EGU2020-10369
https://doi.org/10.5194/egusphere-egu2020-10369
EGU General Assembly 2020

Geocenter Motion from a Combination of GRACE Mascon and SLR Data

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GRACE and GRACE Follow-On (FO) Level 2 data provide quasi-monthly, band-limited estimates of Stokes (geopotential, spherical harmonic) coefficients mostly reflecting surface mass variability due to non-tidal atmosphere, ocean, and continental hydrology.
Although space gravimetry does not directly provide CM-related degree-1 Stokes coefficients, GRACE data have been successfully used over the years to complement time series of station positions from global space-geodetic (SG) network when inverting for Center-of-Mass to Center-of-Network (CM-CN) displacements (Wu et al, 2006).

Surficial mass variability observed through GRACE/GRACE-FO can be conveniently converted into load-induced (ENU) deformations at SG observing sites by adopting a spectral (i.e. load Love-number based) formalism and assuming Earth's response is fully elastic and isotropic. GRACE-derived elastic displacements at observing sites would represent, if accurate, band-limited (degree 2 to 96, or higher if Mascon solutions are adopted) load-induced deformations that can be removed from SG-derived station displacements in order to more accurately recover degree-1 surface deformation signature (and therefore geocenter motion).

In this study, we adopt GRACE JPL Mascon RL06 data in conjunction with Preliminary Reference Earth Model-derived load Love numbers to infer elastic displacement at SG sites and remove them from SLR inherently geocentric time series of station positions.
In so doing, the residual SLR station displacements, consistently expressed in a geocentric frame, would in principle reflect a degree-1 deformation signature that can be recovered via either surface deformation (Chanard et al, 2018) or translational approach.

We will compare the SLR/GRACE (CM-CN) determined in this study to standard estimates of geocenter motion such as ILRS's and JTRF2014's estimated via translational approach and spectrally inverted solutions (CM-CF).

References

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