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The Orbiting Carbon Observatory (OCO) mission: retrieval characterisation and error analysis

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The Orbiting Carbon Observatory (OCO) mission will make the first global, space-based measurements of atmospheric carbon dioxide (CO2) with the precision, resolution, and coverage needed to characterize CO2 sources and sinks on regional scales. During its 2-year mission, OCO will fly in a 1:15 PM sun-synchronous orbit with a 16-day ground-track repeat time, just ahead of the EOS Aqua platform. It will carry a single instrument that incorporates three bore-sighted high-resolution spectrometers designed to measure reflected sunlight in the 0.76-micron O2 A-band and in the CO2 bands at 1.61 and 2.06 microns. Soundings recorded in these three bands will be used to retrieve the column-averaged CO2 dry airmole fraction (XCO2). Each sounding will be analyzed with an algorithm that incorporates an atmospheric radiative transfer model, an instrument simulator model, and an inverse method that adjusts the assumed atmospheric state to better match the measurements.

We have simulated a set of realistic OCO spectra for locations covering different geophysical regimes. Using the linear error analysis technique, we have studied in detail the sensitivity of our XCO2 retrieval to the atmospheric CO2 profile and to other atmospheric/surface parameters such as temperature or aerosol optical depth. This analysis also allowes us to quantify the effects of various forward model and instrumental errors on derived XCO2 and to isolate areas where knowledge must be improved to meet mission accuracy goals. Finally, the retrieval characterization and error analysis provide parameters, such as averaging kernels and smoothing error estimates, that are needed when using OCO data for the inversion of carbon sources and sinks.