THE ORBITING CARBON OBSERVATORY (OCO)

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The Earth System Science Pathfinder Orbiting Carbon Observatory (OCO) will make the first space-based measurements of atmospheric carbon dioxide (CO\textsubscript{2}) with the precision, resolution, and coverage needed to characterize the geographic distribution of CO\textsubscript{2} sources and sinks and quantify their variability over the annual cycle. After launch, in late 2007, OCO will fly in a 1:15 PM Sun synchronous polar orbit that provides near global coverage of the sunlit portion of the Earth with a 16-day repeat cycle. The observatory carries a single instrument that incorporates three high-resolution grating spectrometers, designed to measure the near-infrared absorption by CO\textsubscript{2} and molecular oxygen (O\textsubscript{2}) in reflected sunlight. Spectra of the CO\textsubscript{2} bands near 1.61 and 2.06 \(\mu\text{m}\) will be analyzed to retrieve the CO\textsubscript{2} column. Bore-sighted measurements in the 0.76 \(\mu\text{m}\) O\textsubscript{2} A-band will provide accurate surface pressure measurement and provide constraints on the cloud and aerosol distribution. The orbit’s near-noon equator crossing time maximizes the available signal and minimizes diurnal biases in CO\textsubscript{2} measurements associated with photosynthesis. Large numbers of coincident CO\textsubscript{2} and O\textsubscript{2} soundings will be collected at high spatial resolution to reduce the impact of random errors and minimize biases associated with clouds and other sources of spatial inhomogeneity within each measurement footprint. Independent calibration and validation approaches will be used to identify and correct regional-scale (1000 km by 1000 km) biases in the space-based \(X_{CO2}\) data. These validation methods include ground and aircraft field measurements and modeling studies. Once validated, the space based \(X_{CO2}\) measurements will be combined with other environmental data in sophisticated carbon cycle models to characterize CO\textsubscript{2} sources and sinks on regional scales at monthly intervals over two annual cycles.