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The influence of Frankfurt am Main on the composition of the lower troposphere at Taunus Observatory during PARADE 2011

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The planetary boundary layer (PBL) describes the lower part of the atmosphere which is characterized by exchange of heat, momentum, gaseous and aerosol constituents of the atmosphere and the surface. The primary driver of this exchange is atmospheric turbulence. Surface cover, daytime, orography and weather lead to a high variability of this atmospheric layer. This variability strongly affects the mixing between the PBL and the free troposphere (FT). The quantification of the exchange between these layers is still an issue of current research.
We present data from the field campaign PARADE, which took place in August and September 2011 at Taunus Observatory on Mount Kleiner Feldberg about 20 km northwest of the City of Frankfurt am Main in Germany. An extensive amount of ground based measurements including trace gases, reactive species, aerosols and meteorological parameters were done. Airborne measurements during one week in September contribute additional information on the composition of the lower troposphere at the site and the surrounding area especially for CO, CO_2, O_3, aerosols and relative humidity.
For the identification of the height of the PBL ground based and airborne measurements were analyzed. First results from the comparison of radio soundings, ceilometer data and aerosol vertical profiles show a highly variable PBL with heights between 1 km and 2.5 km depending on the meteorological situation and the complex terrain in the measurement region. The influence of pollution plumes from Frankfurt and the Rhine-Main area on the composition and chemistry of the PBL and the free troposphere is investigated. Trace gas correlations also indicate complex mixing between these two regimes during the transport of the plume to the measurement site. We further characterized the chemical evolution of the plume with respect to ozone production and the influence of mixing on different tracer budgets.