FLOOD FORECAST OPERATIONS AT THE NATIONAL WEATHER SERVICE FORECAST OFFICE

James Noel [1/] and Jeffrey C. Dobur [2/]

AUTHORS: [1/]Service Hydrologist [2/]Hydrometeorologist. National Oceanic and Atmospheric Administration, National Weather Service Forecast Office. 4 Falcon Drive. Peachtree City, GA 30269
REFERENCE: Proceedings of the 2003 Georgia Water Resources Conference, held April 23-24, 2003, at the University of Georgia. Kathryn J. Hatcher, editor, Institute of Ecology, The University of Georgia, Athens, Georgia.

Abstract. The National Weather Service mission is to protect life and property and to enhance the economic well being of the United States through the issuance of weather and water forecasts and warnings. Greater technology has provided the growing capability to extract critical hydro-meteorological information and predict natural hazards related to weather, water, and climate with increasing confidence. National Weather Service Doppler Radar (WSR-88D), the Advanced Weather Interactive Processing System (AWIPS) and the Weather Forecast Office Hydrologic Forecast System (WHFS) highlight this high tech capacity. In addition, the design of interaction between the National Weather Service Forecast Offices (WFOs) and the River Forecast Centers (RFCs) afford a pathway for accurate and timely hydrological forecasts and warnings. These products are disseminated through a number of possible venues for public use whereby action can be taken to save lives and property during times of hazardous weather.

INTRODUCTION

The mission of the NWS Hydrologic Services Program is to provide river and flood forecasts and warnings for the protection of life and property and to provide basic hydrologic forecast information for the United States economic and environmental well being. Based on the United States Army Corp of Engineers (CORPS) Annual Flood Damage Report of 1998, flooding kills over 100 people and causes approximately $4.5 billion in damage annually. Based on NWS information, flooding remains the number one weather related killer in the United States. This has made the NWS focus on continued improvements in accessibility and availability of higher quality and detailed hydrologic information. Advances in technology during the NWS Modernization and Restructuring (MAR) of the 1990s increased the capacity to serve this mission. The WSR-88D stands as a cornerstone to the MAR era. In the hydrologic operations of the NWS, it has aided in the capability of increased detection of real-time precipitation while estimating precipitation amounts vital to hydrologic forecasting. Another upgrade in operations came with the addition of AWIPS. This system provided high tech scientific workstations to run various meteorological and hydrological support software. Noteworthy within the hydrologic support software is WHFS. WHFS allows for detailed analysis of hydrologic data while providing the capability to create hydrologic forecasts.

The tools discussed above along with others assist a process of hydrological data collection and analysis used in making reliable and timely meteorological and hydrological forecasts. This data collection and hydrological forecast operation process is supported by the WFO and RFC through a unique relationship. Hydrologic prediction consists of site-specific information in addition to area-wide hydrologic products that are disseminated through a number of venues for public use.

FORECAST PROCESS

Vast amounts of meteorological and hydrological data flow between the RFC and WFO on a continuous basis. WFOs provide hourly WSR-88D precipitation estimates, cooperative gage and precipitation data, and various other data from many sources including NWS Automated Surface Observing Systems (ASOS). In addition, a vast amount of hydrologic data is received from other sources, i.e., CORPS and United States Geologic Survey (USGS). RFCs assimilate this gage and precipitation data into their hydrologic models. Furthermore, quantitative precipitation forecasts (QPFs) are ingested into the hydrologic models to represent the best available meteorological assessment of future precipitation aiding in increased lead-time and accuracy of forecasts. After executing the models and

interactive analysis of output by RFC hydrologic forecasters is complete, hydrologic forecasts are distributed to the WFOs. The WFO reviews the current data with the forecast before disseminating a public forecast.

Hydrologic forecasts from the WFOs consist of both site-specific products and area-wide products. Site-specific products include stage or flow forecasts for a particular location on a river segment at a particular time. In addition, other site-specific products include river flood warnings and statements for specific points along larger river segments. These forecasts and warnings are issued at least once daily, but are updated when forecasts and observed readings diverge. Site-specific hydrologic forecasts and warnings are made through the cooperative operation of both the RFC and the WFO.

Area-wide hydrologic products include Hydrologic Outlooks, Flash Flood and Flood Watches, Flash Flood Warnings and Urban and Small Stream Flood Advisories. The responsibility of these products falls to the WFO. RFCs support this function by providing flash flood guidance products to the WFOs on a routine basis. The flash flood guidance are numerical estimates of the average amount of liquid precipitation needed over an area in a specified time to initiate flooding on small creeks or streams in a predefined area (i.e. county area). When a QPF is expected to exceed the flash flood guidance over a defined time period, the WFO forecaster may be inclined to issue a hydrologic outlook (1-3 days in advance) or a flash flood or flood watch (Rainfall duration less than/greater than 6 hours). Warnings are issued when flash flooding is being observed or when rainfall estimates from the WSR-88D and/or precipitation gages are showing amounts exceeding guidance within a specified time period over a particular area. Flash flooding has been handled using countywide warnings through 2002. This is because of the vast numbers of small creeks and streams within the WFO area of responsibility, the lack of a Geographic Information System (GIS), the lack of Remote Sensing data, and the inability to account for flash flooding on a wide extent through a dense gage network.

NEW FORECAST TOOLS

However, new technology has recently been deployed to WFOs as part of WHFS. This technology is becoming a part of WFO operations in 2003. This advanced technology will allow the NWS WFOs to issue more site-specific information in a more timely fashion to customers. These tools include the Multi-sensor Precipitation Estimator (MPE), the Site Specific Model, and the Flash Flood Monitoring Program (FFMP). MPE is used in conjunction with the WSR-88D and rainfall gages. MPE is used to correct rainfall estimates from the WSR-88D by adjusting the rainfall estimates based on the bias of the radar versus rainfall gages. MPE is used as input into the Site Specific Model. The Site Specific Model allows WFOs to issue flash flood warnings for specific points rather than just for large generic county areas. Currently, it uses the Antecedent Precipitation Index (API) Model along with higher resolution RFC gridded flash flood guidance, and 1-hr unit hydrographs to generate its forecast. In Georgia, the Site Specific model is being put into use along Peachtree Creek and Sope Creek in the Atlanta Metro area this winter and spring. Operating plans call for the expansion of the site-specific model later this year. Finally, FFMP is being implemented to assist forecasters in recognizing the threat for flash flooding prior to its onset. FFMP uses a high resolution GIS databases of basins, gridded flash flood guidance from the RFC, and WSR-88D rainfall estimates. FFMP ranks the probability of flash flooding for specific basins with a county to allow for specific streams and creeks to be included in flash flood warnings. Critical to the expansion of site specific warnings is the higher resolution of real-time data via the USGS and its cooperators.

Future technology that will significantly improve hydrologic forecasts is called the Advanced Hydrologic Prediction System (AHPS). This system will allow probabilistic forecasts and graphics to be issued by the RFCs and WFOs to give customers more power to make decisions for themselves based on their needs. This system is being implemented across the United States currently and should arrive in Georgia in the next few years.

A push toward more site-specific information in the next few years along with the implementation of more detailed forecasts can be expected. This information will become available through multiple sources including the media, internet, and NOAA Weather Radio for use by emergency management and other customers.

SELECTED REFERENCES

National Weather Service Hydrologic Services Correspondence Program Manual. March 1997. U.S. Department of Commerce, National Oceanic and

Atmospheric Administration, National Weather Service Office of Hydrology.
United States Army Corp of Engineers Annual Flood Report of 1998. United States Army Corp of Engineers. 1998.