EMME-CARE
EASTERN MEDITERRANEAN
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EMME-CARE

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D5.1 Report on the structure of the Environmental Observations Department

August 2021

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V1	27/05/2021	Initial version		CEA
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V5 (Final)	30/08/2021	Final Version	Creation of the Final Version based on the suggestions of the CARE-C Director and RISO team	Cyl

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Table of Contents

1. Introduction

The **"Eastern Mediterranean Middle East – Climate and Atmosphere Research" Project** *(EMME-CARE, H2020 GA no.856612)* provides scientific, technological and policy solutions through the establishment of a world-class Center of Excellence focusing on environmental challenges. To address these objectives, the Atmosphere & Climate Division (ACD) of the Cyprus Institute (CYI) has been upgraded, its partnerships with world-renown institutes strengthened, and its status and contribution in regional/global networks of the field enhanced. The new CoE established (in January 2020) is the Climate and Atmosphere Research Center (CARE-C) of the CYI.

The Deliverable 5.1 at hand, as per the GA, reports on the **structure of the Environmental Observations Department (EOD) of the Centre of Excellence (CoE)**. It presents an update on its establishment, structure and functions. It further showcases the role of the EOD in alignment with the EMME-CARE scientific and educational objectives, its linkage to the national and international infrastructure and research landscape, and the overall expected and realized impact. Part of the information delivered here has been reported in the *"Periodic Report to European Commission corresponding to First Reporting Period – RP1 – Technical Part".*

Operational context

This Deliverable (*D5.1 Report on the structure of the Environmental Observations Department*) is the first deliverable of Work Package led by CEA and connected to MS19 (see below)

Work package number	**5**	**Lead Beneficiary**			**CEA**
Work package title	**Environmental Observations Department**				
Participant number	1	2	3	4	
Short name of participant	CyI	MPG	CEA	UH	
Person months per participant:	**180**	**14**	**64**	**50**	
Start month	**M1**	**End month**		**M84**	
Objectives: This WP will support the creation and long-term development of an Environmental Observations Research Department that will provide high quality environmental observations currently missing in the EMME region, to better inform model predictions and support impact assessment studies of air pollution, climate change and related environmental questions.					
Deliverables D5.1: Report on the structure of the Environmental Observations Dept. - linked to Task 5.1 (M24). D5.2: Report on new environmental observations in the EMME region - linked to Task 5.2 (M36). D5.3: Mid-term Report on the CoE's scientific leadership in regional environmental observations – Linked to Tasks 5.3, 5.4 (M42). D5.4: Final Report on the CoE's scientific leadership in regional environmental observations – Linked to Tasks 5.3, 5.4 (M84). D5.5: Review report on the long-term research strategy/performance high-impact roadmap toward 2030+ (M84)					
Milestones MS19: Environmental Observations Research Department. established & fully operational (M24). MS20: First environmental observations in the EMME region (M24). MS21: Long-term comprehensive environmental observations fully implemented in Cyprus and integrated in EU research infrastructure and international networks (M48). MS22: Regional network on environmental observations established (M60).					

The Environmental Observations Department is an upgrade of the Experimental Group of the Atmosphere and Climate Division, previously under the Energy, Environment and Water Research Center (EEWRC) of the Cyprus Institute.

As per the EMME-CARE Grant Agreement, the Environmental Observations will be focused on:

- An "***Environmental Monitoring***" whose aim is to characterise atmospheric composition, related environmental parameters and trends through continuous long-term measurements, combining ground-

based (in-situ and remote sensing) observations, vertical in-situ profiling (UAVs), and satellite-based measurements.

- An "***Emissions and Processes***", whose aim is to analyse, through intensive experimental studies, the atmospheric composition and interactions between gaseous and aerosol pollutants in urban and remote regions of the EMME, identify the sources, quantify the fluxes, and determine the environmental fate, and effects on air quality, climate and biogeochemical cycles.

2. Structure

2.1. Establishment of the Environmental Observations Department (EOD)

2.1.1. Mission

As per the EMME-CARE Grant Agreement, "*the Environmental Observations Department characterises the atmospheric composition through **long-term observations** at remote sites across Cyprus and the EMME region by combining ground-based (**in-situ and remote sensing**) observations with vertical in-situ profiling (UAVs) and satellite-based measurements. These observations offer a comprehensive description of the atmospheric composition (**GHGs, reactive gases, aerosols, clouds**) at the Cyprus Atmospheric Observatory (CAO), far from local emissions and representative of the regional (EMME) atmospheric environment. Long-term observations are complemented by intensive field studies performed in the EMME region on specific **emission** factors and source profiles for source apportionment studies and emission inventory validation. Atmospheric **processes** specific to the EMME region (such as the impact of air pollution on desert dust) are being characterised experimentally under controlled atmosphere (laboratory experiments) and in real-world conditions*".

2.1.2. Staff profile

While Facilities operating under the CARE-C Research Infrastructure Unit gather only Technical Experts, the four (4) CARE-C Departments are exclusively composed by Faculty (Assistant, Associate, and Full Professor) and Researchers (Assistant, PhDs, Post-Docs, Associate Research Scientists, and Research Scientists). **Figure 1** (below) shows the current structure of EOD (as of 31/08/2021).

2.1.3. Structure and Governance

Department Head: The terms of reference of the Department Head are limited and reflects the enhanced level of autonomy given to the different research groups of EOD (see below). Financial resources of EOD (managed by the Department Head) are also limited since research projects are managed at research group level by Faculty. Most of the responsibilities given to the Department Head concern the overall coordination of EOD and its optimal integration within the CARE-C structure. These responsibilities include (not exhaustive):

- Management and Administration (e.g. annual budget from CyI, infrastructure needs (offices), annual reporting to the CARE-C Scientific Expert Panel, etc.).
- Scientific development of EOD (e.g. recruitment of Faculty/Research staff, Scientific strategy of the Department, response to (inter)national calls, field campaigns, etc.).
- Scientific dissemination/communication through regular internal meetings, and the development of regional (EMME) and international networks.
- Career development of young researchers (e.g. mentoring, PhD dissertation advisory committees, annual performance evaluation of researchers/faculty).
- Coordination with the CARE-C Research Infrastructure Unit for the allocation of optimal technical support from the different facilities.

Prof. J. Sciare is currently the Head of the EOD. He is the most senior faculty of this Department (the only full-time Professor of EOD) with the best knowledge of the overall R&I priorities of the CoE (as EMME-CARE Coordinator and CARE-C Director). Nevertheless, this responsibility (Head of EOD) will

be transferred to another senior Faculty, as soon as she/he will be either recruited or promoted internally.

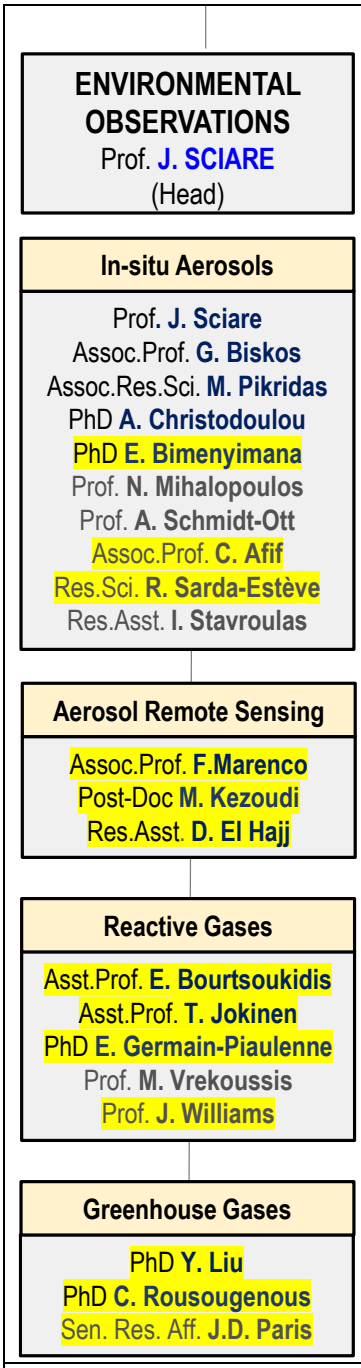


Figure 1: Composition of the Environmental Observations Department.
New staff (recruited since the beginning of EMME-CARE) are in yellow fields.

Composition: Faculty (5) (+3), Associate Research Scientists (1), Post-doc (1) (+1), PhD Students (5) (+4), Research Assistant (1) (+1), Affiliated Faculty (5) (+2), Affiliated Researchers (3) (+2)

TOTAL STAFF: 21 (+13 since the beginning of EMME-CARE)

List PhD research projects:

1. **PhD** A. Christodoulou (2018-2021) (cotutelle CyI – Univ. Lille, France), "*Experimental characterization of organic aerosol and volatile organic compound sources in East Mediterranean and Middle East (EMME) region*"
2. **PhD** Y. Liu (2019-2022) (cotutelle CyI – CEA – Univ. Paris-Saclay, France), "*Profiling Greenhouse Gases (CO_2 and CH_4) source emissions from Unmanned Aerial Vehicles (UAVs)*"
3. **PhD** C. Rousogenous (2019-2022) (CyI), "*Temporal variability and sources of Greenhouse Gases in the Eastern Mediterranean Region*"
4. **PhD** E. Bimenyimana (2020-2023) (CyI): "*Spatial and Temporal variability of atmospheric PM pollution sources in Cyprus*"
5. **PhD** E. Germain-Piaulenne (2020-2023) (cotutelle CyI – CEA – Univ. Paris-Saclay, France)," Contribution *of light hydrocarbon tracers to the estimation of methane sources*"

Key Performance Indicators:

- **Gender Balance of new recruited staff: Male: +8, Female: + 5**
- **Diversity: 9 different nationalities among the 13 recruited staff** (Burundi, China, Cyprus, Finland, France, Greece, Italy, Lebanon, UK)
- **Number of new joint PhDs (co-tutelle): 2** with Advanced Partners (CEA = 2)
- **Number of new affiliates from Advanced Partners: 3** (CEA = 2; MPG = 1)
- **Long-term sustainability: Salary of all Faculty is secured on indefinite basis** (tenure/tenure-track contracts covered by the annual budget received by the Cyprus Institute)

[Note: EOD within the overall CARE-C Organogrammatic Structure is shown in Annex II]

Research Groups: The EOD was initially thought to be structured within 2 groups (Atmospheric Monitoring, and Emission & Processes). However, most of the researchers/faculty of EOD are involved in these 2 research domains, making such split artificial and counterproductive. Consequently, the structure of EOD has been reconsidered and further re-organized as a function of the scientific expertise of Researchers/Faculty.

