Uncertainty determination of Earth Rotation Parameters from LLR by parameter variation during data analysis

Vishwa Vijay Singh (1, 2), Liliane Biskupek (2), Jürgen Müller (2), Mingyue Zhang (1, 2)
(1) Institute of Geodesy (IfE), Leibniz University Hannover, Hannover, Germany; (2) Institute for Satellite Geodesy and Inertial Sensing, German Aerospace Center (DLR), Hannover, Germany

Lunar Laser Ranging (LLR) has been measuring the distance between the Earth and the Moon since 1969. The IfE LLR dataset includes more than 30,000 normal points (NPs), currently until the end of April 2022. The analysis in the IfE LLR software (LUNAR) follows an iterative adjustment process where each iteration step first calculates the ephemeris of the solar system followed by the estimation of parameters. The adjustment is performed following the Gauß-MarkovModel (GMM). In a standard calculation, LUNAR can determine over 175 parameters, and in cases of extension, the Earth rotation parameters (ERP; terrestrial pole offsets, xp and yp, and Earth rotation phase, ΔUT1) can also be estimated. The ERPs are determined for a subset of nights selected, based on the LLR NPs. The standard deviation of all parameters determined from LUNAR (standard calculation and extensions) are determined from the adjustment following the GMM, and the uncertainty of the parameters is reported as 3-sigma values (i.e. three times standard deviation, for a more realistic representation). In this study, we determine the ERPs from LUNAR, creating different modifications to the software to address various cases (for example, by keeping all LLR parameters fixed to standard solution values or adjusting them along with ERPs) and to obtain ERPs from all these different cases. Overall, the different cases provide a range of values for the determined ERPs on each night. Preliminary results show that the range of the ΔUT1 values is in close agreement with the 3- sigma values obtained from the GMM. Recent and more sophisticated results of ERP determination (from LLR) for the different cases will be presented and the different approaches to determine the errors for the standard parameters and the ERPs will be discussed.