SeaTech
ÉCOLE D'INGÉNIEURS

Full reports: click on the link on the right.

Presentation of projects:

Modeling Fluid Computations and Structures - CFD

Dupont Ronan

Contents:

- *Modelling the spread of epidemics on the French territory with the SIR model.*
- *Contributions of tide and wind on water levels, overcoasts and port oscillations.*
- *Solving the Euler bi-fluid equations, application with the calculation code BBAMR.*
- *Numerical Method: Mesh of a sphere.*
- *Ocean modeling with the ROMS calculation code.*
- *Falling of a box in the water in 2D with Ansys Fluent.*
- *Other projects*

Modelling the spread of epidemics on the French territory with the SIR model.

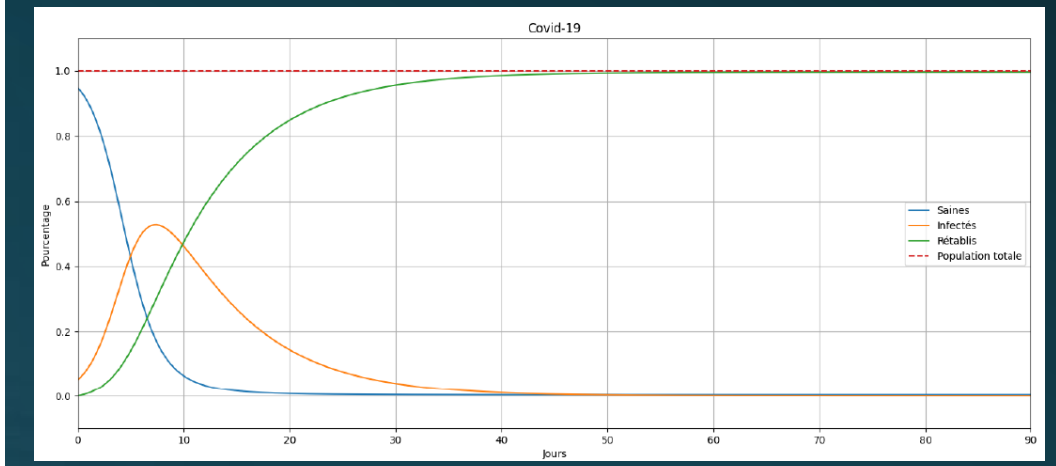
Report above

- *Modeling and solving partial differential equation (PDE) systems with* **python** *scattering.*
- *Change from SIR model to SZR model of zombie propagation.*
- *Image processing and display.*

$$S \xrightarrow{\beta} I \xrightarrow{\gamma} R$$

$$\begin{cases} \frac{\partial S}{\partial t} = -\beta SI \\ \frac{\partial I}{\partial t} = \beta SI - \gamma I \\ \frac{\partial R}{\partial t} = \gamma I \end{cases}$$

Classic SIR Model: Healthy/Infected/Restored



Covid-19 evolution with the SIR model

Propagation with the SZR model from Toulon

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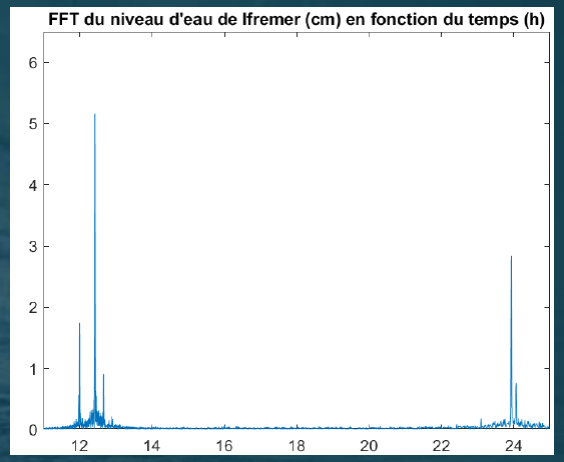
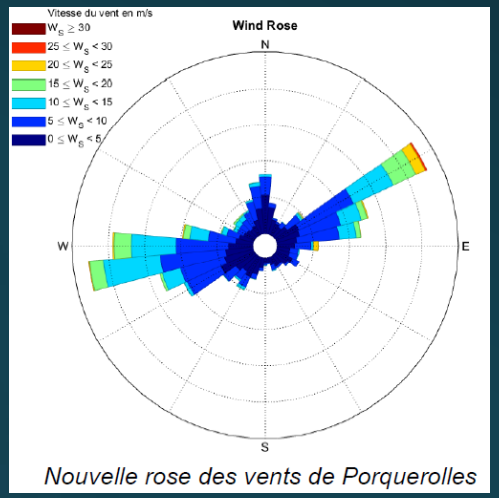
Contributions of tide and wind on water levels, overcoasts and port oscillations: Study based on temporal data of water levels by a network of instruments in the Var and the Bouches-du-Rhône departments.

