Deliverable 7.1: Recommendations for establishing level of contractual agreement with National, European, and International initiatives and programs

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1. Introduction

ACTRIS PPP is an essential step toward the realization of the ACTRIS infrastructure and the transition from a project-based approach to a long-term RI organization. ACTRIS PPP has established and facilitated the work of ACTRIS members (countries) in the Interim ACTRIS Council. During the PPP, feedback and continuous communication with ACTRIS stakeholders and funding agencies have been organized and facilitated so that legal, funding and policy documents are ready for final approval by ACTRIS members. In this deliverable 7.1, recommendations are provided to address the nature of the agreements to be established with external entities of the infrastructure. D7.1 only deals with the level of contractual agreement outside ACTRIS and will not consider the establishment of contracts between ACTRIS ERIC[1] and the other elements in ACTRIS, such as the Central Facilities or the modalities for participation of third countries in the RI. In this document, external entities (or partners) refer to a legal organisation, a private enterprise or any institution that received a mandate from its members to sign any kind of agreement with another legal institution.

2. Objectives of D7.1

Establishing formalized collaboration at European and international level (including national & international authorities as well as non-governmental organizations and industrial cooperation) is a key activity of a RI that should be addressed to strengthen its long-term sustainability and contribute to the broadening, diversification and effectiveness of its activities. There is a huge diversity of types of RIs and consequently, there are also a very broad range of interactions between the RI and its surrounding environment. The level of interaction between the RI and its external bodies (networks, research organisations, etc..) will vary substantially depending on the scope of the relationship.

The scientific scope, application areas of ACTRIS and set of services are very broad, and we expect solid interactions with partners outside of the RI with which ACTRIS will interact with different objectives. The objective of this deliverable is to define the level of contractual agreement that will be required for the proper management of the overall mission of ACTRIS including its scientific and innovation strategy. This deliverable only refers to the contractual agreements to be established at the level of the ACTRIS ERIC on behalf of its members, and not to the specific partnership that are established by the single partners that in any case will not be formally ACTRIS contracts. All contracts that will refer to ACTRIS (name ACTRIS used) will be in some level tackled by ACTRIS ERIC, either so that ACTRIS ERIC will be the signatory party or ACTRIS ERIC is delegating the signatory rights to ACTRIS partner according to the decision of ACTRIS ERIC GA or by agreement of ACTRIS Management Committee or ACTRIS RI Committee. The application of subsidiarity principles in ACTRIS for specific needs within a CF can then be handled on case-by-case and is not in the scope of D7.1 which then assumes all contracts are handled at the ERIC level.

The level of contractual agreement between external partners and ACTRIS ERIC will essentially be determined by the need of ACTRIS to become operational and respond to the expected tasks and activities listed in its status. The tasks and activities of ACTRIS are currently defined as such:

Tasks and activities of the distributed research infrastructure	
2.1	The goal of ACTRIS (Aerosol, Clouds and Trace Gases Research Infrastructure) is to produce high-quality integrated datasets in the area of atmospheric sciences and provide services, including access to instrumented platforms, tailored for scientific and technological usage.

[1] ACTRIS European Research Infrastructure Consortium

2.2 ACTRIS ERIC provides the governance of the distributed research infrastructure ACTRIS. ACTRIS ERIC establishes and operates the research infrastructure and coordinates the strategic and financial development and eventual long-term operation of ACTRIS.

2.3 In pursuit of its purpose, and in accordance with the rules defined in these statutes, ACTRIS ERIC shall, in particular, carry out the following activities:

(a) coordinate and monitor adequate provision of data from the National Facilities;
(b) coordinate and monitor activities at the Central Facilities and their service development strategies;
(d) ensure open and timely access to ACTRIS data and data products through the Data Centre;
(e) operate a physical and remote access program to the Topical Centres, Data Centre and National Facilities
(f) any other activity to fulfil its objectives.

