

Long waves on the North Sea

M.Sc. Graduation project

Keywords: Infragravity waves, observations, meteo tsunamis, storm conditions, coastal safety

Introduction

Novel observations of long waves with periods between 50 and 1000 seconds have been collected by Rijkswaterstaat at a number of locations on the North Sea (see Figure 1). This provides a unique picture of the long wave conditions as they propagate across the North Sea, including infragravity waves and meteo tsunamis (see Figure 2). The long waves are important in the generation of harbour oscillations, dune erosion during storms (Figure 3), potential overtopping, overwash and inundation. In view of coastal safety it is thus pertinent to understand the spatial and temporal distribution of the long waves as well as the underlying mechanisms that cause them. Currently most modeling efforts start at 20 m water depth ignoring the long waves that have been generated on the North Sea shelf, thus potentially leading to an under prediction of the extreme water levels in front of the coast during storm conditions.

Objectives

In this thesis we aim to answer the following research questions:

RQ1: What is the spatial and temporal distribution of the long waves on the North Sea?

RQ2: How do the long wave conditions transform from the North Sea towards the coast?

RQ3: What are the processes that control the generation and propagation of these long waves?

RQ4: Can these long waves be predicted at the coastal boundary?

RQ5: Can their importance during storm conditions be quantified?

Approach and activities

The project will be done in close collaboration with Rijkswaterstaat with the opportunity of working at their office in Delft using the following approach:.

- retrieve the data and subject it to various statistical analyses to extract both the short-term and long-term behavior of the long waves.
- cross-reference with potential forcing mechanisms including air-pressure, wind stresses, concurrent wave conditions, tidal elevation, shoaling and refraction, etc.
- predict the occurrence of long waves incident on the coast as function of the environmental conditions
- Assess their contribution to potential flooding and beach erosion using modeling

Candidate

Pro-active, independent master student with affinity with the following subjects: Waves, data analyses, scripting (Matlab/Python) and modeling.

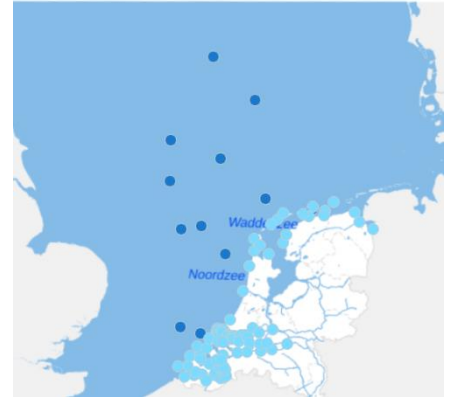


Figure 1: Measurement locations of long waves (dark blue circles).



Figure 2: Arrival of Meteo tsunami at Zandvoort (courtesy of NOS).



Figure 3: Example of dune erosion along the Dutch Coast.

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