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Dear Rafael,
many thanks for your positive and motivating review. It is very helpful to correct and clarify the manuscript along the points that you have raised. For identification of what we did, we explained the changes item-wise below.
With best regards, Charlotte.

Reply to *Interactive Comment* by R. Bartolomé

1. Numbers must match in the abstract and manuscript.

➢ We have matched the numbers accordingly (first part of chapter 2).

2. Signal generator frequencies ranges from 0.05-1kHz, and receivers have a maxi- mum sampling of 20 MHz (page 1322)……..

➢ The first mentioning of the value in the text was wrong. Thus, in accordance with the table, we corrected it to 0.5-1 MHz. This correction also resolves the questions raised in comments 3, 5, 7, and 14.

3. Transducers (page 1323)
➢ See comment on item 2.

4. with incidence angles below 35° (page 1323)
This angle limitation, and therefore maximum source-receiver offset, in the current sand-box experiments has to be considering for future experiments and a reference to that could be included in the main text by the authors.

➢ This point is important and was picked up here and also its further elaborations in comments 6 and 8. A reference is inserted in sub-chapter 2.4, and a new paragraph is added in the discussion chapter.

5. Test experiments (page 1323)
➢ See comment on item 2.

6. Test experiments (page 1323)
➢ See comment on item 4.

7. Page 1324 "Here, the source frequency varied systematically between 100 kHz and 1 MHz"………
➢ See comment on item 2.

8. Page 1325, "Due to data acquisition very near to the model surface, only this trace

provided enough sensitivity and a clear signal"

- See comment on item 4.

9. Page 1328, "The shear zone images by disruptions of the very strong bounding reflectors in the upper part" As written, is difficult to understand the meaning of this sentence.

- This is rephrased.

10. Page 1328 and Figure 8

Before and after the migration, would be interesting to perform a time variant frequency analysis of the reflections to know exactly the high frequency loss and the content of the bandwidth in reflection signals. This analysis could be included as a third column in Fig 8. This decrease of the high frequency due to the succeeding reflections could also explain the "wormy" shape, increasing in time, of the seismic images that we observe in Fig. 8, below the interface between 0.16-0.18μs, notably after migration. Migration parameters used during processing must also be included in the main text. In some cases, in order to reduce the migration PC time consuming processing, a reduced signal bandwidth is used instead of a Nyquist maximum frequency. Is this the case? Could you check migration parameters?

- The processing and migration parameters are given in chapter 4 with a filter defined there taking into account the signal spectrum. The source signal could be improved beyond, but considering the discussion and recommendations of Buddensiek et al. (2009) the acquisition geometry has some shortcomings as discussed, and the processing could be more elaborated. This way, the weak to non-existent reflections of the artificially generated shear zone could be enhanced. However, at this point we wish to demonstrate whether ultrasonic seismic imaging is feasible to image the structures relevant in sandbox modeling to a degree that this should be taken further. The true limiting factor might be the low penetration depth of 5 cm, where we have seen sandbox models achieve elevations of 15 cm and more. This is part of the discussion and explained there.

11. Page 1329 "Because of the required resolution of 1 to 3 mm"
i) Vertical resolution of a signal is calculated by $^1{}_4$the wavelength (λ). And the wave-length is calculated by λ= V/F, v= seismic velocity and F= seismic frequency
For 1mm resolution, λ/4=4V/F=1mm, then F=4V/1mm = 6*106Hz = 6 MHz. For 3mm resolution, F= 2 MHz
But during processing, a band-pass filtering of 75-125-750-800 KHz was applied. Are you sure that the resolution of the features that you are imaging is 1 to 3 mm?
ii) In the reflection seismic sections of Fig. 8, 1mm vertical spacing at 1500 m/s velocity corresponds to 1.3 μs two way travel time (twtt). Time=Displacement/velocity= 10-3 / 750 = 1.3 μs. In other words, 1 mm vertical spacing corresponds to 1.3 μs twtt. But vertical scale of Fig. 8 goes from 0.12-0.20 μs, that is, 0.08 μs thick. Could you explain why the vertical resolution (1 mm) is larger than all the vertical section May be you should distinguish between horizontal and vertical resolution in the manuscript.

➢ To distinguish the two resolution types is always good. Here, please consider the values of the experiment, then also the filtering and processing parameters are reasonable, with the scales discussed: F=v/(4*res)=1500/(4*0.001)=375 Hz and =155/(4*0.003)=125 kHz. 1500 m/s correspond to 1.500 mm/microsec. The temporal resolution is given by the sampling rate which was 0.05 microsecs.

12. Page 1330, discussion about grain surface texture and saturation.
Because I am not an expert in saturation, could there be any reason to use salt water instead of fresh water in your models? Could salt water increase sand saturation? In other words, salt water behaves like freshwater in terms of saturation? This point will be more realistic to nature (because salty sea water), although as the authors commented in the paper, algae and other organic growth is a time depending problem during the saturation process.

➢ Salt water would bear the potential to grow crystals or close smallest pores between the grains, so that we did not consider it. But we also did not test it systematically.

13. Figure 4
Bottom-right panel vertical scale (0-0.25 μs) is different from the rest of pictures in the Figure (0-0.30 μs)

➢ Yes, the recording is less long, but we showed it on a larger scale on purpose, to better reveal the tiny structures. Since reviewer M.-A. Gutscher prefers to have this clearly shown, we decided to leave the figure as it is and not to squeeze the vertical scale of panel D further down to the same size as A-C. This would be our compromise to satisfy all needs. For clarity, this is added in the figure caption.

14. Table 1
➢ See comment on item 2.