Deliverable D5.1: ACTRIS roadmap report for the next 5 to 10 years

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Background

ACTRIS results from more than 15 years of consistent development funded by both Member States and the European Commission through the Research Infrastructure programme. ACTRIS was initiated as an Integrated Initiative in 2011 building on three historical European research collaborations: **EARLINET** (European Aerosol Research Lidar Network, EU-FP5 and FP6 projects), **EUSAAR** (European Supersites for Atmospheric Aerosol Research, EU-FP6 project), earlier **CREATE** (Construction, use and delivery of an European aerosol database, EU-FP5 project), and **Cloudnet** (started as an EU-FP5 project for observing cloud profiles), to which a new integration of long-term **trace-gas** observatories was then added (Figure 1). The operations are currently running as part of ACTRIS-IA, funded as a new IA programme by the European Commission in H2020. Many of the observatories in ACTRIS are co-located with EMEP, GAW and GRUAN sites, and in many cases observations started prior to the mentioned EU projects in quasi-independent initiatives. In addition, a few facilities such as large simulation chambers are proposed as part of ACTRIS, and have been operating for years within the **EUROCHAMP** projects. The **ARISE** (Atmospheric Dynamics Research Infrastructure in Europe) project is a design study (FP7 and H2020) aimed at establishing an atmospheric research and data platform to elucidate the dynamics of the middle and upper atmosphere, including the lidar network of NDACC. ACTRIS will build upon ARISE as part of its National Facilities.

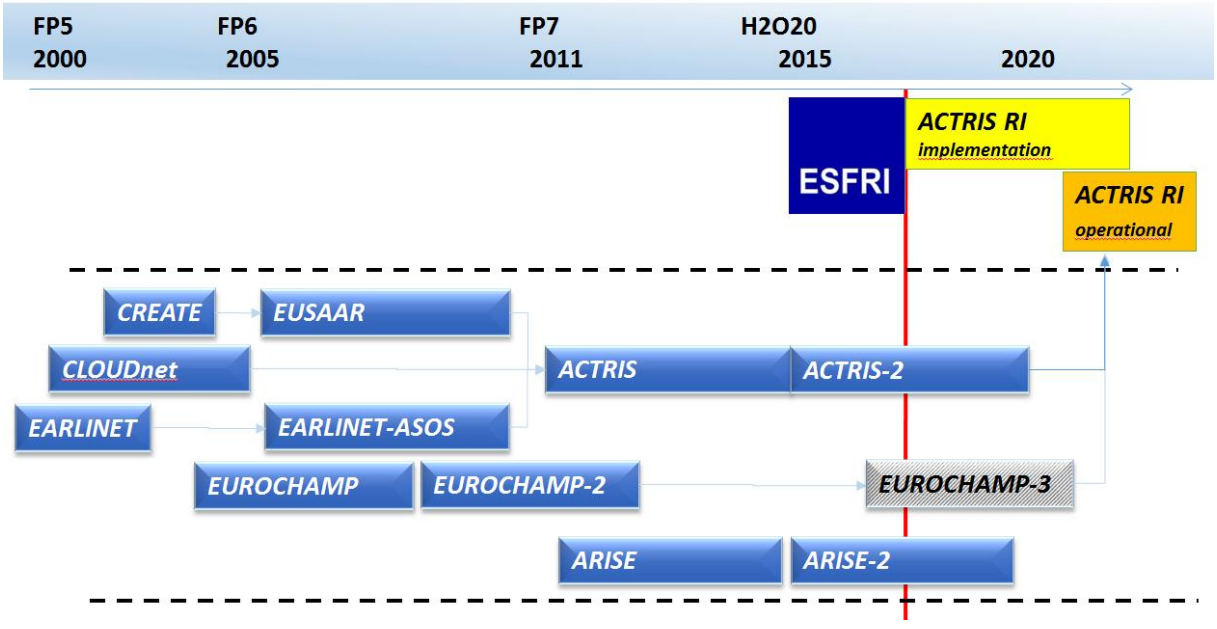

Figure 1. The evolvement of ACTRIS from FP5-FP7 projects.

