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Multi-decadal Satellite Gravity Mission Simulations Comparing Resolving Capabilities of a Long-term Trend in the Global Ocean Heat Content

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Satellite gravity missions have been almost continuously observing global mass transports for more than two decades. The resulting data record already improved our understanding of large-scale processes of the water cycle and is reaching a timespan, which has significance concerning climate related mass transport signals such as changes in the essential climate variables terrestrial water storage (TWS) and sea level. The observations of the currently flown GRACE-FO mission will be continued by NASA's Mass Change (MC) Mission and extended to the Mass change And Geosciences International Constellation (MAGIC) by ESA's Next Generation Gravity Mission (NGGM), setting anticipation for higher spatial and temporal resolution of satellite gravity observations in the near future.

This contribution presents initial results of multi-decadal closed loop simulations of current and future satellite gravity observations, comparing their capabilities to allow a direct estimation of long-term trends in changes of TWS and ocean mass. The observed climate signal is based on components of the TWS, as well as mass change signals of oceans, ice sheets, and glaciers extracted from CMIP6 climate projection following the shared socio-economic pathway scenario. A special focus here is on the long-term trend over the oceans. By subtracting the observed ocean mass change from the overall sea level change, the global ocean heat content can be computed from the steric component of the sea-level rise. The resulting long-term trends are then compared to initial inputs to the simulation to illustrate the difference in performance between current and future satellite gravity constellations.