



Aeolus Data Innovation Science Cluster DISC

Aeolus Level 2a Processor Software Release Note

(former AE-RN-DLR-L2A-001)

DISC-Ref.: AED-SD-DoRIT-L2A-028

Issue: V 3.16

Date: 31/01/2023



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Document Change Log

Issue	Date	New pages	Modified pages (after introducing new pages)	Observations	Name
V 1.0	03.11.06			Initial version	Huber
V 1.1	10.11.06			Update for L2a processor delivery version 0.2	Huber
V 1.3	17.01.07			Comments ESA on V 1.1 implemented	Huber
V 1.4	12.03.07			Updates for SPRs # 1, 3, 4, 5, 6 implemented	Huber
V 1.4	29.06.07			Updates for SPRs # 7 ,8 ,10, 11, 12, 13	Huber
V 2.0	04.12.07			Updates for processor version 2.0	Huber
V 2.1	31.01.08			FAT comments implemented	Huber
V 2.2	Apr 08			Internal version	Huber
V 2.3	31.01.09			Algorithm changes; FFC and SCO implemented; ARs	Huber
V 2.4	23.03.09			AE-IPF-1, AE-IPF-10, AE-IPF-13, AE-IPF-15, AE-IPF-17, AE-IPF-18, AE-IPF-21, AE-IPF-22	Huber
V 2.5	29.06.09			AE-IPF-42, AE-IPF-45, AE-IPF-49, AE-IPF-50, AE-IPF-51	Huber
V 2.5_P2	19.11.09				Huber
V 2.7	16.02.12			AE-IPF-106, Continuous Mode	Huber
V 3.0	15.02.12			Major revision of all algorithms in the L2A prototype	Huber
V 3.1				New build system; interfacing to L1bP V6.03 products; first version of automatic test system; AE-IPF-160;	Huber
V 3.02	16.03.15			AE-IPF-196; AE-IPF-191; AE-IPF-178 Partial implementation of new FeatureFinder	Huber

V3.02 Patch- 1	24.03.15	Bug fix Failure message in log file	Huber
V 3.03	31.08.15	Delivery of v 3.03, with completed Feature Finder and Scene Classification, new data sets and bug fixes for AE-IPF-216, AE-IPF-228, AE-IPF-230, AE-IPF-232; new installation test.	Huber
V3.04	17.06.16	Delivery of v 3.04, AE-IPF-229, AE-IPF-248, AE-IPF-271, AE-IPF-272; new AUX_CAL files; AE-IPF-160: updated documents SUM and IODD	Huber
V3.05		Delivery of L2aP v 3.05;	Huber
V3.06	12.03.18	Delivery of L2aP v 3.06	Huber
V3.07	08.02.19	Delivery of L2aP v 3.07	Huber
V3.08	23.08.19	Delivery of L2aP v 3.08	Huber
V3.10	31.01.20	Delivery of L2aP v 3.10 Version number 3.09 skipped on purpose to re-align numbering with the L2aP prototype version	Huber
V3.10. 1	25.03.20	Delivery of L2aP v 3.10.1	Huber
V3.11	31.07.20	Delivery of L2aP v 3.11 Regression based on M1 temperatures for Kray, Kmie MCA processing top most bin DI2a_005, DL2a_011, DL2a_015 AE-IPF-327 Several minor updates	Huber
V3.11. 1	30.10.20	Delivery of L2aP v3.11.1 Deleted QC check on SNR for signal accumulation Update formulas for wind induced frequency shift, varLOD calculation, and difference between observed and predicted signal	Huber

