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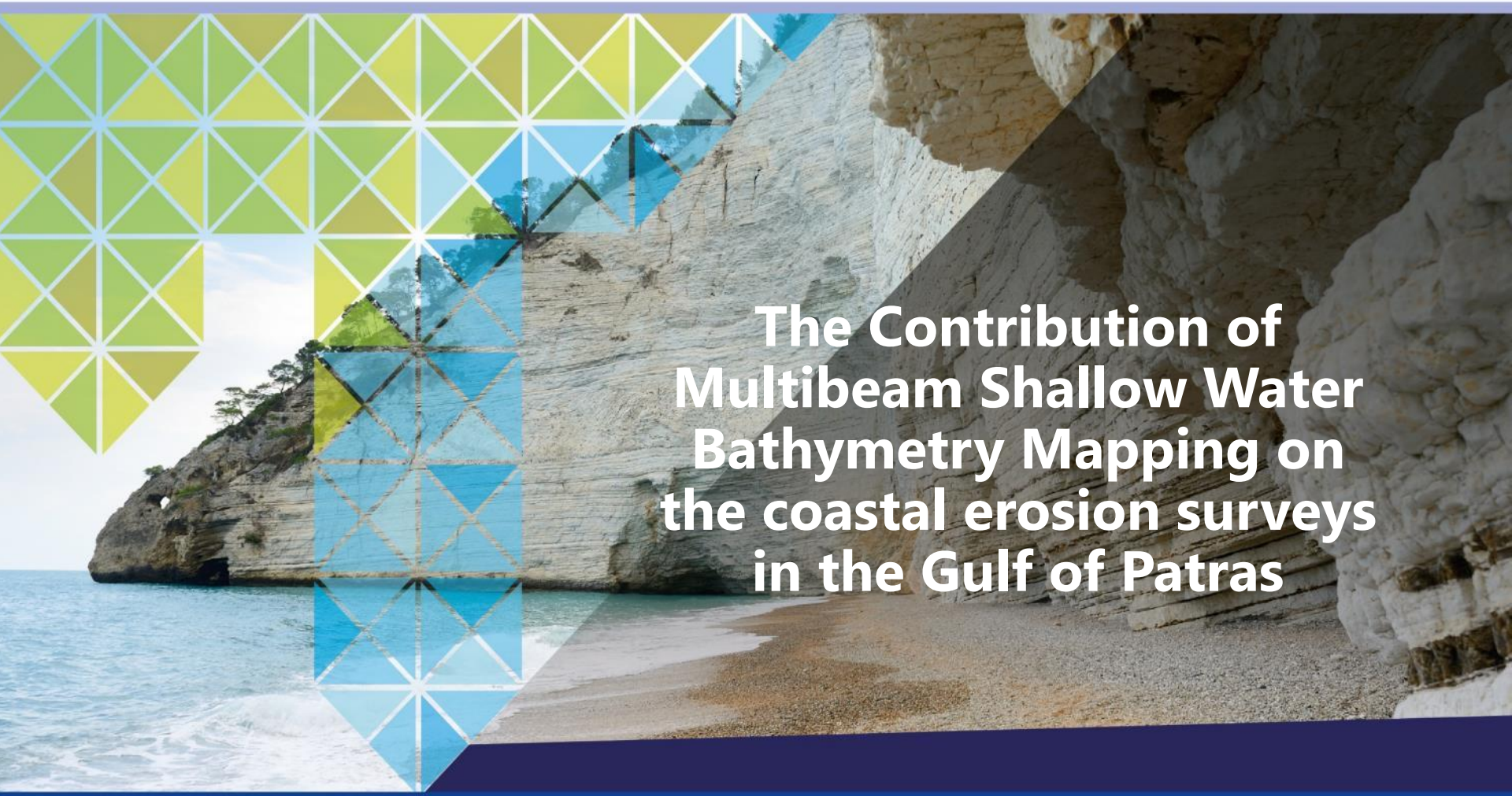

The Contribution of Multibeam Shallow Water Bathymetry Mapping on the coastal erosion surveys in the Gulf of Patras

Project co-funded by European Union, European Regional Development Funds (E.R.D.F.) and by National Funds of Greece and Italy

RESEARCH TEAM - LMGPO

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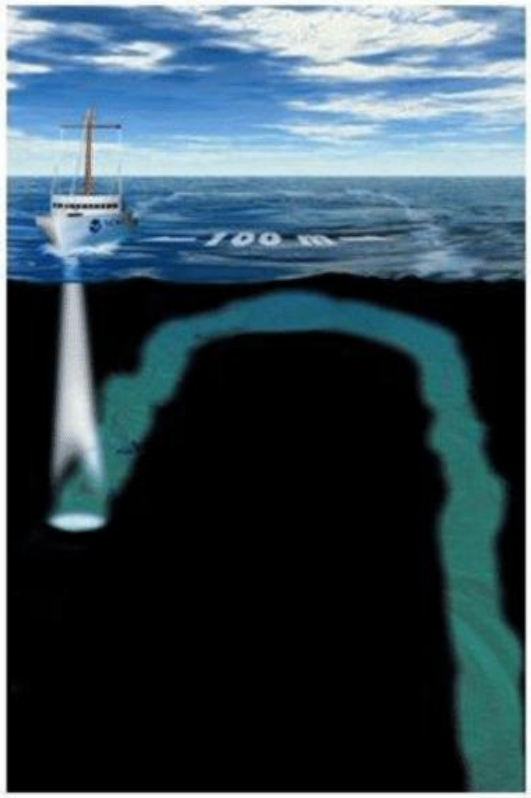
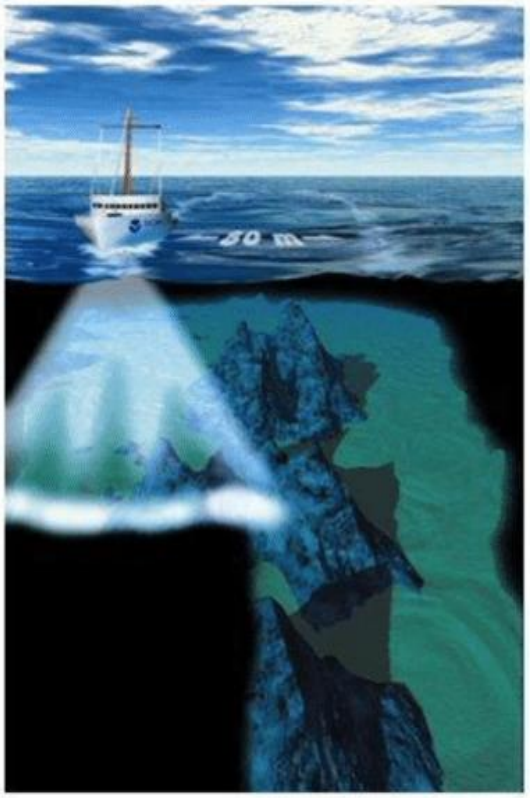
- Dr. Fakiris Elias, Research assistant
- Dr. Dimitris Christodoulou , Research assistant

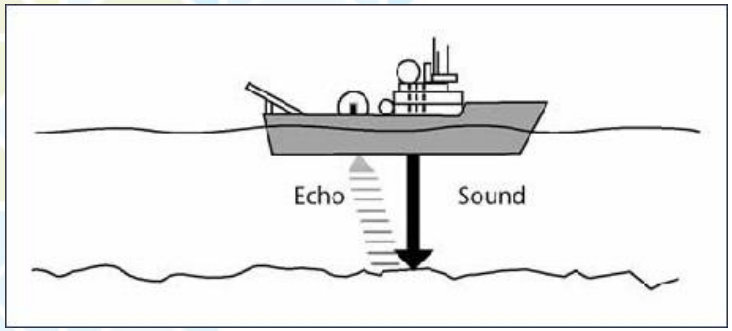
- Xenophon Dimas, PhD Candidate
- Nikos Georgiou, PhD Candidate

