Satellite Solutions for Tracking Litter & Plastic Pollution in the Ocean

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ARGOS CLS

1. Marine litter tracking solutions from Space

2. Drift modeling based on Surface Currents from Space

3. Use Case : Cleaning campaign during Rio 2016 Olympics

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COLLECTE LOCALISATION SATELLITES

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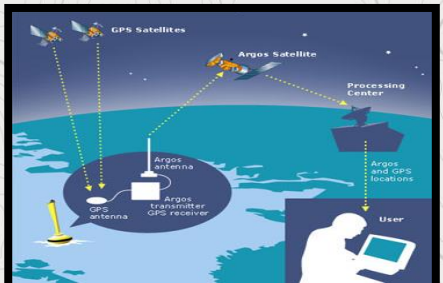
A global, non-profit satellite-based data collection and positioning system, dedicated to studying and protecting the Earth's environment.

It **locates any mobile object equipped** with a compatible transmitter and send data measured by sensors connected to it.



Marine litter tracking

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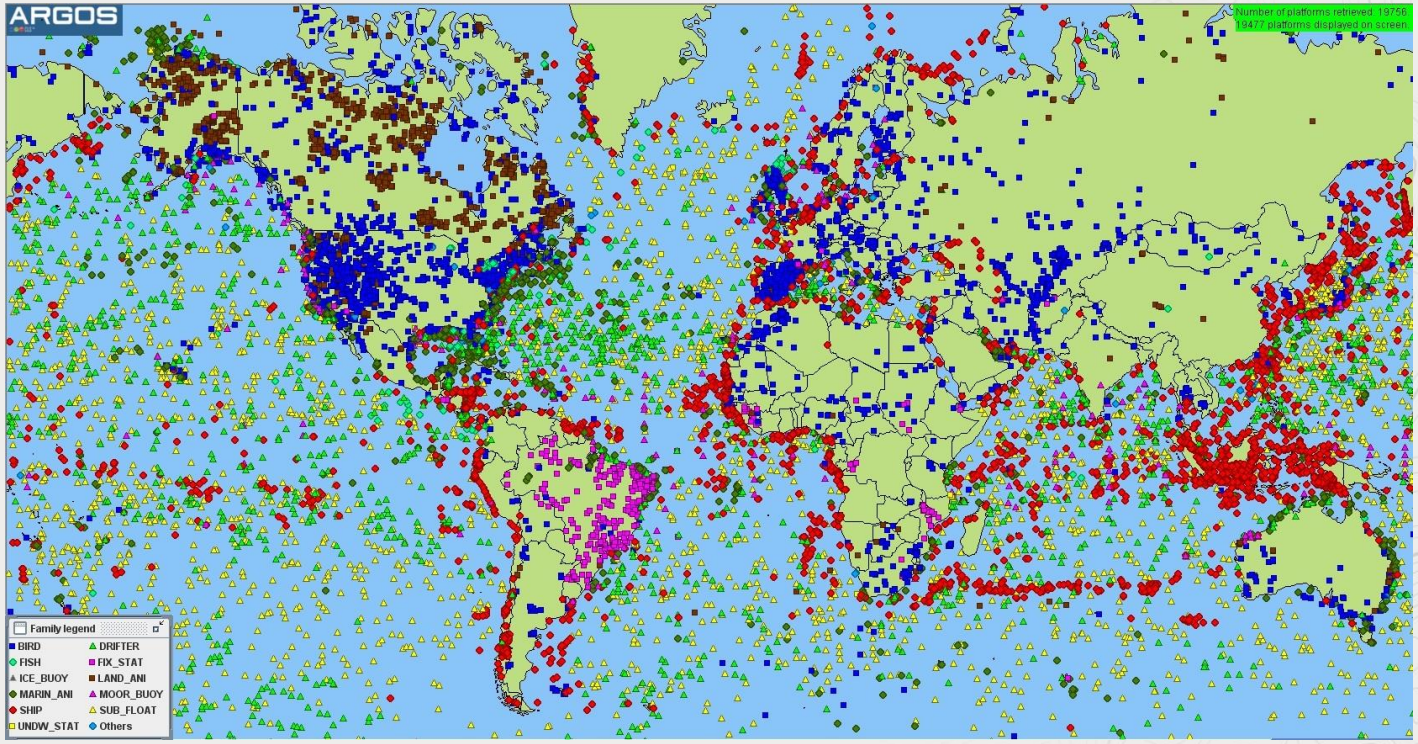
CLS is the ARGOS system operator on behalf of the 4 space agencies

NOAA – National Oceanic and Atmospheric Administration – U.S. Department of Commerce
cnes – Centre National d'Études Spatiales
इसरो isro
EUMETSAT



7 LEO operational satellites

7000 animals

6500 ocean sensors

6500 vessels

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2021: a new constellation > Kineis

kinéis

20
NANOSATELLITES
INTEGRATED PROPULSION

25
GROUND STATIONS

3
STRATEGIC PARTNERS

2021
PUT INTO ORBIT

2022
OPERATIONAL SYTEM

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GIVES BIRTH TO A COMPANY DEDICATED TO THE NEXT ARGOS SYSTEM

Standalone floating beacons

Surface floating buoys with satellite telemetry: a great tool to observe the drift at the ocean surface.

