



**MERCATOR
OCEAN**
INTERNATIONAL

Modeling core engines for European Digital Twin Ocean, the EDITO Model Lab project

Yann Drillet and EDITO Model Lab partners

Digital Twin Ocean : Ambitious and shared initiative

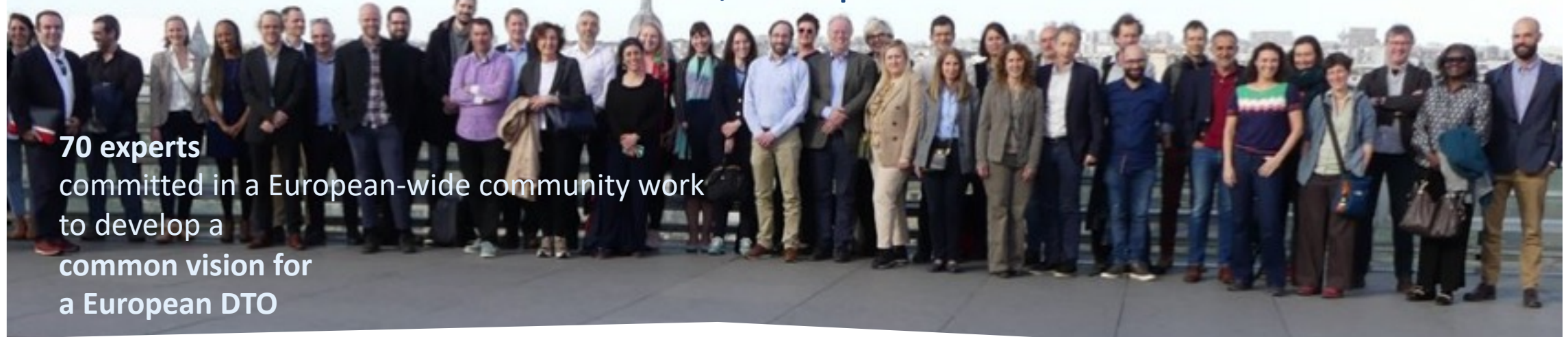


The **Digital Twin of the Ocean** is a **collaborative initiative**. It will make **ocean knowledge open-access**, available to **citizens, scientists and policymakers around the world**. It will be a platform for **global cooperation**.

The **Digital Twin of the Ocean** is a **unique tool** to **preserve a sustainable ocean and marine biodiversity**, relying on powerful multivariable modelling, integrating citizen science observations, combining ocean physics and biogeochemistry parameters to assess **biodiversity health, primary production and conditions for species development**.



1st DIGITAL OCEAN FORUM – Paris, 21 April 2022



70 experts
committed in a European-wide community work
to develop a
common vision for
a European DTO



EDITO: European Digital Twin Ocean:
« **EDITO Infra** » and « **EDITO Model Lab** »
Two Horizon Europe projects



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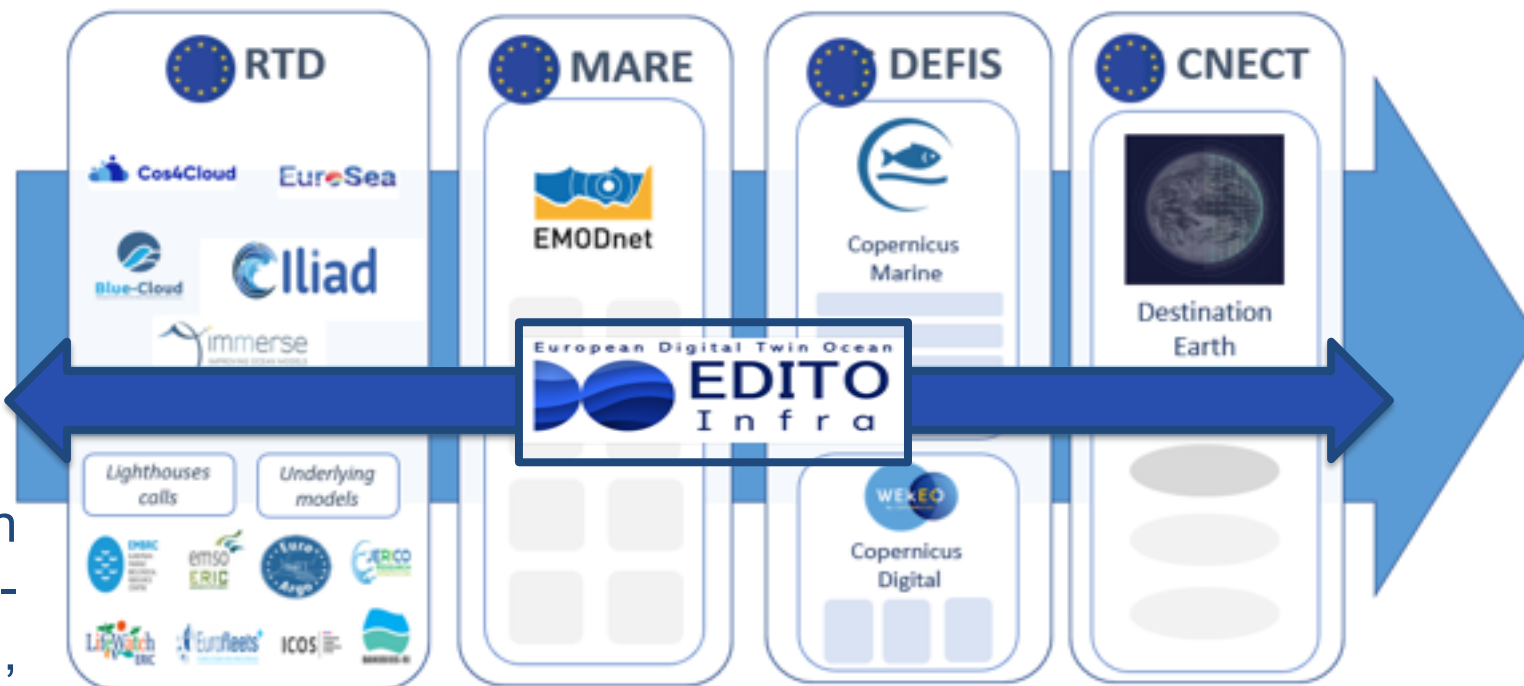


