

openEO: Connecting to Big Earth Observation Cloud Backends in a Simple and Unified Way

Edzer Pebesma



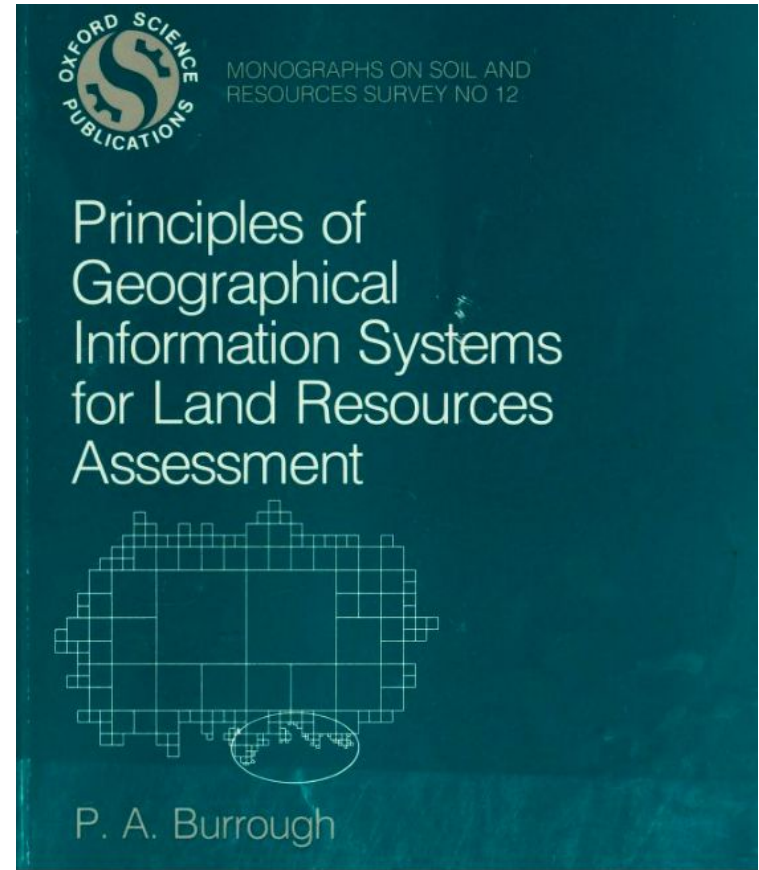
R Foundation

With: A. Jacob, M. Mohr, P. Griffiths, C. Briese, J. Dries, G. Milcinski, M. Claus, P.J. Zellner, S. Lippens, D. Thiex, V. Ardizzone, D. Clarijs, B. Driessen, C. Reimer and P. Stranner

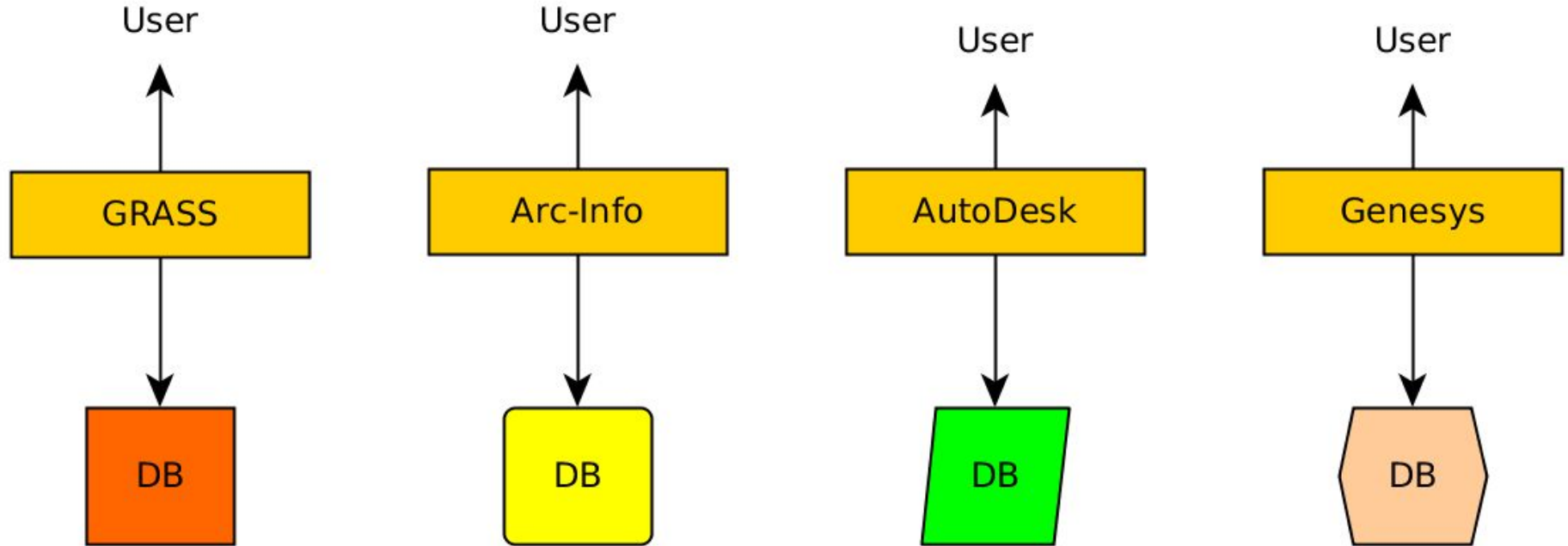
Where I come from...

Utrecht University,
1985-1991, 1991-1996

We wrote command-line
programs. In C, to make them
portable. Understanding file
formats meant interoperability.

