Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2018-157-RC2, 2018

Geoscientific Model Development Discussions

Interactive comment on "Similarities within a multi-model ensemble: functional data analysis framework" *by* Eva Holtanová et al.

Anonymous Referee #2

Received and published: 2 October 2018

The submitted paper describes an inter-model distance metric which uses transient climate evolution to assess model similarity - which could potentially be developed as the basis model weighting scheme which had the capacity to assimilate inter-model distance information. The paper has two main novelties over existing work - a consideration of the distances between GCM/RCM pairs in the CORDEX ensemble and the fact that transient rather than mean climate information is used as the basis for the method. The method is applied to single timeseries of area averaged temperature and precipitation in the CORDEX ensemble The distances are evaluated in a basis set comprising a set of spline-based functions, and take into account both absolute difference in time-series and gradient similarity.

The paper makes advances on the literature in attempting to apply a similarity criterion

to GCM/RCM pairs in CORDEX, and initial results are promising - but need a little more expansion. Results for temperature give qualitatively very different structure to the precipitation results, which needs more discussion. The layout graphs are nice - but the authors should reference relevant earlier work. The paper would be acceptable with minor corrections.

Specific points: - the analysis uses only spatially averaged time-series information, unlike earlier work (e.g. Knutti 2013, Sanderson 2015) which primarily use spatial bias correlation to assess similarity. By not using spatial information, it seems like the authors are throwing away a lot of potentially useful information. This is not a show-stopper - but the authors should acknowledge that by using both spatial and temporal information, more meaningful results could probably be obtained - some parameter sensitivity is required - or at least an explanation of why some arbitrary decisions were made. The domain averaging size, for example - a larger averaging area for precipitation might result in a less noisy field in which model similarities are more accurately identified. Similarly, the averaging period and the parameters of the spline expansion - how sensitive is the method to these choices? - what is the expected noise from climate variability, and can this be quantified more accurately? Can the authors use initial condition ensemble members to identify the expected intermodel distance which arises from climate variability alone? - the graph plots are nice - but there are precedents in the literature for presenting model similarities in 2D space, which should probably be cited here (Sanderson 2015). - I feel slightly more could be made of the discussion of parent GCMs and embedded RCMs. Figure 4 suggests that the parent GCMs dominate the inter-model distances for both d0 and d1 for temperature, but perhaps not for precipitation where there is clear structure from RCM pairs. This is perhaps one of the more interesting results from the paper - and the authors should make more of it. Why is this the case, what are the mechanisms? What recommendations would the authors give for end-users of CORDEX given this finding?

Sanderson, B. M., Knutti, R., & Caldwell, P. (2015). Addressing interdependency in a

multimodel ensemble by interpolation of model properties. Journal of Climate, 28(13), 5150-5170. Knutti, R., Masson, D. and Gettelman, A., 2013. Climate model genealogy: Generation CMIP5 and how we got there. Geophysical Research Letters, 40(6), pp.1194-1199.

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