Scale Error Caused by the Change of Antenna Phase-Center Correction Model in GPS Analysis (II)

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IGS (International GNSS Service) has changed the method to estimate GPS precise ephemeris since Nov. 5, 2006 (GPS week 1400). Among the three changes, according to the change of the receiver antenna phase correction model, that is, the change from relative phase characteristics model to the choke-ring antenna to the absolute phase characteristics model, the scale changes are arose in the coordinate solutions of GPS tracking network sites. Thus in NIED the GPS data analysis method was revised to add the estimation of scale factor to reduce the offset seen in the time series of the baseline vectors caused by the scale change (Shimada and Herring, 2007).

In the offset estimation, it is clarified that the scale changes at 1400 week amount 12 ppb in the analysis of the GEONET network with the fiducial IGS sites in NIED, although the scale changes amount only 3 ppb in the analysis of the IGS network by the Massachusetts Institute of Technology. Because both analyses apply GAMIT/GLOBK analyzing program, and the same analyzing procedure, the difference of the scale changes are thought to be caused by the GEONET receiver antenna phase model. The GEONET sites use exclusive antenna radomes, which show unique and imprecise phase model compared with typical antennas and radomes adopted in the IGS sites. In the NIED analysis, the GEONET sites are analyzed with about 20 IGS sites in and around Japan as fiducial, thus there arises inconsistency of the scale changes between the IGS sites and the GEONET sites. Actually after the scale estimations, there are still seen the offset in the time series of the baseline vectors between some of the GEONET sites and the IGS sites at 1400 week.

Therefore in this paper we do adopt the absolute phase model before 1400 week in the NIED analysis to reduce the offset in the time series of the baseline vectors. Of course the IGS precise ephemeras were estimated using the relative phase characteristic model in the IGS analysis centers, there still remain scale changes at 1400 week in this analyzing approach. In fact in the analysis of only the fiducial IGS network sites adopted in NIED, there exist 0.6 ppb scale changes at 1400 week applying the absolute phase model both before and after 1400 week, although those are 3 ppb scale changes for the case when the relative phase model are applied before 1400 week. In the NIED conventional method to analyze the GEONET network, the scale changes amount 0.6 ppb applying the absolute phase model both before and after 1400 week, coinciding with the case of the analysis of the fiducial IGS network sites alone, although the scale changes become 12 ppb when the relative phase model adopted before 1400 week.

According to this study, even there may exist the inconsistence in the antenna phase correction model between the calculations by the IGS analysis centers and the NIED regional analysis, it affects almost the same amount for the IGS and GEONET networks, and the scale changes are much smaller than those in the case of the relative antenna model.

Actually in the time series of the baseline vectors between the GEONET sites, between the GEONET and the IGS sites, and between the IGS sites indicate very little offset at 1400 week in the NIED conventional analysis adopting the absolute phase model before and after 1400 week.