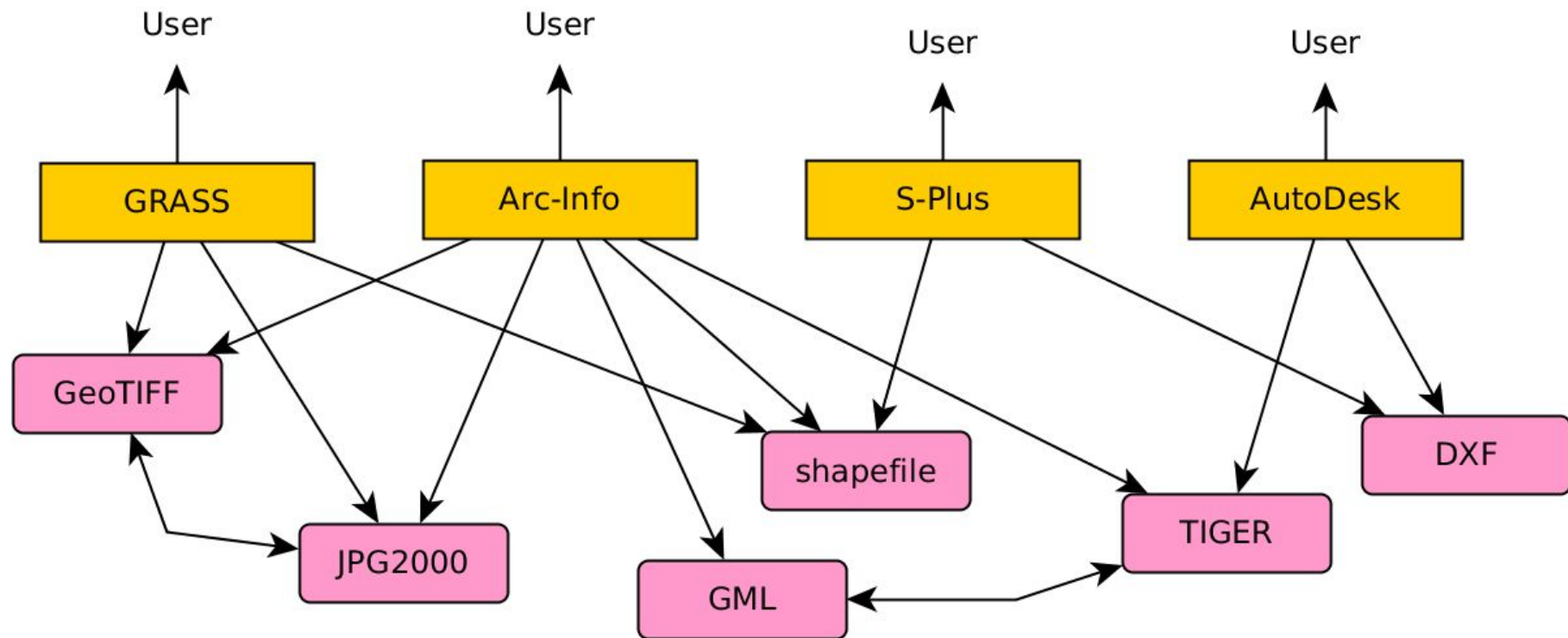


What GIS meant in the 1980's:

