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On the principles of satellite-based Gravity Field Determination with special focus on the Satellite Laser Ranging technique

The estimation of the Earth´s gravity field from space is based on observation of satellite orbit perturbations, satellite-to-satellite tracking and satellite gravity gradiometry. These space techniques as realized with the recent and current missions CHAMP, GRACE and GOCE allows presently for the estimation of static gravity field models up to spherical harmonic degree/order of 300 and of monthly time variable gravity field models up to degree/order of almost 100. Global static gravity field models of higher spatial resolution are obtained by combination with ground data from satellite altimetry and terrestrial gravimetry. Currently, such high resolution global gravity field models are of maximum degree/order 2190. The SLR technique is still indispensable for global gravity field determination. SLR data from geodetic satellites like LAGEOS, STELLA or STARLETTE significantly contribute to determination of long wavelength components of the Earth´s gravity field and its temporal variations. For instance, the time variable GRACE solutions suffer from the poor determination of the C20 coefficient when using GRACE data alone. This deficiency can be overcome by combination with SLR data from the LAGEOS satellites which finally leads to a proper estimation of the flattening of the Earth including its temporal variation. This presentation gives an overview of the basic principles of satellite based gravity field determination, focuses on recent, current and future gravity satellite missions and emphasizes the contributions of the SLR technique to global gravity field determination.