P1.41 OPERATIONAL USES OF FX-COLLABORATE AT THE SOUTHEAST RIVER FORECAST CENTER

*Jack S. Bushong
NOAA/NWS/Southeast River Forecast Center, Peachtree City, Georgia

1. INTRODUCTION

The National Weather Service (NWS), Southeast River Forecast Center (SERFC), in Peachtree City, Georgia, is responsible for the production of river and flood forecasts for all rivers that drain into the Atlantic Ocean along the coasts of North Carolina, South Carolina, Georgia, and Florida, as well as the rivers that drain into the Gulf of Mexico from Mobile Bay to the southern most tip of Florida. In addition, the SERFC provides hydrologic support to thirteen basins throughout the island of Puerto Rico.

In January 2001, the SERFC was selected by the NWS Southern Region Headquarters to be a test site for a weather collaboration program called FX-Collaborate (FXC.) This software was developed by the Systems Development Division of the NOAA Forecast Systems Laboratory (FSL) located in Boulder, Colorado. FXC is an application that allows users at different locations to jointly view meteorological models, imagery, and other meteorological and/or hydrologic data. This Java-based program works on Windows and Linux PCs and communicates with a remote server that hosts Advanced Weather Information Processing System (AWIPS) data. The SERFC has been using FXC during flood events to communicate hydrometeorological information to a variety of SERFC partners.

This paper discusses the current operational use of FXC software at the SERFC and its future as an effective intercommunication tool.

2. FXC OVERVIEW

**Corresponding author address:* Jack S. Bushong, NOAA/NWS/Southeast River Forecast Center, 4 Falcon Drive, Peachtree City, GA 30269; email:jack.bushong@noaa.gov

FXC has the flexibility to be used for a variety of hydrometeorological applications. A suite of drawing tools can be used to help the meteorologist internally coordinate on a complex forecast problem with surrounding NWS offices. In addition, FXC can also be used in an external capacity as a powerful tool to communicate information to a diverse audience.

The FXC graphical user interface (Figure 1) is similar to the AWIPS Display 2-Dimension (D2D) program used by the NWS. FXC has the same workstation functions that allow users to zoom, animate, and overlay weather maps. However, FXC has functions that are not available with AWIPS, such as the ability to display and annotate images using line, shape, text, and meteorological symbol tools. FXC has the capability to display a variety of images, including *. png, *.gif, and *. jpeg files. Annotated images and weather maps can also be saved for future review or reference.

Another important feature of FXC is its ability to be remotely accessed, thereby providing the user access to the full suite of AWIPS products.

2.1 OPERATING MODES

The FXC system has the capability of being used under two operational modes: stand-alone and collaborative.

In the “stand-alone server mode,” the user connects to an FXC server, which stores the AWIPS data, and can work independently from other users connected to the same server. In this mode the user can download the full suite of AWIPS products, select Internet products, and has the ability to annotate the images received. These images can then be saved.

In the “collaborative server mode,” users also connect to an FXC server, but all users connected will share the same view. Each user in the collaborative session will have equal image,

display, and annotation abilities. All connected users can see the displayed image simultaneously. For example, a user at Site A can display a satellite image, which will become visible to the user at Site B. The user at Site B can then add his/her own drawing and/or text to the satellite image, which will become visible to the user at Site A.

2.2 FXC SOFTWARE AND COMMUNICATION LINKS

There are two types of FXC software, server and client. The server software loads onto a Linux PC that is capable of receiving AWIPS data and is the server that feeds data to the client PCs. The client FXC can operate on any Linux or Windows PC that has an Internet connection with static IP addresses. This software is used to communicate with other FXC users in collaborative mode via the FXC server. There are two-way Internet communications between each client PC and the FXC server. All communications go through the server before reaching the other clients.

Since FXC is based on two-way communication, user firewalls can create obstacles to full implementation by blocking return communications from the FXC server. Typically, each FXC user will have user-specific firewall issues to identify and resolve. The SERFC has worked both internally within the NWS and externally with its partners on potential strategies to resolve these issues. For partners that have to remain inside their own firewalls, an approach is to open a specific port to the FXC server's IFP address.

