

COST Action ES1309 OPTIMISE

Introduction to OPTIMISE review papers:
**Sun-Induced Chlorophyll Fluorescence - from instrument
characterization and measurement protocols to retrieval
methods**

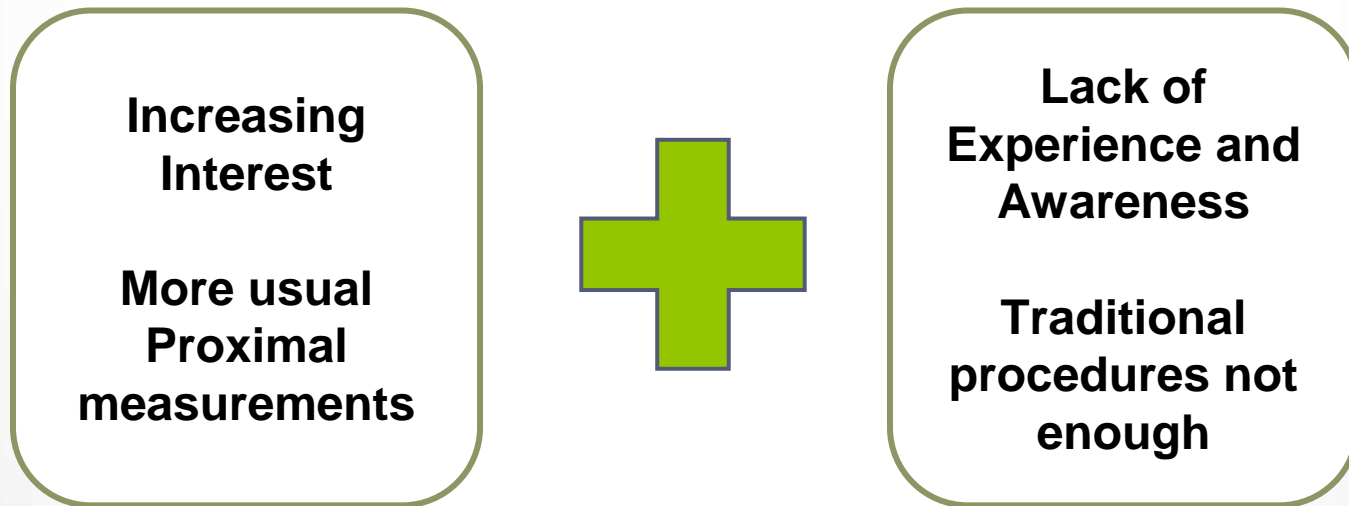
Presenters: Javier Pacheco-Labrador, M. Pilar Cendrero-Mateo, Helge Aasen, Shari
Van Wittenberghe

OVERVIEW

1. MOTIVATION
2. INTRODUCTION SUN-INDUCED CHLOROPHYLL
FLUORESCENCE NOMENCLATURE
3. OPTIMISE DISSEMINATION PAPERS
4. OPTIMISE SPECIAL ISSUE

