

## The concept and description of ACTRIS variables and ACTRIS data

### ACTRIS variables

ACTRIS variables are atmospheric variables for which an operation procedure is discussed within ACTRIS NAs or JRAs, or for which ACTRIS contributed to improving measurement and data quality. Appendix I includes a list of all ACTRIS variables and recommended measurement methodology. The list will undergo regular revisions, and evolve in accordance with the work in ACTRIS NAs and JRAs, and the scientific consensus about the need for observations and selection of appropriate measurement methodology.

### Definition of ACTRIS data

ACTRIS data are variables measured with the recommended methodology as specified in Appendix I. Furthermore, the data are qualified as ACTRIS data only if the following additional requirements are met:

- **Aerosol profiling** is qualified as ACTRIS data only if
  - The data are provided by an ACTRIS partner, third party, or associated partner.
  - The lidar channels used to obtain the data follow the EARLINET hardware quality-assurance internal procedures described in the document "*Lidar quality-assurance internal checkups*" available in the WP2 domain of the ACTRIS intranet, and from the ACTRIS data center.
  - The lidar station providing the data is in the roster of periodical direct intercomparisons against a reference system.
  - The algorithms used to retrieve the data from the measurements have successfully passed the tests set and recommended by ACTRIS aerosol profile expert group, available through the ACTRIS<sup>1</sup> web pages.
  - The data variables and their format comply with the EARLINET variables and format as described in the data archive and user section of the EARLINET intranet, and made available at the ACTRIS web pages.
  - The data are available from the EARLINET database.

The data can also be associated to other programs and frameworks such as GAW, GALION, and national EPA etc. The data providers determine project associations.

- **Aerosol *in situ* data** are qualified as ACTRIS data only if the measurement data are submitted to EBAS by using the templates recommended by the ACTRIS aerosol community, and following the procedures described in the available measurement guidelines. The templates ensure that the measurements are reported in accordance with the procedures for the employed instrument, and include all the necessary metadata required to precisely describe the measurements. In this way, all ACTRIS aerosol *in situ* data are accompanied by a sufficient documentation of the measurements to have information on the quality of the data.

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<sup>1</sup> <http://www.actris.net/language/en-GB/Publications/ACTRISQualityStandards.aspx>

For *in situ* variables from Appendix I; all ACTRIS partners shall label their contribution to EBAS with “ACTRIS”. The data can also be associated to other programs and frameworks like GAW, EMEP, and national EPA etc. Project associations are determined by the data providers.

- **Trace gas *in situ* data** are qualified as ACTRIS data only if the measurement data are submitted to EBAS by using the templates recommended by the ACTRIS trace gas community, and following the procedures described in the drafted measurement guidelines. The templates ensure that the measurements are reported in accordance with the procedures for the employed instrument, and include all the necessary metadata required to precisely describe the measurements. In this way, all ACTRIS trace gas *in situ* datasets are accompanied by a sufficient documentation of the measurements to have information on the quality of the data.

For *in situ* variables from Appendix I, all ACTRIS partners shall label their contribution to EBAS with “ACTRIS”. The data can also be associated to other programs and frameworks like GAW-WDCGG, EMEP, InGOS, and national EPA etc. The data providers determine project associations.

- **Cloud profiling data** is qualified as ACTRIS data only if:
  - The measurement data that are submitted have followed the procedures detailed within WP5 and Cloudnet. These procedures provide a template which enforces standardised objective processing and classification of the data.
  - The measurement and derived product variables are provided together with sufficient metadata (as detailed in WP5 and Cloudnet)
  - The data are available from the Cloudnet database.

The data can also be associated to other programs and frameworks such as Cloudnet, ARM, HD(CP)<sup>2</sup> and national EPA etc. The data providers decide project associations.

## ACTRIS site

An ACTRIS station is a measurement site delivering ACTRIS data to the ACTRIS Data Centre in accordance with the ACTRIS requirements described above. The ACTRIS stations can be called *ACTRIS aerosol in situ station*, or *ACTRIS trace gas in situ station*, or *ACTRIS aerosol profile station* or *ACTRIS cloud profile station*, depending on the variables provided.

## ACTRIS Secondary data products and project data tools

**ACTRIS Secondary Datasets** are derived from primary ACTRIS data by e.g. averaging, filtering of events, interpolation of data etc. ACTRIS secondary data sets and project data tools can also include codes, algorithms and software used to generate ACTRIS primary or secondary data. Whereas primary datasets are regularly updated mainly due to extension of a new year, secondary datasets are normally not updated. Secondary datasets are usually the result of targeted analysis, special studies or processed for model experiments. ACTRIS secondary data sets are stored in dedicated catalog in the ACTRIS Data Centre or specified in the ACTRIS relational databases to provide long term access for all users.

