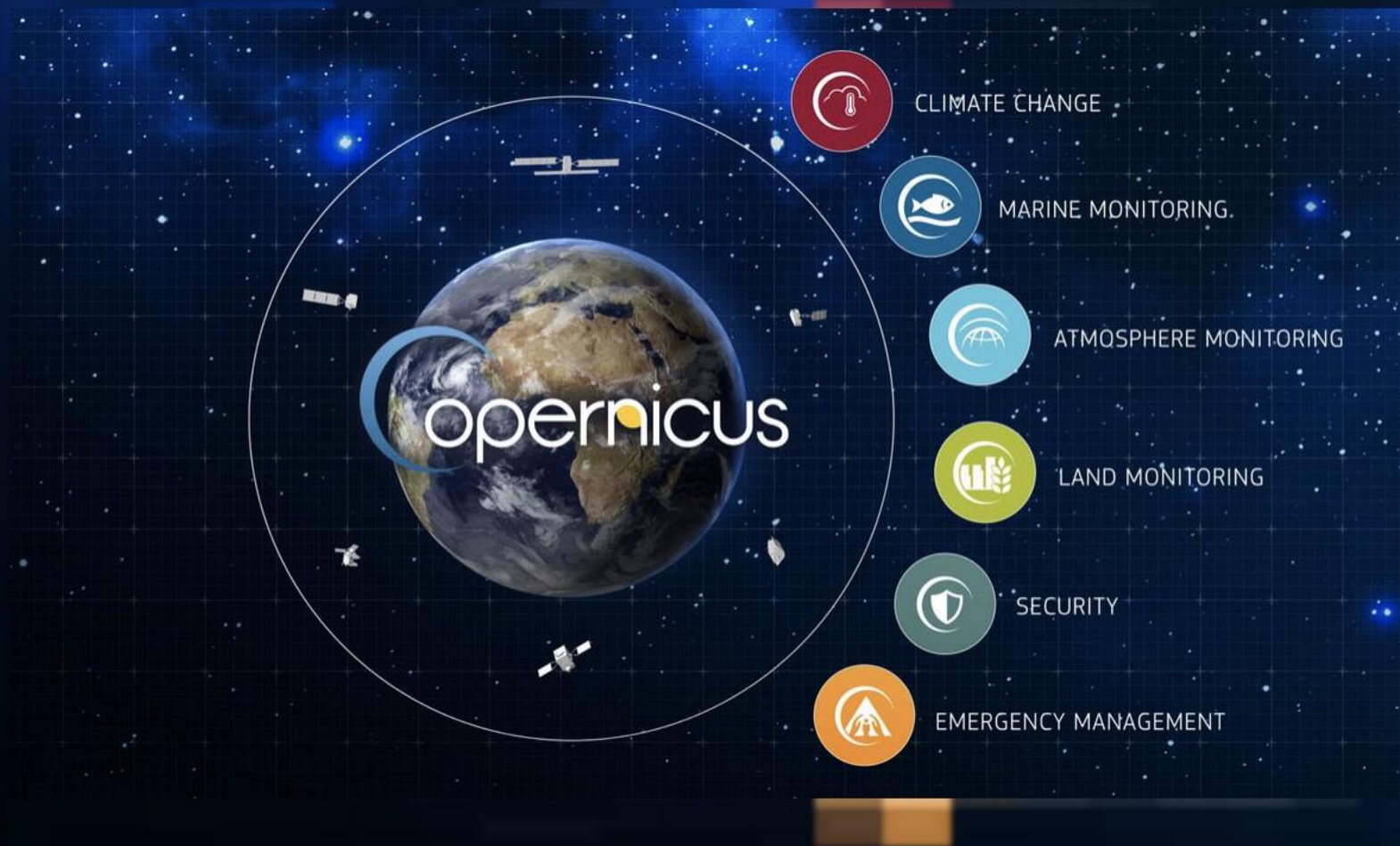




M. Bussettini, S. Mariani, B. Lastoria, M. Casaioli e F. Piva (BIO-ACAS)

L'integrazione di dati da Sentinel Copernicus e da drone per lo sviluppo di strumenti finalizzati al monitoraggio idromorfologico dei fiumi a supporto delle Direttive Europee Acque e Alluvioni

IDRAIM: FRAMEWORK ITALIANO PER LA VALUTAZIONE IDROMORFOLOGICA, ANALISI E MONITORAGGIO DEI CORSI D'ACQUA

State of the art /
User requirements

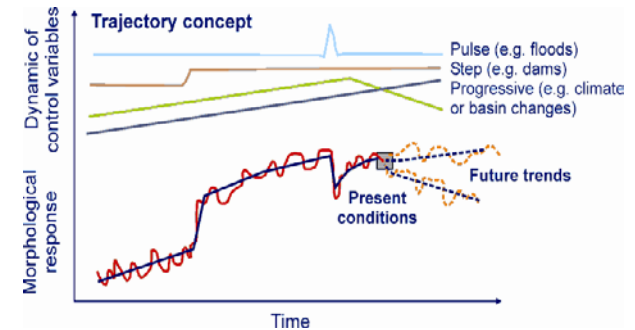
- National activity: Regional and local Authorities responsible for Hymo monitoring, ISPRA and MATTM
- EU Commission activity: **WG ECOSTAT & WG Floods** of the CIS for **WFD** and **FD + AHTG on Hymo**
- New **EU Standard on Hymo** – **WG CEN**
- EU project **REFORM**: review Hymo tool based on RS data
- Research and scientific studies

Operational
framework

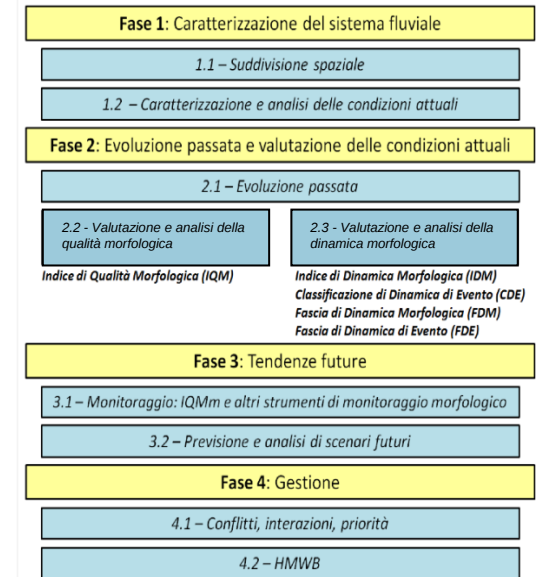
- **IDRAIM**-stream Hymo evaluation, analysis & monitoring system, developed by ISPRA and 3 Italian Universities
- **SUM**–Geomorphic Unit survey and classification System
- **e-MesoHABSIM** for modeling & evaluating river habitat integrity
- **Specialized training by ISPRA**

