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Investigating convective transport processes and large scale stratospheric dynamics with ICON-ART

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We have extended the global ICON (ICOsahedral Nonhydrostatic) modelling framework. ICON is a joint development by the German Weather Service (DWD) and the Max-Planck-Institute for Meteorology (MPI-M). We added modules for gas-phase chemistry and aerosol dynamics (ART, Aerosols and Reactive Trace gases) [1]. ICON allows a regional grid refinement with two-way interactions between the different horizontal grids. It is used by DWD for numerical weather predictions and will be used by MPI-M for climate projections [2].

The extended modelling framework ICON-ART is developed in an analogous way to its predecessors COSMO-ART [3], so that aerosol and chemical composition feedbacks can be considered in a comprehensive way. Up to now, ICON-ART accounts for volcanic ash tracers, radioactive tracers, sea salt and mineral dust aerosols. Additionally, several gaseous tracers have been introduced. For the dynamics (transport and diffusion) of aerosol and gaseous tracers, the original ICON tracer framework is used. For the model physics, numerical time integration follows a process splitting approach separating physical processes. Each process is called independently via an interface module. Currently, the processes of emission, dry and wet deposition, sedimentation, and first order chemical reactions are included.

We will present a simulation of the transport of ozone depleting short-lived trace gases from the surface into the stratosphere as well as of long-lived tracers. The simulated tracer distributions are used to investigate the ability of ICON-ART to simulate convective vertical transport in the troposphere as well as of large-scale stratospheric dynamics.

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