



# ECOPROPHET

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BEODAY MEETING, BEERSEL, 30<sup>TH</sup> JANUARY 2018



ECOPROPHET *“Improved Ecosystem Productivity Modeling by Innovative Algorithms and Remotely Sensed Phenology Indicators”* is a project funded by BELSPO (Belgian Science Policy Office) in the frame of the STEREO III programme (Contract number: SR/00/334)

# This project

Title: Improved **ECO**system **PRO**ductivity Modeling by Innovative Algorithms and Remotely Sensed **PHE**nology Indicators

Promotors: Prof. Ivan Janssens & Manuela Balzarolo

Period: 15/12/2016 – 31/07/2021 (56 months)

Funded by BELSPO in the frame of the STEREO III programme

Contract N. **SR/00/334**

Project website: <http://ecoprophet.meteo.be>

# Project team



Coordinator  
University of Antwerp  
UA

- Ivan JANSSENS (PI)
- Manuela BALZAROLO (PI)
- Matteo CAMPIOLI
- Sara VICCA
- Maral MALEKI - PHD Student\*



Belgian partner 1  
Royal Meteorological Institute  
P1, RMI

- Françoise MEULENBERGHS
- Rafiq HAMD I
- Miguel BARRIOS\*
- Nicolas GHILAIN
- Alirio ARBOLEDA



International partner 1  
Peking University  
IP1, PKU

- Shilong PIAO
- Sushi PENG
- Zaichun ZHU
- Qiang LIU
- Post-doc researcher\*



International partner 2  
Laboratoire des Sciences du  
Climat et de l'Environnement  
IP2, LSCE

- Philippe CIAIS
- Ana BASTOS
- Fabienne MAIGNAN
- Xiuzhi CHEN\*

# Some definitions

GPP = the total amount of carbon fixed in the process of photosynthesis by plants in an ecosystem.

NPP = Net Primary Production is the amount of carbon uptake after subtracting Plant Respiration (RES) from Gross Primary Productivity (GPP).

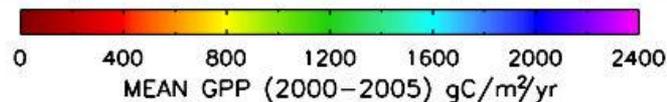
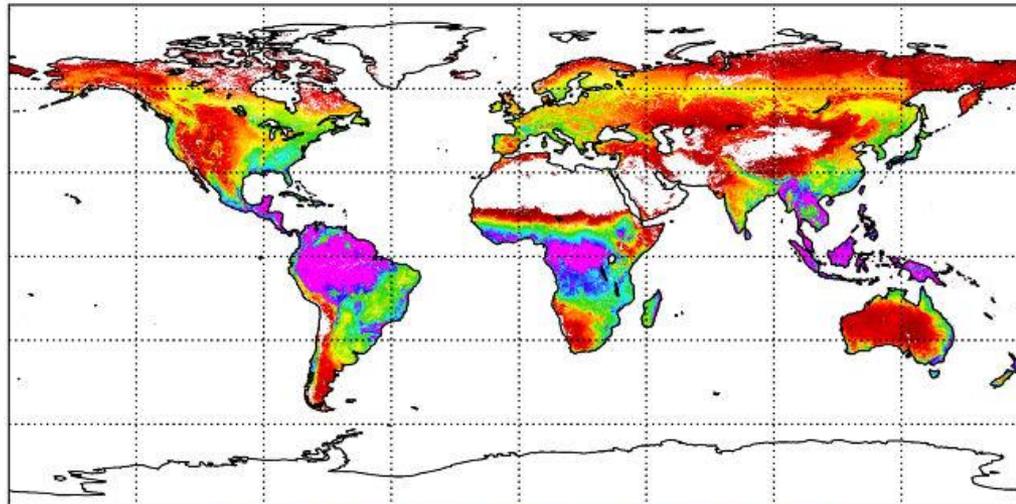
$$NPP = GPP - RES$$

# Motivation

Terrestrial ecosystems provide food, feed, fibre, ...

