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Geocenter Coordinates from a Combined Processing of LEO and Ground-based GPS Observations

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The GPS observations provided by the global IGS (International GNSS Service) tracking network play an important role for the realization of a unique terrestrial reference frame that is accurate enough to allow the monitoring of the Earth's system. Combining these ground-based data with GPS observations tracked by high-quality dual-frequency receivers on-board Low Earth Orbiters (LEO) might help to further improve the realization of the terrestrial reference frame and the estimation of the geocenter coordinates, GPS satellite orbits and Earth rotation parameters (ERP).

To assess the scope of improvement, we processed a network of 50 globally distributed and stable IGS-stations together with four LEOs (GRACE-A, GRACE-B, OSTM/Jason-2 and GOCE) over a time interval of three years (2010-2012). To ensure fully consistent solutions the zero-difference phase observations of the ground stations and LEOs were processed in a common least-square adjustment, estimating GPS orbits, LEO orbits, station coordinates, ERPs, site-specific tropospheric delays, satellite and receiver clocks and ambiguities.

We present the significant impact of the individual LEOs and a combination of all four LEOs on geocenter coordinates derived by using a translational approach (also called network shift approach). In addition, we present geocenter coordinates derived from the same set of GPS observations by using a unified approach. This approach combines the translational and the degree-one approach by estimating translations and surface deformations simultaneously. Based on comparisons against each other and against geocenter time series derived by other techniques the effect of the selected approach is assessed.