MOHIDing 2025, 25-27 June 2025

# ART (Automatic Running Tool): a simple and generic (but robust) python tool for operationalization of processes

CoLAB +ATLANTIC

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# The Automatic Running Tool

- It is a full python code designed to automatise repetitive processes and suitable for operationalization of numerical models.
- It is the evolution of a previous tool with the same name programmed in C#
- The tool is totally open and available at the MOHID Github repository
- The configuration is made through a simple YAML file.
- The tool is able to incorporate in a very simple way new processes.

In collaboration

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Preparation of data Sources





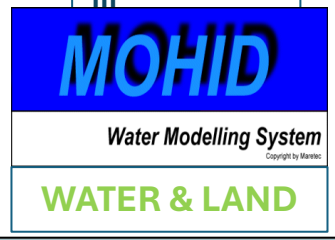

Pre-processing

Simulations

Simulation



Wave Watch III

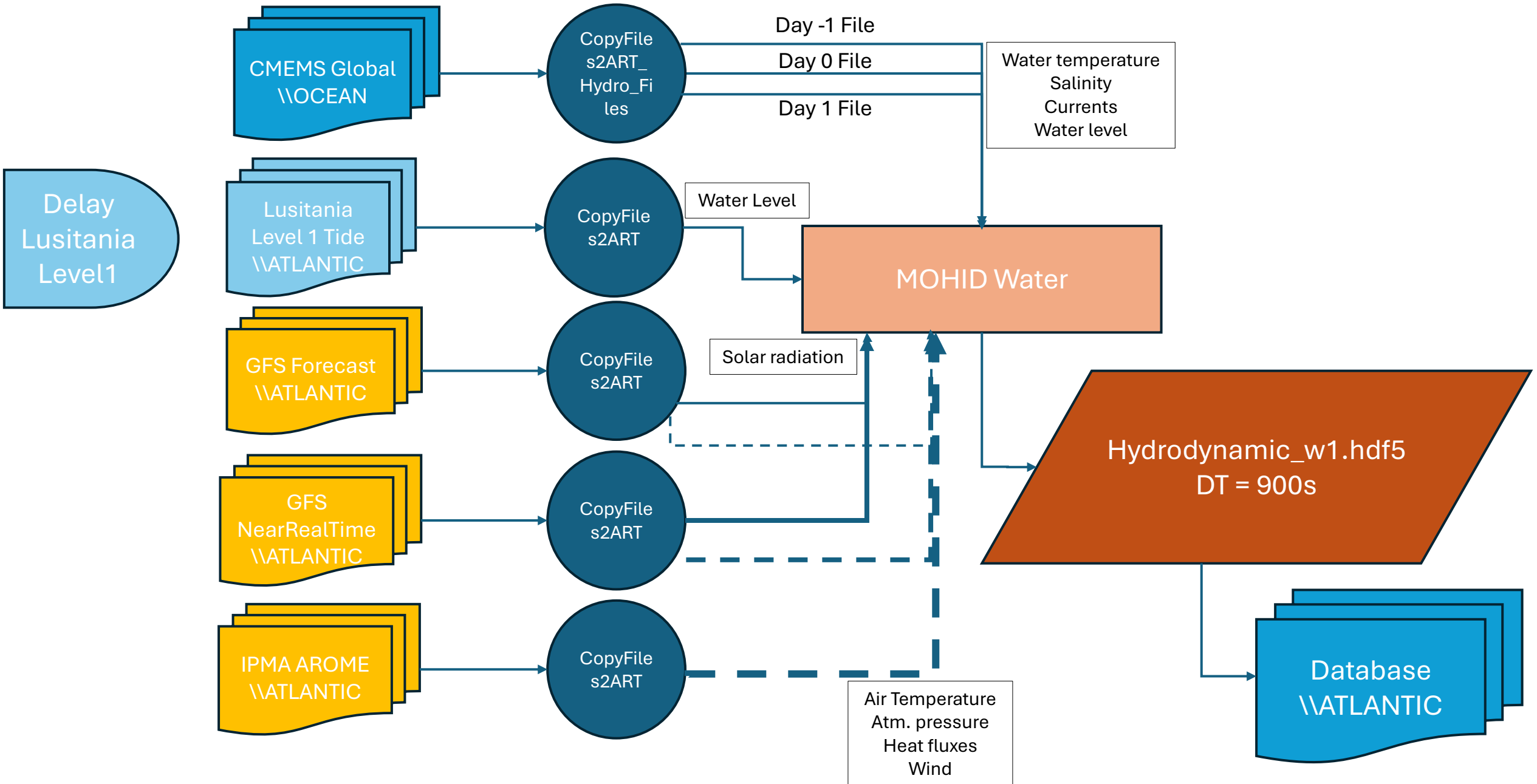



Post-Processing

Results distribution

Validation Tools


# Lusitania – Level 2 3D



## Groupings

Processes are divided into PRE_PROCESSING, RUN_SIMULATION, POST_PROCESSING groups that can be individually switched on and off

