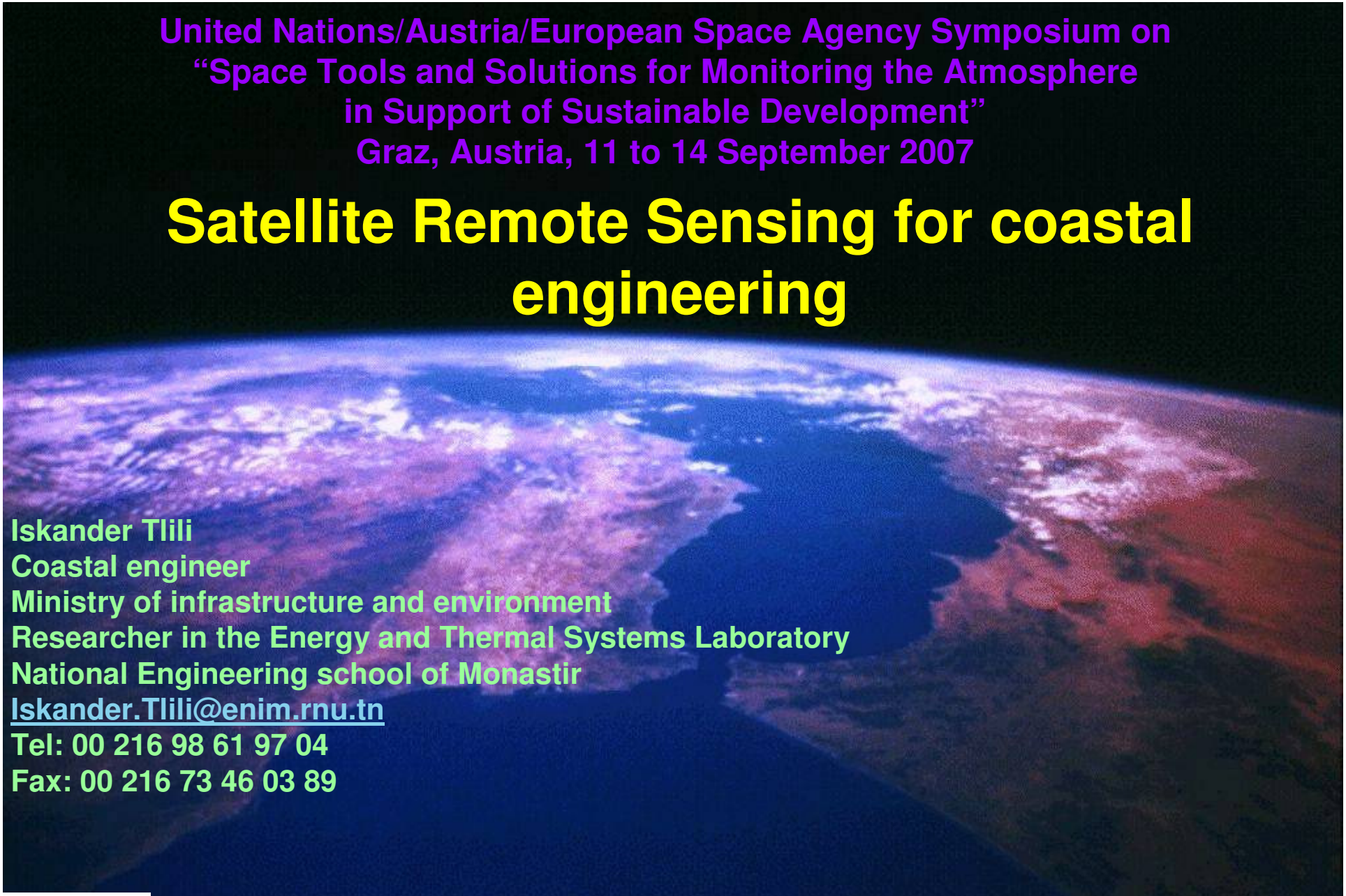
United Nations/Austria/European Space Agency Symposium on
"Space Tools and Solutions for Monitoring the Atmosphere
in Support of Sustainable Development"
Graz, Austria, 11 to 14 September 2007

Satellite Remote Sensing for coastal engineering



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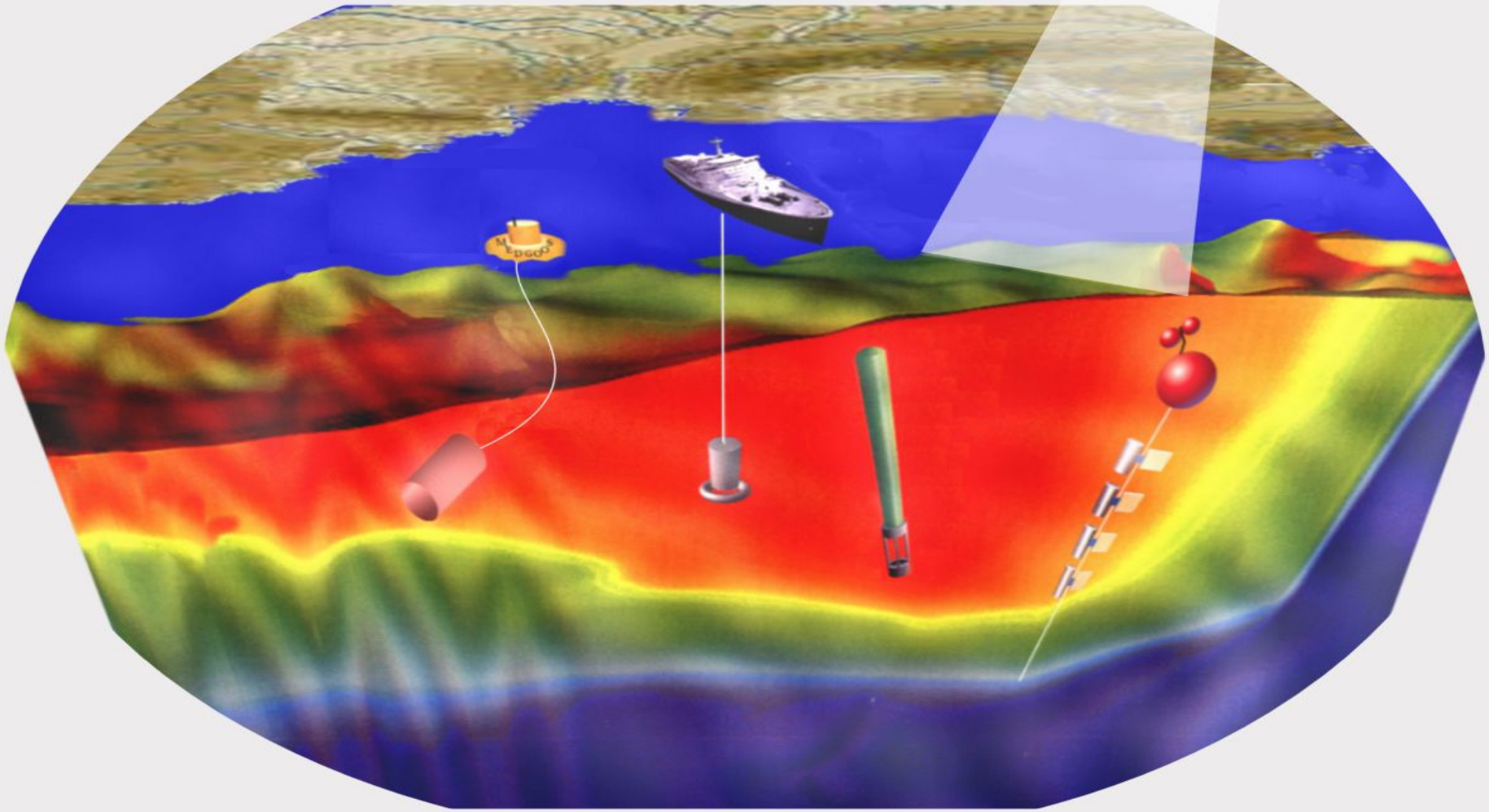
➢WHY WE OBSERVE THE SEA?



- ✓Policy formulation and sound management based on facts
- ✓Monitor the health of the coastal sea and safeguard resources
- ✓Protect from disasters/hazards
- ✓Support marine safety
- ✓Support marine industries by added-value products and specialized services

COUNTLESS ECONOMIC AND RECREATIONAL ACTIVITIES OF THE SEA

❑ *The sea as a supplier of services*

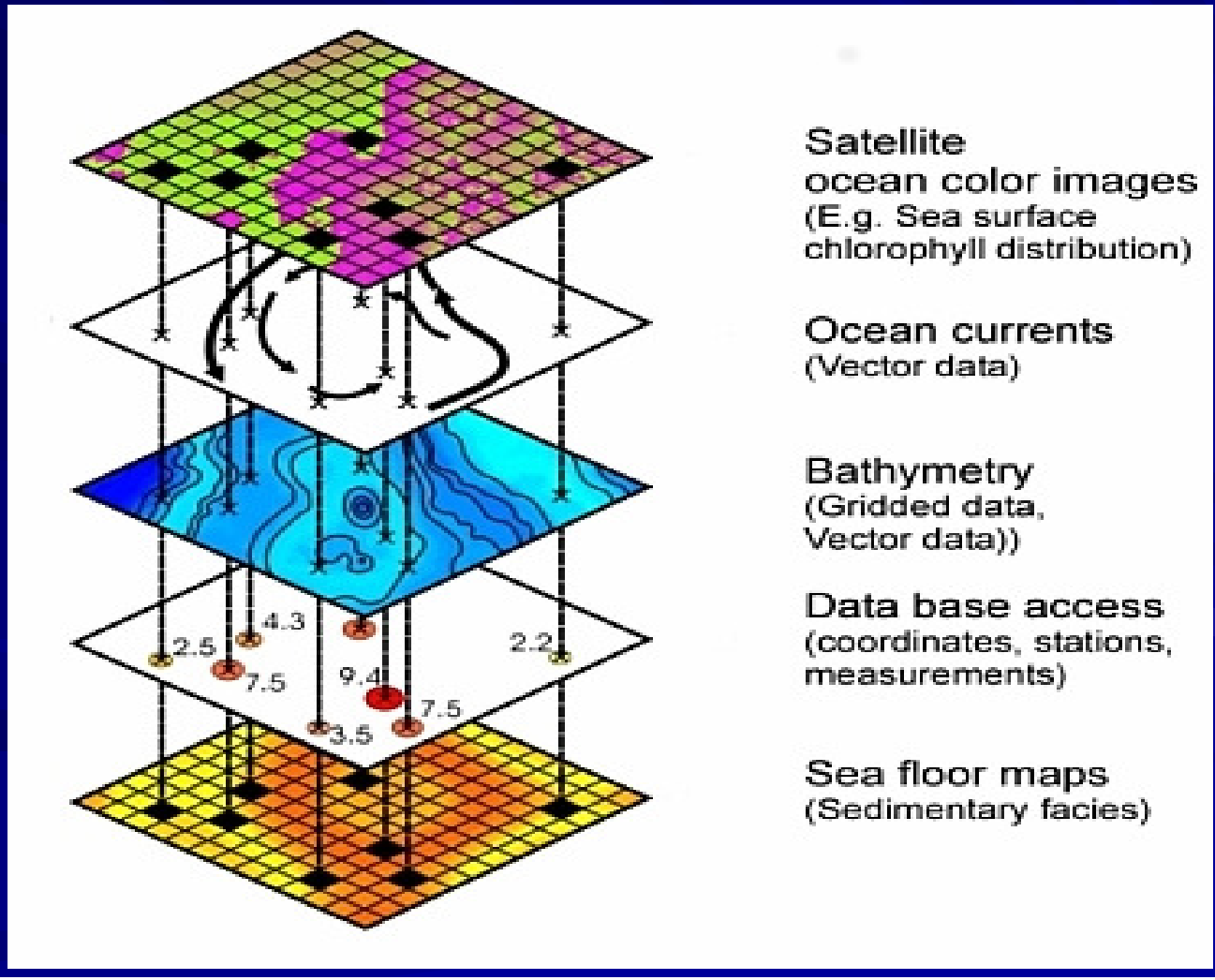
- ship transport accounts for 90 % of the world's trade tonnage.
- Tourism (the largest industry worldwide) was a business of $525 billion in 2003, employing 260 million people

