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 3.14.8

Date: 13/06/2022

Document Change Log

Issue	Date	New pages	Modified pages (after introduc-ing 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 imple-mented	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 Dl2a_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	26.02.2021		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	21.04.2021		Delivery of L2aP v3.12.1 FFT version using no license implemented	Huber
V3.13	30.07.2021		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	14.02.2022		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	21.02.2022		Delivery of L2aP v3.14.1 Runtime performance updates	Huber
V3.14.2	28.02.2022		Delivery of L2aP v3.14.2 Bug fix for EMSR calculation Bug fix for AEDIPF-29	Huber
V3.14.3	08.03.2022		Delivery of L2aP v3.14.3 Bug fix for AEDIPF-32	Huber

V3.14.4	10.03.2022	Delivery of L2aP v3.14.4 Further bug fix for AEDIPF-32	Huber
V3.14.5	17.03.2022	Add information on the L-BFGS-B license	Huber
V3.14.6	23.03.2022	Delivery of L2aP v3.14.5 Roll back to simple FFT	Huber
V3.14.7	10.06.2022	Delivery of L2aP v3.14.7 New simple fft	Huber
V3.14.8	13.06.2022	Delivery of L2aP v3.14.8 AEDIPF-34 Bug fix List_of_Dsds in *.HDR	Huber

Table of Contents

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 03.14, dated Feb 14th, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.1, dated Feb 21st, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.2, dated Feb 28th, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.3, dated Mar 8th, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.4, dated Mar 10th, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.4, dated Mar 10th, 2022; it provides additional information on the L-BFGS-B license situation.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.5, dated Mar 23rd, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.7, dated June 10th, 2022.

This document provides information relevant to the release of the Aeolus Level 2A Processor (L2aP) software issue 03.14.8, dated June 13th, 2022.

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 V3.14 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.

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 3.14.8 software delivery. It consists of a source code package

- L2aP_Source_3.14.8,

one dedicated PDGS inputs compatibility test case,

- 20220210T1201

three updated documents,

- AED-SD-DoRIT-L2A-028, Aeolus Level 2a Processor Software Release Note, V 3.14.8, dated 13.06.2022
- AED-SD-DoRIT-L2A-025, Aeolus Level 2a Processor Input/Output Data Definition, V 3.14, dated 14.02.2022
- AED-SD-DoRIT-L2A-029, Aeolus Level 2a Processor Software Life-Cycle Document References, V 1.12 dated 14.02.2022

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

2.1 Major Source Code Updates

- A first version of the MLE algorithm is implemented; results are written to the new data sets SCA_MLE_PCD_ADS and SCA_MLE_MDS. Results are still flagged invalid by setting the Overall_Quality = 0 (**dL2A_008, dL2A_017**).

- To match the MétéoFrance prototype version 3.14 delivered on Dec. 17, 2021 several code changes have been implemented:
    - MLE data sets are now only provided for BRCs where also the SCA data set is provided.
    - Group data quality flag retrieval is now based on absolute errors (**dL2A_PP_005**).
    - Group post processing check as introduced with version 3.13 has been deleted again; now the FeatureFinder already performs this check on the total Mie SNR (**dL2A_PP_006**).
    - Reading of total Mie SNR from L1B implemented.
    - Added usage of total Mie SNR to cross talk correction, SCA, and group data calculation.
- Several small code updates, mainly bug fixes, have been carried over from the new KNMI input prototypes for the AEL-FM and AEL_PRO parts. Among the updates worth mentioning:
    - The Spacecraft_Attitude_On_Target flag is now evaluated; method calculateSurfaceMask had to be updated (**dL2A_PP_FM_001**).
    - New methods MedianFM and HybridMedianFM have been added.
    - High resolution ATB calculation has been updated.
- The sources of the commercial fftw3 (commercial-fftw-3.3.10.tar.gz) have been integrated into the source code package of the L2A. The build system has been updated, such that the sources of the fftw3 are inflated, and compiled into the library libfftw3.a; this library is then linked to the main L2A.
- Several new parameters have been added to the AUX_PAR_2A for the control of the AEL-PRO algorithm.
- The ICA data sets ICA_PCD and ICA_OPT have been deleted from the L2A product; ICA data retrieval code has been deleted. Some code parts could not be removed, as still the possibility to write old format L2A products is needed for test runs with the AEL-PRO. A compile flag -DWITH_L2A_OLD_3_13 has been introduced; if set to 1, the old product format 3.13 is written; if not used at all or explicitly set to 0, the new product format 3.14 is written.
- A big work package are ongoing code modifications for runtime performance optimizations and code consolidation, especially for the new algorithm parts of the AEL-FM and AEL-PRO. Even though a lot of effort has already been put into this issue, the processing time has increased significantly with version 3.14 due to the new algorithm part for MLE now being executed, and increased processing time if the AEL-PRO when fed with correct inputs.
- A bug fix for new settings of NxP where N = 10 or N = 5 has been added to the main processing; a hard coded access to measurement no. 15 had to be removed.

2.2 3/14_1: Extension of 3/14

Several code modifications have been made to the source code file KnmiAelPro.cc to improve the runtime performance of the L2A. Updates have no impact on the results in the L2A product.

2.3 3/14_2: Extension of 3/14_1

- Bug fix writing the parameter List_of _Dsds in the *.HDR file.
- Bug fix writing the proper data to the output EMSR parameter.

2.4 3/14_3: Extension of 3/14_2

- Bug fix for AEDIPF-32; filtering inf values in AEL_PRO_OPT and AEL_PRO_PCD.

2.5 3/14_4: Extension of 3/14_3

- Further bug fix for AEDIPF-32; filtering inf values in AEL_PRO_OPT again after multiplication with 10^6; overflow after multiplication caused inf to be written to the L2A product.

2.6 3/14_5: Extension of the SRN of 3/14_4

- Only document update; added section 10 to this SRN.

2.7 3/14_6: Extension of of 3/14_5

- Deleted usage of library fftw3; deleted utest directory
- Bring back in Simple FFT calculation
- Implement cleaning of 'green' background in feature mask.

2.8 3/14_7: Extension of of 3/14_6

- Implemented new 2D simple fft
- dL2A_028: An error in the calculation of the missed hot pixels has been identified and corrected.
- Fixed two index bugs in the ATB calibration part of the code.
- Replaced hard coded parameter with parameter **Cal_Std_Dev_Fit_Limit** of the AUX_PAR_2A; parameter was already read from the AUX_PAR_2A but not yet forwarded to the part where it was needed.
- Introduced matrix rank calculation method.

2.9 3/14_8: Extension of of 3/14_7

- AEDIPF-34: Bug fix writing List_of_Dsds in *.HDR file.

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://commissioning.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 V3.14, a new version will be delivered in parallel to L2aP V3.14 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

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	03.13	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 v3.14.7 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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Publisher	Public Domain
Published	July 22, 1999[8]
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