Frascati, 13-16 November 2018

the esa earth observation Φ-week

EO Open Science and FutureEO

EO in Society: Open Science and Innovation

Maria Antonia Brovelli

Politecnico di Milano – Milano - Italy

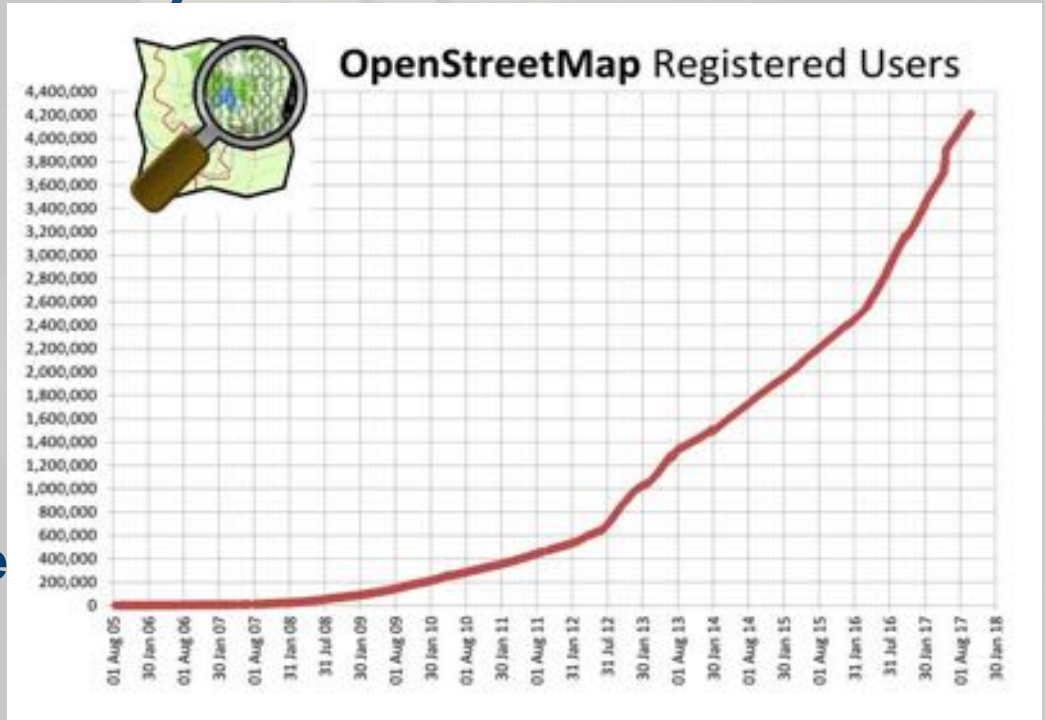
Citizen Science

- **The appearance of "new" human actors**
  - **Citizen science**: set of practices in which **citizens** participate in data collection, analysis and dissemination of a **scientific project** (Cohn 2008)
  - **citizen cyberscience**: use of computers, GNSS receivers and mobile phones
  - Enabling factors:
    - Geolocation sensors and handheld sensors. → **Space products and services (success of GNSS)**
    - Web2.0 technologies
    - Collective Intelligence

Citizen Science

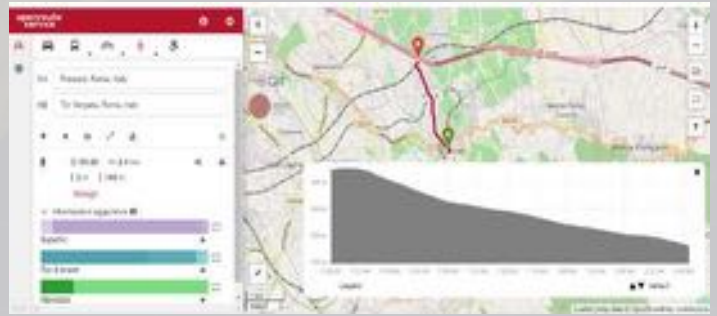
OpenStreetMap (OSM)

The OSM project was born in **2004** to encourage the creation of geo data that is **free to use and shareable with anyone** (licensed under the **Open Data Commons Open Database License** (ODbL)) by the OSM Foundation (OSMF).

