ADM-Aeolus Rayleigh-Brillouin Correction Look-up Tables Generator

Input/Output Data Definitions Interface Control Document

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CHANGE LOG

Version	Date	Comment
1.0 (draft)	19 Jul 2006	First draft
1.1	12 Mar 2007	SPH correction, Update in the list of reference documents, Addition of the XML root tags in the headers (in line with L2B IODD)
1.2	15 Jun 2007	Fix SPR 0016 / ACMF-63: DS names in SPH Fix SPR 0014 / ACMF-61: file type changed to AUX_RBC_L2 Fix SPR 0008 / ACMF-24: explain that XML sizes are indicative only
2.0	30 Jan 2012	Introduction of an additional DSD for parameter setting file ('AUX_PAR_RB) Definition of Laser_Frequency_Start and Laser_Frequency_Stop in RBC SPH

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1. Introduction

1.1. Purpose of Document

This document defines the interface specification for data files that constitute the input to and output from the ADM-Aeolus Rayleigh-Brillouin Correction (RBC) look-up tables Generator. This software is abbreviated RBCGen in the rest of the present document. In general terms, the file specifications must adhere to the content and formats defined in [AD1-AD6].

The RBC Generator creates the auxiliary file that the ADM L2B processor needs for correcting L1B Rayleigh winds from pressure, temperature and Mie contamination effects. The correction algorithm is explained in [RD4] (theoretical baseline) and section 14 of [RD2]. The RBC Generator is explained in [RD5].

RBCGen output products are also described in the present document.

1.2. Relationship of the Input/Output Data Definition Files

The relationship and normal processor flow between the three files involved in RBC Generator software is illustrated in Figure 1. The current document gives the Input/Output Data Definition for two of them listed in

Table 1. The remaining file (shaded) is defined elsewhere, see Table 2.

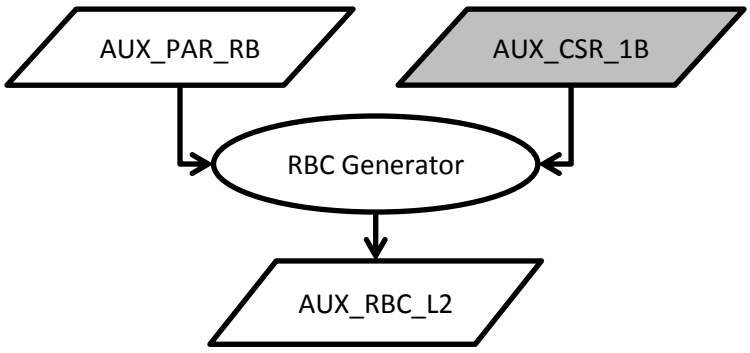

Figure 1: Relationship of Input/Output Files for the Aeolus Rayleigh-Brillouin Correction look-up tables Generator

- **The AUX_RBC_L2 file** is the principal output created by the ADM-Aeolus RBC Generator Processing task. It must be re-computed each time an Instrument Spectral Registration (ISR) or Instrument Auto Test (IAT) is performed [RD5]. The data in the file are used as a lookup table by the L2B Processor to calculate Rayleigh-Brillouin corrections, given temperature, pressure, and backscatter ratio in the sensing volume. It is described in the present document as well as in section 5.2 of [RD3].

- **The AUX_CSR file** is the principal instrumental input to the RBC Generator and is typically provided by the Thin Layer. The EE-format is expected, with a content fully described in [RD7].
- **The AUX_PAR_RB file** is an auxiliary input to the RBCGen that is created by external tools (e.g. a text editor), at the discretion of the site installing the RBCGen. It defines parameters and settings required to define operation of the RBCGen.

Table 1: RBCGen Input/Output Data Definition Files described in the present document

File Type Identifier	File Type	Description	Created By	Used By
	RBC Look-up Table Product File			
AUX_RBC_L2	RBC Generator Product File	Section 3	RBC Generator	L2B Processor
	Input Auxiliary File			
AUX_PAR_RB	RBC Generator Processing Parameters	Section 4	ACMF and/or L2-PF (ECMWF)	RBC Generator

Table 2: Supporting file defined in another document

File Type Identifier	File Type	Description	Created By	Used By
	Level 1B File			
AUX_CSR_1B (.EEE)	Level-1B CSR File in Earth Explorer format	[RD7]	Core PDS	RBC Generator

2. Documents

2.1. Applicable Documents

Ref	Document title	Document ref	Ver	Date
[AD1]	PDS-IPF ICD Generic Interface Guidelines	ESA-ID-ACS-GS-0001	2.2	Aug 2006
[AD2]	ADM-Aeolus, Data Products Contents Guidelines	AE-TN-ESA-SY-007	1.B	May 2004
[AD3]	Earth Explorer Ground Segment File Format Standard	PE-TN-ESA-GS-0001	1.4	Jun 2003
[AD4]	CFI Software: Mission Conventions Document	CS-MA-DMS-GS-0001	1.3	Jul 2003
[AD5]	PDS to ECMWF: Interface Control Document.	XADM-GSEG-EOPG-ID-04-0002	1.5	Oct 2006
[AD6]	Implementation of Level 2B/2C Processing Facility. Technical Requirements	XADM-GSEG-EOPG-RD-04-0003	1.1	Jun 2004

