Milestone MS10.9: Description of the ACTRIS Level 1 Level 2 and Level3 aerosol profile data

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Objectives

The ACTRIS aerosol profile database is facing a complete reshape *in a more user oriented approach* but still in continuity with the past: the new EARLINET database will be based on the standard files, but providing to the users also more directly accessible information with no needs for expert's mediation.

The design of the new ACTRIS aerosol profile database is the result of the progresses made within the corresponding network activity (WP2) and has been discussed and defined within the related scientific community (WP2) as described in the deliverable D2.1.

The definition on how these new products will be implemented and handled with related data curation are described in this milestone together with the main aspects of the data themselves. The effective implementation of the complete chain are one of the main objective f the WP10, Virtual Access workpackage and will be achieved by the end of the ACTRIS-2 project. The reshaping of the EARLINET database is currently in progress, but in order to assure the service of data collection and provision in the meanwhile the old structure of the database is still operational. The need of providing a continuous service to both sides (data originators and data users) imposes a slow transition between the 2 versions of the EARLINET database. Furthermore it has to be taken into account that the data provision and the data products themselves are always improving, keeping the database structure and content highly dynamic and with continuous improvements.
The complete description into details of all data products in terms of variables, names and so on is out of the scope of the present document and will be delivered together with the effective data product delivery. Instead, the aim of this document is describing the general design and data content for Level1, Level 2 and Level 3 aerosol profile data, providing all needed information about which physical information are available and in which product with this new database design.
The current document firstly provides a general description of the structure of the new EARLINET database and its organization in Levels. Then a short description of the EARLINET data processing workflow and finally a draft of the structure of each EARLINET data product are reported.

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General description of the new EARLINET database

The new structure of the EARLINET database is schematically reported in Figure 1. The ***Level 1*** contains ***pre-processed lidar data***, i.e. a step in between the raw signal (Level 0 data stored at each station) and the optical properties, where all instrumental corrections are already implemented. The Level 1 data are the base for the retrieval of the ***optical properties*** contained in the ***Level 1.5*** products. The Level 1.5 datasets are not quality checked, except for format aspects, and therefore released as soon as data originators submit them to the database. Afterwards, all the Level 1.5 data pass through quality check procedures. Data originators are informed about data not passing these procedures. Only the data that passed the quality checks go into the ***Level 2*** which is therefore the ***quality checked optical properties*** level. Finally, the ***Level 3*** data contain ***climatological datasets*** retrieved from the Level2optical products.

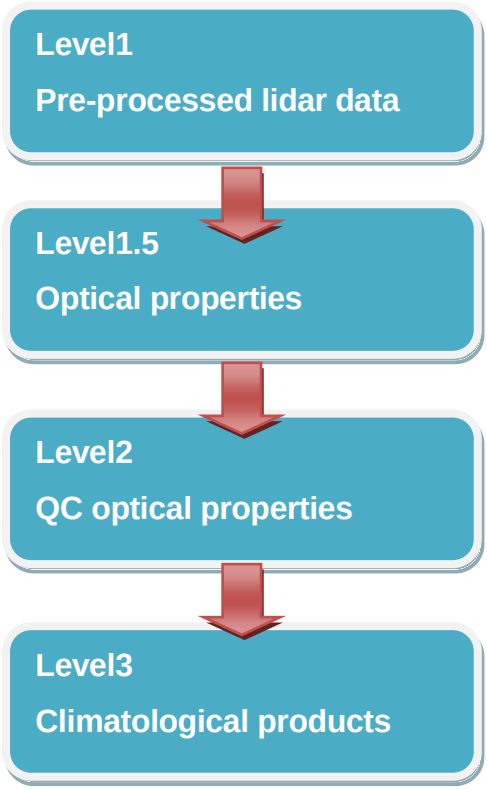

Fig. 1: Layout of the new structure of the EARLINET database.