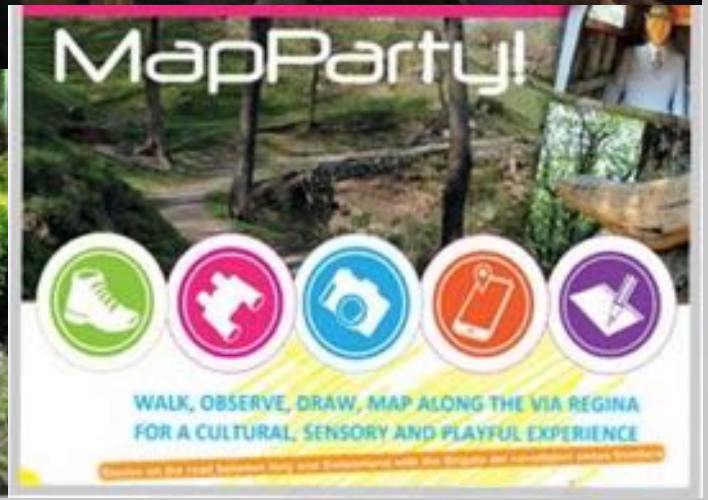


Citizen Science

OSM Ecosystem



Citizen Science



Citizen Science

OSM Ecosystem

youthmappers POLI MAPPERS

HOT Humanitarian OpenStreetMap Team

GEOCHICAS

Missing Maps

CROWD2MAP TANZANIA
Putting rural Tanzania on the map
crowd2map.org

OSGeo

Commercial OSM Software and Services

Citizen Science

Quality (examples)

- **OSM Building footprints Lombardy** (Italy): the spatial accuracy is comparable to the authoritative dataset at scale **1:5000**
- Streets in **Kenya, Tanzania, Uganda**: comparison OSM and UNECA (United Nations Economic Commission for Africa); the latter dataset is based on the Digital Chart of the World

Country	OSM [m]	UNECA [m]	OSM/UNECA
Kenya	165842875	37107320	4,5
Tanzania	426683257	55336417	7,7
Uganda	148997450	18545031	8,0

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Citizen Science

A GROWING GLOBAL COMMUNITY

CITIZEN SCIENCE | GLOBAL PARTNERSHIP

EUROPEAN CITIZEN SCIENCE ASSOCIATION

CITIZEN SCIENCE ASSOCIATION

Australian Citizen Science Association

"No PhDs needed: how citizen science is transforming research" Nature 23 October 2018

EO and Citizen Science

- What is missing? How to elicit the exploitation of EO products different from simple optical HR imagery?
- There are potentially billions of intelligent sensors!!
- There is a need of cross-fertilization for synergizing the two worlds (**EO4CS**).