All SERFC critical operations are protected by a firewall maintained by the NWS Southern Regional Headquarters (SRH). To maintain operational security, while at the same time allowing FXC implementation, SRH installed a stand-alone DSL line at the SERFC, outside the NWS firewall.

In a demonstration of emerging wireless technology, the SERFC has successfully transmitted data from remote locations directly to the FXC server. FXC could also be used with a traditional land telephone line connection, but its usefulness would be severely limited due to a low transmission rate.

3. SERFC CRITICAL COMMUNICATION NEEDS

On the average, floods cause more deaths and property damage in the U.S than any other weather hazard. The mission of the National Weather Service is the protection of life and property through accurate warning of weather- and water-related hazards. An accurate river forecast is vital in warning communities of devastating floods. Equally critical are both effective and efficient communication of hydrometeorological information between the SERFC and its partners. Emergency managers need clear, concise information on the flood threat. This includes information on the areal extent of the flood, timing of flood inundation, and anticipated flood crest. In addition, when making decisions to evacuate people or spending millions of dollars in emergency flood preparation, decision makers need information directly from the SERFC, such as contingency (alternate scenario) information and the forecaster's degree of confidence.

The SERFC routinely coordinates closely in the communication of vital hydrometeorological information with nineteen NWS Weather Forecast Offices, U.S. Army Corps of Engineers (USACE), U.S. Geological Survey (USGS), State Emergency Management offices in seven states and Puerto Rico, and several regional power companies. Depending on the situation, the SERFC may also be asked to brief other decision-making groups, such as state Department of Natural Resources.

FXC has proved extremely successful in meeting the numerous and varied needs of SERFC partners during critical flood events.

3.1 SPECIFIC USES OF FXC AT THE SERFC

Information with FXC flows two ways. FXC allows the SERFC to provide heads-up or longer lead-time forecast information to decision makers (Figure 2). These partners can also provide detailed information to the SERFC that can lead towards more accurate forecasts. An example of such information might include information by the USACE on planned releases from Corps-operated reservoirs.

On September 13th, 2002, Tropical Storm Hanna was forecast to move inland over the Florida panhandle, spreading heavy rain and possibly resulting in flooding. Using FXC (Figures

3 and 4), the SERFC Hydrologist-in-Charge (HIC) was able to remotely brief a large group of emergency management personnel at the Florida Division of Emergency Management in Tallahassee, Florida. At the Florida EOC, the FXC briefing was displayed on large video projection screens.

Communication between the SERFC and water management agencies is crucial. The Army Corps of Engineers and other reservoir operators rely on SERFC river forecasts to make decisions regarding future water releases that can impact communities downstream.

An example of effective coordination with reservoir operations occurred during Tropical Storm Isidore on September 24, 2002. Isidore was forecast to make landfall along the gulf coast, with the SERFC forecasting four to six inches of basin average precipitation across southern Alabama, southern Mississippi, and the Florida Panhandle. SERFC hydrologists concentrated on anticipated releases of water downstream from reservoirs on the Tombigbee River possibly exacerbating flooding downstream. The SERFC used FXC to coordinate with USACE reservoir operators on anticipated inflows into their reservoirs. Due to this coordination, reservoir operators significantly reduced their anticipated releases, not only reducing the downstream flood threat, but also saving valuable water supply during a long-term drought.

4. SERFC FUTURE PLANS FOR FXC

FXC has already proved its usefulness during several critical flood events. Near-term plans call for FXC installation at SERFC FXC-serviced state divisions of emergency management. Other possibilities include SERFC "professional partners," such as the USACE, USGS, and other water management agencies.

Installing FXC software at other river forecast centers, the Tropical Prediction Center (TPC), and the Hydrometeorological Prediction Center (HPC) would allow its use as a coordination tool amongst meteorologists and hydrologists. In particular, FXC is ideally suited towards coordination of the Quantitative Precipitation Forecast (QPF), which is an essential component in the river forecasts.

FXC could also be used as a self-briefing tool for SERFC staff. The software can be used on personal computers, at home, and/or during travel. By incorporating the use of a wireless modem, products can be accessed from the field, at any location. The SERFC's Flood Fast Response and Survey Team (FFRST) tested this capability during Tropical Storm Hanna. The FFRST supports the SERFC by traveling to areas affected by major flooding and relaying real-time information back to the SERFC.

