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Earth Surface Dynamics Discussions

Interactive comment on "Controls on the rates and products of particle attrition by bed-load collisions" *by* Kimberly Litwin Miller and Douglas Jerolmack

Stephanie Deboeuf (Referee)

stephanie.deboeuf@dalembert.upmc.fr

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The work of Miller and Jerolmack entitled 'Controls on the rates and products of particle attrition by bed-load collisions' deals with earth surface dynamics, by taking into account fracture mechanics, leading to a very interesting and well treated multi-disciplinary approach.

The authors realized well controled experiments of particle impact and attrition and clever data analysis, as well as precise size measurements of attrition products, allowing them to get their main experimental results: impact erosion can be treated 'as brittle fracture in the purely elastic regime'. Additionally, their fine observations of chipped

particles allow them to support that 'the common fatigue failure model is inappropriate', but 'propose that Hertzian fracture is the dominant mechanism'. Again, materials mechanics appear surprisingly as a relevant tool for bedrock erosion, sand production, bed-load transport, ... The authors also consider the limitations of the methods and take time to explain them to the readers, that is really appreciated.

The whole work is realized rigorously. High numbers of different experiments are done to ensure good statistics (450 collisions to test the randomness of the grain rotation, 50 to 10 000 collisions, 20 000 collisions, ...), that is really appreciated. I also really appreciate the analysis of experimental data by using dimensional analysis and knowledge from elasto-plasticity, as well as the desire of the authors to use 'physically-meaningful quantities'.

For all these reasons, I agree the publication of the paper. However, I have some suggestions reported in sequence in the pdf file.

Please also note the supplement to this comment:
https://esurf.copernicus.org/preprints/esurf-2020-86/esurf-2020-86-RC1-supplement.pdf

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