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# Distribution and degradation of terrestrial organic matter in the sediments of peat-draining rivers, Sarawak, Malaysian Borneo

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**Abstract.** Tropical peatlands are one of the largest pools of terrestrial organic carbon ($OC_{terr}$); however, our understanding of the dynamics of $OC_{terr}$ in peat-draining rivers remains limited, especially in Southeast Asia. This study used bulk parameters and lignin phenol concentrations to investigate the characteristics of $OC_{terr}$ in a tropical peat-draining river system (the main channel of the Rajang and three smaller rivers: the Maludam, Simunjan, and Sebuyau) in the western part of Sarawak, Malaysian Borneo. The depleted $\delta^{13}C$ levels and lignin composition of the organic matter indicates that the most important plant source of the organic matter in these rivers is woody angiosperm $C_3$ plants, especially in the three small rivers sampled. The diagenetic indicator ratio, i.e., the ratio of acid to aldehyde of vanillyl phenols ($(Ad/Al)_V$), increased with decreasing mean grain size of sediment from the small rivers. The selective sorption of acid relative to aldehyde phenols might explain the variations in the $(Ad/Al)_V$ ratio. Elevated $(Ad/Al)_V$ values observed from the Maludam's sediments may also be attributed to source plant variations. The $(Ad/Al)_V$ ratio appears to be related to the C/N ratio (the ratio of total organic carbon to total nitrogen) in the Rajang and small rivers. In small rivers, a quick decline of C/N ratios is a response to the slower modification of $(Ad/Al)_V$ ratios due to better preservation of lignin phenols. An accumulation of lignin phenols with higher total nitrogen percentages (TN%) in the studied systems was observed. Most of the $OC_{terr}$ discharged from the Rajang and small river systems was material derived from woody angiosperm plants with limited diagenetic alteration before deposition and thus could potentially provide significant carbon to the atmosphere after degradation.

## 1 Introduction

Tropical peatlands are one of the biggest terrestrial organic carbon pools, accounting for about 89 000 Tg (Moore et al., 2013; Rieley et al., 1996, 2008). It is reported that about 77 % of the carbon stored in all tropical peatlands is derived from Southeast Asia, which equals 11 %–14 % of the total carbon pool stored in all peat. However, increasing anthropogenic disturbance in the form of land-use change, drainage and biomass burning are converting this peat into a globally significant source of atmospheric carbon dioxide (Dommain et al., 2014; Miettinen et al., 2016; Koh et al., 2009; Page et al., 2011). The rivers draining these peatlands are typically rich in lignin phenols and humic substances and are often referred to as "blackwater" rivers (Baum et al., 2007; Cook et al., 2017; Moore et al., 2011). However, knowledge of the fate of terrigenous organic matter in such peat-draining rivers and estuaries remains limited (Gandois et al., 2014; Hall et al., 2015; Lourençato et al., 2019).

The transport, degradation, and sequestration of terrestrial organic carbon ($OC_{terr}$) in river systems are important because of their roles in constraining carbon cycle budgets (Aufdenkampe et al., 2011; Battin et al., 2009; Feng et al., 2016; Spencer et al., 2010; Wu et al., 2018). In terms of transport within fluvial systems, $OC_{terr}$ is subject to various