

# TBA 4270: Coastal Engineering

## Research-based education

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# TBA 4270: Coastal Engineering

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- Wave theory
  - linear, nonlinear, regular, irregular
- Wave propagation from offshore towards the coast
- Wave statistics: Long term and short term
- Extreme value analysis
- Tides and water levels
- Local scour under waves and current
- Numerical modelling



# TBA 4270: Coastal Engineering

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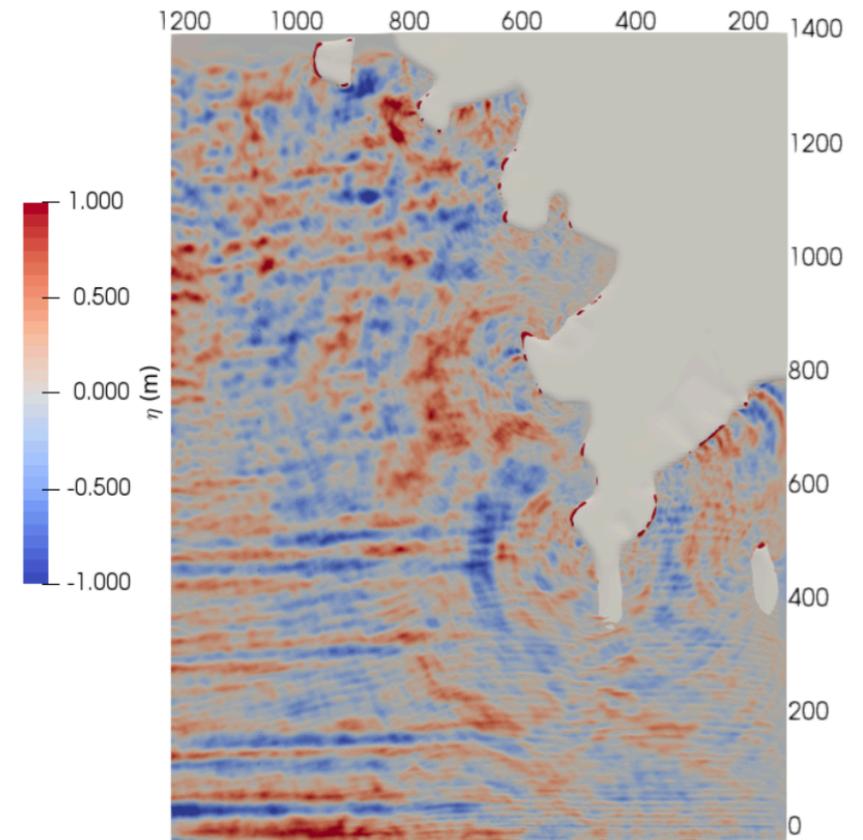
- Coastal infrastructure projects
  - Aquaculture sites
  - Harbour protection
  - Safety of coastal constructions
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- Synergy with
    - TBA 4265 Arctic and marine civil engineering
    - TBA 4145 Port and coastal facilities



# Research-based education

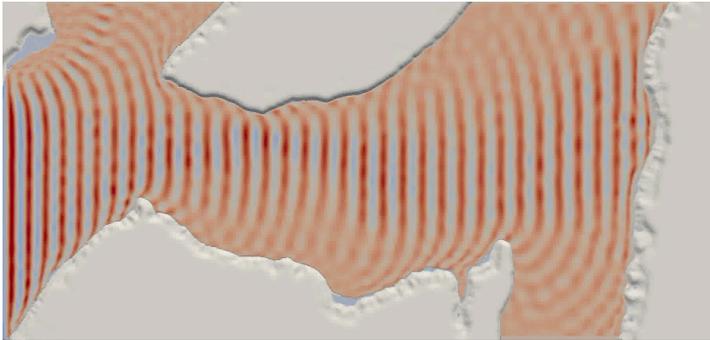
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- Combined responsibility of teaching and research
  - Students get access to the state-of-the-art research
  - Quick uptake of latest knowledge in industry
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- Foundation in theory
  - Introduction to new methods
  - Practical application of methods
  - Skills in
    - Identification of applicable methods
    - Use and analyse



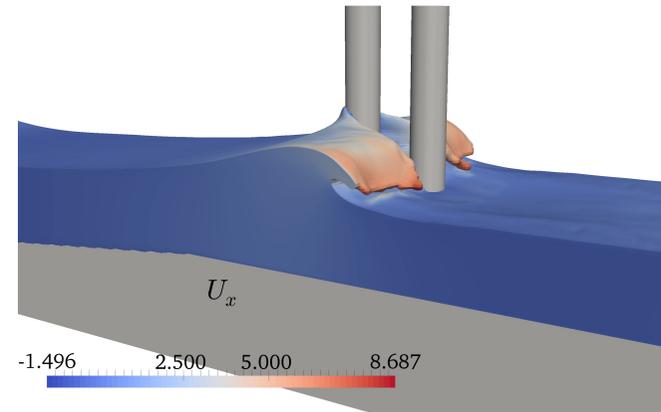
# Numerical wave modelling research at MB

