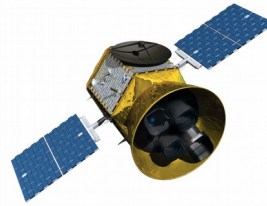


# Osservazione della terra da piattaforme remore ed in-situ fisse e mobili

**Massimo Caccia**

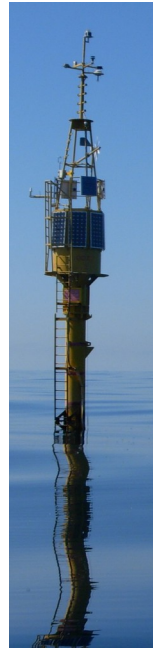
**CNR - ISSIA**

**[massimo.caccia@ge.issia.cnr.it](mailto:massimo.caccia@ge.issia.cnr.it)**



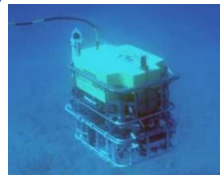
**geo-physical  
monitoring**

**environmental hazards  
monitoring**



**ecosystems  
monitoring**

**oceanographic processes  
monitoring**



**Remote  
sensing**

**Marine  
observatories**

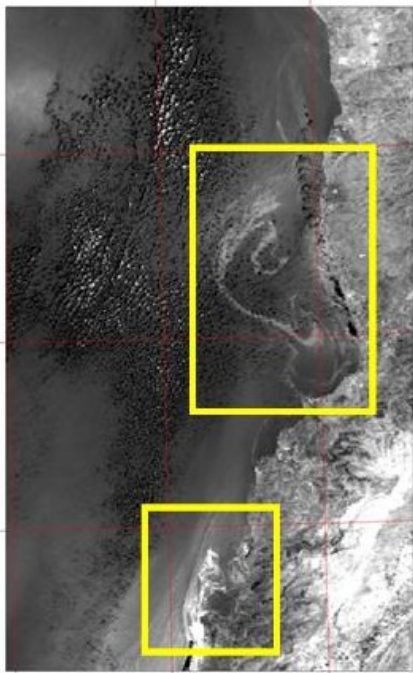
**Mitigation of natural and anthropogenic risks**

**Preserve natural environment**

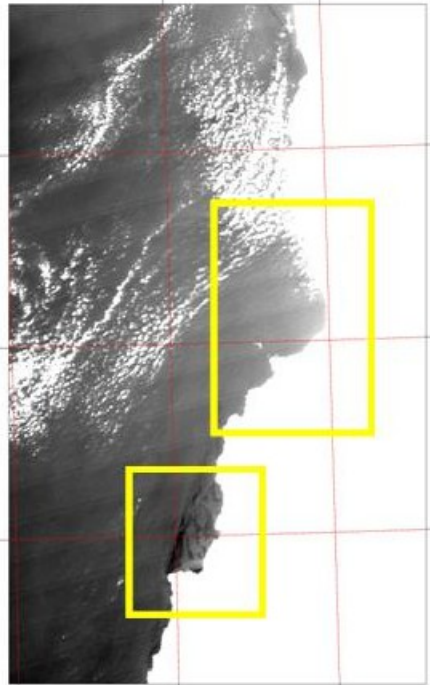
**Land monitoring for water and food security**

# Oil Spill detection

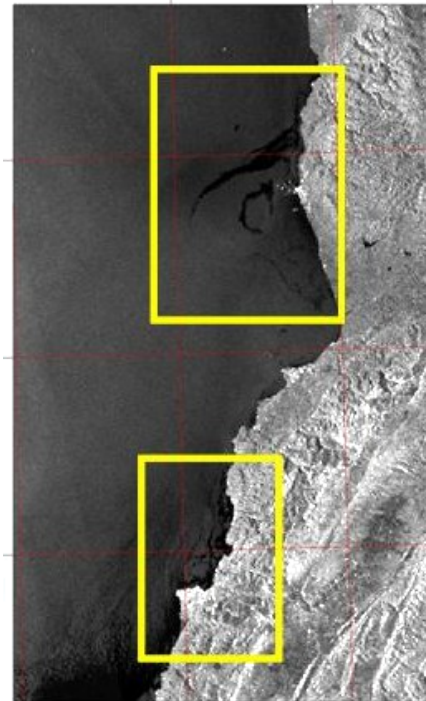
- Oil spill detection (Integrated approach VIS + SAR)
- Case study: Lebanon crisis after Israeli bombing (15000 tons of heavy fuel spilled)



