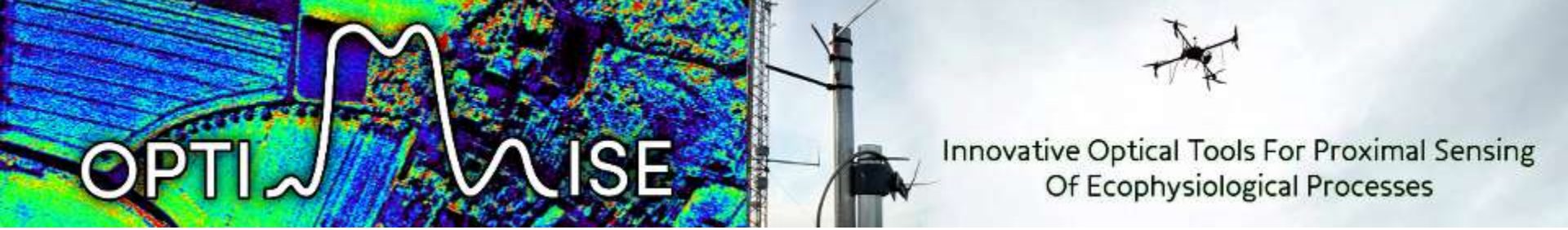

P2: Measuring sun-induced fluorescence at different scales: a review on instruments, measurement setups and protocols at leaf an canopy scale

Helge Aasen, Yves Goulas, Neus Sabater Medina, Sebastian Wienecke, Shari Van Wittenberghe, Andreas Hueni, Alexander Damm, Luis Alonso, Ma Pilar Cendrero Mateo, Javier Pacheco-Labrador …

COST is supported by the EU Framework Programme Horizon 2020

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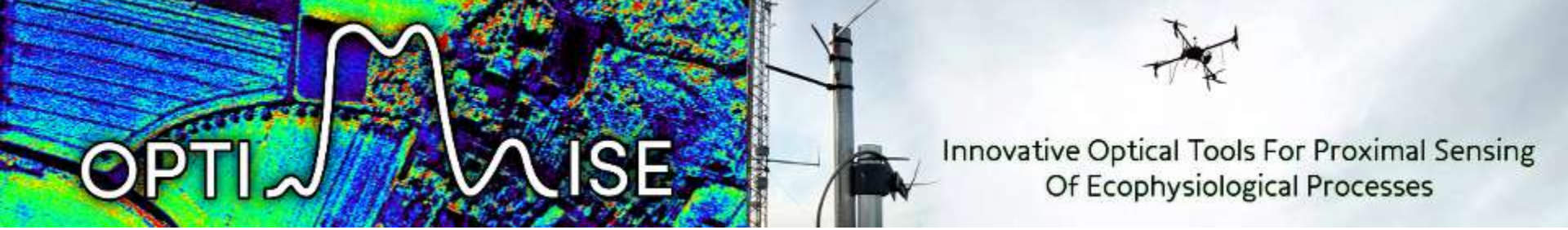
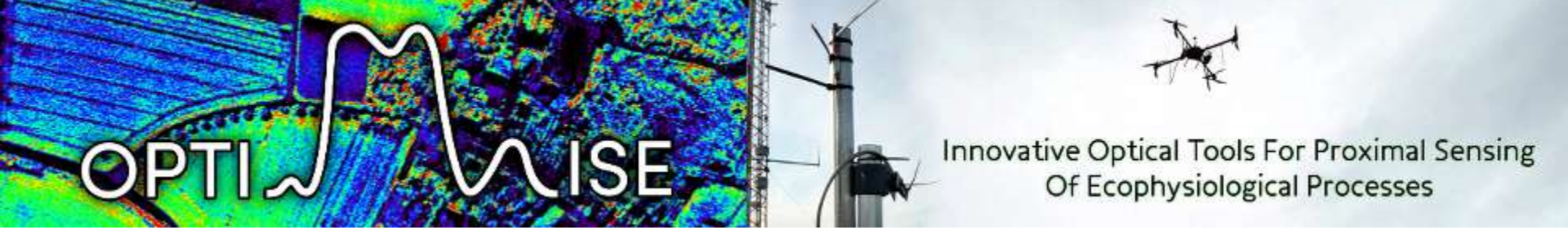


Outline

- Introduce the approche to «OPTIMSE three papers" - manuscript 2
- Outline of the manuscript
  - Review part
  - «research» part
- Current state and way to proceed



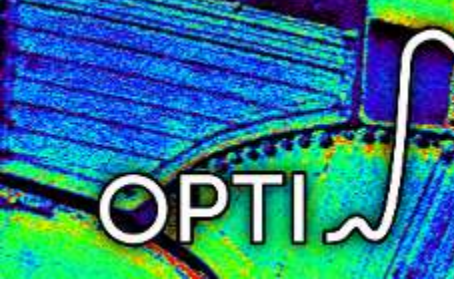
Approach

- Original idea: Compilation of knowledge of the OPTIMSE community and beyond

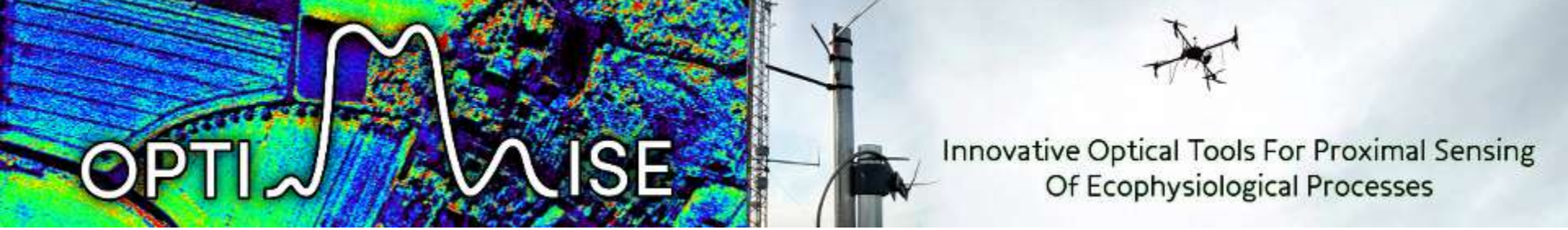
➢ Expert interviews (questionnaire)

