

Interactive comment on “Volcanic stratospheric sulphur injections and aerosol optical depth from 500 BCE to 1900 CE” by Matthew Toohey and Michael Sigl

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Received and published: 9 July 2017

This paper is an important contribution to the reconstruction of volcanic forcing for climate modeling studies. It builds on two previous ice-core-based reconstructions of global volcanism, by extending the temporal coverage to 500 BC and improving the event chronology. The paper is nicely written; the results are clearly presented and discussed. I recommend the paper to be published in this journal after addressing the following points:

1. A number of acronym have been introduced in the paper, which may cause some confusion without careful reading. To minimize the confusion, please consider use the

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full name for certain terms (such as the EVA generator); for VSSI and SAOD, consider use eVolv2K-VSSI and eVolv2K-SAOD naming style consistently throughout the paper. 2. P6L20, please explain in more detail how does the analysis verify the representativeness of the few long term cores. In Figure 4, please use the number of 48 events (instead of the same marker) to plot the figure, so the readers could have a rough assessment of how individual event is represented. 3. P7L2-4, “Before 1 CE,, a constant uncertainty value of 26% is assumed, based on regression analysis between AVS-2k. . .and single ice-core records”. Please specify on which period was the regression analysis done. 4. P7L8-11, please provide a brief description of the method of standard error propagation rules, and explain how the two-core and three-core composite uncertainties were obtained. Since the assessment of the signal core uncertainties were provide in Appendix A. The authors may consider add the assessment of the two-core and three-core composite uncertainties right afterward. 5. P8 section 2.3, the discussion of previous work leading towards the modification done by this study could be shortened or moved to the supplementary information. 6. P10L25-29, could the authors please provide a list of eruptions that belong to “such cases”, and explain briefly how “such cases” were identified. 7. P17L24-26, I do not quite follow the logic of the discussion in this paragraph. When the authors came to the conclusion that “The VolcEESM 20th 25 century reconstruction therefore appears to be more consistent with eVolv2k than with the IVI2 reconstruction.”, did they assume that the 25% decrease of 20th century VSSI from the 500-1900 CE mean VSSI in IVI2 also holds true in VolcEESM and eVolv2k? How was this assumption justified, if the magnitude of IVI2 itself were not in good agreement with the other two?

A few comments on the technical details: 1. P4L24 Introduce the name of these two chronologies (i.e., NS1-2011 and WD2014) here, so the readers will know that the NS1-2011 and WD2014 discussed later are not new chronologies. 2. P9L10, please change “(Gao et al., 2007) used” to “Gao et al. (2007) used”. 3. P12L20, “The SAOD results shown hereafter, produced by the EVA forcing generator using the eVolv2k VSSI database, are denoted as ‘EVA(2k)’”. “EVA(2k) “ does not seem to appear in the later

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sections; instead, “EVA(eVolv2k)” was referred to in various parts of the paper. Could the authors please check whether the two terms refer to the same data, and fix it?

Interactive comment on Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2017-31>, 2017.