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Earth Surface Dynamics Discussions

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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Grieve et al.'s study investigates how different spatial resolutions of digital elevation models (DEMs) affect topographic derivatives that are particularly relevant for characterizing geomorphological processes. They place emphasis on the second derivative curvature that is the basis for channel network identification, estimating hillslope diffusivity, and measuring hillslope length and relief. I have rarely received a request for reviewing a paper that is in such good shape. The manuscript is very well written, concise, and the methodology sound. Overall, the conclusions drawn by the authors are well supported by their analysis. Notwithstanding, I have two comments that should be addressed before the manuscript is ready to be published.

1. The problem of coarsening resolutions is addressed by downsampling high-resolution LiDAR data. However, this approach neglects that DEMs are acquired by different sensors that may generate artefacts due to vegetation, shadowing, foreshortening, etc. These systematic data errors are likely not captured by the local binning algorithm that the authors used to downsample the dense point clouds. My concern is that, now that a globally available DEM with 12 m resolution is available (WorldDEM), researchers may place a possibly to high confidence into the fidelity of that product. The incorporation of this data (or other data sources) into the analysis would provide guidance here.

2. The mathematical treatment of the observed loss of fidelity with increasing spatial resolution appears somewhat misplaced in the discussion. Instead, this part could well serve as a motivation of the study that should be placed at the beginning of section 2. Moreover, I think that this part is not intelligible for many who are infamiliar with wavenumber response functions. Adding more detail here will certainly be thanked by the general readership of ESURF.

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