Geophysical Research Abstracts, Vol. 9, 04366, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-04366

Influence of convection on ozone production in the free troposphere during GABRIEL

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Convective transport of ozone precursors from the boundary layer to the free troposphere can influence the photochemistry and lead to an increase in ozone production in the upper troposphere. Analysis of a case study of convective transport during the GABRIEL campaign over the tropical rain forest in Suriname in October 2005 is presented. On the last part of measurement flight GAB08 on October 12 the inflow and the outflow region of a nearly completely developed cumulonimbus cloud have been characterized. There is a clear indication of convective transport in the dataset of that flight. We identified a distinct layer between 9 and 11 km altitude in the assumed outflow region with enhanced mixing ratios of CO, HO_x, acetone, acetonitrile, isoprene, methanol and different VOCs. O_3 and NO are also elevated in that layer. That is contrary to the expectations of convective transport from the boundary layer and lower troposphere to the upper troposphere, where we would expect low ozone and NO compared to the background air. The high mixing ratio of ozone has dynamical reasons with upward transport of ozone rich air from layers above the boundary layer, and is further enhanced by photochemical production of ozone in a high NO environment. The increased NO is most likely due to lightning activity in the observed area. NO reacts with peroxy radicals to NO_2, which can then lead to ozone production in further reactions. The contribution of photochemical ozone production to the elevated mixing ratio is investigated with photostationary state model calculations.