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Current state of ocean tide loading displacement modelling

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Nowadays the attainable measurement accuracy of ocean tide loading (OTL) is around 1 mm at discrete sites where many years of GPS/VLBI data are available. Ideally the OTL displacement should also be predicted (modelled) to this accuracy or better, in order to remove the phenomenon adequately from geodetic measurements so as not to bias the resulting coordinate and baseline time series. Using the recent ocean tide models FES99, FES2004, NAO.99b, CSR4.0, GOT00.2 and TPXO.6.2, we demonstrate that the error of the OTL displacement values is still dominated by the differences in the ocean tide models used. This difference is for harmonic M2 mostly smaller than 0.4 mm for inland sites but can reach up to 3 mm at some coastal sites. The numerical error of the OTL computation is smaller, 2-5% of the loading value itself. However, much larger numerical errors can arise at sites within approximately 150 km of the coastline, depending on the method used to refine the discrete regularly spaced grid cells of the ocean tide model to better fit the coastline closest to the site of interest. We investigate several techniques for this refinement and show some results using the OTIS hydrodynamic modelling software. Using tidal GPS observations in the UK we select the best performing refinement method. Applying this one method to the loading software packages OLFG/OLMPP, SPOTL and CARGA, we show that the OTL displacement values invariably agree to the millimetre level for coastal sites, and better than 0.2 mm for sites more than about 150 km inland.