## Control

Configuration files are controlled by the data that need to have this format

START : 2022 01 01 0 0 0

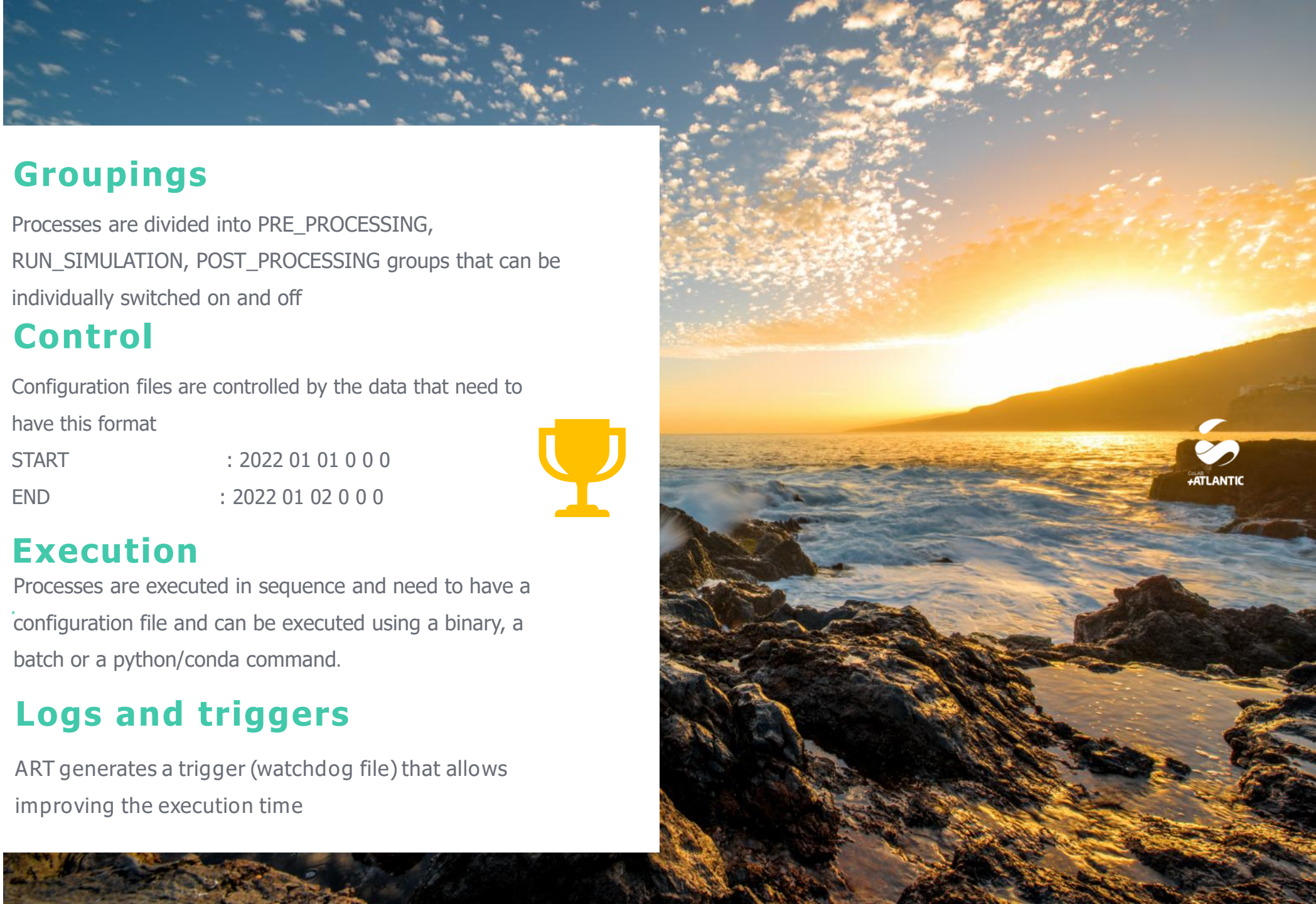
END : 2022 01 02 0 0 0

## Execution

Processes are executed in sequence and need to have a configuration file and can be executed using a binary, a batch or a python/conda command.

