Milestone 23: Definition of User Requirements

Authors: Sabine Philippin, Lucas Alados Arboledas, Andres Alastuey, Jean-Pierre Cammas, Jean-François Doussin, Olivier Favez, Philippe Goloub, Valérie Gros, Markus Hermann, Nikos Kalivitis, Angela Marinoni, Ina Mathis, Ottmar Möhler, Doina Nicolae, Tuukka Petäjä, Anne Priem, Jean-Philippe Putaud, Harald Saathoff, Stéphane Sauvage, Paul Seakins, Gerald Spindler, Ralf Tillmann, Dominik van Pinxteren, Milan Vana, Ulla Wandinger

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1 Purpose

This document aims at defining the user requirements for the services provided by ACTRIS. A consolidated knowledge about the user communities and their needs is fundamental for each research infrastructure to ensure the provision of optimum services to its users and ensure excellent science and innovation in the long term. The user requirements are part of the overall ACTRIS user strategy which is developed and established in the preparatory phase and formalized in the ACTRIS Business plan.

2 User strategy

The user strategy is the long-term planning for the provision of services a research infrastructure (RI) can offer to users in response to their needs. The user strategy is one out of five dimensions that are taken into account to assess the scientific case of a research infrastructure project on the ESFRI roadmap[1] and that are considered essential for its successful implementation. The development of an RI's user strategy can be described according to the overall ESFRI lifecycle approach for each stage where the provision of services should be developed and aligned to evolving user needs and research gaps. This below section addresses the user strategy and requirements to be considered within ACTRIS as part of the process towards the operational phase.

2.1 User strategy in the RI lifecycle

The lifecycle of a RI comprises the following stages: 1) Concept development, 2) Design phase, 3) Preparation phase, 4) Implementation phase, 5) Operation phase, and 6) Termination phase. An RI is considered relevant only if the objectives of each dimension, including the user strategy, are met throughout and for each stage of the RI lifecycle. Figure 1 depicts an expected RI lifecycle and the objectives for the user strategy from the design to the operation phase[2]. At the end of the preparatory phase and with respect to the user strategy, ACTRIS is expected to achieve the following objectives:

- Identify the user categories;
- Execute a survey to demonstrate the expected user community and description of it in terms of origin and size;
- Identify the services based on a clear identification of demands and needs;
- Outline a single entry point for users.

The user strategy and the access policy are essential elements of each RI, and particularly of distributed RIs, consisting of a central hub and various European- or national-level facilities. They are required to implement a single point of access that allows to facilitate and optimise the access including assistance and support to users throughout the entire process from proposal preparation, choice of facilities and services, proposal submission, realisation of the access and service provision, and post-access activities (access reporting, data provision, etc.).

[1] ESFRI Strategy Report on Research Infrastructures, Roadmap 2021 Public Guide (25th September 2019): https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf
[2] Public Roadmap 2018 Guide final version (9th December 2016): https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf

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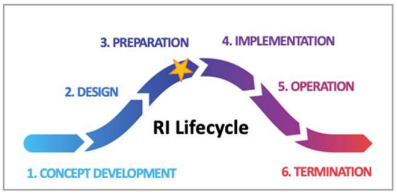
An RI's user strategy evolves in a continuous process as a function of the evolving user needs and the capacities of an RI to provide the services. Developing a user strategy necessitates knowledge about the user requirements.



Scientific Excellence | Pan-European Relevance | Socio-Economic Impact | User strategy & Access policy | E-Needs

Design	Preparation	Implementation	Operation
• Vision about the user community • Access modes described	• User categories identified • Survey executed demonstrating expected user community and description of it in terms of origin and size • Identified services based on a clear identification of demands and needs • Single entry point for users outlined	• User community in terms of origin and size consolidated • Mechanism of exchange/ engagement with users • Accommodation of users needs/ feedbacks • Catalogue of initial services for users • User strategy consolidated (including training aspects) • Common access policy –excellent driven access taken into account / transparent process, international research programmes, etc. • Organisational structure and procedure for regulating access – including single entry point for users decided and approved	• Common access management plan including: • Solid mechanism of exchange with users • Established catalogue of services for users • Operational single entry point for access established • Assistance to users for the entire process (from the proposal till after the access) s • IPR policies fully established • Dissemination programmes in place, including innovation actions

Figure 1: Stages of an RI lifecycle including the five relevant dimensions assessed by ESFRI for the scientific case (scientific excellence, pan-European relevance, socio-economic impact, user strategy and access policy, e-needs), and the minimum objectives to be reached for the user strategy in the design, preparation, implementation and operation phase. The asterisk indicates the actual ACTRIS position in the lifecycle process at the end of the preparatory phase.

2.2 User strategy and requirements

The ACTRIS user strategy aims at delivering its services by considering the user dimension and identifying the gaps between the RI capabilities and evolving user needs. The definition of user requirements is the first step towards an operational services provision, as illustrated in figure 2, and involves the definition of different categories that allow to describe the user needs and access-related information. The different categories are described in chapter 3 of this document. Based on these, an initial survey has been carried out in the preparatory phase of ACTRIS to get information on the size and need of the users. First preliminary results are presented in section 4.