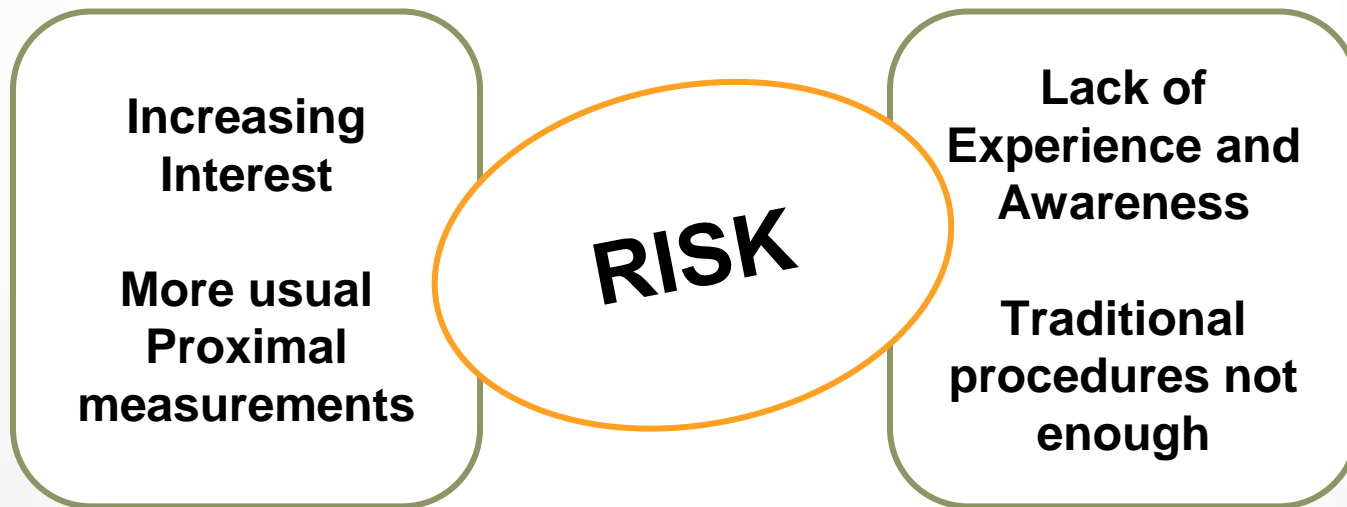
1. MOTIVATION

- ▶ Scientific community interest on Sun-Induced Chlorophyll Fluorescence (F) is skyrocketing in the last years
 - ▶ Boosted by up-coming FLEX mission and Remote F retrievals from meteorological satellites



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1. MOTIVATION

- ▶ Spectroradiometric measurements
 - ▶ One of the least reliable of all physical measurements (Kostkowski, 1997)
 - ▶ Multidimensional problem
 - ▶ Instability of measuring instruments and the uncertainty of the standards
 - ▶ Principles and techniques used for eliminating (or reducing) measurement errors due to this multidimensionality or instability have not been widely disseminated
- ▶ “Traditional” Field Spectroradiometry
 - ▶ Measurement of reflectance factors
 - ▶ Radiometric calibration usually not needed or not compulsory for all applications
 - ▶ Assess strong signals (phenology, land covers...)
 - ▶ Comparison with remote sensors with quite coarser spectral resolutions

Can afford
relatively large
uncertainties

1. MOTIVATION

▶ “Traditional” Field Spectroradiometry

1. Instrumentation

- ▶ High trust on the producer specifications
- ▶ Lack of instrumental characterization
- ▶ Lack of uncertainty quantification / propagation

EXPENSIVE

2. Methods

- ▶ Not always robust to variation in E_{\downarrow}
 - Reference – Target –T –T –T –T –T –T ...
- ▶ New platforms (towers, UAVs)
 - Atmospheric depth effects usually ignored
- ▶ Many metadata still not even recorded

*MORE
SAMPLES
*EASIER
PROCESSING

▶ Sun-Induced Chlorophyll Fluorescence (F)

- ▶ Unclear use of terminology
- ▶ Different retrieval methods (Robustness?)
- ▶ Different post-processing (understanding?)
of the signal

