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UoNGBR: A New Assimilation Tidal Model for the Great Barrier Reef and Coral Sea, Australia

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Great Barrier Reef and Coral Sea include 10 percent of the world's reef ecosystems with more than 3000 coral reefs and 600 continental islands. Due to bioenvironmental concerns about this marine conservation zone, more accurate knowledge of the hydrodynamics is of priority. Tides are the major contributor to ocean hydrodynamics in GBR causing tidal currents and variations in sea level. Considerable fluctuations in bottom topography, which is due to numerous continental islands, lead the tidal regime of the area to be complicated. In addition, studies have shown noticeable variations of drag coefficient values over reef zones in comparison to non-reef areas. According to sensitivity analysis done in this study, both new bathymetry and spatial variable drag coefficient value lead to more accurate tidal model for the region. UoNGBR tidal model by using new bathymetry model, gbr100, with a high spatial resolution and spatially variable drag coefficient over this area, which is provided by a recent baroclinic model named GBR1 hydrodynamic model, attempts to analyse the tidal behaviour over GBR and Cora Sea. This new model has been developed using Oregon state university Tidal Inverse Software (OTIS) with a 2 minutes spatial resolution that includes tidal constants and currents for 37 major and shallow water tidal constituents.
The results of validation against independent datasets, coastal tide-gauges and Sentinel-3A, shows noticeable improvement of UoNGBR compared to TPXO models, (e.g. TPXO8 and TPXO9) that also have been implemented by the method used in OTIS. UoNGBR compares more favourable than TPXO models over coastline, coastal and shelf zones at mean RMS difference of $\sim$18, $\sim$5 and $\sim$3 cm respectively. While model inaccuracies are more located in southern part of GBR, results suggest that UoNGBR has an acceptable performance in that area. The new model has better performance in predicting tidal heights over coastline and coastal zones compared to FES2012 at 1 cm of mean RMS difference.