

MOHID Lagrangian Notebook

User Guide

v1.0

Mohid-Water-Modelling-System / MOHID_Jupyter-Notebooks

https://github.com/Mohid-Water-Modelling-System/MOHID_Jupyter-Notebooks/tree/master

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About

20cc5e7 · 4 minutes ago 32 Commits

guifranz Update README.md

MOHID_Lagrangian Download wind from ERA5 Reanalysis 3 weeks ago

MOHID_Preprocessing Update MOHID_Preprocessing.ipynb 30 minutes ago

MOHID_Water Get river data yesterday

README.md Update README.md 4 minutes ago

README

Jupyter Notebooks for the MOHID Water Modelling System

preprocessing jupyter-notebooks mohid

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3:35 PM
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Clone using the web URL.

Open with GitHub Desktop Download ZIP

About

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Name

 MOHID_Lagrangian

 MOHID_Preprocessing

 MOHID_Water

 README.md

Mohid-Water-Modelling-System/  

   https://github.com/Mohid-Water-Modelling-System/MOHID_Jupyter-Notebooks/tree/master        

 README 

Below is a step-by-step guide on how to set up and launch MOHID Jupyter Notebooks for interactive computing:

1. Download and Install Miniconda:

- Visit the [Miniconda download page](#).
- Download the Miniconda installer for your operating system (Windows, macOS, or Linux).
- Follow the installation instructions to install Miniconda on your system.

2. Open the Terminal or Command Prompt:

- Windows: Open the Anaconda Prompt or Command Prompt.
- macOS/Linux: Open your preferred Terminal application.

3. Create a Conda Environment:

It's best practice to use a dedicated environment for each project. To create the MOHID environment, follow these steps:

- Download the YAML file:

 6 watching

 0 forks

[Report repository](#)

Releases

No releases published

[Create a new release](#)

Packages

No packages published

[Publish your first package](#)

Languages



Language	Percentage
Fortran	71.0%
Python	14.2%
Jupyter Notebook	14.0%
Other	0.8%

Suggested workflows

Based on your tech stack

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PTB2
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 README



- Download the YAML file:

Obtain the .yaml (or .yml) file that lists all required packages.

- Create the environment:

Run the following command (make sure you're in the directory where your yml file is located):

```
conda env create --file ENV_NAME
```



Replace ENV_NAME with the name of the environment you wish to create.

4. Activate the environment:

To work within the new environment, activate it by running:

```
conda activate ENV_NAME
```



Replace ENV_NAME with the name of the environment you wish to activate.

5. Launch Jupyter Notebook:

Suggested workflows

Based on your tech stack



Pylint

Configure

Python Package using
Anaconda

Configure

Python application

Configure

Create and test a Python application.

[More workflows](#)

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Mohid-Water-Modelling-System/ | X +

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README

5. Launch Jupyter Notebook:

Once the environment is activated and all necessary packages are installed, launch Jupyter Lab (or Notebook) by issuing:

```
jupyter lab
```

This command will open the Jupyter interface in your default web browser. Tip: If you prefer the classic Jupyter Notebook interface, use jupyter notebook instead.

6. Open the Notebook

Within the Jupyter interface:

- Navigate to the directory where the notebook file (.ipynb) is located.
- Click on the the notebook file (.ipynb) to open it.

By following these steps, you'll have a fully functional MOHID Jupyter Notebook environment for interactive computing.

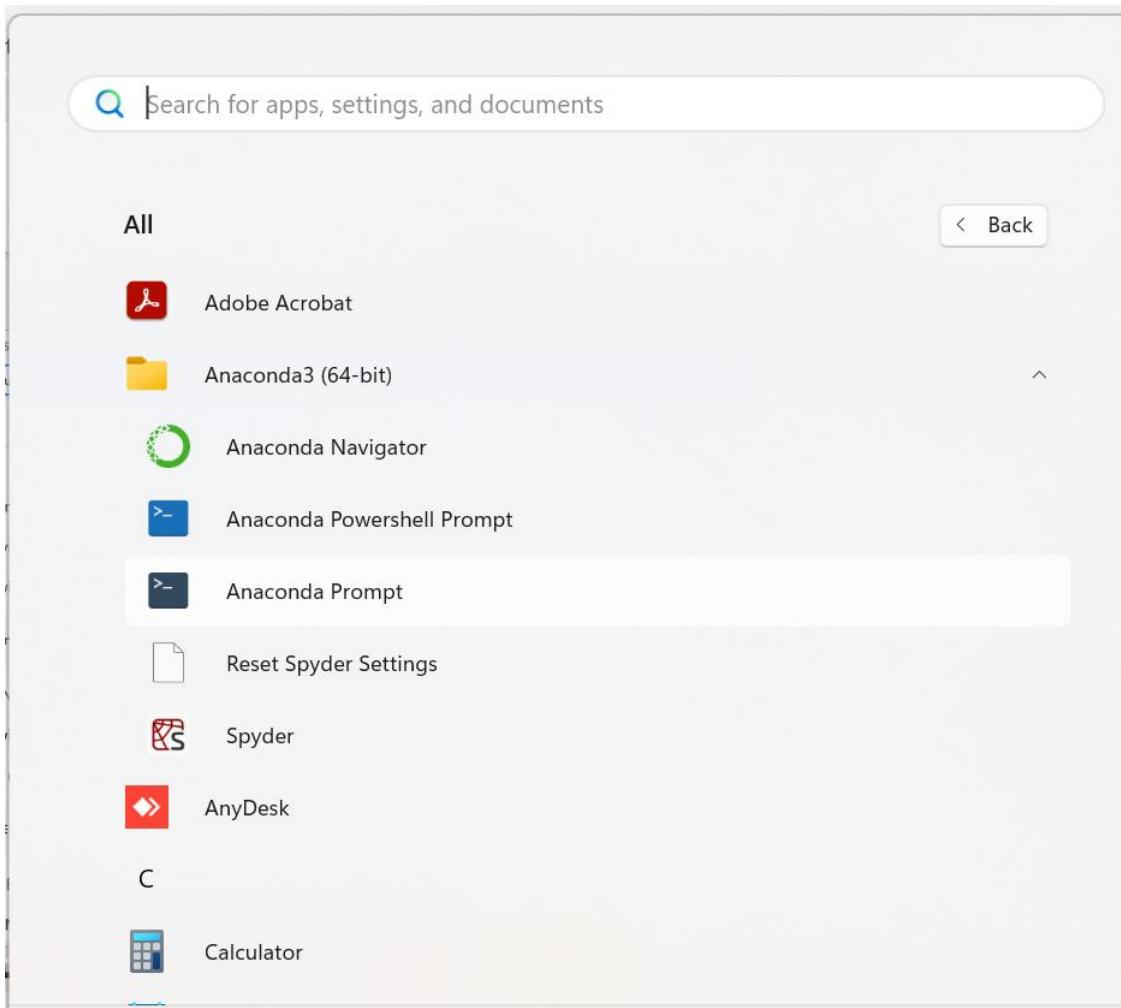


9+ 3:45 PM
ENG PTB2 5/27/2025

1. Download and Install Miniconda:

The screenshot shows a web browser window with the URL <https://www.anaconda.com/docs/getting-started/miniconda/install>. The page is titled "Installing Miniconda - Anaconda". The main content area is titled "Basic install instructions" and lists three steps: "Windows installation", "macOS/Linux installation", and "Verify your install". A sidebar on the left contains links for "Getting Started", "Tools", "Package Security Manager", "Data Science & AI Workbench", and "Reference". The "Getting Started" link is currently selected. A note in the main content area states: "On Windows, macOS, and Linux, it is best to install Miniconda for the local user, which does not require administrator permissions and is the most robust type of installation. However, if you need to, you can install Miniconda system wide, which does require administrator permissions." The browser's address bar, search bar, and various icons are visible at the top, and the taskbar with application icons is visible at the bottom.

