HIDROMOD

MOHID Water - New features 2019

Hidromod contribution

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Overview

- Areas of interest to HIDROMOD
- New features
- “Forseen” developments

Areas of interest to HIDROMOD

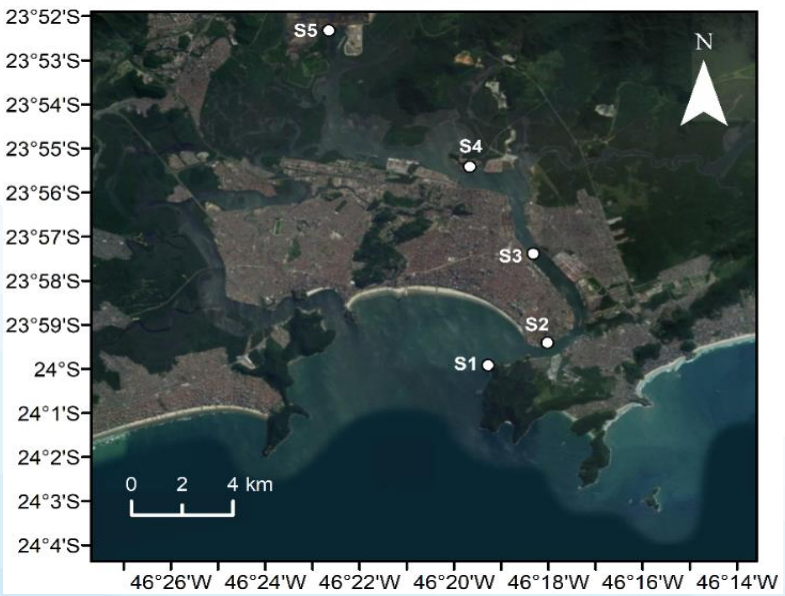
- Local discharges: outfall, rivers, etc.
- Sediment transport: cohesive and non-cohesive
- Running MOHID in forecast mode to support operations
- Coastal marine pollution risk analysis
- Water quality: fecal contamination, oxygen, etc.
- Non-hydrostatic: wind waves.

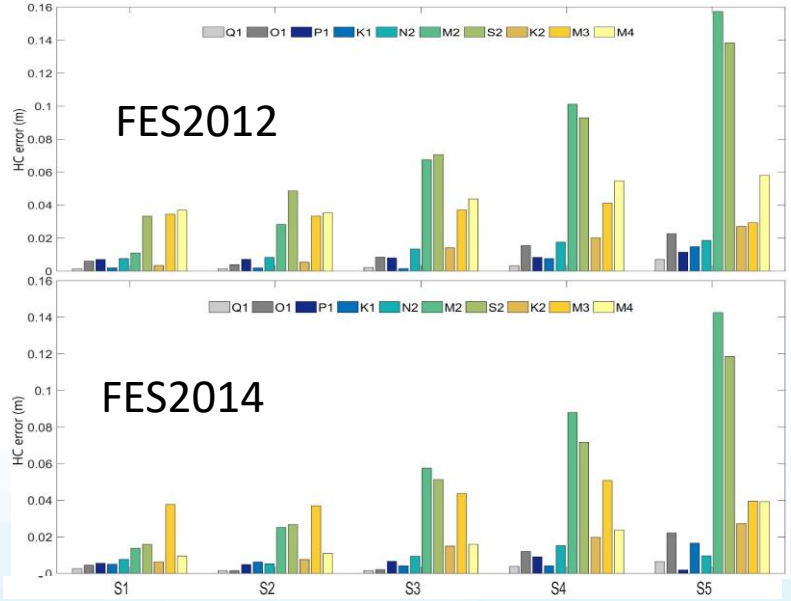
New features

Description	Subject	Modules/software
Simplification of the tidal forcing (FES2014 – complete reference solution)	Harmonic tide forcing	Assimilation, Hydrodynamic
Sample focus in running MOHID 3D WQ in forecast mode in coastal areas	MOHID Forecast mode	Hydrodynamic, Turbulence, Assimilation
Orchestrating a chain of actions that help to achieve the Continuous Integration process in an automated fashion.	Testing	Jenkins
Coastal sediment discharge associated with a flood event	Sediment transport	LagrangianGlobal
Modelling floating trajectories and beaching without input grids	Risk analysis	LagrangianGlobal
Sand transport more consistent for thin layers	Sediment transport	Sand
Wind wave absorption in coastal structures	Non-hydrostatic	Hydrodynamic

Simplification of the tidal forcing

- FES2014 better than FES2012 for the same implementations (e.g. Santos)





Mendes, J.; Leitão, P.; Chambel Leitão, J.; Bartolomeu, S.; Rodrigues, J.; Dias, J.M. Improvement of an Operational Forecasting System for Extreme Tidal Events in Santos Estuary (Brazil). Geosciences 2019, 9, 511.

- FES2014 have barotropic velocities. The user can avoid the traditional first nesting level forced only with astronomic tide. Please check if the results are better than the traditional approach.

