

## OPTIMISE COST ACTION, NEWSLETTER 2

*In This Issue:*

### **3<sup>rd</sup> Plenary Meeting, WG1 Workshop and ST MSs.**

### **Update of Activities and Future Plans**

#### **Editorial**

We are happy to share with you the second issue of the OPTIMISE COST Action (ES1309) Newsletter. The goal of these Newsletter series is to regularly compile and disseminate the main highlights accomplished during OPTIMISE Cost Action. In this issue we summarize the outcome from the 3<sup>rd</sup> Plenary Meeting and WG1 Workshop that took place in Dubrovnik last February. We also introduce the early-career scientists that have so far conducted an OPTIMISE Short-term scientific mission and learn about their work and their feelings after their STSMs. Last of all, we present an overview of general activities and plans for the upcoming months by the Chair.

**We hope you enjoy it!**

#### **The Editors**

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#### **3<sup>rd</sup> OPTIMISE PLENARY MEETING**

##### ***A VIEW FROM THE LOCAL ORGANIZERS***

A Combined WG1 workshop and OPTIMISE WGs workshop/conference and MC meeting were held in Dubrovnik (Croatia) from February 22<sup>nd</sup> to 26<sup>th</sup> 2016. The events were kindly organized with the support of two local organizers - [University of Osijek](http://www.unios.hr) and [University of Dubrovnik](http://www.unidubrovnik.hr). The University of Dubrovnik, established in 2003, is the “youngest” university in Croatia. The University of Osijek (UNIOS), established in 1975, is also young university compared to some other European universities. Despite their relatively recent

establishment, the history of higher education in this area began almost three centuries ago, i.e. in 1707, when the first high school was founded in Osijek, say the local organizers: Prof. Branimir K. Hackenberger and Ms. Željka Lončarić from the Department of Biology at the University of Osijek.

The OPTIMISE WG1 workshop, “Programming SPECCHIO”, was held at one of the computer classrooms of the University of Dubrovnik. The training school, coordinated by Dr. Andreas Hueni (Switzerland) and Mr. Helge Aasen (Germany), was attended by 10 participants from 9 countries. Participants learned how to install and use the SPECCHIO database software,

how the SPECCHIO database is structured and organized, and how to select, process and insert spectral data and metadata into SPECCHIO. Participants had also the chance to analyze their own data with individual support and guidance from the trainers, something that was very valuable, point out the local organizers.

A remarkable transfer of knowledge and experience among participants was achieved through very interesting lectures, related to remote sensing and spectrometry, followed by fruitful discussions say local organizers. "Overall, it is a great privilege for any country to participate in a successful COST action, especially for countries where the related technology and science is just starting to develop. As a local organizer we are grateful for the excellent cooperation with all participants and committee members that were involved in the organization", conclude Prof. Branimir and Ms. Žejlka.

#### **WG1 – SPECTRAL INFORMATION SYSTEM: SPECCHIO PROGRAMMING COURSE**

As part of WG1 activities, the SPECCHIO Programming Course introduced the SPECCHIO spectral information system to 10 students from 9 different countries. During the first day, the theoretical background was explained and the students started with tutorials to familiarize themselves with SPECCHIO related programming. On the second day, the SPECCHIO API was introduced and experiences during the tutorials were discussed, explain Dr. Andreas Hueni from the Department of Geography at the University of Zurich in Switzerland, and Mr. Helge Aesen from the Department of Geography at the University of Cologne in Germany.

After this initial stage, the students came up with small projects, which were related to their own research and served as examples to use SPECCHIO in a more applied setting. Metadata requirements were also discussed in an interactive session based on the experience of the students in their research. The outcome highlighted the importance of metadata for applications on different scales. On the third day, additional SPECCHIO tools were introduced and the participants continued to work with their projects.

All course material can be found on the SPECCHIO website at: [SPECCHIO.ch](http://SPECCHIO.ch) – [programming course](#). We would like to thank the local organizing committee for their excellent support, point out the WG1 leaders.

Later on, during the Plenary meeting, WG1 leaders reported on the current status and progress of the WG1 activities. The assembly was also informed that the SPECCHIO system is available as a virtual machine downloadable from the SPECCHIO webpage. Furthermore, it was informed that the training school data assembled during the SWAMP and ABEL training schools last year is now accessible online through SPECCHIO and all OPTIMISE members can access it. Request for access credentials can be ask from Andreas ([ahueni@geo.uzh.ch](mailto:ahueni@geo.uzh.ch)).

