«dalla luna alla laguna» - June 18, 2024

ESA_Lab@CaFoscari

Agostino Cortesi
DAIS
Ca' Foscari University of Venice

The ESA_Lab network

ESA launched the ESA_Lab@ initiative in 2016 to create a hub for disruptive innovation and cross-fertilisation.

An ESA_Lab@ is:

- A joint initiative between ESA and academia/research institutions located within their own premises
- Supported by ESA via open data access policy and expertise
- An institutional link between ESA and universities/academia/research institutions

The network helps ESA leverage academic and research capabilities across Europe to advance its missions and objectives.

The ESA_Lab network

Scientific Committee of ESA_Lab@CaFoscari

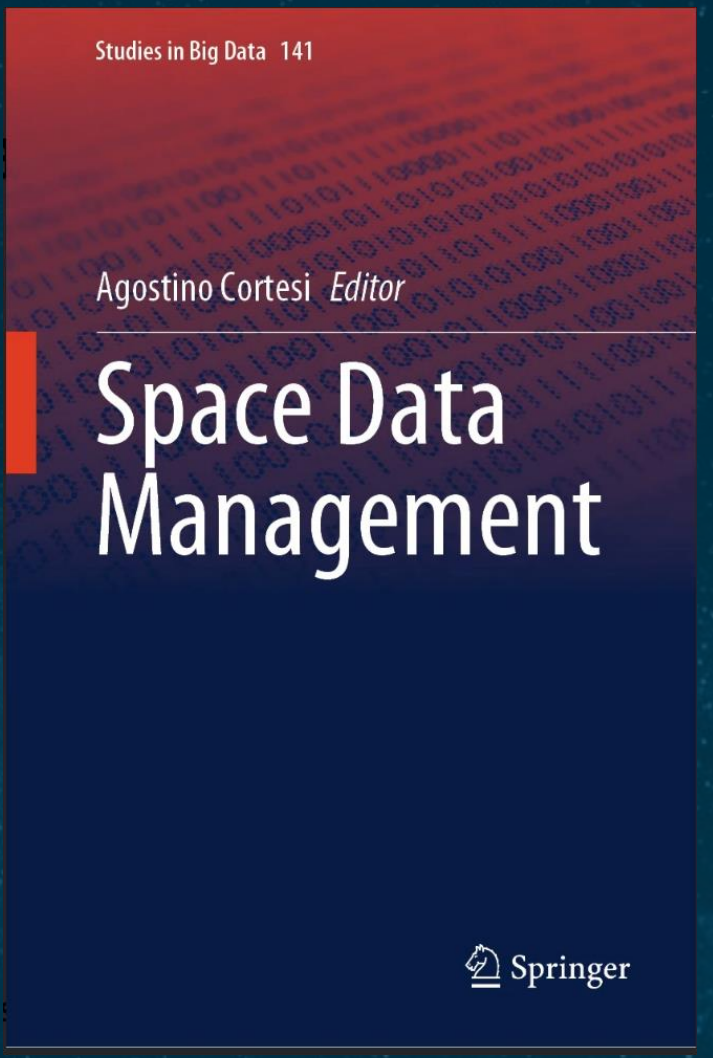
- Carlo Barbante, Chimica Analitica & Scienze Polari
- Francesco Bosello, Economia Politica
- Cristina Cavinato, Impianti Chimici
- Agostino Cortesi, Software Engineering (coordinatore)
- Andrea Critto, Chimica dell'Ambiente
- Enrica De Cian, Politica Economica
- Achille Giacometti, Fisica della Materia
- Claudio Lucchese, Artificial Intelligence
- Alessio Rovere, Geografia Fisica

ESA_Lab@CaFoscari: Space Data Management

The first main initiative of ESALab@CaFoscari was the organization of the first international ESALab Workshop on Space Data Management in july 2023

As a follow-up of this meeting a book has just been published by Springer-Nature collecting the revised contributions

https://link.springer.com/book/10.1007/978-981-97-0041-7



SHARE-ENV: an open access dataset to better understand the relationship between the climate & wellbeing

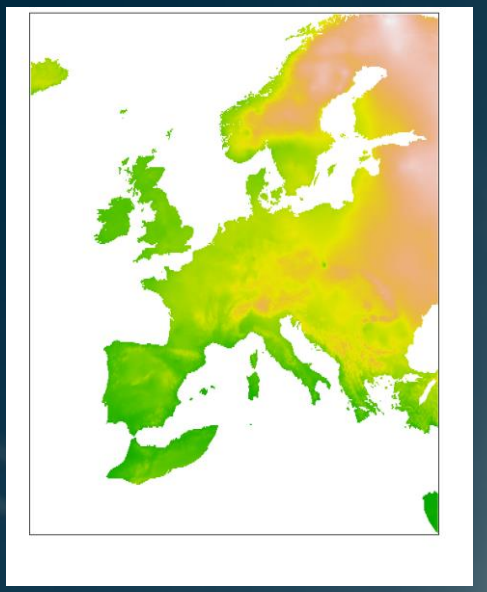
Prof. ENRICA DE CIAN

SHARE-ENV, augments the public database SHARE, *a longitudinal Survey of Health, Ageing and Retirement in Europe*, with a rich set of geospatial variables characterizing the quality of the environment and climate-related hazards.