2.2. Reference Documents

Ref	Document title	Document ref	Ver	Date
[RD1]	Selection of L2B Parameters (Study TN2.1)	AE-TN-MFG-L2P-0021	2.0	May 2006
[RD2]	ADM-Aeolus Level-2B Algorithm Theoretical Baseline Document (Mathematical Description of the Aeolus L2B Processor)	AE-TN-ECMWF-L2BP-0023	2.1	Feb 2007
[RD3]	Aeolus Level 2B Processor Input/Output Data Definitions Interface Control Document	AE-IF-ECMWF-L2BP-001	1.31	Jun 2007
[RD4]	ILIAD: Impact of line shape on Aeolus-ADM Doppler estimates	Final report contract 1833404/NL/MM		11/2005
[RD5]	RBC Generator: Detailed Processing Model	AE-TN-MFG-GS-0001	2.0	17/01/12
[RD6]	Explorer_Data_Handling Software User Manual	CS-MA-DMS-GS-0009	3.4	Nov 2005
[RD7]	Generation of AUX_CSR	AE-TN-MFG-L2P-CAL-0003	2.0	17/01/12

2.3. Acronyms

ACMF	Aeolus Calibration and Monitoring Facility
ADS	Annotation Data Set
AMD	Auxiliary Meteorological Data
AOCS	Attitude and Orbit Control System

BRC	Basic Repeat Cycle
BUFR	Binary Universal Format for Representation
CFI	Customer Furnished Item
CSR	Coherent Spectral Registration
DBL	Data Block
DEM	Digital Elevation Map
DSD	Data Set Descriptor
DSR	Data Set Record
DS	Data Set
ECMWF	European Center for Medium-Range Weather Forecast
EE	Earth Explorer
FH	Fixed Header
HDR	Header
HLOS	Horizontal Line of Sight
KVT	Key, Value, Terminator
IAT	Instrument Auto Test
IODD	Input/Output Data Definition(s)
ICD	Interface Control Document
ISR	Instrument Spectral Registration
L1B	Level-1B
L2B	Level-2B
L2BP	Level-2B Processor
L2-PF	Level-2B Processing Facility (ECMWF)
LOS	Line Of Sight
LTA	Long Term Archive
MPH	Main Product Header
MDS	Measurement Data Set
NWP	Numerical Weather Prediction
PBL	Planetary Boundary Layer
PCD	Product Confidence Data
PDS	Payload Data Segment
PRF	Pulse Repetition Frequency
QC	Quality Control
RBC	Rayleigh Brillouin Correction
RBCGen	Rayleigh Brillouin Correction look-up tables Generator
SNR	Signal to Noise Ratio
SPH	Specific Product Header
VH	Variable Header
WGS84	World Global System 84 : Reference Ellipsoid for GPS data.
WMO	World Meteorological Organization
XML	Extensible Markup Language
TGZ	Tar, g-zipped.

3. General Input/Output File Format

It is envisaged that all Aeolus L2B-related files handled by the Thin Layer will conform to EE-format. The general conventions for EE-format have been detailed elsewhere [AD3] but are repeated in this Section to make the current document self-contained.

3.1. File Naming Conventions

The file naming conventions to be applied for Aeolus data files and products are in line with the Earth Explorer File Format Standard [AD3]. The general file name structure is:

AE_CCCC_TTTTTTTTTT_<instance_ID>.EEE

where

'AE' denotes the Aeolus mission

CCCC denotes the file class (four uppercase letters/digits)
- 'OPER' for routine operations
- 'TEST' for internal tests

TTTTTTTTTT is the file type identifier (total of ten uppercase letters/digits/underscores).

<instance_ID> is the file instance ID (variable length, up to 41 letters/digits/underscores), where the <instance_ID> string will include creation time/validity time information
- <instance_ID> = yyyymmddThhmmss_yyyymmddThhmmss_vvvv
- yyyymmddThhmmss: date/time strings of validity interval start and stop times
- vvvv: file version number (4 digits starting with 0001).

EEE is the file extension taking 3 possible values:
- 'EEF' if header and datablock are contained in a single file
- 'HDR' in the case of a header file
- 'DBL' in the case of a datablock file

Only auxiliary data are used/created by the RBCGen. For these data, the file type identifier takes the form

TTTTTTTTTT = AUX_PPPPPP

where

'AUX' denotes an auxiliary file
PPPPPP = CSR_xx for CSR calibration files
(xx denotes the processor level generating the file)
= 'PAR_xx' for a processing parameter/algorithm settings file
(xx denotes the processor level that uses the file, "L2" for the L2BP)
= 'RBC_ss' for Rayleigh-Brillouin correction data

(ss denotes the processor that generates the file or the processing levels permitted to use the data)

3.2. Format Conventions (XML, KVT, Binary)

Format conventions for XML and KVT syntax are recalled in Table 3 and Table 4. Binary data types and corresponding sizes in bytes are also recalled in Table 5. Note that these conventions are recalled from tables 3-1 and 3-2 of [RD7] and conform to the standards expressed in [AD3].