The EARLINET data processing workflow is schematically reported in Figure 2. The steps in between the different Levels of Figure 1 are schematically described in Fig 3 referring to the Single Calculus Chain (SCC). The Single Calculus Chain (SCC) is open source software for analyzing aerosol lidar data to obtain aerosol optical property profiles from raw data. The ACTRIS RI provides the SCC to the EARLINET data originator support for centralized data processing in order to accomplish the fundamental need of coordinated lidar network to have an optimized and automatic tool providing high-quality aerosol property profiles. Main concepts at the base of the SCC are automatization and full traceability of quality-assured aerosol optical products. However data originators can even use their own data processing from raw data to aerosol optical properties using well documented quality-assured retrieval under the Data Originator responsibility. These data undergo the QC check procedures as well.
The processing steps can be summarized as follows:

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1. SCC web interface

This module represents the interface between the raw data originator and the SCC. The web interface provides a user-friendly way to interact with the SCC database by using any of available web browsers. The SCC database is a relational database which handles the large number of input parameters needed for the retrievals of aerosol optical products from lidar signal. Two different types of parameters are needed: experimental (which are mainly used to correct instrumental effects) and configurational (which define the way to apply a particular analysis procedure). Typically this information is provided by the QA procedures applied through the Lidar Calibration center (http://lical.inoe.ro). The web interface here and at the other processing steps, allows the monitoring of the processing status of each measurement.

2. Pre-processor module (ELPP: EARLINET Lidar Pre-Processor)

The ELPP module implements the corrections to be applied to the raw lidar signals before they can be used to derive aerosol optical properties. Following the EARLINET quality assurance program some instrumental effects are corrected. The raw lidar signals have to be submitted in a NetCDF format with a well-defined structure. Output are stored in internal SCC archive and then on the EARLINET database (currently available through agreement to external users).

3. Optical processor module (ELDA: EARLINET Lidar Data Analyser)

ELDA enables the retrieval of particle backscatter coefficients, the calculation of particle extinction coefficient and finally the computation of particle and volume linear depolarization profiles. New modules in implementation will allows for multiwavelength and layer products, The final optical products are written in NetCDF files with a structure fully compliant with the EARLINET database and then submitted to the EARLINET database.

4. QC procedures

Level 1.5 data collected at the EARLINET database are subject to centralized quality check procedures. Technical checks are procedures for the control of the file content respect to the file structure as defined in the EARLINET database. In addition scientific content QCs are related to the content of the EARLINET files in terms of validity of the EARLINET measured parameters. The data submitter receives feedback of the outcome of the QC. Data compliant to all the QC requirements are made publicly available as Level2 data. Level 2 data will be regularly published with primary Digital Object Identifiers (DOIs) in continuity with first volume publications on the CERA database made on 2014 (The EARLINET publishing group, 2014a and 2014b).

5. Averaging for climatological products

Level 2 aerosol optical products will be aggregated into monthly, seasonal and annual datasets for both profiles and integrated quantities. Information about the number of collected samples, mean, median and standard deviation of the properties, as well as mean statistical error for each property will be reported. Metrics of the comparison with reference datasets (as AERONET for AOD) will be reported whenever available, in order to provide information about data representativeness.

