Hydrometeorological sensitivities of net ecosystem carbon dioxide and methane exchange of an Amazonian palm swamp peatland

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Project Abstract:

Tropical peatlands are a major, but understudied, biophysical feedback factor on the atmospheric greenhouse effect. The largest expanses of tropical peatlands are located in lowland areas of Southeast Asia and the Amazon basin. The Loreto Region of Amazonian Peru contains ~63,000 km^2 of peatlands. However, little is known about the biogeochemistry of these peatlands, and in particular, the cycling of carbon dioxide (CO_2) and methane (CH_4), and their responses to hydrometeorological forcing. To address these knowledge gaps, we established an eddy covariance (EC) flux tower in a palm (*Mauritia flexuosa* L.f.) swamp peatland near Iquitos, Peru. Here, we report ecosystem-scale CO_2 and CH_4 flux observations for this Amazonian palm swamp peatland over a two-year period. The seasonal variation in hydrometeorology (wet versus dry seasons) had a strong effect on CO_2 and CH_4 fluxes. High air temperature and vapor pressure deficit (VPD) exerted an important limitation on photosynthesis during the dry season. Evidence from light- response analyses and flux partitioning support that photosynthetic activity was strongly downregulated during the dry seasons. The cumulative net ecosystem CO_2 exchange indicated that the peatland was a significant CO_2 sink ranging from −420 (−349 to −543) in 2018 to −455 (−384 to −542) g C m^{-2} y^{-1} in 2019. The forest was a CH_4 source of 27 (24 to 30) g C m^{-2} y^{-1}, similar in magnitude to other tropical peatlands and larger than sub-boreal peatlands. Thus, the annual carbon budget of this Amazonian palm swamp peatland appears to be a major carbon sink under current hydrometeorological conditions.