Deliverable D1.3: 1st ACTRIS Stakeholder Handbook

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ACTRIS

Aerosols, Clouds, and Trace gases Research Infrastructure

Stakeholder Handbook 2017

ACTRIS

Aerosols, Clouds, and Trace gases
Research Infrastructure

Stakeholder Handbook
2017

ACTRIS Stakeholder Handbook 2017 (first edition)

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FOREWORD

The Research Infrastructure (RI) ACTRIS – Aerosols, Clouds, and Trace Gases - is the pan-European RI that consolidates activities amongst European partners for observations of aerosols, clouds, and trace gases and for understanding of the related atmospheric processes, to provide RI services to wide user groups. ACTRIS is composed of 9 connected elements: distributed National Facilities (observation platforms and exploratory platforms) both in Europe and globally, and 8 Central Facilities (Head Office, Data Centre and 6 Topical Centres). ACTRIS provides access to its facilities, open-access data, measurement support, instrument calibration and development, and training to various user groups. By providing data and access ACTRIS enhances science, but it also generates and disseminates knowledge, boosts technological development, and creates human capital and jobs for the benefit of the society. ACTRIS will positively impact on e.g. human health, climate resilience, and protection from environmental hazards and reduction of air pollution. ACTRIS has been selected to the ESFRI roadmap in 2016 as mature enough to be fully implemented within the next ten years. ACTRIS Preparatory Phase Project (PPP) has a significant role in enabling the transition from a project-based network of research facilities to a centrally coordinated integrated pan-European RI. ACTRIS PPP brings together a wide community of research performing organizations, research funding organizations and ministries needed to take the decisions and actions to move forward in the implementation of ACTRIS.

This is the first edition of ACTRIS Stakeholder Handbook to be published annually from this year on. The Handbook is produced under ACTRIS PPP. The Handbook contains general information on ACTRIS; what ACTRIS is, why it is crucial for the European community in facing global challenges such as climate change, how ACTRIS is structured, and gives annual update of the implementation of ACTRIS. Stakeholder handbook also provides the latest information of the national profiles of 22 countries involved in ACTRIS. I wish you a good reading experience and that the Stakeholder Handbook will meet your information needs.

With best regards,

Sanna Sorvari
ACTRIS PPP coordinator

Contents

SIRTA Observatory
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SCIENCE CASE

The ability to predict the future behaviour of the atmosphere over all time scales (hours to decades) brings great benefits to society and the economy. Examples include short-term hazardous weather and health warnings as well as long-term evaluation of climate change and policy effectiveness. Atmospheric predictions of all kinds use complex models that are underpinned by observations. Without high quality observation data to constrain predictive models any forecasts of the atmosphere are highly unreliable.

Aerosols, Clouds, and Trace gases Research Infrastructure (ACTRIS) focuses on producing high-quality observations of short-lived climate forcers (SLCFs) and other short-lived atmospheric components. These components have a residence time in the atmosphere from hours to few weeks, which differentiates them from long-lived greenhouse gases. The short lifetimes make their concentrations highly variable in time and space and involve processes occurring on very short timescales. These considerations separate SLCFs from long-lived greenhouse gases (LLGGs), and calls for a distributed observatory (WMO, 2012). Such an observatory is provided by ACTRIS consisting of different stations in Europe and outside Europe, and a number of Central facilities fundamental for the provision of harmonized high-precision data required by the scientific community.

The services provided by ACTRIS are important for a number of scientific questions:

- How aerosols and trace gases affect Earth's radiation balance.
- How clouds will respond to global warming. There are large uncertainties due to the complexity of cloud systems and how they respond to aerosols, in particular the concentrations of cloud condensation nuclei. Clouds are one of the major sources of uncertainty in future-climate predictions. These uncertainties severely undermine our ability to make credible predictions of future climate change.
- Information on concentrations and distributions of aerosols and trace gases is required in order to reduce air pollution and related adverse effects on health and ecosystems. It is well established that aerosol particles, at concentrations typically found across Europe, give rise to severe and unacceptable health effects in the European population (WHO, 2013). The situation is even worse in other regions of the globe.
- There are major gaps in knowledge to quantify the impact of climate-induced feedback mechanisms on atmospheric composition. The number of drivers of change is very large and the various systems are strongly coupled. An additional level of complexity is linked to the issue of anthropogenic-induced climate–chemistry interaction. Emissions of pollutants change the atmospheric composition contributing to climate change through the aforementioned climate components, and, vice-versa, climate change influences atmospheric composition through a series of feedback process.

Deeper understanding of the driving forces of climate change and air pollution requires quantification of SLCF emissions, sinks, and their atmospheric spatial and temporal variability. Improving the modelling capacity will require secured access to long-term observational data provided with high precision and with sufficient density. This is the grand challenge for ACTRIS.

ACTRIS Heritage

ACTRIS results from more than 15 years of consistent development funded from national sources and the European Commission Research Infrastructure programme. ACTRIS was initiated as an Integrated Initiative in 2011 building on three historical European research collaborations: **EARLINET** (European Aerosol Research Lidar Network, EU-FP5 and FP6 projects), **EUSAAR/CREATE** (European Supersites for Atmospheric Aerosol Research, EU-FP6 project, Construction, use and delivery of an European aerosol database, EU-FP5 project) and **Cloudnet** (started as an EU-FP5 project for observing cloud profiles). New integration of long-term trace-gas observatories was then added in 2011 (**ACTRIS-I3 EU-FP7** project, see ***Figure 1***). The current operations are pursued as part of ACTRIS-2, funded as an IA programme by the European Commission in H2020. ACTRIS National facilities include also atmospheric simulation chambers which have been operating for years within the **EUROCHAMP** (European Simulation Chambers for Investigating Atmospheric Processes) projects, currently EUROCHAMP-2020.

In 2016 ESFRI selected ACTRIS as a new RI on its roadmap encouraging ACTRIS implementation within a 10-year time frame. The ACTRIS Preparatory Phase Project (PPP) (EU-H2020 project) supports the RI development at the organizational level and, hence, enables the transition from a project-based network of research facilities to a centrally coordinated integrated pan-European RI. ACTRIS PPP will set a solid basis for ACTRIS as a research infrastructure in terms of legal, financial and technical maturity to continue towards the implementation of the RI and later on towards full operation expected in 2025.

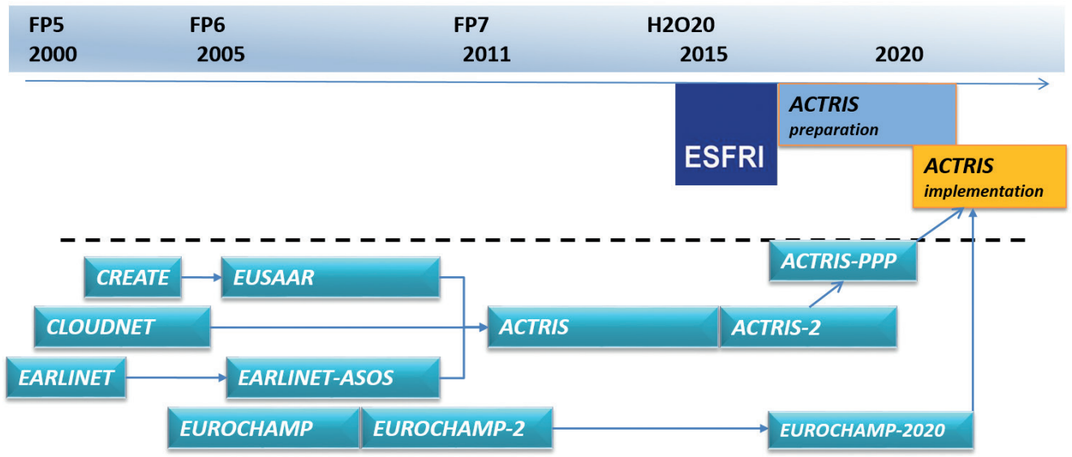

Figure 1. *ACTRIS heritage over the past 18 years.*

Landscape

ACTRIS is an important RI in the atmospheric research infrastructure landscape as it provides high-quality data and information very relevant for atmospheric science not covered by any other European RIs (see ***Figure 2***). In addition, ACTRIS is the only ESFRI RI in the atmospheric domain offering physical access to advanced facilities and laboratories. ACTRIS integrates five atmospheric science communities (aerosol, cloud, lidar, trace gases, and simulation chamber communities) in Europe into one coherent research infrastructures, making ACTRIS the biggest in size, covering most of the atmospheric observations and experiments, and providing broadest set of atmospheric variables in the atmospheric research infrastructure domain.

ACTRIS is fully integrated in the European Landscape of Atmospheric Research Infrastructures together with IAGOS-AISBL, the atmospheric component of ICOS ERIC and the EISCAT-3D and cooperation with other RIs (which may be formalized) is part of its overall strategy. More specifically:

- ACTRIS complements the area of the Atmospheric component of ICOS ERIC (greenhouse gas concentrations) with the provision of information on short-lived pollutants including short-lived climate forcers.
- ACTRIS completes information provided by IAGOS-AISBL both temporally by adding the required continuity of the time series and spatially by offering 3-D information across Europe on parameters measured by both RIs.
- ACTRIS investigates the atmosphere from surface to stratosphere and therefore complements the EISCAT-3D, mostly focusing on upper atmosphere dynamics, a region and a domain not covered in the ACTRIS.

In addition, there are other projects currently funded under the European Commission Horizon 2020 Research Infrastructure Programme by the European Commission which are connected to the Atmospheric Domain of ENVRI:

- ARISE2: a design study aimed at monitoring atmospheric dynamics up to the stratosphere and coupling of modelling and observations.
- EUROCHAMP-2020: a clear convergence is established between ACTRIS and EUROCHAMP to merge activities into ACTRIS.
- HEMERA: a newly funded project dealing with atmospheric sounding technologies. HEMERA is a starting community and connections have not been established.

ACTRIS is seeking for synergies and collaboration opportunities with other (environmental) RIs, wherever it is feasible and reasonable. The motivation for collaboration derives from the fact that by increasing data interoperability, co-locating RI facilities and widening the access beyond RI specific user communities, unprecedented scientific breakthroughs can be achieved. Therefore the focus of the collaboration and seeking synergies is at the RI operation level, especially related to enhance the data interoperability and co-location activities. This work is on-going in the framework of ENVRI community, in where ACTRIS is actively participating the cross-RI collaboration and shaping the RI landscape. The cooperation with other RIs in ENVRI domain, and particularly the atmospheric domain, is a key to the users and stakeholders.

Outside the atmospheric domain, ACTRIS has potential cooperation with other RIs in the ENVRI domain, such as EPOS, for studying the evolution of a volcanic ash cloud after an eruption, or with the marine RIs such as Euro-Argo ERIC and EMSO ERIC, for the atmosphere-marine coupling for climate and environmental research. ACTRIS is cooperating with all the ENVRI RIs within the ENVRIplus project to create a more coherent, interdisciplinary and interoperable cluster of Environmental Research Infrastructures across Europe.

Potential future co-operations are also possible with RIs from other domains for example: CTA (Cherenkov Telescope Array), in the Physics domain, where ACTRIS can provide relevant data for atmospheric transmissivity, or in the energy domain where the ACTRIS data and technologies are relevant for both energy supply and consumption (wind energy, solar energy etc.), or in the health and food domain where the ACTRIS data are relevant for impact on health and on the agriculture (i.e. ANAEE) and also within the social science where the ACTRIS data and technologies are relevant for the impact on cultural heritage (E-RIHS) and on life (ESS ERIC, SHARE- ERIC).

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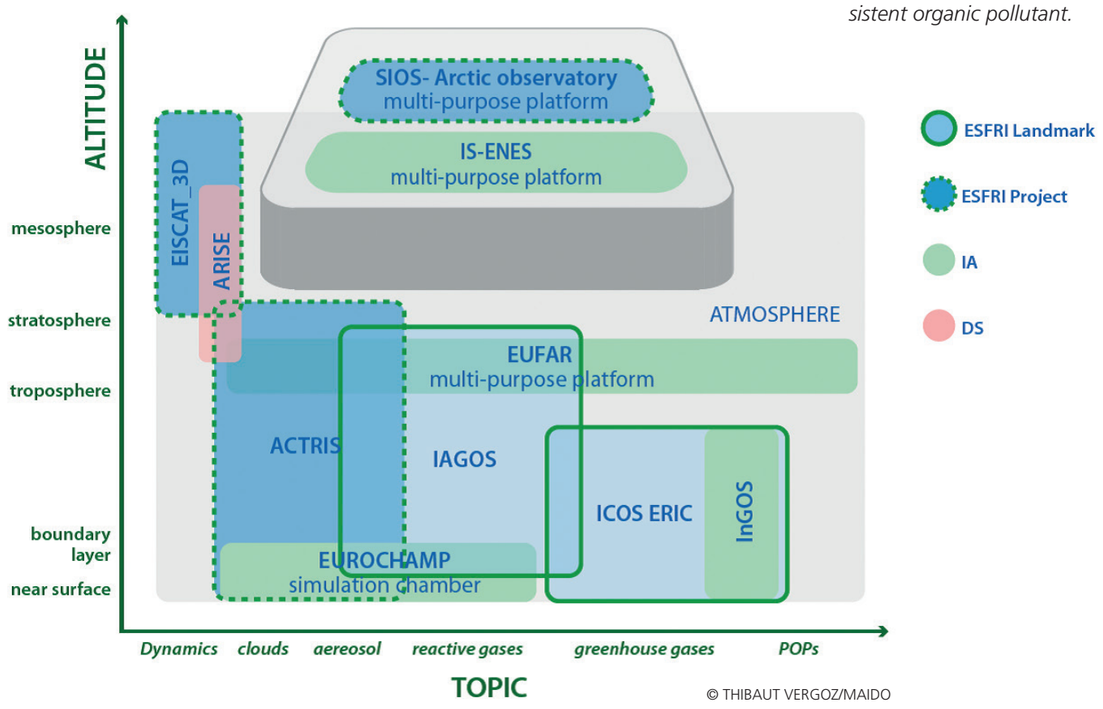

***Figure 2**. ACTRIS in the atmospheric research infrastructure landscape. IA stands for Integrated Action, DS for Design Study, and POP for persistent organic pollutant.*

ACTRIS

VISION & MISSION

Vision statement of ACTRIS
ACTRIS will be the fundamental European research infrastructure for short-lived atmospheric constituents increasing the excellence in earth system research and developing sustainable solutions to environmental challenges.

Mission statement of ACTRIS
ACTRIS shall establish, operate, and develop a pan-European distributed research infrastructure for short-lived atmospheric constituents. ACTRIS shall provide effective access for a wide user community to its resources and services, in order to facilitate high-quality earth system research.

ACTRIS as a pan-European research infrastructure enables to establish the world-leading expertise community in atmospheric science, observation, process studies, data analysis and modelling, data management, delivery procedures, and in RI management. ACTRIS shall provide understanding of long-term trends and atmospheric processes related to air pollution, aerosol-cloud interactions, and climate change. ACTRIS shall be the best supporter to enable innovations, economic enhancement and solutions to tackle and predict societal issues.

ACTRIS aims to operate a world-class research infrastructure to enable science, education, and innovation and to strengthen the European Research Area. In order to achieve this, ACTRIS will

- obtain measurement data on the four-dimensional distribution of clouds and of the physical, optical, and chemical properties of short-lived atmospheric species;
- obtain measurement data on the atmospheric processes that control the life-cycles and of aerosols, clouds and reactive trace gases and determine their influence on climate, air quality, ecosystems and human health;
- harmonise the applied measurement techniques and operation procedures;
- harmonise the provided data and enable its identification, interoperability with other measurements and easy usage;
- provide fully documented world-class measurement data free of charge
- provide physical access to the research platforms in the best atmospheric measurement facilities in Europe
- the users and early-career researchers to benefit from the services of the RI;
- facilitate the European research programmes and projects
- make an impact on the society through scientific knowledge, policy practices, innovations and jobs
- coordinate and support the technological development for high-quality and cost efficient measurements

ACTRIS consists of National Facilities (observation platforms, exploratory platforms), both within Europe and at selected global sites, and a number of Central Facilities (Topical Centres, Data Centre, and Head Office). ACTRIS National Facilities are responsible for the acquisition and delivery of highly-reliable, quality-controlled data on aerosols, clouds and reactive trace gases, and the processes that control their life-cycles. They also provide physical access and test beds for users.

ACTRIS Central Facilities are fundamental in ensuring that ACTRIS procedures and policies are respected and maintained. The Central Facilities are required to ensure that all ACTRIS data are treated and quality-controlled with similar procedures, properly archived for the long term, and accessible in a timely manner to all users. ACTRIS Central Facilities are fundamental in coordinating physical access to ACTRIS National Facilities and providing the appropriate level of training and education, both within and outside the RI, as well as delivering tailored services for specific users: the scientific community, space agencies, Copernicus, the private sector, and others.

Maido Observatory, La Réunion

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Users

An ACTRIS user is a person, a team, or an institution using either ACTRIS data or any other ACTRIS service. ACTRIS users originate from academia, public and private-non-profit research organisations, business, industry and public services, other non-profit organisations and citizen, from ACTRIS member countries as well as from countries, which are not ACTRIS members, inside and outside Europe.

ACTRIS is clearly user-oriented. While the extensive use of ACTRIS data and data products can be already documented, it is obvious that the infrastructure will produce data and data products essential to a wide range of communities that will be further expanded with a secured long-term strategy. These user communities are:

- Atmospheric science research communities world-wide (climate and air-quality, observational/ experimental/ modelling/ satellite communities, national and international research programmes and organisations);
- Environmental science research communities and communities from other neighbouring fields: hydro-marine, bio-ecosystem, geosciences, space physics, energy, health, and food domain, to study interactions and processes in across different disciplines;
- Instrument manufacturers and sensor industries for development, testing, prototyping and demonstration;
- Operational services, National weather services, climate services for model validation, weather and climate analysis and forecasting;
- Space agencies for validation and the development of new satellite missions;
- National and regional air quality monitoring networks and environmental protection agencies for air quality assessments and validation of air pollution models;
- Policy makers and local/ regional/ national authorities for climate and air-quality related information for decision making and policy development.

Products & services

ACTRIS provides different categories of services, which are briefly described below. A detailed list of services applicable to each ACTRIS Central Facility (CF) is presented in the individual Concept Documents.

Services related to ACTRIS data, data products, and data tools are provided by ACTRIS Data Centre (DC) and include:

- Long-term archiving and preservation of ACTRIS level 0 to level 3 data and data products,
- Access to ACTRIS data, data products, and digital tools through a single point of entry,
- Documentation of data, data flow, citation service, and data attribution, including version control, data traceability, and interoperability,
- Data curation for campaigns and dedicated research projects and initiatives, external or internal to ACTRIS.

Services related to ACTRIS technology are provided by ACTRIS Topical Centres (TCs) and include:

- Provision of measurement quality assurance and quality control procedures and tools,
- Instrument-specific calibration,
- Knowledge transfer and operator training,
- Improvement of measurement and retrieval methodologies for aerosols, clouds, and reactive trace gases.

Services related to ACTRIS in general are provided by ACTRIS Head Office (HO)/SAMU (Service and Access Management Unit) and include:

- Provision of information on ACTRIS and ACTRIS services (service catalogue),
- Provision of a single point of entry for users to ACTRIS (SAMU),
- Outreach, communication, and representation of ACTRIS for various user communities, stakeholders, and interest groups.

Access to some ACTRIS services is open and free, most importantly the access to ACTRIS data, data products, and digital tools provided by the DC, which is the point of entry for free ACTRIS data services. Other access to ACTRIS services is considered competitive access based on capacity or excellence and will require a review process that is centrally managed by the HO/SAMU. SAMU is the single point of entry for user access to all TC services and to some specific services and data products provided by the DC. Access is regulated by both the ACTRIS access policy and the ACTRIS data policy, respectively.

Benefits to main users of ACTRIS

ACTRIS benefits scientists by providing quality-assured and open-access ACTRIS data; standardized operating procedures; instrument and procedure intercomparisons; access to research platforms for conducting excellent research and creating new scientific knowledge; enhancement of research performance due to centralized access to ACTRIS data and specific services; increased possibilities for international collaboration, large-scale research projects and training opportunities; and technical support from CFs and on-site support from NFs.

ACTRIS benefits policy makers by providing support for policy-driven networks established under EU-directives (local and European air-quality networks); development of new policies by provision of novel tools for validating the impact of regulation strategies and emission abatement policies through direct evaluation of atmospheric trends at regional / European scale; decision-making regarding environmental issues by provision of high-quality and long-term data for predicting climate scenarios from local and regional up to national and international level; atmospheric hazard (e.g. volcanic eruptions) management and risk mitigation via the knowledge base of ACTRIS expert teams and monitoring of extreme atmospheric events; and enhancing job creation indirectly (expert jobs, new business opportunities).

ACTRIS benefits the private sector via open-access data; expert services and physical access to the infrastructure for innovative research for the development of novel technologies and products and as a test bed for new technologies and instruments; development of quality assurance standards to support the technological development; and novel public-private collaborations leading to the establishment of spin-off and start-up companies.

ACTRIS benefits ministries and funding organizations by optimization of national investments in research infrastructures; providing better value for money via pan-European dimension and coordinated access to data and services; and by the establishment of a unique research infrastructure for atmospheric sciences within Europe to improve efficiency of operation and coordination among the European research institutions avoiding the duplication and fragmentation of research efforts.

ACTRIS benefits educators by offering training, exchange programmes and knowledge transfer, e.g. basic and advanced international courses on atmospheric composition and processes for Master's and PhD students; providing educational material; and offering expertise (e.g. expert visitors to schools of all levels).

ACTRIS benefit to Civil Society (e.g. general public, national and international media) arises from improved weather, climate and air quality predictions due to novel scientific findings resulting from ACTRIS; enhanced awareness on the environmental challenges that society is facing, e.g., climate change and air quality issues; and promotion of dialogue between researchers and society to translate scientific knowledge into practical applications.

ACTRIS Central Facilities

ACTRIS operations are performed on the European level by **ACTRIS Central Facilities** (CFs) that include six Topical Centres, Data Centre and Head Office (***Figure 3***). ACTRIS CFs represent the key operative entities of this RI and have a fundamental role as they provide services to the users according to the ACTRIS access policy as well as operation support to the National Facilities (NFs). CFs are operated at the European level and are part of the governance and decision-making structure of the RI. Each CF may have several operational Units that can be located in the same or different locations, and are operated by research performing organizations (RPOs) or by ACTRIS ERIC. The CFs link the NFs, i.e. the observation and exploratory platforms, which are operated at the national level and produce the majority of the ACTRIS measurement data.

ACTRIS Head Office

ACTRIS Head Office (HO) coordinates, develops, monitors, and integrates the RI operations as well as facilitates the work of the defined ACTRIS executive bodies, steering committees, and advisory boards. The HO coordinates the RI at the European level, in close cooperation with the national ACTRIS consortia, the NFs, and the other CFs. HO acts as the single point of entry for users requesting ACTRIS services. The Service and Access Management Unit (SAMU) of HO manages the user requests and organise all the needed access processes.

The HO comprises of four operational units: SAMU, ERIC Management Unit, RI Operations Unit and Strategies and Relations Unit. Italy is foreseen to host SAMU and Finland is foreseen to host other units of the Head Office and the statutory seat of ACTRIS ERIC. Finland and Italy have already in the ESFRI application phase indicated their commitment and readiness to host the ACTRIS Head Office.

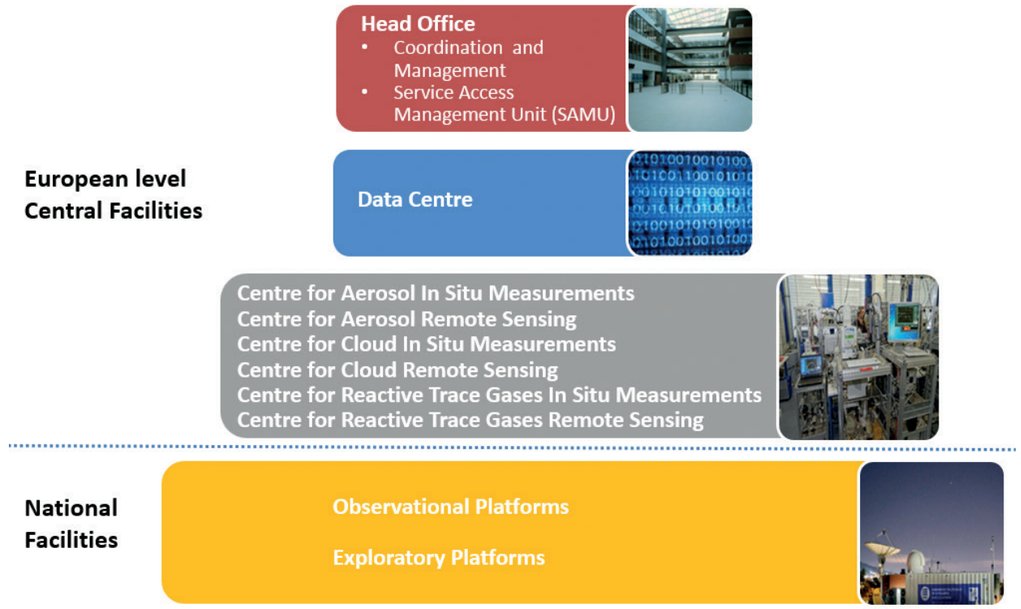

Figure 3*. ACTRIS research infrastructure core components; National and Central Facilities, including the indication of national and European level operations.*

ERIC Management Unit manages the day-to-day operations of the legal entity. SAMU manages the user requests and organises the needed access processes. The RI operation Unit ensures the smooth operation of ACTRIS RI and develops technical aspects for new services. The strategies and relations Unit handles the liaisons and partnership with new user communities, countries, stakeholders incl. innovation and service development. It is also responsible for the strategic planning for collecting data to support the strategy-based decision-making. The HO is responsible for engaging new countries and developing pan-European networks.

ACTRIS Data Centre

ACTRIS Data Centre (DC) is responsible for handling the ACTRIS data. The primary role of ACTRIS DC is to compile, archive and provide access to well documented and traceable ACTRIS measurement data and data products, including digital tools for visualisations, data analysis and research. As a tool for science, the highest priorities for ACTRIS DC is to maintain and increase the availability of ACTRIS data and data products relevant to climate and air quality research for all interested users.

All primary data and added-value data products are made available to the users via the ACTRIS data portal. ACTRIS DC will provide scientists and other user groups with free and open access to all ACTRIS data, and ACTRIS follows the open research data initiative of the Commission, making data discoverable (DOI identification), accessible (via open license) and assessable (via necessary documentation and description). The architecture of ACTRIS DC will be compliant with international frameworks such as the WMO Information System (WIS) and the Global Climate Observing System (GCOS).

ACTRIS DC provides access to all measurements, both quality-assured data and near-real-time data, archived in three interoperable topical data repositories handling very diverse type of data (Aerosol profiles/column, Aerosol and Trace-gases near surface, Cloud profiles). ACTRIS DC is foreseen to consist of five contributing scientifically-based topical units; Cloud remote sensing data services, Aerosol remote sensing data services, In situ aerosol and trace gas data services, Atmospheric simulation chamber data services and ACTRIS Data Access and Services. ***Potential hosts include the following countries: Norway, Italy, Finland, and France.***

Climate and air quality assessments for scientific communities and National and International Environmental agencies are ultimate user of ACTRIS data and data products. Furthermore, ACTRIS DC will interact with European and global initiatives. ACTRIS data base infrastructure and tools for data production and processing developed within ACTRIS aim to contribute to global initiatives as GAW-WDCA, GAW-WDCRG, and European long-term monitoring programs as EMEP, improving data quality and ensuring harmonized data on pan-European level.

