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## Deliverable D 9.2: Final report on access to advanced ACTRIS stations

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### Deliverable D 9.2: Final report on access to advanced ACTRIS stations

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## Final report on access to advanced ACTRIS stations

### 1 Introduction

ACTRIS-2 provided a coordinated framework to support and facilitate physical access to a selected number of advanced ACTRIS stations in Europe to a wide community of users. The objective of this document is to report in details on the outcome of the Transnational Access activity to observational facilities for the entire project.

### 2 Infrastructures providing Transnational access to advanced ACTRIS stations

Within work package 9, ACTRIS-2 has provided physical, free-of-charge, transnational access (TNA) to users from the academic and private sector to 18 observational facilities in Europe. The ACTRIS stations offering TNA are advanced multi-instrumented facilities for atmospheric observations and are unique within Europe. The facilities were selected for their representative location (with respect to air mass type, altitude etc.), most of them have been operational for decades (except for a few new stations), documenting a long record and experience of access with available logistics to accommodate external research groups, and offer high quality research equipment making them world-class research stations. An overview of the observational facilities offering TNA is given in Figure 1, a short description of the infrastructures is provided on the ACTRIS website at: <http://www.actris.eu/DataServices/ObservationalFacilities/AccessToObservationalFacilities.aspx>

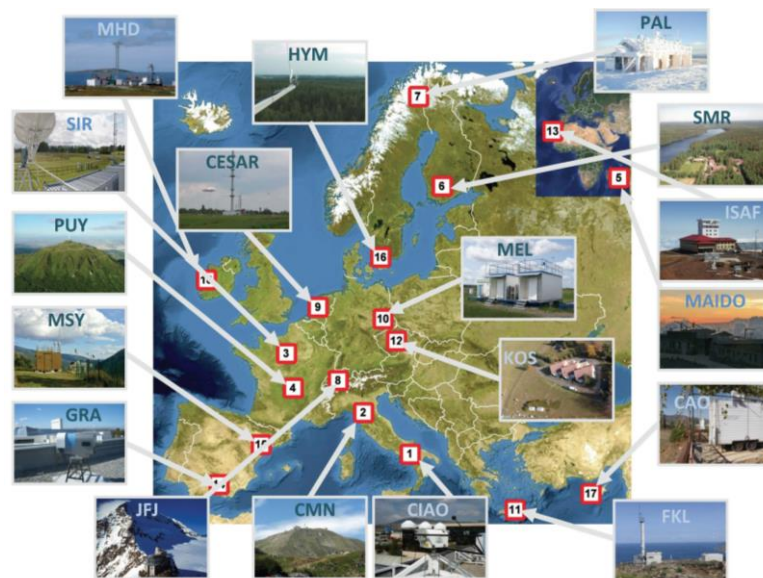


Figure 1: Overview of observational facilities within ACTRIS-2 providing physical TNA.

The observational facilities comprise high altitude research stations, e.g., PUY (1565 m, regional background), MAIDO (2160 m, south-western, tropical Indian Ocean), CMN (2165m, polluted environment, ISAF (2370 m, subtropical site, free troposphere), JFJ (3500 m, free troposphere), stations in Northern Europe's boreal forest (SMR, HYM, PAL at border of

Arctic), maritime/continental stations (MHD, CESAR / SIR, MEL, KOS), Mediterranean stations with urban background (MSY, GRA, CIAO, FKL, CAO).

The opportunities for physical access have allowed external users, including those from the private sector and users from outside Europe, to have access i) to cutting-edge research opportunities and ii) to intercomparison campaigns and for instrument testing using the state-of-the-art equipment for aerosol and cloud profiles, aerosol-cloud observations, and near-surface aerosol and trace gas observations, fostering research at the forefront of science; iii) to international capacity building opportunities by participating in scientific measurement campaigns and comprehensive measurement programmes, and by benefitting from the scientific expertise and support provided by the personnel operating the infrastructures, and from the available high level of services, including training to young scientists and new users.

### **3 Description of the transnational access procedure**

The TNA activity to observational facilities offered within ACTRIS-2 has been based on specific guidelines and rules for access that follow the Horizon 2020 rules. The procedure is described below, including the advertisement of the opportunities for access and the specific procedure of proposal submission, evaluation, and selection.

#### **3.1 Description of the publicity concerning the opportunities for access**

A number of measures have been taken to advertise the opportunities of transnational access within ACTRIS-2:

##### **3.1.1 Continuous calls for access via website and TNA infrastructure websites**

An official permanent call concerning transnational access opportunities to the observational facilities within WP9 was largely publicized at project start via the ACTRIS-2 website and simultaneously permanently promoted via the websites of the observational facilities and related projects/networks concerned. Please refer to D9.1 for more details (available at the [ACTRIS website](#) ).

##### **3.1.2 Special calls for access**

A number of special calls to the calibration and observational facilities were launched and widely announced throughout the project. The measurement campaigns and related activities have pursued defined objectives for calibration and intercomparison exercises, measurement campaigns, or joint TNA opportunities with collaborating EU-Integrating activities. These were organized either by the corresponding access providers and/or were linked with ACTRIS-2 networking and joint research activities if carried out at an infrastructure open for TNA, and allowed other research groups outside the project to participate via the TNA opportunities. An overview of corresponding TNA opportunities organized throughout the length of the project is listed in Table 1.

Table 1: Special calls to transnational access opportunities launched since project start

<b>TNA Opportunity</b>	<b>Dates</b>	<b>Organizer / Access provider / Location</b>	<b>Website address</b>
MelCol 2015	June 2015	TROPOS / MEL Germany	<a href="http://www.actris.eu/Outreach/News/Campaigns/Melpitzcolumn2015.aspx">http://www.actris.eu/Outreach/News/Campaigns/Melpitzcolumn2015.aspx</a>
PACE 2015	September-December 2015	FMI / PAL Finland	<a href="http://www.actris.eu/Events/Campaigns/PACE2015.aspx">http://www.actris.eu/Events/Campaigns/PACE2015.aspx</a>
Athens Smog Campaign	December 2015-February 2016	NOA / FKL Greece	<a href="http://www.actris.eu/Outreach/News/Campaigns/JRA1AthensDec2015.aspx">http://www.actris.eu/Outreach/News/Campaigns/JRA1AthensDec2015.aspx</a>
Cyprus campaign 2016	April 2016	CYI, CAO Cyprus	<a href="http://www.actris.eu/Outreach/News/Campaigns/Cyprus2016.aspx">http://www.actris.eu/Outreach/News/Campaigns/Cyprus2016.aspx</a>
INTERACT II	July-December 2016	CNR-IMAA / CIAO Italy	<a href="http://www.actris.eu/Outreach/News/Campaigns/INTERACTIICampaign2016.aspx">http://www.actris.eu/Outreach/News/Campaigns/INTERACTIICampaign2016.aspx</a>
Precipitation Field Campaign 2016	September-December 2016	CNRS / SIRT France	<a href="http://www.actris.eu/Portals/46/Outreach/Campaigns/SIRT-TNA_precipitation_2016.pdf?ver=2016-07-19-175127-140">http://www.actris.eu/Portals/46/Outreach/Campaigns/SIRT-TNA_precipitation_2016.pdf?ver=2016-07-19-175127-140</a>
Intercomparison Field campaign at PUY	October 2016	CNRS / PUY France	<a href="http://www.actris.eu/Outreach/News/Campaigns/Intercomparisonfieldcampaign2016.aspx">http://www.actris.eu/Outreach/News/Campaigns/Intercomparisonfieldcampaign2016.aspx</a>
ACTRIS-2 & EUFAR TNA	2016-2017		<a href="http://www.actris.eu/Outreach/News/CallsforTNA/CallforACTRIS-2EUFARjointTNA.aspx">http://www.actris.eu/Outreach/News/CallsforTNA/CallforACTRIS-2EUFARjointTNA.aspx</a>
CyCARE Campaign 2017	October 2016-August 2017	TROPOS/CYPRUS University of Technology	<a href="https://www.tropos.de/en/institute/departments/remote-sensing-of-atmospheric-processes-new/ground-based-remote-sensing/cyprus-clouds-aerosol-and-rain-experiment-cycare/">https://www.tropos.de/en/institute/departments/remote-sensing-of-atmospheric-processes-new/ground-based-remote-sensing/cyprus-clouds-aerosol-and-rain-experiment-cycare/</a>
KOS Call for TNA	June 2017	National atmospheric observatory Košice	<a href="https://www.actris.eu/Portals/46/Events/Events%20descriptions/2017/ACTRIS-2%20(use%20precise%20folder)/Flux_measurement%20campaign_NAOK.pdf?ver=2017-06-12-155852-737">https://www.actris.eu/Portals/46/Events/Events%20descriptions/2017/ACTRIS-2%20(use%20precise%20folder)/Flux_measurement%20campaign_NAOK.pdf?ver=2017-06-12-155852-737</a>
PTR-MS Intercomparison	September 2017	Cabauw The Netherlands	<a href="http://www.actris.eu/Portals/46/Events/Events%20descriptions/2017/PTR-MS%20campaign%20sept%202017/PTR.pdf?ver=2017-04-03-134820-307">http://www.actris.eu/Portals/46/Events/Events%20descriptions/2017/PTR-MS%20campaign%20sept%202017/PTR.pdf?ver=2017-04-03-134820-307</a>
Cloud Radar Calibration Campaign	May 2018	SIRTA Observatory, France	<a href="http://www.actris.eu/Events/Campaigns/CloudRadarCalibrationCampaign,SIRTAObservatory2018.aspx">http://www.actris.eu/Events/Campaigns/CloudRadarCalibrationCampaign,SIRTAObservatory2018.aspx</a>
Aerosol Ice Nucleation Campaign	October 2018	PUY Station, France	<a href="https://www.actris.eu/Portals/46/Events/Events%20descriptions/2017/ACTRIS-">https://www.actris.eu/Portals/46/Events/Events%20descriptions/2017/ACTRIS-</a>

TNA Opportunity	Dates	Organizer / Access provider / Location	Website address
			<a href="#">2%20(use%20precise%20folder)/WP9/TNA_LaMP_Aerosol%20Ice%20nucleation%20Campaign-2.pdf?ver=2017-11-15-143627-383</a>
SCC summer school	4-6 Dec. 2018	CIAO, Potenza, Italy	<a href="http://www.actris.eu/Events/Eventsdescriptions/ACTRIS-2Events/WP2SCCWinterSchool.aspx">http://www.actris.eu/Events/Eventsdescriptions/ACTRIS-2Events/WP2SCCWinterSchool.aspx</a>

### 3.1.3 Mailing lists and electronic means

The launch of TNA opportunities and permanent and special calls for access to observational facilities were advertised via various mailing lists within the project but also outside ACTRIS-2, e.g., mailing lists of international networks and coordinated observations, projects, and cooperating scientific communities: ENVRIplus (Implementation and operation of cross-cutting services and solutions for clusters of ESFRI and other relevant research infrastructure initiatives, EU H2020), EUFAR (European Facility for Airborne Research, EU FP5,6,7), ESA (European Space Agency), ChArMEx (Chemistry-Aerosol-Mediterranean Experiment), INUIT (Ice Nuclei Research Unit). Furthermore used are the mailing lists of the more than 20 beneficiaries and linked third parties hosting TNA infrastructures, the mailing lists of national ACTRIS communities within Europe, and communication through direct links with international collaborators.



### 3.1.4 Outreach activities

The ACTRIS-2 infrastructures offering TNA have been largely promoted during invited talks, conferences (presentations and posters), workshops, project meetings, communications and direct announcements. Project brochures have been distributed at such events. Direct oral advertisement has proven efficient to encourage scientific activities at, e.g., TNA stations. See also Figures 2a-c).



Figure 2a: ACTRIS-2 poster advertising the access opportunities via TNA (EAC-2016)



Figure 2b: Advertisement for TNA infrastructure at Jungfrauoch, Switzerland (WP9).



Figure 2c: Advertisement for TNA to observational facilities (2<sup>nd</sup> ACTRIS-2 Science meeting, Granada).

### 3.1.5 Newsletters, brochures, and other outreach material

TNA infrastructure and services is also advertised through further promotional channels such as posters, brochures, and leaflets (Figures 3a-c), distributed at conferences or meetings or by e-mail.



Figure 3a: ACTRIS-2 project brochure promoting the access opportunities via TNA (WP1).



Figure 3b: Leaflet offering Transnational Access to the infrastructure Košetice – Křešín u Pacova (WP9 / KPO), July 2015.



Figure 3c: Leaflet about description of opportunities at the Atmospheric research facility at Agia Marina Xiliatou (WP9 / CAO), June 2016.

Social medias were also used to promote TNA opportunities as for instance ACTRIS twitter channel (@ACTRISRI) with about 5000 reach:



Figure 3d: ACTRIS Twitter account promoting the access opportunities via TNA.

### 3.2 Description of the selection procedure

The centralised access and application procedure is described in details in D9.1 “Intermediate Report on access to advanced ACTRIS stations” which is available at the [ACTRIS website](#).

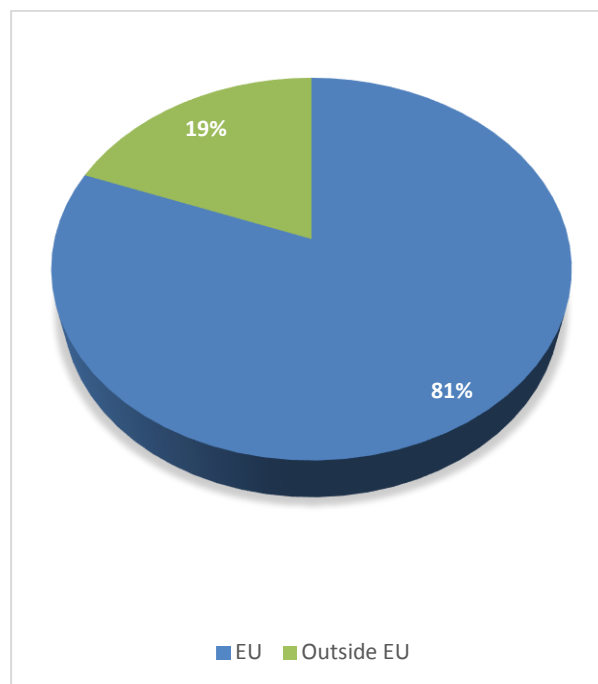
## 4 Summary of Transnational Access activity to advanced ACTRIS stations

The call for physical access was launched in the beginning of the project. Since the start of the project, 153 proposals to the 18 observational facilities have been received of which 136 were selected for access support. 6 proposals were withdrawn by the users, 6 were not eligible and 5 more were not evaluated sufficiently high to reach the threshold to be accepted. The quantity of access provided (referring to estimated access and ongoing projects) in units of RWD (1 research-person-working-day) since the beginning of the project equals to 3'202 days corresponding to 145% out of the estimated access of 2'195 days foreseen in the contract. This is a positive figure showing that access has continued even after the travel and subsistence budget have been spent.

### International collaboration

The importance and impact of access opportunities offered by ACTRIS-2 world-wide is clearly demonstrated. Since the start of the project 605 access days have been consumed by users outside Europe (19%), slightly below the threshold for the overall limit of 20% (WP9 TNA only). This corresponds to 26 projects (see figure 5 below).

Those international users came from 18 different countries: Algeria, Antigua and Barbuda, Argentina, Brazil, Canada, Chile, China, Colombia, Costa Rica, Indonesia, Mexico, Nigeria, Russia, South Korea, United States, Taiwan, Tunisia, Turkey.



*Figure 5: Breakdown of physical TNA user projects originating from countries within and outside EU, during the ACTRIS-2 project.*

### Private sector collaboration

Through TNA, ACTRIS-2 has strengthened its links and fostered participation with the private sector. 13 out of the total 136 TNA requests accepted involved the private sector -representing 89 access days and 10% of the projects carried out. In the 1<sup>st</sup> reporting period, SME requests were Envricontrol SA, Belgium. Under the second reporting period were Palas GmbH-Germany, Sunset Laboratory BV-The Netherlands, GRASP and Aerodyne Research Inc. In the third reporting period were Aerosol doo, Droplet Measurement technologies, EKO Instruments EUROPE BV, IONICON Analytik and Raymetrics SA. The milestone report MS4.5 details the SMEs access to ACTRIS-2 facilities.

The use of the ACTRIS observational platforms by the thirteen private sector users is shortly summarized in the following:

#### Aerodyne Research Inc. (USA) @ Monte Cimone/Po Valley facility (CMN, Italy)

Aerodyne Research Inc. is an instrument manufacturer that provides instrumentation and consulting for environmental air quality monitoring and measurements. The Aerodyne Center for Sensor Systems and Technology (CSST) designs and develops innovative sensors utilizing proprietary technology for its own use and for delivery to private, academic and government customers. It has built and marketed state-of-the-art monitors that employ cavity attenuated phase shift (CAPS) techniques. One of such CAPS monitors is the CAPS SSA, a single scattering albedo monitor for direct, combined measurements of both extinction and scattering in the same volume. Particle absorption can be obtained by subtraction of the two measured quantities (extinction minus scattering), with an uncertainty of 5-6%. Upcoming in July 2017, Aerodyne participates in an international field campaign at the Monte Cimone and Po Valley sites to assess the accuracy of aerosol absorption and black carbon measurements. The CAPS SSA is collocated with other instrumentation for aerosol measurements of optical, physical, and chemical properties: a nephelometer, an Aerosol Chemical Speciation Monitor, an optical particle counter. The presence of multiple techniques for measuring aerosol absorption (by difference with the CAPS SSA and on a filter) will allow measurement intercomparison and observe the changes in optical properties with changes in the chemical composition of the sub-micron aerosol as determined by the ACSM. In particular, the specific goal of the campaign is a comprehensive closure between absorption coefficient and BC concentration and an assessment of the reasons for the variability of the mass absorption efficiency using commercial instrumentation.

#### Aerodyne Research Inc. (USA) @ KNMI – Cabauw Experimental Site for Atmospheric Research (CESAR, The Netherlands)

AVVICATO (Application of a VOCUS VOC Integrated Calibration system at a Tower Observatory) involved the manufacturer Aerodyne Research Inc. using their automated PTR-MS calibration and background system in cooperation with other PTR instruments. The constructed PTR time-of-flight mass spectrometer (PTR-ToFMS) has a unique ionization source compared to other instruments in attendance, and has never been quantitatively evaluated against other PTR instruments.

#### Aerosol d.o.o. (Slovenia) @ Cyprus Atmospheric Observatory (CAO, Cyprus)

[Aerosol d.o.o.](#) is a SME that develops and manufactures Aethalometer® instruments that are used in air monitoring network stations for sampling and measurement of the mass

concentration of black carbon particles. The SME supplied a platform, installed at CAO in December 2018 in the frame of the CADB project led by Grisa Mocnik, from the J. Stefan Institute, using Aethalometers AE33 with different inlets to:

- measure fine aerosol absorption (AE33 with a PM1 inlet),
- measure concentrated coarse fraction absorption (AE33 with a virtual impactor inlet) and calculating the coarse fraction absorption as a difference between the concentrated sample (which contains some fine fraction) and the fine fraction. In addition to the measurements of absorbing aerosols, additional measurements of all carbonaceous aerosols at high time resolution have been implemented at Nicosia.

Aerosol d.o.o. (Slovenia) @ CSIC Montseny (MSY, Spain)

This private company supplied a platform, installed at MSY in February 2019 in the frame of the CADB-2 project led by Grisa Mocnik, from the J. Stefan Institute, using Aethalometers AE33 with different inlets to measure fine aerosol absorption (AE33 with a PM1 inlet), and to measure concentrated coarse fraction absorption (AE33 with a virtual impactor inlet). Aerosol d.o.o has supplied two additional platforms installed at BCN urban background sites and MSC mountain site. This approach together with concurrent aircraft measurements will permit to determine the pure Saharan dust optical properties before it is mixed into the receptor site mixing layer, discriminating whether internally mixed dust and BC are from the source or receptor regions, respectively.

Droplet measurement technologies, (USA) @ Puy de Dome high altitude station (PUY, France)

[Droplet measurement technologies](#) is an instrument manufacturer based in Colorado, USA, specialized in the production of cutting-edge instruments for measuring water droplets, ice crystals, CCN, black carbon, bioaerosols and other aerosols. The company provides accessories for these instruments such as calibration devices and power distribution systems, as well as high-quality software.

The company accessed the Puy de Dome high altitude station in France with a Spectrometer for Ice Nuclei (SPIN), which is one of the ice nuclei spectrometers commercially available. Given the wide variety of ice nucleation instruments in use, differences in ice nucleation observations arise, in part, from the different techniques used. The TNA project proposal aimed at describing the differences between one SPIN unit versus another, as well as to compare SPIN with other types of CFDCs. Understanding the source of these differences helps with data quality of SPIN in particular and CFDCs in general. Furthermore, an improved SPIN enables scientists interested in conducting measurement with access to an instrument that is well characterized by experts in this field. Specific objectives of the project have been i) the characterization of the differences in particle concentrations measured by SPIN units and other CFDCs under different meteorological conditions; ii) the characterization and investigation about features of the parallel plate type CFDC to better learn how to calibrate instruments of this type and in what detail the calibration is necessary; iii) the improvement of methods and procedures to minimize frost background in SPIN, isolating the effects that lead to frost formation and implementing changes in the procedure that might arise in frost; iv) improved measurement of ice crystal concentrations by utilizing advanced analysis techniques of particle-by-particle polarization ratio.