By linking **individual-level information and health variables** with **exposure to environmental and climate hazards,** SHARE-ENV makes it possible to **causally attribute** changes in health outcomes to variations in climate and environmental exposure.

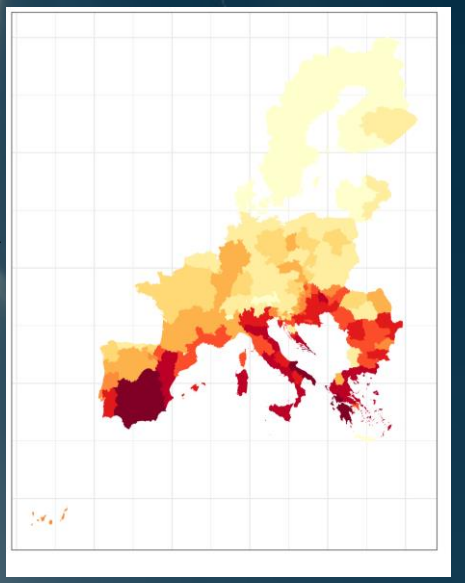
Environmental and climate data include:
High-resolution, gridded-observational meteorological data from E-OBS (European Climate Assessment & Dataset, ECA&D);
Dartmouth Flood Observatory (DFO);
Monthly averaged fields on pollutant concentration from Copernicus Atmosphere Monitoring Service (CAMS) global reanalysis (EAC4)

1920-2020 gridded datasets of environmental variables



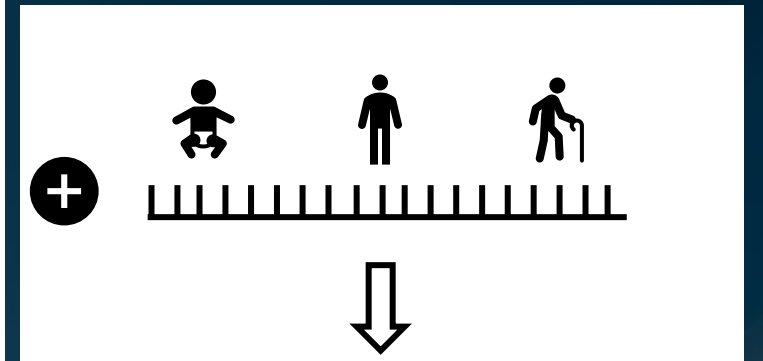
Temperature
Precipitation
Radiation
Pollutant concentration
Pollutant emissions
Flood events

Population-weighted yearly environmental exposures



Yearly exposure to avg. T > 27.5ºC and many others

longitudinal, representative EU wide survey (SHARE)



SHARE-ENV dataset:

