Copernicus FICE 2025

Copernicus FRM4SOC-2025 Training In Above-Water Radiometry

The AAOT and the CNR Ocean Observing System

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7 July 2025 - Venice, Italy

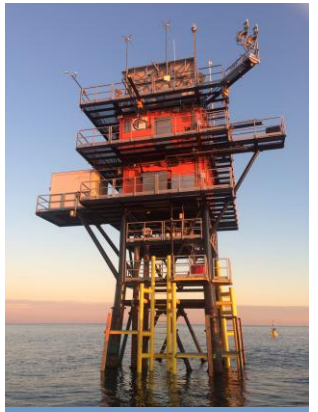
IMPLEMENTED BY EUMETSAT
fiducial reference measurements for satellite ocean colour
PROGRAMME OF THE EUROPEAN UNION
FRM4SOC Phase-2
CNR ISMAR ISTITUTO DI SCIENZE MARINE

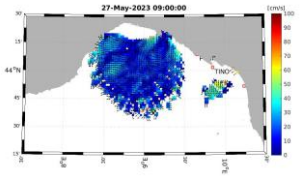
CNR-O(cean) Observing System

Diversity and geographical distribution of the National Research Council of Italy (CNR-ISMAR) ocean observing system:

- ■ Fixed observatories
- ● Spar-buoy
- ● Buoy
- ⬇ Mooring
- ⬟ Coastal stations
- ◆ HF-Radar
- ▲ Lidar
- \+ Autonomous vehicles (Gliders, EuroARGO, OpenSWAP, SWAMP, Drifters, etc.)

✻ Resarch vessels





Survey

Coordination: Exploitation & Growth

Infrastructure upgrade plan as percentage of EOV/EVC/EBV per site (Rif. GOOS Strategy)

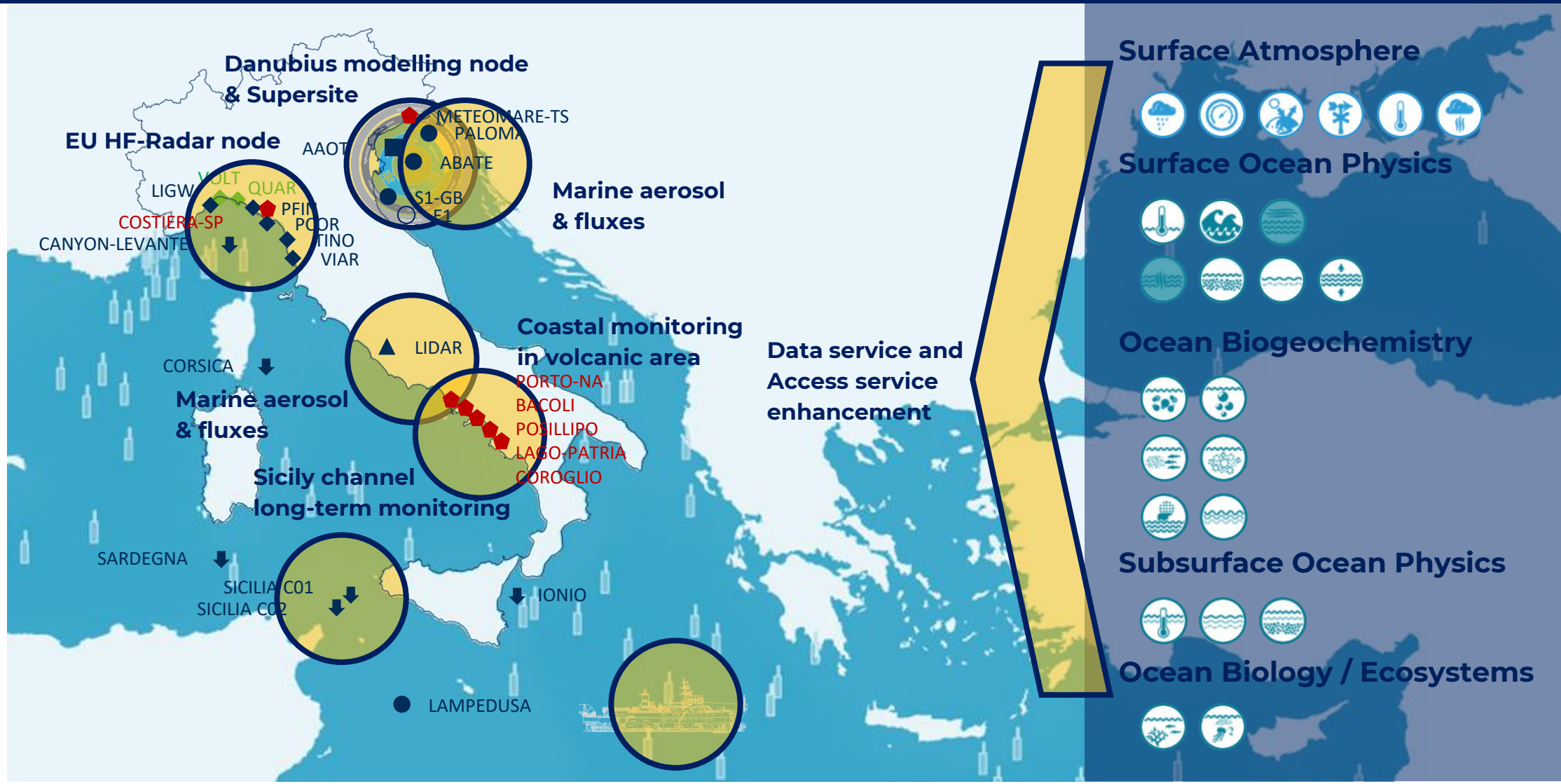
Objectives:
Fill the **crucial data** gaps, monitoring, **foster interdisciplinary research** (key enabler)

	AAOT	PALOMA	MEDAS1-GB	BOAE1	MEDABATE	MEDALAMP.	MCORSICA	MC01	MC02	MSARDINIA	MIONIO	RADAR-HF	MAREOTS	METEOTS	LIDAR	METEOPOS.	METEOP.NA	METEoBACOL	METEoL. PA.	METEOCOR
ECV - Aerosols	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Carbon Dioxide, Methane & Other Greenhouse Gases	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ozone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Precursors for Aerosols and Ozone	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Atmosphere, Surface: Precipitation	4	1	1	0	0	0	0	0	0	0	0	0	0	1	0	2	2	2	2	0
ECV - Atmosphere, Surface: Surface Sea Level Pressure	4	2	1	1	1	1	0	0	0	0	0	0	2	1	0	1	1	1	1	0
ECV - Atmosphere, Surface: Surface Radiation Budget	2	3	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	2	0
ECV - Atmosphere, Surface: Surface Air Temperature	4	3	1	1	1	1	0	0	0	0	0	0	0	3	1	1	1	1	1	2
ECV - Atmosphere, Surface: Surface Water Vapour	4	2	1	1	0	1	0	0	0	0	0	0	0	1	1	1	1	1	1	0
ECV - Atmosphere, Surface: Surface Wind Speed and Direction	9	6	2	2	2	1	0	0	0	0	0	0	0	4	0	4	4	4	4	0
ECV - Ocean, Physical: Ocean Surface Heat Flux	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Sea Level	5	1	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
ECV - Ocean, Physical: Sea State	14	4	0	2	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Sea Surface Currents	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Sea Surface Salinity	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Sea Surface Stress	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Sea Surface Temperature	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Subsurface Currents	1	1	0	0	0	0	5	6	7	2	3	0	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Subsurface Salinity	3	0	3	2	1	1	15	12	7	4	5	0	0	0	0	0	0	0	0	0
ECV - Ocean, Physical: Subsurface Temperature	3	8	3	2	1	3	18	16	12	4	5	0	0	7	0	0	0	0	0	0
ECV - Ocean, Biogeochemical: Inorganic Carbon	1	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Biogeochemical: Nitrous Oxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Biogeochemical: Nutrients	2	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Biogeochemical: Ocean Colour	4	0	2	2	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ECV - Ocean, Biogeochemical: Oxygen	2	4	1	1	0	1	1	2	0	0	4	0	0	0	0	0	0	0	0	0
ECV - Ocean, Biogeochemical: Transient Tracers	0	0	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV - Biogeochemistry: Particulate Matter	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV - Biogeochemistry: Stable Carbon Isotopes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV - Biogeochemistry: Dissolved Organic Carbon	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV - Biol. and Ecosys: Phytoplankton Biomass and Diversity	6	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV - Biol. and Ecosys: : Zooplankton Biomass and Diversity	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV – Biol. and Ecosys: Fish Abundance and Distribution	3	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV – Biol. and Ecosys: Microbe Biomass and Diversity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV – Biol. and Ecosys: Invertebrate Abundance and Distrib.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EOV - Cross-Disciplinary: Ocean Sound	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	29	18	16	11	7	10	6	4	3	3	4	2	2	7	3	5	5	5	6	1
PERCENTUALE ECV/EOV	83%	51%	46%	31%	20%	29%	17%	11%	9%	9%	11%	6%	6%	20%	9%	14%	14%	14%	17%	3%
INCREMENTO ITINERIS	20%	-%	9%	2%%	9%															

critical approach

ITINERIS

Multi- & Trans-domain approach



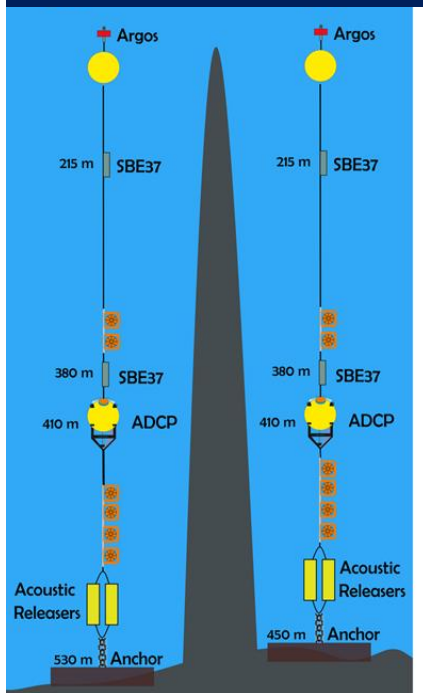
Multi-platform approach

Buoys

Calibration facilities

Platforms

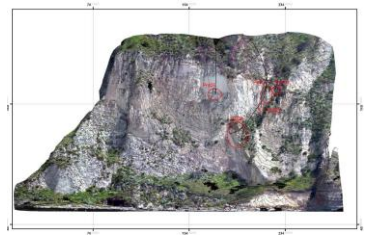
Moorings



Argo floats

Lidar

Coastal stations



Samplings

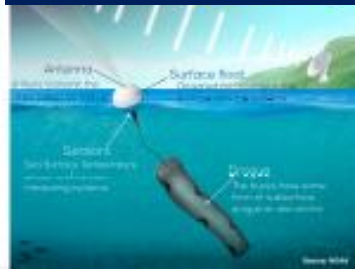
Gliders

Radars

Ferry box

Bottom-based obs.

