Land surface Carbon Constellation project

Marko Scholze and project team

EGU General Assembly, 24 May 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 (Sodankyla, Majadas, Reusel).

For this we will:

- Generate 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

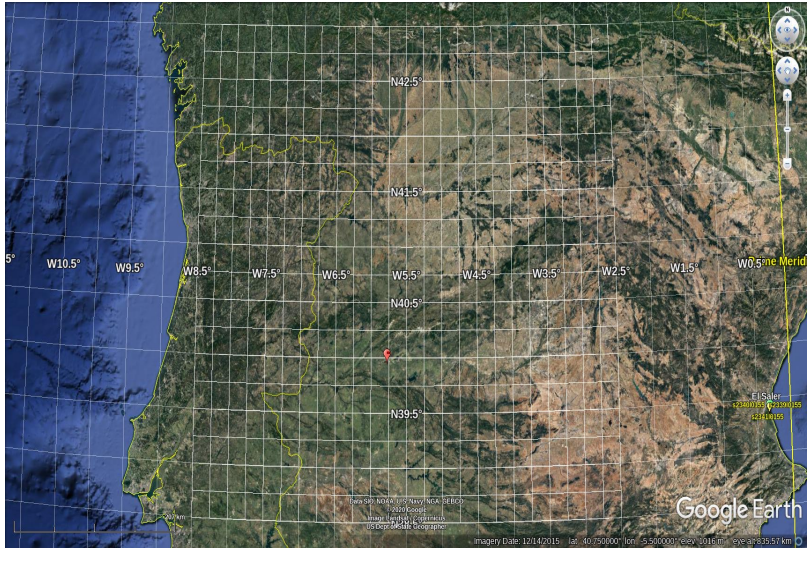
- Kicked off Oct 2020
- 13 partners
- 30 months duration
- More info at https://lcc.inversion-lab.com