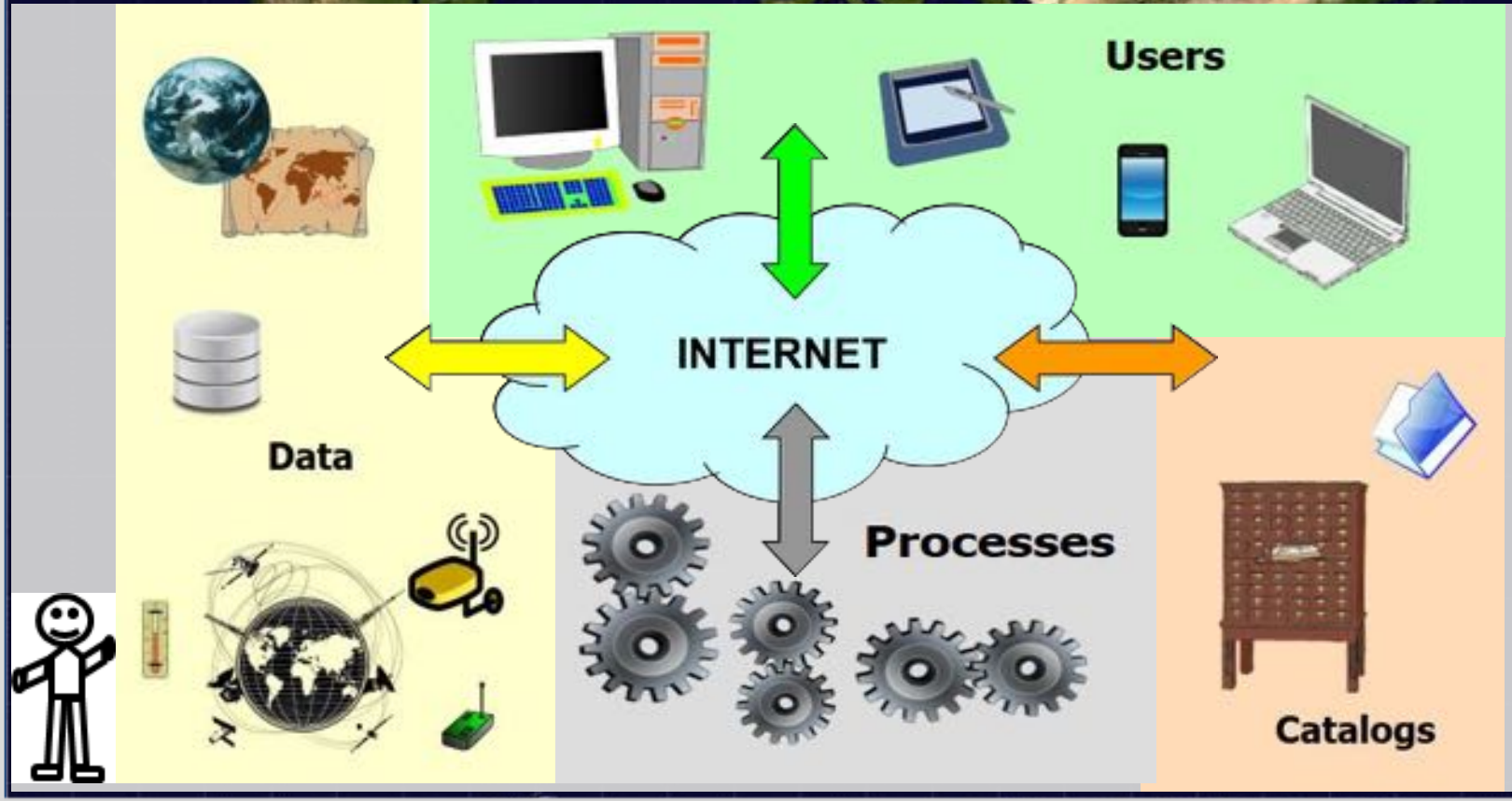
The Digital Earth

"a **multi-resolution**, **three-dimensional** representation of the planet that would make it possible to find, visualise and make sense of vast amounts of georeferenced information on the **physical and social environment**.

Such a system would allow users to **navigate through space and time**, access to historical data as well as future predictions based for example on environmental models, and **support access and use** by scientists, policy-makers and children alike"

Gore, A., 1998. The Digital Earth: Understanding our planet in the 21st Century.

The Geospatial Web



The Geospatial Web

- Geo Web Services
  (Catalogues, Data, Processing)
- Clients
  (Web Mapping, Mash-up, Web2.0)
- Interoperability

Dealing with Big Data

- Over **10 Petabyte/year** of new data with just Sentinels-1,-2 and -3 fully operational
- immediately consumable for users (even if Big Data)
  - WCS: Web **Coverage** Service

representations of space/time varying phenomena:
regular and irregular grids, point clouds and general meshes

Datacubes: multidimensional arrays is a subset of coverages that focuses on regular and irregular spatio-temporal grid

