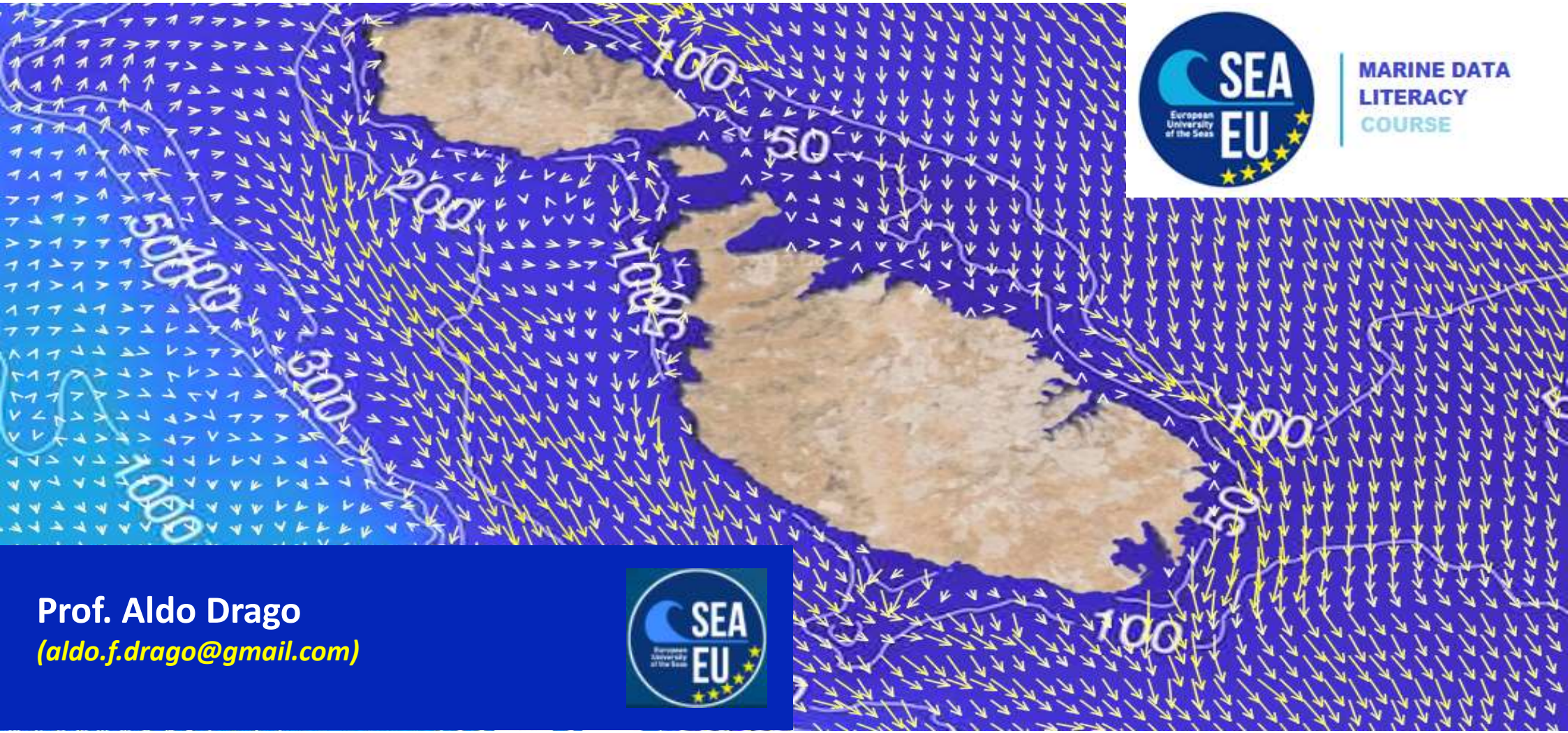


MARINE DATA LITERACY COURSE

Prof. Aldo Drago
(aldo.f.drago@gmail.com)

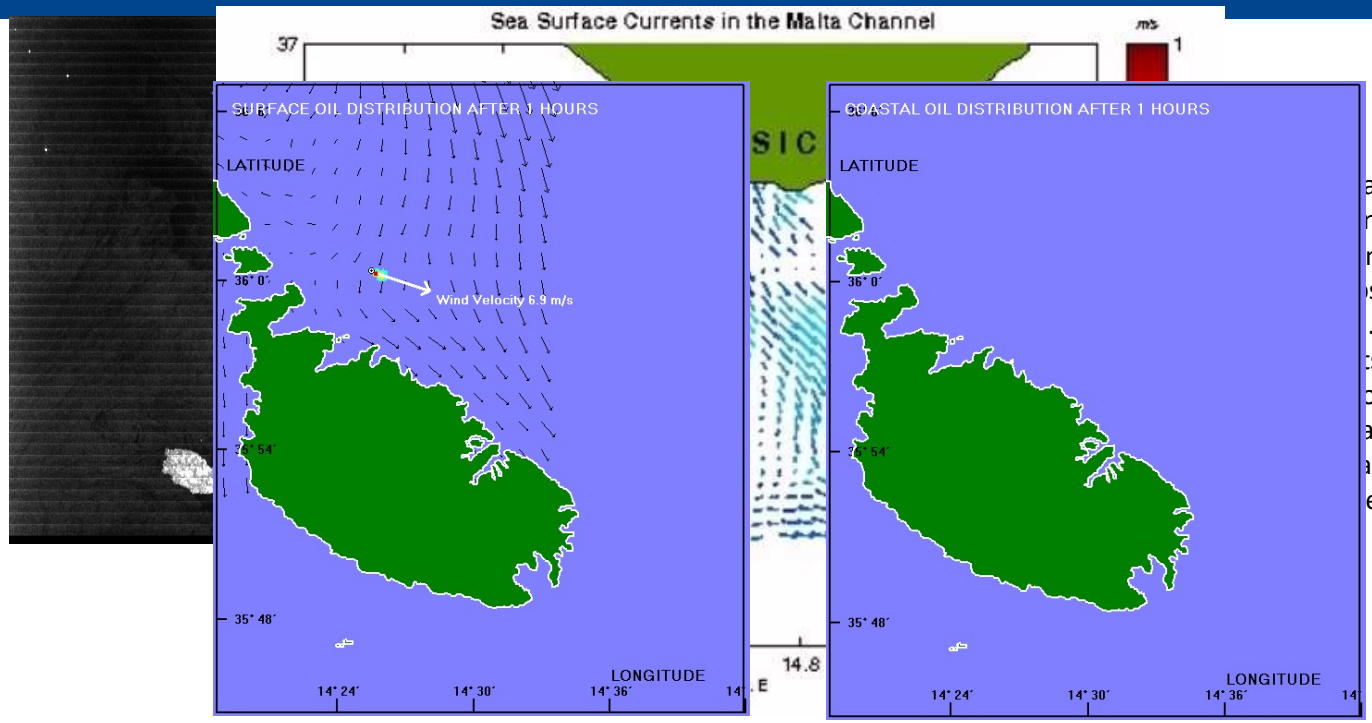
Lecture 1: Data in Operational Oceanography

WHAT IS OPERATIONAL OCEANOGRAPHY

More than research .....
...observe the sea to provide support to a wide range of users

delivers an interoperable, fully integrated multiplatform observing and forecasting capability, with systematic and long-term routine measurements of the seas and oceans and atmosphere, and the rapid interpretation and dissemination of information with the production of dedicated data services, *supporting the conservation of biodiversity, forecasting and management of risks and emergencies at the coast and at sea*.

REAL CASE STORYLINES



alta Channel
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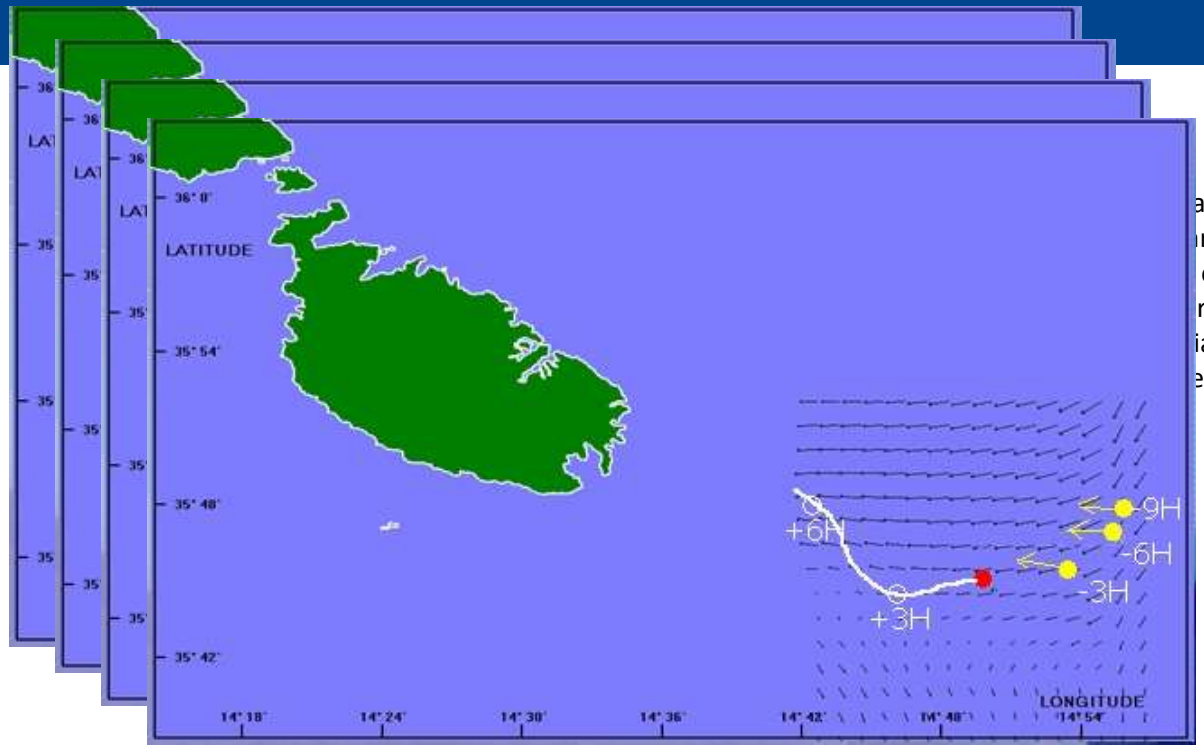
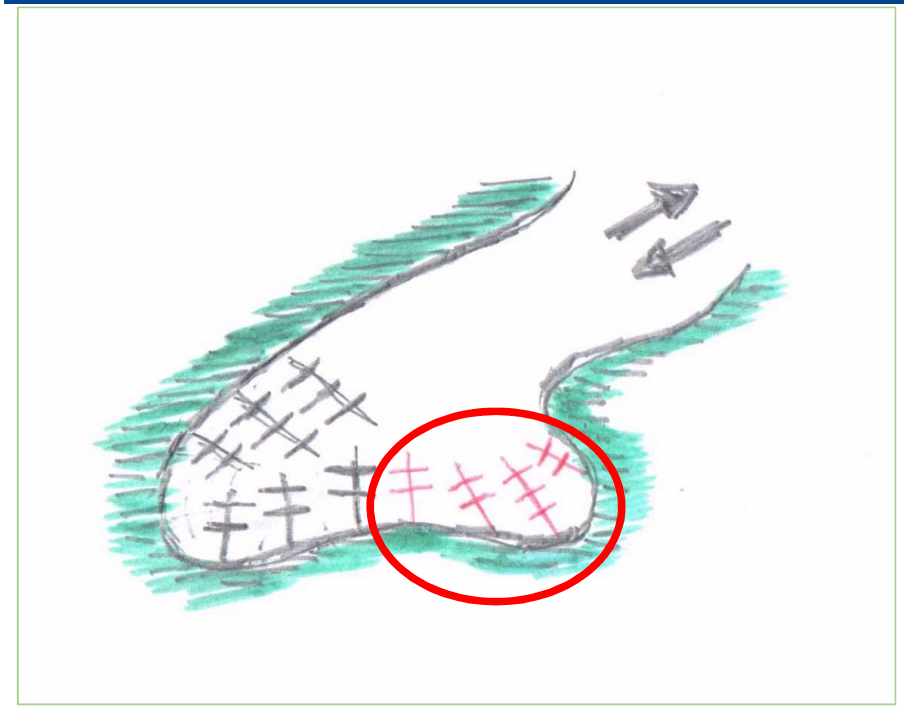
REAL CASE STORYLINES



all boat sighted with no crew on
rd. Boat description coincides to a
of distress received 12h earlier.
rch and rescue operation is
iated and several scenarios are
estigated to restrict S&R area.

