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End-to-end Retrieval Characterization of CO2 Retrievals from OCO (Orbiting Carbon Observatory) Observations

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The Orbiting Carbon Observatory (OCO) mission is NASA's first dedicated mission to measure the CO2 concentration in the Earth's atmosphere with the precision, resolution, and coverage needed to characterize CO2 sources and sinks on regional scales. OCO is scheduled for launch in February 2009 and it will fly in a 1:30 PM sun-synchronous orbit with a 16-day ground-track repeat time, just ahead of the EOS Aqua platform. The observatory 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. The first OCO spectra are expected to become available after the initial on-orbit checkout period of 37-90 days after launch and calibrated OCO spectra will be delivered to the data archive 6 months later.

Here, we will first give a description of the OCO full-physics retrieval algorithm which has been developed to retrieve the column-averaged CO2 dry air mole fraction, XCO2, from a simultaneous fit to the OCO spectra using the optimal estimation method and then present a characterization of its precision and accuracy based on end-to-end retrieval simulations. To this end, we have applied the full physics algorithm to spectra that have been simulated for the nadir and glint observational modes of OCO using the OCO forward model for a large range of realistic geophysical conditions, in particular for thin water and ice clouds. These retrieval simulations show that the algorithm performs well under most conditions with a single-sounding precision of typically less than 1 ppm. Aerosol and thin cirrus clouds have the potential to introduce small biases in retrieved XCO2 and a careful validation will be necessaryto ensure the accuracy goals of OCO.