HYDROMETEOROLOGICAL ANALYSIS AND SUPPORT FUNCTION AT THE SOUTHEAST RIVER FORECAST CENTER

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Abstract. In the late 1980s, the National Weather Service (NWS) launched its ten year, 4.5 billion dollar Modernization and Restructuring (MAR) program to take advantage of rapidly advancing scientific and computer technologies. The implementation of MAR is complete and has succeeded in modernizing the hydrometeorological operations of the NWS. As a result of MAR, all 13 River Forecast Centers (RFC) across the U.S. restructured their operations and upgraded computer technology. The RFCs have extended their hours into the evening and nearly doubled their staffs, which included the hiring of three meteorologists at each RFC. These meteorologists have become part of a new function at RFCs, known as the Hydrometeorological Analysis and Support (HAS) function, to manage the greatly increased flow of hydrometeorological data for input into the hydrologic models. The HAS forecaster is primarily responsible for the production of the Quantitative Precipitation Forecast (QPF), the verification activities associated with the QPF, the comparison and quality control of radar and rain gage data, and the production of hydrometeorological discussions.

INTRODUCTION

The Southeast River Forecast Center (SERFC), with a responsibility for river and flood forecasting for the Southeastern United States and Puerto Rico, has been incorporating 24-hour Quantitative Precipitation Forecast (QPF) for the Carolinas and Virginia since the late 1980s, and for the rest of the Southeast U.S. since 1995. Presently, Hydrometeorological Analysis and Support (HAS) forecasters receive QPF guidance from the NWS' Hydrometeorological Prediction Center (HPC), located in Washington, D.C. The HAS forecaster makes modifications to this QPF guidance, if needed, and prepares it for use in the hydrologic model.

The HAS forecaster uses several tools to quality control rain gage data that is used as input in the hydrologic model. In the near future, the hydrologic forecasters will have the choice of using either rain gage-adjusted radar data or strictly rain gage data in the hydrologic model. This radar data is analyzed and quality-controlled by the HAS forecaster and is available on the Internet.

In addition, the HAS forecaster assimilates information describing the current and future hydrometeorological situations and issues a daily hydrometeorological discussion in text and graphical formats.

This paper will describe the most important duties of the HAS forecaster and discuss the tools he or she uses to analyze hydrometeorological data that supports the SERFC mission. An Internet link will be supplied for each product discussed.

ADVANCED WEATHER INTERACTIVE PROCESSING SYSTEM

The Advanced Weather Interactive Processing System (AWIPS) is the final piece to the modernized National Weather Service office and became operational in the late 1990s. Prior to AWIPS, forecasters had to use different computers to view all the weather products available. AWIPS now brings all weather products to one workstation and can also overlay different products on the same map. For instance, a forecaster can view a satellite picture overlaid with meteorological model data.

The SERFC has seven Unix-based AWIPS workstations, each of which includes two graphical interactive displays and one text display. Most of the software used by the SERFC is run on the two graphical interactive displays. Text messages such as forecasts, statements, and warnings are viewed or edited on the text display.

The software run on AWIPS includes the Stage3 application, an interactive radar display program, the

Interactive Forecast Program (IFP), which is the interactive river forecast model application, and the D2D (Display 2-Dimensional), which is a viewer of satellite, radar, and meteorological model data.

STAGE 3/RFC-WIDE

The SERFC is normally opened daily from 6 a.m. to 11 p.m. local time. If flooding is imminent or occurring, the office hours are extended to cover 24-hour operations. The HAS forecaster is typically the first person to report for duty each morning.

The first duty of the HAS forecaster is to run Stage 3 application. Stage 3 is a one-hour precipitation estimate based on a mosaic of the 28 WSR-88D radars. The precipitation is adjusted using ground-based rain gages (Figure 1). Stage 3 is so named because of the three steps, or stages, to get the final product. The first stage is a one-hour precipitation estimate based on the reflectivity of each individual radar. The second stage is the adjustment of the one-hour precipitation with ground-based rain gages. Finally, the third stage is the quality control of the radar mosaic by the HAS forecaster. In Stage 3, hourly estimates are mosaicked onto a 4 KM grid. Quality control steps may include the elimination of radar returns due to ground clutter, anomalous propagation, or faulty rain gages.

The products from Stage 3 are available on the Internet at:
http://www.srh.noaa.gov/atr/qpfvsmap.htm

The RFC-wide application will replace the Stage 3 application in the summer of 2001. RFC-wide will provide several improvements over the Stage3 program, the most important being the use of radar climatology to determine areas of reduced accuracy due to beam blockage of each radar (Breidenbach et al., 2000).

