

Milestone 8.2: A first evaluation of alignment of ACTRIS with international networks

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1. Introduction

ACTRIS is a large, highly distributed pan-European Research Infrastructure that has entered its implementation phase in 2020. The aim of the ACTRIS Implementation project (ACTRIS IMP) is to coordinate and accomplish the actions required for implementing a globally recognised long-term sustainable research infrastructure with operational services by 2025. ACTRIS IMP builds on three main pillars: i) securing the long-term sustainability, ii) implementing ACTRIS functionalities, and iii) positioning ACTRIS in the national, European and international science and innovation landscape. ACTRIS IMP will enable ACTRIS to respond to user-community needs and requirements for fully operational services and enhance ACTRIS relevance, innovation potential, and societal impacts.

One of the key objectives of ACTRIS IMP is to ensure that ACTRIS is well positioned with partners on European and International level. In fact, ACTRIS aims to be recognized as a Global Research Infrastructure (GRI). A GRI can be generally defined as a facility whose governance and services are fundamentally international in character, meaning that it will fulfil a number of criteria related to its scope that should be of global interest, to its capacity to attract wide interest from researchers outside of the host nation and to a shared international governance and of specific responsibilities in the GRI lifecycle management and the way it will interact with other GRI partners. The definition of a GRI is obviously not so specific as it applies to both single site facility and distributed network of facilities, as in the case of distributed RIs, such as ACTRIS.

ACTRIS can be defined as a GRI for the following reasons:

- The RI deals with scientific issues that require cooperation beyond the perimeter of the European RI, i.e. short-lived atmospheric constituents are affecting the Earth's radiation balance, Air quality and public health, through long-term and short-term exposureto pollutants and extreme weather events, by contributing to a changing energy balance at the ground and in the atmospheric column
- The RI is offering open access to its platforms and its data in a seamless manner, to both public and private sectors and aims to favour their use by researchers at the international scale
- The RI operates pieces of global observing system, such as calibration centers or data centers, and is actively engaged to define procedures for atmospheric probing,
- Finally, ACTRIS is contributor to different international networks that have been operating in the landscape for many years. Because ACTRIS data life cycle is strongly connected to its economic model (specific funding mechanisms for the Central Facilities, specific licencing of data produced), it cannot work independently of other networks

It is therefore important to define, ahead of establishment as ERIC, the possible ways ACTRIS will interact with other key players in the landscape. This is seen as a first step for promoting the international collaboration of ACTRIS, as a player of the Climate and Air Quality global challenges. It is also very clear that ACTRIS must engage in facilitating access to its products and data.

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2. ACTRIS questionnaire to define level of interaction with international partners

Once ACTRIS-ERIC is created, ACTRIS policies will come into force. Because parts of ACTRIS were originally built as contributions to some European and International observing networks, ACTRIS-HO must anticipate how ACTRIS-ERIC will liaise with these external entities that may provide, use or share some services.

The procedure to prepare the first draft was to question Central Facility leaders to identify the main issues that ACTRIS must account for in defining the level of interaction with international networks. In the following, ACTRIS data and products are defined as resulting from a data chain involving ACTRIS-NFs à ACTRIS TCs à ACTRIS DC that delivers an ACTRIS variable

In this document, an international network is defined as an organized activity where observations are made in a coordinated manner, and where data are compiled to serve its stakeholders. The questionaire is addressed to the governing bodies of the individual networks (including legal entities which has an official role and can represent the networks in the case the network represents a Convention). This document was then filled by identified scientists in ACTRIS also involved in the International Network.

The purpose of this exercise is to start the process of identify the potential conflicts induced by nonalignment of policies (access and data policies) or governance between ACTRIS and the International networks, and propose potential solutions. It must be clear as a general strategy in ACTRIS that 1) ACTRIS data/data products must be traceable and 2) that the establishment of ACTRIS must always facilitate uptake of data by users and 3) that ACTRIS has the ambition of becoming a Global Research Infrastructure

Three specific points are addressed to five different networks (AERONET, NDACC, EMEP, GAW, EARLINET, e-Profile, NOAA-FAN). E-profile so far did not respond to the questionnaire. The 3 points are as follow:

