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Dynamics in rainfall and throughfall nutrient fluxes in a palm-rich open tropical rainforest (Rondônia, Brazil)

S. Germer (1), J. Chaves (2), A. Krusche (3), H. Elsenbeer (1)

(1) Institute of Geoecology, University of Potsdam, Germany, (2) The Ecosystems Center, Marine Biological Laboratory, Woods Hole, MA, USA, (3) CENA, University of São Paulo, Piracicaba, S.P., Brazil (sgermer@uni-potsdam.de / Phone: +49-331-9772640)

As rain passes through the canopy it can either become enriched or depleted in a particular solute. The flux of nutrients in throughfall is usually studied on a weekly or monthly basis, less frequently on an event basis. Useful insights into temporal patterns can be gained from the analysis of throughfall chemistry at event, or even at within-event basis. Our study investigated nutrient fluxes in rainfall and throughfall in a palm-rich open tropical rainforest in southwestern Amazon with mean annual precipitation of 2300 mm and a marked dry period. Covering the rainy season of 2004/2005 and the transition from dry to rainy season we sampled 42 and 35 rainfall events on event and on within-event basis, respectively. Net throughfall fluxes were positive for K^+, Na^+, Mg^{2+}, Cl^-, NO_3^-, SO_4^{2-}, DOC and DIC and were negative for part of the events for H^+, Ca^{2+}, NH_4^+, and NO_2^-. Elevated solute fluxes during the transition from dry to the rainy season were associated with 1) intense burning activities of primary forest and pasture, 2) high nutrient availability due to litter decomposition and 3) high input fluxes from rainfall. The proportional relevance of these processes differs among solutes. The within-event sampling revealed that dry deposition if present is washed off the canopy during the first few mm of precipitation of each event. After that "early flushing", throughfall is characterized by relative constant fluxes for some solutes, which we attribute to leaching processes within the canopy. Our findings suggest that solute fluxes in throughfall have a pronounced seasonal pattern, while at the within-event scale fluxes are highest at the beginning of rainfall events. The implications of these findings deserve consideration when trying to understand how elements and nutrients flow through tropical forest ecosystems and are either retained or delivered to streams via various hydrological flowpaths.