EKO Instruments EUROPE BV (The Netherlands) @ Izaña Subtropical Access Facility (ISAF, Spain)

[EKO Instruments EUROPE BV](#) is a Dutch company established in 1927 with three core business areas, which are remote sensing, evaluation and measurement of photovoltaic performance, and radiation and spectral measurements.

The research project main purpose is the evaluation of the EKO MS-711 spectroradiometer measurements at the Izaña Subtropical Access Facility (ISAF, Spain). The project foresees an intercomparison between instruments provided by EKO as well as other radiometers already installed at IARC-AEMET testbed in order to perform i) comparison of the direct normal irradiance measurements performed by the collimated and rotating shadow band EKO spectroradiometers; ii) evaluation and comparison of current methods for the retrieval of aerosol optical depth (AOD), precipitable water vapor (PWV), and the spectral irradiance extension, based on spectral DNI measurements from both collimated and RSB MS-711, iii) comparison between indoor and outdoor spectroradiometer calibrations; and to iv) quantify the measurement improvements in the measurement accuracy of the stray light corrected DNI measurements of the EKO spectroradiometer in the UV range against the NASA Pandora spectrometer; v) quantify the measurement improvements in the measurement accuracy of the stray light correction measurements of the EKO spectroradiometer. During the visit has been foreseen the assembly of instrumentation on site for the measurement campaign. Two spectroradiometers will be provided by EKO Instruments to be installed in Izaña testbed. One collimated EKO MS-711 will be installed with collimation in an EKO STR-22G sun tracker and one EKO MS-711 will be installed in the EKO RSB-01S rotating shadow band.

[Envicontrol SA \(Belgium\) @ CNR IMAA Atmospheric Observatory \(CIAO, Italy\)](#)

[Envicontrol](#) is specialized in measuring equipment for gases, air and dust (sampling, analysis, calibration and generating of gases), as well as in acquisition and management systems for monitoring and warning networks. The SME has exclusive dealership for about 15 manufacturers in Benelux, France, and Africa. Envicontrol has participated in the measurement campaign INTERACT-II (INTERcomparison of Aerosol and Cloud Tracking) where a number of commercial instruments were involved: two multi-wavelength Raman lidars, a Raymetrics UV scanning Raman lidar, a VAISALA CT25K ceilometer, a VAISALA CL51 ceilometer, a JENOPTIK CHM15k ceilometer, a Campbell CS135s ceilometer, and a Sigma Space mini-Micro Pulse Lidar. Envicontrol has been in charge of operating the mini-MPL system to study the system performance for the measurements of aerosols and clouds, instrument stability, and accuracy of calibration. Envicontrol furthermore received training for advanced Raman lidar operation and use of calibration procedure for the lidar depolarization technique.

[GRASP S.A.S \(France\) @ FINOKALIA Atmospheric Observatory \(FKL, Greece\)](#)

The objective of the GLAM (Comparison of GARRLIC Absorption Profiles with Airborne In-situ Measurements during the DETECT Campaign in Crete) campaign was the evaluation of the GARRLiC retrievals with high-quality airborne and in-situ measurements of aerosol absorption performed during the campaign at Finokalia. The TNA was carried out by the start-up company GRASP S.A.S.

[IONICON Analytik \(Austria\) @ TROPOS Research Station Melpitz \(MEL, Germany\)](#)

The main scientific objective of this TNA is to field test and validate the new CHARON PTR-TOF 6000 X2 instrument. The instrument detects gas-phase organics at single-digit ppt levels and particle-phase organics at triple-digit pg/m<sup>3</sup> levels. The instrument exhibits a series of user friendly features such as automated zeroing, automated switching between gas phase and

particle inlet and real-time display of concentrations. IONICON will provide a PTR-TOF 6000 X2 instrument that is equipped with the latest version of the CHARON particle inlet. The CHARON (“Chemical Analysis of Aerosol On-line”) inlet consists of i) a gas-phase denuder for removing gaseous organics, ii) an aerodynamic lens for enriching the particle concentration in the instrument subsampling flow and iii) a vaporization unit for evaporating particle-bound organics [Eichler et al.; doi: 10.5194/amt-8-1353-2015; Müller et al., doi: 10.1021/acs.analchem.7b02582] The commercial instrument offers a variety of new features (automated zeroing, automated switching between gas phase and particle inlet, real-time display of concentrations, sub-ng detection limit, new vaporizer design) that have not been field-tested and validated. Dr. Markus Müller, the developer of both the PTR-TOF-MS instrument and the CHARON inlet, will set-up, calibrate and operate the CHARON-PTR-ToF-MS analyzer during week 1. During week 2 remote operation will be tested. During week 3, the PhD student Felix Piel will be on site for training purposes together with his supervisor Prof. Armin Wisthaler who has also multi-year experience in PTR-ToF-MS and particle analysis using the CHARON inlet. This will be the first medium-term field test and validation exercise of the new CHARON-PTR-ToF-MS analyzer. Data analysis and write-up (method/intercomparison paper) will be carried out in joined work by IONICON, the University of Oslo and TROPOS. The TNA will end the 1<sup>st</sup> of March 2019 and a complete scientific report will be published.

Palas GmbH (Germany) @ Puy de Dome high altitude station (PUY, France)

[Palas](#) is a company specialized in particle measurement technology and the development and production of filter test systems and optical aerosol spectrometers. In October 2016, Palas participated in an intercomparison field campaign of cloud microphysical probes with two of its Fidas® 200 S instruments. Fidas® 200 S is a fine dust monitoring and ambient air measurement system for ambient air monitoring of fine dust for regulatory purposes. Goal of this campaign is to evaluate a new automatic instrumentation for clouds droplet real time analysis. The new Fidas® 200 analyser supplies a particle size distribution (mass and/or number) between 0,4 and 40 µm. The aim is to study the interaction between droplets size and condensation nucleus with two analysers, installed side by side. One is configured to measure droplets size, the other to dry droplets and to evaluate condensation nucleus size. If successful, the low-cost and low maintenance instrument could be an efficient solution for long-term measurement of cloud droplets at ACTRIS stations.

Palas GmbH & Airclip Service GmbH (Germany) @ Pallas-Sodankylä Global Atmospheric Watch Station (PAL, Finland)

The 7<sup>th</sup> Pallas Cloud Experiment combined in-situ and remote-sensing observations to provide the best basis for process-level research on cloud-atmosphere interaction.

Palas GmbH together with Airclip Service GmbH & Co KG provided a Fidas Fly 200 instrument and flight robot (HORUS 2.0 octocopter), respectively during this campaign.

Fidas Fly200 provided the continuous and simultaneous measurement of the PM-fractions PM1, PM2.5, PM4, PM10, as well as in addition the particle number concentration as well as the particle size distribution in 32 size classes per decade within the particle size range of 0.18 – 18 µm or 0.5 – 40 µm - and all this in an additional spatial dimension. Besides the experiments were the first time to actually use the new Fidas Fly 200 in combination with HORUS in such weather conditions, regarding humidity and temperature. This proves that the system works and shows what needs to be improved.

[Raymetrics \(Greece\) @ SIRTAs Atmospheric Research Observatory \(SIR, France\)](#)

The objective of this TNA has been the development of new software and hardware tools for improving lidar alignment mechanism and strategies and optimizing lidars field of view. In many lidar systems optimizing day light background suppression mechanism is based on reducing the lidar's field of view. However, minimizing field of view requires an improved "mechanism" for lidar alignment. By using a combination of a special designed CCD camera and multi-anode PMT, lidar signal optimization and accurate positioning of the field stop of the lidar was accomplished. Monitoring the image of the telescope focal plane and detecting the position of the lidar return signals in respect of Field Stop Diameter allows user to check the "correct" position of the Field Stop and the quality of the lidar alignment. The use of a multi anode PMT and specially developed software allows real time alignment monitoring and correction by a motorized laser beam steering mechanism. The unique combination of a CCD and a multi anode PMT opens new ways for checking lidar alignment, lidar setup integrity and lidar signal background suppression. A better positioning of the Near Range field stop achieved even from the very first day of these TNA. Near ranges signals were improved significantly and telecover test performed successfully. CCD camera solutions were deployed and checked. It was proved that such solutions can be used successfully for visible but also for ultra violet signals day and night for IPRAL lidar.

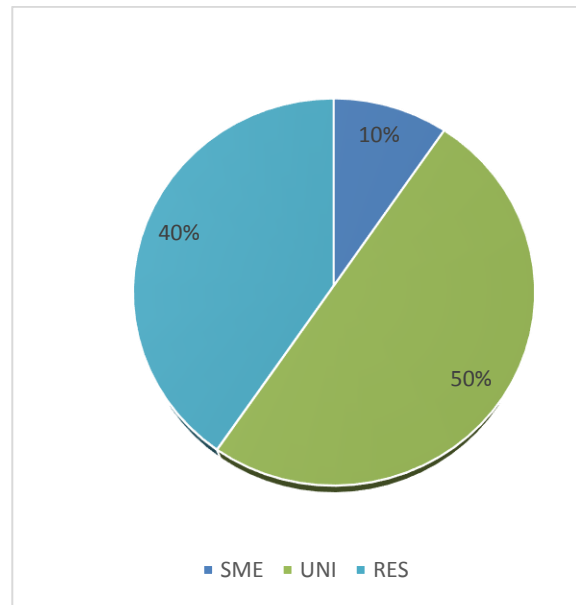
[Sunset Laboratory Inc. \(The Netherlands\) @ CSIC Montseny \(MSY, Spain\)](#)

[Sunset Laboratory Inc.](#) is a company specialized for manufacturing devices for organic carbon and elemental carbon (OC-EC) aerosol analysis and in the field of aviation, mining, marine, astronomy, construction, and weather research. Their equipment is suitable for the laboratory or in the field, and ready for use with different methods, among others the EUSAAR2 protocol developed within the ACTRIS-1 predecessor EU project. Sunset Laboratory has developed the Sunset SemiContinuous Field OCEC analyzer. To evaluate its performance with the EUSAAR2 protocol, Sunset Laboratory has used the ACTRIS-2 site MSY during a TNA project "SLOPE". The EUSAAR2 is a required protocol for the networks of all EU member states to measure EC and OC in particulate matter at background sites according to the Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe. The European Committee of Standardization (CEN), has recently adopted EUSAAR2 as the reference temperature protocol to be used when performing the offline, thermal-optical/transmittance (TOT) Organic and Elemental Carbon analysis (OCEC) (CEN/TC 264/WG 35 prEN16909:2016). Sunset investigates the comparison of the online OCEC analysis method with the offline, reference method at a challenging rural environment, dominated by biogenic emissions, for their comparability and to evaluate the hightime resolution concentrations.

**Profile of the users**

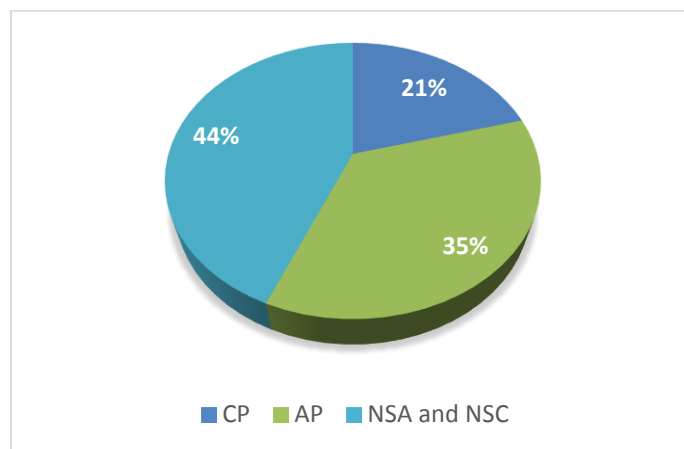
Figure 6 shows the different sector representation including the private sector, the public sector (universities and research institutes) within the projects carried out. The majority of users having used the observational platform have come from the public research sector.





*Figure 6: Representation of public sector (Research, Universities) and private sector (SME) in the number of TNA projects carried out during the ACTRIS-2 project.*

The research domain targeted by the completed TNA projects are well distributed among the three ACTRIS topics aerosol profiling (35%), cloud profiling (21%) and trace gases and near surface aerosol (44%), as summarized in figure 7 below.



*Figure 7: Representation of project users in aerosol profiling domain, cloud profiling and near surface aerosol properties and trace gases.*

A significant number of users have benefitted from the opportunities offered through ACTRIS-2 TNA: 371 researchers (representing 140% of 264 initially estimated users, as in Annex 1 of the grant agreement) have been able to benefit from TNA to the advanced observational facilities, of which 88% are new users, demonstrating that ACTRIS-2 has been successful in promoting the use of its facilities to users that have never visited the ACTRIS stations for research before (See Figure 8), including scientists young researchers and scientists from new regions/countries. 34% of the researchers are female scientists (see Figure 9). 28% (undergraduate and postgraduate) of the researchers were young scientists as shown in Figure 10, 28% of the projects aimed at training purposes (to get trained in observation measurements,

scientific integration, for developing specific expertise, or to benefit from a facility which is not available in the home country of the researchers), 48% contributed to mobility of experts (e.g., for participation in scientific campaigns, for instrumental synergies, to carry out interdisciplinary research project or collaborative campaigns), and 24% represented a combination of both, training and mobility. A representation of the training is as in Figure 11.

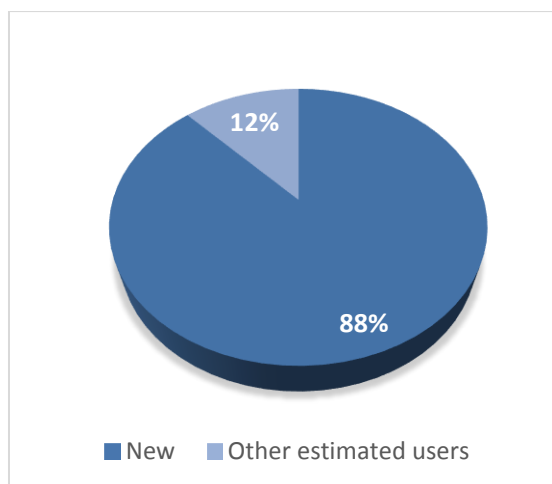


Figure 8: Representation of new TNA users

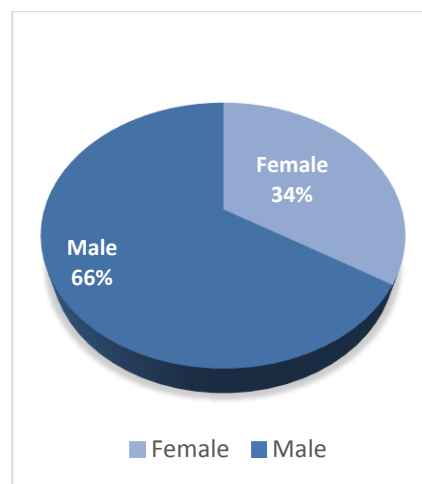


Figure 9: Representation of female TNA users.

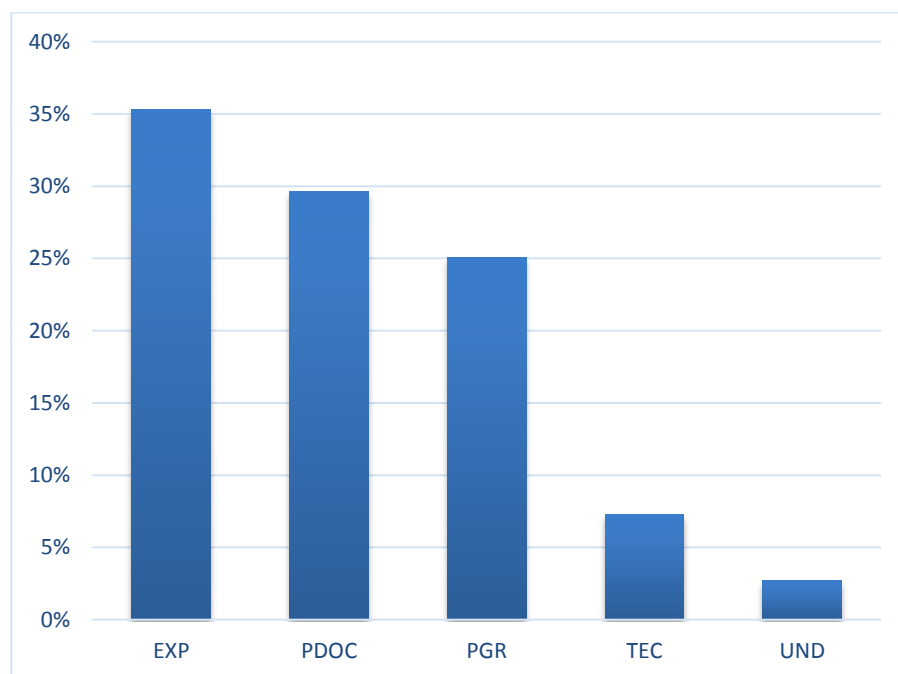


Figure 10: Representation of user profile ranging from expert, post graduate, post doctorate, technician, undergraduate.

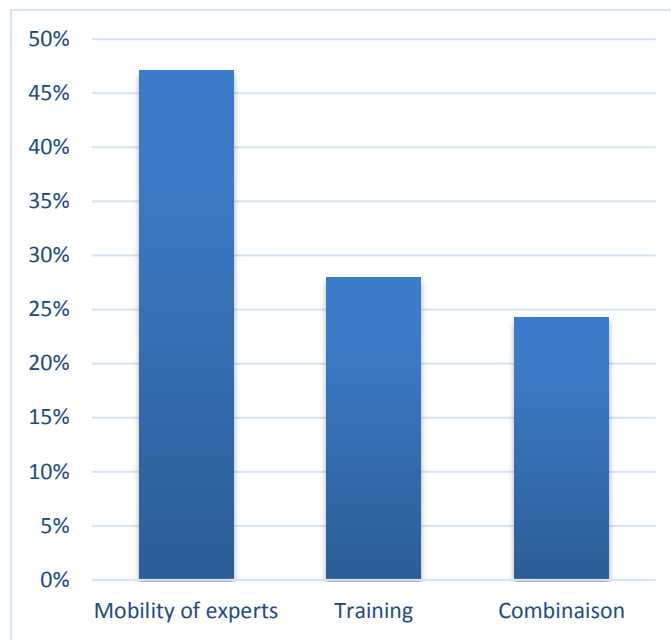
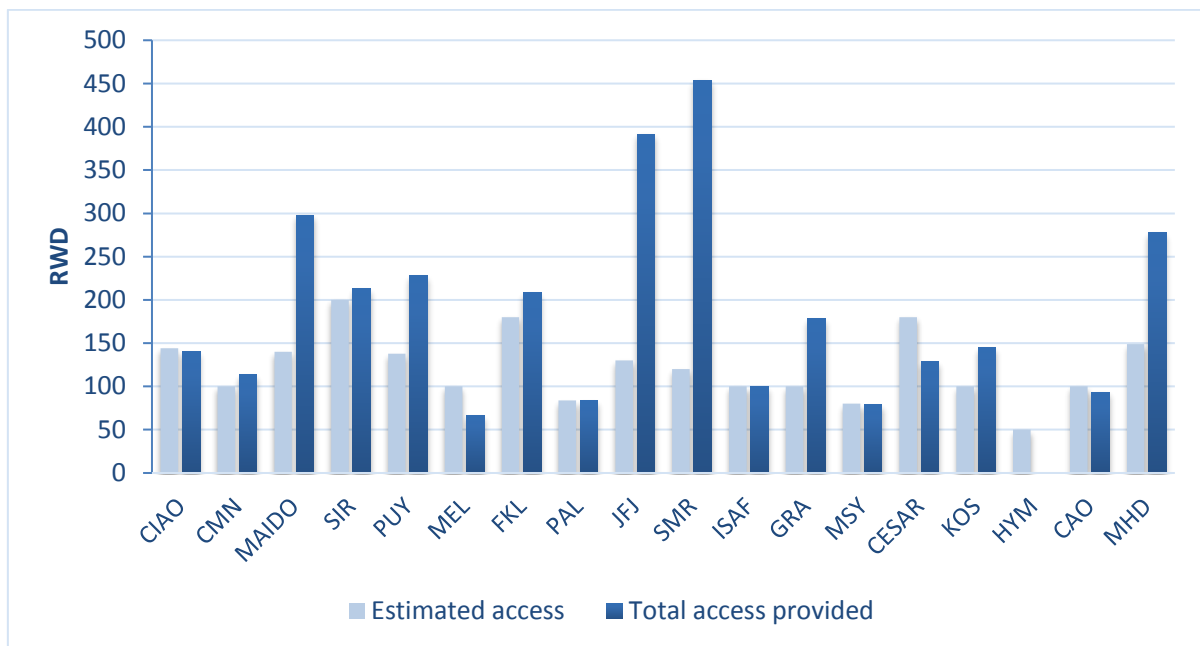


Figure 11: A representation of the projects submitted for different purposes.

