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Improved algorithms for the retrieval of the h_2 Love number of Mercury from laser altimetry data

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We simulate measurements to be performed by the BepiColombo laser altimeter (BELA) aboard the Mercury Planetary Orbiter (MPO) of the BepiColombo mission and investigate whether coverage and accuracy will be sufficient to retrieve the h_2 Love number of Mercury. The h_2 Love number describes the tidal response of Mercury's surface and is a function of the materials in its interior and their properties and distribution. Therefore, it can serve as an important constraint for models of the internal structure. The tide-generating potential from the Sun causes periodic radial displacements of up to $\sim$2 m on Mercury which can be detected by laser altimetry. In this study, we simultaneously extract the static global shape, parametrized by local basis functions, and its variability in time. The usage of cubic splines as local basis functions in both longitudinal and latitudinal direction provides an improvement over the methodology of Koch et al. (2010, Planetary and Space Science, 58(14), 2022-2030) who used cubic splines in longitudinal direction, but only step functions in latitudinal direction. We achieve a relative 1σ accuracy of the h_2 Love number of 1.7% assuming nominal data acquisition for BELA during a one-year mission, but considering only stochastic noise.