

Interactive comment on “Quantifying CanESM5 and EAMv1 sensitivities to volcanic forcing for the CMIP6 historical experiment” by Landon A. Rieger et al.

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The paper describes the differences in instantaneous radiative forcing, temperature, and precipitation in simulated post-Pinatubo climate changes when using version 4 of the CMIP6 Stratospheric Aerosol data set instead of version 3 in the Canadian Earth System Model version 5 (CanESM5) and in the Energy Exascale Earth System Model (E3SM) Atmosphere Model version 1 (EAMv1). In general, the differences between both versions of the volcanic forcing data set are small compared to internal variability except for temperature anomalies in the tropical stratosphere. Overall, the climate impact due to a version upgrade is small.

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The paper is well written, the figures are nicely prepared and the abstract provides a concise and complete summary of the paper. The structure of the paper is clear. The different intercomparison steps are well documented and sufficiently explained. In summary, the paper is a solid piece of work, which provides very valuable information for the CMIP6 community and is therefore very well suited for GMD. I recommend the paper for publications after a few minor revisions.

General comments:

There is some general issue throughout the text incl. the abstract with respect to the name of the volcanic forcing data set. To my understanding GLOSSAC and the CMIP6 Stratospheric Aerosol data set are not the same. The stratospheric aerosol data set for CMIP6 is build on the Global Satellite-based Stratospheric Aerosol Climatology (GloSSAC, Thomason et al., 2018) for the satellite area (from 1980) onwards. The version 3 (Luo, 2017) is based on GloSSAC v1.0 (Thomason et al., 2018), while the revised version v4 for Jan 1991-Dec 1994 (Luo, 2018) is based on the new data set GloSSAC v1.1 (Thomason 2018). So there exist no GLOSSAC version 4. Please check and revise the text carefully with respect to the name convention.

In the release note to version 4 of the stratospheric aerosol data set for CMIP6 (Luo, 2018), some first comparison between Stratospheric Aerosol Optical Depth and extinction of version 3 and 4 were already made with similar results as listed in section 2. This should be mentioned.

Specific comments:

Title: The title is a little bit misleading and need to be changed as the authors consider only the Post Pinatubo episode (1990 -1996) and not the full CMIP6 historical period.

Page 1, line 20 (also page 12, line 7), "can be as large as 3 C" . Maybe the authors could be more specific here and can give the exact duration and the altitude of this local maximum. If I look at figure 5, I can hardly see a temperature anomaly of 3 C. A

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supplementary lon/lat figure might be helpful here to better illustrate this point.

Page 2, line 2, "an estimated 10 Tg of sulfur into the stratosphere." The S emission of Mt Pinatubo is uncertain current estimates range between 5 to 10 Tg S, see for example Timmreck et al. (2018) , p 2583.

Page 2, line 16-18, Please reformulate this sentence as it is a bit misleading. Solomon et al (2011) and Fyfe et al (2913) used an updated version of the Sato et al. (1993) data set which includes the more recent eruption.

Page 3, line 7, " an error was found " You can be more specific here and mention that it was a CLAES cloud clearing problem which affected the Pinatubo period mostly in the first months after the eruption , see "Release Notes Stratospheric Aerosol Radiative Forcing and SAD version v4.0.0 1850 - 2016 (Luo, 2018).

Page 5, line 8, Some information about the vertical resolution in the stratosphere and in the tropical tropopause region in the CanESM5 would be nice.

Page 5, line 17, Same for the EAMv1.

Page 5, line 26, One has to be careful to compare here not apples and oranges. All the cited papers (Minnis et al., 1993; Stenchikov et al., 1998; Ramachandran et al., 2000) show a decrease in net shortwave flux radiation but mention an increase in reflected shortwave radiation.

Page 8, line 8, "three realizations were performed using the EAMv1 model" As the EAMv1 model produces the QBO, I wonder about the QBO in the model. Were the QBO in different phases in the model run and how does they differ from the actual observed phase?

Page 12, line 10-11, I wonder if you had a look on possible changes in sea ice in the CanESM5?

Figure 3, The authors might think about to present the flux anomalies in the more com-

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mon way with negative net short wave flux anomalies and net positive LW anomalies.

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