

Validation Activities

At Forschungszentrum Jülich

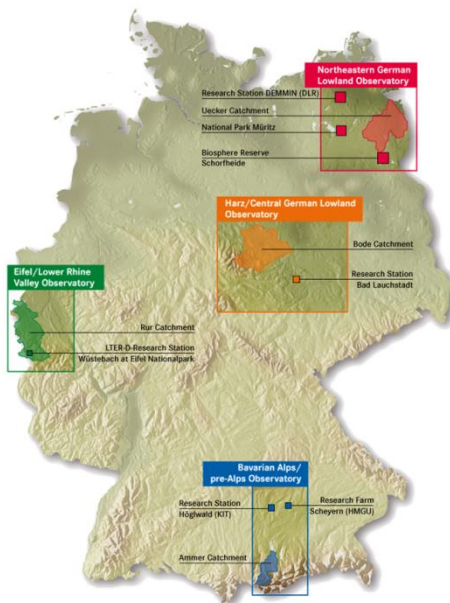
TERENO network and FLUXNET

March 2016 | Jörn Ungermann

TERENO

In situ observations

TERENO Terrestrial Environmental Observatories
TERRESTRIAL ENVIRONMENTAL OBSERVATORIES

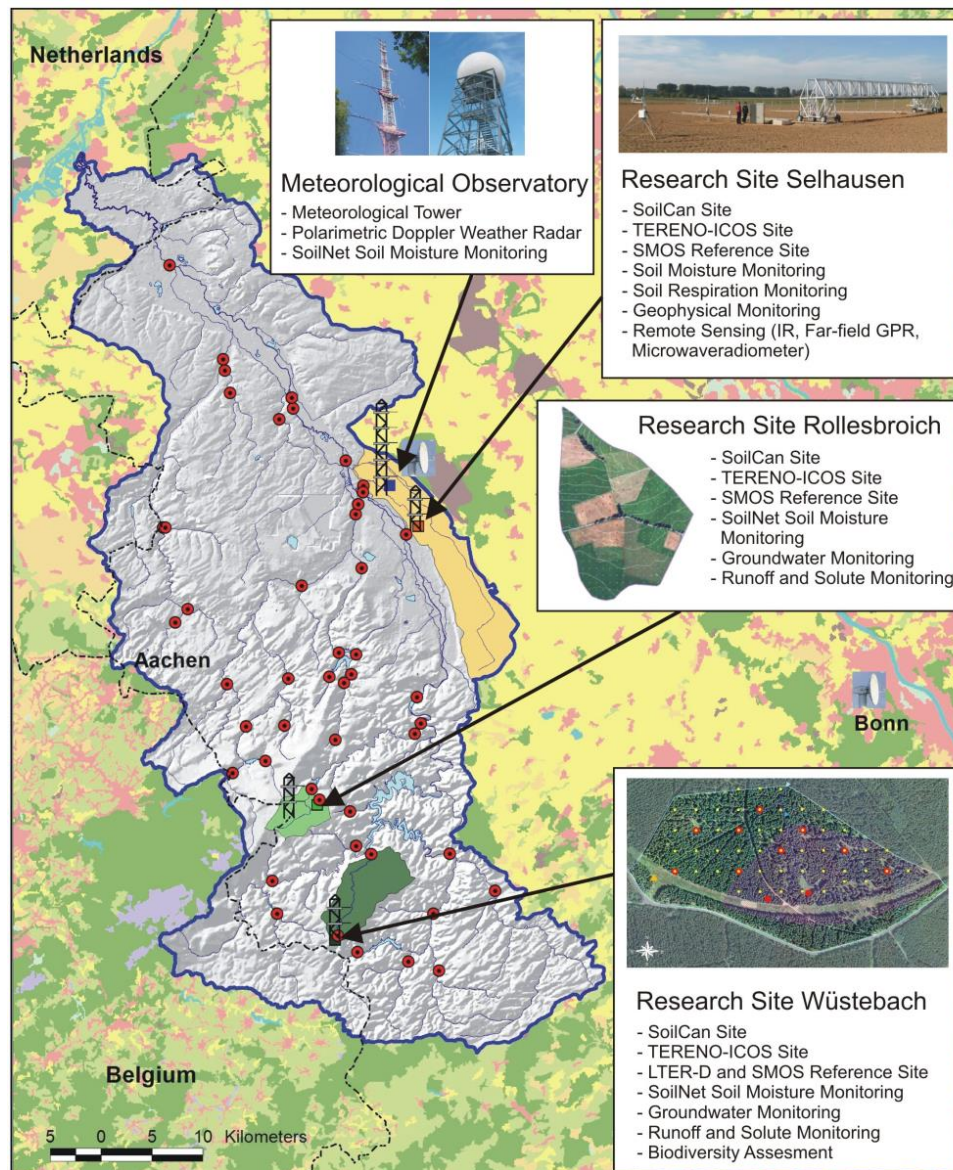


Observatorium Nordostdeutsches Tiefland
Koordination: GFZ

Observatorium Harz / Mitteldeutsches Tiefland
Koordination: UFZ

Observatorium Eifel / Niederrheinische Bucht
Koordination: FZJ

Observatorium Bayerische Alpen / Voralpenland
