Insights on the trade-offs between climate change-induced dryness and agricultural water use within a water stressed area: The case of Souss basin

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Abstract

The Souss basin is characterized by a semi-arid climate and suffers from a severe deficit, and irrigated agriculture is the primary consumer of water. In addition, Recent climate attributes in Souss is characterized by gradual warming and unpredicted trends in rainfall variability. Climate change is affecting negatively Souss's agriculture through changes in precipitation and temperature with impacts on water availability. Therefore, understanding the agricultural water usage and demands over the basin is essential for adaptation in the water and agriculture sectors, especially that water resources are already scarce in the region. This study aims to assess the climate change impacts on surface water management by analyzing agricultural unmet demand from allocated surface water from reservoirs, including under previous dry episodes. ModSim 8.1, a generic river basin management decision support system (DSS), for water allocation modeling, was selected for that study. Once calibrated and validated over the period from 1990 to 2019 using recorded data about physical processes and hydraulic infrastructures features and management. The simulations succeeded in replicating different deficit episodes at the various irrigated perimeters. The simulation period shows a considerable decrease in the supply levels of the different dams, the supplies of the different dams have decreased during the last years (2012-2019) between 38% and 89% for the different dams of the basin. The differences among different supply sources fluctuate during the simulation period, resulting from changes in the available water inputs to the reservoirs each year. As result, the average total unmet demand for surface water from reservoirs in irrigated areas reached 201 Mm^3 between 1990-2019. The monthly average demand increases by 55% in the dry season, compared to the demands in the rest of the year. The significant amount of unmet demand across all demand sites suggest that demands are satisfied by the withdrawal of water from groundwater resources. The adopted simulation approach has shown to be a useful decision support tool to understand the interaction between water resources use in agriculture and climate change-induced dryness in the Souss basin. Decision makers require reliable tools to represent the basin's various trade-offs in relation to adaptation in agriculture water resources. Thus, additional investigation improving the representation of groundwater/surface water interaction is required to enhance the evaluation of the consequences of different uses at the basin level.

Keywords: Water allocation modelling; ModSim; Agricultural water demand; Souss basin.