Testing the homogeneity of point precipitation time series from the Madeira Islands

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Several variability, trend analysis and climate change studies have been conducted on the Iberian Peninsula, which includes Mainland Portugal, in recent years. Hardly any studies have been carried out, however, on the North Atlantic Portuguese Islands, such as Madeira and Porto Santo Islands.

Aiming to contribute to the characterization of precipitation in the Madeira archipelago, which exhibits high variability, this work concentrated on detecting/identifying non-homogeneities in the available point-precipitation data. The presence of heterogeneities in the data can affect the characterization of climate variability in this region, in both spatial and temporal terms. The lack of reliable metadata enhances the importance of this essential preliminary step in the study of the precipitation data from Madeira and Porto Santo Islands.

Although there is one long time series (Funchal) in our data set, dating from 1865, the majority of the fourteen time series that were tested in this study cover the period 1940-1994. Some of the time series have been recorded until 2005. The measuring stations are randomly scattered over the study area, allowing the different precipitations regimes affecting the islands to be represented in this study. The islands' most frequent circulation pattern is controlled by the Azores High with northerly flow and the second most important is the westerly flow, due to perturbations associated with the normal track of Atlantic depressions. The orography of the islands is quite rough. The relief of Madeira Island is dominated by a central peak (1800 m) which divides the island into a northern and a southern part. The complexity of the topography creates numerous microclimatic characteristics which are reflected in both the temperature and in the precipitation variability.

Four tests were applied to the precipitation data: the Alexandersson Standard Normal Homogeneity test, the Pettitt test, the Van Neumann Ratio and the Buishand Range Test. These tests were selected on the basis of their different sensitivity to where the break is likely to be expected. All the tests except the Von Neumann Ratio test give information about the location of the shift. Results show that the majority of the series

can be classified as “useful” for trend or extreme analyses of precipitation. Moreover, the tests helped to detect several heterogeneities in the data that had not been reported before, and contributed to the characterization of the precipitation time series.

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