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The OCO-3 Mission : Overview of Science Objectives and Status

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The Orbiting Carbon Observatory 3 (OCO-3) is a space instrument that will investigate important questions about the distribution of carbon dioxide on Earth as it relates to growing urban populations and changing patterns of fossil fuel combustion. OCO-3 will explore, for the first time, daily variations in the release and uptake of carbon dioxide by plants and trees in the major tropical rainforests of South America, Africa, and Southeast Asia, the largest stores of aboveground carbon on our planet. NASA will develop and assemble the instrument using spare materials from OCO-2 and host the instrument on the International Space Station (ISS) (earliest launch readiness in early 2018.)

The low-inclination ISS orbit lets OCO-3 sample the tropics and sub-tropics across the full range of daylight hours with dense observations at northern and southern mid-latitudes (+/- 52º). At the same time, OCO-3 will also collect measurements of solar-induced chlorophyll fluorescence (SIF) over these areas. The combination of these dense CO_2 (expected to have a precision of 1 parts per mission) and SIF measurements provides continuity of data for global flux estimates as well as a unique opportunity to address key deficiencies in our understanding of the global carbon cycle. The instrument utilizes an agile, 2-axis pointing mechanism (PMA), providing the capability to look towards the bright reflection from the ocean and validation targets.

The PMA also allows for a snapshot mapping mode to collect dense datasets over 100km by 100km areas. Measurements over urban centers could aid in making estimates of fossil fuel CO_2 emissions. This is critical because the largest urban areas (25 megacities) account for 75% of the global total fossil fuel CO_2 emissions, and rapid growth (> 10% per year) is expected in developing regions over the coming 10 years.

Similarly, the snapshot mapping mode can be used to sample regions of interest for the terrestrial carbon cycle. For example, snapshot maps of 100km by 100km could be gathered in the Amazon or key agricultural regions. In addition, there is potential to utilize data from ISS instruments ECOSTRESS (ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station) and GEDI (Global Ecosystem Dynamics Investigation), which measure other key variables of the control of carbon uptake by plants, to complement OCO-3 data in science analysis.