As shown in Table 3, sizes and XML format are variable. Therefore, throughout this document, sizes of parameters and files in XML format (i.e. header and EEF file) are indicative only.

Table 3: Format conventions used for headers in XML format

Format	Description	Size	Example
DateTime	Any UTC time uses the "standard with reference" format 'UTC=yyyy-mm-ddThh:mm:ss', where: - yyyyis a 4 digits integer representing the year - mm is a 2 digits integer representing the month - dd is a 2 digits integer representing the day - hh is a 2 digits integer representing the hour - mm is a 2 digits integer representing the minutes - ss is a 2 digits integer representing the seconds.	23	UTC=2005-03-31T12:00:00
String	array of characters	variable	"A_STRING"
Enum	array of characters with a fixed number of valid values	variable	"A_STRING"
Boolean	False or True	variable	False or True
IntAuc	unsigned char integer	variable	"221"
IntAc	signed char integer	variable	"-221"
IntAus	Unsigned short integer	variable	"+65535"
IntAs	signed short integer	variable	"-12828"
IntAul	unsigned long integer	variable	"1010000000"
IntAl	signed long integer	variable	"-1010000000"
IntAd	long long integer	variable	"240000000"
FAdoxy	float with x digits before the decimal point and y digits after	variable	"034.8399"
Spare	array of characters filled with blanks	variable	

Table 4: Format conventions used for headers in KVT format

Format	Description	Size (bytes)	Example
DateTime	Any UTC time uses the "Envisat with microseconds" format '*dd-mmm-yyyy hh:mm:ss.uuuuuu*', where: • *dd* is a 2 digits integer representing the day • *mmm* is a 3 characters string representing the month, e.g., JAN, FEB, etc. • *yyyy* is a 4 digits integer representing the year • *hh* is a 2 digits integer representing the hour • *mm* is a 2 digits integer representing the minutes • *ss* is a 2 digits integer representing the seconds • *uuuuuu* is a 6 digits integer representing the micro-seconds	27	09-OCT-2007 11:21:32.210146
String	String written with quotes before and after. The text is left justified, e.g., any added blanks should appear at the end of the field string.	variable	"A_STRING"
Enum	String without quotes	variable	A_STRING
Boolean	0 (for FALSE) or 1 (for TRUE)	1	0 or 1

IntAuc	Unsigned char integer, written with a '+' at the beginning	4	+221
IntAc	Signed char integer, written with the sign at the beginning	4	-221
IntAus	Unsigned short integer, written with a '+' at the beginning	6	+65535
IntAs	Signed integer, written with the sign at the beginning	6	-12828
IntAul	Unsigned long integer, written with a '+' at the beginning	11	+1010000000
IntAl	Signed long integer, written with the sign at the beginning	11	-1010000000
IntAd	Long long integer, written with the sign at the beginning	21	+00000000000240000000
FAdo*xy*	Float with x digits before the decimal point and y digits after, written with the sign at the beginning	X+Y+2	+034.8399 (FADO34)
Spare	The space is filled with blanks	40	

Table 5: Data types and corresponding size in bytes for binary data

Format	Description	Size (bytes)	Example
DateTime	Any UTC time uses the Modified Julian Date 2000 (MJD2000) format. In binary format, an MJD2000 time is represented by the format <days>.<seconds><microseconds>, where: ▪ <days> is a 4 byte signed long integer representing the number of days since January 1st, 2000 at 0:0 hour (which may be negative) ▪ <seconds> is a 4 byte unsigned long integer representing the number of seconds elapsed since the beginning of the day ▪ <microseconds> is a 4 byte unsigned long integer representing the number of microseconds elapsed since the last second	12	
String	Array of characters	variable	A_STRING
Enum	A set of fixed values	1	A_STRING
Boolean	0 (for FALSE) or 1 (for TRUE)	1	0
IntAuc	Unsigned char integer	1	[0, +255]
IntAc	Signed char integer	1	[-128, +127]
IntAus	Unsigned short integer	2	[0, +65,535]
IntAs	Signed short integer	2	[-32 768, +32 767]
IntAul	Unsigned long integer	4	[0, +4 294 967 295]
IntAl	Signed long integer	4	[-2 147 483 648, +2 147 483 647]
IntAd	Long long integer	8	[-9 223 372 0368 54 775 808, +9 223 372 036 854 775 807]
FAdoxy	Double precision floating point (See Document A-22)	8	[-1.79e+308, 1.79e+308] [-2.22e-308, 2.22e-308]
Spare	Array of characters filled with space (ASCII 32) characters	variable	

3.3. General File Structure

All the Aeolus files comply with the Earth Explorer Ground Segment File Format Standard, including auxiliary and non-product files (such as processing report files).

The Aeolus RBCGen input and output files follow a general structure containing:

- A Fixed Header (FH) written using the XML standard. This header is identical for all files and is described in Section 3.3.1.
- A Variable Header (VH) which varies from one file type to another. It consists of
  - A Main Product Header (MPH) written using the XML standard. The MPH is identical for all files and is described in Section 3.3.2.

- A Specific Product Header written using the XML standard. This is is part of the MPH that varies for each product type, and is thus described separately for each product type in the relevant sections.

