# Tutorial CROCO:
# Sediments - Idealized Cases

## 1. Purpose

In this tutorial we will learn to run several idealized cases that include the sediment module in CROCO.

Some of test cases are also described on the review of sediment test cases presentation, there : https://drive.google.com/drive/u/1/folders/1miCFLe7mRxUzPW2wTUIFKzVuVVfQt2MB

### 1.1. Installation

#### 1.1.1. Cluster environment

First open the terminal and connect to the cluster

```
1  ssh -X yourlogin@scp.chpc.ac.za
2  yourlogin@scp.chpc.ac.za's password:
```

Then reserve 1 processor:

```
1  qsubi1
```

#### 1.1.2. Setting environment

```
1  cp /mnt/lustre/users/gmorvan/SpringSchool2022/bashrc ~/.bashrc
2  source ~/.bashrc
```

```
1  cd lustre/
2  mkdir SEDIMENT
3  cd SEDIMENT/
```

Get the code and the the crocotools tar file :

```
1  cp -rf /mnt/lustre/users/gmorvan/SpringSchool2022/Sources/croco/ .
2  cp -rf /mnt/lustre/users/gmorvan/SpringSchool2022/Sources/croco_tools/ .
```

Now , we are going to create your Run directory

```
1  cd croco
2  nedit create_config.bash
```

to edit the file and modify the following lines to

```
1  MY_CONFIG_NAME=Run_Sedim
```

Now type :

```
1  ./create_config.bash -o all-dev
```

And we are all set to start :

```
1  cd Run_Sedim
```

## 1.2.   Basic Steps

The basic steps to run an idealized case are:

1. Edit **cppdefs.h**

2. Compile using **jobcomp**

3. Select the correct **.in** file from **TEST_CASES** directory

4. Run compiled executable **croco**

5. Plot using Matlab scripts in **TEST_CASES** directory

# 2.   SANDBAR

This test case is part of an effort to develop a comprehensive 3D nearshore model that predicts onshore and offshore sandbar migrations under storm and post-storm conditions, without the need to modify the model setting parameters. In this test, we attempt to reproduce the results of sandbar migration experiments, the European Large Installation Plan (LIP) experiments, which were carried out at full scale in Delft Hydraulics's Delta Flume (Roelvink and Reniers, 1995).

## 2.1.   Configuration

```
1  #define  SANDBAR          /* Bar-generating Flume Example */
```

Notice that there are several options for the **SANDBAR** case

```
1  # define SANDBAR_OFFSHORE /* LIP-1B */
2  # undef  SANDBAR_ONSHORE  /* LIP-1C */
3  # undef  OPENMP
4  # undef  MPI
```

After compilation (./jobcomp) we can use :

```
1  ./croco TEST_CASES/croco.in.Sandbar_1B
```

You can run with different namelists :

```
1  croco.in.Sandbar   croco.in.Sandbar_1B
2  croco.in.Sandbar_1C
```

Namelist from sediment model are on TEST_CASES directory :

```
1  sediment_sandbar_1B.in        sediment_sandbar_1C.in
2  sediment_sandbar.in
```

You can do it as is:

```
1  matlab -nodesktop
2  start
3  addpath TEST_CASES
4  plot_sandbar
```