➢ Literature review

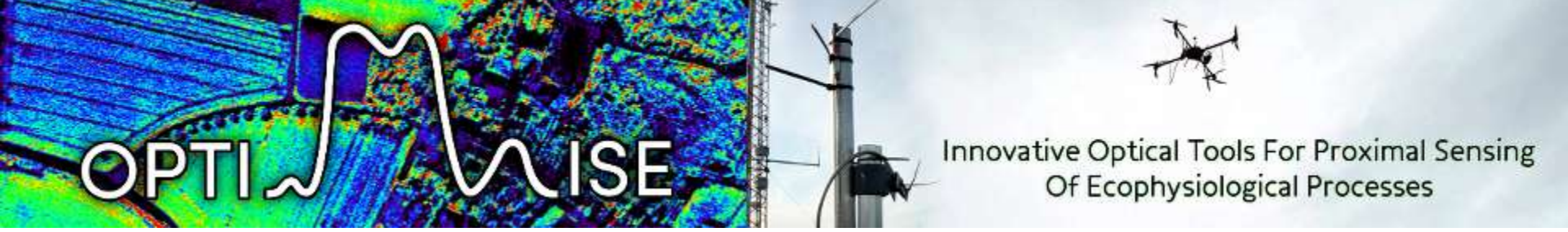
➢ Expert contributions



Outline



PART1: Instruments, measurement setups and installations (canopy)



Instruments

(since Meroni et al. 2009)

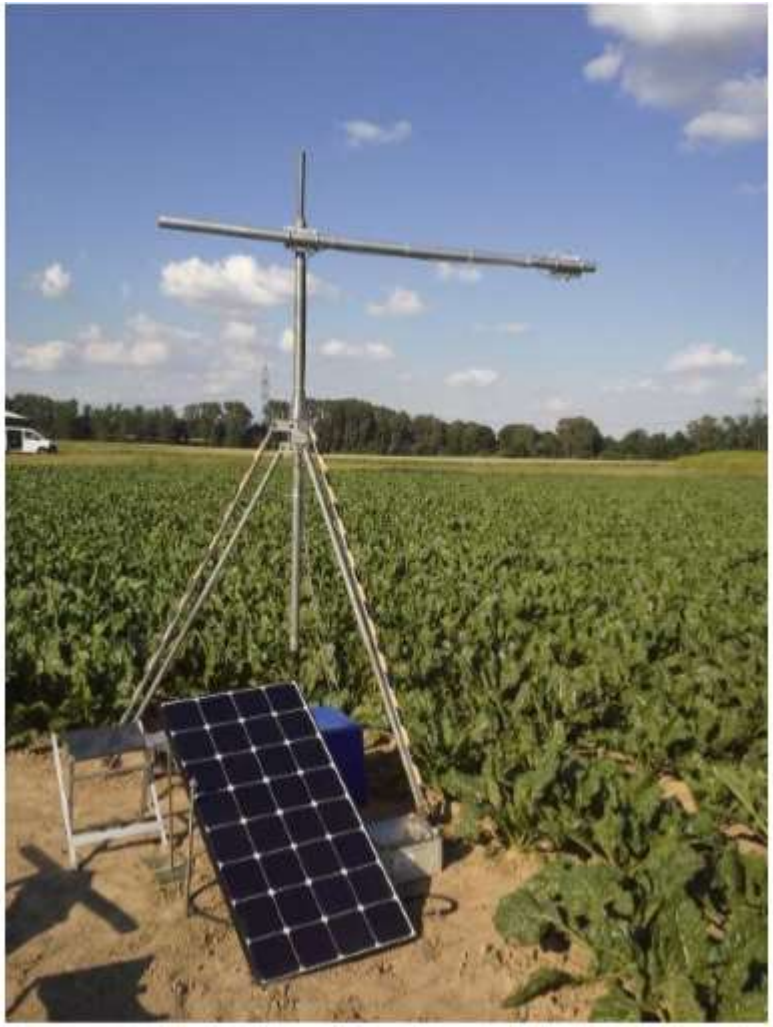
Name	range [nm]	FWHM [nm]	sampling interval [nm]	noise level in NEdL or SNR	spatial res. [pixel]	F retrieved at	retrieval methods
ASD FieldSpec III	350 - 2500	3	1.4	NEdL 1.1 x 10-9 W/cm2/nm/sr			3FLD (Schickling et al. 2016; Damm et al. 2011; Damm et al. 2014),
ASD FieldSpec Pro FR	350 - 2500	3	1.4		/	THESE ARE LEAF level measurements / indoor - exclude from table	FLD (Cordon et al. 2016; Romero et al. 2018)
Ocean Optics HR2000+ (FluoSpec system)	680 - 775	0.13				760	SFM (Yang et al. 2017; Yang et al. 2015)
Ocean Optics HR2000+ (TriFLEX system)	630 - 815	0.5	0.09			687, 760	nFLD (Daumard et al. 2010; Goulas et al. 2017; Daumard et al. 2012)
Ocean Optics HR4000	707 - 805	0.13	0.02	300 SNR			SVD, FLD (Guanter et al. 2013); SFM (Guanter et al. 2013; Migliavacca et al. 2017; Rossini et al. 2015)
Ocean Optics HR4000	700 - 800	0.1	0.04			760	SFM (Cogliati et al. 2015)
Ocean Optics QE Pro	645 - 805	0.31	0.155	1000 SNR	/		FLD, 3FLD, iFLD, pFLD, A-SFM (Liu et al. 2017)
Ocean Optics STS-VIS (SIF-Sys system)	337 - 823	3		1500 SNR (nominal)		760	FLD (Burkart et al. 2015)
Ocean Optics USB4000	400 - 1000	1.5					FLD (Cheng et al. 2013)