## Logs and triggers

ART generates a trigger (watchdog file) that allows improving the execution time



## Code repository

Accessed at:

https://github.com/maretec/ART/tree/v2

## Binary or code

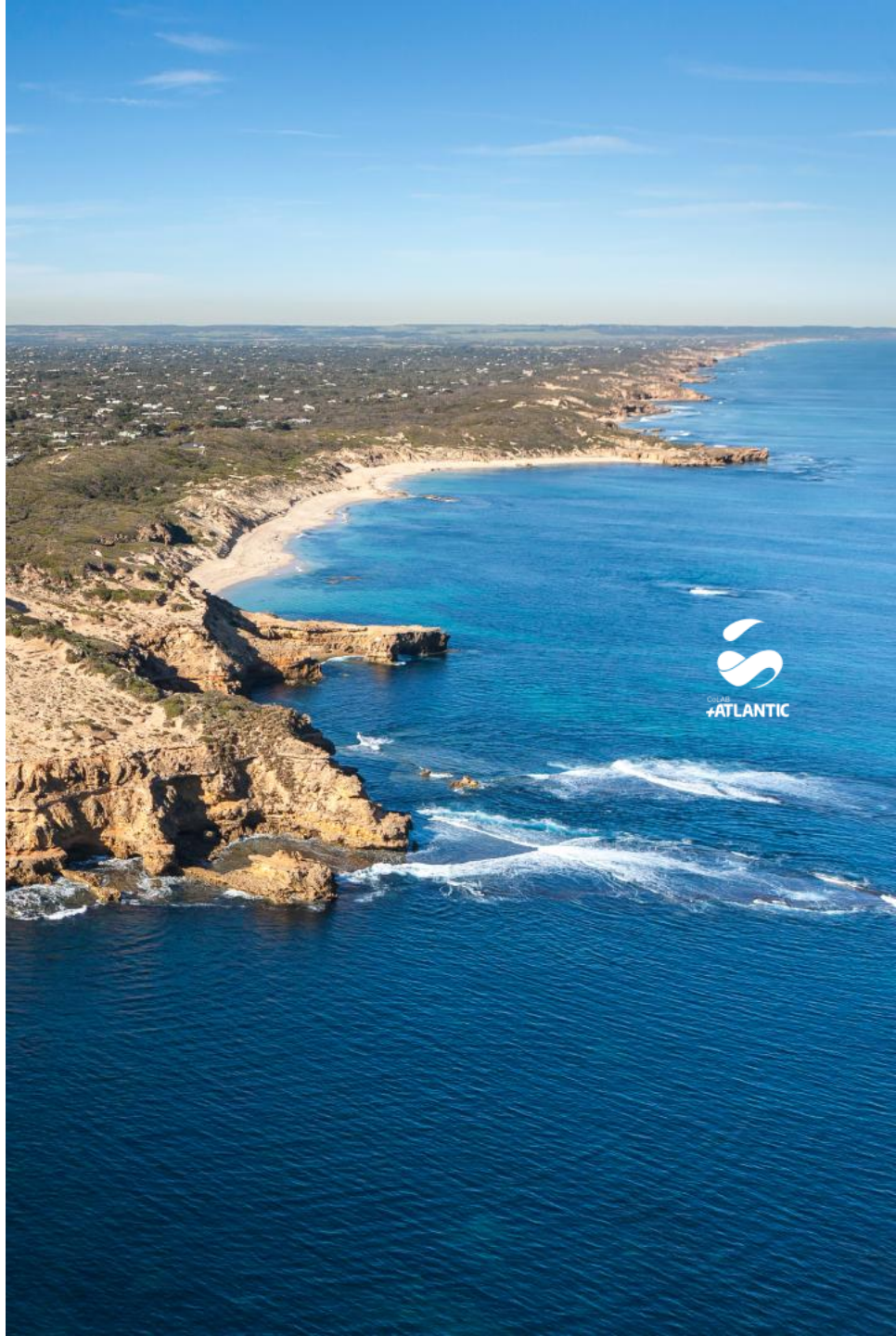
The code can be easily compiled for windows and currently is being adapted to Linux