## 2.2. Results

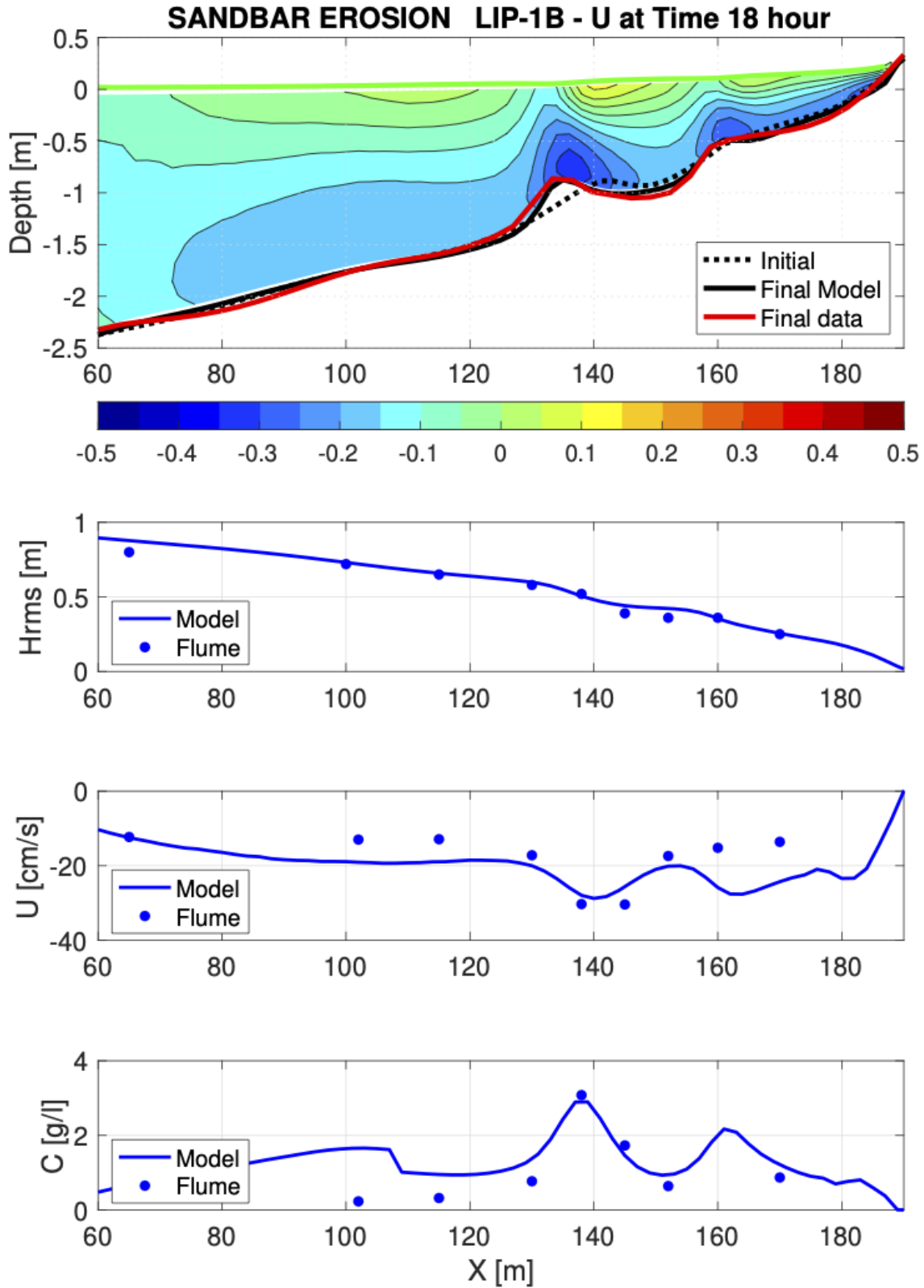Using the script **plot_sandbar.m** we get



Figura 1: Test case Sediments : Sandbar

# 3.   RIP

Rip currents are strong, seaward flows formed by longshore variation of the wave-induced momentum flux. They are responsible for the recirculation of water accumulated on a beach by a weaker and broader shoreward flow. Here, we consider longshore variation of the wave-induced momentum flux due to breaking at barred bottom topography with an imposed longshore perturbation, as in Weir et al. (2010) but in the 3D case. The basin is rectangular (768 m by 768 m) and the topography is constant over time and based on field surveys at Duck, North Carolina. Shore-normal, monochoromatic waves (1m, 10s) are imposed at the offshore boundary and propagate through the WKB wave model coupled with the 3D circulation model (Uchiyama et al., 2011). The domain is periodic in the alongshore direction. We assume that the nearshore boundary is reflectionless, and there is no net outflow at the offshore boundary.

