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A system dynamics model of human-water interaction in anthropogenic droughts

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Modelling is set to be a key part of socio-hydrology's quest to understand the dynamics and long-term consequences of human-water interactions. As a subject in its infancy, still learning the questions to ask, conceptual models are of particular use in trying to understand the general nature of human-water systems. The conceptual model of Di Baldassarre et al. (2013), which investigates human-flood interactions, has been widely discussed, prompting great steps forward in understanding and coverage of socio-hydrology. The development of further conceptual models could generate further discussion and understanding. Flooding is one archetypal example of a system of human-water interaction; another is the case of water stress and drought. There has been a call to recognise and understand anthropogenic drought (Aghakouchak et al. 2015), and so this study investigates the nature of the socio-hydrological dynamics involved in these situations.

Here we present a system dynamics model to simulate human-water interactions in the context of water-stressed areas, where drought is induced via a combination of lower than usual water availability and relatively high water use. It is designed based on an analysis of several case-studies where recent droughts have occurred, or where the prospect of drought looms. The locations investigated are Spain, Southeast Brazil, Northeast China and California. The numerical system dynamics model is based on causal loop, and stocks and flows diagrams, which are in turn developed from the qualitative analysis of the different cases studied. The study uses a comparative approach, which has the advantage of eliciting general system characteristics from the similarities between cases, while using the differences to determine the important factors which lead to different system behaviours.

References:
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