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Impacts of Polarimetric CASA Radar Observations on a Distributed Hydrologic Model

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Radar can monitor the atmospheric conditions of a wide area very quickly and provide advanced observations and warnings for the precipitation systems at high spatial resolution. Over the past two decades, significant progress has been made in dual-polarization radar quantitative precipitation estimations (QPE). The polarimetric radar observations can provide more information on the drop size distribution and hydrometeor classifications over traditional Z–R methods. Among different rainfall algorithms, the Kdp-based QPE was proved to be immune to the partial beam blockage and hail contamination, and it is also less prone to the calibration errors. The networked Kdp-based QPE system developed by the U.S. National Science Foundation Engineering Research Center (NSF-ERC) for Collaborative Adaptive Sensing of the Atmosphere (CASA) has shown a great improvement compared with state-of-the-art.

The high spatial and temporal resolution rainfall products from CASA QPE system can serve as a reliable data input for distributed hydrological models. The Research Distributed Hydrologic Model (RDHM) developed by the U.S. National Weather Service (NWS) Office of Hydrologic Development (OHD) is a promising tool for generating streamflow and other hydrological information such as soil moisture, etc. It can incorporate the heat transfer (HT) dynamics with the Sacramento soil moisture accounting model (SAC) to simulate rainfall-runoff and channel routing models for routing streamflow. In this research, the SAC-HT model was forced using hourly rainfall estimates produced by the CASA X-band dual-polarization radar network, for the purpose of predicting hydrological response and dealing with the flash flood issues.

This paper will present a brief overview of the CASA QPE system and its various products. Then, the impacts of CASA QPE on SAC-HT model are mainly focused on, by using the networked polarimetric radar observations collected in IP-1 test bed in Southwestern Oklahoma. The “first” observation in CASA’s urban demonstration network being deployed in the populous Dallas-Fort Worth (DFW) metroplex is also expected for the hydrological analysis.