Solid Earth
Discussions

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Interactive comment on "Obtaining reliable localizations with Time Reverse Imaging: limits to array design, velocity models and signal-to-noise ratios" *by* Claudia Werner and Erik H. Saenger

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Dear Anonymous Referee 1,

thank you for reviewing our manuscript. We carefully considered all of the comments you made and changed the manuscript accordingly. Thanks to your review we were able to improve the readability of the manuscript significantly. Additionally, we added a new set of simulations based on your suggestion which shows that an array with regular inter-station distances produces more reliable source locations then the random distributed real stations. This and additional changes you suggested are described below in the order of your comments as well as marked in the attached modified manuscript.

Additionally, changes made based on the comments by referee 2 are incorporated as well.

Please note: In the following text referee's comments are put in bold while the author's response is in normal script. Referee's comments may have been shortened for easier reading. No meaning of content was changed. Numbering of the comments of referees was kept the same.

Major comments:

1) The study suggests that more regular arrays should be better than relative asymmetric arrays. Can the authors present an array design works equally or even better than the 31-receiver irregular array?

Thank you for your suggestion. We added extra simulations with 32 regular stations, as you proposed, with the real velocity model in Southern California and found that it produces the most accurate source locations.

2) The authors improve RTI procedure by Witten and Artman (2011) using illumination map to remove artefacts from velocity models. To make readers directly known how this works, figures for one velocity model in Figure 11 before dividing illumination map, illumination map and after dividing could be presented.

This is a very good suggestion. However, we feel that the manuscript is quite long already (which was also hinted at by Referee 2) and therefore refrain from adding this additional figure. Nevertheless, we added a more direct reference to the study of Witten and Artman (2011) in which such figures are shown and discussed.

3) The authors demonstrate the imaging conditions I_e and I_p in Figure 1. But there other two imaging conditions I_s and I_d used in this study. To display the imaging conditions well to the readers, the other two should be plotted in Figure 1 as well.

We thank you for pointing out this missing information. We added I_d to the figure as

you suggested. As you can see, Id is not able to locate the source reliably in this case. There are artificial focusing spots outside the source region. Since this example shows an explosion source, Is does not show anything and we therefore omitted it.

4) To assess the effect of signal-to-noise ratio to localization quality, a set of SNRs have been used in this study. It will be better to add a noise-free results into Figure 13 as a reference for the other results derived from traces with noise.

Thank you for suggesting to add the results without any noise to Figure 13. In our opinion, this will improve the readability.

Minor comments:

Page 2 Line 8: "Conditions" should be "conditions" Page 6 Line 25: "position" should be "positions" Page 14 Line 4: "Fig.(a)" should be "Fig.14(a)" Thank you for your thorough read of the manuscript. All minor comments as mentioned above were corrected in the revised manuscript as suggested.

Page 25 Figure 2: The width of the source area may need to be labeled such as where is the wavelength of p-wave

We regret not designing the figure more self-explanatory. We modified Figure 2 and hope that it is more clear now. We rephrased the x-axis label and added the source position on the x axis. Additionally we marked the y values that are discussed in the text. However, we do not want to put an explicit distance on the x axis because this figure should just show a concept that can be applied to arbitrary models and arbitrary location errors.

Sincerely, Claudia Werner and Erik H. Saenger

Please also note the supplement to this comment:
https://www.solid-earth-discuss.net/se-2018-76/se-2018-76-AC1-supplement.pdf

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2018-76, 2018.