ACTRIS Topical Centres

ACTRIS TCs are or will be organized around the main scientific themes of ACTRIS: aerosols, clouds, and reactive trace gases, each with a particular focus on either remote sensing or in situ measurement techniques. The ACTRIS TCs are the

1. Centre for Aerosol Remote Sensing,
2. Centre for Aerosol In Situ Measurements,
3. Centre for Cloud Remote Sensing,
4. Centre for Cloud In Situ Measurements,
5. Centre for Reactive Trace Gases Remote Sensing,
6. Centre for Reactive Trace Gases In Situ Measurements.

The key services and operation support provided by the TCs are a) procedures and tools for quality assurance and quality control of ACTRIS measurements and data, b) transfer of knowledge and training to ACTRIS operators and users, and c) improvements of measurement methodologies for aerosols, clouds, and reactive trace gases. The TCs should operate at the state-of-the-art, fostering the implementation of validated new techniques in ACTRIS. To sustain a high level of performance and to stimulate the advancement of new techniques and methodologies, the TCs contribute to expert collaboration networks.

ACTRIS TCs under implementation include the existing European WDC and WCC components of GAW, the European component of the AERONET calibration facility, and complement Centres already operating within other RIs (e.g. ICOS) or activities already ongoing in networks (NDACC; www.ndacc.org) in Europe. Quality objectives are therefore compliant with international standards. It should be noted that not all the TCs are currently at the same level of maturity, some are nearly operational while others are still in planning. Each of the TCs is foreseen to be organized as a consortium with several Units.

The Zeppelin Observatory in Ny-Alesund - Svalbard, Arctic - View from the roof top

1) Centre for Aerosol Remote Sensing

The Centre for Aerosol Remote Sensing is foreseen to consist of scientifically-based topical facilities in **France, Germany, Italy, Romania** and **Spain**.

The mission of this TC is to offer operational support to ACTRIS National Facilities operating aerosol remote sensing instrumentation: profile and column observation. The Centre for Aerosol Remote Sensing will offer operation support and services for the following ACTRIS variables and measurement techniques:

ACTRIS variables	Measurement techniques
• Particle backscatter coefficient profile • Particle extinction coefficient profile • Lidar ratio profile • Ångström exponent profile • Backscatter-related Ångström exponent profile • Particle depolarization ratio profile • Particle layer geometrical properties (height and thickness) • Particle layer optical properties (extinction, backscatter, lidar ratio, Ångström exponent, depolarization ratio, optical depth) • Aerosol optical and microphysical properties (column) • Planetary boundary layer height	• High-power aerosol lidar • Automatic low-power aerosol lidar • Automatic sun/sky/lunar photometer

Synergies between these variables and techniques are being developed to provide higher-level aerosol variables such as daytime extinction, backscatter, absorption and mass concentration (total, fine, coarse) and aerosol microphysical properties.

Additionally, the Centre for Aerosol Remote Sensing offers specialized services for the above instruments and related ACTRIS variables, to ACTRIS users of various types.

The Centre comprises fixed and mobile sub-units as well as specialized laboratories for characterization of components and blocks, offering a wide range of operational support and services for the measurement techniques in its responsibility. The Centre includes AERONET-Europe calibration facility for photometers which complements the AERONET-NASA calibration facility in the USA. There is also a close link to the Centre for Cloud Remote Sensing because low-power lidars belong to the minimum required instrumentation of NFs for cloud remote sensing.

The Units of the Centre are partially operational, and provide trans-national access in ACTRIS-2.

2) Centre for Aerosol In Situ Measurements

The Centre for Aerosol In Situ Measurements is foreseen to consist of scientifically based topical units in **Czech Republic, Finland, France, Germany** and **Italy.**

The mission of this TC is fundamental to improve the quality of the ACTRIS in situ aerosol measurement, by offering operation support to NFs, operating instruments for the physical or chemical in situ characterization of atmospheric aerosol particles as well as for particle sampling and subsequent laboratory analysis of these particles.

The Centre for Aerosol In Situ Measurements will offer operation support and services for the following ACTRIS variables and measurement techniques:

ACTRIS variables	Measurement techniques
• Particle number size distribution – mobility diameter (10 - 800 nm) • Multi-wavelengths particle light scattering & backscattering coefficient • Multi-wavelengths particle light absorption coefficient & equivalent black carbon • Mass concentration of particulate organic and elemental carbon • Particle number size distribution – optical and aerodynamic diameter (0.2 - 10 µm) • Particle number concentration (> 10 nm) • Mass concentration of particulate heavy metals • Particle mass concentration of specific organic tracers • Concentration of cloud condensation nuclei at various supersaturations • Mass concentration of non-refractory particulate organics and inorganics • Nanoparticle number concentration (< 10 nm) • Nanoparticle number size distribution	• Mobility Particle Size Spectrometers • Integrating Nephelometer • Absorption Photometers • Thermo-optical method on quartz filters • Aerodynamic & Optical Particle Size Spectrometers • Condensation Particle Counters • Filter-based X-ray Fluorescence or Particle Induced X-ray Emission • Filter-based IC, GC-MS, HPLC-MS, or LC-MS • Cloud Condensation Nucleus Counter • Aerosol Mass Spectrometers • Particle Size Magnifier • Scanning Particle Size Magnifier, Neutral cluster and Air Ion Spectrometer, Nano Mobility Particle Size Spectrometer

Additionally, the Centre for Aerosol In Situ Measurements will offer specialized services for the above instruments and related ACTRIS variables, to ACTRIS users of various types.

The Units of the Centre are partially operational, and provide trans-national access in ACTRIS-2.

3) Centre for Cloud Remote Sensing

The Centre for Cloud Remote Sensing is foreseen to consist of scientifically-based topical facilities in the **France, Germany, the Netherlands** and **United Kingdom.**

The mission of this TC is to offer operational support to ACTRIS National Facilities operating cloud remote sensing instrumentation. The Centre is elemental in developing calibration methods for cloud radars and microwave radiometry to be

implemented on site e.g. self-consistency techniques using rain and mobile services e.g. drone-calibration.

The Centre for Cloud Remote Sensing will offer operation support and services for the following ACTRIS variables and measurement techniques:

ACTRIS variables	Measurement techniques
• Cloud/aerosol target classification • Drizzle drop size distribution • Drizzle water content • Drizzle water flux • Ice water content • Liquid water content • Liquid water path • Temperature profile • Relative humidity profile • Integrated water vapor path	• Cloud radar • Doppler cloud radar • Microwave radiometer

Additionally, the Centre for Cloud Remote Sensing will offer specialized services for the above instruments and related ACTRIS variables, to ACTRIS users of various types.

The Centre comprises stationary and mobile sub-units and will permit the absolute calibration of radar reflectivity measurements and the quantification of error.

The Units of the Centre are in preparation.

4) Centre for Cloud In Situ Measurements

The Centre for Cloud In Situ Measurements is foreseen to consist of scientifically-based topical facilities in **Finland, France, Germany** and **United Kingdom.**

The mission of this TC is to offer operational support to ACTRIS National Facilities performing cloud in situ measurements. The Centre for Cloud In Situ Measurements will offer operation support and services for the following ACTRIS variables and measurement techniques:

ACTRIS variables	Measurement techniques
• Rainrate • Liquid Water Content • Ice water content • Droplet number concentration • Droplet size distribution • Ice particle number concentration • Ice particle size distribution • Temperature • Relative humidity • INP (ice nucleating particle) concentration	• Drop-counting raingauge • Disdrometer • In-situ cloud-microphysical sensors

The support is fundamental in order to make the cloud in situ measurements more accurate and reliable.

The Units of the Centre are in preparation.

5) Centre for Reactive Trace Gases Remote Sensing

The Centre for Reactive Trace Gases Remote Sensing is currently foreseen to consist of scientifically-based topical facilities in **Austria, Belgium, France, Germany,** and **the Netherlands**. **Portugal** has also expressed its interest in participating in hosting the Centre. The facilities are dealing with different trace gas remote sensing techniques: *Fourier-transform infrared spectrometry (FTIR), differential optical absorption spectrometry in the UV-visible range (UVVIS) and ozone LIDAR or O3 DIAL (differential absorption lidar).*

The mission of the Centre is to offer operational support to ACTRIS National Facilities operating reactive trace gases remote sensing instrumentation. The Centre for Reactive Trace Gases Remote Sensing will offer operation support and services for the following ACTRIS variables and measurement techniques:

ACTRIS variables	Measurement techniques
• Ozone profile • Ozone partial columns • Ozone column • Formaldehyde column • Formaldehyde lower tropopheric profile • NO2 column • NO2 lower tropopheric profile • NH3 column • C2H6 column	• ozone DIAL (Differential Absorption Lidar) • FTIR (Fourier-transform infrared spectroscopy) • UVVIS (differential optical absorption spectrometry in the UV-visible range)

The Centre provides essential knowledge about the observation techniques (measurement and retrieval) that may be applied in future applications (e.g., new satellite sensors, progress in air quality modelling etc.) to species that are currently not addressed. There is already a mature basis for providing these data within ACTRIS community in and outside of Europe based on the expertise built in NDACC and in collaboration with NDACC. ACTRIS as a research infrastructure will implement the remote sensing of trace gases in an operational way to ensure long-term sustainability.

The Units of the Centre are in preparation.

6) Centre for Reactive Trace Gases In Situ Measurements

The Centre for Reactive Trace Gases In Situ Measurements is foreseen to consist of scientifically-based topical facilities in **Finland, France, Germany** and **Switzerland.**

The Centre is fundamental in providing operational support to National Facilities measuring key trace gases (non-methane hydrocarbons (NMHC), oxidized volatile organic compounds (OVOC), biogenic volatile organic compounds (BVOC),

specific direct aerosol precursors, NO and NO2) in order to produce traceable, reliable and quality controlled datasets with high compatibility.

The Centre for Reactive Trace Gases In Situ Measurements will offer operation support and services for the following ACTRIS variables and measurement techniques:

ACTRIS variables	Measurement techniques
• NMHCs • OVOCs • Terpenes • NO • NO2 • Condensable vapors	• gas chromatographic methods with flame ionization (FID) or mass spectrometric detection (MS) • Online Chemical ionization at atmospheric pressure coupled to MS (PTR-MS, CI-APi-TOF) • High performance liquid chromatography (HPLC) • Diverse sampling methods for organic gases including on- or off-line traps and whole air samplers • NO-O3 chemiluminescence detection (CLD) • photolytic conversion and CLD • Cavity Attenuated Phase Shift Spectroscopy (CAPS) • Formaldehyde-Hantzsch

The Centre comprises inter alia the WMO (World Meteorological Organization) Global Atmosphere Watch (GAW) World Calibration Centres (WCC) for Volatile Organic Compounds (WCC-VOC) and for NOx (WCC-NOx). Both WCCs have been approved by the international science community and form one corner stone of the Quality Assurance/Quality Control (QA/QC) framework established within WMO-GAW.

The Units of the Centre are in preparation.

ACTRIS National Facilities

ACTRIS NFs consist of **observational and exploratory platforms** producing data and, if appropriate, providing physical access to selected platforms. They are operated (or co-operated) by ACTRIS RPOs. **Observational platforms** perform measurements of aerosols, clouds, and reactive trace gases from the Earth surface throughout the troposphere up to the stratosphere by applying state-of-the-art remote-sensing and in situ measurement techniques under consideration of harmonized, standardized, and quality-controlled instrumentation, operation procedures and data retrieval schemes. The sites are strategically located in diverse climatic regimes both within and outside Europe, and many of them contribute to one or several European and international networks, such as EMEP, NDACC, or GAW, and are possibly partly shared with other environmental infrastructures, such as ICOS, SIOS, or ANAEE. Exploratory platforms include mobile platforms and atmospheric simulation chambers or laboratories, which are operated on campaign basis. They contribute dedicated data on specific species, processes, events or regions by following common ACTRIS standards. Atmospheric simulation chambers and laboratories provide facilities for the determination of parameters needed for monitoring chemical, physical, or biological processes and for controlled simulation experiments under near-realistic environmental conditions. Mobile platforms comprise land-based, shipborne and airborne facilities and thus, allow investigations of various processes under specific meteorological, climatic, or topographic conditions in different environments and ecosystems.

At the moment, the requirements for ACTRIS NFs are under development among other important frameworks that may affect the participation of the facilities such as ACTRIS funding model, access policy etc. Therefore the list of NFs provided in this document is very preliminary and rather gives an overview of the most advanced European atmospheric research facilities. The vast amount of these facilities, both observational and exploratory, highlight the great potential of ACTRIS being able to provide atmospheric data across Europe and from around the globe.

Country profiles from 22 countries participating in ACTRIS are provided in the end of the Handbook. The country profiles provide information on national ACTRIS consortia and representation, list of NFs, planned contribution to host ACTRIS CFs and overview of the national financial situation.

Pallas station, Finland

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IMPLEMENTATION

Lifecycle

ACTRIS was adopted to the ESFRI roadmap in 2016. During the ongoing preparation phase (2017-2019) ACTRIS shall achieve maturity at organizational, operational, and strategic levels. The preparatory phase is supported by the European Commission (ACTRIS PPP) and partner countries and organizations at the national level. During the implementation phase (expected 2018-2025), the CFs are constructed and their services are tested and NFs are upgraded and constructed to fulfil the ACTRIS standards. ACTRIS operations will start step-by-step (pre-operation) by ramping up the service provision through SAMU. After the necessary legal preparations ACTRIS shall become a legal entity (ERIC, European Research Infrastructure Consortium) funded by the Member countries. The target is to launch ACTRIS ERIC in the beginning of 2020. It is foreseen that ACTRIS will be fully operational by 2025. ***Figure 4*** illustrates the different phases of ACTRIS towards fully operational services.

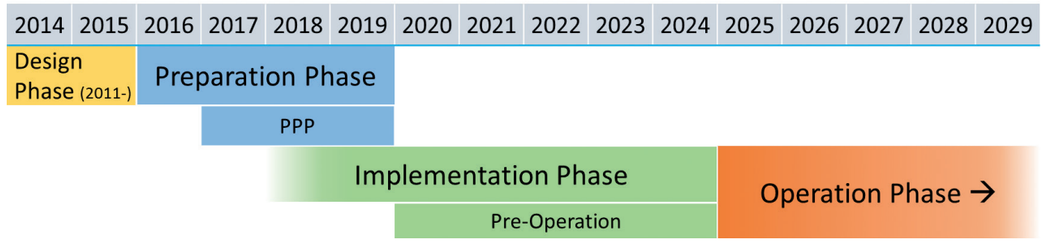

Figure 4. *ACTRIS lifecycle phase - from design to preparation and to operation.*

In the following, the most important activities during the different phases of the ACTRIS research infrastructure development from 2017 onwards are highlighted.

The ACTRIS construction consists of two main branches of parallel activities that are needed to achieve the operational phase - organisational and operational (see *Figure 5*). The main tasks in setting up ACTRIS as a research infrastructure that are linked to the operational side define the requirements and construction of the operational facilities, such as NFs, CFs, and Service Access Management Unit (SAMU) and to generating the needed services and the service platforms. The actions and tasks related to the organisational development of the ACTRIS research infrastructure comprise setting up the governing structure (including the interim stages of the same) and establishment of the legal, policy and financial frameworks for the research infrastructure. These actions are generated in the work distribution using different sources of primary funding, the current ACTRIS-2 H2020 and EUROCHAMP-2020 projects (mainly contributing to the scientific and technical developments), ACTRIS PPP H2020 project (contributing to the setting up the organisational structures and frameworks, and operational concepts) funded by H2020, and national funding supporting the overall implementation and the construction of the NFs and CFs.

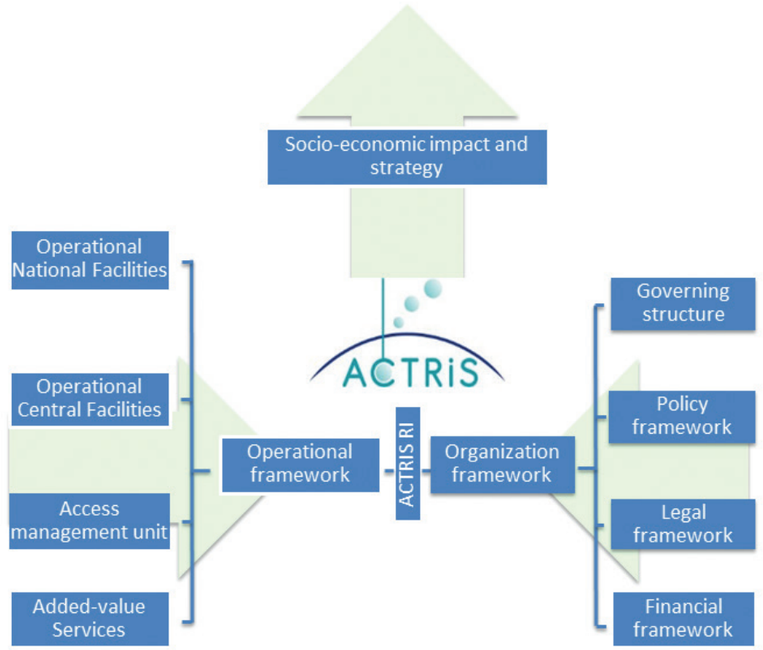

Figure 5*. ACTRIS Work Breakdown Structure. Each box describes a key action/product.*

Preparation phase (ongoing until 2019)

The preparation phase is needed for making the groundwork for ACTRIS to be implemented. Preparation work and construction are needed both at the European and national level. The most important activities during the preparation phase at the European level are:

- Finalizing the ACTRIS NF requirements and starting of labelling of the individual national facilities as ACTRIS National Facilities;
- Finalization of CF concept papers and evaluation of the multinational consortia CF proposals for final siting selection;
- Finalizing the ACTRIS data management plan, ACTRIS access and data policy protocols, and the implementation of the protocols;
- Establishing the interim phase governance bodies (Interim ACTRIS Council established 02/2017) to finalize and decide on the ACTRIS ERIC statutes and ACTRIS Financial Plan for the first years of operations;

Parallel to European-level planning, the national-level construction of ACTRIS NFs will continue. The construction is based on the technical requirements originating from various previous and on-going projects, see ***Figure 1***, and on the protocols and methodologies agreed during ACTRIS PPP.

Implementation phase (expected 2018-2025)

After the formal decisions on the ACTRIS CF siting and composition are made, the decisive construction of the Central Facilities can begin based on the technical baseline concepts established in the PPP. After the physical Central Facility construction, the testing of the services and user interactions will start at the research infrastructure level in a coordinated manner.

After the establishment of the ACTRIS ERIC, the official operations and the service provisions for users will start. Key personnel for ACTRIS ERIC, including the Director General, will be selected. ACTRIS services are operated according to ACTRIS access policy. Gradually ACTRIS will ramp up to its full service provision and data distribution capacity. This will be accomplished once the NF labelling process is finalised and the foreseen new ACTRIS Members are included in the research infrastructure operations and to the governance structure. First full-scale operational and management assessments will be performed during this phase. Also, the first strategies for future development and sustainability of the operations are done.

Fully operational phase (2025 – 2045 and beyond)

It is estimated that after the implementation phase (pre-operation), ACTRIS will enter the fully operational phase which is estimated to last at least 20 years. During the operative phase, assessments on the impact and performance will be conducted on regular intervals, and foresight studies will be made. The agility of the operations and management is one of the main focus areas to sustain the novel research infrastructure environment, high-quality user services, and long-term funding.

Decommissioning or a major upgrade

The purpose of the decommissioning plan is to ensure an orderly adoption of the major changes in the operational plan and if needed, the liquidation of the business and conservation of the resources developed in the ACTRIS research infrastructure. The decommissioning plan gives guidance on how to proceed if the ACTRIS research infrastructure is subject to the major revision of operations or major upgrades. It also states how ACTRIS research infrastructure data, equipment, staff, and other resources are handled, including a detailed timetable for decommissioning in case the research infrastructure closes down.

In the case of foreseen scientific and technical revision of the ACTRIS operations, the proposed revisions/major upgrades need to be agreed unanimously in the ACTRIS General Assembly (GA) and the revision/upgrade should not have any major financial implications to the ACTRIS Financial Plan within two years in order to allow ACTRIS members to adapt to the new financial situation.

3

ACTRIS Preparatory Phase Project

The ACTRIS Preparatory Phase Project (PPP) is EU Horizon 2020 Coordination and Support Action (grant agreement No 739530, 1/2017-12/2019). ACTRIS PPP has altogether 28 beneficiary partners, representing 20 participating countries and the European Commission's Joint Research Centre. The project beneficiaries are listed in ***Table 1***. In addition, ACTRIS PPP has 12 linked third parties and currently 44 associate partner organizations involved in the project.

The main objectives of ACTRIS PPP are to develop the organizational, operational and strategic frameworks of the RI. The work includes legal, governance, financial, technical, strategic, and administrative aspects carried out in 10 work packages. There were initially nine WPs and WP10 was added to ACTRIS PPP by the European Commission during grant agreement phase. The main outcomes of the PPP are signature-ready documents for establishment of the ACTRIS ERIC with well-defined operations and a sound business plan.

The ACTRIS Preparatory Phase Project is built upon three themes; organizational framework (WPs 1-3), operational framework (WPs 4-6) and strategic work (WPs 7 and 8) as illustrated in ***Figure 6***. Work package 9 (ACTRIS PPP management) manages the other work packages and ensures high quality contributions in a timely manner. Note that WP9 focuses on the management of ACTRIS PPP, not on the management of ACTRIS as a research infrastructure. The three themes are highly interconnected, with each theme having mutual dependencies on actions taken in another theme. Information from all themes is directed to WP1 (governance), where it is then collated and provided to the Interim ACTRIS Council for the final decisions on ACTRIS as a research infrastructure.

WP10 (Ethics requirements) is a virtual work package which aims to provide deliverables in the six issues in which the Ethical Board of European Commission has asked for more information from the project.

Cyprus Atmospheric Observatory

Participant No	Participant organization name	Country
1	Ilmatieteen laitos (FMI) (Coordinator)	Finland
2	Helsingin yliopisto (UHEL)	Finland
3	Consiglio Nazionale Delle Ricerche (CNR)	Italy
4	Centre National de la Recherche Scientifique (CNRS)	France
5	National Institute of R&D for Optoelectronics (INOE)	Romania
6	Český Hydrometeorologický Ústav (CHMI)	Czech Republic
7	Leibniz-Institut für Troposphärenforschung e.V. (TROPOS)	Germany
8	Karlsruher Institut für Technologie (KIT)	Germany
9	National Observatory of Athens (NOA)	Greece
10	Norsk Institutt for Luftforskning (NILU)	Norway
11	Universitat Politècnica de Catalunya (UPC)	Spain
12	Agencia Estatal Consejo Superior de Investigaciones Cientificas (CSIC)	Spain
13	Universidad de Valladolid (UVA)	Spain
14	University of Manchester (UMAN)	United Kingdom
15	National Environmental Research Council (NERC)	United Kingdom
16	Science and Technology Facilities Council (STFC)	United Kingdom
17	Koninklijk Nederlands Meteorologisch Instituut (KNMI)	Netherlands
18	Paul Scherrer Institut (PSI)	Switzerland
19	Eidgenössische Materialprüfungs und Forschungsanstalt (EMPA)	Switzerland
20	The Cyprus Institute (CyI)	Cyprus
21	Instytut Geofizyki Polskiej Akademii Nauk (IGF PAS)	Poland
22	Lunds Universitet (ULund)	Sweden
23	Koninklijk Belgisch Instituut voor Ruimte-Aeronomie (BIRA-IASB)	Belgium
24	National University of Ireland Galway (NUIG)	Ireland
25	Estonian University of Life Sciences (EULS)	Estonia
26	Aarhus Universitet (AU)	Denmark
27	Institute for Nuclear Research and Nuclear Energy (INRNE)	Bulgaria
28	Joint Research Centre (JRC) of the European Commission	Belgium

Table 1. List of ACTRIS PPP beneficiaries.

ACTRIS PPP governance

ACTRIS PPP has a standard European Commission project management structure with PPP General Assembly, project coordinator, co-coordinator, coordination team and management office and Executive Board (see ***Figure 7***).

The PPP General Assembly is the decision-making body of the project consortium to deal with project related issues, and it consists of one authorized representative of each PPP beneficiary. The ACTRIS PPP coordinator represents the project consortium towards the European Commission and ACTRIS Member

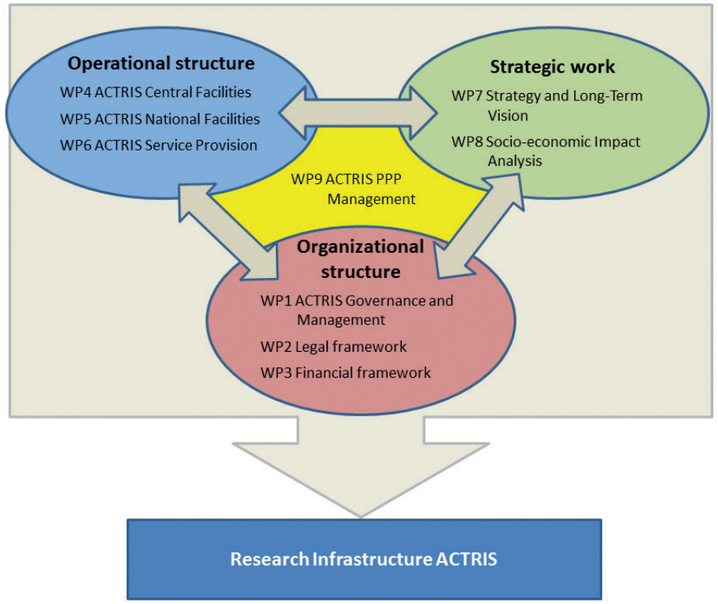

Figure 6. illustrates the three themes of the ACTRIS Preparatory Phase Project: organizational, operational, and strategic work together with their associated work packages.

countries, and is in charge of the administrative, legal, and financial management of the PPP project.

Each of the ACTRIS member countries has nominated a National ACTRIS Contact Person who acts as a main contact point in the ACTRIS research infrastructure (see the list in section ACTRIS Community). The ACTRIS Contact Person is responsible for organising the coordination of the ACTRIS community at national level and is responsible for ensuring the proper dissemination and information flow from the European ACTRIS activities to the national science communities and the relevant national stakeholders.

