# Multi-decadal temporal reconstruction of Sentinel-3 OLCI vegetation products with multi-output Gaussian process regression

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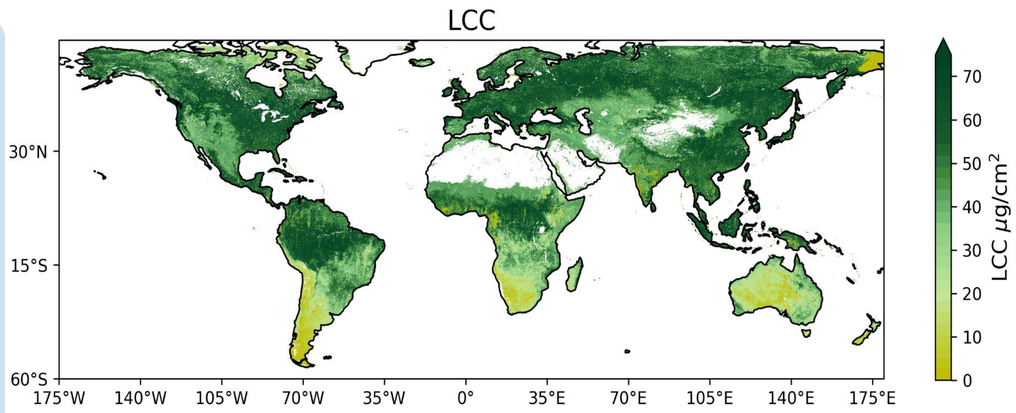
## Motivation

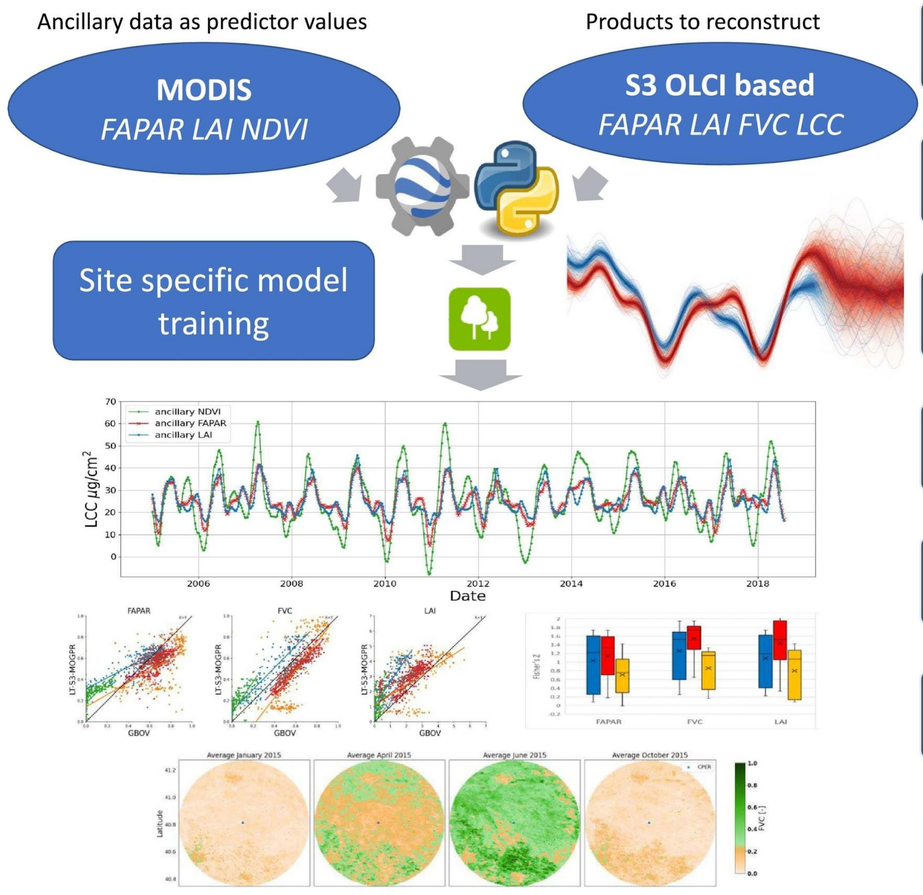
Sentinel-3 (S3) was **launched in 2016**
S3 OLCI provides biophysical trait maps, including **LAI**, **FAPAR**, Fractional Vegetation cover (**FVC**) and Leaf **Chlorophyll** Content (LCC)
S3 has ***only* 9 years** of imagery → **inadequate for long-term** climate analysis
However!
MODIS was launched in 2002: still operational → opportunity to **harmonize data**
Fused MODIS and S3 time series data, to **reconstruct S3 back-in-time,** to 2002.