Drifters



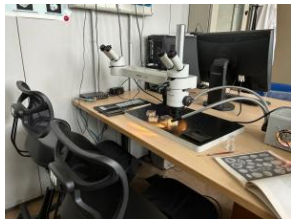
Sensors & Labs

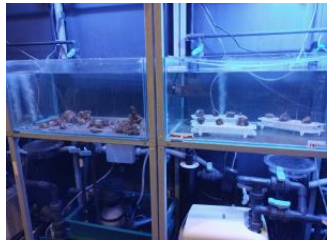
Vessels

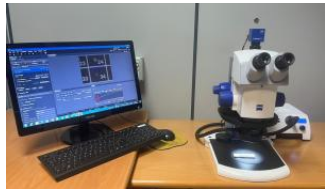
ROV

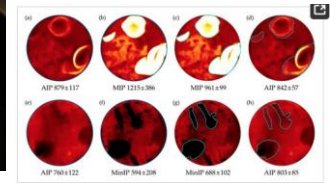
Network of marine labs

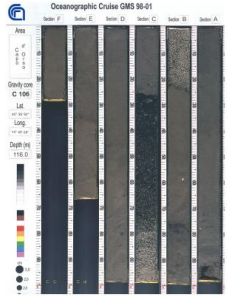
The CNR-ISMAR Sea Laboratories are 13 entities each operating in multiple locations of the Institute, aimed at the treatment, study and analysis of the environmental and biological matrices.



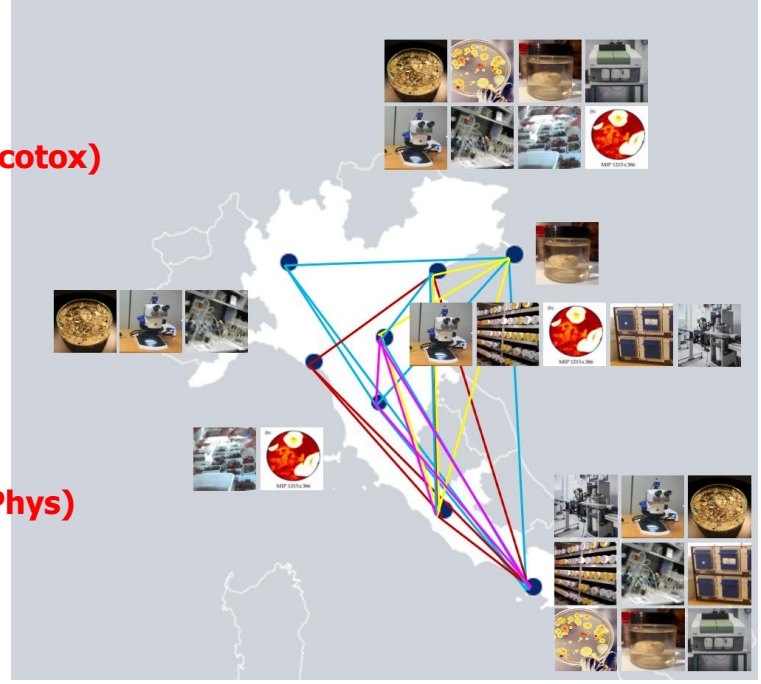






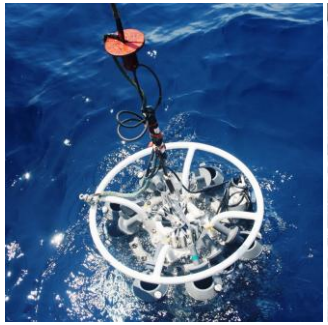


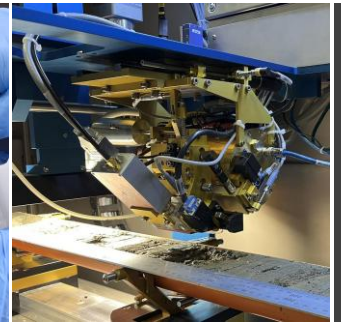
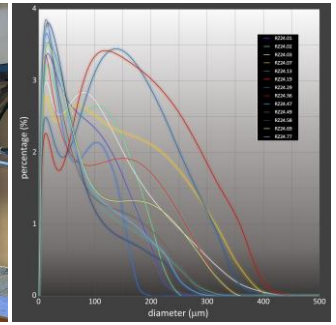
- **COLLECTION AND TREATMENT OF SAMPLES (SAMPLES)**
- **CORE REPOSITORY (ISMAR_CoRe)**
- **NON-DISTRUCTIVE CORE LOGGING AND ANLSYSIS (O-SED)**
- **SEDIMENTOLOGY AND GRAIN-SIZE (GRAIL)**
- **OPTICAL MICROSCOPY AND DIGITALIZATION (MicrODig 2D/3D)**
- **CONTAMINANTS AND MICROPLASTICS (Cont-Plas)**
- **MICROBIOLOGY, MOLECULAR BIOLOGY, ECOTOXICOLOGY (Bio-Ecotox)**
- **MARINE ECOLOGY (Eco-Mar)**
- **BIOGEOCHEMISTRY (BioGeoChem)**
- **MICROCOSMS (µ-COSM)**
- **OCEANOGRAPHIC SENSORS (Ocean-I)**
- **MAGNETISM AND PALEOMAGNETISM (PMAG)**
- **PHYSICS AND GEOCHEMISTRY OF SEDIMENTS AND ROCKS (GeoPhys)**



Coordination: national and international

Objective:
Integration and harmonization of all research infrastructures also in the ESFRI context to guarantee **access**, **services** and **long-term interdisciplinary research and data interoperability**, for impactful contribution at EU and international level; **avoid overlapping** and ensure effective **HR and cost management**



DANUBIUS-RI
International Centre for Advanced Studies on River-Sea Systems

eLTER

JERICO RESEARCH INFRASTRUCTURE

emso ERIC
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

ACTRiS
Exploring the Atmosphere

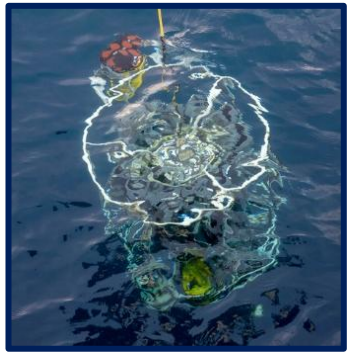
ICOS
Integrated Carbon Observation System

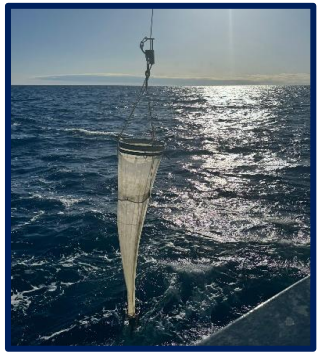
Euro Argo

OceanSITES
Taking the pulse of the global ocean

Eurofleets+
An alliance of European marine research infrastructure to meet the evolving needs of the research and industrial communities

RV Gaia Blu





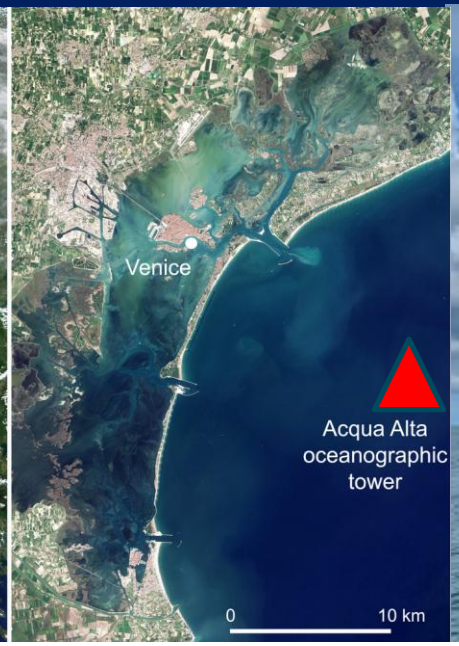
12 Oceanographic campaigns

184 Days on board

>40 Colleagues involved

New submission, very soon

Acqua Alta Oceanographic Tower (AAOT)



GPS Coordinates: 45° 18’ 51’’ N, - 12° 30’ 29’’ E

Installation: 1970, refit 2018

➔ OBSERVATIONS (routine)

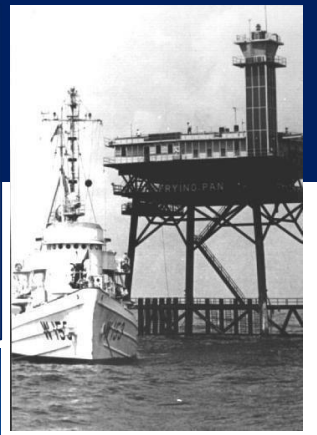
SEA (level, waves, temperature, salinity, currents, nutrients, oxigen, plankton, carbon, ocean color)

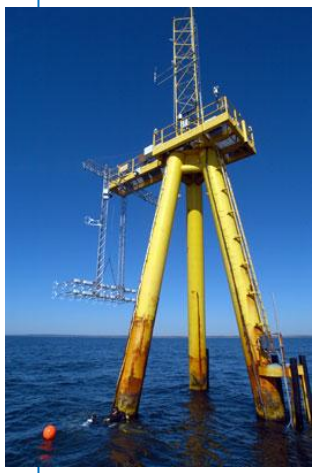
ATMOSPHERE (wind, pressure, precipitation, radiation budget, water vapour, carbon)

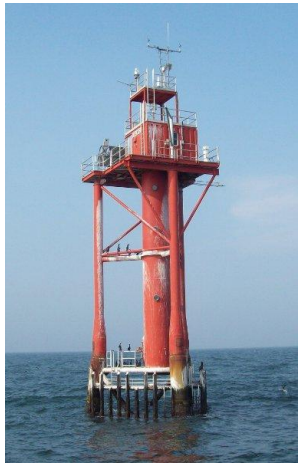
TRAINING & MEETING ACTIVITIES

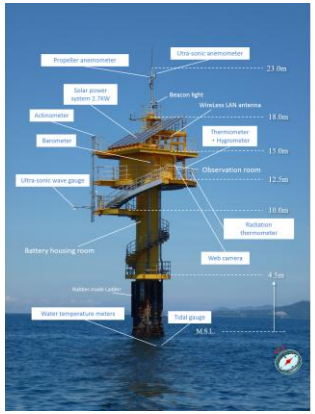
- **Ocean Color Training** (2024)
- **Users meeting** (2024)
- **Bulletin of activities** (yearly)
- **Full Data sharing** (soon)

