

# **Comparison of PROBA-V 100 m, 300 m and 1 km NDVI datasets for yield forecasting at the field level**

Bernard Tychon and Yetkin Özüm Durgun  
University of Liège - VITO

# Yield forecast

Why forecasting yield?

- Large impact on strategic planning and world markets

Why at field level?

- Easy and nice sampling to have an accurate information at province, department or national level

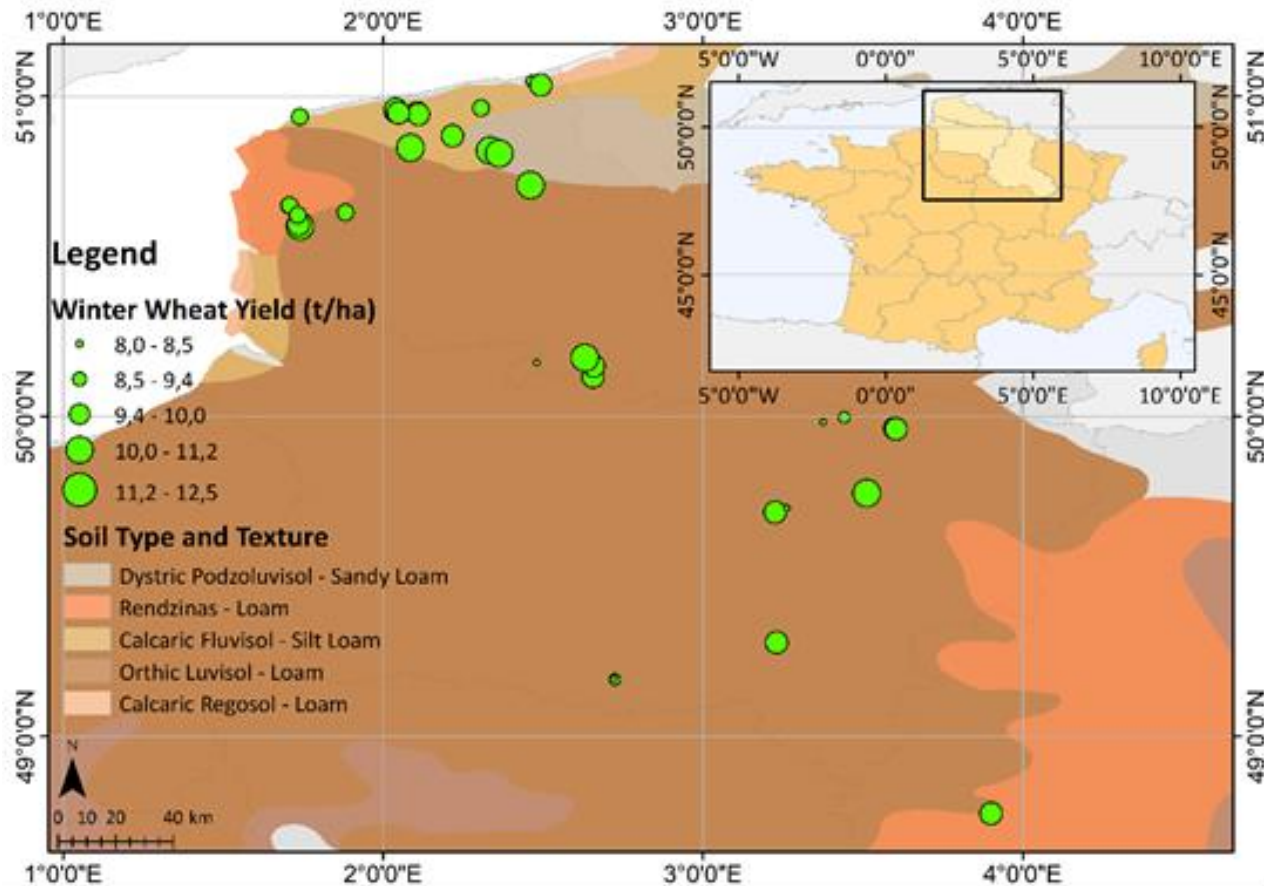
Potential of remote sensing in YF?

