Geophysical Research Abstracts
Vol. 20, EGU2018-7598, 2018
EGU General Assembly 2018

On the fundamental spatial resolution dependence of observed short-duration extreme convective rainfall intensity

Katharina Schroeer (1,2), Gottfried Kirchengast (1,2,3), Sungmin Oh (2,3)

(1) Wegener Center for Climate and Global Change, University of Graz, Graz, Austria (katharina.schroeer@uni-graz.at), (2) FWF-DK Climate Change, University of Graz, Graz, Austria, (3) Institute for Geophysics, Astrophysics, and Meteorology/Institute of Physics (IGAM/IP), NAWI Graz, University of Graz, Graz, Austria

The fundamental dependence of extreme sub-hourly and hourly rainfall intensity of summertime convective precipitation events at mid- latitudes on the spatial density of observing station networks is still weakly quantified at the 1 km to 30 km resolution scales. The reason is that no long-term observing station network with data at sufficient space-time resolution was available so far. This dependence over the range from local to regional scale is critical for many applications, for example to evaluate the precipitation modeling skill of high-resolution convection-permitting weather and climate models.
Here we explore this dependence by means of the very high density rain gauge network of the WegenerNet Feldbach region (WEGN) in southeastern Styria, Austria, and the surrounding networks of the Austrian Weather Service (ZAMG) and Hydrographic Services (AHYD). This joint network covers inter-station distances at scales from 1 km to 50 km in an area of about 60 km x 60 km. The data used cover a full decade (2007-2016) at 10 min time resolution from a total of 172 rain gauges.
We introduce the fishnet-windowed triangular mesh (FWTM) method as a novel robust spatial sampling technique in order to empirically discover the spatial resolution dependence of maximum observable area rainfall over the 1 km to 40 km scale. For ensembles of increasingly less dense sub-networks, we sample the maximum area rainfall in a total of 527 summertime (April-October) convective rainfall events.
We use time integrations from 10 min to 3 h and find that an observing network's capability of representing the event maximum area rainfall intensities at sub-hourly scales deteriorates quickly within the first 10 km (minus 50%), and at slower rates out to 30 km (a further minus 15%). This decay can be well approximated by a power-law, and we present parameters for this relation for time integrations at the sub-hourly to 3-hour scale.
We consider the dependencies representative for short-term summertime convective storms over similar land areas at middle latitudes. Given the robust way of statistically characterizing the spatiotemporal properties of convective rainfall events, we find the results can be valuable for model testing and improvement at the nexus of regional and high-resolution climate models and impact models.