NWS River Forecasting

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Floods are the most frequent and costly natural disasters in terms of human hardship and economic loss. As much as 90 percent of damage related to natural disasters is caused by floods and associated mud and debris flows. The National Weather Service (NWS) has been providing river and flood forecasts for the public since 1890. These forecasts are provided for protection of life and property in the vicinity of rivers. NWS scientists work with partner agencies to produce nationwide river forecasts, both routinely and during extreme conditions.

Collaborative Effort

The NWS uses many sources of data when producing river forecasts, including the U.S. Geological Survey (USGS) and Corps of Engineers (COE). The USGS streamflow-gaging network provides real-time river observations for 98% of the NWS river forecast locations across the U.S. The USGS also maintains rating curves for the streamflow gages, which identify the relationship between flow and stage for each gage point. In addition to USGS data, the NWS also incorporates information from COE and other dam and reservoir operations into the forecast process. In some locations, data is also provided through state and local organizations or partnerships.

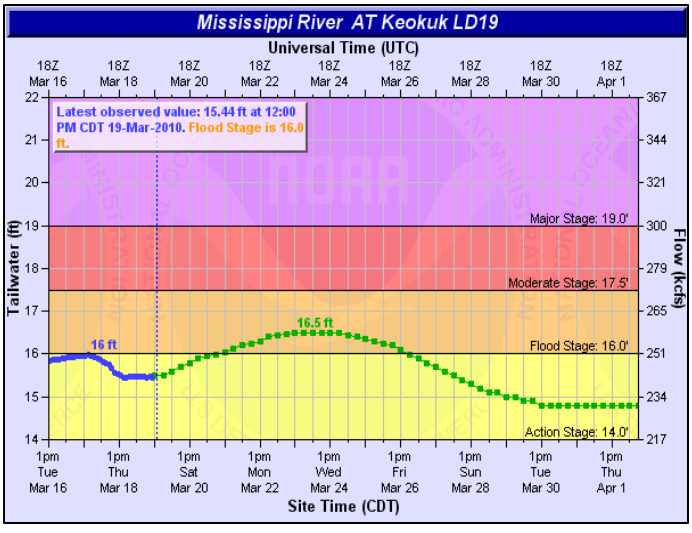

Photo courtesy USGS

Creating the Forecast

The NWS operates 13 river forecast centers (RFCs) across the U.S., each with a specialization in their regional river basins. Hydrologists in the RFCs use scientific computer programs known as “river forecast models” as the foundation for their forecasts.

River forecast models incorporate observations of river stage/flow, precipitation, soil moisture, and temperature; they also take into account soil type, land use, terrain, and snow cover. Additionally, NWS river forecast models include forecast precipitation, typically for the next 24 hours. Forecast precipitation expertise is provided by the NWS Hydrometeorological Prediction Center (HPC) and local NWS forecast offices.

Taking all of these parameters into account, the RFC hydrologists use the computer model to create an initial scenario based on the historical record at each site. Depending on the nature of the river basin, raw model forecasts may be shared with partner agencies such as the COE for feedback and input. The RFC hydrologists then apply their own expertise and knowledge of each basin to make adjustments and produce the final river forecast guidance. Although this guidance is available to the public via the internet, its primary purpose is for use by the local NWS Forecast Offices.



Official forecasts and warnings are issued by the NWS Forecast Office, which focuses on and has expertise about the local weather and river conditions. At the local forecast office, the RFC’s river forecast guidance is reviewed by meteorologists and hydrologists; any adjustments are coordinated with the RFC; and then the local forecast office issues the official forecasts, warnings, and/or statements as appropriate.

Different Kinds of Models

The NWS uses a combination of hydrologic and hydraulic river forecast models. Hydrologic models are used to simulate what happens to precipitation when it hits the ground as snow or rain, and predict when and how much of this precipitation will end up as river flow. Hydrologic models have the capability to update continuously and incorporate forecast precipitation and runoff beyond the initialization.

