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MEASURING EARTH'S CARBON CYCLE

By **Jesse Smith**

One of the crowning achievements of modern environmental science is the Keeling curve, the detailed time series of the concentration of atmospheric carbon dioxide (CO_2) begun in 1958 that has enabled deep insights into the mechanisms of global climate change. These measurements were difficult to make for most of their 60-year history, involving the physical collection of air samples in flasks at a small number of sites scattered strategically around the globe and the subsequent analysis of their CO_2 inventories in a handful of laboratories throughout the world. The Orbiting Carbon Observatory-2 (OCO-2) mission was designed to circumvent those limitations by providing a platform with which atmospheric CO_2 can be measured spectrally from space over large geographic areas, thereby offering an unprecedented capability to study, in great detail, the processes that affect the concentration of the gas over a variety of spatial and temporal scales. The satellite can also measure solar-induced fluorescence, a proxy for photosynthesis, which provides valuable information about the biological processes that affect atmospheric CO_2.

In this issue, a collection of Research Articles presents the initial results from OCO-2, covering the detection of CO_2 emissions from specific point sources; measurements of CO_2 variations associated with El Niño, on land and at sea; and solar-induced fluorescence measurements of photosynthesis for determining gross primary production by plants. With its impressive collection of observational capabilities, OCO-2 will enable measurements of atmospheric CO_2 to be made with sufficient precision, resolution, and coverage to faithfully characterize its sources and sinks globally over the seasonal cycle, a long-standing goal in atmospheric and climate science.

The OCO-2 satellite can measure photosynthesis, as well as the amount of CO_2 in the atmosphere, and so will shed new light on the carbon cycle.

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