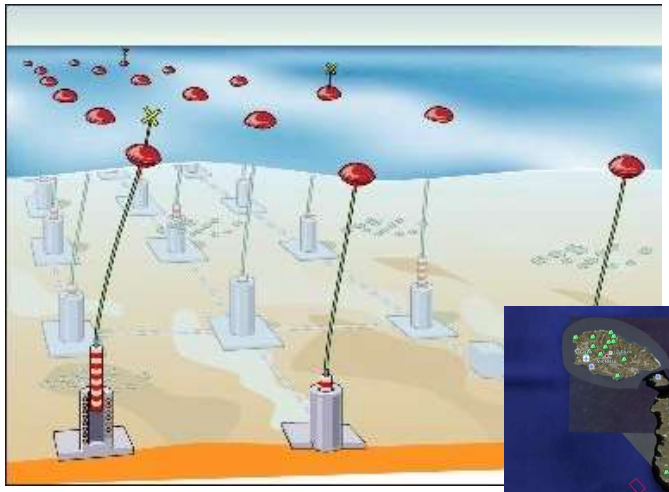
REAL CASE STORYLINES

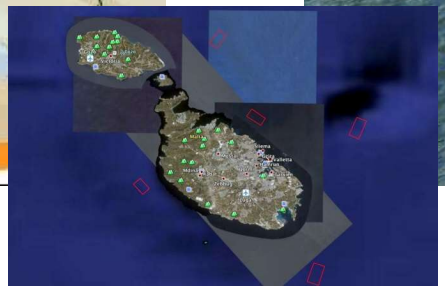


Coastal development in an embayment: extension of a yacht marina.

- Assesments on wave impact on new installations
- Changes in circulation,
- Carrying capacity of the embayment
- Quantify risks

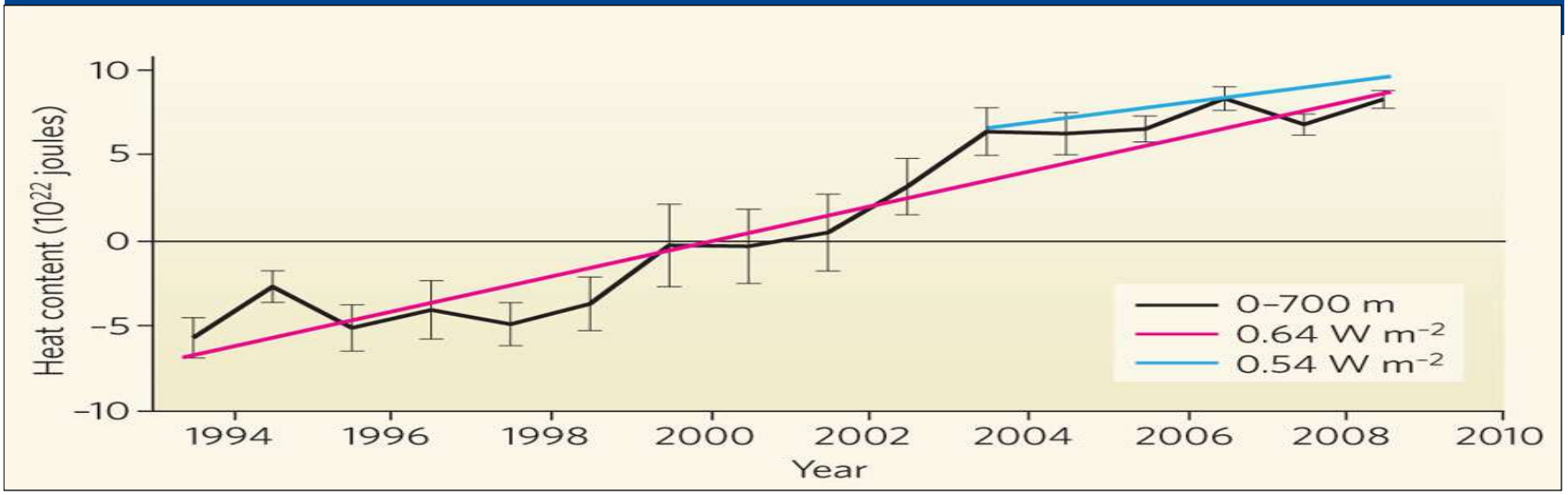
REAL CASE STORYLINES





Tapping wave energy from the sea around the Maltese Islands.
Assess the wave resource potential.

REAL CASE STORYLINES

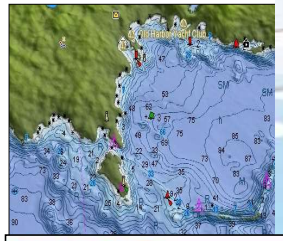


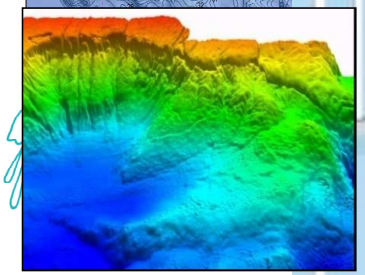
Trends in ocean warming between 1993 and 2008.
['*Robust Warming of the Global Upper Ocean'* (Lyman John M. et. al,), Nature: May 2010]

Long term monitoring
- Sea level variability and trends
- state of health of coastal seas through water quality parameters (PH, Diss O_2, nutrients, etc.)
- Impacts of climate change
--Global ocean warming
- Checking environmental impacts such as from coastal development

SUPPORT OF OCEANOGRAPHY

BASELINE DATA
Coastline.....Bathymetry.....geomorphology.....hydrography...
.....combined to non-scientific data: resource mapping, socio-economic, etc.





OPERATIONAL DATA
Forecast data.....short term data series.....instant processing
Historical data.....long term data series.....delayed mode
In situ vs remote.....physical vs biogeochemical....obs vs model

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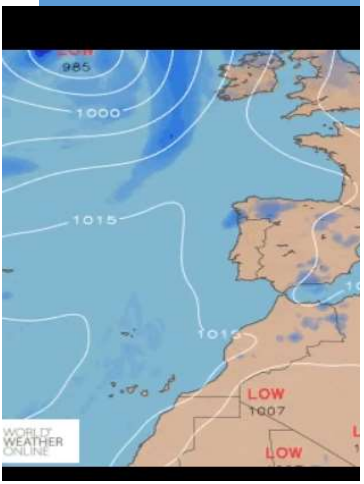
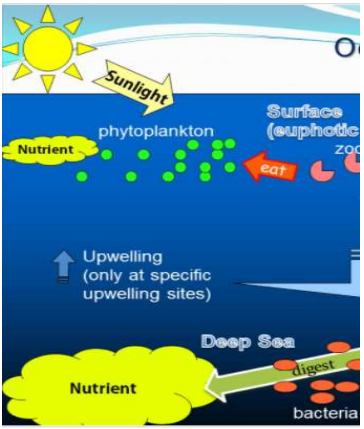
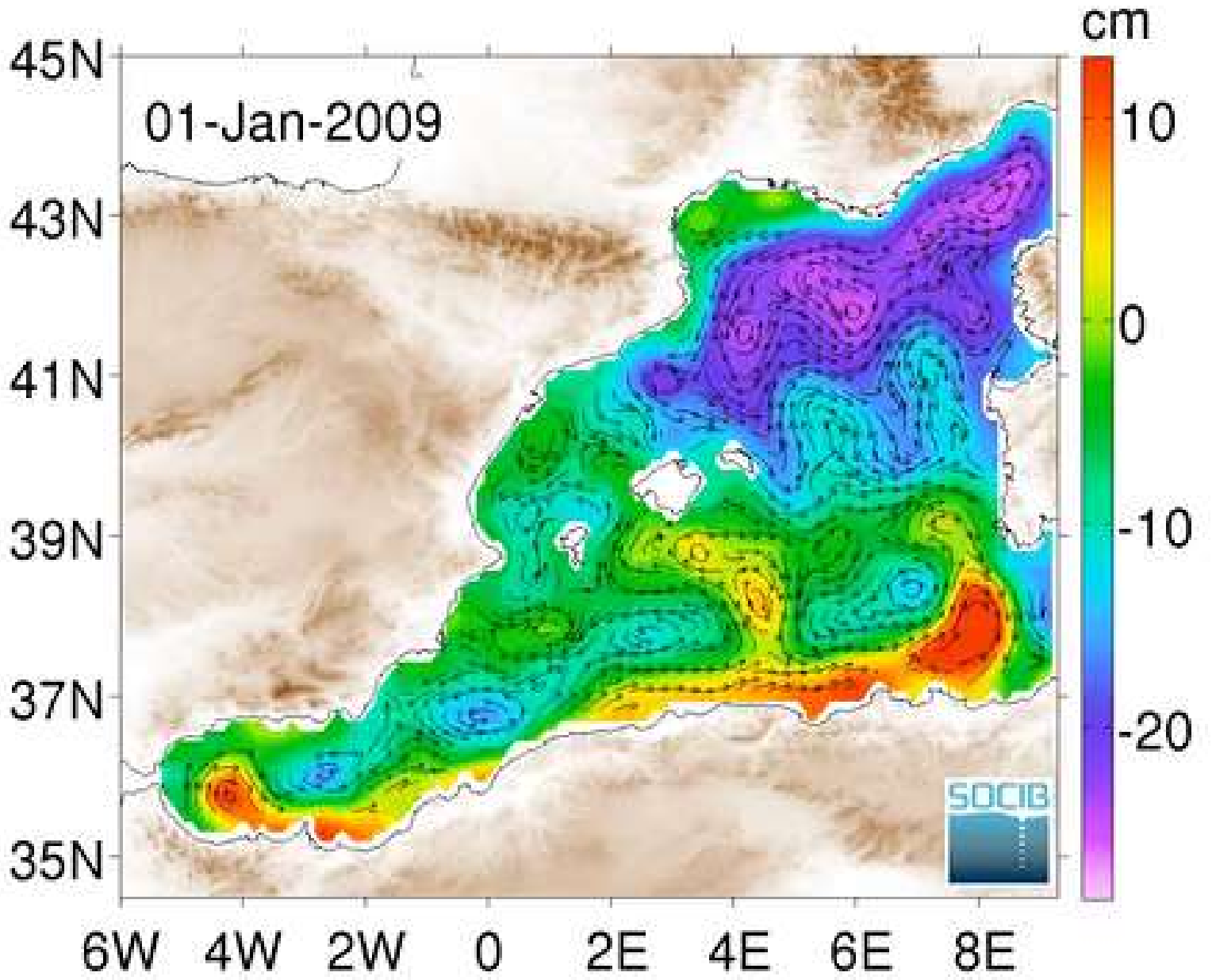
LECTURE 1

