Deliverable 10.12: Third summary of the ACTRIS data offered by the ACTRIS Data Centre

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Content

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Summary

This report focuses on the full ACTRIS-2 period and gives an overview of the data offered through the data centre from 1st of January 2014 – 31th of December 2018. The activities within the ACTRIS Data Centre and provision of measurement data from the research infrastructure is on behalf of all the data originators (instrument principle investigators) and for the whole ACTRIS consortium. It is a high priority to have continuation of long time series with harmonised methodologies, and consistent data throughout the research infrastructure. Some data sets range back to the year 2000, achieved through ACTRIS precursor-projects (EARLINET, EUSAAR, CLOUDNET ACTRIS-1 and others).

Currently, ACTRIS data includes about 110 different atmospheric variables, comprising: about 80 different trace gases, 12 different in situ aerosol variables measured near the surface, 10 aerosol profile variables, 8 cloud profile variables. The measurements utilise almost 40 different methodologies with time resolution ranging from seconds to 1 week. Additionally, ACTRIS provides near real time data (NRT) from about 25 sites in this period. ACTRIS aerosol in situ data has been provided in NRT from 51 instruments distributed over 16 sites, and practically all ACTRIS cloud profile sites have provided data in NRT during this period. 17 aerosol profile sites have set up automatic transfer of NRT data to ICARE/AERIS and groups involved in JRA 3; this is in progress.

Moreover, the ACTRIS Data Centre offers higher level data product (level 3 data). Level 3 datasets are derived from primary datasets, by e.g. averaging, filtering of events, and interpolation of data. These datasets are usually the result of analysis for a targeted article, special studies or processed for model experiments. This archive is evolving, also with DOI associated to the data.

Section 1 introduces the ACTRIS Data Centre and includes central definitions and links to core documents for ACTRIS Data Centre activity. Section 2 provides an overview of primary measurement data sets offered, while section 3 provides information on secondary data.

1 Introduction and definitions

ACTRIS measurement data are available through the ACTRIS Data Portal http://actris.nilu.no. The data are handled in 3 highly specialised topic data repositories. By the start of ACTRIS-2, measurement data from about 60 sites and ~130 different atmospheric variables were included in the ACTRIS data centre (including instrument variables). The data curation is closely linked to the networking activities and to the calibration centres to facilitate and ensure standardized and comparable procedures throughout the infrastructure. By 31 December 2018, the ACTRIS data centre has been handling data from more than 90 sites and ~130 different atmospheric variables, of these ca 80 different trace gases, 12 different aerosol variables measured near the surface, 10 aerosol profile variables, and 8 cloud variables. The data result from ca. 40 different methodologies, both near surface and remote observations, with time resolution ranging from seconds to 1 week. All data are available from the ACTRIS portal: http://actris.nilu.no, except for 8 aerosol profile variables and 1 cloud profile variable which are available upon request.

The ACTRIS data portal is a metadata catalogue. Development, management and maintenance of the data flow to the ACTRIS data portal is a centralised task performed by NILU, and the portal has been up and running close to 100% of the time, 24/7. Figure 1 shows the main structure of the portal. The metadata catalogues are updated regularly, every night through various procedures, so that new data added to the topical data bases are available through the portal by the following day at the latest. The structure is

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flexible, e.g. to add and change access to topic databases, implementation of various password and registrations procedures etc.