Broad range of activities:

1. Field activities (microwave radiation, fluorescence, vegetation water)
2. EO data
3. Model and observation operators
4. Data assimilation

Regional scale modelling

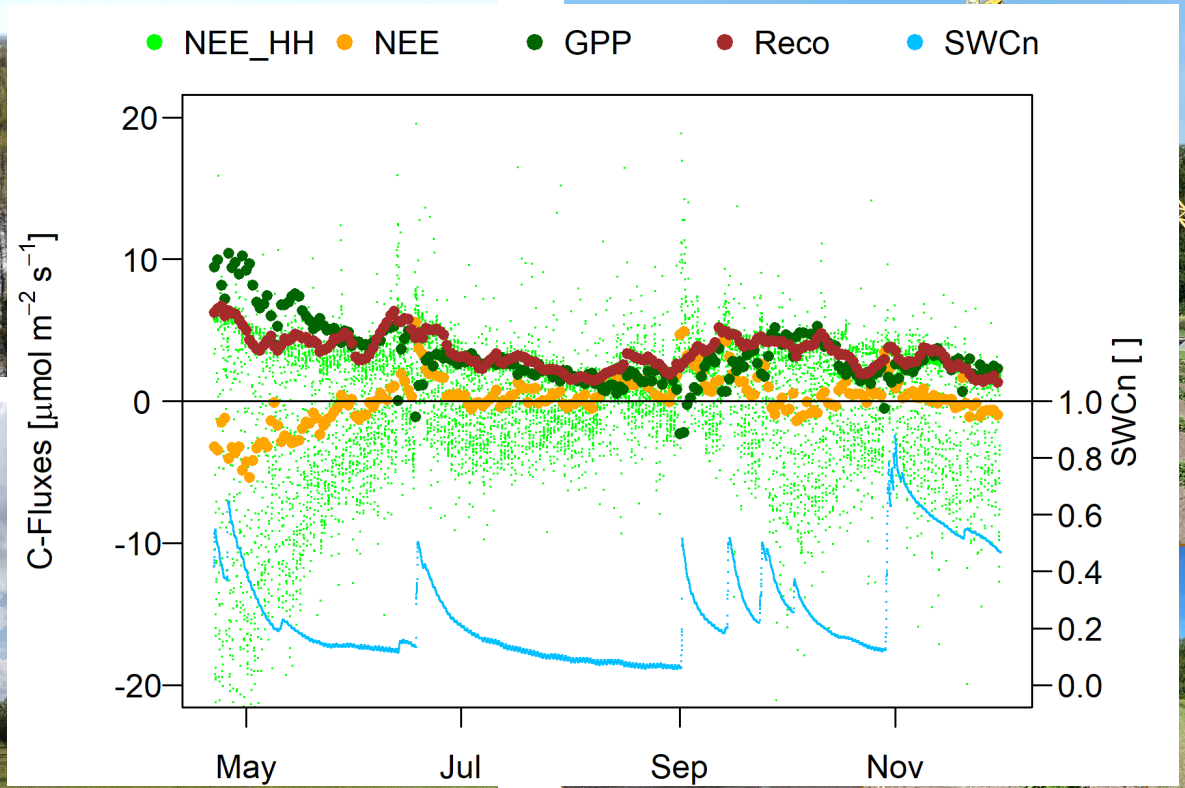
- Demonstration of synergistic use of observations at local and regional scale
- Regional scale: 500 km x 500 km area around the sites at 0.25 deg resolution (Sodankylä & Majadas)