New tools &
indicators based
on Copernicus data

- **Habitat Mapping project:**
 - Developing tools and indicators for **Hymo** monitoring based on **Copernicus Sentinel 1** and **2** data in the framework of IDRAIM to support regional and local Authorities for **WFD** and **FD** implementation
 - Testing tools and indicators on four river basins
 - Optimization of costs by integration of RS-based and traditional monitoring (e.g. **WFD**, **HBD**)

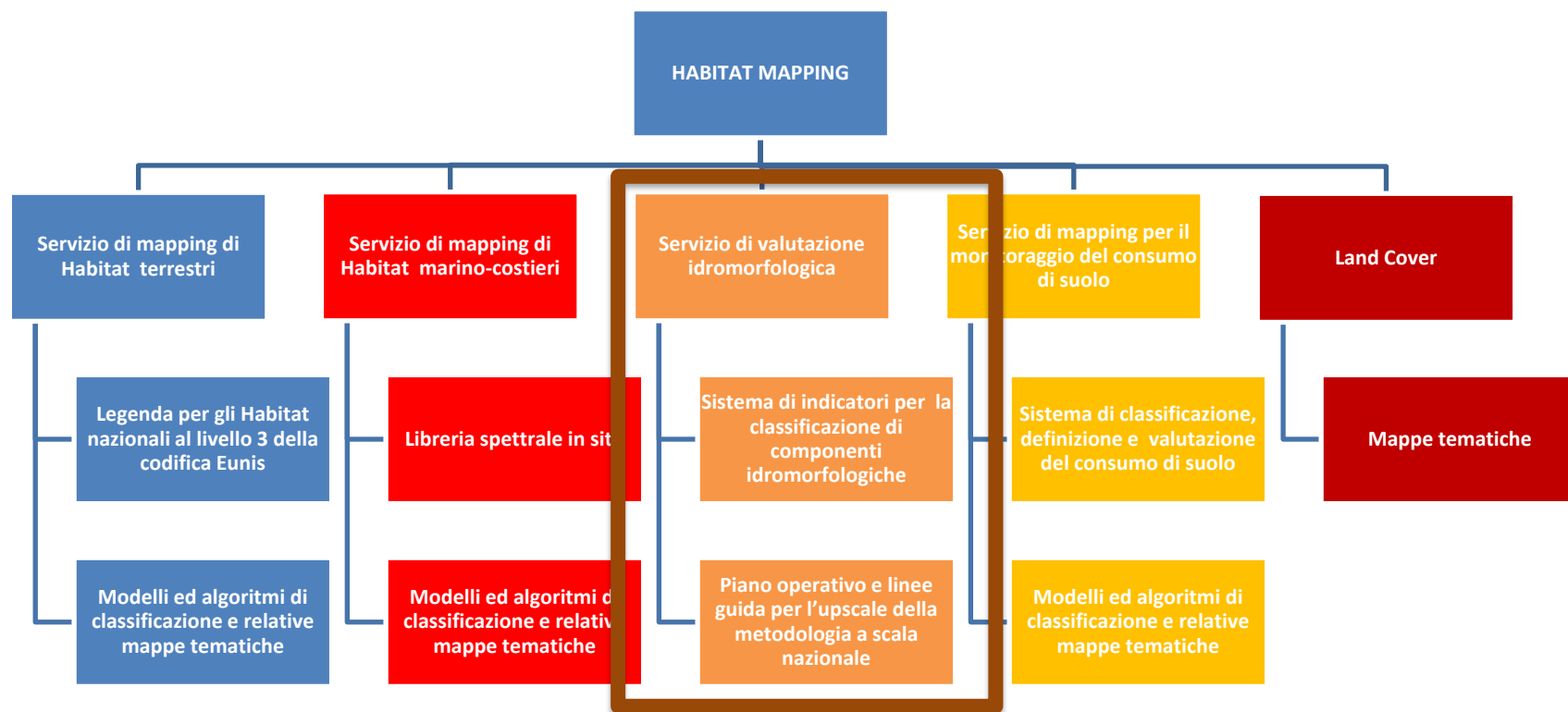


IDRAIM



CONVENZIONE OPERATIVA ASI-ISPRA "HABITAT MAPPING"

COORDINAMENTO SCIENTIFICO PROF. TARELLI (IUSS PAVIA & ISPRA)





AIM: A MULTI-SCALE RIVER OBSERVATORY PLATFORM WHICH INTEGRATES ACQUISITIONS FROM LOW-COST UAVS AND EU COPERNICUS SENTINEL-1 AND -2.

- Low cost global river processes mapping, monitoring and modeling.
- Drones and traditional field techniques (e.g. RTK-GPS) are used to survey local river features (e.g., orography, sediment size, vegetation, morphological habitats) to provide ground truth.
- Understanding on what river size these indicators will work (e.g., in terms of channel type) and with what accuracy.