→ Important to monitor global ecosystem productivity and build better models

→ R:S-based models & Land surface models



MOD17

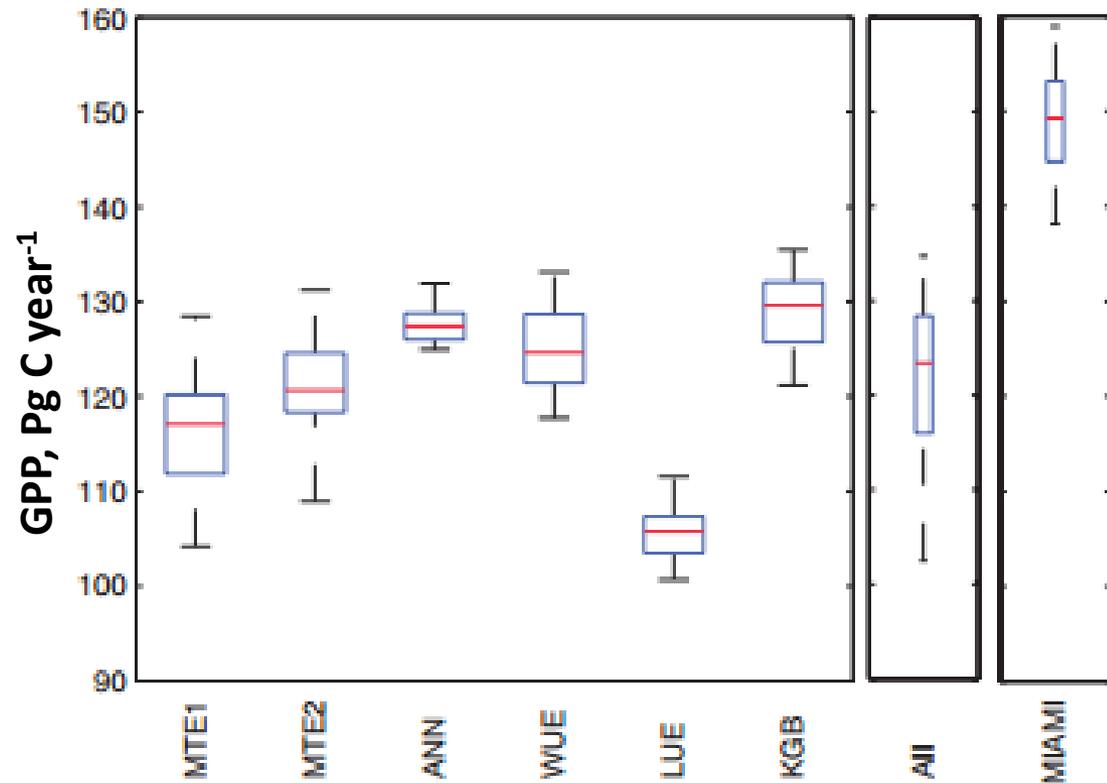
# Motivation

Terrestrial ecosystems provide food, feed, fibre, ...