❑ *The Sea as a supplier of goods*

- Living resources
  - ✓ Fisheries
  - ✓ Bio-products
- Non-living resources
  - ✓ Energy
  - ✓ Mineral deposits

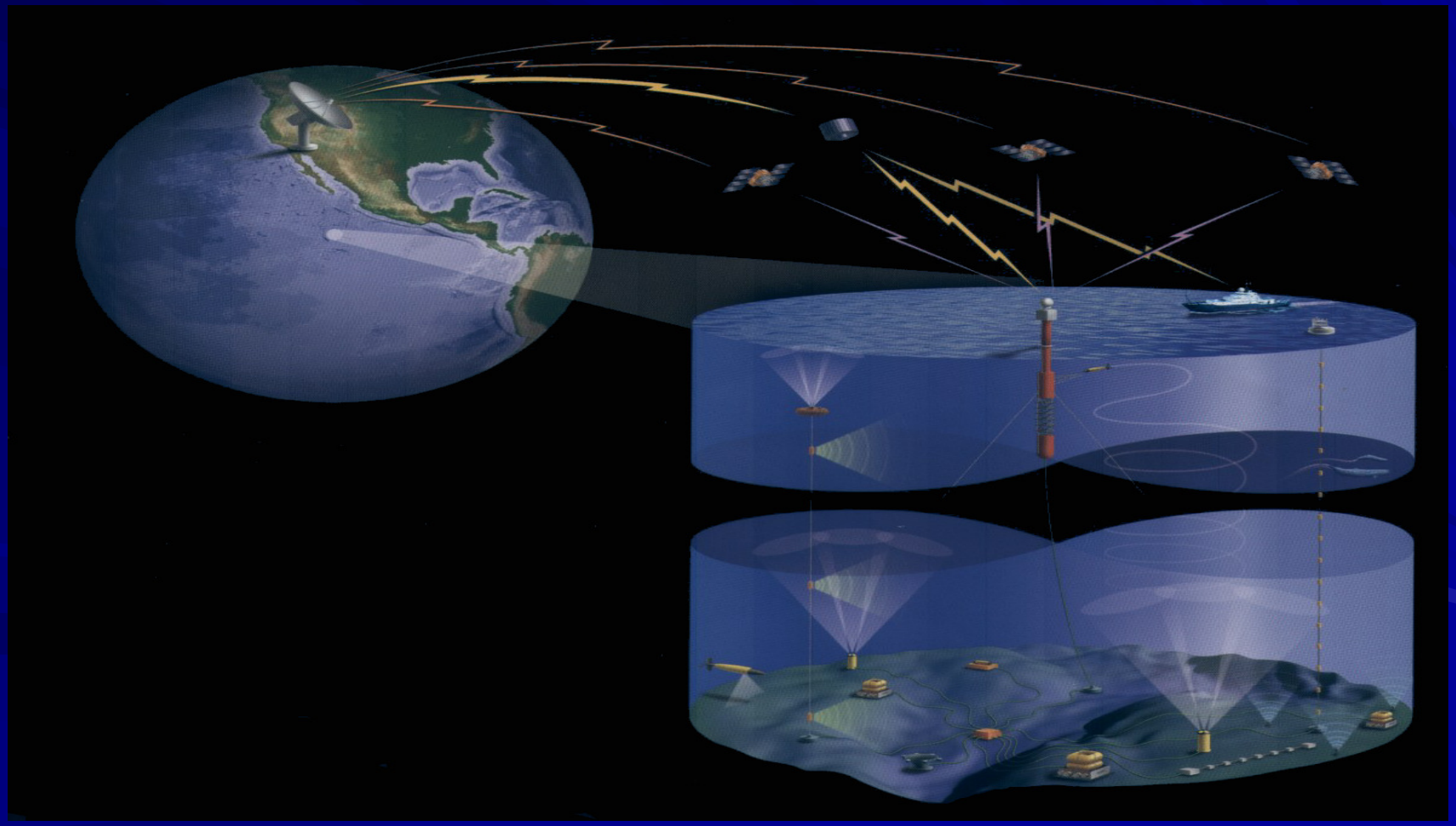
Remote sensing for sustainable development

Human mind and technological development would solve all obstacles to future progress and economic growth, finding substitutes for depleted resources.



The observing system

There are three RS data sources:



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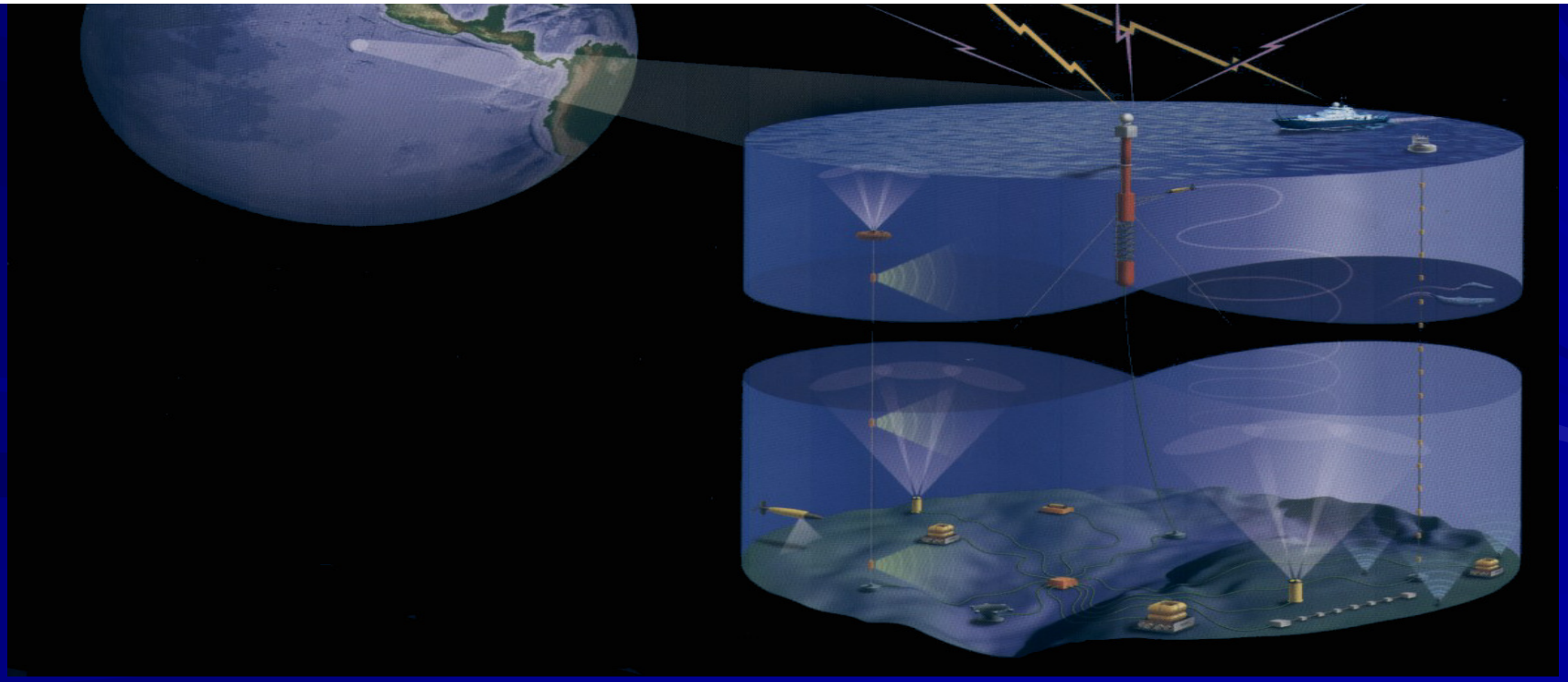
Satellite data: made available through data bases (1972 onwards starting with LANDSAT MSS)



