Land surface Carbon Constellation project

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Metrology for Climate Action 2022

Objectives of the project

Investigate the **terrestrial biosphere's net ecosystem exchange** – photosynthetic CO_2 uptake minus respiratory CO_2 release – **response to climatic drivers** by means of combining a process-based model with a **wide range of observations (in-situ and remotely sensed) on local and regional scale** around two (three) sites (Sodankylä, Majadas, Reusel).

For this we will:

- Develop a **community land surface model for its application in a data assimilation framework**

- Acquire and analyse **EO and campaign data sets**

Overview of the LCC project

- Kicked off Oct 2020

- 13 partners

- 30 months duration

- https://lcc.inversion-lab.com

Broad range of activities:

1. EO data

2. Field activities

3. Model and observation operators

4. Data assimilation

Modelling at local and regional scales

- Demonstration of synergistic use of observations at local and regional scale

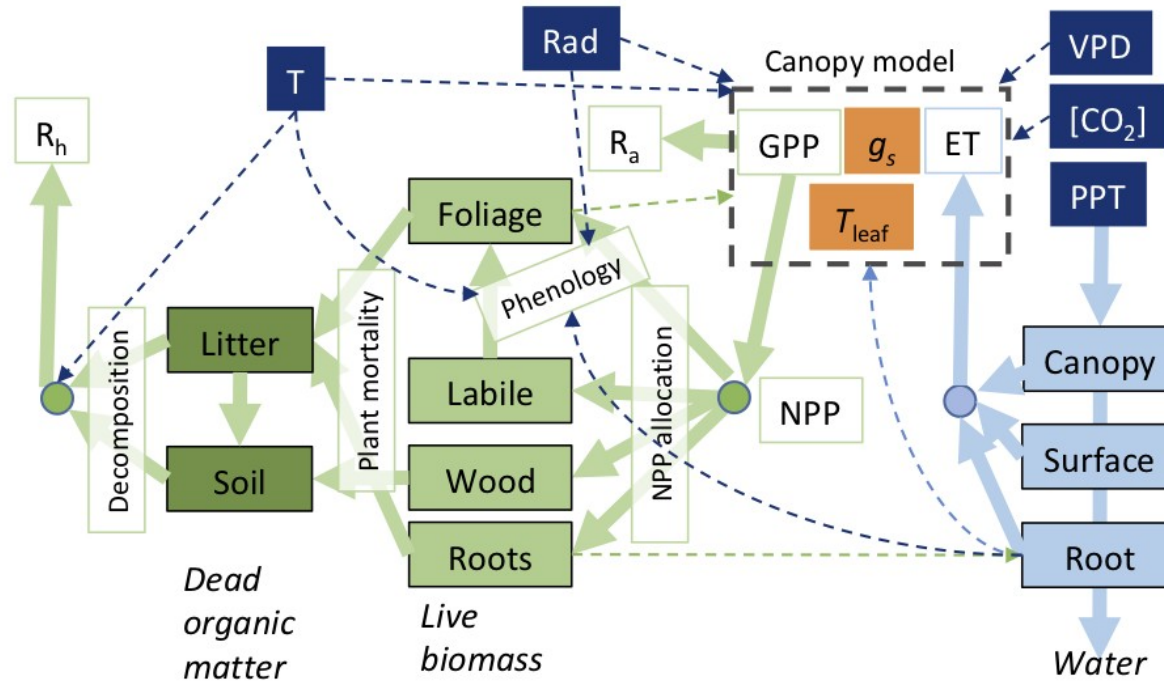- Regional scale: 500 km x 500 km area around the sites at 0.25 deg resolution (Sodankylä & Majadas)
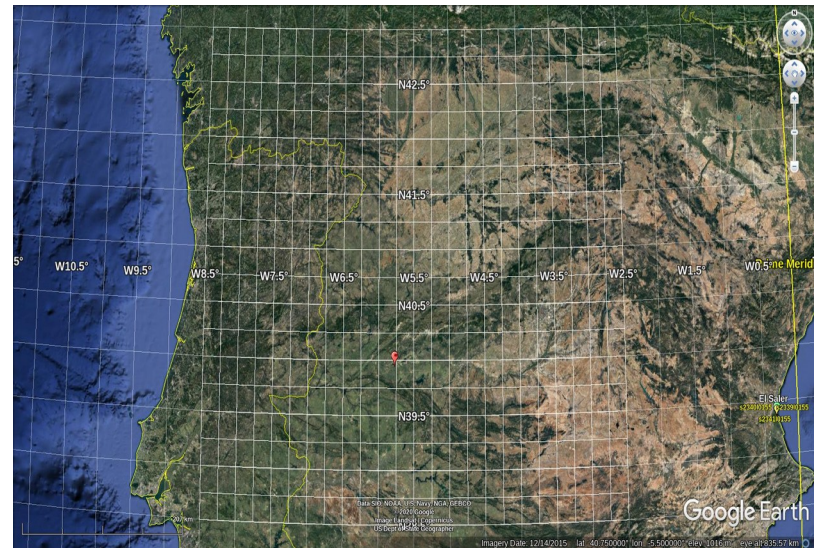
Observation operators and data assimilation (on the swath)
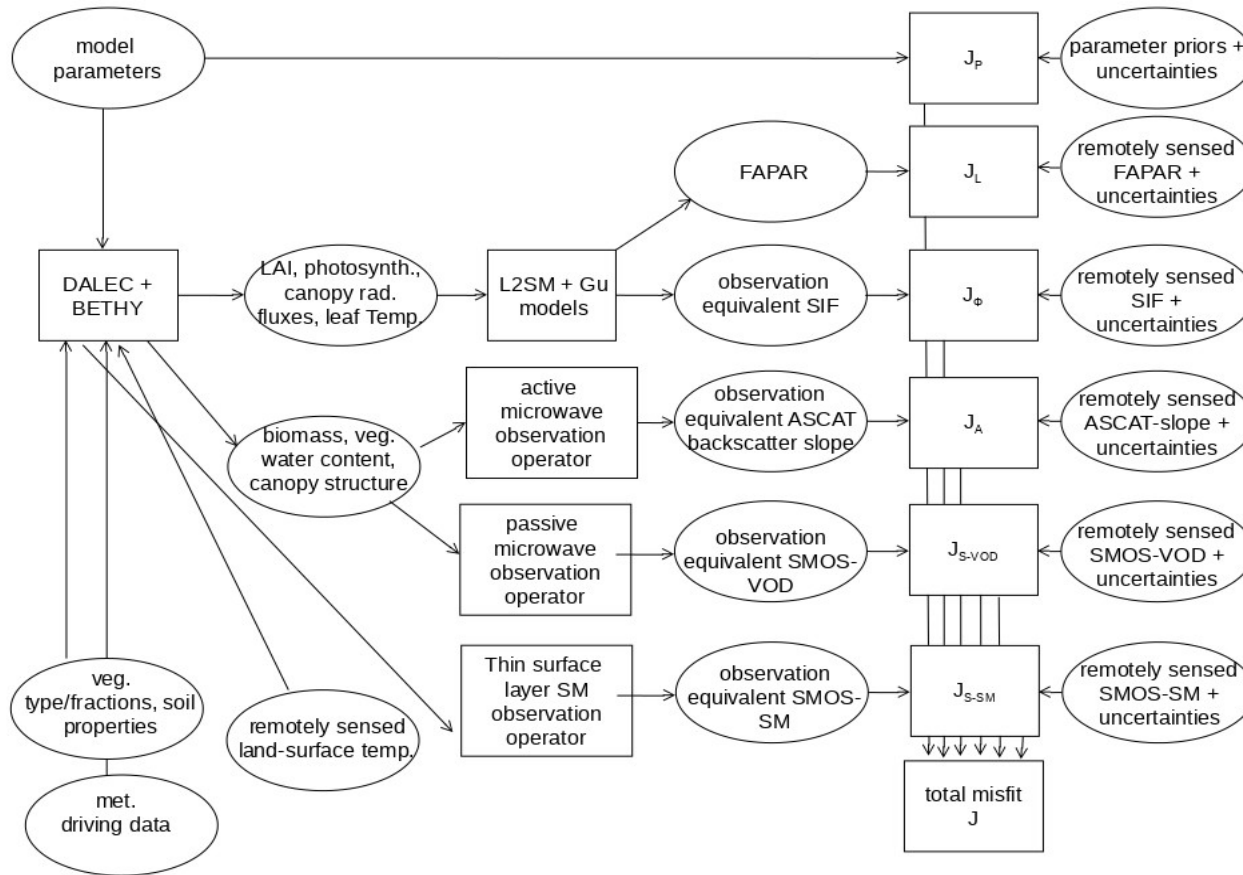
Community land surface model: D&B model

