

→ 9th ADVANCED TRAINING COURSE ON LAND REMOTE SENSING: AGRICULTURE

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Université catholique de Louvain | Belgium

Biophysical variables retrieval and time series smoothing

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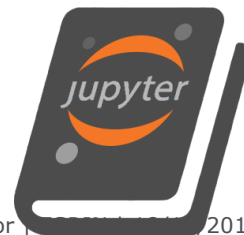
Hosted by



- Generate Biophysical Variables products from Sentinel-2 data using neural network algorithms implemented in SNAP and Sen2-Agri
- Analyze the temporal dimension of the LAI time series, focussing on crop land
- Apply a simple empirical algorithm to model the LAI trajectory through time
- Apply an interpolator method (spline) and a smoothing method (savitzky golay)
- Run a simple validation plan

The training is based on :

- Jupyter notebook, providing all instructions
- SNAP
- Sen2-Agri
- Python 3 is used for coding



Part 1: Generate LAI image using SNAP

Part 2: Generate LAI time series using Sen2Agri

Part 3: Derive LAI Time Series per field

3.0. Visualize the Input data using QGIS

3.1. Import and generic functions definition

3.2. Import of the crop field shapefile

3.3. Open and display one LAI product

3.4. Zonal Statistics

Part 4: Analyse the LAI time-series

4.1. Introducing the CSDM

4.2. Analyze one LAI time-series

4.3. Introducing two other LAI interpolators

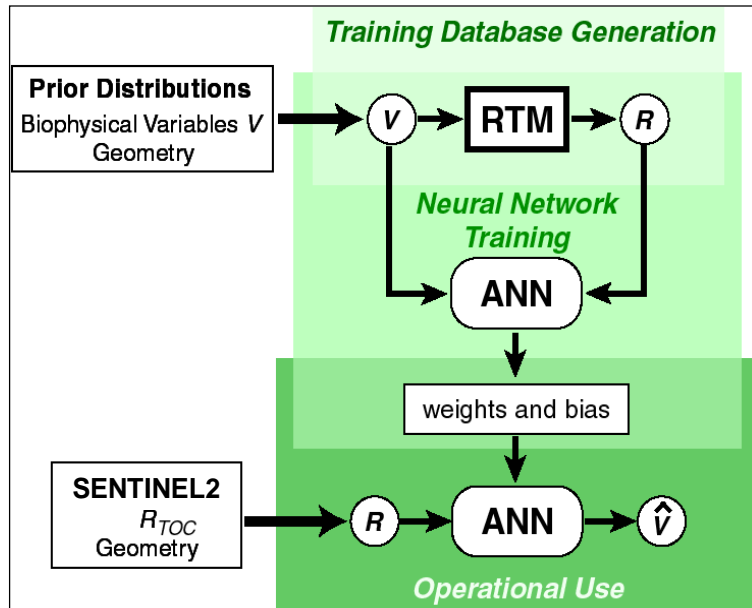
4.4. Run CSDM and interpolators on all fields

4.5. Run CSDM per crop type

Part 5: LAI Validation



NEURAL NETS TRAINED ON 1D SIMULATIONS



- **RTM= PROSAIL model**
1D – Turbid medium
- **Inputs (20m)**
Reflectances + geometry (cosine)

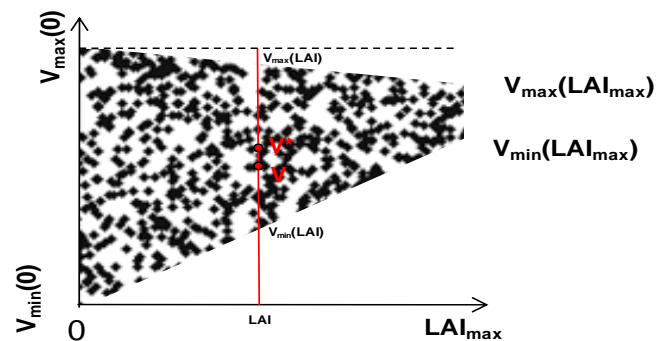
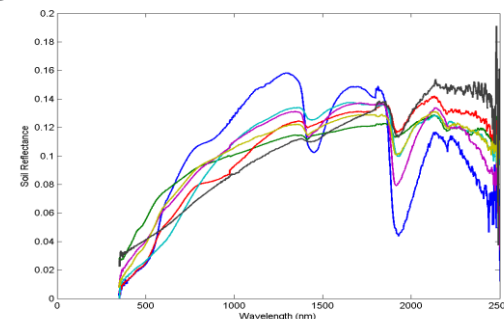
Acronym	Central (nm)	Width (nm)	Spatial resolution (m)
B3	560	35	10
B4	665	30	10
B5	705	15	20
B6	740	15	20
B7	783	20	20
B8a	865	20	20
B11	1610	90	20
B12	2190	180	20

