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Parameterization of the nitric acid effect on CCN activation

S. Romakkaniemi, H. Kokkola, and A. Laaksonen
Department of applied physics, University of Kuopio, Kuopio, Finland

Abstract. In this paper we present a parameterization of the nitric acid effect on cloud droplet formation. The new parameterization is intended to be used in large scale models in order to obtain regional and global estimates of the effect of nitric acid on cloud drop concentrations and the radiative balance. The parameterization is based on numerical air parcel model simulations and can be applied for unimodal and bimodal lognormal aerosol particle size distributions in a large variety of different conditions. In addition to the aerosol particle distribution and gas-phase HNO_3 concentration, the parameterization requires temperature, total pressure, updraft velocity, and the number concentration of cloud droplets formed at zero nitric acid concentration, as input parameters. The parameterization is also suitable for describing the effect of hydrochloric acid on the cloud drop concentrations, and in practice, the HNO_3 and HCl concentrations can be summed up to yield the total effect. The comparison between the parameterization and the results from numerical air parcel model simulations show good consistency.

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