V3.12	26.02.20 21	Delivery of L2aP v3.12 First version of KNMI ATB and FeatureMask algorithms implemented dL2A_016, dL2A_019, dL2A_020, dL2A_021	Huber
V3.12. 1	21.04.20 21	Delivery of L2aP v3.12.1 FFT version using no license implemented	Huber
V3.13	30.07.20 21	Delivery of L2aP v3.13 New product data sets for AEL-PRO and AEL_PRO implemented New product data sets for MLE and only partial implementation of MLE algorithms Improvement of data quality flags Introduction of cloud screening based on MET data	Huber
V3.14	14.02.20 22	Delivery of L2aP v3.14 Deletion of ICA dL2A_008, dL2A_017: First version of MLE running dL2A_PP_005 absolute errors for group QC dL2A_PP_006 total Mie SNR for groups and postprocessing of groups integrated into Feature-Finder dL2A_PP_FM_001 spacecraft attitude on target flag used in AEL-FM But fix for unusual NxP settings	Huber
V3.14. 1	21.02.20 22	Delivery of L2aP v3.14.1 Runtime performance updates	Huber
V3.14. 2	28.02.20 22	Delivery of L2aP v3.14.2 Bug fix for EMSR calculation Bug fix for AEDIPF-29	Huber
V3.14. 3	08.03.20 22	Delivery of L2aP v3.14.3 Bug fix for AEDIPF-32	Huber

V3.14. 4	10.03.20 22	Delivery of L2aP v3.14.4 Further bug fix for AEDIPF-32	Huber
V3.14. 5	17.03.20 22	Add information on the L-BFGS-B license	Huber
V3.14. 6	23.03.20 22	Delivery of L2aP v3.14.5 Roll back to simple FFT	Huber
V3.14. 7	10.06.20 22	Delivery of L2aP v3.14.7 New simple fft	Huber
V3.14. 8	13.06.20 22	Delivery of L2aP v3.14.8 Bug fix List_of_Dsds in *.HDR	Huber
V3.15	29.07.20 22	Delivery of L2aP v3.15 Sub-BRC MLE Delete writing of empty MLE data sets	Huber
V3.16	31.01.20 23	Delivery of L2aP v3.16 Match prototype deliveries AEL-FM 1.6, AEL-PRO 1.6, 1.6.1, and 1.62 Match Prototype 3.16	Huber
V3.16. 1	24.03.20 23	Delivery of L2aP v3.16.1 Bug fix for AEDIPF-41	Huber

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1 Introduction

The present document is the Software Release Note for the ADM L2A operational processor. It is part of the deliverables of the DISC contract and one of the outputs of WPs 1000 and 2000.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.16, dated Jan 31st, 2023.

This document provides also information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.16.1, dated Mar 24th, 2023.

This document is intended for individuals that will be installing and using this release of the Level 2a Processor software.

Chapter 2 briefly describes the L2A processor release; chapter 3 picks up known issues; chapter 4 lists regression test cases run with V3.16 prior to delivery, chapter 5 makes a note on the compatibility with current PDGS inputs; chapter 6 and 7 hold information on the processor version compatibility and auxiliary inputs files compatibility. Chapter 8 provides an overview of platforms used for testing the L2aP prior to delivery. Finally, chapter 9 lists the requirements on platforms used for installation of the L2aP, and finally chapter 10 provides license information.

1.1 Compliance Statement

The Aeolus Level 2a Processor Software Release Note is fully compliant with the management requirements of the DISC contract.

1.2 Applicable Documents

[AD-1] DLR (2019): DISC Project Management Plan. AED-PMP-DLR-001, V 1.2, 29/05/2019.

1.3 Reference Documents

[RD-1] ADM-Aeolus Level 2A Processor Software User Manual, AED-SD-DoRIT-L2A-027

[RD-2] ESA Contract No 4000126336/18/I-BG: AEOLUS Data Innovation Science Cluster – “AEOLUS DISC”

1.4 Acronyms & Abbreviations

See [AD-1] for a complete list of acronyms and abbreviations.

