Author comment 2.

We thank both reviewers for their constructive and helpful comments on this article.

Interactive comment on "Chemistry-climate model simulations of the Mt. Pinatubo eruption using CCMI and CMIP6 stratospheric aerosol data" by Laura Revell et al.

Anonymous Referee #2

In this manuscript the authors compare the results of SOCOLv3 simulations performed using the SAGE-4λ and SAGE-3λ stratospheric aerosol datasets, used for the CCMI-1 and CMIP-6 model intercomparisons, respectively. In particular, the authors compare the temperatures and ozone concentrations during the post-Pinatubo period in the two simulation ensembles to each other and to the MERRA and ERA-Interim reanalysis. I have found this an interesting paper, well-written and logically organized. It is a good paper that represent a necessary reference to document the differences between the two datasets. I have only some minor comments:

- page 3 line 13: "we investigate the impact of the Mt. Pinatubo eruption on climate and stratospheric chemistry". The authors only show changes in temperature and w, too little to speak about changes in climate. I would explicitly write "we investigate the impact of the Mt. Pinatubo eruption on stratospheric temperatures and chemistry".*

Changed as suggested.

- section 2.3 is not very clear. Starting from the title, I would spell out the full names of the databases: "The SAGE-3λ and SAGE-4λ". Initially I wondered if the authors where introducing a third database that merges SAGE-3λ and SAGE-4λ. Secondarily, I do not understand the steps. Step 1 is the calculation of n, r, and σ from the different wavelengths. But what is step 2? Which correction is calculated? Or did you mean "correlation"? Also, what are the remaining two parameters, n and σ? But they have already been obtained in step 1.

We have changed the title of this section as suggested. And yes, "correlation" was meant rather than "correction" – thanks for bringing this error to our attention! Step 2 describes how n and σ can be obtained from the correlation even when SAGE II data are not available. We have rewritten step 2 as:

"In step 1, *n*, *r* and σ were obtained using the extinction coefficients at three wavelengths for the CMIP6 data set, and four wavelengths for the CCMI data set, which are partially correlated. However, a small measurement error on the input values may cause large inaccuracies in the output parameters (*n*, *r* and σ). Therefore a σ -k_{1020} correlation was used in the CMIP6 data set to minimize the effects introduced by the measurement errors, even during the SAGE II period, where extinction coefficients at three wavelengths were available. This correlation is obtained from the output of step 1. In CCMI,

the r_{eff}-k_{1020} correlation was used to obtain *r*. The remaining two parameters (*n* and σ) were obtained by fitting to the measured extinction coefficients. The fitting quality remains almost as good as step 1.

For other time periods (outside the SAGE II period), extinction coefficients at only one wavelength were available (from satellite instruments or photometers). Both correlations (σ -k_{1020} and r_{eff}-k_{1020}), again obtained from the SAGE II time period, were used to calculate the remaining unknown parameter, the number density."

- figure 4: The authors compare with MERRA and ERA-Interim to establish which one of the two databases lead to better simulations. However, reanalysis might not be the best tool to evaluate a model after a volcanic eruption, as they are driven by satellite data which might not be reliable after such strong perturbation. Additionally, they might not respond correctly to such a strong and sudden perturbation. I would suggest to add a comparison to measurements, many of which as cited in the introduction.

We note that the reanalyses assimilate all available data, not just satellite data. Further, Dee et al. (2011) note that in ERA-Interim they apply a bias correction which avoids some of the problems encountered in the post-Pinatubo eruption period in the ERA-40 reanalysis. Zonal-mean latitude/pressure cross-sections of temperature anomalies in the MERRA and ERA-Interim reanalyses (Figure 1 below) show warming in the tropical lower stratosphere of ~3 K, which, given that this is a 6-monthly average, is in good agreement with the "up to 3.5 K" warming reported by Labitzke and McCormick, 1992 (cited in the introduction).

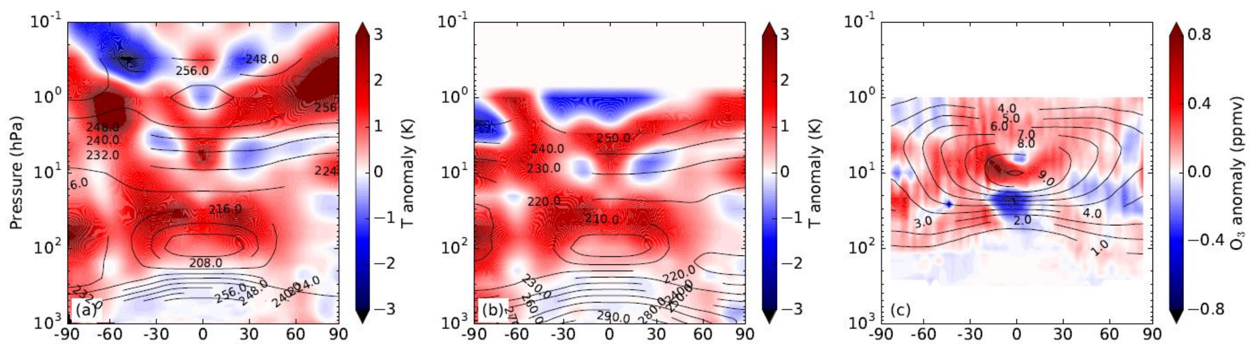

Figure 1: Anomalies in the 6 months following the Mt. Pinatubo eruption for (a) MERRA temperature reanalyses; (b) ERA-Interim temperature reanalyses; (c) SWOOSH ozone observations. Black contour lines show the annual climatological mean (1986-2005).