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Solid Earth
Discussions

Interactive comment on "Seismic imaging of sandbox experiments – laboratory hardware setup and first reflection seismic sections" *by* C. M. Krawczyk et al.

D. Leparoux (Referee)

donatienne.leparoux@ifsttar.fr

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The study presented in the submitted paper combines two scientific topics of Earth Sciences : the issue concerning the experimentation on analogue models for modeling geodynamic processes through a small scale sandbox and the issue concerning the small scale seismic measurement in laboratory. This combination aims to investigate inside the modeled structural medium. In this point of view, the study is novel and contribute to advances in the physical modeling issue in Earth Sciences.

About the imagery approach, I just have a general question : if your goal is to image the inner structures of the analog model, why don't you try to perform a tomographic

imagery by transmission method (inversion of first arrival times)? Actually you could use sensors all around the model.

Technical information concerning the seismic measurement device is clearly presented.

Globally, the paper structure is clear but I am not sure that the way you chose - that consists in firstly presenting the experimentation and the experimental data as very clean results and afterwards proposing a separated discussion - is the more convincing : when I read the paper, I wonder that some points were not discussed (but I found them in the discussion part) for example concerning the saturation of the model (How are you sure it is homogeneous saturated..?), the shear zone modeling, but also about the spectral content of the source signal ..etc. You could discuss these key issues when you developed the experimentation and results analysis.

About the paper content, my comments are the following ones :

the increment of the receiver and source position is very accurate (0.120 mm). If I well understand, it concerns a relative position accuracy (incremental position accuracy) but what about the absolute position? I mean, how do you know the position of your measurement device in your model reference and what is the accuracy of this position ?

You present the capacity of your measurement device for providing a 3D measurement configuration but in this case, you should involve multi-offsets acquisition in all the directions in the model surface. Thus, even if the sensor array can be moved laterally, it remains a set of 2D acquisitions. As well, the last model you investigate provide only 2D structures (channel and shear zone), thus it is not really a 3D model. You should precise it.

About the scale factor : the piezoelectric sensors are 5 mm diameter : i.e. 500 m in reality ! It provides a spatial average of recording data (like a spatial filter). Moreover,

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because of their size, these sensors are very directive and not adapted for great offset measurement. You could adapt a cone (see for example Bretaudeau et al., 2011) to minimize the impact point and to provide a more isotropic source pattern.

Please write Bretaudeau et al. (20011) without “x”

you should precise the seismic velocity and the associated wavelength in the media used. Actually a priori knowledges of the media characteristics (including the Quality Factor) are one of the advantage of laboratory seismic measurement : you should emphasize this key point and maybe discuss the way to evaluate them in an independent manner.

The temporal source used is monofrequency with an apodization. However, the signal imagery resolution depends on the frequency bandwidth. Actually, because your imagery process are done in the time domain, you should use a very short pulse, i.e. a large bandwidth in the spectral domain. This should attenuate the secondary oscillations (ringing) in the signal.

The model is very small compared to the box but do you record boundary effects in the data ?

For both your experimentation results and particularly the last one, you should present a seismic shot gather in order to expertise the different arrivals.

Why do you assert that interferometry measurement does not allow to provide structural information (interfaces) ? The laser interferometer allow to record the particular displacement at the surface of the model as the piezoelectric transducer does. I think you should precise what you mean (or correct this sentence).

You should present a structural scheme near the raw and migrated data sections for a direct visual comparison.

Interactive comment on Solid Earth Discuss., 4, 1317, 2012.