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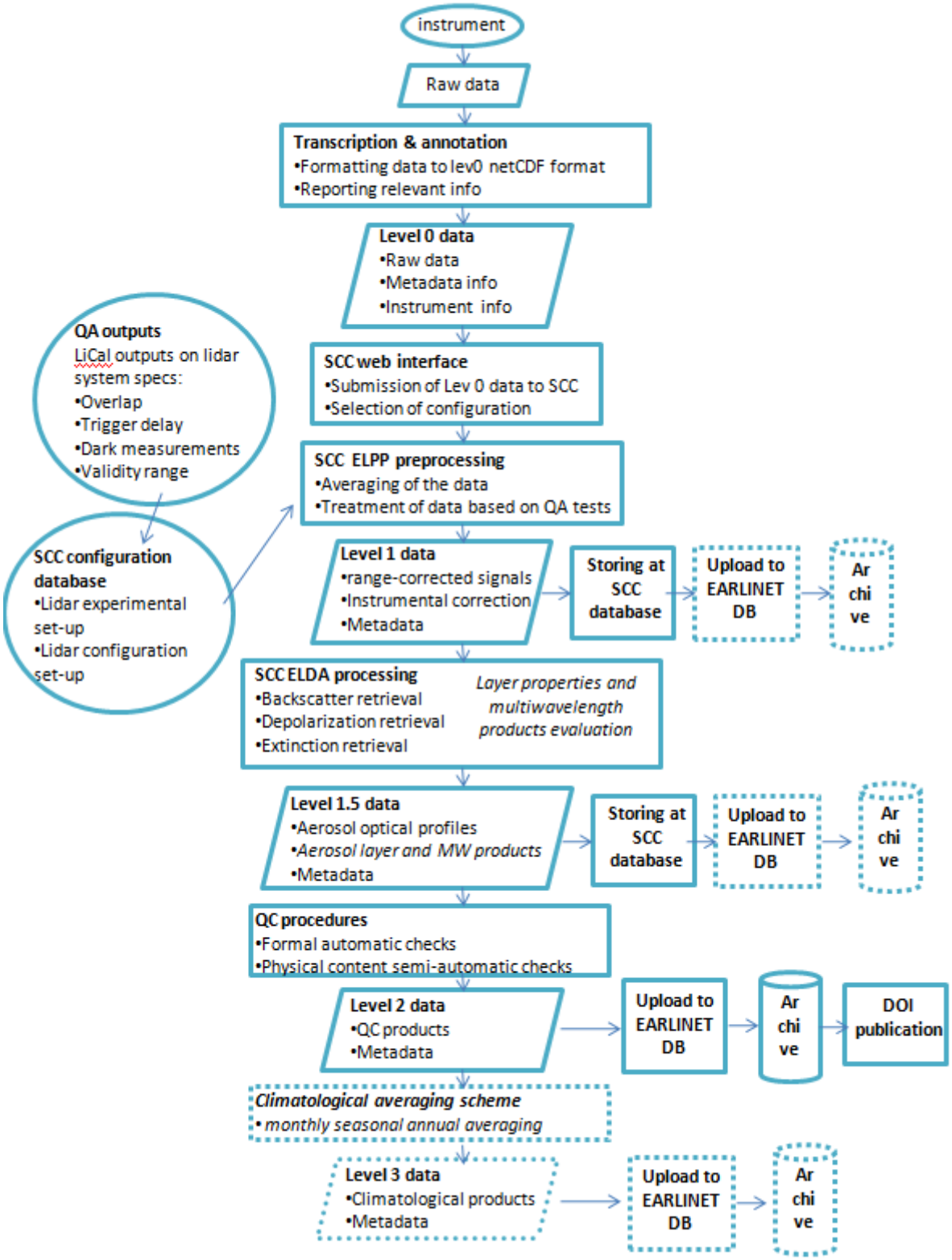

Figure 2: Workflow diagram for processing of EARLINET aerosol profiles data. In italics and bounded by dotted lines are reported processing steps under development.

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All the data products are in netCDF format as one of the more accepted format within the environment and climate domain. The CF compliance is envisaged for all the products but more in particular for the Level 2 and Level 3 data, in order to foster a wide use of the EARLINET data within the climate modeling community. Activities in this respect are already started for preparing a request of new variable nomenclature suitable for aerosol lidar data products, in agreement with not European aerosol lidar group under the GALION-WMO umbrella.

Level 1 aerosol profile products

The Level 1 data contain the pre-processed lidar data, i.e. range-corrected signals derived from the raw lidar data acquired at each station for each detection channel of the lidar system corrected for dead-time, partial overlap between laser beam and receiving system etc. The Level 1 data products include standardized data at high temporal and vertical resolution, which are also compliant to the SCC. The Level 1 products could be the result of the pre-processing module of the SCC or not, but in any case the application of all the quality check procedures will be assured. Moreover, a direct link is established between the Level 1 products and both the Handbook of Instruments and the approval of instrumental quality checks scheduled within the network.

The content of the Level 1 files is mainly summarized in the following tables for the general information related to location in time and space of the measurements and system (instrument + algorithm) [Table 1], instrumental parameters [Table2], physical assumptions [Table 3] and finally measured quantities [Table4].

Table 1: general information reported in Level 1 products as global attributes.

Parameter	Data Type	Unit
Location	Char	n.a.
System	Char	n.a.
Latitude_degrees_north	Float	Degree
Longitude_degrees_east	Float	Degree
Altitude_meter_asl	Float	m
Measurement_Start_Date	Int	n.a.
Measurement_Date_Format	Char	n.a.
Measurement_Start_Time_UT	Int	n.a.
Measurement_Time_Format	Char	n.a.
Measurement_ID	Float	n.a.
SCCPreprocessingVersion	Char	n.a.

