

Digital Earth Observation infrastructures and initiatives: a review framework based on open principles

M. Di Leo, M. Minghini, A. Kona, N. Spadaro, A. Kotsev, J. Dusart, S. Lumnitz, C. M. Ilie, C. E. Kilsedar, A. Tzotsos



Outline

- Context background and objectives
- EO cloud infrastructures and initiatives
- Identification of users needs
- The development lifecycle
- Users' feedback
- Good practices and technological enablers
- Future developments: towards a protocol for (self) assessment of the digital platforms based on user's needs

Context background

"Data is the new oil"

- The EU Strategy for Data aims at creating a single market for data sharing that ensures
 Europe's global competitiveness and data sovereignty. The Strategy also stresses on the
 need to put people first in developing technology, and on the need to promote EU values and
 rights in how we design, make and deploy technology in the real economy. Common EU Data
 Spaces are instrumental for the implementation of the EU digital market
- The EU has put large investments in making data accessible, examples of which are the **Copernicus** Programme, the Group on Earth Observation (**GEO**) intergovernmental partnership and the **Horizon 2020** and successive **Horizon Europe** funding programmes. Among these, several **cloud platforms for EO** have been developed, providing access to data, tools and services that enable policymakers to make **evidence-based policy**.



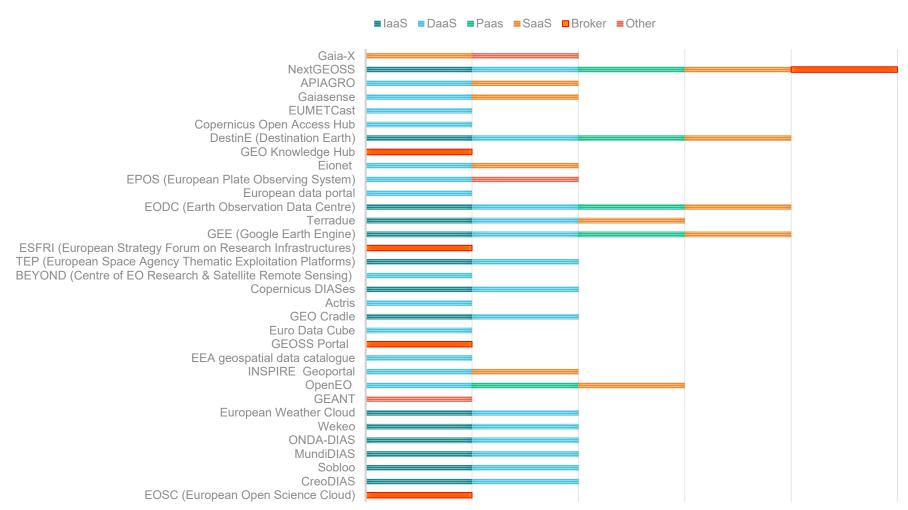
Context background

- The landscape of EO digital platforms is fragmented
- Limitations currently faced by the users
- Discoverability: no single place where all the information on available services and costs
 can be found
- Developers often struggle to find the services that match their needs
- No information about users' uptake and level of satisfaction on the current usage of the platforms
- Users' feedback hardly taken into account. Top-down design of platforms does not always take into account the diverse needs of under-represented communities (e.g. indigenous communities)
- Overlapping services



Context background

CATEGORIES OF SERVICES OFFERED BY THE DIGITAL PLATFORMS





Objectives

- Gain understanding of users' pain points / bottlenecks, wishes and ideas. Make users feel heard ask for feedback implement a long-term **co-design strategy**
- Promote strengths of current digital infrastructure's offer. Improve discoverability of available services.
 Improve overall impact and visibility of EU Digital Platforms
- Identify gaps in the current offer vs. users' demand. Inform stakeholders on how to fill existing gaps and promote a seamless, inclusive user experience of existing infrastructures in the context of **EuroGEO** (European contribution to GEO)
- Identify "technological enablers": successful, reusable technologies that facilitate integration, interoperability and reuse of components



EO cloud infrastructures and initiatives: classification scheme

- Data providers: make EO datasets available within infrastructures
- Cloud-based geoprocessing platforms: computational capacity may also be offered by data providers in line with the paradigm "bring the user to the data"
- Brokers and catalogues: offer discovery services by harvesting data from existing catalogues
- Thematic hubs and Research infrastructures: incorporate EO data relevant to specific thematic domains
- Data cubes: implement a multidimensional array structure
- Virtual infrastructures: additional layers on top of existing platforms with the goal to facilitate data access and increase the discoverability of and interoperability
- Initiatives and programmes: EO-related, publicly funded programmes



EO cloud infrastructures and initiatives: inventory

Currently inventoried 100+ platforms





Here you can find our article featuring tables with digital infrastructures and initiatives that we have classified

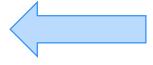
Ongoing inventory open for contribution by the Community – OSGeo Wiki?
 GitHub? Other?



