DHM-TF: Flash flood forecasting with NEXRAD precipitation data and a threshold frequency implementation of a distributed hydrologic model

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A method to use a distributed hydrologic model in conjunction with threshold frequencies (DHM-TF) and NEXRAD precipitation data has been developed to improve the accuracy of flash flood forecasts at ungauged locations. The model produces high-resolution grids of discharge, which are compared to the model's long-term climatology to characterize the real-time flow in terms of return period. Forecasters can compare these return periods to locally derived threshold frequencies to aid in warning decisions. Local threshold frequencies may be derived from several sources of information such as known or computed flood frequencies at selected river locations or frequencies associated with culvert designs. The model characterizes flood severity at gauged and ungauged locations, and provides an inherent bias correction to reduce systematic errors in model predicted peaks. This inherent correction is the technique's key to extending flash flood forecasts to ungauged areas at high spatial resolution. The distributed model basis for the approach offers advantages over current lumped and distributed model-based National Weather Service (NWS) flash flood guidance (FFG) procedures because it employs channel routing and makes hydrologic calculations at spatial and temporal scales that are more commensurate with flash flooding.

Three NEXRAD-based precipitation products are used as input to the DHM-TF system: 1) a Multi-Sensor Precipitation Estimator (MPE) product, for precipitation history prior to 3-6 hours 2) a High-Resolution Precipitation Estimator (HPE) product for precipitation in the last few hours, and 3) a precipitation forecast for the next one-two hours, based on the High Resolution Precipitation Nowcaster (HPN). In a collaborative NWS OHD/River Forecast Center (RFC)/Weather Forecast Office (WFO) effort, prototype real-time flash flood forecast systems based on the DHM-TF modeling approach and NEXRAD data described above have been put in place over the Pittsburgh WFO's County Warning Area (CWA), and over a portion of the Baltimore/Washington WFO's CWA. Near-term expansion plans include the Binghamton WFO's CWA. An overview of the DHM-TF modeling system, the

NEXRAD data used to force the system, and an analysis of flash flood case studies will be presented.