

# Rebuilding the natural integrity of barrier islands

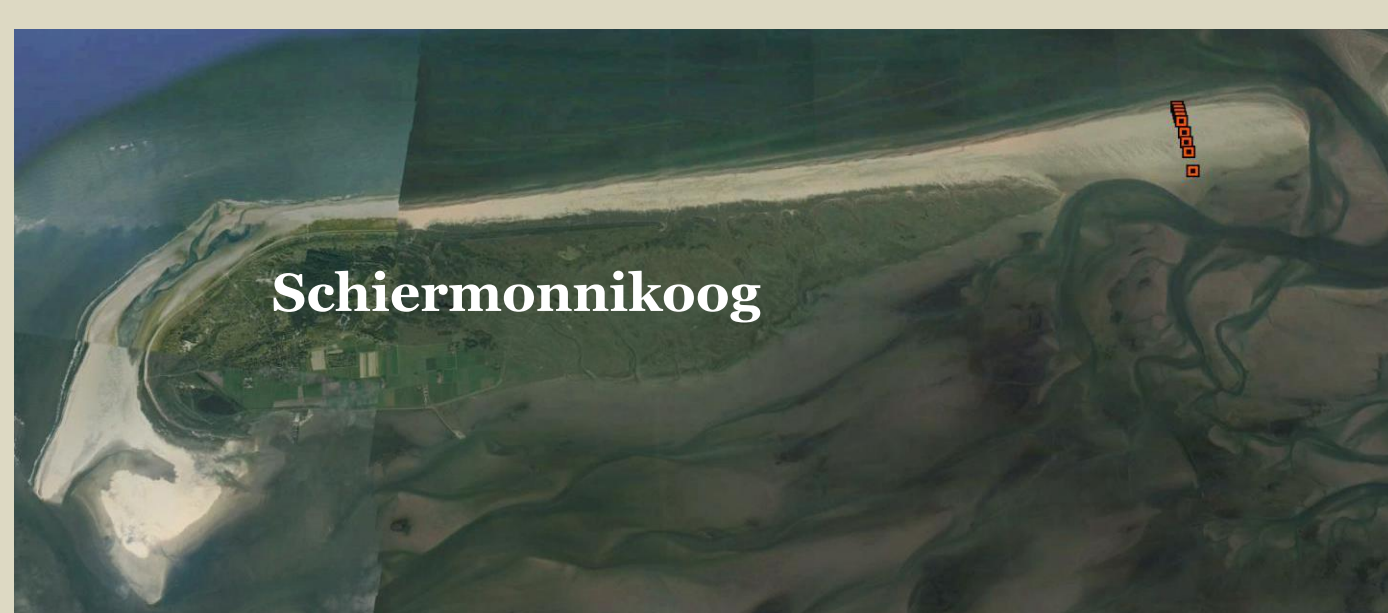
## Observations of the hydrodynamics during inundation on Schiermonnikoog

