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# Priority Environmental Issues in the Mediterranean

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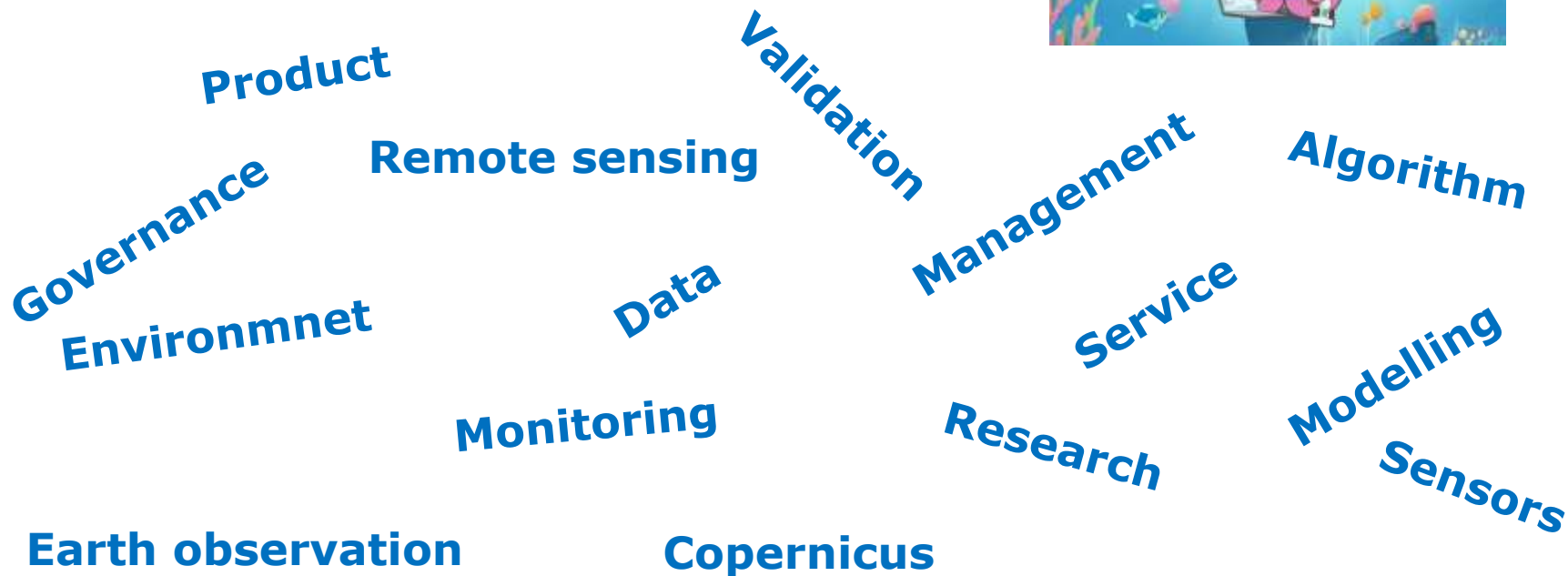
**ISPRA – Italian National Institute for Environmental  
Protection and Research**

Antonello Bruschi, Roberta De Angelis, Arianna Orasi



# Priority Environmental Issues in the Mediterranean

Once upon a time.....





# Priority Environmental Issues in the Mediterranean

Now I am telling you my story.....



- ✓ **Complexity of the coastal and marine management**
- ✓ **Complexity of Policies in Action for coastal and marine environment**
- ✓ **Connecting science and policy**
- ✓ **Tools for marine ecosystem management**
- ✓ **ESA data for marine environmental issues**





