Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2016-28-AC4, 2016

Earth Surface Dynamics Discussions
Open Access
EGU

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

Stuart W. D. Grieve et al.

s.grieve@ed.ac.uk

Received and published: 15 June 2016

Throughout this document the reviewer's comments are in **bold type** and our responses are in standard type.

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

Printer-friendly version

Discussion paper

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 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.

We thank the reviewer for their thorough and positive appraisal of our work. We appreciate the constructive comments and have addressed them fully below. As a consequence of these comments we have expanded sections of the introduction, discussion and conclusion in addition to improving the clarity of one of the figures. We believe that as a result of these suggestions the manuscript is considerably stronger and will reach a wider audience.

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.

We have expanded the discussion in Section 2.1 around the gridding of LiDAR data to reflect this challenge, highlighting the difficulty of generating a high density of ground returns in heavily vegetated areas such as the Oregon Coast Range and justifying our

gridding of each dataset to 1 meter resolution with reference to previous studies.

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?

We have addressed this issue in response to reviewers 1 and 3 and will expand this section to provide more clarity to readers who are less familiar with these techniques, in addition to better relating the material in Section 5.1 to the rest of the manuscript's results. As recommended we will also add a more explicit statement of the spectral analysis within the abstract and introduction.

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).

In responding to reviewer 1, we have provided more nuance to this idea within the discussion (Section 5.1.2), highlighting that some ancillary data or field exploration will be required in order to evaluate results derived from low resolution data. We have also revised lines 815-817 to reflect this more nuanced conclusion.

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.

Included in this response is the data in Figure 9 re-plotted using a log scale on the y-axis. It shows little change in the overall patterns with no structure around the median value becoming apparent in any of the 3 hillslope length and relief figures.

The points in Figure 5 are hard to see.

We have replotted this data using increased marker sizes, and have used differing marker shapes in addition to colors to better differentiate between the two datasets.

Section 1.1 labeling is superfluous as there is no section 1.2

This section labeling is a function of the Esurf latex template and should be resolved in the final form of the manuscript.

Interactive comment on Earth Surf. Dynam. Discuss., doi:10.5194/esurf-2016-28, 2016.

Printer-friendly version

Discussion paper

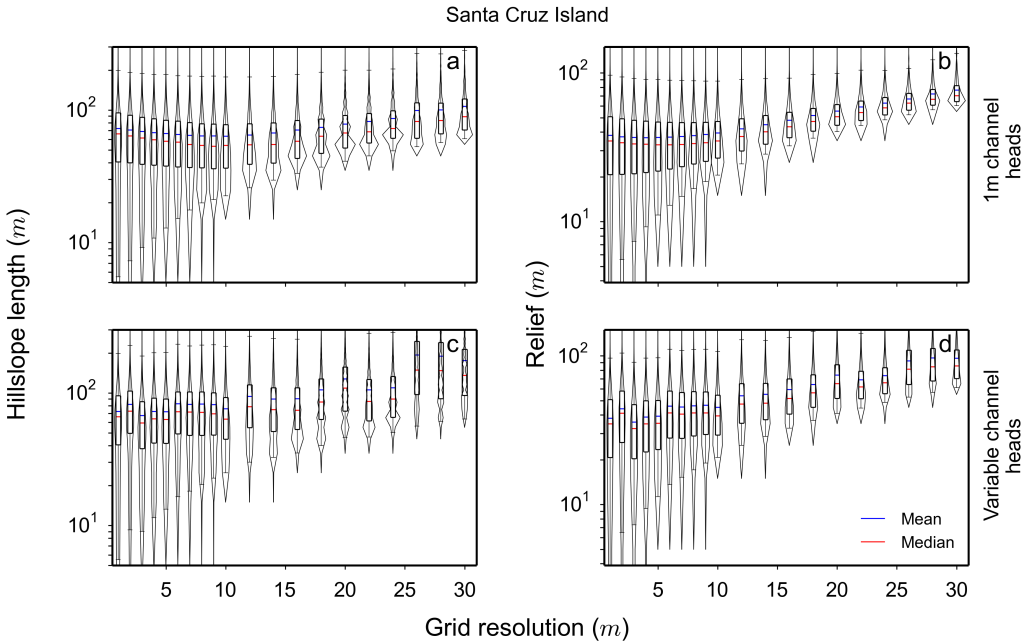

Fig. 1.

Printer-friendly version

Discussion paper