Amongst the achievements of the 15-yr pre-ACTRIS research infrastructure activities is the complex data-stream from data collected through the routine operations of the National Facilities, their quality assurance and their use in higher-level data products distributed through the Data Centre, featuring search engines, multipass data selection, graphical views of data and data products, some of them in near real-time. It is also the very high quality of data provided that facilitated research of a very large community of users worldwide.

ACTRIS provides unique data sets, not covered by any other European RI, and thus complements the focus area of ICOS (greenhouse gases) with the provision of information on short-lived pollutants including short-lived climate forcers (Figure 5). Information required for addressing the complex interconnections between aerosols, clouds, and trace gases requires heavily instrumented sites that provide observations in four dimensions and the collection of a massive amount of atmospheric measurements needed to create climate-relevant long-term data. Data from ACTRIS facilities provide information to help quantify the impact of aerosols on the radiative balance of the Earth's climate system, both directly and indirectly through their influence on clouds. In fact, ACTRIS is currently unique in providing both long time series of essential climate variables as recognised in the recent IPCC report, and short-term information on significant atmospheric processes.

ACTRIS completes information provided by IAGOS both the temporal sense, by adding the required continuity of the time series, and spatially, by offering 3-D information across Europe on parameters measured by both RIs. Because ACTRIS is not limited in payload, it can deploy the heavy instrumentation required to relate cloud, aerosol, and trace-gas observations to climate and chemistry-transport model development and evaluation. In addition, ACTRIS secures operations supporting European contributions to global networks, and, in particular, data collection at several key stations world-wide forming also the NDACC component of the ARISE-2 design study.

Several exploratory platforms are part of the EUROCHAMP network which developed a grid of environmental chambers designed for the scientific investigation of atmospheric chemical and physical processes. Other exploratory platforms are offered in ACTRIS to enhance their availability and usage. The role of ACTRIS in the landscape of research infrastructures and project on the atmospheric domain is presented in figure 2.

