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EXCELSIOR Project

H2020-WIDESPREAD-2018-2020 | Grant Agreement No 857510	
Project full title:	**ERATOSTHENES : Excellence Research Centre for Earth Surveillance and Space-Based Monitoring of the Environment**
Project acronym:	**EXCELSIOR**
Work Package:	**WP6 Knowledge transfer and capacity building**
Deliverable:	**D6.4 Workplan for transfer of knowledge and experience (update 3)**
Version:	**Final D6.4**
Dissemination level:	**Public**

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Call / Topic:	**H2020-WIDESPREAD-2018-01 /** **WIDESPREAD-01-2018-2019** **Teaming Phase 2**
Project full title:	**ERATOSTHENES : Excellence Research Centre for Earth Surveillance and Space-Based Monitoring of the Environment**
Project acronym:	**EXCELSIOR**
Work Package (WP): Task (T):	**WP6 Knowledge Transfer and Capacity Building** **T6.1 Personnel mobility scheme**
Deliverable (D):	**D6.4 Workplan for transfer of knowledge and experience (update 3)**
Due date of deliverable:	**31 October 2024** **(Month 61 of the project)** | Version: **Final D6.4**
Author(s):	ECoE: **Theofilos ANTONIOU** DLR: **Thomas KRAUSS** NOA: **Maria KASKARA** TROPOS: **Johannes BÜHL**, **Patric SEIFERT** PMOD/WRC: **Stelios KAZADZIS**
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Document Sign-off

Nature	Name	Role	Partner	Date
DRAFT	**Theofilos ANTONIOU**	HR Officer	ECoE	14/10/2024
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REVIEWED	**Diofantos HADJIMITSIS**	Project Coordinator	CUT	29/10/2024
APPROVED	**All Partners**			30/10/2024

Work Package 6: Knowledge Transfer and Capacity Building

D6.3 Workplan for transfer of knowledge and experience (update 2)

Sections to be protected	Description	Owner	Access Rights	
			Period	Type*
None			**-**	**PD**

*PD: Public dissemination CA: Confidentiality Agreement required for disclosure

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Executive Summary

The deliverable "D6.4 Workplan for Transfer of Knowledge and Experience (update 3)" provides an overview of the capacity building activities implemented under Training Scheme B from June 2023 to October 2024, aimed at enhancing the skills of participants within the ERATOSTHENES Centre of Excellence (ECoE). The report details the diverse training sessions, workshops, and seminars conducted by strategic partners including NOA, DLR, TROPOS, and PMOD/WRC, which focused on thematic areas such as agriculture, disaster risk reduction, atmospheric studies, and remote sensing analysis. Despite challenges such as scheduling and infrastructure limitations, significant progress was made in strengthening institutional expertise through both theoretical and hands-on training, fostering collaborative research efforts, and developing practical skills among participants. The outcomes of these activities are instrumental in advancing ECoE's capacity to conduct high-quality research and contribute effectively to regional environmental management and sustainability.

Also, this report outlines the activities planned for the Training Scheme C (November 2024 to June 2026) that will be provided by the advanced partners to ERATOSTHENES research staff.

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Abbreviations

CoE	Centre of Excellence
CUT	Cyprus University of Technology
DEC	Department of Electronic Communications
DLR	German Aerospace Centre
DMRID	Deputy Ministry of Research, Innovation and Digital Policy
ECoE	ERATOSTHENES Centre of Excellence
EO	Earth Observation
EXCELSIOR	ERATOSTHENES : Excellence Research Centre for Earth Surveillance and Space-based Monitoring of the Environment
GBS	Ground-based Remote Sensing Station
NOA	National Observatory of Athens
PMOD/WRC	Physikalisch-Meteorologisches Observatorium Davos / World Radiation Center
TROPOS	Leibniz Institute for TROPOSpheric Research
TBD	To be determined

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1 Introduction

The deliverable "D6.4 Workplan for Transfer of Knowledge and Experience (update 3)" provides an updated overview of the capacity building activities implemented under Training Scheme B from June 2023 to October 2024. This report builds upon the previous deliverable, D6.3, by detailing the progress made in enhancing the skills and expertise of participants from the ERATOSTHENES Centre of Excellence (ECoE). Training Scheme B builds on the foundation of the previous scheme, aiming to further strengthen the capacity of all thematic areas of the ERATOSTHENES Centre of Excellence, while continuing to foster a culture of continuous learning.

The capacity building activities within Training Scheme B comprised a diverse set of training sessions, workshops, seminars, and hands-on courses aimed at addressing specific needs of the ECoE and enhancing technical and research skills. The strategic partners, including NOA, DLR, TROPOS, and PMOD/WRC, collaborated in organizing these events, delivering a well-rounded training experience. Each session targeted different aspects of knowledge transfer, from theoretical underpinnings and practical applications to complex data analysis techniques and advanced research methodologies.

Throughout this period, several notable milestones were achieved, reflecting the successful completion of training activities, including online training webinars, in-person workshops, and collaborative research campaigns. These activities included training on remote sensing data analysis, explainable AI for agriculture, disaster risk reduction, atmospheric modeling, and geospatial analytics. The diverse thematic areas addressed were designed to empower ECoE members with the latest tools and methods, thereby advancing the institution's research capabilities in Earth observation and environmental monitoring.

The activities were not without challenges, as some initiatives had to be adjusted or postponed due to logistical reasons, such as scheduling conflicts or infrastructure limitations. Nevertheless, the adaptability of the training program ensured that the intended knowledge transfer continued effectively. Adjustments included rescheduling certain activities and transitioning others to online formats to accommodate unforeseen circumstances, all while maintaining the quality and comprehensiveness of the training.

This deliverable highlights the impact and outcomes of the capacity building efforts, including increased expertise among participants, enhanced research collaboration between ECoE and its strategic partners, and improved practical skills that can be directly applied to ongoing and future research projects. These capacity-building activities are vital to the ECoE's mission of becoming a leading centre of excellence in Earth observation, supporting sustainable environmental management and regional development.

Following the evaluation of the activities implemented from June 2023 to October 2024, and after carefully assessing the current capacity building needs of the teams working on the running projects, the strategic partners have proposed a series of targeted capacity building activities. These activities are designed to address the identified gaps and enhance team capabilities, ensuring optimal project performance. The proposed activities will be implemented as part of Capacity Building Scheme C,

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which is scheduled to run from November 2024 to June 2026, aiming to further strengthen the teams and support the successful execution of ongoing and future projects.

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2 Capacity Building Scheme B (June 2023 to October 2024)

Capacity Building Scheme B is a core component of the knowledge transfer strategy aimed at enhancing the skills and expertise of participants within the ERATOSTHENES Centre of Excellence (CoE). This section provides an overview of the activities undertaken under Scheme B, emphasizing the progress made since the previous update *(deliverable D6.3)*. It details the achievements, challenges encountered, and the adjustments implemented to optimize the impact of these activities.

2.1 Completed Activities

Within the Training Scheme B, the following training sessions, workshops, and other knowledge transfer activities have been successfully conducted. The completion of these activities represents significant milestones in strengthening the capabilities of participants, contributing to the overall goals of enhancing institutional expertise and fostering a culture of continuous learning and improvement.

The table 1 below provides an overview of the capacity building activities implemented across different thematic areas by the strategic partners. A total of 11 capacity building activities, including trainings, workshops, lectures, seminars, webinars and hands-on sessions, have been carried out. NOA has conducted 7 activities, one (1) of which was in collaboration with PMOD/WRC in the thematic areas of Energy and Atmosphere, four (4) in the thematic area of Disaster Risk Reduction, one (1) for Agriculture, and one (1) for Big Data. TROPOS has contributed 3 activities, all in the thematic area of Atmosphere, while DLR has implemented 1 activity in the Water thematic area.

Table 1: Implemented capacity building and knowledge transfer activities

Partner / Lecturer	Capacity Building / Knowledge Transfer Activity	Type of Activity	Month, Week	# of days	Thematic Area	# of participants
DLR	Time series analysis: Calculation of trends and driving variables Description: The knowledge transfer covers the analyses of vegetation dynamics and drought patterns over Cyprus using remote sensing time series for the last two decades. In detail, trends and driving variables of	Online training, webinar	M45, W1 (June 2023)	1	Water	12

	vegetation will be evaluated. To this aim, MODIS data and further climatic variables will be used. The trainees are expected to have relevant knowledge in R, Python, and Jupyter Notebook. Basic scripts will be provided to the trainees. Based on these, the trainees could develop and conduct further advanced analyses.					
NOA	Causal & Explainable AI in Agriculture Description: This session will focus on the theory and practical use of Causal and Explainable AI in Agriculture. Specifically, it will cover: a) invariant learning for robust predictions under different environments, b) explainable and interpretable predictions for trustworthiness and c) causal effect estimations for assessment of digital agriculture. The aforementioned methods will be	Training Workshop	M50, W4 (November 2023)	3	Agriculture	11

	applied in two real life applications around pest and yield prediction.					
TROPOS	pyLARDA tutorial seminar	Online Seminar	M48, W2 September 2023	1	Atmosphere	2
NOA	Seminar on the development of automatic processing chains for data collection and preprocessing. Description: This knowledge transfer activity will benefit ECoE members to enhance their knowledge on earth observation for fire applications. The activity will offer the background, context and motivation behind the aforementioned domain, but also the technologies and models used (state-of-the–art, the beyond state-of-the-art). Finally, it will highlight the research capabilities of ECoE, assist in the demonstration scenarios, promote ideas creation, sharing, evaluation and dissemination.	Training Workshop	M50, W2 November 2023 M51, W2 December 2023	2	Disaster Risk Reduction	10

NOA	Seminar on holistic multi-parameter flood risk assessment and management planning at high spatial resolution. Description: This knowledge transfer activity will benefit ECoE members to enhance their knowledge on holistic multi-parameter flood risk assessment and management planning at high spatial resolution (building block level) in order to support public actors and stakeholders in decision-making and flood management.	Training Workshop	M48, W3 September 2023	2	Disaster Risk Reduction	13
PMOD/WRC and NOA	Modeling of solar radiation, part 2 and scientific applications for Cyprus / Modeling exercise discussion. Description: The training is a continuation of the one that took place in November 2022 at Davos, Switzerland. It is needed in order to enhance the knowledge on modelling aspects and related	Workshop and webinar	M45, W1 June 2023	2	Energy & Atmosphere	6

	applications. Trainees are already model users and will have a closer look at atmospheric aspects and also published results using such tools. Knowledge transferred will be both technical but also seminar based, sharing ideas for possible scientific research outcomes by ERATOSTHENES CoE scientists.					
NOA	Training course on InSAR time-series analysis using Sentinel-1 images and ISCE software. Description: This knowledge transfer activity will benefit ECoE members to get familiar with new methods and implement them in future research activities. It will highlight the research capabilities of ECoE, assist in the demonstration scenarios later on, promote ideas creation, sharing, evaluation and dissemination.	Hands-on training	M48, W4 September 2023	2	Disaster Risk Reduction	9
NOA	Seminar on Machine Learning and Geospatial	Training Workshop	M56, W4 May 2024	2	Disaster Risk Reduction	15

	Analytics for Fire Risk Management. Description: This knowledge transfer activity will benefit ECoE members to enhance their knowledge on earth observation for fire applications. The activity will offer the background, context and motivation behind the aforementioned domain, but also the technologies and models used (state-of-the–art, the beyond state-of-the-art). Finally, it will highlight the research capabilities of ECoE, assist in the demonstration scenarios, promote ideas creation, sharing, evaluation and dissemination.					
NOA	Synergizing Street-Level Data with Satellite Imagery in Agriculture. Description: This session will focus on the integration of street-level data with satellite imagery, specifically	Training Workshop	M54, W2 March 2024	1	Big Data	9

	tailored for agricultural applications. Throughout the session, these methods will be practically applied to the task of crop identification.					
TROPOS	Lecture about microwave and radar remote sensing	Lecture (online)	M49, WK1 to M52, WK14 (October 2023 – January 2024)	14	Atmosphere	2
TROPOS	Lecture about optical remote sensing lidar and radar remote sensing	Lecture (online)	M49, WK1 to M52, WK14 (October 2023 – January 2024)	14	Atmosphere	2

2.2 Evaluation of the Impact and Effectiveness of Conducted Activities

This section provides a comprehensive assessment of the capacity-building activities implemented during the reporting period. This evaluation aims to measure the extent to which the activities have achieved their intended objectives, focusing on enhancing knowledge transfer, skill development, and organizational capabilities. This section also offers insights into participant engagement, the applicability of the knowledge gained, and the overall contribution of these activities to the ERATOSTHENES CoE's mission. The outcomes will help identify areas of improvement for future activities and ensure alignment with the long-term strategic goals of capacity building.

2.2.1 Training Evaluation Results and Feedback from Participants

2.2.1.1 NOA

2.2.1.1.1 Seminar on holistic multi-parameter flood risk assessment and management planning at high spatial resolution.

This seminar held from 18th to 19th September 2023, at the ERATOSTHENES CoE premises and delivered by Dr. Alexia Tsouni from our Strategic Partner NOA, aimed to enhance ECoE members' knowledge in this field to support decision-making and flood management. The NOA/BEYOND/FloodHub team presented state-of-the-art technologies and models, focusing on the case study of the Mandra river basin in Attica, Greece, where flood risk assessment was recently conducted. The methodological framework integrates various data sources and simulations developed

by research groups, providing significant added value. The activity highlighted ECoE's research capabilities, facilitated the flood demo project, and promoted idea creation and dissemination. The training objectives included an introduction to multi-parameter flood risk assessment, and the outcomes encompassed hydrological and hydraulic simulations for different flood scenarios, vulnerability and exposure assessments, flood risk assessment, critical points mapping, and proposals for mitigation measures.

The evaluation of this training workshop revealed that it significantly enhanced the expertise of ERATOSTHENES CoE members in hydrology, modeling, and GIS procedures. The step-by-step presentation covered all key stages of flood risk assessment and introduced new perspectives, such as the use of Earth Observation (EO) products and field visit methodologies, which were presented in detail. Although ERATOSTHENES CoE members already have substantial experience in hydrological and hydraulic modeling, GIS techniques, and remote sensing, this training deepened their understanding of flood risk theory and rainfall-runoff procedures, addressing a crucial knowledge gap. It was recommended to organize a secondment training for further knowledge transfer, given that ERATOSTHENES CoE has already implemented NOA's proposed methodology. Additionally, site-specific training tailored to flood-prone areas in Cyprus could further enhance the team's expertise.

