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Assessing hydrological drought risk for the irrigation sector in future climate scenarios: lessons learned from the Apulia case study (Italy)

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Climate change is already affecting the frequency of drought events which may threaten the current stocks of water resources and thus the availability of freshwater for the irrigation. The achievement of a sustainable equilibrium between the availability of water resources and the irrigation demand is essentially related to the planning and implementation of evidence-based adaptation strategies and actions. In this sense, the improvement (of existing) and the development of (new) appropriate risk assessment methods and tools to evaluate the impact of drought events on irrigated crops is fundamental in order to assure that the agricultural yields are appropriate to meet the current and future food and market demand. This study evaluates the risk of hydrological drought on the irrigated agronomic compartment of Apulia, a semi-arid region in Southern Italy. We applied a stepwise Regional Risk Assessment (RRA) procedure, based on the consecutive analysis of hazards, exposure, vulnerability and risks, integrating the qualitative and quantitative available information.
Future climate projections for the timeframes 2021-2050 and 2041-2070 were provided by COSMO-CLM under the radiative forcing RCP4.5 and RCP8.5. The run-off feeding the water stocks of the most important irrigation reservoirs in Apulia was then modeled with Arc-SWAT. Hence, the hazard analysis was carried out in order to estimate the degree of fulfillment of actual irrigation demand satisfied by water supply of different reservoirs in future scenarios. Vulnerability of exposed irrigated crops was evaluated depending on three factors accounting for crop yield variation vs water stress, water losses along the irrigation network, diversification of water supply.
Resulting risk and vulnerability maps allowed: the identification of Reclamation Consortia at higher risk of not fulfilling their future irrigation demand (e.g. Capitanata Reclamation Consortia in RCP8.5 2041-2070 scenario); the ranking of most affected crops (e.g. fruit trees and vineyards); and finally, the characterization of vulnerability pattern of irrigation systems. Major achievements included the definition of a portfolio of science-driven adaptation strategies to reduce the risk pattern at both agronomic level (preferring crops with low vulnerability score, as olive groves) and at structural level (differentiating the water stocks and supplies and reducing losses and inefficiencies).