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Earth Surface Dynamics Discussions

Interactive comment on "Sediment dynamics on a steep, megatidal, mixed sand-gravel-cobble beach" *by* A. E. Hay et al.

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Hay, Zedel and Stark present results from a field experiment on a megatidal mixed beach using an instrument frame that includes a new wide-band acoustic Doppler profiler. Additionally they present bed roughness data, including from a forcing event showing the development of large scale bedforms that are constructed on the rising tide and subsequently planed flat during the falling tide, resulting in the decrease in beach bed grain size during storm events.

I found this work to be stimulating, not only because of the presentation of MFDop field results but also because of the relationship between bedform generation and size sorting/segregation. The ms was well written and clear; the figures were clear, readable and at appropriate resolution. The manuscript cites the relevant literature and places

the current study in context, which is helpful for the reader. Lastly the paper offers observations and hypotheses that will motivate future studies.

I suggest publication after (very) minor (mostly technical) edits:

P120 Line 13-15; Because of the punctuation I am unclear as to which studies correspond to wave forcing measurements from buoys and pressure sensors. Perhaps a parenthesis should extend from the Allan ref. to the Dickson ref.?

P121 Line 17-25: I understand this paragraph to mean that the grain size analysis is contained, in significant detail, in the Stark et al. manuscript which is submitted. It would be helpful to include slightly more quantitative information in this paragraph because the sedimentological metrics are so significant in this work, for instance: is the distribution unimodal or bimodal and what are the grain sizes at the peaks?

P124 Line 20-21: It is interesting that the ripples continue to decay during ebb tide even as the significant wave orbital velocity is tending to increase.

Fig 14 caption: In panel a, please specify if 'x' is alongshore and 'y' is cross shore (or vice versa)

Page 125, Line 1-11; The fining of the lower beach face is quantified using the photographic method of Rubin (2004) and sieve analysis. I have two comments here:

A) Basic results from the sieve analysis are presented here. Are results from the sieve analysis presented in more detail in Stark et al Submitted? (if so please cite so the reader can followup for more detail)

B)Later in the paper, (Page 127, Line 18-19) the fining of the bed is discussed as a 'veneer'. I can intuitively understand how this would be the case using the mechanisms discussed, but it would be interesting if the authors could present this information in the results section. Did you quantify the depth of the veneer in the field?

Page 128; Line 5âĂŤ Is the aspect ratio eqn describing ripple steepness? if so 'eta'

should be in the numerator (or is this a different metric?). Also, Clifton and Dingler (1984) report 'typical' steepness of 0.15 with the range being as high as 0.22.

Page 128; Line 4-5âĂŤ The proportionality constant K is (likely) a function of grain size (Becker et al 2007, paragraph 26 of that study; Cummings et al. 2009; Goldstein et al 2013). This inverse relationship likely makes your observations less anomalous. However the previously mentioned studies are all in well sorted unimodal sediment ('all bets are off' in mixed sed.)... With that being said, I think you make a convincing case that the ripples are out of equilibrium (smaller) b/c of the unsteady flow conditions and the very short evolution time ($\sim$20 mins). Therefore I don't feel the need for these papers to be included in your work necessarily, I just want to alert you that they exist (my apologies if you know of them already).

As a side note the time scale for ripple formation (the immersion of the instrument frame) could be a valuable data point for quantifying ripple evolution vs. forcing conditions (Davis et al., 2004), though there must be an assumption of a flat bed (c.f., your discussion of the IK06 observations).

P129 Line 7-9 âĂŤ The concordance between Fig 16 panels, the caption, and the in text description of the figure panels should be checked.

Refs cited in this review: Becker, J.M., Firing, Y.L., Aucan, J., Holman, R., Merrifield, M., Pawlak, G., 2007. Video-based observations of nearshore sand ripples and ripple migration. Journal of Geophysical Research 112, C01007, http://dx.doi.org/10.1029/2005JC003451.

Cummings, D.I., Dumas, S., Dalrymple, R.W., 2009. Fine-grained versus coarse-grained wave ripples generated experimentally under large-scale oscillatory flow. Journal of Sedimentary Research 79, 83–93.

Davis, J.P., Walker, D.J., Townsend, M., Young, I.R., 2004. Wave-formed sediment ripples: transient analysis of ripple spectral development. Journal of Geophy- sical

Research 109, C07020, http://dx.doi.org/10.1029/2004JC002307.

Goldstein, E. B., Coco, G., and Murray, A. B.: Prediction of wave ripple characteristics using genetic programming, Cont. Shelf Res., 71, 1–15, 2013.

Interactive comment on Earth Surf. Dynam. Discuss., 2, 117, 2014.