Loading deformation due to non-tidal ocean variavility

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Precise modern geodetic observation is influenced by oceanic mass variability through loading deformation of the Earth, which should be corrected for before interpreting the geodetic data. Although ocean tide is the most powerful contributor to the loading effect, the loading correction for diurnal and semi-diurnal band has generally enough accuracy owing to improvement in recent ocean tide models based on precise satellite altimeter data such as TOPEX/POSEIDON. Long-period oceanic valiabilities, e.g., with monthly, semi-annual, and annual periods, however, are still poorly understood because of the complexity in meteorological driving forces and in ocean's response to them. In order to adequately understand the long-period signals in the modern geodetic observation, estimation of loading response of the solid Earth to the non-tidal oceanic variability is becoming more and more important.

We will present an estimate of loading deformation based on bottom pressure data from global ocean circulation model (ECCO, kf049f) developed by NASA, JPL. We analyzed 10 years of the data from 1993 to 2002. Daily oceanic mass grid maps of 1-degree resolution are calculated in terms of variable component by subtracting 10-year mean field for each grid. The daily maps are subjected to spherical harmonic decomposition degree and order up to 180. By using the spherical harmonic coefficients and loading Love numbers, we calculated 3657 daily global loading maps for radial and horizontal components. These products would be useful to calculate time series of loading deformation caused by non-tidal ocean variability at any surface point on the Earth. We estimated, as an example, the loading deformation at three antenna sites of VERA, which requires annual site position be determined in mm accuracy for radio astrometric purpose. The result indicates that the maximum site displacements are about +-3.6 mm, +- 2.9 mm, and +-2.2 mm for Mizusawa, Ogasawara, and Ishigaki station, respectively. The largest displacement at Mizusawa is unexpected because it is the inward station. The large oceanic variability in the Japan Sea seems to explain this result. In the near future, we are going to validate the present result by comparing independent observation such as GPS.