



Long-term trends and variability of precipitation extremes in North Africa

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Maghreb countries in North Africa are highly vulnerable to extreme hydrological events, such as floods and droughts, driven by the strong variability of precipitation. There is a questioning about a possible increase in their intensity or occurrence, since a significant increase in the vulnerability of the populations has been observed during the last decades in this region. While several studies have analyzed the presence of trends in precipitation records for the Euro-Mediterranean basin, this study provides the first assessment of trends in its southernmost shores. A database of 22 stations located in Algeria, Morocco and Tunisia with between 33 and 59 years of daily precipitation records is considered. Eleven climate indices describing several features of the precipitation regime are computed. The change points and trends are analyzed using robust statistics taking into account the serial and cross correlations present in the dataset. The issue of conducting multiple hypothesis tests is also addressed through the implementation of a false discovery rate procedure. In addition to the trend analysis, the inter-annual variability of the precipitation indices in the different stations is compared with large scale atmospheric circulation patterns, including the North Atlantic oscillation (NAO), Western Mediterranean oscillation (WEMO), Mediterranean oscillation (MO) and El Niño Southern Oscillation (ENSO). Results show a strong tendency towards a decrease of precipitation totals and wet days together with an increase in the duration of dry periods, mainly for Morocco and western Algeria. On the opposite, only a few significant trends are detected for heavy precipitation indices. The NAO and MO patterns are well correlated with precipitation indices describing precipitation amounts, the number of dry days and the length of wet and dry periods, whereas heavy precipitation indices exhibit a strong spatial variability and are only moderately correlated with large scale atmospheric circulation patterns.