## 5 Description of Transnational Access

The transnational access activities are described by observational facility and direct scientific output resulting from TNA is summarized in scientific activity reports available on the ACTRIS website at [https://www.actris.eu/Documentation/ACTRIS-2IAinH2020\(2015-2019\)/WPdocuments/TNAOverview/Physical.aspx](https://www.actris.eu/Documentation/ACTRIS-2IAinH2020(2015-2019)/WPdocuments/TNAOverview/Physical.aspx) . A short overview of TNA activities at each individual station is described below.

Figure 12 below illustrates the use of the 18 individual stations. One station has provided no access (HYM) and although some stations have provided fewer access (e.g., CESAR, MEL), some others have overspend the minimum quantity of access due to the high user demand (e.g., CMN, JFJ, FKL, GRA, MAIDO).



*Figure 12: Number of access days per individual station (planned access vs total access provided)*

### 5.1 CNR IMAA Atmospheric Observatory, CIAO (CNR)

CIAO has hosted ten TNA projects, for a total duration of 140 days, accounting for near 100% of the access offered.

CIAO-1: Within the project, named MICROLIRA, 11 access days, (MICROphysical characterization of cirrus clouds by Lidar and RAdar instruments), the vertical profile of dust and cirrus cloud extinction coefficient retrieved using the Raman Lidar technique has been compared with the current MPLNET V3 extinction retrieval obtained from micro-pulse lidars, which is based on the assumption of the value of the extinction-to-backscatter ratio (Lidar Ratio). The vertical profile of the extinction coefficient is a fundamental climate variable to estimate the radiative forcing and the microphysical properties of atmospheric particles. Moreover, cirrus cloud extinction coefficient is required in the Heymsfield parameterization to calculate cirrus clouds mean crystal size and Ice Water Content (IWC): both the extinction coefficient and the IWC are input parameters for the Fu-Liou-Gu (FLG) radiative transfer code to calculate TOA forcing. The work carried out in the frame of MICROLIRA has allowed to quantify the sensitivity of the Fu-Liou-Gu (FLG) Radiative Transfer Model to estimate the aerosol-cloud net radiative forcing using different lidar instruments/algorithms/techniques applied to the retrieval of the extinction coefficient and in particular the effect of the smoothing of lidar profiles. The effect of smoothing on the atmospheric features of the original vertical lidar profile is resulted substantive and must be taken into account when a radiative analysis is performed with pre-processed lidar data.

The results of the project have been presented at EGU 2016, DUST 2016, and at ICCP 2016 collecting good feedbacks; a journal article will be also submitted by the end of the year.

CIAO-2: For the INTERACT-II project, 4 days, commercial ceilometers and a miniMPL lidar have been inter-compared in the frame of the INTERACT-II campaign and this was performed at CIAO (CNR-IMAA Atmospheric Observatory) in Tito Scalo, Potenza, Italy (760 m a.s.l.,

40.60°N, 15.72°E) from July 2016 . The stability, sensitivity and uncertainties of these commercial automatic lidars and ceilometers for tropospheric profiling of aerosols and clouds have been evaluated, using advanced research lidars as reference. The instruments involved in the campaign have been: Luftt CHM15k, Vaisala CT25K, VAISALA CL51, Campbell CS135, Sigma Space mini-Micro Pulse Lidar (MPL). The last three instruments have been deployed by the related manufacturers which have also provided their support in the data evaluation.

CIAO-3 was withdrawn by CIMEL due to inability to go to the station.

CIAO-4: Satellite validation using ground based lidar measurements. The project developed and provided a collocation match up database and associated graphical user interface tools for aerosol reference quality observations. The tool is developed in synergy with the GAIA-CLIM project with the aim to allow the users to easily investigate the temporal congruence with EO measurements.

CIAO-5: TRAIning on Lidar INstrument for ATmospheric studies on Aerosol and Clouds to BMKG (Indonesia). The training have added knowledge and skills on how to manage and analyze the data from Lidar observation. Study how to manage and analyze the lidar data in ascii format will be done in the future.

CIAO-6: The tools developed at CIAO facilities for visualization and fast analysis of the aerosol lidar data has been presented and described into details to the Proposer. With the guidance, training and support of the CIAO experts, the algorithmic tool that provides automated remote access to the Single Calculus Chain has been introduced to the Proposer. More specifically, the tool was modified and the automated upload of the lidar measurement files of the station as well as the ancillary files that include the overlap function, the atmospheric sounding and the lidar ratio profiles has been achieved for the station of Thessaloniki.

CIAO-7: In this project, a lidar-based approach to identify different aerosol types and to separate the profiles of highly and weakly depolarizing particles has been tested. Moreover, this approach enabled us to derive the mass concentrations of coarse-mode and fine-mode particles, based on sun photometer observations. This method can be easily applied in several desert dust and BBA cases by assuming that we have no more than two dominant types and that each aerosol type consists exclusively by fine-mode or coarse-mode particles. Further analysis of Saharan dust intrusions over the southern Europe will allow to extend the application of our lidar-photometer method to dust observations taken over Athens, Greece by the NTUA lidar station (EARLINET).

CIAO-8: The project was configured as a mobility of experts to allow CIAO staff to learn also how to use the code implemented by Veselovskii et al. (2015) to invert lidar measurements to the particle microphysical properties using regularization algorithm, considering both spherical and spheroidal kernel functions. Different sets of multiwavelength lidar observations have been used and in particular dust episodes over CIAO station. A comparative analysis to parameters obtained at SHADOW campaign has been also carried out. Results are under evaluation for future publications.

CIAO-9 : The measurement campaign was performed in Potenza. CMA LIDAR have been compared with MUSA Potenza lidar. The comparison shows a good agreement between the signals coming from the two LIDAR systems. It also suggests to furtherly investigate the results of the measurements, in order to understand if the signal pre-processing and the experimental set-up must be improved, to verify the calibration of the depolarization channel and to test the

retrieval of the optical parameters. The CMA has established an integrated meteorological observing system incorporating space-based, airborne and ground-based observations, which has steadily improved the accuracy of weather forecasts and climate predictions. The technical staff of CMA during the measurement campaign in Italy benefitted of the training at the CIAO infrastructure on both theoretical and experimental domain.

CIAO-10: The main objective of this TNA project was the training of the participants to the usage of the Single Calculus Chain (SCC). The SCC training consisted in 3 full days at the end of which the participants were able to setup (beginners) and optimize (advanced users) the SCC platform in order to homogenize the lidar processing and the quality assurance procedures. One of the main issues in research and satellite validation is the integration of the observations from the different networks. Some of these structures have developed operation procedures that allow a strict control on the data quality. Nevertheless, there is a lot of work to be done to homogenize these programs and procedures for a global perspective. The harmonization of standard operation procedures between different lidar stations and networks is the first step towards an operational infrastructure, enabling its contribution to GALION and its support to satellite atmospheric missions and joint research activities from a global perspective. The SCC platform is one of the tools that can provide means for this harmonization from the data format and processing perspective. The use of such a platform can enable new opportunities for the research institutions that employ it.

CIAO-11: The data collected with the MUSA Raman lidar system deployed at CIAO has been used jointly with the technique developed by Lolli et al., 2013 to retrieve the precipitation median volumetric size through multi-wavelength lidar measurements. The scanning of the available has allowed to detect only one recent case study with 24 hours of data. Nevertheless, a concept for the identification of suitable measurement scenarios has been developed and a three-level algorithm or the measurement screening has been designed. The method will be expanded in future to be tested on to other different lidar system within EARLINET.

The collective effort of the different experts working within the CIAO staff, involving scientist, technicians and software developers has allowed the successful implementation of the TNA projects and allowed to provide scientific results presented at conferences and peer-reviewed literature. TNA projects has also allowed to establish a good synergy with other H2020 projects (e.g. GAIA-CLIM) and with the work carried out by lidar/ceilometer manufacturers.

## **5.2 Monte Cimone taking advantage of Po Valley facility, CMN (CNR)**

In total, CMN has hosted 7 projects, accounting for 114 access days.

CMN-1: During the first reporting period, the NICE project provided 8 access days to Basel University participants and was focused to study the variability of INPs of biological origin on a broader spatial scale. In fact it constitutes a first structure of such connection of Observatories, including Monte Cimone, Jungfrauoch, Puy de Dome, Izana and Halddde. NICE project was successful in collecting the first data on INPs of biological origin at Monte Cimone. Preliminary results confirm that at Cimone the passage of front systems accounts for larger airborne INPs. This project also allowed collecting simultaneous samples for determining IN with two different techniques, one carried out in Basel and the other at ISAC-CNR. A scientific publication is planned including these results.

CMN2-7:

During the second reporting period, six TNA projects have been carried out at CMN for a total of 106 RWD provided. The AFPO project (AOD's with filter photometers observation at high mountain station, CMN-2) aim to use PFR filter photometers and MICROTOPS II (MT2) ozone monitoring for the determination of aerosol optical depth in a synergistic way. Despite that bad weather conditions which did not allow for the computation of the multiple parameters, the project has been important preparatory work for the use of the developed system (automatic MICROTOPS measurements). The majority of TNA projects focused on the JRA1 field campaign taking place at Monte Cimone and Po Valley during July 2017 which we opened for participation to external via TNA. It was an international effort to investigate aerosol optical properties with up-to-date techniques. The experiment mainly focused on observation and prediction of aerosol light absorption and the quantification of black carbon, in particular on the factors affecting the ability of BC to absorb solar radiation, i.e. its Mass Absorption Cross section (MAC).

In particular at Monte Cimone through the PaSCIM project (CMN-4) run a custom made photoacoustic instrument was assembled, calibrated and installed at Monte Cimone for testing the ability of the prototype to measure aerosol absorption at the low concentrations typically sampled at the site. Moreover samples were collected for off-line chemical and morphological analysis. The COLOSSEUM MtCMN (CMN-5) project was focused on the chemical properties of non-refractory submicron aerosols (NR-PM1: organics, nitrate, sulfate, ammonium and chloride), which together with black/elemental carbon measurements cover main components of sub-micron particulate matter (PM). The chemical composition of particles with high-time-resolution will help to characterise the sources and origins of particles and may clarify the condition affecting the variability in MAC. The projects CAPS-SSA (CMN-6) and AA-Ex-Sca-CMN (CMN-3) were concentrated on measurement in the Po Valley, at a urban and a rural site: Bologna and San Pietro Capofiume. At both sites a CAPS PMssa was transferred and installed for real-time and non-filter based extinction/scattering measurements. The CAPS PMssa simultaneously measures light extinction and scattering coefficients and thus the absorption (extinction minus scattering) on the same sample volume. The great advantage of this technique, in contrast of using two separate instruments to measure scattering and absorption, is that there is no need for wavelength correction. CMN-6 was carried out by an SME (Aerodyne Research Inc. for the characterization of the single-scattering albedo with their CAPS PMssa monitor.

The ZeMATRAP (CMN-7) project was carried out during the field campaign, with a goal on the gas phase measurements: the ACTRTIS-2 field campaign represented a good opportunity to fully deploy techniques and different remote sensing and in-situ instruments. An alt azimuth platform called MIGE - Multiple Input Geometry Equipment) was coupled through an optic fibre to the GASCODNG2 (Gas Analyzer Spectrometer Correlating Optical Differences-New Gen. Mod. 2) in order to increase the measurements capabilities of the instrument. The total content of NO<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub>, BrO, CHOCHO, H<sub>2</sub>CO and their vertical distributions were measured with a resolution of about 5 km.

In total, 114 access days were provided by CMN.

### **5.3 SIRTA Atmospheric Research Observatory, SIR (CNRS)**

SIRTA Atmospheric Research Observatory welcomed 19 projects and has provided 213 access days which was the quantity of access foreseen in the project.

SIRTA-1 project, TREBOL, was by high frequency acquisition (1 Hz) of data from Doppler and/or Elastic lidar to investigate boundary layer turbulence by using the particle backscatter coefficient profiles, as the aerosols act as tracers.

SIRTA-2 project enabled a user from Chile to be trained in cloud radar operation and calibration. The work achieved contributed to the Master of Science thesis of the user.

SIRTA-3 project enabled a user from Ireland to test a retrieval algorithm developed for cloud microphysical properties based on cloud radar and microwave radiometer measurements. Retrievals were compared to in-situ measurements of droplet size distributions. The results have been submitted for publication (Dupont et al. 2018, submitted).

In the SIRTA-4 project, a user from the United Kingdom received training regarding retrieval steps used in the STRAT+ algorithm that retrieves atmospheric boundary layer heights from automatic lidar and ceilometer measurements. Results have been presented during a TOPROF COST action workshop in Dublin (Sept 2017).

SIRTA-5 project enabled two users, from Spain and to apply a method developed at SIRTA to study the hygroscopic growth of aerosols using attenuated backscatter signal measured by a ceilometer. Results were presented at ACTRIS-2 WP2 workshop in Delft (Nov 2017)

SIRTA-6 project enabled a user from the Netherland to evaluate LES runs of a continental fog event against detailed in-situ and remote sensing observations from SIRTA. Results will be submitted for publication (Waersted et al. 2018 to be submitted).

SIRTA-7 project enabled two users from Romania to be trained about configuring a CHM15k ceilometer and the use of ceilometer measurements to study continental fog events. Following this training a new ceilometer was deployed at their home institution.

SIRTA-8 project enabled a returning user from Chile to participate in novel tests to improve our capacity to calibrate cloud radars. This project enabled the user to start a collaboration with a graduate student from TU-Delft (NL). Results combining TNA8 and TNA9 project will be presented at the ECAD conference in July 2018.

SIRTA TNA9 project enabled two users from the Netherland to test a cloud radar calibration method involving a calibration target flown by a drone, a novel method that could be very useful to calibrate vertically pointing cloud radars.

SIRTA-10 project enabled a user from the Belgium Meteorological services to develop his expertise further in the field of fog process understanding and fog nowcasting using automatic lidars and ceilometers.

SIRTA-11 enabled a user from the University of Granada (Spain) to be trained on using a Cloud Radar just purchased by the University. The Cloud radar performance was also evaluated.

SIRTA-12 enabled a student from Delft University (Netherland) to further train himself on the use of UAVs and targets to calibrate Cloud radars. The TNA allowed also a UAV pilot from Delft University to further his flight expertise to position cloud radar targets at precise locations.

SIRTA-13 enabled a Lidar expert from the company Raymetrics (Greece) to test a CDD camera to perform Lidar optical component alignments. His tests were performed on the SIRTA aerosol and cloud Raman Lidar (IPRAL).



SIRTA-14 and SIRTA-15 allowed an expert from IDAEA (Spain) and an expert from the University of Manchester (UK) to work on a method to better quantify organic nitrates using ACSM instruments in order to better understand the origin of organic nitrates.

SIRTA-16 allowed a doctoral student from the University of Texas (USA) to learn how to use automatic lidar and ceilometer measurements to retrieve the height of the boundary layer. This work will contribute to his PhD thesis where he studies the influence of ABL height and meteorology and Ozone concentrations in the city of El Paso, Texas.

SIRTA-17, SIRTA-18, SIRTA-19 are three projects that enabled several users to improve their knowledge on cloud radar calibration. These projects enabled a senior scientist from UKRI and a doctoral student from the University of Leeds (UK), a doctoral student from INOE (Romania) and a post-doctoral fellow from the University of Cologne (Germany), a doctoral student and a technician from Delft University (Netherlands) to work together on testing different techniques for cloud radar calibration, including reference targets, calibration transfer, UAVs and disdrometers.

These activities open new opportunities for TNA users to carry out research at SIRTA or to benefit from training opportunities.

#### **5.4 Puy de Dôme Observatory, PUY (CNRS, UBP)**

13 TNA projects were carried out at the Puy De Dome station for intercomparison campaigns at the PUY station in October 2016 and October 2018. The total access days provided is 228,5. The Puy de Dome site is a strategic place that provides the opportunity to sample within the planetary boundary layer and the free troposphere. The site is principally advected by westerly air masses (50%), but also from the southerly and easterly sectors and hence samples varied air mass. Locally the site is closed to public transport and hence is not influenced by local transport. Occasionally, in the case of easterly air masses, emissions from the nearby city of Clermont Ferrand can be advected to the site. The site is otherwise surrounded by fields and forested areas contributing to biogenic emissions being sampled at the site.

The Cloud microphysical probe inter-comparison campaign, took place at the PUY station from October 2<sup>nd</sup> to October 31<sup>st</sup> 2016, with 9 participating teams, among which 6 TNA projects. 16 probes were installed on the roof platform and 9 in the wind tunnel. 16 cloud events occurred and were characterized, corresponding to 193 hours of clouds between the 6<sup>th</sup> and the 26<sup>th</sup> of October (21 days of measurements).

INCePT (FMI, FI, PUY2) The Forward Scattering Spectrometer Probe (FSSP-100) and the Cloud, Aerosol and Precipitation Spectrometer probe (DMT-CAPS) probe were evaluated against each other and against the instrumentation of the partners contributing to cloud campaign in a natural cloud environment .

LWC-Comp (TROPOS, DE, PUY3): The Cloud Droplet Probe 2 with particle by particle feature (CDP-2), the Liquid Water Content Sensor 300 (LWC-300) and two Particle Volume Monitors 100A (PVM-100A) were evaluated. The campaign allowed to measure natural clouds in a wind tunnel with different cloud microphysical probes at the same time. So far, the campaign gave a better understanding of the new probes, CDP-2 and LWC-300, and showed how to handle these. It showed the operating limits of the LWC-300.

InterHOLIMO (IACS, CH, PUY4): The holographic imager HOLIMO and a Fog Monitor (DMT) were installed at the PUY station. In addition, a sonic anemometer measured the wind

direction to turn the Fog Monitor into the ambient wind field. The comparison of the concentration measurements and the liquid water content estimates from the new HOLIMO instrument will be used to quantify the uncertainties in the measurements as a function of the cloud properties and environmental conditions (wind speed/direction/temperature).

InterFOG (CNR-ISAC, IT, PUY5): CNR-ISAC provided a PVM system that is the fundamental measurement system for long-term liquid water content (LWC) observations at ground-based stations. An inter-comparison with similar (or alternative) measurement systems for LWC is therefore a prerequisite to assure high-quality observations for the long term record of fog at the SPC station.

ACTRIS2-FIDAS (PALSA, DE, PUY6): The Goal of the TNA access was to evaluate a new automatic instrumentation for cloud droplets real time analysis. This new instrument, called Fidas® 200 S, is based on TÜV certified analyzers used in long term air quality monitoring. This analyzer supplies a particle size distribution (mass and/or number) between 0.4 and 40 µm in 64 sizes channels. With two parallel running Fidas® 200 S the droplet distribution and density of clouds was measured. One Fidas® 200 S was running without an activated aerosol drying system and therefore measured the cloud droplets.

UTIPEX (U. Herthfordshire, PUY7): The Centre for Atmospheric and Instrumentation Research has recently developed a low-cost, miniature particle counter for use with disposable radiosondes, dropsondes, UAVs or in dense ground-based sensor networks. This Universal Cloud and Aerosol Sounding System (UCASS) is an open path optical particle counter, intended for deployment on balloon borne sounding systems, or as a dropsonde. The goal of the TNA was to evaluate the possibility of adapting this probe for a low price ground-base application, especially its robustness for long term measurements at ACTRIS stations.

The Puy de Dome ICe Nucleating Intercomparison Campaign (PICNIC), organised in October 2018, was a opportunity for a number of international researchers to share knowledge on aerosol ice nucleating particles. It was also a unique experiment with an unprecedented number of both direct and indirect measurement instruments for aerosol ice properties. A total of 12 research groups from seven different countries, participated in this exercise. Of these 12 research groups, 7 groups applied for and received transnational access (TNA) funds.

Luis Ladino and Caroline Ramirez from the National University of Mexico (*PUY11 - MOUDI-DFT\_PDD*) spent almost three weeks at the Puy de Dome during the TNA-PICNIC experiment. During this time they installed their 10 stage filter collector to examine aerosol ice nucleating properties as a function of size. Using electron microscopy analysis of these filters, they are also able to link aerosol ice nucleating properties to aerosol particle morphology and chemistry. The data acquired during this exercise will be compared to similar measurements taken at other high altitude sites in Mexico Mt. Altomozzi.

Duncan Axisa, a researcher from Droplet measurement technologies (DMT, Colorado, USA) worked alongside Martin Wolf from Massachusetts Institute of Technology (MIT), Boston to study the aerosol ice nucleating properties using the online Spectrometer for Ice nuclei (SPIN) instrument (*PUY 10 & 13*). This commercially available instrument is capable of attaining a wide temperature range, making it possible to study several ice formation pathways from immersion to deposition freezing. Martin Wolf will focus his analysis on how the deposition freezing of aerosol particles is dependent on their physical and chemical properties.

Paul DeMott, (Colorado State University (CSU, USA), a well-known international figure in ice nucleation research benefited from ACTRIS TNA funds to carry out measurements at the Puy de Dome with both the online continuous flow diffusion chamber and the indirect measurements using the Ice spectrometer –data analyzed by Dr. Tom Hill (CSU, USA). During the PICNIC experiment, a research scientist Ezra Levin, and a masters student Kevin Barry, both from Paul DeMott’s research group participated in the exercise. Their analysis includes a comparison of their two techniques and they have also provided their data for the general overview publications that are being prepared (*PUY9*).