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## Shallow water Model / Potential Flow Model

- Large Scale
- Phase-resolving models for Norwegian Conditions
- REEF3D : SFLOW
- REEF3D : FNPf



## Numerical Wave Tank

- Near-field
- Flow resolving
- REEF3D : CFD

# Numerical Modelling

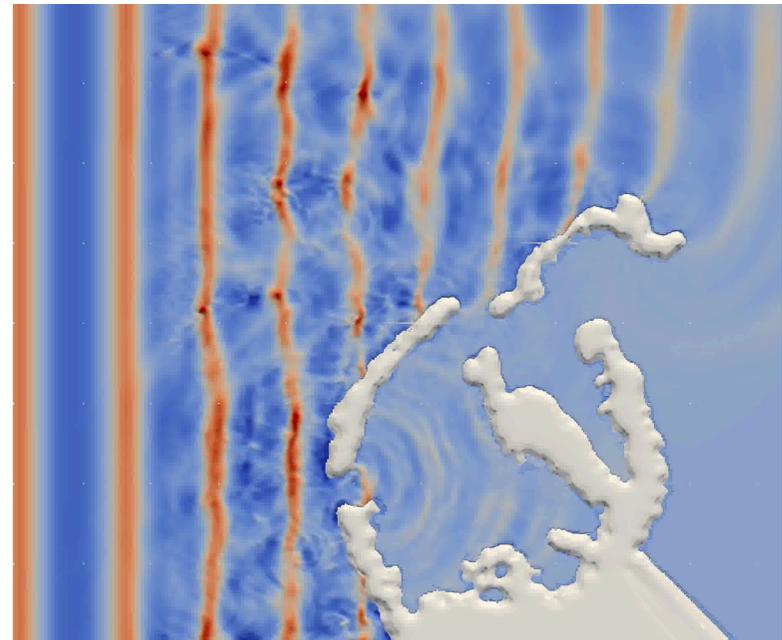
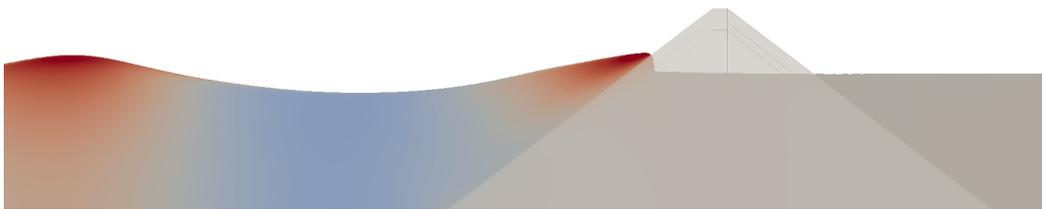
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- Large spatial and temporal scale
- Different methods and combinations
  - FEM/DEM/FNPF/Boussinesq/CFD
- Transition from research to a practical engineering tool
  - eg. aerodynamics and car industry
  - “the future is simulation based design” -Frederick Stern
  - step-by-step development: code- validation- design and analysis tool

# Numerical modelling

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- Increasing relevance
- Easier to setup and operate
- User input and interpretation important



# Numerical modelling

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- Focus on practical work to understand and apply
- Theory in lectures, application in assignments
  
- SWAN modelling for Sulafjord (deep water)
- SWAN modelling towards harbour (deep to shallow)
- SWAN modelling for breakwaters
- REEF3D: : SFLOW Shallow water modelling
- REEF3D: : FNPF Fully nonlinear potential flow modelling
- REEF3D: FNPF for harbour modelling