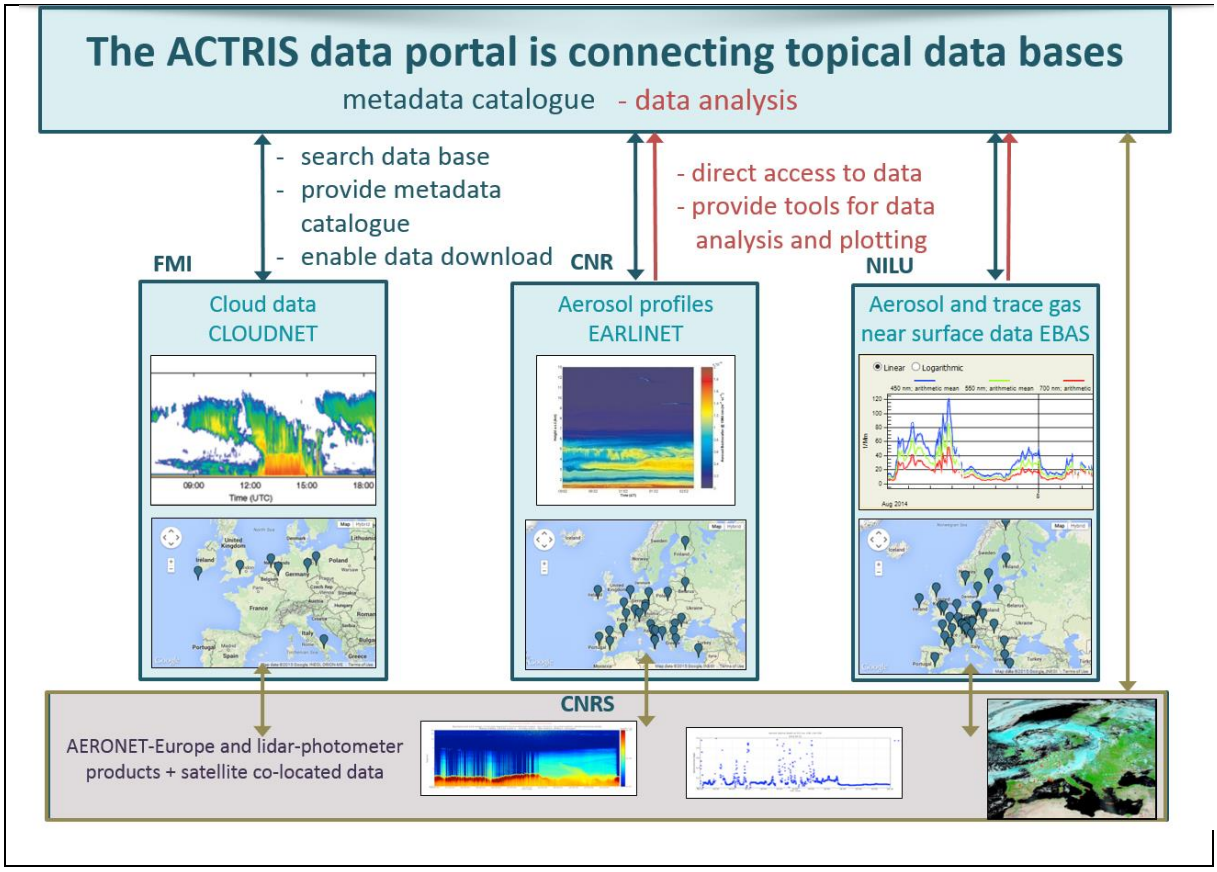

Figure 1: Overview of the core structure of the ACTRIS Data Centre.

Updates of the portal development and work during ACTRIS-2 is summarized in the two deliverables "*D10.5: Documentation and release of new ACTRIS data portal versions with implementation of new functionalities and tools*" and "*D10.6 Documentation and release of second version of ACTRIS data portal with implementation of functionalities and tools*"

The data curation of the ACTRIS primary measurements data is organised in the 3 specialised data repositories:

- All cloud profile data are archived in the Cloudnet DB: http://cloudnet.fmi.fi/ under the responsibility of FMI.
- All aerosol profile data are archived in the EARLINET data base: http://access.earlinet.org/ under the responsibility of CNR
- All aerosol and trace gas near surface data are archived in EBAS: http://ebas.nilu.no/, under the responsibility of NILU

In addition, AERIS-ICARE is the fourth topic database, which combines lidar profiles from the Earlinet database with collocated AERONET sunphotometer measurements to retrieve additional advanced aerosol data sets (GRASP/GARRLiC), and also offers satellite data support to facilitate combining ACTRIS ground data with Earth observation data.

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All data repositories are linked via the ACTRIS data portal: http://actris.nilu.no/, and the ACTRIS measurements are accessible also through the portal. Additionally, the portal provides access to secondary data. Secondary datasets are derived from primary measurement data by e.g. averaging, filtering of events, interpolation of data etc. Secondary datasets are usually the result of analysis for a targeted article, special studies or processed for model experiments. Primary datasets are regularly updated mainly due to extension of an additional year; secondary datasets are normally not updated over time.

1.1 Definitions and terms

The ACTRIS data management plan describes requirements and recommendations for ACTRIS data sets, the data flow, how the data is made available, and the data repositories. The data management plan includes a list with all ACTRIS atmospheric variables together with their recommended measurement methodology. The ACTRIS data policy and data management plan are available through the ACTRIS data portal.

Additionally, a document with central definitions has been produced to define ACTRIS data sets together with harmonised vocabulary and metrics across the ACTRIS Data Centre. This document is available at ACTRIS-2 Intranet (login is required).The following definitions will be used in this report:

- **One ACTRIS data set:** is one variable per year of measurement data with time resolution as defined in appendix 1 in the ACTRIS data management plan. The instrument has to comply with the recommendations and provide data for at least 75% if the total time defined there, over 1 year.
- **ACTRIS near real time data (NRT),** means preliminary data available within less than 3 h from the ACTRIS data Centre for near surface data, and for Cloud profile data, this is relaxed to be within one day.
- **Access and use of 1 data set**: The access of one data set: follow the definition of the data set above. A value of 1 is defined as accessing one full year of data. If a user only plots or downloads part of a year, this is a fraction of a year.

2 Primary ACTRIS data offered by the ACTRIS Data Centre

This chapter provides an overview of the quality assured ACTRIS data sets offered to all users by the ACTRIS data centre. Most sites have time series that start much earlier; this is indicated in the detailed overview on section 3. The period selected is from 1th of January 2014 – 31 December 2018 to reflect the continuous data flow and overlap with ACTRIS-FP7, and covers the first ACTRIS reporting period. Only quality assured data are included in the overview, hence some data might have been submitted to the data centre by the data originators, but is still in the progress of final quality assurance and control, before they are inserted in the data bases and accessible for users.

Figure 2 gives a broad overview of the active sites providing data to ACTRIS data centre, and accessible from the ACTRIS Data portal. The upper row shows all sites, while the second row shows distribution of site for the various domains: aerosol profile sites, aerosol near surface sites, trace gas near surface and sites providing cloud profile data. Only sites active within ACTRIS after 2011 are included.

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Figure 2: Map with overview of the active sites offering ACTRIS data accessible though the ACTRIS Data portal. The upper row show all 96 sites in one map, while the second row shows a distribution of sites for the various domains: 34 aerosol profile sites, 57 aerosol in situ sites, 27 trace gas near surface sites and 9 sites providing cloud profile data by December 2018. Aerosol in situ data are also available from Arctic, Antarctic and one south-American alpine site, illustrated in the small panel inserted.

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Within ACTRIS there is a clear ambition of providing full year with quality assured measurement data as defined in section 1. The next figures and Table gives an overview the number of sites offering full year of quality assured data through the data centre for each of the ACTRIS variables listed in the ACTRIS Data Management plan. The data sets offered for the period 2014 – 2018 are included. The statistics are calculated from the data available in the database in the period 10-20th of February 2019. As for in situ data, the reporting deadline is 31 May 2019 for 2018 data, and for aerosol profile data, the data submission to the data centre is expected within 3 months from the measurement time. Accordingly, there are few quality assured data from 2018 available at the time of this report. However, increasing numbers of NRT data, both with respect to number of variables and number of sites, is included for 2018. Note also that a few in situ variables have lower numbers for 2017 than earlier years at the time of this report. These is explained by the fact that some data are still in progress with QA/QC measures and issues with the data the identified by the data centre, that has to be corrected.