Grant to Identified Beneficiary



representing Copernicus and EMODnet

The project is built to capitalize on existing european assets and is co-designed with EC Directorates RTD, MARE, DEFIS and CNECT



EDITO-Infra will provide the foundation for the further development of the European DTO initiative, hosting the deployment of multiple DTO applications from ongoing and future digital twin projects, supporting the deployment of new generation of ocean models like the underlying models of the EDITO-Model-Lab project and the Mission Ocean Lighthouses projects. It is set to be fully compatible with Destination Earth.

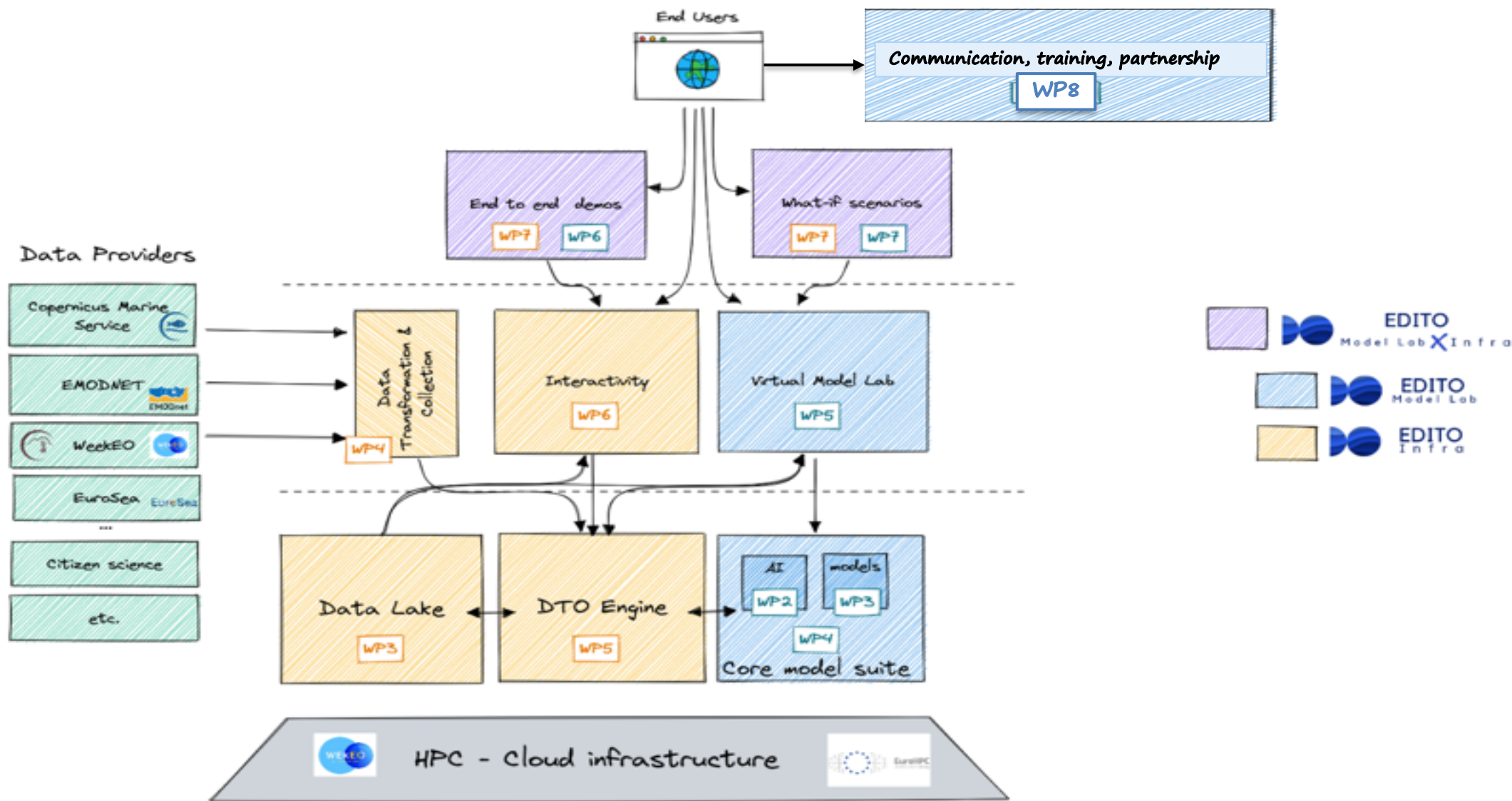
European Digital Twin Ocean

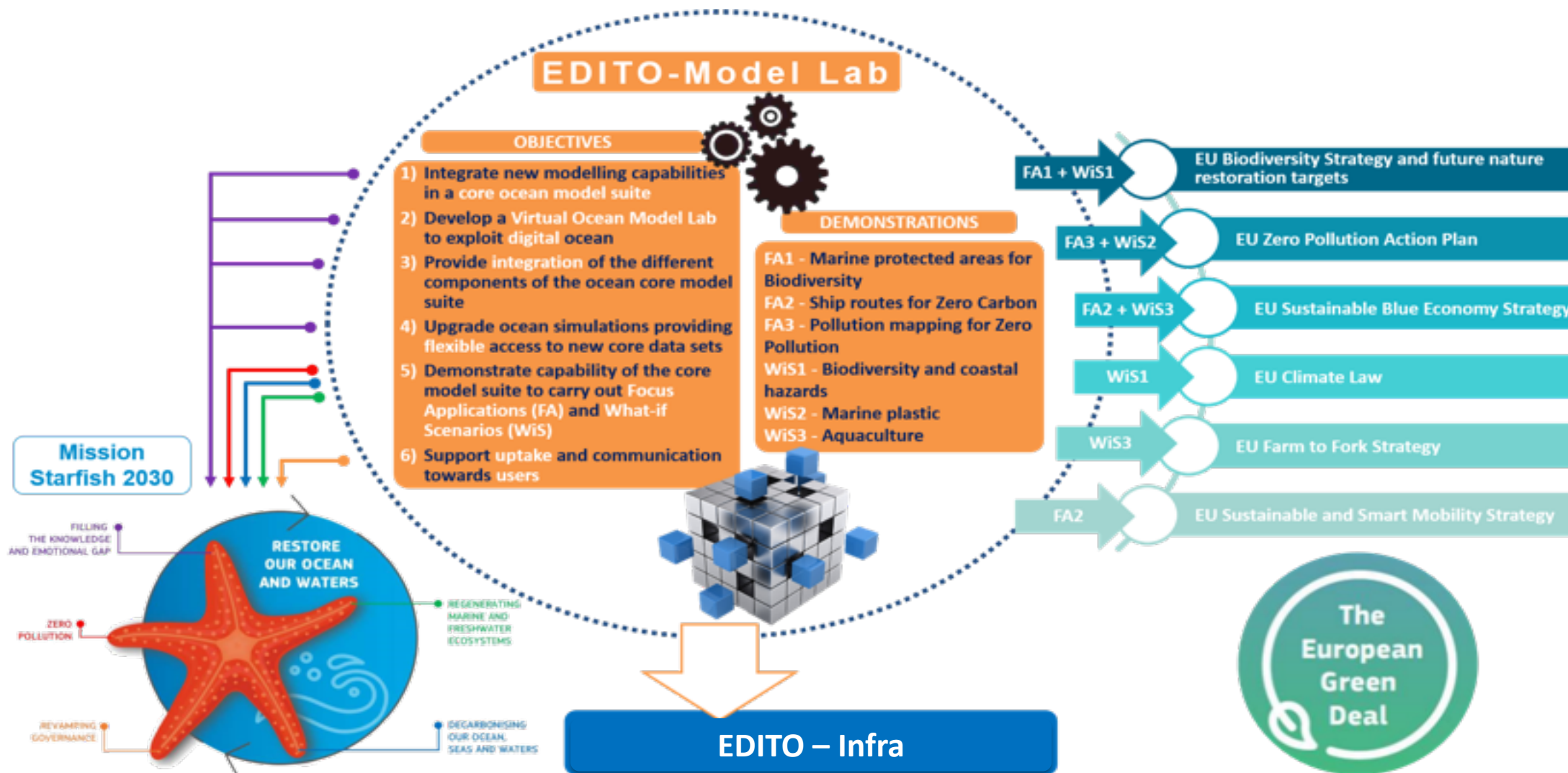


14 partners from 9 countries with expertise in :

