ECOPOTENTIAL DATA CUBES

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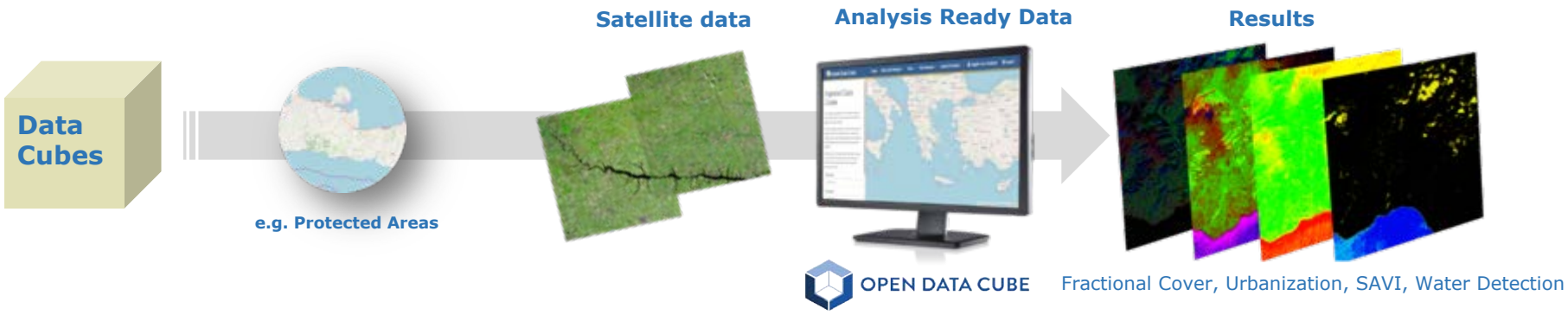
Data Cubes in ECOPOTENTIAL - Vision

- Explore the potential of Data Cubes in some of the Protected Areas
- Build capacity to the Protected Areas to deal with long time series of remote sensing data
- Make time series analysis easy
- Provide decision-ready products

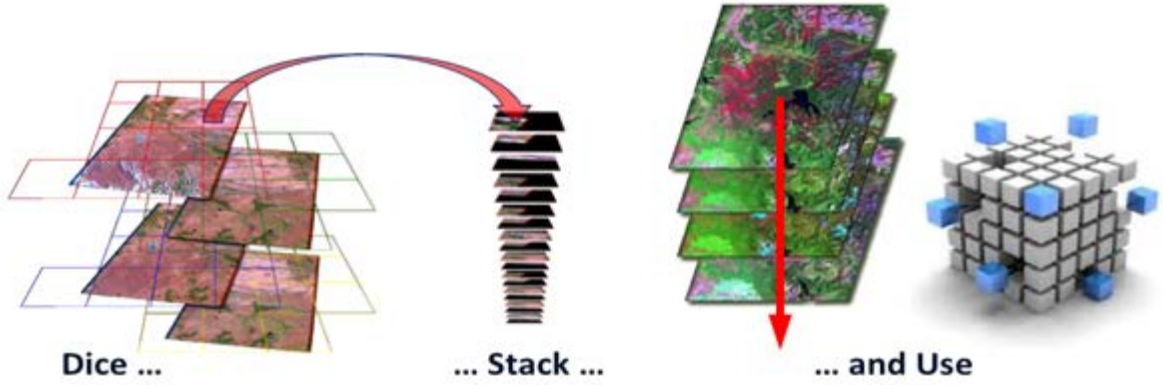


Data Cubes in a nutshell

Data cubes are time-series multi-dimensional (space, time, data type) stack of spatially aligned pixels.

Data Cubes:

- are based on the Open Data Cube open source software.
- allow **analysis-ready satellite data** to be packaged in “cubes” in order to minimize data preparation complexity.
- include modules which can be used to perform analysis in matters such as Urbanization, Water Detection, etc.



https://www.opendatacube.org/

Data cube modules

Land	Water	General
Spectral Indices	Water Detection	Cloud Coverage
Fractional Cover	Water Quality TSM	Custom Mosaic
Urbanization*	Coastal Change*	
Slip*		
NDVI anomaly*		
Land Degradation*		

*Available soon..

SWISS DATA CUBE *in Numbers*

A unique Analysis Ready Data Archive

Updated every week!