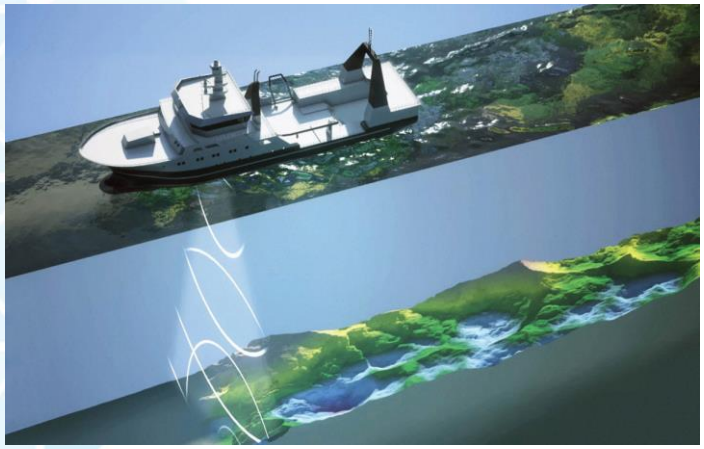
1. Sonar bathymetry

Single-beam vs Multibeam echosounders



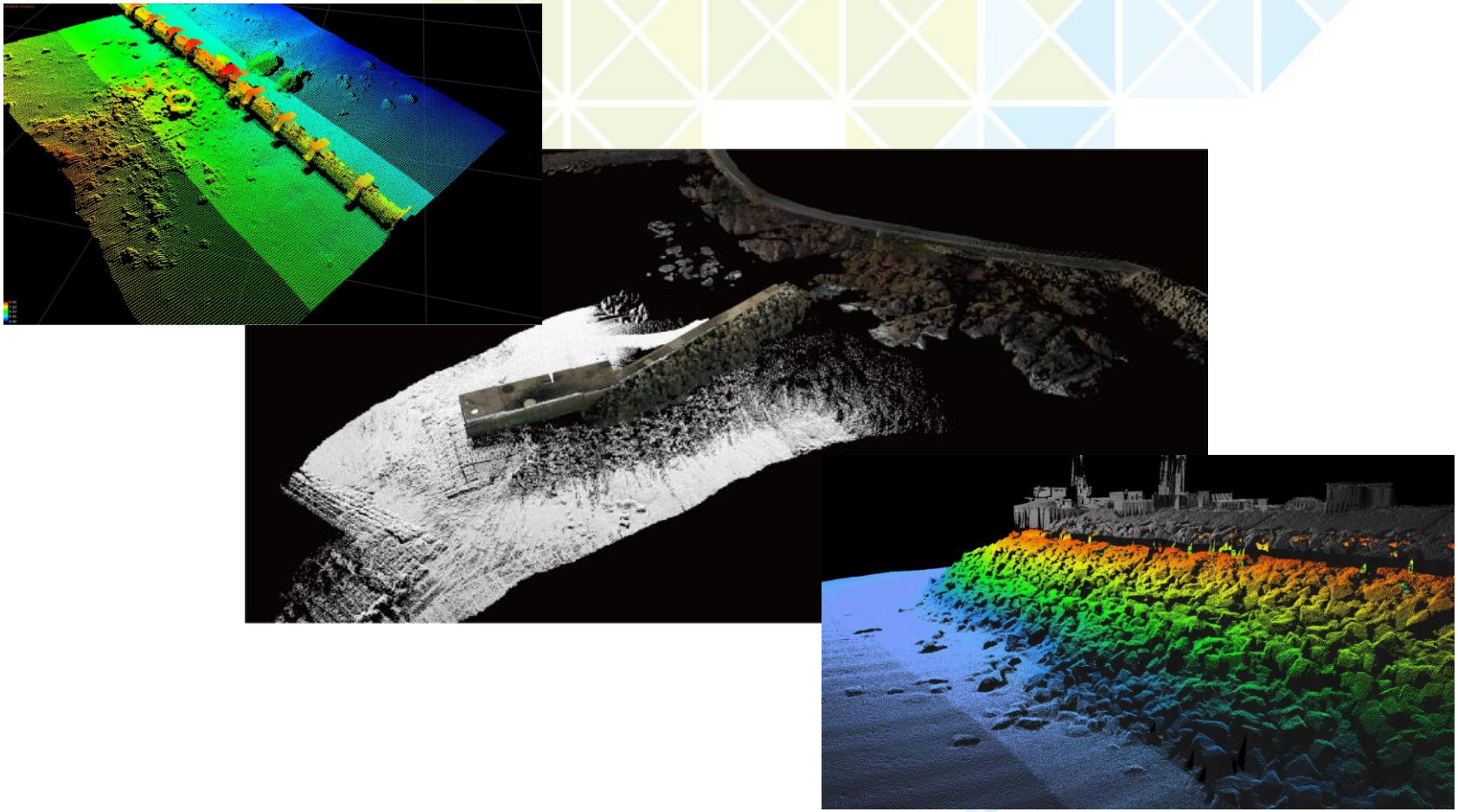






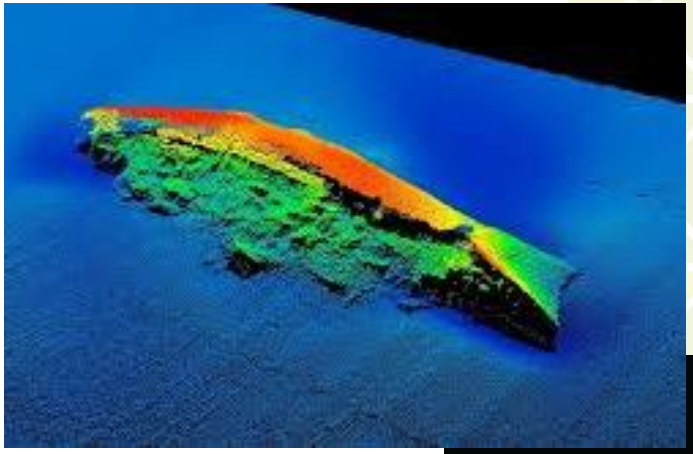
1. Sonar bathymetry

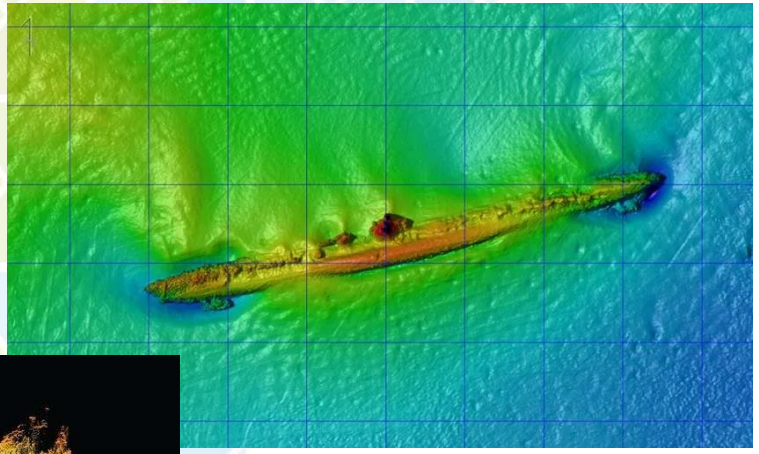
Multibeam echosounder applications: Engineering

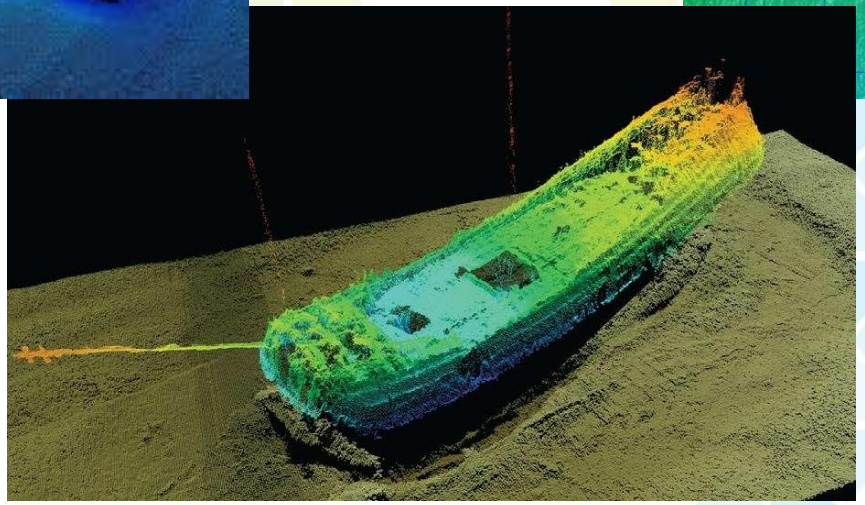


1. Sonar bathymetry

Multibeam echosounder applications: Cultural heritage

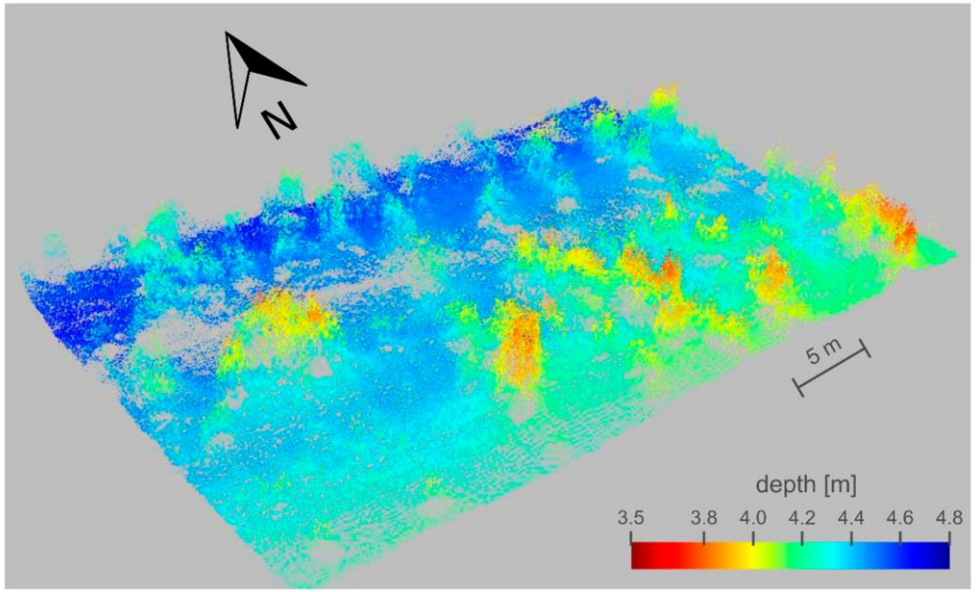


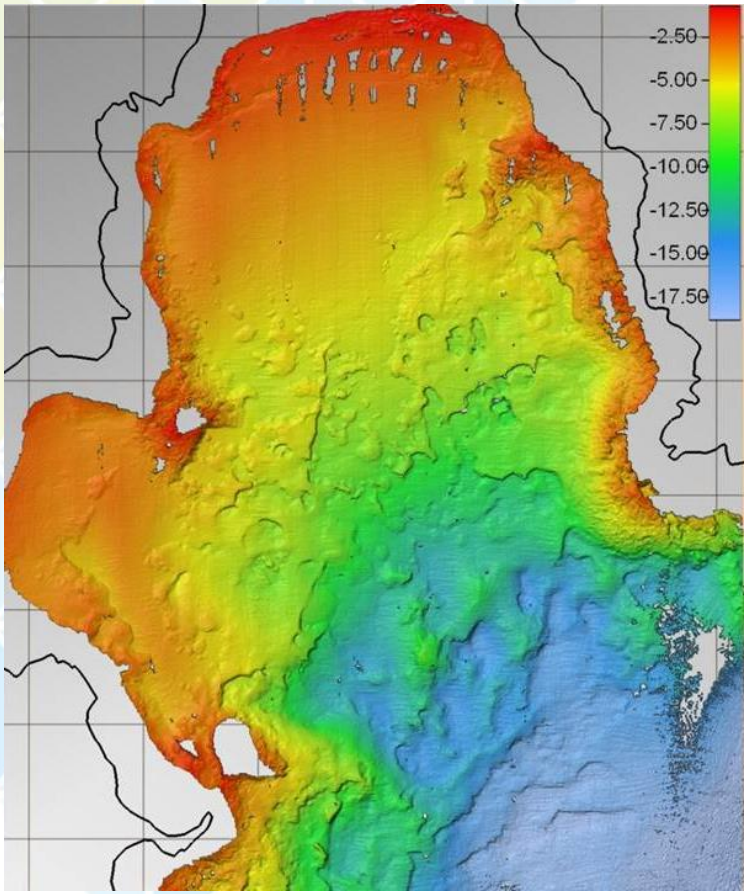




1. Sonar bathymetry

Multibeam echosounder applications: Habitat mapping

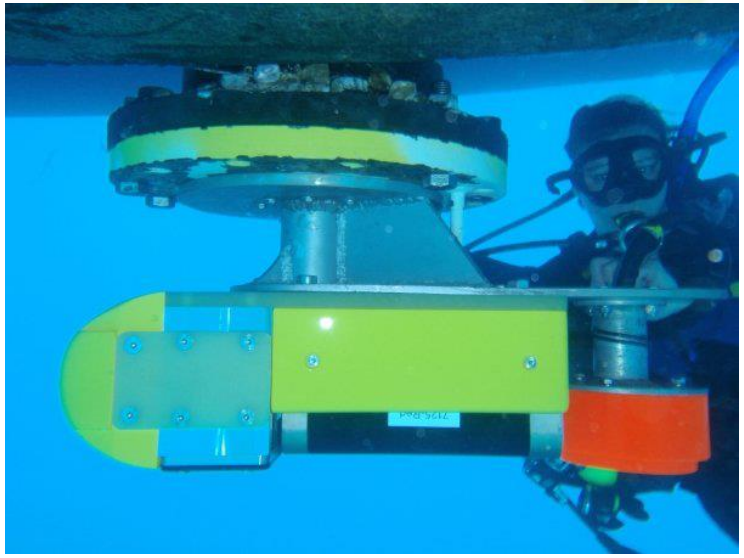




1. Sonar bathymetry

Multibeam echosounder: Types and mounting

Deep water



1. Sonar bathymetry

Multibeam echosounder: Types and mounting

Shallow water

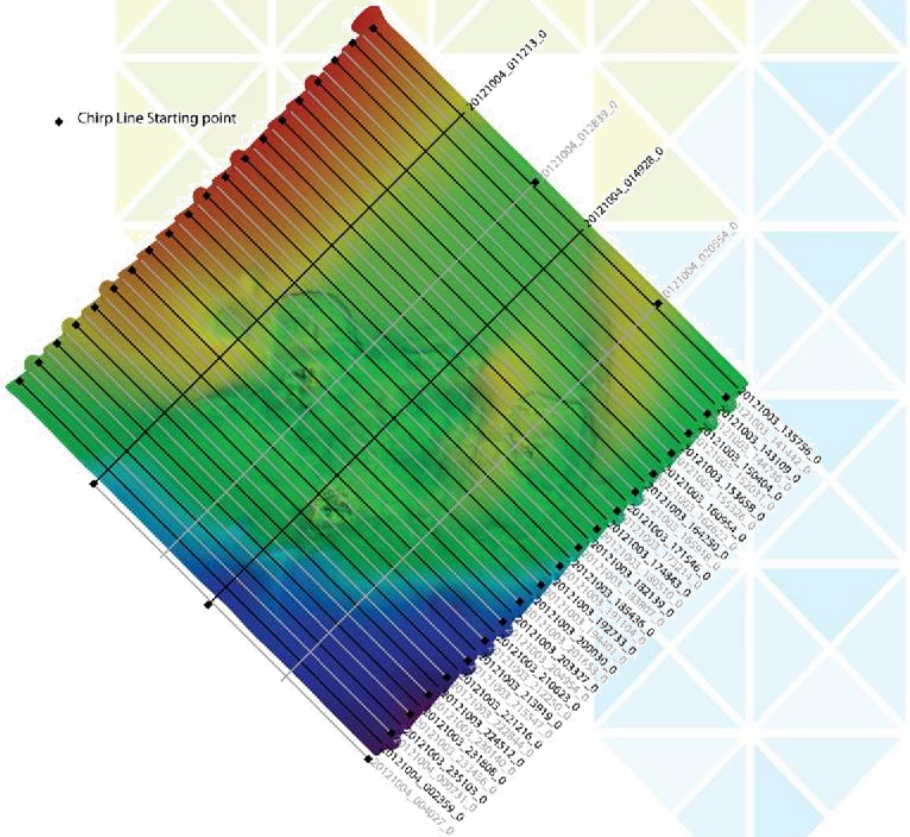
1. Sonar bathymetry

Multibeam echosounder: Types and mounting

Shallow water

1. Sonar bathymetry

Multibeam echosounder: Survey



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Why do we need bathymetry in studying coastal erosion

?

