

COST Action ES1309
(25/04/2014– 24/04/2018)

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

PROGRESS REPORT AT MONTH 30

This report is submitted by the MC Chair on behalf of the Management Committee.

Confidentiality: This report, other than section II.D, is non-confidential. Section II.D is confidential to the Management Committee and the COST Association (including the Committee of Senior Officials, Scientific Committee and Administration).

Executive summary of the Progress Report:

Good progress has been made towards achieving the main Aims of this Action: a spectral data and information storage and sharing system (SPECCHIO) has been modified and trialled during OPTIMISE training courses. However, further development work to enable 3D data sets (geo-referenced images) to be indexed and the benefits of configurations for ecosystem-specific applications remain to be assessed; trial flights of one multispectral imaging system and further trials of two imaging/UAV systems and were successfully conducted. However, one other innovative and high quality spectrometer systems remain to be tested on UAVs. This system has been ground-tested and offers a significant technological advancement over other 'beam' spectrometer UAV systems. The same design of spectrometer can also be used for fixed-point logging applications and is currently deployed at the U. of Helsinki Hyytiälä research site. This system will offer a significant improvement in data quality and flexibility of application. A wireless communication system has been tested locally but is still to be deployed and tested in the field. More progress has been made with the reflectance and fluorescence aspects of the Action, themed workshops held and a number of international journal articles have been published and others are currently under review. ESRs have been actively encouraged to participate in the Action management, five of the eleven core group members are ESRs, and an ESR (Dr Helge Aassen) has organised and led one of the WG themed workshops in an 'inclusiveness country'. Each working group has held a themed workshop and dissemination activities have progressed: additional content has recently been included (STSM Report and Training School Science Reports) on the OPTIMISE website and the second OPTIMISE Newsletter has been published and the third OPTIMISE Newsletter is in preparation. A major success for the OPTIMISE network has been the announcement by the European Space Agency that the Fluorescence Explorer (FLEX) concept has been selected as the next Earth Explorer mission, with a launch scheduled for 2022. The work of COST Action ES1309 'OPTIMISE' was explicatively cited in the report submitted to ESA (ESA, 2015). Many of the OPTIMISE network are actively involved in FLEX and in the establishment of a ground validation network for the space-based observations of photosynthesis fluorescence, a more direct measure of vegetation health and primary productivity. Four OPTIMISE MC members are members of the FLEX Mission Advisory Group and OPTIMISE has provided ESA with a list and capabilities of its network of Earth Observation calibration and validation and research sites. During STSMs and practical workshops the next generation of environmental scientists (PhD students and ESRs) are being specifically trained to build future capacity to utilise this exciting development in Earth observation for global monitoring and environment and security (GMES). Inclusiveness countries: Cyprus; Czech Republic; Estonia, Croatia; Hungary; Portugal; Bulgaria; Turkey; and Estonia have joined the Action and actively participate in workshops and meetings. In fact the OPTIMISE 2016/17 annual workshop and MC meeting will be held in Cyprus..

I. Progress Report

I.A. COST Action Profile

Objective/ Aim

The aim of the Action is to promote reflectance and fluorescence measurements of ecosystems as ground validation networks for Earth system models and global satellite observations, using innovative spectrometer and UAV platforms, and develop automated wireless communication systems with on-line spectral information storage, quality assurance and data product sharing portals

Details

MoU:

056/13

Start of Action:

25/04/2014

CSO approval date:

15/11/2013

End of Action:

24/04/2018

COST Member Countries and Cooperating State having accepted the MoU

Austria, Croatia, Estonia, Greece, Italy, Poland, Sweden, Belgium, Cyprus, Finland, Hungary, Latvia, Portugal, Bosnia and Herzegovina, Czech Republic, France, Ireland, Netherlands, Romania, Turkey, Bulgaria, Denmark, Germany, Israel, Norway, Spain, Switzerland, United Kingdom.

Intentions to Accept the MoU

Copy section from Action fact sheet here or enter "0"

Other participants:

Institution Name	Country
Scientific Centre for Aerospace Research of the Earth, Institute of Geological Science, NASU	Ukraine
University of Wisconsin-Madison	USA
University of Alberta	Canada
European Space Agency	Europe
University of Tasmania	Australia

Contacts

Chair/ Vice Chair

Position	Name	Contact details	Country	Date of PhD:	Gender
Chair:	Dr Alasdair Mac Arthur	University of Edinburgh Grant Institute, Kings Buildings, University of Edinburgh EH9 3JW Edinburgh United Kingdom alasdair.macarthur@ed.ac.uk	UK	2012	M
Vice Chair:	Dr Micol Rossini	Remote Sensing of Environmental Dynamics Laboratory, DISAT, Universit degli Studi Milano-Bicocca piazza della Scienza, 120126 Milano Italy. micol.rossini@unimib.it	Italy	2006	F

Working Group Leaders

WG#	WG Title	WG Leader	Country	Date of PhD:	Gender	Number of participants
1	WG1 – Spectral Information System	Dr Andrea Hueni	Switzerland	2011	M	37
2	WG2 – Unmanned Aerial Vehicles	Dr Enrico Tomelleri	Germany	2007	M	44

3	WG3 – Reflectance and Fluorescence	Prof. Christiaan van der Tol	Netherlands	2007	M	46
---	------------------------------------	------------------------------	-------------	------	---	----

Other positions if applicable (STSM Coordinator, WG Vice Leader, Task Force Leader...)