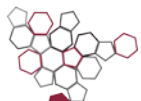
POLITECNICO
MILANO 1863



Durham
University

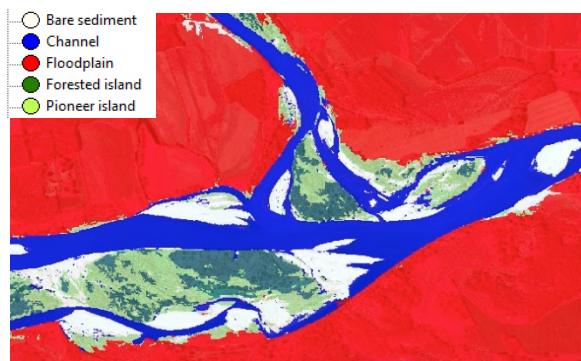


ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale



Sistema Nazionale
per la Protezione
dell'Ambiente

SVILUPPO DI INDICATORI IDROMORFOLOGICI DA DATI SATELLITARI COPERNICUS NEL QUADRO PROTOCOLLO NAZIONALE IDRAIM

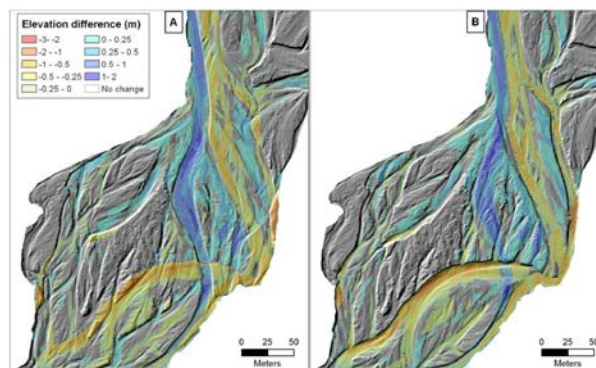


**Habitat mapping:
macro-unità morfologiche**

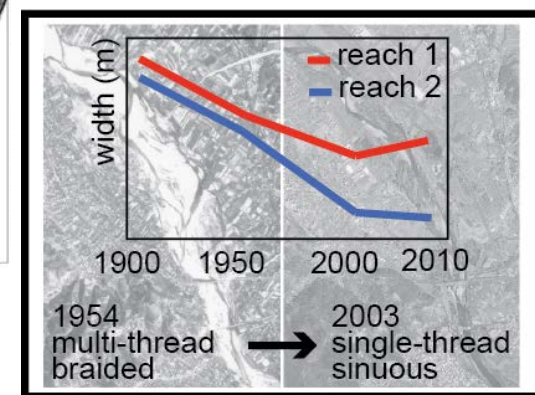


Classi granulometriche

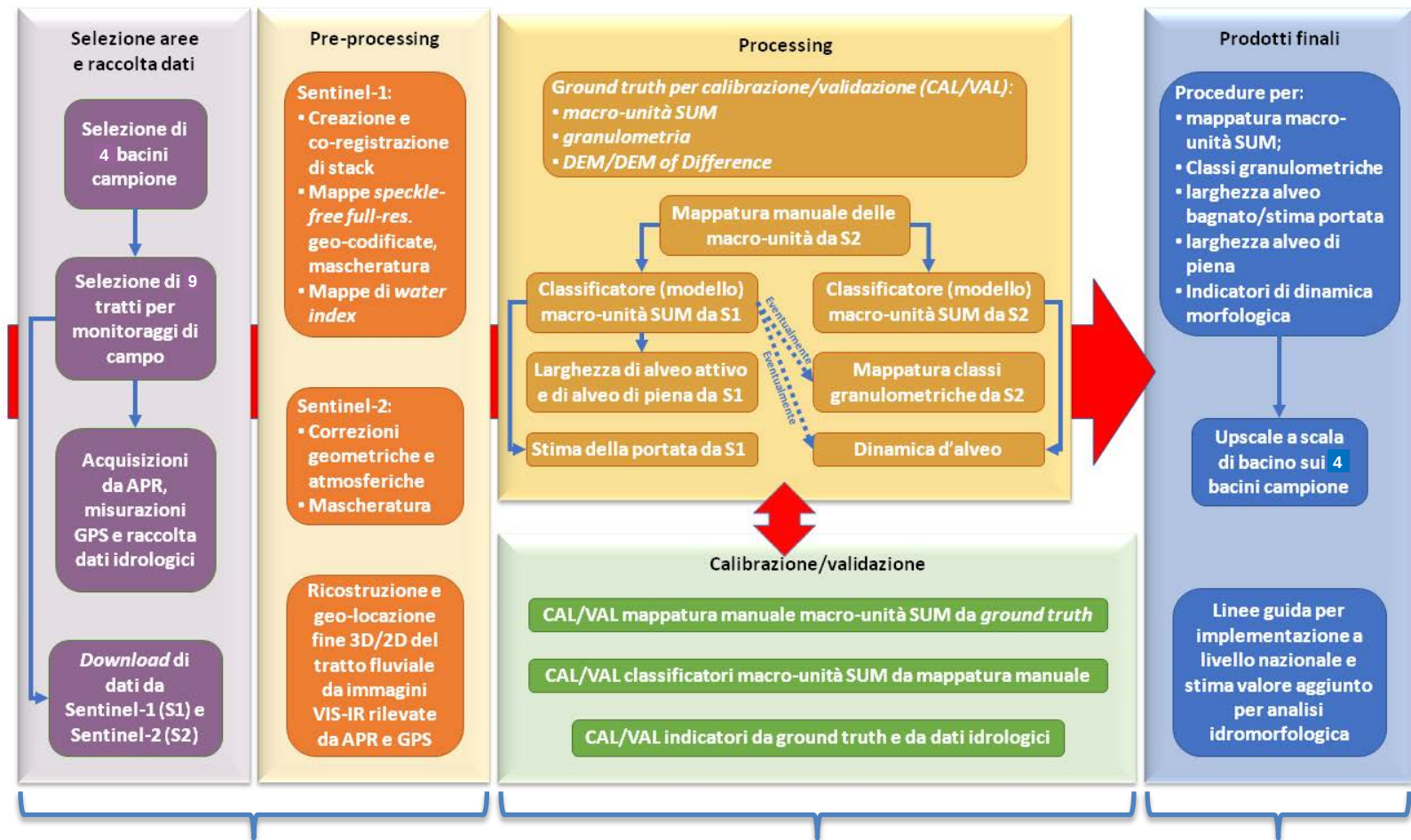
**Alveo bagnato e
alveo di piena**



**Indicatori di dinamica
morfologica**



MODELLO CONCETTUALE PER LE ATTIVITÀ DI SVILUPPO DEGLI STRUMENTI APPLICATIVI BASATI SU DATI COPERNICUS SENTINEL 1 E 2



INPUT

- Dati idrologici in situ
- Rilievi GPS
- Acquisizioni APR (*ground truth*)
- Dati Copernicus Sentinels

METODOLOGIA

- Sviluppo di processori (semi-) automatici per la classificazione delle immagini Sentinel
- Calibrazione e validazione mediante dati in situ e acquisizioni APR

