



# AMIS

## Advanced coastal risk Monitoring systems and digital twins for coastal safety and resilience

Systèmes évolués de surveillance et jumeaux numériques pour la sécurité et la résilience côtière

*Sistemi Avanzati di Monitoraggio e gemelli digitali per la Sicurezza e resilienza della costa*

**Roberta Ferretti (CNR-INM)**



Regione Toscana



REGIONE LIGURIA



REGIONE AUTONOMA DE SARDIGNA  
REGIONE AUTONOMA DELLA SARDEGNA

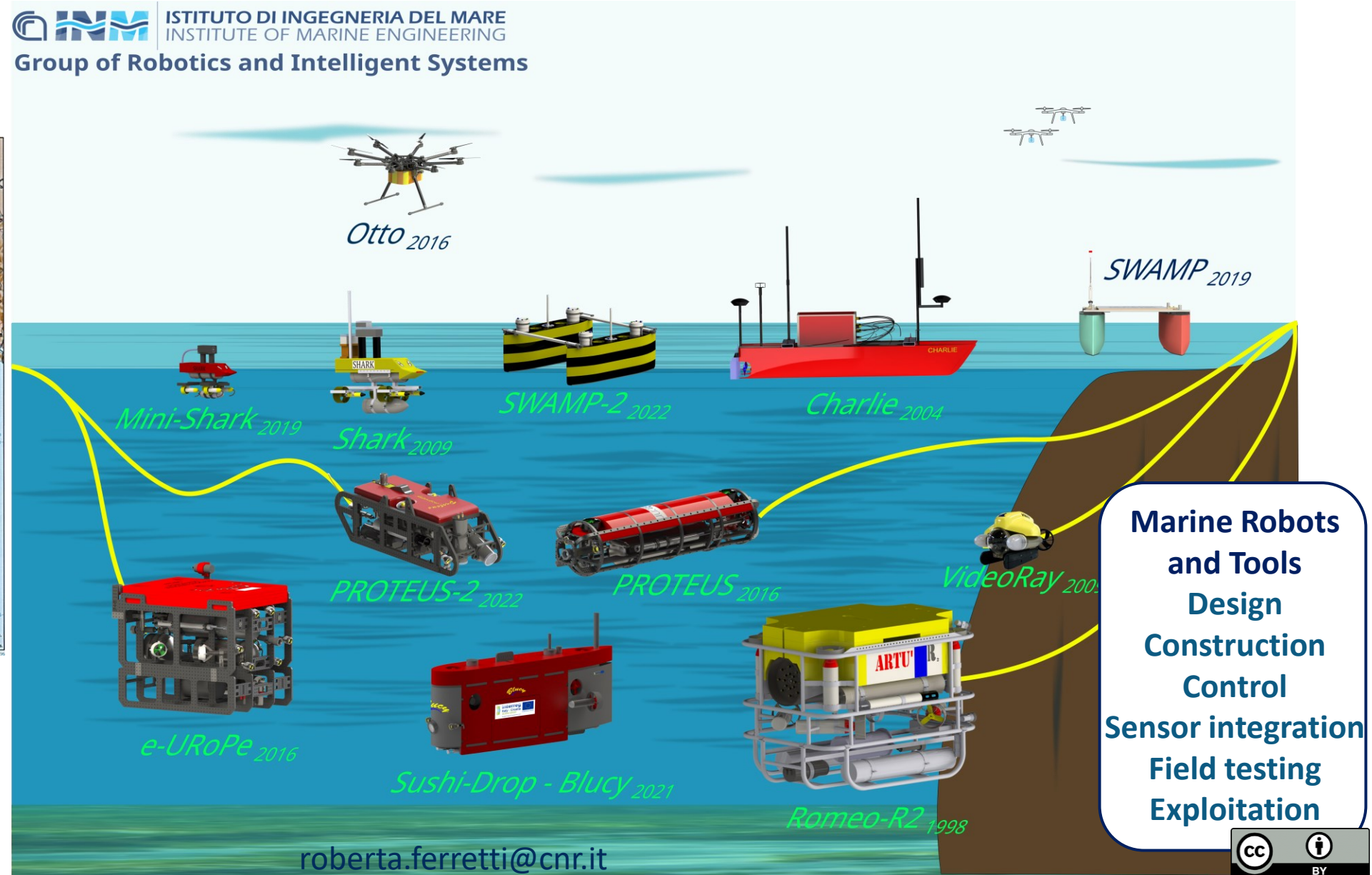


INstitute of Marine engineering – National Research Council


**ISTITUTO DI INGEGNERIA DEL MARE**  
**INSTITUTE OF MARINE ENGINEERING**  
**Group of Robotics and Intelligent Systems**



