Geophysical Research Abstracts
Vol. 21, EGU2019-6799, 2019
EGU General Assembly 2019

Using quantum sensors on-board satellites for determining the Earth's gravity field

Jürgen Müller and Hu Wu
Leibniz Universität Hannover, Institut für Erdmessung, Hannover, Germany (mueller@ife.uni-hannover.de)

In the past two decades, satellite missions like GRACE(-FO) and GOCE have remarkably advanced our knowledge on the Earth's gravity field, by measuring the first- and second-order derivatives of the gravitational potential. However, a more precise gravity field model with better spatio-temporal resolution is still highly demanded for geodetic and further geoscience applications. New technologies based on quantum optics emerged and quickly developed in the past years, which will enable novel observation concepts and deliver gravimetric observations with an unprecedented accuracy in future. For the first time, atomic clocks and relevant frequency links provide the particular opportunity to directly observe gravity potential differences by measuring the relativistic redshift effect with clocks ("relativistic geodesy"). Those measurements will be sensitive to the large structures of the gravity field. In addition, for the fine structures, a quantum gradiometer, e.g., the Cold Atom Interferometry (CAI) gradiometer, is expected to deliver gravity gradients with an accuracy of about one order of magnitude higher than that of GOCE. To figure out how these future gravimetric sensors will benefit the determination of the Earth's gravity field, their individual contributions will be evaluated through closed-loop simulations, where the specific instrumental and conceptual errors are consistently mapped to the gravity field coefficients.