Coastal Improvements for Tide Models: the Impact of ALES retracker

G. Piccioni, D. Dettmering, M. Passaro, C. Schwatke, W. Bosch, F. Seitz
Deutsches Geodätisches Forschungsinstitut (DGFi-TUM)
Technische Universität München
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Autor(en) des Beitrags: Piccioni G., Dettmering D., Passaro M., Schwatke C., Bosch W., Seitz F.
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Abstract:

Since the launch of the first altimetry satellites, ocean tide models improved dramatically for deep and shallow waters. However, issues are still found for coastal regions, which are areas of great interest for climate change. The purpose of this study is to analyze the influence of the ALES coastal retracker on tidal modeling with respect to a standard open ocean retracker (SGDR). The approach used to compute the tidal constituents is an along-track, updated version of the Empirical Ocean Tide model developed at DGFi-TUM. The harmonic constants of EOT are derived from a residual least-square harmonic analysis based on the FES2014 tidal model. The study compares an EOT version based on ALES sea-level estimations with respect to the original EOT version based on SGDR. Better performances are found with respect to the fitting error of the least-squares for the EOT-ALES solution, especially at distances closer than 20 km from the coast. The harmonic constants estimated in the two experiments are compared in terms of root mean square and root sum squared values against in-situ data. Preliminary results show that in the global average, the solutions based on ALES are superior to solutions based on SGDR for
every constituent. Among the major tidal constituents, the use of ALES produces an improvement of over 10% for K2, O1 and P1. For Q1, the improvement is over 25%. It was observed that these improvements are larger for distances closer than 10 km from the coast, and are independent on the sea state. Lastly, it was found that the performance of the solutions changes according to the satellite's flight direction: for tracks approaching land from open ocean, root mean square differences larger than 1 cm are found in comparison to tracks going from land to ocean. The improvements shown in this study were found despite the ALES retracking strategy was only applied in the residual analysis of the EOT procedure, while the original FES2014 model, which corrects for most of the tidal variability, is still based on SGDR data. We expect therefore that the use of ALES data could bring a decisive improvement in coastal tide modeling if used as a data source to estimate the full tidal component of the sea level variability.

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