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Adding the human dimension to drought: an example from Chile

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Drought and water scarcity are important hazards and can lead to severe socio-economic impacts in many regions of the world. Given the interlinked interactions and feedbacks of hydrological droughts and their impacts and management, we need tools to evaluate these complexities and effects on the availability of water resources. Here we use a real-world case study of the Huasco basin (Northern Chile) in which we quantify the influence of human activities on hydrological drought signals. In this arid region, Andean snowmelt provides water essential for users, with agriculture acting as the main water consumer (85% of total). An increasing water demand from different water sectors (agriculture, mining, and domestic water usage) has increased pressure on available water and its management. Consequently, the Santa Juana dam was built by 1995 to increase irrigation security for downstream users, and recent management and restrictions have been established with the objective to limit impacts of hydrological droughts across the basin.

The feedbacks between water availability and water management are explored for this water stressed region in Chile. Hydro-meteorological (e.g. precipitation, temperature, streamflow, reservoir levels) variables have been analysed to assess trends and drought patterns. Data over the past three decades has indicated a decrease in surface water supply, with the basin entering a situation of water scarcity during the recent multiyear drought (2007 – to-date), partly caused by meteorological drought and partly by abstraction. During this period, water supply failed to meet the demands of water users, resulting in the implementation of water restrictions. As well as the necessary continuous hydro-meteorological data, here we used information on human water users and scenario modeling, allowing for the analysis and quantification of feedbacks. This work highlights the importance of local knowledge, especially in understanding water laws, rights, regulations and therefore interpretation of the data and results.

We will repeat the analysis done in Chile in a diverse series of case studies across the world to reflect different natural and human influences on the water cycle. This will enable an increased understanding of our influence on water resources and the feedbacks involved, which may be both positive and negative. Ultimately, this research will develop a methodology for identifying and quantifying human activities and use this information in combination with water management modeling and forecasting for effective drought early warning and risk management.