35 years
FROM 1984 to 2019

7 sensors
LANDSAT 5/7/8;
SENTINEL-1/2 A-B

10-30-90m
PIXEL RESOLUTION

> 450 millions
PIXELS

> 200 billions
OBSERVATIONS

~ 10000 images
INGESTED

~6 TB
ANALYSIS READY DATA

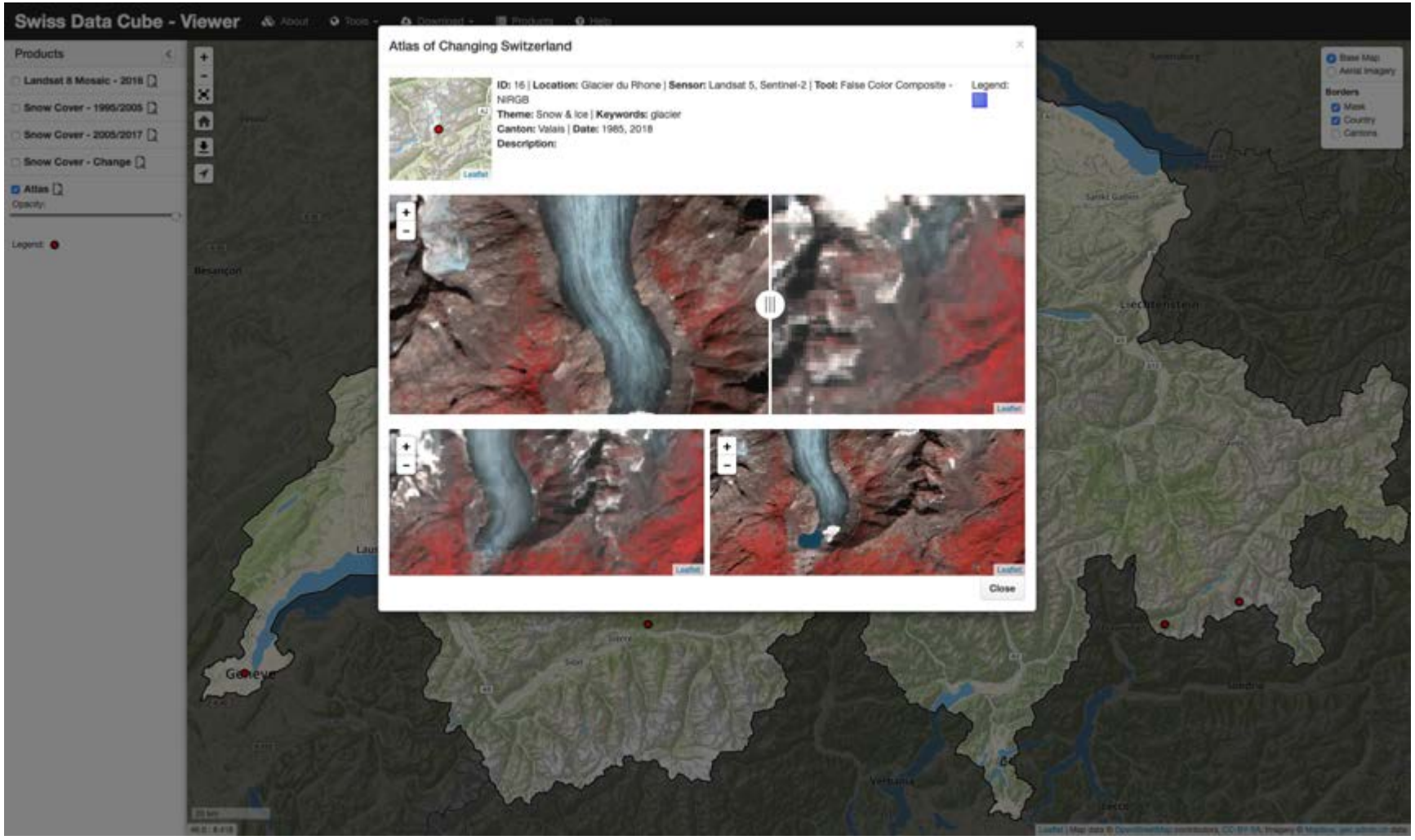
~10 millions CHF
COST OF DATA WITHOUT OPEN DATA ACCESS POLICY