→ Huge uncertainty in global GPP & NPP estimates

## GPP:

Beer et al. Science 2010



# Motivation

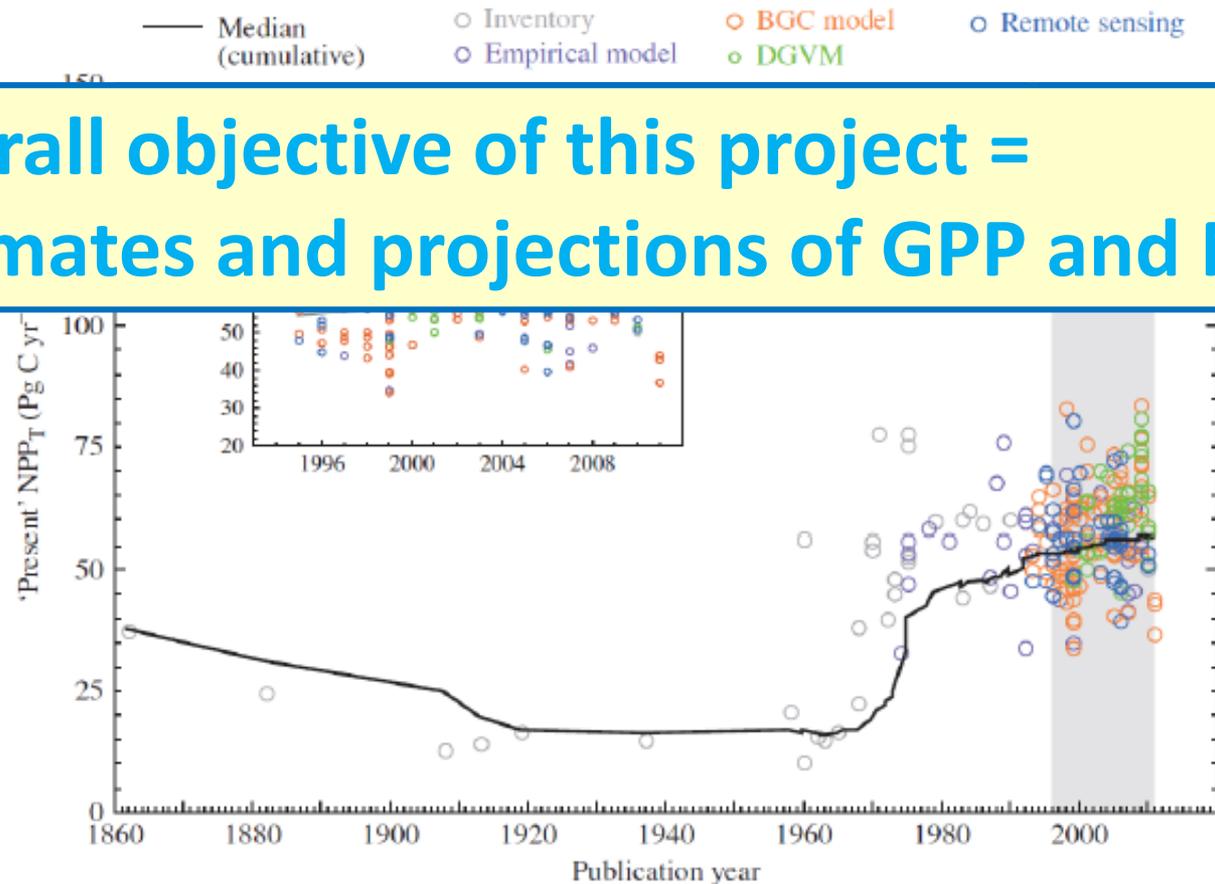
Terrestrial ecosystems provide food, feed, fibre, ...

→ Huge uncertainty in global GPP & NPP estimates

**Overall objective of this project =  
improve estimates and projections of GPP and NPP**

**NPP:**

Ito, GCB 2011

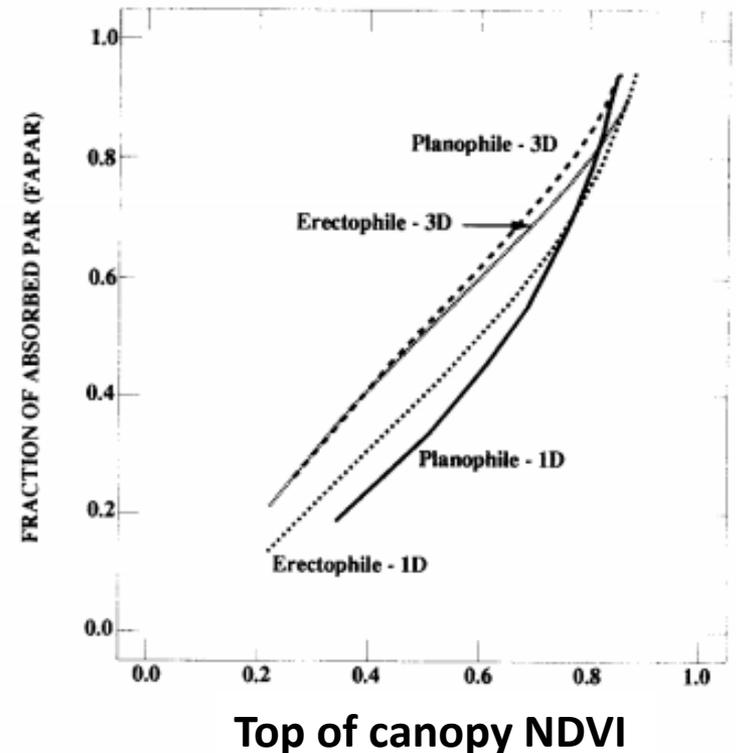


# Motivation

Both R:S-based and Land surface models depend on observations of surface greenness (NDVI, fAPAR)

R:S-based models:  $GPP = PAR_{in} * fAPAR * \epsilon$

NDVI converted into fAPAR :  
(e.g. Myneni & Williams 1994)