PRODOTTI

- Prototipi processori
- Mappe e indicatori
- Linee guida



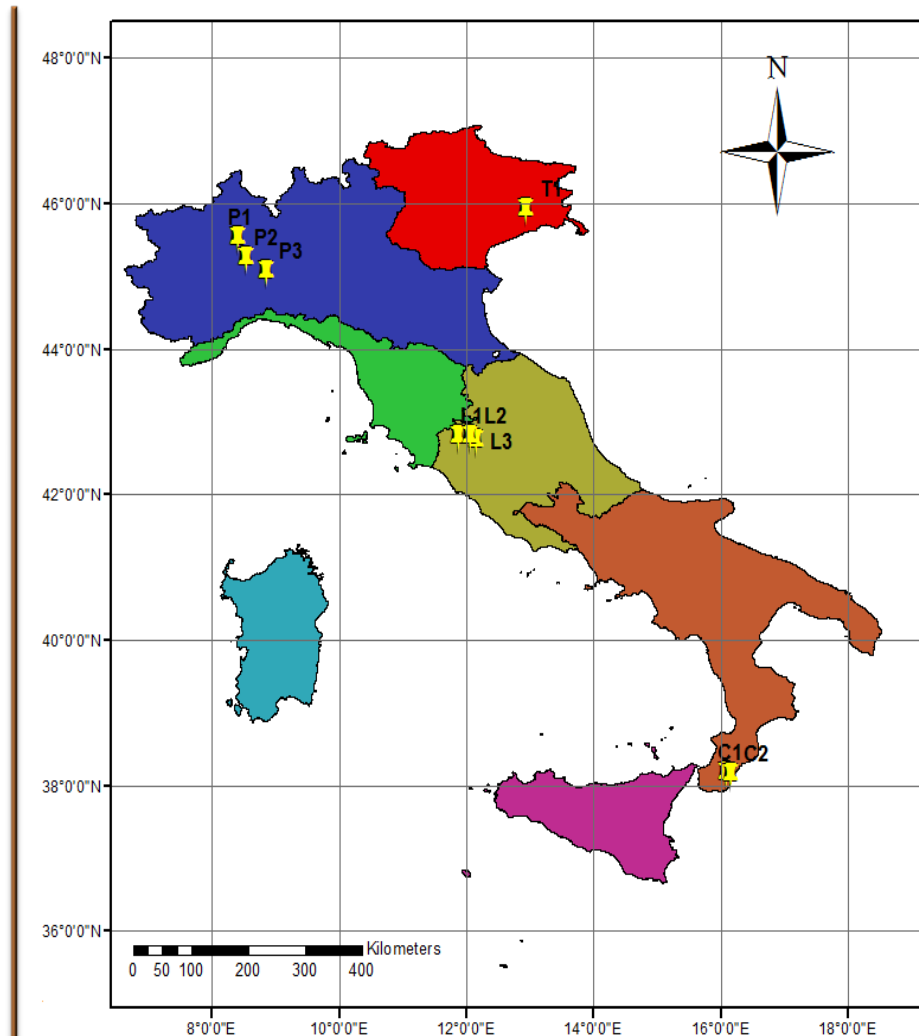
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University



SELEZIONE BACINI CAMPIONE



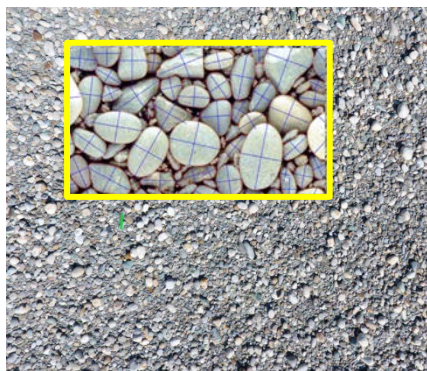
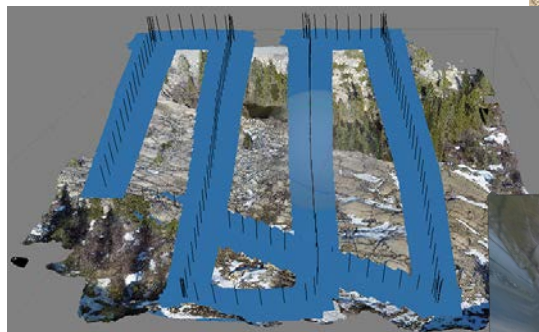
Bacini campione

- ☐ **Po/Sesia** (3 tratti fluviali)
Distretto Idrografico Fiume Po
- ☐ **Tevere/Paglia** (3 tratti fluviali)
Distretto Idrografico Appennino Centrale
- ☐ **Bonamico** (2 tratti fluviali)
Distretto Idrografico Appennino Meridionale
- ☐ **Tagliamento** (1 tratto fluviale)
Distretto Idrografico Alpi Orientali

Very high resolution remote sensing data (UAV)