environment-wellbeing nexus
climate change damages
climate change adaptation

EPOC Economic Policy in Complex Environments

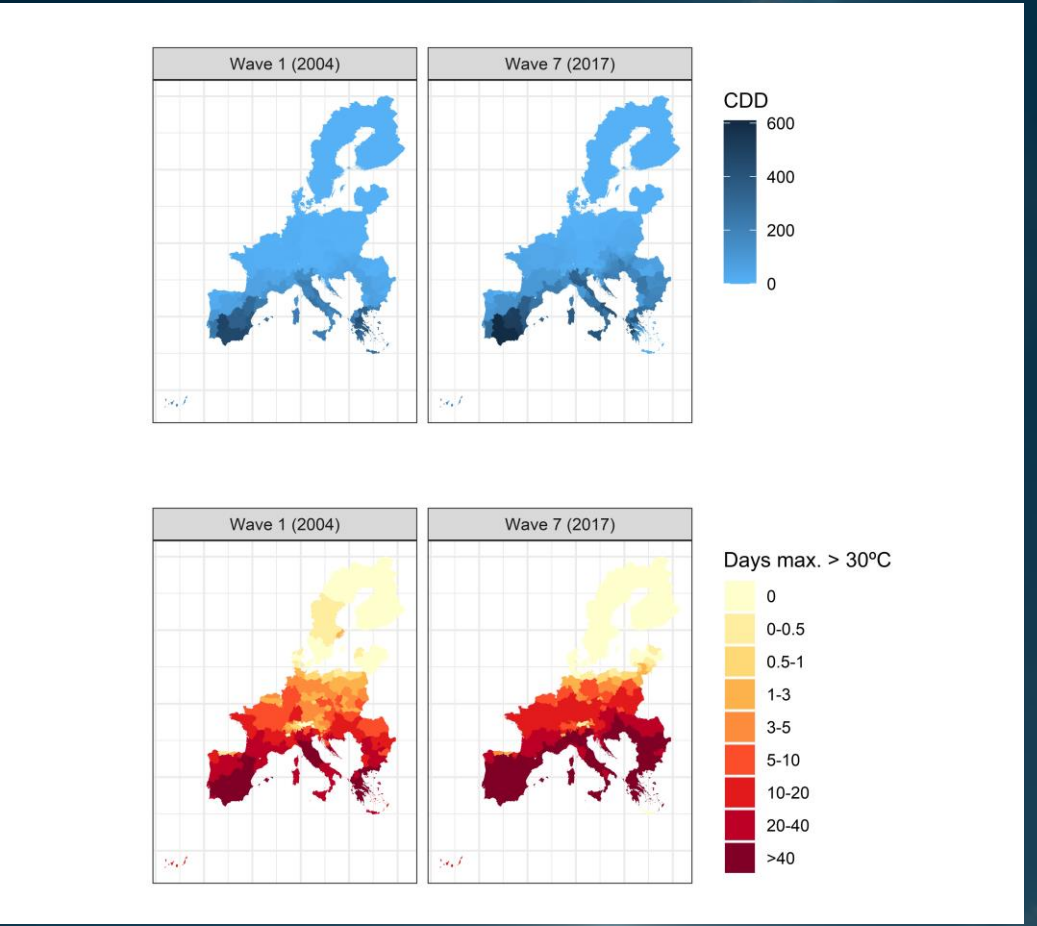
SHARE-ENV: an open access dataset to better understand the relationship between the climate & wellbeing

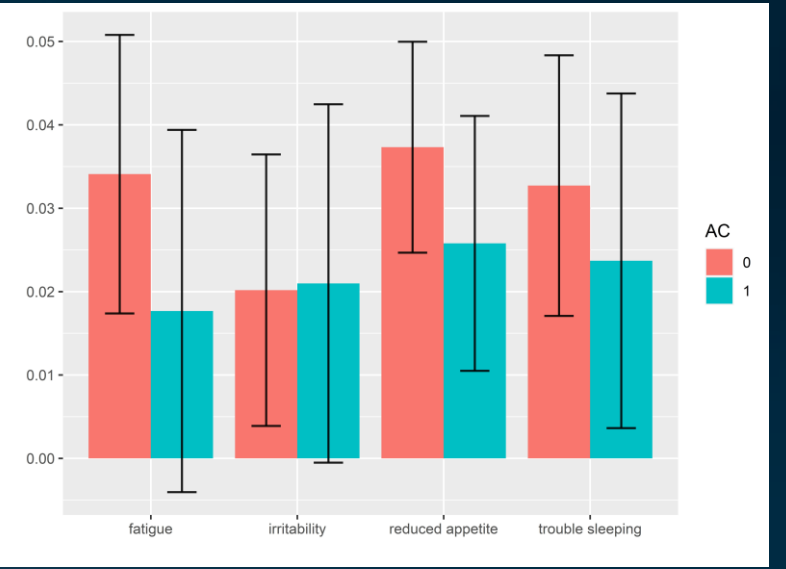
Results

Our results corroborate the robust evidence on the relationship between high temperatures and wellbeing outcomes: self-reported fatigue, reduced appetite, irritability, and issues sleeping.

10 extra days at 31º, i.e., 100 extra CDDs, brings an increase between 2 p.p. (irritability) and 6 p.p. (reduced appetite) in the probability of reporting each of the states

AC eliminates the impacts on fatigue and ameliorates those on reduced appetite, but not on trouble sleeping and irritability.