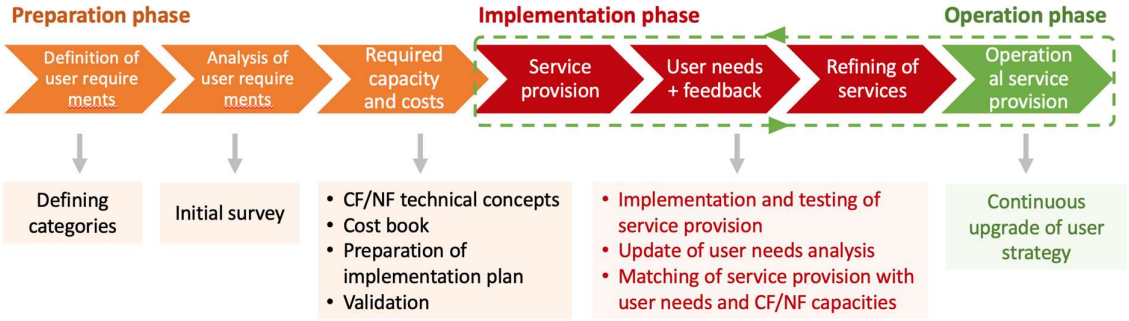


Figure 2: User requirements and strategy from the preparation to implementation and operation phase.

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3 Categories of user requirements

The definition of categories for describing the user needs in ACTRIS allow establishing a basis for monitoring and reporting the service provision during the pre-operational and operational phases. The categories comprise the user communities, their needs, the ACTRIS services offered to them, access-related information and potential costs related to accessing the services. The different user requirement categories are listed and described in more details in the following.

3.1 User communities

Quantitative and qualitative information about the user communities comprises knowledge about their size, type, and origin. An ACTRIS user is a person, a team, or an institution making use of ACTRIS data or other ACTRIS services, including access to ACTRIS facilities.

- **Size of the user community**: indicated by the number of users having accessed a service during a defined period of time, e.g., annually. The size of the user community can be described based on historical data. Predictions about future service provision can be indicated as expected minimum and maximum values which are to be adjusted on a regular basis.

- **Type of user**: the type of user can be described by different attributes, for example:
    - gender: female, male
    - professional profile: young vs expert scientist, staff type (technician, engineer, researcher)
    - frequency: new user, recurrent user
    - user community type:
        - academia and public research organisations, including international organisations, non-profit private research organisations,
        - private companies and businesses
        - public services: owned or supported by the government,
        - other: voluntary organisations, non-profit, non-governmental, citizen, …

- **User origin and background**: the user origin designates the originating country of the organisation the user is affiliated with, and can be further described by the scientific field a user is associated with:
    - Origin or originating country of a user:
        - local / regional / national
        - European member or associated state / other international country
        - ACTRIS member country / ACTRIS observer country / country outside ACTRIS
    - User scientific field: physics, chemistry, life sciences & biotechnology, Earth sciences & environment, engineering & technology, mathematics, information & communication technologies, material sciences, energy, social sciences, humanities, …

3.2 User needs

The ACTRIS services offered to the users are developed in response to the user demand, although they are limited by the available CF and NF technical capabilities and resources. Continuous interactions with

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the users are crucial for implementing an optimum service offer. The user needs may be very specific should be described with sufficient details.

Different needs of users interested in the ACTRIS services include:

- Use of long-term, reliable, high-quality data and products for modelling and forecasts, studying of trends and processes,
- Use of climate and air-quality information for decision making and policy development on local/regional/national/international level
- Use of instrumented platforms for basic and applied research for new scientific and technological knowledge
- Use of experimental facilities for innovative research and developing new technological knowledge
- Use of experimental facilities for instrument testing and development or instrument intercomparisons
- Training and best practices
- Specific services, e.g., tailored services.

3.3 ACTRIS services

ACTRIS promotes the provision of access to a large variety of high-quality services offered by the ACTRIS facilities (Central Facilities – Data Centre (DC) and Topical Centres (TC), National Facilities – Observational and Exploratory Platforms), to a wide range of users and needs, for scientific, technological and innovation-oriented usage.

ACTRIS aims at providing access to different types of services, such as:

- **Data Services**: related to ACTRIS data, data products, and data tools that include:
  - Access to ACTRIS data, data products, and digital tools through a single-entry point;
  - Long-term curation, archiving and preservation of ACTRIS data;
  - Citation services, data attribution, and data traceability;
  - Data curation for campaigns and dedicated research projects and initiatives, external or internal to ACTRIS.
- **Research Services:** related to opportunities for realising hands-on experiments and scientific excellence that include:
  - Physical access to instrumented observational and exploratory platforms for realisation of scientific experiments under ambient or controlled conditions;
  - Use of state-of-the-art instrument and equipment supporting scientific excellence.
- **Technical Services**: related to ACTRIS technology that include:
  - Provision of procedures and tools for quality assurance and control of ACTRIS measurements data from both observational and exploratory platforms;
  - Instrument-specific calibration, testing, and intercomparison;
  - Improvement of measurement and retrieval methodologies for aerosol, clouds, and reactive trace gases.
- **Innovation Services**: related to technological innovation that include:
  - Development of new observation techniques for aerosol, clouds, and reactive trace gases;

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- Improvement of measurement and retrieval methodologies for aerosol, clouds, and reactive trace gases;
- Exploration of instrument synergies and novel innovative research capabilities.

- **Training Services** that include:
  - Spreading best practices, knowledge sharing with and knowledge transfer internally and to ACTRIS users;
  - Training of instrument operators and data managers to ensure compliancy with ACTRIS standards;
  - Training of users of ACTRIS data, products and tools and training of young scientists and users from new regions world-wide;

General Services and user support are furthermore provided by the ACTRIS Head Office (HO) and includes a single-access point to all ACTRIS services, a helpdesk, a Science and user forum, and the catalogue of services.

A catalogue of services will be developed during the ACTRIS implementation phase (2020-2024) that will describe the curated collection of all services and associated information available in ACTRIS. The catalogue of services will improve the visibility of available ACTRIS services and will allow users to easily find all relevant information about the location of the service, modalities, costs, etc. The catalogue of services will be an on-line and interactive tool that is regularly updated and will help guiding the users in their quest for the needed services.

