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Extraction of tidal Love number h by local basis functions expressed as rectangular grid for synthetic data of the BepiColombo laser altimeter

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Solar tidal forces generate elevation changes of Mercury's surface of the order 1 m within one Hermean year. Knowledge of the precise reaction of the planet to tidal forcing, expressed by the Love numbers h_2 and k_2 puts constraints on the internal structure, for example the state and the size of the core. We investigate if the Love number h_2 can simultaneously be determined together with the static topography of the planet from a global synthetic altimetry record of the BepiColombo Laser Altimeter BELA over the nominal mission duration of approximately 4 Mercury years. We find that for a precise determination of the tidal Love number h_2 the extracted topography grid must have a resolution similar to the resolution given by the spacing of spacecraft tracks on Mercury's surface. The tidal Love number is extracted with an accuracy of at least 3% by using higher order interpolation methods such as cubic Spline interpolation. Restricting the data coverage in time or space or both leads to an increase of the uncertainty of the tidal Love number. The simulation results demonstrate that it seems feasible to test current models on Mercury's interior with sufficient precision using BepiColombo Laser Altimeter data.