**MERIS**  
05/08/2006 08:16



**MODIS/Aqua**  
05/08/2006 10:25



**ENVISAT-ASAR WS**  
05/08/2006 19:30



issia<sup>nr</sup>



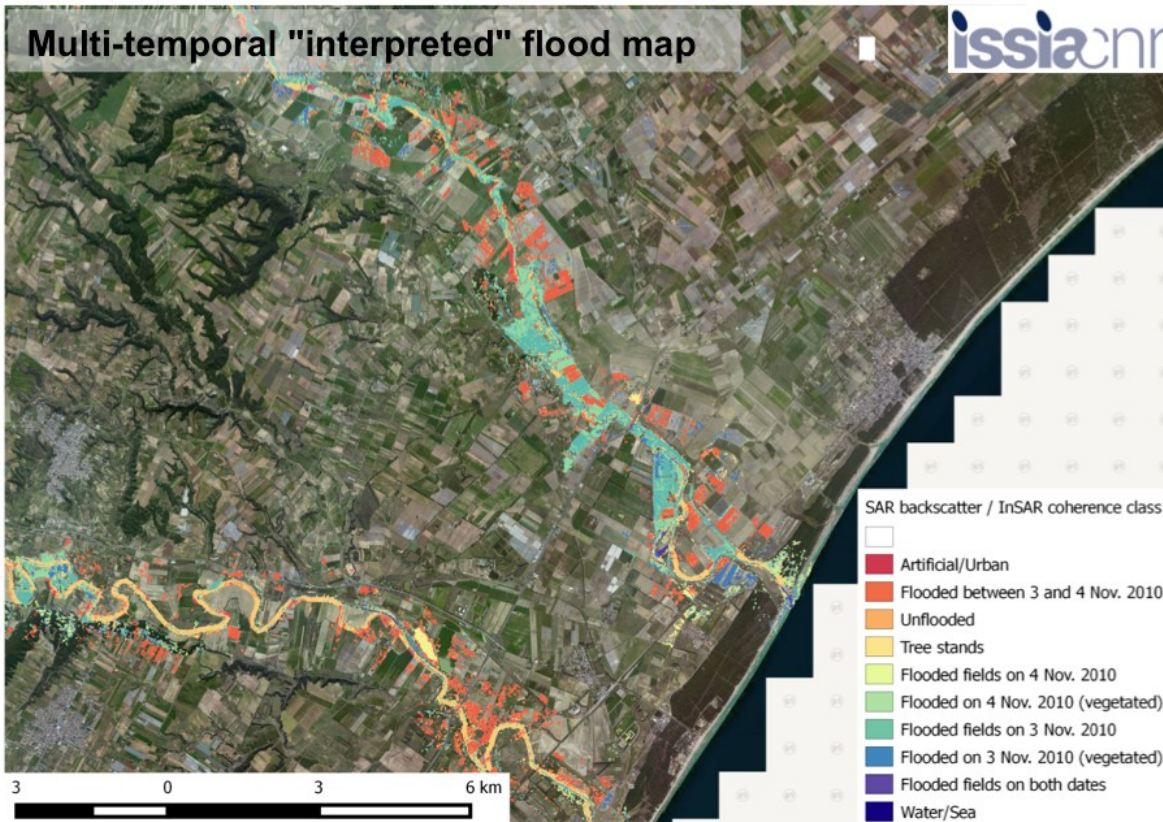
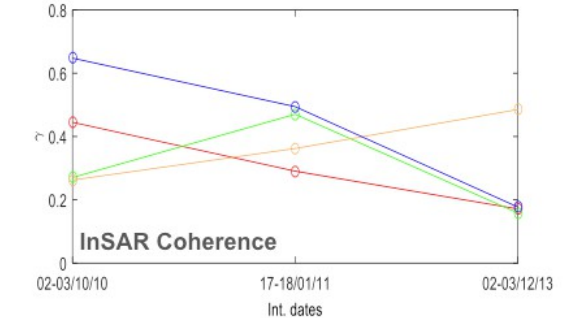
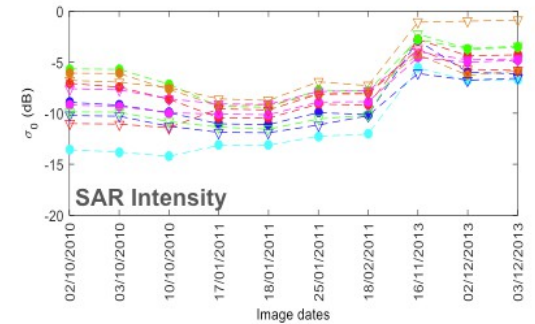
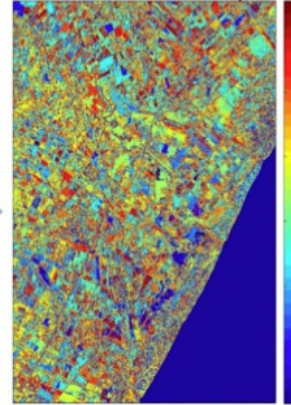
# SAR-based Flood Detection

Cosmo-SkyMed data

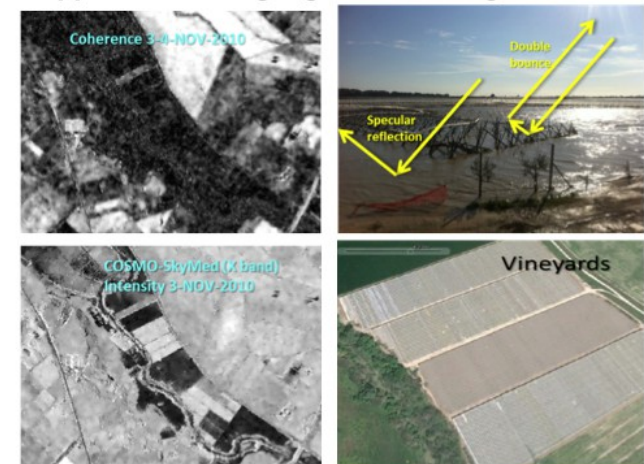
Floods	SAR $\sigma^0$	InSAR Coh.
2010	2 October 3 October 10 October 3 November 4 November 11 November	2-3 October 3-4 November
2011	17 January 18 January 25 January 18 February 19 February	17-18 January 18-19 February
2013	16 November 2 December 3 December	2-3 December