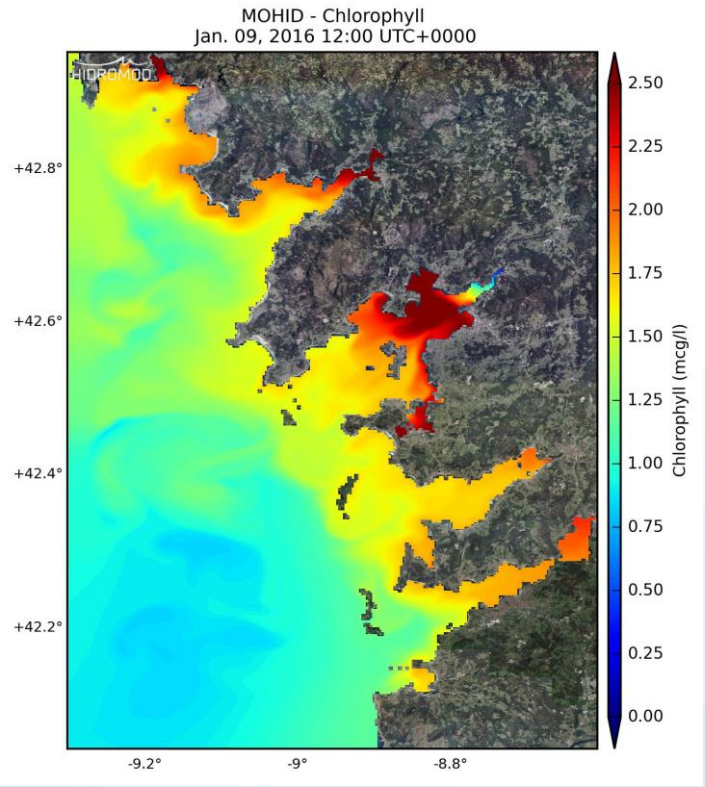
Sample – Coastal 3D Operational

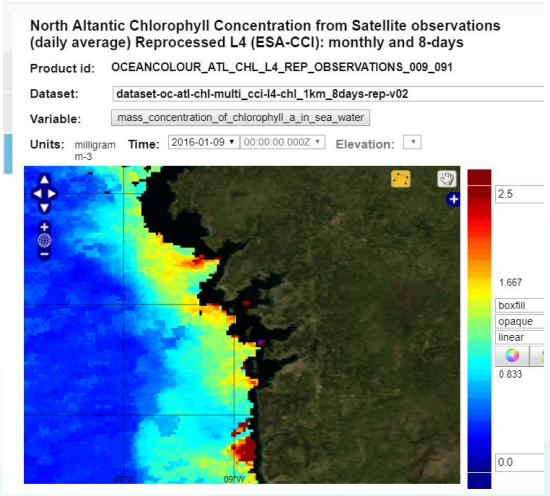
https://github.com/Mohid-Water-Modelling-System/Mohid/tree/master/Samples/Coastal3D_Operational

Hydrodynamic_1.dat - Notepad

File Edit Format View Help

```
WATER_DISCHARGES            : 1
|
CONTINUOUS                  : 0

IMPOSE_INVERTED_BAROMETER : 1
OPERATIONAL_MODEL_DEFAULT : 1
!1 = true (default - no fes2014)
!0 = false (with fes2014)
ASSIMILA_ONE_FIELD          : 0

RESIDUAL                    : 1
ENERGY                      : 1

OUTPUT_TIME                 : 0  86400
SURFACE_OUTPUT_TIME         : 0  3600
```





Speed up factor of 11
for 24 threads
3h run = 4 days forecast

305 x 232 x 35

Sample – Coastal 3D Operational

Assimilation_1.dat - Notepad

File Edit Format View Help

```
<beginproperty>
NAME                    : barotropic velocity U
UNITS                   : m/s
DIMENSION               : 2D
OUTPUT_HDF              : 1
GROUP_OUTPUT_NAME       : velocity U Astro


<<begin_field>>
DEFAULTVALUE            : 0
INITIALIZATION_METHOD   : HDF
FILE_IN_TIME            : HDF
FIELD4D                 : 1
SPATIAL_INTERPOL        : 1
EXTRAPOLATE             : 1
FILENAME                : X:\GlobalTide\FES2014.hdf5
TYPE_ZUV                : z
HARMONICS               : 1
SLOWSTART               : 86400
UNITS                   : m
HARMONICS_FIELD_DIM     : M2/amplitude
ADDING_FACTOR           : 0
<<<beginharmonics>>>
SA
SSA
MU2
NU2
MSF
2N2
J1
K1
K2
L2
M2
```

Ln 1, Col 1

Assimilation_1.dat - Notepad

File Edit Format View Help

```
<<begin_field>>
DEFAULTVALUE            : 0
INITIALIZATION_METHOD   : HDF
FILE_IN_TIME            : HDF
FIELD4D                 : 1
SPATIAL_INTERPOL        : 1
EXTRAPOLATE             : 1
FILENAME                : ../../generalData/Ocean/Ocean.hdf5
TYPE_ZUV                : z
<<end_field>>

<<begin_coef>>
DEFAULTVALUE            : 1e9
TYPE_ZUV                : u
FILE_IN_TIME            : NONE
REMAIN_CONSTANT         : 1
INITIALIZATION_METHOD   : Sponge
FILE_DT                       : 1
<<end_coef>>
```