Read the paper here
https://pubs.acs.org/doi/epdf/10.1021/envhealth.3c00065

EPOC Economic Policy in Complex Environments

Purple-B: Hydrogen production from immobilized cells in photo-bioreactors

Prof. CRISTINA CAVINATO

GreenPropulsionLab

BIO-ENERGIA VERITAS

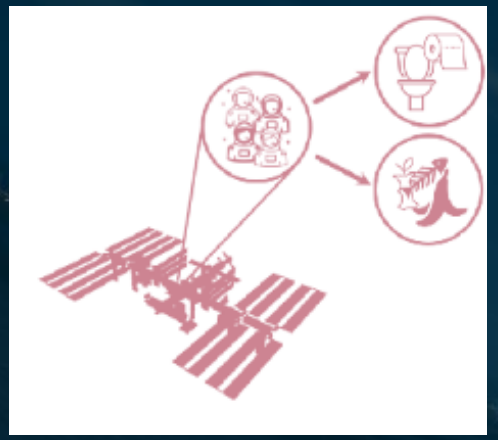
Subcontractors:

Università Ca'Foscari Venezia

Università degli Studi di Padova

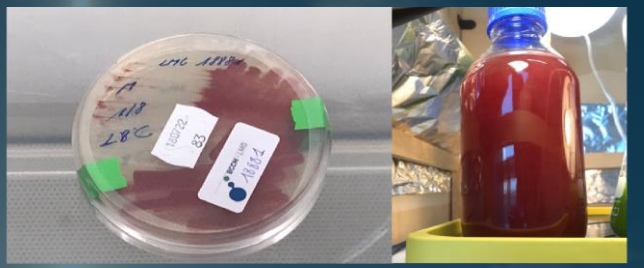
9-Tech

Fermentazione substrati organici



VFA

Adattamento delle colture di Batteri Rossi



Produzione di Biomassa e Idrogeno

BIOMOONPROJECT

LUNAR GRAVITY BIOREFINERY

GREENPROPULSIONLABORATORY

GreenPropulsionLab

BIO-ENERGIA VERITAS

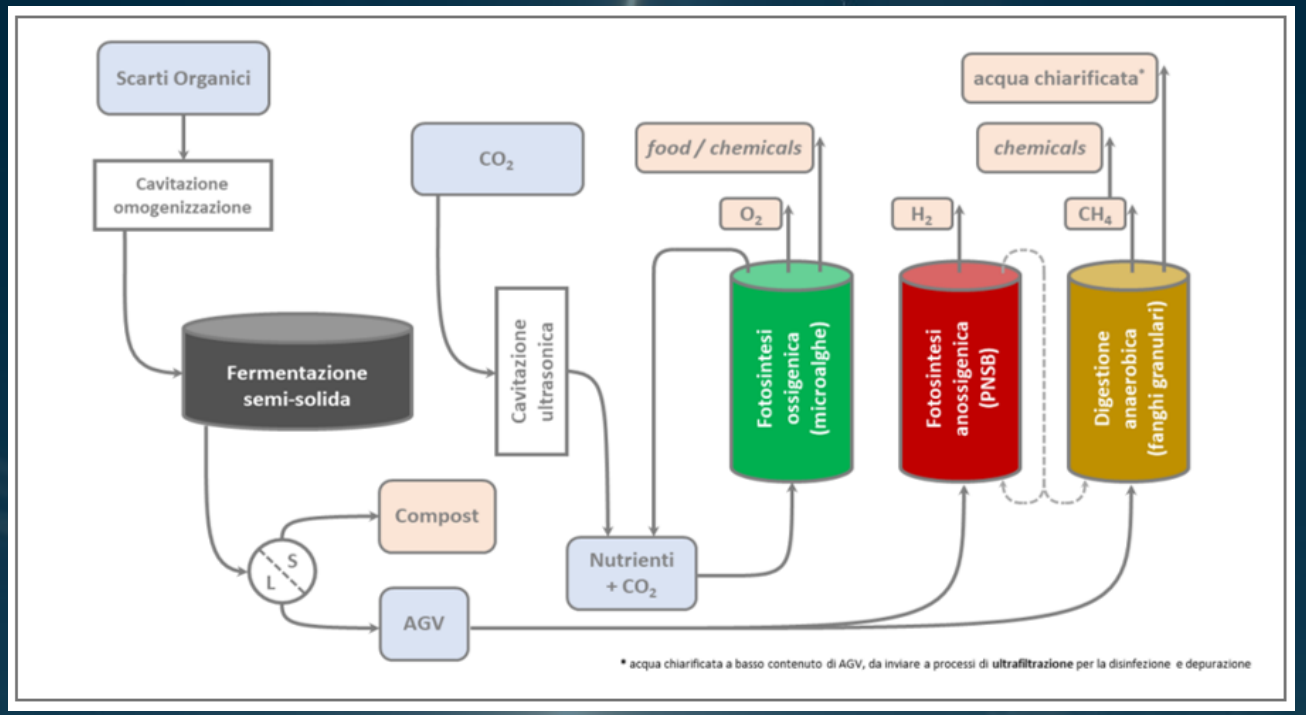
Università Ca'Foscari Venezia

Università degli Studi di Padova

Agenzia Spaziale Italiana

UNIVE

NODO 3000	NODO 4000
Valutazione delle rese dei sistemi immobilizzati a scala laboratorio UNIVE RF	Bioreattore di fermentazione semi-solida per produzione AGV UNIVE RF

