High Fire-derived Nitrogen Deposition on Central African Forests

Bauters, M. (Ghent U., Applied Analytical and Physical Chemistry); Drake, T.W. (Florida State U., Earth, Ocean and Atmospheric Science); Verbeeck, H. (Ghent U., Computational and Applied Vegetation Ecology); Bodé, S. (Ghent U.); Hervé-Fernández, P. (Ghent U.); Zito, P., Podgorski, D.C. (U. of New Orleans, Chemistry); Boyemba, F., Makelele, I. (Université de Kisangani); Ntaboba, L.C. (Université Catholique de Bukavu); Spencer, R.G.M. (Florida State U., Earth, Ocean and Atmospheric Science) and Boeckx, P. (Ghent U., Applied Analytical and Physical Chemistry)

Introduction

Atmospheric nitrogen (N) deposition is an important determinant of N availability for natural ecosystems worldwide. Increased anthropogenic N deposition shifts the stoichiometric equilibrium of ecosystems, with direct and indirect impacts on ecosystem functioning and biogeochemical cycles. Current simulation data suggest that remote tropical forests still receive low atmospheric N deposition due to a lack of proximate industry, low rates of fossil fuel combustion, and absence of intensive agriculture.

Results and Discussion

We present field-based N deposition data for forests of the central Congo Basin, and use ultrahigh-resolution mass spectrometry (21-Tesla FT-ICR MS) to characterize the organic N fraction (Fig. 1). Additionally, we use satellite data and modeling for atmospheric N source apportionment. Our results indicate that these forests receive 18.2 kg N ha^{-1} yr^{-1} as wet deposition with dry deposition via canopy interception adding considerably to this flux. We also show that roughly half of the N deposition is organic, which is often ignored in N deposition measurements and simulations. The source of atmospheric N is predominantly derived from intensive seasonal burning of biomass on the continent. This high N deposition has important implications for the ecology of the Congo Basin and for global biogeochemical cycles more broadly.

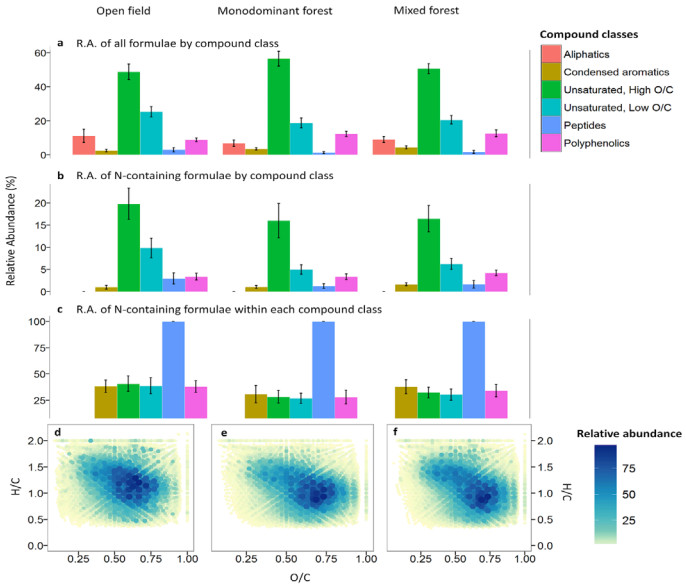

Fig.1 Molecular characterization of rainfall and throughfall samples. Relative abundance of different compound classes **(a)** of dissolved organic molecular formulae in the open field rainfall and throughfall of monodominant and mixed lowland tropical forest samples, with (**b**) the relative abundance of nitrogen containing compounds in the samples, and (**c**) the relative abundance of nitrogen containing compounds within each separate compound class; molecular formulae **(e-f)** of the open rainfall, monodominant forest and the mixed forest, respectively, plotted in the van Krevelen space. Relative abundance is the mean intensity of the plotted formula.

Acknowledgements

The National High Magnetic Field Laboratory is supported by the National Science Foundation through NSF/DMR-1157490/1644779 and the State of Florida. This research has been supported by the Belgian Development Cooperation through VLIR-UOS. T.W.D., D.C.P and R.G.M.S. were supported by the Winchester Foundation and partially by NSF OCE-1464396. P.H.-F. is funded by Programa de Formación de Personal Avanzado CONICYT, BECAS Chile.

References

Bauters, M., *et al.*, Proceedings of the National Academy of Sciences, **115**(3), 549-554 (2018)