

We appreciate the time and effort by the referee in reviewing this manuscript. We will address all issues, as highlighted below (reviewer text in red):

Line 29-30: Revise “the isotopic composition of the ITCZ” to “the isotopic composition of precipitation in the ITCZ”.

Thank you for the suggestion– we will modify the text.

Line 33-35: Revise the final sentence of the abstract (“for the testing of models against paleoclimate evidence.”) to be more specific.

We will change to, “Our results highlight the need for the careful consideration of the spatial structure of volcanic forcing for interpreting volcanic signals in proxy records, and therefore in evaluating the skill of Common Era climate model output.”

We will add an example figure in the supplementary along these lines for the Asian monsoon, which exhibits a different response to our northern or southern volcano categories.

Line 75 (and elsewhere): Revise reference “Adam et al., 2016, in press” to “Adam et al., 2016”

Thank you, we will update the reference.

Line 87: Remove semi-colon before references.

Thank you for noticing this. It looks like an extra parenthesis needs to be removed.

Line 89: Add “in” between “asymmetries” and “the”.

Thank you, we will correct.

Line 189-190: Are the previous five seasons or five years used as a reference period?
Both are mentioned.

We will clarify. Anomalies are with respect to the previous five years during the same time of year under consideration (e.g., NDJFM is relative to the previous five NDJFM’s), otherwise the seasonal cycle becomes part of the response. For figures showing the monthly evolution of some variable (e.g., Figure S6) or an annual-mean (Figure 8-9) metric, anomalies are with respect to the same months in the previous five years, or the entire 60-month interval prior to the eruption, respectively.

Line 268: Remove “that these results are consistent with”, as it is unnecessary and diminishes the clarity of the sentence.

Thank you, we will re-word this part.

Line 281: “the ITCZ shift may result in” May result in or does result in? Has this been specifically evaluated in your analysis?

and,

Line 282-283: Rephrase “since the precipitation signal is strongest moving with the ITCZ”. Unclear what is meant here.

Yes, Figure 5 shows this. We will re-word the sentence with stronger language and clarity, but the answer has eruption/ensemble member dependence and so cannot be made into a general statement. More often than not, however, precipitation increases in the hemisphere-mean when the ITCZ moves toward it. The mean is strongly sensitive to the ITCZ domain itself (rather than e.g., extratropical precipitation changes) since the amplitude of the anomaly is very large, and located in the deep tropics where the grid cell areas are larger.

Line 291: Rephrase “and therefore we restrict the anomalous precipitation field to a single season” to “and therefore we restrict the anomalous precipitation field to the same season.”

Thank you for the (improved) edit.

Line 296-303: The reference to Fig. S8 is missing. I suggest revising or removing this paragraph, as it does not seem to add any new substantive information to the discussion.

Thank you for pointing out that we missed the reference, we will edit the paragraph to improve the presentation and connection to the animations.

Line 325: Replace “eruptions in Table 1, multiplied by 15 ensemble members” to “16 eruptions in Table 1, multiplied by 15 ensemble members”.

and,

Line 338: Suggest replacing “In addition” with “Consistent with the SST anomalies,”

and,

Lines 341-344: Suggest replacing “we argue that the El Niño tendency in CESM is a forced response in ASYMMNH but otherwise depends on the state of internal variability concurrent with a given eruption. This explains why no such ENSO response is associated with” with “we argue that the El Niño tendency in CESM is a forced response in ASYMMNH but otherwise depends on the state of internal variability concurrent with a given eruption, as no such ENSO response is associated with...”

Agreed with all recommendation. Thank you.

Lines 432: Rephrase or revise figure reference. Figure S5 shows that the NH-SH zonally precipitation asymmetry is correlated to the AOD gradient. It does not show a correlation between (18Op) and P.

This is correct, thank you. We will clarify this part of the paper.

Line 466-467 (Eqn 3): Derive this equation from first principles, or provide a description of how Eqn. 3 was derived (e.g. modify Eqn. 1 in Hwang and Frierson, GRL, 2010 to include the storage term).

Thank you, we will add references to justify the equation.

Lines 523-527: Is this data shown? If not, state as such.

We did not explicitly show the relationship between AHT_{eq} and the EFE. We will state this.

Lines 537-538: Unclear what is meant by “the anomalous precipitation response is still coherent”. Rephrase to clarify.

and,

Lines 552-553: Replace “regressing the different events in all three categories together” to “regressing the precipitation median against the AET_{eq} for each eruption (after averaging over ensemble members)”.

and,

Lines 552-554: Cite which figure this data is taken from. Also add the equation of the regression lines and correlation coefficients in Fig. 9.

We agree with the above and will re-phrase and modify the text or figures accordingly.

Lines 565-574: It is unclear how to interpret the representation of the ITCZ shift presented in Eqn. 7 (and the relationship between the ITCZ shift and AHT_{eq}) without a theoretically-constrained N. It doesn't appear valid (or meaningful) to conclude that “energetically, it is quite easy to move the ITCZ”, given that “the slope of the relationship between ITCZ location and AET_{eq} may vary by a factor of 4-5 depending on the relationship used”. Further explanation and discussion of this issue is needed here.

Thank you. We will elaborate in the revised text, but we agree that it is difficult to interpret the magnitude of ITCZ shifts in the absence of a well-defined ITCZ metric. However, several past papers have reported such numbers, and so here we are highlighting that the slope is sensitive to which metric one chooses. This is an attempt to illuminate prior discussions and interpretations rather than offer a “best” N, which may indeed turn out to not be a useful question.

Lines 574-575: The final sentence in this paragraph seems abrupt and out of place. Consider adding a few sentences or a paragraph to summarize the findings of the energy budget analysis.

Line 687: Replace “to” with “in”.

Line 690: Replace “Results shown” with “Results are shown”.

Lines 693-694: Replace “N=the number of events used in each category, consistent with the number of listed events in Table 1 (multiplied by 15 for CESM and 3 for GISS-E2).” with “N=the number of events used in each category (consistent with the number

of listed events in Table 1, multiplied by 15 ensemble members for CESM and 3 ensemble members for GISS-E2).”

Line 715: Replace “Ensemble/Eruption” with “Composite”

Lines 717-718: Replace “Lighter lines associated with the dry and latent components indicate the eruption spread, each averaged over 14 ensemble members.” with “Lighter lines represent individual eruptions, each averaged over 14 ensemble members.”

Fig. 2 and Fig. 4: Revise labels to be consistent with text. E.g. replace “North” and “South” with “ASYMMNH” and “ASYMMSH”.

Fig. 9: Plot ITCZ shift on same y-axis range for each subplot for visual clarity. Add 1:1 line to bottom left plot for visual clarity. Add equation of regression lines and correlation coefficients to upper subplots and bottom left subplot.

We agree with all recommendations and will modify the text and figures. Thank you for the suggestions.