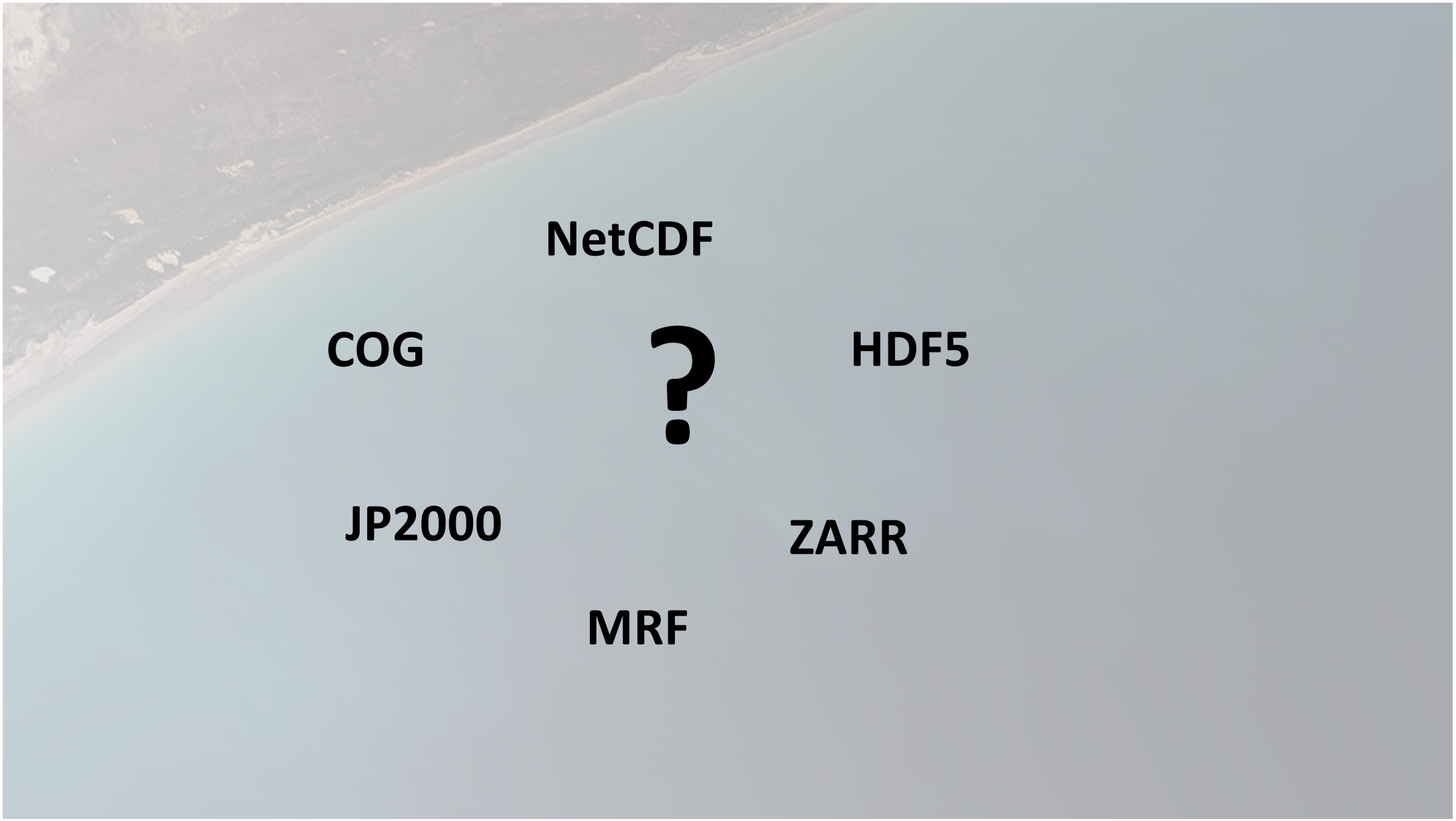
SENTINEL Hub

One Data Format to Rule Them All

Grega Milcinski

Sinergise/Sentinel Hub

grega.milcinski@sinergise.com


NetCDF
COG
?
HDF5
JP2000
ZARR
MRF

SENTINEL Hub

One Data ~~Format~~ Pattern to Rule Them All

