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EFFECT OF DRAG-FREE CONTROL ON THE NEXT-GENERATION GRAVITY MISSION'S MEASUREMENT PERFORMANCE

Abstract

The Next-Generation Gravity Mission (NGGM), part of the Mass-change and Geosciences International Constellation (MAGIC), is being designed to fulfill stringent gravimetry performance objectives, with the aim to provide improved, continuous coverage of Earth's gravitational field with high temporal and spatial resolutions (down to 3 days and 100 km, respectively).

This technical objective places a particular spotlight on Earth's water cycle, and the ongoing climate-related impacts on it, prioritizing hydrology and cryosphere time-variable gravitational monitoring where ground surveys are unavailable or impractical, and prior space-based missions lack NGGM's precision.

This unprecedented observational performance requires both nm-level intersatellite biased ranging at low altitude (LL-SST), and the discrimination of non-gravitational disturbances on the signal through high-precision accelerometry yielding pm/s^2-level accuracy in the frequency range of interest at mHz regimes, including superb stability against orbit-dependent systematic effects causing additional tonal errors. The need for ultra-precise drag-free and pointing control systems is therefore analyzed within this challenging context of non-gravitational disturbance rejection from the planet's variable gravity field signal, demonstrating measurement performance impacts and the consequences on NGGM's foreseen gravitational monitoring service.