

# ***EPS-SG IASI-NG Level 1D Auxiliary Data Specification***

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## Document Change Record

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v1	19/12/2014	—	First version in view of the V0 as per EPS-SG Development Logic Plan, for internal review in view of the System PDR.
v1A draft	12/02/2015	—	Updates from internal review
v1B	05/03/2015	—	Intermediate version, editorial
v1C	05/03/2015	—	V0 in EPS-SG Development Logic
v2	17/09/2015	—	Changes in view of v1 as per ESP-SG Dev.Logic. Moved open issues out in a separate issue tracking document as per doc coordination meeting. Added G/R field in filenames
v2Adraft	15/12/2015	—	Includes changes from review
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v2D	17/10/2016	—	Delivery for v2 as per ESP-SG Dev.Logic.
v2E draft	5/12/2016	EPSSG_DCR_501	Added 1D to Auxiliary Data ID of PCC and OUTL as well as other minor changes from review.
v3	29/09/2017	—	The XML file of AUX_OUTL is added.
v3A	07/03/2018	EPSSG_DCR_832	The descriptions of the auxiliary data are changed. A table for each group and the dimensions of AUX_OUTL is defined. Addition of a missing auxiliary data in the table 2.2. Updates of the TBC/TBD tables.
v3B	27/09/2018	—	The type of Longitude and Latitude in AUX_OUTL is changed. New version of the XML file of AUX_OUTL. New reviewer added.
v3C	21/02/2019	EPSSG_DCR_1135	The example of filename of the static aux data is changed. EPS-SG IASI-NG L2 Product generation specification is not a Reference Document. The format of the Netcdf and HDF5 tables are changed to include (if available) unit, valid_min and valid_max. The range is added for some variables.
v3D	12/11/2019	EPSSG_DCR_1383	Table 3.3 is changed: Eigenvalues is added in Variables of AUX_EIGV. Table 3.5 is changed: nbr_scores is added in Variables of AUX_PCCC.
v3E	25/03/2020	EPSSG_DCR_1766	Changed "residualmean" and "residualstdv" to "residual_mean" and "residual_stdv" in xml file for OUTL.
v3E	22/04/2020	EPSSG_DCR_1766	Removed "gqisflagqual" from OUTL. Removed data group in xml for OUTL

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## 1 INTRODUCTION

### 1.1 Purpose and Scope

This document is the Auxiliary Data Specification for the EPS-SG IASI-NG Level 1D Auxiliary Data sets used or generated by the EPS-SG Ground Segment. It aims at specifying the detailed format of the IASI-NG Level 2 auxiliary data in agreement with the format and naming conventions set out in the Generic Auxiliary Data Specification [GADS] applicable to all EPS-SG Auxiliary Data.

### 1.2 Relation to other documents

The EPS-SG IASI-NG Level 1D Auxiliary Data Specification [IAS-L1D-ADS] is a System document in the EPS-SG System Specification Tree. It is applicable to the [SRD], [OGSRD], IASI-NG L1D Product Generation Specification [IAS-L1D-PGS], IASI-NG L2 Product Generation Specification [IAS-L2-PGS] and EPS-SG System and Ground Segment documents including ICDs/IRDs related to the IASI-NG L1D auxiliary data format and content.

This document is derived from and compliant to [GADS] for generic auxiliary data format, naming conventions and metadata applicable to all EPS-SG Auxiliary data files.

### 1.3 Applicable Documents

ID	Title	Reference
[GADS]	"EPS-SG Generic Auxiliary Data Specification (GADS)"	EUM/LEO-EPSSG/SPE/13/718291
[MCSD]	"EPS-SG Mission Conventions and Standards Document"	EUM/LEO-EPSSG/STD/14/745221
[DEV]	"Development Logic for EPS-SG L0-L1-L2 Processing Specifications"	EUM/LEO-EPSSG/TEN/14/763159
[HQBAS]	"EPS-SG Data and Products Generation, Archiving and Dissemination Baseline at EUMETSAT HQ"	EUM/LEO-EPSSG/SPE/15/819557

### 1.4 Reference Documents

ID	Title	Reference and version
[SRD]	EPS-SG System Requirements Document	EUM/LEO-EPSSG/SPE/13/735903
[OGSRD]	EPS-SG Overall Ground Segment Requirements Document	EUM/LEO-EPSSG/REQ/13/725156
[IAS-L1D-PGS]	EPS-SG IASI-NG L1D Product Generation Specification	EUM/LEO-EPSSG/SPE/14/776813

## 1.5 Acronyms

The definition of conventions, terms and abbreviations applicable to the EPS-SG programme can be found in [MCSD].

