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Geoscientific Model Development Discussions
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Interactive comment on "HCLIM38: A flexible regional climate model applicable for different climate zones from coarse to convection permitting scales" *by* Danijel Belušić et al.

Anonymous Referee #2

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General Comments:

The goal of this study is to introduce the HCLIM38 model, explain its origins, and describe the results from a number of simulations at different resolutions, using different physics packages. The authors provide ample evidence of performance over differing parts of the globe and over varying topography/climates. Overall, the simulation results show that HCLIM38 performs as well as or better (specifically at higher resolutions) than other RCM/CPRCMs.

While the scientific evidence is strong, work is needed to clarify the origins of HCLIM38 and its different configurations to reduce confusion. In addition, I would streamline

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the discussion of small nuances of HCLIM38 as compared to many other related, but different NWP and GCM/RCM systems, since the latter aren't the focus of this paper. Focusing on the three configurations of HCLIM38 and the over-arching differences will improve clarity.

With sufficient improvement to the manuscript, publication in Geoscientific Model Development should be considered.

Major Comments:

1. Section 2.1 (and beyond) is very confusing. Even after reviewing Table 1, I'm unable to make the right connections for each system. If HARMONIE is not an actual model, is it just HIRLAM-ALADIN with a scripting system? It would be good to specify that HIRLAM-ALADIN is being phased out for AROME in the text (not in the table). Also, distinction between a model and its self-titled physics suite is necessary (AROME is a model, but has a physics suite with the same name). Line 3 states that HCLIM is based on ALADIN-HIRLAM, but line 8 says HARMONIE-AROME is the basis for HCLIM. A clear delineation between what is a true model, what is just a configuration of a model, what is a physics package, and how HCLIM38 fits into this picture is needed. I understand that a slew of changing acronyms is part of our work, but clarification of this section is necessary, and would go a long way toward reader comprehension.

2. It would be beneficial to have a table/plot showing how the three HCLIM38 configuration climate simulations were run. What did the domains look like (maybe provide a plot for each)? What were the time steps and required wall clock times to run the simulations? What were the LBCs used and from what models (some of this is already in the text)? How often were the LBCs updated?

Minor Comments:

1. Please expand upon/describe what "added value" is referring to in the first paragraph of the introduction. I assume this is referring to climate forecast accuracy, but it would

be good to have a better idea of what metrics the authors have in mind.

2. Please briefly summarize the over-arching/major changes/improvements compared to older versions of HCLIM in the introduction.

3. Is there a hydrostatic vs. non-hydrostatic namelist option in HCLIM that is invoked when using the different physics packages (AROME vs. ALADIN or ALARO)?

4. More information is necessary on what the term “cycle” represents. What systems correspond to the “NWP model configurations” that are referred to as cycles? Which MET services are running them in real-time?

5. The authors discuss different model resolution configurations in 2.2, but then switch to physics packages with the same names as the models halfway through the paragraph. The delineation between the model and associated physics should be clear. Is the “HARMONIE-AROME” model the “similar NWP system” referenced in line 26 on Page 3? If so, it should be clarified and tied into the previous sentence.

6. The authors state that there is no deep convection parameterization, so it can only be used at convection-permitting scales. Are there any scale-aware schemes that could handle unresolved convection below 4 km?

7. Please describe how Fig. 2 was created. What is EOBS? Are these mean temperature/precip differences averaged across the whole 10-year period?

8. It appears as though Crespi et al., 2019 used the in-situ observations to correct the bias of HCLIM38-AROME precipitation data over Norway in order to arrive at a more accurate precipitation climatology. It might be good to explain this detail.

9. There is no Fig S1 or Table S1, but they are referred to in the text.

10. Please briefly describe the exceedance plots and how you calculated them.

11. Any idea why HCLIM36-ALADIN would have early biases for both the time of maximum precipitation and maximum hourly intensity (Fig. 7)? Something in the convective

parameterization scheme?

12. How did the CAMS based aerosol climatology improve HCLIM38 if it wasn't coupled with radiation or microphysics parameterizations? If they weren't coupled, weren't they just passive tracers?

Introduction - Are there scale-aware physics parameterizations in GCMs, RCMs, and CPRCMS (as there are in NWP) that could handle increasing resolutions of climate modelling and could shut themselves off appropriately?

Introduction - Are the terms convection-"resolving" and convection-"permitting" interchangeable for CPRCMS?

Page 2, Line 18 – I might expand briefly upon why nesting from O(10km) to O(1km) is not possible, aside from the reference, since this is regularly done in NWP.

Page 3, Line 21 – Climate or NWP limited-area models? Page 3, Line 26-29 – ALADIN or ALARO physics, model, or both? This needs to be clear. Page 6, Line 2 – I assume it be used with GCMs and not just RCMs for LBCs? Page 8, Line 3-4 – EOBS and PRUDENCE are not defined. Page 6, Line 23 – I'm not sure what the "e.g." is doing here. Page 10, Line 31 – There is no Fig. S3 as referred to in the text. Page 13, Line 16 – There is no Fig. S5 as referred to in the text.

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