

EGU2020-12893

<https://doi.org/10.5194/egusphere-egu2020-12893>

EGU General Assembly 2020

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A decision-theoretic approach to sustain public protection under climate change based on ensembles of future hazard developments

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In large parts of the world, an increasing number of damaging events caused by previously rare extreme weather phenomena is being observed. This poses a challenge to those responsible for civil protection of how to sustain current safety levels under accelerated climate change. The aim of this study is to contribute to meeting these challenges by providing methods to determine anticipatory strategies for decades of sustainable protection.

This endeavor requires the identification of weather-related hazard processes on the one, and the establishment of corresponding future hazard development corridors on the other hand. The former, so-called Climate Indices (CIs), are determined by blending damage events and spatiotemporal highly resolved meteorological data for three different regions in the Austrian Alpine region and six different process categories via multivariate statistical analyses. The derivation of hazard development corridors describing future changes in risk landscapes requires ensembles of regional climate projections, in which the occurrence of corresponding CIs is detected.

Results are incorporated into the decision-making process and processed together with experts in civil protection. The determination of optimal, sustainable protection strategies is based on decision-theoretical techniques and the application of the expected utility theory (Bernoulli principle).

The feasibility of integrating hazard development corridors into decision-making processes, as well as the satisfactory implementation of established procedures, is demonstrated by the most comprehensive civil protection project in Austria to date. The results are consistent and show significant differences between near (2036-2065) and far future (2071-2100) time periods, as well as between the threat levels corresponding to the "climate-friendly" path of humanity and those associated with the "business as usual" scenario. The results are in line with the European Floods Directive by ranking linear measures behind resettlement and retention measures.