Grega Milcinski

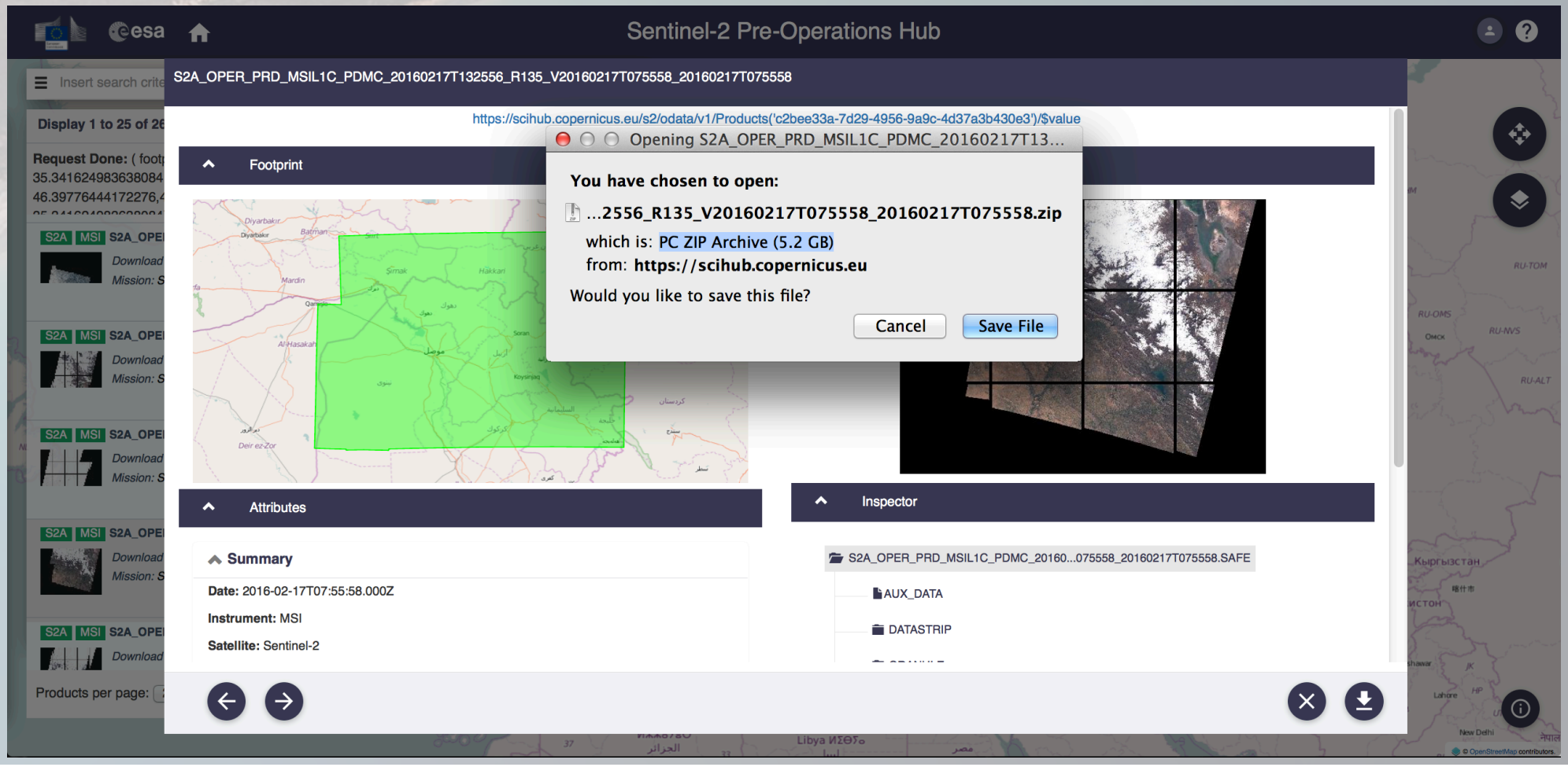
Sinergise/Sentinel Hub

grega.milcinski@sinergise.com

Optimization factors

- open-source drivers (GDAL et al)
- cloud friendly
  - storage
  - speed
  - compute costs
  - access to subset

