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Analysis of Rainfall Changes in Transnational Basins in Portugal and Spain

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The impact of climate regime variability on the hydrology and water resources of the major transnational basins in Iberia (Portugal and Spain) is being studied. Spain is the source of the three major rivers that flow through Portugal, leaving this country in a vulnerable position. There is a strong interannual precipitation variability in Iberia, with very wet and very dry years occurring frequently. Situations of water scarcity are already frequent in the south of Portugal and Spain, so in the future, a critical problem of water availability for Iberia might arise.

An analysis of changes in rainfall records covering the three major transnational basins was performed, using data from Spain and Portugal which are normally considered separately. This study area, defined by basins instead of countries, is more coherent for water resources analysis.

Change point and trend analysis was performed on rainfall records in the transnational basins of rivers Douro, Tagus and Guadiana for the period 1961 to 2009. Non-parametric tests (Pettitt test, cusum test and Mann-Kendall test) were used in order not to have to assume a specific distribution for the data. Field significance was taken into account when calculating trends and change points. The importance of spatial correlation when calculating field significance was demonstrated.

As well as finding changes in rainfall which have great significance for water resources, some important issues are raised as to the nature of changes in rainfall to be expected. Significant decreases in rainfall were found for the month of February and, to a lesser extent, March. Significant increases in rainfall were found for October in the Spanish side of Douro and Tagus catchments. The NAO index was considered as a possible explanation for the changes detected.

It was also demonstrated that changes in rainfall cannot always be interpreted as trends or change points because the pattern of change can be more complex than these two simplistic ways of describing change. Furthermore, the magnitude of the change can be completely different depending of the type of change assumed. Therefore the quantification of the change must be made with care, as the widely used linear trend can be ambiguous and in principle is not coherent with the multiple alternative hypotheses (different admissible monotonic patterns) implied by nonparametric tests.