ISPRA

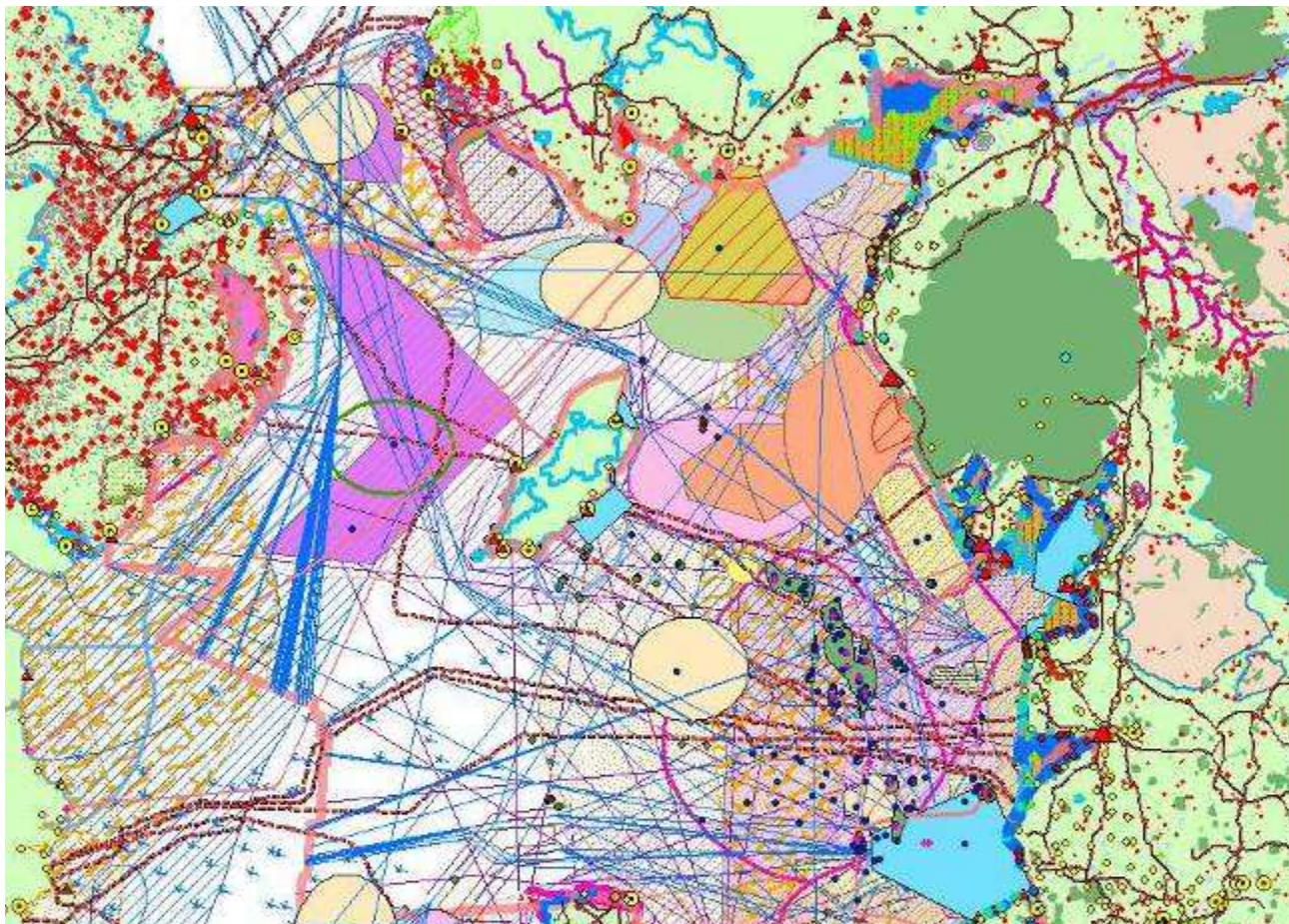
Istituto Nazionale per lo Studio e la Difesa Ambientale



Istituto Nazionale  
per lo Studio e la Difesa  
Ambientale

# Complexity of the coastal and marine management

- Landuse
- Tourism
- Oil & Gas
- Mariculture
- Coastal Defence
- Ports Navigation
- Military Activities
- Culture
- Conservation
- Dredging & Disposal
- Submarine Cables
- Fishing
- Renewable Energy
- Marine Recreation
- Mineral Extraction





# Complexity of Policies in Action for coastal and marine environment protection/management

**UWWT, Nitrates (EC, 1991)  
IPPC (EC, 1996) Directives:**

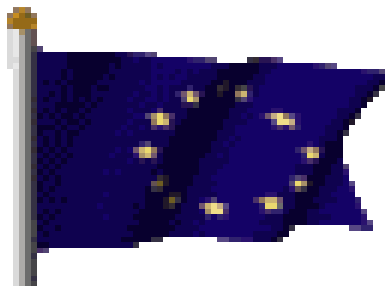
**Water Framework Directive  
(EC, 2000)**

**Priority Substances  
Directive (EC, 2008)**

**Floods Directive (EC, 2007)**

**Navigation safety (Directives  
2009/45/EC, 2003/25/EC,  
98/41/EC)**

## EU policies



**Habitats (EC, 1992) and Birds  
(EC, 1979 and 2009) Directives:**

**Common Fishery Policy (EC,  
2002, 2013)**

**ICZM Recommendation (EC  
2002) Protocol**

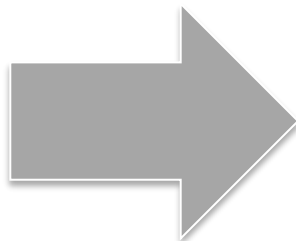
**Bathing Water Directive (EC,  
2006)**

**Marine Strategy Framework Directive (EC, 2008)**

**Maritime Spatial planning (EC, 2014)**



# How to promote the sustainable growth of maritime economies , preserving and protecting the marine environment?





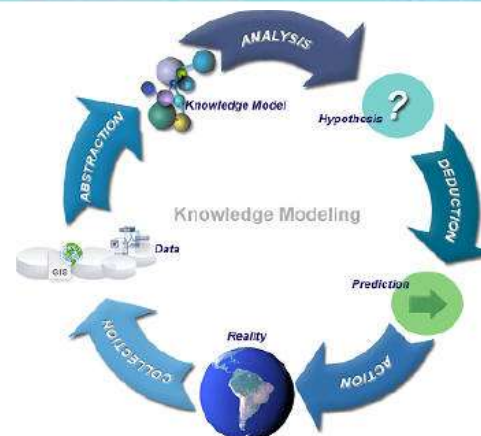


ISPRa

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e la Ricerca Ambientale

## Governance

**ISPRA is the bridge:  
connecting science and policy**



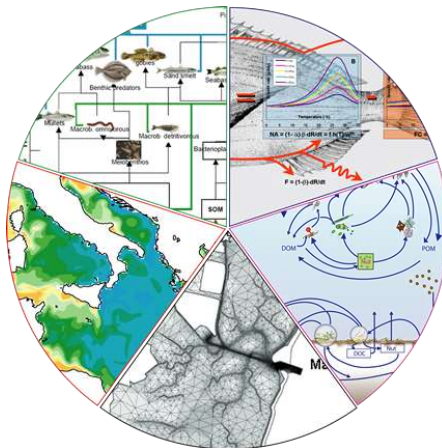
## Research

**Governance** builds its own decision-making elements through the basic knowledge, methods and tools of analysis provided by **Research**.

