We would first like to thank the anonymous reviewer for their thoughtful review. In the below document, the reviewers comments are in black; our responses to reviews are in blue italics.

This manuscript compares three different techniques to track bedforms and estimate bedload transport rates. This paper could be very useful for scientists who consider estimating bedload transport rates by bedform tracking, even though the paper does not include new methods. In general, the introduction, discussion and conclusion are very clear and informative. However, the methods and results are sometimes more difficult to read and need extra sentences to explain the concepts and how the conclusions are derived from the results. See my comments below.

Specific comments:
- P2, L30: "(also called altimeters. . .)", depending on the importance of this message, should this be mentioned earlier in the text and not between brackets?
We have removed this information from the text, because we feel "stationary single beam echosounder" is well understood.

- What is the difference between the second and third research question at the end of the introduction? It reads like it is the same question, but then the other way around.
The second question asks if changes in bedform size and shape affect measurements from different sampling methods. The third question asks how it affects the measurements. We have reworded these in the text for clarity.

- What is the possible influence of the study area on the results? In the introduction there is a distinction between shallow and deep rivers when mentioning the practical use of the multibeam and single beam, is the study area shallow or deep?
The study area is quite deep (6-9 m depending on discharge) so multibeam is a practical choice. This information has been added to the revised manuscript.

In the results, it is mentioned that there is a daily discharge variation that influences the bedform dimensions, how extreme are these discharge variations compared to other rivers and would this influence the advice in the discussion?
On a daily timescale, these changes are pretty significant compared to other rivers. That being said, sediment and water discharge conditions vary continuously in natural rivers causing bed morphology to often be out of equilibrium with prevailing flow conditions. As we state in our introduction, numerous field studies suggest that bedform disequilibrium is likely the norm rather than an exception in natural river systems (e.g., Frings and Kleinhans, 2008; Julien et al., 2002; Ten Brinke et al., 2009; Wilbers and Ten Brinke, 2003). It is for this reason that the sinusoid model was developed, to account for non-stationarity in the flow causing increases or decreases in bedform dimensions in time. The sinusoid model is suggested as a utility for such situations to minimize the error in single beam style estimates of bedload flux from stationary echosounders in unsteady flow.

- Is there an effect expected of using virtual single and multiple single beam profiles based on the multibeam data, instead of measuring it separately and thus independently in the field?
There are arguments both ways: (1) The benefit of this virtual experiment is that we know the virtual single beam echosounders are measuring the exact same bedforms the multibeam is measuring, so independent measurements might have more error. (2) That being said, real single beam echosounders can operate at a finer temporal scale than we are able to approximate in our virtual experiment. As shown by our virtual experiment, temporal resolution makes a big difference in bedload flux estimates. If independent single beam measurements were made a fine enough scale, this could greatly reduce the error. We also were limited by our field site, which has no bridge access. So at this location we were not able to take independent single beam measurements. We have added text to the discussion in regards to this question.

- Section 2.2, L11-14: fluxes caused by dunes that are not aligned perpendicular to the flow are ignored to be able to compare the results between multibeam and single beam. How much is this expected to influence the estimated bedload transport? Is this taken into account in other multibeam studies? The effect of varying dune dimensions due to disequilibrium with the flow is taken into account, should transport direction be taken into account as well?
Single beam echosounders would not be able to assess transport in other directions besides streamwise. However, the multibeam data are chosen specifically to be comparable to single beam data. As such, it isn't in the scope of any paper to look for directionality in a single beam trace.

- Section 2.2, L14: "we have chosen not to incorporate the ISDOTTv2": add a short explanation of what this method entails.
We have removed this section of the text on the advice of another reviewer.

- Section 2.2: I think the readability of this section could be improved by removing some of the information between brackets and incorporate it in the sentence. E.g. line 9-10, line 13. This might be a personal preference, but in general it feels like there is important information between brackets throughout the paper and therefore this information seems less important and less clear. Another example is the definition/cause of bedform equilibrium in the first sentence of section 2.4. I think some definitions and explanations will be clearer when this is explained in extra sentences.
We have reworded and reorganized this section for clarity.

