Space-Based Measurements for Long-Term Global Monitoring of Atmospheric CO_2

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Measurements of reflected sunlight in near infrared CO_2 and O_2 absorption bands with instruments such as the recently launched Japanese IBUKI TANSO-Fourier Transform Spectrometer (FTS) provide new opportunities for long-term, global, space-based monitoring of CO_2 and other greenhouse gases. These measurements must be thoroughly validated to demonstrate their accuracy and range of validity. Prior to the failure of the NASA Orbiting Carbon Observatory (OCO) launch, the OCO team developed a comprehensive validation strategy, designed to relate these space based measurements to the World Meteorological Organization (WMO) CO_2 standard that is maintained by NOAA ESRL Global Monitoring Division. A critical element of this strategy was the Total Carbon Column Observing Network (TCCON), which uses high resolution FTS's to measure the absorption of direct sunlight by CO_2 and O_2, in the same spectral regions used by the TANSO-FTS (Figure 1). Over-flights of TCCON stations by aircraft carrying *in situ* instruments calibrated with WMO referenced gases have been used to validate the TCCON results. CO_2 profiles extending from the boundary layer to the middle troposphere are integrated to derive a value of XCO_2. Simultaneous TCCON FTS and TANSO-FTS measurements are then compared to transfer the WMO standard to the spacecraft measurements. To further validate these space-based measurements, they can be assimilated into global carbon source/sink inversion models to derive near-surface CO_2 fields that can be validated against measurements from the Cooperative Air Sampling Network. We now plan to use these methods to assist in the validation of IBUKI results.

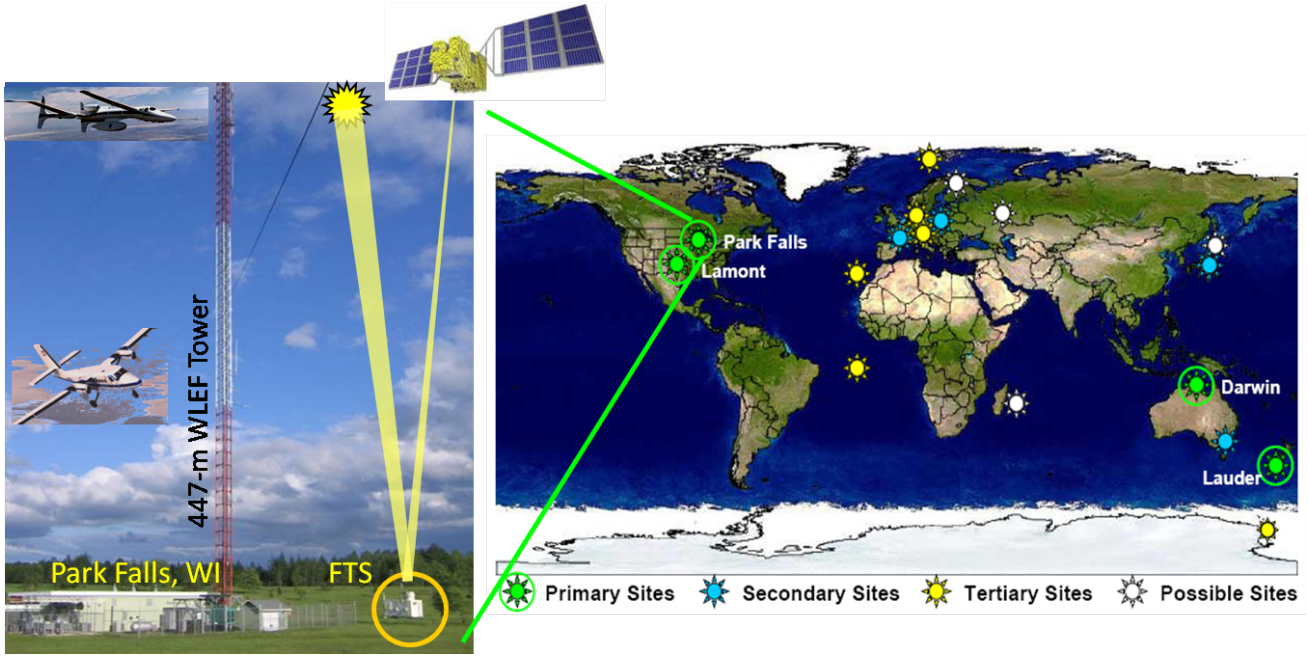

Figure 1. (Left) TCCON station at Park Falls, WI shown adjacent to the WLEF Tower. (Right) Map of TCCON stations.