- Provide a definition of measurement network/programme + short text that explains why the linkages with ACTRIS is relevant. Indicate 1) the corresponding data hub and 2) the corresponding stakeholder or authoritative body
- Identify Issues that will require attention in establishing the liaison with ACTRIS
 - Regarding SOP and QA/QC procedures and tools. Most networks/programmes have their own SOP, QA/QC procedures and tools, data archiving policies and data portal, and have Web-interfaces to provide access to documents, tools, events, etc. Which issues must be addressed in terms of the exchanges and alignment between the measurement network/programme's common practices and the ones developed in ACTRIS ?
 - Regarding the network of stations in the International networks with respect to stations listed as ACTRIS NF? Do you foresee any specific issues related to the fact some ACTRIS stations may belong to more networks?
 - Regarding data archiving policies and practices (data licensing, DOI, data access, metadata, etc). Do you foresee any issue related to data management in ACTRIS that would not be aligned with procedures implemented at partner networks
 - Regarding Data hubs providing access to procedures, tools, Do you foresee ...

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3.1.1 Do you have ideas on the most suitable framework for collaboration between ACTRIS and the network? MoU ? legally binding document ? Scientific collaboration agreement ? Else ?

3. Answers to questionnaire

3.1.2 Provide a definition of measurement network/programme + short text that explains why the linkages with ACTRIS is relevant. Indicate 1) the corresponding data hub and 2) the corresponding stakeholder or authoritative body

3.1.3 NDACC

www.ndacc.org; De Mazière et al., 2018, https://doi.org/10.5194/acp-18-4935-2018

NDACC is a global network for atmospheric ground-based remote sensing observations with many contributions provided by European partners. Besides the fact that it covers observations of short-lived climate pollutants that are relevant for ACTRIS, it covers observations of many more atmospheric species and variables, at the global scale. NDACC has a long heritage of coordinating and ensuring the acquisition and dissemination of high-quality observational data, and of serving various user communities that are also relevant for ACTRIS (research community, policy makers, Copernicus services, satellite teams and modellers for validation/verification of their data, etc.)

NDACC data base: https://www-air.larc.nasa.gov/missions/ndacc/data.html

NDACC authoritative body: Steering Committee (http://www.ndaccdemo.org/about/steering-committee)

3.1.4 WMO/GAW

The Global Atmosphere Watch (GAW) coordinates high-quality atmospheric composition observations across global to local scales to drive high-quality and impact science while co-producing a new generation of research enabled products and services. About 100 countries are participating in the GAW Programme. Some components of the GAW observational network are recognized as comprehensive and baseline networks of the Global Climate Observing System (GCOS). The GAW Programme operates according to the GAW Implementation Plan 2016-2023. ACTRIS has had strong links to GAW since ACTRIS' inception. Several GAW World Calibration Centres (WDCs) are now also serving as ACTRIS TCs. Two GAW World Data Centres (Aerosol, WDCA; Reactive Gases, WDCRG) are co-located and co-operated with the ACTRIS In Situ DC node. Through representation of ACTRIS CF stake holders in GAW bodies, both networks work towards alignment of operating and quality control procedures. Many ACTRIS NFs double as GAW member stations, which makes data treatment tightly integrated between GAW and ACTRIS for ACTRIS In Situ parameters. Legal constraints and procedures for data access need to be co-ordinated between ACTRIS and GAW, as well as the conditions for mutual access to services.

GAW-WDCA / WDCRG data portal: http://ebas-data.nilu.no/

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Authoritative body: Environmental Pollution and Atmospheric Chemistry Scientific Steering Committee (SSC-EPAC), https://community.wmo.int/governance/commission-membership/research-board/ssc-epac

Contact point: GAW secretariat, led by Oksana Tarasova (otarasova@wmo.int)

3.1.5 NOAA-FAN

NFAN is a global network of GAW stations receiving operational support by the aerosol group of the Global Monitoring Laboratory, part of the NOAA Earth System Research Laboratories. The operational support includes guidance and capacity building on instrument setup, operation, and calibration, as well as data handling. NOAA provides NFAN stations with a software package for data acquisition, data quality control, and submission for both RT and fully QCed data to the GAW-WDCA, covering a selection of most commonly used instrument types, makes, and models for measuring aerosol particle properties. The NFAN software routes the data via NOAA servers, making NFAN to a data production node for the GAW aerosol network. Many ACTRIS stations are using the NFAN software for handling their data. NOAA and ACTRIS have a long-standing collaboration on station operation in the context of GAW, building on informal, voluntary contributions.