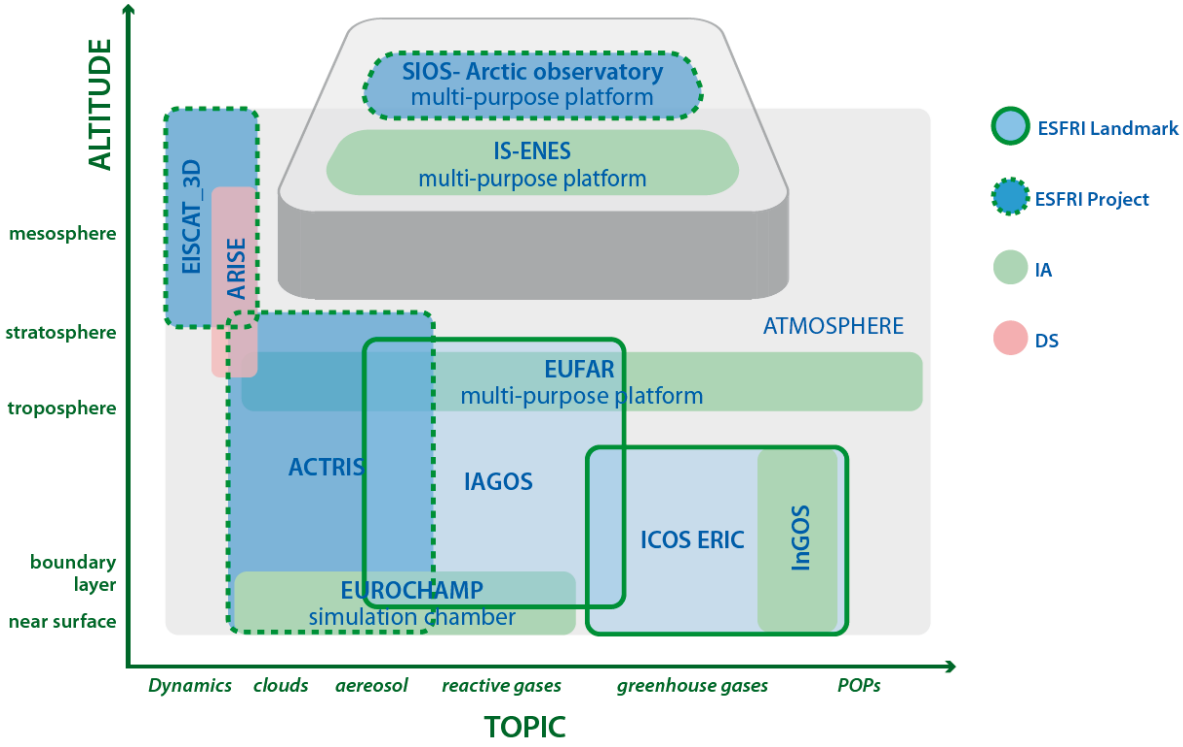

Figure 2: The European landscape for atmospheric observations from the ground as in 2015, organized according to project category.

The Road Ahead

During the past projects it has become evident that the long term sustainability of ACTRIS-type international collaboration has to be built on something else than projects. The aim of the ACTRIS community is to reshape ACTRIS into a European Research Infrastructure (RI) with its own legal entity and long term funding solution. This started by getting ACTRIS on the ESFRI (European Strategy Forum for Research Infrastructures) roadmap. The projects have already prepared the research community for this, and a lot of the research actions are already in shape that is implementable for RI form. The organizational structure, legal agreements and political and financial framework have to be implemented before the RI can be founded as its own legal entity. This process is foreseen to take roughly the years 2016-2020, at which stage ACTRIS can start its operations with limited operational capacity. The full operational capacity in terms of both service types and service volume in ACTRIS will be reached within the first operational period, years 2021-2025.

The ESFRI process towards a European Research Infrastructure also requires ACTRIS to have well-functioning national organizations. For this reason ACTRIS is pushing the national ACTRIS communities to establish joint research units and national ACTRIS consortiums in those countries where such are not yet present. It is also important for the process to get ACTRIS on the national roadmaps.

Currently international collaboration in ACTRIS is funded by EC within the Horizon-2020 Integrated Activity project ACTRIS-IA, which lasts from 5/2015 to 4/2019. The aim of this project is to strengthen the collaboration within ACTRIS community in means of common standards, common instrument calibrations and common data procedures and data flow. ACTRIS was adopted on the ESFRI Roadmap on March 10th 2016 among the six new potential Research Infrastructures. The ESFRI roadmap status enhances the role of ACTRIS in negotiations at both European and national levels. It also enables ACTRIS to apply for INFRADEV-02 funding as a preparatory phase project. ACTRIS is preparing to submit a funding proposal for a Preparatory Phase Project (ACTRIS-PPP) by June 22nd 2016.

It is projected that the ACTRIS-IA will run in parallel to the ACTRIS Preparatory Phase Project, which will be elemental for supporting the ACTRIS research infrastructure implementation. The ACTRIS Preparatory Phase Project actions will have their main focus on constructing the needed structure for National and Central Facilities for ACTRIS, establishing the European-level governance for common decision making and ensuring the European level long-term funding engagements from the Member States. Therefore, the ACTRIS-IA is a complementary action and it will support the setting up of the pan-European ACTRIS research infrastructure as the ACTRIS-IA enables the engagement of the user communities, and promotes the scientific and technical development of ACTRIS. It should be noted that all partners setting

up international facilities in the framework of ACTRIS-IA project have received support from their country, either at Ministry or Research Performing Organisation level to participate in the ACTRIS ESFRI initiative to integrate the ACTRIS network to the pan-European-level research infrastructure. A coherent interaction between ACTRIS-IA and ACTRIS Preparatory Phase Project in the planning and construction phases would be a clear asset to the project.

EUROCHAMP-community is looking for close synergies with ACTRIS. They have recently submitted an IA proposal (EUROCHAMP-3) in which they are investigating the possibility of merging into ACTRIS in near future. The short-lived components of **NDACC** (Network for the Detection of Atmospheric Composition Change) will be incorporated in the Research Infrastructure ACTRIS, also building on advances made in the NORS programme. Additionally ACTRIS is looking for collaboration opportunities with ARISE, ICOS and IAGOS.

