Chemical weathering of ultramafic rocks at the Rio Cupeyes NEON site in southwestern Puerto Rico

Amanda Albright Olsen[1]
William H. McDowell[2]
Thomas Korstanje[3]

[1]School of Earth and Climate Sciences, University of Maine, Orono, ME 04469 (amanda.a.olsen@maine.edu)
[2]Department of Natural Resources and the Environment, University of New Hampshire, Durham, NH 03824 (Bill.McDowell@unh.edu)
[3]School of Earth and Climate Sciences, University of Maine, Orono, ME 04469 (thomas.korstanje@maine.edu)

The weathering of mafic and ultramafic rocks in tropical environments has been demonstrated to be a major consumer of atmospheric CO_2 (Dessert et al. 2003); however, determining weathering fluxes is complicated due to the time and expense of extensive sampling programs. For this reason, few studies of mafic rocks include calculated weathering fluxes over a range of yearly weather conditions. The Rio Cupeyes Core Aquatic NEON site is a 4.26 km^2 watershed in western Puerto Rico that has been continuously monitored since 2018. The entire Rio Cupeyes watershed is located on serpentinite bedrock, which is depleted in essential plant nutrients including K and P, has a low Ca to Mg ratio, and contains high concentrations of heavy metals. The watershed experiences wet and dry seasons as well as hurricanes leading to extreme high flow events; landslide activity is also common.

Watershed-integrated chemical weathering fluxes for the Rio Cupeyes watershed were calculated using discharge data from **continuous sensors** and stream and precipitation chemistry collected approximately twice monthly from 2018 to 2022, yielding nearly 100 distinct chemical weathering flux measurements. The average Ca to Mg ratio for stream samples is 0.1; average Mg concentrations are 1340 μmol/L and vary little with season or discharge. Average Ca concentrations are 130 μmol/L, and average K concentrations are 6 μmol/L. Because Mg is the dominant weathering-derived cation, seasonal changes in weathering fluxes are controlled by variations in discharge, which span three orders of magnitude. For the Rio Cupeyes watershed, this means that measuring chemical weathering yields infrequently and extrapolating those data over the calendar year could dramatically over- or underestimate weathering yields depending on sampling date.