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Interactive comment on "The Model Intercomparison Project on the climatic response to Volcanic forcing (VolMIP): Experimental design and forcing input data" *by* Davide Zanchettin et al.

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We thank the CMIP6 Panel for the comments on the VolMIP protocol and on this manuscript. Below are our responses to their specific comments (original comments reported in between quotation marks):

"The relation to the standard forcing dataset provided for the CMIP6 historical simulations [...] is somehow unclear. The standard forcing dataset for stratospheric aerosol data include the following quantities: 1) sad: surface area density; 2) rmean: mean radius (required for some heterogonous reactions); 3) volume density: aerosol volume density; 4) H2SO4 mass. In addition, the models require model-tailored optical properties for the radiative transfer parametrizations (e.g., extinction coefficient, sin-

gle scattering albedo, asymmetry parameter for the different bands, and AOD). Again these are provided for all participating CMIP6 models. What are the exact parameters that will be provided for the additional VolMIP forcing datasets? Are the methods to include the additional forcing datasets exactly the same or is a different approach required in the models to implement the additional VolMIP forcings? Please clarify and coordinate with the team who is providing the standard CMIP6 forcings."

RESPONSE: VolMIP requests to use the model-specific CMIP_(YOUR MODEL)_radiation.nc data for the volc-pinatubo experiments. The data are those available at ftp://iacftp.ethz.ch/pub_read/luo/CMIP6/ , which include four dimensional (time, altitude and latitude, no of the band) arrays of extinction coefficient, single scattering albedo, asymmetry parameter for the solar and the terrestrial part of the spectrum. The volcanic forcing data sets produced with EVA, which must be used for the volc-long and volc-cluster experiments, will have the same format as the CMIP6 standard forcing files described above, i.e., aerosol extinction, single scattering albedo and asymmetry factor, all as a function of latitude, height and the spectral bands of the model.

"When the proposed model EVA is used to produce the additional VolMIP forcings for the Pinatubo eruption, how do the results compare to the standard CMIP6 standard dataset? Please comment."

RESPONSE: We clarify here that the volc-pinatubo experiments will use the CMIP6 standard forcing files mentioned in our response above. VolMIP will use forcing dataset generated by the EVA module only for the volc-long and volc-cluster experiments, in line with what has been proposed for the PMIP past1000 experiment (Kageyama et al., 2016). Details about EVA including comparison with other forcing data sets is described in Toohey et al (2016), where the EVA forcing is also compared to the CCMI/SAGE_4lambda dataset, itself a forerunner to the CMIP6 volcanic forcing. EVA is therefore highly compatible with the CCMI Pinatubo forcing in terms of such general features such as mean extinction vertical profile, the mean meridional structure of

extinction, and the spread of extinction from the tropics to extratropics with time.

“Any specification how to apply the additional forcing datasets with respect to the tropopause in each model?”

RESPONSE: The aerosol forcing produced by EVA decays to zero around the tropopause. Therefore, no clipping of the forcing is necessary at the tropopause. We will specify this in the revised version of the manuscript.

“The data availability section should be revised. The details on the WIP contribution are already included in the CMIP6 overview and can be deleted here. However, in order to run the experiments in VolMIP, other forcings that are developed for the CMIP DECK and the CMIP6 historical simulations are required. Therefore please expand the data availability section to refer to these forcings, e.g. ’"In order to run the experiments, data sets for natural and anthropogenic forcings defined for the DECK and the CMIP6 historical simulations are required. These forcing data sets are described in separate invited contributions to this special issue. In addition, specific volcanic forcings are required for the VolMIP experiments that are described in this paper. All forcing data sets will be made available through the ESGF with version control and DOIs assigned.”’

RESPONSE: agreed, but we keep the original version of the last statement (“The forcing datasets or, alternatively, dedicated tools to derive them will be made available through the ESGF with version control and DOIs assigned.”), since for some experiments we request that the model-specific volcanic forcing input files will be derived by EVA by the different modeling groups rather than being provided as data. We are convinced that this is the most efficient way to handle this, also taking into account the future use of the same tool for a different set of climate models.

“Please ensure consistency of the experiment short name and other abbreviations with the CMIP6 overview paper (see Table 2 of Eyring et al., 2016) (e.g. ’piControl for the pre-industrial control experiment).”

RESPONSE: we will check names for consistency.

“Please ensure consistency with the final abbreviations of the CMIP6-Endosed MIPs (see Table 3 of Eyring et al., 2016) (e.g. DynVarMIP instead of DynVar).”

RESPONSE: we will check names for consistency.

“Line 319: "VolMIP has defined a new group of variables (Volcanic Instantaneous Radiative Forcing, or VIRF, see Table 4), which includes additional variables that were not in the original set provided by CMIP and are necessary to generate the volcanic forcing in some experiments.” Please specify for which experiments these additional group of variables is requested, in particular whether this group is only requested for all or a subset of the VolMIP experiments, or also for the DECK and the CMIP6 historical simulations.”

RESPONSE: we will specify for which experiments the VIRF diagnostics are necessary, for how many years and for how many simulations.

Line 320: we suggest to replace ’"were not included in the original set provided by CMIP" with "were not included in the CMIP5 data request"

RESPONSE: agreed

“Line 327: we suggest to repeat the actual parameters that are provided with the standard forcing dataset for the CMIP6 historical simulation here.”

RESPONSE: agreed, we will include the following text in the revised manuscript: “Specifically, the reference stratospheric aerosol forcing dataset for the CMIP6 historical experiment includes model-specific data for aerosol extinction, single scattering albedo and asymmetry factor, all as a function of latitude, height and the spectral bands of the model (see ftp://iacftp.ethz.ch/pubread/luo/CMIP6).”

“Lines 362/363: can the parameters that are provided by EVA be given? How do they differ from the standard forcing dataset? See also the comments above.”

RESPONSE: As noted in the response to the first comment, the forcing sets produced with EVA have the same format as the CMIP6 standard forcing files, i.e., aerosol extinction, single scattering albedo and asymmetry factor, all as a function of latitude, height and the spectral bands of the model. We will better specify this in the manuscript by reporting the statement above in this part of the text.

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