

Interactive comment on “Topographic roughness as a signature of the emergence of bedrock in eroding landscapes” by D. T. Milodowski et al.

Anonymous Referee #2

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In this paper, Milodowski et al. propose a new metric of hillslope bedrock exposure based on topographic roughness. They calibrate their metric using orthophotos of two granitic landscapes characterized by moderate relief and sparse vegetation cover, and then analyze the hillslope response to transient baselevel fall along the Feather River, CA and the Salmon River, ID.

In short, I think the first half of the paper is generally well-written, and presents a useful new technique (supported by code made publically available) that overcomes some key limitations of prior approaches (i.e., characterizing bedrock exposure in low-sloping landscapes). The second half of the paper feels disjointed from the first half and needs to be – at the least – significantly tightened to better serve as an example of the utility of the new roughness-based metric.

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This will make a nice contribution once a few key issues have been addressed:

1) In the introduction (Page 374-375), much of the argument for developing a new metric of bedrock exposure is centered on the challenges and limitations of the current approaches dealing with a threshold slope cutoff. While the new method clearly does a better job than slope-based metrics in capturing exposed rock in low-sloping landscapes, the accuracy is still dependent on choice of measurement scale, cutoff values for roughness, and the ability to easily calibrate against veg-free orthophotos from a similar landscape. I would tighten the introduction to clarify the general challenges to objectively mapping bedrock exposure, and highlight how different metrics/approaches overcome these challenges, rather than pitching it as a solution to the above challenges.

2) Following on the first point, I think the discussion could expand on the path forward for other landscapes beyond just low-moderate relief, granitic top-dominated hillslopes. Will this roughness metric work in steep landscapes? What about layered rocks? Perhaps it is even worth another figure to show how this tool handles a different type of landscape?

3) The most glaring issue with the manuscript for me is section 4 – the application to Bald Rock Basin and Harrington Creek. The application of the new roughness based metric takes a backseat to a discussion that feels either repetitive from other work in the Feather (e.g., Hurst et al. 2012/2013) or speculative and unsupported by analysis in the current paper. I would focus on choosing a solid example of where the roughness metric gives new insight to a geomorphic problem beyond that possible from just looking at slope. Or, perhaps a comparison of the different bedrock exposure metrics to highlight any potential pitfalls. The Feather river example might still work well for this with the discussion of “Big Bald Rock Dome” for example.

Line comments:

P374 Line 23-24: “typically obtained” – perhaps better to say “for example”. Also, isn’t

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the new method subject to the same challenges and limitations w.r.t. calibration and vegetation cover?

P384 Line 9-11: I would be cautious here. Both validation landscapes are actually quite similar (low/moderate relief with granitic bedrock outcropping as sparse tors). The nature of bedrock exposure morphology is quite diverse, and so it is unlikely single metric will capture the full spectrum of behavior (i.e., granite tors, dip/anti-dip slopes in layered rock, glacially sculpted landscapes, desert landscapes e.g., Navajo Sandstone in Utah). This point touched on briefly by the authors, but perhaps deserves more explicit discussion, given the emphasis on the broad application of this metric/approach.

P388 Line 14: Detrital silts? The Ferrier 2012 paper focused on point measurements of ^{10}Be concentrations in soils.

P391 Line 13: Again, silts? Check this to be sure, but I suspect it is sand or coarser.

P393 Line 22-25: "Booth et al. (2009) exploited. . ." This should be introduced earlier in the paper.

P394 Line 14-17: This can be expanded - compare slope vs roughness metrics?

P395 Line 12-15: What are the implications of this?

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