Abstract

The scientific community is interested in the impact of climate change on past and future evolution of precipitation, especially at the regional scale, and relations with the different types of atmospheric circulation. However in Algeria, although many studies have been conducted on the temporal evolution of average rainfall at region or watershed scale, there are still very few works that are interested in the daily rainfall evolution especially extremes. Explaining rainfall variability in Northern Algeria and analyzing their future evolution remain to be explored.

So this thesis has been conducted in this sense for a better understanding of climate variability of northern Algeria, and its relations with major regional and global climate signals.

This work aims on first step to analyze the variability of average and daily rainfall of northern Algeria over the period 1940-2010. The second step is to look for relationships between rainfall variability and the different modes of general atmospheric circulation. Then, in a third stage regional climate models are evaluated to test their ability to reproduce rainfall variability at different time scale, and simulate future changes of rainfall to the end of the 21st century.

Trend and breaking tests showed a significant decrease of annual rainfall in the northwest of Algeria associated to a reduction of rainfall in winter and spring. The analysis of daily rainfall indices corresponding to the frequency of rainy days per percentile (5, 10,25, 50, 75, 90, 95, 99%) and rainfall Class (1-5, 5-10, 10-20, 20-50, ≥50mm) showed that the decline in rainfall has affected mostly the 10-20mm rainfall class. While the daily rainfall intensity does not show a significant change. It also appears that temporal evolution of extreme events has not changed significantly during the study period.

Climate indices of four atmospheric circulation patterns of North Atlantic Oscillation (NAO), El Nino SouthenOscillation (ENSO), Mediteranean Oscillation (MO), and WestMediteranean Oscillation(WeMO) were correlated with annual and monthly rainfall and daily rainfall indices. It appears that El Nino Southen Oscillation and Mediteranean Oscillation are the dominant circulation patterns explaining the rainfall variability of northern Algeria, particularly the North-West of Algeria characterized by a significant reduction in rainfall.

At the 1961-2000 control period, comparison of the observed seasonal and extreme precipitation to outputs of 10 regional climate models of ENSEMBLESproject, using the bias method , allowedto select the CNRM, CHMI ETHZ and GKSS as the most performant models for Northern Algeria. These models simulate a decrease in rainfall at 2021-2050 period which will worsen at the 2070-2099 horizon, especially in winter and spring.

Keywords: rainfall, extremes, climate indices, regional climate models, Algeria