Geophysical Research Abstracts
Vol. 21, EGU2019-16246, 2019
EGU General Assembly 2019

Assessing global changes in tides due to sea-level rise

Sanne Muis (1,2), Maialen Irazoqui Apecechea (1), Marjolijn Haasnoot (1,3), Martin Verlaan (1,4), and Renkse de Winter (1)

(2) Institute for Environmental Studies (IVM), Vrije Universiteit Amsterdam, Amsterdam, Netherlands (sanne.muis@vu.nl), (1) Deltares, Delft, The Netherlands, (3) Utrecht University, Utrecht, The Netherlands, (4) TU Delft, Delft, The Netherlands

Sea-level rise (SLR) is threatening the low-lying and densely-populated coastal zone. With an increased contribution of the Antarctic ice sheet it is possible that mean sea levels rise well beyond 1 m by 2100. Tidal amplitudes show a strong response to SLR which affect the high and low waters, which can have wide-ranging societal imacts. Any change in tides directly affects flood risk, but can also impact navigation and port operations, functioning of ecosystems in intertidal areas, stratification of shallow seas, and sediment dynamics.

Despite the strong response of tides to SLR the assessment of suchs impacts has received relatively little attention in literature. In this contribution, we apply a cutting-edge approach to advance our understanding of how tides along the world's coastline may respond to SLR by 2100. This approach is based on Global Tide and Surge Model (GTSM) version 3.0 (Irazoqui Apecechea, in review). GTSM3.0 has an unprecedented high resolution along the coast (1.25km for Europe), no open boundaries, and has a good performance without data assimilation. We combine GTSM3.0 with probabilistic SLR projections that include an increased contribution from Antarctica (Le Bars et al., 2018). The 50th and 95the SLR projection for RCP8.5 indicate sea levels that are respectively 1.8 m and 2.9 m higher by 2100.

Preliminary results show that tidal characteristics can change significantly in response to SLR, especially in shallow seas such as the North Sea and the seas surrounding Indonesia. Changes can be asymmetric, for example, by an increase in the Mean High High Water (MHHW) and no change in the Mean Low Low Water (MLLW). Furthermore, changes are not always proportional to the local SLR, suggesting that changes in tides are sensitive to regional variation of SLR. The effect of coastline recession and retreat of grounding line of ice sheets should be explored further. Our findings show that tides cannot be considered to be constant in time, which suggest that climate impacts studies should address changes in sea level using an integrated approach.

References

Irazoqui Apecechea, M., Verlaan, M., Williams, J., de Lima Rego, J., Muis, S., van der Pijp, S., Kernkamp H., (2018). GTSM v3.0: A next generation Global Tide and Surge Model. In review Ocean Modelling.

Le Bars, D., Drijfhout, S., & de Vries, H. (2017). A high-end sea level rise probabilistic projection including rapid Antarctic ice sheet mass loss. Environmental Research Letters, 12(4), 044013.