ESD response to the review by Dr. Bertoni

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While our paper is admittedly a theoretical model, still, its main goal is to offer a new toolkit to geologists. It is reassuring to know that this approach was vetted by an expert field geologist and we would like to sincerely thank Dr. Bertoni for his comments.

We very much appreciate his positive opinion on the problem statement and result discussion. This gives us hope that field experts may, in the future, engage in exploring this interesting subject.

Our referee raises the question how our theoretical predictions may be tested. While we regard this as a key issue, we did not elaborate on this aspect since no testing has been done so far. Still, some of the potential testing strategies appear to be quite clear as we discuss it below.

In all experiments the validity depends on the ability of the experimenter to make measurements on the same particle population. To make the experiments consistent with this study, the most straightforward approach is to track the evolution $R(t)$ of the relative variance.

(a) *Tumbler experiments*. In this case the validity of the experiment is automatically guaranteed. The energy level of the experiment may be controlled either by adjusting the speed or by adding water. Recording $R(t)$ at a wide range of energy levels may help to confirm some aspects of the presented theory.
(b) *Flume experiments*. Here again, the validity of the experiment is guaranteed. Circular flumes may be adequate testing platforms for lower energy levels.
(c) *Field experiments*. In this case both the validity and consistency of the experiment is a hard question. The most plausible option are radio-tagged particles, however, low recovery rates may prohibit a reliable monitoring of $R(t)$.

The referee also raises the question whether and to what extent our theory may help to distinguish between coastal and fluvial environments. The question is justified, yet, in the absence of experimental results, a full answer is lacking. Still, this question may be a main motivation behind the design of targeted experiments.

Based alone on the predictions of the paper, focusing and dispersing behavior may be present both in a fluvial and in a coastal setting. Focusing processes operate at lower energy levels: this may characterize the lower reaches of rivers as well as wave-current-driven frictional abrasion in coastal environments. These are the

scenarios where our theory predicts that abrasion and transport act in a similar manner on mass distributions.

On the other hand, high energy levels indicate dispersing processes where abrasion and transport are counter-acting. Such scenarios may be observed in the upper reaches of rivers as well on high-energy beaches often visited by storms.

As we can see, at higher energies both transport and abrasion operate much faster and it is a truly challenging question to find out which of these natural processes dominates. Our study offers a tool to make a meaningful statement: by measuring $R(t)$ in any of these settings, one can safely decide this question.

We thank the referee for indicating minor points in the manuscript. In the resubmitted version, beyond the summary of the above ideas, we will correct those points.

Once again, we sincerely thank for the report which raised fundamental questions and motivated us to think further about the applicability and testing of the proposed theory.