2 Version Description

This release contains the Level 2A Processor Issue 3.16.1 software delivery. It consists of a source code package

- L2aP_Source_3.16.1

one dedicated PDGS input compatibility test case,

- OSVA_20230126T0730_WVM

three updated documents,

- AED-SD-DoRIT-L2A-028, Aeolus Level 2a Processor Software Release Note, V 3.16.1, dated 24.03.2023
- AED-SD-DoRIT-L2A-025, Aeolus Level 2a Processor Input/Output Data Definition, V 3.16, dated 31.01.2023
- AED-SD-DoRIT-L2A-029, Aeolus Level 2a Processor Software Life-Cycle Document References, V 1.14 dated 31.01.2023

seven unmodified documents,

- AED-SD-DoRIT-L2A-026, ADM Aeolus Data Visualization Software User Manual, V 1.4 dated 31.07.2020
- AED-SD-DoRIT-L2A-027, Aeolus Level 2a Processor Software User Manual, V 2.17 dated 21.04.2021
- AED-SD-DoRIT-L2A-021, Aeolus Level 2a Processor External Interface Control Document, V 2.05 dated 31.07.2020
- AED-SD-DoRIT-L2A-022, Aeolus Level 2a Processor Design Document, V 2.6 dated 31.07.2020
- AED-SD-DoRIT-L2A-020, ADM Aeolus L2A Auxiliary Data Editor Software User Manual, V 1.3 dated 31.07.2020
- AED-SD-DoRIT-L2A-024, Aeolus Level 2a Processor Software Verification & Validation Plan, V 2.3 dated 31.07.2020
- AED-SD-DoRIT-L2A-023, Aeolus Level 2a Processor Software Requirements Document, V 2.3 dated 31.07.2020

and six regression test cases,

- 25977
- 25983
- 10000287
- 10000291
- 10000312
- 10000700

Note: The auxiliary files provided with the source code package and installed into the ./aux directory of the runtime are applicable to the installation test. Further auxiliary inputs can be found in the zip folder Aux-Inputs.zip, which holds three different directories:

- **fromPDGS:** For convenience this directory holds copies of the most recent auxiliary inputs from the ADDS. These are only files that have not changed their format or content with L2AP V3.16.
- **newFormat:** This directory holds all auxiliaries that have changed their format.
- **newContent:** This directory holds all auxiliaries that have changed their content but not their format.

2.1 Major Source Code Updates

2.1.1 QC in MLE subBRC

A quality flag calculated like the one for the BRC level MLE results has been added to the subBRC MLE PCD.

2.1.2 Dealing with negative z_{mid} column values in L1b data

The columns which have more negative than positive values are set to -2 in the algorithm; thus, these profiles have no further impact on the AEL-PRO part.

2.1.3 Improved Cloud/aerosol discrimination

New parameters have been added to the AUX_PAR_2A; basically, the atmosphere is now split into three different regions with their own discrimination parameters. Processing is also performed separately for these three regions.

2.1.4 Addition of quality flags

A new quality flag has been added to the AEL PRO PCD data set for data retrieval on measurement level. Currently the flag can be set to the following values:

0 No retrieval (e.g. no valid data)

1 High value of χ^2_{sq} in optimal estimation minimization (obs. level pass 1)

2 High level of χ^2_{sq} in optimal estimation minimization (meas. level pass 2)

3 Maximum number of iterations reached (obs. level pass 1)

4 Maximum number of iterations reached (meas. level pass 2)"

2.1.5 calculate_pixel_center

As currently the laser does no longer operate at a frequency which will give a Mie fringe in the centre of the ACCD, a new method had to be developed, to identify the new pixel centre and the Mie and Rayleigh areas on the Mie ACCD.