Figure 1: Seminar by NOA on 18th and 19th September 2023

2.2.1.1.2 Training course on InSAR time-series analysis using Sentinel-1 images and ISCE software.

This training course, conducted on 28th and 29th September 2023, by Dr. Stavroula Alatza from our Strategic Partner NOA at the ERATOSTHENES CoE premises, aimed to familiarize ECoE members with new methods for future research activities, emphasizing their research capabilities and facilitating demonstration scenarios. The training objective focused on equipping ECoE members with skills in Persistent Scatterer Interferometry (PSI) techniques using ISCE and StaMPS software. Outcomes included the implementation of PSI and SBAS techniques in geohazards monitoring and knowledge of processing Sentinel-1 SLC images. The hands-on training allowed ECoE members to develop practical skills, particularly in big data handling, time-series InSAR processing, and ISCE software usage, with theoretical knowledge augmented through interaction and Q/A sessions. Collaboration between ECoE and NOA members improved significantly during the course, fostering exploration of research opportunities and enhancing the capacity to adopt new technologies and methods. Additionally, an introduction to Line of Sight (LOS) decomposition on the second day laid the groundwork for future detailed training, further enriching the learning experience and solidifying collaboration between the two entities.

The evaluation of the training highlighted several positive outcomes for the participants. The in-person, hands-on training significantly increased the efficiency of processing tasks and established a better level of collaboration between the ERATOSTHENES CoE and NOA. The engagement and motivation of the ERATOSTHENES CoE team were notably improved, and new research ideas were introduced, sparking further innovation. Participants reported increased confidence in using ISCE for InSAR processing, and the dedication, focus, and motivation of ERATOSTHENES CoE members to incorporate new technologies into their research activities were evident. The workshop not only boosted technical skills but also fostered a sense of teamwork and excitement for future research endeavors.

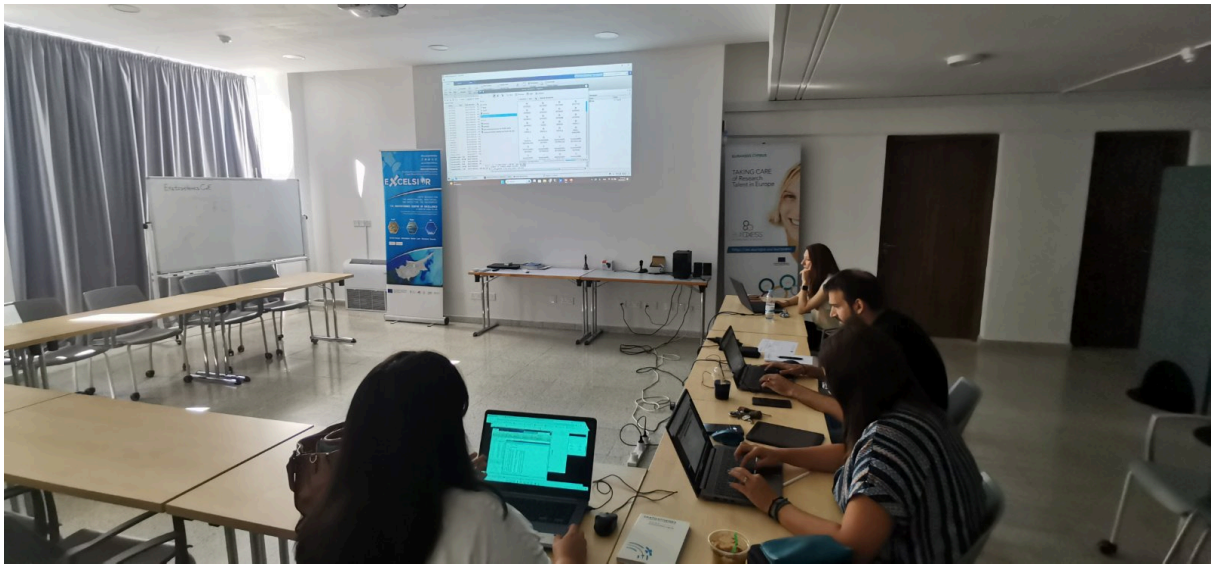

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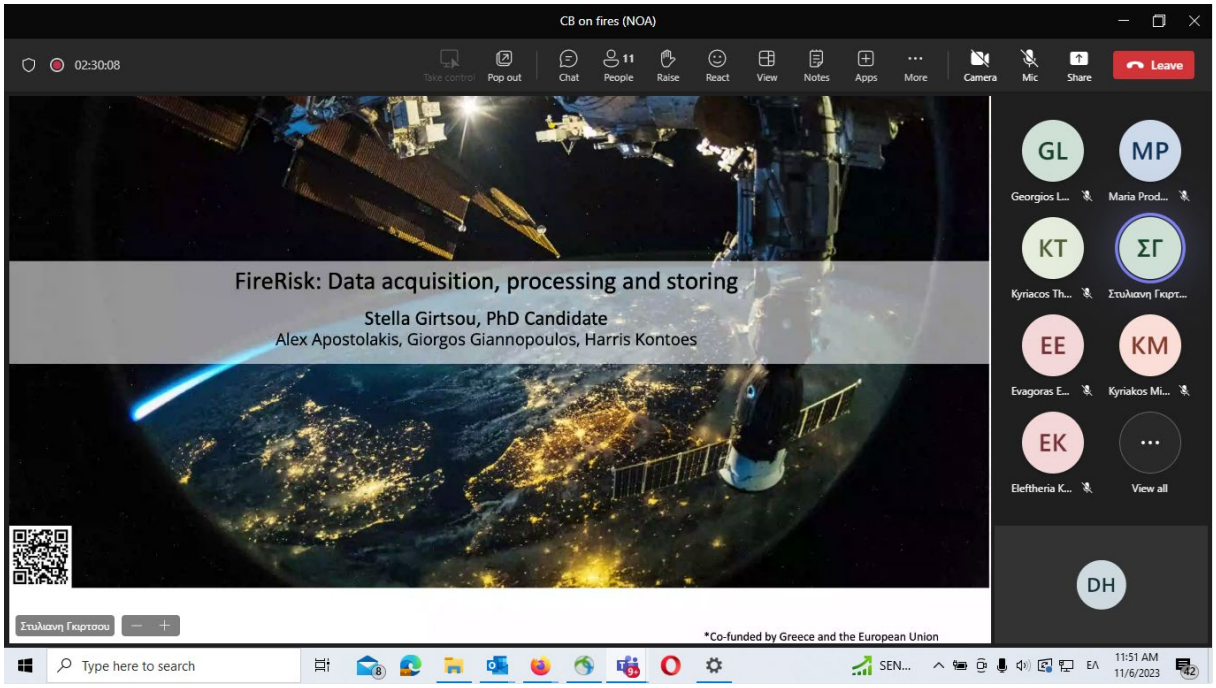
Figure 2-3: Training by NOA on 28th and 29th September 2023

2.2.1.1.3 Seminar on the development of automatic processing chains for data collection and preprocessing

This seminar took place on 6th and 7th of November 2023 and a 3rd part on 13th of December 2023, delivered by Dr. Stella Girtsou (Strategic Partner: NOA) at ERATOSTHENES CoE premises in Limassol, Cyprus, and aimed to benefit members of the ERATOSTHENES by enhancing their understanding of earth observation for fire applications, providing background, context, and motivation within the domain. It covered state-of-the-art and beyond technologies and models, showcasing ERATOSTHENES CoE's research capabilities, aiding in demonstration scenarios, and fostering idea creation, sharing, evaluation, and dissemination. Despite the Forest Department of Cyprus implementing various precautionary measures to prevent forest fires, remote sensing techniques are notably absent. Therefore, through a demonstration project, NOA provided the necessary knowledge and data for the preparation of a fire risk prediction model using remote sensing data. The content of the activity included discovery of fire drivers, data preprocessing, acquisition of imagery and land data, database management, introduction to data cube technologies, fusion of datasets, Python packages for geospatial data analysis, and concepts and algorithms for geospatial predictive analysis.

The evaluation of the training highlighted several positive outcomes. Participants noted that the in-person, hands-on training significantly improved their efficiency in data processing workflows, leading to a more streamlined approach to handling complex data tasks. Engagement and motivation among ERATOSTHENES CoE members were notably increased, and the workshop introduced new research ideas that have the potential to be further explored. ERATOSTHENES CoE participants reported greater confidence in using Python for data processing, and their dedication, focus, and enthusiasm for

incorporating new technologies into their research activities were evident. The training effectively boosted both technical skills and collaborative capacities, setting a strong foundation for future research initiatives.



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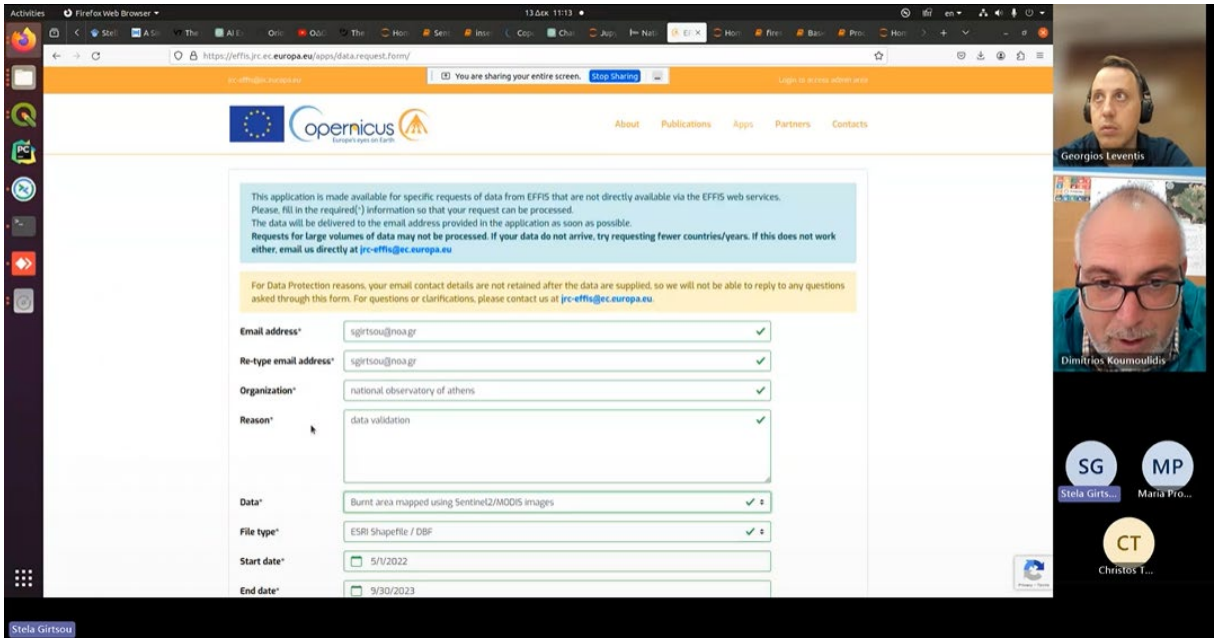

Figure 4-5: Seminar by NOA on 6th and 7th of November 2023

2.2.1.1.4 Causal & Explainable AI in Agriculture

This workshop, held from 21st to 23rd November 2023, at the ERATOSTHENES CoE premises and conducted by Dr. Ilias Tsoumas, Dr. Dilli Paudel, and Mr. Ornela Nanushi (Strategic Partner: NOA), focused on the theory and practical application of causal and explainable AI in agriculture. It covered topics such as invariant learning for robust predictions under different environments, explainable and interpretable predictions for trustworthiness, and causal effect estimations for assessing digital agriculture. These methods were applied in real-life scenarios involving pest and yield prediction, with hands-on exercises tailored to the expertise of participants in infrastructure provision at ERATOSTHENES CoE in agriculture. The outcomes of the training included the implementation of causal and explainable AI techniques in agricultural systems, the application of learned knowledge to real-world agricultural problems, and a deeper understanding of invariant learning, explainability, and causality in digital agriculture. Moreover, the workshop yielded deliverables in the form of an end-to-end formulation and concept aimed at leveraging causality and remote sensing for a future demonstration project and journal paper. This concept involved exploring the impact of passive and active reforestation after wildfires on biodiversity, utilizing diff-in-diff and synthetic control causality concepts to identify and estimate the causal effect of different reforestation practices on remote-sensing-derived biodiversity indices, with collaboration from experts in biodiversity, AI, remote sensing, and causality from various institutions.

The evaluation of the training indicated positive feedback from the participants. The in-person, hands-on training sessions significantly increased the efficiency of learning and application processes. The workshop also fostered high levels of engagement and motivation among the team, encouraging

participants to actively contribute to discussions and tasks. Members of the ERATOSTHENES CoE showed strong dedication, focus, and enthusiasm in incorporating new technologies and methodologies into their research activities, particularly the integration of causal and explainable AI in agricultural systems. This training served to enhance both technical proficiency and the overall motivation of the ERATOSTHENES CoE team for future research endeavors.

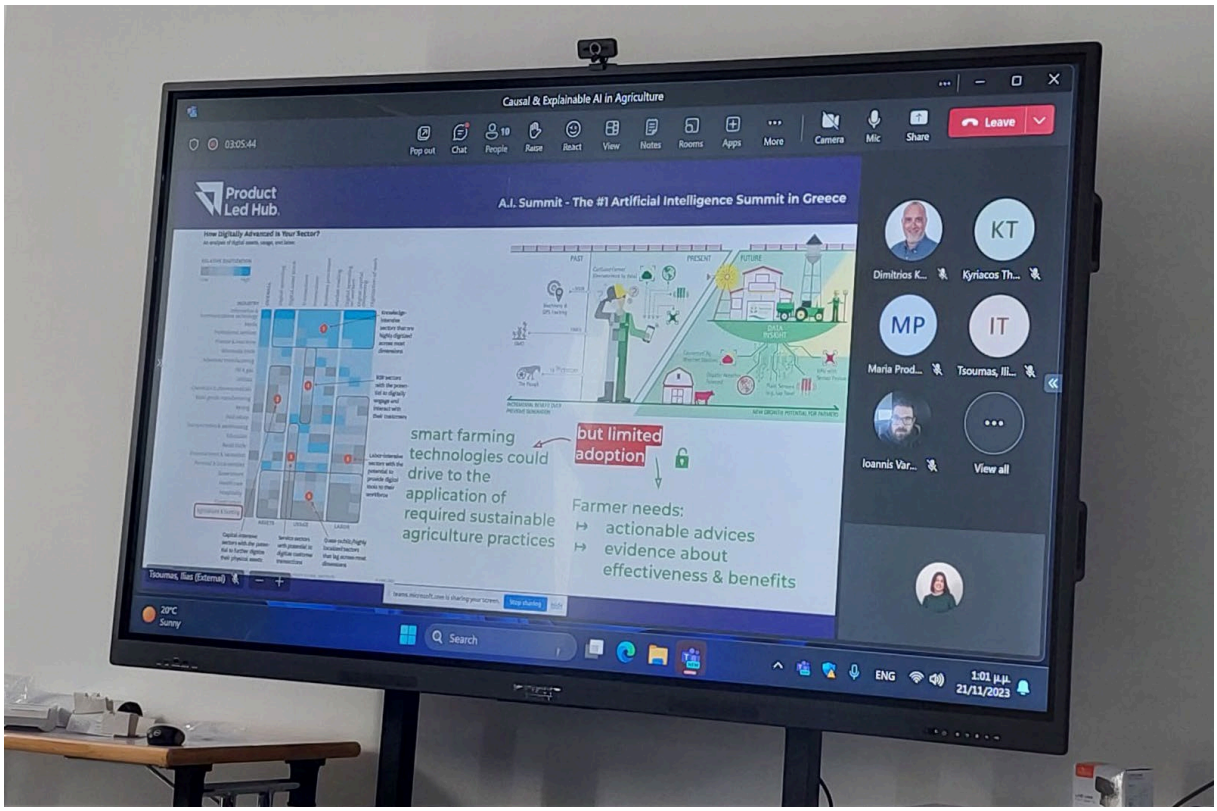

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Figure 6-7: Workshop by NOA from 21st to 23rd November 2023

2.2.1.1.5 Synergizing Street-Level Data with Satellite Imagery in Agriculture

This training workshop was conducted on 13th March 2024 focusing on enhancing the use of innovative data sources for agricultural applications. The workshop covered the integration of street-level data with satellite imagery, emphasizing its application in agriculture to achieve more precise insights and effective decision-making. Participants explored crowdsourced platforms and the use of street-level images, gaining a comprehensive understanding of how these resources can empower actionable data in agricultural practices. Training sessions on data processing and retrieval through the Mapillary platform demonstrated practical methods for utilizing street-level data efficiently. The workshop also included annotation techniques using acquisition coordinate transformations and LPIS/GSAA parcel geometries, crucial for improving the quality of street-level imagery. Additionally, strategies to exploit street-level images for enhanced predictive capabilities in agriculture were presented, leveraging deep learning methodologies. A brief overview of data fusion techniques and deep learning potentials in earth observation was also provided. The deliverables resulting from this training included an introduction, motivation, theory, and hands-on activities to guide participants in formulating, developing, and integrating street-level data through crowdsourced platforms and AI solutions within agricultural settings.

