A Terrestrial Carbon Community Assimilation System, TCCAS, for combining observations with a biosphere model into a consistent view of the terrestrial carbon cycle

Marko Scholze[1], Thomas Kaminski[2], Wolfgang Knorr[2], Michael Voßbeck[2], Mathew Williams[3], Luke Smallman[3], Mika Aurela[4], Alexandre Bouvet[5], Emanuel Büechi[6], Wouter Dorigo[6], Matthias Drusch[7], Tarek El-Madany[8], Tim Green[3], Marika Honkanen[4], Yann Kerr[5], Anna Kontu[4], Juha Lemmetyinen[4], Hannakaisa Lindqvist[4], Arnaud Mialon[5], Mirco Migliavacca[8], Tuuli Miinalainen[4], Pablo Reyes Muñoz[9], Amanda Ojasalo[4], Tristan Quaife[10], Peter Rayner[2], Nemesio Rodríguez-Fernández[5], Dirk Schüttenmeyer[7], Susan Steele-Dunne[11], Tea Thum[4], Jochem Verrelst[9], Mariette Vreugdenhil[6], Sönke Zaehle[8], Songyan Zhu[3]

[1]Lund University, Lund, Sweden. [2]The Inversion Lab, Hamburg, Germany. [3]University of Edinburgh, Edinburgh, United Kingdom. [4]Finish Meteorological Institute, Helsinki, Finland. [5]CESBIO (Université de Toulouse), Toulouse, France. [6]TU Wien, Vienna, Austria. [7]European Space Agency, ESTEC, Noordwijk, Netherlands. [8]MPI Biogeochemistry, Jena, Germany. [9]Universidad de Valencia, Valencia, Spain. [10]University of Reading, Reading, United Kingdom. [11]TU Delft, Delft, Netherlands

Objectives

The Terrestrial Carbon Community Assimilation System (TCCAS) has been developed to investigate the land C ecosystem exchanges by means of combining a process-based model with a wide range of observations (in-situ and remotely sensed) through data assimilation on local and regional scales.

