

Clim. Past Discuss., referee comment RC2
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Comment on cp-2021-182

Anonymous Referee #2

Referee comment on "Mechanisms of hydrological responses to volcanic eruptions in the Asian monsoon and westerlies-dominated subregions" by Zhihong Zhuo et al., Clim. Past Discuss., <https://doi.org/10.5194/cp-2021-182-RC2>, 2022

This paper uses the PMIP3/CMIP5 past1000 ensemble to investigate how explosive volcanic eruptions affect surface climate in the Asian monsoon region. The paper provides a nice analysis of the hydrological response in different regions within this larger area, and also contrasts the response to predominantly Northern hemisphere eruptions and Southern hemisphere eruptions. The analysis is interesting and clearly described and as such is publishable in this journal. Before this occurs though I have two more major concerns which I would like to see addressed, in addition to some more minor comments.

As also mentioned by reviewer 1, care needs to be taken when talking about these results in the context of the "wet-gets-wetter, dry-gets-drier" paradigm. Schurer et al 2020 (in addition to a number of previous studies) analysed precipitation across the whole tropic and found a detectable response in the wettest and driest regions. I do not think that it is definitely the case that this will also apply when restricting the analysis to only the summer climate of the Asian monsoon region, and particularly not to PDSI over this region. Also the fact that you are analysing PDSI should be taken into account when discussing the link to temperature.

As correctly acknowledged by the authors, there have already been a number of other studies analysing the response to the monsoon regions to large volcanic eruption. Although many have been cited here (e.g. lines 38-41, 51-55) I think that the paper would really benefit with a more detailed description of what some of these key papers found, in particular highlighting what exactly is novel here.

Minor comments:

In the abstract (and throughout) please ensure all acronyms are defined (e.g. RWA, RDA, EASM, SASM).

L13 – To avoid misunderstanding - I think it would help to clarify that effects of future volcanic eruptions will only be a temporary, e.g. “future volcanic eruptions may temporarily alleviate...”

L17 – would it be possible to include in figure 1 – what the boundaries are for your definition of the, EASM, SASM. Although not strictly necessary, I think this could help many readers understand the results more quickly.

L20 – how is the modern Asian summer monsoon limit defined (or alternatively give a citation where it is defined)

Section 2.1 – I think that the model selection section could be better explained. Was this entirely based on the work of Zhou et al 2020? If so this should be made clearer. The GRA forcing in GISS was implemented approximately twice as strong as it should have been, see e.g. errata and comments here: <https://data.giss.nasa.gov/modelE/cmip5/> Could this be why the GRA MMM is more significant?

Figure 2 – this should make it clear in the caption that this is just for the GRA dataset.

Section 2.2 – how were the SHVAI eruptions classified – was there a threshold? And are the NHVAI only defined based on a NH threshold? Does this necessarily mean that the NHVAI is larger than the SHVAI? More details and justification are needed for this section.

Section 2.6 – did you mean Pearson correlation?

Figure 3-

Make it clear in the caption which region this refers to.

Can you explain why the SH eruptions seem to be significantly wet even before the eruption (e.g. year -3)? Given that the PDSI before the eruption seems so different between the GSH and GNH can you really be confident the value for the GSH in year +2 is significant, and due to the eruption?

Figure 4 – can you describe what significance test you performed here? Is it also possible in this and subsequent figures to make the stippling clearer?

Section 3.3 – says that the results will only discuss the NHVAI – yet go onto to also discuss the SHVAI.

Figure 8 – What is the scale for the arrows? Is it the same in all figures? Also the caption should make it clear that the color scales are different.

Figure 9 – why is the feature in figure b such a clear line – is this expected? In panel b why is there no effect at all in the NH (whereas there is in the SH in panel a) – is this expected given the definition of SHVAI?

Line 268 – should this refer to figure 3?