Title: Probabilistic Quantitative Precipitation Estimates

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Progress in precipitation estimation is critical to advancing weather and water budget studies and to predicting natural hazards caused by extreme rainfall events from the local to the global scales. An interdisciplinary challenge in remote sensing, meteorology, and hydrology is the impact, representation, and use of uncertainty. Understanding precipitation processes and hydrometeorological applications with ground-based radar networks like NEXRAD and satellite-based active and passive sensors of the Global Precipitation Measurement (GPM) and the GOES-16 missions require more than just one deterministic "best estimate" to adequately cope with the intermittent, highly skewed distribution that characterizes precipitation. Explicitly integrating uncertainty as an integral part of ground- and space-based active- and passive remote sensing quantitative precipitation estimation increases hydrometeorological information for hydrological modeling, storm prediction, and flash flood monitoring. Probabilistic QPE (PQPE) was introduced across the conterminous US with the NOAA/NSSL Multi-Radar/Multi-Sensor (MRMS). Extension to satellite based GOES16 and GPM DPR precipitation estimates was later demonstrated. Probability distributions of precipitation rates are computed instead of deterministic values to describe the range and values of possible rates given the remote sensing observations. By increasing the information content in QPE, precipitation probability maps compare favorably to the deterministic QPE. PQPE provides the basis for precipitation probability maps, precipitation ensembles needed for multisensor merging of precipitation, early warning and mitigation of hydrometeorological hazards, and hydrological modeling. PQPE usability was assessed by NWS forecasters and NSSL scientists in the Hydrometeorology Testbed MRMS Hydro Experiment (HMT-Hydro) 2019. It allowed users to investigate probabilistic grids for flash flood warning decision making. The presentation will discuss the evaluation of precipitation probability maps in this context.