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Space-time conditional disaggregation of precipitation at high resolution via simulation

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Daily rainfall data are more plentiful and reliable than pluviometer data and are the best data set to start data-repair from, worldwide. Clusters of pluviometers (a term used herein for instruments recording at subdaily intervals) record wet and dry periods in close synchrony and larger and smaller catches tend to be recorded in similar groups, but they have many gaps that require infilling. We present a method of disaggregating daily rainfall to subdaily intervals, contemporaneously infilling gaps in the pluviometers. Then the observed data, together with the infilled and disaggregated values, are interpolated over the intervening space. To achieve this disaggregation, we used a Gaussian copula-based model with time-dependent marginal distributions and censored values representing the dry periods. In addition, we generated stochastically meaningful ensembles of missing or disaggregated values, while constraining each realization to the observed daily total where relevant. This applies to the gaps filled in the pluviometers as well as the disaggregation of the daily totals. Using the disaggregated and infilled subdaily ensembles, we then conditionally spatially simulated historical rainfall in the space between the gauges and pluviometers. The mean of these stochastic realizations was compared to interpolated fields using two other procedures: Rescaled Ordinary Kriging and Rescaled Nearest Neighbors, and found our method to be superior. Where there are daily data, the daily sum constrains the simulation. In the intervening space, in a chosen daily subinterval, there will be an ensemble of values simulated from the observations. We present the results of measurements and validation of the applications to an unusually large amount of data (not just a few convenient samples), and are confident that the methodology is sound and applicable in a variety of geographies.