  All SPH structures will include one or more Data Set Descriptors (DSDs) which describe the format/structure of individual Data Sets in the Data Block portion of the product. The DSD structure is described in Section 3.3.3.

- A Data Block (DBL) containing one or more Data Sets (DS), each consisting of one or more Data Set records (DSRs). Each product will contain different types of DSs and these are described in the relevant sections. Data sets in the Data Block can be of three different types: Measurement Data Sets (MDS), Annotation Data Sets (ADS) or Global Annotation Data Sets (GADS).

For small data volume, all components are stored in the same physical file and the data block is written using the XML standard.

For large data volume, the Data Block is stored in a separate file and has an ASCII header containing a copy of the MPH and SPH (which includes DSDs) written using KVT format.

3.3.1. Fixed Header.

The structure of the Fixed Header is common to all Earth Explorer products. It is recalled below in Table 6, Table 7 and Table 8. An example is given in Figure 2. Note that the FH is written only once in XML in the header section of the RBCGen output product file. It is not repeated in the Data Block file.

Table 6: Fixed Header Content Description

Tag Name	Content Description	Unit	Type	Size (XML)
Fixed_Header	Root tag		Structure	14 0 15
File_Name	Logical file name without the extension		String	11 62 13
File_Description	One line description of the file		String	18 32 20
Notes	Multi-lines free text		String	7 32 9
Mission	String representing the mission name ('Aeolus' for the ADM-Aeolus mission). Note that, in the File_Name, the Mission ID is a two character string ('AE' for the ADM-Aeolus mission)		String	9 6 11
File_Class	OPER (file type as indicated in the file name) or TEST		String	12 4 14
File_Type	The part of the file name that gives the file type. For explanation of the different valid values see Section 3.1.		String	11 10 13
Validity_Period	See **Table 7** for structure description		Structure	18 112 19
File_Version	The vvvv part of the file name (see Section 3.1)		Integer	14 4 16
Source	See **Table 8** for structure description		Structure	9 172 10
Total size for XML FH in bytes:				**697**

Table 7: Fixed Header Validity_Period Content Description

Tag Name	Content Description	Unit	Type	Size (XML)
Validity_Start	Validity start time as specified in the file name. To indicate the beginning of the mission, the special value: 'UTC=0000-00-00T00:00:00' can be used.	UTC	DateTime	16 23 18
Validity_Stop	Validity stop time as specified in the file name. To indicate the end of the mission, the special value: 'UTC=9999-99-99T99:99:99' can be used.	UTC	DateTime	15 23 17
Total size for XML FH in bytes:				**112**

Table 8: Fixed Header Content Description

Tag Name	Content Description	Unit	Type	Size (XML)
System	"L2_PF" in case of creation at ECMWF, or "PDS" in case of creation at ESRIN. **TBC**		String	8 19 10
Creator	L2BP if generated at ECMWF, otherwise RBCGen (**TBC**) if generated by ad-hoc processing facility		String	9 12 11
Creator_Version	Version of RBCGen used for the generation of the present product file.		String	17 12 19
Creation_Date	Date/time of creation.	UTC	DateTime	15 23 17
Total size for XML FH in bytes:				**172**

Figure 2 : Example of RBCGen Fixed Header.

```
<Fixed_Header>
        <File_Name>AE_TEST_AUX_RBC_L220071002T000001_20081002T000002_0001</File_Name>
        <File_Description>RBC Product</File_Description>
        <Notes>Room for some
additional remarks</Notes>
        <Mission>Aeolus</Mission>
        <File_Class>TEST</File_Class>
        <File_Type>AUX_RBC_L2</File_Type>
        <Validity_Period>
                <Validity_Start>UTC=2007-10-02T00:00:01</Validity_Start>
                <Validity_Stop>UTC=2008-10-02T00:00:02</Validity_Stop>
        </Validity_Period>
        <File_Version>0001</File_Version>
        <Source>
                <System>LOCAL</System>
                <Creator>L2BP</Creator>
                <Creator_Version>1.31</Creator_Version>
                <Creation_Date>UTC=2006-01-30T15:25:25</Creation_Date>
        </Source>
</Fixed_Header>
```

3.3.2. Main Product Header.

The structure of the MPH is common to all AEOLUS products. It is detailed in Table 9. It is similar to the MPH structure of L1B products as described in section 3.3.2 of [RD7] and matches the standards expressed in [AD2] and [AD3]. The data types (column 4) are defined in Section 3.2. Note that the MPH is written in XML in the header file and repeated in KVT in the Data Block file. This is why the size is evaluated for both KVT and XML formats in the last two columns.