Project co-funded by European Union, European Regional Development Funds (E.R.D.F.) and by National Funds of Greece and Italy

2. Bathymetry and coastal erosion

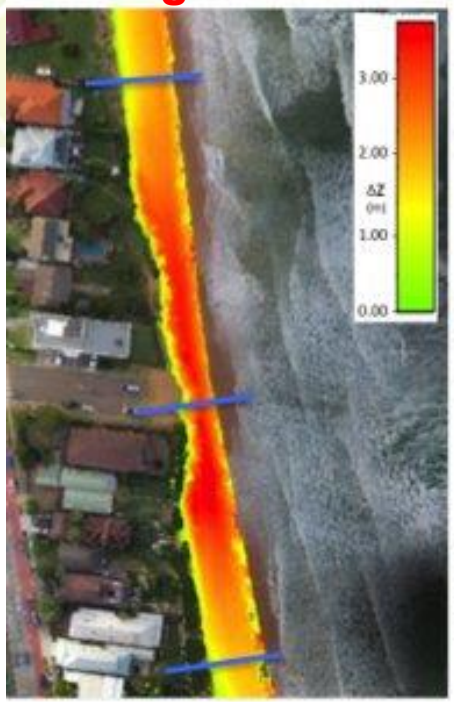
What do we need to monitor the vulnerability of a beach to erosion?

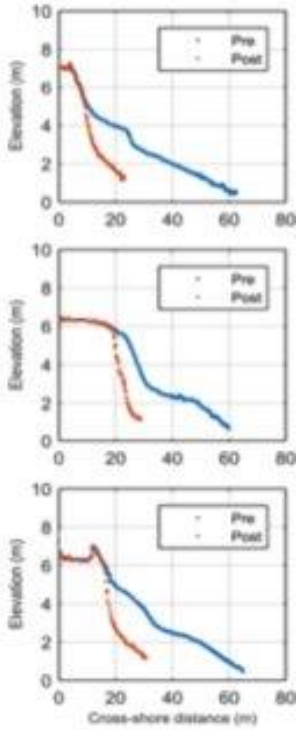
Coastal State Indicator	Measurement
Dune strength	Cross-shore topographic profile
Momentary coastline	Cross-shore topographic profile
Basal foundation	Cross-shore bathymetric profile
Shoreface volume	Cross-shore bathymetric profiles
Shoreline position	GPS following shoreline
Shoreline position	GPS following berm
Backshore width	Cross-shore topographic profile
Dune zone width	Cross-shore topographic profile
Dune zone height	Cross-shore topographic profile
Coastal slope	Cross-shore bathymetric profile
Beach width	Cross-shore topographic profile
Total beach volume	Cross-shore topographic profile
Barrier width	Cross-shore topographic profile
Barrier crest position	Cross-shore topographic profile
Coastline position	Visual inspection

In other words ….
We need the coast in **3D**!

2. Bathymetry and coastal erosion

Subaerial monitoring has been done … Is it enough?

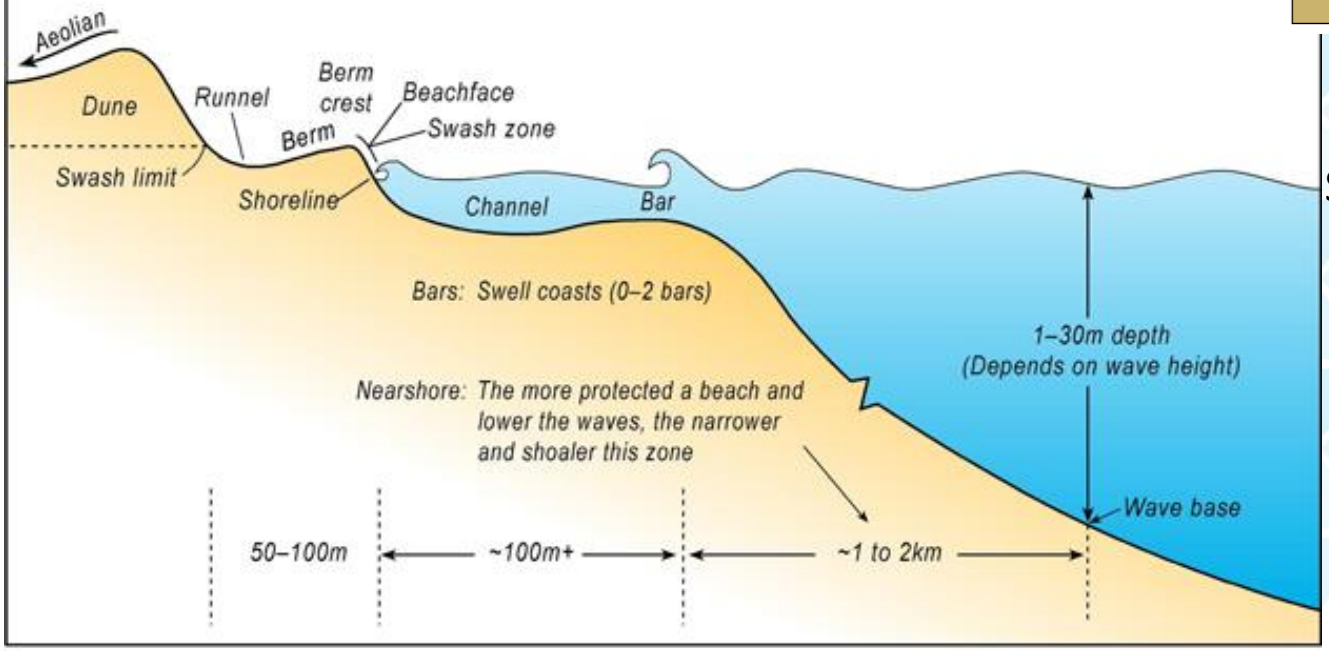


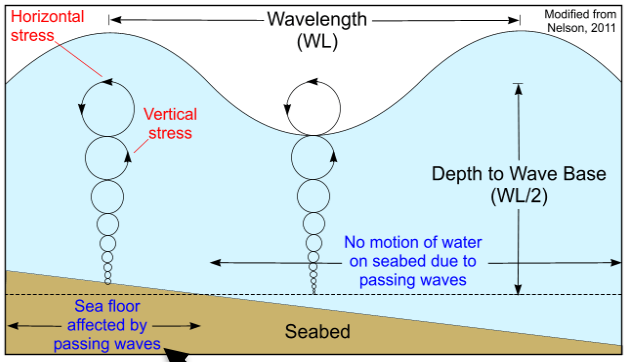


2. Bathymetry and coastal erosion

The beach system…

MORPHOLOGY	BEACH SYSTEM			INNER CONTINENTAL SHELF
	SUBAERIAL BEACH	SURF ZONE	NEARSHORE ZONE	
Wave Process	Swash	Wave Breaking	Wave Shoaling	