The participants provided positive feedback, emphasizing the value of the interactive, hands-on approach adopted during the sessions. The training empowered ERATOSTHENES CoE members by enabling them to master new technical skills, significantly enhancing their understanding and capabilities in the integration of street-level data with satellite imagery for agricultural applications. Furthermore, the workshop fostered strong team engagement, encouraging collaboration and building a cohesive foundation for upcoming tasks and research activities. Participants appreciated the practical nature of the training, which allowed them to directly apply the concepts learned and strengthened their readiness for future projects.

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Figure 8-9: Training workshop by NOA on 13th March 2024

2.2.1.1.6 Seminar on Machine Learning and Geospatial Analytics for Fire Risk Management.

This online workshop conducted on 20th and 21st of May 2024 focusing on enhancing the ERATOSTHENES CoE members' knowledge in Earth observation for fire applications. This knowledge transfer activity aimed to provide a comprehensive understanding of fire risk management, including the context, technologies, and models—ranging from state-of-the-art to beyond state-of-the-art approaches. The workshop highlighted the research capabilities of ERATOSTHENES CoE, promoted the creation and sharing of ideas, and helped in the formulation of demonstration scenarios. Given ERATOSTHENES CoE's existing expertise in post-fire monitoring, such as burned area mapping, fire severity assessment, and time-series analysis, the workshop aimed to build on these skills by introducing fire risk prediction modeling using remote sensing data. This initiative was especially timely, as the Forest Department of Cyprus, despite having several precautionary measures for fire prevention, had yet to integrate remote sensing techniques into these measures. NOA experts provided insights into the data and information needed for developing a fire risk prediction model. The content covered key concepts such as supervised and unsupervised machine learning, model evaluation, and methodologies for predicting wildfire risks using advanced data analytics. Participants learned about managing large datasets, data cubes for multi-dimensional geospatial data, and techniques for analyzing trends and visualizing complex data. The main outcomes of the workshop included a solid understanding of both basic and advanced machine learning theory, in-depth knowledge of the fire risk dataset, skills in working with Earth Observation datacubes, and the ability to explore dependent variables and analyze trends, thus enhancing EcoE's capacity for fire risk prediction and management.

The evaluation of this workshop by the participants indicated that it provided valuable knowledge transfer to the ERATOSTHENES CoE members, significantly enhancing their expertise in EO technologies for wildfire applications. While ERATOSTHENES CoE already had substantial experience in post-fire monitoring, this training filled a crucial gap by expanding their understanding of fire risk prediction and trend analysis. Participants explored the theoretical foundations of machine learning and its application to wildfire risk, including key concepts such as supervised and unsupervised learning, model evaluation, and various data analysis techniques. The importance of managing large datasets and data cubes for geospatial data processing was also highlighted, which is critical for analyzing past fire events and identifying trends. This newly gained knowledge equips ERATOSTHENES CoE members to develop more advanced fire risk prediction models, further strengthening the centre's research capabilities and its ability to contribute to proactive fire management strategies.

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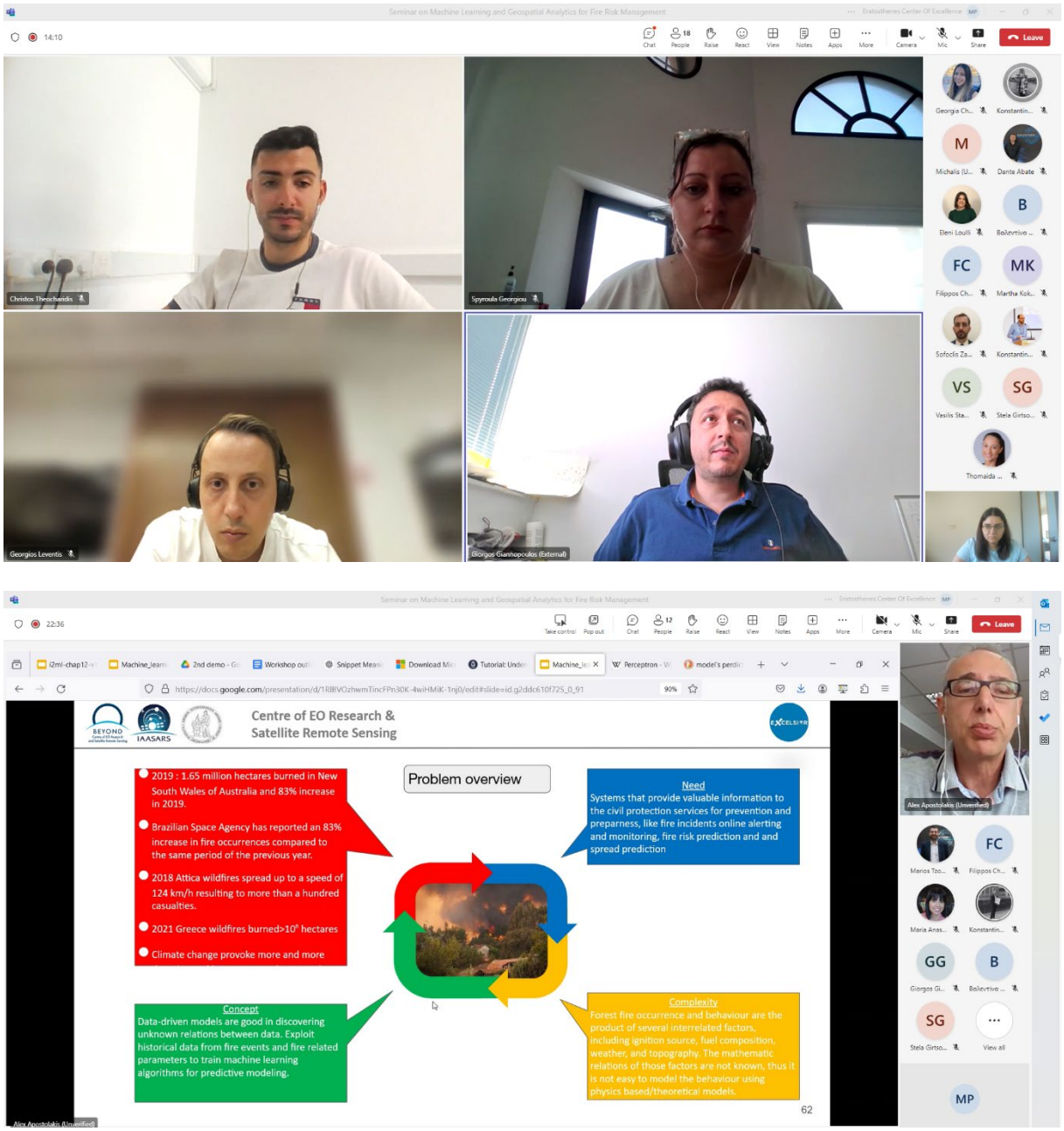


Figure 10-11: Online workshop by NOA on 20th and 21st of May 2024

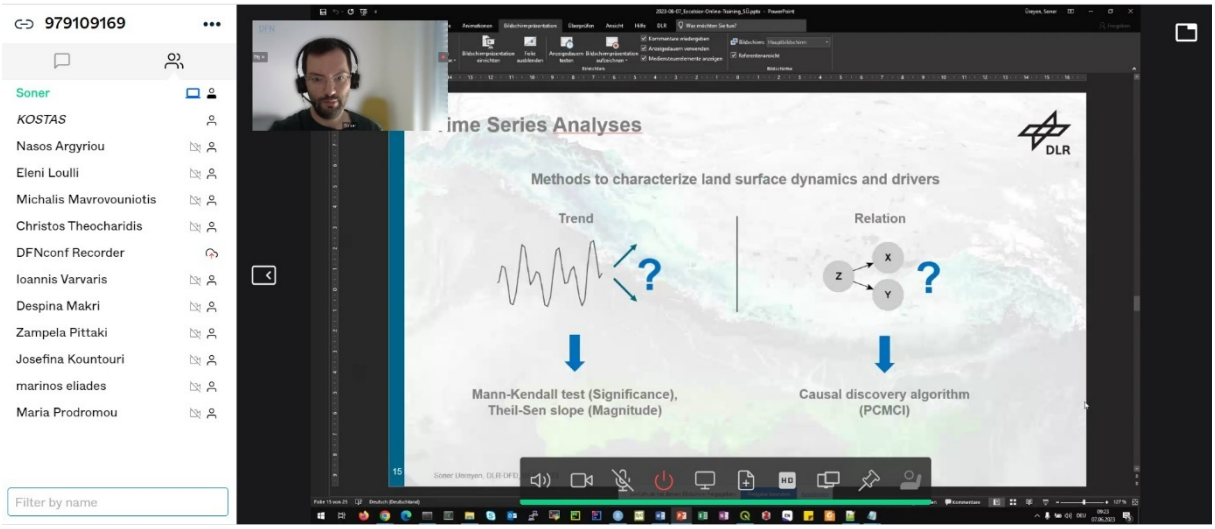
2.2.1.2 DLR

2.2.1.2.1 Time series analysis: Calculation of trends and driving variables

This online training session conducted on 7th June 2023 focusing on analyzing vegetation dynamics and drought patterns over Cyprus using remote sensing time series data from the past two decades. The training introduced participants to evaluating trends and driving variables of vegetation by utilizing MODIS data alongside other climatic variables. Trainees were expected to have prior knowledge of R, Python, and Jupyter Notebook, and they received basic scripts in these programming languages to

assist them in conducting advanced analyses. The main objective of the training was to enable participants to gather and process relevant remote sensing and climatic data to perform time series analysis related to vegetation condition. As a result of the training, participants were empowered to use Google Earth Engine for gathering and processing time series data, perform analyses to identify trends in vegetation condition using the normalized difference vegetation index (NDVI), and analyze the drivers of vegetation dynamics using causal graphs. These tasks were demonstrated using both R and Python programming languages, equipping the trainees with practical skills and foundational scripts for relevant time series analysis.

The evaluation of the training indicated that the participants found the session effective in providing the necessary skills and resources for performing the presented analyses. The trainees reported that the provided materials, including scripts and the video recording of the session, were valuable in supporting their understanding and enabling them to replicate the analyses independently. The practical approach taken during the training, complemented by accessible reference materials, ensured that participants could confidently apply the concepts of time series analysis, particularly in evaluating vegetation dynamics and identifying driving variables using remote sensing data.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 857510.

This project has received funding from the Government of the Republic of Cyprus through the Directorate General for the European Programmes, Coordination and Development as well as the Cyprus University of Technology.

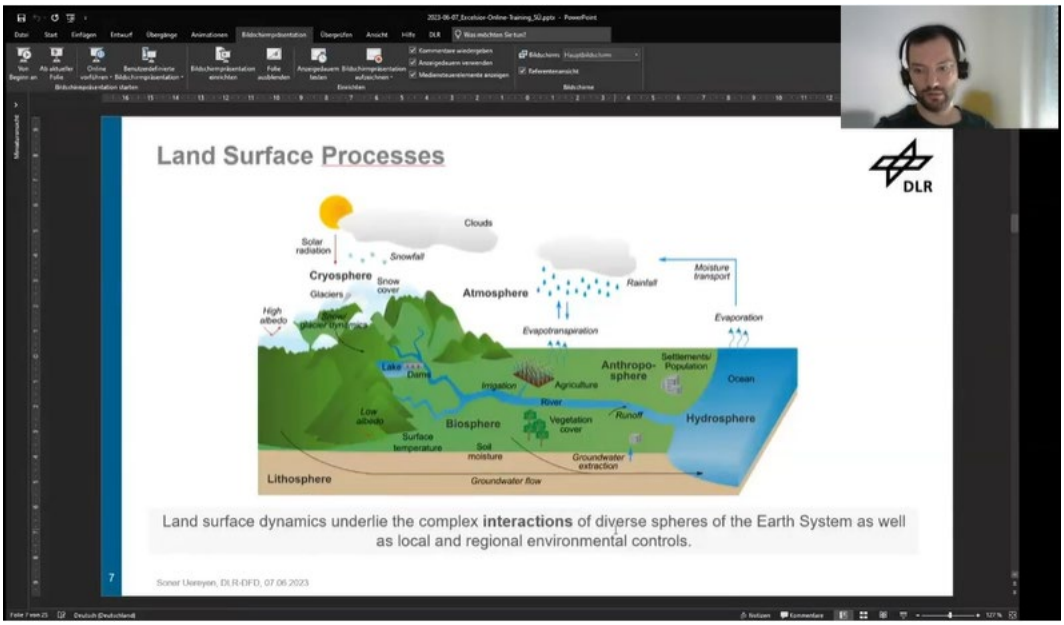


Figure 12-13: Online training by DLR on 7th June 2023

2.2.1.3 Activities leading to Capacity Building Scheme C

2.2.1.3.1 Joined flight campaign CERAD in Cyprus.

The Cyprus Flight Campaign of the ERATOSTHENES CoE and DLR (CERAD) took place from 9th to 14th October 2023 within the framework of the EXCELSIOR H2020 Widespread Teaming Phase 2 project titled "ERATOSTHENES: EXcellence Research Centre for Earth SurveiLlance and Space-Based Monitoring of the EnviRonment." The campaign's primary objective was to acquire approximately 100,000 high-resolution stereo 3K images and hyperspectral HySpex images, complemented by ground truth measurements for high-resolution hyperspectral analysis and 3D mapping. It aimed to develop the capacity of ERATOSTHENES CoE staff in processing this imagery, performing cross-calibration and validation of sensors, and analyzing land, water, and cultural heritage sites with hyperspectral sensors. High-resolution hyperspectral imagery across the spectral range of 420–2500 nm was captured over several parts of Cyprus, including the Paphos and Limassol districts. The ERATOSTHENES research team conducted a ground-based measurement campaign involving spectroradiometric measurements (HR 1024 and GER 1500), collection of water and soil samples for laboratory analysis, GPS tracking, and the use of soil moisture and meteorological sensors, as well as UAV multispectral cameras. The collected data will support various applications such as calibration and validation of satellite products, environmental monitoring, vegetation analysis, and disaster risk assessment.