**Research** is continuously focused on new cognitive needs emerging from political needs.



# How to do that?



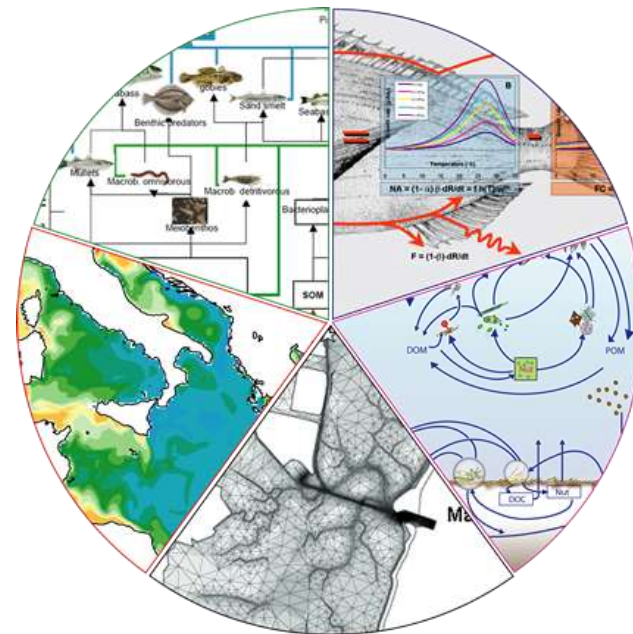
Using the right **tools** to understand the changing of the marine environment to answer the requirements of the legal frameworks.





# Tools for marine ecosystem management

- *In situ* data/mapping
- Earth observation/remote sensing
- Operational modelling

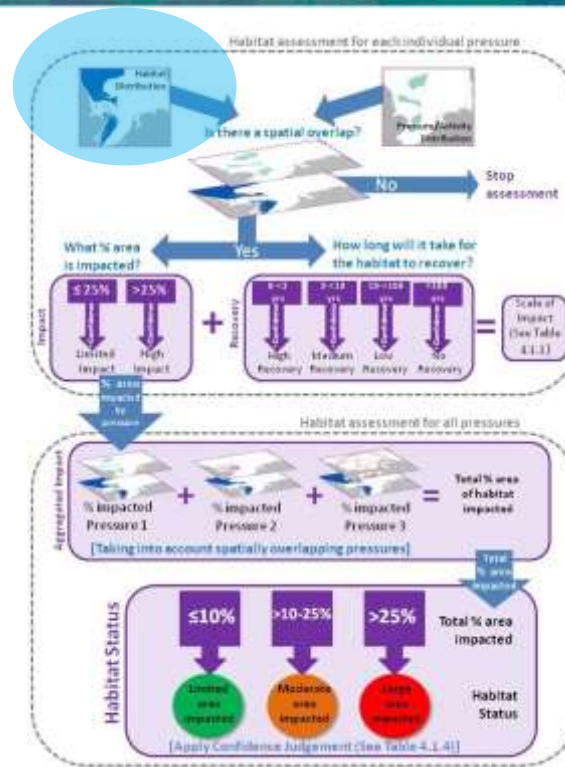




# Tools for marine ecosystem management

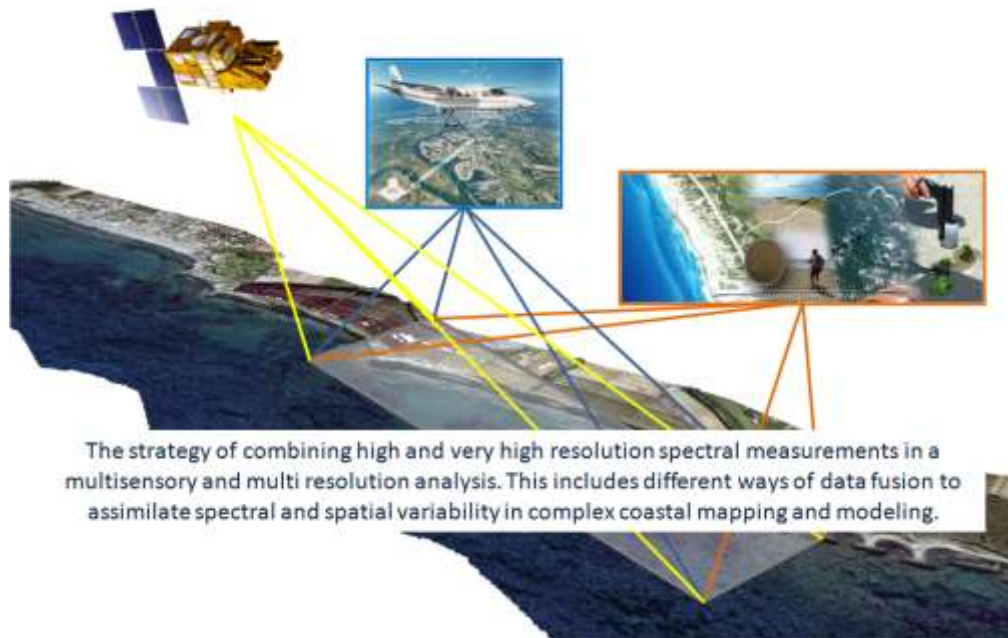
## Mapping

Standardized regional maps of marine environment can help in the development of predictive models of the ecosystem dynamics and can facilitate strategic planning to maximize management and conservation.