Planned structure of ACTRIS as Research Infrastructure

As operational Research Infrastructure ACTRIS is planned consist of National Facilities and Central Facilities, those being 5 Calibration Centres, Data Centre and Head Office (Figure 3). National Facilities are measurement stations and other exploratory platforms producing ACTRIS data and offering research capabilities. They are planned to be operated at national level. The five thematic Calibration Centres offer their services and expertise in specific research as well as in instrument calibration. ACTRIS Data Centre is the route through which data from ACTRIS National Facilities is quality assured and distributed. Data Centre offers also more advanced data products. Head Office coordinates and manages the ACTRIS operations, including subsidized physical access to ACTRIS Central- and National Facilities.

Figure 3: Planned structure of ACTRIS when operational

Schedule

This section gives a short description of the different phases of implementing the ACTRIS research infrastructure and indicates the main activities within each phase.

The planned ACTRIS research infrastructure implementation phase includes decisive planning and construction phases from now to 2021. The ACTRIS research infrastructure is estimated to be operational in 2021 and fully operational in 2025. Figure 4 illustrates the different phases of ACTRIS towards fully operational services. ACTRIS aims to be operational for at least 20 years after the initiation of the operations, from 2025 – 2045 (and beyond). More detailed actions during these phases are given in figure 5, and the procedure and schedule of setting up ACTRIS Central Facilities is given in figure 6.

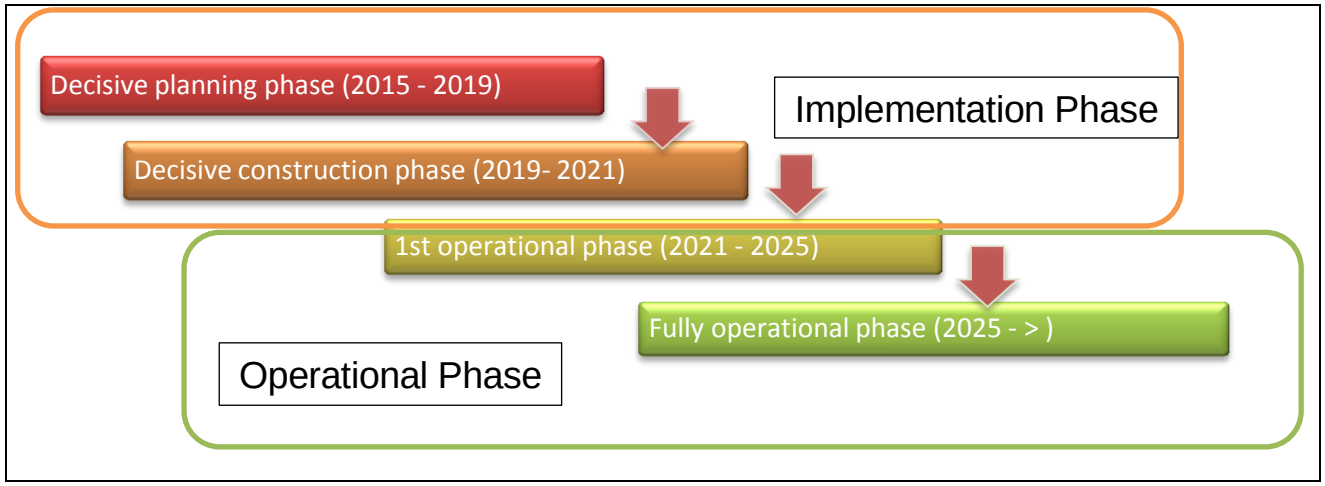

Figure 4. ACTRIS implementation phases towards fully operational ACTRIS services and implementation timeline.

Decisive planning phase (ongoing until 2019)

The decisive planning phase is needed for setting up the ACTRIS research infrastructure and this phase includes the ESFRI roadmap application process and Preparatory Phase Project. The most important activities during the planning phase are:

- Finalizing the ACTRIS National Facility requirements and starting of granting (labelling) of the individual national facilities as ACTRIS National Facilities;
- Finalization of Central Facility concept papers and evaluation of the multinational consortia Central Facility proposals for final siting selection;
- Finalizing the ACTRIS data management, ACTRIS access, and data policy protocols > implementation of the protocols;

- Establishing the interim phase governance bodies to finalize and decide on the ACTRIS ERIC statutes and ACTRIS Financial Plan for the first years of operations;
- Selection of the key personnel for the research infrastructure, including the Director General.

