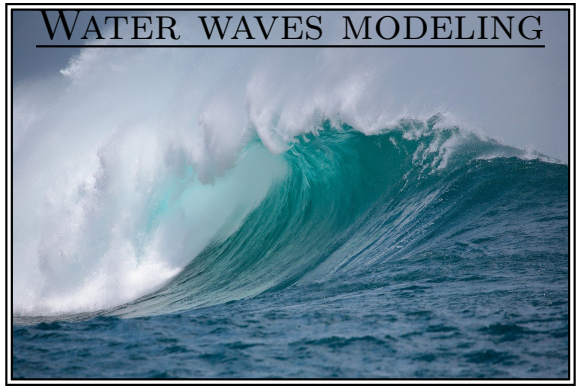
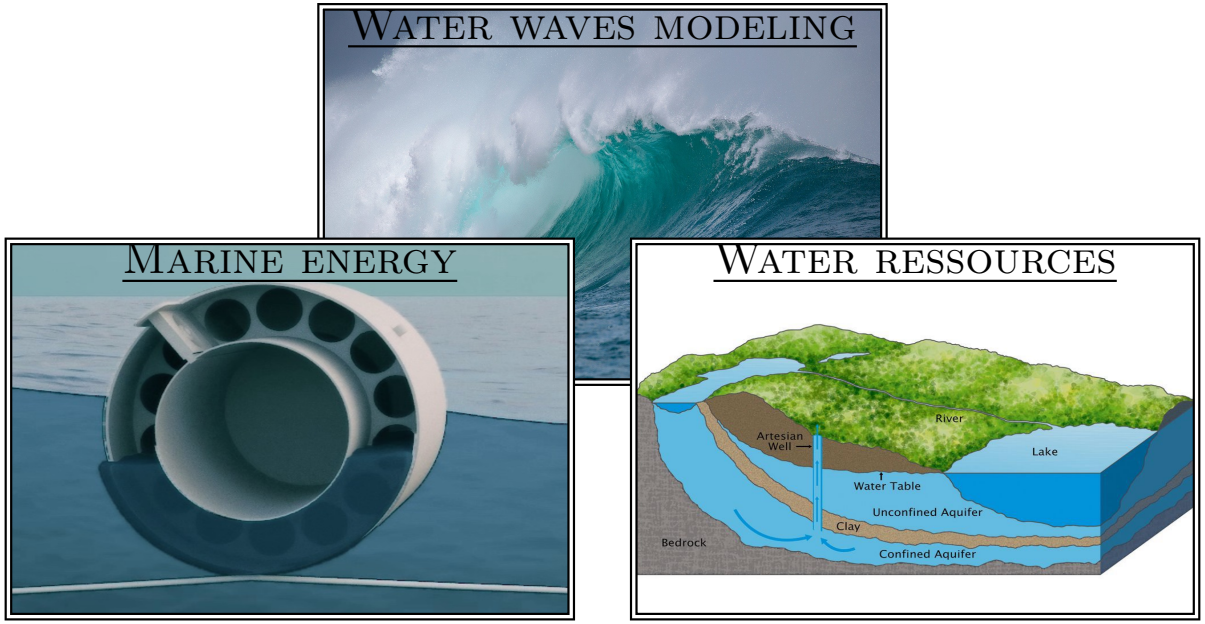


