Calibration of simulation models by integrating remote sensing estimates of leaf area index

Pepijn van Oort, Frits van Evert, Corne Kempenaar

Wageningen Plant Research

BU: Agrosystems Research

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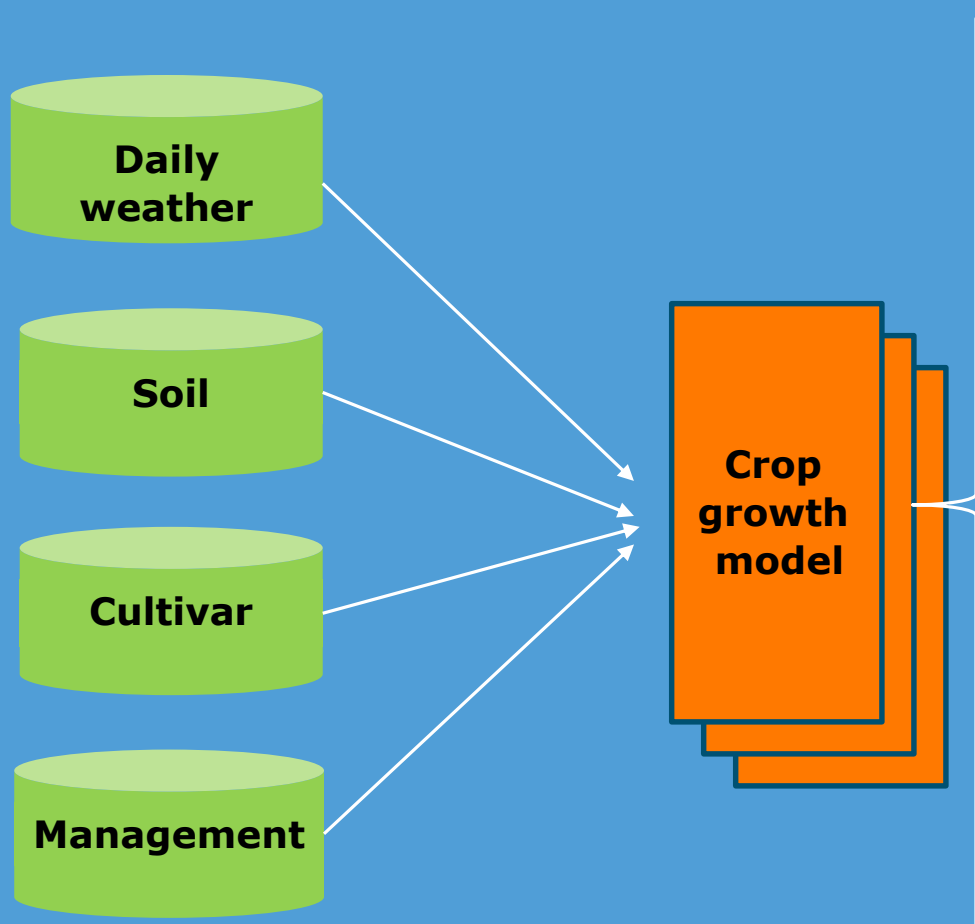
Aim: potato yield prediction for any parcel in NL

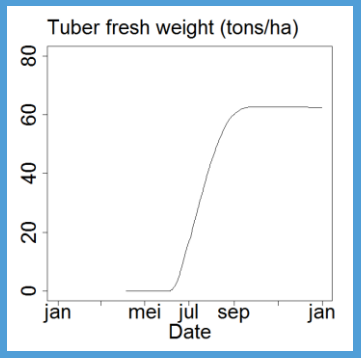
- Data (IoT, sensors, databases, ..)
- Crop growth models (Tipstar, Wofost, Lintul-DSS)
- Data + model → interpretation → advice

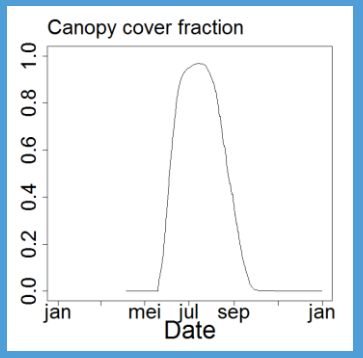
Data

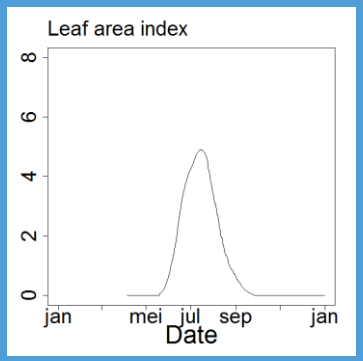
- Daily weather data
  - **KNMI (web)**
  - Local weather stations
- Soil data
  - **Soil map (web)**
  - Sensors (ECa, soil moisture)]
  - Soil analysis
- Crop reflectance
  - **Satellites (web)**
  - **Cropscan (hand-held)**
  - drones, tractor-mounted
- Management data
  - **Cultivar**
  - Fertilization (dates, amounts, type)
  - Irrigation (dates, amounts)
  - Crop protection (date, amounts)
  - **Planting date**
  - End date (crop dead)
- Yield history data