Based on a coupling of DALEC and BETHY

Surface Layer Soil Moisture
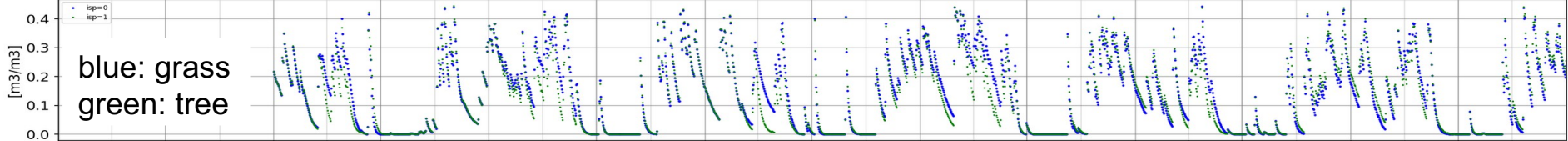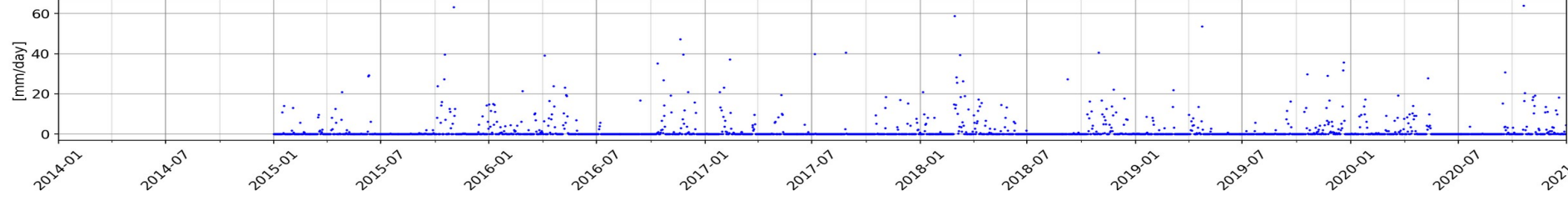
D&B simulated Fraction of Absorbed Photosynthetically Active Radiation
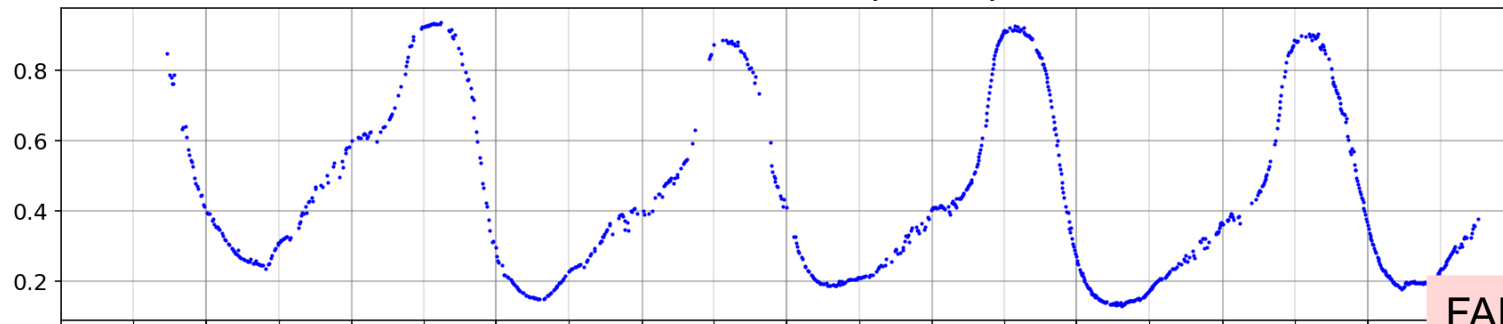
S3 FAPAR
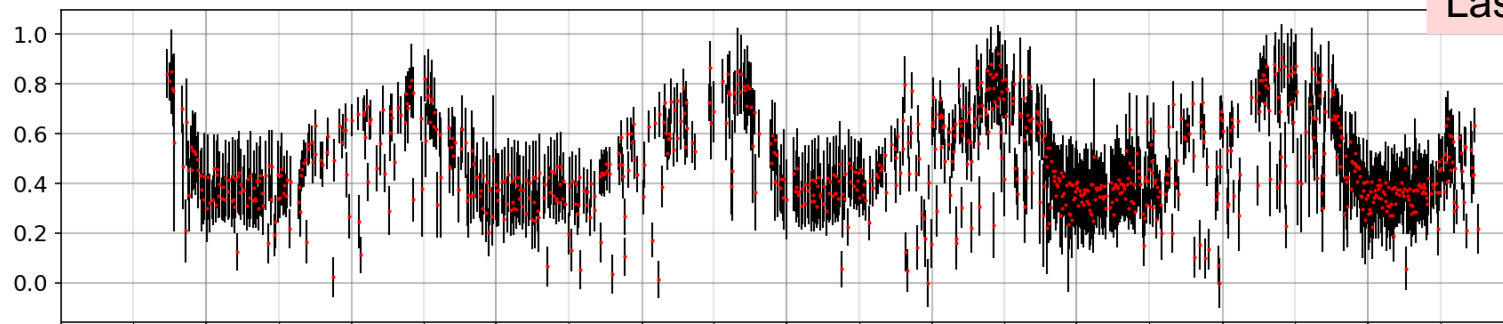
D&B - observed
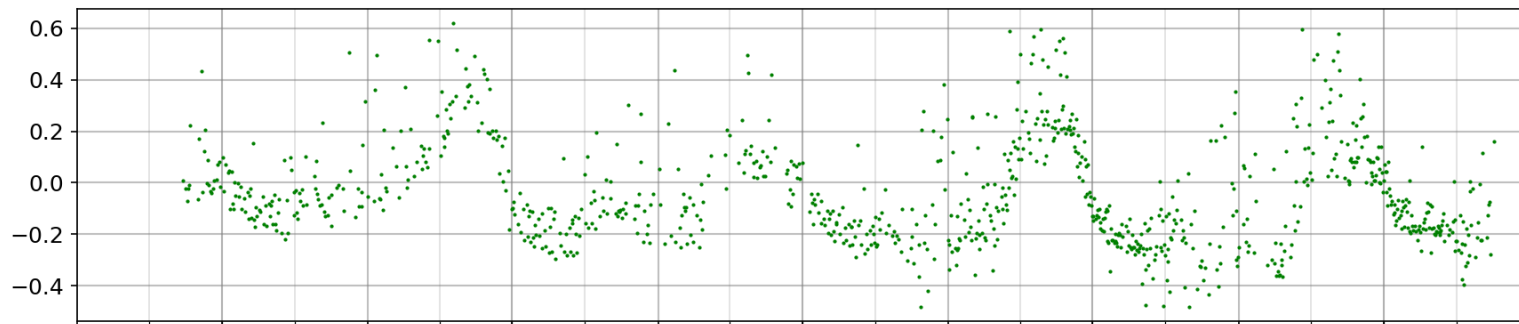
FAPAR at Las Majadas

Sodankylä prior

D&B simulated vegetation_optical_depth

SMOS-L2 vod (filter: chi2<2.2, rfi_prob<0.2, vod_dqx<0.1)
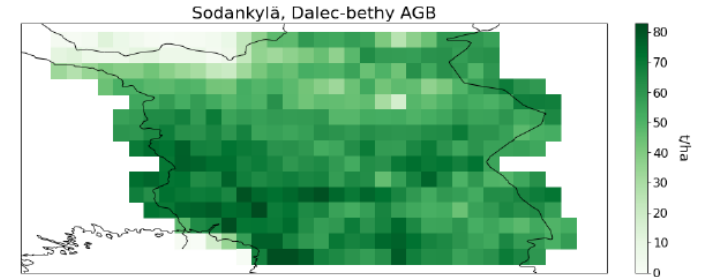
[-]

