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Geoscientific Model Development Discussions

Interactive comment on "Earth System Model Evaluation Tool (ESMValTool) v2.0 – diagnostics for emergent constraints and future projections from Earth system models in CMIP" *by* Axel Lauer et al.

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Reply to the reviewers' comments on the GMDD manuscript

Below we address the comments of reviewer #1 raised during the open discussion of the paper "Earth System Model Evaluation Tool (ESMValTool) v2.0 – diagnostics for emergent constraints and future projections from Earth system models in CMIP". We would like to thank the reviewer for the time and effort reviewing the paper. We

feel it has improved thanks to the constructive comments. We have listed all reviewer comments below and our answers are provided in blue. All line numbers refer to the "track changes" version of the revised manuscript that is provided alongside the revised manuscript files.

Anonymous Referee #1

The authors present a description of the latest version of ESMValTool, including details on the new evaluation metrics and 'recipes' that are included. These are clearly linked to the original publications which describe the metrics and examples are provided. This is a clear and well structured paper that I am happy to recommend be published with only minor changes.

We thank Reviewer #1 for providing helpful comments to improve the manuscript.

I do have two minor comments on the tool and its presentation here. The first is regarding the recipe names which seem somewhat arbitrary. It might be clearer if they followed a standardised format. The other comment is on the various example emergent constraint plots. While it's certainly useful to be able to directly compare with the published work, the very different plot styles jars slightly when presented together like this. Would it be possible to make the original paper formatting of the plots optional, otherwise reverting to a single consistent format? Would it also be possible to add R^2 values to the plots to indicate how well a linear fit really captures the relationship in the models?

The used naming convention for all recipes that are based on a single peer-reviewed publication or report is recipe_FirstAuthorName_Year_JournalAbbreviation,

e.g. recipe_deangelis15nat.yml. However, for recipes that are based on multiple papers, we relaxed this convention leaving it up to the authors of the diagnostics to decide on a meaningful name, e.g. recipe_seaice.yml combines different diagnostics for sea ice that are based on various articles. An example not fully fitting into either of these categories is recipe_toymodel.yml. In these cases, the naming convention has also been relaxed to any descriptive term chosen by the authors of the diagnostic.
The emergent constraints shown in Figures 6, 7, 8, 9, and 10 have been programmed by different authors (in different languages) as contributions to different projects. In order to give the scientists contributing to the ESMValTool as much freedom as possible and to keep the bar for contributions as low as possible (which is admittedly already quite high) we consider this fine. Homogenizing these figures would require significant recoding. All these diagnostics do, however, output the results as netCDF files, so any plotting program could be used with the ESMValTool output to produce additional plots in the format and layout as desired. Following the suggestion of the reviewer, we added the R^2 values to all panels of Figure 6.

Other, minor, grammatical comments: L5: "...implemented include ECS..." -> "...implemented include constraints on ECS..." L195: "used as emergent constraint." -> "used as an emergent constraint."

Changed as suggested.