## Daily or monthly operations

The software is easily adapted to perform daily simulations or monthly simulations (e.g. validation processes)

## Easy to replicate in Windows

Configurations needed to copy and start using in another machine are very simple



# Main configuration

```
ART:
  PROJECT_PATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/
  MODULE:
    MOHID_WATER: 1 # 0 or 1, false or true
    MOHID_LAND: 0 #0 0 or 1, false or true
    WW3: 0 # 0 or 1, false or true
    SWAN: 0 # 0 or 1, false or true
EMAIL_NOTIFICATION: # NOT MANDATORY, if present all following KEYWORDS are mandatory
  ENABLE: 0 # 0 or 1, false or true


    RECEIVERS: #list of emails that are notified at the end of the run
      - francisco.campuzano@colabatlantic.com
PRE_PROCESSING: true    # false or true
RUN_SIMULATION: true      # false or true
POST_PROCESSING: true # false or true

  LOG:
    ENABLE: 0
    FOLDER_PATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Logs

SIMULATION:
  RUN_TWICE: 0
  OPERATIONAL_MODE: 1
  MONTH_MODE: 0
  DAYS_PER_RUN: 1
  REF_DAYS_TO_START: -16
  NUMBER_OF_RUNS: 16
  START_DATE: "2024 03 12 0 0 0"
  END_DATE: "2024 03 20 0 0 0"
```

Options not ready yet

Switching on/off a pre, post or simulation

1 Operational 0 dates defined below

Month mode on or off

Dates to simulate in operational mode

Dates to simulate in NOT operational mode

```
TRIGGER:
  ENABLE: 1
  CHECK_ALL: false
  FOLDERS_TO_WATCH:
  TRIGGER_MAX_WAIT: 1
  TRIGGER_POLLING_RATE: 120
  WRITE_TRIGGER: 1
```

```
TRIGGER:
  ENABLE: 1
  CHECK_ALL: false
  FOLDERS_TO_WATCH:
    - //OCEAN/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA/Logs/Triggers/
  TRIGGER_MAX_WAIT: 1
  TRIGGER_POLLING_RATE: 120
  WRITE_TRIGGER: 1
```

