

## Review of the manuscript

Easy Volcanic Aerosol (EVA v1.0): An idealized forcing generator for climate simulations

by M. Toohey et al.

submitted for publication in Geoscientific Model Development

### **General**

The manuscript describes an algorithm for calculating temporal, latitudinal, vertical and wavelength dependent distribution of sulfate aerosols for the use in comprehensive Earth System Models. The manuscript is very well structured, organized and written. The main part of the manuscript describes in a formal way the physics behind the EVA algorithm which is important for groups that would like to apply the algorithm for their individual models. However, for the general readership the manuscript would benefit including a number of paragraphs introducing general physical concepts in the context of stratospheric volcanic aerosols that are referred to in the body of the manuscript.

I suggest final publication of the manuscript when the minor points below are addressed in the revised version.

### **Specific**

#### *Introduction*

The introduction lacks two or three additional paragraphs for assisting the reader that is not a specialist to get a basic overview about the physical mechanisms involved in the context of stratospheric sulfate. This relates to a general introduction into the basic concepts of the gas-particle conversion in the stratosphere and the general effect of the volcanic sulfate aerosols on the modification of incoming solar radiation (e.g. related to EXT, SSA and ASY).

A second point relates to the availability of volcanic reconstructions carried out in former studies as introduced in chapter #2 (e.g. Crowley and Unterman, 2013; Gao et al. (2008)) and uncertainties involved. This could also be used to address different sources and amounts of uncertainties involved in volcanic reconstructions. The authors state in one of their following chapters on the uncertainties involved in their reconstruction approach based on specific assumptions, for instance based on the Pinatubo eruption. However, taken into account the large uncertainties involved in the reconstruction of stratospheric aerosol loadings based on ice core data and according dating uncertainties this might put some of those EVA-specific uncertainties into perspective.

### *Existing data set and approaches*

There is one earlier volcanic reconstruction based on Crowley (2000) which was used as forcing by a number of climate simulations. The discussion of the reconstruction of the volcanic forcing already includes most of the mechanisms implemented for the later reconstruction of Crowley and Unterman 2013. Maybe the authors can add this data set and the references as additional source for volcanic reconstructions.

### *The EVA approach*

p. 9, l. 19: The authors mention several times the Brewer-Dobson circulation and its significance for the aerosol distribution and transport – A small paragraph in the introduction or within this chapter would help to understand the overall significance and mechanisms controlling the BD circulation.

A second general remark relates to the importance of the specific synoptic meteorological conditions for the individual outbreaks including the timing in the annual cycle (cf. p. 9 27 ff.) – A few words on how this could impact on the eventual depositing of the sulfate in Greenland and Antarctic ice cores could help to motivate the high degree of uncertainty involved in the reconstruction based on ice cores.

### *Sample Results*

p. 15 l. 17: Is there a way to improve the accuracy of small-type extratropical high latitudes eruptions, knowing that their impact in EVA might be too exaggerated?

p. 16 l. 3ff: Is there an explanation why the linear scaling used in EVA for Tambora produces lower AOD values than the non-linear scaling in CU13 ?

### *Conclusion and outlook*

The EVA algorithm will most likely have also an important role in the PMIP4 simulations and the VolMIP project. A concluding paragraph on the linkages with PMIP4 could also serve as an outlook for applications of EVA in producing consistent volcanic data sets for paleoclimatic modelling of the Holocene and the last 2,000 years.