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Climate Projections over Mediterranean Basin under RCP8.5 and RCP4.5 emission scenarios

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In the study, 50 km resolution downscaled results of two different Earth System Models (ESM) HadGEM2-ES and MPI-ESM with regional climate model of RegCM are used to estimate present and future climate conditions over Mediterranean Basin. The purpose of this study is to compare the projections of two ESMs under Representative Concentration Pathways 4.5 (RCP4.5) and 8.5 (RCP8.5) over the region of interest seasonally and annually with 50 km resolution. Temperature and precipitation parameters for reference period (1971-2000) and future (2015-2100) are analyzed. The average temperature and total precipitation distributions of each downscaled ESM simulations were compared with observation data (Climate Research Unit-CRU data) to explore the capability of each model for the representation of the current climate. According to reference period values of CRU, HadGEM2-ES and MPI-ESM, it is seen that both models are warmer and wetter than observations and have positive temperature biases only around Caspian Sea and positive precipitation biases over Eastern and Central Europe. The future projections (from 2015 to 2100) of HadGEM2-ES and MPI-ESM-MR simulations under RCP4.5 and RCP8.5 emission scenarios are compared with reference period (from 1971 to 2000) and analyzed for temperature and precipitation parameters. The downscaled HadGEM2-ES forced by RCP8.5 scenario produces higher temperatures than the MPI-ESM-MR. The reasons of this warming can be sensitivity of HadGEM2-ES to greenhouse gases and high radiative forcing (+8.5 W/m2). On the other hand, MPI-ESM produce more precipitation than HadGEM2-ES. In order to analyze regional responses of the climate model chains, five main regions are selected which are Turkey, Central Europe, Western Europe, Eastern Europe and North Africa. The average biases of the HadGEM2-ES+RegCM and MPI-ESM-MR+RegCM model chains are also calculated for temperature and precipitation variables, and future expectations in each region are discussed under RCP4.5 and RCP8.5 scenarios. According to the regional analysis, North Africa is the warmest region for HadGEM2-ES and MPI-ESM-MR, and Central Europe warms up similar to North Africa in MPI-ESM-MR coupled simulations under both RCPs. In addition, Eastern Europe is expected to be the wettest region in both models and in both emission scenarios. On the other hand, the driest conditions are expected over Western Europe for MPI-ESM-MR and over Turkey for HadGEM2-ES under RCPs.