NASA STUDIES TROPICAL ECOSYSTEMS' REGULATION OF CARBON DIOXIDE

MOFFETT FIELD, Calif. – NASA scientists discovered that, unlike other parts of the planet, year-to-year changes in temperature over the tropics act in concert on both photosynthesis (absorption of carbon dioxide) and respiration (release of carbon dioxide). Rising temperatures, influenced by natural events such as El Niño, have a corresponding increase in the release of carbon dioxide from tropical forest ecosystems, according to their study.

An international team of scientists found that a temperature anomaly of just 1degree Centigrade, in recorded near surface air temperatures in the tropics, leads to a 3.5-Petagram (a billion tons of carbon) anomaly in the annual carbon dioxide growth rate, on average. This is the equivalent of one third of the annual global emissions from the combustion of fossil fuels and deforestation together. The paper was published today in the journal Proceedings of the National Academy of Sciences.

Importantly, the NASA-led study results show that there is a strong and robust coupling between year-to-year variations in atmospheric carbon dioxide growth and tropical temperatures over the past 50 years and this provides scientists with a key diagnostic tool to assist in our understanding of the global carbon cycle.

"What we learned is that in spite of droughts, floods, volcano eruptions, El Niño and other events, the Earth system has been remarkably consistent in regulating the inter-annual variations in atmospheric carbon dioxide levels," said Weile Wang, a research scientist at NASA's Ames Research Center, Moffett Field, Calif. and lead author of the paper.

The current study provides supporting evidence for the "carbon-climate feedback," which is a belief by many scientists that a warming climate will lead to accelerated carbon emissions from vegetation and soils into the atmosphere. Multiple Earth system processes, such as droughts and floods, contribute to changes in carbon emissions. Findings show observed temperature changes are more important than changes in rainfall, which also influences the concentration of carbon dioxide in the atmosphere.

"Climate warming is what we know with certainty will happen under climate change in the tropics, but there are still large uncertainties about the future precipitation in tropical regions," said Josep G. Canadell, the executive director of the Canberra-based Global Carbon Project and co-author of the paper.

The team used a state-of-the-art, high-performance computing and data access facility called NASA Earth Exchange (NEX) platform at Ames. This facility allowed scientists to analyze widely available data of atmospheric carbon dioxide concentrations and global air temperatures between 1959 and 2011, while simultaneously studying outputs from

several global dynamic vegetation models. They wanted to understand the mechanisms underlying the persistent association between carbon dioxide levels and increased temperatures.

Climatic events may disturb the behavior of temperature-carbon dioxide association from year-to-year or even decades, yet the coupling always recovers after such events and is robust over the 50-year period.

“The study really highlights the importance of long-term Earth observations for improving our understanding of the Earth system, conclusions drawn from analysis of shorter records could be misleading, ” says Rama Nemani, principal scientist for the NEX project.

The study was supported by NASA Carbon cycle science program and NASA’s Earth Exchange project.

For more information about NASA’s NEX facility, visit:

https://c3.nasa.gov/nex/

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