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Interactive comment on "Determining the Optimal Grid Resolution for Topographic Analysis on an Airborne Lidar Dataset" *by* Taylor Smith et al.

Anonymous Referee #1

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The manuscript by Smith et al. deals with the identification of the optimal grid resolution for slope and aspect derivation from LiDAR dataset. The topic is relevant and of utmost importance in the quantitative geomorphology and hydrology fields since aspect and, especially, slope are fundamental parameters for different analyses commonly carried out such as synthetic channel network derivation, feature extraction and modeling. The paper presents the theoretical steps and a real-world application of a quality metric for slope and aspect calculations developed to determine the optimal resolution minimizing truncation error and the propagated elevation uncertainty. In my opinion, the work is very well structured and the method is robust and clearly outlined in the manuscript. This innovative approach is highly promising and will be most likely of great interest for the geomorphometric community thanks also to the fact that made available the de-

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veloped code in the GitHub repository. My only minor concern about this high quality work is related to the assumption that the optimal grid resolution of a Digital Elevation Model (DEM) is the one minimizing the total error. This is certainly true in most cases but for several applications, the choice of the DEM resolution is mainly controlled by the dimension of the feature investigated that is some cases may be quite small (e.g. ephemeral gully, colluvial channels) and, thus, a fine resolution may be the best choice. Typically, this is addressed by choosing a high resolution and then computing geomorphometric parameters using large moving window to filter out the noise. Apart from the sentence at lines 1-2, page 18, this issue is not mentioned in the manuscript. I suggest adding some text on this to better clarify your assumption on the “optimal” grid size. Some specific (minor) comments are given below: L. 22, p. 1 (and throughout the text): lidar-> LiDAR L. 24-25, p.1: please consider providing a range of resolution for “high” and “low” resolution in place of e.g 1 and 30 meters L. 3-10, p. 2: I suggest mentioning also stream power studies that are quite relevant in hydrology and soil science. L. 7, p. 8: differently->different? Figure 13 caption: sq km->kmˆ2 L. 7, p. 21: also averaging values could be tested as resampling method, maybe the results are different with respect to those obtained using bilinear resampling. In general, I know it is out of the scope of the paper but it would be interesting to compare different resampling techniques in order to suggest the best method to resample resolution

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