Anonymous (Referee #1)
Review of "Revealing the deeper structure of the end-glacial Pärvie fault system in northern Sweden by seismic reflection profiling" by Ahmadi, Juhlin, Ask, and Lund

The paper presents new results regarding imaging the deep geometry of crustal faults related to end-glacial faulting. This imaging is important for understanding the faulting processes and it is critical for future studies involving e.g. drilling. The onshore reflection seismic profiling is state-of-the-art and of high quality. The processing of the data is challenging and very critical for the imaging of the fault zones. The paper will be interesting to readers who focus on reflection seismic imaging or on post glacial rebound and faulting. Illustrations are generally of high quality and they are all needed.

Points regarding the imaging of the faults:
Dear Sir/Madam, we would like to thank you for your comments. In the following paragraphs, we reply to each comment:

Some more details regarding the recording geometry and choice of NMO velocity should be given.
Although the recording geometry and seismic acquisition is explained in the seismic acquisition section, we added more details to Table 1 to clarify our seismic experiment.

Moreover, more arguments for choosing the very high NMO velocity of 13000 m/s should be presented. The exact choice of stacking velocity should have a major impact on the strength of the fault reflections.
In this study, we aimed to enhance dipping faults in the area. An extensive velocity analysis was performed and finally an NMO correction with a high constant velocity of 13000 m/s resulted in the best image. This description is now added to the text.

In Figure 5, R1 is very strong compared to R3. Does a different choice of NMO velocity result in stronger R3 reflectivity compared to R1?
Given that NMO velocity should scale by the inverse of the cosine of the dip, then the 13000 m/s choice is consistent for reflections dipping at 60 degrees. This is now mentioned in the text.

Will a reduced NMO velocity (e.g. 6000 m/s) result in better imaging of sub-horizontal reflectivity in the crust? Imaging of sub-horizontal reflections would potentially allow for estimation of vertical throw across the fault zone, depending of course on the vertical resolution. These aspects should be tested and discussed.

As it was explained before, the high constant velocity model gives the best result. Although with using low velocities (e.g 6000 m/s) it is expected to image sub-horizontal reflections, but this is not the case with this dataset. We have tried to explain this in the processing section. In below an NMO stacked section with low velocities and its corresponding migrated section are shown. The sections show that it is not effective to use low velocities to enhance either sub-horizontal reflections or steeply dipping faults.