Location field provides automatically information on the corresponding shorting code for the data archiving in the EARLINET database for this and the other products in the processing chain.
System allows directly the link to the system configuration reported in the SCC internal database for the data analysis and to the outputs of the system quality assurance tests performed in the related NA.
Measurement_ID is a field which univocally identifies the set of analysed measurements.
SCCPreprocessingVersion is a field that allows the unique identification of the version of centralized software for the aerosol lidar preprocessor. A similar field could be implemented in case of other utilized software.

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Table 2: instrumental parameters reported in Level 1 products.

Parameter	Data Type	Unit	Dimension
altitude_resolution	double	m	Scan_angles
range_resolution	double	m	Scan_angles
laser_pointing_angle	double	Degree	Scan_angles
emission_wavelength	double	nm	channels
detection_wavelength	double	nm	channels
laser_pointing_angle_of_profiles	int	u.l.	time
shots	int	u.l.	time
start_time	int	n.a.	time
stop_time	int	n.a.	time
Depolarization_Factor	double	u.l.	n.a.

The possibility to have as additional dimension the scan_angles allows to deal with the scanning configuration at present available in some EARLINET sites, but which could be widely useful in the perspective of offering the SCC and the storage in the EARLINET database to external users.
There are two different variables for ***altitude_resolution*** and ***range_resolution*** where range indicates distance from the laser emission and which are coincident in case of vertical pointing lidars.
The ***start_time, stop_time*** and ***shots*** fields provide the information about the start and stop of each one of the profile, but even of the number of laser shots during the elapsed time which is essential for statically evaluation of the errors.
Finally **Depolarization_Factor** provides the needed factor for the calibration of the depolarization profiles following the quality assured protocols defined within the NA.

Table 3: physical assumption references reported in Level 1 products.

Parameter	Data Type	Unit	Dimension
Elastic_Mol_Extinction	double	m^{-1}	scan_angles, points
LR_Mol	double	sr	n.a.
Emission_Wave_Mol_Trasmissivity	double	u.l.	scan_angles, points
Detection_Wave_Mol_Trasmissivity	double	u.l.	scan_angles, points
overlap_correction	int	u.l.	n.a.
cloud_flag	int	u.l.	time, points

Elastic_Mol_Extinction contains for each of the defined scanning angles the profile of the molecular extinction needed for the evaluation of the aerosol optical products reported in the next product level. This could be obtained using standard atmospheric profiles, model forecasts/analysis or collocated radiosoundings. Starting from this information also the ***Emission_Wave_Mol_Trasmissivity*** and ***Detection_Wave_Mol_Trasmissivity*** profiles are evaluated and reported as function of the scanning angle. ***LR_mol*** reports the value assumed for the lidar ratio for the molecules in air. ***cloud_flag*** indicates if the file is affected by clouds, while ***overlap_correction*** refers to the overlap correction function reported in the HoI and internal database of the SCC.

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Table 4: measured quantities reported in Level 1 products.

Parameter	Data Type	Unit	Dimension
elPR	double	u.l.	time, points
elPR_err	double	u.l.	time, points
elPT	double	u.l.	time, points
elPT_err	double	u.l.	time, points
vrRN2	double	u.l.	time, points
vrRN2_err	double	u.l.	time, points

The signals and the errors for the different channels are reported as measured quantities. The nomenclature is *el* for elastic channels, *vrR* for vibrational-rotational Raman, *N2* indicates that the Raman for the nitrogen is used. The signals are range-corrected lidar signals corrected for the different instrumental factors (overlap, deadtime if detectors, trigger delay, gluing of the signals...).
The quantities reported in Table 4 are just one example, but more can be contained in Level1 products depending on the experimental set-up. For example for the same physical quantity there could be more than 1 signal because one signal is acquired for the near field and another one for the far field.

Level 1.5 aerosol profile products

Level 1.5 aerosol profile data products have the same content of the Level2 ones discussed in the next section. The only difference is that level 1.5 data not pass through all the quality check procedures. The only QC procedures for Level 1.5 data will be some basic format checks.
The Level 1.5 will permit the use of lidar data in NRT. This capability is particularly interesting for assimilation purposes (as planned in JRA3 of ACTRIS-2), but also in more general context like for instance the activities of the Copernicus programme.

