



**MERCATOR
OCEAN**

INTERNATIONAL

Mercator Ocean International

OPOS

Yann Drillet

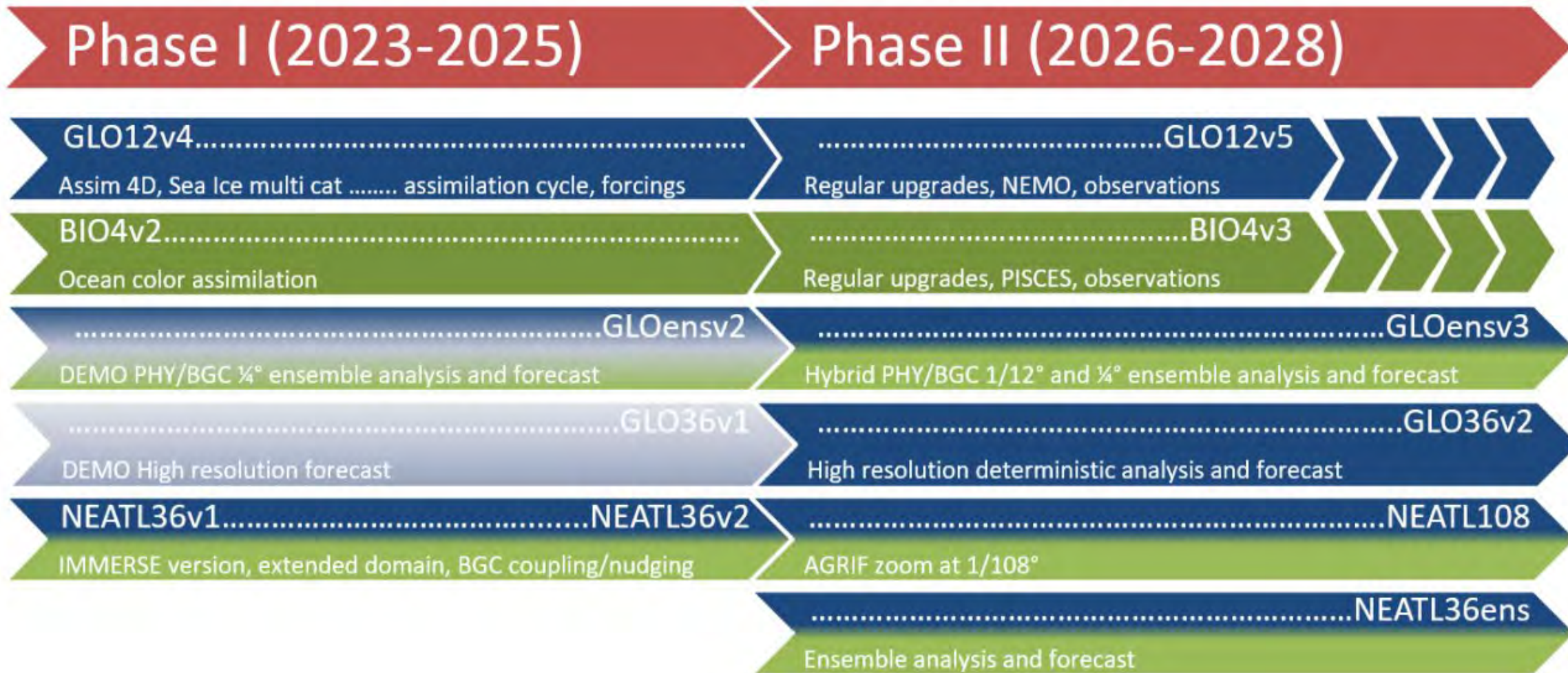
Jean Michel Lellouche and Moi collaborators