D&B - observed
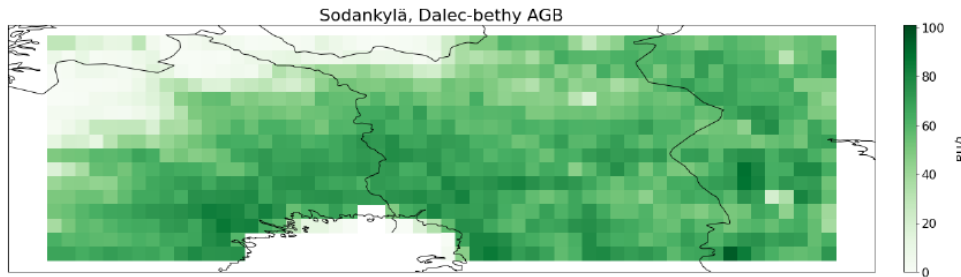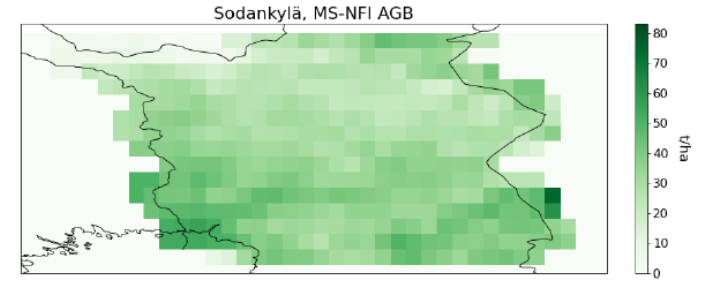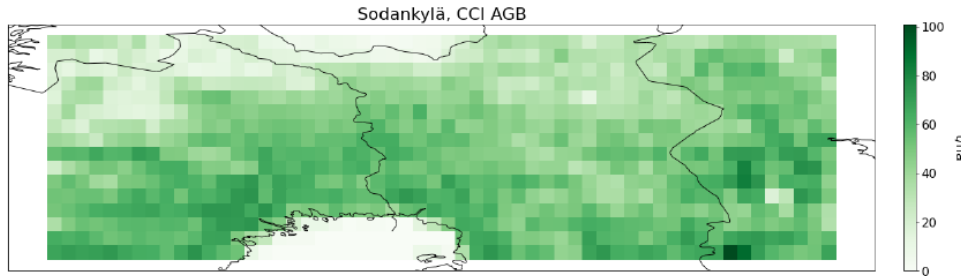abs-diff, min/mean/max = 0.000/0.114/0.669
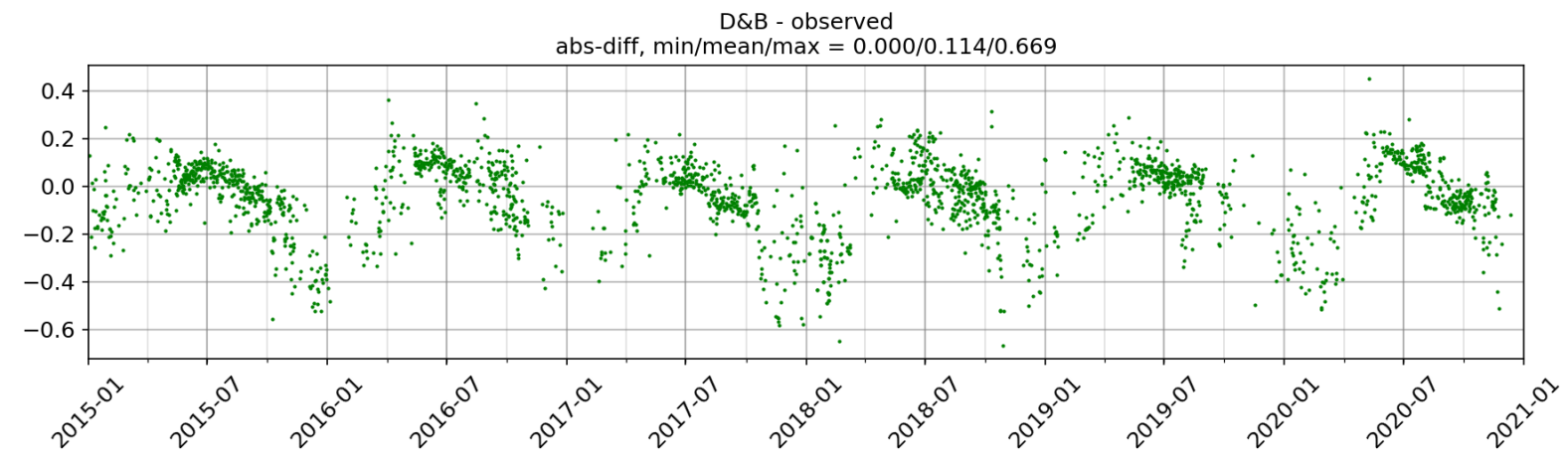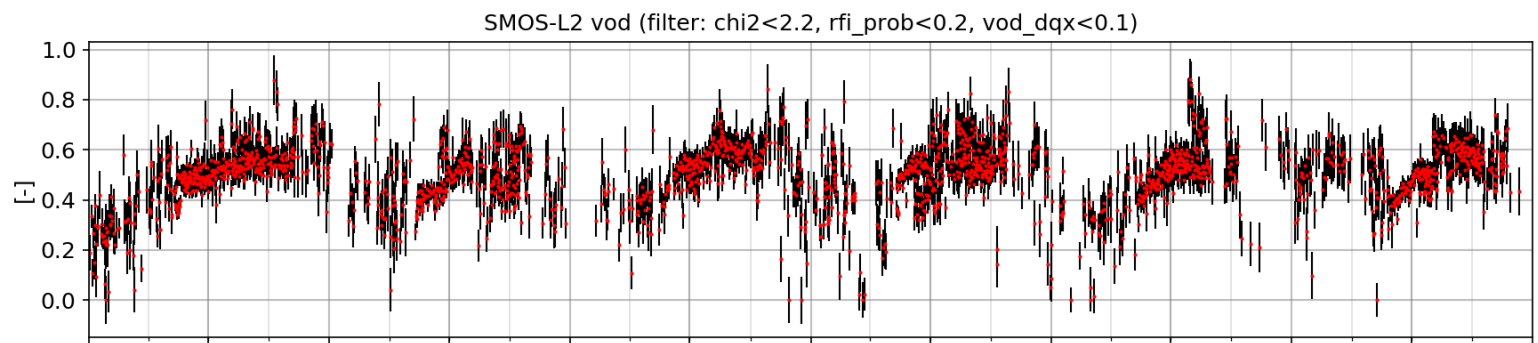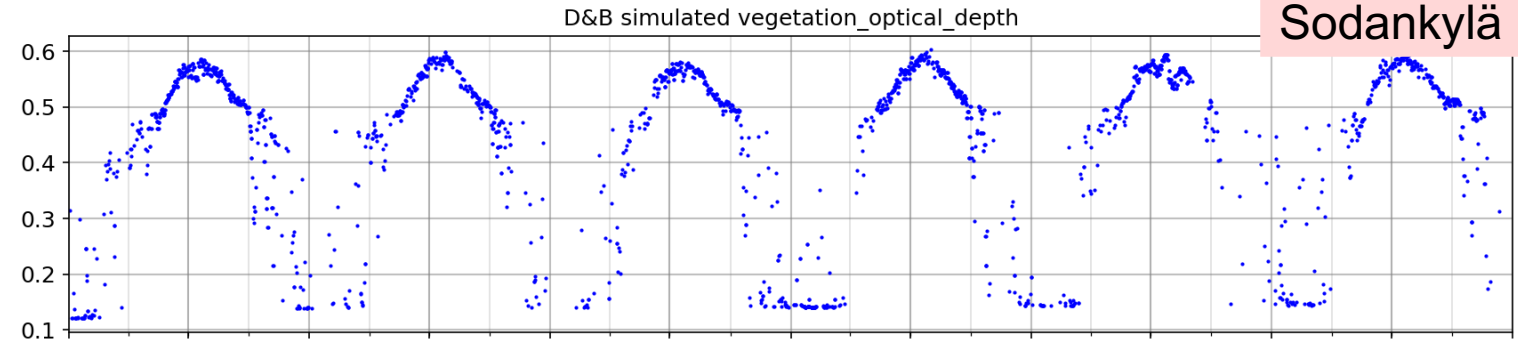
