3.3 THE AVIATION WEATHER TESTBED: INFUSION OF NEW SCIENCE AND TECHNOLOGY FOR AVIATION OPERATIONS

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1. INTRODUCTION

The Aviation Weather Testbed (AWT) located at the Aviation Weather Center (AWC) in Kansas City, MO is designed to create an opportunistic environment for the transfer of new and innovative aviation weather forecast technology into real-time operations for safe and efficient flight, and to engage in the strategic implementation of the FAA's NextGen requirements for aviation weather. The primary objective of the AWT is to test, evaluate, and refine promising aviation weather research in partnership with the AWC's government, academic, and private sector stakeholders, with the eventual goal of implementing new ideas into a robust, secure, and real-time operational environment.

The 1100 square foot AWT facility was completed in the fall of 2009, and is a state-of-the-art room with several computer workstations that replicate the operational workstations used by AWC meteorologists, as well as video teleconferencing technology and an advanced video matrix switch that allows for broadcasting output from one workstation to one of several, large, overhead flat-panel monitors. This room was designed to foster maximum interaction between teams located at different areas, so that, for example, the teams could focus on collaboration during periods of evaluating experimental data or a new forecast process (Kain 2008). This paradigm will be used frequently in the AWT, and is the model for interaction between operational forecast staff and external research partners while in the testbed facility.

Many new concepts for the future forecast process and support of NextGen weather concepts exist. The AWT will be an important resource in helping to decide which ideas have meaningful and demonstrated benefits, are efficient and reliable to implement, have long-term sustainability, and are compatible with reasonable information technology infrastructures.

2. CURRENT AND FUTURE AWT PROJECTS

The AWT is currently supporting several projects that are designed to accelerate science and technology infusion into the AWC, and enhance forecasts and warnings through increasing the value of numerical model guidance, observational analysis, theoretical research, and human-in-the-loop interaction with data. Some of the major AWT projects are detailed here.

During the next decade, new observational data sets will help provide forecasters and computational algorithms with improved data quality and frequency, and the AWT will need to evaluate these data sets for operational use. To that end, the AWT is participating in testing data from experimental GOES-R (Schmit 2008) algorithms, and is partnering with the GOES-R Proving Ground in creating graphical displays of new data sets for use by operational forecasters. The GOES-R Proving ground data will be evaluated by AWC meteorologists and includes output from algorithms that detect volcanic ash, convection, lightning, rapid changes in clouds and visibility, and aircraft icing. The convection algorithms include a new "nearcast" convection product (Peterson 2008), and a convective initiation product, which are produced in real-time and are important for improving forecasts of the initiation, timing, and morphology of convection and translating that forecast into air traffic impact.

As more observational and numerical weather model data become available, the interactions between forecasters and that data through display software will need to be explored, especially for the next generation of forecasts for decision support of very high impact weather events. The AWT is evaluating the IC4D – Interactive Calibration of Four Dimensions - (Petrescu, 2009) software for use in interacting with gridded data sets. This software is developed by the National Weather Service and is an extension to the Graphical Forecast Editor (GFE). It allows a forecaster to manipulate gridded forecast fields in a meteorologically consistent manner, with built-in algorithms that produce derived products for aviation impact variables. The software can display data in four dimensions (three space plus time) and allows for editing grids within that framework, plus it contains algorithms that will adjust grids based on consistent model error. The evaluation is a component of AWT research towards examining "human-in-the-loop" processes for editing gridded model data to produce forecasts, and to support next generation decision making.

In the spring of 2010, the AWT helped support the 2010 Hazardous Weather Testbed Spring Experiment, held at the National Weather Center in Norman, OK. The experiment brought forecasters from three operational centers together (Aviation Weather Center, Storm Prediction Center, Hydrometeorological Prediction Center) and numerous researchers from academia and the private sector, to evaluate high resolution deterministic and ensemble numerical weather prediction model data for use with a suite of experimental forecast products. The aviation weather component of the experiment focused on producing detailed forecasts of Day 1 convection intensity and storm top height, issued once in the morning and then again in the afternoon with updated model information. Also, an experimental Day 2 forecast was issued as well. The results of the forecasts, as well as evaluations of numerical model performance, were also performed daily through web-based surveys. AWC provided

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technological and scientific support, and benefited greatly with the interactions between the severe weather component (hosted by the SPC) and the QPF component (hosted by the HPC) at the Weather Center. Results of the 2010 experiment will help in the design of the 2011 Thunderstorm Impacts Experiment, to be held during the summer of 2011 (June – August) at the AWT, which will examine a ten member high resolution ensemble (4km) created by the Department of Defense. In partnership with the Air Force Weather Agency (AFWA), the AWC will explore creating new tools for exploring the large data volumes produced by the ensemble, design new methods and techniques for display and analysis, and create experimental forecasts to support air traffic decision makers.

Finally, many new forecast models are in development and will be evaluated either during the summer 2011 experiment or in on a formal basis by the AWT. The High Resolution Rapid Refresh (HRRR), a 3km resolution deterministic model with advanced data assimilation (Benjamin 2009), will be tested for use with convection forecasts. The AWT also plans to refine its use of the NCEP Short-Range Ensemble Forecast (SREF) system and create new display for both operational forecasters and display via the AWC web site. Also, the AWT will continue to partner with MIT/Lincoln Labs in evaluating and improving various components of the Consolidated Storm Prediction for Aviation (CoSPA) system (Wolfson 2008), for enhancing the Collaborative Convective Forecast Product (CCFP) forecast products, and process, at the AWC.

3. RESEARCH-TO-OPERATIONS AND OPERATIONS-TO-RESEARCH (R2O AND O2R)

The process by which new knowledge from research or the development of new tools for operational forecasting becomes implemented, and supported, for real-time operations contains many facets and details. One of the primary functions of the AWT is to examine and refine this science infusion process, and to act as a two-way bridge between both the operational and research communities.

A major challenge of the research-to-operations process is integrating new software into an operational environment. The software could be a new algorithm that produces post-processed data from a model, for example, or a new graphical interface tool like IC4D. Ensuring that researchers and real-time operations personnel understand the various components of each other's information technology infrastructures, as well as long-term maintenance, training, risks, security, and further software upgrades, will be an important part of reducing costs and ensuring rapid implementation of new technology ("When Weather Matters", 2010). The AWT will help develop processes and procedures to ensure that all components of the R2O and O2R concepts are communicated and implemented effectively.

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