Position	Name	Country	Date of PhD:	Gender
Training Leader	Dr Radosław Juszcak	Poland	2004	M
Dissemination Leader	Dr Albert Porcar	Finland	2008	M
MEG Leader	Dr Loris Vescovo	Italy	2004	M
WG 1 co-coordinator	Dr Helge Aasen	Germany	2016d	M
WG 2 co-coordinator	Dr Andreas Burkart	Germany	2015	M
WG 3 co-coordinator	Dr Maria-Pilar Cendrero	Germany	2014	F

Action website:

<http://optimise.dcs.aber.ac.uk/>

I.B. Progress with MoU objectives and deliverables and additional outputs

MoU objectives

MoU objective	Achieved Yes/ Partially/ No	Evidence of (partial) achievement including hyperlink to enable assessment of the achievement ¹ . Justification if full achievement is not foreseen
Support the ICOS network, bringing together EC scientists and the proximal sensing community, in order to enhance and enlarge the global spectral sampling network	Partly	<p>PR1 Prof. Christiaan van der Tol gave a OPTIMISE presentation in ICOS Finland during 2014 where (Werner Kutsch, ICOS Director, was also present). Link: http://www.icos-infrastructure.fi/?q=node/20</p> <p>An ICOS-OPTIMISE discussion was held during the workshop in Madrid March 2015. See agenda http://optimise.dcs.aber.ac.uk/workshops-meetings/madrid-workshops-mc-meeting-2015/</p> <p>PR2 Two ICPOS members have been invited to the OPTIMISE 2016/17 annual workshop and MC meeting to be held in Cyprus</p>
Harmonize instruments and measurement protocols to be adopted, across different ecosystems	Partly	<p>PR2 The OPTIMISE Best practice in UAV Sampling (OPTIMISE BUS) was outlined by Mac Arthur et al at ESA LP16 in Prague and</p> <p>Co-ordinated by Dr P. Martin OPTIMISE members from SpecLab-CSIC (Spain), Max Planck Institute of Biochemistry (Germany), University of Milano Bicocca (Italy) and Forschungszentrum Jülich (Germany) collaborated in a field campaign in Majadas in June 2016 (see www.lineas.cchs.csic.es/fluxpec/node/71). The campaign was partly dedicated to the cross-calibration and testing of different hyperspectral sensors (an automated spectroradiometric system and an imager) as well as radiation sources dedicated to estimation and validation of sun induced fluorescence retrievals. In addition, UAV-borne spectroradiometric measurements over vegetation canopy were carried out in a showcase fashion, this transfer of knowledge has contributed to the implementation of a similar UAV system in SpecLab-CSIC.</p> <p>Work by Dr A. Hueni (WG1 leader) resulted in the publication Hueni, A., Damm, A., Kneubuehler, M., Schläpfer, D. and Schaepman, M. (2016). "Field and Airborne Spectroscopy Cross-Validation - Some Considerations." IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing PP(99): 1 – 19. which highlights the need to harmonize instruments and measurement protocols</p>
Promote the use of a common 'smart' on-line spectral information system to share standardized	Partly	<p>PR1 Open floor discussion held during WG1 workshop Madrid, March 2015. See agenda</p>

¹ The links to the outputs and deliverables will be used by the Action Rapporteur in assessing the progress.

proximal sensing data and products with other scientific communities (FLUXNET, ICOS, FLEX)		http://optimise.dcs.aber.ac.uk/workshops-meetings/madrid-workshops-mc-meeting-2015/
Develop a framework in the on-line system for consolidated metadata for specific ecosystem types and applications	Partly	PR2 A practical workshop was held in Dubrovnik to start to address this issue See http://optimise.dcs.aber.ac.uk/working-groups/wg1-spectral-information-system/events/
Bridge the gap between in-situ measurements and satellite sensor data by promoting the development and use of UAV-based observation and their integration with modelling approaches for monitoring and investigating ecosystem functioning across differing temporal and spatial scales, leading to the better exploitation of satellite data	Partly	PR1 Trial during SWAMP training school Poland July, 2015 See Group Reports http://optimise.dcs.aber.ac.uk/training-schools/the-6th-eufar-optimise-training-course-on-spectrometry-of-a-wetland-and-modelling-of-photosynthesis-with-hyperspectral-airborne-reflectance-and-fluorescence/ PR2 Flux tower footprint modelling tol workshop planned for Feb 2017. (See WG2 objectives below)
Support the RS activities focused on steady-state fluorescence and the Fluorescence Explorer (FLEX) mission, promoting, coordinating, and disseminating the results of validation and calibrations campaigns	Partly	PR1 Trials and field work conducted during SWAMP training school Poland July, 2015 and data sets made available via SPECCIO spectral information system. http://specchio.ch/campaign_overview.php PR2 Mac arthur et al presentation at ESA Living Planet Prague 2016 (http://lps16.esa.int/page_session125.php#1972p)

