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Carbon dioxide (CO2) retrievals from Atmospheric Chemistry Experiment (ACE) solar occultation measurements from January 2004-March 2008: Volume mixing ratio 7-10 km altitude and 60 deg. N-60 deg S latitude time series and their comparison with surface and space-based measurements

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The Atmospheric Chemistry Experiment ACE satellite (SCISAT-1) was successfully launched into an inclined orbit on 12 August 2003 and is now recording high signal-to-noise 0.02 cm-1 resolution solar absorption spectra covering 750-4300 cm-1 (2.3-13 μm). Previously, we reported a procedure for determining precise tangent point densities from solar occultation spectra based on measurements of N2 collision-induced absorption in the 4.3 micron window region. This continuum absorption appears as the underlying broad background absorption extending 2400 to 2600 cm-1. We have developed a procedure for retrieving average CO2 mixing ratios in the mid-troposphere (7-10 km altitude) from the SCISAT-1 spectra based on measurements of absorption by N2 in a window region by applying an altitude shift to the tangent heights retrieved in version 2.2 SCISAT-1 processing and eliminating cloudy or aerosol-impacted measurements from the database. Monthly-mean volume mixing ratio (VMR) measurements covering the 60°S to 60°N latitude for the January 2004 to March 2008 time period have been analyzed with consistent increase rates trends inferred from measurements in both hemispheres. The ACE CO2 time series have been compared with previously-reported surface and space-based measurements covering the same time span. The northern hemisphere measurements show a maximum in January while the southern hemisphere annual seasonal cycle maximum occurs in July. The VMRs retrieved from the ACE spectra are higher on average by a factor of 1.09 than those measured at surface stations in both hemispheres and the CO2 increase rate is 1 ppmv higher than measured at surface stations during the same observation period.