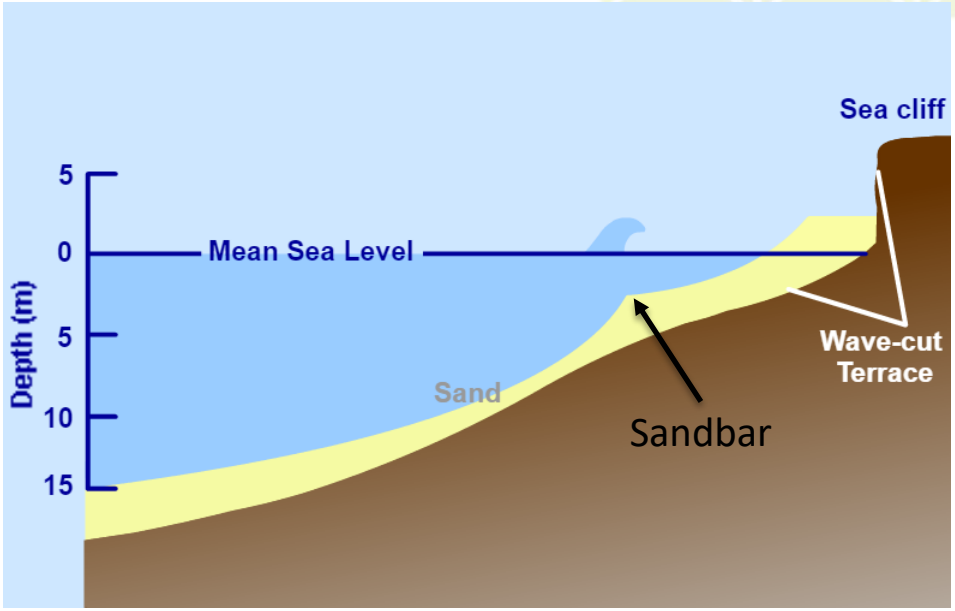




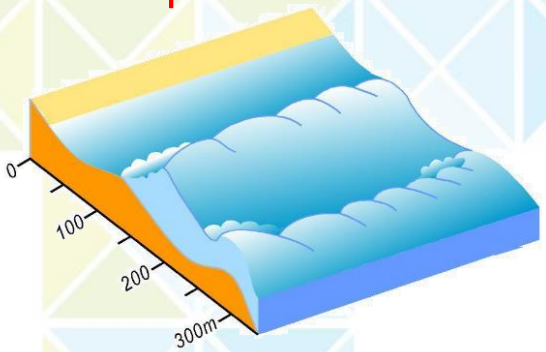
Sediment re-suspension

2. Bathymetry and coastal erosion

Sediment Transport processes: Equilibrium beach profile

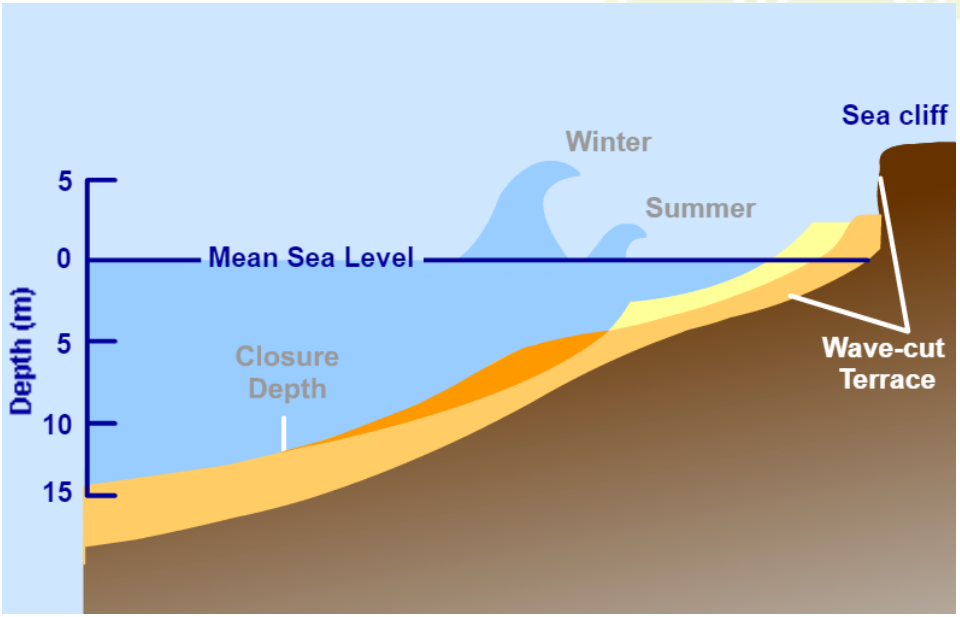


Summer

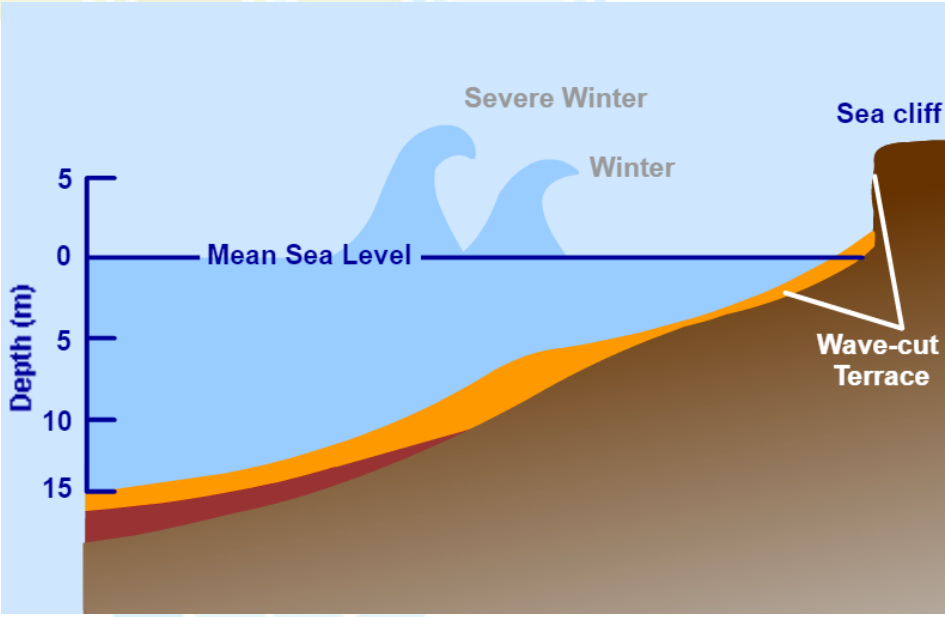


2. Bathymetry and coastal erosion

Sediment Transport processes: Equilibrium beach profile



Winter vs Summer



Severe Winter vs Winter

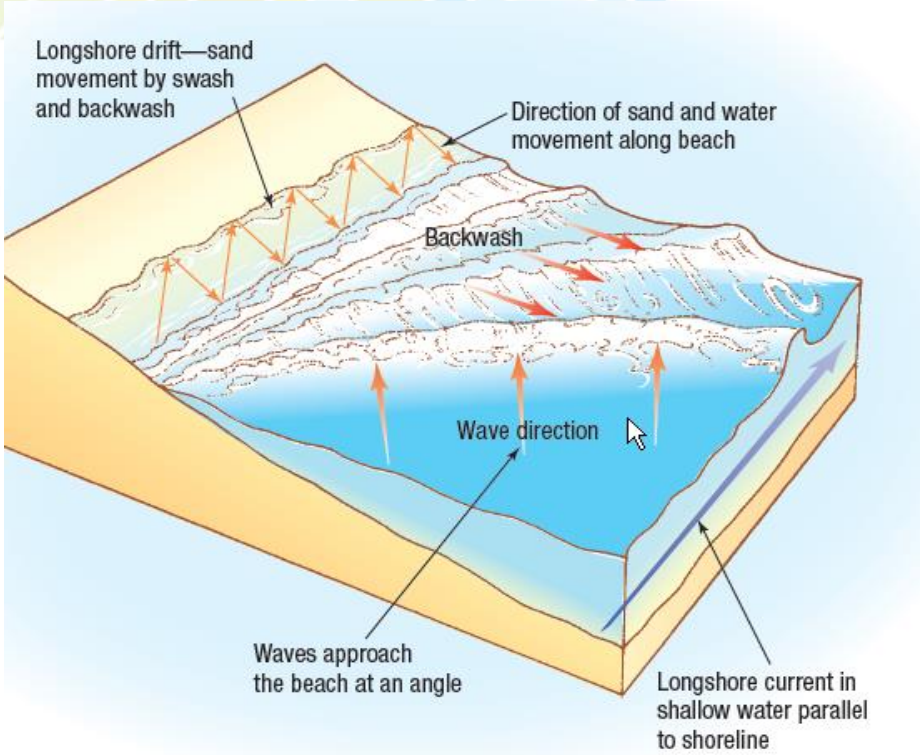
2. Bathymetry and coastal erosion

Sediment Transport process - Longshore Drift

Longshore Drift/ current
This is the process of waves moving (transporting) material (load) along a coastline through:

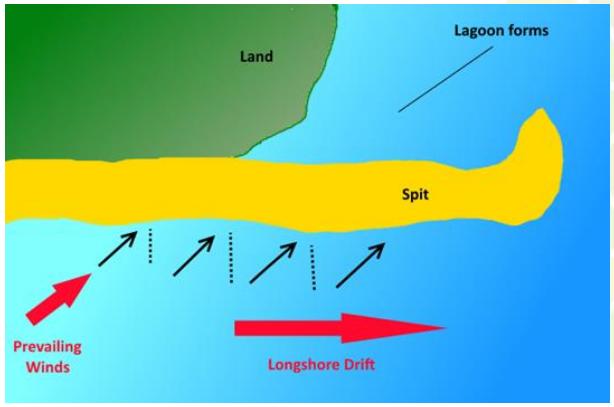
- **Swash:** moves (resuspends) material up the beach and
- **Backwash** moves sediment back into the sea.

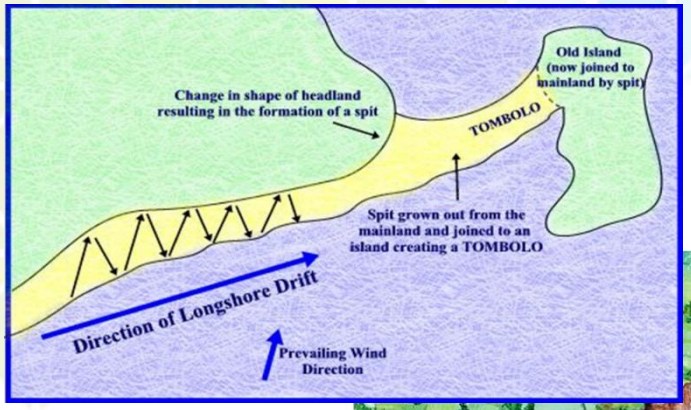
* It only happens when the waves hit the beach is at an angle to the wave. It doesn't necessarily cause erosion…