2.4 ACTRIS ERIC shall also carry out other activities, such as:

(a) promoting ACTRIS to science communities, private sector and the general public;
(b) implementing societal and technological developments related to the tasks as defined in article 2.1 and 2.3;
(c) developing joint activities with user groups including industry;
(d) promoting knowledge transfer to industry and policy makers;
(e) harmonizing the ACTRIS implementation with national priorities and strategies;
(f) promoting the resources of ACTRIS for education and training purposes;
(g) collaborating and interoperating with other research infrastructures in related and complementary fields;
(h) fostering training, outreach and international cooperation;
(i) participating as a funded or funding partner in scientific research activities relevant for its tasks; and
(j) any other related action necessary to achieve its aim.

2.5 ACTRIS ERIC shall pursue its tasks on a non-economic basis. ACTRIS ERIC may carry out limited economic activities, provided they are closely related to its principal tasks and they do not jeopardise the achievement thereof. Any income generated by these limited economic activities shall be used by ACTRIS ERIC to enhance and strengthen its purposes.

Generally, the level of agreement will distinguish whether a given partner is acting as supplier to ACTRIS, is co-constructing or involved in operating some elements of the RI, or is using services, or requesting tailored services, that are, can or will be, offered by the RI.

- **Supplier to ACTRIS:** Agreements with ACTRIS-suppliers will be required whenever the service provided by the RI will permanently depend on a product, or a service, from a unique external supplier. In that case, a product can refer to a technological component, as in the case of an industrial supplier providing a specific instrument, a specific data information or simply, and more generally, knowledge. The contractual agreement will in that case serve to ensure continuous provision of the product under specific procurement or within closer collaboration conditions.
- **Co-constructing or involved in operating some elements of ACTRIS:** Agreements with ACTRIS co-developers or co-operators will be required whenever elements of ACTRIS are being developed/operated in a wider context than the RI itself. This may be for example the case when ACTRIS operates the European node of an international research infrastructure. Mutual benefits of joint operations are essential issues for joint operations
- **User of services or requesting tailored services from ACTRIS**: Agreement with ACTRIS users will be implemented when there is a user request for a specific tailored service for a certain purpose that is not offered free-of-charge in the catalogue of services or otherwise require major effort for

setting up and operating the specific tailored service. Non-pricing or pricing of these tailored services are beyond the scope of the deliverable and is addressed elsewhere in ACTRIS PPP.

The level of agreement between ACTRIS ERIC and a party, whether it is supplier, co-developer/co-operator or user will fall either in the form of a contract where the parties intend to be legally bound by its terms or in the form of a Memorandum of Understanding (MoU) or similar where the parties do not intend to be legally bound but it shall be considered an important public statement of cooperation between ACTRIS and other parties. Alternatively, the level of cooperation with ACTRIS, or the nature of the envisaged relationship, may not require any binding or no-binding agreement, and will remain under the level of a liaison, where all parties are committed to maintain a high level of information and/or cooperation according to informal mechanisms.

Please note that this document will not address the specific case of agreement between the ACTRIS ERIC and the ACTRIS components (i.e. Central Facilities or National Facilities).

3. Establishing the need for cooperation agreement in ACTRIS

Facilitating the implementation of ACTRIS in the European landscape will require to identify possible cost-effective options for synergistic operations and a clear understanding of ACTRIS links with supplier, co-developers and users. It is important that links are formalized with the implementation of a long-term development strategy, addressing both national and European dimensions.

Deliverable 7.1 by providing recommendations for the establishment of the proper level of agreement of ACTRIS with external entities will support shaping the ACTRIS strategy. The potential partners of ACTRIS have been listed in many ACTRIS documents and have been identified as follow:

Research Performing organisations

- Universities
- Public Research Organisations
- Private Research Organisations

Public National/Regional Organisations and agencies

- National Space Agencies
- National Metrology Institutes
- National Hydrological and Meteorological services
- National and Regional Environmental agencies

International organisations

- The European Commission
- United nations agencies: UNEP[2], WMO[3], UNESCO[4], WHO[5]
- European Space agencies: ESA[6], EUMETSAT[7]
- European Environmental Agency: EEA[8]

[2] UNEP: United Nation Environment Program

[3] WMO: World Meteorological Organization

[4] UNESCO: United Nation Education Science and Culture Program

[5] WHO: World Health Organization

[6] ESA: European Space Agency

[7] EUMETSAT: European Organisation for the Exploitation of Meteorological Satellites

