

Interactive comment on “Some improvements in subbasalt imaging using pre-stack depth migration” by I. Flecha et al.

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GENERAL COMMENTS

This paper concerns an important problem in hydrocarbon exploration that has not been solved. It is clear from many field surveys that it is difficult to image below basalt layers due to their heterogeneity, both vertically and laterally. There is significant scattering of the seismic wavefield as it passes through these heterogeneous basalts, resulting in that traditional CDP stacking methods tend to fail. The authors present this problem in a clear manner and present a partial solution to the problem, namely to apply pre-stack depth migration to long-offset data. Although this approach is reasonable and has been tried in the past, the authors fail to make a strong case for the methods presented in the paper. First of all, it is not clear what is new with the method from the

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paper and, secondly, there are number of tests which should have been performed to convince the reader that something new has been done. I will elaborate on these tests below. The paper certainly has the potential to make an impact, but the reader needs more convincing of the effectiveness and novelty of the method.

SPECIFIC COMMENTS

I see three points that need to be addressed before the paper can be published.

1. In spite of the good summary concerning the difficulties in imaging through basalts due to their heterogeneity, the authors chose a very simple model to test their migration technique on. There is neither vertical, nor horizontal heterogeneity included in the basalt layer. The authors need to generate a more realistic model to test their migration method on. Preferably they should choose a model similar to the geology they believe they are trying to image. Suitable horizontal and vertical scales for the basalt heterogeneity can be found in the literature.

2. The authors claim they have an improved pre-stack depth migration routine. If so, they should test it against an existing pre-stack depth migration routine. The authors should have such routines available to them in commercial software packages. I know of at least one package that uses the eikonal equation to calculate traveltimes. It may be that the presented method handles long-offset data better than the available methods (it probably does), but this needs to be shown to the reader.

3. The authors compare their pre-stack depth migration results with conventional CDP stacking. The former appears to show a better image below the top of the basalt. However, it is not clear if the same data have been used as input. The paper states that only the 1st pass data were used for the CDP stacking. Was more data input into the pre-stack routine? The authors should input the same data into their comparison of the methods. If this has already been done then this should be stated. The CDP stacking method is very powerful in imaging sub-horizontal interfaces and should be given a fair chance. Furthermore, the authors should depth convert the CDP stacked

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section and plot it with the same parameters as the pre-stack depth migrated section. It is difficult to see anything in the CDP stack due to choice of plotting method.

TECHNICAL CORRECTIONS

There are several spelling and numerous grammatical errors in the paper that need to be addressed. I have noted many of these on a paper copy that I can make available to the authors upon request. The native English speaking co-author should go through the paper.

Geographic directions (NW and SE) should be included in Figure 5.

Interactive comment on Solid Earth Discuss., 2, 1, 2010.