NOAA National Severe Storms Laboratory

FLASH

The Flooded Locations And Simulated Hydrographs project (FLASH) was launched in 2012 by NOAA in partnership with collaborators to improve the accuracy and timing of flash flood warnings. FLASH runs in real-time across the U.S. in demonstration mode at www.nssl.noaa.gov/flash.

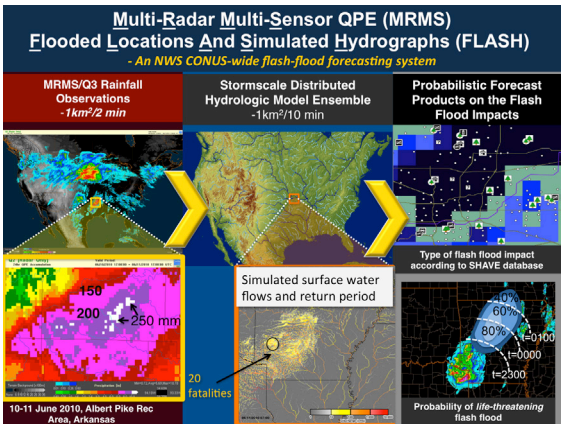
State-of-the-art technology

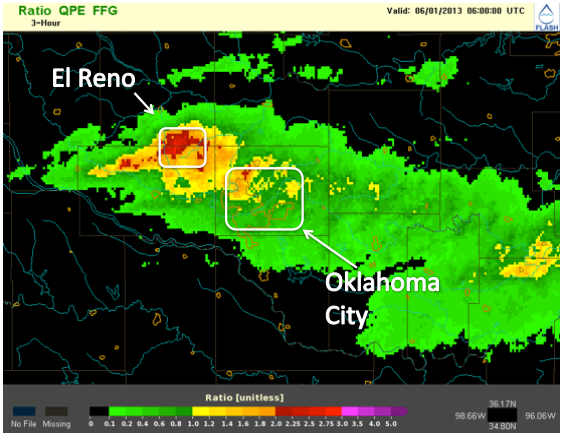
FLASH is unique because it uses NEXRAD-based rainfall data from NSSL's Multiple-Radar Multiple-Sensor system (MRMS) to force a hydrologic model and produce flash-flooding forecasts up to 6 hr in advance with a 5-min update cycle. The real-time forecasts are compared to historical simulations that were performed with a more-than-decade-long time series of NEXRAD-based inputs at each 1-km grid point. This means that the FLASH forecasts of flash flooding can be generated anywhere in the US that is covered by radar, without the requirement of runoff measurements to calibrate the model. FLASH yields seamless forecasts across the US that indicate the rarity of the predicted event in terms of probability of exceedance.

May 31, 2013 flash flooding event

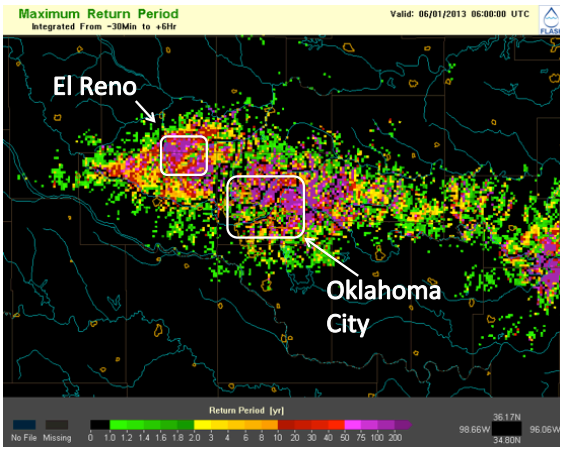
The FLASH system was running during the May 31, 2013 supercell thunderstorm that caused nine tornado-related fatalities near El Reno, Okla. and 14 flash-flooding deaths. In the FLASH maximum return period plot, rare (~100 yr), high flows were predicted out to six hours in advance in the northwest part of Oklahoma City near El Reno and also in the metropolitan region of Oklahoma City. This means the FLASH model was forecasting a flash-flooding event that statistically has only a 1% chance of occurring within a given year. The FLASH model was able to predict a catastrophic flash flood in Oklahoma City (where most of the fatalities occurred) and in the El Reno area because of its representation of surfaces that do not absorb water in an urban zone, modeling of dynamic soil moisture conditions, and routing of water downstream. These key physical representations were needed to adequately predict this deadly event.