The observing system

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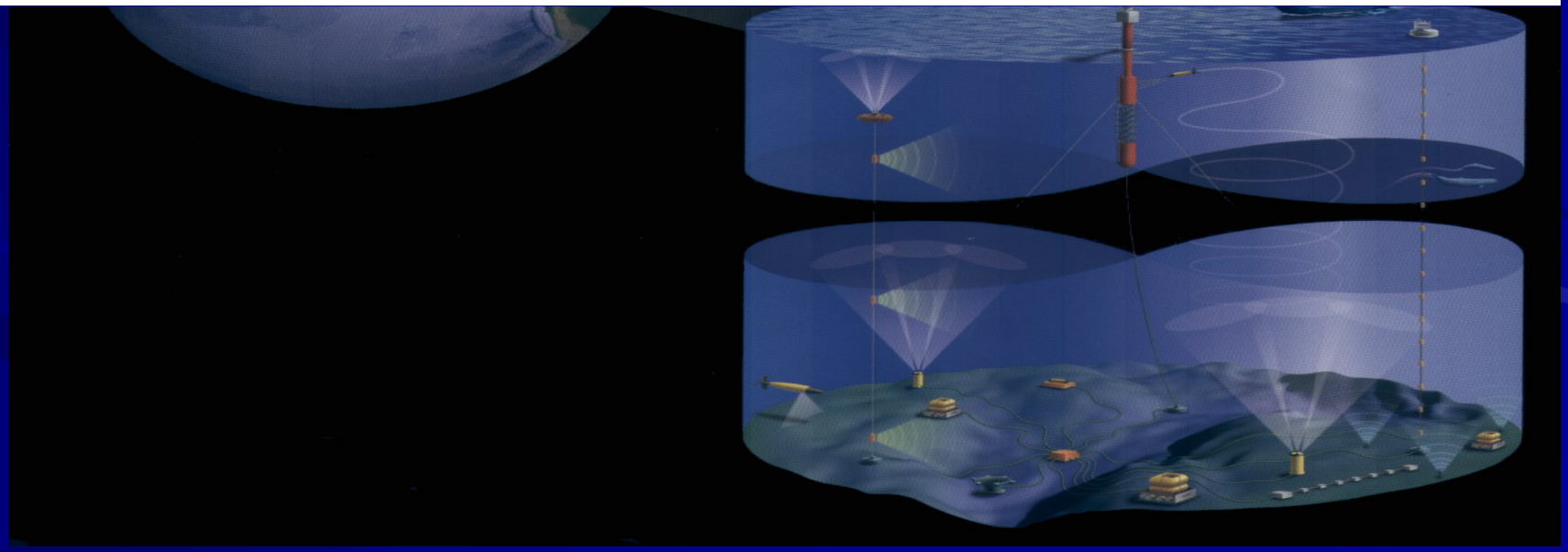
Satellite data: made available through databases (1972 onwards starting with LANDSAT MSS)

Digital airborne data: recorded for specific projects with restricted coverage



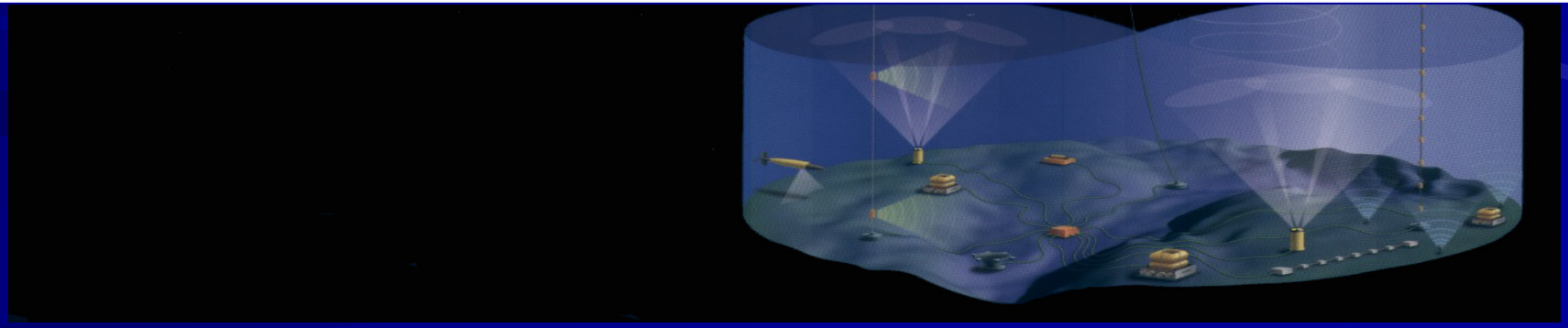
The observing system

There are three RS data sources:

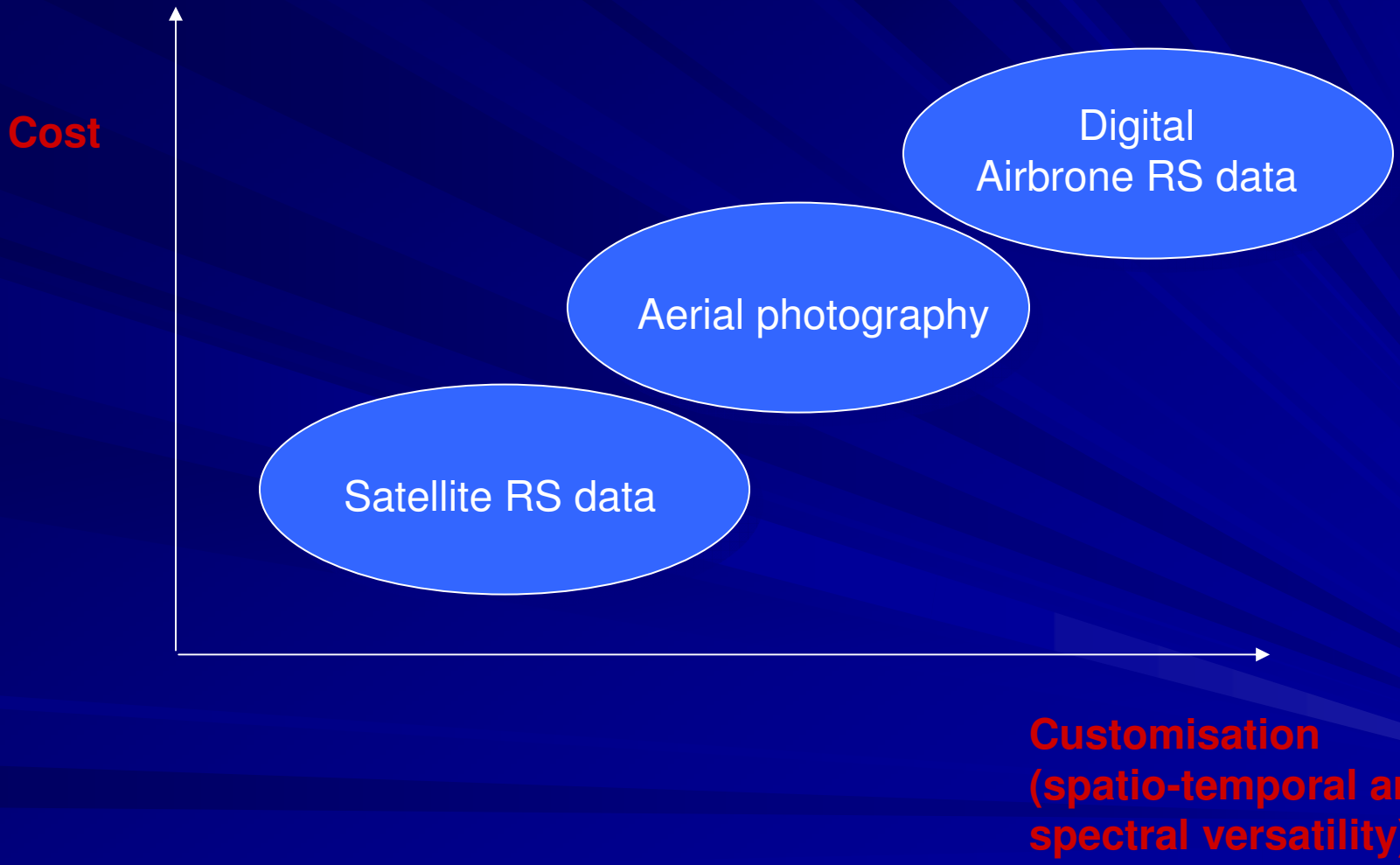
Satellite data: made available through databases (1972 onwards starting with LANDSAT MSS)

Digital airborne data: recorded for specific projects with restricted coverage

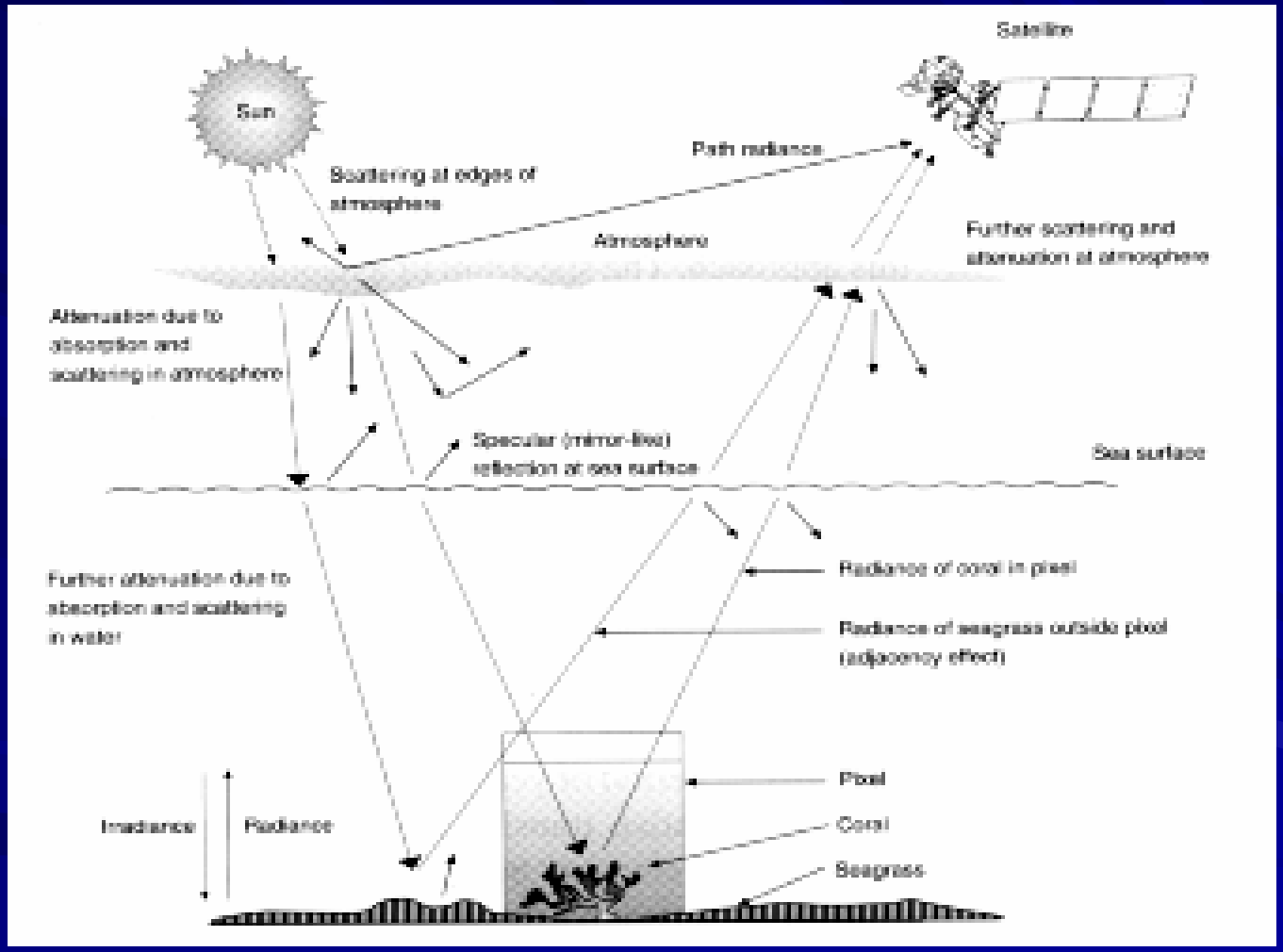
Aerial photography recorded for a specific project or obtained from an archive



Remote sensing using Satellite data offers large benefits because of the high costs of monitoring using only traditional methods.

