



## Rainfall Trends over a Small Island Teleconnected to the North Atlantic Oscillation - the Case of Madeira Island, Portugal

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### Abstract

For improving sustainable water resources management and planning at local and regional scales, specifically in small islands, long-term and recent rainfall trends due to temporal shifts in major climatic drivers should be investigated based on dense and long-running ground data series — as done in this research work for the North Atlantic Portuguese island of Madeira (741 km<sup>2</sup>). Monthly, wet season and annual rainfall trends have been obtained via the non-parametric Mann-Kendall (MK) and the Sen's slope estimator tests for 41 rain gauges spanning from 1940/41 to 2016/17 (77 hydrological years, each starting on October 1). By means of the Sequential Mann-Kendall (SQMK) test, abrupt temporal shifts in the wet season and annual rainfall, and in the North Atlantic Oscillation index (NAOI) series have been identified on the late 1960's — sandwiched by two subperiods with clearly opposite trends. In general, the results suggest considerably and statistically significant decreases in rainfall, exacerbated in recent years at the central region of the island — one of the most important locations in terms of fresh water security. Additionally, this work provides a solid basis to explain the climate change effects on the Madeira rainfall, suggesting that abrupt changes of the island's rainfall variability can be directly linked to those of the North Atlantic Oscillation (NAO) climatic driver based on the strong established teleconnection. These findings are expected to contribute to the improvement of actions towards sustainable water management in the island, and of some other small islands with climatic characteristics influenced as well by large-scale circulation patterns.

**Keywords** Rainfall trends · Small island · Madeira Island · Teleconnection · North Atlantic oscillation index

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