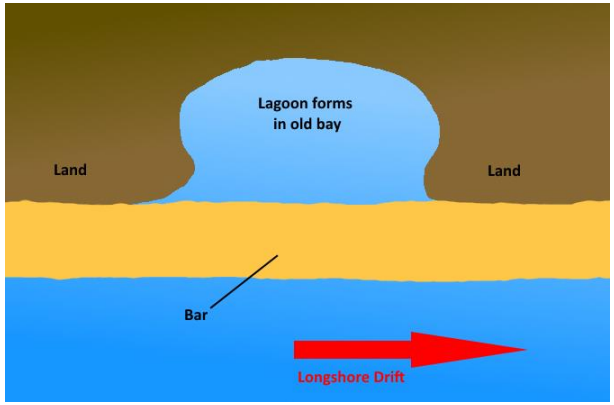


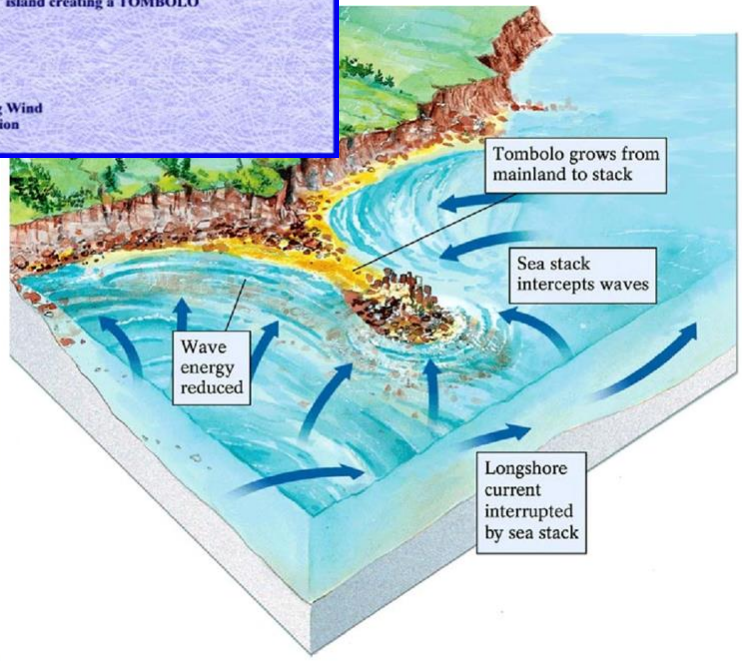
2. Bathymetry and coastal erosion

Sediment Transport process - Longshore Drift – Landforms









2. Bathymetry and coastal erosion

Sediment Transport process - Longshore Drift – Landforms

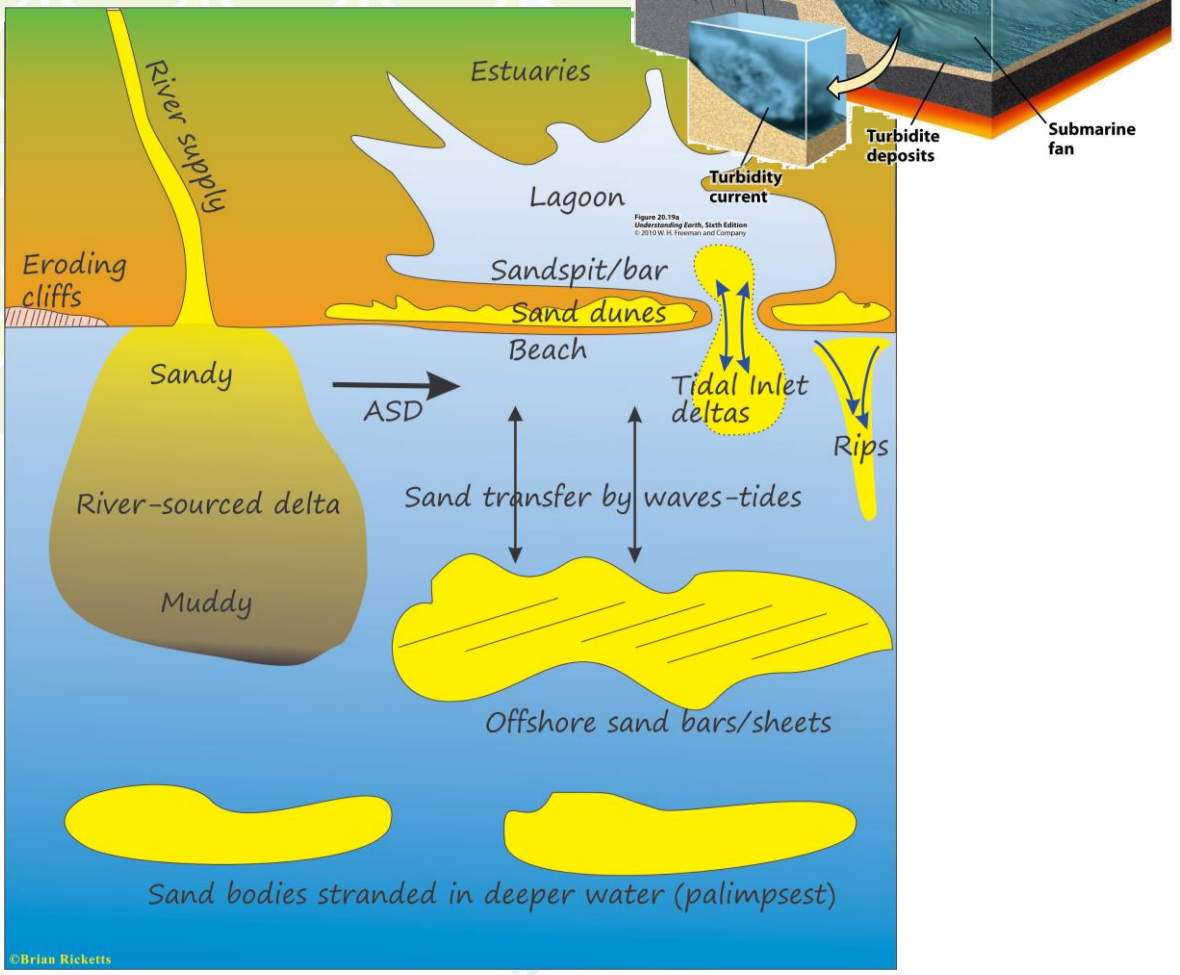
Miami beach

2. Bathymetry and coastal erosion

The littoral cell

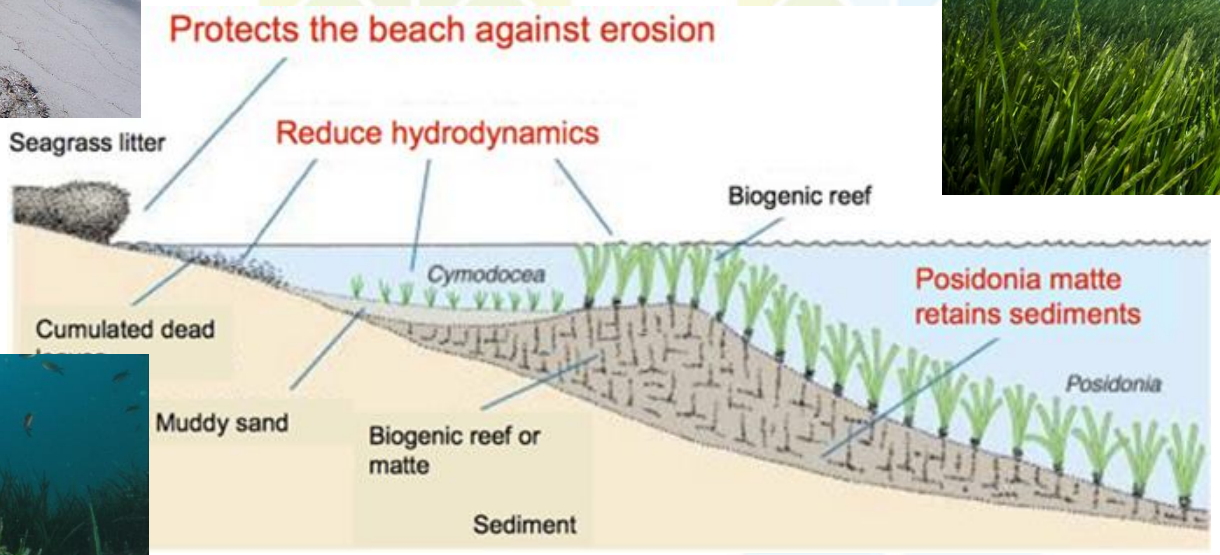
A littoral cell is a coastal part that contains a complete cycle of sedimentation including sources, transport paths, and sinks.

The cell boundaries delineate the geographical area within which the budget of sediment is balanced, providing the framework for the quantitative analysis of coastal erosion and accretion (Sediment budget).



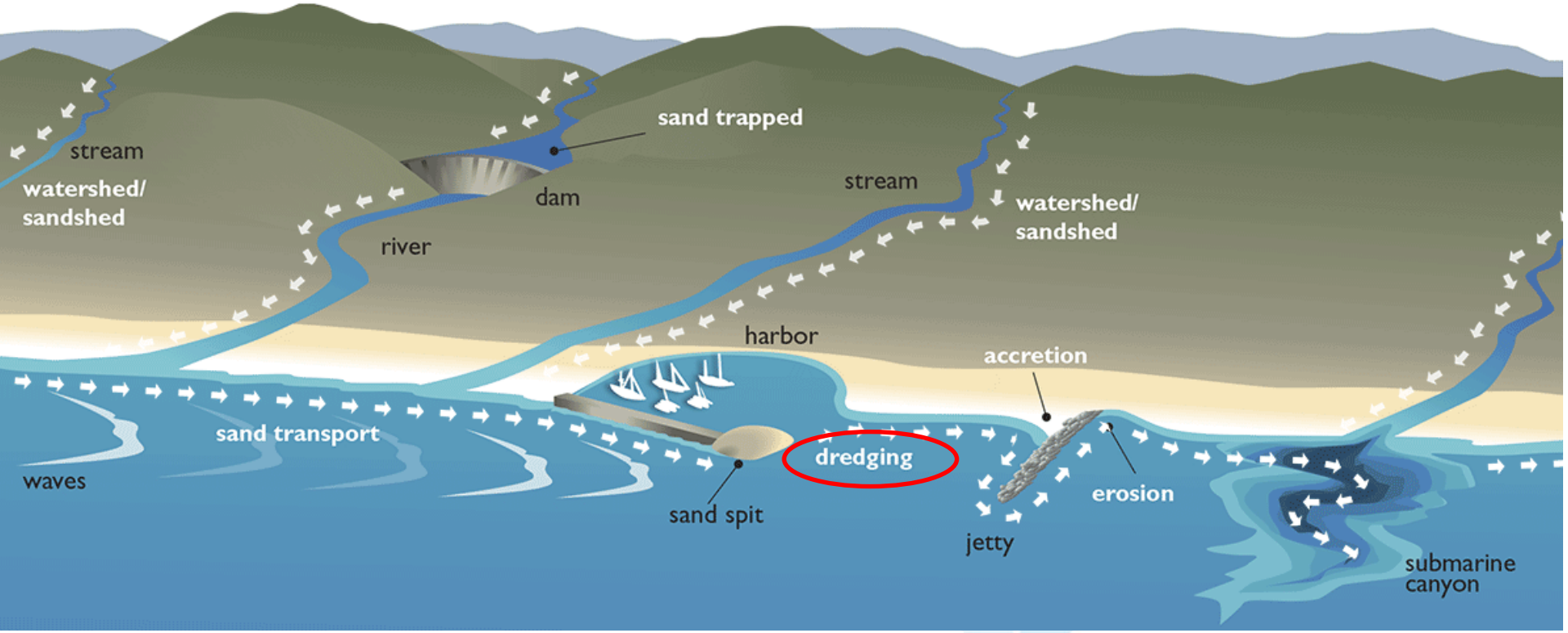
2. Bathymetry and coastal erosion

Self-protection of beaches – aquatic vegetation and habitats



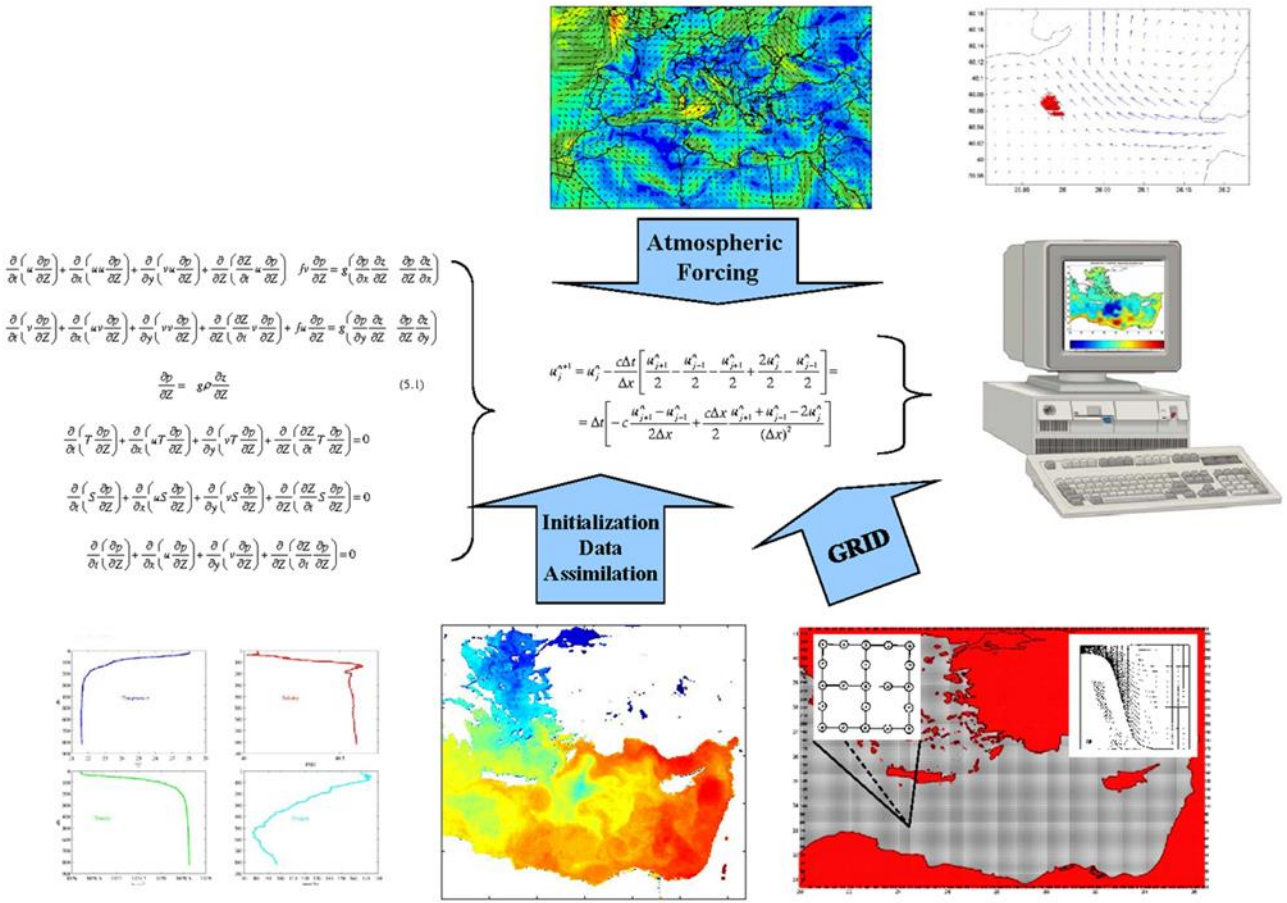
2. Bathymetry and coastal erosion

Anthropogenic interventions in the sediment budget



2. Bathymetry and coastal erosion

Mathematical modelling: Wave propagation – sediment transport



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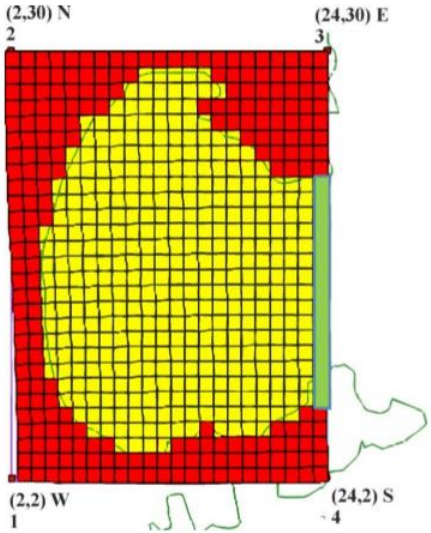
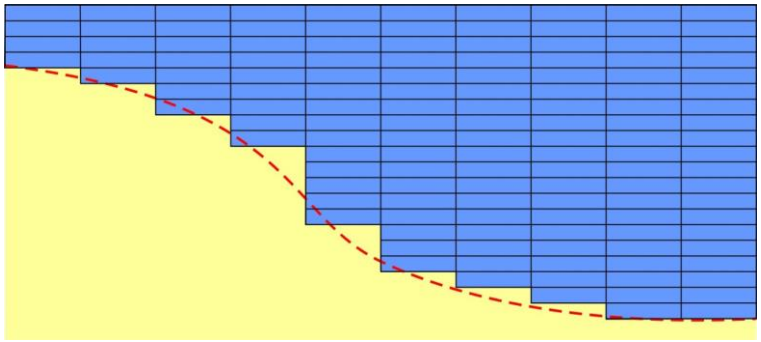
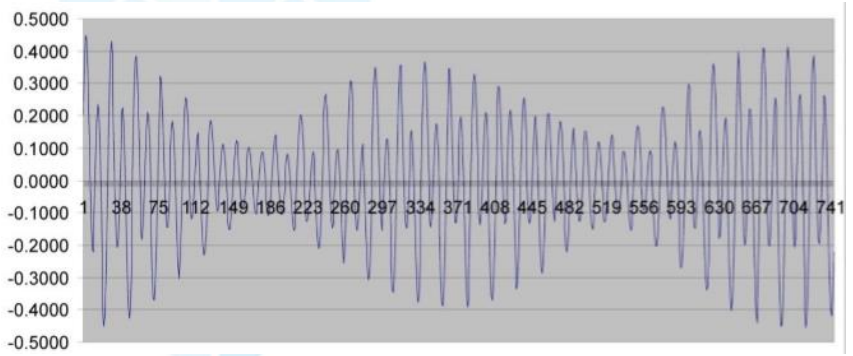
Mathematical modelling: Wave propagation – sediment transport