(Right) FLASH successfully predicted rare high water flows six hours in advance of a catastrophic and deadly flash flood in Oklahoma City, Okla.





Rainfall measurements exceeded the 6-hour flash flood guidance estimates on May 31, 2013.



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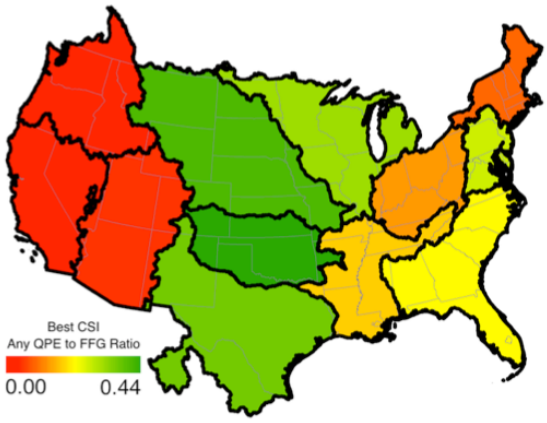
HWT-hydro

The Inaugural Hazardous Weather Testbed - Hydrologic Experiment (HWT-hydro) was launched on July 7, 2014 for four-weeks. Three to four NWS forecasters from different regions in the US join the experiment for weekly shifts. The HWT-hydro experiment bridges with the Flash Flood and Intense Rainfall (FFaIR) experiment held at the Weather Prediction Center. FFaIR is responsible for experimental flash flood guidance in the 6-24 hr forecast range, while HWT-hydro acts as a "floating NWS forecast office" and issues experimental flash flood watches and warnings in the 0-6 hr timeframe. The experimental watches/warnings are unique in that they are based on the experimental FLASH products, one of which is now forced by quantitative precipitation forecasts from the High Resolution Rapid Refresh model. The experimental watch/warning products are also unique in that they communicate the uncertainty (i.e., 25%, 50%, 75%, 100%) and anticipated magnitude of flash flooding (i.e., nuisance vs. major impacts).

Forecasters work with experimental products during HWT-hydro 2014.

FLASH improves upon operational benchmark

The FLASH team successfully assembled the most-comprehensive-to-date flash flood observation database across the US and made it available to the research community in 2013. They also used it to benchmark, for the first time, the skill of the operational flash flood guidance (FFG) methods. Determining these benchmark skill values was essential to establish the status of existing tools, and as a bar to measure the skill of newer approaches. In a study focused on the Arkansas-Red basin in Oklahoma, they found the FLASH system offered a 68% improvement in skill over the NWS operational FFG system.



Critical Success Index (or skill) of the current NWS operational flash flood guidance method.

FLASH as a research centerpiece

Current research projects include studying human behavior during flash flood events, forecaster interpretation of FLASH products, and the identification of hydrologic model physics required for adequate flash flood simulation. Other projects to optimize the use of forcing from polarimetric radar products and stormscale ensemble quantitative precipitation forecasts are underway. Another FLASH objective is to localize and specify the model outputs so that they are providing probabilistic information regarding the forecast of specific impacts resulting from flash flooding, including hazardous street flooding, inundation of structures, flooded crops, and other threats to lives and property. A component of this effort involves the development of a georeferenced photograph database, which will eventually be used to communicate forecast hazards to the public.

Inundated roads and vehicle flooding in Oklahoma City during a flash flood on July 14, 2010.