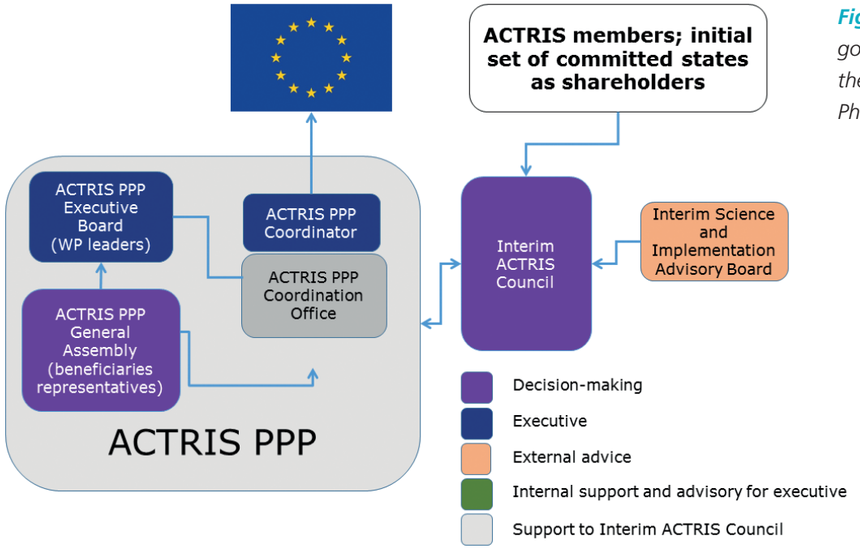

Figure 7. illustrates the governance structure of the ACTRIS Preparatory Phase Project.

Interim ACTRIS Council

The IAC is the superior decision-making body for ACTRIS as a research infrastructure prior to ERIC has been established is. The Council consists of ACTRIS members (country representatives nominated by the ministries or organisation mandated to act on the behalf of the country). The Council is responsible for negotiating and approving the legal model, governance structure, statutes and all other necessary constitutional documents, Financial Plan and financial internal rules, policy documents such as data policy, access policy, and staff policy for the ACTRIS research infrastructure.

The IAC has currently 12 Members and 3 Observers. The list of the Council Members / Observers is given in ***Figure 8***. The Council had its founding meeting in February 2017 in Helsinki, Finland. The second meeting was held in October 2017 in Rome, Italy, and the third meeting will take place in Bucharest, Romania on 26-27 February 2018.

The overall governance structure, the roles and responsibilities of the bodies for ACTRIS RI are described in more detail elsewhere (ACTRIS PPP D1.1 ACTRIS Governance and management structure, submitted in 05/2017).

***Figure 8**. List of the Members and Observers of the Interim ACTRIS Council as of January 2018.*

Cyprus Member	**Romania** Member
Czech Republic Member	**Spain** Member
Finland Member	**Switzerland** Member
France Member	**United Kingdom** Member
Greece Member	
Italy Member	**Denmark** Observer
Netherlands Member	**Germany** Observer
Poland Member	**Norway** Observer

ACTRIS-2

The project ACTRIS-2 Integrating Activity (IA) is funded by the European Union's Horizon 2020 research and innovation programme (grant agreement No 654109, 5/2015-4/2019). ACTRIS-2 addresses the scope of integrating state-of-the-art European ground-based stations for long-term observations of aerosols, clouds and short-lived gases. ACTRIS-2 runs in parallel to the ACTRIS Preparatory Phase Project. ACTRIS-2 is a complementary action and it supports the setting up of the pan-European ACTRIS research infrastructure as it enables the engagement of the user communities and promotes the scientific and technical development of ACTRIS, while the ACTRIS PPP focuses on setting up the structures and processes for managing the research infrastructure.

The main activities in ACTRIS-2 are related to providing transnational access for users, strengthening the measurement and calibration capabilities, and developing data comparability and data life-cycles. ACTRIS-2 facilitates the improvement of the technical level of planned RI services, enhances RI collaboration on a national, regional, and global scale, and encourages public-private partnerships and collaboration.

The ACTRIS-2 consortium has 31 partners and 21 linked third parties. In addition, the project has more than 80 associated partners including several SMEs. Innovation in instrumentation is one of the fundamental building blocks of ACTRIS-2. Associated partnership with SMEs stimulates development of joint-ventures addressing new technologies for use in atmospheric observations.

EUROCHAMP-2020

EUROCHAMP-2020 (Integration of European Simulation Chambers for Investigating Atmospheric Processes–towards 2020 and beyond) is funded from the European Union's Horizon 2020 research and innovation programme (grant agreement No 730997, 12/2016-11/2020). The EUROCHAMP network has developed a grid of environmental simulation chambers designed for the scientific investigation of atmospheric chemical and physical processes. These chambers are seen as potential ACTRIS National Facilities (exploratory platforms). ACTRIS PPP is strongly connected to EUROCHAMP, with many partners (or associated partners) in ACTRIS operating EUROCHAMP simulation chambers and being partners in the EUROCHAMP-2020 project. The integration of the atmospheric simulation chambers as National Facilities and the connected activities for the definition of access policies will be elaborated jointly with the extended EUROCHAMP communities.

EUROCHAMP-2020 aims at further integrating the most advanced European atmospheric simulation chambers into a world-class infrastructure for research and innovation. The project includes networking activities, which deliver improved chamber operability across the infrastructure as well as standard protocols for data generation and analysis. Trans-national access is provided to sixteen different chambers and four calibration centres, becoming the core of the project. Joint research activities enhance the capability of the infrastructure to provide improved

The Inter-University Institute for Earth System Research (Instituto Interuniversitario de Investigación del Sistema Tierra en Andalucía or CEAMA) - CIMEL instrument

services for users. Cooperation with the private sector is a fundamental element of the project, and it is necessary to exploit the innovation potential of the infrastructure by supporting development of scientific instruments, sensor technologies, and de-polluting materials.

Financial overview

The main objectives of ACTRIS PPP (WP3) regarding ACTRIS financial framework are to define the overall infrastructure construction and operational costs, assess financial models best suited for delivering the construction and operational needs of ACTRIS, develop policy recommendations on financial principles, and establish the ACTRIS financial plan for the entire lifetime of ACTRIS.

So far the work has concentrated on defining a complete Cost Book for ACTRIS. The aim of the ACTRIS Cost Book is to give a clear identification, definition and realistic planning of the overall ACTRIS RI costs for its entire lifetime, in order to 1) support the stakeholders engagement by providing information on the value of the investment needed to realize the entire RI or one of its Central and/or National Facilities, 2) provide comprehensive information for the ESFRI monitoring and evaluation activities, and 3) assess the necessary information to evaluate the long-term sustainability of ACTRIS RI in the Financial Plan.

The early stage of the Cost Book, as of now (early-2018), will focus on the Central Facilities. Subsequent releases of the Cost Book will include data for the National Facilities and updates for both. At the end of the PPP, the final version of the Cost Book will report all the costs as resulting from the final Technical documentation of the selected ACTRIS Facilities, and embedded in the Financial Plan. The Cost Book is not a Financial Plan.

The resources to cover those costs will be identified in the Financial Plan that will be developed following the Cost Book and in discussion with the stakeholders. To have a sound financial framework, several questions have to be addressed, including the RI Structure, RI User Strategies and the Stakeholders' engagement/ commitments. ACTRIS Financial Plan has to be featured by robustness, credibility and flexibility.

The preliminary estimates for the total costs of the Central Facilities upon the implementation and operation phase have been estimated. For the Central Facilities (excluding Cloud In Situ TC), the total implementation cost is about 66 M€ and the estimated average annual operation cost is about 15 M€. The presented numbers are subject to change. It should be noted that part of the estimated costs have already been funded. In the next Stakeholder Handbook, there will be a more consolidated and elaborated figures on the financial issues.

ACTRIS COMMUNITY

ACTRIS has a large European wide community - at the moment 23 countries have shown their commitment at organizational or state level (***Figure 9***) and the overall ACTRIS community involves more than 100 RPOs. The list of ACTRIS National representatives is given in ***Table 2***. Currently 12 countries are Members in the Interim ACTRIS Council and thus committed to politically and financially support the implementation of ACTRIS as a research infrastructure in the coming years.

In this section, country profiles from the 22 countries participating in ACTRIS are provided. Country profiles give information on the national level ACTRIS community, provides a list of potential ACTRIS National Facilities and the plans to host ACTRIS Central Facility units. Current level of national ACTRIS funding situation is also briefly stated. As already noted, the provided information regarding ACTRIS National and Central Facilities is very preliminary. Final decisions on the ACTRIS National Facilities and Central Facility hosts will be done later on by 2019.

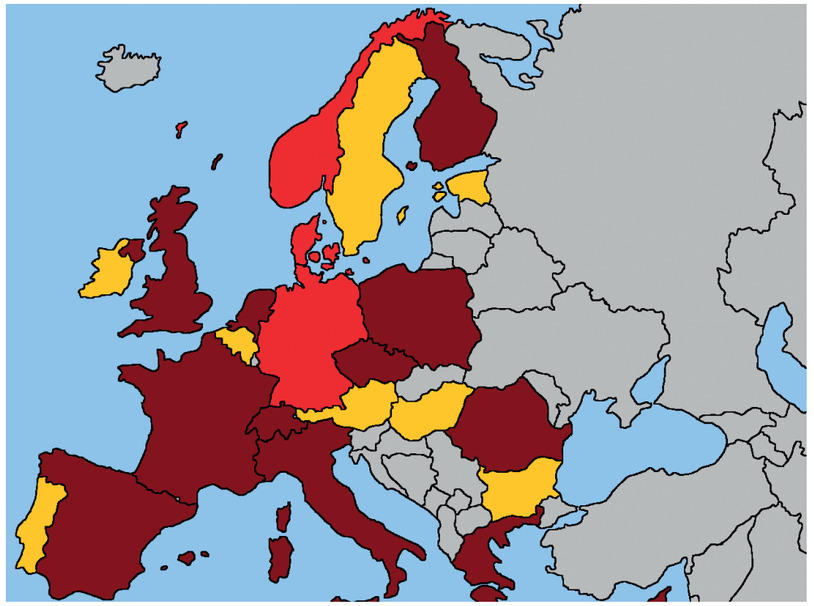

Figure 9*. Countries involved in ACTRIS. Members of the ACTRIS Interim Council are marked with dark red and Observers with red. Countries marked with yellow have been committed to ACTRIS at the organization-level or are in middle of negotiations at the moment (December 2017).*

Table 2. List of ACTRIS National Coordinators.

Country	National ACTRIS Coordinator	Contact information
Austria	Jochen Wagner Division for Biomedical Physics Medical University Innsbruck	jochen.wagner@i-med.ac.at
Belgium	Martine De Mazière Royal Belgian Institute for Space Aeronomy (BIRA-IASB)	Martine.DeMaziere@bira-iasb.oma.be
Bulgaria	Dimitar Tonev and Ivo Kalapov Institute for Nuclear Research and Nuclear Energy (INRNE)	kalapov@inrne.bas.bg dimitar.tonev@inrne.bas.bg
Cyprus	Jean Sciare The Cyprus Institute	j.sciare@cyi.ac.cy
Czech Republic	Milan Váňa Czech Hydrometeorological Institute	vanam@chmi.cz
Denmark	Henrik Skov Aarhus University	hsk@envs.au.dk
Estonia	Steffen M. Noe Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences	steffen.noe@emu.ee
Finland	Markku Kulmala University of Helsinki Contact person: Silja Häme University of Helsinki	markku.kulmala@helsinki.fi silja.hame@helsinki.fi
France	Paolo Laj Université Grenoble Alpes (UGA)/ Centre National de Recherche Scientifique (CNRS)	paolo.laj@univ-grenoble-alpes.fr
Germany	Ulla Wandinger Leibniz Institute for Tropospheric Research (TROPOS)	ulla@tropos.de
Greece	Nikolaos Mihalopoulos University of Crete and National Observatory of Athens	nmihalo@noa.gr
Ireland	Colin O'Dowd National University of Ireland, Galway (NUIG)	colin.odowd@nuigalway.ie
Italy	Gelsomina Pappalardo National Research Council of Italy - Institute of Methodologies for Environmental Analysis (CNR-IMAA)	gelsomina.pappalardo@imaa.cnr.it
The Netherlands	Arnoud Apituley Royal Netherlands Meteorological Institute (KNMI)	arnoud.apituley@knmi.nl
Norway	Cathrine Lund Myhre NILU – Norwegian Institute for Air Research	cathrine.lund.myhre@nilu.no
Poland	Aleksander Pietruczuk Institute of Geophysics Polish Academy of Sciences	alek@igf.edu.pl
Portugal	Daniele Bortoli Institute of Earth Sciences - University of Evora (ICT-UE)	db@uevora.pt
Romania	Doina Nicolae National Institute of R&D for Optoelectronics	nnicol@inoe.ro
Spain	Adolfo Comerón Universitat Politècnica de Catalunya Amalia Muñoz CEAM	comeron@tsc.upc.edu amalia@ceam.es
Sweden	Erik Swietlicki Lund University	erik.swietlicki@nuclear.lu.se
Switzerland	Urs Baltensperger Paul Scherrer Institute	urs.baltensperger@psi.ch
United Kingdom	Geraint Vaughan National Centre for Atmospheric Science (NCAS) and School of Earth and Environmental Science, University of Manchester	geraint.vaughan@manchester.ac.uk
European Commission -Joint Research Centre	Jean-Philippe Putaud	jean.putaud@ec.europa.eu

4 COUNTRY PROFILES

Puy de Dôme Station
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ACTRIS-Austria

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Sonnblick Observatory, 3106 m

National ACTRIS coordinator and contact person:
Jochen Wagner
Division for Biomedical Physics
Medical University Innsbruck

Membership status in the Interim ACTRIS Council
- No membership

Ministries and other possible funding organisations supporting ACTRIS

- Federal Ministry of Science, Research and Economy
- FWF - Der Wissenschaftsfonds (Austria Research Fund)
- Bundesland Kärnten (federal state Carinthia) - Sonnblick Observatory
- Bundesland Salzburg (federal state Salzburg) - Sonnblick Observatory

Research performing organisations in the national ACTRIS consortium

So far the ACTRIS National Consortium consists of seven partners, five universities, the national weather service (ZAMG) and one private Company (Luftblick). The partners are located at the three different locations Innsbruck, Sonnblick and Vienna. There are three national facilities planned and usually a joint effort is necessary to fulfil the requirements of national facilities.

- Institute of Atmospheric and Cryospheric Sciences (**ACINN**), University of Innsbruck,
  http://acinn.uibk.ac.at/
  Contact person: Thomas Karl

- Aerosol Physics & Environmental Physics (**AEP**), Universität Wien,
  http://aerosols.univie.ac.at/
  Contact person: Bernadett Weinzierl

- Division of Biomedical Physics (BmP), Medical University Innsbruck,
  https://www.i-med.ac.at/dpmp/bmp/
  Contact person: Jochen Wagner

- Institut for Meteorology (Boku-Met), University of Natural Resources and Life Sciences, Vienna
  https://www.wau.boku.ac.at/met/
  Contact person: Stana Simic

- LuftBlick Earth Observatory Technologies, Mutters, Tyrol
  http://luftblick.at/
  Contact person: Alexander Cede

- Sonnblick Observatory,
  https://www.sonnblick.net/en/
  Contact person: Elke Ludewig

- Institute of Chemical Technologies and Analytics(TU-CTA), Division Environmental and Process Analytics Enviromental Analytics, Vienna University of Technology,
  https://www.cta.tuwien.ac.at/division_environmental_and_process_analytics/environmental_analytics/research/
  Contact person: Anne Kasper-Giebl

Planned contribution to the ACTRIS Central Facilities

- Centre for Reactive Trace Gases Remote Sensing (Innsbruck)

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- Sonnblick Observatory
  - in situ aerosol measurements
  - high altitude research station at an altitude of 3.106 meters **(https://www.sonnblick.net/en/)**
  - Sonnblick could provide physical access to users (not decided yet)
- Vienna,
  - remote sensing aerosol measurements

- There are three research performing ACTRIS organisations located in Vienna with measurement platforms at the roof of Boku University. The focus is on aerosol remote sensing.
- There are two Sunphotometer (CIMEL), two MAXDOAS instruments. A multi-wavelength Raman and polarization LIDAR systems (POLLY) is already financed – however operation is planned not before 2019 (2020?).
- Innsbruck,
  - reactive trace gas remote sensing
- One or two (at different altitude) Pandora spectro radiometer.
  - physical access at the Innsbruck Atmospheric Laboratory (IAO) could be provided
  - meteorological flux tower
  - micrometeorological instrumentation for momentum and trace gas fluxes incl. broad band radiation sensors.
  - sunphotometer with more than 10 years timeseries of AOD
  - in addition one unit for trace gas remote sensing (Pandora instruments) is planned

The status of national ACTRIS consortium

Five out of seven partners signed a LoI (letter of Intent) concerning ACTRIS so far. There is regularly communication via email and physical meetings. Unfortunately there is no national research infrastructure roadmap in Austria. However the Federal Ministry of Science, Research and Economy welcomes ACTRIS. There are negotiations going on to eventually get a LoI (Letter of Intent) from the ministry.

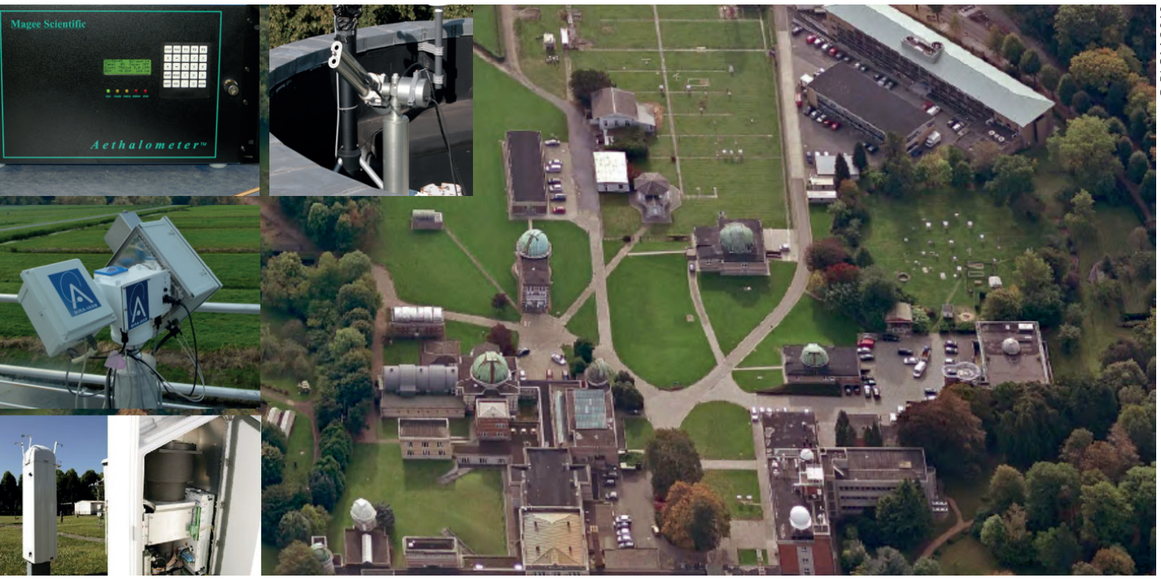
Funding for ACTRIS

There is a very preliminary table stating the ACTRIS related costs from 2016:

TU-CTA research project with an overall budget of about 100.000 €

Partner	staff	laboratory	office	measuring devices	third-party funds	others
ACINN	2 persons 130.000 €	80 m^2	60 m^2	200.000 €	FWF, EU, FP7, TWF 150.000 €	consumption 5.000 €
AEP						
BmP	1.5 persons 97.000 €	30 m^2 45.000 €	42,4 m^2	depreciated	FFG 29.670 €	consumption 1.500 €
Boku-Met	1 person 62.500 €	32 m^2	21 m^2	depreciated	FWF 15.000 €	consumption 1.500 €
LuftBlick	4 person 194.173 €		48,5 m^2	284.380 € ca. 25% depreciated	ESA 240.000 €	consumption and material 55.236 €
Sonnblick	1.5 Persons	47,6 m^2	12 m^2	depreciated and a new purchase 2017 (CPC)	BMLFUW 49.050 € BMWFW: 49.050 € Land Kärnten: 5.540 € Land Salzburg: 5.450 €	

ACTRIS-Belgium



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The site of Ukkel (50,51°N, 4,3°E) proposed as an ACTRIS National Facility of Belgium - including some instruments operated at the site by the local RPOs.

National ACTRIS coordinator and contact person:
Martine De Mazière
Royal Belgian Institute for Space Aeronomy (BIRA-IASB)

Membership status in the Interim ACTRIS Council
- No membership. Plans to apply the member status in the near future.
- Country (national authority) contact persons: Laurence Lenoir and Aline Van der Werf, Belgian Science Policy Office (BELSPO)

Ministries and other possible funding organisations supporting ACTRIS
- Federal Science Policy
- Flemish Ministry for Work, Economy, Innovation, Scientific Policy and Sport
- Walloon ministry for Economy, Industry, Research, Innovation, Digital world, Employment and Training
- Walloon ministry for Environment, Ecological Transition, Territorial planning, Public works, Mobility, Transport, Animal well-being, and Zonings

For all: financial commitment to be confirmed

Research performing organisations in the national ACTRIS consortium
- Royal Belgian Institute for Space Aeronomy, Martine De Mazière, **http://www.aeronomie.be**
- Royal Meteorological Institute of Belgium, Hugo de Backer, **http://www.kmi.be**
- University of Liège, Emmanuel Mahieu, **https://www.uliege.be**
- Institut Scientifique de Service Public, Benjamin Bergmans, **http://www.issep.be**
- University of Antwerp, Reinhart Ceulemans, **https://www.uantwerpen.be**

Planned contribution to the ACTRIS Central Facilities
- Centre for Reactive Trace Gases Remote Sensing, contributions to FTIR and UVVIS units

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing Belgian sites
- Ukkel, urban site (outer-Brussels), hosting clouds and aerosol remote sensing instruments, aerosol in-situ instrumentation, as well as a remote sensing UVVIS instrument; additional meteorological observations, ozone totam column and ozone vertical profile soundings are also available
- Vielsalm, rural ICOS ecosystem site, hosting instrumentation for in-situ measurements of aerosol and trace gases. The plan is to add remote sensing instruments for reactive trace gases in the future.

Existing Swiss-Belgian site
- Jungfraujoch, Alpine high mountain site, including Swiss facilities + Belgian FTIR and UVVIS instruments for remote sensing of reactive trace gas instruments; Jungfraujoch is also an ICOS site.

Existing Franco-Belgian site
- La Réunion, mountain site, equipped with instruments for remote sensing of reactive trace gases: Belgian FTIR and UVVIS instruments and French LIDAR instruments; La Réunion is also an ICOS atmospheric station

Existing Belgian site
- Brasschaat: actually an ICOS ecosystem site, where some in situ measurements of atmospheric trace gases are already carried out. The plan is to upgrade it to a combined ICOS-ACTRIS site.

Exploratory platforms (mobile platforms and measurement chambers)
None existing; none planned for now

The status of national ACTRIS consortium

The interested parties have met and discussed several times, and agreed about the National Facilities and contributions to Topical Centres in ACTRIS; there is not yet any MoU nor official consortium document established.

Belgium does not yet have a national Roadmap but is planning to have one in the future. The Belgian (federal) Science Policy Office is supporting ACTRIS. A meeting with all Belgian funding authorities to solicit support for ACTRIS will be organized soon.

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Funding for ACTRIS
Not yet possible: we are awaiting the meeting with the funding authorities to get an idea about the financial support to ACTRIS.

Users of ACTRIS
The user communities in Belgium are:

- The scientific research community dealing with environmental questions and air quality
- The federal and regional agencies/policy departments dealing with air quality in Belgium
- VITO, the Flemish Institute for Technological Research
- The education sector
- The transport sector (air traffic in particular)
- The health sector

ACTRIS-Bulgaria

BEO Moussala

National ACTRIS coordinator and contact person:
Dimitar Tonev, Ivo Kalapov
INRNE
Membership status in the Interim ACTRIS Council

- Observer status is planned to be applied.

Ministries and other possible funding organisations supporting ACTRIS

- Ministry of Education and Science of Bulgaria
- Bulgarian Academy of Sciences
- National Science Fund of Bulgaria

Research performing organisations in the national ACTRIS consortium

- Institute for Nuclear Research and Nuclear Energy
  http://www.inrne.bas.bg
- Institute of Electronics, Bulgarian Academy of Sciences
  Laser Radars Laboratory
  http://www.ie-bas.org/ie_Eng.htm

Existing and/or planned ACTRIS observational platforms and exploratory platforms
Observation sites (stationary measurement sites)
Existing

- BEO Musala, Rila Mountain, peak Musala – 2925 ASL, Measurement of physical and optical properties of aerosols

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- Sofia Lidar Station at the Institute of Electronics, Bulgarian Academy of Sciences
- Aerosol remote-sensing observations

The status of national ACTRIS consortium

The ACTRIS-BG Bulgarian national consortium consists of two research organizations, Institute for Nuclear Research and Nuclear Energy and Institute of Electronics at the Bulgarian Academy of Sciences, which have signed a Memorandum of Understanding. The organizations are involved in ACTRIS activities with their atmospheric measurement sites - mountain station BEO Moussala (for aerosol in situ observations) and Sofia EARLINET lidar station (for aerosol remote-sensing observations). Since June 2017 ACTRIS-BG has been on the Bulgaria National roadmap for research infrastructure 2017-2023, which is a clear sign for the national recognition of the conducted research.

Funding for ACTRIS

- Ministry of Education and Science - BULGARIA NATIONAL ROADMAP FOR RESEARCH INFRASTRUCTURE 2017-2023
- Bulgarian Academy of Sciences.

Users of ACTRIS

Eventual users of ACTRIS data:

Educational and Research Institutions:

- Sofia University, Faculty of Geology and Geography, Chair of Climatology, Hydrology and Geomorphology;
- Konstantin Preslavsky University of Shumen;
- University of National and World Economy;
- Bulgarian Centre for Solar Energy
- National Institute of Meteorology and Hydrology;

Policy makers:

- Ministry of Environment and Water;
- Sofia Municipality.

ACTRIS-Cyprus

Cyprus Atmospheric Observatory (CAO)

National ACTRIS coordinator and contact person:
Prof. Jean Sciare
EEWRC director, The Cyprus Institute

Membership status in the Interim ACTRIS Council

- Member

Nominated representatives:

- Christos ASPRIS, Planning Officer, Directorate General for European Programmes, Coordination and Development (DGEPCD)

Ministries and other possible funding organisations supporting ACTRIS

- Ministry of Finance, Directorate General for European Programmes, Coordination and Development (DGEPCD)
- Ministry of Education and Culture
- Ministry of Labour, Welfare, and Social Insurance
- Ministry of Agriculture, Rural development, and Environment
- The Cyprus Institute
- Cyprus University of Technology

Research performing organisations in the national ACTRIS consortium

The Cyprus Institute (CyI), Nicosia, Cyprus
(www.cyi.ac.cy)
Contact: Jean Sciare **(j.sciare@cyi.ac.cy)**

Cyprus University of Technology (CUT),
Limassol, Cyprus
Department of Civil Engineering & Geomatics
Contact: Diofantos Hadjimitsis
(d.hadjimitsis@cut.ac.cy)

Department of Labour Inspection (DLI),
Air Quality section
Contact: Chrysanthos Savvides
(csavvides@dli.mlsi.gov.cy)

Department of Meteorology (DoM)
Contact: Filippos Tymvios
(ftymvios@dom.moa.gov.cy)

Existing ACTRIS observational platforms and exploratory platforms

- The Cyprus Atmospheric Observatory (CAO), EMEP (CY0002R), WMO-GAW **(www.cyi.ac.cy/index.php/cao.html)**
  - Plain boundary layer, Mediterranean climate, Cyprus, Natural background, data contributing to Aerosol Remote Sensing, Aerosol In-Situ, Reactive Gases In-situ
- Cyprus University of Technology (CUT)
  - Coastal site, Mediterranean climate, Limassol area, urban background, Cyprus, data contributing to Aerosol Remote Sensing

Planned ACTRIS observational platforms and exploratory platforms

- Upgrade of Cyprus University of Technology (CUT)
  - Multi-wavelength Aerosol lidar, AERONET (Sun/sky photometer), Raman lidar, CLOUDNET station, trace-Gas Remote Sensing Observations: Raman lidar (H2O profiling)

- Troodos Monitoring station (TROODOS)
  - Mountain site, Cyprus, Natural background, data contributing to Aerosol In-Situ, Reactive Gases In-situ

Existing Exploratory platforms (mobile platforms and measurement chambers)

Unmanned System Research Laboratory (USRL)

- **(www.cyi.ac.cy/index.php/usrl.html)**
  - Unmanned Aerial Vehicles (UAVs), data contributing to Aerosol Remote Sensing (sun/sky photometer), Aerosol In-Situ, Reactive Gases (VOCs) In-Situ

The status of national ACTRIS consortium

ACTRIS-Cy has been ranked first of the ESFRI projects in the Expression of Interest coordinated in July 2017 by the Directorate General for European Programmes, Coordination and Development (DGEPCD) in the framework of the 2016 National Roadmap. The governance structure of ACTRIS-Cy is currently being setting up.