Contact point: Patrick Sheridan (patrick.sheridan@noaa.gov)

3.1.6 EMEP

EMEP (https://www.emep.int): The links with EMEP (European Monitoring and Evaluation Programme) have 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) for international co-operation to solve transboundary air pollution problems. ACTRIS contributes to the quality assurance and quality control of EMEP measurements and data (the quality assurance and quality control of EMEP measurements and data (the quality assurance and quality control procedures), and propose implementation of new and/or improved methodologies and procedures for the EMEP network.

There are links between ACTRIS and EMEP on 4 principally different levels; 1) sharing of sites, 2) the use of TCs, and EMEP-CCC (Chemical Coordination Centre), 3) the use of data infrastructure and repository EBAS, including quality control of data and 4) EMEP funding supports ACTRIS in-situ data flow

Authoritative body EMEP: UNECE-CLRTAP with the Executive Body is the governing body: https://unece.org/executive-body EMEP contact point; EMEP-CCC is responsible for coordinating the EMEP measurement actitites. EMEP-CCC is headed by Kjetil Tørseth (NILU): kt@nilu.no

3.1.7 EARLINET

www.earlinet.org; Pappalardo, G. et al., 2014, https://doi.org/10.5194/amt-7-2389-2014.

The European Aerosol Research Lidar Network, EARLINET, was founded in 2000 as a research project for establishing a quantitative, comprehensive, and statistically significant database for the horizontal,

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vertical, and temporal distribution of aerosols on a continental scale. With its 51 lidar stations (out of which 33 currently operating) located in 18 countries, EARLINET provides the most extensive collection of ground-based data for the aerosol vertical distribution over Europe. The developments for the quality assurance strategy, the optimization of instruments and data processing, and the dissemination of data have contributed to a significant improvement of the network towards a more sustainable observing system. EARLINET is an important part of ACTRIS, however 7 permanent stations and 2 temporary stations remain external to ACTRIS for multiple reasons. EARLINET is part of GALION (GAW Aerosol Lidar Observation Network).

EARLINET data base: https://data.earlinet.org/

EARLINET authoritative body: EARLINET Council (https://www.earlinet.org/index.php?id=117)

3.1.8 AERONET

The AERONET (AErosol RObotic NETwork) program is a federation of ground-based remote sensing aerosol networks established by NASA and PHOTONS Network (PHOtométrie pour le Traitement Opérationnel de Normalisation Satellitaire; CNRS, University of Lille, CNES) and is greatly expanded in Europe by networks (RIMA Network in Spain) and collaborators from national agencies, institutes, universities, individual scientists, and partners.

Since 1994, the program has provided long-term, continuous and readily accessible public domain database of aerosol optical, microphysical and radiative properties for aerosol research and characterization, validation of satellite retrievals, and synergism with other databases.

With its ~145 permanent stations located distributed in ~25 European countries, in ~10 African countries, plus a couple of stations in Asia and Polar regions, the European branch of AERONET provides the most extensive collection of aerosol column integrated properties over Europe. Among these 145 stations, ~95 stations are not in the above-mentioned French and Spanish networks and correspond to current ACTRIS users. AERONET is an important contributor to ACTRIS and vice-versa, and the only network providing real time QC/QA aerosol products, early 2020. The network imposes standardization of instruments, calibration, processing and distribution. In addition, traceability of AERONET AOD with GAW/WMO reference instrument is also considered both at French and Spain calibration facilities.

https://aeronet.gsfc.nasa.gov; Holben B. et al., 1998; https://doi.org/10.1016/S0034-4257(98)00031-5

AERONET data base: <u>https://aeronet.gsfc.nasa.gov</u>

Synchronized Database at French and Spanish AERONET/CARS components. ACTRIS-Data Center updated everyday.

AERONET authoritative body: NASA Goddard Space Flight Center, Biospheric Sciences Laboratory, Code 618, Greenbelt, MD 20771, USA

3.1.9 E-PROFILE

No response

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3.1.10 Identify Issues that will require attention in establishing the liaison with ACTRIS regarding SOP and QA/QC procedures and tools. Most networks/programmes have their own SOP, QA/QC procedures and tools, data archiving policies and data portal, and have Web-interfaces to provide access to documents, tools, events, etc. Which issues must be addressed in terms of the exchanges and alignment between the measurement network/programme's common practices and the ones developed in ACTRIS ?