Modelling Approach

The D&B community land surface model (Knorr et al., 2024) is based on a coupling of the DALEC (Williams et al., 2005) and BETHY (Knorr, 1997) models. D&B simulates terrestrial carbon and water cycles constrained by EO data from optical as well as passive and active microwave sensors.
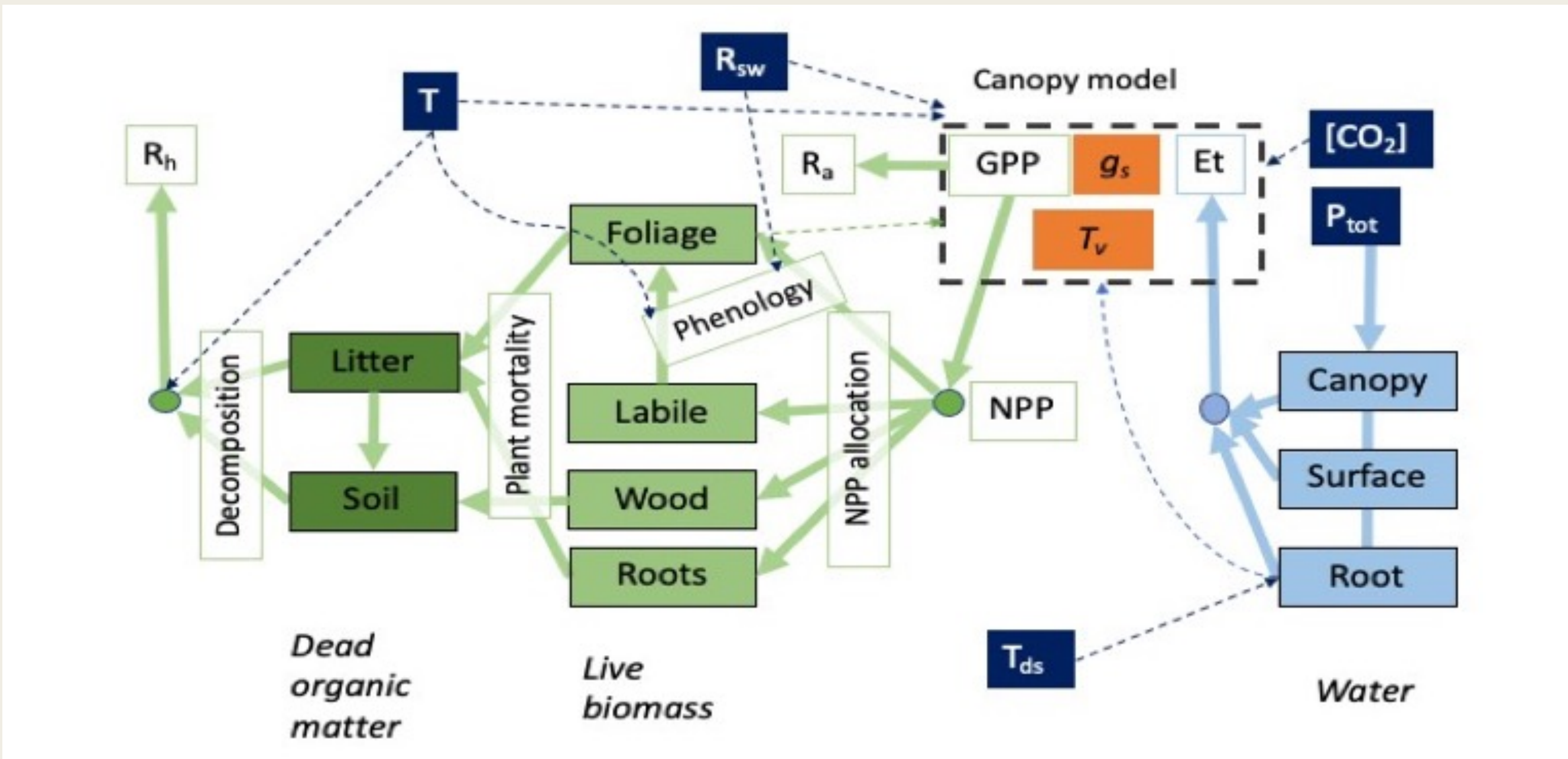
Demonstrating the synergistic use of observations at local scale for the two Fluxnet/ICOS sites Sodankylä (boreal, Finland) and Majadas del Tietar (savanna, Spain) and at regional scale for an area of 500 km x 500 km area around the sites at 0.25 deg resolution.
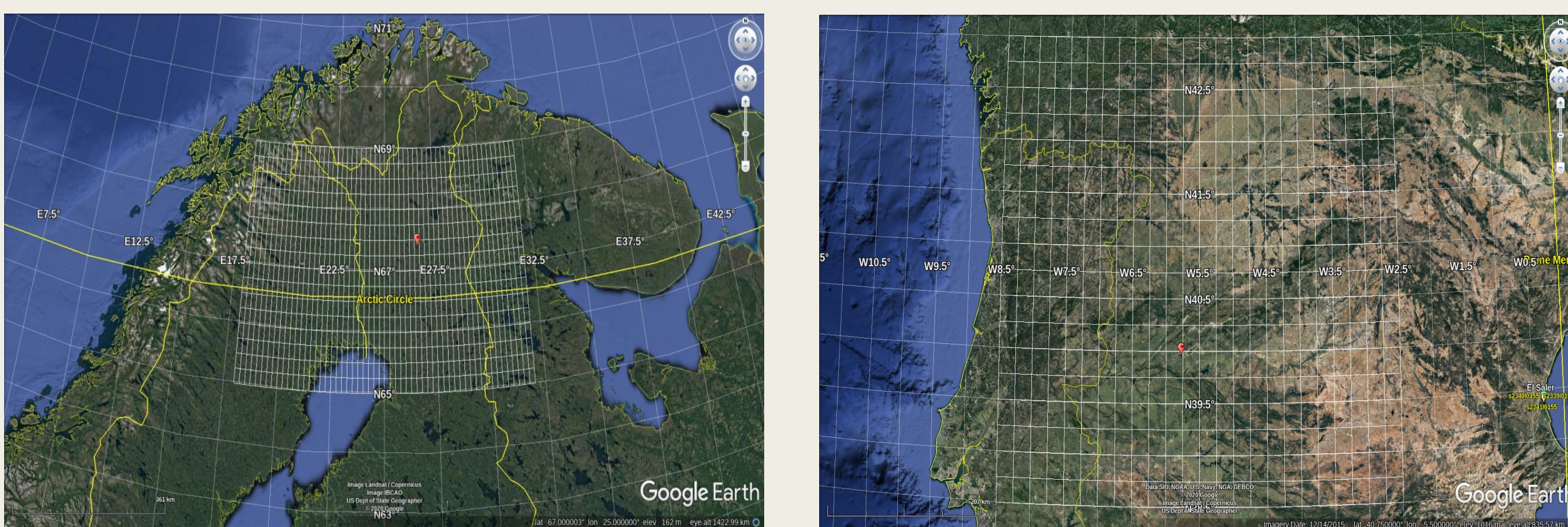
Code and Data Availability