Layer and columnar parameters listed in ***Error! Reference source not found.*** will be accepted within the ACTRIS Data Centre by the end of ACTRIS-2 project as result of the complete redesign of the ACTRIS aerosol profile database (which now cannot accept this kind of data), and therefore there are no data delivered until now.

More details about the distribution sites for the various variables is available in the ACTRIS Data portal, and also shown in section 2. More details are included in Table 1 on page 12.

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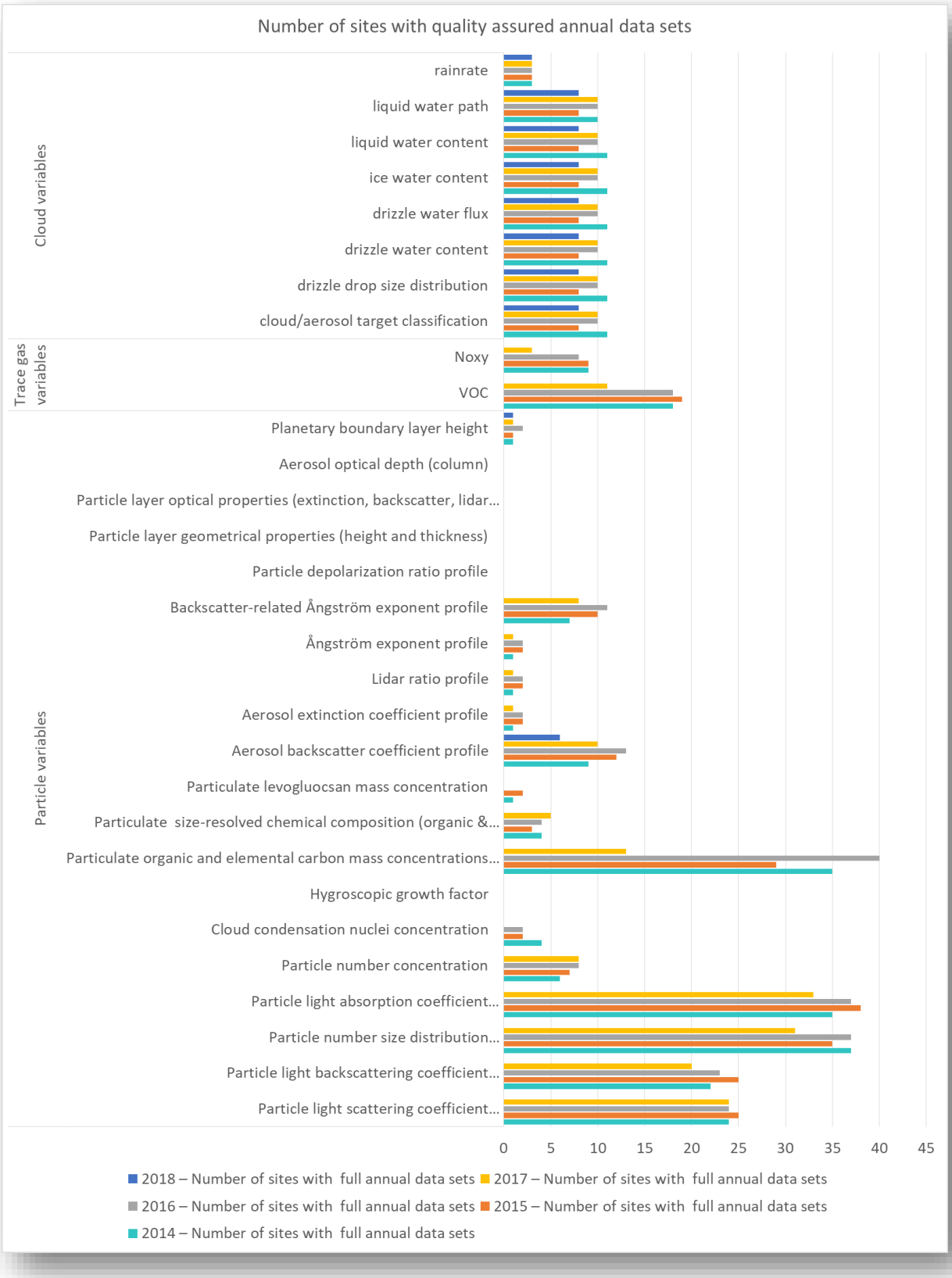

Figure 3: Overview of the ACTRIS variables and the number of sites providing quality assured annual data sets (measurements more than 75% of the defined time) - last updated February 2019.