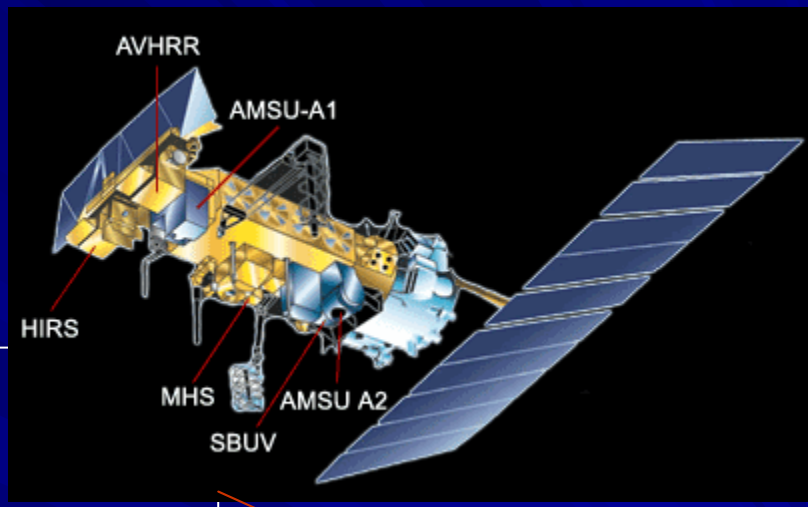


Among the most useful indicators of water quality is ocean colour. It is the result of the interaction between visible solar irradiance, water, and substances like phytoplankton, suspended sediment, and coloured dissolved organic matter, which in turn may reflect the condition of water bodies.



Attempts to quantify these variables have been made using a variety of sensors, among which are:

Examples of RS satellite Imagery useful for coastal and ocean applications



AVHRR SENSOR ON NOAA 9-18

Advanced Very High Resolution Radiometer

Coastal/Ocean applications
Sea surface temperature; ocean colour
Platform: NOAA POES
Sensor: Advanced Very High Resolution Radiometer
Operation: 1984-present
Spatial resolution: 1.1km; temporal resolution: 12 hours
Wavebands: Band 1: 580-680nm
Band 2: 725-1100nm
Band 3: 3550-3930nm
Band 4: 10.3-11.3um
Band 5: 11.4-12.4um

Solar Backscattered Ultraviolet system/Version 2

AVHRR SENSOR ON NOAA 9-18

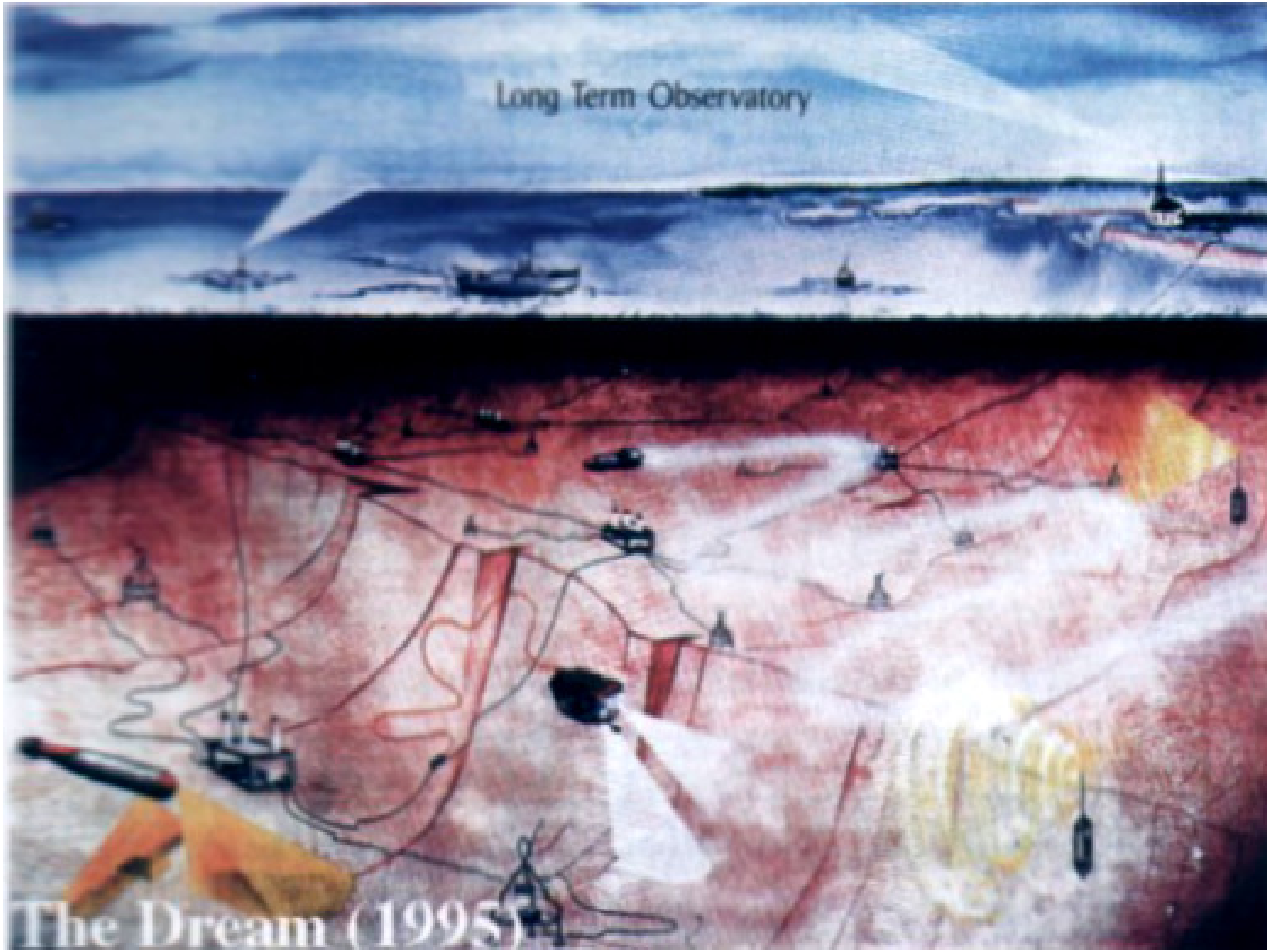
Image dimensions: 2399km
Products available: Photographic and digital images
Cost per image: Free from own receiving station; media costs and postage; free download by ftp.

Source: http://www.class.noaa.gov
The Comprehensive Large Array-data Stewardship System (CLASS): an electronic library of NOAA environmental data.
This web site provides capabilities for finding and obtaining those data.

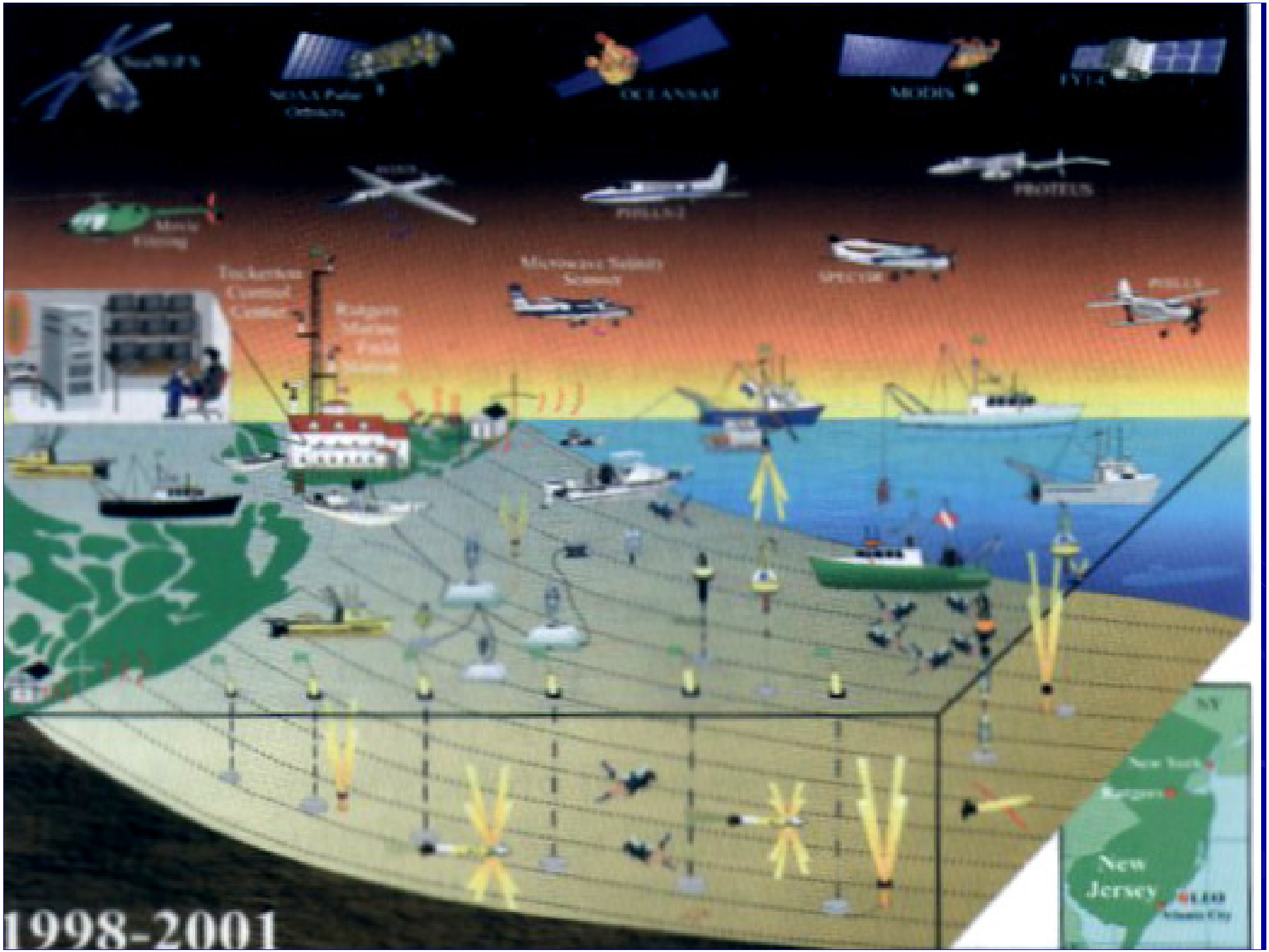
Kind of information necessary for marine sustainable development?

