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Empirically-based ensemble generator of radar-rainfall data

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There are large uncertainties associated with operational precipitation estimates produced by U.S. national network of WSR-88D radars. Numerous sources of these errors are due to parameter estimation, the observational system and measurement principle and not fully understood physical processes. Propagation of these uncertainties through rainfall-runoff models where radar-rainfall is used as input is required for improved understanding and interpretation of the predicted runoff. However, a comprehensive evaluation of these uncertainties has not yet been achieved. To fill this gap, the authors developed a model based on the empirical characterization of these uncertainties. According to their approach, a realistic parameterization of the relationship between true rainfall (RT) and radar-based rainfall (RR) can be achieved with a model described by two elements: a deterministic distortion function and a random component. The model is developed using a nonparametric framework and rain gauges are used as approximation of RT. The proposed results are based on a six-year sample of Level II data from the Oklahoma City radar site (KTLX) and processed through Build 4 of the Open Radar Product Generator Precipitation Processing System (PPS). The radar data are complemented with the corresponding rain gauge observations from the Oklahoma Mesonet and Agricultural Research Service Micronet. This model has the flexibility to account for range from the radar, different spatio-temporal scales, rain regime and space and time dependency of the errors. In this paper, the authors present two different scenarios of using the model: a static estimation of probability maps and an ensemble generator. Given an hourly accumulation RR product, the former generates maps which represent the probability of exceedance of some arbitrary threshold values by the true rainfall. A possible application could be in the flash flood guidance systems to estimate the probability of RT to exceed some threshold value of rainfall

known or determined a priori to cause flooding. In the second proposed scenario of using the model, given a time series of hourly radar-rainfall data, user can generate an ensemble of rainfall field realizations which are congruent with the model's statistical error structure. The random component of the generator is based on the Cholesky decomposition method, which provides the flexibility to account for correlation in space and time and non-stationarity in variance of the error fields. The authors also discuss possible implication of the use of the generator in hydrologic forecast models.