Mean areal precipitation derived from Stage3/RFC-wide output (MAPX) may be used as input in the hydrologic model. It is expected that the higher the temporal and spatial resolution in the rainfall input, the more accurate the river forecast (Stellman, Fuelberg and Garza et al., 1998).

Currently, mean areal precipitation derived from gage data (MAP) (Figure 2) is the primary rainfall input in the hydrologic model. MAP products are available on the Internet at:
http://www.srh.noaa.gov/atr/qpfvsmap.htm.

QUANTITATIVE PRECIPITATION FORECASTING

In 2000, the SERFC assumed the primary responsibility of Quantitative Precipitation Forecasting (QPF) from the local NWS Weather Forecast Offices (WFOs).

The HAS forecaster uses several tools and procedures in determining QPF. Traditional meteorological models are viewed on D2D, and experimental models are available to the forecaster on the Internet. Once the HAS forecaster has reviewed all the products related to the QPF generation, he or she may coordinate the QPF forecast with the local WFOs, HPC, and adjacent River Forecast Centers.

Using the AWIPS software called NMAP (National Centers for Environmental Prediction-AWIPS Map), SERFC HAS forecasters are able to view the national QPF forecasts prepared by HPC (Figure 3). These precipitation forecasts are used as guidance and can be edited by the HAS forecaster. Once the editing is complete, NMAP outputs the QPF for a 24-hour period in 6-hour intervals in both text and graphical form. The QPF is routinely prepared twice a day and is available on the Internet at:
http://www.srh.noaa.gov/atr/qpfpage.html

Updated QPF products are normally available by 9 a.m. and 9 p.m. daily.

QPF VERIFICATION METHODS

Locally-produced software is used to verify the SERFC QPF forecasts. Many statistics are computed. However, the one used most often is the Mean Absolute Error (MAE). In this case, MAE is defined as:

$$\mathrm{MAE} = \frac{1}{N}\sum_{n=1}^{N} |QPF - MAP|$$

where,
QFP = Quantitative Precipitation Forecast for a particular basin
MAP= Mean Areal Precipitation for a particular basin
N = Number of basins

HPC also runs a QPF verification program for each RFC which compares the Mean Absolute Error of the RFC and HPC QPF with the QPF computed by several meteorological models (Figure 4).