Giuliani G., Chatenoux B., De Bono A., Rodila D., Richard J.-P., Allenbach K., Dao H., Peduzzi P. (2017) Building an Earth Observations Data Cube: lessons learned from the Swiss Data Cube (SDC) on generating Analysis Ready Data (ARD). *Big Earth Data 1(1):1-18*

Atlas of Changing Switzerland

https://www.swissdatacube.org/viewer

Explore how Switzerland's landscape has been affected by climate change, natural hazards, or urbanization | Landsat & Sentinel-2 data



Bringing Open Data Cube into Practice

https://www.swissdatacube.org/index.php/edsproject/bringing-open-data-cube-into-practice/

Bruno Chatenoux, Jean-Philippe Richard, Yaniss Guigoz, Charlotte Poussin, Gregory Giuliani

Bringing Open Data Cube into Practice

OPEN DATA CUBE

http://www.opendatacube.org

Freely available training material has been developed to **help people who want to install; configure; and use** an Open Data Cube instance.

Harnessing the information power of satellite data

Asmaryan S., Muradyan, V., Tepanosyan G., Hovsepyan A., Saghatelyan A., Astsatryan H., Grigoryan H., Abrahamyan R., Guigoz G., Giuliani G. (2019) Paving the way towards an Armenian Data Cube. Data 4(3):117 https://www.mdpi.com/2306-5729/4/3/117

Part of the Special Issue "Earth Observation Data Cubes": https://www.mdpi.com/journal/data/special_issues/EODC

Version 2019.06 – July 2019

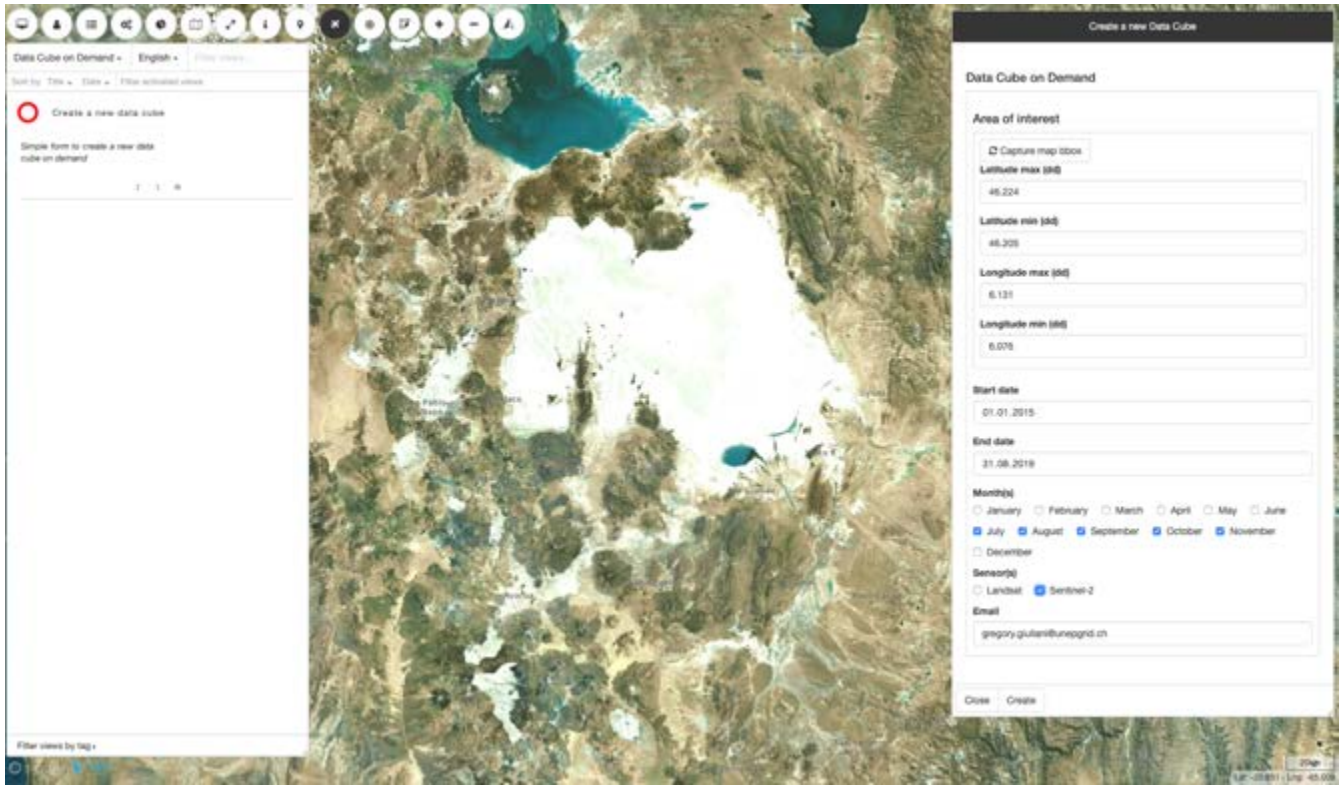
Data Cube on Demand (DCoD)

