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New NDACC recommendations for the retrieval of stratospheric NO_2 columns

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Stratospheric nitrogen dioxide (NO_2) column measurements are daily performed at sunrise and sunset using ground-based zenith-sky UV-visible spectrometers deployed all over the world in about 35 stations, most of them belonging to the Network for the Detection of Atmospheric Composition Change (NDACC). Despite several cross evaluation exercises, it has been recognized that the NO_2 data records still suffer from residual inconsistencies mainly due to (1) differences in the DOAS settings, in particular the temperature dependence of the NO_2 absorption cross sections and (2) a lack of homogeneity in the air mass factors (AMFs) applied to the measured NO_2 slant columns for their conversion into vertical columns.

Recently, the NDACC UV-visible Working Group has formulated new recommendations aiming at improving the homogeneity of the stratospheric NO_2 column measurements. Regarding the spectral analysis, a list of recommended settings has been established including fitting intervals, absorption cross sections data sets and temperature dependence, as well as methods for wavelength calibration and residual amount in the reference spectrum determination. In case of AMFs, look-up tables (LUTs) have been built from NO_2 profile climatologies based on the harmonic decomposition of the HALOE, SAGE-II and POAM-III data records for the stratosphere and on SAOZ balloon observations for the UTLS, allowing accounting for the dependence of the AMF on the latitudinal and seasonal variations of the NO_2 vertical profile at sunrise and sunset. The calculated LUTs, only suitable for background aerosols conditions, depend on latitude, day of year, wavelength, SZA, surface albedo, and station altitude. The error budget on the AMFs as well as on the spectral analysis is evaluated. The impact of those recommendations is investigated through their application to measurements from a selection of stations of the NDACC UV-visible network. The consistency of the new NDACC stratospheric NO_2 data sets with correlative observations from the ERS-2/GOME, ENVISAT/SCIAMACHY, and EOS-AURA/OMI satellite nadir instruments is also discussed.