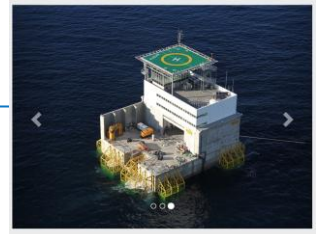
The global picture



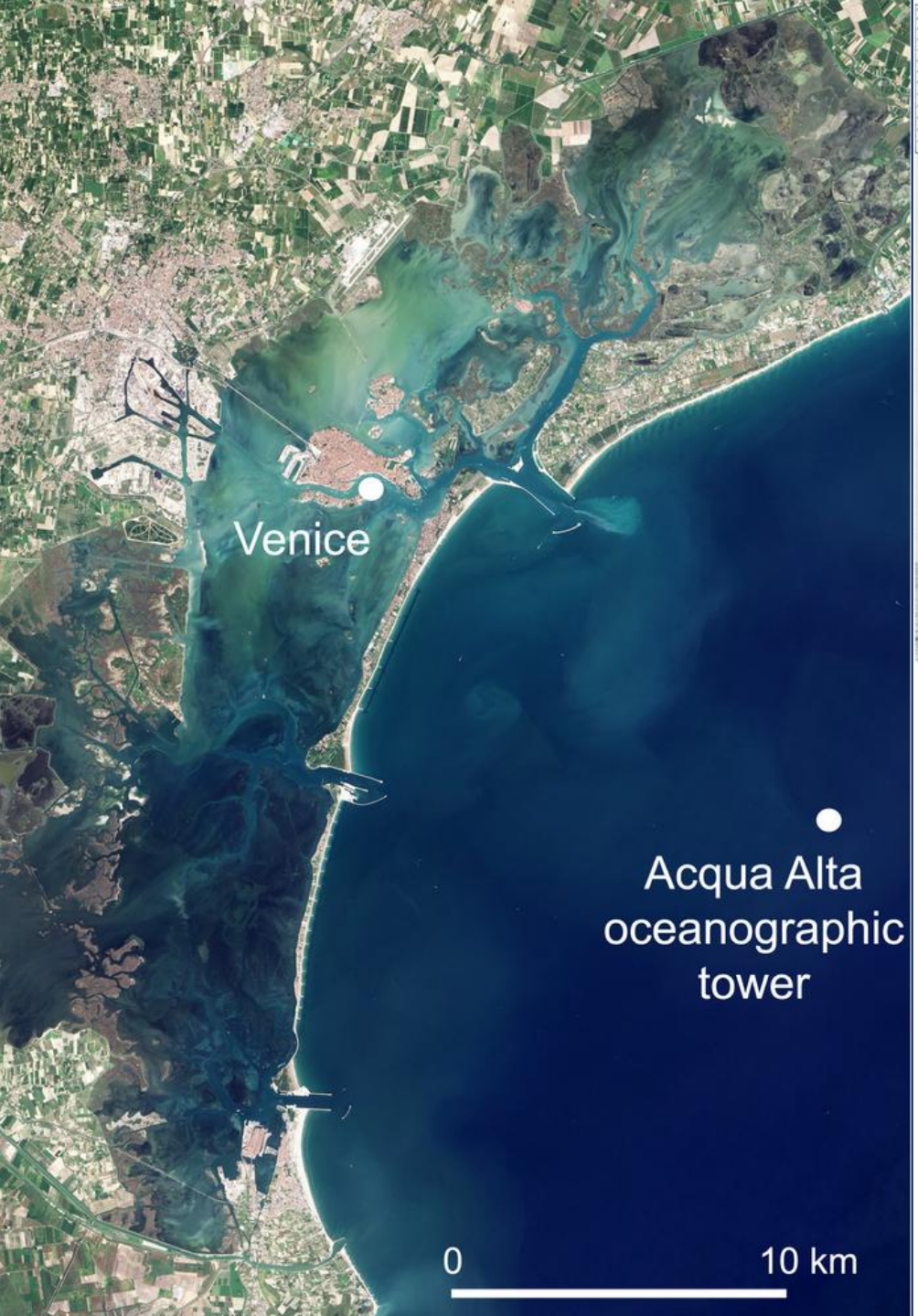








Acqua Alta Oceanographic Tower (AAOT)



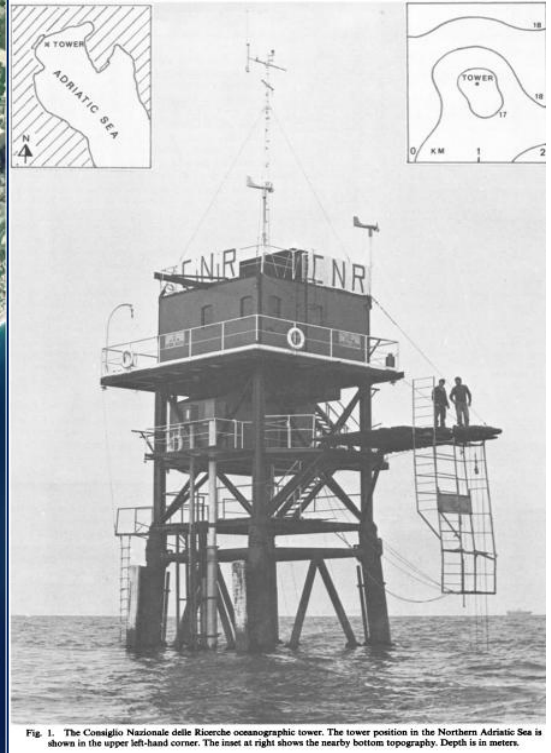
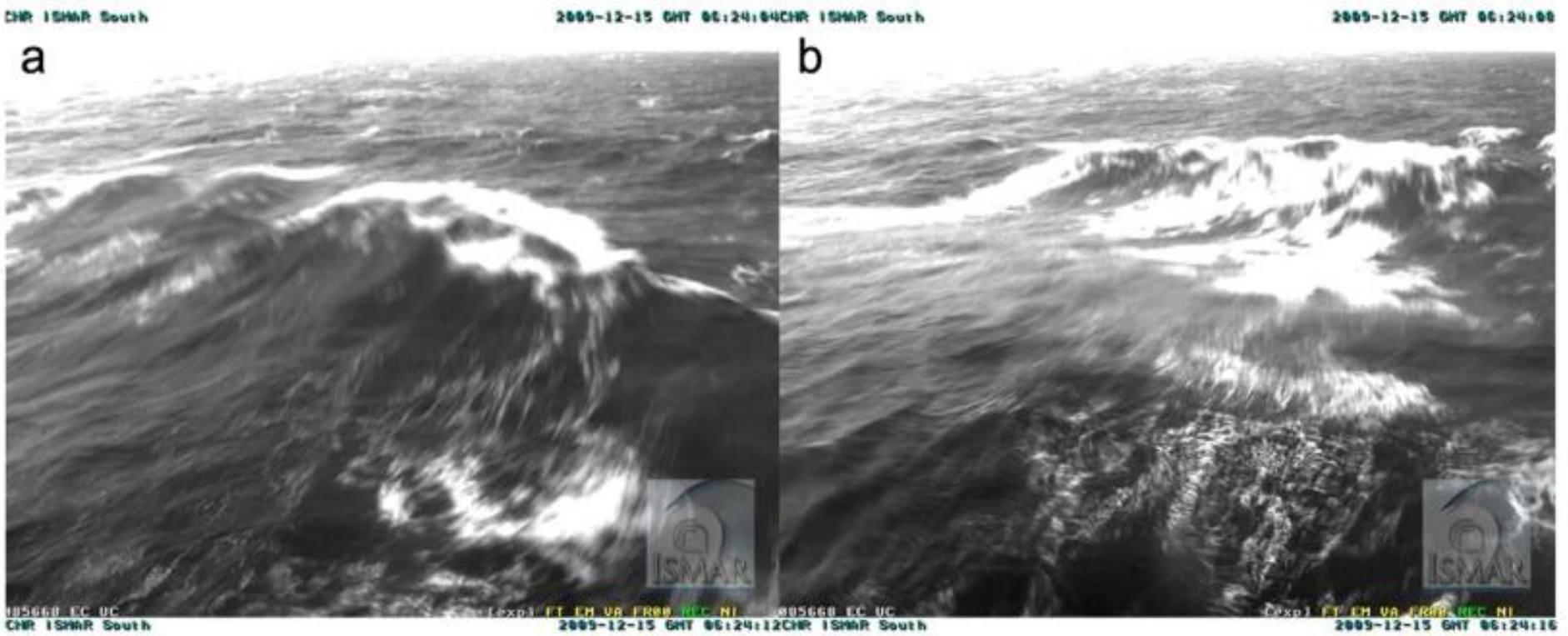


Fig. 1. The Consiglio Nazionale delle Ricerche oceanographic tower. The tower position in the Northern Adriatic Sea is shown in the upper left-hand corner. The inset at right shows the nearby bottom topography. Depth is in meters.

