openEO Platform – Basic Training – 27th September 2022

Dr. Benjamin Schumacher (EODC)

Agenda

Morning 09:00 – 12:00 CEST

09:00 – 10:00 Welcome + presentation about the working principles of openEO

10:00 – 10:15 Coffee break

10:15 – 11:00 Demonstration of Python client, R client, Webeditor and JupyterLab

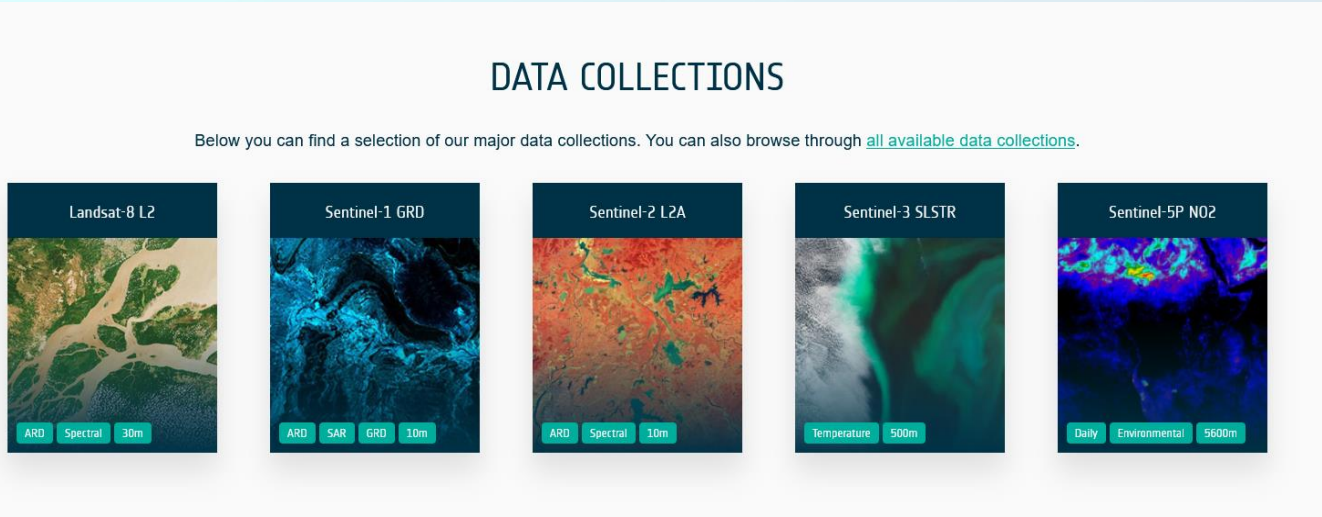
11:00 – 11:15 Coffee break

11:15 – 12:00 Login Procedure, Sign-Up, Documentation, User Forum, Summary & Questions

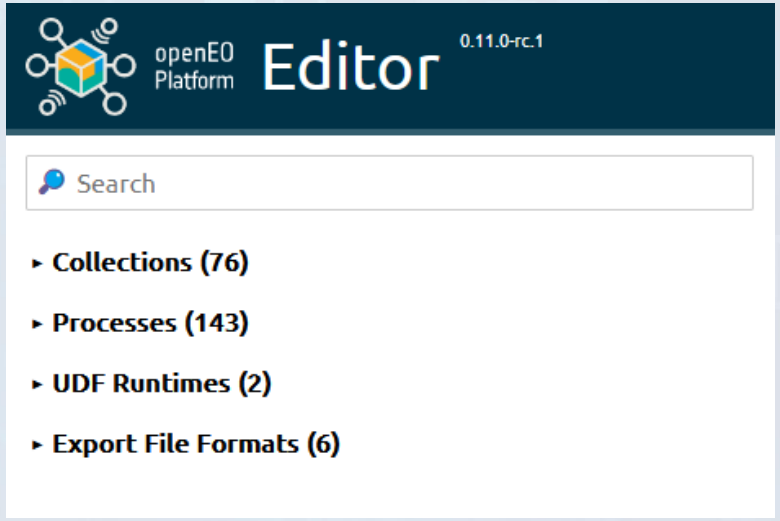
What programming / EO experience do you have?

https://forms.office.com/r/MGbywT4TbT

What is openEO Platform?



-> openEO Platform provides intuitive programming libraries to process a wide variety of Earth Observation datasets.



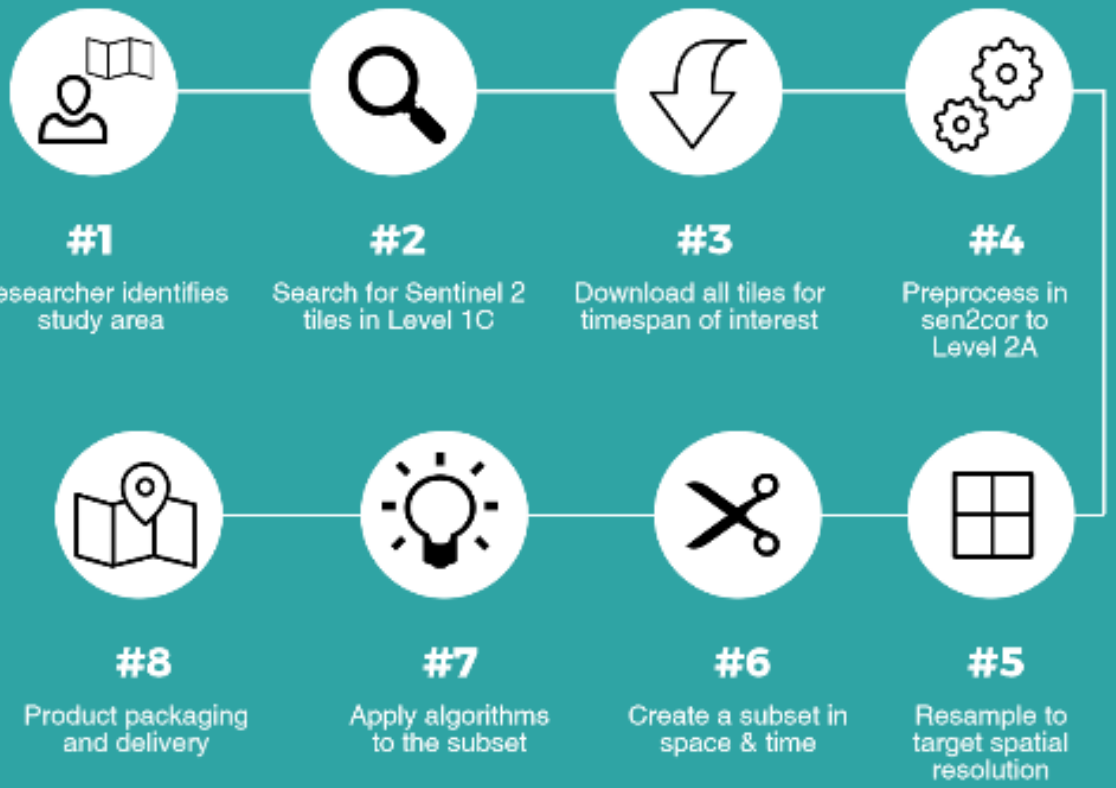
-> Run your earth observation analysis on our federated infrastructure!