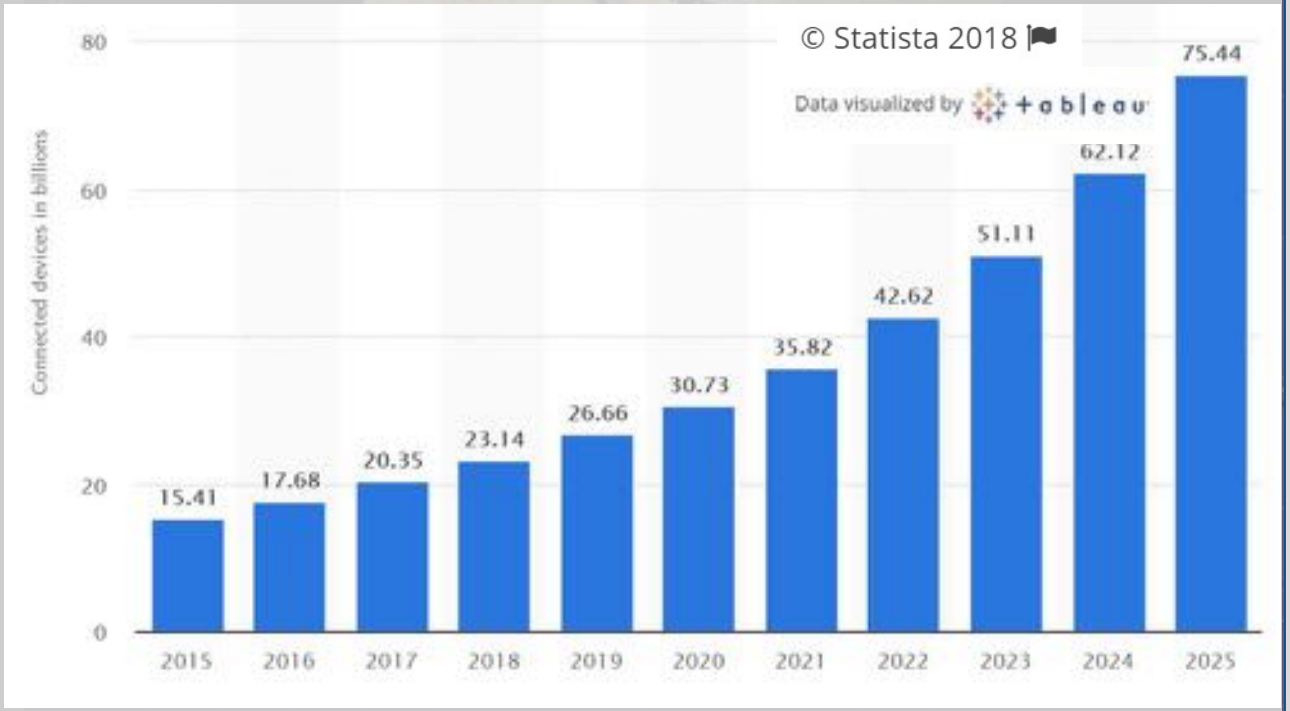
- Cloud Processing

Google Earth Engine

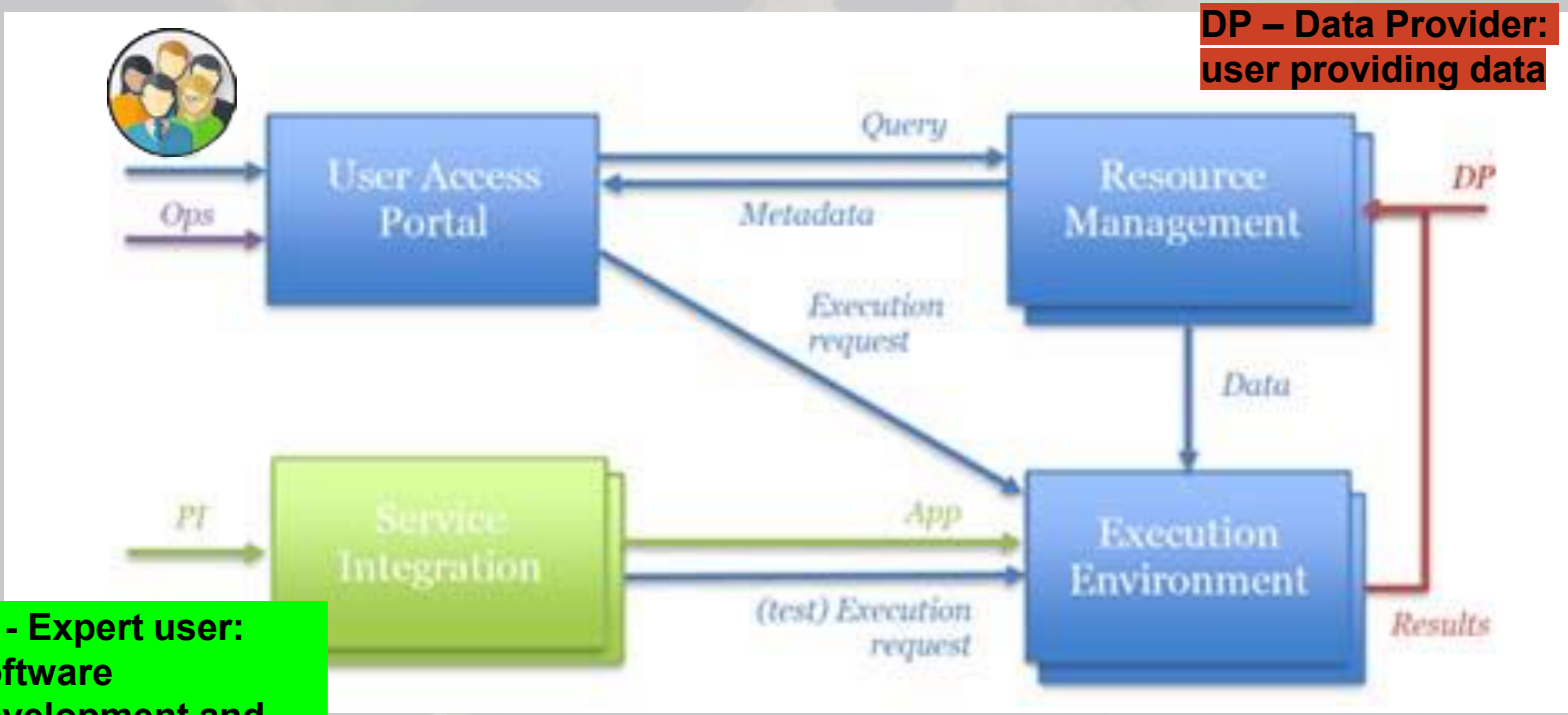
Dealing with Geo IoT

→ Sensors everywhere

→ Internet of Things (connected devices)



ESA Thematic Open Exploitation Platform