Trigger configuration

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# Example Pre-Processor

```
PRE_PROCESSING:
  CopyFiles2ART_CMEMS_Hydro:
    RUN: 0
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Hydro/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Hydro/CopyFiles2ART.dat
    EXE_PATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Hydro/CopyFiles2ART.exe"
  CopyFiles2ART_CMEMS_Hydro_Files:
    RUN: 1
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Hydro_Files/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Hydro_Files/Copy_fromExt
    EXE_PATH: "C:/Users/Atlante/.conda/envs/opendap/python.exe"
    FLAGS: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Hydro_Files/Copy_fromExtractor.py"
  CopyFiles2ART_CMEMS_Bio:
    RUN: 0
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Bio/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Bio/CopyFiles2ART.dat
    EXE_PATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFiles2ART_CMEMS_Bio/CopyFiles2ART.exe"
  GetMeteoForecast_Portugal_GFS_Forecast:
    RUN: 0
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/GFS2Me_V2_0p25_2018_Forecast/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/GFS2Me_V2_0p25_2018_Forecast/Gfs2Me_V2.dat
    EXE_PATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/GFS2Me_V2_0p25_2018_Forecast/Gfs2Me_V2.exe"
  GetMeteoForecast_Portugal_GFS_NRT:
    RUN: 0
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/GFS2Me_V2_0p25_2018_NRT/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/GFS2Me_V2_0p25_2018_NRT/Gfs2Me_V2.dat
    EXE_PATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/GFS2Me_V2_0p25_2018_NRT/Gfs2Me_V2.exe"
```

Name of the process (can not be repeated)

Switching on/off a process

CONFIG_FILE dates will be modified

Using a binary/batch file for running

Unlimited number of blocks

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# Example Post-Processor

```
POST_PROCESSING:
  copy_input_file:
    RUN: 1
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/CopyInputFiles/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/CopyInputFiles/GetInputFile.dat"
    EXE_PATH: "C:/Users/Atlante/.conda/envs/opendap/python.exe"
    FLAGS: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/CopyInputFiles/GetInputFile.py"
  GLUE:
    RUN: 1
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/GlueHDF/
    DAT_DATE_CHANGE: 0
    EXE_PATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/GlueHDF/Convert2Hdf5.exe
  edit_HDF5:
    RUN: 0
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/edit_HDF5/
    DAT_DATE_CHANGE: 0
    EXE_PATH: "C:/Users/Atlante/.conda/envs/opendap/python.exe"
    FLAGS: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/edit_HDF5/edit_HDF5.py"
  convert_to_netcdf:
    RUN: 1
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/Convert2Netcdf/
    DAT_DATE_CHANGE: 0
    EXE_PATH: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/Convert2Netcdf/Convert2netcdf.exe
  compress_netcdf:
    RUN: 1
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/compress_netcdf/
    DAT_DATE_CHANGE: 0
    EXE_PATH: "C:/Users/Atlante/.conda/envs/opendap/python.exe"
    FLAGS: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/compress_netcdf/nccopy_convert.py"
  copy_output_file:
    RUN: 1
    WORKING_DIRECTORY: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/CopyOutputFiles/
    DAT_DATE_CHANGE: 1
    CONFIG_FILEPATH: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/CopyOutputFiles/GetOu
    EXE_PATH: "C:/Users/Atlante/.conda/envs/opendap/python.exe"
    FLAGS: "C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/OpenDAP_Python_3D/CopyOutputFiles/GetOutputFile.p
```