The **current structure of EOD is composed by 4 Research Groups**, namely:

- "***In-situ Aerosols***"
- "***Aerosol Remote Sensing"***
- "***Reactive Gases***" (both in-situ and remote sensing)
- "***Greenhouse Gases***" (both in-situ and remote sensing)

It is important to note that this structure is fully aligned with the mission of EOD (section 2.1.1), covering the 3 most important components of the atmospheric composition (GHG, reactive gases, aerosols) and gathering both in-situ AND remote sensing expertise. This structure is flexible enough to accommodate new research groups that may be established following the recruitment of new faculty/research personnel with new scientific expertise (e.g. clouds). As highlighted in Figure 1, 3 out of the 4 research groups of EOD are completely new and illustrate the new scientific expertise brought within CARE-C by the recruitment of early career scientists and the alignment of their research thrust with the EMME-CARE Research Objectives (see later on section 3).

The formation of these 4 research groups within EOD is also motivated by the need to help new faculty to lead as soon as possible their own groups with the objective:

- To provide better visibility (inside/outside CARE-C) of their scientific expertise
- To allow them to develop their research with the maximum level of autonomy
- To provide them with clear supervision responsibilities (supervision of PhDs and Post-doc)

2.1.4. Financial Resources

(Inter)Nationally funded Research Projects are managed by Researchers/Faculty within CARE-C departments and most of the financial resources of EOD come from these projects (EMME-CARE included). Salaries, mostly covered by projects, represent, by far, the first expense of EOD, followed by business travels (conferences, workshops, etc.).

As such, the development of EOD (i.e. the recruitment of new research staff) will strongly rely on the funds granted by research projects while Faculty have their salary already secured through the annual budget received by CARE-C from the Cyprus Institute. More details on the financial sustainability of EOD are provided in section 6 (Sustainability).

2.1.5. Infrastructure

During the construction of the CARE-C Headquarters (expected to be finalized by end of 2023), CARE-C staff is occupying almost completely 3 different buildings, located next to each other. However, each CARE-C department has been put into a single building to facilitate exchange and collaborations.

The Environmental Observations Department is currently located in the NTL building. Each (Cyprus resident) Faculty of EOD enjoys a private office located next to the others. All the EOD Faculty are conducting experimental research. Therefore, their offices are also conveniently located in proximity of the CARE-C Research Facilities (INL, USRL, ECL, and a part of CAO facilities are also located in the NTL Building).

Table 1: Salary cost (in euros) for 2021 and 2021 for EOD staff. Share between “core” (Cyl annual budget), EMME-CARE (EU), and other research projects. “Core” salaries can be considered as secured salaries with typically indefinite contracts (i.e. permanent positions).

2020		**2021**	
CORE	278,895	CORE	396,679
EMME-CARE	125,985	EMME-CARE	167,613
OTHER	33,557	OTHER	89,643
TOTAL	**438,437**	**TOTAL**	**653,935**

Note: The above numbers correspond to calendar years (Jan. to Dec.) and coincide with the establishment of CARE-C (and EOD) as of 01/01/2020.

- Secured (core Cyl) salaries represent as much as 2/3 (61% in 2020; 63% in 2021) of the total cost of CARE-C/EOD researcher staff and faculty. These salaries correspond to Faculty and senior

researchers with indefinite/permanent positions. This share highlights the solid structure of EOD in its long-term operation with low risk to lose critical staff/knowledge due to lack of soft funds.

- The trend of salary cost between 2020 and 2021 (+50%) reflects the strong development of EOD in 2021 (recruitment of 3 faculty on core CyI and new PhD students on soft funds).
- All young researchers (PhDs, Post-docs) are covered on soft projects. EMME-CARE (EU) does contribute for c.a. 150k€/year, which represents about 27% in the total salary cost for EOD. To become fully sustainable, with no dependence on EMME-CARE funds, EOD will have to increase in the next 5 years the amount of research grants secured every year to cover young researchers' salary. This objective seems very reasonable when accounting for the recruitment of 3 new faculty in 2021 and their expected success in raising competitive funds.

2.1.6. Research achievements

Environmental Observations performed as part of EOD are mostly concerning 1) Experimental Observation of Climatic Parameters and 2) Experimental Observations of Atmospheric Composition, with a typical ratio 1/3 and 2/3, respectively, in terms of publications (see EOD Publication list for 2020 in **Annex I**).

Most of experimental observations on climate parameters are performed in close collaboration with the Cyprus Department of Meteorology and its CARE-C affiliates (e.g. Prof. S. Michaelides). Most of the experimental observations on atmospheric composition have a regional (EMME) focus (14 out of 16 publications for 2020) with CARE-C EOD researchers/affiliates as co-authors.

Non-exhaustive list of scientific research currently performed under EOD:

1. *Organic aerosol and volatile organic compound sources in Nicosia/Cairo* (PhD A. Christodoulou)
2. *Spatial and Temporal variability of PM pollution sources in Cyprus* (PhD. E. Bimenyimana)
3. *Atmospheric PM pollution sources in Qatar* (Master project)
4. *Profiling Greenhouse Gases source emissions from Unmanned Aerial Vehicles* (Ph Y. Liu)
5. *Temporal variability and sources of Greenhouse Gases in the East. Med.* (PhD C. Rousogenous)
6. *Light hydrocarbons as tracers of CH_4 sources in the EMME* (PhD E. Germain-Piaulenne)
7. *Optical properties of Mediterranean Aerosols* (M. Kezoudi, F. Marenco)
8. *Source apportionment of fine/coarse carbonaceous aerosols in Cyprus* (M. Pikridas, J. Sciare)
9. *Dust aerosol properties in Cyprus* (M. Pikridas, J. Sciare)
10. *Long-term observations of Air Pollutants in Cyprus* (M. Vrekoussis et al.)
11. *Long-term observations of Pollen and Fungal Spores in Cyprus* (R. Sarda-Estève et al.)
12. *Long-term observations of New Particle Formation (M. Pikridas, T. Jokinen, et al.)*

2.2. Advanced Partners Contribution

2.2.1. CEA (WP5 leader)

CEA is the main Advanced Partner involved in the construction of EOD (WP5) with 64 PM.

Establishment of the GHG research group: This group has just been established (summer 2021) and is built around 2 PhD students (incl. one joint PhD with CEA) and 1 affiliate (from CEA). Research activities undertaken by this group cover:

1) ground-based in-situ GHG observations in Cyprus (in the framework of the ICOS EU Research Infrastructure);
2) UAV-based in-situ GHG observations (joint PhD); and

3) ground-based remote sensing GHG in Cyprus in collaboration with Univ. of Bremen (in the framework of the TCCON international network). The consolidation of this group will have to include very soon the recruitment of an experienced researcher on GHG to further develop the regional GHG network and enhance its scientific exploitation, and the funding of GHG-oriented research projects.

Establishment of scientific expertise on Bioaerosols (Aerosol in-situ research group): The affiliation of a senior scientist from CEA, the installation of CEA scientific instrument in Cyprus, and the transfer of knowledge on bioaerosols has allowed CARE-C to initiate the first-ever long-term observations of pollen/spores in Cyprus (Nicosia) since 2019. The consolidation of this scientific expertise will have to include the recruitment of a young researcher (PhD, Post-doc) to enhance the scientific exploitation/dissemination of the large bioaerosol database accumulated so far in Cyprus and to be integrated in the EMME region in the forthcoming years. The development of this experimental research on bioaerosols and in particular the collection/analysis of living organisms (i.e. bacteria, viruses) is currently boosted by the current COVID-19 pandemic.

Contribution to the Reactive Gases research group: CEA is also strongly involved in the PhD (co-funding and supervision) of a research project at the interface of GHG and reactive gases (PhD project #5, Figure 1), with additional contribution in scientific instrumentation (PICARRO for GHG, GC-FIDs for NMHC).

High quality GHG measurements: In the context of EMME-CARE, CEA participates in the development of high accuracy GHG measurements and efficient scientific exploitation. CEA currently runs a global network of 16 high accuracy GHG continuous monitoring stations (several of which are part the ICOS European atmospheric network); it has extensive experience operating continuous in-situ isotope analysers (for source identification for GHGs), and has also long-term expertise of airborne and balloon borne GHG measurements, data analysis and interpretation. Regular exchanges took place between ATC staff at LSCE and EOD scientific staff.

The first phase was to interact on the ICOS specifications, in order to ensure that the investments done in Cyprus will make it possible to integrate the long-term monitoring station in the research infrastructure. It was therefore a question of helping the EOD to draw up the technical file for the call for tenders for the purchase of the spectrometer, of assistance on the setup of the air sampling installation, of the definition of the calibration scales, and the full evaluation of the GHG analyzer test at ATC laboratory at LSCE. The second phase consists of regular support to help diagnose problems on the analyzer or on its installation, with the aim of increasing the expertise of EOD personnel gradually gaining autonomy for the maintenance of GHG measurement systems. Beyond the surface measurements of GHG, a transfer of knowledge and skills was also carried out on low-cost CO_2 sensors for measurements using drones, as well as measurements of AirCores for the characterization of vertical profiles of GHG. More specifically, a PhD student was trained by LSCE to evaluate CO_2 sensors in the lab and on board a drone, and training in the measurement of AirCores was carried out in February 2020, thus allowing the realization of a first campaign by the staff of CyI in Spring 2020.

2.2.2. UH

UH is the second most contributing Advanced Partner involved in the construction of EOD.

New scientific knowledge on New Particle Formation (Aerosol in-situ research group): The University of Helsinki (UH) is a European-level node carrying out land-atmosphere research infrastructure development. It has functioned as the backbone for the development of multidisciplinary science and has enabled highly productive inter-disciplinary crossover within scientific communities. UH supports implementing the SMEAR (Station for Measuring Ecosystem-Atmosphere Relations)

concept, which promotes continuous, comprehensive, collocated measurements of the atmosphere, Earth surface, and biosphere covering meteorology, atmospheric composition, fluxes, as well as ecosystem variables (Hari et al. 2016).