Koordination: KIT / HMGU



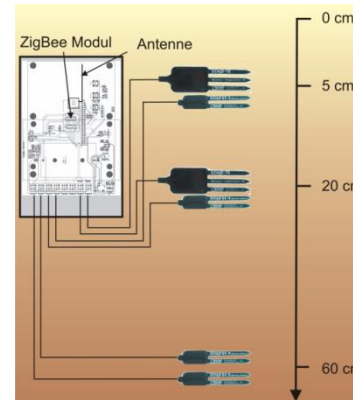
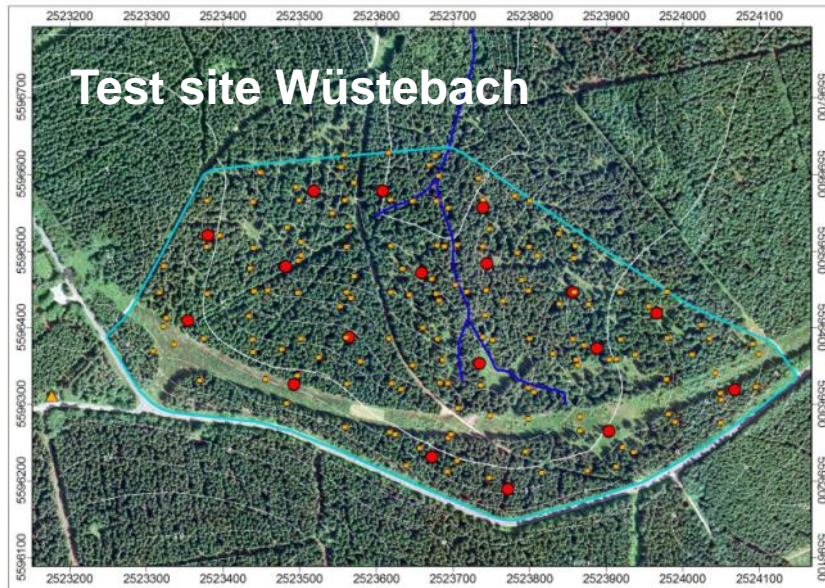
TERENO
TERRESTRIAL ENVIRONMENTAL OBSERVATORIES

Eifel/Lower Rhine Valley Terrestrial Observatory

- Rur Hydrological Observatory
- Ellebach Subbasin
- Kall Subbasin
- Erkensruhr Subbasin
- Waterbodies
- Streams
- National border
- Runoff gauging station
- Eddy flux tower
- Weather Radar

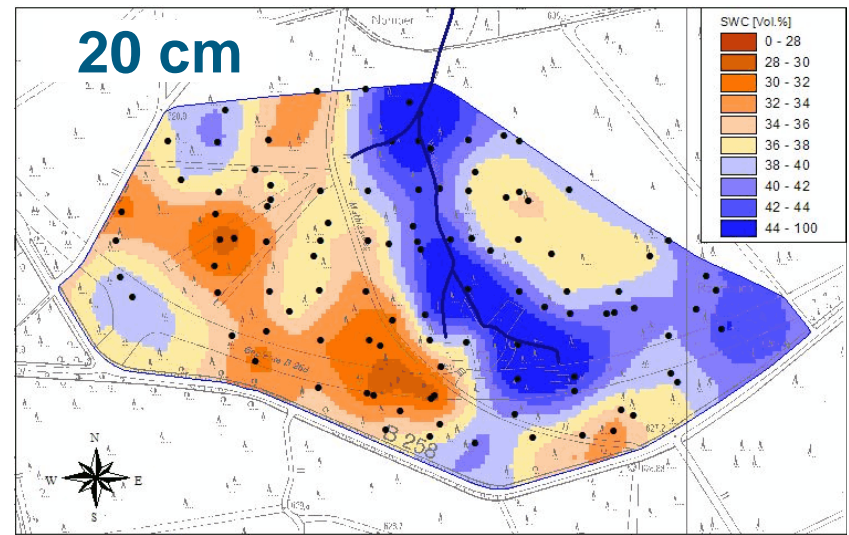
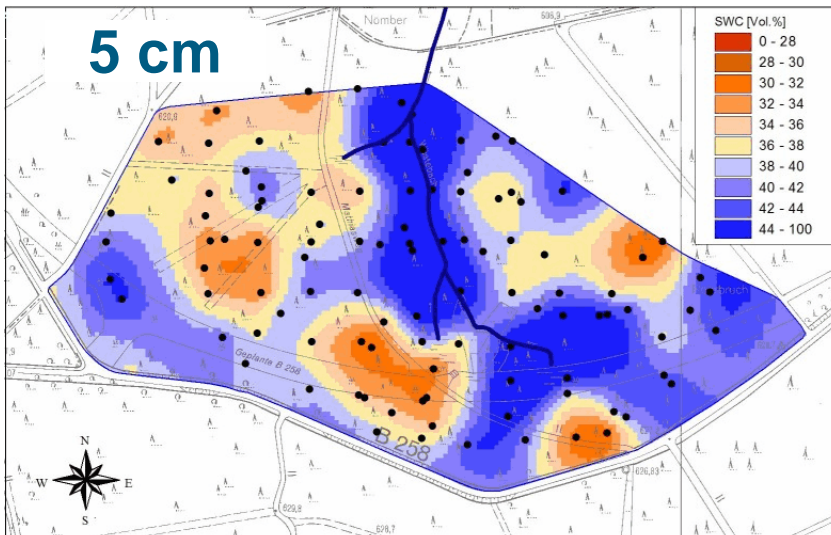
Map editing: Dr. H. Bogaen; July 2009