Using python commands

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# Typical log file from ART

```
[INFO] - 2025-06-20 06:00:01: Starting MOHID Water module
[INFO] - 2025-06-20 06:00:01: Running in Operational Mode
[INFO] - 2025-06-20 06:00:01: Initial Date : 2025 06 04 00 00 00
[INFO] - 2025-06-20 06:00:01: Final Date: 2025 06 05 00 00 00
[INFO] - 2025-06-20 06:00:01: Number of runs : 16
[INFO] - 2025-06-20 06:00:01: Running Mohid Water in Operational Mode
[INFO] - 2025-06-20 06:00:01: ========================================
[INFO] - 2025-06-20 06:00:01: STARTING FORECAST ( 1 of 16 )
[INFO] - 2025-06-20 06:00:01: ========================================
[INFO] - 2025-06-20 06:00:01: Executing Pre Processing
[INFO] - 2025-06-20 06:00:01: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\Work\CopyFiles2ART\CopyFiles2ART_CMEMS_Hydro_Fil
[INFO] - 2025-06-20 06:00:01: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\Work\CopyFiles2ART\CopyFiles2ART_CMEMS_Hydro_Fil
[INFO] - 2025-06-20 06:00:01: Executing Pre Processing module: C:/Users/Atlante/.conda/envs/opendap/python.exe
[INFO] - 2025-06-20 06:00:25: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\Work\CopyFiles2ART\CopyFiles2ART_GFS_NRT_REPLACE
[INFO] - 2025-06-20 06:00:25: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\Work\CopyFiles2ART\CopyFiles2ART_GFS_NRT_REPLACE
[INFO] - 2025-06-20 06:00:25: Executing Pre Processing module: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFi
[INFO] - 2025-06-20 06:00:29: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\Work\CopyFiles2ART\CopyFiles2ART_GFS_NRT\CopyFil
[INFO] - 2025-06-20 06:00:29: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\Work\CopyFiles2ART\CopyFiles2ART_GFS_NRT\CopyFil
[INFO] - 2025-06-20 06:00:29: Executing Pre Processing module: C:/Aplica/BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly/Work/CopyFiles2ART/CopyFi
[INFO] - 2025-06-20 06:00:30: Creating new model file for model: Portugal
[INFO] - 2025-06-20 06:00:30: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\WestIberia_Window\Portugal\data\Model_1.dat STAR
[INFO] - 2025-06-20 06:00:30: Changed START of C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\WestIberia_Window\Portugal\data\Model_1.d
[INFO] - 2025-06-20 06:00:30: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\WestIberia_Window\Portugal\data\Model_1.dat END
[INFO] - 2025-06-20 06:00:30: Changed END of C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\WestIberia_Window\Portugal\data\Model_1.dat
[INFO] - 2025-06-20 06:00:30: Modifying C:\Aplica\BIOPCOMS_2023_WestIberia_Portugal_Hydro_IPMA_Weekly\WestIberia_Window\Portugal\data\Model_1.dat STAR
[INFO] - 2025-06-20 06:00:30: Model Portugal .dat file was created.
```