Funding for ACTRIS

Cypriot RPOs have invested c.a. 2M€ over the past 5 years for setting up Research Infrastructure related to ACTRIS (national and lab facilities) and the global annual operation costs in 2016 (early construction phase) are estimated at c.a. 0.4 M€ (including costs for investment, operations, and staff), representing c.a. 5 FTE.

Users of ACTRIS

Cyprus is a remote Mediterranean island - EU member state - located in the Middle East and strategically located to receive long-range transported air pollution from 3 different continents (Europe, Africa, Asia) and the two largest world-wide deserts (Sahara, Arabic Peninsula). Cyprus is the EU member that is the most impacted by desert dust, the only one impacted by Middle anthropogenic pollution.

Within the last 3 years, ACTRIS-Cy Research Infrastructures have attracted a large number (>30) of international RPOs working on aerosol-cloud interactions and long-range transported air pollution, combining ground-based (in-situ) and vertical (remote sensing and in-situ UAV) atmospheric observations.

Several Ministry Departments (DoM, DLI) are directly benefiting from ACTRIS-Cy activities for weather/dust/air quality forecasting, operation of the EMEP station (QA/QC, data submission), and compliance with several EU environmental directives on Air Quality (Aerosol chemical composition).

ACTRIS-Czech Republic

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National atmospheric observatory Košetice

National ACTRIS coordinator and contact person:
Milan Váňa
Czech Hydrometeorological Institute

Membership status in the Interim ACTRIS Council
- Member

Nominated representatives:
- Milan Váňa, Czech Hydrometeorological Institute
- Helena Římská, Ministry of Education Youth and Sports
- Petr Ventluka, Ministry of Education Youth and Sports

Ministries and other possible funding organisations supporting ACTRIS
- Ministry of Education Youth and Sports of the Czech Republic

Research performing organisations in the national ACTRIS consortium
- Czech Hydrometeorological Institute
  Website: **www.chmi.cz**
- The Institute of Chemical Process Fundamentals of the CAS, v.v.i.
  Website: **http://www.icpf.cas.cz**
- Global Change Research Institute CAS, v.v.i.
  Website: **http://www.czechglobe.cz**
- Masaryk university
  Websites: **http://www.recetox.muni.cz**

Planned contribution to the ACTRIS Central Facilities
- the Centre for Aerosol in-situ Measurements

Existing and/or planned ACTRIS observational platforms and exploratory platforms
Observation sites (stationary measurement sites)
Existing
- National Atmospheric Observatory Košetice
- Suchdol
- Ústí na Labem

Exploratory platforms (mobile platforms and measurement chambers): No at this stage

The status of national ACTRIS consortium
Based on the long-term collaboration on implementation of the national and international projects, monitoring programmes and networks, four partners (Czech Hydrometeorological Institute, The Institute of Chemical Process Fundamentals of the CAS, v.v.i., Global Change Research Institute of the CAS, v.v.i., Masaryk univerzity CAS, v.v.i.), signed the Memorandum of Understanding on Future Cooperation in 2013 and formally established the ACTRIS consortia in the Czech Republic.

ACTRIS-CZ is on the national research infrastructure roadmap.

www.actris-ri.cz

Funding for ACTRIS
The total scale of funding for ACTRIS activities in the Czech Republic: 3,8 mil EUR for the period 2016-2019. The project ACTRIS-participation of the Czech Republic (ACTRIS-CZ), funded by The Ministry of Education Youth and Sports of the Czech Republic

Users of ACTRIS
The research infrastructure was selected based on its uniqueness within Europe, offering a comprehensive measurement programme at the forefront of research in the specific domains covered within ACTRIS (vertical aerosol distribution, in-situ aerosol properties, trace gases) together with state-of-the-art equipment, high level of services, and capacity to provide research-driven training to young scientists and new users. The users request an e-access to RI data on aerosols (mostly ICPF, some 40 accesses of researchers, technicians, and students a year) or meteorological parameters and greenhouse gases (mostly GCRI some accesses of researchers a year) directly and data on persistent pollutants through the databases of RECETOX (**www.genasis.cz**), EBAS (**www.ebas.nilu.no**) or UNEP (**www.pops-gmp.org**). The latter are more frequent - hundreds of such uses.

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Many researchers interested in persistent organic pollutants, their levels and spatial and temporal trends, size-specific particle distribution and particle-size specific compound distribution, particle-gas partitioning or source assessments request an access not only to OBK but also to the trace laboratories of RECETOX where the analysis of all such samples are carried out. The users of the RI are both scientists from the ACTRIS consortium and external, as well as students in frames of regular training courses organized at the national and international levels. International summer schools of environmental chemistry and ecotoxicology is organized by RECETOX on the annual basis as well as practical courses for the undergraduate students of Masaryk and Charles University. Research fellowships and training courses are also irregularly organized by the Institute for Environmental Studies, Faculty of Science and Charles University in Prague.

ACTRIS-Denmark

Air Observatory at Villum Research Station located 2 km outside the central complex of the Danish Military outpost, Station Nord

National ACTRIS coordinator and contact person:
Henrik Skov
Aarhus University

Membership status in the Interim ACTRIS Council
- Observer

Nominated representatives:
- Troels Rasmussen, Ministry for Higher Education and Science

Ministries and other possible funding organisations supporting ACTRIS
- Ministry for Higher Education and Science
- Universities

Research performing organisations in the national ACTRIS consortium
- Aarhus University
  Website: **www.AU.DK**
- University of Copenhagen
  Website: **www.ku.dk**

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Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- Villum Research Station
- Planned
- Risø (funding provided for construction)

Exploratory platforms (mobile platforms and measurement chambers):

- Aarhus University Research on Aerosols smog chamber facility (AURA). Cold room chamber facility for studies of aerosol formation, growth and processes. Operational in the temperature range -15 to 25° C. Aarhus University is EUROCHAMP 2020 associated partner.

  The chamber is complemented by sea spray simulation chambers for simulation of bubble mediated aerosol formation and a laminar flow tube system for studies of aerosol thermodynamic properties

- State of the art atmospheric analytical chemistry laboratory for molecular speciation of aerosol constituents.

See: **http://chem.au.dk/en/research/research-areas/physicalchemistry/atmospheric-physical-chemistry/equipment/**

The status of national ACTRIS consortium

Aarhus University is running all monitoring networks in Denmark and in Greenland including particle size distribution measurements.

ACTRIS-DK is not on the national research infrastructure roadmap, but initiatives are taken to have it on the road map in future.

Funding for ACTRIS

At present there is only limited funding for ACTRIS PPP and no national funding allocated explicitly for ACTRIS activities.

Users of ACTRIS

The research infrastructure in Denmark was designed to most efficiently to fulfil requirement from EU to determine transboundary air pollution and to provide unique data for model validation of atmospheric chemical physical transport models. Thus, the stations in Denmark provide data to e.g. EMEP (**http://www.emep.int/)** for Europe and in Greenland to AMAP (**www.amap.no.**)

In North Greenland, we Denmark is operating a research station; Villum Research Station that is well equipped with state-of-the-art instrumentation. The complete list can be seen on **www.villumresearchstation.dk.** A new test and research facility will be constructed at Risø 8 km outside Roskilde, Denmark.

The University of Copenhagen and Aarhus University are developing and deploying portable monitors for urban pollution and coupling this with modeling. We are interested in using the ACTRIS instrument calibration centers to develop these technologies and to participate in field campaigns.

ACTRIS-Estonia

The SMEAR Estonia 130m atmospheric tower and the station main cottage

National ACTRIS coordinator and contact person:
Dr.rer.nat. Steffen M. Noe
Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences.

Membership status in the Interim ACTRIS Council

- No membership

Ministries and other possible funding organisations supporting ACTRIS

- Ministry of the Environment
- Estonian Science Agency
- Ministry of Education and Research
- Environmental Investment Centre
- Estonian Environmental Agency

Remark: The Ministry of Agriculture and the Ministry of Economic Affairs and Communication offer targeted funding opportunities, which may be related.

- Estonian University of Life Sciences
- University of Tartu
- Tartu Observatory (as of January 2018 part of University of Tartu)
- Estonian Environmental Research Centre

Research performing organisations in the national ACTRIS consortium
So far the ACTRIS-Estonia national consortium consists of four partners:

- Estonian University of Life Sciences, Steffen M. Noe (steffen.noe@emu.ee), **https://www.emu.ee/en, http://smear.emu.ee**
- University of Tartu, Urmas Hõrrak (urmas.horrak@ut.ee), **http://www.ut.ee/en/**
- Estonian Environmental Research Centre, Erik Teinemaa (erik.teinemaa@klab.ee), **http://www.klab.ee/en/**
- Tartu Observatory, Mait Lang (mait.lang@to.ee), **http://www.to.ee/eng**

Existing and/or planned ACTRIS observational platforms and exploratory platforms
Observation sites (stationary measurement sites)

- **SMEAR Estonia, (Station for Measuring Earth surface-Atmosphere Relations)**, measures continuously aerosol, trace gas, and Biosphere - aerosol - climate interactions. The SMEAR Estonia station (smear.emu.ee) is the southernmost located SMEAR station contributing to the worldwide unique SMEAR network (https://www.atm.helsinki.fi/SMEAR/).
  - SMEAR Estonia (Järvselja, 58.2714 N, 27.2703 E), rural background site in a hemiboreal mixed forest environment.
- **Tahkuse air monitoring station** (58°31,47'N, 24°55,53'E, 24 m a.s.l.), rural background site in south-western part of Estonia, in-situ aerosol size distribution and trace gases measurements. Station, which belongs to the Institute of Physics, University of Tartu, contributes also to the Estonian ambient air quality measurements **(http://airviro.klab.ee/seire/airviro/en)**.
- **EKUK monitoring sites**, various urban and rural air quality monitoring sites whereof some belong to EMEP system as well **(http://airviro.klab.ee/seire/airviro/en).**
- **Aerosol Physics laboratory** in the Institute of Physics, University of Tartu **(https://www.fi.ut.ee)**. Provides experimental facilities for testing and calibration of aerosol instrumentation: test aerosol generation and classification system for the calibration of aerosol size distribution spectrometers.
- **Remote sensing**, Tartu Observatory atmosphere monitoring station in Tõravere (58.27° N, 26.46° E, 70 m a. s. l.). At Tartu Observatory is one AERONET station and measurements of global and diffuse spectral UV radiation are carried out.

Exploratory platforms (mobile platforms and measurement chambers)

- Estonian Environmental Research Centre owns two Mobile Aerosol Laboratories for investigation of atmospheric air quality, equipped with devices for aerosol size distribution, trace and polluting gases and basic meteorological measurements.
- Tartu Observatory has unmanned aerial vehicle (UAV)

All of the ACTRIS-Estonia research facilities already exist. Upgrading of the facilities and instruments to be ACTRIS compliant is needed. The joint efforts of national partners are necessary to fulfil the requirements of national facilities.

The status of national ACTRIS consortium
The interested parties have met and discussed several times, and agreed about the National Facilities and contributions to Topical Centers in ACTRIS. Formally, Estonian University of Life Sciences, University of Tartu and the Estonian Environmental Research Centre are associated partners of ACTRIS.

There is not yet a statement from official Estonian stakeholders on ACTRIS participation. Lobby work is conducted.

Funding for ACTRIS
There is no dedicated funding for ACTRIS in Estonia yet.

Users of ACTRIS
The user communities in Estonia are:

- The scientific research community dealing with investigation of environmental processes (atmospheric aerosols, radiation, forest ecosystem etc.), environmental questions and air quality.
- The national and regional agencies/policy departments dealing with air quality in Estonia (http://airviro.klab.ee/seire/airviro/en).
- Data from Estonian measurement sites are used in modeling of both, scientific and public institutions. (e.g HIRLAM numerical weather forecast).

Data provided by the Estonian facilities is used the ERA-PLANET and the PEEX project. Further in bilateral research projects. The international users community includes mostly climate and air-quality related research communities but also ecology and sustainable development of natural resources and energy communities are collaborators.

ACTRIS-Finland

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SMEAR II (Station for Measuring Earth surface-Atmosphere Relations) aerosol measurement cottage and instrumented mast in boreal forest, Hyytiälä, Finland

National ACTRIS Coordinator / Director:
Markku Kulmala
University of Helsinki

National ACTRIS Contact person:
Silja Häme
University of Helsinki

Membership status in the Interim ACTRIS Council
- Member

Nominated representatives:
- Aino Sipari, Ministry of Transport and Communications
- Petteri Kauppinen, Ministry of Education and Culture
- Merja Särkioja, Academy of Finland.

Ministries and other possible funding organisations supporting ACTRIS
- Ministry of Transport and Communications
- Ministry of Education and Culture
- Academy of Finland
- University of Helsinki
- Finnish Meteorological Institute
- University of Eastern Finland
- Tampere University of Technology

Research performing organisations in the national ACTRIS consortium
- University of Helsinki, Tuukka Petäjä (tuukka.petaja@helsinki.fi), **https://www.helsinki.fi/en**
- Finnish Meteorological Institute, Heikki Lihavainen (heikki.lihavainen@fmi.fi), **http://en.ilmatieteenlaitos.fi/**
- University of Eastern Finland, Annele Virtanen (annele.virtanen@uef.fi), **http://www.uef.fi/en/etusivu**
- Tampere University of Technology, Miikka dal Maso (miikka.dalmaso@tut.fi), **http://www.tut.fi/en/home**

Planned contribution to the ACTRIS Central Facilities
- **ACTRIS Head Office** (HO), it is envisaged that the statutory seat of ACTRIS legal entity will be in Finland. Head Office is planned to consist of four units (Service and Access Management Unit; ERIC Management Unit, RI Operations Unit and Strategies and Relations Unit). Italy is foreseen to host SAMU while Finland is foreseen to host other units of the Head Office. Finland and Italy are already in ESFRI application phase indicated their commitment and readiness to host the ACTRIS Head Office.
- **ACTRIS Data Centre** (DC), Finland (Finnish Meteorological Institute) is foreseen to host a Central Facility Unit namely the CloudNet database.
- **ACTRIS Centre for Aerosol in-situ Measurements**, Finland (University of Helsinki) is foreseen to host a Central Facility Unit focusing on the size distribution measurements of sub-10nm aerosol particles.
- **ACTRIS Centre for Reactive Trace Gases in-situ Measurements**, Finland (University of Helsinki) is foreseen to host a Central Facility Unit focusing on instrument development and cluster measurements. The Finnish Unit of the Centre is also foreseen to promote education and outreach activities for the scientific community and for the general public.
- **ACTRIS Centre for Cloud Remote Sensing**, Finland (Finnish Meteorological Institute) is planning to host a central facility unit focusing on Doppler Lidar products and data processing procedures development.

ACTRIS National Facilities - Existing ACTRIS observational platforms and exploratory platforms
All of the ACTRIS-Finland research facilities already exist. Upgrading of the facilities and instruments to be ACTRIS compliant is needed.

Observation sites (stationary measurement sites)
Existing
- **SMEAR I-IV (Station for Measuring Earth surface-Atmosphere Relations)**, continuous aerosol and trace gas measurements, and Biosphere - aerosol - cloud - climate interactions. The SMEAR stations I-IV are unique entities in the world with their comprehensive measurements on their respective locations (www.atm.helsinki.fi/SMEAR).

- SMEAR I (Värriö), background site in Finnish Arctic
- SMEAR II (Hyytiälä), rural background site in a boreal forest environment
- SMEAR III (Helsinki), urban background site, air quality monitoring
- SMEAR IV (Kuopio), top of Puijo Tower, semi-urban environment, in-situ-cloud measurements, aerosol and trace gases.

- **Pallas Atmosphere-Ecosystem Supersite**, background site in Finnish Arctic, aerosol in situ, cloud in situ, trace gas in situ, Aerosol and cloud remote sensing
- **Utö Atmospheric and Marine Research Station**, background station on the Baltic sea, aerosol and trace gas in situ

High quality contributing observation sites
- **Marambio**, Antarctic Peninsula, permafrost, aerosol in situ
- **Tiksi**, Northern Siberia, tundra (permafrost), aerosol in situ

Exploratory platforms (mobile platforms and measurement chambers)
Existing
- **Multi-wavelength Raman Lidar (mobile)**, studies on optical and microphysical aerosol properties
- **Doppler Cloud Radar (mobile)**, cloud research, cloud parameters for a large altitude range (up to 15-20 km) with high temporal resolution, cloud retrievals within CloudNet
- **Doppler Lidar (mobile)**, monitoring of particulate air pollution and boundary layer properties in near real time
- **Kuopio Atmospheric Simulation Chambers (KASCs)**, chambers for aerosol formation and aging studies including 2 separate chambers: 1) chamber for biogenic precursor studies and 2) ILMARI chamber facility enabling real combustion emission source studies. Chambers belongs to EUROCHAMP2020 facilities.
- **Mobile Aerosol Laboratory**, on-road studies within real traffic setting and measurements of roadside aerosols when stationary, studies on aging and secondary formation of urban and emission aerosols.
- **Unmanned aerial vehicle (UAV)**, aerosol, cloud and trace gas studies, test area at Pallas Atmosphere-Ecosystem Supersite
- **Aerosol, cluster and trace gas laboratory (Helsinki)**, size distribution measurements of sub-10nm aerosol particles, cluster measurements.
- **Cessna aircraft**, in situ aerosol and trace gas measurements.

The status of national ACTRIS consortium

ACTRIS belongs to the Finnish RI roadmap 2014-2020 as a major part of INAR (Institute for Atmospheric and Earth System Research). Overall, INAR integrates the national leading organizations and infrastructures in the atmosphere-ecosystem research. ACTRIS-Finland has a steering committee and it is operated under the Collaboration Agreement of INAR. Webpage: **https://www.helsinki.fi/en/ inar**

Funding for ACTRIS

- Costs of the Finnish component of ACTRIS consist of national ACTRIS activities mainly upgrading the national facilities, planning and implementation activities at the European level and development / construction of the Central Facility units Finland plans to host.
- **For 2017-2019, the estimated annual costs of the Finnish component of ACTRIS are 3.85-4.75 M€/year.** The funding for these costs is secured. 0.75-1.5 M€/year comes from the ministries supporting ACTRIS, 2.6-3 M€/year from the research performing organizations within the ACTRIS national consortium, and 0.5 M€/year from European commission as project funding.
- Year 2020 onwards when ACTRIS legal entity is foreseen to exist, the estimated annual costs of the Finnish component of ACTRIS are around 4.9 M€/year (national facilities 2.5 M€, central facilities 2.1 M€, ACTRIS membership fees 0.3 M€). The ministries supporting ACTRIS as well as the research performing organizations within the ACTRIS national consortium have been committed to contribute significantly to cover the costs.

Users of ACTRIS

- ACTRIS-Finland facilities are currently being used in over 30 international research projects and ACTRIS-Finland facilities host over 3200 research visitor days annually. ACTRIS-Finland users mainly include climate and air-quality research communities (e.g. iLEAPS, Future Earth, PEEX), institutes for ecosystem studies of the interaction of atmosphere and biosphere, universities and research institutions for training of researchers and young scientists. ACTRIS-Finland is actively collaborating with ICOS ERIC.
- On a national level ACTRIS-Finland capacity is actively used by the Center of Excellence in Atmospheric Science (https://www.atm.helsinki.fi/fcoe/). As a total, approximately 615 person months is used each year within ACTRIS-Finland.
- Technological collaboration between ACTRIS-Finland and private sector has created spin offs and it is foreseen that private sector will continue to benefit from ACTRIS services.

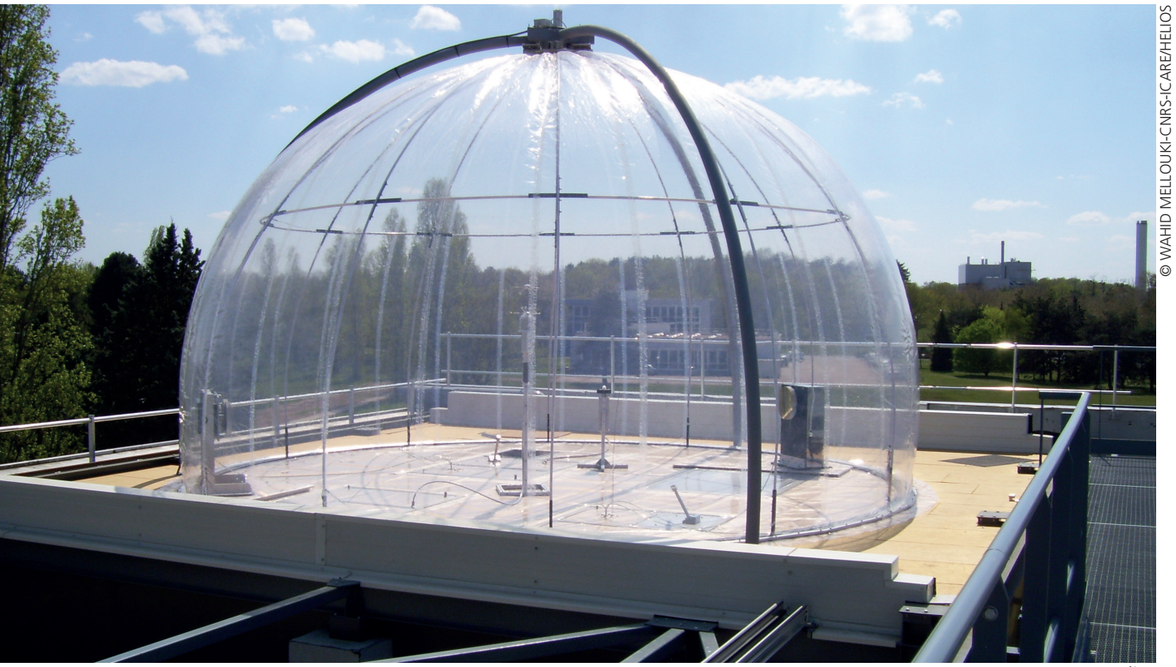
FINNISH METEOROLOGICAL INSTITUTE

TAMPERE UNIVERSITY OF TECHNOLOGY

UNIVERSITY OF EASTERN FINLAND

HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

ACTRIS-France



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Helios

National ACTRIS coordinator and contact person:
Paolo Laj
Université Grenoble Alpes (UGA)/ Centre National de Recherche Scientifique (CNRS)

Membership status in the Interim ACTRIS Council
- Member

Nominated representatives:
- Jean Marie FLAUD, Ministère de l'enseignement supérieur de la recherche et de l'innovation (MESRI)
- Bruno BLANKE, Centre National de Recherche Scientifique (CNRS)/Institut National de Sciences de l'Univers
- Juliette LAMBIN, Centre National d'Etudes Spatiales (CNES)

Ministries and other possible funding organisations supporting ACTRIS
- Ministère de l'Enseignement Supérieur de la Recherche et de l'Innovation (MESRI)
- Centre National de Recherche Scientifique (CNRS)
- Centre National d'Etudes Spatiales (CNES)
- Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA)
- Institut de Recherche pour le Développement (IRD)
- Institut Paul-Emile-Victor (IPEV)
- Institut Mines-Télécom Lille Douai (IMT)
- Institut National de l'EnviRonnement Industriel et des RisqueS (INERIS)
- Météo France (MF)
- Aix-Marseille Université (AMU)
- École des Ponts ParisTech (ENPC), Champs-sur-Marne
- Ecole Polytechnique (EP), Palaiseau
- Université Grenoble-Alpes (UGA)
- Université Clermont Auvergne (UCA)
- Université Lille 1 - Sciences et Technologies (Lille 1)
- Université Paris Diderot (UPD)
- Université Paris-Est Créteil (UPEC)
- Université Pierre et Marie Curie (UPMC)
- Université de la Réunion (UR)
- Université Versailles St. Quentin (UVSQ)
- Université de Toulouse III Paul Sabatier (UPS)
- European Commission
- French Environmental protection agencies
- Regions
- Other exceptional funding contributors (e.g., SMEs, Space Agencies (ESA, NASA/NOAA)

Research performing organisations in the national ACTRIS consortium
- Centre National de Recherche Scientifique (CNRS)
- Centre National d'Etudes Spatiales (CNES)
- Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA)
- Institut de Recherche pour le Développement (IRD)
- Institut Paul-Emile-Victor (IPEV)
- Institut Mines-Télécom Lille Douai (IMT)
- Institut National de l'EnviRonnement Industriel et des RisqueS (INERIS)
- Météo France (MF)
- Aix-Marseille Université (AMU)
- École des Ponts ParisTech (ENPC), Champs-sur-Marne
- Ecole Polytechnique (EP), Palaiseau
- Université Grenoble-Alpes (UGA)
- Université Clermont Auvergne (UCA)
- Université Lille 1 - Sciences et Technologies (Lille 1)
- Université Paris Diderot (UPD)
- Université Paris-Est Créteil (UPEC)
- Université Pierre et Marie Curie (UPMC)
- Université de la Réunion (UR)
- Université Versailles St. Quentin (UVSQ)
- Université de Toulouse III Paul Sabatier (UPS)

Planned contribution to the ACTRIS Central Facilities

- Centre for Aerosol in-situ Measurements, ACMCC unit (CEA, INERIS, CNRS)
- Centre for Reactive Trace Gases in-situ Measurements (contributing to VOC unit) (IMT-Lille)
- Centre for Cloud Remote Sensing, Cloud Radar unit (CNRS, EP, Modem, UPD)
- Centre for Aerosol Remote Sensing, one unit AERONET node (CNRS, MF, Lille1, CNES)
- Centre for Reactive Trace Gases Remote Sensing, Ozone (CNRS, UVSQ)
- Data Centre, EUROCHAMP node, Data and Service Node (CNRS, CNES, UPS, Lille1, UPD, UPMC, UPEC)

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites) in France will be selected in the following station list

- Site Instrumental de Recherche par Télédétection Atmosphérique (SIRTA)
  - Plain boundary layer, Paris Area, surburban background, temperate oceanic climate, host Cloud RS TC and ACMCC TC, data contributing to following TCs: Aerosol RS, Cloud RS, Trace Gases IS, Aerosol IS, Cloud IS
- Site d'observations atmosphériques Puy de Dôme/Opme/Cézeaux (PUY)
  - Plain to mountain site, Natural background, Central France, data contributing to following TCs: Aerosol RS, Trace Gases IS, Aerosol IS, Cloud IS
- Observatoire atmosphérique du MAÏDO (MAIDO), La Réunion
  - Plain to mountain site, Natural background, tropical climate, data contributing to following TCs: Aerosol RS, Trace gases RS, Trace Gases IS, Aerosol IS
- Plateforme Pyrénéenne d'Observations Atmosphériques (P2OA)
  - Plain to Mountain site, Natural Background, Pyrenees, data contributing to following TCs: Aerosol IS, Cloud IS
- Observatoire de Haute Provence (OHP)
  - Mountain site, Natural background, Southern Alps, data contributing to following TCs: Aerosol RS, Trace Gases RS,
- French Southern and Antarctic Lands (Dumont d'Urville, Adélie Land, Antarctica, Ile d'Amsterdam)
  - Coastal site, Natural background, Antarctica, data contributing to following TCs: Trace Gases RS, Aerosol RS
- Observatoire atmosphérique de Chacaltaya (CHC)
  - Valley to Mountain site, Tropical Andes, Bolivia, jointly operated with UMSA (Bolivia), TROPOS, data contributing to following TCs: Aerosol IS
- Observatoire Pérenne de l'Environnement (OPE)
  - Hill Boundary layer, East France, data contributing to following TCs: Aerosol IS
- Site EMEP FR13 Peyrusse-Vieille, 43°37'0" N ; 0°11'0"E ; alt. 200m
  - Plain boundary layer, South of France, Rural , Temperate Oceanic climate, data contributing to following TCs: Trace Gases IS (NOx, VOCs), Aerosol IS

- Site EMEP FR15 Tardière, 46° 39' 0'' N, 0° 45' 0'' W Alt. : 133 m
  - Plain boundary layer, West of France, Rural , Temperate Oceanic climate, data contributing to following TCs: Trace Gases IS (VOCs, NOx), Aerosol IS
- Site EMEP FR09 Revin, 49°54'0" N ; 4°38'0"E ; alt. 390m
  - Plain boundary layer, North-East of France, Rural, Forest, Temperate Semi-Continental climate, data contributing to following TCs: Trace Gases IS, Aerosol IS
- Station Géophysique de LAMTO (LAMTO)
  - Savanna boundary layer, Ivory Coast (120km of Abidjan), wet savanna regional background, humid tropical climate, data contributing to following TCs: Aerosol RS, Aerosol IS, Trace Gas IS.