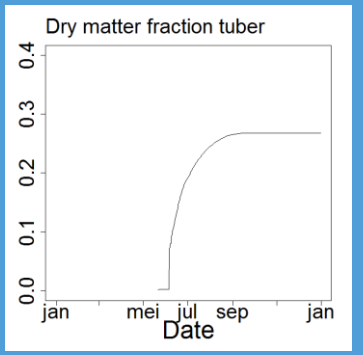
Crop growth models

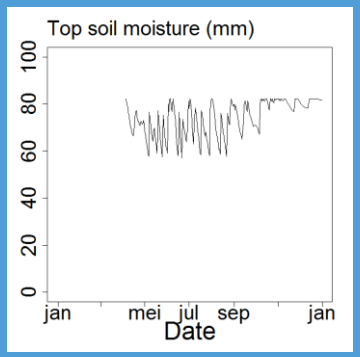


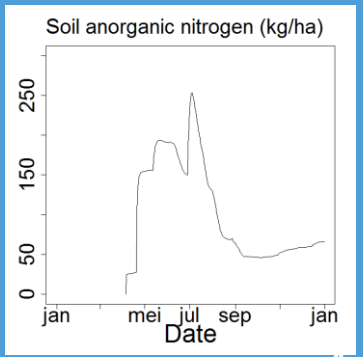












and more...

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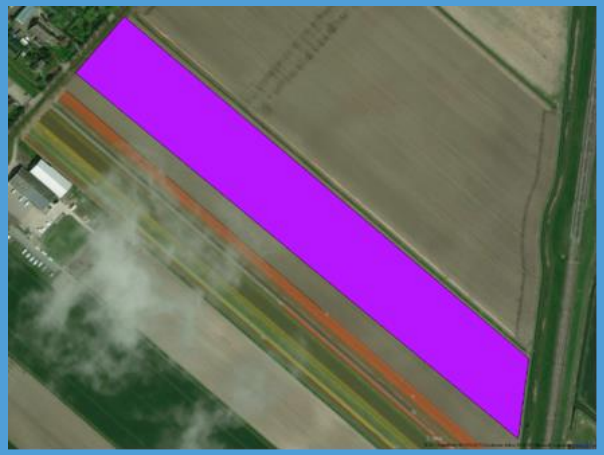
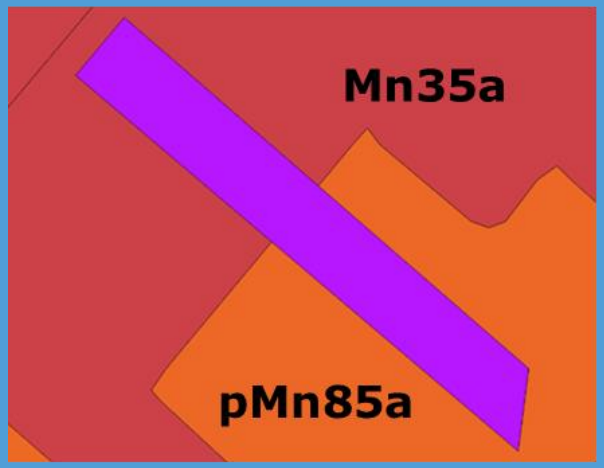
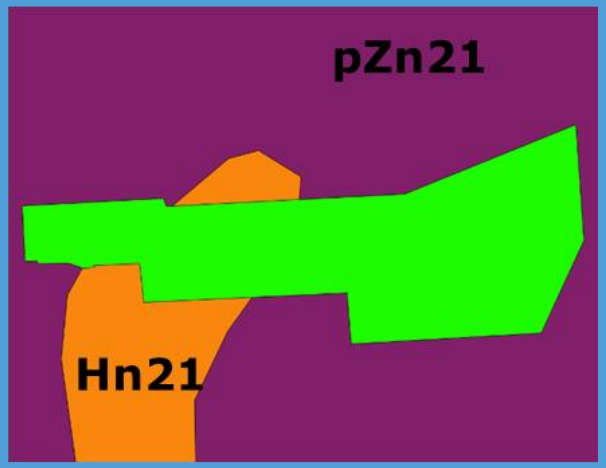
Selection of field specific properties