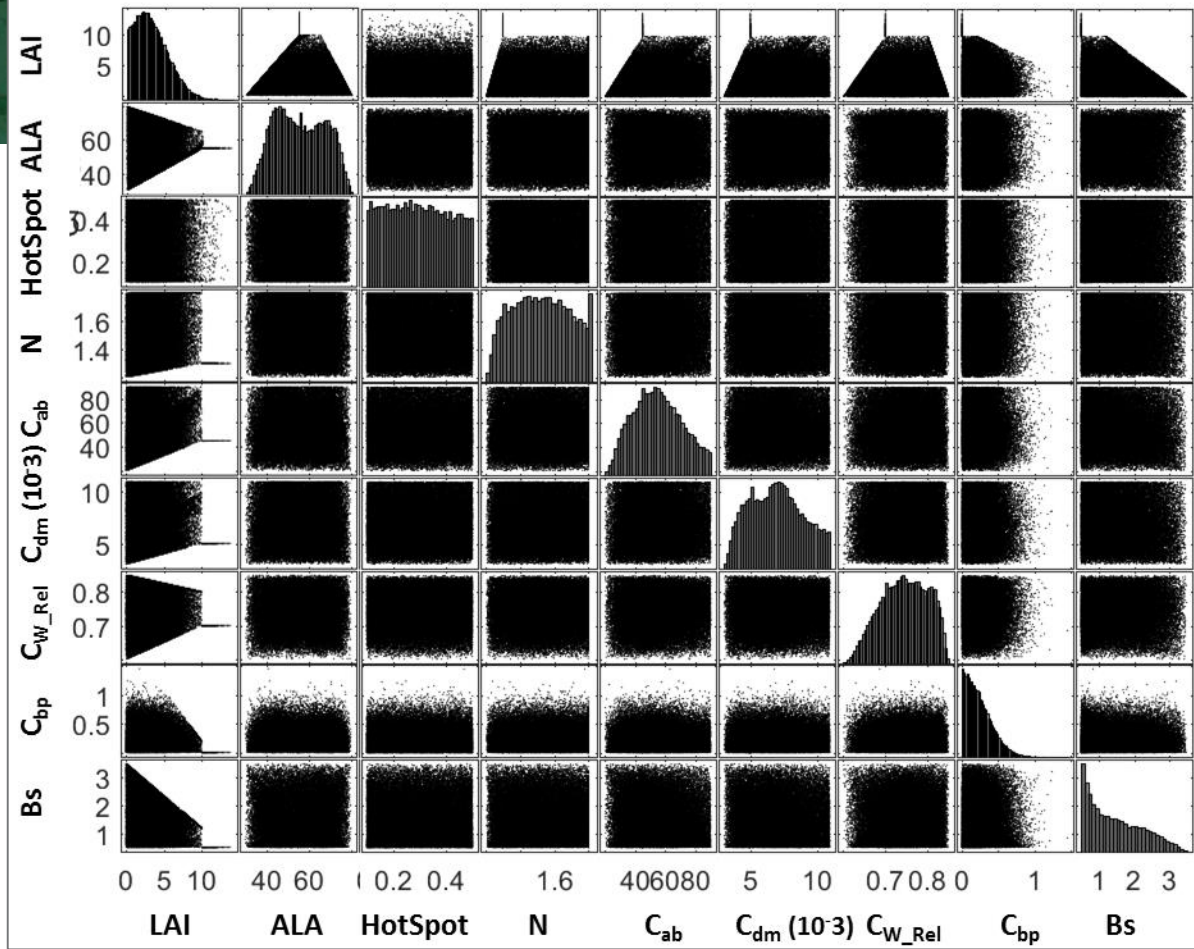
- **Biophysical Variables: GAI, fAPAR, fCover**

Canopy Chlorophyll Content, Canopy Water Content

Composition of the training dataset

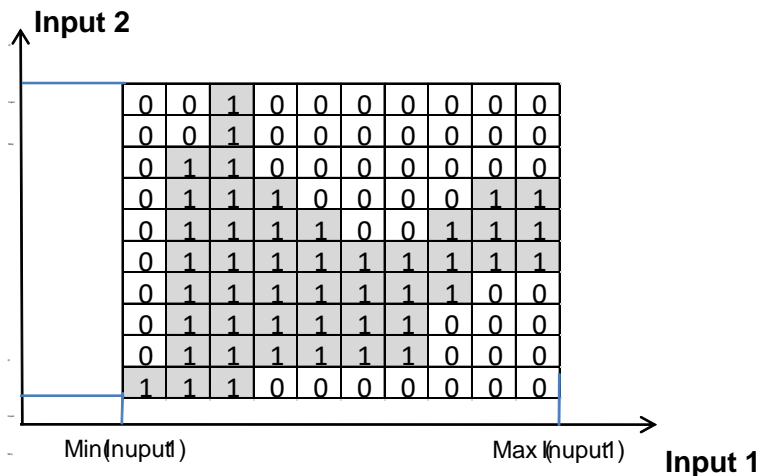
- **Soil Background:** 7 reference spectra & Brightness index
- **GAI, Inclination, Leaf Optical properties:** distribution parameters taken from littérature
- Co-distribution based on a simple assumption (saturation)





