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Interactive comment on "Features of the Earth surface deformations in Kamchatka peninsula and their relation with geoacoustic emission" *by* I. A. Larionov et al.

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Dear Yury V. Marapulets and Igor A. Larionov,

thank you for your reply. I would like to comment on one item.

Vibrations propagate through soil and damp off after a suitable distance. If damping occurs excessively rapidly, it is useless to monitor such a vibration. Damping depends on frequency. As a thumb rule, it is likely to expect that a vibration affords to propagate at some reasonable distance, only if (order of magnitude) the typical size of soil inhomogeneities is smaller than the vibration wavelength.

As far a sedimentary soil is concerned, signal propagation is eventually much more effective due to either one (or both) of two physical processes.

On the one hand, sediments can be compacted and substantially "rigid", due to some lithostatic pressure which could be either operative at present, or have been operative during some geological past.

On the other hand, sediments can be hydrated. In this case, they are not an efficient source of vibration, but they have an excellent conductivity. You carry out measurements inside a water well. This is an excellent way to ensure an almost perfect acoustic contact between the soil environment and your detector.

In this way you afford to detect all signals which are generated somewhere within soil, inside a suitable volume around your measuring device.

For instance, you mention that there are "big stones up to the depth of 50 meters". As far as some comparatively high frequency (HF) is concerned, even one "big stone" (how big?) can be a source of such an HF AE. This occurs because some low frequency (LF) vibration triggers the generation of HF AE inside the "big stone".

That is, the "big stone" behaves like some kind of efficient natural "probe" that detects LF soil vibration by generating HF AE that you can detect.

But, a source for HF AE can also be the compacted (?) soil below 50 m depth etc.

In either case, HF AE eventually propagates through the either compacted or hydrated soil, until it reaches your detector and recording device.

That is, soil is an environment crossed by several HF AE signals that you can detect by your instruments, and that are originated by some unknown source, or by several sources.

Therefore, an important point stressed by your investigation is the strict need for simultaneous records of different frequencies.

My point, however, deals with the information that can be provided by different frequency bands.

Comparatively lower frequencies denote the different propagation efficiency of soil. Soil damps off, or selects, different spectral bands. In addition, these records result to be eventually more or less correlated with some macroscopic deformation, such as either records by tiltmeters or extensometers etc., or seismic activity etc. That is, by this you monitor the evolution of the soil environment on some comparatively large spatial scale.

In contrast, comparatively higher frequencies monitor the formation of microcracks inside some rigid component of the system. In this way, they can be an effective diagnostic tool to monitor the progressive ageing of some solid structure underground. This is the typical information that is needed in order to monitor the loss of performance of some local "elastic" structure, which is accumulating a harmful local amount of potential seismic energy.

That is, these comparatively higher frequencies are relevant in order to monitor the evolution of local structures that might be the source of a future local earthquake. In contrast, the comparatively lower frequencies are an effective way to investigate the large-scale propagation of vibrations originated at some large distance and that propagate through soil, which can be either sedimentary or not, either compacted or not, either hydrated or not, etc. But, on an intuitive although reasonable ground, this information seems to be less relevant as far as the study is concerned of earthquake or volcanic precursors.

Summarizing, while I express my sincere real appreciation for your investigation, I just want to stress that the comparatively higher frequencies are diagnostically more effective, and I want to emphasize again the great merit of your investigation by using several frequencies.

This appears to be a rare merit and a presently unusual way to approach these prob-

lems. In general the literature is concerned with seismic frequencies, which typically can propagate through the planetary scale when they are sufficiently intense. Otherwise, papers mention AE, recorded by some piezoelectric transducer, basically with no concern about what frequency range is being recorded.

During comparatively very recent years, a large literature is appearing dealing with previously unusual frequency ranges, including e.g. slow earthquakes, hum, seismic free oscillations of the Earth, etc.

That is, it appears that the realm of the study of mechanical vibrations of solid Earth is still in its infancy, while everybody seems to feel safe inside the niche of paradigms and of "generally agreed" believes, or inside an obsessive and repetitive recording of seimic signals with no real new achievemment of understanding.

But science is made first of all of unprecedented observations. You must read first the book written by Nature and only later on the books written by men (Leonardo da Vinci).

Congratulations again for your study.

Giovanni P. Gregori

Interactive comment on Solid Earth Discuss., 6, 2401, 2014.