[8] European Environmental Agency

- European Meteorological agencies or research centres: ECMWF[9], EU-JRC[10]
- International associations: EUMETNET[11]
- Non-European research and space agencies : NOAA[12], NASA[13], JAXA[14],…
- International Bureau of Weight and Measures: BIPM[15]

Research Infrastructures

- ERICs[16], AISBL[17] and other RI legal entities

Research projects

- EOSC[18] related projects
- H2020 and Horizon Europe funded projects

International and European research programs:

- SOLAS[19], IGAC[20], WCRP[21], WWRP[22], SPARC[23], ARM[24]
- GEO[25]
- COPERNICUS[26]

International and European networks for Earth and atmospheric observation

- EMEP[27]
- NDACC[28]
- AERONET[29]
- GAW[30]
- AGAGE[31]

National and regional authorities, protocols and conventions

- Ministries and national public authorities
- Authorities in charge of Regional policies
- Civil aviation authorities
- Authorities in charge of the management of environmental hazards in particular Montreal Protocol and its Adjustments and Amendments and Convention for long range transboundary air pollution

Private sector

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[9] ECMWF: European Center for Medium-Range Weather Forecast

[10] EU-JRC: European Joint Research Center

[11] EUMETNET: European Meteorological Services Network

[12] NOAA: National Oceanic and Atmospheric Administration

[13] NASA: National Atmospheric and Space Administration

[14] JAXA: Japanese Atmospheric and Space Administration

[15] BIPM: Bureau International des Poids et Mesures

[16] European Research Infrastructure Consortium

[17] AISBL: Association Internationale sans but lucratif

[18] EOSC: European Open Science Cloud

[19] SOLAS: Surface Ocean - Lower Atmosphere Study

[20] IGAC: International Global Atmospheric Chemistry

[21] WCRP: World Climate Research Program

[22] WWRP: World Weather Research Program

[23] SPARC Stratosphere-troposphere Processes And their Role in Climate

[24] ARM: Atmospheric Research Monitoring Program of US Department of Energy

[25] GEO: Global Earth Observation

[26] COPERNICUS: https://www.copernicus.eu/fr

[27] EMEP: European Monitoring and Evaluation Programme

[28] NDACC: Network for the Detection of Atmospheric Composition Changes

[29] AERONET: Aerosol Robotic Network

[30] GAW: Global Atmosphere Watch Program of WMO

[31] AGAGE: Advanced Global Atmospheric Gases Experiment

- Instrument and equipment manufacturer
- Consultancy
- Data and service providers

This list of partnership illustrates the diversity of engagements that the atmospheric research infrastructure ACTRIS will be facing. Clearly, not all partners/users of ACTRIS will have the need for establishing a direct relationship and contract.

4. Contractual agreement and ACTRIS ERIC perimeter

The structure of ACTRIS ERIC and its perimeter is not yet finalized, and different options are still opened that may change the way of ACTRIS ERIC will engage in a legal binding with a third-parties. An important issue is that ACTRIS ERIC, through will have the capacity to engage in providing all services listed in its status in complete autonomy, implying that all the core operations and resources are under the perimeter of the ERIC or that a very clear and comprehensive agreement is established with one of the ACTRIS components to ensure ACTRIS ERIC can engage in providing the service. In the unlikely situation that all core operations and resources are under the perimeter of the ERIC, ACTRIS ERIC can effectively legally engage in binding agreements with any third-parties requiring the service. In the alternative solutions a service is not directly under the perimeter of the ERIC, but, for example proposed by a TC outside the perimeter and it is connected to ACTRIS ERIC by an agreement (i.e. ACTRIS ERIC – CF agreement). Therefore, ACTRIS ERIC does not solely has the formal capacity to engage into a service that is not directly operated by the ERIC. In these cases, all the parties needed to be included in the contractual agreement. This clearly poses a number of issues for service provision to third parties including liabilities, budgeting, ownership and IPR.

In D7.1, we consider a situation where all services are within the perimeter of the ERIC, which may not be the case when ACTRIS is operational. This means that all RI operations and resources under one legal entity, ACTRIS ERIC.

