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Estimation of the Earth's gravity field by combining normal equation matrices from GRACE and SLR

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Since 2002, GRACE observes the Earth's gravity field with a spatial resolution up to 150 km. The main goal of this mission is the determination of temporal variations in the Earth's gravity field to detect mass displacements. The GRACE mission consists of two identical satellites, which observe the range along the line of sight of both satellites.
GRACE observations can be linked with the Earth's gravitational potential, which is expressed in terms of spherical harmonics for global solutions. However, the estimation of low degree coefficients is difficult with GRACE. In contrast to gravity field missions, which observe the gravity field with high spectral resolution, SLR data allow to estimate the lower degree coefficients. Therefore, the coefficient C20 is often replaced by a value derived from Satellite Laser Ranging (SLR).
Instead of replacing C20, it can be determined consistently by a combined estimation using GRACE and SLR data. We compute monthly normal equation (NEQ) matrices for GRACE and SLR. Coefficients from monthly GRACE gravity field models of different institutions (Center for Space Research (CSR), USA, Geoforschungszentrum Potsdam (GFZ), Germany and Jet Propulsion Laboratory (JPL), USA) and coefficients from monthly gravity field models of our SLR processing are then combined using the NEQ matrices from both techniques.
We will evaluate several test scenarios with gravity field models from different institutions and with different set ups for the SLR NEQ matrices. The effect of the combination on the estimated gravity field will be analysed and presented.