(7-240325-A) **Monitoring the "*Health*" of the Global Carbon Cycle with NASA's Orbiting Carbon Observatory Missions**

A. Chatterjee[1], J. Liu[2], V. Payne[2], and The OCO-2/3 Science Team[2]

[1]NASA Goddard Space Flight Center (GSFC), Greenbelt, MD 20771; 626-372-2234, E-mail: abhishek.chatterjee@jpl.nasa.gov
[2]NASA Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

The climate change trajectory critically depends on the balance between emissions from fossil fuel burning and the uptake by natural carbon sinks over the land and the ocean. Thus, it is important to monitor the changes of both fossil fuel emissions and natural carbon sinks as countries around the world pledge to reduce fossil fuel emissions. NASA's pathfinder missions, Orbiting Carbon Observatory-2 (OCO-2) and Orbiting Carbon Observatory-3 (OCO-3), launched in July 2014 and May 2019 respectively, provides a unique vantage point from space to observe global column CO_2 concentrations and solar-induced chlorophyll fluorescence (a proxy for tracking gross primary productivity) at unprecedented spatiotemporal resolution. In conjunction with a growing network of in-situ measurements, a decade of OCO-2 data has enabled the scientific community to: (1) observe the recovery from the impact of 2015–2016 El Niño over the tropical continents, (2) shed new light on seasonal- and interannual-scale variability of the regional carbon cycle, especially over the tropics and high latitudes where conventional observations are sparse, and (3) reveal the outsized impact of extreme climate events such as flood, drought, and fire on ecosystem health and regional carbon budgets. In addition to the narrow swath (~10 km cross track) observing mode as OCO-2, OCO-3 also has a snapshot area mapping mode that scans a ~80 x 80 km^2 area to provide localized, high-density data over CO_2 emission hotspots. These observations have been successfully used in quantifying fossil fuel emissions from large point sources and urban domes.

In this talk, we will first describe the two missions and the quality of OCO-2/3 retrievals, followed by highlight of recent achievements of using OCO-2 and OCO-3 to quantify the impact of natural climate anomalies, and emissions over cities and power plants. We will end with an outlook of future scientific opportunities with longer OCO-2/3 data records and discuss the need for a coordinated diverse observing portfolio, comprising of airborne, remote sensing and ground measurements in order to obtain a deeper understanding of the changing carbon cycle and its co-evolution with atmospheric composition and climate.

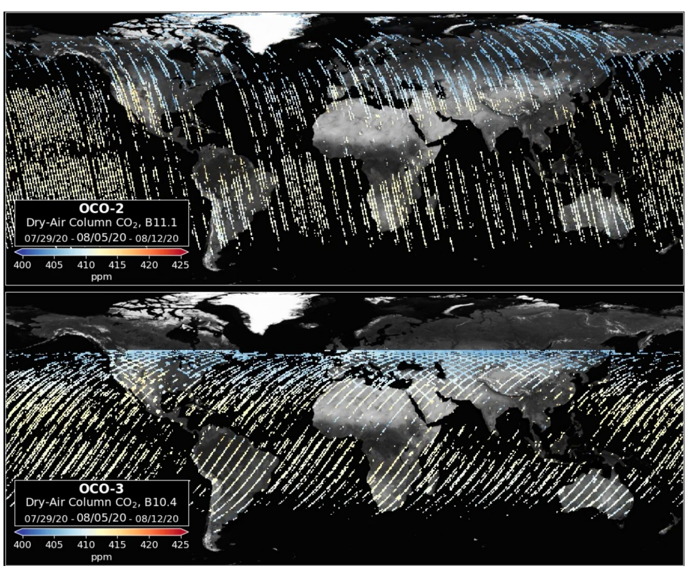

Figure 1. Snapshot of column CO_2 data collected from OCO-2 and OCO-3 over a 7-day period. OCO-2 being in a sun-synchronous polar orbit provides pole-to-pole coverage, while OCO-3 stationed on the International Space Station captures data between 52°N and 52°S.

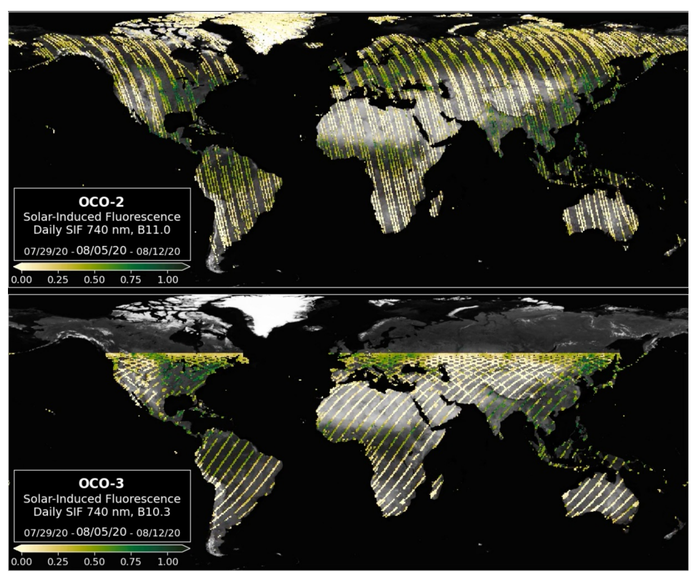

Figure 2. Snapshot of solar-induced chlorophyll fluorescence (SIF) data collected over land from OCO-2 and OCO-3 over a 7-day period. OCO-2 being in a sun-synchronous polar orbit provides pole-to-pole coverage, while OCO-3 stationed on the International Space Station captures data between 52°N and 52°S.