# Tools for marine ecosystem management

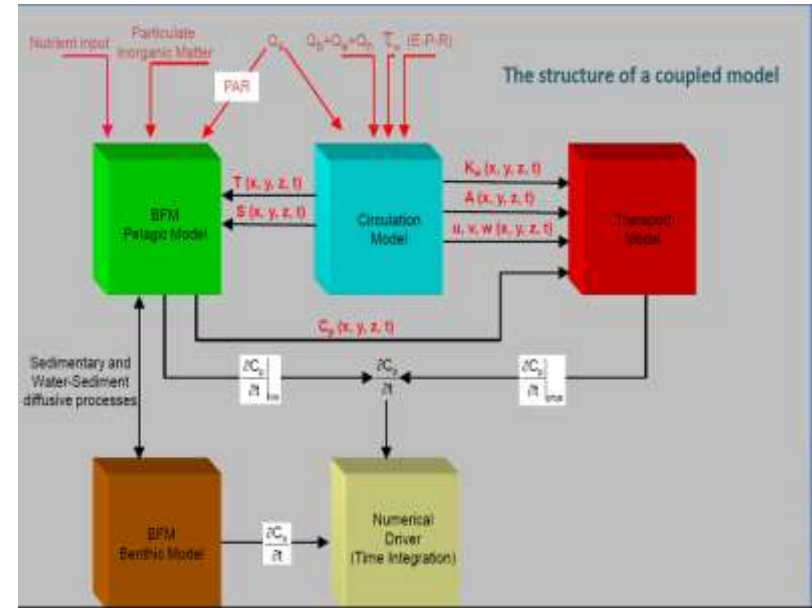


**EO/Remote sensing are a powerful tool for making spatially detailed marine environmental maps to aid in decision making and planning for natural resource management over large study areas.**



## Operational modelling

Ecological models have been recognised as powerful tools to evaluate ecosystem structure and function and predict the impacts of human activities on marine ecosystems.

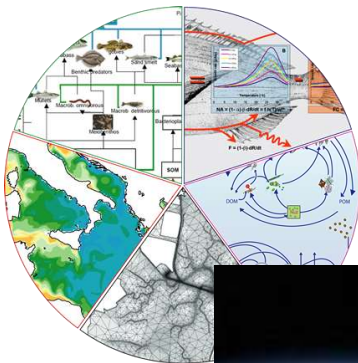


Marco Zavatarelli: Summer School-PERSEUS, 2015-  
Assessing the potential of modelling in the  
Mediterranean sea