Why do we need openEO?
The Data Management Burden…

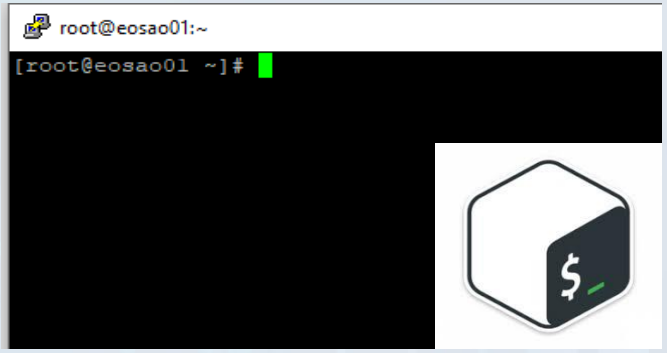
openEO Platform

esa

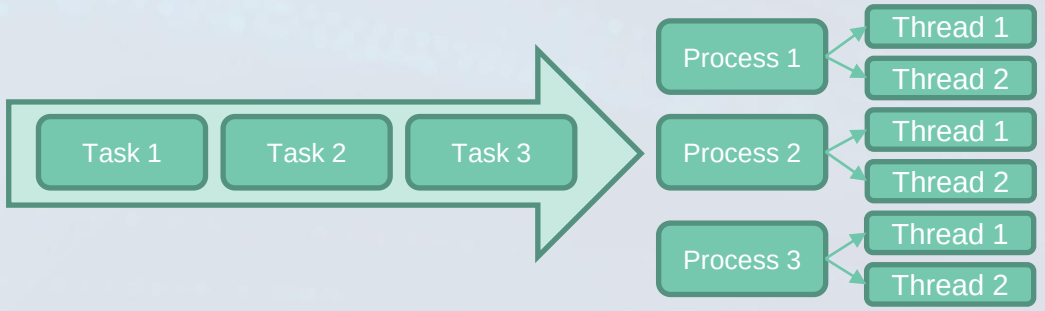
Traditional remote sensing product process for Sentinel-2



Credits: H. Kristen – ESA open Science 2017

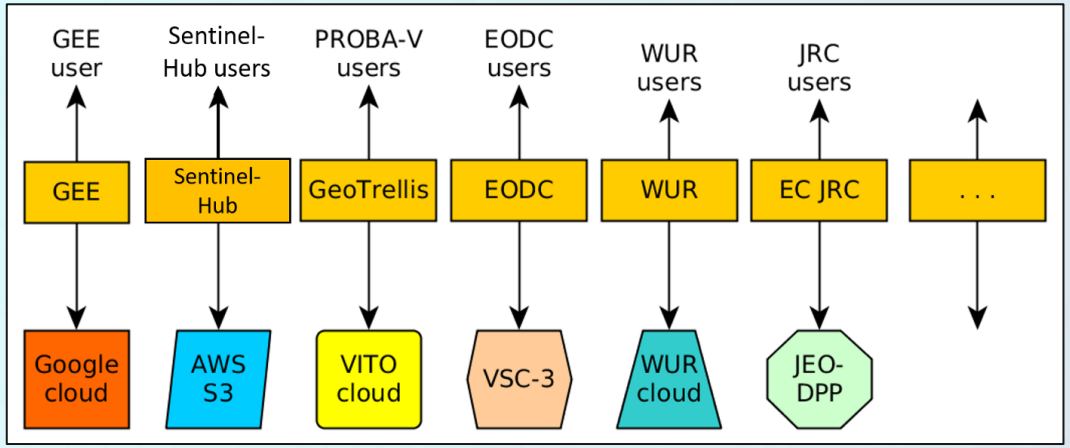


Allocated CPU	Allocated MEM	Status
8200 / 9600 (85%)	520GB / 1007.3GB (52%)	ON
4700 / 5600 (84%)	444GB / 503.6GB (88%)	ON
5200 / 5600 (93%)	358GB / 503.6GB (71%)	ON

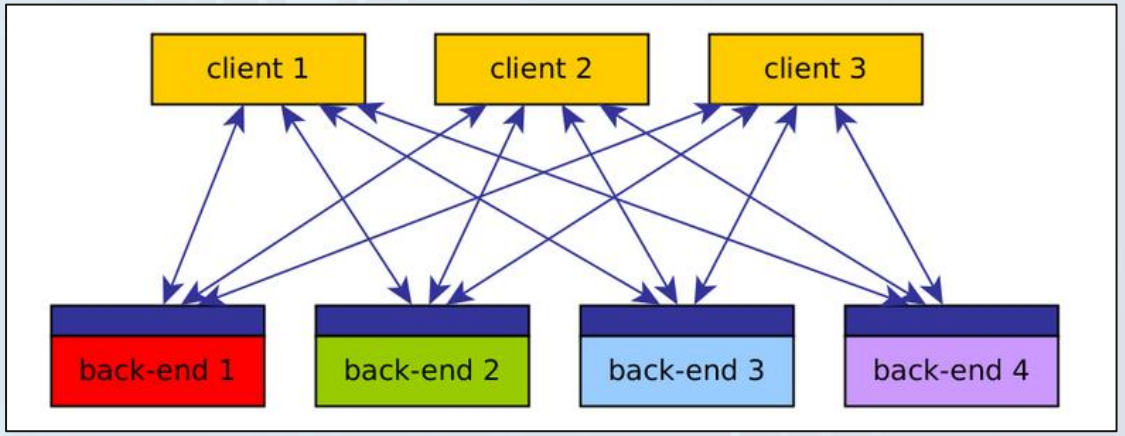


How does it work?

Situation before openEO:

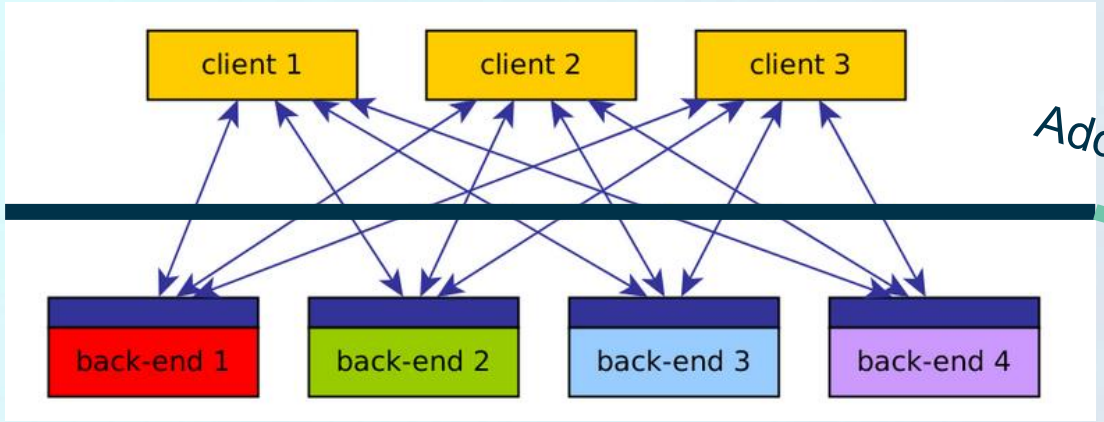


openEO API:



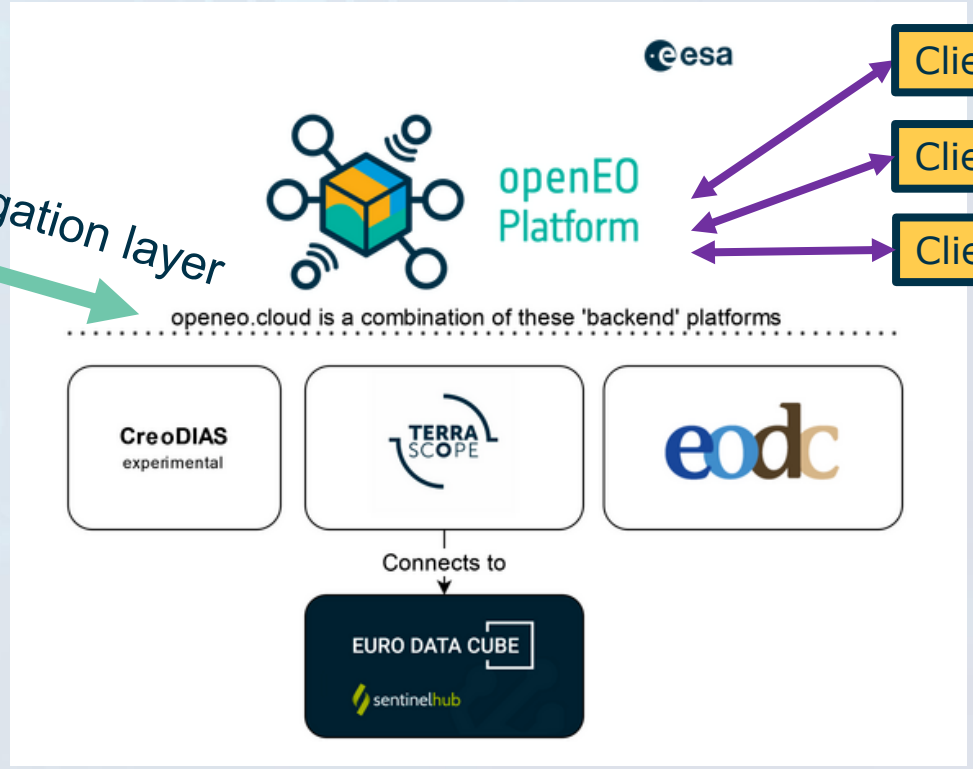
How does it work?

openEO API:

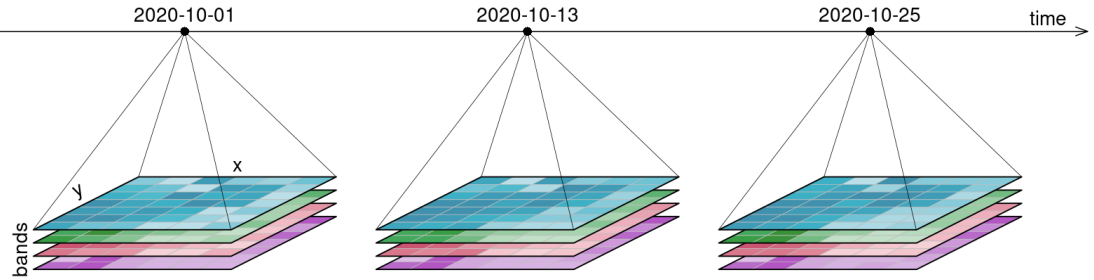


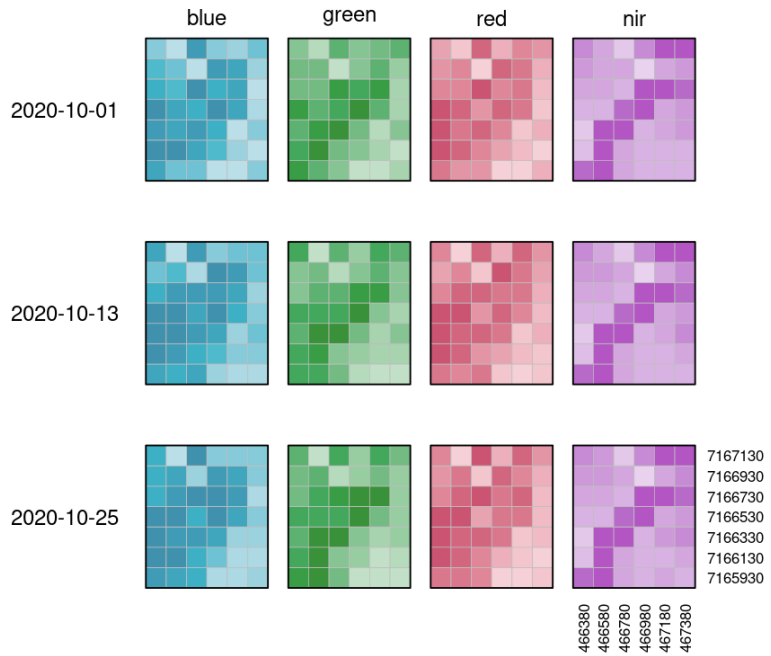
Added aggregation layer

openEO Platform:



Concepts of openEO - Datacubes



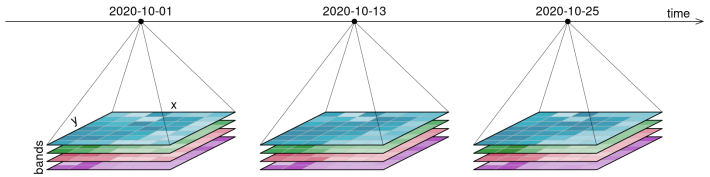


-> multidimensional arrays with one or more spatial or temporal dimension

-> Data in OpenEO is represented in this way

-> Any representation of the data cube is fine (meaning – dimensions can be switched in display)

Concepts of openEO – Datacubes - Dimensions



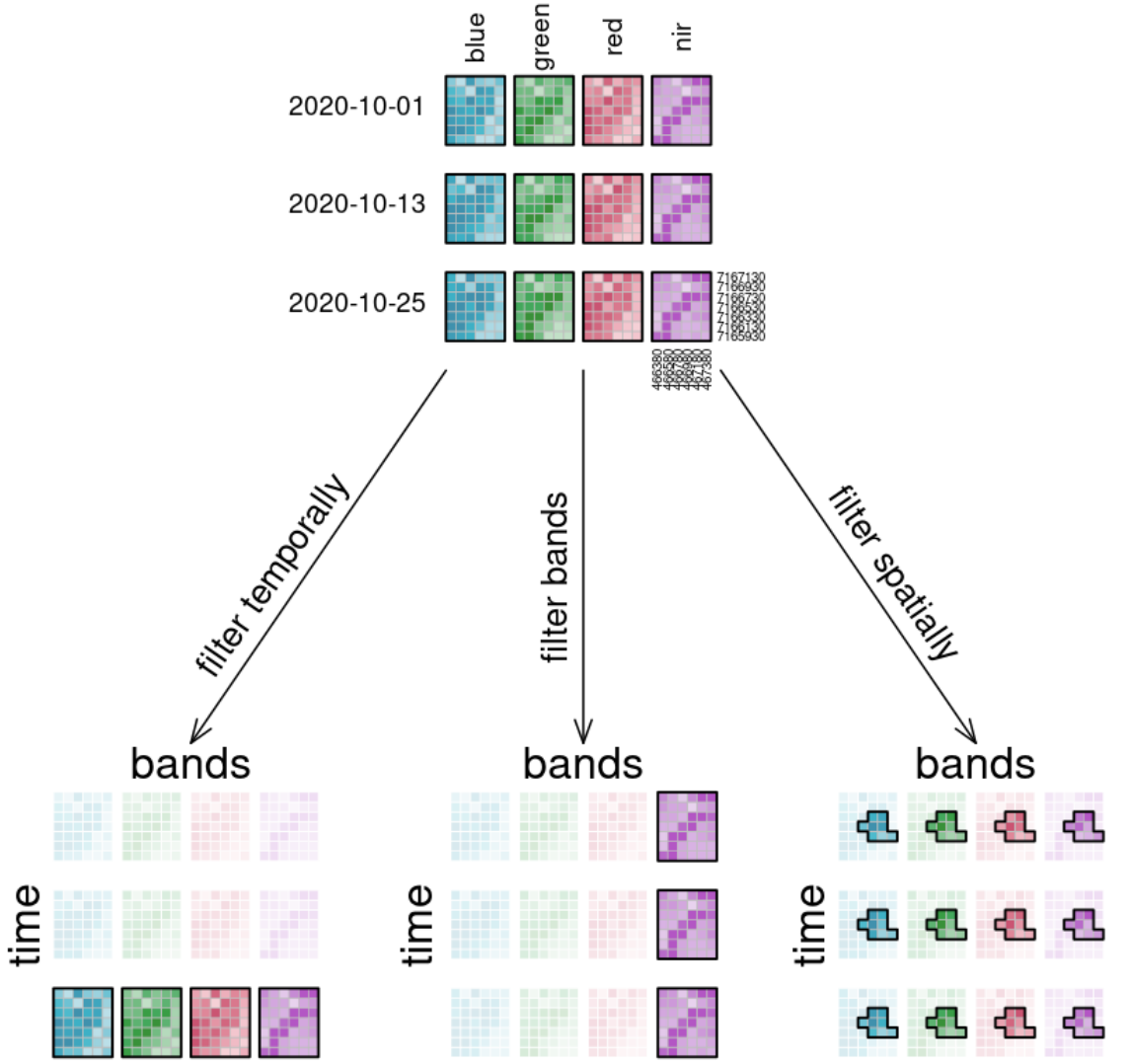
#	dimension name	dimension labels	resolution
1	`x`	`466380` , `466580` , `466780` , `466980` , `467180` , `467380`	10m
2	`y`	`7167130` , `7166930` , `7166730` , `7166530` , `7166330` , `7166130` , `7165930`	10m
3	`bands`	`blue` , `green` , `red` , `nir`	4 bands
4	`t`	`2020-10-01` , `2020-10-13` , `2020-10-25`	12 days

