



Trends in temperature extremes in Morocco

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A heat wave is a period of excessively hot weather; severe heat waves can cause catastrophic crop failures, thousands of deaths and widespread power outages due to increased use of air conditioning. The heat wave in Maghreb during the summer of 2012 had bad consequences on the agricultural sector in Morocco that was hit by losses of 12 million Euros for poultry farmers. The aim of this study was to analyze the trends in extreme temperature during the last decades in two different regions: the Bourgreg in the North and the Tensift in the South of Morocco. Such analyses can help improve our understanding of local natural and anthropogenic climate variability. We identified extreme temperature events, using percentile thresholding (the 95th (5th) percentile for hot (cold) events). We studied their frequency, occurrence and their correlations with the North Atlantic Oscillation (NAO) and the Mediterranean Oscillation (MO) indexes using the Kendall's coefficient. We used daily maximum and minimum temperature series recorded by four meteorological stations on the full period of availability and also on the period common to all the series (1983-2009). Temperature datasets of the meteorological stations of Rabat-Sale on the coastline of the Bouregreg basin, Kasba-Tadla from the inland, Safi on the coastline of the Tensift basin and Marrakech from the inland were used.

To deal with uncertainties in data, the study period for each time series was chosen after applying criteria for the elimination of datasets with several missing data. According to the Mann-Kendall test, most of the observed trends during the common period of data (1983-2009) are not statically significant; this may be due to the shortness of this period compared to full lengths records available at each station. Main conclusions focus on the results obtained over the full period available in each station. Most of the estimated trends in seasonal mean maximum and minimum temperature have positive magnitudes; these were estimated using the Sen's slope approach. The trend magnitudes in both basins are of the same order, no discernible spatial trend appears in the two datasets, however the number of stations considered is small so it reduces the possibilities of regional interpretations. Changes in cold events are larger than those for warm events. The southern region (Tensift) is the most affected with the changes of the temperature regime. The Kendall's coefficient of correlation is significant between the extreme temperature events during the summer and the MO index while the circulation related to the NAO doesn't affect recorded extreme events.

The results of this study highlight uncertainties in the response of the small scale regions to the recent global warming, this response may depend on the region characteristics and that emphasize the need for more regional studies. It would be worth while making such a study on other areas from Morocco or North Africa, if more long daily data records were to be recovered.