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Inhomogeneities detection in annual precipitation time series in Portugal using direct sequential simulation

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Climate data homogenisation is of major importance in monitoring climate change, the validation of weather forecasting, general circulation and regional atmospheric models, modelling of erosion, drought monitoring, among other studies of hydrological and environmental impacts. This happens because non-climate factors can cause time series discontinuities which may hide the true climatic signal and patterns, thus potentially bias the conclusions of those studies.

In the last two decades, many methods have been developed to identify and remove these inhomogeneities. One of those is based on geostatistical simulation (DSS – direct sequential simulation), where local probability density functions (pdf) are calculated at candidate monitoring stations, using spatial and temporal neighbouring observations, and then are used for detection of inhomogeneities. This approach has been previously applied to detect inhomogeneities in four precipitation series (wet day count) from a network with 66 monitoring stations located in the southern region of Portugal (1980–2001). This study revealed promising results and the potential advantages of geostatistical techniques for inhomogeneities detection in climate time series.

This work extends the case study presented before and investigates the application of the geostatistical stochastic approach to ten precipitation series that were previously classified as inhomogeneous by one of six absolute homogeneity tests (Mann–Kendall test, Wald–Wolfowitz runs test, Von Neumann ratio test, Standard normal homogeneity test (SNHT) for a single break, Pettit test, and Buishand range test). Moreover, a sensibility analysis is implemented to investigate the number of simulated realisations that should be used to accurately infer the local pdfs. Accordingly, the number of simulations per iteration is increased from 50 to 500, which resulted in a more representative local pdf. A set of default and recommended settings is provided, which will help other users to implement this method. The need of user intervention is reduced to a minimum through the usage of a cross-platform script. Finally, as in the previous study, the results are compared with those from the SNHT, Pettit and Buishand range tests, which were applied to composite (ratio) reference series.

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