Wireless soil moisture sensor network SoilNet



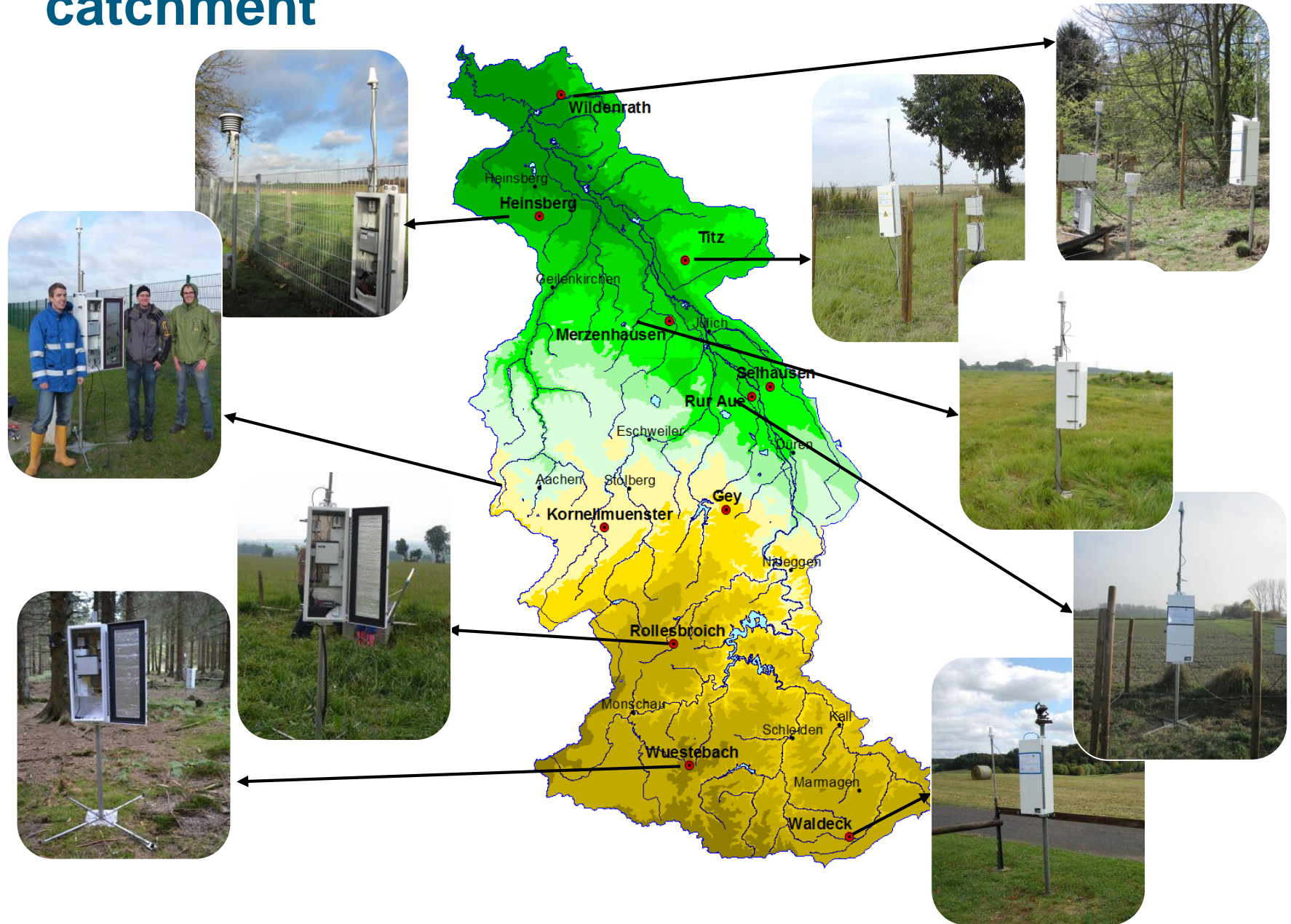
- 150 Sensor units
- 18 Router units
- 900 Soil moisture sensors
- 300 Temperature sensors

455 days: ~10 Mio. hourly measurements!



Bogena et al. (2010)

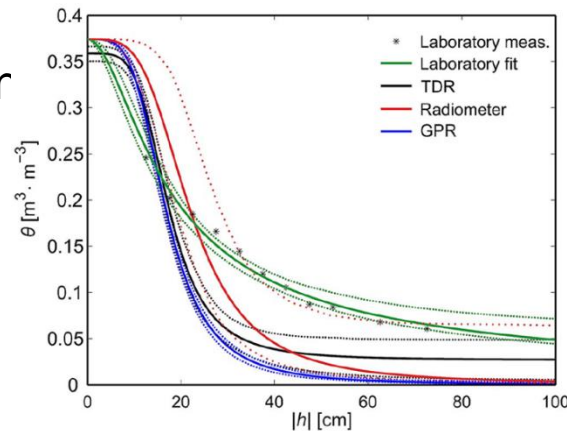
Cosmic Ray Probe Network in the Rur catchment



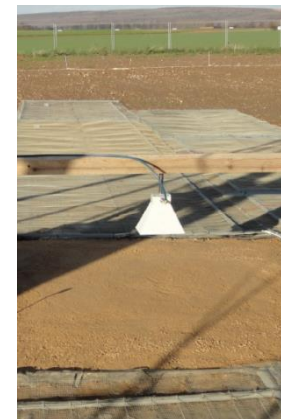
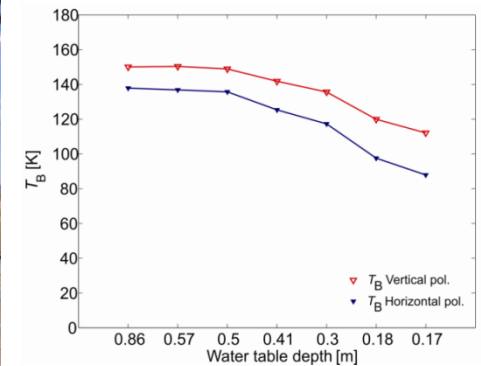
Passive and active microwave monitoring at L-band



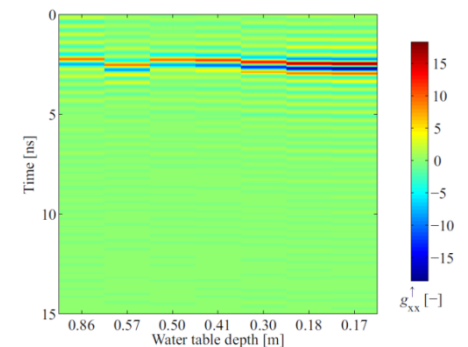
Inverse estimation
of hydraulic
parameters



radiometer



GPR



[HOMEPAGE](#)[LOGIN](#)

TERENO

TERRESTRIAL ENVIRONMENTAL OBSERVATORIES



 Search

+ What ?

+ Where ?

+ When ?