Larissa Larcher, a postdoctoral research fellow from Ottmar Mohler’s research group in Karlsruhe Institute of Technology in Germany, participated to the PICNIC exercise with the newly developed Portable ice nucleation expansion chamber (PINE). As a result of the unique features of this instrument, it was operated continuously over the month of October (*PUY14*). L. Larcher also collaborated closely with Mike Adams from University of Leeds (*PUY15*), who was also operating another PINE instrument. In collaboration with all participants, Larissa Larcher will make a detailed comparison on the online instruments operating during the PICNIC exercise. Another colleague from the Ottmar Mohler group, Barbara Bertozzi also participated in the intercomparison where she was collecting offline filter measurements

Stephanes Mertes and Conrad Jentsch, in collaboration with Heike Wex, all from TROPOS laboratory in Leipzig Germany installed two types of indirect sampling apparatus during the PICNIC experiment, one of which is commonly used in aircraft studies (*PUY12*). The objective of using two different sampling sets was to do a series of tests to determine the reproducibility of their techniques over an extended sampling period.

The principle objectives of this exercise were to compare different methods and a great effort was made to ensure that all instruments were operating over similar sampling conditions. However thanks to the wide range of aerosol chemical and physical measurements installed at the Puy de Dome site we will also dedicate one part of this study to identifying the links between aerosol properties and their ability to become an ice nuclei. In parallel to this experiment, and in collaboration with a large number of European colleagues a number of filters samples were collected at 12 different ACTRIS sites, the objective of this side study were to compare IN conditions throughout Europe and also to put in place a series of standard operating procedures that can be used in various sampling sites for the study of aerosol ice nucleating properties.

## **5.5 Maïdo Observatory - Observatoire de Physique de l’Atmosphère à La Réunion, MAIDO-OPAR (CNRS, UR)**

Within ACTRIS-2, WP9 framework, OSU-R has accommodated the scientific missions of seven international groups (Belgium, Finland, Germany, Greece, Switzerland, and USA) at the atmospheric Maïdo Observatory (accounting for 298 access days). The research topics encompass a large panel of sharing activities in studies for composition of air masses, aerosol characterization, and procedures to calibrate instrumentation, between the TNA-ACTRIS researchers and researchers and engineers at OSU-R/LACy (Laboratoire for Atmosphere and Cyclones, UMR 8105) and OSU-R/UMS 3365.

TNA activities led by DWD (Lindenberg, Germany), ETHZ (Zurich, Switzerland) and NOAA (Boulder, USA) at the Maïdo observatory have allowed to make significant progresses in bringing quality (QA/QC) in the radiosonding processes to establish water vapour vertical

profiles in the atmosphere according to the GRUAN (GCOS Reference Upper Air Network) principles. Collaborative research on the topic is ongoing and is focusing on the impact of water vapour transport processes in the Tropical Tropopause Layer. TNA activities led by IASB (Brussels, Belgium) and UHEL (University of Helsinki, Finland) at the Maïdo observatory initially planned to prepare the groundwork on the topic of atmosphere-biosphere exchanges processes have confirmed the interests to further study the complete cycle of aerosols emitted by the biosphere in their impact on the cloud microphysics in La Réunion. TNA activities have acted as a technology incubator to successfully mount the French national research project ANR BIO-Maïdo (<https://anr.fr/Projet-ANR-18-CE01-0013>) and an international project BELSPO OCTAVE (<http://www.belspo.be/belspo/fedra/proj.asp?l=en&COD=BR/175/A2/OCTAVE>). Collaborative research on the topic is ongoing.

TNA MORGANE-MAIDO (MAIDO1, May 2015): The goal of this project was to provide high-resolution balloon measurements of temperature and water vapour to complement existing instruments at the Maïdo observatory in the framework of the MORGANE (Maïdo ObservatoRy Gas and Aerosols NDACC Experiment) campaign. Suzanne Meier (DWD, Lindenberg, Germany) was invited to participate to the campaign. She was in charge of water vapour radio soundings with the CFH (Cryogenic Frost-point Hygrometer) sonde. She trained our local staff to operate the sondes, Stéphanie Evan (OSU-R/LACy) and Jean-Marc Metzger (OSU-R/UMS). CFH data are being used for validation of the water vapour lidar data. A draft paper is in preparation (Vérèmes et al.). The measurements are also used to characterize the vertical structure of the UTLS over the Indian Ocean.

TNA FTIR-Cal-LaReunion (MAIDO2, October 2015): This project aimed at calibrating the two IFS 125HR spectrometers in operation at Maïdo observatory and at La Reunion University with the help of a well-calibrated lightweight, portable, low-resolution spectrometer - EM27/SUN. The two IFS spectrometers are labelled in the NDACC and TCCON networks. Work is still in progress to validate the calibration methodology which has the advantage to reduce the procedures for such a remote observatory in the southern hemisphere.

TNA AEROMARINE (MAIDO3, March 2016): The goal of this project is i) to test innovative measurement techniques with a drone and miniaturized particle counter instrument (POPS), ii) to acquire datasets on marine aerosol distribution and atmospheric thermodynamic state to further our understanding on marine aerosols and marine boundary layer, iii) to estimate the exchange of aerosols between the MBL and free troposphere. This project is also envisioned as an international collaborative effort between NOAA (USA) and OSU-Reunion and LACy laboratory. By bringing in expertise from NOAA, it will help design new strategies at Maïdo Observatory on innovative measurement techniques for future monitoring of atmospheric composition. This TNA action has promoted an exchange of expertise on aerosol measurements between NOAA scientists and OSU-Réunion scientists. OSU-Réunion, LACy and NOAA/CSD will collaborate on pursuing POPS measurements at Reunion Island.

TNA MAIDO4 was not accepted by reviewers.

TNA MAIDO5, SHUTLS, May 2017: The title of the proposal is “Composition of the Southern Hemisphere Tropical UTLS”. Visiting scientists were R. Dirksen (Meteorological Observatory Lindenberg, Deutscher Wetterdienst, Germany) and F. Wienhold (Institute for Atmospheric and Climate Sciences, ETH Zürich). The current project leverages on a collaborative effort to elevate the Maïdo Observatory to an essential observatory for monitoring the Southern Hemisphere Upper Troposphere Lower Stratosphere composition (water vapor, ozone, aerosols). By bringing in expertise from the Lindenberg GRUAN Lead Centre and ETH, the overall objective of the project is to support the long-

term development of a balloon sonde program in Reunion Island for the monitoring of atmospheric composition over the tropical Southern Hemisphere.

TNA MAIDO6, IAMBIO, May 2017: The title of the proposal is “Identification of air masses arriving over Maïdo observatory with emphasis on biomass burning particles using aerosol and ozone lidar techniques and implications for climate change”. Visiting scientist was S.C. Richardson (National Technical University of Athens, Greece). The goal for this graduate student was to be trained for the acquisition and treatment of lidar data at the Maïdo observatory and to build collaborations between scientists at NTU (Greece) and scientists at LACy (Laboratoire de l’Atmosphère et des Cyclones, Université de La Réunion).

TNA MAIDO7, OCTAVE/ISM, October 2017: The title of the proposal is “Oxygenated organic Compounds in the Tropical Atmosphere : Variability and atmosphere-biosphere Exchanges / In Situ Measurements “ . Visiting scientists were C. Amelyinck, N. Schoon, S. De Pauw (Royal Belgian Institute for Space Aeronomy, Brussels, Belgium). The OCTAVE project, aims to provide an improved assessment of the budget and role of oxygenated volatile organic compounds in tropical regions, and especially over oceans, relying on an integrated approach combining in situ measurements, satellite retrievals and global modelling. The general project is co-financed by the Belgian Federal Science Policy Office in the framework of the BRAIN.be program (<http://octave.aeronomie.be>). The goal of the TNA was to install the in-situ instrumentation (Mass Spectrometer) at the Maïdo Observatory. The project aims at obtaining a continuous series of measurements by the spectrometer at high temporal resolution for a period of two years. Collaborations are built with scientists at LACy (Laboratoire de l’Atmosphère et des Cyclones, Université de La Réunion for the scientific exploitation of the data.

TNA MAIDO8, OCTAVE, Feb May 2018: A field campaign was conducted in Maido-OPAR station during February-May 2018 and part of this time coincided with the OCTAVE (Oxygenated Compounds in the Tropical Atmosphere: Variability and Exchanges) intensive operation period. The motivation for the measurements was to infer the nucleating chemical vapours in the remote marine boundary layer (during day time), and in the free troposphere (during night time) at the 2.1 km altitude of the Maido-OPAR. For this purpose, a collection of mass spectrometric detection and nanoparticle size distribution characterization methods were utilized. The diverse emission profile of the site and the direct connection to free tropospheric air masses allowed to study various processes not easily accessible in most other locations, and lead to the following scientific objectives: (a) resolve the composition of in-situ nucleating vapours at the Maido-OPAR station (b) determine the potential role of halogen oxides in nanoparticle formation under free tropospheric conditions.

## **5.6 Station for Measuring Ecosystem – Atmosphere Relations II, SMR (UHEL)**

SMR TNA access illustrated the large applicability of the SMR station for multidisciplinary research and also the wide variety of science that is part of our ACTRIS activities. Six TNA projects (454 access days, more than 3 times the planned number of access days) have been carried out at the station:

TNA BVOC-NPF (SMR-1, 46 access days) included detailed trace gas measurements (A Hansel, Innsbruck, Austria) with their new PTR3 mass spectrometer. This provided novel insights into the interplay between the volatile organic compounds emitted by the biosphere and atmospheric processes, such as formation of nanoparticles.

TNA HCCNP (SMR2- 25 access days) by Z. Wang, MPI performed measurements on hygroscopicity of these nanoparticles providing new data on their chemical composition with indirect methods.

TNA BORCOS (SMR-3, 18 access days), K. Maseyk, UK connected the biosphere-atmosphere interactions by looking at carbonylsulfide fluxes (COS) in the boreal environment. The hypothesis is that the COS flux is an independent measure of photosynthesis and the measurements during this TNA enabled us to probe into the ecosystem scale photosynthesis, which we can connect to the emissions of volatile compounds and aerosol formation and growth.

TNA SMR-4 was withdrawn by the user.

During the Hyytiälä Ice Nucleation Experiment 2018 (HyICE-2018) first comprehensive and long-term measurements of both aerosol properties and INP concentrations at the Hyytiälä Forestry Field Station, Finland, have been performed. The major goals of the campaign, led by the University of Helsinki, were (1) to measure the variability of both the total amounts and the temperature spectrum of INP concentrations, (2) to relate the INP results to aerosol variables like the number concentration and size distributions; this includes aerosol from local sources, e.g. formed during nucleation events or during and after precipitation, and aerosol from long-range transport, (3) to relate both aerosol and INP concentrations to meteorological conditions, (4) to relate the INP concentrations to ice observed in clouds around the field site with remote sensing (radar) and in situ (Unmanned Aerial Vehicles) methods, and (5) to use the results as input to cloud modelling in order to improve the understanding of primary ice formation in clouds, and to test and compare newly developed instruments for INP measurements. Three TNA projects were performed during this campaign.

KIT (SMR-5, 191 access days ) contributed to HyICE-2018 using INSEKT (Ice Nucleation SpEctrometer of the Karlsruhe Institute of Technology) and the newly developed instruments PINE (Portable Ice Nucleation Experiment) for INP measurement. INSEKT makes use of aerosols sampled over longer time periods of hours to days. The aerosols are then washed off the filters and analyzed for the average INP concentrations of the sampled air in the temperature range from  $-5^{\circ}\text{C}$  to  $-25^{\circ}\text{C}$ . Aerosol samples have been taken at different locations in Hyytiälä (in the forest and from above canopy) and analyzed on site, so that the results were immediately available for comparison to other INP results and for guiding the ongoing campaign activities. Also, filters sampled during Cessna flights close to Hyytiälä Forestry Field Station allowed for very first investigations of INP concentrations in the boundary layer and free troposphere above a boreal forest. PINE is a new expansion type INP chamber developed together with the University of Leeds (SMR-7, 85 access days). PINE is constructed for fully automated operation and continuous INP measurements at high time resolution (minutes) and temperature from  $-5^{\circ}\text{C}$  to  $-40^{\circ}\text{C}$ . KIT and University of Leeds operated two PINE instruments during the HyICE campaign. Our first aim was the test and intercomparison of those new devices at the same location with other INP instruments under ambient sampling conditions. The second aim was to provide long-term INP data at selected activation temperatures with a shorter time resolution than the filter-based methods. The work carried out by the ETH (SMR-6, 89 access days) directly measured ambient INPs at several temperatures in condensation freezing mode. This was achieved by the implementation and utilisation of the technological advances to existing instrumentation intended to lower the limit of detection, allowing for accurate measurements of INPs at the temperature of  $\sim -30^{\circ}\text{C}$ . Additional instrumentation deployed during HyICE-2018 provided information about the biological components in aerosol particles,

chemical composition of both gas and particle constituents in the atmosphere, as well as relevant cloud properties. These were supplemented by an amass of gas, particle and meteorological instrumentation available at the site. The projected outcomes will improve the IN parameterisations from field and lab studies based on the new data in order to reliably use them to predict atmospheric INP concentrations.

### **5.7 Pallas-Sodankylä Global Atmospheric Watch Station, PAL (FMI)**

The station welcomed 6 TNA and provided 79,5 access days throughout the ACTRIS-2 project.

1) During the first reporting period, FMI hosted the TNA project ACITIC of PI Jaroslav Schwarz and his PhD student Petr Vodička: Aerosol-Cloud Interactions and their Impact on Arctic Climate as part of the Pallas Cloud Campaign, PaCE 2015, Finland (13.5 access days were provided). For this study, two months of EC/OC data, from 1st October to 1st December 2015, were taken by two EC/OC semi-online devices. Measurements covered 96% of the campaign period. The aim of the TNA was to study an earlier unexpected discrepancy of a factor of five between equivalent BC (eBC) measured by optical methods multi-angle absorption photometer (MAAP) and aethalometer and refractive BC measured by Single Particle Soot Photometer (SP2) by comparing the EC and OC measurements with results from other instruments. A comparison of the equivalent black carbon (eBC) results from aethalometer and MAAP one can determine the relevance of obtained EC measurements. Applicable EC and OC data will be used for an analysis of impact of these aerosols on Arctic climate.

During the 7<sup>th</sup> Pallas Cloud Experiment combined in-situ and remote-sensing observations to provide the best basis for process-level research on cloud-atmosphere interaction. We utilized combination of several research approaches: existing long-term continuous ground-based observations with in-situ sensors (Sammaltunturi station), airborne in-situ measurements (several remotely piloted aircraft systems and meteorological balloons), ground-based remote-sensing (lidars, ceilometers and cloud radar) and satellite retrievals. The pristine environment of Pallas area is characterised by very low aerosol load and optically thin clouds thus making vertical profiling (both in-situ and remote-sensing) very challenging. Intensive part of the campaign took place from September 8<sup>th</sup> to October 6<sup>th</sup>, during this period several groups visited Pallas. Since each group uses different instrumentation for in-situ measurements of aerosol and cloud properties aimed to have all groups in the air at the same time to maximize data overlap. During the campaign the airspace (PALLAS-EFD431) was reserved around Sammaltunturi station with radius of 6 km and ceiling at 2 km a.s.l. One of the special focus areas of the campaign was super-cooled liquid (SCL) water clouds. SCL water has significant influence to cloud radiative properties, precipitation through ice formation, and they create icing (e.g. wind turbines and air traffic). Forecasting and monitoring of the SCL layers is currently challenging and limited by measurement methods. Experiences from 6<sup>th</sup> PaCE suggest that combination of different scales of observations serve as best basis for investigating SCL properties and influence, and develop data retrieval methods. The following projects were conducted during PaCE 2017.

2) PAC-UAV-PaCE2017, Energy, Environment and Water Research Center (EEWRC), The Cyprus Institute: With the use of the UAVs, we obtained vertical profiles of particle size distributions within and above the boundary layer, as well as provided data from one or more altitudes separately. The flight path were designed to cover interesting areas and altitudes.

3) TNA-MWR\_PaCE2017, University of Cologne: The HATPRO Microwave radiometry provided valuable information on the total water content of the clouds observed and thus ideally complement the other sensors at the site. This will allow to constrain the radar reflectivity profile for retrievals of the liquid water content profile.

4) VPPM-PaCE2017, Palas & Airclip: Palas GmbH together with Airclip Service GmbH & Co KG will provided a Fidas Fly 200 instrument and flight robot (HORUS 2.0 octocopter), respectively. Fidas Fly200 provided the continuous and simultaneous measurement of the PM-fractions PM1, PM2.5, PM4, PM10, as well as in addition the particle number concentration as well as the particle size distribution in 32 size classes per decade within the particle size range of 0.18 – 18 µm or 0.5 – 40 µm - and all this in an additional spatial dimension.

5) SINP-PaCE2107, Karlsruhe Institute of Technology: Aerosol filter samples for offline analysis of daily averaged INP temperature spectra were taken over the whole campaign period.

6) ACCD-PaCE2017, University of Reading: Vertical profiles of (a) backscatter from cloud droplets, (b) in cloud turbulence, (c) electrical charge within clouds, and (d) supercooled liquid water (SLW) content were measured during the campaign. This was achieved by the use of specially developed disposable research sensors which were flown alongside standard meteorological radiosonde balloons.

## **5.8 High Altitude Research Station Jungfraujoch, JFJ (PSI)**

Overall, nine TNA projects were undertaken at the Jungfraujoch which accounts for 391,5 access days. Notably, eight TNA projects were performed on occasion of the CLACE2017 campaign (Cloud and Aerosol Characterization Experiment 2017) which took place in January and February 2017.

1) A TNA NUCLACE-2016 was performed at the Jungfraujoch (3 access days). F. Bianchi, University of Helsinki, installed a neutral cluster air ion spectrometer (NAIS, Airel Ltd.), provided by the University of Helsinki. This instrument is able to detect aerosols below 5 nm (0.8 nm - 45 nm mobility diameter for ions and 3 - 45 nm for neutral particles). The NAIS is an ion mobility spectrometer that measures the number size distribution of ions and total (charged and neutral) particles. As the instrument will stay at the Jungfraujoch for 2 years it is premature to present results at this stage, however, interesting differences between positively and negatively charged small ions have already been observed and will be further evaluated.

2) CLACE-INUIT 2017, 53.5 access days, by participants from the University of Manchester (UoM) made measurements of the Microphysical parameters of the Clouds enveloping the Sphinx laboratory on the Jungfraujoch (JFJ). A suite of state-of-the-art instruments (see instrument list below for description of instruments and acronyms) was deployed, mounted on a purpose built platform capable of automatically rotating and tilting the instruments directly into the ambient wind for unperturbed cloud sampling. The following measurements of cloud microphysical properties were made throughout the period of the experiment using : - a 3V-CPI probe, to observe the cloud particle size distributions, particle habit (derived from particle images), and hence formation of ice particles in cloud and degree of cloud glaciation; - a CDP to observe the cloud droplet size distributions (within super-cooled and mixed phase clouds) (NB; the 3V-CPI and CDP both mounted on a tilting rotating wing to direct probes into wind)



a fixed position heated ultrasonic anemometer - to measure the 3-D wind vector and automatically direct cloud probes into wind; a wing mounted heated ultrasonic anemometer - to attempt measurements of cloud particle (drop and ice crystal) fluxes; a fixed position PVM - to make bulk cloud water measurements (in super-cooled and mixed phase conditions); T and RH measurements - made in vicinity of cloud microphysics/dynamics measurements. The measurements of the liquid and ice phase cloud particle size distributions are to be used to calculate the cloud liquid and ice phase water contents (the former was also be measured directly); Interpretation of the combined aerosol and cloud data set (available to all) will be undertaken to identify the important ice formation mechanisms acting within the clouds.

3) For the INUIT JFJ project 2017, 32 access days, total aerosol particles and IPRs were sampled in parallel with the use of a MINI cascade impactor. The IPRs were collected behind the Ice-selective inlet (Ice-CVI). A dilution system was built to have the possibility to sample total particles for a longer time to match the duration of Ice-CVI sampling. Several different instruments for characterisation of the composition and physical properties of total aerosol, interstitial aerosol and IN. Single particles will be characterised by electron microscope (size, morphology, mixing state and chemical composition) at TU Darmstadt.

4) For FRIDGE@CLACE2017, 36 access days, ice nucleus counter FRIDGE was set up in a laboratory of the Research Station. From January 25 to February 20, 2017 atmospheric aerosol samples were collected at in the Sphinx Laboratory. Samples were collected by two independent methods from a joint total aerosol inlet as well as downstream of a counterflow virtual impactor. For analysis of immersion freezing INP aerosol particles were collected by filtration, using membrane filters. For analysis of deposition/condensation INP particles were collected by electrostatic precipitation onto Si-wafers. At least one sample of each type was collected per day. Both types of samples were analysed in FRIDGE. Immersion freezing INP were measured at 0°C - -30°C in aqueous extracts of the filters, using the drop freezing method of Vali (1971). Deposition freezing INP were analysed between -20°C and -30°C by growing ice on the Si substrates, followed by photography and counting of the ice crystals. It is assumed that one ice crystal represents one ice nucleus.

