Hydrological N export from tropical forests in the Congo Basin

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Abstract

Nitrogen (N) budgets in tropical African forests show higher N inputs than outputs, however forests paradoxically appear to tightly cycle soil N. We try to compare the magnitude and seasonality of aquatic N export from three different forest types in the Congo Basin and to assess dominating N export on a catchment scale. Our preliminary results from a lowland headwater stream show a high loss of PON during storm events. The loss of N as particulate organic N (PON) to streams has been shown to constrain ecosystem level N budgets in other tropical forest systems.

Keywords: particulate N, tropical forest, Congo Basin

1. Background

Tropical forests play an important role in the global carbon cycle and represent a significant CO_2 sink. Maintaining this function requires a large and sutained availability of nitrogen (N). As a result, understanding N cycling is crucial for the assessment of future productivity of tropical forest ecosystems (Cleveland et al., 2013). PON export is potentially an important loss in tropical landscapes (Taylor et al., 2015), however, the lack of studies targeting PON losses, and overal N species composition in catchment-scale export across forest types, is a large knowledge gap.

2. Objective

The objective of this study is to quantify aquatic N losses from the three major forest types in the Congo Basin. Given that it results from erosion and generally represents the largest pool of aquatic N, PON will be the main focus of this study. Specifically, we aim to assess whether erosion driven losses of PON can close ecosystem level N budgets.

3. Methods

Headwater streams draining three different forest types in the Congo Basin (lowland tropical forest, montane tropical forest and a tropical moist decidious forest) have been monitored using a concrete flume and pressure transducer to measure disscharge and turbidity sensors. Bi-weekly grab sampling allows to determine dissolved and particulate N and P losses. To determine nutrient losses during storm events, autosamplers have been installed. Samples are beeing

analysed for PON, DON and DIN and the ^{15}N isotopic composition.

4. Preliminary Results

We intend to present at the conference a comparison of particulate and dissolved N export from different forest types in the Congo Basin. Preliminary data from three months of turbidity and total suspended solids (TSS) measurements in a lowland tropical forest site show a TSS export of 5.06 t TSS km^{-2} yr^{-1}. The corresponding PON export of around 0.25 kg N km^{-2} yr^{-1} is quite small compared to DON export of 6.2 kg N ha^{-1} yr^{-1} reported by Bauters et al. (2019) from the same site. During a storm event TSS increases with increasing discharge and shows clockwise hysteresis (Fig. 1). Over 66% of the sediment export of 3 months occurred during four storm events (19h in total).
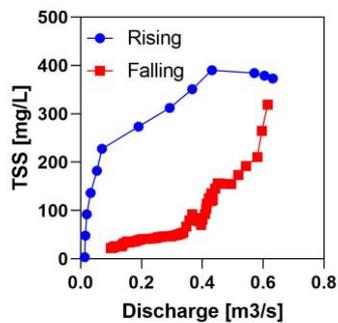

Fig. 1: TSS-discharge relationship during a storm event in a lowland tropical forest in the Congo Basin.

Acknowledgements

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