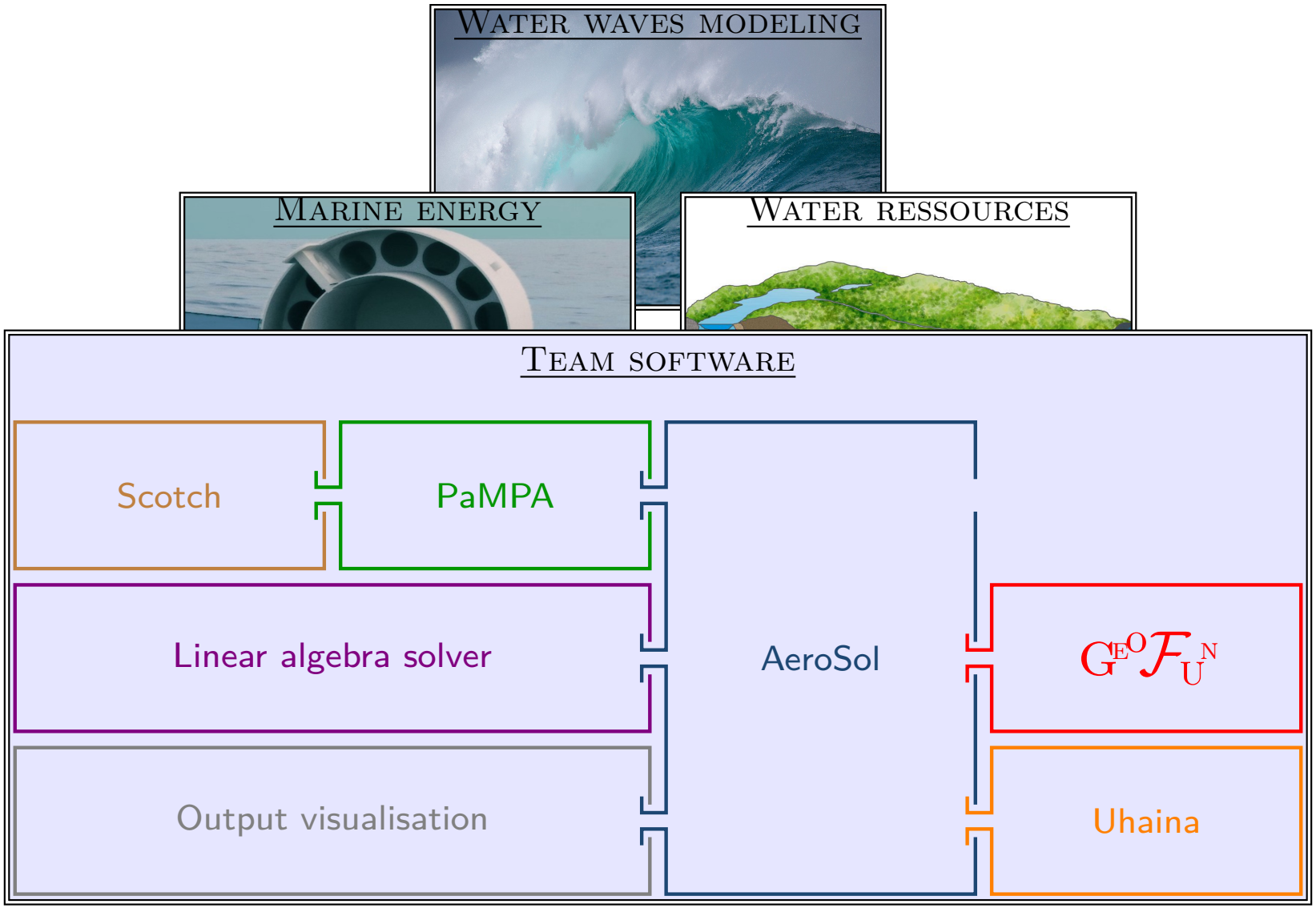
permanents :

Mathieu Colin (MdC HDR, INP)
Maria Kazolea (CR)
Martin Parisot (CR)
Mario Ricchiuto (DR)

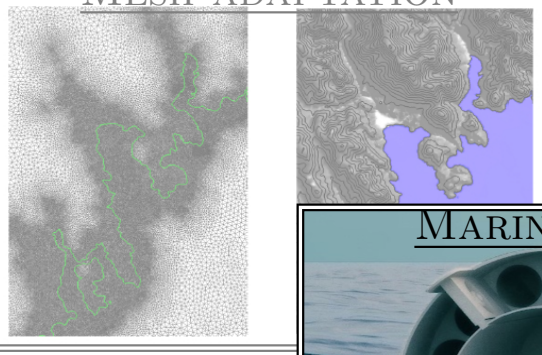
non-permanents :

Manon Carreau (PhD)
Marco Lorini (Eng)
Christopher Poette (Post-doc)