Status and on going development

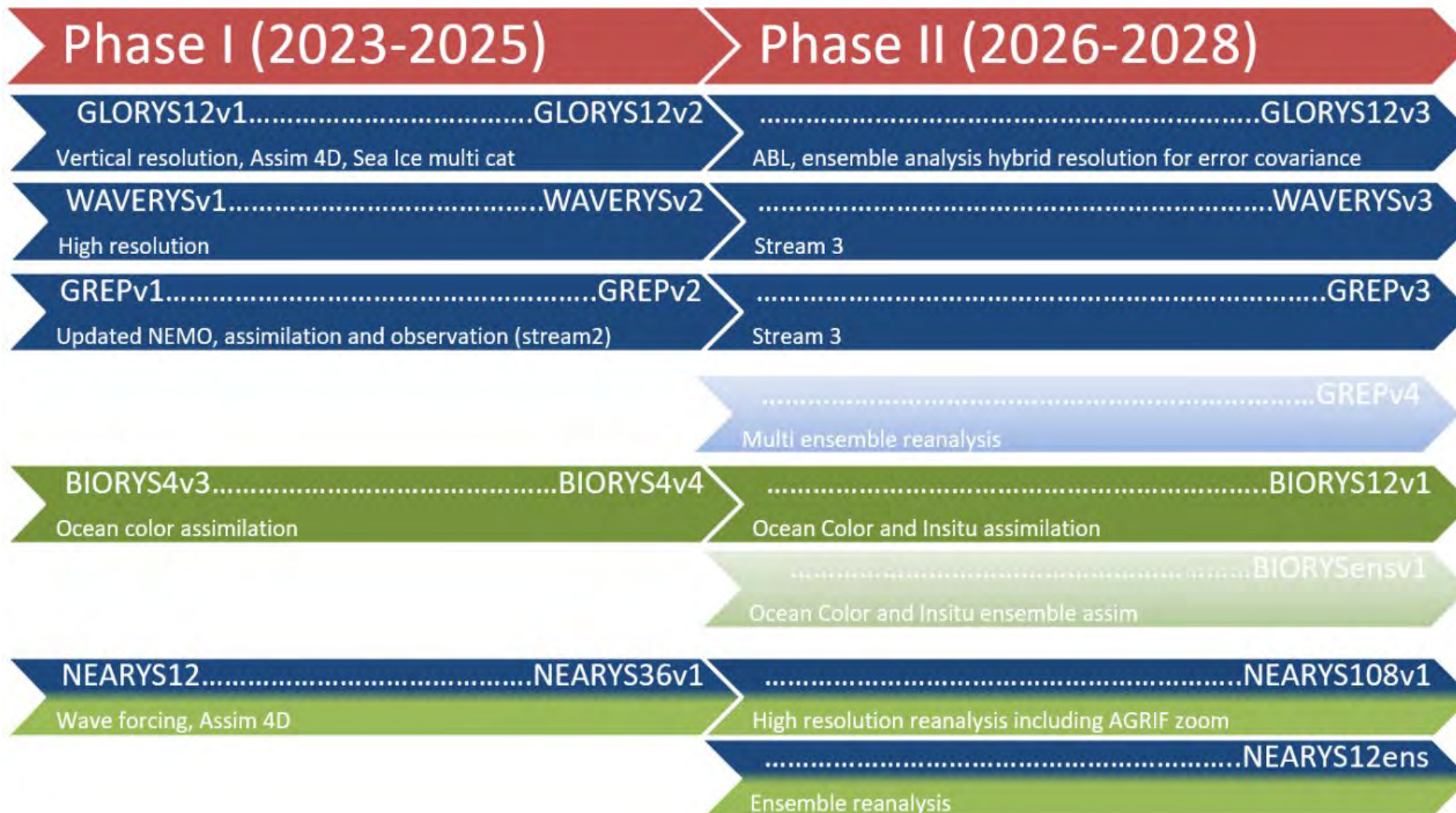
System description

- NEMO3.6 LIM3, 50 vertical levels, $1/12^\circ$ (~9km)
- Joint assimilation (multivariate) of SST, Sea Level Anomalies, T(Z) S(Z), Sea ice concentration
- Bias correction of large scale temperature and salinity
- Atmospheric forcing : ECMWF operational high resolution analyses and forecast (1 hour frequency)
- “4D” (SAM2 SEEK) Ocean analysis updated weekly (on Wednesdays)
- 10-day forecast updated daily
- Nov 2020-now daily/monthly/hourly variables

Operational forecasting systems



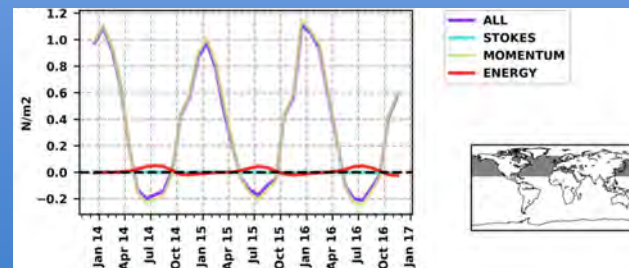
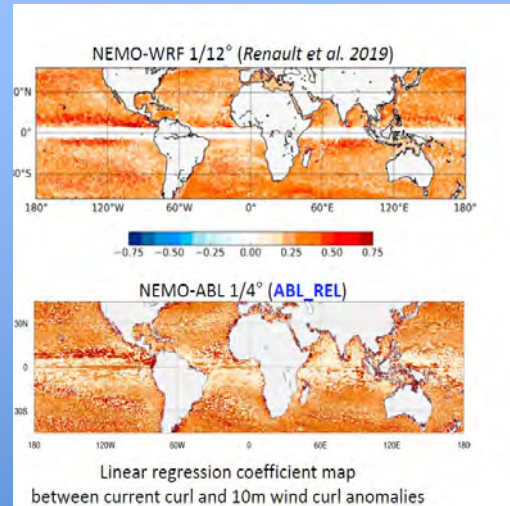
Ocean Reanalysis



- Improving trends in ocean model simulations
- Effective resolution in ocean model
- Ocean model HPC optimization
- Optimal resolution of ocean models
- Coupling and interaction between model components
- Hybrid model

Forcing

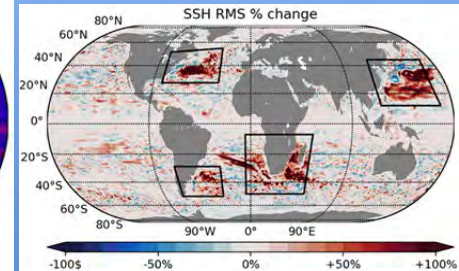
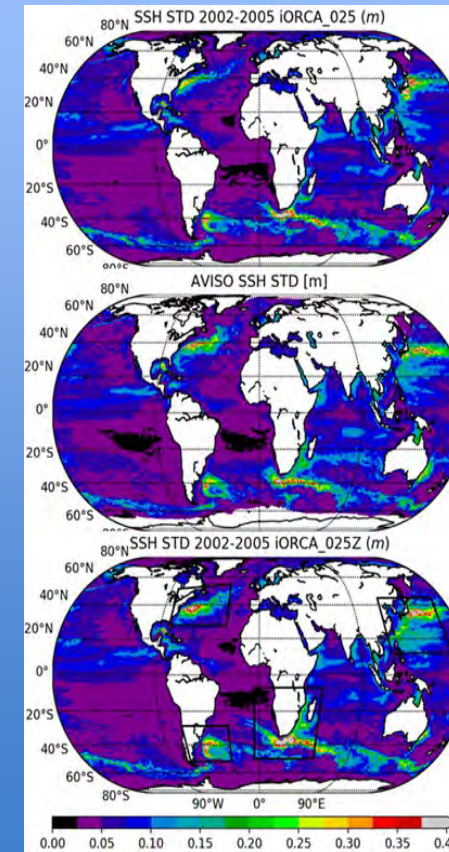
ABL, Waves
Copernicus, NEMO