## **Appendix I:**

### **List of ACTRIS variables and recommended methodology**



<b>ACTRIS aerosol variables</b>					
<b>Variable</b>	<b>Recommended instruments/methodology</b>	<b>QA</b>	<b>NRT</b>	<b>Approx. time resolution</b>	
<b>Aerosol in situ</b>					
light scattering coefficient	Neph	X	X	1h, continuous measurements	
light backscattering coefficient	Neph	X	X	1h, continuous measurements	
Number size distributions	D/SMPS	X	X	1h, continuous measurements	
Absorption coefficient	PSAP/MAAP/Aeth.	X	X	1h, continuous measurements	
Number concentration	CPC	X	X	1h, continuous measurements	
Cloud Condensation Nucleus Counter	CCNC	X	X(later)	1h, continuous measurements	
Hygroscopic growth factor	HTDMA	X		1h, continuous measurements	
Chemical characterization of EC/OC	EC/OC filter	X		1d-1week	
Chemical characterization (size, organic and inorganic speciation and mass)	AMS	X		1h, continuous measurements	
Levoglucosan	Filter, SOP under development			1d-1week	
<b>Aerosol profiles (remote observations from ground)</b>					
Aerosol backscatter coefficient profile	Backscatter lidar / Raman lidar/High spectral resolution lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Aerosol extinction coefficient profile	Raman lidar / High spectral resolution lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Lidar ratio profile	Raman lidar / High spectral resolution lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Ångström exponent profile	Multiwavelength Raman lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Backscatter-related Ångström exponent profile	Multiwavelength backscatter lidar/Raman lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Linear particle depolarization ratio profile	Depolarization backscatter lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Planetary boundary layer height	Backscatter lidar / Raman lidar/ High spectral resolution lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Aerosol layer geometrical properties (height and thickness)	Backscatter lidar / Raman lidar/ High spectral resolution lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Aerosol layer optical properties (extinction, backscatter, lidar ratio, Ångström exponent, depolarization ratio, optical depth)	Multiwavelength Raman lidar	X		0.5 h, 2+1 measurements per week + special events + CALIPSO overpasses (2.5 h)	
Aerosol optical depth (column) + AERONET related products	Sun/sky photometer	X	X		

## ACTRIS trace gas variables

Variable	Recommended instruments/methodology	QA	NRT	Approx. time resolution
NMHCs (C2-C9 hydrocarbons)	on-line (GC-FID, GC-MS, GS-FID/MS, GC-Medusa, PTR-MS) and off-line traps ( ads-tubes) and off-line (steel canisters + glass flasks)	X		1 h-2/week
OVOCs (oxidised volatile organic compounds as aldehydes, ketones, alcohols)	on-line (GC-FID, GC-MS, GS-FID/MS, GC-Medusa, PTR-MS) and off-line traps ( ads-tubes, DNPH-cartridge-HPLC)	X		1 h-2/week
terpenoides (biogenic hydrocarbons with a terpene-structure)	on-line (GC-FID, GC-MS, GS-FID/MS, GC-Medusa) and off-line traps (ads-tubes)	X		1 h-2/week
NO	NO-O <sub>3</sub> chemiluminescence	X	X	1 min - 1 h
NO <sub>2</sub>	indirect: NO-O <sub>3</sub> chemiluminescence coupled to photolytic converter (Xenon lamp (PLC) or diode (BLC)), direct: cavity ring down spectroscopy (CRDS), laser induced fluorescence (LIF), Cavity Attenuated Phase Shift Spectroscopy (CAPS)	X	X	1 min - 1 h
NO <sub>y</sub> (NO, NO <sub>2</sub> , NO <sub>3</sub> , N <sub>2</sub> O <sub>5</sub> , HNO <sub>2</sub> , HNO <sub>3</sub> , PAN, organic nitrates and aerosol nitrates sum of oxidized nitrogen species with an oxidation number >1, both organic and inorganic.)	indirect: NO-O <sub>3</sub> chemiluminescence coupled to gold converter	X	X	1 min - 1 h

<b>ACTRIS cloud variables</b>				
<b>Variable</b>	<b>Recommended instruments/methodology</b>	<b>QA</b>	<b>NRT</b>	<b>Approx. time /height resolution</b>
cloud aerosol target classification	cloud radar, lidar/ceilometer, NWP model or radiosonde (optional: microwave radiometer, raingauge)	X	X	30 seconds / 60 metres
drizzle drop size distribution	Doppler cloud radar, lidar/ceilometer, NWP model or radiosonde (optional: microwave radiometer, raingauge)	X	X	30 seconds / 60 metres
drizzle water content	Doppler cloud radar, lidar/ceilometer, NWP model or radiosonde (optional: microwave radiometer, raingauge)	X	X	30 seconds / 60 metres
drizzle water flux	cloud radar, lidar/ceilometer, NWP model or radiosonde (optional: microwave radiometer, raingauge)	X	X	30 seconds / 60 metres
ice water content	cloud radar, lidar/ceilometer, NWP model or radiosonde (optional: microwave radiometer, raingauge)	X	X	30 seconds / 60 metres
liquid water content	cloud radar, lidar/ceilometer, microwave radiometer (optional: raingauge)	X	X	30 seconds / 60 metres
liquid water path	dual- or multi-frequency microwave radiometers (ceilometer useful for identifying clear-sky)	X	X	30 seconds
rainrate	drop-counting raingauge or disdrometer preferable to tipping bucket raingauges	X	X	30 seconds