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Climate effects of aerosol nitrate from lightning

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The atmospheric aerosol, especially secondary semi-volatile aerosol species, are still a major uncertainty in the assessment of aerosol - climate interactions.
In this study, we try to reduce some of the uncertainty by systematically analysing the effects of aerosol nitrate originating from lightning NO_x production under present day and preindustrial conditions. As the formation of aerosol nitrate, mostly in the form of NH_4NO_3, is more efficient at colder temperatures such as in the middle and upper troposphere and lightning represents an upper tropospheric source after chemical conversion of the NO_x to HNO_3, the vertical distribution of aerosol nitrate can have a substantially different impact on the climate system compared to surface emitted hydrophilic aerosol compounds.

To analyse theses effects, we will present decadal global model simulation results, investigating whether the nitrate from lightning in addition to the cooling by additional scattering (direct effect) causes positive or negative indirect aerosol effects.
A potential cooling could result from the increase in CCN activity for low clouds, but as the nitrate will also substantially affect the upper troposphere it also plays a role in the IN activity of aerosol particles. Due to coating effects the IN number could be potentially decreased, reducing short wave cloud effects of high clouds.