Finally, FXC has the potential to be utilized in scientific training between the SERFC and other partner agencies.

5. CONCLUSION

Over the last year, the SERFC has used the FXC software extensively to communicate with state management offices and FEMA during flooding events. The SERFC's partners believe FXC is a very useful tool during briefing situations, as well as for coordination during high-risk weather-related events.

In the future, FXC has the potential of being widely distributed amongst offices within the National Weather Service nationwide, as well as other government agencies that help support the NWS mission. Once this goal is reached, hydrometeorological briefings will help the NWS in the issuance of warnings and forecasts. In turn it will help other agencies to understand this information.

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7. REFERENCES

Grote, U.H., and C. Golden, 2003: Enhancements to FX-Collaborate to Support Operations at NWS, USAF, and NASA, 19th International Conference on the Interactive Information and Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology, Long Beach, CA, Amer. Meteor. Soc.

NOAA Forecast Systems Laboratory, 2001: FXC System Overview.

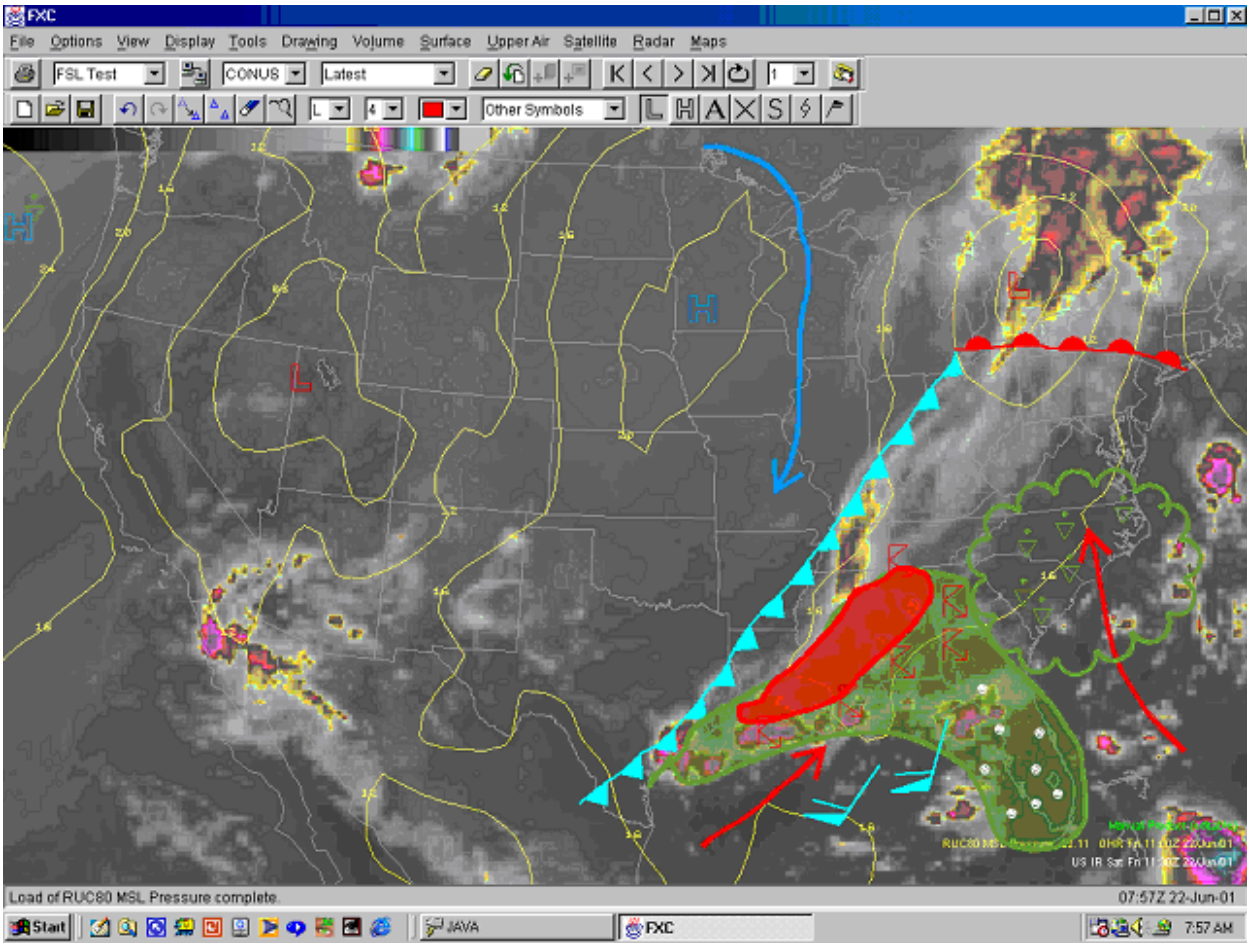

Figure 1. FXC Graphical User Interface, showing annotated infrared satellite image.

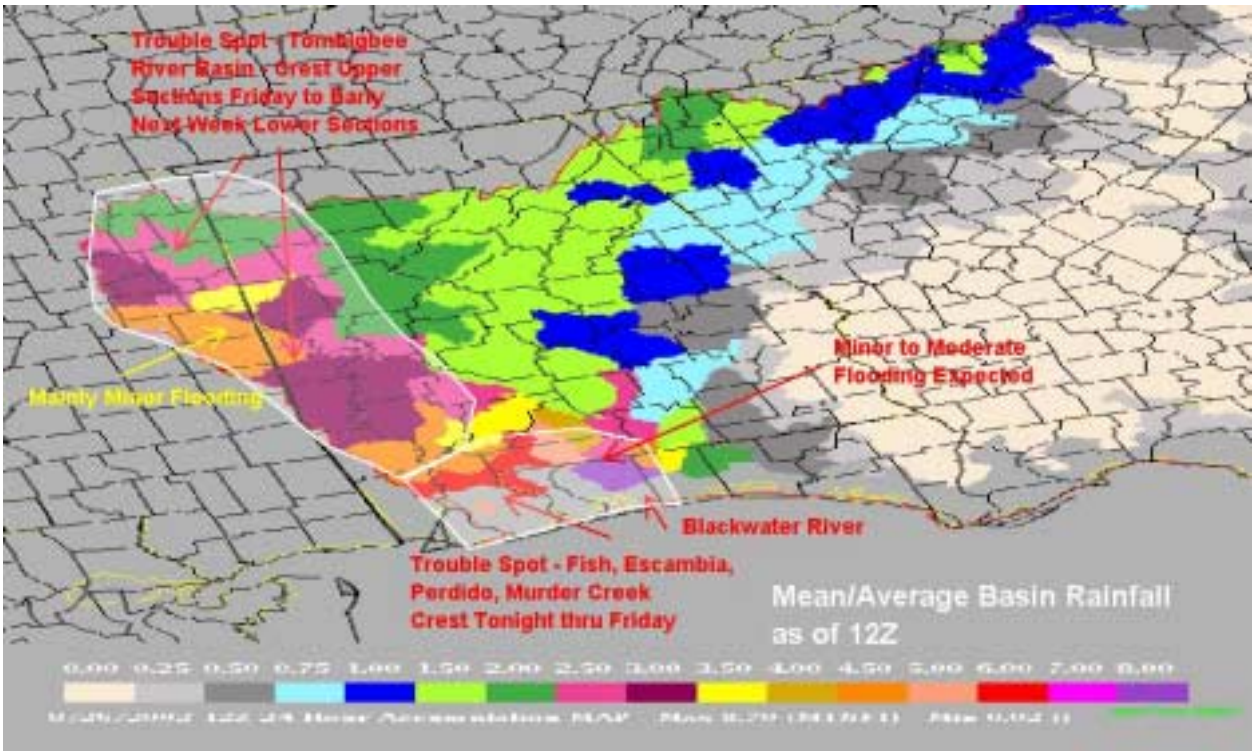

Figure 2. Example of hydrometeorological information being shared with FEMA IV via FXC as Tropical Storm Isidore causes flooding in Alabama and Mississippi.

Figure 3. John Feldt, HIC at the SERFC in Peachtree City, Georgia, giving a briefing on heavy rain amounts forecast due to Tropical Storm Hanna.

Figure 4. The SERFC's rain forecast is simultaneously being displayed on one of the large projection screens at the Florida Division of Emergency Management in Tallahassee, Florida.