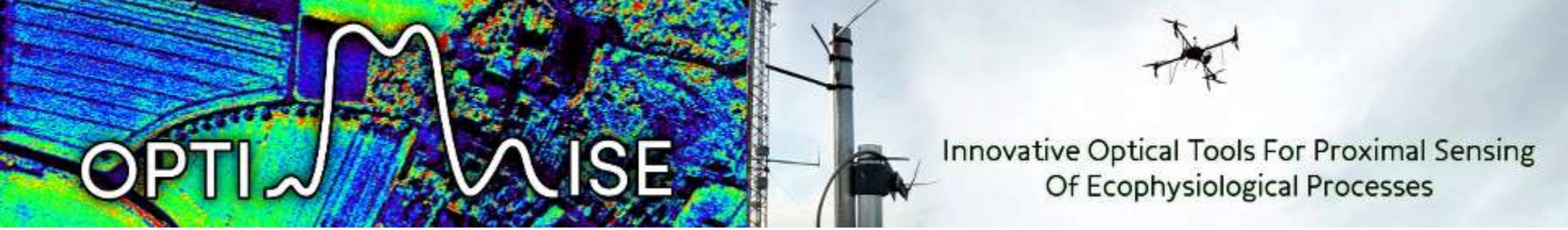
https://docs.google.com/document/d/1UVb6B07wYZUcL9oYDojCtCM3LNRB1C8Pv0Tufmskb_c/edit?usp=sharing

Measurement setups

- Single Spectrometer, Single FOV (1-1)
- Single spectrometer, dual FOV (1-2)
- Dual spectrometer (2-2)
- Panel and Cosine

- **Wanted: Figures / Schematics**

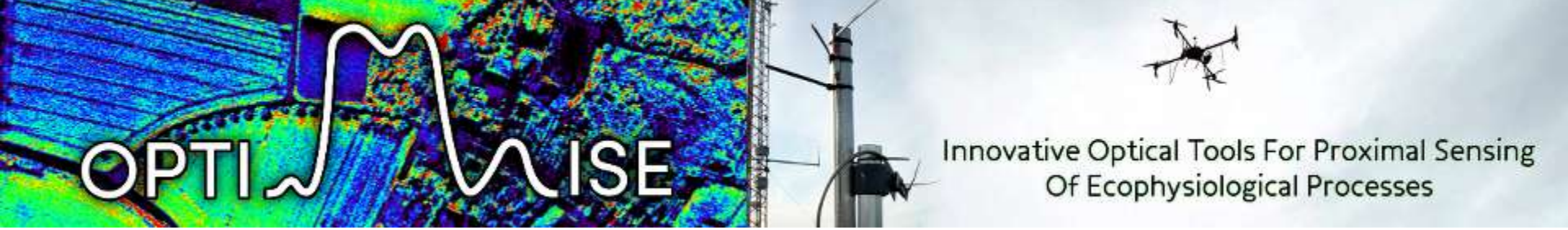




Setups and installations table

Platform and system	Location	target	height above canopy (m)	downward FOV and viewing zenith angle	Reference mode	reference frequency	atmospheric correction	Supplemental measurements	Main aim	reference
pole	Maryland, USA (39.030°N, 76.845°W) 2008, 2010, 2011, 2012, 2016	corn (Zea mays L.)	1		1-1 panel			LAI, fPAR, PRI (531.01, 570.08), Eddy	GPP	cheng 2013
rotating mast	Northern Italy (45°03'46.25 N, 8°40'06.74 E, 88 m a.s.l.)	rice (Oryza sativa L. var. japonica)	1	25° nadir	1-1 panel	sequentially, one reference per measurement			Method paper	guanter 2013

https://docs.google.com/document/d/1jcOmwDeB9T6UBxRXNPm7gTmW29JSyvQEnMNqNMlJLgU/edit?usp=sharing

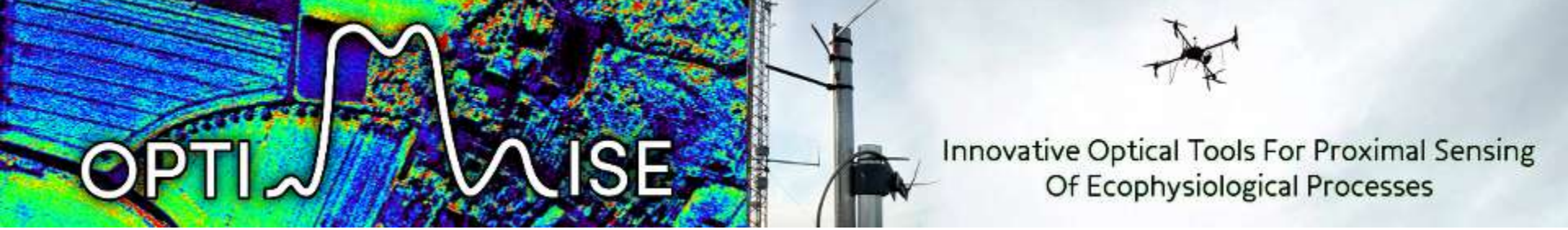


Document with list of measurement sites, setups and installations

- Please participate:
- have a look and fill it
  - add sensor, other measurements, location, height dual FOV, single FOV

