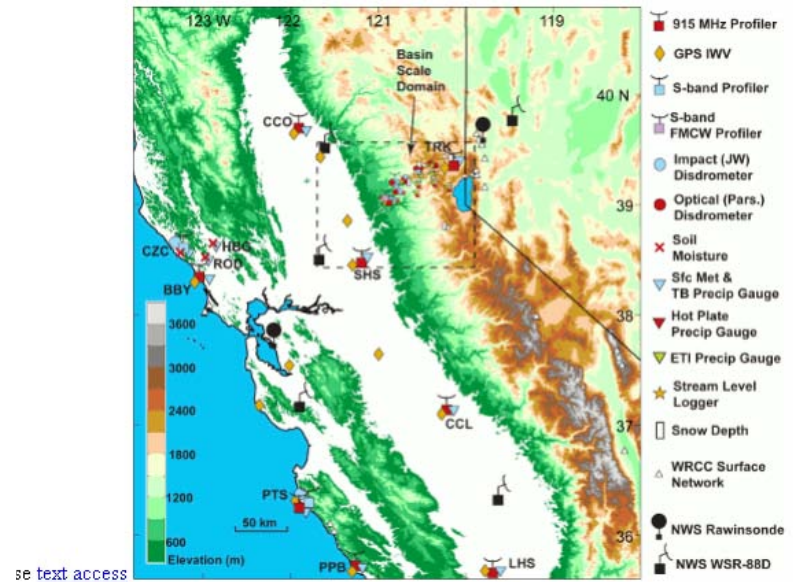


# Beyond IOC Testbeds and Proving Grounds



- HydroMeteorological
- Hazardous Weather
- Joint Hurricane
- JCSDA

HMT West 2009

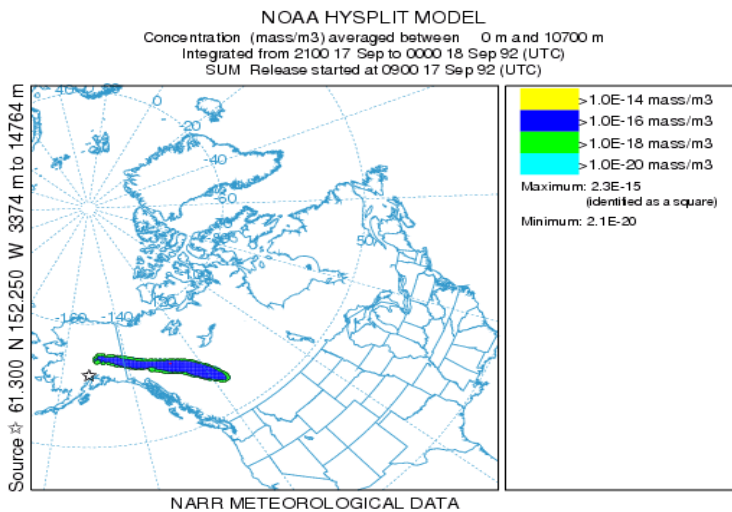




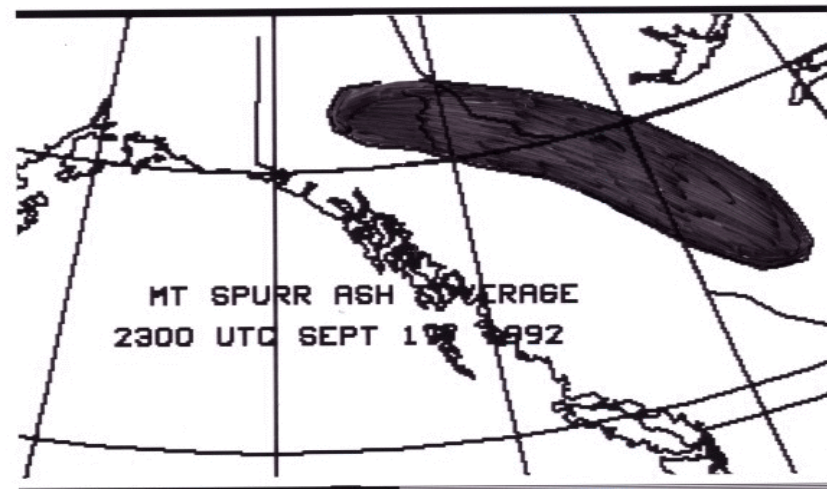
# Beyond IOC Air Quality and dispersion



- Airborne volcanic ash transport and dispersion research



Model-calculated concentration  
2100 Sep 17 to 0000 Sep 18



Satellite analysis – 2300 Sep 18  
(NOAA NESDIS)



# Science Challenges and Opportunities



- Downscaling for increased resolution of numerical models and analyses (spatial and temporal)
- Initiation and propagation of convection
- Boundary layer forecasts
- Solar radiation forecasts
- Integration of Space Weather data



# Next Steps for NextGen Science Plans



- Complete Integrated Science Roadmap
- Build Joint Science Plans on:
  - Initiation and propagation of convection
  - Downscale models to meet terminal scale requirements
  - Refine forecast process
- Conduct Convection Science Workshop
  - Develop NOAA research plan with community



# Background

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# Leverage OAR Research: Human Forecast Process



- ESRL
  - Network Enabled Verification System
  - Probabilistic visualization and editing tools for the forecaster
  - HydroMet Testbed forecast products
- NSSL
  - Social Science Woven Into Meteorology (SWIM)
  - Hazardous Weather Testbed forecast products
  - Weather hazards identification





# Summary



- NextGen transforms National Air Transportation System
  - Critical first step for NextGen is WIDB
  - Plan to accomplish IOC by 2013
- Many research challenges for NextGen weather plans
- Leverage AWRP activities and OAR research
- Establish key partnerships with NWS/OAR labs
- Benefits and results not unique to NOAA's Aviation Services