K-means results,  $K_1=32$



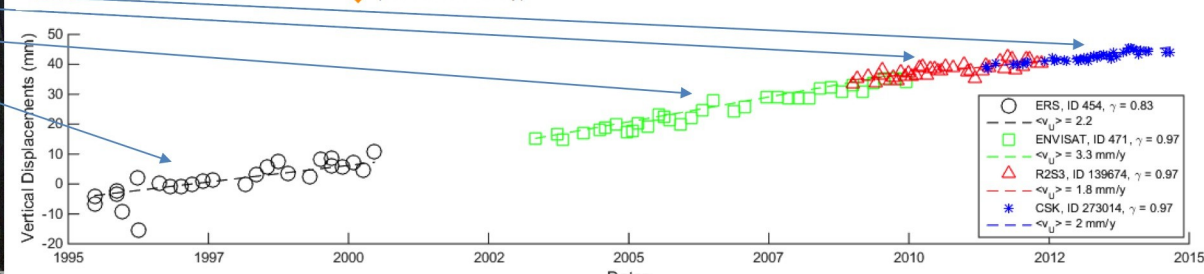
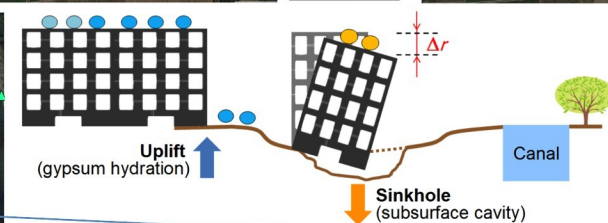
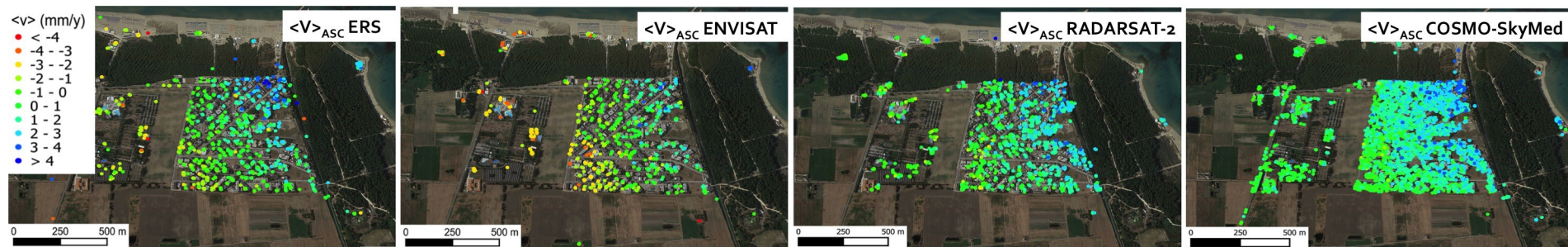
Support in solving signature ambiguities.





