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Pantropical Trends in Peatland Methane Fluxes

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Wetlands are the largest source of methane (CH_4) to the atmosphere and tropical peatlands in particular offer ideal conditions for methanogenesis. However, prior work found unexpectedly low CH_4 emissions from tropical peat, based on measurements of surface emissions using chambers (Jauhiainen et al., 2005). In contrast, our measurements and modeling results show that CH_4 production in these ecosystems may be an order of magnitude higher than previously measured. We find that the relatively rapid groundwater flow through tropical peatlands alters the relative importance of transport pathways compared to northern peatlands. This is evident in CH_4 and DIC isotope and concentration data, which show strikingly similar trends across the tropics, including in Panama and Brunei Darussalam (Holmes et al., 2015; Hoyt et al., 2016).

This suggests strong pantropical trends in tropical peatland CH_4 cycling. Here we synthesize data on CH_4 transport pathways in tropical peatlands. We find relatively little ebullition and small surface fluxes relative to northern peatlands, which we can replicate by modeling the high flow rates common in tropical peatlands. High rates of oxidation also reduce surface fluxes. Tree transport plays an important role in peatlands, but varies over orders of magnitude with tree species, leading to high variability (Pangala et al., 2013; van Haren et al., 2016). We also assess the potential for lateral subsurface transport of dissolved CH_4, facilitated by high flow rates. Finally, we address reasons methanogenesis may be inhibited in tropical peatlands.