Search

Clear

Map Viewer



+ Search Results

+ Sensor Search Results

Cosmic Ray/Climate/Soil station Ruraue



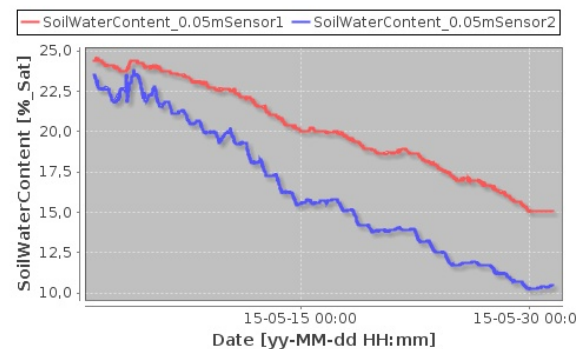
▼ Select Data

Query Stations Style Basket

Offering	Public	SoilTemperature_0.2mSensor1
		SoilTemperature_0.2mSensor2
		SoilTemperature_0.5mSensor1
		SoilTemperature_0.5mSensor2
		SoilWaterContent_0.05mSensor1
		SoilWaterContent_0.05mSensor2
		SoilWaterContent_0.2mSensor1
		SoilWaterContent_0.2mSensor2

► Information

▼ Result



TERENO

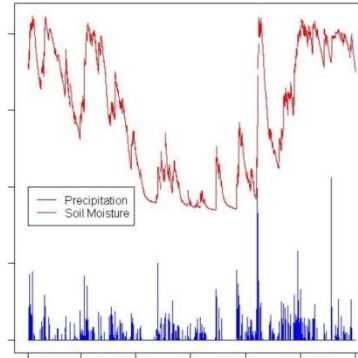
- Long-term monitoring of the terrestrial environment (>15 years)
- Focus on water and energy fluxes
- Monitoring data available to the public
- TERENO part of Integrated Carbon Observation System (ICOS) European Research Infrastructure Consortium (ERIC)

SMOS VALIDATION CAMPAIGN 2010

Soil moisture reference (area-wide time series)

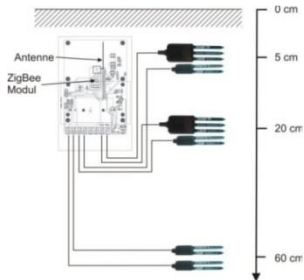
**Soil moisture
measurements**

WaSiM-ETH
modelling

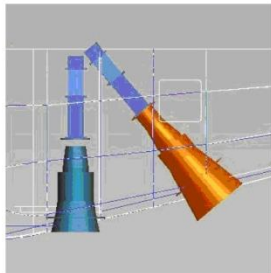


Product-
validation

**SMOS
soil moisture**



**Radiometric
measurements**



Radiative Transfer
Model L-MEB

Parameter
estimation

**Tb (area-wide
time series)**

Aggregation/
Validation

SMOS Tb

SMOS Level 2
Processor

local

regional

global

Airborne measurements with the Short Skyvan of Aalto University



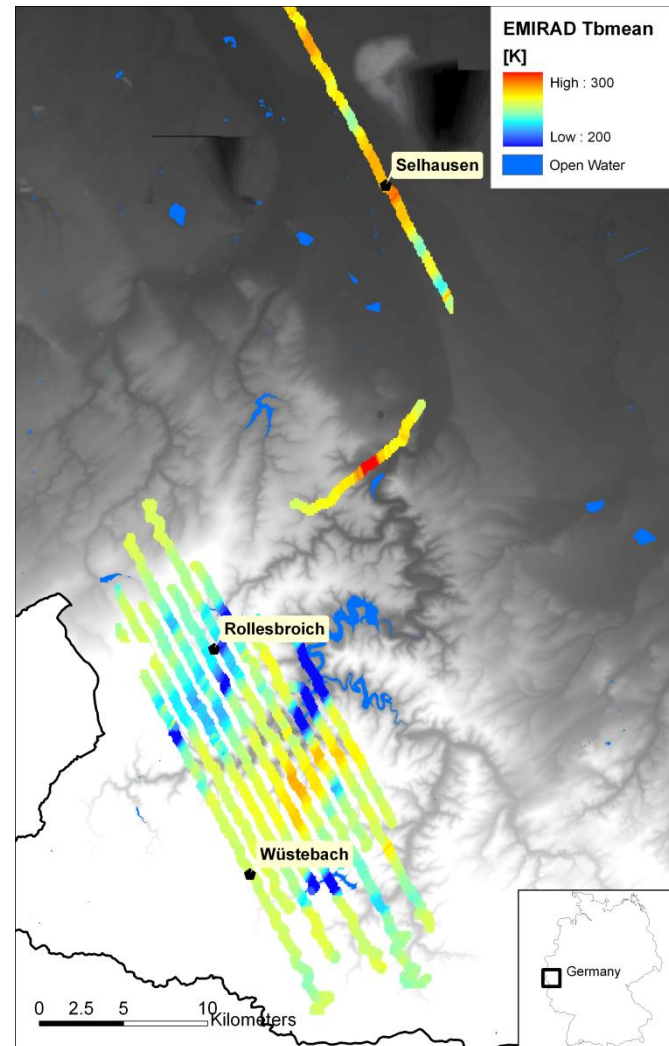
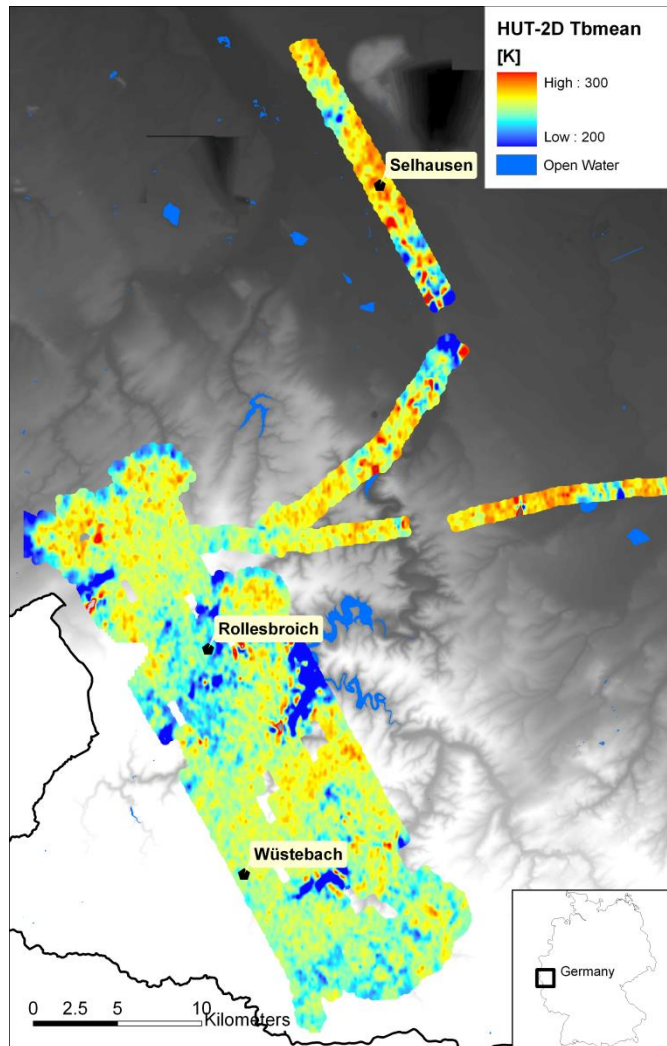
HUT-2D Radiometer Aalto University