UNDER
DEVELOPMENT

1. MOTIVATION

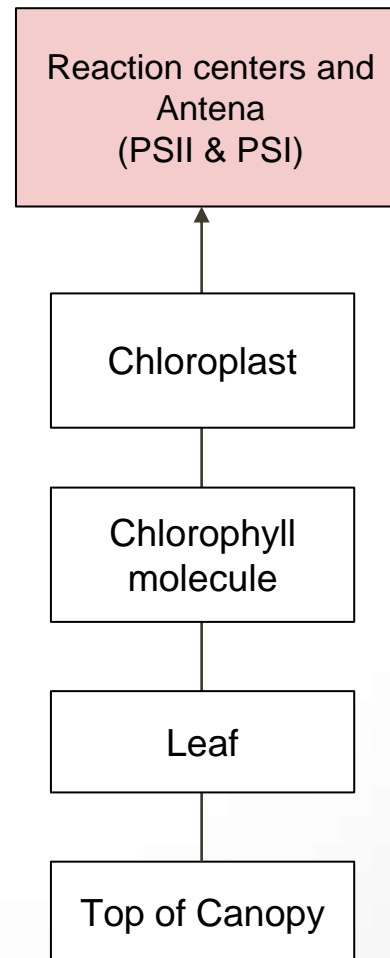
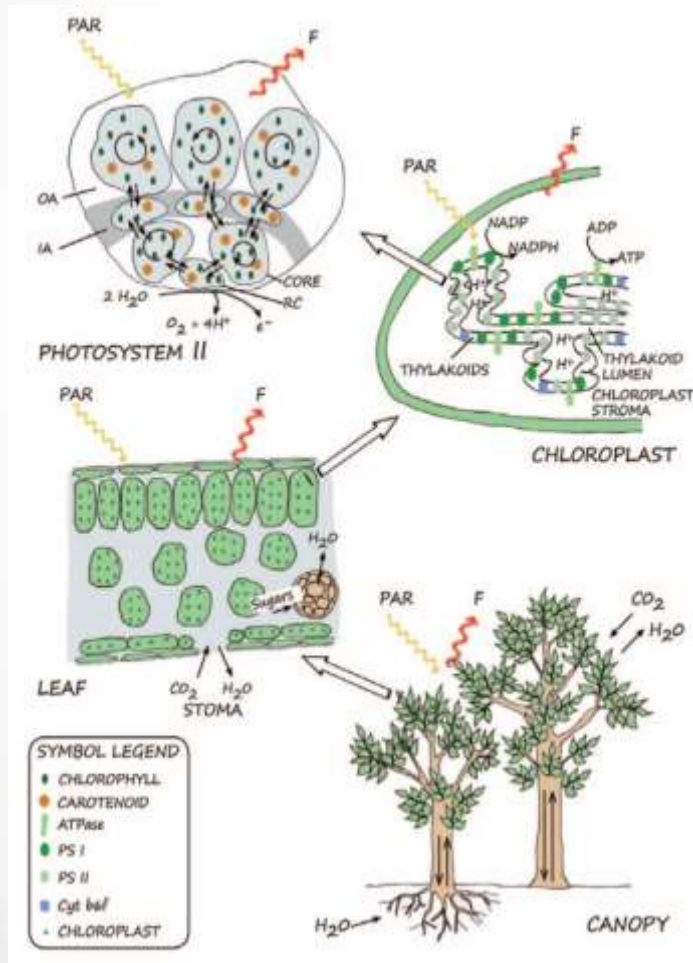
- ▶ “ F -dedicated” Field Spectroradiometry
 - ▶ F = Relative metric $\rightarrow f(\text{Vegetation variability})$
 - ▶ Treatments, phenotypes, species...
 - ▶ Phenological changes
 - ▶ F = Absolute Radiometric Quantity
 - ▶ Model and understand plant physiology
 - ▶ Comparable (sensors, datasets)

Can afford
small
Uncertainties
?

Can afford
very small
uncertainties
?

