Controls on African Dust Deposition across the Luquillo Mountains, Puerto Rico

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Dust has the potential to be a key source of rock derived nutrients in highly weathered terrestrial ecosystems [1]. Dust fluxes are most commonly estimated using point measurements, which are then extrapolated across the ecosystems. Our study in the Luquillo Critical Zone Observatory (LCZO) shows that both wet and dry deposition are spatially and temporally variable on the landscape scale. LCZO is an especially interesting place to study dust deposition because it receives large inputs of P-rich African dust which is isotopically distinct from the underlying bedrock, and it has been suggested to be a P-limited ecosystem [2].

Analyzing data from two weekly rain chemistry records dating back to 1988 for dissolved SiO_2 ($dSiO_2$), non-seasalt Ca^{2+}, and total suspended solids (TSS) (n>1000), in conjunction with backward airmass trajectories calculated using HYSPLIT, we find that dust deposition is not spatially or temporally homogenous. Openfall fluxes of $dSiO_2$ are stongly correlated with with TSS. The flux of $dSiO_2$ at one station is better correlated with Sahara-Sahel airmass trajectories and is double that of another station that is 10km away, despite having similar elevation and forest type. In addition to spatial variability, we also found seasonal and yearly variations in how well openfall $dSiO_2$ correlated with airmass trajectories originating in the Sahara-Sahel region. Counterintuitively, the generally strong correlation between openfall $dSiO_2$ and Sahara-Sahel airmass trajectories becomes much weaker during the latter half of the year, which is the dominant African dust transport season to the Caribbean. Comparison of throughfall and openfall records suggests that the ratio of dry to wet deposition varies seasonally.

Our study highlights the need to characterize variability when quantifying dust fluxes. Understanding the erratic nature of dust deposition is one of the first steps to fully quantifying nutrient fluxes from atmospheric deposition, and assesing whether land-use changes on one continent can affect ecosystems across an ocean.

[1] Pett-Ridge, J. C. (2009) *Biogeochemistry,* **94** 63-80 [2] Silver WL (1994) *Oecologia* **98** (3–4):336–343