➤ Definition Domain

Adequation with the training dataset

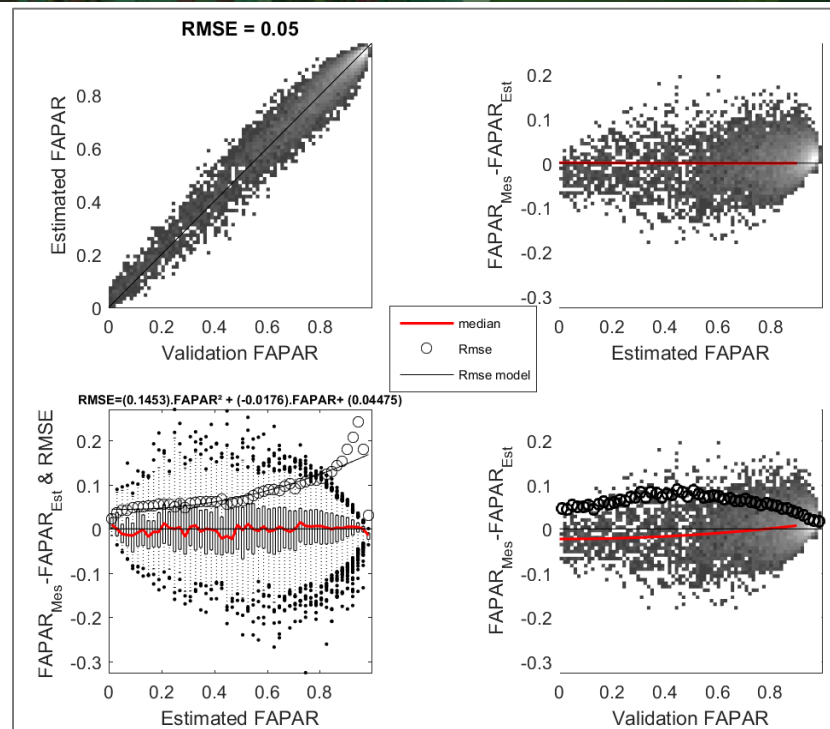
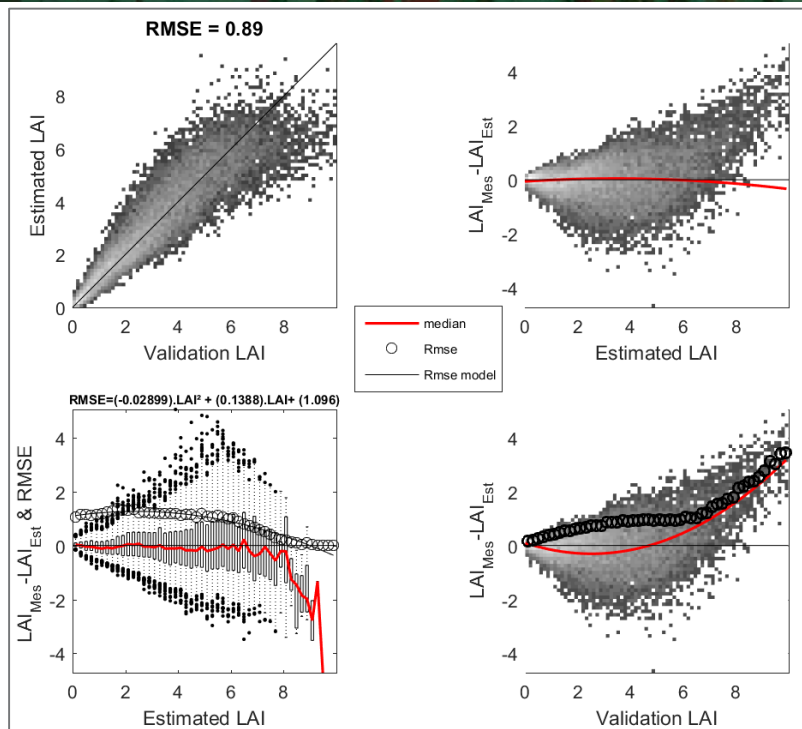


➤ Output out of range

Is the estimated product in the range of the training data set

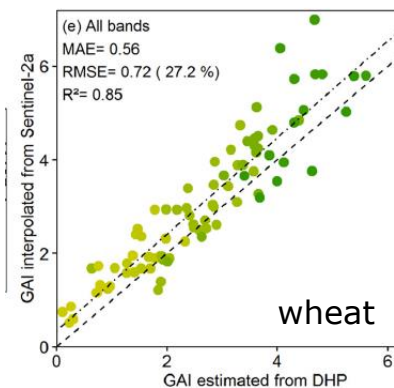
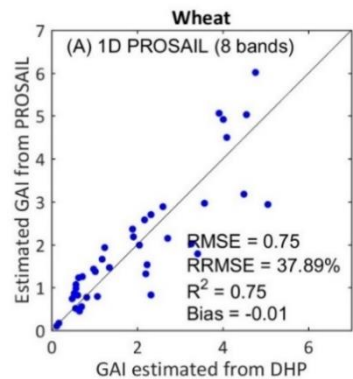
	Tolerance	P _{min}	P _{max}
LAI	0.2	0	8.0
FAPAR	0.1	0	0.94

Theoretical performances

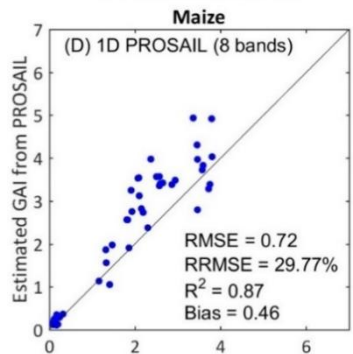


Pseudo-independent database, still simulated with SAIL

Validation against measurements (GAI)