Turbulent sys
open sea and ev
Complexity o
and intricate bio







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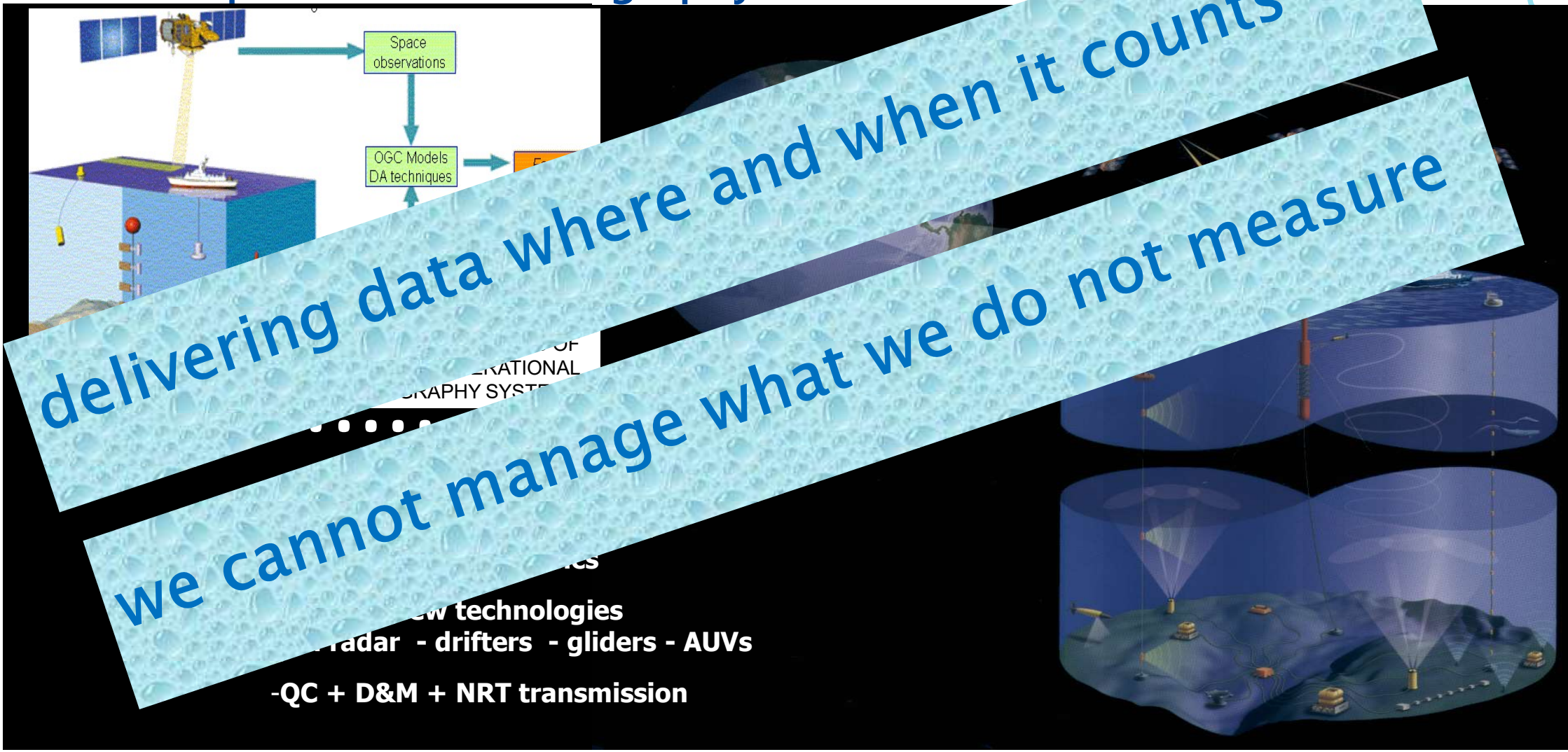
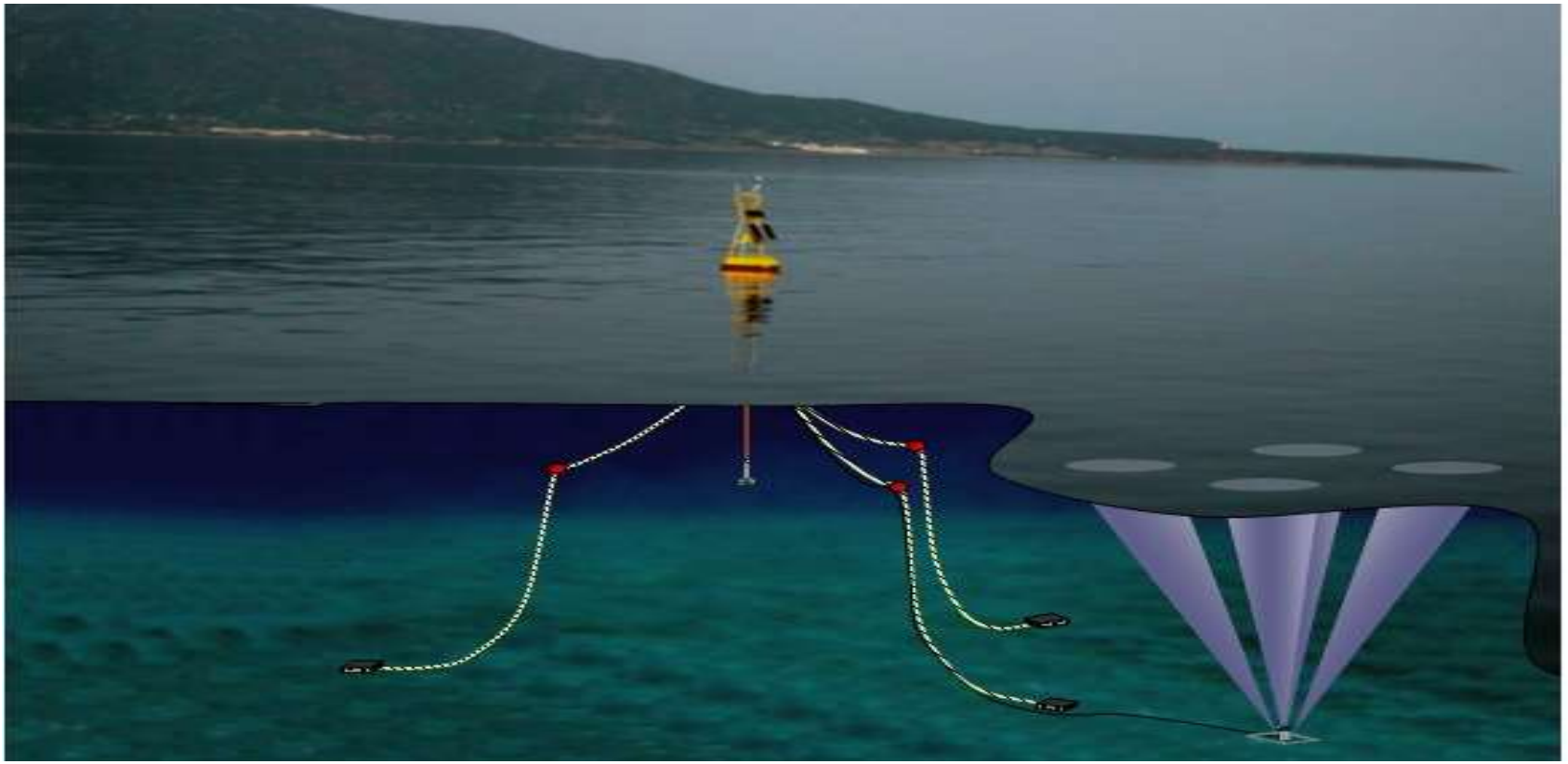
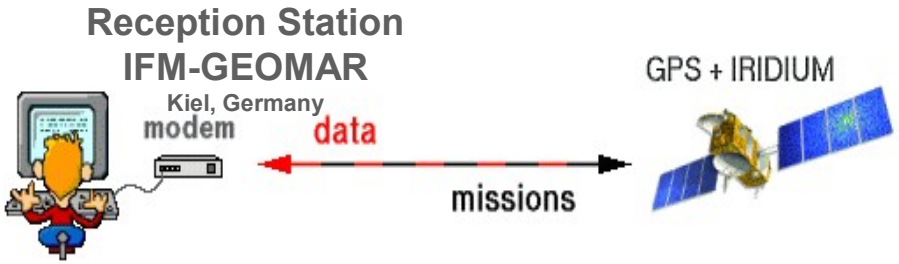
What is Operational Oceanography?



Typical observing systems – Moored stations

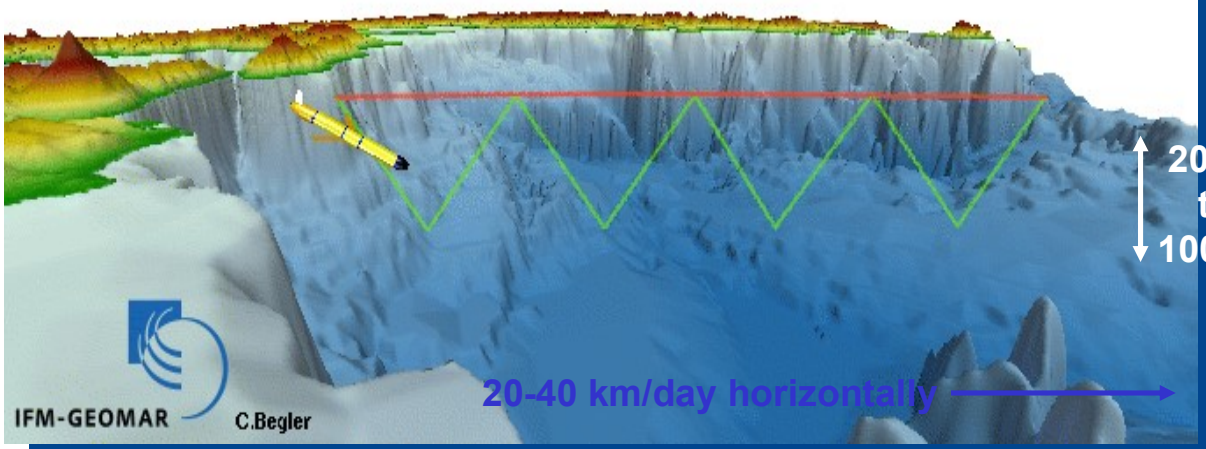


Autonomous Unmanned Vehicles - Sea glider



ftp

Coriolis Data Center
IFREMER
Brest, France
→ MODELS,GTS,...



Mission parameters in MFSTEP experiment

angle of ascent/descent = 25 º
(minimum energy cost)

surfacings every 4 hours:
8 yos [200m-18m]
or 2 yos [1000-20m] with the deep prototype

CTD downcasts only
(energy cost)

~ 11 minutes at surface
1.5 minutes GPS
8 minutes Iridium
1.5 minutes GPS

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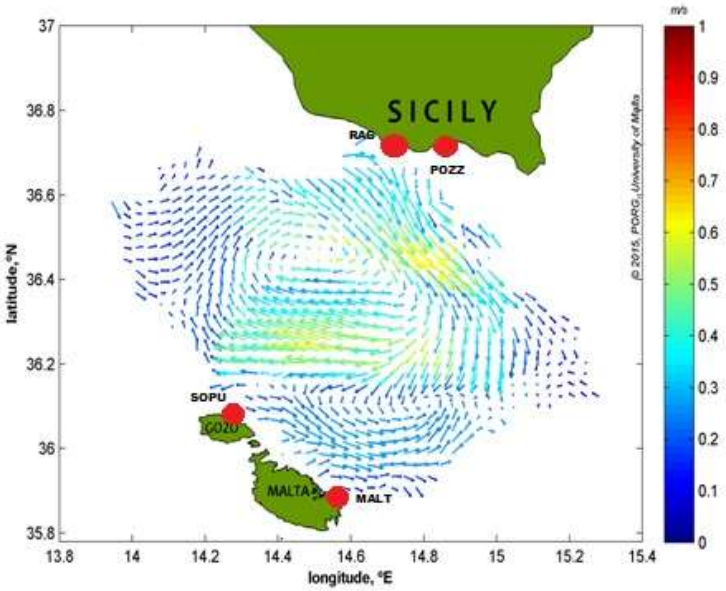
HF radar for mapping sea surface currents

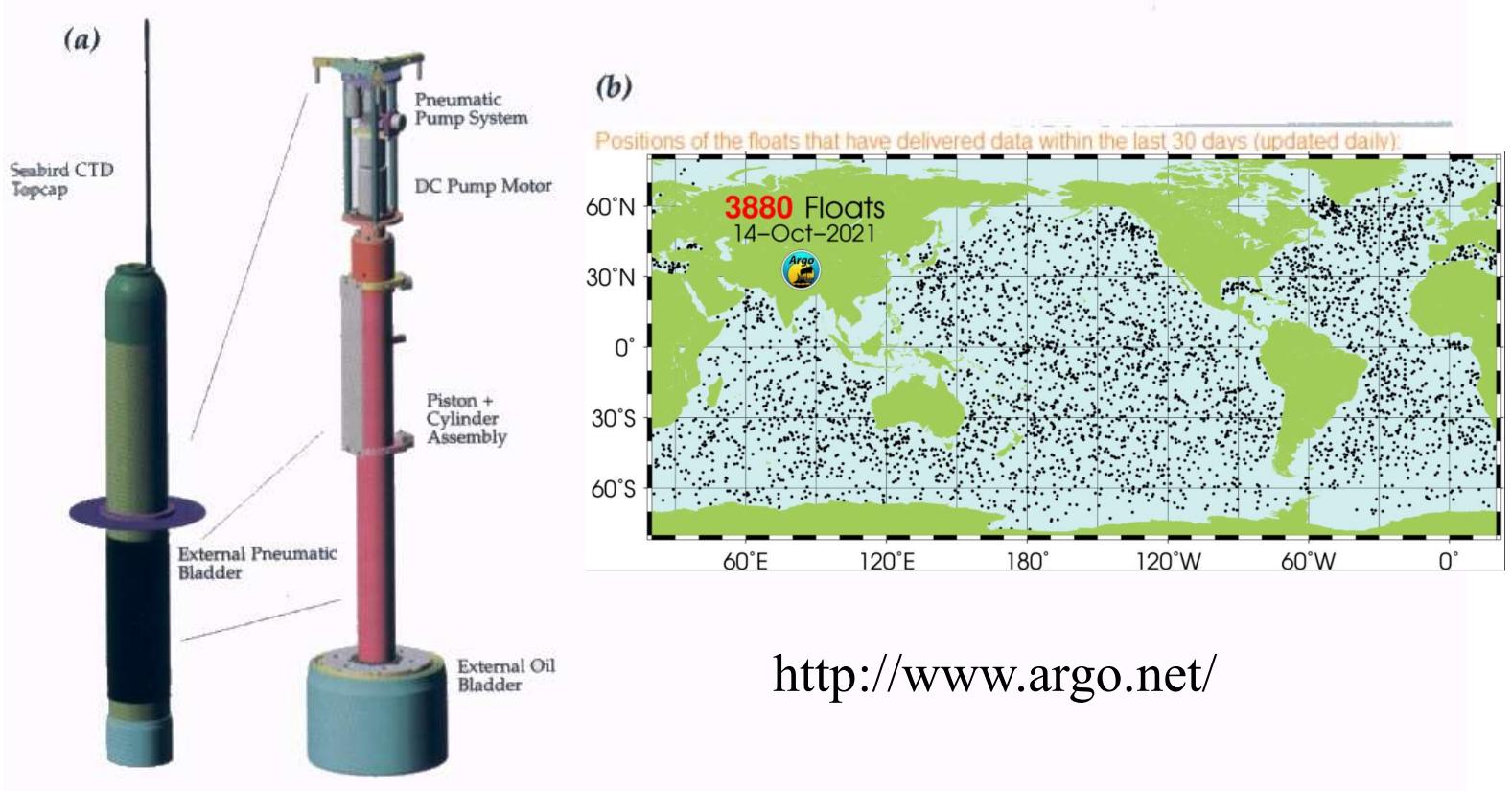
Technology:
Backscatter from sea surface of HF radar overlapping beacons

