

MAGIC mission science and applications related to Cryosphere, Solid Earth and Neutral Atmosphere

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The GRACE and GFO missions have revolutionised our understanding of mass movement at and below the surface of the Earth but they, nonetheless, have restrictions related to spatial and temporal resolution and instrument sensitivity that limits our ability to resolve certain processes. In this presentation we focus on the advances and capabilities that the proposed Mass change And Geosciences International Constellation (MAGIC) mission will deliver for cryosphere and solid Earth applications and will also consider the potential it will have for studying the neutral atmosphere.

The time-varying gravity missions to date have had an effective spatial resolution of ~ 300 km, which is larger than the scale of any glacier or ice caps and larger than most catchments on the Greenland Ice Sheet. Even over Antarctica, the limited spatial resolution is a major limitation for regions such as the Antarctic Peninsula. Tectonic process, such as Earthquakes, volcanic activity and even viscous mantle flow can take place on scales smaller than can be resolved currently. The target resolution and accuracy for MAGIC over ice is 170 km at 2.6 mm/yr EWH over the long term and 250 km at 5.5 mm EWH at monthly resolution plus lower accuracy daily to weekly capabilities. We consider here what this means for understanding and observing ice mass exchange with the oceans and improving our ability to measure the manometric contribution to sea level rise. Based on similar targets, we also explore the improvements this offers for monitoring different types of solid Earth processes including geohazards, crustal evolution and deep interior properties and dynamics. We also consider what contributions MAGIC will be able to make to observations of thermosphere neutral density and related atmospheric parameters.