Report above

- *Data exploitation in* **Matlab**.
- *Highlighting of tidal peaks/seiches using sliding averages and Fourier transforms.*
- *Creation of wind roses*
- *Modeling a probabilistic model*



Tidal Fourier Transforms



Wind Rose of Porquerolles

v0 (m/s)	5		10		15	
σ (cm)	5	10	5	10	5	10
P(V∩S) (%)	1.9	1.3	0.4	0.26	0.027	0.027
P(V) (%)	9.9	9.9	1.7	1.7	0.04	0.04
P(S) (%)	26.5	12.3	26.5	12.3	26.5	12.3
P(V|S) (%)	7.3	10.5	1.6	2.1	0.1	0.22
P(S|V) (%)	19.6	13.1	25	15.3	67	67
P(V)*P(S) (%)	2.6	1.2	0.44	0.21	0.01	0.049
Indépendant	non	oui	oui	oui	non	non
Erreur relative indépendance moyenne	26%	7%	7%	14%	61%	69%

Dépendance entre le vent d'Est (α=90) et les surcotes. Influence de v0 et σ

V: wind S: overcoast

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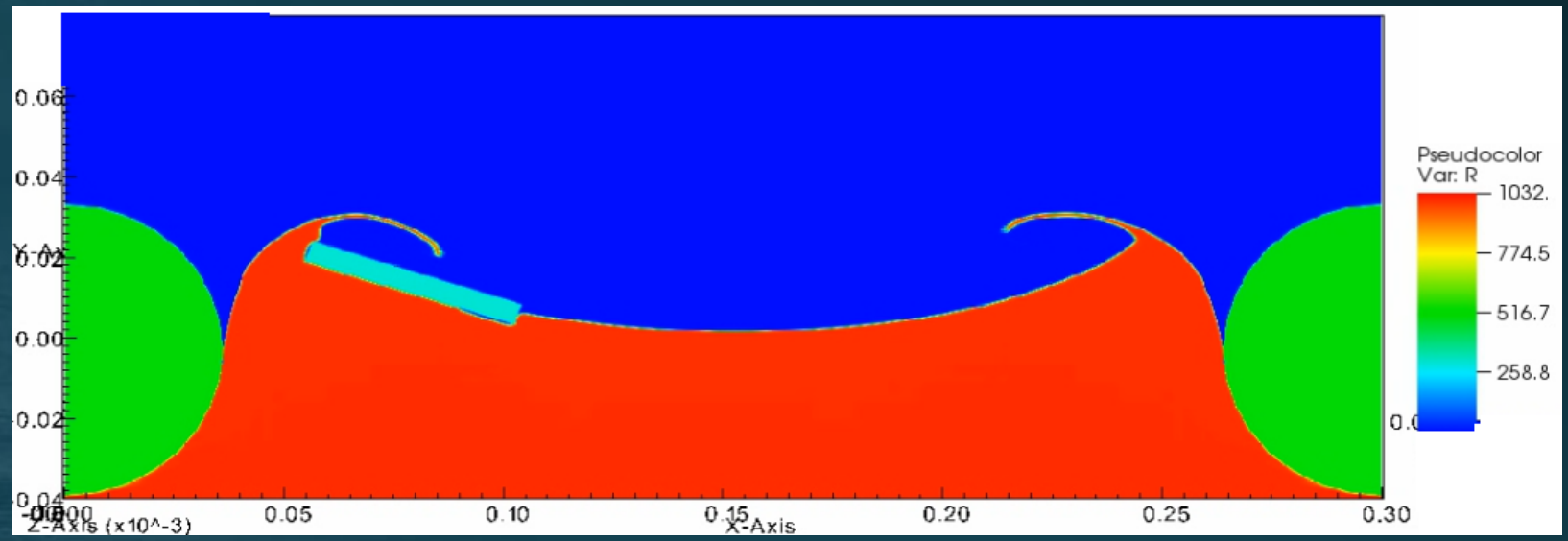
Solving bi-fluid Euler equations, application with the calculation code BBAMR