Future plans for WG1 include joining UAV summer training schools, producing wireless automated dataflow from in-situ and UAV sensors for the database system, defining a data processing algorithm and quality check for Fluowat that is integrated with SPECCHIO, and integrating SPECCHIO with radiative transfer models, e.g. ARTMO toolbox or SCOPE model.

#### **WG2– EXTRACTING INFORMATION FROM UNMANNED AERIAL VEHICLES**

The WG2 section offered a nice overview on OPTIMISE Members' activities. Presentations covered different aspects, from UAV-based sensors development to application of commercial instruments, explains Dr. Enrico Tomelleri from the Institute for applied remote sensing in Bolzano (Italy) and leader of WG2.

Fred Baret gave a presentation about detailed vegetation monitoring based on multi/hyper spectral UAV observations. Rune Storvald gave a nice overview on UAV based hyper/multi-spectral imaging for retrieval of vegetation parameters in Boreal forest in Finland and Iceland. Peter Ketersz told us about grassland biomass estimations based on multispectral imagery and their problems and challenges. Taras Kazantsev showed some interesting examples about UAVs and AVs and custom sensors for agriculture applications. Andreas Burkart talked about his PhD thesis "Multitemporal assessment of crop parameters using multisensorial flying platforms" and Enrico

Tomelleri himself explained some recent development about high resolution thermal imaging for modelling evapotranspiration. The session was closed with a lively discussion addressing scientific and technical issues about the use UAVs for ecological research, concludes Enrico.

### **WG3– DISENTANGLING REFLECTANCE AND FLUORESCENCE**

The WG3 session on reflectance and fluorescence was a real treat. Excellent presentations on mature scientific work were flanked by debates, not only on the presented science but also on future directions for research. The enthusiasm of all participants may have been the fruit of the previous workshops and training schools that has teamed us up. It may also have been the selection of the FLEX mission by ESA in November last year that has already created the environment for growth of our discipline. In any case the session demonstrated that the working group has gained momentum says Dr. Christiaan van der Tol from ITC Faculty of Geo-Information Science and Earth Observation at the University of Twente in the Netherlands and leader of WG3.

Yves Goulas kicked off by presenting a complete overview of the current state of the art of chlorophyll fluorescence measurements and applications in vegetation studies. He started his presentation by demonstrating how chlorophyll fluorescence looks like using a chlorophyll extract and a blue flashlight. Maria-Pilar Cendrero presented active and passive fluorescence techniques and nomenclature, and showed how leaf nitrogen affects the actively measured chlorophyll fluorescence signal of crops. Neus Sabater presented her impressive work on atmospheric correction that she carried out in feasibility studies for FLEX. New instrumental approaches were also shown; Dan Sporea presented the unique facilities in his laser and photonics laboratory, including a terahertz spectrometer and an OL 750 spectroradiometric measurement system (Gooch and Housego), extremely versatile but not yet used for vegetation spectroscopy. Three presenters showed results of reflectance and fluorescence measurements in the field: Daniel Kovac presented

time series measurements on the photochemical reflectance index of trees, a typical stress indicator; Mirco Migliavacca showed measurements and model simulations of the effects of fertilization of Spanish 'Dehesa' ecosystem on fluorescence and reflectance; and Petra D'Odorico measurements of vertical gradients of photosynthesis in vegetation canopies in research sites in Switzerland.

The session was completed by different participants of the working group presenting ideas for short term scientific missions at their research facilities, to promote collaboration and increase the scientific output of the project, concludes Christiaan van der Tol.

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### **UPDATE ON SHORT-TERM SCIENTIFIC MISSIONS (STSMs)**

COST Short-term Scientific Missions (STSMs) provide the opportunity to early-career scientists to learn new techniques and establish valuable collaborative links with Scientists and Labs from other countries. So far, a total of nine STSMs have been granted by OPTIMISE from April 2014 to March 2016. Six early stage researches coming from different European countries have already performed their stages and the remaining three grantees will perform their STSM by the end of 2016. We wanted to know what are so far the experiences and opinions from the grantees:

**Javier Pacheco Labrador** worked for three weeks in December 2014 at the Remote Sensing of Environmental Dynamics Laboratory (DISAT) of Università degli Studi di Milano-Bicocca in Milan, Italy. He learned the use of time series of hyperspectral imagery to retrieve vegetation sun-induced fluorescence (SIF) and spectral indices to model carbon fluxes. He also explored the use of fine resolution images to understand the spatial heterogeneity of the ecosystem. "Overall, the experience was quite positive and I would like to say to Micol Rossini, the supervisor of my STSMs, and to all researchers of DISAT, *Grazie mille!!* for their kind support and help during my stay" says Javier. To Javier STSMs are a great opportunity for students and early-career researchers to complement their training and meet new research groups with the best expertise in the selected area.



