EGU21-6162, updated on 14 Jun 2021
https://doi.org/10.5194/egusphere-egu21-6162
EGU General Assembly 2021

Analysis of cumulative climate risks and associated impact cascades in Switzerland

Raphael Neukom[1,2], Nadine Salzmann[1], Christian Huggel[2], Veruska Muccione[2], Sabine Kleppek[3], and Roland Hohmann[3]

[1]Department of Geosciences, University of Fribourg, Fribourg, Switzerland (neukom@giub.unibe.ch)
[2]Department of Geography, University of Zurich, Zurich, Switzerland
[3]Federal Office for the Environment (FOEN), Bern, Switzerland

A recent study on 'climate-related risks and opportunities' of the Swiss Federal Office for the Environment (FOEN) identified knowledge gaps and related missing planning tools for risks with low probability of occurrence but potentially very severe impacts for society and/or the environment. Such risks refer in particular to risks triggered by cumulating meteorological/climatic extremes events, which (i) exacerbate through process cascades or (ii) return within shorter time intervals than expected.

To respond to these knowledge gaps and 'blind spots' in climate risks, a collaborative effort including academic and government institutions at different administrative levels is undertaken in order to explore and analyse the potential of such large cumulative, complex risks and to suggest actions needed to manage them in Switzerland. The project is based on two case studies, which are developed in consultation with stakeholders from science, policy and practice at the national and sub-national level.

The case studies analyse risks triggered by meteorological events based on projected and recently published Swiss Climate Scenarios CH2018, considering rare but plausible scenarios where such triggering events cumulate and/or occur in combinations.

The first case study focuses on mountain systems in the southern Swiss Alps, with a potential reduction of the protective capacity of forests caused by extreme drought and heat, and subsequent increase of risks due to multiple natural hazards (fires, snow avalanches, landslides). A semi-quantitative analysis based on expert surveys allows us to estimate the probability of different levels of loss of the protective function caused by the given meteorological trigger event. In a parallel bottom-up approach we perform the analysis with an impacts-perspective and estimate the ecological and climatological thresholds that lead to a partial or complete loss of protective function. Results from the two methods are qualitatively compatible, but the bottom-up approach tends to show a higher risk of damage compared to the more 'classical' top-down analysis for similar meteorological events.

The second case study focuses on cascading impacts in relation with recurrent large-scale drought

and heat events on urban systems and their vulnerable elements. We draw potential process cascades across various socio-economic systems for the urban area of Basel based on a systematic analysis of potentially relevant precedent information from selected past cases worldwide.

Our study is expected to provide important information concerning highly vulnerable systems and elements, their protection, and tipping points towards severe risk amplification. Moreover, we point to feasible risk management approaches and suggest transformative adaptation measures.