Lessons learned – Sentinel-2



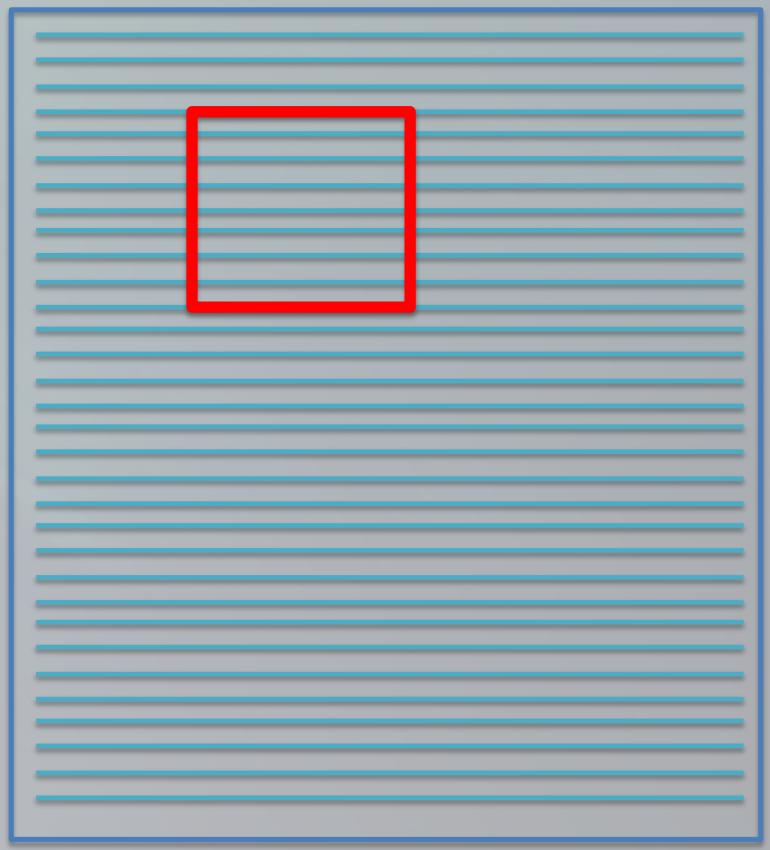
Lessons learned – Sentinel-2

- JP2000 vs. COG
- precint (min. processing size) - 2.048x2.048px vs. 256x256 px
  - (same for tiles in COG)
  - <number of requests> vs. <data transfer cost/bandwidth/speed> vs. <decompression CPU> vs. <memory needed>
- raster meta-data in raster not in XML/GML
- appropriate bit depth (SCL, CLD, SNW in 16 bit)
- SCL in COG not JP2000
- processing baseline should change whenever processing process changes
- introduction of changes only when it makes sense (GRANULES->GRANULE) and with advance notice
  - Is regression testing too much to expect?

Lessons learned – Sentinel-1 GRD

- It is GeoTiff!

- No internal tiling
- No overview files
- Header position at EOF



When ZIPs do make sense

- Replication of archives (1 week/month rolling archive)
- Sentinel-1 SLC et al

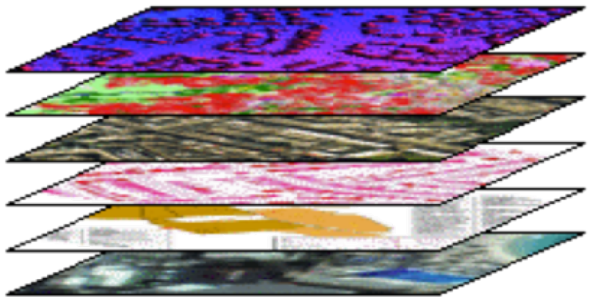
Analysis ready data

- Which projection to use?
- Which processing parameters to use?
- Which digital elevation model to use?

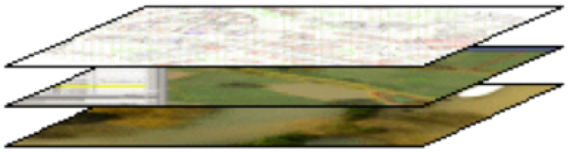
- Who will pay for processing and storage?

- When moving to cloud, only perform compute-intensive steps, which benefit vast majority of users and do not impact the quality

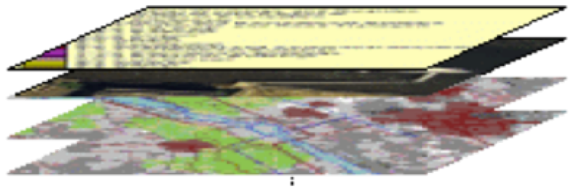
Sentinel-1, Sentinel-2 @ AWS EU-1



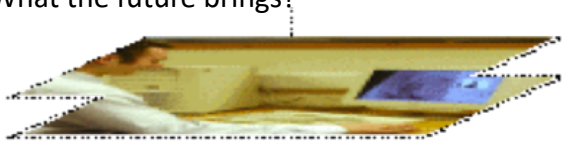
Landsat, MODIS @ AWS US-West



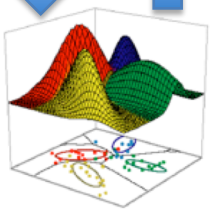
User data in COG, data on DIAS-es, ...



What the future brings?



SENTINEL Hub



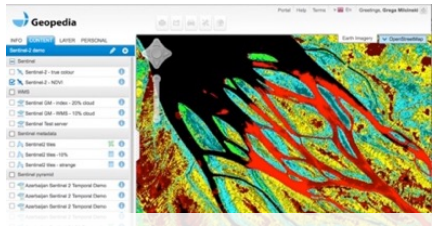
Machine learning

WMTS

WMS

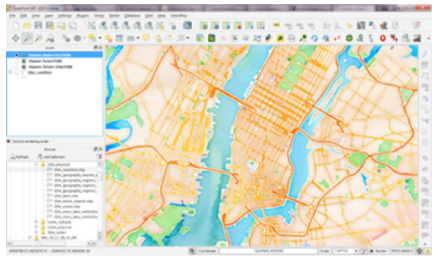
WCS

API



Cloud GIS

Web / Mobile apps



Desktop (QGIS,, ArcGIS...)

