Lightning-produced NO_x (LNOx) in a Hector blow-up during SCOUT-O3 and ACTIVE: bridging clouds

Huntrieser[1], H., H. Schlager[1], G. Allen[2], A. Volz-Thomas[3], H. Höller[1], and D. Brunner[4]

[1]Deutsches Zentrum für Luft- und Raumfahrt (DLR), Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany.
[2]School of Earth, Atmospheric & Environmental Sciences, University of Manchester, UK.
[3]Institut für Chemie und Dynamik der Geosphäre (ICG-2), Forschungzentrum Jülich (FZJ), Germany.
[4]Laboratory for Air Pollution and Environmental Technology Empa, Swiss Federal Laboratories for Materials Testing and Research, Dübendorf, Switzerland.

Hector is a tropical mesoscale thunderstorm complex that develops on a regular basis over the Tiwi Islands, just north of the Australian mainland. The area extending from the Tiwi Islands to the Indonesian archipelago belongs to a major region of global latent heat release, maintaining the planetary-scale Hadley and Walker circulations. In 2005, the SCOUT and ACTIVE field campaigns were conducted in this area during the transition season November-December. An explosive Hector storm developed on 19 November upon the collision of a sea breeze front in the east and a gust front in the west. Trace gas measurements inside, above, and below the anvil outflow were carried out with three aircraft. A Lightning Location Network (LINET) registered the strokes. Observed mean anvil-LNOx mixing ratios and stroke rates were much higher (factor ~4) than observed in a previous tropical field experiment TROCCINOX over Brazil (Huntrieser et al., ACP, 2008), more similar to Florida thunderstorms. The SCOUT data also support the finding that thunderstorms in environments of higher vertical wind shear produce more LNOx per stroke, as found during TROCCINOX. Our results indicate a global annual LNOx production rate of 1.4 Tg(N) a-1 and 3.1 Tg(N) a-1 for regions with 5 and 15 m s-1 vertical wind shear, respectively (wind velocity difference between anvil outflow and steering level).