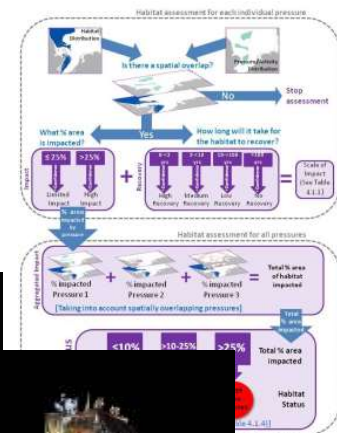


# Integration of tools

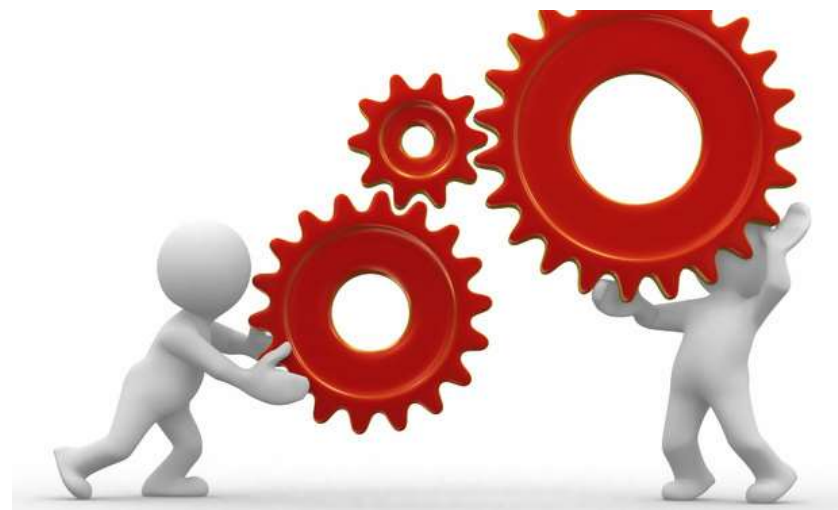
## Operational modelling



## Mapping



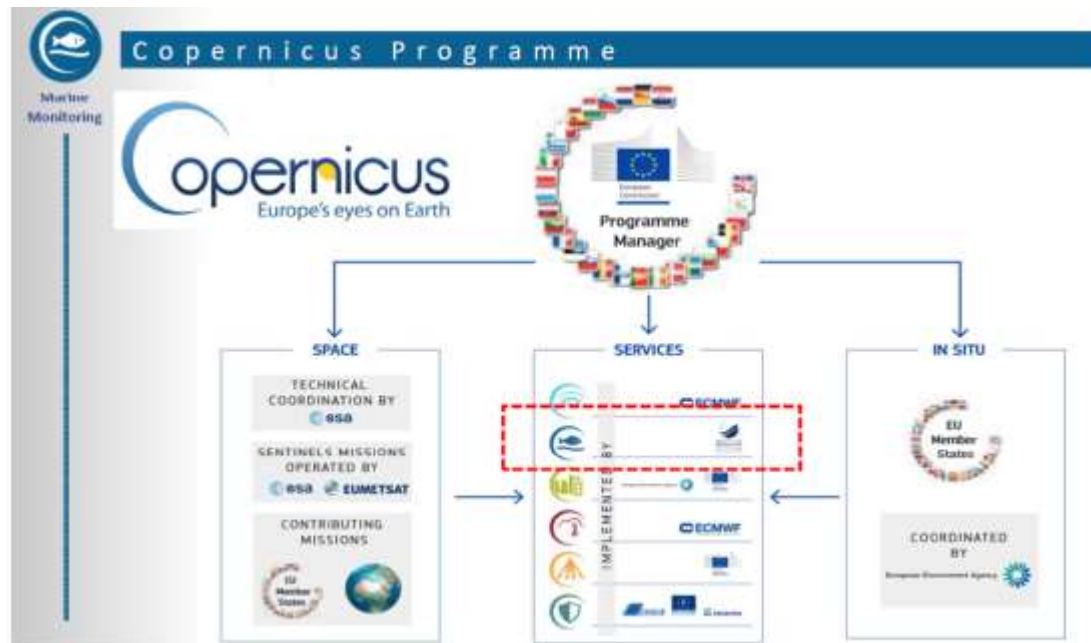
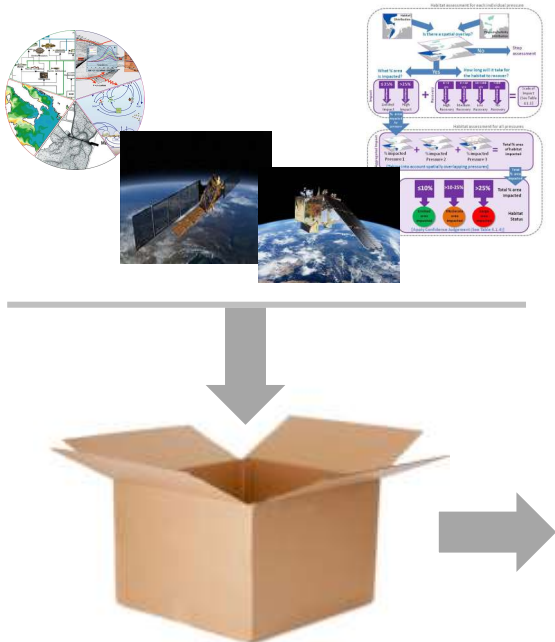
**The integration of tools is the way for connecting science and policy**



## Earth observation



# Example of integration: COPERNICUS













# Copernicus Core Services to support the National Implementation of several EU Environmental Framework



## Copernicus Application domains

Copernicus Application Domain	Related Copernicus Service(s)	Link
Agriculture, Forestry and Fisheries	  	<a href="http://www.copernicus.eu/main/agr-forestry-and-fisheries">http://www.copernicus.eu/main/agr-forestry-and-fisheries</a>
Biodiversity and Environmental Protection	   	<a href="http://www.copernicus.eu/main/bio-and-environmental-protection">http://www.copernicus.eu/main/bio-and-environmental-protection</a>
Climate and Energy	   	<a href="http://www.copernicus.eu/main/climate-and-energy">http://www.copernicus.eu/main/climate-and-energy</a>
Civil Protection and Humanitarian Aid	 	<a href="http://www.copernicus.eu/main/civil-protection-and-humanitarian-aid">http://www.copernicus.eu/main/civil-protection-and-humanitarian-aid</a>
Public Health	   	<a href="http://www.copernicus.eu/main/public-health">http://www.copernicus.eu/main/public-health</a>
Tourism		<a href="http://www.copernicus.eu/main/tourism">http://www.copernicus.eu/main/tourism</a>
Transport and Safety	   	<a href="http://www.copernicus.eu/main/transport-and-safety">http://www.copernicus.eu/main/transport-and-safety</a>
Urban and Regional Planning	 	<a href="http://www.copernicus.eu/main/urban-regional-planning">http://www.copernicus.eu/main/urban-regional-planning</a>
<b>Legend</b>  Copernicus Marine Environment Monitoring Service (CMEMS)  Copernicus Land Monitoring Service (CLMS)  Copernicus Climate Change Service (C3S)  Copernicus Emergency Management Service (EMS)  Copernicus Security Service (CSS)  Copernicus Atmosphere Monitoring Service (CAMS)		