Level 2 aerosol profile products

Three different data products are present in Level 2 (and Level 1.5): single-wavelength optical property profiles, multi-wavelength optical property profilesand layer products. The temporal resolution of these products is between 30m and 1.5 h in continuity with the pre-ACTRIS-2 situation, but it could be longer in case of the multi-wavelength products according to the specific signal-to-noise ratio needs.

Single-wavelength optical property profiles

These products are the main ones and are in continuity with the past: each one of the main product of the EARLINET observations, i.e. the aerosol extinction and backscatter profiles are reported at their best vertical resolution in separated files.

Table 5: general information reported in Level 2(and 1.5) products as global attributes.

Parameter	Data Type	Unit
Location	Char	n.a.
System	Char	n.a.
Latitude_degrees_north	Float	Degree
Longitude_degrees_east	Float	Degree
Altitude_meter_asl	Float	m

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StartDate	Int	n.a.
StopDate	Int	n.a.
StartTime_UT	Char	n.a.
StopTime_UT	Char	n.a.
ShotsAveraged	Int	u.l.
EmissionWavelength_nm	Float	nm
DetectionWavelength_nm	Float	nm
DetectionMode	Char	n.a.
ZenithAngle_degrees	float	degree
ResolutionRaw_meter	float	m
ResolutionEvaluated	char	n.a.
EvaluationMethod	char	n.a.
InputParameters	char	n.a.

ResolutionEvaluated provides information on the effective vertical resolution of the optical products evaluated following the Rayleigh criterion as described in Iarlori et al., 2016. ***EvaluationMethod i***ndicates if the optical products are the result of combined Raman/elastic it simply elastic retrieval and ***InputParameters*** provides the information about the needed assumption for the retrieval itself, like calibration value and region and lidar ratio assumed values.

Table 6: parameters reported in Level 2 (and 1.5) products.

Parameter	Data Type	Unit	Dimension
Altitude	Float	m	Length
Backscatter	Float	m^{-1} sr^{-1}	Length, Time
ErrorBackscatter	Float	m^{-1} sr^{-1}	Length, Time
Extinction	Float	m^{-1}	Length, Time
ErrorExtinction	Float	m^{-1}	Length, Time
ParticleDepolarization	Float	u.l.	Length, Time
ErrorParticleDepolarization	Float	u.l.	Length, Time
VolumeDepolarization	Float	u.l.	Length, Time
ErrorVolumeDepolarization	Float	u.l.	Length, Time
RayleighExtinction	Float	m^{-1}	Length, Time
AerosolBoundaryLayerHeight	Float	m	Time
MixingLayerHeight	Float	m	Time

RayleighExtinction reports the molecular extinction profiles used for the retrieval of aerosol optical properties profiles. ***AerosolBoundaryLayerHeight*** reports the altitude asl of the top of the aerosol boundary layer, calculated as agreed within the EARINET community and reported in Matthias et al., 2004. Whenever available the altitude asl of the top of the aerosol mixing layer is reported in the ***MixingLayerHeight.***

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Table 7: acquisition and processing parameters reported in Level 2 (and 1.5) products.

Parameter	Data Type	Unit	Dimension
DatabaseCategory	Binary	u.l.	Time
Measurement_ID	Char	n.a.	1
SCCPreprocessingVersion	Char	n.a.	1
SCCProcessingVersion	Char	n.a.	1
QClevel	Float	n.a.	1

DatabaseCategories is a 10-bit binary code reporting information on the scheduling of the measurements. Following the EARLINET rules, it is required that each station performs measurements at a fixed scheduling per week. Measurements performed accordingly to this scheduling are labeled as climatological measurements. Additional measurements are performed for CALIPSO validation purposes following requirements of the CALIPSO scientific team. These measurements are labeled as CALIPSO ones. Additionally categories are related to special measurements for Saharan dust, volcanic and forest fires events monitoring.
SCCProcessingVersion is a field that allows the unique identification of the version of centralized software for the aerosol lidar processor. A similar field could be implemented in case of other utilized software. ***QClevel*** indicates the highest version of QC procedures the product is compliant with.
Level 1.5 products are only checked for format issues through on-fly procedure in the file uploading phase so that level 1.5 ***QClevel*** is expected to be lower than for the level 2 products.