# SAR multi-temporal Interferometry

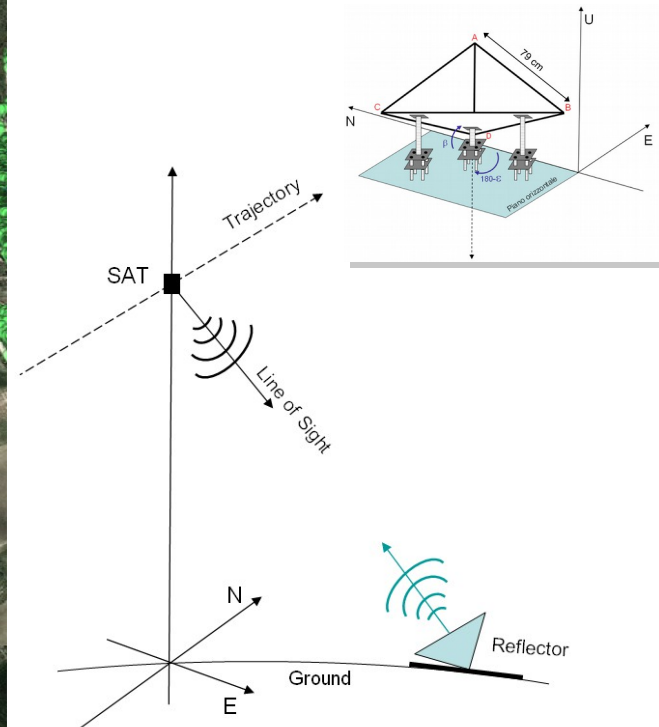
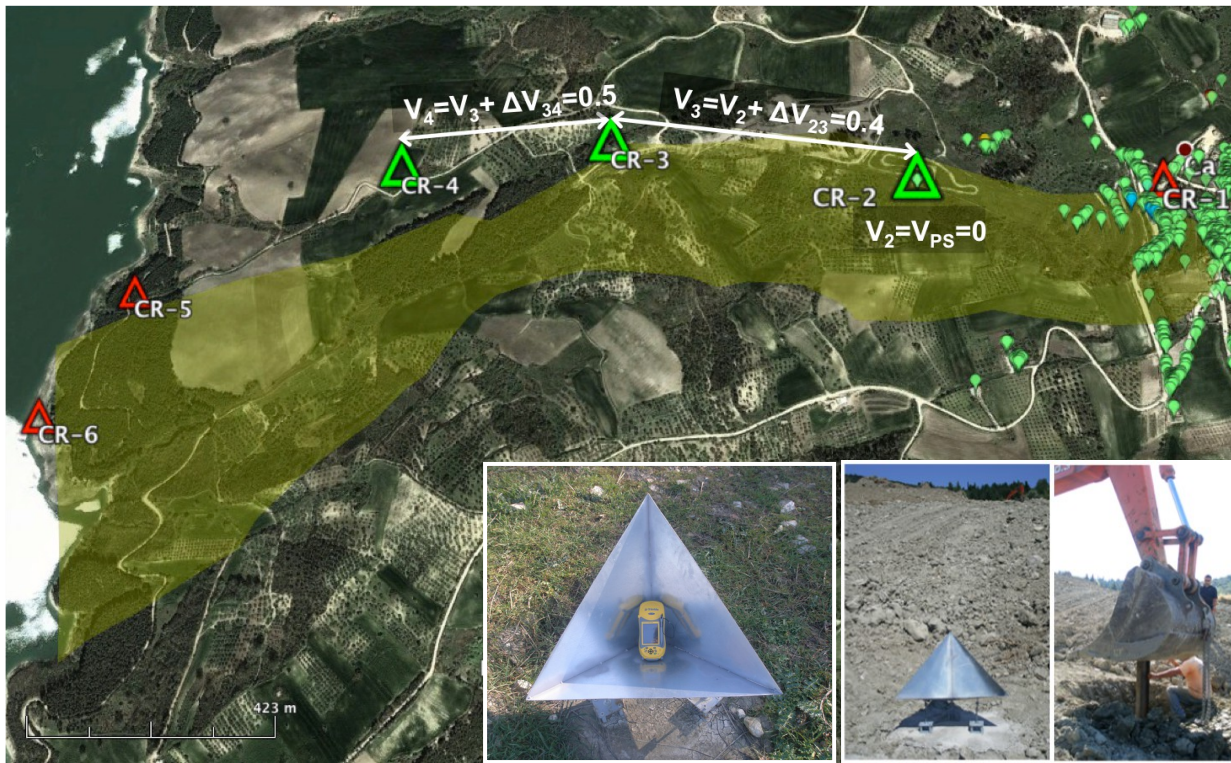
- Ground deformation monitoring (subsidence, landslides, seismic events, building stability ...)
- Multi satellite sensors approach (ERS, ENVISAT, RadarSAT, COSMO-SKyMed): time series analysis over more than 20 years.
- Marina di Lesina: monitoring uplift and sinkholes due to the underground anhydrite hydration.





# SAR multi-temporal Interferometry

- Ground deformation monitoring (subsidence, landslides, seismic events, building stability ...)
- Design and deployed of passive reflectors for SAR interferometry over vegetation and variable land cover.
- Carlantino: landslide monitoring.

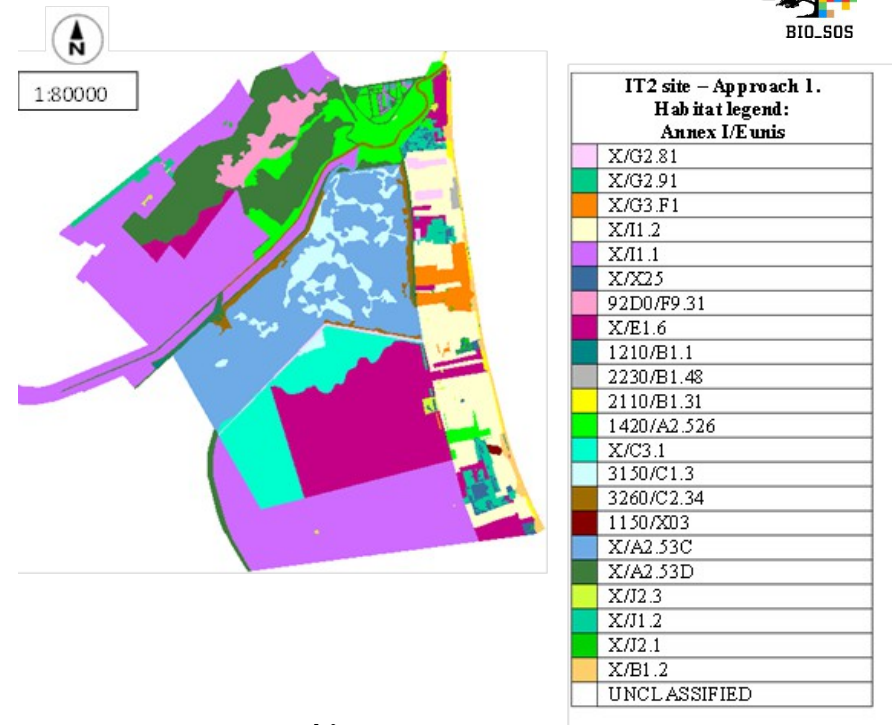


# Remote sensing for ecology: Habitat Map

- **FP7-BIO\_SOS:** BIOdiversity multi-source monitoring system: from Space to Species (FP7-SPACE-2010-1, GA 263435)
- Objective: to develop an operational ecological modeling system suitable for effective and timely multi-annual monitoring of NATURA 2000 sites and their surrounding from EO and in-situ data ( [www.biosos.eu](http://www.biosos.eu) ).



