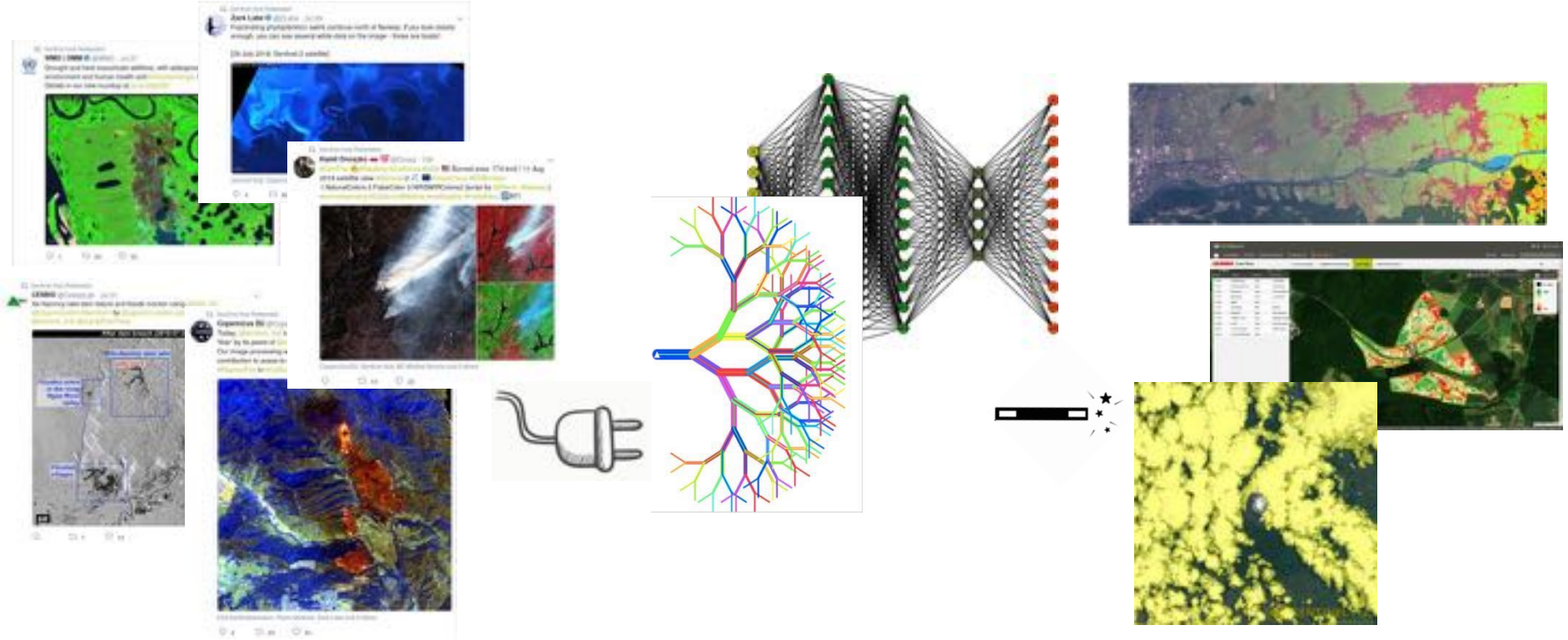
PRODUCTION READY EARTH OBSERVATION APPLICATIONS USING MACHINE LEARNING

Devis Peressutti, EO Research, Sinergise

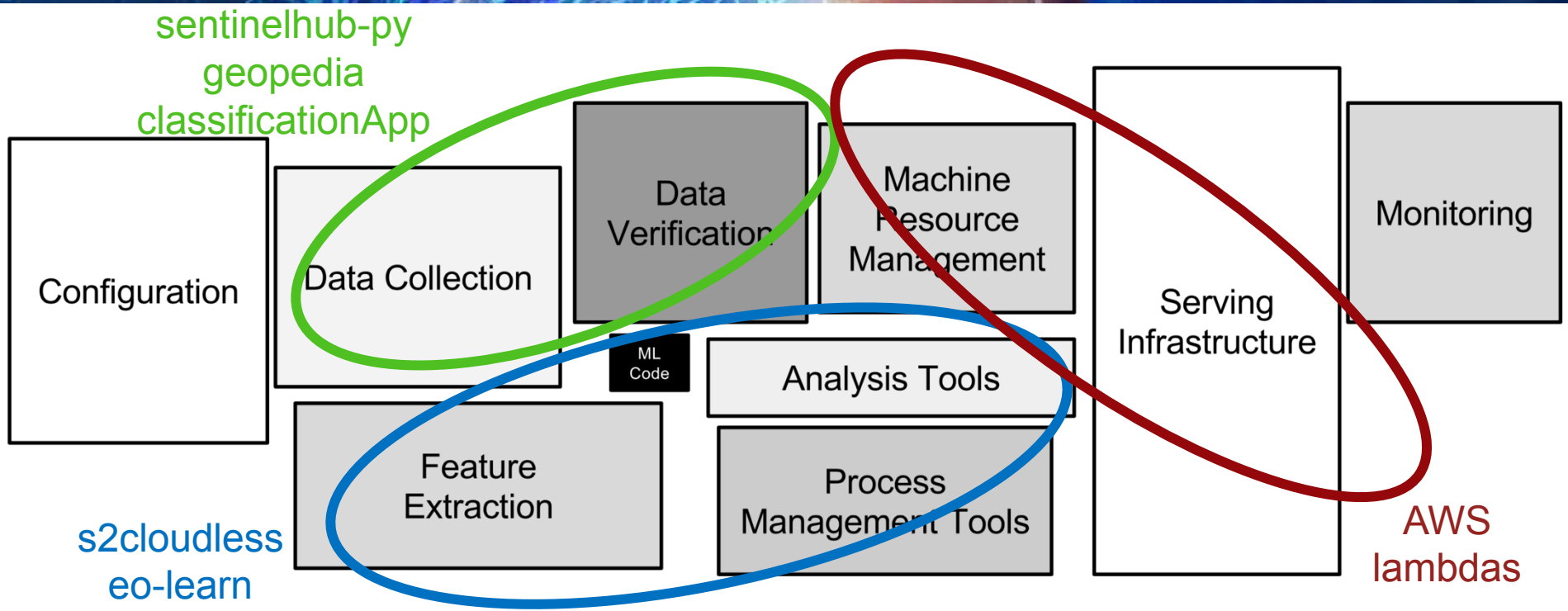
13/11/2018

ESA UNCLASSIFIED - For Official Use

Machine Learning in Earth Observation



Machine Learning in Earth Observation



