Geophysical Research Abstracts
Vol. 20, EGU2018-13693, 2018
EGU General Assembly 2018

Impact of soil and landslide erosion processes on chemical weathering

Aaron Bufe (1), Robert Emberson (2), Niels Hovius (1), Jeremy K. Caves Rugenstein (3), and Hima Hassenruck-Gudipati (4)

(1) GFZ German Research Center for Geosciences, Section 5.1 Geomorphology, Department of Earth Science, Santa Barbara, Germany (aaronbufe@gmail.com), (2) Surrey, BC, Canada, (3) Department of Earth Sciences, ETH Zürich, 8092, Zurich, Switzerland, (4) Jackson School of Geosciences, University of Texas at Austin, Austin, Texas, 78712, USA

Chemical weathering of silicate rocks strongly modulates Earth's carbon cycle by removing atmospheric CO_2 via reaction with carbonic acid. Recent work has suggested that coupled sulfide oxidation and carbonate weathering, which releases CO_2, may be a sufficiently important process to also modulate the long-term carbon cycle. Landslide erosion in active mountain ranges may be critical to this process by not only increasing weathering rates but, importantly, also increasing the relative contribution of minor, highly soluble (labile) carbonate and sulfide phases to the total weathering flux. However, it remains unclear to what extent high concentrations of labile phases in weathering products from landslide-prone catchments compared soil-erosion-dominated areas reflect differences in the processes of landslide and soil erosion. The apparent difference could also be due to generally higher erosion rates in landslide-prone regions, or measurements of short-lived transients after major landslide events.

In order to investigate how weathering varies in catchments dominated respectively by soil erosion and landslide erosion, here, we take advantage of a transition from low relief, soil covered hillslopes to high relief landslide-prone hillslopes across the southern tip of Taiwan. A combination of water chemistry, landslide volumes, topographic data, and erosion rates in catchments across this transition allows us to isolate the effect of soil erosion versus landslide erosion. Our preliminary data suggest that the effect of landslides is to significantly increase coupled carbonate and sulfide weathering and reduce silicate weathering. The reduction of silicate weathering is hypothesized to occur because acidity is consumed in weathering readily available and rapidly dissolving carbonate phases at the expense of slower silicate weathering reactions. We postulate that, in mountain ranges in which physical erosion occurs predominantly via landsliding, the effect of CO_2 removal via silicate weathering is dampened and potentially reversed, due to both, enhanced sulfide-carbonate weathering and reduced silicate weathering.