Geophysical Research Abstracts
Vol. 20, EGU2018-8847-1, 2018
EGU General Assembly 2018


# Biosphere / atmosphere exchange of trace gases and water-soluble aerosol chemical compounds above tropical rainforest

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The interaction between biosphere and atmosphere in the cycling of gas and aerosol species is of key importance in considering overall emission and deposition rates of nutrients and pollutants. Understanding of the biosphere-atmosphere processes that govern these cycles is critical to modelling global concentrations of atmospheric aerosols and trace gases, which in turn is vital to developing predictions for future climate, air quality and trans-boundary air pollution. However, to understand these processes, more measurements over a variety of different ecosystems are required, preferably measurements which are taken in real time, which are of high temporal resolution and which record a variety of species simultaneously and at potentially low background concentrations. In particular, very little is known about the role of biosphere-atmosphere exchange in the nutrient cycling in and above tropical rain forests.

In this project the Gradient of Aerosols and Gases Online Registrator (GRAEGOR) (Thomas et al., 2009), was used to determine concentrations and fluxes of the trace gases NH3, HCl, $HNO_2$, $HNO_3$ and $SO_2$ and the water-soluble aerosol species $NH_4^+$, $Cl^-$, $NO_2^-$, $NO_3^-$ and $SO_4^{2-}$ at two heights above a tropical rainforest site located at the Amazon Tall Tower Observatory (ATTO) in Amazonia, Brazil. Hourly measurements were taken from the 4th October to the 10th November 2017. From the measured concentration-gradients and ancillary meteorological measurements, fluxes for each species were developed using the hybrid Aerodynamic Gradient Method (Nemitz and Sutton, 2004) and the Modified Bowen Ratio Method (Meyers et al., 1996). Deposition velocities for each species were calculated and compared to theoretical deposition velocities, and interpreted in relation to measurements of leaf wetness at the canopy level.

The average mean concentration for each of trace gases measured throughout the campaign at each of the measurement heights (42 m/60 m) was 0.26/0.23 $\mu$g $m^{-3}$ for $NH_3$, 0.10/0.11 $\mu$g $m^{-3}$ for HCl, 0.06/0.06 $\mu$g $m^{-3}$ for $HNO_2$, 0.24/0.26 $\mu$g $m^{-3}$ for $HNO_3$ and 0.20/0.23 $\mu$g $m^{-3} for SO_2$. For the water- soluble aerosol species measured, the mean concentration values were 0.26/0.26 $\mu$g $m^{-3}$ for $NH_4^+$, 0.11/0.12 $\mu$g $m^{-3}$ for $Cl^-$, 0.01/0.01 $\mu$g $m^{-3}$ for $NO_2^-$, 0.39/0.48 $\mu$g $m^{-3}$ for $NO_3^-$ and 0.48/0.49 $\mu$g $m^{-3}$ for $SO_4^{2-}$.

Thomas, R.M., Trebs, I., Otjes, R., Jongejan, P.A.C., Brink, H.T., Phillips, G., Kortner, M., Meixner, F.X. and Nemitz, E. (2009) An Automated Analyzer to Measure Surface -Atmosphere Exchange Fluxes of Water Soluble Inorganic Aerosol Compounds and Reactive Gases, Environmental Science and Technology 43, 1412 - 1418.

Nemitz, E. and Sutton, M. (2004) Gas-particle interactions above a Dutch heathland: III. Modelling the influence of the $NH_3$-$HNO_3$-$NH_4NO_3$ equilibrium on size-segregated particle fluxes, Atmospheric Chemistry and Physics 4, 1025 - 1045.

Meyers, T.P., Hall, M.E., Lindberg, S.E. and Kim, K. (1996) Use of the Modified Bowen-Ratio Technique to Measure Fluxes of Trace Gases, Atmospheric Environment 30, 3321 - 3329.