➢ **Please send me a mail**

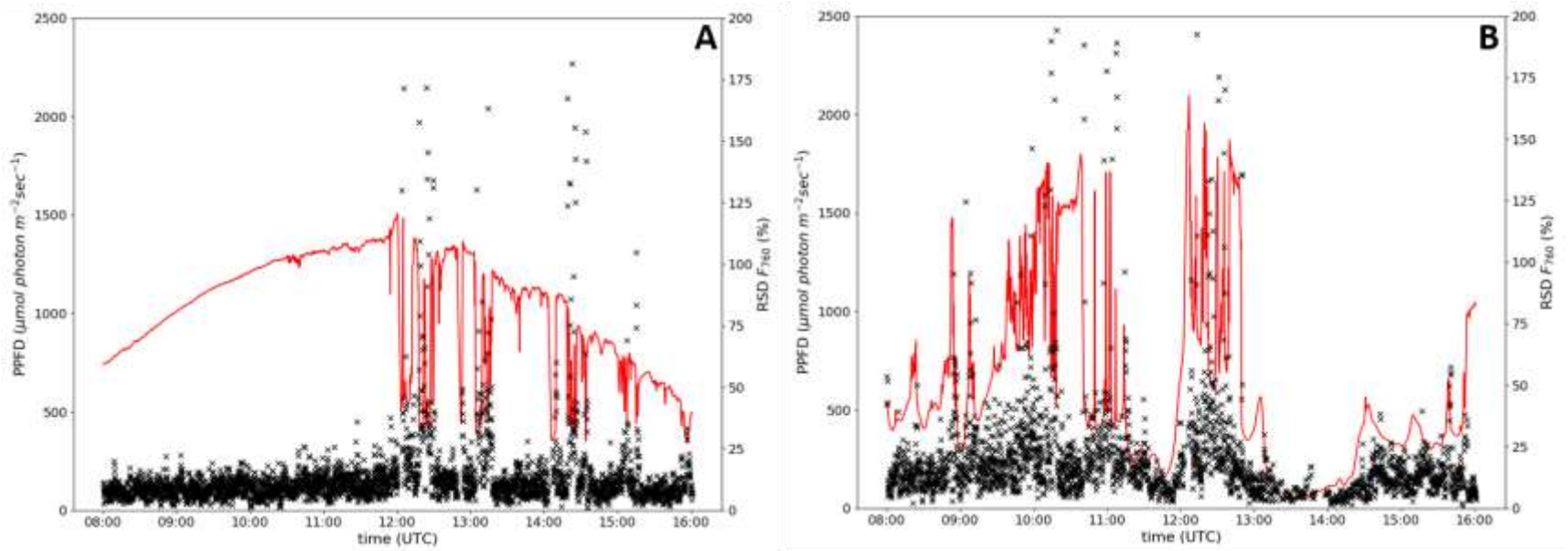
helge.aasen@usys.ethz.ch



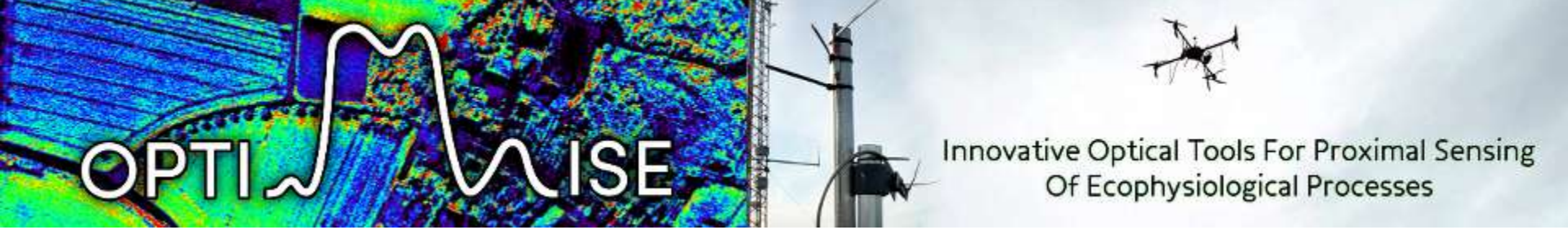
PART2: post processing

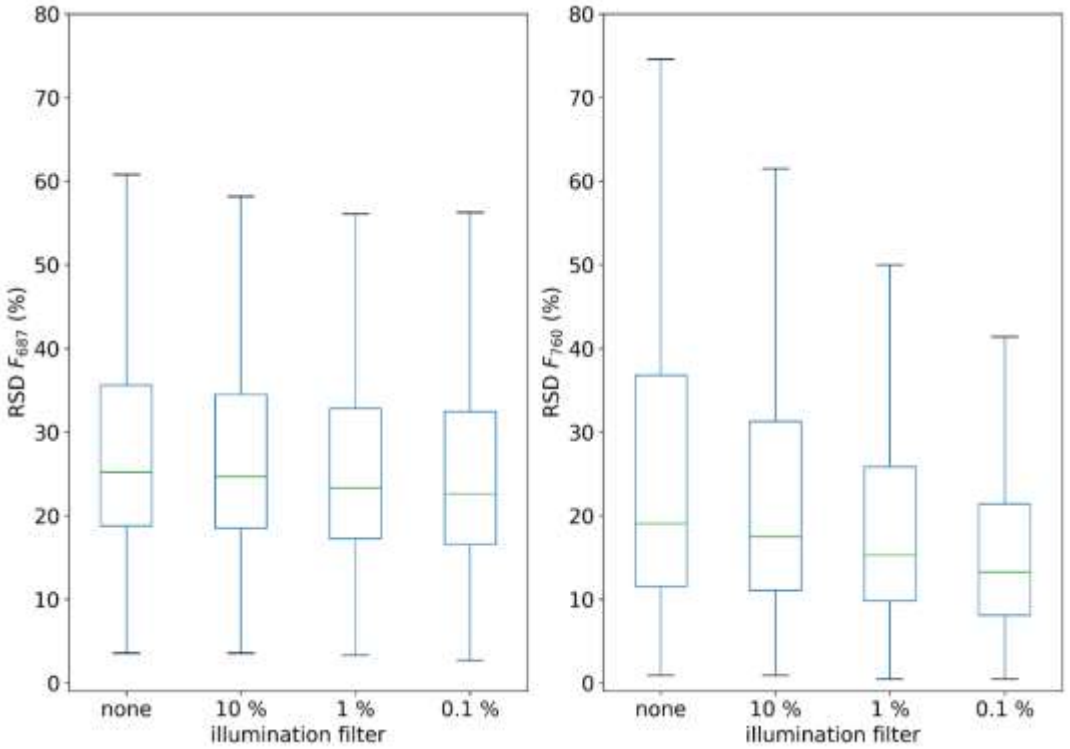
Quality checks (Sebastian Wienecke)

