

Intelligent Earth system sensing, scientific enquiry and discovery

M2 tidal parameter modulation revealed by superconducting gravimeter

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Abstract:

Analyzing consecutive and independent 1-yr data sets of 10 European superconducting gravimeters (SG) reveals statistically significant temporal variations of M2 tidal parameters. Both common short-term (< 2 yr) and longterm (> 2 yr) features are identified in all SG time series but one. The averaged variations of the amplitude factor are about 0.2 per mille. The path of load vector variations equivalent to the temporal changes of tidal parameters suggests the presence of an 8.85 yr modulation (lunar perigee). The tidal waves having the potential to modulate M2 with this period belong to the 3rd degree constituents. Their amplitude factors turn out to be much closer to body tide model predictions than that of the main 2nd degree M2, which indicates ocean loading for 3rd degree waves to be less prominent than for 2nd degree waves within the M2 group. These two different responses to the loading suggest that the observed long-term modulation is more due to insufficient frequency resolution of limited time series rather than to time variable loading. Presently, SG gravity time series are still too short to prove if time variable loading processes are involved too as in case of the annual M2 modulation known to appear for analysis intervals of less than 1 yr. The observed variations provide an upper accuracy limit for Earth model validation and permit estimating the temporal stability of SG scale factors and assessing the quality of gravity time series.