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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Passive Acoustic Measurement of Bedload Grain Size Distribution using the Self-Generated Noise" *by* Teodor I. Petrut et al.

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NOTE: The authors did a change in the Eq. (7) which will slightly changes the results of numerical tests and field spectra inversion presented in this article. The change has the physical meaning of passing from power to energy representation of impacts and so it avoids the usage of time in the impact modeling. As the clarity of the presentation was invoked by the two referees, we also did some changes regarding the system of notation in order to define easier-to-read equations. In consequence, some parts of the text change but the modifications still follow the pertinent advices of the referees. The resulted paper is also added in the supplement of this response comment. Below,

we are considering the referee's suggestions and corrections step by step.

1. Added reference (Parker, 1990) instead of 'Parker'

2. Correction applied.

3. On P6 Line 25 was given the argument for the use of slab-sphere impact instead of sphere-sphere impact. This means that the slab do not contribute to hertzian sound production as it does not oscillate; his role in the sound production is the reflection of the sound from the impactor particles, by which it allows the method of image modelling. As the impactee particles in the bed river are fixed, we may consider the bed river as a massive slab which reflects the hertzian sound pressure generated by impactor particles. In this way, we skip the task of determining the dimensions of impactee particles."

Thus, we rephrase:

"This could justify the reason to use the sphere-slab impact physics instead of sphere-sphere impact, to reduce eliminate the need for the dimensions of the impactee object"

to the following:

"In this paper, we choose to use a slab model to model bedload SGN as it simplifies the inverse problem. Indeed, the task of determining the dimensions of impacted particles is skipped. Therefore, we consider that the riverbed could be modeled as a slab. This hypothesis could be supported when the riverbed is armored or paved, but may be false when the river bed is totally mobile and when the impacts between particles of different diameters are very common."

4. Correction applied. Thanks!

5. The notation in this case does not have technical significance; we could have call it a 'catalog'. There is no work to approach this subject so we must invent a notation system for our spectrum model. We chose the Greek letter for 'D', from 'Dictionary',

and to not be confused with 'Diameter'. The dictionary contains analytical spectra for each 1-mm size class, from 1 mm to 150 mm. Thus, the dictionary is a matrix whose columns are spanned by analytical spectra. The explanation is made after Eq. (9a-b).

6. Considering the present system of notation we rephrase the paragraph including the P7 lines 8/9 :

"where PP$\Sigma\Delta$ is the PSD of the bedload, ΓPMF is a probability mass function (PMF) of the number of collisions, and Pi is the analytical elementary PSD of the impact between spheres of the size class i (Eq. (7)). The matrix Δ contains the analytical spectra of impacts for each size classes . The size class i takes integer values, from the lowest limit, 1 mm, to the highest one, K mm, where K is the largest diameter considered in modelling. Here, the studies considers K equal to 150 mm. Thus, the ni represents the probability to observe an impact of the particle of the size class i."

to the following:

"where Δ is the dictionary of elementary ESD of impacts between spheres and slab and I is the vector of impact rates per diameter class or, basically, a histogram. The class i takes integer values, from the lowest limit, 1 mm, to the highest one, K mm, where K is the largest diameter considered in modelling. Here, the studies considers K equal to 150 mm. The parameter NFFT is the number of values contained in the spectrum or the number of Fourier Transform points on which the spectrum is modelled."

7. Rephrasing the line to the following:

"but pertinent ideas could be drawn on the model's behaviour"

8. Rephrasing the line to the following:

"The angle of the point of observation with respect to the impact, θ, and the propagation medium properties, and c, are considered of little inïňĆuence on the values of fpeak".

9. Replacement applied. Thanks!

10. Equation redefined according to new system of notations and without the argmin operation and least square framework.

11. Replacement applied. Thanks!

12. To explain this, the following statement is added on P12 Line 8:

"Two main sources of noise can be distinguished in the recordings: below and above 400 Hz (fig. 7). Bedload impacts can clearly be heard in the higher frequency band, it sounds like the crackling of the flames. Sounds occurring below 400 Hz are not propagating sounds as they are localized below the cutoff frequency of the river waveguide (Geay et al., 2017b; Rigby et al., 2016).".

13. Indeed, low frequency noises have two origins. The continuous noise below 400 Hz is probably related to turbulence induced noise around the sensor. A second type of noise (impulsive) can be observed in the spectrogram. This noise is due to some mechanical movements of the structure sharing the hydrophones. The median filter enables to filters these unwanted/intermittent noises.

Added remark on P12 Line 13: "The median procedure is used to provide better smoothing as it better filters the unwanted low-frequency noises (Geay et al., 2017a). "

14. Thanks, it has been changed. Correction: "1-2 mm" to "10-14 mm".

15. Rephrasing:

"The model Eq. (9) is valid if the acoustic propagation only takes into consideration the sound divergence models."

to the following:

"The proposed model (eq. 9b) has been elaborated by assuming a simple geometrical spreading model of the acoustic waves in the river."

16. The word "overtakes" is removed from the statement. Thanks!

17. In P15 Line 30, the word “repartition” is replaced with “range”. The statement is reformulated.

Rephrasing:

“If regression law Eq. (14) is used, then the estimated diameters run from 23 mm to 73 mm which is happening to be the repartition of all possible radii of curvature of the respective zones of contact.”

to the following:

“If regression law Eq. (14) is used, then the estimated diameters span the range from 23 mm to 73 mm which is the repartition of all possible radii of curvature of the respective zones of contact. ”

18. “Size” is linked to particles or grains which is equal to an equivalent diameter, Deq, because the real grains are not perfectly spherically. On the other hand, the terms “radius” and “diameter” are attributed to spheres. Parameter “radius” is also present in the equations of hertzian impact for sphere impacts.

19. Following the recommendations in the last point, we decided to do changes in the system of notations to clarify as much as possible the formulation. The modified version according to all of the above points is in the supplement of this comment.

Please also note the supplement to this comment:
https://www.hydrol-earth-syst-sci-discuss.net/hess-2017-171/hess-2017-171-AC1-supplement.pdf

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