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Accuracy assessment of recent empirical and assimilated tidal models for the Great Barrier Reef region

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This paper investigates the performance of recently regional and global tidal models in tidal constituent estimation and tidal height prediction over the Great Barrier Reef, Australia. Nine models, including TPX08, EOT11a, HAMTIDE, FES2012, FES2014, OSUNA, OSU12, GOT 4.10 and DTU10, were considered. To evaluate the accuracy of the models in tidal constant estimation, eight major constituents (i.e. K1, O1, P1, Q1, M2, S2, N2 and K2) and three shallow water ones (M4, MS4 and M6) were extracted based on analyzing sea level observations in 926 altimetry along track locations and tide gauge stations using the response method and harmonic analysis, respectively. The outcomes were compared to those of the model estimations in corresponding points at spatial scales of coastline, coastal, shelf and deep ocean zones. Then the root mean square (RMS) of differences for each tidal constituent and root sum square (RSS) of differences for all major tidal constants were calculated and discussed. To assess the tidal prediction ability, the sea level anomaly (SLA) from the recent Sentinel-3A mission was detided using the tidal height predicted by each model and the RMS of the SLA residuals (SLAR) was computed.

According to this study no single model can be ranked as the best model in tidal constant estimation and tidal height prediction over all zones. On coastline TPX08, FES models and DTU10 estimate major constituents more accurately than other models at RSS of $\sim$ 21 to 25 cm. On coastal, shelf and deep ocean zones all models show fairly similar performance. In regard to tidal height prediction ability, a visual correlation between fluctuations in bottom topography and model inefficiencies suggests that a combination of bathymetry variations and proximity to coast or islands contribute to the model's prediction accuracy. Also a comparison between performance of EOT11a and EOT11ag in tidal height prediction revealed that the influence of GRACE on ocean tidal modelling in this region seems to be insignificant.