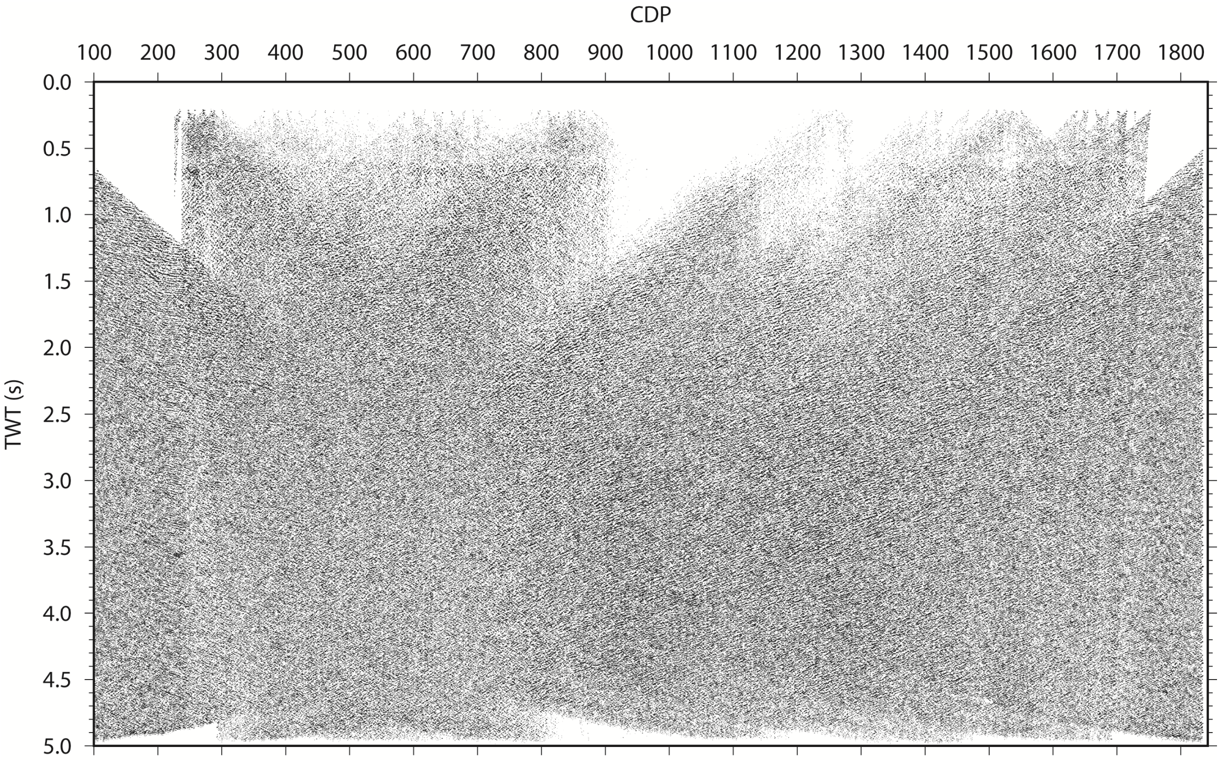

Figure 1. NMO stacked section with low velocities.

