Geophysical Research Abstracts
Vol. 13, EGU2011-7049, 2011
EGU General Assembly 2011

Influence of cold corona discharge on the ozone budget in the tropical free troposphere: A case study of deep convection during GABRIEL

Heiko Bozem and the GABRIEL Team
University Mainz, Institute for Atmospheric Physics, Mainz, Germany (bozemh@uni-mainz.de, +49 6131 39 23532)

Convective redistribution of ozone and its precursors between the boundary layer (BL) and the free troposphere (FT) influences the photochemistry, in particular the ozone production in the middle and upper troposphere (UT). We present a case study of convective transport during the GABRIEL campaign over the tropical rainforest in Suriname in October 2005. On the last part of a measurement flight on October 12 the inflow and outflow regions of a nearly completely developed cumulonimbus cloud (Cb) have been characterized, providing clear indications of convective transport. We identified a distinct layer between 9 and 11 km altitude with enhanced mixing ratios of CO, O_3, HO_x, acetone and acetonitrile. The elevated O_3 contradicts to the expectation of convective transport of low ozone air from the boundary layer. The high mixing ratio of ozone in the outflow has mainly dynamical reasons. Entrainment of ozone rich air into the convective outflow accounts for 64 % of the observed O_3 value. Ozone is further enhanced by photochemical production in the outflow, with enhanced NO, that is most likely due to lightning activity. The contribution of photochemical ozone production to the elevated mixing ratio amounts to 2-3 % based on steady state model calculations, using in-situ observations including the first reported HO_x measurements over the tropical rainforest. The missing ozone in the outflow might be attributed to an additional dynamical or photochemical source, whereas the most probable source is direct production from lightning by cold corona discharge. We present a production rate of 5.19×10^{28} molecules O_3/flash (range: 4.19×10^{27} - 9.96×10^{28} molecules O_3/flash) which is one order of magnitude higher compared to known values from the literature.