3.1.10.1 NDACC

NDACC has developed its own SOP and QA/QC tools, and we must ensure that there is no disruption in the NDACC community caused by ACTRIS. In other words, it is the aim that the procedures and tools developed in the ACTRIS RTGRS component build on the NDACC heritage and stay at all times aligned with NDACC and that the NDACC Community agrees to these tools/procedures. We take it for granted that ACTRIS requirements can only be stricter than the network requirements, i.e., if a dataset is compliant with ACTRIS requirements it will also be compliant with the network's requirements but the vice-versa is not necessarily true because compliancy with ACTRIS standards may require efforts from the PI that are unaffordable for the network as a whole. The vice-versa should also be true: new developments made in NDACC – e.g., by non-European partners – that are relevant for ACTRIS must be available to ACTRIS and integrated in the ACTRIS procedures/tools under the responsibility of TC CREGARS

3.1.10.2 GAW

The operating and data quality control procedures between ACTRIS, EMEP, and GAW have been developed in parallel, with the intention of alignment, but have diverged somewhat over recent years. In general terms, many requirements for instrument operation are more strict in ACTRIS than EMEP and GAW, but nevertheless compatible. A few more challenges exist concerning data quality control. ACTRIS aims for strict harmonisation of QC, with common guidelines for QC flagging with a reduced set of flags and compulsory use of common QC software tools. In GAW, the responsibility for QC rests with the station, only the general QC philosophy is harmonised.

For the microphysical and optical aerosol insitu measurements the recommendations are harmonized between EMEP, GAW and ACTRIS. Also the calibration facility WCCAP is identical for the there programs.

In the future, there is a need for regular meetings across the networks to ensure and maintain harmonised approaches on data management, quality control, and operating procedures.

3.1.10.3 NOAA-FAN

The functionality of the NFAN software package covers many aspects of the data handling needs which ACTRIS CFs intend to provide NFs with, however lacking in a few aspects of data FAIRness. ACTRIS cannot use NOAA services since a legal agreement between ACTRIS (European Research Infrastructure) and NOAA (U.S. government agency) appears to be unlikely or impossible. Intended ACTRIS services to NFs will be more comprehensive than NOAA once established, but NOAA services have been reliable while covering the essential aspects of NF operation, despite limited staff resources at NOAA, and are free of charge. Some European countries might consider NFAN services as an inexpensive, yet sufficient alternative to ACTRIS in situ aerosol services, despite NFAN services being less comprehensive.

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3.1.10.4 EMEP

See 3.2.1.2 GAW as message applies also to EMEP

Quality assurance combines efforts of ACTRIS TC efforts and those of the EMEP Chemical Coordinating Centre (EMEP-CCC). For the ACTRIS variables (aerosol chemical optical and physical properties, and VOCs and NOxy) EMEP is aiming for the same quality assurance and quality control as within ACTRIS. This is important for harmonisation and production of comparable data across Europe. The ACTRIS TCs 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 (lead by NILU) is contributing to ACTRIS data production by performing the quality control tasks of offline chemical analysis (EC/OC).

The production of ACTRIS NOx data requires input of EMEP ozone measurements (not a apart of ACTRIS). EMEP also offers PM10, PM2.5, PM1 mass data, which are relevant for interpretation of ACTRIS aerosol data and users of ACTRIS data. In addition, EMEP also includes a wide range of other atmospheric variables including inorganic chemistry, heavy metals, persistent organic pollutants and precipitation chemistry.

