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# Vulnerability assessment for climate adaptation planning in a mediterranean basin

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In the context of climate uncertainty, planning for resilient, robust and adaptive water measures to achieve social, economic and environmental objectives, is a challenge.

The aim of this study is to identify critical climatic conditions that cause system failure in a Mediterranean basin in order to evaluate vulnerabilities and design robust and adaptive measures of water supply. The methodology employed adopts a stress test under non-stationary climatic conditions consisting of: 1) generation of meteorological scenarios, by using a weather generator, 2) generation of hydrological scenarios by using a hydrological model, and 3) evaluation of system performance by using a water resource system model whose outcomes are used to identify climatic vulnerabilities .

Meteorological scenarios are built using, first, a weather generator at the sub-basin scale that generates synthetic precipitation (P) and temperature (T) time series at annual scale by using autorregressive models to extract low-frequency signals. Afterwards, these series are disaggregated to the monthly scale by the method of fragments. Finally, climate change modifications are introduced to alter weather variables outside of the range of historical variability. Changes in the precipitation monthly mean ranged from -30% to +30%, using increments of 15% (5 increments). The coefficient of variation of monthly precipitation changed from -30% to +30%, using increments of 30% (3 increments). A quantile mapping method altered the distribution of monthly precipitation. For temperature, shifts in the monthly mean ranged from 0ºC to 3ºC by increments of 1ºC (4 increments). An standard additive method was used for altering temperature distribution. The combination among modifications led to a total of 60 (5 x 3 x 4) climate change scenarios to consider.

This methodology is applied to the Serpis River basin, which has an area of 752.8 km2 and it is regulated by one reservoir whose main function is water supply to agriculture. A total of 434 generation runs per scenario were developed in MATLAB® in order to explore model uncertainty.

Potential evapotranspiration (ETP) time series were estimated from T by using a periodic factor previously obtained from historical data and using Fourier series method. A hydrological semi-distributed model (Temez model) was employed to transform meteorological data into

hydrological discharges.

A water resource system model built using the GAMS software (General Algebraic Modeling System) was applied to evaluate the performance of the river network system and to identify critical conditions for allocation reliability. Identification of adaptation actions was based on future risk and the likelihood of future conditions that was defined by a high convergence in the GCM predictions from CMIP6.