Aims at **facilitating the generation and use of an ODC instance virtually anywhere in the World**.

Users are only required to specify:

- an area of interest on a web-based mapping application;
- types of sensors between Landsat 5-7-8 and Sentinel-2;
- desired temporal frame;

Then automatically an empty ODC instance is instantiated and desired data are ingested.



Already available in Mapx!

Giuliani G., Chatenoux B., Piller T., Moser F., Lacroix P., Data Cube on Demand (DCoD): Generating Earth Observation Data Cube anywhere, Submitted to International Journal of Applied Earth Observation and Geoinformation.

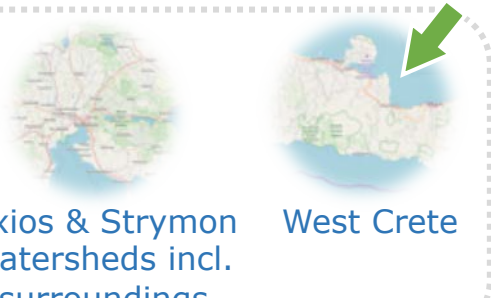
Greek Data Cube

- The Greek Data Cubes (GDC) application is operating in beta version. It is based on CEOS and the Swiss Data cube. GDC contains Sentinel-2, Landsat 5,7 and 8 Analysis Ready Data for West Crete, since 1996.
- The encapsulation of a second micro-cube is in progress. The micro-cube of Axios and Strymon watersheds including surroundings, is currently ingesting satellite data.