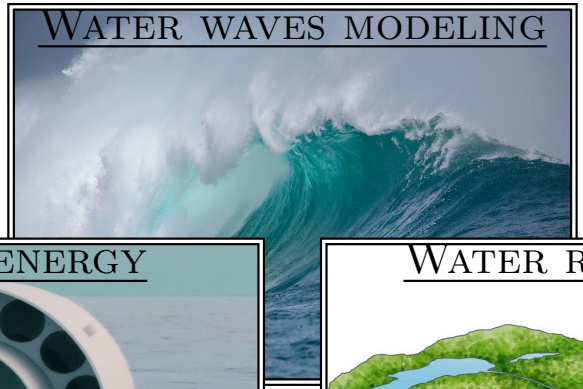

WATER WAVES MODELING
MARINE ENERGY
WATER RESSOURCES
River
Artesian Well
Lake
Water Table
Unconfined Aquifer
Clay
Bedrock
Confined Aquifer


Water waves modeling
Marine energy
Water ressources
Team software
Scotch
PaMPA
Linear algebra solver
Output visualisation
AeroSol
GEOFUN
Uhaina

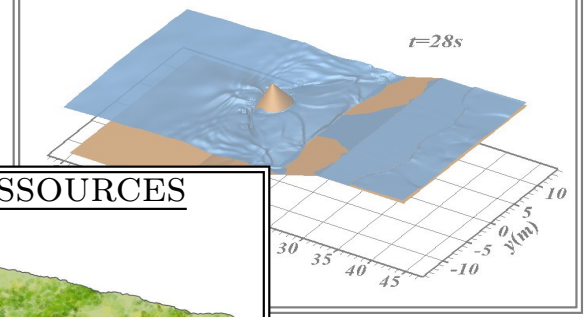
Mesh adaptation



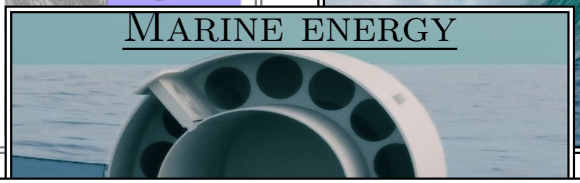
Water waves modeling



