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## Cooperation under conflict: a framework for participatory modeling under severe social and climate change pressures

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Hydrological modeling tools are usually used to obtain broad scale understandings of ecological and hydrological interconnections in a basin. They have also been presented as useful to support collaborative decision processes by visually displaying hydrological systems connections, uncertainties and gaps, as well conflicting preferences over water management strategies. However, many challenges remain at capturing and communicating the complexity of couple human-hydrological systems. The Aculeo basin in Chile is an internationally publicized case due to the disappearance of a 12 km<sup>2</sup> lake that led to increasing conflicts over water scarcity and the cause of the catastrophe. A traditional hydrological model study and a separate collaborative agreement process were implemented in parallel to find answers and discuss solutions to the water scarcity crisis. The model initially designed to answer a single water balance question, was finally turned in a question-driven socio-hydrological modeling process used to explore a diversity of uncertainties emanating from the collaborative agreement process. Model development and some results of this integration are presented, displaying how science-policy process forces adjusting model structure, challenging official information and searching for alternatives sources and approaches to find answers. This research presents how a hydrological model can be used as a dynamic framework to address poor knowledge on the system behavior, disagreements on the water crisis causes and contradictions on the management options proposed. However, it also shows that participation can be an instance used by stakeholders to question and challenge the rigidity, scope and accuracy of the model information being presented. Therefore, flexible approaches and research agendas should support the exploration of this type of synergies towards more collaboration and production of useful and legitimate socio-hydrological models.