Field sites

Reusel, The Netherlands

Sodankylä, Finland



Majadas de Tietar, Spain

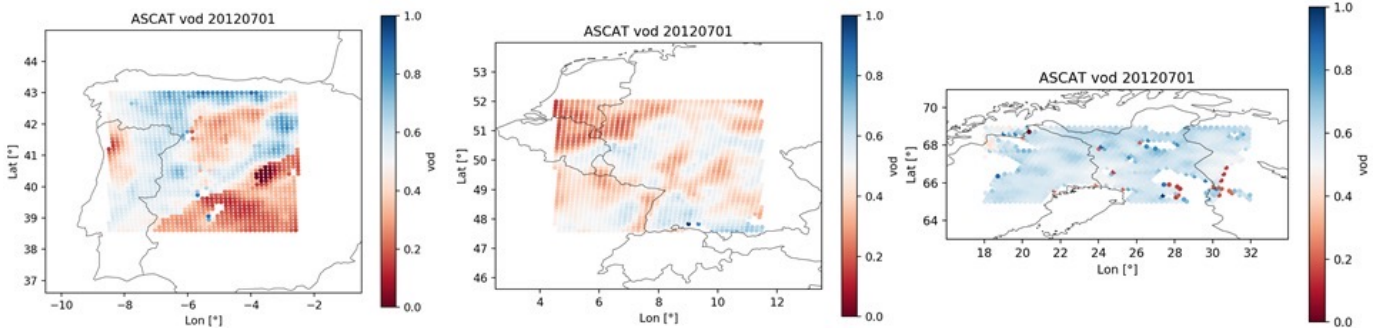
EO data

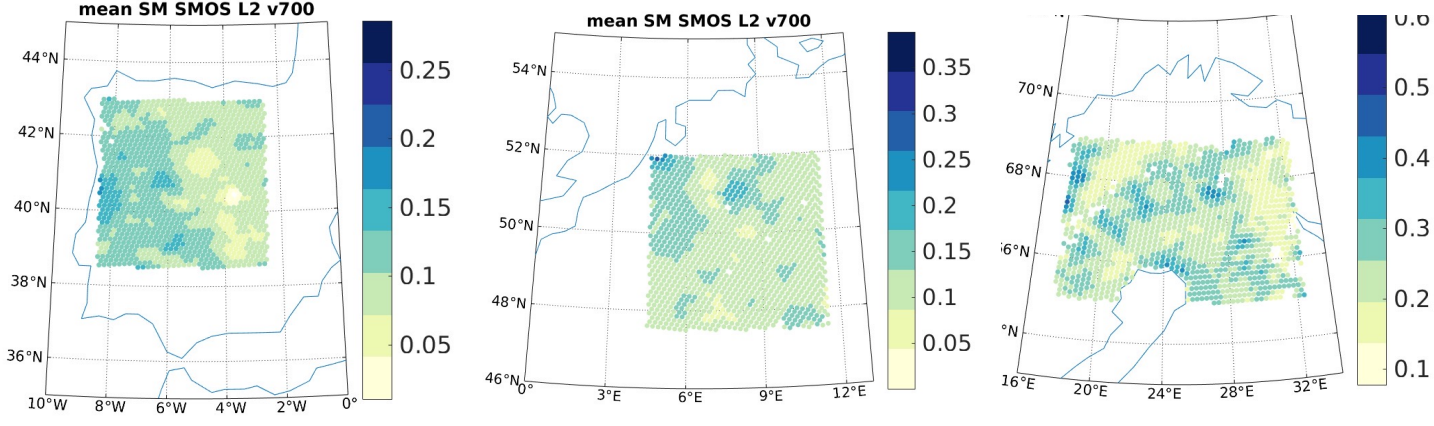
Compiling a database (L2 data) for use in assimilation, validation and process understanding including data analysis and uncertainties evaluation for

- Optical data
- Microwave (passive and active) data

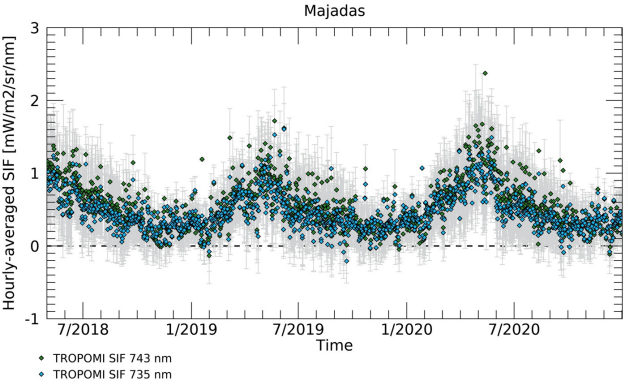
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Purpose
SMOS L-VOD												Assimilation
ASCAT C-VOD												Assimilation
OCO-2 SIF												Assimilation
Sentinel 5P SIF												Assimilation
S3 FAPAR/LAI												Assimilation
ASCAT backscattering												Validation
SMOS soil moisture												Assimilation
SMOS TB												Validation
AMSR-2 C-VOD												Validation
AMSR-2 X-VOD												Validation
MODIS LST												Auxiliary
MODIS PRI												Auxiliary
S3 LCC												Auxiliary
S3 FVC												Auxiliary