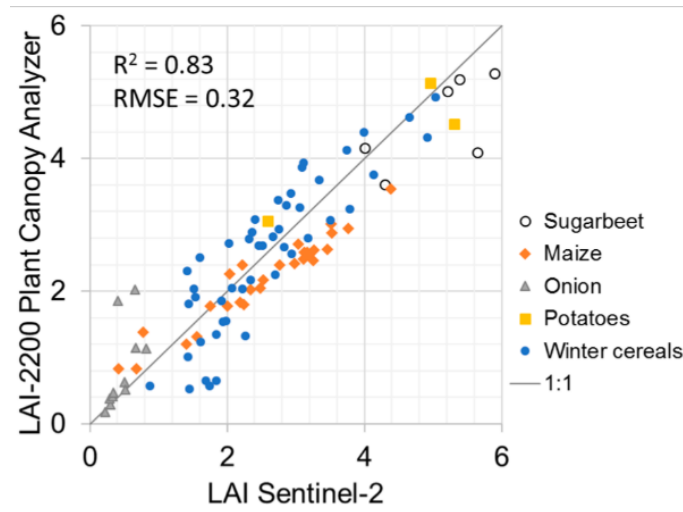


From Delloye et al, RSE, 2018



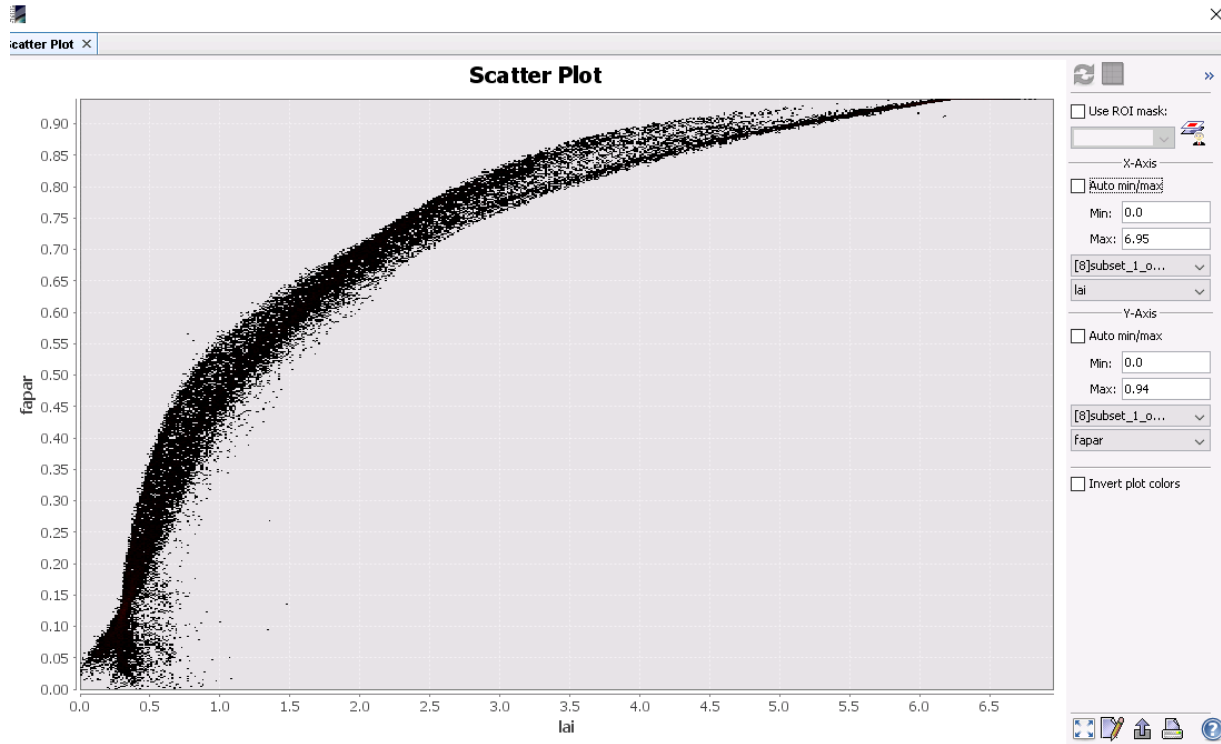
From Jiang et al, in prep

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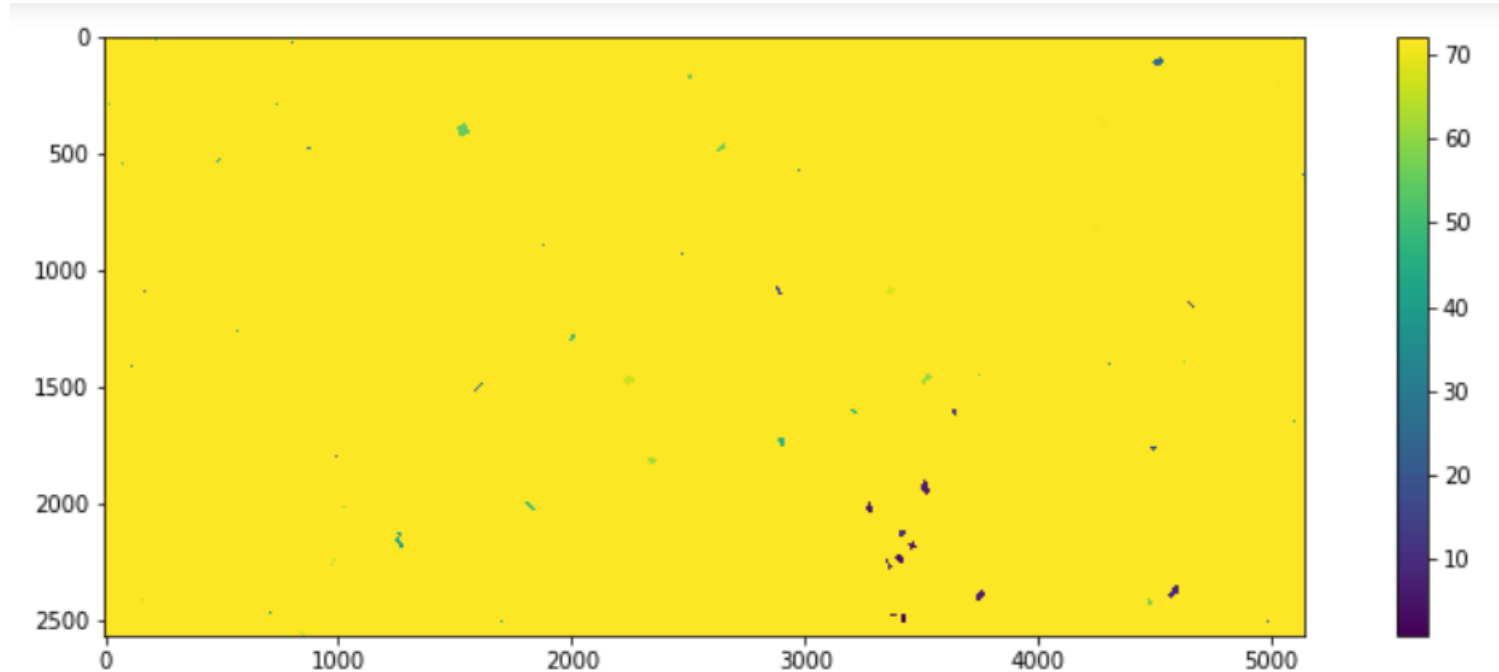