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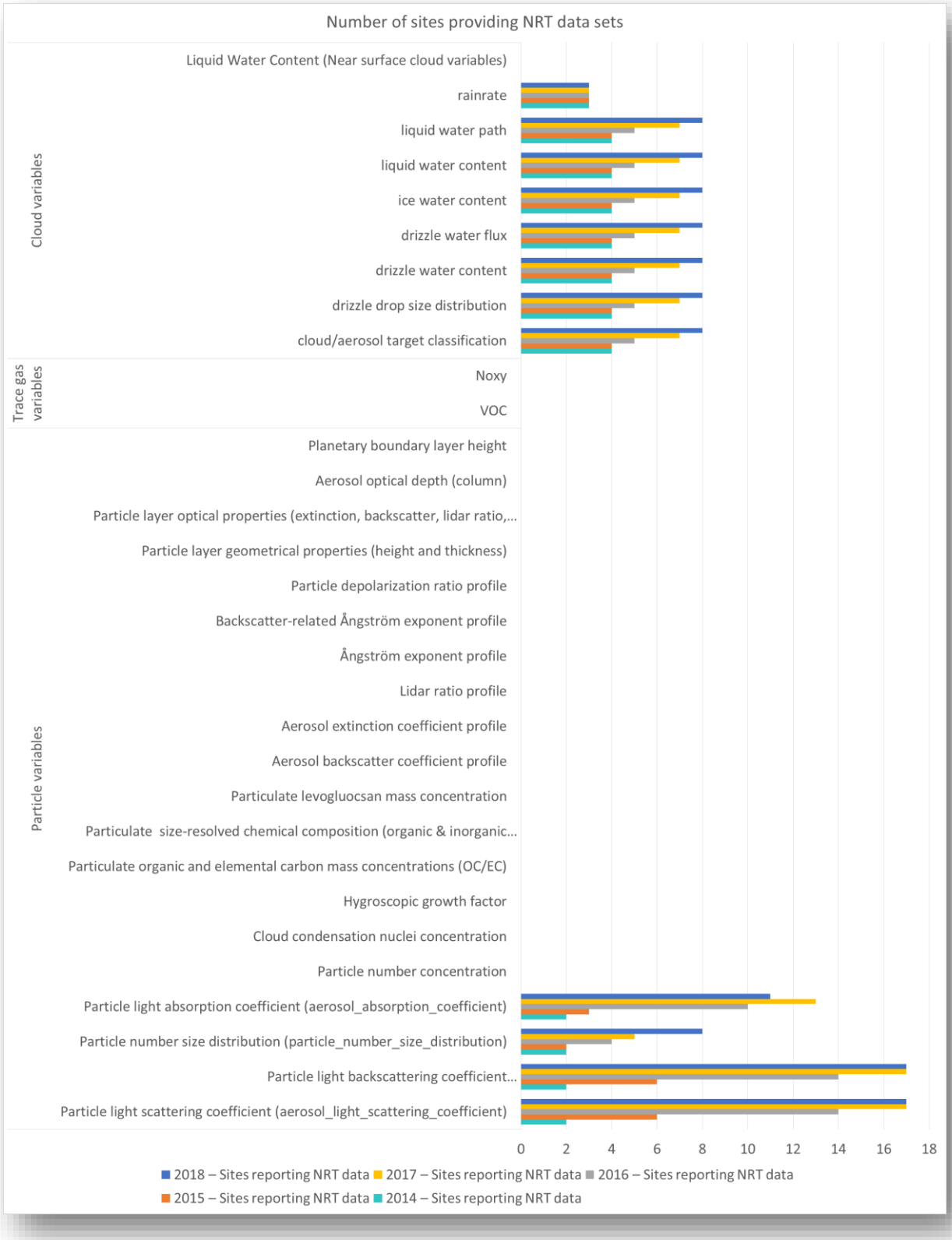

Figure 4: Overview of ACTRIS NRT variables, and the number of sites where the data centre is offering near real time data - last updated February 2019

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For aerosol profile data, there is implemented a tailored NRT data delivery to target users. In 2017, 12 sites have set up automatic transfer of aerosol profile NRT data to ICARE/AERIS for downstream processing and groups involved in JRA 3. This number had increased to 17 sites in 2018.

The following Table 1 includes the numbers for 2014-2018. Additionally, information of the sites providing data for shorter period than full year is included. This can be either intensive campaign data, or sites with lower data capture due to instrument problems, or funding challenges.

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Table 1: Overview of quality assured, and near real time data sets and campaign data offered by ACTRIS Data Centre t (per 10-20th of February 2019), measured in 2014 and onwards. Annual data sets are data sets with measurements more than 75% of the time with the required time resolution as described in ACTRIS Data Management Plan. Additionally, the number of sites providing data for shorter period than full year is included. NRT data are data sets made available for users through the data centre less than 3 hours after measurements are done.

		2014			2015			2016			2017			2018		
	Variable name	#sites, annual data sets	#sites, NRT data	#sites, campaign data sets*[1]	# sites, annual data sets	#sites, NRT data	#sites, campaign data sets*	# sites, annual data sets	#sites, NRT data	#sites, campaign data sets*	# sites, annual data sets	#sites, NRT data	#sites, campaign data sets*	# sites, annual data sets	#sites, NRT data	#sites, campaign data sets*
Aerosol in situ variables	Particle light scattering coefficient	24	2	3	25	6	2	24	14	1	24	17	1	0	17	0
	Particle light backscattering coefficient	22	2	3	25	6	1	23	14	1	20	17	0	0	17	0
	Particle number size distribution	37	2	4	35	2	1	37	4	4	31	5	1	0	8	0
	Particle light absorption coefficient	35	2	4	38	3	0	37	10	1	33	13	2	0	11	1
	Particle number concentration	6	0	0	7	0	0	8	0	1	8	0	0	0	0	0
	Cloud condensation nuclei concentration	4	0	0	2	0	0	2	0	0	0	0	0	0	0	0
	Hygroscopic growth factor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Particulate organic and elemental carbon mass concentrations (OC/EC)	35	0	0	29	0	2	40	0	0	13	0	0	0	0	0
	Particulate size-resolved chemical composition (organic & inorganic size-	4	0	3	3	0	2	4	0	1	5	0	2	0	0	2