D&B simulated slope
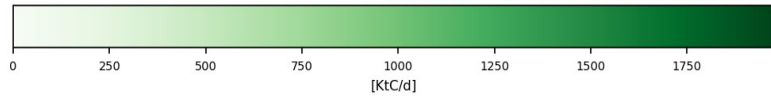ASCAT slope_masked (filter: qflag==0)
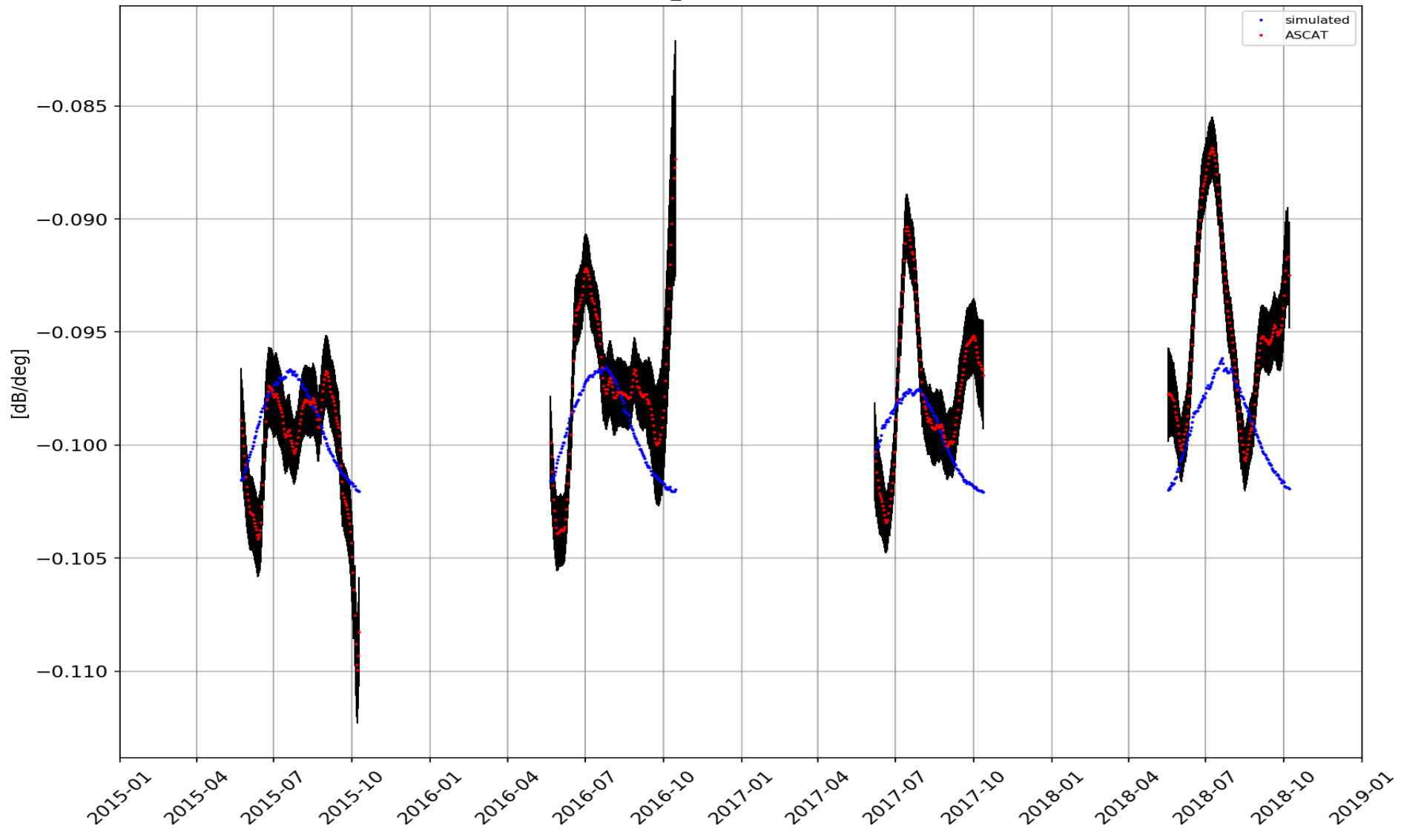
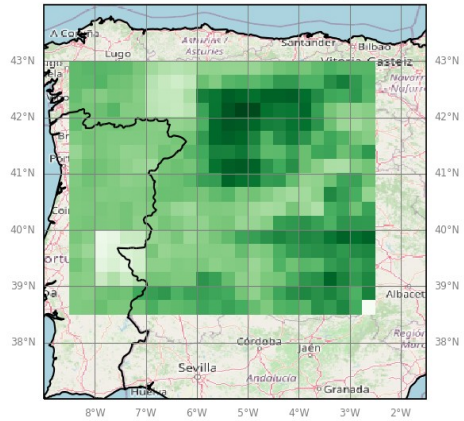# GPP and SIF at Sodankylä