From Vuolo et al, RS, 2016

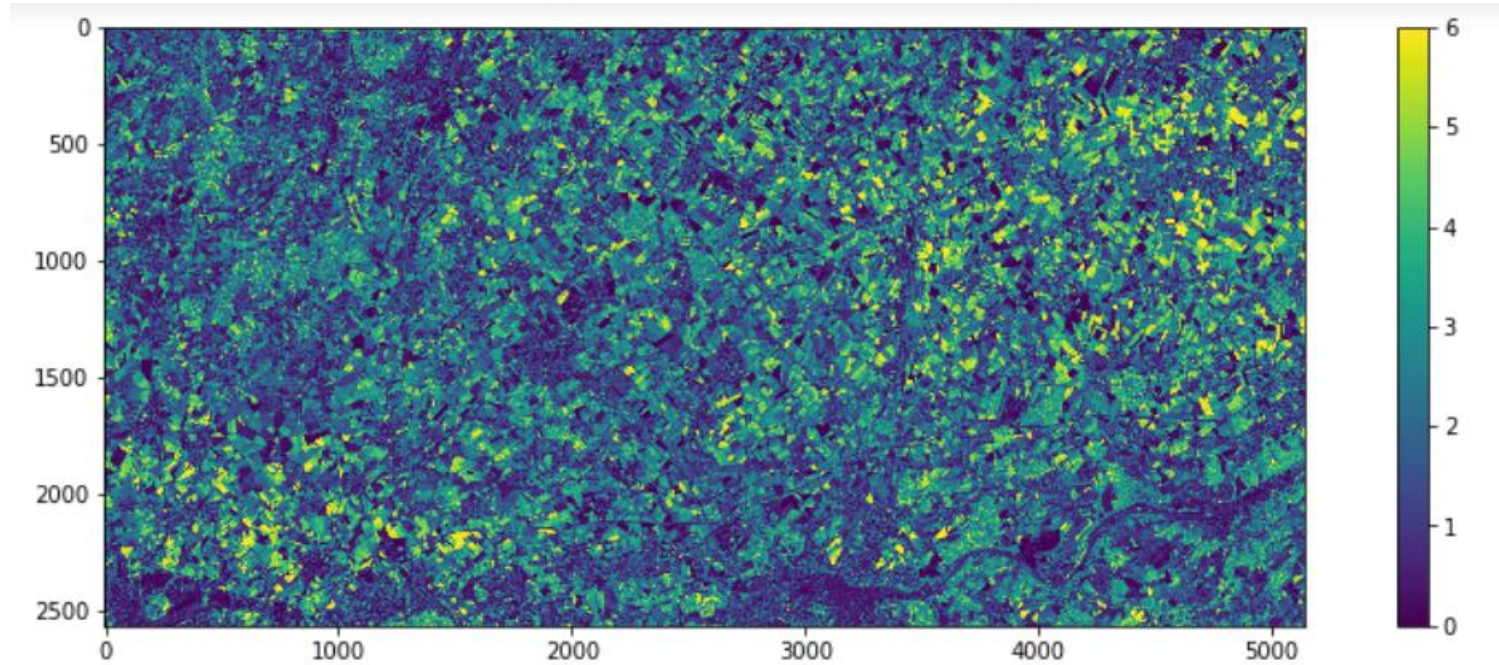
3.3. Import of the crop field shapefile



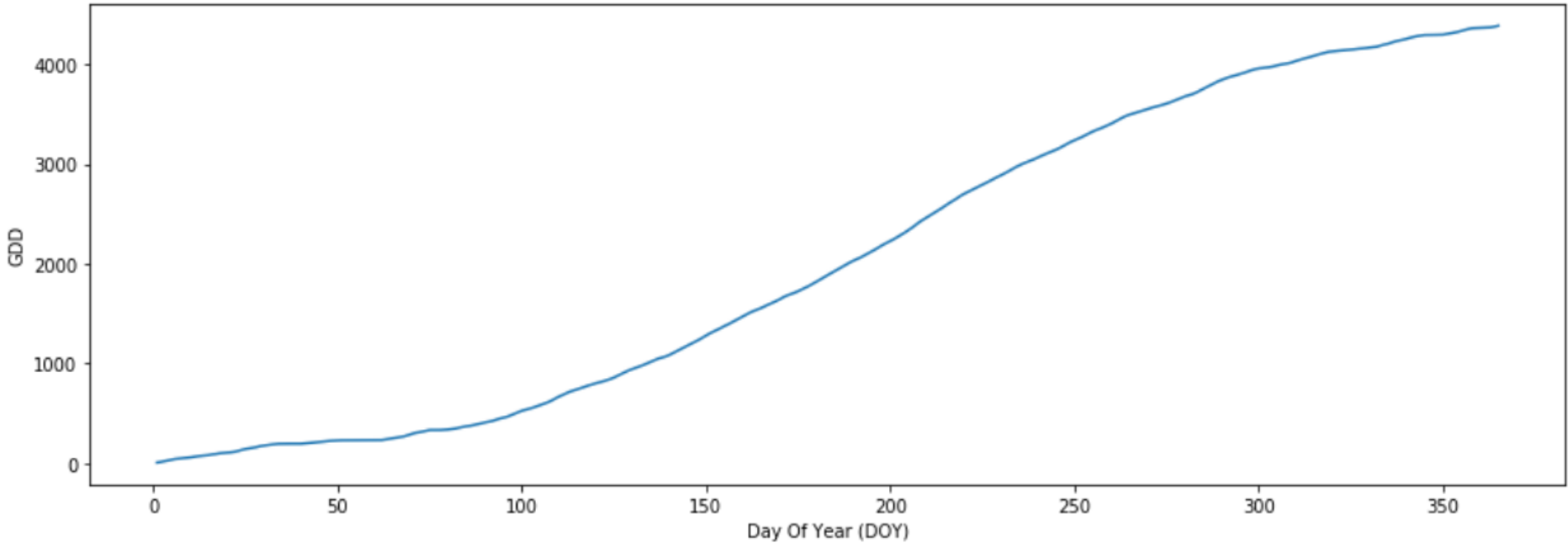
