

# Delta-X Application Workshop

## Delft3D model

Luca Cortese

May 5<sup>th</sup>, 2022



**Jet Propulsion Laboratory**  
California Institute of Technology



**BOSTON**  
UNIVERSITY

# Boston University group



Sergio Fagherazzi



Xiaohe Zhang



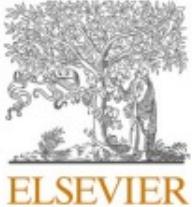
Carmine Donatelli



Luca Cortese

# Coupling model with remote sensing

Advances in Water Resources 159 (2022) 104088



Contents lists available at ScienceDirect

Advances in Water Resources

journal homepage: [www.elsevier.com/locate/advwatres](http://www.elsevier.com/locate/advwatres)



Using rapid repeat SAR interferometry to improve hydrodynamic models of flood propagation in coastal wetlands



Xiaohe Zhang <sup>a,\*</sup>, Cathleen E. Jones <sup>b</sup>, Talib Oliver-Cabrera <sup>b</sup>, Marc Simard <sup>b</sup>, Sergio Fagherazzi <sup>a</sup>

<sup>a</sup> Department of Earth and Environment, Boston University, Boston, MA, USA

<sup>b</sup> Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

<https://doi.org/10.1016/j.advwatres.2021.104088>

# Overview



- Developed by Deltares (Netherlands)
- Numerical model used in coastal, river, lake, and estuarine areas
- Many processes:
  1. Flows induced by tides, density gradients and wave induced currents
  2. Wave propagation
  3. Sediment transport
  4. Morphological changes
  5. Advection/dispersion of effluents
  6. Water quality

# Delft3D versions

- Delft3D v4 (classic version)



Delft3D-FM (flexible mesh)



LUCA CORTESE



HOME COMMUNITY NEWS DOWNLOADS RESEARCH

SEARCH

## Get Started

### Get the Delft3D Graphical User Interface (free of charge)

When you are signed in (top right corner of the page), you will see the text titled "GUI" below, containing information on how to request a GUI package and a link to the GUI request form.

### Download source code

Go to the Source Code section below and follow the steps as indicated to download the source code.

#### How to obtain a GUI package

To receive this GUI package and a license file valid for one year, please [fill out this GUI request form](#).

Your request will be handled within 5 working days.

### Get high level support

If you want the Delft3D software and GUI as package, you can request a quote. An overview of the Delft3D Software Service Packages can be found [here](#). Please contact us for a quote or more information.

# Delta-X model

We use 3 modules:

