

# 9<sup>TH</sup> EUROGOOS INTERNATIONAL CONFERENCE



## Seamless earth system approach for operational marine climate service

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*With contribution from 19 EuroGOOS partners*

# Operational information service for marine climate change adaptation

- **User needs**

- Implementation of Green Deal at national level: GHG neutral emission in 2050; more climate resilient socioeconomy, infrastructure and environment

- **Scope: ocean's role in GD**

- Climate indicator service
- Pilot services to support marine climate adaptation pathways

- **Scales**

- From synoptic (days) to climatic scales (up to 100yrs)
- Open sea-coastal-esuary for national applications
- PHY-BGC-BIO-socioeconomic

- **Platform: Operational marine climatology**

- **Objectives:**

- To establish a database of high resolution Climate-PHY-BGC-BIO projections in EU seas;
- To quantify uncertainties in models and projections
- To reduce forecast and projection uncertainties by developing MME;
- To develop an interactive, harmonized, European Marine Climate Atlas web-service
- To develop an interactive, integrated web-service for multi-sectoral coastal and offshore operations
- To engage end-users to co-design the marine climate services
- To develop five pilot services to support marine climate change adaptation pathways

# State-of-the-art on operational marine climatology

## Observation databases:

- For model validation, extreme, variability and trend analysis
- In-situ: sea level, T/S, oxygen, nutrients, carbon, pH
- Satellite: sea level, waves, winds, SST, chl-a, optics, salt marshes, coastal erosion

**Model database:** coastal ocean projections mainly developed by MS.

## Modelling:

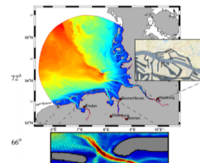
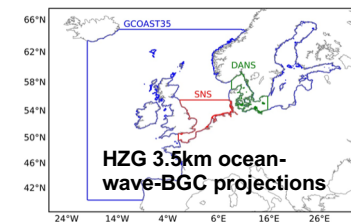
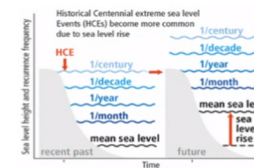
- **CMEMS modelling system: regional seas**
- **Member States:**
- Open sea-coastal-estuary PHY-BGC modelling
- Climate-Hydrological modelling
- Climate-PHY-BGC-BIO-Socioeconomic modelling
- E2E modelling Atlantis

## Product & Service:

- CMEMS: OMIs, OSRs
- Member States: climate indicator service
- Regional: e.g. BalticEarth-HELCOM indicator service

**Table I.** Existing high resolution marine climate projections produced by EuroGOOS partners

	Waves	Ocean(-ice)	BGC	BIO
<b>EU Arctic</b>	MET.No (Nordic Seas)	IMR (Barents Sea)		
<b>Baltic-North Sea</b>	HZG	DMI, HZG, SMHI, BSH	SMHI, HZG	
<b>North-East Atlantic</b>	HZG, MET.no, MI (SW Ireland),	HZG, IEO (NW Iberia) and MI (SW Ireland)	HZG	
<b>Mediterranean</b>	CSIC	CSIC, OGS	OGS	



## What we already have

- Climate hindcast/reanalysis, projections
- Best practices on national & regional climate (web) service
- Multi-model ensemble forecast



## Gaps on operational marine climatology

### Observation databases:

- Length: mainly during satellite era
- Variables: lack of BGC esp BIO variable long-term records

**Model database:** lack of coastal-estuary projections

### Product & Service:

- Significant gaps
- Fragmented, lack of coordination

### Numerical modelling & resources:

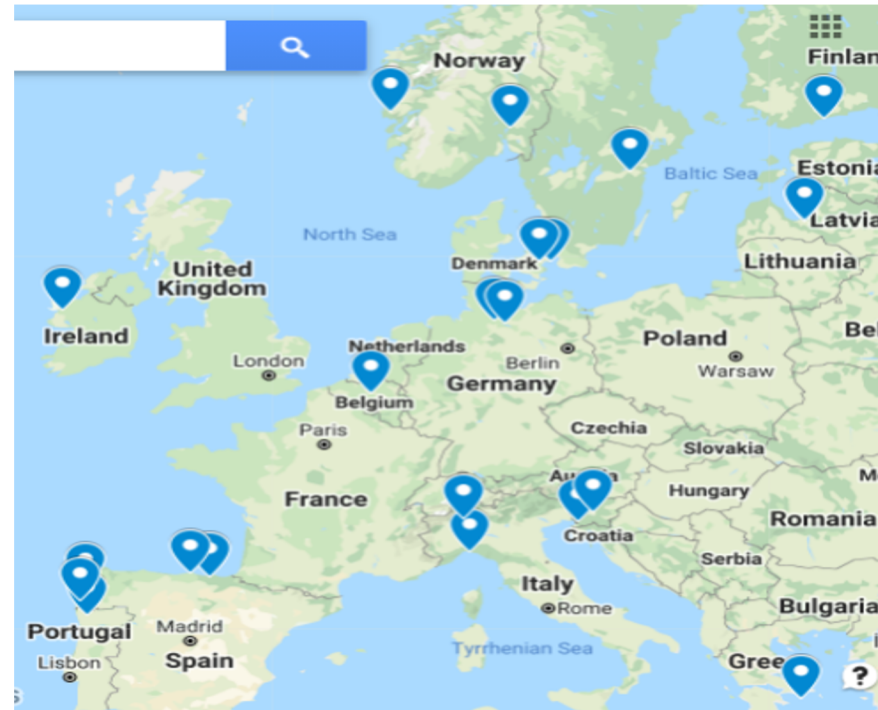
- Long-term performance of operational models yet to be validated
- Fully coupled system yet to be developed
- Lack of critical mass on operational marine climatology

