



## **Decision theory based procedure for forward-planning sustainable protection measures based on ensembles of flooding occurrences driven by different pathways of mankind until 2100**

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All over the world, an increasing number of weather-induced damage events can be observed. They are due to enhanced frequencies and intensities of previously scarce weather patterns. This development raises consciousness among federal officials and industry executives responsible for public protection as it increases the risk of casualties and losses to society, ecosystems, socio-economics, infrastructure and therefore poses the question of how the actual level of protection can be sustained in the decades to come.

This study investigates the use of decision theory techniques to support decision-making processes actually used by the authorities responsible for civil protection. In order to accomplish these tasks, we apply the Bernoulli Principle in conjunction with a set of rules to a very comprehensive and complex case study in which the standard decision-making procedures of the authorities have not yielded a clear result.

By employing protection-strategies used by the authorities (retention strategies, linear as well as retention measures) under coherently compiled assumptions concerning their potential future evolution, we employ decision theory methods to address the challenge of how to sustain present-day protection-levels under enhanced flooding-occurrences derived from ensembles of downscaled climate-change projections associated with different future pathways of mankind.

Achieved results highlight the significance of this approach in forward-planning sustainable public protection-strategies and safeguarding critical infrastructure. This is of far-reaching importance because presented approaches allow for the consistent integration of decisive future threat-levels. Anticipatory planning is in fact urgently needed in this context because by now the maintenance of structures in place already makes up a substantial part of the total budget available for public measures.

The achieved findings of this study have already caused discussions by authorities in charge of civil protection on so far utilized decision-making processes. In addition, the intense cooperation with European transport, freight and logistics leaders has allowed us to estimate the implementation of presented strategies with regard to their future cost development. Apart from that results correspond to the recommendations of the Federal Ministry for Sustainability and Tourism (BMNT) regarding the Flood Directive and the publications of the European Union on flood protection.