**MEASURING REFLECTANCE FACTORS IS NOT THE
SAME THAN MEASURING SUN INDUCED
FLUORESCENCE**

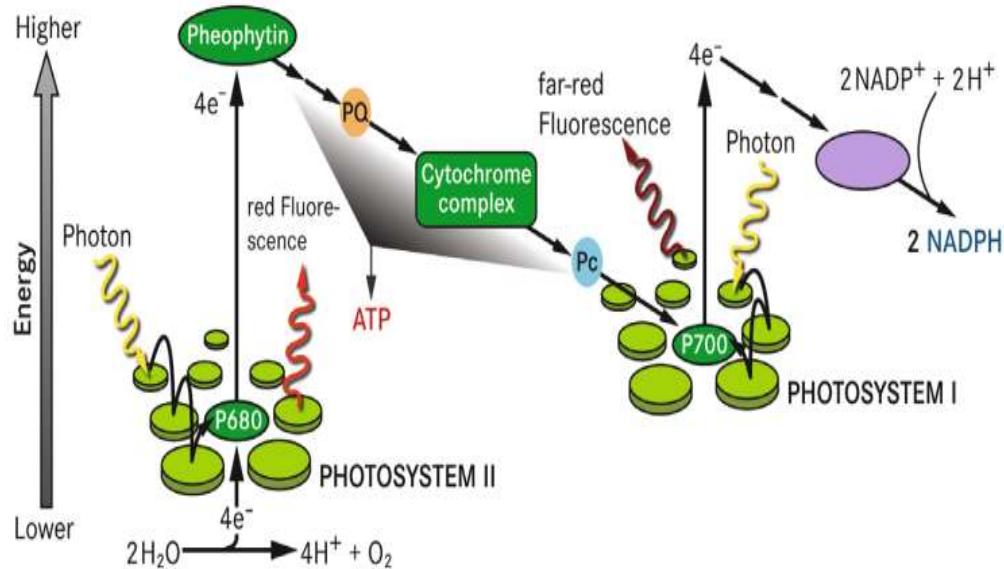
2. INTRODUCTION SUN-INDUCED CHLOROPHYLL FLUORESCENCE NOMENCLATURE



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PS I - P700
Absorbs light at longer wavelengths (infrared)

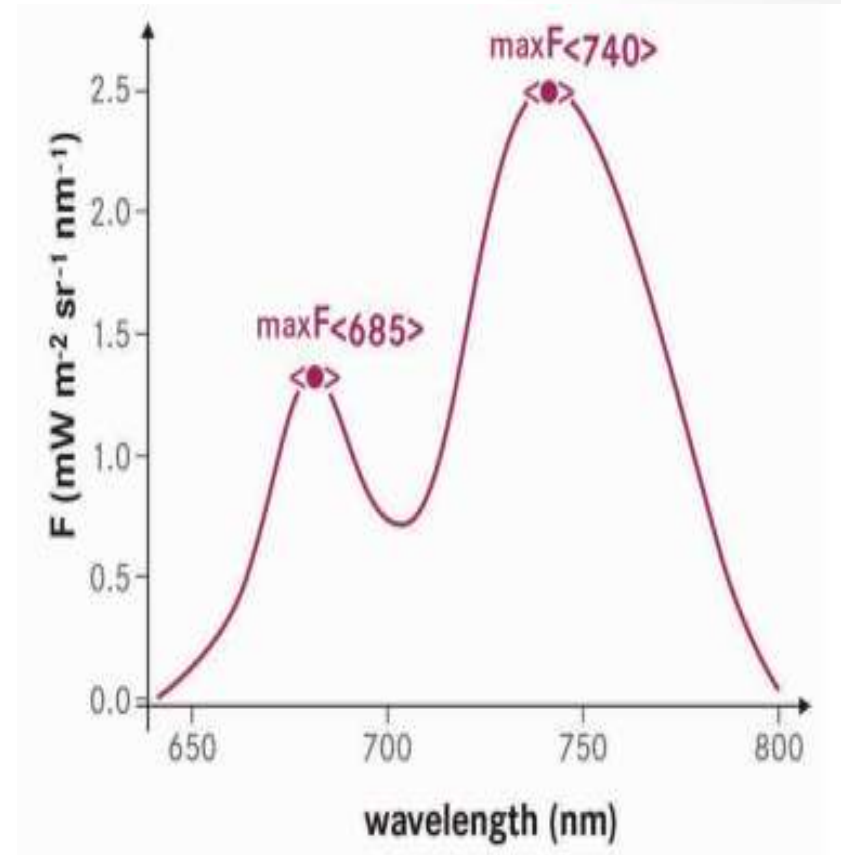
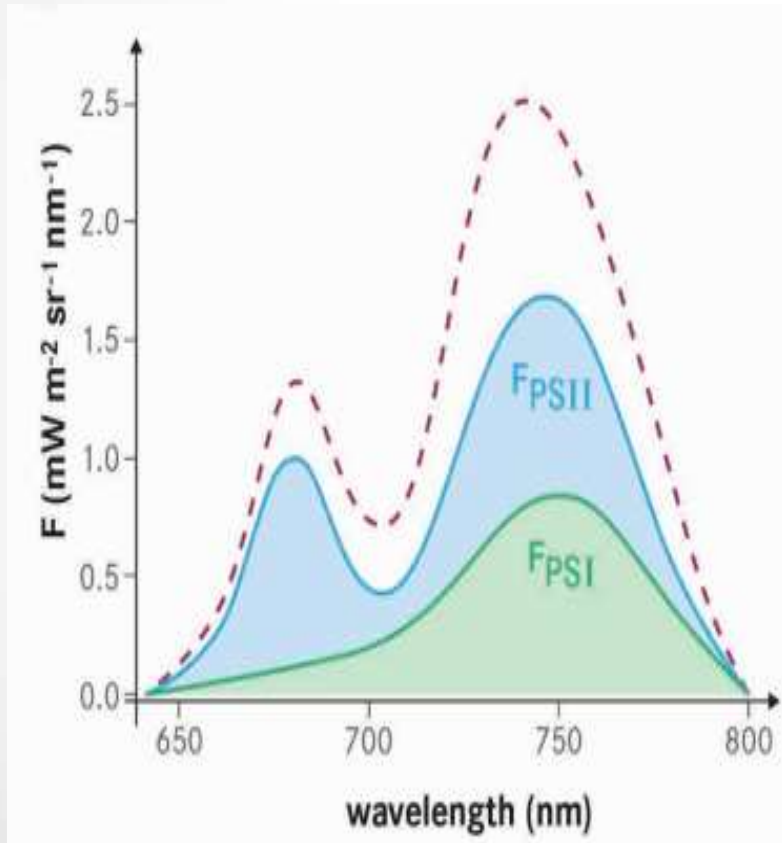
PS II - P680
Absorbs light at short wavelengths (red)