## 3.1.   Configuration

```
1   #define  RIP              /* Rip Current Test Case */
```

Compile and load Matlab to create the **rip_grd.nc** file

```
1   matlab -nodesktop
2   start
3   make_rip
```

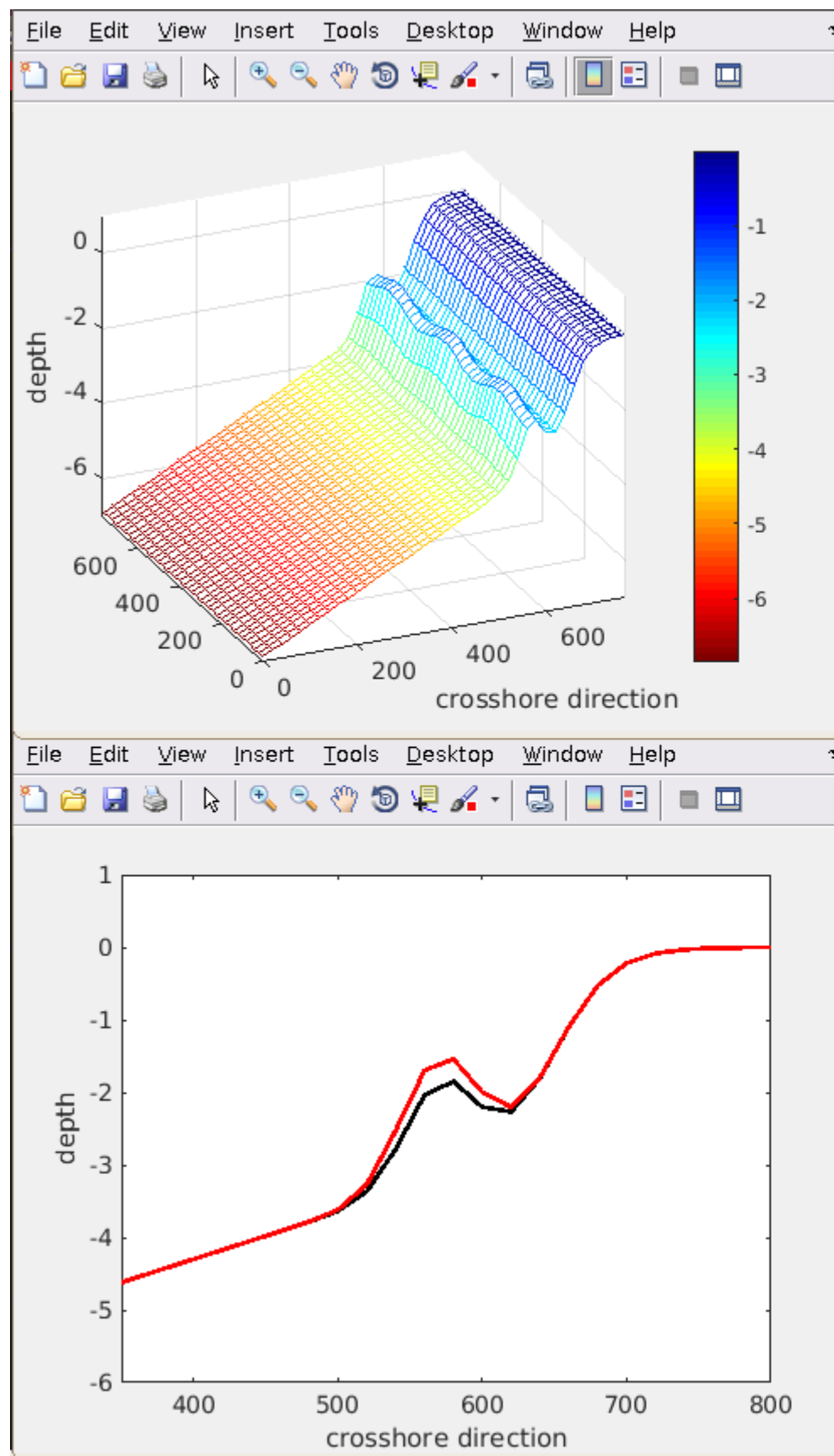which gives the file

```
1   rip_grd.nc
```

and the plots

Figura 2: Bathymetry for the RIP case

Now for no tides experiment, just do :

```
./croco TEST_CASES/croco.in.Rip
```

For tide experiment, define $ANA_T IDES on cppdefs.h, compile and type$ :
To plot use

```
plot_rip.m
```

