4.176 Direct grand-based observation of lightning-induced nitrogen oxides in the free troposphere.

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Abstract:

An important source of NO_x is lightning (LNO_x). Lightning occurs in the troposphere and LNO_x has generally been observed from aeroplanes. Recently, satellites have also been used to detect LNO_x, and the amount of LNO_x has been estimated with laboratories based on the available data; however, there is a large uncertainty around the actual amount of LNO_x. One of the reasons for this uncertainly is that the available observation data are limited (Schumann and Huntrieser, 2007). LNO_x could not be effectively detected using grand-based observation. If the LNO_x data can be obtained by grand-based observations, the uncertainty of the estimated amount of LNO_x can be minimised. In this study, we did our observations at the Mt Fuji Research Station (MFRS) which was located at the top of Mt. Fuji (3776 m a.s.l.). Since the mountain top is located in the free troposphere, the influence of NO_x emission based on human activities from the ground is insignificant. We obtained the concentrations of nitric oxide (NO), nitrogen dioxides (NO_2) and NO_x oxidation products (NO_z) during the summer of 2017. NO_2 concentrations were measured using laser induced fluorescence spectroscopy, and NO and NO_y concentrations were measured using the chemiluminescence method. The NO_2 peaks were observed at 12:45 and 13:18 on 22 August 2017 (GMT). These peaks corresponded to maximum concentrations of 0.90 ppbv and 0.96 ppbv over durations of 32 min and 34 min, respectively. These NO_2 peaks unaccompanied CO enhancement, which suggested that the air mass did not contain emissions from combustion sources. The air mass backward trajectories at the above times came across the area lightning occurred. We have discussed the direct LNO_x measurement made by grand-based observation in detail.