Project: **1128**

Project title: **Investigation of the influence of air pollution on DMS and its role in the Earth's climate**

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Report period: **2023-01-01 to 2023-12-31**

In the current allocation period, computing time has been granted for ECHAM-HAMMOZ simulations that focus on (i) the effect of bush and savanna fires on the atmospheric composition and radiation budget and (ii) on new advances in the oxidation of DMS.

Simulations with ECHAM-HAMMOZ were performed for two fire episodes (i) California wildfires in 2017 and (ii) Australian bushfires in 2019. For the Australian bushfire simulation, a setup designed for ECHAM-HAM was already available and used for both episodes. However, the effect of wildfires on the atmospheric composition and Earth's radiation budget depends on the emission height. For Australian bushfires these were well determined through comparison with observations and as a consequence, further focus was set on the results of the Australian bushfires.

Five simulations were performed. These were divided into three simulations dealing sole aerosol particle emission from the wildfires and two simulations with aerosol particle, NOx and VOC emission. The simulations results were compared with the monthly averaged ozone column measurements provided at the NASA Ozone Watch website (https://ozonewatch.gsfc.nasa.gov, last access: 16 June 2023). The comparison with the measurements and the default simulation revealed that the strong ozone hole observed during September and October 2020 can be simulated, when aerosol particles are emitted into the stratosphere, solely. However, a simulation with deactivated radiative forcing through the emitted aerosol particles reveal also a shrinking of the ozone hole. This result leads to the conclusion that the increased ozone depletion relates towards strengthen heterogeneous chemistry and are affected by the increased aerosol surface from the wildfire emission. The importance of the chemical related processes through increased wildfire aerosol particles on the ozone hole has been proven by other global simulations (see Damany-Pearce et al., 2022 and Rieger et al., 2021).

Interestingly, the effect of VOC and NOx emissions result into shrinking of the ozone hole. Thus, emitted VOCs and NOx might not be emitted completely into the height of the aerosol injection, but reasons are not clear. Assumptions are that either the emissions are too high scaled or VOCs and NOx do not reach the same intrusion level as the aerosol particles.

In order to understand this, the ECHAM-HAMMOZ model is further modified to better distinguish between intrusion of aerosol particles into stratospheric layers and VOCs into the planetary boundary layer and/or lower Free Troposphere. Current simulations and model development is ongoing.

Because of the further simulations on wildfire chemistry currently the simulations for improved DMS chemistry are pending.