- Extensive research has been done over the past decades to apply remote sensing for predicting yields at different scales

# Objectives

Compare the 5-daily and daily PROBA-V NDVI datasets at 100 m, 300 m and 1 km resolutions to estimate **wheat** yield at the field level.

# Methodology (1/3)



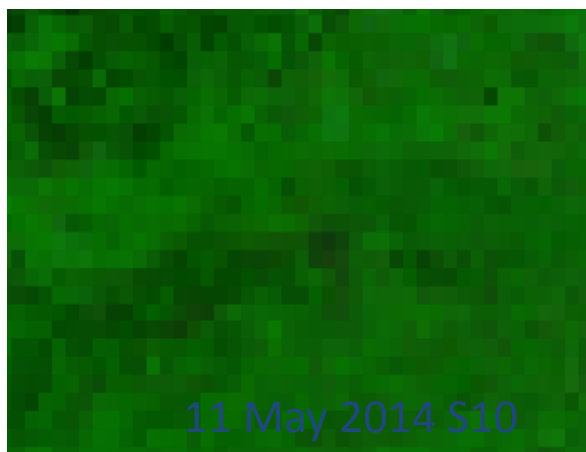
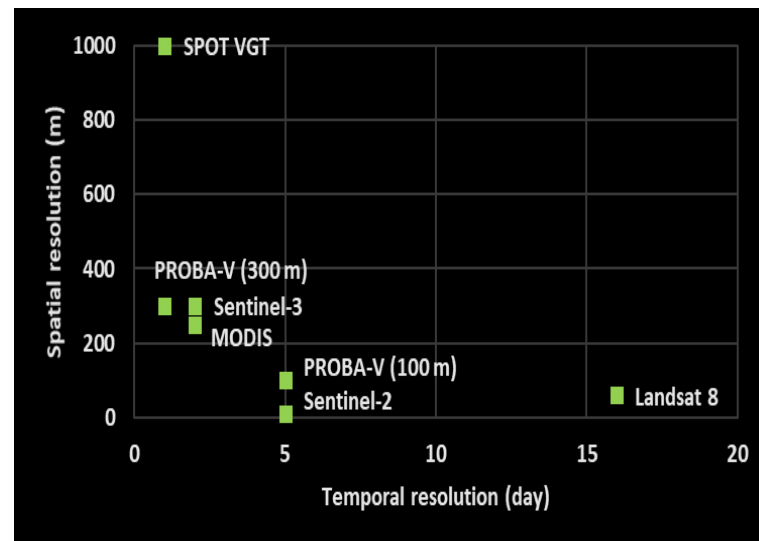
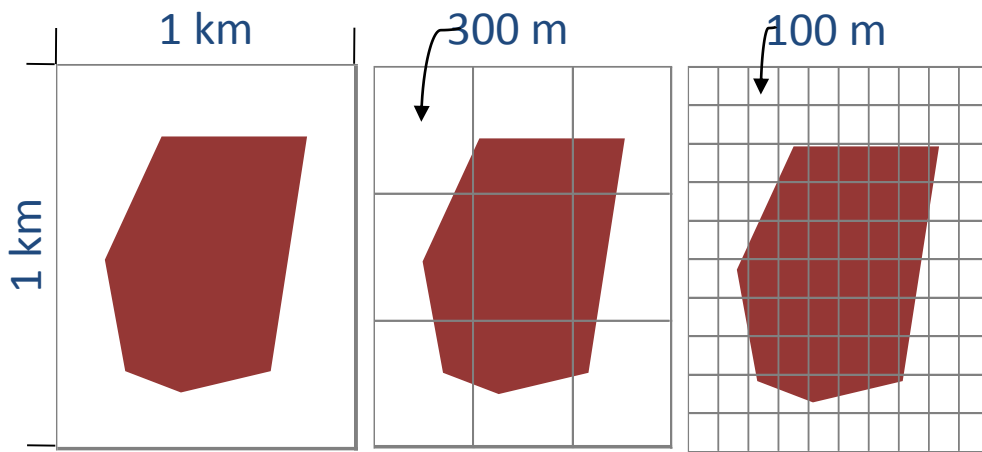
Study area : Northern France

