



Mapping extreme rainfall in the Northwest Portugal region: statistical analysis and spatial modelling

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Extreme precipitation events are one of the causes of natural hazards, such as floods and landslides, making its investigation so important, and this research aims to contribute to the study of the extreme rainfall patterns in a Portuguese mountainous area. The study area is centred on the Arcos de Valdevez county, located in the northwest region of Portugal, the rainiest of the country, with more than 3000 mm of annual rainfall at the Peneda-Gerês mountain system. This work focus on two main subjects related with the precipitation variability on the study area. First, a statistical analysis of several precipitation parameters is carried out, using daily data from 17 rain-gauges with a complete record for the 1960-1995 period. This approach aims to evaluate the main spatial contrasts regarding different aspects of the rainfall regime, described by ten parameters and indices of precipitation extremes (e.g. mean annual precipitation, the annual frequency of precipitation days, wet spells durations, maximum daily precipitation, maximum of precipitation in 30 days, number of days with rainfall exceeding 100 mm and estimated maximum daily rainfall for a return period of 100 years). The results show that the highest precipitation amounts (from annual to daily scales) and the higher frequency of very abundant rainfall events occur in the Serra da Peneda and Gerês mountains, opposing to the valleys of the Lima, Minho and Vez rivers, with lower precipitation amounts and less frequent heavy storms. The second purpose of this work is to find a method of mapping extreme rainfall in this mountainous region, investigating the complex influence of the relief (e.g. elevation, topography) on the precipitation patterns, as well others geographical variables (e.g. distance from coast, latitude), applying tested geo-statistical techniques (Goovaerts, 2000; Diodato, 2005). Models of linear regression were applied to evaluate the influence of different geographical variables (altitude, latitude, distance from sea and distance to the highest orographic barrier) on the rainfall behaviours described by the studied variables. The techniques of spatial interpolation evaluated include univariate and multivariate methods: cokriging, kriging, IDW (inverse distance weighted) and multiple linear regression. Validation procedures were used, assessing the estimated errors in the analysis of descriptive statistics of the models. Multiple linear regression models produced satisfactory results in relation to 70% of the rainfall parameters, suggested by lower average percentage of error. However, the results also demonstrates that there is no an unique and ideal model, depending on the rainfall parameter in consideration. Probably, the unsatisfactory results obtained in relation to some rainfall parameters was motivated by constraints as the spatial complexity of the precipitation patterns, as well as to the deficient spatial coverage of the territory by the rain-gauges network.

References

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