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Applied Weather Associates (AWA) analyzed hundreds of storms worldwide using the Storm Precipitation Analysis System (SPAS) program to develop an understanding of rainfall magnitude and produce hourly/sub-hourly gridded rainfall data. Available rainfall forecast data can be integrated with SPAS and used to produce depth-area-duration information for nearly real-time flood forecasting. However, conventional hydrologic modeling techniques typically use lumped (unit hydrograph) processes to transform runoff to flow hydrographs. These lumped techniques can be derived/calibrated using rainfall and streamflow gage data but are unreliable in simulating a watershed's response to events that have significantly different precipitation magnitude and/or configuration than the calibration event(s). Furthermore, lumped modeling techniques become unreliable at intermediate watershed points, upstream of streamflow observation locations. Unreliability increases on small to medium size watersheds that have no or insufficient rainfall or streamflow gage data.

In partnership with AWA and JBA Consulting, Aterra is developing a technique to use a fully-distributed, two-dimensional, global hydrologic modeling system for real-time flood forecasting. This modeling interface would provide a reliable flood-forecasting tool and offer flexibility in simulating a watershed's response to diverse rainfall intensities, durations, and temporal/spatial distributions. Calibration is still be important to ensure the system is properly configured to a particular region but, once calibrated, real-time information can be extracted from the model at nearly any point in the watershed.

This paper describes the technique, demonstrates a proof-of-concept by applying to an example watershed and storm, and discusses its usefulness in emergency response and decision making. Forecast precipitation data analyzed through SPAS are run through the hydrologic system to better understand how differences in the forecast and post-event data translate to differences in anticipated and actual flood conditions. The objective is to create a real-time automated process for translating forecast precipitation to flood flows/levels at dams to enhance dam safety decision-making (spillway operations, temporary stabilization measures, downstream warnings, etc.), along with other state/federal emergency management agencies. While SPAS improves accuracy of rainfall forecasts, the hydrologic system can be used to assess uncertainty in the rainfall forecasts by simulating "what-if" scenarios as a storm develops for more advanced decision-making.