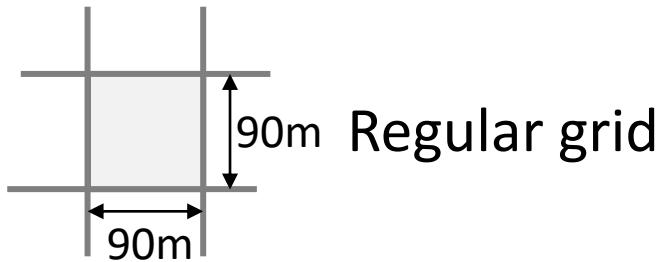
- Delft3D-FLOW and Delft3D-MOR

Hydrodynamics (water levels and velocity)  
2D shallow water equations

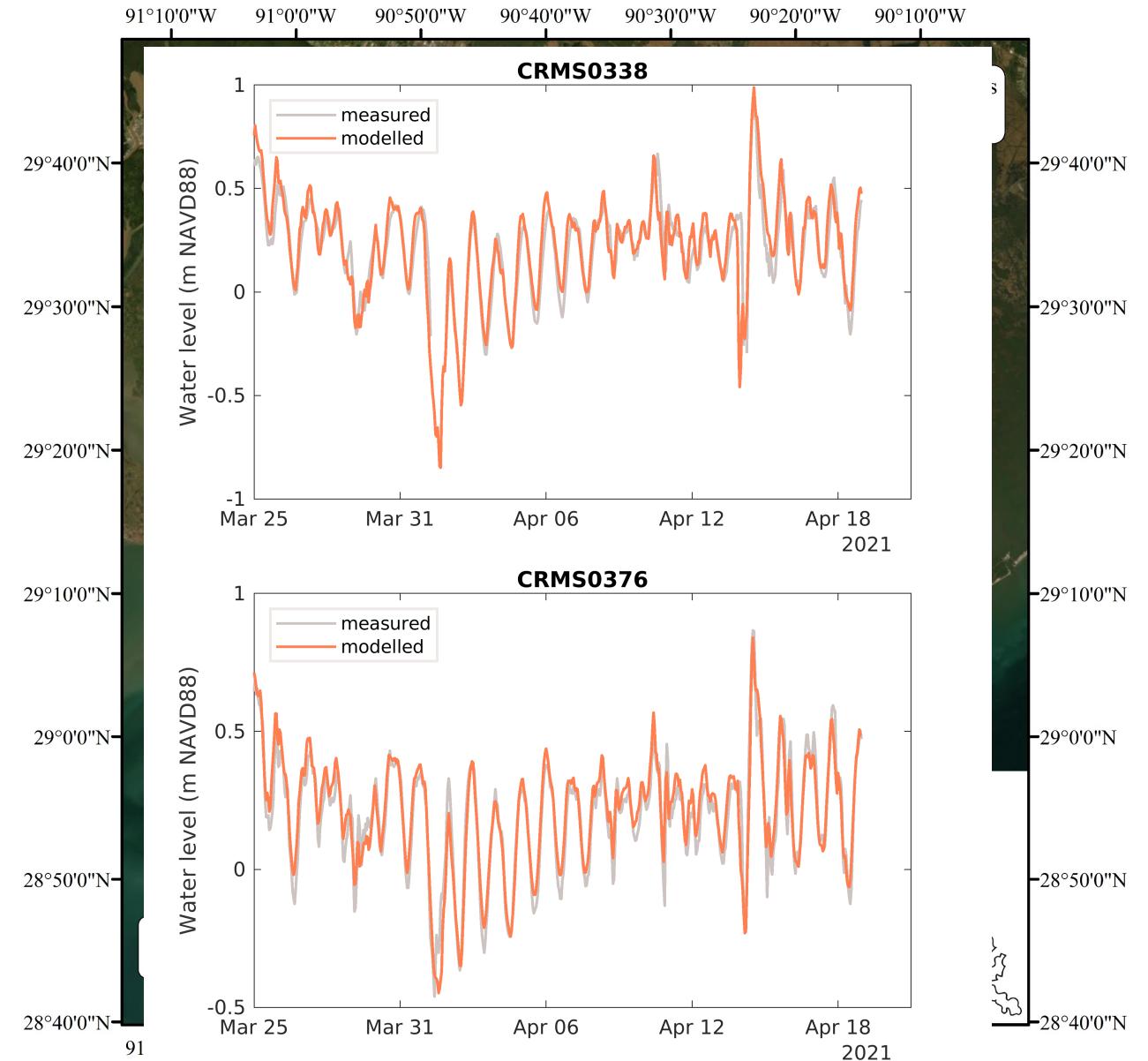
Sediment transport and morphology

- Delft3D-WAVE → SWAN (Waves)

