

Interactive comment on “How does grid-resolution modulate the topographic expression of geomorphic processes?” by Stuart W. D. Grieve et al.

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General comments This paper seeks to determine whether low-resolution (i.e., > 10 m grid cells) can be used to quantify topography relevant to geomorphic processes (channelization, hillslope diffusion, etc.). The authors document the grid-resolution dependence on the median values of curvature, slope, and relief, and on the fidelity of channel head identification algorithms. Their data demonstrates how decreasing grid resolution cuts off extreme values of topographic metrics, a finding well-represented in the literature but never so comprehensively. To explain this effect, they use spectral analysis to show why this effect occurs, and on the basis of this finding, argue that the utility of low-resolution data is highly dependent on the morphology of the study

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landscape. This argument provides a promising way forward and gives hope for studies based on low-resolution data in landscapes with relatively long hillslopes (landscapes that support much of the human population). The paper is exceptionally well-written and organized; I have a few ideas I would like the authors to consider and a smattering of technical notes that will hopefully improve the clarity of the paper even further.

Specific comments

1. In section 2.1, I would like to see more discussion/acknowledgment of or grappling with the issue of gridding point cloud data and potential over-interpolation of Lidar. For example, in the Oregon Coast Range, forests are generally logging company plantings and have exceptionally high canopy density, occasionally limiting bare earth data to a point or two per hillslope, especially on steeper slopes.
2. The spectral analysis discussion (section 5.1) comes out of nowhere in the context of the paper's organization – it's not mentioned at all in the introduction, abstract or methods. Explaining the origin of the grid resolution effect is one of the great strengths of the paper; hence, I would advise more emphasis on these ideas – perhaps a section in the methods or theoretical underpinnings?
3. As noted, I like that the authors provide guidance for a way forward, but I take issue with their concluding assertion on lines 815 – 817. As presented in the paper, constraining the accuracy of coarse resolution results requires having high-resolution data to compare it to, or at the very least, the ability to measure hillslope length (which requires a lot of fieldwork, or high-resolution topography).

Technical notes - I'm interested to see what a log-scale on Figure 9 would look like. It seems like all the distributions are skewed and with a log scale we could maybe see more structure around the median value. - The points in Figure 5 are hard to see. - Section 1.1 labeling is superfluous as there is no section 1.2

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