Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

U01-08 Room:IC Time:May 23 12:05-12:30

Atmospheric CO2 Observations from Space by the GOSAT Mission

David Crisp[1*], Annmarie Eldering[1], Michael Gunson[1]

[1]Jet Propulsion Laboratory, California Institute of Technology

Fossil fuel combustion, deforestation, and other human activities are now adding more than 30 billion tons of carbon dioxide (CO2) to the atmosphere each year. These CO2 emissions are superimposed on an active carbon cycle, driven by natural processes in the land biosphere and oceans. These processes emit more than 25 times as much CO2 into the air each year as human activities and then reabsorb at least that much, along with about half of the human contributions. Precise measurements of atmospheric CO2 concentrations over the past 50 years indicate that these natural carbon sinks have somehow been keeping up with the 5-fold increase in the fossil fuel CO2 emission rates over that period, reducing the rate of buildup of CO2 by a factor of two. The nature and location of these increasingly efficient CO2 sinks is still largely unknown. Because of this, it is impossible to predict how much longer they will continue to control the atmospheric CO2 buildup rates.

While the ground-based greenhouse gas monitoring network now provides a strong global constraint on both human and natural CO2 fluxes into the atmosphere, it still does not have the resolution and coverage needed to identify and quantify sources and sinks on regional scales. One way to improve the spatial and temporal coverage and resolution is to retrieve precise, spatially-resolved, global measurements of CO2 from space. High resolution spectroscopic observations of reflected sunlight by CO2 and O2 bands are well suited for monitoring surface CO2 fluxes. These measurements can be analyzed to yield estimates of the column-averaged CO2 dry air mole fraction, XCO2, which are most sensitive to CO2 variations near the surface. The Japanese Greenhouse gases Observing SATellite (GOSAT, nicknamed Ibuki) was the first satellite specifically designed to exploit this approach. The NASA Atmospheric CO2 Observations from Space (ACOS) team has been collaborating closely with the GOSAT Project team to perform annual vicarious calibration campaigns, retrieve XCO2 from GOSAT TANSO-FTS spectra, and validate these results against a variety of standards, including surface-based XCO2 retrievals from the Total Carbon Column Observing Network (TCCON). Recent XCO2 products from this collaboration show little or no bias and have random errors that are typically less than 0.5% on regional scales over much of the Earth. These XCO2 estimates are now being used in flux inversion models to assess their impact on our understanding CO2 sources and sinks. This experience is expected to accelerate the delivery of high quality XCO2 products from the NASA Orbiting Carbon Observatory-2 (OCO-2), once it has been successfully launched.

Keywords: carbon dioxide, CO2, carbon cycle, remote sensing, GOSAT