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On the Degree of Freedom of the Integrated Approach for the GPS/CHAMP/GRACE Constellation Extended to Earth Rotation Parameters

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As already introduced the integrated approach is a promising method for determining a variety of Earth System Parameters by means of dynamic satellite orbit adjustment from an ensemble of satellites and tracking techniques. Here the full GPS constellation is processed within one step together with one or more Low Earth Orbiters (LEOs) using GNSS measurements as well as K-band intersatellite observations between the LEOs. In order to optimally apply this method the inherent degree of freedom should be examined in order to identify the parameters that can or cannot be solved for.

The case of simultaneously estimating low-degree harmonic coefficients of the Earth gravity field and ground stations coordinates is investigated based on simulations. It can be shown that the degrees of freedom consist of a translation in z-direction and a rotation around the z-axis. This means that these elements are rather weakly determined and not solvable to a convincing accuracy without additional a priori
information. On the other hand the x- and y-components of both the dynamic and geometric origin can be retrieved with high accuracy and resolution.

In a further step the degree of freedom is investigated for the case of estimating in addition Earth Rotation Parameters (polar motion, UT1-UTC).