Geophysical Research Abstracts
Vol. 14, EGU2012-7938, 2012
EGU General Assembly 2012

Sources and sinks of methane and nitrous oxide in the tropical Andes

Y. A. Teh (1), T. Diem (1), S. Jones (2), V. Oliver (1), E. Baggs (3), P. Smith (3), M. Richards (3), and P. Meir (2)

(1) University of St Andrews, School of Geography & Geosciences, St Andrews, United Kingdom (yat@st-andrews.ac.uk, +44 1334 463949), (2) University of Edinburgh, School of Geosciences, Edinburgh, United Kingdom, (3) University of Aberdeen, Institute of Biological and Environmental Sciences, School of Biological Sciences, Aberdeen, United Kingdom

Inverse models and remote sensing studies indicate that tropical ecosystems are stronger sources of methane and nitrous oxide than previously predicted by bottom-up emissions inventories. This indicates that prior inventories have either underestimated the strength of existing sources or "missed" key habitats. One of the key areas neglected by previous studies are montane tropical ecosystems. Tropical montane ecosystems are characterized by cooler temperatures (relative to the lowlands), high rainfall, large organic matter pools, and frequent anaerobiosis. These kinds of conditions can promote methane and nitrous oxide production, suggesting that these montane ecosystems may be important contributors to atmospheric budgets of methane and nitrous oxide. In addition, the release of these non-carbon dioxide greenhouse gases have the potential to offset the "cooling" effects of plant carbon uptake. However, less is known about these diverse habitats than lowland ecosystems, largely because of their remoteness and inaccessibility. Here we report data on methane and nitrous oxide fluxes from a long elevation gradient in the Peruvian Andes (from 0 to 3500 m.a.s.l.), incorporating a broad range of habitats, from lowland forest to cloud forest. Trace gas fluxes were collected on a monthly basis from 4 elevation bands and over 10 different ecosystem types, including managed and unmanaged habitats. We also conducted high frequency measurement campaigns exploring short-term, weather-driven changes in hydrology on trace gas exchange. Overall these Andean ecosystems were strong sources of nitrous oxide, with emissions equal to or greater than fluxes from the lowland tropics (the single largest source region worldwide). Methane fluxes were much less consistent in direction and magnitude, with some ecosystems acting as net sources while others were weak atmospheric sinks. Nitrous oxide was the dominant global warming agent, offsetting the effects of plant assimilation. The contribution of methane to overall global warming potential across the elevation gradient was less important because forests – which accounted for most of the land cover – were largely methane sinks. High elevation grasslands, wetlands, and lakes were methane sources during the wet season and weak sinks during dry periods. These data suggest that one of the key challenges of incorporating montane tropical environments into bottom-up inventories of methane and nitrous oxide fluxes is the spatial and temporal heterogeneity of fluxes from these diverse habitats.