5. A case-by-case approach for the level of contractual agreement in ACTRIS

This section addresses on a case-by-case approach the expected level of contractual agreements foreseen with specific key partners. It does not preclude that contracts could be established also at different levels with the same organisation, by the ACTRIS-ERIC or, by any other ACTRIS member mandated by the ERIC. This simply reflects that operations in ACTRIS will cover a wide range of applications with very different scopes.

5.1. Cases for establishing an official high-level liaison

High-level liaison of a specific entity with ACTRIS may be required to ensure strategic advice by ACTRIS, through its Director-General (DG) or anyone mandated by the DG but may not need an official representation of ACTRIS as a stakeholder. High-Level liaison is the mechanisms by which ACTRIS DG is informed on policies and strategies of the partners that, in turn, may have substantive implications on ACTRIS strategy and organisation. Currently, we can foresee that this will be the case for the following:

- Cooperation with other **Research Infrastructures** in the environmental domain will be established through the participation of ACTRIS ERIC in the Board of Environmental Research Infrastructures (BEERI). In the short term ACTRIS may place its strategy towards EOSC in the context of ENVRI cluster and BEERI.

- Cooperation with European Space agencies **ESA** and **EUMETSAT**. ACTRIS must be recognized as a key player for operating the ground-based segment of Earth Observations. ACTRIS ERIC must be represented as such in relevant initiatives linked to Earth Observation from Space. A key aspect of ACTRIS strategy for Cal/Val activities is obviously linked to the participation of **National Space Agencies** in National ACTRIS activities.
- ACTRIS liaises with **EEA** on several issues, in particular connected to provision of relevant information for COPERNICUS CAMS.
- The high-level liaison will be the informal tool for ACTRIS to be represented in research projects of Horizon Europe or other.
- Many partnership communications start with the high-level liaison and can further develop more concrete collaborations including development of contractual agreements.

5.2. Cases for ACTRIS participation as a stakeholder

ACTRIS may see a legitimate interest in a project or entity to become an official stakeholder. ACTRIS ERIC or partners given the mandate by ACTRIS ERIC will act as ACTRIS community representative in a project or an initiative whenever the strategy of the project, or the initiative, may impact on ACTRIS activities. Currently, we foresee only a few. This may include a financial participation and/or the signature of a membership agreement.

- ACTRIS may seek a specific role as a stakeholder within the European Metrology Networks" (EMN) on Essential Climate Variable which has recently been established by **EURAMET**, the European Association of Metrology Institutes. It is essential that ACTRIS jointly works with National Metrology Institutes (NMIs) for improving standardization of ACTRIS procedures and, in parallel, ensures that the recommended ACTRIS procedures are accepted and used by a large body of users, in Europe and beyond. The recommended action is therefore to established ACTRIS ERIC possibly as a member of the EMN on Essential Climate Variables
- A common goal of ACTRIS and other partners world-wide is the creation of a "International Observing System for Short-lived species » established as a **GEO** Flagship. The overarching goal of the flagship would be to support all interested Parties in the policy process of the UNFCCC by providing Internationally representative measurements of short-lived species data relevant for constraining and evaluating models and prediction for radiative forcing of aerosol on climate. In order to achieve this objective, the flagship may be established as a non-legally binding partnership agreement inviting all GEO members and GEO associated parties, to become partners. It is therefore expected that ACTRIS ERIC becomes a member of the GEO flagship initiative, involving participation in a non-binding agreement that organizes the flagship activities. For example, relationship between ACTRIS and other Institutions involved in Earth Observation of Short-lived species from the ground, such as **ARM**, **NOAA** in the US, the **Chinese Academy of Sciences** in China, **Environment Canada**, etc.. may be officially established through a GEO flagship.

5.3. Cases for a Cooperation requiring a specific contractual agreement

A contractual agreement must be established whenever services provided by ACTRIS will permanently require a product from a unique supplier or when services are requested by ACTRIS to implement or co-develop its own services.