The complexity of the marine litter drift forecast can be addressed by the use of drifting buoys to track and characterize the garbage drift, anticipate the trajectories and concentration zones.

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iridium

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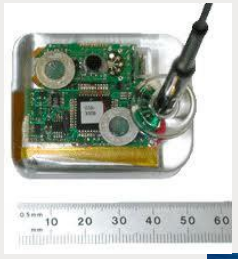
Direct tracking of Marine litter with small ARGOS beacons

- Self contained, autonomous small & waterproof ARGOS satellite trackers
- Many models, with various shapes, sizes, sensors, etc,
- GPS and/or ARGOS positioning
- Solar panels and/or lithium batteries : high autonomy (over 1 year)
- Flexible transmission strategies



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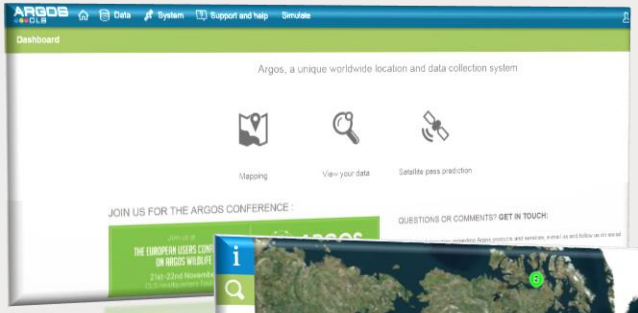
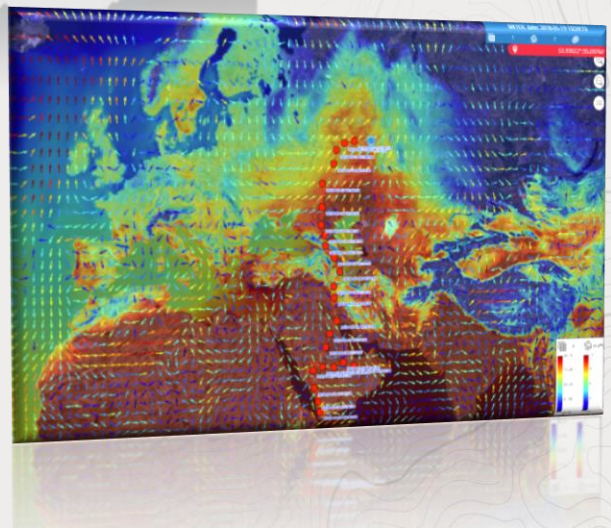
ARGOSWEB to display trajectories and more..



A single secured web site to:

- ✓ View all positions on a map
- ✓ Download all available data
- ✓ Export Google Earth files
- ✓ Manage users settings

- ⇨ *Meteorology & Oceanographic data*
- ⇨ *Mapping and along-track sampling*
- ⇨ *Mobile friendly responsive design*



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MOBIDRIFT

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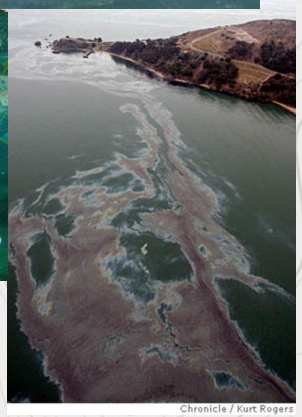
Icebergs