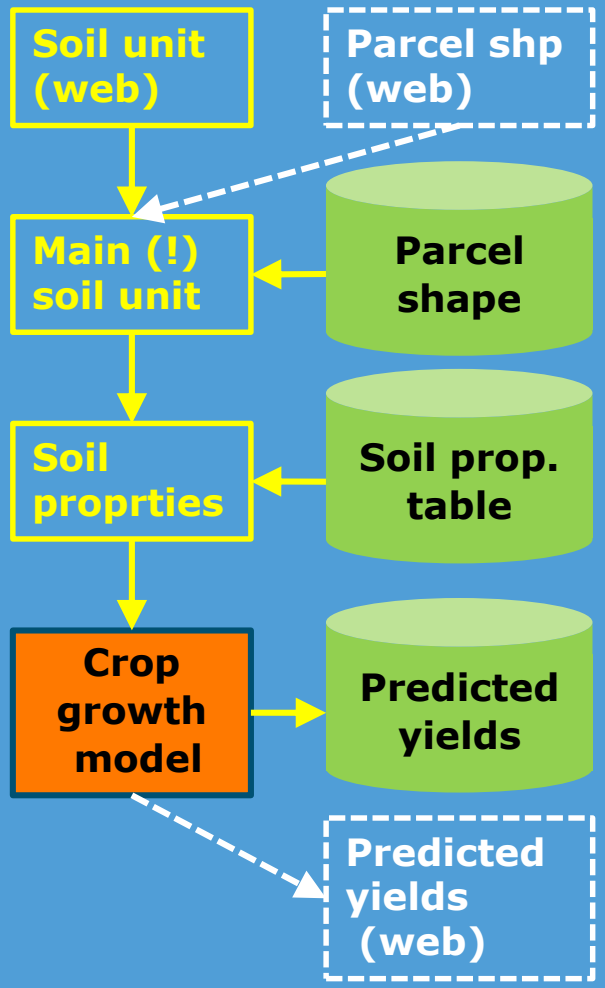
Abbenes

Reusel





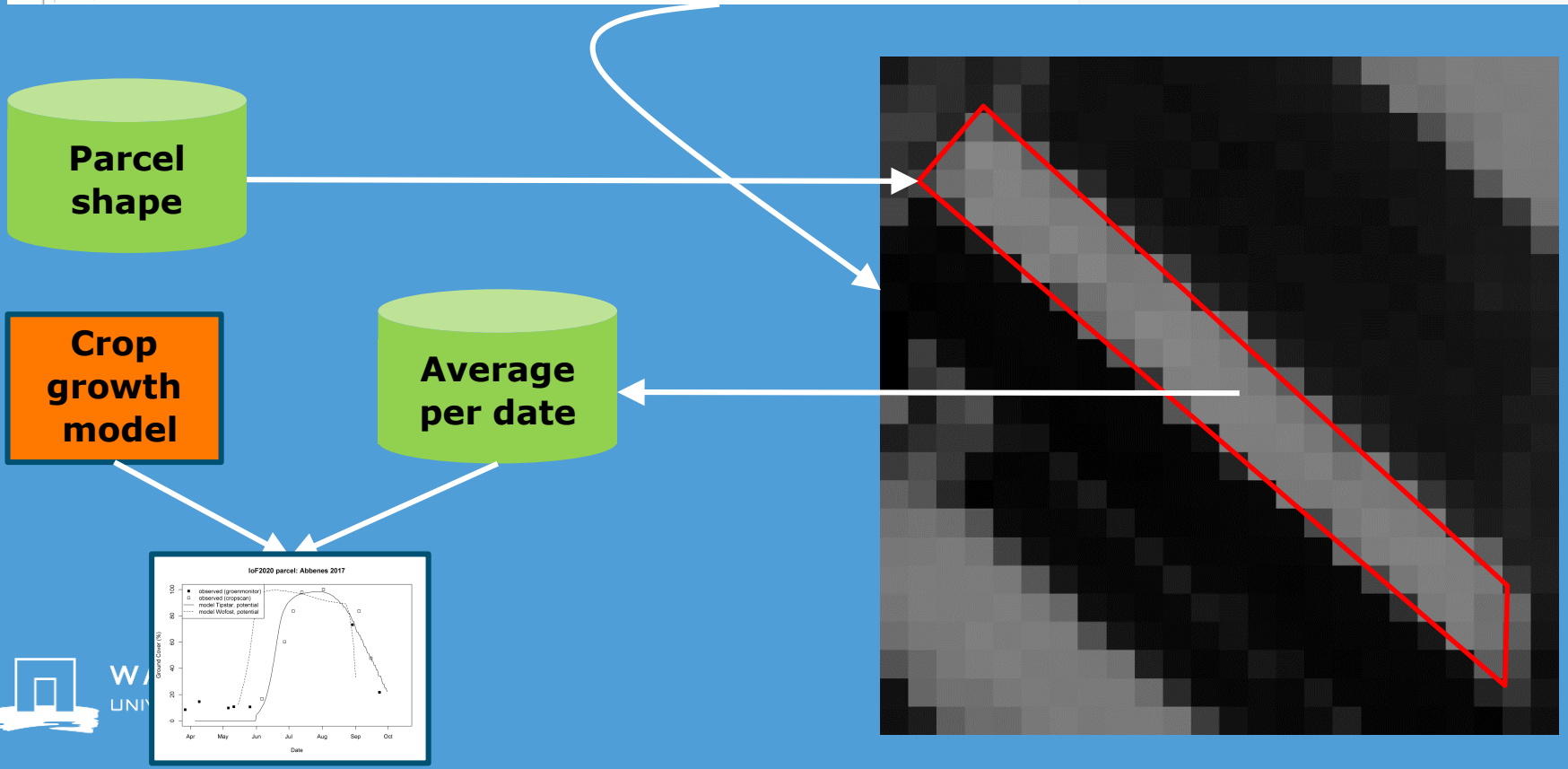




Crop reflectance: www.groenmonitor.nl

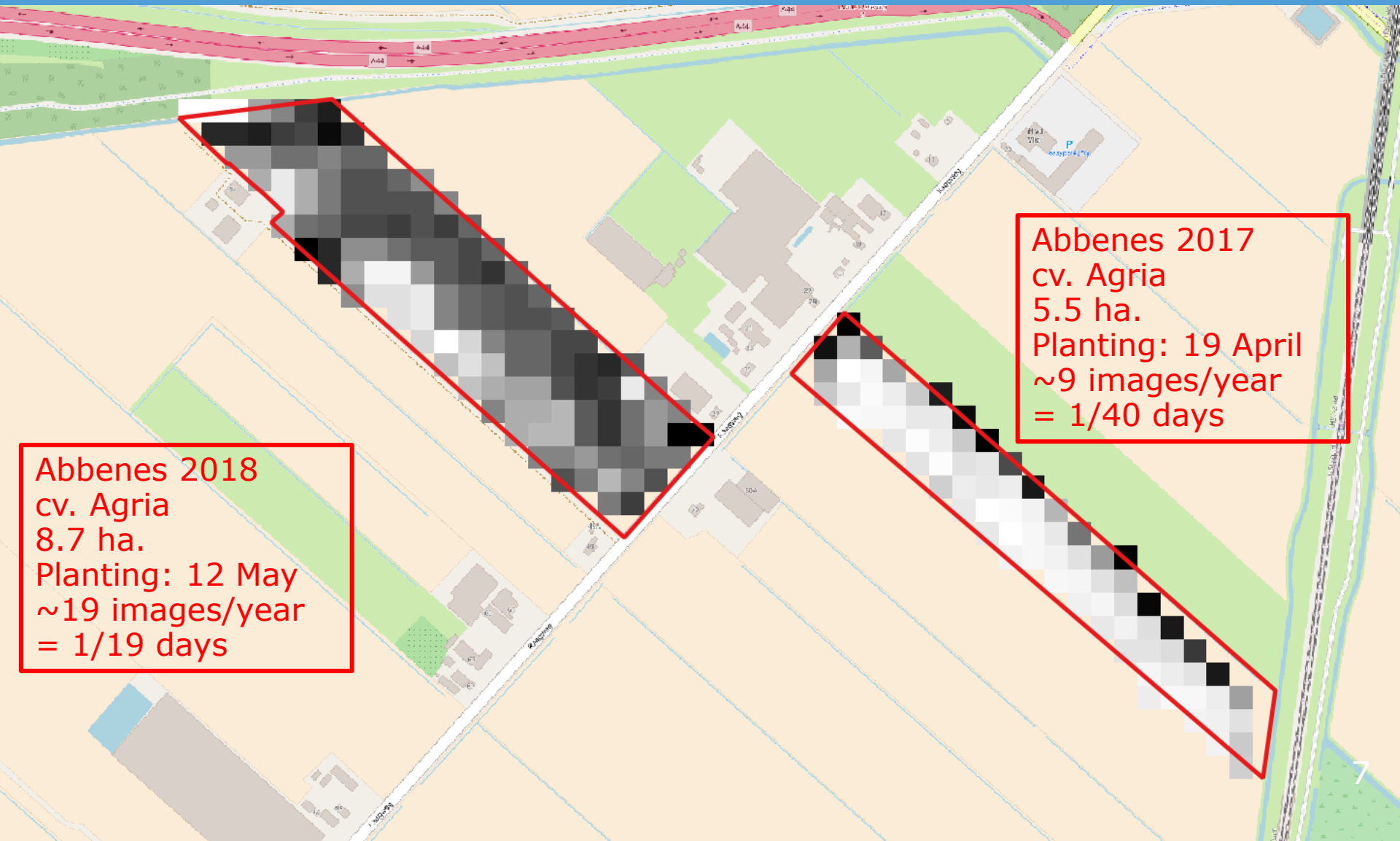
pixels 25 x 25 m. 1/20 days (except 2017: 1/40 days)

```
namespace groenmonitor
{
    class Program
    {
        //        static string webAddr = "http://services.geodesk.nl/arcgis/services/groenmonitor/DMC_NDVI/ImageServer/WCSServer?service=WCS&version=1.0.0&reques
        static string webAddrTempl = "http://services.geodesk.nl/arcgis/services/groenmonitor/DMC_{5}/ImageServer/WCSServer?service=WCS&version=1.0.0&request=GetC
        static string addrAvailableYears = "https://groenmonitor.services.geodesk.nl/dataaccess/dobs/readavailableyears";
```



Crop reflectance: www.groenmonitor.nl

pixels 40 x 40 m. 1/20 days (except 2017: 1/40 days)



