

Development of software for precise LLR data analysis

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For the purpose of determining the lunar orbital and rotational motion using lunar laser ranging (LLR) observation data, analysis software is being developed.

As the first step of this study, we construct an LLR observation model, combining the newest physical models. The model consists of the lunar orbit and libration obtained from DE421 (provided by NASA Jet Propulsion Laboratory), Earth orientation, solid Earth/Moon tides, and some factors affecting propagation delay such as aberration of light, atmospheric effects, and relativistic effects. In order to calculate these components precisely, we use the modules of the geodetic data analysis software "c5++" (Otsubo et al., JpGU, 2011). LLR observation data are provided by Crustal Dynamics Data Information System (CDDIS), from which 2029 normal points from June 1996 to December 2011 are obtained.

Comparing the observed and predicted one-way range, the mean of the residuals is about 0.18 meters, and the standard deviation is about 0.09 meters. Although there seems to be room for improvement, the error of DE421 itself is unknown to us. Therefore, the estimation of lunar orbit and libration parameters might improve the fit.

We will report a result of the above-mentioned modeling and comparison, and our future plan of the software development.

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