

# MELODIES – Kick Off Meeting

University of Reading

20<sup>th</sup> – 21<sup>st</sup> November 2013

Work Package 6

Assessment of Good Environmental Status  
for the oceans and seas

Partners: ACS, INGV

# Motivation/background

- Copernicus Marine Service provides new open source data in Europe to contribute to GEOSS societal benefit areas and in particular for: Water, Climate, Disasters, Weather, Ecosystems, and Energy
- Recently (2010) Europe adopted a new Directive, to be implemented by Member States by 2015, that should assess ‘Good Environmental Status (GES)’ for European marine areas
- New commercial activities could develop by creating technological tools to post-process the available data (sustain the blue economy in Europe)

# Motivation/background

- The main strategic goal of the Marine Directive is to achieve Good Environmental Status of EU marine waters by 2020
- GES = The environmental status of marine waters where these provide ecologically diverse and dynamic oceans and seas which are clean, healthy and productive” (Article 3 of the Directive)

# Motivation/background

Eleven GES descriptors:

1. Biodiversity is maintained
2. Non-indigenous species do not adversely alter the ecosystem
3. The population of commercial fish species is healthy
4. Elements of food webs ensure long-term abundance and reproduction
5. Eutrophication is minimised
6. The sea floor integrity ensures functioning of the ecosystem
7. Permanent alteration of hydrographical conditions does not adversely affect the ecosystem
8. Concentrations of contaminants give no effects
9. Contaminants in seafood are below safe levels
10. Marine litter does not cause harm
11. Introduction of energy (including underwater noise) does not adversely affect the ecosystem

# What will the service/application do?

- Application:
  - 1) toolbox for interpolation of Met-ocean and marine data sets into a common, interoperable format so that they can be discovered and analyzed together
  - 2) toolbox of GES characteristics and indicators that can be extracted from the Met-ocean and marine data
- Service: extraction of GES characteristics and indicators and their provision by visualization, downloading and linked data set

# The descriptors and Characteristics in the Marine Strategy Framework Directive

<b>Descriptors</b>	<b>Characteristics and/or indicators that can be extracted from Met-ocean and marine data</b>
<b>Biodiversity</b>	<b>NONE</b>
<b>Non-indigenous species.</b>	<b>NONE</b>
<b>Populations of all commercially exploited fish and shellfish.</b>	<b>NONE</b>
<b>Marine food webs and their components.</b>	<b>Phytoplankton, bacterioplankton and zooplankton biomass climatology and standard deviations, trends</b>
<b>Human-induced eutrophication.</b>	<b>Satellite ocean color and Common Specific Indicator (CSI) 023, oxygen concentration</b>
<b>Sea-floor integrity.</b>	<b>NONE</b>
<b>Hydrographical conditions.</b>	<b>Temperature, Salinity fields and trends, ice cover mixing indicator, upwelling indicator and residence time</b>
<b>Concentrations of contaminants.</b>	<b>NONE</b>
<b>Contaminants in fish and other seafood.</b>	<b>NONE</b>
<b>Marine litter.</b>	<b>NONE</b>
<b>Energy introduction, including underwater noise</b>	<b>NONE</b>

# Who are the direct users?

- The scientific community at large
- The European Environmental Agency and its Thematic Centers
- The Met-ocean services and consulting companies
- The Members States marine environmental protection agencies (Letter of interest from ARPAL)

# The 'wider' benefit

- Assessment of Good Environmental Status done with pan-european protocols and methods
- Show the possibility to extract indicators from the Copernicus Marine Service data in a consistent way for all European Seas and the global ocean
- Contribute to the big data science for oceanography and meteorology



# Data Inputs

- Data sources :
  - DI-1 Copernicus re-analysis data sets: temperature, salinity, currents, ice cover, phytoplankton, bacterioplankton and zooplankton, oxygen and dissolved nutrients
  - DI-2 Copernicus satellite data reconstructions: multi-satellite sea surface temperature, ocean color and sea level
  - DI-3 ECMWF ERA-INTERIM data sets for surface variables: air temperature, 10 m winds, humidity, clouds, mean sea level pressure, precipitation
  - DI-4 EMODNET chemical, physical and habitat data sets

# Data Inputs

- Access method: subsetter, direct download, ftp
- Format:
  - DI-1,-2,-3 are in NetCDF-CF format
  - DI-4 probably in text format
- Size: referred to monthly mean data
  - DI-1 has from 7 MB (Baltic area) to 1.8 GB (Global ocean) data sets, 10-40 years time series available
  - For the rest to be found out

