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Influence of different types of boundary conditions on high-resolution simulation of a heavy precipitation event with respect to climate simulations

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The need of producing realistic climate simulations in complex topographical areas like the Alps is growing, especially for the climate impact community. To be able to produce realistic results grid sizes of the order of 1 km are needed to properly represent the topography and thus the terrain-induced atmospheric phenomena. Simulations at these resolutions, though, come with very high computational costs presently still limiting long-term climate simulations. When moving towards those high resolutions also the physical parameterisations have to be re-evaluated since they were written and implemented for coarser resolutions. However, the foreseeable development of computer capabilities together with some code modifications will enhance the possibility of performing long-term climate simulations at such scales in the near future.

How the models should be driven for time slice experiments is still a bending question. Although re-analyses data are commonly used for such experiments, this is not totally equivalent to a free running model, as re-analyses are influenced by observations. Climate simulations are more similar to forecast runs. Interpretation, though, of the results will not be easy, as the forecasts include a forecast error.

To quantify this "re-analysis" effect a comparison of ERA-Interim re-analysis, ERA-Interim forecast, and operational forecast (6-hourly input of forecast – hours 66 and 72) forced simulations was carried out within the HiRmod project. The episode selected for this study was a heavy precipitation event in the Austrian Inn Valley in August 2005. A week before the floodings in the Inn Valley, 14 – 17 August 2005, a trough crossing the Alps from the Benelux countries to the Balkan peninsula resulted in heavy precipitation saturating the soil. This pre-floodings episode was simulated using the different boundary conditions. Furthermore, these simulations used already re-classified Corine land-use data, which have a resolution of 100 m, to better represent the surface conditions. All simulations were carried out using WRF ARW v3.2.1 with a spatial resolution of 0.8 km in the innermost domain and a vertical resolution of 39 full sigma levels.