**Roma (Headquarter)**  
**Roma – ARTOV**  
**Genoa**  
**Palermo**



**Marine Robots and Tools**  
**Design**  
**Construction**  
**Control**  
**Sensor integration**  
**Field testing**  
**Exploitation**

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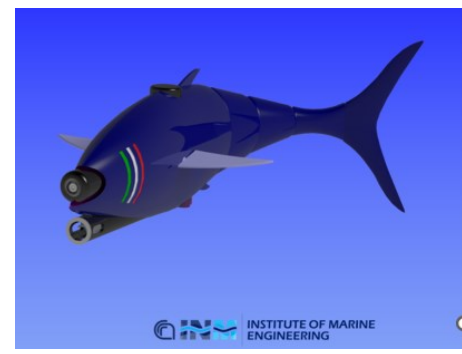




## AI: Machine learning and learning by imitation



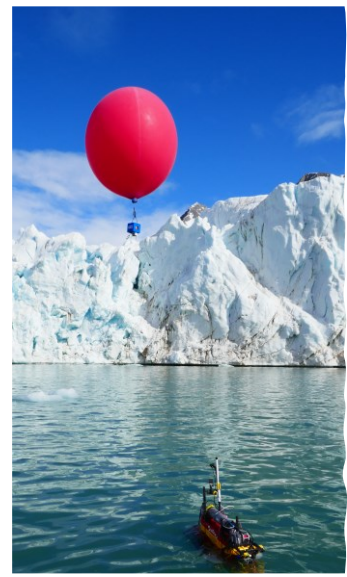
## Bio-inspired marine robotics PERSICO



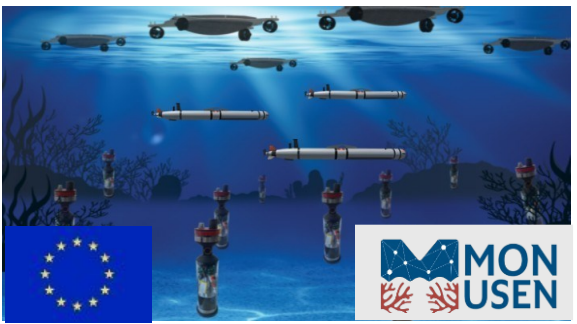
## Lagoon environmental monitoring



## Artica and Antartica missions



## Autonomous sensor networks



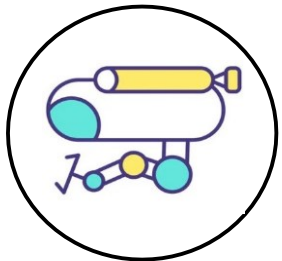
## Coastal tourism, Marina and harbour monitoring



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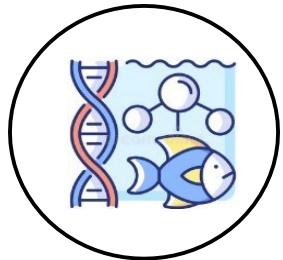
Arenzano, 27-29/5/2024



ROBOTICS RESEARCH



MARINE ENGINEERING INNOVATION



MARINE SCIENCE APPLICATIONS

INTER-DISCIPLINARITY

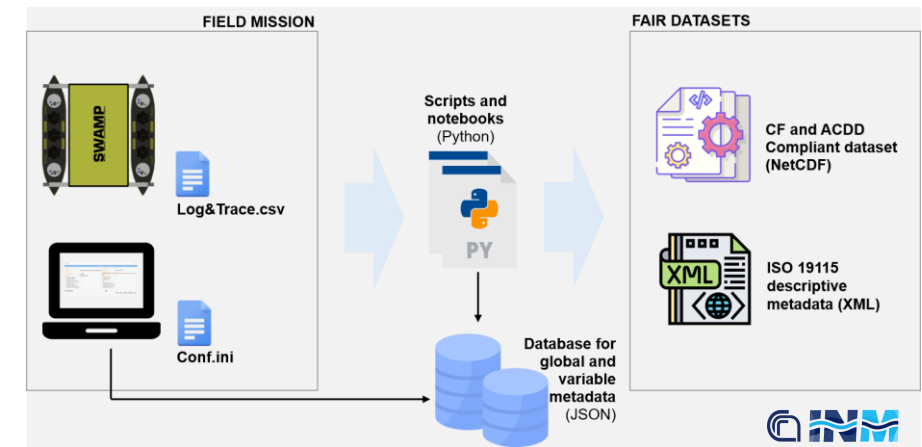


MULTIPLE END-USERS

DATA-CENTERED VISION

A new way of thinking to our research activities from a **data perspective**

Motta, Aracri, Ferretti et al., *A framework for FAIR robotic dataset*, Scientific Data 2023