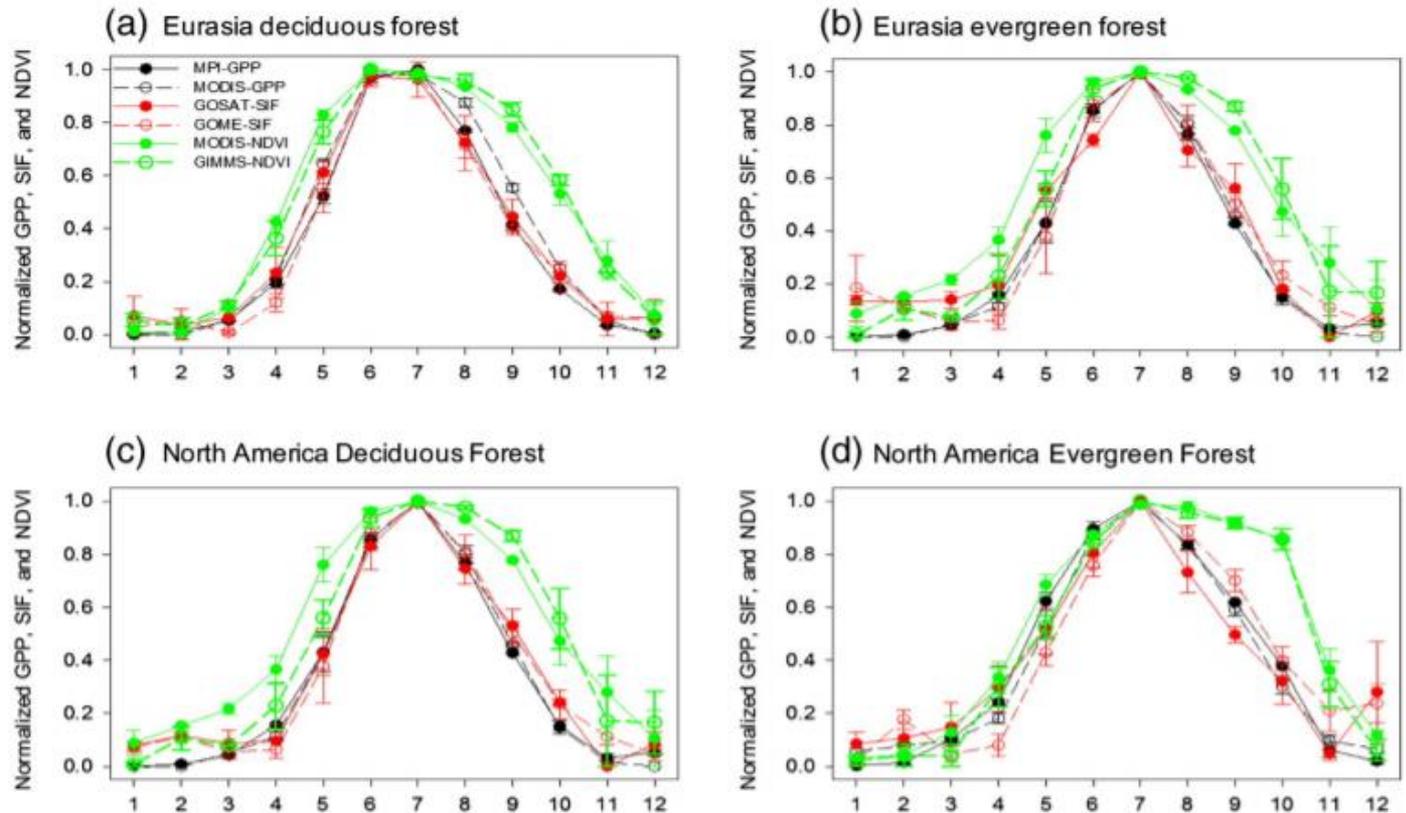


# Greening of the Earth

Both R:S-based and Land surface models depend on observations of surface greenness (NDVI, fAPAR)