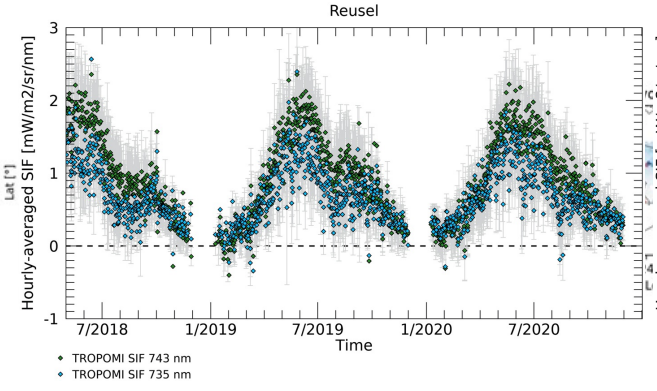
EO data: Examples

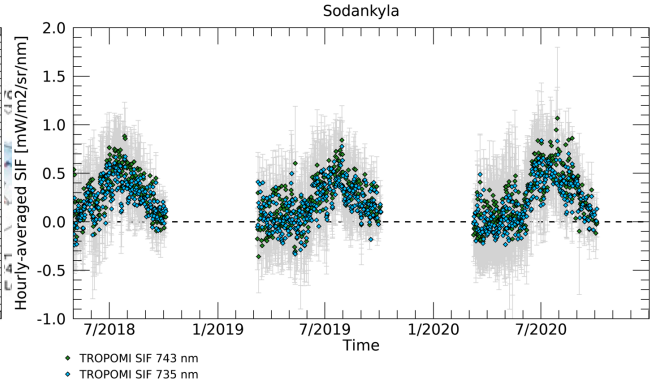


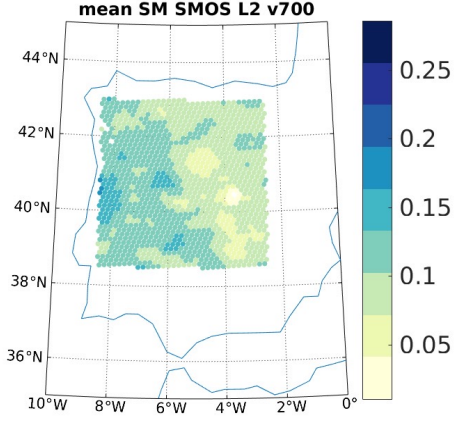


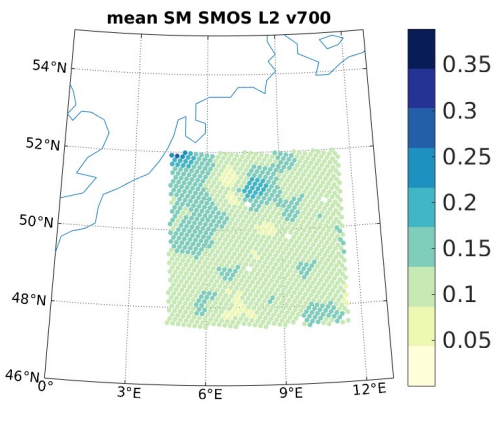
EO data: Examples

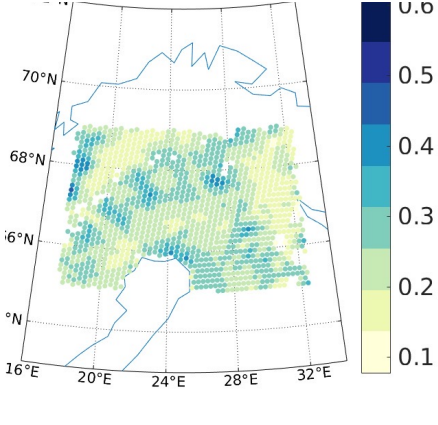




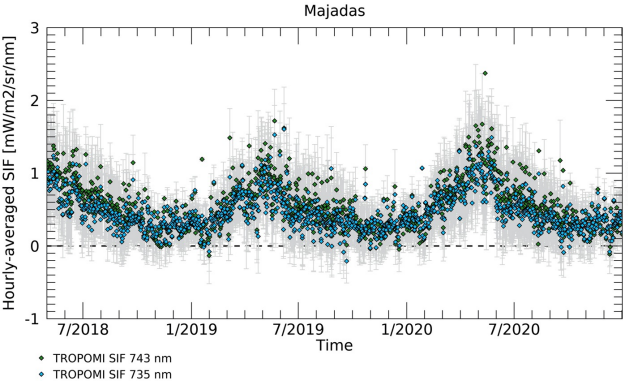


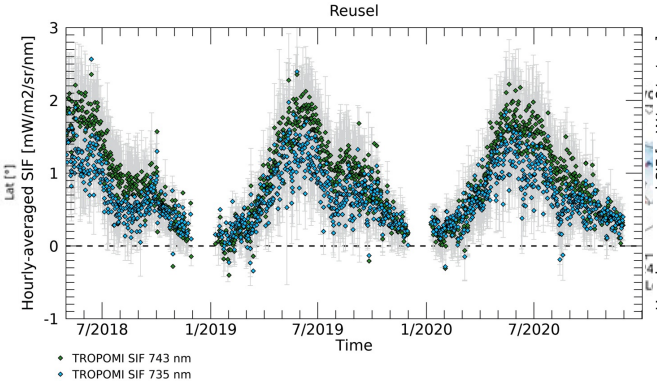


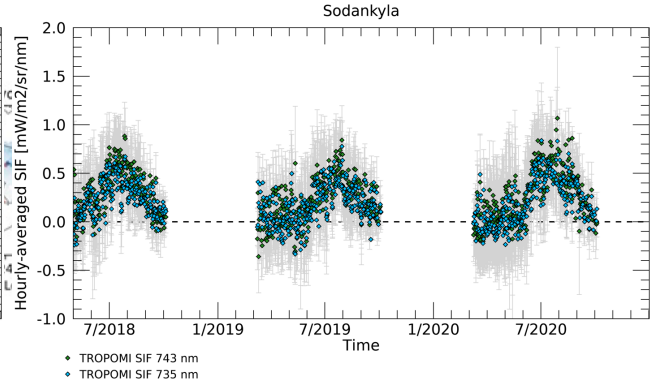


