



SEPARATION OF TROPOSPHERIC AND STRATOSPHERIC NO₂ BY SYNERGISTIC USE OF NADIR DOAS SOUNDINGS AND SOLAR FTIR AT THE GROUND-TRUTHING FACILITY ZUGSPITZE

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Ground-based FTIR is a highly accurate measure for the pure stratospheric column of NO₂, and can thus be used synergistically with satellite NADIR DOAS soundings to complement the reference sector method for global tropospheric NO₂ retrievals. Columnar NO₂ from FTIR measurements at the Zugspitze (47.42 °N, 10.98 °E, 2964 m asl.) were used synergistically with SCIAMACHY satellite data (Univ. Bremen algorithm UB1.5). A new concept to match FTIR data to the time of satellite overpass makes use of the NO₂ daytime increasing rate retrieved from the FTIR data set itself [$+1.02(6)E+14 \text{ cm}^{-2}/\text{h}$]. SCIAMACHY data within a 200-km selection radius around Zugspitze were considered, and a pollution-clearing scheme was developed to select only pixels corresponding to clean background (free) tropospheric conditions. Analysis of the averaging kernels gives proof that a high-mountain-site FTIR is a highly accurate measure for the stratospheric column, while SCIAMACHY shows significant tropospheric sensitivity. Based on this, we set up a combined FTIR-SCIAMACHY retrieval for NO₂ which delivers two independent pieces of information for troposphere and stratosphere, respectively. It yields an annual cycle of the background (free) tropospheric column between $0.75\text{-}1.54E+15 \text{ cm}^{-2}$, and an intermediate phase between that known for boundary layer and stratosphere, respectively.

Reference: Sussmann, R., et al., Atmos. Chem. Phys., 5, 2657–2677, 2005