EMIRAD Radiometer DTU Denmark



Airborne Radiometer data



SMOS Validation at TERENO Sites

- Validation on both brightness temperature level and on soil moisture level
- Airborne campaign to cover scale between in situ point measurements and spaceborne measurements

SMAP VALIDATION AT NASA

Global SMAP Validation



Soil Moisture Active Passive (SMAP) Mission

In situ data transfer status: SM



- Automated pull running
 - SMOSMANIA (#01)
 - TEREÑO (#02)
 - REMEDHUS (#03)
 - Reynolds Creek (#04)
 - Kuwait (#05)
 - HOAL (#06)
 - Monash (#07)
 - AAFC (#09)
 - SCAN (#11)
 - Twente (#12)
 - ARS (#16)
 - FMI (#17)
 - SAOCOM (#19)
 - CRN (#21)
 - Kenya (#24)
 - SoilSCAPE (#25)
 - Kenaston (#27)
 - Tabasco (#32)
 - Valencia (#41)
 - EURAC (#44)
 - GPS (#49)
- Automated pull ready to start
 - Merguillil (#08)
 - Oklahoma Mesonet (#46)
- Initials setup but some further details need to be worked out
 - Millbrook (#26)
 - Berambadi (#42)
- Work needed
 - NEON (#47)
- No automation planned at the moment
 - Tibet (#12)
 - AMMA (#45)
 - Mongolia (#53)

Source: Andreas Colliander, NASA

SMAP Validation at TERENO Rur

Climate class: Temperate (Cfb)

Landcover: Croplands

TERENO (Candidate Pixel)



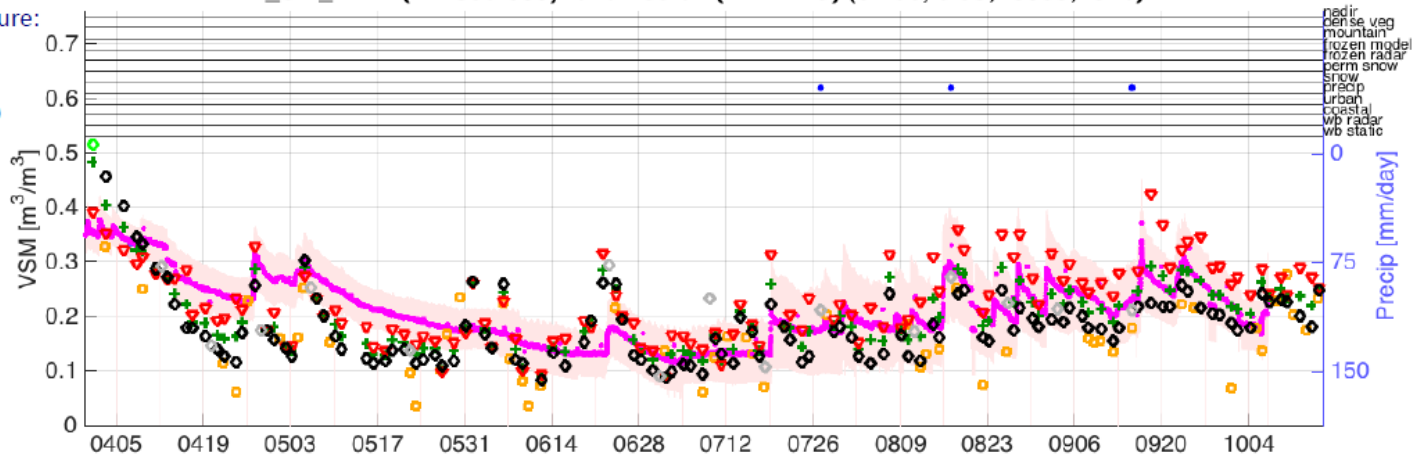
L2_SM_P-BL (T11880-999): 0201-36-01 (TERENO) (51.00, 6.35; -5988, -540)

Soil texture:

S-%: 41

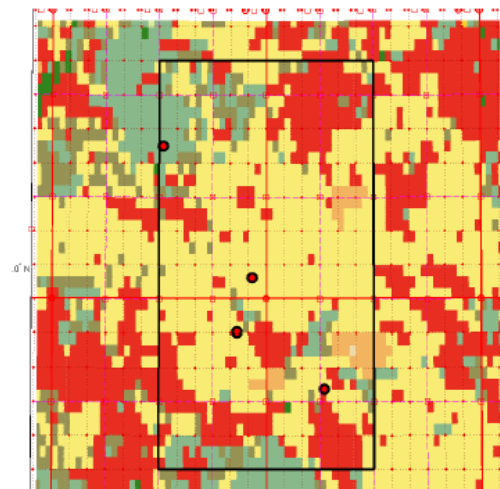
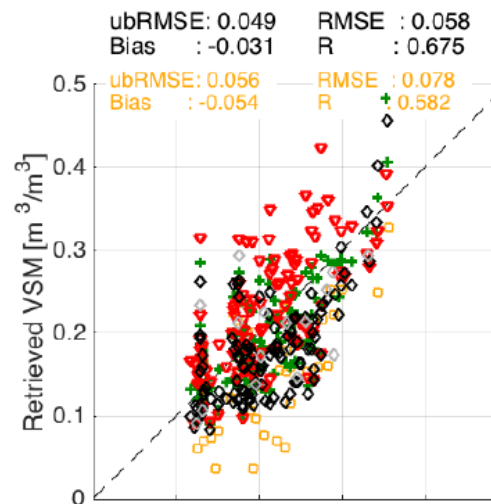
C-%: 22