2. Open the Terminal or Command Prompt:



3. Create a Conda Environment:

Name



run_cases



MOHID_Lagrangian.ipynb



MOHID_Lagrangian_environment.yaml



update_xml_case.py

3. Create a Conda Environment:

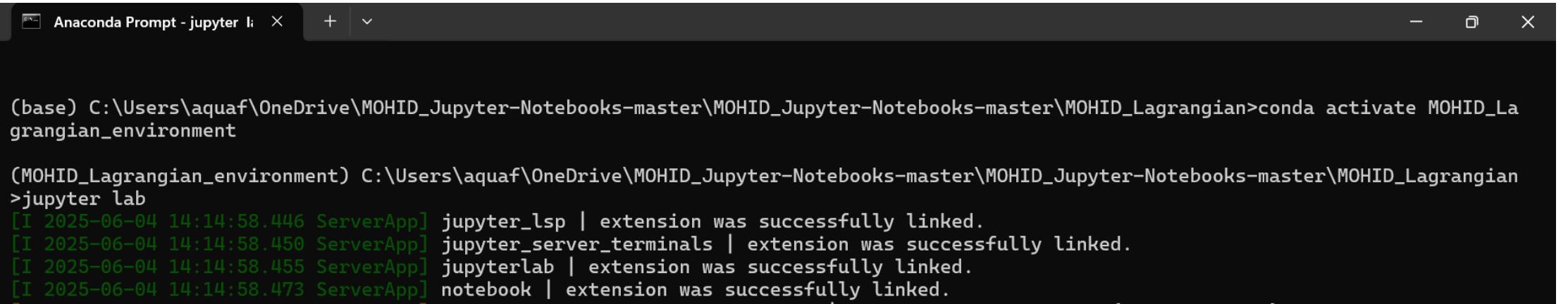
```
(base) C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian>conda env create --file MOHID_Lagrangian_environment.yaml
Channels:
- conda-forge
- defaults
Platform: win-64
Collecting package metadata (repodata.json): done
Solving environment: done

Downloading and Extracting Packages:
```

4. Activate the environment:

```
Executing transaction: /  
-  
done  
#  
# To activate this environment, use  
#  
#     $ conda activate MOHID_Lagrangian_environment  
#  
# To deactivate an active environment, use  
#  
#     $ conda deactivate  
  
(base) C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian>conda activate MOHID_La  
grangian_environment  
  
(MOHID_Lagrangian_environment) C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian  
>
```

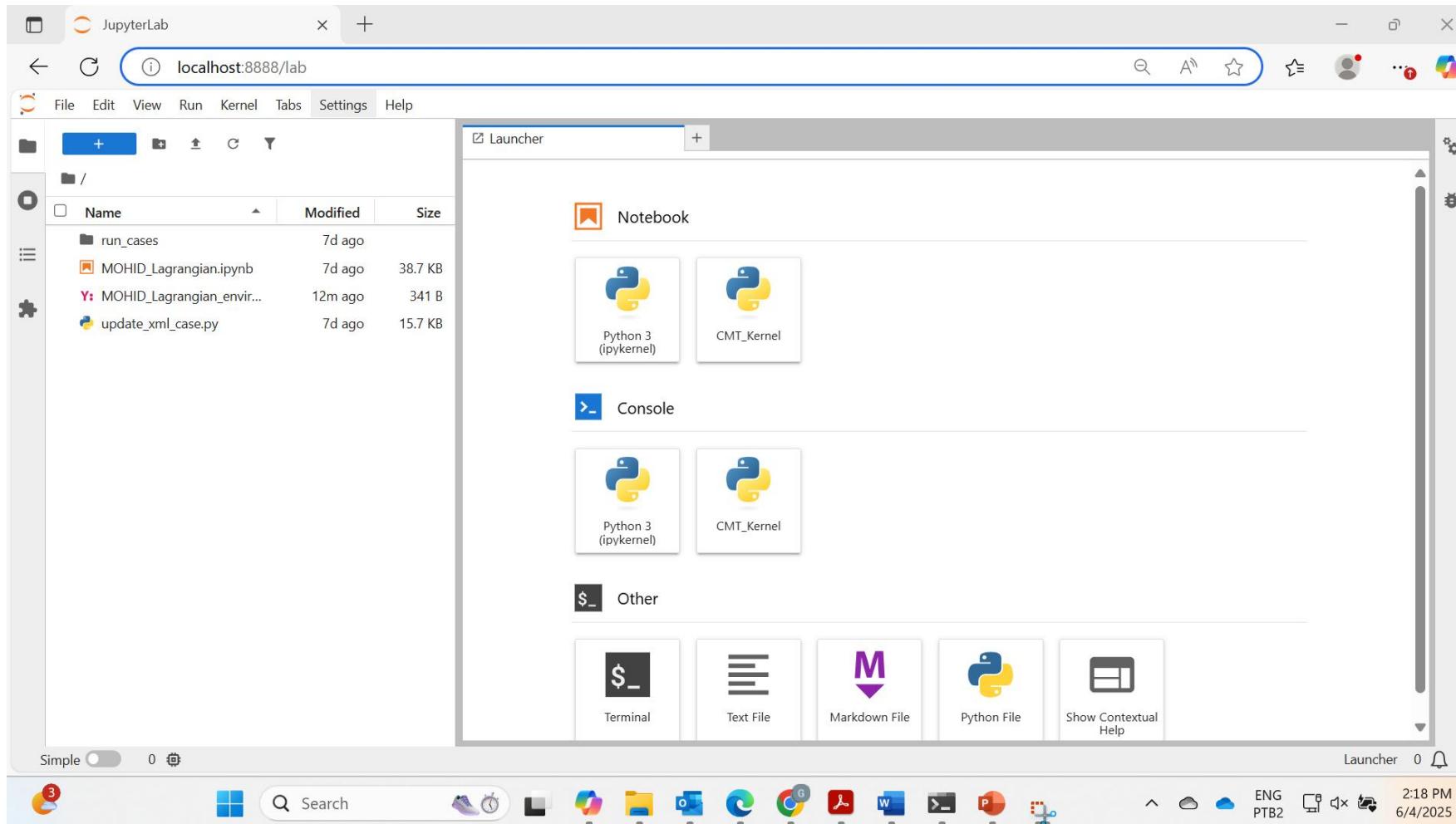
5. Launch Jupyter Notebook



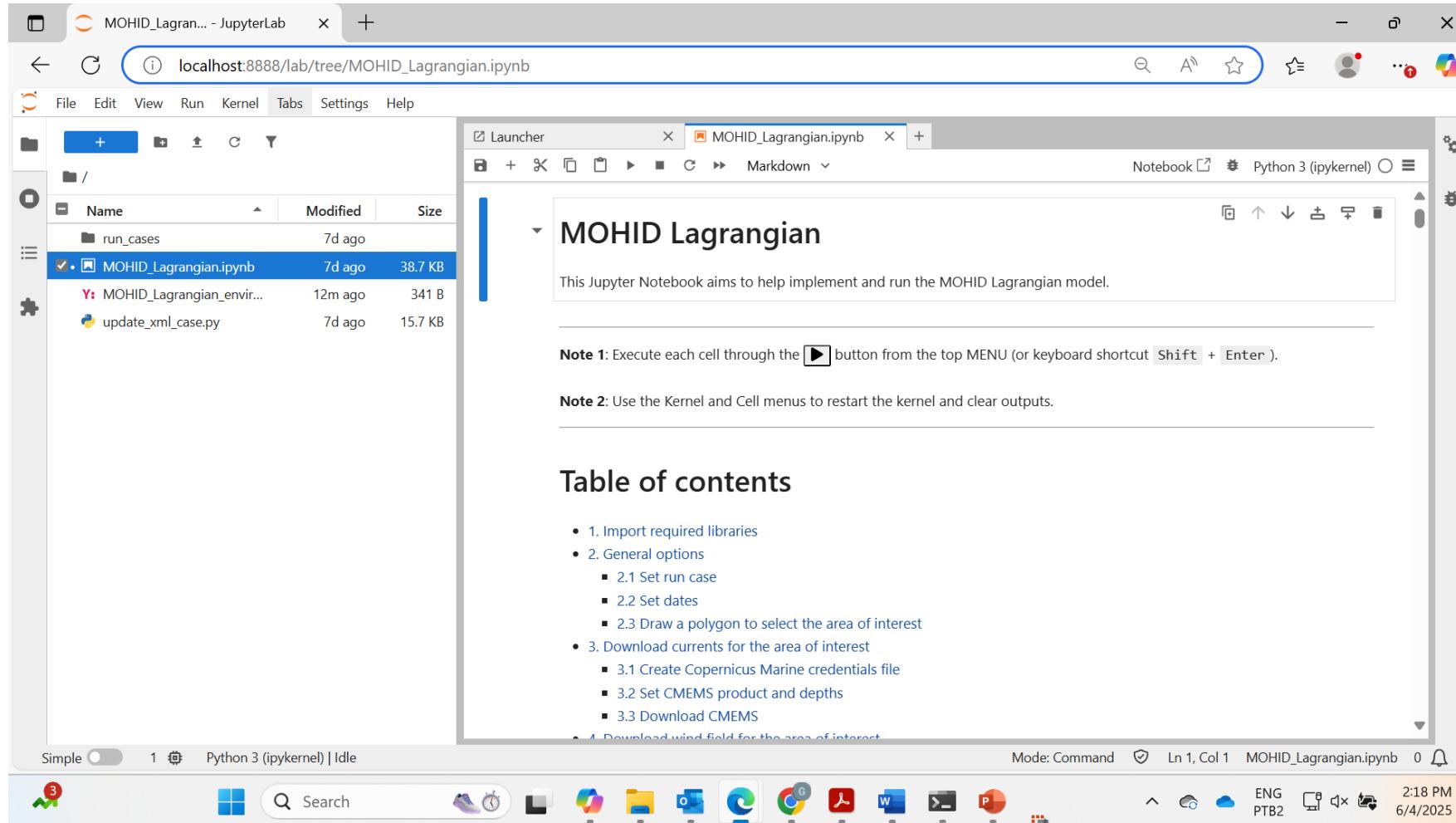
The screenshot shows a terminal window titled "Anaconda Prompt - jupyter". The command line displays the following sequence of actions:

```
(base) C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian>conda activate MOHID_Lagrangian_environment  
(MOHID_Lagrangian_environment) C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian>jupyter lab  
[I 2025-06-04 14:14:58.446 ServerApp] jupyter_lsp | extension was successfully linked.  
[I 2025-06-04 14:14:58.450 ServerApp] jupyter_server_terminals | extension was successfully linked.  
[I 2025-06-04 14:14:58.455 ServerApp] jupyterlab | extension was successfully linked.  
[I 2025-06-04 14:14:58.473 ServerApp] notebook | extension was successfully linked.
```