Product:
real-time remotely sensed maps every 30 min of near-surface (1m) currents that cover the nearshore to the outer continental shelf (200m)

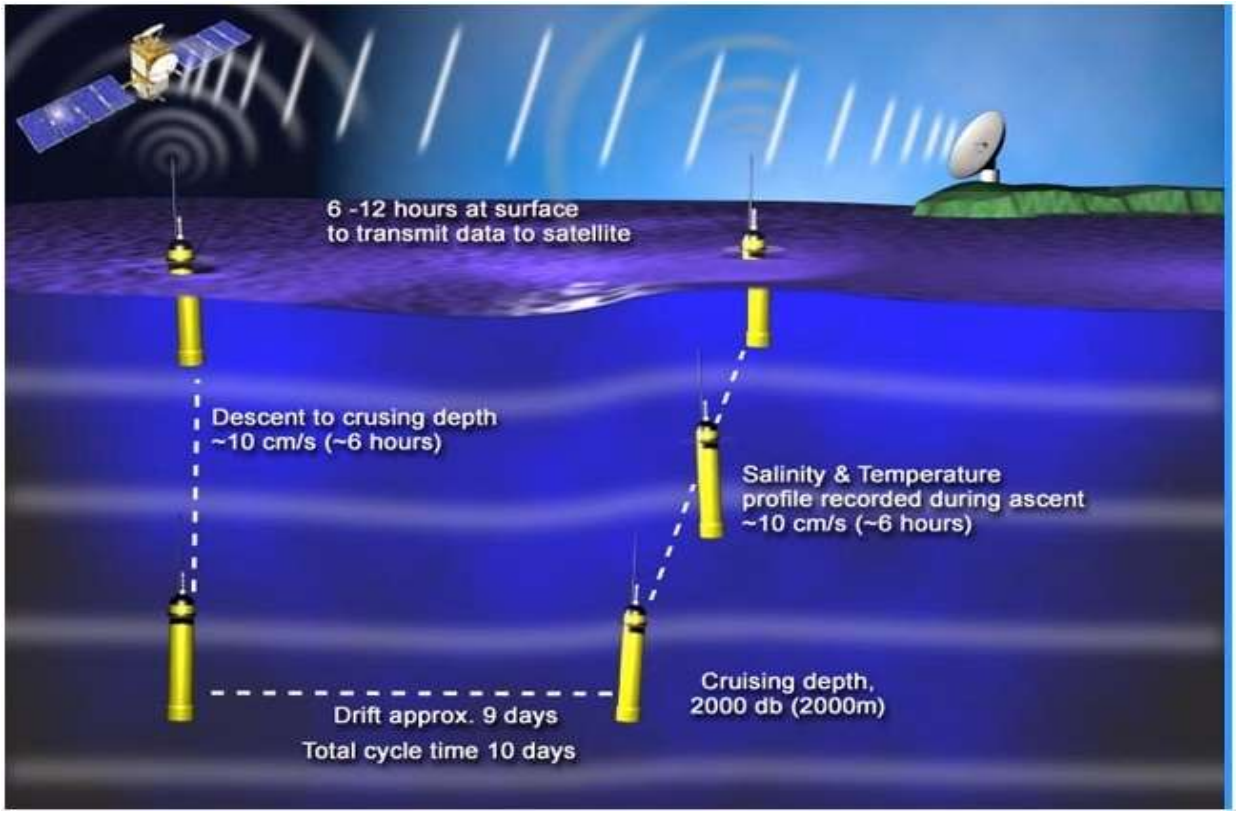
Application:
Improved nowcasts/forecasts of 3D flow fields for port & coastal authorities, coast guard, fisheries regulation bodies, pollution mitigation agencies, etc.



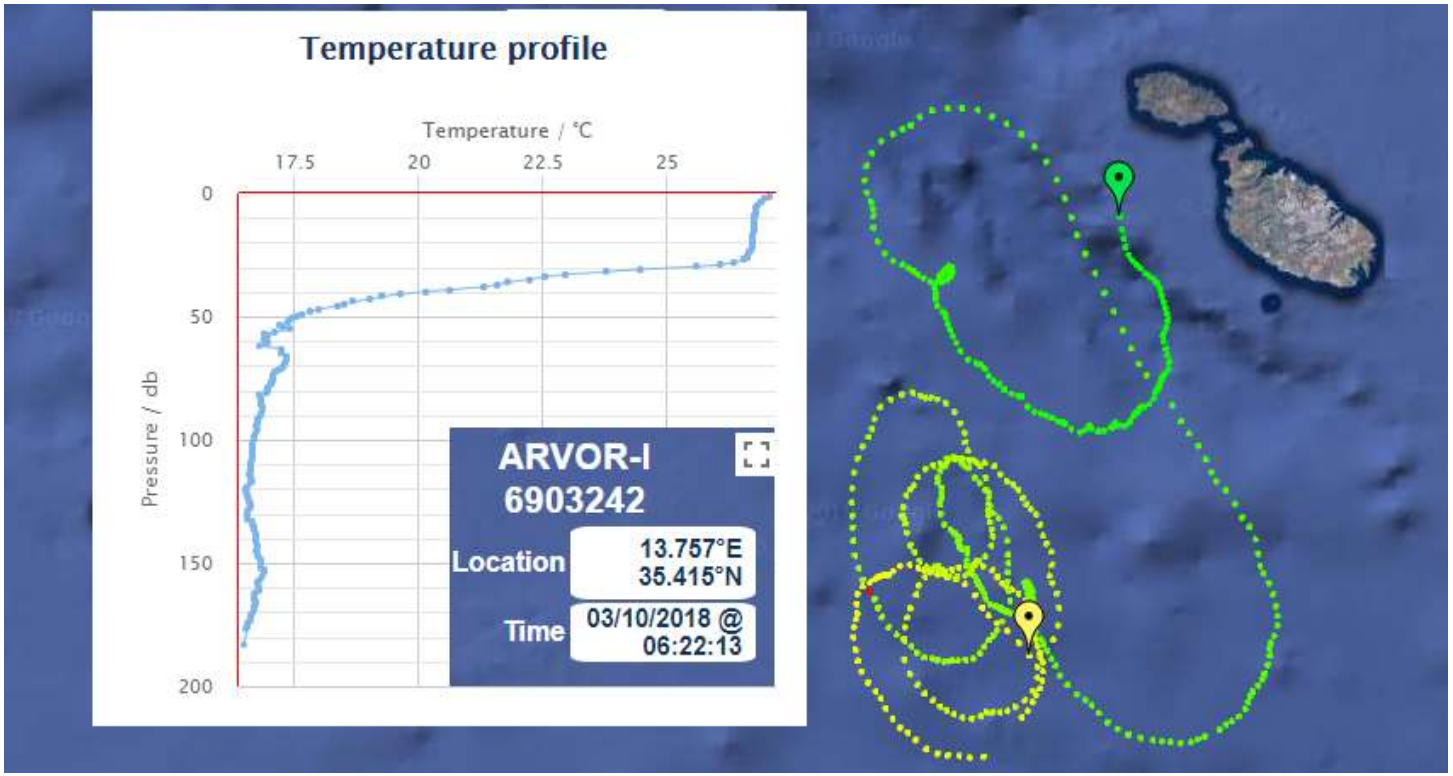
ARGO float programme



http://www.argo.net/

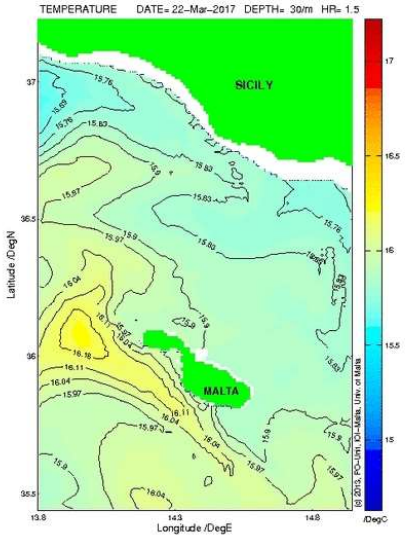


The float descends to cruising depth, drifts for several days, ascends while taking salinity and temperature profiles, and then transmits data to satellites.

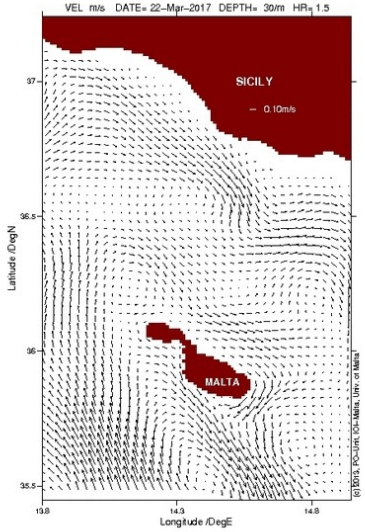


Physical Oceanography Research Group participates by ad hoc ARGO float deployments in the Central Mediterranean

