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ICON-ART - A new online coupled model system for the global to regional scale

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We extend the global modelling framework ICON (ICOsahedral Nonhydrostatic) by modules for gas-phase chemistry and aerosol dynamics (ART, Aerosols and Reactive Trace gases). ICON is developed jointly by German Weather Service (DWD) and Max-Planck-Institute for Meteorology (MPI-M), and is used for numerical weather prediction as well as for future climate predictions(1). In order to account for the spatio-temporal evolution of aerosol and trace gases and the related feedback processes with clouds and radiation, the extended modelling framework ICON-ART is developed in an analogous way to its precursor COSMO-ART(2).
For the dynamics (transport and diffusion) of aerosol and gaseous tracers, the original ICON tracer framework is used. Up to now, ICON-ART accounts for six monodisperse volcanic ash tracers, nine monodisperse radioactive tracers, three log-normally distributed modes for sea salt aerosol, and three log-normally distributed modes for mineral dust aerosol. Additionally, several gaseous tracers have been introduced.
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 accounted for are emission, dry and wet deposition, sedimentation, and first order chemical reactions.
We present the concept of the ICON-ART code structure, first results of the spatio-temporal evolution of aerosol, and a first study of the transport of ozone depleting short-lived trace gases into the stratosphere.
(1) Zaengl G., Reinert, D., Rípodas M.-P., and Baldauf M., 2013. The ICON ((ICOsahedral Nonhydrostatic) modelling framework of DWD and MPI-M: Description of the nonhydrostatic dynamical core. Q. J. Roy. Meteor. Soc. (submitted)
(2) Vogel, B., Vogel, H., Baeumer, D., Bangert, M., Lundgren, K., Rinke R., and Stanelle T., 2009. The comprehensive model system COSMO-ART - Radiative impact of aerosol on the state of the atmosphere on the regional scale. Atmos. Chem. Phys., 9, 8661–8680.