<u>Exploratory platforms (mobile platforms and measurement chambers)</u>

- Atmospheric Simulation Chamber (CESAM)
  - Multiphase chamber, contributing to Aerosol RS, Aerosol IS, Trace Gas IS.
- Chambre de simulation atmosphérique à irradiation naturelle d'Orléans (HELIOS)
  - Photochemical chamber, contributing to IS Cloud , Aerosol IS, Trace Gas IS.
- Interfaces Simulation Atmospheric Chamber (ISAC)
  - Interface chamber, contributing to Aerosol IS, Trace Gas IS.

The status of national ACTRIS consortium

ACTRIS-FR (**www.actris.fr**) is on the French National Roadmap since 2016 and is in its interim phase until the consortium agreement, currently under preparation, will be signed. The governance structure comprises 4 different bodies: a general assembly, executive board, scientific board, and coordination.

Funding for ACTRIS

Global annual operation costs in 2016 (early construction phase) are estimated at 9.2 M€ (including costs for investment, operations, and staff), representing 58.3 FTE.

Users of ACTRIS

- More than 30 research institutes working in Atmospheric and Climate Research (representing a community of several thousand researchers and engineers).
- Key RPOs involved connected to climate, space, environmental, air quality research
- Several Ministries connected to ACTRIS (represented by Ministry for Research)

ACTRIS-Germany (ACTRIS-D)

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Leipzig Aerosol and Cloud Remote Observations System (LACROS) in front of the Leipzig Aerosol-Cloud Interaction Simulator (LACIS)

National ACTRIS coordinator and contact person:
Dr. Ulla Wandinger
Leibniz Institute for Tropospheric Research (TROPOS), Leipzig

Membership status in the Interim ACTRIS Council
- Observer

Nominated representatives:
- Dr. Christian Plaß-Dülmer (DWD) on behalf of Federal Ministry of Transport and Digital Infrastructure
- Dr. Marion Wichmann-Fiebig (UBA) on behalf of Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

Ministries and other possible funding organisations supporting ACTRIS
- Federal Ministry of Education and Research (BMBF)
- Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)
- Federal Ministry of Transport and Digital Infrastructure (BMVI)
- German Environment Agency (UBA)

Research performing organisations in the national ACTRIS consortium

Leibniz Institute for Tropospheric Research (TROPOS)
Contact: Prof. Andreas Macke
www.tropos.de

Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research (AWI)
Contact: Prof. Antje Boetius
www.awi.de

Bergische Universität Wuppertal (BUW)
Contact: Prof. Peter Wiesen
www.ptc.uni-wuppertal.de

Deutscher Wetterdienst (DWD)
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Observatory Hohenpeissenberg
www.dwd.de/mohp

Forschungszentrum Jülich GmbH (JUELICH)
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Goethe University Frankfurt am Main (GUF)
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www.goethe-university-frankfurt.de/45678073/IAU

Karlsruhe Institute of Technology (KIT)
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www.imk.kit.edu

Ludwig-Maximilians-Universität (LMU)
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www.meteo.physik.uni-muenchen.de

Max Planck Institute for Chemistry (MPI-C)
Contact: Prof. Jos Lelieveld
www.mpic.de

Max Planck Institute for Meteorology (MPI-M)
Contact: Prof. Bjorn Stevens
www.mpimet.mpg.de

German Environment Agency (UBA)
Contact: Prof. Ruprecht Schleyer
www.umweltbundesamt.de

University of Bremen (UNIHB)
Contact: Prof. Justus Notholt
www.iup.uni-bremen.de

University of Cologne (UCOL)
Contact: Prof. Susanne Crewell
www.geomet.uni-koeln.de

Planned contribution to the ACTRIS Central Facilities

- Centre for Aerosol in-situ Measurements, unit for aerosol physics at TROPOS
- Centre for Aerosol in-situ Measurements, unit for organic tracers at TROPOS
- Centre for Aerosol Remote Sensing, unit for high-power aerosol lidar at LMU
- Centre for Aerosol Remote Sensing, unit for automatic low-power aerosol lidar at DWD
- Centre for Reactive Trace Gases in-situ Measurements, unit for NOx at JUELICH
- Centre for Reactive Trace Gases in-situ Measurements, unit for VOC at KIT
- Centre for Reactive Trace Gases in-situ Measurements, unit for VOC and NOx at DWD
- Centre for Reactive Trace Gases Remote Sensing, unit for FTIR calibration at KIT
- Centre for Cloud in-situ Measurements, unit for INP instrument calibration at KIT
- Centre for Cloud in-situ Measurements, unit for development of chemical standards at TROPOS
- Centre for Cloud Remote Sensing, unit for microwave radiometer calibration at UCOL

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites

Existing observation sites in Germany

- Bremen (UNIHB): NDACC FTIR reactive-trace-gases remote sensing
- Garmisch-Partenkirchen (KIT): EARLINET aerosol remote sensing, NDACC FTIR reactive-trace-gases remote sensing
- HPBißenberg (DWD): EARLINET/AERONET aerosol remote sensing, aerosol and reactive-trace-gases in-situ measurements; GAW, ICOS and NDACC observations
- Jülich Observatory for Cloud Evolution – JOYCE (UCOL and JUELICH): CLOUDNET cloud remote sensing, AERONET
- Karlsruhe (KIT): NDACC FTIR reactive-trace-gases remote sensing, AERONET
- Leipzig (TROPOS): EARLINET/AERONET aerosol remote sensing, aerosol and reactive-trace-gases in-situ measurements
- Lindenberg (DWD): CLOUDNET cloud remote sensing, AERONET, high-power aerosol lidar; GRUAN, BSRN and ICOS observations
- Melpitz (TROPOS): aerosol and reactive-trace-gases in-situ measurements, experimental field site, basis for airborne platforms
- München (LMU): EARLINET/AERONET/CLOUDNET aerosol and cloud remote sensing
- Schmücke (TROPOS): aerosol in-situ measurements (hill-top site)
- Zugspitze: NDACC FTIR reactive-trace-gases remote sensing (KIT), CLOUDNET cloud remote sensing (operated by consortium Schneefernerhaus), GAW observations (UBA)

Existing observation sites outside of Germany

- Barbados Cloud Observatory (MPI-M): CLOUDNET cloud remote sensing, AERONET, high-power aerosol lidar and various other active and passive sensors
- Cape Verde Atmospheric Observatory (TROPOS): aerosol in-situ measurements, AERONET
- Izaña, Tenerife, Spain (KIT): NDACC FTIR reactive-trace-gases remote sensing
- Kiruna, Sweden (KIT): NDACC FTIR reactive-trace-gases remote sensing
- Ny-Ålesund, Spitsbergen (AWI): AWIPEV atmospheric observatory, CLOUDNET cloud remote sensing (operated by AWI and UCOL), AERONET, high-power aerosol lidar, NDACC FTIR reactive-trace-gases remote sensing (UNIHB)
- Paramaribo, Surinam (UNIHB): NDACC FTIR reactive-trace-gases remote sensing

Planned observation sites and site upgrades in Germany

- Gartow (DWD): upgrade of ICOS station with reactive-trace-gases in-situ and Doppler lidar measurements
- Jülich (UCOL and JUELICH): upgrade of JOYCE with EARLINET aerosol remote sensing and aerosol in-situ measurements
- Karlsruhe (KIT and DWD): upgrade of ICOS station with reactive-trace-gases in-situ and Doppler lidar measurements
- Melpitz (TROPOS): upgrade with EARLINET/AERONET/CLOUDNET aerosol and cloud remote sensing
- Steinkimmen (DWD): upgrade of ICOS station with reactive-trace-gases in-situ and Doppler lidar measurements
- Torfhaus (DWD): upgrade of ICOS station with reactive-trace-gases in-situ measurements
- Schmücke (TROPOS): upgrade for cloud in-situ measurements, aerosol-cloud interaction observations in Lagrangian setup (before, in and behind hill cap cloud)
- Taunus Observatory (GUF): aerosol, cloud and reactive-trace-gases in-situ measurements at a hill-top site located in a forest

Planned observation sites and site upgrades outside of Germany

- Barbados Cloud Observatory (MPI-M): upgrade with NDACC FTIR reactive-trace-gases remote sensing
- Cape Verde Atmospheric Observatory (TROPOS): upgrade with EARLINET/AERONET/CLOUDNET aerosol and cloud remote sensing and aerosol in-situ measurements in the remote marine atmosphere

- Dushanbe, Tajikistan (TROPOS): EARLINET/AERONET aerosol remote sensing of Central Asian dust
- Limassol, Cyprus (TROPOS): EARLINET/AERONET aerosol remote sensing in the polluted eastern Mediterranean
- Nicosia, Cyprus (MPI-C): NDACC FTIR reactive-trace-gases remote sensing
- Ny-Ålesund, Spitsbergen (AWI): upgrade for EARLINET with high-power scanning Raman lidar for low-level aerosol in the Arctic

Exploratory platforms (mobile platforms and measurement chambers)
Existing chambers

- Leipzig Aerosol Cloud Interaction Simulator (LACIS at TROPOS): cloud simulation chamber to investigate interactions between turbulence and cloud microphysical processes
- Leipzig Aerosol Kammer (LEAK at TROPOS): aerosol simulation chamber to investigate the degradation of compounds, the formation of products and the influence on the aerosol formation
- Quartz Glass Reactor (QUAREC at BUW): atmospheric simulation chamber for investigations of gas-phase photo-oxidation processes
- Atmosphere Simulation Chambers 'SAPHIR' and 'SAPHIR-PLUS' (JUELICH): simulation chambers for investigations of atmospheric chemical processes
- Aerosol Interaction and Dynamics in the Atmosphere (AIDA at KIT): aerosol and cloud simulation chamber, used as reference for instrument calibrations and for training workshops

Planned chambers

- AIDA-2 dynamic cloud chamber (KIT): currently under construction for cloud in-situ studies at well controlled convective cloud and storm conditions

Existing mobile platforms

- Leipzig Aerosol and Cloud Remote Observations System (LACROS), mobile radar-lidar facility operated by TROPOS in CLOUDNET
- OCEANET mobile shipborne remote sensing facility operated by TROPOS

Planned mobile platforms

- Shipborne ACTRIS laboratory on research vessel Polarstern-2 operated by TROPOS
- Airborne aerosol in-situ measurement facility (balloon, kite, UAVs) operated by TROPOS
- Four mobile FTIR spectrometer facilities for measuring columns of reactive trace gases operated by KIT and UNIHB
- Mobile remote-sensing platform in analogy to Barbados Cloud Observatory for twin operations operated by MPI-M
- Mobile VOC laboratory operated by UBA

The status of national ACTRIS consortium

- The consortium ACTRIS-D consists of 13 RPOs which have signed Letters of Commitment regarding the long-term operation of ACTRIS infrastructure provided that ACTRIS-D is selected for the National Roadmap for Research Infrastructures. Nine RPOs have signed Letters of Intent to support the ESFRI Roadmap process.
- The application for the National Roadmap for Research Infrastructures is under evaluation. The ACTRIS-D application received a very good scientific assessment. Economic and political assessment is pending (expected publication of the National Roadmap in spring 2018).

www.leibniz-gemeinschaft.de/en/infrastructures/leibniz-roadmap-for-research-infrastructures/actris/
www.tropos.de/en/research/projects-infrastructures-technology/coordinated-observations-and-networks/actris/

Funding for ACTRIS

- German RPOs have invested about 30 million Euro for setting up research infrastructure related to ACTRIS in the last 10 years and spend about 3.5 million Euro per year for maintaining and operating German ACTRIS facilities. ACTRIS-D has applied for a substantial upgrade in the course of the National Roadmap process.
- Long-term funding for the German CF units will be applied for at the ministries. Thus funding of CF units is not secured yet. Long-term operational funding of NFs is committed by the RPOs for the existing facilities and will also be provided by the RPOs in case that the substantial upgrade of NFs proposed in the ACTRIS-D application for the National Roadmap for Research Infrastructures will be granted.

Users of ACTRIS

- ACTRIS-D data are used for assimilation purposes, model development and evaluation (e.g., by DWD, for EURAD model CAMS, for ICON and ICON-ART)
- ACTRIS-D observation sites contribute to global and regional networks of GAW and EMEP
- ACTRIS-D observation sites serve as calibration and validation stations for satellite data (e.g., by DLR, ESA, Copernicus, NASA)
- ACTRIS-D facilities are used by German universities for research and education purposes (e.g., by Technische Universität Bergakademie Freiberg, Universität Leipzig, Technische Universität Darmstadt)
- ACTRIS-D offers services for and collaborates with federal and regional environment agencies (e.g., Umweltbundesamt; Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie; Landesamt für Umwelt Brandenburg; Landesamt für Umwelt, Naturschutz und Geologie Mecklenburg-Vorpommern) and with governmental institutions (e.g., Sachsenforst; Staatliche Betriebsgesellschaft für Umwelt und Landwirtschaft; Land Berlin, Senatsverwaltung für Stadtentwicklung und Umwelt; Staatliches Gewerbeaufsichtsamt Hildesheim)

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- ACTRIS-D offers services for and collaborates with SMEs active in meteorological and air-quality sensor technology (e.g., ECO PHYSICS GmbH, München; Metek GmbH, Elmshorn; Licel GmbH, Berlin; G. Lufft Mess- und Regeltechnik GmbH, Fellbach; Radiometer Physics GmbH, Meckenheim; Vaisala GmbH, Bonn)
- DWD and Federal Ministry of Transport and Digital Infrastructure are users of the volcanic ash observations by the DWD high- and low-power lidars which are linked to the ACTRIS activities on aerosol remote sensing

ACTRIS-Greece

Finokalia Atmospheric Observatory, Greece

National ACTRIS coordinator and contact person:
Nikolaos Mihalopoulos
University of Crete and National Observatory of Athens

Membership status in the Interim ACTRIS Council
- Member

Nominated representatives:
- Dr. Vassilis Amiridis (National Observatory of Athens)
- Ms. Maria Koutrokoi, MSc , GR's delegation member to ESFRI & RIs Programme Committee, Ministry of Education, Research and Religious Affairs

Ministries and other possible funding organisations supporting ACTRIS
- Ministry of Education, Research and Religious Affairs
- Hellenic Foundation for Research and Innovation
- Ministry of Environment, Energy and Climate Change
- Universities (University of Crete, Aristotle University of Thessaloniki, National Technical University of Athens, University of Patras)
- Research Centers (National Observatory of Athens (NOA), National Center for

Scientific Research Demokritos (NCSR), Foundation for Research and Technology Hellas (FORTH))
- Regional Authorities (Region of Attica, Region of Crete, Region of Western Greece, Region of Central Macedonia, Region of Ipirus)
- European Commission
- European Space Agency
- Other exceptional funding contributors (e.g., SMEs, Public Benefit Foundations)

Research performing organisations in the national ACTRIS consortium
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- Aristotle University of Thessaloniki (AUTH). Contact: Prof. Dimitris Balis (balis@auth.gr).
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- University of Ioannina (UoI). Contact: Prof. Nikolaos Hatzianastassiou (nhatzian@cc.uoi.gr)
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- Demokritus University of Thrace (DUTH). Contact: Prof. Konstantinos Kourtidis (kourtidi@env.duth.gr)
- University of Aegean (UoAegean). Contact Prof. Christodoulos Pilinis (xpil@aegean.gr)
- National Kapodistrian University of Athens (NKUA). Contacts: Prof. Panagiotis Nastos (nastos@geol.uoa.gr), Eleni Giannakaki (elina@phys.uoa.gr)

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing
- **Finokalia Observatory**. Located on Crete Island, Finokalia is a regional background site in operation since 1993, for in situ aerosol measurements, greenhouse gases, reactive trace gases, ozone, radiation and column measurements of aerosols (sun photometer) and aerosol profiling (multi-wavelength Raman lidar).
- **Helmos Observatory.** Located at Helmos mountain (Peloponnese) is a background atmospheric site in the free troposphere for in situ measurements of aerosols, greenhouse gases, reactive trace gases, ozone and radiation.

- **NEO observatory.** Located at Navarino (Peloponnese) is a regional background site for in situ measurements of aerosols, ozone and radiation.
- **Demokritus-Athens** sub-urban background site with for in situ measurements of aerosols.
- **NOA-Athens** urban background site with for in situ measurements of aerosols, reactive trace gases, ozone, radiation and column measurements of aerosols (sun photometer) and aerosol profiling (ceiliometer)
- **Zografou-Athens**, sub urban site for aerosol column measurements (sun photometer) and aerosol profiling (multi-wavelength Raman lidar)
- **AUTH-Thessaloniki**, urban site for aerosol column measurements (sun photometer) and aerosol profiling (multi-wavelength Raman lidar)

Planned
- **Antikythera-supersite**. Regional background site for in situ aerosol measurements, greenhouse gases, reactive trace gases, ozone, radiation and column measurements of aerosols (sun photometer), aerosol and cloud profiling (multi-wavelength Raman lidar, cloud radar, microwave radiometer)

Exploratory platforms (mobile platforms and measurement chambers)

Existing
- FORTH laboratory atmospheric simulation chamber equipped with advanced instrumentation for measurement of trace gases and aerosols.
- FORTH dual mobile atmospheric simulation chambers for the in-situ study of atmospheric chemical processes using nearly real conditions equipped with advanced instrumentation for measurement of trace gases and aerosols.
- Mobile units of NOA and FORTH for in situ aerosol, reactive trace gases and ozone measurements.

The status of national ACTRIS consortium

Several Greek institutions, both Universities and Research Performing Organizations, work on ACTRIS related research activities since about 20 years within several research and collaboration projects. ACTRIS-GR is on the Greek National Roadmap since 2016 under the name PANACEA. It will be enter soon in its preparation phase and the consortium agreement, will be signed until mid- 2018. The ACTRIS-GR foreseen, as a governance body, the General Assembly and a coordination team for a day-to-day activities managing.

Funding for ACTRIS

ACTRIS-GR has made already significant investments in the existing infrastructure (more than 5 M€ in the last 10 years). More investments are already expected in the frame of PANACEA or other ACTRIS related proposals (up to 3 mil. € between 2018-2020). ACTRIS-GR has invested also in human resources (more than 3 M€ the last 10 years) and will continue to do it in the following years (more than 1 M€ between 2018-2020).

In terms of operation costs, it is estimated that for all fully developed ACTRIS-GR facilities, the annual operation cost is about 0,7 M€. These costs will be covered partially by the state through salaries to the permanent staff (expected: more than

0.5 M€ annually) and partially as in-kind contribution from the RPOs (expected: 0.2 M€ annually). The funding program for the operation phase is not yet in place.

Users of ACTRIS

The following kind of ACTRIS users have been identified in Greece:

- By application of ACTRIS products
  - Climate modelling
  - Weather forecasting
  - Atmospheric environment modelling and forecast
  - Ecological research and monitoring
  - Health studies and epidemiology
  - Energy (solar energy)
  - Earth observation satellite community (atmospheric correction)

- By activity domain
  - Academic research
  - Meteorological agencies
  - Environmental ministries and agencies at national and regional levels
  - Health agencies
  - SMEs, including companies in a large span of sizes and activities

The number of people potentially using ACTRIS products in Greece is estimated to be around 70 in the academic domain and rest of fields, including industries and meteorological and environmental agencies, health agencies and policymakers at the national, regional and local levels.

ACTRIS-Ireland

Mace Head Atmospheric Research Station

National ACTRIS coordinator and contact person:
Colin O'Dowd
National University of Ireland, Galway (NUIG)

Membership status in the Interim ACTRIS Council
- No membership

Ministries and other possible funding organisations supporting ACTRIS
- Department of Communications, Climate Action and Environment (DCCAE)
- Department of Education and Skills
- Environmental Protection Agency (EPA)
- Irish Research Council (IRC)
- Science Foundation Ireland (SFI)

Research performing organisations in the national ACTRIS consortium
- National University of Ireland, Galway (NUIG)
- University College Cork (UCC)
- Met Éireann
- Environmental Protection Agency (EPA)

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Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

- Mace Head Atmospheric Research Station (NUIG)
- North Atlantic coastal GAW global station providing ground based and remote sensing measurements of aerosols, clouds and trace gases
- UCC Atmospheric Monitoring Station (UCC)
- Urban background site providing remote sensing measurements of aerosols (current) and ground based measurements of gases and aerosols (planned).
- Valentia Observatory (Met Éireann)
- North Atlantic coastal GAW regional station providing ground based and remote sensing measurements of aerosols and trace gases

Exploratory platforms (mobile platforms and measurement chambers)

- Irish Atmospheric Simulation Chamber (IASC) Facility (UCC)
- Investigations of gas and particle phase atmospheric processes

The status of national ACTRIS consortium

The ACTRIS-Ireland consortium is yet to be formalised. The two main participants (NUIG and UCC) are already part of ACTRIS and EUROCHAMP-2020. Discussions have been initiated with Met Éireann and plans to engage with the principal funding agencies (EPA, SFI, IRC), as well as the relevant government departments are in place. The aim is to secure a letter of intent signed by the ministries/funding agencies and prepare a Memorandum of Understanding between the consortium members.

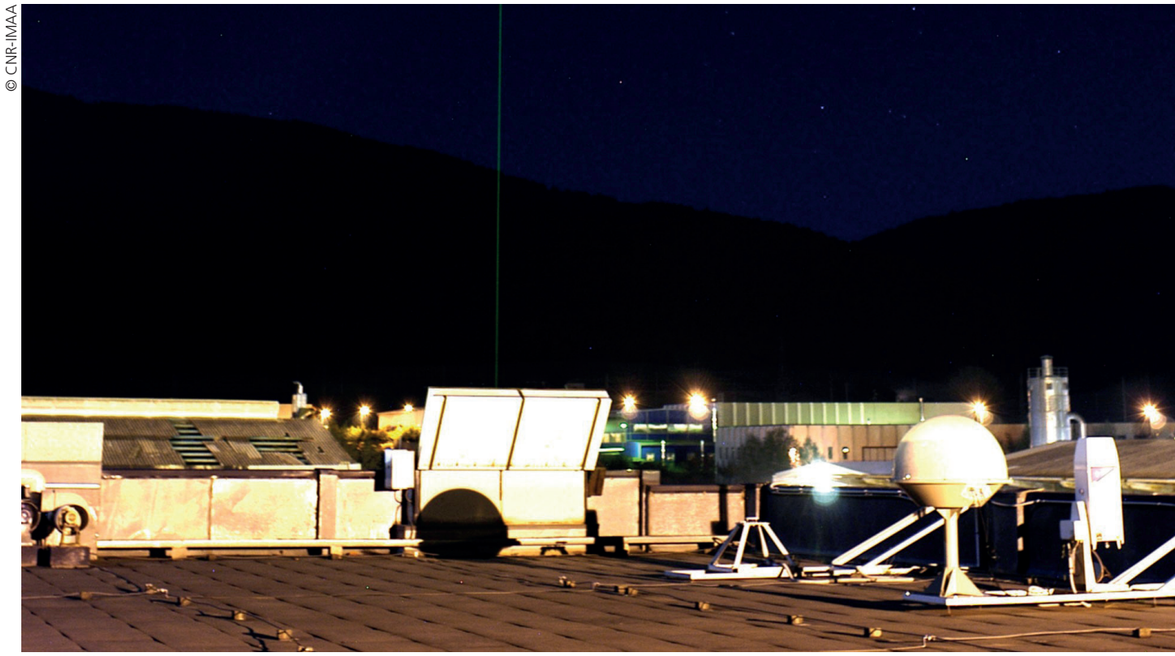
Funding for ACTRIS

ACTRIS/EUROCHAMP-2020 facilities in NUIG and UCC have already been supported by research infrastructure funding from EPA, Met Éireann and SFI. The respective institutions have also supported the research facilities in terms of equipment and staff. Continued operation of these facilities into the Implementation and Operational Phases of ACTRIS can only be ensured through the commitment of national funding agencies. This needs to be discussed.

Users of ACTRIS

- Researchers in various academic institutes across Ireland (DIT, TCD, NUIM).
- State organisations carrying out research in air quality and atmospheric modelling (EPA, Met Éireann).
- Local authorities interested in air quality data (City and county councils).
- Private sector companies (airlines, scientific instrument developers, air quality sensor companies).