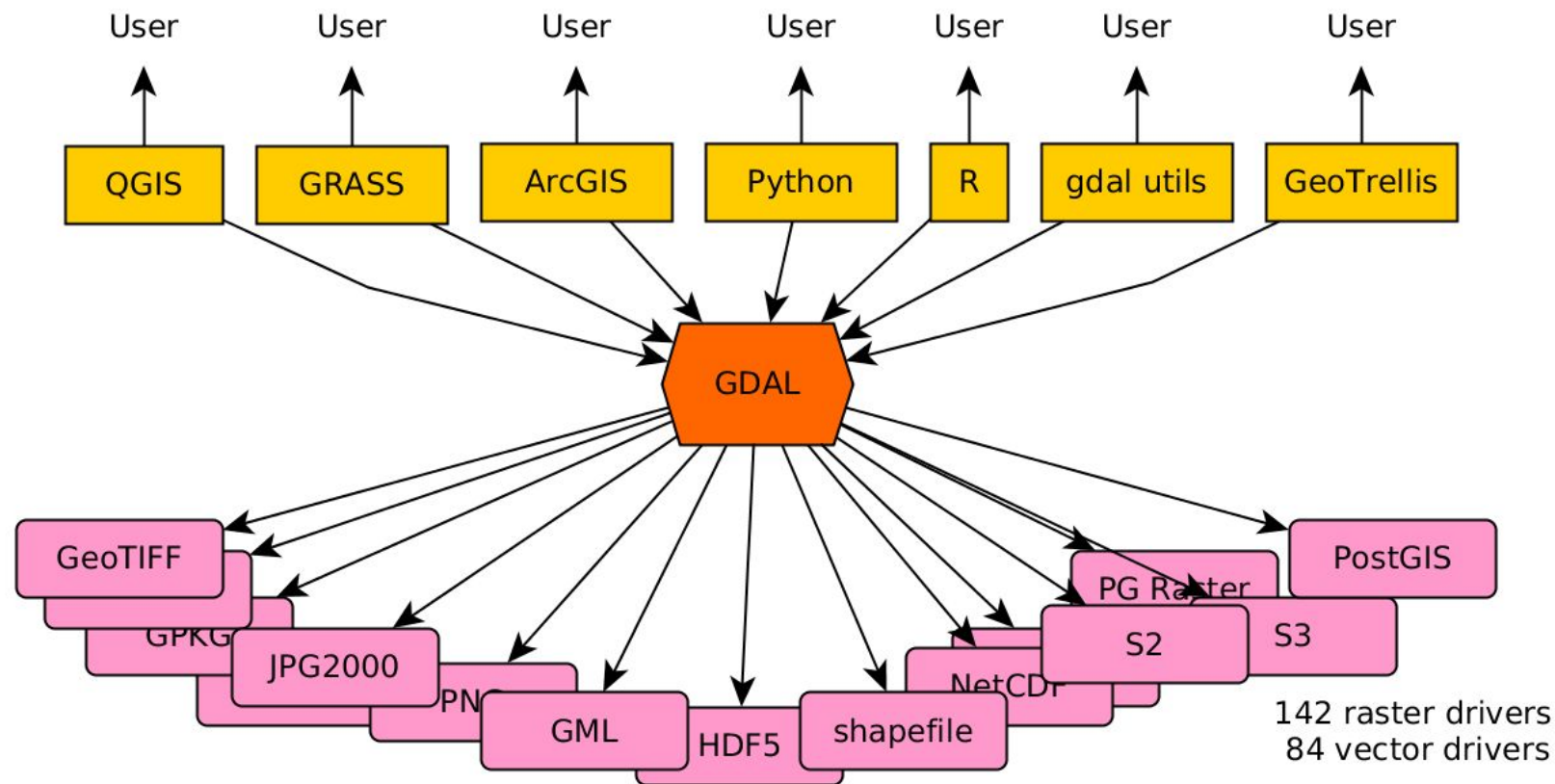


<https://r-spatial.org/2016/11/29/openeo.html>

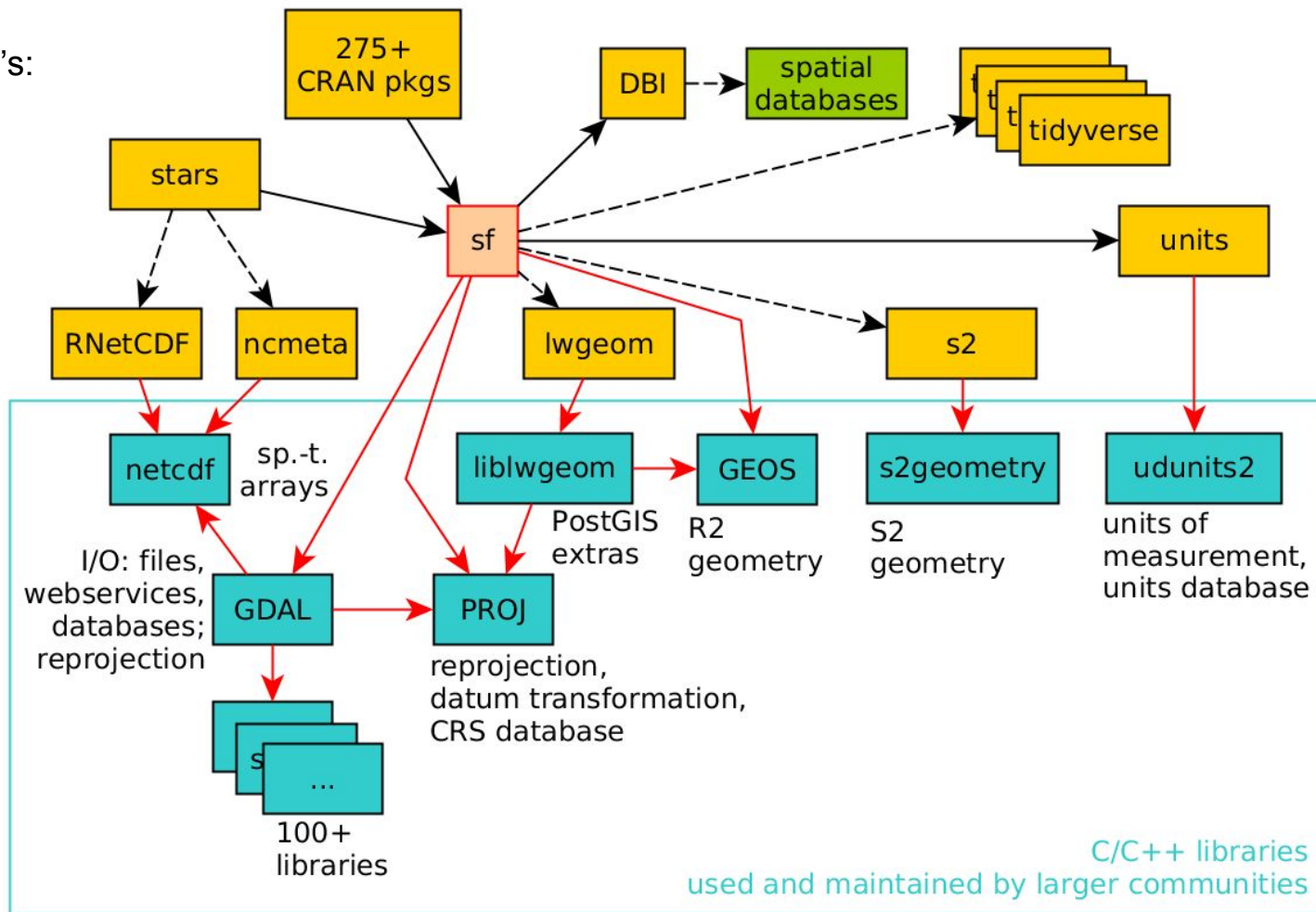
What GIS meant in the 1990's:



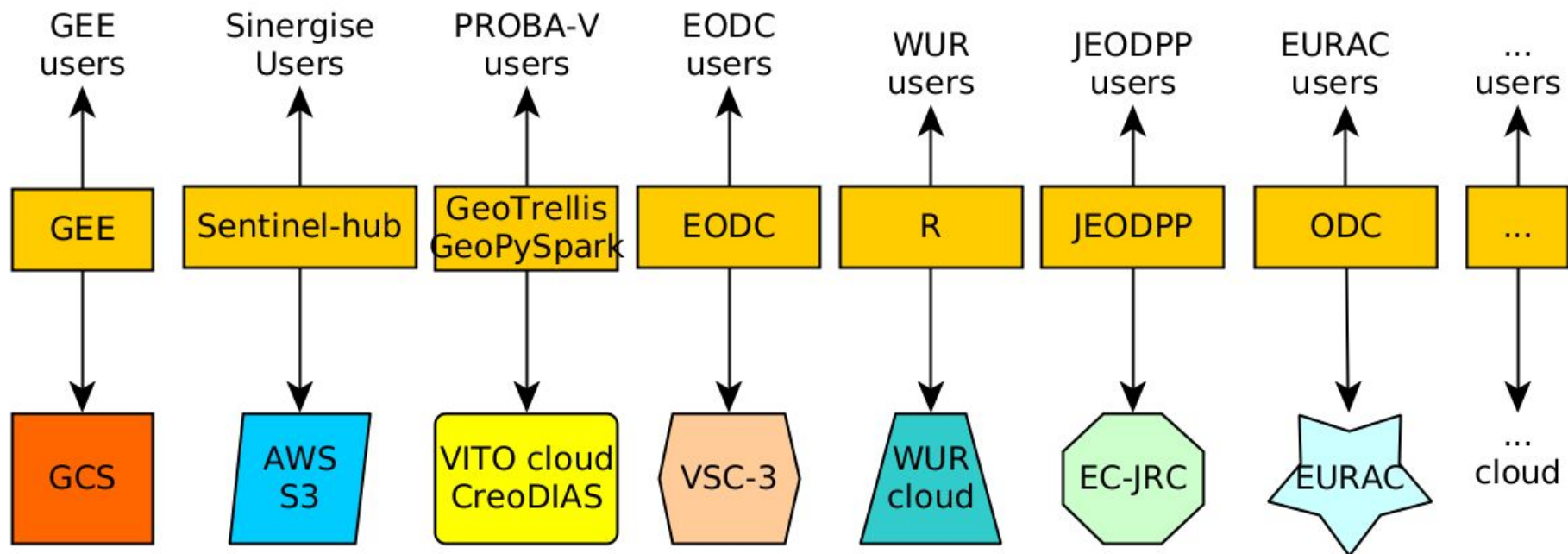
Open source GIS / spatial data science in the 2000's:
For GDAL, also read: PRØJ, GEOS, ...