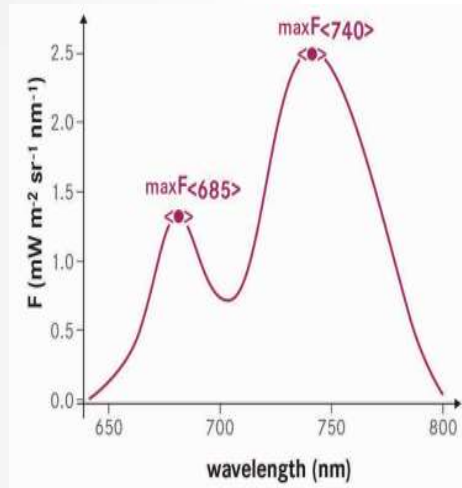
PS I - P700
Re-emits light in **F740**

PS II - P680
Re-emits light in **F685**

Sun-Induced Chlorophyll Fluorescence (F) is the plants light re-emission in the red (F685) and near infrared (F740) in response to absorbed radiation.

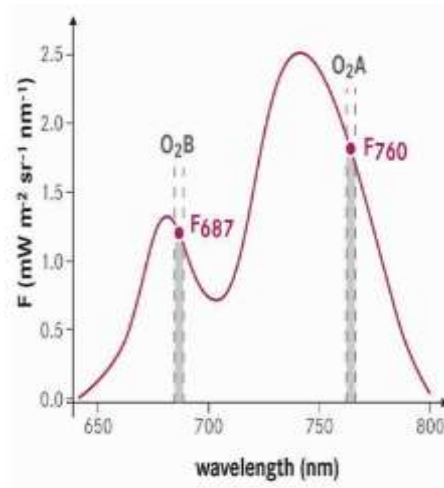


2. INTRODUCTION SUN-INDUCED CHLOROPHYLL FLUORESCENCE NOMENCLATURE



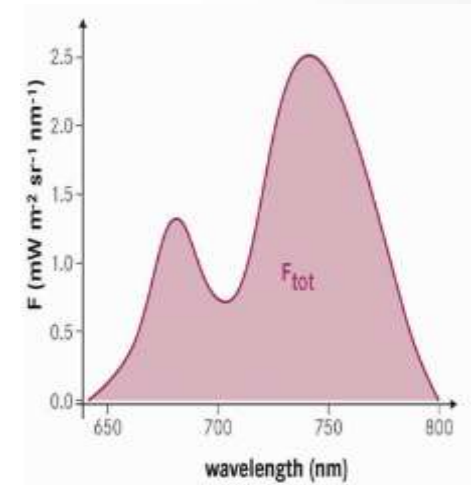
$\text{maxF}<685>$

$\text{maxF}<740>$



F_{687}

F_{760}



F_{tot}

3. OPTIMISE DISSEMINATION PAPERS

- Idea (Dubrovnik):