Crop reflectance: www.groenmonitor.nl

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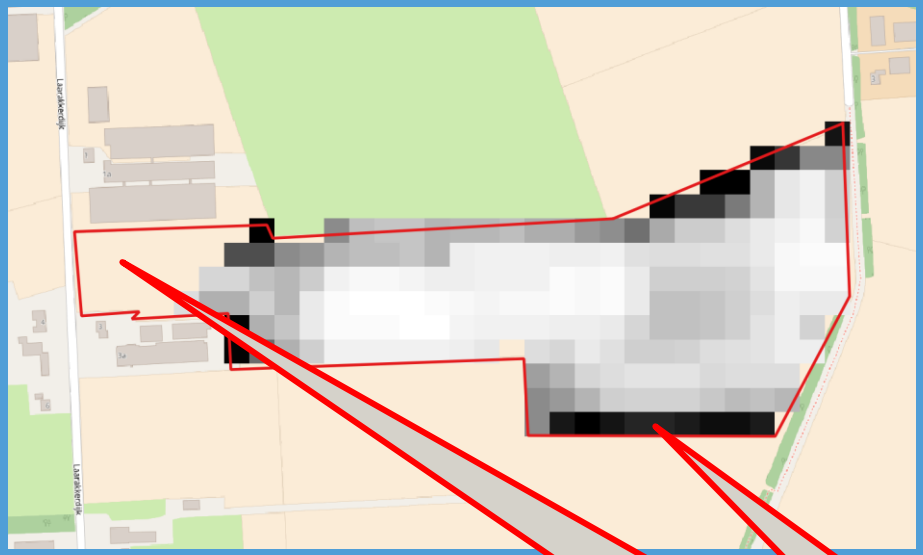
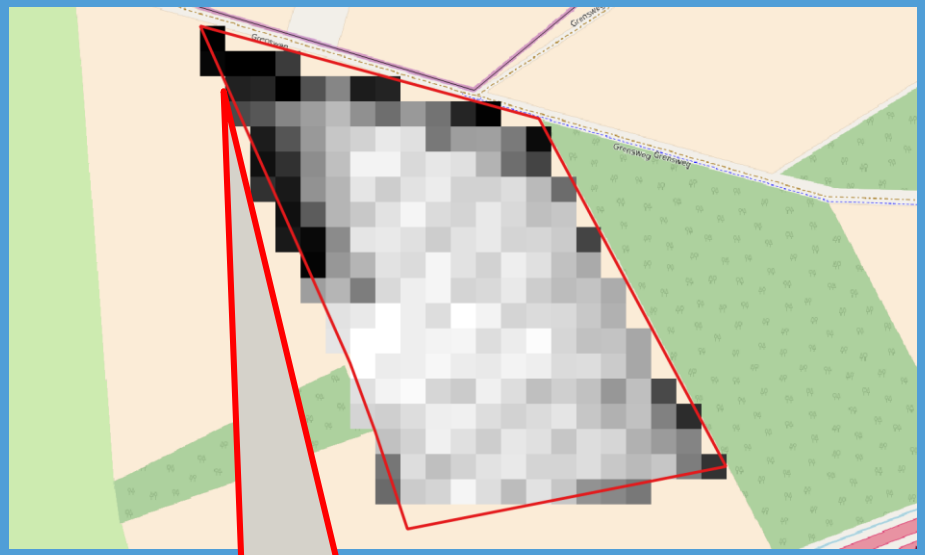




Reusel: 'Van Gompel Herdersdreef' 2017
cv. Fontane
13.1 ha.
Planting: 14 April
~9 images/year
= 1/40 days

Clouds = ignored (transparent)

Parcel boundaries:
- lower (black),
- but little impact on avg.(parcel)

Reusel: Grensweg 2018
cv. Fontane
13.7 ha.
Planting: 14 April
~19 images/year
= 1/19 days

Crop reflectance: Cropscan

Crop growth models

Model	Potential	Water-limited	Water & N limited	Other stress (P, K, S, phytoptera, etc)
Tipstar	☑			
Wofost	☑			
LINTUL				