Following this concept and as an initial stage, UH initiated continuous aerosol particle measurements down to ~1nm in size at The Cyprus Atmospheric Observatory- Agia Marina Xyliatou station (CAO-AMX) during teaming phase 1 of the EMME-CARE project. These measurements aimed to enhance the knowledge about particle sources, especially those of secondary origin. The EMME region is known to have high aerosol loading as it lies at the crossroad of air masses with distinct chemical characteristics originating from continental, maritime, and desert-dust sources (Lelieveld et al., 2002). Atmospheric aerosols are directly emitted to the atmosphere predominantly from the North African and Arabian desert dust outbreaks or from local and transported anthropogenic sources. However, secondary sources remain of vast importance, especially since the region is known for having intense solar radiation and high tropospheric ozone levels all year round, driving photochemical oxidation reactions that favour secondary aerosol formation (Kanakidou et al., 2011). The newly-introduced particle size distribution measurements at the rural background site of CAO-AMX enable studying how these oxidized precursor gases form molecular clusters, which in turn grow in size by multi-component gas condensation in a process referred to as new particle formation (NPF) and growth. This process modifies the number concentration, size distribution, chemical composition, and mass loading of atmospheric aerosol particle population, thereby having close associations with air quality and climate.

Development of the Reactive Gases research group: The recent recruitment of a young faculty (Assistant Professor) from UH within the Reactive Gases research group will secure/allow the further development of this scientific topic in the coming years and strengthen the overall collaborations with UH.

2.2.3. MPG

The recent recruitment of a young faculty, also from MPG, also at Assistant Professor level, within the Reactive Gases research group will further contribute to the development of the **Reactive Gases Research Group** in the coming years, thus strengthening the overall collaborations with MPG.

3. Alignment of the EOD objectives with EMME-CARE objectives

The EMME-CARE organization into four departments has been structured to better connect research and innovation, and implement optimally the specific (research/innovation/education) objectives as illustrated in **Figure 2** and detailed below.

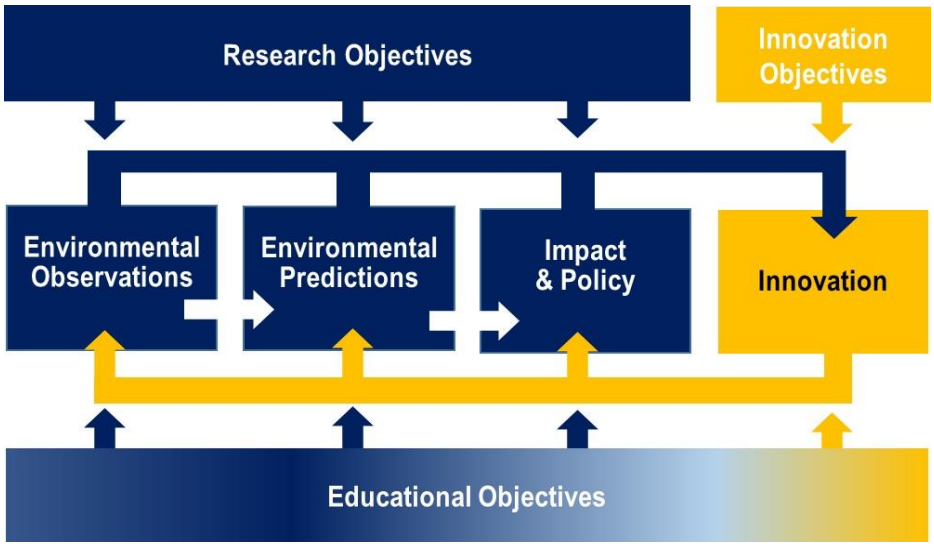


Figure 2: Interrelation between the four departments and the research, innovation, and education objectives of EMME-CARE.

The EMME-CARE Research objective #1 "Atmospheric composition" is directly linked to the Environmental Observations Department:

Atmospheric composition will be characterised experimentally by different methods (in-situ, remote sensing) and means of interpretation. The contribution of GHG and pollutant sources in the EMME to air quality and climate change will be assessed.

Long-term observations: Although the EMME region is a climate change hot spot with very high loads of atmospheric pollutants, it has received only little attention, e.g. in reports of the Intergovernmental Panel on Climate Change (Stocker et al., 2013). One reason is that observational data is insufficient, unavailable or of limited quality. In the Middle East, atmospheric composition data is very sparse. The source categories of GHG and air pollutants, including urban and industrial activities (Kanakidou et al., 2011) and biomass burning (Sciare et al., 2008), are poorly documented. According to data captured by satellites and models (Nabat et al., 2013), polluted air masses may originate in Europe (Pace et al., 2006), Asia (Lelieveld et al., 2002; Randel and Park, 2006), Africa (Ziv et al., 2004; Liu et al., 2009) and even North America (Christoudias et al., 2012). These studies have shown that, especially during the warm and dry summer, air pollution levels are significantly higher compared to continental Europe. They are promoted by the absence of rain and wet deposition, and augmented by intense solar insolation that favours the photochemical formation of secondary pollutant gases and aerosols.

EMME-CARE will alleviate the lack of environmental data through a continuous, comprehensive observational programme in Cyprus made possible by the expansion of a recently established measurement station into an observatory modelled on that of UH in northern Europe (SMEAR)[1]. The original concept was introduced by Hari and Kulmala (2005), and the design principles are described by Hari et al. (2016). The UH observatory is the most advanced international atmospheric station of its kind, carrying out measurements 24/7 of an estimated 1,200 parameters, and it plays a central role in European research networks and infrastructure. Having 25 years of operation, during which it has been continuously upgraded, the station has consistently demonstrated its benefits to international atmospheric research and innovation (Kulmala et al., 2014). Altogether, the data have been directly or indirectly the basis of more than 2,000 scientific articles, including 40 in *Nature* and *Science.* Similar, long-term outputs are expected for EMME-CARE, and it is anticipated that the station will play a key role in understanding the climate of southern Europe.

EMME-CARE will aim to develop a more comprehensive understanding of the land-surface and atmospheric feedback mechanisms and their role in climate change and pollution in the EMME region. Ground-based observations will be conducted in conjunction with regular measurement flights by instrumented UAVs and the retrieval of satellite data. The simultaneous characterisation of atmospheric chemistry, aerosols and GHG will facilitate the attribution of sources. The combination of the complementary boreal and Mediterranean stations in Finland and Cyprus, respectively, has the potential to become the backbone of European observational infrastructure.

Measurements from space: Satellite observations of environmental parameters in the EMME indicate that inter-annual variability and trends in atmospheric dust concentrations are related to soil moisture, precipitation and surface winds. Klingmüller et al. (2016) used satellite data from a combination of these parameters, to identify a connection between climate change and dust trends in the Middle East: namely that when surface temperature increases over dry desert soils it decreases relative humidity and promotes dust mobilisation. Tree ring analysis furthermore suggests that the recent drought in Syria

[1] http://www.atm.helsinki.fi/SMEAR/index.php

and Iraq, which has lasted for more than 15 years, has been the driest period of the past 900 years (Cook et al., 2016). It has been accompanied by a strong upward trend in aerosol optical depth, which has been attributed to atmospheric desert dust (Hsu et al., 2012; Yoon et al., 2016). Data derived from satellite observations of NO_2 and SO_2 have revealed strong air pollution trends in the Middle East since 2010, according to Lelieveld et al. (2015), who relates this to crises, conflicts and migration in the region. New satellite measurements of atmospheric GHG from a suite of space missions show clear enhancements of GHG over urban areas and indicate that growing emissions from the EMME region are themselves a main driver of global climate change.

EMME-CARE will be well placed to take advantage of the large amount of time each year that the region has clear skies, to facilitate comprehensive remote sensing of atmospheric and surface parameters. It will maximise the opportunities created by the latest European satellite instruments such as Sentinel–5P, launched in 2018[2], and capable of detecting GHG and air pollutants from space with ever-increasing spatial-temporal resolution. This combination of ground-based and space-borne data in the EMME, together with inverse modelling techniques, will provide a unique perspective on the region's climatic and environmental health.

4. Environmental Observations Department roadmap

The current and future development of the Environmental Observations Department is driven by the different Tasks of WP5. We present below the main achievements and future prospects for these different Tasks. The first 3 sub-sections (4.1, 4.2, 4.3) are directly connected to the Deliverable D1.5, whereas the other sections illustrate the future.

4.1. Supporting recruitment and training of highly qualified research staff (D1.5)

Task 5.1. Creation of an Environmental Observations Department (Lead: CEA) (M1- M24)
Task 5.1.a. *The Advanced Partners will support the recruitment of highly qualified research staff and young international talents (linked to Task 2.2), leveraging the R&D Mobility Programme (see description in Section 1.3.5.1)*

The former "Experimental Group" of the EEWRC 'ATMO-CLIMA' Division has been multiplied by 2.5 to reach a total of 21 staff (incl. 8 with 10 to 20% FTE). In that perspective, EOD has fulfilled after only 2 years its final (7-year) objective in terms of staff number. Among the main achievements over these 2 years, we should note:

- The **successful recruitment in 2021 of three (3) Faculty** (the number of full-time faculty was only 2 before EMME-CARE):
  - Prof. E. Bourtsoukidis (Assistant Professor, 100% FTE, https://www.cyi.ac.cy/index.php/care-c/about-the-center/care-c-our-people/itemlist/user/1161-efstratios-bourtsoukidis.html);
  - Prof T. Jokinen (Assistant Professor, 100% FTE, https://www.cyi.ac.cy/index.php/care-c/about-the-center/care-c-our-people/itemlist/user/1196-tuija-jokinen.html); and
  - Prof. F. Marenco (Associate Professor, 50% FTE with UK Met Office, https://www.cyi.ac.cy/index.php/care-c/about-the-center/care-c-our-people/itemlist/user/1181-franco-marenco.html).

It is worth noting here that 2 (out of 3) of the Faculty recruited in EOD are originating from our Advanced Partners (E. Bourtsoukidis from MPG, J. Jokinen from UH), one of which has formed new research groups within EOD (i.e. "Research Gases" and "Aerosol Remote Sensing" research groups).
A second group (Aerosol remote sensing has been also established).

