

# The Study of Using SLR and GPS Observation Data to Estimate Geocenter Motion.

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Geocenter motion describes the difference of Center of Figure (CF) respect to Center of Mass of the Earth system (CM) due to the mass re-distribution and deformation of the Earth system. This is a factor that cannot be ignored in the maintenance of the high-precision terrestrial reference frame. As precision requirements and application demands in space geodesy increase, research on estimation of the geocenter motion become increasingly important as the key point to realize a reference frame with its origin fixed to the center of mass of the Earth system. In this study, GPS (Global Positioning System) observation data from IGS (International GNSS Service) and SLR (Satellite Laser Ranging) tracking data in the period of 2007 to 2016 are applied to estimate the coordinates of IGS sites on Earth's surface by using the GAMIT/GLOBK and Bernese software. Then, the Helmert transformation model is used to acquire seven parameters between the ITRF (International Terrestrial Reference Frame) reference frame and the CM reference frame. There are three parameters of them are related to the shift in three axes, which are the results of the geocenter motion. Afterwards, the geocenter motion time series are applied with the linear fitting method in order to obtain the amplitudes and phases along three axes of geocenter motion. The annual amplitude of X-, Y-, and Z- components between the years 2007 and 2016 are  $2.6 \pm 0.2$  mm,  $4.1 \pm 0.2$  mm, and  $5.6 \pm 0.3$  mm respectively. The annual phase of X-, Y-, and Z- components are  $72^\circ$ ,  $330^\circ$ , and  $145^\circ$  respectively. The accuracy of this study is significant improvement comparing to just using GPS or SLR technique only.

Keywords: Geocenter motion, Global Positioning System, Satellite Laser Ranging