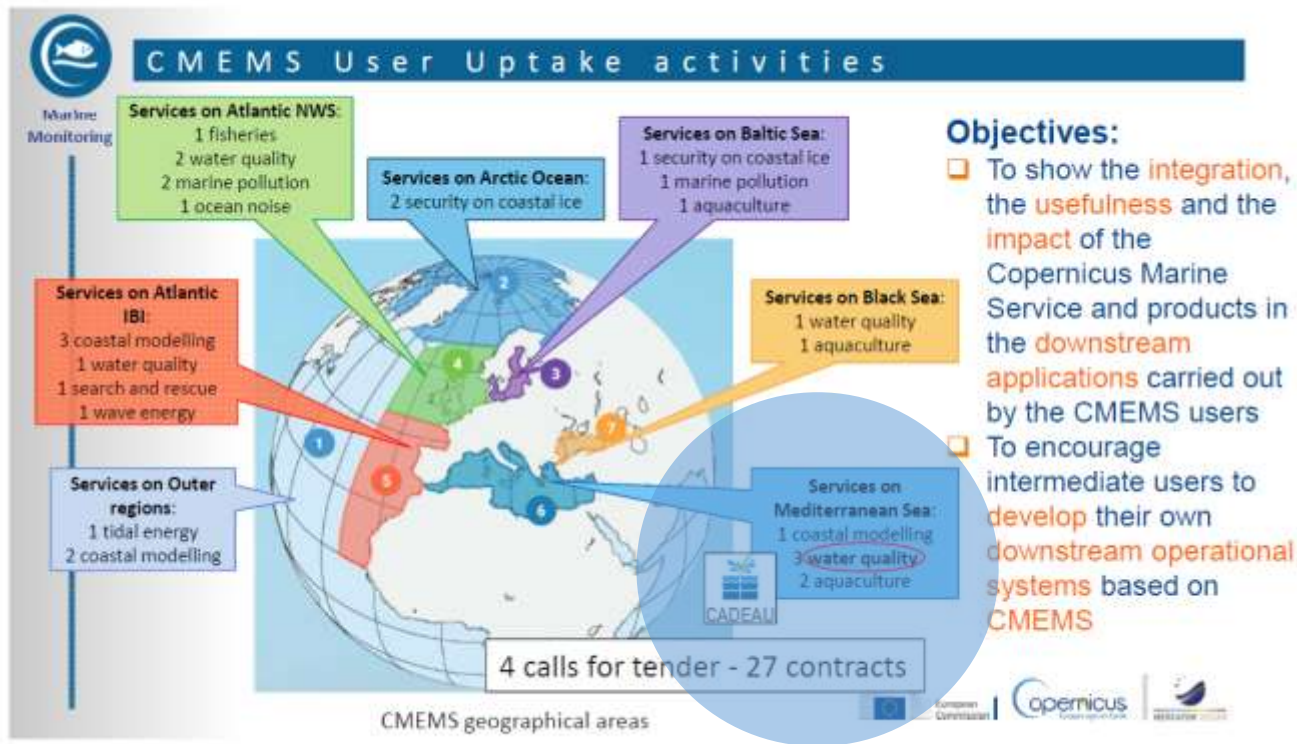
## EU POLICY



European Policies	Application domains
Common Agricultural Policy (CAP) Nitrates European Directive (91/676/EEC) Habitats Directive (92/43/EEC) Birds Directive (2009/147/EC) Water Framework Directive (2000/60/EC) Floods Directive (2007/60/EC) Marine Strategy Framework Directive (2008/56/EC) Bathing Water Directive (2006/7/EC) Maritime Spatial Planning Directive (2014/89/EU) Strategic Environmental Assessment Directive (2001/42/EC) Directive on Urban Waste Water Treatment (91/271/EEC) Habitats Directive (92/43/EEC) Birds Directive (2009/147/EC)	Agriculture/Food security
Animal By-products Regulation (1069/2009/EU) Ambient air quality and cleaner air Directive (2004/107/EC AND 2008/50/EC)	
The General Conference of the United Nations Educational, Scientific and Cultural Organization meeting in Paris from 17 October to 21 November 1972 Raw Materials Initiative [COM(2008)699] Restrictions on the marketing and use of certain dangerous substances and preparations [Directive] (1999/45/CE) Floods Directive (2007/60/EC) Water Framework Directive (2000/60/EC) Thematic strategy on soil protection [COM(2006)283] Waste Directive (2008/98/EC) National Urban Directives Identification and monitoring of national protected areas	Inland/coastal water and environment
	Ecosystem structure/composition
	Air quality
	Cultural heritage
	Raw Materials
	Natural and man-made hazards
	Urban area management



# CMEMS USER UPTAKES activities





## CADEAU Project



Assimilation of national water quality data in **C**oastal **A**reas for a  
marine **D**irectives ori**E**nted downstream **A**m prod**U**ct

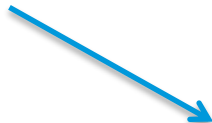
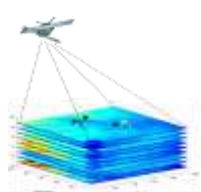
<http://www.bio.isprambiente.it/cadeau/>





Marine Environment  
(CMEMS)

