Supplement of

Chemical and meteorological influences on the lifetime of NO₃ at a semi-rural mountain site during PARADE

N. Sobanski et al.

Correspondence to: J. N. Crowley (john.crowley@mpic.de)

The copyright of individual parts of the supplement might differ from the CC-BY 3.0 licence.
**Fig. S1.** Land-use in the area surrounding the PARADE campaign measurement site. The inner circle has a radius of 5 km, the outer circle a radius of 50 km. Both areas are divided into four sectors (North-East, South-East, South-West and North-West). For each of the 8 sectors the land-use is given by a pie chart. The Fr, Wi and Mz symbols represent the approximate location of the cities Frankfurt, Wiesbaden and Mainz, respectively. The map was generated from the CORINE Land Cover database by Dr. Pablo J. Hidalgo.
Fig. S2. Simulated evolution of the steady state lifetime of NO$_3$ assuming reaction of NO$_2$ with O$_3$ as the only NO$_3$ source, and both a homogeneous and a heterogeneous loss process. The simulation assumes variable [O$_3$] and [NO$_2$] as would be the case for a point source and a constant NO$_3$ reactivity in the gaseous phase (0.00253 s$^{-1}$, due e.g. to VOCs). The different curves each correspond to a different initial NO$_2$ mixing ratio (with a fixed initial [O$_3$] for each simulation). The NO$_3$ losses through N$_2$O$_5$ uptake on aerosols is simulated by keeping the aerosol surface area (ASA) and the uptake coefficient $\gamma$ constant at the values listed in the figure. The overall heterogeneous sink, depending on [NO$_2$], is thus different for each simulation, which explains the slightly different effective lifetime ($\tau_{ss}(NO_3)$ for $t \to \infty$). At short times, the true steady state lifetime (350 to 380 s) is underestimated.
Fig. S3. Comparison between $\tau_{SS}(NO_3)$ and $\tau_{DER}(NO_3)$ using the same $[NO_3]$, $[NO_2]$ and $[O_3]$ datasets. For most of the nights both datasets agree even though outliers for $\tau_{DER}(NO_3)$ are sometimes calculated due to noise in the raw data.
Fig. S4. Time series of the mixing ratios of the reactive (highlighted) VOCs in Table 2.
Fig. S5. Individual and summed reactivities (towards NO₃) of the VOCs listed in Table 2. 
$L_{iso}$, $L_{pin}$, $L_{lim}$ and $L_{myr}$ represent respectively the losses due to isoprene, α-pinene, limonene and myrcene. All the alkenes and alkanes reactivities are summed in the $L_{alk}$ term. The $L_{VOCs}$ term sums up the individual terms ($L_{iso}$, $L_{pin}$, $L_{lim}$, $L_{myr}$ and $L_{alk}$). The steady-state loss rate constant for NO₃ ($L_{ss}$) is also plotted.
Fig. S6. CO$_2$ during PARADE. The grey shaded area indicates no significant nocturnal build-up of CO$_2$ (contrast e.g. the nights of 27.8 - 30.8 or 6.9 - 9.9) and is coincident with NO$_3$ lifetimes exceeding 2000 s.