On a correction method for non-tidal loading effect and its application to GSI South Pacific GPS network daily solutions

Hiroshi Munekane[1], Shigeru Matsuzaka[1]

[1] GSI

A considerable seasonal variability is found in coordinate solutions from the GSI South Pacific GPS network, which covers a wide range of the Pacific Ocean. The ocean mass loading is a very plausible cause for this variability since the ocean surrounds every site. In this presentation, the effect of non-tidal mass loading on the variability of the coordinates is evaluated using the Green's function approach. An applicability of a correction with the admittance method is also tested.

First, deformations caused by non-tidal ocean mass are calculated with the Green's function method. A program 'NLOADF', which was developed by Agnew (1997), is used for a calculation. The 1x1-degree gridded TOPEX/POSEIDON altimetry data (WOCE_version 3) is used to estimate nontidal ocean mass. Steric height change due to salinity/thermal change should be removed from the altimetry height since it does not accompany mass change. The steric height change due to salinity change is neglected since its magnitude is considered to be small and only that due to thermal change is removed by using 1x1 degree gridded AVHRR SST data (WOCE version 3). It is found that at Christmas island and Kwajalein island (IGS station), where large deformations are expected since large mass-transfer events such as El nino are observed in the surrounding sea, deformations that amount to 1cm in vertical direction are expected indeed. These changes are well detectable in the GPS solutions. Inter-annual changes corresponding to large oceanic events like El nino are dominant.

Next, an applicability of the admittance method for a correction of this effect is examined. It is obvious that the most precise way to correct these changes would be to integrate the loading effect throughout the globe, as done above. However, there is usually a delay before altimetry data become available. In this case, this method is not suitable for real/near-real time correction, and the approximate correction with the admittance method may be valuable. The applicability is tested as follows. First, tide gauge data at Christmas and Kwajalein Island are compared with the altimeter-derived sea level change. Good agreement is found between them, showing the tidal data represent that sea level change of surrounding open-sea and well suited for the admittance method. Then the admittance between the altimeter-derived vertical change and tidal data is calculated. It is found that the linearity between them is very good, and the derived admittance matches that used in the atmospheric correction. It is found that several mm precision would be achieved with the admittance correction method.