5. Launch Jupyter Notebook



5. Launch Jupyter Notebook



MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb

File Edit View Run Kernel Tabs Settings Help

+ /

Name	Modified	Size
run_cases	7d ago	
MOHID_Lagrangian.ipynb	7d ago	38.7 KB
Y: MOHID_Lagrangian_envir...	12m ago	341 B
update_xml_case.py	7d ago	15.7 KB

Launcher MOHID_Lagrangian.ipynb +

Notebook Python 3 (ipykernel)

- 1. Import required libraries
- 2. General options
 - 2.1 Set run case
 - 2.2 Set dates
 - 2.3 Draw a polygon to select the area of interest
- 3. Download currents for the area of interest
 - 3.1 Create Copernicus Marine credentials file
 - 3.2 Set CMEMS product and depths
 - 3.3 Download CMEMS
- 4. Download wind field for the area of interest
 - 4.1 Setup the CDS API personal access token
 - 4.2 Download ERA5 Reanalysis
- 5. Define sources
 - 5.1 Load a NetCDF dataset
 - 5.2 Load a MOHID HDF5 dataset
 - 5.3 Draw markers on the map to define the source coordinates
- 6. Setup MOHID Lagrangian xml input files
 - 6.1 Parameter definitions
 - 6.2 Simulation definitions
 - 6.3 Source definitions
- 7. Run MOHID Lagrangian
- 8. Visualize the final results

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

3 Search

2:19 PM 6/4/2025

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

1. Import required libraries

```
[1]: from update_xml_case import *
import copernicusmarine
import cdsapi
import zipfile
import os
from ipyleaflet import Map, TileLayer, DrawControl, GeoJSON, Marker
import json
import re
import datetime
import time
import numpy as np
import xarray as xr
import matplotlib.pyplot as plt
from matplotlib.colors import Normalize, to_hex
import ipywidgets as widgets
from IPython.display import display
import pandas as pd
import shutil
import subprocess
import sys
import vtk
import folium
import matplotlib as mpl
from folium.plugins import MeasureControl
import glob
import h5py
```

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

Search

2:20 PM 6/4/2025

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

2. General options

2.1 Set run case

```
[2]: name = "Plastic_Case"  
      dirpath = "run_cases"  
  
      xml_file_path = f"{name}.xml"  
  
      # Construct the path and change the working directory  
      os.chdir(os.path.join(dirpath, name))
```

2.2 Set dates

+ 1 cell hidden

2.3 Draw a polygon to select the area of interest

+ 1 cell hidden

3. Download currents for the area of interest

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

4 Search

2:21 PM 6/4/2025

Plastic_case

OneDrive MOHID_Lagrangian run_cases Plastic_case

Search Plastic_case

New Sort View ... Details

Name	Status	Date modified	Type	Size
materialTypes.xml	✓	5/27/2025 3:40 PM	Microsoft Edge HTM...	4 KB
ncNamesLibrary.xml	✓	5/27/2025 3:40 PM	Microsoft Edge HTM...	5 KB
outputFields.xml	✓	5/27/2025 3:40 PM	Microsoft Edge HTM...	1 KB
Plastic_Case.xml	✓	5/27/2025 3:40 PM	Microsoft Edge HTM...	6 KB

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MOHID-Lagrar
MyTools
Pictures
Projetos

4 items

4 Search Google Chrome Microsoft Word Microsoft Excel Microsoft Powerpoint Microsoft OneNote Cloud Sync 2:21 PM ENG PTB2 6/4/2025

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

2.2 Set dates

```
[3]: start_date = datetime.date(2025,1,1)  
end_date = datetime.date(2025,1,5)
```

2.3 Draw a polygon to select the area of interest

+ 1 cell hidden

3. Download currents for the area of interest

Skip this step if you have another hydrodynamic dataset.

+ 6 cells hidden

4. Download wind field for the area of interest

4.1 Setup the CDS API personal access token

It has to be done only once!

If you do not have an account yet, please register (<https://cds.climate.copernicus.eu/>). If you are not logged in, please login.

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

4 Search

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

+ /

Name	Modified	Size
run_cases	7d ago	
MOHID_Lagrangian.ipynb	10s ago	38.8 KB
Y: MOHID_Lagrangian_envir...	12m ago	341 B
update_xml_case.py	7d ago	15.7 KB

Launcher MOHID_Lagrangian.ipynb +

Notebook Python 3 (ipykernel)

