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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling study of the impact of SO_2 volcanic passive emissions on the tropospheric sulfur budget" *by* Claire Lamotte et al.

Anonymous Referee #2

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The paper by Lamotte et al. studies the effect of SO2 volcanic degassing emissions on tropospheric sulfur budget, using the MOCAGE global CTM implemented with new volcanic emission inventory of Carn et al. (2016, 2017). By model sensitivity tests, tropospheric SO2, sulfate and AODs simulated with new and old emission inventories for the year 2013 are compared and validated against SO2 GOME-2 and AOD MODIS satellite data sets. The results show that the new inventory (CARNALTI) is the best with reference to satellite observations. Such kind of study is interesting and should provide important information for understanding the sulfur global budget. On the other hand, in the opinion of this referee, the manuscript still needs improving a lot before acceptance for publication.

I agree with Referee #1 and Dr. Pasquale Sellitto that other observational data should be used for the validation of the model simulations. In addition, I am very concerned about the effects of the volcanic emission heights on the simulated results. Tables 1 and 2 present different simulation scenarios, but I missed the detailed information on emission heights of the new inventory of Carn et al. (2016, 2017). As I understand, the emission heights are provided in the work of Carn et al. (2016, 2017), but for the sensitivity test, all the volcanic emissions (eruptive and passive) were arbitrarily forced to the model surface for the scenario CARN. While the SO2 tropospheric columns are compared, can the vertical distributions of SO2, sulfate or aerosols be better simulated using CARNALTI than with CARN?

Other issues:

2.3 Emissions (L109-L114): The emission inventories (MACCity and GFAS) are for the years before 2010, earlier than the simulated year 2013. Can this affect the comparing results?

2.4.1 Gaseous species (L123-125): Two schemes, RACM and REPROBUS, are used for tropospheric chemistry and stratospheric chemistry, respectively. How the model grid cells are distinguished between the troposphere and the stratosphere so that only one of them is applied? How are stratospheric tracers (e.g., CFCs and OCS) and tropospheric tracers (e.g., NMVOCs) treated in the model grid cells? Can TUV calculate the photodissociation rates of stratospheric chemical tracers?

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