Small catchments sustain silicon signatures following storms

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Small catchment areas, like Northern California's Eel River watershed, demonstrate site-specific silicon export signatures. Credit: Lobsang Wangdu, UCNRS

The outer skin of our planet—the critical zone—stretches from treetops to the lower limits of groundwater. In this layer, interactions between rock, soil, water, air, and living organisms shape Earth's surface and sustain life. Silicate weathering, for example, influences global climate

by removing carbon dioxide from the atmosphere and contributes nutrients to diverse ecosystems.

However, scientists have largely overlooked the contributions of storms to silicate weathering. Rainfall and snowmelt can send huge amounts of fluid through watersheds, which clears out molecules produced by weathering reactions. Ignoring these effects could provide misleading conclusions about silicate weathering in drainage networks.

In a new study published in the *Journal of Geophysical Research: Biogeosciences*, Fernandez et al analyzed stream water samples from six small catchments in French, Canadian, and U.S. critical zone networks and discovered they had unique patterns of silicon chemical and isotopic export. The researchers developed a combined model that identified two factors behind these differences. One driver was site-specific differences in hydrological routing. The second was the unique combination of biogeochemical reactions in each catchment.

The team found that these unique silicon signatures were preserved following storm events and the patterns after storms were consistent with longer-term data sets, suggesting that data from storm events could serve as proxies of long-term silica weathering dynamics. According to the authors, an area of future study could be whether watershed silicon signatures continue to remain resilient in the face of more frequent severe storms due to global warming.

More information: N. M. Fernandez et al, Resiliency of Silica Export Signatures When Low Order Streams Are Subject to Storm Events, *Journal of Geophysical Research: Biogeosciences* (2022). DOI: 10.1029/2021JG006660

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