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2007年能登半島地震の余震に伴う電場変化の周波数応答

Frequency response of electric field variations associated with aftershocks for the 2007 Noto Peninsula Earthquake

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We showed a clear example of circular polarization of electric field for the first time for an aftershock of the earthquake of magnitude 6.9 (JMA), which occurred in 2007 off the coast of the Noto Peninsula. Since then we have obtained more examples showing such polarizations for aftershocks of the 2008 Iwate-Miyagi Inland earthquake of magnitude 7.2 as well as for artificial earthquakes due to blasting. We also showed that such a circular polarization could be well interpreted in terms of resonance of motion of one kind of ion in the groundwater with the ground velocity due to seismic wave. If such resonance is actually occurring, some peaks in the spectra of the electric field should be expected to appear. With this expectation in mind, we made analyses of transfer functions with two components of ground velocity on the plane perpendicular to the magnetic field of the Earth as inputs and two horizontal components of electric field as outputs. We made this analysis for five aftershocks with magnitude of 4.3, 4.2, 4.1, 3.9, 3.3, respectively, and took averages of transfer function estimates. As expected we could find some peaks for the two components of electric field for the eastward ground velocity. However, the peak frequencies do not correspond to the cyclotron frequencies of some ions widely existing in groundwater and shift to lower frequencies. Such a shift seems to be understood as response to the vertical component of the magnetic field of the Earth rather than the total magnetic field. This is presumably due to the boundary condition at the Earth surface; that is, the vertical electric field should disappear there and hence horizontal motion only is allowed for ions in groundwater. Anyway, the frequency response confirms our mechanism of seismic dynamo effect and we regard this as the resonance of seismic wave with the magnetic field of the Earth.

Keywords: seismic dynamo effect, seismic wave, electric field, resonance