The Impact of the TSIS-SIM Data on the OCO-2/OCO-3 Data Analysis

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Space-based measurements of shortwave-infrared solar radiation reflected by the Earth and its atmosphere are providing new insights into the sources that are emitting carbon dioxide (CO_2) and methane (CH_4) into the atmosphere as well as the natural sinks that remove these gases. Accurate measurements of the top-of-atmosphere solar spectrum play two critical roles in the analysis of the space-based CO_2 and CH_4 measurements. First, observations of the solar spectrum provide the primary on-orbit radiometric and spectroscopic calibration standard for both individual instruments and for cross-calibrating instruments on different platforms. An accurate, high-resolution description of the solar spectrum is also critical for use in the remote sensing retrieval algorithms needed to estimate the column averaged CO_2 and CH_4 dry air mole fractions from the reflected solar spectra (XCO_2 and XCH_4, respectively.

For OCO-2, a high-resolution solar spectrum is constructed by combining a high resolution solar "transmission spectrum" derived from ground based and airborne FTS measurements (G. Toon personal communication) with a solar continuum derived from space-based instruments. Until recently, we used a solar continuum derived from the data derived from the ATLAS 3 SOLSPEC experiment. However, recent measurements from the Solar ISS and TSIS SIM instruments showed significant discrepancies with the ATLAS 3 SOLSPEC estimates. TSIS SIM results (E. Richard, personal communication) were adopted as the new standard in the latest algorithm build. This changed the continuum level by ~1.3% near 760 nm, 3% near 1610 nm, and 6.5% near 2060 nm. These changes introduced a small reduction in the retrieved surface pressure over land and an increase in the surface pressure retrieved over ocean. The associated changes in XCO_2 were small (< 0.3%) but were positive over land and negative over water. While the changes were small, they were still significant source-sink inversion studies due to their spatial structure.