- Data filtering based on changes in irradiance between two sucessive measurements



Irradiance on «stable» day «cloudy» day

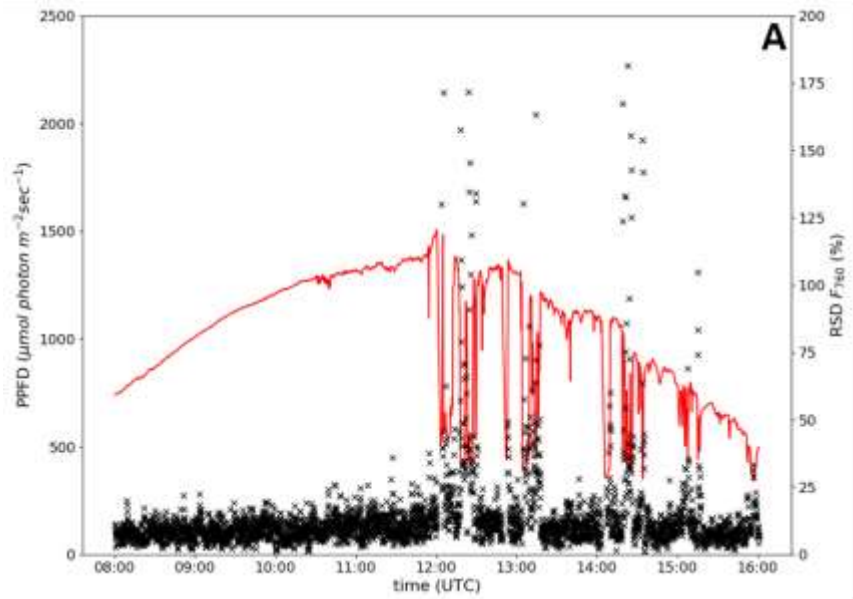


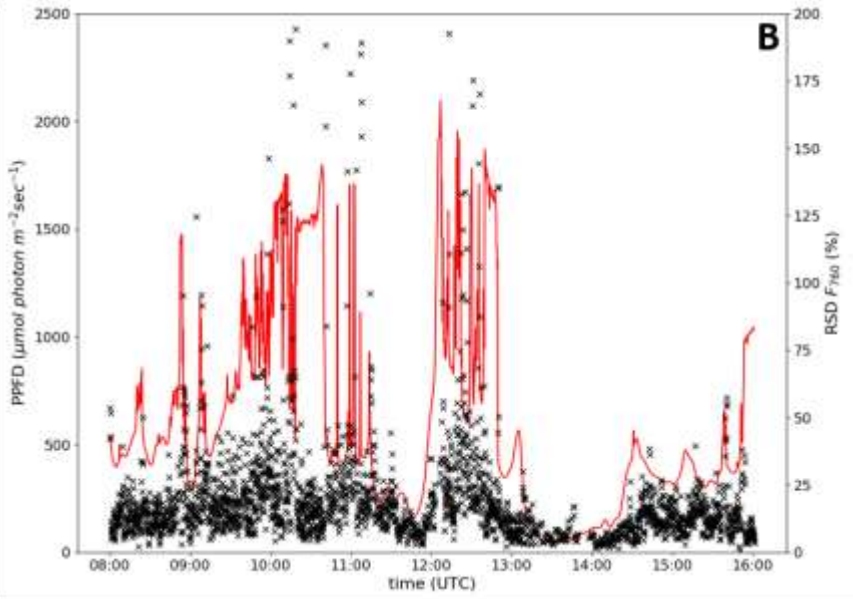


Box plot of the relative standard deviation (RSD) within a 30 sec moving window (6 sec per measurement cycle) of fluorescence at 760 and 687 nm (F_{760} and F_{687}) for four different illumination quality filter.

- While with the 10 % filter only 1 % of the data is discarded, the 1 % filter discards 25% and the 0.1 % ca. 70 % of the data. Due to the strong data loss we therefore advise to use a 1 % illumination change filter.

