

Drought in the Anthropocene: examples from around the world

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In the current human-modified world, or 'Anthropocene', the state of water stores (soil water, groundwater) and fluxes (river flow) has become dependent on human actions as well as on natural processes. Hydrological droughts are the result of a complex interaction between meteorological anomalies, land surface processes, and human inflows, outflows and storage changes. Our current inability to adequately analyse and manage drought in many places points to gaps in our understanding of this interaction and to inadequate data and tools to study it in depth. The Anthropocene requires a new framework for drought concepts, definitions and research. To progress the field, the drought conceptual framework needs to be revisited to explicitly include human processes driving and modifying hydrological drought development. Here we will give recommendations for more robust drought definitions in the Anthropocene, distinguishing between climate-induced, human-induced and human-modified hydrological drought. Additionally, our understanding and analysis of drought need to move from single driver (i.e. meteorological anomalies) to multiple drivers (i.e. meteorological anomalies and anthropogenic water abstraction) and from uni-directional (i.e. propagation from driver to drought to impacts on society) to multi-directional (i.e. feedback responses from society that affect drought). Based on literature reviews, our own previous work and current studies done through the Panta Rhei network, we visit example catchments around the world where human and natural drought processes are strongly interrelated. We discuss drought development in relation to natural and human drivers, responses to drought, both positive (i.e. more abstraction aggravating drought) and negative (i.e. water management alleviating drought) feedbacks, with the aim to get a more general understanding about drought in the Anthropocene. Based on the case studies, we identify research gaps and propose analysis approaches for drought in the Anthropocene, requiring qualitative and quantitative data as well as mixed modelling approaches on different scales. We expect this will shape the drought research agenda for the coming years, or even decade.

This work has been developed in the framework of the IAHS Panta Rhei working group "Drought in the Anthropocene".

Keywords: drought, Anthropocene, conceptual framework

