



Optimizing the operating rule of a controversial interbasin water transfer: the Tagus-Segura aqueduct (Spain)

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Interbasin water transfers (IBWT) are often conceived as solutions to balance freshwater's uneven spatial and temporal distribution. Climate change, increasing water demand and water quality deterioration are expected to further increase the importance of water transfer schemes in future. At the same time, IBWT are often controversial and raise concerns about their social, environmental and economic impacts.

The Tagus-Segura aqueduct (TSA) in Spain is among the major IBWT projects existing in the world. It is designed to transfer a maximum of 650 hm³/year from the Entrepeñas and Buendía dams in the Tagus headwaters river basin to the Segura river basin for irrigation and urban water supply purposes. The reduction of the natural runoff registered since the 80ies, the implementation of a non-optimal operating rule and, finally, the degradation of the Tagus river ecosystems have generated strong, still unsolved tensions between donor and receiving regions.

In this study, we employ the Evolutionary Multiobjective Direct Policy Search (EMODPS) to optimize the operation of the TSA with respect to four potentially conflicting objectives: the Tagus (i) and the Segura water demands (ii); hydropower production downstream of the Entrepeñas and Buendía dams (iii) and the social-economic benefit of the population living on the shores of the reservoirs (iv). The release decision parameters and the operating rule parameters are jointly optimized, thus allowing the exploration of trade-offs between objectives and the definition of an operating rule that could benefit all the stakeholders involved. We tested the optimization under several scenarios, with the aim to assess the effect of the implementation of different environmental flows in the Tagus river on the TSA operations.

By applying a state-of-art method such as the EMODPS to the TSA case, this work contributes to the intense ongoing debate on the present and future of this controversial water transfer in Spain. We also explore the potential of the EMODPS approach to guide the design of efficient and sustainable operating rules of water transfers, with the ultimate goal of mitigating tensions between recipient and donor regions and seeking to fulfil the environmental needs in the donor basin.