Properties:

- **name**
- **axis / number**
- **type (spatial/temporal/bands/other)**
- **extents or nominal dimension labels**
- **reference system / projections**
- **resolution**

-> be careful with dimensions and your coordinate reference system – location x,y change in different CRS
-> be carful with changing data types of dimensions – do this only if the backend supports it

Concepts of openEO – Datacubes - Filters



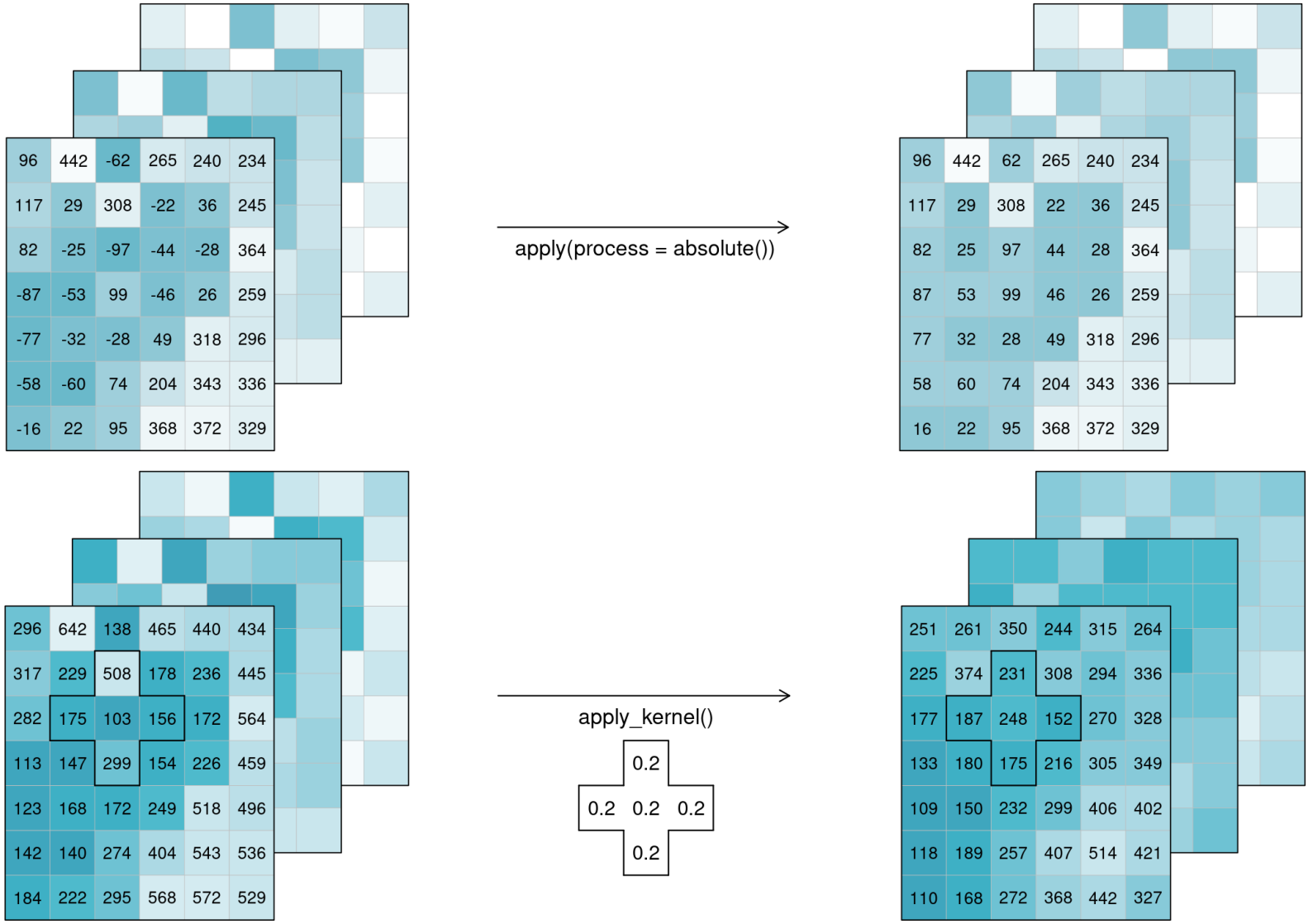
Filters:

- **Filter temporal**
- **Filter bands**
- **Filter spatial**

-> Data that satisfy the condition is returned

-> Datacube becomes smaller (selection process)