From local to global

- Worldwide **longest directional wave dataset** (since 1979) enabling detection and understanding of climate change trends
- Sea level integ**rated with the high-tide warning system** of the municipality of Venice
- Full **meteo-oceanographic and hydrological** variables coverage



SCIENTIFIC DATA

Check for updates

OPEN

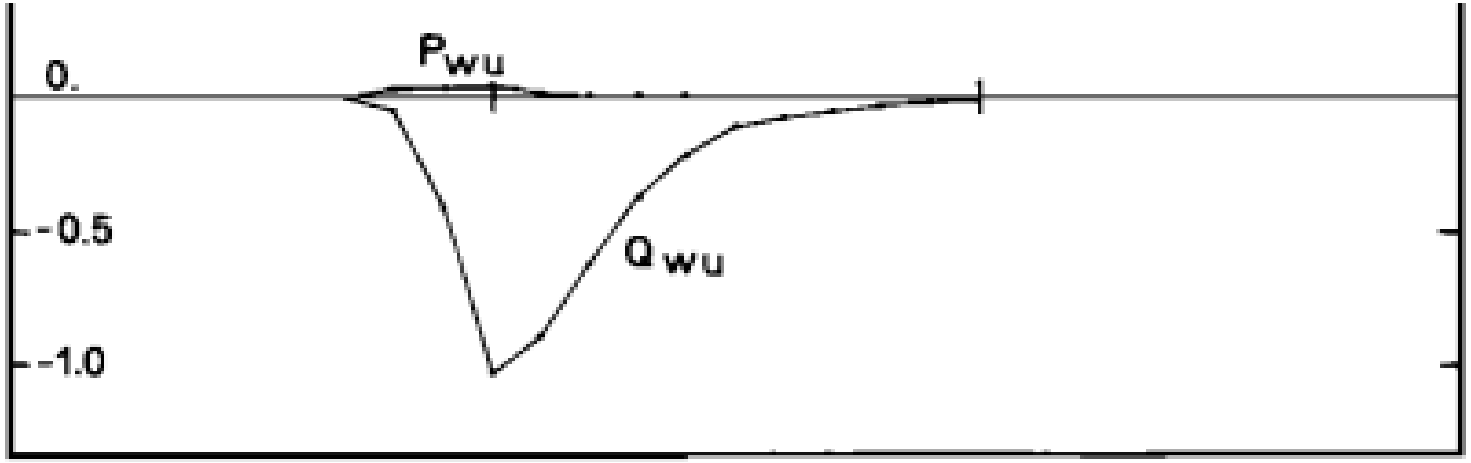
TA DESCRIPTOR

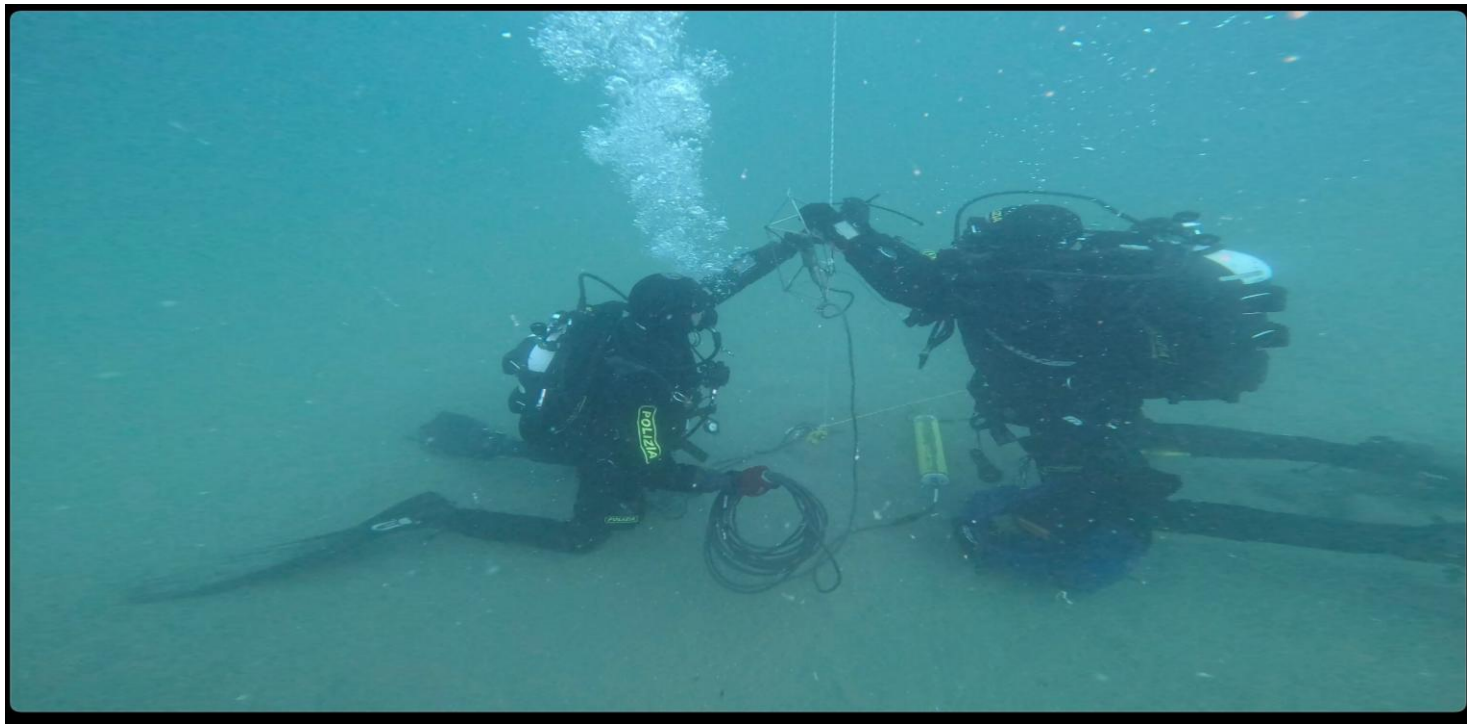
An exceptionally high wave at the CNR-ISMAR oceanographic tower in the Northern Adriatic Sea

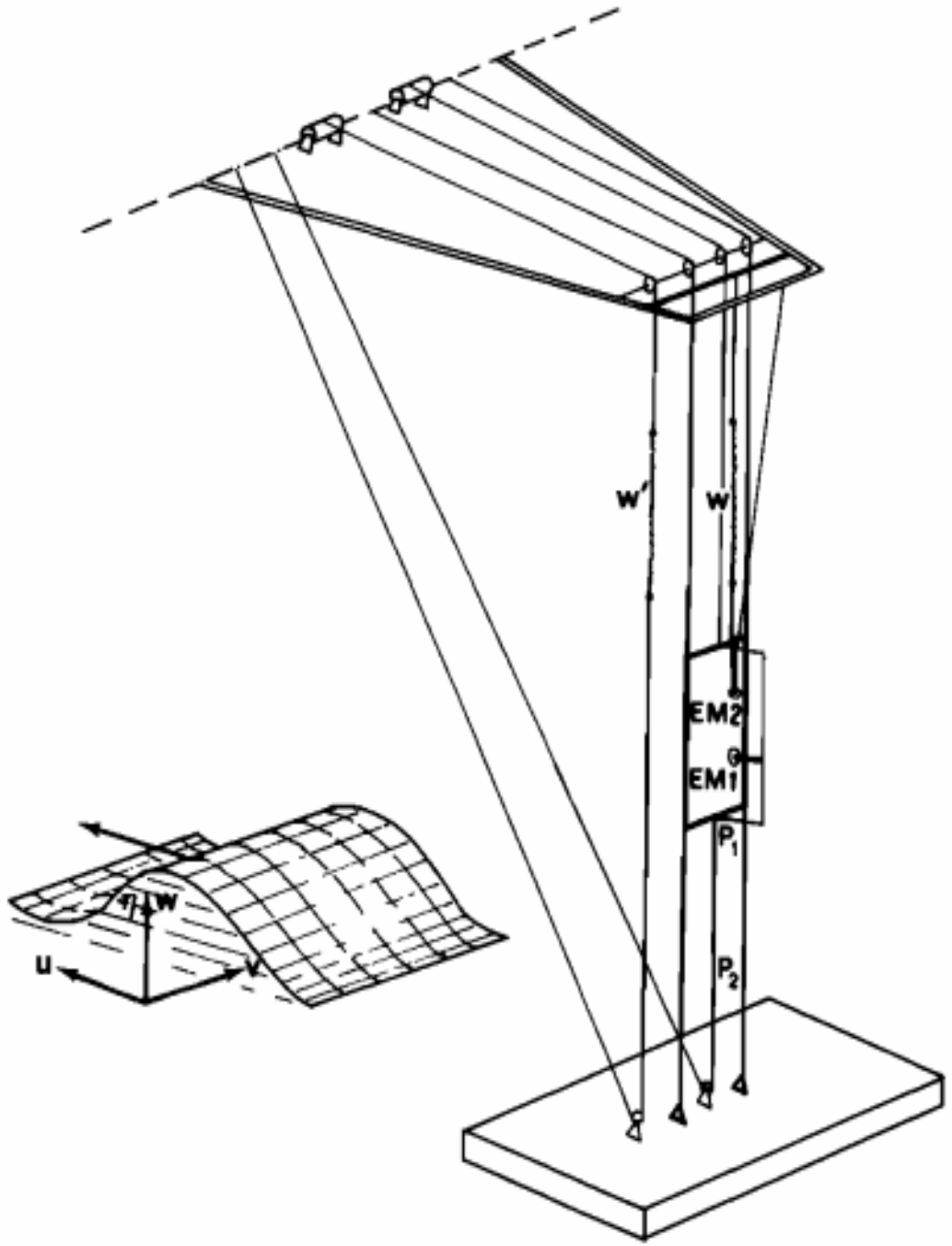
Luigi Cavaleri, Francesco Barbariol, Mauro Bastianini, Alvise Benetazzo, Luciana Bertotti & Angela Pomaro ✉

On December 15, 2009, a very high wave crest was recorded by a local camera at the CNR-ISMAR oceanographic tower, 15 km offshore Venice in the Northern Adriatic Sea (Italy). The height of the estimated crest elevation appears well beyond the value ($1{,}25 \cdot H_s$) commonly used to identify a wave as freak. We document the wave event with a full description of the corresponding met-ocean conditions and related measurements, of which we provide a critical analysis.