BD: 1.40



- In Situ
- ◆ SCA-H
- + SCA-V
- ▲ DCA
- ◻ SMOS SM

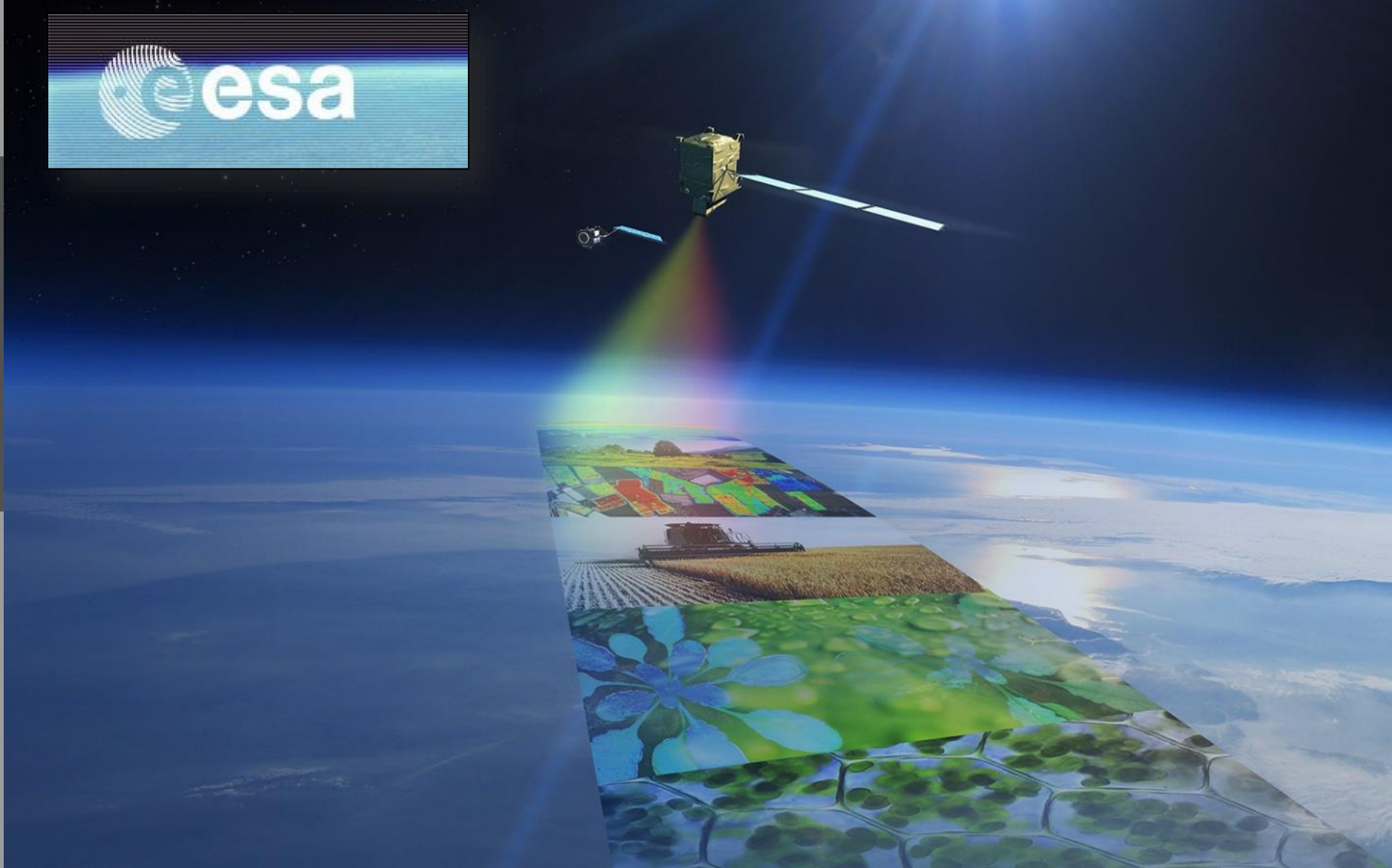
Alg	ubRMSE	Bias	RMSE	R
SCA-H	0.049	-0.031	0.058	0.675
SCA-V	0.048	-0.009	0.049	0.713
DCA	0.056	0.016	0.058	0.646



Source: Andreas Colliander, NASA

FLEX

FLEX – a satellite mission to directly measure actual photosynthesis from space



FLEX products validation

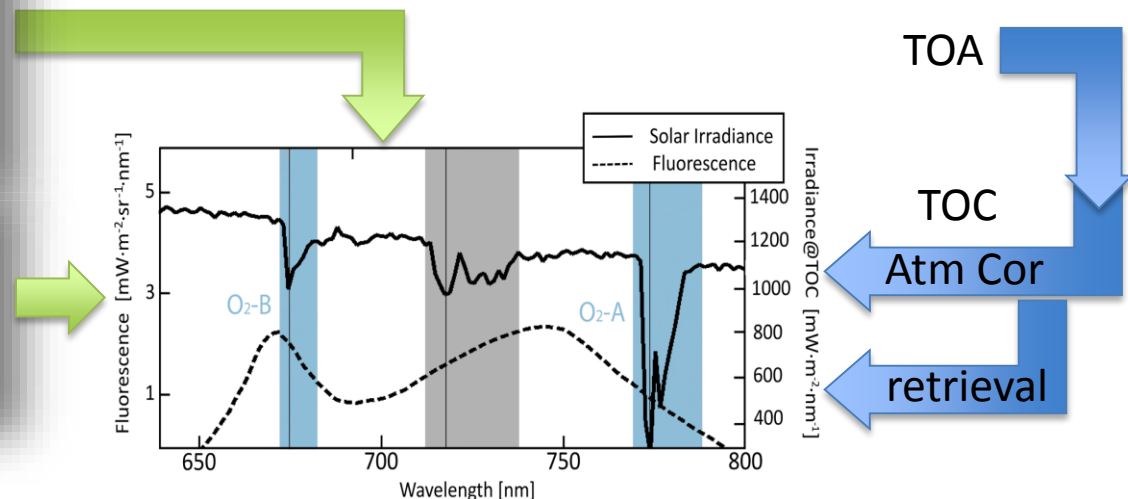
- Fluorescence products validated using in-situ measurements
 - selection of sites, field instruments and protocols
 - scaling methods
- Validation of atmospheric corrections and surface reflectance
 - surface solar irradiance measurements
 - surface spectral reflectance characterization
- Validation of derived vegetation products (LAI, f_{Cover} , Chlorophyll)