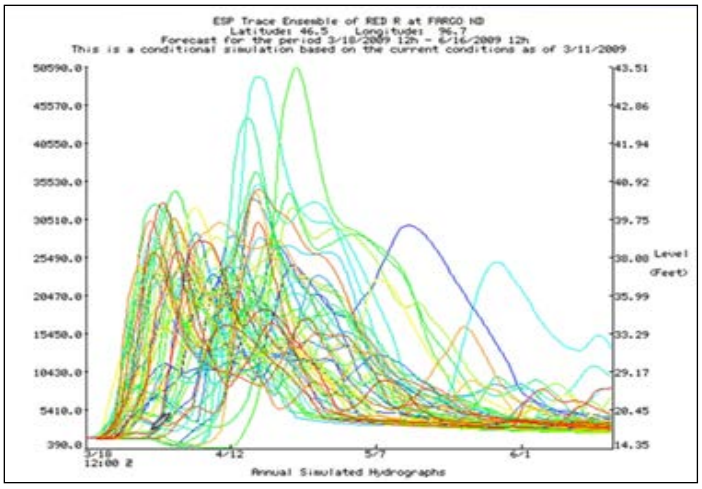
Hydraulic models are then used to predict how the water in the rivers will move from point A to point B to point C as the water moves downstream through a river system. Hydraulic models can account for complex terrain and may model on smaller scales of time and space.

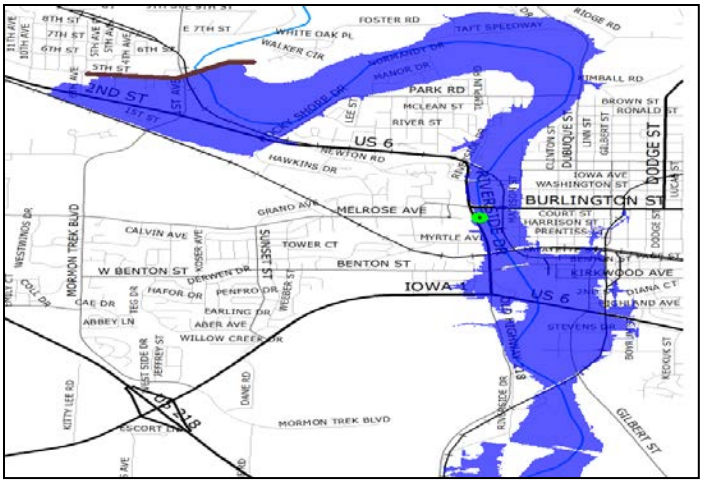
What's next?

Modeling - The NWS is aggressively developing the Community Hydrologic Prediction System (CHPS) – a more robust forecasting system for operational use. CHPS uses an open architecture that will allow the NWS to continually implement the latest modeling improvements, including those developed by research universities, partner agencies, and NWS scientists. To improve modeling in areas with complex terrain, the NWS is also incorporating the hydraulic model HEC-RAS into the NWS river forecasting system.

Probabilistic Forecasts - Decision-makers often prefer to know a range of possibilities or the probability of a particular scenario occurring. In response to this need, the NWS is developing short term probabilistic river forecast capability.

Inundation Mapping - Flood inundation mapping can be a useful tool for preparedness and planning, providing communities with a visual approximation of the potential impact of a range of river stages. Through the cooperation of numerous partners, the NWS has begun to make inundation maps available for select river forecast locations. Although an intense and expensive endeavor, these maps may become available at more locations as additional cooperators emerge and future funds and resources allow.





On the web:

National Weather Service ..... water.weather.gov
NWS River Forecast Centers ..... water.weather.gov/ahps/rfc/rfc.php
NWS Hydrometeorological Prediction Center..... www.hpc.ncep.noaa.gov
NWS Inundation Mapping ..... water.weather.gov/ahps/inundation.php
NWS Community Hydrologic Prediction System (CHPS)..... www.nws.noaa.gov/oh/hrl/chps
US Geologic Survey (USGS)..... www.usgs.gov
Corps of Engineers (COE) ..... www.usace.army.mil