The campaign demonstrated the effectiveness of airborne hyperspectral imaging for capturing detailed environmental data and underscored the importance of ground-truth measurements for validating airborne data and enhancing environmental monitoring efforts. The campaign also contributed to enhancing the ERATOSTHENES CoE's capabilities in hyperspectral image processing, sensor cross-calibration, and analysis of diverse environments across Cyprus.

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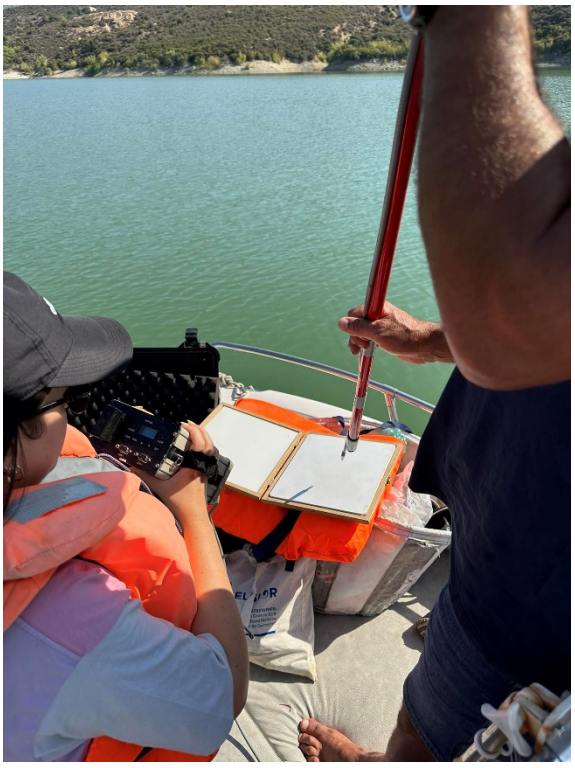

Figure 14-15: Joined flight campaign CERAD in Cyprus

2.2.1.4 PMOD/WRC and NOA

2.2.1.4.1 Modeling of solar radiation, part 2 and scientific applications for Cyprus / Modeling exercise discussion.

This online workshop was conducted on 7th and 8th June 2023, serving as a continuation of the training initiated in November 2022 in Davos, Switzerland. The aim was to enhance the understanding of modeling aspects related to solar radiation and their applications, with a focus on atmospheric components. Trainees, who were already familiar with the use of models, were provided with deeper insights into radiative transfer modeling, particularly in relation to aerosol optical properties and dust profiles. The training combined technical instruction and seminar-based discussions, facilitating the exchange of ideas for potential research outcomes by ERATOSTHENES CoE scientists. Through hands-on exercises and presentations of published research, participants improved their knowledge of solar radiation transfer in the atmosphere, focusing on links with aerosols and practical applications relevant to Cyprus. The workshop defined a strategy for integrating models and measurements to support ECoE activities and the Excelsior project, identified connections with demonstration projects 1 and 2, and discussed potential timelines for publications and collaborations, along with opportunities for synergies between atmospheric and solar research groups.

The evaluation of the workshop showed that the participants, ranging from early PhD candidates to experienced atmospheric scientists, found the session highly engaging and beneficial. The training was structured around three main areas: a literature overview of solar radiation and atmospheric studies, hands-on modeling exercises with a focus on common aspects such as aerosol profiling for both solar and atmospheric research, and a discussion on the upcoming installation of instrumentation at the ERATOSTHENES CoE. Additionally, funding opportunities for early career scientists, such as the COST action Harmonia, were discussed. Interactions with the new members of ECoE were instrumental in fostering initial collaboration. Throughout the session, trainees fully participated, actively discussing presented topics and solving assigned exercises, contributing to a productive learning environment. Trainers also considered the interaction to be fruitful. Recommendations were made for a follow-up session in late 2023 to cover practical aspects of solar instrumentation and quality assurance/quality control (QA/QC). The workshop highlighted the strong scientific link between the solar and atmospheric groups at ECoE, emphasizing the value of their collaboration in advancing research on aerosol and cloud properties, radiative forcing, and related effects.

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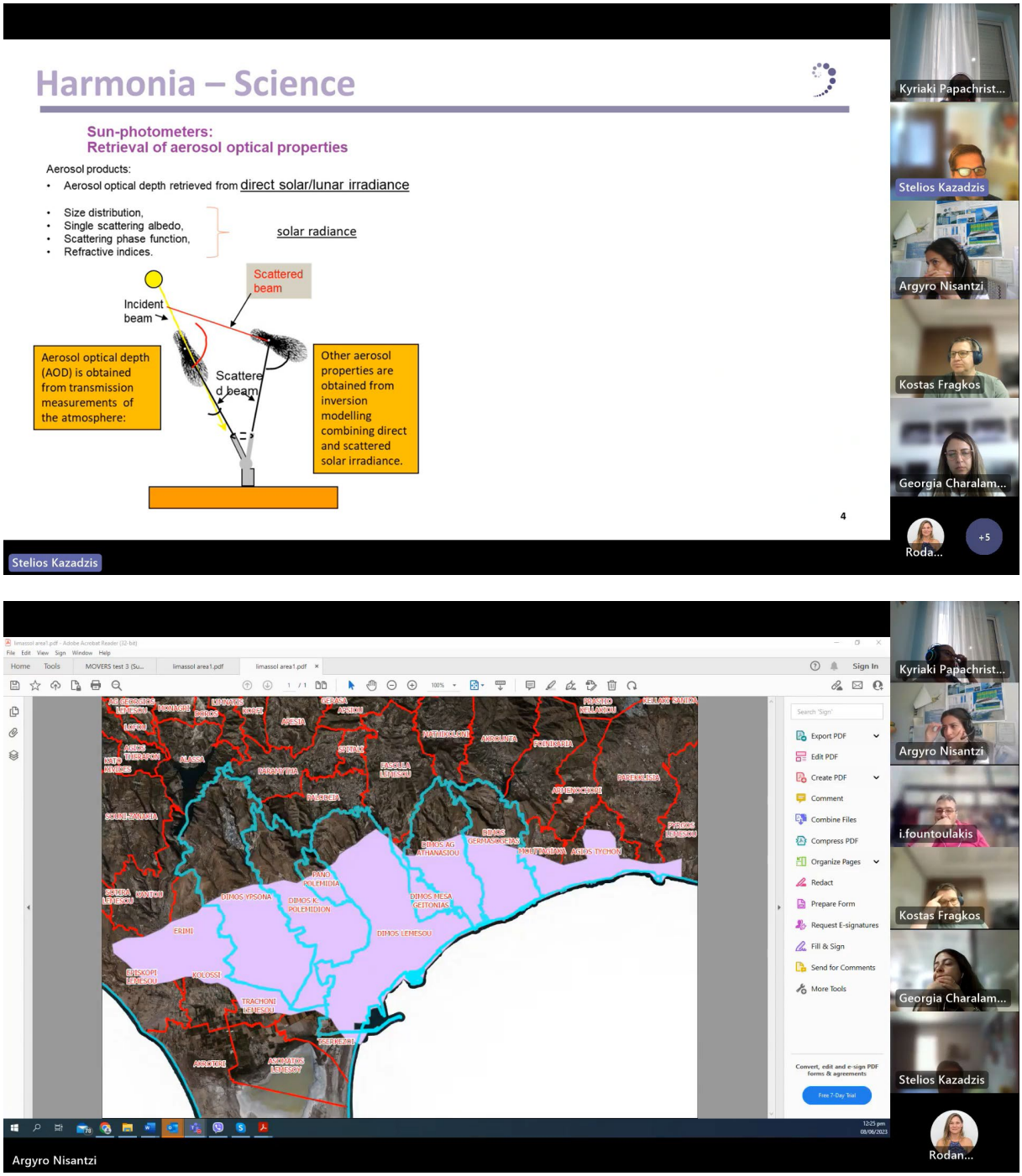

Figure 16-17: Workshop by PMOD/WRC and NOA on 7th and 8th June 2023

2.2.1.5 TROPOS

2.2.1.5.1 pyLARDA tutorial seminar

On 24th of September 2024, an online workshop on "pyLarda" was conducted by TROPOS, focusing on utilizing the pyLarda environment for processing and visualizing remote sensing data. Led by Martin

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Randenz and Andi Klamt from the TROPOS team, the workshop provided an overview of the history, installation process, backend configuration, and usage of pyLarda. Participants were introduced to its capabilities through test examples, allowing them to familiarize themselves with the environment's functionality. The workshop aimed to equip attendees with the necessary skills to leverage pyLarda for their remote sensing data analysis and visualization needs.

The evaluation this workshop highlighted its effectiveness in providing a comprehensive overview of the Larda environment for processing and visualizing remote sensing data. Participants noted that mastering these tools is crucial for data synergy scientists, as it enhances their ability to handle and analyze remote sensing data more efficiently. The insights gained during the workshop deepened participants' understanding of pyLarda's potential, particularly in configuring and modifying the tools to suit specific needs. This improved their data interpretation capabilities and is expected to contribute to more accurate results in ongoing and future projects.

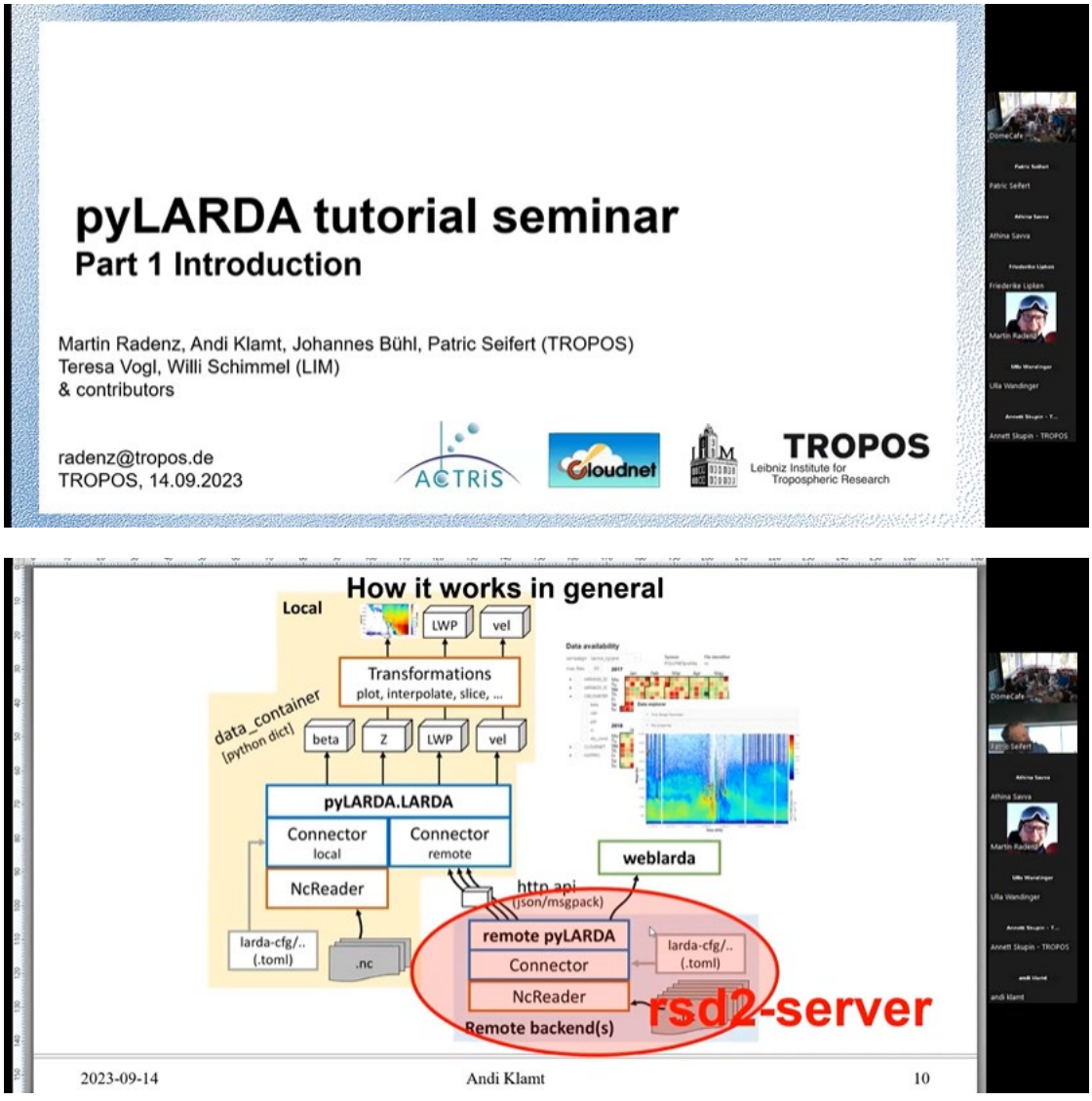

Figure 18-19: Online workshop by TROPOS on 24th of September 2024

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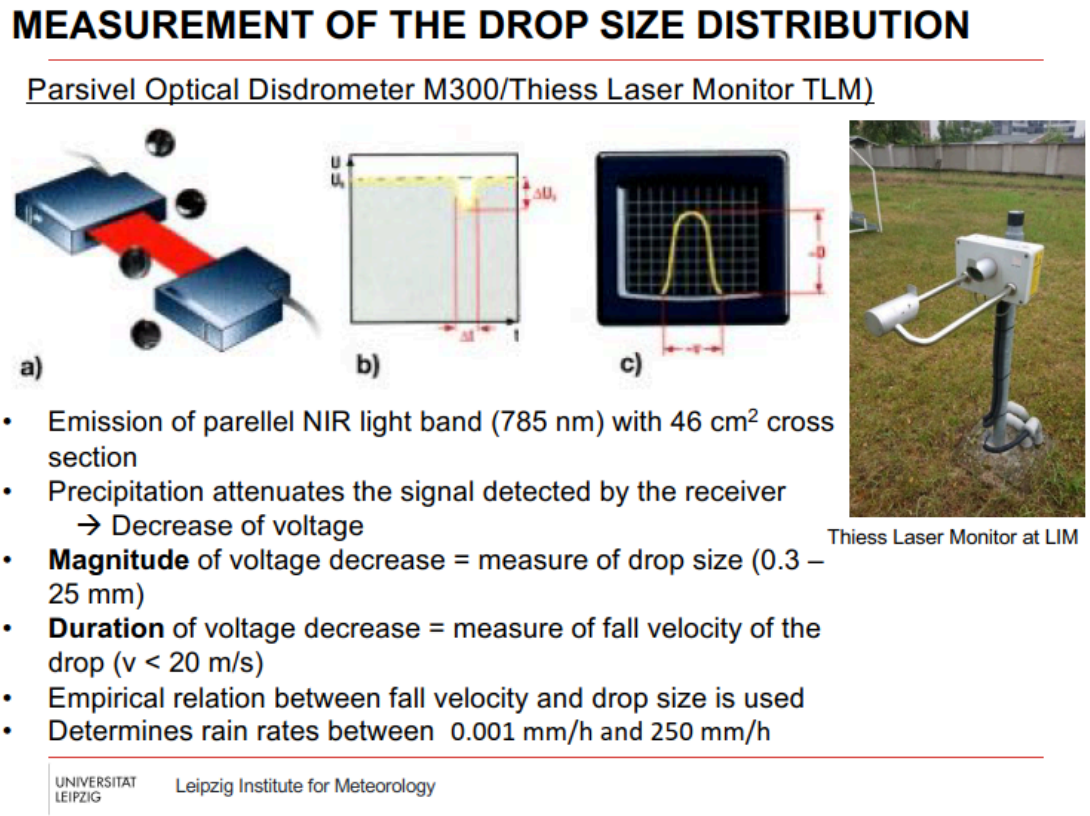
2.2.1.5.2 Lecture about microwave and radar remote sensing

The online lectures on "Remote Sensing of the Atmosphere with Radar and Microwave Radiometers," conducted from October 2023 to January 2024, focused on both active and passive remote sensing methods. The lectures explored the operation of radar and microwave radiometers and their applications in acquiring atmospheric state parameters and cloud properties. The training consisted of well-structured presentations, which provided a detailed understanding of the physics behind these instruments and their operational principles. Special emphasis was placed on imparting theoretical knowledge, with ample time dedicated to addressing participants' questions and clarifying complex topics.

