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Unravelling socio-hydrological processes behind cascading drought-to-flood disasters

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Future climate projections show a strengthening of the hydrological cycle with more droughts and floods expected in many regions of the world. This means a higher likelihood of cascading drought-to-flood disasters such as the Millennium Drought – Brisbane flooding in Australia or the California drought – Oroville spillway collapse in the US. Droughts allow ample time for impacts and adaptation, which influence hazard, exposure, and vulnerability of a subsequent flood. When we treat the flood risk as independent from the drought this might lead to large underestimations of future risk.

Here, we present the PerfectSTORM project ('STORYlines of futuRe extreMes'). In this project we will study drought-to-flood events to provide the understanding needed to prevent major disasters in the future. We will use a mixed-methods approach based on a combination of qualitative and quantitative storylines of past and future drought-to-flood risk in case studies and extrapolation of this rich case study information to the global scale. Qualitative storylines will be collected with narrative interviews and mental simulation workshops and will be analysed to develop timelines and causal loop diagrams. Quantitative storylines will be developed from timeseries of hydrological and social data that will be analysed to distinguish interrelated drivers and modelled with system dynamics modelling. These storylines will then be combined in an iterative way using innovative data visualisation as a basis for co-creating management solutions.

To generalise our case study understanding, a range of global datasets will be analysed to find global types and hotspots of drought-to-flood events. This information will be combined with the system dynamics model developed in the case studies and a global multi-dimensional possibility space will be developed. This will allow us to explore positive pathways for future management of drought-to-flood events in different parts of the world. The PerfectSTORM project will provide in-depth understanding of the hydrosocial feedbacks and dynamic vulnerability of cascading hazards.