

Some characteristics of electric field variations generated by ground velocity due to blasting

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We have demonstrated many examples of electric field variations in association with earthquakes and also with artificial blasting: one typical example is a circular polarization of electric field, as was found for the first time for aftershocks of the earthquake of magnitude 6.9 (JMA), which occurred in 2007 off the coast of the Noto Peninsula, and then for aftershocks of the 2008 Iwate-Miyagi Inland earthquake of magnitude 7.2. Such a circular polarization could be well interpreted in terms of resonance of motion of one kind of ion in the groundwater with the seismic wave. Another typical example is a linear polarization of electric field, but so far we have been unable to interpret this. Also, arrival of electric signal earlier than seismic signal, which should be expected from the proposed mechanism of seismic dynamo effect, has not yet been established, although slightly earlier arrival was recognized in the case of M5.2 aftershock of the Iwate-Miyagi Inland Earthquake. In association with blasting experiments recently made in some areas, we made electric field observations and found three typical cases for nearly the same waveform of the dominant UD component of ground velocity; a circular polarization, a linear polarization and earlier arrival. We first try to interpret a linear polarization of electric field in terms of a combination of two kinds of ions. Motion of each kind of ion should respond to the magnetic field, but the response of respective ions to the electric field should be for the resultant electric field created by two kinds of ions. Hence the basic equation must be modified. If a pair of positive and negative ions is considered, the electric field polarization for a positive ion is clockwise, whereas it is counterclockwise for a negative ion, resulting in cancellation in a certain direction and hence in a linear polarization. As we expect, a linear polarization is realized, but the direction of polarization turned out to be slightly different from the observation, implying contribution of other kinds of ions may be involved. Finally we show a more beautiful example of earlier arrival of electric field at a site where the ratio of generated electric field to ground velocity is rather small. Such an earlier arrival of electric signal can be interpreted as due to weak attenuation of electric field variations in the less conducting ground.