A method to fill-in discontinued daily precipitation series from nearby stations

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Cornerstone of the meteorological and climatological science is the quality measurements of the precipitation. Large instrumentation gaps occur due to network destructions (fires, wars) or even technical limitations that dictate network reorganizations. This is a difficult to tackle issue as there are legacy networks that provide decades of valuable data, but for various reasons have been discontinued. A method to work out such problems is to include only part of the data to the analyses, or to use methods to fill the measuring gaps from nearby stations, such as interpolation techniques, regression techniques. In this work, we present and assess a method to estimate missing values in daily precipitation series based on a quantile mapping approach, originally used for bias correction of climate model output. The overall methodology is based on a three-step procedure. The first is to assess the missing values from nearby stations using inverse distance weighting interpolation method. Then, as a second step, the wet day fraction is adjusted to fit the respective fraction of the target point existing data. The third step is to adjust the biases in the probability density function of the filled values towards the target point existing data, using the Multi-segment Statistical Bias Correction methodology (MSBC- Grillakis et al., 2013). The methodology is applied to each calendar month separately. The presented methodology has the advantage of correcting the number of rainy days that is usually overestimated by conventional interpolation approaches, as well as, better reproduces large daily precipitation values. The methodology is assessed for its performance on completing the timeseries of a dense precipitation stations network, using data of a second, also dense station network for the island of Crete – Greece. Conceptual limitations of the method are discussed.

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