Short Term Position Variation due to the Atmospheric Loading near Semi-closed Sea

Hiroshi Takiguchi[1]; Thomas Hobiger[1]; Toshimichi Otsubo[2]; Ryuichi Ichikawa[1]; Yasuhiro Koyama[1]; Yoichi Fukuda[3]

[1] KSRC,NICT; [2] Hitotsubashi Univ; [3] Geophysics, Kyoto Univ.

Temporal changes of surface loadings due to the mass redistribution of the fluid envelope of the Earth, i.e., the atmosphere, hydrosphere, and cryosphere, cause the Earth to deform and consequently change the coordinates of observation sites. The coordinate changes can be measured by space geodetic techniques such as very long baseline interferometry (VLBI) (e.g., van Dam and Herring, 1994) and the global positioning system (GPS) (e.g., van Dam et al., 1994). For the reduction of these influences, we estimated the crustal displacements due to atmospheric loading (AL), non-tidal ocean loading (NTOL), continental water loading (CWL) and snow loading (SL) influences. And we showed that a combination of AL, NTOL, and CWL can eliminate about 20% of the annual signal in the GPS coordinate time series (e.g., GEONET F2 solution) (Takiguchi et al., 2006).

In this study, we investigate primarily the short period load influences. Takiguchi et al., (2006) have already discussed about annual signal influences. Especially, we will focus on the atmospheric load influences in the coast area near semi-closed sea.

In general, the static response of the sea level caused by the forcing of atmospheric pressure on the sea surface was assumed to follow the Inverted Barometer (IB) response. However, it was shown that there was an area which can not be explained by the IB response, as observed from satellite altimetry missions such as Topex/Poseidon and Jason-1 (Fu and Pihos, 1994). Especially, some studies showed that a response time delay at a semi-closed sea has to be considered, when the atmospheric pressure changes with cyclonic scale. Le Traon and Gauzelin (1997) showed that the response of sea level due to the forcing of atmospheric pressure at tens of diurnal cycles can be delayed by up to three days in the Mediterranean sea. Moreover, Lyu et al., (2002) showed by the model analysis that the response of the Sea of Japan is delayed by about several hours (Inazu et al., 2005). In Takiguchi et al., (2006), the response of the whole sea area was assumed to follow on IB response, the atmospheric load was calculated and a detailed discussion was presented. Certainly, it is necessary to use IB and non-inverted barometer (NIB) properly in the sea area to obtain high accuracy.

In a preliminary study, we calculated the atmospheric load at GEONET sites for the case of assuming only IB response and for the case of using NIB at several km from the Japanese coast. The difference of between both loads reached about 1mm in the vertical component at several sites.

In the presentation, we will compare the atmospheric load time series when NIB is assumed in a semi-closed sea area and when only IB is assumed.