MoU deliverables

MoU deliverable	Level of progress ¹	Evidence of (partial) delivery achievement including hyperlink to enable assessment of the delivery ¹ . Justification if full achievement is not foreseen
WG1:		
Definition of a mandatory metadata set, aligned with current international efforts in the spectroscopy community	Partly	PR2 Metadata set has been coordinated with the NASA funded EcoSIS project (https://ecosis.org). Efforts are ongoing, including collaboration with SpecNet (http://specnet.info).
Develop an on-line instance of a spectral information database to serve as demonstration and testing platform for data sharing and information building	Partly	PR1 Data sets from SWAMP training school Poland July, 2015 made available via SPECCIO spectral information system. http://specchio.ch/campaign_overview.php PR2 Both ABEL and SWAMP training school data are available online (http://specchio.ch/campaign_overview.php). A new web-based data portal is currently under development.
Develop a wireless automated dataflow from in-situ and UAV	Partly	PR1 Field trials of prototype system initiated

sensor for the database system		<p>PR2</p> <p>Wireless spectrometer control software with data upload to web based storage is currently under development. Prototype to be presented at EARSeL Special Interest Group Imaging Spectroscopy (SIG-IS) Workshop (Zurich, 19-21 April 2017):</p> <p>ASD Spectroradiometer Tablet Control. R. Bolliger, A. Luescher, M. Gwerder, University of Applied Sciences and Arts Northwestern Switzerland A. Hueni, RSL, University of Zurich, Zurich, Switzerland</p> <p>SPECY open source spectroscopy system, www.specy.de A prototype for URL based transfer of spectral data to the SPECCHIO database is currently under development and testing. Burkart, IBG-2 Research Center Jülich, Germany (See http://www.fz-juelich.de/ibg/ibg-2/EN/methods/specy/specy_node.html)</p>
Definition and implementation of data pre-processing and metadata augmentation algorithms and routines including quality checks and flagging and data assimilation	Partly	<p>PR1</p> <p>Trial data sets developed during SWAMP training school Poland July, 2015 made available via SPECCIO spectral information system. http://specchio.ch/campaign_overview.php</p> <p>PR2</p> <p>Two pre-processing tools with direct SPECCHIO database connectivity are currently under development: SALSA++: Unispec spectrometer data pre-processing with time-series support (http://www.geo.uzh.ch/en/units/rsl/news/2013/130218/, https://github.com/ahueni/SALSA-PlusPlus). In collaboration with SpecNet.</p> <p>RSL reflectance processing tool: intelligent processing of radiance data to reflectance including quality checks in the framework of the APEX airborne imaging spectrometer project (apex-esa.org). To be presented at EARSeL Special Interest Group Imaging Spectroscopy (SIG-IS) Workshop (Zurich, 19-21 April 2017): Applied Spectral Databases - APEX Spectral Ground Control Point Handling S. Bertschi, A. Hueni, RSL, University of Zurich, Zurich, Switzerland</p> <p>Dr A. Hueni collaboration with DLR, where SPECCHIO is used to build a spectral library. Spectral Database session at ISSI (Presented by Uta Heiden): http://www.issibern.ch/workshops/earthecosystem/wp-content/uploads/2016/11/ISSI_Workshop_Imaging-Spectroscopy_Program_final-3.pdf</p>
Definition and implementation of system interfaces and algorithms for data retrieval allowing the building of products using sources such as biogeochemical modelling, flux data specialisation and space-sensed data	Yes	<p>PR1</p> <p>Trial data sets developed during SWAMP training school Poland July, 2015 made available via SPECCIO spectral information system. http://specchio.ch/campaign_overview.php</p> <p>PR2</p> <p>Coupling of SPECCHIO and higher level programming languages (Matlab, R and Python). The API is available online (http://www.specchio.ch/doc/index.html) and training material as well (http://specchio.ch/programming_course.php).</p> <p>A example of an integration has been done for the Fluspect model: (http://specchio.ch/programming_course.php). The code of the GUI is available via Matlab Central:</p>

