

Contribution of SLR tracking data to GNSS orbit validation and determination

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GNSS orbits derived from microwave tracking data may be validated using SLR range measurements. Recent validation results show mean range residuals of several centimeters for both, GPS and GLONASS satellites, as well as significant seasonal variations for the two GPS satellites that are equipped with retro-reflector arrays. These differences may be assigned to orbit or observation modeling problems, or both.

In order to study this issue, we analyze several time series of SLR range residuals. Dependencies on the SLR sites and the observation scenario are discussed. GNSS microwave orbits differing in arc-length, in orbit modeling, and in attitude modeling are compared. The resulting orbit differences show periodic variations too, which are correlated with eclipsing seasons and the sun's elevation above the orbital plane.

Moreover, we address the question, whether it would make sense to perform a combined analysis of microwave and SLR data for GNSS orbit determination. With the available low number of SLR observations no significant improvement of the orbit accuracy can be found. A variance-covariance analysis shows an improvement of the situation, if continuous SLR tracking data of a very small number of globally distributed SLR sites were available.