2.3 Draw a polygon to select the area of interest

```
[4]: # Create an ipyleaflet map centered at (0,0)
m = Map(center=[0, 0], zoom=2)

# Define WMTS Layer
wmts_layer = TileLayer(
    url="https://wmts.marine.copernicus.eu/terowmts/?"
        "service=WMTS&request=GetTile&version=1.0.0&"
        "layer=GLOBAL_ANALYSISFORECAST_PHY_001_024/"
        "cmems_mod_glo_phy-cur_anfc_0.083deg_P1M-m_202406/sea_water_velocity&"
        "tilematrixset=EPSG:3857&tilematrix={z}&tilerow={y}&tilecol={x}&"
        "format=image/png&transparent=True",
    name="Sea Water Velocity"
)

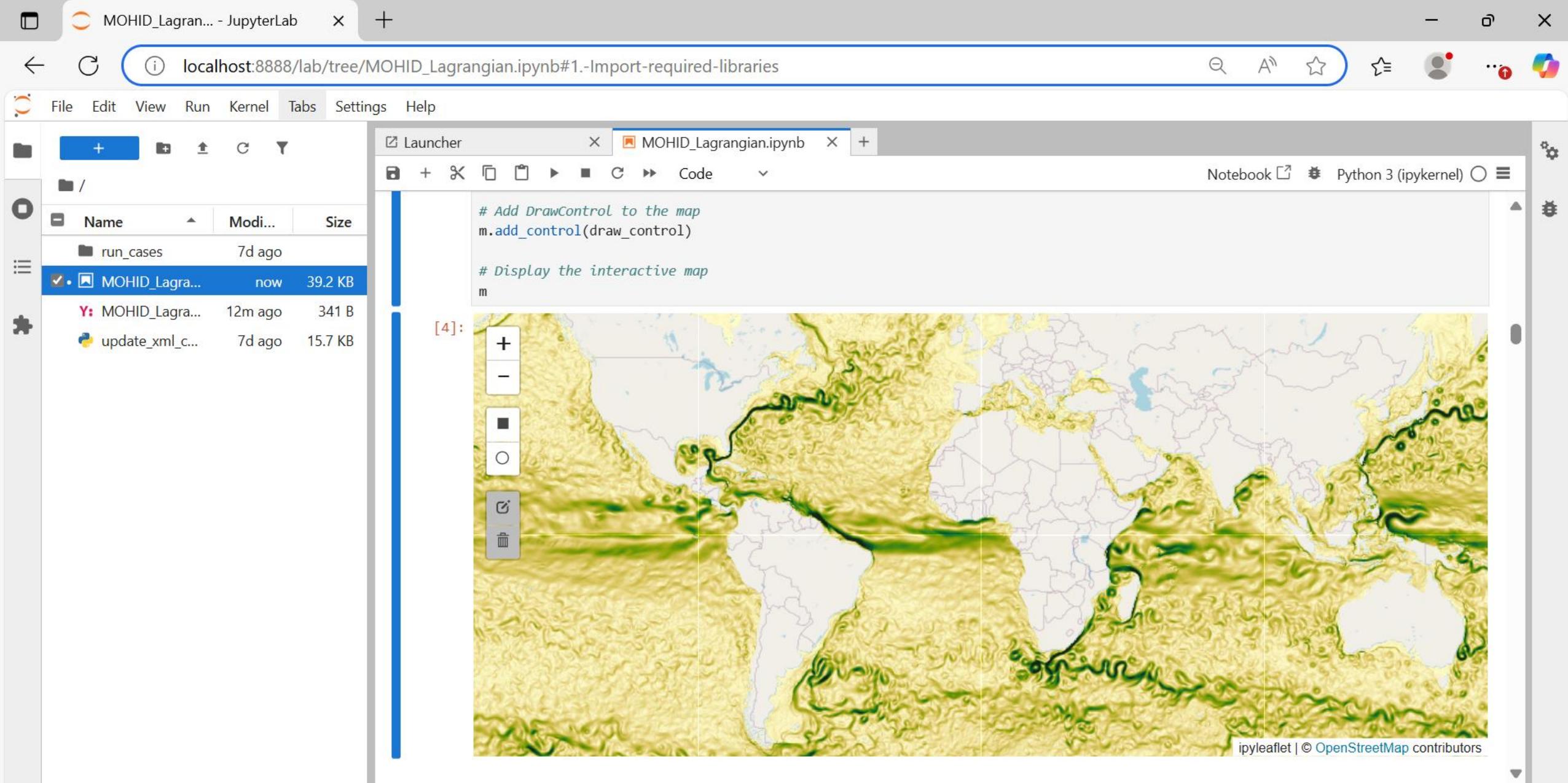
# Add WMTS Layer to the map
m.add_layer(wmts_layer)

# Create a DrawControl for user interaction
draw_control = DrawControl(
    polygon={}, # Empty dict disables polygon
    rectangle={"shapeOptions": {"color": "blue"}}, # Enable rectangles
    circle={}, # Empty dict disables circles
    polyline={}, # Empty dict disables polylines
    marker={} # Empty dict disables markers
)
```