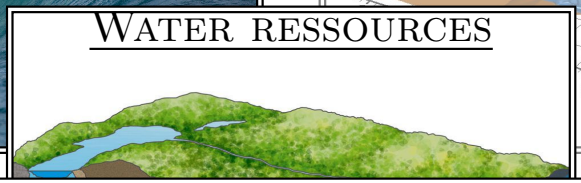
High order schemes



Marine energy



Water ressources



Team software

Scotch

PaMPA

Linear algebra solver

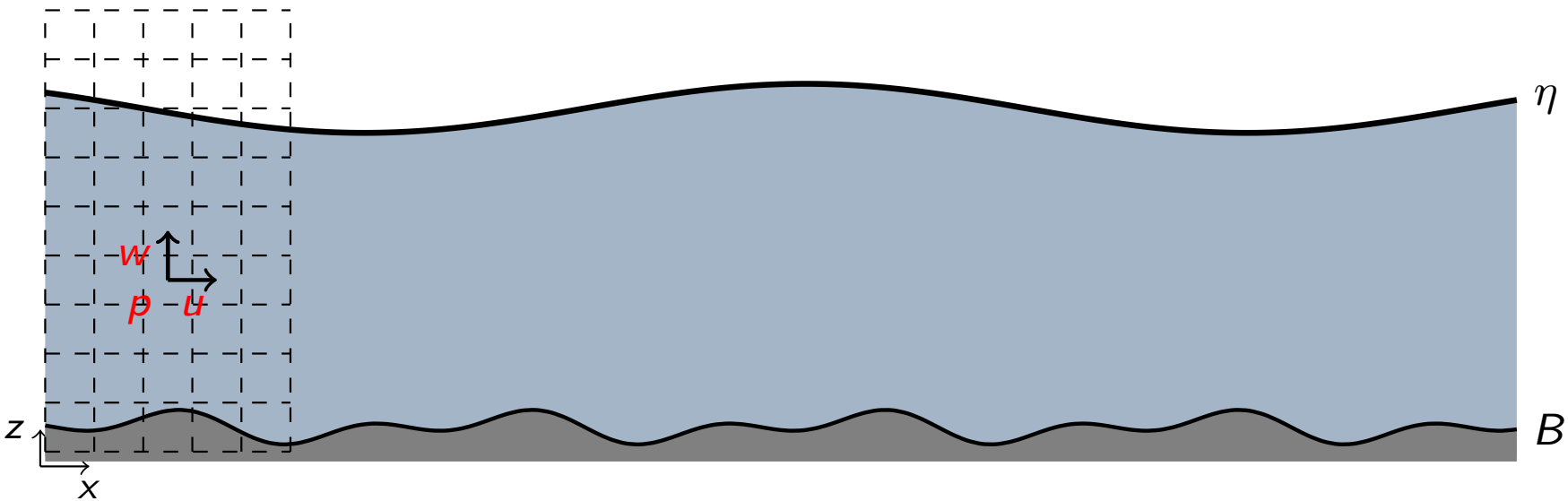
Output visualisation

AeroSol

GEOFUN

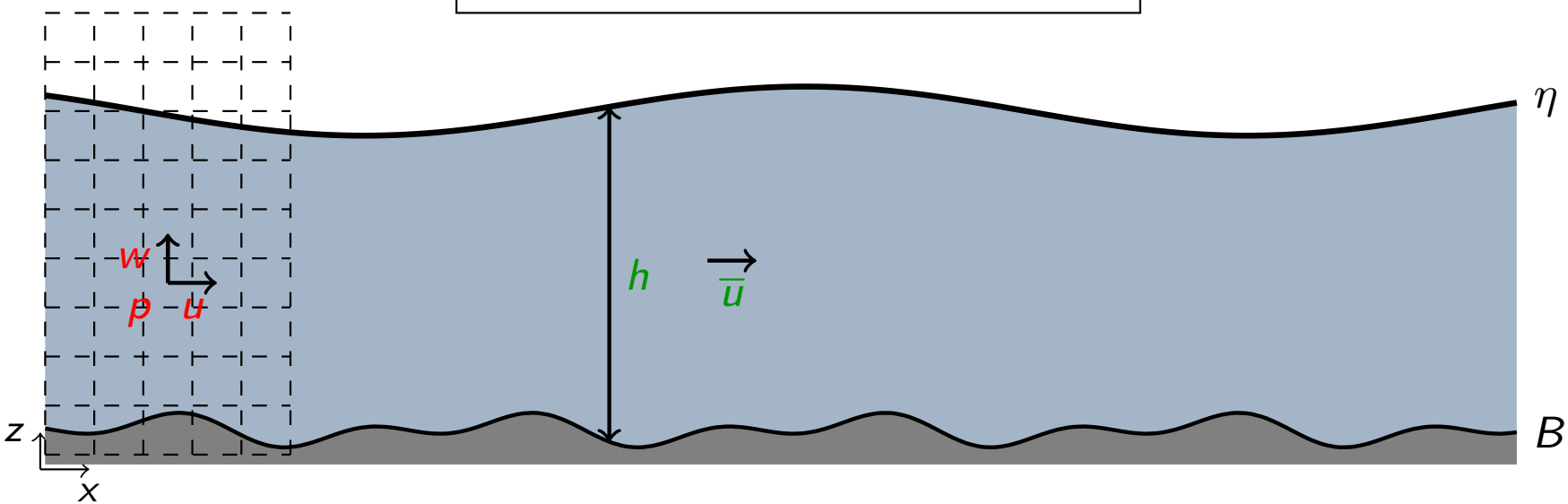
Uhaina

	BOXES	NATURAL DISASTER		INDUSTRY
space scale	m^3	$10^6\,km^2$	km^2	km^2
time scale	minutes	hours	weeks	hours
WATER WAVES acc.	✓	✓		✓
WATER WAVES cost	✓	✗		✗