Particles
Oil, Sargassum
Algae, Marine litter

Search & Rescue

Container



- Global
- Surface /2D drift
- Real-time, forecast or archive data

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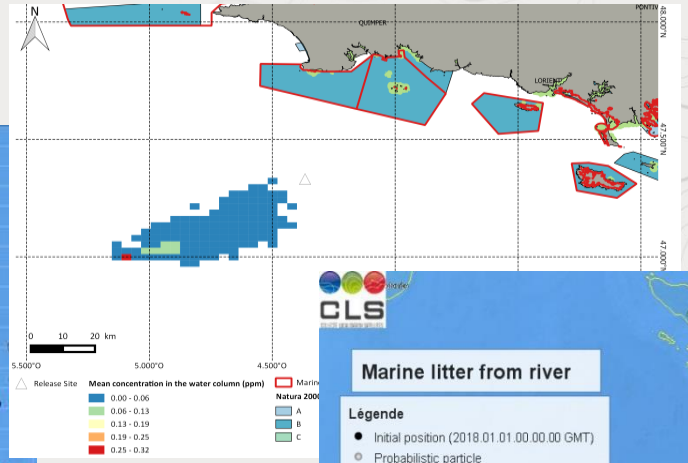
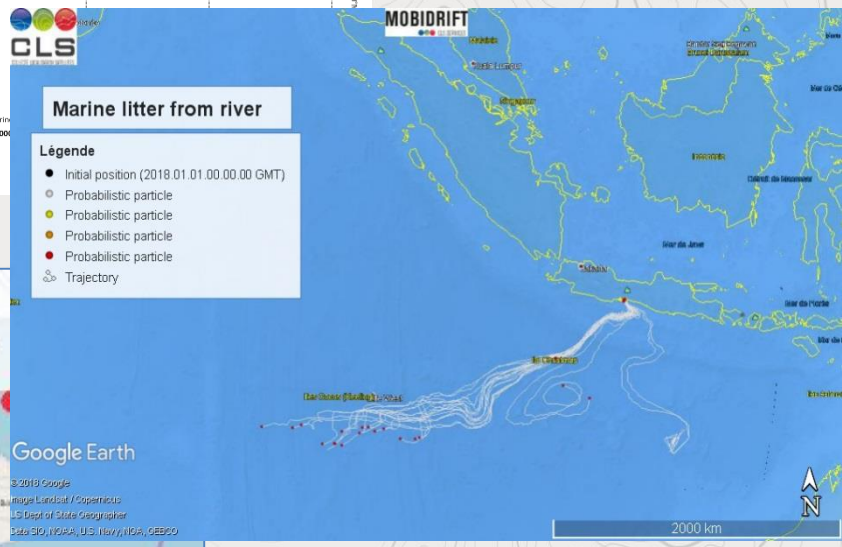
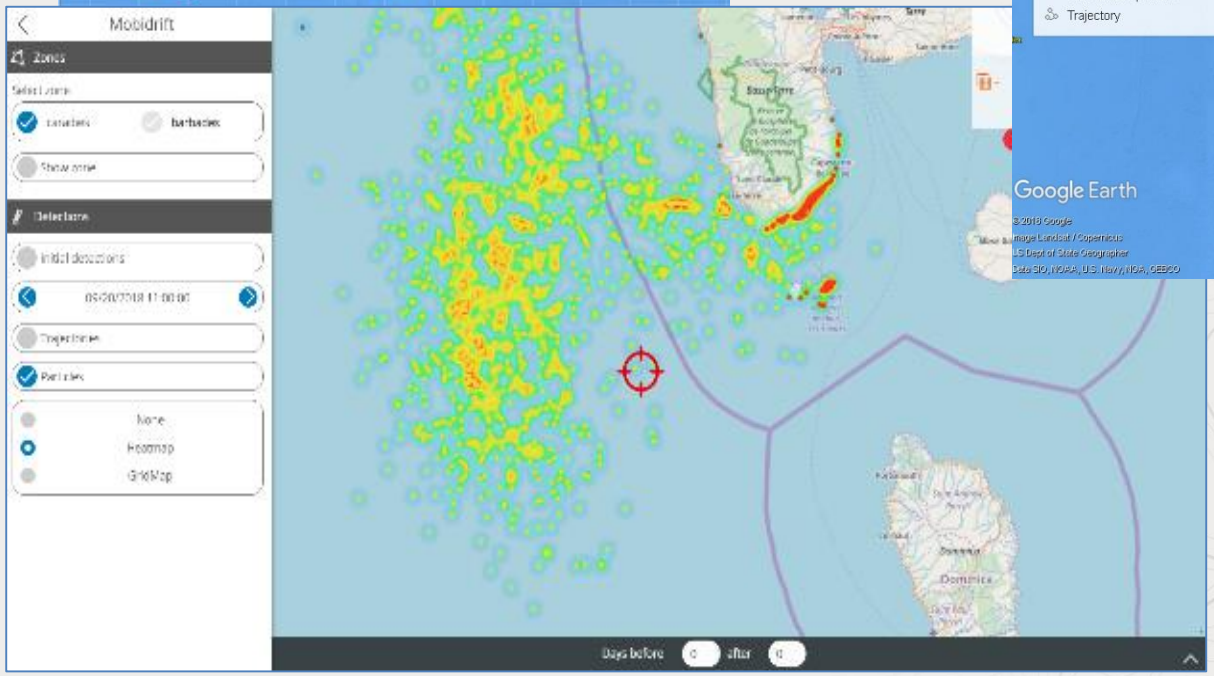
Drift bulletins







