



The STRatospheric Estimation Algorithm from Mainz (STREAM): Estimating stratospheric NO₂ from nadir-viewing satellites by weighted convolution

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The STRatospheric Estimation Algorithm from Mainz (STREAM) determines stratospheric columns of NO₂ which are needed for the retrieval of tropospheric columns from satellite observations. It is based on the total column measurements over clean, remote regions as well as over clouded scenes where the tropospheric column is effectively shielded. The contribution of individual satellite measurements to the stratospheric estimate is controlled by various weighting factors. STREAM is a flexible and robust algorithm and does not require input from chemical transport models. It was developed as verification algorithm for the upcoming satellite instrument TROPOMI, as complement to the operational stratospheric correction based on data assimilation. STREAM was successfully applied to the UV/vis satellite instruments GOME 1/2, SCIAMACHY, and OMI. It overcomes some of the artefacts of previous algorithms, as it is capable of reproducing gradients of stratospheric NO₂, e.g. related to the polar vortex, and reduces interpolation errors over continents. Based on synthetic input data, the uncertainty of STREAM was quantified as about $0.1\text{-}0.2 \times 10^{15}$ molecules cm⁻², in accordance to the typical deviations between stratospheric estimates from different algorithms compared in this study.