# Data Inputs

- All data are open and free
- Pre-processing is required, carried out by interpolation toolbox
- Challenge: the subsetting method and software
- Products are evolving: size is expected to increase
- Use of data from WP9 (MetOcean services to the marine transport sector) to be considered carefully

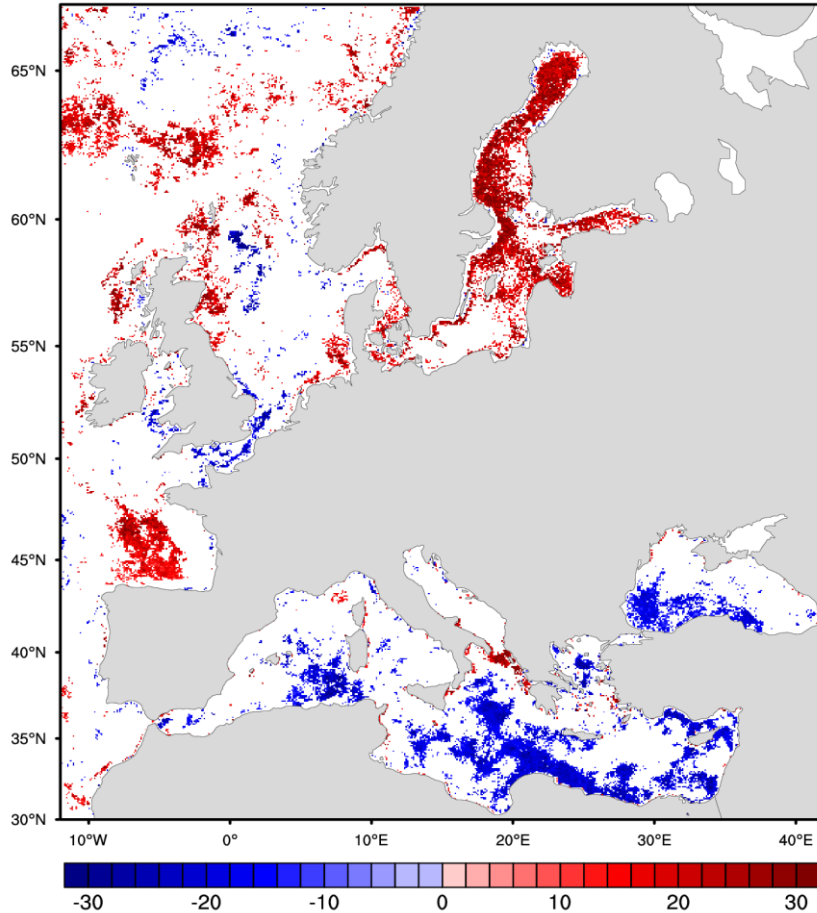
# Data outputs

- Data are Geo-spatial arrays representing the specific indicators of GES
- Format is NetCDF
- Size is the same order of magnitude of input time series (some GB for 10 years at global scale)
- Data policy: open

# Data Outputs

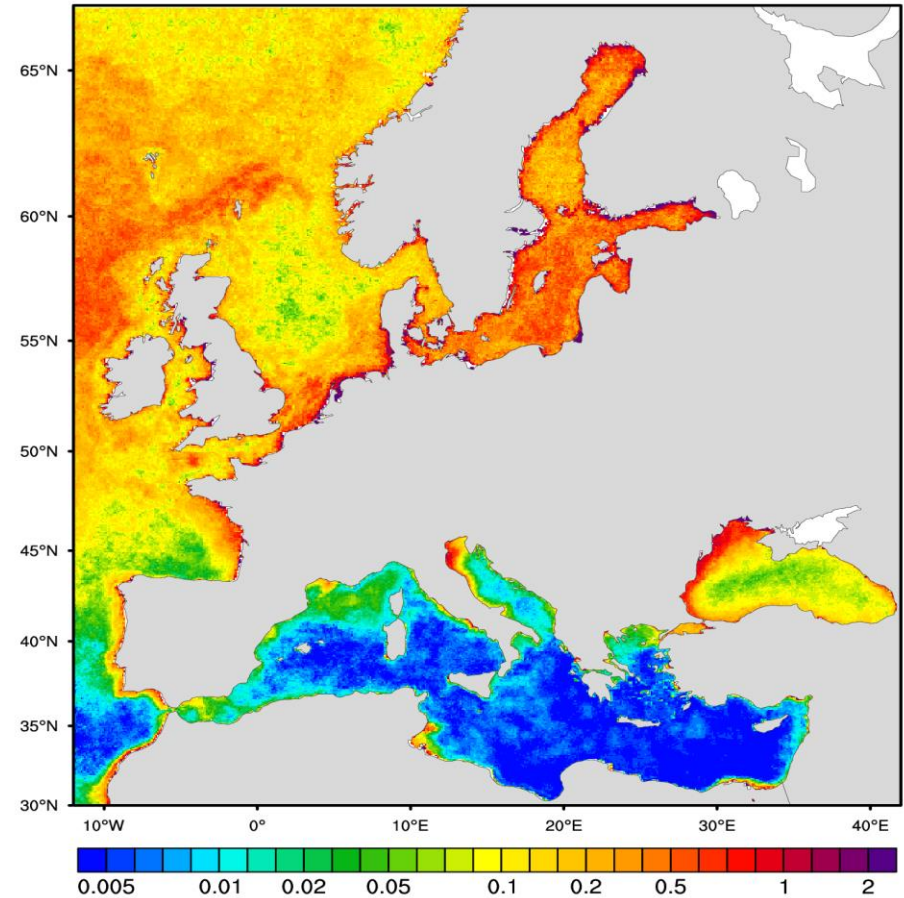
- Example for GES indicator CSI023(+) Chlorophyll in transitional, coastal and marine waters

