Authors' Response to Editors' comment of

Downstream rounding rate of pebbles in the Himalaya

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RC: ***Editors' Comment***, AR: Authors' Response, ☐ Manuscript Text

1. Editors' comment: Rebecca Hodge

AR: Dear Rebecca Hodge,

Thank you very much for handling our paper and for providing comments and suggestions that have contributed to enhancing the quality of our manuscript. We would also like to express our gratitude to entire editorial team for diligently conducting the review process efficiently. Your prompt and thorough feedback has been invaluable. Additionally, we appreciate the extension you provided, which allowed us the necessary time to incorporate the suggested improvements. Your support throughout the editorial process is truly appreciated.

Kind regards,
Pokhrel et al.

RC: ***Public justification (visible to the public if the article is accepted and published):***

AR: We agree to make it visible to the public if the article is accepted and published.

RC: ***Thanks for your thorough and careful revision of your paper. Thanks also for providing a comprehensive response to reviewers document that makes it clear how you have addressed each comment. I have a handful of very minor edits to for you to consider, but otherwise I am happy to recommend this paper for publication and think that it will be a very useful addition to the research literature in this area.***

AR: Thanks once again for providing comments and suggestions that have contributed to enhancing the clarity of our manuscript. We have provided a detailed response below.

RC: ***Comments by line number (in the tracked changes version):***

RC: ***53: You define roundness later on, but I think that it would be useful to add a brief definition here to clarify that you are talking about perimeter shape rather axes ratios.***

AR:

> There are different views regarding the controls on and trends in pebble roundness as one moves downstream ~~(Figure 1).~~. Figure 1 illustrates the downstream change in the perimeter shape of the pebbles.

RC: ***100: Another reference that might be useful to add to this section is Bodek and Jerolmack (2021), who also used image analysis to quantify particle shape in rotating drum experiments and calculated IR: https://esurf.copernicus.org/articles/9/1531/2021/esurf-9-1531-2021.html***

AR:

However, studies developing an automated workflow to reduce the subjectivity in calculating the shape parameters have been recently published ~~. For example,~~ (e.g., (Roussillon et al., 2009; Cassel et al., 2018; Bodek and Jerolmack, 2021)). Roussillon et al. (2009) developed a tool for the automatic extraction of pebble shape from 2D images.

RC: ***200: Do you mean perimeter instead of contour?***

AR: The definitions of curvature of contour and perimeter differ in Durian et al. (2006). They quantify the shape of flat pebbles by measuring curvature at each point along the entire two-dimensional contour. Curvature (K) is defined as the reciprocal radius of a circle that locally matches the contour, deduced from the coordinates of the pebble boundary (Weisstein, 1999). However, in our study, we consider the measurement of the pebble boundary itself as the perimeter. Due to this distinction, replacing the word "contour" with "perimeter" would not be appropriate. Therefore, we propose excluding the entire sentence from our manuscript to prevent any potential confusion.

~~Durian et al. (2006) found that the curvature measured along the contour of pebbles allows finer discrimination of a pebble's shape than the traditional measures of aspect ratio.~~

RC: ***337: Do you mean bounding instead of bonding?***

AR:

Finally, the major (a) axis and intermediate (b) axis are measured using the ~~"Minimum bonding geometry"~~"Minimum bounding geometry" function from the search box tool in ArcGIS, with "Geometry type" as convex hull and "Geometry characteristics" as attribute added.

RC: ***414: I'm not sure what 'negative of the R-squared values' means, as I would assume that R-squared is always positive?***

AR: When using the downhill gradient method, such as the 'Nelder-Mead' method, the goal is to minimize a cost or objective function. In the context of maximizing R-squared, which is a measure of the goodness-of-fit in regression analysis, the convention is to frame the optimization problem as a minimization task. This is why the negative of the R-squared values is used in the optimization process. By minimizing the negative of the R-squared values, the optimization algorithm is effectively seeking parameter values that maximize the original R-squared value. This is a common approach in optimization problems, where the focus is on minimizing a cost function or, in this case, the negative of a performance metric.

AR: For clarity, the sentence now has been rephrased.

This method aims to minimise the negative of the ~~$R-squared$ values~~performance metric , effectively maximising the $R-squared$.

RC: ***462: Change consist to consists.***

AR:

The sample site is located in the Indo-Gangetic plain which ~~consist~~consists of a full mixture of

sediments from Higher to Lesser Himalaya and Sub-Himalaya

RC: ***512: It's not clear to me what alluvial fans you are referring to. Maybe remove this?***

AR:

It is important to note that the granite clasts are absent in the alluvial fan deposits ~~.~~(top unit in Figure 12).

RC: ***Figure 13: Use the same number of decimal places throughout the caption, so 0.975 rather than 0.98.***

AR:

Photograph showing the IR_n value of the clasts at location "a" ($\sim$ 8 km downstream from channel head) in Figure 3 (d). Note that the roundness value for this location ranges from 0.867 to 0.975. Although the pebble with ~~$IR_n = 0.98$~~$IR_n = 0.975$ has travelled only 8 km from the channel head, its roundness is equivalent to that of pebbles which have travelled 50 km transport distance.

References:

Weisstein, E.W., 1999. CRC concise encyclopedia of mathematics. CRC press. In: Durian, D.J., Bideaud, H., Duringer, P., Schröder, A., Thalmann, F. and Marques, C.M., 2006. What is in a pebble shape?. Physical Review Letters, 97(2), p.028001.

Bodek, S. and Jerolmack, D.J., 2021. Breaking down chipping and fragmentation in sediment transport: the control of material strength. Earth Surface Dynamics, 9(6), pp.1531-1543.