Decisive construction phase (ongoing until 2021)

Parallel to European-level planning, the national-level construction of the ACTRIS National Facilities will continue. The construction is based on the technical requirements originating from the ACTRIS-I3 and ACTRIS-IA projects and on the protocols and methodologies agreed during the Preparatory Phase Project.

When the formal decisions on the Central Facility siting and composition are made, the decisive construction of the Central Facilities can begin. After the physical Central Facility construction, the testing of the services and user interactions will start at the research infrastructure level in a coordinated manner.

In 2021, when all the components of the ACTRIS research infrastructure are estimated to be in place, the overall testing of the data and service work flows between the research infrastructure components will be performed. The testing phase still allows moderations and corrections of operational performance and adjustments of the research infrastructure management design to the optimal level. Specific user analysis, use cases, and user training activities will be organised to optimize the services for various user groups.

During the implementation phase, also the construction of the long-term management and monitoring systems will be set-up.

ACTRIS is seeking for co-governance benefits from the existing environmental research infrastructure legal entities. It is proposed that ACTRIS should adopt ERIC as a legal model either by establishing its own ERIC or by joining an existing ERIC, e.g., the ICOS ERIC. The description of the legal model and structure for implementation in this document is based on the assumption that ACTRIS will establish its own legal entity and governance. However, this decision will eventually be made by the ACTRIS members in the Interim ACTRIS Council.

If the ERIC is chosen as a legal model for ACTRIS, the legal documents for the ACTRIS ERIC Step 1 submission are estimated to be ready in 2018, and by the end of 2018 the ERIC Step 1 documents will be submitted to the EC. The year 2019 is dedicated to implementing the EC comments and organising the national signature process for ERIC Step 2 documents. The target is to launch ACTRIS ERIC in 2020.

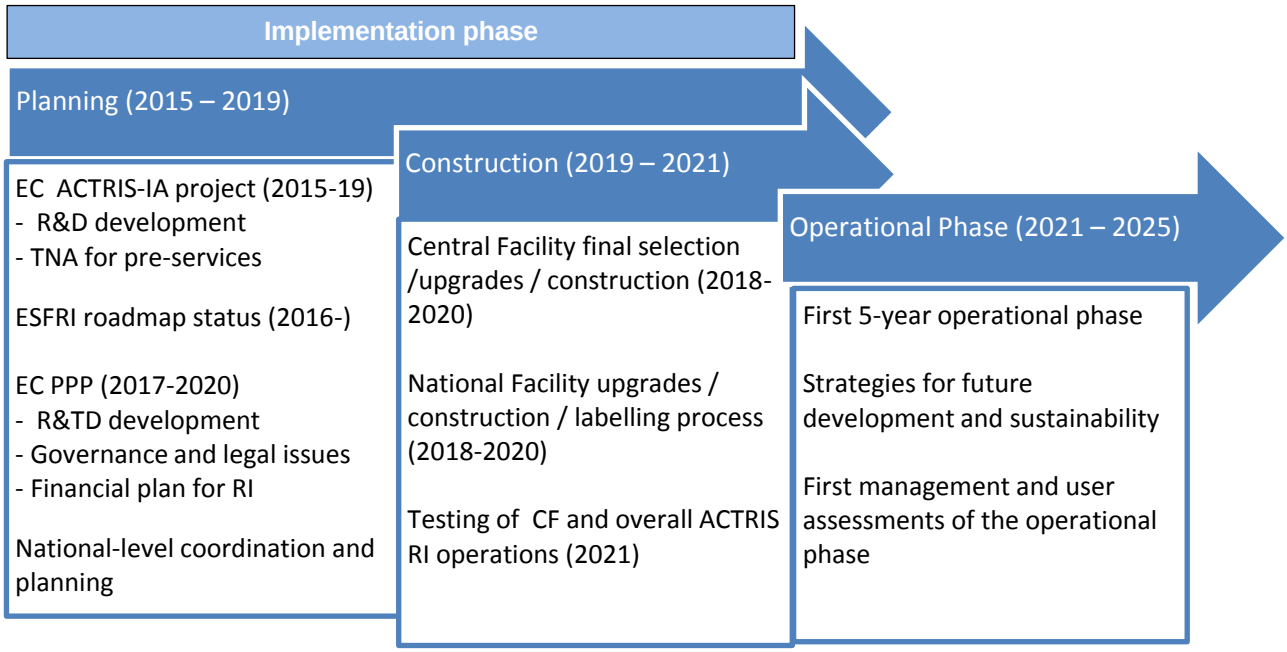

Figure 5. The main actions of ACTRIS towards operational Pan-European ACTRIS research infrastructure.