3.4 Access-related information

Access-related data is essential and associated with the quantitative description of the users and includes the information on the type of access, access modes, unit of access and quantity of access provided.

(1) Type of access. ACTRIS covers the following types of access:

- ***Virtual access*** means free access to Users provided through communication networks; the available services or resources can be simultaneously used by an unlimited number of Users and the Users are not selected. Virtual access within ACTRIS concerns access to ACTRIS data and digital tools offered by ACTRIS through the ACTRIS DC or access to ACTRIS tools offered through ACTRIS TCs. *Examples for virtual access: data, products, software, computing resources, other digital tools or ACTRIS tools.*
- ***Physical access*** is "hands-on" access when users physically use an infrastructure/facility/equipment. Physical access means access to services offered by ACTRIS through ACTRIS CFs or NFs. The available services or resources are not unlimited, and a competitive process is required for selecting the users, based on a defined selection procedure and criteria. Physical access within ACTRIS may concern access to ACTRIS TCs, DC, observational and exploratory NF. *Examples for Physical access: execution of scientific experiments on fixed and mobile platforms (ground-based observation stations, atmospheric simulation chambers, mobile experimental facilities, …), education and training activities, expert support, station audits, and other services or tools.*
- ***Remote access*** is access to resources and services offered by ACTRIS through ACTRIS CFs or NFs without users physically visiting the infrastructure/facility. Similar to physical access, the services or resources are not unlimited, and a competitive selection is required. *Examples for*

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Remote access: sample distribution, instrument calibration, QA/QC services, analytical services, provision of specific digital tools and products, computing, or other services CF.

(2) Access modes. Access modes regulate the conditions for the selection of users that may benefit from ACTRIS services. Access modes are part of the ACTRIS-internal selection and access process and are a priori not discernible to users. Access modes may differ as a function of the service requested, and may depend on possible contractual and legal obligations, capacities, resources, membership, etc. Within ACTRIS, the following access modes apply:

- ***Excellence-driven access***: the access depends on scientific excellence, originality, quality and technical and ethical feasibility of an application. The access is competitive and requires a user selection based on the ACTRIS access process and modalities: the request is evaluated through peer-review conducted by a review panel. Upon selection, users get access to the ACTRIS facilities, resources or services available. This access mode is intended to enable collaborative research, knowledge transfer, training and best practice, and technological development efforts across geographical and disciplinary boundaries based on scientific excellence. Examples for Excellence-driven access: physical and remote access to services provided by ACTRIS NFs (observational and exploratory platforms).
- ***Technical need-driven access***: the access depends on the user's technical needs to ensure instrument quality, high performance measurements, and dissemination of good practices. The access is competitive and requires a review process and evaluation. Examples for need-driven access: physical and remote access to services provided by ACTRIS CFs.
- ***Market-driven access***: the access is defined through an agreement between ACTRIS ERIC and the user; the access may be tailored to the user needs and involve user fees. This access is considered competitive access but does not necessarily involve a peer-review. Example for market-driven access: remote access to digital services provided by the ACTRIS DC.

(3) Unit of access. The unit of access (AU) is a measure to specify the quantity of access offered to a User. The AU will be defined for each ACTRIS service offered via competitive access (in case of virtual access, the definition of access units is not necessarily required), and also depends on the facility type. Different AU may be applied among the different ACTRIS services. Examples for ACTRIS access units are the following:

- one ***staff-working-day*** (1 SWD) or one staff-working-hour (1 SWH): equivalence of labour days or hours required by the CF or NF staff person to provide the ACTRIS services;
- one ***user-working-day*** (1 UWD): equivalence of one working day spent by one User at a CF or NF to benefit from the ACTRIS services provided. 1 UWD is a common AU applied at, e.g., NF (observational platforms);
- one ***research-working-day*** (1 DAY): equivalence of one working day spent by one or several Users at a CF or NF to benefit from the ACTRIS services provided. 1 DAY is a common AU applied at, e.g., NF (exploratory platforms/ simulation chambers);
- ***one service*** provided: e.g., calibration of one instrument, one intercomparison exercise, one training session, one site audit, one downloaded data set / data product, one analysis process, one processing of specific data, one model output, one-time use of a digital operation tool, one-time support to other digital service, …;

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- For DC services, the AU may also relate to memory space used per amount of time (e.g., x TB/month for storage space); the processing time by one central processing unit (e.g., y computational resources used per time interval); etc.

Within ACTRIS, the following AU are likely to be used:

- at TC: 1 SWD or SWH, or another appropriate unit relating to staff-working-time;
- at Observational NF: 1 UWD;
- at Exploratory NF: 1 DAY;
- Competitive access to other ACTRIS facilities has not yet been offered and the AU is not yet known but may include any of the AU defined above.

(4) Quantity of access provided. The quantity of access is a measure describing the number of users having accessed a specific service for a given AU.

3.5 User fees

User fees are the costs charged to users for the provision of a service. User fees are defined according to a transparent ACTRIS access pricing scheme that will be developed in the ACTRIS implementation phase. Different user fees may apply in operational ACTRIS, ranging from free-of-charge access to paid access. While user or service fees based may be envisaged in case of specific services (e.g., tailored services) or specific users (e.g., users from outside ACTRIS member/observer countries or private sector users), the costs charged to users from the public sector – being mostly academic users – are expected to be handled in a more flexible way with predominantly free-of-charge access for users from ACTRIS member countries.