## Satellite data



## In situ data



## Modelling



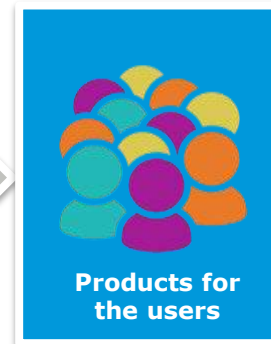
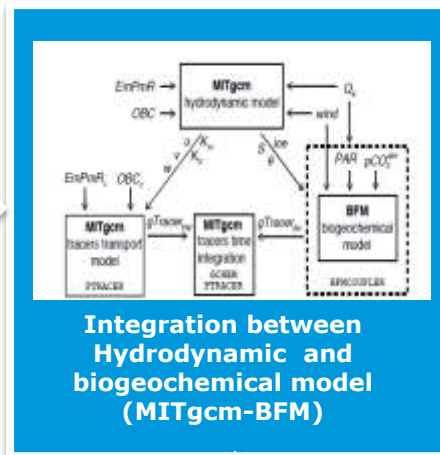
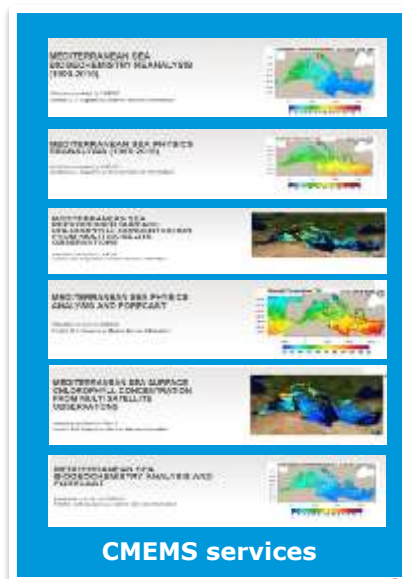
## Products for the users





# Example of marine coastal monitoring service (CADEAU project)

## Production of the service



**Assimilation Validation data 2001-2017**  
*in situ* data coming from the National monitoring programme

NO <sub>2</sub>	Sea-Oxig	PO <sub>4</sub>	pH	Salinity	Transparency	SiO <sub>4</sub>	Transparency	SiO <sub>4</sub>	Temperature	Phos	NO <sub>3</sub>	Chlorophyll	DOC	POC	OC	DO	NO <sub>2</sub>
(µmol/l)	(‰)	(µmol/l)			(m)	(µmol/l)	(m)	(µmol/l)	(°C)	(µmol/l)	(µmol/l)	(µg/l)	(µmol/l)	(µmol/l)	(µmol/l)	(µmol/l)	(µmol/l)
0.45	85.4	0.05	8.404	35.3888	3.1	5.9	3.1	5.9	9.2294	0.54	0.8	35.5379		1.89	277.2	27.8	9.48
0.58	86.2	0.19	8.327	35.3864	3.1	10.54	3.1	10.54	7.849	0.79	0.8	35.5407		5.14	268.7	28.2	14.28
0.70	85.4	0.03	8.507	35.4938	3.4	6.23	3.4	6.23	16.1415	0.55	0.8	38.9177		1.53	140.45	48.58	23.13
0.43	86.9	0.09	8.232	35.6482	5.2	5.06	5.2	5.06	16.1415	0.55	0.8	46.7804		1.83	202.78	23.69	6.23
0.55	105.1	0.05	8.299	29.6297	0.9	18.14	0.9	18.14	30.1950	0.62	0.79	39.5288		10.18	518.14	41.24	24.11
0.66	184.4	0.06	8.47	35.6046	3	1.08	3	1.08							881.89	35.35	18.29
2.1	106.4	0.08	8.463	35.3156	0.9	13.27	0.9	13.27									