☑ Operational: Tipstar potential & Wofost potential

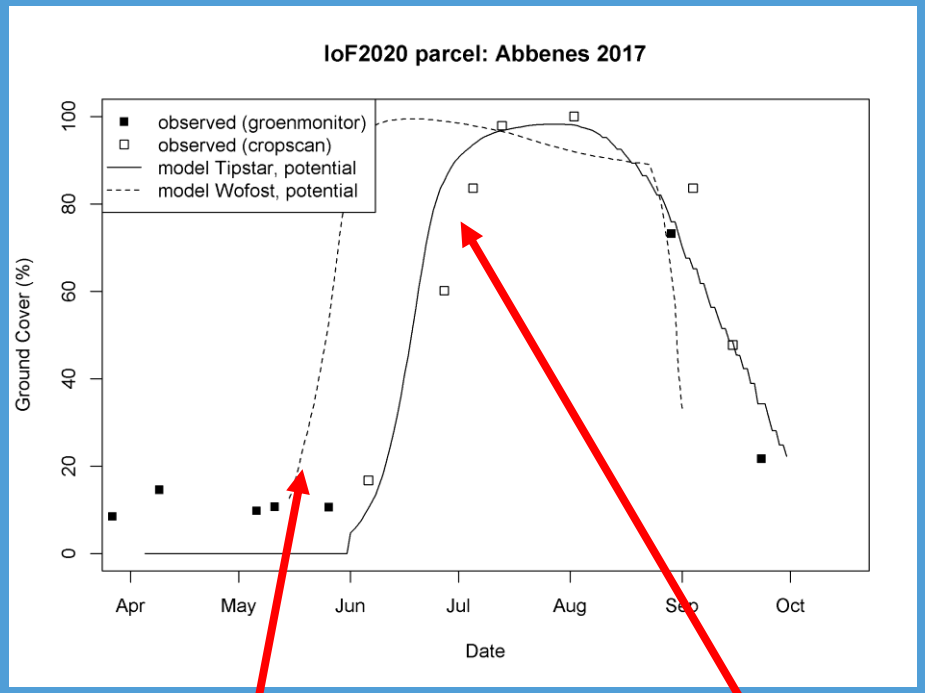
☐ Ongoing work: water & N limited

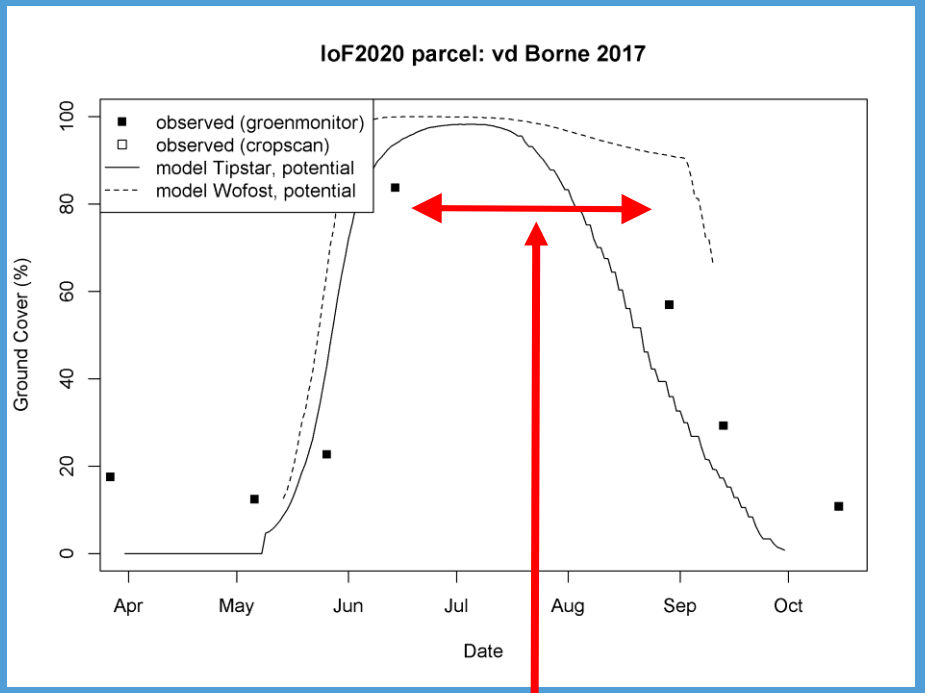
☐ Ongoing work: calibrate variety parameters

