Geophysical Research Abstracts
Vol. 18, EGU2016-5721, 2016
EGU General Assembly 2016

Downscaling 20th century flooding events in complex terrain (Switzerland) using the WRF regional climate model

Ulla Heikkilä (1), Juan Jose Gómez Navarro (2,3), Jörg Franke (2), Stefan Brönnimann (2), and Réne Cattin (1)

(1) Meteotest, Bern, Switzerland (ulla.heikkila@meteotest.ch), (2) Climate and Environmental Physics, Physics Institute, University of Bern, Bern, Switzerland, (3) Oeschger Centre for Climate Research, Bern, Switzerland

Switzerland has experienced a number of severe precipitation events during the last few decades, such as during the 14-16 November of 2002 or during the 21-22 August of 2005. Both events, and subsequent extreme floods, caused fatalities and severe financial losses, and have been well studied both in terms of atmospheric conditions leading to extreme precipitation, and their consequences [e.g. Hohenegger et al., 2008, Stucki et al., 2012]. These examples highlight the need to better characterise the frequency and severity of flooding in the Alpine area. In a larger framework we will ultimately produce a high-resolution data set covering the entire 20th century to be used for detailed hydrological studies including all atmospheric parameters relevant for flooding events. In a first step, we downscale the aforementioned two events of 2002 and 2005 to assess the model performance regarding precipitation extremes.

The complexity of the topography in the Alpine area demands high resolution datasets. To achieve a sufficient detail in resolution we employ the Weather Research and Forecasting regional climate model (WRF). A set of 4 nested domains is used with a 2-km resolution horizontal resolution over Switzerland. The NCAR 20th century reanalysis (20CR) with a horizontal resolution of 2.5° serves as boundary condition [Compo et al., 2011].

First results of the downscaling the 2002 and 2005 extreme precipitation events show that, compared to station observations provided by the Swiss Meteorological Office MeteoSwiss, the model strongly underestimates the strength of these events. This is mainly due to the coarse resolution of the 20CR data, which underestimates the moisture fluxes during these events. We tested driving WRF with the higher-resolved NCEP reanalysis and found a significant improvement in the amount of precipitation of the 2005 event. In a next step we will downscale the precipitation and wind fields during a 6-year period 2002-2007 to investigate and validate the model performance during a larger number of events.

Compo, G. P., J. S. Whitaker, P. D. Sardeshmukh, N. Matsui, R. J. Allan, X. Yin,B. E. Gleason, R. S. Vose, G. Rutledge, P. Bessemoulin, S. Bronnimann, M. Brunet, R. I. Crouthamel, A. N. Grant, P. Y. Groisman, P. D. Jones, M. C. Kruk, A. C. Kruger, G. J. Marshall, M. Maugeri, H. Y. Mok, O. Nordli, T. F. Ross, R. M. Trigo, X. L. Wang, S. D. Woodruff, S. J. Worley, 2011: The Twentieth Century Reanalysis Project. Quarterly J. Roy. Met. Soc., 137, 1-28, DOI: 10.1002/qj.776.

Hohenegger, C., Walser, A., Langhans, H. and Schär, C., 2008, Cloud-resolving ensemble simulations of the August 2005 Alpine flood, Q. J. R. Meteorol. Soc. 2008, DOI: 10.1002/qj.252

Stucki, P., Rickli, R., Brönnimann, S., Martius, O., Wanner, H., Grebner, D. and Luterbacher, J., 2012, Weather patterns and hydro-climatological precursors of extreme floods in Switzerland since 1868, Meteorologische Zeitschrift, Vol. 21, No. 6, 531–550.