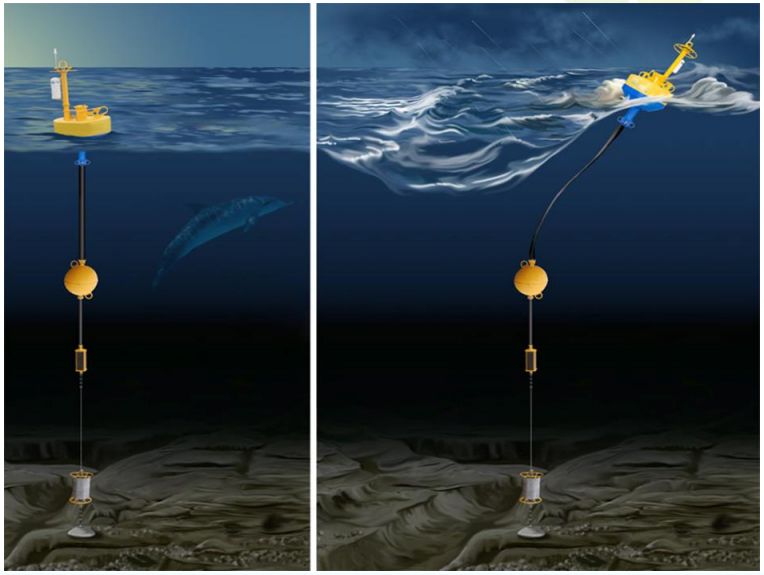


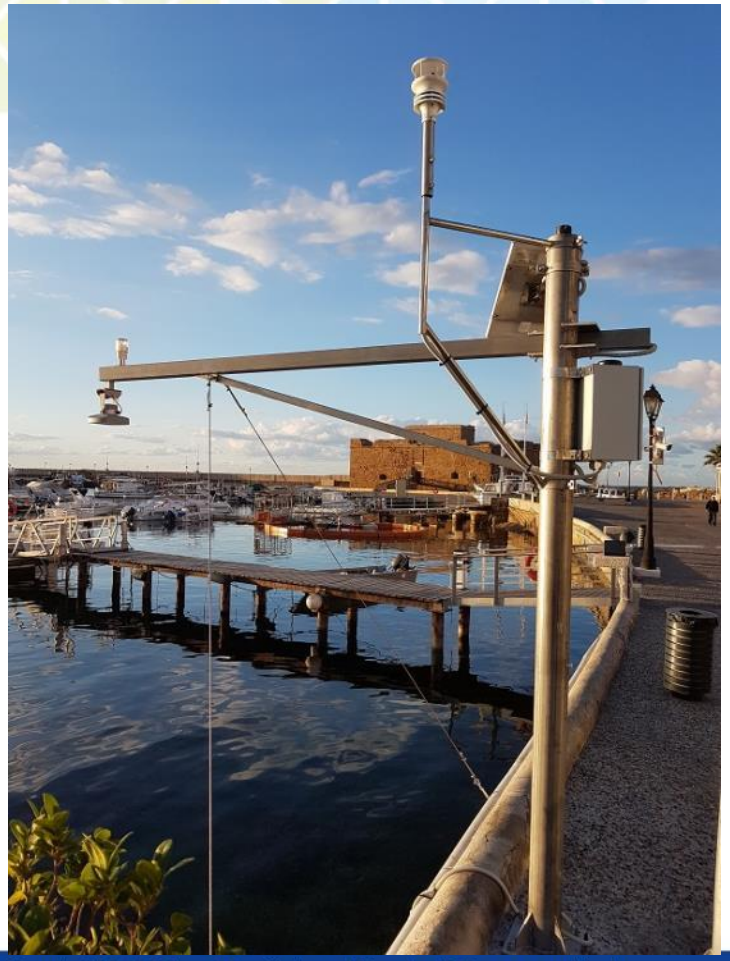




2. Bathymetry and coastal erosion

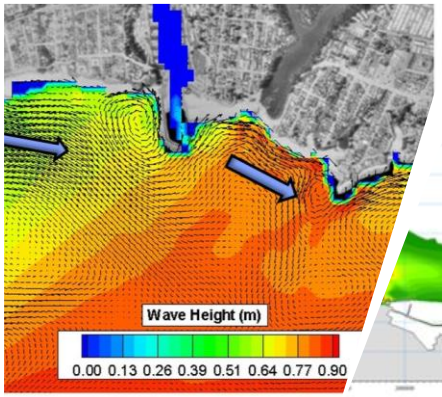
Wind, tide and wave (validation) data are being collected … Is it enough?

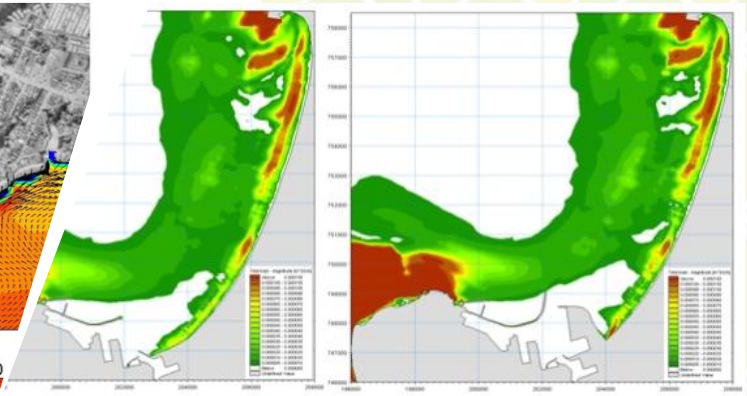


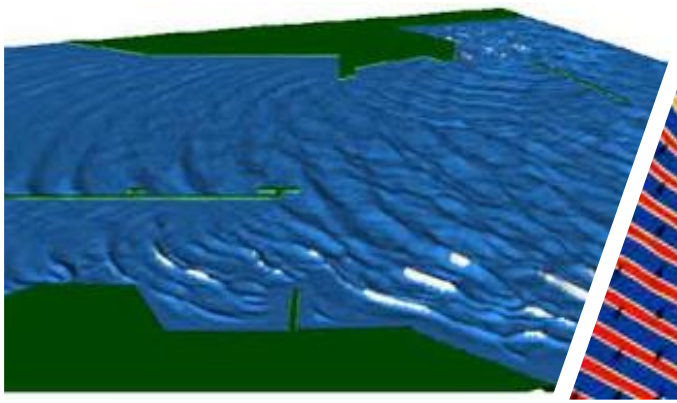


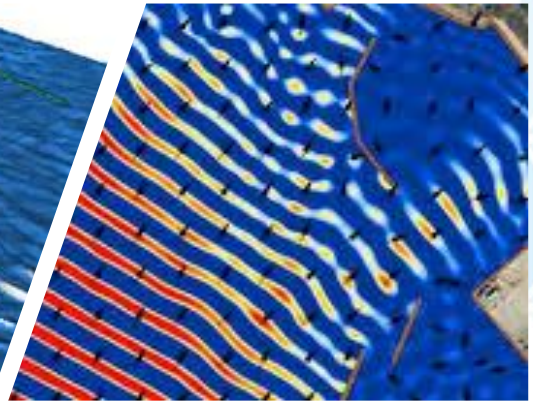
2. Bathymetry and coastal erosion

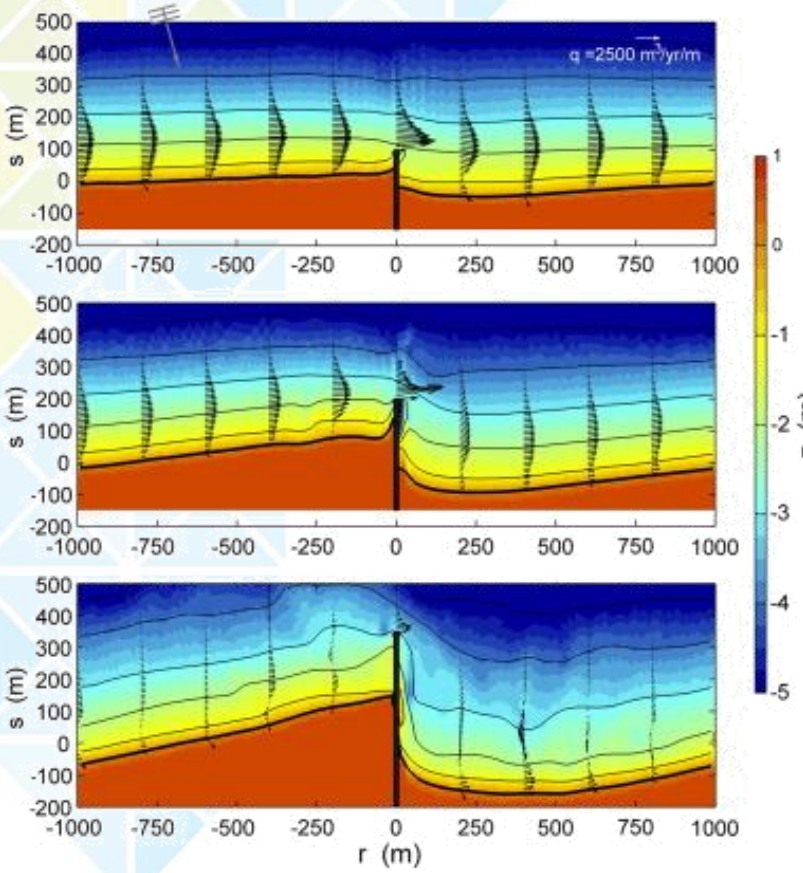
Mathematical modelling: Wave propagation – sediment transport









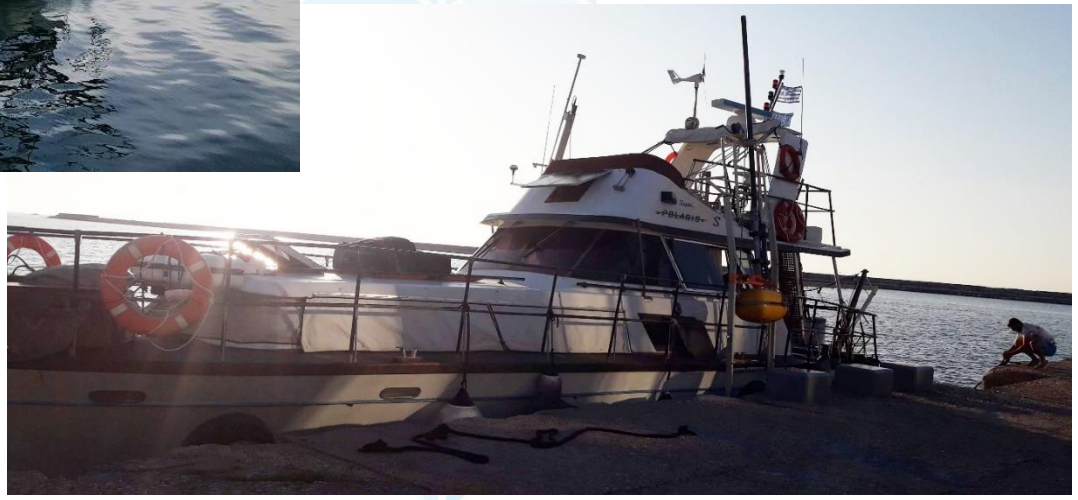


Multibeam bathymetric survey in the Gulf Of Patras

Project co-funded by European Union, European Regional Development Funds (E.R.D.F.) and by National Funds of Greece and Italy

