**Impacts of Climate Change on the Reservoir Storage and Irrigation Water Demands in a Mediterranean Watershed during the 21st Century**

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**Abstract**:

Water storage requirements in the Mediterranean region are strongly affected by the local geography and climate conditions. In this study, potential impacts of climate change on the water balance of the main storage structure, a reservoir, in the Gediz Watershed under Mediterranean-climate were assessed throughout the 21st century. A monthly dynamic water balance model was developed to simulate the historical and future water storage in the reservoir. The model was driven by fine-resolution dynamically downscaled climate projections of the 21st century from four GCMs (General Circulation Models) from the CMIP5 (Coupled Model Intercomparison Project Phase 5) archive, namely CCSM4, GFDL-ESM2M, HadGEM2-ES, and MIROC5, under two different representative concentration pathway emission scenarios (RCP4.5 and RCP8.5), and the hydrologic data simulated from these downscaled climate projections. The reservoir outflows including the reservoir evaporation and downstream irrigation water demand were also modeled using the projected climate variables. The net irrigation water requirement of the crops in the irrigation system, seasonal evapotranspiration rates, and reservoir evaporation rates were estimated by the Penman-Monteith Evapotranspiration method (FAO-56 Method). The study investigates whether the future water supply from the reservoir will be sufficient to meet the future irrigation water demand for the years from 2017 to 2100. The results show that under all eight modelled climate change projections statistically significant increasing trends for the annual irrigation water demand throughout the 21st century are expected. Higher evapotranspiration rates are predicted under the ensemble average of RCP8.5 emission scenario projections, compared to that of the RCP4.5 emission scenario projections. Although the total monthly volumes of each water balance component are expected to change from the historical period to the projected future periods, their contribution to the water balance of the reservoir changes minimally, except for the months of October and November. Finally, future climate change under the abovementioned emission scenarios is expected to affect the reservoir water availability and its variability, especially during the irrigation seasons when higher water demands are expected. These impacts indicate the importance of sustainable water resources management in the region to be able to provide sufficient irrigation water from reservoirs, and to sustain agricultural productivity under projected water limitations due to climate change.