On changes in the electric and magnetic fields associated with the Izmit earthquake, Turkey

Yoshimori Honkura[1], Masaki Matsushima[2], Naoto Oshiman[3], Akihiko Ito[4], Yoshihisa Iio[5], Serif Baris[6], Ahmet Isikara[6]

[1] Earth and Planetary Sci., Tokyo Institute of Technology, [2] Dept. Earth Planet. Sci., Tokyo Inst. Tech., [3] DPRI, Kyoto Univ., [4] Utsunomiya Univ., [5] ERI, [6] Kandilli Observatory and Earthquake Research Institute, Bogazici University

In association with the Izmit earthquake, which occurred on 17 August 1999, the electric and magnetic fields were observed at four sites located near the earthquake source area. During the mainshock, remarkable changes in the electric and magnetic fields were observed and they could be interpreted as arising from a seismic dynamo effect. For discussion on possible changes before the mainshock, naturally occurring magnetotelluric fields must be removed. Here we used a linear system with two horizontal components of the magnetic field at the reference station as inputs and each component of the electric and magnetic fields at the target sites as an output. We then found that most of the magnetotelluric fields at four sites located near the earthquake source area can be well predicted.

In association with the Izmit earthquake, which occurred on 17 August 1999, the electric and magnetic fields were observed at four sites located near the earthquake source area. In addition to these four sites, one reference station was in operation at a rather remote area. During the mainshock, remarkable changes in the electric and magnetic fields were observed and they could be interpreted as arising from a seismic dynamo effect; that is, electromagnetic induction by seismic waves in the conducting Earth under the presence of the static magnetic field of the Earth. The seismic and electromagnetic data simultaneously obtained at one of the four sites during an aftershock event provide important information on the detailed mechanism of the seismic dynamo effect, although an analytical approach to a realistic case seems to be complicated.

For discussion on possible changes before the mainshock, naturally occurring magnetotelluric fields must be removed from the original records. In fact, we can easily find that large variations at the target sites are similar to those at the reference site, implying that the variations are mostly of magnetotelluric origin. If we assume that the observed data at the remote reference station are little affected by the occurrence of the Izmit earthquake, it would be possible to predict the magnetotelluric fields at the target sites from those at the reference station, because of linear nature in electromagnetic induction. Here we used a linear system with two horizontal components of the magnetic field at the reference station as inputs and each component of the electric and magnetic fields at the target sites as an output. We then found that most of the magnetotelluric fields at four sites located near the earthquake source area can be well predicted, but some residuals of unknown origin remain, particularly in the electric field. Before a definitive conclusion, however, careful examination would be required to identify possible precursory changes in the residuals.