Solid Earth
Discussions

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Interactive comment on "Studying local earthquakes in the northern Fennoscandian Shield using the data of the POLENET/LAPNET temporary array" *by* O. A. Usoltseva and E. G. Kozlovskaya

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We thank Anonymous Referee #2 for constructive comments on our manuscript and useful references. We have performed additional calculations, changed text, tables, figures, carefully incorporated all the comments and suggestions into the revised manuscript attached below. The revised parts are highlighted by red.

1) Reading the manuscript clearly shows that many parts of northern Fennoscandia are not investigated in this study. The authors should change title and text accordingly.

[Reply] We changed the title and the text as proposed.

2) Some relevant literature has not been cited (e.g., Bungum et al., J. Geol. Soc., 167, 373-384; Lindholm et al., Geol. Soc. London, Special Publication, 167, 429-439,2000).

[Reply] We have added the recommended citations of the papers of Bungum, Lindholm, Lund and others.

3) The usage of the words accurate and precise is mixed up. Please check this and change it according to e.g., Bormann et al., Glossary of interest to earthquake and engineering seismologists, DOI: 10.2312/GFZ.NMSOP-2_Glossary 7, C1914–C1916, 2016

[Reply] We have checked the usage of the words accurate and precise.

4) To the discussion about the amplitude behaviour of P onsets (page 5/6) one should mention that these amplitudes are influenced by the radiation pattern of the respective earthquakes.

[Reply] We have changed text.

The local explosion (Fig. 3c) with ML=1.1 has less distinct first arrival of S-wave, that is explained by complex source mechanism as explosions are usually done in series. For deep earthquake we observe strong S-wave arrivals and weak P-wave arrivals at distances less than 100 km from the epicentre. These amplitudes are also influenced by the radiation pattern of the earthquake."

5) Page 6: Why was the 6-layers model changed to constant velocities? This should be explained.

[Reply] This part of the text was misunderstood. In Janik et al. (2009) model consists of 6 layers in the crust and 2 layers in upper mantle, in which velocities in each layer are constant. In our work we use a simplified version of this model (Table 1) with 5 crust layers and 2 mantle layers. Two upper layers were replaced with one single layer

because of their small thickness (0.5 and 0.8 km).

6) The first paragraph on page 9 has to be explained better. What data sets are giving more accurate solutions? How are you deciding what solution is more accurate? The RMS value has always to be seen in context to location uncertainty and the number of used data points. If a solution including S gives a similarly accurate location than with less data (P-only), the solution based on more observations is to be preferred.

[Reply] We agree that the solution based on more observations is to be preferred and therefore we have relocated our hypocenters using first arrivals of both P and S waves. The correspondent changes are made in Table 3 and in text of chapter Relocation.

7) Page 9, paragraph 2: I am not surprised that the acoustic amplitudes at different sites in different azimuth directions from the source are different: it is well documented that infrasound amplitudes are strongly depending on weather conditions (wind directions, temperature).

[Reply] We have added the text: This is explained by strong dependence of acoustic wave propagation on weather conditions.

8) Page 10, last paragraph: determination of an event depth is in principle quite difficult, in particular if you have no very close by stations. I refer here to Havskov et al., Seismic Source Location, DOI: 10.2312/GFZ. NMSOP-2_IS_11.1.

[Reply] For deep events we have estimated how many stations and observations are at the distances less than 2 times the depth

2007/06/09 2:52 UTC – 4 stations, 8 observations

2007/10/03 12:26 UTC – 1 station, 2 observations

2008/03/26 10:55 UTC – 3 stations, 5 observations

2008/09/22 14:30 UTC – 2 stations, 4 observations

2008/11/09 17:00 UTC – no data

2009/01/29 22:20 UTC – 4 stations, 8 observations

2009/03/12 22:42 UTC – 3 stations, 6 observations

The correspondent text is added to the manuscript. Also we added one figure in Supplement that shows the relations between the depth and the RMS. This analysis was used to investigate the depth determination stability.

9) Page 11 and Fig. 11: The data for the focal mechanisms are limited and the shown solutions are just one possibility. Please show in Fig. 11 the whole range of possible solutions (uncertainty range) and take them in account when discussing the results.

[Reply] We have deleted from manuscript information about deep event and present the mechanism for the shallow event with better quality of focal mechanism. We present the area of acceptable solutions and distribution of acceptable dip, strike and rake in the Fig.11. We have performed and described the test connected with reliability of solution. Probably more reliable results may be obtained with the help of amplitude S/P and surface wave in our future work.

10) Page 13: I am surprised that the station corrections resulting from VELEST are correlating with station elevations. The standard procedure to locate seismic events is Discussion Paper to apply elevation corrections from the beginning (see Havskov et al., Seismic Source Location, DOI: 10.2312/GFZ. NMSOP-2_IS_11.1). Was this not done? Then the relocation results have to be regarded with care.

[Reply] In our study the elevation corrections were applied in a standard way. In most cases, according to Kissling, (1988), the station corrections should reflect the basic features of surface geology and can be considered as an additional information about the study area. That is why we decided to present them separately in the topographic map.

11) Please check (or have the manuscript checked) the English: I found e.g., Finnish-

Swedish boundary (instead of border) or strike-sleep faulting (instead of strike-slip).

[Reply] We have corrected these mistakes and checked the text one more time.

Please also note the supplement to this comment:
http://www.solid-earth-discuss.net/7/C2018/2016/sed-7-C2018-2016-supplement.zip