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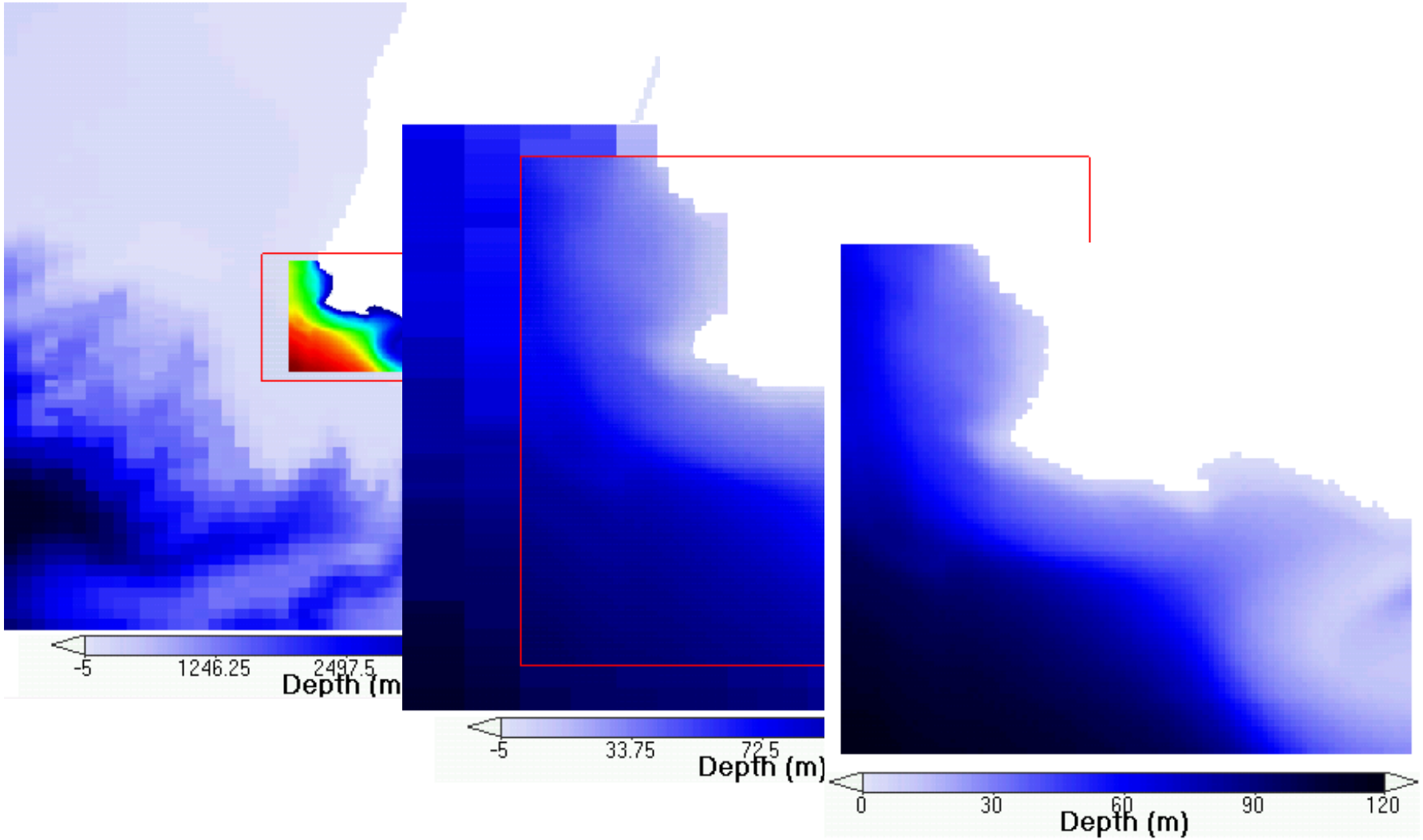
# The window downscalling technique



# The cascade strategy

- A model/process is waiting for a signal from an upwind process indicating that all the conditions are ready to start running. A synchronization optimize computing time and reduce operating errors.

## Typical Trigger File

2023-10-07_2023-10-08.dat

```
FILE AUTOMATICALLY GENERATED TO BE USED AS TRIGGER
DO NOT EDIT, CHANGE, MOVE, DELETE THIS FILE!

MOHID forecast and backup finished for the following period:
START                                 : 2023 10 07 0 0 0
END                                   : 2023 10 08 0 0 0
STATUS                                : FINISHED
SYSTEM TIME                           : 2023-11-19 10:12
```

Only two options running or finished

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# Conclusions

- Easy to implement/replicate automatic/operational processes (downloads, simulations, validation, etc..)
- Generic software that allow to incorporate on an easy way new processes/calculations etc
- Programmed on python and suitable for Windows and Linux environments
- Very stable and robust software
- Homogenous logging and easy to configure
- Concept proved with many implementations and operational downloads

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# On-going and Future work

- Running simultaneous process within any block: multiple pre- or post-processing activities
- Triggers (watchdog) in pre- and post-processing blocks
- Controlling dockers activities from local PC
- Including configurations for other numerical models (SWAN, Xbeach, etc.)

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