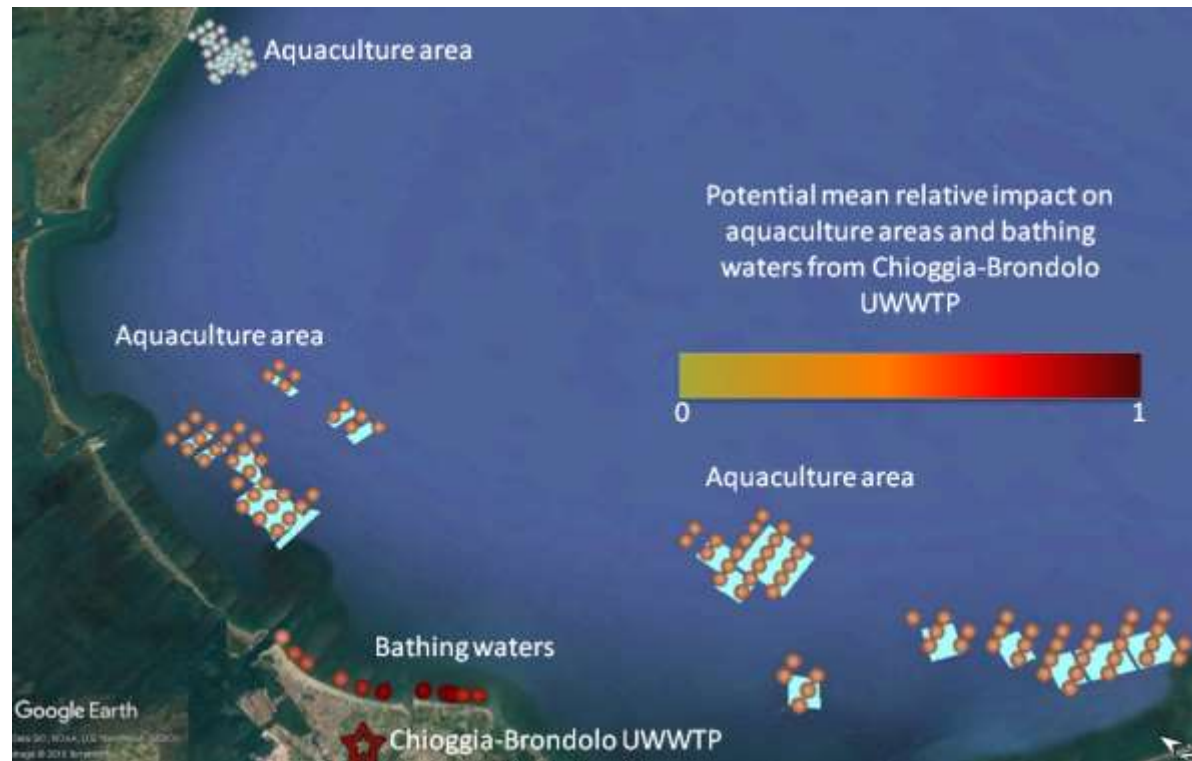
## Quality of marine waters

WFD (2000/60/EC)  
MSFD (2008/56/EC)

- ✓Nutrients  
( $\text{NO}_2$ ,  $\text{NO}_3$ ,  $\text{NH}_4$ ,  $\text{NTot}$ ,  $\text{PO}_4$ ,  $\text{PTot}$ )
- ✓Chlorophyll "a"
- ✓Oxygen
- ✓Temperature
- ✓Salinity
- ✓TRIX

## Bathing waters Directive Aquaculture (Private sector)

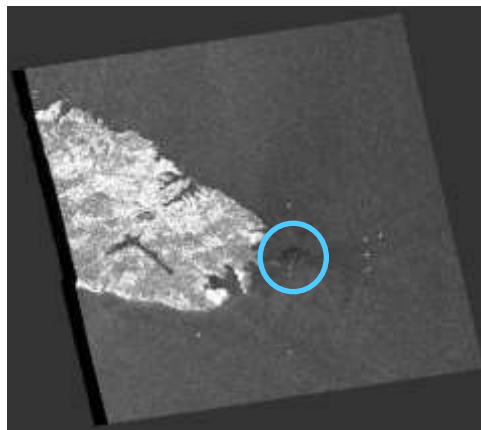
- ✓Indicators for the potential impact of bacterial pollution on a bathing water and shellfish farming





# Example of integration: SAR Sentinel 1 images

## Identifying potentially harmful jellyfish blooms using SAR Sentinel 1 images



From the Scientific Data Hub of ESA was selected the granule **S1A\_IW\_GRDH\_1SDV\_20160611T165532\_20160611T165557\_011666\_011DB9\_DB7B**

The selected image was analyzed using SNAP software developed by ESA, focusing on the southern-eastern area of the Maltese coast.



# Identifying potentially harmful jellyfish blooms using SAR Sentinel 1 images

The detection of jellyfish blooms in the open sea, connected to availability of operational oceanographic model (e.g Copernicus Marine Core Service) lead to the possibility to build up an early-warning system to identify the coastal areas that will be hit by the bloom in the following days.





## Why ESA is important for ISPRA?

Theme: physical state of the sea

Sensor	Product	Issue
Altimeter and SAR	Sea Surface height Surface currents Waves Wind Coastline detection Coastal digital elevation models Ground motion	<ul style="list-style-type: none"> <li>✓ Monitoring of the meteorological conditions</li> <li>✓ Meteorological climate studies (long time series)</li> <li>✓ Monitoring of flooding by sea storm / extreme sea level / tsunami</li> <li>✓ Monitoring of coastal erosion phenomena</li> <li>✓ Monitoring of coastal subsidence phenomena</li> </ul>
	<b>Derived product</b> Improvement of numerical modelling tools	<ul style="list-style-type: none"> <li>➤ Sea state analysis, reanalysis and forecasting</li> <li>➤ Search and rescue</li> </ul>



## Why ESA is important for ISPRA?

Theme: Marine water quality

Sensor	Product	Issue
Ocean Colour Spectroradiometer	Sea Surface Temperature Attenuation coefficient Chlorophyll a Hydrocarbon at sea Algal blooms Jellyfish blooms	<ul style="list-style-type: none"> <li>✓ <i>Posidonia oceanica</i> mapping</li> <li>✓ Identification of oil spill events</li> <li>✓ Detection of events of algal blooms and in particular of the harmful algal blooms and cyanobacteria</li> <li>✓ Identification of jellyfish blooms</li> <li>✓ Identification of plastic "hot spot"</li> </ul>
	<b>Derived product</b> Improvement of numerical modelling tools	<ul style="list-style-type: none"> <li>➤ Water quality analysis, reanalysis and forecasting</li> <li>➤ Transport and diffusion forecast of oil spill, algal blooms, jellyfish blooms, plastic "hot spot"</li> </ul>



## Why ESA is important for ISPRA?

Theme: Uses of the sea

Sensor	Product	Issue
SAR	Vessel identification/tracking	✓ Environmental pollution prevention/accounting
	<b>Derived product</b> Improvement of numerical modelling tools	➤ Analysis, forecast of impacts on human activities (e.g. aquaculture, bathing waters)



## Now you can tell us your stories.....