Report above

- *Resolution in* **Fortran 90**.
- *Resolution by the Finite Volume method using different schemes (Godunov, HLLC, Lax) on Fortran.*
- *Display and exploitation of the solutions on the* **Visit** *software.*
- *Use of a calculation code and creation of rigid fluids.*



Simulation of double sphere fall in a basin containing a wooden board with the calculation code BBAMR

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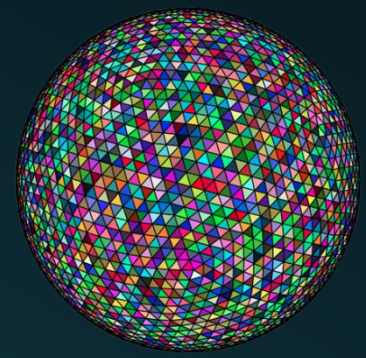
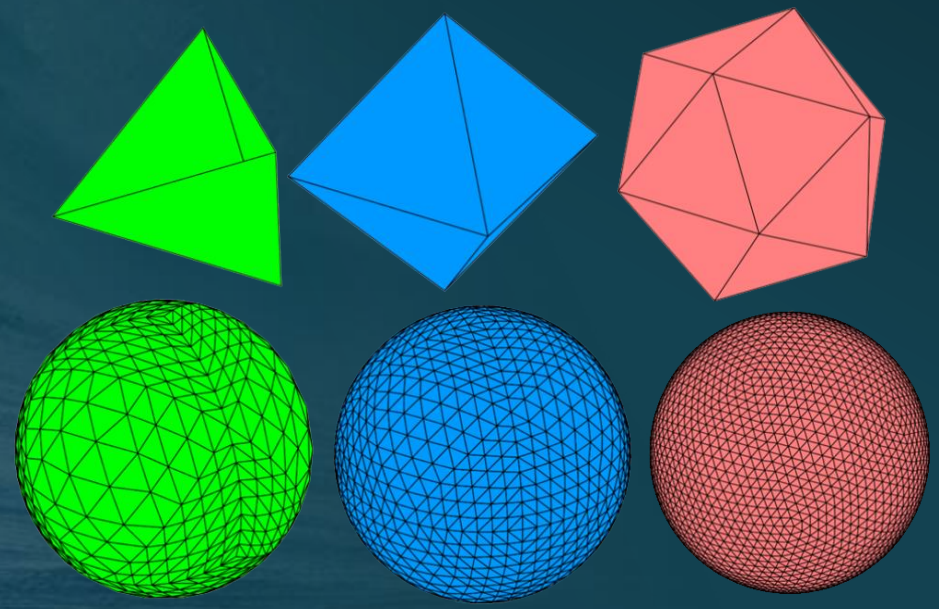
Numerical Method: Mesh of a sphere