[1] ***measurement period over 1 M or more**

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	resolved mass speciation)															
	Particulate levogluocsan mass concentration	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Trace gas in situ	VOC	18	0	1	19	0	1	18	0	2	11	0	0	0	0	0
	Noxy	9	0	1	9	0	0	8	0	0	3	0	0	0	0	0
Column and profile aerosol particle variables (remote observations from	Aerosol backscatter coefficient profile	9	na	17	12	na	18	13	na	21	10	12 stations set up automatic transfer of data to ICARE/AERIS + JRA3 groups	20	6	17 stations set up automatic transfer of data to ICARE/AERIS + JRA3 groups	9
	Aerosol extinction coefficient profile	1		7	2		10	2	0	11	1		8	0		1
	Lidar ratio profile[2]	1		7	2		10	2	0	11	1		8	0		1
	Ångström exponent profile[2]	1		6	2		9	2	0	10	1		7	0		1
	Backscatter-related Ångström exponent profile[2]	7		13	10		15	11	0	17	8		18	0		7
	Particle depolarization ratio profile	0		1	0		6	0	0	5	0		4	0		1
	Particle layer geometrical properties (height and thickness) [2]	na		na	na		na	na	14	na	na		na	na		na
	Particle layer optical properties (extinction, backscatter, lidar ratio, Ångström exponent, depolarization ratio, optical depth) [2]	na		na	na		na	na	14	na	na		na	na		na

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	Aerosol optical depth	na		na	na		na	na	4	na	na		na	na		na
	Planetary boundary layer height	1		2	1		4	2	10	3	1		2	1		0
	Column integrated extinction	4	na	na	4	na	na	6	na	na	7	13	na	6	10	na
	Aerosol columnar properties (effective radius coarse/fine, volume concentration, spherical fraction, volume size distribution, single scattering albedo, refractive index)	4	na	na	4	na	na	6	na	na	7	13	na	6	10	na
	Aerosol profile microphysical and optical properties (single scattering albedo, number concentration fine/coarse)	4	na	na	4	na	na	6	na	na	7	13	na	6	10	na
Column and profile cloud variables	cloud/aerosol target classification	11	4	4	8	4	4	10	5	4	10	7	5	8	8	3
	drizzle drop size distribution	11	4	4	8	4	4	10	5	4	10	7	5	8	8	3
	drizzle water content	11	4	4	8	4	4	10	5	4	10	7	5	8	8	3
	drizzle water flux	11	4	4	8	4	4	10	5	4	10	7	5	8	8	3
	ice water content	11	4	4	8	4	4	10	5	4	10	7	5	8	8	3
	liquid water content	11	4	4	8	4	4	10	5	4	10	7	5	8	8	3
	liquid water path	10	4	3	8	4	3	10	5	3	10	7	4	8	8	2
	rainrate	3	3	0	3	3	0	3	3	0	3	3	0	3	3	0
	Liquid Water Content (Near surface cloud variables)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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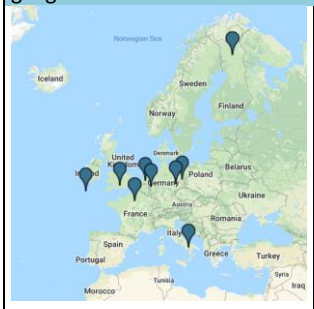
2.1 Provision of ACTRIS cloud data

The data curation of cloud profile data is performed at FMI in dialogue with each site, with all ACTRIS cloud profile data archived and accessible through the Cloudnet DB. Currently ACTRIS cloud profile data is available from 9 sites each providing 8 variables were available through the data centre by 31 December 2018. 1 variable is not available through the portal. These datasets were effectively provided as NRT data streams, while in accordance with the ACTRIS Data Management Plan. The next reporting period will include two streams, a NRT stream, and a fully-curated final stream, together with campaign sites that already produce (NRT) data, but are not yet qualified as ACTRIS data.

Table 2: ACTRIS cloud profile data archived in the topic data base Cloudnet DB. All data are accessible from the ACTRIS portal http://actris.nilu.no.

Distribution of sites March 2018	Access to QA data sets offered for download and more metadata.	Development over ACTRIS-2	NRT data
Cloud profiles: Methodology: Cloudnet scheme using cloud radar, ceilometer, microwave radiometer and (optional) rain gauge			
	Use http://actris.nilu.no and select ACTRIS-Cloudnet in networks, or download data from here http://www.cloud-net.org/data/index.html No password needed.	**May 2015:** 3 sites **November 2016:** 5 sites **December 2017:** 9 sites **February 2019:** 9 sites	Improvement in NRT capability from 3 to 5 sites, August 2016, then to 8 sites by end of 2018. Daily update of quick looks available in the ACTREIS portal: http://actris.nilu.no/content/nrt-data

2.2 Provision of ACTRIS aerosol data

2.2.1 The available aerosol profile data

CNR performs the data curation of profile data, and all ACTRIS aerosol profile data are archived and accessible through the EARLINET DB. During the first period of ACTRIS-2, 17 sites and 6 variables were sent to the data centre by 31 August 2016, either as yearly data sets (11 sites) or shorter campaign periods. Provision of NRT data (part of aerosol profile Level 1,5 data accordingly to DMP) in a standardized manner is planned for the next year. However, the capability of the NRT data stream has been considerably improved since the start of ACTRIS-2 throughout the EARLINET network and will further increase thanks to the upgrade of some systems reported in WP2. The effective provision of NRT data is expected for the next reporting period.

