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Mechanisms of future extreme precipitation intensification in a convection-permitting model

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Convection-permitting models exhibit considerable added value for the representation of both extreme precipitation in the present climate and future changes therein in a warmer climate. In particular for sub-daily precipitation extremes, convection-permitting models show a stronger response to warming than that found in coarser models with parametrized convection. Due to their explicit simulation of key processes, e.g. deep convection, convection-permitting models also offer an ideal platform for studying the different physical mechanisms which may lead to the future intensification of extreme precipitation, and their relative importances.

Using a regional domain centred on the catchment of the River Wupper (western Germany) – a key study region of the H2020 project BINGO <www.projectbingo.eu> – we perform historical and future (RCP8.5) climate simulations at 0.02° (∼2.2 km) resolution with the COSMO-CLM model; the GCM is MPI-ESM-LR. In line with previous studies, an intensification of extreme rainfall tending towards the Clausius-Clapeyron rate is found for the most extreme percentiles. With a focus on the summer season, we explore the physical mechanisms behind this intensification and the roles of internal variability and model physics in the results.