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Re: tc-2020-147 Resubmission. Response to Reviewer 2 and Editor Comments.

We thank the editor and reviewer for their additional comments. In the following we reproduce these comments and suggestions in *italics* with our replies shown in plain text.

Editors Comments

Please respond to the minor concerns raised by RV-2 and incorporate the suggested editorial remarks. Please also make sure that all Figures are placed as intended. RV-1 has mentioned possibly missing Figures that appear in the response-to-reviews but did not make it into the final version (I think they did, but just make sure that this is indeed the case).

We have reviewed the figures and they all appear present and in the correct place. The reviewer may have been referring to the clustering analysis which was included in the reply to the reviewer but was deliberately not included in the resubmission. This was discussed in the reply to reviewer and further supported by Reviewer 2.

Minor edits

Eq (6) appears misplaced (should be close to l. 17 on p. 9).
Change made.

Table 2 add units.
Change made.

Table 3 add units.
Change made.

Reviewer 2 Comments

The authors have made significant changes to the original manuscript. This has improved the clarity and completeness of the paper. The authors have in general addressed the points raised in my original review with one omission as detailed below. The removal of the clustering (in response to Reviewer 1) has, to my mind, improved the manuscript by removing unnecessary distractions from the key messages. There are some important results pertaining to reliable data analysis for basal properties.

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There is still an issue with regards the free surface effect, as discussed on Page 3 of Reviewer 2 response. Shearer (2009) Eq 6.19 accounts for the amplification effect due to conservation of energy that results from the density contrast between the source and receiver depths. However, this amplification is in addition to the free surface effect which is a doubling of amplitude at the free surface due to the conservation of energy (which I would argue is still pertinent with a receiver burial depth of 0.5 m). It just so happens that all these methods rely on amplitude ratios to derive A0 and the free surface effect therefore drops out. However, for completeness it should be included, or words to this effect included, as per HA2009.

We appreciate the reviewer persisting with this comment. We have now included additional text addressing this. This additional text reads:

"H&A2009 noted that placing receivers at a free surface results in a further doubling of recorded amplitudes for normal incidence returns. We tested including free surface amplification but did not apply it to the analysis presented here due to the burial of our receivers, although the shallow burial depth of 0.5 m may justify its inclusion. If included, this additional amplification would have resulted in a halving of the source sizes for two of our methods (the multiple bounce method and the known reflector method (Sections 2.4.1 and 2.4.3, Table 1). Including free surface amplification would have had a small effect (<17%) on the direct path method source size median values (Section 2.4.2, Table 1). Regardless of whether free surface amplification is included or excluded, our choice of preferred method for estimating A_0 would not change. The recovered bed properties also would not change as the same path effects used to calculate source size are later used to estimate bed properties."

Additional minor comments

P8L23 (HA2009, Eq. 9)
Change made.

P9L18 should this be A 0 rather than R(θ)
R(θ) is correct. We have modified the sentence to add clarity.

P17 Figure 8 – for clarity plot the red tidal signal on top of the blue bars
Change made.

P18 L3 – reproduce not reproduced
Change made.

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In closing we again thank the reviewer and editor for their constructive reviews. We appreciate the time and thought that went into them.

Sincerely

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