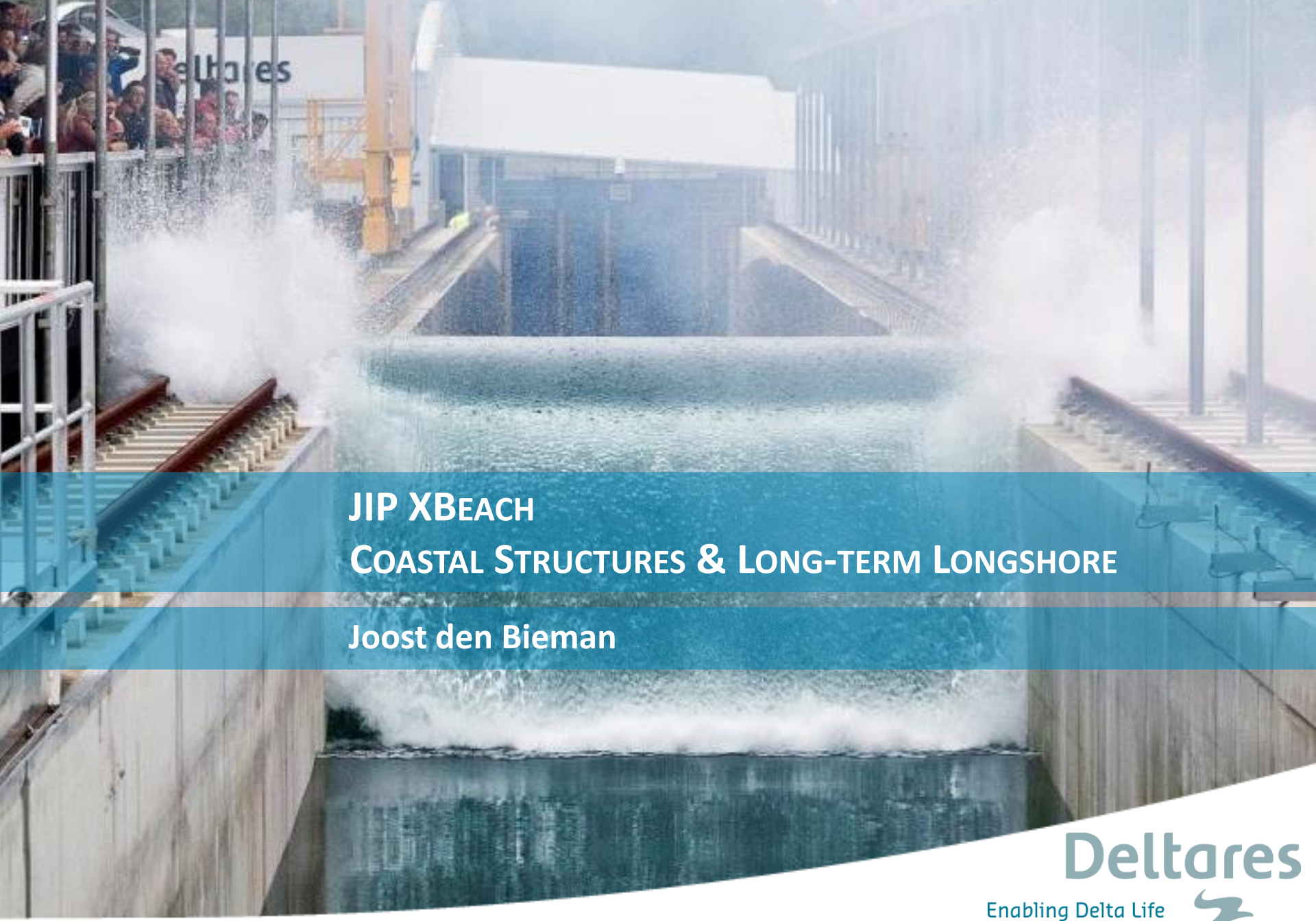


JIP XBeach
Coastal Structures & Long-term Longshore

Joost den Bieman

Deltares
Enabling Delta Life

Coastal Structures

Focus on further validation of:

- Wave overtopping over non-porous structures
- Wave transmission of coastal structures through porous submerged structures

Main driver:

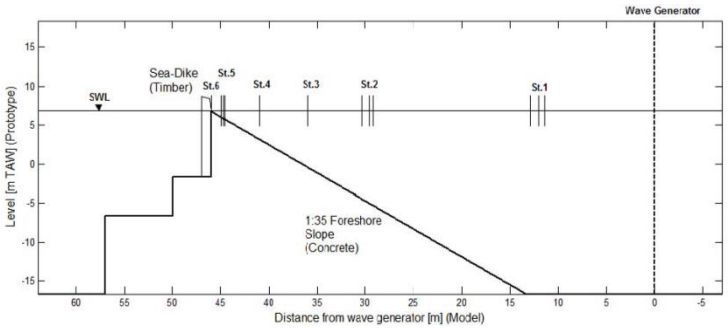
- Applicability in engineering context with coastal structures

