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Trend analysis of stratospheric NO_2 above Jungfraujoch (46.5°N, 8.0°E) using long-term ground-based UV-visible and FTIR observations

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Nitrogen dioxide (NO_2) plays an important role in controlling ozone abundances in the stratosphere, either directly through the NO_x ($NO+NO_2$) catalytic cycle, or indirectly by converting active chlorine, bromine, and hydrogen into their reservoir forms, reducing their availability for ozone-destroying catalytic cycles.

Ground-based zenith-sky UV-visible and Fourier transform infrared (FTIR) solar absorption measurements have been performed at the NDACC (Network for the Detection of Atmospheric Composition Change) station of Jungfraujoch (46.5°N, 8.0°E) since 1991 and 1984, respectively. Stratospheric NO_2 columns are retrieved from UV-visible and FTIR observations by applying Optimal Estimation Method (OEM)-based and non-linear least-squares fitting algorithms, respectively. The inclusion of a stacked-box photochemical model in the forward model of the UV-visible OEM algorithm allows the photochemical matching between the UV-visible and FTIR NO_2 column retrievals.

In this presentation, we will first investigate the consistency between both UV-visible and FTIR NO_2 column data sets given their respective error budgets. Then a trend analysis performed on monthly means time-series using a statistical model including functions for annual, semi-annual and four-month period variations, 10.7 cm solar flux, Quasi-Biennal Oscillation, Southern Oscillation Index, and volcanic terms will be presented. The volcanic terms are essential since both UV-visible and FTIR observations started before the Mount Pinatubo eruption. The consistency between inferred NO_2 trend values and the increase of N_2O (nitrous oxide) also monitored at Jungfraujoch will be discussed.