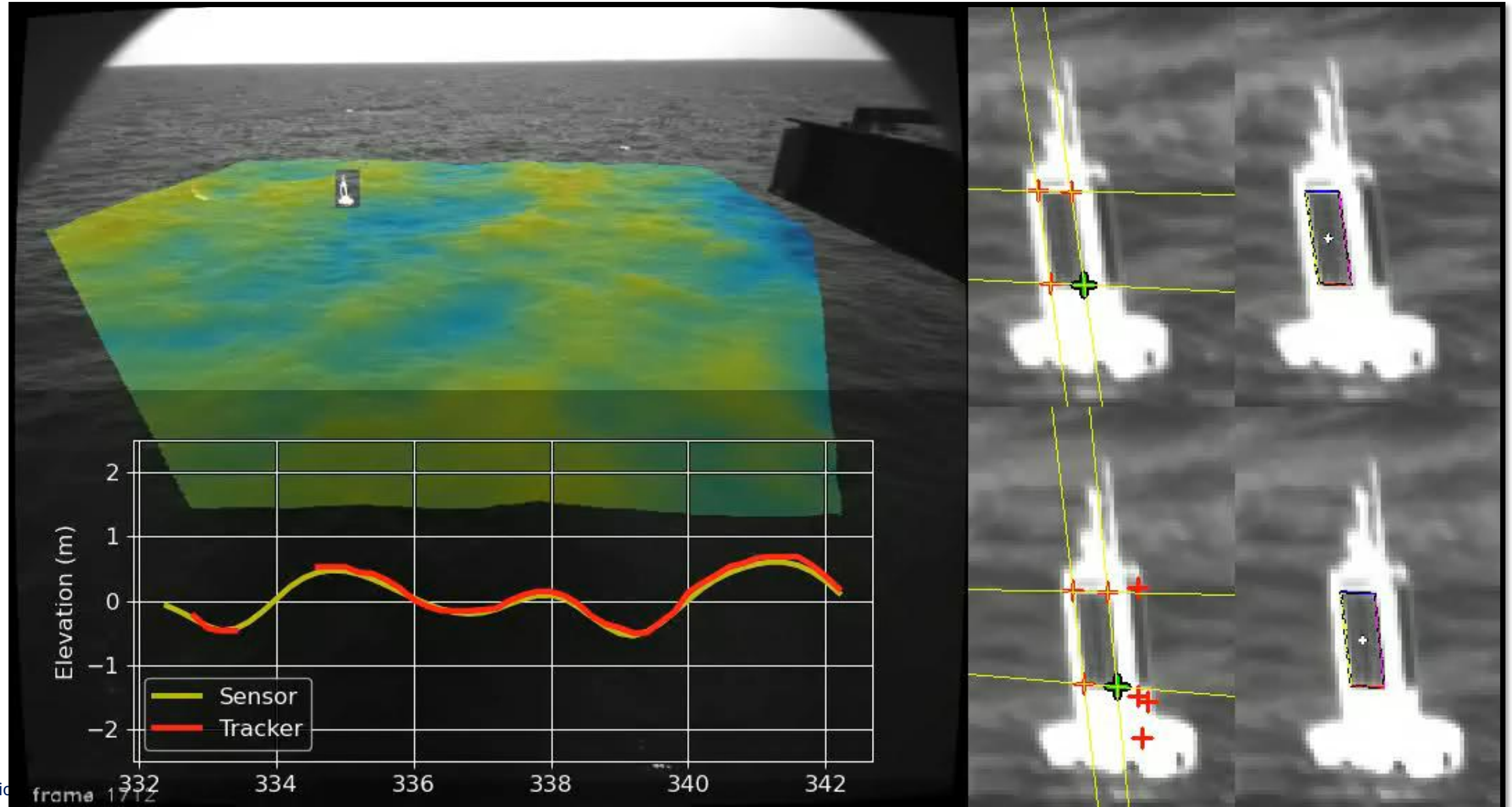
Experimental campaigns planning



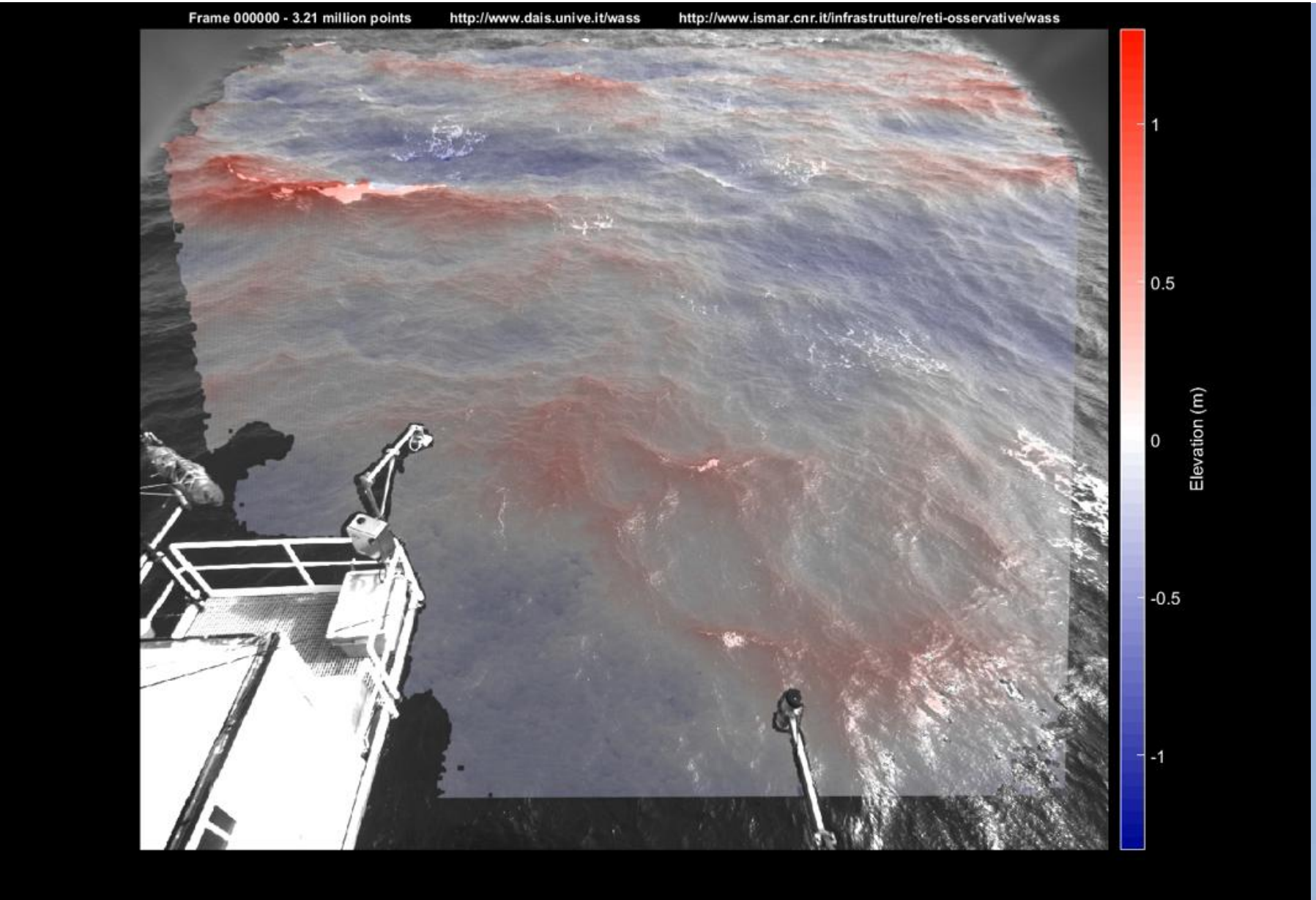




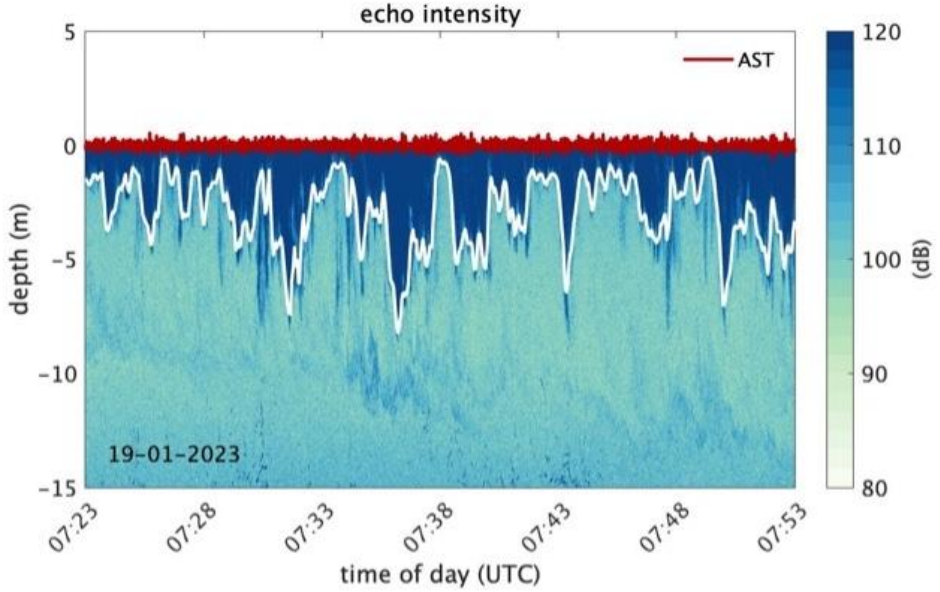
… and instrumental testing

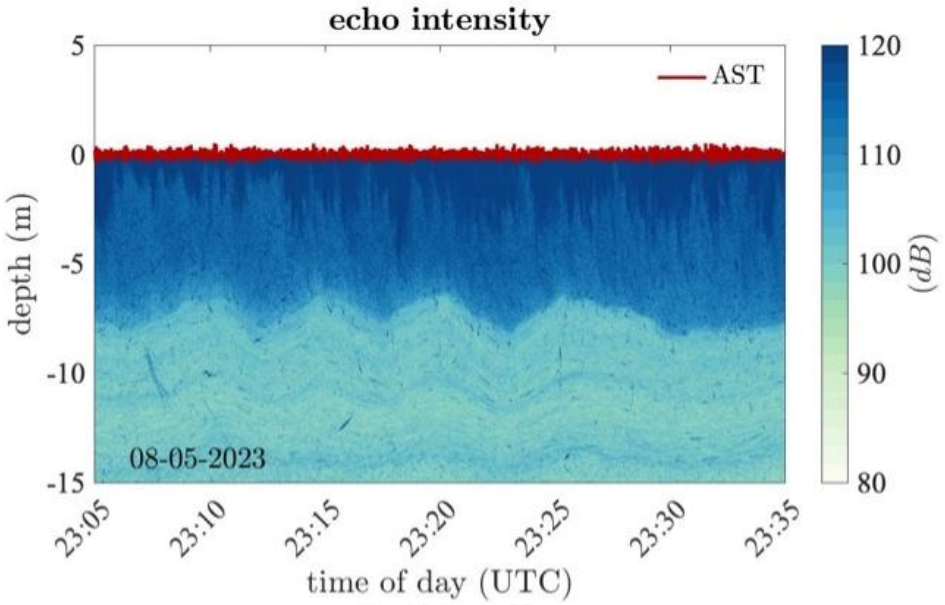


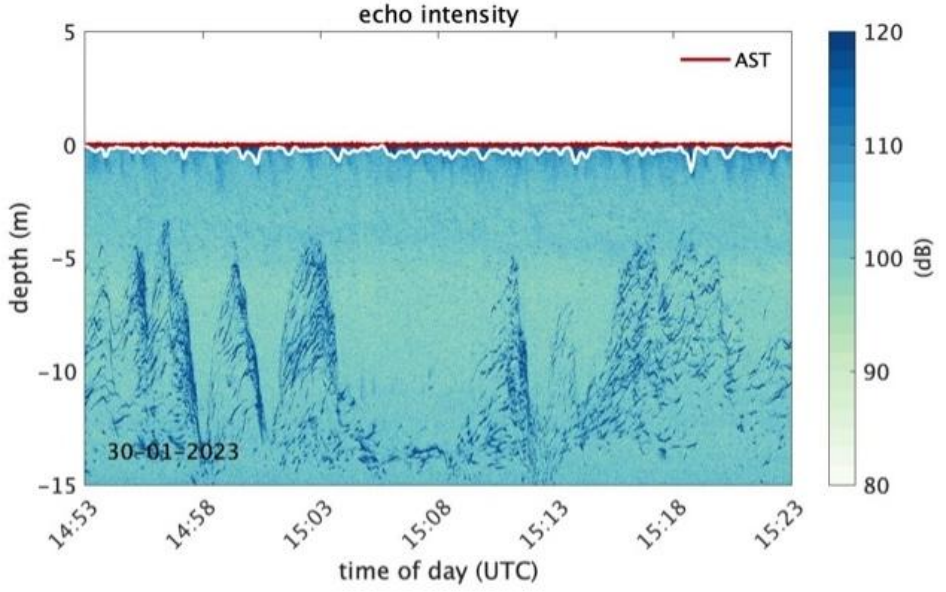
Patents development

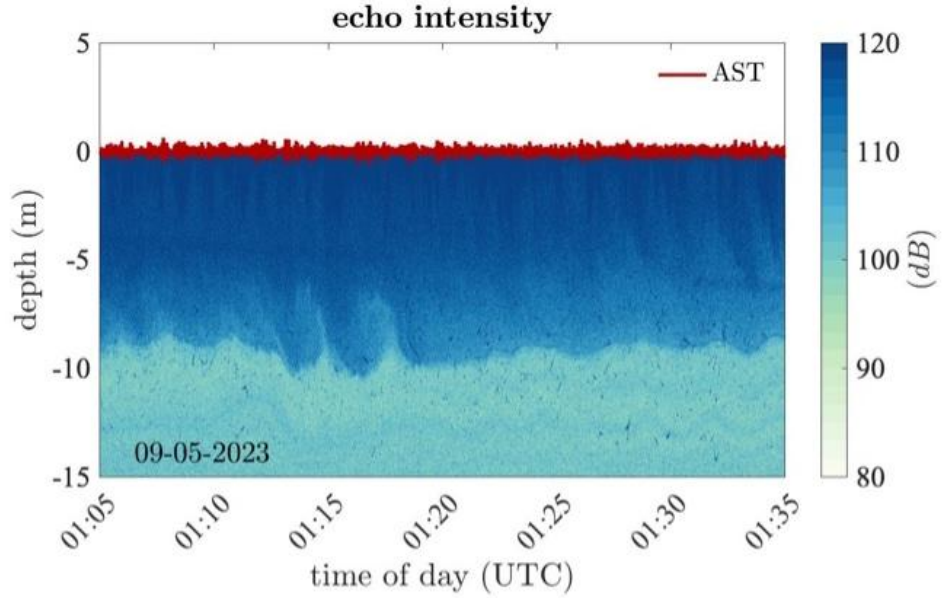


