Editor comments (EC)

EC1

L41-43"Here you say that acoustic techniques have only been applied in coarse rivers, but then at the end of this section you say that you will apply them in river with a fine bed. Is this the first time that this has been done, or can you refer to previous acoustic work in fine bedded rivers?"

As far as we know, passive acoustic technique have never been applied in large lowland sandy fluvial environments. The only work that refers to sand particles is from Geay et al. (2020). They investigated 14 rivers where the median grain size (D_{50}) of bedload samples varies between 0.9 and 62 mm. They also measured the surface GSD (Grain Size Distribution) from surrounding emerged bars and, for example, the river with the finer sampled D_{50} (0.9 mm, the Romanche River) have a surface D_{50} of 31 mm. These wide range of the D_{50} is not characteristic of sandy-gravel bed rivers. Moreover, the slope of this river (0.13%) is very high in comparison with the Loire River (0.02%). The same authors have demonstrated that the riverbed slope is an important parameter to take into account in the sound wave propagation especially for sand particles.

Earlier, Thorne (1984, 1986) investigated the passive acoustic technique in marine environments but this work was focus on gravel movement in turbulent tidal currents (particles larger than 2mm). Some laboratory works have been carried out with finer particles (0.3 mm; Thorne, 1985 and Thorne, 1986) but never in natural systems.

EC2

L.54-55 "it might be useful to give an indication of grain size here, (e.g. sand-bedded river), so that it is clear by the end of the intro that you are focusing on sand-bedded channels".

Detail of grains size distribution are given in the study site paragraph (few lines under this sentence). We modified the sentence to introduce sediment characteristics as you prescribed : "*The investigation took place in a reach of the Loire River (France), which is characterized by a sandy gravel bed evolving through bars and superimposed dunes migration (Le Guern et al., 2019b).*"

EC3

L. 64 “What does 'it' refer to - D50?”

Yes it refers to the median diameter D_{50} mentioned in the previous sentence. We specified this by modifying “it” by “The D_{50}”.

EC4

L. 66 “Briefly introduce the sampling first, e.g. 'For this work we measured flow and bedload at positions along the channel (Fig 1). At these sampling points, hydraulic conditions...' “

“During this work we measured the grain size distribution and flow characteristics at different locations along a cross section (Fig. 1). The riverbed is composed of a mixture of siliceous sands and gravels with a median diameter (D_{50}) of 0.9 mm. The D_{50} varies between 0.3 and 3.1 mm with a standard deviation of 0.4 mm. The 90th percentile of the sediment grain size distribution (D_{90}) is variable with a median value of 3.3 mm varying from 0.5 to 15.7 mm. Hydraulic conditions varied according to discharge between 0.5 and 5.4 m for the water depth, and between 0.2 and 1.4 $m.s^{-1}$ for the water velocity (median water depth and water velocity are 1.9 m and 0.9 $m.s^{-1}$, respectively).*”*

EC5

L. 67 “are these medians across the 100 times range in discharge? Given the wide variation in discharge, it might be useful to give the range of flow depths as well”

These medians were extracted from aDcp measurements performed during bedload sampling surveys done with BTMA. We added the range of water depth and water velocity variation related to this discharge variation. “Hydraulic conditions varied according to discharge between 0.5 and 5.4 m for the water depth, and between 0.2 and 1.4 $m.s^{-1}$ for the water velocity (median water depth and water velocity are 1.9 m and 0.9 $m.s^{-1}$, respectively).”

EC6

The appendixes are very useful, but you need to add a reference to them at an appropriate location in the text

Done

EC7

L. 88 "It's not clear to me whether all types of measurements were collected on all measurement dates. Are the isokinetic samplers the same as the BTMA?

Explain all abbreviations in the caption, even if they are also in the main text"

It is difficult to show all types of measurements performed at different dates because sometimes we have 2 types of measurements, sometimes 3 at the same time. So, in order to make the figure more readable, we decided to put only BTMA measurements on the hydrograph because this is the reference measurement which is used to compare with other methods. We specified in the figure caption that this figure is related to bedload sampling surveys only.

EC8

L. 108 "Explain that the suspended sediment stopped you seeing the bed"

We added this sentence in order to be clearer: "The increase of the water depth limits the light at the bottom of the water column and the addition of a mounted light did not improve the visibility because of particles in suspension."

EC9

L. 116 "min for the case with bedforms"

Rennie et al. (2002) did not mention that the sampling time determined by their study is related to the presence of bedforms. Contrarily, Conevski et al. (2019) prescribed a sampling time for the case without bedforms because when bedforms were present, they selected only the signal from the stoss side of the dune (eliminating values from the trough). Therefore, they did not need to register several dunes in order to take into account the variability of bedload due to the presence of these bedforms in the mean signal.

