

File Revision Date:

September 27, 2017

Data Set Description:

PI: Richard Querel
Instrument: Lauder UV/Vis Spectrometer
Site(s): Macquarie Island (54.5S, 158.9E)
Measurement Quantities: NO₂

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 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 t 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 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: M25

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.

Instrument identification number: M17

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 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 = Equivalent to Vers 1.0 (in lieu of Ring correction to the NO₂ results a scale of 1.05 has been applied)

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:

M25 estimated to be 5% +/- 0.15 x 10¹⁶ cm⁻²

M17 estimated to be 5% +/- 0.15 x 10¹⁶ cm⁻²

Measurement statistical error given in data.

Instrument History:

1996 - 2008, M25 instrument

2009 - present, M17 instrument