

Climate change impacts on sustainable management of surface water reservoir systems in Portugal

Summary

In southern Portugal, the dry summers together with low precipitations and high temperatures highlight the importance of surface water reservoirs, built mainly for water storage and to smoothing the inter-annual surface runoff variability.

The reservoirs often play an important role in mitigating water supply problems. However, the implications of climate change are not always considered in the reservoir planning and management. This study will aim to address this challenge in different selected watersheds in southern Portugal that might be more vulnerable to future water scarcity due to global warming.

The study will analyze whether or not the shortage of water supply can be effectively addressed through the existing reservoirs considering future climate projections or the construction of new reservoir systems might be required. The hydrological model Soil and Water Assessment Tool (SWAT) and modified Sequent Peak Algorithm (SPA) will be applied to simulate the storage capacity of reservoirs. The simulation with modified SPA will apply a Monte-Carlo technique. The performance of water resource systems will be evaluated and measured by indicators (e.g., reliability, vulnerability, resilience, sustainability, and drought-risk index indices) which are based on the specific aspects of an unsatisfactory operation during water sortage periods. Different General Circulation Models (GCM) for a few scenarios (e.g., RCP 2.6, 4.5, and 8.5) will be statistically downscaled and bias-corrected with ground observations. The expected future overall variations in temperature and precipitation will be evaluated using different climatic models. Moreover, the general variation of annual and seasonal surface runoff will be estimated and discussed. SWAT and modified SPA simulations will suggest the required storage capacity under current climate conditions and under climate change scenarios. The estimated performance criteria will be used to identify sustainable solutions for water resources management. As a result, the solution to water supply problems in this region adopted taking only present-day climate into account, might show to be inefficient under future climate conditions. Hence, possible climate change adaptation and mitigation strategies will be discussed for water management of multipurpose reservoirs.

Keywords

Climate change, water supply, modified SPA, RCP scenarios, sustainability index, adaptation strategies.



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