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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessing the Added Value of the Intermediate Complexity Atmospheric Research Model (ICAR) for Precipitation in Complex Topography" *by* J. Horak et al.

Anonymous Referee #3

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Overview This well-written manuscript details a comparison between ERA-Interim and ICAR at generating precipitation over New Zealand's south island. They find that ICAR adds value over ERA Interim at most alpine locations, but not at coastal stations. They additionally tease apart ICAR performance during different flow regimes (identified by the Froude number) and during different weather regimes (identified through synoptic patterns). The work is useful and complete, and I have only minor comments, enumerated below.

Specific Comments P. 3, l. 27-29: During my first read through of the manuscript this sentence made me question how this replacement of unstable locations/times with

weakly stable locations/times impacts ICAR's performance (since it's very unphysical). Some comment here or perhaps in the introduction about application of ICAR during unstable conditions (referring to section 2.6, which is how it is handled in this manuscript), and how/where this factor limits ICAR's use, is warranted.

P. 5, l. 10: '6 h h' the second h is a mistake

P. 5, l. 21-24: I found the way this is notated to be somewhat confusing. I think the reason the authors are using the nomenclature 'ICARcp' to replace P(t) (i.e., ICAR precipitation added to ERA Interim convective precipitation regridded through bilinear interpolation to the 4km grid) is because it's basically ICAR plus convective precipitation. But this seems more complicated than necessary – why not use P(t) and Pi(t) throughout the text? If the authors insist on keeping ICARcp and ICAR then they should use this nomenclature in equation 1 and include a sentence explaining the nomenclature after the equation.

P. 7 l. 12: 'In case of the coastal weather stations,...' is awkward.

P. 8, caption of Table 1, last sentence: 'north respectively south' should read 'north and south, respectively'

P. 12, l. 4: 'performs very similar' should read 'performs very similarly'

P. 13: Fig 3 panel b: coastal is misspelled in title.

P. 14, table 2 caption, last sentence, asterisk is misspelled.

P. 16, l. 16-17: It's unclear to me exactly what this sentence is describing since the figure is not shown; does this mean that the amplitude of the seasonal cycle is too small in ICAR or more generally that ICAR underestimates climatological precipitation at some locations? More discussion is warranted and perhaps this figure should be included in the manuscript.

P. 16, l 23-24: Is there any reason to think that the correspondence in seasonal errors

between ICAR and ERA-I (i.e., that both have largest errors in summer and smallest in winter) is causal? That is, since ERA-Interim provides lateral boundary conditions for ICAR? P. 17, Figure 5: masking the ICAR and ERAI values over the ocean would be less distracting (since there is no 'truth' over the ocean, anyways).

P. 19, l. 11: What percentage of the crest of the southern Alps is over 1500m? Based on Fig. 1 it seems closer to 1000m would be a somewhat more appropriate height to use in the calculation of Froude number; are the results pertaining to the Fr<1 and Fr>1 cases sensitive to this mountain height?

P. 25, second sentence in Fig 9 caption: This sentence is poorly worded.

P. 26, l. 12-13: This sentence is poorly worded.

P. 29. L18-23: Can the authors speculate why there is this sensitivity to model top height?

P. 29, L. 21: 'estimation the model' is missing 'of'

P. 30, L. 9-13: This paragraph should be expanded for clarity (i.e., rather than saying 'solution to issue (iv) it would be helpful to repeat the description of the issues).

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