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The Aerosol Cloud of a large Volcanic Eruption: Simulation of Evolution and Climatic Influence

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Super eruptions exert an extreme forcing on the Earth System. The emitted volcanic aerosol stays several years in the stratosphere, causing strong radiative effects with consequences for atmospheric processes. The interactive simulation of formation, dispersal and temporal development of a very large volcanic cloud is a challenging task for every aerosol climate model. For our studies we use the middle atmosphere general circulation model MAECHAM5 including the global aerosol module HAM. HAM calculates the aerosol microphysics of sulfate and other species and their source and sink processes. The model setup has been validated for the Pinatubo eruption, showing good agreement with satellite data. The results show a realistic atmospheric life cycle of the aerosols, including removal processes and the caused radiative forcings.

The simulations are carried out for a possible Northern Hemisphere mid-latitude super eruption located at Yellowstone National Park, because it seems to be one of the most likely possible sites for such an event at higher latitudes, and for a tropical one.

The discussion includes the evolution of the sulfate aerosol, the radiative forcing and changes in atmospheric transport and circulation. We also show the influence of the model set up, e.g. resolution, OH-limitation, on the results.