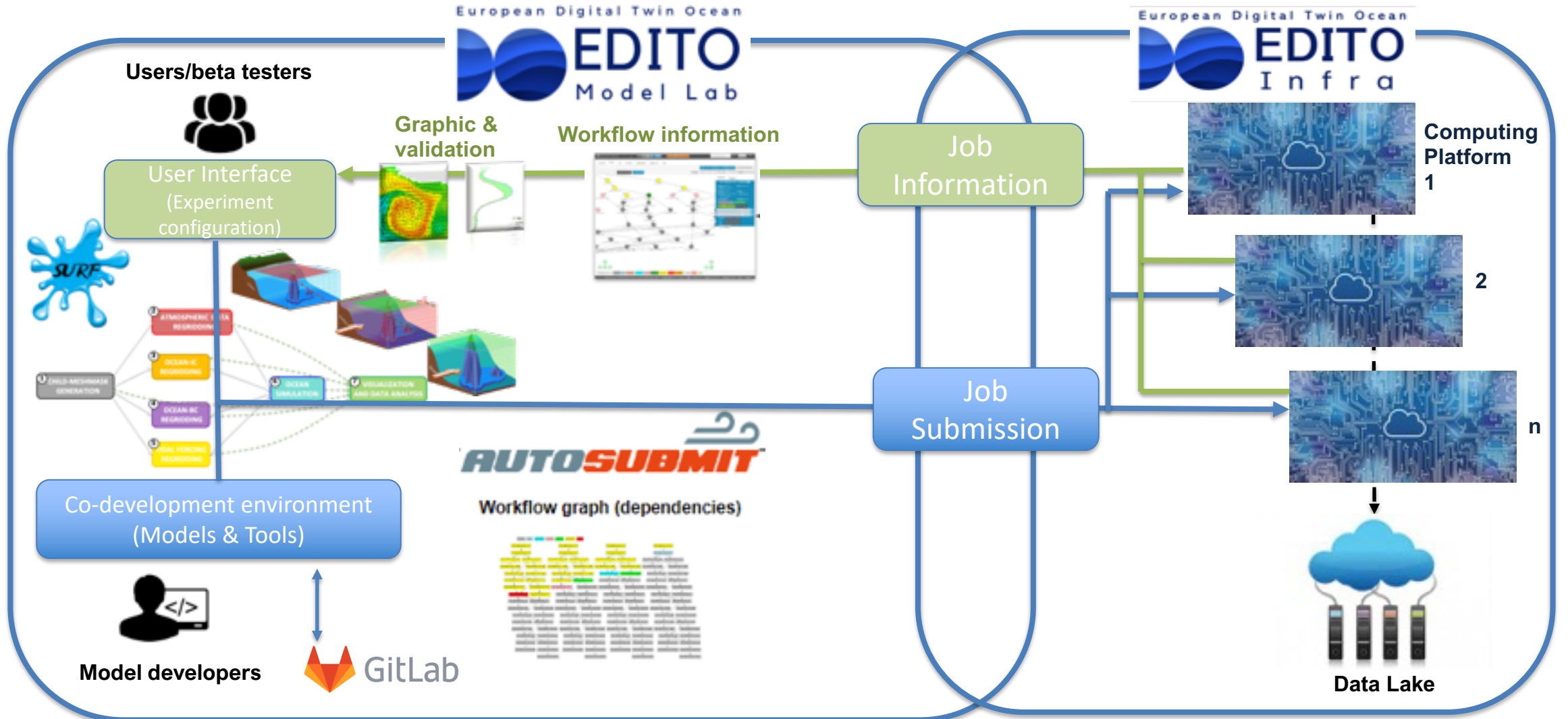
- **Ocean modeling** from global scale to coastal, for ocean physics, biogeochemistry and marine environment
- **Supercomputing** including experts from computing centers and GPU conceptor
- **Artificial Intelligence** applied to ocean application
- **Software development**, model and tools co-development
- **Operational oceanography** with strong links with Copernicus Marine, Ocean Predict and UN decade
- Intermediate to final **User applications**





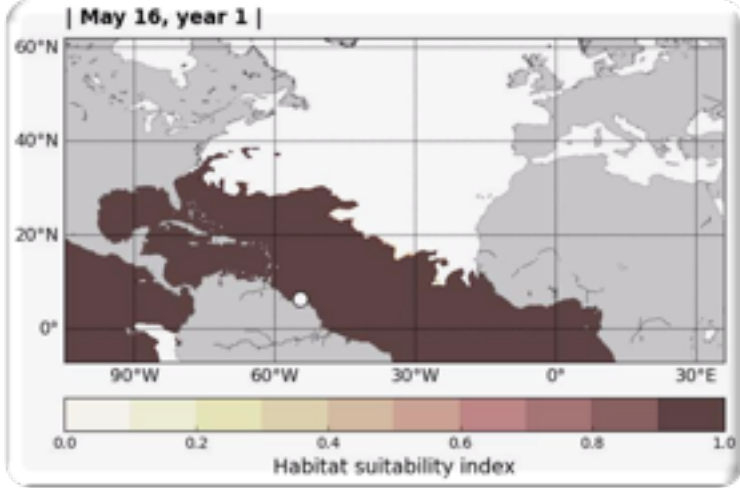


A co-development environment to share model development and configure simulations