A link to the HPC Verification Unit and QPF versus

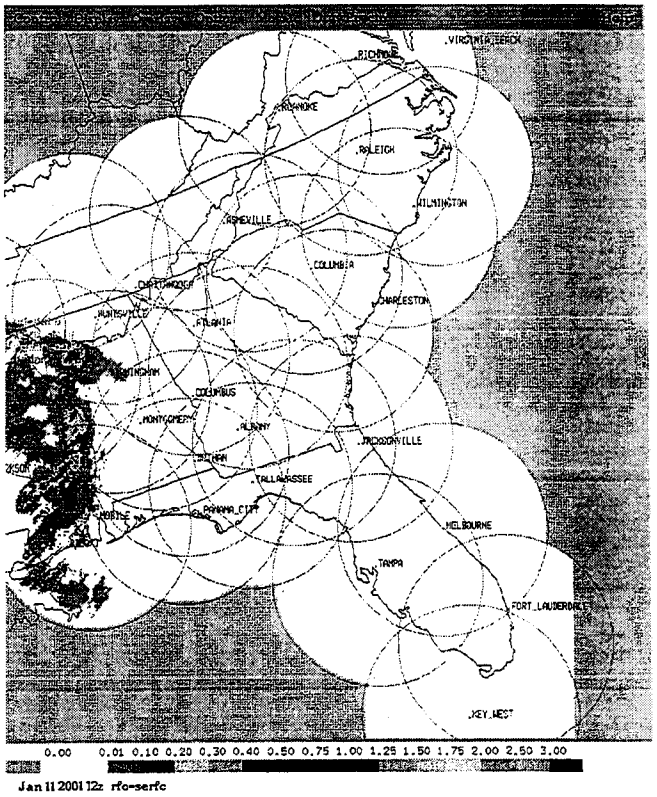

Figure 1. Stage 3

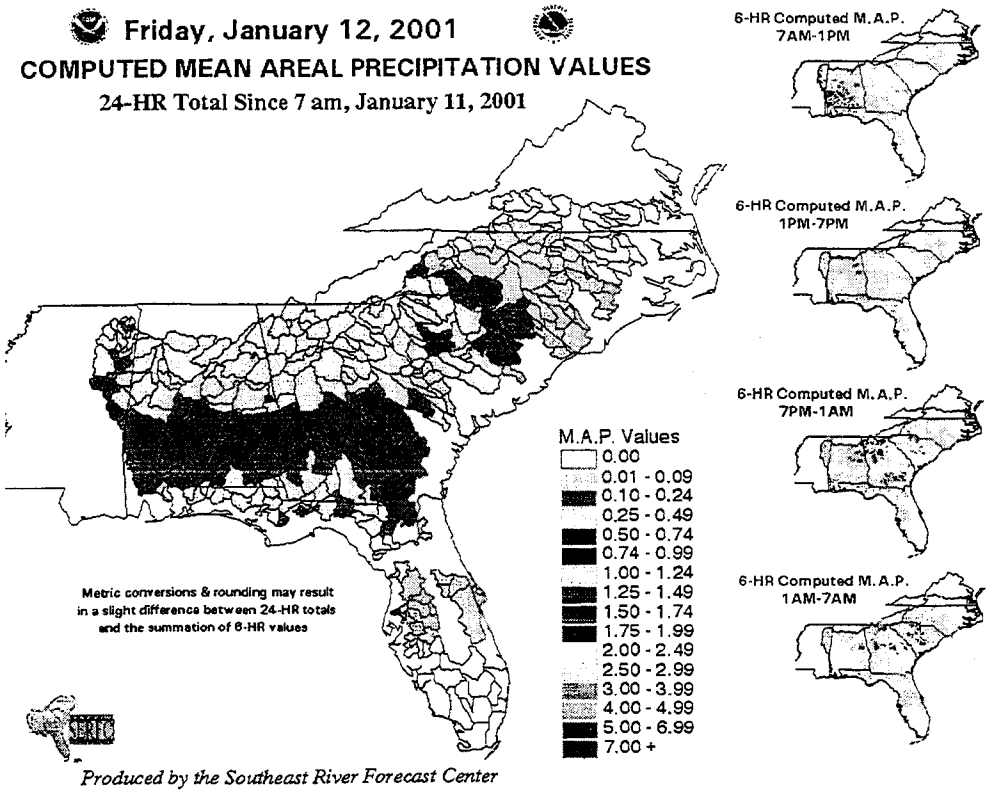

Figure 2. Mean Areal Precipitation

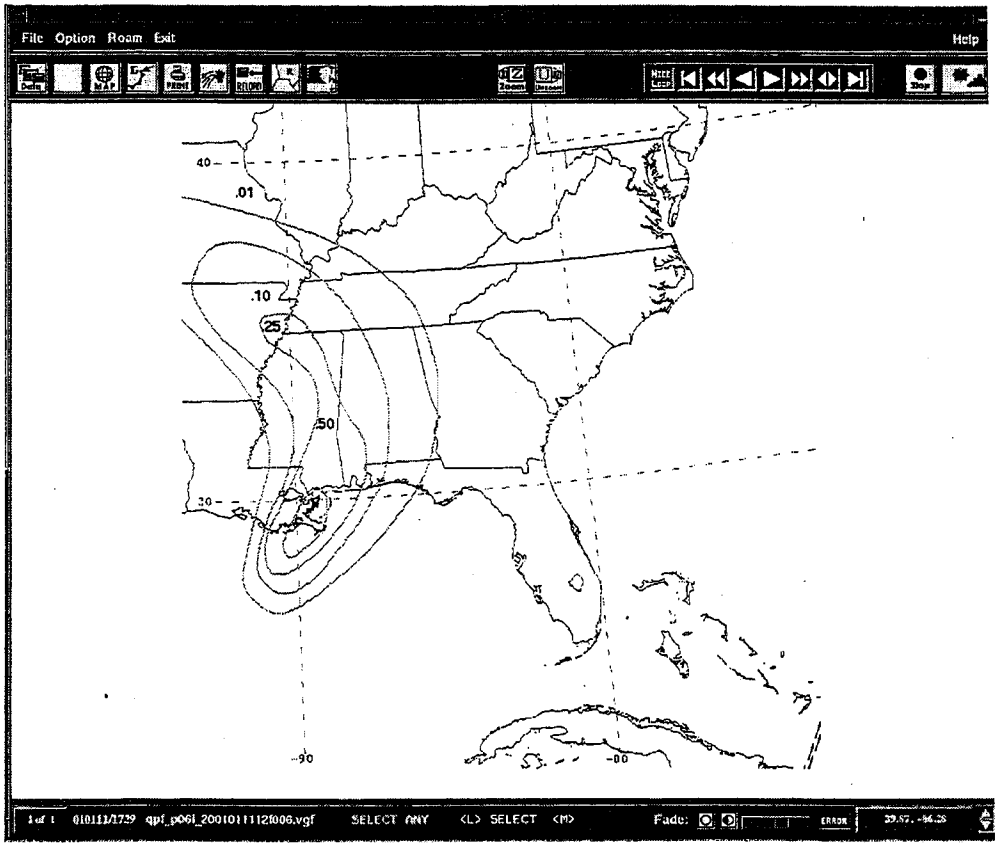

Figure 3. NMAP

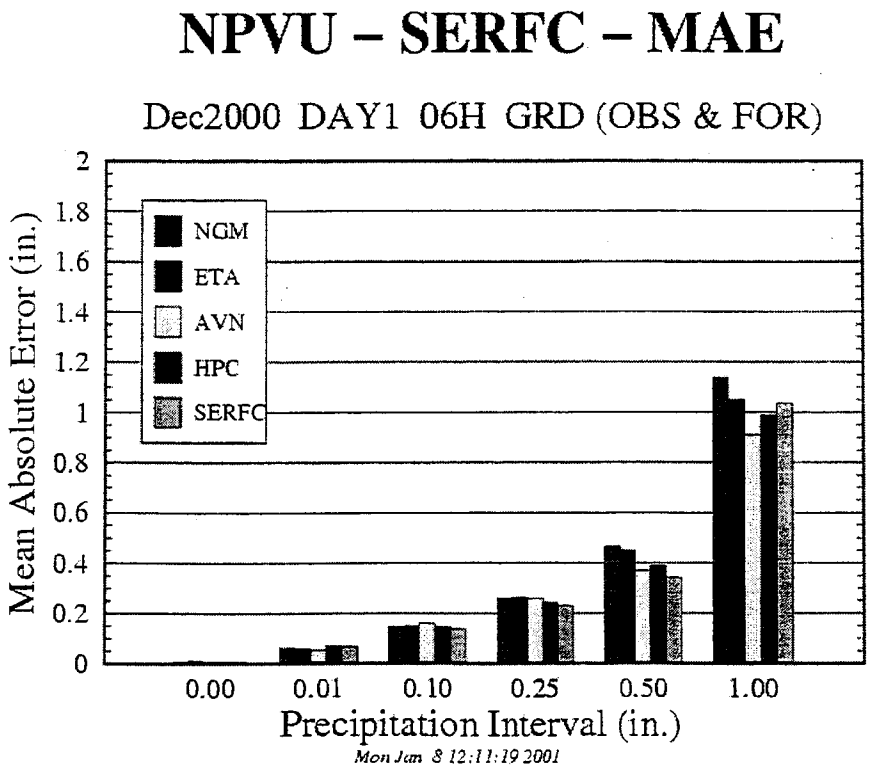

Figure 4. QPF Verification from the Hydrometeorological Prediction Center

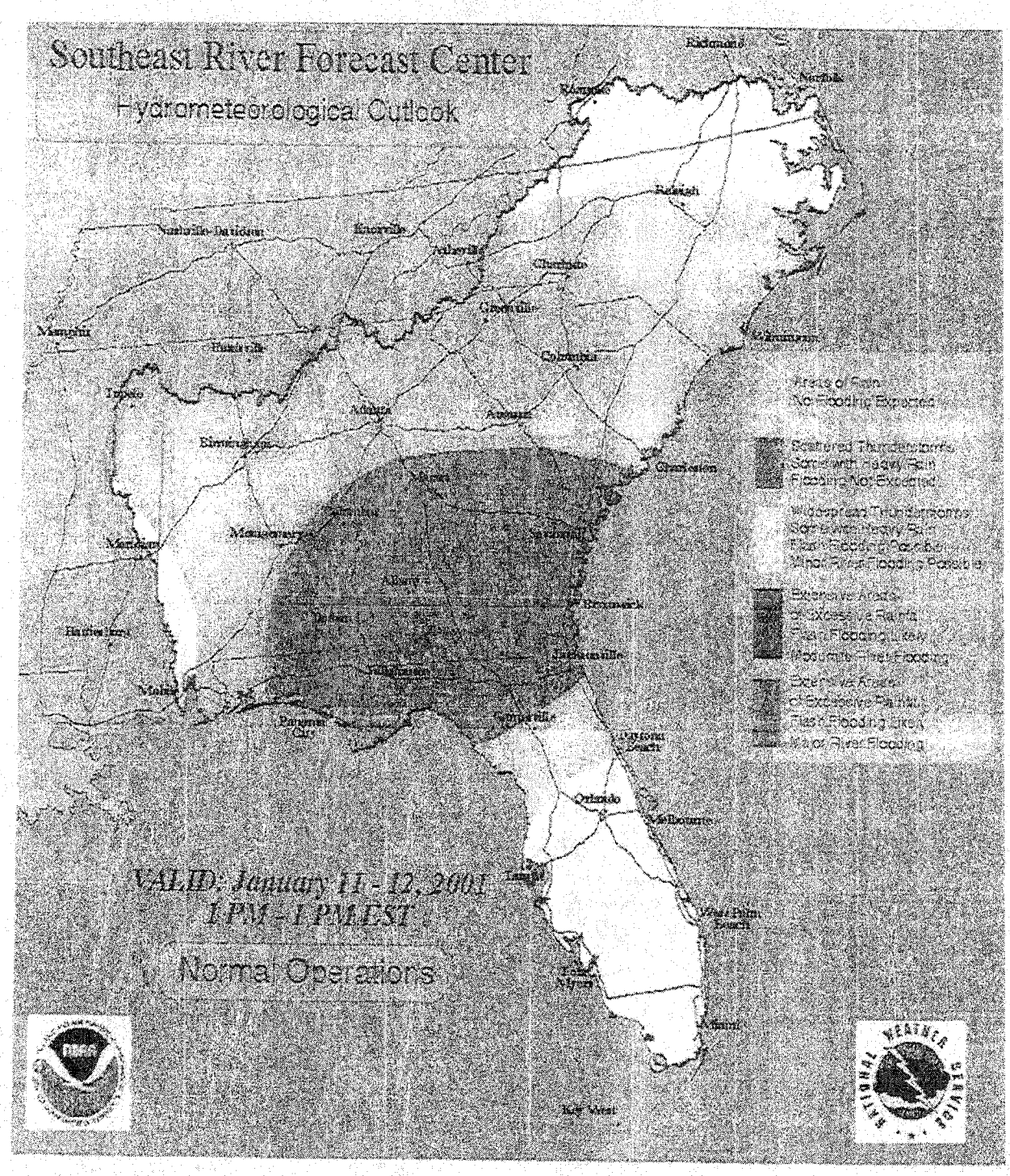

Figure 5. Hydrometeorological Outlook

MAP graphics are available daily on the SERFC QPF web page.

HYDROMETEOROLOGICAL DISCUSSION

The HAS forecaster leads a daily weather briefing each morning. This briefing focuses on hydrometeorological concerns in the SERFC forecast area.

Once the SERFC hydrologists have produced and disseminated the river forecasts through AWIPS and the Internet, they brief the HAS forecaster on current river conditions. The HAS forecaster may also view the river conditions graphics and hydrographs that are available on the SERFC home page at:
