Estimation of geocenter motion and the second-degree gravitational harmonics from LAGEOS data

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Geocenter motion is one of the keys to achieve the geocentric reference frame with millimeter-level accuracy, and the information contained in the low-degree coefficients of the Earth's gravity field accounts for the largest proportion in all the spectrum. SLR is the most effective means to determine the above Earth parameters currently, but the accuracy is still affected by some measurement and satellite dynamic modelling errors. In this study, 30 years of monthly geocenter motion and the second-degree gravitational harmonics are estimated from LAGEOS satellite data spanning from year 1993 to 2023. Station range bias and the empirical force model parameters are estimated simultaneously to mitigate the errors. Despite using only two LAGEOS satellite data in this study, the geocenter motion and the second-degree gravitational harmonics can be recovered well, with accuracy comparable to the CSR(Cheng and Ries, et al. 2013, Cheng and Ries, 2017, 2018) and AIUB(So?nica et al. 2015) results, which used 5 and 9 satellites respectively. The product is of great significance for establishing and dynamically maintaining a geocentric reference frame with mm-accuracy, developing a Earth gravity field model with more complete spectral information and higher accuracy, and exploring precisely the mass migration process of earth System.