Wind stress time series differences (with respect to REF)

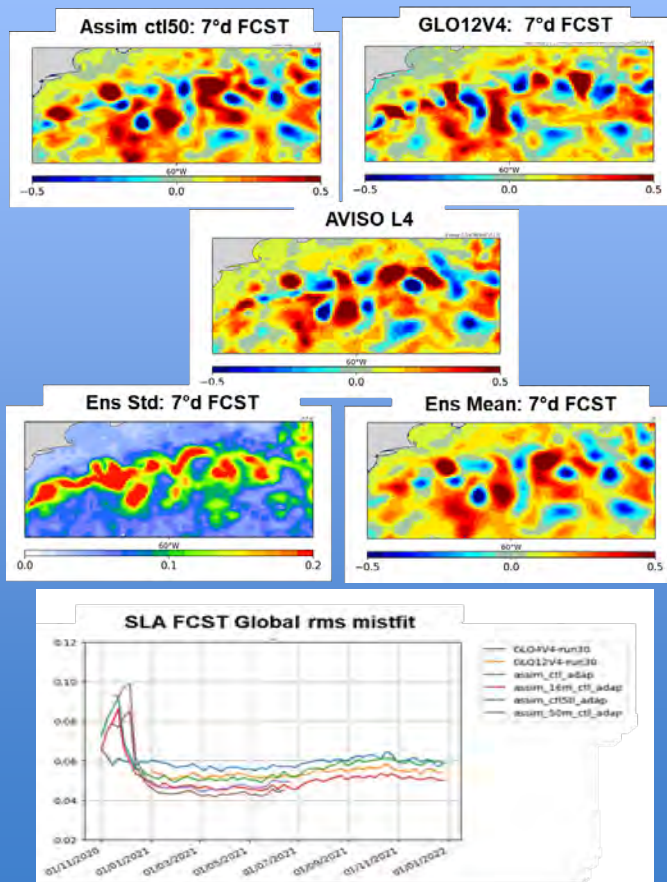
Resolution

AGRIF, Downscaling
Copernicus

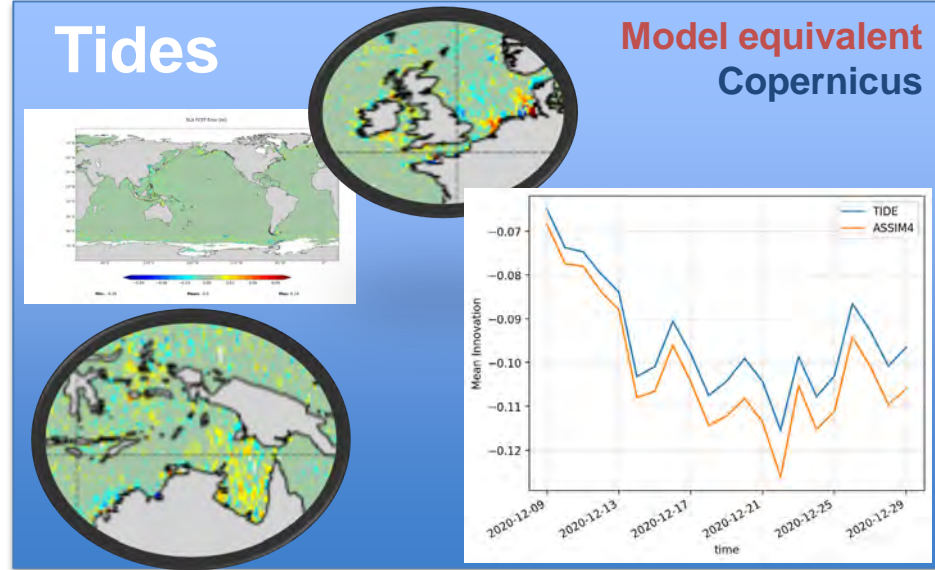


- Uncertainty quantification
- Coherent assimilation of large/meso/small scales
- New processes in the system
- Coherent assimilation of blue/white/green information