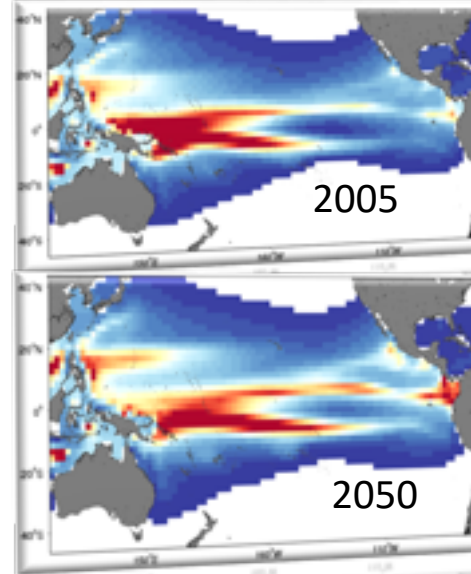


Models and tools

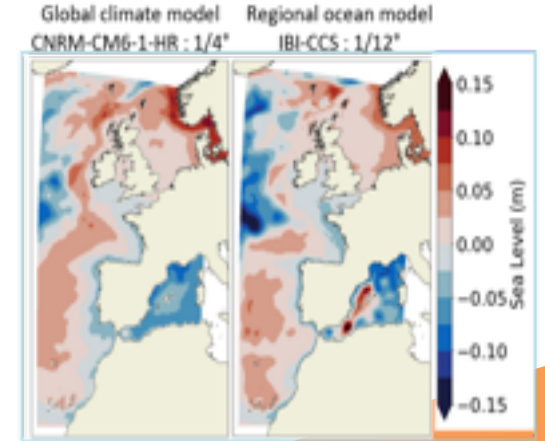
Sea turtles habitat suitability index



Fish stock projection in the Pacific Ocean

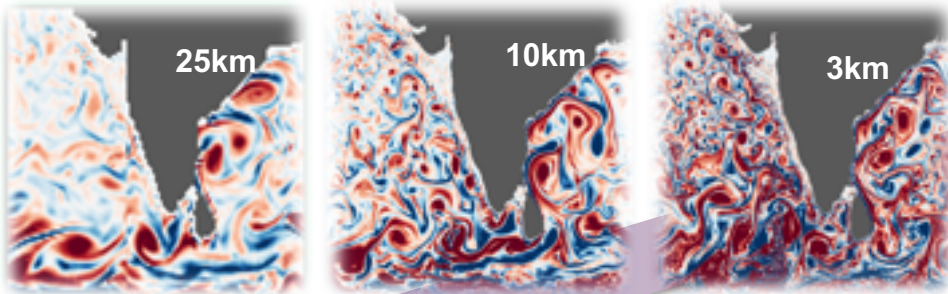


Regional downscaling scenario for sea level rise



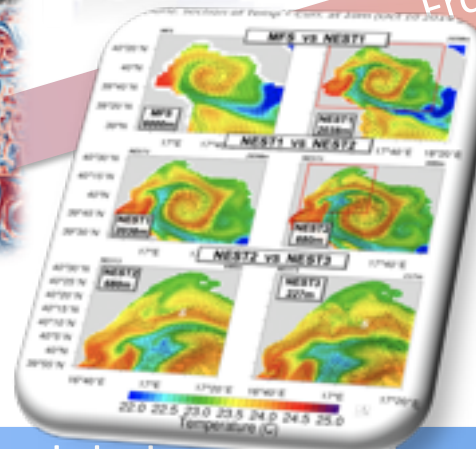
Projections of dynamic sea level (due to ocean circulations)
2081-2100 minus 1986-2005
SSP5-8.5 (high-emission scenario)