CSI023(+), mg m<sup>-3</sup> (mg m<sup>-3</sup>)-1 yr<sup>-1</sup>



Ocean Color Chl-a Std. Dev., mg m<sup>-3</sup>

1998-2009 May-September



**CSI023 (+) in [mg m<sup>-3</sup> (mg m<sup>-3</sup>)<sup>-1</sup> y<sup>-1</sup> ]  
units and 1998-2009 period.**

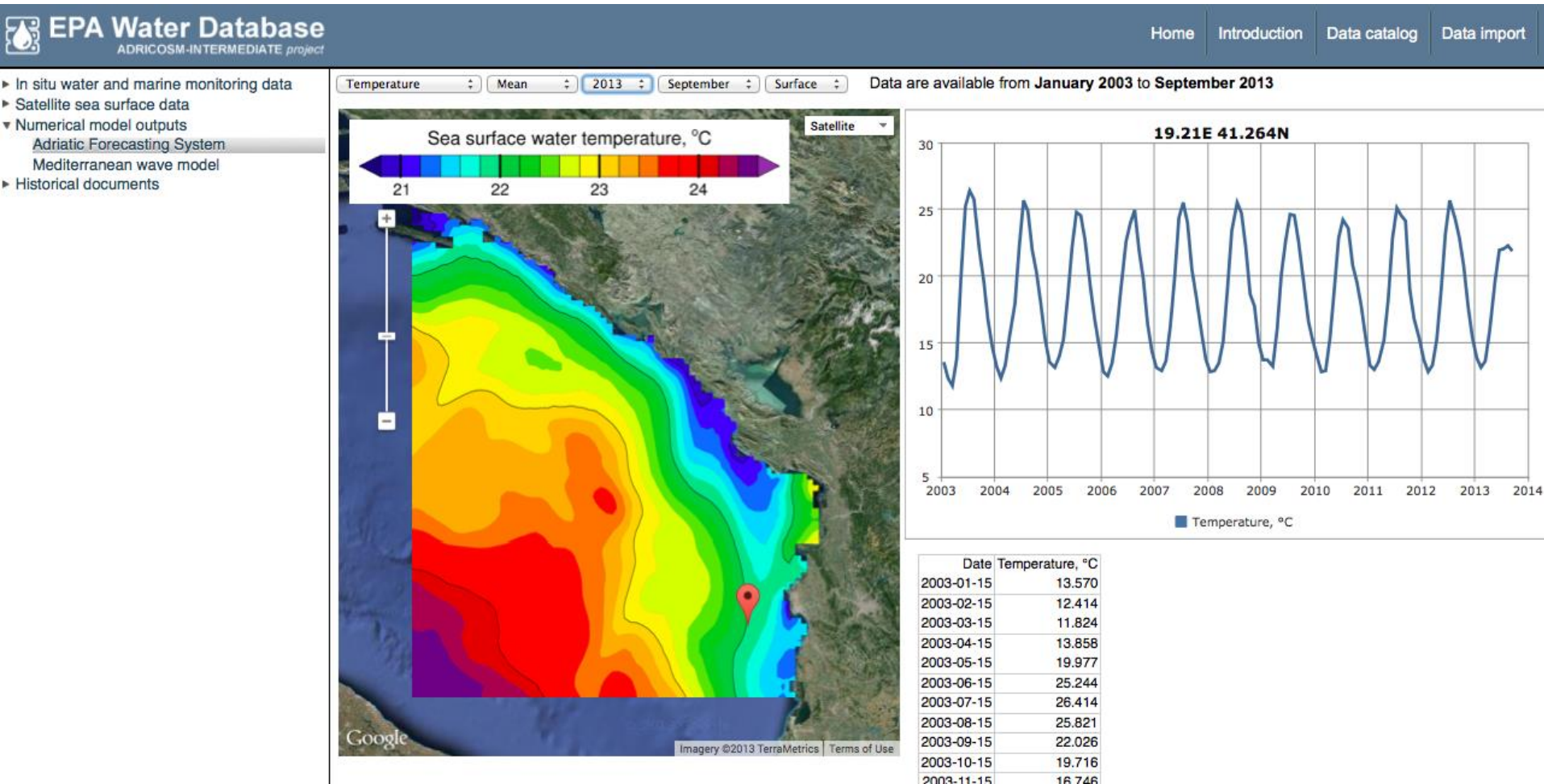
**Standard deviation in [mg m<sup>-3</sup>]  
for the period 1998-2009.**