**Remote sensed Image:**  
WorldVie2 image June 2010. RGB  
Protected area "Lago Salso" (Italy)  
(SCI IT9110005; SPA IT9110038)



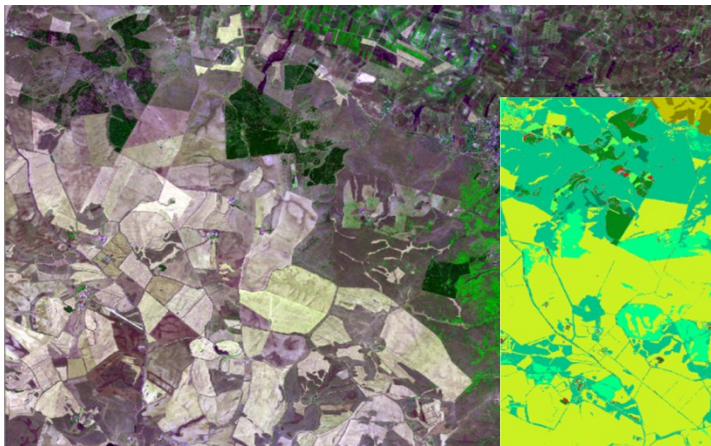
**Habitat map:**  
Habitat map of the Natura 2000 site .  
Annex I to the Habitat Directive/EUNIS habitat codes



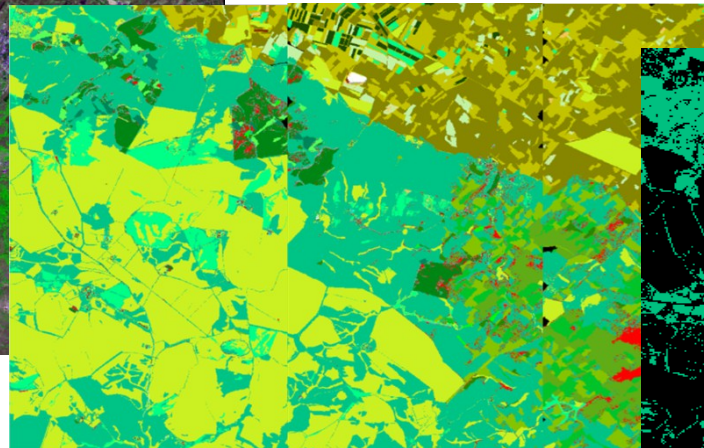


# Remote sensing for ecosystem monitoring

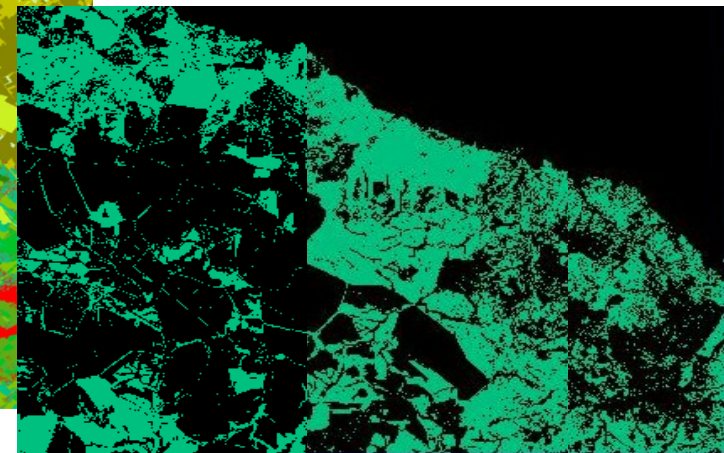
- **Horizon 2020-ECOPOTENTIAL:** IMPROVING FUTURE ECOSYSTEM BENEFITS THROUGH EARTH OBSERVATIONS (GA 641762). June 2015- May 2019
- Objective: To design, develop and validate a pre-operational multi-modular system named **EO Data for Ecosystem Monitoring (EODESM)** for **monitoring the status of ecosystem functions and services in Protected Areas**, in support to decision makers and stakeholders..
- Methodology: best use of existing and new multi-scale/source EO and in situ monitoring data integrated by appropriate automatic knowledge drive and data driven techniques.



