Study reveals dry season increase in photosynthesis in Amazon rain forest

October 22 2019

Uncontacted indigenous tribe in the brazilian state of Acre. Credit: Gleilson Miranda / Governo do Acre / Wikipedia

A University of Oklahoma-led study demonstrated the potential of the TROPOspheric Monitoring Instrument on board the Copernicus

Sentinel-5 Precursor satellite to measure and track chlorophyll fluorescence and photosynthesis of tropical forests in the Amazon.

The Amazon is the largest terrestrial contributor to global atmospheric carbon fluxes, but it has been debated whether photosynthesis in the Amazonian forest increases during the dry season. Field data indicates that GPP increases during the dry season due to loss of old-age leaves and the flushing of new leaves, but due to the sheer size and remoteness of the Amazon forest it is impossible to thoroughly ground-sample the forest. Thus, scientists have relied on satellite-based data to investigate whether the processes they observe at the field sites are occurring at larger spatial and temporal scales. Understanding the seasonality of photosynthesis and its drivers in the Amazon is particularly important, because changes in the sequestration and emission of carbon from and to the atmosphere in the Amazon play an important role in determining the Earth's atmospheric carbon dioxide concentration. Furthermore, if researchers wish to confidently forecast how changes in climate and land use in the Amazon may impact global atmospheric carbon concentrations in the future, then it is necessary to understand the dynamics of Amazonian photosynthesis.

Plants emit a low amount of energy when photosynthesizing, which is called solar-induced chlorophyll fluorescence. Technological advancements now allow us to observe the emission of SIF by plants from space using satellites. The paper reports new evidence that there is a dry-season increase in photosynthesis in the Amazon rainforest, using observations of solar-induced chlorophyll fluorescence from the TROPOMI. The paper results provide additional confidence in understanding about the seasonality of photosynthesis in the Amazon, and the methods developed in this study are an important step forward in the application of satellite-based SIF data.

The OU-led study, "TROPOMI reveals dry-season increase of solar-

induced chlorophyll fluorescence in the Amazon forest," was published by the *Proceedings of the National Academy of Sciences*. The paper was led by graduate student Russell Doughty, who is a Ph.D. candidate in ecology and evolutionary biology in the Department Microbiology and Plant Biology. Professor Xiangming Xiao in the Earth Observation and Modeling Facility, Department of Microbiology and Plant Biology, coordinated this research activity. This study was in part supported by the Geostationary Carbon Cycle Observatory project, which is led by the University of Oklahoma and funded by NASA. By 2022, the GeoCarb mission is planned to launch an instrument that will provide sub-daily to daily SIF, CO_2, CO and CH_4 observations over North America to South America.

More information: Russell Doughty et al, TROPOMI reveals dry-season increase of solar-induced chlorophyll fluorescence in the Amazon forest, *Proceedings of the National Academy of Sciences* (2019). DOI: 10.1073/pnas.1908157116

Provided by University of Oklahoma