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Growth of upper tropospheric aerosols due to uptake of HNO₃

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Abstract. The effect of nitric acid on the equilibrium size distributions of upper tropospheric aerosols is calculated as a function of relative humidity. It is shown that HNO₃ concentrations above a few tenths of a ppb can cause substantial increases in haze mode particle concentrations at relative humidities at about 60% and above. The effect can be strongly magnified when letovicite particles are present in addition to sulfuric acid aerosols. Letovicite particles are less acidic than the sulfuric acid particles and so more nitric acid can be absorbed. This effect can be seen even at RH below 50% due to the lowering of the deliquescence RH of letovicite in the presence of gaseous nitric acid at low temperatures. We have also compared equilibrium calculations of the HNO₃ effect with observations of increased haze mode concentrations at relative humidities above 50% (Petzold et al., 2000). Nitric acid mixing ratios on the order of 0.5-2ppb may explain the observed increase of haze mode particles at least partially.

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