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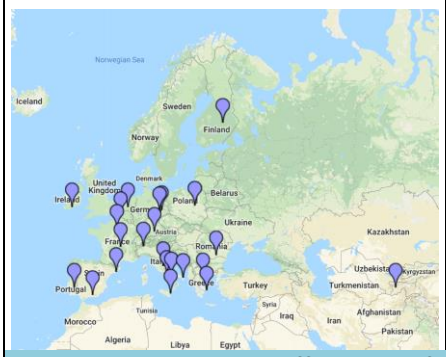
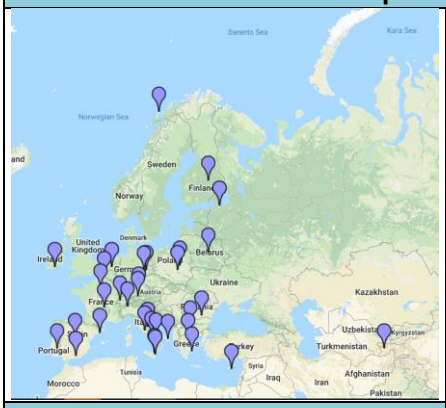
*Table 3: ACTRIS aerosol profile data archived in the topic data base EARLINET DB. All data marked with * are also accessible from the ACTRIS portal http://actris.nilu.no.*

Distribution of sites March 2018	Access to QA data sets offered for download and more metadata	Development over ACTRIS-2	NRT data
Aerosol Extinction coefficient profile* - Methodology: Raman lidar/HSRL			
	Use http://actris.nilu.no and select ACTRIS-EARLINET in networks, or download data from here http://www.earlinet.org/index.php?id=125 Password needed.	16 sites provided public data during ACTRIS per May 2015 19 sites provide public data per December 2016. 21 sites provided public data per December 2017 23 sites provided public data per December 2018 First data: Hamburg 12 January 1998	Not available
Aerosol Backscatter coefficient profile* - Methodology: Backscatter/Raman lidar/HSRL			
	Use http://actris.nilu.no and select ACTRIS-EARLINET in networks, or download data from here http://www.earlinet.org/index.php?id=125 Password needed.	28 sites provided public data during ACTRIS. 31 sites provide public data per December 2016. 33 sites provided public data per December 2017 34 sites provided public data per December 2018 First data: Hamburg 1 December 1997	Not available
Volume Depolarization			
Andoya, Barcelona, Clermont-Ferrand, Kupio, Leipzig, Potenza and Warsaw	Use http://actris.nilu.no and select ACTRIS-EARLINET in networks, or download data from here http://www.earlinet.org/index.php?id=125 Password needed.	10 sites provided public data per December 2017 7 sites provided public data per December 2018	
Planetary Boundary Layer			

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Distribution of sites March 2018	Access to QA data sets offered for download and more metadata	Development over ACTRIS-2	NRT data
Aberystwyth, Athens, Barcelona, Belsk, Bucharest, Cabauw, Cork Catania, Evora, Garmisch-Partenkirchen, Hamburg-Bergedorf, Hamburg, Ispra, Kuehlungsborn, Kuopio, L'Aquila, Lecce, Leipzig, Limassol, Madrid, Minsk, Maisach, Munich, Naples, Neuchatel, Nicolosi, Palaiseau, Potenza, Payerne, Sofia, Thessaloniki and Warsaw	Use http://actris.nilu.no and select ACTRIS-EARLINET in networks, or download data from here http://www.earlinet.org/index.php?id=125 Password needed.	28 sites provided public data per December 2017 32 sites provided public data per December 2018	
Particle Depolarization			
Andoya, Barcelona, Bucharest, Clermond-Ferrand, Dushanbe, Kupio, Leipzig, Limassol, Melpitz, Maisach, Potenza, and Warsaw	Not available through the portal Use http://actris.nilu.no and select ACTRIS-EARLINET in networks, or download data from here http://www.earlinet.org/index.php?id=125 Password needed.	10 sites provided public data per December 2017 12 sites provided public data per December 2018	
Additional optical and microphysical parameters - Methodology: GRASP/GARRLiC			
Athens, Barcelona, Belsk, Bucharest, Cabauw, Clermond-Ferrand, Cork, Evora, Granada, Kuopio, L'Aquila, Leipzig, Lille, Limassol, Madrid, Potenza, Thessaloniki, Warsaw	Not available through the portal yet (planned in 2019). Download data from: http://www.icare.univ-lille1.fr/archive/?dir=GROUND-BASED/ACTRIS-EARLINET Accept specific data policy (temporary for access to provisional data) at: http://www.icare.univ-lille1.fr/data_policy?policy=garrlic Registration required	7 sites provided public data in 2014 8 sites provided public data in 2015 12 sites provided public data in 2016 13 sites provided public data in 2017 10 sites provided public data in 2018	

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2.2.2 The available aerosol in situ data

The data curation of ACTRIS near surface aerosol measurements are performed by NILU, and the data are archived in EBAS. By March 2018, 64 sites have submitted in total 99 variables (including instrument parameters) of aerosol near surface data to EBAS complying with the ACTRIS recommendations as described in the data management plan. In addition, the number of sites providing NRT data has increased remarkably since start of ACTRIS-2. Table 4 provides full overview of the aerosol near surface data offered, and show the distribution of sites for the various aerosol near surface variables, include direct link to the QA and NRT data and compare the status to start of ACTRIS-2.

Table 4: ACTRIS aerosol in situ data offered by the data centre. The links are direct to the data archived in the EBAS data repository, and all data are also accessible from the ACTRIS portal http://actris.nilu.no. All NRT data are visualised here: http://actris.nilu.no/content/nrt-data