Growing season : 2014-2015

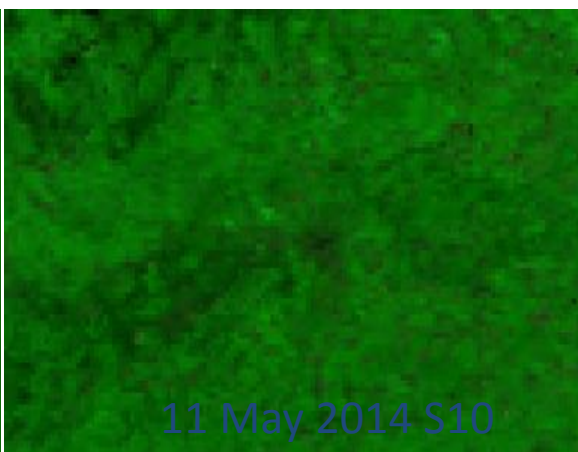
# Methodology (2/3)

- Ground data : 56 fields from a private company, selection of 39 fields from 8 to 12.5 ha
- Daily temperature data from JRC-MARSOP 0.25 ° grids → Thermal time
- PROBA-V NDVI images and status maps at 100 m, 300 m and 1 km resolutions

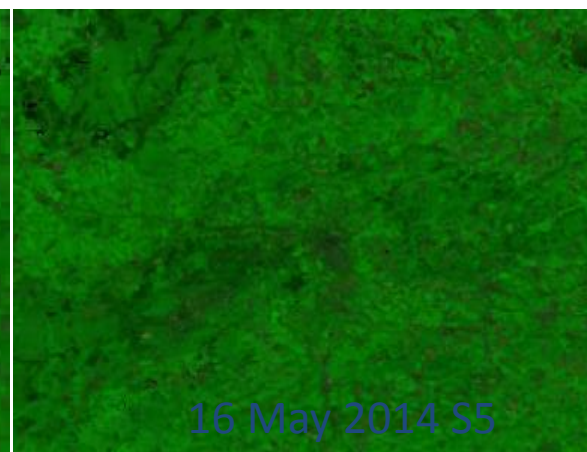
# Spatial and Temporal resolution of PROBA-V