- It is expected that TC operations may require specific contractual agreement with external bodies. For example, ACTRIS will permanently require data and products provided by **ECMWF,** in particular for the operations of the Cloud Remote Sensing Measurements Topical Centre and in the Cloud remote sensing Data Centre Unit (CLU), in the production of cloud remote sensing data products. A specific contract may be established with ECMWF. Similarly, some operations in Centre for

Reactive Trace Gases Remote Sensing (CREGARS) may require specific agreement with **ESA** or with **NOAA** for using the travelling standard laser from a US Research Performing Organisation. This will be also the case for **National Metrology Institutes** providing standards for ACTRIS operations in Centre for Reactive Trace Gases In Situ Measurements (CIGAS). Some operations of Centre foe Aerosol In Situ Measurements (CAIS) may also use software developed elsewhere, and thus require authorization from the owner.

- Copernicus Atmospheric Services (**CAMS**) may be requesting specific tailored data products in the future, such as Real-Time validated data sets. This will require establishing a specific contract with **CAMS/ECMWF**, established by ACTRIS ERIC on behalf of its members.
- The **private sector**, including industry and small medium enterprises (SMEs), is both a supplier and a potential user for ACTRIS. Because in the construction and major upgrade stages of RIs – design, engineering, commissioning – industry acts mainly as a provider of state-of-the-art technologies, new designs, components, software, under standard procurement conditions or in closer collaborative conditions. The ACTRIS strategic plan for cooperating with the private sector will require addressing its specific roles in the partnership and to define the most appropriate level of contractual agreement for full exploitation of ACTRIS services and must include specific scientific and financial issues to be addressed, together with legal and ethical issues depending on the level of cooperation.
- Specific agreement with the **Private Sector** may also be required. This will be the case when a specific service needed by ACTRIS bodies (TC/DC) will only be provided by a unique supplier. Strategy towards harmonization of the ACTRIS relevant instruments may lead to specific contractual liaisons with specific suppliers in the private sector.

5.4. Cases where signature of a memorandum of understanding is foreseen

Some operations in ACTRIS are performed in a wider context and rely on contributions from external entities/patterns. This may require a mutual comprehension of roles with other parties, in particular when operations will be complementary. Several examples illustrate this situation.

- The interactions with the **World Meteorological Organization** are and will continue to be extensive. While ACTRIS services must be clearly integrated in **WCRP** and **WWRP** strategies, some specific activities of WMO are closely linked to ACTRIS and must addressed in specific MOUs . This may concern:
    - MOU for supporting **GAW** operations or for complementary operations between ACTRIS and GAW. This will be the case for the World Calibration Centers operated as non-ACTRIS activities by partners of Topical Centre CAIS and Topical Centre CIGAS but providing similar services.
    - MOU for the specific provision of data and products to **VAAC**
    - MOU for the specific provision of data and products to Sand and Dust Storm Warning Advisory and Assessment System (**SDS-WAS** idem as for VAAC.
- The contribution to the European node of **AERONET** (Aerosol Robotic Network of NASA). In that case, the agreement with **NASA** is established by ACTRIS partners operating the European node in the corresponding Topical Centre CARS and could remain that way if a clear agreement is made between ACTRIS ERIC and CARS in case CARS is not integrated to the ACTRIS ERIC perimeter.
- The contribution to the European node of **NDACC** the reactive trace gases remote sensing community in ACTRIS is part of the European NDACC community and the requirements for compliancy with the ACTRIS standards in this domain build on the NDACC instrument and data quality protocols. The ACTRIS data in the domain of reactive trace gases remote sensing must also be considered NDACC data. It is beneficial for the reactive trace gases remote sensing community at the global level that any evolution in ACTRIS or in NDACC be shared between each other in order to keep consistency between what happens at the European and at the global level. A MoU

between ACTRIS and NDACC establishing the knowledge and data sharing agreements as well as the willingness to evolve consistently together towards the future will be very useful.