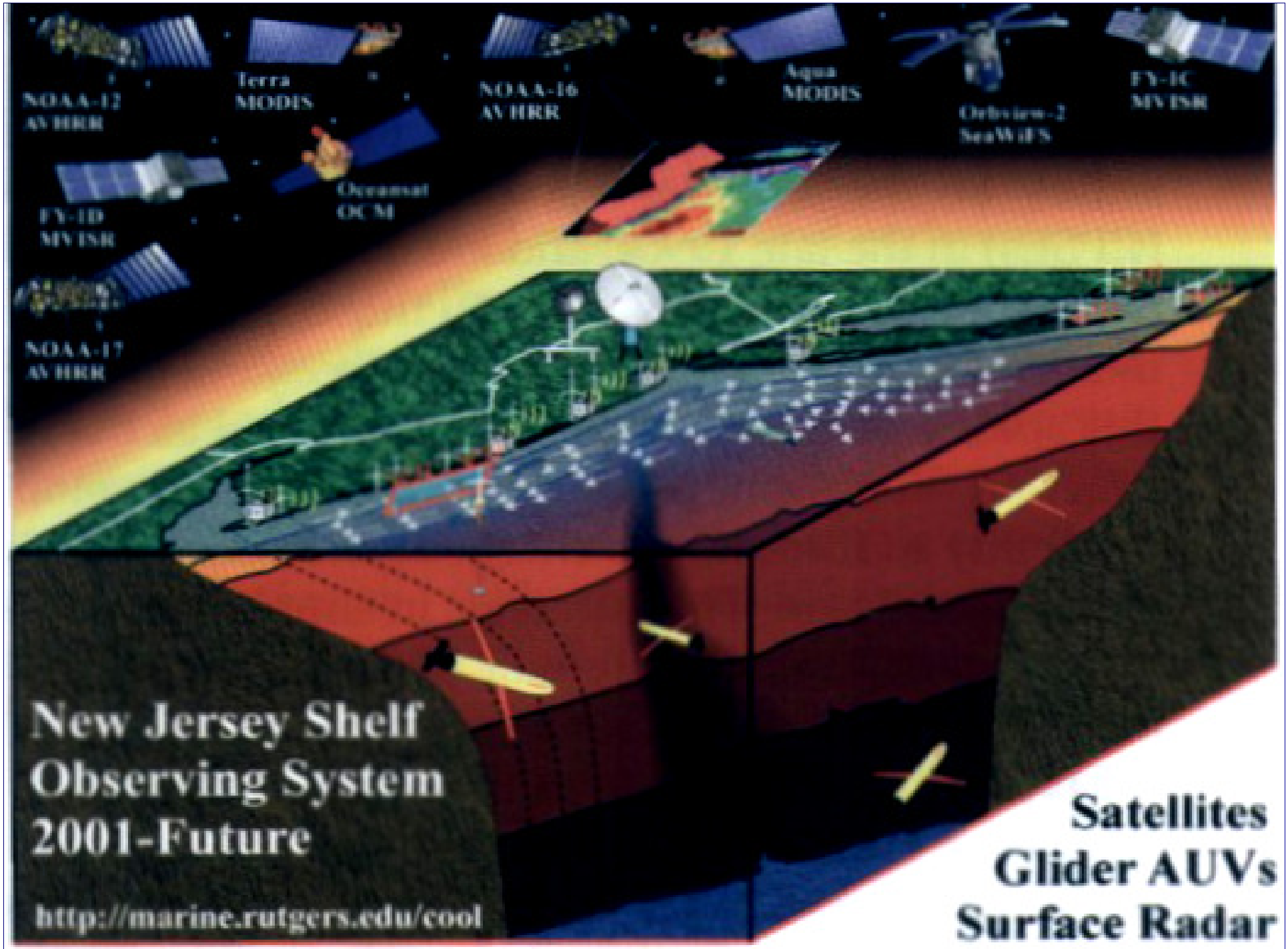
Business and regulatory users like scientists need to know :

- **What?** …most important parameters to measure
- **Where?** …more than local observations
- **When?** …understanding occurrence of ocean processes inforecasts
- **Why?** … most fundamental and hardest question

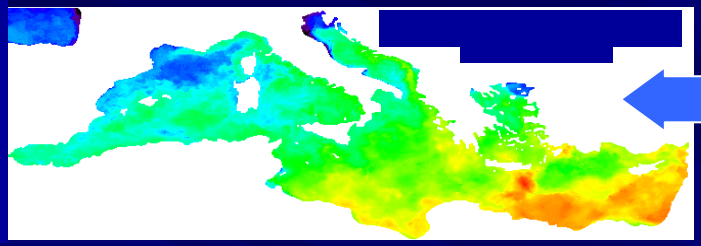


The Dream (1995)


OCEANSAT
MODIS
PROTEUS
Rutgers Marine Field Station
New Jersey
1998-2001

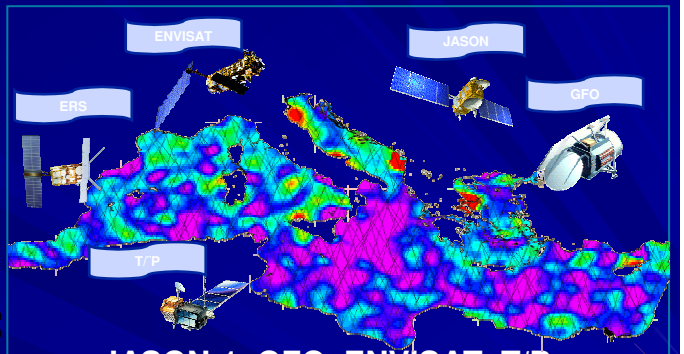

NOAA-12
AVHRR
Terra
MODIS
NOAA-16
AVHRR
Aqua
MODIS
Orbview-2
SeaWiFS
FY-1C
MVISR
FY-1D
MVISR
Oceansat
OCM
NOAA-17
AVHRR
New Jersey Shelf
Observing System
2001-Future
http://marine.rutgers.edu/cool
Satellites
Glider AUVs
Surface Radar

Satellite observations



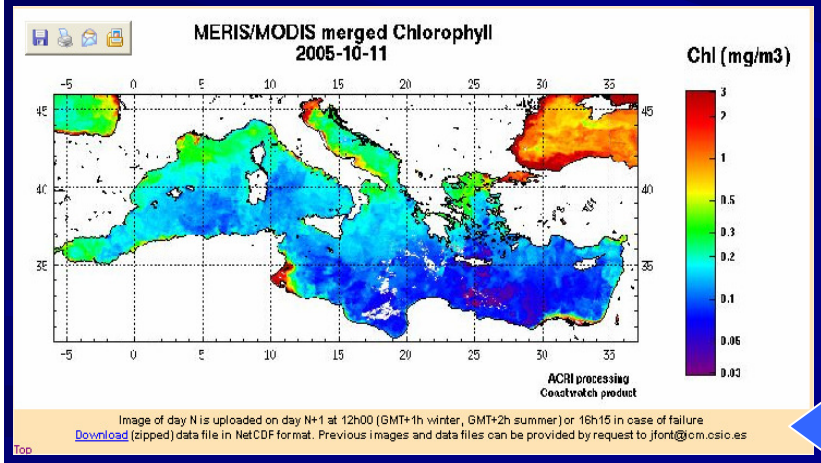
Daily satellite SST interpolated in RT on model grid (one day delay)

SST – delineates sea surface dynamic features in cloud free conditions

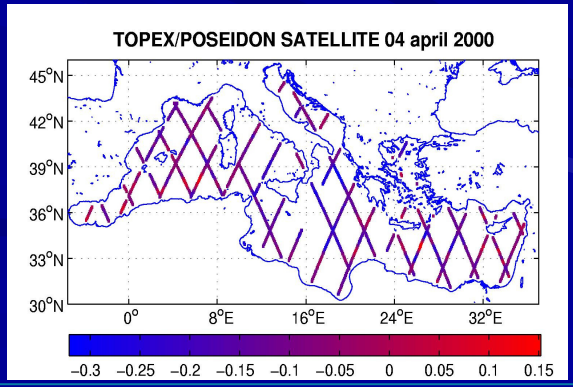


JASON-1, GFO, ENVISAT, T/P Sea Level Anomalies (few days delay)