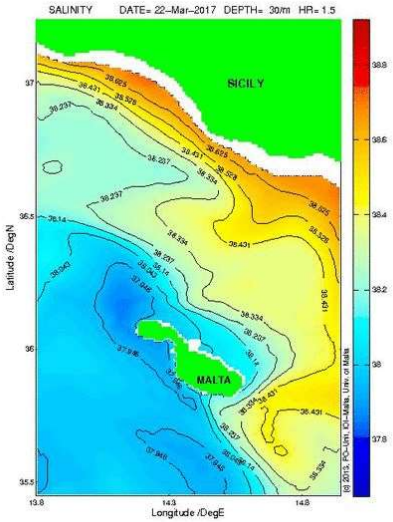
Operational Oceanography in Malta



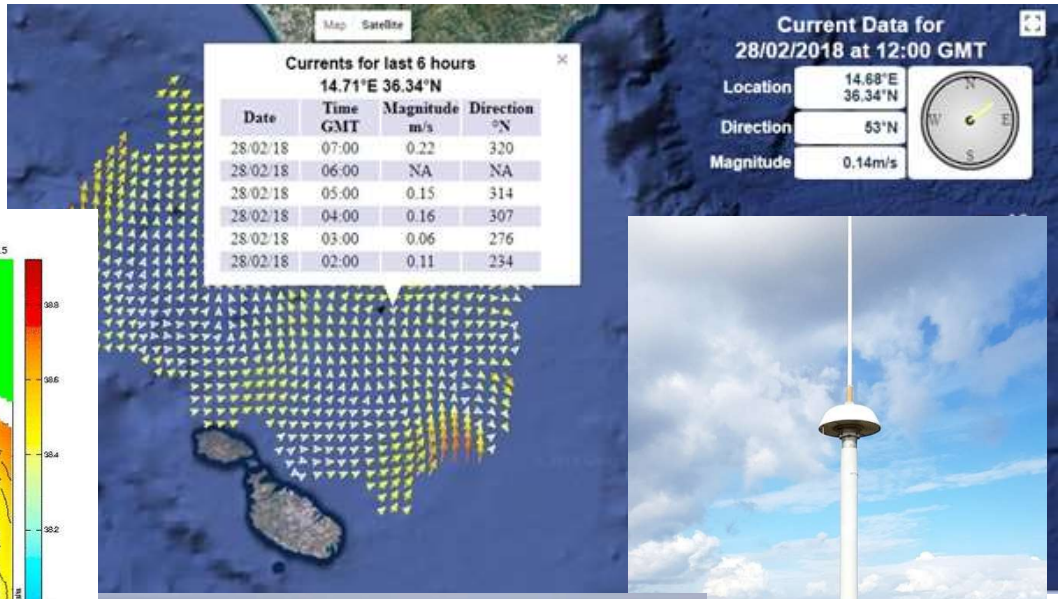
SS Temperature

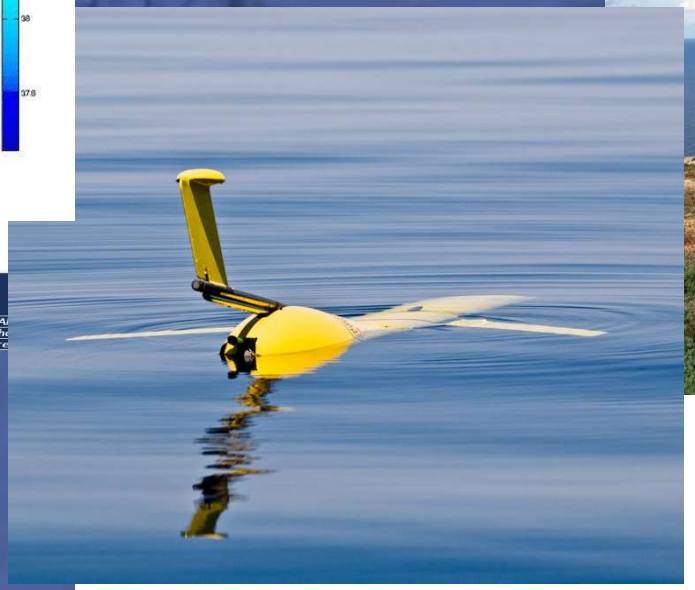


SS Velocities

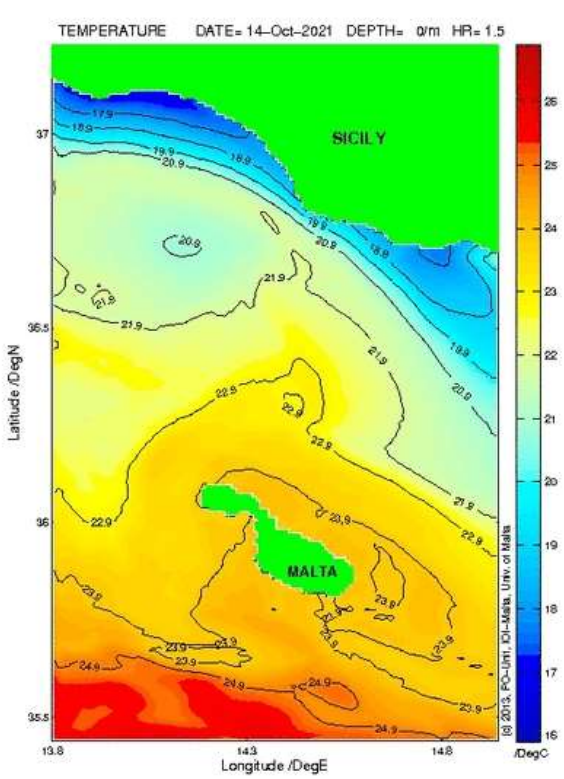


SS Salinity

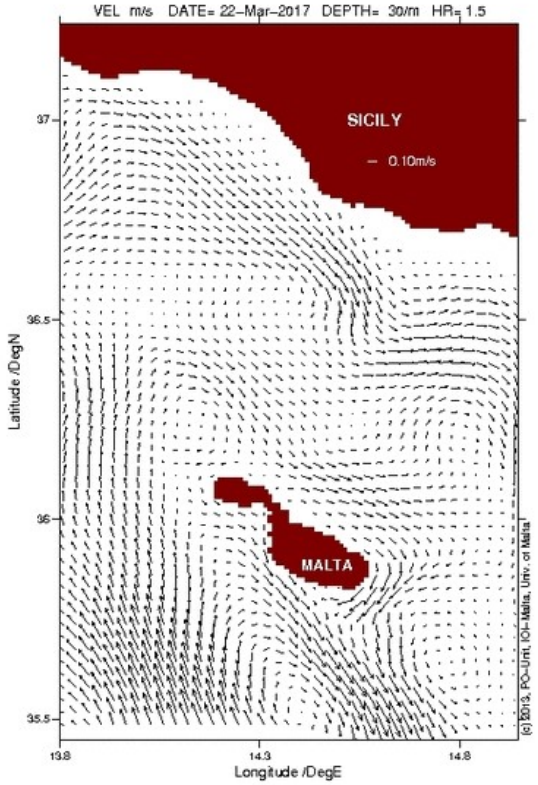




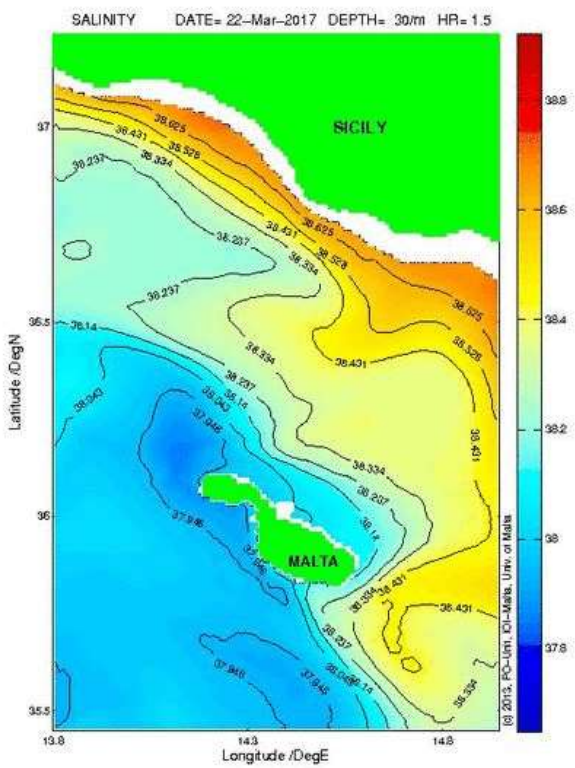
www.capemalta.net



SS Temperature



SS currents



SS Salinity

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LECTURE 1

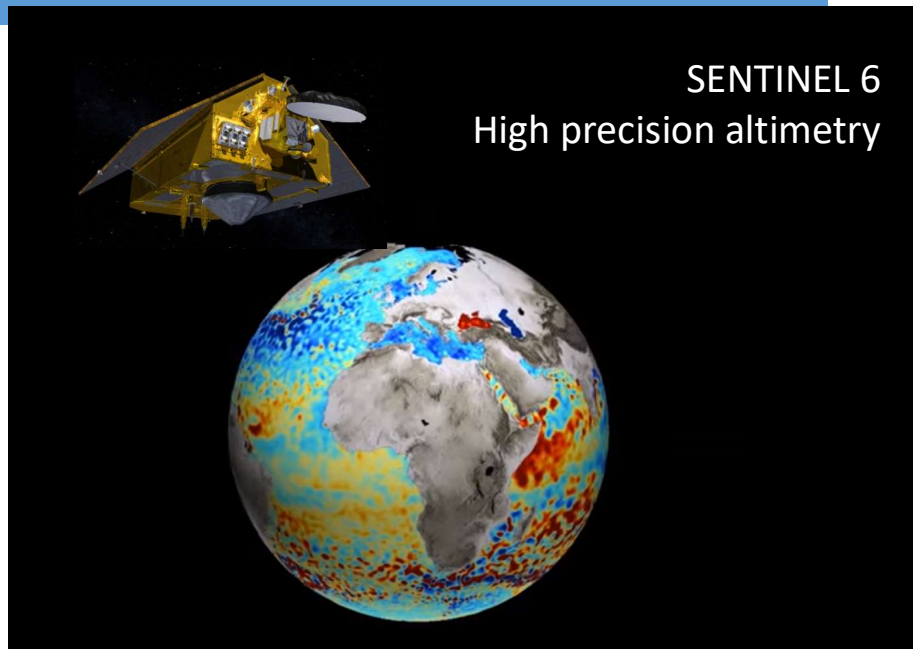
OBSERVATIONS FROM SATELLITES

Many essential parameters can be measured from space

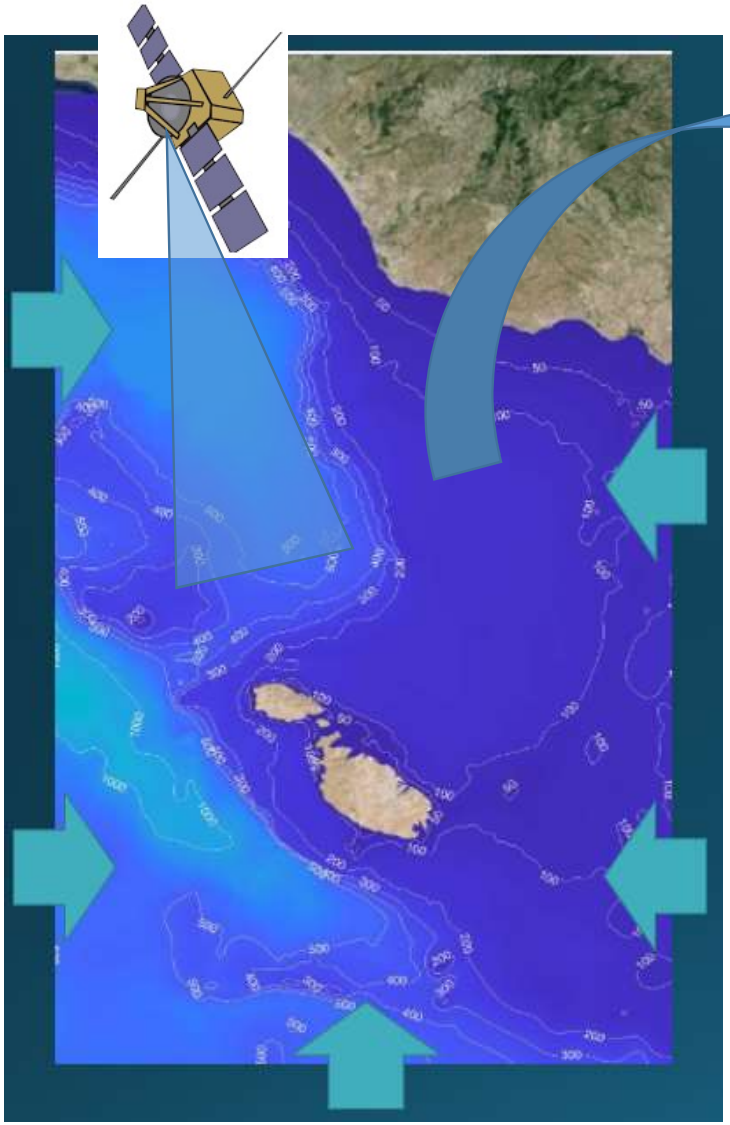
Satellite observations do not always meet the precision requirements especially in the dynamic coastal zone areas

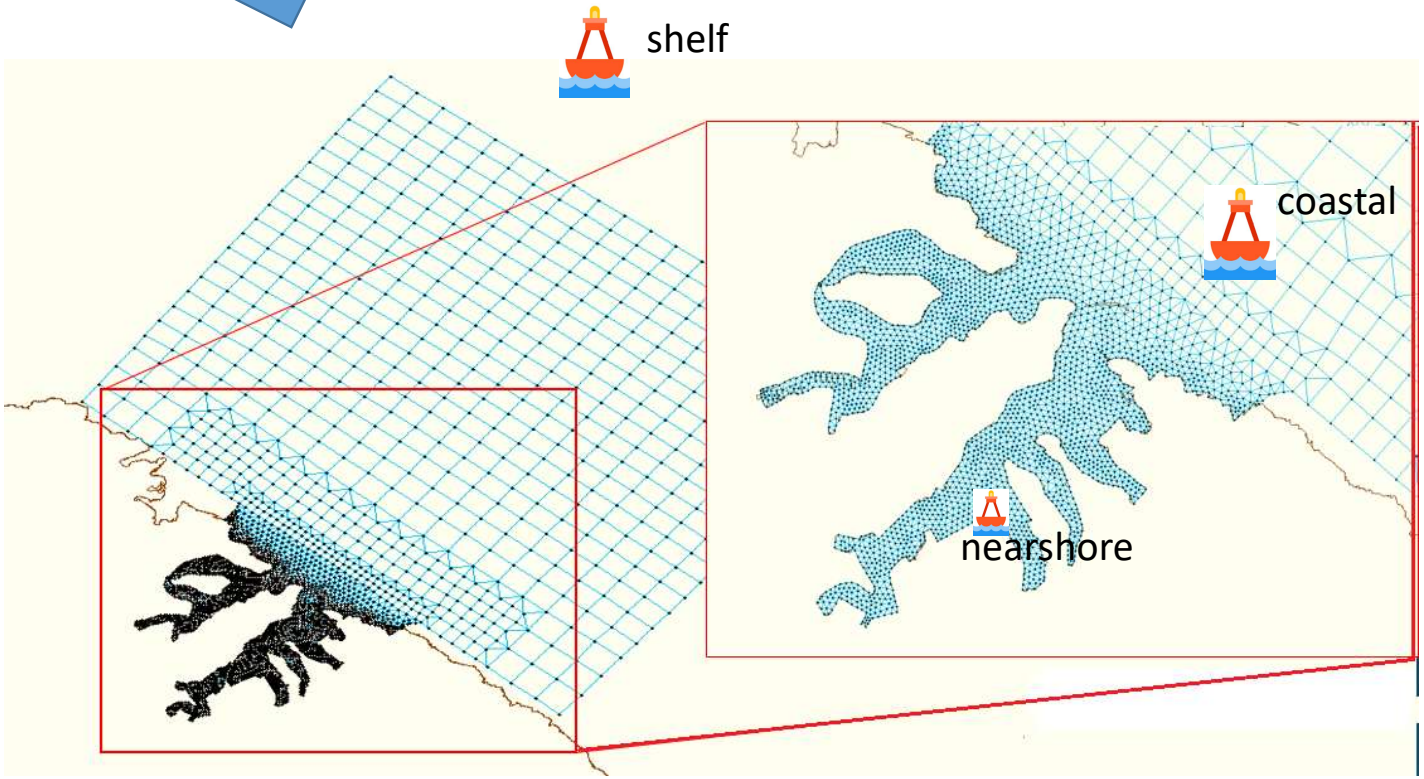
Particular challenges from land contamination and geophysical corrections