- The link with **AGAGE** (Advanced Global Atmospheric Gases Experiment) is important for the trace gas in-situ community of ACTRIS. Albeit AGAGE is mainly focussed on ozone-depleting substances, the replacement gases and non-CO_2 greenhouse gases also a suite of stable VOCs (e.g. ethane, propane and benzene) are continuously analysed with the same instrumentation. This puts the European-wide measurements of VOCs in a global context. Vice versa global modelling performed within AGAGE also benefits from access to high-quality regional data produced under ACTRIS.
- The links with **EMEP** (European Monitoring and Evaluation Programme)[32] activities is strong and has been developed over many years. EMEP is the co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe. It is a scientifically based and policy driven programme under UNECE and the Convention on Long-range Transboundary Air Pollution (CLRTAP)[33] for international co-operation. ACTRIS is acting as a research component of EMEP, with contribution both to the quality assurance and quality control procedures and supports the implementation of new and/or improved methodologies and procedures. There are links between ACTRIS and EMEP on 3 principally different levels;
    1) many ACTRIS in-situ sites (potentially NF) are also EMEP sites, and in some countries, both National ACTRIS and National EPAs are contributing to operations,
    2) for some variables, the quality assurance program recommended by EMEP-CCC (Chemical Coordination Centre) relies upon the use of services provided by ACTRIS Topical Centres, in some cases (OC/EC) they are integrated.
    3) the quality and the observation data labelled EMEP, ACTRIS or both are stored and made available to user through a single EBAS data infrastructure/repository, part of ACTRIS-DC.

Measurement of ACTRIS variables (aerosol chemical optical and physical properties, and VOCs[34] and NOxy) are included in EMEP, the monitoring strategy with EMEP recommending the use of ACTRIS measurement guidelines and SOPs, and aiming for the same quality assurance and quality control as within ACTRIS, and recommended by ACTRIS. This has been important for harmonisation and production of comparable data across Europe. The ACTRIS Topical Centres are unique to ACTRIS and covering a wide range of variables (aerosol chemical optical and physical properties, and VOCs and NOxy). As a part of this, EMEP-CCC is contributing to ACTRIS data production by performing the quality control tasks of offline chemical analysis (EC/OC), for some ACTRIS/EMEP sites.

3) Finally, ACTRIS In-Situ Data Centre Unit is using **EBAS** data base infrastructure which is operated to support operations of both EMEP and ACTRIS, and other frameworks such as GAW-WDCA and GAW-WDCRG. EBAS was developed to handle, store and disseminate atmospheric composition data generated by international and national long-term monitoring programmes and research projects. EBAS is the official observational data archive for the CLRTAP, reporting to the EMEP and serves as the official repository for all ACTRIS in situ data. The development of EBAS procedures under ACTRIS are directly benefitting the improvement of the quality and control of EMEP and GAW-WDCA and GAW-WDCRG data.

5.5. Relationship not requiring any specific level of liaison

For regular operation in ACTRIS, is not expected that ACTRIS ERIC would need to establish specific liaison with the national bodies (National Research Performing organisations, Public national and

[32] https://www.emep.int

[33] http://www.unece.org/env/lrtap/welcome.html.html

[34] Volatile Organic Carbon

regional authorities). It is naturally the role of National ACTRIS organizations to establish the necessary liaison with these bodies.

6. Specific note concerning the partnership with associated third countries in ACTRIS

Climate change and air pollution have negative impacts on the health of the global population and the economy. Providing societies, communities, citizens and international development partners with the best available science and expertise related to weather, climate, water and related environmental information are part of the objectives in ACTRIS.

Changing atmospheric composition is one of the important drivers of climate change acting both on the global scale (i.e. warming related to long-lived greenhouse gases such as CO_2) and on the regional scale where atmospheric compounds with shorter lifetime will enhance or slightly reduce warming from long-lived greenhouse gases. To strengthen the global response to the threat of climate change, countries adopted the Paris Agreement at the COP21 in Paris, which went into force in November 2016. In the agreement, all countries agreed to work to limit global temperature rise to well below 2°C.

Atmospheric pollutants are also responsible for poor air quality which causes 4 million premature deaths every year. Even very small amounts of air pollutants can have serious impacts on human health. Fine particles are particularly harmful due to their ability to penetrate deep into the lungs and blood streams. The measured decrease in atmospheric pollutant concentrations is the ultimate indicator of a successful policy to reduce emissions. Yet, very important observational data are missing, especially in developing countries to guide such policy. It is absolutely critical that new observational sites are selected and implemented in order to fill gaps in the global observing system.