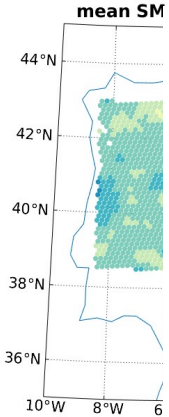


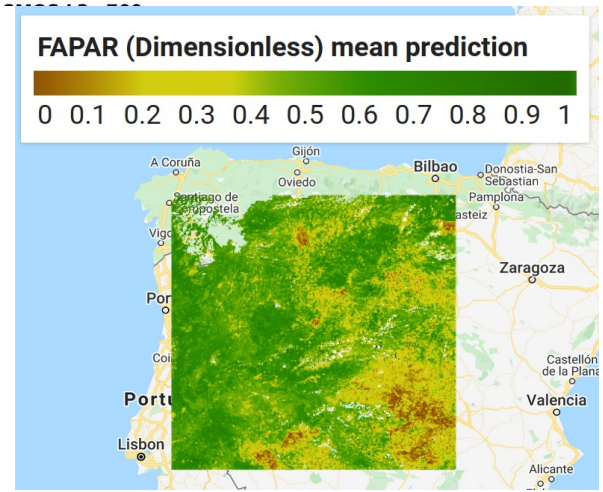
EO data: Examples

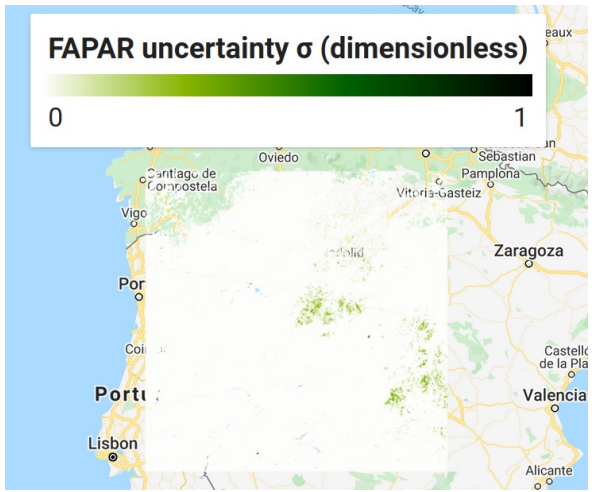






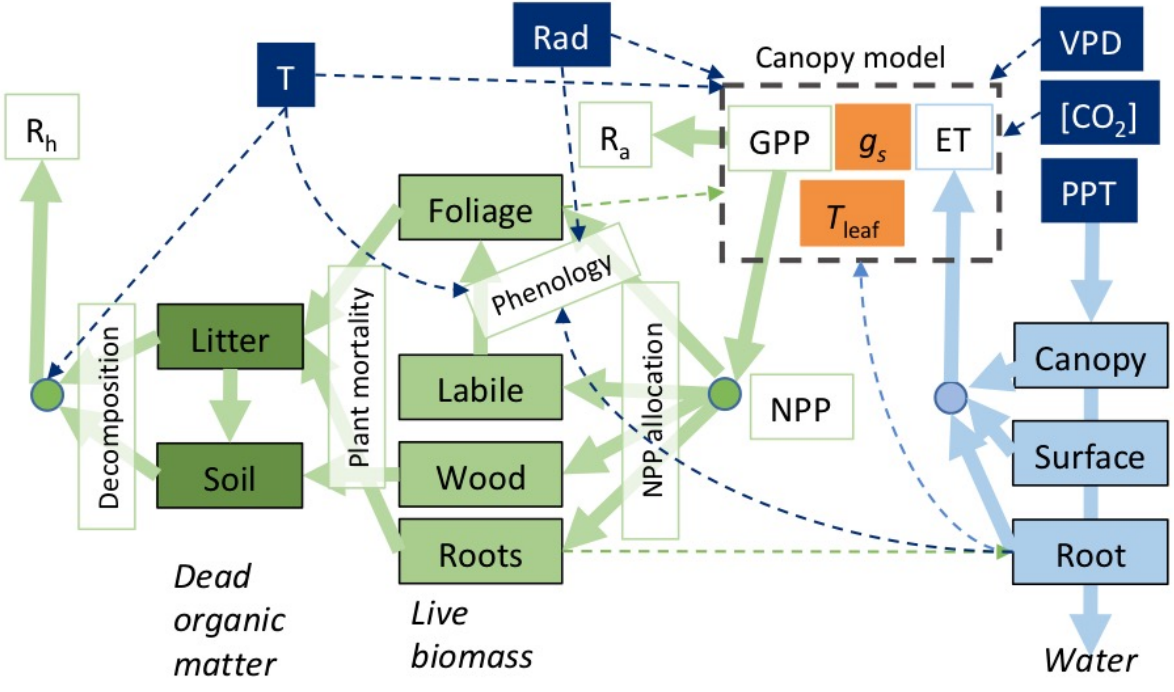






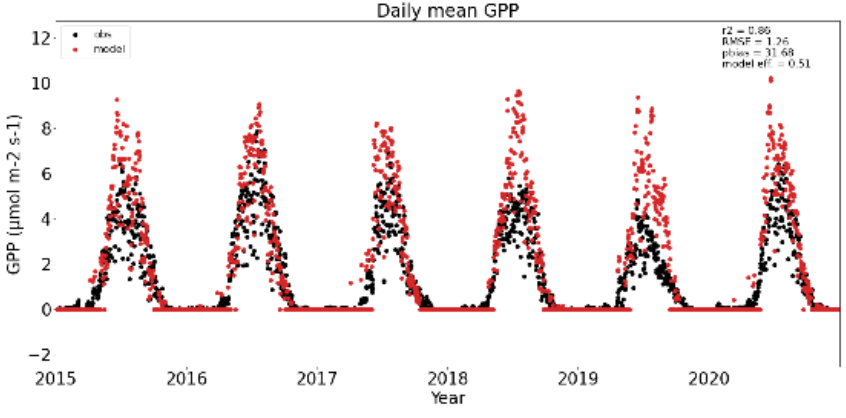
Community land surface model: D&B model

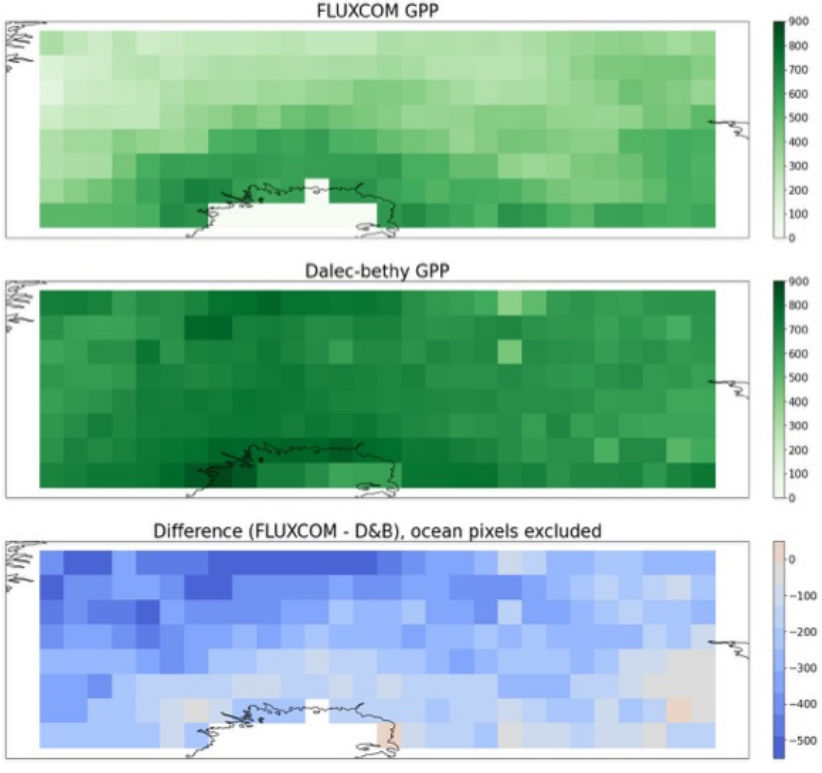
Based on a coupling of DALEC and BETHY