Table 9: Main Product Header Content Description

Tag Name	Content Description	Unit	Type	Size (KVT)			Size (XML)		
Main_Product_Header	Root tag (XML format only)		Structure				22	0	23
Product	Logical file name, i.e., file name excluding the extension		String	9	62	2	9	62	11
Proc_Stage	Processing stage flag: 'N' for nominal processing (quasi- or close to real-time), 'T' for test product, 'R' for reprocessed.		Enum	11	1	1	12	1	14
Ref_Doc	Reference document describing the product		String	9	23	2	9	23	11
Spare_1			Spare	40	0	1	11	0	0
Acquisition_Station	Acquisition station ID		String	21	20	2	21	20	23
Proc_Center	Processing centre ID, e.g., 'L2_PAF'		String	13	6	2	13	6	15
Proc_Time	Time of processing	UTC	DateTime	11	27	2	11	30	13
Software_Ver	Software version number of processing software. Format: name of processor (up to 10 charac-ters)/version number(4 characters)		String	14	14	2	14	14	16
Spare_2			Spare	40	0	1	11	0	0
Sensing_Start	Start time of sensing	UTC	DateTime	15	27	2	15	30	17
Sensing_Stop	Stop time of sensing	UTC	DateTime	14	27	2	14	30	16
Spare_3			Spare	40	0	1	11	0	0
Phase	Phase number. If not used set to 'X'		Enum	6	1	1	7	1	9
Cycle	Cycle number		IntAuc	6	4	1	7	4	9
Rel_Orbit	Start relative orbit number		IntAs	10	6	1	11	6	13
Abs_Orbit	Start absolute orbit number		IntAs	10	6	1	11	6	13
State_Vector_Time	Time of state vector	UTC	DateTime	19	27	2	19	30	21
Delta_UT1	Delta_UT1 = UT1-UTC	s	FAdo06	10	8	4	20	8	13
X_Position	X position in Earth-fixed reference	m	FAdo73	11	12	4	21	12	14
Y_Position	Y position in Earth-fixed reference	m	FAdo73	11	12	4	21	12	14
Z_Position	Z position in Earth-fixed reference	m	FAdo73	11	12	4	21	12	14
X_Velocity	X velocity in Earth-fixed reference	m/s	FAdo46	11	12	6	23	12	14
Y_Velocity	Y velocity in Earth-fixed reference	m/s	FAdo46	11	12	6	23	12	14
Z_Velocity	Z velocity in Earth-fixed reference	m/s	FAdo46	11	12	6	23	12	14
Vector_Source	Source of orbit vectors (not used by ADM-Aeolus)		String	15	2	2	15	2	17
Spare_4			Spare	40	0	1	11	0	0
Utc_Sbt_Time	Time corresponding to SBT below (not used by ADM-Aeolus)	UTC	DateTime	14	27	2	14	30	16
Sat_Binary_Time	Satellite Binary Time (not used by ADM-Aeolus)		IntAul	16	11	1	17	11	19
Clock_Step	Clock step size (not used by ADM-Aeolus)	ps	IntAul	11	11	5	22	11	14
Spare_5			Spare	32	0	1	11	0	0
Leap_Utc	Time of occurrence of the leap second	UTC	DateTime	10	27	2	10	30	12
Leap_Sign	Leap second sign (+001 if positive leap second, -001 if negative)		IntAc	10	4	1	11	4	13
Leap_Err	Leap second error. '1' if leap second error occurs during processing segment, '0' otherwise		Boolean	9	1	1	10	1	12
Spare_6			Spare	40	0	1	11	0	0
Product_Err	'1' or '0'. If '1', errors have been reported in the product. User should then refer to the SPH or Quality ADS of the product for details of the error condition. '0' otherwise.		Boolean	12	1	1	13	1	15
Tot_Size	Total size of product (#bytes DSR+SPH+MPH)	bytes	IntAd	9	21	8	23	21	12
Sph_Size	Length of SPH (#bytes in SPH)	bytes	IntAl	9	11	8	23	11	12
Num_Dsd	Number of DSDs (10 for L2B files, 15 for L2C files, 4 for AMD files, 3 for RBC files, 1 for L2B_Param files, 1 for L2C_Param)		IntAl	8	11	1	9	11	11

Dsd_Size	Length of each DSDs (#bytes for each DSD, all DSDs shall have the same length	bytes	IntAl	9	11	8	23	11	12
Num_Data_Sets	Number of DSs attached (not all DSDs have a DS attached)		IntAl	14	11	1	15	11	17
Spare_7			Spare	40	0	1	11	0	0
Total Size for KVT and XML MPH in bytes:				**1247**			**1630**		

3.3.3. Data Set Descriptor

Data Set Descriptors contain information on the structure and size of a data set in the Data Block. They have a standard structure common to all Aeolus products, are defined in [AD3, RD7] and re-called here in Table 10. They are included in the SPH.

Table 10: Data Set Descriptor Content Description

Tag Name	Content Description	Unit	Type	Size(KVT)			Size(XML)		
Dsd	Root tag (XML format only)		Structure				6	0	7
DS_Name	DS descriptor ASCII string describing the data set		String	9	28	2	9	28	11
DS_Type	Type of DS. 'M' if Measurement DS, 'A' if Annotation DS, 'G' if Global ADS and 'R' if Reference DS (no DS attached)		Enum	8	1	1	9	1	11
Filename	If DS_Type='R', this field contains the name of external file used to process the current product. Otherwise, this field is left blank		String	10	62	2	10	62	12
Ds_Offset	Offset if bytes from the beginning of the file	bytes	IntAd	10	21	8	24	21	13
Ds_Size	Size of Data Set	bytes	IntAl	8	11	8	22	11	11
Num_Dsr	Number of Data Set Records in Data Set		IntAl	8	11	1	9	11	11
Dsr_Size	Size of Data Set Record, -1 if DSRs have variable sizes.	bytes	IntAl	9	11	8	23	11	12
Byte_Order	"3210". For binary DS's to designate byte order is most significant byte first.		String	12	4	2	12	4	14
Spare_1			Spare	32	0	1	11	0	0
Total size for KVT and XML in bytes				**288**			**386**		

