Benefit of improved Lunar Laser Ranging data for the determination of Earth orientation parameters

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The Earth-Moon distance has been measured with Lunar Laser Ranging (LLR) since 1970. In the current analysis we use more than 30000 normal points (NPs) covering the period until April 2022. In recent years, there have been improvements in both, observations and analysis. For example, the NPs now are better distributed over the lunar orbit and retro-reflectors. In addition, the measurements have achieved a higher accuracy and the number of NPs per night is higher compared to the years before 2015. Together with improvements in the LLR analysis software, such as refined modelling (e.g. of the lunar core) and changes in the analysis strategy (e.g. optimised calculation of ephemerides), the determination of various parameters in the Earth-Moon system is now possible with higher accuracy. The recent improvements in NPs and their analysis will be presented and discussed.

By analysing LLR data, Earth Orientation Parameters (EOP) such as the Earth rotation phase ΔUT1, terrestrial pole coordinates, and nutation coefficients, as corrections to the MHB2000 model of the IERS Conventions 2010, can be determined along with other parameters of the Earth-Moon system in a least-squares adjustment. FocusingonΔUT1 and terrestrial pole coordinates from different LLR constellations such as single or multi-station data and for different numbers of NPs per night, the accuracies of the estimated Earth rotation phase and pole coordinates from the new LLR data have improved significantly compared to previous results. We now achieve an accuracy of about 20 µs for ΔUT1 and about 2 mas for xp and yp from subsets of the LLR time series with 15 normal points per night. Focusing on determining corrections to the nutation coefficients to theMHB2000 model, significantly smaller correction values and higher accuracies with an order of magnitude improvement, i.e., accuracies better than 0.01 mas, are obtained now. Recent results for these parameters are presented and discussed.