# Domain



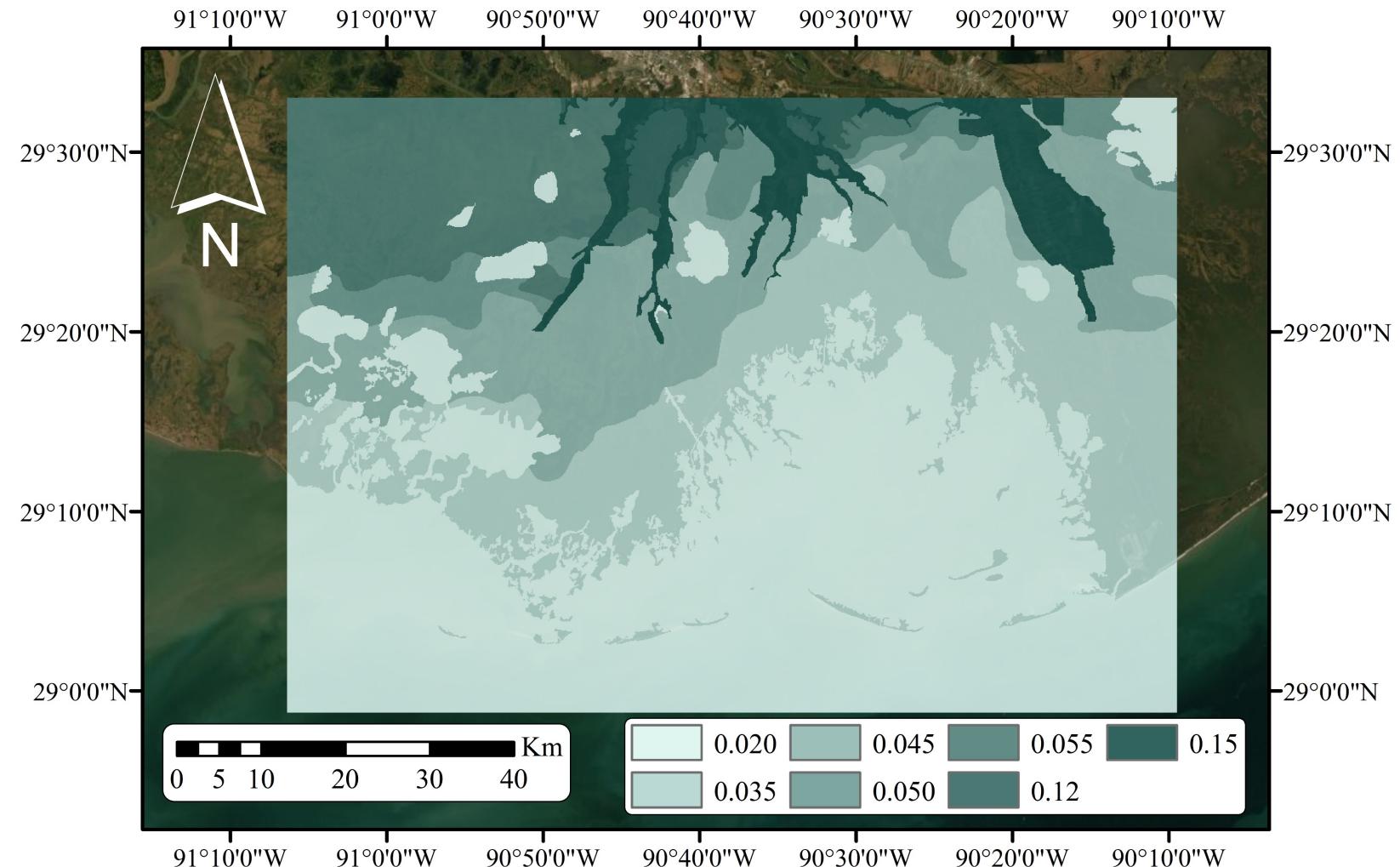
Coastwide Reference Monitoring System (CRMS) stations for validation