4 Analysing the user requirements

Information about the user requirements can be obtained by thoroughly analysing the past record of access provided and estimating the expected user community in terms of size, type and origin in the implementation and operational phase.

4.1 Initial survey

An initial survey has been prepared and carried out at the end of the first year of ACTRIS PPP to gather quantitative information about the ACTRIS users and services. The aim was to get comprehensive information on user requirements available to date from the ACTRIS CFs and NFs. The survey was designed to obtain quantitative information both in absolute numbers and percentages for the different phase of ACTRIS in its life cycle (figure 3):

- current situation (status January 2018): actual number of users to which access is provided.
- implementation phase (pre-operational phase, 2020-2024): expected minimum and maximum values
- operational phase (2025+): expected minimum and maximum values

The initial survey is based on the user categories presented in section 3. Examples extracted from the survey are given in the following.

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1) Total annual number of users

[ACTRIS Facility]	Current/year (avg of recent yrs)		Per year for 2020-2024 period (pre-operations)				Per year for 2025+ period (operations)				Comments
	number	%	MIN number	MIN %	MAX number	MAX %	MIN number	MIN %	MAX number	MAX %	
1- Total number of ACTRIS users/year											

Figure 3: Information on total annual number of users in the initial survey for the current situation, implementation and operational phase, latter ranging between minimum and maximum values.

Although the number of users can easily be tracked in the case of physical access to NF and TC, the number of actual users can not always be counted in case of access via communication networks, e.g., to DC services. Unless users are authenticated, access is often recorded via IP addresses only, often representing a specific institution rather than the actual and different users.

2) User profile

The survey is designed such that the quantitative user information is given as absolute number and as a relative percentage (see example on user profile in figure 4). E.g., the number of new users may be x users per year or y % of the total number of users.

[ACTRIS Facility]	Current/year (avg of recent		Per year for 2020-2024 period (pre-operations)				Per year for 2025+ period (operations)				Comments
	number	%	MIN number	MIN %	MAX number	MAX %	MIN number	MIN %	MAX number	MAX %	
1- Total number of ACTRIS users											
2- Gender of ACTRIS users	number	%	number	%	number	%	number	%	number	%	
Female											
Male											
3- New users (if the users are not differentiable	number	%	number	%	number	%	number	%	number	%	
New users											
Recurrent users											
4- Research status	number	%	number	%	number	%	number	%	number	%	
UGR (undergraduate)											
PGR (post graduate)											
PDOC (post doctoral)											
EXP (expert)											
TEC (technician, engineer)											

Figure 4: Annual number of users with respect to user profile (gender, new users, research status) in the initial survey, in absolute numbers and percentage of the total annual users.

3) User background, origin and type

The user community type is indicated by the user's originating country and type and its scientific field (figure 5). The user community type is distinguished further by user community sub-categories (see figure 6), for example: type of atmospheric research community (climate research, modelling, satellite community, etc.), type of other environmental research community (hydrosphere, eco-biosphere, solid Earth domain), other research community (space physics, nanoparticle research, energy, health, ...), private sector type (instrument manufacturer, sensor industry, spin-off companies, etc.), public sector type (operational data services, air quality networks, public authorities, media, ...), other (climate and air quality initiatives, NGOs, non-profit research institutions, citizen, etc.).

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[Indicate ACTRIS Facility]	Current/year (avg of recent yrs) number	%	Per year for 2020-2024 period (pre-operations) MIN number	MIN %	MAX number	MAX %	Per year for 2025+ period (operations) MIN number	MIN %	MAX number	MAX %	*Comments*
1- Total number of ACTRIS users/year (excluding operation support)											
5- Scientific field of ACTRIS users	number	%	number	%	number	%	number	%	number	%	
Physics		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Chemistry		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Life sciences & Biotech		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Earth sciences & Environment		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Engineering & Technology		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Mathematics		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Information & Communication Technologies		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Material sciences		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Energy		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Social sciences		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Humanities		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
6- Origin of ACTRIS users	number	%	number	%	number	%	number	%	number	%	
ACTRIS member countries		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
ACTRIS observer countries		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Other European countries		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Other non-European countries (Third countries)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Local / regional / national		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
7- User community type	number	%	number	%	number	%	number	%	number	%	
7.1- Academia and public research organisations											
Academia		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Public research organisations (incl. international and private non-profit organisations)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
7.2- Business & Industry											
SMEs		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Large enterprises		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Other profit private organisations		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
7.3- Public services		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
7.4- Other		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	

Figure 5: Annual number of users with respect to the user scientific field, originating country, and user community type.

[Indicate ACTRIS Facility]	Current/year (avg of recent yrs) number	%	Per year for 2020-2024 period (pre-operations) MIN number	MIN %	MAX number	MAX %	Per year for 2025+ period (operations) MIN number	MIN %	MAX number	MAX %	*Comments*
1- Total number of ACTRIS users/year (excluding operation support)											
8- User community sub-type *(The below listed in green, column B, are examples only. Please adjust the titles of sub-categories as necessary. If you can not provide any quantitative information on the sub-user community types, you should at least provide a qualitative description in column M.)*	number	%	number	%	number	%	number	%	number	%	*(mandat*
8.1- Academic and Public research organisations *(the sum should equal the number of users in the same line, to the right)*	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	
8.1.1- Scientists from the atmospheric science research community											
Atmospheric pollution and air quality		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Climate		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Solar radiation, UV & Ozone layer, emissions & surface fluxes, Boundary layer meteorology											
Observational, modelling, satellite community		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
National and international research programmes		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
8.1.2- Scientists from various other environmental research communities											
Hydrosphere /marine domain		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Biodiversity /ecosystem domain		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Solid earth domain / geosciences, geophysics		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
8.1.3- Scientists from other research communities:											
Physics (space physics, nanoparticles, ...)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Engineering & Technology (sensor technology, ...)											
Energy domain		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Health domain		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
8.2- Business and industry *(the sum should equal the number of users in the same line, to the right)*	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	
Instrument manufacturers, sensor industries		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Spin-off companies (monitoring techniques, software for environmental technologies, ...)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Private media		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
8.3- Public services *(the sum should equal the number of users in the same line, to the right)*	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	
Operational services, National weather services, climate data services		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
National and regional AQ networks, EPAs, ...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Policy makers, local / regional / national authorities		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Public media		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
8.3- Other *(the sum should equal the number of users in the same line, to the right)*	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	0	#DIV/0!	
Voluntary and community organisations (climate, AQ initiatives, ..)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
NGOs, non-profit research institutions		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
Citizen		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	- ...