The participants found the lectures highly insightful. The lectures provided a clear and comprehensive overview of both active and passive methods, particularly radar and microwave radiometer techniques. The detailed explanations of these methods and their applications in atmospheric monitoring have enhanced the participants' understanding, allowing them to apply the content practically, especially in the operation of the cloud station at ERATOSTHENES CoE. These lectures expected to significantly improve their ability to use advanced remote sensing methods in their atmospheric research efforts.



Thiess Laser Monitor at LIM

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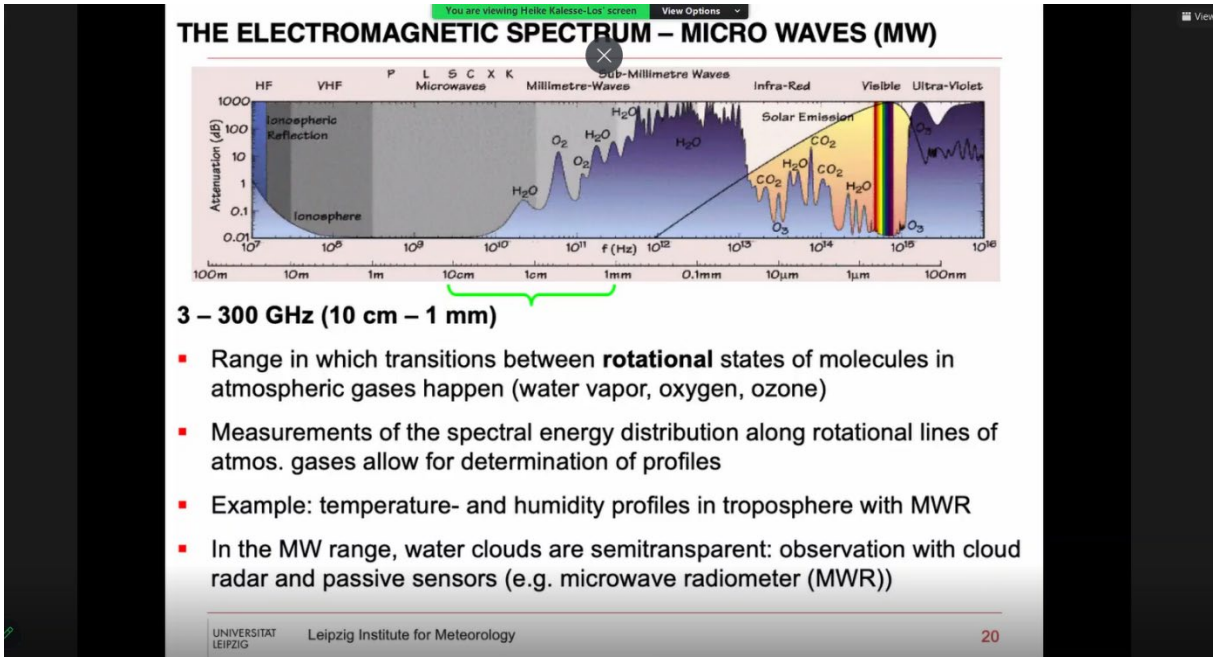

Figure 20-21: Lecture by TROPOS from October 2023 to January 2024 (microwave)

2.2.1.5.3 Lecture about optical remote sensing lidar and radar remote sensing

The online lectures on "Active Remote Sensing with Lidar," conducted from October 2023 until January 2024, provided an in-depth exploration of Lidar methods and analysis techniques. The sessions focused on the principles of Lidar operation, highlighting various types of Lidar systems and their unique characteristics for studying aerosols, clouds, and wind patterns. A dedicated lecture on wind Lidar was also included. Through structured online presentations, trainers shared theoretical insights into the operation of Lidar systems and their applications, while also engaging with participants' questions to clarify key concepts and practical uses.

The participants found the lectures highly valuable, as they provided essential insights into the principles of lidar instruments and their measurement products. The lectures effectively covered the fundamentals of lidar operation, which are crucial for understanding the instrument's capabilities. Learning about the key parameters for aerosol and cloud studies, as well as the applications of wind lidar and other types of lidars, was particularly beneficial. This knowledge will significantly enhance the participants' ability to utilize the corresponding instruments at the CARO station of the ERATOSTHENES CoE, supporting their atmospheric research efforts.

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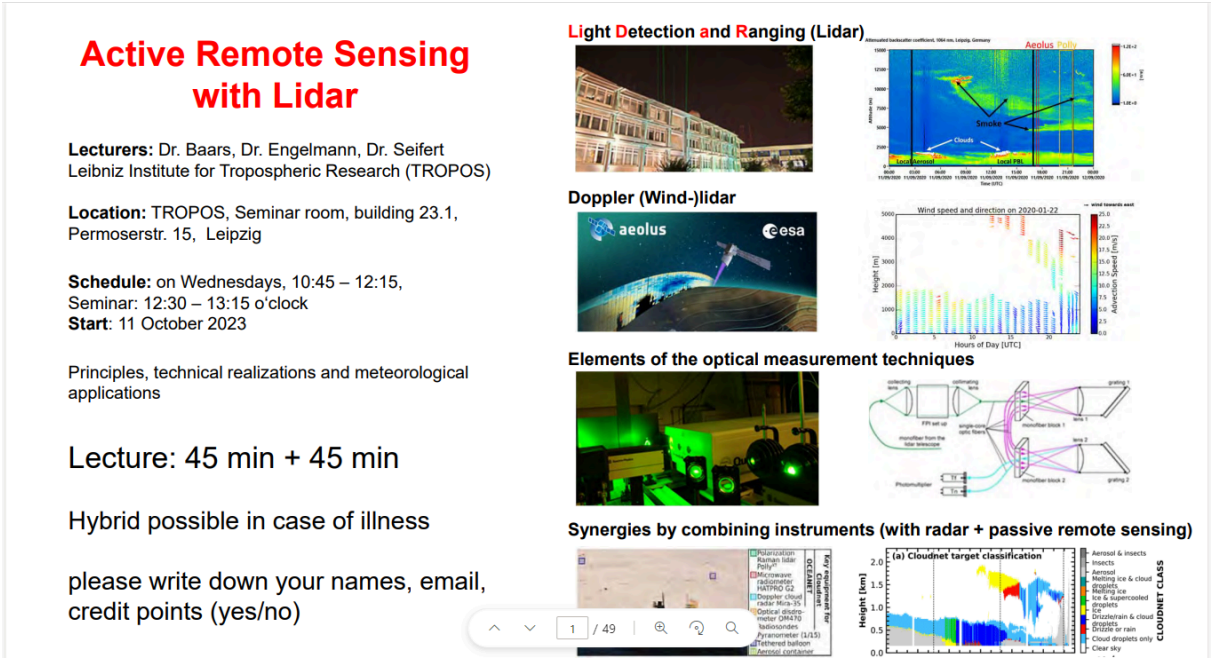

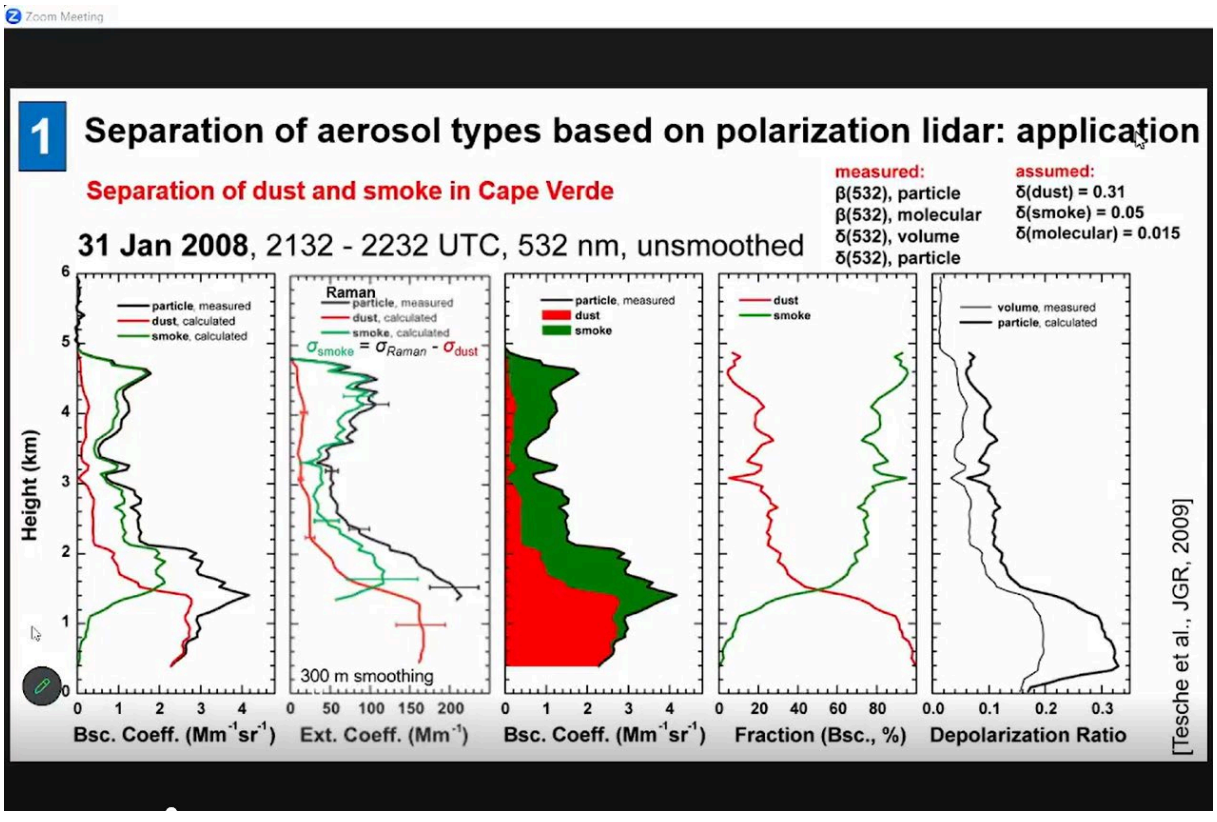

Figure 22-23: Lecture by TROPOS from October 2023 to January 2024 (lidar)

2.2.2 Assessment of Impact

This section evaluates the outcomes of the capacity building activities carried out between June 2023 and October 2024 (Training Scheme B). These activities were designed to enhance the skills, knowledge, and collaborative potential of participants, contributing significantly to the ERATOSTHENES CoE's mission. The assessment covers both qualitative and quantitative measures, highlighting the growth in expertise and capabilities among the participants. The impact of these activities is evident in several tangible achievements, including the submission of research proposals, as well as increased publication output and dissemination efforts, showcasing the successful integration of new knowledge into the scientific community.

2.2.2.1 Proposals Submitted

A total of eight proposals were submitted across two departments. The Resilient Society Department accounted for six submitted proposals. Of these, three were focused on disaster risks, one on maritime, and two on energy. The Environment & Climate Department contributed two proposals, both targeting the area of atmosphere. These submissions demonstrate the departments' active engagement in seeking funding and collaboration opportunities aligned with their strategic focus areas.

2.2.2.2 Publications and Dissemination

The ERATOSTHENES CoE published a total of 15 works, consisting of 12 conference publications, and 3 journal publications. The Resilient Society Department published 10 conference publications, of which five focused on disaster risks, two on maritime, and three on energy. The department also published two journal articles, one in the area of disaster risks and one in energy, along with an abstract publication in disaster risks. The Environment & Climate Department contributed with two conference publications in agriculture and one journal publication in the area of atmosphere. These outputs highlight the organization's efforts to disseminate research findings and contribute to scientific knowledge in key areas of expertise.

In addition to the publications, the ERATOSTHENES CoE actively disseminated the results of its capacity building activities by organizing the Tenth International Conference on Remote Sensing and Geoinformation of Environment (RSCy2024). The conference, held from 8-9 April 2024 in Paphos, Cyprus, served as a platform for ERATOSTHENES researchers to present the outcomes of their capacity building activities and demonstration projects. Collaborating closely with the organization's Strategic Partners, the researchers were able to share their findings with a broad audience of EO scientists, institutions, and stakeholders. This event played a critical role in strengthening international networks, offering valuable opportunities for collaboration and promoting the capacity building efforts of the organization on a global scale.

3 Challenges and Adjustments Made

Several activities were initially scheduled but were not implemented as planned due to various challenges. This section provides an overview of the scheduled activities, including the type of activity, and the reasons for their adjustment or cancellation. A primary reason for these changes was the need to realign the activities based on the current needs of the teams, ensuring they remain relevant and effective. Additional factors, such as equipment delays, also contributed to the adjustments in the original workplan.

3.1 TROPOS

Several activities under Capacity Building Scheme B, planned by Strategic Partner TROPOS, were not implemented as initially scheduled. Some of these activities were fully or partially covered through other training activities, ensuring continuity in research personnel's skill development. The remaining activities have been rescheduled for implementation and transferred to the Capacity Building Scheme C.