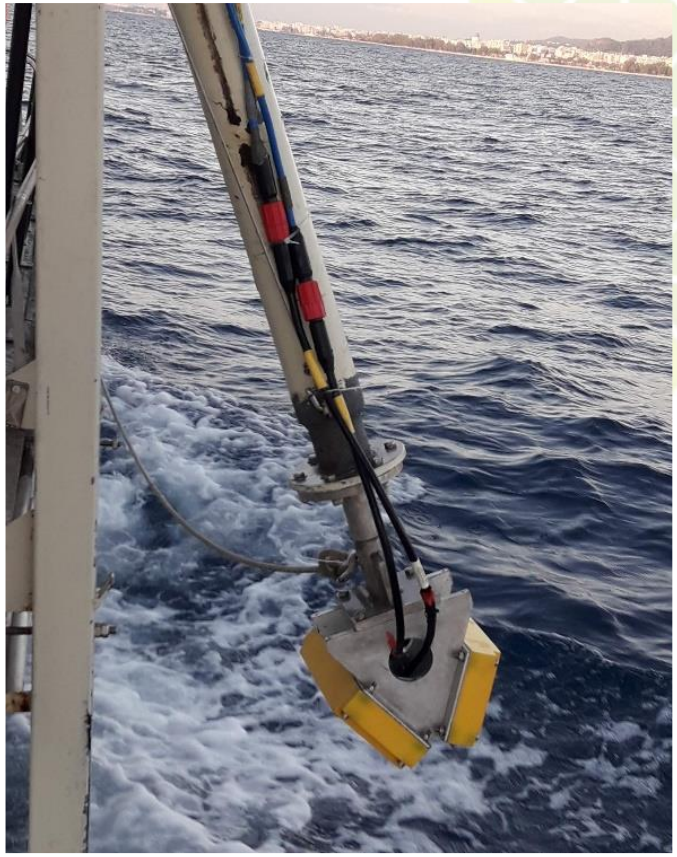
2. Gulf of Patras Bathymetric survey

Research vessel: 24 - 30th September 2019

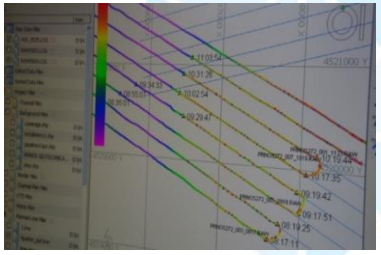


2. Gulf of Patras Bathymetric survey

Equipment



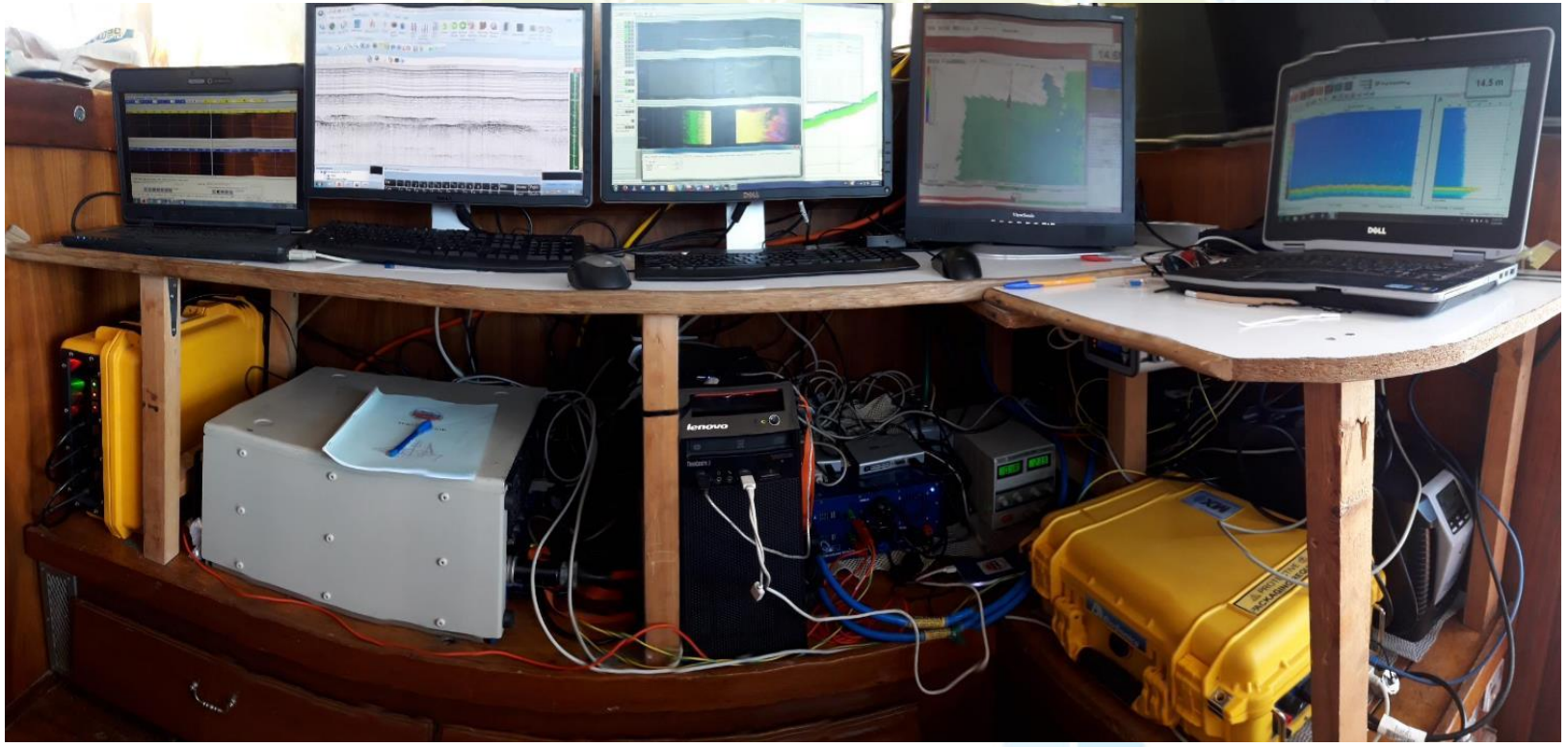
Leica GS08 RTK GNSS System (left image) and Hemisphere VS101 GPS (right image)



Hypack 2014 navigation software display

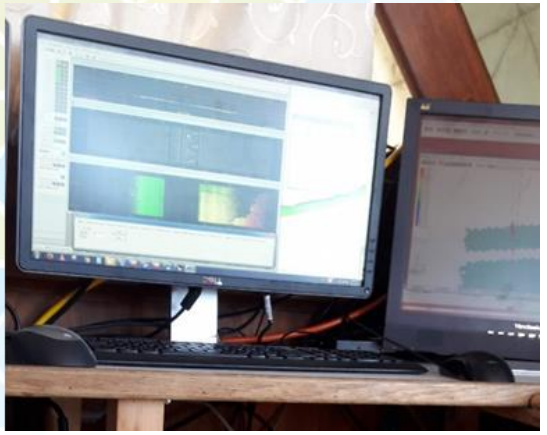
2. Gulf of Patras Bathymetric survey

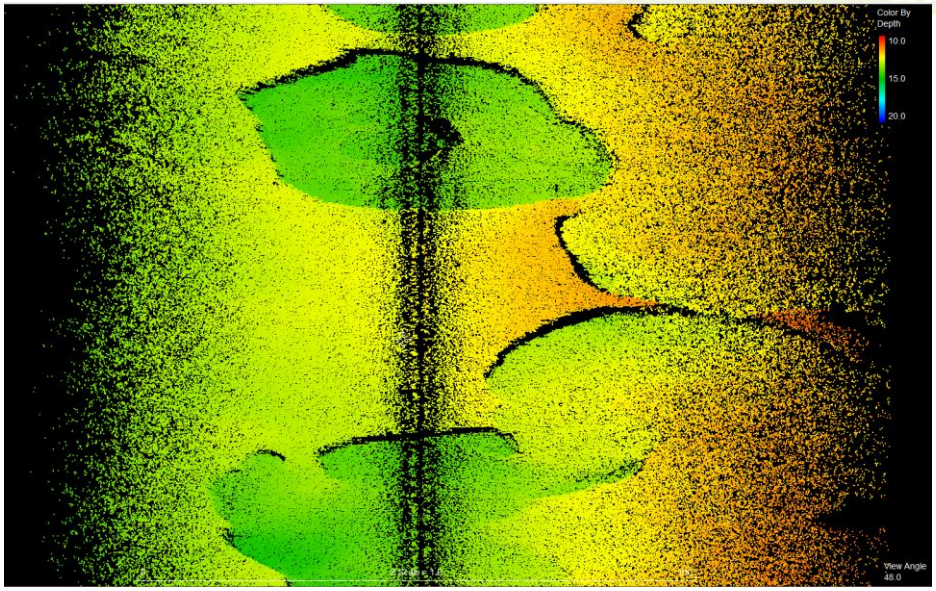
Equipment

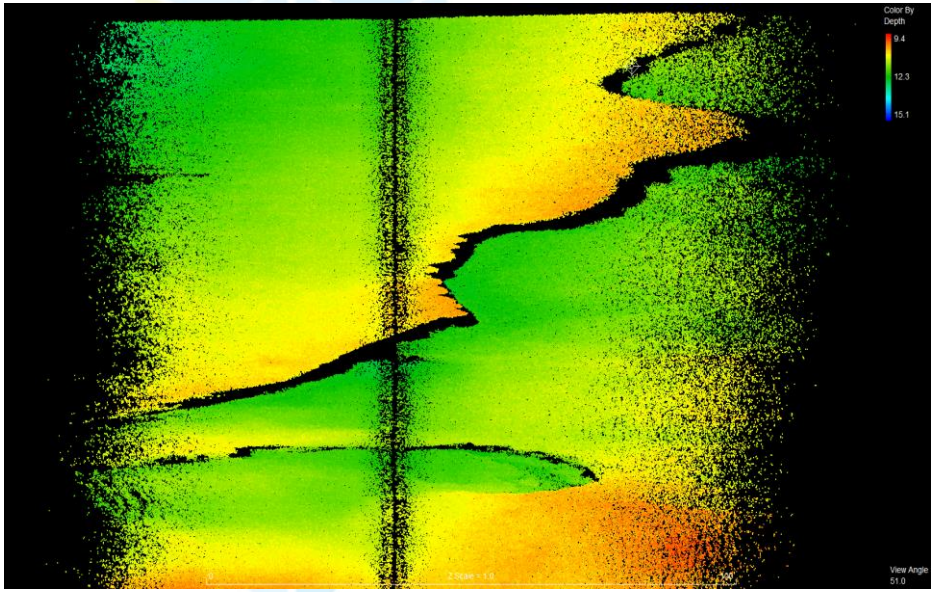


2. Gulf of Patras Bathymetric survey

Data acquisition

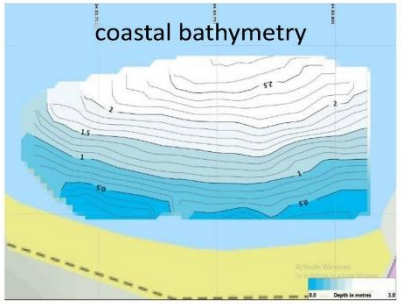


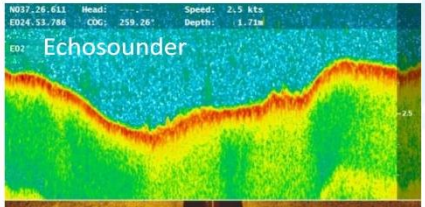


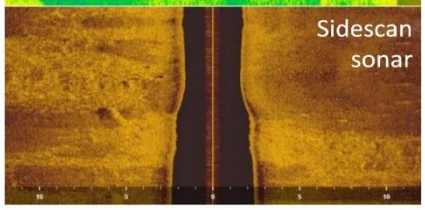


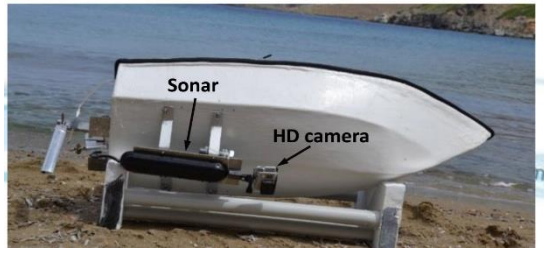
2. Gulf of Patras Bathymetric survey

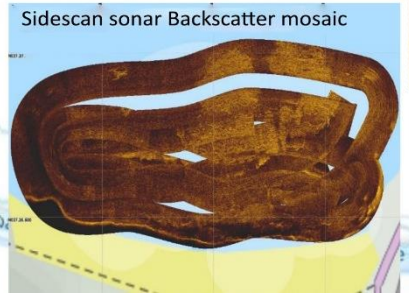
Unmanned Surface Vehicle (USV)