### Data modelling

- Advanced multivariate and non-stationary extreme value analysis for complex geospatial data have not been widely applied for predicting future extremes

# Marine climate service partnership (24 partners, 14 countries)

Partner name	Country
Danish Meteorological Institute (DMI)	DK
Slovenia Environment Agency (ARSO)	SI
Aarhus University (AU)	DK
FUNDACIÓN AZTI – AZTI FUNDAZIOA (AZTI)	ES
The Federal Maritime and Hydrographic Agency (BSH)	DE
Agencia Estatal Consejo Superior de Investigaciones Científicas (CSIC)	ES
Technical University of Denmark (DTU)	DK
ETT SpA (ETT)	IT
European Global Ocean Observing System (EuroGOOS)	BE
Finnish Meteorological Institute (FMI)	FI
Hellenic Centre for Marine Research (HCMR)	GR
Helmholtz-Zentrum Geesthacht (HZG)	DE
Instituto Español de Oceanografía (IEO)	ES
The Institute of Marine Research (IMR)	NO
Italian Institute for Environmental Protection and Research (ISPRA)	IT
Latvian Institute of Aquatic Ecology (LHEI)	LV
DXCASC (MeteoGalicia)	ES
Marine Institute (MI)	IE
MetNorway (METNO)	NO
Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)	IT
Institut Royal des Sciences Naturelles de Belgique (RBINS)	BE
Swedish Meteorological and Hydrological Institute (SMHI)	SE
University of Latvia (UL)	LV
Universidade do Minho (UMINHO)	PT



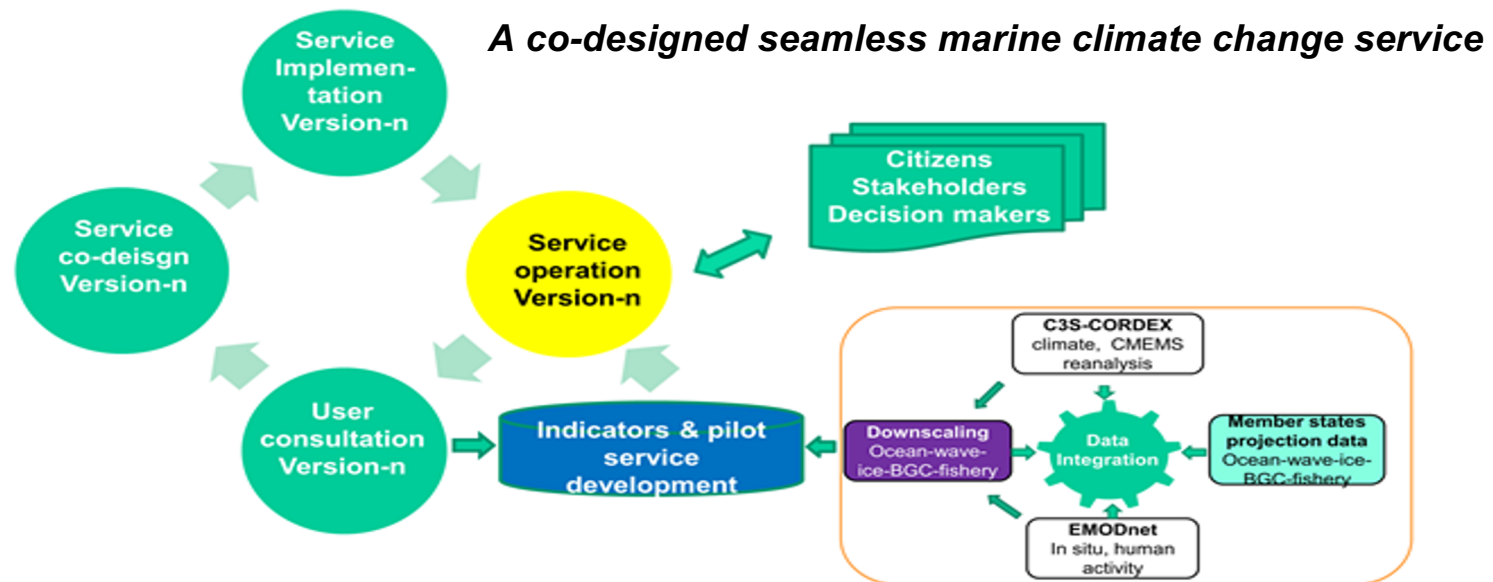
## Marine climate service to be developed – a preliminary mapping