3.4. Conventions for Missing Data Indicators

Similarly to what is done in the L2B/L2C processors, RBC products adopt conventions for Missing Data Indicators. Such conventions are not a requirement of the Earth Explorer format but are regularly found in meteorological applications. The conventions are that, for numerical datatypes (i.e. all Integer and FAdoxy datatypes), the maximum value is reserved to denote missing data. The use of Missing Data Indicators is additional to the standard practice of reporting error quantifier parameters to indicate whether product parameters are suitable for use.

4. RBC Product

4.1. Product Structure

The RBC product conforms to the product structure defined in Section 3.3.

4.1.1. File Name

The RBC Data file name has the format defined in Section 3.1:

```
AE_CCCC_AUX_RBC_L2_yyyymmddThhmmss_yyyymmddThhmmss_vvvv.EEE
```

The extension `EEE` is `HDR` for the header and `DBL` for the data block. That is, the RBC product consists of two files:

- A header containing a Fixed Header, MPH, and SPH with DSDs. The header is in XML format and has extension EEE='HDR'.
- A datablock containing a copy of MPH and SPH in KVT format followed by the DataSets in binary format. The data block has the file extension EEE='DBL'.

4.1.2. File Structure

The Header File contains a Fixed Header and MPH as described in Section 3.3. The SPH is described in Section 4.2 below. The Data Sets in the datablock are described in Section 4.3.

4.2. RBC Specific Product Header

The Specific Product Header of the L2B RBC is detailed in Table 11.

Table 11: RBC Specific Product Header Content Descriptor

Name	Description / Comment	Unit	Type	Size (KVT)			Size (XML)		
Specific_Product_Header	Root tag (XML format only)		Structure				26	0	27
Sph_Descriptor	Specific Product Header descriptor: ASCII string describing the product		String	16	28	2	16	28	18
Spare_1			Spare	40	0	1	11	0	0
Ref_RBC_Suite	Reference of the processing suite that was used to produce the Rayleigh Brillouin lookup tables		String	15	20	2	15	20	17
Num_P	Number of pressure bins in P_Grid (typical value: 23)		IntAs	6	6	1	7	6	9
Num_T	Number of temperature bins in T_Grid (typical value: 161)		IntAs	6	6	1	7	6	9
Num_F	Number of frequency bins in F_Gridtmp (typical value: 937)		IntAs	6	6	1	7	6	9
Num_FP	Number of frequency bins in F_FP. This number is also the size of the arrays TA_FP and TB_FP. (Typical value: 877)		IntAs	7	6	1	8	6	10
Num_Fd	Number of frequency bins in Fd (typical value: 61)		IntAs	7	6	1	8	6	10
Num_RR	Number of responses in RR (typical value: 101)		IntAs	7	6	1	8	6	10
Spare_2			Spare	40	0	1	11	0	0
P_min	Minimum pressure considered in the RBC calculations	Pa	IntAul	6	11	5	17	6	9
P_max	Maximum pressure considered in the RBC calculations	Pa	IntAul	6	11	5	17	6	9
T_min	Minimum temperature considered in the RBC calculations	10-2K	IntAus	6	6	8	20	5	9
T_max	Maximum temperature considered in the RBC calculations	10-2K	IntAus	6	6	8	20	5	9
Laser_Freq_Offset_Start	First offset of the laser frequency in the RBC file	MHz	FAdo56	24	13	6	36	11	27
Laser_Freq_Offset_Stop	Last offset of the laser frequency in the RBC file	MHz	FAdo56	23	13	6	35	11	26
Total_Num_of_Observations	Total number of observations used in the Fabry-Perot transfer function file (presently set to 0)		IntAl	26	11	1	27	11	29
Total_Num_of_Measurements	Total number of measurements used in the Fabry-Perot transfer function file (presently set to 0)		IntAl	26	11	1	27	11	29
Total_Num_of_Reference_Pulses	Total number of reference pulses used in the Fabry-Perot transfer function file (presently set to 0)		IntAl	30	11	1	31	11	33
Total_Num_of_Corrupt_Mie_Meas	Total number of corrupted Mie measurements in the Fabry-Perot transfer function file		IntAl	30	11	1	31	11	33

Total_Num_of_Corrupt_Ray_Meas	Total number of corrupted Rayleigh measurements in the Fabry-Perot transfer function file (presently set to 0)		IntAl	30 11 1	31 11 33
Total_Num_of_Corrupt_Mie_RefP	Total number of corrupted Mie reference pulses in the Fabry-Perot transfer function file (presently set to 0)		IntAl	30 11 1	31 11 33
Total_Num_of_Corrupt_Ray_RefP	Total number of corrupted Rayleigh reference pulses in the Fabry-Perot transfer function file (presently set to 0)		IntAl	30 11 1	31 11 33
Averege_Error_FP_Response_A	Average error in Fabry-Perot response in the transfer function file, for channel A (presently set to 0)		FAdo36	28 11 1	29 11 31
Averege_Error_FP_Response_B	Average error in Fabry-Perot response in the transfer function file, for channel B (presently set to 0)		FAdo36	28 11 1	29 11 31
Spare_3			Spare	40 0 1	11 0 0
List_of_Dsds	See Table 12 for a description			864	1158
Total size for KVT and XML in bytes				**1686**	**2425**

The Data Sets listed in Table 12 appear in the Rayleigh-Brillouin Correction auxiliary products, each described by a DSD in the SPH.