VHR Optical data: WorldView2  
Murgia Alta National Park. Italy  
Area covered: 485 km<sup>2</sup>



Land cover map in FAO-LCCS taxonomy:  
WorldView2 . Murgia Alta National Park. Italy



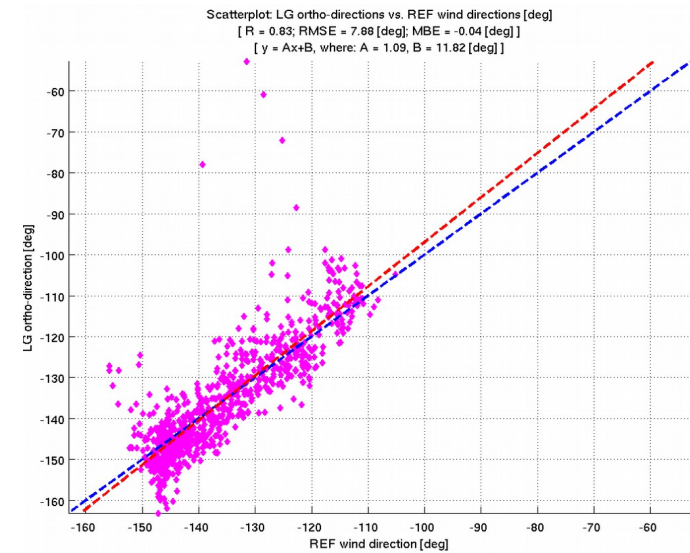
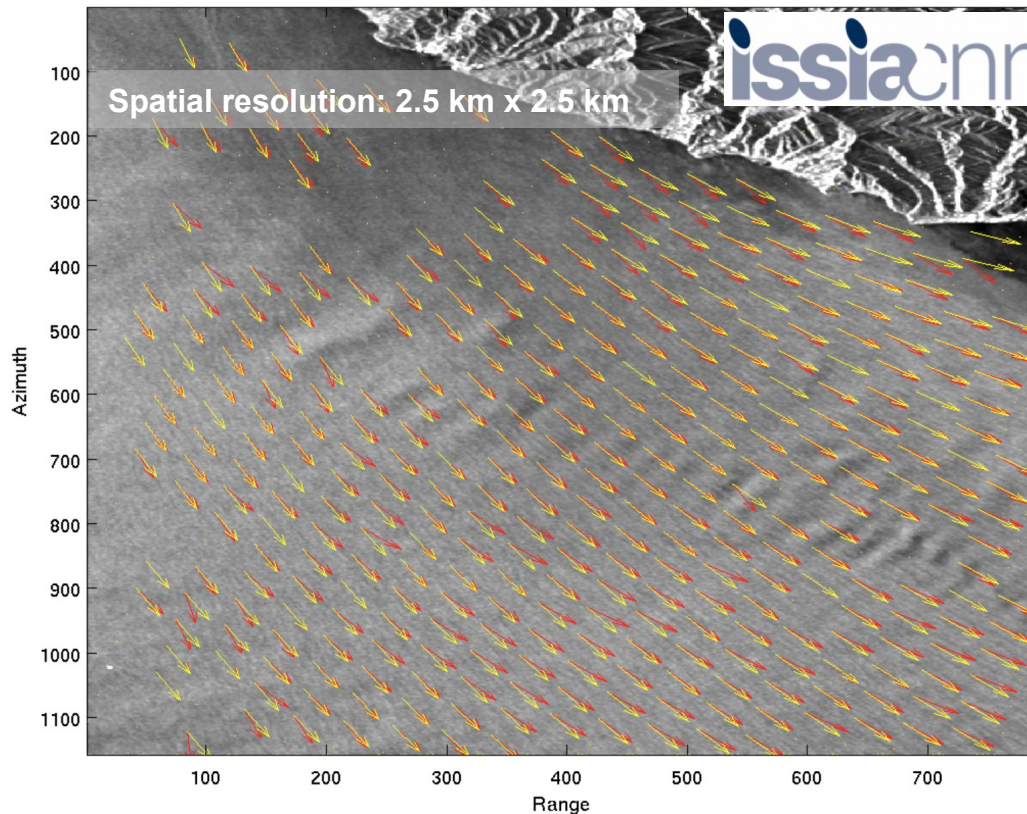
Grassland ecosystem layer  
Murgia Alta National Park. Italy

1:150000

# Wind field retrieval

- Wind direction map: SAR amplitude analysis through LG mod algorithm.
- Nice (France)
- TerraSAR-X ScanSAR data.