- The **successful recruitment of 4 new PhD students** (the number of PhD was only 1 before EMME-CARE). See the list in **Figure 1**. Importantly 2 (out of these 4 new PhDs) are joined with CEA in terms of supervision (50/50) and co-funding (50/50) illustrating the success of the EMME-CARE R&D Mobility

[2] https://earth.esa.int/web/guest/missions/esa-eo-missions/sentinel-5p

Programme. This number is expected to rise in 2022 (PhD scholarships are part of the recruitment package of the 3 new faculty)

- The **achievement of a number of important KPIs** (Gender, Diversity, joint PhDs with Advanced Partners, Affiliation of Advanced Partners), see **Figure 1**.

4.2. Significant contribution to EU Research Infrastructures & international networks (D1.5)

Task 5.1. Creation of an Environmental Observations Department (Lead: CEA) (M1- M24)
***Task 5.1.b**. The Advanced Partners will actively engage the department in contributing to EU Research Infrastructure and international networks*

The below summary on Task 5.1.b can also be found in Deliverable D4.2 (Report on the structure of the Research Infrastructure Unit) (section 5.4).

4.2.1. ICOS

Benefiting from the major role of CEA in operating the ICOS Atmosphere Thematic Center (https://www.icos-cp.eu/observations/atmosphere/atc), and the recruitment of two technical experts (working previously in the ICOS Department at CEA), CARE-C has established ICOS greenhouse gases measurements at CAO-CyI since beginning of 2020 while discussions on the optimal station location for conducting long-term GHG observations in Cyprus fulfilling ICOS criteria are still ongoing. The station in question will go through the official labelling process of ICOS once Cyprus officially joins the ICOS network. This labelling ensures access to services for atmosphere stations provided by the ICOS Atmosphere Thematic Centre. These services include: data processing, quality control performed by the metrology laboratory and mobile unit; software that centrally processes and quality-control the data from the atmosphere stations; regular survey, test and analysis of new measurement technologies for GHG and isotope instruments; graphical applications to provide NRT data products and services from the Calibration Laboratory; provision of calibration gases; routine measurement of integrated air samples with specific sampling equipment; analysis of flask samples for components that are not measured continuously at the stations (such as O_2/N_2 ratios, stable isotope ratios of CO_2 or 14C radiocarbon for estimates of fossil fuel CO_2); development of improved methodologies to determine fossil fuel CO_2.

On institutional level, first contacts were established with the international affairs unit of ICOS where the administrative/political pathway towards integrating ICOS could be streamlined. ICOS is a landmark infrastructure that has the statutes of an ERIC since end 2015. Countries being members of the ERIC, the Cyprus country financial contribution was computed and a template for a formal application letter was provided. The total contribution of a country to ICOS is composed of three parts:

- The common basic contribution, identical for each Member or Observer country, has a fixed amount of €18,861.38.
- The common GNI-based contribution, for which each Member or Observer country pays a different amount according to its GNI.
- The station-based contribution, for which each Member or Observer country pays a different amount according to the type, class and number of stations. The number of stations can be revised every year in June for the following year. The final annual contribution of a country results in the sum of the previously mentioned amounts.

In the coming months, the application for an integration into ICOS will be established for a presentation to the responsible Cypriot ministries, mainly the Ministry of Research, Innovation and Digital Policy and the Ministry of Agriculture, Rural Development and Environment.

4.2.2. ACTRIS

(The Aerosol, Clouds and Trace Gases Research Infrastructure, http://actris.net/): ACTRIS is currently rank first of the Cyprus roadmap for ESFRI projects with strong support from the Cyprus Government (DGEPCD) to support it financially (annual membership). CyI/CARE-C (J. Sciare) is acting as the national contact point for ACTRIS and has organised the kick-off meeting of H2020-ACTRIS-IMP in Larnaca in March 2020 (a week before the lockdown). Additionally, and within the framework of building the strategy for Innovation in ACTRIS, CyI organized a virtual workshop 'Innovation in Atmospheric Sciences' (https://www.actris.eu/innovation-workshop) with the main aim to bring several EU Atmospheric Sciences (Research Infrastructure) communities together with various key stakeholders (e.g. Private Companies) and **exchange on the most recent innovation activities** (e.g. development of new products, services to be offered), and **share new opportunities to join forces for further enhancing R&D. The workshop was highly successful gathering almost 400 participants from 45 countries, and created a unique platform for networking and knowledge-exchange between key contacts from academia, private companies, the public sector and NGOs.** CAO and USRL are part of the ACTRIS network of national facilities and are receiving EU financial support to perform TransNational Access (TNA) in the framework of H2020-ACTRIS-IMP (started beginning of 2020) and H2020-ATMO-ACCESS (started beginning of 2021).

4.2.3. eLTER

(Long-term Ecosystem Research in Europe, https://www.lter-europe.net/): The integration into eLTER was discussed in the WP4 meeting on September 25th, 2020. Membership to eLTER Europe is challenged through a national network of institutes and scientists. Therefore, the first step is to establish national connections to the relevant Research Performing Organisations in this field within Cyprus and subsequently approach national funding structures, such as the Ministry of Environment (MoE). After national discussions, a letter indicating a request to join eLTER Europe should be submitted to the Chair of eLTER Europe.

4.2.4. BSRN

The BSRN (Baseline Surface Radiation Network; https://bsrn.awi.de/) network, developed by the World Meteorological Organization (WMO), is the most internationally prestigious solar radiometric network which was initiated by the World Climate Research Programme (WCRP) of the WMO. The objective of the BSRN is to provide observations of the best possible quality for short- and long-wave surface radiation fluxes with a high sampling rate to detect important changes in the Earth's radiation field at the Earth's surface, which may be related to climate changes. Within the past two years, the Cyprus Institute has upgraded the capabilities of its Platform for Research, Observation, and TEchnological Applications in Solar energy (PROTEAS) to measure solar radiation and other meteorological variables of interest by defining, designing, procuring, and erecting a BSRN station. The PROTEAS BSRN station has been equipped with state-of-the-art solar radiation sensors attached on a high-end sun tracker, able to measure the Direct, Diffuse, and Global solar irradiance as well as the down-welling infrared radiation. Apart from solar radiation sensors, the station is also equipped with high-end meteorological sensors, including air temperature and humidity sensors, wind speed and wind direction sensors, atmospheric pressure, and accumulated precipitation sensors. Moreover, the station has been expanded beyond the BSRN requirements by installing a sky imaging camera that complements the solar radiation measurements and facilitates assessing their quality. The PROTEAS BSRN station will enable access to high-quality data that various research departments can utilise to validate and evaluate satellite-based estimates of the surface radiative fluxes, compare climate model calculations, and develop representative radiation climatologies for cloud absorption modelling, forecasting, and other modelling activities. These advances in observation capabilities are crucial for the research carried out by the CyI/EEWRC/Energy Division and for increasing co-located measurements and complementing CARE-C's RI.

The PROTEAS BSRN candidacy has been successfully defended by Dr. Kypros Milidonis on the BSRN 2020 Virtual Workshop (October 1st, 2020) and currently has a ''pending'' status. It is envisioned that the PROTEAS BSRN station will be established as a full member of the BSRN at the next biennial BSRN meeting.

4.2.5. TCCON

A TCCON (Total Carbon Column Observing Network, http://www.tccon.caltech.edu/) station for long-term observations of GHG has been set up at CAO-CyI and is operational since September 2020. This station provides the first-ever standardised and high-precision continuous data of column-integrated greenhouse gases (CO_2/CH_4/N_2O) observations in the EMME region and will operate for more than ten years to uncover the long-term trends of GHG in the region. These measurements will feed the ongoing Ph.D. project "Temporal variability and sources of Greenhouse Gases in the Eastern Mediterranean Region", co-supervised by CyI and Univ. Bremen. They are further used to calibrate the NASA OCO2 and OCO3 satellites. In parallel to the TCCON measurements, five (5) vertically-resolved GHG measurements (up to several tens of km altitude) were performed by the mean of "AirCores" flights. These flights were achieved in collaboration with colleagues from CEA and the French AirCore (AC) program. The AirCore in-situ GHG profiles are used to further validate TCCON observations. They provide an additional constrain for the validation of atmospheric transport models.

4.2.6. CTBT

Comprehensive nuclear-Test-Ban Treaty Organization, (https://www.ctbto.org/): Initial contacts were taken with CTBT at their Austrian Headquarter back in Spring 2018. The Government of Cyprus (Ministry of Foreign Affairs) has been mobilised to integrate this network and (through the Department of Meteorology) will operate (at no cost) an infra-sound system in Cyprus in the next couple of months. This system will allow a better investigation of the atmospheric dynamic of the upper atmosphere, which is very relevant for EMME-CARE. The deployment of a radionuclide monitoring station in Cyprus is currently under discussion.

4.2.7. AGAGE

The AGAGE network is a global measurement network of GC-MS instruments (https://agage.mit.edu/) coordinated by Prof. Prinn (MIT) and Prof. Weiss (Uni. San Diego). The focus is on organohalogen compounds, particularly those regulated by the Montreal Protocol and subsequent replacement species. In addition, several other globally relevant species are measured. The network has a reputation for extremely high-quality measurements and regularly produces high impact publications.
A meeting was set up on November 25th to discuss joining the network. The coordinators were very interested and supportive of the proposal. The location of the proposed instrument would be on the west coast main measurement site, which is in the outflow of western Europe, eastern Europe (from where fugitive methyl chloroform emissions have been previously seen), and even Arabia. Co-ordinates of CAO-PEY site were given to Prof. Prinn, and he intends to run back trajectory simulation to assess the site footprint.

4.3. Participation in ongoing/new research projects (D1.5)

Task 5.1. Creation of an Environmental Observations Department (Lead: CEA) (M1- M24)
Task 5.1.b. *The Advanced Partners will actively engage the department in continued participation in the ongoing/new research projects with the Advanced Partners*

A summary of funded ongoing research projects currently managed by EOD (excluding EMME-CARE) is reported in the below **Table 1**.

- EOD is currently managing 10 research projects of a total of 1.8M€.

