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Lightning: Is its impact decreasing? - An ensemble simulation from 1960 to 2020

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Lightning discharges produce nitrogen oxides (NO_x), which are emitted at altitudes, where no other natural emissions occur. Nitrogen oxides are a precursor for ozone. Since in some regions lightning dominates the background NO_x concentration, it also dominates the production and concentration of ozone. Further, ozone is a greenhouse gas, which has a direct implication for climate and climate change.

Here, an ensemble climate-chemistry simulation for the period 1960 to 2020 is presented in which lightning frequencies and related NO_x emissions are parameterised on the basis of the strength of mass fluxes in convective events. An intercomparison with OTD/LIS data is performed to show abilities and shortcomings of this approach. A trend analysis shows a decline in the number of global lightning frequencies in the order of 1-2% over the whole period. The implications on chemistry and climate are discussed.