FIELD SURVEY

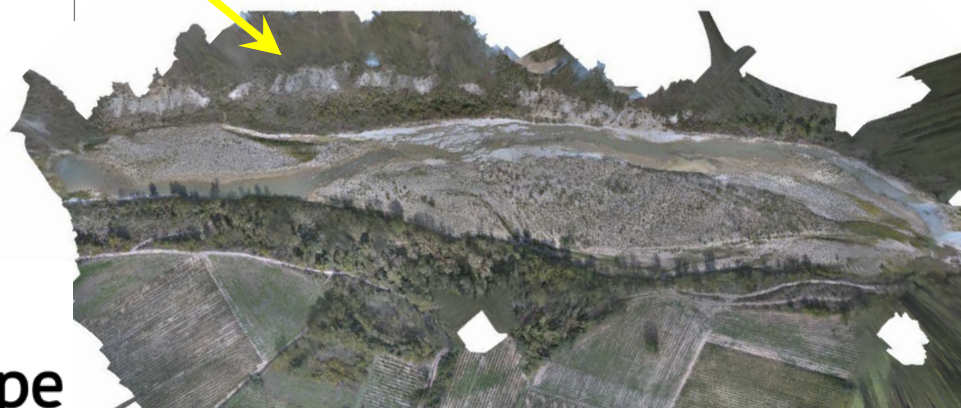
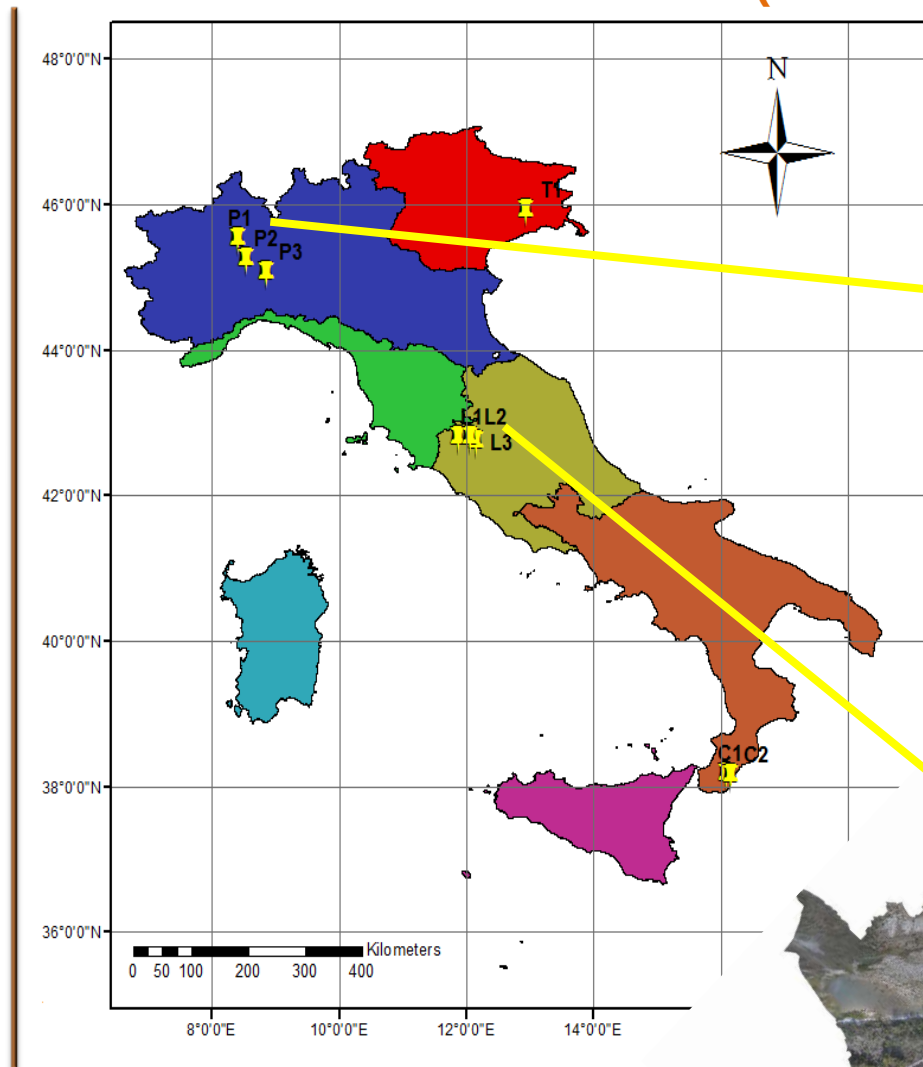
Very high resolution topographic data (GPS)



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GENERAZIONE GROUND TRUTH: PRE-PROCESSING ACQUISIZIONI APR (ORTOFOTO)

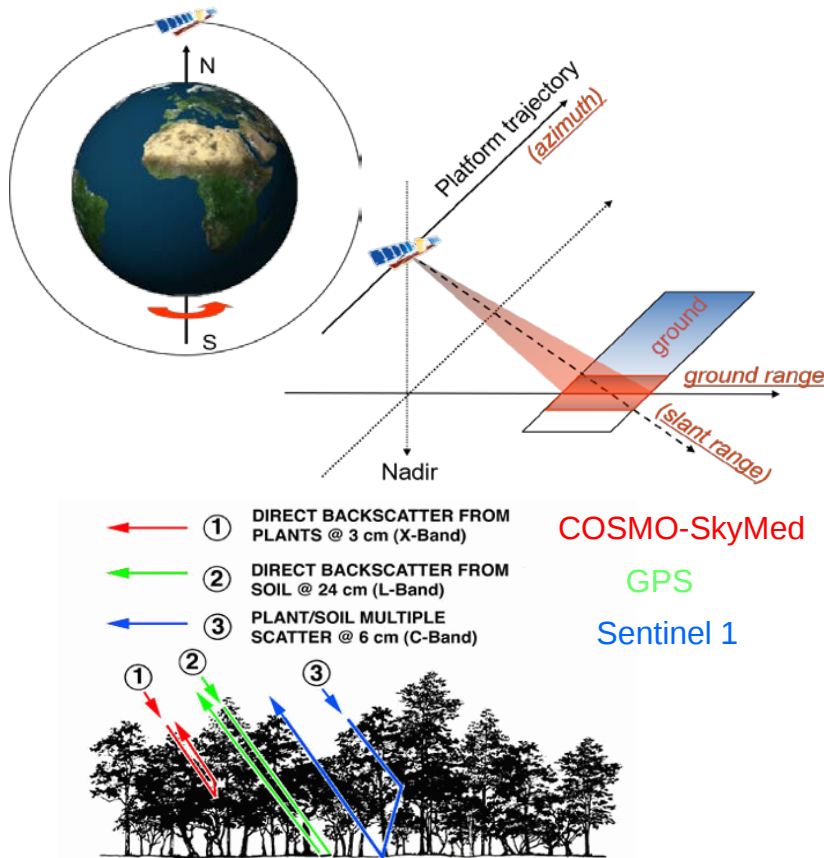


COPERNICUS SENTINEL

SENTINEL 1: radar (SAR) C-Band

Pixel 20 x 5 m

Frequency of acquisition: 6 days

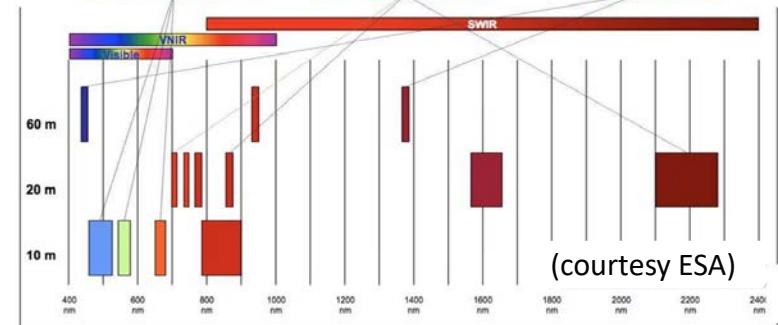
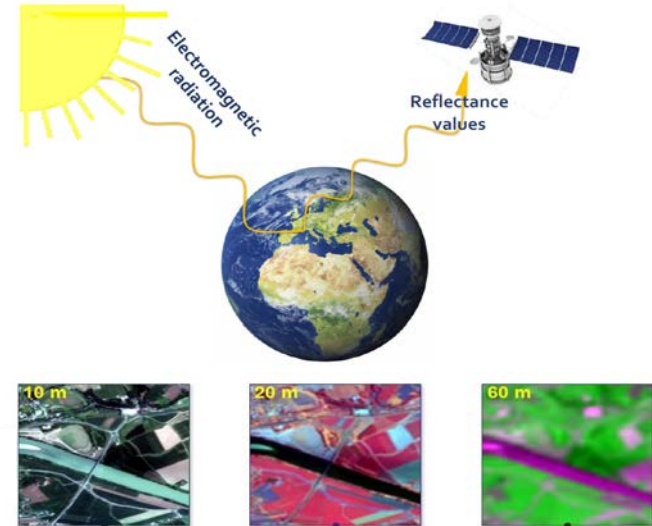