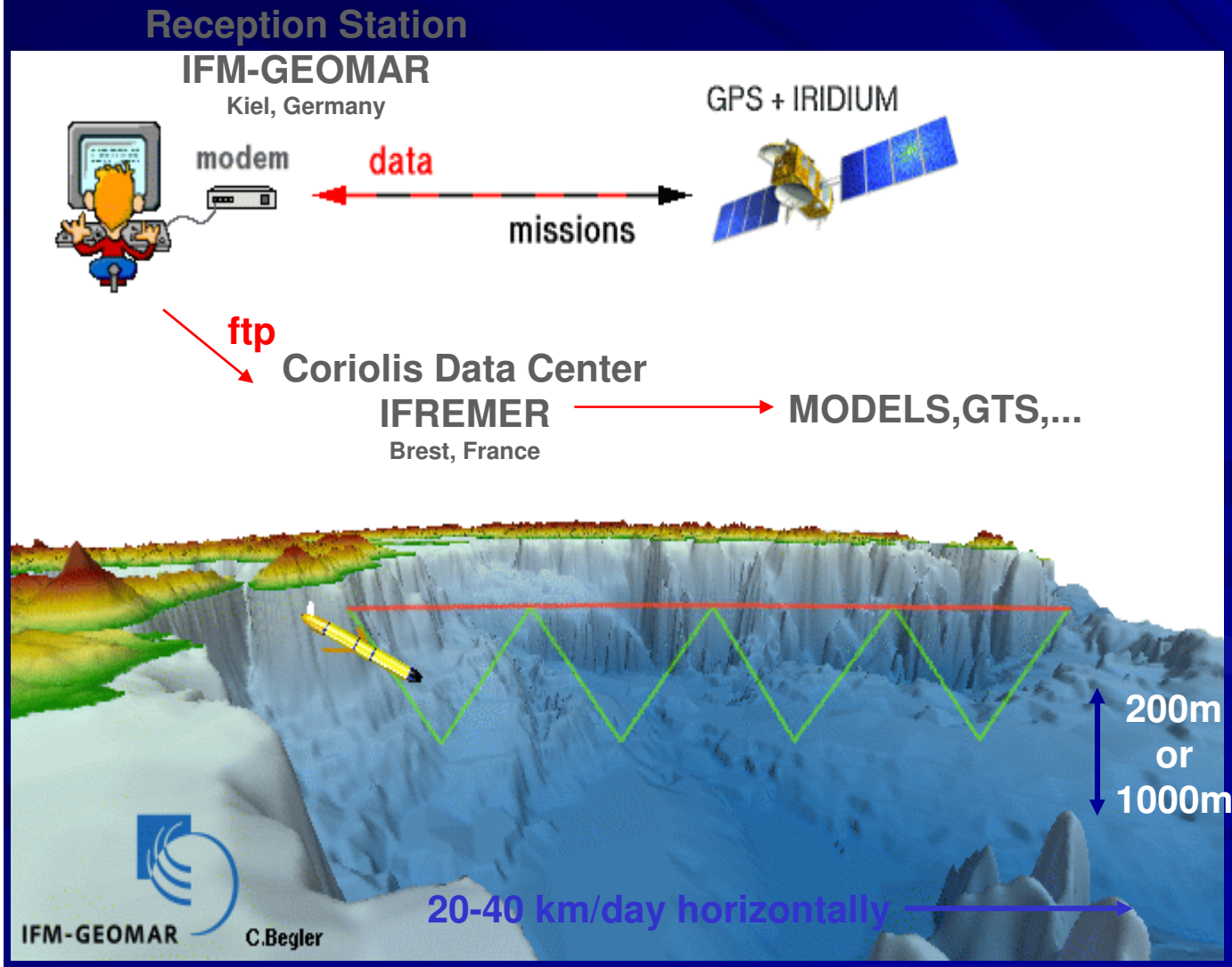
Ocean colour by satellite spectrometry provides synoptic pictures of sea water properties such as phyhthoplankton



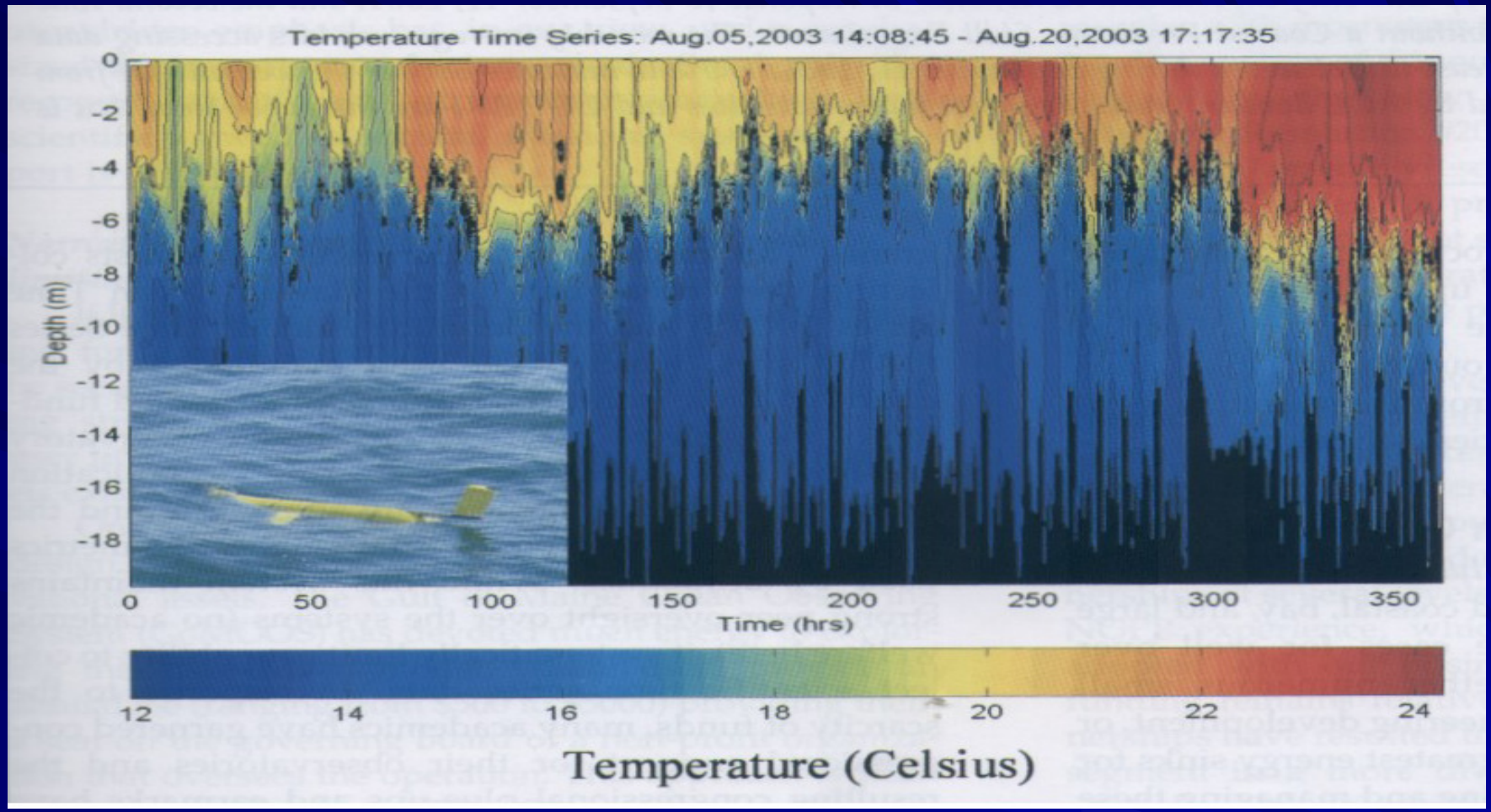
Altimetry – NRT currents from gradients in sea surface heights



MOON (Mediterranean operational oceanography Network) now: pre-operational GLIDER MONITORING EXPERIMENTS

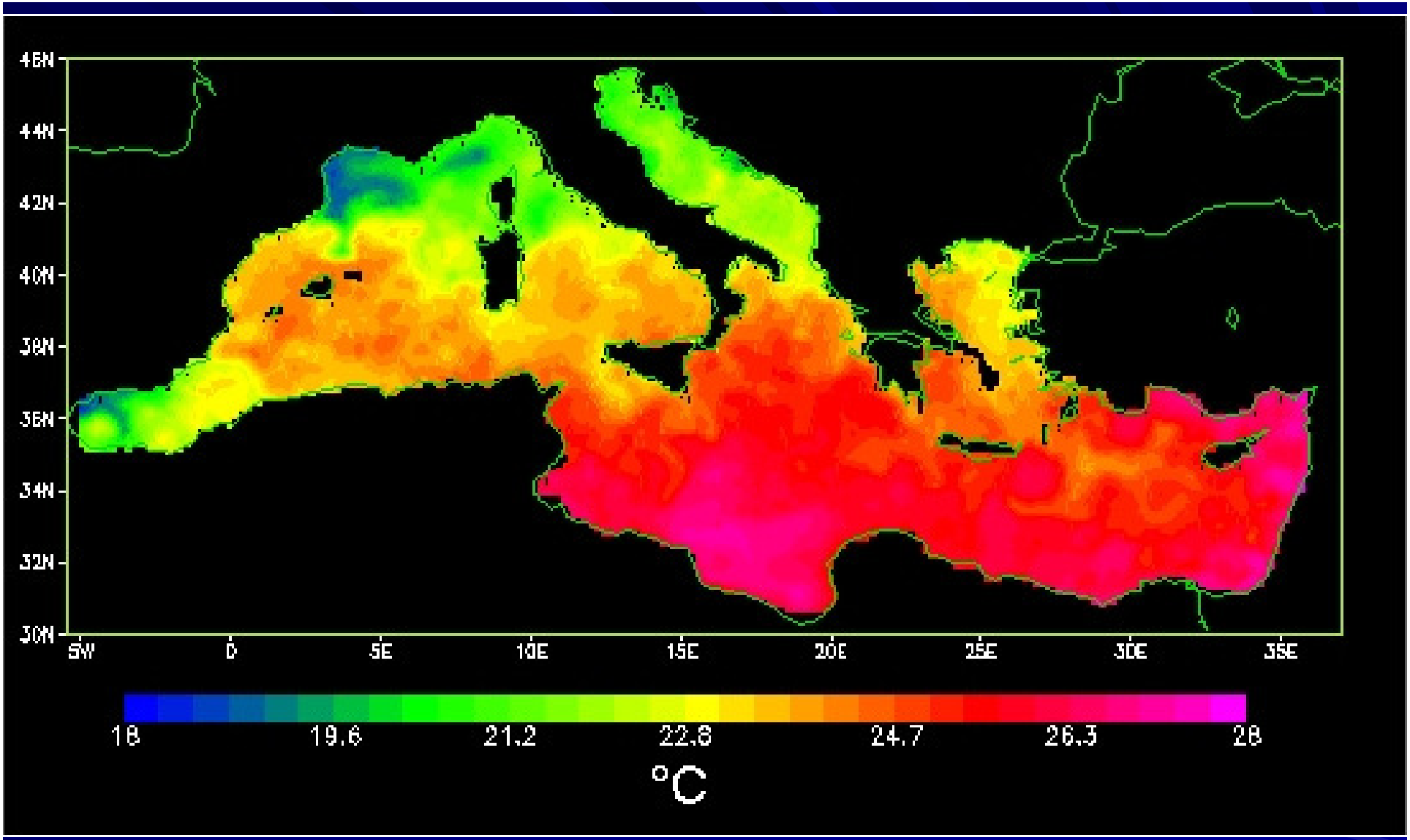


Glider is a coastal electric engine which detects the temperature of deep ocean that is capted by the satellite then sent to reception station

