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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.

Anonymous Referee #2

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The authors present an interesting analysis which is designed to look at the effects of grain shape on sediment friction angle and critical shear stress using sediment samples from a stable sloped mixed sand gravel macro-tidal beach in Nova Scotia (Advocate Beach). The manuscript reports on a series of standard sediment laboratory tests using 2 different direct shear boxes, an annular shear stress tank and some tilting plate tests. The authors report to have observed that sand samples collected at Advocate Beach had a high level of elongated grains and that this sediment displayed elevated friction angles and critical stress and that the addition of this sediment to native gravel samples similarly increased the critical stress of the mixtures relative to the pure gravel sample. The study examines the dilatory behaviour of the sediment and identifies a

multi-step sequence which at increasing levels of stress initiates with compaction as the loose grain initial arrangement reorganizes to a more compact packing then dilation as the mixture shears followed by subsequent dilation which represents abrasive destruction of the grains. The entire studied is motivated by the historically stable beach slope in this macro-tidal environments as well as the resultant deposition on the exposed beach face of the sandy sediments following an energetic storm event.

While the authors confront an interesting and important topic, there are unfortunately a series of serious shortcomings in the submission which leave its value in considerable doubt. In no particular order, these include:

- 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 analysis 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.

- 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.

- 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. 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.

- 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.

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