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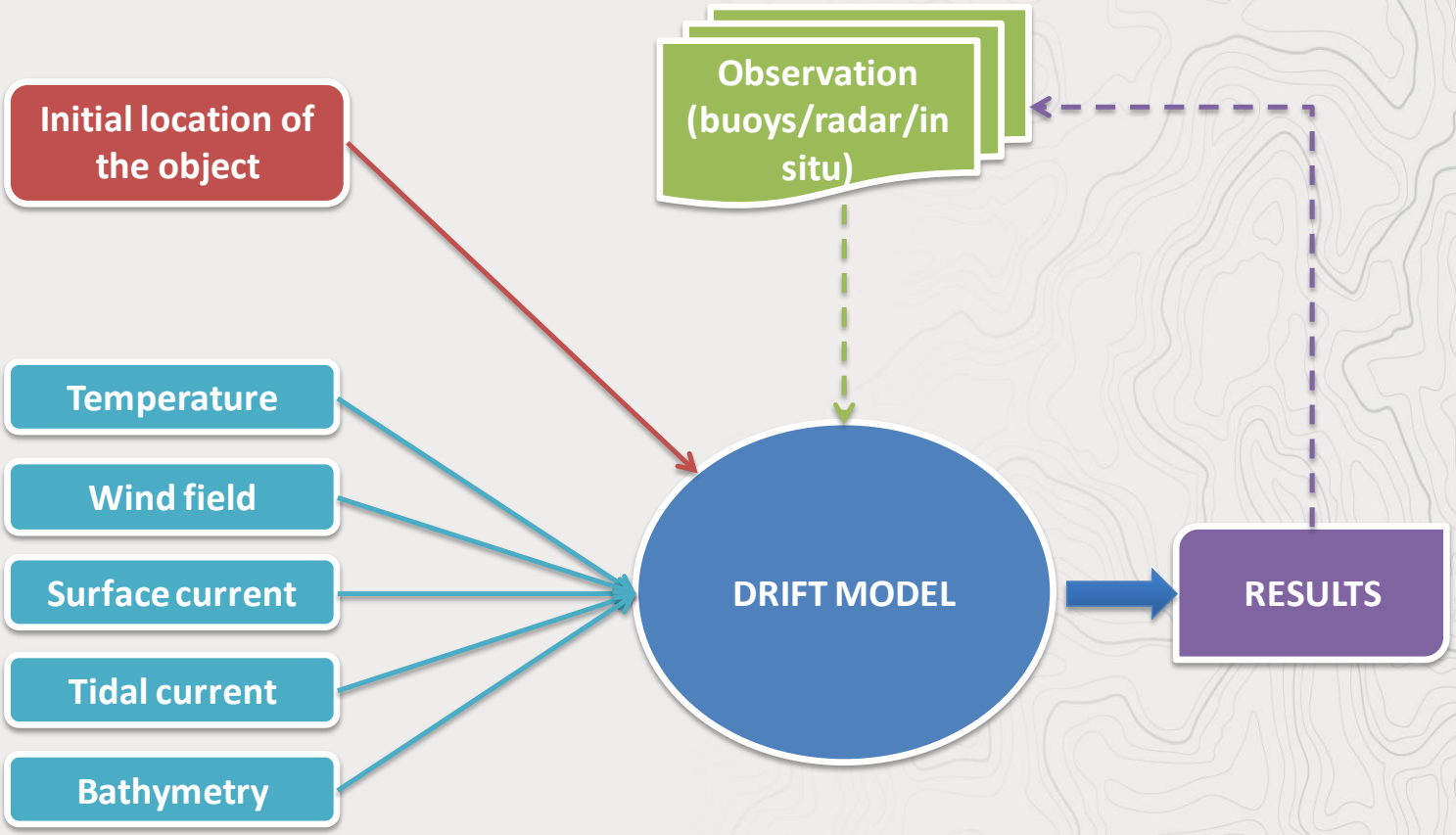
System



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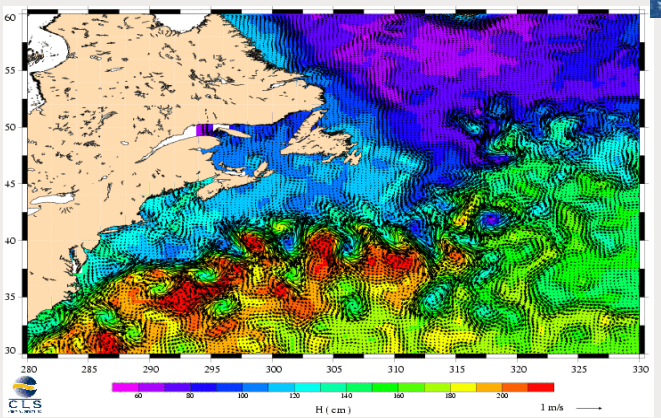
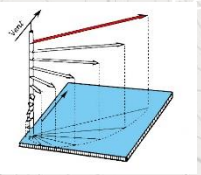
Global Surface Current from Space

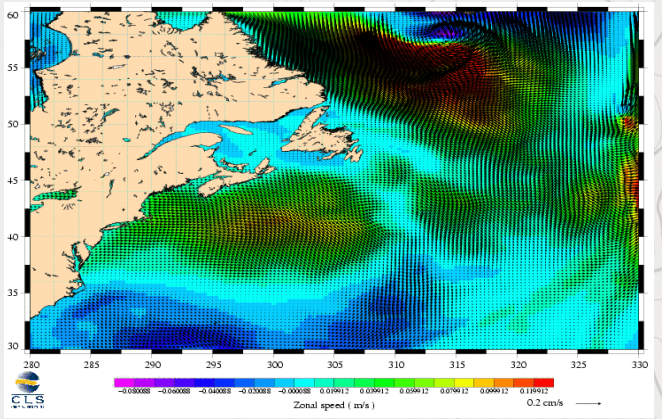
Geostrophic currents



From altimetry

Wind-driven (Ekman) currents





From Rio 2014 model fitted on **satellite-tracked surface drifting buoys**

COPERNICUS · MARINE ENVIRONMENT MONITORING SERVICE
CMEMS OCEAN MULTI OBSERVATIONS TAC
Contract 83-CMEMS TAC MOB
Until March 31 2021

GLOBCURRENT

Total currents at the surface and 15m depth

- ¼° spatial resolution
- Near Real Time (6h resolution) from 2017 to D-1
- Delayed time (3h resolution) : 1993-2017