11 May 2014 S10  
TOC 1 km



11 May 2014 S10  
TOC 300 m

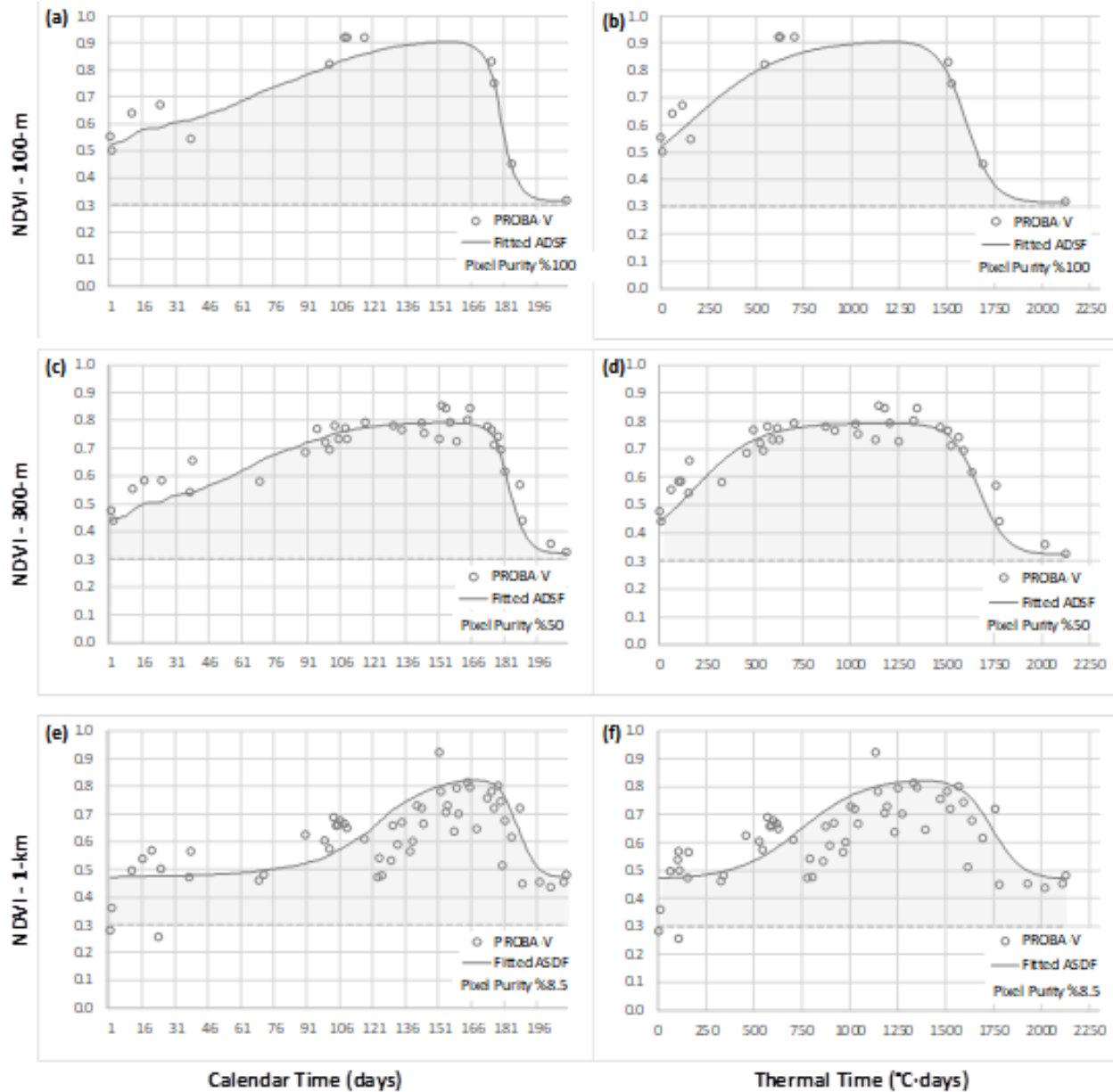


16 May 2014 S5  
TOC 100 m

# Methodology (3/3)

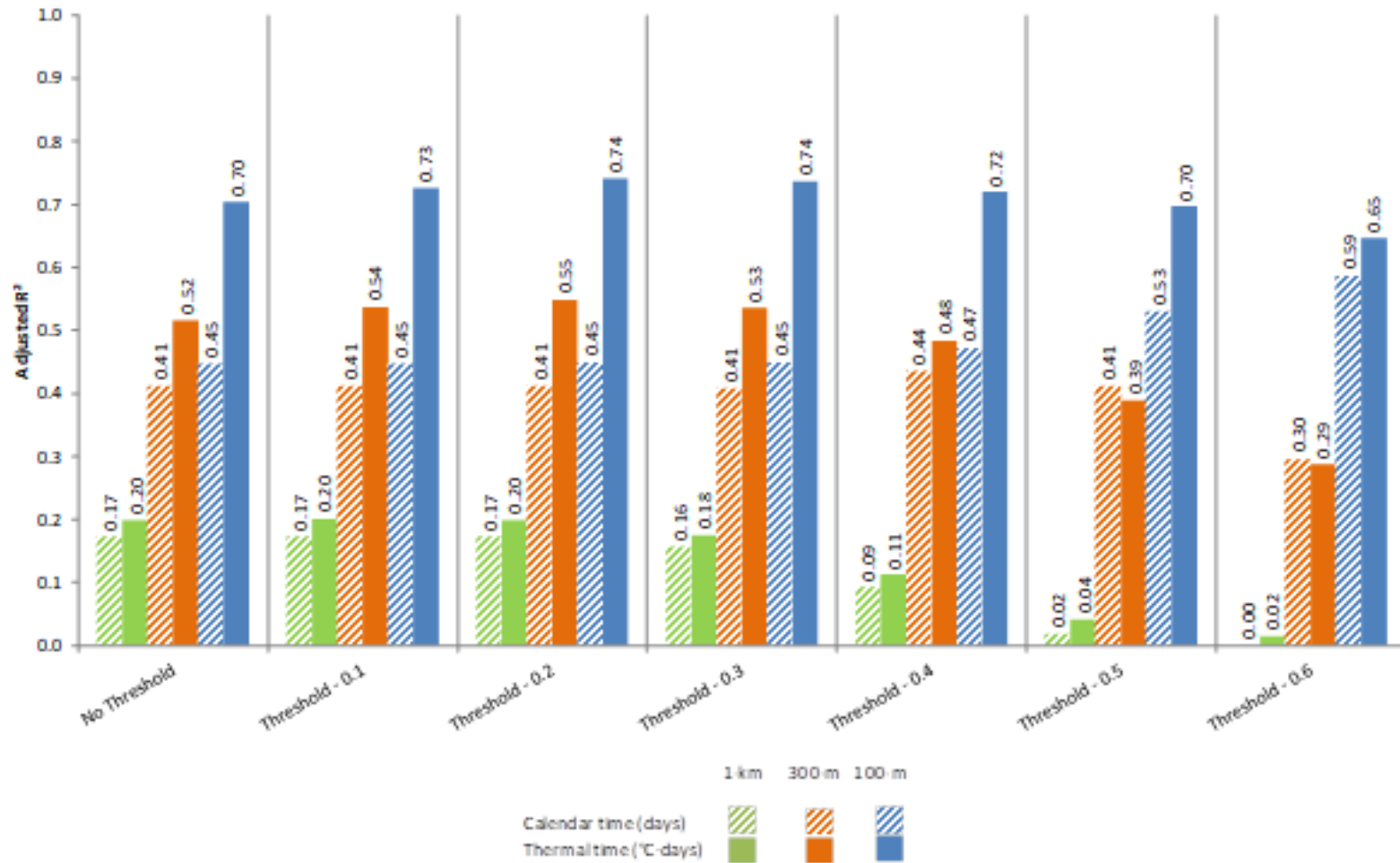
- An asymmetric double sigmoid function (ADSF) was fitted to the NDVI time series of the central pixel of each field for thermal time and for calendar time.
- Pixel sizes impact.
- Pixel purity impact.
- Wheat yield assessed from the area under the ADSF curve with different minimum threshold values with calendar time or thermal time in the X axis.

