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How much water do we need for irrigation under Climate Change in the Mediterranean?

Marianela Fader (2), Bondeau Alberte (1), Cramer Wolfgang (1), Decock Simon (2), and Shi Sinan (2)

(1) Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale (IMBE), Aix-Marseille Université, CNRS IRD UAPV, Technopôle Arbois-Méditerranée, Bât. Villemin – BP 80, F-13545 Aix-en-Provence cedex 04, France, (2) OT-Med, Technopôle Arbois-Méditerranée, Bât. Villemin – BP 80, F-13545 Aix-en-Provence cedex 04, France

Anthropogenic climate change will very likely alter the hydrological system of already water-limited agricultural landscapes around the Mediterranean. This includes the need for, as well as the availability of irrigation water. On top of that Mediterranean agroecosystems are very likely to be under strong pressure in the near future through changes in consumer demands and diets, increasing urbanization, demographic change, and new markets for agricultural exportation.

As a first step to assess the water demand of the agricultural sector, we use an ecohydrological model (the Lund-Potsdam-Jena managed land model, LPJmL) to estimate current and future irrigation water requirements of this region, considering various climate and socio-economic scenarios. LPJmL is a process-based, agricultural and water balance model, where plant growth is ecophysiologically coupled with hydrological variables. For these simulations, the model was adapted to the Mediterranean region in terms of agrosystems as well as crop parameters, and a sensitivity analysis for the irrigation system efficiency was performed.

Patterns of current irrigation water requirements differ strongly spatially within the Mediterranean region depending mainly on potential evapotranspiration, the combination of crops cultivated and the extension of irrigated areas. The simulations for the future indicate that the Mediterranean may need considerable additional amounts of irrigation water. However, the regional patterns differ strongly depending on changes in length of growing periods, changes in transpirational rate (temperature and precipitation change, CO_2-fertilization), and the consideration of potential improvements in irrigation system efficiency.