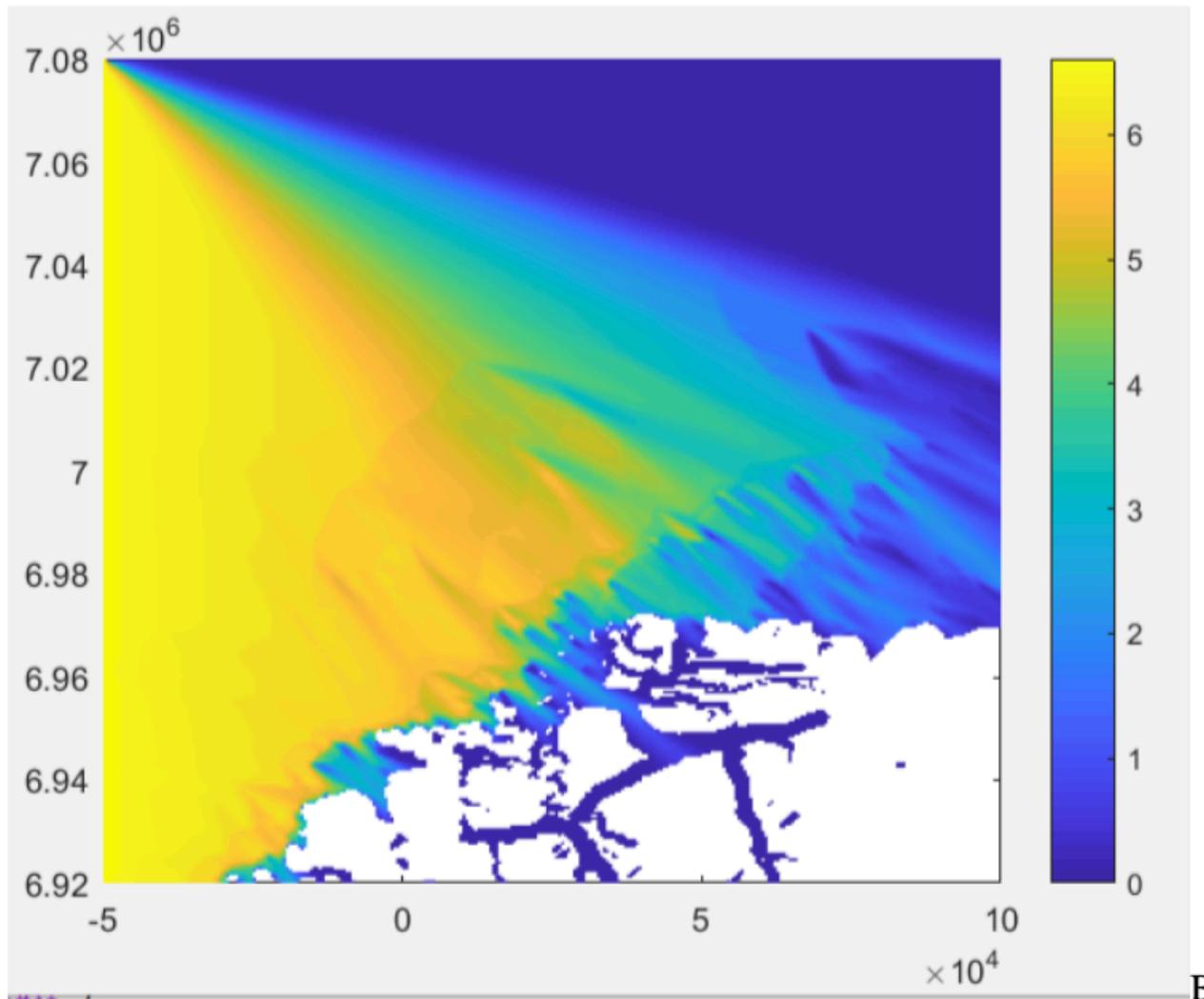
# Numerical modelling

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