



## **The risk of water scarcity at different levels of global warming**

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Water scarcity is a threat to human well-being and economic development in many countries today. Future climate change is expected to exacerbate the global water crisis by reducing renewable freshwater resources different world regions, many of which are already dry. Studies of future water scarcity often focus on most-likely, or highest-confidence, scenarios. However, multi-model projections of water resources reveal large uncertainty ranges, which are due to different types of processes (climate, hydrology, human) and are therefore not easy to reduce. Thus, central estimates or multi-model mean results may be insufficient to inform policy and management. Here we present an alternative, risk-based approach. We use an ensemble of multiple global climate and hydrological models to quantify the likelihood of crossing a given water scarcity threshold under different levels of global warming. This approach allows assessing the risk associated with any particular, pre-defined threshold (or magnitude of change that must be avoided), regardless of whether it lies in the center or in the tails of the uncertainty distribution. We show applications of this method on the country and river basin scale, illustrate the effects of societal processes on the resulting risk estimates, and discuss the further potential of this approach for research and stakeholder dialogue.