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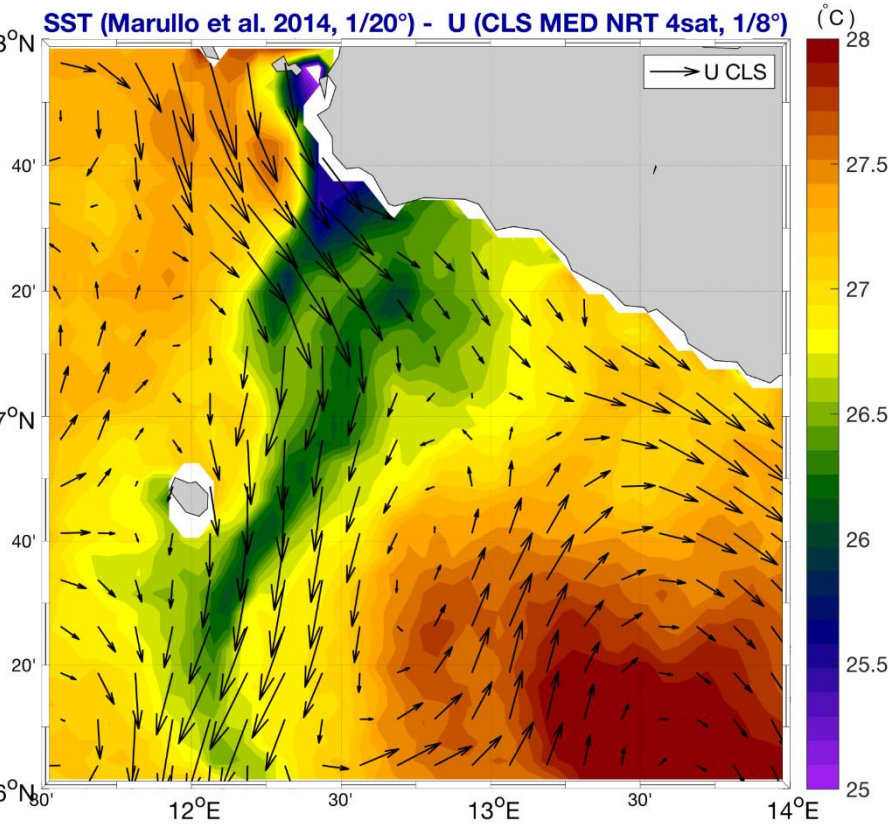
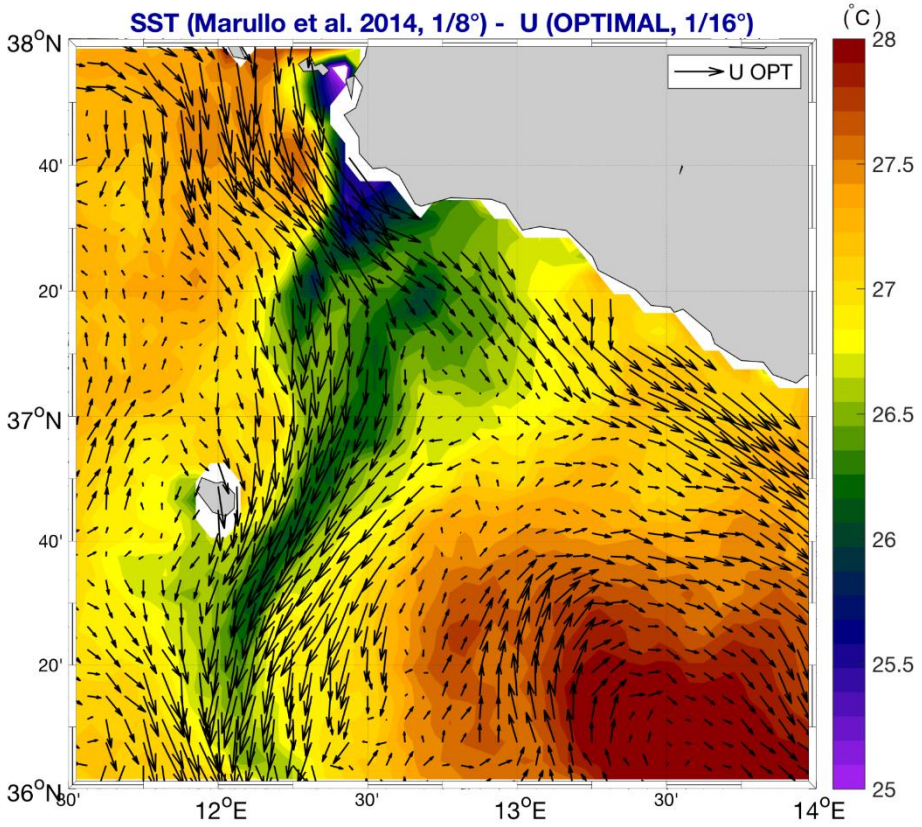
Surface Current from Space

Altimetry / Sea Surface Temperature synergy for « optimal » HR currents





Example: Sicily strait in the Mediterranean Sea (in collaboration with D. Ciani, CNR, Italy)

