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ClNO₂ and nitrate (NO₃⁻) formation via N₂O₅ uptake to particles: Derivation of N₂O₅ uptake coefficients from ambient datasets

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We present estimates of the uptake coefficient of N₂O₅, $\gamma(\text{N}_2\text{O}_5)$, using ambient measurements of the trace gases N₂O₅ and ClNO₂ and particle composition and surface area at the Kleiner Feldberg observatory, near Frankfurt, SW Germany, during the PARADE campaign (summer 2011). Three methods used to extract $\gamma(\text{N}_2\text{O}_5)$ from the datasets were found to be in reasonable agreement, generating values between 0.001 and 0.4. $\gamma(\text{N}_2\text{O}_5)$ displayed a significant dependence on relative humidity (RH), the largest values obtained, as expected, at high RH. No significant dependence of $\gamma(\text{N}_2\text{O}_5)$ on particle organic content or sulphate-to-organic ratio was observed. The variability in $\gamma(\text{N}_2\text{O}_5)$ is however large, indicating that humidity is not the sole factor determining the uptake coefficient. There is also an indication that the yield of ClNO₂ with respect to N₂O₅ uptake is larger with lower concentrations of PM1 total organics. Our results will be compared to existing uptake coefficients from laboratory studies and those derived from field-observations.