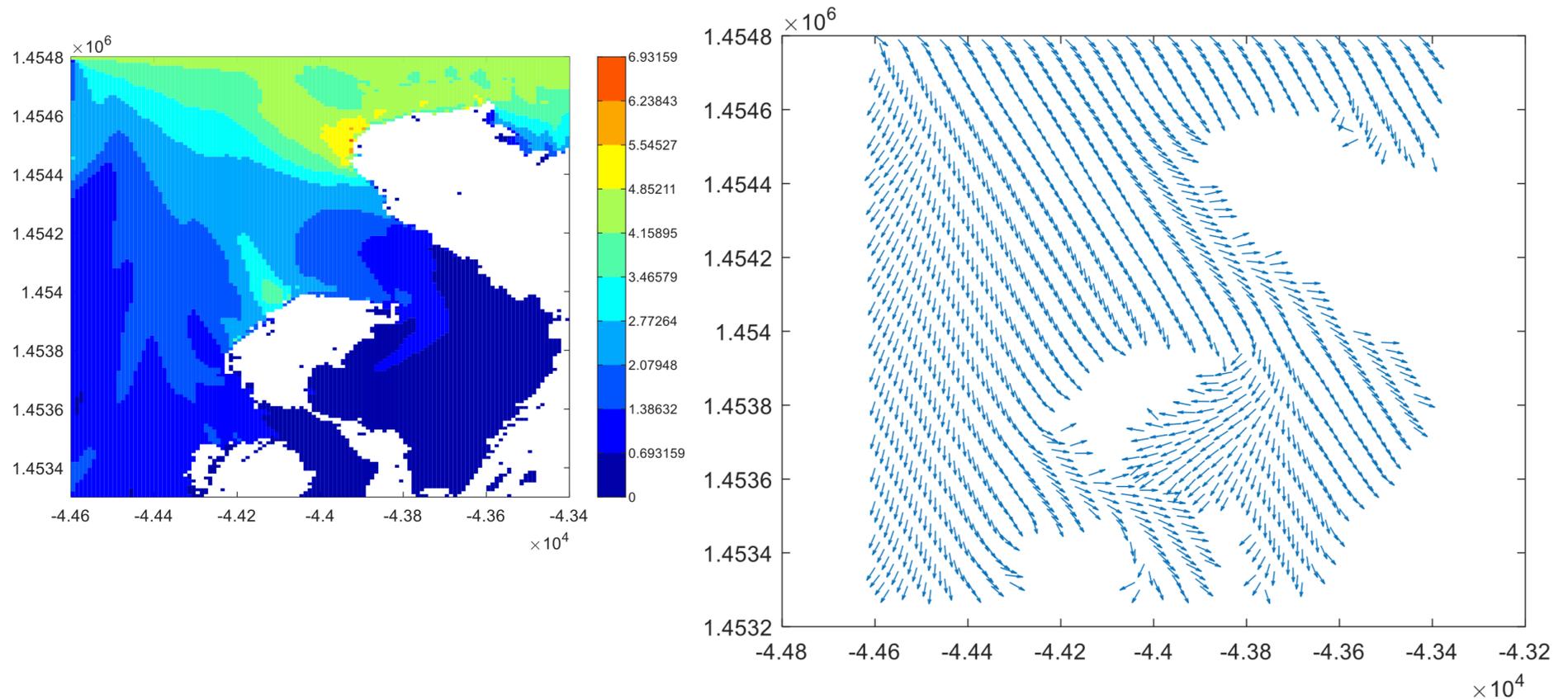
# SWAN modelling for Sulafjord