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

2:26 PM 6/4/2025



Simple

1

Python 3 (ipykernel) | Idle

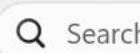
Mode: Command

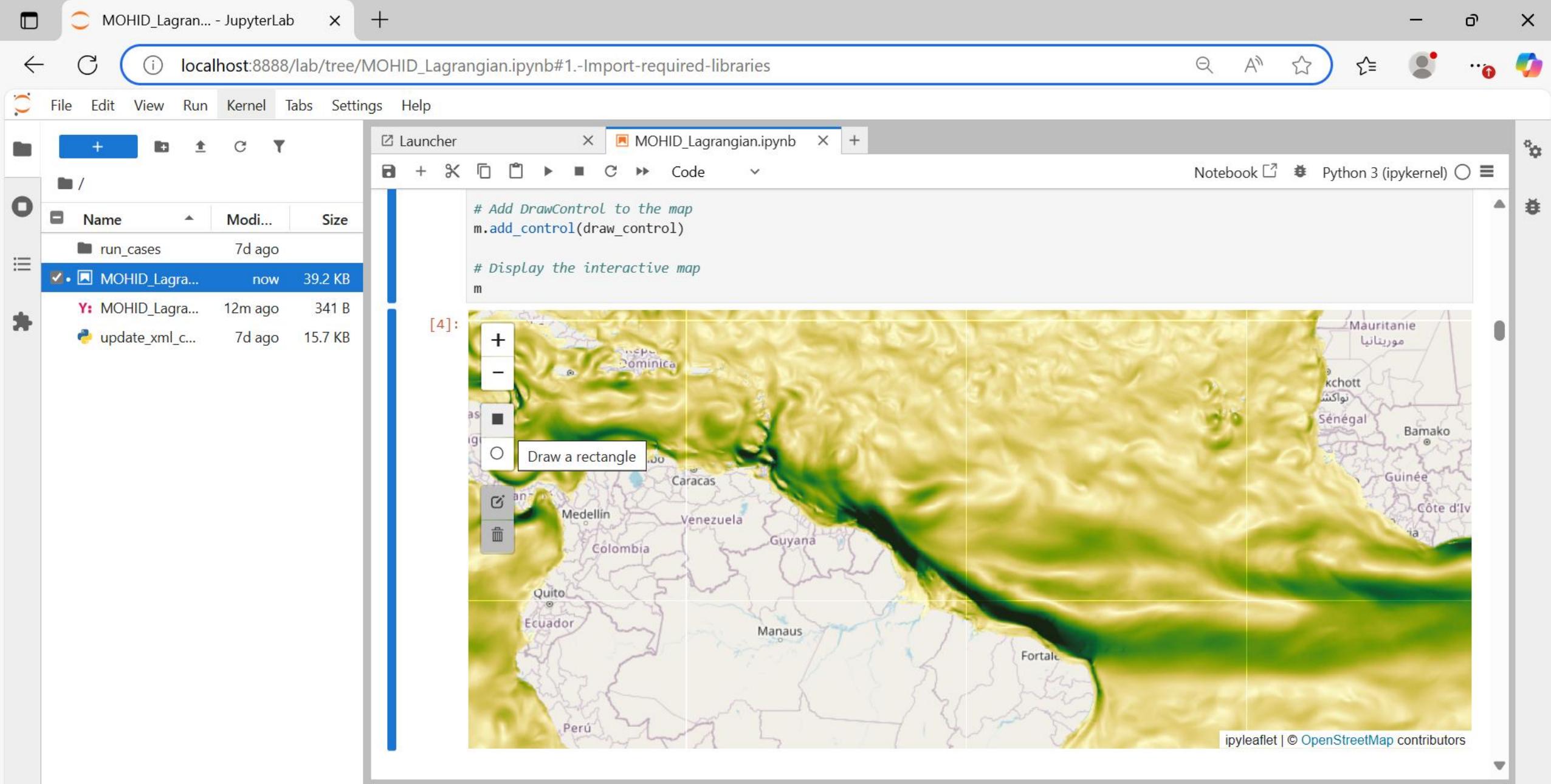


Ln 28, Col 43

MOHID_Lagrangian.ipynb

0

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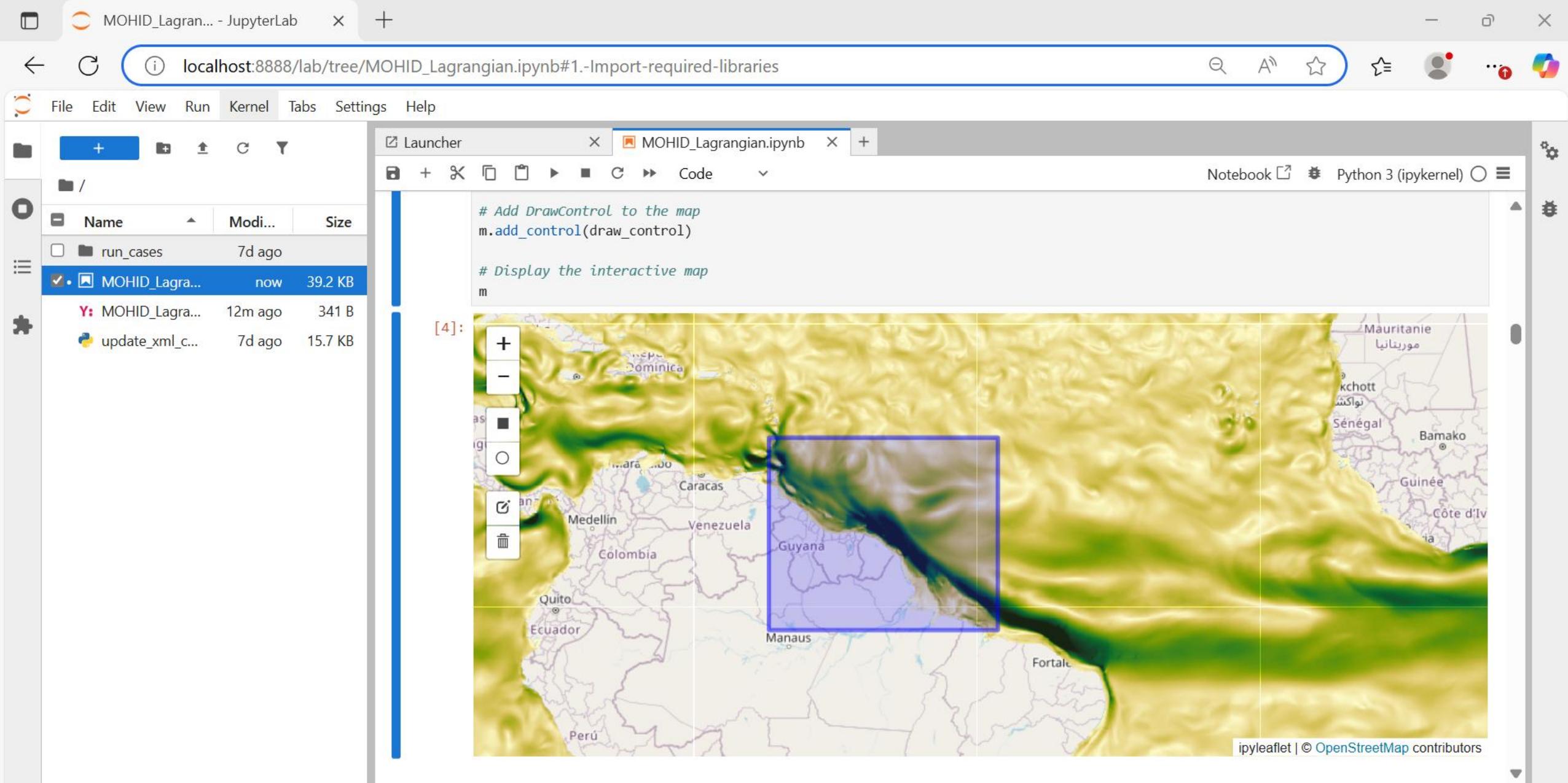


localhost:8888/lab/tree/MOHID_Lagrangian.ipynb# Idle

Mode: Command Ln 28, Col 43 MOHID_Lagrangian.ipynb 0



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Simple 1 Python 3 (ipykernel) | Idle

Mode: Command Ln 28, Col 43 MOHID_Lagrangian.ipynb 0



Search



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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

3. Download currents for the area of interest

Skip this step if you have another hydrodynamic dataset.

3.1 Create Copernicus Marine credentials file

#It has to be done only once!

```
[*]: #The login command will check your Copernicus Marine credentials and create the configuration file.  
copernicusmarine.login()  
  
INFO - 2025-06-04T17:30:50Z - Downloading Copernicus Marine data requires a Copernicus Marine username and password, sign up for free at: https://data.marine.copernicus.eu/register  
Copernicus Marine username:  

```

3.2 Set CMEMS product and depths

+ 1 cell hidden

3.3 Download CMEMS

+ 1 cell hidden

Simple 1 Python 3 (ipykernel) | Busy Mode: Command Ln 2, Col 25 MOHID_Lagrangian.ipynb 0

6 Search

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

3.2 Set CMEMS product and depths

```
[6]: output_dir_cmems = os.path.join(os.getcwd(),"nc_fields","currents")  
  
#hourly instantaneous  
#product_id = "cmems_mod_glo_phy_anfc_merged-uv_PT1H-i"  
  
#6-hourly instantaneous  
#product_id = "cmems_mod_glo_phy-cur_anfc_0.083deg_PT6H-i"  
  
#daily mean  
product_id = "cmems_mod_glo_phy-cur_anfc_0.083deg_P1D-m"  
  
start_depth = 0.49402499198913574  
end_depth = 0.49402499198913574  
#end_depth = 5727.9
```

+ 1 cell hidden

3.3 Download CMEMS

4. Download wind field for the area of interest

4.1 Setup the CDS API personal access token

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 5, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

3.3 Download CMEMS

```
[ ]: #####
def download_file():

    variable = ['uo', 'vo']

    copernicusmarine.subset(
        dataset_id = product_id,
        minimum_longitude = min_lon, maximum_longitude = max_lon,
        minimum_latitude = min_lat, maximum_latitude = max_lat,
        minimum_depth = start_depth, maximum_depth = end_depth,
        start_datetime = str(start_date.strftime('%Y-%m-%d'))+' 00:00:00',
        end_datetime = str(end_date.strftime('%Y-%m-%d'))+' 00:00:00',
        variables = variable,
        output_directory = output_dir_cmems,
        output_filename = output_file_cmems,
        netcdf3_compatible = True)

#####

output_file_cmems = "cmems_"+str(start_date.strftime("%Y%m%d")) + " " + str(end_date.strftime("%Y%m%d")) + ".nc"

if not os.path.exists(output_dir_cmems):
    os.makedirs(output_dir_cmems)

nc_files = glob.iglob(os.path.join(output_dir_cmems,"*.nc"))
```

Simple 1 Python 3 (ipykernel) | Idle Saving completed Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Start_datetime = str(start_date.strftime('%Y-%m-%d'))+' 00:00:00',
end_datetime = str(end_date.strftime('%Y-%m-%d'))+' 00:00:00',
variables = variable,
output_directory = output_dir_cmems,
output_filename = output_file_cmems,
netcdf3_compatible = True)

#####

output_file_cmems = "cmems_"+str(start_date.strftime("%Y%m%d")) + "_" + str(end_date.strftime("%Y%m%d")) + ".nc")

if not os.path.exists(output_dir_cmems):
 os.makedirs(output_dir_cmems)

nc_files = glob.iglob(os.path.join(output_dir_cmems,"*.nc"))

for filename in nc_files:
 os.remove(filename)

download_file()

INFO - 2025-06-04T17:32:57Z - Selected dataset version: "202406"
INFO - 2025-06-04T17:32:57Z - Selected dataset part: "default"
INFO - 2025-06-04T17:33:08Z - Starting download. Please wait...
100% 50/50 [00:23<00:00, 1.72it/s]

INFO - 2025-06-04T17:33:33Z - Successfully downloaded to C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian\run_cases\Plastic_Case\nc_fields\currents\cmems_20250101_20250105.nc

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

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currents

X +

← → ↑ ↻ OneDrive ⌂ MOHID_Lagrangian > ... run_cases > Plastic_case > nc_fields > currents Search currents

New ⌂ ⌂ ⌂ ⌂ ⌂ ⌂ Sort ⌂ View ⌂ ... Details

Name	Status	Date modified	Type	Size
cmems_20250101_20250105.nc	✓	6/4/2025 2:33 PM	NC File	1,554 KB

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Conferências
Curriculo
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Doutoramento
MOHID_Jupyter
MOHID-Lagrangian
MyTools
Pictures
Projetos

1 item

6

Search

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

4. Download wind field for the area of interest

4.1 Setup the CDS API personal access token

It has to be done only once!

If you do not have an account yet, please register (<https://cds.climate.copernicus.eu/>). If you are not logged in, please login. Once logged in, copy the URL and key.

Create a file named .cdsapirc in your home directory.

\$HOME/.cdsapirc (in your Unix/Linux environment)

%USERPROFILE%.cdsapirc file (in your windows environment,%USERPROFILE% is usually located at C:\Users\Username folder).

Paste the URL and key into .cdsapirc file.

The CDS API expects to find the .cdsapirc file in your home directory.

