Scientific Themes: upper tropopheric pollution, carbon monoxide

Carbon monoxide measured by the EOS Microwave Limb Sounder on Aura: First results , M. J. Filipiak, R. S. Harwood, J. H. Jiang, Q. Li, N. J. Livesey, G. L. Manney, W. G. Read, M. J. Schwartz, J. W. Waters, D. L. Wu, *Geophys. Res. Lett.*, Vol. 32, No. 14, L14825 10.1029/2005GL022765

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Summary

EOS MLS makes daily global measurements of carbon monoxide (CO) in the atmosphere from ∼8 to ∼80 km. CO can be used as a tracer of pollution in the troposphere, and as a dynamical tracer in the polar winter stratosphere.

During the polar winter, descent in the vortex brings carbon monoxide rich air from the thermosphere and mesosphere into the stratosphere. In the winter polar night there is no OH in the stratosphere and lower mesosphere to destroy the CO, so it acts as a good tracer of vortex dynamics until spring. Descent of CO-rich mesospheric air into the north polar stratosphere was observed during the 2004–2005 northern winter, with descent rates reaching 21 K/day.

In the troposphere, carbon monoxide can be transported from the boundary layer (BL) into the upper troposphere by frontal lifting, deep convection, and orographic lifting. MLS observed a strong enhancement in CO in the upper troposphere over southern Asia during late August–early September 2004, with mixing ratios reaching 180 ppbv. The enhancement is seen in the maps of retrieved CO (Figure 1), and in the radiance signal (Figure 2).

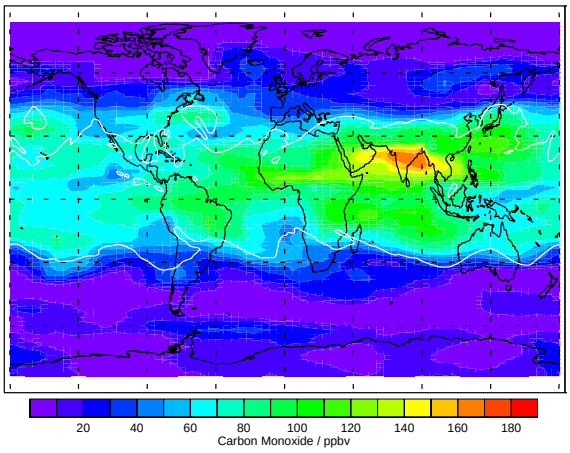

Figure 1: CO measured by MLS at 147 hPa (upper troposphere in the tropics, lower stratosphere at mid- and high-latitudes) for 30 August 2004. White curves are contours of potential vorticity ($\pm 2.0 \times 10^{-6}$K m^2 kg^{-1} s^{-1}) defining the dynamical tropopause.

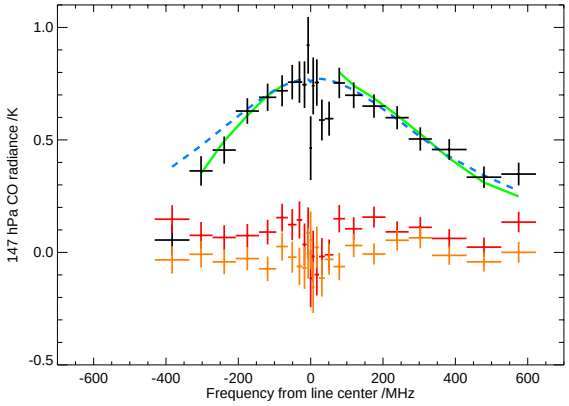

Figure 2: Radiance spectra centred on the CO emission line at 230.538 GHz, measured by MLS on 30 August 2004. The spectra are the difference between south Asia and the tropical Pacific, with the contributions from water vapor, dry-air, and ozone removed. Black crosses are the measured radiance difference, green line is the radiance difference calculated from the retrieved CO, and the blue dashed line is calculated relative sensitivity of radiance to CO. Red and orange crosses are similar radiance differences between north and south, and east and west tropical Pacific regions.