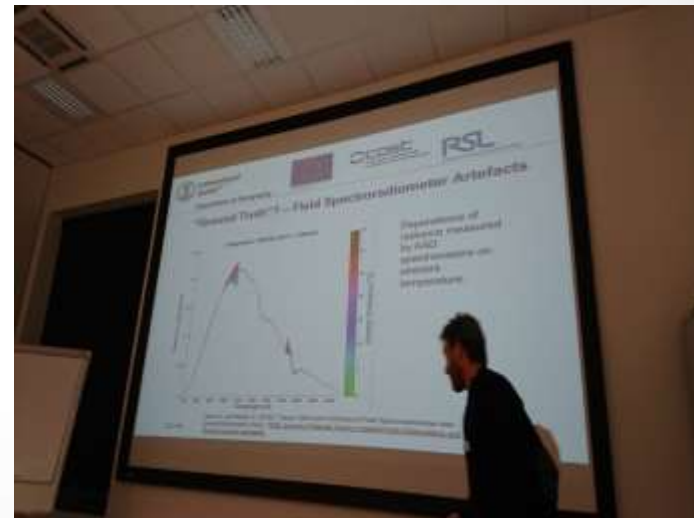
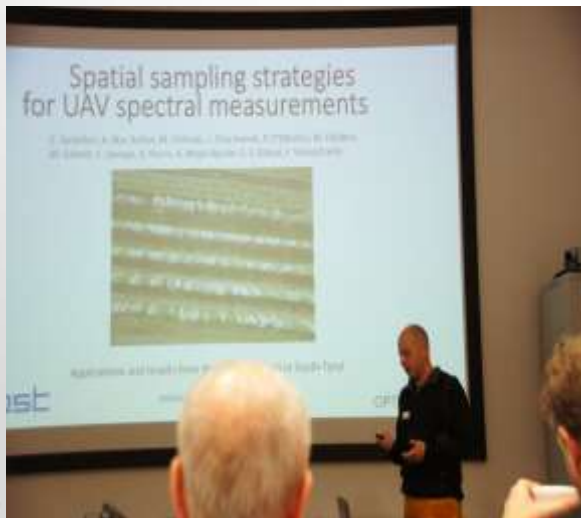
Best practice for UAV Spectral sampling

OPTIMISE - BUS

- Collect and summarize the knowledge on “good” reflectance and fluorescence (radiance) measurements

3. OPTIMISE DISSEMINATION PAPERS

- Practice for spectral sampling
 - September 2016: ITC
 - October 2016: Bolzano
 - November 2016: Tartu
 - March 2017: Bucharest
 - October 2017: Luxembourg



3. OPTIMISE DISSEMINATION PAPERS

- Outcome: OPTIMISE three (+2) papers (read: manuscripts)
 - Instrumental considerations for the measurement of sun induced fluorescence (led by Javier)
 - Measuring sun-induced fluorescence at different scales: Overview over instruments, measurement setups and protocols at leaf and canopy scale (led by Helge)
 - Ground measurements of Solar-induced chlorophyll fluorescence: retrievals methods and practical cases (led by MaPi)
 - (UAV spectral sensing systems – sensors, geometric and radiometric data processing and best practice from particle to pixel (Helge, Eija, Arko))
 - (publication on UAV survey, led by Helge)

4. OPTIMISE SPECIAL ISSUE

IMPACT
FACTOR
3.244



remote sensing

OPTIMISE: Innovative Optical Tools for Proximal Sensing of Ecophysiological Processes

An Open Access Journal by MDPI

Deadline for manuscript submissions: **31 October 2018**

Keywords

- Remote Sensing
- Proximal Sensing
- Unmanned Aerial Vehicles
- Reflectance
- Fluorescence
- Spectral Information Systems
- Biogeochemical Cycles

Submission

- Open!
- Submit online at www.mdpi.com
- Published upon acceptance
- Research articles, review articles as well as short communications are invited
- Open access, processing charge

**THANKS FOR YOUR
ATTENTION**

...

QUESTIONS / REMARKS