**NDVI  $\neq$  GPP**

Jeong, RSE 2017



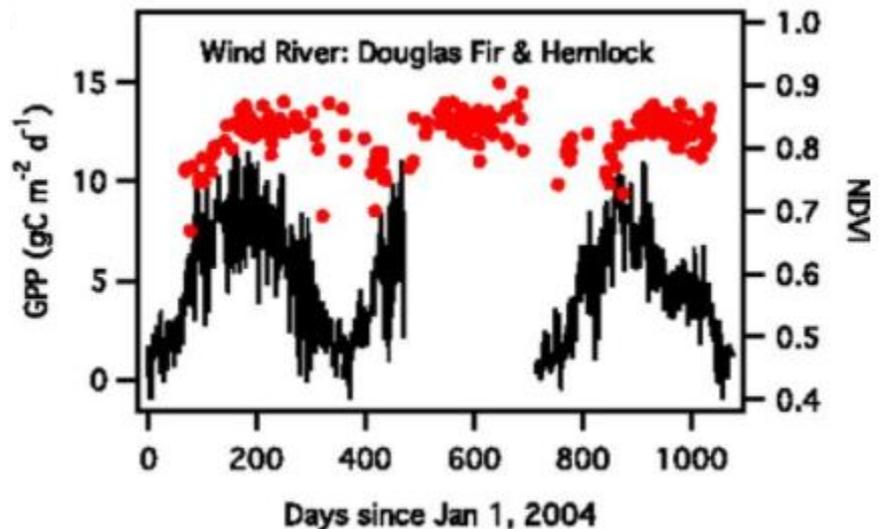
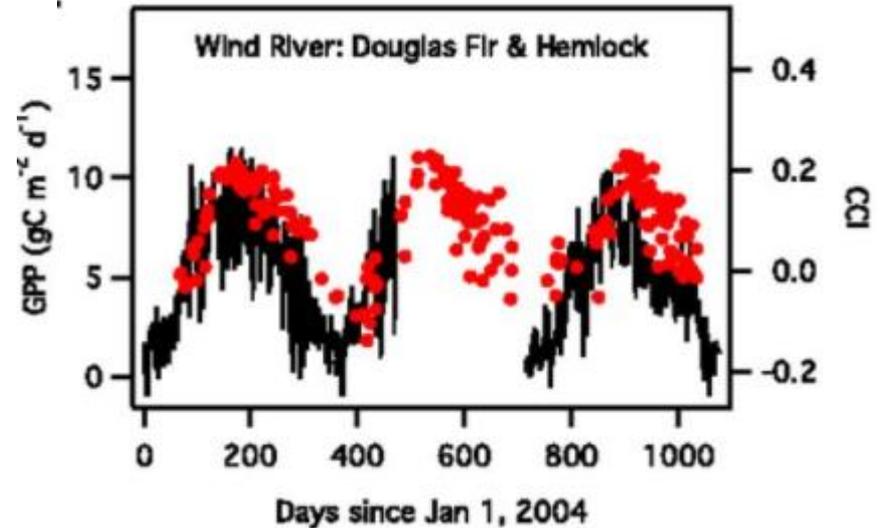
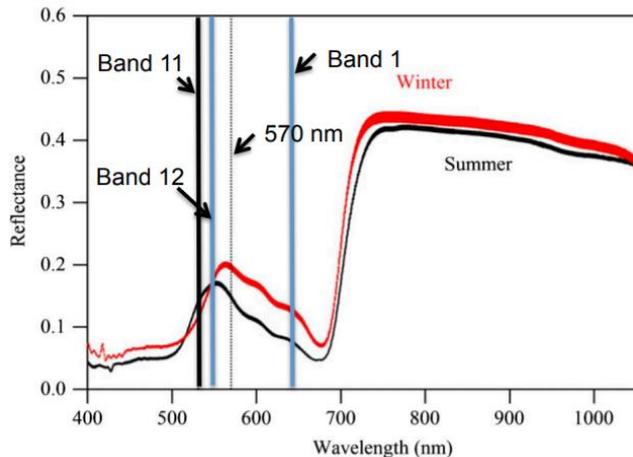
# “Invisible” evergreen phenology

## CCI

Gamon et al.,  
PNAS 2016

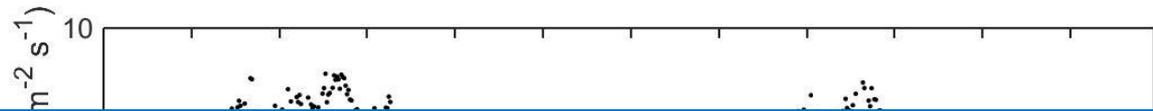
Chlorophyll:Carotenoid Index:

$$CCI = \frac{\text{Band 11} - \text{Band 1}}{\text{Band 11} + \text{Band 1}}$$



# Greening of the Earth

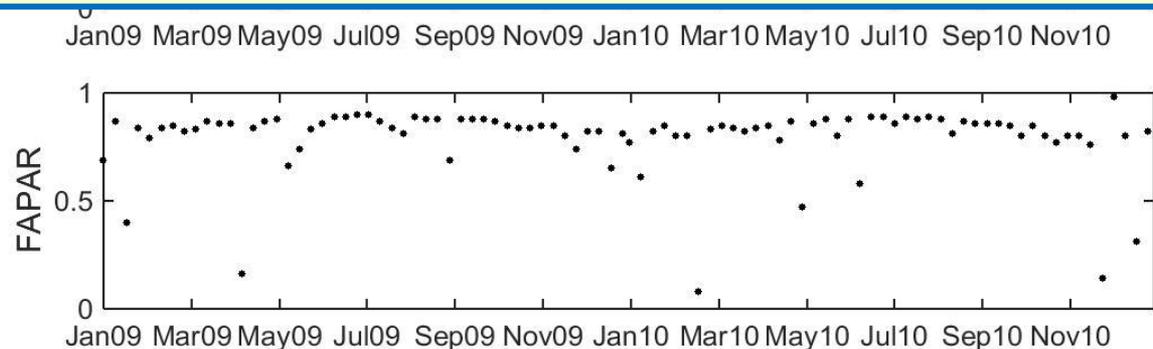
e.g. Mediterranean oak forest



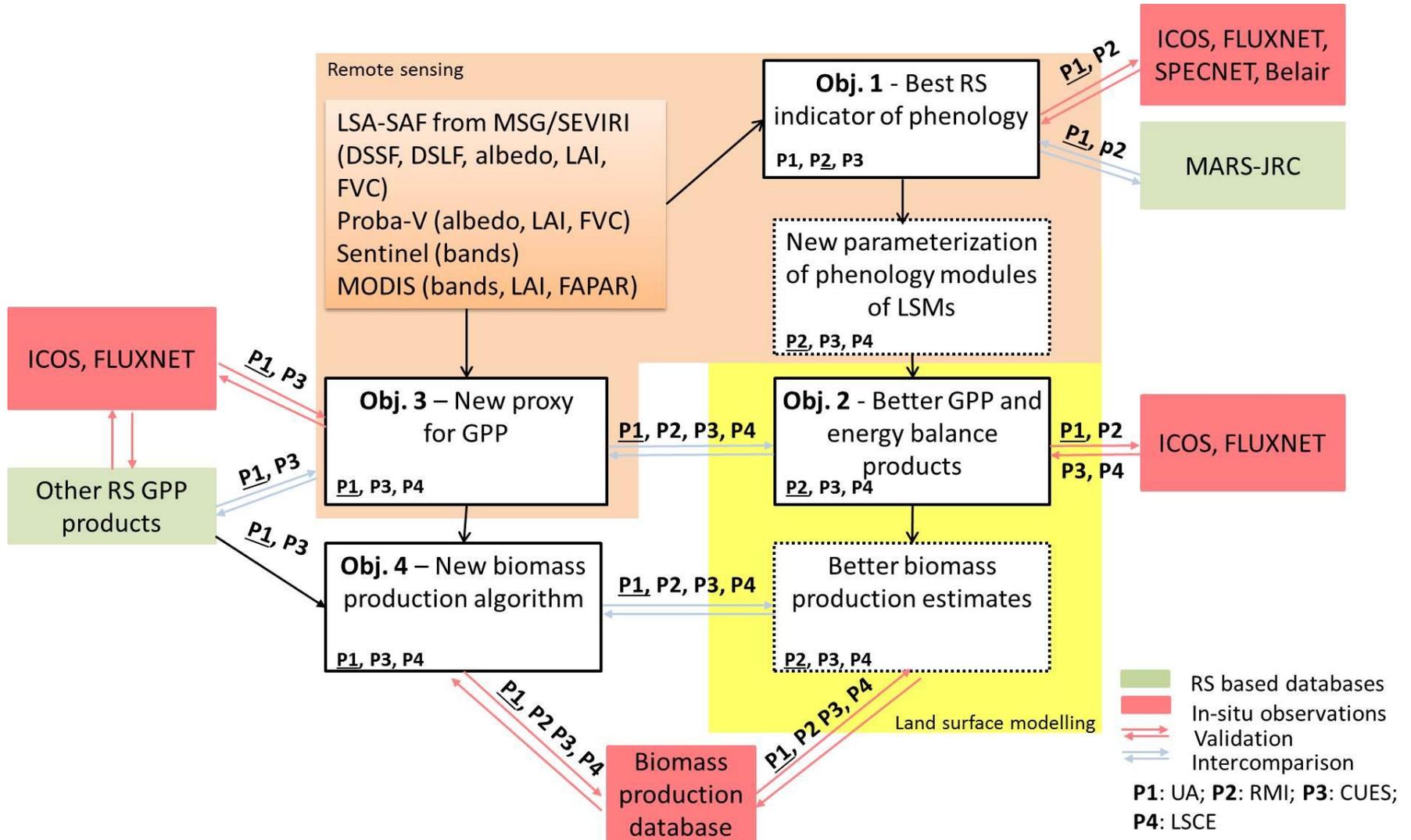
**Resolve this issue by no longer depending on NDVI**