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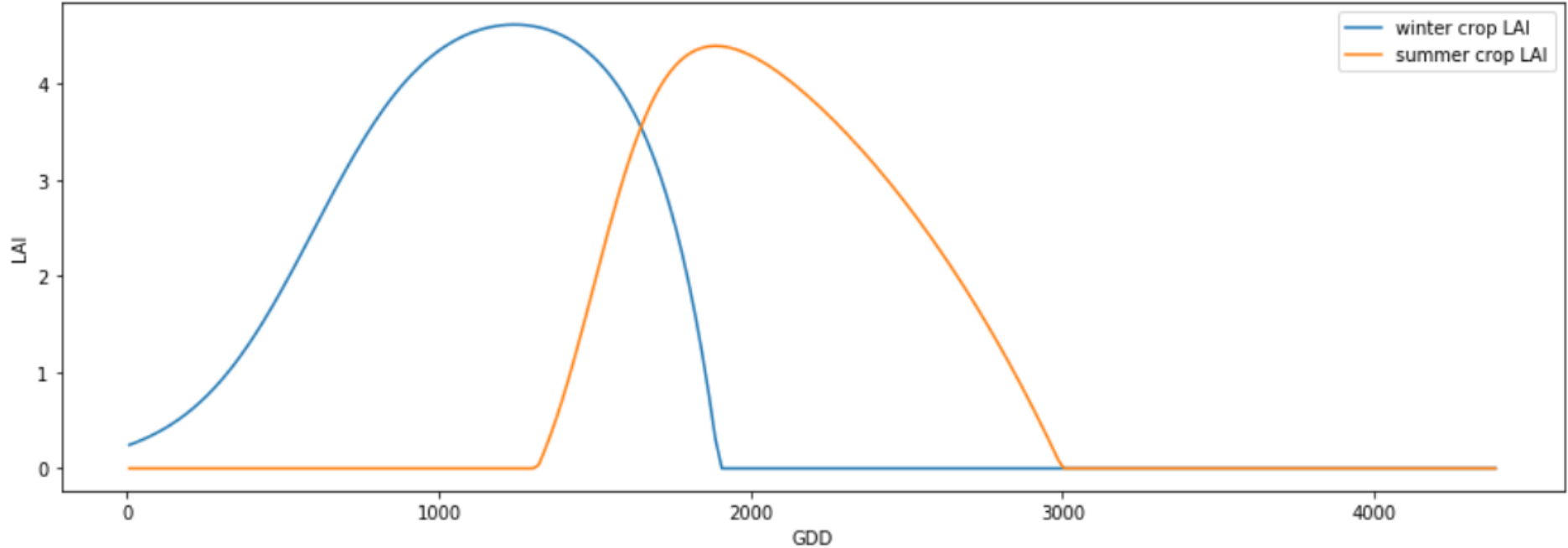
3.4. Open and display one LAI product