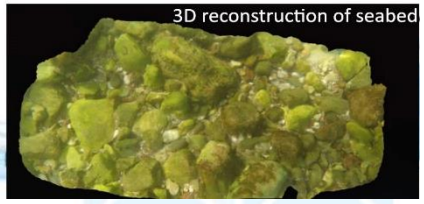












2. Gulf of Patras Bathymetric survey

Survey planning

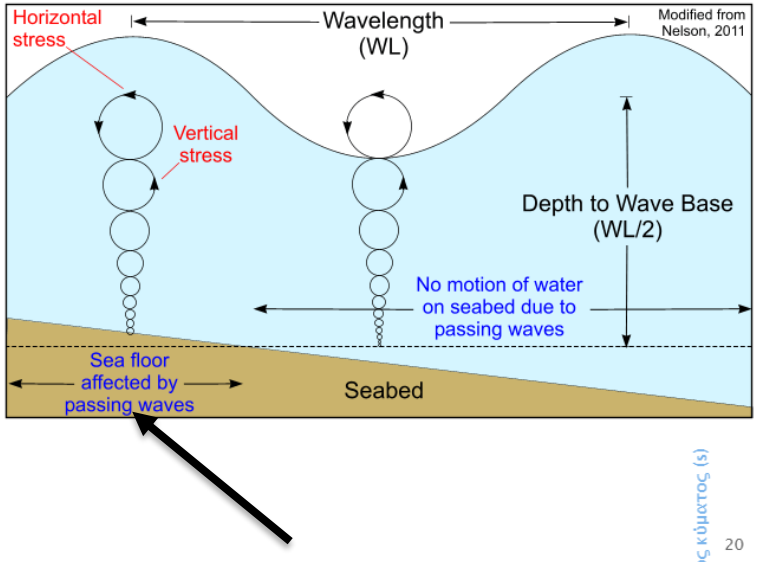
Information regarding the survey lines conducted

Instrumentation used	No. of survey-lines	Total length (km)	Line Order/ Orientation	Line spacing (m)	Research area
MBES, SBES	52	276	Parallel to the coastline	100	Southern part of the gulf of Patras

Map of the gulf of Patras presenting the vessel's bathymetric survey track lines

2. Gulf of Patras Bathymetric survey

Survey planning: Depth limit = - 20 m. Why?

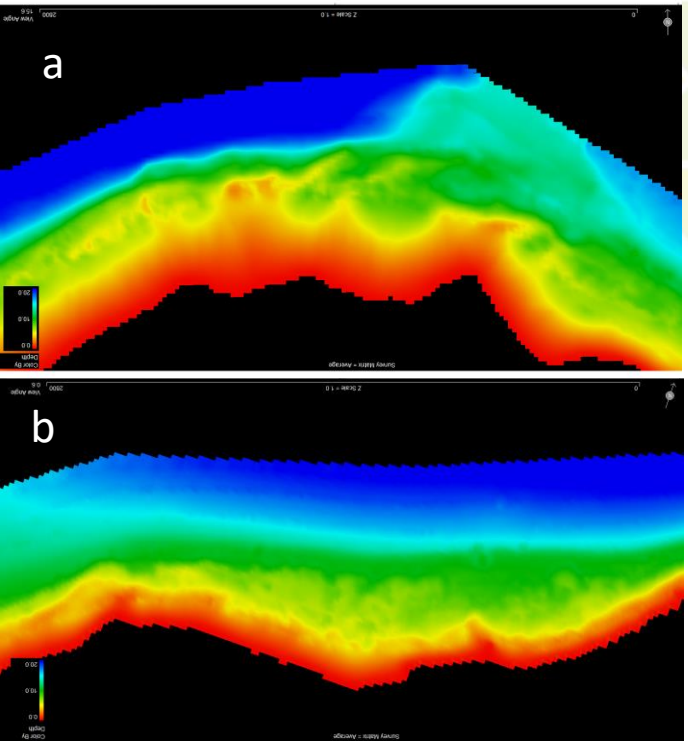


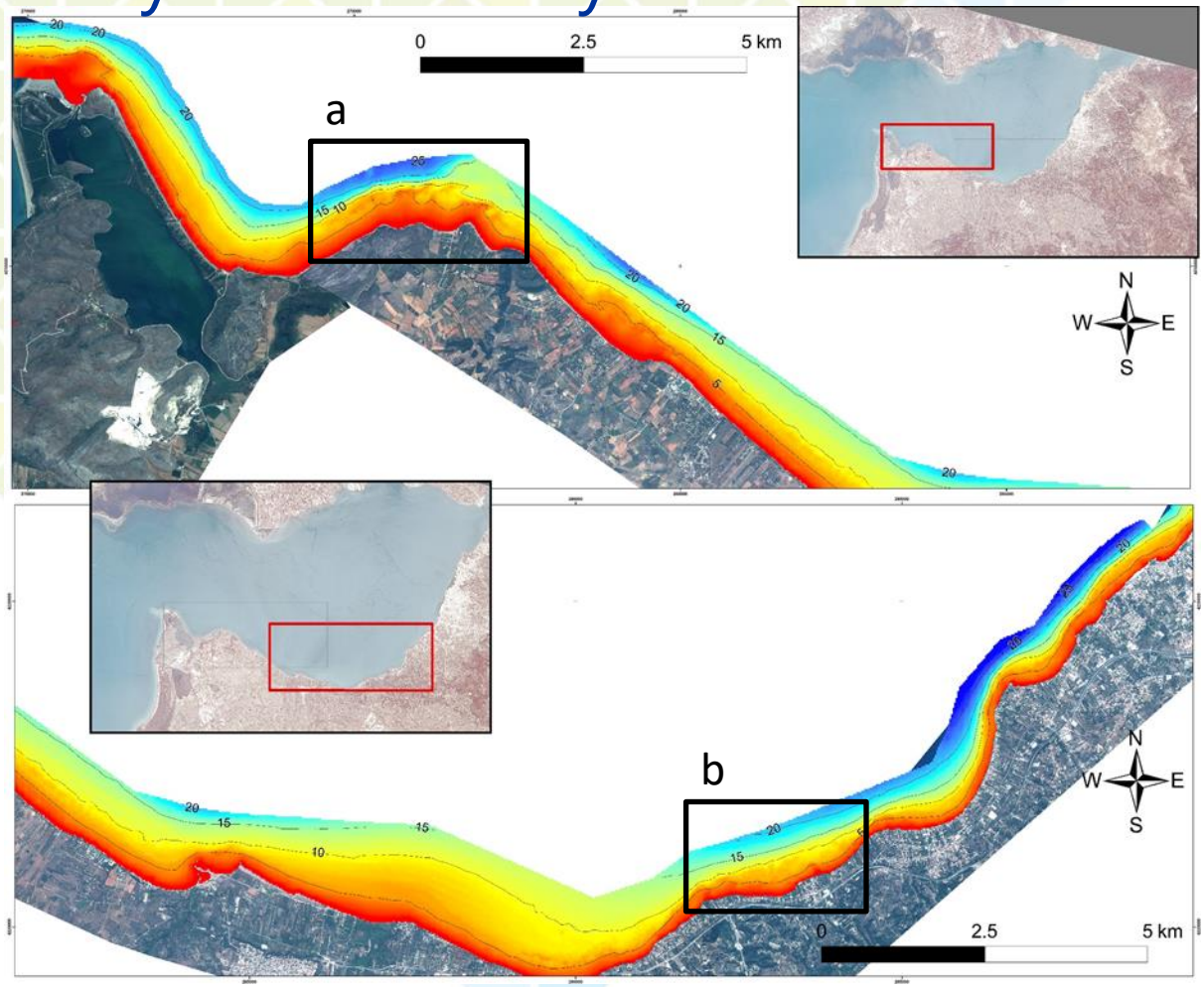
Sediment re-suspension

Mean period = 5 s → Mean wavelength = 40 m

2. Gulf of Patras Bathymetric survey

Results: General bathymetry

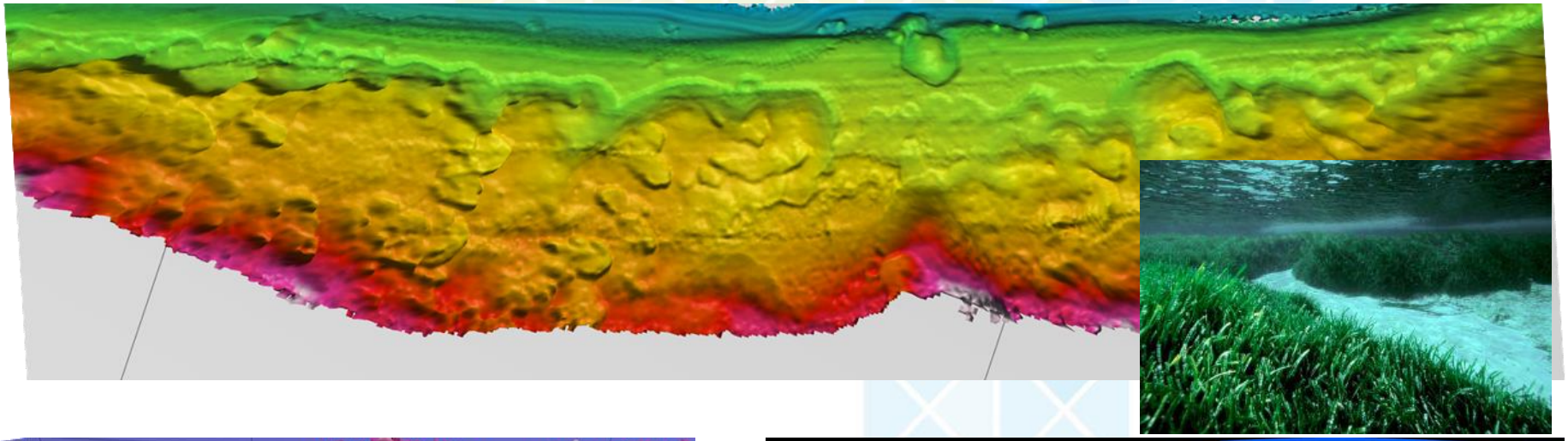


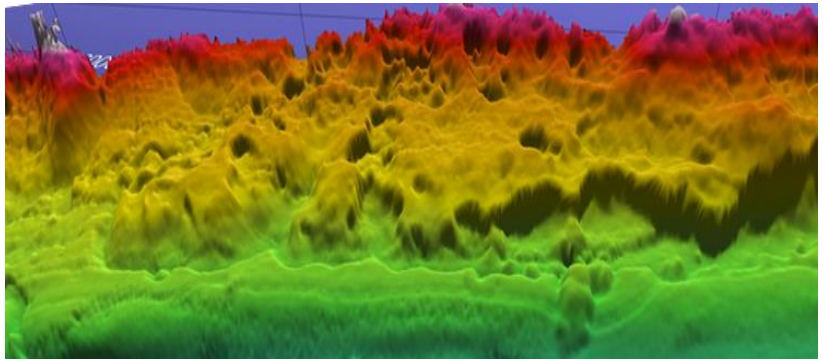


Bathymetric map of the coastal area of the Southern part of the gulf of Patras

2. Gulf of Patras Bathymetric survey

Results: General bathymetry





2. Gulf of Patras Bathymetric survey

Results: *P. oceanica* mapping

Interreg Greece-Italy
European Regional Development Fund

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Triton

Lead Partner
REGIONE PUGLIA

Technical support
arti Agenzia regionale per la tecnologia e l'innovazione

Project Partners
REGION OF WESTERN GREECE
cmcc Centro Euro-Mediterraneo sui Cambiamenti Climatici
ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ
EGTC Ekxini Poli European Group of Territorial Cooperation

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