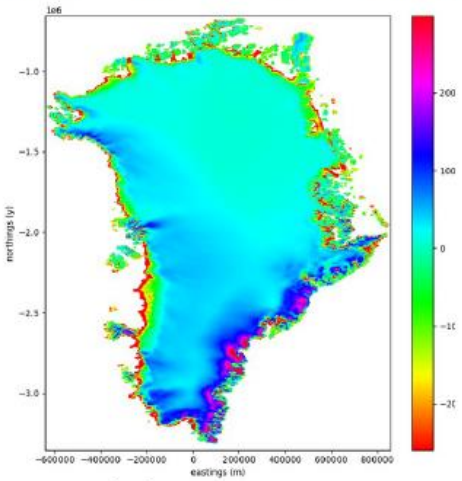


SKYNET: Estimating the ice volume of Earth's glaciers via Artificial Intelligence and remote sensing (Marie Curie Global Fellowship 2023-2026)

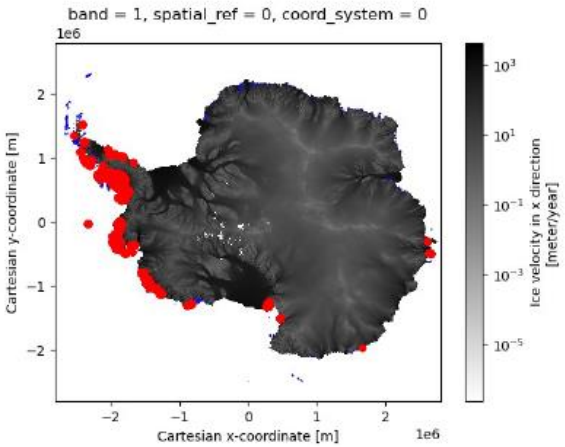
Partners: Ca' Foscari University of Venice, University of California Irvine, Jet Propulsion Laboratory

Team: Dr. Niccolo' Maffezzoli, Prof. Carlo Barbante, Prof. Eric Rignot

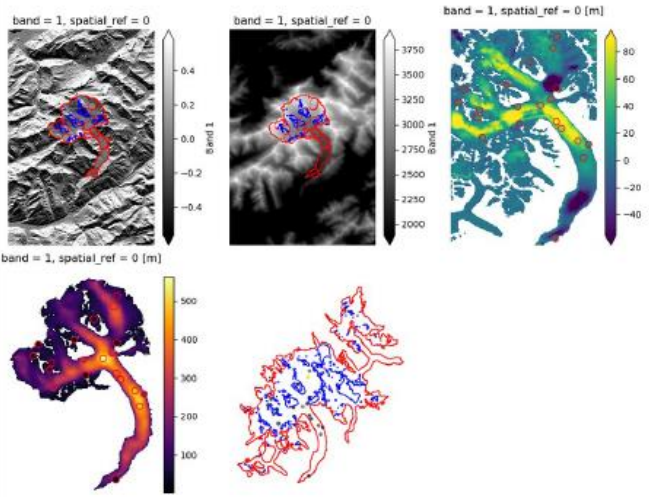
Inputs: Tandem-X elevation models, ice velocity from multiple satellite interferometric synthetic-aperture radar systems, mass balance from Regional Atmospheric Climate Models, ice thickness measurements from NASA Operation IceBridge airborne surveys