- F**indable
- A**ccessible
- I**nteroperable
- R**eusable





## **AMIS - Advanced coastal risk Monitoring systems and digital twinS for coastal safety and resilience.**

### **Funding program: Interreg Italy-France Maritime 2021-2027**

Cross-border program co-financed by the European Fund for Regional Development (FESR), within the European Territorial Cooperation (CTE) objective of the EU Cohesion Policy 2021 - 2027



### **Priority 2 “A resilient and resource-efficient cross-border area”**

**SPECIFIC OBJECTIVE 2.4)** Promote **adaptation to climate change, disaster risk prevention** and resilience, considering ecosystemic approaches

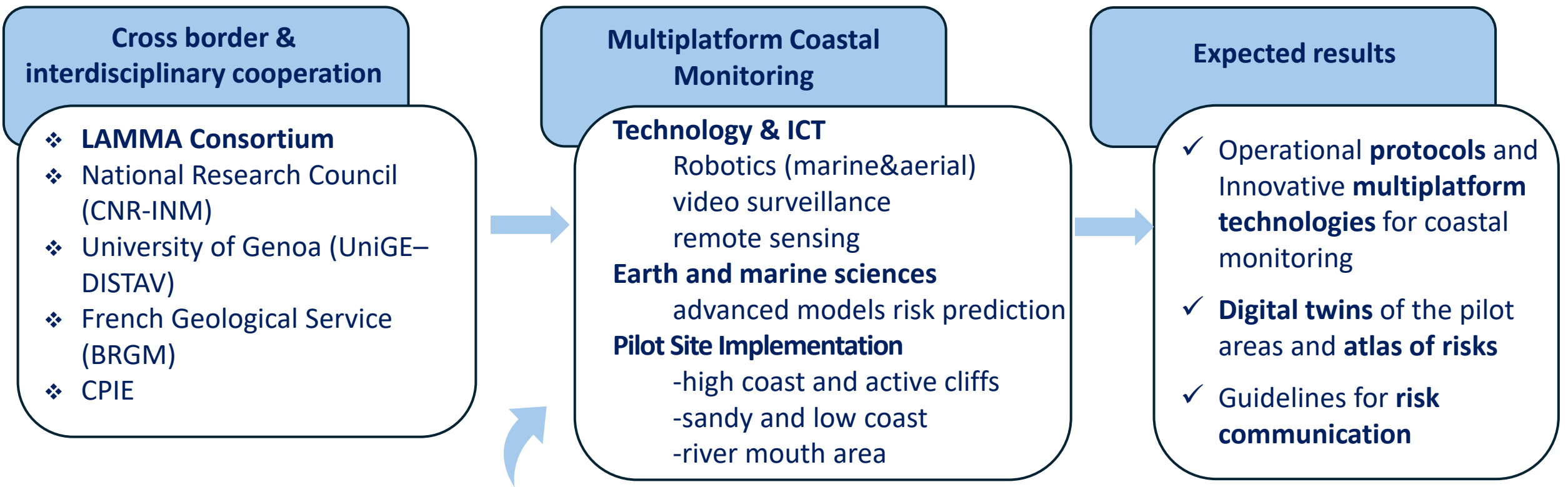


### **AMIS - Simple innovative project**

Duration: **30 months** (1 March 2024 – 31 August 2026)

Financial size: **1.9** million euros





Capitalization from Interreg IT – FR (2014-20)

- MAREGOT
- MATRAC-ACP



**Public Authority (partner & end-users)**

- ❖ District Basin Authority of the Northern Apennines (ABDAS)
- ❖ Autonomous Region of Sardinia -General Directorate of Civil Protection (RAS)
- ❖ Region of Liguria - Territorial Planning Sector (RL)

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**WP1**  
Digital twins for coastal risk analysis  
in relation to climate change