da settembre 2017 a settembre 2018

SENTINEL 2: Multispectral optical

Pixel 10x10 or 20x20

Frequency of acquisition: 5 days



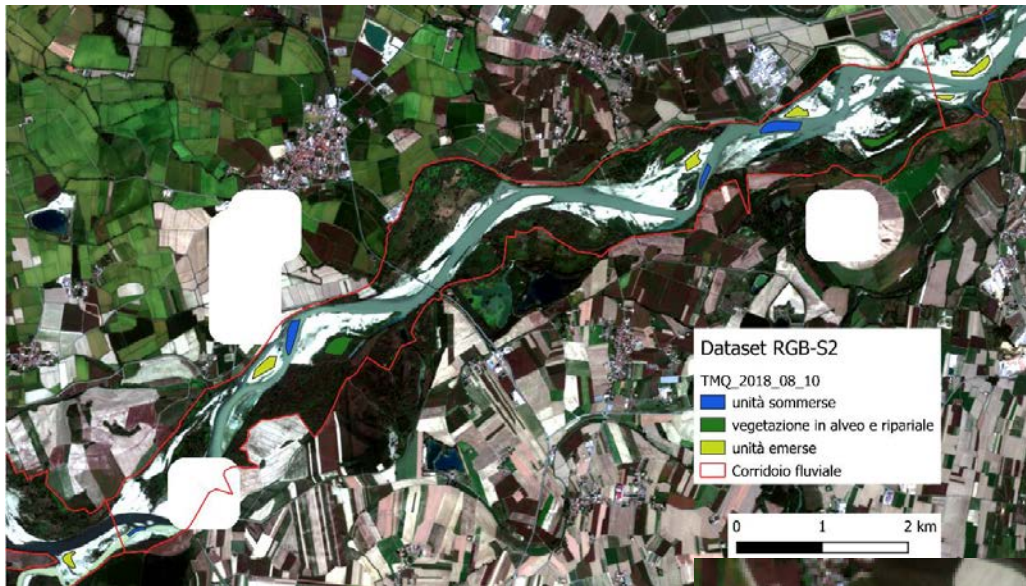
da novembre 2015 a ottobre 2019



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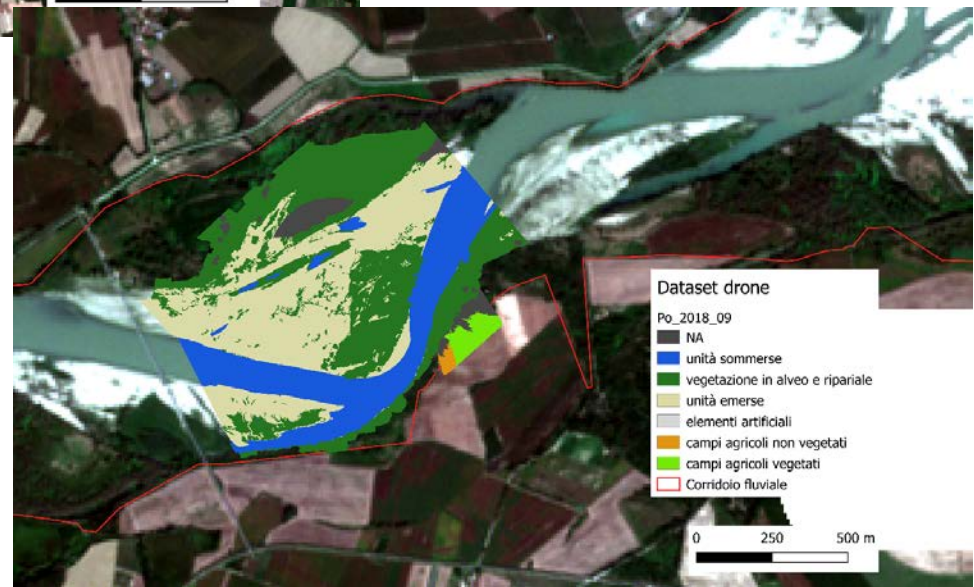
GROUND TRUTH (FIUME PO)



Dataset RGB-S2:

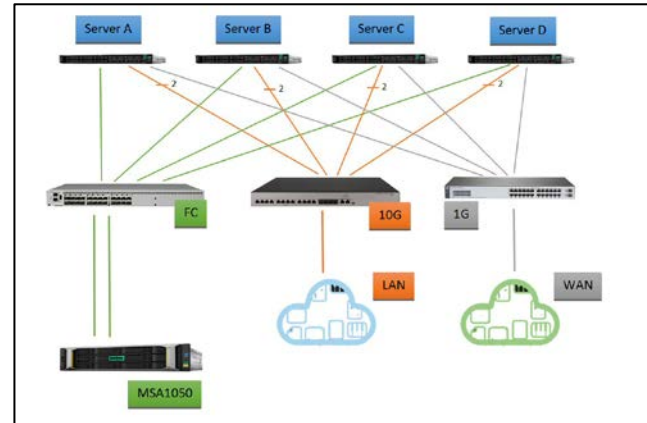
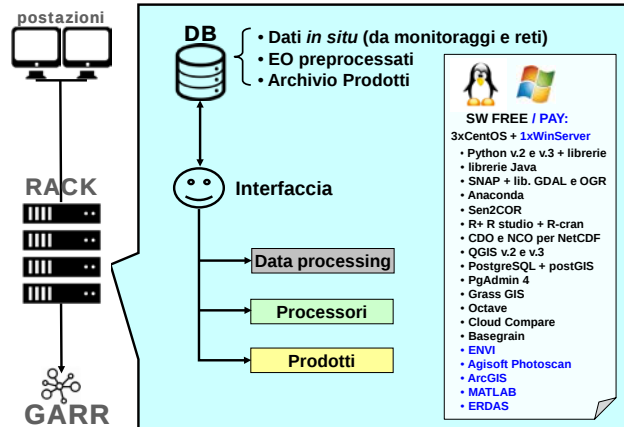
classi “pure” identificabili in modo univoco dall’operatore sulla base delle immagini RGB a 10 m derivata dalle bande 2, 3 e 4 di S2