It is now possible to develop information products adapted to a variety of policy-relevant applications: identification of pollutant emission sources, production of increasingly reliable air quality forecasts, evaluation of the effectiveness of emission reduction policies, support to renewable energy production, etc. The diversity of applications for atmospheric impacts on climate, human health and ecosystems requires the development of numerous specific modelling tools with different spatial and temporal scales. To improve and validate models, they need to be compared with measured atmospheric composition. Therefore, the availability of data of known quality in terms of precision, accuracy and representativeness are of paramount importance to support continuously improving modelling tools and applications. This is now almost operational in Europe thanks to the development in ACTRIS and its contribution to relevant policy-oriented networks, such as EMEP.

Still, the existing in-situ observations are mainly based on infrastructure operated at the national level or by academic institutions, and only sustained in a limited number of regions in the world, resulting in an evidently inadequate distribution. Global coverage is lacking in the observational data bases, with substantial gaps in Africa, Latin America, and large parts of Asia. Causes may be connected to difficulties making the data accessible through the relevant Data Centers in some cases, but for many areas of the world the gaps are related to the missing observational infrastructure.

Several ACTRIS research teams have worked in the past to support initiatives to fill the existing gaps in observations from areas outside Europe. Examples of successful implementation in third countries exist in ACTRIS, with different ACTRIS partners and different countries. In fact, a number of observational platforms beyond Europe have been listed in the ACTRIS stakeholder handbook by different countries.

It is fundamental for a Research Infrastructure with the goal of becoming a Global Research Infrastructure that the international, non-European dimension is clearly recognized and that a specific case is made to

include sites located in third countries. Partners in third countries are particularly interested in the following aspects:

1. Receive support for **integrated training and capacity building**. The approach to capacity building is considered particularly successful if it is not restricted to the technical dimension required for maintaining operation at monitoring stations but also includes a wider level, to raise expertise in relation to science and technologies, science management, adaptation strategies, etc.
2. Receive support for **investment and operations**. The investment required for operating an observational platform is substantial and does not end after installing the equipment. The construction of an observational site responding to ACTRIS requirements, even minimal, is expensive and often not feasible in many countries. In addition, replacement and operation costs are high. In many countries however, cost of human resources is lower than Europe and this is a very important strength when developing stations.
3. Receive support to help raising **awareness and stimulating the demand for observations and information on climate and air quality** at the country level**.** ACTRIS observations are made more sustainable whenever embedded in an ongoing national program that may include stakeholders from policy ranging from national to city scale, for example. Awareness may initially arise from the demand for a specific information or application of high interest to the country.

ACTRIS sites in third countries are operated under very different conditions, depending on the country and the way the station was initiated. Conditions varies from simple support to operating instruments to a full responsibility of the ACTRIS partner on the station. The specific conditions for these potential ACTRIS National Facilities have not yet been tacked in the ACTRIS preparatory phase but will be handled during the ACTRIS implementation phase. When the inclusion of these NFs locating beyond Europe are discussed, the following points must be taken into account:

- The concept of Research Infrastructure is European, and not fully understood in many other countries. Operating an observational site is more related to the concept of participation to a network, which does not involve any corresponding fee. Many sites in different continents in the Global Atmosphere Watch network are actually receiving support for free, as services are paid by National GAW activities (mostly in Switzerland and Germany),
- Conditions for third countries, mostly in emerging economies, to enter ACTRIS as members, may face issues linked to costs, and even more to the capacity at the national level to engage in any kind of commitment. Stations are often operated outside of the perimeter of a research or Environmental Ministries and driven by research interest and expertise of academic teams.
- Observational sites in third countries are, by definition, located far away from the corresponding Topical Centres in Europe. Issues linked to customs and travel will prevent Third Country partners to fully engage with ACTRIS recommended procedures for operations, as listed by Topical Centres. Specific arrangements must be made to ensure that ACTRIS services can be used without leading to extensive periods without measurements due to participation in intercomparison exercises for example.