4.2 Download ERA5 Reanalysis

+ 1 cell hidden

5. Define sources

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0 ENG PTB2 2:34 PM 6/4/2025

Search

Clouds ENG PTB2



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25 Sep 2024

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https://cds.climate.copernicus.eu/datasets



2:27 PM
PTB2
5/30/2025

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← → ↑ ↓		This PC > OS (C:) > Users > aquaf >		Search aquaf	
New		✖	✖	✖	Details
Desktop	📁	.bash_history	2/28/2025 3:14 PM	BASH_HISTORY File	1 KB
Downloads	⬇️	.python_history	4/11/2025 3:46 PM	PYTHON_HISTORY File	1 KB
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MOHID_Preproc	📁	.continuum	9/16/2024 4:52 PM	File folder	
UserGuides	📁	.copernicusmarine	4/17/2025 2:46 PM	File folder	
Tide	📁	.git	2/28/2025 3:09 PM	File folder	
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2:30 PM	ENG	PTB2	🔊	🖨️	📅
5/30/2025					

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

4.2 Download ERA5 Reanalysis

```
[ ]: era5_dir = os.path.join(os.getcwd(),"nc_fields","winds")
target = os.path.join(os.getcwd(),"nc_fields","winds", "ERA5.zip")

if not os.path.exists(era5_dir):
    os.makedirs(era5_dir)

nc_files = glob.iglob(os.path.join(era5_dir,"*.nc"))

for filename in nc_files:
    os.remove(filename)

# Extract days across months correctly
days = []
current_date = start_date
while current_date <= end_date:
    days.append(str(current_date.day))
    current_date += datetime.timedelta(days=1)

dataset = "reanalysis-era5-single-levels"
request = {
    "product_type": ["reanalysis"],
    "variable": [
        '10m_u_component_of_wind',
        '10m_v_component_of_wind',
    ],
    "year": sorted([str(start_date.year), str(end_date.year)]).
```

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

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Launcher MOHID_Lagrangian.ipynb

Name Mod... Size

run_cases 7d ago

MOHID_Lagra... now 42.2 KB

Y: MOHID_Lagra... 12m ago 341 B

update_xml_c... 7d ago 15.7 KB

```
print("Error: The file is not a valid ZIP archive.")  
except FileNotFoundError:  
    print("Error: The ZIP file was not found.")  
except Exception as e:  
    print(f"An unexpected error occurred: {e}")  
  
original_file_name = os.path.join(era5_dir, "data_stream-oper_stepType-instant.nc")  
output_file_era5 = os.path.join(era5_dir, "era5_" + str(start_date.strftime("%Y%m%d")) + "_" + str(end_date.strftime("%Y%m%d")) + ".nc")  
os.rename(original_file_name, output_file_era5)  
  
## Open the file in update mode ('r+' allows in-place modifications)  
#with netCDF4.Dataset(output_file_era5, mode='r+') as ds:  
#    ds.renameVariable('valid_time', 'time')  
#    ds.renameDimension('valid_time', 'time')  
  
print(f"Files extracted to {era5_dir}")
```

2025-06-04 17:36:17,470 INFO [2024-09-26T00:00:00] Watch our [Forum](<https://forum.ecmwf.int/>) for Announcements, news and other discussed topics.
2025-06-04 17:36:19,115 INFO Request ID is 6dfa9dfd-bbde-4597-bf7f-923d176467f2
2025-06-04 17:36:19,360 INFO status has been updated to accepted
2025-06-04 17:36:24,986 INFO status has been updated to running
2025-06-04 17:36:41,992 INFO status has been updated to successful
Download completed successfully!
Extraction completed successfully.
Zip file has been removed.
Files extracted to C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian\run_cases\Plastic_Case\nc_fields\winds

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

2:37 PM 6/4/2025

winds

X + - ×

← → ↑ C OneDrive ... MOHID_Lagrangian > run_cases > Plastic_case > nc_fields > winds Search winds

New ✎ ⌁ ↪ A ↩ ⌁ Details

Name Status Date modified Type Size

era5_20250101_20250105.nc	✓	6/4/2025 2:36 PM	NC File	2,334 KB
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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

5. Define sources

5.1 Load a NetCDF dataset

```
[ ]: output_dir_cmems = os.path.join(os.getcwd(),"nc_fields","currents")
#output_file_name = "cmems_20250101_20250105.nc" #Load your own NetCDF instead of CMEMS, otherwise comment out this line
CurFName = os.path.join(output_dir_cmems, output_file_cmems)
dataset = xr.open_dataset(CurFName)

CurFName = os.path.join(output_dir_cmems, output_file_cmems)
# Open the datafile
CurDS = xr.open_dataset(CurFName, engine="netcdf4")

U = dataset['uo'].isel(time=0).isel(depth=0).squeeze() # Result is 2D: (lat, lon)
V = dataset['vo'].isel(time=0).isel(depth=0).squeeze() # Result is 2D: (lat, lon)

# Show info of dataset
CurDS
```

5.2 Load a MOHID HDF5 dataset

+ 1 cell hidden

5.3 Draw markers on the map to define the source coordinates

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Dimensions: (depth: 1, latitude: 182, longitude: 218, time: 5)

Coordinates:

- depth (depth) float32 0.494
- latitude (latitude) float32 -1.833 -1.75 -1.667 ... 13.17 1...
- longitude (longitude) float32 -61.42 -61.33 ... -43.42 -43.33
- time (time) datetime64[ns] 2025-01-01 ... 2025-01-05

Data variables:

- uo (time, depth, latitude, longitude) float32 ...
- vo (time, depth, latitude, longitude) float32 ...

Indexes: (4)

Attributes:

- source : MOI GLO12
- Conventions : CF-1.8
- institution : Mercator Ocean International
- contact : <https://marine.copernicus.eu/contact>
- references : <http://marine.copernicus.eu>
- title : daily mean fields from Global Ocean Physics Analysis and Forecast updated Daily
- credit : E.U. Copernicus Marine Service Information (CMEMS)
- producer : CMEMS - Global Monitoring and Forecasting Centre
- copernicusmarin... 2.1.2

Simple Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

5.3 Draw markers on the map to define the source coordinates

```
[ ]: # -----
# Start timing
# -----
start_time = time.time()

zi = np.sqrt(u**2 + v**2) # Velocity magnitude, 2D array

# Create an Output widget to capture the callback prints
output = widgets.Output()
display(output)

# -----
# Optional Downsampling for large datasets
# -----
downsample_factor = 4 # Adjust as needed.
zi = zi[::downsample_factor, ::downsample_factor]
lon = dataset['longitude'].values[::downsample_factor]
lat = dataset['latitude'].values[::downsample_factor]

#print("zi:", zi.shape)
#print("Latitude size:", lat.shape)
#print("Longitude size:", lon.shape)

# -----
# Get coordinate grids
# -----
LonGrid, LatGrid = nn.meshgrid(lon, lat)
```

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

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Name Mod... Size

- run_cases 7d ago
- MOHID_Lagra...** now 74 KB
- Y: MOHID_Lagra... 12m ago 341 B
- update_xml_c... 7d ago 15.7 KB

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

Display the map

m

[10]:

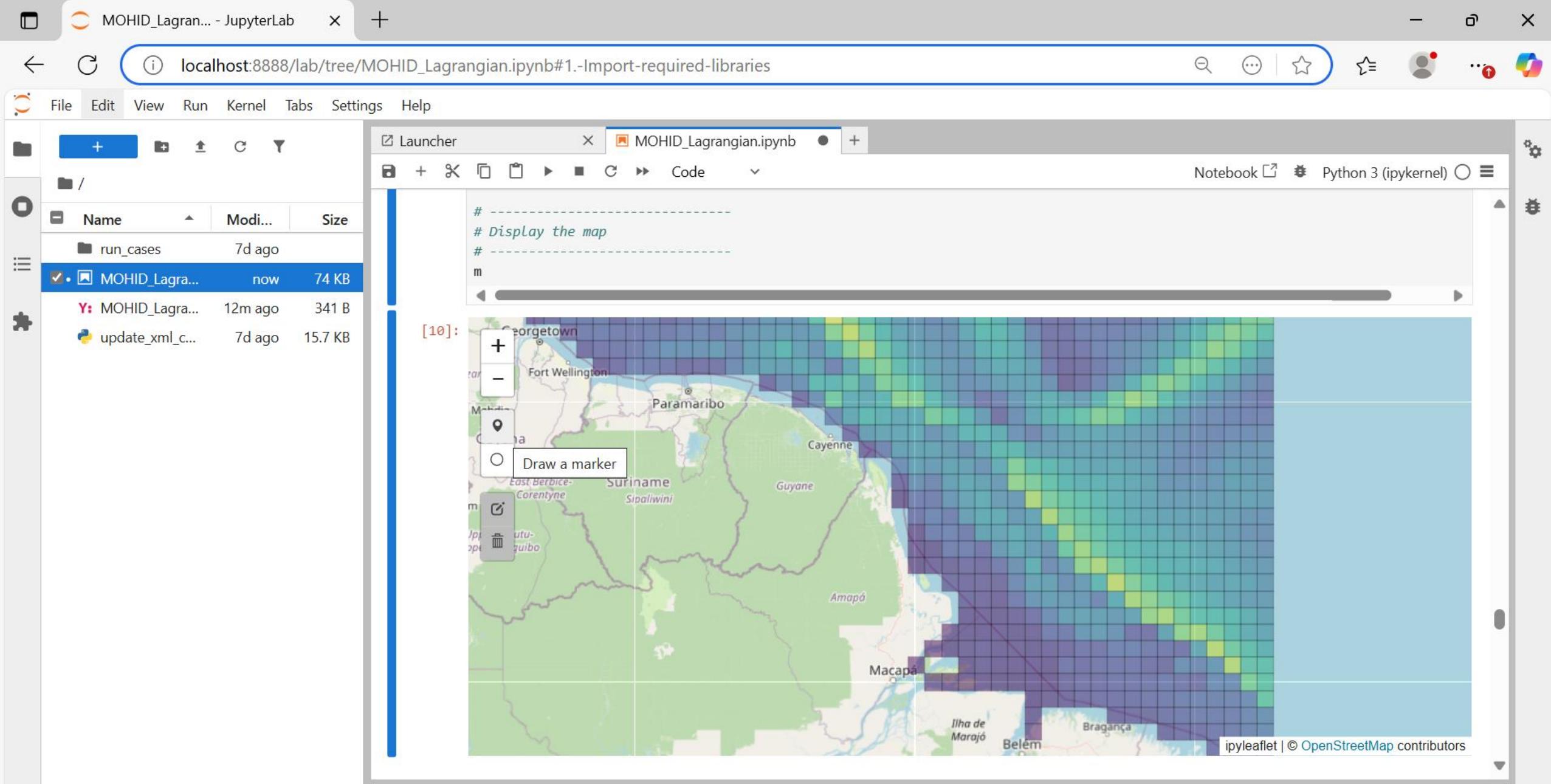
ipyleaflet | © OpenStreetMap contributors