Scripting (R, Python, ENVI...)

https://services.sentinel-hub.com/ogc/wcs/<INSTANCE>?SERVICE=WCS&REQUEST=GetCoverage
&COVERAGE=1_VV_ORTHORECTIFIED
&TIME=2018-07-17/2018-07-17
&BBOX=15.28815,107.07000,14.75496,106.09153
&RESX=20m&RESY=20m
&FORMAT=image/tiff&SRS=EPSG:4326

No worries about download, storage, decoding,
stitching scenes, reprojection, scaling, mosaicking,
meta-data parsing, backscatter calibration, orthorectification ...

Processing options

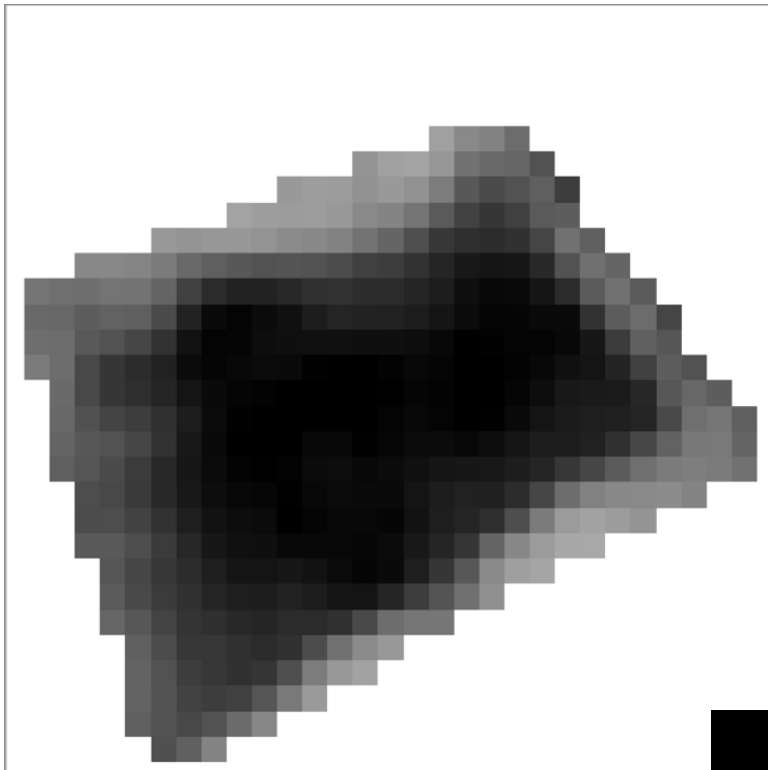
- Pre-defined product (true color, false color, etc.)
- Custom band combination

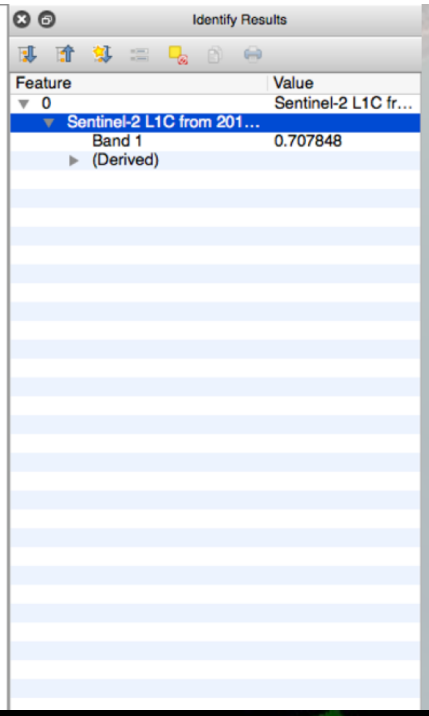
```
return [2.5*B08, 2.5*B04, 2.5*B03];
```

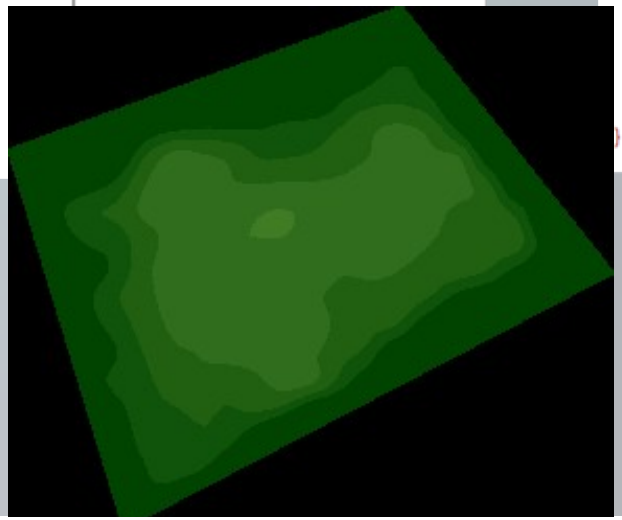
- Various indices

```
var val = (B08-B04)/(B08+B04);
return [val];
```