Identification of users needs

 Understand how users interact with existing platforms, collecting information on user's experience



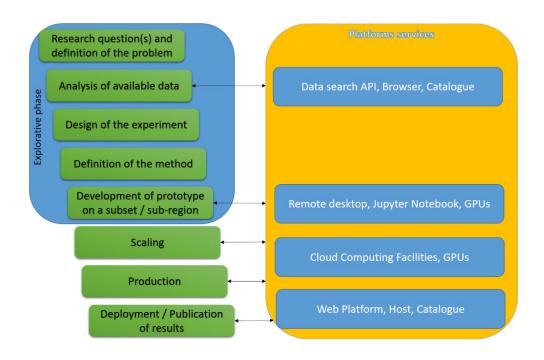


If you have developed a use case on cloud platforms we would appreciate your feedback by filling our survey

- What are the most used platforms?
- What are the most used services? Which is the provider?
- What are the bottlenecks in the development lifecycle?

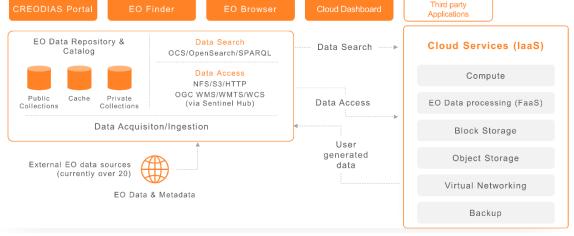


The development lifecycle



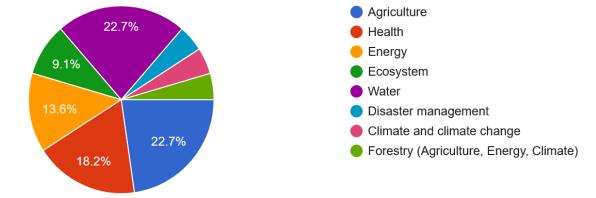
Hands-on development of use case on forest Above Ground Biomass (AGB) estimation using ML techniques







Users' feedback (1/3)



- Fragmentation: multiple platforms, redundancy of services
- Steep learning curve to start. Documentation not always up-to-date
- Pricing not fully transparent
- Not clear what services are offered and if they fit users' needs
- Sustainability after public funding period
- Top-down design and implementation
- Limited attention to users' needs



Users' feedback (2/3)

- Customization of environment many users preferred in-house solutions because more customisable
- Facilitate data and model sharing
- Effective and quick support, both commercial and technical. Ideally provided in different languages
- Several levels of operationality for data provision; demand for decision is getting faster; capacity problems in areas with conflicts; need to be able to respond quickly to disasters
- Quality check for data



Users' feedback (3/3)

- Ability to assess and control costs. Ideally implement pre-paid or threshold.
 Pay per use. Scalability of the costs.
- Users should be able to access a basic set of services for free for sandboxing and evaluate if the offer fits their needs
- Effective communication channels: competent helpdesk, forum, bug tracker.
 Timely assistance
- Updated documentation, webinars and tutorials
- Rather difficult to compare offers from different providers



Good practices and technological enablers that might help address some of the pain points raised by the users



Technological enablers (1/2)

- Federated infrastructure: interoperability, accessibility, discoverability (JRC currently testing Gaia-x)
- Single sign-on
- Federated catalogue featuring self-descriptors for different assets in the context of EuroGEO (presentation of Albana Kona on Thursday about JRC prototype)
- The NoR Portal comparing services and prices
- The Yellow Pages discoverability of data providers
- OpenEO API interoperability; vendor lock-in



Technological enablers (2/2)

- Analysis-Ready Cloud Optimized (ARCO) datasets and Cloud Optimised GeoTIFF maximize the usability of EO data in a cloud environment
- The Open Geospatial Consortium (OGC) APIs a new generation of OGC standards designed to make it easy for anyone to serve and consume geospatial data on the web.
- The Spatio-Temporal Asset Catalogs (STAC) provides a standardized way to expose collections of spatio-temporal data that improves indexing of assets.



Good practices

Problems	Good practices
Sustainability after the project is finished	Open governance: building a community of users/developers around the project leads to more people taking a stake in the preservation of the project and its outcomes. Releasing software under open source licensing fosters reuse and growth of products that are judged useful by the community. Adopting open standards or else at least releasing the specs in the public so that can be reused in other implementations, facilitates reuse and interoperability.
Fragmentation: multiple platforms, redundancy of services	Open source licensing fosters collaboration and reuse The adoption of common open standards and APIs fosters interoperability and reuse Federation of resources, and federated authentication
Steep learning curve to start using digital platforms	Sandboxing allows one to experiment and to see if the offer of a certain platform meets the needs of the user. Webinars are extremely useful to provide the user with a quick introduction to main functionalities
Pricing not fully transparent. Not clear what are the services offered.	Provide a full and transparent list of services and relative costs
Top-down design and implementation. Limited attention to user's needs.	Co-design: involving the user's active participation in all phases of design and implementation of services, adjust to user's feedback. Create and actively attend to helpdesks, forums, mailing lists. Cultivate the community around the project. Open source development and open governance.

Future developments: towards a protocol for (self) assessment of the digital platforms based on user's needs

A set of criteria for self assessment based on the following points:

- Interoperability
- Accessibility
- User's onboarding and satisfaction
- Customer care, documentation, webinars, tutorials etc.

- Customisation
- Cost transparency
- Discoverability of services
- Adoption of open standards and APIs
- Licensing
- Community





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