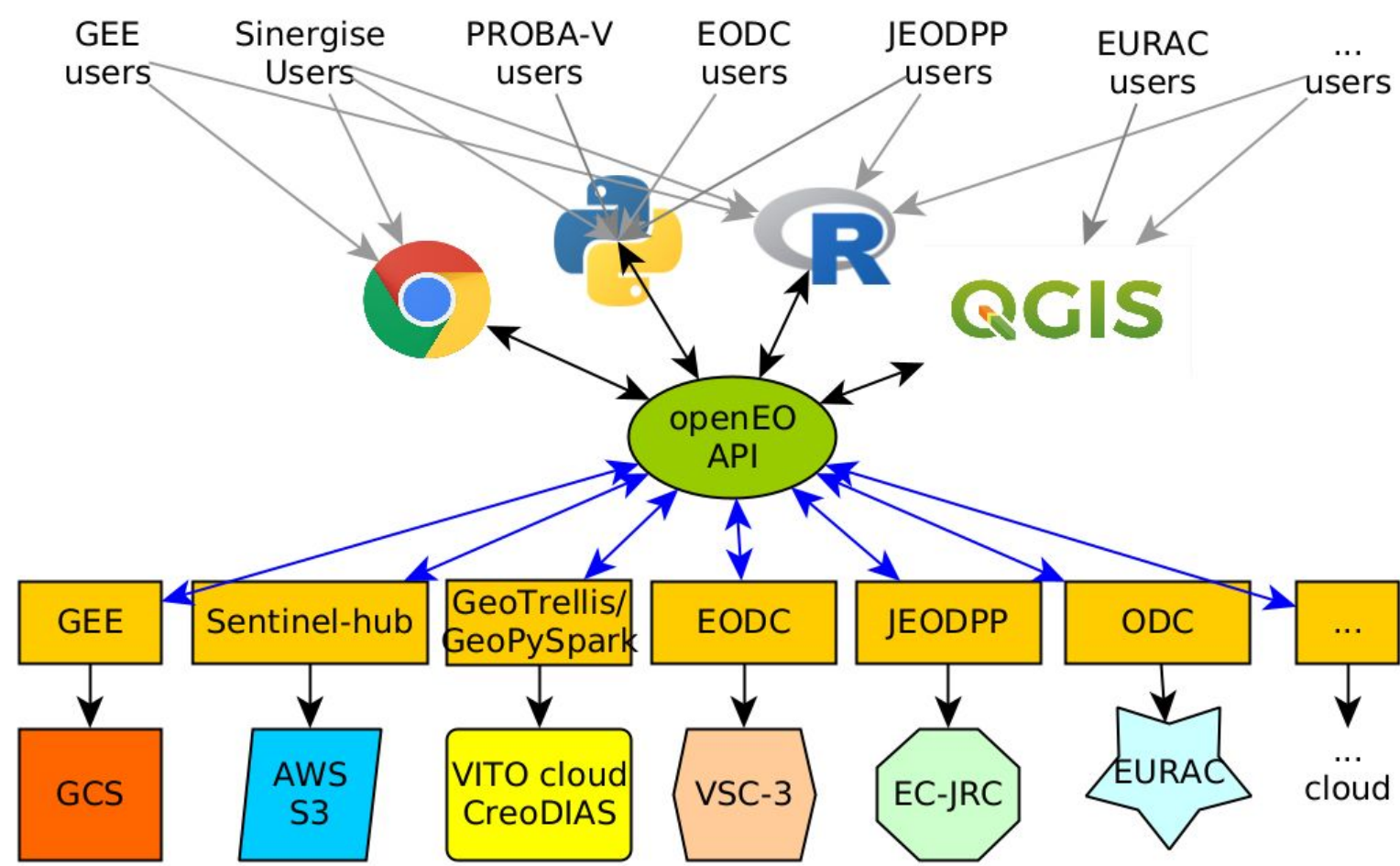
R-Spatial around 2020's:



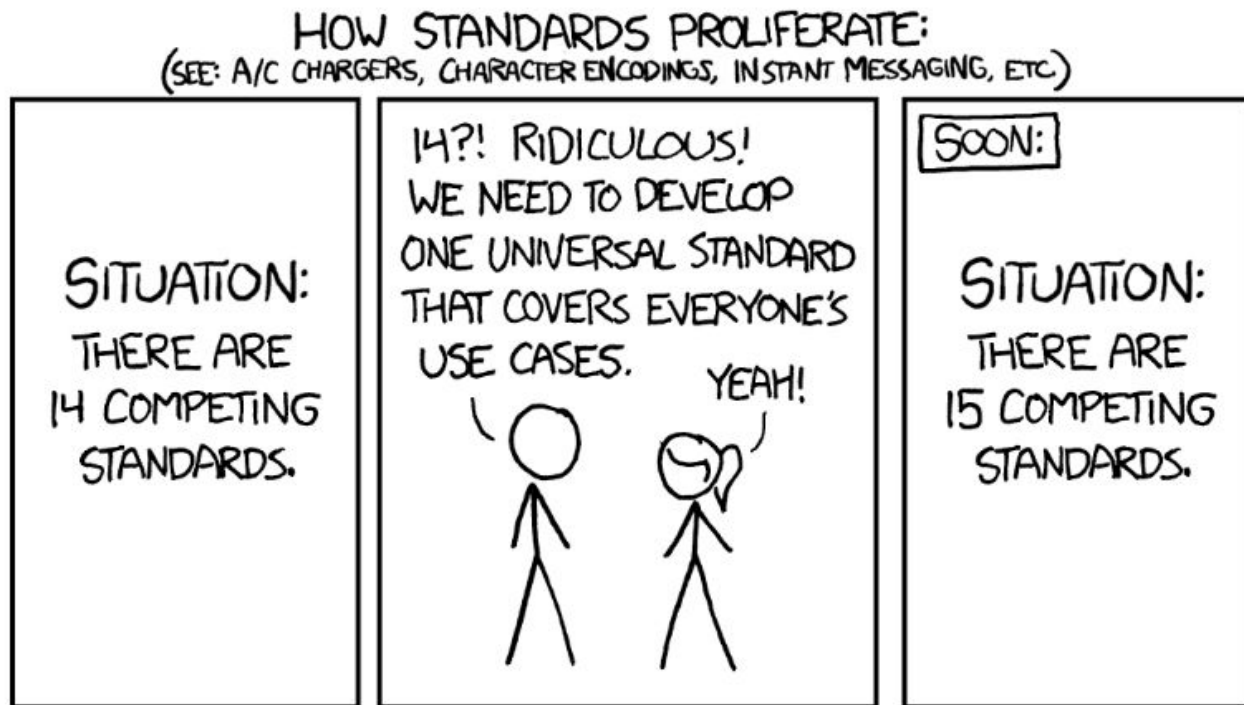
Big Earth Observation data analysis platforms, 2010's:



Big Earth Observation data analysis platforms, 2020's:



But isn't this....



<https://xkcd.com/927/>

Well, is it?