Ln 1, Col 1

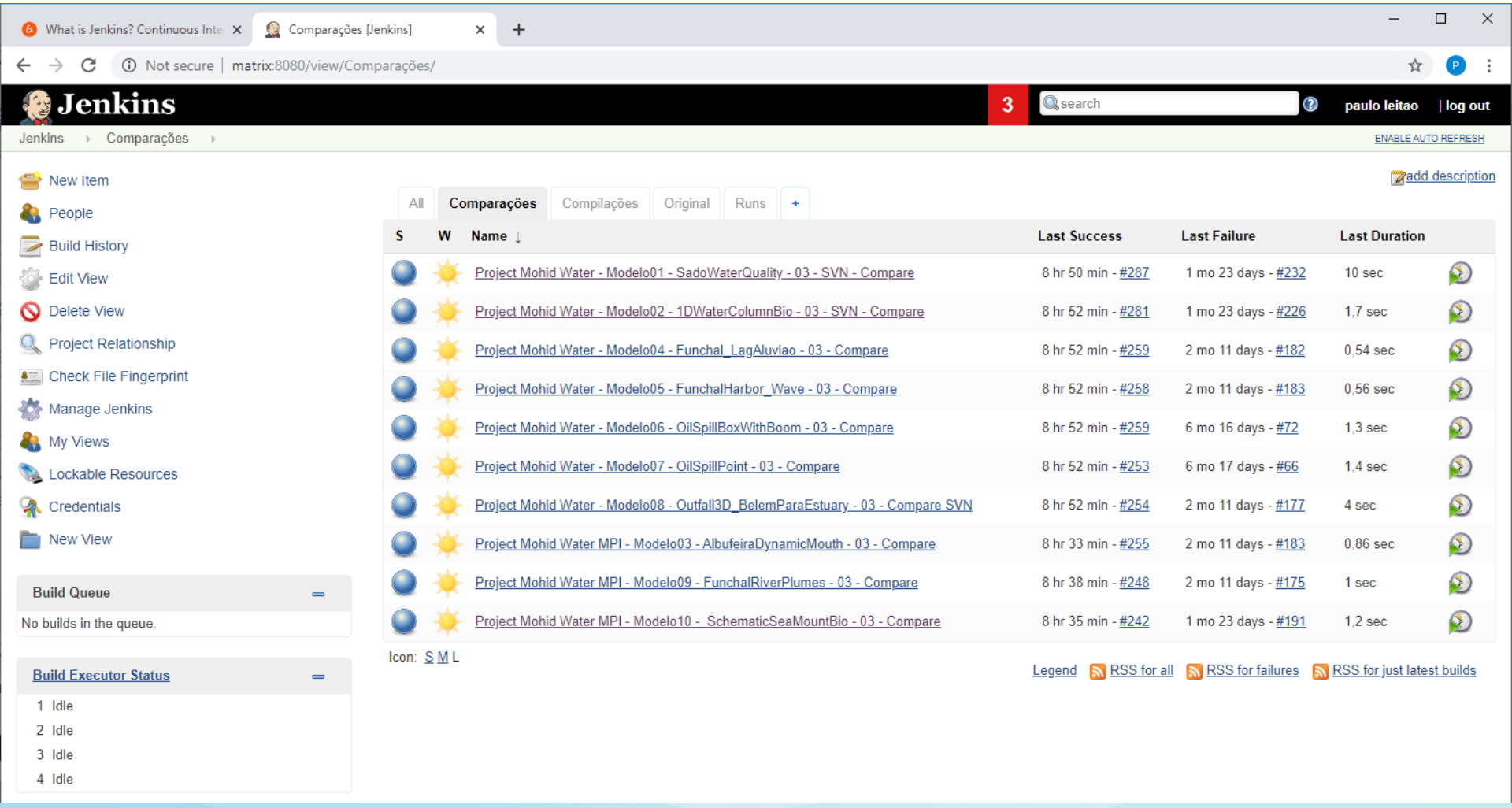
Turbulence_1.dat - Notepad

File Edit Format View Help

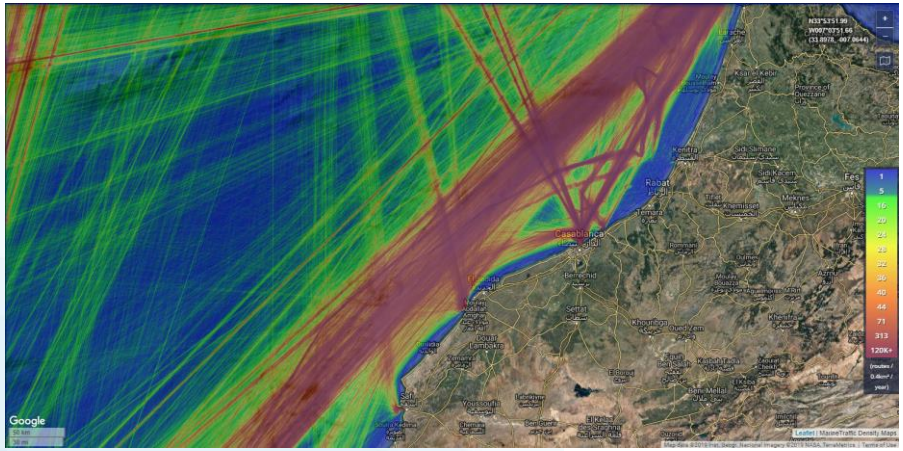
```
OUTPUT_TIME             : 0  86400

MODVISH                 : file2D

<begin_viscosity_h>
DEFAULTVALUE            : 0
TYPE_ZUV                : z
FILE_IN_TIME            : NONE
INITIALIZATION_METHOD   : Sponge
VISC_TURB_SPONGE        : 1
SPONGE_EVOLUTION        : 2
<end_viscosity_h>

MODTURB                 : turbulence_equation


CONTINUOUS              : 0
```

