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Optimized strategy for the calibration of superconducting gravimeters at the one per mille level

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We investigate the causes of uncertainties on the amplitude calibration factor of a superconducting gravimeter determined by comparison with an absolute gravimeter (AG). This allows providing methods to mitigate those errors.
We demonstrate that measuring for more than five days around a tidal extreme does not improve the precision in the calibration factor significantly, given the variability in the amplitude of the tidal signal. Restricting the AG measurements during tidal extrema reduce instrument wear, while this does not affect the precision on the calibration factor significantly. When the macroseismic noise is high, it causes aliasing in the AG time series; increasing the AG sampling rate then improves dramatically the determination of the calibration factor, rather than extending the measurement time. We also discuss the attenuation bias that might be induced by noisy time series of the superconducting gravimeter. If the standard deviation of the noise affecting the SG is at least 100 times lower than the standard deviation of the tidal signal used to compute the calibration factor, then the attenuation bias remains lower than the 0.1‰ level.
Finally, if each experiment is performed at the 1‰ level, 7 are needed to ensure that the error in the calibration estimate will be at the 1 per mille level with a 99% confidence. This protocol may change in the future when atom AGs are easily available, as they should measure for several weeks without additional cost.