# Bottom friction

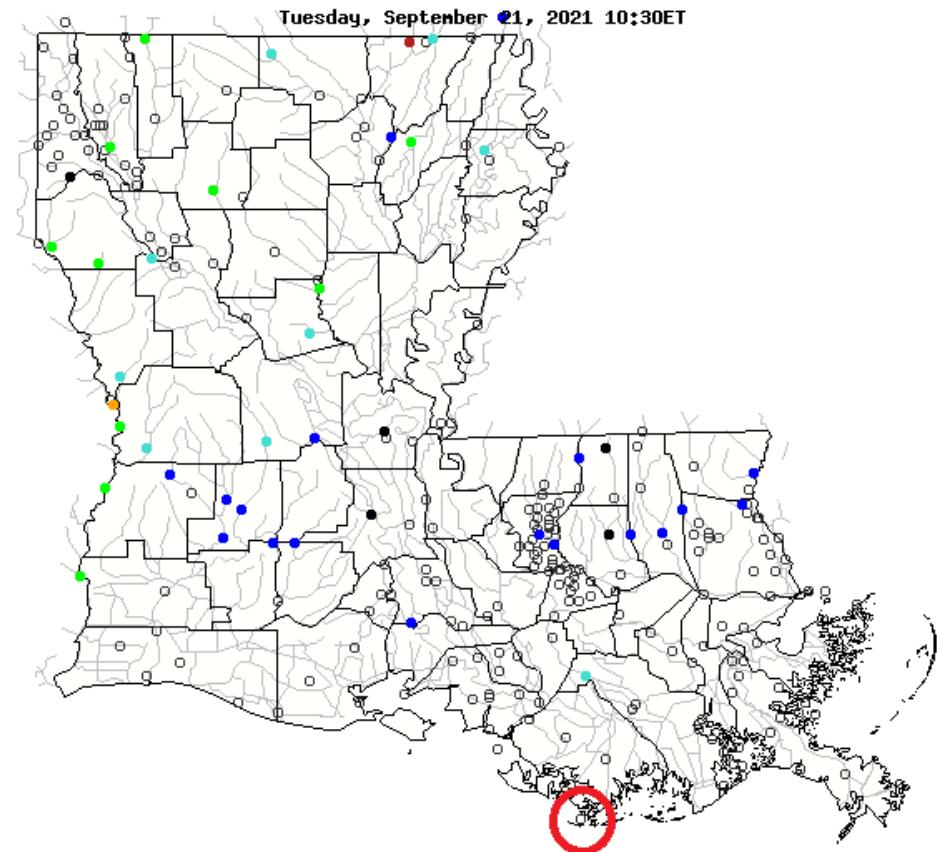
Manning coefficient based  
on the type of wetland  
(info from CRMS)

Values from LA-  
GAP classification



# Boundary conditions

Water