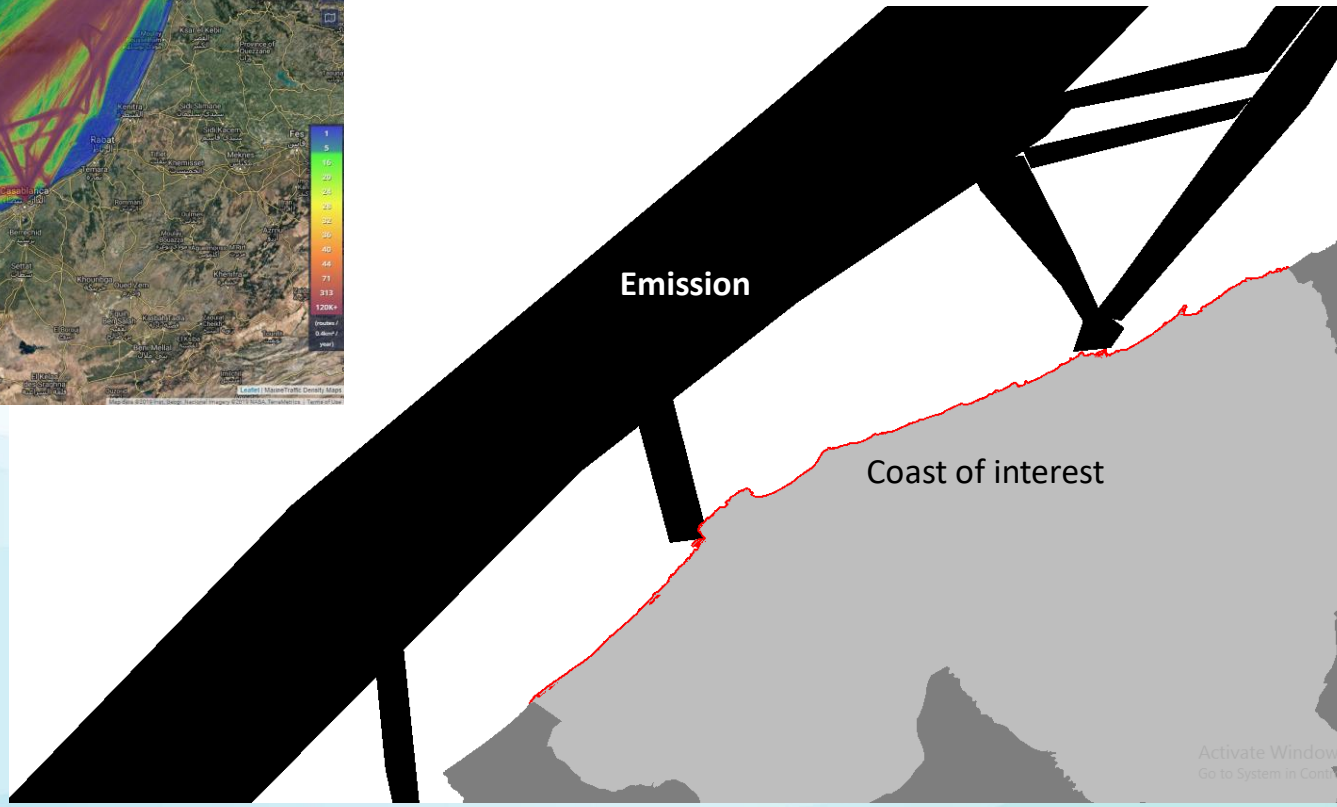
Ln 1, Col 1

Jenkins – Continuous integration



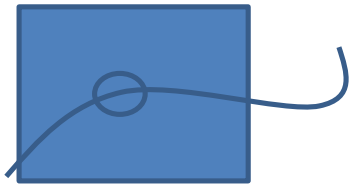
Emission in polygons not in boxes





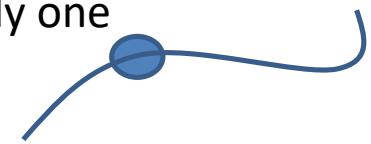
Trajectories independent of the grid

Relative position to the corners



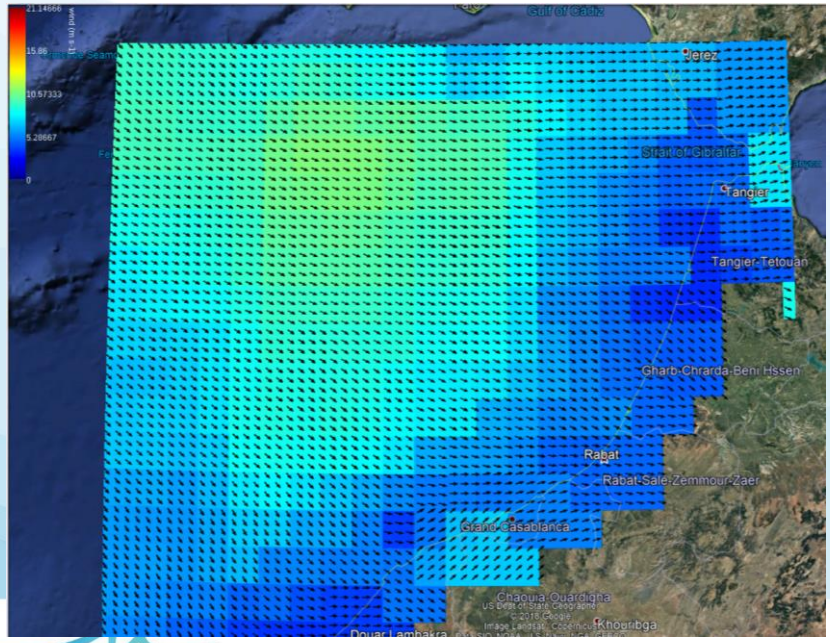
Since the first version

Position relative to only one origin

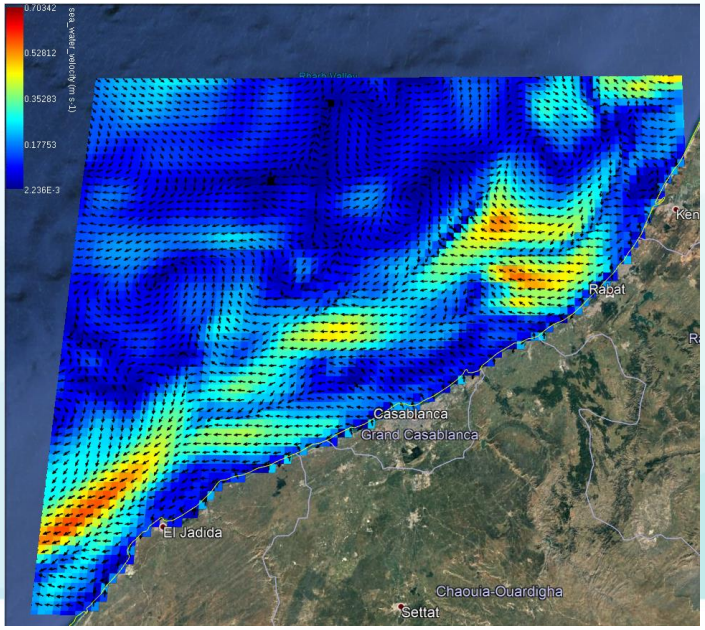


Since last week

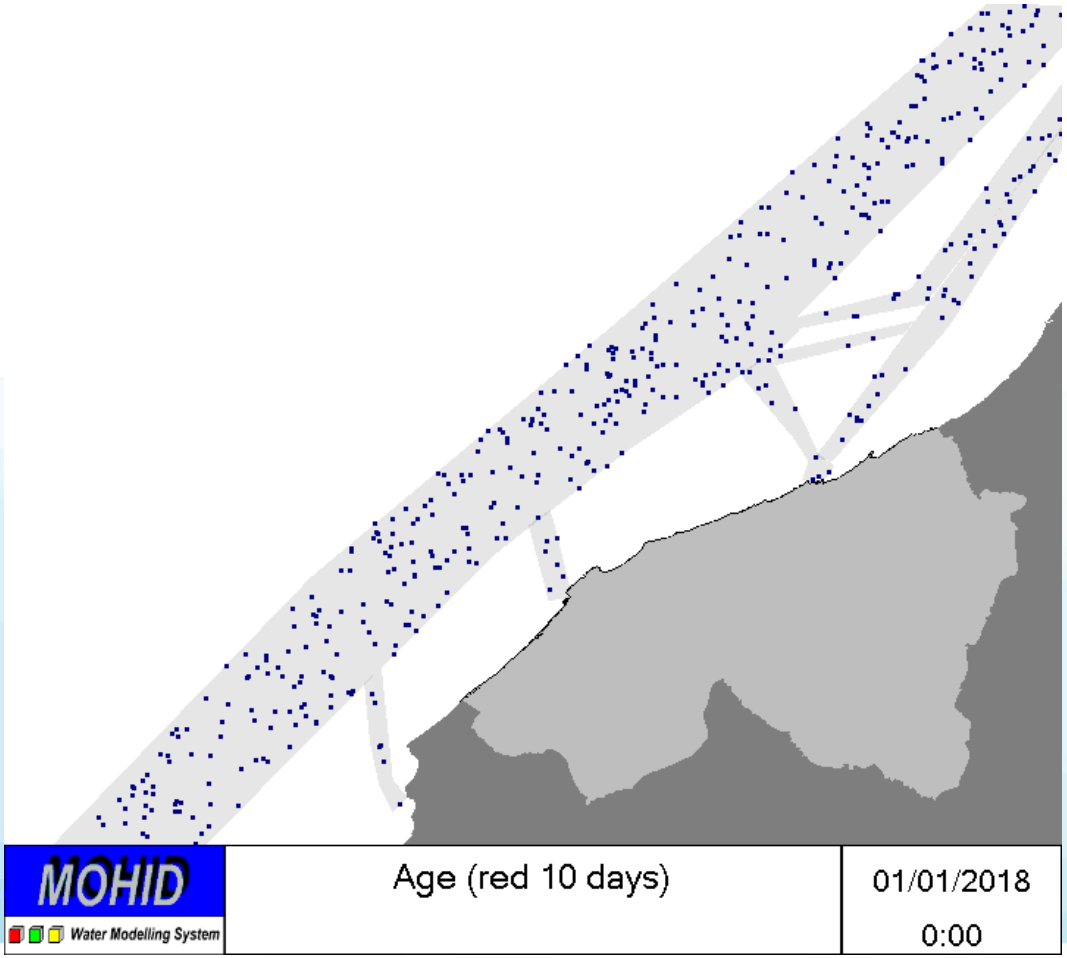
Wind – remote sensing - CMEMS



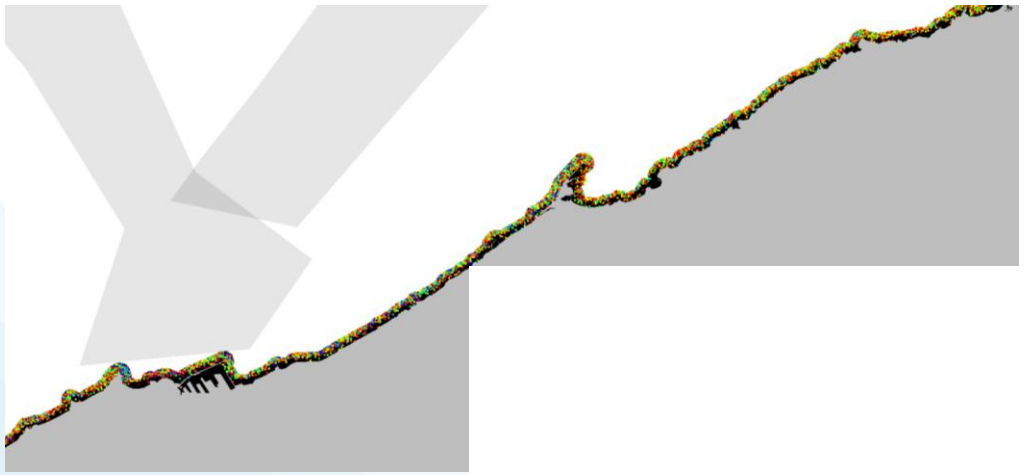
Currents - CMEMS



Parcels age (red – 10 days) one year simulation - 2018



Parcels age (red – 10 days)



Beaching using
polygons not grids

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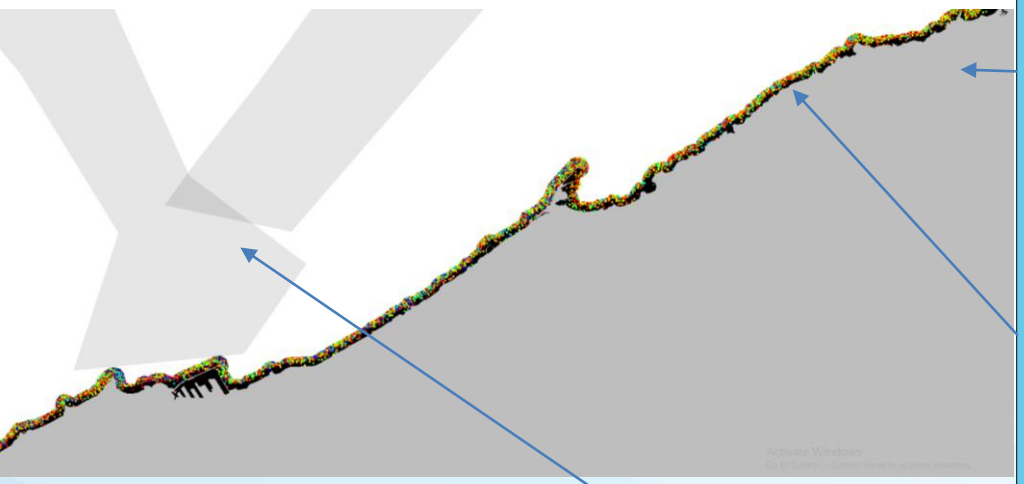
modelação em engenharia

N output grids available only in the Litter module



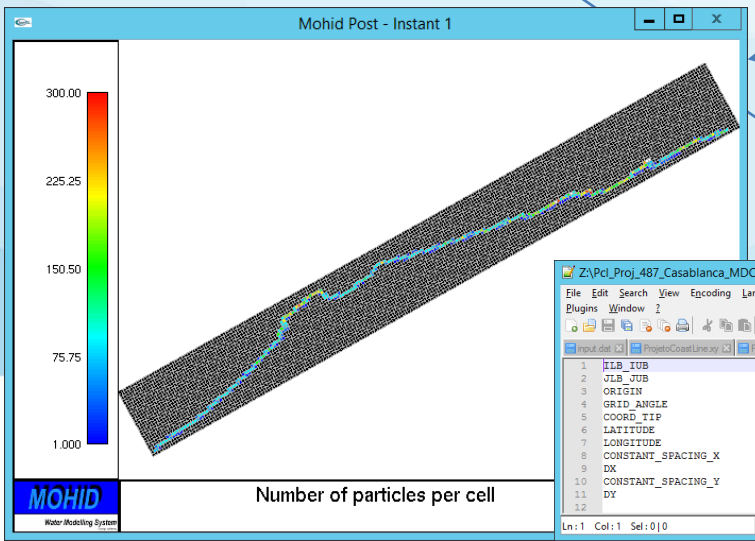
Lagrangian_1.dat - Notepad

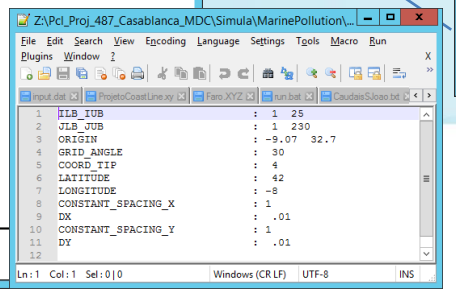
File Edit Format View Help

```
OUTPUT_CONC                 : 2

THINWALLS_FILE              : ..\..\GeneralData\Land\OpenStreetMapCoastLine.xy
