

Interactive comment on “The results of experimental studies of VLF–ULF electromagnetic emission by rock samples due to mechanical action” by A. A. Panfilov

Anonymous Referee #1

Received and published: 11 February 2014

Dear Author, I see a lot of technical work in the preparation of tests on rock with three different types of mechanical stress. There is the preparation of numerous samples but also the development of three experimental apparatus and as many instrumental settings. Perhaps this is why arises some questions on the ambiguity I see in the definition of the instrumental parameters and analysis. Also were obtained three heterogeneous groups of experimental results that rightly were compared between them but maybe the study of each of them does not seem to thorough. In particular the results of tests of gradual loading could be more widely investigated, especially if compared with the literature.

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———— Page 7823; Lines 3-5 ————— “Laboratory experiments show that rocks, even those that do not contain piezoelectric materials. . .”.

It is not correct to speak of materials. We speak of piezoelectric minerals. The minerals are contained in rocks. The rocks can be considered "material" but they contain a mixture of minerals, some of which may have piezoelectric properties.

I invite you to see a paper, that you have not mentioned, that says the same things about signals in the rocks that do not contain piezoelectric minerals and also describes the signals that you have observed in the gradual loading tests: Nardi, A., Caputo, M.: Monitoring the mechanical stress of rocks through the electromagnetic emission produced by fracturing, Elsevier, International Journal of Rock Mechanics & Mining Sciences, 46 (2009) 940–945.

———— Page 7824 ———— There is confusion about the instrumental parameters. It is stated that:

- 1) “Antenna was connected to a signal amplifier with operating frequency band 1–200 kHz;”
- 2) “the amplifier was linked to the analog-to-digital converter of a computer.”
- 3) “The recording of the signal was carried out via the sound card (frequency bandwidth 10–24 000 Hz)”
- 4) “The monitoring was held in 10–30 kHz range”

From (3) affirmation, it can be assumed that 24 kHz is the Nyquist frequency of a sampling performed at a frequency of 48 kHz (compatible with the sound card). But from the sentence (2) it seems that it has not been used any filtering before of the sound card and yet from (1) the amplifier has a bandwidth greater than the bandwidth of sampling (3). If so, is there no risk of aliasing on the signal being analyzed?

Furthermore, given the assertions (1), (2) and (3) what does it mean then (4)? Because

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the upper limit is 30 MHz? In the graph (C) of Figure 3 on page 7836 it shows the signal over the frequency of 24 kHz. This is compatible with the statement (4) but incompatible with the (3).

In a nutshell: it would be necessary to clarify whether the signal has been filtered before sampling, specify what was the frequency of sampling and determine the instrumental and analysis parameters.

————— Page 7827; Lines 3-4 ————— It reads as follows: "The appearance of series of repetitive weak peaks (Fig. 6) on certain frequencies, before and after EM impulses emitted, during samples fracturing stays not understood".

Once again recommend you see this job: Nardi, A., Caputo, M.: Monitoring the mechanical stress of rocks through the electromagnetic emission produced by fracturing, Elsevier, International Journal of Rock Mechanics & Mining Sciences, 46 (2009) 940–945.

In this work were observed two types of pulses: disordered sequences with high intensity and ordered sequences with low intensity. Did you see both in your Figure 6 on page 7839. In particular, the signals so called "OIS" seem your "repetitive weak peaks". Are they really the same signals?

It would be extremely interesting to know if you have observed the same signals as described in Nardi et Caputo 2009. Is it a correspondence with their description? If so, it is important to clarify if you have observed these signals exclusively in the tests of gradual loading or even in the tests of impact and friction. In any cases, this ascertainment represents a further step in the research.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 7821, 2013.