# Computing requirements

- Pre-processing of data needs several hours of a single processor while extraction of GES indicator is few minutes
- Should be valuable to be on-demand but probably for the global ocean should be offline

# Output visualization

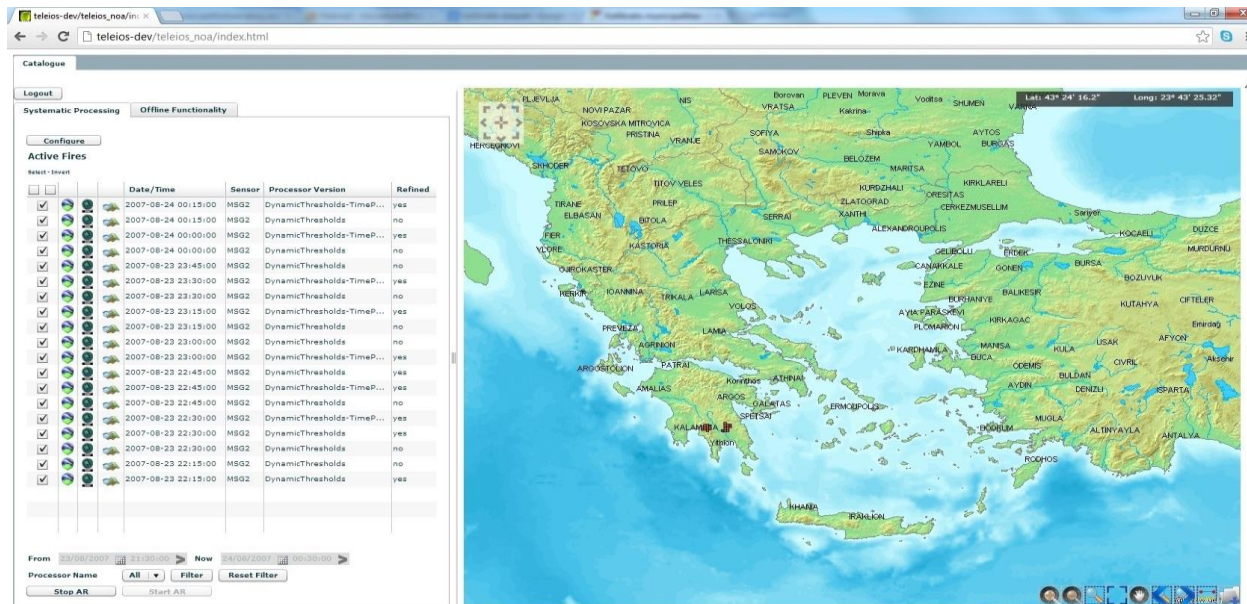
- Example of GES Service GUI



# Output visualization

In general terms:

- Outputs are grids of parameters displayed over some configurable GIS layers
- The visualization will be based on WebGIS systems developed by ACS and INGV





# WP6 Timeline

- The first version (M12) of the toolboxes is designed and developed, featuring a simple Web User interface and some access to common data available on tech platform.
- The second version (M24) will feature all functionality, in some cases with limited performances. Tech platform will allow access to shared data, large-scale processing and linked data database.
- The third version (M32) will have an operational capability that will allow users to evaluate the service in view of a full scale deployment. The access to operational service hosting in tech platform will be added.