3.1.10.5 EARLINET

EARLINET has its own website where documentation and guidelines are posted. Nevertheless, most of the institutions participating to EARLINET are now involved in ACTRIS, therefore alignment of the guidelines, procedures and tools should be naturally done. First of all because EARLINET lidar stations involved in ACTRIS cannot follow double standards. Second because it was EARLINET'S goal to evolve towards ACTRIS with the risk that not all the stations can be actually ACTRIS National Facilities. It is expected that EARLINET will become an extension of the ACTRIS aerosol remote sensing component, contributing to the globalization of ACTRIS lidar standards. The EARLINET QA/QC program developed in the frame of several successive projects stays at the foundation of the QA/QC measures promoted by ACTRIS Centre for Aerosol Remote Sensing (CARS) and the Aerosol Remote Sensing unit at the ACTRIS Data Centre (ARES). It is foreseen that EARLINET will link to, and implement the guidelines, SOPs and SQAPs issued by CARS and ARES. Up to now, EARLINET stations participated in all CARS and ARES events and activities, as they were all ACTRIS National Facilities. No specific issues must be addressed, except the distinction between the rights and obligations of ACTRIS aerosol remote sensing NFs versus rights and obligations of other EARLINET stations (some activities which are mandatory for the ACTRIS NFs will not be mandatory for the rest of the EARLINET stations, e.g. the measurement schedule, direct comparison with reference lidar, site audits etc.).

A certain agreement between EARLINET and ACTRIS should be put in place in order to regulate the rights and obligations of the non-ACTRIS EARLINET stations.

3.1.10.6 AERONET

Since 1994, AERONET has developed its own observation and quality control and assurance procedures thanks to long-term partnerships between the USA and European French and Spanish components. AERONET has its own website where documentation and guidelines are available and updated.

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Standardized procedures and tools used by the European AERONET components part of the Centre for Aerosol Remote Sensing (CARS) are, and will remain, naturally, the same as AERONET ones since AERONET has a centralized approach. New procedures and tools possibly developed in the ACTRIS CARS components in the frame of various projects, are built on the AERONET heritage and can contribute, when relevant, to AERONET. Symmetrically, new developments made in AERONET – e.g., by non-European partners – that are relevant for ACTRIS, will be available to ACTRIS and integrated in the ACTRIS procedures/tools under the responsibility of CARS since both CNRS and UVA are fundamental components of AERONET.

3.1.10.7E-PROFILE

No response

3.1.11 Identify Issues that will require attention in establishing the liaison with ACTRIS regarding the network of stations in the International networks with respect to stations listed as ACTRIS NF? Do you foresee any specific issues related to the fact some ACTRIS stations may belong to more networks?

3.1.11.1NDACC

The main questions to be addressed are: How to deal with the CREGARS services to NDACC affiliated instruments that do not belong to an ACTRIS RTGRS NF ? There are a few European sites, affiliated to NDACC but not to ACTRIS (example of the network of stations operated by KIT, or some stations not meeting CREGARS ACTRIS requirements in France. And how to deal with the data for the ACTRIS variables provided by such instruments ?

NDACC's point of view: NDACC affiliated instruments (in Europe and beyond) should be serviced by CREGARS within the limits of its capacity, and without going through SAMU for approval of the service request. In case of limited capacity, first priority will go to NDACC instruments from an ACTRIS Member State, second priority to NDACC instruments that are co-located at an ACTRIS NF. They will however not go through the full labelling procedure and not get the 'ACTRIS data' label but the 'ACTRIS affiliated data' label in case they fully comply with ACTRIS standards

3.1.11.2GAW

The global and regional GAW stations, some of which are also future ACTRIS National Facilities, undergo the ACTRIS quality assurance and quality control in future.

3.1.11.3 NOAA-FAN

Not applicable

3.1.11.4EMEP

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Most ACTRIS in-situ sites are official EMEP sites and the ACTRIS In-Situ sites are both potential ACTRIS NF and ongoing (and future) EMEP sites, and the sites and measurements are contributing to both EMEP and ACTRIS in-situ.

3.1.11.5 EARLINET

ACTRIS aerosol remote sensing NFs are the majority of EARLINET stations. The rest of the stations can be considered as 'regional partner facilities' because in general they belong to countries which are not part of the European Union (Serbia, Belarus). It is expected that these stations will not invest in additional instrumentation (e.g. sun/sky/moon photometer) or in upgrading the lidar system to reach a higher dynamic range or full automatization, as recommended to ACTRIS ARS NFs. However, most of the tools and procedures under the responsibility of CARS and ARES are applicable to all aerosol lidar systems. No particular effort from CARS and ARES is required in order to maintain a reasonable quality control of the EARLINET measurements, considering that their number will not significantly increase in the future. CARS implementation plan and cost book are built such as to allow minimum QA/QC for **up to 10 additional EARLINET stations**. Minimum QA/QC involves mainly the expert analysis of the QA tests, consultancy for upgrades/improvements of the instrument, participation to workshops and webinars, support for data processing with the Single Calculus Chain (SCC). Expensive activities (e.g. direct comparisons, site audits) will only be granted if additional funds are available (e.g. projects).

