NASA SLR Systematic Error Analysis

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Abstract. Not solving for SLR range biases in individual SLR stations resulted in small scale errors in the International Terrestrial Reference Frame 2014 (ITRF 2014) [Appleby et al, 2016]. In order to improve the scale of the next ITRF, we will present approaches for investigating known systematic errors in the NASA SLR MOBLAS and TLRS systems and their net results. This approach relies upon several data sources including the NASA SLR processing summary database; NASA SLR system characterization ground test results; raw NASA SLR fullrate data; NASA SLR Survey Reports; Vienna Mapping Function data; the NASA SLR LOR Timing database; the Time Transfer by Laser Link (T2L2) results [http://www.geoazur.fr/t2l2/en/data/v4/], and satellite center of mass corrections [Rodriguez, 2019]. Based on our analysis we will then compare our systematic errors to the ILRS Systematic Error file, a recent by-product of the SLR ITRF 2020 solution. Therefore, this report is different than a typical system characterization report, where Root Sum of the Squares (RSS) analysis of theoretical SLR error sources per sub-system are aggregated over different time scales [Pearlman, 1984], but will be more valuable to the end user. First, we will discuss the most common types of range biases and their signatures as a function of range and elevation. Then we will discuss the systematic errors for each station. We will conclude with recommendations on how to improve NASA SLR data accuracy.