5) INUIT-2017-MPIC, 57 access days, included instruments provided by the MPIC group included: single particle mass spectrometer ALABAMA, the aerosol mass spectrometer C-TOF AMS and additional instrumentation as a particle counter (CPC), optical particle sizers (OPC), and a Multi Angle Absorption Photometer (MAAP). During the campaign five different inlet systems were operated. The ICE-CVI (TROPOS) and the ISI (PSI) inlet were installed to select freshly produced ice particles out of mixed-phase clouds. The ALABAMA was connected to the ICE-CVI or ISI every time clouds were present around the JFJ-station. The C-ToF-AMS was connected to the ICE-CVI during a few selected cloud events. Besides of the ice selective inlets a total inlet (provided by PSI) was used most of the time for measurements with ALABAMA

6) For CLACE 2017, 30 access days, INP abundance was measured using the Horizontal Ice Nucleation Chamber (HINC). The chamber was operated at 242K and relative humidity of 94% and 104% with respect to water, respectively. The generally low concentrations of INPs in the free-troposphere, were detected by applying the new portable particle concentrator upstream of HINC. A heated particle inlet was deployed from the rooftop of the station to the laboratory, where the concentrator and HINC was located. In addition to the measurements with HINC, several other INP and aerosol instruments, which were participating the in the field project, could be attached downstream of the particle concentrator. Measurements were taken with the

laser ablation single particle aerosol mass spectrometer ALABAMA (Brands et al. 2011), a second aerosol mass spectrometer (AMS, both from the Max Planck Institute for Chemistry in Mainz), the ice nucleation chamber FINCH (Bundke et al. 2008), the deposition freezing experiment FRIDGE (both University of Frankfurt), a wideband integrated bioaerosol sensor (WIBS) and the Laser Ablation of Aerosol Particles Time of Flight Mass Spectrometer (Laaptof from KIT). Our measurements of INP concentrations are complemented by several cloud measurements, conducted by our collaborators during this field project.

7) For INUIT-CLACE-2017, 47 access days, to achieve the scientific objectives, a laser ablation single particle time of flight mass spectrometer (LAAPTOF, AeroMegt GmbH) was deployed on the Jungfraujoch station measuring single particle composition of aerosol particles or residual particles selected by the different aerosol inlets available: total (w/o particle concentrator), interstitial, Ice counter flow virtual impactor (ICE-CVI) or ice selective inlet (ISI). Furthermore, aerosol particles were collected by the KIT filter sampler setup connected to the total aerosol inlet via a vertical sampling line. With this setup, particles were collected on filters during day and night time with a frequency of two filters per day. In total 57 filters were collected covering the time period from January 24th to February 22th. After collection, the filters were stored at  $-20^{\circ}\text{C}$  and at the end of the campaign they were transported back to KIT. There, the collected aerosol particles will be washed off and will be analysed for their ice nucleation behaviour with an immersion freezing method, which is similar to the Ice Spectrometer of the Colorado State University (Hiranuma et al., 2015). The aerosol mass spectrometer and the filter sampling system were installed, tested and calibrated at the Jungfraujoch in the week from January 16th to 20th, 2017 and were taken down on February 23rd, 2017. Depending on the meteorological conditions, measurements were performed sampling continuously or intermittently at the different inlets.

8) The FINCH\_INUIT-JFJ 2017, 60 access days, with the fast ice nucleus chamber, FINCH. Was meant to determine the number concentration of INP under different temperature and humidity conditions, on line. Supersaturation in the chamber is reached by mixing the aerosol flow with another very cold flow ( $-50^{\circ}\text{C}$ ) and a moist flow. Particles enter the chamber and grow to crystals if they are ice-active. Below the chamber an optical particle counter (FINCH-OPC, self-built) detects the number and size of the grown particles (particle size is proportional to the intensity of the forward scattered light). Thus it can be derived how many of the available particles were ice active (so-called INP). Moreover the autofluorescence of the particles, which are excited with UV light, is detected - this gives information whether the INP contained biological material. During the INUIT-JFJ 2017 campaign we operated FINCH at three different inlets: - At a total inlet (operated by PSI) to sample interstitial and activated aerosol. This inlet was used for most time of the campaign. - At an Ice-CVI (counterflow virtual impactor, operated by TROPOS; Mertes et al., 2007) to sample ice particle residuals. This inlet was used only for a few hours because particle number concentrations were too low to allow reliable INP detection with FINCH. - At a total inlet with concentrator (operated by ETH Zürich) to sample a concentrated flow of interstitial and activated aerosol. This inlet was used during the last five days of the campaign. The chamber temperature in FINCH was kept to  $-25^{\circ}\text{C}$  for most of the campaign whereas the saturation ratio with respect to ice (sice) was varied between 1.1 and 1.3 to cover the humidity range below and above water saturation. Approximately once per hour sampling was done through a zero-filter for ca. 10 min to obtain the level of background noise. FINCH was operated usually only during daytime since it is an instrument that needs intensive maintenance.

9) For the project INUIT2-RP2-TROPOS, 73 access days, the high alpine research station Jungfraujoch allowed to sample ice particles in real atmospheric mixed-phased clouds and the aerosol characterization of their ice particle residuals (IPR), which are closely related to atmospheric relevant INP. Thus, the objectives were the physico-chemical characterization of IPR within natural mixed-phase clouds. The determination of the IPR properties required the coupling of the unique Ice-CVI, developed by TROPOS, with several aerosol state of the art instruments. The IPR number concentration and size distribution were measured by CPC, OPS and UHSAS. The IPR chemical composition and mixing state is obtained by single particle mass spectrometry and electron spectroscopy applied by the cooperation partners MPI Mainz and TU Darmstadt.

Overall, the number of TNA days at the JFJ was nearly a factor of 3 higher than planned, demonstrating the success of TNA at the Jungfraujoch.

### **5.9 Cabauw Experimental Site for Atmospheric Research, CESAR (KNMI, TNO, TUD, UU, ECN)**

Six TNA projects have been carried out at CESAR, having provided 129 access days (RWD) to users.

CESAR-1: In September 2016, a large-scale field campaign was held at the Cabauw Experimental Site for Atmospheric Research: The Second Cabauw Intercomparison Campaign for Nitrogen Dioxide Measuring Instruments — CINDI-2. The number of participating groups was 34 and involved 42 instruments. To support the campaign goals, NO<sub>2</sub> profiles were provided by NO<sub>2</sub> sondes and lidar, as well as through in-situ observations using the Cabauw meteorological tower. Extensive aerosol information was gathered using Raman aerosol lidar as well as by in situ samplers. Several publications based on the campaign are in preparation. These will possibly be bundled in a special issue.

The TNA project CEILMAX (CESAR-2: Development of aerosol retrieval techniques from MAX-DOAS and lidar/ceilometer measurements) aimed at obtaining extensive data of the atmospheric composition and meteorological conditions for the diagnostic of the MAX-DOAS retrieval technique and to develop a new technique for the retrieval of aerosol optical properties by integrating MAX-DOAS and lidar/ceilometer observations.

In September 2017, Utrecht University organized the Proton-transfer-reaction mass-spectrometer (PTR-MS) Intercomparison campaign in CABauw during which 5 TNA projects were accommodated involving groups outside the ACTRIS consortium. Eleven PTR-MS instruments operated by European and US groups measured for two weeks the ambient air composition at the CESAR observatory near Cabauw. All instruments were subjected to new calibration procedures, developed at UU/IMAU, using a gas standard custom manufactured by the National Physics Laboratory (NPL), UK. PTR-MS technology recently underwent major innovations that boosted the sensitivity by 2-3 orders of magnitude. These new generation instruments detect organic species at extremely low mixing ratios of 100 parts per quadrillion (fmol/mol) with a really great performance: 10 seconds time resolution and a precision of ~10%! We were fortunate to attract this latest technology (only 2 instruments exist worldwide) as well as instruments that have served already for more than 10 years.

CESAR-3: PIP (Participation in PTR-MS intercomparison) contributed to the intercomparison with two brand-new types of PTR-MS instruments by University of Leicester.

CESAR-4: QUAPACT (Quality Assurance of PTR based trace gas measurements at the ACTRIS - CESAR observatory) involved different types of PTR MS instruments from FZ Jülich.

CESAR-5: PRT3ACO (Use of a novel PTR3 instrument for comparison with other PTR based trace gas measurements at the ACTRIS - CESAR observatory) contributed with a PTR3 instrument for which IONICON, the leading manufacturer of PTR-MS instruments, is the only supplier, from a group from Harvard, US.

CESAR-7 PICAB (PTR-MS Intercomparison campaign at Cabauw) involved an PTR-MS instrument from the University of Birmingham.

CESAR-6,8 and 9 were not eligible as linked to WP3 activities.

CESAR- 10: AVVICATO (Application of a VOCUS VOC Integrated Calibration system at a Tower Observatory) involved an SME (Aerodyne Research Inc., USA) using their automated PTR-MS calibration and background system in cooperation with other PTR instruments. The constructed PTR time-of-flight mass spectrometer (PTR-ToFMS) has a unique ionization source compared to other instruments in attendance, and has never been quantitatively evaluated against other PTR instruments.

### **5.10 TROPOS Research Station Melpitz, MEL (TROPOS)**

Four TNA projects have been carried out at the TROPOS Research Station Melpitz. 67 RWD were provided in total which is less than initially planned.

1) TNA “Evaluate CALIPSO aerosol Classification product, using Airborne and ground-based IN-situ instrumentation” (ECA-IN), 7 access days, aimed at a validation exercise of CALIPSO aerosol classification product during the satellite overpass close to the TROPOS Research Station Melpitz. A direct comparison with corresponding retrievals from airborne in-situ measurements acquired during the Melpitz Column Experiment was done. For the used application, it has been shown that it is feasible to evaluate space-borne profiling measurements and aerosol typing.

2) IMAC project (30 access days): The project objectives were achieved through comprehensive intercomparison experiments with existing, well-characterized techniques for measuring rBC mass concentrations and absorption coefficients. The following instruments were included in the experiments: a single particle soot photometer (SP2 DMT), a seven-wavelength aethalometer (AE33, Magee Scientific), a multi-angle absorption photometer (MAAP, ThermoFisher Scientific), an integrating nephelometer (Aurora 4000, Ecotech) and cavity attenuated phase shift monitors with and without integrating nephelometers operating at three different wavelengths (CAPS PMex and PMssa monitors, Aerodyne). The project was split into two components. The first component was a series of laboratory tests and calibrations conducted at the TROPOS institute in Leipzig from 23 - 29 January 2017. Following this, field measurements were conducted at the Melpitz research station from 1 February to 15 March 2017.

3) The MARLO project (18 access days) aimed at comparing HONO-measurements with MARGA and LOPAP at TROPOS research-site Melpitz. The measurement site was chosen because of the different air mass influences.

4) The objective of CHARON (12 access days) was to field test and to validate the new CHARON PTR-TOF 6000 X2 instrument. This instrument is IONICON's (Austrian SME)

current flagship, offering a variety of new features for the user. The instrument worked flawlessly and stably for 3 weeks (including 10 days of unattended operation) between 11 February and 1<sup>st</sup> March 2019. The data is still currently being reduced and analysed.

### **5.11 Finokalia Atmospheric Observatory, FKL (NOA)**

In total 13 TNA projects have been carried out at Finokalia during the whole project accounting for 209 RWD.

1) TNA BL-SMOG (11 access days) performed boundary layer aerosol profiling starting as close to near-surface as possible, by using the NARLa lidar receiver collocated with the NOA-PollyXT lidar. Participation in the JRA1 campaign gave the opportunity to perform spectrally dependent measurements to study absorbing aerosol smog layers that frequently occur in lowermost boundary layer over Athens during the winter season.

2) The objective of TNA LAMP (4 access days) was to estimate the ABL depth to provide NRT information on the distribution of aerosol particles and wind profiles. The ABL was compared with the corresponding retrievals of the multi-wavelength aerosol Raman lidar PollyXT-NOA. Primary goal of the study is to demonstrate if a reliable monitoring of the boundary layer top, under different aerosol and meteorological conditions, is possible.

3) TNA DAVP-RS (21 access days) aims at validating AAI values with combined remote sensing and near surface in-situ measurements of the Athens campaign. Although it is quite difficult to use passive remote sensing data alone for determining aerosol properties, there is no ground based active remote sensing device in Turkey operating for scientific purposes currently. This project was a good starting point to develop methods for implementing passive remote sensing data to pollution studies in Turkey.

4) During FAME-16 (24 access days), portable smog chambers have been deployed for the first time to our knowledge in the field. These chambers easy to assembly and handle, can be built at a very reasonable price and allow to expose real-time atmospheric chemical substances to variable conditions to address scientifically important issues. For instance when aged organic aerosol (OA) are exposed to additional OH the following questions can be answered? Does it get more oxidized? Does it start fragmenting with mass decreases?

5) During BIOMEDS (12 access days), state-of-the-art sampling techniques and protocols developed and combined with the speciation of biological atmospheric particles (PBAPs) by flow cytometry (FCM) were deployed for the first time to our knowledge in Europe to identify and quantify speciated bioaerosol populations.

In the frame of JRA1 activities an experimental campaign focusing on desert dust microphysical characterization from remote sensing was performed from 1<sup>st</sup> to 30<sup>th</sup> of April 2017 at the observatory of Finokalia. Specifically, the aim of the campaign is to validate the remote sensing retrievals against surface and airborne in-situ measurements. During this campaign advanced inversion techniques developed in the framework of ACTRIS, focusing on aerosol absorption to fulfill the objectives of the ACTRIS JRA1 activity (“Improving the accuracy of aerosol light absorption determinations”) were deployed. During this campaign eight TNAs were performed at Finokalia: ABISI, DUSTSONDE, VASAI, CHDLDC, POLLUX, ICARUS DREAM,

GLAM and ITALI) deploying numerous state of the art instruments to study the absorbing properties of dust and check the validity of inversion algorithms such as GARRLiC.

6) ABISI campaign (24 access days ) was held at the FKL site during April 2017 and during this campaign measurements of a PSR instrument that has been developed and calibrated at the PMOD/WRC were analysed. For the ABISI PSR measurements were used to retrieve Aerosol Optical Depth (AOD) and Single Scattering Albedo (SSA).

7) The aim of DUSTSONDE (26 access days) was to test observations with the Universal Cloud and Aerosol Sounding System (UCASS) against independent data from airborne in-situ measurements with research aircraft and findings of the advanced microphysical aerosol retrievals (TiARA, LIRIC and GARRLiC) that have been developed in the framework of ACTRIS-1.

8) The aim of VASAI (21 access days) was the validation of Skynet Aerosol Inversions in comparison to other ground based and airborne retrievals.

9) The focus of the POLLUX (21 access days) was the retrieval of parameters of mineral dust microphysical parameters, i.e. particles of non- spherical shape which can be characterized in a reliable way if only lidar data, e.g. 3 backscatter coefficients (measured at 355, 532, and 1064 nm) and 2 extinction coefficients (355 and 532 nm), commonly denoted as “3+2”, and up to linear three depolarization ratios (355, 532, and 1064 nm) are used as during the JRA1 campaign performed at Finokalia.

10) The scientific objective of CHDLDC ( 4 access days) was to characterize the depolarization channel performance of Halo Photonics Stream Line Doppler lidar by comparison to observations from co-located calibrated multi-wavelength aerosol lidar.

11) The objectives of the ICARUS DREAM (14 access days) were to use the DREAM model products along with the ACTRIS in-situ and remote sensing measurements to improve knowledge on the cold cloud-aerosol interactions.

12) The objective of the GLAM campaign (9 access days) was the evaluation of the GARRLiC retrievals with high-quality airborne and in-situ measurements of aerosol absorption performed during the campaign at Finokalia.

13) The ITALI project (18 access days) aimed at investigating the Twilight zone between Aerosols and clouds using microwave radiometry and multiwavelegth Lidar data. In order to characterize the twilight zone, a synergy of active and passive remote sensing instrumentation has been used to find evidence of the presence of liquid water in visible clear skies, near clouds or in broken clouds.

## **5.12 Košetice-Křešín u Pacova, KOS (CHMI, ICPF, CVGZ)**

During the whole project, 6 projects were hosted at Kosetice accounting for 145 access days.

*1) Two HEights Black Carbon and SIZE distributions measurements (THE\_BC\_SIZE), 19-27.6.2017, 2 persons, RWDs: 18*

TNA was focused on studying variations of BC concentrations and aerosol number size distributions at two heights (ground level and 230 m above the ground level) in Kosetice, a rural background site from ACTRIS network. Comparing BC ground-based and tower-based data give indications on BC atmospheric pathways, whereas possible relationships between BC concentrations and number particles concentrations at selected sizes, could give some indication on the “freshness” of BC particles in this rural site. In addition, ground-based radiometric measurements of direct solar irradiance, for the first time performed at this background site, will give information on atmospheric aerosol radiative and the application of a suitable technique to these radiometric data will highlight the contribution of aerosol components to the total aerosol optical depth. Kosetice Observatory was chosen as the most continental site in ACTRIS network and far from strong sources of pollution. 270 m tall tower enable to study quantification and localization of GHG sources and sinks. It represents a good site to measure, for the first time in such a site, variations of BC concentrations at two heights (ground level and 230 m), it’s scaling with height and its relationship with aerosol sizes.

Data discussed in a very preliminary way represent a starting point for a much more effective analysis. Co-located BC measurements suggest a general agreement between AE33 and AE31, even if should be understood how humidity affect BC data. Moreover, it is necessary to analyze the whole BC data-sets and the two data-sets of SMPS size distributions, to compare them and to verify possible correlations between BC concentrations and number concentrations at different sizes. Finally, radiometric ancillary measurements need to be analyzed and integrated with the two-quot data.

*2) Introduction of the sampling capacities in Košetice observatory, possible analytical determination of POPs and monitoring data processing (POPs TRAIN), 29.6.2017, 30 persons, RWDs: 30*

The week-long International Summer School of Toxic Compounds in the Environment organized by the Research Infrastructure RECETOX and The Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology (SCRC) helps build global capacities for the environmental chemistry and ecotoxicology, including aspects of analytical and process chemistry, long-range transport, fate and effects, and provides a hands-on experience with the chemical and toxicological tests designed to answer specific environmental problems. The study plan include a field trip to the Košetice observatory, mutlimaterix sampling site, serving as the complex background station for the Central and Eastern Europe under the Global Monitoring Plan, in the EMEP as well as providing data in other long-term monitoring activities in relation to air, water, soil, deposition and other environmental and biotic matrices. The international summer school is organized once per year and ask capacity of ACTRIS research infrastructure for 1- day intensive expert training for group of participants (include post doc and young researcher). Košetice observatory is a unique sampling site with a long term integrated environmental monitoring.

*3) Introduction of the sampling capacities in Košetice observatory, possible analytical determination of POPs and monitoring data processing (POPs monitoring), 19.6.2018, 35 persons, RWDs : 35*

The week-long International Summer School of Toxic Compounds in the Environment organized by the Research Infrastructure RECETOX helps build global capacities for the

environmental chemistry and ecotoxicology, including aspects of analytical and process chemistry (sampling and analytical techniques), long-range transport, fate and effects (sources, levels, transformations, toxic and ecotoxic effects on biota, biotests and biomonitoring), risk assessment, data analysis and modelling including GIS, and provides a hands-on experience with the chemical and toxicological tests designed to answer specific environmental problems. The special topic of this year was Smart and Healthy Cities. The study plan include a field trip to the National Atmospheric observatory Košetice, multimeter sampling site, serving as the complex background station for the Central and Eastern Europe under the Global Monitoring Plan, EMEP (Cooperative Programme for Monitoring and Evaluation of the Long-Range Transmissions of Air Pollutants in Europe) as well as providing data in other long-term monitoring activities in relation to air, water, soil, deposition and other environmental and biotic matrices. This part of Summer School was led and organized by prof. Martin Scheringer from Institute for Chemical and Bioengineering ETH Zurich. The international summer school is organized once per year and ask capacity of ACTRIS research infrastructure for 1- day intensive expert training for group of participants (include post doc).

The plan for 1-day intensive training was completely fulfilled. The training module attended 35 participants from 21 countries (Armenia, Austria, Belarus, Bosnia and Herzegovina, Denmark, France, Costa Rica, Chile, Germany, Hungary, Italy, Lithuania, Malaysia, the Netherlands, Nigeria, Norway, Poland, Russia, Serbia, Ukraine, USA). Passive and active air samplers, sampling of POPs in ambient air, long-term monitoring of POPs in ambient air and atmospheric deposition, integrated monitoring of POPs in ambient air, atmospheric deposition, surface water, sediment, soil, needles, and lichen, active and passive water samplers, atmospheric deposition samplers, detailed studies of the POPs distribution among the size segregated atmospheric aerosols and the gas phase and the impact on their lifetime, long-range transport and related health risks and studies focused on POPs scavenging efficiency of dry and wet deposition processes and application of new knowledge in model development and validation were the key activities of training in observatory and were introduced and/or demonstrated to participants. Available capacity, services and instruments of ACTRIS research infrastructure in the field of air and water monitoring of POPs at Kosetice sampling site were introduced.

