# Exploratory study: wind wave growth in phase-resolving wave models

Client
Rijkswaterstaat

Date
2022-2023

Services:
Research and development
Consultancy advice
Model development

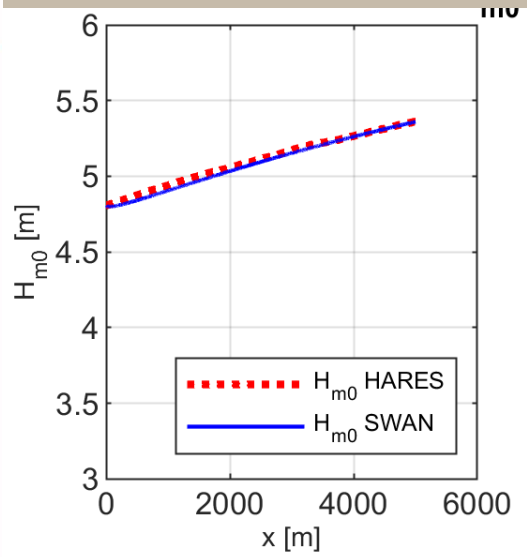
Certain types of wave studies may require the application of phase-resolving wave models, e.g. studies on wave propagation in harbours, non-linear waves and dune erosion. The physical process of wind wave growth (describing local wave growth under the influence of wind) is presently not included in such models. This has led to the demand by Rijkswaterstaat to perform an exploratory study to the importance of this process and possibilities to implement wind growth in phase-resolving wave models.

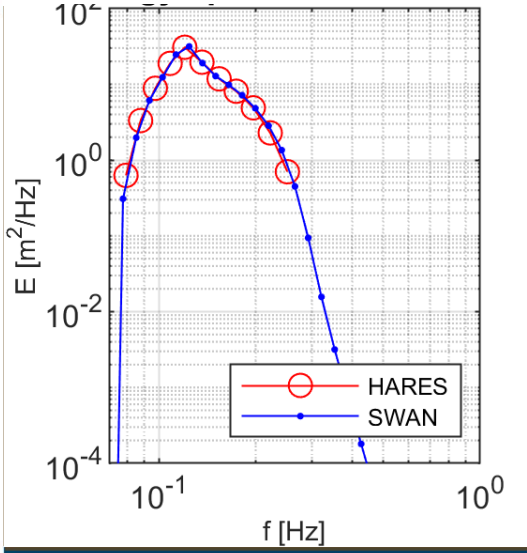
Svašek has performed this study as commissioned by Rijkswaterstaat. The study was split in two parts. Part A involved the exploration of wind growth physics and making an inventory of types and applications of phase-resolving wave models. In Part B, two promising paths from part A were further developed.

Wind wave growth involves two basic mechanisms: 1) initial growth of waves and 2) ongoing growth of existing waves. Although numerical tests show that both processes can be replicated by phase-resolving models, simulating initial growth is practically unworkable for large-scale applications. This is due to the extremely fine mesh resolutions (and hence vast computational times) that are required to simulate the emergence of very short initial waves.

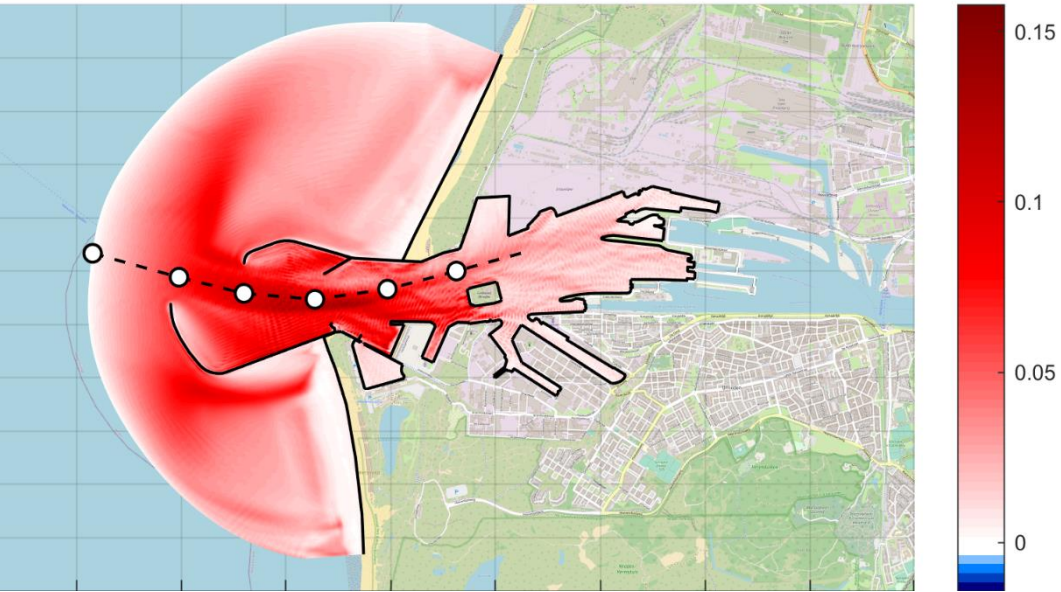
Ongoing growth of existing waves, in contrast, can be implemented in e.g. mild-slope and non-hydrostatic wave models. The latter one is especially challenging as it is prone to numerical instabilities. Other model types (e.g. Boussinesq) were also included in the inventory from Part A.

In Part B, implementation of wind wave growth in mild-slope models was elaborated in detail. The mild-slope approach turned out to be quite promising; furthermore, it is currently the only type of phase-resolving model that is officially applied to the Dutch coastal safety assessment. In addition, a research plan has been prepared by Svašek for the implementation of wind wave growth in SWASH, such in collaboration with TU-Delft and Rijkswaterstaat.




**Differences in significant wave height $H_{m0}$, wind vs. no wind**

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