Code, data and training material are made available through an ESA funded follow-up project on TCCAS as a community tool: https://tccas.inversion-lab.com/

A dedicated training event (online and in person) is organised on 7/8 October 2024, more information including application form (deadline 31 July 2024):
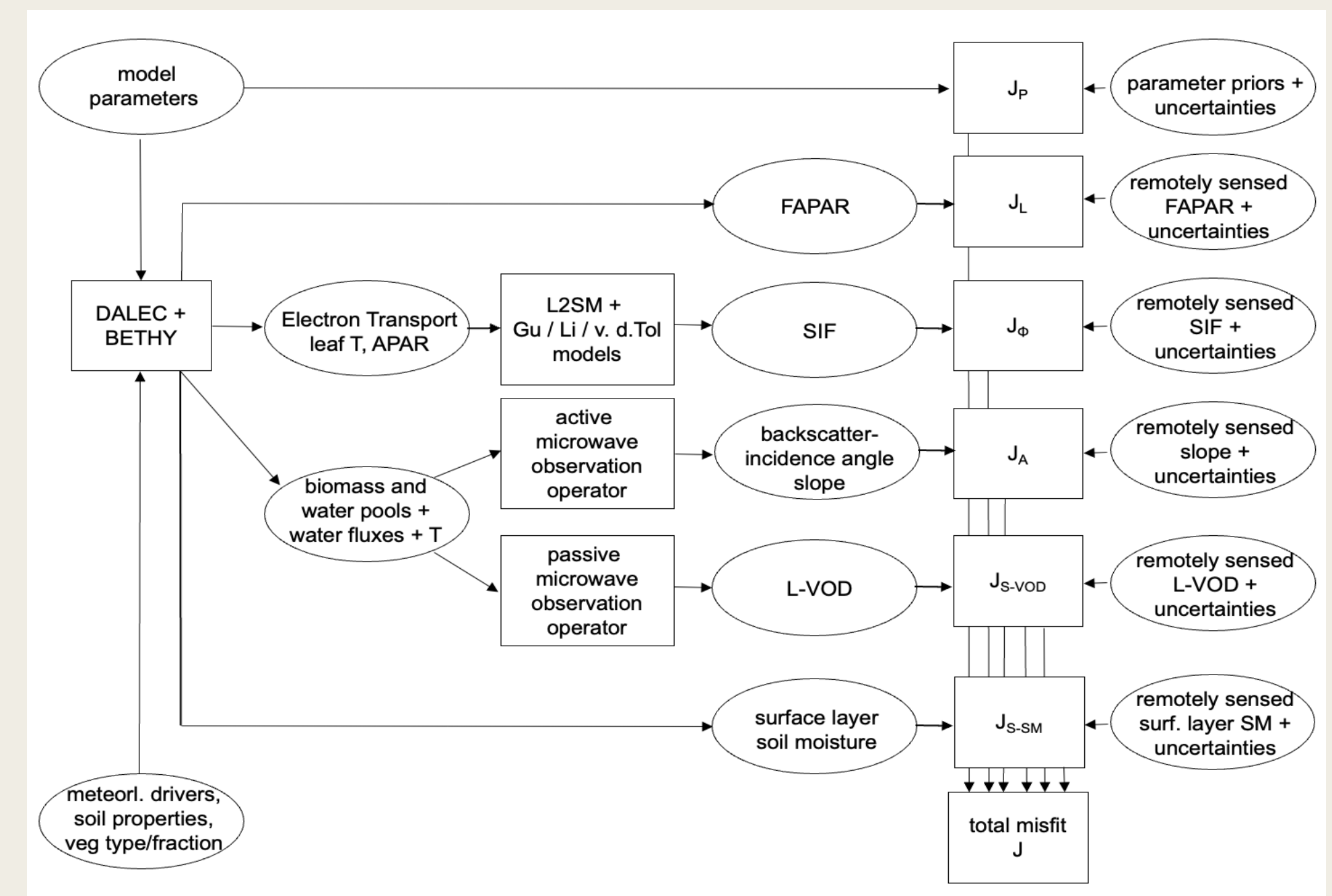
https://tccas-study.inversion-lab.com/training.html

