File Revision Date:
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Data Set Description:

PI:	John P. BURROWS
	DOAS UV-Visible Spectrometer
Site(s):	NY-AALESUND 78.9 N 11.9 E
Measurement Quantities:	O_3, NO_2

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Reference Articles:

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Hommel, R., Eichmann, K.-U., Aschmann, J., Bramstedt, K., Weber, M., von Savigny, C., Richter, A., Rozanov, A., Wittrock, F., Khosrawi, F., Bauer, R., and Burrows, J. P.: Chemical ozone loss and ozone mini-hole event during the Arctic winter 2010/2011 as observed by SCIAMACHY and GOME-2, Atmos. Chem. Phys., 14, 3247-3276, doi:10.5194/acp-14-3247-2014, 2014

<u>Instrument Description:</u>

Briefly, scattered light from the sky is collected by a telescope and focussed onto a depolarising quartz fibre bundle, which transmits the light to the entrance aperture of a Czerny-Turner spectrograph. Linear diode array and later 2d CCD detectors are used allowing simultaneous measurements over a large wavelength range. The instrument observes in the near-UV and visible in the range 327-491 nm having a FWHM of 0.9 nm. Zenith sky spectra are measured every day for solar zenith angles smaller than 96°. Since 1999, horizon measurements and later measurements at different elevations and azimuths were added fro tropospheric observations.

<u>Algorithm Description:</u>

The spectral analysis is described below. After a precise wavelength alignment with the use of the Fraunhofer solar absorption lines, actual spectra are divided by a reference spectrum recorded at high sun on a clear and unpolluted day. Large scale variations of the signal (mainly due to scattering) are then removed by subtracting a polynomial resulting in an atmospheric differential spectrum, into which narrow features corresponding to absorption by ozone, nitrogen dioxide, O4 (oxygen dimer), and other trace gases are remaining.

Slant columns are then calculated by least squares fitting between the signal and the differential cross sections of each absorber in an iterative process in which the contributions of the various species are calculated and removed sequentially. Ozone and NO2 are measured in the visible (435-490 nm).

Expected Precision/Accuracy of Instrument:
Converting slant columns relative to a given reference spectrum into vertical columns requires the knowledge of the optical path of the light scattered at zenith, that is the Air Mass Factor (AMF) and the residual amount of constituent still present in the reference spectrum. The AMF is calculated by modelling the radiative transfer of the sunlight into the atmosphere. These calculations are carried out by the model package SCIATRAN.
The precision of the total column measurements at twilight (86°-91° SZA) is 2 Dobson Unit for ozone and 1.5 1014 mol/cm2 for NO2.
The accuracy, including uncertainties of cross-sections and their temperature dependencies and that of Air Mass Factors (vertical profiles of the constituent, stratospheric temperature seasonal changes and photochemical changes for NO2) is: ± 10% for ozone and +25, -45% for NO2 (for small amounts in early spring and late autumn).

Instrument History:
starting date: 1995/02/20/
spectrometer: Acton Research SpectraPro500, grating: 300 gr/mm, 330-490nm, FWMH: 0.7nm
detector: IKS Diode Array, 1024 pixel
entrance slit: 100 microns
telescope unit: zenith-sky only

starting date: 1999/04/15/
spectrometer: Acton Research SpectraPro500, grating: 300 gr/mm, 330-490nm, FWMH: 0.7nm
detector: IKS Diode Array, 1024 pixel
entrance slit: 100 microns
telescope unit: zenith-sky and horizon

starting date: 2000/02/20/
spectrometer: Acton Research SpectraPro500, grating: 300 gr/mm, 330-490nm, FWMH: 0.9nm
detector: EG&G Diode Array, 1024 pixel
entrance slit: 150 microns
telescope unit: multiple elevations

starting date: 2003/03/11/
spectrometer: Acton Research SpectraPro500, grating: 300 gr/mm, 500-570nm, FWMH: 0.9nm
detector: Andor CCD, 1024 x 256 pixel
entrance slit: 150 microns
telescope unit: multiple elevations

starting date: 2010/03/05/

spectrometer: Acton Research SpectraPro500, grating: 300 gr/mm, 500-570nm, FWMH: 0.9nm
detector: Andor CCD, 1024 x 256 pixel
entrance slit: 150 microns
telescope unit: multiple elevations, multiple azimuths