Table 12: RBC Data Sets

DSD_Number	Name	Description / Comment	DataSet Type	Update Frequency
1	Rayleigh_Brillouin_ADS	DSD for Rayleigh Brillouin look-up tables (1 DSR only)	A	1 DSR per dataset
2	PAR_ADS	DSD for Parameter settings	R	No DS
3	Fabry_Perot_MDS	DSD for Fabry-Perot transfer response functions	R	No DS

A description of the "Data Set Type" can be found in Table 10. The first dataset is of type 'A', or 'Attached', meaning that it is included in the AMD datablock file. Its content is described in Section 4.3.

4.3. RBC Data Set

The content of the RBC data set is described in Table 13. The data set size in bytes is equal to

$$Num\_P * 4 + Num\_T * 2 + Num\_frb * 8 + Num\_FP * 24 + Num\_Fd * 8 + Num\_RR * 16 + Num\_P * Num\_T * (Num\_frb * 8 + Num\_RR * 16 + Num\_Fd * 8)$$

In the tables below, reported sizes are for $Num\_P = 110$, $Num\_T = 161$, $Num\_F = 937$, $Num\_FP = 877$, $Num\_Fd = 61$ and $Num\_RR = 121$.

Table 13: RBC Data Set Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
P_Grid	Array of Num_P pressures covering the range [P_min,P_max]	Pa	Num_P * IntAul	440
T_Grid	Array of Num_T temperatures covering the range [T_min,T_max]	10-2K	Num_T * IntAus	322
F_Gridtmp	Array of Num_F frequencies covering the range [-FSR-USR/2,+FSR+USR/2].	Hz	Num_F * IntAd	7496
Spec_Grid_PTF	List if Num_P structures Spec_Grid_TF containing the spectra for temperature and frequency (see Table 14)		list of Num_P structures	132754160
F_FP	Array of Num_FP frequencies covering the range [-FSR,+FSR]	Hz	Num_FP * IntAd	7016

TA_FP	Array of Num_FP Fabry-Perot responses interpolated to the frequency array Freq_FP for channel A		Num_FP * Fadoxy	7016
TB_FP	Array of Num_FP Fabry-Perot responses interpolated to the frequency array Freq_FP for channel B		Num_FP * FAdoxy	7016
Fd	Array of Num_Fd frequencies covering the range [-USR/2,+USR/2]	Hz	Num_Fd * IntAd	488
RR	Array of Num_RR responses covering the range [-0.5,0.5]		Num_RR * Fadoxy	968
Fcalib_PTR	List of Num_P structures containing the Rayleigh Brillouin corrections for temperature, and response (see Table 16)		list of Num_P structures	34286560
Nab_PTFd	List if Num_P structures Nab_TFd containing the photocounts on A & B Rayleigh channels for temperature and frequency (see Table 18)		list of Num_P structures	8642480
Fint_R	List of Num_RR frequencies corresponding to the response RR on the internal reference	Hz	Num_RR * IntAd	968
Total size in bytes				**175714930**

Table 14: RBC Spec_Grid_PTF Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
Spec_Grid_TF	List of Num_T structures Spec_Grid_F containing the spectra for frequency (see Table 15)		list of Num_T structures	1206856
Total size in bytes				**1206856**

Table 15: RBC Spec_Grid_TF Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
Spec_Grid_F	Array of spectra of size Num_F		Num_F * Fadoxy	7496
Total size in bytes				**7496**

Table 16: RBC Fcalib_PTR Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
Fcalib_TR	List if Num_T structures Fcalib_R containing the corrections for response (see Table 17)		list of Num_T structures	311696
Total size in bytes				**311696**

Table 17: RBC Fcalib_TR Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
Fcalib_R	Array of corrections of size Num_RR	Hz	Num_RR * Fadoxy	968
Fcalib_R_error	Error of Fcalib_R	Hz	Num_RR * Fadoxy	968
Total size in bytes				**1936**

Table 18: RBC Nab_PTFd Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
Nab_TFd	List if Num_P structures Nab_TFd containing the photocounts on A & B Rayleigh channels for temperature and frequency (see Table 19)		list of Num_T structures	78568
Total size in bytes				**78568**

Table 19: RBC Nab_TFd Content Descriptor

Name	Description / Comment	Unit	Type	Size (Binary)
Na_Fd	Array of Rayleigh photocounts for channel A, of size Num_Fd		Num_Fd * IntAul	244
Nb_Fd	Array of Rayleigh photocounts for channel B, of size Num_Fd		Num_Fd * IntAul	244

Total size in bytes	**488**

The parameter Fcalib_R_error is an error estimate for the parameter Fcalib_R, for potential use in computation of the total error in L2B wind parameters.

