EGU2020-4791
https://doi.org/10.5194/egusphere-egu2020-4791
EGU General Assembly 2020

Update of the volcanic sulfur emission inventory in MOCAGE CTM and its impact on the budget of sulfur species in the atmosphere

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Constraining emission inventories into chemistry-transport models (CTM) is essential. In addition to anthropogenic emissions, natural sources of pollutants must be considered. Among them, volcanoes are large emitters of gases, including sulfur dioxide (SO_2), a volatile species, causing environmental and health issues.

Volcanic SO_2 emission inventories are usually integrated in global CTMs, in order to improve the modelling of chemical species in the atmosphere. Here, we use the model MOCAGE, developed at CNRM, which currently uses Andres & Krasgnoc's inventory (1998); a temporal average of emission on some 40 volcanoes, monitored through the synergy of satellite data and surface remote sensing instruments, for 25 years (from 1970's to 1997). However, this inventory is now quite old and is therefore no longer sufficiently accurate.

Thanks to the development of new satellite observations, it has become possible to produce such inventories with an improved accuracy. The global coverage and higher sensitivity of these instruments has allowed to reference more emission sources (hard-to-access volcanoes, small eruptions or even passive degassing). Hence, a new inventory of Carn et al (2016,2017) based on satellite observations has been implemented in MOCAGE. Besides being recent (from 1978 up to 2015), it combines eruption and passive degassing over more than 160 volcanoes. Passive degassing fluxes are provided as annual averages and eruption fluxes as daily total quantities (in case of events). In addition, information on volcanoes vent altitude and eruptive plume heights is available, which has been used to better constraints the model.

We focus our study at the global scale. The years 2013 and 2014 were chosen as the years with the lowest and highest total eruptive emissions respectively, in Carn's inventory. Thus, 2013 highlights mainly the impact of passive degassing, while 2014 provides additional information on eruptions.

For each of the years studied, the sulfur species budget in MOCAGE simulation is increased when the inventory is updated and therefore the relative contribution of volcanic sulfur emissions is larger. We note the global increase in sulfur dioxide and sulfate aerosol burdens; an increase even more significant when the injection heights of the emissions are taken into account.