Top-of-Canopy

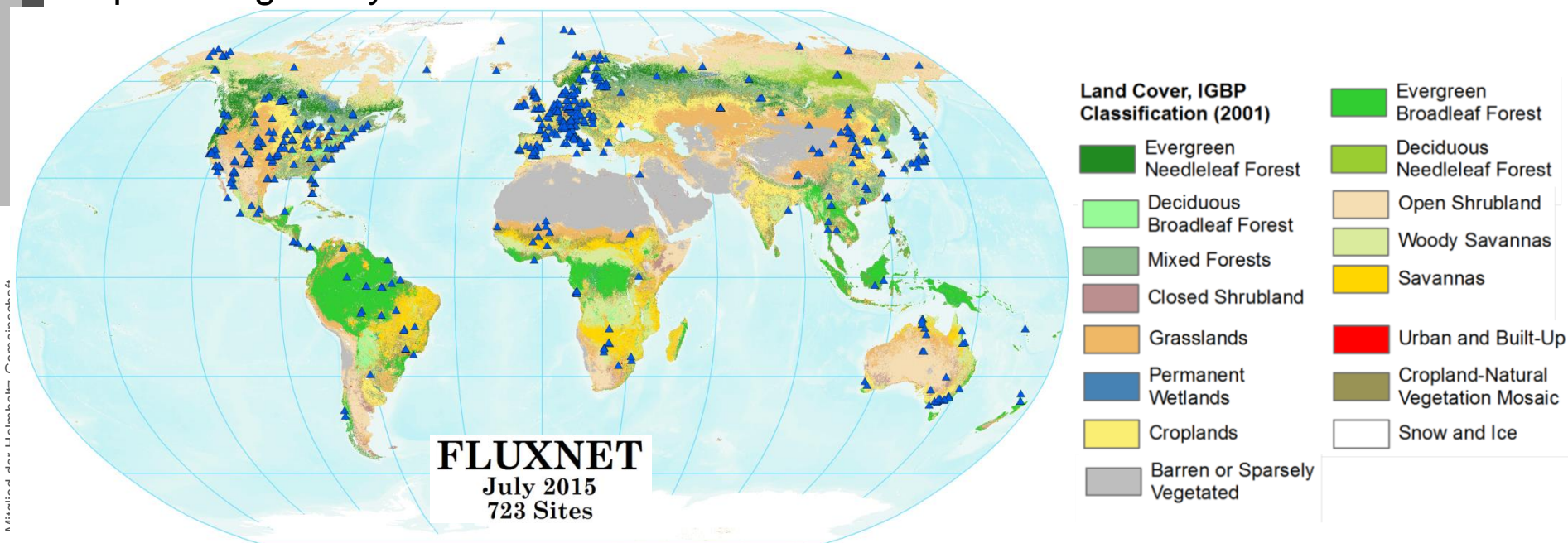


Leaf level



Selection of Cal/Val sites

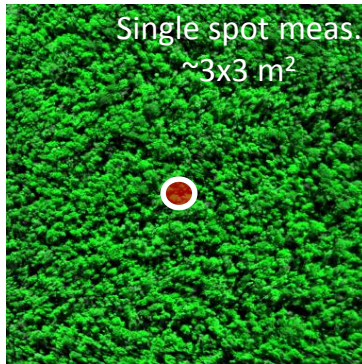
- Cal-Val sites (CVS) distributed around the globe:
 - Existing optical spectral measurements at flux towers, ecological sites, ...
 - Dedicated supersites
- Spatial domain: analyse correlation significance over all CVS points in a single global coverage
- Temporal domain: analyse correlation significance for each CVS over a full phenological cycle



Available technologies for field fluorescence measurements



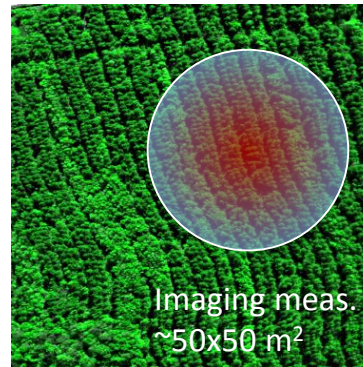
Spot spectroradiometer



Fluorescence at O_2 -A and O_2 -B
Fully autonomous
Single spot, localized
High temporal sampling (seconds)



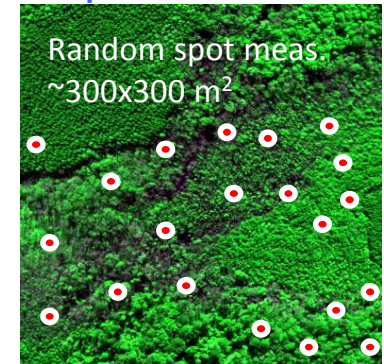
Robotized imaging spectroradiometer



Fluorescence at O_2 -A
Fully autonomous
Imaging, localized
Mid temporal sampling (hours)



UAV mounted spot spectroradiometer



Fluorescence from RT modelling
Partially autonomous
Multiple spots, delocalized
Low temporal sampling (days)

Dedicated ground spectrometers



ESSEM COST Action ES1309

Innovative optical Tools for proximal sensing of ecophysiological processes (OPTIMISE)

Descriptions are provided by the Actions directly via e-COST.