Sculley *et al.* **Hidden Technical Debt in Machine Learning Systems**, NIPS 2015

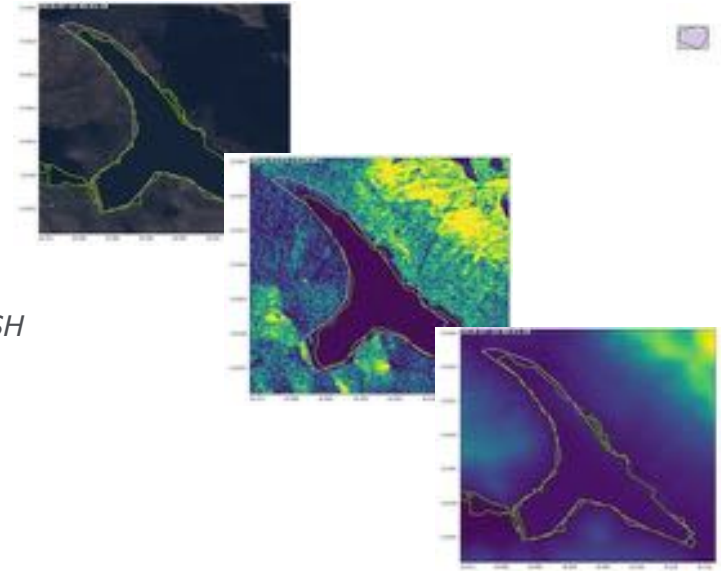
Use case: Global Water-Level Monitoring

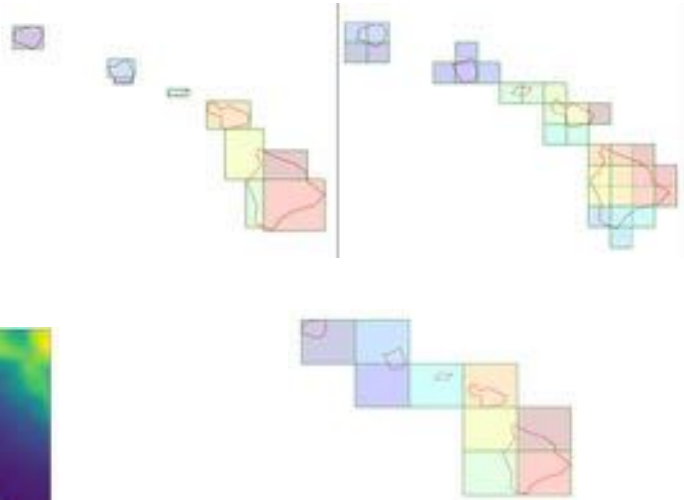
Data Collection

Fast, reliable and seamless retrieval of data-sources for any given Area-of-Interest (AOI)