- Most of these projects (7 out of 10) are funded by international agencies (EU-H2020, EEA Norway, AUF-IRD, IAEA, ESA, World Bank) illustrating the diversification of revenues and international competitiveness of CARE-C/EOD.
- Half of these projects have been won after EMME-CARE started (Sept. 2019).
- 4 (out of these 10 projects) have direct collaborations between CARE-C/EOD and EMME-CARE Advanced Partners.
- All these projects do contribute to Scientific Objective #1 (which is the main objective of EOD) while half of them do also include Innovative Objective#1, illustrating the added value of our Research AND Innovation portfolio.

Table 1: List of on-going Research Projects (competitive grants) of the CARE-C / EOD.

Underline = PI; **Blue = Advanced Partners** (N=4) (Cyl, UH, CEA, MPG). Red = Department of the Republic of Cyprus. Gold = National Academic partners. Black = SMEs; Green = Regional (EMME) partners; Grey = Other EU partners.

#	Project Title	Consortium	Call + Funds (Cyl)	CoE's objectives	Description / Contribution of Cyl
1	**ACCEPT** (2018-2022)	DoE, Cyl, DoM, DLI, CUT, EUC	Norway Grants 608k€	Scient. Obj. #1,2,3 Innov. Obj. #1,2	Description: Assessment of Climate Change Effects on Pollution Transport in Cyprus. Cyl contribution: Ground-based + UAV long-term monitoring, Emission inventory, Air Quality modelling, High Resolution Climate projections.
2	**AQ-SERVE** (2018-2021)	Cyl, CEA, DoE, DLI, DoM, CUT, EUC ADITESS,	RPF Integrated Project 468k€	Scient. Obj. #1,2,3 Innov. Obj. #1,2	Description: Air Quality Services for a Cleaner Air in Cyprus. Cyl contribution: long-term Air Quality monitoring, UAV profiling, Air Quality modelling/forecasting, Risk Assessment (Health, Ecosystem)
3	**POLCAIR** (2018-2021)	Cyl, USJ, NRC, CEA + EU partners	AUF-IRD-STDF 50k€	Scient. Obj. #1	Description: Air pollution in Greater Cairo (Egypt): sources and impacts. Cyl contribution: 1-year monitoring + intensive field campaign (reactive gases, aerosols), Air quality modelling
4	**RER7011** (2018-2021)	Cyl + 15 Europe partners	IAEA Tech. Coop. 40k€	Scient. Obj. #1	Description: Apportioning air pollution sources on a regional scale (Central and Eastern Europe). Cyl contribution: 1-year monitoring in Cyprus (Nicosia) in collab. with Cyprus Air Quality Section (DLI)
5	**ACTRIS-IMP** (2020-2022)	Cyl, UH, CEA + 20 EU partners	H2020 110k€	Scient. Obj. #1, Innov. Obj. #1	Description: Implementation of the EU Research Infrastructure "ACTRIS". Cyl contribution: Innovation with private sector, provision of TransNational Access for USRL
6	**ASKOS** (2019-2021)	Cyl + NOA + EU partners	ESA 80k€	Scient. Obj. #1, Innov. Obj. #1	Description: Development of new access for Atmospheric EU Research Infrastructures (ACTRIS, ICOS). Cyl contribution: Provision of TNA for CAO and USRL
7	**ATMO-ACCESS** (2020-2023)	Cyl, UH, CEA + 30 EU partners	H2020 300k€	Scient. Obj. #1, Innov. Obj. #1	Description: Development of new access for Atmospheric EU Research Infrastructures (ACTRIS, ICOS). Cyl contribution: Provision of TNA for CAO and USRL
8	**AIR-COVID-NETWORK** (2020-2021)	Cyl, CING	RIF + AUF (43k€)	Scient. Obj. #1	Description: Network for the monitoring of airborne SARS-CoV-2. Cyl contribution: Coordination, Collection of airborne SARS-CoV-2 in Cypriot Hospitals.
9	**CURE-SARS** (2020-2021)	Cyl, CING	RIF (25k€)	Scient. Obj. #1	Description: Network for the monitoring of airborne SARS-CoV-2. Cyl contribution: Coordination, Collection of airborne SARS-CoV-2 in Cypriot Hospitals.
10	**PMEH** (2020-2021)	Cyl + INERIS	World Bank 30k€	Scient. Obj. #1	Description: Development of a new Air Quality laboratory in Cairo (Egypt) to monitor PM pollution sources Cyl contribution: Provision of technical training
11	**CURE3AB** (2020-2021)	Cyl + Brazilian partner	RIF (80k€)	Scient. Obj. #1 Innov. Obj. #1	Description: Network for the monitoring of airborne SARS-CoV-2. Cyl contribution: Coordination, Collection of airborne SARS-CoV-2 in Cypriot Hospitals.
Total Cyl secured funds			**1.8M€**		

4.4. Development of competitive research through continuous observations and field studies

Task 5.2. New environmental data from continuous observations and field studies (Lead: CEA) (M6-M36)
Leveraging the EMME-CARE research facilities (see WP4), the Advanced Partners will:
a. *Initiate long-term continuous high-quality in-situ and remote sensing measurements of GHG (**CEA**), and reactive gases/aerosols (**UH**) to be performed at the Cyprus Atmospheric Observatory (purchase, installation, operation, maintenance, calibration, data quality) **(M6-M24)***

We provide below a brief review of the continuous observations and field studies performed under EOD since the beginning of EMME-CARE (Sep. 2019).

POLCAIR campaign in Cairo, Egypt: (in collab. with CNRS-France, IMT-France, NRC-Egypt, Univ. Cairo-Egypt, Univ. St Joseph-Lebanon). An intensive field experiment was performed in Nov. 2019 – Feb. 2020 at an urban background site of Cairo (Egypt) to document the major sources of air pollution with a focus (for CARE-C) on sources of Organic Aerosols using a suite of on-line/off-line techniques with, for the first time in this city, a comprehensive high-tech instrumental package (Aerosol Mass Spectrometer, Proton-Transfer-Reaction Mass Spectrometer) in close collaboration with Advanced Partner CEA. Despite very complex bureaucracy, we have managed to achieve successfully the objective of this campaign (the first of such calibre in Cairo for the last 15 years) that will be further exploited in the PhD project of A. Christodoulou.

Long-term observations of Greenhouse Gases: The collaboration established between CyI and LSCE on the development of expertise in Cyprus for the innovative measurement technique of AirCore has made it possible to successfully carry out two measurement campaigns, with 5 vertical profiles performed in June 2020, and one in June 2021. It is important to note that this type of measurement of vertical GHG profiles is only carried out regularly at two sites in the United States and two sites in Europe (Trainou in France, Sodankyla in Finland). These are therefore unique data in this part of the world, which are of major scientific interest for the validation of local TCCON measurements, total column satellite measurements, as well as atmospheric transport models such as the CAMS model of the European Center. Those data have been used for presentation at international conferences like the TCCON/COCCON Meeting 2021, June 8-10 (TCCON Nicosia: First XGHGs in the Eastern Mediterranean and Middle East Pollution Crossroads in the EMME), and the IGAC 2021: TCCON Nicosia: First ground-based FTIR greenhouse gas measurements in the Eastern Mediterranean and Middle East region. AirCore was also presented at a CARE-C Seminar on 29 October 2020.

The collaboration on the measurement of greenhouse gases has also made it possible to develop mobile measurement campaigns on the surface and in the lower atmosphere with a drone. An integrated Greenhouse Gas (CO2 and CH4) observation system has been set up in a car, including the analyzer, a battery and a converter, a filter, a sonic anemometer, a GPS, an inlet and a meteorological box for merging and reading data. Since August 2020, mobile measurements have been performed twice every month, with the goal to investigate potential methane hotspots over Cyprus, such as closed and active landfills, cattle farming areas and reservoirs. Another analyzer was also used to investigate the methane emission in Athalassa national park close to the Cyprus institute by bike parallel to the UAV-CO2 flights. The same Los Gatos analyzer has been integrated into a manned aircraft together with a meteo box, a GPS, an extra T/RH sensor and a pressure sensor. Three flights over Cyprus have been performed, and each flight lasted around 2.5 hours. For the UAV flights, a CO2 sensor from Senseair AB (Sweden), initially tested at ATC lab at LSCE, was integrated into a multicopter, and the system was developed and improved during the past one year. Recently, the UAV-CO2 sensor system was validated at Athalassa national park (20 flights in total). Another UAV-CO2 field flight in September, 2021 over the east of Nicosia is being planned.

Long-term observations of Air Quality: Several gas phase pollutants (CO, NO_x, SO_2, O_3) are monitored continuously at CAO-CyI through a collaboration with JRC (Ispra, Italy) since beginning of 2020, in parallel with aerosol absorption (Black Carbon) measurements obtained in the framework of the DNAAP project and $PM_{2.5}/PM_{10}$ by an on-line analyser owned by Univ. Patras (Greece). Continuous observations of near-real-time dust concentrations in PM were initiated end of 2018 in the framework of the DNAAP project at both CAO-AMX and CAO-CyI monitoring sites. In collaboration with the Department of Labour inspection, filter sampling is conducted at the rooftop of CAO-CyI for PM chemistry and source apportionment. Dry deposition measurements are also conducted in collaboration with the TU Darmstadt (Germany) and CNRS-LISA (France). These observations are completed by the long-term measurements performed by CAO-AMX since 2015 in the framework of the ACTRIS EU Research Infrastructure (on-line PM_1 chemistry, aerosol light absorption/scattering properties, aerosol number size distribution). The EMME-CARE Investment Funds (Cyprus Government) are being utilized to acquire all the scientific instrumentation that is necessary to secure/maintain the continuous observations of these Air Pollutant parameters.

Long-term observations Pollen and Fungal Spores (in collaboration with CEA): Pollen and Fungal Spore monitoring were initiated back in 2018 at CAO-CyI and currently stand for the only Pollen observations in Cyprus, so far. Analyses are performed using standard operating protocols of the French National Network on Bioaerosol surveillance (RNSA). The objective is to further develop this activity in Cyprus with on-site analysis and weekly bulletin on pollen for the population as done in many EU countries. A set of 6 Pollen collectors have been purchased during the period M1-M15 to further develop a regional (EMME) network and establish long-term / high quality observations.

New Particle Formation (in collaboration with UH): As part of UH contribution, we performed an extended observation period at Agia Marina observation site. We deployed a combination of Neutral Cluster and Air Ion Spectrometer (NAIS, Manninen et al. 2016) and Particle Size Magnifier (PSM, Vanhanen et al. 2011) providing novel insights into physical characterization of nanoparticles in Cyprus. The chemical identity of the clusters and their concentrations were detected with Chemical Ionization mass spectrometry (Jokinen et al. 2012).