Important European and international initiatives (SPECNET, BIOSPEC and COST Action ES0903) explored the use of proximal optical sensing of



Contents lists available at [ScienceDirect](#)

Remote Sensing of Environment

journal homepage: www.elsevier.com/locate/rse

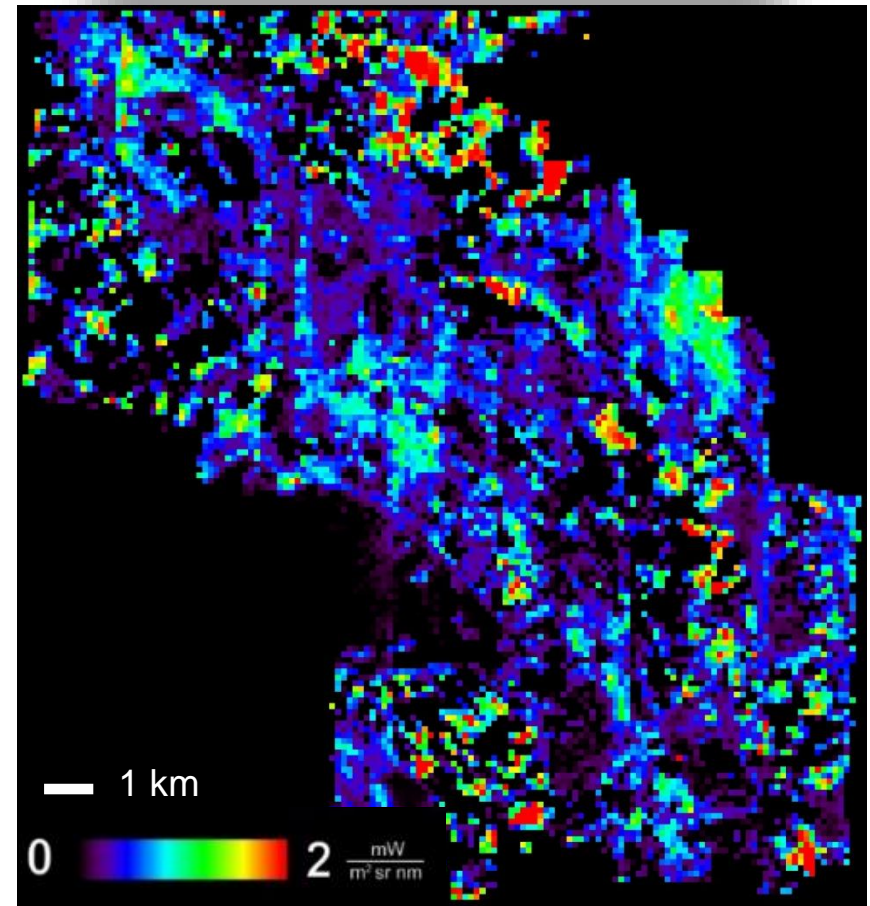
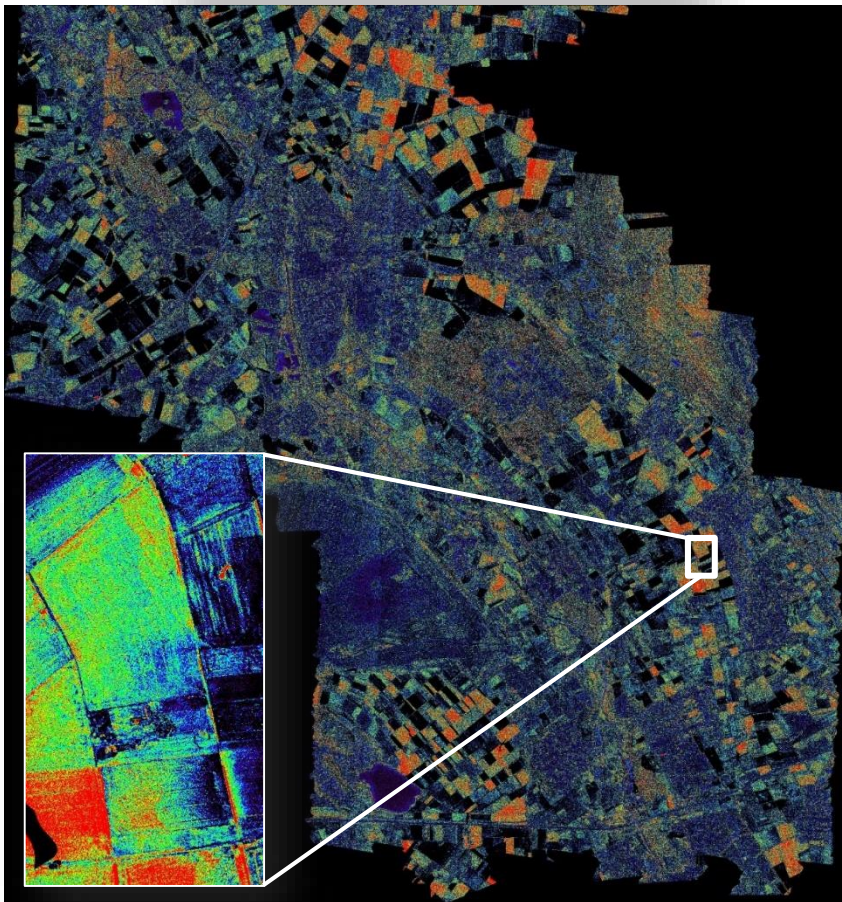
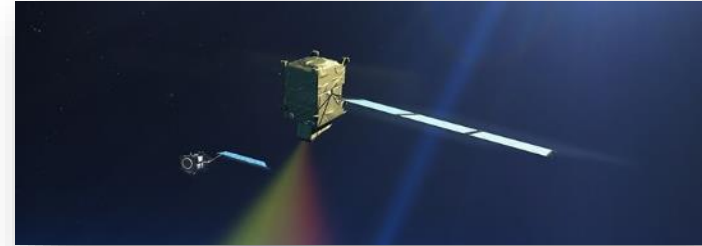


Continuous and long-term measurements of reflectance and sun-induced chlorophyll fluorescence by using novel automated field spectroscopy systems



S. Cogliati ^{a,*}, M. Rossini ^a, T. Julitta ^a, M. Meroni ^{a,b}, A. Schickling ^c, A. Burkart ^c, F. Pinto ^c,
U. Rascher ^c, R. Colombo ^a

Airborne tool for validation (upscaling)





**University of
Zurich** ^{UZH}



**Centre de Recherche Public
Gabriel Lippmann**



Freie Universität **Berlin**



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DEPARTMENT OF GLOBAL ECOLOGY
Extending the Frontiers of Science



**Institut
Pierre
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Laplace**



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ITC
UNIVERSITY OF TWENTE.



**VNIVERSITAT
DE VALÈNCIA**



**Consiglio
Nazionale delle
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P & M Technologies
Innovations in Plant Science & Technology



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SPACE FLIGHT CENTER