! Activates litter module
LITTER_ON                   : 1
<EndGeneralKeywords>

<BeginLitter>
! (in sec)
AGE_TO_BEACH                : 0.
KILL_BEACH_LITTER           : 1
<<BeginBeachArea>>
NAME                        : Beaching area 1
DESCRIPTION                 : Area where litter can beach
FILENAME                    : ..\..\GeneralData\Beaching\Buffer_MarinePollution.xy
COAST_TYPE                  : 1
PROBABILITY                 : 0.5
!AGE_LIMIT                   : 2592000.
<<EndBeachArea>>
<<BeginOutputGrid>>
OUTPUT_TIME                 : 0. 3600.
OUTPUT_FILENAME             : ..\res\Lagrangian_1_LitterNumber.hdf5
INPUT_GRID_FILENAME         : ..\..\GeneralData\Beaching\Buffer_OutGrid.grd
<<EndOutputGrid>>
<EndLitter>
!
<BeginOrigin>
DEFAULT                     : 1
ORIGIN_NAME                 : SourceTemplate
GROUP_ID                    : 1
OLD                         : 0
! Emission type & position
EMISSION_ON                 : 1
EMISSION_SPATIAL            : Poly
POLY_EMISSION_FILE          : ..\..\GeneralData\Discharges\DischargePoly.xy
```