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Student submission

# SWAN modelling for Mehamn



Student submission

# SWAN modelling for breakwater design

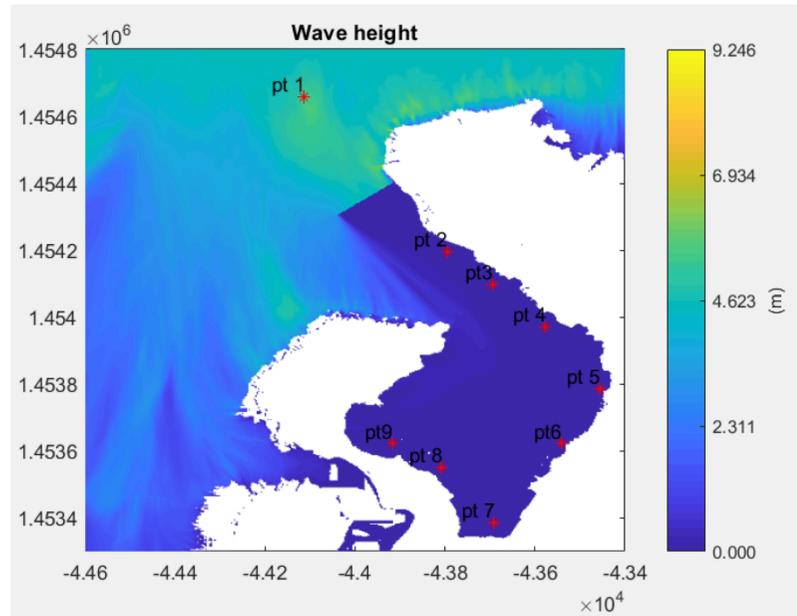


Figure 4 : Significant wave height with breakwater C165

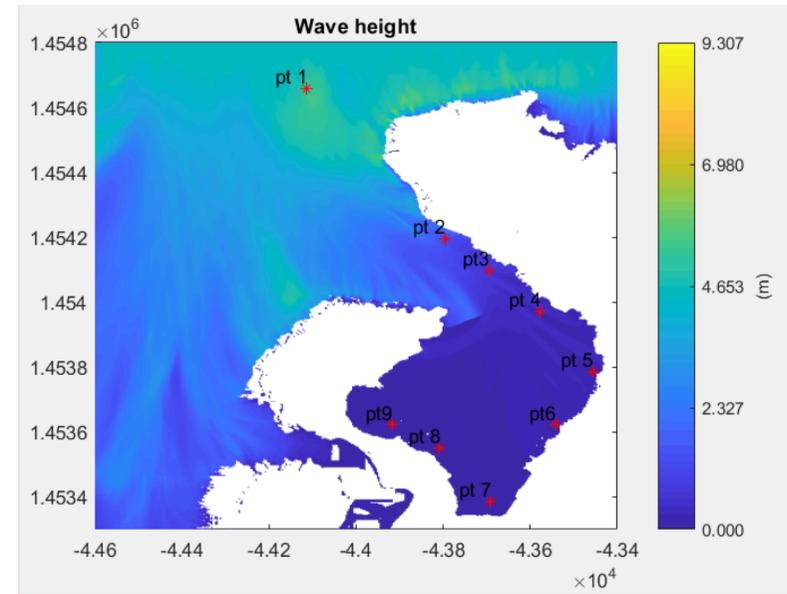
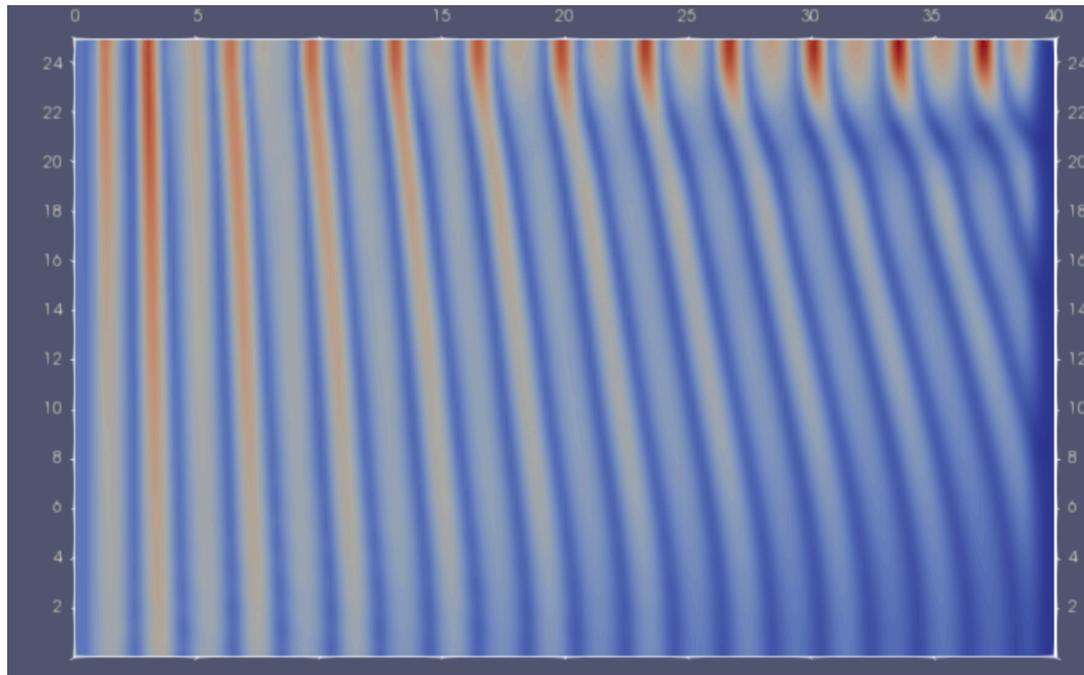
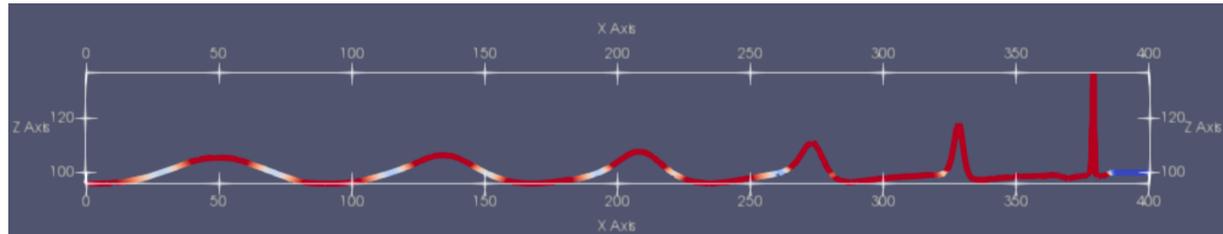