# FY09-10 R&D Activities



- NextGen R&D Coordinator
  - Darien Davis on 1 year detail supporting OAR/ESRL NextGen R&D Planning
  - Focal Point for building an interagency Roadmap
  
- FY09-10 Organizational Tasking
  - Product generation application
    - MDL, NCAR
  - Statistical applications
    - MDL
  - Probabilistic data
    - MDL, NCAR
  - Aviation weather hazards
    - NCAR
  - Data quality control and baseline assessments
    - ESRL
  - Verification
    - MDL, ESRL
  - Numerical Modeling and objective analysis
    - NCAR, EMC, ESRL



# NextGen R&D Benefits



- R&D Challenges are not unique to Aviation Services
- Strengthens Research Partnerships:
  - Within and External to NOAA
  - Inter-agency activities for AWRP
  - Invest, leverage and apply NOAA's research in operations
- Standards:
  - Institute NOAA wide standards for Environmental and Weather Data System Architecture
- Processes:
  - New Aviation Forecast Processes for Digital Data
- Technology:
  - NWS acquires technology required to improve spatial, temporal and inter-element consistency among gridded forecasts
  - Leverage R&D Projects for AWIPS, MADIS, and RTMA to support NextGen
- Services:
  - Solutions applicable to multiple services areas
  - Enhanced NWS Digital Services
  - Accelerate implementation of NWS gridded verification capabilities



# NextGen R&D FY09-10



- NOAA Laboratories and Centers
  - NWS Office of Science and Technology (OS&T)  
Meteorological Development Laboratory (MDL)
  - OAR Earth System Research Laboratory (ESRL) Global Systems Division (GSD) and Physical Sciences Division (PSD)
  - National Centers for Environmental Prediction (NCEP)  
Environmental Modeling Center (EMC)
- Non-profit Organizations
  - University Corporation for Atmospheric Research (UCAR)  
National Center for Atmospheric Research (NCAR)  
Research Applications Laboratory (RAL)