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Modelling long-term sustainability of irrigation practices in semi arid region

Nicolas Guyennon (1), Emanuele Romano (1), and Ivan Portoghese (2)

(1) National Research Council, Water Research Institute, Rome, Italy, (2) National Research Council, Water Research Institute, Bari, Italy

The impact of climate change on groundwater or surface water resources can be investigated through models simulating the hydrological and hydrogeological processes at the atmosphere/surface water/soil/groundwater interfaces. However, in aquifers extensively exploited for irrigation purposes, the water demand variability related to actual water availability, as well as to variation of the crops, and associated supply management options should be considered to evaluate impacts. Moreover, in the case of a multi-resources water supply system it is necessary to develop models able to simulate also the variation of the total demand distribution among each resource.
We proposed a modeling scheme able to simulate an integrated multiple-resources and multiple-purposes water supply system by merging distributed crop water requirements with surface reservoir and ground water mass balance, considering resources availability and management, with emphasis on irrigation practices.
The overall framework has been implemented for the case study of the Fortore water supply system, a semi-arid region in south Italy. It permits to simulate the conjunctive use of the water from the Occhito artificial reservoir (160 Mm3) and from groundwater to supply domestic, industrial and agricultural demand. The overall model successfully reproduces the Occhito dam level variability (both seasonal and inter-annual) as well as the observed groundwater depletion.
The proposed model was forced by 60 years of meteorological observation to test the long-term sustainability of the current irrigation practices and has been extended to the next decades under a1b IPCC scenario using three ENSEMBLES member to test adaptation strategies.