Geophysical Research Abstracts
Vol. 16, EGU2014-16691, 2014
EGU General Assembly 2014

Improvement of a windgust parametrization with an application using the Canadian Regional Climate Model over Switzerland

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Severe winds recorded during a number of winter storms are simulated over the period 1990 to 2011 with the Canadian Regional Climate Model (CRCM) at a high spatial resolution. Flow fields are first downscaled from NCEP-NCAR reanalyses and then down to 2-km grid spacing in the horizontal through a self-nesting technique. During this last step, different windgust schemes of different complexities were tested and their performances compared one to each other and to observations from MeteoSwiss national network. Simple schemes reproduced the surface observations in an overall realistic manner but differences are noticed in the hourly maximum values. In order to improve the scheme in operational use at MeteoSwiss, an empirically fixed parameter in the formulation is now allowed to vary in the horizontal where values have been calibrated using the MeteoSwiss stations hourly wind maximum. Then, these unequally-spaced values are statistically predicted and interpolated onto the model surface computational grid with a cokriging analysis based on elevation data such as terrain curvature, slope and aspect. This parameters' map is used to improve one of the gusts scheme and the CRCM is run on the 2-km grid in order to qualify and quantify the changes of the hourly gust values during the storms. The improvements are significant where hourly differences between observed and simulated values are reduced at several stations. The performance of this method is shown to be closely related to the analysis of the main flow regimes in Switzerland during which the storms are simulated. An application of this modified gust scheme for numerical weather prediction modelling is envisaged in the near future.