Mass balance

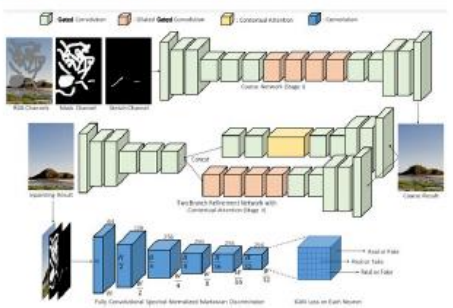


Ice velocity



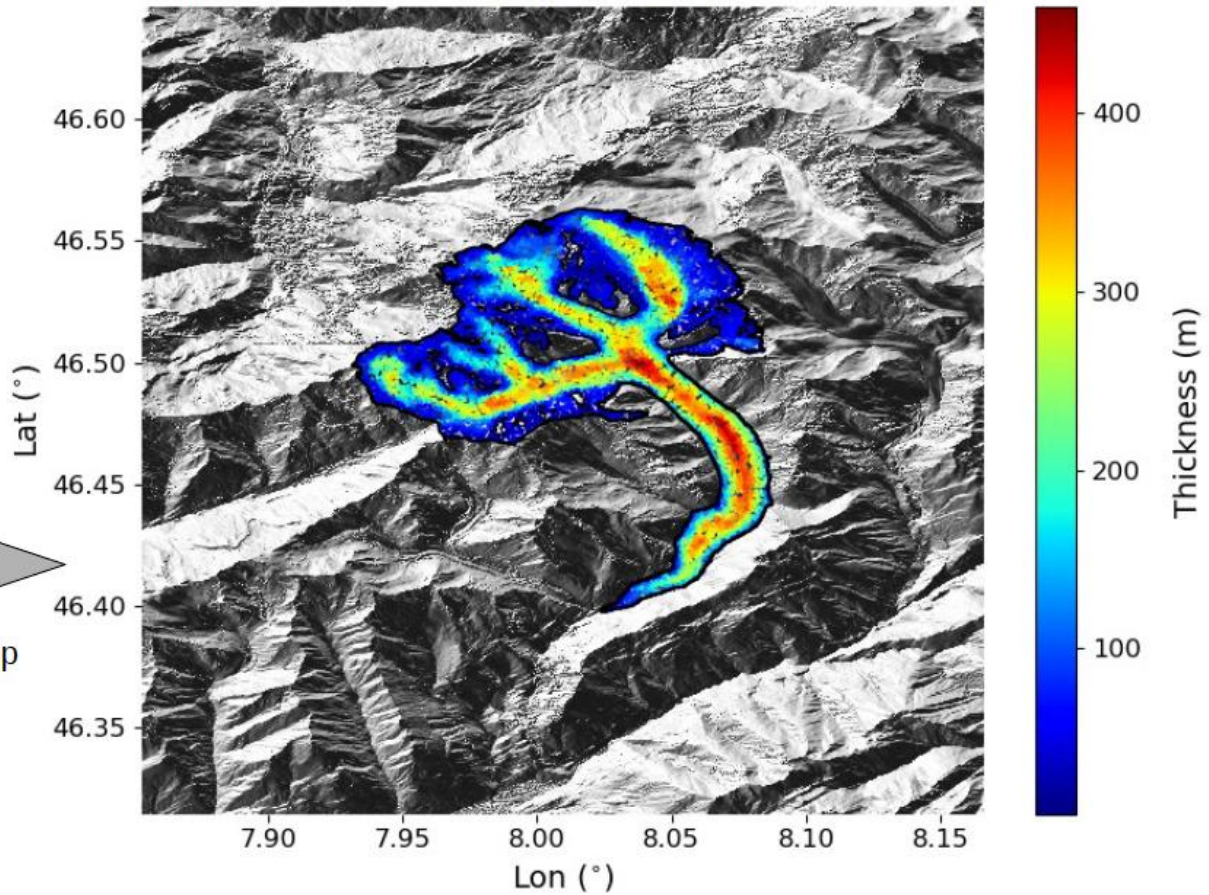
Other glacier ice features and data

Models: supervised machine learning / deep learning architectures



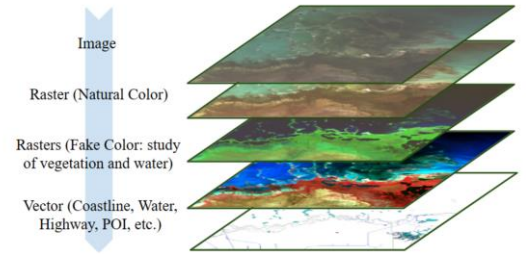
Yu et al. (2019)

Output: Glacier ice thickness modeled distribution and volumes

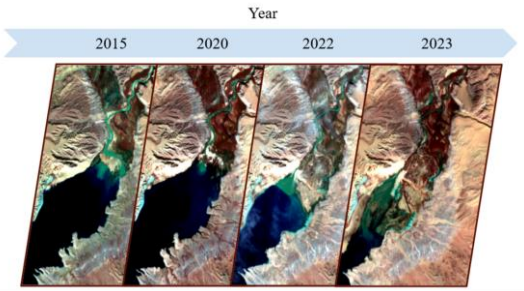


Ice thickness distribution of the Aletsch glacier (Swiss Alps) modeled using machine learning (Maffezzoli et al., unpublished)

