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GCM selection for dynamical downscaling of extreme rainfall changes over Belgium

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Regional climate models (RCMs) may provide detailed climate information that is required by local stakeholders. Additionally, RCMs have shown added value in their representation of extremes such as extreme rainfall, with respect to Global Climate Models (GCMs). However, RCM simulations are computationally very expensive and depend strongly on the forcing GCM. Therefore, it is essential to carefully select the GCM. Previous coordinated ensemble simulations from EURO-CORDEX forced by GCMs from CMIP5 did not include a coordinated GCM selection. Recent efforts using CMIP6, on the other hand, do provide a framework for GCM selection (Sobolowski et al., 2023) based on different criteria for Europe. These criteria include model performance, availability and reliability of the climate-change signal. In Belgium, the CORDEX.be II project aims to provide regional climate-change information for climate services in support of climate adaptation and mitigation. This information will be extracted using three regional climate models: ALARO-SURFEX, COSMO-TERRA-URB and MAR at convection-permitting resolutions (Termonia, et al., 2018). We present the overall setup of the CORDEX.be II methodology and the GCM selection. Thereby, the selection criterion of covering the entire range of climate-change signals, as used within the EURO-CORDEX effort, is replaced with the criterion to obtain the strongest changes in climate extremes possible, in line with the demand from the main stakeholders. More specifically, based on the EURO-CORDEX downscaling results forced by CMIP5, we outline a methodology for GCM selection to obtain the highest likelihood of strong changes in rainfall extremes. We explore the dependence of this likelihood with respect to different model predictors, RCM and GCM model groups and regions over Europe. We then apply this methodology on the CMIP6 ensemble over Belgium to obtain a list of selected runs for dynamic downscaling.

Termonia, et al. (2018). The CORDEX. be initiative as a foundation for climate services in Belgium. Climate Services, 11, 49-61.

Sobolowski et al. (2023) 10.5281/zenodo.7673399.