Capacity Building / Knowledge Transfer Activity	Type of Activity	Rationale of Adjustment
Cloud Radar Operation	Workshop (On-site in Limassol)	Partially covered during the installation of radar end of June 2024. The operation training offered by METEK company on 10-13 September 2024 in Limassol.
GBS instrument integration at Leipzig	Workshop (On-site at Leipzig)	The instrument integration is an ongoing on-side activity based on the receiving of instruments. The installation of 5 instruments has been completed in June 2024. The GBS server is expected to be installed by the end of 2024.
GBS Data Evaluation Workshop	Workshop (in-person)	Maria Poutli attended a training at Leipzig during secondment between 20th of February to 7th of March 2024.
Training on usage of LARDA³ remote sensing data cube	Training (in-person)	Dragos Ene attended a training at Leipzig during secondment between 12th to 27th of February 2024.
Implementation of Cloudnet Processing Scheme	Training (in-person)	The first part has been done during Dragos Ene's secondment. The Implementation of Cloudnet Processing Scheme is an ongoing activity based on the

		availability of the IT server infrastructure of ERATOSTHENES CoE.
GBS set-up at TROPOS	Secondment	No physical participation of ERATOSTHENES CoE staff. CARO team participated remotely in core activities during the integration of the Cloud radar container.
Lecture about atmospheric remote sensing	Lecture	Transferred to Training Scheme C due to the delayed starting date of GBS.
Lecture about remote sensing of wind	Lecture	Transferred to Training Scheme C due to the delayed starting date of GBS.
Atmospheric Active Remote Sensing	Workshop	Transferred to Training Scheme C due to the delayed starting date of GBS.
Implementation of PollyNET Processing Scheme	Training (online)	Cancelled because of the complexity to be implemented by ERATOSTHENES CoE. It is agreed that ERATOSTHENES CoE will receive in real time the PollyNET processing data for CARO station.

3.2 DLR

Regarding the activities for Capacity Building Scheme B not implemented by Strategic Partner DLR**,** the activities were adjusted to the needs of the ERATOSTHENES Centre of Excellence (ERATOSTHENES CoE). One activity has been rescheduled for implementation under the future Capacity Building Scheme C and two have been replaced by a workshop that covered the needs of the Maritime team.

Capacity Building / Knowledge Transfer Activity	**Type of Activity**	**Rationale**
Training on DLR's SAR-AIS Integrated Toolbox (SAINT) software which is used to derive Level 2 (L2) maritime information products, such as ship detection, wind speed, and sea state, fully automatically and in near real-time. This training includes operation and configuration of SAINT and ancillary software,	Training	Replaced with the "Second Workshop on Maritime Security, Surveillance, and Awareness" held in Paphos on 9th of April 2024 during the 10th Conference on Remote Sensing and Geoinformation of the Environment (RSCy 2024).

settings for operational processing to cover different types of sensors and products, as well as validation of the generated L2 products. (Marine)		
Introduction and NSG specific technical overview of antenna system, reception and automation system including antenna HF components, baseband systems, and telemetry processing and storage systems. (Marine)	Training	Replaced with the "Second Workshop on Maritime Security, Surveillance, and Awareness" held in Paphos on 9th of April 2024 during the 10th Conference on Remote Sensing and Geoinformation of the Environment (RSCy 2024).
Training on processing data derived from flight campaign CERAD in Cyprus. The flight campaign will be a new Research-Capacity-Demonstrator also including the processing of the data. (Big Data)	Training	**Transferred to Training Scheme C**. The reason for the delay is that the required pre-processing of the collected data has just been completed.

3.3 NOA

Several activities planned by Strategic Partner NOA under Capacity Building Scheme B were not implemented as originally scheduled. Some of these activities were replaced by a training linked to a demo project, ensuring relevant knowledge transfer. The remaining activities have been rescheduled for implementation under the next Capacity Building Scheme C.

Capacity Building / Knowledge Transfer Activity	Type of Activity	Rationale
Floods: Overview of using data and state-of-the-art technologies, models and scientific approaches wrt: Diachronic Sentinel-based flood extent mapping, & NWP forecasting system for early warning and hydrologic and hydraulic models for real time monitoring	Training	Replaced with "Seminar on holistic multi-parameter flood risk assessment and management planning at high spatial resolution." Linked with demo project.
Floods: Overview of assimilation techniques with the integration of Sentinel-based flood extent mapping with other data sources.	Training	**Transferred to Training Scheme C** Allocation of enormous amount of time from the

Ingestion of crowdsourced and EO data for real time monitoring and Flood frequency analysis		advance partners (NOA) to train the research team of ERATOSTHENES CoE on hydraulic modelling and multi-criteria decision analysis for identifying optimal escape routes under different flood scenarios. This decision was mutually agreed by both parties due to the necessity to acquire solid background on this field of research.
Overview of FloodHub workflows: This session could include an overview of using data and state-of-the-art technologies, models and scientific approaches with regard to: Real-time & near real-time disaster flood monitoring. (Disasters Risk Reduction)	Training (Limassol, Cyprus)	**Transferred to Training Scheme C** Allocation of enormous amount of time from the advance partners (NOA) to train the research team of ERATOSTHENES CoE on hydraulic modeling and multi-criteria decision analysis for identifying optimal escape routes under different flood scenarios. This decision was mutually agreed by both parties due to the necessity to acquire solid background on this field of research.
Fires: Overview of using multisource EO/in-situ/sensor data and state-of-the-art technologies, models and scientific approaches to support fire fighting in all phases of crisis management (preparedness, during crisis, post crisis) wrt: Dynamic fire risk; Damage assessment (post crisis); Early detection; Fire monitoring	Training	Replaced with "Seminar on the development of automatic processing chains for data collection and preprocessing" and "Seminar on Machine Learning and Geospatial Analytics for Fire Risk Management". Linked with demo project.
Overview of FireHub workflows: This session could include an overview of using multisource EO/in-situ/sensor data and state-of-the-art technologies, models and scientific approaches to	Training (Limassol, Cyprus)	Replaced with "Seminar on the development of automatic processing chains for data collection and preprocessing" and "Seminar on Machine Learning and Geospatial

support firefighting in all phases of crisis management (preparedness, during crisis, post crisis) with regards to: Dynamic fire risk; Damage assessment (post crisis); Early detection; Fire monitoring. (Disasters Risk Reduction)		Analytics for Fire Risk Management". Linked with demo project.
Estimation of yield productivity: This session could cover the theory and practical applications of various techniques for estimating crop yields, uncertainty analysis, and validation of results, with opportunities for participants to ask questions. Hands-on exercises to be decided depending on the infrastructure provision of ERATOSTHENES CoE. (Agriculture)	Seminar (Limassol, Cyprus)	Replaced with "Causal & Explainable AI in Agriculture" workshop.
Decomposition of ascending and descending velocities: This session could involve delivering a presentation or workshop that covers the theory and practical applications of this technique. It covers the mathematical basis of the decomposition method, as well as the data requirements and processing steps involved. Additionally, the workshop could include hands-on exercises that allow participants to apply the decomposition method to datasets, with guidance and feedback provided by the trainer. (Disasters Risk Reduction)	One-to-one Training (online)	Replaced with "Training course on InSAR time-series analysis using Sentinel-1 images and ISCE software." Linked with demo project.
Phenology monitoring using Earth Observation: This session could include: applications of different methods for phenology prediction using multiple heterogenous data	Seminar (Limassol, Cyprus)	Replaced with "Causal & Explainable AI in Agriculture" workshop.

sources (e.g., EO, satellite, meteorological); analyzing temporal patterns in remote sensing data; in-situ campaign protocol; interpretation of results. (Agriculture)		
Data fusion of in-situ IoT sensors data and satellite data: This session could include the different techniques for integrating at least two types of data sources to equip participants with the skills and knowledge needed to effectively fuse in-situ IoT sensors data (e.g., meteorological data or street-level images) and satellite data for various applications. (Agriculture)	Workshop (Limassol, Cyprus)	Replaced with "Synergizing Street-Level Data with Satellite Imagery in Agriculture" workshop.
Comprehensive training on PSI/SBAS and other advanced SAR processing techniques: This session could cover the theory, data processing steps, and practical applications of these techniques. The workshop could include lectures on the underlying principles of SAR interferometry, processing and analyze real SAR data using PSI/SBAS and other advanced techniques. Additionally, the workshop could cover topics such as data quality control, error analysis, and interpretation of results, with opportunities for participants to ask questions and receive feedback from the trainer. (Disasters Risk Reduction)	Training (online)	Replaced with "Training course on InSAR time-series analysis using Sentinel-1 images and ISCE software." Linked with demo project.
Overview of GEObservatory workflow: This session could cover the basic features and functionalities of the GEObservatory workflow and include examples of how the	Training (Limassol, Cyprus)	Replaced with "Training course on InSAR time-series analysis using Sentinel-1 images and ISCE software." Linked with demo project.

workflow has been used in NOA's projects, in order to illustrate its potential applications and benefits. (Disasters Risk Reduction)		
Automation of satellite image processing steps using programming	Workshop	Replaced with "Training course on InSAR time-series analysis using Sentinel-1 images and ISCE software." Linked with demo project.
Land and crop suitability analysis: This training will include causality and Machine Learning techniques, as well as jupyter notebook for practical applications. (Agriculture)	One-to-one Training	Replaced with "Causal & Explainable AI in Agriculture" workshop.
WebGIS for agricultural applications: This activity is designed to provide participants with an introduction to the tools and techniques for visualizing and publishing geospatial data via web apps. The activity will guide participants through the process of creating a web-based map using popular geospatial software tools and will cover topics such as importing data, sharing data, configuring the map layout, customizing the appearance of the map and handlings users requests. Topics like experimenting with different features and creating a web app or/and API on the top of repository hosting geospatial data may be covered. (Agriculture)	Workshop	Cancelled as ECoE hired personnel with relevant expertise, and the training will take place internally.

3.4 PMODWRC

Regarding the activities for Capacity Building Scheme B not implemented by Strategic Partner PMODWRC, one activity has been replaced by a training linked to a demo project, ensuring relevant knowledge transfer, and one has been rescheduled for implementation under the Capacity Building Scheme C.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 857510.

This project has received funding from the Government of the Republic of Cyprus through the Directorate General for the European Programmes, Coordination and Development as well as the Cyprus University of Technology.

Capacity Building / Knowledge Transfer Activity	Type of Activity	Rationale
Set-up of network of in-situ sensors and training on the fusion modeling /assimilating satellite and in-situ/sensor data (PMOD/WRC and NOA)	Workshop	Replaced with "Synergizing Street-Level Data with Satellite Imagery in Agriculture" workshop.
Energy related products. Description: The seminars are intended in order to provide basic knowledge on applications that can be developed, used also in Cyprus	Lecture	Replaced with " Modeling of solar radiation, part 2 and scientific applications for Cyprus / Modeling exercise discussion." Linked with demo project.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 857510.

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4 Description of Demonstration Activities linked with Capacity Building Activities

4.1 Overview of Demonstration Activities

4.1.1 Capitalizing on the Eratosthenes Data Cube to Support the Development of the Fire Risk Prediction Model

This demonstration aims to advance the sustainable management of forest fires by developing an accurate fire danger prediction model. This initial phase, conducted in collaboration with NOA and the ERATOSTHENES CoE, focused on collecting and integrating essential datasets into the ERATOSTHENES Data Cube to support NOA's existing fire risk framework. This process prepares the data for subsequent phases (Demonstration 2) by enabling data processing steps crucial for fire risk prediction. The proposed model incorporates multispectral optical imagery, geomorphological parameters, and meteorological data to develop enhanced products and services, leveraging both existing and new observational capabilities. This effort highlights the potential for research excellence within the ERATOSTHENES CoE, utilizing advanced models and methodologies for effective forest fire management. Notably, these efforts have been documented in a joint publication with NOA and NTUA, titled "Spatio-temporal Analysis of Forest Fires in Cyprus Utilizing Multimodal Dataset." Linked capacity-building activities have included seminars on developing automatic processing chains for data collection and pre-processing (November 2023) and on using machine learning and geospatial analytics for fire risk management (May 2024).

4.1.2 Flood Risk Assessment Toward Disaster Risk Reduction

This demonstration focused on showcasing the skills and knowledge gained during a capacity-building training course provided by NOA as part of WP6. Conducted by Alexia Tsouni (in-person), and Stavroula Sigourou and Vasiliki Pagana (online), this activity aimed to enhance flood risk assessment capabilities to support disaster risk reduction. The project demonstrated the application of research enablers in flood risk assessment by leveraging existing data, new observational tools, and advanced models. It also highlighted the capabilities of ERATOSTHENES CoE through collaboration between its staff and NOA/IAASARS/BEYOND as a strategic partner. Following the project, ERATOSTHENES CoE personnel are expected to train new employees from other thematic clusters and conduct a gap analysis to identify future needs in flood risk assessment. The project included a practical case study on the Mandra river basin in Attica, Greece, using a methodology that integrated remote sensing, geospatial data, in-situ observations, and hydrological and hydraulic simulations. This activity involved ERATOSTHENES CoE experts in hydrology, hydraulics, GIS, and remote sensing, covering key aspects such as flood vulnerability, exposure assessment, and mitigation measures for worst-case scenarios. By promoting idea creation, sharing, and evaluation, this demonstration project showcased ERATOSTHENES CoE's capacity to contribute to disaster risk reduction effectively.

4.1.3 Cyprus Geohazards Demonstration Project Phase II – Monitoring Critical Infrastructures from Space

This demonstration focuses on demonstrating the capabilities of the ERATOSTHENES CoE in disaster risk reduction, specifically monitoring critical infrastructure using satellite data. This project emphasizes the development of concrete research enablers and aims to showcase the research excellence potential of ERATOSTHENES CoE through the development of enhanced products and services. These services leverage existing data sources, new observational capabilities, and advanced models and methodologies. The project is designed to build lasting capacity within ERATOSTHENES CoE, with knowledge acquired through collaboration with NOA being transferred to new personnel. This initiative also involves evaluating demonstrations, identifying gaps, and updating human resources, equipment, and capacity-building strategies accordingly. As part of this project, NOA conducted a two-day hands-on training session at ERATOSTHENES CoE in September 2023, which covered topics such as the use of ISCE open-source software for InSAR processing, the principles of PSI and SBAS techniques, data acquisition, and the workflow of advanced InSAR techniques. This hands-on training prepared ERATOSTHENES CoE personnel to tackle real-world challenges in critical infrastructure monitoring, further enhancing their technical capacity and readiness for future research initiatives.

