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The influence of nitric acid on the cloud processing of aerosol particles

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Abstract. In this paper we present simulations of the effect of nitric acid (HNO_3) on cloud processing of aerosol particles. Sulfuric acid (H_2SO_4) production and incloud coagulation are both affected by condensed nitric acid as nitric acid increases the number of cloud droplets, which will lead to smaller mean size and higher total surface area of droplets. As a result of increased cloud droplet number concentration (CDNC), the incloud coagulation rate is enhanced by a factor of 1–1.3, so that the number of interstitial particles reduces faster. In addition, sulfuric acid production occurs in smaller particles and so the cloud processed aerosol size distribution is dependent on the HNO_3 concentration. This affects both radiative properties of aerosol particles and the formation of cloud droplets during a sequence of cloud formation-evaporation events. It is shown that although the condensation of HNO_3 increases the number of cloud droplets during the single updraft, it is possible that presence of HNO_3 can actually decrease the cloud droplet number concentration after several cloud cycles when also H_2SO_4 production is taken into account.

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