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# From droughts to floods in Sub-Saharan regions; spatial and temporal patterns in hydrological response and water quality

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While arid Sub-Saharan African countries are mostly characterised as regions with severe droughts, they also experience rare but extreme flood events. Such periods with severe rainfall provide opportunities for recharge, but also induce water resources pollution from dumping sites, landfills and on-site sanitation, and mobilize and deposit fine sediments that alter dam efficiency and groundwater-surface water relationships. Appropriate water resources management under such extreme conditions is limited by a lack of understanding of the main controls and mechanisms associated with surface and groundwater recharge and point source pollution and transport.

Here, we aimed to gain insights into the dominant processes, controlling factors and interactions affecting surface drainage networks, groundwater recharge and water resources pollution in arid contexts following extreme rainfall. We utilised a unique opportunity to monitor at high resolution the spatial and temporal response of surface and groundwater quantity and quality in the upper Limpopo basin in Botswana during and following the 2017 flood event, which was preceded by a severe drought. Data collection involved general water quantity and quality (pH, EC and t°C) indicators as well as stable isotopes, major ions and trace metals to elucidate water source mixing, lithological controls and contaminations, respectively, across $\sim$ 30 boreholes and locations in the surface water drainage network (including reservoirs). We also combined this new dataset with long term hydrometric data to evaluate this event in a longer-term drought-flood cycle context and explore the role of antecedent drought conditions.

Our results demonstrated large spatial and temporal variability in impacts of flooding following extreme rainfall. Physiographical characteristics were key drivers in determining the magnitude and timescale of response, but major water management infrastructures exerted a dominant control (e.g. the location with respect to a reservoir (upstream vs downstream)). However, the spatial organisation of local land use practices and management approaches (e.g. landfills) seems disconnected from these patterns and may put further pressures on water resources (e.g. via contamination). In combination with the longer-term data analyses these results will contribute to the knowledge base for a more integrated water resources management strategy that considers both drought and flood conditions in arid regions.