We, therefore, recommend that access to CARS and ARES documentation and services remain open and free for EARLINET stations which are not part of ACTRIS, ensuring by this the collection of harmonized aerosol profiling datasets from beyond ACTRIS borders. Data collected at these stations should be labelled as 'ACTRIS affiliated data'.

A certain agreement between EARLINET and ACTRIS should be put in place in order to regulate access to certain services provided by CARS and ARES. Provision of continuous (non-competitive) support without involving SAMU should be preferable.

3.1.11.6AERONET

There are many European sites or non-European sites of European interest, affiliated to AERONET (~45 among 95), that would not be labelled as ACTRIS CARS NF. For these users, instruments and data are and will continue to be considered the same way as NF. AERONET affiliated instruments (in Europe and beyond) will continue to be serviced by AERONET/CARS French and Spanish components within the limits of their capacities.

One question to be addressed is with or without going through SAMU (Service Access Management Unit) for approval of the service request? (PG) I would propose to go through SAMU, as it is a good tool to evaluate and monitor activity and also because it show the usefulness of ACTRIS to provide services to users and not only to NF by contributing to an international network. But may be this would be is too heavy for SAMU (since in addition, it is every year), so that we can continue the CNRS-TNA approach (to monitor calibration access, papers, etc) in an easy and in an already efficient manner.

In term of working load:

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~50 expected NF that will not go through SAMU

~45 expected users (non-NF, non-French and Spanish networks) that could go through SAMU, every year.

Within the AERONET network, ACTRIS NF, ACTRIS users and non-ACTRIS French & Spanish stations will be provided exactly the same services (with the exception of observation continuity during recalibration procedure). No objection to have them be labelled ACTRIS data since they will receive the same services with the same quality of service.

3.1.11.7E-PROFILE

No response

3.1.12 Identify Issues that will require attention in establishing the liaison with ACTRIS regarding data archiving policies and practices (data licensing, DOI, data access, metadata, etc). Do you foresee any issue related to data management in ACTRIS that would not be aligned with procedures implemented at partner networks

3.1.12.1NDACC

NDACC data that comply with the ACTRIS standards and rules as verified by CREGARS and the ACTRIS DC, should be archived and disseminated through the ACTRIS DC as all other ACTRIS data. The metadata should indicate the affiliation with both networks. We propose to call them 'ACTRIS affiliated data', indicating clearly that they are of exactly the same quality as the 'ACTRIS data' (metadata label associated with data from a labelled ACTRIS NF) and that the difference compared to 'ACTRIS data' lies only in the funding mechanisms or not being part of an ACTRIS NF. They will of course also keep the metadata label 'NDACC data'.

Data from ACTRIS RTGRS NF or ACTRIS affiliated data that are also affiliated with NDACC must be archived at and disseminated from both the ACTRIS DC and the NDACC DHF (Data Handling Facility). The affiliation to both networks must be visible and both networks should be acknowledged whenever use it made of these data. The data may have two different DOI if that is preferable.

Questions to be answered: What about archiving and dissemination of data from an NDACC-affiliated instrument at an ACTRIS NF for variables that are <u>not</u> an ACTRIS target for now?

NDACC's point of view: We (NDACC) recommend a daily synchronisation between the two datacenters as far as the ACTRIS/NDACC data is concerned, as well as a metadata exchange between NDACC and ACTRIS for all other NDACC data such that a user of the ACTRIS data also finds the complementary NDACC data.

As suggested above, NDACC data that comply with NDACC standards but that have not been verified by CREGARS and therefore not necessarily comply with ACTRIS standards will not get the 'ACTRIS affiliated data' label, only the NDACC data label.

3.1.12.2GAW

The data submission of aerosol in-situ variables of ACTRIS and GAW stations are harmonized at NILU.

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On the use of licenses in EBAS: For in-situ data in EBAS, the data will be licensed. The step to agree and have consistency on CCBY4.0 for ACTRIS and EMEP data in EBAS is a large step forward. This is expected to be approved by IAC January 2022, and has been positively received by EMEP TFMM, EMEP steering body and GAW symposium without any objections.

