

Evaluation of satellite-based LNO_x columns from OMI with columns based on in-cloud aircraft measurements

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Lightning is the largest source of NO_x in the upper troposphere. Accurate quantification of this source is crucial as LNO_x affects the distributions of tropospheric ozone, hydroxyl radical (OH), and methane. A validation of the technique, provided by Bucsel *et al.*, (2019), for the use of OMI satellite instrument for observations of LNO_x production, is performed through the analysis of three case studies that took place on June 11th, 2012 during the Deep Convective Clouds and Chemistry (DC3) campaign, August 5th, 2007 from the Tropical Composition, Cloud, and Climate Coupling (TC⁴), and on August 6th, 2006 during the African Monsoon Multidisciplinary Analysis (AMMA) campaign. For each case, vertically integrated in-cloud in-situ aircraft measurements of LNO_x were compared to columns of LNO_x from the OMI instrument. This approach for validation of OMI LNO_x column amounts using in-situ data from aircraft profiles has not previously been attempted. In addition, the mean LNO_x produced per flash or stroke, production efficiency (PE), is determined for each case. For these case studies, aircraft transects of the storm anvils were completed near the time of the OMI satellite overpass, allowing for direct comparison of partial column amounts of LNO_x from the cloud top to the OMI optical centroid pressure (OCP) between the satellite and aircraft. Aircraft measurements not available for a layer were estimated using case-specific LNO_x mass ratios from a cloud scale model. Comparison of OMI LNO_x and aircraft LNO_x will be used to assess uncertainties in the satellite-based columns. Decreasing uncertainty in LNO_x will allow for more definitive estimates of the impact of LNO_x on atmospheric composition and air quality following thunderstorms. The differences between the aircraft and OMI LNO_x column amounts for the three cases are compared with the 36% LNO_x uncertainty given by Bucsel *et al* (2019). These findings also lend support for the LNO_x PE estimates that have been made through the use of OMI, TROPOMI, and TEMPO data.