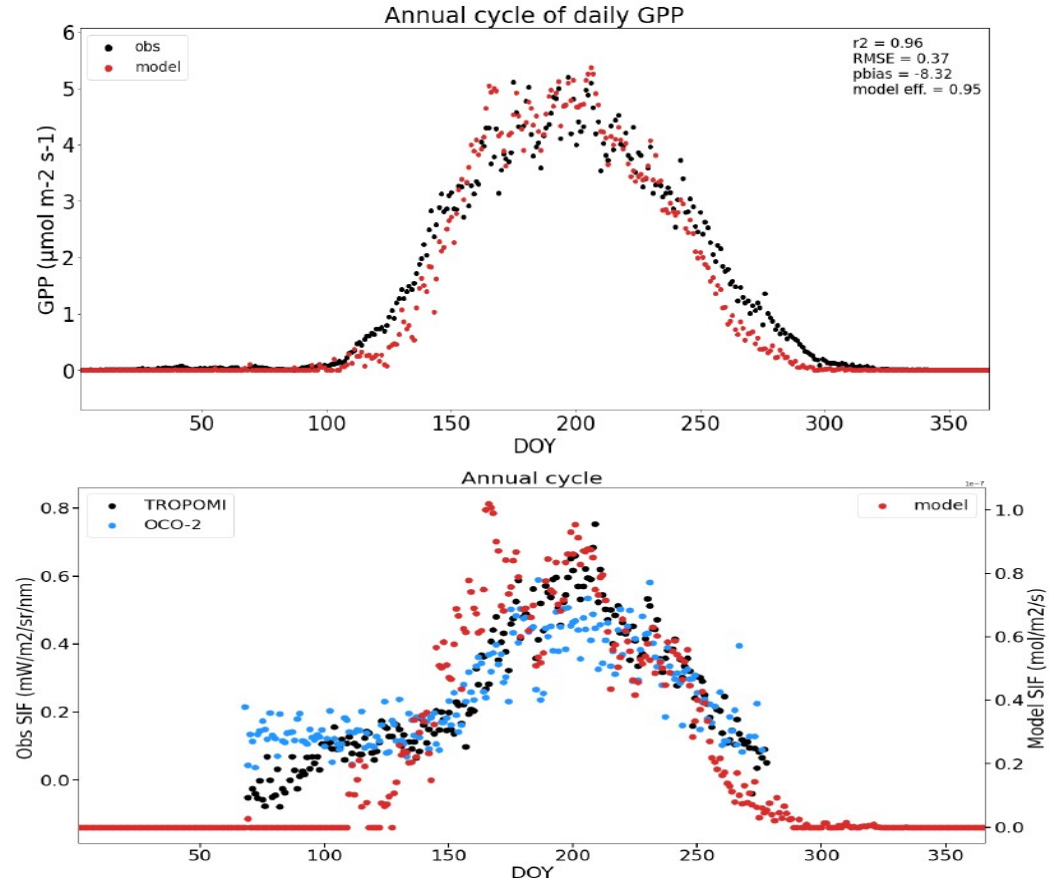
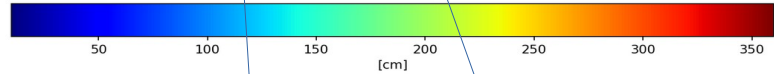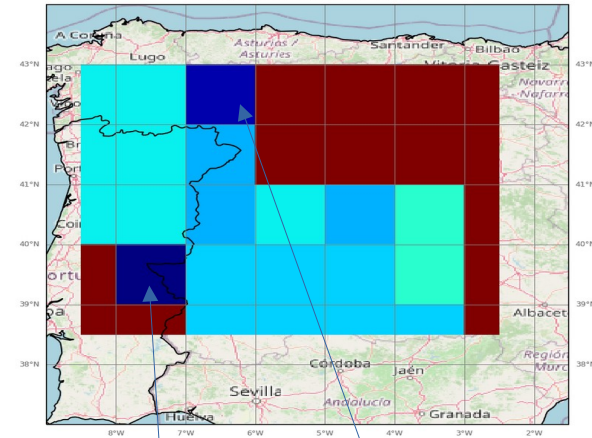# AGB over Finnish region against CCI and NFI
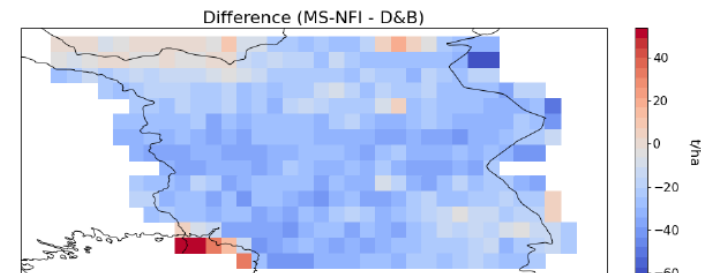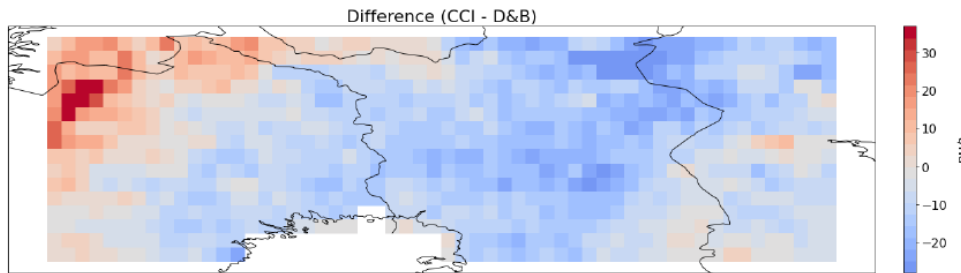
Soil depth and GPP at Majadas