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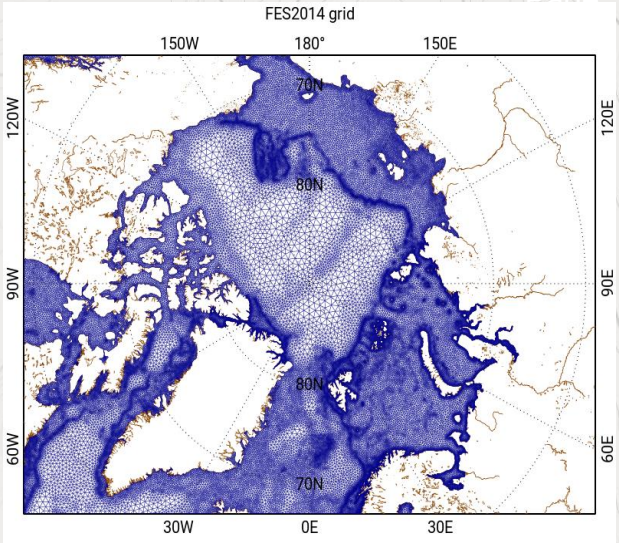
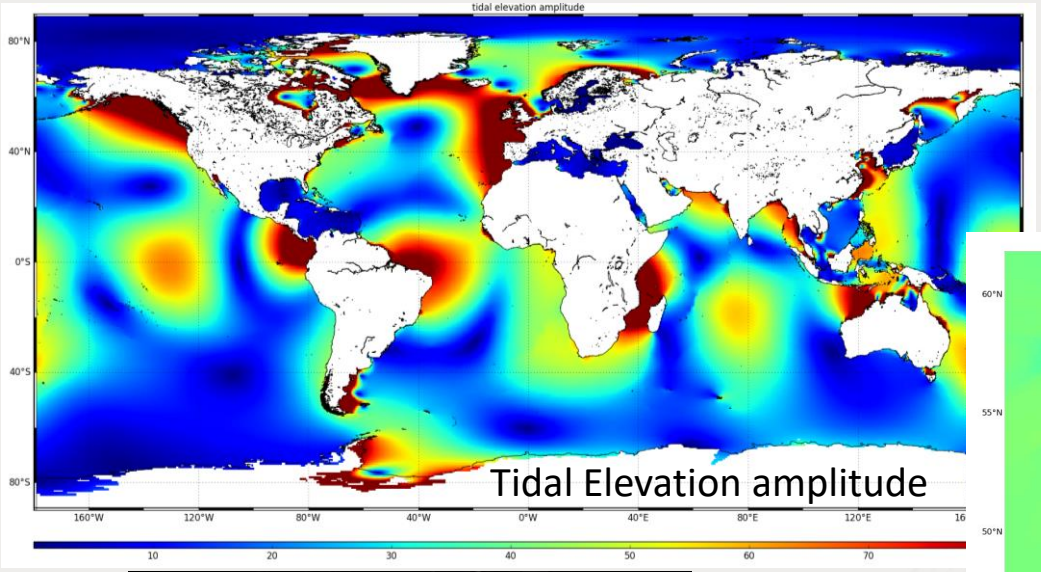
Global tidal current from Space FES2014

- Global tidal model (Carrere et al. 2016, Lyard et al. 2017)
- Shallow water equations ⇨ TUGO model (spectral version)
- High resolution finite element mesh (~5-7 km on shore)
- **<u>Assimilation of satellite altimeter data</u>** and tidal gauges

