Frequency Characteristics of Electromagnetic Noises Observed at Awaji-shima Island

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Since 1996, 21 potential differences over telecommunication cables and a geomagnetic vector field have been monitored every second at Awaji-shima island. However, those data are severely contaminated by noises from surrounding cities at periods mainly shorter than 1000 seconds.

We developed a method to remove the noises so that geophysical signals are detected. To remove the noise from the geoelectric field, we make use of the fact that the impedance of the noise is a constant with zero phase lag at frequencies except those of the line peaks. Induction parts of the geoelectromagnetic fields at Awaji-shima island are estimated by use of the geomagnetic field variations at Kakioka and the residual of the geomagnetic field is used as a reference to the noise in the geoelectric field.

A network of large-scale telecommunication cables to measure geoelectric potential differences over cable lengths was established at Awaji-shima island in 1996. Since then, 21 potential differences and a geomagnetic vector field have been monitored every second in order to detect seismo-electric signals. However, those data are severely contaminated by noises from surrounding cities at periods mainly shorter than 1000 seconds. The amplitude of noise except midnight is in the order of 100mV/km that is large enough to overwhelm geophysical signals.

We attempt to investigate the noises and develop a method to remove them from the electromagnetic variations at Awaji-shima island. Characteristics of the noises are (1) a large amplitude difference between daytime and midnight, (2) a long period variation at midnight, (3) sharp spectral peaks at the period of approximately 900 seconds and its harmonics, and 600 seconds and its harmonics with amplitudes and periods fluctuated, and (4) DC-like impedances between the electric and magnetic fields.

To remove the noise from the geoelectric field, we make use of the fact that the impedance of the noise is relatively stable and a constant with zero phase lag at frequencies except those of the line peaks. Induction parts of the geoelectromagnetic fields at Awaji-shima island are estimated by use of the geomagnetic field variations at Kakioka and the residual of the geomagnetic field at Awaji-shima is used as a reference to the noise in the geoelectric field. Our method is based on Egbert (1992) and the response of the observed data to the reference in the frequency domain is transferred into an impulse response in the time domain. We will discuss evaluation of our method and possible improvements.