Data identification: Identification of data, i.e. issuing of DOIs on the data, will refer to the primary repository the data is stored at (EBAS), not the associated networks (EMEP, GAW, ACTRIS). Networks will be referenced in dedicated metadata elements.

3.1.12.3 NOAA-FAN

To ensure implementation of all data FAIRness aspects, ACTRIS in situ will require NFs to use data acquisition and handling software provided by the TCs. This will remove ACTRIS station currently part of NFAN from the NFAN network. Some data handling functions that NFAN supports are currently not yet implemented in ACTRIS. NFAN doesn't seem concerned about this development.

3.1.12.4 EMEP

Data are processed in a common ICT infrastructure (EBAS@nilu.no) and made available to users in a harmonized way. 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 as GAW-WDCA and GAW-WDCG. 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 Parties to the Convention on Long-range Transboundary Air Pollution (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 contributing to improvement of the quality and control of EMEP (and GAW) data.

NILU as EMEP CCC receives funding from the CLRTAP EMEP protocol that amongst others covers the data flow from EMEP stations. As mentioned in point 1, there is collocation between EMEP and ACTRIS sites, which means that EMEP funds also support the ACTRIS data management for in-situ data. NILU has included this revenue as part of the Norwegian host premium contribution to ACTRIS.

On the use of licenses in EBAS: For in-situ data in EBAS, the data will be licensed. The step to agree and have consistency on CCBY4.0 for ACTRIS and EMEP data in EBAS is a large step forward. This is expected to be approved by IAC January 2022, and has been positively received by EMEP TFMM, EMEP steering body and GAW symposium without any objections.

Data identification: Identification of data, i.e. issuing of DOIs on the data, will refer to the primary repository the data is stored at (EBAS), not the associated networks (EMEP, GAW, ACTRIS). Networks will be referenced in dedicated metadata elements.

3.1.12.5 EARLINET

All EARLINET stations (ACTRIS NFs or not) have access to the Single Calculus Chain (SCC) for processing their lidar data. As such, all of them can follow the same data workflow. Only data processed with the SCC

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and following the ACTRIS guidelines and procedures should be labelled as "ACTRIS data" (for ACTRIS NFs) or "ACTRIS affiliated data" (for EARLINET stations which are not ACTRIS NFs). For the "ACTRIS affiliated data" as a general category, we recommend to add specifics referring to the provenience (e.g. "ACTRIS affiliated data – EARLINET"). EARLINET database is and will be under the ARES unit of ACTRIS DC. All the data would be archived and disseminated by the ACTRIS DC. The affiliation to EARLINET and ACTRIS must be visible and should be acknowledged whenever use is made of these data. The data may have two different DOI if that is preferable.

About archiving and dissemination of data from an EARLINET-affiliated instrument at an ACTRIS NF for variables that are not an ACTRIS target for now: This situation does not apply to EARLINET. ACTRIS aerosol remote sensing variables are also EARLINET variables, except the synergy products (GARRLIC). In case that an EARLINET lidar station does not operate a collocated sun/sky/moon photometer, such synergy products cannot be obtained, however all the single-instrument variables can.

A certain agreement between EARLINET and ACTRIS should be put in place in order to regulate the data policy details.

3.1.12.6AERONET

All stations (ACTRIS NFs and ACTRIS users) managed by the French and Spanish CARS components have access to AERONET processing services. AERONET data and products (Worldwide) are available in real time in the ACTRIS DC as well as in the French and Spanish CARS components.

Affiliation to AERONET and ACTRIS must be visible and should be acknowledged whenever use is made of these data.

3.1.12.7E-PROFILE

No response

3.1.13 Identify Issues that will require attention in establishing the liaison with ACTRIS regarding Data hubs providing access to procedures, tools, Do you foresee ...

3.1.13.1NDACC

- ➡ Question to be addressed: Does it make sense to have SOP, QA/QC tools, etc., available at two different Web-sites ?
- ▷ NDACC's point of view: SOP, procedures, tools, ... that have been developed/ fine-tuned by CREGARS will be disseminated via the ACTRIS/CREGARS website; the NDACC Webpages will link to this Website for these protocols and tools..