D&B simulated annual-gpp (2018)

[KtC/d]

9.000W-1.500Wx37.000N-44.000N: soil profile depth [cm]
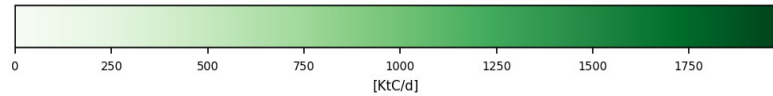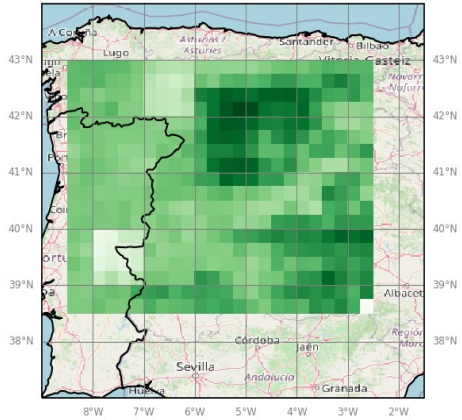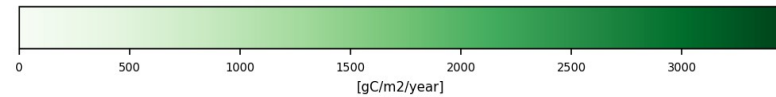min/mean/max = 1.0000E+01/2.0291E+02/3.6000E+02

[cm]

10 cm   25 cm

Soil depth and GPP at Majadas
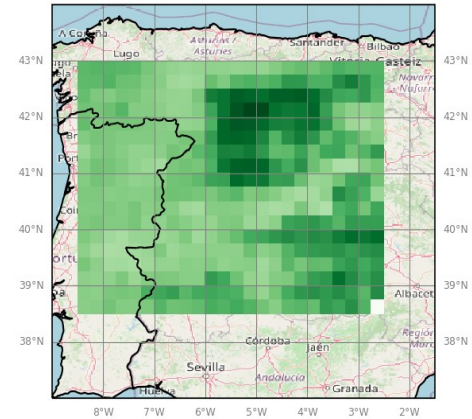
With soil depth
floor of 115 cm