Multi-wavelength optical property profiles

The multi-wavelength profile product contains the vertical profiles of all the optical properties measured in the same temporal window and with the same vertical resolution. This new product is envisaged in order to take the most from the multi-wavelength capabilities widely available within the network.

The content of the file is the same of the single-wavelength optical property profiles, but allows for additional evaluation. Therefore general information are the same reported in tables 5-6, while some parameters are added respect to table 7:

Table 8: parameters reported in Level 2 (and 1.5) Multi-wavelength products.

Parameter	Data Type	Unit	Dimension
Altitude	Float	m	Length
Backscatter	Float	$m^{-1}\ sr^{-1}$	Length, Wavelength
ErrorBackscatter	Float	$m^{-1}\ sr^{-1}$	Length, Wavelength
Extinction	Float	m^{-1}	Length, Wavelength
ErrorExtinction	Float	m^{-1}	Length, Wavelength
ParticleDepolarization	Float	u.l.	Length, Wavelength
ErrorParticleDepolarization	Float	u.l.	Length, Wavelength
VolumeDepolarization	Float	u.l.	Length, Wavelength
ErrorVolumeDepolarization	Float	u.l.	Length, Wavelength
RayleighExtinction	Float	m^{-1}	Length, Wavelength
AerosolBoundaryLayerHeight	Float	m	Time
MixingLayerHeight	Float	m	Time
LidarRatio	Float	sr	Length, Wavelength

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ErrorLidarRatio	Float	sr	Length, Wavelength
AngstromExponent	Float	u.l.	Length,WaveCouple
ErrorAngstromExponent	Float	u.l.	Length,WaveCouple
BackscatterAngstromExponent	Float	u.l.	Length,WaveCouple
ErrorBackscatterAngstromExponent	Float	u.l.	Length,WaveCouple

Respect to the single wavelength products here the profiles are reported in matrix where the second dimension is the wavelength for allowing reporting simultaneous multiwavelength observations. ***LidarRatio*** (i.e. extinction to backscatter ratio) are reported in the MWfiles together with its error ***ErrorLidarRatio.*** Similarly ***AngstromExponent*** and ***BackscatterAngstromExponent*** are calculated from simultaneous extinction and backscatter profiles calculated with the same spatio-temporal resolution.

Layer products

Building on the experience gained within EARLINET in the previous 15 years, the Level 2 Layer Product will report for each Level 2 profile relevant information for each identified layer such as the base, top and thickness of each identified layer as well as mean, median, standard deviation and mean statistical error for each measured optical property. Integrated quantities inside each layer and columnar ones will be reported for extensive optical properties.

Table 9: general information reported in Level 2 layer products as global attributes.

Parameter	Data Type	Unit
Location	Char	n.a.
System	Char	n.a.
Latitude_degrees_north	Float	Degree
Longitude_degrees_east	Float	Degree
Altitude_meter_asl	Float	m
StartDate	Int	n.a.
StopDate	Int	n.a.
StartTime_UT	Char	n.a.
StopTime_UT	Char	n.a.

The general information allows the full traceability of the products from the measurements down to the layer product.

The products reported in Level2 Layer products are statistical properties of the multiwavelength products evaluated in each identified layers and are summarized in the following table.

Table 10: parameters reported in Level 2 (and 1.5) layer products.

Parameter	Data Type	Unit	Dimension
Layer_bottom	Float	m	aerosol_layers
Layer_top	Float	m	aerosol_layers
Layer_width	Float	m	aerosol_layers
Stat_Backscatter355	Float	m^{-1} sr^{-1}	stat_parameters, aerosol_layers
Stat_Backscatter532	Float	m^{-1} sr^{-1}	stat_parameters, aerosol_layers
Stat_Backscatter1064	Float	m^{-1} sr^{-1}	stat_parameters, aerosol_layers

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Stat_ Extinction 355	Float	$m^{-1} sr^{-1}$	stat_parameters, aerosol_layers
Stat_ Extinction 532	Float	$m^{-1} sr^{-1}$	stat_parameters, aerosol_layers
Stat_LidarRatio355	Float	$m^{-1} sr^{-1}$	stat_parameters, aerosol_layers
Stat_LidarRatio532	Float	$m^{-1} sr^{-1}$	stat_parameters, aerosol_layers
Stat_ParticleDepolarization355	Float	u.l.	stat_parameters, aerosol_layers
Stat_ParticleDepolarization532	Float	u.l.	stat_parameters, aerosol_layers
Stat_VolumeDepolarization355	Float	u.l.	stat_parameters, aerosol_layers
Stat_VolumeDepolarization532	Float	u.l.	stat_parameters, aerosol_layers
Stat_AngExp_355_532	Float	u.l.	stat_parameters, aerosol_layers
Stat_BackAngExp_355_532	Float	u.l.	stat_parameters, aerosol_layers
Stat_BackAngExp_532_1064	Float	u.l.	stat_parameters, aerosol_layers

