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Scientific assessment of a Next Generation Gravity Mission

Pieter Visser (1), Michael Murböck (2), Tonie van Dam (3), Tilo Reubelt (4), Alberto Anselmi (5), Luca Massotti (6), and the NGGM study Team

(1) Delft Institute of Earth Observation and Space Systems (DEOS), Delft University of Technology, Delft, The Netherlands (P.N.A.M.Visser@tudelft.nl), (2) Institut für Astronomische und Physikalische Geodäsie (IAPG), TU München, Munich, Germany (murboeck@bv.tum.de), (3) Faculté des Sciences, de la Technologie et de la Communication, University of Luxembourg, Luxembourg, (4) Geodätisches Institut (GIS), Universität Stuttgart, Stuttgart, Germany, (5) Thales Alenia Space (TAS), Torino, Italy, (6) European Space Research and Technology Centre (ESTEC), ESA, Noordvijk, The Netherlands

A comprehensive study has been carried out to possible future gravity field missions or Next Generation Gravity Missions (NGGM). The study team was led by Thales Alenia Space (TAS) and included both industrial partners and scientific institutes, where the latter were coordinated by DEOS. The study covered all aspects from science requirements, sensor and instrument characteristics, satellite design, mission concepts and mission performance. Detailed instrument and satellite models were used to derive realistic error spectra (so-called Power Spectral Densities or PSDs). Mission orbit analysis tools were used to select feasible orbital parameters. In addition, quick-look tools were used to further zoom in on orbit and mission selection. Although these quick-look tools are limited to propagation of sensor error PSDs, they are very efficient to assess the impact of many mission parameters, including not only orbit parameters (e.g. altitude, inclination, baseline length, repeat period with possible sub-cycles, combination of satellite or satellite pairs in different orbits), but also for example observation types (low-low satellite-to-satellite tracking, satellite gravity gradiometry, orbit perturbations). Finally, rigorous end-to-end simulations were carried out where space-borne gravimetric observations according to sophisticated sensor and instrument models (including errors) were simulated and converted to gravity field model solutions with exactly the same tools that are used to process real observations (such as e.g. coming from GRACE and GOCE). This study is comprehensive in the sense that gravity field mission performance predictions by the end-to-end simulator were compared with the science requirements, leading to the conclusion that significant advances can be anticipated given the current development of enhanced mission and sensor concepts.

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