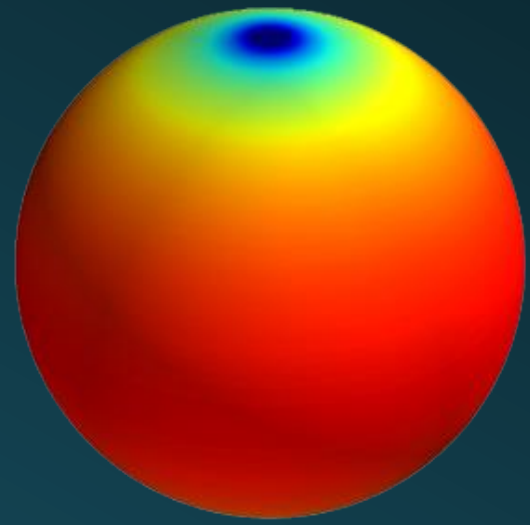
Report above

- *Modeling of the surface mesh (2D) of a sphere in* **Fortran 90** *and display in* **Python**.
- *Creation of types and functions allowing the numbering of vertices and the storage of their coordinates.*
- *Application to simple diffusion problems.*





Evolution of the mesh of a sphere with different starting geometries.



Thermal diffusion on the surface of a sphere

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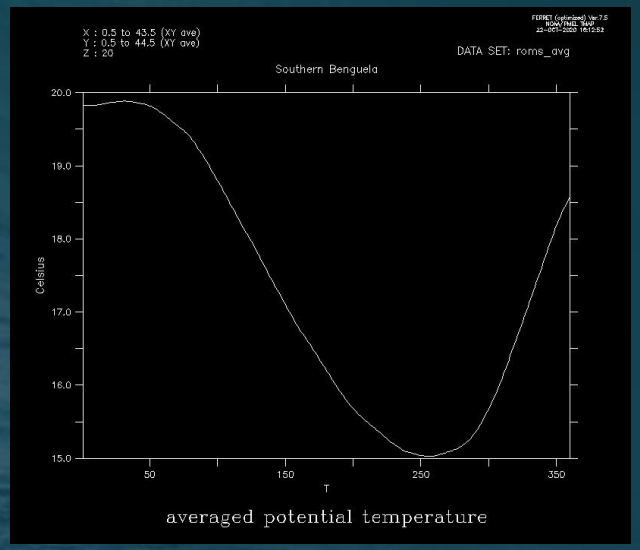
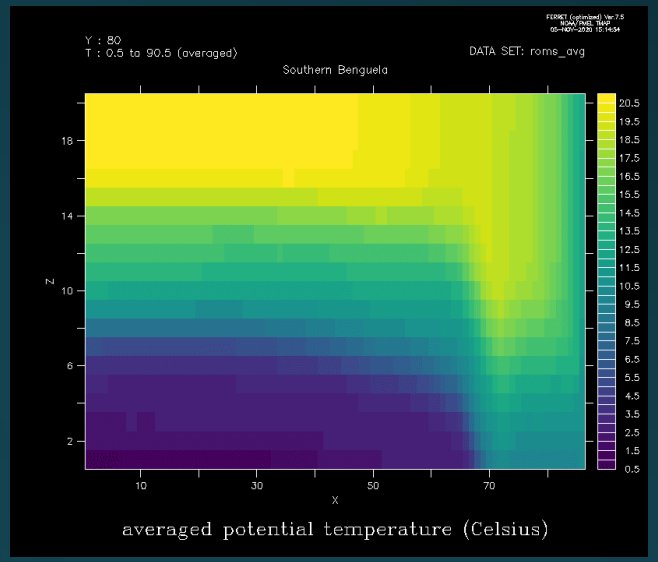
Ocean Modeling with ROMS calculation code