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

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ENG PTB2



Search



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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

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Name Mod... Size

run_cases 7d ago

MOHID_Lagrangian.ipynb now 74.7 KB

Y: MOHID_Lagrangian.ipynb 12m ago 341 B

update_xml.c... 7d ago 15.7 KB

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

Display the map

m

ask_marker_name invoked for marker 0

Source name: S1|

Confirm

[10]: Confirm

Georgetown Fort Wellington Paramaribo Cayenne Amapá Macapá

Suriname Sipaliwini Guyane

East Berbice-Corentyne

Map

+

-

Confirm

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 11, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

Cloud ENG PTB2 2:42 PM 6/4/2025

The figure shows a map of the Amazon basin and surrounding regions. The map is overlaid with a grid of colored cells, likely representing a simulation or model output. The colors range from dark purple (low values) to bright yellow (high values). A blue location marker is placed on the map, specifically near the mouth of the Amazon River. To the left of the map, there is a file browser window showing local files and a code editor window containing a snippet of Python code. The code includes comments to display the map and a call to 'ask_marker_name'. A confirmation dialog box is overlaid on the map, asking for a source name, with 'S1' typed into the input field.

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

Display the map

m

ask_marker_name invoked for marker 0
ask_marker_name invoked for marker 1

Source name: S2

Confirm

[10]:

Georgetown Fort Wellington Paramaribo Cayenne Amapá Macapá Suriname Sipaliwini East Berbice-Corentyne

Confirm

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 11, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

2:43 PM 6/4/2025

The screenshot shows a JupyterLab environment with a sidebar containing a file tree and a central workspace. The workspace displays a map of the Amazon region with a grid overlay, likely representing simulation results. A confirmation dialog box is overlaid on the map, prompting for a source name. The Python code in the notebook cell includes comments to display the map and handle marker names.

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

6. Setup MOHID Lagrangian xml input files

6.1 Parameter definitions

```
[11]: # Get time limits (min and max time values in the dataset's 'time' variable)
start, end = min(dataset['time'].values), max(dataset['time'].values)

# Convert the numpy.datetime64 to a Python datetime object using pandas
Start = pd.to_datetime(start) #Date of initial instant based on nc file
End = pd.to_datetime(end) #Date of final instant based on nc file
#Start = datetime.datetime(2024, 1, 1, 0, 0, 0)
#End = datetime.datetime(2024, 1, 2, 0, 0, 0)

Integrator = 2 #Integration Algorithm 1:Euler, 2:Multi-Step Euler, 3:RK4 (default=1)
Threads = "auto" #Computation threads for shared memory computation (default=auto)
OutputWriteTime = 86400 #Time out data (seconds)
BufferSize = 86400 #control the amount of hydrodynamic data to store in RAM memory (seconds)

# Run the update function
update_parameter_definitions(xml_file_path,Start,End,Integrator,Threads,OutputWriteTime,BufferSize)

Updated <parameters> block in 'Plastic_Case.xml' successfully.
```

6.2 Simulation definitions

MOHID_Lagrangian

OneDrive MOHID_Jupyter-Notebooks-master MOHID_Lagrangian

Search MOHID_Lagrangian

New Sort View ...

Home .ipynb_checkpoints _pycache_ run_cases MOHID_Lagrangian.ipynb MOHID_Lagrangian_environment update_xml_case.py

C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian\update_xml_case.py

File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?

update_xml_case.py

```
1 import xml.etree.ElementTree as ET
2 from xml.dom import minidom
3 import re
4
5 def update_parameter_definitions(xml_file_path, Start, End, Integrator, Threads, OutputWriteTime, BufferSize):
6     """
7         Updates only the content of the <parameters> block in the XML file with simulation information,
8         preserving any text outside this block unchanged.
9     """
10
11     <parameters>
12         <parameter key="Start" value="2024 01 24 00 00 00" comment="Date of initial instant" unit="ISO8601"/>
13         <parameter key="End" value="2024 01 25 00 00 00" comment="Date of final instant" units="ISO8601"/>
14         <parameter key="Integrator" value="2" comment="Integration Algorithm 1:Euler, 2:Multi-Step"/>
15         <parameter key="Threads" value="10" comment="Computation threads for shared memory computation"/>
16         <parameter key="OutputWriteTime" value="86400" comment="Time out data (1/Hz)" units="comment"/>
17         <parameter key="BufferSize" value="86400" comment="Optional parameter. Controls input frequency"/>
18     </parameters>
```

Python file length : 16,122 lines : 342 Ln : 1 Col : 1 Pos : 1 Unix (LF) UTF-8 IN

6 items 1 item selected 15.7 KB Available on this device

3 Search ENG PTB2 4:48 PM 6/4/2025

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

6.2 Simulation definitions

```
[12]: # -----
# Get area limits
# -----
min_lat, max_lat = min(dataset['latitude'].values), max(dataset['latitude'].values)
min_lon, max_lon = min(dataset['longitude'].values), max(dataset['longitude'].values)

resolution = 8000 #metres (m)
timestep = 180 #seconds (s)
BoundingBoxMin = min_lon,min_lat,-1 #defines the corners of your simulation domain x,y,z (deg,deg,m)
BoundingBoxMax = max_lon, max_lat,1 #defines the corners of your simulation domain x,y,z (deg,deg,m)
VerticalVelMethod = 3 #1:From velocity fields, 2:Divergence based, 3:Disabled. Default = 1
BathyminNetcdf = 0 #bathymetry is a property in the netcdf. 1:true, 0:false (computes from layer depth and openPoints. Default = 1
RemoveLandTracer = 0 #Remove tracers on land 0>No, 1:Yes. Default = 1
TracerMaxAge = 0 #maximum tracer age. Default = 0.0. read if > 0

# Run the update function
update_simulation_definitions(xml_file_path,resolution,timestep,BoundingBoxMin,BoundingBoxMax,VerticalVelMethod,BathyminNetcdf,R
```

Updated <simulation> block in 'Plastic_Case.xml' successfully.

6.3 Source definitions

```
print(markers_dict)
```

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

6 Search

2:45 PM 6/4/2025

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

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Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

6

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

Search

2:46 PM 6/4/2025

6.2 Simulation definitions

+ 1 cell hidden

6.3 Source definitions

[13]:

```
print(markers_dict)
```

```
{0: {'location': [3.994968, -48.566685], 'name': 'S1'}, 1: {'location': [1.998031, -46.544542], 'name': 'S2'}}
```

[14]:

```
rate_seconds = 3600 #emission step in seconds
rate_trcPerEmission = 5 #number of tracers emitted every rate_seconds

update_source_definitions(xml_file_path, markers_dict, rate_seconds, rate_trcPerEmission)
```

Updated <sourceDefinitions> block in 'Plastic_Case.xml' with 2 marker(s).

