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Title:
Significant seasonal and event-driven changes of carbon and nutrient fluxes to first-order streams of an Amazon forest

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Abstract:
Carbon and nutrient inputs to streams show significant seasonality in forested and human-impacted watersheds throughout the Amazon Basin. Both higher and lower concentrations during low-flow than high-flow conditions have been reported. Our results from four forested headwater watersheds in seasonally-dry southern Amazonia show DOC and nutrient concentrations to be inversely related to stream discharge on a seasonal basis, while these seasonal dynamics are significantly affected by storm-flow events. Rainfall rapidly generates overland flow and responses in stream discharge are observed within 5 minutes after the beginning of a storm. Streamflow increases rapidly and recedes quickly, generally within 30 minutes following the end of a rainfall event. Concentrations of DOC in streamflow increase four-fold during storm events, whereas K tended to increase slightly by 12% and Ca, Mg, NO_3, NH_4 decrease compared to baseflow.

Large increases in stormflow DOC compared to baseflow DOC concentrations appear to be independent of season, while both baseflow and storm flow concentrations become more dilute through the rainy season (from 3 and 12 mg/L early in the rainy season to 2 and 8 mg/L by mid-rainy season, base flow and storm flow respectively). A greater litterfall during the dry than the rainy season and a resulting larger accumulation of litter on the soil surface does not only explain larger DOC concentrations originating from overland flow, but also inputs of coarse organic matter (>2mm). Coarse organic matter fluxes in streams are high during the dry-to-wet season transition, but drop off substantially by mid-rainy season. Large fluxes of coarse organic matter were mobilized by large storm events early in the rainy season, while storms of similar magnitude transported little of this material during the mid- and late rainy season. Particulate organic carbon (POC) (<2mm) was low in comparison with DOC at baseflow (0.3 mg/L POC vs. 2 mg/L DOC). Stormflow POC was significantly higher than stormflow DOC (18 mg/L vs. 10 mg/L). DOC concentrations were similar for stormflow discharges that were five and ten times baseflow, while a doubling of stormflow discharge more than doubled POC concentrations for most of the watersheds studied.

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