Sea basin	Marine climate atlas	MME forecast	Blue carbon	Green shipping	Blue energy	Marine resources	coastal adaptation
Arctic/ GIN Seas	√	√		√		√	√
Baltic Sea	√	√	√	√	√	√	√
NW Shelf Sea	√	√		√	√		
Iberia-Biscay-Irericsh Seas	√		√			√	√
Mediterranean Sea	√	√	√	√		√	√

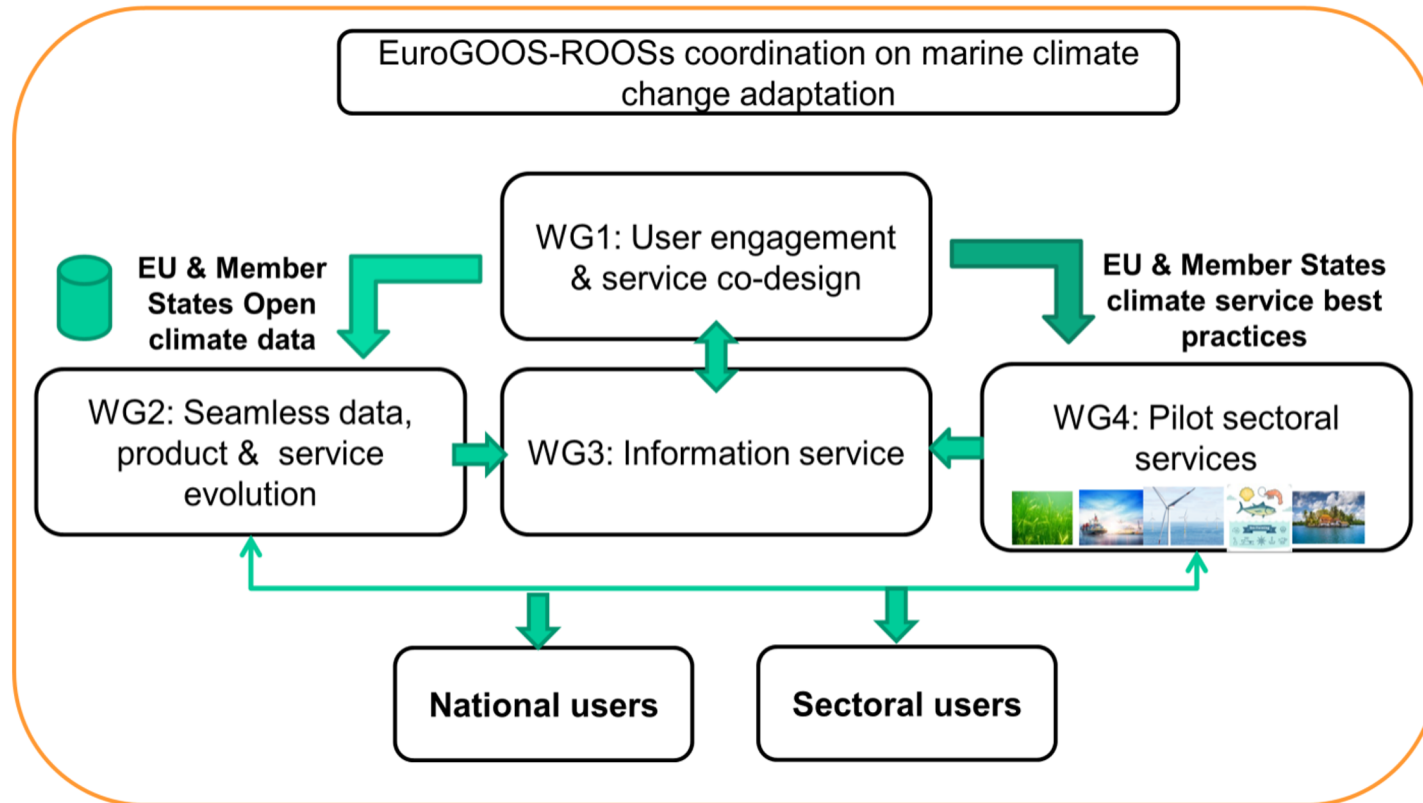
- Marine climate atlas: to provide a comprehensive marine climate indicator service
- Blue carbon: a pilot service to map the distribution of blue carbon and support mitigation strategies and preserving blue carbon ecosystems

# Operational marine climatology: implementation

- Support implementing **marine pathways for Green Deal**: blue carbon, green shipping, blue energy, Aqua-farming & fishery, resilient coastal zone
- Establish **marine climate projection database**
- Develop **marine climate analysis tools**: extremes and statistics of complex data
- Produce **marine climate indicators**



# Operational marine climatology: Organization







External funding is needed to implement the seamless European  
marine climate service

Thank you!