**→ Use new RS products that correlate with plant functioning, not with canopy greenness**

Reports 2016



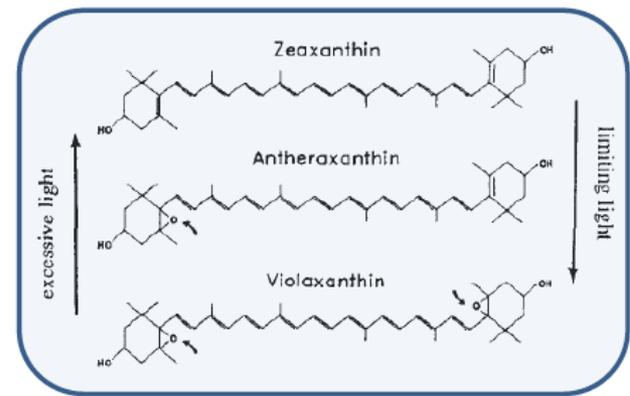
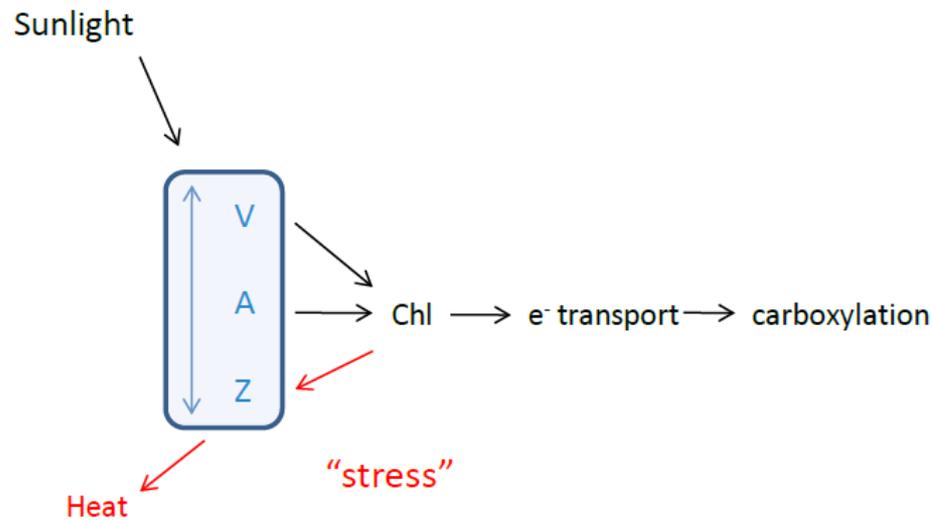
# Specific objectives



# Functional phenology indices

Test the large variety of new R:S products (Sentinel; PROBA-V)

