Ocean Hemisphere EM network to study electrical conductivity structure in the mantle

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This paper reports results of electromagnetic observations of the Ocean Hemisphere Network Project (OHP), aiming to reveal the electrical conductivity structure in the mantle. US and Japanese research groups carry out voltage measurements by using submarine cables in the Pacific. A complete set of available cable data has been obtained by data exchange. This dataset will be used to infer large-scale structure beneath the Pacific. On the other hand, Network-MT experiments are carried out in Japan and in the northeastern part of China. Data obtained by this technique provides a higher spatial resolution. 3-D modeling of the data will delineate upper mantle conductivity structure typical to a region of plate subduction.

Electromagnetic (EM) component of the geophysical observation network by the Ocean Hemisphere Project (OHP) aims to reveal (1) dynamics inside the outer core and of core-mantle boundary, and (2) large-scale electrical conductivity structure in the mantle, by long-term observation of geo-electric and magnetic field variations in the Pacific region. In structure study (2), a special attention is paid for that of subduction zone in the western Pacific where a large-scale downward flow of mantle convection takes place. So far few electromagnetic observations for such purposes were done in the Pacific hemisphere, but this situation has been remarkably improved by the OHP. In addition to semi-permanent observations, mobile array observations with denser station distribution have been or will be done. This paper makes a preliminary report on electromagnetic studies of mantle conductivity distribution based on electric field data obtained by a network of submarine cables in the ocean and by telephone lines (so-called the Network-MT) in Japan and the eastern part of China.

A complete dataset of submarine cable electric field was recently obtained by exchanging individual datasets between US and Japan. This dataset includes all available data in the whole Pacific region, which is expected to enable us to explore as deep as to the lower mantle depth. Such an analysis is possible only for the electric field data obtained by a long submarine cable, as it gives long-term stability and high S/N. Deep conductivity distribution in the mantle will be discussed by using EM responses of period up to several tens of days.

Network-MT experiments are being made in Japan and in the northeastern part of China. In this report, a preliminary result of three-dimensional (3-D) modeling to interpret observed data in Japan will be shown. In NE China, mobile electric field observations have been carried out in Jilin province and will be extended in surrounding areas. 1-D inversion of MT responses has indicated the presence of a high conductivity layer between 70 and 100 km beneath this region. Further 3-D interpretation will be able to reveal structures down to the depth of transition zone, which needs a correct estimation of effects of lateral conductivity variations such as land-ocean distribution.