Funding situation:

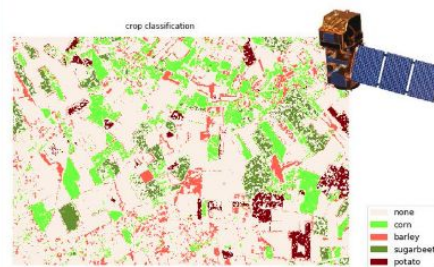
- openEO H2020 “EO Big Data shift” call, 2017-2020, ~2M, <https://openeo.org/> : API, processes, use cases, P.O.C.
- openEO Platform: ESA “Open Earth Engine” ITT; 2020-2022, ~1M, <https://openeo.cloud/> : public instances, use cases, ARD, ...
- @ESA Phi Week: call for early adopters (free!)



EO OPEN SCIENCE
@EO_OPEN_SCIENCE

.@openEO_Platform provides intuitive programming libraries in #Python, #R or #JavaScript to process a wide variety of earth observation datasets. 🌍
•• Take a sneak peek at openeo.cloud/data-collection...

🚀 Don't miss key note session and the official launch at #PhiWeek!



```
all_bands = features.apply_dimension(dimension='t', target_dimension='bands', process=lambda x:  
bandnames = [band + " " + stat for band in all_bands.metadata.band_names for stat in ["jan", "Feb"]  
all_bands = all_bands.rename_labels('bands', target_bandnames)
```

EO DC GmbH and 9 others

10:39 AM · Oct 10, 2021 · Twitter Web App



openEO Platform

A Federated Open Earth Observation Platform

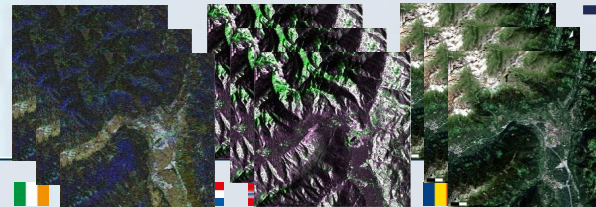
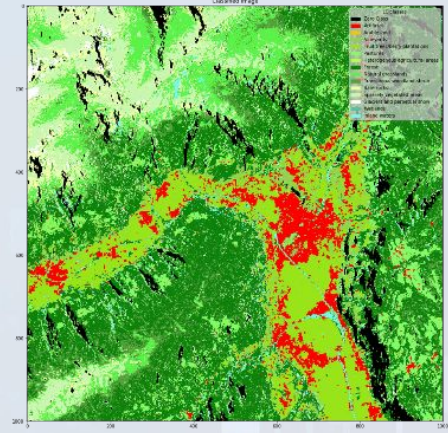
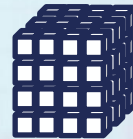
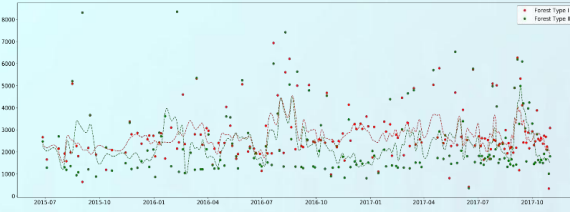
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openEO
Platform

- Why do we need openEO?
 - Capability Gaps
 - Data Management Burden
 - Vendor lock-in
 - Reproducibility
- Intro to openEO:
 - API
 - Processes
 - Clients
- What added value brings openEO platform?
 - openEO as a service
 - Data and Processing Federation
 - Added Capabilities & Use Cases
- How to get involved?
 - Early Adopters
 - Forum

Why do we need openEO? The Standardization GAP



Eurac Research
2021, contains
modified
Copernicus
Sentinel data
[2016], processed
by ESA.

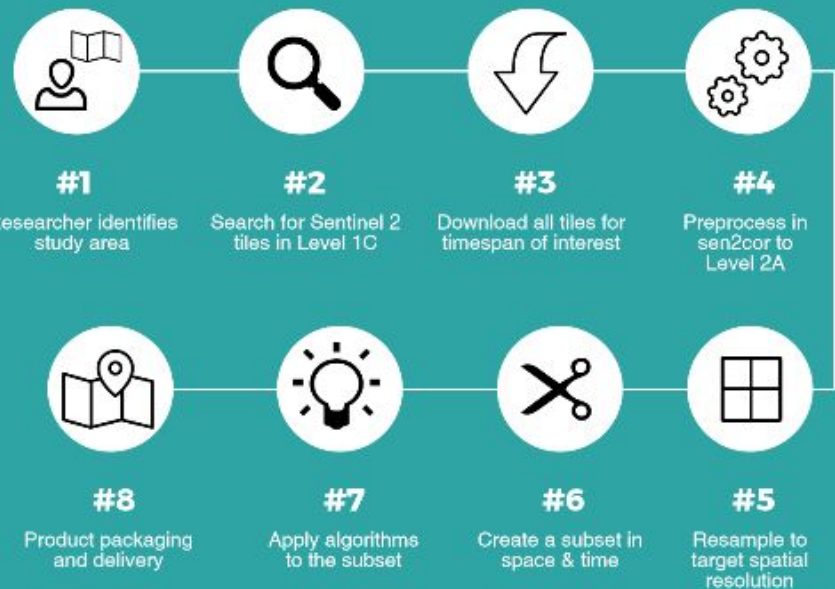


Why do we need openEO?

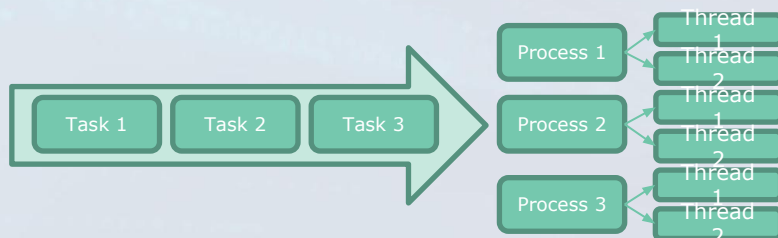
The Data Management Burden...