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### Research aim

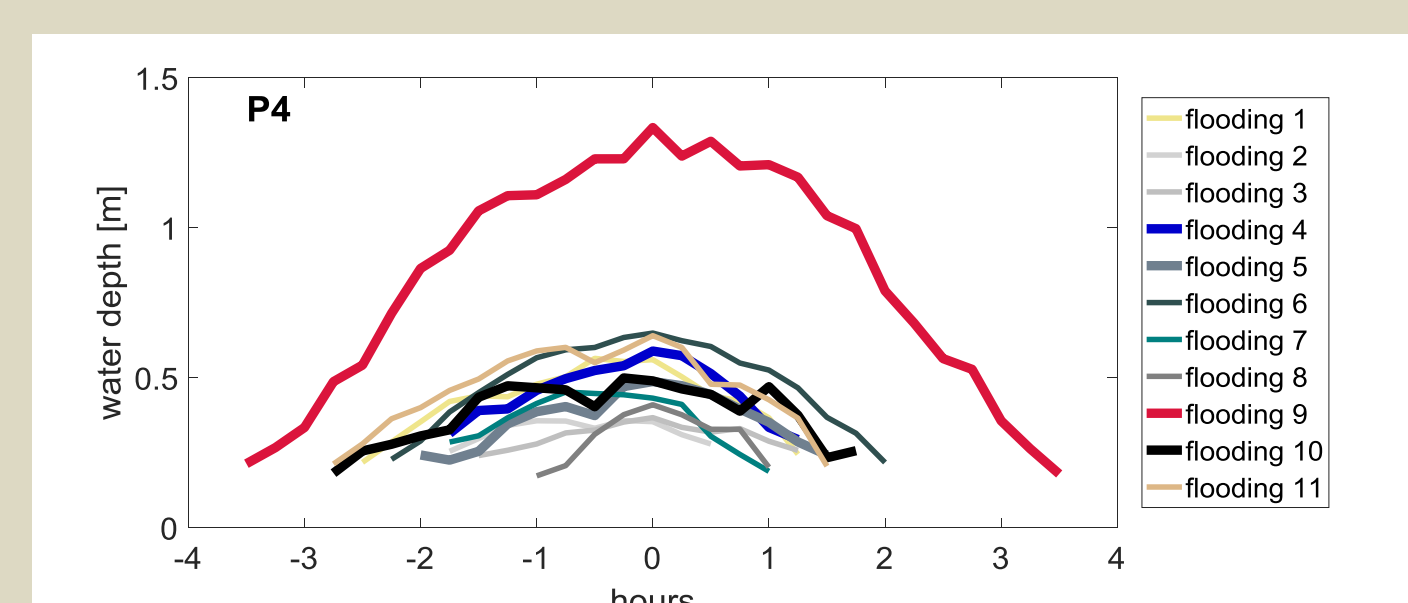
- In general, our studies focus on understanding the prerequisites for a successful redevelopment and activation of overwash, inundation, and the formation of washovers. The purpose of these measures is to reintroduce dynamic processes which can promote sediment deposition to compensate for subsidence and sea level rise and to stimulate ecological development and biodiversity. In these studies we will not only consider the feasibility and effectiveness of such an approach, but we will also generate design procedures and dimensions.
- This part of the project focuses on the detailed, short-term, hydrodynamics and the associated morphological response during inundation. The specific goal of the work presented here is to identify the main hydrodynamics, such as current strength and direction as well as wave transformation. For this, fieldwork was carried out in the winter of 2014/2015 on Schiermonnikoog.

### Field site



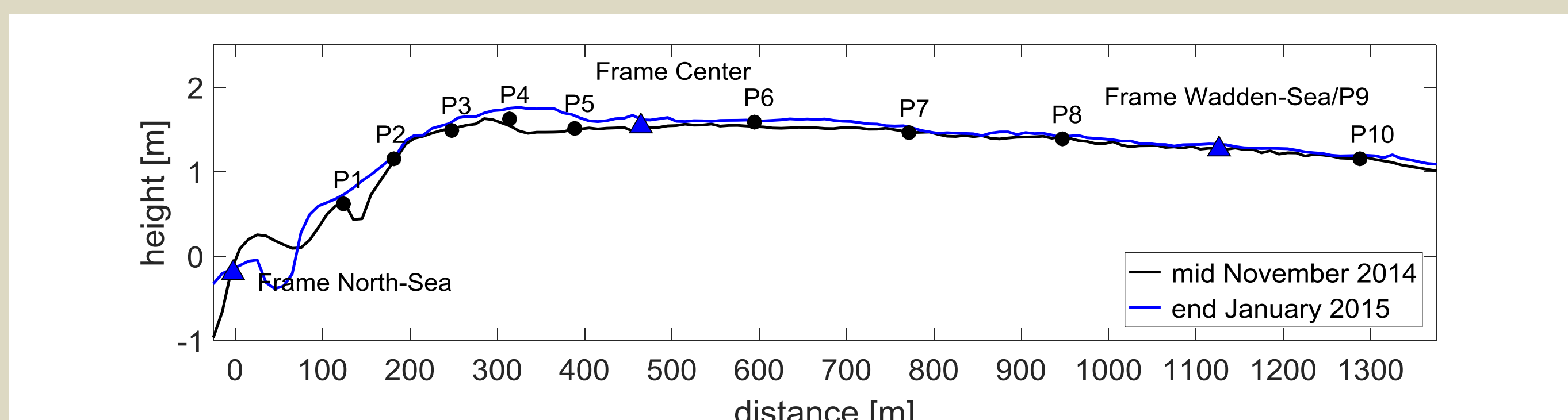
The orange squares indicate the location of the field site.

