Global modelling of future extreme sea-levels using a high-resolution Global Tide and Surge Model

Maialen Irazoqui, Sanne Muis, Martin Verlaan, and Kun Yan
Deltares, Delft, Netherlands (maialen.irazoqui@deltares.nl)

The increasing sea-level and meteorological changes associated with climate change increase the flood risk in coastal cities and low lying areas. Understanding the magnitude and impact of such changes is vital to design adaptive strategies and create awareness. Such risk predictions are possible with the use of hydrodynamic models that are coupled to climate models.

In the context of the CoDEC project (Coastal Dataset for Evaluation of Climate impact), we compute the climate change induced changes on future sea-level, storm-surge, tides and waves, and the associated impacts on coastal flood risk for Europe from present date to 2100. We consider the 4.5 and 8.5 Representative Concentration Pathways (RCP), and produce extreme value statistics representing mid-century and end of century conditions. For the water levels, we use the Global Tide and Surge Model v3.0 (GTSMv3.0), a high resolution hydrodynamic model with global coverage. The model has a coastal resolution of 2.5km globally and 1.25km in Europe, and incorporates dynamically sea-level rise, tides and surge, and therefore calculates the non-linear interactions between them. For the meteorological forcing, we use the global EC-Earth climate model together with a European-wide high resolution climate model from the EURO-CORDEX archive. In order to assess the changes relative to present and past conditions, we perform a reanalysis of extreme sea levels using the newly available high resolution ERA5 forcing. Based on the relative changes, we design a number of indicators that provide useful information about the possible impacts of climate change globally. For Europe, a number of user cases are defined in which different industries use such indicators and global model outputs to downscale and assess impacts at a regional/local scale.

We produce output for not only global coastlines at a high resolution, but also at predefined nesting points covering the global ocean which can be used for regional downscaling anywhere in the globe.