Uncertainties in modeled extreme precipitation

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Research field "Physical climate science: Uncertainties about changes in precipitation in a changing climate"
Research question 2 | Cluster 1
Links to showcases Maraun 1, Kirchengast 1, Steiner 2, Birk 1, Sass 1

Background: One of the generally expected consequences of anthropogenic climate change is an increase in the frequency and intensity of extreme precipitation events. When we want to project the intensity of future precipitation events we have to rely on climate models—which are known to have substantial deficiencies, especially in their ability to predict precipitation (changes). With increasing computer power, regional and local climate models reach higher and higher spatial resolution, and it seems reasonable to assume that convection-resolving climate models should be able to provide a more realistic picture of the atmosphere—and thereby a better performance in predicting precipitation.

Goal: This leads to a fundamental question: How can we accurately validate the performance of high-resolution models? Here we can build on the results obtained in the "phase 1" of the DK by using more than ten years of data from the WegenerNet in Southeast-Styria (Austria), with its dense grid of meteorological stations. We will (1) determine the observed characteristics of extreme precipitation events over this time period, in particular the (2) resolution-dependent representation of such events, and we will (3) determine how well such events are represented in models with approx. 1 km resolution, driven by observed boundary conditions.

Methods and disciplinary background: In phase 1 of the DK we have focused on insufficiencies of our knowledge on past and present extreme precipitation events. We could demonstrate that data from the WegenerNet, a dense network of 153 meteorological stations (with about one station per 2 km^2) in a terrain of moderate complexity, are well suited to characterize extreme precipitation events (O et al., 2016) and to validate satellite data with coarser resolution (O et al., 2017). We will use the observed data to validate the output from the atmospheric regional climate model CLM, which is able to resolve deep convection and the topography of the region (see showcase 1 by Douglas Maraun).

References:

Sungmin O, U. Foelsche, G. Kirchengast, and J. Fuchsberger (2016) Validation and correction of rainfall data from the WegenerNet high density network in southeast Austria, Journal of Hydrology, DOI:10.1016/j.jhydrol.2016.11.049

Sungmin O, U. Foelsche, G. Kirchengast, J. Fuchsberger, J. Tan, and W.A. Petersen (2017) Evaluation of GPM IMERG Early, Late, and Final rainfall estimates with WegenerNet gauge data in southeast Austria, Hydrology and Earth System Sciences Discuss., DOI:10.5194/hess-2017-256