sentinelhub-py is a Python wrapper of Sentinel-Hub OGC service

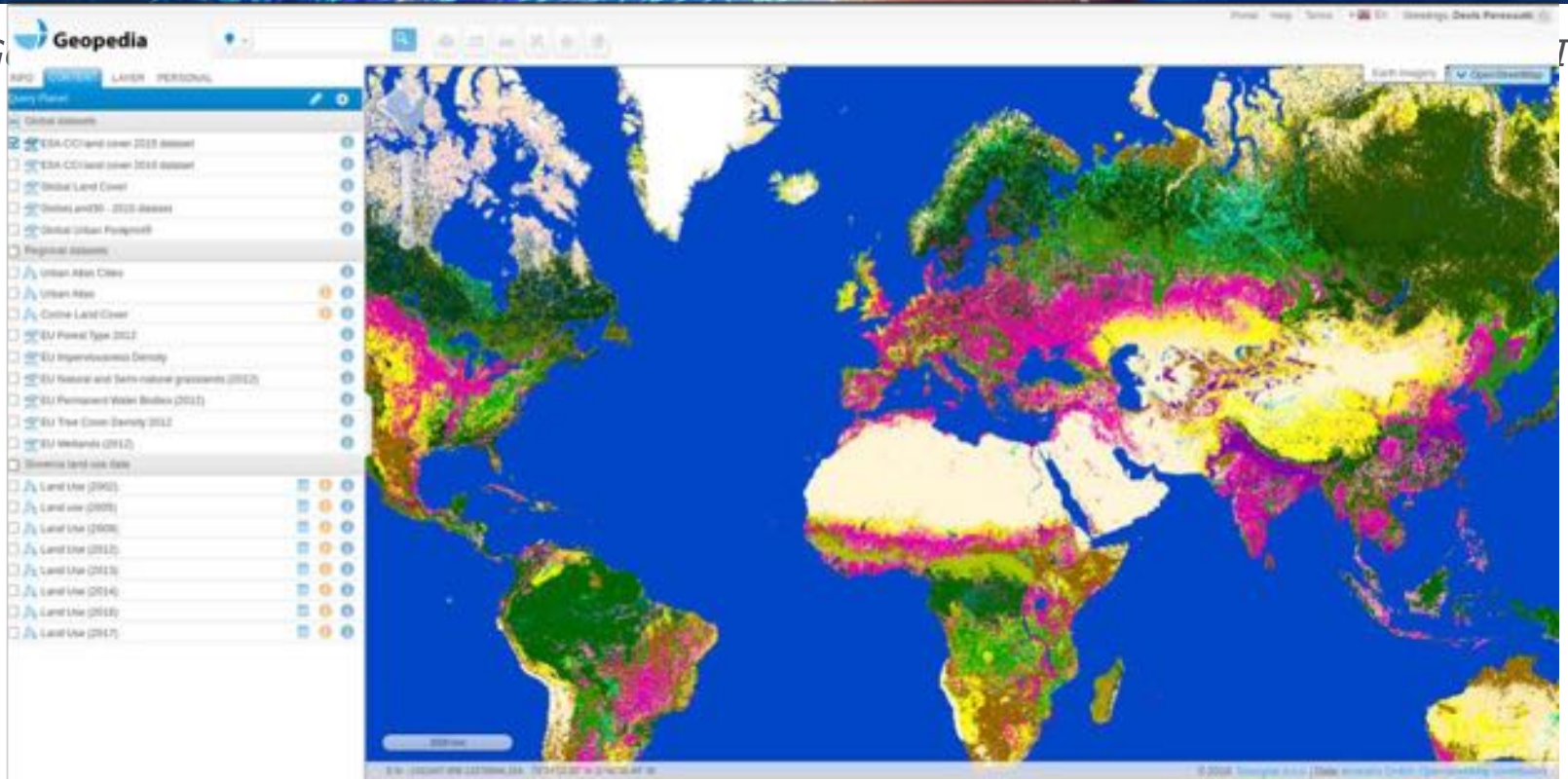
DataSource.SENTINEL2_L1C
DataSource.SENTINEL2_L2A
DataSource.SENTINEL1_IW
DataSource.SENTINEL1_EW
DataSource.SENTINEL1_EW_SH
DataSource.DEM
DataSource.MODIS
DataSource.LANDSAT8