4.1.4 Maritime Situational Awareness "MARSIAWA''

This demonstration activity focused on developing a system for automatic maritime situation awareness in the eastern Mediterranean Sea using Synthetic Aperture Radar (SAR) data processed by DLR's SAINT processor. This demonstrator utilized SAR Earth Observation data from the Copernicus Data Hub and DLR archive as well as Automatic Identification System (AIS) data received via our own ERATOSTHENES CoE AIS station in Limassol to derive crucial maritime information, including ship positions, wind speeds and wave heights, providing a comprehensive spatial overview and identifying potential hazards. By combining SAR data from Sentinel-1 and AIS data, the ERATOSTHENES CoE contributed to maritime protection, conservation, and safety management. The focus was on demonstrating near real-time (NRT) satellite-based solutions for maritime situation awareness. The demonstration project included tasks such as mission planning for a defined Area of Interest (AOI), starting with data from available via the Copernicus Data Space Ecosystem and real-time downlink and processing of Sentinel-1 data using DLR ground station assets, L2 processing, and data fusion to generate information products, followed by process and product evaluation. To support capacity building, a training on "Principles of SAR-based Maritime Information Retrieval for Maritime Safety and Security" was conducted from 7th to 9th February 2023, enhancing ERATOSTHENES CoE's expertise in maritime safety and security using advanced SAR techniques and NRT processing applications.

4.1.5 Solar energy and UV radiation: Improvement of Forecasting Products and Initiation of the Surface-Based Monitoring Network

This demonstration activity aimed to enhance solar energy forecasting and UV radiation monitoring capabilities in Cyprus. During the first phase of the project, an application was developed to forecast the biological effects of solar UV irradiance on humans, providing a UV index forecast for the next 24 hours under cloudless conditions. In the second phase, the application was upgraded to include cloud effects, allowing accurate UV index forecasting for the next 48 hours under all-sky conditions. Additionally, a new product was created to forecast potential solar energy production in Limassol using the Global Horizontal Irradiance (GHI) metric. To support this effort, a network of five ground-based monitoring stations was established across Cyprus to monitor the UV index and GHI, providing essential data for the validation of forecasting products. The project's primary objectives included establishing a comprehensive solar radiation and energy monitoring network, developing a solar energy forecasting application, and upgrading the UV index forecasting application. To support capacity building, Dr. Ilias Fountoulakis from NOA visited the ERATOSTHENES CoE in November 2023, assisting with the installation of instrumentation and providing training on the proper operation and maintenance of the instruments.

4.1.6 Active Remote Sensing Observations for Aerosol Resulted from Wildfires

This demonstration activity aimed to enhance understanding of aerosol properties resulting from biomass burning events, particularly those affecting the eastern Mediterranean atmosphere. Led by ERATOSTHENES CoE with guidance from the advanced partner TROPOS, this project utilized the newly built Ground-Based Station (GBS) in Limassol, equipped with PollyXT Raman lidar and Doppler wind lidar, to produce critical atmospheric products. The focus of this initial phase, which began in September 2023, was on studying aerosol properties, with plans to expand into aerosol-cloud interaction studies in 2024 when the GBS reaches full operational capacity. Biomass burning aerosols, which play a significant role in the atmosphere, have become more prevalent due to increased wildfire frequency and intensity, linked to climate change. The project captured data from significant wildfire events, such as the Canadian fires and the Mediterranean fires in 2023, highlighting the importance of understanding aerosol interactions with radiation, clouds, and atmospheric processes. Notably, during the summer of 2021, PollyXT-CYP lidar detected smoke from the extensive wildfires in Turkey, demonstrating the capabilities of the GBS for monitoring transboundary air pollution. Results from these observations were presented at various conferences, including EGU23, RSCy23, and ILRC24. The study continues as part of the Research and Capacity Development (RCD) activities, incorporating additional lidar observations and other datasets from Atmospheric Data Store, Climate Data Store, and spaceborne sensors. To further support capacity building, ERATOSTHENES CoE personnel made two visits to TROPOS in early 2024, with Dragoș Ene in February and Maria Poutli from February to March, facilitating knowledge transfer and skill development.

4.1.7 Agriculture Monitoring: Development and Empirical Evaluation of a Knowledge-Based Recommendation System for Optimal Potato Sowing in Cyprus

This demonstration activity aimed to enhance sustainable potato farming by providing farmers with data-driven insights for improved crop management. The ERATOSTHENES CoE, in collaboration with the NOA, developed a knowledge-based recommendation system to optimize sowing practices, thereby increasing productivity, mitigating risks, and optimizing resource use. This system utilized daily forecasts generated by ERATOSTHENES CoE's Weather Research Forecast (WRF) model to classify optimal sowing conditions into four categories: not recommended, minimum conditions, maximum conditions, and optimal conditions. These classifications were depicted on a grid map, providing farmers with an intuitive visual representation of the best times and locations for sowing. The development of a proof-of-concept application in a user-friendly environment further facilitated adoption. To support the system's implementation, NOA conducted training on "Explainable and Causal AI," enhancing the stakeholders' understanding of the technology and its potential to support sustainable agricultural practices.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 857510.

This project has received funding from the Government of the Republic of Cyprus through the Directorate General for the European Programmes, Coordination and Development as well as the Cyprus University of Technology.

5 Capacity Building Scheme C (November 2024 to June 2026)

Capacity Building Scheme C continues the efforts of the previous training scheme, focusing on further knowledge transfer tailored to the current needs of the ERATOSTHENES CoE's teams. This scheme aims to enhance the knowledge building upon the previous scheme, skills and expertise across all thematic areas, providing advanced training and development opportunities. By addressing the teams' evolving needs, Scheme C ensures that researchers are fully prepared to innovate and meet emerging scientific challenges effectively.

Table 2 outlines the planned activities for Capacity Building Scheme C by the Strategic Partners. This selection includes activities that were postponed from Capacity Building Scheme B, along with the updated requirements of the ERATOSTHENES CoE's researchers. The table details the capacity-building and knowledge transfer activities to be undertaken by each Strategic Partner, specifying the type of activity and the scheduled month and week for implementation. A total of 11 capacity building activities, including trainings, workshops, lectures, webinars and secondments, have been proposed by the strategic partners. Five (5) activities will be conducted by TROPOS in the thematic area of Atmosphere, one (1) by DLR in the thematic area of Big Data, four (4) from NOA in the thematic areas of Flood and Agriculture, one (1) of which will be in collaboration with PMOD/WRC in the thematic areas of Energy and Atmosphere, and one (1) by PMOD/WRC in the thematic area of Energy.

This information underscores the comprehensive strategy for capacity building and knowledge transfer. Further details regarding the selected activities can be found in the Appendices.

Table 2: Capacity building and knowledge transfer activities for Capacity Building Scheme C

Partner / Lecturer	**Capacity Building / Knowledge Transfer Activity**	**Type of Activity**	**# of days**	**Expected Impact**
TROPOS	Atmospheric remote sensing education	Online lecture	1	Equip participants with the knowledge and skills to critically assess various measurement techniques and apply them in atmospheric remote sensing.
TROPOS	GBS – Setup of PollyNET processing chain	Training workshop	4 weeks	Empower participants with the skills to generate high-quality PollyXT Raman lidar profiles using the PICASSO analysis software. Participants will also be capable of producing publication-grade results, significantly enhancing their ability to

				contribute to cutting-edge research in atmospheric science and lidar data analysis.
TROPOS	Microwave and radar remote sensing	Online lecture	1	Provide participants with the expertise to evaluate the strengths and limitations of microwave and radar sensing techniques, and also be able to apply them to available data.
TROPOS	Optical remote sensing	Online lecture	1	Equip participants with the ability to critically assess various optical sensing techniques, and also be able to apply them to available data.
TROPOS	Remote sensing of wind	Online lecture	1	Provide participants with a comprehensive overview of the methodologies used to measure global wind.
DLR	Training on processing data derived from flight campaign CERAD in Cyprus. The flight campaign will be a new Research-Capacity-Demonstrator also including the processing of the data. (Big Data)	Training	1	Empower ERATOSTHENES CoE's researchers with a thorough understanding of the data processing methods used for the imagery collected during the flight campaign. The researchers will also be equipped to utilize the resulting outcomes—such as true-ortho-images, digital surface and terrain models—in their own studies, enhancing the quality and depth of their research.
NOA	Floods: Overview of assimilation techniques with the integration of Sentinel-based flood extent mapping with other data sources. Ingestion of crowdsourced and EO data for real time	Training	2	By familiarizing members of the ERATOSTHENES CoE with these processes, this training will empower them to effectively implement

	monitoring and Flood frequency analysis			flood monitoring strategies.
NOA	Overview of FloodHub workflows: This session could include an overview of using data and state-of-the-art technologies, models and scientific approaches with regard to: Real-time & near real-time disaster flood monitoring. (Disasters Risk Reduction)	Training	2	
NOA	EO change detection for improved grassland monitoring	One to one training	1	Provide participants with hands-on experience in utilizing EO data for effective grassland monitoring. The participants will also be able to apply machine learning techniques to analyze the impacts of various grassland management activities. Additionally, the participants will develop improved skills in Python programming for data analysis in environmental contexts.
PMOD/WRC and NOA	Analysis of UV/VIS Spectrum from Bentham Spectroradiometer. Description: Train participants to analyze UV/VIS spectral data to understand solar irradiance, atmospheric constituents, and the effects of aerosols or clouds.	Webinar	2	Equip participants with specialized skills in spectroradiometric data analysis, enhancing their ability to interpret UV/VIS spectral data effectively. Additionally, a common effort will begin towards using ERATOSTHENES CoE's solar and aerosol data resulting into a publication.
PMODWRC	Secondment at PMOD/WRC for solar instrument and data analysis / aerosol cloud radiation interaction training / satellite validation training, transfer of knowledge	Secondment	3 periods 3 weeks each	Enhance participants' expertise in solar radiation instrumentation and their understanding of aerosol-cloud radiation

				interactions. Through comprehensive training on field campaign protocols, measurement, standards, satellite products and validation techniques, participants will be better equipped to analyze existing data. This collaborative effort will also support their progression towards a conference presentation and contribute to their PhD research, fostering knowledge transfer and practical application of advanced concepts in the field.

The proposed capacity building activities under the EXCELSIOR project are designed in response to the project's ongoing needs and priorities. The proposed activities for Capacity Building Scheme C are preliminary and may be subject to adjustments. These modifications will be implemented as necessary by the advanced partners and the ERATOSTHENES CoE to ensure alignment with the specific requirements and needs.

The above-mentioned trainings, workshops, webinars, and lectures aim to significantly enhance the ERATOSTHENES CoE's researchers' skills and knowledge in key areas of remote sensing, data analysis, environmental monitoring, and advanced technologies. Through hands-on experience and the application of machine learning, Python programming, and specialized software tools, the researchers will develop the ability to process, analyze, and interpret complex data sets for diverse applications. These activities will foster the development of expertise in using Earth Observation data and promote collaborative efforts toward impactful research and publications.

This flexibility ensures that the capacity building efforts remain effective and tailored to address the dynamic needs of all stakeholders involved in the project.

6 Conclusions

In conclusion, the activities for transfer of knowledge and experience have effectively strengthened the ERATOSTHENES CoE's capacity through a series of diverse and targeted training activities. These activities, carried out between June 2023 and October 2024, were designed to address specific knowledge gaps in all three departments: Environment & Climate, Resilient Society, and Big Data Analytics. Collaborating with strategic partners like NOA, DLR, PMOD/WRC and TROPOS, the capacity-building programs emphasized both theoretical and practical aspects, ensuring participants acquired advanced technical and research skills. The successful execution of these activities not only increased institutional expertise but also fostered collaborative research and application of new methodologies that are critical to the ERATOSTHENES CoE's growth and development.

Despite facing logistical challenges such as equipment delays and scheduling conflicts, the flexibility of the training programs allowed for adjustments, such as transitioning to online formats when necessary. These adaptations ensured the continuity of knowledge transfer and maintained the high quality of the training sessions. Overall, the deliverable demonstrates significant progress in achieving the intended outcomes of capacity building, with visible improvements in research capabilities, technical skills, and participant expertise.

Appendix A - Selected trainings by TROPOS scheduled for Capacity Building Scheme C

TROPOS Capacity Building Scheme C will be featured as described in the below table:

Partner	Title	Kind of training		Length
(1) Atmospheric remote sensing education				
TROPOS	Atmospheric remote sensing education	Lecture	2025/2026	1 day each
TROPOS	➔ Optical remote sensing lidar	Lecture		
TROPOS	➔ Microwave and radar remote sensing	Lecture		
TROPOS	Remote Sensing of Wind	Lecture		
(2) GBS implementation				
TROPOS	Set up of PollyNet Processing chain on ECoE virtual server	Knowledge transfer	2025/2026	4 weeks

Training / Workshop / Webinar form

Title of Training	Atmospheric remote sensing education
Introduction / Description	Basic and advanced knowledge about remote sensing of the atmosphere with active and passive measurement techniques working in the microwave wavelength regime.
Strategic Partner	TROPOS
Name of applicant	TROPOS
Name of presenter(s)	Holger Baars, Patric Seifert, Heike Kalesse-Los
Number of Participants	Up to 10
Duration of Training	4 h per week
Location of Training	Online
Duration - dates	October 2024 – January 2025
Type of Training	Lectures
Training skills required	Basic training in geophysics, physics or meteorology
Training equipment	Computer with internet access and web browser
Training objective	The lectures will teach the most important measurement principles of active and passive remote sensing with microwave and optical techniques such as radar and lidar. • Introduction • EM waves • Physical laws of radiation scattering • Inverse methods • Passive remote sensing with microwaves • Active remote sensing with radar • The Doppler effect (effect, radar, dilemma) • Doppler spectra • Microphysics of the liquid phase • Microphysics of the ice phase, radar polarimetry I • Radar polarimetry II • Radar forward modeling • Cloud radar applications • Advanced Cloudnet radar products • Optical remote sensing with lidar • Spaceborne remote sensing • Remote Sensing of Wind • Wrap-up and implementation session
Outcomes	The participant is capable of assessing the capabilities of the measurement techniques presented and able to apply them to available data.
Program	See attachments: • Program – Lidar remote sensing (lidar_lecture.pdf) • Program – Microwave remote sensing (mwr_lecture.pdf)

Activities (must be attached)	See attachments: • Program – Lidar remote sensing (lidar_lecture.pdf) • Program – Microwave remote sensing (mwr_lecture.pdf)

The final approval is required by the EXCELSIOR project manager.

Training/ Workshop / Webinar form

Title of Training	GBS – Setup of PollyNET processing chain
Introduction	The activity is intended for specialists working with PollyXT Raman lidar data enabling them to handle, evaluate and use of its data.
Strategic Partner	TROPOS
Name of applicant	TROPOS
Name of presenter(s)	Holger Baars and Andi Klamt (both TROPOS)
Number of Participants	up to 5
Duration of Training	4 weeks
Location of Training	online / remote server access
Duration -Beginning/ end dates	Continuous until processing chain is set up
Type of Training	Research capacity transfer action
Training skills required	Computer programming in python and matlab
Training equipment	Computer with internet access
Training objective	Enabling processing of PollyXT Raman lidar data on ECoE servers. Generation of profiles of multi-wavelength aerosol extinction coefficient, depolarization ratio and angstrom exponent. Ability to disambiguate between ice, drizzle and aerosol particles. Knowledge about presenting data and scientific usage.
Outcomes	Participants are capable of creating PollyXT Raman lidar profiles with the specialized PollyXT Raman lidar analysis software PICASSO in order to produce publication-grade results.
Program **(must be attached)**	tbd
Activities **(must be attached)**	tbd

The final approval is required by the EXCELSIOR project manager.