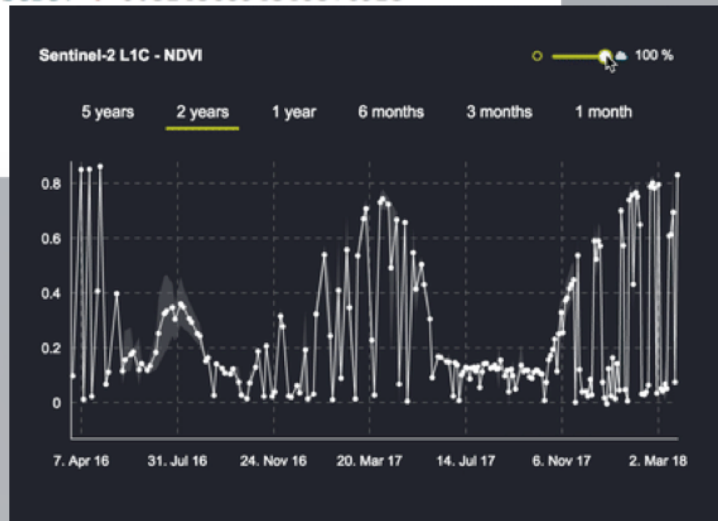
- More complex algorithms
  - LAI, FAPAR – (basic) neural networks
  - https://github.com/sentinel-hub/custom-scripts/blob/master/sentinel-2/lai/script.js
- https://github.com/sentinel-hub/custom-scripts/
- Ortorectification







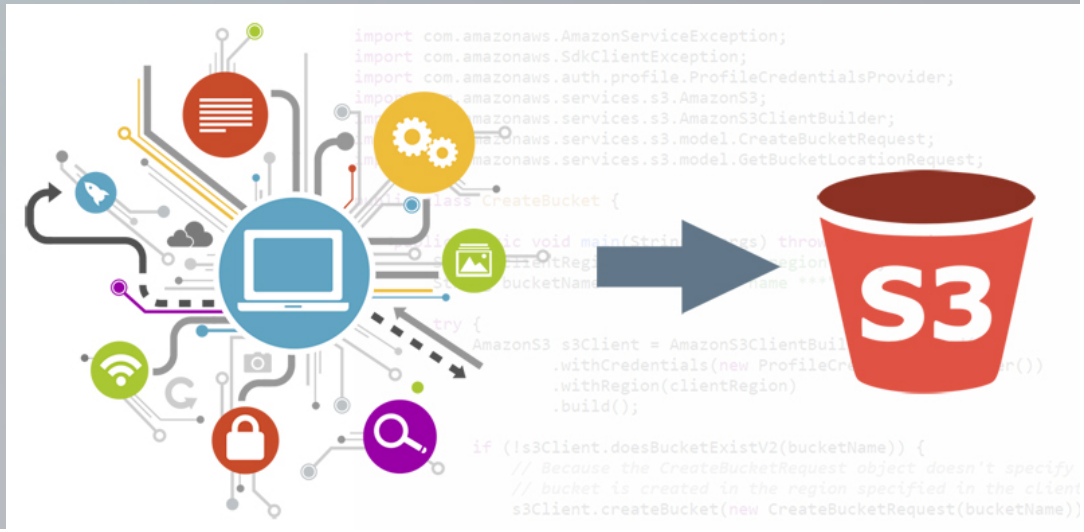

```
{
  "NDVI": [
    {
      "date": "2015-08-30",
      "basicStats": {
        "min": -0.5478424429893494,
        "max": 0.7815912365913391,
        "mean": 0.147320137875888,
        "stDev": 0.35443419609590726
      }
    },
    {
      "date": "2015-07-11",
      "basicStats": {
        "min": -0.5127978920936584,
        "max": 0.8115044236183167,
        "mean": 0.20168528533031557,
        "stDev": 0.31436594348376923
      }
    }
  ]
}
```