level and wind data are taken from the USGS station 073813498



# Sediment transport

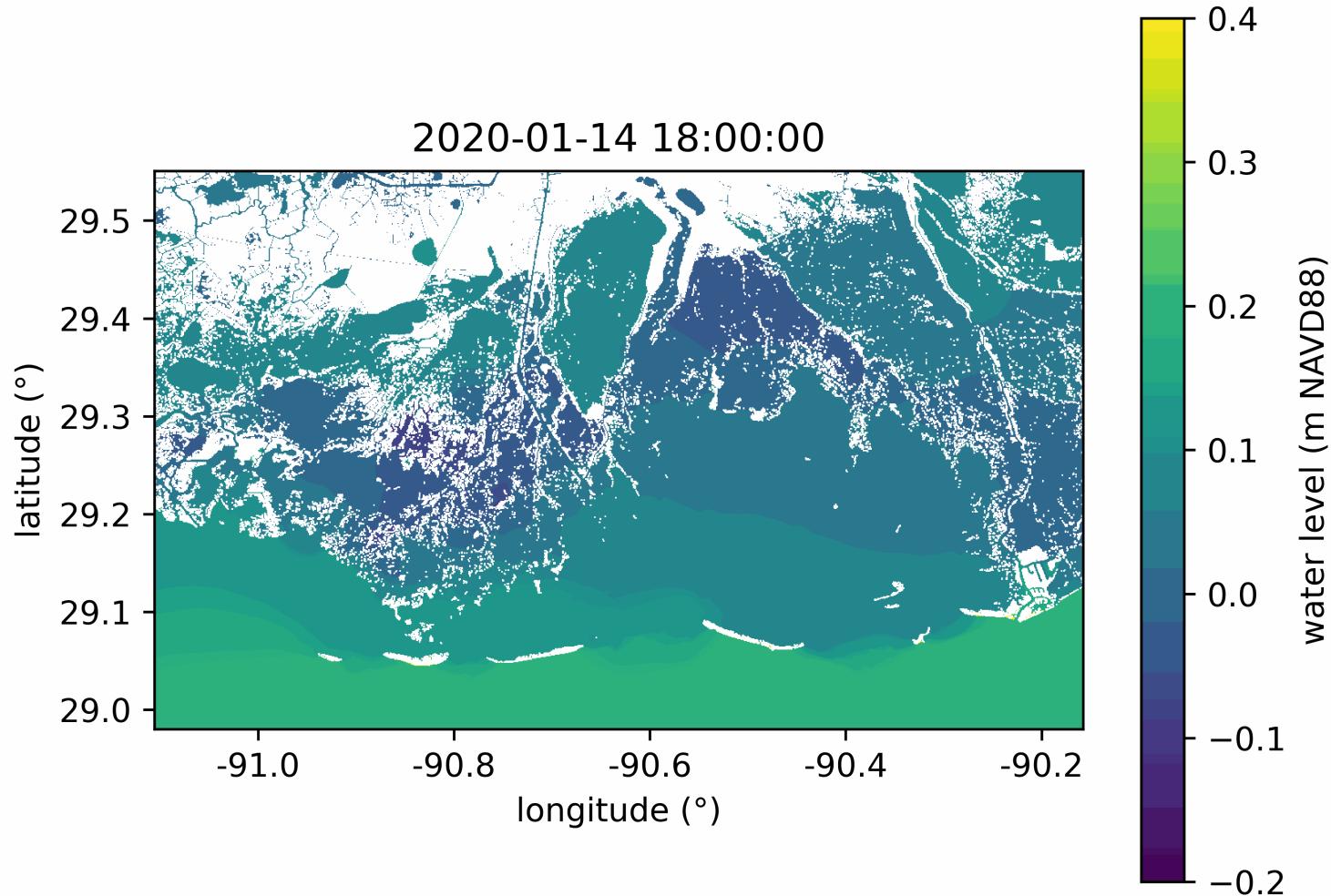
Sediments are resuspended from the bottom and transported by the water flow