**WP2**  
Advanced technologies for coastal monitoring

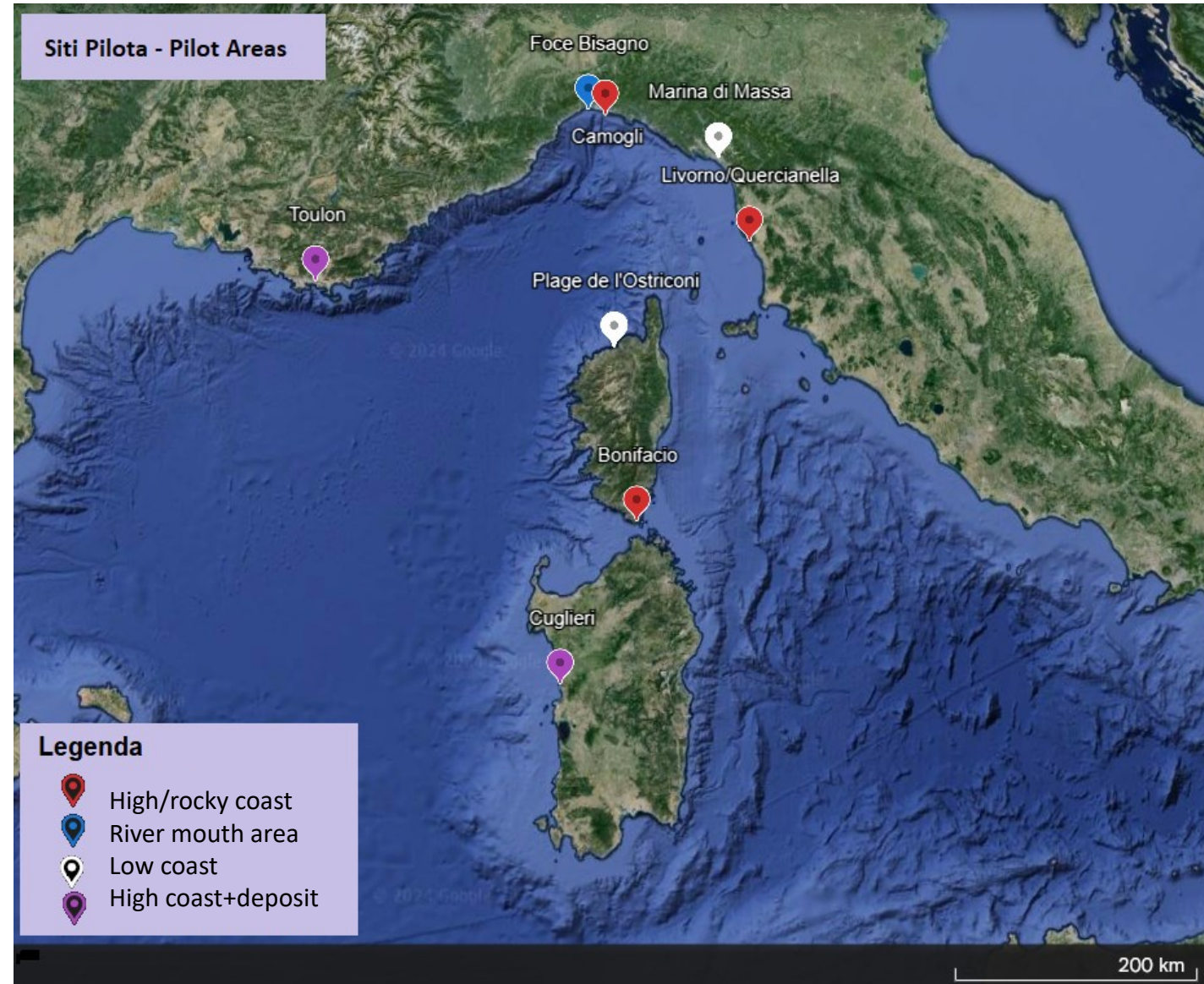
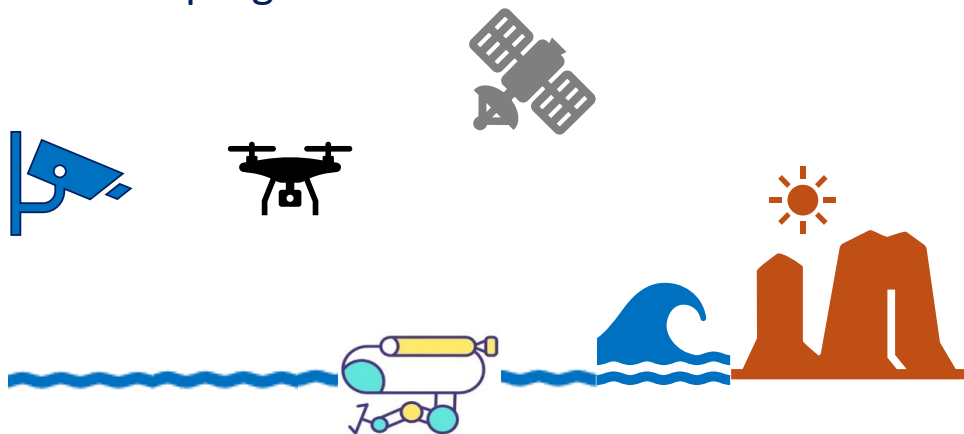