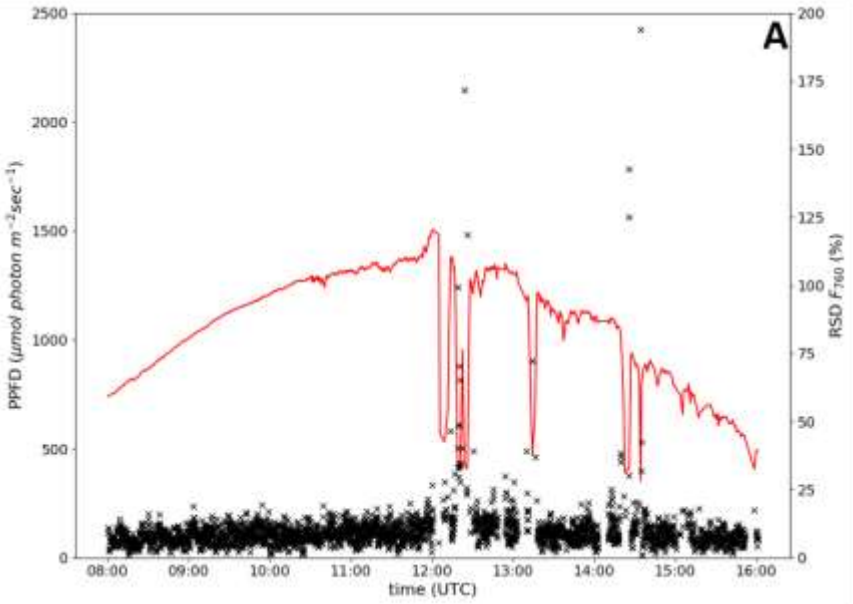
unfitered

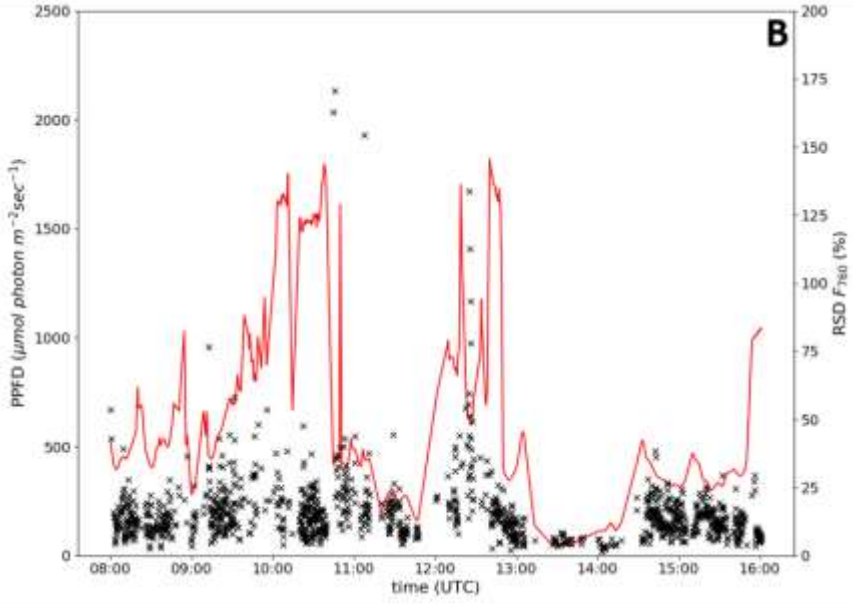


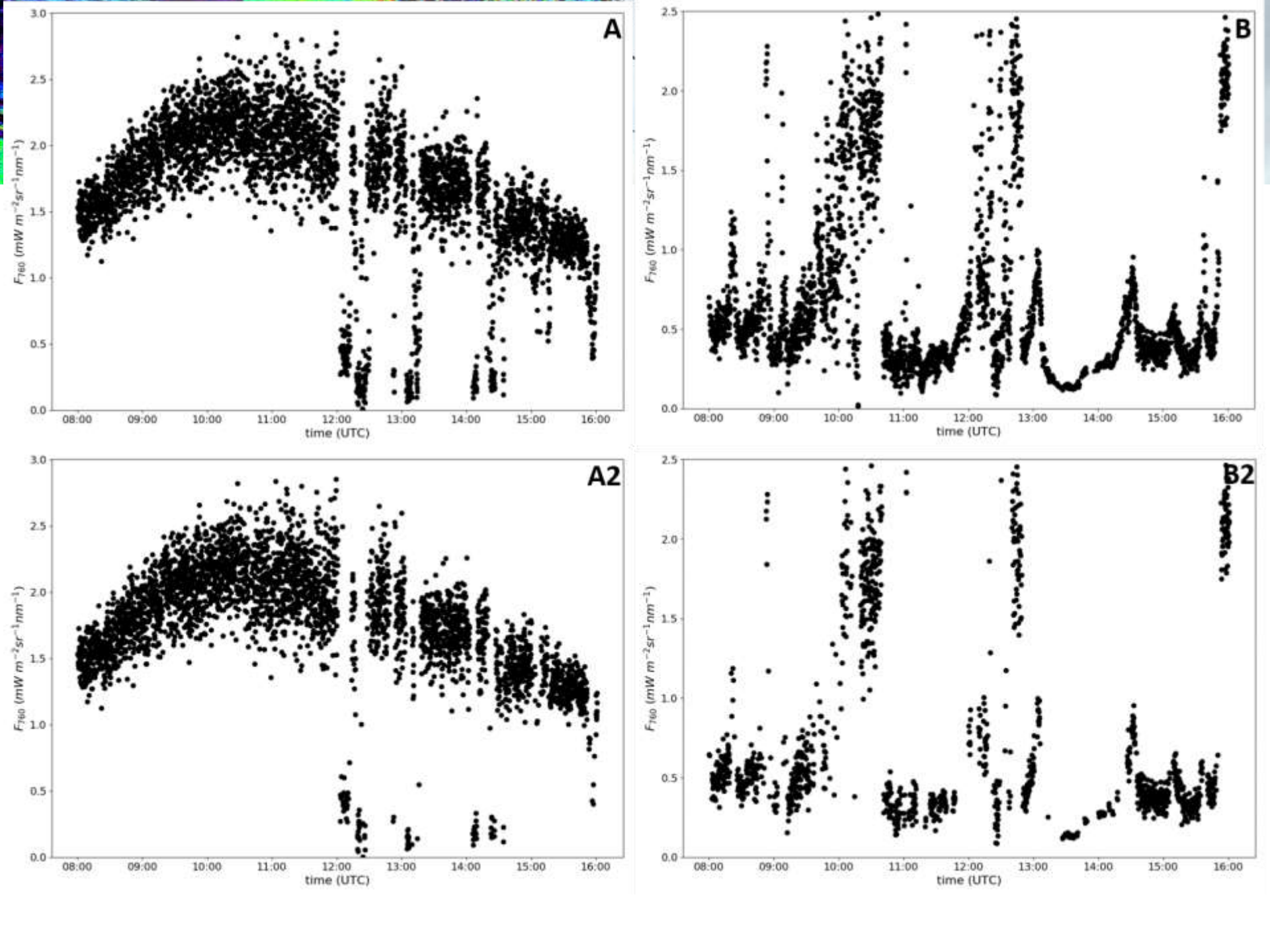


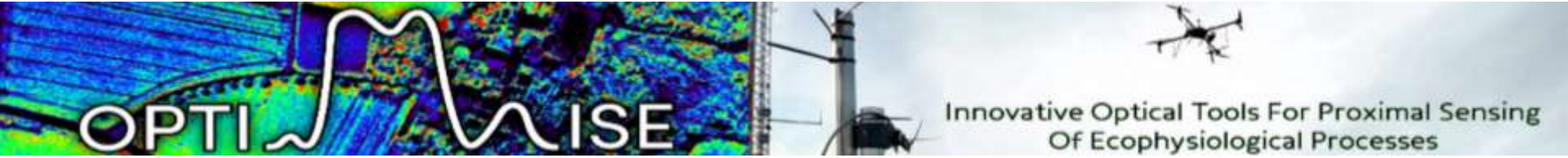
Irradiance on «stable» day «cloudy» day

filtered






A
B
A2
B2
F_{760} ($mW\ m^{-2}sr^{-1}nm^{-1}$)
time (UTC)
08:00
09:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00



