The August 4, 2009 Louisville Flash Flood: A Case Study

Frank J. Pereira
DOC/NOAA/NWS/NCEP/Hydrometeorological Prediction Center

This presentation examines observational and forecast aspects of the August 4 Louisville, KY Flash Flood. On August 4, 2009 record-breaking heavy rains fell in Louisville, Kentucky as strong thunderstorms regenerated and remained stationary over the area. Five inches of rain fell in 90 minutes from 7:45am to 9:15am at the Louisville, KY airport, and rainfall rates up to 8.80 inches per hour were reported. As a result of the torrential rainfall, nearly 200 people required rescue from the tops of cars and homes. Areas incurring major flooding included Churchill Downs and the University of Louisville campus, where approximately 50 people were rescued by boat from an office building.

Analysis of observations of the prestorm environment showed subtle indications of the heavy rainfall potential. Weak warm air advection ahead of a developing warm front supported weak low-level lift in a moist (2 inch integrated precipitable water) and unstable (CAPE > 2000 J/kg) environment. A 500 mb short wave was notably absent, with the nearest short wave over 1500 km upstream. These features were depecited in output from lower resolution numerical weather models. However, short term (12 h) quantitative precipitation forecasts from these same models were especially underdone (some models forecasting dry conditions), as were both deterministic and associated probabilistic forecasts issued by the Hydrometeorological Prediction Center. However, output from the high-resolution (4 km) convection permitting Weather Research and Forecasting – Nonhydrostatic Mesoscale Model showed superior skill in forecasting the event, including accurate forecasts of the lifecycle, timing, and evolution of the convection and associated torrential rainfall. This case illustrates the importance of considering high-resolution convection permitting model guidance in the forecast process. Such guidance may be essential to raising situational awareness of potential flash flood events, given limitations associated with coarser resolution convection parameterized model guidance.

Corresponding author address: Frank J. Pereira, NOAA Science Center, Rm. 410, 5200 Auth Rd., Camp Springs, MD 20746. Email: Frank.Pereira@noaa.gov.

Preferred method of presentation: oral presentation.