

Earth Surf. Dynam. Discuss., referee comment RC1
<https://doi.org/10.5194/esurf-2021-13-RC1>, 2021
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Comment on esurf-2021-13

Anonymous Referee #1

Referee comment on "Sediment shell-content diminishes current-driven sand ripple development and migration" by Chiu H. Cheng et al., Earth Surf. Dynam. Discuss., <https://doi.org/10.5194/esurf-2021-13-RC1>, 2021

Cheng et al. investigate the affects of shells and shell fragments on the formations and migration of ripples under uni-directional flows. They conducted two sets of experiments to investigate (1) ripple morphodynamics and (2) flow conditions of incipient motion with increasing concentrations of shells/shell fragments. The authors find that increasing shell concentrations drastically impacts ripple morphodynamics as well as flow characteristics needed for incipient motion. Overall, this study is well conducted and yields intriguing results and discussion points. Below is one main comment followed by a few minor comments/questions.

Main Comment:

How do fluid turbulent structures vary with increasing shell concentrations? I'd be interested to see how near bed fluid velocity fluctuations vary in each of your experiments as you increase shell concentrations. I recommend conducting quadrant analysis (or octant, since you have cross-stream ADV data as well) and seeing if there are any discernible differences as you increase shell concentrations. Along these same lines, you might also consider calculating the Reynold's stress for comparison to your calculations of bottom shear stress.

References to consider:

- Keylock, C. J., S. N. Lane, and K. S. Richards (2014), Quadrant/octant sequencing and the role of coherent structures in bed load sediment entrainment, *J. Geophys. Res. Earth Surf.*, 119, 264–286, doi:10.1002/2012JF002698.
- Bogard, D. G., and W. G. Tiederman (1986), Burst detection with single-point velocity measurements, *J. Fluid Mech.*, 162, 389–413.

Minor Comments & Questions:

- Are the shells ever incorporated into the ripples or do they primarily armor the bed and the ripples migrate over them? If the later, could the armoring essentially restrict the sediment supply for the ripples in that they can no longer entrain additional sediment from below them?
- Throughout the manuscript you refer to near-bed flow in the "horizontal" direction. I think "streamwise" would be a better word to use as "horizontal" could apply to either the cross-stream (y) or streamwise (x) directions.
- Any time-averaged variable should have an overbar to denote the time-averaging. I noticed this mainly in figures 5 and 6 but should be applied throughout the paper.
- In figure 7, what are the black data points? Add a label directly to the figure to denote what these are. You can also add a label directly to the figure for the 95-percentile shaded areas. I tend to lean towards labeling as much as I can in the figure itself rather than "hiding" that information in the captions. Makes it easier for readers to get everything out of the figure without having to flip back and forth with the text.
- I think it would be worth while to add a table to supplement that summarizes your experimental conditions (essentially a table of the paragraph that starts on line 142).