

EGU22-9505, updated on 12 Aug 2022

<https://doi.org/10.5194/egusphere-egu22-9505>

EGU General Assembly 2022

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Developments of the Global Tide and Surge Model

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The Global Tide and Surge Model (GTSM) is a depth-averaged hydrodynamic model, developed by Deltares. GTSM can be used to dynamically simulate water levels and currents, that arise from tides and storm surges. The model is based on Delft3D Flexible Mesh software and has a spatially varying resolution which increases towards the coast. Previous studies with this model used GTSMv3.0 and focused for instance on operational forecasting, reanalysis and climate projections and estimation of return periods (Muis et al., 2020; Dullaart et al., 2021), satellite altimetry (Bij de Vaate, 2021), changes in tides due to sea level rise and various others.

Significant improvements in model performance were made in the newest GTSMv4.1, released in 2021. This model with increased resolution and improved representation of physical processes was calibrated by applying bathymetry and friction correction (Wang et al., 2021). From GTSMv3.0 to GTSMv4.1, the model performance showed great improvements with a 37% reduction of the root-mean-squared-error between modelled and observed tides from 17.8 cm to 11.3 cm.

The model development is an ongoing and continuous effort. The current developments are to improve the grid+bathymetry, representation of the sea-land interface, improving the spatial distribution of internal tide energy dissipation and the inclusion of other baroclinic processes like steric and radiational tides. Preliminary results show improvements in several areas. Furthermore, improving geometry representation by cutting parts of coastal cells with a landboundary often shows to improve the model performance just as significant as a resolution increase, while saving computational cost.