**Chao Zhang** performed her STSM at SMEAR II/Hyytiälä Forest Field Station of the University of Helsinki, Finland, from March to May 2015. She chose SMEAR II station because a lot of long-term monitoring experiments and data are available to explore the use of remote sensing to understand forest dynamics. In addition, the spring recovery of photosynthesis in Scots pine in Hyytiälä is a great example to detect the interaction between fluorescence signal and photosynthetic performance. The experience was so great for Chao: “I learnt a lot on the use of professional instruments for fluorescence and reflectance measurements and realized how important it is to draft a detailed protocol for the measurements at the beginning of the experiments and how critical it is to control and reasonably arrange the protocol step by step during the experiments”, explains Chao. She is very grateful to Albert Porcar-Castell, from the University of Helsinki, who helped and taught her during the STSM. This STSM was a great chance to learn and study this interesting topic related to my PhD, says Chao. Finally, Chao also pointed out that the final report is a valuable feedback from the participants and it also facilitates the preparation of future scientific papers.

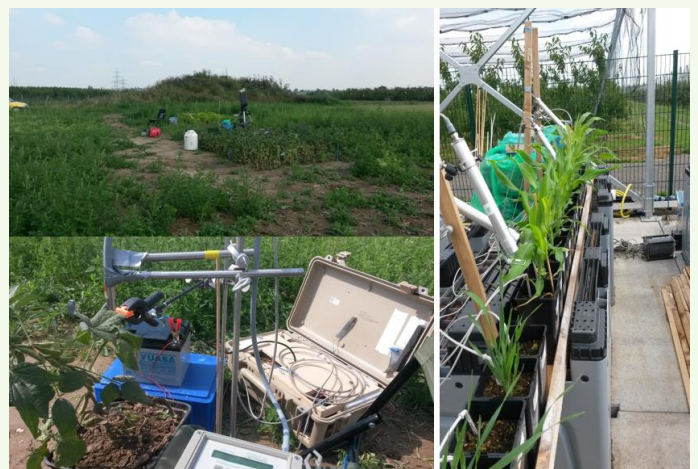


*In the picture: Chao doing her measurements at the SMEAR II Hyytiälä Forest field station, Finland*

**Sarah Asam** stayed at the Laboratory of Earth Observation (LEO), at the Image Processing Laboratory (IPL) of the University of Valencia in Spain, from March 9<sup>th</sup> until March 27<sup>th</sup> 2016. She selected LEO laboratory

for working with Jochem Verrelst and getting in depth knowledge on the Automated Radiative Transfer Models Operator (ARTMO) for the retrieval of biophysical vegetation parameters from remote and proximal sensing data. Sarah's activities focused on the improvement of LAI derivation based on multispectral and hyperspectral images by the tuning of model parameterization, cost function, and other optimization techniques. This work laid the foundation for further research on biophysical parameter estimation from different spectral sensors in her current project. “A direct output of my STSM was a conference contribution to the EARSeL Spectroscopy Workshop that took place on April 14<sup>th</sup> – 16<sup>th</sup> 2015 in Luxembourg on Leaf Area Index derivation from hyperspectral and multispectral remote sensing data in heterogeneous grassland”, says Sarah. “Overall, this STSM was very informative and pleasant”, concludes Sarah.

**Peiqi Yang** carried out his STSM at the Forschungszentrum in Jülich, Germany. He performed his field experiment at the Campus Klein Altendorf (CKA), a research site close to Bonn, Germany, where different kinds of experiments are carried out both in the greenhouse and in the field. During the STSM Peiqi aimed to compare active and passive fluorescence measurements, which requires some specific instruments. He learnt several innovative optical tools for fluorescence detection (i.e. SIF-box, Moni-PAM and LIFT) from Onno Muller, Maria Pilar Cendrero, Andreas Burkart and Beat Keller, who are well experienced in plant physiology.