Traditional remote sensing product process for Sentinel-2

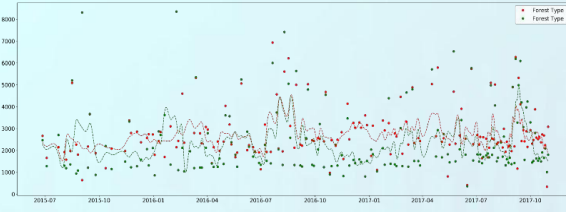


Allocated CPU	Allocated MEM	Status
8200 / 9600 (85%)	520GB / 1007.8GB (52%)	ON
4700 / 5600 (84%)	444GB / 503.6GB (88%)	ON
5200 / 5600 (93%)	358GB / 503.6GB (71%)	ON



Credits: H. Kristen – ESA open Science 2017

Introduction to openEO The API

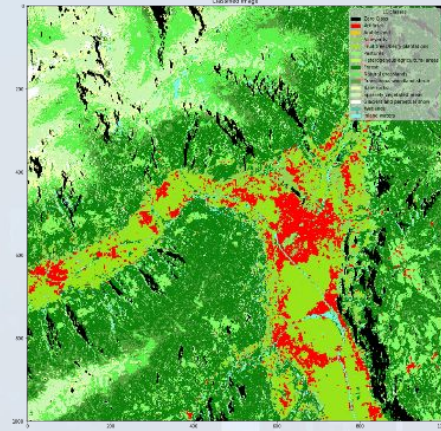
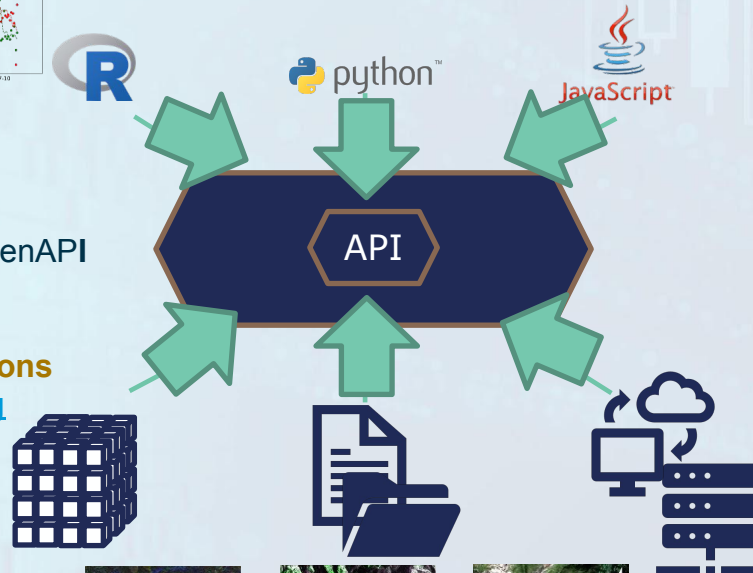


<https://openeo.org>



RESTful **API**, specified with OpenAPI
<https://api.openeo.org>

Pre-defined **process** descriptions
<https://processes.openeo.org>



STAC for meta data description
<https://stacspect.org>

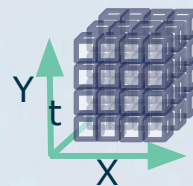
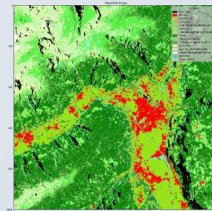
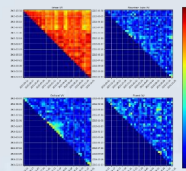
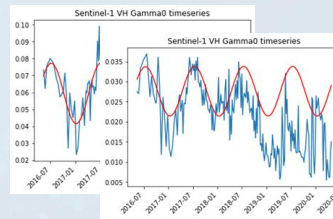
based on **OGC API** building blocks

Eurac Research
2021, contains
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by ESA.

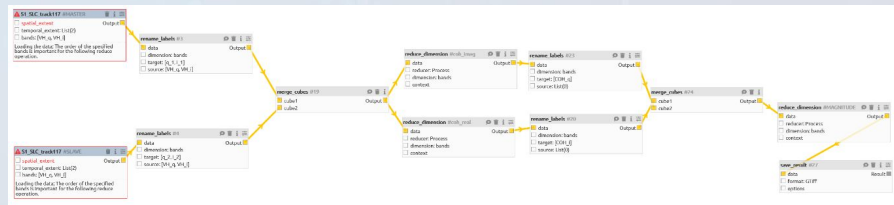
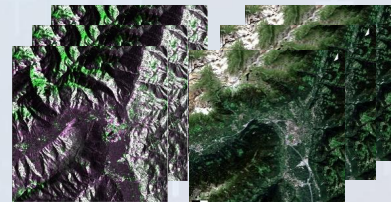
Introduction to openEO Processing



Clients



Feature 1
...
Feature N



Data Selection

Data Analysis

Result Access

Abstract workflow definition

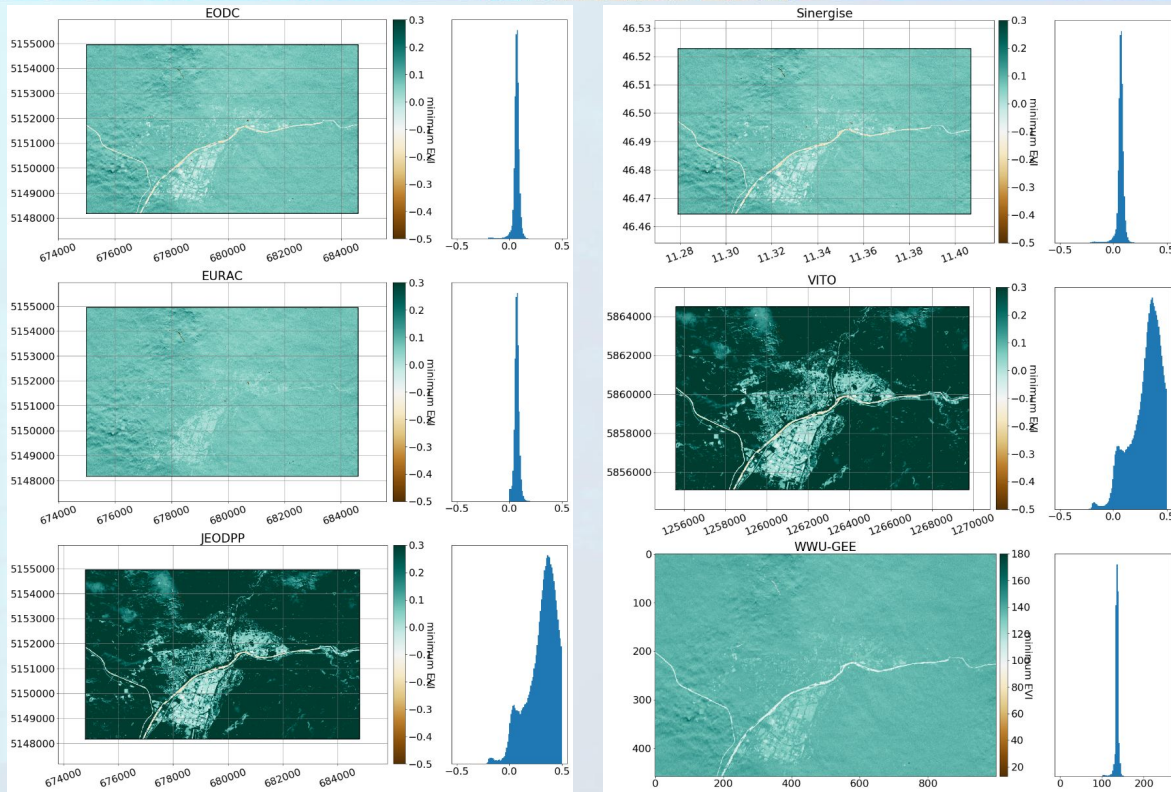
Job Management

Graph Parsing

Execution Engine

openEO back-end infrastructure

Why do we need openEO? The Standardization GAP



EODC 2020, contains modified Copernicus Sentinel data [2018], processed by ESA.

openEO Platform responds to the ESA tender “Open Earth Engine”, targeting a federated open infrastructure for **scalable, cloud-based** EO processing and **analytics**.



