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Amanda Donaldson
1156 High Street
Earth and Planetary Sciences
Santa Cruz, CA 95064
amdonald@ucsc.edu

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Journal of Geophysical Research: Earth Surface
RE: Submission of research article

Dear Dr. Amy East,

We are electronically submitting a research article, "Expect the unexpected: Four hypotheses to explain unexpected critical zone symmetry in hillslopes with opposing aspects" for consideration of publication in *Journal of Geophysical Research: Earth Surface*. In this article, we test the commonly accepted conceptual model that north-facing slopes are steeper, have higher subsurface water content, and thicker saprolite compared to south-facing slopes. Within a rain-dominated catchment underlain by sedimentary rocks in Central Coast California, we combine terrain analysis, soil pit characterizations, soil and groundwater measurements with seismic refraction surveys to demonstrate that this expectation is not always true. Specifically, we observed similar hillslope steepness and similar saprolite thickness. In addition, we found that deep soil moisture was similar between slope aspects and the south-facing slope had a higher groundwater response compared to the north-facing slope.

We propose four testable hypotheses that may explain the symmetry in critical zone physical structure between slope aspects. Specifically, symmetry in hillslope steepness could be driven by 1) similar sediment transport between slope-aspects or 2) more geologic time is required to produce the expected slope-aspect asymmetries. In addition, symmetry in saprolite thickness could be driven by 1) more geologic time required to produce the expected saprolite thickness asymmetries, 2) similar vertical recharge extent between hillslopes with opposing aspects despite aspect-dependent flowpaths, 3) similar total bio-chemical weathering between hillslopes with opposing aspects. These proposed hypotheses serve as exciting research frontiers across scientific communities including critical zone development, hydrology and ecohydrology.

Within the article, we cite the article " Mapping variations in bedrock weathering with slope aspect under a sedimentary ridge-valley system using near-surface geophysics and drilling" by Hudson-Rasmussen et al. which was recently accepted with major revision in the *Journal of Geophysical Research: Earth Surface*. We have provided a copy of the pre-print within this email. We declare that there are no conflicts of interest and that this article contains original work that is not currently under revision elsewhere. All data used in the publication are cited in the references and hosted on the Consortium of Universities for the Advancement of Hydrologic Science, Inc. web based hydrologic information system, HydroShare (http://www.hydroshare.org/resource/9a9897aa0bb14d20ab4189b98a8439f6). We will upload and publish finalized scripts and figures once the article is accepted for publication.

Thank you for your consideration,

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