Geophysical Research Abstracts
Vol. 18, EGU2016-2613, 2016
EGU General Assembly 2016

A Decade-long Continental-Scale Convection-Resolving Climate Simulation on GPUs

David Leutwyler (1), Oliver Fuhrer (2), Xavier Lapillonne (2,3), Daniel Lüthi (1), and Christoph Schär (1)

(1) Institute for Atmospheric and Climate Science, ETH, Zürich, Switzerland, (2) Federal Office of Meteorology and Climatology, MeteoSwiss, ETH, Zürich, Switzerland, (3) Center for Climate Systems Modeling, C2SM, Zürich, Switzerland

The representation of moist convection in climate models represents a major challenge, due to the small scales involved. Convection-resolving models have proven to be very useful tools in numerical weather prediction and in climate research. Using horizontal grid spacings of O(1km), they allow to explicitly resolve deep convection leading to an improved representation of the water cycle. However, due to their extremely demanding computational requirements, they have so far been limited to short simulations and/or small computational domains. Innovations in the supercomputing domain have led to new supercomputer-designs that involve conventional multicore CPUs and accelerators such as graphics processing units (GPUs). One of the first atmospheric models that has been fully ported to GPUs is the Consortium for Small-Scale Modeling weather and climate model COSMO. This new version allows us to expand the size of the simulation domain to areas spanning continents and the time period up to one decade.

We present results from a decade-long, convection-resolving climate simulation using the GPU-enabled COSMO version. The simulation is driven by the ERA-interim reanalysis. The results illustrate how the approach allows for the representation of interactions between synoptic-scale and meso-scale atmospheric circulations at scales ranging from 1000 to 10 km. We discuss the performance of the convection-resolving modeling approach on the European scale. Specifically we focus on the annual cycle of convection in Europe, on the organization of convective clouds and on the verification of hourly rainfall with various high resolution datasets.