How it works

1. Log in: ***datacube.iti.gr***

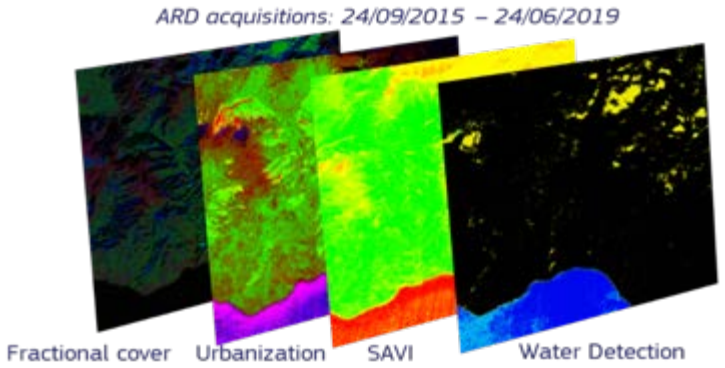
2. Select tool / module



3. Select the micro-cube

4. Select satellite, time range, etc. ***Submit***

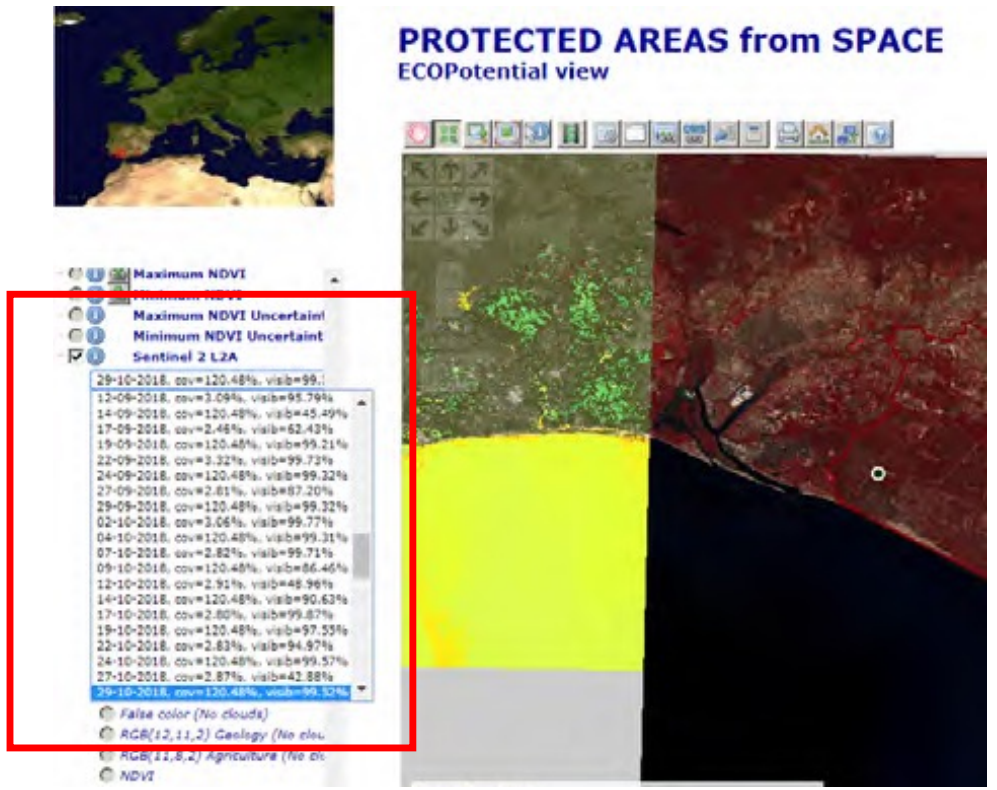
Results:



