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Geochemical assessment of atmospheric deposits to the Amazon Rainforest using a Passive Sampling Sigma-2 method

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The Amazon rainforest is a huge natural ecosystem hosting roughly half of the world's species and plays an important role in global tropospheric chemistry. The intensity and complexity of biosphere-geosphere interactions and the rapid trace element cycling in the soils make the region vulnerable to external disturbances that may result in dramatic changes in global biodiversity and the climate. While it is well established that the supply of trace elements via atmospheric deposition (including micronutrients such as Zn, Fe, and Cu and toxic elements such as Pb, As, Cd) are controlling the continued growth and replenishment of remote and vulnerable ecosystems like the Amazon Rainforest, we know very little about what processes control atmospheric trace element deposition, i.e. what the sources are and how their contributions vary spatially and temporally over the basin. The latter is of particular challenge to survey given the vastness and remoteness of the area. The supply of Saharan dust during the winter as well as the increasing extent of anthropogenic emissions around the major human centres such as Manaus, Belem and Fortaleza have been suggested as major sources, but the lack of long term monitoring data has hampered the advance in our understanding.

The aims of this study were to develop a low cost and low maintenance monitoring system that enables the qualitative study of atmospheric trace element deposition on large spatial and temporal scales. To this end, we decided to combine passive sampler collecting with the analysis of inorganic and isotope geochemistry. We placed passive samplers using the Sigma-2 collector at field stations in Macapá and Santarèm and determined for the first time the isotopic and trace element composition. Aerosols were collected every one to two months at ~15m height between July 2013 to July 2015. We were successful to collect sufficient material although very low (~0.001g per sample) for the analysis of elemental and isotopic (Pb) data within the one and two month samples. The sampler was easy to install at various locations.

This presentation will discuss some of the seasonal patterns and compositions in multi-element data (elemental concentrations and element ratios) and Pb isotopic data of aerosols that arrive at Macapá and Santarèm.

We endeavor that the results from this study can be useful for multi-disciplinary studies in particular those addressing provenance tracing of atmospheric particulates to the Amazon Rainforest, atmospheric modeling, and the effects of aerosols on fauna, flora and human health in the Amazon. An improved qualitative and quantitative understanding of the changes in source contributions to atmospheric particulates reaching in the Amazon Rainforest through a low cost and low maintenance monitoring system combining passive samplers and inorganic geochemistry will provide a valuable basis with a view to set up useful environmental and social policies that would help to mitigate negative changes.