Solid Earth Discussions

Solid Earth Discuss., author comment AC4
https://doi.org/10.5194/se-2021-143-AC4, 2022

Reply on EC1

Tomi Jusri et al.

Author comment on "Angle-domain common-image gathers from Fresnel volume migration" by Tomi Jusri et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-143-AC4, 2022

Dear Editor,

Thank you for your patience. We have discussed your comments thoroughly.

The proposed approach is based on a homogeneous medium assumption, and therefore, it is valid for amplitude calculation only from a single reflector. Using a complex geologic model, for example, a two-reflector model, the proposed approach will not calculate the AVA curve for the deeper reflector correctly because it does not consider factors affecting the wave propagation through the heterogeneous media, such as amplitude losses and ray bending. If we want to consider heterogeneous media, we will have to incorporate another sophisticated method to allow estimating the amplitudes correctly, for example, the transport equation (e.g., Buske S., Finite-difference solution of the transport equation: First results, Pure and Applied Geophysics, 148, 565–581,1996). The inclusion of such a method is beyond the scope of our manuscript.

On the other hand, our manuscript offers a novel approach to obtaining angle domain common image gathers (ADCIGs) from Fresnel volume migration (FVM) for a simple two-layer geologic model. While we understand that the test on a more complex geologic model is essential for establishing a technique for QI in hard rocks, we strive to reach intermediate progress and a new milestone in this very challenging topic. We doubt that we can provide a more established technique soon enough for the current submission. Nevertheless, for the current submission, we can offer the following:

1) A synthetic test using a single dipping reflector, as you also mentioned, as one of the possibilities for a more complex geologic model :

"Therefore, I insist on making another synthetic example with more layers and/or complex structure (dipping reflector, wedge) to better illustrate the above issue."

2) Editing the premise of the manuscript to make it clearer to the readers from the beginning that the current experiment is limited to a simple two-layer geologic model. We will change the title, abstract, introduction, discussion, and conclusions of the manuscript for this.

Regarding the field seismic data set, we do not have proper borehole data for the AVA analysis for the geothermal area in Italy. Furthermore, since the approach is not yet valid

for a multi-reflector model, we doubt that performing AVA inversion from field seismic data controlled by borehole data will be meaningful. However, what we can offer for the current submission is:

3) Prestack analysis from the migrated field seismic data, made possible now by the proposed approach.

In conclusion, we hope you can consider the three points mentioned above sufficient for the revised manuscript. Should you be willing to consider this revision, we would like to ask for more time to submit the revised manuscript, i.e., until 31 July, when possible.

We look forward to hearing from you.

Sincerely,

Authors