High-resolution instrumentation (e.g., Nortek signature ADCP)







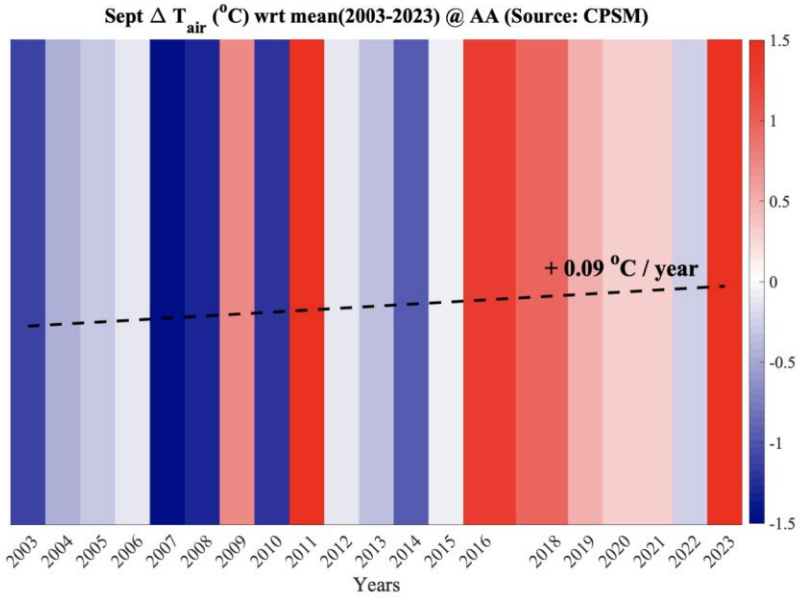


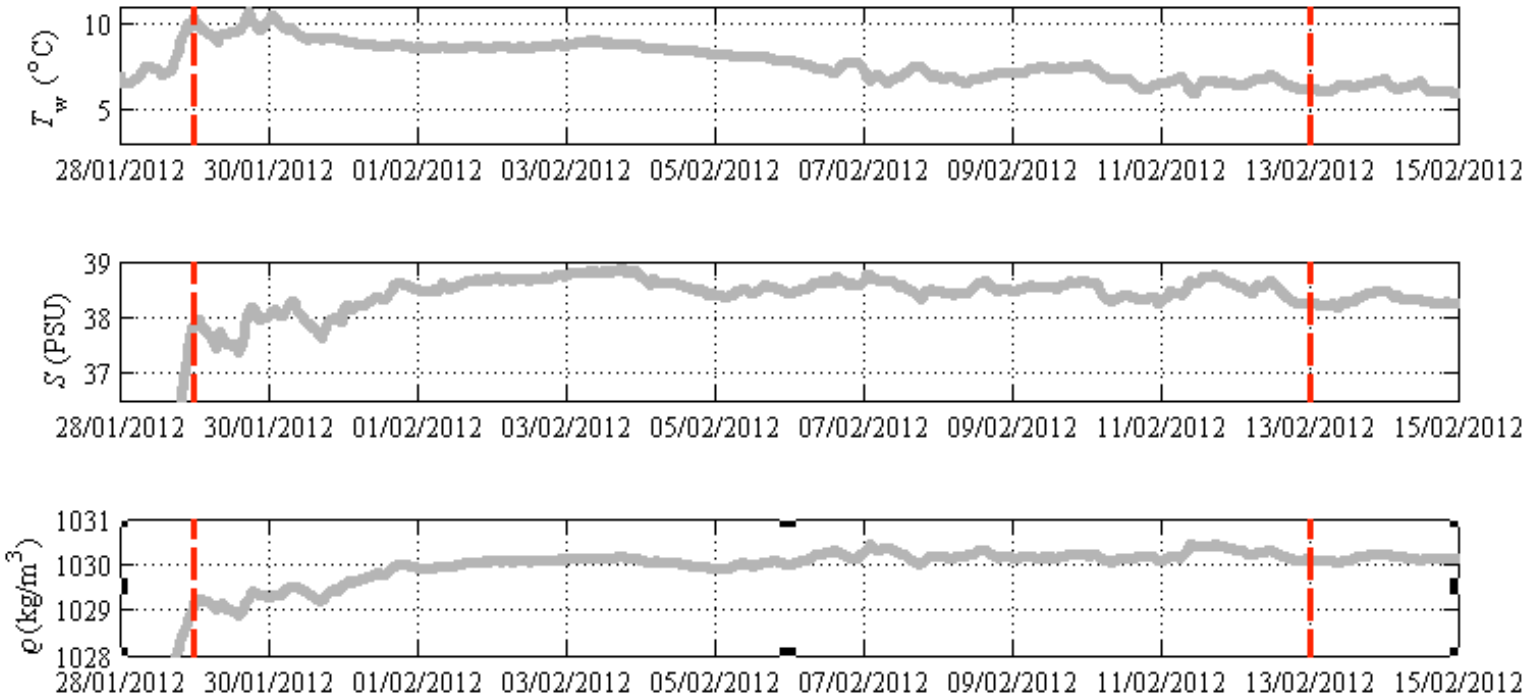
Long and short term variability studies

Measurement of **hydrological parameters** at different depths.

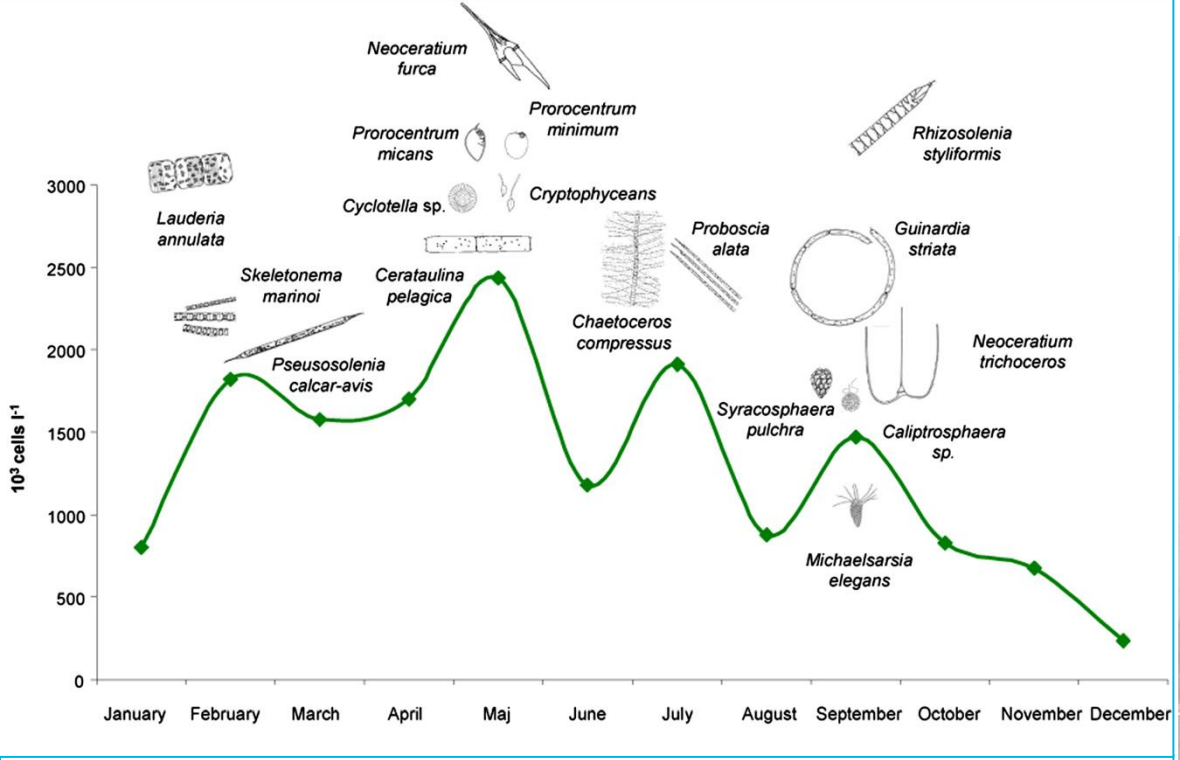
Applications:

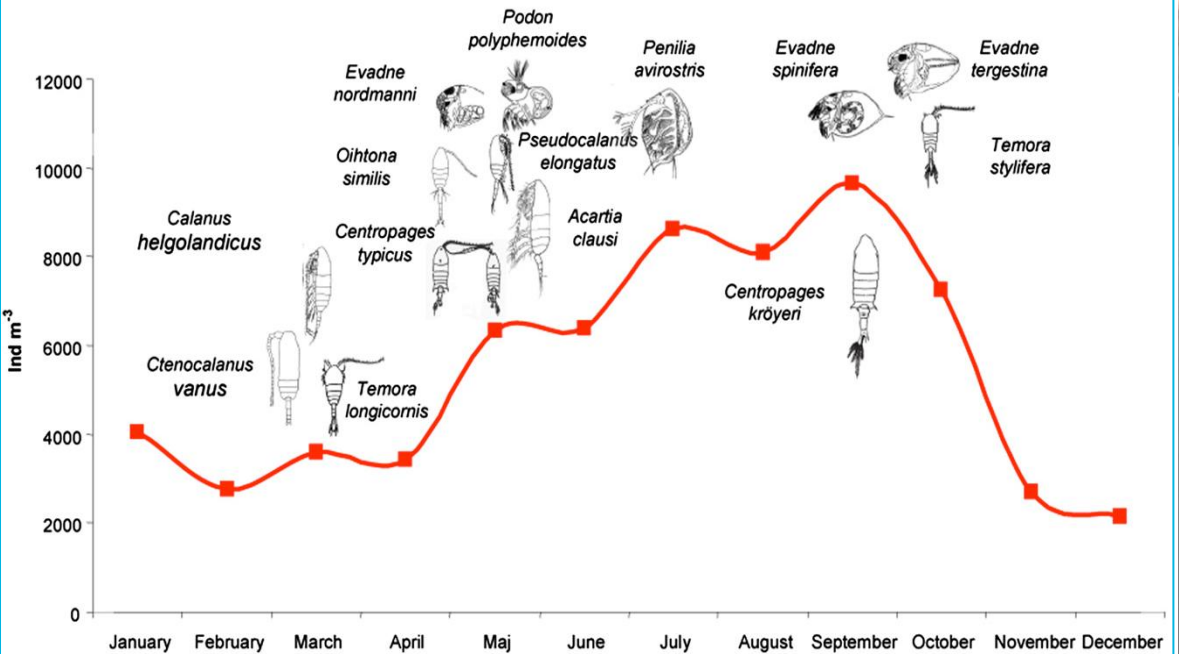
- River plumes detection
- Dense water formation and related processes
- Long-term monitoring





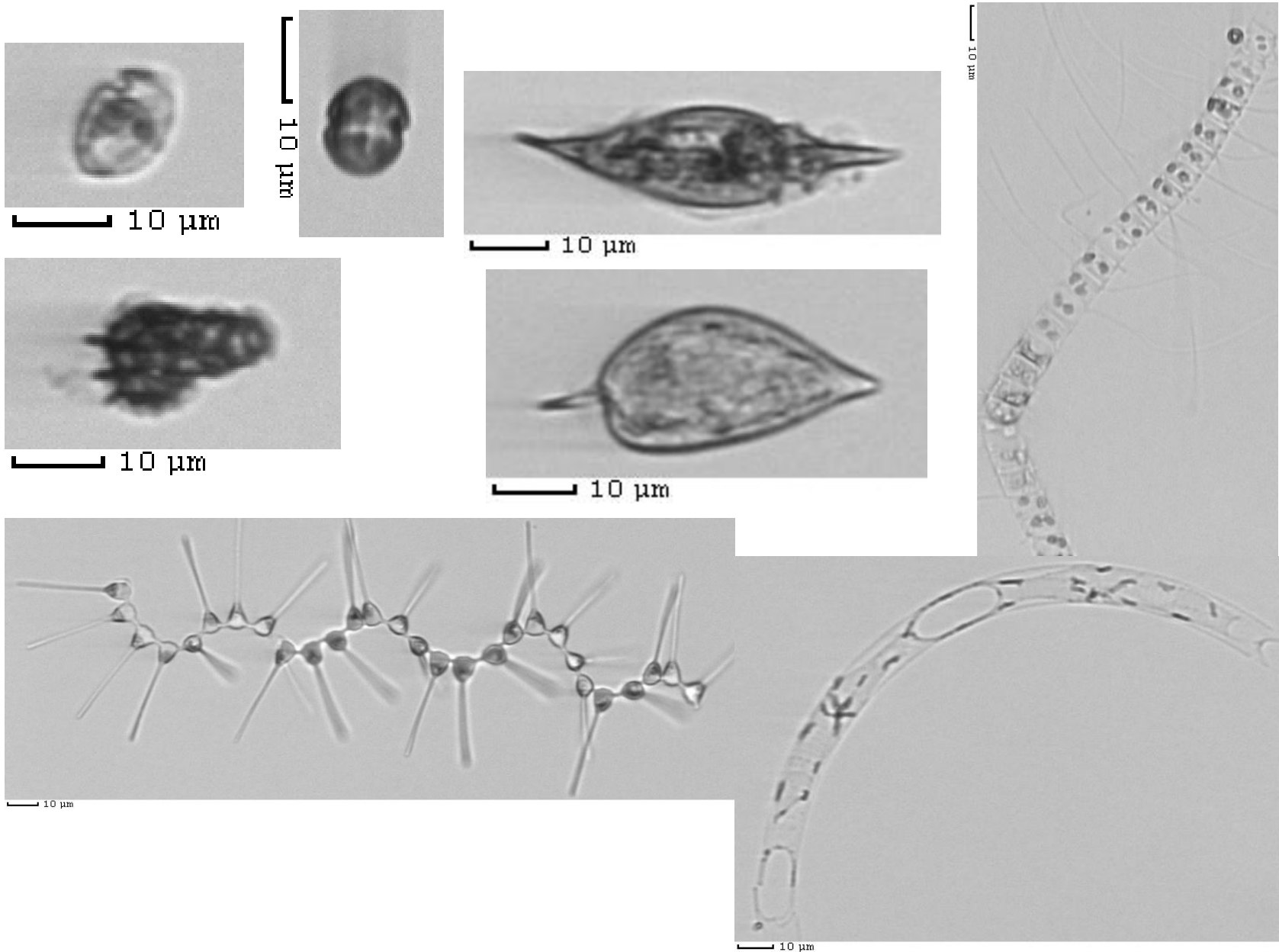
Biogeochemical observations



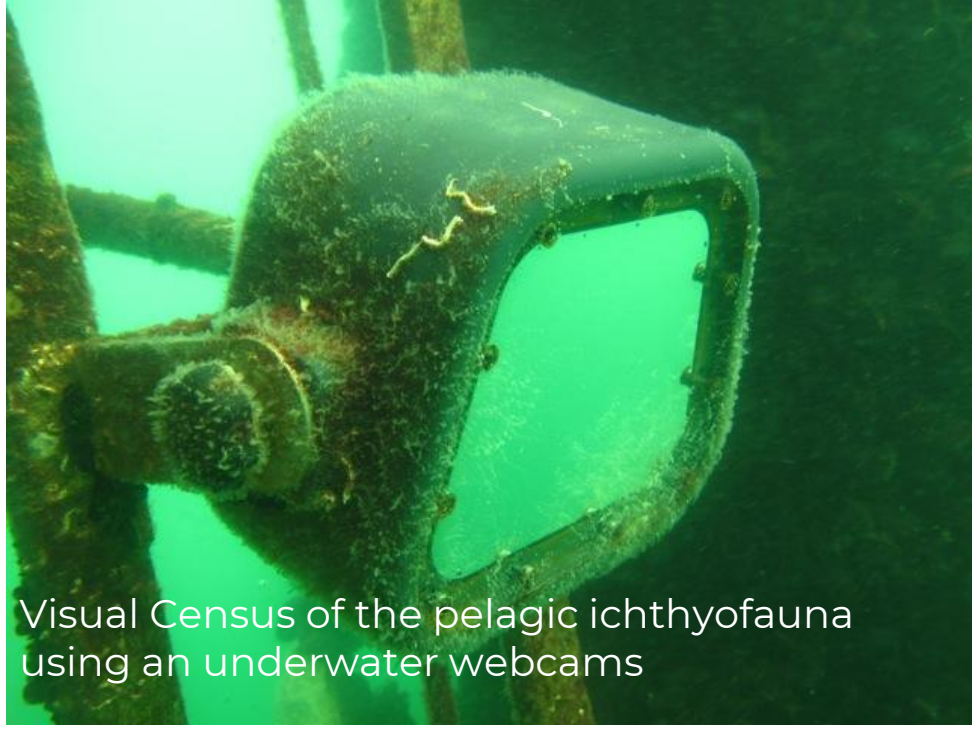


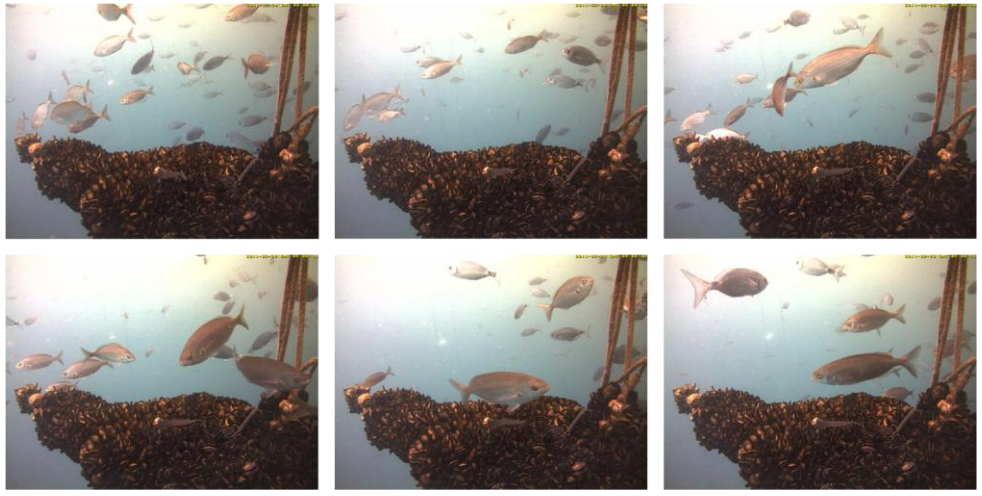
Automated microscopy imaging system AI assisted