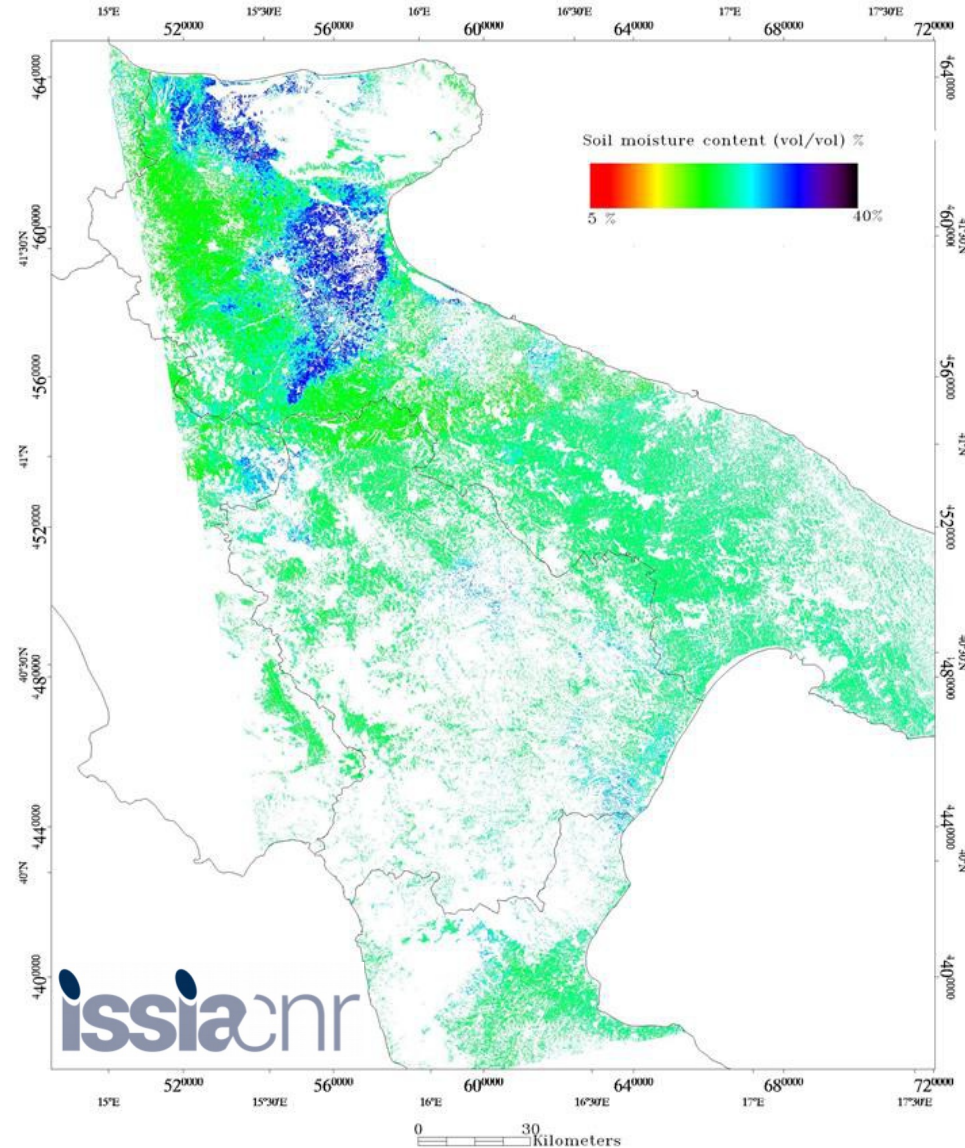
LG-Mod ortho-directions vs. ETA wind directions [ with SAR  $\sigma_0^W$  background ]





# Soil moisture retrieval

- Near surface Soil Moisture Content (SMC) map derived from a Sentinel-1A W swaths acquired over southern Italy on October, 27, 2014.
- Time series of SMC maps are obtained by means of the SMOSAR algorithm (Soil MOisture retrieval from multi-temporal SAR data)
- A calibration/validation facility of SAR-derived SMC products has been set up on the Apulian Tavoliere in the Segezia experimental farm. The facility consists of a hydrologic network of 11 ground stations continuously measuring SMC and soil temperature at various depths. In addition an agro-meteorological station recording all the main meteorological parameters is maintained on site.



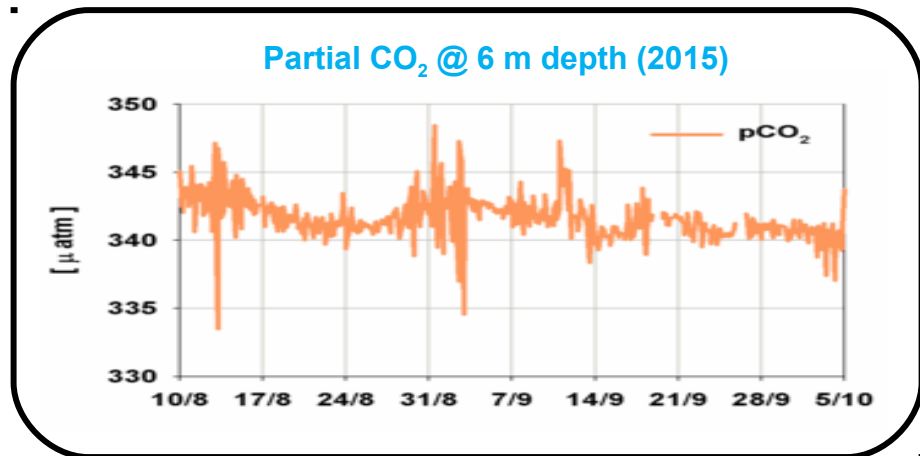
# W1-M3A observatory

W1-M3A observatory is composed of the ODAS Italia 1 spar buoy (12 tons/51 m long) and a subsurface mooring positioned in the Ligurian Sea (80 Km offshore – 1200 water depth).

W1-M3A observatory is currently the only CNR offshore deep platform monitoring near surface atmosphere processes as well as interior physical and biogeochemical properties of the water column.

The platform provides scientific data for studying the variations of the heat fluxes and the marine ecosystem fulfilling the concept of the Global Climate Observing System (GCOS) Essential Climate Variables (ECVs).