		http://uk.mathworks.com/matlabcentral/fileexchange/60451-specchio-fluspect-gui
WG2		
Review and report on the challenges for optical sensing in up-scaling biophysical properties of vegetation and test different UAV platform/measurement instruments setups	Partly	<p>PR1 Approaches for linking ground and remote sensing approaches are being explored. Imaging spectrometer acquisitions have been used for retrieving biophysical parameters through inversion of RTM models. The ARTMO toolbox (Verelst et al. http://ipl.uv.es/artmo/) has been tested for this purpose during the SWAMP summer school. See Group Reports http://optimise.dcs.aber.ac.uk/training-schools/the-6th-eufar-optimize-training-course-on-spectrometry-of-a-wetland-and-modelling-of-photosynthesis-with-hyperspectral-airborne-reflectance-and-fluorescence/</p> <p>PR2 Extensive discussion on instruments traceability and UAV spectral data processing has been conducted during the Tartu Workshop. http://optimise.dcs.aber.ac.uk/workshops-meetings/esr-think-tank-tartu-observatory-estonia/</p> <p>Challenges of UAV spatial sampling workshop Bolzano, 17-20 October 2016 See report at http://optimise.dcs.aber.ac.uk/workshops-meetings/workshops-meetingschallenges-of-uav-spatial-sampling/</p>
Development of a footprint tool for optimal placement of fixed spectrometers and for combination of EC measurements with UAV-based spectral data	Not yet	<p>PR1 Currently the footprint must be characterized. At the moment no specific tool is available.</p> <p>PR2 An experts workshop has been planned for integrating the footprint tool by Prof. N. Kljun with Remote Sensing data (http://footprint.kljun.net) Feb 2017</p>
Liaise with industry representatives to improve accuracy of GPS	Partly	<p>PR1 The advantage of combining GPS and GLONASS has been tested in cooperation with UAV producers (e.g. www.soleon.it). An online system for real-time GPS correction is not being tested. We tested that differential correction of ground control points is necessary for matching time series of UAV borne measurements.</p> <p>PR2 During the Bozen UAV workshop, tests for comparing multiple on-board GPS instruments have been executed. http://optimise.dcs.aber.ac.uk/workshops-meetings/workshops-meetingschallenges-of-uav-spatial-sampling/. Tests for making use of REACH RTK (www.emlid.com) have been conducted during Michal Chlinski STSM. See http://optimise.dcs.aber.ac.uk/stsms/approved-stsms/</p>
Definition of new methods for scaling up functional relationships between optical properties and ecosystem processes from in-situ to landscape scale by	Partly	<p>PR1 An imaging spectrometer and a hyperspectral camera have been used for characterizing the footprint area of test sites in the North Eastern Alps and in Poland from UAV. i) Thermal data are currently being used for ET modelling and ii) hyperspectral data for retrieving biophysical parameters. The preliminary results of i) will be presented to AGU 2016 (Castelli et al.) and preliminary results of ii) have been presented to EARSEL 2015 (Tomelleri et al. 2014)</p>

means of UAVs, including identification of adequate radiative transfer models to be coupled with biogeochemical models for linking biogeophysical properties of vegetation with its optical properties		http://www.earsel2015.com/fileadmin/user_upload/Program_short.pdf). Further developments will be presented to the next ESA living planet conference. PR2 a contribution to the ESA Living planet conference has been presented (Multi-Scale estimates of ecosystem traits: a meta-model approach by Tomelleri et al.)
WG3		
Review and report on the methods and instruments used to estimate the solar-induced fluorescence from passive remote measurements	Partly	PR1 A questionnaire has been carried out among the working group members out the methods that are currently used. https://drive.google.com/file/d/0B3SaimDgRZM1MWd6eFNTbnVxMW8 Measurement protocols have been practised at the training schools. This will result in defined best practise protocols in the final stage of the project (see next deliverable). PR2 As a follow up to the questionnaire in the community, a workshop has been organized to address all 4 objectives for WG3 in depth (41 participants of which 23 from OPTIMISE). A research article on (i) and (ii) is in preparation now, and the outcome of the workshop has been published on http://optimise.dcs.aber.ac.uk/workshops-meetings/wg1-wg3-combined-workshop-twente/ Dr Albert Porcar-Castell received funding for “Cost-effective methods for tracking large scale vegetation physiology: Participatory phase and pilot experiments”, is a two year project (Oct 2016 – Sep 2018) funded by the Academy of Finland under the key Funding Call. The goal of the project is to evaluate the feasibility and potential of SIF and PRI for tracking large scale vegetation physiology, and to identify novel and cost-effective methods to optimize vegetation management in real-case scenarios. See http://blogs.helsinki.fi/optics-of-photosynthesis/keyproject/ Dr Albert Porcar-Castell also received funding for FLUOSYNTHESIS, a 5 year project Funded by the Academy of Finland, 1MEur. Goal: to obtain novel mechanistic understanding of the processes that control the dynamics of chlorophyll fluorescence signal across time, space and species. Novel methods, protocols, and process-based mathematical models will be developed and for VIHREAVALO (=GREENLIGHT), a 2 year project funded by the Academy of Finland, 0.3 MEur, (PI Porcar-Castell). Goal: to assess the potential of new optical indices such as chlorophyll fluorescence or the photochemical reflectance index for pre-visual stress detection and online vegetation management in real-case scenarios co-designed with key stakeholders. The methods will be assessed both at the leaf level as well as using hyperspectral imaging cameras mounted on UAVs. Dr Mac Arthur (with PI Prof. M. Williams) have had a 4 year ‘precision agriculture’ project (ATEC) funded by two UK research councils (BBSRC and NERC). This project will use knowledge gained through