All other protocols and tools that have been or may be produced in the future mainly by NDACC non-ACTRIS partners and that are directly relevant for ACTRIS (e.g., SFIT4 S/W) will be disseminated from the NDACC webpages and will be referenced and made accessible from the ACTRIS webserver through direct links.

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NDACC protocols and tools that are not directly relevant for ACTRIS will reside only at the NDACC Webpages.

In case of shared development – which will often be the case - it is important to acknowledge both contributions on both webpages.

3.1.13.2GAW

The procedures for data submission and for quality control are harmonized between NILU and the ACTRIS central facilities (e.g. WCCAP).

3.1.13.3 NOAA-FAN

Not applicable

3.1.13.4EMEP

The procedures for data submission and for quality control are harmonized between EMEP and the ACTRIS central facilities (e.g. WCCAP).

3.1.13.5 EARLINET

The SOPs, QA/QC tools, etc. will be available only through the CARS minisite and links to those will be implemented at the EARLINET website. It is the most effective way to ensure harmonization across Europe and beyond, because there is no equivalent to CARS in EARLINET. CARS has the responsibility to document all the procedures and tools to be used in ACTRIS >>> these procedures and tools should be picked up by EARLINET >>> updates easily done at CARS minisite >>> automatically referenced in the EARLINET website.

The same applies for the data quality control, algorithm procedure and data curation procedures regulated and under the responsibility of ARES: these will be documented in the ARES part of ACTRIS DC site and links will be provided in the EARLINET webpage.

3.1.13.6AERONET

The SOPs, QA/QC tools, etc. will be available through the CARS and AERONET websites..

3.1.13.7E-PROFILE

No response

3.1.14 Do you have ideas on the most suitable framework for collaboration between ACTRIS and the network? MoU ? legally binding document ? Scientific collaboration agreement ? Else

3.1.14.1 NDACC

An MoU (not legally binding) might be the most appropriate framework for NDACC (NDACC has no legal status). The MoU should detail the conditions for collaboration including the required acknowledgements.

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3.1.14.2 GAW

ACTRIS must become at minimum a contributing network to GAW. MoUs must be put in place to operate WDC and WCCs (including audits to Non-NF Global GAW stations) on behalf of GAW. No corrective actions on SOPs/Licencing foreseen but to be checked.

3.1.14.3 NOAA-FAN

Even though outer boundary conditions, i.e. data FAIRness requirements, require ACTRIS stations currently part of NFAN to leave the NFAN network, NOAA and ACTRIS are still partners through their contributions to GAW. NOAA is currently modernising its software package supporting stations, very much in line with what ACTRIS is planning. Both NOAA and ACTRIS are planning to support GAW stations globally. It could be beneficial for both sides to collaborate on the software package development and maintenance supporting GAW stations. To achieve this, ACTRIS needs to decide to what degree, by what means, and under which conditiond ACTRIS will support GAW stations in- or outside Europe that aren't formally part of ACTRIS.

3.1.14.4 EMEP

NILU has a contract with UNECE – CLRTAP in relation to EMEP-CCC. NILU will have a contract with ACTRIS ERIC. Through these contracts NILU will make efforts to ensure harmonization between EMEP and ACTRIS.

Suggestions means no formal relationship between ACTRIS and EMEP

3.1.14.5 EARLINET

EARLINET has no legal status, therefore no legally binding document applies. A scientific collaboration agreement may not be sufficient because we need long-term collaboration, involving operational work. Probably the most appropriate would be a MoU.

3.1.14.6AERONET

Since 2001, a legal binding is existing and renewed every 10 or 5 years between CNRS/University of Lille and NASA. This scientific collaboration agreement was sufficient for more than 20 years, which can be considered as a long-term collaboration. Similar legal link exists between UVA and NASA. Therefore, we propose to continue on the same simple basis.

3.1.14.7E-PROFILE No response

4. Conclusions / Recommendations

First survey of the possible interaction of ACTRIS with international networks shows that there is a variety of situations to be handled rapidly to avoid mixing responsibilities. Some will simply be solved with MoU, others may be more problematic and must be solved on a case-to-case basis, often including ACTRIS RPOs which currently are holding contracts/agreements with network representatives.

It is recommendend, in the absence of face-to-face meetings that each situation is discussed in dedicated meeting with limited attendance.

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