

Geosci. Model Dev. Discuss., referee comment RC1
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Comment on gmd-2021-372

Anonymous Referee #1

Referee comment on "Effects of forcing differences and initial conditions on inter-model agreement in the VolMIP volc-pinatubo-full experiment" by Davide Zanchettin et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-372-RC1>, 2021

This paper presents an overview of initial results of the VolMIP volc-pinatubo-full experiment and discuss future directions for the improved experiment. I find it generally well written with useful details. However, there are some places that need more information and/or clarification, which would strengthen the key messages.

No observed values are used when evaluating model climatology and responses to volcanic forcing. Although I agree that the aim of this paper is to provide an initial assessment based on idealized experiments, not historical transient experiments which are comparable to the observations, assessing the degree of inter-model agreement in volcanic influences without any relevant comparison with observed values could be misleading given that models may have systematic biases. I strongly suggest including observed values somehow in their plots and interpreting results accordingly.

This study aims at providing preliminary assessments but more efforts to quantify factors responsible for inter-model discrepancies would be useful. One way would be to add summary bar graphs or tables for some key variables (with observed estimates if possible, see my comment above) where readers can find actual values for individual models and how much differences exist between models and also between different ocean initial conditions (ENSO phases). Mostly, time series are displayed and it is inconvenient to identify specific model responses.

Some places need more explanations for better understanding. It's unclear how authors have selected samples for "equally distributed cold/neutral/warm states of ENSO and negative/neutral/positive states of NAO". Exact details of sampling methods look very important for interpreting results as well as for planning the next VolMIP protocol. Also, authors consider radiation feedbacks in their evaluations but its association with inter-model spreads needs to be explained more clearly. Another one is why ECS is considered here, which represents equilibrium sensitivity to doubled CO₂.

Authors conclude that influence of ocean initial conditions is weak or even negligible but this conclusion can be dependent on how to measure ENSO-like responses. Other studies used relative SST as authors briefly mentioned, and results can be affected much by applying different metrics. Since understanding ENSO influence is one of major issues, I think that adding more discussion with appropriate sensitivity tests would be useful, e.g. comparing relative SST responses with Nino3.4 responses. In terms of NAO or AO responses, target season and region can be revised as boreal winter and high latitude areas, for better comparisons with previous findings.