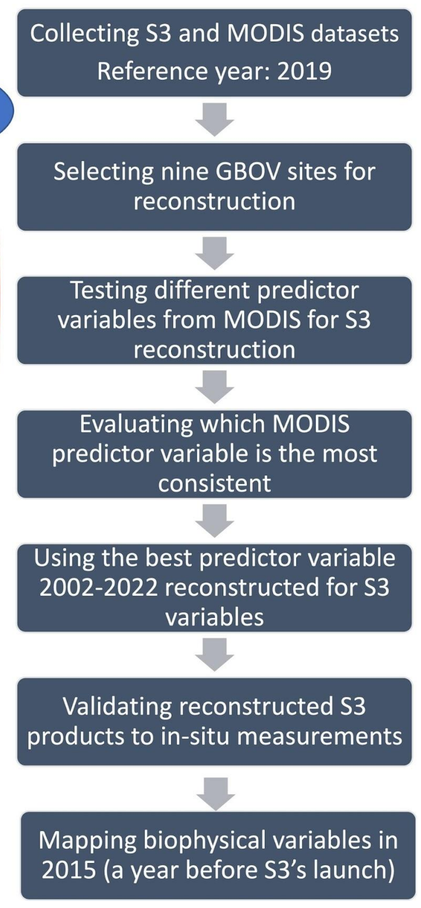



S3 OLCI based LCC map in 2019 June

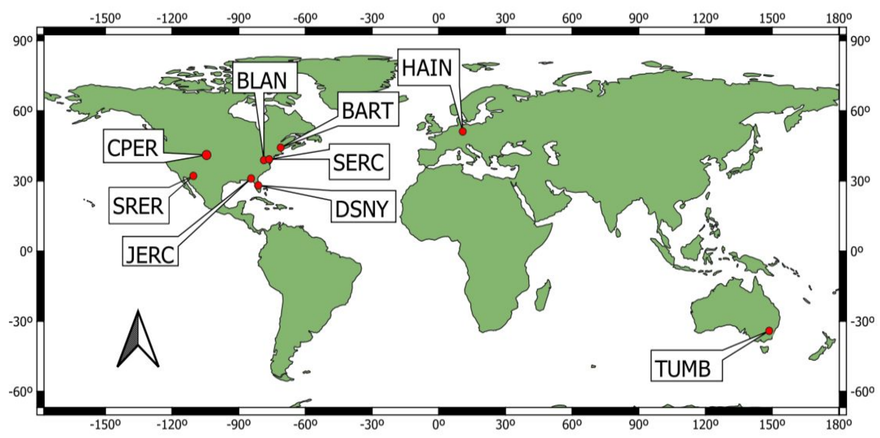
## Workflow

1. GBOV (validation) test sites around the world: retrieve S3 OLCI based data in 2019
2. Train multi-output Gaussian Process Regression (MOGPR) over 2019 with S3 and MODIS based vegetation traits (LAI,FAPAR, NDVI)
3. Reconstruct S3 based traits back to 2002 with MOGPR
4. Test how different MODIS based variables affect the output (LAI works best)
5. Validating “back-in-time” S3 vegetation traits to in-situ data
6. Correlating “back-in-time” S3 vegetation traits to CLMS data
7. With **openEO**: Map S3 vegetation traits in 2015 before the S3 satellite was launched