Figure 6: Annual number of users with respect to the user community sub-types (academic and public research sector, private, public and other sector).

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4) User needs

Information on user needs are indicated as a function of the ACTRIS facility type: Head Office, DC, TCs, observational NFs, exploratory NFs (chambers), exploratory NFs (mobile platforms) (figure 7). The user needs may correspond with the ACTRIS services described in section 3.3: data services, research services, technical services, training services, innovation services, general services.

[Indicate ACTRIS Facility]	Current/year (ave of recent yrs) number	%	Per year for 2020-2024 period (pre-operations) MIN number	MIN %	MAX number	MAX %	Per year for 2025+ period (operations) MIN number	MIN %	MAX number	MAX %	Comment
1- Total number of ACTRIS users/year (excluding operation support)											
9-User needs (Please list the user needs in coherence with your facility concept in the yellow fields (column B), expand lines where necessary)											
9.1- Head Office (the sum should equal the number of users in the same line, to the right)	0	0%	0	0%	0	0%	0	0%	0	0%	
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
9.2- Data Centre (the sum should equal the number of users in the same line, to the right)	0	0%	0	0%	0	0%	0	0%	0	0%	
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
8.3- Topical Centre (the sum should equal the number of users in the same line, to the right)	0	0%	0	0%	0	0%	0	0%	0	0%	
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
9.4- National Facility- Observational platforms (the sum should equal the number of users in the same line, to the right)	0	0%	0	0%	0	0%	0	0%	0	0%	
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
9.5- National Facility- Exploratory platforms (chambers) (the sum should equal the number of users in the same line, to the right)	0	0%	0	0%	0	0%	0	0%	0	0%	
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
9.6- National Facility- Exploratory platforms (mobile) (the sum should equal the number of users in the same line, to the right)	0	0%	0	0%	0	0%	0	0%	0	0%	
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...
...		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	-...

Figure 7: Annual number of users per access type, access mode and unit of access.

5) Access information

Access information indicates the number of users as a function of type of access, access type, access mode, and unit of access (figure 8)

[Indicate ACTRIS Facility]	Current/year (ave of recent yrs) number	%	Per year for 2020-2024 period (pre-operations) MIN number	MIN %	MAX number	MAX %	Per year for 2025+ period (operations) MIN number	MIN %	MAX number	MAX %	Comments
1- Total number of ACTRIS users/year (excluding operation support)											
11- Access type	number	%	number	%	number	%	number	%	number	%	
Virtual access		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Physical access		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Remote access		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
12- Access mode	number	%	number	%	number	%	number	%	number	%	
Wide access (e.g., free / virtual access to DC)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Excellence-driven access (competitive)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
Market-drivent access (competitive)		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!		#DIV/0!	
13-Access unit / quantity of access provided per year	Quantity of access		Quantity of access		Quantity of access		Quantity of access		Quantity of access		
1 AU = 1 UWD (user-working-day)											
1 AU = 1 DAY (x users per working day)											
1 AU = 1 SWD (staff-working-day)											
1 AU = 1 tailored service: ... (e.g., CAL / training session / site audit / data product / data process / use of digital tool / memory space per time / CPU processing time / etc.)											Specify
Other:											Specify

Figure 8: Annual number of users per access type (virtual, physical, remote), access mode, and unit of access.

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5) Information on user fees

Access cost-related information is not included as an access pricing scheme and user fees are not yet established and in place.

4.2 Results of initial survey

The initial survey has been carried out at the end of the first year in the ACTRIS PPP project. Not all CF units have participated, as some of the units are only being constructed (and have no records of access yet). All CFs were preparing their technical concepts in parallel to the survey, therefore, particularly the results related to the expected future access presented in this section must be considered very preliminary. Furthermore, Information from the ACTRIS DC is not included in the results although the number of users of the data services are considered to be significant.

The following CF/NF units and platforms have participated in the survey (status January 2018):

- CAIS (Centre of Aerosol In Situ Measurements): 5 units – WCCAP, ACMCC, OGTAG, INFN, ERLAP[3]
- CARS (Centre for Aerosol Remote Sensing): 3 units – AHL, ALC, ASP[4]
- CIS (Centre for Cloud In Situ Measurements): 1 unit
- Cigas (Centre for Reactive Trace Gases In Situ Measurements): 6 units – DWD, FZJ, IMT, KIT, EMPA, HEL[5]
- 9 observational platforms – CIAO, CMN, SIRTA, PUY, MAIDO, MEL, KOS, GRA, MSY[6]
- 8 exploratory platforms (atmospheric simulation chambers) – CESAM, SAPHIR, ASIBIA, LEAK, HIRAC, EUPHORE, MACC, AIDA[7]

Some selected results are presented in the following. Access-related information is not included due to required iteration with the different NF/CF. As the technical requirements were only being prepared in 2018, a more realistic and representative analysis is planned to be carried out in the implementation phase when knowledge of the corresponding capacity and services will be more advanced and available.

