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Space-based near-infrared CO2 retrievals: testing the OCO retrieval and validation concept using SCIAMACHY measurements over Park Falls, Wisconsin

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We have used SCIAMACHY spectra measured over Park Falls, Wisconsin to critically test the prototype Orbiting Carbon Observatory (OCO) retrieval algorithm and validation concept. Specifically, we have retrieved the column-averaged dry air mole fraction of CO2 (XCO2) from SCIAMACHY measurements and from coincident groundbased Fourier Transform Spectrometer (FTS) measurements of the O2 A-band at 760 nm and the 1580 nm CO2 band using the same algorithm. Even after accounting for a systematic error in our modeling of the O2 absorption cross-sections, we still obtained a positive bias between SCIAMACHY and FTS XCO2 retrievals of up to ˜3.5%. Additionally, the retrieved surface pressures from SCIAMACHY systematically underestimate measurements of a calibrated pressure sensor at the FTS site. These findings lead us to speculate about inadequacies in the forward model of our retrieval algorithm. By assuming a 1% intensity offset in the SCIAMACHY O2 A-band spectra, we could significantly improve the spectral fit and achieve good consistency between SCIAMACHY and FTS XCO2 retrievals. We compared the seasonal cycle of the CO2 column at Park Falls from SCIAMACHY and FTS retrievals with model calculations of the MATCH/CASA model and found a good qualitative agreement, with MATCH/CASA underestimating the measured seasonal amplitude. Finally, we

argue that significant improvements in precision and accuracy can be obtained from a dedicated CO2 instrument such as OCO, which has much higher spectral and spatial resolutions than SCIAMACHY. These measurements will then provide critical data for improving our understanding of the carbon cycle and carbon sources and sinks.