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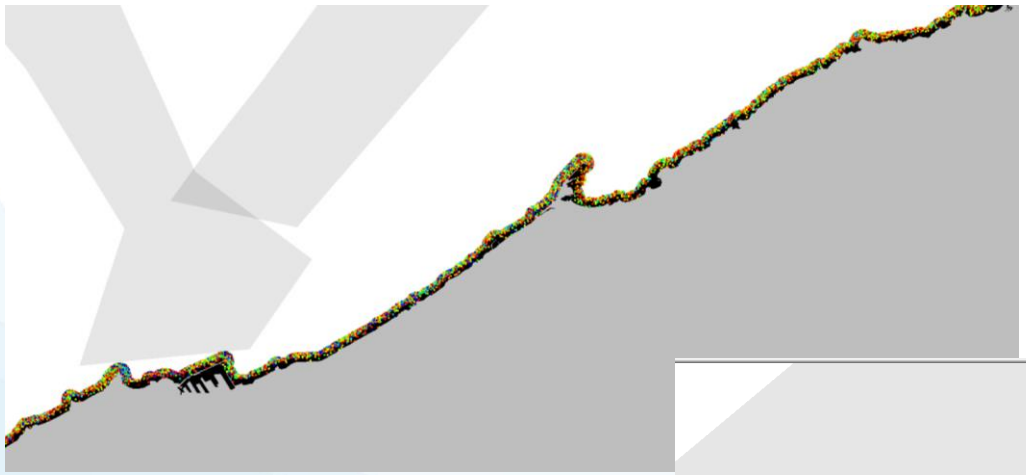
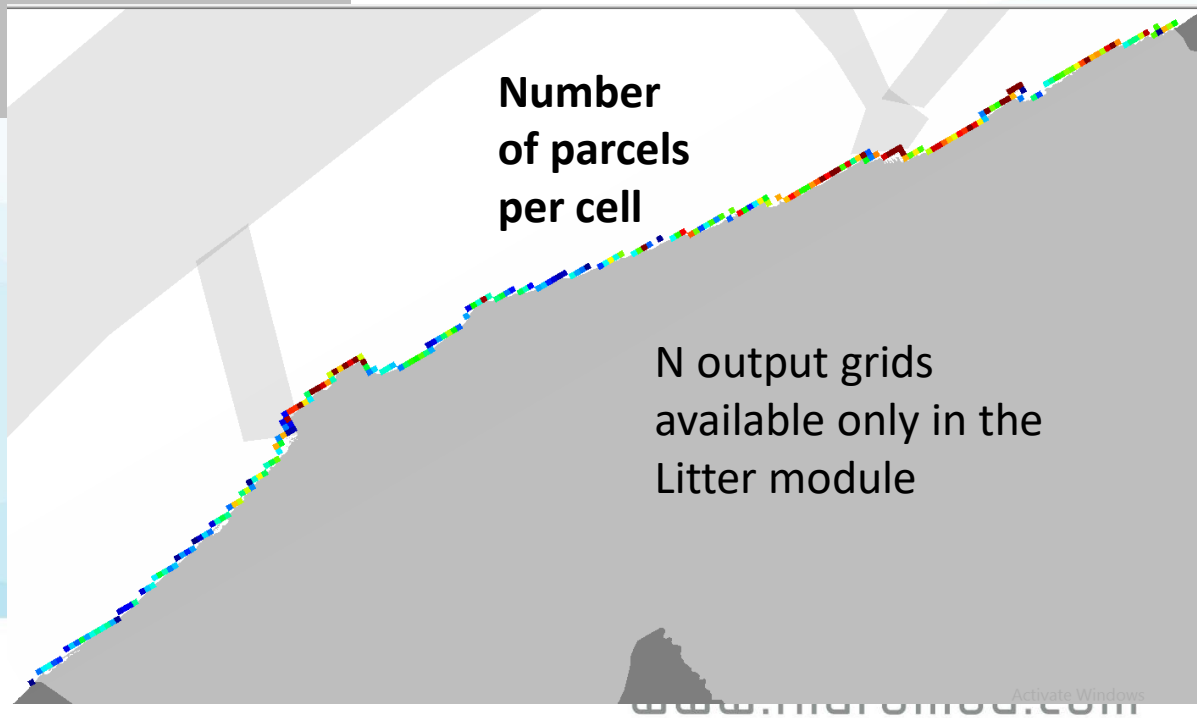
Parcels age (red – 10 days)





N output grids available only in the Litter module

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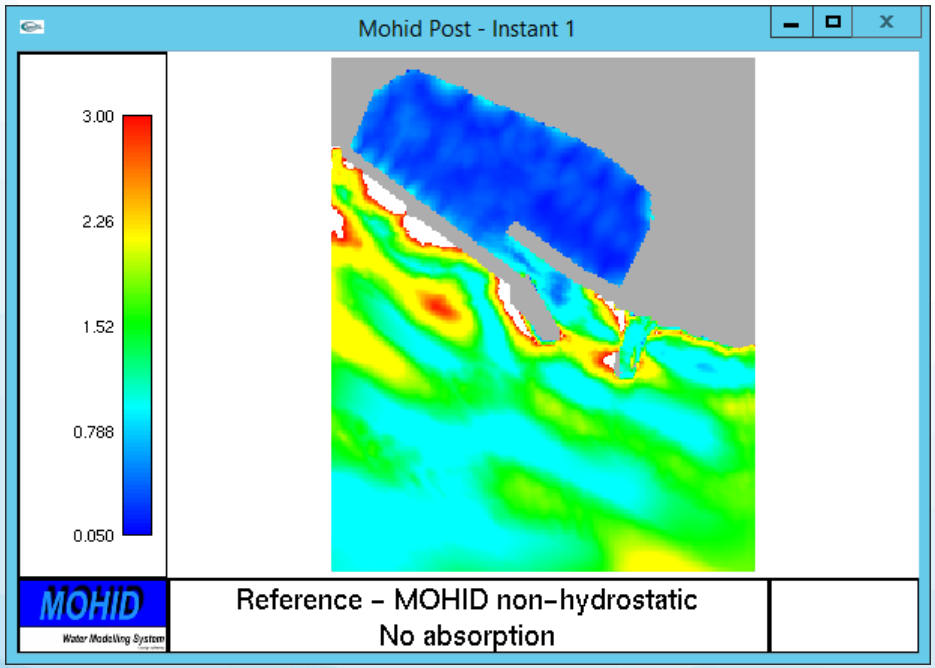
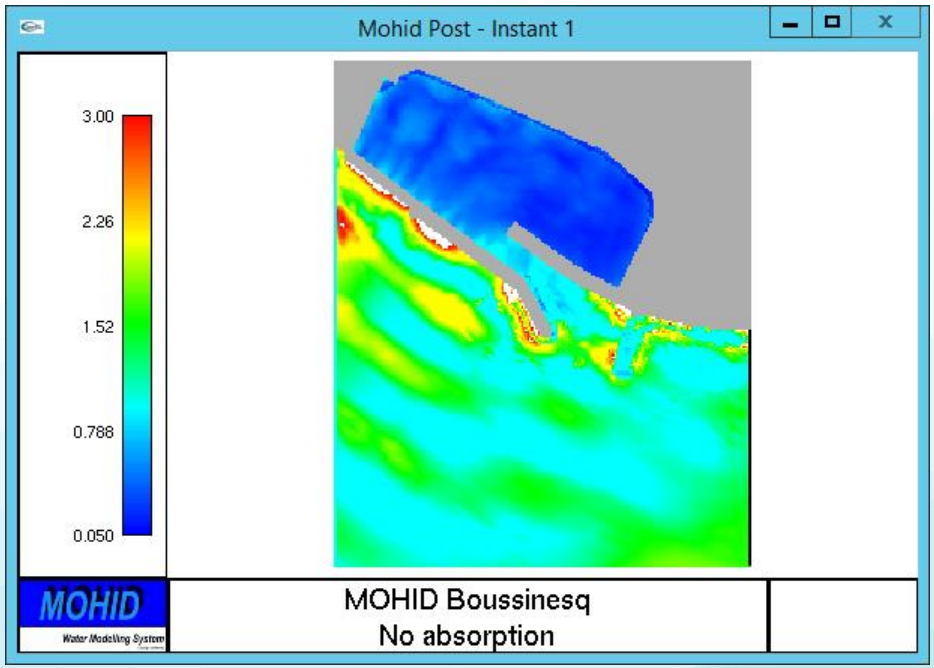
modelação em engenharia

