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FX-NET, INTEGRATING AIR CHEMISTRY AND WEATHER DATA FOR RESEARCH AND OPERATIONS

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1.0 INTRODUCTION

Transitioning research algorithms and systems to operations is a painstaking, incremental, process, at best, and at worst, a major operational disruption. As the amount of data and applications waiting to be delivered to the operational community continues to grow, the ability to test and evaluate new products and applications falls behind. In order to bridge this gap between R&D and operational systems, a test system that mirrors the operational database, adds the experimental data, and provides quasi-operational access to that data should be utilized. Having been used as an operational field system by NWS Incident Meteorologists (IMETS), Bureau of Land Management (BLM) fire weather meteorologists and state and local air quality forecasters, as well as by the air chemistry and university research community, the FX-Net system is a proven bridge.

FX-Net is a weather forecasting workstation that provides access to operational NOAAPort data using an Internet connection. NOAA's Forecast Systems Laboratory has been developing this system since 1997. Previous versions of the workstation (Madine, et al, 2002) have provided a solid, operational system that continues to expand with new tools and data sets. This most recent version of FX-Net leverages the latest AWIPS server developments to deliver a full suite of National Weather Service data. FX-Net file server and client software automatically updates client menus when specialized data sets are added to the data servers.

2.0 SYSTEM OVERVIEW

The FX-Net client displays NWS data with a Java-developed user interface that emulates the AWIPS D2D user interface and display capability. Products are requested using an http request over the Internet to the FX-Net servers. Improved data compression techniques, along with multithreaded client-side processing and communication are used to overcome limited communications bandwidth. The FX- Net client is easily installed on a desktop or laptop PC. The FX-Net server software is built based on modified AWIPS data and file servers. A single FX-Net server system can support 35 to 45 users simultaneously.

Since the FX-Net architecture allows for the relatively easy addition of spatially related data sets, it provides researchers with a real-time environment in which experimental observing systems and model output can be evaluated, verified and modified. An example of spatially related additions are the experimental air quality forecasts, EPA AIRNOW observational data, and university experimental air quality observations.

3.0 FX-NET BENEFITS TO OPERATIONAL USERS

As a real-time operations tool, FX-Net is used by air quality researchers and meteorological forecasters during field experiments and by operational fire weather forecasters as a tactical, all-hazards workstation.

State and local air quality forecasters in the eastern U.S. are evaluating the use of FX-Net to produce operational ozone and PM2.5 forecasts. Along with the NOAAPort data, forecasters now have EPA AIRNOW data, experimental model output (such as WRF/Chem), and experimental air quality observations. Prior to their use of FX-Net, forecasters accessed needed data from multiple web sites and online applications. Increased demands to produce timely air quality forecasts forced many forecasters to spend extra time searching web sites and developing their own analysis tools to keep up with current conditions and new data sets. The automated, spacially and time matched data sets provided to FX-Net users gave forecasters more data in less time

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with more analysis and display flexibility.

NWS IMETS deploy to wild land fires with a tactical all-hazards system which includes FX-Net. Communication with the FX-Net servers is accomplished via an Internet connection using a VSAT system. Data, from local models, regional mesonets, and mobile observing systems, specific to the IMETS region, are added to the FX-Net servers at NWS Regional offices. The AWIPS-like user interface and access to NOAA-Port data provides an easy transition from office to field for these users.

BLM fire weather meteorologists at the Geographical Area Coordination Centers use FX-Net as a short and long-range fire potential and fire weather forecasting system. These users also relied on web sites for forecast and analysis data. The ability to overlay and spatially match data sets added a great deal of time and inefficiency to their forecasting process. The speed with which they can now access data and create their forecast products has improved substantially.

During the Summer 2004 New England Air Quality Study- Intercontinental Transport and Chemical Transformation project, FX-Net was used by the NOAA researchers to forecast flight tracks, and by Plymouth State University to forecast weather conditions affecting chemical transport to provide guidance to researchers in other aircraft and aboard the NOAA ship, Ronald H. Brown.

4.0 FX-NET BENEFITS TO RESEARCH USERS

As a research tool, FX-Net is used by the University of New Hampshire (UNH) and Plymouth State University (PSU) as a part of the AIRMAP program. The system is the central teaching tool used by professors at PSU to teach air chemistry and meteorology courses. Data sets added to FX-Net to customize it specifically for air quality researchers include the UNH's experimental observations, the EPA's AIRNOW observations, the CAPS profilers and the experimental WRF/Chem forecast model.

Professors at the University of Northern Iowa use the system to provide instruction to science teachers in yearly seminars.

During the 2004-2005 DTC (Developmental Test Center) Winter Forecast Experiment (DWFE), researchers from FSL, NCAR, NCEP will evaluate three versions of the WRF model using the FX-Net system. All three models will be added to the FX-Net servers at FSL. FX-Net clients will also be installed at NWS WFO's in all four CONUS regions. Operational NWS forecasters will have access to all of the experimental models, as well as the current NOAAPort model and observational data. Forecasters will have the opportunity to subjectively evaluate all three versions of the WRF models and compare them to the current operational model. This capability would not be possible using standard data distribution systems as the volume of data would overwhelm the existing communication bandwidth. FX-Net's capability of distributing compressed graphical and raster images over the Internet allows users to view these experimental data as they would on the operational AWIPS system without impacting their already strained communications resources.

REFERENCES

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