Figure 3: Significant wave height with breakwater G120

Student submission

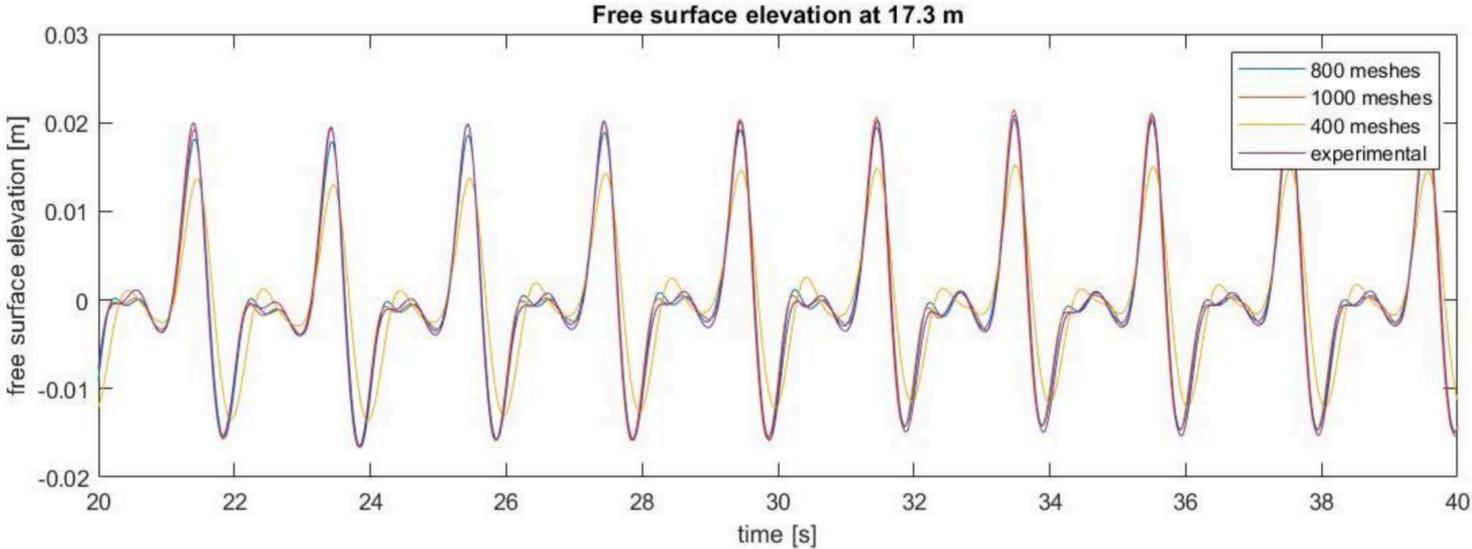
# REEF3D: : SFLOW

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Student submission

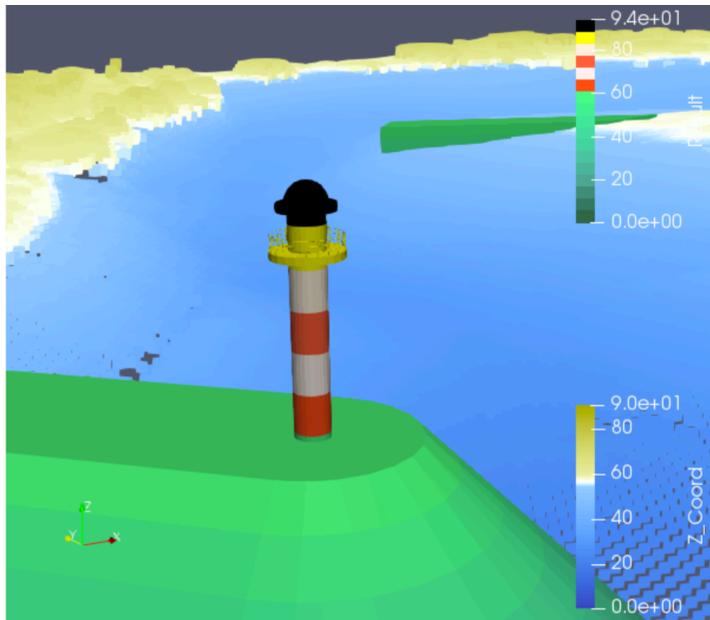
# REEF3D: : FNPF



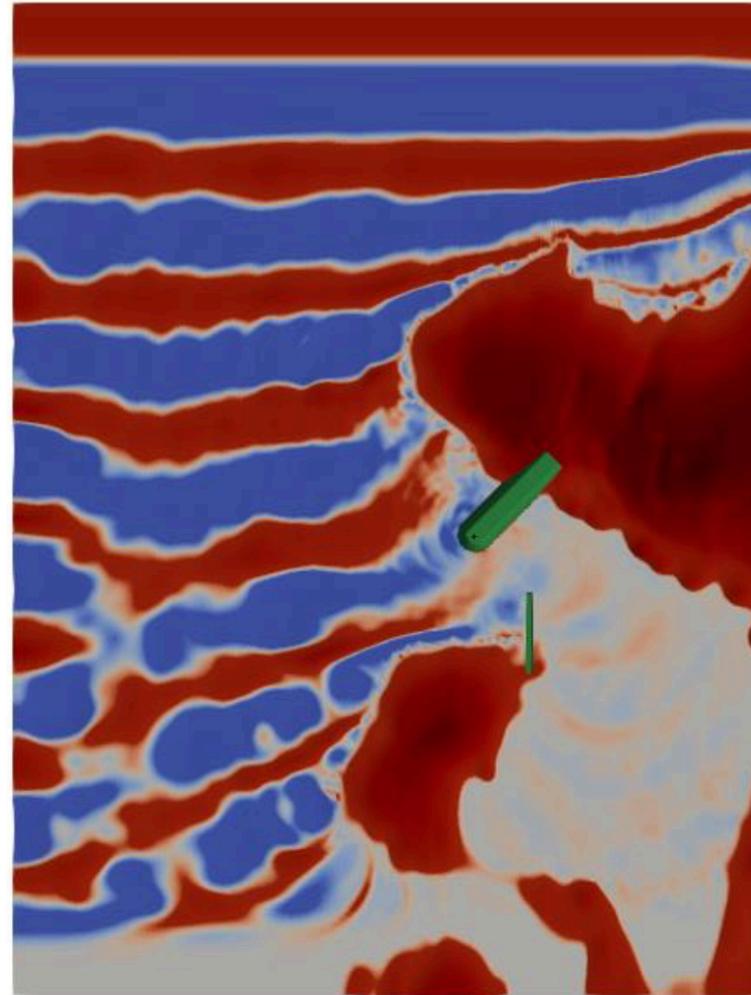