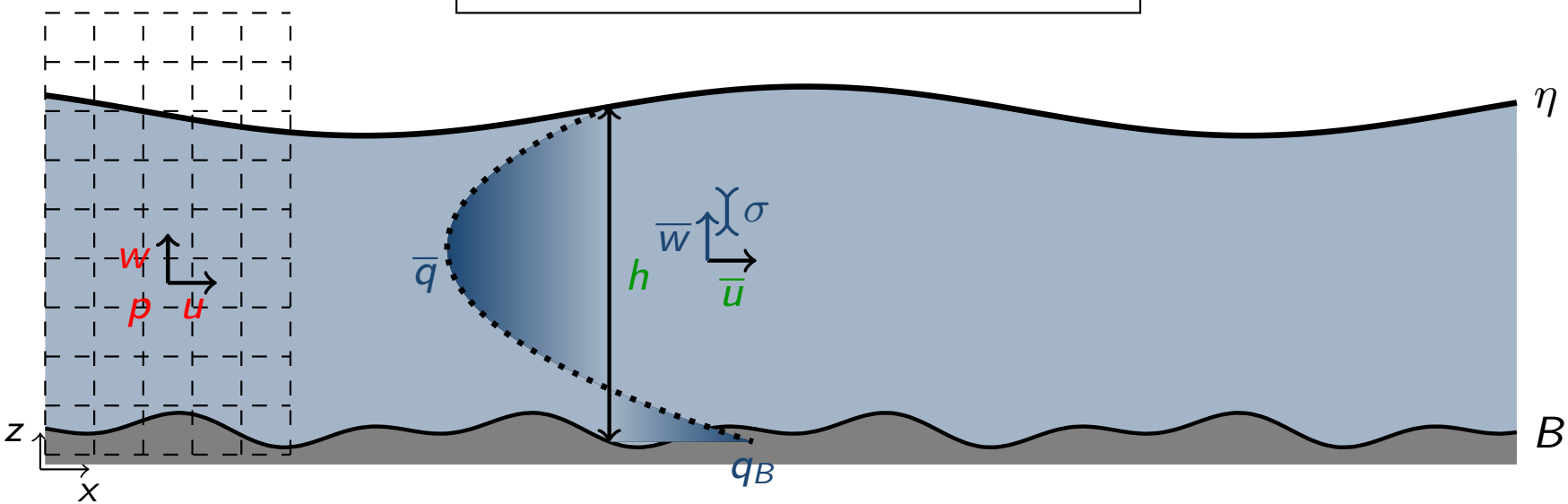
	space scale time scale	BOXES m^3 minutes	NATURAL DISASTER $10^6\,km^2$ hours	 km^2 weeks	INDUSTRY km^2 hours
WATER WAVES	acc.	✓	✓		✓
	cost	✓	✗		✗
SHALLOW WATER	acc.	✗	✓		✗
	cost	✓	✓		✓

