

Simulation of stratospheric aerosol and its radiative forcing with the comprehensive chemistry - climate model EMAC based on satellite and aircraft observations

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Volcanic eruptions contribute strongly to the radiative effects on climate by stratospheric aerosols. We have used satellite data, including anomalies in SO_2 concentrations and optical extinction, to analyze sulfate in the lower stratosphere. We present results of transient simulations for the period 2002 to 2012, using the chemistry-climate model EMAC in different configurations with interactive tropospheric and stratospheric aerosol processes. We show that the volcanic emissions are essential to reproduce observed stratospheric aerosol optical depth and compute the radiative forcing of climate. Analyzing newly available 3D-datasets of the MIPAS and GOMOS instruments on ENVISAT, with reduced data gaps, increased the number of identified volcanic eruptions to about 230 events. This includes strong volcanic eruptions injecting directly into the stratosphere and medium and small volcanic eruptions reaching the stratosphere through transport from the upper troposphere. This update improves the EMAC-simulated global radiative forcing by stratospheric aerosol and aerosol optical depth. The availability of in situ aircraft measurements in the UTLS region by M55-Geophysica from the StratoClim project providing information on sulfate and silicate fraction and also size distribution appears to be very important to define the optimal model configuration.