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A Cross-Scale, Hydro-Meteorological Forecast Evaluation of National Water Model Forecasts of the May 2018 Ellicott City, MD Flood

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The NOAA National Water Model (NWM) became operational in August 2016, producing the first ever real-time distributed continuous hydrologic forecasts over the Continental United States (CONUS) and significantly expanding guidance spatially and temporally in previously underserved locations. This project applies the CONUS-scale, distributed NWM to predict the high-impact 1000-year rainfall event that brought catastrophic flood damage in Ellicott City, Maryland on 27-28 May 2018.

The short-range cycle (0-18 hours) of the NWM is explored, focusing on the quality of the quantitative precipitation forecast (QPF) from the High-Resolution Rapid Refresh (HRRR) model and the corresponding streamflow response from the NWM in short-term HRRR-driven hydrologic forecasts. The interaction of hydrometeorological processes from the meteorological mesoscale to the small hydrologic catchment scales and resulting flood inundation areas are considered using a combination of object-based, grid-based, hydro point-based verification and the height above nearest drainage (HAND) method.

Results highlight some benefits and risks of using a unified hydrologic model tool, such as the NWM, to connect CONUS-scale forcings to local scale impact predictions. For the Ellicott City event, the HRRR model forecast shows some QPF displacement errors, but an overall skillful result in depicting the intensity and the main meteorological mesoscale characteristics of the event. The streamflow evaluation shows an intense flash-flooding signal from the HRRR cycles that were able to produce intense rainfall over the area. In general, across consecutive model forecast cycles, indications of the possibility of a fast-onset flash flood event offered short-term forecast utility for the Ellicott City event.