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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The sensitivity of Alpine summer convection to surrogate climate change: An intercomparison between convection-parameterizing and convection-resolving models" *by* Michael Keller et al.

Anonymous Referee #2

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Major comments: This is a potentially interesting study that deserves publication if the three major changes listed below are made: 1. The number of lines on each plot is too high to properly absorb the message you are trying to communicate. For instance, figure 6 has 12 lines on four plots for 48 lines. While I appreciate that you are trying to make a point that many of the lines are on top of each other, I have a hard time distinguishing the lines from each other and also the difference between one line or another and the key from one line to another. One suggestion is to delete

the comparison to the one moment and two moment microphysics schemes from this paper. There is very little sensitivity and most of your points were made in the previous paper. I would focus on the difference between the 2.2 km and 12 km simulations and the current and surrogate climate.

2. The paper treats all the results with nearly equal weight. I find it to more of a travelogue than a research paper. I think you have a message you want to convey to the reader and I would focus on that message from both the figures you show and the discussion in the text. As I mention above, I was most interested in the difference between the convective permitting and the convection parameterization simulations for both current and future climate. This message is lost in the travelogue style of presentation.

3. I would like to see more emphasis on the physical reason for the results. For instance, why is the diurnal timing for convection changed going from convective permitting to convective parameterization simulations in figure 4? Why does the CPM simulation have less precipitation? Is the amount it estimated close to observations? Otherwise these are just model results and I haven't really learned anything other than there is a difference between the runs or not. There are only 11 days of simulation, so a focus on the physics rather than the climatology seems warranted and appropriate.

Minor comments: Page 3, line 1. Please state the height in the atmosphere for which the north-south temperature gradient is impacted. Page 6. Line 29. Delete "steps at". Page 6. I would like to see an image of the analysis domain in this paper. Page 7, line 8. I would have liked to have seen a sequence of synoptic maps characterizing the 10 day period (if nearly constant, a composite map). Page 9. Line 22."with" should be replaced by "by". Page 10. I would like to see difference plot for figure 3. It is very difficult to see what the differences in various runs actually are and what magnitude otherwise. Page 9, line 29. Can you be more clear about the expected cirdulation changes? Page 11, line 9. Need to state what the differences are between the 12 km and 2 km runs and how they agree with Ban et al. (2015). Page 11, line 14. Need to state what

the values of vertical velocity you are talking about. Page 14. Lines 3-14. This is an interesting discussion of the causes for the differences in the VW and HW simulations. I would encourage a more detailed analysis as the discussion speculates more than determines what the real cause is. It might be useful to examine the evolution of clouds in detail for one or two days for both VW and HW to determine the cause. You only have 11 days, so an average does not necessarily give you a robust result. Page 16. Lines 15 and 16. Why is there an increase in heavy precipitation events for the CPM runs compared to the CRM runs? Do the CPM runs compare well to the CRM runs for non-heavy events? Page 16, lines 24-26. I think this is the most interesting result of the paper and should be explored deeper. First of all, how does the VW change in vertical distribution physically effect the clouds? You only have 11 days of simulation, so you should be able to note some common evolution and physical changes. Second, why is the response of the CRM different than the CPM for HW and VW? This is a very interesting result that deserves more investigation.

Final comment: The conclusion section is much too short. There should be much deeper discussion of the results here that can help the reader understand the detailed simulation results presented in the previous section. What do you want the reader to take away from this study? I am current not sure, and that is a problem.

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