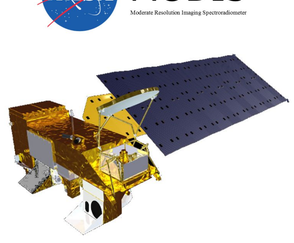


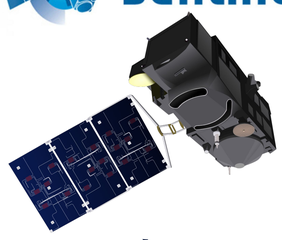




Validation over 9 validation sites from GBOV

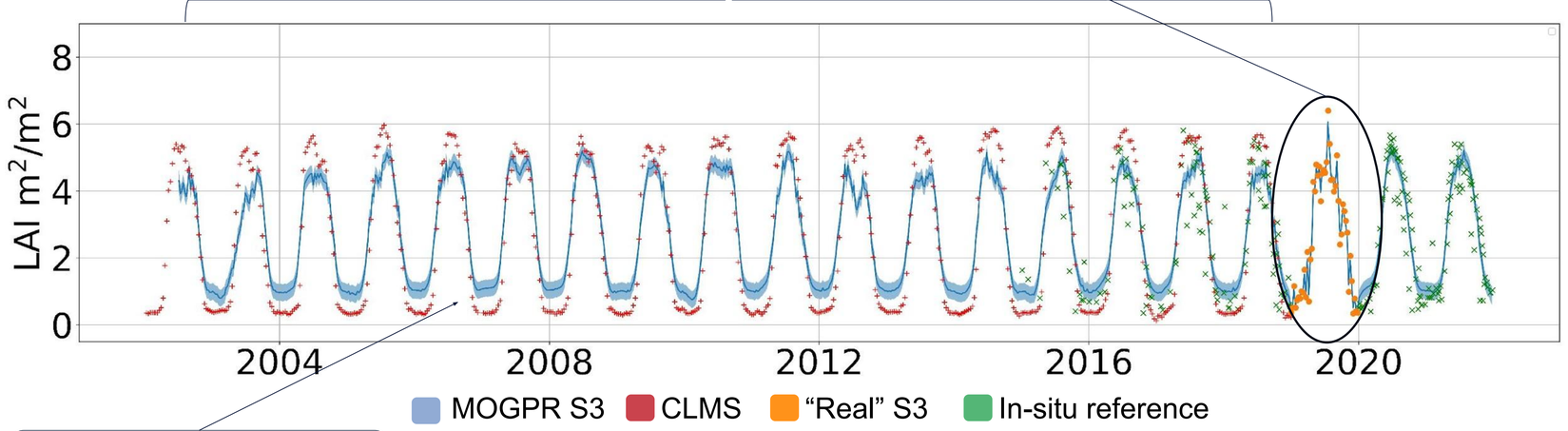



MODIS LAI used as ancillary variable to back-predict S3 data





One year of S3 and MODIS used to train MOGPR algorithm

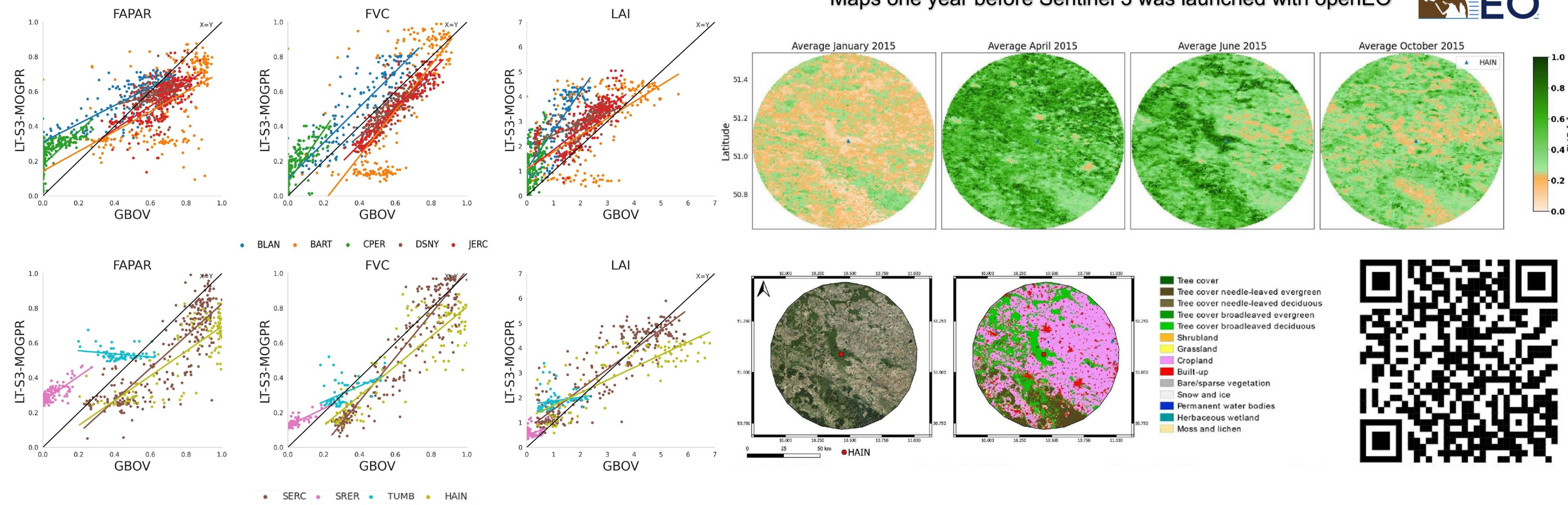



Reconstructed S3 LAI

Validation to in-situ data




Maps one year before Sentinel 3 was launched with openEO




Want to retrieve maps of over **26 vegetation** traits including LAI, FAPAR, Canopy Nitrogen or Leaf Chlorophyll content, from sensors like Sentinel-2 or Sentinel-3? Check out **PyEOGPR**