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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

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Thank you for your comments. Modifications have been made to the text to reflect the suggestions.

1- Based on the flow parameters, the orbital diameter of the motion far from the bed is quite close to one wavelength. Certainly if the orbital motion were any greater, the domain size would be a major limitation to the present setup. Initial tests with larger domains of two or three ripple wavelengths, however, did not show significantly different behavior, but this was not systematically tested. In many regards these tests were compared to the Reynolds averaged and discrete vortex models of van der Werf et al. (2008), who also used one wavelength for a computational domain size in the longitudinal direction, and who obtained seemingly good results, but recently it is in-

creasingly common to model larger domains for this type of problem as computational power becomes more reasonable. Additional discussion has been added to the text.

2- This was worded incorrectly, or awkwardly at best. Thank you for bringing this to our attention. In fact vorticity is ejected into the flow, although of course the magnitude of the velocity present in these ejected vortices is small compared to the rest of the flow. This has been corrected in the text. (And the fact that these vortices are being ejected is well-illustrated in Fig. 5 of van der Werf et al. 2008.) This is not focused on much in the article's figures (e.g., Fig. 7), but still present, as we do not show the full computational domain, as our focus is on the sediment flux, which is largest close to the bed.

3- By changing the surface roughness used, it is clear that model is quite sensitive in some ways (e.g., total sediment flux), but not particularly sensitive in others (e.g., suspended sediment concentration in Fig. 12 – in fact, if you compare with the Fig. 9 of van der Werf et al. 2008, you can see that the present LES results match much better, by several orders of magnitude, for the suspended sediment concentration far from the boundary). The source of the sensitivity in sediment flux can be seen by comparing Fig. 10 and 11, which show that even if the flow and sediment concentration agreed for most of the domain and for most of the period of oscillation, the results for the suspended sediment flux differ from the experiments mostly because of the behavior just above the crest, and for points very close to the boundary. For a LES, more sophisticated approaches than those used here are typically needed to adequately handle boundaries with flow separation, whereas for these types of applications, similar models have been used even recently (e.g., Chou and Fringer; 2010). This may indicate that sediment flux is a good indicator for validating LES of vortex ripples in the future, as opposed to just qualitative behavior or averaged (whether spatially- or time-averaged) velocity or suspended sediment concentration separately. Additional discussion to this effect has been added to the text.

4- The text has been re-edited to be more concise and to check for the types of errors mentioned.

5- Additional discussion of the ABS has been included. It is also worth noting that the additional work of van der Werf et al. (2008) provided error estimates for the sediment transport measurements, so the expected errors of any particular measurement should not be as large as possibly indicated by that comment on pg. 768. The text has been augmented to reflect this point.

6- It is agreed, that combining these figures would make it clearer for the reader, and this modification has been made.

Finally, the technical corrections mentioned are much appreciated.

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