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Variability and trends in stratospheric NO₂ in Antarctic summer, and implications for stratospheric NO_y

P. A. Cook and H. K. Roscoe

British Antarctic Survey, Madingley Rd, Cambridge CB3 0ET, UK

Abstract. NO₂ measurements during 1990–2007, obtained from a zenith-sky spectrometer in the Antarctic, are analysed to determine the long-term changes in NO₂. An atmospheric photochemical box model and a radiative transfer model are used to improve the accuracy of determination of the vertical columns from the slant column measurements, and to deduce the amount of NO_y from NO₂. We find that the NO₂ and NO_y columns in midsummer have large inter-annual variability superimposed on a broad maximum in 2000, with little or no overall trend over the full time period. These changes are robust to a variety of alternative settings when determining vertical columns from slant columns or determining NO_y from NO₂. They may signify similar changes in speed of the Brewer-Dobson circulation but with opposite sign, i.e. a broad minimum around 2000. Multiple regressions show significant correlation with solar and quasi-biennial-oscillation indices, and weak correlation with El Niño, but no significant overall trend, corresponding to an increase in Brewer-Dobson circulation of 1.4 ± 3.5%/decade. There remains an unexplained cycle of amplitude and period at least 15% and 17 years, with minimum speed in about 2000.

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