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Extreme events in a WRF regional climate model validation run for EURO-CORDEX

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The goal of this validation study is to investigate how well precipitation extreme events are represented in high-resolution regional climate model runs in comparison to observational reference datasets. A higher spatial resolution leads to a more realistic representation of surface heterogeneities and hence the surface-atmosphere coupling and processes that affect extreme events should be better reproduced as well. With a climate change induced modification of the hydrological cycle, decision makers need adequate and suitable information specifically at a local to regional scale for impact studies. The RCM validation runs used here are part of CRP-GL's contribution to the EURO-CORDEX project. We participate with the Advanced Research Weather and Forecasting Model (WRF/ARW v3.3.1). The 0.11degree domain (about 12.2km) encompassing the CORDEX European focus domain is driven by a 0.44degree domain (about 48.8km) run in a one-way double-nesting setup with 50 model levels. Boundary forcing is provided from European Centre for Medium-Range Weather Forecasts (ECMWF) ERA-Interim reanalysis at 6h intervals with a 0.75degree spatial resolution, no nudging is applied. WRF is run with non-hydrostatic dynamics; physics are set to the WRF Single-Moment 6-class cloud microphysics scheme, the CAM short- and long-wave radiation scheme, the YSU atmospheric boundary layer parameterisation and the Kain-Fritsch scheme for cumulus parameterisation. The Noah land surface model is used with MODIS satellite-derived land-cover and FAO soil information. The temporal coverage is from 1989 to 2010 with 1989 for model spinup. The coarse and high-resolution model outputs are validated against daily precipitation totals from (a) the gridded E-OBS dataset from the European Climate Assessment and Dataset project at 25km resolution for all of Europe and (b) the newly available gridded HYRAS (Hydrometeorological Reference Data for Central Europe) dataset from Germany's National Meteorological Service on behalf of the German Federal Institute of Hydrology; it covers the major Central European river catchments albeit with a 5km spatial resolution. The validation itself is split into two parts. (1) The model has to be able to match at both resolutions observed average spatial precipitation distributions and seasonal cycles for sub-domains as well as capture the observed variabilities. (2) A selection of the climate-change relevant CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) extremes' indices is used as a standardized diagnostic for extreme precipitation. We compare spatial patterns and empirical distributions for subsets of selected indices e.g. the sum of the total annual precipitation for those events above the 95 percentile of all wet-days or the number of wet-days per year above a certain threshold.