Observation Operators and Data Assimilation

Dedicated observation operators have been developed and are made available for Solar Induced Flourescence (SIF), Vegetation Optical Depth (L-VOD; passive microwave) and backscatter incident angle slope (active microwave).
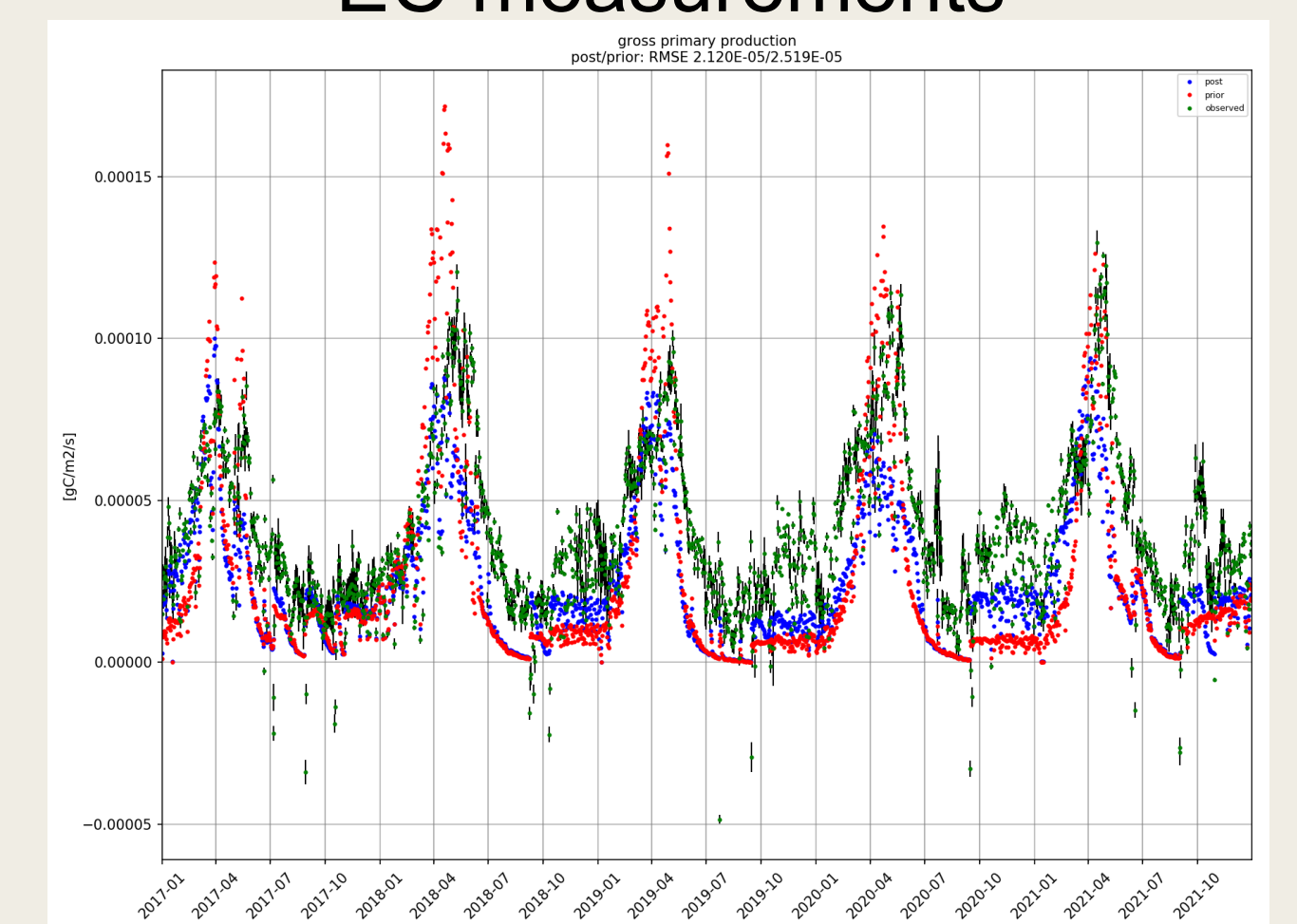

Results: 2 Examples

1) Site scale experiment at Majadas assimilating FAPAR, SIF, L-VOD and surface layer soil moisture for the years 2017-2021

