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Observations of the inverse seismoelectric effect of the second kind during electrical sounding in the Central Sakhalin fault zone

[1*] Leonid M. Bogomolov, https://orcid.org/0000-0002-9124-9797, bleom@mail.ru
[2,1] Dmitry V. Kostylev, https://orcid.org/0000-0002-8150-9575, d.kostylev@imgg.ru
[1] Natalya V. Kostyleva, https://orcid.org/0000-0002-3126-5138, n.kostyleva@imgg.ru
[1] Sergey A. Gulyakov, https://orcid.org/0009-0001-7924-6972, gulyakov_97@mail.ru
[1] Ilya P. Dudchenko, https://orcid.org/0000-0002-4967-7405, ilpadu@mail.ru
[1] Pavel A. Kamenev, https://orcid.org/0000-0002-9934-5855, kamepav@mail.ru
[1] Nikolay S. Stovbun, https://orcid.org/0009-0004-1927-798X, nikolay19972016@gmail.com

[1]*Institute of Marine Geology and Geophysics of the Far Eastern Branch of RAS, Yuzhno-Sakhalinsk, Russia*
[2] *Sakhalin Branch of the Federal Research Center of Geophysical Survey of RAS, Yuzhno-Sakhalinsk*, *Russia*

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Abstract. The results of experiments on electrical sounding of the near-surface layer of the Earth's crust in the fault zone, which have involved a recording of seismoacoustic and seismic noise in the close zone near the source (the primary dipole source), are represented. The experiments were carried out in 2021–2022 in the southern part of the Central Sakhalin fault with the use of the generator of electric pulses developed at IMGG FEB RAS, output electric power being up to 3 kW. The aim was to reveal seismoacoustic signatures of the medium reaction to the soundings with current pulses of 5–13 A. The generator provided significantly higher current in the dipole than its typical characteristics in the case of soundings for electrical exploration by resistance methods, as well as in the case of conventional seismic and electrical exploration. At the same time, the range of current amplitudes was much smaller in comparison with the case of a deep sounding based on application of geophysical MHD generators or other extra high-power electric pulses units. Up to now, the inverse seismoelectric effect has remained practically unexplored at currents in the “intermediate” range of ~10 A and scale lengths of the order of few hundreds of meters. The presence or absence of the medium reaction to electrical soundings was distinguished by the records of molecular-electronic sensors developed by R-sensors LLC: the CME-6111 broadband seismometer and the hydrophone, installed at a distance of about 50 m from one of the poles of the electric dipole source. An increase in the average level of seismoacoustic noise during electrical soundings was revealed, which is essentially a variety of the inverse seismoelectric effect of the second kind (excitation of elastic waves during an electric current run in a two-phase medium). Previously, no similar signature of medium reaction to the current pulses was noted in the close zone adjacent to one of the dipole electrodes. The noise level increase occurs almost without delay after the start of electrical soundings, and this is in accordance with the previously obtained results on the responses of seismic acoustic emission to powerful current pulses, which were used for a deep sounding in the Northern Tien Shan.

Keywords:

electrical sounding, seismic noise, medium seismoacoustic reaction, seismoelectric effect

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