With the observational data, we showed that NPF is a very frequent phenomenon at this site and has a higher frequency of occurrence during spring and autumn. NPF events were both of local and regional origin and the local events occurred frequently during the month with the least NPF frequency. Additionally, the NPF events were observed during the night-time and during episodes of high desert dust loading. Particle formation rates and growth rates were comparable to those of urban environments, although our observations were performed in a rural site. Meteorological variables and trace gases played a role in explaining the intra monthly variability of NPF events but did not explain why summer months had the least NPF frequency. Similarly, H_2SO_4 and pre-existing aerosol loading did not explain the observed seasonality. Air masses arriving from the Middle East were not observed during the month with the least NPF frequency which could suggest that precursor vapors important for nucleation and growth are transported to our site from the Middle East. The results are presented in *Baalbaki et al*. (2020)[3]. The observations on the nanoparticle size distributions are on-going at Agia Marina. As part of the capacity building we aim to establish continuous observations with CI-APiTOF to resolve the processes and participating precursors in more detail.

[3] Baalbaki, R., Pikridas, M., Jokinen, T., Laurila, T., Dada, L., Bezantakos, S., Ahonen, L., Neitola, K., Maisser, A., Bimenyimana, E., Christodoulou, A., Unga, F., Savvides, C., Lehtipalo, K., Kangasluoma, J., Biskos, G., Petäjä, T., Kerminen, V.-M., Sciare, J. and Kulmala, M. (2020) Towards understanding the mechanisms of new particle formation in the Eastern Mediterranean, Atmos. Chem. Phys., 21, 9223-9251, https://doi.org/10.5194/acp-21-9223-2021, 2021.

b. *Combine these measurements with satellite data and regular UAV-based atmospheric profiling developed by EMME-CARE (Unmanned Systems Research Laboratory, USRL)* ***(M18-M30)***

This activity (to be initiated in March 2021) will be fed by the several research projects recently funded and focusing on UAV-satellite observations such as ESA "ASKOS" (calibration/validation of Aeolus dust products with UAV-balloon-sensor systems), EEA-NORWAY "ACCEPT" (intensive UAV-sensor profiling in Cyprus), EU-H2020 "ACTRIS-IMP" (transnational access of USRL). The satellite activity is expected to significantly increase with the current recruitment of new Faculty with scientific expertise on remote sensing of aerosols.

c. *Develop and support competitive research through the utilization of the new EMME-CARE research facilities (Data Centre, Environmental Chamber Lab., Mobile Lab.) in Cyprus and the EMME region* ***(M12-M36)***

CARE-C/USRL contributed to the development of several UAV-sensor systems that were evaluated for atmospheric profiling in the framework of EU-H2020 ACTRIS-2 for the measurement of Black Carbon (Pikridas et al., 2019) and Aerosol number size distribution (Marinou et al., 2019). **CARE-C/CAO** hosted international field campaigns and led to the publication of 1) important scientific results on UAV-based and remote sensing-based measurements of cloud properties (Calmer et al., 2019; Ansmann et al., 2019) in the framework of EU-FP7 BACCHUS; 2) new techniques to measure in real-time carbonaceous/light absorbing aerosols (Rigler et al., 2019; Drinovec et al., 2020); 3) New Particle Formation (Dada et al., 2020; Baalbaki et al., 2020). **CARE-C/ECL** contributed to off-line chemical analysis of atmospheric samples collected in Greece (Liakakou et al., 2019; Wong et al., 2019a, 2019b).

d. *Support the implementation, exploitation and, dissemination of "research boost projects" (selected in phase I) which involve the Environmental Observations Department.* ***(M1-M24)***

The "boost project" with VAISALA (https://www.vaisala.com/en; world-leader company in weather observations) has started mid of November 2020. A dense network of low-cost Air Quality sensors developed by VAISALA and CyI will be deployed for a period of 1 year over the Nicosia agglomeration to better map the local (city-scale) concentrations of EU regulated air pollutants. These observations will be completed by vertical profiling using remote sensing (ceilometers) and in-situ UAV techniques and support for the PhD project "*Development of Low-cost Gas Sensors for Air Quality Monitoring*". Discussions are still undergoing with KARSA (http://karsa.fi/) and Origins Earth (https://www.origins.earth/) companies to finalize the respective "boost projects" that will engage them.

4.5. High quality long-term atmospheric observations embedded in international networks

Task 5.3. High quality long-term atmospheric observations embedded in international networks (Lead: UH) (M12 to M84)
The Advanced Partners will:
a. *Gradually transfer the scientific leadership of the continuous monitoring activities (Task 7.2) to the newly recruited/trained research staff of the Environmental Observations Dept.* ***(M12-M36).***

The transfer of the scientific leadership on research topics such as Greenhouse Gases, Pollen, New Particle Formation is a long process (estimated between M12 and M36). It has been initiated with the Advanced Partners (CEA, UH) through the recruitment and co-supervision of PhD students and Technical Research Specialists at the Cyprus Institute. The on-going recruitment of new Faculty at CARE-C will facilitate this transfer of the scientific leadership.

High quality long-term aerosol observations: A team from UH set up the measuring instruments and trained the scientists and technical staff of CARE-C on the operation and maintenance of aerosol instruments. The observations collected within the first year were analyzed as a joint effort, and the results were published in an open-access peer-reviewed article (Baalbaki et al., 2021). While the measurements continue at CAO-AMX with UH borrowed instruments, the center's own instruments were purchased, and these will be characterized both in the laboratory and in the field before being deployed for long-term operation. The laboratory characterization will be performed at UH premises, where the research staff of CARE-C will receive a comprehensive training on the operation, maintenance, and calibration of these instruments scheduled for the last two weeks of September 2021. Once these instruments are set up, the future aim is to expand these measurements to other sites in Cyprus and the EMME region.

UH will continue to support the operation and maintenance of these instruments. In addition, it will provide tools and solutions to support the data analysis enabling aerosol physical characterization and a comprehensive understanding of aerosol variability at the measurement sites. In parallel to the aerosol physical characterization, UH will support the planned activities aimed at the chemical characterization of nucleating clusters and the long-term observations of reactive gases such as sulphuric acid, methanesulfonic acid, and highly oxygenated molecular compounds. This support will be in the form of regular exchange and dedicated training events, and it will cover the purchase of instruments, installation, operation, data integration, data analysis, and dissemination of results.

4.6. Enhance regional scientific capacities on atmospheric composition

Task 5.4. Enhance regional scientific capacities on atmospheric composition (Lead: Cyl) (M36-M84)
The Environmental Experiments Department will:
a. *Develop regional scientific capacities regarding the atmospheric environment; establish a regional observational network connected to EU Research Infrastructure, using the CoE as a regional node for capacity building.*

This activity is expected to start from September 2023. In the meantime, CARE-C is purchasing a wide range of new scientific instruments (e.g. fully automated aerosol filter sampling units and Pollen traps) to build such regional network with up to 6 monitoring stations.

b. *Actively engage its regional collaborators in high quality research, leveraging the EMME Professorship Programme and using the same strategy developed by the Advanced Partners in Task 7.2.b*

This activity is expected to start from September 2023. In the meantime, the EMME-CARE Professorship program has been initiated with secured collaboration (through Memorandum of Understanding) with top regional institutions including 1) *The National Kapodistrian University of Athens* (Athens, Greece), 2) The *St Joseph University* (Beirut, Lebanon), 3) *The Egyptian-Japanese University of Science and Technology* (Alexandria, Egypt) and 4) the *Kuwait Institute for Scientific Research* (Kuwait). These bilateral collaborations will enable to build-up a regional observational network to monitor air pollution and greenhouse gases concentrations.

5. Sustainability

The sustainable development of EOD requires securing a number of resources (financial, staff, infrastructure) through a strategy that is presented in section 4 (Environmental Observations Department roadmap) and reported in the EMME-CARE Grant Agreement under WP5. Additional measures are taken to prepare this Department to continue to operate and develop beyond the lifetime of the 7-year Teaming project.

Most of the research funds (>90%) from EOD are brought by a single faculty, putting at risk the sustainable development of the Department. The recent recruitment of 3 new Faculty in the EOD will alleviate this threat and secure extra research funds within the Department. Time is of essence here. In this respect, it has become of high priority for CARE-C to boost, in the timeliest manner, the career development of these Faculty in order to make them rapidly competitive at international level:

- Over the last few months, scientific coordination delegation to the newly recruited Faculty of (inter)national ongoing research projects (e.g. H2020 ATMO-ACCESS, EEA NORWAY ACCEPT, ESA ASKOS) has been put in place. These delegations will 1) train the new faculty to manage their future research projects, 2) make their CV more competitive with early career coordination activities and opportunities for additional scientific exploitation/dissemination, and 3) expose them (enhance their visibility) to competitive consortia of top performers.
- As part of their recruitment package, these new faculty members have been given the unique opportunity to purchase cutting-edge scientific instrumentation (e.g. highly expensive Mass Spectrometers such as PTR-ToF-MS and API-ToF-MS) that will allow them to uncover unexpected regional atmospheric processes that have never been reported in the literature so far. Reputation of the new faculty will also be enhanced while integrating close communities of privileged end-users of such high-tech scientific instrumentation.
- As part of their recruitment package, these new faculty members have also been given extra funds for the recruitment and mentoring of PhD students or Post-doctoral fellows, who will further enhance scientific developments led by the new faculty.
- As mentioned in section 2.2, the construction of new research groups led by the new Faculty will offer them the necessary visibility inside/outside the CoE, and allow them to develop their research with the maximum level of autonomy.
- This new faculty has been given managerial responsibilities through the lead of flagship CARE-C research infrastructure (e.g. Cyprus Atmospheric Observatory), which skills are expected to become more and more crucial when advancing their research career
- The strong support and unique expertise of the CARE-C RISO (Research and Innovation Support and Operation) in preparing/submitting competitive research proposals will provide additional chances for the new faculty to win highly competitive international grants (e.g. ERC).
- Last but not least, these new faculty are receiving a close mentoring from more senior faculty (Department Heads) through regular face-to-face meetings, benefiting as much as it needs from the scientific expertise and research experience of well-established faculty at the Cyprus Institute.

