Geophysical Research Abstracts
Vol. 14, EGU2012-13844-2, 2012
EGU General Assembly 2012

Precipitation variability and future projections for water resources management in Tunisia Northern Coastal basins

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Northern Tunisia is the rainiest part of the country. This is the reason why the surface water resources management scheme of Tunisia is principally focused on that area. The strategic situation of the study area, with respect to surface water resources, encourages the investigation of the climate change impacts as projected by climate models. The goal of this study is first to compare the observed precipitation with climate model outputs, and then to evaluate the future changes projected by the models. The study area is subdivided into three regions: the transboundary Medjerda basin, the northern coastal basins (Zouara, Sidi El Barrack, Lake Ichkeul basins) and the eastern coastal basins (Cap-Bon region and wadi Meliane basins). Rainfall data are collected in this area since the late 19th century. A data base provided by the Tunisian hydrological service (DGRE) is including 388 stations with monthly precipitation data over the period 1961-2000. Recent advances in downscaling have provided regional climate model (RCM) simulations at a coarser resolution than Global climate models (GCM). However there is a need to validate RCM outputs with respect to observed precipitation data before using them to make future projections. For that purpose, an ensemble of RCM simulations provided by the European Union–funded project ENSEMBLES (www.ensembles-eu.org) are used. Six RCM models runs (CNR_ARPEGE, DMI_ARPEGE, DMI_BCM, ICT_ECHAM, SMH_BCM, SMH_ECHAM) are tested for a control period (1961-2000) and two projection periods (2011-2050 and 2051-2090).The models efficiency in reproducing seasonal precipitation amounts and variability over the study domain is evaluated. A 1-km monthly precipitation grid is first obtained through the interpolation of rainfall observations during the period 1961-2000 with kriging techniques. Monthly precipitation series averaged over the three great regions are built for comparison for the control period. The RCM outputs are evaluated with respect to the annual precipitation cycle and rainfall frequency distribution using robust statistics over the 3 basins. For the control period, features of the seasonal regimes are well reproduced by all models. It is found that models underestimate seasonal precipitation in average by 20%. The discrepancy between model outputs and observations depends on the season. For the future, in summer and autumn the different model projections are not in agreement. However, for winter and spring, all the models are projecting a significant decrease in the median of the seasonal distributions of precipitation over the three regions.