$$\partial_t U + \nabla \cdot (F(U)) = S(U)$$

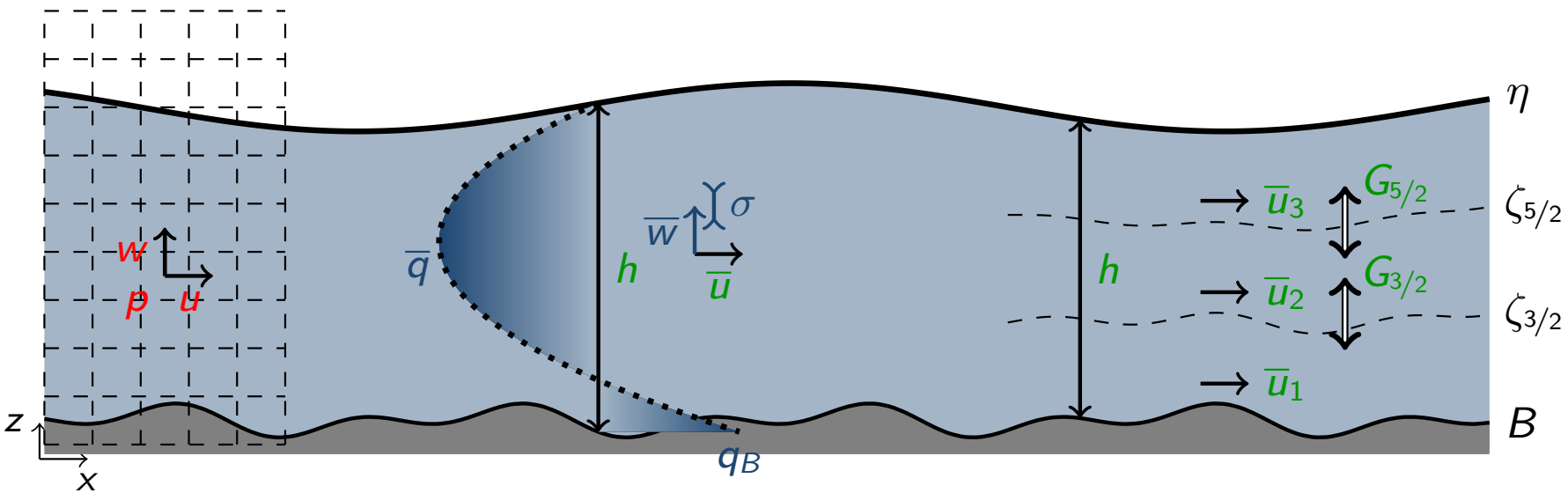


space scale / time scale		BOXES m^3 minutes	NATURAL DISASTER $10^6\,km^2$ hours	NATURAL DISASTER km^2 weeks	INDUSTRY km^2 hours
WATER WAVES	acc.	✓	✓		✓
	cost	✓	✗		✗
SHALLOW WATER	acc.	✗	✓		✗
	cost	✓	✓		✓
SHALLOW WATER + DISPERSION	acc.	✗	✓		✓
	cost	✓	✗		✓

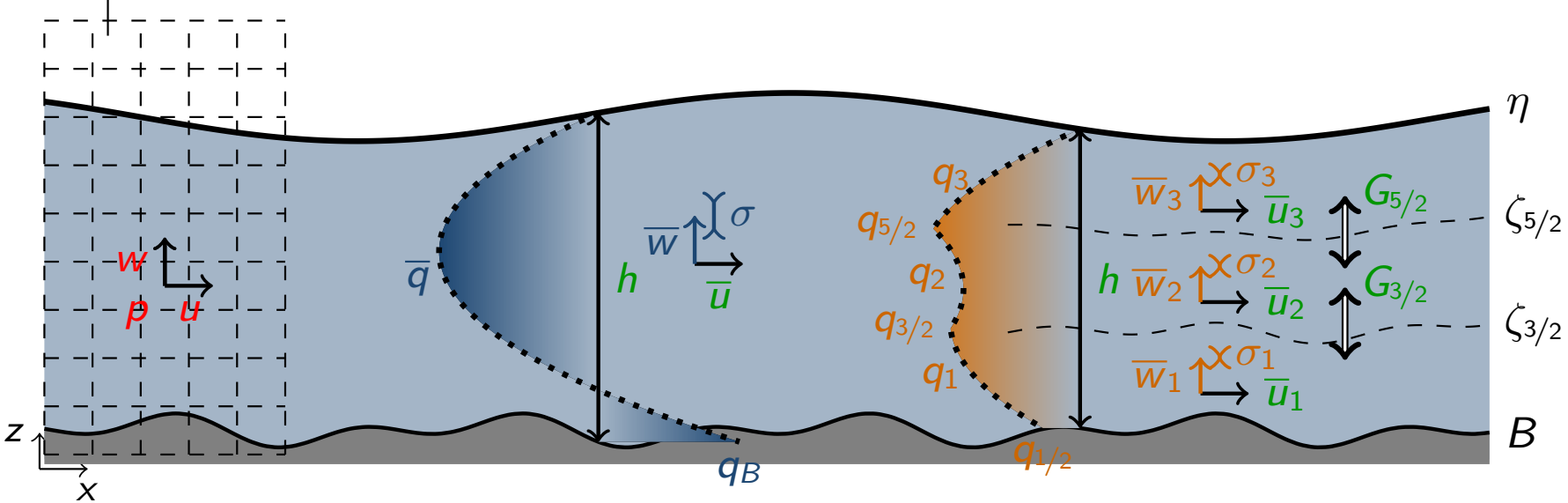
$$\partial_t U + \nabla \cdot (F(U)) = S(U) + \widetilde{\nabla} Q$$
$$\widetilde{\nabla} \cdot U = 0$$



space scale / time scale		BOXES m^3 / minutes	NATURAL DISASTER $10^6\,km^2$ / hours	NATURAL DISASTER km^2 / weeks	INDUSTRY km^2 / hours
WATER WAVES	acc.	✓	✓		✓
	cost	✓	✗		✗
SHALLOW WATER	acc.	✗	✓		✗
	cost	✓	✓		✓
SHALLOW WATER + DISPERSION	acc.	✗	✓		✓
	cost	✓	✗		✓
LAYERWISE SW	acc.	✗	✓		✗
	cost	✓	✓		✓