# Results : example for one field

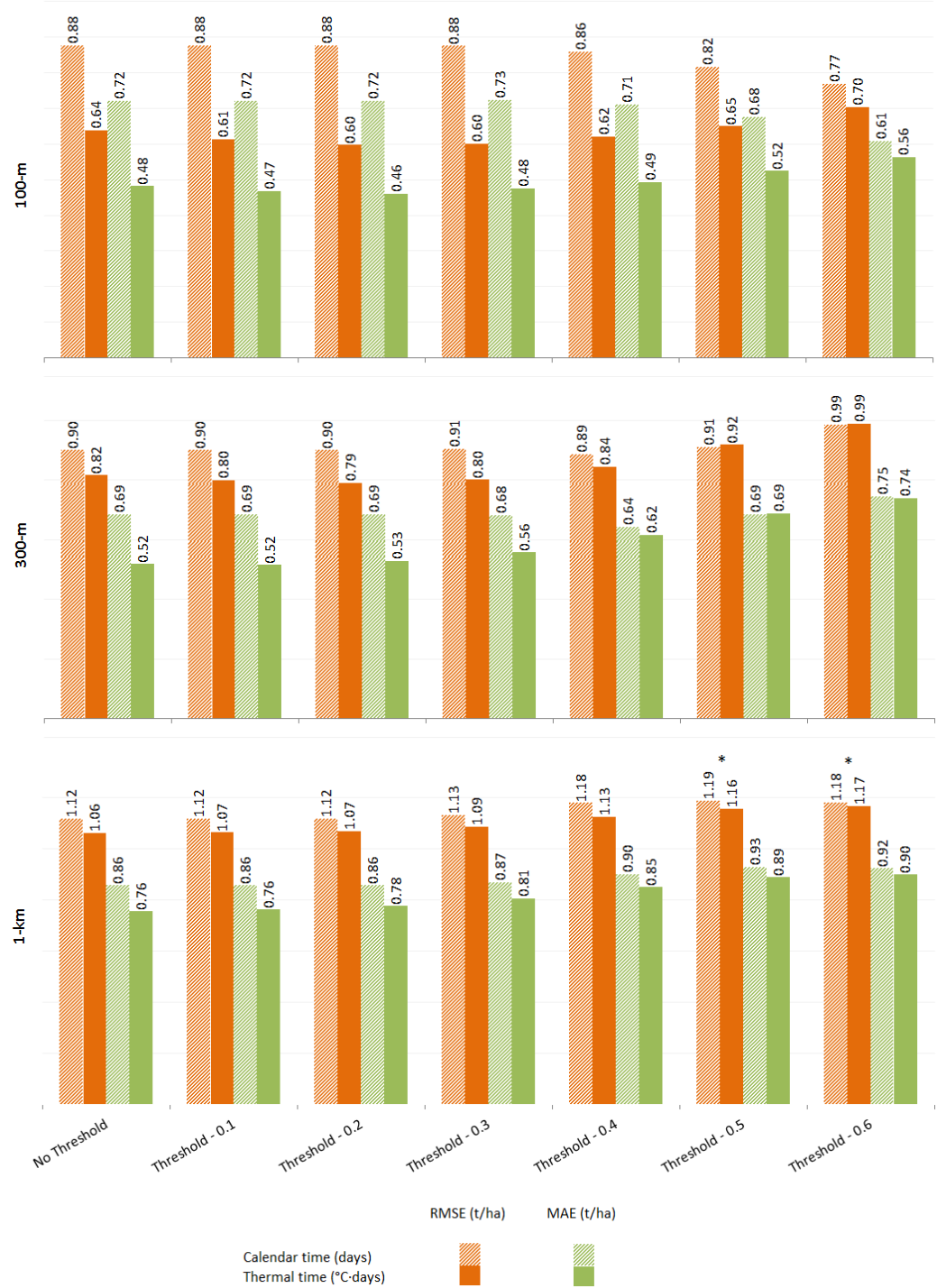




# Adjusted R<sup>2</sup>



# Results : RMSE and MAE



# Results : determination coefficient according to spatial resolution, pixel purity and type of time

		100 m										300 m										1 km														
		Calendar Time					Thermal Time					Calendar Time					Thermal Time					Calendar Time					Thermal Time									
Pixel purity (%)		0	15	40	65	90	0	15	40	65	90	0	15	40	65	90	0	15	40	65	90	0	15	40	65	90	0	15	40	65	90	0	15	40	65	90
Number of fields		39	39	39	37	34	39	39	39	37	34	39	37	27	12	5	39	37	27	12	5	39	9	1	0	0	39	9	1	0	0	39	9	1	0	0
NDVI threshold	No	0.4	0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.4	0.4	0.5	0.8	0.9	0.5	0.5	0.6	0.6	0.6	0.2	0.3	N/A	N/A	N/A	0.2	0.3	N/A	N/A	N/A					
	0.1	0.4	0.4	0.4	0.5	0.6	0.7	0.7	0.7	0.7	0.8	0.4	0.4	0.5	0.8	0.9	0.5	0.5	0.6	0.6	0.6	0.2	0.3	N/A	N/A	N/A	0.2	0.4	N/A	N/A	N/A					
	0.2	0.4	0.4	0.4	0.5	0.5	0.7	0.7	0.7	0.7	0.8	0.4	0.4	0.5	0.8	0.9	0.5	0.5	0.6	0.7	0.7	0.2	0.3	N/A	N/A	N/A	0.2	0.4	N/A	N/A	N/A					
	0.3	0.4	0.4	0.4	0.5	0.5	0.7	0.7	0.7	0.7	0.8	0.4	0.4	0.5	0.8	0.9	0.5	0.5	0.6	0.6	0.6	0.2	0.2	N/A	N/A	N/A	0.2	0.3	N/A	N/A	N/A					

