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Identifying and characterizing drought and water scarcity risk: usability of global data and models

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The availability of freshwater resources is pivotal in daily life, as it is used to feed populations, to drive local and global economies, and to sustain terrestrial and aquatic habitats. Although water is abundant globally, much of it is not directly available for human use nor environmental needs. As a result many regions are currently experiencing drought and water scarcity. The impacts of drought and water scarcity are numerous and include crop failures, food shortages and famines, economic losses as a result of the disruption of business activities, and the degradation of terrestrial and aquatic ecosystems. This makes drought and water scarcity one of the three global risks of highest concern, and it is expected that water scarcity will be one of the most pressing global issues in the near future, both in terms of its likelihood of occurrence and impact.

An urgent need exists to develop effective strategies for coping with drought and water scarcity. In order to make sound decisions, a well-rounded understanding of the mechanisms that drive drought and water scarcity on both the global and regional scales is needed. Driven by the societal and scientific needs to correctly model drought and water scarcity, as well as their underlying driving forces, a fair amount of research has been carried out lately to represent human activities and their interactions with the hydrological cycle in global hydrological models (GHMs). The use of these GHMs – including the human dimension – is widespread, and applications range from water resources and natural hazard and risk related research to contributions that feed into global policy making. Global users like the. Red Cross Red Crescent, World Bank, GFDRR, UN and IPCC rely more and more on GHMs and global data to conduct first-order assessments as data, time or resources are in short-supply for setting-up and executing multiple in-depth local studies. Being able to providing sufficient insight in the capacity of such models to resemble real-world hydrological conditions is key in these developments.

In this contribution we reflect on the latest developments in the field of modelling drought and water scarcity at the global and regional scales: I) We show how drought and water scarcity may (not) be interrelated in various parts of the globe; II) We discuss the influence of socioeconomic and hydro-climatic drivers on drought and water scarcity, in both historical and future time periods; II) We evaluate the ability of global hydrological models to correctly represent fresh water resources and to identify historical drought and water scarcity conditions; and III) We provide an outlook to future research directions in the field of drought and water scarcity modelling at the global and regional scales, identifying a number of emerging topics that future studies may address.