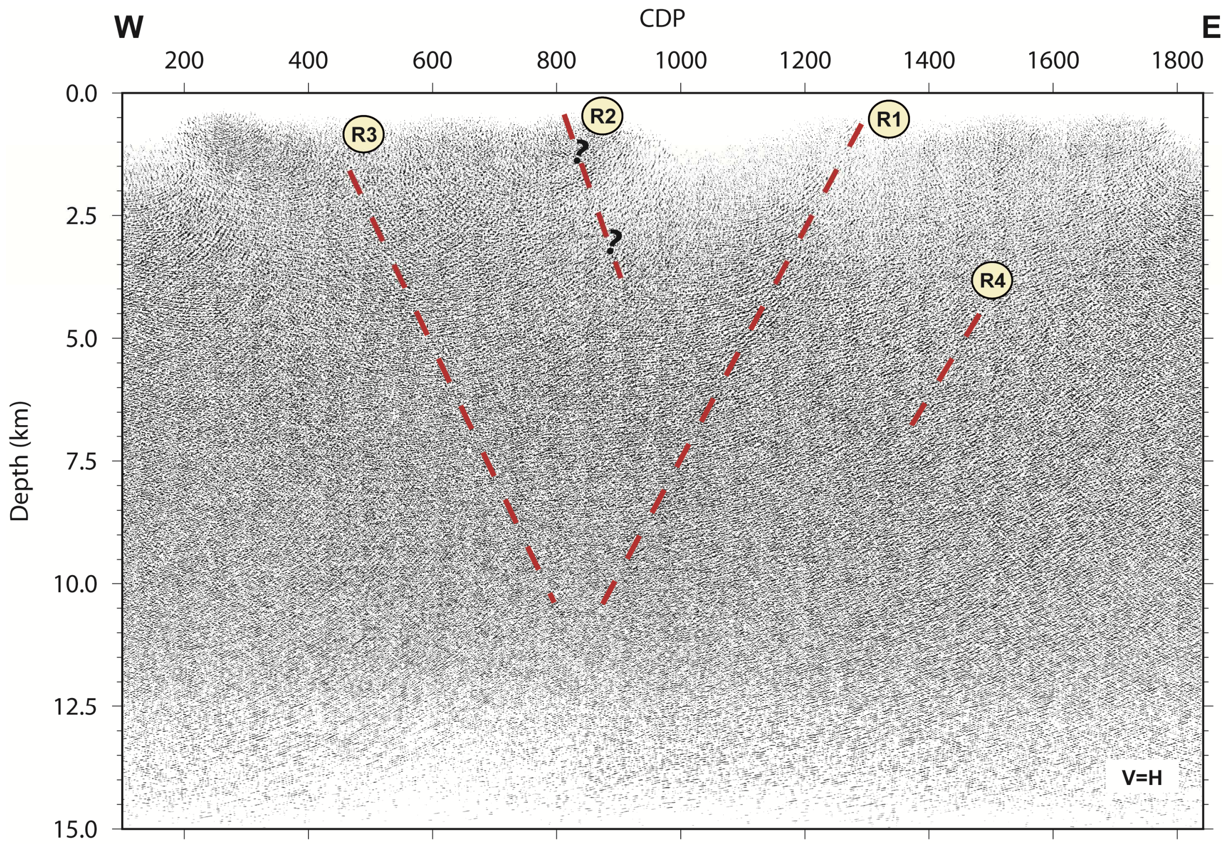

Figure 2. Migrated section with low velocities.

The authors suppress frequencies below 15 Hz during their processing of the data? Why? Other studies (in particular in areas with sedimentary covers) indicate that frequencies of 8-10 Hz propagate over large distances in the crystalline crust and carry much information. Does the low-frequency part of the data not carry any information of importance for the fault imaging?
In the pre-stack processing of the data, we applied a band-pass filter with a frequency range of 10-20-100-150 Hz. This frequency range was the most effective range to suppress noise and the ringing signals. Following the pre-stack filter, a filter with a range of 15-25-90-120 Hz resulted in the best stacked section.

Other points:
With reference to other studies, it is argued that the Pärvie fault system is related to last glaciation of the area. Is there any evidence (e.g. in the new data) that the fault system was active also during previous events?
We would need much higher resolution data across the faults to study this question.

A brief mentioning of the amount of post glacial rebound of the studied region is in my opinion needed in the introductory part of the manuscript.

The current rebound rate is approximately 7.7 mm/yr in the Pärvie area. We do not have empirical data for how much rebound there has been in the area. Estimates for the central depression under the former ice sheet (in the Bay of Bothnia) is 600 – 1000 m vertical displacement (Mörner (1980), Balling (1980), Fjeldskaar (1994), Lund et al (2009) and our models would predict 250 – 370 m for the Pärvie area. We added text on the uncertain amount of rebound in the area.

Add to the text: "The amount of vertical displacement of the Pärvie region under the former ice sheet is not known from observations. Models indicate that it could have been on the order of 250 – 400 m (Lund et al., 2009)."

Balling, N.,1980.The land uplift in Fennoscandia, gravity field anomalies and isostasy. In: Mörner, N.-A.(Ed.), Earth Rheology, Isostasy and Eustasy. Wiley & Sons, pp. 297–321.

Fjeldskaar, W.,1994.The amplitude and decay of the glacial forebulge in Fennoscandia. Nor. Geol. Tidsskr. 74, 2–8.

Mörner, N.-A.,1980.The Fennoscandian uplift: geological data and their geodynamic implication. In: Mörner, N.-A.(Ed.), Earth Rheology, Isostasy and Eustasy. Wiley & Sons, pp. 251–284.

The last 7 lines of the Introduction sound more like conclusions. These lines should be re-formulated or moved to a different part of the manuscript.

The text is re-written and modified.

On lines 3-5 on page 540 (and in other places), I would write: "deeper-lying" instead of "deeper lying", "east-dipping" instead of "east dipping", and "west-dipping" instead of "west dipping".

Followed.

It is not clear whether or not Figures 5 and 7 are plotted with the same horizontal axis. These two figures should be plotted with the same horizontal axis to allow for direct comparison.
The figures are plotted in a way to fit in an A4 paper. Since in Figure 7, small portions of the previous seismic profile have been shown, therefore it is not possible to plot them with the same scale which is used for the bigger section in Figure 5 (either the figures will be too small or big!). CDP numbers for both the new and old surveys are shown in Fig. 7, this should help readers to correlate these two figures.