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USE OF QUANTITATIVE PRECIPITATION FORECASTS IN THE EASTERN REGION HYDROLOGY PROGRAM

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INTRODUCTION

This attachment presents an overview of the Eastern Region's use of Quantitative Precipitation Forecasts (QPF) in our river forecasting and flood warning program; recognizing and incorporating the limitations and shortcomings of quantitative precipitation forecasts.

QPF has been in use in the Eastern Region Flood Forecast Program since 1979. The purpose of the QPF input is two fold: The primary purpose is to extend the lead time for forecasts of Flood Stage and Crest Stage. The lead time can be extended by 6 to 24 hours at many river forecast points, providing users additional time for flood preparedness and response. A secondary goal is to reduce "stair-stepping" in river forecasts. It is not uncommon in a prolonged major flood event to issue several forecast updates of higher river crests, based on observations of heavy rainfall or rising river levels. With the use of QPF in the initial release, the forecaster can reduce the number of revisions required, thereby providing a more responsive service to the public.

CRITICAL FLOOD SUPPORT

Eastern Region QPFs are prepared by a Critical Flood Support Office (CFSO). These CFSOs are assigned Weather Service Forecast Office(s) (WSFOs) in the River Forecast Center (RFC) service area. The CFSO is the direct interface between the RFC, the National Meteorological Center (NMC), and other WSFOs served by the RFC. The major task of the CFSO is to tailor NMC QPF and temperature products for RFC operational use during designated Critical Flood Periods. This occurs whenever guidance products show a threat for flooding, or at a predetermined precipitation threshold. A Critical Flood Period can be initiated by either the CFSO, RFC, or at the request of a WSFO in the RFC service area.

The RFC service area is divided into a number of QPF basins. A large river drainage may have several QPF basins. In tailoring QPF products for the RFC, the CFSO starts with guidance from the NMC Heavy Precipitation Branch. NMC and model guidance are overlaid on the QPF basins and six-hour areal average rainfall,

out to 24 hours, are computed for each basin. Note that the QPF is a basin average and not the maximum or the expected heaviest rainfall within an area.

The QPF for each basin is reviewed and adjusted using the latest hydrometeorological data (rainfall reports/radar/satellite). Local enhancements to QPF such as terrain are also taken into account. The adjusted six-hour basin averages are then transmitted to the RFC in the Standard Hydrometeorological Exchange Format (SHEF) over AFOS. The CFSO QPF is then input into the RFC forecast model. When QPF is included in the operational forecasts, the public release indicates that the forecast is based on observed and expected rainfall, and the amount of QPF is specified.

DAILY QPF

In 1987, WSFO Charleston, WV began a program to provide daily QPF support to the Ohio River Forecast Center (OHRFC). QPFs were issued early in the morning, and updated in the evening, allowing sufficient time for use in the RFC operational models. A goal of this program was to have the forecasters start thinking routinely in terms of forecasting precipitation, and evaluating daily the effects of precipitation on the river forecast. In a sense, this was the first step taken to introduce an operational hydrometeorological mind-set.

Following the successful initiation at WSFO Charleston, WV, daily QPF support to the OHRFC was expanded to WSFO Pittsburgh. In 1989, a similar program was begun in the Northeast River Forecast Center's (NERFC) service area. WSFO Boston, the CFSO to the NERFC, coordinates a program that includes daily QPF support from all the WSFOs in the NERFC area. To facilitate the CFSO operation, WSFO Boston developed a semi-automated QPF program that transforms hand-drawn isohyetal analysis to basin average precipitation suitable for RFC input.

ENHANCEMENTS

Among the recent QPF enhancements being developed in Eastern Region are:

1. WSFO Cleveland has developed an interactive QPF program that allows the forecaster to draw forecast isohyets on a base map with a mouse. The program then calculates basin average precipitation, and transmits the output in a SHEF message over AFOS to the RFC.

2. WSFO Pittsburgh has developed a standardized approach to QPF verification based on a Western Region AFOS program.

3. Eastern Region has implemented a strategy for using QPF in issuing Flood Watches and Warnings.

FUTURE DEVELOPMENTS

As part of the NWS's restructuring program, a Hydrometeorological Analysis and Support (HAS) function is planned at co-located RFCs and NEXRAD offices. The HAS function will provide a high level of interaction between the RFC hydrologists and WFO meteorologists both at the co-located facility, and among the WFOs in the RFC service area. The HAS function will initially take over the CFSO support function, and ultimately integrate daily QPF support, through the WFOs, for the entire service area. An early start-up of the HAS function is proposed for OHRFC in 1991. This regional risk reduction would test the concept of a dedicated group of hydrometeorologists in providing QPF support for RFC operations.

The HAS support will be staffed by 3 hydrometeorologists who will initially work parallel hours with the OHRFC hydrologists. At times the staff will be supplemented by a RFC hydrologist. A main advantage of having a dedicated HAS staff, is the ability to focus primary resources to the QPF problem. This should allow more time for recognizing the need for QPF updates, and doing local

analysis. A deficiency of the current CFSO operations is the lack of a dedicated QPF forecaster in providing sufficient updates, under changing hydrometeorological conditions.

Under restructuring, the local Weather Forecast Office (WFO) will provide 6 to 24 hour QPF for its service area. A major task of the HAS support at the RFC will be to coordinate temporally and spatially the QPF from as many as 20 WFOs that may fall under the umbrella of one RFC. The HAS forecaster will need to assimilate many data and guidance products. This will range from WFO, NMC and model QPF guidance, to many precipitation data sets both manual and automated, including NEXRAD precipitation products. The task of monitoring the voluminous data fields and the currency of the QPF will be extensive. There will be a clear advantage in having a dedicated individual in performing this function for the RFC service area.

Besides the proposed HAS function, other planned developments in the QPF area are:

1. The possibility of issuing QPF for selected grid points in addition to river basins.

2. Incorporating the QPF aspects of local or regional models such as the Penn State mesoscale model, and "model enhancement" techniques such as the North Carolina terrain enhancement technique, to support the WSFOs/RFCs.

3. WSFO Pittsburgh is working with the University of Virginia on a project to develop probabilities for quantitative precipitation forecasts.

4. National Weather Service River Forecast System (NWSRFS) enhancements, such as, automatic processing of QPF data in SHEF.

5. Assigning probabilities to QPF-based river forecasts.

As more demands are placed on the NWS to provide river forecasts for headwater points and smaller tributaries with shorter lead times, the use of QPF will become even more important with time. Since these streams crest rapidly following the occurrence of heavy rain, accurate and timely QPFs are necessary to provide adequate lead time for flood response.

In addition, the NWS is embarking on a program to expand its river forecasting to support a variety of water resource needs. This will involve the issuance of extended range forecasts as well as the shorter period forecasts. River users responsible for managing water supply, drought conditions, navigation, and reservoir operations, will benefit from the greater spectrum of forecast issuances. The use of QPF input in these forecasts is paramount in getting the greatest possible pay back for these users.

SUMMARY

In conclusion, Eastern Region has intensified its efforts in using QPF as data input in our river and flood forecast operations. Recognizing some of the shortcomings, has, and will require a flexible operational strategy. Despite the deficiencies, there is a definite benefit to our users by providing them with more lead time for evacuation, preventive measures, and planning.