ACTRIS-Italy



CIAO: CNR-IMAA Atmospheric Observatory located in Tito Scalo, Southern Italy

National ACTRIS coordinator and contact person:
Gelsomina Pappalardo
CNR-IMAA - Institute of Methodologies for Environmental Analysis of CNR

Membership status in the Interim ACTRIS Council

- Member

Nominated representatives:

- Salvatore La Rosa – Italian Ministry of Research and Education
- Grazia Pavoncello - Italian Ministry of Research and Education
- Gelsomina Pappalardo - National Research Council of Italy

Ministries and other possible funding organisations supporting ACTRIS

- Italian Ministry of Research and Education
- Italian Ministry of Economic Development
- Regions in which territory ACTRIS national and/or central facilities are located:
  - Abruzzo Region
  - Basilicata Region
  - Calabria Region
  - Campania Region
  - Emilia Romagna Region
  - Lazio Region

- Liguria Region
- Puglia Region
- Sicilia Region

Research performing organisations in the national ACTRIS consortium

- CNR - National Research Council of Italy - Gelsomina Pappalardo - **https://www.cnr.it/en**
- ENEA - Italian National Agency for New Technologies, Energy and Sustainable Economic Development – Giandomenico Pace - **http://www.enea.it/en**
- INFN – Italian National Institute for Nuclear Physics – Paolo Prati - **http://home.infn.it/en/**
- University "Federico II" of Naples – Nicola Spinelli - **http://www.unina.it/en_GB/home**
- University of L'Aquila – Vincenzo Rizi - **http://www.univaq.it/en/index.php?&lang_s=en**
- University of Salento – Maria Rita Perrone - **https://international.unisalento.it/**
- University of Urbino – Michela Maione - **https://www.uniurb.it/international**

Planned contribution to the ACTRIS Central Facilities

- Head Office: hosting SAMU
- Centre for Aerosol Remote Sensing: hosting LIDAR calibration center
- Data Center: hosting EARLINET data center
- Centre for Aerosol in-situ Measurements: hosting LABEC, the Ion Beam Analysis centre in Florence

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- **Mt Cimone with Po Valley facilities (CNR)** – The Italian Climate Observatory "O. Vittori" (CMN) is located on the top of Mt. Cimone (2165 m a.s.l.) and represents a strategic platform to study the chemical-physical characteristics and climatology of the free troposphere in the South Europe and North Mediterranean basin (**www.isac.cnr.it/cimone/**). The observations from Monte Cimone are integrated by the measurements across the Po Valley in urban and rural sites (Bologna and San Pietro Capofiume).
- **L'Aquila (UNIAQ/CETEMPS)** – Active and passive remote sensing for atmospheric aerosols monitoring and characterization.
- **Roma (CNR) – CIRAS** (CNR Isac Rome Atmospheric Supersite) gathers a unique ensemble of advanced instrumentation for atmospheric remote-sensing (aerosol, cloud and trace gases) in a semi-urban environment at the southern outskirts of Rome (http://www.isac.cnr.it/en/observatories).
- **Napoli (UNINA)** – Active and passive remote sensing for atmospheric aerosols monitoring and characterization. Physical characterization of aerosol in situ.

- **Potenza (CNR)** – CIAO (CNR-IMAA Atmospheric Observatory) represents a well-established ground-based remote-sensing observatory for the study of weather and climate. The observatory consists of a combination of advanced systems able to provide high quality long-term observations of aerosol and cloud properties (**www.ciao.imaa.cnr.it**).
- **Lecce (CNR and UNISal)** – Active and passive remote sensing for atmospheric aerosols monitoring and characterization and for the study of weather and climate. Chemical, physical, optical, and toxicological characterization of aerosol in situ.
- **Lamezia (CNR)** - Active and passive remote sensing for atmospheric aerosols monitoring and characterization. Chemical/physical characterization of trace gases and aerosol in situ. Organic and inorganic aerosol chemical composition.
- **Capo Granitola (CNR)** - At this Observatory, well representative of the western Sicily/central Mediterranean basin conditions, continuous atmospheric composition measurements are carried out.
- **Lampedusa (ENEA)** -The ENEA Station for Climate Observations "R. Sarao" on the island of Lampedusa is a research facility in the Mediterranean dedicated to measurements of climatic parameters operational since 1999 (**www.lampedusa.enea.it**).

Planned

Exploratory platforms (mobile platforms and measurement chambers)

Existing

- Genova (INFN) - ChAMBRe (Chamber for Aerosol Modelling and Bio-aerosol Research) is stainless steel atmospheric simulation chamber designed to study atmospheric processes involving mainly bio-aerosol (**https://labfisa.ge.infn.it/index.php/chambre**).

Planned

- (CNR) Mobile platforms for aerosol and cloud remote sensing and in situ observations.

The status of national ACTRIS consortium

Seven Italian institutions, both Universities and Research Performing Organizations, work on ACTRIS related research activities since about 15 years within several research and collaboration projects. National consortium has been recently organized as a Joint Research Unit named ***ACTRIS Italy*** (ACTRIS- IT) and has been formally established in October 2017. The ACTRIS-IT foreseen, as a governance body, the ***General Assembly***, that will be established in the first part of 2018 and is the major decision body, and a coordination team for a day-to-day activities managing. ACTRIS-IT will have a multi-annual activity plan as well as a financial plan. All the parties of the JRU will contribute in terms of human and instrumental resources.

ACTRIS is present in PNIR, the national research infrastructure roadmap, on-line at **www.ponrec.it/media/388972/pnir.pdf.**

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The Italian National Research Infrastructure Program (PNIR) indicates: (a) the objectives of the realization and management of national research infrastructures of national research and of its international competitiveness; (b) the resources that the Country undertakes to invest, until 2020, as a co-financing for the realization, development and consolidation of a national IR network; (c) the criteria for defining access priorities for public resources.
www.actris.it

Funding for ACTRIS

ACTRIS activities in Italy is funded based on the principle of synergies between the different Union funds as encouraged from the European Commission to amplify the research and innovation investments and their impact. The EU collaboration and strategic preparation and implementation is funded at EU level (i.e. ACTRIS-PPP, ACTRIS2, EUROCHAMP2020), as well as for future operation of the RI. The realization and upgrade of the facilities is in charge of National funds through the National Research and Education Ministry public calls on Research Infrastructures. Local ESIF fund is foreseen to cover the activities with a major local impact as well as innovation actions and connection with SMEs to support innovative ideas further along the innovation cycle or value chain to bring them to the market.

A strong contribution of about 60% is based on the contribution of all the RPOs involved by putting efforts and human and instrumental resources to ACTRIS related activities for both implementation and operation.

Users of ACTRIS

Italian user communities is primary composed by a large number of researchers working on atmospheric research, weather forecasting modeling, climate modeling, modeling of the atmospheric environment, satellite calibration and validation programme, air quality monitoring, as well as Educational/outreaching activities. The policy makers representing user for ACTRIS are at first national governance in his different expressions: Ministry of Research and Education, Ministry of Environment, Ministry of Economic Development, National Agency of Aerospace, the regional agencies for environmental monitoring and so on. This user community is more related to the information content of ACTRIS data that can be used as a decision or regulatory support. However, to fulfill this objective a long collaboration to introduce this in a formalized manner within the policy makers institutional activities is foreseen.

Industrial sector, especially SMEs, represents a large user community that can benefit from data but also from the access to knowledge and facilities. The linkage with this community will trigger the value chain from research to innovation. Finally, the media is an essential part of ACTRIS Italy user strategy as the tool to reach the general public to contribute to reinforce the public awareness of the public utilities of ACTRIS activities, data and related information.

Consiglio Nazionale delle Ricerche

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

UNIVERSITÀ DEGLI STUDI DE L'AQUILA

INFN
Istituto Nazionale di Fisica Nucleare

UNIVERSITÀ DEL SALENTO

1506 UNIVERSITÀ DEGLI STUDI DI URBINO CARLO BO

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

ACTRIS-The Netherlands

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CESAR site

National ACTRIS coordinator and contact person:
Arnoud Apituley
Royal Netherlands Meteorological Institute (KNMI)
Herman Russchenberg
Technical University Delft

Membership status in the Interim ACTRIS Council
- Member

Nominated representative:
- Prof.dr. Gerard van der Steenhoven, Director General, Royal Netherlands Meteorological Institute (KNMI), De Bilt, The Netherlands

Ministries and other possible funding organisations supporting ACTRIS
- Ministry of Infrastructure and Water Management, Directorate-General for the Environment and International Affairs (DGMI)
- Ministry of Education, Culture and Science
- The Netherlands Organisation for Scientific Research (NWO)
- Ministry of Economic Affairs and Climate Policy

Research performing organisations in the national ACTRIS consortium (research organisations foreseen to host ACTRIS national and/or central facilities)

The following institutes work together under a collaboration agreement and jointly operate the Cabauw Experimental Site for Atmospheric Research (CESAR), **http://www.cesar-observatory.nl**, which is hosted by KNMI.

Royal Netherlands Meteorological Institute (KNMI)
Contact: Ir. Arnoud Apituley
www.knmi.nl

Delft University of Technology (TU-Delft)
Contact: Prof.dr.ir. Herman Russchenberg
www.tu-delft.nl

National Institute for Public Health and the Environment (RIVM)
Contact: Prof.dr.ir. Guus Velders
www.rivm.nl

Energy research Centre of the Netherlands (ECN)
Contact: Sjaak van Loo
www.ecn.nl

Netherlands Organisation for applied scientific research (TNO)
Contact: Ronald Albers
www.tno.nl

Wageningen University and Research (WUR)
Contact: Prof.dr. Maarten Krol
www.wur.nl

Utrecht University – Institute for Marine and Atmospheric Research (IMAU)
Contact: Prof.dr. Thomas Röckmann
www.uu.nl

European Space Research and Technology Centre (ESA-ESTEC)
Contact: Dr. Nicolas Floury
http://www.esa.int
Planned contribution to the ACTRIS Central Facilities

- Centre for Cloud Remote Sensing, development of cloud radar calibration techniques and their evaluation using the facilities at the Cabauw Experimental Site for Atmospheric Research (CESAR), **http://www.cesar-observatory.nl**
- Centre for Reactive Trace Gases Remote Sensing facilities for calibration and evaluation of UV-VIS remote sensing techniques at the Cabauw Experimental Site for Atmospheric Research (CESAR), **http://www.cesar-observatory.nl**

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- The Cabauw Experimental Site for Atmospheric Research (CESAR), **http://www.cesar-observatory.nl**. This site situated in the centre of The Netherlands hosts a range of cloud, aerosol and trace gas measuring instruments using a combination of in-situ, column integrated and remote sensing instruments. A notable feature is the 213 metre meteorological tower.

Exploratory platforms (mobile platforms and measurement chambers)

Planned

ACTRIS related exploratory platforms planned and requested in a proposal for the national roadmap for large scale research infrastructures.

- Instrumented van and trailer Used both in mobile mode or as temporary measurement station for campaigns for greenhouse gas and aerosol source mapping and fingerprinting, and evaluation and anchoring of aircraft measurements, satellite ground-truthing data.
- Transportable cloud profiler for dedicated campaigns at non-cloud profiling stations international campaigns (ACTRIS, ICOS) and intercalibration campaigns.

The status of national ACTRIS consortium

The ACTRIS consortium in The Netherlands has a formal collaboration agreement under the name of CESAR (Cabauw Experimental Site for Atmospheric Research). The collaborating parties are listed above. The CESAR facility has been placed on the National Roadmap for large scale scientific research infrastructures. In 2017 a proposal has been submitted in response to an infrastructure call for the National Roadmap. This proposal was submitted by the CESAR consortium, merged with the ICOS-NL consortium. The ICOS partners have signed declarations of intention to join the CESAR collaboration agreement if the roadmap proposal will be accepted.

Funding for ACTRIS

The total scale of funding for ACTRIS activities

- Capital cost so far in building ACTRIS infrastructure (CESAR) exceeds 10 M€. The Cabauw tower was built in 1972 and considerable investments have been added since.

Preliminary information on funding for annual operation and for construction, upgrade and implementation.

- Current funding for CESAR contributed by all partners together amounts to approximately 2M€ per year for data production, data quality assurance and submission, and maintenance of the site. These costs do not include investments or research. Some of the costs, but not all, are provided through short-term projects, in particular for the consortium members with Universities.
- A National Roadmap proposal has been submitted for ACTRIS-NL and ICOS-NL together for investments and exploitation for the next 10 years. In this proposal the consortium members commit to support the infrastructure for the next 10 years.

Users of ACTRIS

- The users of the ACTRIS-NL facilities in Cabauw are the CESAR partners, other national and international research institutes and private companies. CESAR participates in the ACTRIS-2 Trans National Access and has an access policy for visitors that can not apply in the framework of ACTRIS. Several long term collaborations exist with private companies at the site.
- For non-physical access, all measurements are publically available and have been used by scientists, policy makers and the general public since the start of the observations at Cabauw in 1972. The Cabauw data is well-known in the research community of use in Numerical Weather Prediction model validation.
- A particular use of the Cabauw site is for (large scale) field campaigns that have been conducted every one to two years for various subjects, including clouds and radiation research, air quality studies, application of satellite data and satellite validation. In September 2016, the Second Cabauw Intercomparison of Nitrogen Dioxide Measuring Instruments (CINDI-2), involving more than 100 researchers working on-site from 34 institutes around the world. In September 2017 the first Proton-transfer-reaction mass-spectrometer (PTR-MS) Intercomparison campaign in CABauw (PICAB) was held as part ACTRIS-2. 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 IMAU, using a custom manufactured gas standard.

ACTRIS-Norway

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Birkenes Observatory

National ACTRIS coordinator and contact person:
Cathrine Lund Myhre
NILU – Norwegian Institute for Air Research

Membership status in the Interim ACTRIS Council:
• Observer
Nominated representative:
• Åsa Alexandra Borg Pedersen, Norwegian Environment Agency

Ministries and other possible funding organisations supporting ACTRIS
- The Research Council of Norway
- NILU – Norwegian Institute for Air Research
- Norwegian Environment Agency
- Norwegian Meteorological Institute - Met.No

Potential funding supporting institutions in the future are
- Norwegian Defence Research Establishment
- Norwegian Ministry of Climate and Environment
- Norwegian Ministry of Education and Research
- University of Oslo

Research performing organisations in the national ACTRIS consortium
- NILU - Norwegian Institute for Air Research, **http://www.nilu.no**
- Norwegian Meteorological Institute, **http://met.no**

Planned contribution to the ACTRIS Central Facilities
ACTRIS Data Centre (DC), Norway (NILU) is planning to host and lead the ACTRIS Data Centre. The ACTRIS Data Center will consist of several topic data center units, and NILU aim to host one of these, namely the data center unit for all aerosol and trace gas in situ data. NILU will also host the ACTRIS Data Center portal which links all data centre units and provides access to all data from the infrastructure. Met.No will contribute to this work and production of higher level data and products.

ACTRIS National Facilities - Existing and/or planned ACTRIS observational platforms and exploratory platforms
All of the ACTRIS-Norway research facilities exist already. Upgrading of the facilities and instruments to be ACTRIS compliant as required.

Observation sites
Existing
- **Birkenes Observatory**, 58° 23'N, 8° 15'E, 190 m a.s.l., regional background site located in a forest area in southern part of Norway. Birkenes is an ACTRIS aerosol in situ measurement site for which data also supports other programs and RIs (EMEP, ICOS).
- **Zeppelin Observatory,** 78.91N, 11.89E, 474m, is hemispheric background site in the Arctic located at a mountain top at Svalbard. ACTRIS aerosol and trace gas in situ measurement site, for which data also supports other programs and RIs (EMEP, ICOS, AGAGE, AMAP and others).
- **Trollhaugen Observatory**, 72S, 2.5E, hemispheric background site in the Antarctica, continuous aerosol in situ measurement program, aim to comply with ACTRIS, but special procedures are required due to the extremely remote location.

The status of national ACTRIS consortium
A memorandum of understanding is signed between NILU and Met.No working actively on setting up ACTRIS in Norway. ACTRIS-Norway is not on the Norwegian Roadmap, but receives support from the Norwegian Reserach Coucil for Norwegian participation in preparation of research infrastructures on ESFRI Roadmap. This is support is for the period 2017-2019.

Funding for ACTRIS
- Costs of the Norwegian engagement in ACTRIS consist of national ACTRIS activities mainly maintaining measurements programs and national facilities, planning and implementation activities at the European level and development/construction of the Central Facility unit Norway plans to host.
- The ACTRIS Data Centre.

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Observatories and measurement programs are funded by various sources, mainly the following;

- Direct infrastructure funding from Norwegian ministry of Climate and Environment.
- Measurement programs funded through contracts with Norwegian Environment Agency
- NILU institutional funds

NILU is hosting e-infrastructure capacities, including data bases and data curation of ACTRIS data with shared solutions and infrastructures with other central programs, in particular, EMEP, GAW-WDCA, GAW-WDCRG, AMAP. This is funded by various sources now, mainly the following;

- NILU – Norwegian Institute for Air Research
- EMEP – European Monitoring and Evaluation Programme
- EU – H2020 through ACTRIS-2, ENVRIplus
- Other minor contributions

The total cost per year is ca 1 M€/year now for full e-infrastructure for in situ data in EBAS, including the ACTRIS data portal.

Users of ACTRIS

The Norwegian climate research community is the most frequent user of the national ACTRIS data. This community consists of a large number of governmental and private institutes and institutions, such as e.g. NILU, the Norwegian Meteorological Institute (Met.No), University of Oslo, Cicero, and includes modelers, experimental scientists and PhD students. National and international air quality assessments for National and International Environmental agencies are also based on ACTRIS data and are the ultimate user of ACTRIS activities by NILU and Met.No.

The Norwegian observatories are unique in their kind, considering their location and complexity of the measurements carried at the sites. Norway is also contributing with the Arctic component, the Zeppelin Observatory. Activities funded in ACTRIS contribute to a wide range of research projects and an increasing number of publications. ACTRIS data from the Norwegian sites Zeppelin and Birkenes is archived in EBAS (**http://ebas.nilu.no**), the topical data base for all ACTRIS aerosol and trace gas in situ data now. Since 2010, more than 13 000 downloads of time series from Zeppelin and Birkenes data were effectuated by 1800 different users. The users of ACTRIS data from Zeppelin and Birkenes stem from 40 countries worldwide.

ACTRIS-Poland

Warsaw

National ACTRIS coordinator and contact person:
Aleksander Pietruczuk
Institute of Geophysics Polish Academy of Sciences

Membership status in the Interim ACTRIS Council

- Member

Nominated representatives:

- Michal Rybinski, Ministry of Science and Higher Education Republic of Poland
- Aleksander Pietruczuk, Institute of Geophysics Polish Academy of Science
- Iwona S. Stachlewska, Faculty of Physics, University of Warsaw

Ministries and other possible funding organisations supporting ACTRIS

- Ministry of Science and Higher Education Republic of Poland

Research performing organisations in the national ACTRIS consortium

- Institute of Geophysics Polish Academy of Sciences, **www.igf.edu.pl**
- University of Warsaw, Faculty of Physics, **www.fuw.edu.pl**
- Institute of Environmental Engineering Polish Academy of Sciences, **www.ipis.pan.pl**
- Institute of Meteorology and Water Management National Research Institute, **www.imgw.pl**

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- Belsk (central Poland), rural site for aerosol remote sensing to be upgraded to aerosol in-situ measurements and trace gases, GAW/WMO Regional station, together with Warsaw station will be joint observatory for urban/sub-urban studies
- Warsaw (central Poland), urban site for aerosol remote sensing to be upgraded to aerosol in-situ measurements, together with Belsk station will be joint observatory for urban/sub-urban studies
- Raciborz (southern Poland), aerosol in-situ and aerosol remote sensing site operated by three consortium partners (IGF PAS, IEE PAS, IMWM NRI), site needs upgrade to fulfil planned minimum ACTRIS requirements

Planned

- Rzecin (western Poland) collocated site with planned ICOS (if ICOS succeed in Poland) to be equipped with aerosol remote and in-situ observation and/or cloud remote observations

and /or

- Diabla Góra (northern Poland), existing EMEP station, to be equipped with aerosol remote and in-situ observations
- Exploratory platforms (mobile platforms and measurement chambers)
- Planned mobile platform for aerosols measurements, mobile laboratory owned by IEE PAS to be upgraded to fulfil planned minimum ACTRIS requirements

The status of national ACTRIS consortium

- Consortium agreement signed between Institute of Geophysics PAS, Institute of Environmental Engineering PAS, Institute of Meteorology and Water Management NRI and University of Warsaw.
- Extension of existing consortium or reestablishment of new extended one is planned when a call for national roadmap upgrade and evaluation will be opened (expected at the beginning of 2018), whereby the potential candidates are:
  - Institute of Environmental Protection NRI (operator of Diabla Góra site)
  - Poznan University of Life Sciences (operator of Rzecin site)
  - University of Silesia in Katowice

Funding for ACTRIS

Costs of ACRIS in Poland are under estimation because of non-final shape of the consortium. Real costs could be estimated after call for national road map upgrade and evaluation.

Users of ACTRIS

- ACTRIS resources are used by current consortium members as well as by Poznan University of Life Sciences for scientific research and education.
- ACTRIS data will be used for atmospheric modelling (by universities and state agencies) after signing ACTRIS – CAMS agreement.

ACTRIS-Portugal

National ACTRIS coordinator and contact person:
Daniele Bortoli
Institute of Earth Sciences - University of Evora (ICT-UE)

Membership status in the Interim ACTRIS Council
- No membership

Country (national authority) contact persons:
- Prof. Miguel Castanho and Dr. Cristiana Leandro

Ministries and other possible funding organisations supporting ACTRIS
- Technology and Science Foundation (FCT)
- Commissions for Coordination of Regional Development (CCDRs)
- Ministério da Ciência, Tecnologia e Ensino Superior (MCTES)

For all: financial commitment to be confirmed

Research performing organisations in the national ACTRIS consortium

- Institute of Earth Sciences (University of Evora) (**http://www.ict.uevora.pt/?lang=en**)
  Contact: Daniele Bortoli - db@uevora.pt

- University of Aveiro (**https://www.ua.pt/**)
  Contact: Celia Alves - celia.alves@ua.pt

- University of Azores (**http://international.uac.pt/**)
  Contact: Paulo Fialho - fialho.paulo@gmail.com

- University of Beira Interior (**http://www.ubi.pt/en/)**
  Contact: Sandra Mogo - sipmogo@gmail.com

- LEPABE - Laboratory for Process Engineering, Environment, Biotechnology and Energy - LEPABE University of Porto (**https://paginas.fe.up.pt/~lepabe/**)
  Contact: Sofia Sousa - sofia.sousa@fe.up.pt

- IPMA - Instituto Portuguese do Mar e Atmosfera (**https://www.ipma.pt/en/index.html**)
  Contact: Pedro Viterbo - pedro.viterbo@ipma.pt

Planned contribution to the ACTRIS Central Facilities

Portugal is interested in contributing to ACTRIS Centre for Reactive Trace gases Remote Sensing, (UVVIS units for South Europe). The activities are planned to be shared with Italy, specifically with the CNR-ISAC (The Institute of Atmospheric Sciences and Climate).

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing sites

- **Observaty of Atmospheric Sciences**– Évora (**http://www.cge.uevora.pt/en/laboratobservat-mainmenu-101/fca-da-atmosfera-mainmenu-102**)

Localization and type: Évora, 38.56783° N, 7.91150° W, 293 m asl; background urban station

Observations: aerosols; CIMEL solar photometer (AERONET); Raman LIDAR PAOLI (PollyXT Type) (EARLINET); UV-VIS MAX-DOAS spectrometer (SPATRAM); meteorological station; Ceilometer CL31; HATPRO Microwave radiometer (MWR-net); spectral and broadband radiometers, Skycam; TEOM, Aerodynamic Particle Sizer (APS), Multi-Angle Absorption Photometer (MAAP); nephelometer.

in addition to the main observatory, the ICT team is also responsible for:

- **Observatory CdR**:
  Localization and type:: Cabo da Roca, 38.78333° N, 9.50000° W, 140 m asl.; costal
  Observations: aerosols; CIMEL solar photometer (AERONET)
- **Observatory of Sines:**
  Localization and type: Sines, 37.95402° N, 8.865486° W, 10 m asl.; costal
  Observations: UV and broadband solar radiation
- **Observatory of Alqueva:**
  Localization and type: Albufeira de Alqueva, 38.223542° N, 7.459495° W, 83 m asl.; rural background
  Observations: CO2 and water vapour fluxes; spectral reflectivity; infrared and broadband solar radiation; meteorological stations.
- **Mitra station:**
  Localization and type: Herdade da Mitra, 38°31'31.4"N, 8°00'59.8"W, 257 m asl.; rural background
  Observations: infrared and solar radiation; meteorological stations.

- **GOA-UVa in situ measurement station (http://webx.ubi.pt/~goa/)**
  Localization and type: Covilhã, 40.275N, 7.510W, 704 m asl., rural background

Observations:nephelometer TSI 3563; PSAP 3 wl; APS TSI 3321; CPC TSI 3022A; Oregon WMR928NX; AirVisual Node: https://airvisual.com/portugal/covilha ; uRAD monitor model A: https://www.uradmonitor.com ;-PM10/PM1.

- **Pico Mountain Observatory (http://pico-mt.mtu.edu/)**
  Localization and type: (38.0478N, 28.4038W), maritime background
  Observations: Aethalometer (AE31) for estimation of the black carbon mass concentration and aerosol absorption angstrom exponent.

Planned or upgrade sites

- **Observaty of Atmospheric Sciences– Évora:**
  upgrade of the PAOLI LIDAR system to extend the analyzed channels; acquisition of one doppler lidar, one lunar CIMEL, a new generation ceilometer, a PANDORA spectrometer and one FTIR spectrometer (Bruker EM27 2nd gen).
- **Pico Mountain Observatory:**
  acquisition of one raman LIDAR system, one doppler lidar, one lunar CIMEL, one Vaisala ceilometer, a UV-VIS MAXDOAS Spectrometer, one MAAP, one APS-TSI
- **Lisbon airport -**
  Doppler lidar station initially planned to study atmospheric turbolence.

Exploratory platforms (mobile platforms and measurement chambers)

- **Mobile Station for Air Quality Assessment:**
  Observations: in situ gas analyzers (O3, NOx, SO2, CO, VOCs); UV-VIS MAX-DOAS spectrometer meteorological station

The status of national ACTRIS consortium

Since 2009, the University of Evora through ICT (former CGE- Geophysics Centre of Evora) is the only Portuguese associated partner of the ACTRIS projects (ACTRIS, ACTRIS2, ACTRIS-PPP) Only in 2015, the Portuguese research institutions started to organize them self as a consortium and nowadays the Portuguese ACTRIS community is discussing with the decision makers about the setup of the consortium; there is not yet any MoU nor official consortium document established. ACTRIS is not inserted yet in the national Roadmap. The Portuguese Science Foundation is partially supporting national ACTRIS activities of the associated partner. A meeting with the Portuguese funding authorities to solicit support for ACTRIS is soon envisaged.

Funding for ACTRIS

Not possible to quantify yet: a meeting with the funding authorities is planned to get an idea about the available Portuguese financial support to ACTRIS.