*4) Supersite measurements for research and modelling (REACHMOND). 24-27.9.2018. 10 persons, RWDs : 40*

The main goal of the visit was educational in order to familiarize with the established EU environmental research infrastructure ACTRIS. As a new EU member state Croatia is interested in focused training and transfer of knowledge with respect to development and utilisation of scientific monitoring infrastructure and data. Introduction of the sampling capacities in Košetice observatory and monitoring data processing enabled Croatian scientists to learn about multiple aspects of planning, establishing and implementation of scientific monitoring, including its operational and financial sustainability. The second element of the project was to learn about the data and its use in research projects, models' evaluation as well as for regulatory purposes. Specifically, interest was focused on advanced aerosol measurements (EC-OC, size particle distribution, and aerosol optical properties), data quality objectives, QA/QC, as well as data control and manipulation. In addition guidance in the field of sampling and chemical analysis of air, particulate matter and precipitation, enable Croatian scientists to learn how to develop and upgrade monitoring activities in this area to cover the chemical properties of atmosphere that would include, among others, the analysis of heavy metals and persistent organic pollutants.



These measurements are currently missing in South-eastern Europe. The lectures and practical exercises were focused on:

- theoretical background of various monitoring elements (air, aerosols, precipitation)
- organizational aspects of research monitoring: planning, establishment, implementation, sustainability
- operational aspects of monitoring and on-site field study
- data analysis, validation and QAQC
- data management and dissemination
- data utilisation for scientific research and regulatory purposes
- discussion and exchange of experiences covering all topics

5) *ACTRIS-CZ for air quality monitoring and modelling in Slovakia (ACTRIS-CZ\_SR). 13-16.11.2018. 5 persons, RWDs : 18*

The TNA of new staff members from Slovak Hydrometeorological Institute (SHMU) was focused on the education in the field of atmospheric processes and the training in monitoring technologies. Slovakia is the only country in the Central Europe, which still does not participate on the ACTRIS initiative. The visit offered the opportunity to introduce the infrastructure of ACTRIS to young scientists and technicians and to prepare further cooperation.

Despite its development in the last few years, the air pollution monitoring in Slovakia is still suffering from the missing measurements of the atmospheric aerosol properties (aerosol size fractions, light absorption and scattering, wet deposition of POPs). The training in the Kosetice monitoring superstation supported the team in integration of missing measurements into the air quality monitoring program in Slovakia. The second purpose of the stay was focused on the improvement of the air quality modelling in Slovakia. Air quality modelling is used for the regulatory purposes with aim to identify origin of the pollution and to assess effect of the measures in different emission scenarios on air quality improvement. Measured data from ACTRIS research infrastructure will be used for the validation of air quality model output and its meteorological inputs.

The programme of TNA was organized in following main topics:

- Presentation of ACTRIS and its role in the atmospheric research infrastructure landscape in Europe
- Physical and chemical processes in the atmosphere and their influence on the path of the pollutants in the surface layer.
- Practical exercises in air quality monitoring and assessments (technical aspects, data validation and analyses, data reporting)
- General aspects of air quality (Air pollution abatement strategies, increase of public awareness on air quality problems)
- Individual consultation focused on air quality model validation and the formation of atmospheric aerosols.

6) *Spatial distribution of atmospheric aerosols sources impacting central Czech Republic and Northern France (SOURCEIMPACT). 23-25.1.2019. 2 persons, RWDs : 4*

Recent studies showed Central Europe as a potential source area of PM<sub>10</sub> impacting the Northern France region during exceedance episodes frequently occurring in spring. Long term monitoring networks across Europe, such as EMEP network, aims at studying the source and trends of atmospheric particles. The National Atmospheric Observatory Košetice observatory (ACTRIS, EMEP, GAW) is a a multimatrix sampling site serving as a complex background station for Central Europe impacted by emission sources from neighbouring countries as well as long distance transport sources. The main objective of the project “SOURCEIMPACT” was to identify the possible geographical origins of atmospheric pollutants impacting Kosetice rural receptor site in comparison to Revin (Northern France) rural sites (EMEP). Based on historical air pollutants data (2009-2013) collected on both sites and 72-h air mass back trajectories, the influence of more or less frequent local and long distance sources was investigated using two complementary trajectory-based statistical models: Concentration Field and Potential Source Contribution Function. These models include various constraints (precipitations, boundary layer height, density of Back-Trajectory endpoints) to improve the spatial representativeness and the statistical significance of the potential source maps. The selection of the air trajectory model, fine tuning of the database validation and quality control are some of the key parameters to evaluate in type of project.

The visit helped to get familiar with monitoring aspect (ground base and tall tower) and data processing at Košetice observatory. It's a key step for building our cooperation for future research projects.

The TNA included following topics:

- Presentation of the research activities of The National Atmospheric Observatory Košetice (NAOK)
- Visit through the monitoring infrastructure (ground base and tall tower) at NAOK
- Introduction of the sampling capacities at NAOK
- Establishment and discussion around the validation and QAQC of the database

### **5.13 Izana Subtropical Access Facility, ISAF (AEMET)**

Overall, ISAF has provided 100 access days, accounting for 100% of the access planned, as part of 8 TNA projects.

1) The project ISAF-1 ( 8 access days) was devoted to training, which is a very important activity (capacity building) focused on colleagues and institutions that can benefit from the expertise of ISAF staff. It has also promoted cooperation between CONICET in Argentina and the University of Valladolid, with plans to sign a collaboration agreement that is currently being prepared.

2) ISAF2 - PSCIZO2016 (57 access days) participated in the PMOD/WRC campaign at the Izaña Subtropical Access Facility. It was aimed at obtaining a calibration of aerosol optical depth for the standard, ultraviolet and lunar precision filter radiometers (PFR) operated within the GAW PFR global network. This calibration would also allow the traceability of measurements at the Izaña Subtropical Access Facility to become traceable to the world reference for AOD, represented by a Triad of PFR instruments stationed at the World Optical Depth Research and Calibration Center (WORCC). In addition, a spectroradiometer was operated for direct solar irradiance measurements in the range 300 to 500 nm to retrieve solar

irradiance spectra and derive spectral aerosol optical depth over this wavelength range. The instruments were brought to the Izaña Subtropical Access Facility on 5 September and removed at the end of the campaign on 29 September 2016. The instruments were operated on solar trackers on the radiation platform of the Izaña Subtropical Access Facility. Measurements of solar irradiance were performed every minute for the PFR instruments, and every 20 minutes with the spectroradiometer. The measurement period covered the period 7 to 28 September 2016.

3) The ISAF-03 project (4 access days) involved the performance of the following: Practice with sunphotometers: installation of Cimel sunphotometer, configuration of ASTPwin control software, performance of daily and weekly maintenance, troubleshooting and packing.

It also involves introduction to calibration system in AERONET: calibration of direct sun measurements (Pre and Post-calibration) and calibration of radiance measurements in the optical calibration laboratory. - Access to measurements and derived products: AERONET products, alert system at AERONET and alert system at CAELIS not excluding data analysis, interpretation and limitation.

4) ISAF-5 project / PICASSO-VISION (7 access days): The measurements have been done with the Engineering Model of VISION. The solar images have been recorded at specific wavelengths in the visible and near-infrared spectral domain. For ozone retrieval, observations have been made at three different wavelengths, one at 601 nm, at the centre of the Chappuis O<sub>3</sub> absorption band, and at two wavelengths located on each side of the Chappuis band, where O<sub>3</sub> absorption is negligible and only Rayleigh and aerosols scatterings contribute: the ratio of these wavelengths will provide the quantity of O<sub>3</sub> present in the path. The intensity of the signal versus solar elevation will provide information about extra-terrestrial solar flux (Langley plot), as well as the atmospheric aerosol and ozone content. Moreover, the shape of the solar image, particularly at low solar elevations where it is deformed by the refraction, will provide information about the temperature profile in the atmosphere (the refraction angle is depending on the air density, which in turn depends on the temperature).

5) Project ISAF-7 (Training on AERONET photometer operation for Tunis\_Carthage technicians, 2017, 4 access days) was devoted to training, which is a very important activity (capacity building) to institutions and instrument operators that can benefit from the expertise of ISAF staff.

6) Project ISAF-8 (HM-CLuP: High Mountain Calibration of Lunar Photometer, 8 access days) was a mobility of expert. the station was chosen for a calibration/intercalibration campaign of lunar photometers, including a two-days workshop on this developing technique.

7) Project ISAF-9 (4 access days) was devoted to training, which is a very important activity (capacity building) focused on colleagues and institutions that can benefit from the expertise of ISAF staff. It was also related to providing actively support to the monitoring programs in developing countries. In particular, Tamanrasset station is in the heart of the Sahara desert, covering a lack of atmospheric measurements in that area. That project belong to non-EU users, reaching the 20% quota for non-EU users of the total accesses.

8) Project ISAF-10 (8 access days) was a combination of training and expert mobility. The researchers from the private company EKO Instruments ran their own instruments at ISAF because of the unique characteristics of the Observatory, and obtained ancillary and

complementary data and information provided by ISAF. Both parties benefited from enhanced scientific cooperation.

ISAF-4 and ISAF-6 were withdrawn by the users.

#### **5.14 Granada Atmospheric Observatory, GRA (UGR)**

Seven TNA projects accounting for 179 access days ( nearly twice the minimum quantity of access foreseen ) have been carried out at GRA:

1) TNA TRAMP (TRaining on Aerosol Microphysical Profiling (transfer of knowledge from ACTRIS2 to LALINET, 34 access days), focused on an intensive training to apply GRASP algorithm to sun/sky photometer and elastic lidar data acquired in our station. The training process developed successfully, opening new possibilities for the Latin American Lidar Community taking into account that the team at Sao Paulo where Dr. Lopes develop his activity is coordinating the activities of LALINET, Latin American Lidar network. Along the next months transfer of knowledge will develop in LALINET, using the different workshops and some exploratory work will develop in order to check the feasibility of microphysical retrieval using limited configurations of input data, like those typically available in some LALINET stations.

2) TNA HYGROLIRA (Study of aerosol hygroscopicity by combination of lidar and microwave radiometer, 25 access days) focused on the study the aerosol hygroscopic growth by means of remote sensing techniques, in particular using lidar and microwave measurements. During the TNA period Dr. Navas collected with the help of the Granada's personal a data set of measurements useful for this study. He implemented two methods for calibrating the lidar water vapour channel using RS measurements. In addition, he also set up an automatic algorithm to combine the water vapour profiles from the lidar and the temperature profiles from the microwave radiometer to retrieve relative humidity profiles. The aerosol hygroscopic growth has been studied by means of the enhancement factor of the backscatter coefficient. This factor combines information of aerosol and relative humidity profile. Some study cases have been analysed and compare with previous studies and main results will be presented in the next AGU fall meeting. These studies on hygroscopic growth will continue in the next months during the stay of Colombian PhD student, developing a Double PhD between la Universidad Nacional de Colombia y la Universidad de Granada. Dr. Navas will provide advice for developing an extended experimental period and for analyzing the data.

3) The TNA Aer-Cloud RenSen (Remote sensing activities with LIDAR, photometers, microwave radiometer and on-site measurements of the aerosol and clouds, GRA-4, 15 access days) involved a team of researcher from CEILAP-UNIDEF (CITEDEF-CONICET) from Buenos Aires (Argentina). The PI was Dr. Elian Wolfran who sent the Graduate Pablo Martin Vasquez for a full training in the use of a set of remote sensing instruments involved in the SLOPE II project (Sierra Nevada Lidar AerOsol Profiling Experiment II. The training period was held in the weeks between 20th of June and 5th of July. A particular training was received from Granada Atmospheric staff on the use of SUN radiometers, concerning alignment, data acquisition and properly work of this kind of instruments. Also training in the use of Multi- $\lambda$  LIDAR and data interpretation for the lidar signal was tested. Special care was paid to the interaction between different instruments, combining multispectral Raman lidar with sun photometer, Doppler Lidar, In Situ measurements and sky-cameras. The training received was applied to a particular case of study, collected on June 13th 2017, when a forest fire occurred

in the surroundings of Granada and a column of smoke rose above the city. The study case has served for the application of the different techniques and have been presented in poster format in different ACTRIS meeting and will be submitted for presentation at the European Lidar Conference.

4) The TNA IPA-SLOPE-II, (Individual particle analysis of atmospheric aerosols during SLOPE II, GRA-5, 13 access days) was developed from 18/06/2017 – 01/07/2017. The activity proposed by the PI Prof. Sandra Mogo was developed by the Graduate Student Renan Zocca from the University of Beira Interior (Portugal). The aim of the TNA was analyzing in situ aerosols during the SLOPE II field experiment. The aerosol concentration and size distribution were obtained as well as the chemical composition and the morphology of the individual atmospheric aerosols, using gravimetry, transmission electron microscopy (TEM) and scanning electron microscopy with energy dispersive x-ray analysis (SEM/EDX). During the campaign the aerosol samples were continuously deposited onto a polycarbonate membrane filter at a known flow rate. The cut-off diameter of the inlet nozzle and sample transport line was approximately 10 microm. The mass levels of particulate matter are obtained by weighting the filters with standard methods. The filters were weighed before and after collection and care is taken to eliminate electrostatic charges (using a Po-210 neutralizer) before weighing. Subsequently, the filters with their collected aerosols are analyzed in the lab, work that is under development. The under graduate student, attending the TNA, participated in SLOPE II, operating the sampling systems used for collecting the samples to be later analyze at the lab. He learnt about the in-situ techniques used during SLOPE II.

5) The TNA ReSASE (Remote Sensing and in-situ Activities during SLOPE2 Experiment, GRA-6, 32 access days), was developed in coincidence with the experimental activities of SLOPE II. Scientists from the University of Evora with different level of expertise led by Dr. Daniele Bortoli contribute to the experimental campaign with remote sensing and in-situ measurements of trace gases. Furthermore, they develop an intensive field campaign for intercomparing different remote sensing profiling systems. Thus, for the full period of the field campaign (June-July-August) it has been performed remote sensing and surface measurements of trace gases with a DOAS spectrometer in Zenith sky as well as in MAX-DOAS configuration and with an Air Quality mobile station (AQMS) equipped with in-situ analyzers respectively, in order to assess the role of atmospheric tracers on atmospheric compounds (clouds, aerosol....) and interactions between them. Furthermore, during a short period of about 10 days at the beginning of the project an intensive campaign was developed: gathering data useful for testing the retrieval schemes to be applied for 24-hour absorption coefficient profiling through inversion of remote sensing observations. This has been done with a RPG G4 Microwave Radiometers (MWR) and a Vaisal CL31 ceilometer from the University of Evora used in parallel with the G2 MWR, as well as a Jenoptik CHM 15k Nimbus ceilometers and a Doppler lidar (DL) available at the GRANADA station.

6) PoliSyns (Polarization Lidar calibration and Lidar signal analysis by synergetic numerical algorithms, 32 access days). The TNA applicant is currently developing a project called "Polarimetric system for the identification and classification of atmospheric aerosols" where depolarization measurements of atmospheric aerosols will be performed in controlled laboratory conditions. To be able to compare the in-situ and remote-sensing depolarization measurements, the TNA applicant needs an advanced training to reach a deep understanding of the lidar depolarization technique and, in a more general way, the retrievals and algorithms applied to remote-sensing measurements. Thus, the main scientific objective of the PoliSyns is

a training-through-research on: 1) Calibration method for depolarization lidar measurements (Bravo-Aranda et al., 2016; Belegante et al., 2018). This work will be used to learn about empirical and theoretical analysis of atmospheric aerosols under different atmospheric and aerosol load situations that can be found in Medellin (Colombia). 2) Retrieval algorithms such as LIRIC and GARRLIC combining collocated Lidar and AERONET sun photometer measurements. 3) Transfer of knowledge about the optimization of optical systems for a correct acquisition and study of depolarization by backscattering of aerosols will be assured through the training-through-research as well as scientific-technical meetings nourished by the extensive experience of the GFAT-UGR on processing and analysis of remote-sensing measurements (particularly on LIDAR systems).

7) DePLUME (Dust size distribution profiling with bespoke balloon-borne and UAV-based particle counters, 28 access days): The main objective was to use the ACTRIS GRA Research Infrastructure in order to assess the Universal Cloud and Aerosol Sounding System (UCASS) - based on balloon and UAV platforms - against the advanced retrievals from LIRIC and GARRLIC codes, as well as the POLIPHON method (Ansmann et al., 2012). The UCASS is an open-path OPC that has been developed at the University of Hertfordshire and can be used on a balloon, as a dropsonde, or deployed on a UAV. The UCASS allows for affordable in-situ profiling of the size distribution of aerosols and cloud droplets in 16 size bins, capable of sizing particles in the range 0.4-40  $\mu\text{m}$ . The University of Hertfordshire Aerosol SAMpling UAV (UH-AeroSAM) is a bespoke UAV designed to take in-situ measurements of aerosol properties using a modified UCASS, along with other variables which are common inputs for cloud and aerosol parameterizations (e.g. temperature and humidity). Since UAV based measurements in atmospheric science are still in their infancy, this platform requires a rigorous validation procedure with reference instruments which the ACTRIS GRA Research Infrastructure provides (along with balloon-based soundings). The specific scientific objectives of DePLUME were: i) the assessment of the quality of UCASS measurements deployed on 2 different systems (balloon-borne and on a UAV), ii) the contribution towards the validation of UH-AeroSAM for temperature, humidity and aerosol properties, and iii) the study of the dust microphysics using the synergy of remote sensing and in-situ methods.

### **5.15 CSIC Montseny, MSY (CSIC)**

During the whole project period, six projects were carried out at the MSY infrastructure. 79 access days were provided, accounting for near 100% of the access offered.

Four of the projects were related to the investigation of processes of formation of particles with special emphasis in the organic aerosols. These processes are relevant at the area due to the combination of high insolation and high temperatures that favor the oxidation of gaseous precursors and also enhance emissions of biogenic compounds and the formation of semi volatile compounds, increasing the concentration of ultrafine particles, mainly at midday during summer).

The National Centre for Atmospheric Sciences, from the University of Birmingham, performed in 2015 the TNA AUFU-UHIC (MSY-2), led by David Beddows, aimed to study the nucleation episodes by using a Particle Size Magnifier (PSM) that permits to measure the concentration of ultrafine particles (UFP) with diameter higher than 1 nm. PSM measurements combined with

routine measurements carried out by the IDAEA group by means of SMPS instruments (Tropos SMPS, Long DMA TSI-3080 SMPS; a short DMA TSI-3082). This set of instruments permitted to determine number concentrations and particle size spectra spanning size bins 1.25 - 478.3 nm. Nucleation events were observed using the PSM at the Barcelona urban site but not at the Montseny rural background site probably because of the high loading of particulate matter observed during these days.

The Laboratoire Chimie Environnement (LCE) from Aix Marseille Université, carried out two projects, both led by Nicolas Marchand, at Montseny: TNA UFO-AHI (MSY-1) and HOUSE2 (MSY-5). During both projects, LCE deployed a PTR-ToF-MS 8000, Ionicon. This instrument permits to quantify VOCs in near real time. The high mass resolution of the mass analyzer allows the identification (chemical formulae) and quantification of about a hundreds of VOCs (about 20 could be identify unambiguously). It provides the opportunity to capture the rapid changes of the overall VOCs mixture which can be further study by factorial analysis such as constrained PMF.

During UFO-AHI, performed in 2015, not a relevant relationship between the gas and organic compounds and the formation of UFP was established probably attributed to the adverse meteorological conditions. Therefore, the repetition of measurements was planned for the next periods. The HOUSE 2 project, was carried out in 2017 within the framework of the HOUSE project (IDAEA-CSIC, <http://www.idaea.csic.es/egar/portfolio-items/house>) aimed at investigating the atmospheric scenarios and processes yielding to the high formation rates of ozone (O<sub>3</sub>), ultrafine particles (UFP) and secondary aerosols (SA) typical of the Western Mediterranean Basin in summer. PTRM measurements carried out by Aix Marseille University allowed to investigate the time variations of VOCs concentrations, identifying a clear diurnal cycle for monoterpene, characteristic of a local production, whereas the diurnal cycle of isoprene is more complex.

In the framework of HOUSE, vertical profiles of O<sub>3</sub>, UFP, BC, PM with instrumented tethered balloons were performed by researchers from the Department of Mechanical Engineering of Hanyang University under the HOUSE 1 TNA project (MSY-4). This group, led by Professor Kang-Ho Ahn, has experience on designing and constructing miniaturized instruments for measuring aerosol properties by using UAV. Vertical profiling with miniaturized instruments is an interesting strategy for characterizing the stratification layers caused by the recirculation of air masses, typical in summer in the study area.

TNA to MSY were also focused to testing new instrumentation. Thus, during HOUSE 1, the performance of the Hanyang miniaturized instruments was tested against with the MSY site instruments, operating under ACTRIS requirements. Two other TNA projects were carried out by SMEs aimed to test new instrumentation and techniques under the Mediterranean specific conditions.