		<p>the OPTIMISE network to use UAVs for spatial sampling, reflectance and fluorescence as measurements and the SPECCHIO spectral information storage system as an archive and initial analysis portal</p> <p>Dr Micol Rossini H2020/Marie Curie The TRuStEE project. The TRuStEE idea was born in the context of two EU COST actions: ES0903 "Spectral Sampling Tools for Vegetation Biophysical Parameters and Flux Measurements in Europe" (EUROSPEC, 2009-2013) and ES1309 "Innovative optical Tools for proximal sensing of ecophysiological processes" (OPTIMISE, 2014-2017) where most of the participants involved (UNIMIB, UNEXE, CSIC, Jülich, UT, FEM, NERC) met.</p>
Definition of the technical requirements and acquisition protocols for reflectance and fluorescence measurements from UAV and ground-based instruments	Partly	<p>PR2</p> <p>Extensive discussion on instruments traceability and UAV spectral data processing has been conducted during the Tartu Workshop. http://optimise.dcs.aber.ac.uk/workshops-meetings/esr-think-tank-tartu-observatory-estonia/</p> <p>A proposal for a national grant has been submitted to the Romanian Space Agency concerning the upgrade of the existing infrastructure in order to develop procedures for field instruments calibration for fluorescence measurements to support ESA FLEX. OPTIMISE MC member D. Sporea led this bid with OPTIMISE Chair A. Mac Arthur providing additional expertise.</p>
Database of reflectance, fluorescence and productivity data for later use in models and applications	Completed	<p>PR2</p> <p>The database of the SWAMP summer training school has been included in the SPECCHIO software. The data are not yet easily accessible for the general public outside the network.</p>
Integration of ground and UAV measurements with biochemical model outputs to better understand the links between photosynthesis, plant stress, growth and physiology with the temporal dynamics of reflectance and fluorescence	Partly	<p>PR1</p> <p>Two training schools in which both datasets have been collected: http://optimise.dcs.aber.ac.uk/wp-content/uploads/OPTIMISE-Newsletter1.pdf</p> <p>One online course on model-data integration for reflectance and transmittance: https://canvas.instructure.com/courses/993194/assignments/syllabus</p> <p>PR2</p> <p>See Dimitri Dauwe and Marco Celeste STSMs at U. of Twente http://optimise.dcs.aber.ac.uk/stsms/approved-stsms/</p>

Co-authored publications and FP7/ H2020 proposals

The co-authored publications and FP7/ H2020 proposals/ projects resulting from the Action are listed on the page following the "Additional outputs and achievements" section

Additional outputs and achievements

Please describe any other outputs and achievements that have resulted or are in progress, focusing in particular on those that contribute to the COST mission of "COST enables break-through scientific developments leading to new concepts and products and thereby contributes to strengthen Europe's research and innovation capacities."

PR1

- A prototype of a hyperspectral sunphotometer for the validation of Sentinel-2 and 3 and FLEX observations have been developed and will be field trialled during a STSM in March 2016. This work will be presented at the ESA Living Planet workshop in Prague 2016.

- Collaborations with DLR for the calibration and validation of Sentinel-2 observations has been initiated. This project will uniquely use ground reflectances, as well as atmospheric soundings to validate Sentinel-2 observations.
- OPTIMISE members: Moreno; Rascher; Rossini; van der Tol; Damm; Magnani; Alonso; Cendrero-Mateo; Sabate; Verrelst; and Mac Arthur participated in the FLEX-Bridge project. FLEX is the ESA EE8 mission to measure photosynthesis fluorescence from space recently approved by the ESA board and with the intention to launch in 2022. The goal of the FLEX Bridge Study was to optimize approaches for SIF retrievals and applications in the assessment of photosynthesis and stress status in terrestrial vegetation, including the development of a calibration/validation strategy for FLEX products. See http://www.flex-photosyn.ca/FB_AboutFB.htm. This work directly furthers the aims of OPTIMISE

PR2

- ESA Earth Explorer 8 mission FLEX mission has been approved with a launch date scheduled for 2022. Dr Mac Arthur has provided details of the OPTIMISE research site network which are being proposed as cal/val sites and research sites for FLEX. OPTIMISE member Prof. Jose Moreno is chair of the FLEX Mission Advisory group (FLEX MAG) and OPTIMISE MC members Prof. C. van der Tol, Dr Yves Goulas and Prof. U. Rascher are also members of the FLEX MAG
- Establishment of a Europe-wide network of EO cal/val and research site with a specific interest in vegetation fluorescence as a measure of primary productivity, stress limitations and health (See <http://optimise.dcs.aber.ac.uk/dissemination/supporting-materials/>)
- The FLUOSYNTHESIS project “From Chlorophyll fluorescence to photosynthesis: upscaling the link” funded by the Academy of Finland (2015-2020) project led by Dr Albert Porcar-Castell of U. of Helsinki investigates the role of physical, ecological and methodological factors in controlling the fluorescence signal. A multiscale campaign will be organized during 2017 as part of FLUOSYNTHESIS project. The goal of the campaign is to co-register the optical signals generated by the spring recovery of photosynthesis of a boreal forest at multiple scales, combining leaf, canopy and UAV measurements in an attempt to quantify the impact that physical, physiological and methodological factors exert on the interpretation of fluorescence data. The campaign is a joint effort of more than 20 research groups, most of them involved in OPTIMISE, and closely aligned with OPTIMISE goals. The results will serve to test and validate our current understanding and hopefully improve it. (See <http://blogs.helsinki.fi/optics-of-photosynthesis/hyytiala-2017-campaign-materials-and-updates/>)

Co-authored publications and FP7/ H2020 proposals

Co-authored publications

Enter in the table below only publications on the topic of the Action, co-authored by at least two Action participants from two different countries participating in the Action and for which the Action networking added value. A maximum of ten publications may be entered. If the Action has more than ten such publications the Core Group should select the ten most significant ones to include in the table below.