Ambitious goal to be met by **reuse** and integration of existing components:

- Built on the foundation of H2020 [openEO project and API](#) (grant number [776242](#))
- Consortium including three key EO cloud operators
- Building on active user community

Driving concepts for addressing the **capability gap in Europe**:



Enabling simplicity: intuitive analytics & programming libraries, dynamic resource allocation, federated cloud environments

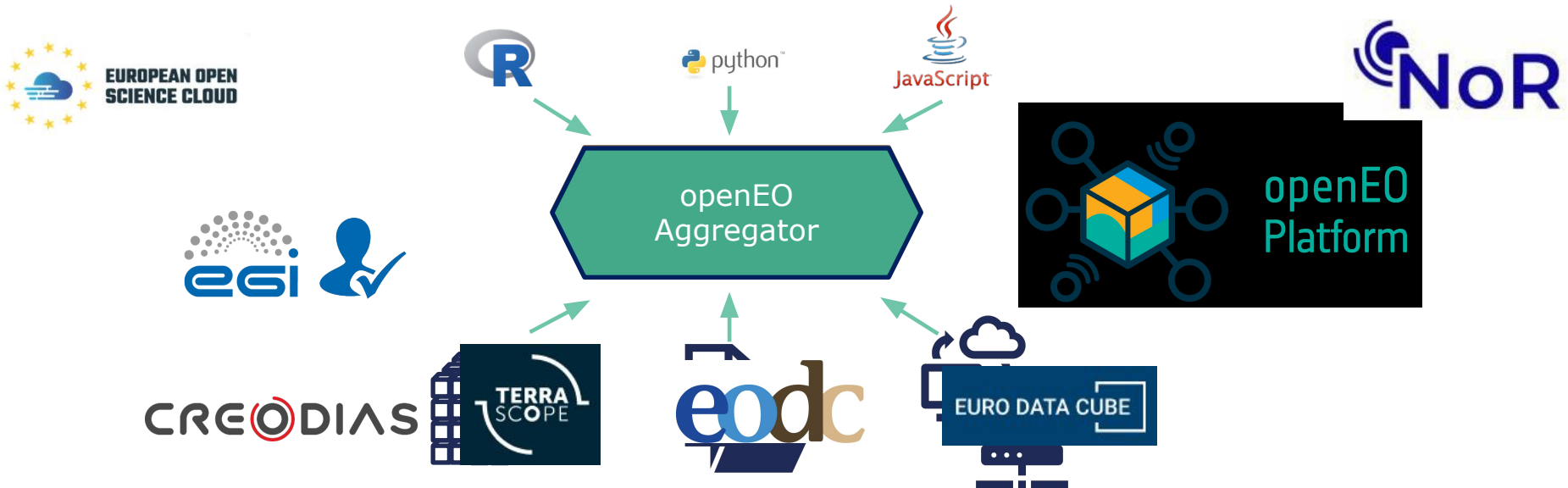


Providing transparency: Transparency of source code, scientific integrity & reproducibility, clarity & prior estimation of costing, confidentiality of IPR;



Pixel to continental scalability: pixel-level data access, scalable “building block” processes, clear roadmap for continental-global scale processing;

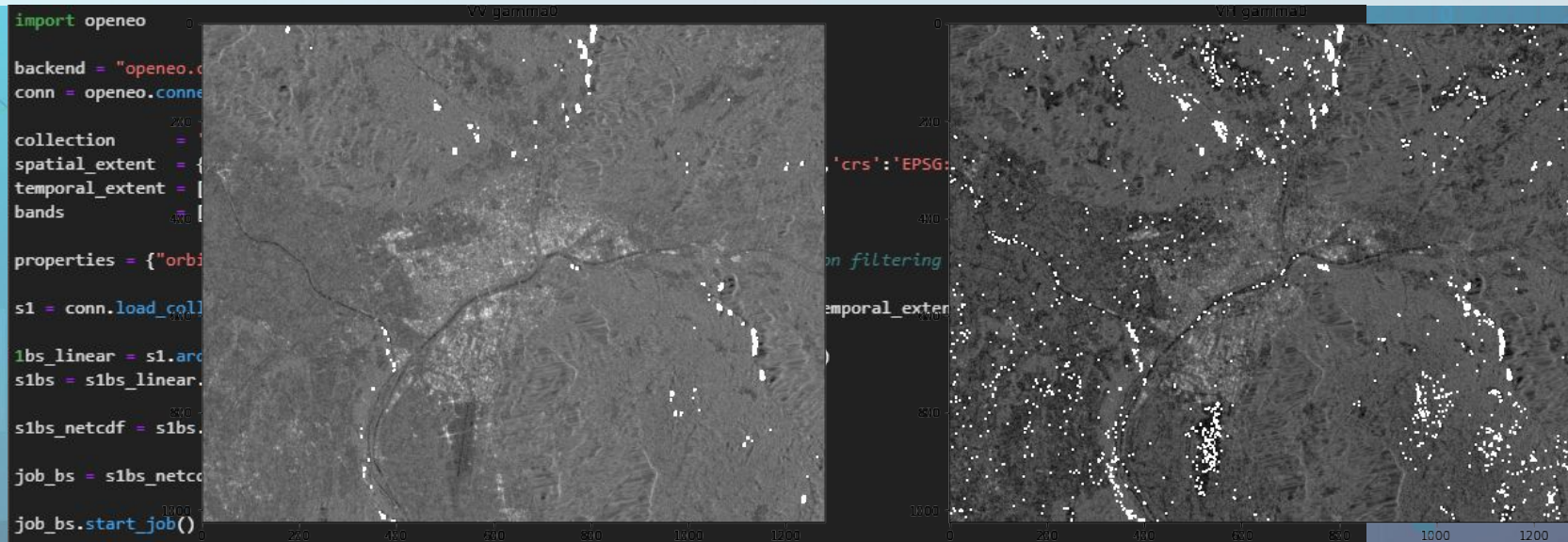
<https://openeo.cloud>



Processing of Analysis Ready Data (ARD)