### Floodings



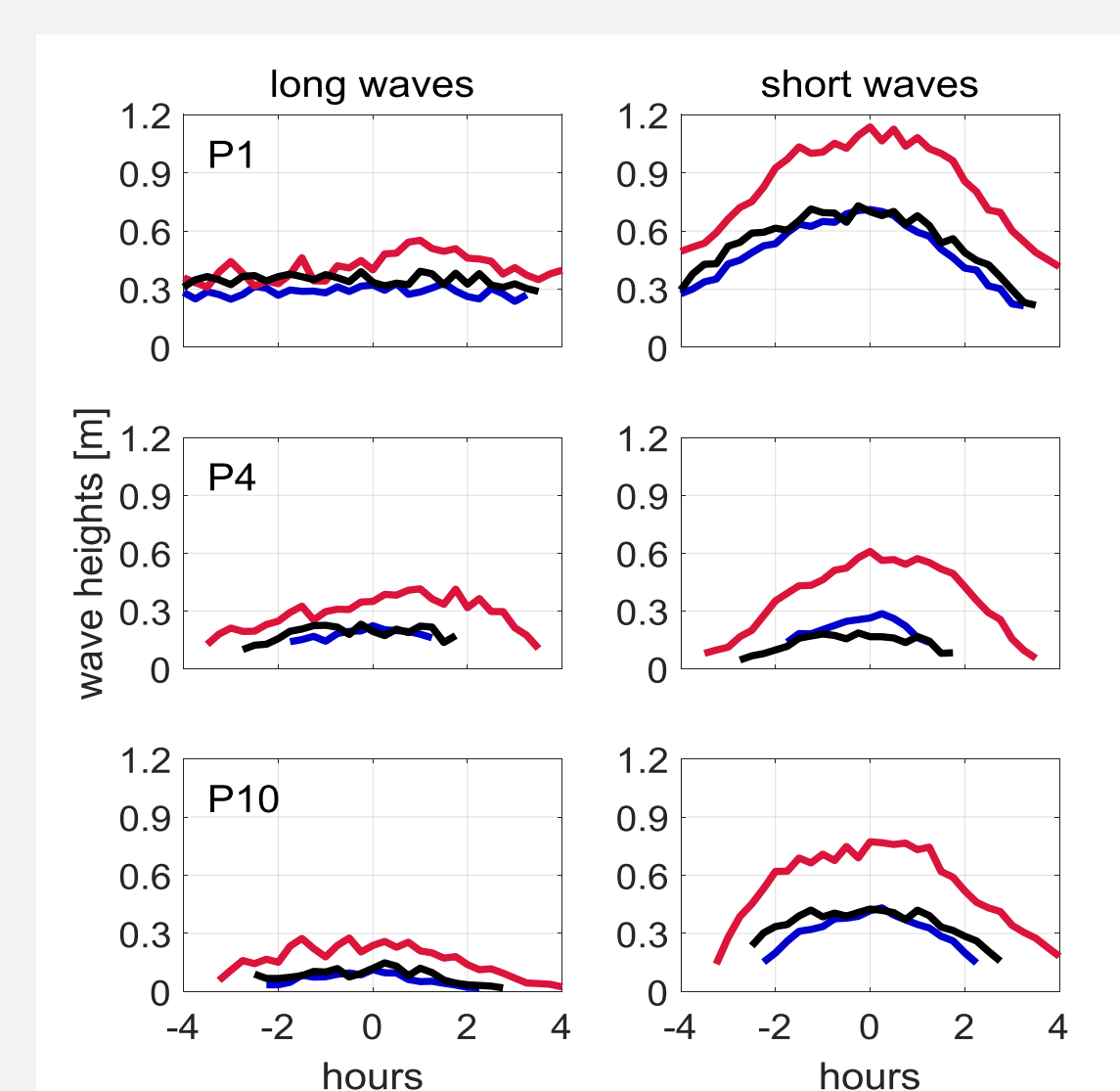
Inundation depths at the highest located sensor.

