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Stochastic generation of conditional precipitation replicates for ensemble forecasting and data assimilation

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Realistic rainfall replicates are required for ensemble approaches to hydrologic forecasting and data assimilation. Ensemble-based forecasting and assimilation algorithms can be expected to work better when their synthetically generated prior replicates closely resemble observed rainfall populations. In this paper we present results from a new probabilistic procedure for generating realistic rainfall replicates. The procedure generates random clusters of non-zero rainfall intensity within regions of remotely sensed cloud top low temperature. The cluster replicates are obtained from a multipoint geostatistical algorithm that infers spatial structure from NOWRAD training images. A multiscale tree with irregular spatial support is then used to generate rainfall intensity within each cluster at each assimilation time. The required tree parameters are selected to provide a good to observed rainfall features. We illustrate this rainfall generation algorithm with an example using GOES infrared measurements and NOWRAD radar data for the United States Great Plains.