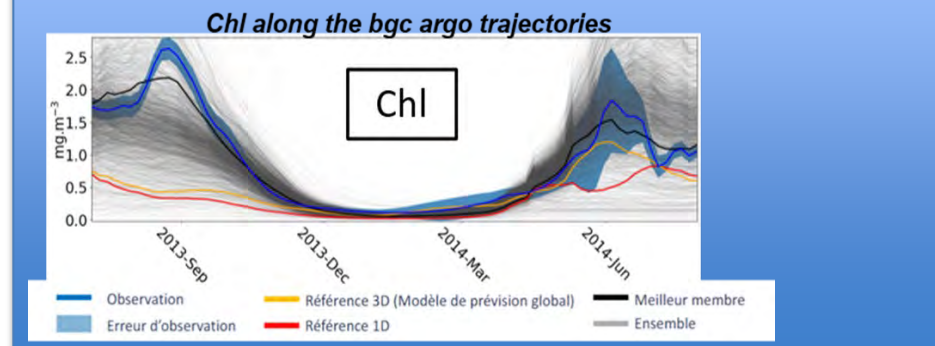
Ensemble Assimilation Scheme Copernicus



Tides Model equivalent Copernicus



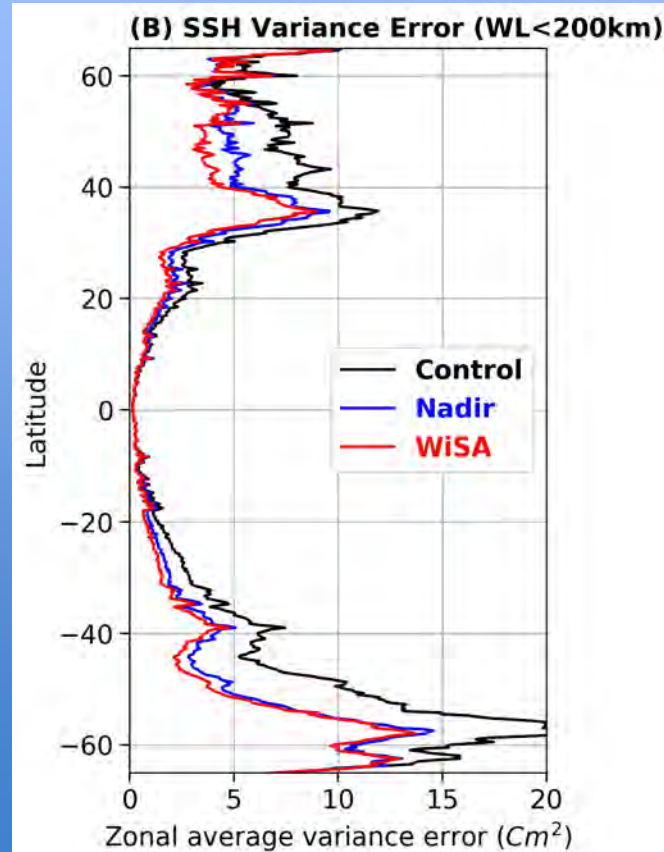
BGC Optimisation of parameters Eurosea, Copernicus



- Constrain mesoscale ocean features
- Provide regular information to design ocean observation network to improve representation of ocean state including the unobserved areas and parameters and the coastal zones.
- Design, co design and produce ocean frontier experiments to provide and share reference nature runs and to perform sensitivity experiment.

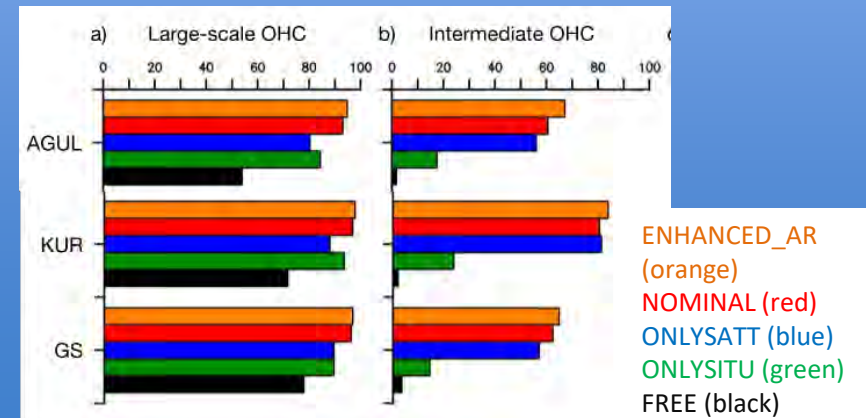
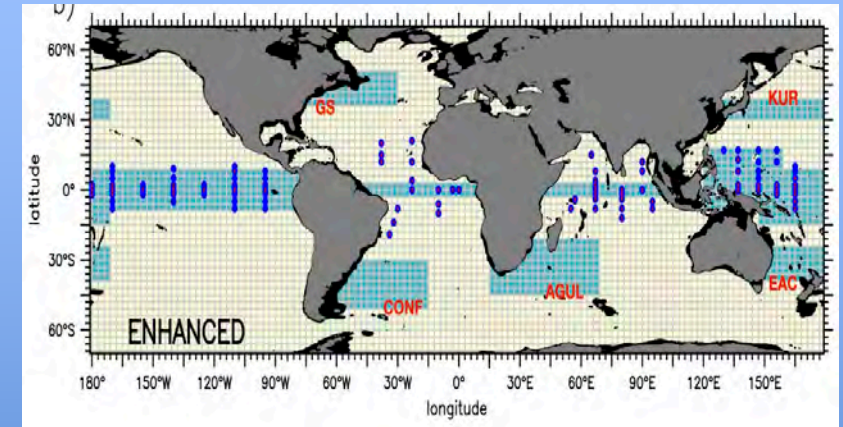
Altimetry

SWOT & Large Swath
CNES, ESA



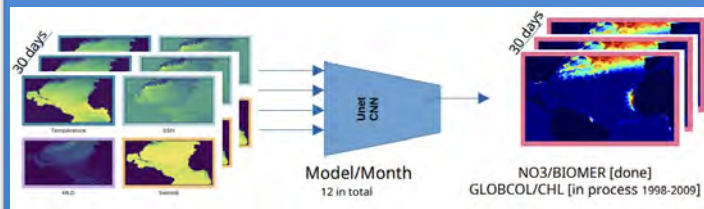
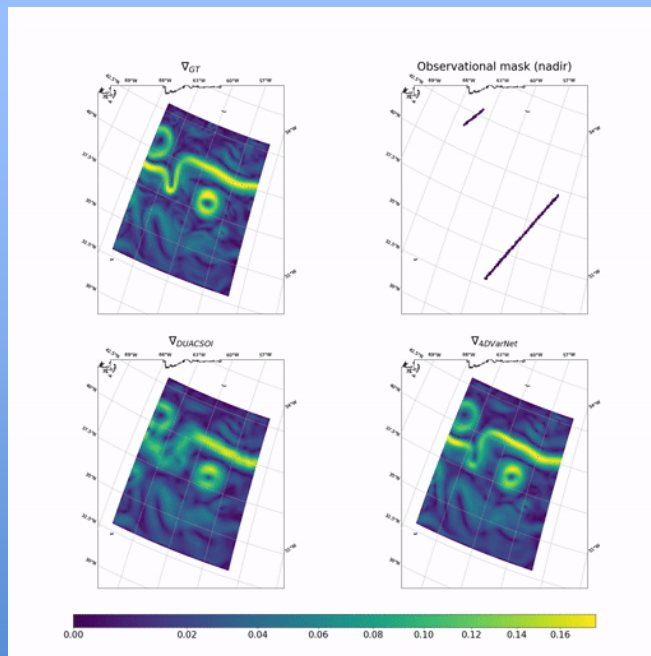
In Situ