4.4. File Size

The size of the fixed header of the RBC file is shown in Table 6 and that of the Main Product Header is shown in Table 9. Adding these sizes with that of the Specific Product Header and the Data Sets, the total size of the RBC file is about 34 Mb. We remind here that the RBC file is not created every day, but only when and instrument spectral registration or instrument auto-test is performed.

Table 20: Size of RBC Data file.

	Section	Format	Size per file
Header File	FH	XML	697
	MPH	XML	1630
	SPH	XML	2425
Total size in bytes for HDR file			**4895**
Data Block	MPH	KVT	1247
	SPH	KVT	1686
	RBC ADS	Binary	175714930
Total size in bytes for DBL file			**175717863**
Total size for HDR+DBL in Mb			**167,58**

5. Parameter settings for the RBC Generator.

This section proposes a detailed description of the parameter setting file for the RBC generator. Due to its small size, all the information is contained in one single (header) file and written in XML. There is no binary (KVT) part for the parameter settings file of the RBC Generator.

5.1. Product Structure

The RBCGen Parameters file conforms to the Earth Explorer standard defined in Section 3.3. It is contained in one product file, containing Fixed Header and Main Product Header as defined in sections 3.3.1 and 3.3.2 respectively, as well as a Specific Product Header and a single Data Set as defined in the following subsections. All headers and data sets are in XML format.

5.1.1. File Name

The name of the RBC parameter file is:

`AE_OPER_AUX_PAR_RB_yyyymmddThhmmss_yyyymmddThhmmss_vvvv.EEF`

where `yyyymmddThhmmss` designates the start and end validity dates of the file, and `vvvv` is a version number. Note that the `EEF` extension signifies that the parameter setting file is contained in a single physical file.

As the RBC parameter settings should remain the same throughout the mission, the end date of the validity period should be `99999999T999999`.

5.1.2. File Structure

The Header File contains a Fixed Header and MPH as described in Section 3.3. The SPH is described in Section 5.2 below. The Data Sets in the datablock are described in Section 5.3.

5.2. RBC Parameter Settings Specific Product Header

Table 21: AUX_PAR_RB SPH

Name	Description / Comment	Unit	Type	Size (XML)
Specific_Product_Header	Root tag		Structure	26 0 27
Sph_Descriptor	Specific Product Header descriptor: ASCII string describing the product		String	16 28 18
Spare_1			Spare	10 0 11
List_of_Dsds	List of Data set descriptors. There is only one DSD in this file. Its name is RBC_Proc_Param_ADS. See Table 10 for a description.		DSD Structure	25 386 16
Total size for KVT and XML in bytes				**563**

5.3. RBC Parameter Settings Data Set

Table 22: Content of RBC_Proc_Param_ADS

Name	Description / Comment	Unit	Type	Size (XML)
RBC_Proc_Param_ADS	Root tag			21 0 22
RB_FH_Default_Fields	Default fields for the RBC fixed header. See Table 23.			23 137 24
L2C_MPH_Default_Fields	Default fields for the L2C Main Product Header. See Table 24			24 111 25
RB_Params	Parameter settings for the RBC generator. See Table 25.			12 319 13
			Total size for KVT and XML in bytes	**731**

Table 23: Content of RB_FH_Default_Fields

Name	Description / Comment	Unit	Type	Size (XML)
File_Description	File description. Default : RBC Product			18 11 20
Mission	Name of mission: Aeolus			9 6 11
Mission_Id	Mission ID: AE			12 2 14
File_Version	Number of file version		IntAus	14 4 16
			Total size in bytes	**137**

Table 24: Content of L2C_MPH_Default_Fields

Name	Description / Comment	Unit	Type	Size (XML)
Ref_Doc	Reference of RBC IODD			9 17 11
Software_Ver	Software version			14 11 16
Proc_Center	Processing centre			13 5 15
			Total size for KVT and XML in bytes	**111**

Table 25: Content of RB_Params

Name	Description / Comment	Unit	Type	Size (XML)
Pmin	Minimum pressure	hPa	IntAul	17 4 8
Pmax	Maximum pressure	hPa	IntAul	17 4 8
DeltaP	Pressure step	hPa	InAuc	19 2 10

Tmin	Minimum temperature	K	IntAus	15	3	8
Tmax	Maximum temperature	K	IntAus	15	3	8
DeltaT	Temperature step	K	IntAuc	17	2	10
Rmin	Minimum response		Fado11	6	4	8
Rmax	Maximum response		Fado11	6	4	8
DeltaRR	Response step		Fado12	9	5	11
FSR	Free spectral range (in GHz)	GHz	Fado19	16	11	7
USR	Useful Spectral Range	MHz	Fado41	16	6	7
df	Frequency resolution for the computation of RBC_AUX parameters	MHz	Fado21	15	4	6
			Total size for KVT and XML in bytes		**319**	

5.4. File Size

An indicative size of the XML file is 3887 bytes.