It is important for ACTRIS to have ERIC in place in 2020. ACTRIS-IA will end in 4/2019 and ACTRIS-PPP is expected to end in early 2020. From 2020 onwards ACTRIS is expected to be funded by means of national funding commitments to ACTRIS ERIC.

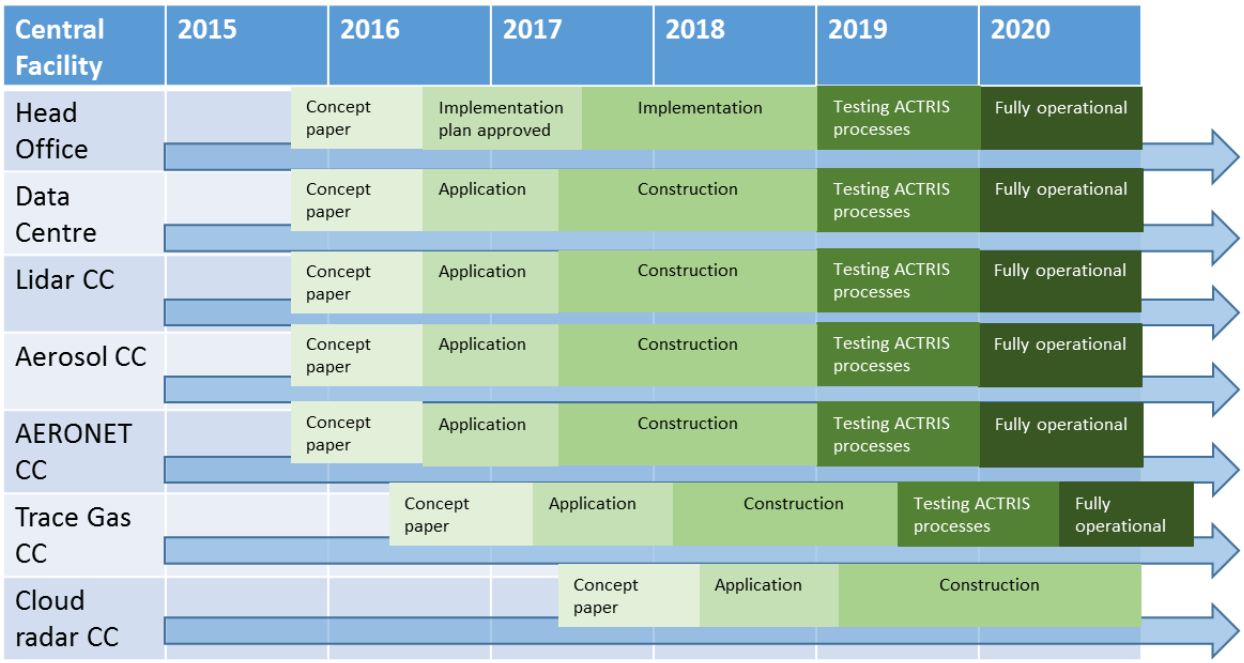

Figure 6: Implementation procedure and estimated implementation schedule for ACTRIS Central Facilities.

Initial operational phase (2021-2025)

After the establishment of the ACTRIS legal entity, the official operations and the service provisions for users will start. The ACTRIS research infrastructure services are operated according to the decided ACTRIS governance structure and according to the ACTRIS Financial Plan and Annual Activity Plan.

Gradually during the initial operation phase in 2021-2025, the ACTRIS research infrastructure will ramp up to its full service provision and data distribution capacity. This will be accomplished once the National Facility labelling process is finalised and the foreseen new ACTRIS members are included in the research infrastructure operations and to the governance structure.