Report above

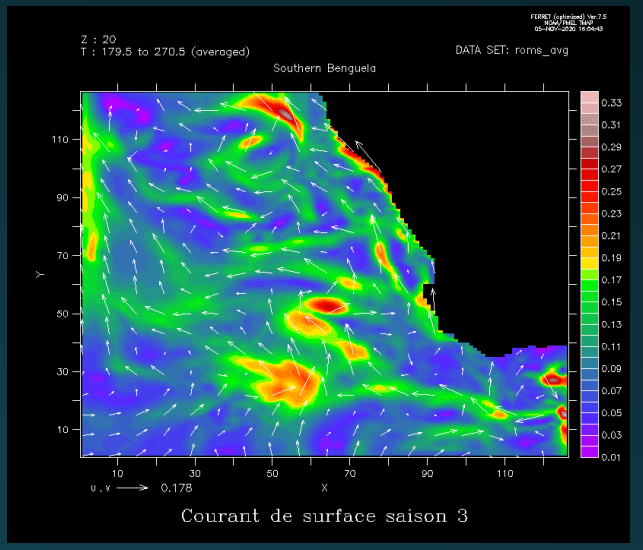
- *Use of the calculation code ROMS and the display software* **NOAA Ferret**.
- *Getting to grips with the calculation code with its various numerical resolution parameters.*
- *Highlighting of typical phenomena of a particular dynamic: seasonal temperature, upwellings...*



Seasonal Temperature Variations at Benguela



Highlighting upwelling in Benguela



Currents from July to October at Benguela

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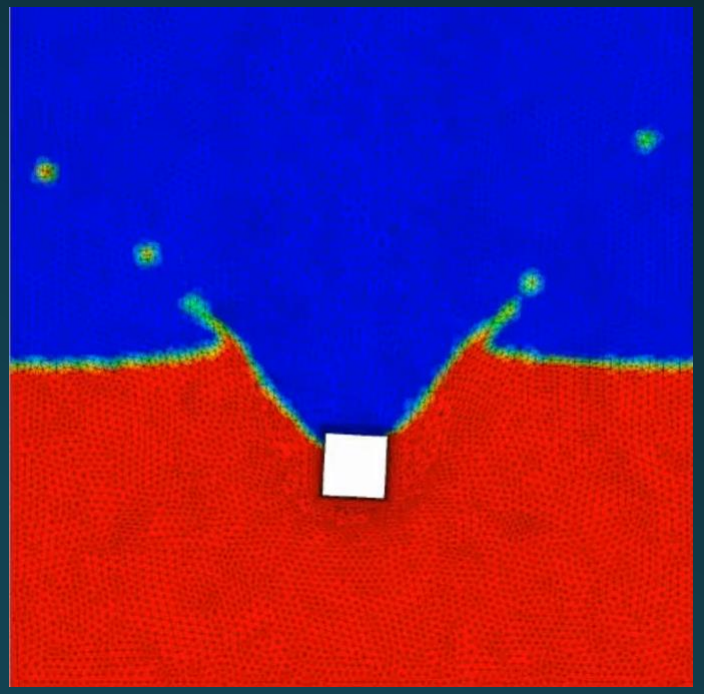
Falling of a box in the water in 2D with Ansys Fluent

- *Getting to grips with* **Ansys Fluent**
- *Theoretical model study: statistical approach (RANS method)*
- *Closing equations with the k-ε model*
- *Mesh sensitivity*



Falling of the box into the water

Dupont Ronan

Other projects

Full reports: click on the link on the right.

- **Numerical analysis:** *finite differences / Monte-Carlo.*
- **Stochastic computation:** *Monte-Carlo, quantization algorithms (K-mean, Kohonen), minimization algorithms (CEP).*
- **Numerical Method:** *Heat Equation / Nonlinear Thermal Diffusion / Transport Equation.*
- **Finite volumes:** *Road traffic modeling.*
- **FreeFem++:** *Solving the advection-diffusion equation.*
- **Hydrodynamics:** *Wave spectral analysis / Stresses on a cylinder with uniform flow / Shaoling effect.*
- **Fluid Mechanics:** *Coriolis / Turbulent boundary layer / Spin(up/down) effect.*