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Stratospheric chemistry and aerosol modeling in CAMS with the IFS-CB05-BASCOE-GLOMAP (ICBG) system: evaluation in quiescent conditions and in a volcanic eruption.

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We present interactive stratospheric aerosol simulations with the ICBG system, a global tropospheric-stratospheric combined aerosol-chemistry model which is an extension to the ECMWF Integrated Forecasting System (IFS), and is developed as part of the Copernicus Atmosphere Monitoring Service (CAMS). ICBG is the result of the merging of two existing CAMS configurations of the IFS:

- The IFS-GLOMAP tropospheric-stratospheric aerosol microphysics system, which has the GLOMAP-mode aerosol scheme configured for forecast-cycling experiments within the IFS,
- The IFS-CB05-BASCOE tropospheric (CB05) – stratospheric (BASCOE) chemistry scheme, which is also an established configuration of the IFS within CAMS.

During the first phase of CAMS, the stratospheric chemistry scheme IFS-BASCOE was extended to include the stratospheric sulphur chemistry from the UM-UKCA model, with sulphuric acid production rates from IFS-BASCOE passed each timestep to the aerosol scheme IFS-GLOMAP for aerosol particle nucleation and condensation. The aerosol surface area densities (SAD) simulated by IFS-GLOMAP simulated are similarly passed each timestep to the stratospheric chemistry scheme IFS-BASCOE for heterogeneous reactions. In a recent progression of this strato-tropospheric modelling system, the climatology for meteoric smoke particles (MSP) used in UM-UKCA has also been implemented. Thus the simulated stratospheric aerosol layer comprises not only pure sulphuric particles nucleated homogeneously but also meteoric-sulphuric particles formed from the MSPs.

We evaluate the simulated stratosphere aerosol layer in quiescent conditions, comparing it to SAGE-II measurements from the 1998-2002 period. The simulated stratospheric sulfate burden, aerosol extinction, stratospheric aerosol optical depth (sAOD) and surface area density (SAD) agree well with the SAGE-II retrievals. We also show results from ICBG simulations of the volcanic

aerosol cloud from a large-magnitude tropical eruption (Pinatubo, June 1991, VEI6) and a medium-magnitude eruption at a northern mid-latitude (Raikoke, June 2019, VEI4).