Contribution ID: **14** Type: **60s-Pitch + Scientific Poster**

Capturing Flood Vulnerability using SocioHydrological Flood Risk Models: A data-driven Framework

DoctoralDays 2025

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From dryproofing buildings to installing barriers, private precautionary measures reduce flood losses. Yet their implementation greatly varies with past flood experiences and community risk awareness. Capturing the uptake differences is imperative to understand the evolution of flood adaptation in societies. In this respect, sociohydrological flood risk models (SH-FR) were developed. Based on system dynamics ordinary differential equations are used to link hydrological and societal forces. Owing to the variability in human-flood processes, the application of SH-FR models remains region-specific, limiting generalization and transferability. In my research, I seek to establish a reliable data-driven framework to capture flood-related societal shifts across Germany. I work on developing a deeper process understanding by studying 24 German case studies in order to capture long-term vulnerability trends across regions.
The SH-FR models will be calibrated at the NUTS3 level for the time period between 1950 and 2020 using data from the Global Runoff Data Centre, GFZ post event surveys, and historic data by the HANZE flood archive. Although, this combined data sets represents a valuable resource, it has many limitations, such as data incompleteness and sparseness. The SH FR models will be evaluated using a synthetic data set of 100 regions, that enables tests of performance, sensitivity, and reliability across varied levels of data availability. Insights from the synthetic experiments will inform the application of the SH FR framework to the 24 German case studies, allowing me to assess the approach in both data rich and data scarce contexts.
Through the study of human-flood systems and especially vulnerability dynamics, this work advances the integration of the social component of flood risk with hydrological systems.

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