## 3.2.   Results
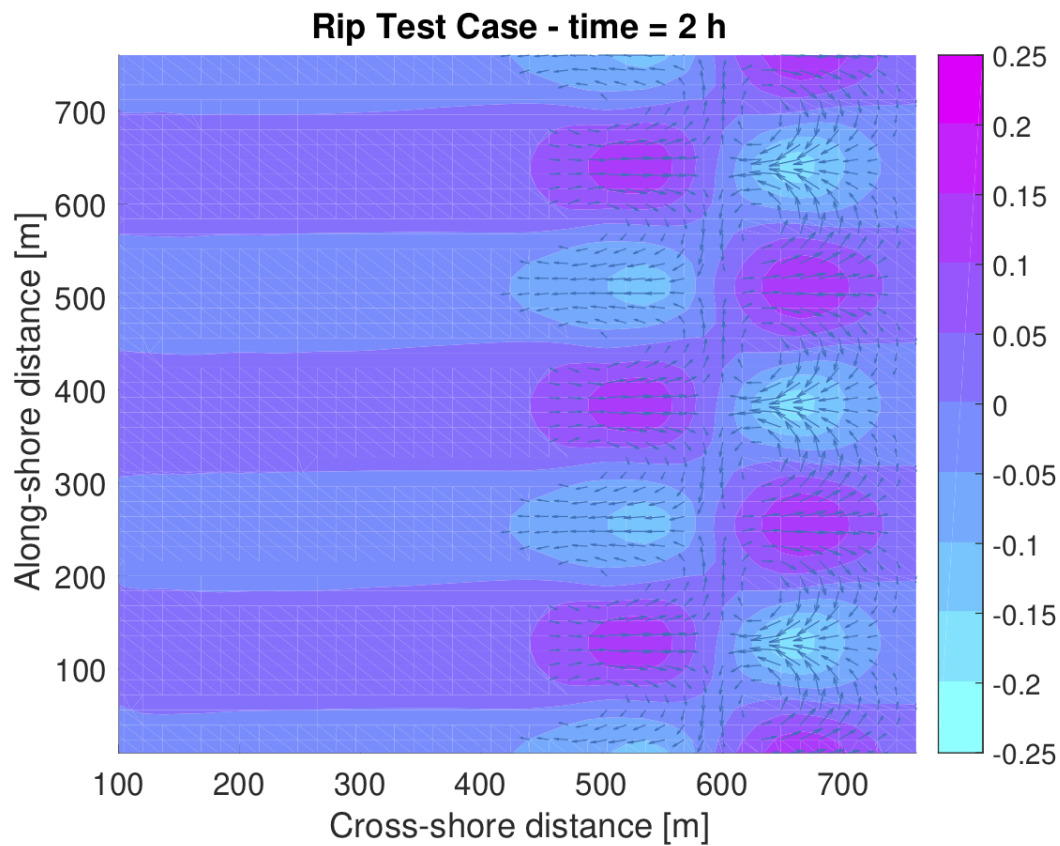
Using the script **plot_rip.m** we get



Figura 3: Test case Sediments : RIP

# 4. SED_TOY

Single column test case.

- ROUSE Case:Testing sediment suspension in a 1DV framework to verify the agreement with Rouse theory

- CONSOLID case : This 1DV test case exemplifies the sequence of depth-limited erosion, deposition, and compaction that characterizes the response of mixed and cohesive sediment in the model.

- RESUSP case : This 1DV test case to demonstrate the evolution of stratigraphy caused by resuspension and subsequent settling of different class of sediment during time-dependent bottom shear stress events.