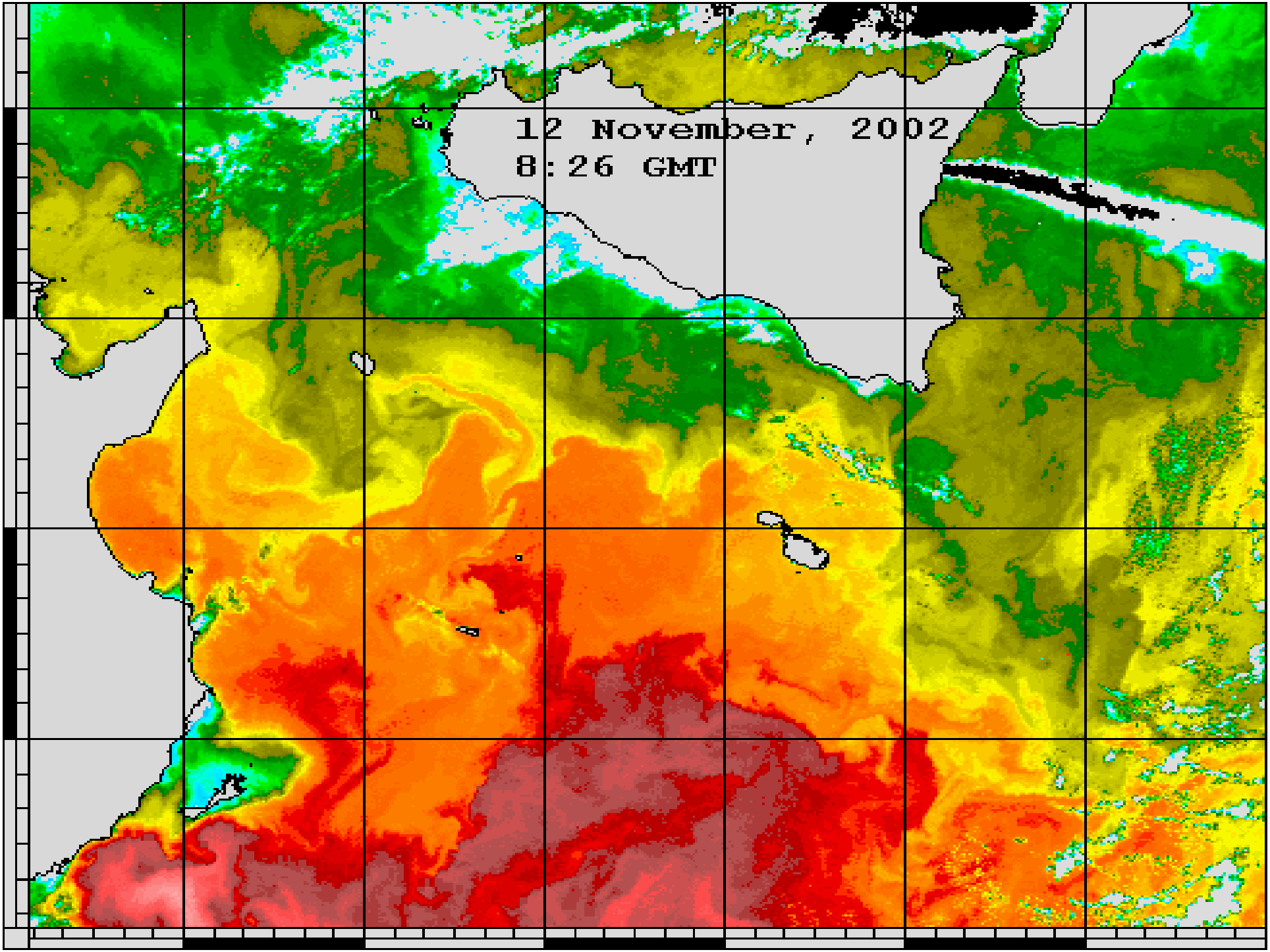


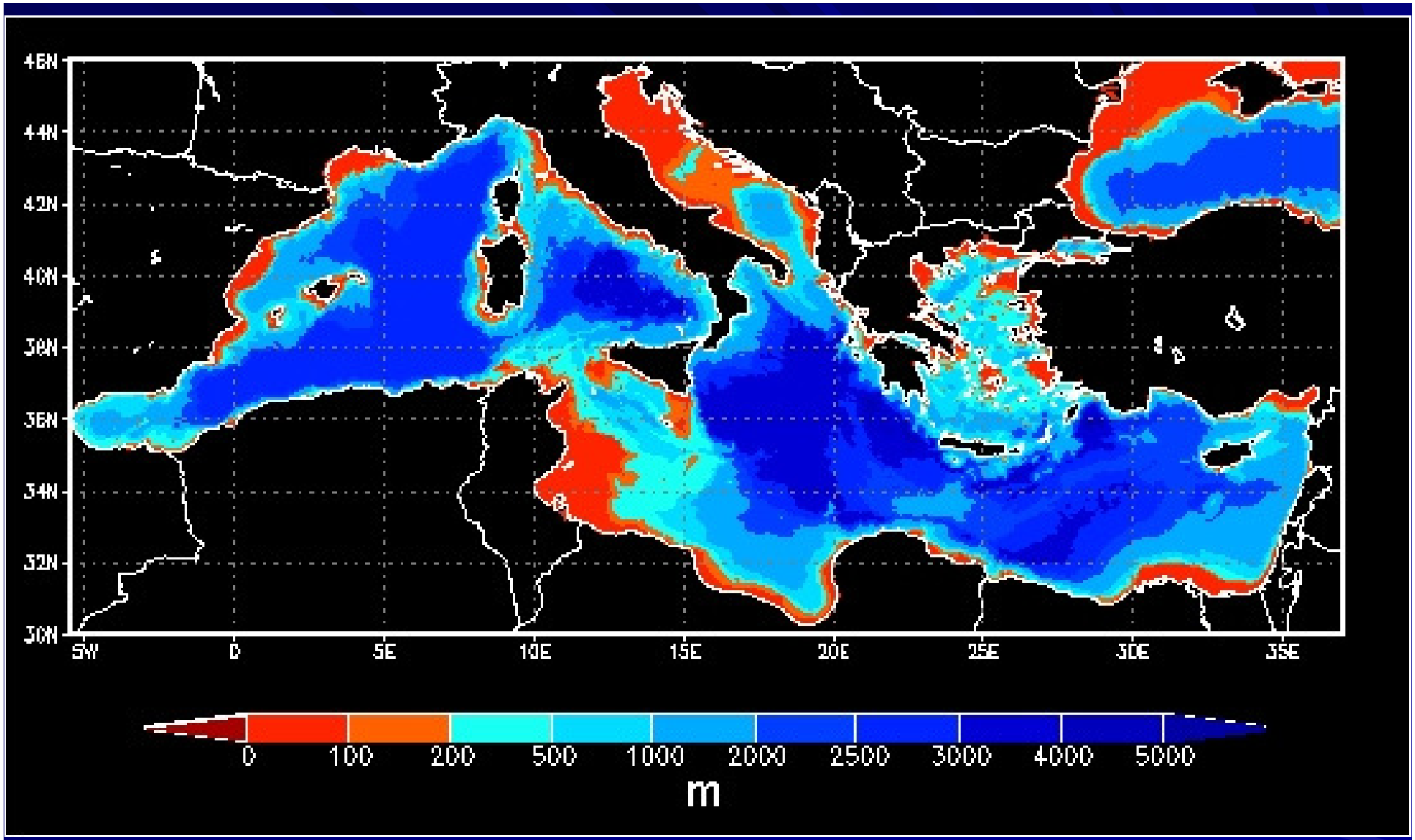
This figure shows a 15 day continuous temperature time series collected by Glider which is ready to transition to becoming a pre operational tool for oceanography.


Remote sensing allow us to explore the different characteristics of oceans like the Mediterranean one



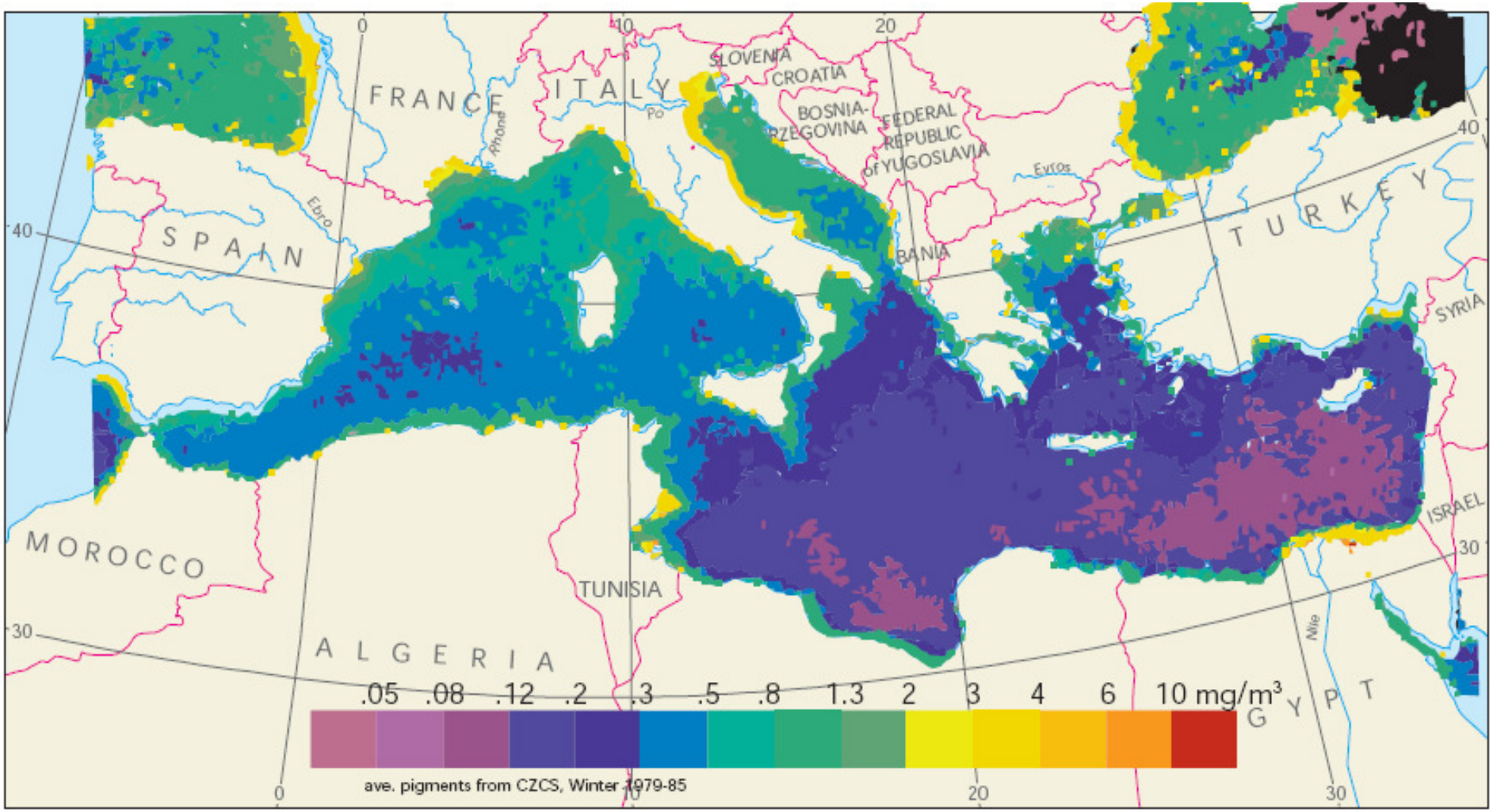
Average SST for the week October 5 to 11, 2001 from satellite data


