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Earth Surface Dynamics Discussions

Interactive comment on "The impact of particle shape on friction angle and resulting critical shear stress: an example from a coarse-grained, steep, megatidal beach" *by* N. Stark et al.

N. Stark et al.

ninas@vt.edu

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We thank anonymous referee #2 for the detailed comments and suggestions which will certainly lead to an improvement of the article. In the following, we reply and discuss the respective comments and suggest changes and additions to the manuscript, respectively. The referee's comments are highlighted in bold

Comment 1: "The sedimentological analysis necessary to support the authors work as well as to place in into context is completely lacking. There is not a single grain size analysis presented in the entire manuscript and perhaps even more significant considering the stated aim of the presentation is the lack of any kind of statistical anal-

ysis on grain shape. The only evidence presented to support the authors claims are 3 roughly elongated grains in a single sediment image. Finally, there is no indication of the mineralogical makeup of the studied sediments which is of considerable interest considering the reported rapid abrasion of the grains as well as providing sediment density for determining critical shields stress values for the sediments under study. All of these weaknesses are sufficient to require re-submission of the manuscript."

We agree with the fact that the manuscript would benefit from more sedimentological analysis.

We suggest the following changes:

- Grain size analyses are not presented in detail, because the samples used in the shear tests represent fractions in chosen size ranges after sieve analysis. However, for more detailed comparison and discussion regarding the beach environment, we will include grain size distributions of beach surface sediments and identify the sample size ranges which were tested in the laboratory. Furthermore, we can conduct a more detailed grain size analysis of the fine fractions which were currently only summarized as sand-sized. (see referee 1, comment 8)

- We will determine and include the Corey Shape Index for representative samples and include in a table (see referee 1, comment 3 and 4).

- We will determine the mineralogical makeup and sediment grain density and include this in the results section, and the discussion section when discussing the observed abrasion during long-term shearing.

Comment 2: "The authors attempt to validate their frictional angle tests by providing the results of threshold tilt angles on an inclined plate but unfortunately the authors report that all motion is initiated by failure at the plate-sediment interface thereby converting the tests into a plate roughness and grain density experiment which provides not insight on grain stability whatsoever. These experiments must be repeated with a base layer

of immobilized sediment to have any value."

We agree with the fact that the observed angles in the tilted tray experiment are not directly comparable to the friction angles due to the plate-sediment interface. Such a direct comparison of the angles was also not intended for exactly this reason, but a conceptual comparison was attempted (see l. 196-199; l. 247-257). We also agree that this should be discussed in more detail and that the impact of density should be included in this discussion (see also referee 1 comment 6). Nevertheless, sediment was fed out of a hopper, being another fact that has to be included in more detail, allowing the assumption that not only sediment density controlled the results, particularly when it comes to the initiation of motion. We suggest the following changes:

- More details on tank experiment and limitations regarding the here presented analysis.

Comment 3: "While providing some qualitative comparisons of the experimental results, the authors make absolutely no attempt to place their work in the context of the extensive body of literature on grain critical stress. At a minimum, one might expect that some form of a Shields curve would be presented with the authors measured values included." Agreed. We suggest the following revision:

- Addition of figure with Shields curve based on analysis for particles of elliptic shape by Komar and Li (1996).

Comment 4: Some analysis of the vertical structure of sediments on the Advocate Beach beach face would be informative. In particular, does the post-storm sand covering represent a thin veneer on a gravel base or vice versa during non storm stages or does the change of surficial sediments reflect a significant shift in composition of the beach."

This analysis has been done. It has been found that the upper 20 cm of the beach sediments are subject to rapid and strong changes in grain size distribution depending

on the hydrodynamic forcing. At a sediment depth of 20 cm or larger, the sand-gravel mixture remained approximately constant. Hay et al. (submitted) discuss in detail the observed formation and destruction of ripples and the correspondence to changes in surficial grain size distribution (see for more details also referee 1, comment 10). Ripple crests were rapidly built of local sand-sized particles during the passing swash and surf zone during flood tide. With the passing swash and surf zone of the retreating ebb tide, these bedforms were washed out again, leading to a plane and fine grained beachface. We agree that this information should be included in the motivation and in the discussion when correlating the here presented findings to the beach environment. An additional paragraph at the end of the discussion and an outlook on follow-on research opportunities will be given (see also referee 1 comment 10).

Comment 5: "While the narrative in the manuscript is quite brief (e.g. Reference to standard texts rather than a detailed description of the methods used in the performed experiments), there is the impression of significant repetition in the material which is discussed. The repetition of identical subsection headings may add to this sense of deja-vu."

The description of methods were kept rather brief due to the fact they were discussed in large detail in the literature and due to the page limitation of the manuscript. Identical headings were used in the Methods and Results sections to help associating the results to the respective methods, particularly regarding shear tests.

We suggest the following changes and revisions:

- Check narrative for unnecessary repetition and revise where appropriate.

- Expand description of methods particularly regarding importance of applicability of the shear tests on the beach environment (see also referee 1 comment 2).

Interactive comment on Earth Surf. Dynam. Discuss., 1, 1187, 2013.