Variety calibration status

Model / cv	Agria	Fontane
Tipstar		
Wofost		
LINTUL		

Results: Canopy cover 2017



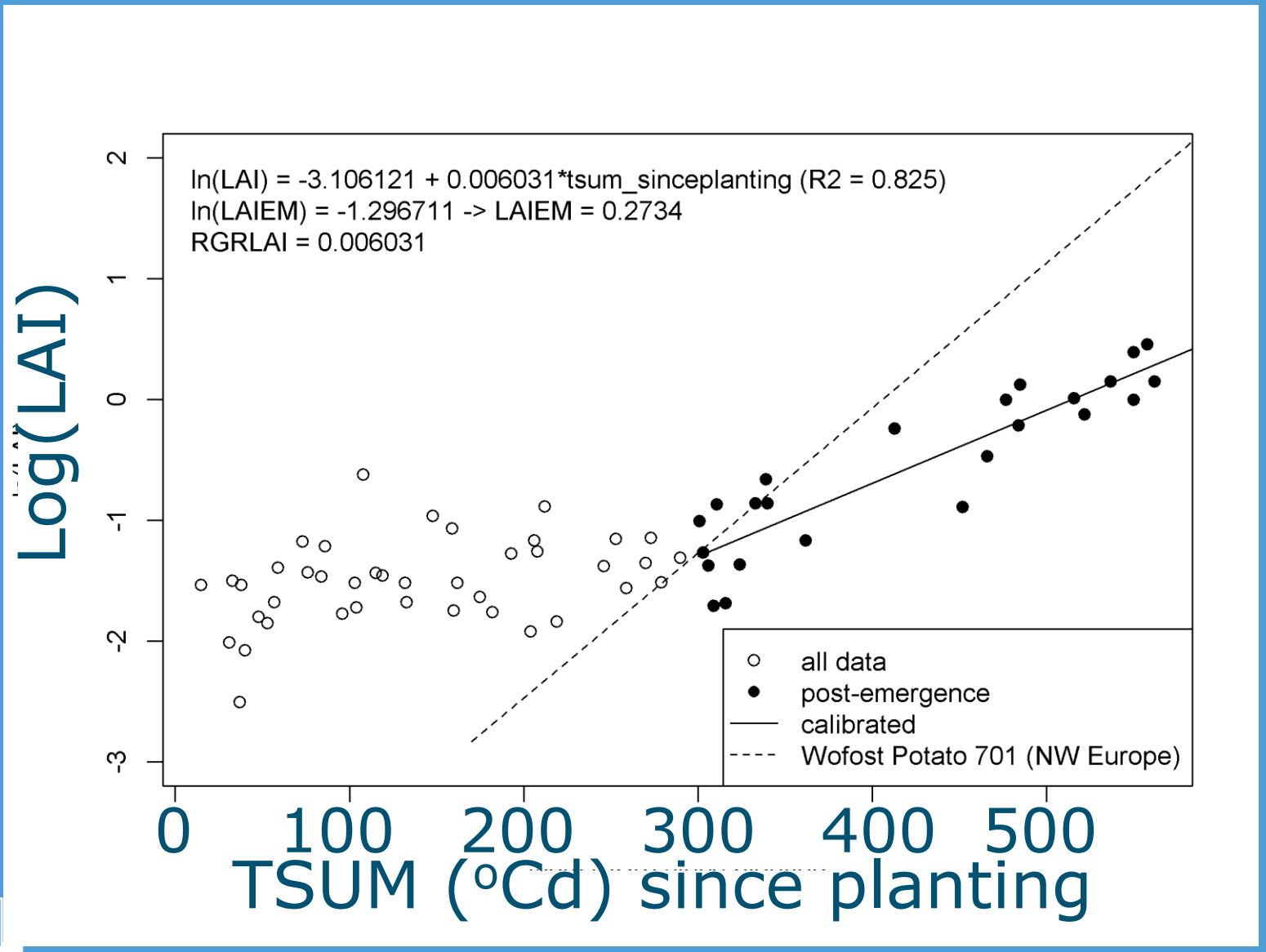


Too early emergence

Too fast early growth

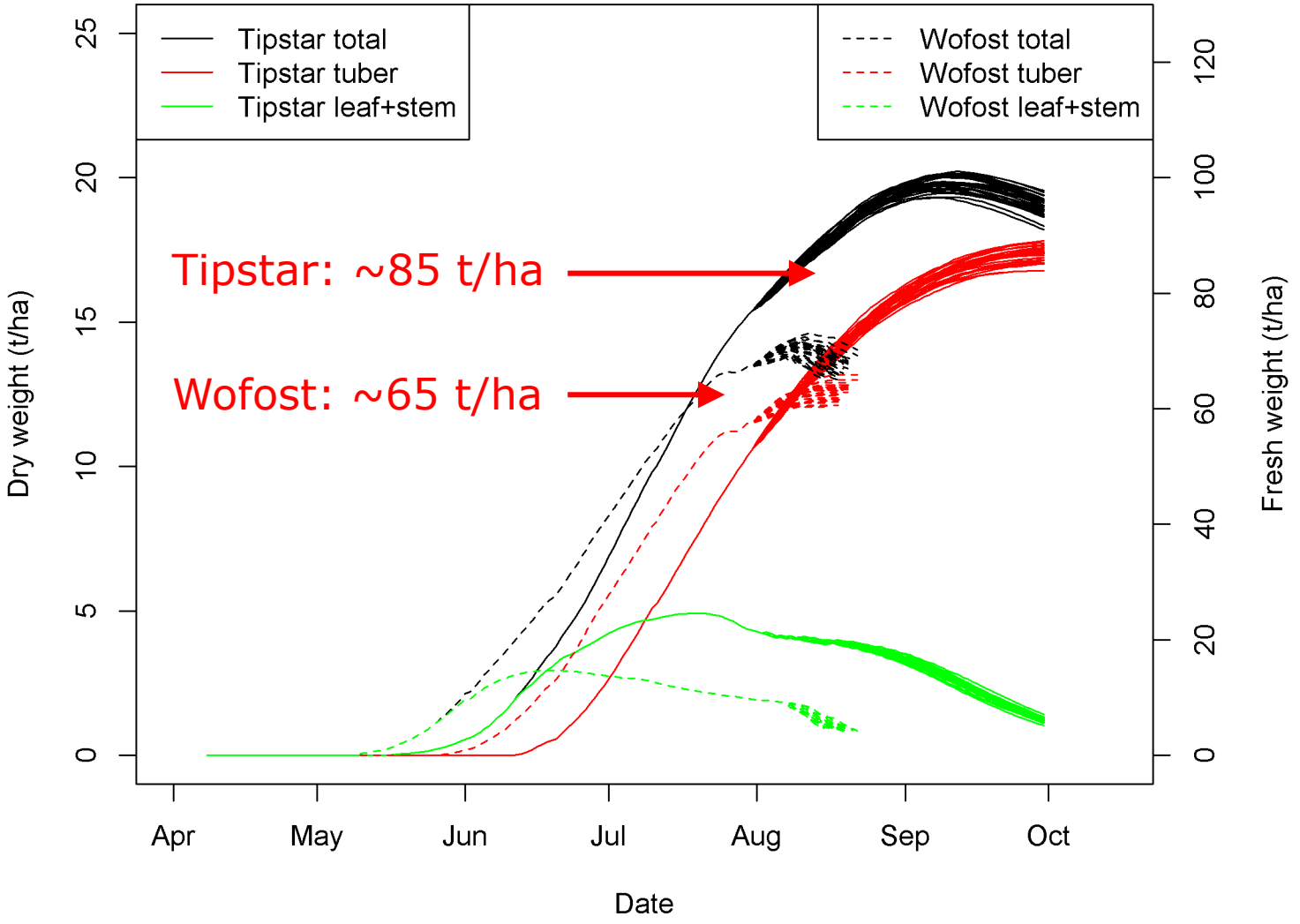
No satellite data

Model parameters from satellite images



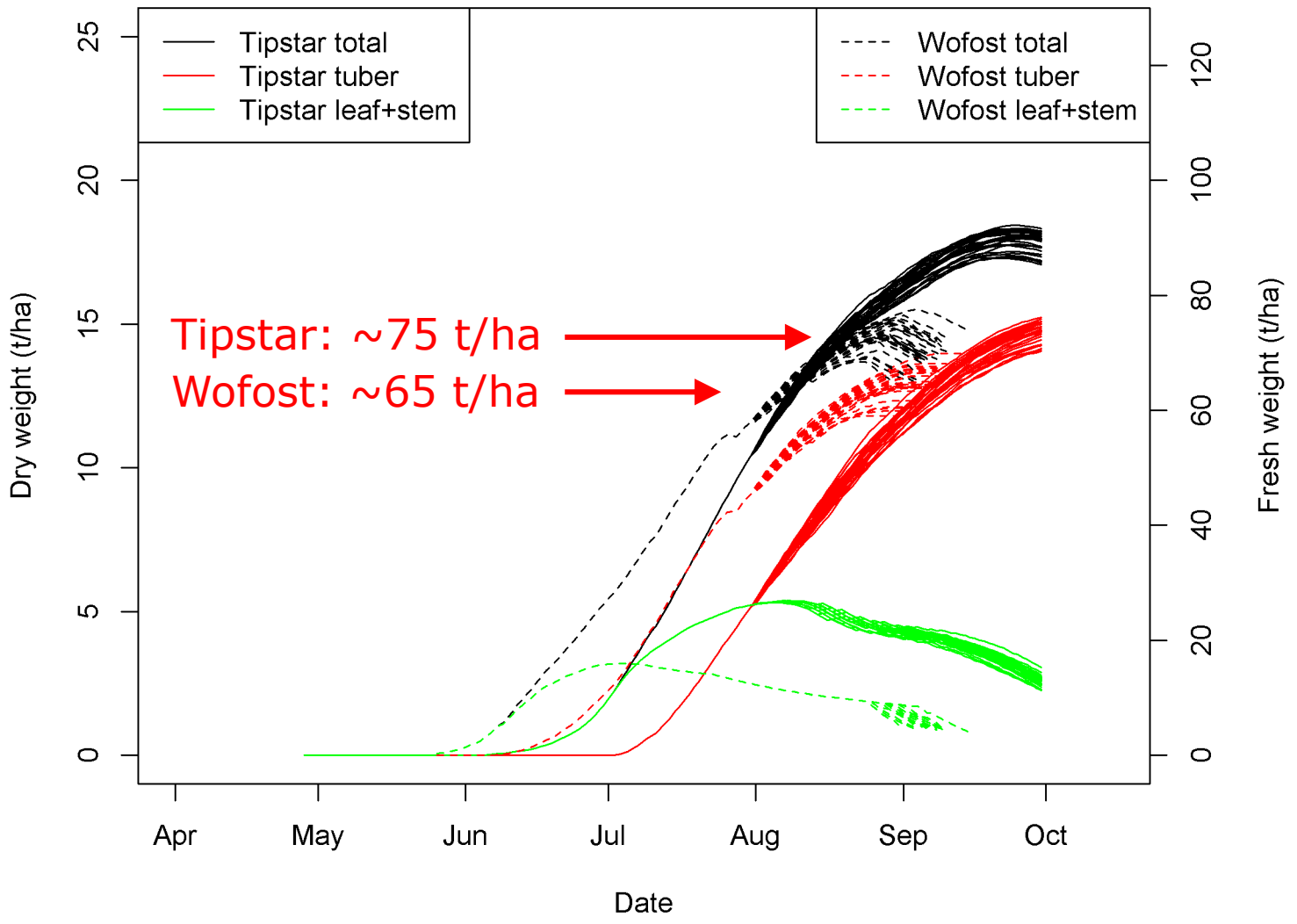
Preliminary results: potential biomass

Forecast vd Borne 2018 (Reusel, Grensweg)



Preliminary results: potential biomass

Forecast Abeness 2018



Summary and discussion

- Operational framework
  - stochastic yield forecasting
  - Operational 2 out of 3 models
  - Preliminary results (requires more calibration)
  - Under construction: Simulation water & N-limited
- Calibration is a challenge:
  - 1/6 varieties calibrated
  - Groenmonitor limited data in 2017 (1/40 days)
  - Cropcan to the rescue, but limited available
  - Which model parameters to calibrate?
- Long term challenge:
  - After simulation USE models for decision support

Thanks for your attention

Data needs water & N limited

Minimum

- Irrigation data (date, mm applied)
- Soil moisture data (date, depth, moisture content) + metadata
- N fertilisation data (date, kg N/ha)

If available

- Soil N content
- Crop biomass
- Crop N