

Interactive comment on “Monitoring induced distributed double-couple sources using Marchenko-based virtual receivers” by Joeri Brackenhoff et al.

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Dear Authors, I enjoyed reading your paper and I found the topic and content very relevant for the Solid Earth community. In your paper you explain a new approach to retrieval of full wavefield subsurface-to-subsurface responses which could be used to numerically reproduce the response of a microseismic event or earthquake at any point in the subsurface given its recording only at the Earth of the surface.

This is very appealing as per today locating microseismic events is mostly done only by taking into account the first (direct arrival) and by means of traveltimes stacking (or backpropagation in a smooth model). While the first approach is very simple, it can

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directly produce as output a map (or a volume) of the events in a area of interest, on the other hand the second approach leaves us with just a wavefield in time and space and subsequent processing (i.e., imaging condition) has to be carried out to produce what is really useful (a map or volume of the events). I find your approach an evolution, or perhaps improvement, of the latter when it comes to the creation of the subsurface wavefield (as also backpropagation is effectively creating a ‘wrong’ homogenous green’s function from the unknown source location to any point in the modelling grid), in this view I feel that you are still lacking a second step to prove that having more detailed (but also complicated) wavefields is actually bringing some value in the localization of events - either accuracy or resolution or both. For this reason I believe that at least one of the numerical examples deserves special attention onto what can we actually do with these wavefields and perhaps using a standard IC for RTI and comparing its result with that produced by standard wavefield backpropagation may be enough to support your point. Otherwise I would fear that some readers may wonder if you are suggesting to monitor microseismicity by simply looking at wavefield snapshots without performing any post-processing to it.

Other than this point, I find the paper very well written, both the theory and examples are clear and easy to follow. I will be happy to recommend your paper for publication as soon as you have addressed my main comment.

Best wishes MR

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