Geophysical Research Abstracts
Vol. 16, EGU2014-14070-1, 2014
EGU General Assembly 2014

Airborne Particulate Transport into the Amazon Basin - The Effect of Atmospheric Processing on Trace Metal Solubility

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Dissolution of airborne particulate matter during atmospheric transport is an important process mobilizing nutrient trace metals from the solid phase and making nutrients readily available to remote marine and terrestrial ecosystems after atmospheric deposition. Recent work suggests that this process is accelerated through the effect of air pollution and the acidification of cloud droplets. Large urban areas surrounding the Amazon Basin have introduced vast amounts of anthropogenic air pollutants from industrial emissions and biomass burning, hence this mechanism is potentially important for the nutrient cycling in this area, affecting climate and environmental health alike.

To this end in the context of the CLIM AMAZON project, we conducted studies to test the dissolution of mineral and road dust under atmospheric pollution conditions relevant to the region and we set up passive samplers to test particle matter reaching the Amazon Basin for evidence of atmospheric processing. Different mineral acids and deionized water at different pH were used. Batch leaching experiments with dust sourced from the Sahara/Sahel region were setup for 144 hours to simulate the transport time of particulate matter in the atmosphere. Trace metal solubility in mineral acids at low pH was up to five times higher than in deionized water, and approximately twice as high in hydrochloric acid compared to nitric acid. A kinetic model for the solubility in the leaching solutions was developed and it was in good agreement with the experimental data.

Further work will test the effect of variable cloud compositions, determine key kinetic and thermodynamic parameters to improve atmospheric reaction models, and characterize the particulate matter collected with the passive samplers.