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Climate-driven local assessment of future irrigation requirements and available water resources in North-West Italy

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The impact of climate change on agriculture is a major challenge for the food and water security of next decades. In the future, the Mediterranean area will be particularly exposed to water scarcity, which may lead to significant losses in agricultural yield. Climate projections show that many densely cultivated areas of Southern Europe will suffer decreases of precipitation intensity and frequency, with severe consequences in terms of irrigation requirements, i.e. the amount of water needed to meet the evapotranspirative demand of crops during dry periods. Therefore, the modelling of climate-driven crop water requirements and available water resources is essential to understand future criticalities for agriculture and to adopt proper adaptation strategies.

In this study, the agricultural irrigation requirement was estimated by modeling the daily water balance in the soil, on the basis of evapotranspirative demand and precipitation, over the densely irrigated basin of Demonte, in South Piedmont (Italy). The volumes of irrigation required by local agriculture were calculated for 30 main crops, taking into account the local information of yearly distribution of crops. The available surface water in the basin was compared to the present irrigation requirements, using flow discharge data from the river that feeds the local network of irrigation channels. In order to analyze future scenarios, precipitation and temperature data from five EURO-CORDEX regional climate models were used to estimate the irrigation requirements and the available surface water for the 2035-2055 period, considering multiple RCP scenarios.

Results show that the current available water resources are little enough to meet the irrigation requirements over the Demonte basin for the months of July and August, when most of the cereals reach the maximum growing phase. The climate-driven assessment for the future decades shows that the water required for irrigation will gradually exceed the threshold of available resources, with different degrees of severity depending on the RCP scenario. Moreover, future scenarios highlight a progressive increase in the temporal lag between the period of maximum irrigation requirements (July-August) and the high-flow regime period in the hydrographic network (April-June). As a consequence, most of the surface freshwater in the Demonte basin will not be available for agriculture during summer, when most of the irrigation will be required. Modeling the future scenarios of agricultural water needs and available resources is an important step to understand the future implications of climate change on food production. Moreover, this is a valuable instrument to support proper adaptation strategies, both in terms of agricultural and water management planning policies.