### Cross-shore profile and change

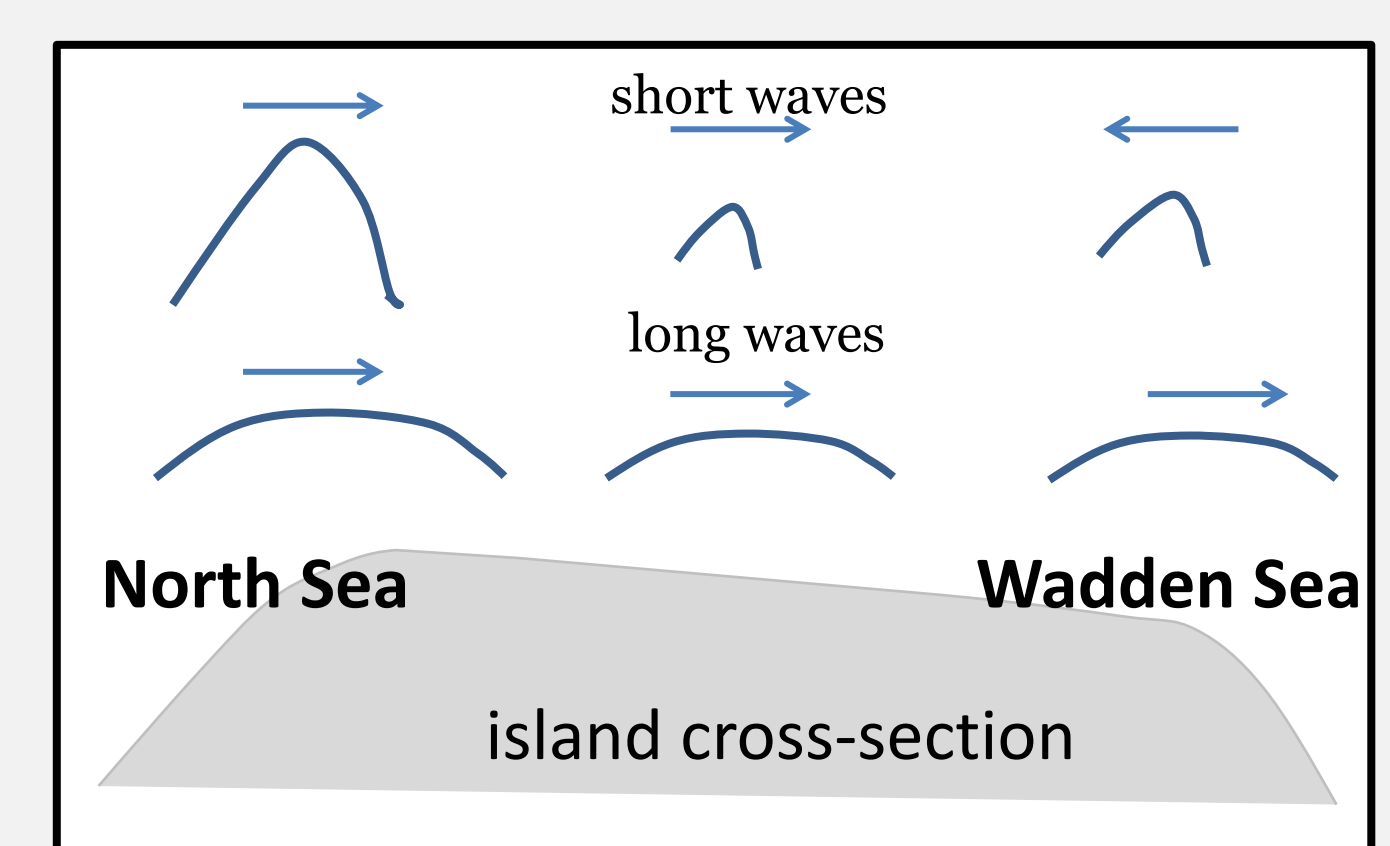


Cross-shore profile at the beginning and the end of the field campaign. The black dots and blue triangles indicate instrument locations.