Bring your own data to Sentinel Hub

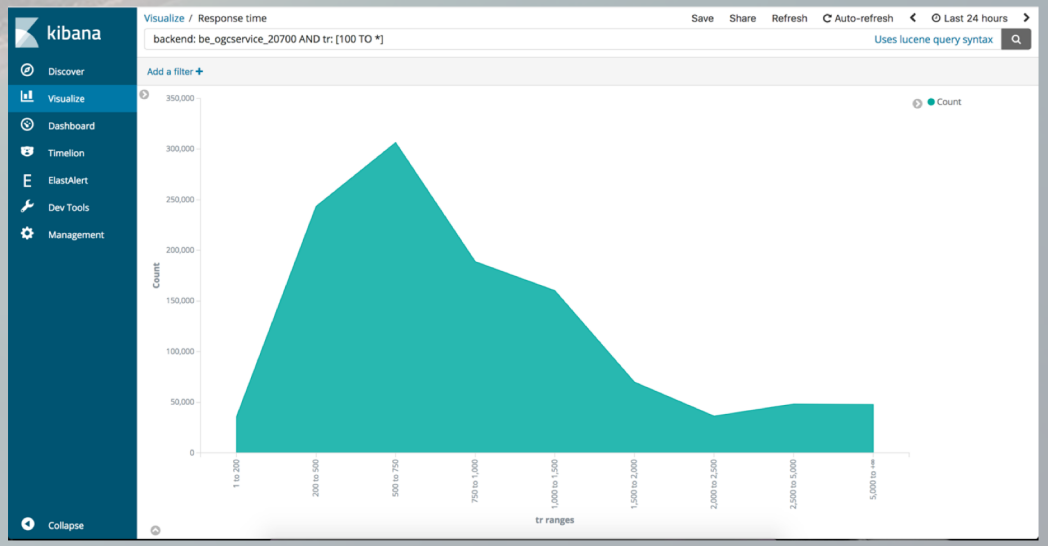
- Self-serve for raster data in COG (and ZARR in a few months)
- Data residing on AWS, Mundi, CreoDIAS
- Full Sentinel Hub functionality
- Data remain under your control

- Satellite imagery
- Derived products



For naysayers

- Yeah, but this is slow.



- Yeah, but this is expensive.

	GET STARTED	INDIVIDUAL NON-COMMERCIAL USE	INDIVIDUAL COMMERCIAL USE	APP DEVELOPERS & ENTERPRISE
Price	**0** €	**13.59** € / month (billed as **163.11 € / year,** + VAT)	**83.25** € / month (billed as **999.00 € / year,** + VAT)	from **500** € / month **(Click for details)**
APP DEVELOPERS & ENTERPRISE				
Enterprise package - basic	**500** € / month (**5.000** € / year, **17 % discount**)	**200.000** processing units / month		
Enterprise package - enlarged	**1.000** € / month (**10.000** € / year, **17 % discount**)	**500.000** processing units / month		
Reserved capacity package 10	**2.000** € / month	**10** proc. unit / second (5 million processing units per month, unspent carried on up to 50 million)		
Reserved capacity package 20	**3.000** € / month	**20** proc. unit / second (10 million processing units per month, unspent carried on up to 100 million)		

Wishlist for Santa

- USGS to move Landsat 5 to AWS
- Move entire production to the cloud and provide access to intermediate steps
- Status dashboard

- Handle the process as an operational, not a research one

More info

- http://sentinel-hub.com/
- http://apps.sentinel-hub.com/eo-browser/
- https://sentinel-hub.github.io/custom-scripts/
- https://github.com/sentinel-hub/eo-learn
- https://education.sentinel-hub.com

