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Learning from catchments to understand hydrological drought (HS Division Outstanding ECS Award Lecture)

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Drought is a global challenge. To be able to manage drought effectively on global or national scales without losing smaller scale variability and local context, we need to understand what the important hydrological drought processes are at different scales. Global scale models and satellite data are providing a global overview and catchment scale studies provide detailed site-specific information. I am interested in bridging these two scale levels by learning from catchments from around the world.
Much information from local case studies is currently underused on larger scales because there is too much complexity. However, some of this complexity might be crucial on the level where people are facing the consequences of drought. In this talk, I will take you on a journey around the world to unlock catchment scale information and see if the comparison of many catchments gives us additional understanding of hydrological drought processes on the global scale.
I will focus on the role of storage in different compartments of the terrestrial hydrological cycle, and how we as humans interact with that storage. I will discuss aspects of spatial and temporal variability in storage that are crucial for hydrological drought development and persistence, drawing from examples of catchments with storage in groundwater, lakes and wetlands, and snow and ice. The added complexity of human activities shifts the focus from natural to catchments with anthropogenic increases in storage (reservoirs), decreases in storage (groundwater abstraction), and changes in hydrological processes (urbanisation). We learn how local information is providing valuable insights, in some cases challenging theoretical understanding or model outcomes.
Despite the challenges of working across countries, with a high number of collaborators, in a multitude of languages, under data-scarce conditions, the scientific advantages of bridging scales are substantial. The comparison of catchments around the world can inform global scale models, give the needed spatial variability to satellite data, and help us make steps in understanding and managing the complex challenge of drought, now and in the future.