Atmospheric effects on Solar Induced Chlorophyll Fluorescence retrieved on proximal sensing: Approaches for different scales

Neus Sabater, Luis Alonso and José Moreno

Image Processing laboratory (IPL), University of Valencia, Valencia, SPAIN

VNIVERSITAT DE VALÈNCIA

COST is supported by the EU Framework Programme Horizon 2020

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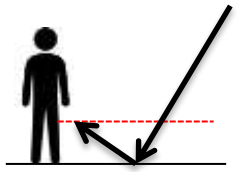
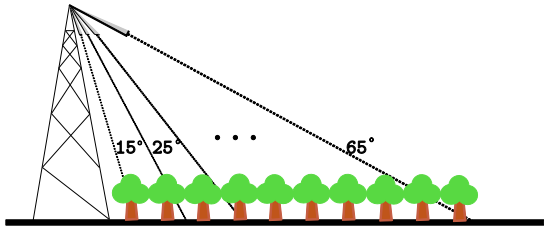
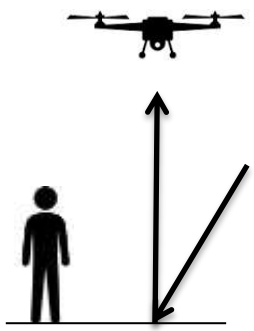
Correction is assumed in airborne spectroscopy

- Is it necessary at closer range?
  - Ground level (human scale)
    < 2 m
  - Tower level
    ~ 10 - 20 m
  - UAV level
    ~ 2 – 100 m





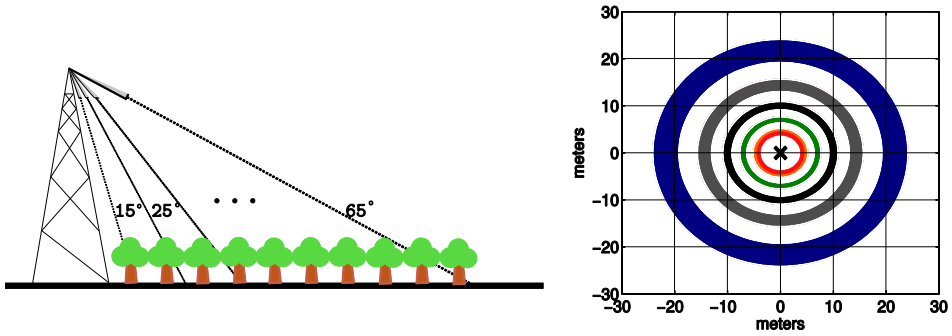


- At human-scale it seems **not** necessary to correct from oxygen absorption neither from aerosol transmittance.
- Except maybe above 2m

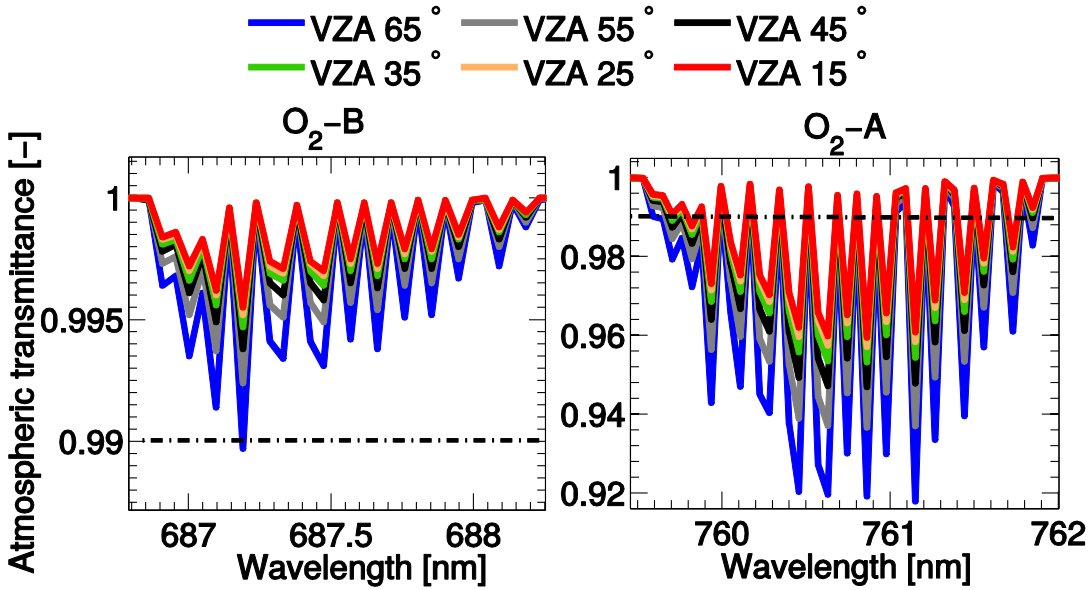
- At tower-scale it is **necessary** to correct from oxygen absorption but on clear sky conditions it might not be necessary to correct from aerosol transmittance.
- If only oxygen absorption is considered, it should be possible to use a parametric O2 transmittance approximation.

