File Revision Date:
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Data Set Description:

PI:	Richard Querel
Instrument:	Lauder UV/Vis Spectrometer
Site(s):	Lauder (45.0S, 169.7E)
Measurement Quantities:	NO2

Contact Information:

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Reference Articles:

Harder, J. W., J. W. Brault, P. V. Johnston, and G. H. Mount, Temperature dependent NO2 cross sections at high spectral resolution, J. Geophys. Res., 102, 3861-3879, 1997.

Hofmann, D., P. Bonasoni, M. De Maziere, F. Evangelisti, G. Giovanelli, A. Goldman, F. Goutail, J. Harder, R. Jakoubek, et al., Intercomparison of UV/visible spectrometers for measurements of stratospheric NO2 for the Network for the Detection of Stratospheric Change, J. Geophys. Res., 100, 16765-16791, 1995.

Johnston, P. V., and R. L. McKenzie, NO2 observations at 45 deg.S during the decreasing phase of Solar Cycle 21, from 1980 to 1987, J. Geophys. Res., 94, 3473-3486, 1989.

Johnston, P. V., R. L. McKenzie, J. G. Keys, and W. A. Matthews, Observations of depleted stratospheric NO2 following the Pinatubo volcanic eruption, Geophys. Res. Lett., 19, 211-213, 1992.

McElroy, C. T., A. Elokhov, N. Elansky, H. Frank, P. Johnston, and J. B. Kerr, Visible light nitrogen dioxide spectrophotometer intercomparison: Mt. Kobau, British Columbia July 28 to August 10, 1991, Rep. Global Atmospheric Watch: WMO Global Ozone Research and Monitoring Project, Report No. 28 (TD No. 835), 71 pp., WMO, Geneva, 1997.

McKenzie, R. L., and P. V. Johnston, Seasonal variations in stratospheric NO2 at 45 deg.S, Geophys. Res. Lett., 9, 1255-1258, 1982.

Roscoe, H. K., P. V. Johnston, M. Van Roozendael, A. Richter, A. Sarkissian, J. Roscoe, K. E. Preston, J.-C. Lambert, C. Hermans, et al., Slant column measurements of O3 and NO2 during the NDSC intercomparison of zenith-sky UV-visible spectrometers in June 1996, J. Atmos. Chem., 32, 281-314, 1999.

Instrument Description:
Instrument identification number: M21 (1980 - 1984)

Type: Commercial MP500 monochromator with in house data logging electronics
Grating: 1200 g/mm
Input optic: views sky through 45 deg. mirror
Detector: bialkali PMT in current mode (EHT varies gain by over 104)
Temperature: room
Wavelength region measured: 435 - 450nm
Field of view: 4 deg.
Spectral resolution: 0.5nm FWHM
Sampling ratio: 5 samples/FWHM
Analog conversion accuracy: 12 bits.

Instrument identification number: M21 (1984 - 1986)
Type: Commercial MP500 monochromator with in house data logging electronics
Grating: 1200 g/mm
Input optic: views sky through 45 deg. mirror
Detector: bialkali PMT in current mode (EHT varies gain by over 104)
Temperature: room
Wavelength region measured: 435 - 450nm
Field of view: 4 deg.
Spectral resolution: 1.0nm FWHM
Sampling ratio: 10 samples/FWHM
Analog conversion accuracy: 12 bits.

Instrument identification number: M21 (1987 - 1989)
Type: Commercial MP500 monochromator with in house data logging electronics
Grating: 2400 g/mm
Input optic: views sky through 45 deg. mirror
Detector: bialkali PMT in current mode (EHT varies gain by over 104)
Temperature: room
Wavelength region measured: 435 - 450nm
Field of view: 4 deg.
Spectral resolution: 1.0nm FWHM
Sampling ratio: 10 samples/FWHM
Analog conversion accuracy: 12 bits.

Instrument identification number: M04
Type: Commercial JY H20 monochromator with in house data logging electronics
Grating: 1200 g/mm concave holographic
Input optic: views sky through 45 deg. mirror
Detector: bialkali PMT in current mode (EHT varies gain by over 104)
Temperature: room
Wavelength region measured: 432 - 457nm
Field of view: 16 deg.
Spectral resolution: 1.3nm FWHM

Sampling ratio: 10 samples/FWHM
Analog conversion accuracy: 12 bits.

Instrument identification number: M08
Type: Commercial ISA HR320 monochromator with in house data logging electronics
Grating: 2400 g/mm holographic
Input optic: field of view split through two mirror image rotators to reducesky polarisation effects
Detector: bialkali PMT in current mode (EHT varies gain by over 104)
Temperature: room
Wavelength region measured: 432 - 490nm
Field of view: 15 deg.
Spectral resolution: 1.2nm FWHM
Sampling ratio: 10 samples/FWHM
Analog conversion accuracy: 12 bits.

Instrument identification number: M07
Type: Commercial ISA HR320 monochromator with in house data logging electronics
Grating: 2400 g/mm holographic
Input optic: views sky through Glan Thompsom polariser
Tracker: instrument on azimuth table to maintain polariser alignment with sun-zenith plane
Detector: bialkali PMT in current mode (EHT varies gain by over 104)
Temperature: stabilised, 32 deg. C
Wavelength region measured: 426 - 490nm
Field of view: 15 deg.
Spectral resolution: 1.2nm FWHM
Sampling ratio: 19 samples/FWHM
Analog conversion accuracy: 12 bits.

Algorithm Description:
Non-linear least squares fitting of absorber cross sections to log ratio spectra (twilight observation and midday reference). The non-linearity arises from shift and stretch applied to the observation spectra with respect to the reference. Corrections are applied for the effect of rotational Raman scattered light ("Ring" effect). Corrections are sometimes applied for the effect of grating polarisation curvature.

A correction for the amount of NO2 in the reference spectra is applied. The results are in units of slant column amount (molecules cm-2), ie., not converted to vertical column amount. Conversion requires air mass factors which are calculated using scattering models. See literature and PI for these and likely conversion errors. Cross sections common to all processing levels: NO2, O3, H2O, Ring (measured or offset equivalent), Rayleigh curvature and O4.

Processing level used for submitted data = Vers 0.5

Processing level Definitions

Version 0.0 - room temperature (Graham and Johnston) NO2 and O3 cross sections, offset Ring cross section. Wavelength region fitted chosen for particular application.

Version 0.5 - low temperature NO2 (Harder et al.) and O3 (measured by Gome satellite group) and offset Ring cross section. Wavelength region fitted chosen for particular application.

Version 1.0 - low temperature NO2 (Harder et al.) and O3 (measured by Gome satellite group) and measured Ring cross section. Wavelength region fitted chosen for particular application.

Expected Precision/Accuracy of Instrument:
M08 Meets NDSC Instrument Specific Appendix requirements (Intercomparison, Lauder, 1992)

M07 Meets NDSC Instrument Specific Appendix requirements (Intercomparison, OHP, 1996) type "1" (5% +- 0.15 x 10^16 cm^-2).

M04/M08/M07 intercompared at Lauder and found to be within the type "1" ISA figures above.

M21 accuracy not quantifiable in the same way but estimated from a months overlap measurements in 1989 to be better than +- 7% +- 0.2 x 10^16 cm^-2.

Measurement statistical error given in data.

Instrument History:
1980 - 1989, M21 instrument in 3 configurations (see above)
1989 - 1992, M04 instrument
1992 - 1996, M08 instrument
1996 - present, M07 instrument