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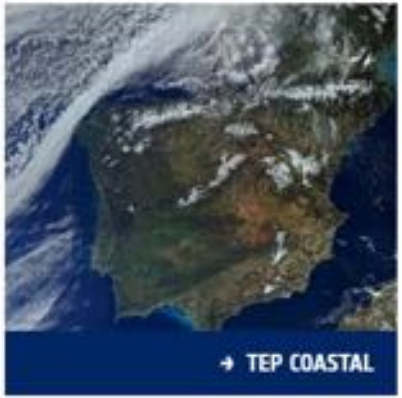
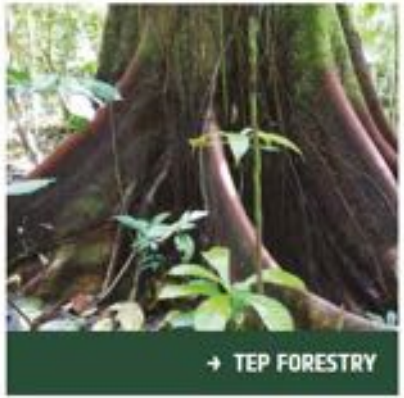
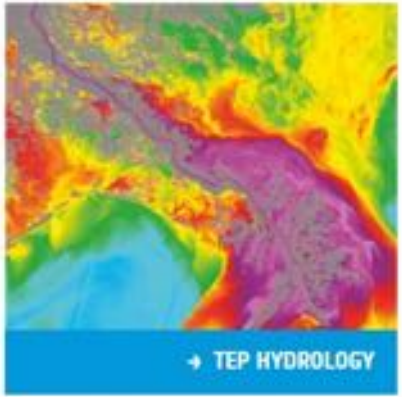
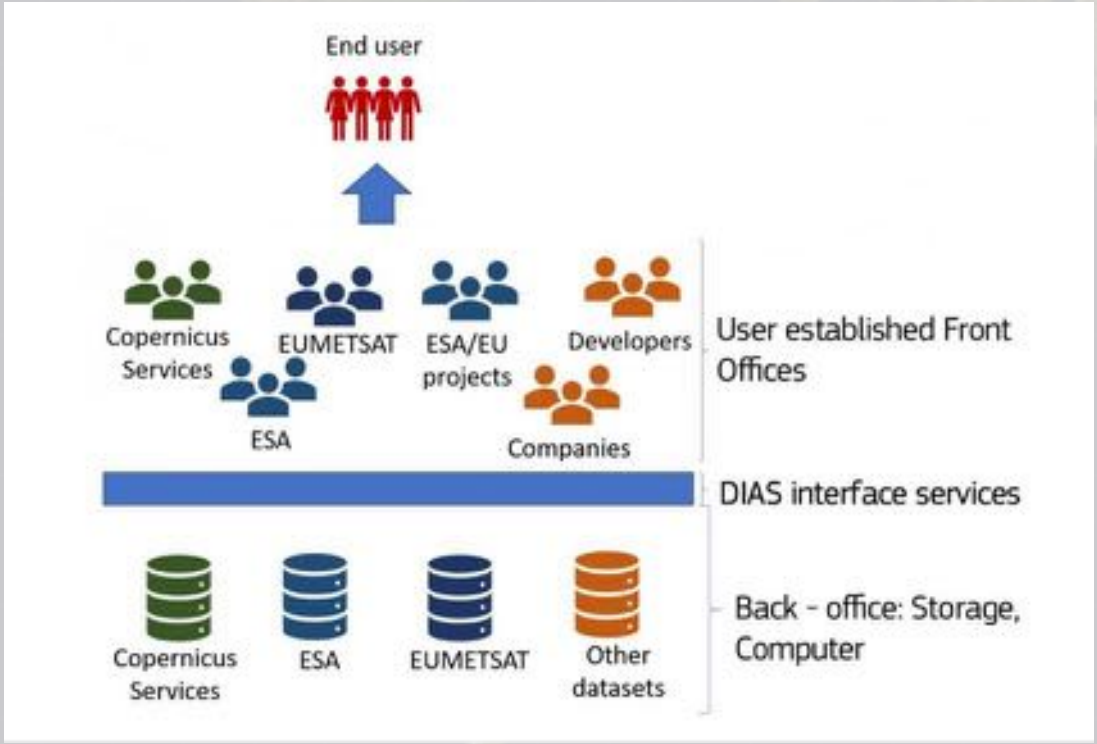






