

File Revision Date:

September 27, 2017

Data Set Description:

PI: Richard Querel  
Instrument: Lauder UV/Vis Spectrometer  
Site(s): Arrival Heights (77.8S, 166.7E)  
Measurement Quantities: NO<sub>2</sub>

Contact Information:

Name: Richard Querel  
Address: Private Bag 50061, Omakau, Central Otago, New Zealand  
Phone: (64) 3 440 0400  
Email: richard.querel@niwa.co.nz

Reference Articles:

Harder, J. W., J. W. Brault, P. V. Johnston, and G. H. Mount, Temperature dependent NO<sub>2</sub> 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 NO<sub>2</sub> for the Network for the Detection of Stratospheric Change, *J. Geophys. Res.*, 100, 16765-16791, 1995.

Johnston, P. V., and R. L. McKenzie, NO<sub>2</sub> 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 NO<sub>2</sub> 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 NO<sub>2</sub> at 45 deg.S, *Geophys. Res. Lett.*, 9, 1255-1258, 1982.

Roscoe, H. K., P. V. Johnston, M. Van Roozendaal, A. Richter, A. Sarkissian, J. Roscoe, K. E. Preston, J.-C. Lambert, C. Hermans, et al., Slant column measurements of O<sub>3</sub> and NO<sub>2</sub> 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: M02

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 and depolariser.

Detector: bialkali PMT in current mode (EHT varies gain by over 104)

Temperature: room

Wavelength region measured: 432 - 484nm

Field of view: 16 deg.

Spectral resolution: 1.3nm FWHM

Sampling ratio: 10 samples/FWHM

Analog conversion accuracy: 12 bits.

Instrument identification number: M09

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: 430 - 490nm

Field of view: 16 deg.

Spectral resolution: 1.3nm FWHM

Sampling ratio: 10 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 NO<sub>2</sub> in the reference spectra is applied. The results are in units of slant column amount (molecules cm<sup>-2</sup>), 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: NO<sub>2</sub>, O<sub>3</sub>, H<sub>2</sub>O, Ring (measured or offset equivalent), Rayleigh curvature and O<sub>4</sub>.

Processing level used for submitted data = Vers 1.0

#### Processing level Definitions

Version 0.0 - room temperature (Graham and Johnston) NO<sub>2</sub> and O<sub>3</sub> cross sections, offset Ring cross section. Wavelength region fitted chosen for particular application.

Version 0.5 - low temperature NO<sub>2</sub> (Harder et al.) and O<sub>3</sub> (measured by Gome satellite group) and offset Ring cross section. Wavelength region fitted chosen for particular application.

Version 1.0 - low temperature NO<sub>2</sub> (Harder et al.) and O<sub>3</sub> (measured by Gome satellite group) and measured Ring cross section. Wavelength region fitted chosen for particular application.

Expected Precision/Accuracy of Instrument:

M02 estimated to be 5% +- 0.15 x 10<sup>16</sup> cm<sup>-2</sup>

M09 estimated to be 5% +- 0.15 x 10<sup>16</sup> cm<sup>-2</sup>

Measurement statistical error given in data.

Instrument History:

1991 - 1996, M02 instrument

1996 - present, M09 instrument