Users of ACTRIS

The user communities in Portugal are:

- The scientific research community dealing with environmental questions and air quality
- The regional departments dealing with air quality
- The education sector
- The transport sector (air traffic in particular)
- The health sector

ACTRIS-Romania

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Mobile laboratory for atmospheric measurements during Pre-Tect campaign in Crete, Apr. 2017 – daytime observations of marine aerosols and clouds with the scanning UV polarization lidar

National ACTRIS coordinator and contact person:
Doina Nicolae
National Institute of R&D for Optoelectronics

Membership status in the Interim ACTRIS Council
- Member

Nominated representatives:
- Viorel Vulturescu, Ministry of Research and Innovation
- Doina Nicolae, National Institute of R&D for Optoelectronics

Ministries and other possible funding organisations supporting ACTRIS
- Ministry of Research and Innovation

Research performing organisations in the national ACTRIS consortium
- National Institute of R&D for Optoelectronics (INOE), Doina Nicolae, nnicol@inoe.ro, **http://environment.inoe.ro**
- "Babes-Bolyai" University of Cluj-Napoca (UBB), Nicolae Ajtai, nicolae.ajtai@ubbcluj.ro, **http://enviro.ubbcluj.ro/en/**
- "Al.I. Cuza" University of Iasi (UAIC), Sivliu Gurlui, sgurlui@uaic.ro, **http://spectroscopy.phys.uaic.ro/**
- "Dunarea de Jos" University of Galati (UGAL), Mirela Voiculescu, Mirela.Voiculescu@ugal.ro, **http://www.ecee.ugal.ro/index.html**
- National Institute of Aerospace Research "ELIE CARAFOLI" (INCAS), Andreea Calcan, boscornea.andreea@incas.ro, **http://www.incas.ro/**

Planned contribution to the ACTRIS Central Facilities
ACTRIS-RO plans to contribute to the Centre for Aerosol Remote Sensing with a Unit specialized in high-power aerosol lidars. This Unit is intended to host the optical characterization laboratory, a fixed and a mobile reference lidar, and training and hands-on facilities. The Unit will offer operation support to Aerosol remote sensing NFs, as well as specialized services to ACTRIS users.

Existing and/or planned ACTRIS observational platforms and exploratory platforms
Observation sites (stationary measurement sites)
Existing
- **RADO-INOE**, SE Romania:
  - Aerosol remote sensing (multiwavelength Raman lidar, sun/sky/lunar photometer)
  - Aerosol in situ measurements (Aerosol Chemical Speciation Monitor, Aethalometer 33, Aerodynamic Particle Sizer, Nephelometer, Condensation Particle Counters, Scanning Mobility Particle Sizer, Cloud Condensation Nuclei Counter)
- **RADO-UAIC**, NE Romania: Aerosol remote sensing (multiwavelength Raman lidar, sun/sky/lunar photometer)
- **RADO-UBB**, NW Romania: Aerosol remote sensing (multiwavelength Raman lidar, sun/sky photometer)

Planned
- **Upgrade of RADO-INOE** (SE Romania) to **MARS** (Magurele Atmosphere and Radiation Studies observatory), 20.000 sqm flat terrain, outdoor and indoor laboratories, focus on atmospheric composition (including Cal/Val of satellite missions) based on synergy of remote sensing and in situ measurement techniques
  - Aerosol remote sensing (automatic multiwavelength Raman lidar, sun/sky/lunar photometer)
  - Cloud remote sensing (Doppler cloud radar, scanning microwave radiometer, multiwavelength Raman lidar / ceilometer)
  - Reactive trace gases remote sensing (Pandora-2S, FTIR, Max-DOAS)
  - Aerosol in situ measurements (Aerosol Chemical Speciation Monitor, aethalometer, aerodynamic particle sizer, nephelometer, Condensation Particle Counters, Scanning Mobility Particle Sizer, Cloud Condensation Nuclei Counter)
  - Ancillary and complementary (wind lidar, radiation, bioaerosols, PMs monitor, eddy covariance, disdrometer, weather station)
- **Upgrade of RADO-UAIC** (NE Romania) to: Aerosol remote sensing (multiwavelength Raman lidar, sun/sky/lunar photometer)

- **Upgrade of RADO-UBB** (NW Romania) to:
  - Aerosol remote sensing (multiwavelength Raman lidar, sun/sky/lunar photometer)
  - Cloud remote sensing (cloud radar with LWP sensor included, multi-wavelength Raman lidar / ceilometer
- **New observation site** (E Romania): Cloud remote sensing (cloud radar with LWP sensor included, ceilometer)

Exploratory platforms (mobile platforms and measurement chambers)
Existing
- **EUROCHAMP atmospheric simulation chamber** at UAIC
- **ATMOSLAB** = airborne laboratories (UAVs, small research aircrafts) at INCAS, aerosol and cloud in situ instrumentation

Planned
- **Upgrade of ATMOSLAB** for implementation of a multiwavelength, multide-polarization High Spectral Resolution Lidar

The status of national ACTRIS consortium

ACTRIS-RO is organized as a consortium of institutions, with a MoU signed. The consortium includes RPOs that are potentially hosting NFs and CF Units, but also institutions that are ACTRIS users (Universities, public services, SMEs). ACTRIS-RO has been recently included on the national research infrastructure roadmap. ACTRIS-RO has applied for structural funds to build further its capacities. For example, MARS site has been approved and is currently under construction. Other applications are foreseen in the near future. The website of ACTRIS-RO is available at: **http://actris.ro/**

Funding for ACTRIS

ACTRIS-RO has made already significant investments in the existing infrastructure (5 mil. € between 2008-2016). More investments are already committed (8 mil. € between 2017-2019). Additionally, ACTRIS-RO intends to apply for the rest of 2 mil. € necessary to finalize the plans described above. ACTRIS-RO has invested also in the preparation of human resources (2 mil. € between 2008-2016) and will continue to do it in the following years (2 mil. € between 2017-2019).

In terms of operation cost, it is estimated that for all fully developed ACTRIS-RO facilities (NFs and CF), the annual operation cost is about 0.8 mil. €. These costs will be covered partially by the state (expected: 0.6 mil. € annually) and partially as in-kind contribution from the RPOs (expected: 0.2 mil € annually). The funding program for the operation phase is not yet in place.

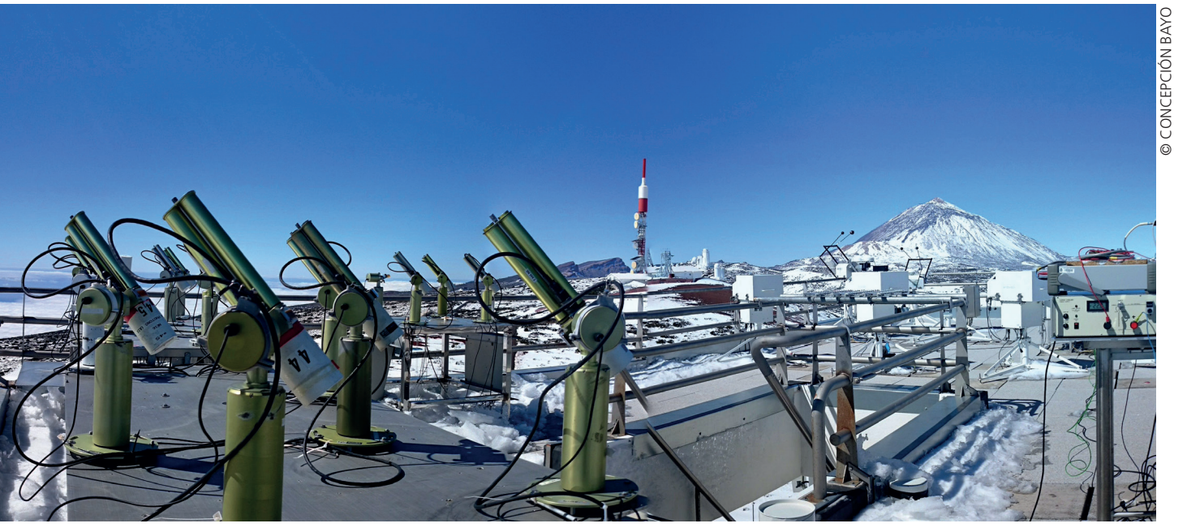
Users of ACTRIS

An important part of the ACTRIS users in Romania is represented by researchers from research institutes and universities (including PhD students). The number of users is difficult to estimate, considering that such institutions are the largest in Romania:
- National Institute for Research and Development for Optoelectronics
- National Institute of Aerospace Research "ELIE CARAFOLI"
- "Babes-Bolyai" University of Cluj-Napoca
- "Al.I. Cuza" University of Iasi
- "Dunarea de Jos" University of Galati
- University of Bucharest
- "Politehnica" University of Bucharest

However, there are also several institutions from the public service domain (aviation, space agency, weather forecast, risk management, environmental protection) or SMEs which have declared their interest towards ACTRIS data and ACTRIS services, e.g.:
- Romanian Air Traffic Services Administration
- Romanian Space Agency
- National Administration for Meteorology
- Centre for Risk and Hazard Management
- ENVIROSCOPY Romania
- INOESY Romania

Some of the above have also signed the ACTRIS-RO MoU. As a first estimation, there are: 7 institutions interested in using ACTRIS services, 8 institutions undertaking research based on ACTRIS data, and 3 institutions using ACTRIS data for other purposes than research.

ACTRIS-Spain



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Master photometers at the calibration centre of Izaña Atmospheric Station

National ACTRIS coordinator and contact person:
Adolfo Comerón
Universitat Politècnica de Catalunya
Amalia Muñoz
CEAM

Membership status in the Interim ACTRIS Council
- Member

Nominated representative:
- Inmaculada Figueroa Rojas, Ministry of Economy, Industry and Competitiveness

Ministries and other possible funding organisations supporting ACTRIS
- Ministry of Economy, Industry and Competitiveness
- Ministry of Agriculture and Fisheries, Food and Environment
- Department of Business and Knowledge, Regional Government of Catalonia
- Department of Territory and Sustainability, Regional Government of Catalonia
- Department of Economy and Knowledge, Regional Government of Andalusia
- Department of Education, Research, Culture and Sports, Regional Government of Comunitat Valenciana
- Department of Education and Research , Regional Government of Madrid
- Department of Education, Regional Government of Castilla y León
- Department of Economy, Industry, Commerce and Knowledge, Regional Government of the Canary Islands
- Agencia Estatal de Meteorología (AEMET)
- Agencia Estatal Consejo Superior de Investigaciones Científicas (CSIC)
- Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC)
- Instituto Interuniversitario de Investigación del Sistema Tierra en Andalucía – Universidad de Granada (IISTA-UGR)
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)
- Fundación de la Comunitat Valenciana Centro de Estudios Ambientales del Mediterráneo (CEAM)
- Instituto Nacional de Técnica Aeroespacial (INTA)
- Universidad Miguel Hernández (UMH)
- Universidad de Valladolid (UVA)
- Universitat de València (UV)
- Universitat Politècnica de Catalunya (UPC)

Research performing organisations in the national ACTRIS consortium
- Agencia Estatal Consejo Superior de Investigaciones Científicas (CSIC). Contact: Prof. Andrés Alastuey (andres.alastuey@idaea.csic.es), **http://www.idaea.csic.es/index.php?lang=en.**
- Agencia Estatal de Meteorología (AEMET). Contact: Dr. Emilio Cuevas (ecuevasa@aemet.es), Dr. Natalia Prats (npratsp@aemet.es), **http://izana.aemet.es/index.php?lang=en**
- Barcelona Supercomputing Center – Centro Nacional de Supercomputación (BSC). Contact: Dr. Carlos Pérez (carlos.perez@bsc.es), **https://www.bsc.es/**
- Instituto Interuniversitario de Investigación del Sistema Tierra en Andalucía – Universidad de Granada (IISTA-UGR). Contact: Prof. Lucas Alados-Arboledas (alados@ugr.es), **http://www.iista.es/en/**
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT). Contact: Dr. Begoña Artíñano (b.artinano@ciemat.es), Dr. Manuel Pujadas (manuel.pujadas@ciemat.es), **http://www.ciemat.es/**
- Fundación de la Comunitat Valenciana Centro de Estudios Ambientales del Mediterráneo (CEAM). Contact: Dr. Amalia Muñoz (amalia@ceam.es), **http://www.ceam.es/GVAceam/ceam_en/home.htm**
- Instituto Nacional de Técnica Aeroespacial (INTA). Contact: Dr. Margarita Yela (yelam@inta.es), **http://www.inta.es/opencms/export/sites/default/ATMOSFERA/en**
- Universidad Miguel Hernández (UMH). Contact: Prof. Javier Crespo (Jcrespo@umh.es), **http://www.umh.es/?lang=EN**
- Universidad de Valladolid (UVA). Contact: Prof. Victoria Cachorro (chiqui@goa.uva.es), Prof. Carlos Toledano (toledano@goa.uva.es), **http://goa.uva.es/**
- Universitat de València (UV). Contact: Prof. José Antonio Martínez-Lozano (Jose.A.Martinez@uv.es), Prof. José Luis Gómez-Amo (Jose.L.Gomez-Amo@uv.es), **https://www.uv.es/solar**
- Universitat Politècnica de Catalunya (UPC). Contact: Prof. Adolfo Comerón (comeron@tsc.upc.edu), **http://www.tsc.upc.edu/en/research/commsenslab**

Planned contribution to the ACTRIS Central Facilities

- Data Centre, Barcelona Supercomputing Center has potential future role in ACTRIS
- Centre for Aerosol Remote Sensing, calibration of sun/sky/moon photometers (AERONET-Europe): AEMET and UVA

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- Izaña Atmospheric Observatory (AEMET), Tenerife (Canary Islands), background atmospheric site in free troposphere (28.3°N, 16.5°W, 2.370 m asl), in situ and column measurements of greenhouse gases, reactive trace gases, ozone, radiation and aerosols (sun/moon photometer)
- CIEMAT-Madrid, urban background site in Iberian peninsula center (40.5°N, 3.7°W, 700 m asl), near-surface measurements of aerosols, and trace gases (DOAS),aerosol column measurements and aerosol profiling (multiwavelength Raman lidar)
- Barcelona Atmospheric Research cluster, three sites:
  - Barcelona, urban site (IDAEA-CSIC, UPC, 41.4° N, 2.1°E, 115 m asl), near-surface measurements of aerosols and trace gases, aerosol column measurements and aerosol profiling (multiwavelength Raman lidar and ceilometer)
  - Montseny, regional background (IDAEA-CSIC, 41.5°N, 2.2°E, 720 m asl), near-surface measurements of aerosols and trace gases
  - Montsec, remote background (IDAEA-CSIC, 42.05°N, 0.73°E, 1600 m asl), near-surface measurements of aerosols and trace gases, aerosol column measurements and aerosol profiling (ceilometer)
- IISTA – Universidad de Granada, two sites:
  - Granada, urban site (37.2°N, 3.6°W, 680 m asl), near-surface measurements of aerosols, aerosol column measurement (sun/moon/star photometer) aerosol and cloud profiling (multiwavelength Raman lidar, cloud radar, Doppler lidar, microwave radiometer, ceilometer)
  - Sierra Nevada, remote background mountain site (37.1 N; 3.4 W, 2550 m asl), near-surface measurement of aerosols and clouds, aerosol column measurement
- INTA, Atmospheric Sounding Station (ESAt), rural coastal background site (37.1°N, 6.7°W, 40 m asl), near-surface measurements of aerosols and trace gases, aerosol column measurement (solar/moon photometer), profiling of aerosol/clouds (lidar) and trace gases (MAX-DOAS)
- Universidad Miguel Hernández, two sites:
  - Aitana station, regional background mountain site (38.6°N, 0.25 °W; 1558 m asl), near-surface measurement of aerosols and trace gases, aerosol column measurements.
  - Elche, urban site (38.4° N; 0.5° W, 80 m asl), near-surface measurement of aerosols and trace gases.

- Universidad de Valencia, two sites:
  - Burjassot, urban site (39.5°N, 0.42°W, 60 m asl), near-surface and column measurement of aerosols and aerosol profiling (Raman lidar, ceilometer)
  - Aras de los Olmos, remote background mountain site (39.9°N, 1.1°W, 1300m asl), near-surface and column measurement of aerosols

Planned

- Universidade da Coruña, urban background site in Atlantic coast (43.3°N, 8.4°W, 140 m asl), near-surface measurement of aerosols.

Exploratory platforms (mobile platforms and measurement chambers)

Existing

- EUropean PHOto-Reactor (EUPHORE, CEAM, member of EUROCHAMP-2020). Outdoor chamber for the study of atmospheric chemical processes simulating nearly real conditions equipped with advanced instrumentation for measurement of trace gases, radicals and aerosols (DOAS, FTIR, FAGE, SMPS, TEOM, PTRMS, GC-MS, LCMS/MS, Radiometers, etc.

The status of national ACTRIS consortium

ACTRIS-Spain (**http://www.bsc.es/actris/en**) is currently organized under a Memorandum of Understanding signed by 11 RPOs, namely:

- Agencia Estatal Consejo Superior de Investigaciones Científicas (CSIC)
- Agencia Estatal de Meteorología (AEMET)
- Barcelona Supercomputer Center - Centro Nacional de Supercomputación (BSC)
- Instituto Interuniversitario de Investigación del Sistema Tierra en Andalucia. Universidad de Granada (IISTA-UGR)
- Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)
- Fundación de la Comunitat Valenciana Centro de Estudios Ambientales del Mediterráneo (CEAM)
- Instituto Nacional de Técnica Aeroespacial (INTA)
- Universidad Miguel Hernández (UMH)
- Universidad de Valladolid (UVA)
- Universitat de València (UV)
- Universitat Politècnica de Catalunya (UPC)

The Spanish National Research Infrastructure Roadmap does not exist at present, but the Ministry of Economy, Industry and Competitiveness, from which research infrastructures depend, has expressed its interest in ACTRIS by providing a letter of intent to the coordinator of the ESFRI proposal. In addition, the RPOs have also provided letters committing in-kind support.

Funding for ACTRIS

The level of investment already devoted to reach the present ACTRIS-Spain capacities is estimated in around 16 M€ (without taking into account all the housing

investments) aggregated for all the signatories of MoU.

The annual funding that the MoU members are attracting for maintaining and upgrading the infrastructure is estimated in 2 M€.

The estimated annual operation cost is also around 2 M€ including in-kind contributions.

Users of ACTRIS

The following kind of ACTRIS users have been identified in Spain:

By application of ACTRIS products

- Climate modelling
- Atmospheric environment modelling and forecast
- Ecological research and monitoring
- Health studies and epidemiology
- Energy (solar energy)
- Earth observation satellite community (atmospheric correction)
- Aerial navigation

By activity domain

- Academic research
- Meteorological agencies
- Environmental ministries and agencies at national and regional levels
- Natural resources ministries and agencies at national and regional levels
- Health agencies
- Industrial users, including companies in a large span of sizes and activities

Present known users include

- climate modelling and atmospheric environment modelling and forecast research groups at Universidad Complutense de Madrid and Universidad Politécnica de Madrid
- several departments at the Meteorological Agency of Spain (AEMET)
- the environmental agency of the Castilla y León Regional Government,
- a health studies and epidemiology group at the research institute of biomedical studies Instituto de Salud Carlos III.

It is reasonably considered that future users can include councils of major Spanish cities, departments with responsibilities in environment, public health, agriculture and food at national and regional levels (besides those already mentioned), as well private companies, especially, but not only, in the energy sector (electricity, gas, oil, etc.).

Some international communities, such as those reached by the WMO's Sand and Dust Storm Warning Advisory and Assessment System (SDS-WAS) Regional Northern Africa-Middle East-Europe (NA-ME-E) Regional Center, under the responsibility of AEMET and BSC, are also potential users of ACTRIS products with high probability.

The number of people potentially using ACTRIS products in Spain is estimated to be 300 in the academic domain and 700 in the rest of fields, including industries and meteorological and environmental agencies, health agencies and policymakers at the national, regional and local levels.

ACTRIS Sweden

Hyltemossa Station

National ACTRIS coordinator and contact person:
Erik Swietlicki
Lund University

Membership status in the Interim ACTRIS Council
- No membership

Ministries and other possible funding organisations supporting ACTRIS
- Swedish Research Council (no funding commitment)
- Swedish Environment Protection Agency
- Lund University
- Stockholm University
- Gothenburg University
- Swedish University of Agricultural Sciences
- Swedish Meteorological and Hydrological Institute SMHI
- Uppsala University
- Swedish private foundations

There is currently no funding from Swedish ministries or research funding organizations explicitly earmarked as ACTRIS. The Swedish Environment Protection Agency funds some ACTRIS-related measurements at two ACTRIS sites since more than 10 years, mostly motivated by air quality issues. The participating RPOs fund ACTRIS-related activities at sites across Sweden, to varying degrees.

Research performing organisations in the national ACTRIS consortium
- Lund University, Erik Swietlicki, erik.swietlicki@nuclear.lu.se, **www.lu.se**
- Stockholm University, Hans-Christen Hansson, HansChristen.Hansson@aces.su.se, **www.su.se**
- Gothenburg University, Mattias Hallquist, mattias.hallquist@gu.se, **www.gu.se**
- Swedish University of Agricultural Sciences, Mats B Nilsson, Mats.B.Nilsson@slu.se, **www.slu.se**
- Swedish Meteorological and Hydrological Institute SMHI, Anke Thoss, Anke.Thoss@smhi.se, **www.smhi.se**
- Uppsala University, Anna Rutgersson, Anna.Rutgersson@met.uu.se, **www.uu.se**

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing
- Hyltemossa (56°06'N, 13°25'E, 115 m asl), operated by Lund University, co-located ICOS-ACTRIS site in southern Sweden. Combined ICOS atmosphere and ecosystem tall-tower station. Main focus of ACTRIS activity; ground-based aerosols observations.
- Norunda (60°05'N, 17°29'E, 46 m asl), co-located ICOS-ACTRIS site north of Stockholm. Combined ICOS atmosphere and ecosystem tall-tower station. ACTRIS activities operated by Stockholm University, ICOS activities operated by Lund University. Main focus of ACTRIS activity; ground-based aerosols observations.

The two previous ACTRIS sites at Vavihill (Lund University) and Aspvreten (Stockholm University) will be dismantled by spring 2018 and replaced with Hyltemossa and Norunda.

Planned and potential future ACTRIS sites

More Swedish sites are planned for future operations, once long-term funding is secured. Potential candidates for ACTRIS sites are listed below. All of these are already existing (ICOS Sweden or SITES).
- Svartberget (64°15'N, 19°46'E, 270 m asl) 60 km west of Umeå in northern Sweden. Combined ICOS atmosphere and ecosystem tall-tower station. Currently no ACTRIS activities.

- Abisko-Stordalen (68°21'N, 19°03'E, 360 m asl, in sub-Arctic sporadic permafrost zone in northern Sweden). ICOS ecosystem station. Currently no ACTRIS activities.
- Östergarnholm (57°26'N, 18°59'E) Baltic coastal 4 km from the eastern coast of Gotland. ICOS planned combined ecosystem and oceanic station. Currently no ACTRIS activities.
- Skogaryd (58°23'N, 12°09'E, 75 m asl) southern Sweden 100 km north of Gothenburg. Part of the Swedish SITES network. Currently no ACTRIS activities.

The status of national ACTRIS consortium

ACTRIS Sweden is formally established (Memorandum of Understanding), involving Lund University, Stockholm University, Gothenburg University, Swedish University of Agricultural Sciences, Swedish Meteorological and Hydrological Institute, and Uppsala University.

Since we are co-locating with ICOS at several sites in Sweden, we aim to integrate extensively with the ICOS Sweden management structure. The links between ICOS Sweden and ACTRIS Sweden remain to be formalized. A major change in organization will be the establishment of a separate ACTRIS Sweden Coordination Office, assuming responsibilities and duties for all ACTRIS-related activities at the selected sites. This office may be co-located with the ICOS Sweden Coordination Office at Lund University. The ACTRIS Sweden Coordination Office will be led by a Director assisted by a Science Officer or similar, both experienced in ACTRIS activities. The current ICOS Board may be modified or enlarged to ensure that competences within all the research fields that are addressed by ACTRIS are also well represented. The Board is responsible for the economy and the overall and long-term strategy of ICOS-ACTRIS Sweden.

ACTRIS Sweden is on the Swedish national roadmap for research infrastructures. Following the previous comprehensive inventory of Swedish national research infrastructure needs during 2015-2016, the Swedish Research Council (VR) ranks ACTRIS Sweden as belonging to group A2, the second highest infrastructure priority group. One requirement from VR before upgrading ACTRIS to the highest A1 priority group (with permission to apply for research infrastructure funding) involves close collaboration between ACTRIS and ICOS.

We are engaged in the next 2-year (2017-2019) cyclic inventory process for Swedish national research infrastructure funding through which we will hopefully be able to secure 50% of the required funding for ACTRIS Sweden activities from the Swedish Research Council, the remainder to be provided from the participating Swedish research-performing organizations. For this bid, we are already prioritized by four Swedish universities; Lund University, Stockholm University, Gothenburg University and the Swedish University of Agricultural Sciences. If prioritized (group A1), ACTRIS Sweden will be permitted to submit a proposal for funding in March 2019, with funding starting earliest January 2020.

Web: **www.actris.se**. See also **http://www.icos-sweden.se/index.html** and **http://www.fieldsites.se/en-GB**.

Funding for ACTRIS

In Sweden, ACTRIS researchers at Lund University and Stockholm University have conducted aerosol measurements since 2000 at the two previous Swedish ACTRIS sites at Vavihill (southern Sweden) and Aspvreten (south of Stockholm). During 2017, researchers at these universities are moving their ACTRIS activies to co-locate with the ICOS Sweden observations at the tall tower sites at Hyltemossa in southern Sweden and Norunda outside Uppsala. In doing so, ACTRIS benefits significantly from the infrastructure already constructed by ICOS in terms of on-site housing and laboratory space, towers, electricity, internet and roads. As an example, the costs for building up the entirely new Hyltemossa station during 2010-2016 amounts to 1.5 MEUR only for direct investments, excluding salaries, running costs and indirect costs. Similar investments have also been made at the two other ICOS tall tower and combined atmospheric/ecosystem sites at Norunda and Svartberget. All these three ICOS sites are now fully operational. In addition to these direct financial co-benefits, the ICOS observations that are now performed on meteorology, boundary layer structure and ecosystem conditions are essential also for ACTRIS.

The cost for procuring and installing equipment over the initial 5 year period amounts to approximately 2.0 MEUR for each ACTRIS site (Hyltemossa, Norunda, Svartberget), the exact sum depending on the level of ambition for the ACTRIS observations. Each site requires at least 1 FTE research engineer (75 kEUR/year) for setting up and servicing the instruments. Management staff (ACTRIS Sweden Head Office) is an estimated additional 150 kEUR/year (part-time coordinator, Scientific Officer). In addition 75 kEUR/year for other direct costs such as travel, workshops, courses, Advisory Board etc. In total, ACTRIS Sweden is estimated to cost 1.5 MEUR/year for the first 5 years pre-operation phase.

Users of ACTRIS

The co-located ICOS-ACTRIS research infrastructure addresses a wide range of Earth system sciences, including atmospheric research, climate science, ecosystem science, meteorology, hydrology, limnology, biology, forestry etc).

At the Universities in Lund, Stockholm and Gothenburg and at SMHI, several of the researchers in these areas of science are involved in the Strategic Research Areas (SRA) MERGE (http://www.merge.lu.se/); Bolin Centre for Climate Research (BBCC; http://www.bolin.su.se/) and BECC (http://www.becc.lu.se/). These SRA are developing climate and Earth system models (MERGE, BBCC) with a strong coupling to biodiversity and ecosystem services (BECC).

To these strong research communities, ACTRIS provides data that are used for model development and verification across a wide range of temporal and spatial scales, going from detailed atmospheric chemistry and aerosol dynamics models to Earth system models such as EC-Earth.