## 4.1. Configuration

```
1  #define  SED_TOY        /* 1DV sediment toy Example */
```

Then choose which case you want to run :

```
1  Choose an experiment
2
3  # define SED_TOY_ROUSE        Rouse
4  # undef  SED_TOY_CONSOLID     Consolidation
5  # undef  SED_TOY_RESUSP       Erosion and sediment resuspension
6  # undef  SED_TOY_FLOC         Flocculation
```

and use the correct .in file

```
1  croco.in.Sed_toy_consolid  croco.in.Sed_toy_floc
2  croco.in.Sed_toy_resusp  croco.in.Sed_toy_rouse
```

Now do :

```
1  ./croco TEST_CASES/croco.in.Sed_toy_rouse
```

Some auxiliary files in the **TEST_CASES** directory are

```
1  sediment_sed_toy_resusp.in
2  sediment_sed_toy_consolid.in
3  sediment_sed_toy_rouse.in
4  sediment_sed_toy_floc.in
```

## 4.2. Results

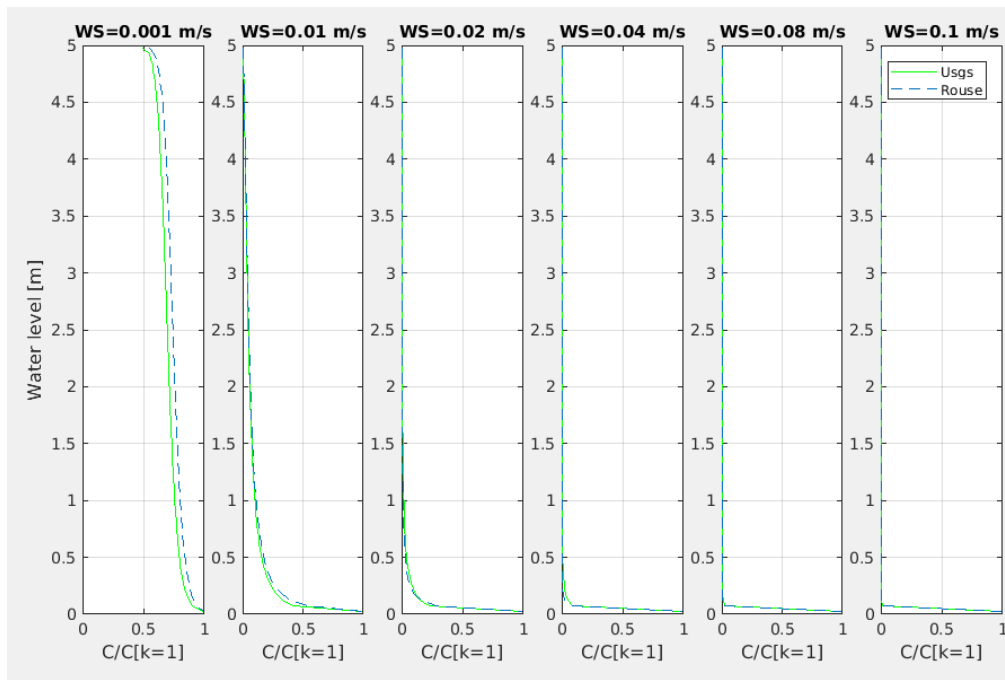Using the script **plot_sed_toy_rouse.m** we get

Figura 4: Test case Sediments : SED_TOY - USGS

# 5.  Vilaine

```
1  #define  COASTAL
2  #undef REGIONAL
3
4  #define  VILAINE              /* Coastal Vilaine Test Case */
```

This realistic test case allows us to analyze the model's ability to represent concentration of sediment close to the Vilaine river on South Britany.
It used Mustang Sediment model.

