Status of the seamless coupled modelling system ICON-ART

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The integrated modelling framework ICON-ART [1] (ICOsahedral Nonhydrostatic – Aerosols and Reactive Trace gases) extends the numerical weather prediction modelling system ICON by modules for gas phase chemistry, aerosol dynamics and related feedback processes. The nonhydrostatic global modelling system ICON [2] is a joint development of German Weather Service (DWD) and Max Planck Institute for Meteorology (MPI-M) with local grid refinement down to grid sizes of a few kilometers. It will be used for numerical weather prediction, climate projections and for research purposes. Since January 2016 ICON runs operationally at DWD for weather forecast on the global scale with a grid size of 13 km. Analogous to its predecessor COSMO-ART [3], ICON-ART is designed to account for feedback processes between meteorological variables and atmospheric trace substances. Up to now, ICON-ART contains the dispersion of volcanic ash, radioactive tracers, sea salt aerosol, as well as ozone-depleting stratospheric trace substances [1]. Recently, we have extended ICON-ART by a mineral dust emission scheme with global applicability and nucleation parameterizations which allow the cloud microphysics to explicitly account for prognostic aerosol distributions. Also very recently an emission scheme for volatile organic compounds was included. We present first results of the impact of natural aerosol (i.e. sea salt aerosol and mineral dust) on cloud properties and precipitation as well as the interaction of primary emitted particles with radiation. Ongoing developments are the coupling with a radiation scheme to calculate the photolysis frequencies, a coupling with the RADMKA (1) chemistry and first steps to include isotopologues of water. Examples showing the capabilities of the model system will be presented. This includes 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.

[1] Rieger, D., et al. (2015), ICON-ART - A new online-coupled model system from the global to regional scale, Geosci. Model Dev., doi:10.5194/gmd-8-1659-2015.
[2] Zängl, G., et al. (2014), The ICON (ICOsahedral Non-hydrostatic) modelling framework of DWD MPI-M: Description of the non-hydrostatic dynamical core. Q.J.R. Meteorol. Soc., doi: 10.1002/qj.2378
[3] Vogel, B., et al. (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