### Waves



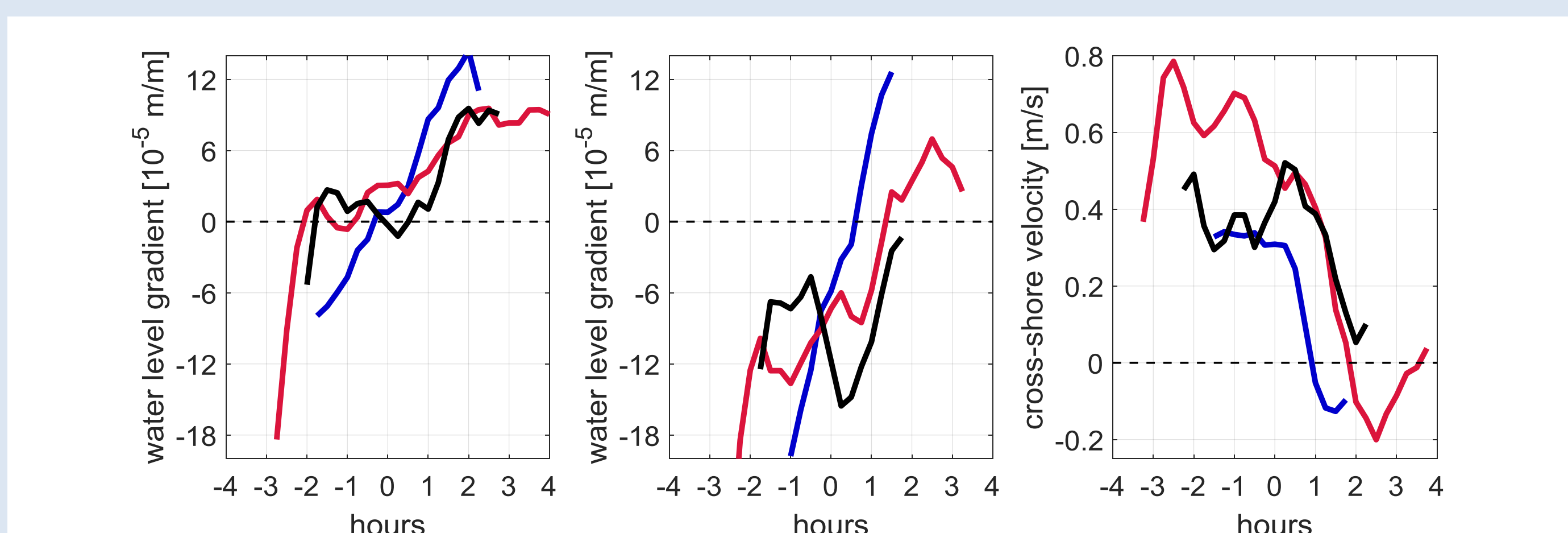
Long and short waves are shown at three different locations for three different occasions.



Short and long waves propagate onshore. In addition short waves, generated in the Wadden Sea, propagate offshore.

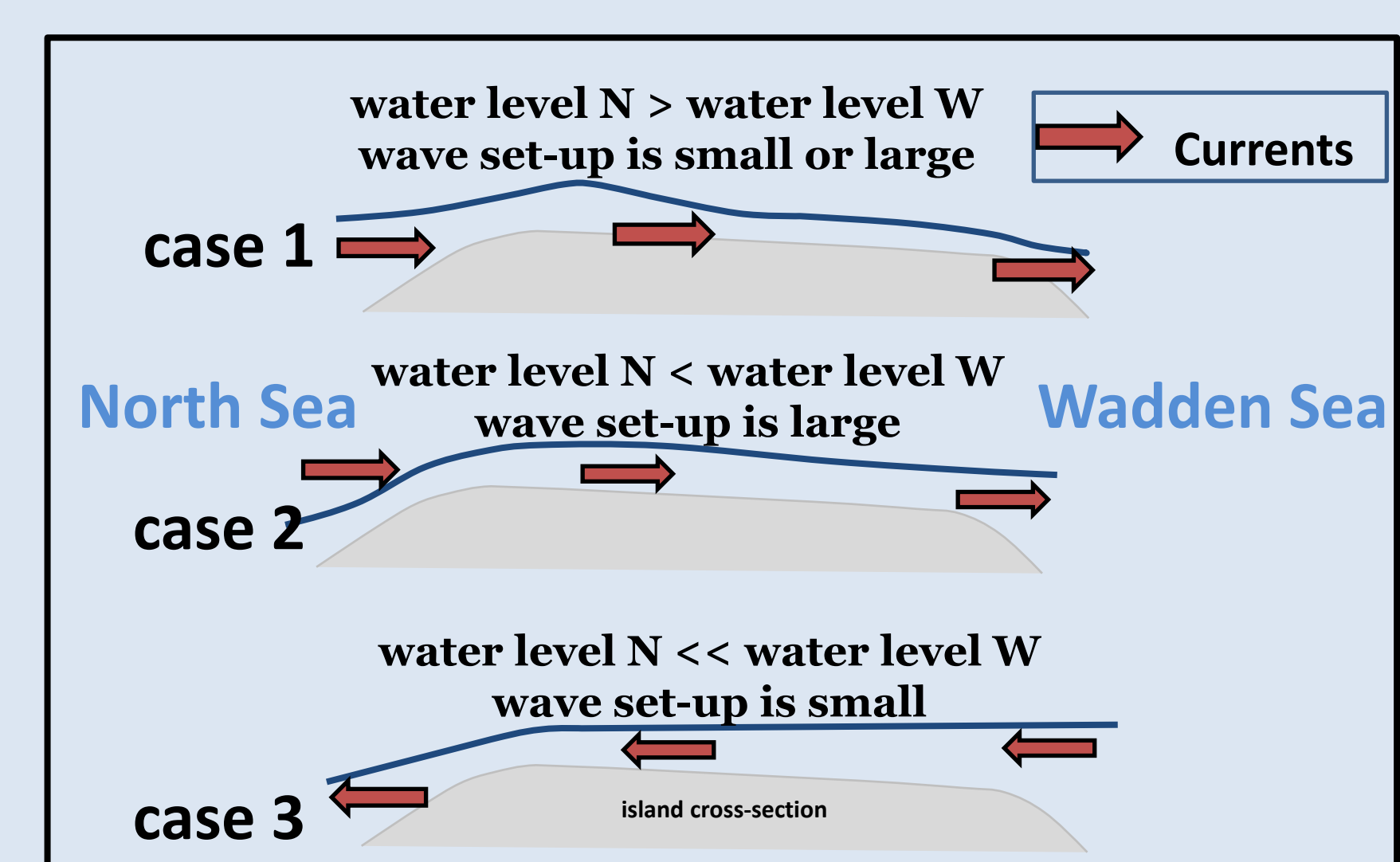
Long waves: periods 20-200 seconds  
Short waves: periods < 20 seconds

