The development of combined analysis method of VLBI and GPS for improved determination of geodetic reference frame : Part2

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I will report the comparison of results from a difference combined analysis method using the recent data from VLBI and GPS around Japan.

It is result revision to Japan Geodetic Datum 2000 (JGD2000) of April, 2002 that international geodetic datum was introduced into Japan. On this JGD2000 construction, we adopted international Terrestrial Reference Frame ITRF94 and defined 1997.0 as epoch. More than 11 years pass since the epoch, and a significant gap due to probable cause of some distortions by crustal movement comes out to JGD2000, and Geographical Survey Institute (GSI) is introducing semi-dynamic calibration as technique to adjust them to the epoch. On the other hand, after ITRF94, a reference frame was frequently revised at ITRF96, 97, 2000 and 2005 internationally by IERS. In addition, Global Geodetic Observing System (GGOS) stands up under the International Association of Geodesy (IAG), and GGOS2020 is going to be putting together as a proposal to the future. In this proposal, geodetic reference frame is evaluated a base of Three Pillars of Geodesy with a key role.

The Japanese Islands located in a plate boundary is susceptible to distortions by crustal movements and it is often that significant gaps are generated by earthquakes or volcanic activities in a short term. In this environment, we have many issues to build the reference frame with long-term stability which is proposed in GGOS2020. I think that we can improve determination of geodetic reference frame by making use of different characteristics of a spatial scale and a time scale by intercomparing multi space geodetic techniques. GSI has VLBI network on 1000km distance and weekly data and GPS network on 20-30km distance and daily data in Japan, therefore I think that it is necessary to develop the combined analysis to improve them. In this case, it will be effective that I will investigate on several stages to clarify individual problems so that many uncertain elements such as intrinsic noise or weight adjustment to each observation technology in combined analysis method. Therefore I am undertaking to establish the combined analysis method to evaluate them at each step, which the first step is a backbone network calculation performed reference frame construction of a horizontal position (2D) on JGD2000, the second step is a combined analysis of VLBI-GPS on three dimensions (3D)including vertical direction, then the third step is spatiotemporal (4D) combined analysis with time series VLBI/GPS data and collocation survey results.

As the first step, I reported the combined analysis of VLBI-GPS by the method and data used in JGD2000 construction in the last 110th meeting. The method of net adjustment with 595 GPS sites which were tied to three VLBI sites (Kashima, Shintotsukawa, Kainan) using collocation data was adopted as the backbone network on JGD2000. I compared the VLBI-GPS combined analysis method that I used the data of that time with the result that I reprocessed analytical method of JGD2000 construction as possible faithfully. There was a difference in a horizontal position around the South-West Islands which were far from three places of VLBI observation sites in the comparison result.

I tried combined analysis to clarify the cause that such a difference arise using the recent VLBI, GPS and the collocation survey results. After JGD2000 construction, GSI built VLBI stations in Tsukuba, Aira and Chichijima and more GPS stations up to about 1200 in the whole country now. Furthermore, we carry out collocation surveying sequentially since 2001 for the purpose of connecting VLBI observation network and GPS observation network at Tsukuba, Shintotsukawa, Aira and Chichijima. Therefore we can carry out evaluation using different distribution data set spatially from JGD2000. I'd like to discuss the case of difference depend on the analytical method by comparing between two methods with the previous evaluation last time.