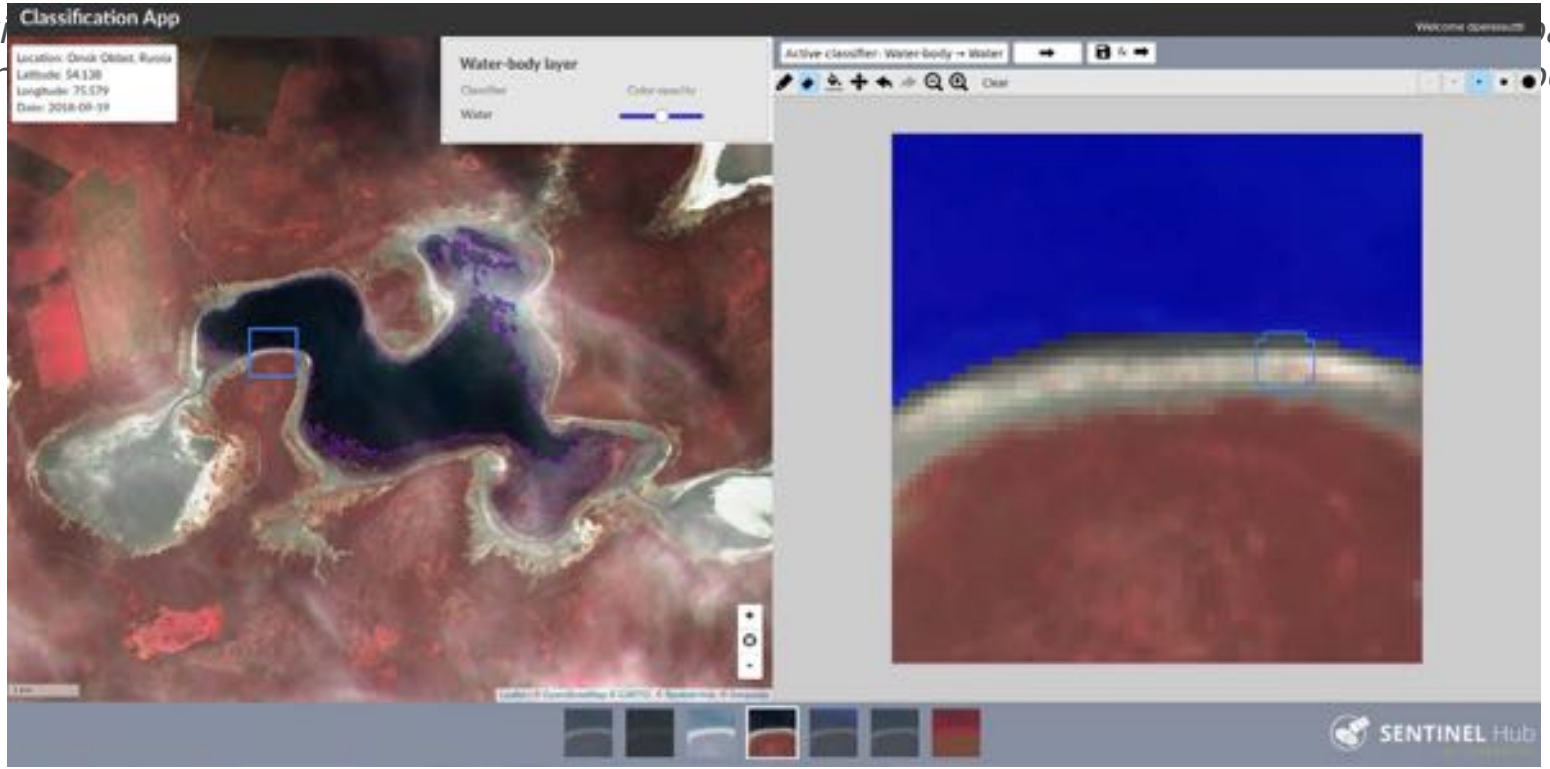
Data Labeling

G *ls*



Data Verification

Worki *aigns*
for *dy*



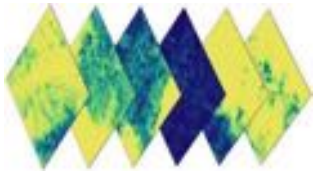
Processing Tools: eo-learn

eo-learn: collection of modular Python sub-packages that allow processing of spatio-temporal data to prototype/build/automate large scale EO workflows. Operates on AOIs of any size

