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Earth Surface Dynamics Discussions

Interactive comment on "Relevance of acoustic methods to quantify bedload transport and bedform dynamics in large sandy-gravel bed river" *by* Jules Le Guern et al.

Anonymous Referee #1

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Evaluation

This is an important study that is based on a comprehensive set of bedload transport measurements obtained from an experiment designed to compare three acoustic methods with isokinetic sampling at locations across a transect of the Loire River during different flow stages. It is significant in that it presents hydrophone-derived measurements in a sandy gravel-bed river, which differentiates it from the numerous studies in gravel-bed rivers, and that it presents hydrophone-derived measurements with a spatial distribution that enables bedload transport to be related to bedform morphology.

The paper addresses relevant scientific questions within the scope of ESurf and

presents novel data with substantial conclusions. The results are sufficient to reach the conclusions given, however some further discussion of the results would improve the quality of the paper.The paper is currently in need of further editing to improve the quality of written English and to more accurately describe the methods in order that other researchers may replicate those methods. The language needs to be more fluent and precise. The overall structure of the paper is relatively clear and a proper consideration is given to related work in setting the novel aspects of the research in proper context. Specifically, in relation to the hydrophone method, I would like to see a clearer explanation of the method and some data that demonstrate the variability of the power-spectral density between hydrophone recordings. I would like the paper to describe if there are significant differences observed between the frequency spectrum of the studied sandy gravel-bed river and the frequency spectra in the comprehensive literature on gravel-bed rivers. How does the different grain size distribution affect the observed frequency spectrum?

Specific comments

Lines 57-58 to estimate the capacity of acoustic signals to detect the bedload axes on relatively wide cross-sections for various discharge conditions

I'm not sure what this means. Are you referring to estimating the accuracy of acoustic methods for measuring bedload transport rates for wide transects across a arrange of flow conditions?

Line 116 giving better results

How do you know that they are better results? Please provide a clearer description of the method used to determine data quality.

Lines 147-148 and could allow a better understanding of the apparent bedload velocity gradient along bedforms.

It's not clear to me what this means. Why would this give a better understanding of

the bedload velocity gradient along bedforms? Is it because the ADCP footprint is relatively small compared with the bedform dimensions? If so, please state typical bedform dimensions relative to the footprint.

Lines 161-162 The determination of a proxy to evaluate sediment transport directly from DTM measurements is difficult.

Explain why it was difficult.

Lines 240-241 and the integration of median PSD over a wider range of frequency in the present study.

What is meant by median? I'm not sure what this is referring to and I think it needs to be explained more clearly. Is the PSD integrated across the median value of each frequency bin?

Lines 251-257 The comparison can be made between indirect methods to discuss the acceptability of the BTMA reference. The apparent bedload velocity and the acoustic power are not well-correlated with mean dune morphological parameters (dune celerity and dune height). The aDcp method is measuring the apparent velocity of the grain being transported from the stoss to the lee side of a dune. It must be noted that apparent bedload velocity is higher than dune celerity with about a factor 100, whereas the grain size (D50) is smaller than dune height with the same order. Therefore, sediments that are 100 times smaller than dune height allows the dune migration with a celerity 100 times smaller than their own celerity.

I'm not sure this section is necessary and I struggle to understand some of the arguments being made. What is meant by the acoustic power and apparent bedload velocity not being well correlated with the morphological parameters? Where is this shown in the data? The comparison between apparent bedload velocity and dune celerity is interesting but I think most readers would already understand that the bedload velocity is much smaller.I'm not sure how this lead on to the next sentence: Lines 257-258 On

the other hand, the apparent bedload velocity is positively correlated with the acoustic power. The RMA regression model explains 76% of the dataset dispersion (Fig. 6a).

What it meant by 'explains 76% of the dataset'? This needs to be accurately described. This paragraph needs to be re-written.

Line 261 and water discharge explain 71% of the dataset dispersion

Again, I do not understand what is meant by explaining the dataset. Please clarify.

Line 286 there was no reference measurements

Why not? – please explain. Can you please add labels, e.g. S1, to the BTMA data points in both panels of Fig. 8 to clearly identify the reference measurements. Why is there no S2 in Fig. 8a? Why are reference measurements missing from Fig. 8b?

Line 294 I would like to see some discussion as to why the hydrophone method is producing larger values of unit bedload rate compared with the BTMA measurements. Just a thought, but could it be related to the omnidirectional hydrophone picking up higher noise magnitudes that are not directly below the boat?

Lines 303-305 For this survey, acoustic signals (i.e. acoustic power, apparent bedload velocity) followed the same evolution pattern as isokinetic samplers along the cross section except for S3.

Again, why is this the case? – is it due to a lack of directionality?

Line 325 Immediately downstream of the bar there are bedload transport values that are higher than those observed further downstream. Is this due to the omnidirectional hydrophone picking up bedload noise from the bar upstream?

Technical Corrections

Lines 52-54 In this work, we compare the efficiency of active (aDcp, echosounder) and passive (hydrophone) acoustic techniques is assessed for the quantification of bedload

transport in a reach of the Loire River (France), which is characterized by the presence of migrating bars and superimposed dunes (Le Guern et al., 2019b).

Please re-write.

Line 127 with D50

Change to ‘where D50”

Line 135 Remove double comma

Lines 149-150 a moving windows

Remove ‘a’

Line 174 I presume this is a hydrophone with an omnidirectional beam-pattern? If so, please state.

Lines 211-212 a factor 2 of the perfect correlation.

Suggest a change to ‘a factor of 2 above and below the perfect correlation’

Line 227 of values in a factor 2, whereas 49% for a discharge coefficient of 0.57.

Suggest a change to: ‘of values within a factor of 2 of the perfect correlation compared with 49% of values for a discharge coefficient of 0.57.,’

Line 237 for estimate

Change to: ‘to estimate’

Line 265 whereas 73% for the aDcp.

Change to ‘compared with 73% for the aDcp’.

Line 278 with respect to bars location

Change to ‘with respect to bar location’

Line 286 there was

Change to ‘there were’

Line 294 whereas hydrophone overestimates BTMA measurements

Change to ‘whereas the hydrophone method overestimates unit bedload rate compared with the BTMA measurements’

Lines 312-313 The amplitude of bedload rates between crest and trough for low flow conditions (Fig. 9a) ranged between 42 g.s-1.m-1 and 69 g.s-1.m-1.

I think this refers to Fig. 9b rather than Fig. 9a. Please check that the plots are correctly referred to in this section.

Line 324 that is materialized by

Change to ‘that is characterised by’

Line 325 This, showed that

Change to ‘This shows that’

Line 365 during few time (an hour).

Change to ‘during a relatively shorter time period (an hour).’

Line 392 Results of Fig. 3b

Change to ‘The results shown in Fig. 3b’

Line 395 it can be criticized for

I’m not sure what this means. Please re-write.

Lines 420-421 the red, yellow, blue and black lines of Fig. 8b (BTMA, DTM, aDcp and hydrophone methods, 421 respectively)

Change to the BTMA, DTM, aDcp and hydrophone methods (respectively the red, yel-

low, blue and black lines of Fig. 8b)

Line 425 taken to local

Change to ‘taken with local’

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