An Update on OCO-2 at the End of Prime Mission

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Space-based measurements of greenhouse gases have the potential to greatly add to our understanding of the state and evolution of the carbon cycle at increasingly finer scales, and of regions that are particularly difficult to monitor with more conventional methods. The NASA Orbiting Carbon Observatory-2 (OCO-2) completed its 2-year prime mission on October 16, 2016 and began its first extended mission. Since 6 September 2014, OCO-2 has been returning roughly 1.5 million measurements of column carbon dioxide (CO_2) (X_{CO2}) per month, which have begun to yield new insights into carbon processes (Eldering et al., 2017). These include both recent insights into terrestrial carbon cycle changes induced by the 2015-16 El Niño, as well as rough proof-of-concept measurements of anthropogenic CO_2 from power plant to regional scales. OCO-2 data are also returning estimates of solar induce chlorophyll fluorescence (SIF), which provides a sensitive indicator of CO_2 uptake by the land biosphere. For CO_2, the end-to-end performance of the instrument and retrieval algorithm is continuously validated though comparisons with X_{CO2} estimates from TCCON (Figure 1) and other standards. Regional and seasonal biases still remain at a level of typically <~ 1 ppm. Improvements, especially over the ocean, are expected with the upcoming version 8 product, which includes a correction for trace amounts of upper-atmospheric aerosols, as well as numerous other minor improvements. SIF has been initially validated by direct comparisons to flux towers as well as to remote sensing measurements made via recent US-based aircraft underflights. Together with the numerous space-based measurements systems currently in planning or recently deployed, such as TanSat, GOSAT-2, MicroCarb, OCO-3, and GeoCarb, the future currently seems bright for space-based greenhouse gas remote sensing.

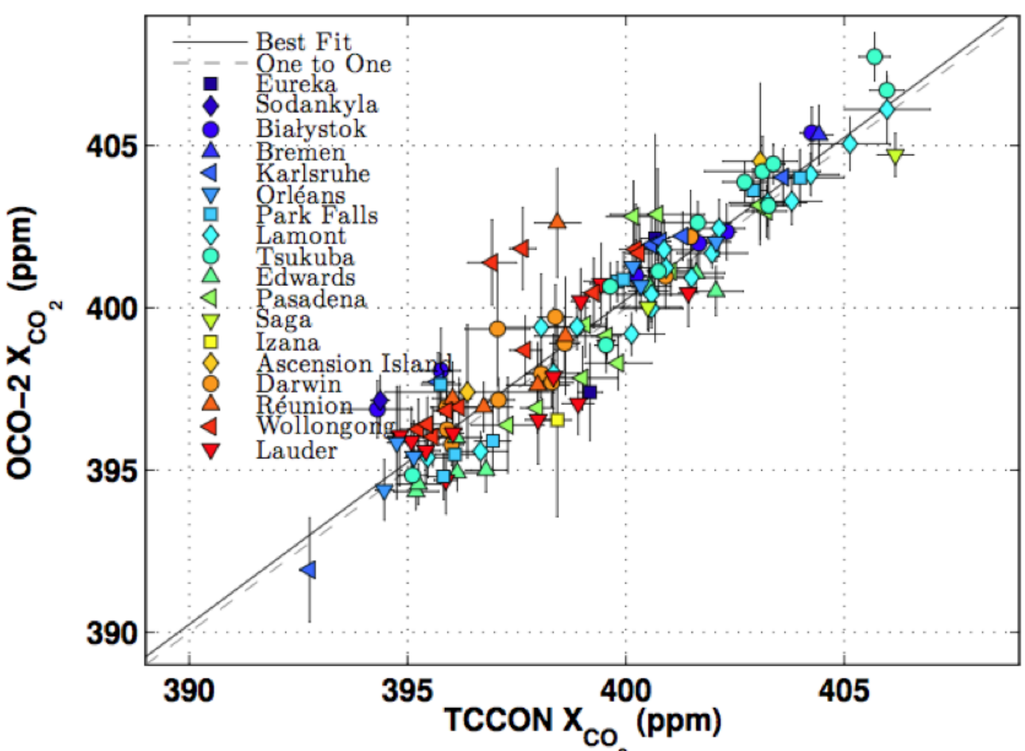

Figure 1. Comparison of OCO-2 X_{CO2} to TCCON. [Adapted from Wunch et al., 2017.]