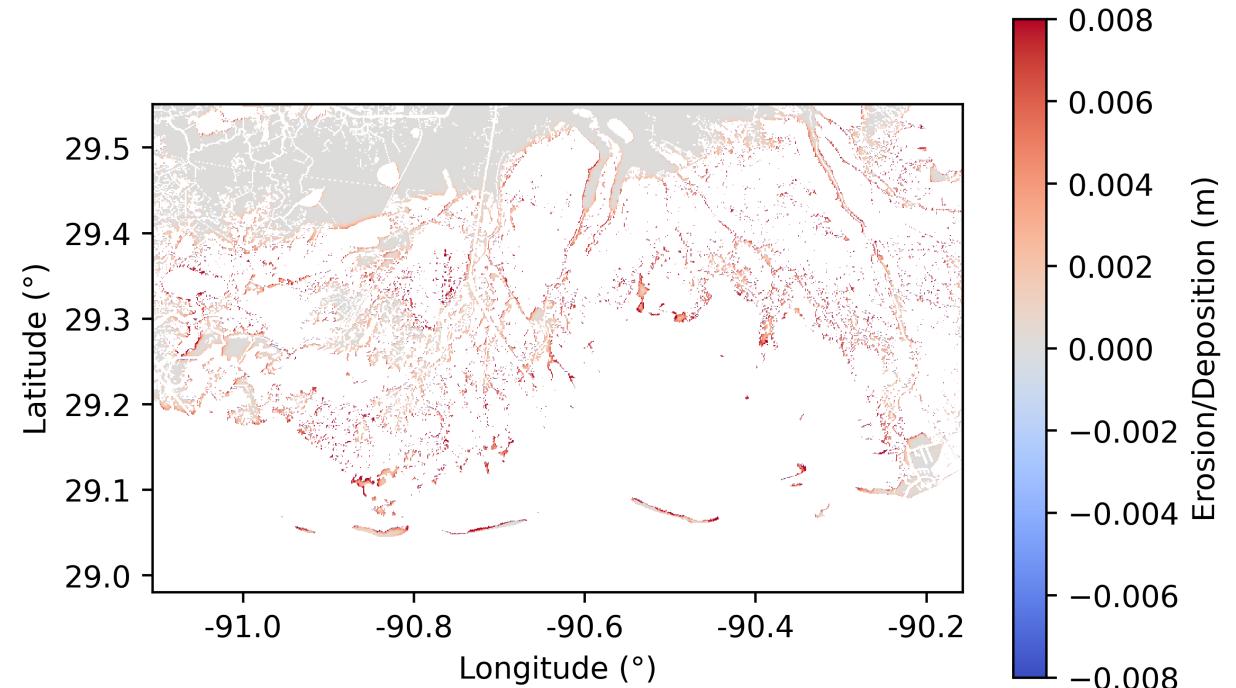
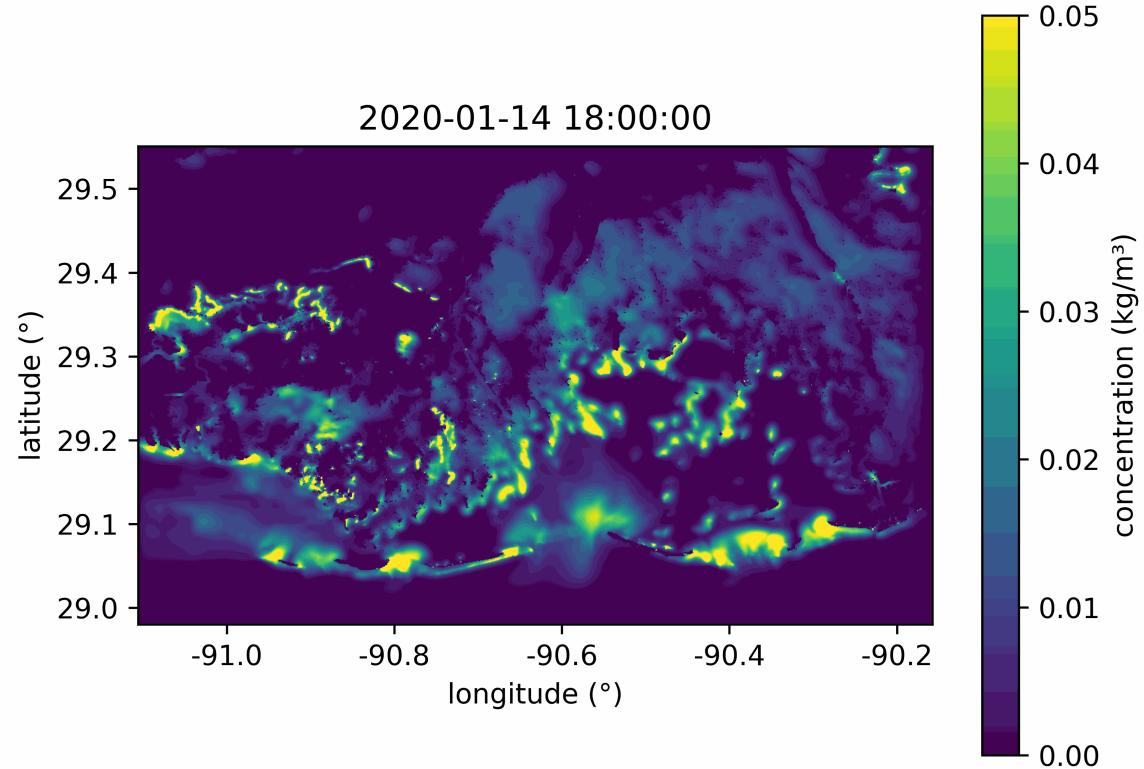