**Identify products that are closely coupled to the phenology of photosynthesis**

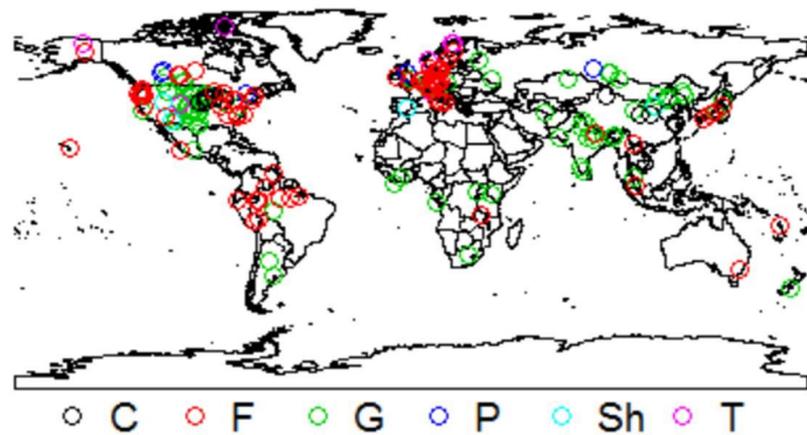
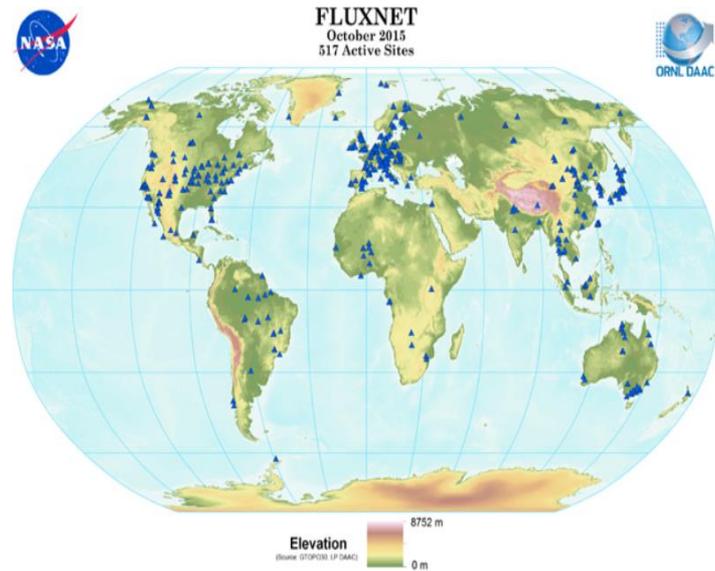


Gamon et al. 1992

**PRI** Chl-related : Red Edge; MTCI; TCARI; CCI; ...

# Database building

Site homogeneity characterization

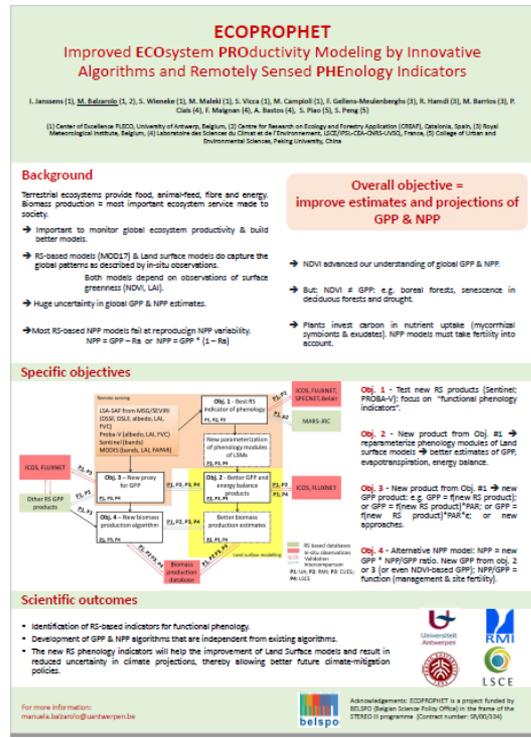
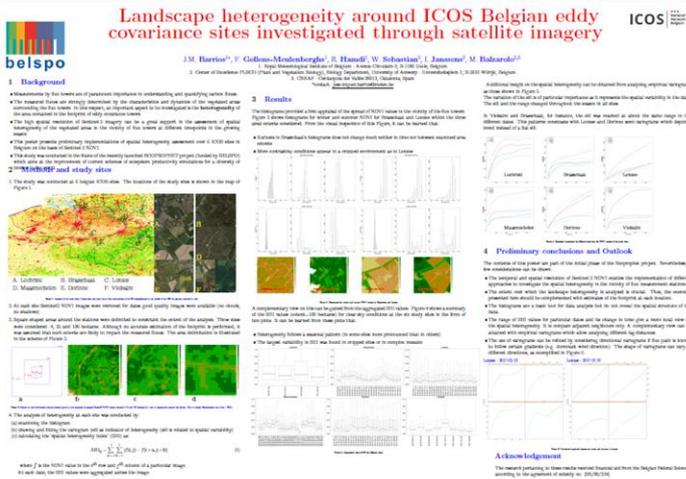


# Dissemination

ICOS Belgium Science Conference, Gembloux (Belgium), 20 October 2017 – Two posters presentation

Project poster

<http://ecoprophet.meteo.be>





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