2.1.6 Matching prototype deliveries AEL-PRO 1.6, 1.61, and 1.62

Several further changes have been implemented to match the AEL-PRO prototype deliveries 1.6, 1.6.1, and 1.62:

- reactivation of filling the detection_mask_total matrix
- update of the method find_simple_class
- addition of calculation of new vectors/variables starting_chisq_value_pass1, ending_chisq_value_pass1, number_of_iterations_pass1, starting_chisq_value_pass2, ending_chisq_value_pass2, number_of_iterations_pass2, and quality_index;

- pinv analysis für matrix H_temp and PINV error handling
- quality_index and find_simple_class updated to prototype version ael_pro 1.6.1
- H_temp and H_inv matrix handling as described in prototype version ael_pro 1.6.2

2.2 Minor Code Updates

- dL2A_PP_011: Several small bug fixes have been implemented to provide the correct latitude, longitude, and altitude values for mid-bin groups.
- Groups are no longer detected in the ground bins.
- Deleted unused parameters Bin_Loaded, Seed_Map, and a Spare from the MEAS_PCD
- An additional 1d smoothing of the histogram has been added to deal with sparse pixels.
- Usage of parameter Apply_Excess_Noise_Factor from the AUX_PAR_2A has been implemented (was hard coded before).

2.3 3/16_1: Extension of 3/16

- AEDIPF-41 reports an inconsistency between actual product size and size reported in the header field Tot_Size. A bug fix has been implemented in the MEAS_PCD writing routine.
- A bug fix has been implemented scaling the output extinction values of the AEL-PRO part with 10e-6.
- A bug fix has been implemented for setting the Quality_Index of the AEL-PRO output.
- Two bugs have been fixed calculating the ATB values.

3 Known Issues

The factory acceptance test is currently not up to date.

4 Regression Test Cases

Regression test cases are part of the software delivery; the examples can be run by just calling the L2aP processor with the JobOrder provided in each package. The purpose is to verify that no processing failures occur, so each example should end with the screen output

[P] Finishing L2A processing.

Further observe that an ALD_U_N_2A product is generated for each case.

4.1 25977 and 25983

These are test cases for the reported INC0019896.

4.2 1000312

This test case is for AE-IPF-325/ wiki issue DL2A_002. It is based on in-orbit data and is available on ftp://commissioning.aeolus.esa.int/FROM_PDGS/PDGS_OBS/AE-CP-AR-49/.

4.3 1000287

This test case is for AE-IPF-325/ wiki issue DL2A_002. It is based on in-orbit data and is available on ftp://com-missioning.aeolus.esa.int/FROM_PDGS/PDGS_OBS/AE-CP-AR-52/.

4.4 1000291

This test case is for AE-IPF-325/ wiki issue DL2A_003. It is based on in-orbit data and is available on ftp://com-missioning.aeolus.esa.int/FROM_PDGS/PDGS_OBS/AE-CP-AR-52/.

4.5 1000700

This test case is for AE-IPF-324/ wiki issue DL2A_001. It is based on in-orbit data and is available on ftp://com-missioning.aeolus.esa.int/FROM_PDGS/PDGS_OBS/AE-CP-AR-54/.

5 PDGS Compatibility Test

The PDGS inputs compatibility test runs with the AUX_CAL, AUX_CLM, and AUX_MET files as currently used in the PDGS.

As the format of the AUX_PAR_2A has changed with L2aP V3.16, a new version will be delivered in parallel to L2aP V3.16 together with the EDFCF form. The PDGS inputs compatibility test uses this new AUX_PAR_2A file.

6 Processor Compatibility Matrix

The table shows allowed combinations of E2S, L1bP, and L2aP software versions.

#	E2S	L1bP	L2aP
1	V4.01	V7.02	V3.06
2	V4.01	V7.03	V3.07
3	V4.03	V7.07	V3.08
4	V4.04	V7.08	V3.10
5	V4.05	V7.09	V3.11
6	V4.05	V7.09.1	V3.11.1
7	V4.06	V7.10	V3.12
8	V4.06	V7.10.1	V3.12.1
9	V4.07	V7.11	V3.13
10	V4.08	V7.12	V3.14
11	V4.08	V7.12	V3.14.1
12	V4.08	V7.12	V3.14.2
13	V4.08	V7.12	V3.14.3
14	V4.08	V7.12	V3.14.4
15	V4.08	V7.12	V3.14.6
16	V4.08	V7.12	V3.14.7
17	V4.08	V7.12	V3.14.8

