Electric field variations due to resonance between ground velocity and ions motion in the Earth's magnetic field

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We have so far observed clear electric field variations coincident with the passage of seismic waves. Circular polarization of electric field is the distinguishing feature in this phenomenon which can be interpreted in terms of the so-called seismic dynamo effect proposed by Honkura et al. (2009). That is, circularly polarized electric field is caused by resonance-like motion of ion in groundwater under the Earth's magnetic field. Therefore, left-handed and right-handed circular polarizations, if seen towards the direction of the magnetic field, are associated with anions with negative charge and cations with positive charge, respectively. Such polarization may be inconsistent with seismoelectric signals due to the electrokinetic mechanism, because they are mainly found in the direction of transmission of seismic compressional waves, as pointed out by Strahser et al. (2007) who examined polarization of seismoelectric signals by recording the three components of electric field. However, many persist in their view that even circular polarization of electric field can be interpreted in terms of the electrokinetic mechanism. Therefore, further convincing evidence is required to support the seismic dynamo effect. On 25-26 July 2011, an experiment for studies of crustal seismic structure was made in central Japan. We carried out simultaneous observations of ground velocity and electric field on this occasion at three sites near a blasting point using 50 kg of dynamite; about 280 m east-southeast, about 190 m east, and about 360 m northwest from the blasting point. Taking into account typical frequencies of ground velocity for artificial earthquakes by blasting higher than those for natural earthquakes, we used data loggers with sampling rate of 1 kHz and could obtain the waveforms of ground velocity and electric field very clearly. We show characteristics of electric field variations, their dependence of azimuth angle with respect to the blasting point, and frequency response functions.