

## ***Interactive comment on “Assessing the impact of large volcanic eruptions of the Last Millennium on Australian rainfall regimes” by Stephanie Blake et al.***

### **Anonymous Referee #2**

Received and published: 12 October 2017

This work analyzed the precipitation response to large volcanic perturbation in Australian, using GISS Model E millennium simulations. The topic is an important contribution to the systematic assessment of global hydroclimate response to the volcanic radiative influence. The paper is well written; the results are clearly presented and discussed. I would recommend a major revision of the paper by addressing the following issues, before it could be accepted for publication:

1. In the "Introduction" section 1.1 It is not clear from the description which relationships between volcanic eruptions and Australian rainfall are unclear and are explored in this paper. Please be more specific. A significant part of the introduction is devoted to

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the literature review of the volcanism and ENSO relationship, while the focus of this study is on volcanic eruptions and Australian rainfall. Please modify either the title, or the structure of introduction. For example, the authors may consider introduce the role of ENSO in changing Australian rainfall before discuss the volcanism and ENSO relationship

2. In the "Data and Method" section 2.1 Line 99, please explain briefly why the last millennium period is especially chosen. 2.2 Please provide a short description of model performance, especially those closely related to the ENSO, IOD and volcanic climate responses. Please also provide a short explanation of why the five volcanically forced scenarios were chosen. 2.3 Line 134, please also discuss the ENSO impact in the chosen north-west and south-east regions.

3. In the "Results" section 3.1 Please explain the advantages of comparing the response between the largest 1257 Samalas and the smallest 1600 Huaynaptina eruption, rather than a series comparison among the 6 eruptions of various size. 3.2 Line 164, there is no ensemble runs for the 2×GC case, please make the distinction. 3.3 One of Figure 8 or Figure 9 should be "SE (instead of NW)Australia" response. Please also correct the reference to the Figure 10 in Line 179. The use of "multi-model mean" in several figures is misleading, please consider change to model ensemble. 3.4 The focus of this work is Australia, however, there is no spatial figures dedicated to the particular area of study. 3.5 Please verify the use of 0.6 standard deviation as the significant level.

4. In the "Discussions and Conclusions" section 4.1 Line 218-221, the difference between Samalas and Huaynaptina response does not seem significant and the use of it as support for the persistence of a high pIOD sounds weak to me. Please consider to use all six (or even more eruptions) of different sizes to analyze the role of eruption magnitude. 4.2 Line 228-235, I do not see the El Nino response persist from year 0 to year 6 in both Fig. 5 and Fig.2. Please explain why the El Nino-like pattern in the eastern Pacific is most visible in year 4, but not earlier. 4.3 Line 241-243, please

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demonstrate in more detail how did the direct precipitation effect of volcanic aerosols override the impact of the IOD on Australian precipitation. Which parameter represents the direct precipitation effect of volcanic aerosols? How was the override effect appear in the results? By the time difference? 4.4 The most important advantage of using modeling results is the capability of exam the physical mechanisms behind the shown effects (such as the impact on ENSO and IOD, and their influence on Australian rainfall). Please provide some discussion of mechanism using the original results from this paper, rather than referring to previous studies.

Please also note the supplement to this comment:

<https://www.clim-past-discuss.net/cp-2017-109/cp-2017-109-RC2-supplement.pdf>

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Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2017-109>, 2017.