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Measuring CO_2 from Space: the Orbiting Carbon Observatory Instrument

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The NASA Orbiting Carbon Observatory (OCO) will make space-based measurements of atmospheric CO_2 with the precision, resolution, and coverage needed to characterize CO_2 sources and sinks on regional scales and quantify their variability. OCO will be launched in late 2008 and fly in a sun-synchronous polar orbit that provides near-global coverage of the sunlit portion of Earth with a 16-day repeat cycle. The observatory carries a single instrument that incorporates three high-resolution grating spectrometers, designed to make bore-sighted measurements of the near-infrared absorption by CO_2 and molecular oxygen (O_2) in reflected sunlight. These measurements will be combined to estimate the column averaged CO_2 dry air mole fraction, X_{CO2}. High resolution ($\lambda/\delta\lambda$>20,000) spectra of the CO_2 bands near 1.61 and 2.06 microns provide estimates of the CO_2 column abundance with their greatest sensitivity near the surface, where most sources and sinks are located. Bore-sighted measurements in the 0.76-μm O_2 A-band ($\lambda/\delta\lambda$>17,000) provide information about the atmospheric pressure and the optical path length as well as the spatial distributions of clouds and aerosols. All three spectrometers use similar optical designs and share a common housing and a common F/1.8 Cassegrain telescope. A small sounding footprint (1.29 km by 2.25 km at nadir) was adopted to maximize the probability of viewing cloud-free scenes even in partially cloudy regions and to minimize the errors introduced by spatial inhomogeneities with each sounding. The instrument collects up to 24 soundings per second as the spacecraft moves along its ground track at 6.78 km/sec, yielding up to 14 million X_{CO2} soundings over the sunlit hemisphere every 16-day global repeat cycle. This presentation will provide a more comprehensive overview of the instrument capabilities and their implications for CO_2 measurements.