NO.	Bibliographic data (including: Title, Authors, Title of the periodical or the series, Issue number or volume, Publisher, Year of publication, Relevant pages)	Main author	Number of authors	Action participants listed among the authors (Name, country and role ²)	WGs involved in publication	Date of submission (must be after Action start date)	Expected date of publication (if not already published)	Persistent link to publicly available version of the paper (if available) or the abstract	Is/Will open access ³ provided to this publication?	Is/ will COST be cited/ acknowledged in the publication?	Are/ will COST funds (be) implicated in this publication	Relevance to H2020 Societal Challenges ⁴ ?	Is it peer-reviewed?	Was the added value of the Action Networking necessary for the publication	Impact Factor (if applicable)
1	PR1 A. Porcar-Castell, A. Mac Arthur, M. Rossini, L. Eklundh, J. Pacheco-Labrador, K. Anderson, M. Balzarolo, M.P. Martin, H. Jin, E. Tomelleri, S. Cerasoli, K. Sakowska, A. Hueni, T. Julitta, C.J. Nichol, L. Vescovo (2015) EUROSPEC: at the interface between remote-sensing and ecosystem CO2 flux measurements in Europe	A Porcar-Castell	16	Primary authors A. Porcar-Castell, A. Mac Arthur (All co-authors in OPTIMISE and contributed to the writing and editing of this review paper)	G1 WG2 WG3	3 rd June 2015	Published	http://www.biogeosciences.net/12/6103/2015/bg-12-6103-2015.html	yes/no	YES. OPTIMISE is introduced in the review	Indirectly YES. The work was planned during OPTIMISE meetings	es	yes	yes	3.98
2	PR1 Cendrero-Mateo, M.P., Moran. S., Papuga, S., Thorp, K., Alonso, L., Moreno, J., Ponce-Campos, G., Rascher, U., and Wang, G. (2015b) Plant chlorophyll fluorescence: active and passive measurements at canopy and leaf scales with different nitrogen treatments. Journal of Experimental Botany, doi:10.1093/jxb/erv456	Cendrero-Mateo, M.P.,	9	1 st author Cendrero-Mateo, M.P., Technical contribution Alonso, L., science contribution Moreno, J., & Rascher, U	WG1, WG2 WG3	25 th April 2015	Published	http://jxb.oxfordjournals.org/content/early/2015/10/18/jxb.erv456.full.pdf	yes	no	no	yes	yes	yes	5.364
3	PR1 Cendrero-Mateo, M.P., Carmo-Silva AE, Porcar-Castell A, Hamerlynck EP, Papuga SA, Moran MS. (2015a). Dynamic response of plant chlorophyll fluorescence to light, water and nutrient availability. Functional Plant Biology 42, 746–757.	Cendrero-Mateo, M.P.,	2	1 st author Cendrero-Mateo, M.P., Contributing author Porcar-Castell A,	WG2 WG3	8 th Jan. 2015	Published	http://dx.doi.org/10.1071/FP15002	yes	no	no	yes	yes	yes	5.364
4	PR1 Burkart A., Schickling A.; Pilar Cendrero Mateo M., Wrobel T.; Rossini M., Cogliati S., Julitta T. & Rascher, U. (2015) A method for uncertainty assessment of passive sun-induced chlorophyll fluorescence retrieval by using an infrared reference light. IEEE Sensors, 15, 4603-4611.	Burkart A.,	6	1 st author Burkart A., contributing authors Cendrero Mateo M.P.; Rossini M., Cogliati S.,	WG2 WG3	Aug. 2015	Published	http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=7086007	yes	no	no	yes	yes	yes	1.852

² MC Member/ MC Substitute/ MC Observer/ WG Member/ Training School Trainee/ STSM Recipient/ Other Action Participant

³ Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

⁴ H2020 Societal Challenges are "Health, demographic change and wellbeing"; "Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy"; "Secure, clean and efficient energy"; "Smart, green and integrated transport"; "Climate action, environment, resource efficiency and raw materials"; "Europe in a changing world - inclusive, innovative and reflective societies"; "Secure societies - protecting freedom and security of Europe and its citizens"

[illegible]



I.C. Networking

Added value of the Networking
This Action has brought together a diverse range of scientists who are not collaborating and developing proposals and received for funding for science activities from national governments Poland (funding received) and Romania (proposal in review) in particular. Proposals are also in preparation for submission to ESA. None of these activities would have occurred without OPTIMISE
Extent of the networking
The network operates well and a diverse range of both MC and WG members attend themed workshops. ESR are actively encouraged to participate and lead activities (i.e. See ESR organised 'think tank' (http://optimise.dcs.aber.ac.uk/workshops-meetings/esr-think-tank-tartu-observatory-estonia/) Activities are held in inclusiveness countries where possible i.e. the 2017 annual workshop and MC meeting will be held in Cyprus and the ESR organised workshop referred to above was held in Estonia Collaborative work between U. of Edinburgh, U. of Life Science, Poznan and DLR to establish a Sentinel-2 mission cal/val field site in Poland

I.D. Impacts

The impacts that have resulted, or might result from the Action are described in the following table.