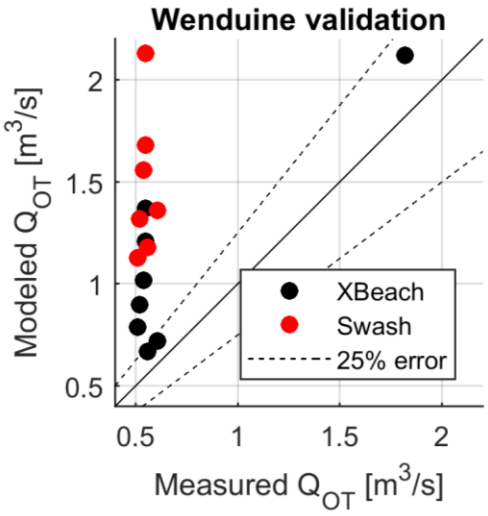
Uses XBeach non-hydrostatic: phase-resolving short waves

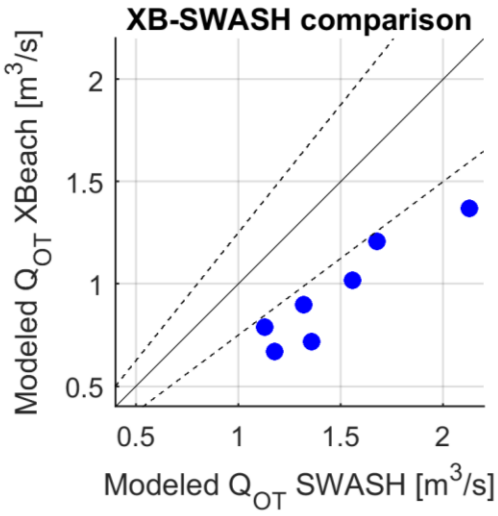
Coastal Structures – wave overtopping

Compare with:

- ‘Wenduine’ validation data (Flanders Hydraulics)
- SWASH model







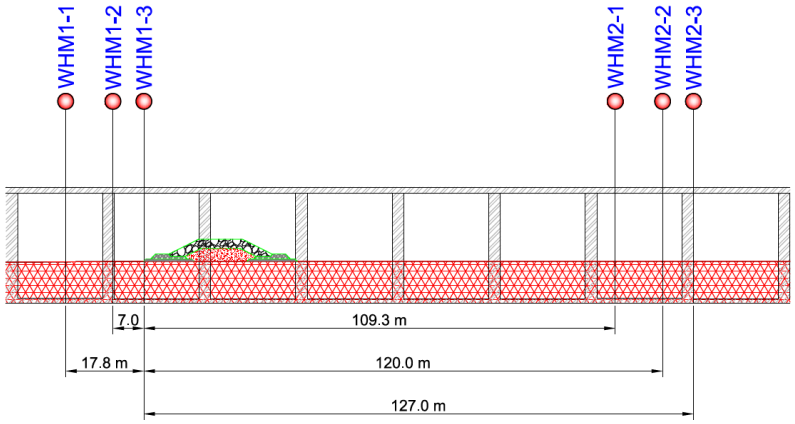
Conclusions:

- Q_{OT} very sensitive to water level at toe (for small freeboards)
- Significant difference in modeled Q_{OT} for similar forcing conditions (highly dependant on exact realisation of wave signal)
- XBeach and SWASH show similar trends
- Q_{OT} from SWASH consistenly higher than XBeach (XB closer to data)

Coastal Structures – wave transmission

Compare with:

- ‘Constanta’ validation data (Van Oord)



Conclusions:

- No significant improved performance with GroundWater module
- Reasonable transmission coefficients for submerged cases
  - Ignoring permeability of breakwater
- Not a feasible approach for emerged or only just submerged breakwaters

Conclusions

Wave overtopping over non-porous structures

- XBeach nonh and SWASH very similar performance
- Reasonable results for large overtopping discharges
- Good enough for engineering purposes

Wave transmission through porous structures

- Groundwater module not suitable for this purpose
- Problematic for limited submergence and emerged structures
- Possible follow-up: implement suitable porous flow formulations

Long-term alongshore

Focus on alongshore processes in long-term models (months-years)
Distinguish between

- Built coast: use of ‘sand breakwater’ to protect jetty
- Sandy coast: development of sand waves due to wave obliquity

Main driver:

- Exploration of morphological development long-term cases

Uses XBeach in stationary mode, assuming surfbeat less important for long-term development

Long-term alongshore – built coast

Sand breakwater

- Situated near Lagos, Nigeria
- Protecting RoRo jetty
- Aligned with dominant wave direction
  - Swell from a very constant direction is typical for this coast
- Compare to FINEL model

videoSandBreakwater

Conclusions:

