Impact of User Needs Consideration on Spatial Gravity Measurement Missions

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Considering user needs in space projects, particularly in Earth observation, is essential to ensure that the data collected is relevant, actionable, and tailored to address real-world challenges such as climate monitoring and disaster management. This approach maximises the project's impact, optimises resources, and enhances the usability of the data for various stakeholders, thereby making the mission more efficient and valuable.

The Earth observation requirements for a future quantum-based space gravimetry mission will not differ significantly from user needs outlined in a study performed by an international multi-disciplinary panel of scientists under the umbrella of the International Union of Geodesy and Geophysics (IUGG). These user needs were independently derived without consideration of satellite mission architectures or available instrumentation and also form the baseline for defining the mission requirements for the Mass-Change and Geosciences International Constellation (MAGIC) mission, which is currently under development. Consequently, the CARIOQA-PMP partners responsible for defining and evaluating user needs notably relay with the IUGG and MAGIC surveys in order to update them for CARIOQA-PMP.

User needs have been defined in terms of the spatial and temporal resolution of mass change observations and the targeted signal amplitudes to be observed, which are required to better monitor and understand the impact of climate change across various applications. The main tasks to improve future gravity field missions, which are capable to address these user needs significantly better as nowadays are:

Spatial and Temporal Resolution: Improving space-time sampling of gravity field observations by constellations of satellites jointly forming a mission, with orbit altitudes as low as possible to enhance sensitivity.

Precision and Accuracy: Enhancing sensor technology to achieve higher precision and accuracy in measuring gravitational variations, which can improve data quality for scientific and practical applications.

Data Integration: Developing better integration methods for combining gravity data with other geophysical data (e.g., satellite altimetry, GNSS) to create more comprehensive models of the Earth's structure and dynamics.

These findings have highlighted several needs expressed by future users, which will be taken into account by technology designers to maximise the mission's impact.

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