12 November, 2002
8:26 GMT



Bathymetry of the Mediterranean Sea

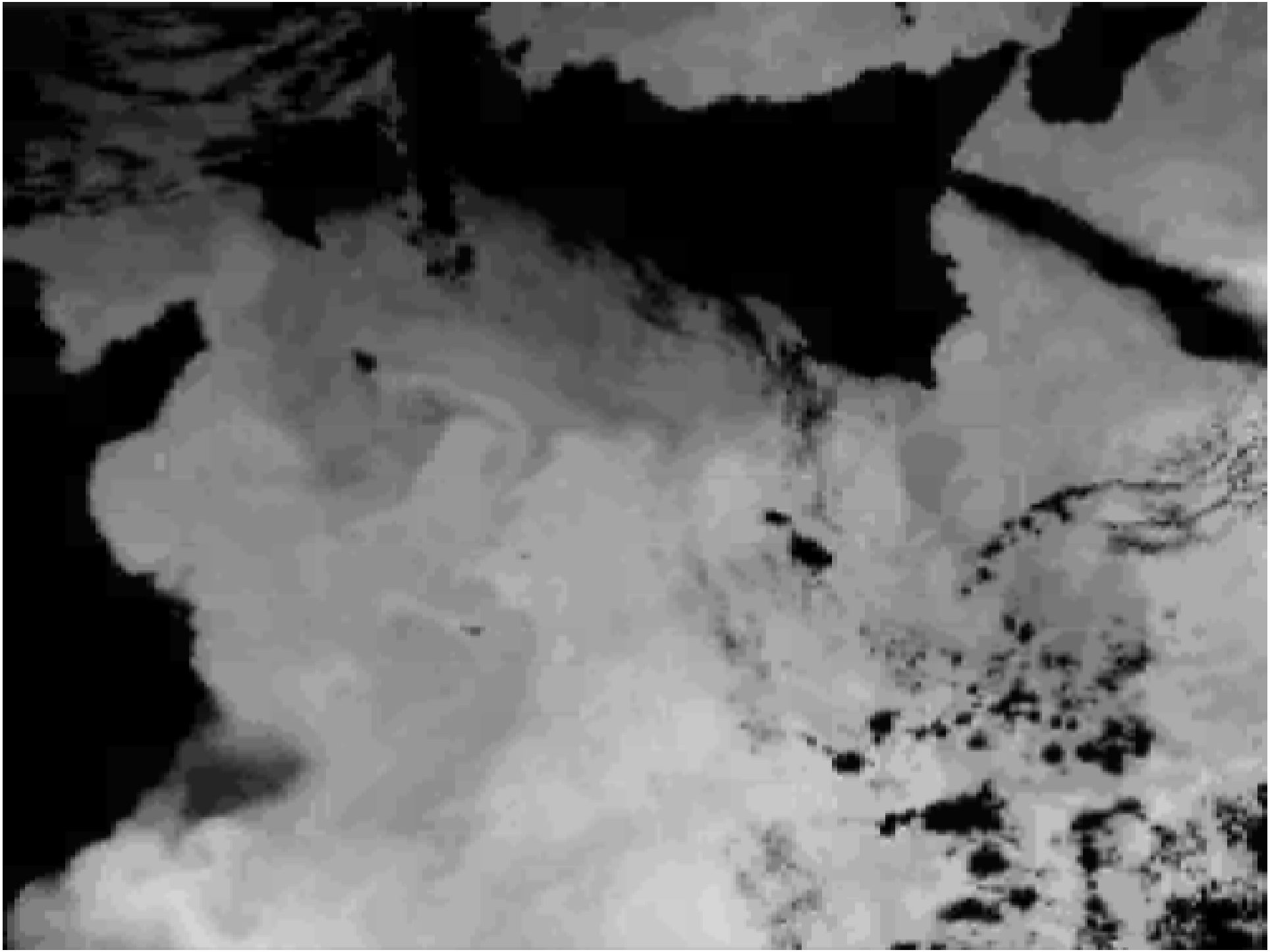
Characteristic narrow shelf areas

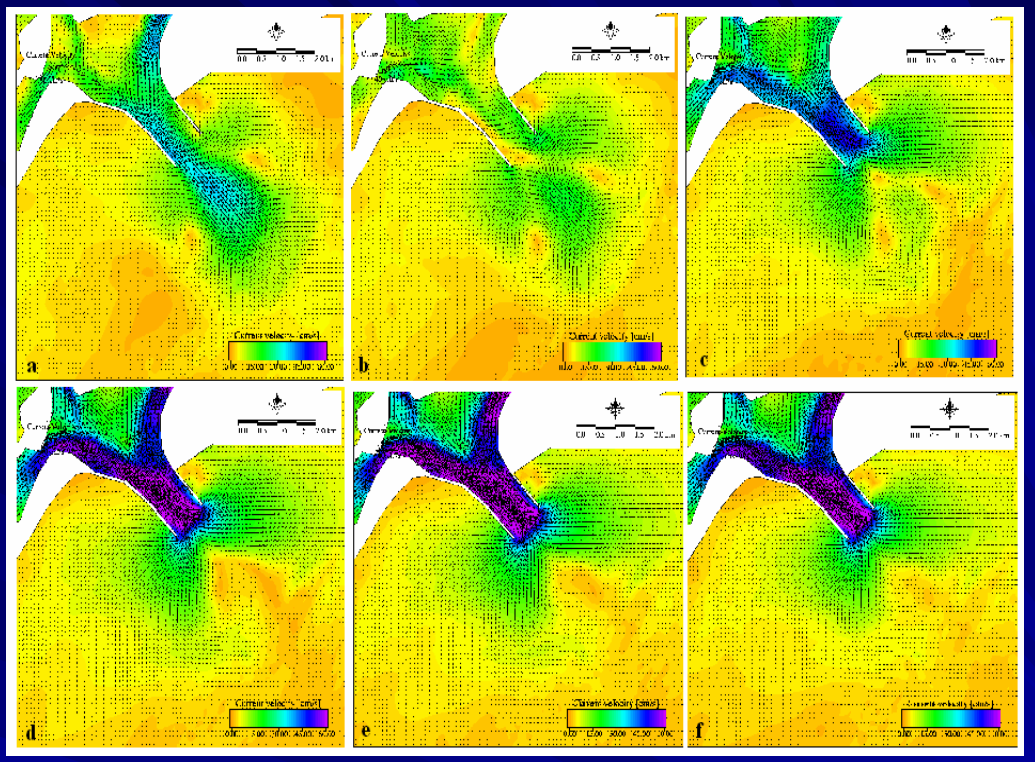


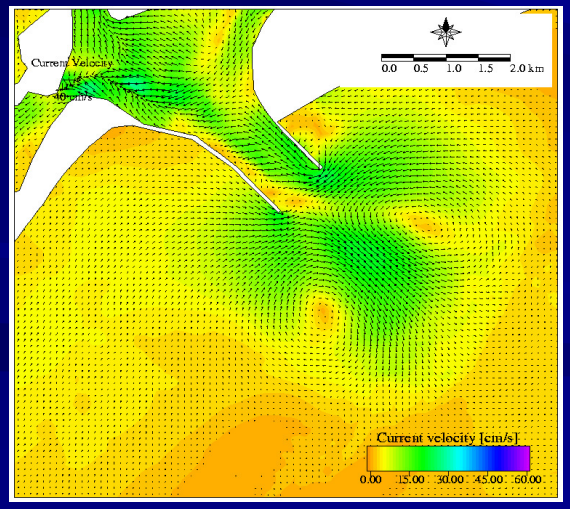
Source: JRC, Ispra

Average chlorophyll variations in surface waters

Wind is relevant to marine management because of its role in the generation of currents, waves, and the direct dispersal of contaminants.







Engineer develop numerical models which have to be experimented in maritime laboratory that are not available anytime and everywhere because of its high cost but actually and thanks to remote sensing we become able to valid our research easily.

General benefits of marine remote sensing

desertification

coastal erosion

coastal algal blooms

oil pollution

marine resources

for coupling with Ocean-Atmosphere Mediterranean regional models

for coupling with wave and sediment transport models at shelf scale

for coupling with biochemical flux models

to be used with oil spill models

to be used with with fishery management models

General applications

- Informed decisions based on knowledge

- Effective and sustainable management of the marine environment
  1. Fisheries
  2. Safe and efficient transportation
  3. Coastal recreation
  4. Marine industries

General applications

- Support economies and improve standards of living
    1. Mitigating marine hazards
    2. Search & Rescue
    3. Public health
    4. Extreme events

- Detecting and forecasting oceanic components of climate variability and change

- Preserving and restoring healthy marine ecosystems


Thank you for your
kind attention