Some statistical values are calculated within the identified layers and reported for each considered parameters. As example for ***Stat_Backscatter355*** reports for each aerosol_layer, which boundaries in altitude are reported in ***Layer_bottom***, ***Layer_top*** and ***Layer_width*** variables, the mean , standard deviation, median and mean error of the aerosol backscatter values included in the selected altitude range. Additionally the number of values on which these statistical parameters are calculated is also reported. Finally, information about the aerosol typing will be reported whenever available. Currently typing procedures are under investigation, however for reporting this valuable information within the EARLINET database suitable variables will be added for reporting the identified aerosol type and a score assessing the typing identification reliability in a statistical sense.

For fully traceability the following information are also reported

Table 11: acquisition and processing parameters reported in Level 2 (and 1.5) layer products.

Parameter	Data Type	Unit	Dimension
Measurement_ID	Char	n.a.	1
SCCPreprocessingVersion	Char	n.a.	1
SCCProcessingVersion	Char	n.a.	1
QClevel	Float	n.a.	1

Level 3 aerosol profile products

The Level 3 standard product contains climatological datasets obtained as aggregated products from the Level 2 aerosol optical products. Data will be aggregated into monthly, seasonal and annual datasets for both profiles and integrated quantities. Information about the number of collected samples, mean, median and standard deviation of the properties, as well as mean statistical error for each property will be reported. Metrics of the comparison with reference datasets (as AERONET for AOD) will be reported whenever available, in order to provide information about data representativeness.

The content of the level 3 files is mainly summarized in the following tables for the general information related to location in time and space of the measurements and system (instrument + algorithm) [Table 12], information about eventual collocated datasets for representativeness information [Table 13],

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information for the traceability and references [Table 14] and finally measured quantities as integrated values [Table15] and vertical profiles [Table 16].

Table 12: general information reported in Level 3 products as global attributes.

Parameter	Data Type	Unit
Location	Char	n.a.
System	Char	n.a.
Latitude_degrees_north	Float	Degree
Longitude_degrees_east	Float	Degree
Altitude_meter_asl	Float	m
PI_name	Char	n.a.
PI_affiliation	Char	n.a.
PI_email	Char	n.a.

Table 13: information about eventual collocated datasets for representativeness study reported in Level 3 products.

Parameter	Data Type	Unit	Dimension
AERONETsite	char	n.a.	1
MODISgrid_resolution	double	degree	2
MODISgrid_center	double	degree	2
MODISdata	char	n.a.	1
DataReference	char	n.a.	1

AERONETsite reports the name of the AERONET site used for the comparison for the AOD EARLINET measured values exactly as reported in the AERONET website. ***MODISgrid_resolution*** and ***MODISgrid_center*** reports the geolocation of the MODIS data used for the comparison. ***DataReference*** reports if it is the case the doi of the dataset publication.

Table 14: information for fully traceability of Level 3 products.

Parameter	Data Type	Unit	Dimension
QueryDate	Char	n.a.	1
QueryRecord	Char	n.a.	1

QueryDate and ***QueryRecord*** provide all the needed information for trace back from the Level 3 reported products to the Level 2 data originating datasets.

Table 15: parameters reported in Level 3 layer products .