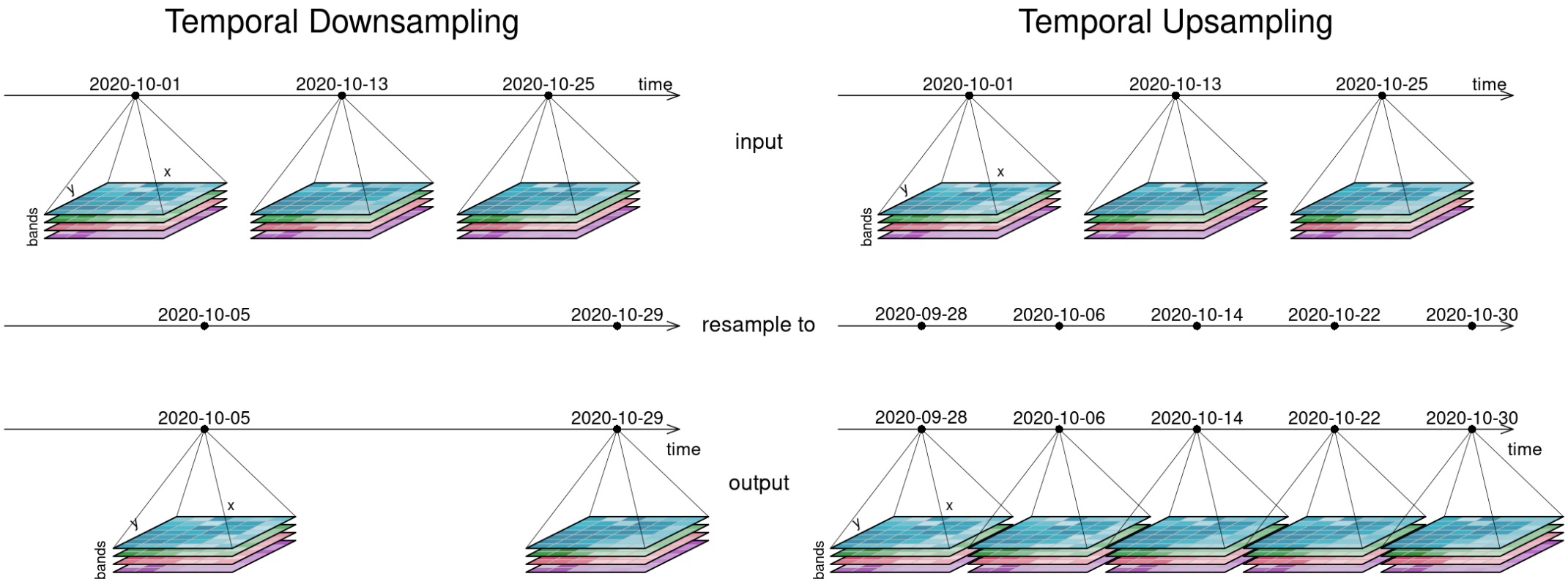
Concepts of openEO – Datacubes - Apply



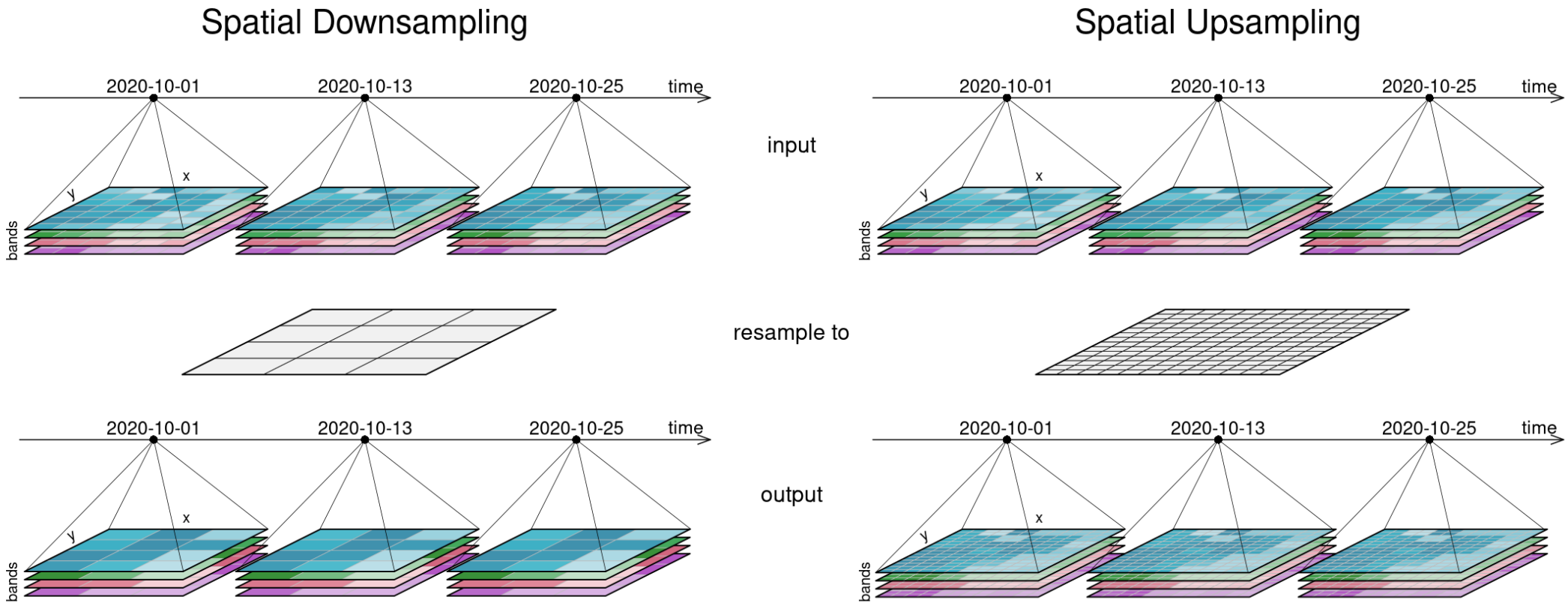
Data manipulation:

- absolute
- Kernels
- Neighborhoods
- Temporal smoothing
- Spatial smoothing

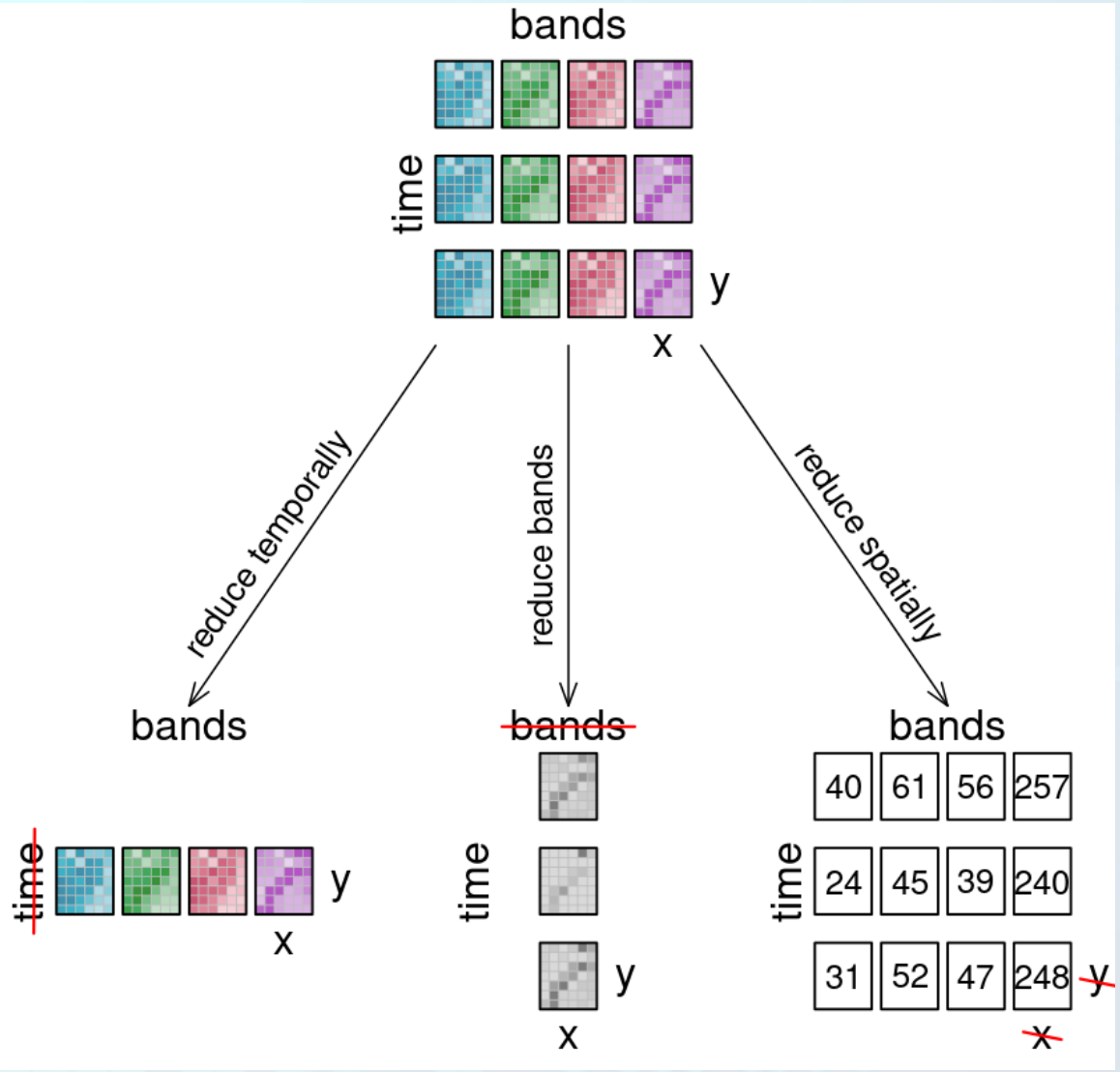
Concepts of openEO – Datacubes - Resample



