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The chemical composition and weathering fluxes of rivers draining volcanoes in the Southern Andes

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Volcanic provinces contribute to chemical weathering fluxes disproportionally given the reactive nature of volcanic glass, presence of acid gases, and constant re-surfacing from volcanic eruptions providing fresh rocks. Volcanic islands and large igneous provinces are hotspots for chemical weathering and play a primary role in the global carbon cycle by offsetting atmospheric CO_2 at geological timescales[1]. These regions are an essential source of rock-derived nutrients delivered from streams to oceans. However, few studies have reported chemical weathering fluxes from river solutes draining continental arc regions: Kamchatka[2], Central America[3,4], Cascades[5]. The Andes is one of the longest (>5000 km) and largest continental active volcanic provinces on Earth. The Southern Volcanic Zone of the Andes is potentially a substantial contributor to global chemical weathering fluxes: high precipitation rates >2 m/yr, numerous catchments feeding larger rivers draining toward the Pacific Ocean, active hydrothermal systems, frequent eruptions, and preferentially mafic volcanic rocks.

We present new geochemical data on the dissolved load of 22 catchments draining the most active volcanoes in the Southern Andes. We collected water samples during the low and high discharge seasons and analyzed them for major ions and trace elements. The dominant anion in most rivers is HCO_3^-. The Ca+Mg flux is equivalent to the Na cationic flux in most basins. Silica concentrations range between 250–950 µM. Previous studies have acknowledged the effects of silicate weathering in nutrient fluxes in the Southern Andes, but they remain unestimated. We combine the river solute concentrations and annual discharge to calculate the first assessment of chemical weathering fluxes in the Southern Andes. Si export fluxes ranges 0.01–1.3 x 10^9 mol/yr. Although we still have to account for the impact of hydrothermalism and volcanic degassing on these fluxes, the preliminary results underscore the importance of continental volcanic arcs on the Earth's chemical weathering engine.

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