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Nonlinear Processes in Geophysics
Discussions
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Interactive comment on "Large eddy simulation of sediment transport over rippled beds" *by* J. C. Harris and S. T. Grilli

Anonymous Referee #2

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General Comments:

This study deals with numerical modeling of sediment transport over sand ripples. A hybrid numerical model was developed in this study. This model combines a far-field inviscid flow model with a near-field LES model. The developed model was tested with the observations from a single experiment in an oscillating column type setup. LES results on the velocity field and suspended sediment concentration over a rippled bed were compared.

The subject of this paper is of high importance for various coastal hydrodynamics applications and fits well into the journals scope. Modeling sediment transport, in particular over a rippled bed in this case, is a difficult endeavor. The study does not cover a thorough model validation/calibration effort and leaves some improvements for future

research. Nevertheless, it presents a notable effort and progress in this difficult endeavor. Therefore, I recommend publication of this manuscript after addressing the comments provided below.

Specific Comments:

1- The boundary size of the model, in particular in the longitudinal direction (i.e. only one ripple length), is rather small. For example, 1 ripple length longitudinal domain size means half ripple length for the lee vortex simulations. This vortex is typically larger than this size, therefore, it is not completely contained within the computational domain. The authors should discuss how this would affect the simulation results. This would not be taken into account by the periodic boundary condition, but it would have significant effect in the simulation results (e.g. deviations of the suspended sediment concentrations in the model and experimental results as these vortices are critical in sediment suspension). This aspect of the simulations should be discussed in detail and justifications for the domain size selection should be made. 2- Page 769, Lines 4-5. If the lee vortices do not detach from the ripple, what happens in the next flow cycle? How do the vortices interact? 3- Page 780, Lines 21-24. The difference in suspended sediment transport rate is very large and the authors note that a minor change in the numerical model would correct this difference. Is the model so sensitive? If so, how to ensure the selected configuration would be adequate for different cases. These modeling challenges and potential solutions should be discussed. 4- The writing style of the manuscript should be improved. There are many long sentences, and they are often not well-structured. This compromises the clarity of the text. Also tense selections are often confusing. For example, use of future tense (e.g. Page 775, Line 9) to refer to a completed task that is presented in the following section is confusing and makes it difficult to read. 5- The authors provide an important limitation of the ABS instrument due to its empirical method of measurements and shortcomings at the sediment interface (Page 768, Lines 11-14). However, it is important to discuss the implications of this measurement accuracy issue in more detail when comparing with

the LES results. 6- I suggested the authors to consider augmenting the relevant graphs from experiments and simulations to make the visual comparisons easier for the reader (e.g. Figs. 2 and 7).

Technical Corrections:

7- The authors should go through the notations carefully to make sure that each of them is defined in the text. For example, “k” in Eq. 18. 8- Page 758: Please clarify “largest laboratory wavetanks”. 9- Page 760, last paragraph, first sentence. Please correct it. As it is, it sounds like ripple heights can be up to several meters. 10- The authors conducted a thorough literature review. However, Bagnold was not the first to study vortex ripples as stated in Page 761. 11- Page 762 Line 20, please clarify “field scale” and provide a size range of ripples. Because there are various other studies with somewhat similar ranges of ripple sizes as van der Werf et al. (2007). 12- Page 763, Line 18: “object” should be “subject”. 13- Page 767 Lines 15-16, “but” should be corrected. (in fact this sentence is a typical example for my comment # 4) 14- Please define “cumulative average” in Page 775 Line 16. 15- Page 775 Line 24: “turblence” should be “turbulence”. 16- Please clarify the statement in Page 777 Lines 22-25. 17- The ordinate of Fig. 6 and the abscissa of Fig. 12 are not shear stress and horizontal velocity as they are called in the respective figure captions.

Interactive comment on Nonlin. Processes Geophys. Discuss., 1, 755, 2014.