

GSTM2020-23

<https://doi.org/10.5194/gstm2020-23>

GRACE/GRACE-FO Science Team Meeting 2020

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The GRACEFUL project : probing the Earth's deep interior with satellite observations of the gravity field, magnetic field and earth's rotation

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Convective motions in the Earth's liquid core are known to generate temporal variations of the magnetic field and of the length of day. Mass redistribution associated with these motions and exchange of matter with the lower mantle at the core mantle boundary (CMB) may eventually also contribute to the temporal variations of the gravity field, possibly detectable in the data of the GRACE and GRACE Follow On missions. In a pioneering work, Manda et al., 2012 detected compelling spatio-temporal correlations at interannual time scale between the gravity and magnetic fields measured respectively by the GRACE and CHAMP satellite missions. These correlations were later interpreted by these authors as the results of physico-chemical interactions between the core and the mantle at the CMB. While such mechanisms are plausible, their mere existence, order of magnitude and time scales remain an open question. Here we present the GRACEFUL project, recently selected by the "Synergy" programme of the European Research Council, which objective is to explore in more detail the previously reported observations described above, in particular the interannual co-variations of the magnetic and gravity fields, as well as their link with deep Earth processes. This presentation is focussed on the gravity field component, in particular on the search for the deep Earth signal that we hope to be able to detect in the GRACE/GRACE FO data, after removing all other contributions due to water mass redistributions occurring in the surface fluid envelopes, as well as unrelated solid Earth signals associated with the Glacial Isostatic Adjustment and large earthquakes.