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In-situ NO and NO_2 profiles measured onboard passenger aircraft over Frankfurt airport in Germany

Florian Berkes (1), Norbert Houben (1), Torben Blomel (1), Marlon Tappertzhofen (1), Andreas Volz-Thomas (2), and Andreas Petzold (1)

(1) Forschungszentrum Juelich, Institute of Energy and Climate Research - Troposphere, Juelich, Germany (f.berkes@fz-juelich.de), (2) IAGOS-AISBL, Brussels, Belgium

NO_x (sum of NO and NO_2) play a central role in atmospheric chemistry related to ozone and oxidation capacity (OH and NO_3 radicals). The most important sources of NO_x in the upper troposphere are lightning, and transport from the boundary layer (combustion processes, from biomass burning, agriculture, and industry/transport/aircraft emissions). In-situ measurements of NO_x from the upper troposphere and lower stratosphere (UTLS) down to the surface are rare, but important for understanding the local photochemistry and for the assessment of the impact of aviation on the budgets of greenhouse gases such as ozone. The European Research Infrastructure IAGOS (In-service Aircraft for a Global Observing System) operates a global-scale monitoring system for atmospheric temperature, trace gases, aerosols and clouds at high spatial resolution by passenger aircraft. The IAGOS NO_x instrument is designed for the autonomous measurement of nitrogen oxides over serval months. The measurement principle is based on the well-established chemiluminescence technique, using one channel with sequential measurements of NO and NO_x every 50 s.

Here, we present vertical profiles of nitrogen oxides from the UTLS down to the surface for day and night time conditions obtained over 12 months in 2015 and 2016. The analysis focuses mainly on Europe, the region with the largest amount of profiles. Other regions (North America, South America and East Asia) will also be discussed. Typically, NO and NO_2 varies in the low ppt range in the UT, slightly increasing towards the pressure altitude of 200 hPa. Down to the surface, the values of NO and of NO_2 increase up to several ppb. These profiles combined with in-situ water vapor and cloud parameters will be valuable for validation of model and of satellite data in the future.