6. Updated Risk management plan for the Environmental Observations Department

Description of Risk	Proposed risk-mitigation measures (contingency plan)
Staff recruitment plan for EOD does not meet targets (quantity/quality) Probability: very low. Most of EOD research staff (Faculty, PhDs) have successfully been recruited over the last 2 years with no major difficulties. Severity: low. if CARE-C can retain its recruited researchers.	Related to HR Recruitment & Mobility Programme (WP# 2) Short-term measures: 1) Ensure all critical staff are paid on core funds (permanent contracts), 2) Further utilization of the joint PhD scheme with Advanced Partners to continue attracting international talents
The EOD does not raise enough **competitive funds** Probability: Medium. Lack of opportunities (national/EU open calls) and poor success rate. Severity: low (short-term) to medium (mid-term). The €1m of competitive funds raised in 2020 will reduce the risk in the next 2 years of the project. Note: To better account for this risk, projection of competitive funds was made conservative	Short-term measures: 1) Activate financial contingency plan for low revenues (see RP1); 2) Realign staffing priorities to reflect the priorities of the emerging portfolio; 3) Improve relevant RISO capacities (staff, training). Mid-term measures: Review critically the cause and redefine Research & Innovation strategy accordingly (guidance from the CoE Scientific Expert Panel).
EOD **long-term sustainability** is weakened by dependency on government funds; Probability: Medium (previously low, before COVID). Severity: Medium. Difficulties to operate CARE-C research facilities in case of a decrease of CyI annual funds.	Short-term measures:1) CARE-C can absorb a 25% decrease its annual core budget from CyI without compromising the payment of permanent staff. 2) Diversification of revenues with stable annual incomes from services (currently 150k/year) has shown to play an important role to cover specific expenses (consumables)
EOD long-term financial sustainability compromised Probability: Low. Conservative budget and long-term sustainability plan. Severity: Medium	Short-term measures: See above (section 5 on Sustainability)
Advanced Partners fail to invest adequately in the development of EOD Probability: low. EOD has been established and launched as planned (Month 24, Deliverable D5.1). Severity: Low. CARE-C is less and less dependent on the contribution/participation of Advanced Partners for the further development of EOD.	Short-term measures: 1) CoE Management Board and SEP to perform (regular) fair evaluation of partners' involvement; 2) Director's Office to ensure the participation of the Advanced Partners in the H2020 deliverables; 3) Increase involvement of Advanced Partners through the R&D Mobility Programme and new R&D initiatives.

7. Key Performance Indicator (KPIs)

- to be monitored from the formal establishment of EOD (August 2021):

WP No.& Title	WP5 - Environmental Observations Department		
Dimension	**Key Performance Indicator**	**Year X**	**Objective 2026**
Effectiveness	**Human Resources:** EOD research staff (number) (incl. affiliates and part-timers)		**30**
	Human Resources: PhD students (number)		**10**
	Human Resources: Post-doc (number)		**5**
	Financial: Number of research proposals submitted		**10**
	Research: Short-term on-site visits of research collaborators (affiliates not included) (days)		**30**
	Research: Conferences/Workshop attended (number)		**10**
	Research: scientific Instruments performing long-term atmospheric observations in Cyprus (number)		**40**
	Research: Intensive field experiments in the EMME (outside Cyprus) (days)		**20**
Outcome	**Science:** Publications in peer-review journals (number)		**30**
	Science: Communications (conferences, workshops) (number)		**30**
	Science: Invited speakers at international conferences (number)		**4**
	Financial: Research proposal funded (number)		**3**
	Financial: Funds from successful research projects (in euros)		**500k€**
	Financial: Funds from successful tenders (in euros)		**100k€**
Efficiency	**Research:** Time coverage of atmospheric observations over the year (percentage)		**85%**
	Research: Atmospheric parameters uploaded in open access international database (percentage)		**80%**
	Research: Utilization rate of scientific instrumentation used for continuous atmospheric observations (percentage)		**90%**
	Science: Publications in top 10 peer-review journals (percentage)		**60%**
	Science: Publications with Advanced Partners (percentage)		**50%**
	Financial: Research proposal funded (percentage)		**25%**
Network	Membership of EU Research Infrastructure Atmospheric Network		**3**
	Active Scientific Agreements and MoUs in the EMME (incl. Cyprus)		**20**
	Regional (EMME) Research Organizations engaged in Atmospheric Monitoring and field campaigns (number)		**10**

8. References

- Hari, P., Petäjä, T., Bäck, J., Kerminen, V.M., Lappalainen, H.K., Vihma, T., Laurila, T., Viisanen, Y., Vesala, T. and Kulmala, M., 2016. Conceptual design of a measurement network of the global change. Atmospheric Chemistry and Physics, 16(2), pp.1017-1028.
- Kanakidou, M., Mihalopoulos, N., Kindap, T., Im, U., Vrekoussis, M., Gerasopoulos, E., Dermitzaki, E., Unal, A., Koçak, M., Markakis, K. and Melas, D., 2011. Megacities as hot spots of air pollution in the East Mediterranean. Atmospheric Environment, 45(6), pp.1223-1235.
- Lelieveld, J., Berresheim, H., Borrmann, S., Crutzen, P.J., Dentener, F.J., Fischer, H., Feichter, J., Flatau, P.J., Heland, J., Holzinger, R. and Korrmann, R., 2002. Global air pollution crossroads over the Mediterranean. Science, 298(5594), pp.794-799.
- Baalbaki, R., Pikridas, M., Jokinen, T., Laurila, T., Dada, L., Bezantakos, S., Ahonen, L., Neitola, K., Maisser, A., Bimenyimana, E. and Christodoulou, A., 2021. Towards understanding the characteristics of new particle formation in the Eastern Mediterranean. Atmospheric Chemistry and Physics, 21(11), pp.9223-9251.

ANNEX I

Publication list of EOD for 2021

Climate Observations

1. Pyrgou, A., Hadjinicolaou, P., & Santamouris, M. (2020). Urban-rural moisture contrast: Regulator of the urban heat island and heatwaves' synergy over a Mediterranean city. Environmental Research, 182 (December 2019), 109102. https://doi.org/10.1016/j.envres.2019.109102
2. Abdelwares, M., J. Lelieveld, G. Zittis, M. Haggag and A. Wagdy (2020) A comparison of gridded datasets for precipitation and temperature over the Eastern Nile Basin region. Euro-Mediterr. J. Environ. Integr. 5, 3. https://doi.org/10.1007/s41207-019-0140-y
3. Morbidelli P., Garcia Marin A.P., Al Mamun A., Atiqur R.A., Ayuso-Muñoz J.L., Bachir T.M., Baranowski P., Bellocchi G., Benjamin I., Bennett B., Byambaa O., Bonaccorso B., Brocca L., Caloiero T., Caporali E., Caracciolo D., Casas-Castillo M.C., Catalini C.G., Chettih M, Kamal Chowdhury A.F.M., Chowdhury R, Corradini C, Custò J., Dari J., Diodato N, Doesken N., Dumitrescu A., Estévez J., Flammini A, Fowler H.J., Freni G., Fusto F., .Garcia-Barron L., Georgiana M., Gönster-Jordan S., Hinson S., Kanecka-Geszke E., Kanti Kar K., Kasperska-Wołowicz W., Krabbi M., Krzyszczak J., Llabrés-Brustenga A., Ledesma L.J., Liu T, Lompi M., Marsico L., Mascaro G., Moramarco T, Newman N., Orzan A., Pampaloni M., Pizarro Tapia R., Puentes Torres A., Rashid M., Rodríguez-Solà R., Sanguesa Pool C., Sepulveda Manzor M., Siwek K., Sousa A., Timbadiya P.V., Tymvios F., Viterbo F., Yoo C., Zeri M., Zittis G., Saltalippi C. (2020) History of the rainfall data time resolution in different geographical areas of the World. Journal of Hydrology (under review: HYDROL-S20-01973)
4. Pantavou, K., Lykoudis, S., Michael, N., Stylianou N., Christou R., Giallouros G., Kouis P., Tymvios F., Nicolaides F., Cartalis C., Nikolopoulos G. (2020) Thermal sensation and indices in the urban outdoor hot Mediterranean environment of Cyprus. Theor Appl Climatol 140, 1315–1329 https://doi.org/10.1007/s00704-020-03163-x
5. Michaelides, S., Ivanov, S., Ruban, I., Charalambous, D., and Tymvios, F.: A Case Study of Weather Radar Data Assimilation into the Harmonie Numerical Weather Prediction System, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-9350, https://doi.org/10.5194/egusphere-egu2020-9350, 2020.
6. Kasparis, T., Michaelides, S., and Lane, J.: Disdrometer Gravitational Sorting Signature in a Mediterranean Environment, EGU General Assembly 2020, Online, 4–8 May 2020, EGU2020-22356, https://doi.org/10.5194/egusphere-egu2020-22356, 2020.
7. Michaelides, S. (2020): Long-Term Analysis of Atmospheric Energetics Components over the Mediterranean, Middle East and North Africa. Atmosphere, 11, 976
8. Retalis, A., Katsanos, D., Tymvios, F. Michaelides, S. (2020): Comparison of GPM IMERG and TRMM 3B43 Products over Cyprus. Remote Sensing. 12, no. 19: 3212.