Total number of users

Although the information for the current status in 2018 is rather representative for those ACTRIS facilities having participated in the survey, it is not representative for ACTRIS as a whole, as not all ACTRIS facilities are included. With respect to the participating ACTRIS facilities, ACTRIS provides annually access to 472 users in 2018 (figure 9). In the implementation phase, the number of users is expected to range between 448 and 788, increasing to 574 to 1024 users in the operational phase. The results do not distinguish

[3] CAIS units: WCCAP (World Calibration Centre for Aerosol Physics), ACMCC (Aerosol Chemical Monitor Calibration Centre), OGTAG (Organic Tracer and Aerosol Constituents Calibration Centre), INFN (Istituto Nazionale di Fisica Nucleare), ERLAP (European Laboratory for Air Pollution)

[4] CARS units: AHL (aerosol high-power lidars), ALC (automatic low-power lidars and ceilometers), ASP (automatic sun/sky/lunar photometers)

[5] Cigas units: DWD (Deutscher Wetterdienst), FZJ (Forschungszentrum Jülich GmbH), IMT (Institution Mines Telecom Lille Douai), KIT (Karlsruhe Institute of Technology), EMPA (Eidgenoessische Materialpruefungs- und Forschungsanstalt), HEL (University of Helsinki)

[6] Observational platforms: https://www.actris.eu/DataServices/ObservationalFacilities/AccesstoObservationalFacilities.aspx

[7] Atmospheric simulation chambers: https://www.eurochamp.org/Facilities/SimulationChambers.aspx

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between those users benefiting from ACTRIS services vs operation support. Operation support is an internal service provided to ACTRIS NF; prior to ACTRIS PPP the service provision has been and is being granted in the framework of, e.g., EU projects such as ACTRIS-2 or EUROCHAMP-2020 where access to both internal and external users is made. In operational ACTRIS, however, operation support is excluded as the service are considered part of the internal process that is necessary for the generation of high-quality data. The corresponding users of the data services will then be recorded via virtual or remote access.

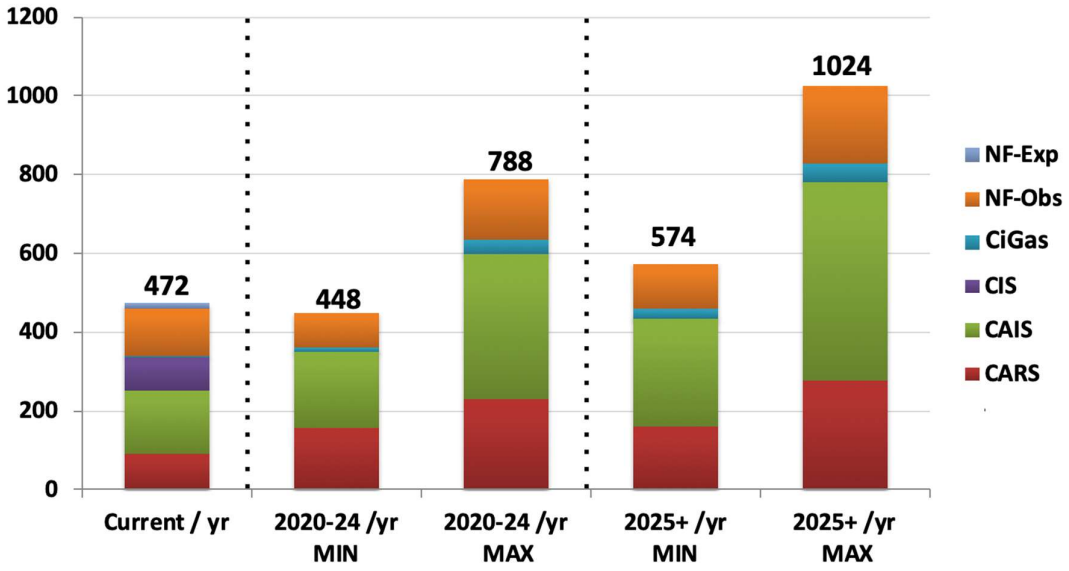

Figure 9. Total annual number of users in 2018 and estimated minimum and maximum number of users during the implementation phase (2020-2024) and operational phase (2025+).

Figure 10 shows the number of CARS users, averaging 92 users in 2018, increasing to 157 to 231 users in 2020-2024 and to 162 and 276 in 2015. The corresponding number of CARS users of both ACTRIS services and operation support as estimated in the technical concepts (see table 1 below) is considerably higher, as latter comprise all CARS units, also those that are only being constructed.

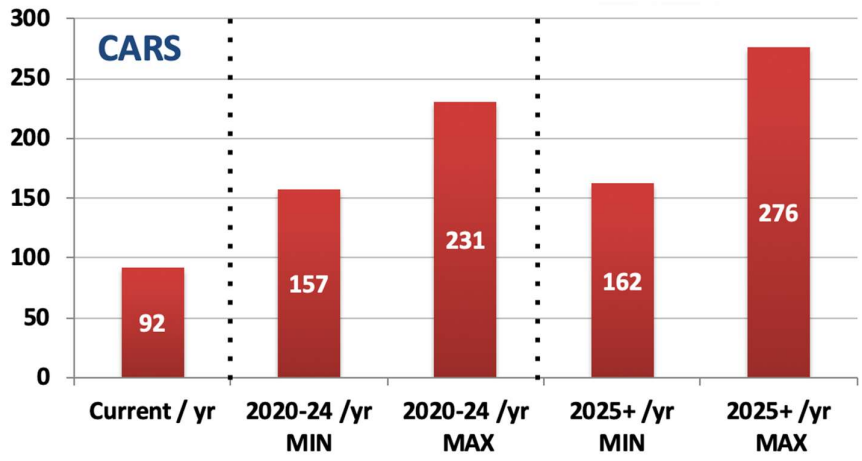

Figure 10. Total annual number of users of the TC CARS.

