Observations of Trace Gas Correlation in the Free Troposphere Derived from the Atmospheric Infrared Sounder (AIRS)

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The Atmospheric Infrared Sounder (AIRS), launched in May of 2002, has the capability to measure trace gases, including ozone, carbon monoxide, methane, carbon dioxide, nitric acid, and nitrous oxide. These products are also derived from other operational sounders such as the Infrared Atmospheric Sounding Interferometer (IASI), launched Oct. 19, 2006 and the Cross-track Infrared Sounder (CrIS) to be launched in 2009. Together these instruments provide measurements of the mid-tropospheric concentration of these gases for at least two decades. With the current satellite systems we now have global measurements at 1:30 am & pm (AIRS) and 9:30 am & pm (IASI).

Trace gas concentrations have been derived from multi-year AIRS measurements, along with the associated vertical averaging kernels, using the NOAA/NESDIS algorithm and re-processing system. AIRS carbon monoxide product has been validation by our university partners (McMillan *et al*. 2005, GRL **32**, p.11801, McMillan *et al*., 2007, JGR, in-press, Warner *et al*. 2007 JGR, in-press) and the AIRS ozone product has been shown to capture upper tropospheric structure in UT/LS events (Bian et al. 2007 JGR **112**, Pan *et a*l, JGR, submitted). Zhang, L. *et al*., 2007 (JGR, in press) have shown that the Aura/TES instrument is sensitive to correlations of O_3 and CO downwind of biomass burning regions.

Here we show that the AIRS instrument confirms the TES result. In the figure below the left panel shows the linear correlation coefficient between ozone and carbon monoxide in the 2-6 km vertical layer for the month of October 2005. In the right panel we show ozone production relative to carbon monoxide as derived from monthly means of AIRS ozone and carbon monoxide products. Given that AIRS does not have high information content in the mid-troposphere this production rate is only a qualitative measure. We will show that correlations between, AIRS derived water, ozone, and carbon monoxide is useful to distinguish different dynamical regimes, such as stratospheric intrusions, biomass burning, and pollution from cities. We will also show the current capabilities with correlations of ozone and carbon monoxide with methane and carbon dioxide. These correlations, measured in a global sense from our operational suite of satellites, illustrates that the total product stream will be significantly more useful in discrimination of processes than the use of any single product alone.

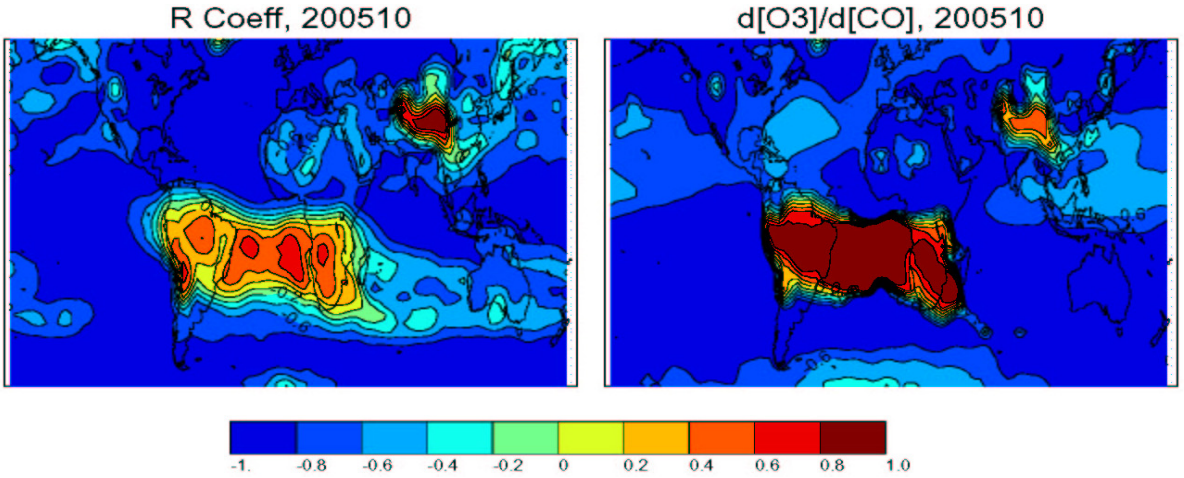

Figure 1. (Left) Linear correlation between O_3 and CO in a 2-6 km layer, October 2005. (Right) O_3 production relative to CO derived from monthly means of AIRS O_3 and CO products.