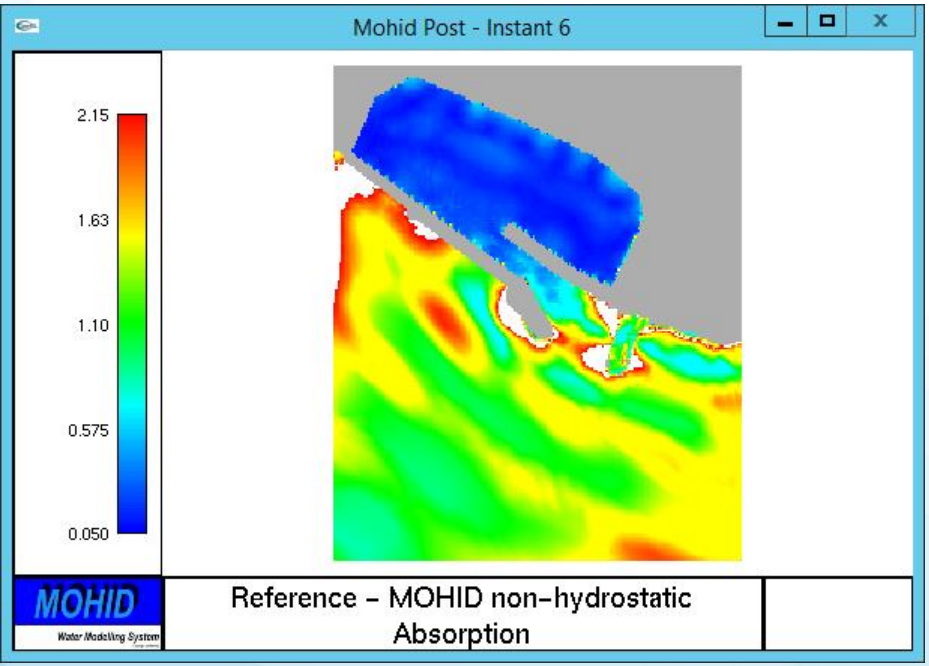
No absorption - Hs = 1 m, T=12s. Dir.=225º

