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On the representation of atmospheric blocking in EURO-CORDEX control runs

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While regional climate models (RCMs) have been shown to yield improved projections, due to better representations of orography and higher resolved scales, impacts on mesoscale phenomena like atmospheric blocking have been hardly addressed. In this study we clarify if the EURO-CORDEX domain is large enough to allow the RCMs to significantly amplify the blocking representation in reference to the underlying driving data.

Therefore, we analyzed blocking accompanying anomalies in temperature near the surface (TAS) and precipitation rate (PR) for a set of RCMs. 5 RCMs stem from the ensemble of EURO-CORDEX control runs, while 3 RCMs are WRF models with different nudging realizations, all of them are driven by ERA-Interim. The used blocking detection method detects blockings by localizing high pressure systems between 55°N and 65°N with the use of geopotential height gradients on the 500 hPa level (Z500), and was applied to ERA-Interim and the mentioned RCM data between 1981 and 2010. Detected blockings centers were spatially attributed to three sectors, which have been shown to display distinctive impacts on TAS and PR during blocking episodes. As a reference for TAS and PR we used 86 weather stations across Europe from the ECA&D dataset.

Our results indicate, that little improvement can be expected in the representation of Z500 fields by the RCMs. Most of them show less blocking than the driving data, while blocking representation was most in agreement with the driving data for RCMs that have been strongly conditioned to the driving data. Further, in our idealized setting the RCMs were not able to reproduce the anomalies for TAS connected to blocking. Moreover, using the blocking index of the driving data could be considered correct, because the representation of TAS and PR for falsely detected blocking and non-blocking days in the RCMs did not deviate strongly.