**WP3**  
Integrated coastal monitoring and risk mapping



## Pilot areas

- Pilot areas distributed across the **Program area** and representative of **different types of coast** (high coast and active reefs; low coast; river mouth area)
- Different **observation methodologies** (marine robot and aerial drones; video surveillance; remote sensing) based on the **type of coast**
- **CNR** engaged in cross-border activities across the entire program area



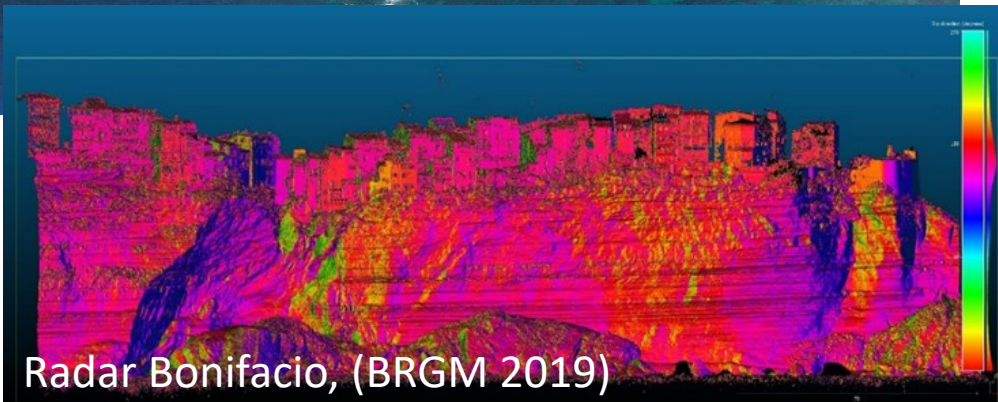




## High and rocky coast - risk of landslides and erosion



Bonifacio, Corsica



Radar Bonifacio, (BRGM 2019)

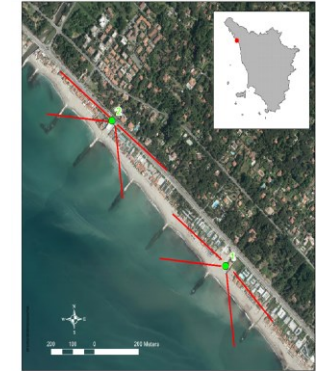
(credits: Balouin, BRGM)