space scale / time scale		BOXES m^3 minutes	NATURAL DISASTER $10^6\,km^2$ hours	NATURAL DISASTER km^2 weeks	INDUSTRY km^2 hours
WATER WAVES	acc.	✓	✓		✓
	cost	✓	✗		✗
SHALLOW WATER	acc.	✗	✓		✗
	cost	✓	✓		✓
SHALLOW WATER + DISPERSION	acc.	✗	✓		✓
	cost	✓	✗		✓
LAYERWISE SW	acc.	✗	✓		✗
	cost	✓	✓		✓
LAYERWISE SW + DISPERSION	acc.	✓	✓		✓
	cost	✓	✗		✓



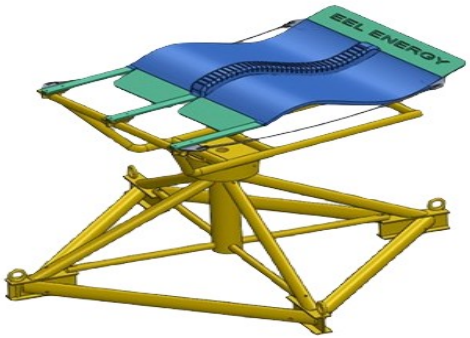
space scale / time scale		BOXES m^3 minutes	NATURAL DISASTER $10^6\,km^2$ hours	NATURAL DISASTER km^2 weeks	INDUSTRY km^2 hours
WATER WAVES	acc.	✓	✓		✓
	cost	✓	✗		✗
SHALLOW WATER	acc.	✗	✓		✗
	cost	✓	✓		✓
SHALLOW WATER + DISPERSION	acc.	✗	✓		✓
	cost	✓	✗		✓
LAYERWISE SW	acc.	✗	✓		✗
	cost	✓	✓		✓
LAYERWISE SW + DISPERSION	acc.	✓	✓		✓
	cost	✓	✗		✓

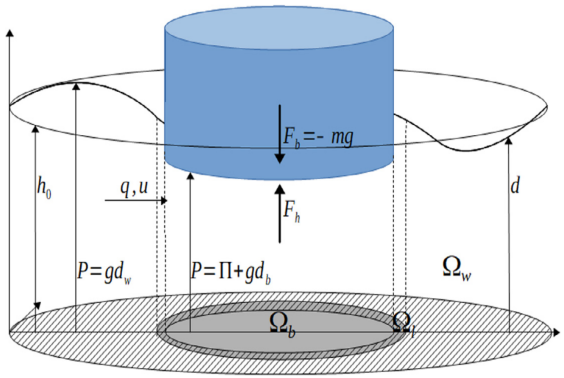
- ✓ Hierarchy of models.
- ↯ Adaptation strategies:
  - limit the projection area
  - adapt the number of layers
- ↯ Breaking waves

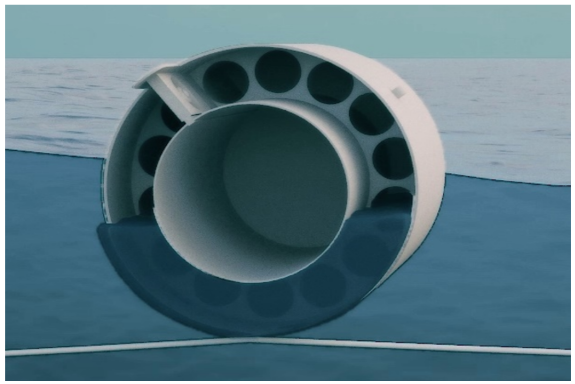
▸ Adaptive projection

Fluid/structures interactions:

- ✓ Congested flows ⇔ asymptotic low-Froude regime
- ✓ Buoyancy
- ↯ Immersed structures
- ↯ Air pockets







Geophysics:

- ✓ Porous media ⇔ asymptotic large-Friction regime
- ✓ Unified Shallow water/Dupuit-Forchheimer model
- ✓ Natural layerwise structure
- ↯ Unsaturated area