- Section 2.3, L28: what is the physical meaning of q_e and why does it need to be added? Could you add a short explanation?
Q_e represents an area of underpredicted transport discussed by Shelley et al. (2013). The area represented by C in Shelley et al. (2013) figure 1 (see below) is not accounted for using the original method of Simons et al. (1965). q_e is the area of triangle D and therefore accounts for that missing portion. We have added a short explanation of q_e to the text. It is a very small contribution to total computed flux.

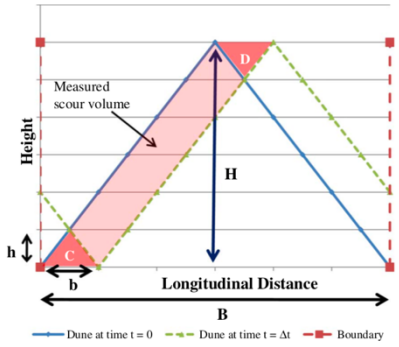

Fig. 1. Dimensions of a triangular sand dune

- Section 2.3: Is it possible to calculate an estimated average wavelength from the time series since you can estimate celerity from this? Would it differ a lot from the spatial estimate?
It's not possible to calculate an average wavelength from the single-beam timeseries because it only measures elevation through time. Guala et al (2014) showed that bedform space-time substitution in this way cannot work; imposing a relationship between the wavenumber and frequency spectra breaks down because small bedforms travel faster on average than large bedforms.

- Section 2.4: this section misses an explanation of why the bedform disequilibrium is determined Even though this is mentioned before, it would help the reader to repeat this here shortly. Furthermore, it is explained how equation 6 is used to calculate synthetic bedload transport estimates, but not how this is used to determine bedform disequilibrium.
We are empirically accounting for bedform adjustment to changing in flow (i.e. bedform growth and bedform decay). We have updated the text to reflect this.

- Where are figures 5 and 6?
Those figure references were for a previous version and were mistakenly left in this version. We apologize for the confusion and have corrected the manuscript to reflect the correct figure references.

- Section 3.2, L 24-26: how are the lag-corrected bedload transport and celerity calculated? And the errors? This might be visible in figure 5 and 6, but the pdf only shows figures 1 to 4.
Please see figure 3A for the regressions and r-squared values mentioned in page 6 lines 22-23.

- Section 3.3: I don't really understand yet how the sinusoid model is used to correct the data. I think this would be clearer if the method section 2.4 explains this better. What do you mean with the ratio between synthetic multibeam and synthetic singlebeam?
We take the ratio of synthetic multibeam bedload transport estimates to synthetic single beam bedload transport estimates and use that ratio as a correction fact for our actual measurements (i.e. multiply the actual single beam estimates by the ratio determined in the sinusoid model). We've added and reworded the text to make this more clear.

- Section 3.3, L 16: is this compared to the multibeam that is corrected for cross- correlation lag errors?
This is in the sinusoid model. We have reworded for clarity.

- Figure 4B: There is only one line for the multiple single beam? Shouldn't there be more lines for different spacings?

We only use a different spacing for the July data. You can compare the CDFs to Figure 4A for the smaller beam spacing.

Technical corrections

We have corrected the below technical corrections in the main text.

- P1, L14: There is a "?" instead of a source
- Figure1C: I do not see the grey section that indicates the area that is mapped with the single multibeam survey.
- Section 2.2, L8: Did you define BEP before this? You can for example add "(BEP)" at line 2 of this section
- Figure 2: there seems to be a caption missing to panel D.
- Figure2B: what is BEP5_2?
- Figure2C: "height vs wavelength" shouldn't this be "wavelength vs height" (Y vs X)? - Figure3A caption: "estimates"
- Figure3C caption: ""single"
- Section 3.3, Line 11: "disequilibrium" and "single"
- Discussion line 30: is "(July)" missing after the 28.3%?