In ACTRIS, we recommended therefore a tailored approach to engage third countries in the RI. A first recommendation would be that the ACTRIS strategy is **embedded in the strategy of the WMO programs, GA, WWRP and WCRP** and use the recent recommendation issued by the WMO congress to stimulate countries to engage in observations of atmospheric composition changes. This can employ similar mechanisms as those that will be developed for meteorological observations in the framework of the **Global Basic Observing Network** GBON (Resolution 34, Cg-18) which represents a new approach in which the basic surface-based observing network is designed, defined and monitored at the global level. Priority sites for both atmospheric and integrated Earth system observatories should be identified by expert teams involving local scientists and organizations and in parallel, ACTRIS must define **acceptable conditions for sites to benefit from ACTRIS services** and must develop specific communication to explain the cost/benefit of participation in the local context. A specific concept providing the site with the status of "**associated**

international ACTRIS sites" should be developed, that would define the specific conditions for a site operated in emerging economies to benefit from ACTRIS. It could be proposed for example that services are offered for free if stakeholders commit to maintaining operations. This can be done only with a very good **knowledge of the specific conditions in the country**. There, cooperation with developing agencies present in the country is essential. ACTRIS must engage to **support participation of third country partners in training activities**, possibly offering T&S support, in a strict partnership with GAW/WMO for example. ACTRIS must work on the win-win benefits for cooperation with third countries, accepting that the monetary approach is in that case of lower importance as for the other European sites. it is important that the **international community supports the countries** which do not have the capabilities nor the capacities to install and maintain the observational infrastructure, and to perform the relevant measurements, analyses and quality control. ACTRIS must develop an active strategy, jointly implemented in GAW, to reach the funding agencies.

Finally, ACTRIS must fix ambitious target to associated international ACTRIS sites. Kulmala (2018) advocated for a global Earth observatory of 1,000 or more well-equipped ground stations around the world that track environments and key ecosystems comprehensively and continuously. Any generalized suggestions regarding recommending a particular strategy is difficult as various options may be developed and evaluated based on the national laws, contexts and circumstances, and the local communities. However, it is clear that the role of ACTRIS in an international perspective would be clearly reinforced with associated observational sites beyond Europe's political boundaries.

It is also clear, although less straightforward, that **exploratory platforms, and especially Simulation Chambers** in third countries can be associated to ACTRIS, under a similar scheme as observational platforms. Examples already exist of simulation chambers constructed in some countries as part of collaboration with ACTRIS partners. However, given the construction costs, it often an activity that is carried out by countries with sufficient resources for investment and operations. It remains that, in that case as well, a specific partnership with ACTRIS "Associated International ACTRIS Simulation Chamber" with terms of reference still to be defined, would clearly reinforce the establishment and the visibility of ACTRIS in the international context.

7. Conclusions

ACTRIS has long-term ambitious aim to become a Global Research Infrastructure and thus ACTRIS is seeking a central position and building key partnerships enabling service provision globally for large user communities, also reaching beyond Europe and traditional user communities.

ACTRIS must have the ambition to increase its services to society, and to extend the scope also beyond Europe. In order to achieve this objective, ACTRIS ERIC must have the liability to engage in any contractual liaison required by the definition of its status, including budgeting, human resource ownership and IPR. It will obviously imply that some level of responsibilities be transferred to the ERIC from its members although, it remains clear the exact nature of the contractual liaison with external bodies must be defined after the ACTRIS perimeter and the exact positioning of Central Facilities (under the ERIC or not) is clearly established. In the case services are offered by Central Facilities outside the ACTRIS ERIC perimeter, the contractual agreement between ERIC and the corresponding Central Facility must clearly allow ACTRIS ERIC to fill its objectives on the behalf of the ACTRIS community.

While ACTRIS high-level representation within international organization and initiatives may be rapidly and naturally established after creating the ACTRIS Director General position, capacity to engage in contractual agreements with third parties will require more attention. There is a clear need to establish specific agreements with suppliers in the public or private sectors for those ACTRIS operations that are relying suppliers' contribution. Moreover, it is important to identify which entities (RPOs contributing to ACTRIS) together with ACTRIS ERIC is needed to connect to these specific agreements. The future of

tailored data services with third parties (e.g. Copernicus CAMS) will also have to be addressed at ERIC level whenever ACTRIS-data are utilized. Joint operations and participation to international networks will most likely require MoUs, once responsibilities are clearly established between ERIC and its members. Last, but not least, fostering the impact of ACTRIS on innovation, technology development and technology transfer by collaboration and providing services to the private sector will require a clear understanding of IPR and responsibilities between ACTRIS and its members.