Dataset drone: generato combinando segmentazione automatica e fotointerpretazione delle immagini acquisizioni da drone su otto siti

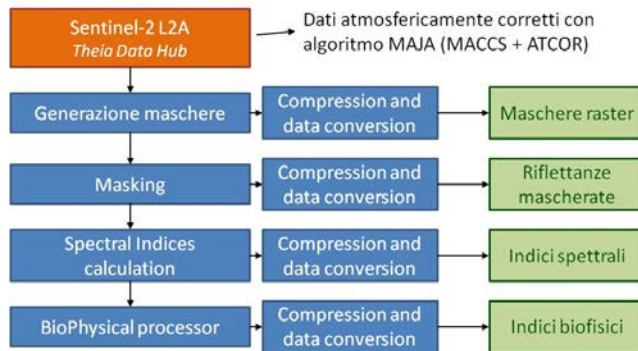


LaViSAM – LABORATORIO VIRTUALE DEI SERVIZI AMBIENTALI E DIAS – DATA AND INFORMATION ACCESS SERVICES

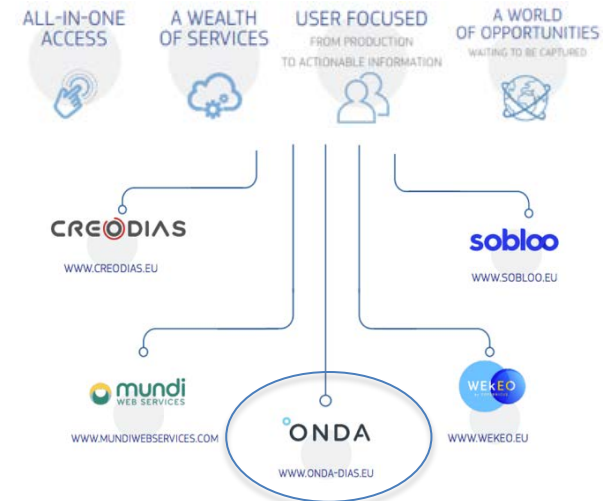
LaViSAM



Preprocessing Sentinel-2 L2A



DIAS



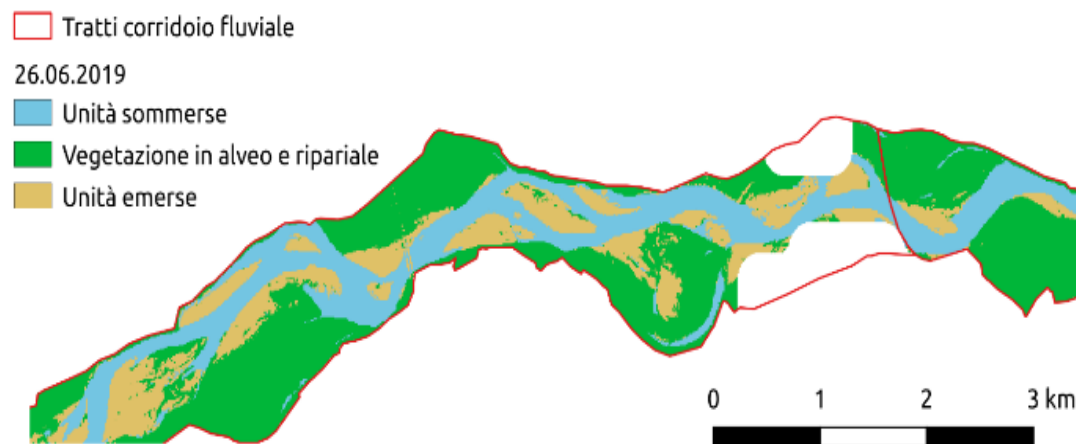
**POLITECNICO
MILANO 1863**



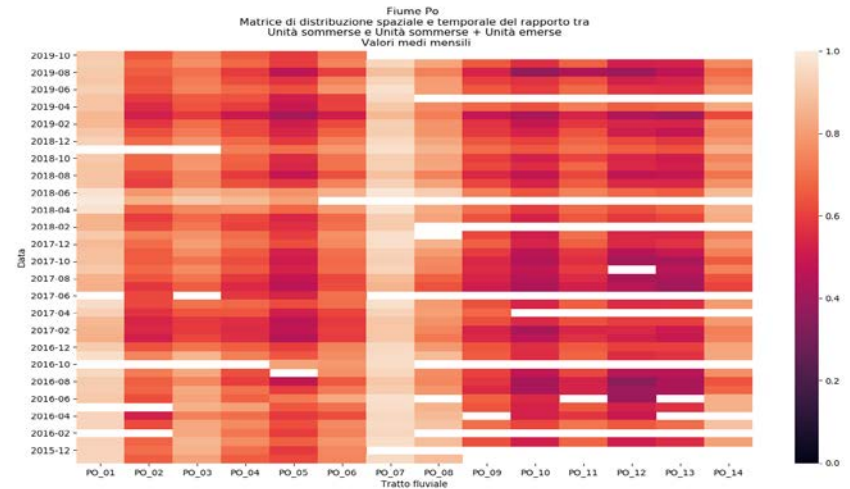
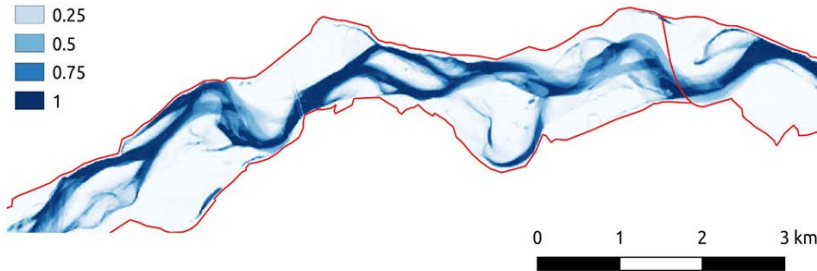
Risultati dei vari esperimenti di calibrazione e validazione

