Submitted Abstract

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Abstract

Cumulative climatic extreme events pose a substantial risk to society and nature, as they can propagate through various socio-economic systems via process cascades. Adaptation to future climate requires estimations of the likelihood and possible combined impacts of cumulating meteorological/climatic extreme events. Due to the very rare occurrence of low probability events, such estimations remain challenging.

Currently, only a few approaches are available to quantitatively model the manifold cascading effects that may propagate through natural and societal systems after the occurrence of combined climatic extremes (e.g. drought, windstorm). In a pilot study conducted for the Swiss Federal Office for the Environment (FOEN) we adapted methods from the field of civil protection and used expert knowledge to develop impact storylines and estimate probabilities and magnitudes of adverse effects of extreme events on society and ecosystems.

We developed an extensive expert survey to estimate the feasibility of a combined drought event and subsequent cascading hazards leading to the loss of the protective function of forests in the southern Swiss Alps. Twenty-nine experts from science, administration and practice provided quantitative estimates of drought thresholds and damage probabilities induced by two consecutive very dry and warm seasons. Results suggest that the probability of the “no harm” case (i.e. protective function retained) decreases from around 70% for single extreme events (drought, windstorm or bark beetle infestation) to less than 20% for combined effects of drought, windstorm and bark beetle infestation.

A follow up study currently focusses on evaluating the forest protective function against gravitational natural hazards under future climatic conditions and disturbance regimes for a case study in the canton of Grisons, Switzerland. We aim to directly implement and extend the cascading hazard scenarios based on the above-mentioned semi-quantitative approach into an avalanche/rockfall model allowing for an in-depth quantitative screening. Here, we present the results of the survey and report on the progress and challenges of the modelling study.