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M2 tidal parameter modulation revealed by superconducting gravimeter time series

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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 long-term (> 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 3^{rd} degree constituents. Their amplitude factors turn out to be much closer to body tide model predictions than that of the main 2^{nd} degree M2, which indicates ocean loading for 3^{rd} degree waves to be less prominent than for 2^{nd} 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.