Training/ Workshop / Webinar form

Title of Training	Lecture: Microwave and radar remote sensing
Introduction	Basic and advanced knowledge about remote sensing of the atmosphere with active and passive measurement techniques working in the microwave wavelength regime.
Strategic Partner	TROPOS
Name of applicant	TROPOS
Name of presenter(s)	Patric Seifert, Heike Kalesse (Uni Leipzig)
Number of Participants	up to 10
Duration of Training	2h per week
Location of Training	online
Duration -Beginning/ end dates	Winter semester of Leipzig University (from 2022)
Type of Training	lecture
Training skills required	Basic training in geophysics, physics or meteorology
Training equipment	Computer with internet access and web browser
Training objective	The lecture will teach the most important measurement principles of active and passive remote sensing in the microwave wavelength regime to the student: • Introduction • EM waves • Physical laws of radiation scattering • Inverse methods • Passive remote sensing with microwaves • Active remote sensing with radar • The Doppler effect (effect, radar, dilemma) • Doppler spectra • Microphysics of the liquid phase • Microphysics of the ice phase, radar polarimetry I • Radar polarimetry II • Radar forward modeling • Cloud radar applications • Advanced Cloudnet radar products

Outcomes	The participant is capable of assessing the capabilities of the measurement techniques presented and able to apply them to available data.
Program **(must be attached)**	tbd
Activities **(must be attached)**	tbd

The final approval is required by the EXCELSIOR project manager.

Training/ Workshop / Webinar form

Title of Training	Lecture: Optical remote sensing
Introduction	Lecture about remote sensing with methods of the optical wavelength regime
Strategic Partner	TROPOS
Name of applicant	TROPOS
Name of presenter(s)	Albert Ansmann, Ulla Wandinger, Dietrich Althausen, … (TROPOS)
Number of Participants	up to 10
Duration of Training	2h per week
Location of Training	online
Duration -Beginning/ end dates	Winter semester of Leipzig University (from 2022)
Type of Training	lecture
Training skills required	Basic training in meteorology, physics, geophysics or similar
Training equipment	Computer with internet access and web browser
Training objective	Teaching the basics of lidar remote sensing • Optical setup of a lidar • Signal recording • Raman lidar technique • Polarization measurement technique • Doppler lidar (turbulence, wind) • HSRL • Synergy with other active and passive remote-sensing measurement techniques
Outcomes	The participant is capable of assessing the capabilities of the measurement techniques presented and able to apply them to available data.
Program **(must be attached)**	tbd
Activities **(must be attached)**	tbd

The final approval is required by the EXCELSIOR project manager.

Training / Workshop / Webinar form

Title of Training	Lecture: Remote sensing of wind
Introduction	The lecture is intended to give the participants an overview about the currently available remote-sensing techniques for measuring wind from ground and space and to familiarize them with the potential of the GBS new Streamline Doppler lidar system.
Strategic Partner	TROPOS
Name of applicant	TROPOS
Name of presenter(s)	Johannes Bühl, Ronny Engelmann (TROPOS)
Number of Participants	Up to 10
Duration of Training	2h
Location of Training	online
Duration -Beginning/ end dates	tbd
Type of Training	Online lecture
Training skills required	Basic knowledge of global wind systems and their remote sensing • Global wind systems • Current ground-based and airborne wind-measuring networks • Remote-sensing of wind from ground • Current space missions for wind measurement
Training equipment	Computer with internet access and web browser
Training objective	Teaching an overview about global wind measurement
Outcomes	Participants have an overview about the measurement of global wind
Program **(must be attached)**	tbd
Activities **(must be attached)**	tbd

The final approval is required by the EXCELSIOR project manager.

Appendix B - Selected trainings by PMOD/WRC and NOA scheduled for Capacity Building Scheme C

Training / Workshop / Webinar form

Title of Training	Analysis of UV/VIS Spectrum from Bentham Spectroradiometer
Introduction / Description	Train participants to analyze UV/VIS spectral data to understand solar irradiance, atmospheric constituents, and the effects of aerosols or clouds.
Strategic Partner	NOA and PMODWRC
Name of applicant	
Name of presenter(s)	Ilias Fountoulakis, Stelios Kazadzis
Number of Participants	3+
Duration of Training	2 days, 3 hours each
Location of Training	Online
Duration - dates	First week of December, date TBD
Type of Training	Webinar
Training skills required	Programming skills, Matlab or Python
Training equipment	PC
Training objective	Data analysis and scientific interpretation of results
Outcomes	Provision of specific spectroradiometric data analysis skills Start of a common effort towards using ECoE solar and aerosol data towards a publication
Program	Preparation phase and data availability, through email 1st day points 1 and 2 below 2nd day points 3 and 4th below.
Activities (must be attached)	• Overview of the Bentham spectroradiometer: how it works, calibration procedures, and data acquisition. • Techniques for interpreting spectral data, focusing on key wavelength bands for atmospheric studies (UV, VIS). • Practical session on identifying and analyzing features related to ozone, aerosols, and water vapor in the UV/VIS spectrum. • Use of specialized software for spectral data processing and analysis

The final approval is required by the EXCELSIOR project manager.

Appendix C - Selected trainings by PMOD/WRC scheduled for Capacity Building Scheme C

Training / Workshop / Webinar form

Title of Training	Secondment of G. Charalampous at PMOD/WRC for solar instrument and data analysis / aerosol cloud radiation interaction training / satellite validation training, transfer of knowledge
Introduction	G. Charalampous is a young scientist that has just started her PhD in atmospheric and solar physics and this secondment can be considered as very important on gaining experience both on three specific aspects: Based on the new solar infrastructure at ECoE; *instrument calibration and quality assurance, also for data analysis, gap filing and related applications.* Based on state-of-the-art atmospheric science gaps related with *aerosol-cloud-radiation interactions* Based on the need of tools and knowledge for *satellite validation especially Earth Care that ECoE will be involved in the near future.* The proposed activity structure is based on the project review comments on secondments: ***"An increased use of secondments is recommended. Such secondments should be of significant length (e.g. at least 3 months), in order to achieve relevant impact."*** The secondment will be held both in PMODWRC, Davos and Zurich ETHZ Switzerland and also a participation in an experimental Earth Care campaign is foreseen according to the schedule presented below.
Strategic Partner	PMODWRC, Switzerland
Name of applicant	G. Charalampous (ECOE)
Name of presenter(s)	S. Kazadzis, A. Masoom, A. Moustaka, K. Papachristopoulou, N. Kouremeti (PMODWRC)
Number of Participants	1
Duration of Training	**3 periods 3 weeks each**
Location of Training	First period at **ETHZ Zurich, department of Physics**, Zurich, Switzerland with 3 daily visits to PMODWRC, Dorfstrasse 33, 7260, Davos Dorf, Switzerland

	2nd period at the **ESA/PMOD/WRC Earth Care Exploratory Campaign** at Thessaloniki, Greece 3rd period at the **WMO international solar and aerosol intercomparison** at PMODWRC, Dorfstrasse 33, 7260, Davos Dorf, Switzerland
Duration - dates	Period 1: 13.1-31.01. 2025 Period 2: 3 weeks during March – April. 2025. Exact dates will be determined in January 2025 Period 3: 22.09.2025 – 12.10.2025
Type of Training	Secondment including both hands-on skills on instrument calibration, tools and sharing knowledge on time series data analysis, theoretical aspects and direct involvement in field experimental campaign tasks and duties. In general, also gaining experience on working in a foreign institute.
Training skills required	Basic knowledge of Atmospheric Physics
Training equipment	Infrastructure of the calibration laboratory of PMOD/WRC will be used in order to demonstrate calibration, quality assurance and control aspects. Field instrument for solar aned aerosol measurements. International WMO based campaign protocols, measurements and instrumentations. ECoE equipment to participate in the campaigns.
Training objective	Share knowledge and experience with solar measurement instrumentation at the WMO defined World solar Radiation Center and also sharing and ideas on the use of existing and foreseen data of solar and aerosol infrastructure at ECoE towards long term trend studies, atmospheric processes studies and satellite validation.
Outcomes	Enhance experience on solar radiation instrumentation. Enhance knowledge on aerosol cloud radiation interactions Enhance knowledge of field campaign protocols, measurements and standards. Enhance knowledge of satellite products and validation techniques Work on existing data towards a conference presentation and PhD progress

Program	Period 1: Week 1 Introduction to aerosol-cloud -radiation interaction based on results webinars and information of the ongoing project Certainty https://certainty-aci.eu/ Week 2. Calibration of sun photometric and aerosol data at PMOD/WRC Davos in order to be used in the Earth Care validation campaign Week 3: Insights on solar data analysis and interpretation Period 2: 3-week participation in the ESA/PMOD/WRC Earth Care validation campaign at Thessaloniki Greece with PMODWR, Un. Of zurich, AUTH and NOA, Greece instruments and participation. (Decision of official participation (including instrumentation) of ECoE in the campaign is under discussion). Period 3: Participation in the 3-week WMO intercomparison campaign with ECoE instrumentation at PMODWRC. The campaign hosts over 100 scientists/institutes and instruments from different worldwide spread institutes. General integration and discussion with different PMOD/WRC scientists including: senior scientists, scientific personnel and technical personnel dealing with solar and aerosol remote sensing calibration and monitoring Overview of ETHZ infrastructures, discussion with relevant scientists.
Activities	As described in the Program

The final approval is required by the EXCELSIOR project manager.

Appendix D - Selected trainings by DLR scheduled for Capacity Building Scheme C

Training/ Workshop / Webinar form

Title of Training	Training on processing and using data derived from flight campaign CERAD in Cyprus (Big Data)
Introduction	The course is intended for students and scientists working with the data derived from the CERAD flight campaign in June 2023
Strategic Partner	DLR
Name of applicant	DLR
Name of presenter(s)	Thomas Krauß (DLR)
Number of Participants	up to 15
Duration of Training	1 day
Location of Training	Online
Duration - dates	4 hours
Type of Training	Training
Training skills required	Basic knowledge on (airborne) remote sensing and hyperspectral imagery
Training equipment	Access to online-meeting (maybe zoom)
Training objective	In the CERAD joint flight campaign 10 locations across Cyprus will be acquired using in parallel the DLR 3K-camera system and the HySpex hyperspectral sensor. In the training the original data and their processing in the processing chain CATENA of DLR will be shown and the characteristics and further usage of the resulting imagery and derived information will be described (true-ortho-images, digital surface and terrain models, …)
Outcomes	Participants know how the original data was processed and can use the resulting outcomes for their own studies.
Program (must be attached)	TBD
Activities (must be attached)	TBD

The final approval is required by the EXCELSIOR project manager.

Appendix E - Selected trainings by NOA scheduled for Capacity Building Scheme C

Training/ Workshop / Webinar form

Title of Training	Overview of FloodHub workflows (Disasters Risk Reduction)
Introduction	This session could include an overview of using data and state-of-the-art technologies, models and scientific approaches with regard to: Real-time & near real-time disaster flood monitoring. (Disasters Risk Reduction)
Strategic Partner	NOA
Name of applicant	ERATOSTHENES
Name of presenter(s)	Alexia Tsouni, Stavroula Sigourou, Vaso Pagana
Number of Participants	TBC
Duration of Training	2 days
Location of Training	Limassol, Cyprus
Duration - dates	TBC
Type of Training	Training / Workshop
Training skills required	EO background and water management specialization.
Training equipment	Laptops, internet connection, HEC-RAS
Training objective	ECoE to familiarize and start working on flood monitoring.
Outcomes	TBC
Program (must be attached)	TBC
Activities (must be attached)	TBC

The final approval is required by the EXCELSIOR project manager.

Training / Workshop / Webinar form

Title of Training	EO change detection for improved grassland monitoring
Introduction / Description	Grasslands are vital ecosystems, providing services like biodiversity support and carbon sequestration, while also serving as key areas for livestock grazing. Sustainable management of these areas requires monitoring changes in grassland conditions, particularly grazing intensity and plant biomass, to maintain ecological balance. Remote sensing (RS) and Earth Observation (EO) data offer effective ways to monitor grasslands, allowing for scalable analysis over time. By utilizing satellite imagery and Machine Learning (ML), this training will focus on detecting changes in plant biomass and assessing the impacts of grazing, providing insights for better land management decisions.
Strategic Partner	NOA
Name of applicant	Menelaos Stavrinides
Name of presenter(s)	Jason Tsardanidis
Number of Participants	1-2 people
Duration of Training	1 day
Location of Training	On-site in ECoE's premises
Duration - dates	December 2024
Type of Training	One to one training
Training skills required	Participants should have: ● Basic knowledge of Remote Sensing ● Familiarity with Data Science principles ● Basic proficiency in Python programming ● An understanding of Machine Learning concepts
Training equipment	Optional: ● Laptop with Python installed ● Jupyter Notebook environment
Training objective	The primary goal of this training is to equip participants with both theoretical knowledge and practical skills to detect changes in grasslands using Earth Observation (EO) data. The workshop will focus on both threshold-based and Machine Learning (ML) approaches to assess activities such as grazing and mowing, and their impacts on plant biomass and ecosystem health. In addition, participants will be introduced to more advanced Artificial Intelligence (AI) techniques and architectures within the broader framework of change detection using EO data. By the end of the session, participants will have a solid understanding of how to analyze satellite imagery, implement ML models, and interpret the results for practical decision-making in the sustainable management of grasslands.
Outcomes	● Participants will gain hands-on experience in using EO data for grassland monitoring.

	● Ability to apply Machine Learning techniques to analyze the effects of diverse grassland management activities. ● Enhanced knowledge of change detection methods in remote sensing. ● Improved skills in Python programming for data analysis in environmental contexts.
Program	*(This is a preliminary suggestion and can be further modified based on requirements)* ● Introduction and Overview ○ Theoretical background on grassland ecosystems and monitoring using EO data ○ Introduction to Earth Observation (EO) techniques and available satellite data (e.g., Sentinel-2, Sentinel-1) ● Data Analytics & Pre-processing ○ EO data acquisition and preparation ○ Basic data pre-processing techniques for satellite imagery ○ Exploration of key vegetation indices (NDVI, EVI) for biomass estimation ● Machine Learning & Change Detection ○ Introduction to supervised ML and basic techniques for change detection ○ Implementing basic ML models to detect changes in grasslands ○ AI for change detection ● Discussion on post-processing techniques and practical applications in grassland management and Interpreting the results for decision-making
Activities **(must be attached)**	● An overview of the theoretical background on grassland monitoring using EO data ● Data analytics and pre-processing of the available EO data ● Exploring vegetation indices (e.g., NDVI, EVI) to assess plant biomass ● Implementing supervised Machine Learning models for change detection ● Post-processing and interpreting results for real-world application ● Q&A and feedback session

The final approval is required by the EXCELSIOR project manager.