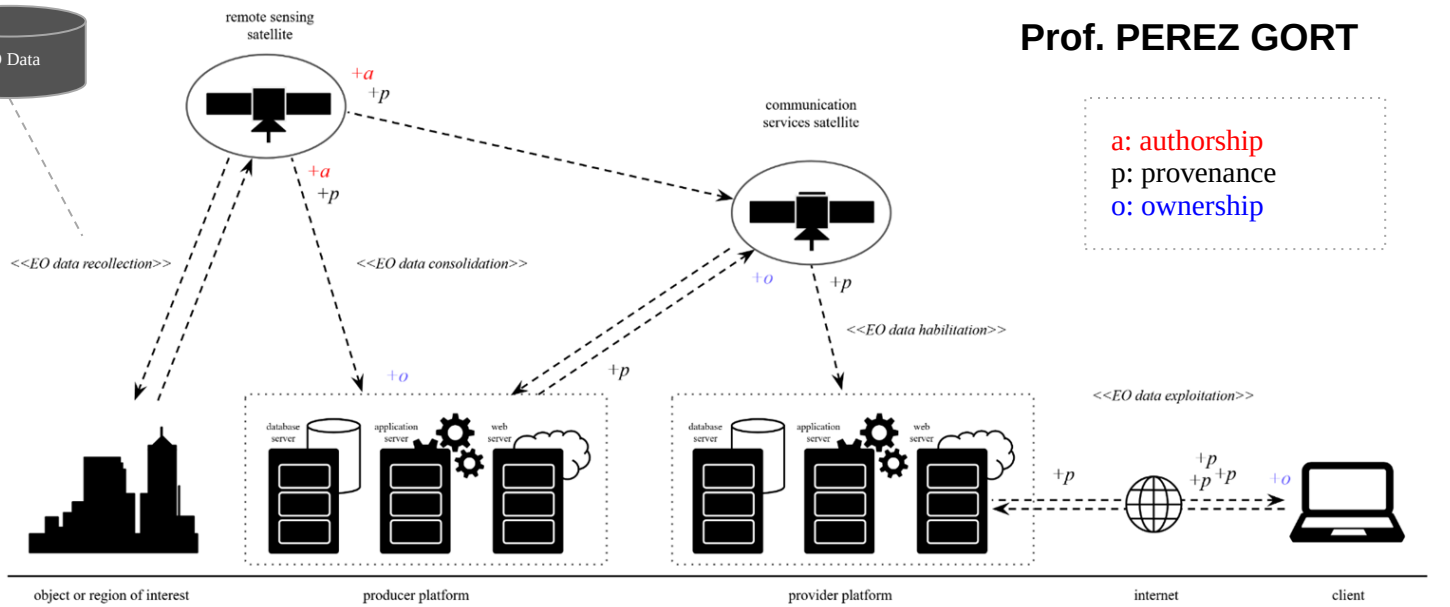
EO Data features

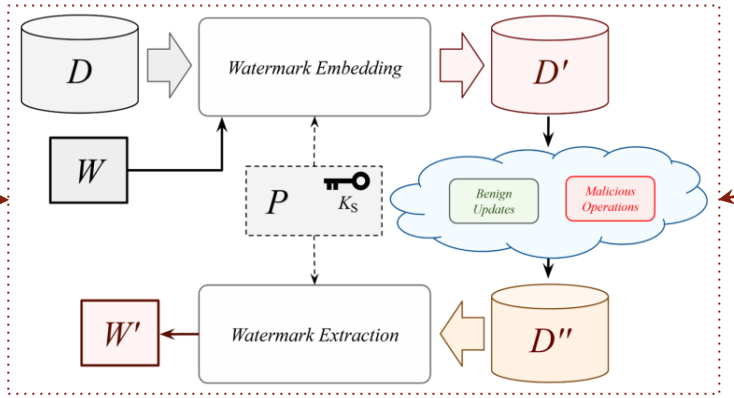


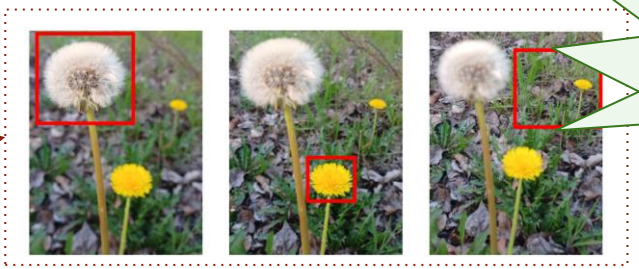
Multi-layer representation



Multi-dimensional (*e.g.*, time and space)