18	V4.08	V7.13	V3.15
19	V4.09	V7.14	V3.16
20	V4.09	V7.14	V3.16.1

7 Auxiliary Files Compatibility Matrix

The table below lists all static auxiliary input files used by the L2a operational processor, where

- **File Type** denotes the specific sub-string of the product name that identifies the product,
- **Origin** specifies the company providing the file,
- **Schema Version** defines the version as specified in the header of the file,
- **Ref Doc** specifies the IODD that defines the product, and
- **s/d** denotes if the input file is static (s) or dynamic (d).

#	File Type	Origin	Schema Version	Ref Doc	s/d
1	AUX_PAR_2A	DoRIT	03.16	AED-SD-DoRIT-L2A-025	s
2	AUX_CAL_L2	MétéoFrance	4.3	AED-TN-MFG-CAL-004	s
3	AUX_CLM_L2	MétéoFrance	03.11	AED-SD-DoRIT-L2A-025	s
4	AUX_MET_12	ECMWF	03.10	AED-SD-ECMWF-L2B-037	d

8 Tested Platforms

8.1 Platform 1 – yuma

#		
1	Hardware Configuration	DELL Latitude 5590 BTX Intel Core i5-8250U, 4 kernels, 1.6GHz 6 MB Cache
2	Linux Distribution	Ubuntu “bionic” 18.04.3 LTS gcc version Matlab R2019a Java Software Development Kit V1.0.4 Perl V5.26.1 cmake 3.10.2 libxml2 2.9.4

8.2 Platform 3 – adm1

#		
1	Hardware Configuration	PowerEdge M640 Blade Server 46 Intel(R) Xeon(R) Gold 6152 CPU @ 2.10GHz 128 GB RAM
2	Linux Distribution	openSUSE Leap 15.0, 4.12.14-lp150.12.45-default x86_64 gcc version 7.4.0 Matlab R2019a Java Software Development Kit V1.6.0 Perl V5.26.1 cmake 3.10.2



#		
		libxml2 2.5.10

8.3 Platform 4 – adm5

#		
1	Hardware Configuration	DELL PowerEdge R410 8 Intel(R) Xeon(R) CPU E5620 @ 2.40GHz 8 GB RAM
2	Linux Distribution	RedHat Linux Enterprise Server, Kernel 2.6.32-71.el6.x86-64 gcc version 4.4.4 20100726 (Red Hat 4.4.4-13) Matlab 7.0.4 Java Software Development Kit V1.6.0 Perl V5.10.1 cmake 2.8 libxml2 2.5.10

9 Environment Needed

This release of the Level 1B Processor software is intended for the following environment:

- RedHat Linux Enterprise Server, Kernel 2.6.32-71.el6.x86-64 for 64bit
- GNU Compiler Collection (GCC) 4.4.4
- GNU Fortran (GCC) 4.4.4
- IBM Java Software Development Kit V1.6.0
- Perl V5.10.1
- Python 2.6
- cmake 2.8
- perl packages Time::Piece, Time::Seconds, Getopt::Long, File::Copy, File::Spec, File::Path, Cwd (necessary only for the test script)
- Matlab R2011A or higher (for plotting and auxiliary data editing only)
- netCDF-C version 4.7.4 (only necessary for the AutoTestSuite run)

9.1 Installation Instructions

Please refer to the Level 2a Processor Software User Manual [RD-1] for instruction on how to compile, install, and test the software.

10 License Information

Following the license agreements in [RD-2], ESA shall have the right to use the Aeolus L2A operational processor v3.16 as an aggregate for the purpose of the Aeolus mission without any restrictions, as long as license terms for single parts of the processors, see sections below, are not violated. License terms for single parts of the processor, where applicable, are outlined below.

10.1 New BSD License for L-BFGS-B

3-clause license ("New BSD License" or "Modified BSD License")

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