Community land surface model: D&B model

Model performance at Sodankylä



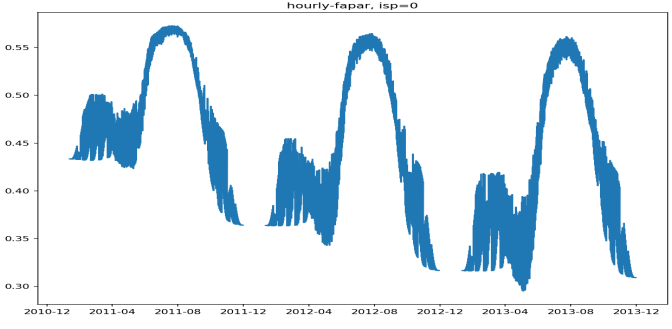


Observation Operators

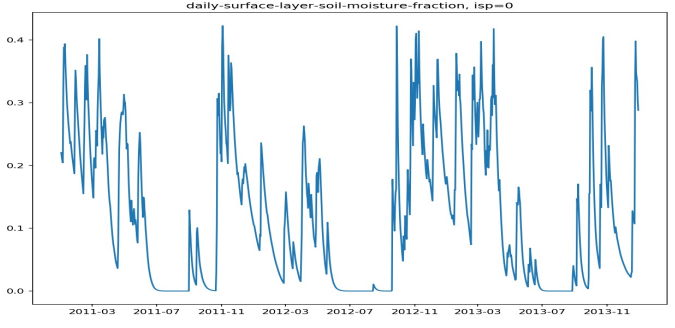
Inclusion of observation operators in the data assimilation framework for:

- FAPAR (Sellers 2-stream model)
- Surface layer soil moisture (1L-VIC)
- SIF (L2SM/SCOPE)
- Active/passive microwave VOD (empirical approach)

FAPAR at Sodankyla



SM at Majadas



Summary

- Database of EO and field data assembled for three sites/regions
- D&B model developed for simulation and assimilation of EO and field data including observation operators for a diverse array of observations as well as tangent and adjoint codes for assimilation
- Data and model will be released to public domain