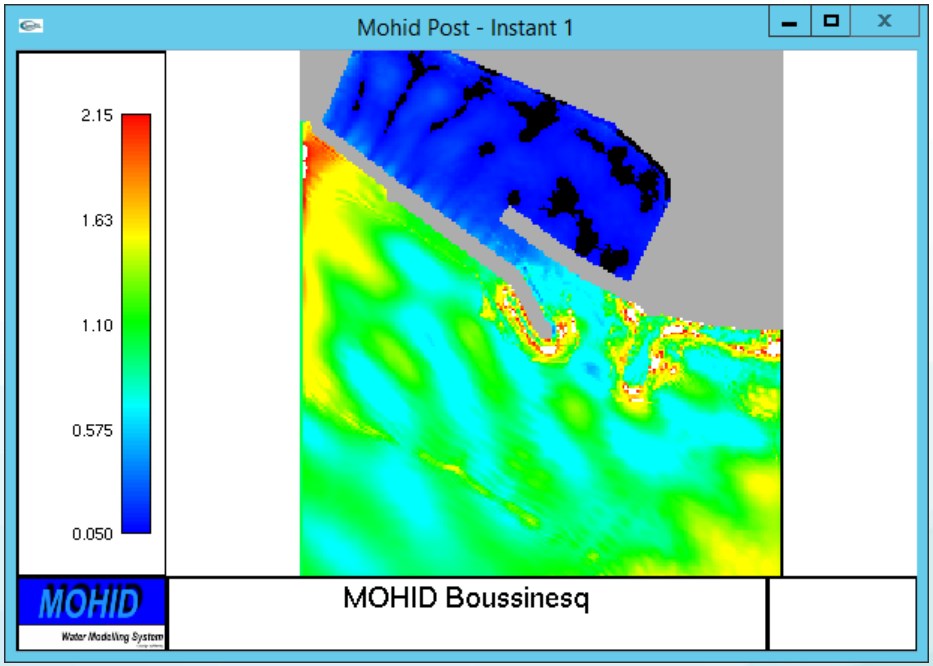




With absorption - Hs = 1 m, T=12s. Dir.=225º

Absorption = partial radiation boundary condition in land boundary





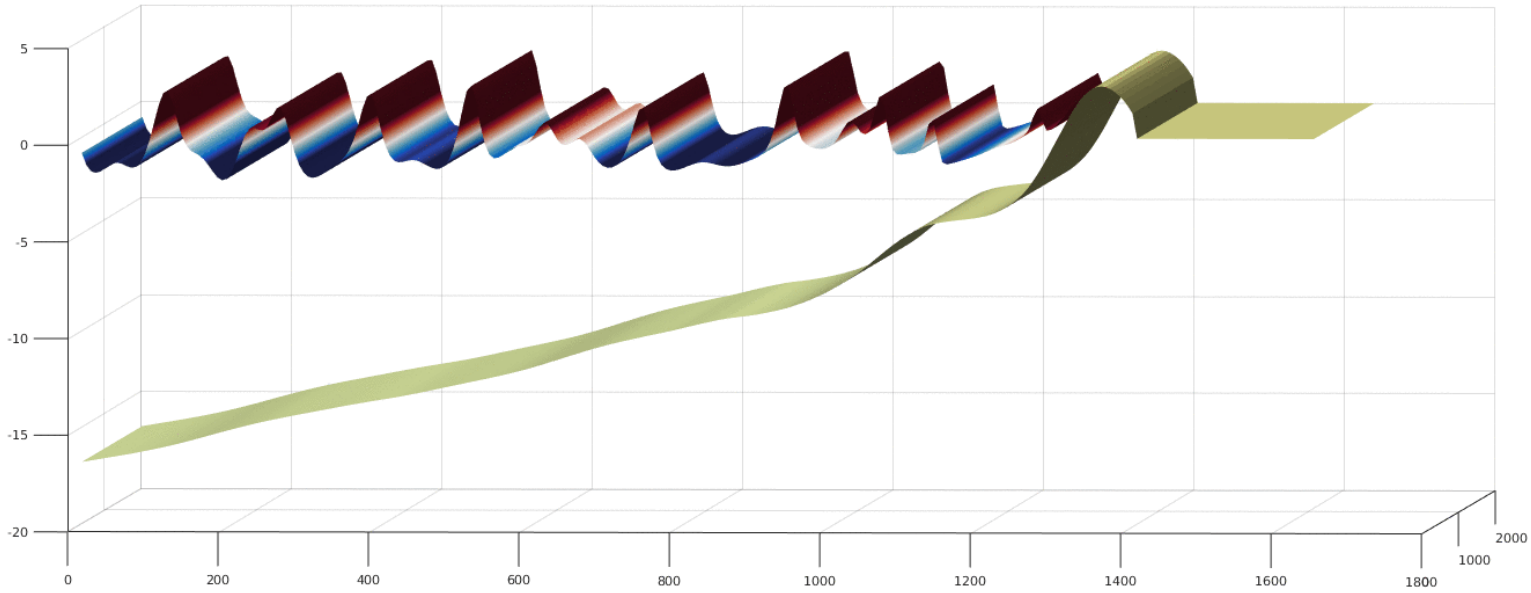
Forseen developments and testing

- Non-hydrostatic : Wind wave interaction with the coast (improve breaking and wet/drying)

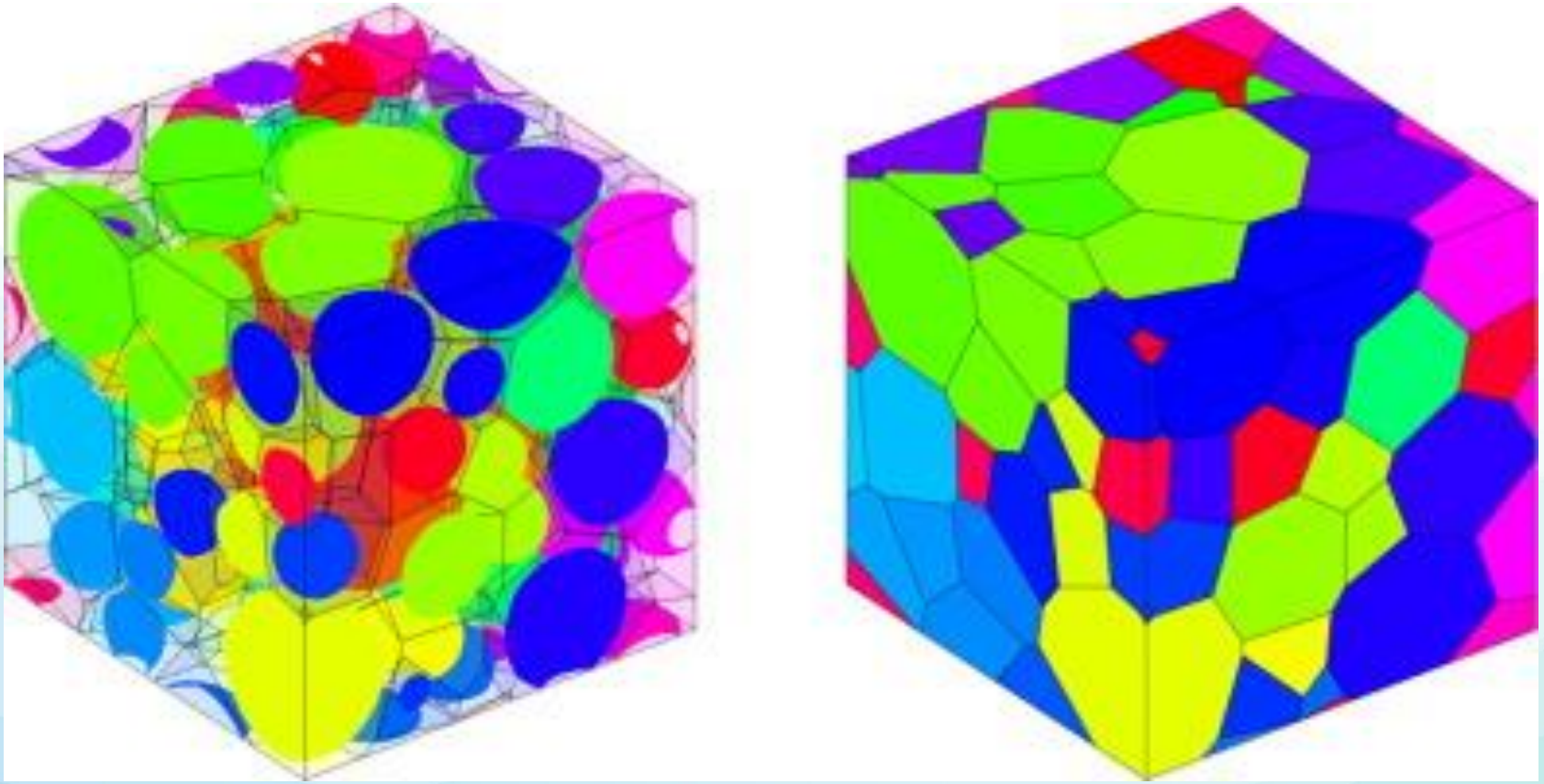
- Participating in the migration of functionalities of LagrangianGlobal to LagrangianParallel:
  - generic vertical ocean solutions,
  - emission/interaction: lines, polygons,
  - Movements: stair case problem, random walk function of the layers thickness gradient;
  - Cartesian vs spherical location;
  - Output grids variable in time and generated based in the parcels position (e.g. Voronoi 3D);
  - Acoplamento do MohidJet, Litter, Oil0D
  - Etc.

Module Sediment: testing the cohesive and non-cohesive mixtures

What I would like to reproduce (SWASH model 1 layer)



Voronoi 3D



OBRIGADO!

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