Weather Clim. Dynam. Discuss., referee comment RC3
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Comment on wcd-2022-11

Anonymous Referee #3

Referee comment on "Convection-parameterized and convection-permitting modelling of heavy precipitation in decadal simulations of the greater Alpine region with COSMO-CLM" by Alberto Caldas-Alvarez et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2022-11-RC3, 2022

Review of

"Scale-dependency of extreme precipitation processes in regional climate simulations of the greater Alpine region"

by

Alberto Caldas-Alvarez et al.

Submitted to Weather and Climate Dynamics

The manuscript investigates extreme precipitation events in two sets of regional climate simulations, as well as observational datasets. The focus of the study is on extreme precipitation that was continuously larger than the 80th percentile for at least two days for a given grid point.

The RCM simulation was executed at 25 km grid spacing, while the CPM set of simulations was performed at 3 km grid spacing, without parametrization for deep convection.

First, the synoptic weather type leading to the extreme precipitation events is determined separately for summer and for winter, then the simulated extreme precipitation is evaluated, followed by an investigation of events, and an investigation of the thermodynamic processes leading to extreme precipitation generation in the two different model configurations.

The subject of the manuscript is interesting, the study is performed with adequate techniques, and the presentation and language are of high quality. I thus recommend the publication of the manuscript after minor corrections.

General remarks:

- title: the word "scale-dependency" suggest that the processes are investigated over a continuous range of resolutions, in search for discontinuities. Yet, only two different set ups are presented. Thus, I suggest a renaming of the title to e.g. something like "extreme precipitation processes in regional climate simulations of the greater Alpine Region in convection-permitting and convection-parametrizing simulations".

- section 6: scale dependency of thermodynamic processes: a regional weather/climate model forced by boundary data is quite constrained in its way to react, as much of the forcing is provided by the boundary data (as the authors also mention). Thus, part of the analysis in section 6 reveals different strategies of the model configurations to deal with this forcing containing different compensating errors. One forcing mechanism that is not mentioned but that can be of importance, at least for summertime precipitation, is radiative cooling. The radiative cooling leads to a destabilization of the atmosphere, that will enhance convective activity. I suggest to also check the outgoing longwave radiation in the two different sets of simulations for its significance in the extreme precipitation cases.

Specific comments:

- Line 65: numerics and physics-dynamics coupling should also be mentioned.

- Line 293: I disagree with the statement “this does not imply a worse performance by CPM …”. The overestimation of grid point extreme precipitation is one of the well-know deficits of convection-permitting models, as you state, despite many advantages. Please reformulate, admitting the issue.

- section 5.2: the difference in temperature lapse-rate should be discussed in more detail. The lapse-rate will be the driver for further convective activity. Or formulated differently, the interior of the model domain may take on a different lapse rate in CPM vs CRM to cope with the different representation of convection (compensation model errors again).

- Figure 10: some of the effects illustrated are very closely linked together, e.g. the effects seen in near-surface specific humidity and surface latent heat flux.

Technical comments:

Line 59: see also Vergara-Temprado et al., 2020

Line 140/141: include “of” before “these data sets”.

Line 156: replace “it” by “they”

Line 221: include “of” between “range” and “values”

Line 241: should “flowing” be “following” ?

Line 282: OSMO ☐ COSMO

Line 305: remove “is”

Line 316. al ☐ all

Legend Figure 6: insert space before “HYRAS”

References:

Vergara-Temprado, J., Ban, N., Panosetti, D., Schlemmer, L., & Schär, C. (2020). Climate Models Permit Convection at Much Coarser Resolutions Than Previously Considered, Journal of Climate, 33(5), 1915-1933.