More information about the GDC may be found at **eoservices.iti.gr**

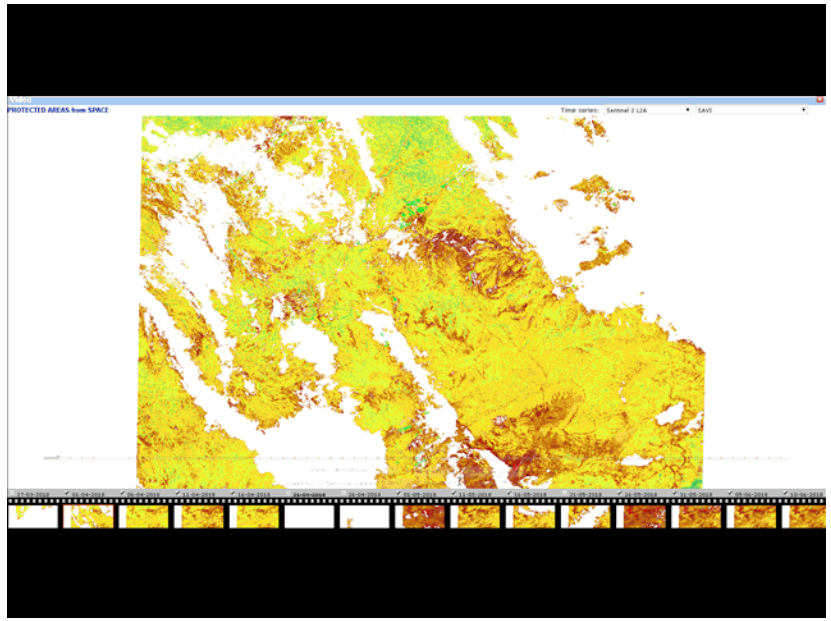
ECOPOTENTIAL Sentinel-2 L2A datacube

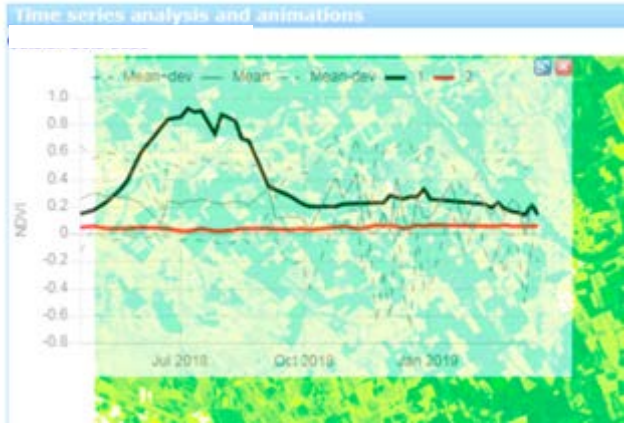
- Outcome: demonstration that is possible the **generation of a data cube for every Protected Area in the world.**
- Aims at facilitating **access and analysis** of long time series of Sentinel-2 L2A (Analysis Ready Data) to **Protected Area managers**.
- ECOPOTENTIAL showcase: Automatic downloading of granules of 18 Protected Areas:
  - Abisko
  - Bayerischer Wald
  - Camargue
  - Doñana
  - Gran Paradiso
  - HarHa Negev
  - High Tatra
  - La Palma
  - Murgia Alta
  - Northern Limestone
  - Ohrid Prespa
  - Peneda-Gerês
  - Samaria
  - Sierra Nevada
  - Swiss National Park
- Ready to be **<u>transferred to each PA</u>**



ECOPOTENTIAL Sentinel-2 L2A datacube

- Request a minimum infrastructure: can be deployed in a common computer
- More than 200000 jp2 files / >1700 scenes / > 4 Tb
- Offering the DC as a WMS service with real data (no pictures)
- Connected to client *Protected areas from Space* browser to allow visualization and make the most of its functionalities (band math, histograms, spatial filters…) and data
- Generation of time profile graphs, analysis of time series and basic statistics





Maso J., Zabala A., Serral I., Pons X. (2019) A Portal Offering Standard Visualization and Analysis on top of an Open Data Cube for Sub-National Regions: The Catalan Data Cube Example 4(3):96 https://www.mdpi.com/2306-5729/4/3/96

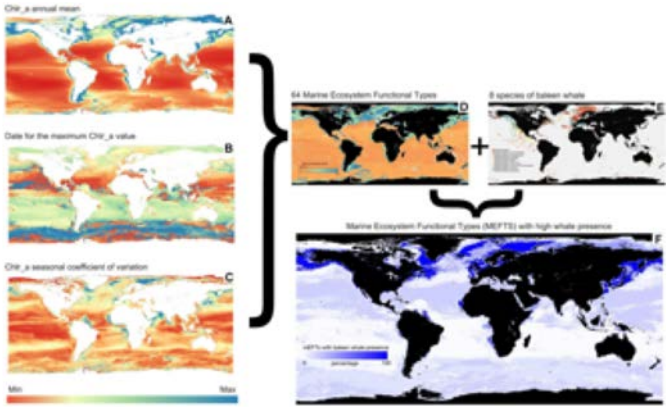
PELAGOS Data Cube

Overall objective- to map areas where whales and human activities are likely to overlap

This kind of information will help decision makers identify high-priority areas for both marine mammals and human activities.

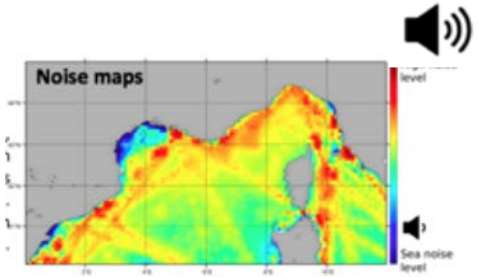
1- by developing high resolution maps of probability of whale encounters using all available data sources

From "Whale counting in satellite and aerial images with deep learning" https://www.nature.com/articles/s41598-019-50795-9