EC10

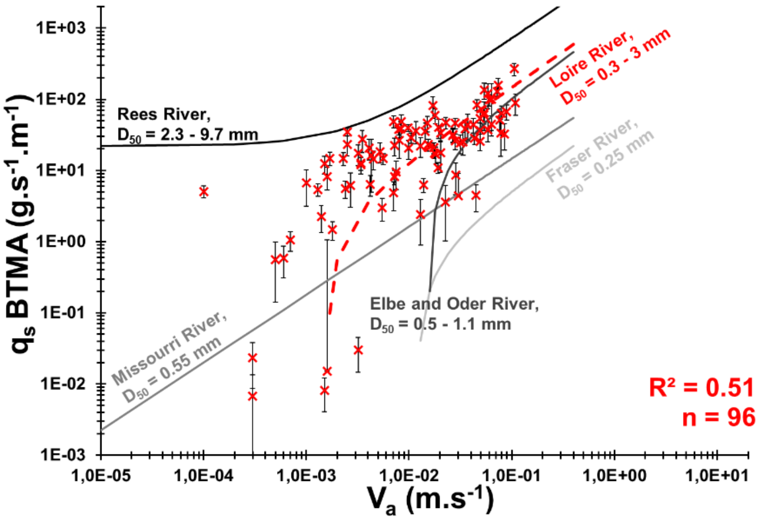
L.125-128 "I think that this sentence could be phrased more clearly - the point that all measurements were made with the boat at anchor is important."

The sentence was modified: "Even if the boat was anchored, the GPS signal was used in the Eq. 2 to correct apparent bedload velocity from small lateral displacements observed. When the GPS signal was poor or missing, V_{GPS} was considered as null and V_a resulted only from the bottom track signal V_{BT} (representing 15% of the dataset)."

EC11

Fig. 3 "Would it be helpful to show this figure with a logged x axis? It's hard to see how well the line fits most of the red data."

We presented the Fig. 3 in a semi-log version because: 1) it allows to plot negative values of the apparent bedload velocity, 2) we though that it better illustrates differences between models of other rivers, especially the link with the grain size (as in Rennie et al., 2017), and 3) it is probably easier to define the lower detection limit mentioned L. 527. You can find the log-log version of the figure below.



EC12

Fig. 6a "is this the PSD of a single measurement, or an average of all the measurements?"

In the case of the Drau River and the Isère River (Geay et al., 2017; Petrut et al., 2018), this is the PSD of a single measurement. In our case, this is the median PSD of 450 measurements. We specified this in the figure caption: "Fig. 6: (a), Comparison of PSD from 3 rivers with varying D50 (PSD of the Drau River and the Isère River are extracted from a single measurement, PSD of the Loire River is the median PSD from 450 measurements)."

EC13

L. 291 "Which apparent velocity are you referring to - the apparent velocity calculated from equation 13? Or using another method?"

We are referring to apparent bedload velocity estimated using an aDcp: "The apparent bedload velocity estimated by aDcp is the velocity of the top layer velocity or dynamical active layer (sediment being transported over a dune), whereas the dune celerity is the mobility of the exchange event active layer, according to Church and Haschenburger (2017)."

EC14

Fig. 8 "how were the DEM data collected?"

These DEM are obtained from the interpolation of 2 single beam bathymetrical surveys using the same material as DTM method. "Fig. 8: Digital Elevation Models (obtained using natural neighbours interpolation of single beam bathymetrical surveys) showing location of sampling points with respect to bar location during: (a), survey of the 17/05/2018 (Q=604 m3.s-1) and (b), survey of the 19/12/2019 (Q=2050 m3.s-1)."

EC15

L. 391 "did you actually calibrate the reduction in efficiency, or is this an estimate?"

We did not perform calibration of the sampler. The sampler was initially calibrated during laboratory tests (de Vries, 1979). The efficiency of the bedload sampler was set at 50%, this means that bedload estimated by measured volumes sampled by BTMA are multiplied by 2. We observed from our camera dataset that, especially for low bedload conditions, the efficiency of the sampler is reduced because the sampler mouth is not well-posed on the river bed.

EC16

The fact that this is the first demonstration that hydrophones work in a sandy gravel-bedded river is important, and you could make more of this in the intro and abstract.

You are right. This part of our study is the most important part and must be to be highlighted. We added the following sentences in the abstract: "This study is the first work which attempted to use a hydrophone to quantify bedload rates in a large sandy-gravel bed river." And in the introduction: "This study aims to develop the use of passive acoustic technique in large sandy-gravel bed rivers for quantifying bedload rates and bedforms dynamics."