In Sweden, several stakeholders and practitioners would benefit from the ACTRIS RI and data:

Governmental agencies

- Swedish Environmental Protection Agency (air quality and climate)
- Swedish Meteorological and Hydrological Institute (climate change and meteorology)
- Swedish Energy Agency (sustainable energy production)

- Swedish Forest Agency (climate change and forest management, forest fires, etc.)
- Swedish Board of Agriculture (climate change and agriculture etc.)
- Swedish Civil Contingencies Agency MSB (climate change, forest fires, etc..)
- LFV Group (air navigation services and volcanoes)
- Swedish Transport Agency (air traffic and volcano plumes, climate change and transport etc.)

Private sector, research institutes:
- Selection of Swedish research institutes that would benefit from the ACTRIS RI and data:
- IVL Swedish Environmental Research Institute
- Swedish Geotechnical Institute (SGI)
- Geological Survey of Sweden (SGU)

Political:
- Swedish Government and Parliament (basis for decision-making)
- Swedish Ministry of the Environment
- Ministry of Education and Research
- Ministry of Enterprise, Energy and Communications
- Permanent Representation of Sweden to the EU
- Swedish regional and local (municipalities) authorities.

Industry:
- Hydropower, energy production sector, insurance sector, forest sector, wood and paper industry, tourism.

ACTRIS-Switzerland

High Altitude Research Station Jungfraujoch, Switzerland

National ACTRIS coordinator and contact person:
Urs Baltensperger
Paul Scherrer Institute

Membership status in the Interim ACTRIS Council
- Member

Nominated representatives:
- Regine Röthlisberger, Federal Office for the Environment, Climate Division
- Urs Baltensperger, Laboratory of Atmospheric Chemistry Paul Scherrer Institute
- Stefan Reimann, Empa - Laboratory for Air Pollution and Environmental Technology

Ministries and other possible funding organisations supporting ACTRIS
- State Secretariat for Education, Research and Innovation, SERI, **https://www.sbfi.admin.ch/sbfi/en/home.html**
- Swiss Federal Office for the Environment FOEN (BAFU), Dr. Richard Ballaman, richard.ballaman@bafu.admin.ch, **https://www.bafu.admin.ch/bafu/en/home.html**

- MeteoSwiss, Prof. Bertrand Calpini, Bertrand.Calpini@meteoswiss.ch, **http://www.meteoswiss.admin.ch/home.html?tab=overview**
- Swiss National Science Foundation, **http://www.snf.ch**

Research performing organisations in the national ACTRIS consortium

- Paul Scherrer Institute, Prof. Urs Baltensperger, urs.baltensperger@psi.ch, **https://www.psi.ch/**
- Swiss Federal Laboratories for Materials Science and Technology (Empa), Dr. Brigitte Buchmann, Brigitte.Buchmann@empa.ch, **https://empa.ch/web/empa**
- University of Bern, Prof. Markus Leuenberger, Prof. Niklaus Kaempfer, leuenberger@climate.unibe.ch, niklaus.kaempfer@iap.unibe.ch, **http://www.unibe.ch/**
- International Foundation High Altitude Research Stations Jungfraujoch and Gornergrat (HFSJG), Prof. Markus Leuenberger, Prof. em. Silvio Decurtins, leuenberger@climate.unibe.ch, silvio.decurtins@dcb.unibe.ch, **https://www.hfsjg.ch/en/home/**
- MeteoSwiss, Prof. Bertrand Calpini, Bertrand.Calpini@meteoswiss.ch, **http://www.meteoswiss.admin.ch/home.html?tab=overview**
- Physikalisch-Metorologisches Observatorium Davos (PMOD), Dr. Julian Gröbner, Julian.groebner@pmodwrc.ch, **https://www.pmodwrc.ch/**
- ETH Zurich, Prof. Ulrike Lohmann, ulrike.lohmann@env.ethz.ch, **https://www.ethz.ch/**

Planned contribution to the ACTRIS Central Facilities

- Centre for Reactive Trace Gases in-situ Measurements

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing

- Jungfraujoch, High Altitude research station, Swiss Alps, 3580 m asl, Comprehensive programs in in situ gas phase and aerosol parameters as well as remote sensing, https://www.hfsjg.ch/en/home/

Planned

- Observation site at MeteoSwiss Payerne, 491 m asl, current focus on remote sensing plus some in situ parameters, the latter to be expanded, **http://www.meteoswiss.admin.ch/home.html?tab=overview**

Exploratory platforms

Existing

- PSI Smogchamber facilities, aerosol formation and transformation, secondary organic aerosol characterization, **https://www.psi.ch/lac/smog-chamber**

The status of national ACTRIS consortium

There is a letter of intent from the Swiss government, and several preparatory meetings have taken place, however, there is no Memorandum of Understanding yet.

The Swiss partners will submit in early 2018 the documentation for the inclusion of ACTRIS into the Swiss national research infrastructure Roadmap 2019

Funding for ACTRIS

Current funding 2.5 M€ per year

The continued operation of the Jungfraujoch station will require the same level of funding in the future; the implementation of Payerne as a second national will require substantial additional funding.

Users of ACTRIS

- Modellers are using the data from this unique site in the lower free troposphere to compare their model results to observations.
- The site is regularly visited by a large number of politicians, e.g. on 22 September 2017 by former UN Secretary-General H.E. Mr. Ban Ki-moon (see **https://www.hfsjg.ch/en/publications/news/2017-09-22/**).
- The site is regularly in the news both in print and TV media **(see, e.g., https://www.hfsjg.ch/en/media/videos/**)
- The site is visited by about 1 million visitors per year, and the research station applies a proactive information policy, e.g. with a brochure (**https://www.hfsjg.ch/en/publications/on-the-top-booklet-about-research-at-jungfraujoch/**), or with permanent video exhibitions.
- A wide variety of data is available online, see **https://www.hfsjg.ch/en/jungfraujoch/online-data/**

ACTRIS-United Kingdom

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Chilbolton Facility for Atmospheric Radar Research

National ACTRIS coordinator and contact person:
Prof Geraint Vaughan
National Centre for Atmospheric Science (NCAS) and School of Earth and Environmental Science, University of Manchester.

Membership status in the Interim ACTRIS Council
- Member

Nominated representative:
- Prof Stephen Mobbs, Director of NCAS and University of Leeds

Ministries and other possible funding organisations supporting ACTRIS

Natural Environment Research Council (NERC)

Science and Technology Facilities Council

Research performing organisations in the national ACTRIS consortium

NCAS,
https://www.ncas.ac.uk/en/

Centre for Ecology and Hydrology,
https://www.ceh.ac.uk/

University of Manchester,
http://www.manchester.ac.uk/

Provisional: University of East Anglia,
http://www.uea.ac.uk/

Planned contribution to the ACTRIS Central Facilities
- Centre for Cloud Remote Sensing, development of cloud radar calibration techniques and their evaluation using 25 m dish at Chilbolton Observatory. (NCAS, STFC)
- Centre for Cloud in-situ Measurements, calibration using Manchester Cloud chamber (University of Manchester, NCAS)

Existing and/or planned ACTRIS observational platforms and exploratory platforms

Observation sites (stationary measurement sites)

Existing
- Chilbolton observatory, **https://www.chilbolton.stfc.ac.uk/**. This site hosts a range of cloud and aerosol remote sensing equipment and is supported through NERC national capability funding
- Auchencorth Moss, **http://www.auchencorth.ceh.ac.uk/**. This site measures surface in situ trace gas and aerosol components. It is supported through NERC NC and DEFRA funding.

Planned
- A number of options are being discussed, but there are questions about the long-term funding and the ability to commit to ACTRIS.

Exploratory platforms (mobile platforms and measurement chambers)

Existing
- Manchester Aerosol chamber, **http://www.cas.manchester.ac.uk/restools/aerosolchamber/** studies atmospheric processes of multicomponent aerosols under controlled conditions.
- Roland von Glasow Sea Ice Chamber, University of East Anglia. **https://www.uea.ac.uk/environmental-sciences/sea-ice-chamber**

Planned

- Lidar development laboratory at the University of Hertfordshire, focusing on developing new aerosol measurement techniques. **http://www.herts.ac.uk/research/centres-and-groups/cair/atmospheric-remote-sensing-laboratory**

The status of national ACTRIS consortium

Currently, the consortium is informal and there is no UK air quality infrastructure roadmap. A UK ACTRIS website is being developed and virtual and face-to-face meetings are being organized in 2018. Both Chilbolton and Auchencorth are funded through Research Centre National Capability funding (though in separate parts) and the future for each site is relatively secure.

Until very recently there wasn't a national infrastructure roadmap, but one will be developed after April 2018 when the research councils formally merge to become UKRI. However, it's not clear whether ACTRIS-UK will qualify for such a roadmap as this will be for very large projects.

Funding for ACTRIS

The total scale of funding for ACTRIS activities

- Capital cost so far in building ACTRIS infrastructure is
- Chilbolton £7M
- Auchencorth £2M
- Manchester £1M
- Herts €200 k so far

Preliminary information on funding for annual operation and for construction, upgrade and implementation.

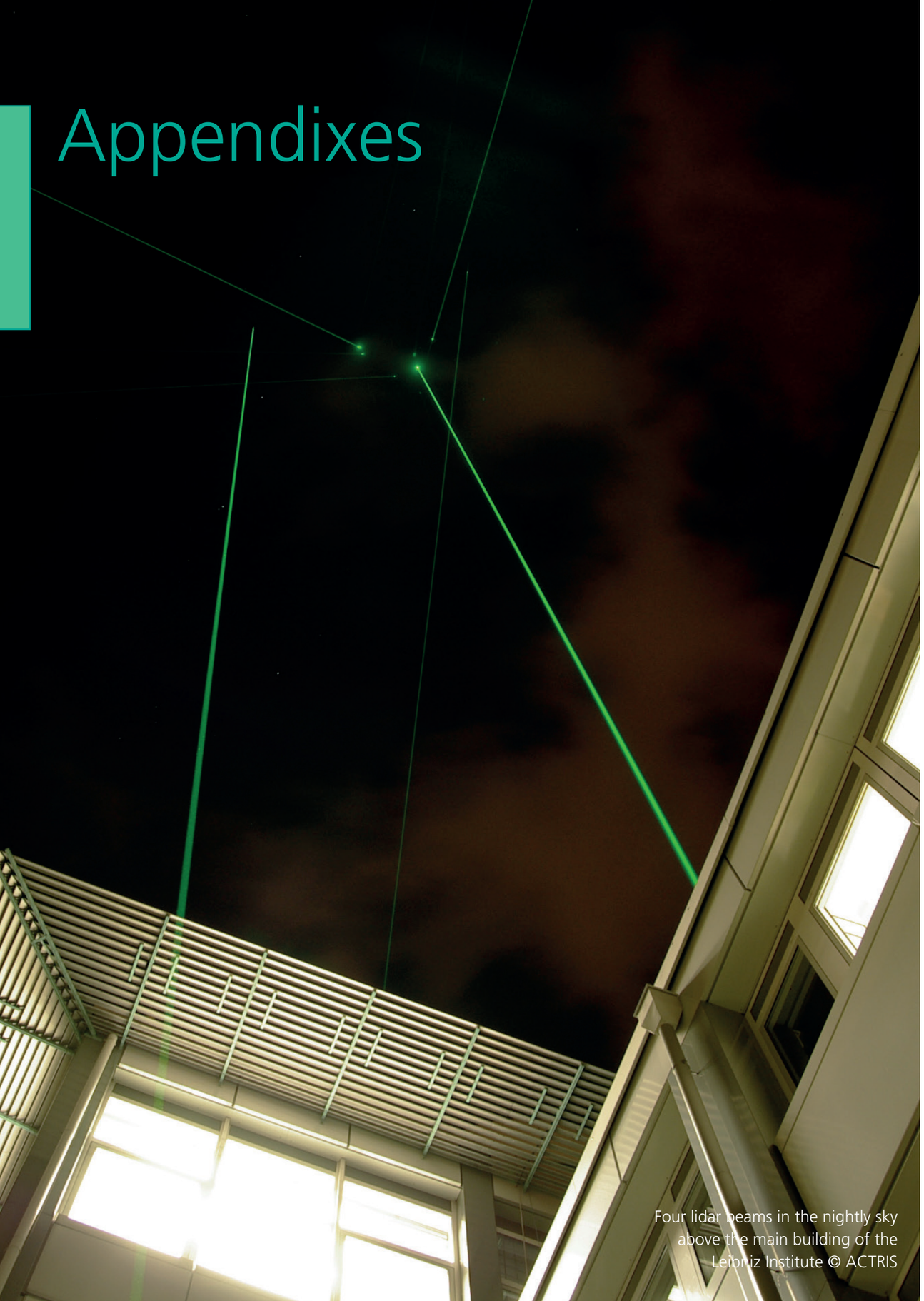
- **Chilbolton**: current funding through NCAS (NERC) for long-term measurement programme £158 k p.a. There is no dedicated budget for capital items, which are bought when money becomes available. ACTRIS research in ACTRIS-2 is €35k over 4 years.
- **Auchencorth Moss**: Current funding through CEH (NERC) for long term measurement programme is £330k per annum of which <10% is directly relevant to ACTRIS. The Defra/EA air quality networks also operate the GS for gas phase organics (VOCs), which is a commercially contracted measurement. ACTRIS research in ACTRIS2 is €100k over 4 years, of which €20k is for long term measurement (surface in situ) meetings
- **Manchester**: Current support through for chamber operations through NCAS long-term science programme £80 k p.a.

Users of ACTRIS

The main ACTRIS user community in the UK is the academic research community, in the Universities and research establishments. There are groups working directly on measurements, groups who use ground-based measurements for 'ground-truthing' satellites, groups who compare measurements and models, and groups who use data in a more applied way to address societal problems such as air quality. Currently, around a dozen research groups have expressed some sort of interest in ACTRIS measurements. Beyond academia, there is interest from DEFRA (the Environment ministry) and the Environment Agency in the surface aerosol and trace gas measurements, and from the Met Office in the lidar and spectrophotometer areas. The devolved administrations (in Scotland, Wales and Northern Ireland) are also interested in the air quality aspects.

For air quality measurements Chilbolton (formerly Harwell) is used as an upwind site to London and similarly Auchencorth is a background site for Edinburgh, used by both scientists and policy makers. VOC measurements at Auchencorth and Chilbolton are used by UK, European and Global scientists. Particle measurements are similarly used by modellers. All measurements at both sites are publically available and have been used by scientists, policy makers and the general public over the past 20 years. Auchencorth has a flat fetch which has been used for long term deposition and emission flux studies both of reactive gases and aerosols and greenhouse gases.

Appendixes



Four lidar beams in the nightly sky above the main building of the Leibniz Institute © ACTRIS

Appendix 1:

ACTRIS Glossary

ACTRIS data - are the ACTRIS variables resulting from measurements that fully comply with the standard operating procedures (SOP), measurement recommendations, and quality guidelines established within ACTRIS.

- **ACTRIS level 0 data**: Raw sensor output, either mV or physical units. Native resolution, metadata necessary for next level.
- **ACTRIS level 1 data**: Calibrated and quality assured data with minimum level of quality control.
- **ACTRIS level 2 data**: Approved and fully quality controlled ACTRIS data product or geophysical variable.
- **ACTRIS level 3 data**: Elaborated ACTRIS data products derived by post-processing of ACTRIS Level 0 -1 -2 data, and data from other sources. The data can be gridded or not.
- **ACTRIS syntheses product** (Proper name to be defined later): Data product from e.g. research activities, not under direct ACTRIS responsibility, but ACTRIS offer repository and access.

ACTRIS Data Centre (DC) - the Central Facility responsible for ACTRIS data curation, preservation, and distribution of data, value-added products and tools, and hosting the ACTRIS data portal.

ACTRIS data originator - entity operating instruments at a National Facility or Topical Centre, resulting in ACTRIS data and delivering ACTRIS data to the Data Centre.

ACTRIS data provider - the Data Centre offering the ACTRIS data and value-added data products and tools to users.

ACTRIS digital tools and services - tailored codes and software for processing and visualization of ACTRIS data, production of ACTRIS data products, and for data analysis and research.

ACTRIS exploratory platform - National Facility (simulation chambers, laboratories, or mobile facilities) operating on campaign basis and delivering dedicated data to the Data Centre.

ACTRIS General Assembly (GA) - a council of ministry- and funding organization representatives of ACTRIS members after ACTRIS legal entity has been established, superior decision-making body of ACTRIS.

ACTRIS Head Office (HO) - a Central Facility coordinating and representing ACTRIS, and holding the statutory seat.

ACTRIS label - earmarks a data set or a measurement site as ACTRIS data or ACTRIS National Facility.

ACTRIS observational platform – ACTRIS National Facility performing long-term, regular observations and delivering standardized data to the Data Centre.

ACTRIS Topical Centres (TCs) – a Central Facility offering services and operation support for QA/QC of measurements and data (including training, calibration, QA/QC tools, and development of standard operation and evaluation procedures)

ACTRIS variables - the measured atmospheric variables as described in the **ACTRIS Data Management Plan**[1].

[1]The ACTRIS data management plan and list of variables were approved by ACTRIS-2 scientific steering committee, October 2015. These documents are expected to be refined during ACTRIS-PPP (WP5).

Central Facility (CF) - a European level ACTRIS component that offers ACTRIS data or other ACTRIS services to users as well as operation support to ACTRIS National Facilities.

Central Facility Unit – part of a Central Facility located at, and operated by a research performing organization (RPO) or by ACTRIS ERIC.

CF Director – the person responsible for the coordination and representation of a Central Facility.

CF Unit Head – the person responsible for the coordination and representation of a Central Facility unit.

CF Management Board – consists of the CF Unit Heads and the CF Director; this board manages the Central Facility.

Data curation - the activity that stores, manages and ensures access to all persistent data sets produced within the infrastructure.

Data traceability - an unbroken chain of uniquely identified process steps leading from raw data to any kind of processed data, where identification of process steps follows the data.

In situ measurements - measured or sampled air and instrument are at the same location and in physical contact. In the context of ACTRIS, in situ measurements of aerosol, cloud, and reactive-trace-gas properties are performed at observational sites near the Earth surface, on mobile surface-based or airborne platforms, and in atmospheric simulation chambers and laboratories.

Interim ACTRIS Council - a council of ministry- and funding organization representatives of ACTRIS members before ACTRIS legal entity has been established (during the ACTRIS Preparation and Transition Phase), superior decision-making body of ACTRIS.

Measurement traceability - an unbroken chain of comparisons relating an instrument's measurements to a known standard, in the ideal case SI units.

National Facility (NF) - an observational or exploratory platform providing data and/or physical access to the platform within ACTRIS.

Quality assurance and control: Quality assurance is process oriented and focuses on defect prevention; quality control is product oriented and focuses on defect identification:

- **Quality Assurance (QA)**: The process or set of processes used to ensure the quality of a product (e.g. data series, instrument, sample, measured value of a variable, etc.),
- **Quality Control (QC)**: The process and activities of ensuring products and services meet the expectations.

Remote sensing - measured air and instrument are not at the same location and not in physical contact. In the context of ACTRIS, active and passive atmospheric remote-sensing techniques for the observation of aerosols, clouds, and trace gases are applied at observational sites and on mobile surface-based or airborne platforms.

RI committee – consists of up to two representatives from each Central Facility and [three] representatives from the National Facilities Assembly; the RI committee supports the (Interim) Director or Board of Directors in operating the RI.

Service and Access Management Unit (SAMU) - a part of ACTRIS Head Office facilitating the access to ACTRIS services.

User - a person, a team, or an institution making use of ACTRIS data or other ACTRIS services, including access to ACTRIS facilities.

Reference documents

ACTRIS-PPP proposal

ACTRIS Data Management Plan, approved by ACTRIS-2 SSC 23 October 2015

ACTRIS Concept Documents

ISO 10012:2003: Measurement management systems — Requirements for measurement processes and measuring equipment

ISO 9000:2015: Quality management systems—Fundamentals and vocabulary

Appendix 2:
List of Acronyms

ACMCC Aerosol Chemical Monitor Calibration Center

ACTRIS Aerosols, Clouds, and Trace gases Research Infrastructure

ACTRIS HO ACTRIS Head Office

ACTRIS DC ACTRIS Data Centre

ACTRIS CF ACTRIS Central Facility

ACTRIS TC ACTRIS Topical Centre

ACTRIS NF ACTRIS National Facility

ACTRIS SAMU ACTRIS Service and Access Management Unit

ACTRIS GA ACTRIS General Assembly

ACTRIS-I3 EU FP7 Aerosols, Clouds, and Trace gases Research InfraStructure Network, grant agreement No 262254 (2011-2015)

ACTRIS-2 Aerosols, Clouds, and Trace gases Research InfraStructure Integrated Activity (IA) project is funded by EU Horizon 2020 Research and Innovation programme (grant agreement No 654109). ACTRIS-2 started on 1 May 2015 for a period of 4 years.

ACTRIS PPP, Aerosols, Clouds, and Trace gases Research InfraStructure Preparatory Phase Project is a EU Horizon 2020 Coordination and Support Action (grant agreement No 739530). ACTRIS PPP started on 1 January 2017 for a period of 3 years.

AERONET Aerosol Robotic NETwork

AISBL Association without lucrative purpose

AMAP Arctic Monitoring and Assessment Programme

ANAEE A European research infrastructure on Analysis and Experimentation on Ecosystems

AOD Aerosol optical depth

ARISE2 Atmospheric dynamics Research InfraStructure in Europe Design Study (DS) is a collaborative infrastructure project (2015-2018) funded by the H2020 European Commission.

BVOC Biogenic Volatile Organic Carbon

CAPS Cavity Attenuated Phase Shift Spectroscopy

CI-APi-TOF Chemical Ionization Time-Of-Flight mass spectrometer

CLD Chemiluminescence detection

CLOUDNET EU FP5 Development of a European pilot network of stations for observing cloud profiles (2001-2005)

COPERNICUS The European Earth Observation Programme

CREATE Establishment, use and delivery of anAS European aerosol database

CTA Cherenkov Telescope Array

DIAL Differential Absorption Lidar

DOI Digital Object Identifier

EARLINET EU FP5 European Aerosol Research Lidar NETwork to establish an aerosol climatology

EARLINET-ASOS EU FP6 European Aerosol Research Lidar Network - Advanced Sustainable Observation System

EBAS Emep data BASe: observation database of atmospheric chemical composition and physical properties

EISCAT-3D The Next Generation Radar for Atmospheric and Geospace Science

EMEP Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe

EMSO ERIC European Multidisciplinary Seafloor and water-column Observatory

ENVRIplus Horizon 2020 cluster project on Environmental Research Infrastructures (ENVRI) Providing Shared Solutions for Science and Society

EPOS European Plate Observing system

ERA-PLANET The European network for observing our changing planet

ERIC European Research Infrastructure Consortium

E-RIHS European Research Infrastructure for Heritage Science

ESA European Space Agency

ESFRI European Strategy Forum on Research Infrastructures

ESS ERIC European Social Survey

EUFAR EU FP5/FP6/FP7 European Facility for Airborne Research

Euro-Argo ERIC European infrastructure for Argo program that aims at sustaining 1/4 of the global network and enhance coverage in European seas.

EUROCHAMP-2020 Integration of European Simulation Chambers for Investigating Atmospheric Processes - Towards 2020 and beyond project is funded from the European Union's Horizon 2020 research and innovation programme (grant agreement No 730997, 12/2016-11/2020).

EUSAAR EU FP6 European Supersites for Atmospheric Aerosol Research Grant Agreement n°026140 (2006-2011)

FID Gas chromatographic methods with flame ionization

FTIR Fourier-transform infrared spectroscopy

Future Earth Global change research program coordinated by the International Council for Science (ICSU)

GAW WMO Global Atmosphere Watch

GAW-WDCA WMO World Data Centre for Aerosols

GAW-WDCRG WMO World Data Centre for Reactive Gases

GC-MS Gas chromatography mass spectrometry

GCOS Global Climate Observing System. A joint undertaking of WMO, ICSU, IOC, UNEP, and UNESCO

GRUAN Global Reference Upper Air Network

HEMERA EU H2020 project dedicated to balloon-based observations of Earth and space

HPLC-MS High performance liquid chromatography mass spectrometry

IAC Interim ACTRIS Council

IAGOS-AISBL European Research Infrastructure on In-service Aircraft for a Global Observing System

IC Ion chromatography

ICOS ERIC Integrated Carbon Observation System Research Infrastructure

iLEAPS Integrated Land Ecosystem-Atmosphere Processes Study, Global Research Project of Future Earth

InGOS EU FP7 Integrated non-CO2 Greenhouse gas Observation System, grant agreement No 284274 (2011-2015)

INP Ice nucleating particle

IS-ENES Infrastructure for the European Network for Earth System Modelling

I3 European Commission's Integrated Infrastructure Initiative of EU FP7 or design study

LC-MS Liquid chromatography mass spectrometry

LIDAR Light detection and ranging

LLGG Long-lived greenhouse gases

MoU Memorandum of Understanding

MS Mass Spectrometry

NASA The National Aeronautics and Space Administration

NDACC International Network for the Detection of Atmospheric Composition Change

NMHC Non-methane hydrocarbon

NOAA National Oceanic and Atmospheric Administration, U.S. Department of Commerce

OVOC Oxidized Volatile Organic Carbon

PEEX Pan-Eurasian Experiment

POP Persistent organic pollutant

PTR-MS Proton-transfer-reaction mass spectrometry

RECETOX Research Centre for Toxic Compounds in the Environment

RI Research Infrastructure

RPO Research performing organization

SHARE ERIC The Survey of Health, Ageing and Retirement in Europe

SIOS Svalbard Integrated Earth Observing System

SLCF Short-lived Climate forcer

SME Small and Medium-sized Enterprise

UAV Unmanned Aerial Vehicle

UNEP United Nations Enviroment Programme

UVVIS Differential optical absorption spectrometry in the ultraviolet-visible range

VOC Volatile Organic Compound

WCC GAW World Calibration Center

WCC-VOC GAW World Calibration Center for Volatile Organic Compounds

WDC GAW World Data Center

WHO World Health Organization

WIS WMO Information System

WMO World Meteorological Organization

WMO-GAW The Global Atmosphere Watch (GAW) programme of WMO

ACTRIS

Aerosols, Clouds, and Trace gases Research Infrastructure

The Aerosols, Clouds and Trace gases Research Infrastructure (ACTRIS) is a distributed infrastructure dedicated to high-quality observation of aerosols, clouds, trace gases and exploration of their interactions. It will deliver precision data, services and procedures regarding the 4D variability of clouds, short-lived atmospheric species and the physical, optical and chemical properties of aerosols to improve the current capacity to analyse, understand and predict past, current and future evolution of the atmospheric environment. ACTRIS serves a vast community of users working on observations, experiments, models, satellite data, analysis and predicting systems and offers access to advanced technological platforms for exploration of the relevant atmospheric processes in the fields of climate change and air quality.

About this book

This is the first edition of ACTRIS Stakeholder Handbook. The Handbook is produced under EU-H2020 ACTRIS Preparatory Phase Project (grant agreement No 739530). The Handbook contains general information on ACTRIS; what ACTRIS is, why it is crucial for the European community in facing global challenges such as climate change, how ACTRIS is structured, and gives annual update of the implementation of ACTRIS. Stakeholder handbook also provides the current national profiles of 22 countries involved in ACTRIS.

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This handbook is also published as an electronic document, available from ACTRIS website at **www.actris.eu**

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