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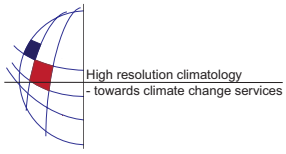

GIS and GAMs to predict extreme wind speeds over Switzerland and to assess storm damage

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A method to assess wind speeds over complex terrain is presented. A combination of Generalized Additive Models (GAMs) and Geographic Information Systems (GIS) layers describing the terrain characteristics can provide spatial predictions of wind speeds even over the highly heterogeneous terrain of Switzerland.

From the meteorological stations weather data, GAMs are used to predict 98th percentiles of daily maximum wind speeds (W98). Physical factors describing the landscape of Switzerland and likely to have an influence on wind flows are introduced in the regression process with the help of GIS tools. A cross-validation model selection is used to select a final model. Bootstrap methods were applied to assess errors, leading to mean and standard deviation predictions of W98 values. The resulting prediction gives convincing values of the W98. Effects of topography are evident on the results. Wind speeds are increasing with altitude and are greatest on mountain peaks in the Alps. Errors calculated on the meteorological stations do not exceed 30%, and only 12 out of 70 stations have errors above 20%.

Using this map, the storm loss model of Klawa and Ulbrich (2003), originally applied to Germany, was tested to the canton of Vaud, in Western Switzerland. As inputs, the model requires population data as well as daily maximum gust wind speeds, which were normalized by the W98 values. Storm events which occurred in Switzerland since 1994 are considered, including the most damaging, the Lothar storm of December 1999.

Results of the loss model are calibrated by Insurance data from the Insurance Company of the Canton de Vaud. Comparisons and a general discussion are provided.