Design Eurosea



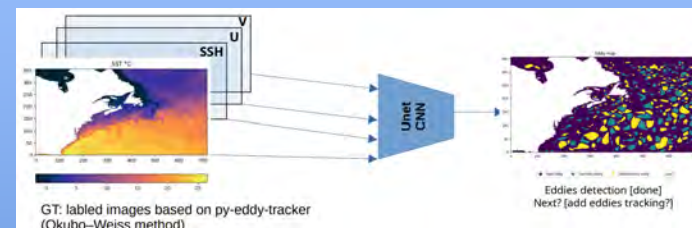
- Emulators for hybrid modeling.
Start development in the framework of EDITO Model Lab project and dedicated NEMO working group
- AI for validation and applications .

Fields reconstruction

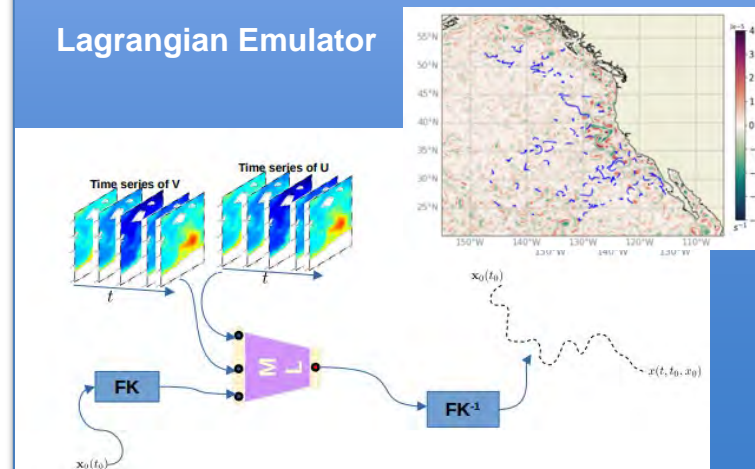


Lagrangian advection and mesoscale structure detection.

Train ML mode to detect mesoscale eddies from SST, SSH, currents



Lagrangian Emulator



Copernicus Marine service


Services and users

Copernicus Marine & Wekeo



European Commission

DG DEFIS


BLUE OCEAN
Currents, temperature, waves, sea level, ...

WHITE OCEAN
Ice coverage, velocity, concentration, icebergs ...

GREEN OCEAN
CO₂, nutrients, oxygen, primary production, ...

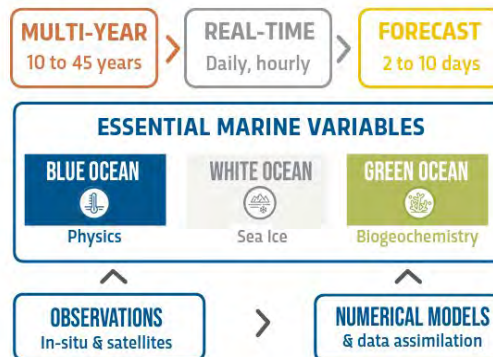
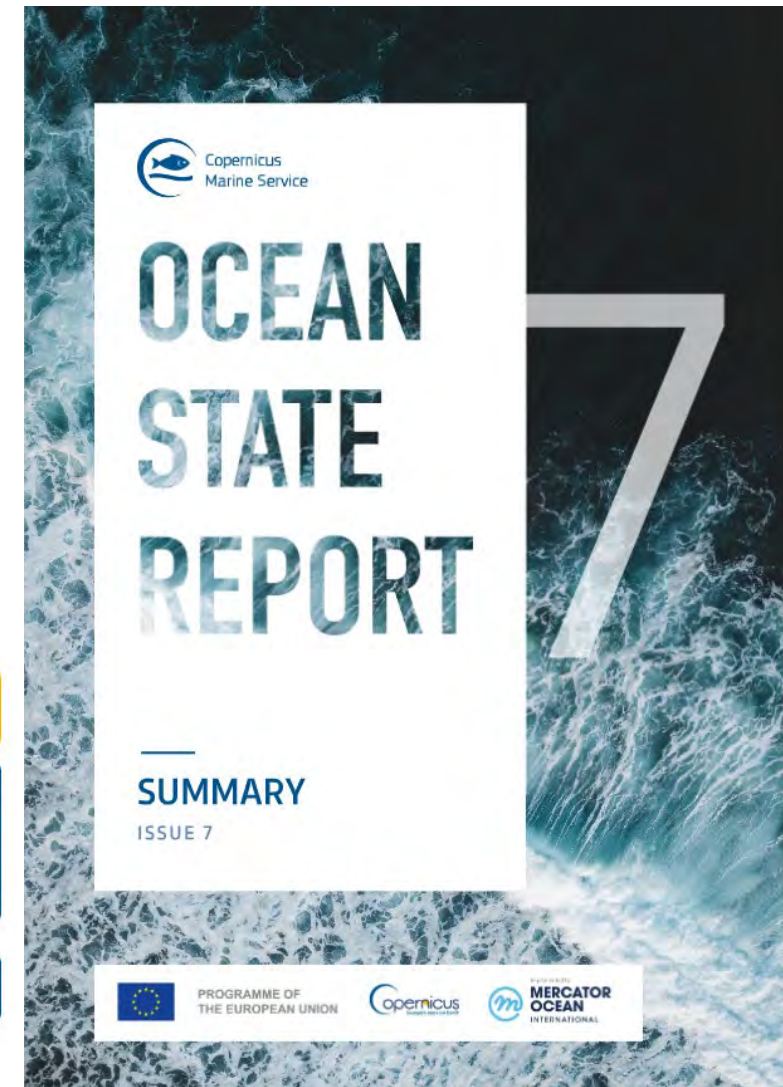
Copernicus Marine Service in COPERNICUS 2:
Continuity of the Blue/White/Green Offer
+ a series of major evolutions developed depending on priorities & budget