Concepts of openEO – Datacubes - Resample



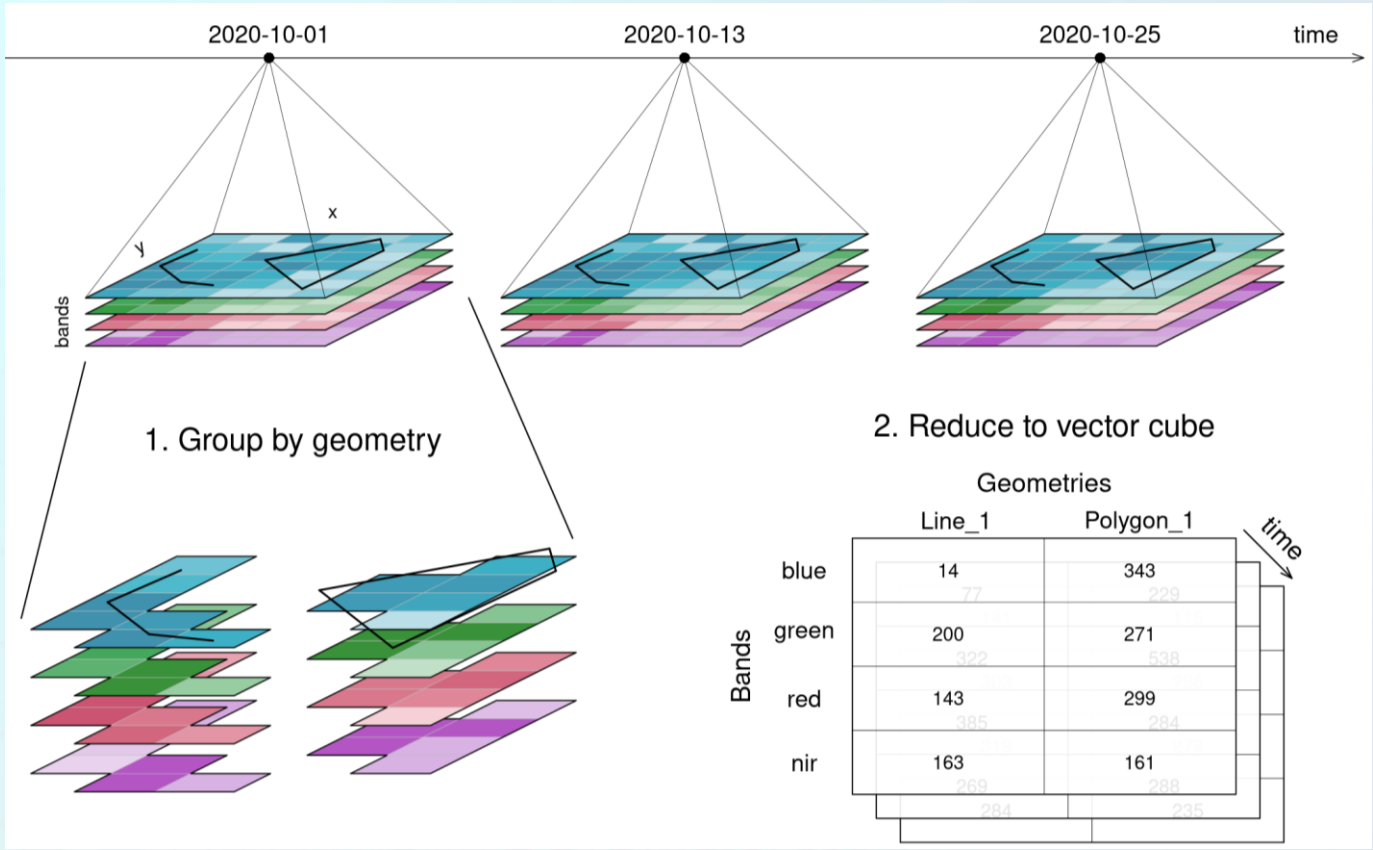
Concepts of openEO – Datacubes - Reduce



Reduce dimension:

- **Collapses one dimension and calculates a single result**
- **Reduce function (e.g. mean, max, min, median…)**

Concepts of openEO – Datacubes - Aggregate



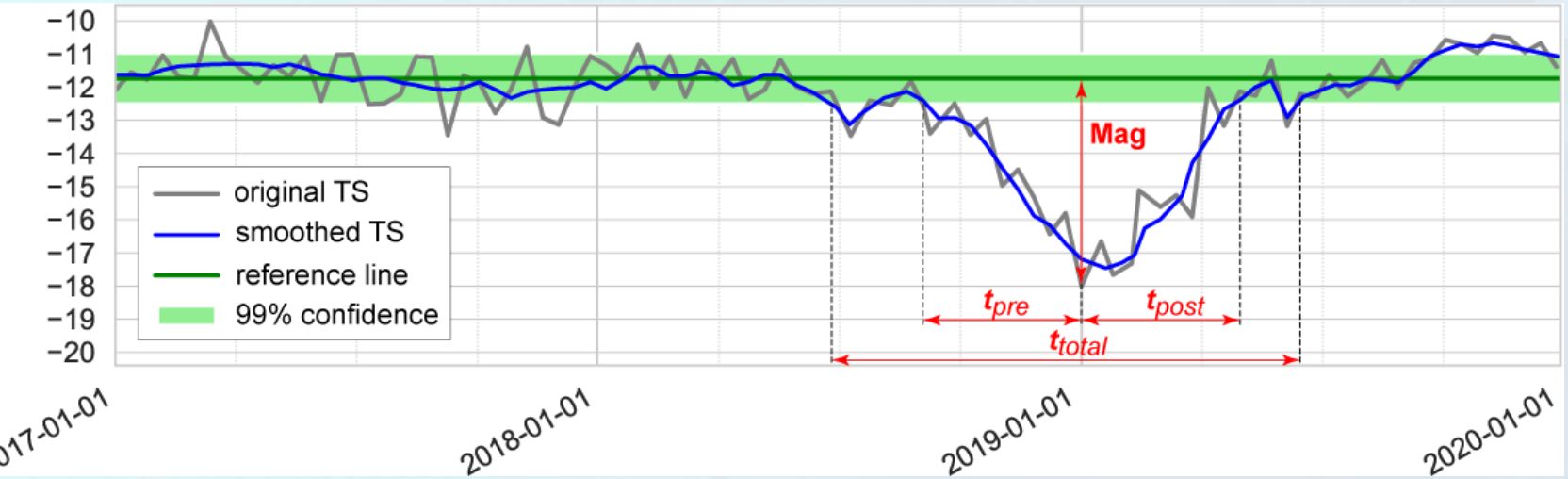
Aggregate Spatial / Temporal:

- **Groups over time or geometry and collapses similarly to reduce to a single outcome**

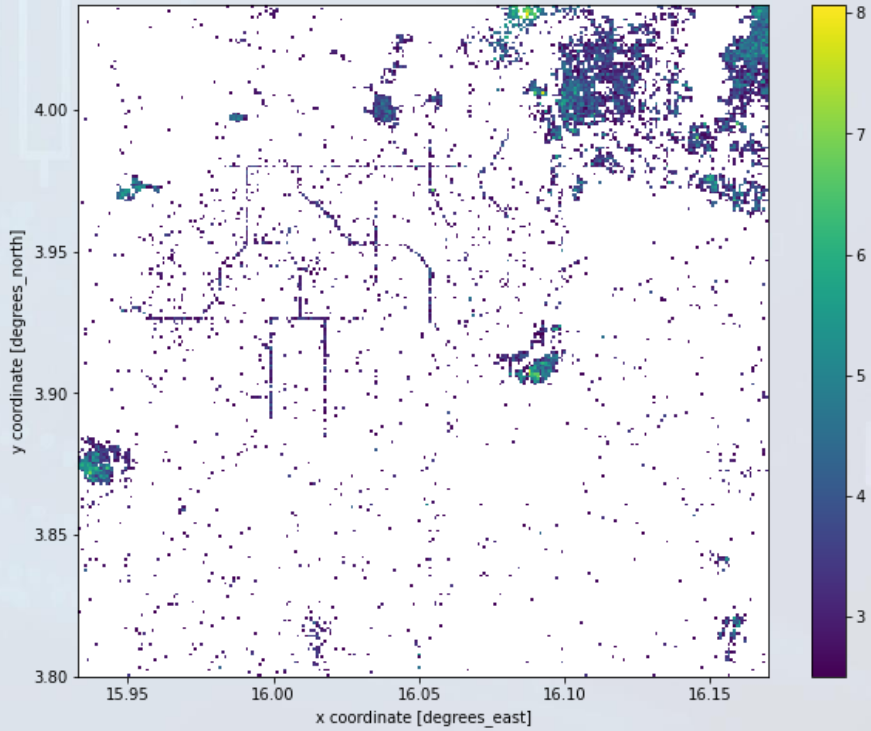
“Use Cases” from the community

Selective Logging Sites in the Central African Rep.

Methodology: Sentinel-1 Signal Disturbance Features

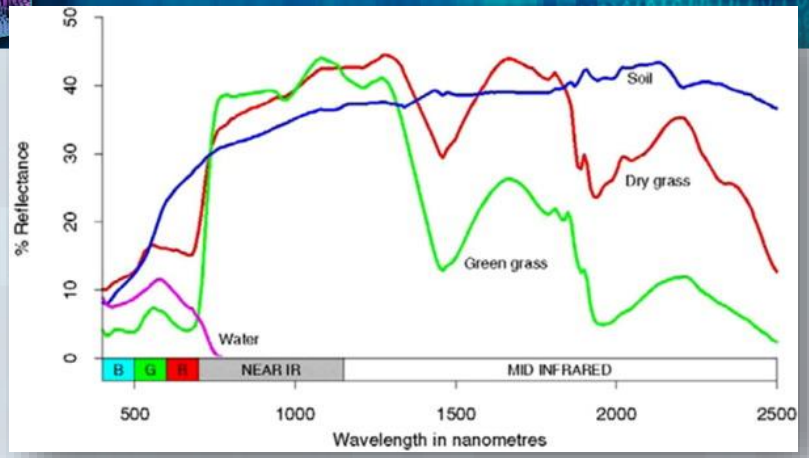


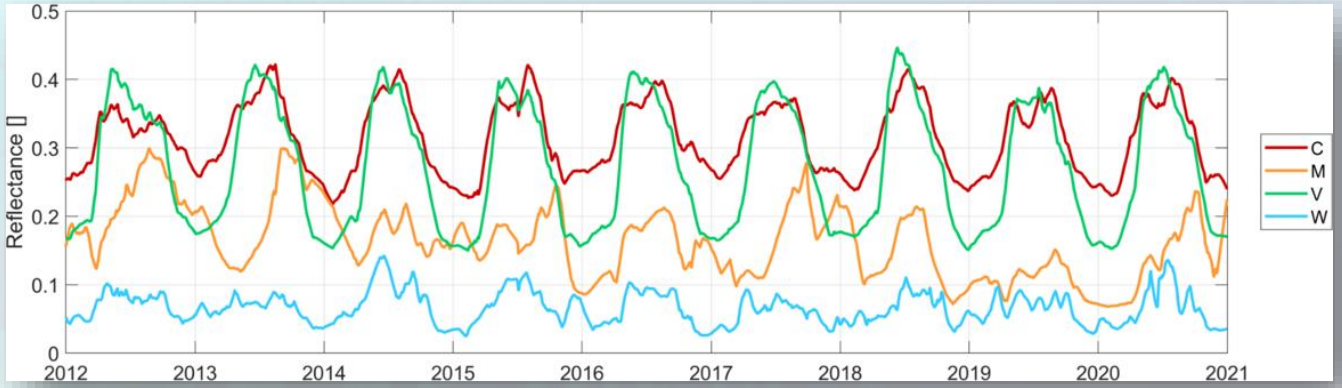
Disturbance Magnitude > 2.5 (dB)