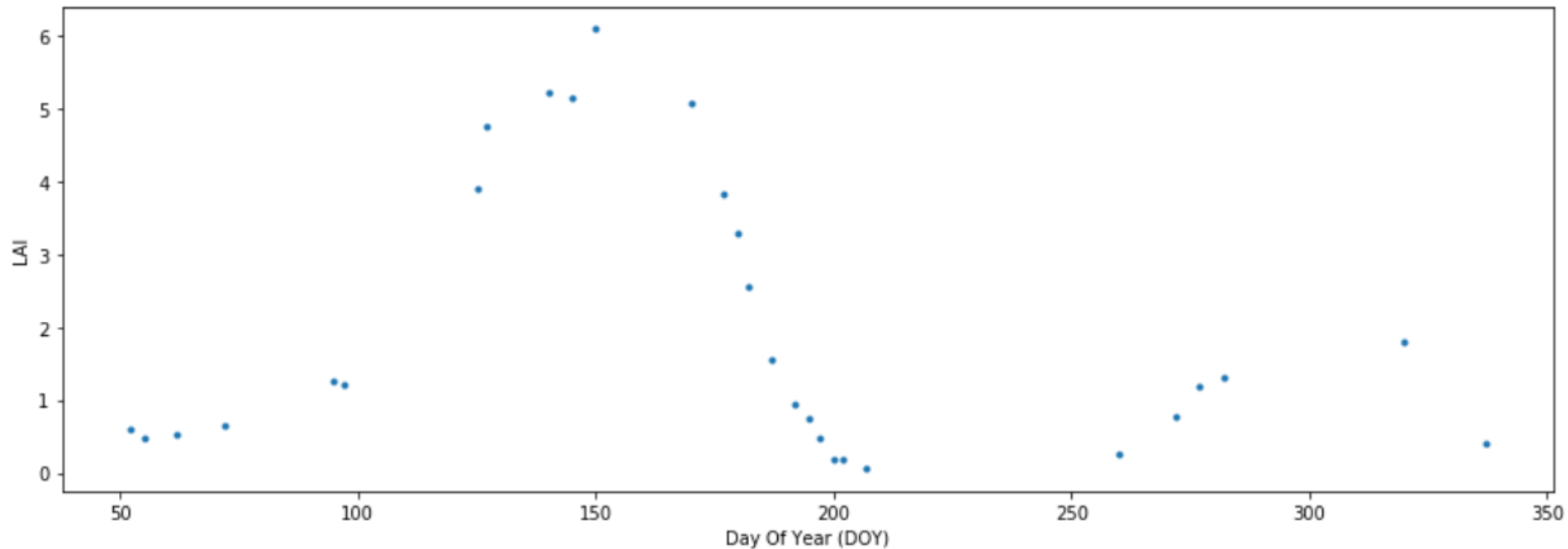
4.1. Introducing the CSDM



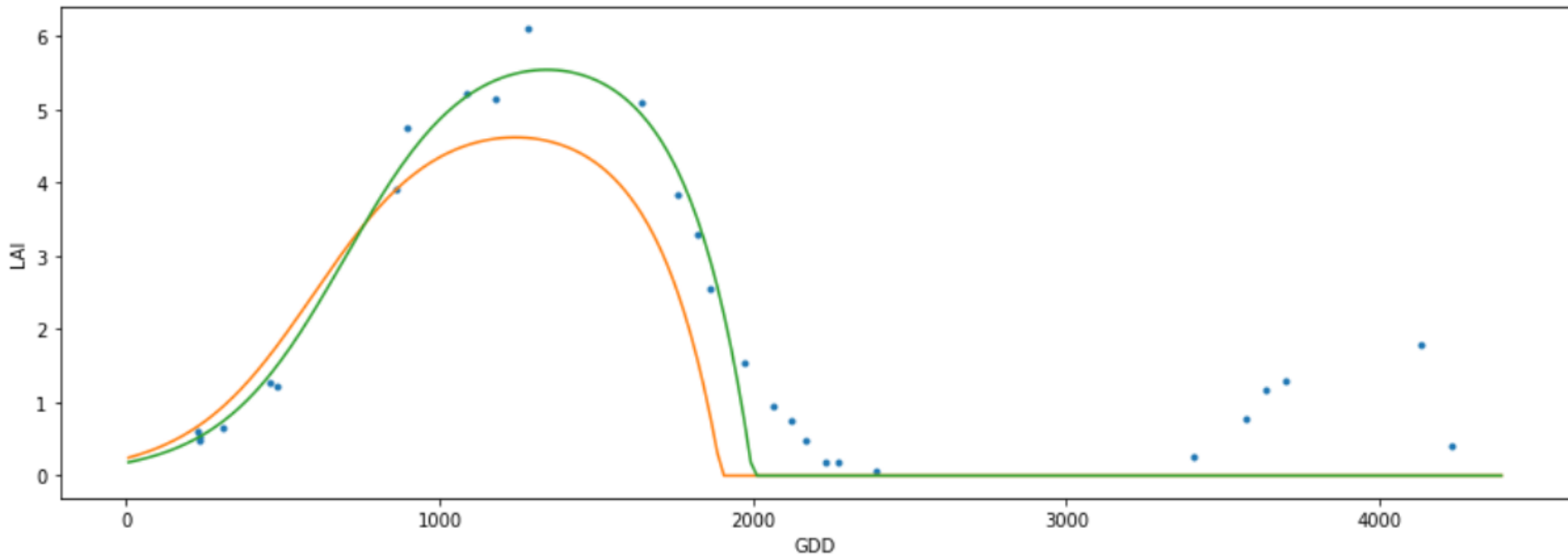
4.1. Introducing the CSDM



4.2 Analyze one LAI time-series

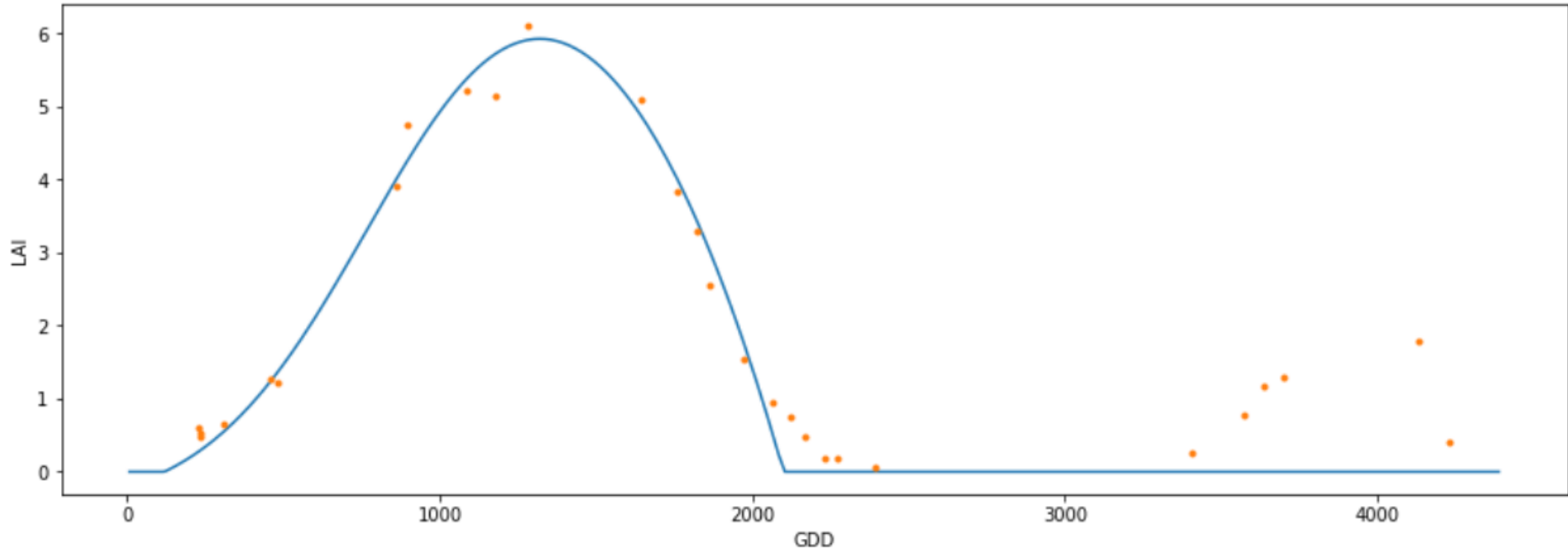


4.2 Analyze one LAI time-series

