

Carbon dynamics in tropical peat draining rivers

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Abstract

Emissions of CO₂ and CH₄ from rivers and streams to the atmosphere represent a globally significant flux in the carbon cycle. Estimates vary strongly from 0.6 - 1.8 TgCyr⁻¹. However, the studies agree that Southeast Asia is a hotspot for river carbon outgassing due to the high carbon storage of tropical peatlands. For this area, measurements are rare and the few existing measurement based studies state moderate emission rates.

This study investigates three tropical peat draining rivers on Borneo, Malaysia. The two rivers with little anthropogenic disturbances show extremely small CO₂ and DOC variation due to a lack of daily patterns caused by the dark river color. In contrast, the third river shows high variability in DOC and CO₂ as well over the river run as between the different years of measurement. One possible explanation for this could be the strong anthropogenic influences on the river. But there might be other causes, since the river shows more characteristics that differ from the other rivers. Atmospheric flux measurements from the rivers result to a mean flux of $(9.5 \pm 4.7) \text{ gCm}^{-2}\text{d}^{-1}$ and a mean exchange coefficient of $k_{600} = (8.5 \pm 4.9) \text{ cm h}^{-1}$.

Additionally, data of this study was used to extend the results of existing case studies by data of high DOC. The results confirm a linear correlation between catchment peat coverage and DOC yield. They advance the knowledge of CO₂ yield correlation to peat coverage and show an initial increase that levels off more rapidly than expected, showing a constant value for peat coverages > 40 %. Also they expand the knowledge about DOC-CO₂ and DOC-O₂ relationships for rivers of DOC > 2 000 μmol L⁻¹, revealing a stagnation in CO₂ increase and O₂ decrease to constant concentrations for rivers of DOC > 2 500 μmol L⁻¹.