http://www.srh.noaa.gov/atr

The river conditions graphics are updated each day at around 12:10 p.m. and are also updated when forecasts are revised.

The HAS forecaster prepares a Hydrometeorological Outlook map using the Unix-based Atlas-GIS software (Figure 5). A text version of the Hydrometeorological Discussion (HMD) is then composed and disseminated. These graphical and text HMD products are available at:
http://www.srh.noaa.gov/atr/hmd/default.html
by 1:00 p.m. each day.

SUMMARY AND OUTLOOK

Since 1994, when the three HAS forecasters arrived at the SERFC, their primary task has been the development of the HAS function. The goals for the HAS forecaster conceived in the NWS Modernization plan of the late 1980s have been met. More use of the Internet, conference calls, and a briefing tool called FX-Connect will allow the HAS forecasters to get specific hydrometeorological information out to our customers such as local WFOs, the emergency management community, and other water resources agencies.

The HAS forecasters will continue to develop and improve the duties described in this paper. They will also expand on an outreach program and implement a river flood watch program.

SUMMARY OF SERFC INTERNET LINKS

SERFC Home Page
http://www.srh.noaa.gov/atr

Mean Areal Precipitation and Stage 3 Products
http://www.srh.noaa.gov/atr/qpfvsmap.htm

Quantitative Precipitation Forecast
http://www.srh.noaa.gov/atr/qpfvsmap.htm

Hydrometeorological Discussion
http://www.srh.noaa.gov/atr/hmd/default.html

Advanced Hydrological Prediction Services
http://www.srh.noaa.gov/atr/ahps/default.html

Ensemble Streamflow Prediction
http://www.srh.noaa.gov/atr/esp/html/esp.htm

For specific Internet addresses, please e-mail jack.bushong@noaa.gov.

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