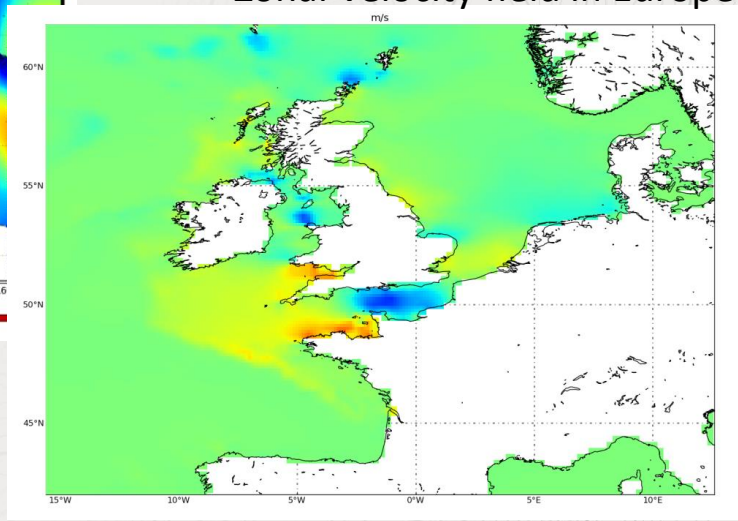


Finite elements mesh



Tidal Elevation amplitude

Zonal Velocity field in Europe



cnes
AVISO+
Satellite Altimetry Data

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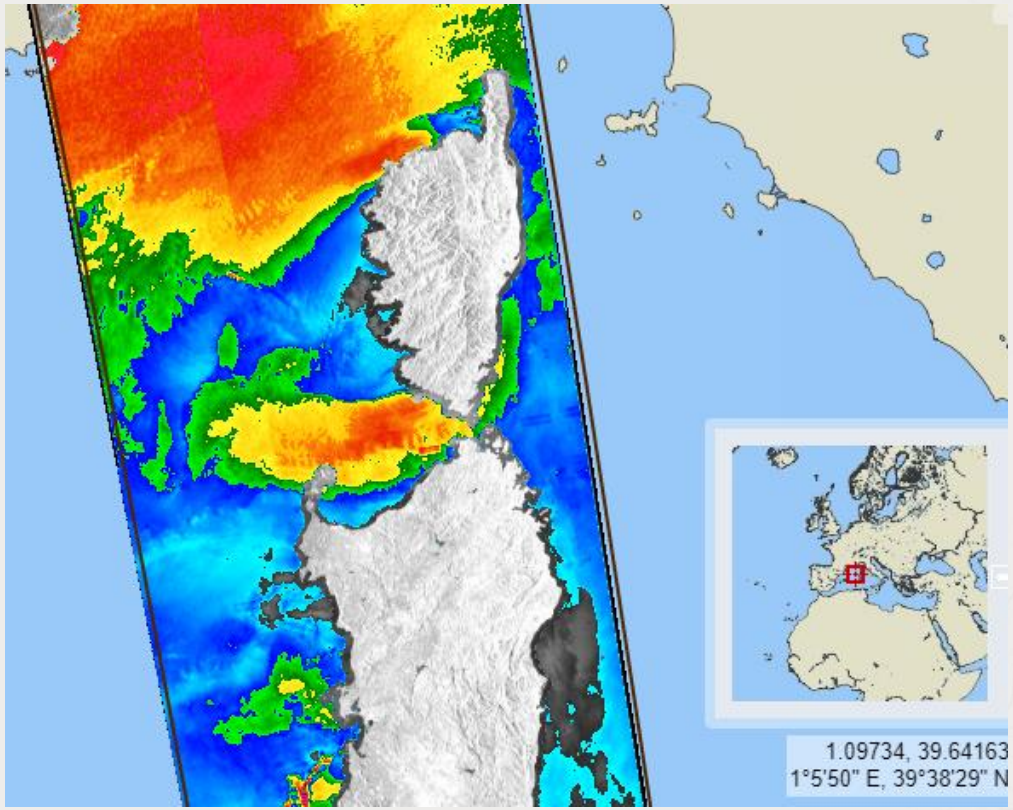
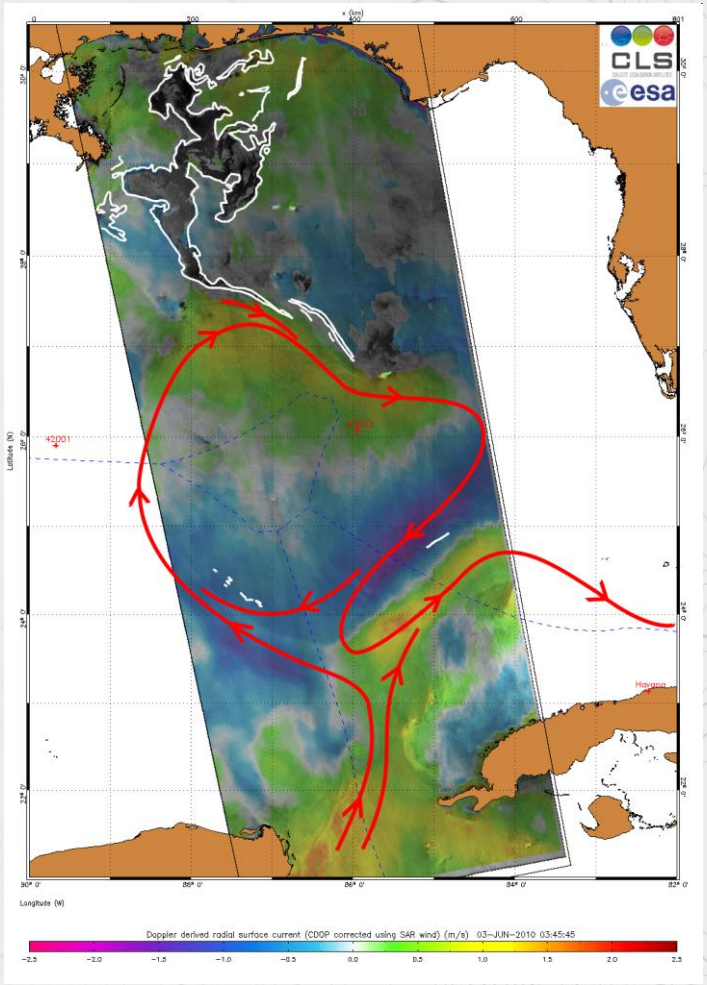
SAR-derived Surface current/wind from Space

Wind field retrieval from Sentinel-1



Doppler radial-velocity from ENVISAT
ongoing « calibration » for Sentinel-1



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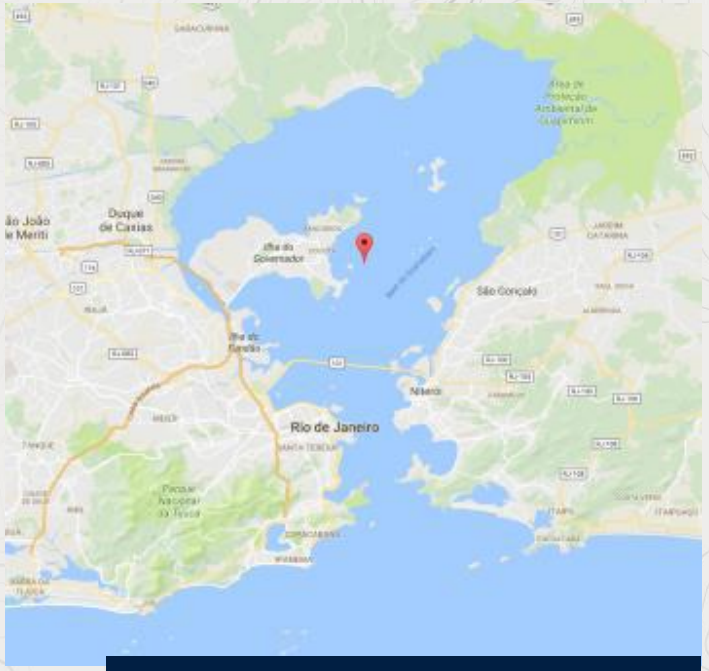
Use case