Student submission

# REEF3D: : FNPF for harbour simulations

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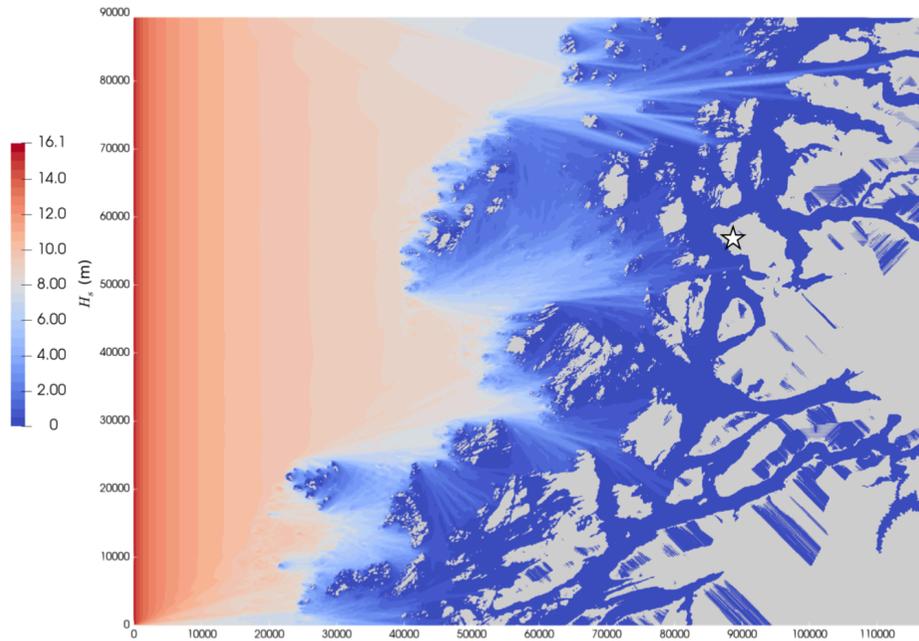
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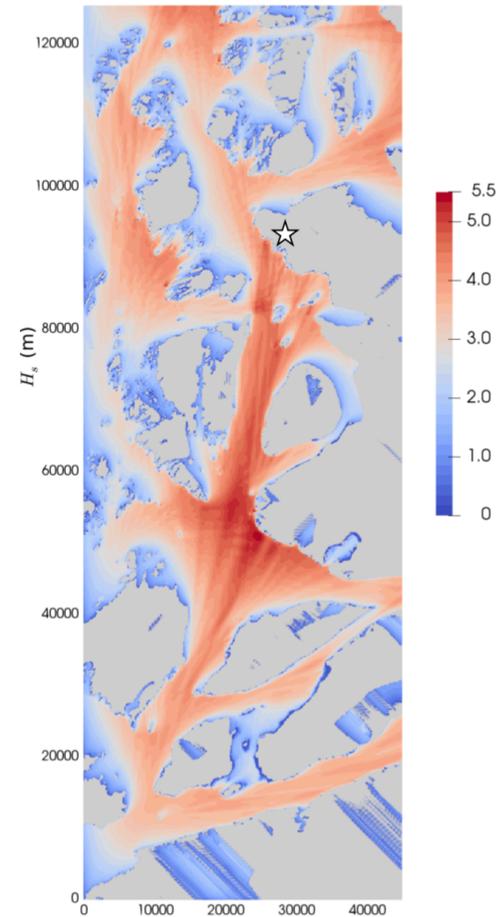
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# Application to projects

