

SEM037-P03

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Effect of solar daily variations on MT and GDS signals

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One-dimensional (1-D) electrical conductivity profiles of the oceanic mantle beneath the Pacific Ocean often show a peak in asthenospheric depths irrespective to ages of the seafloor above it (e.g., Lizzaralde et al., 1995; Toh and Motobayashi, 2007; Baba et al., 2010). It, therefore, might be interpreted as a ubiquitous feature of the oceanic mantle, whose cause can be attributed to onset of partial melting, presence of water or a combination of both. However, a so-called 'semi-global reference' electrical conductivity model for the North Pacific Ocean (Utada et al., 2003) lacks in the asthenospheric conductor.

Although their reference model based only on periods longer than 1 day, one may argue that the reference model is valid even for asthenospheric depths because their data are free from noises in electromagnetic (EM) responses by solar daily variations (e.g., Sq). Utada et al. (2010) claimed that magnetotelluric (MT) responses without pertinent removal of Sq noises possibly contain fictitious curvature in the tidal band to give a false peak in the asthenosphere. On the other hand, it is also true that any 1-D electrical conductivity inversions without MT responses have little sensitivity in the upper mantle depths. It, therefore, is still an open question whether the asthenospheric conductor is only a fictitious image due to Sq noises or a real fact revealed by the seafloor MT data. It is required to find a proper correction method for the Sq noises in order to bridge the gap between the MT band and the geomagnetic depth sounding (GDS) band, the latter of which is originated from long-period (> 2 days) temporal variations of the magnetospheric ring current.

To test the effect of solar daily variations on seafloor MT responses, we used a very long (> 3 years) time-series observed by a seafloor geomagnetic observatory (Toh et al., 2004; 2006) in the Northwest Pacific Ocean (NWP). The 1-D electrical conductivity profile beneath NWP is known to be associated with an asthenospheric conductor with a peak depth and conductivity of ~200 km and ~0.1 S/m, respectively. Although the 1-D electrical model is based on an EM time-series carefully detided by BAYTAP-G (e.g., Tamura et al., 1991), we applied a new Sq removal method that subtracts a mean Sq variation estimated from the international five quietest days of each month (http://www-app3.gfz-potsdam.de/kp_index/quietdst/qd20000x.html) to the original time-series. We compared the new time-series with our former time-series in terms of power spectra, EM response functions and 1-D electrical conductivity profiles.

It was found that even though the Sq noises can affect the MT responses to some extent, it is difficult to deny the presence of the asthenospheric conductor. However, it was also shown that the conductor may have different quantitative features in terms of the peak depth and conductivity. It will be further argued whether it is appropriate to subtract Sq, i.e., the solar daily variations on quiet days, or SD (the solar daily variations on disturbed days).