From physical ocean to marine species and biodiversity

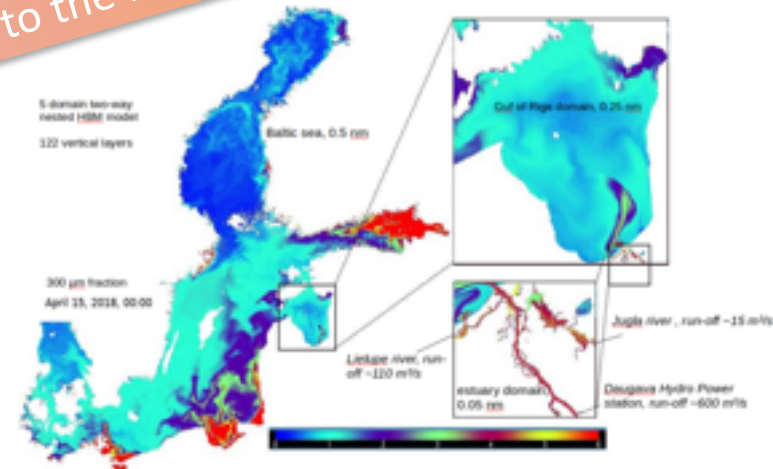


Global downscaling

From the past to the future

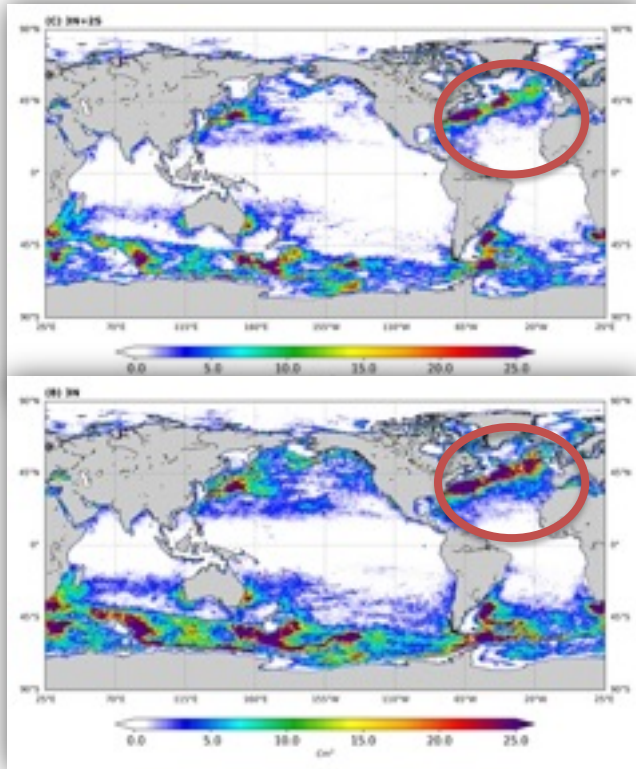


From the global ocean to the coast

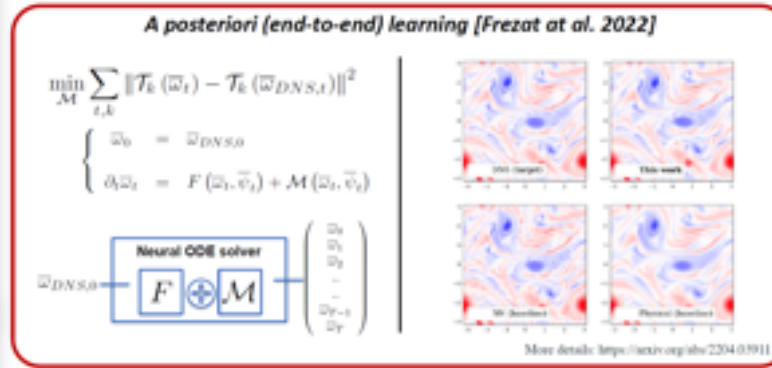


Coastal modeling from sea to estuary

Quantify impact of observation
(benkiran et al, 2021)



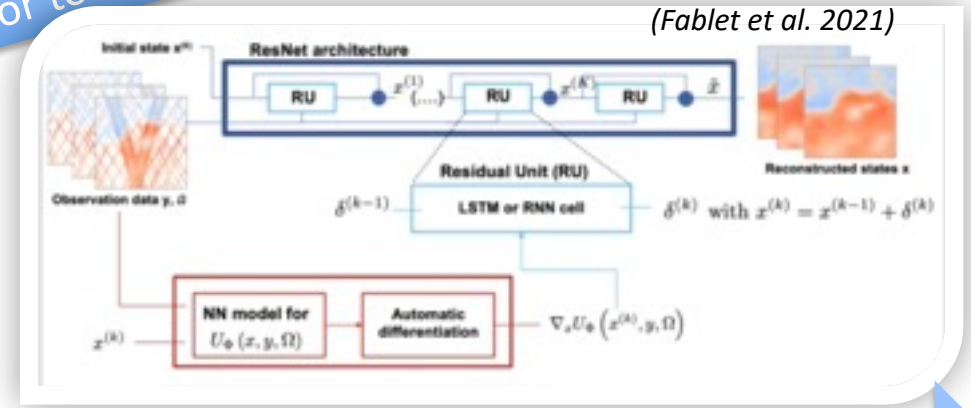
Subgrid scale parameterisation
(Frezat et al. 2022)



DDE for forecasting
(DeepMind, Ravuri et al. 2021)



Neural Network for ocean fields reconstruction
(Fablet et al. 2021)