Distribution of sites March 2018	Link to the QA data sets offered for download and more metadata.	Compared to start of ACTRIS-2	Status of NRT data
Light scattering coefficient - Methodology: Neph			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=nephelometer&components=aerosol_light_scattering_coefficient&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	22 sites May 2015 29 sites November 2016 31 sites December 2017 31 sites December 2018 First measurements: Jungfraujoch, 1995.	3 sites May 2015 12 sites November 2016 15 sites December 2017 15 sites December 2018 http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS_NRT&InstrumentTypes=nephelometer&components=aerosol_light_scattering_coefficient&fromDate=1970-01-01&toDate=2018-12-31
Light backscattering coefficient - Methodology: Neph			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=nephelometer&components=aerosol_light_backscattering_coefficient&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	22 sites May 2015 29 sites November 2016 29 sites December 2017 29 sites December 2018 First measurements: Jungfraujoch, 1995.	3 sites in May 2015 12 sites in November 2016 15 sites December 2017 15 sites December 2018 http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS_NRT&InstrumentTypes=nephelometer&components=aerosol_light_backscattering_coefficient&fromDate=1970-01-01&toDate=2018-12-31
Number size distributions - Methodology: D/SMPS			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=dmps,smps&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	14 sites May 2015 22 sites in November 2016 37 sites December 2017 37 sites December 2018 First measurements: Hyytiälä: 1996	2 sites May 2015 3 sites November 2016 3 sites December 2017 3 sites December 2018 http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS_NRT&InstrumentTypes=dmps&fromDate=1970-01-01&toDate=2018-12-31

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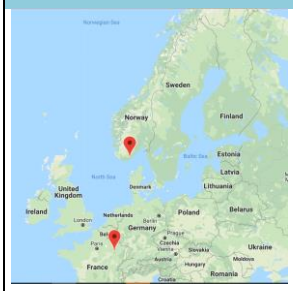
Distribution of sites March 2018	Link to the QA data sets offered for download and more metadata.	Compared to start of ACTRIS-2	Status of NRT data
Absorption coefficient - Methodology: filter absorption photometer (PSAP/MAAP/Aeth.			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=filter_absorption_photometer&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	24 sites May 2015 30 sites November 2016 40 sites December 2017 40 sites December 2018 First measurements: Jungfraujoch, 2001	3 sites May 2015 7 sites November 2016 8 sites December 2017 12 sites December 2018 http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS_NRT&InstrumentTypes=filter_absorption_photometer&fromDate=1970-01-01&toDate=2018-12-31
Number concentration - Methodology: CPC			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=cpc&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	7 sites May 2015 8 sites November 2016 9 sites December 2017 11 sites December 2018 First measurements: Jungfraujoch, 1995	Not available
Cloud Condensation Nucleus - Methodology: CCNC			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=CCNC&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	1 site in May 2015 3 sites in November 2016 3 sites December 2017 3 sites December 2018 First measurements: Vavihill 2006	Not available

Chemical characterization of EC/OC - Methodology: EC/OC filter			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&components=elemental_carbon,organic_carbon&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	7 sites May 2015 11 sites in November 2016 13 sites December 2017 13 sites December 2017 14 sites December 2017 First measurements: Puy de Dôme 2006	Not available
Chemical characterization (size and organic and inorganic speciation and mass) - Methodology: AMS			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS,ACTRIS_preliminary&InstrumentTypes=aerosol_mass_spectrometer&fromDate=1970-01-01&toDate=2019-12-31 Password needed for some sites	Data from JRA, password protected. Started within ACTRIS-FP7 12 sites May 2015 13 sites November 2016 14 sites December 2017 15 sites December 2017 First measurements: Zürich-Kaserne, 2011	Not available
Chemical characterization Levogluocsan - Methodology: Filter			
	1 site May 2015 http://ebas.nilu.no/DataSets.aspx?components=levoglucosan&fromDate=1970-01-01&toDate=2018-12-31	1 site May 2015 1 site November 2016 1 sites December 2017 2 sites December 2018 First measurements: Birkenes 2008 Data from JRA, password protected.	Not available

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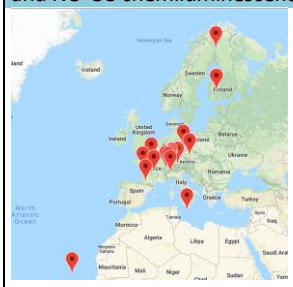
2.3 Provision of ACTRIS trace gas data

The data curation of all ACTRIS near surface aerosol and trace gas measurements are performed by NILU, and the data are archived in EBAS. By 31 December 2018, 27 sites have submitted in total 84 trace gases described in the data management plan and complying with the ACTRIS data management plan to the data centre.

Table 5: ACTRIS trace gas near surface data offered by the data centre. The links are direct to the data archived in the EBAS data repository, and all data are also accessible from the ACTRIS portal http://actris.nilu.no.

Distribution of sites March 2018	Link to the QA data sets offered for download and more metadata.	Compared to start of ACTRIS-2	Status of NRT data
NMHCs (C2-C9 hydrocarbons) Methodology: on-line (GC-FID, GC-MS, GS-FID/MS, GC-Medusa, PTR-MS), **OVOCs** (oxidised VOCs as aldehydes, ketones, alcohols) **Terpenoides** (biogenic hydrocarbons with a terpene-structure) Methodology: on-line (GC-FID, GC-MS, GS-FID/MS, GC-Medusa, PTR-MS) off-line traps (ads-tubes, DNPH-cartridge-HPLC) **All VOC, OVOC, HC**			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=ads_tube,online_gc,online_ptr&matrices=air&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	**May 2015:** 9 sites, 60 VOC, OVOC, HC trace gases in May 2015 **November 2016:** 18 sites 79 VOC, OVOC, HC trace gases **December 2017** 12 sites 67 VOC, OVOC, HC trace gases **December 2018** 12 sites 66 VOC, OVOC, HC trace gases First measurements: Rigi 2001	Not available
NO, NO2 - NOy (NO, NO2, NO3, N2O5, HNO2, HNO3, PAN, organic nitrates and aerosol nitrates (sum of oxidized nitrogen species with oxidation number >1) Methodology: NO-O3 chemiluminescence, CRDS, laser induced fluorescence (LIF), Cavity Attenuated Phase Shift Spectroscopy (CAPS), indirect: NO-O3 chemiluminescence coupled to photolytic converter (Xenon lamp (PLC) or diode (BLC)) and NO-O3 chemiluminescence coupled to gold converter			
	http://ebas.nilu.no/DataSets.aspx?projects=ACTRIS&InstrumentTypes=chemiluminescence_molybdenum,chemiluminescence_photolytic,chemiluminescence_photometer&matrices=air&fromDate=1970-01-01&toDate=2018-12-31 No password needed.	**May 2015:** 13 sites, 4 trace gases **November 2016:** 14 sites, 4 trace gases **December 2017:** 15 sites, 4 trace gases **December 2018:** 17 sites, 4 trace gases First measurements: Jungfraujoch, 1991	Not available