Parameter	Data Type	Unit	Dimension
StartDay	Int	n.a.	n_period
StopDay	Int	n.a.	n_period
Stat_AOD355	Float	u.l.	stat_parameters, n_period
Stat_FTcontribution355	Float	u.l.	stat_parameters, n_period
Stat_AeronetDiff355	Float	u.l.	stat_parameters, n_period

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Stat_ModisDiff355	Float	u.l.	stat_parameters, n_period
AssumedAngExp355	Float	u.l.	n_period
Stat_AOD532	Float	u.l.	stat_parameters, n_period
Stat_FTcontribution532	Float	u.l.	stat_parameters, n_period
Stat_AeronetDiff532	Float	u.l.	stat_parameters, n_period
Stat_ModisDiff532	Float	u.l.	stat_parameters, n_period
AssumedAngExp532	Float	u.l.	n_period
Stat_IB355	Float	u.l.	stat_parameters, n_period
Stat_FTcontributionIB355	Float	u.l.	stat_parameters, n_period
Stat_IB532	Float	u.l.	stat_parameters, n_period
Stat_FTcontributionIB532	Float	u.l.	stat_parameters, n_period
Stat_IB1064	Float	u.l.	stat_parameters, n_period
Stat_FTcontributionIB1064	Float	u.l.	stat_parameters, n_period

Some statistical values are calculated for each considered period (monthly, seasonal, annual averages) and reported for each considered parameters. As example for ***Stat_ AOD355*** reports for each n_period, which limits in time are reported in ***StartDay*** and ***StopDay*** variables, the mean , standard deviation, median and mean error of the aerosol AOD values included in the selected timeframe. Additionally the number of values on which these statistical parameters are calculated is also reported.
Stat_FTcontribution355 reports the above described statistical quantities for the free troposphere (FT) contribution to the measured columnar AOD. This is calculated comparing the columnar AOD against the AOD calculated within the *AerosolBoundaryLayerHeight* reported in the corresponding Level 2 profile data.
Stat_AeronetDiff355 reports the statistics of the difference between the EARLINE data reported and the Aeronet ones as described in the global attributes of Table 11. Similar information is reported for Modis and for different wavelengths. ***AssumedAngExp355*** provides the Angstrom exponent values (as calculated from AERONET collocated measurements) used for each selected period for scaling the Aeronet and Modis measurements to the EARLINET wavelength.

The same kind of information is reported in the climatological profiles for Extinction and Backscatter at the different wavelength as reported in the following table.

Table 15: parameters reported in Level 3 profile products.

Parameter	Data Type	Unit	Dimension
Altitude	Float	m	Length
StartDay	Int	n.a.	n_period
StopDay	Int	n.a.	n_period
AerosolExtinction_355_mean	Float	m^{-1}	length, n_period
AerosolExtinction_355_std	Float	m^{-1}	length, n_period
AerosolExtinction_355_median	Float	m^{-1}	length, n_period
AerosolExtinction_355_mean_error	Float	m^{-1}	length, n_period
AerosolExtinction_355_samples	Float	u.l.	length, n_period
AerosolBackscatter_355_mean	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_355_std	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_355_median	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_355_mean_error	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_355_samples	Float	u.l.	length, n_period

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AerosolExtinction_532_mean	Float	m^{-1}	length, n_period
AerosolExtinction_532_std	Float	m^{-1}	length, n_period
AerosolExtinction_532_median	Float	m^{-1}	length, n_period
AerosolExtinction_532_mean_error	Float	m^{-1}	length, n_period
AerosolExtinction_532_samples	Float	u.l.	length, n_period
AerosolBackscatter_532_mean	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_532_std	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_532_median	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_532_mean_error	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_532_samples	Float	u.l.	length, n_period
AerosolBackscatter_1064_mean	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_1064_std	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_1064_median	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_1064_mean_error	Float	$m^{-1}sr^{-1}$	length, n_period
AerosolBackscatter_1064_samples	Float	u.l.	length, n_period

Conclusions

This document describes all the products which will be implemented in the EARLINET database by the end of the ACTRIS-2 project. The transition between the old structure and the new one is slow in order to offer a continuous data provision service to all the stations. At the moment Level1 and Level 2 -single wavelength data are already provided (unless of few format needed changes) through specific services and the standard database, respectively. The first release of Level 3 data is foreseen for the spring 2017 through devoted services. Level 2 layer and multiwavelength products will be available through SCC as soon as these capabilities will be implemented. the provision of all these data through the database are constrained by the complete reshape of the relational database underlying the EARLINET database and it will be offered through the EARLINET database accordingly to the ACTRIS-2 project by 2018.
Data description reported in the current document can be subject to modification in agreement with the related scientific and user communities, in particular in the perspective of the CF complaint activities. All data provided will be fully documented and all the new implementations clearly announced on the web site and described on the related documentation.

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