

Title: Emission of oxides of nitrogen from lightning

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Abstract: This thesis investigates lightning activity and its role in the production of nitrogen oxide (NO_x) emissions using a numerical modelling approach. Lightning is a significant source of NO in the troposphere, contributing approximately 10 % to global annual NO emissions. Through a combination of observational data and model simulations, the spatial and temporal variations of convective available potential energy (CAPE), lightning density and lightning NO emissions (LNO) are investigated. The model simulations also capture the mean-vertical profile over the measured period of LNO emissions for our selected sub-regions of the whole domain, where each region has a different climate, different convective characteristic hence different distribution of emissions. Comparisons between observations and model inputs and outputs reveal different patterns in lightning density, CAPE, and NO_x emissions, highlighting the importance of more accurate representation of convective dynamics in atmospheric models. The findings emphasize the need for improved lightning parameterization methods in atmospheric models.

Keywords: lightning nitrogen oxides emission modelling