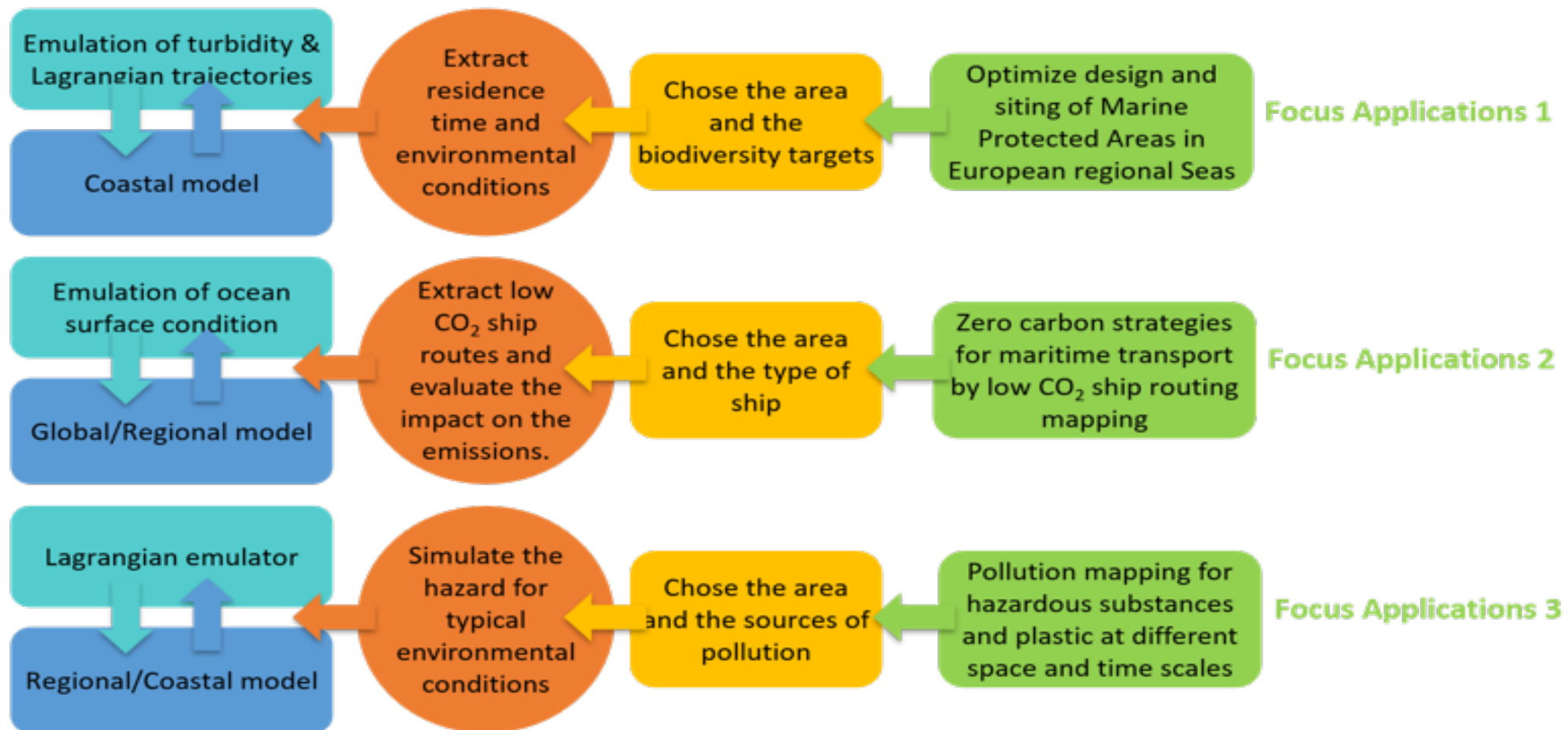


New observation to build a twin ocean

Deep Differentiable Emulator to build hybrid model

New methods for making use of observations

WP6 - Focus Applications

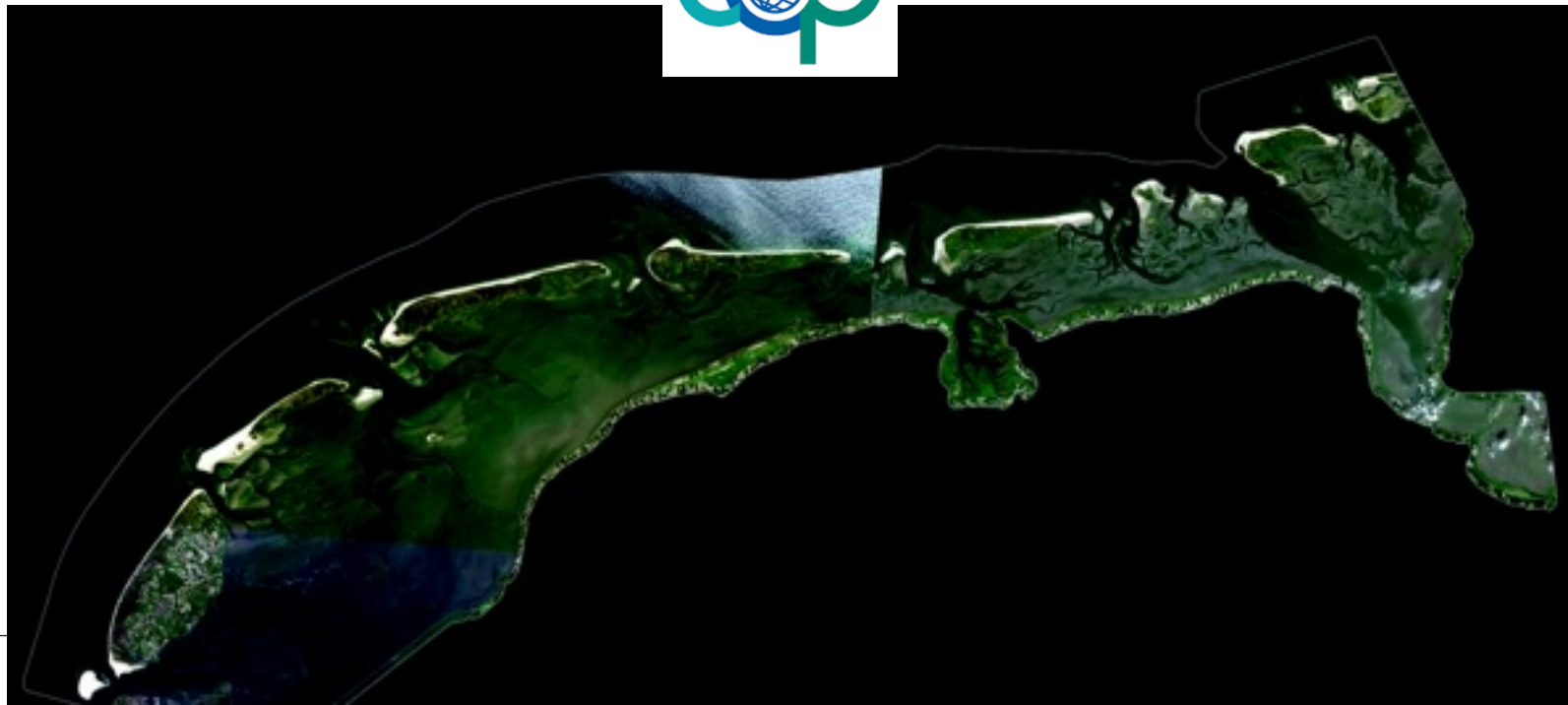


FA1: MPAs

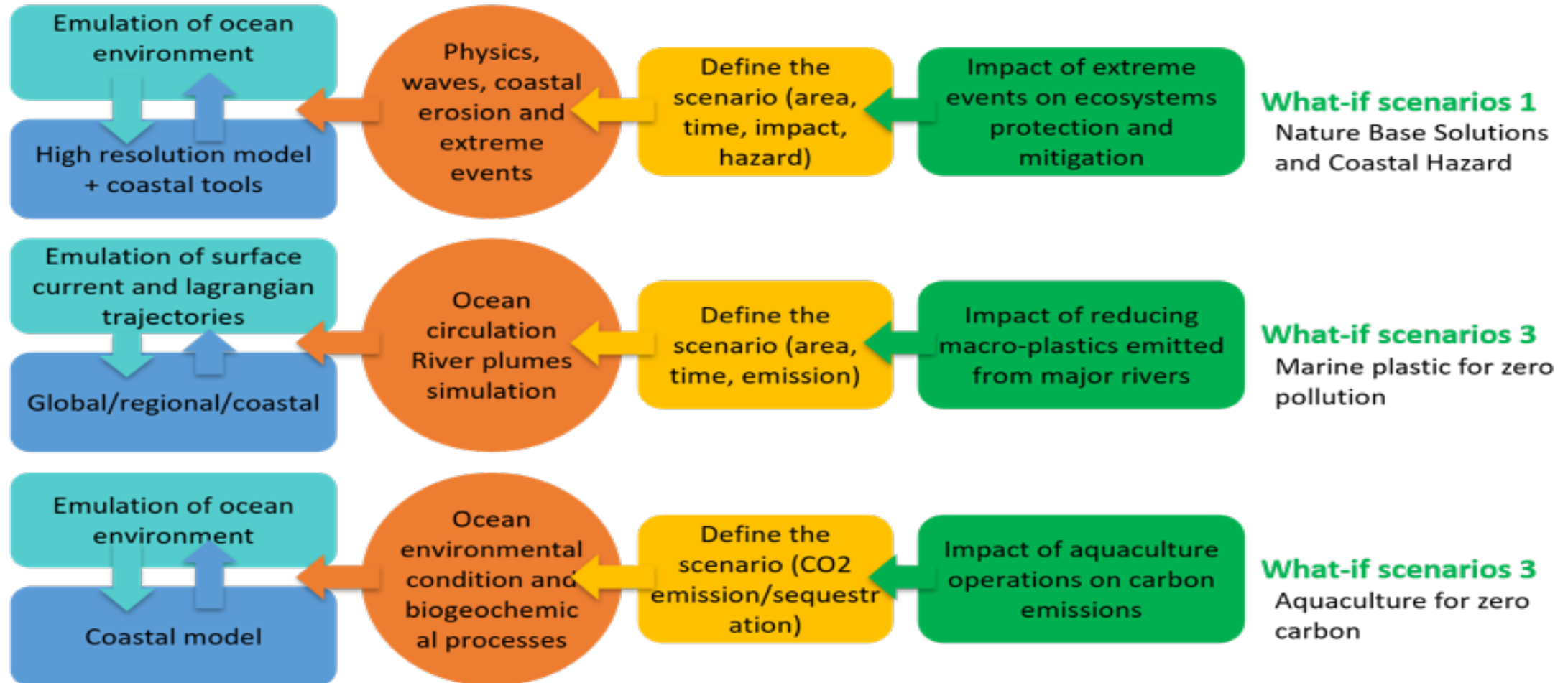


FA-1 on MPAs for Biodiversity

- *reaching the resolution of a few hundred metres*
- *running particle tracking models to extract residence time and environmental conditions*
- *giving the basic data sets for ML algorithms to optimise the size and the location of MPAs for different biodiversity targets*



WP7 - What-if scenarios



WI3: Aquaculture

CO2

What-If in Aquaculture for Zero carbon

- *sustainable intensification of low-emissions mariculture to maintain a low greenhouse gas footprint*
- *For example CO2 sequestration by shellfish, mainly in the shell material and partly in the seabed can be obtained*

