A REALISTIC 3-D RESISTIVITY MODEL EXPLAINING ANOMALOUS LARGE MAGNETOTELLURIC PHASES

HIROSHI ICHIHARA 1, TORU MOGI 2

1 Japan Agency for Marine-Earth Science and Technology, Yokosuka, Japan
e-mail: h-ichi@jamstec.go.jp
2 HokkaidoUniversity, Sapporo, Japan

Magnetotelluric (MT) impedance tensors presenting anomalous, large phases that exceed 90° at lower frequency band in off-diagonal components have been frequently observed in many regions. Because 1-D or 2-D resistivity structures fail to explain these anomalous phases, they present a major problem in accurately interpreting MT data. Egbert (1990) proposed a conceptual model with a complex of 3-D conductors to explain the anomalous phases. When the telluric current is reversed within a complex of channel-shaped conductors, the MT phase is anti-polarised and can thereby exceed 90°. Based on idea, Ichihara and Mogi (revised) proposed “L-shaped conductor model” consisting of a large conductor (regional conductor) and a small conductor (local conductor) attaching to the regional conductor. This model present anomalous phase around the local conductor due to reversed current. We calculated MT impedances changing several parameters on the L-shaped conductor using 3D EM modeling program (Fomenko and Mogi, 2002) and found several conditions to present anomalous phase. First, anomalous phase do not induced when the local conductor attaches at the center side of the regional conductor. Second, size of local conductor has to be adequately larger than the local conductor. If the local conductor is large, current induced in the local conductor overcomes the current derived from the regional conductor and anomalous phase is not presented. We also found that the frequency band appearing anomalous phase depends on size of the regional conductor. The larger conductor appears anomalous phase at lower frequency band. Because of its simple geometry, “L-shaped conductor model” seems to explain various anomalous phase data. However, theoretical discussions are required for the deeper understanding about anomalous phase problem.

magnetotelluric, anomalous phase, current channeling

Hiroshi Ichihara, Japan Agency for Marine-Earth Science and Technology, 2-15 Natsushima-cho, Yokosuka, Japan, e-mail: h-ichi@jamstec.go.jp