Geophysical Research Abstracts
Vol. 19, EGU2017-17372, 2017
EGU General Assembly 2017

A system dynamics approach for integrated management of the Jucar River Basin

Adria Rubio-Martin, Hector Macian-Sorribes, and Manuel Pulido-Velazquez
Research Institute of Water and Environmental Engineering (IIAMA), Universitat Politècnica de València, Valencia, Spain

System dynamics (SD) is a modelling approach that allows the analysis of complex systems through the mathematical definition of variables and their relationships. Based on systems thinking, SD is suitable for interdisciplinary studies of the management of complex systems. Over the past 50 years, SD tools have been applied to fields as diverse as economics, ecology, politics, sociology and resource management. Its application to the field of water resources has grown significantly over the last two decades, facilitating the enhancement of models by adding social, economic and ecological components. However, its application to the operation of complex multireservoir systems has been very limited so far.

In this contribution, we have developed a SD model for the Jucar River Basin, one of the most vulnerable basins in the western Mediterranean region with regard to droughts. The system has three main reservoirs, which allows for a multiannual management of the storage that compensates the highly variable streamflow from upstream. Our SD model of the Jucar River Basin is able to capture the complexity of the water resource system. The model developed consists of five interlinked subsystems:

a) Topology of the system network, including the 3 main reservoirs, water seepage and evaporation, inflows and catchments.
b) Monthly operating rules of each reservoir. The rules were derived from the expert knowledge eluded from the operators of the reservoirs.
c) Monthly urban, agricultural and environmental water demands.
d) State index of the system and drought mitigation measures triggered depending on the state index.
e) Mancha Oriental aquifer and stream-aquifer interaction with the Jucar River.

The comparison between observed and simulated series showed that the model provides a good representation of the observed reservoir operation and total deficits. The interdisciplinary and open nature of the methodology allows to add new variables and dynamics to the model that are rooted on non-physical system components, including management (operating rules), political (drought mitigation measures), and social (population growth) aspects. The structure-behaviour link of SD models allows analysis of how changes in one part of the system might affect the behaviour of the system as a whole. This allows testing how the system will respond under varying sets of conditions, including climate change scenarios.

ACKNOWLEDGEMENTS
This study has been supported by the IMPADAPT project (CGL2013-48424-C2-1-R) with MINECO (Ministerio de Economía y Competitividad, España) and FEDER funds, the European Union's Horizon 2020 research and innovation programme under the IMPREX project (GA n. 641.811), and the Garantía Juvenil grants of the Ministerio Empleo y Seguridad Social, Spain.