Geophysical Research Abstracts, Vol. 7, 10473, 2005
SRef-ID: 1607-7962/gra/EGU05-A-10473

Monitoring CO_2 from Space: The Orbiting Carbon Observatory (OCO)

D. Crisp
Jet Propulsion Laboratory/California Institute of Technology

Several recent studies indicate that precise, global, space-based observations of the column averaged CO_2 dry air mole fraction, $X_{CO2,}$ could dramatically improve our understanding of atmospheric CO_2 sources and sinks. However, precise estimates of X_{CO2} are needed because CO_2 fluxes must be inferred from the small (0.3 to 0.5 %) regional-scale variations in this quantity. NASA's Orbiting Carbon Observatory (OCO) is being designed to address these needs. OCO carries a single instrument incorporating three grating spectrometers that are designed to measure the near-infrared absorption by CO_2 and molecular oxygen (O_2) in reflected sunlight. High resolution spectra ($\lambda/\Delta\lambda$ >20,000) taken in the CO_2 bands near 1.61 and 2.06 μm provide constraints on the CO_2 column abundance, with the greatest information content near the surface, where most sources and sinks are located.. Bore-sighted, high resolution spectra ($\lambda/\Delta\lambda$ >17,000) in the 0.76 μmO_2 A-band provide accurate estimates of surface pressure. The spectral range of the O_2 and CO_2 channels includes the complete molecular absorption band as well as some nearby continuum. This approach provides information about the optical properties of the surface and aerosols at the edges of each band. The bore-sighted O_2 and CO_2 spectra acquired in each sounding will be analyzed with a remote sensing retrieval algorithm to yield spatially-resolved estimates of X_{CO2}.

OCO will be launched into a 705 km altitude, near polar, sun-synchronous orbit on a dedicated Orbital Sciences Standard Taurus launch vehicle. The tentative launch date is mid 2008. It will fly 10 to 15 minutes ahead of the EOS Aqua platform in the Earth Observing System Afternoon Constellation (A-Train). This orbit's 16-day repeat cycle provides global sampling at semimonthly intervals. The early afternoon equator crossing time is ideal for inferring surface sources and sinks from column CO_2 measurements because the planetary boundary layer is relatively deep, and CO_2 is well mixed through the column. The instrument will collect 12 soundings per second as the Observatory moves along its orbit track. A small sampling footprint ($<$3 km^2 at nadir) was adopted to reduce biases in each sounding associated with spatial variations in clouds, aerosols, surface topography. Each 1000 km by 1000 km region on the illuminated hemisphere is sampled 6 or more times during each 16 day period, providing thousands of soundings each month. Clouds and other environmental factors will reduce the number of soundings available for retrieving X_{CO2} to only $\sim$10 to 25% of the total, but even a small fraction of this should be adequate to yield X_{CO2} estimates with accuracies of $\sim$0.3 to 0.5% (1 to 2 ppm) on regional scales at monthly intervals. Because OCO implements an exploratory space based measurement concept that has not yet been validated, a comprehensive ground-based validation program will be used to assess random errors and minimize regional to continental scale biases in the X_{CO2} product. This presentation will summarize the progress toward the implementation of the OCO mission and provide a more compete description of the measurement approach, anticipated data products, and validation methods.