#	Nome	Descrizione	N. Pixel Validazione	Precision micro/macro avg	Recall micro/macro avg	f1-score micro/macro avg
1	s2cal	Calibrazione: RGB-S2 Validazione: Drone	59257	0.82 / 0.78	0.82 / 0.76	0.81 / 0.76
2	uascal	Calibrazione: Drone Validazione: RGB-S2	643878	0.91 / 0.90	0.91 / 0.93	0.91 / 0.91
3	allcal	Calibrazione: (Drone + RGB-S2) (80%) Validazione: (Drone + RGB-S2) (20%)	140627	0.99 / 0.99	0.99 / 0.99	0.99 / 0.99
4	uas50cal	Calibrazione: Drone (50%) + RGB-S2 Validazione: Drone (50%)	29628	0.87 / 0.86	0.87 / 0.83	0.87 / 0.84
5	uas50s295cal	Calibrazione: Drone (50%) + RGB-S2 (95%) Validazione: Drone (50%) + RGB-S2 (5%)	61821	0.94 / 0.94	0.94 / 0.93	0.94 / 0.93

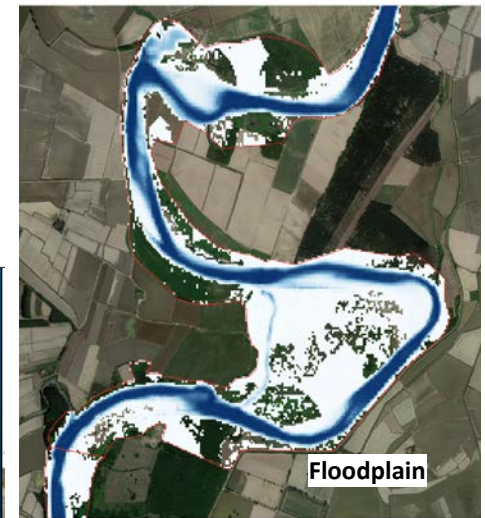
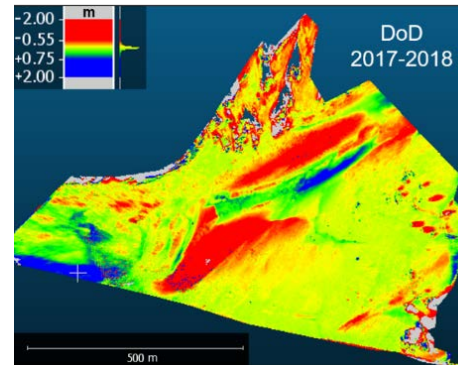
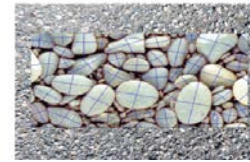
Macro-Geomorphic units derived from Sentinel 2 data



Frequenza Acqua



Grain size



- ✓ The tools prove very efficient in identifying river features (habitat), river corridor and floodplain (ecology; flood defence).
- ✓ Through remote sensing+UAV (drone) acquisition sediment sieving can be carried out.

**FIELD
SURVEY**



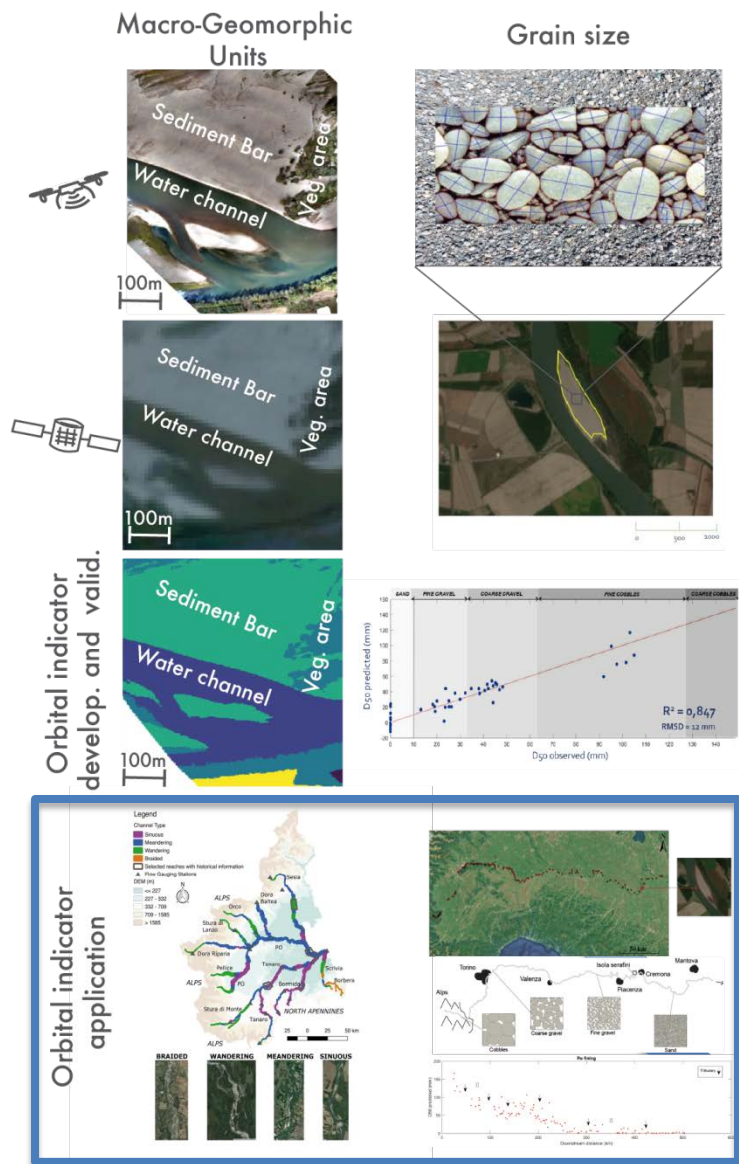
**EARTH
OBSERVATION**



**R&D +
CAL/VAL**



**OPERATIONAL
APPLICATION**

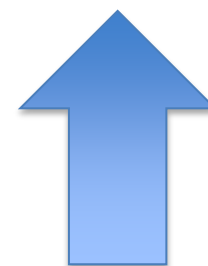


S6



Water resources

**National Space
Economy Programme**



**Development of
innovative services and
products at national level**



Grazie per l'attenzione!



INFO

❑ IDROMORFOLOGIA@ISPRAMBIENTE.IT

❑ [HTTP://WWW.ISPRAMBIENTE.GOV.IT/PRE_METEO/IDRO/IDRO.HTML#HABITATMAPPING](http://WWW.ISPRAMBIENTE.GOV.IT/PRE_METEO/IDRO/IDRO.HTML#HABITATMAPPING)

