

Reply to the interactive comment by G. Alguacil on “Influence of high-latitude geomagnetic pulsations on recordings of broad-band force-balanced seismic sensors” by E. Kozlovskaya and A. Kozlovsky

We are thankful to Prof. G. Alguacil for the valuable comments. Indeed, there could be also other possible mechanisms for frequency-dependent influence of geomagnetic pulsations on broad-band force-balanced seismic sensors. In order to investigate all possible mechanisms, one needs more information about seismometer construction than that is available for ordinary users of such seismometers. But this problem certainly deserves more attention from broad-band seismometers developers.

In our study we used recordings of three permanent seismic stations only, because these stations are collocated with magnetometers. One of the purposes of our paper was to demonstrate how recordings of magnetometers could be used to remove the effect of geomagnetic pulsations from recordings of broadband seismic instruments. In order to make proper correction for this particular type of geomagnetic disturbances, seismic and magnetic instruments should be located at a short distance from each other, as it is discussed in our paper.

It is not correct to say, however, that these stations have some particular installation conditions. There exist a number of requirements concerning construction of a pier for a seismometer at permanent station (see, for example, <http://seismo.berkeley.edu/bdsn/instrumentation/guidelines.html>, or recommendations for seismometer vault construction in the New Manual of Seismological Observatory Practice (Chapter 7)). Namely, it is recommended that a seismometer pier to be constructed from the finest concrete, without reinforcing it by steel elements. All the piers at stations considered in our study are constructed in accordance with these general requirements. However, there is no such strict requirement that a vault surrounding the seismometer pier should contain no ferro- and ferrimagnetic materials. The latter requirement is obligatory for magnetometer installations only. That is why there exist a lot of seismic stations around the world installed in abandoned mines, tunnels and other underground facilities, in which steel reinforced concrete and other metallic constructions are widespread. Such installations are popular, because they provide stable temperature conditions for broad-band seismic instruments. Among them, the SGF station is installed in abandoned underground facility, where the walls of a cave are covered by steel reinforced concrete and the cave itself is located behind the massive metallic door. This site has very stable temperature conditions, but not the best ones from the point of view of geomagnetic field influence.

Prof. Alguacil has also pointed out that our results may be not representative of the general influence of magnetic disturbances on BB seismometers, because only few seismic stations were used. As we wrote above, the main reason why we considered only those stations is that these stations are collocated with magnetometers. However, the effect of geomagnetic pulsations can be noticed also in recordings of other types of broadband instruments installed in Polar

regions. As an example, we would like to show geomagnetic pulsation event on 4.09.2008 recorded by the POLENET/LAPNET temporary array in northern Fennoscandia (Kozlovskaya et al., 2011). In the plot below we show recordings of several types of broadband seismometers. As can be seen, the geomagnetic pulsations are affecting all instruments, although the recordings have different frequency content depending on instrument response. We did not use the data of this experiment in our paper, however, because the stations of the array were not equipped by collocated magnetometers.

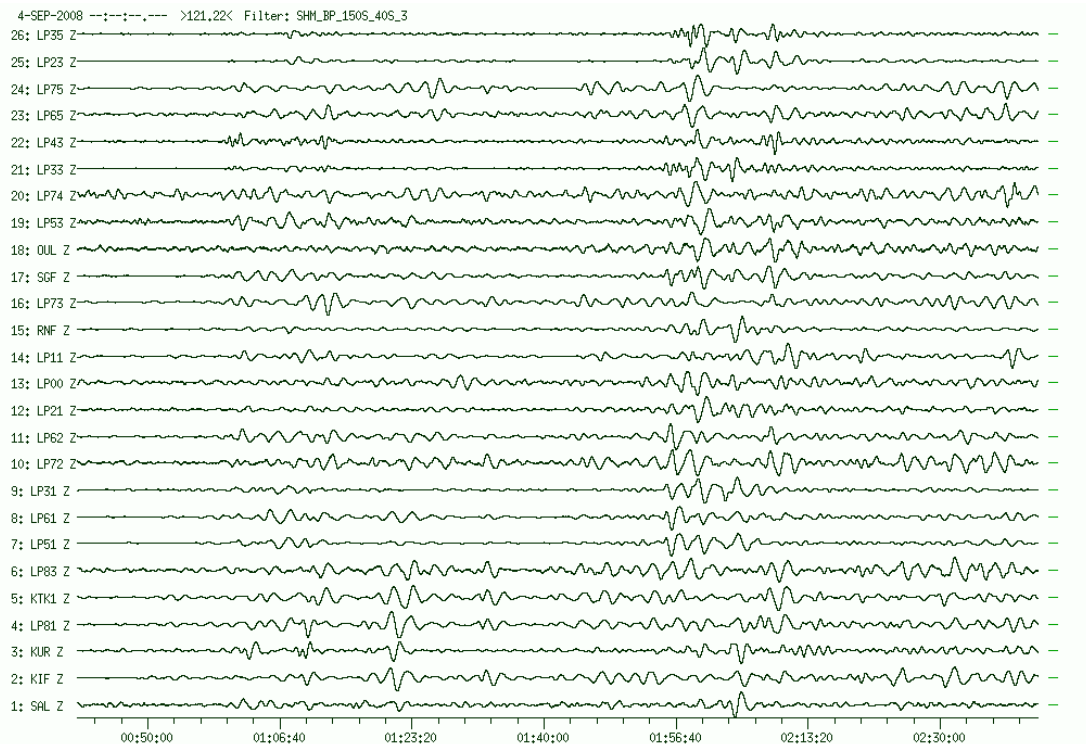


Figure 1. An example of geomagnetic pulsation event recorded by the POLENET/LAPNET seismic array in northern Fennoscandia during the International Polar Year 2007-2009 (<http://www oulu.fi/sgo-oty/lapnet>). Vertical components are shown. The recordings are filtered by the 3<sup>rd</sup> order Butterworth bandpass filter. Most of the stations shown were equipped with the STS-2 seismometers. Permanent stations SAL and KUR of Swedish National Seismological Network and temporary stations LP33, LP43 and LP35 were equipped with the Guralp sensors of different types (see <http://www oulu.fi/sgo-oty/lapnet/stations>).

#### Reference

Kozlovskaya Elena, Alexander Kozlovsky and the POLENET/LAPNET Working Group Team, 2011. Problem of misinterpretation of geomagnetic pulsations recorded by broadband seismometers as seismic signals: possible solutions. Geophysical Research Abstracts Vol. 13, EGU General Assembly 2011. EGU2011-12765.