EOPatch*: stores multi-temporal imaging and non-imaging data in* Numpy *and* Shapely *format*
EOTask*: performs a specific operation on* EOPatch *instances. Easily customisable*
EOWorkflow*: acyclic graph of* EOTasks *to form complete EO pipelines with logging/monitoring*

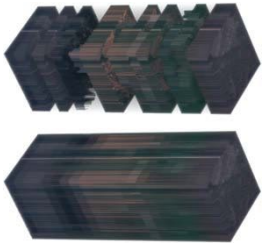
eo-learn-core

eo-learn-mask



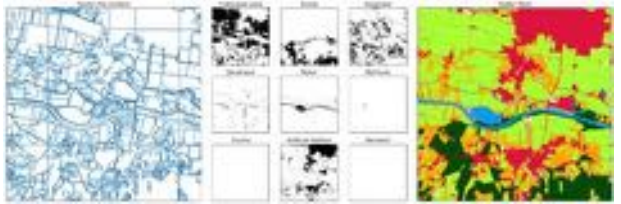
eo-learn-io

eo-learn-features



eo-learn-geometry

eo-learn-ml-tools



eo-learn-registration

Cloud Masking: s2cloudless

Sentinel-2 MSI affected by clouds. Tile-based cloud coverage not suitable for AOI analysis

Developed a Machine Learning model for cloud masking of single-scene S-2 L1C images

TRAINING/X-VAL:
MAJA multi-temporal cloud masks

MODEL:
LightGBM
+ Fast
+ Accurate
- Pixel-based

TESTING:
Hollstein *et al.*

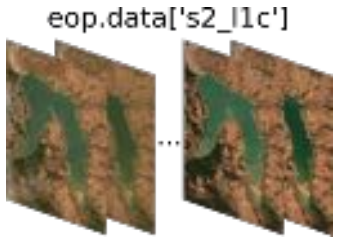
Fraction of classifications as clouds

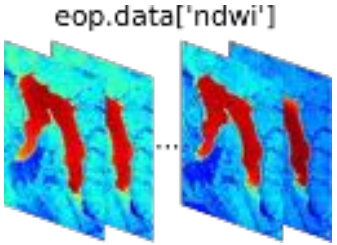
True Label	Fmask	Sen2Cor	Sentinel Hub
Cloud	89.0%	97.5%	99.4%
Cirrus	88.3%	87.7%	83.8%
Land	7.2%	5.7%	2.2%
Water	2.0%	0.0%	0.1%
Snow	39.2%	30.7%	13.5%
Shadow	3.9%	3.9%	5.8%

Packaged as a stand-alone Python package [s2cloudless] for on-the-fly cloud masking

You can read all about the cloud detector on [this] blog post.

Global Water-level Monitoring Workflow





(Down)load images

Cloud detection

NDWI feature

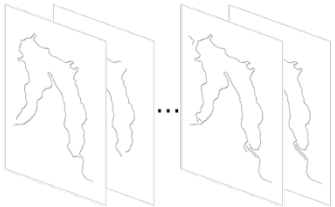
Edge detection

Post processing

Save

AOI

(2015-07-01, 2018-10-13)



Summary

AI4EO applications require more than (EO) data and (AI) models

Tools to handle spatio-temporal data and infrastructure to support the workflow are needed

We provide open-source tools to make creation of AI4EO applications easy and accessible

Come talk to us:

- Tuesday, 17:30–19:00, Tent, Sentinel Hub—where are the limits to on-the-fly processing? *(G. Milčinski)*
- *Wednesday, 14:00–17:30, James Cook, Earth on AWS (G. Milčinski)*
- *Wednesday, 18:00–19:00, Tent, Open-Source Earth Observation Research Framework for Python (M. Aleksandrov)*
- Thursday, 16:00, New Space Economy, Big Hall, Building the company without having an Exit in mind *(G. Milčinski)*
- Friday, 9:45, Research Infrastructures & Platforms, Magellan, Perceptive Sentinel—Big Data Knowledge Extraction and Re-creation Platform *(A. Zupanc)*

More info

- https://sentinel-hub.com/
- https://eo-learn.readthedocs.io/
- https://medium.com/sentinel-hub/
- https://github.com/sentinel-hub

Thanks

esa
amazon web services | Partner Network
SINERGISE
Funded by the H2020 Framework Programme of the European Union
QueryPlanet
European Commission
Copernicus
SENTINEL Hub by SINERGISE
PerceptiveSentinel