



Spatial and temporal variability of precipitation in the Madeira archipelago

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The Madeira archipelago (Portugal) is located in the North Atlantic Ocean, about 900 km from Mainland Europe. It is formed by the Madeira Island (728 km²) and Porto Santo Island (42 km²) and by two other groups of inhabited small islands. Porto Santo Island is situated 40 km to the northeast of the main island. 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. However, the topography of the islands plays a crucial role in the local precipitation regime. The relief of Madeira Island is dominated by a central peak (1862 m) which divides the island into a northern and a southern part. The highest point on Porto Santo Island is 517 m. The complexity of the topography creates numerous microclimatic characteristics which are reflected in both the temperature and the precipitation variability. In particular, total annual precipitation varies greatly with geographical location. This has a strong impact on local society, economic activities (e.g. tourism, agriculture), land use and water resources.

The purpose of this work is to contribute to a better understanding of the variability of precipitation in the Madeira archipelago by investigating its temporal structure with multifractal methods. The empirical exponent functions describing the scaling statistical properties of the precipitation intensity were described using a multifractal model based on Lévy random variables. The results show that the different precipitation generating mechanisms affecting the islands lead to several precipitation patterns over time. The dynamics of precipitation characterized with the multifractal approach is increasing the understanding of the different hydrological regions in the islands.