Thanks

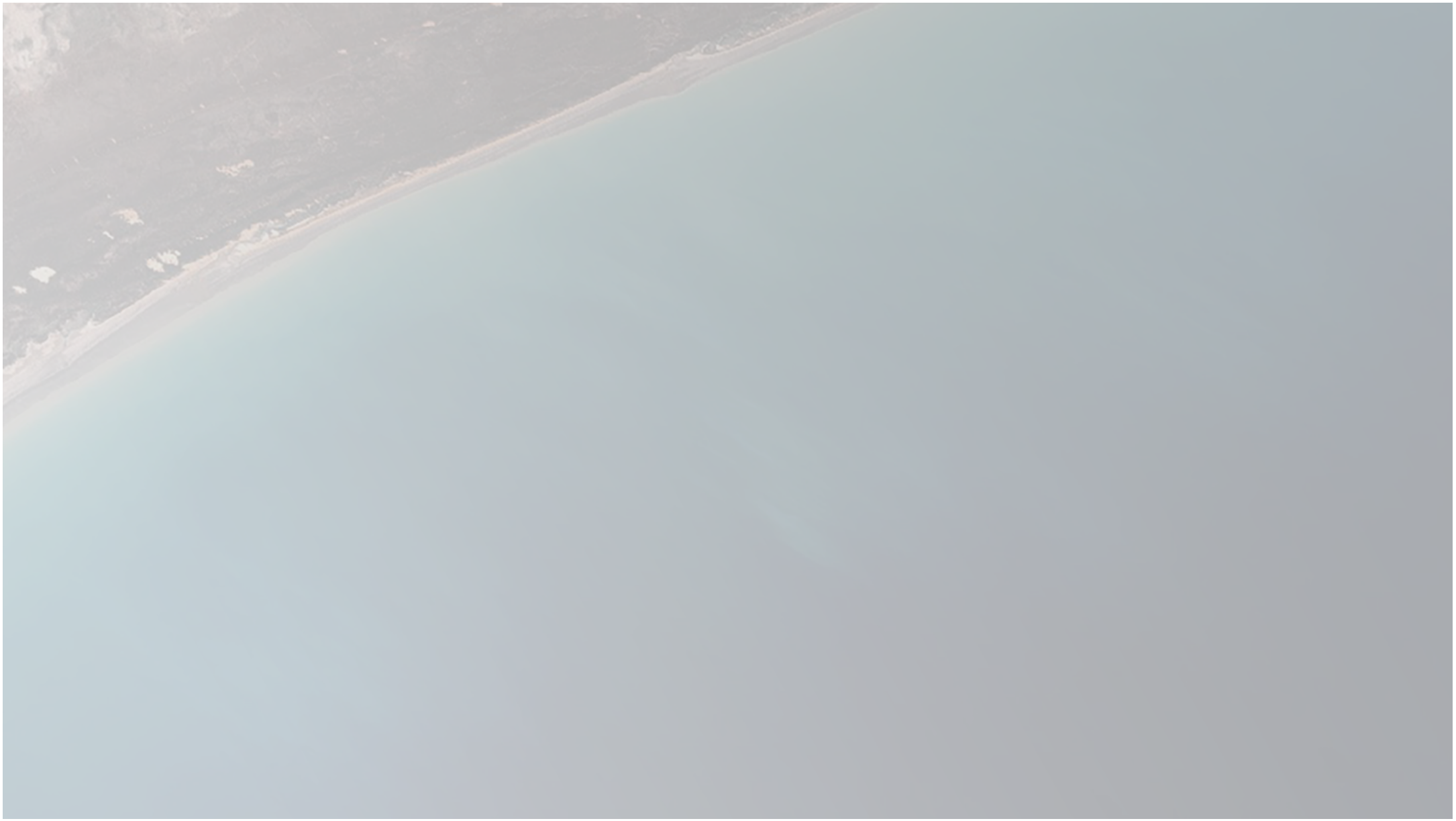
esa

Copernicus
Europe's eyes on Earth

USGS
science for a changing world

Funded by the H2020
Framework Programme
of the European Union

amazon
web services

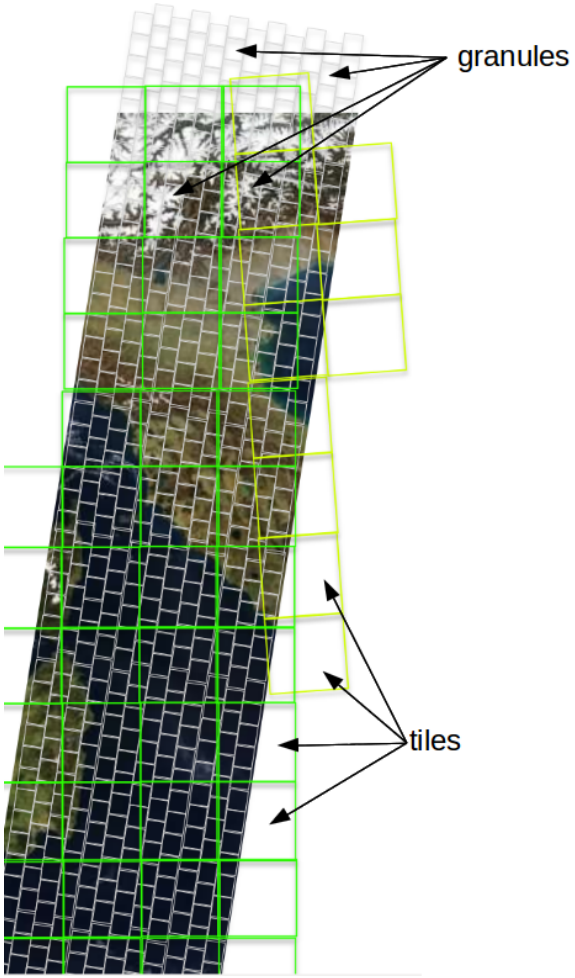


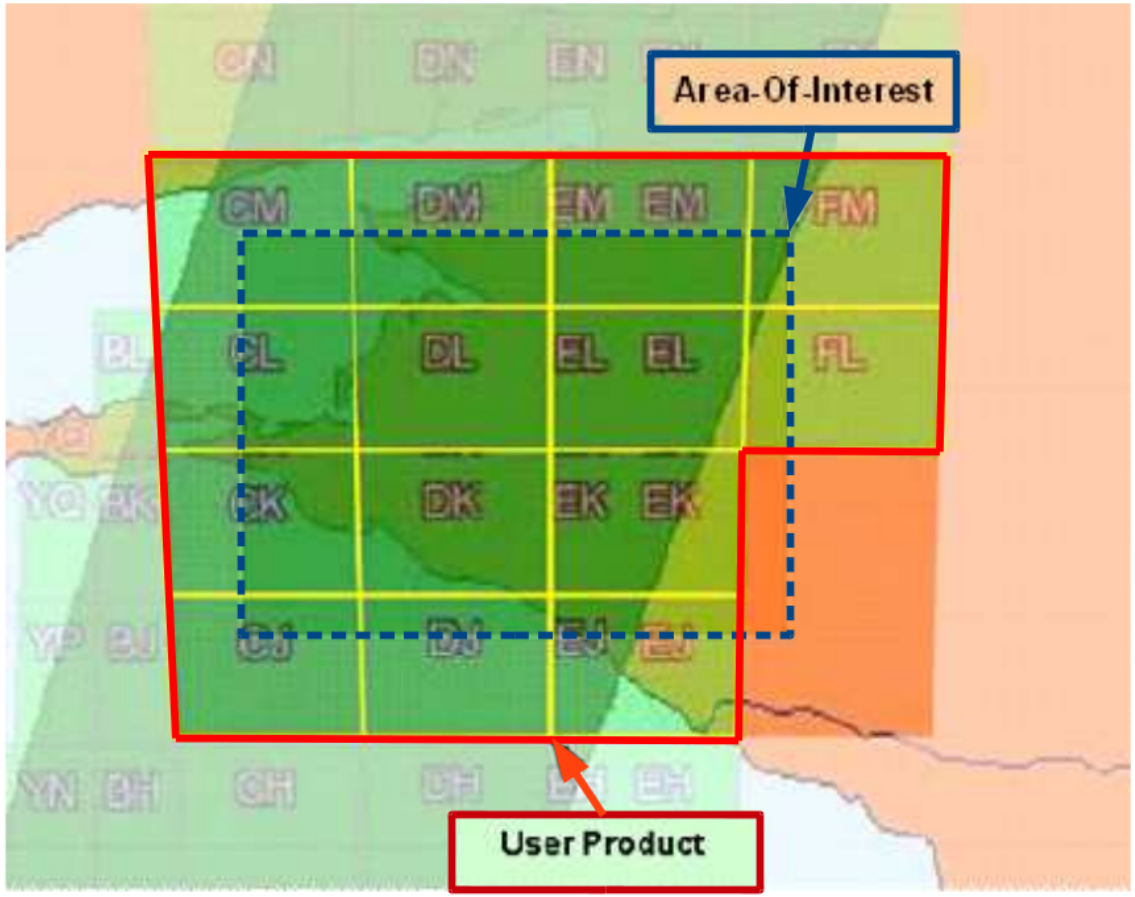
A few years ago…

ENVI, ArcGIS and alike can open any file.

Climate scientists play with NetCDF

Lessons learned – Sentinel-2





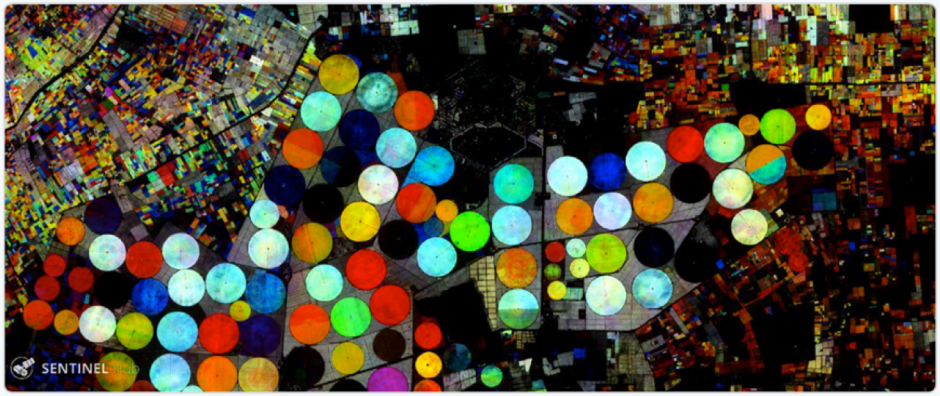
Source: ESA, EOX

Lessons learned – Sentinel-2

- JP2000 vs. COG
- consistency L1C and L2A
- precint (min. processing size) - 2.048x2.048px vs. 256x256 px
  - (same for tiles in COG)
  - <number of requests> vs. <data transfer cost/bandwidth/speed> vs. <decompression CPU> vs. <memory needed>
- raster meta-data in raster not in XML/GML
- appropriate bit depth (SCL, CLD, SNW in 16 bit)
- SCL in COG not JP2000
- processing baseline should change whenever processing process changes
- introduction of changes only when it makes sense (GRANULES->GRANULE) and with advance notice
  - Is regression testing too much to expect?

HD @HarelDan · 24 Oct 2017

Tip: Blue field growing, Green fields maturing, Yellow Fields ripe, Red fields reaped/drying. Same place, 3 days ago apps.sentinel-hub.com/sentinel-playg…



4 5 20

Stef Lhermitte
@StefLhermitte

Following

Replying to @HarelDan @sentinel_hub and 4 others

Wow! The moment even my mom can classify petabytes in seconds on her very old computer is getting closer. Just need to teach her Javascript

8:14 AM - 25 Oct 2017

1 Retweet **9** Likes