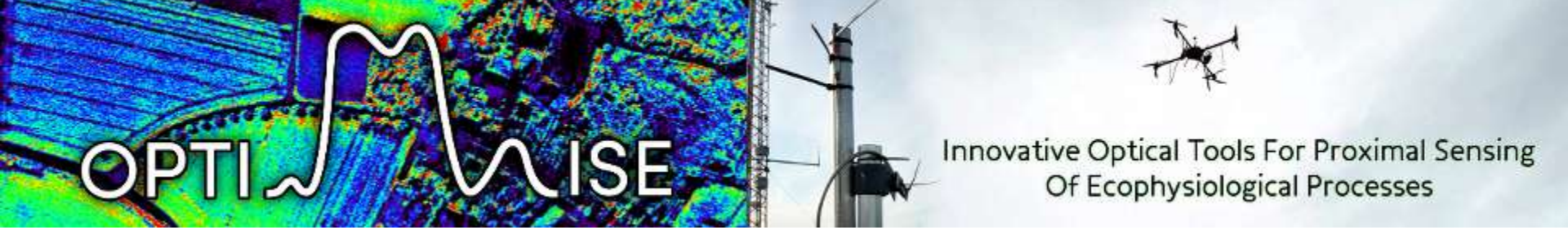
- At UAV-scale it is **necessary** to correct from oxygen absorption
- At low altitudes it seems that on clear conditions it might not be necessary to correct from aerosol transmittance.
- At high altitudes it might be necessary to also include path radiance L0

Specially important on multi-angular acquisition geometries



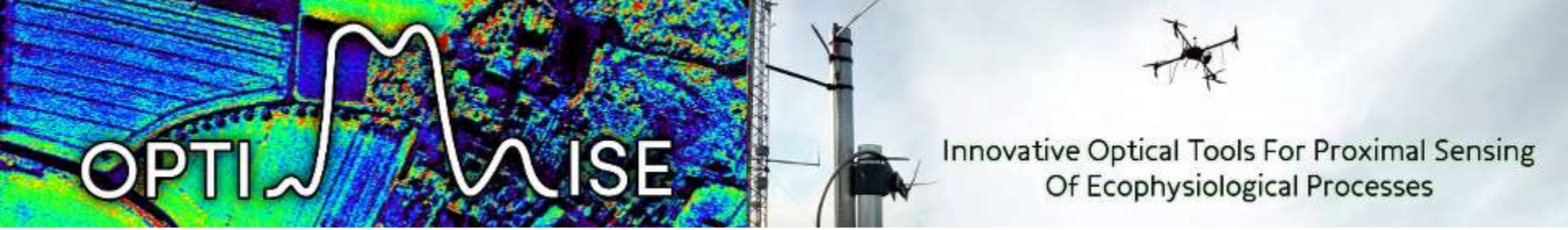
Specially important on up-scaling process for a proper SIF product validation





metadata/ancillary datasets

➢ **next talk**

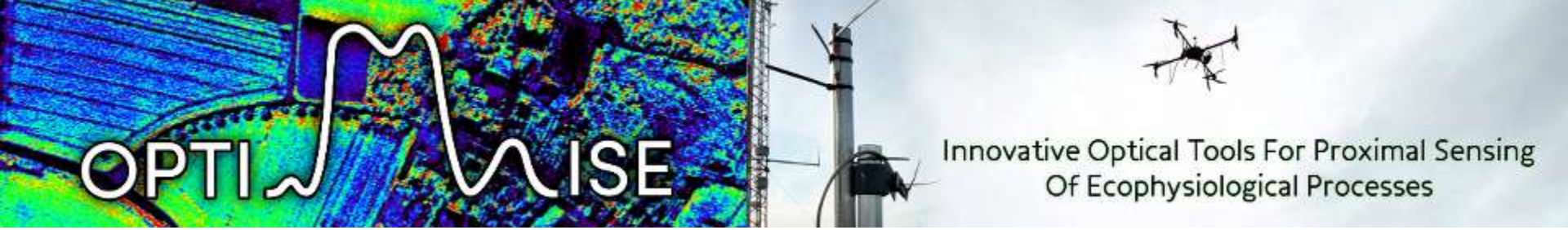


Current status

- Some people have delivered a first draft of their inputs
- Still some large gaps
- Putting everything together in a consistent flow will take some effort

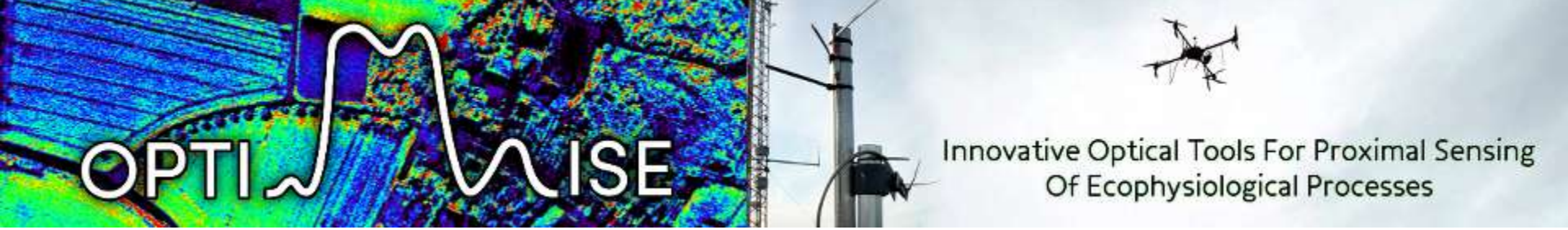
What is still missing

- Section on the current state of upscaling from leaf to canopy – models?



WANTED:

- People who could write a section on upscaling
- People who could write a section on complementary data to make sense of the measured F
- People who commit themselves to intensively review and edit the manuscript before submission to
  - Assure a high quality
  - Make sure we did not miss anything
  - Review with the “seniors eye” to put everything in perspective



A big thanks to everyone who has already contributed to the OPTIMSE three papers

A big to everyone that will contribute to the OPTIMSE three papers in future

Thanks to the whole OPTIMISE community for a great time

COST is supported by the EU Framework Programme Horizon 2020

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