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Gradiometry and GNSS

Abstract

As we know, the gravity field model is the function of the geographical coordinates – latitude and longitude. However, if the rotating Earth is considered in the celestial or inertial reference frame, the model is time dependent. The model can be described in terms of different gravity field parameters, e.g. gradients of the gravity acceleration. Gravity satellite missions like GRACE or GOCE can provide gradient data. On the other hand the GNSS satellite constellations – because of its stability and precision - can substitute the inertial reference system. If equipped with the gradiometric sensors they can sense the rotation of the Earth by gradient measurements.

The question is what are physical limitations of the accuracy of such measurements, taking into account the attenuation of the longitudinal variations of the field model with height of the orbit. From the analysis it looks that such measurement is possible. If so, then the speed of the gravity signal in space could be measured by comparing the field model derived from the low orbit measurements (like GOCE) with the model obtained from high GNSS orbits.