Main parameters:

- $\rho_s = 1600 \text{ kg/m}^3$
  - $w_s = 0.25 \text{ mm/s}$
  - $\tau_{cr,e} = 0.1 \text{ Pa}$  for water
  - $\tau_{cr,e} = 1 \text{ Pa}$  for marsh
- $\rho_s = 2650 \text{ kg/m}^3$
- $D_{50} = 140 \mu\text{m}$

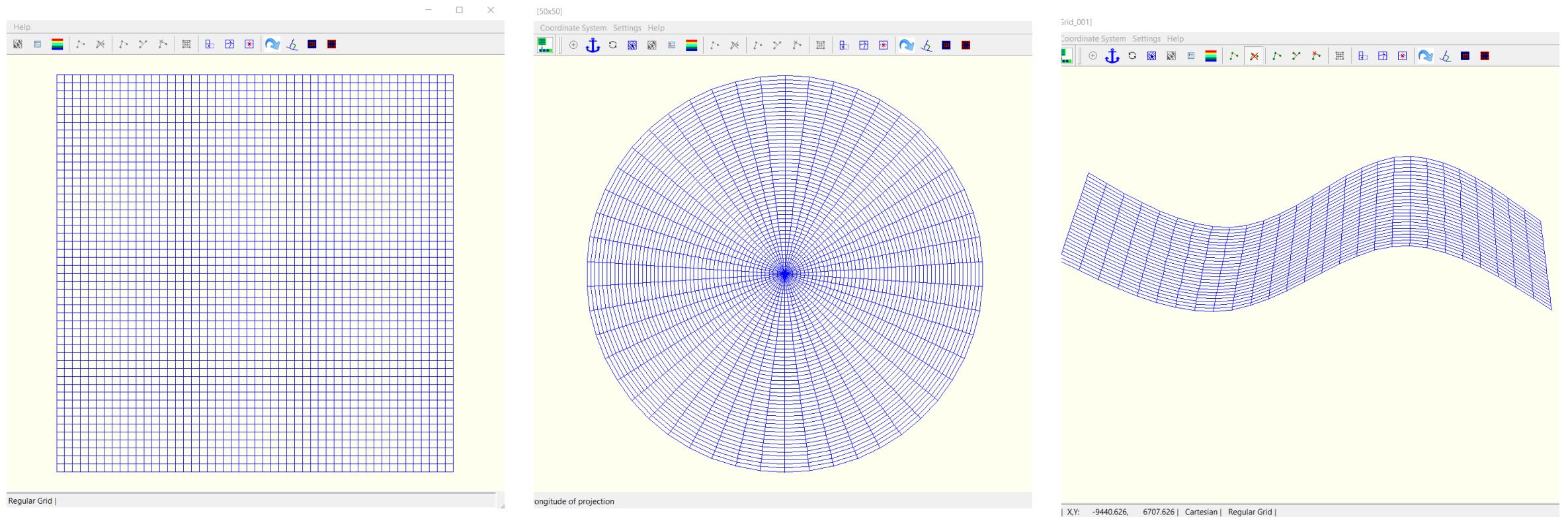
# Outputs from the model





# RGFGRID

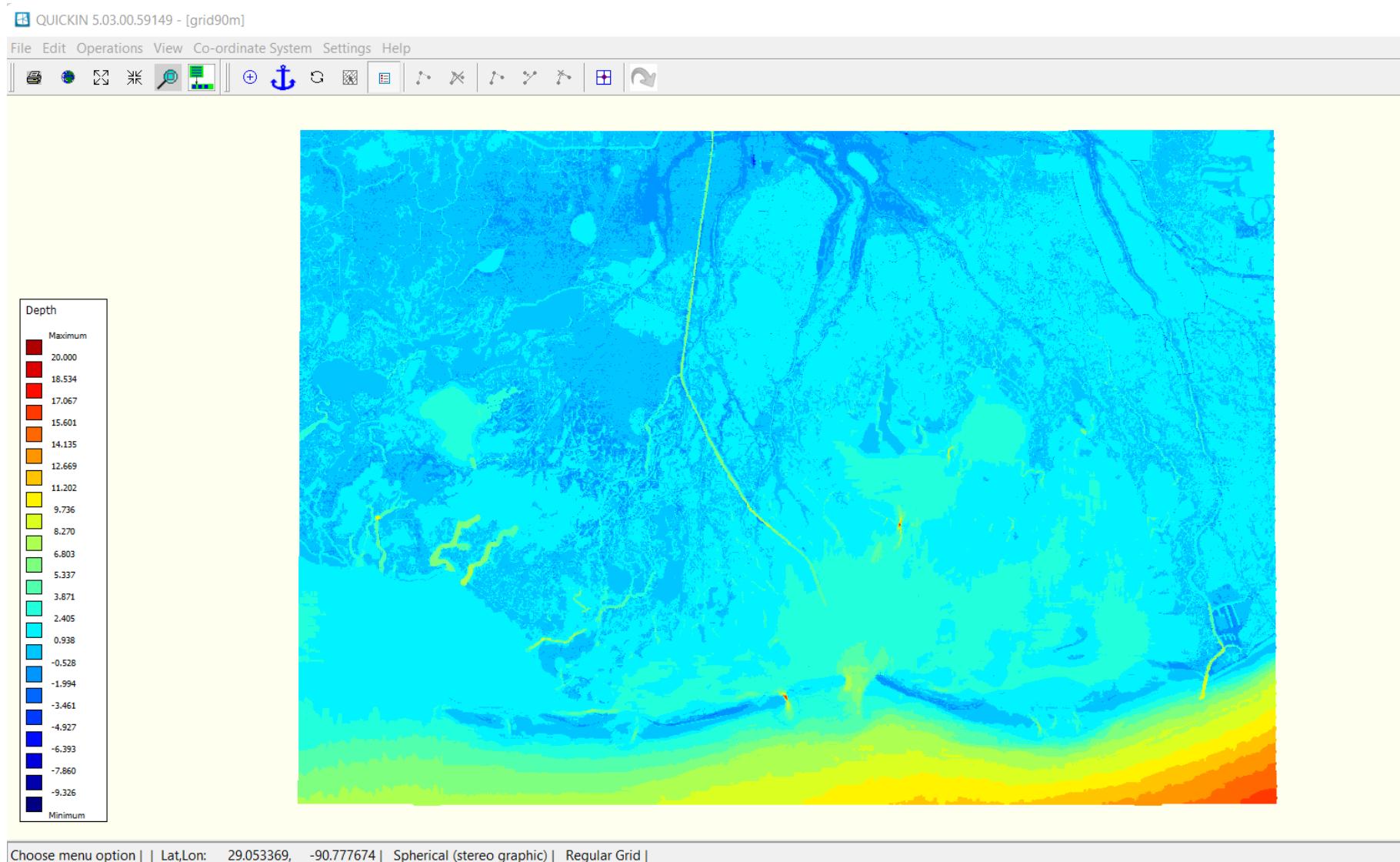
Tool for grid creation



# QUICKIN

Tool to generate:

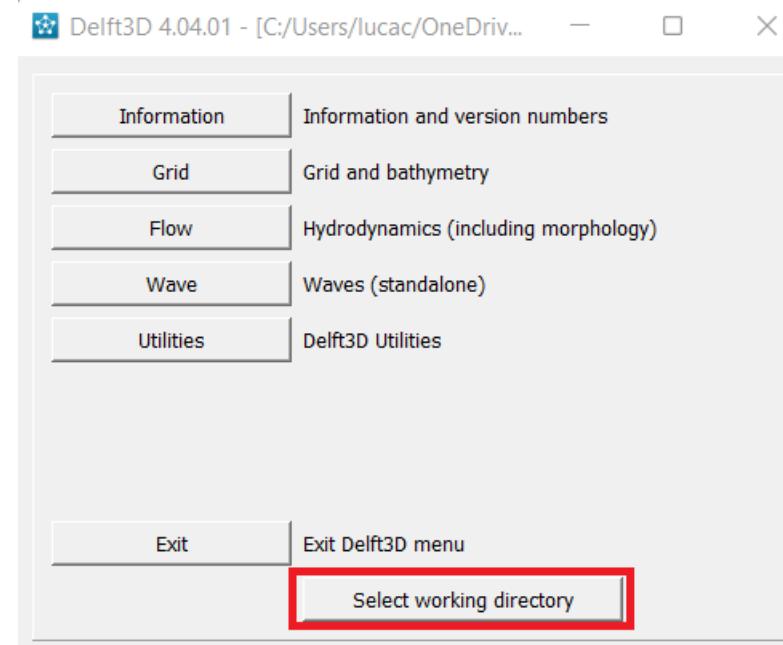
- bathymetric file
- bathymetry modifications
- bottom sediment maps
- vegetation maps
- ...



# LET'S SET UP THE MODEL!

# Useful tips

- Create **one** folder for **each** simulation and store **all** files in it
- **First step:** select the working directory!!!



# Useful tips

- Use the description box at the beginning
- Make sure you **save all files with the GUI**
- Start with a short simulation to check everything works
- Add processes one at the time
- Manuals are very informative

# Useful tips

- Make sure you set enough thickness to avoid sediment starvation

```
|Sediment erosion shortage at NM 751 Fraction: 2 Mass available : -0.2567E-11 Mass to be eroded: -0.2567E-11  
|Sediment erosion shortage at NM 752 Fraction: 2 Mass available : -0.1376E-11 Mass to be eroded: -0.1376E-11
```

- Use QUICKPLOT mainly to export results
- You can use the QUICKPLOT function (d3d\_qp) directly on Matlab