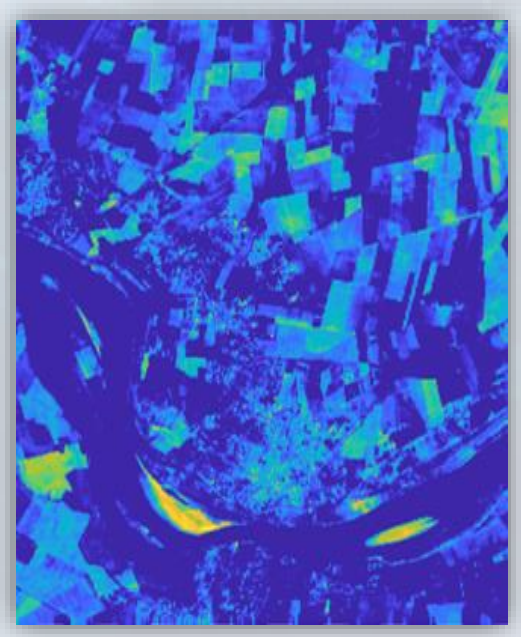


“Use Cases” from the community

River discharge from Sentinel 2 imagery

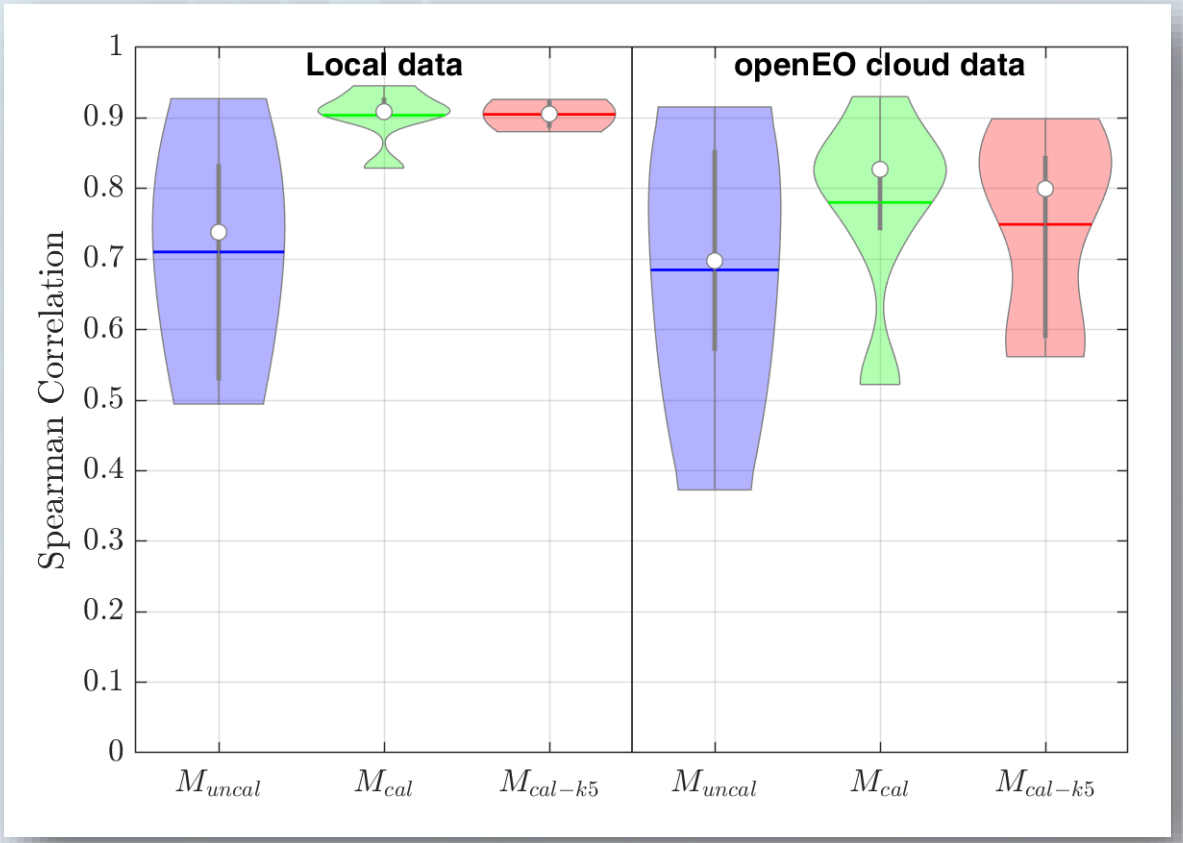






“Use Cases” from the community

- Po (Italy): 2 stations
- Rhein (Germany): 2 stations
- Mississippi (USA): 2 stations



Active User Community

Masked Sentinel 2 standard deviation

openEO Platform python

paolo.filippucci openEO Platform Early Adopter

Hi, I have a question regarding the calculation of the reflectance standard deviation working with spyder, but the standard deviation I obtain with the function "sd" is I obtain by downloading them. Is there any problem with the NaN ingestion?
I paste below the code I'm using.

```
import openeo
from openeo.processes import is_nan,
import numpy as np
```

Issue with spatial mean operation

openEO Platform python

paolo.filippucci openEO Platform Early Adopter 21g

Hi,
I wanted to extract the spatial average of a cloud-masked Sentinel-2 datacube, and I noticed several issues. I decided to report them below for your knowledge:

1. When the average is downloaded as csv file, the obtained values need to be sorted, since the time variable is not consecutive
2. if the average is operated through the instruction **datacube.aggregate_spatial(rect, lambda pixels:** ts with both netcdf and csv, while **ect, "mean")** just the csv file can

formed externally by downloading

Which is the right function to apply sd

openEO Platform python

paolo.filippucci openEO Platform Early Adopter 21g

Hi
I am trying to calculate the temporal standard deviation of the NIR reflectance from Sentinel-2, in order to use the obtained product to create a mask. I have found two ways to do so:
The operation:

imension='t')

.dimension='t')

move the time dimension after the calculation and ension" operation after this one, but when I tried to cide:

0.35

Which one is the function to be used?

Issue with masking procedure

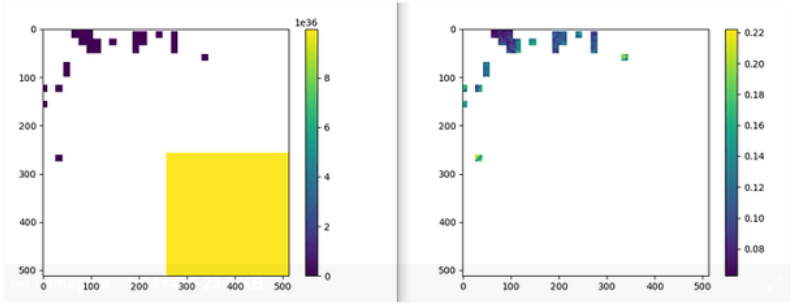
openEO Platform python

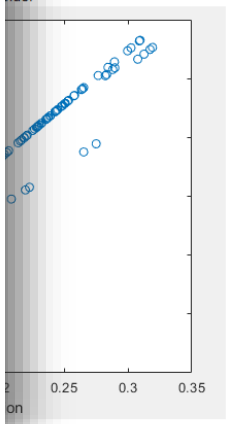
paolo.filippucci openEO Platform Early Adopter 2g

Hi everyone,

I need to apply a kernel to a Sentinel-2 dataset and to mask the clouds. I applied all the operation, but it seems that there is an issue on masking the dataset after the kernel application.

This is my code:





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Last Updated: 8 Jun 2022 20:10

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jeroen.dries Jeroen Dries openEO Platform Developer	7	0	1	18	19	129	20
paolo.filippucci Paolo Filippucci openEO Platform Early Adopter	1	0	2	18	16	119	14
m.mohr Matthias Mohr openEO Platform Developer	7	13	1	17	20	162	17
javier.martinez JAVIER MARTÍ... openEO Platform Early Adopter	2	14	4	11	10	50	8
kyr Christos;Χρήστος Kyranoud... openEO Platform Early Adopter	0	0	4	10	14	76	8
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equiros Elia Quirós openEO Platform Early Adopter	1	0	0	5	0	5	14
datascience Hendrik Wagenseil openEO Platform Early Adopter	2	2	0	4	7	40	4
lukas.weidenholzer Lukas Wei... openEO Platform Developers	1	0	1	3	12	46	7
bryanvallejo16 Bryan Vallejo openEO Platform Early Adopter	0	1	0	3	1	10	14
peterjames.zellner Peter Jame... openEO Platform Developer	1	4	1	2	9	70	9
florian.lahn Florian Lahn openEO Platform Developer	3	0	0	2	5	42	6

What is openEO?

-> Representation of your EO Analysis in a common language. The analysis can be defined in any available client package!

ANNEX - Documentation

-> https://openeo.cloud/

Documentation:
-> openEO Platform: https://docs.openeo.cloud/
-> openEO: https://openeo.org/documentation/1.0/

Questions?
-> Forum: forum.openeo.cloud

ANNEX - Registration

-> https://openeo.cloud/#plans

Follow the Step-by-Step Guide:

How to join OpenEO Platform as Early Adopter (2 Steps)

TESTING PHASE

Currently, openEO Platform is only open for Early Adopters or within a free 30 day trial period. Read more about the Early Adopters program on the information page . Read more about the 30 day trial period on the documentation page

To express your interest in becoming an Early Adopter you need to follow 2 steps:

1. Connect an existing account to EGI check-in
2. Apply to the openEO Platform virtual organization

The 2 steps are described in detail below.