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Towards operationalizing impact-oriented storm warnings using a natural catastrophe impact model

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Many national weather services are moving from weather warnings to impact-based warnings with the goal to increase the preparedness before an event. Currently, Switzerland's meteorological service MeteoSwiss issues storm warnings based on certain wind speeds thresholds.

Since October 2018, we are implementing a pre-operational prototype of impact-oriented storm warnings at MeteoSwiss. In this presentation, we highlight our methodology and first results from our seamless model chain on the economic impacts of storms. Three partners are involved in this project: MeteoSwiss, ETH Zurich, and the public building insurer of the canton Zurich (GVZ). This science-practice collaboration provides a better knowledge foundation for the operationalization of impact-oriented warnings in a national weather service.

Specifically, our method estimates financial damage to infrastructure up to 5 days in advance on a high-resolution grid of 2km x 2km. We do this by coupling the hazard information, wind gusts provided by MeteoSwiss's ensemble forecast, with exposure data and vulnerability estimates simulated with the natural catastrophe impact model CLIMADA, developed at ETH Zurich. The scientific analysis and model development take place through a joint PhD-Thesis at ETH Zurich and MeteoSwiss. Lastly, the collaboration with the public building insurer of the canton Zurich (GVZ) provides recorded building damages of past storm events. This allows to calibrate and validate the forecasted economic impacts, as well as the automatically derived warning level for storms. This information also permits to prioritise the next development steps for the different parts of the model chain.

An exploratory analysis of the first winter season (2018/2019) and of the storm event Burglind/Eleanor in January 2018 sheds light on the uncertainty of the forecasted impacts. This uncertainty represents the likelihood in the "likelihood/severity of impact"-matrix for warning decisions (cf. Neal et al. 2014). For example, on postal code level, the model reveals a high uncertainty, which decreases when impacts are aggregated over increasingly larger areas. This result shows the need to find the best geographical granularity to achieve a useful balance of decision support and represented uncertainty. After undertaking such analyses, forecasted impacts are of even higher value as an input in meteorologists' decisions in warning about storms.