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Supporting flood risk management by combining integrated modelling and participation

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Abstract: Disasters pose a significant risk to societies across the world. This risk will likely increase into the future, due to climate change, urban development and changing demographics. Understanding the range of potential future conditions, and the associated key uncertainties, is essential in designing disaster risk management strategies that holistically account for these drivers.

For this purpose, we have developed a spatially explicit, dynamic, multi-hazard decision support system called UNHaRMED (Unified Natural Hazard Risk Mitigation Exploratory Decision Support System), which calculates dynamic risk profiles as a combination of hazard, exposure and vulnerability. The aim of UNHaRMED is to better understand current and future risk, and assess the impact of (a combination) of risk reduction options under various future conditions. In order to do so, UNHaRMED consists of coupled models integrated into a policy support system. It allows the user to understand the impact of climate change, socio-economic developments and risk reduction options on the future evolution of exposure, hazard and vulnerability and hence the resulting risk.

We have applied this system in support of integrated flood risk management for the Gawler River in South Australia. In collaboration with six councils working collectively as the Gawler River Floodplain Management Authority and State Government agencies, pre-existing socio-economic scenarios for South Australia have been downscaled to the Gawler River basin through a series of participatory exercises. Using UNHaRMED, the impacts of these scenarios on a set of flood risk indicators has been assessed, along with the effectiveness of selected (portfolios of) risk reduction options under the various scenarios. Additional stakeholder concerns relevant to the selection of risk reduction portfolios were assessed through participatory activities. The information obtained from both assessments was then used as a basis for the design of potential pathways for integrated flood management, as a portfolio of policy actions to achieve risk reduction targets under changing circumstances.

The impact assessment modelling of individual options, as well as portfolios of options, showed that a combination of options with immediate effectiveness in protecting existing assets upon implementation (e.g. structural measures such as a dam raise and floodway implementation), and the ability to avoid future risk due to new developments by limiting development in flood prone areas resulting from zoning regulations, would be desirable. Assessing the options under a range of scenarios, showed that scenarios with larger expected socio-economic development benefit strongly from zoning regulations.

Simulating different pathways, and discussing the benefits, drawbacks and sensitivities of (combinations of) options under various scenarios is supporting local councils and state government in developing a collaborative strategic floodplain management plan accounting for urban development and flood risk, and developing the business case for large structural flood mitigation works.

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