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# Formulation of the Piezomagnetic effect considering the seismic wave propagation

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The theoretical and observational studies of piezomagnetic change due to the crustal activity such as earthquakes has been performed by Sasai(1991) and other many authers. On these studies, only static piezomagnetic effect was focused ignoring temporal evolution of crustal stress field, for example, caused by seismic wave propagation. On our study, we tried to formulate the dynamic piezomagnetic effect caused by the crustal stress field change due to the seismic wave propagation and evolution of the fault rupture.
In generally, magnetic potential produced by a magnetized body can be represented by the volumetric integration over the body based on the Coulomb law. The piezomagnetic potential i.e., magnetic potential of the geomagnetic changes due to the piezomagnetic effect also can be written by the volumetric integral over the magnetized region of the crust. In the case of the static piezomagnetic potential, applying the equilibrium equation of crustal stress and Green theorem, this volumetric integral is rewritten as the surface integral over the magnetized crust. This surface integral is called as the representation theorem for the piezomagnetic potential. In our study, applying the wave equation of seismic wave and Helmholtz decomposition theorem to the Coulomb law, we obtained the representation theorem for the dynamic piezomagnetic effect. By the way, the fault plane and its neighborhood are known as an important origin of the piezomagnetic effect. Its contribution is estimated by the same manner of that of Sasai(1991) and Okubo(1990).
To view a general tendency of the expected magnetic field change, we used a simple model. In our model, the crust was assumed as an infinite medium which have uniform magnetization and assumed a point seismic source. It was clarified that, when the continuousness of the moment function and its first order differentiation was assumed, the spherical seismic P and S body waves will not create geomagnetic field change on the outside. The geomagnetic changes are only created by fault rupture and near-field waves. On our presentation, we will report on details about above things.

Keywords: piezomagnetic effect, seismomagnetic effect, geomagnetic field