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Problem of misinterpretation of geomagnetic pulsations recorded by broadband seismometers as seismic signals: possible solutions

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It is known that seismic broad-band sensors with electromagnetic feedback are sensitive to variations of surrounding magnetic field, including variations of geomagnetic field. This problem is of high importance for seismic observations in polar regions (above 60 deg magnetic latitude), where the geomagnetic field is often disturbed and magnitudes of natural magnetic disturbances may be two or even three orders larger than those in the middle and low latitudes. From these disturbances, regular Pc3,4 and irregular Pi2 ultra-low frequency (ULF) magnetic disturbances (geomagnetic pulsations) may create a serious problem for monitoring of glacial earthquakes; particularly if the recording station is located in the vicinity of auroral area. The glacial earthquakes from Greenland and Antarctica generate seismic signals depleted in high frequencies and having dominant periods between 35 and 150 s that are seen in seismograms as transient pulses of duration of 10-20 min (Ekström et al., 2003, Wiens et al., 2008). As the Pc3,4 and Pi2 pulsations have essentially the same periods, they can mask true signals from glacial earthquakes (Pc3,4) and even result in false detections (Pi2).
In our study we investigated the effect of geomagnetic pulsations on different types of seismic broadband sensors and propose how the misinterpretation of geomagnetic pulsations as seismic signals can be avoided. For this we use recordings of the POLENET/LAPNET temporary array in northern Fennoscandia that was in operation during the International Polar Year 2007-2009. Most of the stations of the array were equipped by broadband sensors. To investigate sensitivity of different sensors to geomagnetic pulsations, we compared the recordings of POLENET/LAPNET stations to the data of magnetometers of the IMAGE network located in the same area. Our result shows that all types of broadband sensors used in the POLENET/LAPNET are sensitive to geomagnetic pulsations, although this sensitivity varies both between instruments and sites.
Simple comparison of recordings of seismometers to data of magnetometers deployed in the same area is an efficient way to avoid misinterpretation of Pc3,4 and Pi2 pulsations as seismic signals. Moreover, if the seismometer and magnetometer are collocated, then recordings of magnetometer can be used to remove the effects of these disturbances from seismic recordings. However, there is no reliable way to distinguish long-period signal from glacial earthquakes from recordings of Pi2 pulsations, if the single station is used for glacial earthquakes detection and if there is no additional magnetometer control. Analysis of the array data based on apparent velocity of propagation, event duration at different stations of the array and changes of polarity can help to recognise the Pi2 pulsations in seismic recordings and to avoid misinterpretation.