Data and Information Access Service (DIAS)



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WEkEO by COPERNICUS

Data and Information Access Service (DIAS)

- From the web of people to the web of data/information: intelligence by connecting data and information (Web3.0)
- A great and praiseworthy effort has been made for giving birth to such infrastructures.
- From the industrial point of view (in Europe, fragmented and mainly micro-small sized companies): “around 10 % of the overall sector revenues are driven by free data” and there is optimism with respect to a future grow, in the new era of platforms (EARSC)
- Openness has been a winning choice.

Data and Information Access Service (DIAS)

- How to make these platforms **pervasive** (at least) in the education and research domain and make them competitive with respect to other solutions?
  - Researchers need to be aware and understand the added value of these solutions. But these solutions need to be **sustainable** for researchers
  - Educators have to be “educated” in order to introduce these topics in their courses (secondary and higher education)
  - Cross-fertilisation between GEO (Geospatial science and Earth Observation) and Informatics → GEO Informatics no more seen as a niche subject

Artificial Intelligence

- **Going to machines …**

AI has reached a historical moment

- Big Data
- Processing Power
- Collective Intelligence
- Open Software and Open Data
- Improved Algorithms
- Accelerating Returns

→ AI4EO (AI4GEO)

Harnessing AI for the Earth, PwC, World Economic Forum WEF, 2018

Artificial Intelligence

What do we need?

- DATA (good quality data)
- TOOLS AND INFRASTRUCTURES
- AI4GEO ECOSYSTEM:
  - Researchers
  - Citizen Scientists
  - Private Sector
  - Investors
  - Potential Users

CONCLUSIONS

- Citizen Science is a pivotal element in sensing and monitoring the Earth. How to elicit more participation? (EO4CS)
- We have been experiencing many advancements in a short time: OSM (2004), Sentinels (2014), DIAS (2018): **free and open data** and **free and open source software** have proved to be effective for innovation. Let us go ahead in this direction. Will the new platforms be **sustainabl**e (and of interest) for educators, researchers and in general?
- AI is opening unprecedented ways of studying the World. How to elicit more research on AI4EO in Europe?
- We have today definitely more possibilities of sensing and monitoring our planet (and beyond); **the step between monitoring and controlling is very short**; the prevention against a society of control is participation and openness.