

Interactive comment on “Volcanic forcing for climate modeling: a new microphysics-based dataset covering years 1600–present” by F. Arfeuille et al.

Anonymous Referee #1

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This manuscript reported a microphysics-based volcanic forcing construction for the years AD 1600–present. Forcing index like this one is very important for the reliable evaluation of the climatic impact of past volcanism, and the results presented in the manuscript are significant and appropriate for the journal of Past Climate. I recommend the manuscript for publication after addressing the following issues:

1. The overall structure of the manuscript could be better organized. For example, the technique detail of dataset reconstruction (section 4) may be moved upfront; discussion about the previous datasets (section 2) could be combined with the result (section 5) and shortened by highlighting the main difference or limitations as com-

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pared to this new reconstruction. Section 3 may better be combined with section 6, so that the discussion of the dataset specificities does not seem to come out of nowhere and section 6 does not appear to be too short. 2. As the essential tool for this reconstruction, the AER model should be introduced in a separate section with sufficient details, for example its spatial-temporal resolution, the microphysical processes of nucleation\condensation\evaporation\ coagulation and how were they apply to simulate the evolution of volcanic aerosol cloud, as well as the limitations of the model. 3. In section 4.2.4 the authors used the Plumeria model to extract the information about the altitude of injection “when enough eruption parameters are known”. What parameters were the authors referring to? What’s the advantage of using the Plumeria model? In the end, for how many eruptions the altitude were calculated from the model, and which ones were based on the Pinatubo vertical distribution? 4. In section 5.2 paragraph #2, the authors stated “using different SO₂ injection altitudes does not change the aerosol distribution to a large extent”. What “distribution” do the authors refer to? It seems to be discussing latitudinal distribution but isn’t this section meant to discuss the altitudinal distribution? In addition, to what extend is a “large” change, isn’t 10-15% reduction in tropical loading (and 8-13% increase in mid-latitude) per 4 km a significant change? 5. In the last paragraph of section 7, it would be great to see the authors address how the reconstruction with microphysics-based model could be further improved, rather than a broad perspective on the overall development of volcanic forcing indices, which is more or less well perceived.

A few minor comments 1. Page 979 line 20, what does “injection in the AER-2-D model was made depending on the exact latitude of the volcanoes inside one or two bands in the 15°N-15°S” mean exactly? 2. Page 979 line 25, please explain why did this reconstruction assign the signals identified only in one hemisphere to high latitude in NH but mid-latitude in SH. 3. Page 983 line 29, “limitations in the model prevent a precise testing and analysis of this influence”, please specify what the limitations are. 4. Page 985 line 7-11, “Results from the Sigl et al (2013). . . .and the Serua(1693) and Unknown (1809) eruptions with larger values in the Southern Hemisphere if we use

the sulfate deposition they obtained from Pinatubo to derive new hemispheric factors”
, please explain the second part of this discussion in a more clear way.

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