# Discussion/Conclusion (1/2)

**Search for a trade-offs between the different spatial resolutions provided by PROBA-V products versus the temporal frequency and, additionally, explore the use of thermal time to improve statistical yield estimations.**

- Promising results with a very simple approach
- Thermal time better than calendar time
- PROBA-V 100 m more accurate estimates compared to PROBA-V 300 m and 1 km
- Potentials of 100 m and 300 m PROBA-V datasets
- Limiting factors
  - Cloud cover
    - Simulated 100 m data by Kalman filter by Kempeneers et al. (2016)
    - 300 m dataset with thermal time
  - Limited availability of the field-level ground data

# Discussion/Conclusion (2/2)

- Usefulness of the 100 m resolution
- Same satellite for crop yield and crop identification (area)
- An alternative to Sentinel 2 with image files at least 100 X lighter to process for crop yield and production forecasting at province/department/regional and national levels

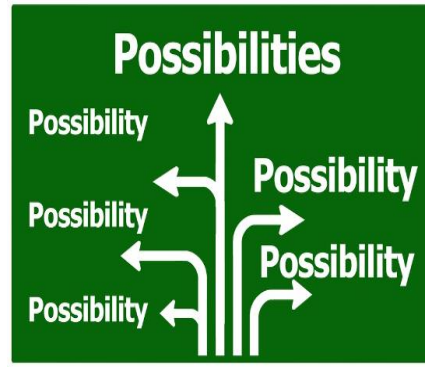
# Conclusions and recommendations



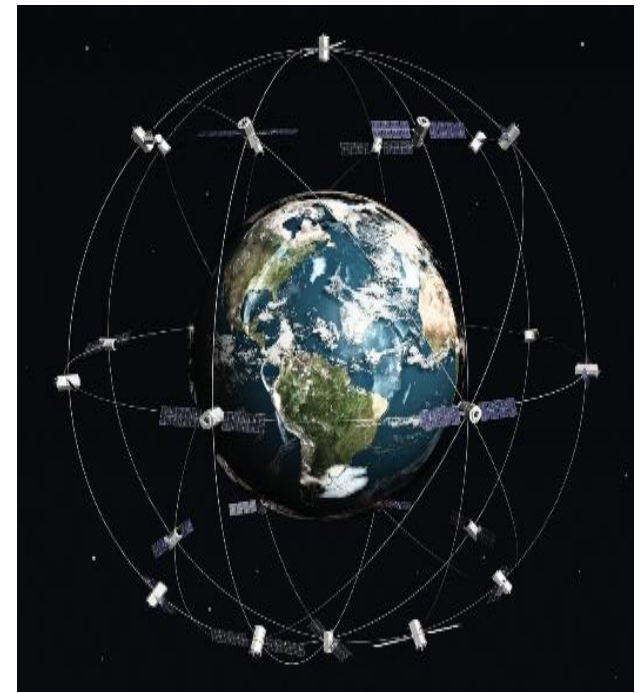
Continuity



Applicability of the methodologies



New possibilities



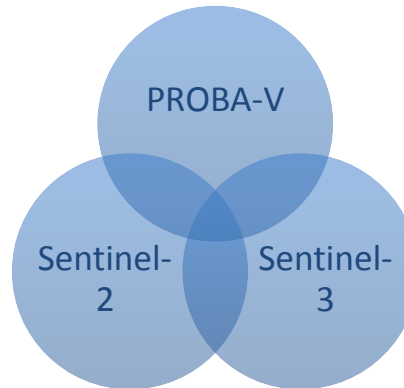
Next generation satellites



Handling big data



Crowdsource data



Combination of different spatial resolution data



Future of low-spatial resolution data