## Low and sandy coast - risk of storm surges and erosion



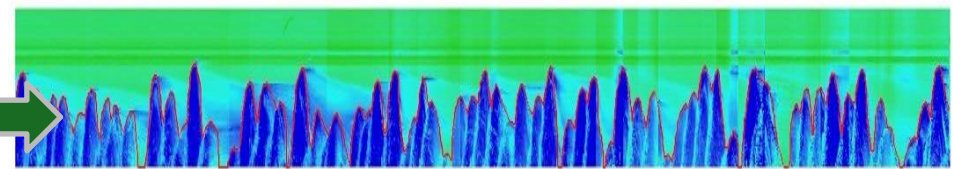
Marina di Massa, Toscana

23/01/2021 10:00



Impact of waves on the coast

Integration with video monitoring systems

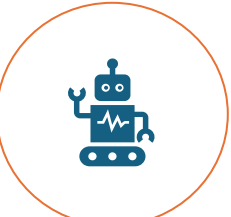


Enhancement of the sea

Time

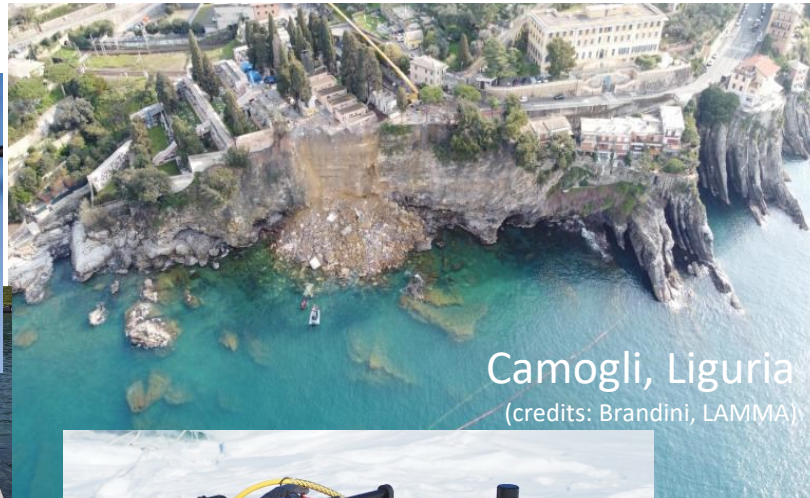
(credits: Brandini, LAMMA)





Bridging the gap between **available technologies** and their use by **public authorities** responsible for managing and planning activities on the territory.

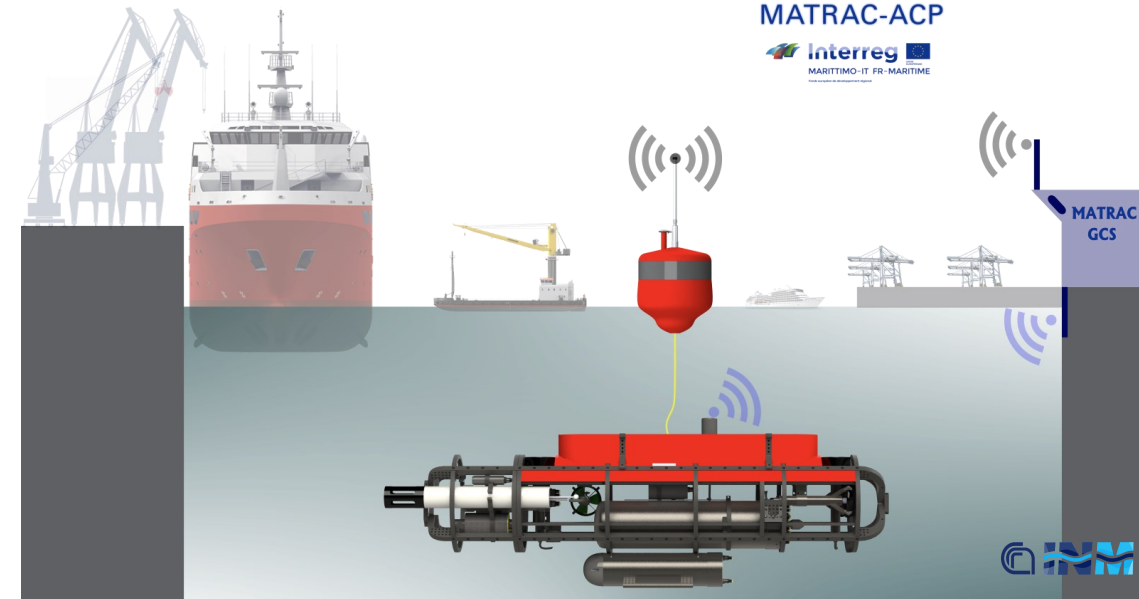
Use a combinations of **aerial and marine drones** to outline the **morphology** of emerged and submerged cliffs for coastal monitoring



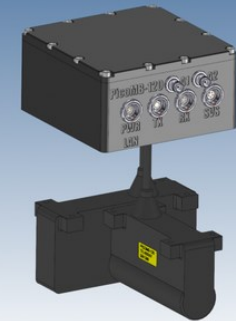
Camogli, Liguria  
(credits: Brandini, LAMMA)