Description of the impact	Type of impact ⁵	Timing of impact ⁶
Enter one impact per line, and specify the type and timing of the impact.		
The possible establishment of a calibration and validation network of field research sites to support ESA FLEX mission and vegetation fluorescence science	Scientific	Foreseen within 2 years
Development of common procedures for laboratory calibration and characterisation of near-ground spectrometers for reflectance and fluorescence measurement in support of FLEX	Scientific	Foreseen within 2 years
Deployment and field trials of spectrometer system developed within OPTIMISE for fixed-point logging	Technical	Foreseen within 2 years
Establishment of a Sentinel-2 calibration and validation site in collaboration with DLR in Poland	Scientific	Achieved
Development of a Sentinel-2 calibration and validation site in collaboration with DLR and ESA in Poland	Scientific	Foreseen within 2 years
Deployment and field trials of spectrometer system developed within OPTIMISE for fixed-point logging	Technical	Achieved

I.E Dissemination and exploitation of Action results

Describe the Action's dissemination and exploitation approach as well as all activities undertaken to ensure dissemination and exploitation of Action results and the effectiveness of these activities.			
Add description here			
Item/ activity	Target audience	Result	Hyperlink
Newsletter1	OPTIMISE community	Wider dissemination of OPTIMISE activities	http://optimise.dcs.aber.ac.uk/wp-content/uploads/OPTIMISE-Newsletter1.pdf
Newsletter2	OPTIMISE community	Wider dissemination of OPTIMISE activities	http://optimise.dcs.aber.ac.uk/wp-content/uploads/OPTIMISE-Newsletter2.pdf

⁵ Scientific/ technological, Economic, Societal

⁶ Achieved/ Foreseen within 2 years/ Foreseen 2-5 years/ Foreseen 5-10 years/ Foreseen 10+ years



I.F. Action success(es)

COST regularly communicates the successes of Actions. At this point in time what aspect(s) (outcomes and/ or impacts, rather than activities) of this Action is/ are the most suitable for communication?

	Dimension of the success ■ Breakthrough: scientific, technological or socioeconomic ■ Policy implementation (specify which policy) ■ Capacity building

II. Management Report

II.A. Overview of expenditure

Insert below in the yellow cells the summary of figures from the Yearly Financial Reports (YFRs) of completed Grant Periods and an IFR of any incomplete Grant Period – the Totals (non-yellow cells) will automatically sum.

	Grant Period 1	Grant Period 2	Grant Period 3
GP start and end dates	01/06/2014-31/05/2015	01/06/2015-30/04/2016	01/05/2016-30/04/2017
Grant Holder institution	Aberystwyth University (GB)	Aberystwyth University (GB)	Aberystwyth University (GB)
Meetings	EUR 55,001.19	EUR 40,970.53	EUR 94,568.91
Training Schools	EUR 30,755.02	EUR 50,900.97	EUR -
STSMs	EUR 5,540.00	EUR 8,440.00	EUR 19,280.00
Dissemination	EUR 4,398.00	EUR 1,500.00	EUR -
OERSA ¹	EUR -	EUR -	EUR -
Total Scientific Expenditure	EUR 95,694.21	EUR 101,811.50	EUR 113,848.91

¹ OERSA = Other Expenses Related to Scientific Expenditure (e.g. bank charges)

² FSAC = Amount received by Grant Holder for Financial Scientific and Administrative Coordination

II.B. Budget and Participation management

II.B.1 Budget spent in relation to individuals/ institutions outside participating COST countries						
STSMs from or to institutions from countries other than Participating COST countries						
The table below describes the added value STSMs to approved institutions in IPC or NNC or Specific Organisations and any STSMs from an approved institution in an NNC to a participating COST country.						
Grantee		Host		Date	Topic and value added to the Action	
Institution	Country	Institution	Country			
None						
Invited Speakers						
The table below highlights the added value of Invited Speakers from COST countries that have not accepted the MoU and/ or non-participating NNC, IPC or Specific Organisations whose participation at a meeting or Training School was reimbursed by the Action.						
Participant name		Institution	Country	Event date	Topic and added value to the Action	
None						
Dissemination meetings						
The table below highlights the added value of Dissemination Meetings financed from Action funds.						
Participant name		Role	Country	Date	Location	Topic and added value to the Action
None						

II.C. Participants

Management Committee		
Name	Country	Email address
Dr Alasdair Macarthur	UK	alasdair.macarthur@ed.ac.uk
Dr Micol Rossini	IT	micol.rossini@unimib.it
Dr Georg Wohlfahrt	AT	georg.wohlfahrt@uibk.ac.at
Dr Hannes Kleindienst	AT	kleindienst@grid-it.at
Dr Kyriacos Themistocleous	CY	Kt33@cytanet.com.cy
Dr Daniel Kovac	CZ	Kovac.d@czechglobe.cz
Mr Andreas Burkart	DE	An.burkart@fz-jeulich.de
Prof Ranus Fensholt	DK	rf@ign.ku.dk
Dr Monica Garcia	DK	mgarca@env.dtu.dk
Dr Pilar Martin	ES	Mpilar.martin@cchs.csic.es
Prof Jose Moreno	ES	Moreno.uv@gmail.com
Dr Lea Hallik	EE	Lea.hallik@to.ee
Mr Joel Kuusk	EE	joel@to.ee
Dr Jean-louis Roujean	FR	jlroujean@gmail.com
Dr Yves Goulas	FR	Yves.goulas@lmd.polytechnique.fr
Dr Albert Porcar-Castell	FI	Joan.porcar@helsinki.fi
Dr Tea Thum	FI	Tea.thum@fmi.fi
Dr Mark Neal	UK	mjn@aber.ac.uk
Dr Karen Anderson	UK	Karen.anderson@exeter.ac.uk
Dr Leonidas Toullos	EL	ltoullos@nagref.gr

