Geophysical Research Abstracts
Vol. 21, EGU2019-1892, 2019
EGU General Assembly 2019

Sub-hourly rainfall in a convection-permitting model

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Convection-permitting models (CPMs) have been shown to add value to coarser models with parametrized convection for the simulation of extreme precipitation, in particular for short-duration (i.e. sub-daily) extremes of a convective nature. Such events are the main cause of flash flooding. The accurate simulation of short-duration rainfall events is thus key for the forecasting of flash-flooding and for predicting how the flash-flooding risk may change in the future. As such, evaluation of short-duration (extreme) precipitation in CPMs is an important endeavour. Owing to a lack of observational datasets at high temporal resolution, however, most evaluations of CPMs have to date been at the hourly (or longer) temporal scale. The validation of precipitation in CPMs at the sub-hourly scale has thus been identified as an important challenge for both weather forecasting and climate science.

Using a unique regional micro-gauge network with 5-minute precipitation observations spanning on average 20 years, we analyse the performance of the COSMO-CLM model at 0.02° (∼2.2 km) resolution in simulating the characteristics – both mean and extreme – of observed precipitation. Results indicate that the CPM simulates 5-minute and sub-hourly precipitation with comparable realism to that found at the hourly scale, suggesting that CPMs can be a useful tool for the study of sub-hourly precipitation extremes