First full-scale operational and management assessments will be performed during this phase. Also, the first strategies for future development and sustainability of the operations will be done.

ACTRIS in 2025

It is estimated that after the first five-year operational phase the ACTRIS research infrastructure will enter the fully operational phase which is estimated to last at least 20 years. During this long period several assessments and foresight studies will be made. The agility of the operations and management is one of the main focus areas to sustain the novel research infrastructure environment, high-quality user services, and long-term funding. With the ability to adapt to future research needs not yet foreseen during the implementation ACTRIS will remain its significance for European and global atmospheric research.

Once ACTRIS is fully operational, it will together with ICOS cover all the fields of anthropogenic radiative forcing in the atmosphere that were presented in IPCC 5th assessment report in 2013 (Figure 7). Besides providing data to scientific communities such as IPCC, ACTRIS complements the role of regulatory networks as a data provider to weather and air quality forecast and Copernicus operational servicers in fields of atmosphere and climate. Even though the spatial coverage of ACTRIS is lower than those of regulatory atmospheric networks, ACTRIS data contains a wider list of variables and higher quality standards. ACTRIS also has the flexibility to provide specific data types and variables when needed.

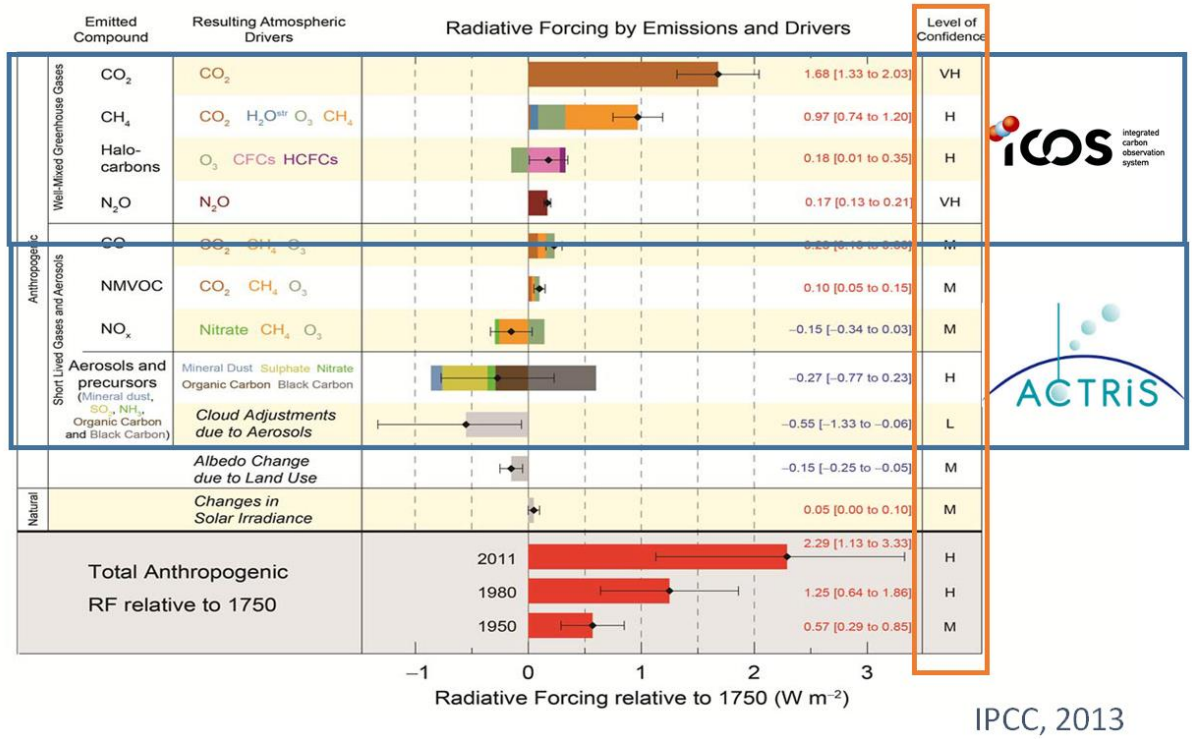

Figure 7: The role of ACTRIS and ICOS in covering the fields of anthropogenic radiative forcing.