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Stormflow influence on nutrient dynamics in micro-catchments under contrasting land use in the Cerrado and Amazon Biomes, Brazil

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The Amazon and Cerrado biomes in Brazil have been under intense land-use change during the past few decades. The conversion of native vegetation to pastures and croplands has caused impacts on hydrological processes in these biomes, resulting in increased streamflow and nutrient fluxes. Our aim was to compare the nutrient dynamics during stormflow events in two pairs of adjacent micro-catchments with similar physical characteristics under contrasting land use, i.e. native vegetation (rainforest or cerrado) and pasture. One pair of catchments was located in the Amazon and the other in the Cerrado, both on the Amazon Agricultural Frontier in the Brazilian states of Mato Grosso and Pará. We collected hydrological and hydrochemical data on 50 stormflow events on a sub-hourly resolution during the wet seasons of 2013 and 2014. We compared the dynamics of total inorganic carbon (TIC), total organic carbon (TOC), dissolved organic carbon (DOC), nitrate (NO_3), calcium (Ca), potassium (K), and magnesium (Mg) in different hydrograph parts, i.e. rising limb, peak and recession limb, between the catchments within the same biome. For the Cerrado biome, our findings show that the nutrient concentrations in the stormflows were higher in the pasture catchment than in the cerrado catchment. In the Amazon biome, we found an inverse relationship with higher concentrations in the forest catchment than in the pasture catchment, except for TIC and K. Most nutrients in the cerrado catchment had the highest concentrations in the rising limb. Mg, however, reached highest concentrations during peak discharge, and lowest in the recession limb. In the adjacent pasture catchment, in contrast, the highest nutrient concentrations were observed during the peak discharge (TIC, TOC, Ca) or the recession limb (DOC, NO_3, K, Mg) with lowest in the rising limb, except for NO_3, which showed the lowest concentrations during peak discharge. In the Amazon forest catchment, the peak discharge showed the highest nutrient concentrations, while concentrations in the recession limb were higher than in the rising limb. We also found that in this catchment K concentrations were lower in the recession limb than in the rising limb. In the Amazonian pasture catchment, the peak discharge showed the greatest concentrations for TIC, TOC, and Ca, and the rising limb the lowest. DOC and NO_3 concentrations in this catchment were the highest in the rising and were lowest in peak discharge, while K increased over time. Based on that, we conclude that stormflow is an important driver of nutrients fluxes due to land-use change on the Amazon Agricultural Frontier, with significant increases and distinguished dynamics during the storm events, and higher nutrient concentrations in the catchments with pastures than in the ones with native vegetation, especially for TIC and K.