- XBeach results are very comparable to FINEL
- Stationary wave solver suitable to run long-term simulations
  - 2+ years in this case

Long-term alongshore – sandy coast

Sand waves

- Schematized bathymetry + Gaussian noise
- Realistic (oblique) wave forcing
- Test sensitivity to grid, wave forcing and morfac

Conclusions:

- XBeach forms instabilities for various configurations of grid and wave forcing
- No clear pattern, some physically impossible
- Only forms with morfac > 50

Long-term alongshore

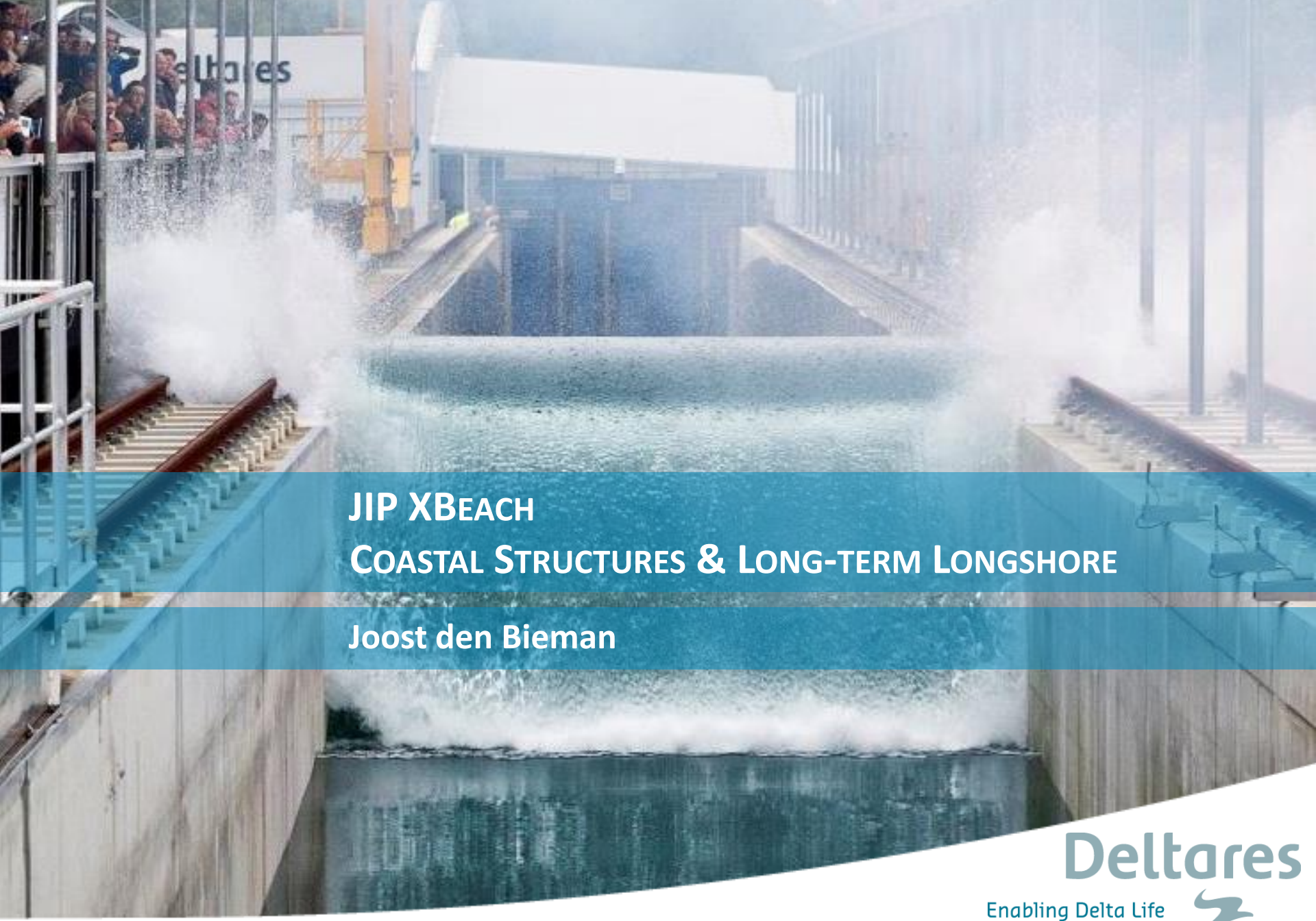
Built coast: use of ‘sand breakwater’ to protect jetty

- XBeach compares reasonably to FINEL model

Sandy coast: development of sand waves due to wave obliquity

- No clear pattern in formation sand waves

Currently, XBeach stationary seems a less-than-ideal tool to simulate long-term morphological development



JIP XBeach
Coastal Structures & Long-term Longshore

Joost den Bieman

Deltares
Enabling Delta Life