EGU21-5341
https://doi.org/10.5194/egusphere-egu21-5341
EGU General Assembly 2021

Simulation study on gravity field determination with small satellites in NGGM

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In the context of an increased public interest in climate-relevant processes, a number of studies on Next Generation Gravity Missions (NGGMs) have been commissioned to better map mass transport processes on Earth. On the basis of the successfully completed gravity field missions CHAMP, GOCE and GRACE as well as the current satellite mission GRACE-FO, different concepts were examined for their feasibility and economic efficiency. The focus is on increasing the spatiotemporal resolution while simultaneously reducing the known error effects such as the aliasing of temporal gravity fields due to under-sampling of signals and uncertainties in ocean tide models. An additional inclined pair to a GRACE-like satellite pair (Bender constellation) is the most promising solution. Since the costs for a realization of the Bender constellation are very high, this contribution focuses on alternative concepts in the form of different constellations and formations of small satellites. The latter includes both satellite pairs and chains consisting of trailing satellites. The aim is to provide a cost-effective alternative to the previous gravity field satellites while simultaneously increasing the spatiotemporal resolution and minimizing the above mentioned error effects. In numerical closed-loop simulations, various scenarios will be conducted which differ in orbit parameters like shape and number of orbits, the number of satellites per orbit and instrument performances. Additionally, the impacts from the co-parametrization of non-tidal temporal gravity field signal and ocean tides on the gravity field solutions, obtained by the different concepts, will be investigated. In particular the possibilities and limits with multiple satellites pairs for achieving the highest possible spatial and temporal resolution in (sub-)daily temporal gravity fields shall be analysed in detail.