### Water levels and Currents



Positive water level slope: water levels higher towards the Wadden Sea  
Positive cross-shore velocities: velocities onshore directed

Shown are the large scale water level gradients between the Wadden and the North Sea and the local gradient at the center (P6-P5). The x-axis shows the time before and after high tide.



Currents are mostly onshore directed even if the water level is higher in the Wadden Sea. This is due to a local increase in water level (wave set-up) around the crest, caused by the breaking waves.

### Discussion

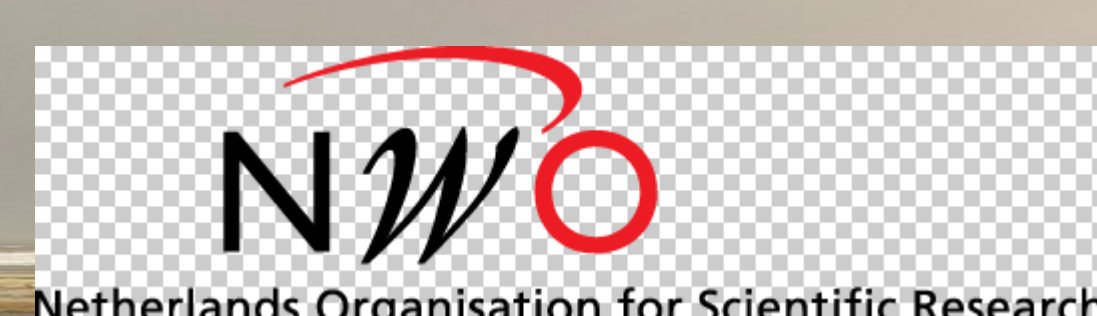
- Increased water levels in the Wadden Sea will most likely slow flow velocities, and therefore impact sediment transport.
- Waves from the Wadden Sea and onshore propagating long wave bores might play an important role in sediment stirring and transport.

### Main findings

- Waves entered from the North Sea as well as from the Wadden Sea.
- Currents were mostly onshore directed, but occasionally reversed direction due to higher water levels in the Wadden Sea.
- Long waves were found to frequently propagate onshore as bores in shallow inundation depths.

### Work in progress

- Simulating waves and currents on various beach slopes and island profiles to investigate how these are changing wave shapes, wave transformation and current velocities (all are important for sediment transport).
- Data collection is in progress (winter 2016/2017) on Schiermonnikoog to gain insight into the relative importance of waves and currents for sediment transport during inundation.



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