Mr Antonis Kavvadis	EL	akavvadias@enagris.gr
Dr Zoltan Nagy	HU	Nagy.zoltan@mkk.szie.hu
Prof Branimir K.Hackenberger	HR	hack@biologija.unios.hr
Dr Micol Rossini	IT	Micol.rossini@unimib.it
Dr Loris Vescovo	IT	Loris.vescovo@fmach.it
Dr Anatoly Gitelson	IL	Agitelson2@uni.edu
Dr Connor Cahalane	IE	Conor.cahalane@nuim.ie
Dr John Connolly	IE	John.b.connolly@dcu.ie
Dr Dainis Jakovels	LV	Dainis.jakovels@gmail.com
Dr Hans Tømmervik	NO	Hans.tommervik@nina.no
Dr Rune Størvold	NO	Rune.storvold@norut.no
Dr Christiaan van der Tol	NL	c.vandertol@utwente.nl
Dr Joao Silva	PT	joaonevessilva@gmail.com
Dr Jan Keizer	PT	jikeizer@ua.pt
Dr Jaroslaw Chormanski	PL	j.chormanski@levis.sggw.pl
Prof Janusz Olejnik	PL	olejnikj@up.poznan.pl
Dr Dan Sporea	RO	Dan.sporea@inflpr.ro
Dr Gheorghe Stancalie	RO	Gheorghe.stancalie@meteoromania.ro
Prof Lars Eklundh	SE	Lars.eklundh@nateko.lu.se
Dr Manuela Balzarolo	BE	Manuela.balzarolo@uantwerpen.be
Prof Frank Veroustraete	BE	Frank.veroustraete@uantwerpe.be
Dr Srdjan Keren	BA	Keren_bl@hotmail.com
Prof Rumiana Vatsseva	BG	rvatseva@gmail.com
Dr Andreas Hueni	CH	Andreas.hueni@geo.uzh.ch
Dr Mathias Kneubuehler	CH	Kneub@geo.uzh.ch
Dr Georgos Papadavid	CY	papadavid@ari.gov.cy
Dr Matthias Peichl	SE	Matthias.peichl@slu.se
Prof Eyup Koksall	TR	eselimk@yahoo.com

II.D. Specific matters

This section is confidential to the Management Committee, and the COST Association (Administration, Scientific Committee and Committee of Senior Officials); and is not included in the version of the report that is made publicly available.

The Action encountered the following particular difficulties in the implementation of the Action (e.g. imbalances of participation across the Working Groups, inactive country representatives).
Describe the issue(s) here or write "no particular difficulties encountered".
The MC did not accept the pending intentions to accept the MoU shown in Section I.A for the following reason.
Write explanation here

Annex 1

Definitions:

COST Action Challenge (main aim)	“The research question addressed by the COST Action targeting scientific, technological, and / or socioeconomic problems”
COST Action Innovation	“The creation and / or development of new or improved concepts, products, processes, services, and / or technologies that are made available to markets, governments and society”
COST Action objectives	“COST Action objectives are the results that an Action needs to achieve in order to respond to meet its challenge. These are SMART (Specific, Measurable, Achievable, Relevant, Timely) and twofold: research coordination objectives and capacity building objectives.”
COST Action research coordination objectives	“Achieving these objectives turns COST Actions from initially scattered teams into one transnational team and leverages the existing funded research. These objectives entail the distribution of tasks, sharing of knowledge and know-how, and the creation of synergies among Action participants to achieve specific outputs.”
COST Action capacity building objectives	“Achieving these objectives entail building critical mass to drive scientific progress, thereby strengthening the European Research Area. They can be achieved by the delivery of specific outputs and / or through network features or types and levels of participation.”
COST Action networking activities	“any activities organised by the COST Action (whether or not directly funded by COST) in order to achieve research coordination and capacity building objectives.”
COST Action networking tools	“instruments through which eligible activities can be funded”
COST Action outputs	“direct results from the COST Action activities. These can be codified knowledge, tacit knowledge, technology, and societal applications.”
COST Action impact	“the short- to long-term scientific, technological, and / or socioeconomic changes produced by a COST Action, directly or indirectly, intended or unintended.”
COST Action deliverable	“a distinct, expected and tangible output of the Action, meaningful in terms of the Action’s overall objectives such as a report, a document, a technical diagram, a software etc. Action deliverables are used to measure its progress and success.”
COST Action milestones	“Control points in the Action that help to chart progress. They are also needed at intermediary points so that, if problems have arisen, corrective measures can be taken. A milestone may be a critical decision point in the Action where, for example, the MC must decide which of several technologies to adopt for further development (e.g. core group and MC meetings, mid-term reviews)”
Inclusiveness Target Country (ITC):	Current COST Member Countries targeted by the COST inclusiveness Policy (“Inclusiveness Target Countries” (ITC)): EU 13 (Bulgaria, Cyprus, Czech Republic, Estonia, Croatia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovenia, Slovakia), EU candidate countries (the former Yugoslav Republic of Macedonia, Montenegro, Republic of Serbia, Turkey) and potential EU candidate countries (Bosnia and Herzegovina). In addition, to comply with the EC criteria for ‘Spreading Excellence and Widening Participation’, Portugal and Luxemburg are included.