Assimilation of SIF
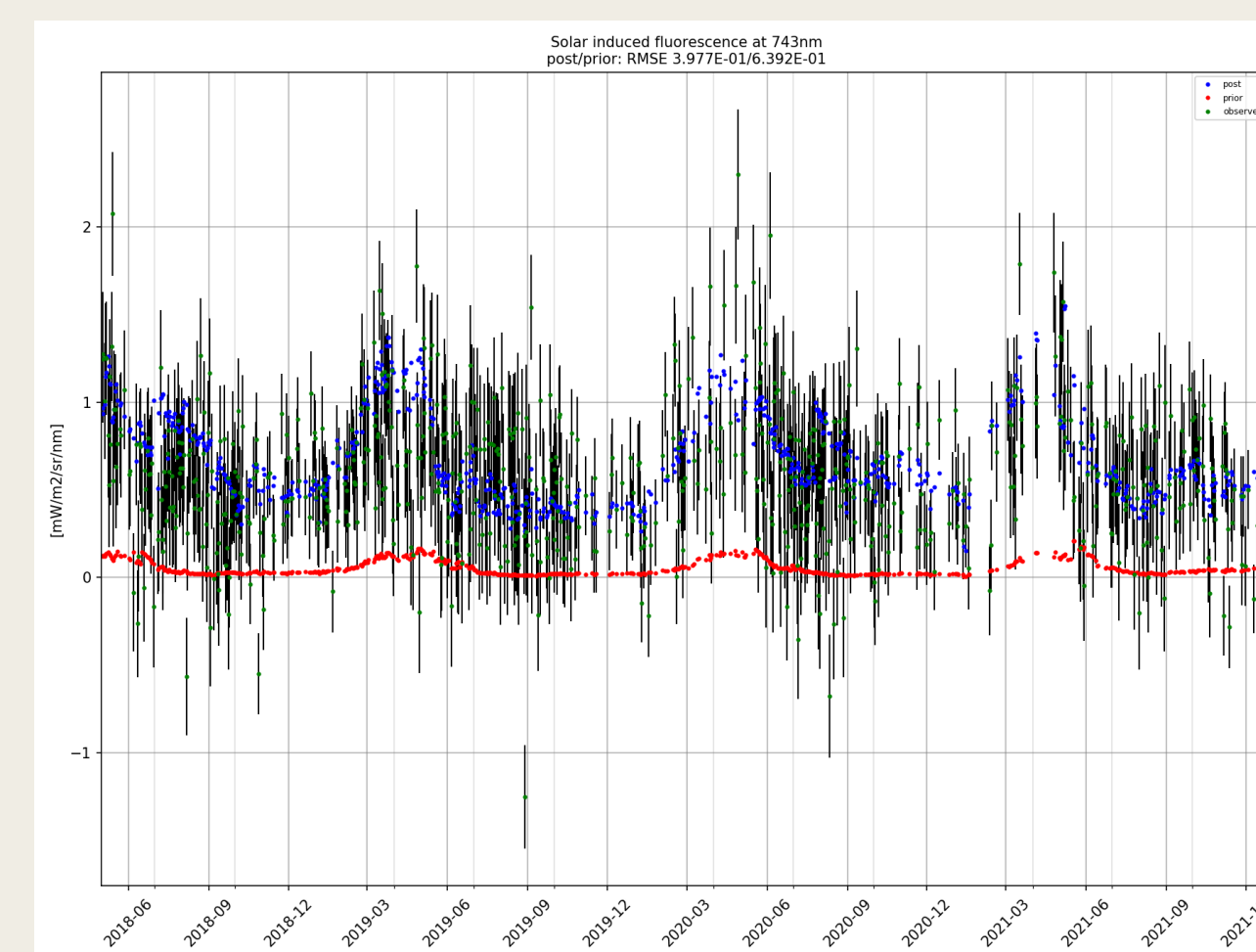
Validation against GPP from EC measurements

2) Regional scale experiment over Lapland assimilating SIF, L-VOD and surface layer soil moisture for the years 2017-2021

posterior validation against 2 AGB (ESA-CCI & Finish NFI) products

References

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Williams, M., Schwarz, P. A., Law, B. E., Irvine, J., and Kurpius, M. R.: An improved analysis of forest carbon dynamics using data assimilation, Global Change Biology, 11, 89–105, 2005

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