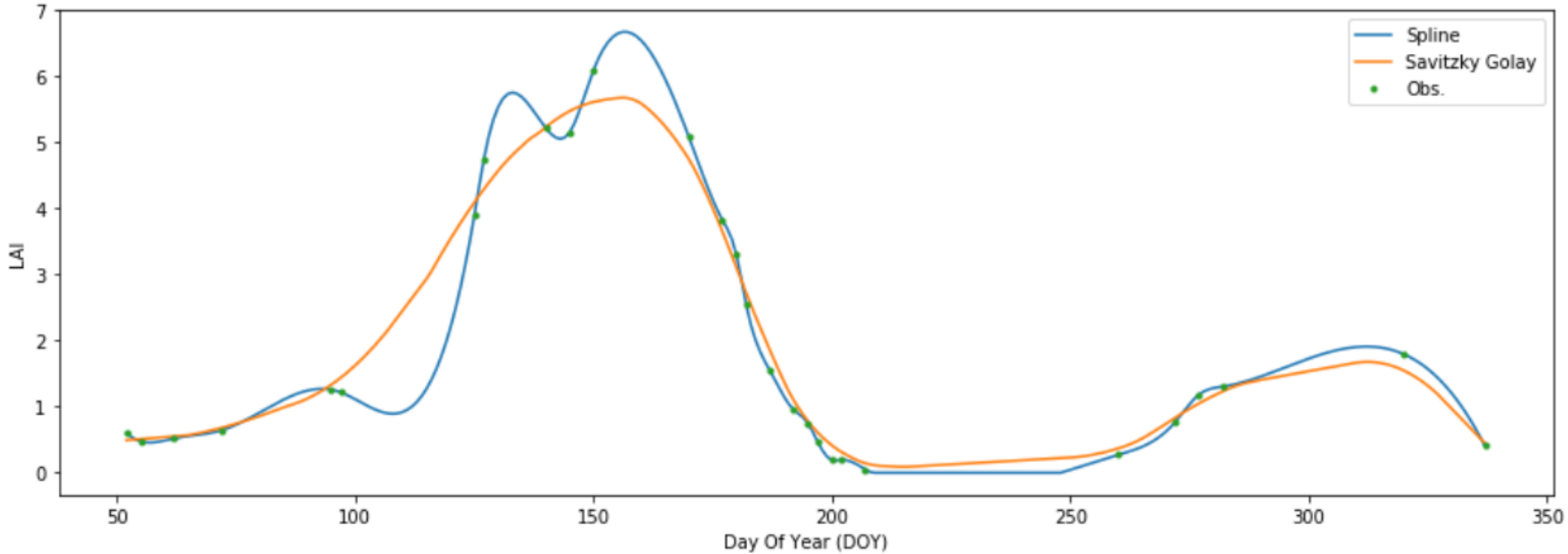


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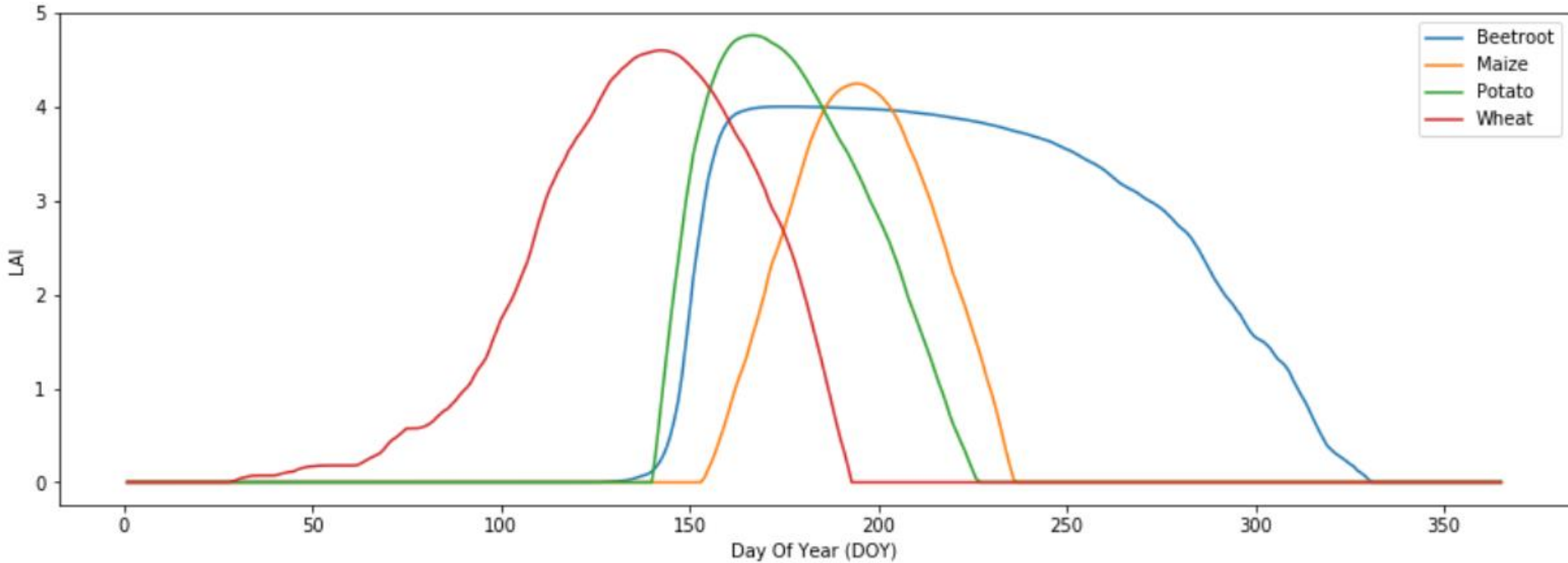
13 (Wheat)



4.3. Introducing two other LAI interpolators



4.5. [Extra] Run CSDM per crop type



Part 5: LAI Validation

RMSE = 1.017
Bias = 0.815

