Estimation of mass-redistribution-induced crustal deformation due to the Earth's fluid envelope to GPS site coordinate time series

Hiroshi Takiguchi[1]; Yoichi Fukuda[2]

[1] Dep.Geophysics,Kyoto Univ.; [2] Geophysics, Kyoto Univ.

We estimated the crustal displacements due to the atmospheric loading (AL), the non-tidal ocean loading (NTOL), the continental water loading (CWL) and the snow loading (SL) effects, and then applied the correction to the International GNSS Service (IGS) and the GPS Earth Observation Network (GEONET) site coordinate time series to eliminate periodic signals of the loading effects. We used the surface pressure data of NCEP/NCAR Reanalysis 1 (Kalnay et al., 1996) for the estimation of AL effects. And, we used the Topex/Poseidon (T/P) altimetry data and the ocean bottom pressure data of the ECCO (Estimating the Circulation and Climate of the Ocean) model for the estimation of NTOL effects. The T/P altimetry data were removed the thermal steric effects assuming a linear relationship (6mm/degree) between the sea surface temperature and steric height (Sato et al., 2001). The continental water loading effects were estimated by using the soil moisture data by Fan and van den Dool (2004). As the time series of GPS site coordinates, we employed a solution of IGS which was calculated by using GIPSY-OASIS II (Heflin et al., 2002) by the Jet Propulsion Laboratory (JPL) and the routine solution of GEONET called F2 solution which was calculated by Bernese ver. 4.2 software (Hatanaka et al., 2003) by the Geographical Survey Institute.

To eliminate periodic signals of the loading effects, we calculated

Corrected GPS = GPS - (Load1 + Load2 + . . . + Loadn).

The result shows that up to 20 % of the annual signal in the coordinate time series of vertical component can be eliminated a combination of the atmospheric pressure effects, the non-tidal ocean loading effects calculated by ECCO model and the continental water loading effects. We also applied the correction to the data of 1997 Bungo channel slow slip event and confirmed that the loading correction can be well applied for the analysis of the slow slip event.