- Define virtual datacube based on collection, time and area of interest
- Apply CARD4L compliant ARD processing in batch mode, to retrieve normalised backscatter

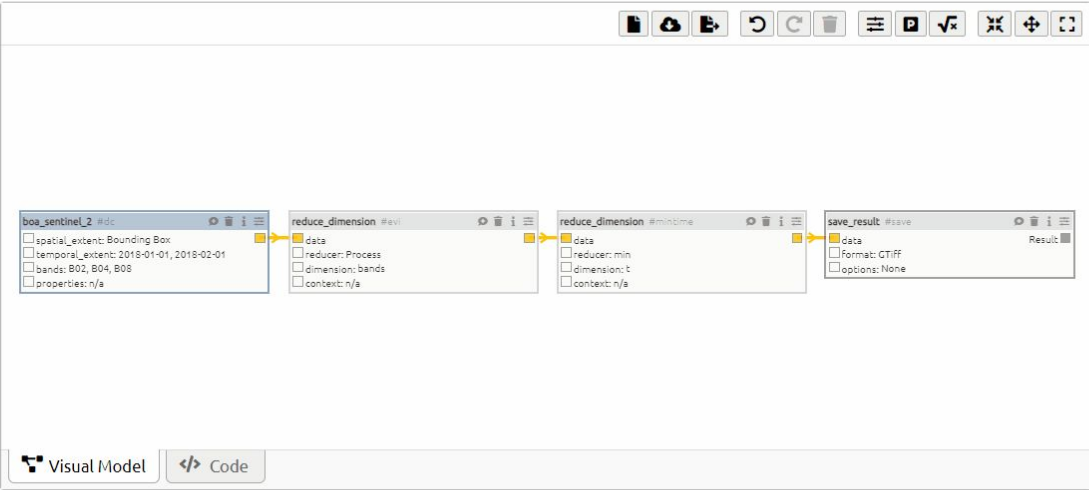


<https://ceos.org/ard/>

<https://github.com/stac-extensions/card4l>

 Search

- ▶ Collections (52)
- ▶ Processes (90)
- ▶ UDF Runtimes (2)
- ▶ Export File Formats (6)



Batch Jobs

+ Create

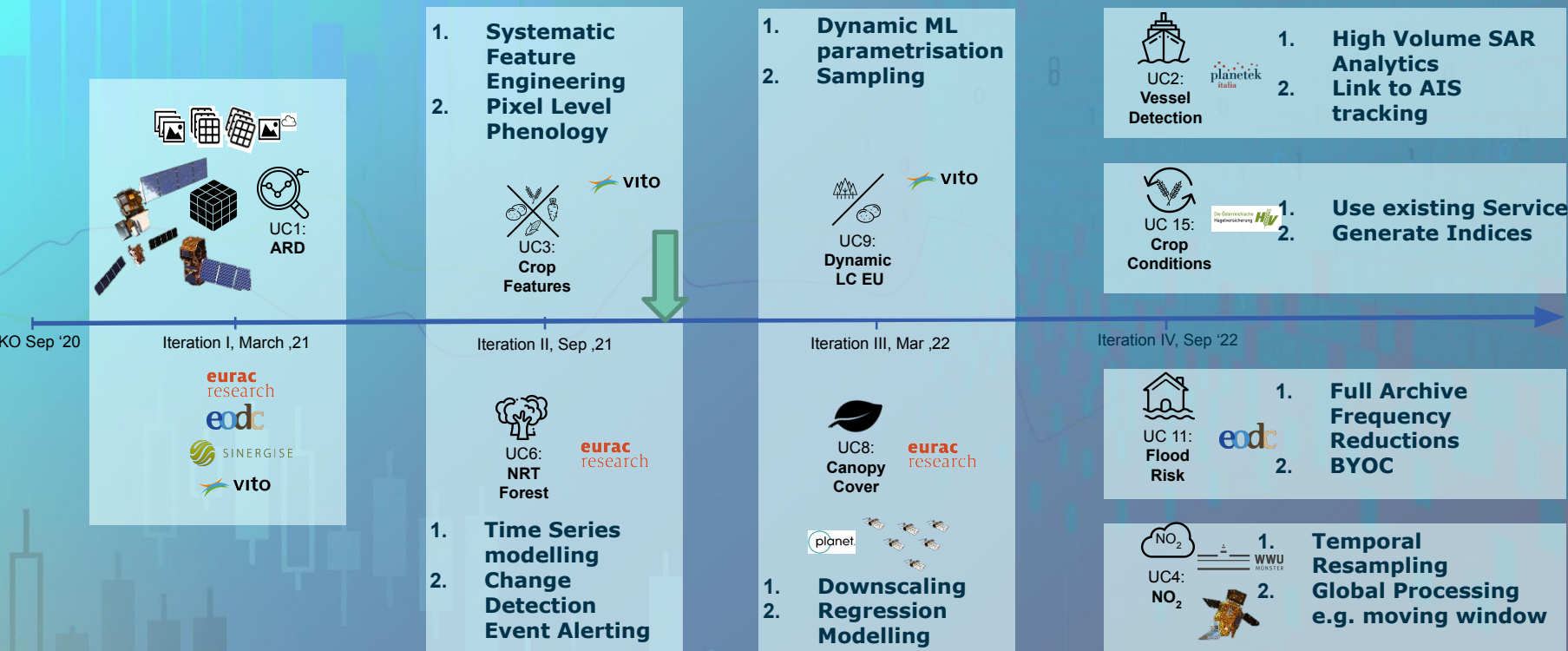
▶ Run now

 Search

Title	Status	Submitted ↓	Last update	Actions
test	created	11.5.2021, 13:44:32 UTC	n/a	   
s1^	created	10.5.2021, 10:33:09 UTC	n/a	   
#5C47AD	created	4.5.2021, 11:30:46 UTC	n/a	   
#A2E683	created	4.5.2021, 11:30:38 UTC	n/a	   
#62D524	created	4.5.2021, 10:51:52 UTC	n/a	   
test	created	4.5.2021, 10:51:18 UTC	n/a	   



Roadmap and use cases



The Early Adopter Community



"Feedback is worth a lot – be part of the community"

Website:



- openeo.cloud

Engage:



- Early Adopter registration: <https://openeo.cloud/early-adopters/>
- Twitter: @openEO_Platform
- <https://forums.openeo.cloud>



Contact Point:

- openeo-platform@eodc.eu