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Table 1: information of estimated number of CARS users in the technical TC concept (status 2018).

Measurement technique	Estimated number of ACTRIS users		
	Now (in the preparatory phase, by 2020)	by 2025	
		Min.	Max.
High-power aerosol lidar (AHL)	18	18	32
Automatic low power aerosol lidar (ALL)	55	55	107
Automatic sun/sky/polarized/lunar photometer (ASP)	68	68	90
Total	**141**	**141**	**229**

Measurement technique	Estimated number of ACTRIS National Facilities (operational support)		
	Now (preparatory phase, by 2020)	by 2025	
		Min.	Max.
High-power aerosol lidar (AHL)	25	30	60
Automatic low power aerosol lidar (ALL)	15	20	25
Automatic sun/sky/polarized/lunar photometer (ASP)	25	30	60

User profile

The user profile gives user information relative to gender, frequency, and professional profile. Figure 11 shows that about a third of the users in 2018 are female users, and on average new users represent about one third of all users across all facilities, although the number is significantly higher for users of instrumented NF (observational platforms and simulation chambers). Results on the professional profile reveal that early-career scientists have equally used the services as expert scientists (figure 12).

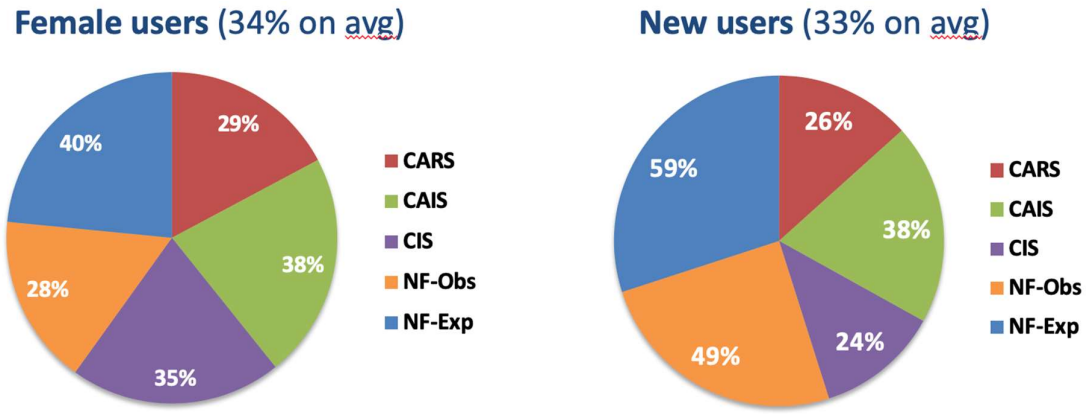

Figure 11. Number of female users (left) and number of new users (right) in 2018.

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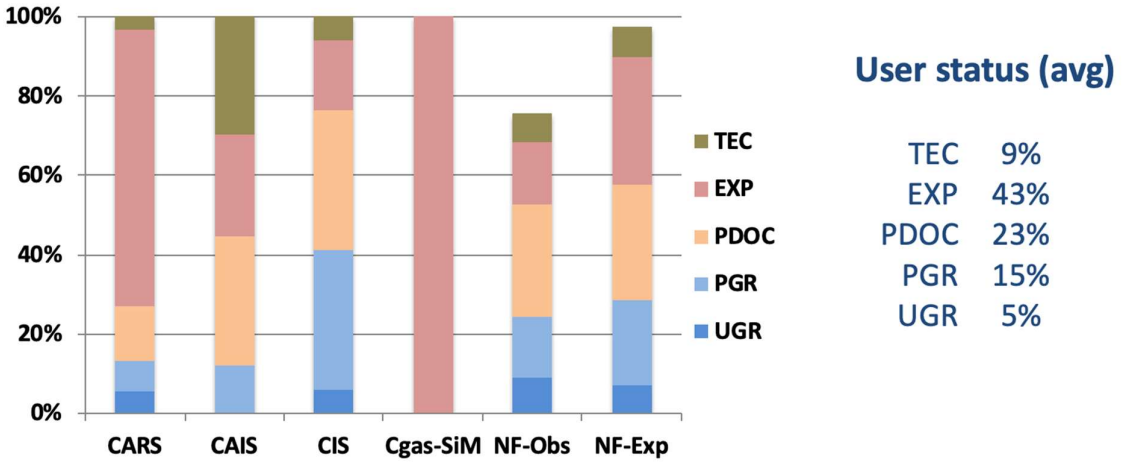

Figure 12: Professional profile of ACTRIS users in 2018, distinguishing technicians and engineers (TEC), expert scientists (EXP), early-career scientists: post-docs (PDOC) and post-graduate students (PGR), and undergraduate students (UGR).

User background

The majority of users in 2018 are from the Earth Sciences and environment domain (more than 60%), physics (19%), and chemistry (13%). Some users are from other domains such as life sciences and bio-technology (5%), or engineering and technology (2%) (figure 13). There are nevertheless significant differences between the individual facility types.