Cleaning Campaign during Rio Olympic Games 2016 in Guanabara Bay

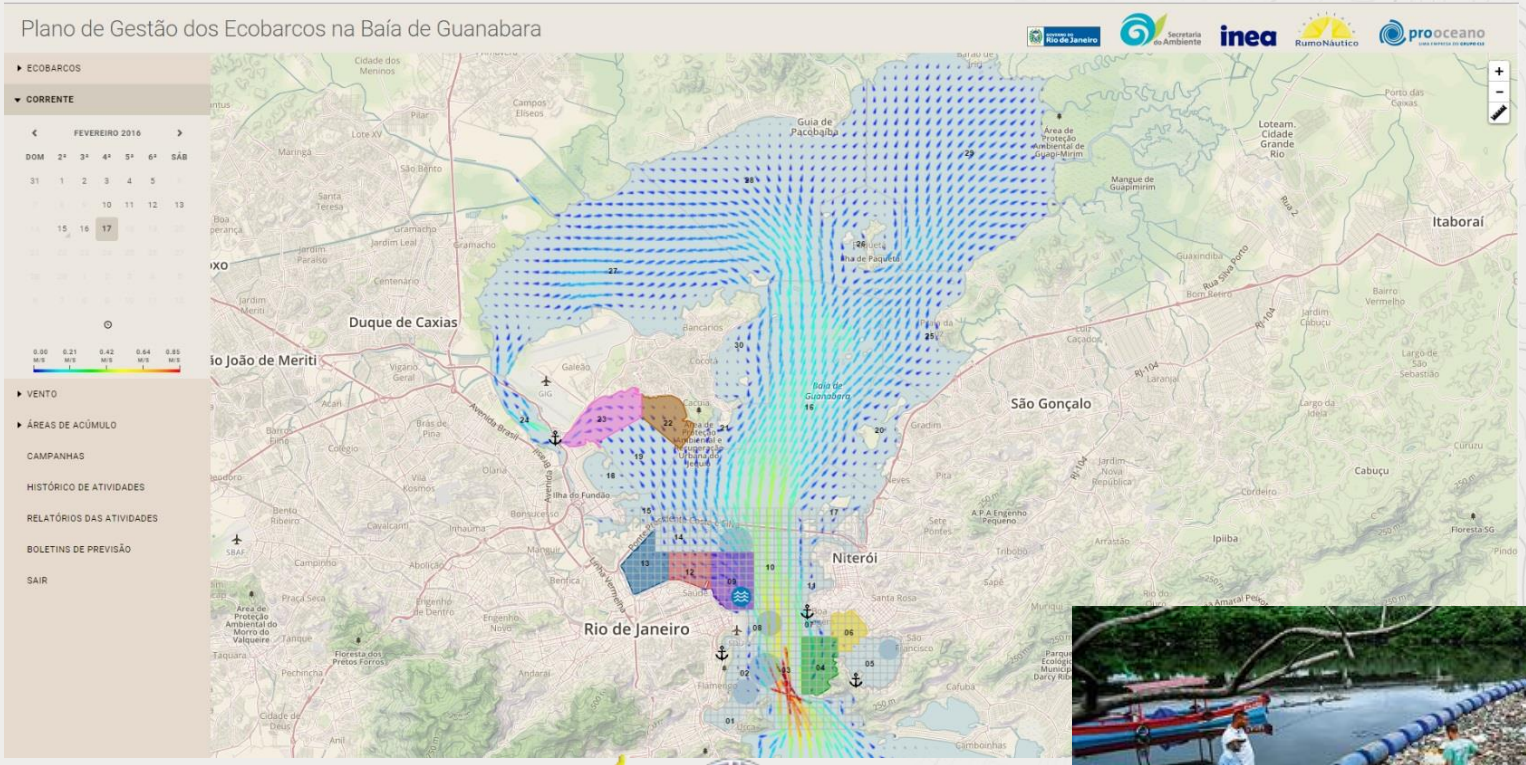
Rio de Janeiro, Brasil



prooceano
A CLS GROUP COMPANY

For over a year, CLS has helped in cleaning the bay of Rio de Janeiro in the run-up of the 2016 Olympics by

- Forecasting surface currents with a high resolution local numerical model
- Predicting waste drift into the bay
- Real-time satellite tracking of boats loaded with garbage during cleaning operation



Forecasting **waste concentration areas**, ocean currents and winds based on HR numerical models developed inside CLS/Prooceano facilities.

BG BRASIL prooceano Grael LAMCE

Thank you !