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Atmospheric Chemistry Experiment (ACE) measurements of upper tropospheric biomass burning emissions and lower stratospheric long-term trends

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Mixing ratios up to 260 ppbv (10^{-9} per unit volume) for CO, 1470 pptv (10^{-12} per unit volume) for HCN, and 1.67 ppbv for C_2H_6 were retrieved from Atmospheric Chemistry Experiment (ACE) solar occultation spectra recorded between 30 September and 3 November 2004 at 15˚S-45˚S latitude with variations that are highly correlated reflecting their similar lifetimes and emission origin. Boreal measurements from June-July 2004 show elevated upper tropospheric CO, C_2H_6, HCN, CH_3Cl, and CH_4. with plumes and mixing ratios up to 189 ppbv for CO, 830 pptv for HCN, 1.40 ppbv for C_2H_6, 3.00 ppbv for CH_3Cl, and 2.09 ppmv for CH_4. The enhancements occurred in western Canada and Alaska near elevated CO mixing ratios measured during the same time by the MOPITT (Measurements of Pollution in the Troposphere) instrument. Back trajectory calculations and fire distributions indicate that the elevated levels resulted from convective transport of the emissions to higher altitudes.

Long-term lower stratospheric trends of HF, HCl, CCl_2F_2, CCl_3F, $CHClF_2$ (HCFC-22), SF_6, and CF_4have been derived by comparing the ACE measurements with similar ATMOS (Atmospheric Trace Molecule Spectroscopy Fourier transform spectrometer) measurements during 1985, 1992, 1993, and 1994. Carbon tetrafluoride (CF_4) is a potent greenhouse gas 10,000 times more effective than CO_2 on a per molecule basis. The combined ACE-ATMOS measurement set show the slowdown in the rate of CF_4 accumulation previously reported from surface measurements through 1997 has propagated to the stratosphere and is continuing.