Atmospheric composition Observations

1. Wang, N., A. Edtbauer, A. Pozzer, E. Bourtsoukidis, L. Ernle, D. Dienhart, B. Hottmann, H. Fischer, J. Schuladen, J.N. Crowley, J.-D. Paris, J. Lelieveld and J. Williams (2020) Measurements of carbonyl compounds around the Arabian Peninsula indicate large missing sources of acetaldehyde. Atmos. Chem. Phys. Discuss. https://doi.org/10.5194/acp-2020-135.
2. Chen, Y., Y. Cheng, N. Ma, C. Wei, L. Ran, R. Wolke, J. Größ, Q. Wang, A. Pozzer, H.A.C. Denier
3. Achilleos S., Mouzourides P., Kalivitis N., Katra I., Kloog I., Kouis P., Middleton N., Michalopoulos N., Neophytou M., Panayiotou A., Papatheodorou S., Savvides C., Tymvios F., Vassiliadou E., Yiallouros P., Koutrakis P.; (2020). Spatio-temporal variability of desert dust storms in Eastern Mediterranean (Crete, Cyprus, Israel) between 2006 and 2017 using a uniform methodology. Science of the total Environment, Volume 714, https://doi.org/10.1016/j.scitotenv.2020.136693

4. Bourtsoukidis, E., A. Pozzer, T. Sattler, V. Matthaios, L. Ernle, A. Edtbauer, H. Fischer, T. Könemann, S. Osipov, J.-D. Paris, E.Y. Pfannerstill, C. Pöhlker, C. Stönner, I. Tadic, D. Walter, N. Wang, J. Lelieveld, and J. Williams (2020) The Red Sea deep water is a potent source of atmospheric ethane and propane. Nat. Comm. 11, 447. https://doi.org/10.1038/s41467-020-14375-0

5. Edtbauer, A., C. Stönner, E.Y. Pfannerstill, M. Berasategui, D. Walter, J.N. Crowley, J. Lelieveld and J. Williams (2020) A new marine biogenic emission: methane sulfonamide (MSAM), DMS and DMSO2 measured in air over the Arabian Sea. Atmos. Chem. Phys. 20, 6081-6094. https://doi.org/10.5194/acp-20-6081-2020

6. Kreher, K. et al, Intercomparison of NO2, O4, O3 and HCHO slant column measurements by MAX-DOAS and zenith-sky UV–visible spectrometers during CINDI-2, Atmos. Meas. Tech., 13, 2169–2208, https://doi.org/10.5194/amt-13-2169-2020, 2020.

7. Alvarado, L. M. A., Richter, A., Vrekoussis, M., Hilboll, A., Kalisz Hedegaard, A. B., Schneising, O., and Burrows, J. P., Unexpected long-range transport of glyoxal and formaldehyde observed from the Copernicus Sentinel-5 Precursor satellite during the 2018 Canadian wildfires, Atmos. Chem. Phys., 20, 2057–2072, https://doi.org/10.5194/acp-20-2057-2020, 2020

8. Drinovec, L., Sciare, J., Stavroulas, I., Bezantakos, S., Pikridas, M., Unga, F., Savvides, C., Višić, B., Remškar, M., and Močnik, G.: A new optical-based technique for real-time measurements of mineral dust concentration in PM10 using a virtual impactor, Atmos. Meas. Tech., 13, 3799–3813, 2020.

9. Lemou, A., L. Rabhi, H. Merabet, R. Ladji, J. B Nicolas, N. Bonnaire, M. Abou Mustapha, R. Dilmi, J. Sciare, N. Mihalopoulos, and N. Yassaa, Chemical Characterization of fine particles (PM2.5) at a coastal site in the South Western Mediterranean during the ChArMex experiment, Environmental Science and Pollution Research, 1-19, 2020

10. Rigler, M., Drinovec, L., Lavrič, G., Vlachou, A., Prévôt, A. S. H., Jaffrezo, J. L., Stavroulas, I., Sciare, J., Burger, J., Kranjc, I., Turšič, J., Hansen, A. D. A., and Močnik, G.: The new TC-BC method and online instrument for the measurement of carbonaceous aerosols, Atmos. Meas. Tech. Discuss., in review, 2019.

11. E. Triantafyllou; E. Diapouli; M.B. Korras-Carraca; M. Manousakas; C. Psanis; A.A. Floutsi; C. Spyrou; K. Eleftheriadis; G. Biskos, Contribution of locally-produced and transported air pollution to particulate matter in a small insular coastal city, Atmospheric Pollution Research, ISSN: 1309-1042, Vol: 11, Issue: 4, Page: 667-678

12. K.M. Fameli, A.M. Kotrikla, C. Psanis, G. Biskos, A. Polydoropoulou,Estimation of the emissions by transport in two port cities of the northeastern Mediterranean, Greece,Environmental Pollution,Volume 257, 2020

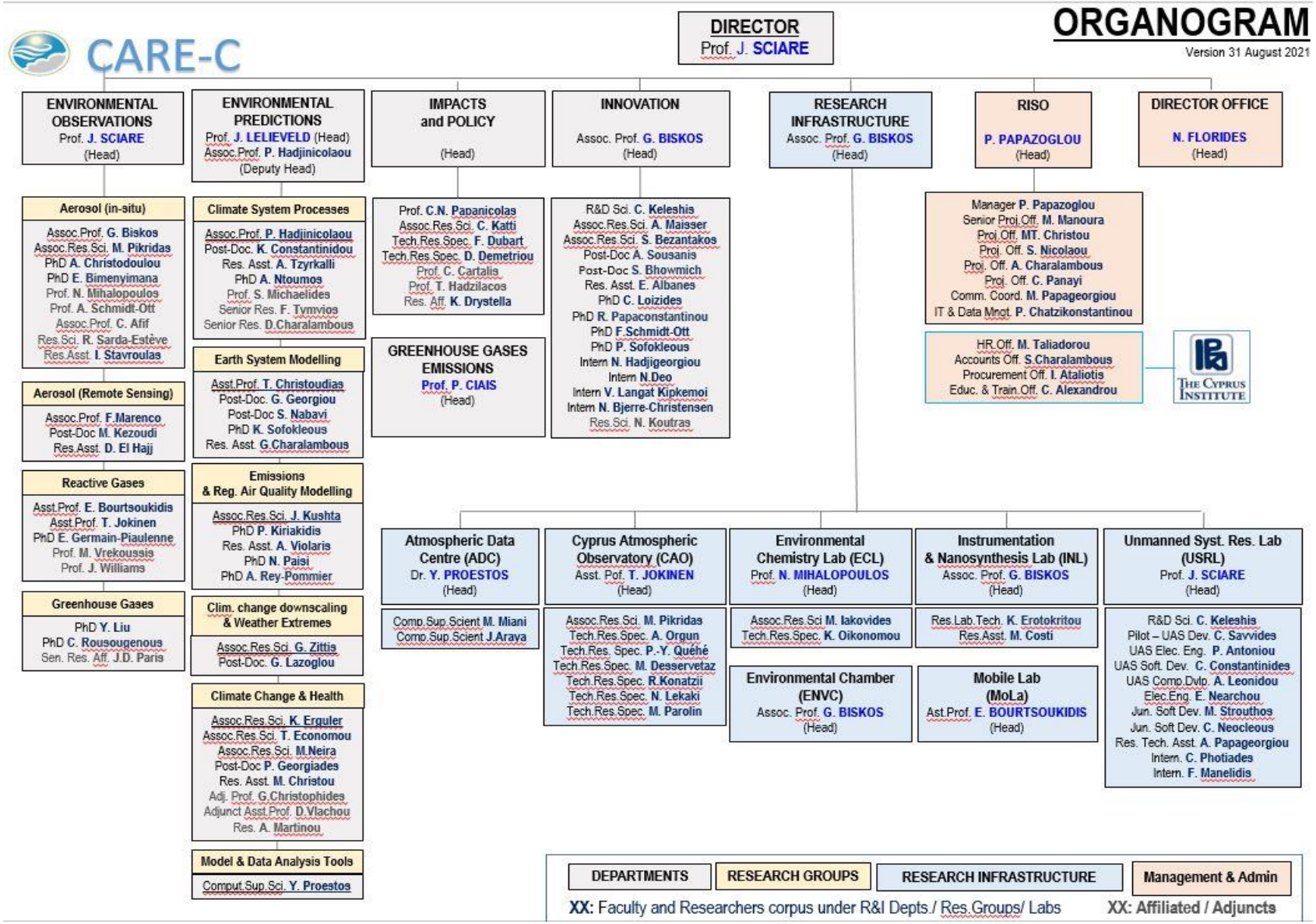
13. Dada, L., Ylivinkka, I., Baalbaki, R., Li, C., Guo, Y., Yan, C., Yao, L., Sarnela, N., Jokinen, T., Daellenbach, K. R., Yin, R., Deng, C., Chu, B., Nieminen, T., Wang, Y., Lin, Z., Thakur, R. C., Kontkanen, J., Stolzenburg, D., Sipilä, M., Hussein, T., Paasonen, P., Bianchi, F., Salma, I., Weidinger, T., Pikridas, M., Sciare, J., Jiang, J., Liu, Y., Petäjä, T., Kerminen, V.-M., and Kulmala, M.: Sources and sinks driving sulfuric acid concentrations in contrasting environments: implications on proxy calculations, Atmos. Chem. Phys., 20, 11747–11766, https://doi.org/10.5194/acp-20-11747-2020, 2020

14. Cuesta-Mosquera, A., Močnik, G., Drinovec, L., Müller, T., Pfeifer, S., Minguillón, M. C., Björn, B., Buckley, P., Dudoitis, V., Fernández-García, J., Fernández-Amado, M., Ferreira De Brito, J., Flentje, H., Heffernan, E., Kalivitis, N., Kalogridis, A.-C., Keernik, H., Marmureanu, L., Luoma, K., Marinoni, A., Pikridas, M., Schauer, G., Serfozo, N., Servomaa, H., Titos, G., Yus-Díez, J., Zioła, N., and Wiedensohler, A.: Intercomparison and characterization of 23 Aethalometers under laboratory and ambient air conditions: Procedures and unit-to-unit variabilities, Atmos. Meas. Tech. Discuss. [preprint], https://doi.org/10.5194/amt-2020-344, in review, 2020.

15. Baalbaki, R., Pikridas, M., Jokinen, T., Laurila, T., Dada, L., Bezantakos, S., Ahonen, L., Neitola, K., Maisser, A., Bimenyimana, E., Christodoulou, A., Unga, F., Savvides, C., Lehtipalo, K., Kangasluoma, J., Biskos, G., Petäjä, T., Kerminen, V.-M., Sciare, J., and Kulmala, M.: Towards understanding the mechanisms of new particle formation in the Eastern Mediterranean, Atmos. Chem. Phys. Discuss. [preprint], https://doi.org/10.5194/acp-2020-1066, in review, 2020

16. Kalkavouras, P.; BougiatiotI, A.; Hussein, T.; Kalivitis, N.; Stavroulas, I.; Michalopoulos, P.; Mihalopoulos, N. Regional New Particle Formation over the Eastern Mediterranean and Middle East. Atmosphere 2021, 12, 13. https://doi.org/10.3390/atmos12010013

ANNEX II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