7. Run MOHID Lagrangian

+ 1 cell hidden

8. Visualize the final results

Define the directory containing VTK files

ENG PTB2

MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

File Edit View Run Kernel Tabs Settings Help

Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

7. Run MOHID Lagrangian

```
[ ]: dirout = f"{name}_out"

# Paths to executables and scripts
tools = r"../build/bin/RELEASE"
mohidlagrangian = os.path.join(tools, "MOHIDLagrangian.exe")

preprocessor_dir = r"../src/MOHIDLagrangianPreProcessor"
preprocessor = os.path.join(preprocessor_dir, "MOHIDLagrangianPreProcessor.py")

postprocessor_dir = r"../src/MOHIDLagrangianPostProcessor"
postprocessor = os.path.join(postprocessor_dir, "MOHIDLagrangianPostprocessor.py")

# Manage output directory
if os.path.exists(dirout):
    shutil.rmtree(dirout)
os.makedirs(dirout)

# Copy XML configuration file
shutil.copy(f"{name}.xml", dirout)

# Run Preprocessing
try:
    subprocess.run(
        [sys.executable, preprocessor, "-i", f"{dirout}/{name}.xml", "-o", dirout],
        check=True,
```

Simple 1 5 Python 3 (ipykernel) | Idle Mode: Command 0 Ln 1, Col 1 MOHID_Lagrangian.ipynb 0 6

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

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Launcher MOHID_Lagrangian.ipynb

All done!

8. Visualize the final results

```
[ ]: # Define the directory containing VTU files.  
dirout = f"{name}_out" # e.g., "case_out" or "Plastic_Case_out"  
  
# Use glob to find all files with the pattern '{name}_*.vtu' in dirout.  
vtu_files = glob.glob(os.path.join(dirout, f"{name}_*.vtu"))  
  
if not vtu_files:  
    raise ValueError(f"No VTU files matching '{name}_*.vtu' found in the directory: {dirout}")  
  
# Function to extract the sequence number from a filename.  
def extract_seq(filename):  
    basename = os.path.basename(filename)  
    match = re.search(r'_(\d+)\.vtu$', basename)  
    if match:  
        return int(match.group(1))  
    else:  
        # Return -1 if the file doesn't match the expected pattern.  
        return -1  
  
# Find the file with the maximum sequence number.  
latest_vtu_file = max(vtu_files, key=extract_seq)  
print("The latest VTU file is:", latest_vtu_file)  
  
# Use the found file directly as the result filename.
```

Simple 1 Python 3 (ipykernel) | Idle Mode: Command Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

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MOHID_Lagran... - JupyterLab

localhost:8888/lab/tree/MOHID_Lagrangian.ipynb#1.-Import-required-libraries

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Launcher MOHID_Lagrangian.ipynb

Notebook Python 3 (ipykernel)

fill_opacity=0.7,
popup=f"Source: {src}"
).add_to(map_vtu)

map_vtu.save(os.path.join(dirout, "map_vtu.html"))
print("Map saved as map_vtu.html")

Display the map inline in a Jupyter Notebook (if applicable)
map_vtu

The latest VTU file is: Plastic_Case_out\Plastic_Case_00004.vtu
Unique sources: [0, 1]
Map saved as map_vtu.html

[16]:

Simple 1 Python 3 (ipykernel) | Idle Mode: Command 5 Ln 1, Col 1 MOHID_Lagrangian.ipynb 0

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Plastic_Case_out

OneDrive MOHID_Lagrangian run_cases Plastic_case Plastic_Case_out Search Plastic_Case_out

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Name

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map_vtu.html
Plastic_Case.pvd
Plastic_Case.xml
Plastic_Case_00000.vtu
Plastic_Case_00001.vtu
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Plastic_Case_00003.vtu
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Plastic_Case_BoundingBox.vtu
Plastic_Case_inputs.xml

Plastic_Case_run.log

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Plastic_Case_run.log

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2
3
4
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7 <MOHIDLagrangian> Copyright (C) 2018 by
R. Birjukovs Canelas
MARETEC - Research Centre for Marine, Environment and Technology
University of Lisbon - IST
A. Daniel Garaboa Paz
Non-Linear Physics Group - University of Santiago de Compostela, Spain

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modify it under the terms of the GNU General Public License as
published by the Free Software Foundation, either version 3 of
the License, or (at your option) any later version.

Normal text file length : 10,172 lines : 183 Ln : 1 Col : 1 Pos : 1 Unix (LF) UTF-8 IN

12 items 1 item selected 9.93 KB Available on this device

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Plastic_Case_out

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MOHID-Lagrar
MyTools
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Name

map_vtu.html
Plastic_Case.pvd
Plastic_Case.xml
Plastic_Case_0000.vtu
Plastic_Case_0001.vtu
Plastic_Case_0002.vtu
Plastic_Case_0003.vtu
Plastic_Case_0004.vtu
Plastic_Case_Blocks.vtu
Plastic_Case_BoundingBox.vtu
Plastic_Case_inputs.xml
Plastic_Case_run.log

C:\Users\aquaf\OneDrive\MOHID_Jupyter-Notebooks-master\MOHID_Jupyter-Notebooks-master\MOHID_Lagrangian\run_cases\Plastic_Case_out

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Plastic_Case_run.log

166 Simulation starting
167 =====
168 | Output time | Simulation time | Finish time | % | Tracer # | Steps | sim/time
169 2025-06-04 14:47:12 ->Building initial state
170 ->Reading nc_fields/currents\cmems_20250101_20250105.nc
171 2025-06-04 14:47:12 | 2025-01-01 00:00:00 | 2025-06-04 14:47:12 | 0.0 | 2 | 1 | Plastic_Case_0000.vtu
172 2025-06-04 14:47:12 | 2025-01-01 00:00:00 | 2025-06-04 14:48:08 | 0.0 | 2 | 2 | Plastic_Case_0001.vtu
173 2025-06-04 14:47:12 | 2025-01-02 00:00:00 | 2025-06-04 14:47:14 | 25.0 | 242 | 482 | Plastic_Case_0002.vtu
174 2025-06-04 14:47:13 | 2025-01-03 00:00:00 | 2025-06-04 14:47:15 | 50.0 | 482 | 962 | Plastic_Case_0003.vtu
175 2025-06-04 14:47:13 | 2025-01-04 00:00:00 | 2025-06-04 14:47:15 | 75.0 | 722 | 1442 | Plastic_Case_0004.vtu
176 2025-06-04 14:47:15 Total elapsed time for Simulation::Total is +0.371670319489203E+001 s
177 2025-06-04 14:47:15 Total elapsed time for Simulation::Preparation is +0.228664006339386E+000 s
178 2025-06-04 14:47:15 Total elapsed time for Simulation::SV encoding/decoding is +0.686876080115326E+001
179 2025-06-04 14:47:15 Total elapsed time for Simulation::Solver is +0.256113209715113E+001 s
180 2025-06-04 14:47:15 Total elapsed time for Simulation::Input is +0.291215011384338E-001 s
181 2025-06-04 14:47:15 Total elapsed time for Simulation::Output is +0.200907967519015E-001 s
182 2025-06-04 14:47:15 Simulation ended, freeing resources. See you next time
183

Normal text file length : 10,172 lines : 183 Ln : 1 Col : 1 Pos : 1 Unix (LF) UTF-8 IN

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Plastic_Case_out

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Name	Status	Date modified	Type	Size
map_vtu.html	✓	6/4/2025 2:47 PM	Microsoft Edge HTM...	742 KB
Plastic_Case.pvd	✓	6/4/2025 2:47 PM	PVD File	1 KB
Plastic_Case.xml	✓	6/4/2025 2:47 PM	Microsoft Edge HTM...	6 KB
Plastic_Case_00000.vtu	✓	6/4/2025 2:47 PM	VTU File	3 KB
Plastic_Case_00001.vtu	✓	6/4/2025 2:47 PM	VTU File	3 KB
Plastic_Case_00002.vtu	✓	6/4/2025 2:47 PM	VTU File	22 KB
Plastic_Case_00003.vtu	✓	6/4/2025 2:47 PM	VTU File	42 KB
Plastic_Case_00004.vtu	✓	6/4/2025 2:47 PM	VTU File	61 KB
Plastic_Case_Blocks.vtu	✓	6/4/2025 2:47 PM	VTU File	14 KB
Plastic_Case_BoundingBox.vtu	✓	6/4/2025 2:47 PM	VTU File	1 KB
Plastic_Case_inputs.xml	✓	6/4/2025 2:47 PM	Microsoft Edge HTM...	1 KB
Plastic_Case_run.log	✓	6/4/2025 2:47 PM	LOG File	10 KB

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