Geophysical Research Abstracts
Vol. 15, EGU2013-8552, 2013
EGU General Assembly 2013

Response of durum wheat to water variability under climate change scenarios in southern Sardinia

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Durum wheat is the most important C3 rainfed crop in southern Sardinia, Italy and is highly vulnerable to climate variability. This region has experienced severe drought conditions and problems of competing water demands during the last decades. Within the framework of European (1) and Regional (2) research projects, a study was conducted to evaluate the effects of increased maximum temperature and high rainfall variability on durum wheat yield, as part of an effort to devise strategies for water management and adaptation at the field and catchment scales in southern Sardinia. Towards this goal, the AquaCrop model was calibrated and its predictive performance was tested in the period from 1995 to 2012 using daily meteorological data and durum wheat (CV Creso) yield measurements from the experimental fields of the Agris Research Agency in Ussana (Sardinia, Italy). During the verification period, the model showed a good performance with a significant correlation between observed and simulated yield for durum wheat and a very good estimation of the water stress conditions during the drought period in 1995. Next, four future scenarios of climate change were simulated with AquaCrop to predict wheat yield responses and to investigate water availability for rainfed and irrigated crops for the 30-year periods 2011-2040, 2041-2070, and 2071-2100. The simulated future scenarios show potential improved productivity arising from the increased CO_2 concentration. This positive outlook is however tempered by increased uncertainty and fluctuations in rainfall during the fall and early winter periods (September–December). The possible tradeoffs between these factors, as well as the expected negative effects of increased maximum temperatures, are being further examined.
(1) Climate Induced Changes in the Mediterranean Region (CLIMB), funded by the European Commission 7th Framework Program.
(2) Valutazione degli impatti sul comportamento idrologico dei bacini idrografici e sulle produzioni agricole conseguenti alle condizioni di cambiamento climatico, funded by L7/2007 of the Sardinia Region.