During the SCOPE TNA project (MSY-3), led by Pavlos Panteliadis, the Sunset Laboratory BV was interested in checking the performance of the Field OCEC analyzer using the EUSAAR2 protocol as following the requirement for the networks of all EU member states to measure EC and OC in particulate matter at background sites according to the Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe. The Montseny (MSY) site was selected by Sunset Laboratory given that it is mostly dominated by biogenic emissions but is also affected by a large variety of emission sources: natural sources such as African dust, marine aerosols, biomass burning and urban emissions from densely populated areas along the

coastline and transboundary sources from the European continent. Measurements were carried out in 2016 and 2017 and were correlated with those obtained by other instruments at MSY. BC measurements (880nm) obtained by the aethalometer were in very good agreement with EC concentrations of the semi-continuous OCEC analyzer,  $R^2=0.94$ . OC online measurements were correlated with the organic aerosol (OA) concentrations calculated from the ACSM data resulting in OA/OC ratio equal to 2.3. The final product of this campaign will be an ACTRIS OCEC semi-continuous analyzer best practice document to be implemented by the ACTRIS users.

Another TNA ongoing project, CADB2@MSY (MSY-6), focuses in the development of a methodology to determine quantitatively the contribution of Saharan dust to PM10 from measurements of the dust optical properties by using Absorption photometers. Saharan dust plays an important role in the climate system, and contributes to PM10 concentrations in large South-European cities. The TNA project is led by Griša Močnik from the J. Stefan Institute from Slovenia, and has the participation of researchers from Aerosol d.o.o. This private company supplied a platform, installed at MSY in February 2019, using Aethalometers AE33 with different inlets to measure fine aerosol absorption (AE33 with a PM1 inlet), and to measure concentrated coarse fraction absorption (AE33 with a virtual impactor inlet). The coarse fraction absorption is calculated as a difference between the concentrated sample (which contains some fine fraction) and the fine fraction. The concentration of relatively weakly absorbing coarse particles allows us to determine the spectrally resolved contribution of the coarse fraction to absorption and whether the coarse dust particles carry impacted BC. Aerosol d.o.o has supplied two additional platforms installed at BCN urban background sites and MSC mountain site. This approach together with concurrent aircraft measurements will permit to determine the pure Saharan dust optical properties before it is mixed into the receptor site mixing layer, discriminating whether internally mixed dust and BC are from the source or receptor regions, respectively. The measurements at the stations are ongoing and airborne measurements are planned for spring.

We like to highlight the aforementioned accesses to MSY site of SMEs (Sunset Laboratory and Aerosol d.o.o.) During these TNA projects the SMES have installed different instrument at MSY for testing their performance in the Mediterranean area. The instruments have been installed for periods longer than three months, under the supervision of the CSIC technical staff.

### **5.16 Hyltemossa, HYM (ULUND)**

No TNA has been provided, contrary to what has been foreseen in the contract. The construction of the new co-located ICOS-ACTRIS site at Hyltemossa (HYM) was considerably delayed due primarily to difficulties securing building permits for the ICOS tall tower and buildings. This also caused a subsequent delay for setting up the ACTRIS extensions to the ICOS site. This meant that TNA was not possible in practice until 2018.

### **5.17 Cyprus Atmospheric Observatory, CAO (CYI)**

Three TNA projects have been accepted at CAO, 93,5 access days are reported. It is a bit less than initially planned (100 RWD):



1) DEPosition Intercomparison Experiment in Agia Marina Xyliatou, Cyprus (DEPEX, 18.5 access days): This is the first and largest intercomparison of wet/dry samplers currently deployed in world-wide atmospheric networks. This experiment covered a period of 16 months (Feb. 2016 to April 2017) and focused on wet/dry composition of ion and metal measurements performed on-site and in different labs participating.

2) TNA INUIT-CYPRUS (70 access days). Ice Nucleation Research Unit – Cyprus INP Closure Study in April 2016 (<http://www.mpic.de/forschung/partikelchemie/gruppe-schneider/projekte/inuit/inuit-cyprus-2017.html>) with two main objectives: 1) a physico-chemical characterization of atmospheric ice nucleating particles (INP) in an environment where mineral dust and marine aerosol is present; and 2) a closure between INP concentrations determined experimentally and predicted by models.

3) CADB2 Saharan dust - characterization of absorption and the dust/BC mixing state (5 access days) has been achieved in February 2019. CADB2 aims to determine the contribution of dust to PM10 concentrations and absorption direct radiative efficiency as well as infer the dust and black carbon (BC) mixing state. The Slovenian SME Aerosol d.o.o was implicated as they provided instruments for the project.

### **5.18 Mace Head Research Station, MHD (NUIG)**

278 RWD were provided at Mace Head Research Station over the whole project which is twice the minimum quantity of access foreseen .

MHD-1 was withdrawn.

MHD-2: Mace Head station had one TNA action during 2nd reporting period (4 RWD which was reported in RP3) – Long-Term Ice Nucleating Particle Measurements at Mace Head (LINAM). The access was provided to install long-term measurement setup taking the advantage of the station being exposed to contrasting clean marine as well as polluted continental air masses. Mace Head station has continuously operating computer controlled sectoral sampling system enabling automatic control of sampling conditions (wind speed, wind direction and BC concentration) without user intervention (except for sample change). Previous extensive and ample research performed at Mace Head revealed that clean oceanic air masses (190-300 deg sector) occur during 50% of calendar time. A system consisting of PM10 size selective sampling inlet and specific filter holders was setup and tested during TNA action. The system was left to run and operate by NUI Galway researchers and appropriate training was obtained. About 20 samples were already collected and shipped to the lab at Karlsruhe Institute of Technology for analysis.

During RP3, there were three TNA actions at Mace Head: BC-PEAT by the University of Manchester, UK during 16/01-10/02/2018; INP-MH by ISAC CNR, Bologna, Italy during 10-12/04/2018 and parallel joint access CONDENZ:MHD Part1 and 2 by the University of Helsinki and University of Tampere during 20/05-25/07/2018.

MHD-3: BC-PEAT undertaken by University of Manchester (UMan) was focussed on black carbon microphysical properties studied during peat burning season in Ireland by integrating near-surface chemical, physical, optical aerosol properties and cloud droplets. The relationships between black carbon (BC), brown carbon (BrC) and their light-absorbing properties are complex, however they are important to consider as these in part dictates their influences on climate and also the ability of instruments like the multiwavelength Aethalometer to quantify

ambient BC and apportion it to sources such as biomass burning and vehicle emissions. Factors to consider include the size, shape and mixing state of BC containing particles and the University of Manchester has investigated techniques for interrogating these parameters and their influences on optical properties. Recently, the UMan team pioneered a technique of combining a Combustion Centrifugal Particle Mass Analyser (CPMA) with a Droplet Measurement Technologies Single Particle Soot Photometer (SP2) to probe mixing state on a single particle level, which has led to new insights on the behaviors of different soot types and how the non-BC material (the ‘coating’) perturbs the optical properties. The data generally showed a very high (>95%) single scattering albedo (SSA) overall, which for a remote coastal site, is not surprising. The absorbing component did show some interesting trends, in particular when contrasting the local pollution with that which was transported from further afield, in particular as regards the Absorption Angstrom Exponent (AAE), which showed that the local emissions absorbed relatively more strongly at the shorter wavelengths. This is characteristic of biomass burning and could indicate a significant BrC contribution. A preliminary analysis of the CPMA-SP2 data from an event period appears to show a mixture of thinly and thickly coated smaller particles and some very large thinly coated particles, but analysis of this is ongoing.

MHD-4: INP-MH was undertaken by ISAC CNR team from Bologna, Italy who installed an INP sampler to make concurrent INP sampling as from another TNA action, but using different sampling strategy. That is significant undertaking given large spread of INP data from same locations. Previous studies have revealed the low ice nucleating ability of sea spray relative to terrestrial sources. However, other groups demonstrated that higher INP emissions were located over ocean regions that were expected to be biologically productive. They also observed higher INP number concentrations per volume of phytoplankton- rich seawater compared to seawater with little phytoplankton biomass, proposing a possible biogenic source of INPs from ocean waters. Elucidating this biologically mediated mechanism for enhanced oceanic INP emissions is needed to accurately estimate atmospheric INP number concentrations and consequent primary ice formation in clouds over the oceans. There are many challenges for observing INP from the ocean source in the ambient atmosphere. As mentioned previously, terrestrial aerosols are more ice nucleation active than sea spray aerosol, making it difficult to distinguish marine organic from terrestrial aerosol influences. Additionally, remote INP number concentrations are low, thus requiring a measurement approach that allows large sampling volumes and has low INP detection limits. This favors offline INP measurements techniques, which are able to reduce the detection limit significantly by increasing the sampling volume. Mace Head is the only station in Europe that allows for sampling of pristine marine air masses from the ocean, for a consistent number of days during the year. Furthermore, at Mace Head a computer- based sampling system allows for a pre- sampling selection of the air masses that is fundamental to operate offline analysis, reducing to a negligible amount influences from the continent and from human activities.

MHD-5 and MHD-6: CONDENZ:MHD was the largest TNA action which involved two research teams from University of Helsinki and University of Tampere, Finland who jointly deployed state-of-the-art instrumentation at Mace Head to study cluster formation in different environments. Previous studies at Mace Head have revealed that the iodic acid (HIO<sub>3</sub>) plays an important role in the nucleation process in the coastal atmosphere (Sipilä et al., 2016, Nature) where sea bed macro algae releases iodine vapours into the atmosphere. However, a complete picture of the formation pathways of HIO<sub>3</sub> from seaweed emitted iodine remains unclear. A state-of-the-art mass spectrometric study was conducted at Mace Head during the summer

2018, as a part of the intensive studies of the Finnish Academy CONDENZ project. The major aim of the study is to extend our knowledge on the iodine inferred mediated nucleation mechanisms and associated gas phase chemistry through measurements of a wider range of oxidants and vapours, including nucleating precursors, and to resolve/validate the potential role of iodide oxides and iodine oxy-acids other than iodic acid in aerosol particle nucleation &/growth which were found to be crucial in the CERN CLOUD chamber experiments. Mace Head was considered as a perfect supreme location for investigating air masses from the open ocean and resolving the key nucleation mechanisms related to emissions of iodine vapours or dimethyl sulphide emitted from oceanic phytoplankton and while at times the location is sometime often influenced by nearby anthropogenic sources. The size of the campaign has been very significant and data analysis is still ongoing which has been a lengthy process given three teams involved.

## **6 Publications and output and resulting from Transnational Access to advanced ACTRIS stations**

The publications resulting from ACTRIS-2 TNA are summarized in Table 2: List of Transnational Access publications. Most often, the analysis of the results from TNA activities takes time and the results are only published with some time lag. Therefore, further publications resulting from TNA are expected in the near future.

Each TNA research group benefitting from physical access to the advanced ACTRIS stations submitted a scientific activity report. All scientific reports are publicly accessible on the ACTRIS website ([https://www.actris.eu/Documentation/ACTRIS-2IAinH2020\(2015-2019\)/WPdocuments/TNAOverview/Physical.aspx](https://www.actris.eu/Documentation/ACTRIS-2IAinH2020(2015-2019)/WPdocuments/TNAOverview/Physical.aspx)). The reports summarize for each TNA project the motivation for the planned project and reason for choosing the station, the scientific objectives, the method and experimental set-up, and the preliminary results and first conclusions.

Table 2. Publications resulting from TNA-4

TNA Acronym	Authors	Title	Year of publication	Type of publication <sup>1</sup>	Peer-reviewed	DOI	Publication references	Open Access
MORGANE-MAIDO (MAIDO1-1)	Vérèmes H., Payen G., Keckhut P., Duflot V., Baray J.-L., Cammas J.-P., Leclair De Bellevue J., Posny F., Evan S., Metzger J.-M., Marquestaut N., Gabarrot F., Meier S., Vömel H. and Dirksen R	A Raman lidar at Maïdo Observatory (Reunion Island) to measure water vapor in the troposphere and lower stratosphere: calibration and validation	2016	Discussion paper	N		<a href="https://hal-insu.archives-ouvertes.fr/insu-01411111">https://hal-insu.arch</a>	Y
HYGROLIRA (GRA-3)	F. Navas-Guzmán, A. Bedoya, M. J. Granados-Muñoz, P. Ortiz, J. L. Guerrero-Rascado, G. Moreira, N. Kampfer and L. Alados-Arboledas	Study of aerosol hygroscopicity by combination of lidar and microwave radiometer.	2016	Conference (poster)			AGU Fall Meeting, San Francisco (USA), 12-16 December 2016.	
MICROLIRA (CIAO-1)	Lolli, S., Madonna, F., Rosoldi, M., Campbell, J. R., Welton, E. J., Lewis, J. R., Gu, Y., and Pappalardo, G.	Impact of varying lidar measurement and data processing techniques in evaluating cirrus cloud and aerosol direct radiative effects	2018	Article in journal	Y	<a href="https://doi.org/10.5194/amt-11-1639-2018">https://doi.org/10.5194/amt-11-1639-2018</a>	Atmos. Meas. Tech., 11, 1639-1651, 2018	Y
INTERACT II (CIAO-2)	Madonna, F., Rosoldi, M., Lolli, S., Amato, F., Vande Hey, J., Dhillon, R., Zheng, Y., Brettler, M., and Pappalardo, G.	Intercomparison of aerosol measurements performed with multi-wavelength Raman lidars, automatic lidars and ceilometers in the frame of INTERACT-II campaign	2018	Article in journal	Y	<a href="https://doi.org/10.5194/amt-11-2459-2018">https://doi.org/10.5194/amt-11-2459-2018</a>	Atmos. Meas. Tech., 11, 2459-2475	Y

<sup>1</sup> Article in journal, Publication in conference proceeding/workshop, Book/Monograph, Chapters in book, Thesis/dissertation.

TNA Acronym	Authors	Title	Year of publication	Type of publication <sup>1</sup>	Peer-reviewed	DOI	Publication references	Open Access
HYGROLIRA (GRA-3)	Bedoya-Velásquez, A. E., Navas-Guzmán, F., Granados-Muñoz, M. J., Titos, G., Roman, R., Casquero-Vera, J. A., Ortiz-Amezcuca, P., Benavent-Oltra, J. A., de Arruda Moreira, G., Montilla-Rosero, E., Hoyos Ortiz, C. D., Artífano, B., Coz, E., Alados-Arboledas, L., and Guerrero-Rascado, J. L	Hygroscopic growth study in the framework of EARLINET during the SLOPE I campaign: synergy of remote sensing and in-situ instrumentation	2017	Article in journal	Y	<a href="https://doi.org/10.5194/acp-2017-993">https://doi.org/10.5194/acp-2017-993</a>	Atmos. Chem. Phys. Discuss: <a href="https://doi.org/10.5194/acp-2017-993">https://doi.org/10.5194/acp-2017-993</a>	Y
HYGROLIRA (GRA-3)	Andres Bedoya, Francisco Navas-Guzmán, Juan Luis Guerrero-Rascado, Lucas Alados-Arboledas	Validation and statistical analysis of temperature, humidity profiles and Integrated Water Vapor (IWV) from microwave measurements over Granada (Spain)	2017	Publication in conference proceeding	Y		Geophysical Research Abstracts Vol. 19	Y
RFOFC (SIR-2)	Felipe Toledo	BASTA-MOBILE Cloud Radar Calibration	2017	MS Thesis				
SYR-SIR (SIR-3)	JC Dupont, M. Haeffelin (IPSL), E. Waersted (LMD), J. Delanoe (LATMOS), JB. Renard (LPC2E), J. Preissler, C. O'Dowd (Univ. Galway).	Evaluation of fog and low stratus cloud microphysical properties derived from in-situ sensor, cloud radar and SYRSOC algorithm	2018	Article in journal		<a href="https://doi.org/10.3390/atmos9050169">doi:10.3390/atmos9050169</a>	Atmosphere 2018, 9, 169	Y
LESFOG (SIR-6)	Wærsted, EG, Haeffelin, M, Steeneveld, G-J, Dupont, J-C	Understanding the dissipation of continental fog by analysing the LWP budget using idealized LES and in situ observations	2018	Article in journal	Y	<a href="https://doi.org/10.1002/qj.3465">https://doi.org/10.1002/qj.3465</a>	QJR Meteorol Soc. 2019; 145: 784-	

TNA Acronym	Authors	Title	Year of publication	Type of publication <sup>1</sup>	Peer-reviewed	DOI	Publication references	Open Access
PaSCIM (CMN-4)	Giroto, Giulia; China, Swarup; Bhandari , Janarjan ; Gorkowski, Kyle; Scarnato, Barbara ; Capek, Tyler; Marinoni, Angela; Veghte, Daniel ; Kulkarni, Gourihar; Aiken, Allison ; Dubey, Manvendra; Mazzoleni, Claudio	Fractal-like Tar Ball Aggregates from Wildfire Smoke	2018	Article in journal	Y	<a href="https://doi.org/10.1021/acs.estlett.8b00229">https://doi.org/10.1021/acs.estlett.8b00229</a>	Environmental Science & Technology Letters	
THE BC SIZE (KOS-1)	F. Esposito, G. Pavese, M. Calvello, A. H. Smejkalova, M. Vana	ACTRIS2-TNA, the project “The_BC_size” a Kosetice (CZ): preliminary results”-	2018	Publication in conference proceedings	Y	<a href="http://www.pml2018.it/wp-content/uploads/2018/06/">http://www.pml2018.it/wp-content/uploads/2018/06/</a>	ISBN code 978-88-942135-1-5.	
PACE 2017 (PAL-2)	Brus D, Neitola K, Doulgieris K, Hirsikko A, Keleshis C, Vouoterakos P, Schaufelberger G, Weiss M, Sciare J, Lihavainen H	Combining airborne and ground based measurements of aerosol and cloud properties - Pallas Cloud Experiment (PaCE 2017)	2018	Publication in conference proceedings	Y		Proceedings of ISARRA 2018, Boulder CO, USA	
INUIT (CAO-3)	Mamali, D., Marinou, E., Sciare, J., Pikridas, M., Kokkalis, P., Kottas, M., Biniotoglou, I., Tsekeri, A., Keleshis, C., Engelmann, R., Baars, H., Ansmann, A., Amiridis, V., Russchenberg, H., and Biskos, G	Vertical profiles of aerosol mass concentrations observed during dust events by unmanned airborne in-situ and remote sensing instruments	2018	Journal	Y	<a href="https://doi.org/10.5194/amt-2017-422">https://doi.org/10.5194/amt-2017-422</a>	Atmos. Meas. Tech. Discuss	Y
INUIT (CAO-3)	Marinou, E., Tesche, M., Nenes, A., Ansmann, A., Schrod, J., Mamali, D., Tsekeri, A., Pikridas, M., Baars, H., Engelmann, R., Voudouri, K.-A., Solomos, S., Sciare, J., Groß, S., and Amiridis, V.:	Retrieval of ice nucleating particle concentrations from lidar observations: Comparison with airborne in-situ measurements from UAVs	2019	Journal	yes	<a href="https://doi.org/10.5194/acp-2018-1203">https://doi.org/10.5194/acp-2018-1203</a>	Atmos. Chem. Phys.	yes

TNA Acronym	Authors	Title	Year of publication	Type of publication <sup>1</sup>	Peer-reviewed	DOI	Publication references	Open Access
INUIT-2017-MPIC (JFJ-5)	Schmidt, S., Schneider, J., Klimach, T., Mertes, S., Schenk, L. P., Kupiszewski, P., Curtius, J., and Borrmann, S.	Online single particle analysis of ice particle residuals from mountain-top mixed-phase clouds using laboratory derived particle type assignment	2017	Journal	Y	10.5194/acp-17-575-2017	Chem. Atoms. Phys.	Y
INUIT-2017-MPIC (JFJ-5)	Eriksen Hammer, S., Mertes, S., Schneider, J., Ebert, M., Kandler, K., and Weinbruch, S.	Composition of ice particle residuals in mixed-phase clouds at Jungfrauoch (Switzerland): enrichment and depletion of particle groups relative to total aerosol	2018	Journal	Y	10.5194/acp-18-13987-2018	Chem. Atoms. Phys.	Y
OCTAVE-ISM (MAIDO7)	Bert Verreycken, Crist Amelynck, Jerome Brioude, Maité Bauwens, Aurélie Colomb, Martine De Mazière, Stephanie Evan, Christian Hermans, Nicolas Kumps, Jean-Marc Metzger, Jean-François Müller, Niels Schoon, Trissevgeni Stavrakou, Pierre Tulet, and Corinne Vigouroux	<b>OCTAVE: First PTR-MS measurements at La Réunion Island: Influences of biomass burning and backtrajectory calculations</b>	2018	Publication in conference proceedings	Y		Geophysical Research Abstracts Vol. 20, EGU2018-9655, 2018, EGU General Assembly 2018.	Y
OCTAVE-ISM (MAIDO7)	<b>Bert Verreycken</b> , Crist Amelynck, Niels Schoon, Trissevgeni Stavrakou, Jean-François Müller, Maité Bauwens, Dominique Fonteyn, Corinne Vigouroux, Nicolas Kumps, Martine De Mazière, Jean-Marc Metzger, Jérôme Brioude, Aurélie Colomb, Manon Rocco, and Valérie Gros	<b>In-situ OVOC measurements in the tropical marine atmosphere for the OCTAVE project</b>	2019	Publication in conference proceedings	Y		Geophysical Research Abstracts Vol. 21, EGU2019-2764-1, 2018, EGU General Assembly	Y
BVOC-NPF (SMR1)	Fischer, L., Breitenlechner, M., Canaval, E., Hansel A.	First ambient flux measurements with the novel PTR3-TOF on top of a measurement tower in Hyttiälä, Finland	2019	Publication in conference proceeding	N	<a href="https://www.ionicon.com/sites/default/files/publications/doc/Contributions_8th-PTR-MS-Conference_b.pdf#2019_we">https://www.ionicon.com/sites/default/files/publications/doc/Contributions_8th-PTR-MS-Conference_b.pdf#2019_we</a>	8 <sup>th</sup> Int. Conf. on PTR-MS	Y