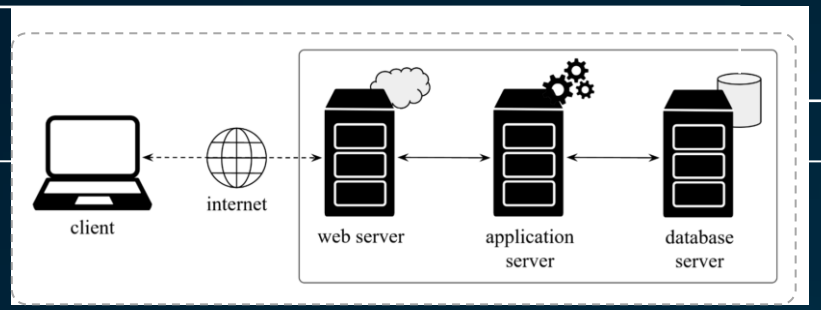




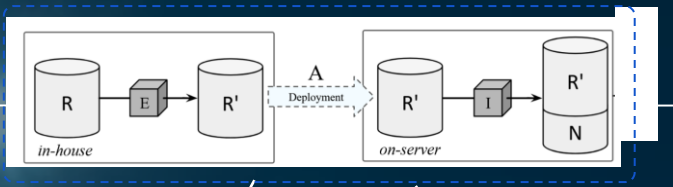


Varying object or feature of interest (same data, different targets)

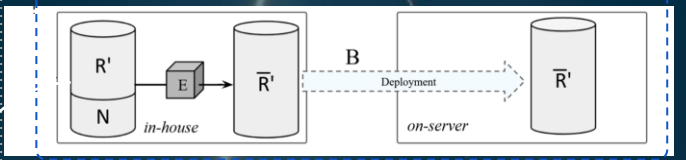
- Protection of authorship, ownership, and provenance of earth observation (EO) data.
- Build a provenance signal and insert it into the EO data, taking advantage of their features.
- Provenance insertion based on digital watermarking.
- Watermark placement is resynchronized to allow the study of different objects or variables of interest (distortion is restored and recalibrated).



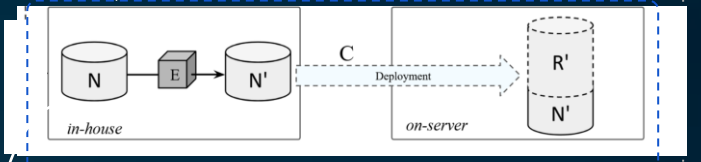
Modification of watermarked relational data R'



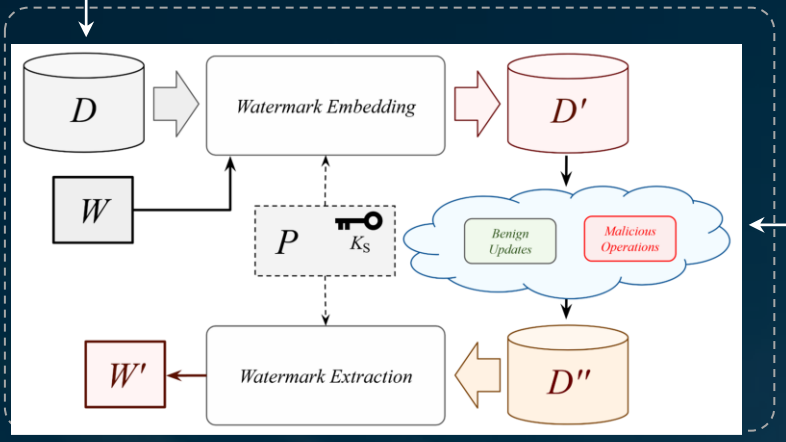
Watermarking of entire database (watermarked data + new data N)

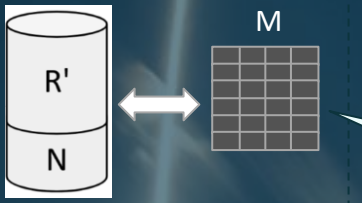


Watermarking only the new data N



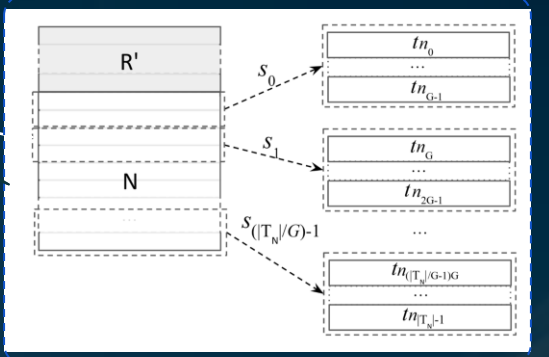
Watermarking and deploying a digital asset *D*





Move N in groups through the environments.

synchronization matrix M to control data deployment and protection



- Extraction, watermarking, and redeployment of data.
- Transmission of data through different environments (access-oriented vs. high-protection-oriented).
- Identification of combined data (protected vs. unprotected).
- Watermarking data considering deployment and protection costs (watermarking scheme with an open architecture).
- Data groups definition depending on non-functional requirements of the organization.