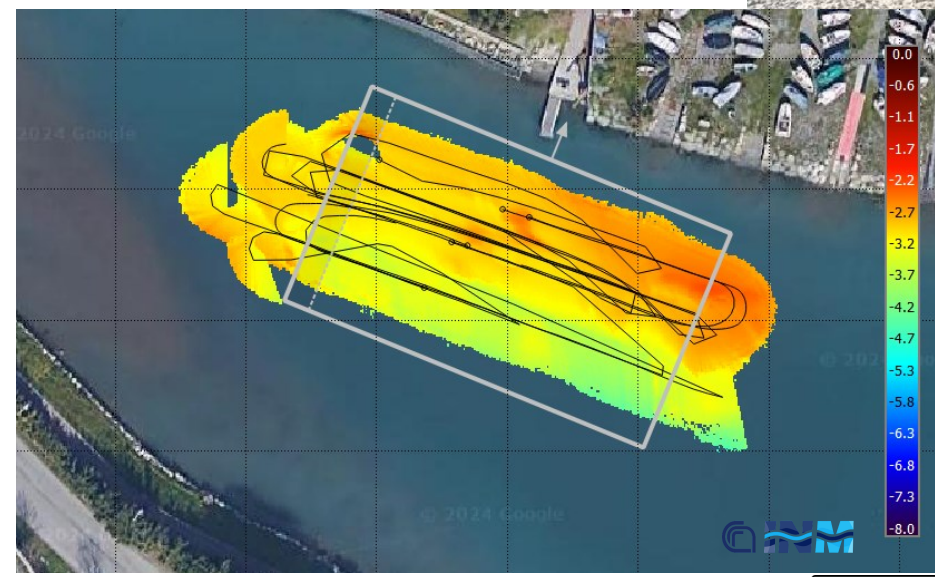
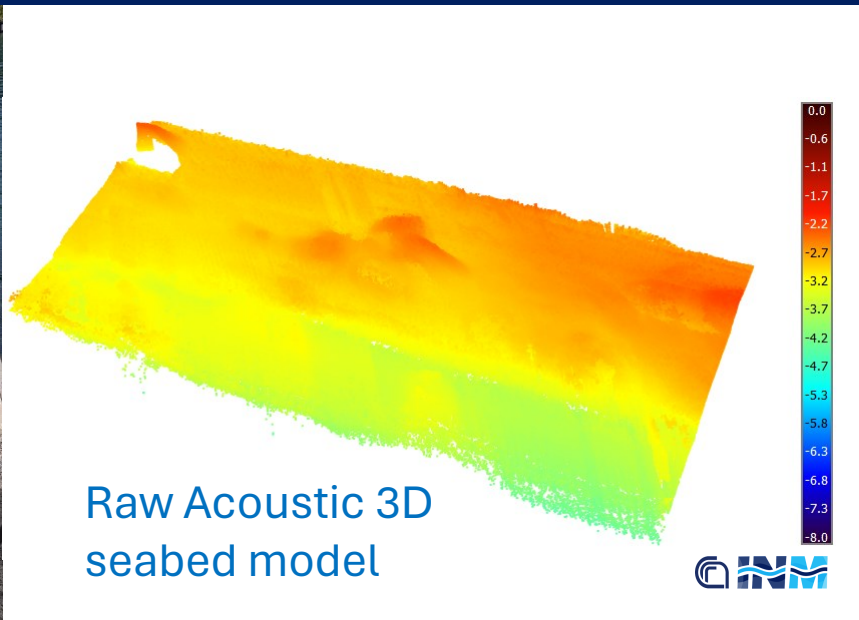
## Capitalization of Interreg IT – FR Maritime 2014-20: **MATRAC-ACP** (P.I. Caccia M. - CNR INM)



The **MBES MATRAC-ACP** kit will be made available for adaptation and use in AMIS







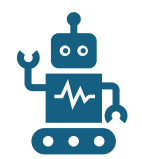
- Port area of Genova Prà (March - April 2024)
- SWAMP ASV with MBES, GNSS+RTK, AHRS, DVL
- Team: 2 people





## Operational Protocols

Shared **guidelines** and **best practices** for effective coastal monitoring



## Innovative Monitoring

Integrated **multiplatform technologies** in pilot sites



## Risk Communication

Harmonized procedures for raising **public risk awareness**, using **gamification** and **citizen science** methods



## Digital Twins and Risk Atlas

Creating **virtual coasts models** linked to cross-border coastal **risks atlas** to support decision-making and planning



**Practical tools** ensuring advanced data representation, adopted by public administrations involved in **coastal management** procedure, **planning** activities and **civil protection**, especially during **emergency** situations



# Thank you!



## Cross-border cooperation: a value to be defended

