

EGU2020-21993

<https://doi.org/10.5194/egusphere-egu2020-21993>

EGU General Assembly 2020

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Building quantitative scenarios of irrigation under climatic and anthropogenic changes in the mediterranean area: application to Morocco

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In a context of major changes (climate, demography, economy, etc.), the Southern Mediterranean area faces serious challenges with intrinsically low, irregular and continuously decreasing water resources. A method for translating a narrative scenario of irrigation water requirements into a quantitative scenario is presented. At first, we propose to describe the Irrigation Water Requirements (IWR) of any area by a single equation. IWR depends on climate (ET₀, Rainfall), crop development estimated from remote sensing time series (crop coefficient/NDVI relationships), and four efficiencies parameters. In a second part, a reference model of the crop coefficient monthly cycle () is proposed by empirically relating to rainfall and NDVI. Three variations of the model are compared in order to make a projection until 2050 based on downscaled climate change scenarios. The reliability of the model depends on the representativeness of the calibration period: It is considered to be high at the beginning of the simulation (RMSE below 0.1), but it deteriorates as the calibrating period gets shorter compared to the objective period: $r^2= 0.5$, RMSE = [0.1-0.14], stderr = [0.02-0.03] by 2050. An alternative scenario is built upon the reference by interpreting the narrative as bending points. Finally, the examination of irrigation water demand until 2050 suggests that the difference between the two climate scenarios is very small (<2%), while the two proposed agricultural scenarios are strongly contrasted both spatially and in their impact on water resources.