Simulation on footprint/target area

Regular Model Grid

$f_1 \ldots f_n$

Observational Footprint
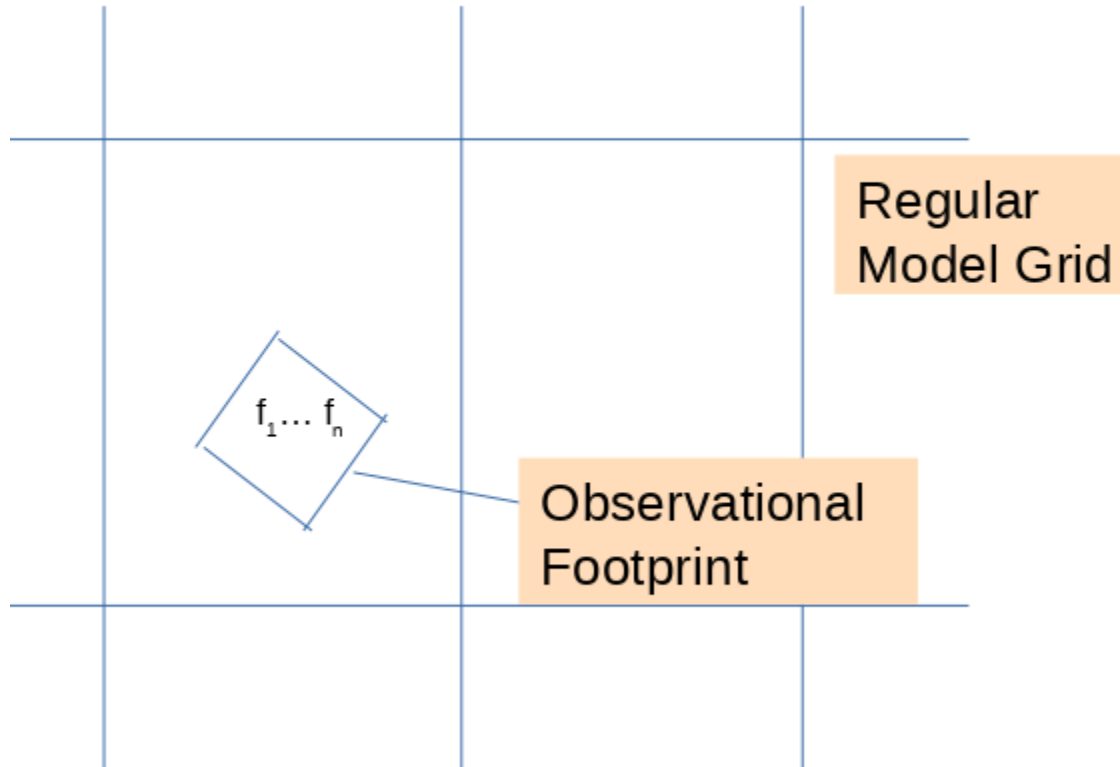
VOD – identical twin experiment

Assimilation of L-VOD, Twin Experiment 2015-2017

Convergence of Parameter Difference to Optimum from 50% perturbation

Summary D&B Model

DALEC & BETHY model:

- developed for simulation and assimilation of EO and field data

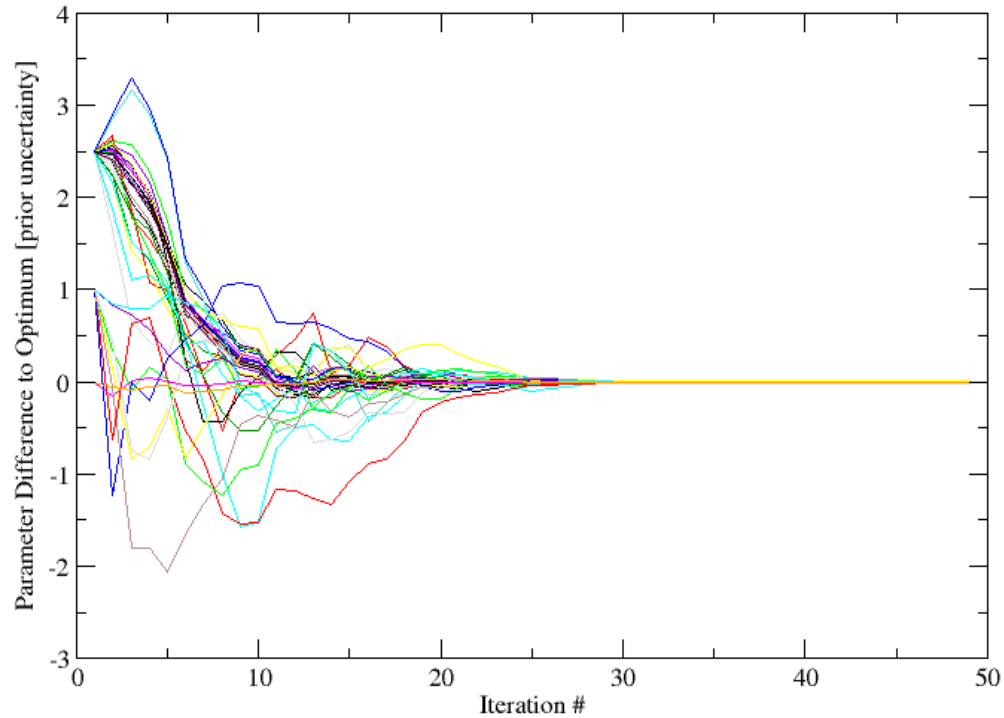- to provide an integrated perspective on terrestrial carbon and water cycles

- includes observation operators "on the swath" for a diverse array of observations

- includes tangent and adjoint codes for efficient data assimilation (system needs to be applicable at high spatial resolution)

- to be released to public domain as community model for use by larger group beyond the LCC team

Working in the LCC team, which combines experts in field work, remote sensing, modelling, and data assimilation is **CHALLENGING, FRUITFUL**, and **FUN,** much more than working isolated within the respective communities

Thank you!
More to come soon…