Geophysical Research Abstracts
Vol. 15, EGU2013-10386, 2013
EGU General Assembly 2013

The impact of spatial resolution on the representation of extreme precipitation in a climate model

Claudia Volosciuk (1), Douglas Maraun (1), Vladimir Semenov (1,2,3), and Wonsun Park (1)

(1) GEOMAR Helmholtz Centre for Ocean Research Kiel, Kiel, Germany, (2) A.M. Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Moscow, Russia, (3) Lomonosov Moscow State University, Moscow, Russia

Extreme weather events can have serious impacts on human society as well as on ecosystems. Future and recent changes, as well as the underlying atmospheric mechanisms of the extremes, are usually estimated from climate model simulations that employ atmospheric general circulation models (AGCMs) of relatively coarse horizontal resolution (of the order of a few hundred kilometers). This coarse resolution has an impact on simulated extreme events, particularly precipitation extremes.

Since heavy precipitation events are highly variable in space, precipitation extremes are expected to decrease with bigger grid size due to the effect of averaging individual small scale events across a bigger area. Coarser horizontal and vertical resolution may also degrade the representation of some physical processes. To study the impact of horizontal and vertical model resolution on the representation of extreme precipitation events, we analysed simulations with the ECHAM5 AGCM at different horizontal (T213, T159, T106, T63, T42, T31) and vertical resolutions (L31 for T213 to T42, and L19 for T63 to T31) using the same transient present day (1982-2009) boundary forcing (sea surface temperature and sea ice concentration). For each season and grid box, parameters of a stationary generalised extreme value (GEV) distribution were estimated and 20 season return values were derived as a measure of extreme precipitation. All results are compared to the simulation with the highest resolution, T213L31. To disentangle the effect of averaging from the scale dependent representation of physical processes, the high resolution T213 was averaged to the grids of the coarser resolutions for comparison on equal spatial scales.

As expected, the return values decrease with coarser resolution. However, the scale dependency changes with region and season. Strongly decreasing return values were found between T106 and T63 covering an almost entire zonal band, which is particularly pronounced in regions of deep convection. It is worthwhile to note, however, that even at the most crude T31L19 resolution, the model was still capable of representing extreme precipitation over the northern hemisphere in winter reasonably well. These precipitation events are mainly caused by large frontal systems. We found high vertical resolution to also be very important for a better simulation of extreme precipitation, as a coarser vertical resolution yields an equatorwards shift of the intertropical convergence zone (ITCZ). The representation of mean precipitation was found to be practically independent of horizontal model resolution.