Coastal
Arctic
Marine Biology
Ocean Climate
Digital services



COPERNICUS MARINE REGIONAL OCEAN PRODUCT DIVISIONS

- 1 Global Ocean
- 2 Arctic Ocean
- 3 Baltic Sea
- 4 European North West Shelf Seas
- 5 Iberian Biscay Ireland Seas
- 6 Mediterranean Sea
- 7 Black Sea







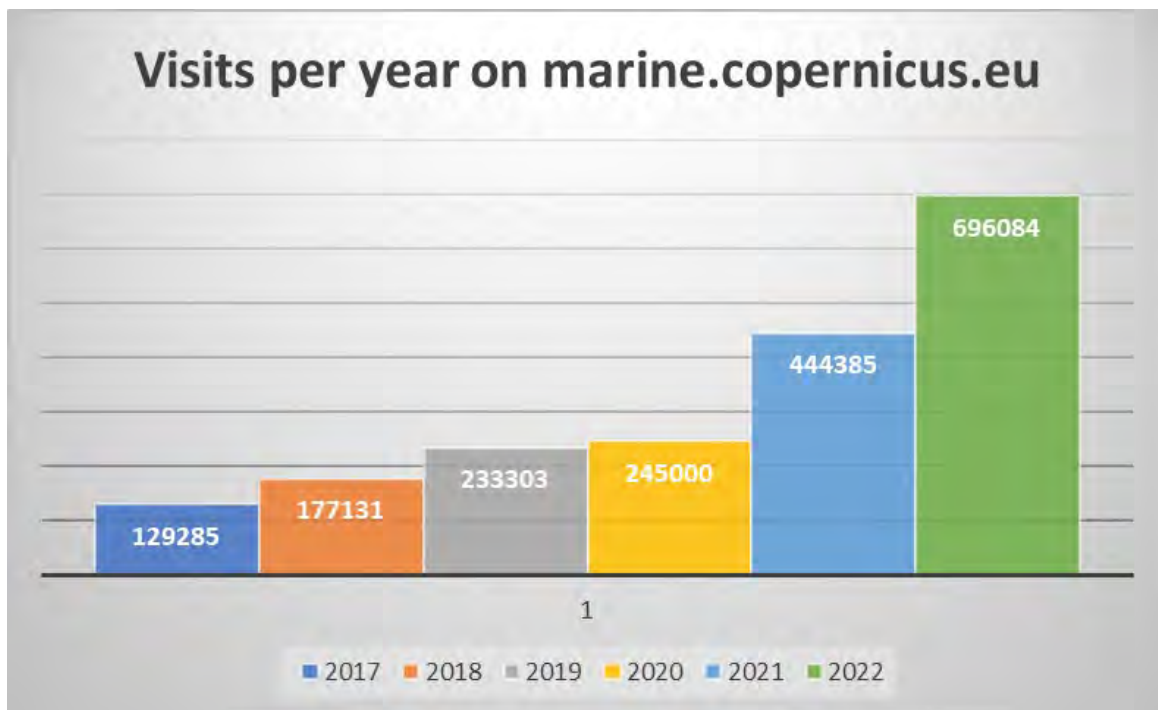
OCEAN
STATE
REPORT

7

SUMMARY

ISSUE 7


PROGRAMME OF THE EUROPEAN UNION





696 000 visits last year

Evolution 2017-2021 : **+ 438%**

Evolution 2021-2022 : **+ 56%**

WEB AUDIENCE HAS DRASTICALLY RAISED

31% Downloads by Business
62% Downloads by Public sector



OVERALL USER SATISFACTION:

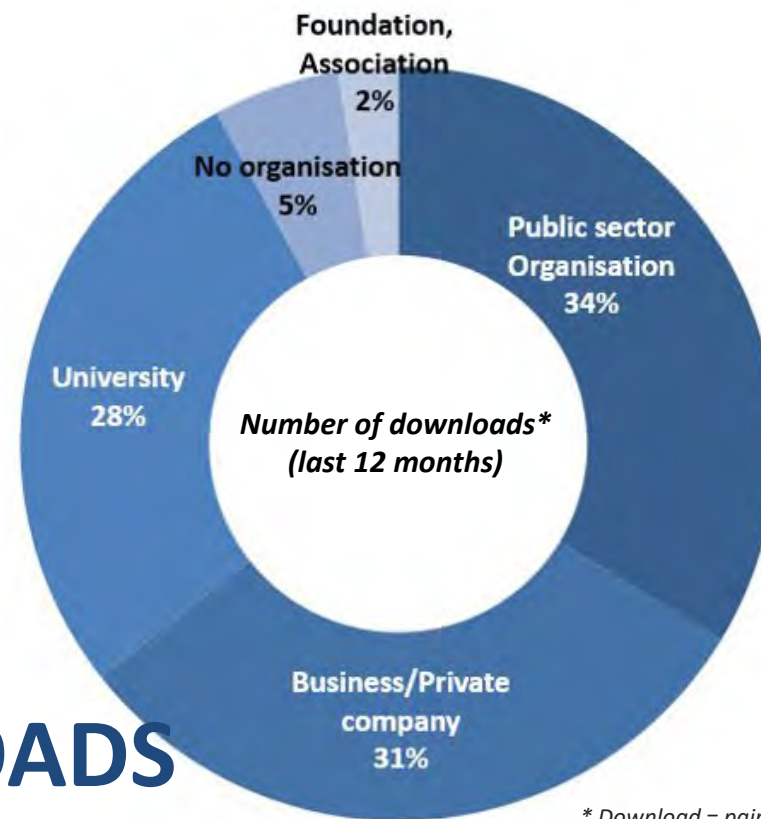
4,2/5

User Survey 2022

USER SATISFACTION ABOUT USER SUPPORT:

4,7/5

Last 12 months



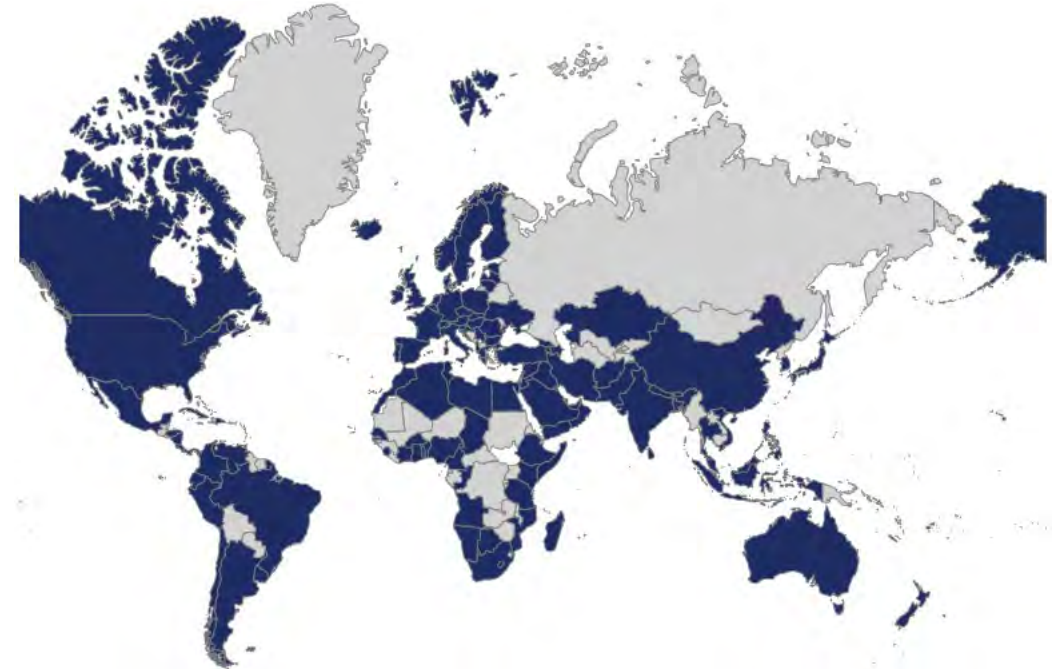
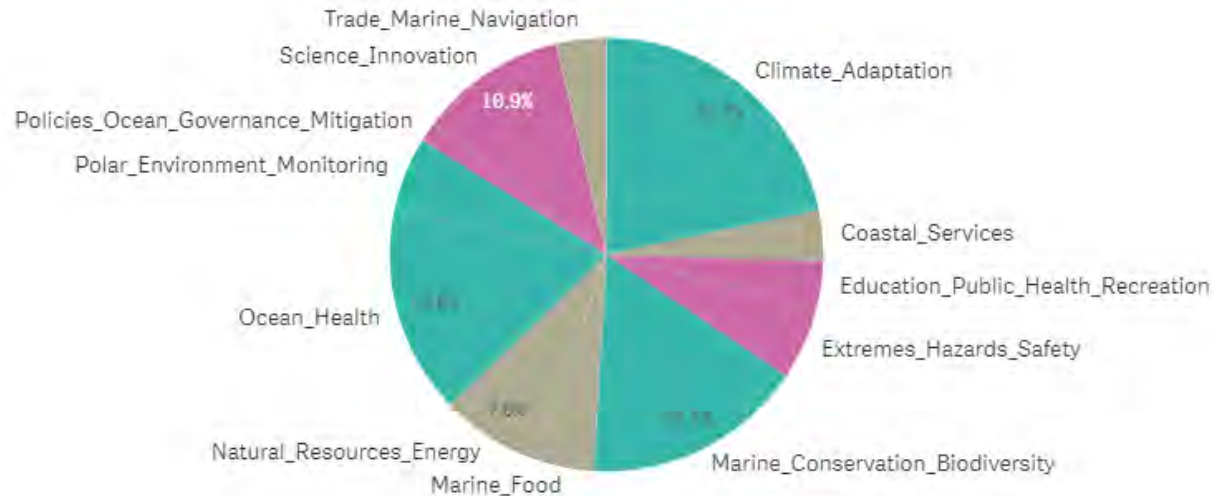
* Download = pair user/dataset per day