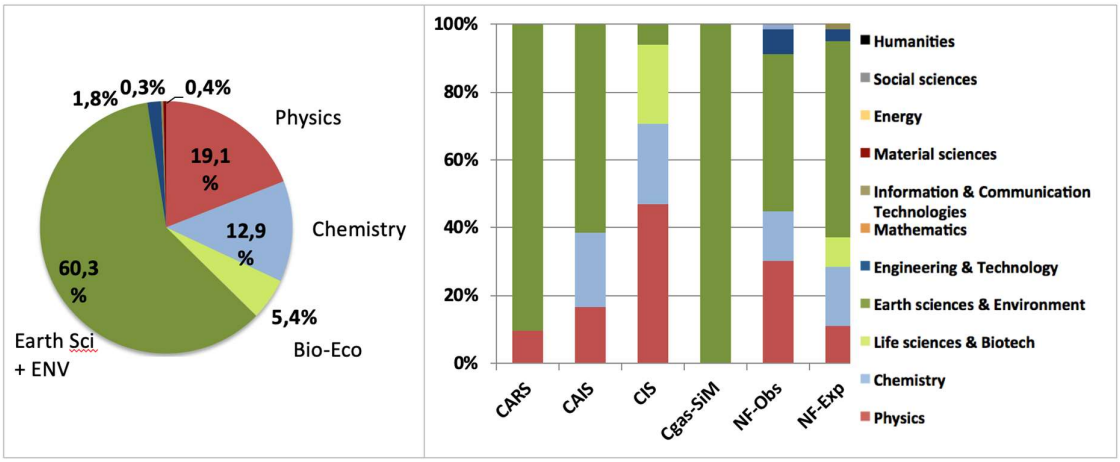

Figure 13: User scientific fields in 2018 for all participating ACTRIS facilities (left) and with respect to the different facility types (right).

User origin

The majority of users in 2018 are affiliated with institutions from ACTRIS member and observer countries (58%). 7% of the users originate from other EU countries, 26% from non-EU countries, and 8% represent local, regional, or national users (figure 14). At the time of the survey (status: 2nd Interim ACTRIS Council meeting, October 2017), ACTRIS comprises

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- 12 member countries: Cyprus, Czech Republic, Finland, France, Greece, Italy, Poland, Romania, Spain, Switzerland, The Netherlands, UK
- 3 observer countries: Denmark, Germany, Norway

Other users originate, e.g.:

- from other EU countries: Serbia, Sweden, Portugal, Belgium, Hungary, Austria, Lithuania, Slovenia, Croatia, Estonia.
- from non-EU countries: Argentina, Brazil, Jordan, Lebanon, Arab Emirates, India, China, South Korea, Georgia, Japan, USA.

ACTRIS user community type

The majority of users in 2018 (70%) are affiliated with research institutions (academia and public research organisations or private non-profit research organisations). 24% are from the public sector including e.g., national weather services and national or regional air quality agencies. About 6% of the users represent private sector users. There are significant variations between the individual ACTRIS facility types.

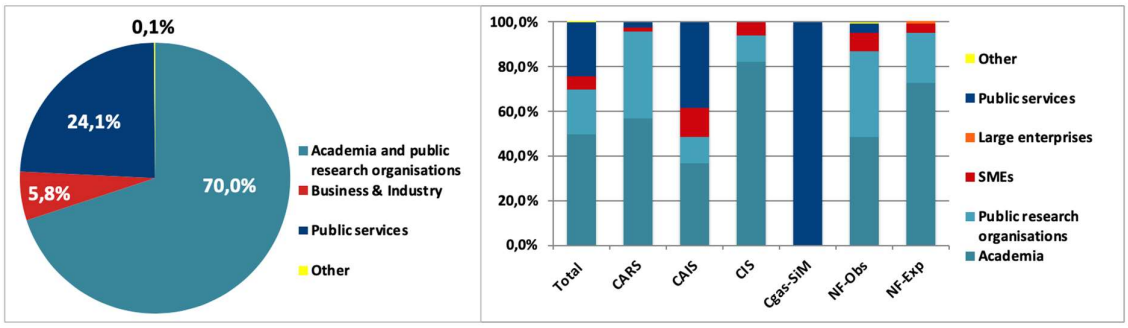

Figure 14: User community type in 2018 for all participating ACTRIS facilities (left) and with respect to the different facility types (right).

Although preliminary, the results from the initial survey on user requirements demonstrate the extent, size and origin of the ACTRIS services.

5 Summary and next steps

Detailed information about the user requirements is essential for ACTRIS in order to be able to adjust its services to the user demands and ensure optimum service provision. This document identifies the categories that should be considered for describing the user requirements which include quantitative and qualitative information about the size and type of the user community, the user origin, the user needs for ACTRIS services as well as other access- and cost-related information (the type of access, quantity of access, access mode, access unit etc.). A survey has been prepared and carried out to gather first results about the current and future user needs and selected initial results have been presented. Although the results are not very representative for the operational ACTRIS, as not all ACTRIS facilities have participated in the survey and the data has evolved throughout the preparatory phase, with the technical concepts being developed, they give valuable preliminary information about the expected user community and services demanded and are good basis for future work. A thorough and comprehensive analysis of the

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user requirements will be carried out in the ACTRIS implementation phase. Detailed Information about user requirements is fundamental for developing the ACTRIS user strategy in order to ensure an efficient and effective long-term service provision to users based on the expectations and needs of the users.

6 Reference documents

ACTRIS PPP - Access and Service Policy (Deliverable 2.6)

ACTRIS PPP - Data Policy (Deliverable 2.3)

ESFRI Strategy Report on Research Infrastructures, Roadmap 2021 Public Guide (25th September 2019): https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf

Public Roadmap 2018 Guide final version (9th December 2016): https://www.esfri.eu/sites/default/files/ESFRI_Roadmap2021_Public_Guide_Public.pdf

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