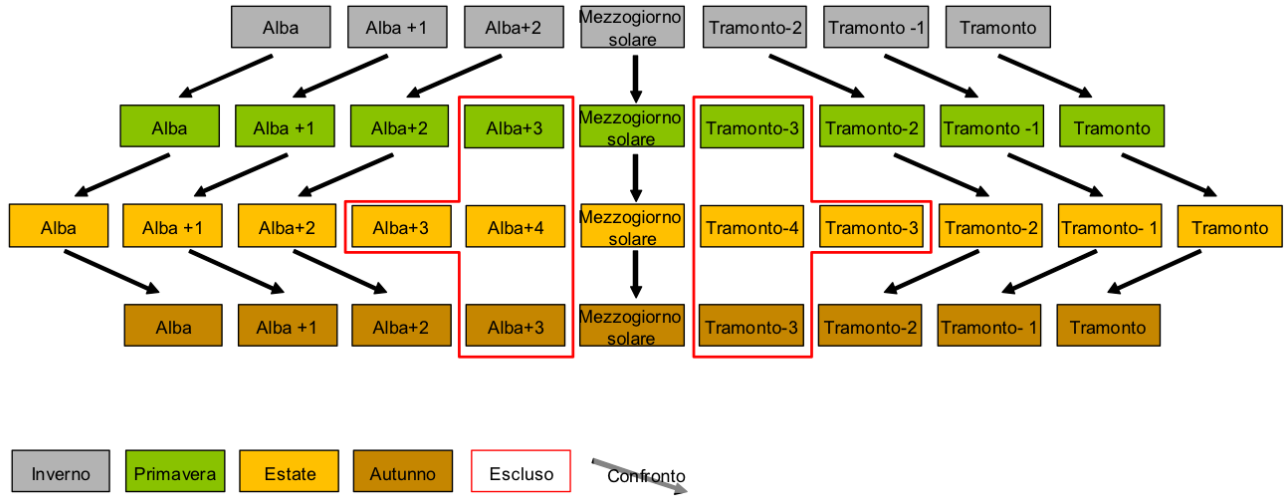
Imaging Flow Cytobot



AI assisted underwater webcams



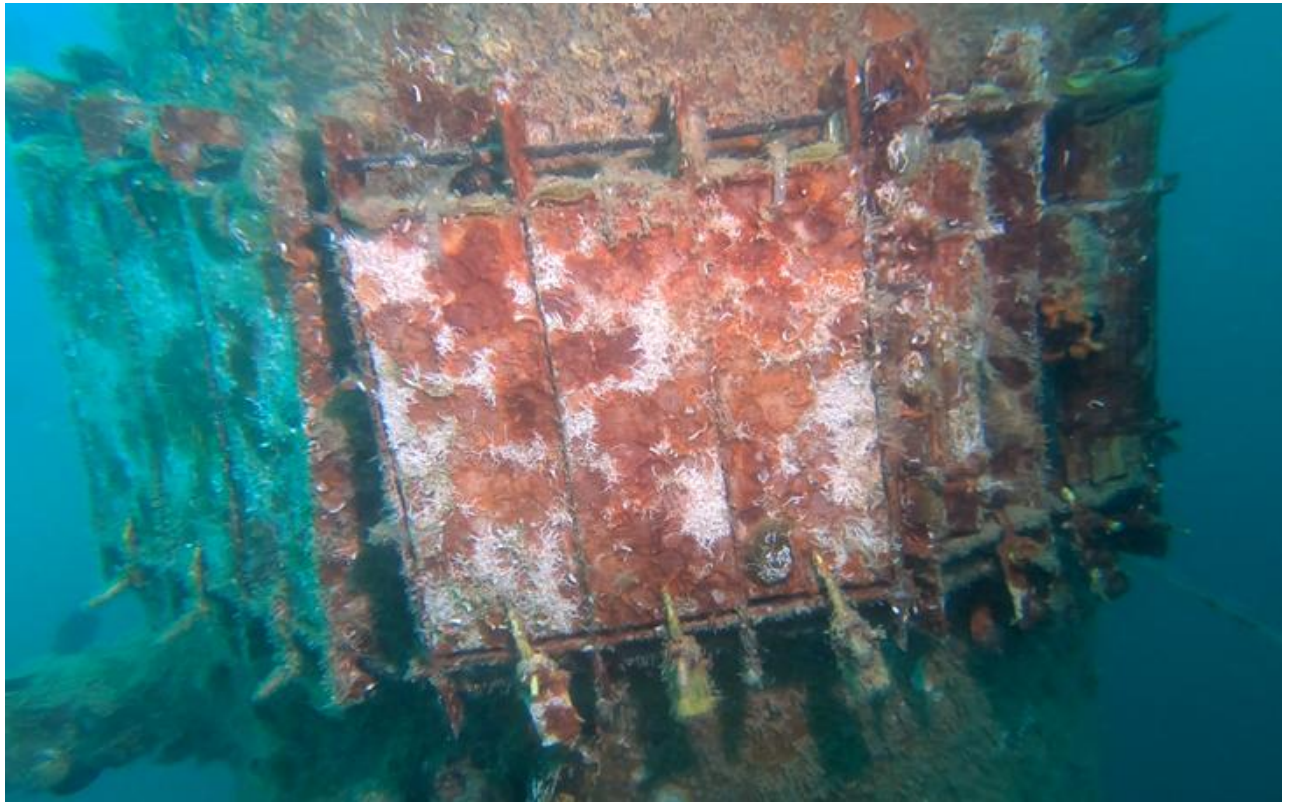




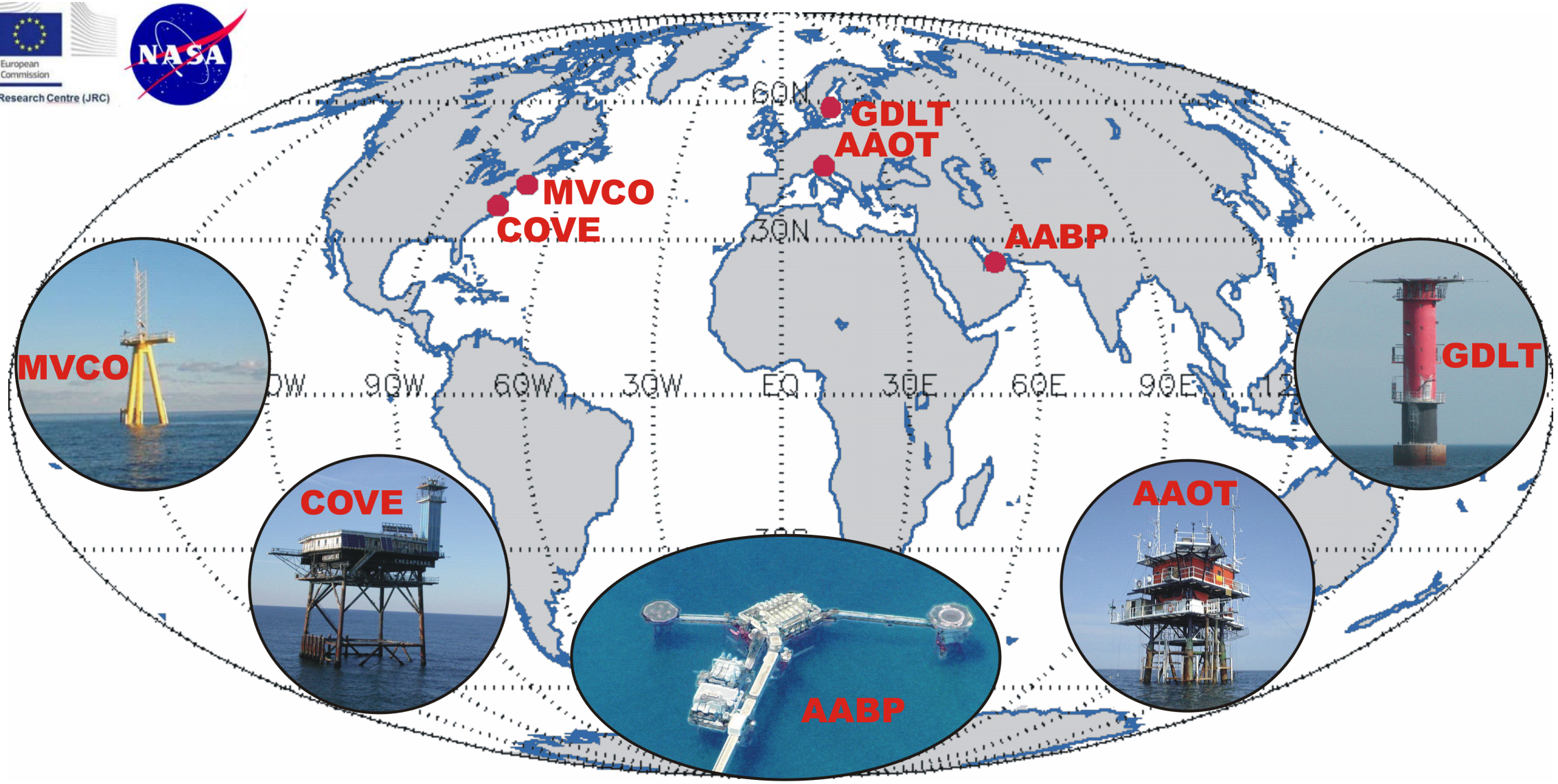
Ecological monitoring studies

Pinna nobilis (Mollusca: Bivalvia) larvae monitoring

Wood samples durability tests



Time-series of bio-optical data for ocean colour applications



Copernicus FICE 2025

Copernicus FRM4SOC-2025 Training In Above-Water Radiometry

Thank you

IMPLEMENTED BY EUMETSAT

fiducial reference measurements for satellite ocean colour

FRM4SOC Phase-2

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