TNA Acronym	Authors	Title	Year of publication	Type of publication <sup>1</sup>	Peer-reviewed	DOI	Publication references	Open Access
CLACE 2017(JFJ7)	Gute, E., Lacher, L., Kanji, Z.A., Kohl, R., Curtius, J., Weber, D., Bingemer, H., Clemen, H.-C., Schneider, J., Gysel-Beer, M., Ferguson, S.T., and Abbatt, J.	Field evaluation of a Portable Fine Particle Concentrator (PFPC) for ice nucleating particle measurements	2019	Article in Journal	Y	<a href="https://doi.org/10.1080/02786826.2019.162634">https://doi.org/10.1080/02786826.2019.162634</a>	Aerosol Science and Technology	
IPA-SLOPE-II (GRA5)	Mogo et al	Individual particle analysis of atmospheric aerosols at Sierra Nevada, during SLOPE2 field campaign	To be submitted Sept 2019	Article in Journal	Y			
CADB2 (CAO-6)	Drinovec, L., B. Višić, M. Remškar, I. Stavroulas, M. Pikridas, F. Unga, J. Sciare, G. Močnik	New method for on-line determination of mineral dust concentration	2019	Publication in conference proceedings			European Aerosol Conference, EAC2019	
DONA / MethodON (SIR-14 & SIR-15)	A. Albinet, J.-E. Petit, A. Lambe, A. Kalogridis, L. Heikkinen, F. Graeffe, M. Cirtog, A. Féron, J. Allan, Z. Bibi, T. Amodeo, N. Karoski, R. Aujay-Plouzeau, L. Meunier, C. Noblet, F. Lestremou, J.-L. Besombes, V. Gros, N. Bonnaire, R. Sarda-Estève, F. Truong, M. Ehn, T. Jokinen, M. Aurela, M. Maasikmets, C. Marin, L. Marmureanu, A. Eriksson, E. Ahlberg, E. Freney, M.C. Minguillón, P. Croteau, J. Jayne, L. Williams, O. Favez	Overview of the ACMCC Particulate Organonitrates (pON) Experiment	2019	Publication in conference proceedings			European Aerosol Conference, EAC2019 Gothenburg, Sweden	



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DONA / MethodON (SIR-14 & SIR-15)	A. Kalogridis, J.-E. Petit, A. Albinet, A. Lambe, L. Heikkinen, F. Graeffe, M. Cirtog, A. Féron, J. Allan, Z. Bibi, T. Amodeo, C. Noblet, N. Karoski, R. AujayPlouzeau, L. Meunier, V. Gros, N. Bonnaire, R. Sarda-Estève, F. Truong, M. Ehn, T. Jokinen, M. Aurela, M. Maasikmets, C. Marin, L. Marmureanu, A. Eriksson, E. Ahlberg, E. Freney, M.C. Minguillón, M. Gini, K. Eleftheriadis, P. Croteau, J. Jayne, L. Williams, O. Favez	Intercomparison of AMS and ACSM measurements for particulate organonitrates (pON)	2019	Publication in conference proceedings			American Association for Aerosol Research 37th Annual Conference, AAAR2019	
DONA / MethodON (SIR-14 & SIR-15)	J.-E. Petit, A. Albinet, A. Lambe, A. Kalogridis, L. Heikkinen, F. Graeffe, M. Cirtog, A. Féron, J. Allan, Z. Bibi, T. Amodeo, N. Karoski, R. Aujay-Plouzeau, L. Meunier, V. Gros, N. Bonnaire, R. Sarda-Estève, F. Truong, M. Ehn, T. Jokinen, M. Aurela, M. Maasikmets, C. Marin, L. Marmureanu, A. Eriksson, E. Ahlberg, E. Freney, M.C. Minguillón, P. Croteau, J. Jayne, L. Williams, O. Favez	Evaluation of the density and absorption properties of generated organonitrate particles (pON)	2019	Publication in conference proceedings			American Association for Aerosol Research 37th Annual Conference, AAAR2019	

## Appendix A: Document templates used within the process of TNA to observation facilities – Application form



1

### Proposal form for ACTRIS-2 Trans-National Access (TNA)

1. Principal Investigator			
First and LAST name:			Gender: <input type="checkbox"/> Female <input type="checkbox"/> Male
Affiliation:			
PI Research status:		Country:	
Postal address:			
E-mail:		Phone number:	
Recent references (5 max; if no references, provide short CV)			
2. Project Information			
Project title:			
Project acronym: (20 characters max)			
Integration in ACTRIS-2 activity:			
TNA type:	<input type="checkbox"/> Training (e.g., UND, PGR)	<input type="checkbox"/> Mobility of expert (e.g., EXP)	<input type="checkbox"/> Combination of training / expert mobility (user group only)
Host infrastructure:	select...		
Access provider: (responsible contact person in charge)	Name:	E-mail address:	
3. Project dates			
Start date:		End date:	

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<b>Do you plan to submit measurement data resulting from your TNA to the ACTRIS Data Centre? (E.g., from other additional measurements at the site during the TNA, from additional instrument(s) deployed during the TNA, etc.)</b>								
<b>Please describe the data resulting from the TNA in more details (unless already included under scientific objectives above):</b>								
<b>5. Participants Employing Organization / Home Institution</b>								
<b>First and LAST name</b>	<b>Email</b>	<b>Institution name</b>	<b>Institution legal status</b>	<b>Institution country</b>				
<b>6. Participants' information</b>								
<b>First and LAST name</b>	<b>Gender</b>	<b>Activity domain</b>	<b>Position</b>	<b>Nationality</b>	<b>New user</b>	<b>Start of TNA dd/mm/yy</b>	<b>End of TNA dd/mm/yy</b>	<b>Duration of TNA</b>
<b>Total number of user days:</b>								<b>0,0</b>

<b>7. Estimated project costs (in EUR, no decimals)</b>		
<b>Travel costs per person (A)</b>	<b>Total number of participants (B)</b>	<b>Total travel costs (C= A x B)</b>
		0
<b>Daily subsistence costs per person (D)</b>	<b>Total number of user days (total from 6) (E)</b>	<b>Total subsistence costs (F= D x E)</b>
	0,0	0,0
<b>Total estimated project costs (G= C + F):</b>		0,0
<b>Financial support requested to ACTRIS-2:</b>		
<b>8. Comments (optional)</b>		

### Application guidance notes

#### 1. Principal Investigator

The Principal Investigator (PI) is the person responsible for the project who acts as contact of the proposal for the research team (user group). The Principal Investigator is expected to participate as a user.

#### PI Research status

Please select:

- UND = Undergraduate
- PGR = Post-graduate, student with 1<sup>st</sup> university degree
- PDOC = Post-Doctoral Researcher
- TEC = Technician
- EXP = Experienced, professional researcher

#### 2. Project information

##### Integration in ACTRIS-2 activity

Please select:

- Profiling of aerosols (including combined Lidar and near-surface activities)
- Profiling of clouds and aerosol-cloud interactions
- Near-surface chemical, physical, optical aerosol properties and cloud droplets
- Near-surface trace gas concentrations

##### TNA type

Specify if the planned project aims at providing training to young researchers or at adding value to the infrastructure (mobility of experts). The review will take into consideration a potential training benefit to young researchers or the expertise of the user group. Both training and mobility must be sufficiently demonstrated in the section "Technical description".

##### Host infrastructure

Please select the host infrastructure from the following list of TNA providing observations facilities:

		Access provider	Email
1-CIAO	CNR IMAA Atmospheric Observatory, CNR, Italy	Lucia Mona	<a href="mailto:Lucia.mona@imaa.cnr.it">Lucia.mona@imaa.cnr.it</a>
2-CMN	Monte Cimone taking advantage of Po Valley facility, CNR, Italy	A. Marioni	<a href="mailto:a.marioni@isac.cnr.it">a.marioni@isac.cnr.it</a>
3-SIR	SIRTA Atmospheric Research Observatory, CNRS, France	Martial Haeffelin	<a href="mailto:Martial.Haeffelin@lmd.polytechnique.fr">Martial.Haeffelin@lmd.polytechnique.fr</a>
4-PUY	Puy de Dôme, CNRS, France	Karine Sellegri	<a href="mailto:sellegri@opgc.univ-bpclermont.fr">sellegri@opgc.univ-bpclermont.fr</a>
5-MAIDO - OPAR	Maïdo Observatory – Observatoire de Physique de l'Atmosphère à La Réunion, France	Jean-Pierre Camas	<a href="mailto:jean-pierre.cammas@univ-reunion.fr">jean-pierre.cammas@univ-reunion.fr</a>
6-SMR	Station for Measuring Ecosystem – Atmosphere Relations II, UHEL, Finland	Tukka Petaja	<a href="mailto:tuukka.petaja@helsinki.fi">tuukka.petaja@helsinki.fi</a>
7-PAL	Pallas-Sodankylä Global Atmospheric Watch Station, FMI, Finland	Heikki Lihavainen	<a href="mailto:heikki.lihavainen@fmi.fi">heikki.lihavainen@fmi.fi</a>
8-JFJ	High Altitude Research Station Jungfraujoch, PSI, Switzerland	Urs Baltensperger	<a href="mailto:urs.baltensperger@psi.ch">urs.baltensperger@psi.ch</a>
9-KNMI	Cabauw Experimental Site for Atmospheric Research, KNMI, The Netherlands	Arnoud Apituley	<a href="mailto:apituley@knmi.nl">apituley@knmi.nl</a>
10-MEL	TROPOS Research Station Melpitz, TROPOS, Germany	Gerald Spindler	<a href="mailto:spindler@tropos.de">spindler@tropos.de</a>
11-FKL	FINOKALIA Atmospheric Observatory, NOA, Greece	Nikolaos Mihalopoulos	<a href="mailto:nmihalo@noa.gr">nmihalo@noa.gr</a>
12-KOS	Košetice-Křešín u Pacova, CHMI, Czech Republic	Vana Milan	<a href="mailto:vanam@chmi.cz">vanam@chmi.cz</a>
13-ISAF	Izana Subtropical Access Facility, UVA, Spain	Emilio Cuevas	<a href="mailto:cuevasa@aemet.es">cuevasa@aemet.es</a>
14-GRA	GRANADA Atmospheric Observatory, UGR, Spain	Lucas Alados	<a href="mailto:alados@ugr.es">alados@ugr.es</a>
15-MSY	CSIC Montseny, CSIC, Spain	Andres Alastuey	<a href="mailto:andres.alastuey@idaea.csic.es">andres.alastuey@idaea.csic.es</a>
16-HYM	Hyltemossa, ULUND, Sweden	Erik Swietlicki	<a href="mailto:Erik.swietlicki@nuclear.lu.se">Erik.swietlicki@nuclear.lu.se</a>
17-CAO	Cyprus Atmospheric Observatory, CYI, Cyprus	Mihalis Vrekoussis	<a href="mailto:m.vrekoussis@cyi.ac.cy">m.vrekoussis@cyi.ac.cy</a>
18-MHD	Mace Head Research Station, NUIG, Ireland	Colin Odowd	<a href="mailto:colin.odowd@nuigalway.ie">colin.odowd@nuigalway.ie</a>

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**3. Project dates**

Indicate the first and last day the infrastructure is accessed by any person of the user group.

**4. Project description**

Please limit the text to the recommended length. If required, you may add supplementary information either in the section "Comments" or in the email to the ACTRIS Coordination office. The Coordination Office will decide whether the information is relevant to be included for the review.

- **Scientific objectives:** Give a concise and clear outline of the objectives that you want to achieve and the specific aims of the project by making reference to its scientific relevance. Identify the gaps the project is intended to fill, state your motivation and importance of your planned research and your reasons for choosing the specific infrastructure.
- **Work plan:** Provide a succinct and accurate description of your plan for achieving the goals in the given time frame, the methods employed, the experimental set-up foreseen, any additional information about planned time table and your justification of training benefit and mobility. The work plan should include sufficient information needed for evaluation of the project.
- **Data management:** Data from measurements at ACTRIS observational facilities are archived in the [ACTRIS Data Centre](#) for long-term storage and access. The ACTRIS Data Centre also offers to archive data resulting from TNA activities. This is optional, and the data can be password-protected. The default embargo time is 1 year after the submission of quality assured data to the ACTRIS topic data base. This can be adjusted in accordance with the data submitter's needs, during the submission processes. The ACTRIS Data Policy is available from: <http://actris.nilu.no/Content/Documents/DataPolicy.pdf>. For data management it is helpful if you included a list of instruments you plan to bring to the site.

**5. Participants' Employing Organization / Home Institution****Institution legal status**

Please select:

- UNI: University and higher education
- RES: Public research (including international research organizations and private research organization controlled by a public authority)
- SME: Small Medium Enterprise
- PRV: Other industrial and/or profit private organization
- OTH: Other

**6. Participants' information:**

- All participants needed to carry out the project and accessing the infrastructure should be listed here.
- A TNA is not possible if the home country of the Principal Investigator's affiliated institution is located in the same country as the host infrastructure ('trans-nationality aspect').
- Position: select the appropriate research status (or equivalent): UND=Undergraduate, PGR=Post-Graduate (student with a first University), PDOC= Post-doctoral researcher (PhD completed within last 5 years), TEC= Technician (or engineer), EXP=Experienced (professional) researcher, senior scientist.
- New user: select 'Yes' if the user has never visited the infrastructure before this specific project. Priority is given to user groups involving new users (users that have never used the infrastructure before or users from institutions/countries that would normally not have access to such unique research facility, e.g., scientists from Central and Eastern European countries).
- Indicate first/last day of TNA (dd/mm/yyyy). If your access to the infrastructure is not continuous, indicate periods on separate lines.
- Indicate the TNA duration in days. The access may be non-continuous and may include days (or half-days) for installation, tests, dismantling (max 20%). Do only include actual days of access to the infrastructure and relevant to the project. Please round to minimum half day (e.g., 2 or 2.5 or 3, etc.). The number of access days will have to be justified for reimbursement.  
The total duration of TNA will have to be included.

**Activity domain**

Please select:

- Physics

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- Chemistry
- Life sciences & Biotech
- Earth sciences & Environment
- Engineering & Technology
- Mathematics
- Information & Communication Technologies
- Material sciences
- Energy
- Social sciences
- Humanities

#### Position

Please select:

- UND = Undergraduate
- PGR = Post-graduate, student with 1<sup>st</sup> university degree
- PDOC = Post-Doctoral Researcher
- TEC = Technician
- EXP = Experienced, professional researcher

#### Estimated project costs

List your real estimated costs for all participants included in the table above. Financial support from ACTRIS-2 to the project user group is intended to facilitate TNA but cannot guarantee full reimbursement of travel expenses of the participating users. It is only available upon request. Please note that:

- Independent from the number of participants, financial support will be decided on a case-by-case basis but will mostly be limited to 2 equivalent persons per project (*e.g., in a project lasting two weeks: 2 persons x 14 days or 4 persons x 7 days etc.*).
- Financial support to travel and subsistence to the user group depends on the host infrastructure, calculations may vary and are based on the availability of funding from the European Commission and on the applicable rates of the accounting practices of the institution in charge of the host infrastructure. The final grant is a maximum amount and will be decided after the evaluation results in agreement with the access provider.
- Instrument transport will not be reimbursed except for TNA to MAIDO-OPAR where some instrument transport is eligible, please include the additional expected costs in the comment section.

Reimbursement of the grant will usually be done after project completion and after submission of all requested documentation to the Coordination Office. Reimbursement is made via the host institution and will require proper justification (original tickets, receipts, etc.) according to the regulation applied to by the host institution. Please contact the access provider for details.

#### Comments

Comments are optional. You may include any additional information you consider pertinent for the TNA project or evaluation.



## Appendix B: Document templates used within the process of TNA to observation facilities – Review form



### TNA Proposal evaluation form for reviewers

Reviewer name:	<input type="text"/>
Project leader name:	<input type="text"/>
Project acronym:	<input type="text"/>

Comments from access provider:	<input type="text"/>
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	Evaluation - Points
<b>Scientific Value</b>	
Originality and scientific quality:	Select... ▾
Interest to scientific community:	Select... ▾
Other (e.g., innovative, technical approach, effective use of infrastructure, etc.):	Select... ▾
<b>Total 1 (Max. 12/20):</b>	<b>0</b>
<b>Users</b>	
Training benefits for the users:	Select... ▾
Expertise of the users (mobility of expert):	Select... ▾
Proportion of new users:	Select... ▾
Female participation:	Select... ▾
<b>Total 2 (Max. 8/20):</b>	<b>0</b>
<b>Total 1 + Total 2 (Max. 20/20):</b>	<b>0</b>

Comments (optional, but appreciated!):	<input type="text"/>
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Proposal accepted:	Select... ▾
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## Proposal evaluation guidelines

### Scientific value

The assessment of the TNA proposal should be based on its scientific merit and impact on the scientific community as well as on its innovative and technical approach, and not on the financial criteria.

### Users

A user refers to any researcher, student, engineer, or technician who needs the support of an advanced research station to carry out a scientific project in the ACTRIS-2 context. Priority should be given to projects providing a potential **training benefit** to the users, or adding value to the infrastructure from **experts**. Also, priority should be given to groups composed of:

- Participants who have not previously used the installation (**new users**);
- Participants who are working in **countries where no equivalent infrastructure exists**.

Furthermore, special attention will be paid to **female participation** in order to promote equal opportunities in the implementation of the TNA activities.

### Non-EU Countries:

Transnational access to user groups in which all or most users work in third countries (non-EU member or associated countries) is eligible but may be limited. This limit accounts for 20% of the requested access by third country users with respect to the total quantity of access offered under the grant and is monitored by the coordination office.

### Comments

Constructive comments or suggestions to the applicants from the reviewers are not mandatory but can be very important in improving the scientific quality of the work.

### Proposal acceptance

A proposal should have at least 10 total points to pass. You may still accept a proposal with less than 10 points if you consider the work worth being supported. In this case please provide a short comment to justify.

## Appendix C: Document templates used within the process of TNA to observation facilities – Confirmation of Access



The completed and signed form below should be returned by email to [actris-co@oagc.univ-bpclermont.fr](mailto:actris-co@oagc.univ-bpclermont.fr).

[Host institution and address]

[Name of project leader]  
[Home institution and address]

### CONFIRMATION OF ACCESS ACTRIS-2 Trans-National Access

I, [Access provider in charge of the Infrastructure], herewith confirm that the following project was carried out at our infrastructure [name of infrastructure] in the context of ACTRIS-2 Trans-National Access:

["Project acronym"].

The amount of access<sup>1</sup> delivered to the project group (project users) is as follows:

	Participant name	Duration of stay (start – end date)	Amount of access <sup>1</sup>
Project leader:		[dd/mm/yyyy – dd/mm/yyyy]	
Project user 1:			
Project user 2:			
Project user ...: <sup>2</sup>			
<b>Total amount of access delivered to project group:</b>			



[Location], [Date (dd/mm/yyyy)]

Location and date

Signature of project leader<sup>3</sup>

[Location], [Date (dd/mm/yyyy)]

Location and date

Signature of access provider<sup>3</sup>




<sup>1</sup> The amount of access is defined as the time, in days, spent by the user at the infrastructure for this project, including weekends and public holidays (e.g., a scientist who spent 4.5 days at the infrastructure must indicate '4.5'). The total amount of access of the group is the sum of access days of each user. Please round to half days where appropriate.

<sup>2</sup> Add new rows if necessary.

<sup>3</sup> The document must be **1)** Signed by the project leader; **2)** Signed by the access provider; **3)** Sent to the Coordination office by the access provider (please respect order).

## Appendix D: Document templates used within the process of TNA to observation facilities – Scientific activity report



**ACTRIS-2 TNA Activity Report**

**[TNA project title, Acronym]**  
**[Name of Project Leader and co-authors]**

Instructions  
Please limit the report to max 3-5 pages, including tables and figures.  
The report should be sent as ~~pdf~~ document and include the subheadings listed below. Please make sure to address any comments made by the reviewers (if applicable, you were informed in this case beforehand).  
The report will be made available on the [actris.eu](http://actris.eu) website. Should any information be confidential or not be made public, please inform us accordingly (in this case it will only be accessible by the EC, ACTRIS-2 project partners, and the reviewers).

- Introduction and motivation
- Scientific objectives
- Reason for choosing station/ infrastructure
- Method and experimental set-up
- Preliminary results and conclusions
- Outcome and future studies
- References