First, we are going to retrieve data to initialize Vilaine test case. We just copy all input files on CROCO_FILES directory , take care if there are already data there, a croco grd file could be overwritten... :

```
1  cp /mnt/lustre/users/gmorvan/SpringSchool2022/TEST_MUSTANG/DATASETS_VILAINE/* CROCO_FILES/
```

Now do :

```
1  cp /mnt/lustre/users/gmorvan/SpringSchool2022/TEST_MUSTANG/run_vilaine.pbs .
```

We are going to use 12 cpus, so we need to adapt the param file :

```
1  parameter (NP_XI=3,  NP_ETA=4,  NNODES=NP_XI*NP_ETA)
```

after compile it, launch it :

```
1  qsub run_vilaine.pbs
```

logfile will be on croco.out ...

Then to plot, we are going to load some module for this test case :

```
1  module load chpc/python/anaconda/3-2021.11
2  cd TEST_CASES
3  python vilaine.py
```

## 5.1.  Results
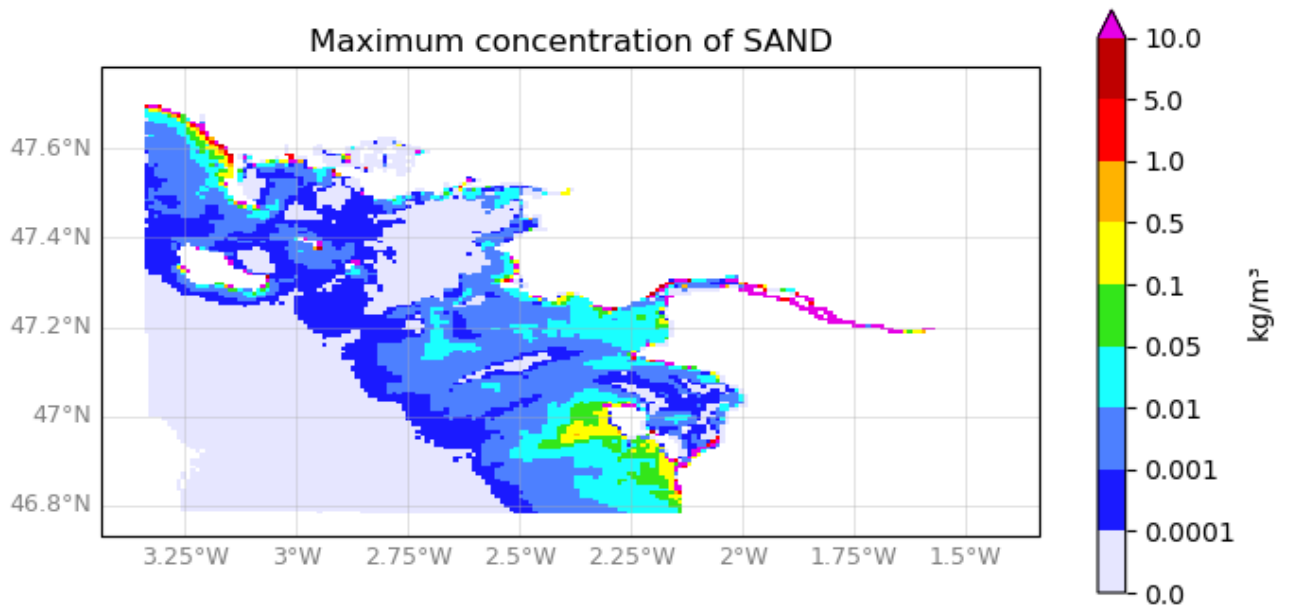
Using the script **plot_vilaine.m** we get



Figura 5: Test case Sediments : Vilaine - MUSTANG

to change to another test case, don't forget to unload python module du to compatibility issues

```
1  module unload chpc/python/anaconda/3-2021.11
```

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**Developed by:**
Rachid Benshila
Patrick Marchesiello
Guillaume Morvan

# 6.   References

Sediment
https://croco-ocean.gitlabpages.inria.fr/croco_doc/model/model.modules.sediment.html

Test Cases
https://croco-ocean.gitlabpages.inria.fr/croco_doc/model/model.test_cases.sediment.html

SANDBAR
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3D wave-averaged oceanic model (CROCO), submitted to Ocean Modelling.