USER SATISFACTION AND DOWNLOADS

2023

Product	Downloads	Users	Data size (TB)
GLOBAL_ANALYSIS_FORECAST_BIO_001_028	110 332	1 529	40,610
GLOBAL_ANALYSISFORECAST_PHY_001_024	708 020	4 600	1 277,551
GLOBAL_ANALYSISFORECAST_WAV_001_027	233 092	1 085	114
GLOBAL_MULTIYEAR_BGC_001_029	4 244	784	85,515
GLOBAL_MULTIYEAR_BGC_001_033	763	122	4,483
GLOBAL_MULTIYEAR_PHY_001_030	24 437	3 030	699,976
GLOBAL_MULTIYEAR_WAV_001_032	3 771	491	26,142
GLOBAL_REANALYSIS_PHY_001_026	333	110	1,050
GLOBAL_REANALYSIS_PHY_001_031	3 323	534	203,215

Applications ([Blue Markets](#))



Digital Twin of the Ocean

Digital Twin Ocean



European Commission

DG RTD
DG MARE



(DG CNECT)

DISCOVER TWO EU INTERDEPENDENT PROJECTS BUILDING
THE EUROPEAN DIGITAL TWIN OF THE OCEAN

EDITO ModelLab
European Digital Twin Ocean

A 3-year project aiming to develop the next generation of ocean models, combining artificial intelligence and high-performance computing, to be integrated into the EDITO public infrastructure, providing access to focus applications and simulations of different what-if scenarios

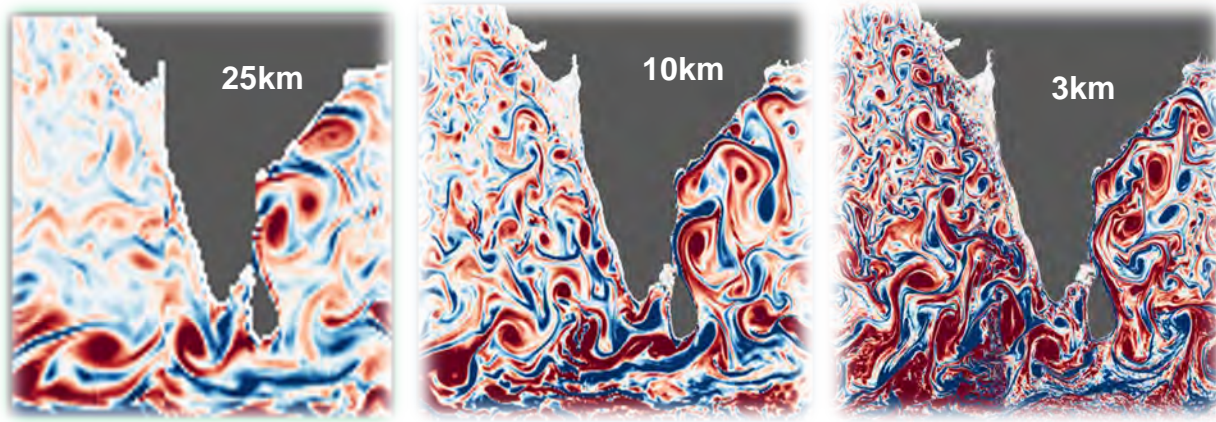
DISCOVER EDITO-MODEL LAB

EDITO Infra
European Digital Twin Ocean

A 2-year project that will build the public infrastructure backbone for EDITO by integrating key data service components (among which Copernicus Marine Service and EMODnet), and by sharing cloud processing capabilities and software into a single digital framework

DISCOVER EDITO-INFRA

PROJECTS

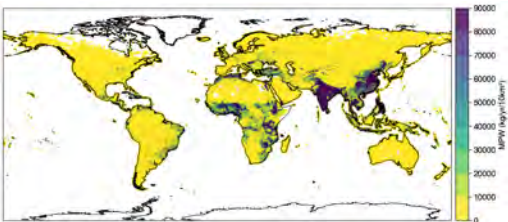


New reference high resolution global simulation

What are the impacts of river and continental inputs of plastics, at what spatial and temporal scales?

1. Plastic waste input

Continental waste

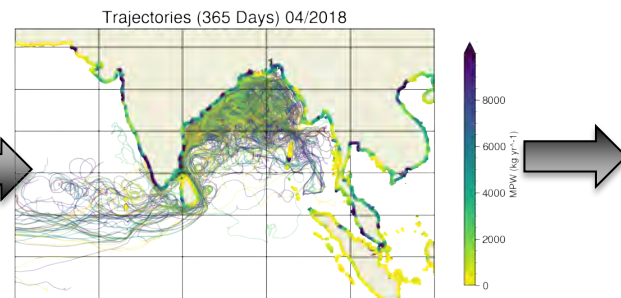


Riverine waste

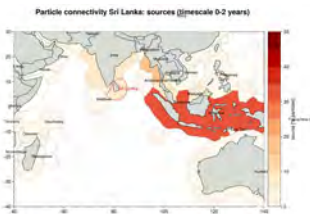
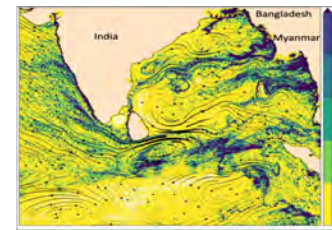


2. Transport in the ocean

Lagrangian modeling



3. Monitoring plastic, and quantifying exposure



4. What if scenario:
Evaluate impact of plastic removal
action plans
e.g. focus on coastal vs riverine?

Community and DCC

Ocean Prediction *DCC*



UNESCO-IOC



Contribution to OceanPrediction DCC Ocean Forecasting co design group

- Status, current landscape, gap analysis
- Definition of architecture
- Operational Readiness Level