Coastal hazards require highly localized measurements

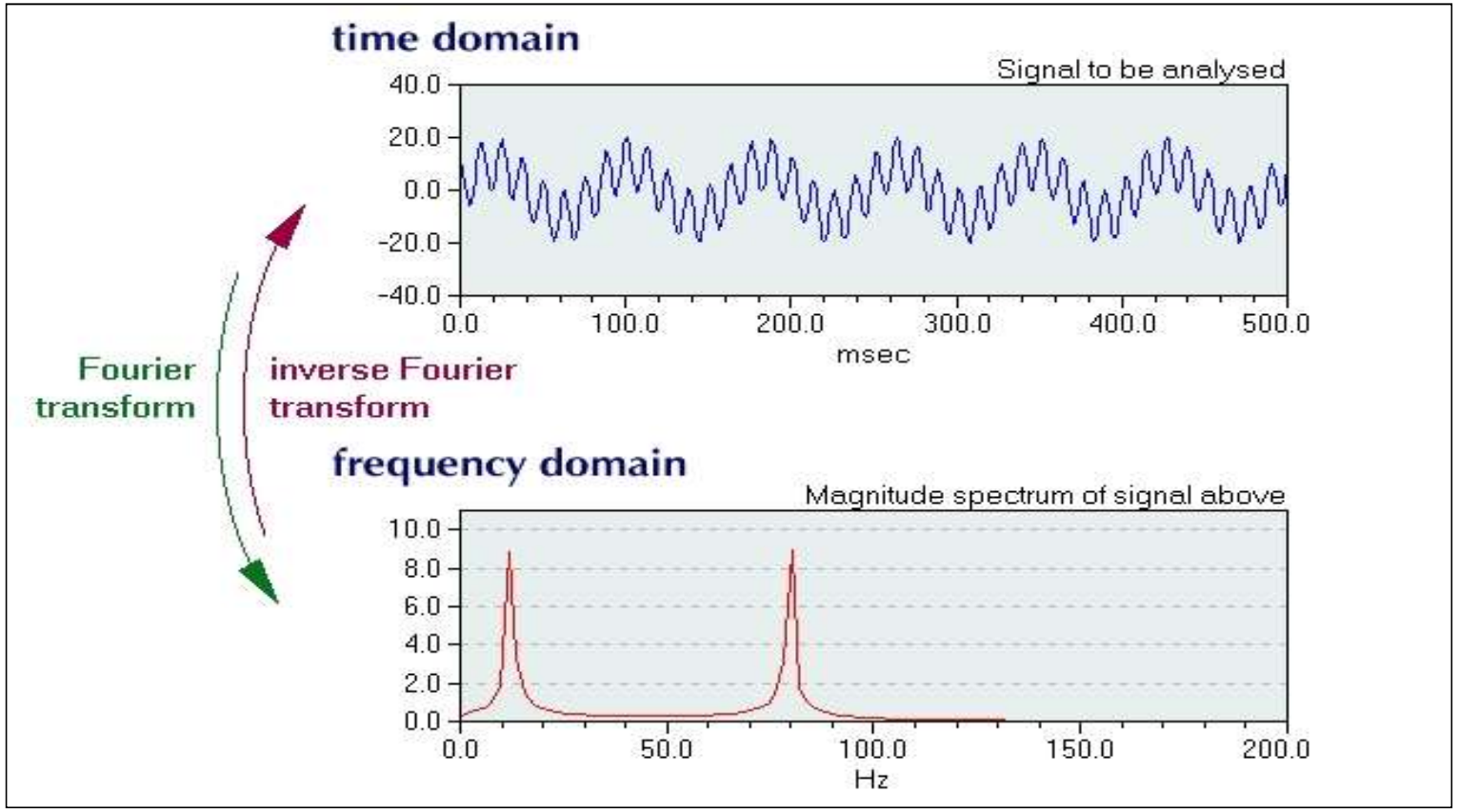


RESOLVING THE COASTAL AND NEARSHORE SCALES BY INTEGRATION TO NUMERICAL MODELS





Data Analysis (1)



Data Analysis (2)

Combination of signals & information

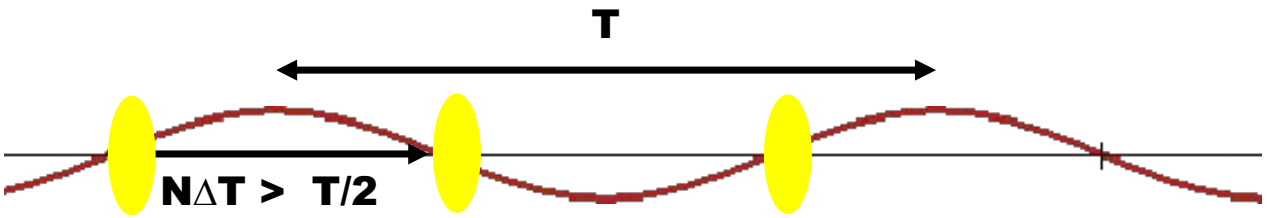
e.g.(1)
sea level = Astronomical tide + Meteorological forcing + Seasonal cycle + Long term + local

e.g.(2)
export rate = Currency exchange + Time of year + Transport costs + Staff costs

Data Analysis (3)

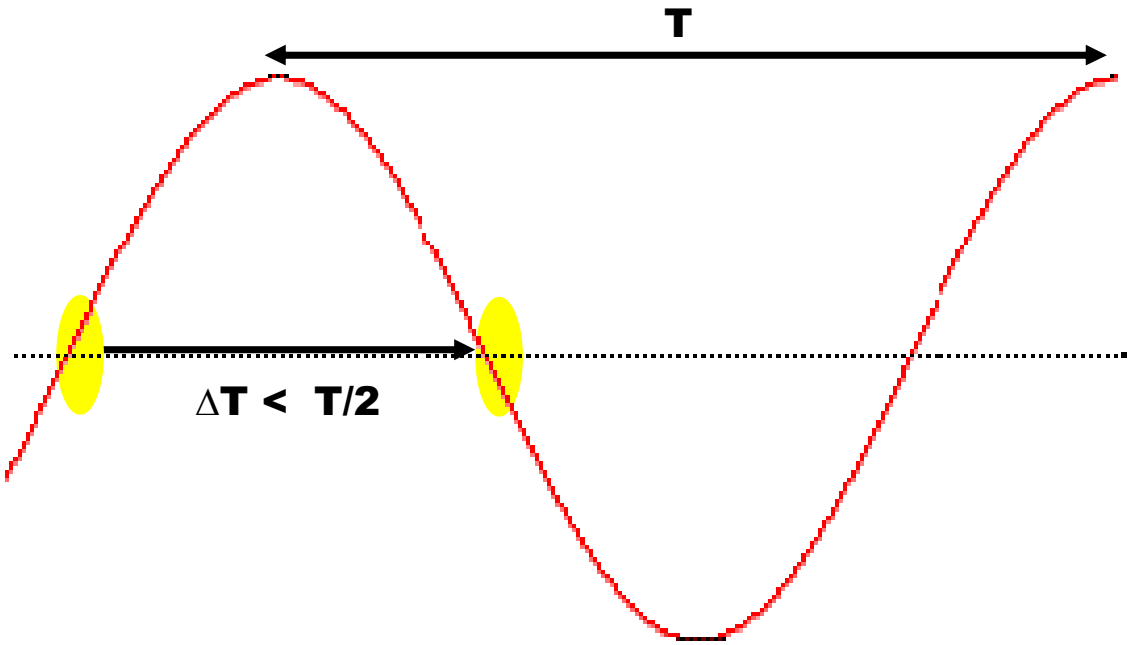
Different signals have different time scales

To identify a signal, data series must be long enough (at least cover half a cycle)



Data Analysis (4)

Data sets must be sampled frequently enough

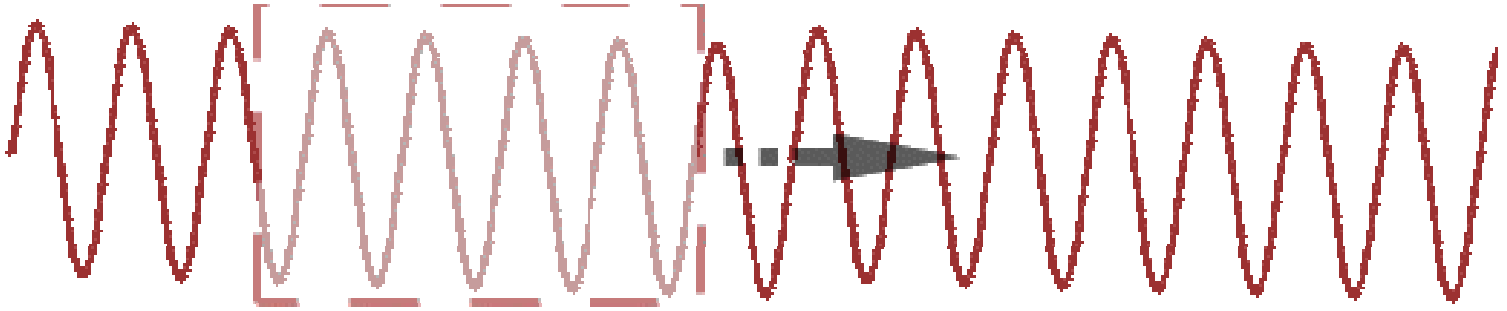


Limit gaps of data

Data Analysis (5)

Evaluating by a running window

scanning the dataset



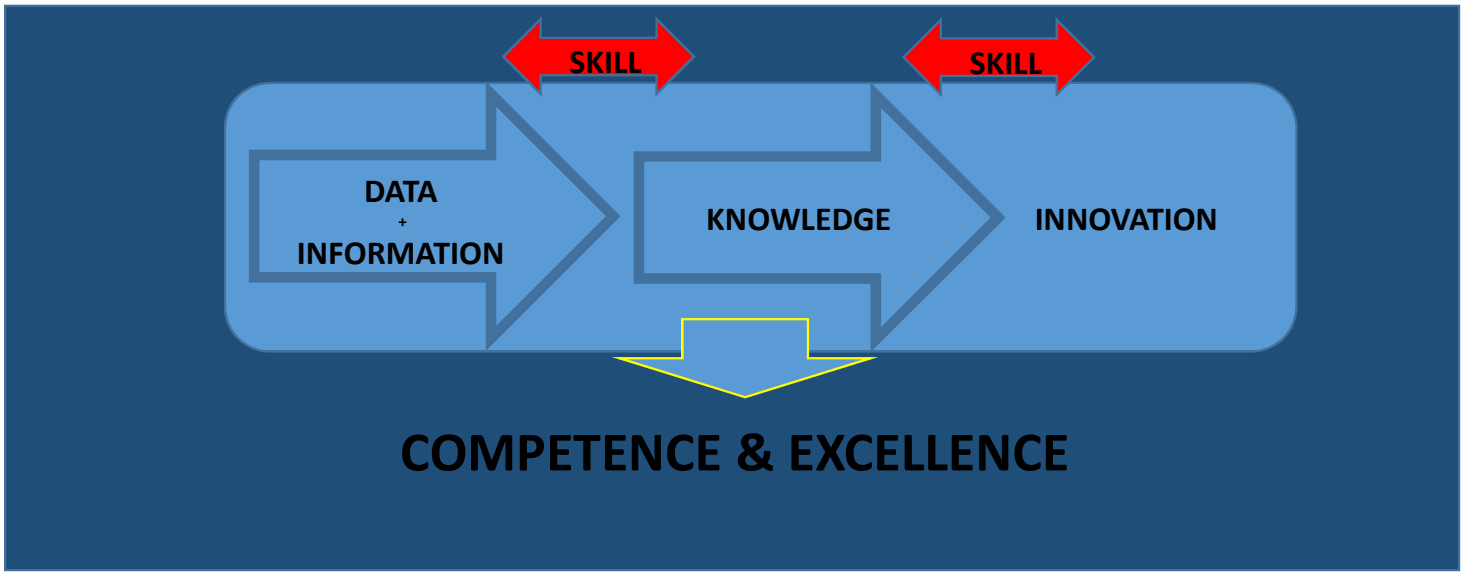
Better resolution in frequency

Better resolution in time

MARINE INTELLIGENCE

WHAT IS INNOVATION?