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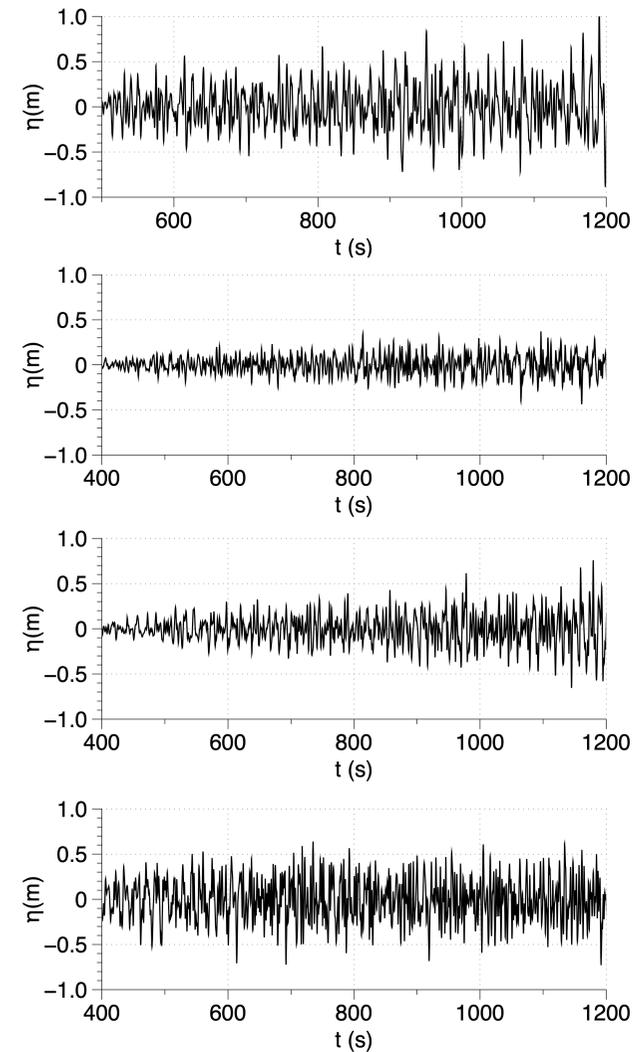
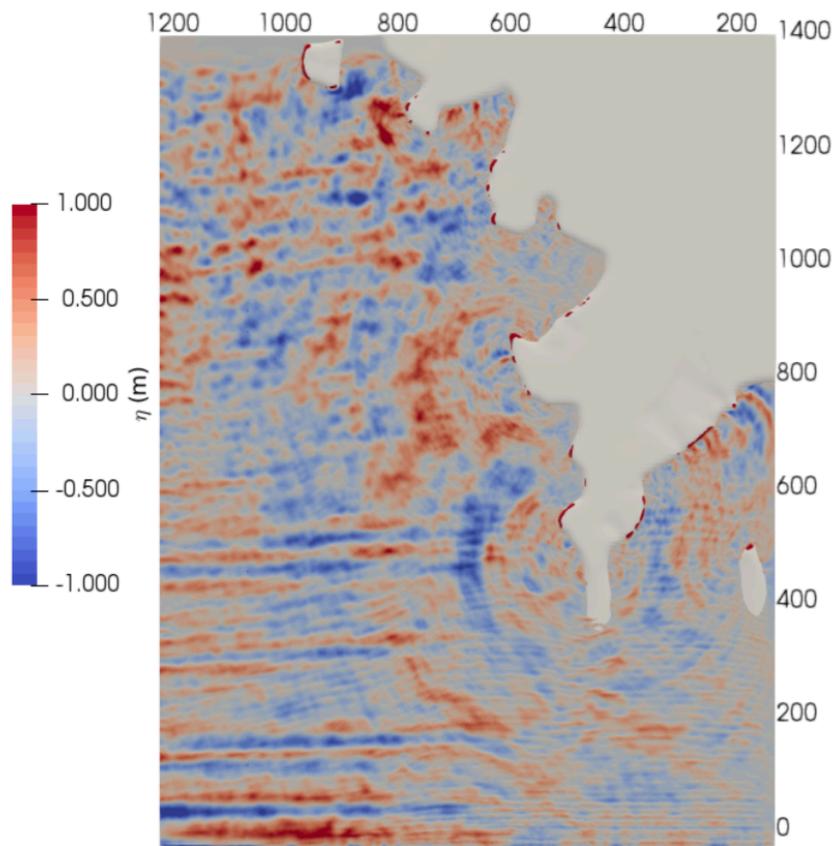
SWAN for swell



SWAN for local wind-generated waves

# Application to projects

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REEF3D: :FNPF- Phase resolved modelling for detailed analysis

# Summary

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- Revised curriculum over the last three years
- Increased teaching and practice of numerical modelling
- Theory, Application, Analysis
- Relevant skills for practical engineering applications
- Continuous upgrade of curriculum based on state of the art research
- Student satisfaction