3 Higher level data sets offered by the ACTRIS Data Centre

ACTRIS level 3 datasets are derived from primary measurement data by e.g. averaging, filtering of events, interpolation of data etc. The primary measurement data can consist only of ACTRIS data sets, or include other data as well. Level 3 datasets are usually the result of analysis for a targeted article, special studies or processed for model experiments.

3.1 Higher level data sets offered through ACTRIS data portal

Higher level data set are available from here: http://actris.nilu.no/Content/products. The DOIs marked in yellow are level 3 data sets. Currently, the following comprehensive data sets are offered:

I. ***Collocated observations of cloud condensation nuclei, particle size distributions, and chemical composition*,** Submitted to Scientific Data September 2016, [pertaining data] [data policy]

II. ***Warming-induced increase in aerosol number concentration likely to moderate climate change*,** Nature Geoscience, DOI:10.1038/NGEO1800. [article] [pertaining data] [data policy]

III. ***Number size distributions and seasonality of submicron particles in Europe 2008–2009***, Atmospheric Chemistry and Physics, DOI:10.5194/acp-11-5505-2011. [article]

IV. ***Aerosol decadal trends - Part 1: In-situ optical measurements at GAW and IMPROVE stations,*** Atmospheric Chemistry and Physics, DOI:10.5194/acp-13-869-2013. [article][pertaining data] [data policy]

V. ***Aerosol decadal trends - Part 2: In-situ aerosol particle number concentrations at GAW and ACTRIS stations*** Atmospheric Chemistry and Physics, DOI:10.5194/acp-13-895-2013. [article] [pertaining data] [data policy]

VI. **Time series of aerosol light-absorption coefficients from Aethalometers at six Arctic stations between 2012 and 2014.** By John Backman*, Lauren Schmeisser, Aki Virkkula, John A. Ogren, Eija Asmi, Sandra Starkweather, Sangeeta Sharma, Konstantinos Eleftheriadis, Stergios Vratolis, Taneil Uttal, Peter Tunved, Anne Jefferson, Michael Bergin, Alexander Makshtas, Peter Tunved, and Markus Fiebig (2017) https://doi.org/10.21336/gen.1

VII. **Trends in atmospheric sulfur components from the major regional monitoring network including results from six global atmospheric transport models, 1990-2015 (data from 1980)** By Wenche Aas*, Augustin Mortier, Van Bowersox, Ribu Cherian, Greg Faluvegi, Hilde Fagerli, Jenny Hand, Zbigniew Klimont, Corinne Galy-Lacaux, Christopher M.B. Lehmann, Cathrine Lund Myhre, Gunnar Myhre, Dirk Olivié, Keiichi Sato, Johannes Quaas, P.S.P. Rao, Michael Schulz, Drew Shindell, Ragnhild B. Skeie, Ariel Stein, Toshihiko Takemura, Svetlana Tsyro, Robert Vet, Xiaobin Xu, https://doi.org/10.21336/gen.2

VIII. **Measured and modeled surface concentrations of aerosols from "Concentrations and radiative forcing of anthropogenic aerosols from 1750-2014 simulated with the OsloCTM3 and CEDS emission inventory"** By Marianne Tronstad Lund*, Gunnar Myhre, Amund Søvde Haslerud, Ragnhild Bieltvedt Skeie, Jan Griesfeller, Stephen M. Platt, Rajesh Kumar, Cathrine Lund Myhre, Michael Schulz , https://doi.org/10.21336/gen.3

IX. **Time series of aerosol light scattering coefficients and enhancement factors from humidified tandem nephelometers at twenty-six stations between 1998 and 2017** By Maria A. Burgos*, Elisabeth Andrews, Gloria Titos, Lucas Alados-Arboledas, Urs Baltensperger, Derek Day, Anne Jefferson, Nikos Kalivitis, Nikos Mihalopoulos, James Sherman, Junying Sun, Ernest Weingartner, and Paul Zieger https://doi.org/10.21336/gen.4

These data sets are archived at NILU in a long term sustainable archive, and with the possibility of having digital object identifier (DOI) for each data set.

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3.1.1 Higher level aerosol profile datasets from particular events or campaigns

The portal also provides links to special aerosol profile datasets measured during particular events or campaigns, archived in EARLINET DB as Aerosol Profile Datasets. These are:

- **EARLINET 72h operational exercise dataset,** Dataset of the lidar products automatically generated by the SCC (Single Calculus Chain) for the intensive operating period: 9 July 2012 at 06:00 UT - 12 July at 06:00 UT, as EARLINET controlled exercise of feasibility to demonstrate its potential to perform operational, coordinated measurements and deliver products in near-real time. See Atmospheric Measurements and Techniques, doi:10.5194/amt-8-4587-2015. [article] [data policy]

- **Eyjafjallajökull 2010 – EARLINET 4D volcanic particles distribution**, A dataset reporting the four-dimensional (4-D) distribution of the Eyjafjallajökull volcanic cloud in the troposphere over Europe as observed by EARLINET during the entire volcanic event (15 April–26 May 2010), Atmospheric Chemistry and Physics, doi:10.5194/acp-13-4429-2013. [article] [data policy]

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