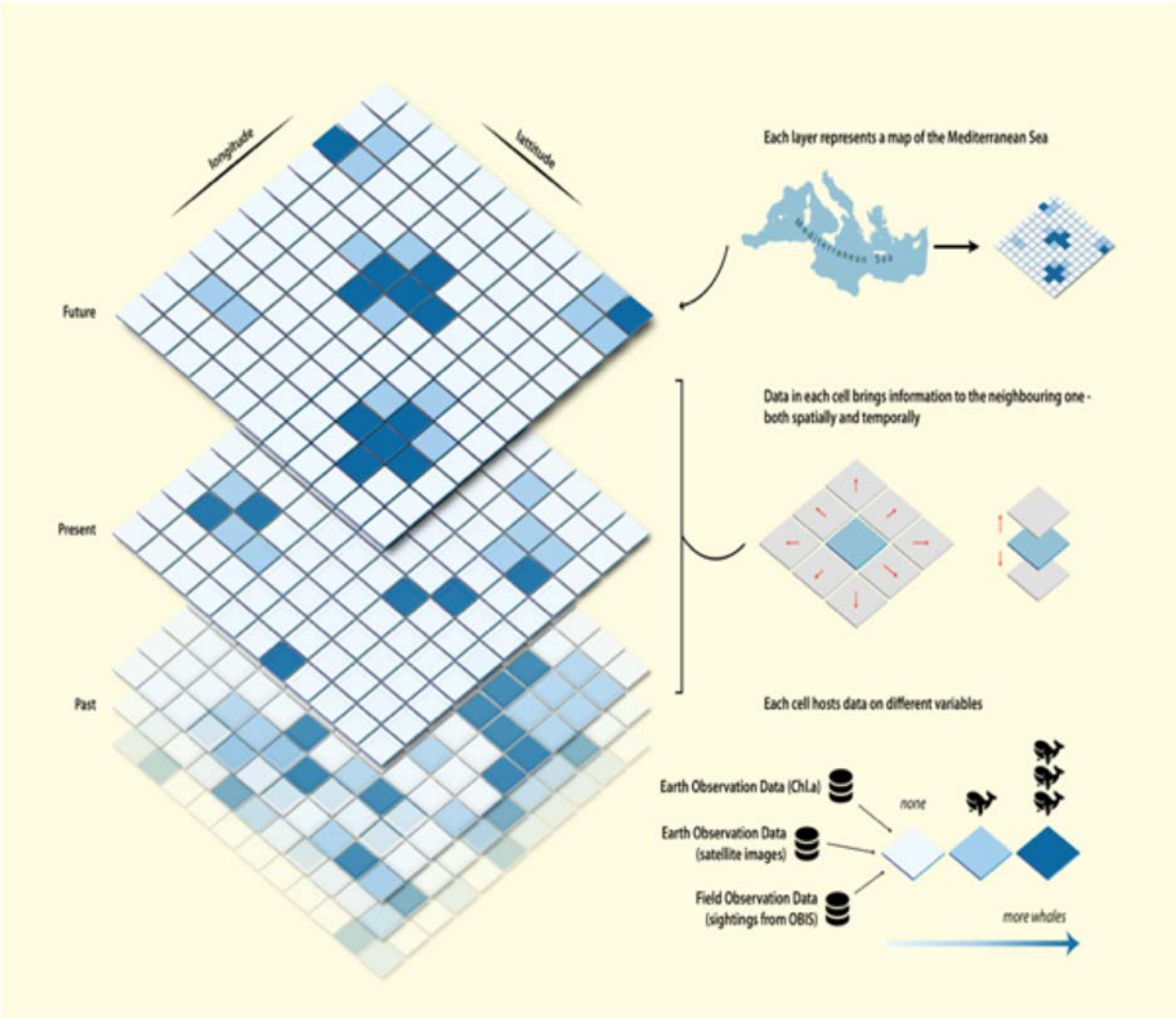


2- by mapping human activities

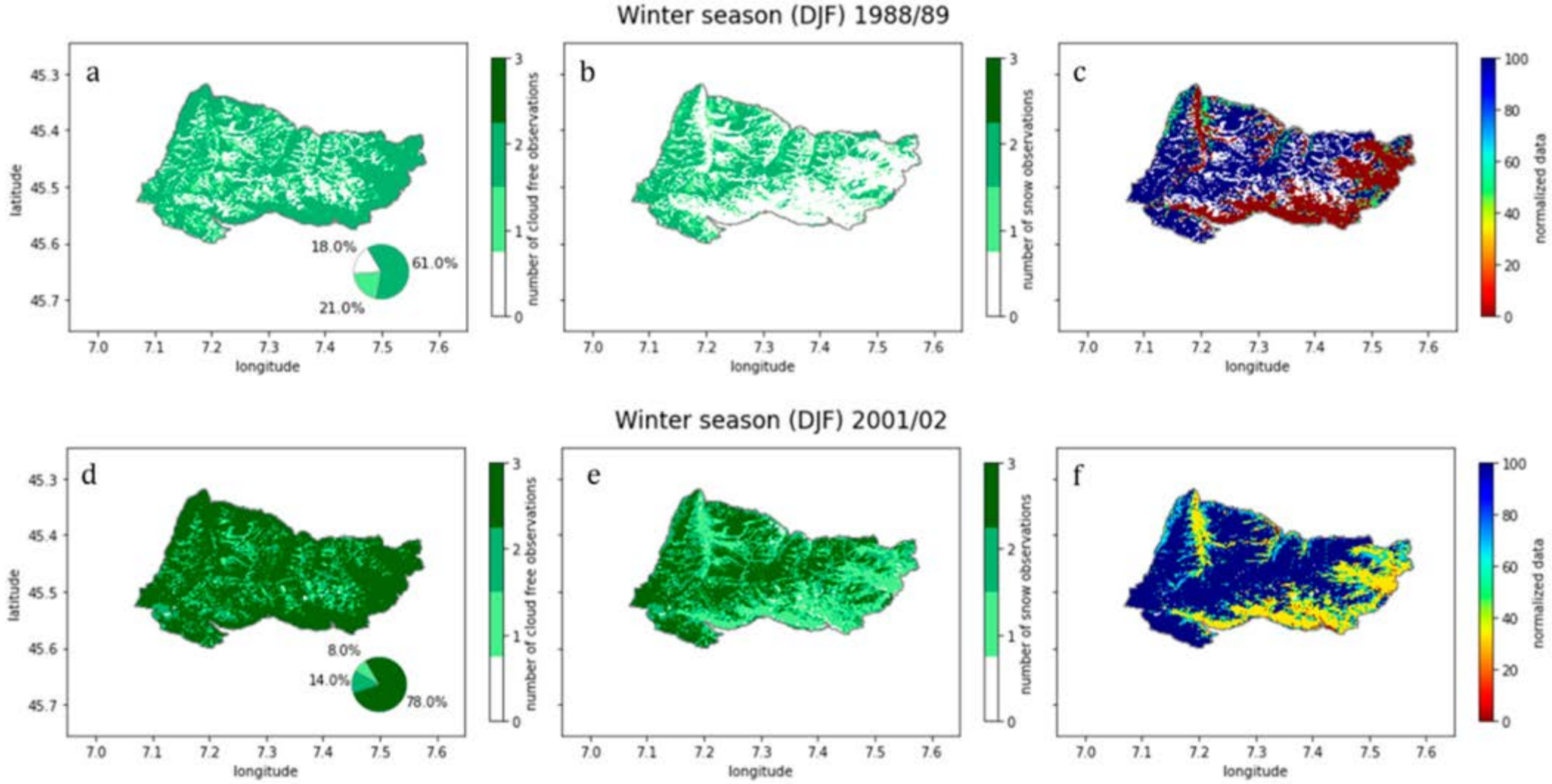
Noise maps from Le Courtois, F., Kinda, B. G. and Stéphan, Y. (2018), "Évaluation du descripteur 11 « Perturbations sonores » en France métropolitaine. Rapport scientifique pour l'évaluation 2018 au titre de la DCSMM". Shom. MTES.



3- to overlap both kinds of information to develop indices to help prioritize marine spatial planning in order to mitigate human impact on marine mammals



Snow Cover Evolution in Gran Paradiso National Park



Poussin C., Guigoz Y., Palazzi E., Terzago S., Chatenoux B., Giuliani G. (2019) Snow Cover Evolution in the Gran Paradiso National Park, Italian Alps, Using the Earth Observation Data Cube, Data 4(4):138 https://www.mdpi.com/2306-5729/4/4/138

- Data Cubes are a promising solution to **use satellite EO data at Protected Areas level**.
- ECOPOTENTIAL helped to foster the use of data cubes for nature conservation, and data cubes helped ECOPOTENTIAL and will help the **GEO ECO Community**.

- Makes life easier for those who want to use EO data.
- Easy transferable requiring a minimum infrastructure.
- Next step: moving toward a “network/federation” of data cube

*Take home message

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