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Development of a lightning model and implementation into a meteorological model developed in Japan~ Validation through the comparison with the ground base measurement

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A lightning model was developed (Sato et al. 2019, 2021) and implemented into a community meteorological model in Japan (SCALE: Nishizawa et al. 2015, Sato et al. 2015). The lightning model coupled with SCALE was validated through the comparison with the ground base lightning measurement (LIghtning DEtection Network system: LIDEN) operated by Japan Meteorological Agency. For the validation, we conducted downscale simulations targeting on two heavy rain events, which occurred on July, 2017 and July, 2018. The heavy rainfall in both events were triggered by Baiu front system on July in Japan and cumulative precipitation exceeded 800 mm/48 hours, but lightning frequency in the 2017 case was much higher than that of the 2018 case.

Our results indicated that the model successfully reproduced the difference of the lightning frequency between the two heavy rain events. Our analyses elucidated that the difference in the lightning frequency was originated from the difference in the vertical distribution of the charged graupel, and as consequence, the vertical structure of the charge separation rate and the charge density.