Geophysical Research Abstracts
Vol. 18, EGU2016-8141, 2016
EGU General Assembly 2016

Future water availability in North African dams simulated by high-resolution regional climate models

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In North Africa, the countries of Morocco, Algeria and Tunisia are already experiencing water scarcity and a strong interannual variability of precipitation. To better manage their existing water resources, several dams and reservoirs have been built on most large river catchments. The objective of this study is to provide quantitative scenarios of future changes in water availability for the 47 major dams and reservoirs catchments located in North Africa. An ensemble of regional climate models (RCM) with a spatial resolution of 12km, driven by different general circulation models (GCM), from the EuroCORDEX experiment have been considered to analyze the projected changes on temperature, precipitation and potential evapotranspiration (PET) for two scenarios (RCP4.5 and RCP8.5) and two time horizons (2040-2065 and 2065-2090). PET is estimated from RCM outputs either with the FAO-Penman-Monteith (PM) equation, requiring air temperature, relative humidity, net radiation and wind, or with the Hargreave Samani (HS) equation, requiring only air temperature. The water balance is analyzed by comparing the climatic demand and supply of water, considering that for most of these catchments groundwater storage is negligible over long time periods. Results indicated a future temperature increase for all catchments between +1.8° and +4.2°, depending on the emission scenario and the time period considered. Precipitation is projected to decrease between -14% to -27%, mainly in winter and spring, with a strong East to West gradient. PET computed from PM or HS formulas provided very similar estimates and projections, ranging between +7% to +18%. Changes in PET are mostly driven by rising temperatures and are greatest during dry summer months than for the wet winter season. Therefore the increased PET has a lower impact than declining precipitation on future water availability, which is expected to decrease by -19% to -33% on average.