A + B = C	Current product
A + ϐ = C’	Change ingredient
A ~ B = C’’	Change process
A + B + x = D	Add ingredient
P + Q = R	Completely new



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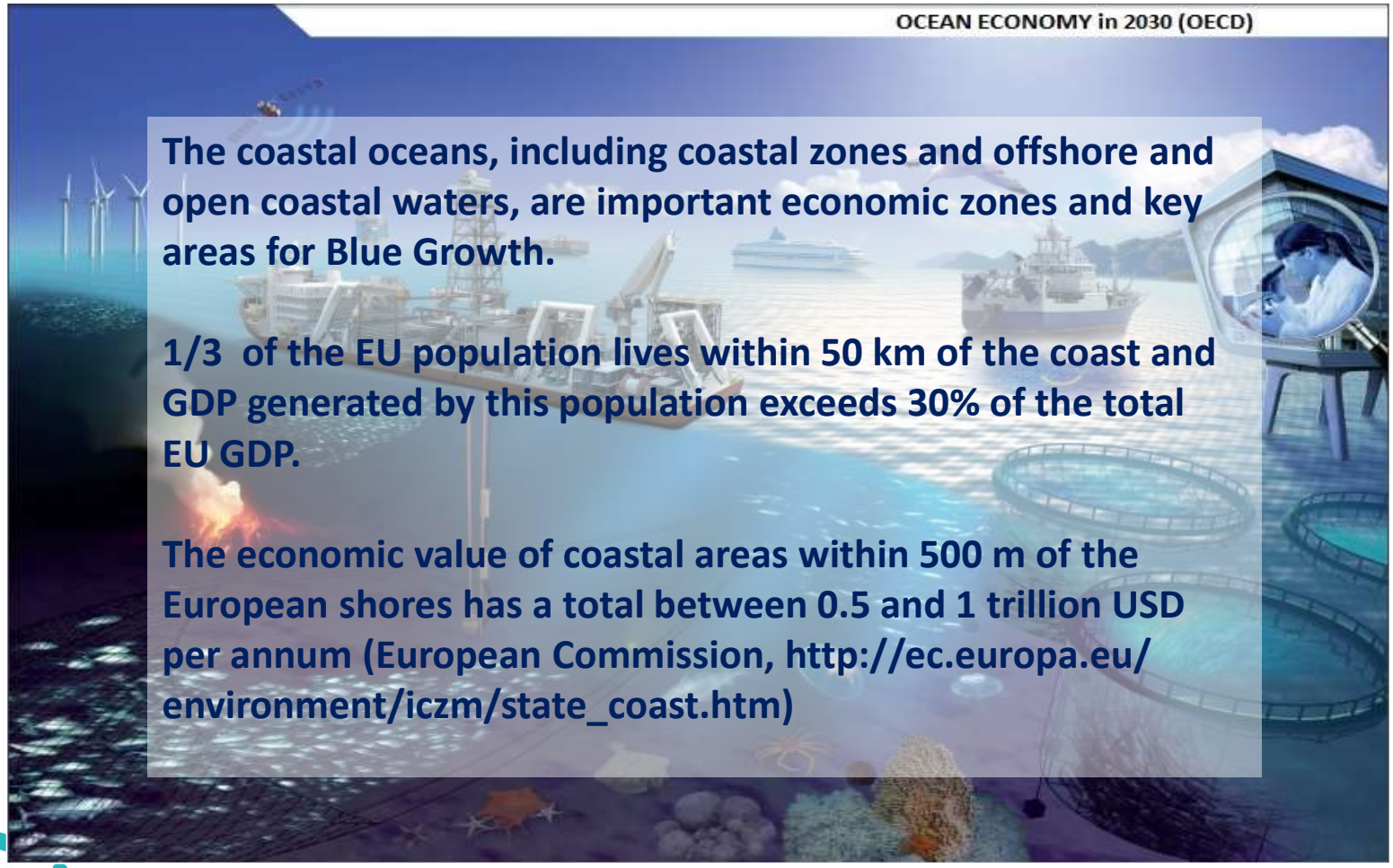
LECTURE 1

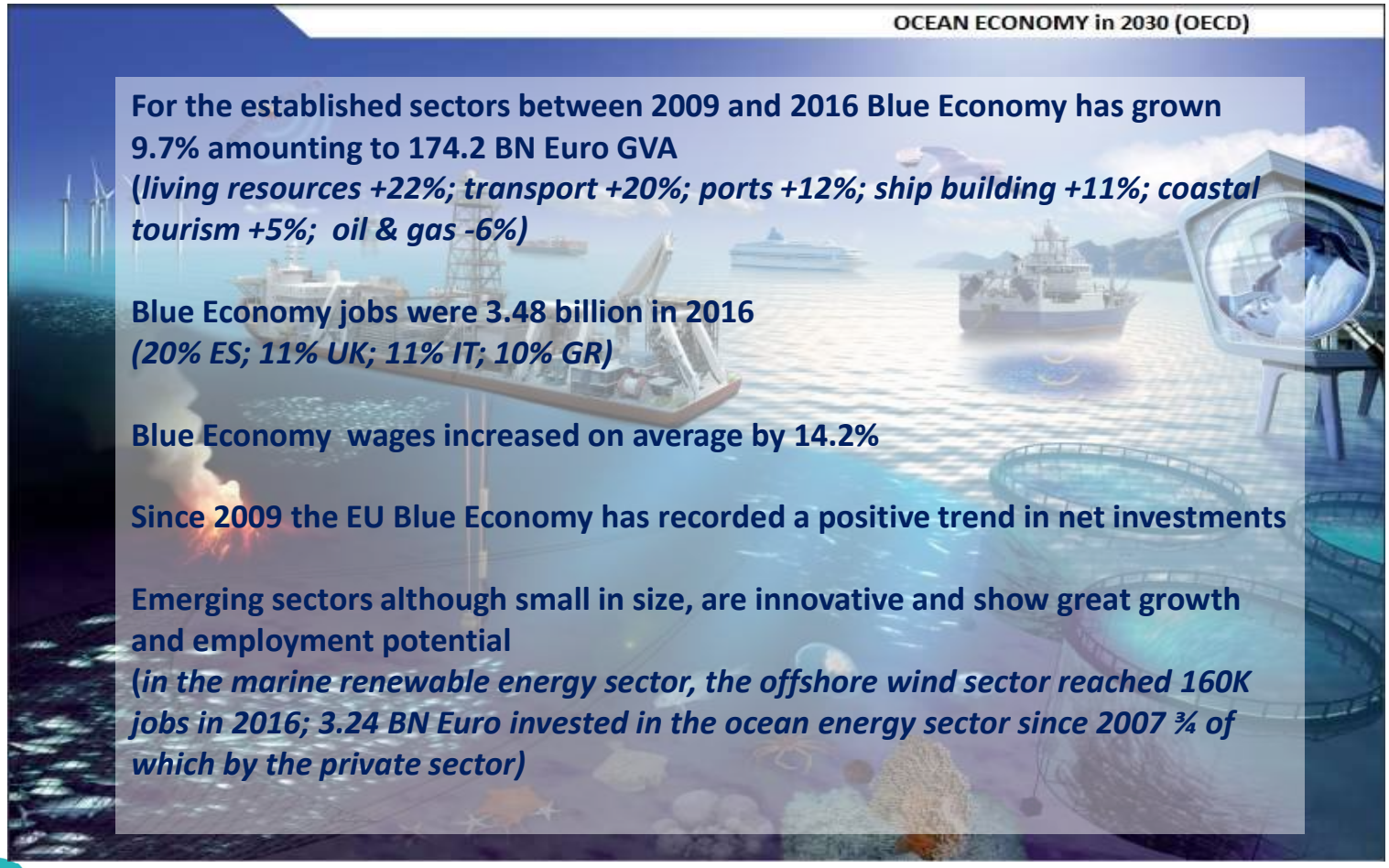

OCEAN ECONOMY in 2030 (OECD)
Ocean economy encompasses ocean-based industries (eg shipping, fishing, offshore wind, marine biotechnology) + natural assets + ocean ecosystem services (eg. fish, shipping lanes, CO_2 absorption, etc.).
Ocean-based economy in 2010 (1.5 trillion USD in value added, 2.5% of world GVA)
….. ocean-based industries have the potential to outperform the growth of the global economy as a whole……. will double by 2030 even on a 'business as usual' scenario
strongest growth: marine aquaculture, offshore wind energy, fish processing, shipbuilding & repair.
40 million full-time equivalent jobs by 2030



The coastal oceans, including coastal zones and offshore and open coastal waters, are important economic zones and key areas for Blue Growth.

1/3 of the EU population lives within 50 km of the coast and GDP generated by this population exceeds 30% of the total EU GDP.

The economic value of coastal areas within 500 m of the European shores has a total between 0.5 and 1 trillion USD per annum (European Commission, http://ec.europa.eu/environment/iczm/state_coast.htm)


OCEAN ECONOMY in 2030 (OECD)
For the established sectors between 2009 and 2016 Blue Economy has grown 9.7% amounting to 174.2 BN Euro GVA
(*living resources +22%; transport +20%; ports +12%; ship building +11%; coastal tourism +5%; oil & gas -6%)*
Blue Economy jobs were 3.48 billion in 2016
(20% ES; 11% UK; 11% IT; 10% GR)
Blue Economy wages increased on average by 14.2%
Since 2009 the EU Blue Economy has recorded a positive trend in net investments
Emerging sectors although small in size, are innovative and show great growth and employment potential
(*in the marine renewable energy sector, the offshore wind sector reached 160K jobs in 2016; 3.24 BN Euro invested in the ocean energy sector since 2007 ¾ of which by the private sector)*

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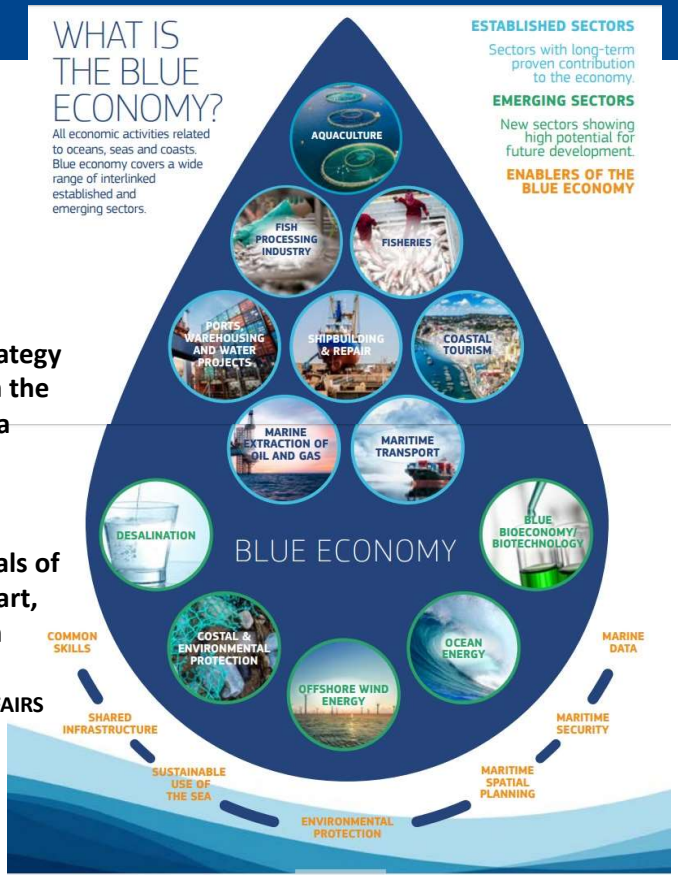
SUPPORT TO BLUE ECONOMY



Blue Growth is the long term strategy to support sustainable growth in the marine and maritime sectors as a whole.

Initiated as the maritime contribution to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth

HTTPS://EC.EUROPA.EU/MARITIMEAFFAIRS

Seas and oceans are drivers for the European economy and have great potential for innovation and growth.