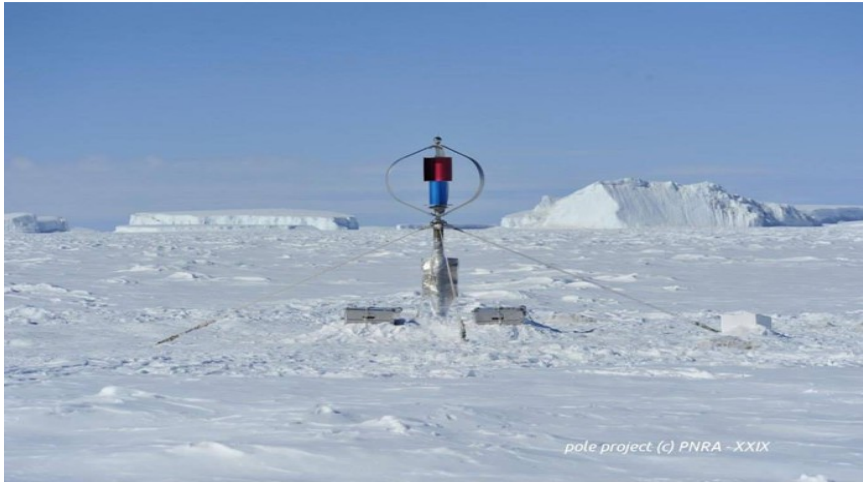
W1-M3A observatory is one of the Italian platforms candidate to become a site of the ICOS Ocean Thematic Center and part of EMSO-IT.



- **FixO<sup>3</sup>**: Fixed Point Open Ocean Observatories Network (FixO3) - FP7-INFRASTRUCTURE-2012-1 (INFRA-2012-1.1.11).



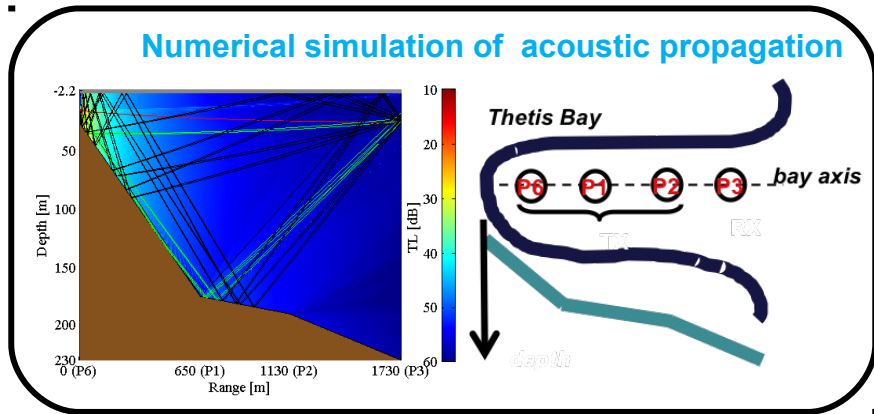




**POLE**



**RAISE**



**Underwater acoustics in Polynya**



**ARCA**

**Arctic project**

# CNR-ISSIA fleet of Unmanned Marine Vehicles



**ALANIS dual-mode vessel**



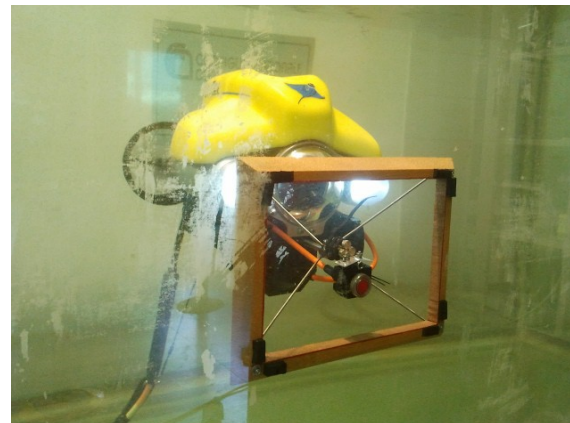
**CART/Shark USSV**



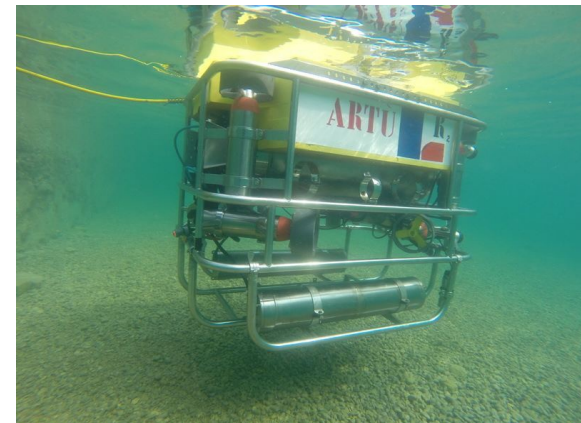
**Charlie USV**



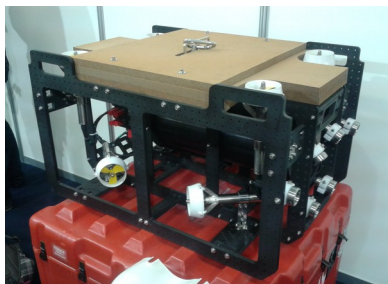
**AscTec FireFly UAV**



**VideoRay Pro 4 mini-ROV**



**R2 ROV**



**E-URoPe AUV/ROV**