*In the picture: Peiqi's experimental set-up used built-up at Forschungszentrum in Jülich, Germany.*

“The core outcome of his study was a comparison between PAM fluorescence and passive fluorescence”, explains Peiqi. Peiqi is also trying to find the potential problems when using PAM fluorescence measurement to estimate the fluorescence yield. He expects that the results will help improving the accuracy of solar induced fluorescence model simulation. “This STSM gave me an opportunity to get access to the new instruments and techniques. More importantly, I had a chance to work with the experts in my field and learn from them”, concludes Peiqi.

**Sheng Wang** performed a STSM at the Laboratory for Research Methods in Quantitative Remote Sensing (QuantaLab), Institute for Sustainable Agriculture (IAS), Spanish National Research Council (CSIC) in Cordoba, Spain, supervised by Pablo Zarco-Tejada. His PhD project focuses on hyper spatial (1 meter resolution) mapping of energy, water and carbon dynamics with UAVs over eddy covariance flux towers. “The first step of my PhD project was to radiometrically calibrate a multispectral camera”, explains Sheng. “For that reason, I chose QuantaLab for getting a training in optical sampling protocols for radiometric calibration”, clarifies Sheng. During his STSM, he successfully learned the protocol of radiometric calibration for a multispectral camera and got useful experience on UAV-based remote sensing. After coming back, he

shared the radiometric calibration protocol with his research group at the University of Denmark which will be used in future field campaigns. “This STSM served also to reinforce the collaboration between QuantaLab-IAS-CSIC and the University of Denmark”, says Sheng. “STSMs are a great platform to learn advanced knowledge, a nice opportunity to communicate with great scientists, and a valuable experience to inspire the future career of early stage researchers”, points out Sheng.



*In the picture: Sheng working with a hyperspectral sensor at the QuantaLab-IAS, CSIC, in Cordoba, Spain.*



**Remember to keep an eye on our website for updates, information and instructions on how to join our Action!**

## OPTIMISE

**ESSEM COST Action ES1309**

This COST Action brings together scientists working within the 3 areas above: Spectral Information Systems, Unmanned Aerial Vehicle Hyper-Spectroscopy, and Reflectance & Fluorescence. We will achieve this through the funding of conferences, workshops and individual Short-Term Scientific Missions.

**Join OPTIMISE**

OPTIMISE builds on the work done in previous international initiatives (SPECNET, BIOSPEC and COST Action ES0903), which explored the use of proximal optical sensing of ecosystems, where carbon and water vapour flux are estimated by eddy covariance techniques.

The recent advances in UAV platforms and optical sensors provide unprecedented opportunities for high spatial, spectral and multi-angular near-ground Earth observations.

**UPDADE OF OPTIMISE ACTIVITIES AND FUTURE PLANS BY THE CHAIR**

*Work and Budget Plan update.* At the MC meeting in Dubrovnik a draft W&BP for the 3rd year of OPTIMISE was presented. This plan was then revised to reflect the MC discussion and recommendations. The W&BP funding request was then submitted to COST and to the MC and has been approved. A budget of €141k has been assigned and the contract between COST and the U. of Aberystwyth agreed and signed off. We can now start to plan our activities. A schedule of activities will be posted on the OPTIMISE web site over the next few weeks. I would like to thank Sallie Jones (OPTIMISE Action Manager), Deniz Karaca, and Christophe Peeters for processing this so promptly and efficiently.

*ESA LP 2016, Prague.* I had the privilege of giving a presentation at the ESA FLEX session in Prague on Thursday 12th May. In this I introduced the outline of the OPTIMISE proximal and UAV sensing network and cal/val plan that the MC agreed we draft to propose to ESA. The ESA FLEX team have already begun compiling a list of possible field sites and I have been asked, representing OPTIMISE, to contribute to this. We have already identified some sites within the OPTIMISE network. However, if you are interested in your site potentially being included please provide me with: a contact person; web page; description of the site; infrastructure; instrumentation; a description of any optical/proximal sensing you have been conducting; and indicate any current networks (e.g. ICOS, FLUXNET) this site is registered in. It would also be useful if you could indicate if you have been or plan to measure reflectance and fluorescence at your site or would be able to do so in the future if the instrumentation was available.

**Dr. Alasdair MacArthur** (OPTIMISE Chair)

Feedback on the Newsletter is most welcome: [joan.porcar@helsinki.fi](mailto:joan.porcar@helsinki.fi)

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