SECTORS HAVE HIGH POTENTIAL FOR SUSTAINABLE JOBS AND GROWTH

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LECTURE 1

Some basic concepts about data

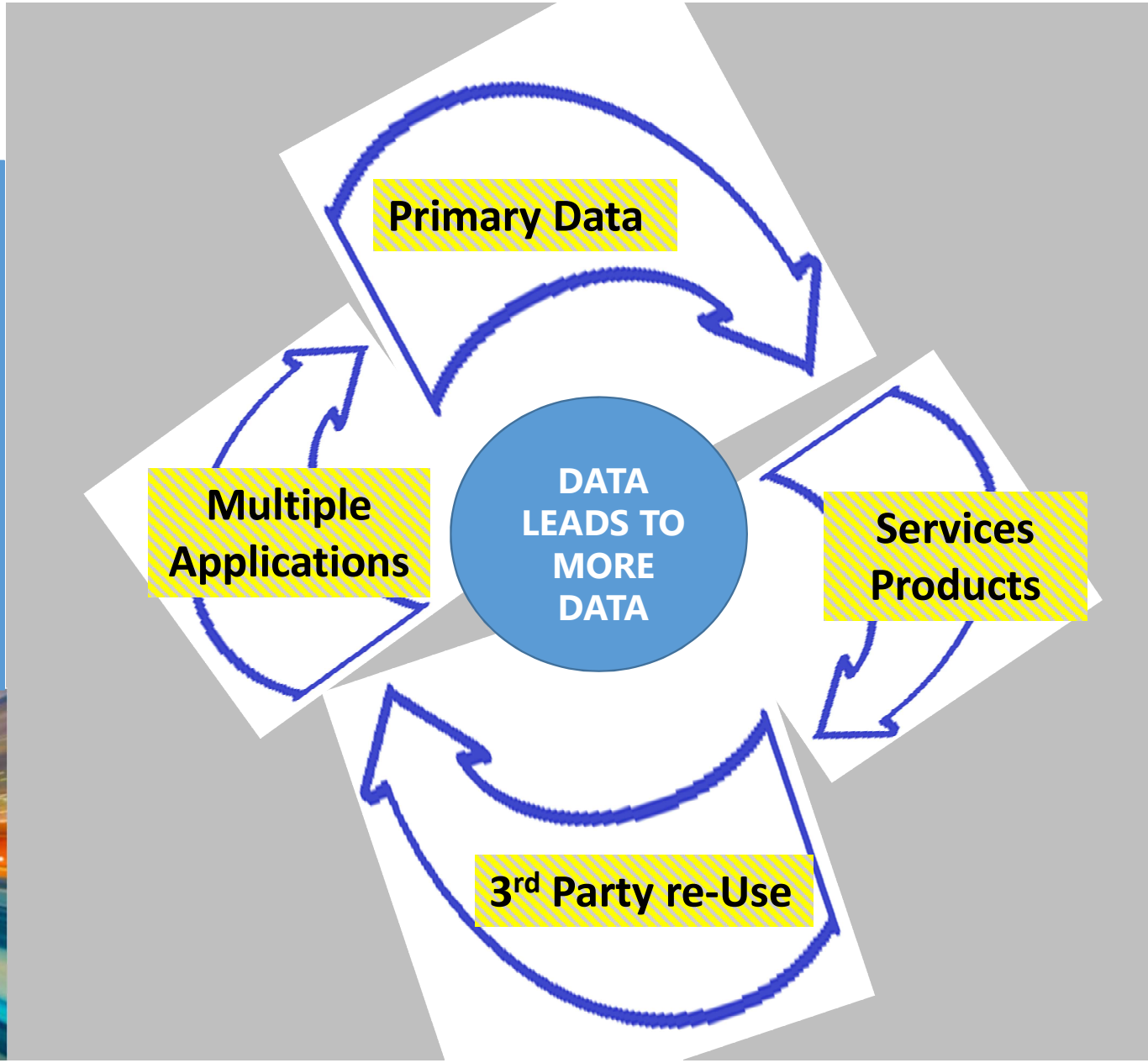
Circular data ecosystem

Raw data is originally generated mainly for target usage and clients

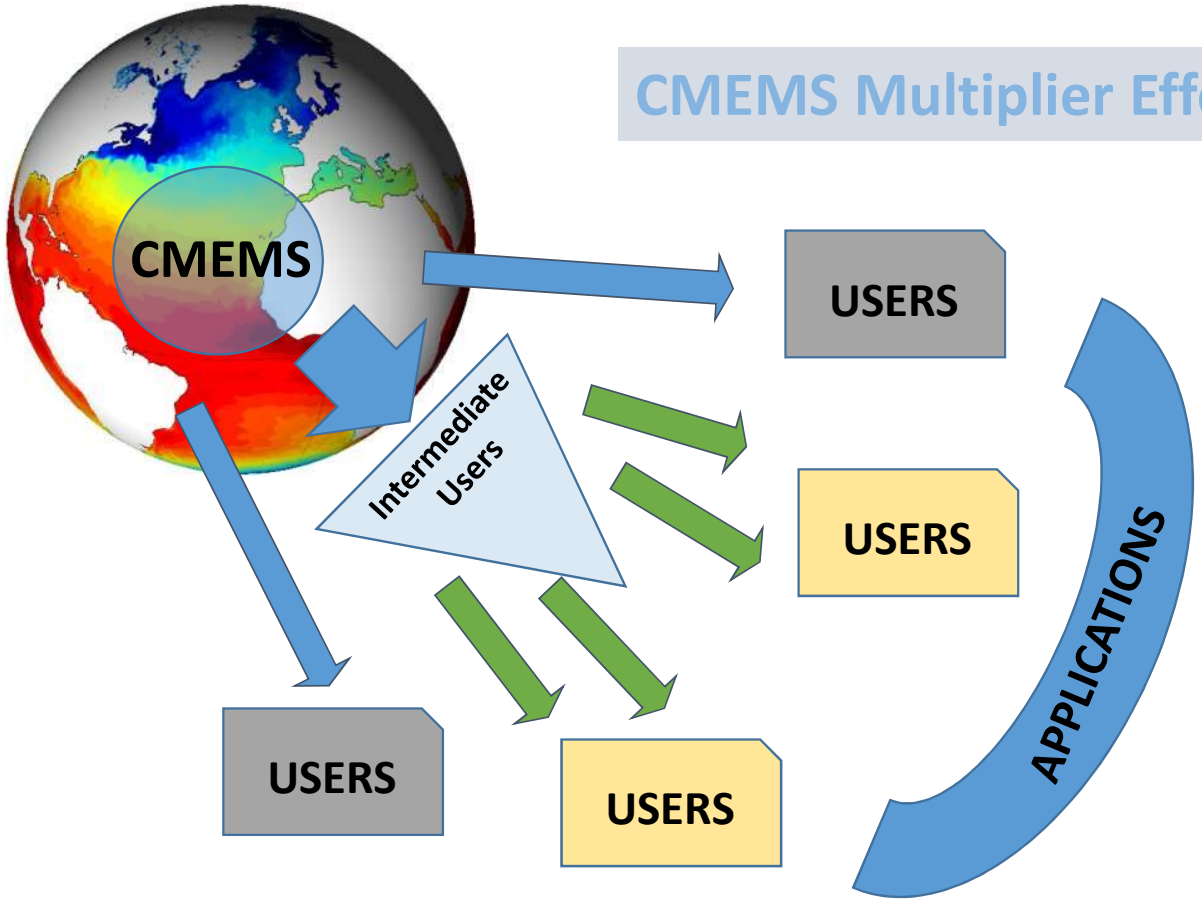
Re-use of data by third parties generates more request of dependent data

Multiple applications further generate more data that is eventually merged to primary data

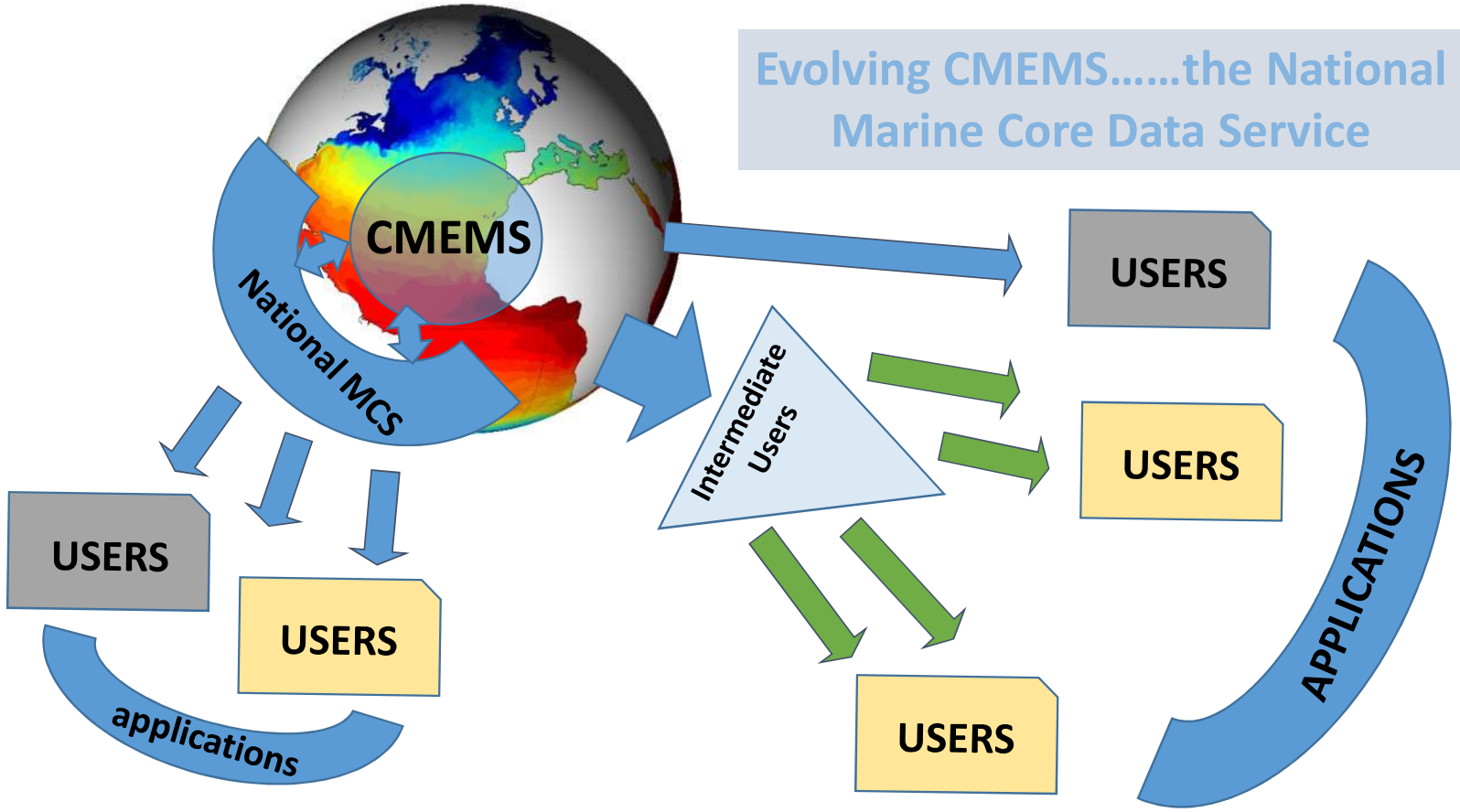
Enhanced data sets spin further and wider usage



Role of national systems in EOOS



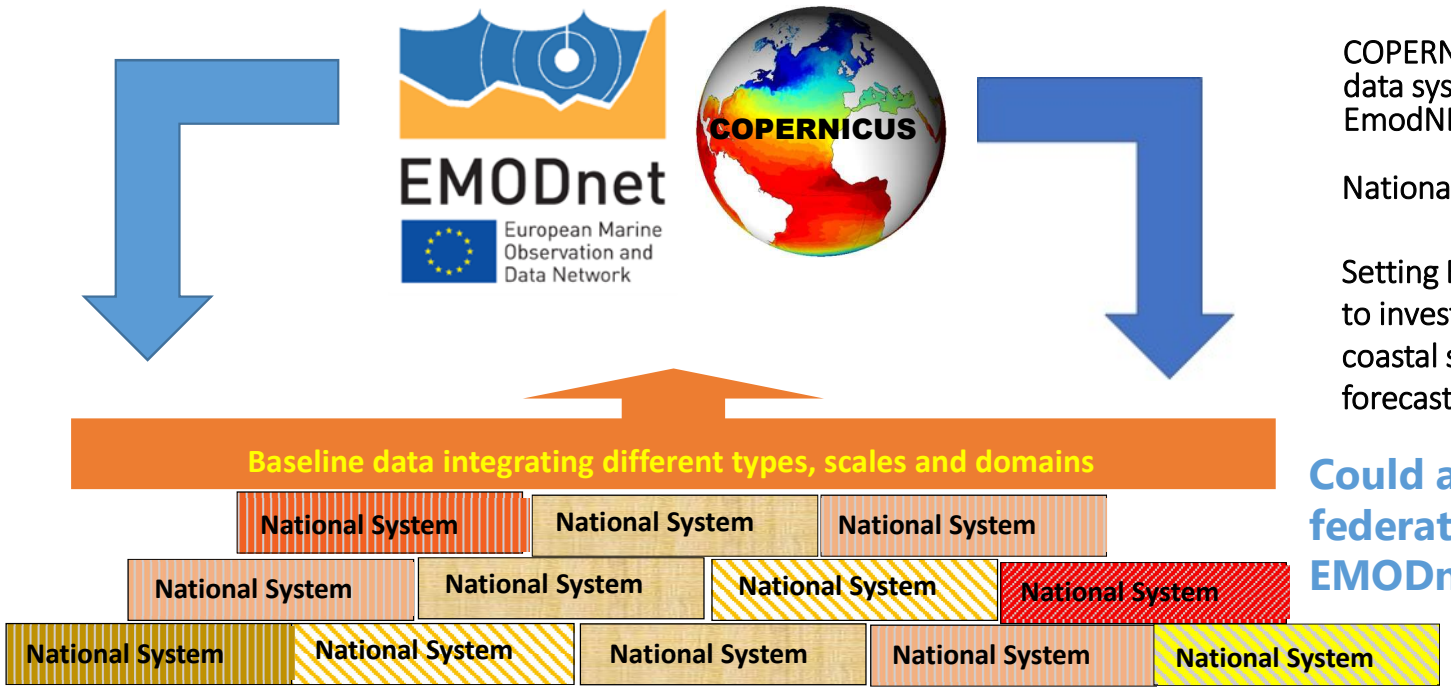
Role of national systems in EOOS



Role of national systems in EOOS

Challenge of MS to coordinate large datasets, needing to adopt a harmonised approach to data management (commons standards) to enable an efficient subsequent integration of data that reaps the full benefits to users

MS need to build, organize and maintain their baseline data in a seamless, interoperable and synergistic system.....such systems need to be similar and not just compatible? ....linked by machine-to-machine communication



EOOS design with NSs serving as building blocks for coastal and HR marine data

COPERNICUS-like national marine core data systems linked to CMEMS and EmodNET

National desk(s) to link to local users

Setting EC targets for commitments to invest in national capacities for coastal sea observations & forecasting

Could a platform of platforms federating national systems to EMODnet and CMEMS work?

CONTACTS AND FOLLOW UP

Prof. Aldo Drago

aldo.f.drago@gmail.com