Validation of Earth's gravity field models using LAGEOS

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Precise orbit determination is an essential task for processing SLR data. The quality of the obtained satellite orbits strongly depends on models and parameters used in the dynamic orbit determination, where the Earth's gravity field model has a crucial impact on the quality and accuracy of estimated and predicted satellite orbits.

In this presentation the influence of different gravity field models on LAGEOS-1 and LAGEOS-2 satellite orbit determination will be discussed. We will show that not only the type of gravity field model but also the proper choice of the maximum degree of the gravity field model is essential.

The quality of the estimated orbit can be validated in two ways: On one hand by investigating the mean error of the solution based on SLR observations and the formal errors of estimated orbit parameters. On the other hand by comparing the orbit predictions with the orbits estimated based on real measurements. Additionally, orbits resulting from solutions based on different gravity field models can directly be compared.

We will present the above mentioned comparisons for solutions based on different gravity field models – the models from pre-CHAMP era as well as models based on the gravity field missions CHAMP, GRACE and GOCE. Additionally, we will address the impact of the maximum degree of gravity field coefficients used for the precise orbit determination of the two LAGEOS satellites.

The precise orbit determination based on SLR data as well as the orbit prediction and comparisons for the two LAGEOS satellites are performed using the Bernese Software.