## 1.6 Document Structure

The document is structured as follows:

- Chapter 1: Introduction (this chapter). The scope and purpose of the ADS document is described, along with lists of Applicable and Reference documents.
- Chapter 2: A high-level overview on the IASI-NG Level L1D Auxiliary is presented in this section. The Auxiliary Data List and the Naming convention are also specified here.
- Chapter 3: The format and content of each IASI-NG Level L1D Auxiliary Data is described in this section.

## **2 EPS-SG IASI-NG LEVEL 1D AUXILIARY DATA OVERVIEW**

### **2.1 Structure of EPS-SG Auxiliary Data**

All auxiliary data in the EPS-SG Ground Segment comply with the generic format and naming convention specified in the [GADS]. The format is a package (i.e. folder) including either a single XML file including the auxiliary data and any metadata or an XML header with metadata (defined as per [GADS]) plus a number of files including the auxiliary data.

Auxiliary data which originate outside the Ground Segment or produced by other Ground Segment functions is wrapped along with the XML header in the package upon entry in the GS. The content of the original file(s) is kept as it is (e.g. ECMWF forecast files in GRIB format).

### **2.2 Naming Convention**

The naming convention of EPS-SG Auxiliary data files complies with the naming convention specified in [GADS].

Consider the following auxiliary data file name (for illustrative purpose only):

SGA1\_IAS\_\_\_AUX\_EIGV\_\_\_S20210101233000\_E20510601120000\_G20201215120000\_CALV\_OPE\_OPER.SIP

In accordance with the naming conventions, this is an auxiliary file (AUX) to be used for both global and regional processing(\_\_\_\_), for Metop-SG-A first satellite (SGA1) IASI-NG (IAS) Level 1D and Level 2 (\_\_\_) product generation and containing the IASI-NG Eigenvectors (EIGV). The file is used within the operational environment (OPE) for routine operations (OPER), and originates from the Cal/Val function (CALV). The file has been generated (G) on the 15 December 2020 at 12:00:00 and is a static file valid for use in the period starting (S) on the 1st January 2021 at 23:30:00 and ending (E) on the 1st June 2051 at 12:00:00.

### **2.3 IASI-NG Level 1D Auxiliary Data List**

The IASI-NG Level 1D PGF takes two static auxiliary data files (AUX\_EIGV and AUX\_PCC) as input and generates a dynamic auxiliary data file (AUX\_OUTL) as output. An overview of the three auxiliary data files used or generated by the IASI-NG Level 1D PGF is given in table 2.2.

The IASI-NG PCC Outlier spectra (AUX\_OUTL) shall be generated in both Global and Regional context.

AUX\_EIGV and AUX\_PCC, but not AUX\_OUTL are required for local mission.

Note that the IASI-NG Eigenvectors (EIGV) are also required by the IASI-NG Level 2 PGS [IASI-L2-PGS].

File	G/R	I/E	S/D	Source	Generation Frequency	Format	Auxiliary Data ID	Size	Required for local mission
<b>IASI-NG Eigenvectors</b>	-	I	S	CALV	Infrequently (May be frequent during commissioning)	HDF5	IAS__AUX_EIGV	100 MB	Y
<b>IASI-NG PCC Configuration</b>	-	I	S	CALV	Infrequently (May be frequent during commissioning)	HDF5	IAS_ID_AUX_PCCC	0.02 MB	Y
<b>IASI-NG PCC Outlier spectra</b>	GR	I	D	PDP_	1 per granule	NetCDF	IAS_ID_AUX_OUTL	4.4 MB/orbit <sup>a</sup>	N

**Table 2.2:** EPS-SG IASI-NG Level 1D Auxiliary Data List

Note: The size is typically very small (i.e. 4.4 MB/orbit) but it can exceptionally increase up to the maximum of 5.000MB. It is expected that these strong increases (between 1GB and 5GB) will only happen approximately once a year whilst moderate increases (between 5 MB and 1GB) will happen more often (weekly).



### 3 EPS-SG IASI-NG LEVEL 1D AUXILIARY DATA DETAILED FORMAT

Each EPS-SG auxiliary data file is a collection of files aggregated and formatted as SIP (Submission Information Package) packages. Each package is a folder which contains two main file components:

- The manifest file, an XML file containing metadata information that describes the content, properties and structure of the auxiliary data files.
- The Auxiliary Data File(s), a file (or collection of files) that contains the specific information required for data processing. The exact content and format depend on the type of auxiliary data. This information is given in the following sections for the auxiliary files required by the IASI-NG L1D processor.

For more details see [GADS].

#### 3.1 IASI-NG Eigenvectors (EIGV)

<b>Name:</b>	IASI-NG Eigenvectors
<b>Example of filename:</b>	SGA1_IAS___AUX_EIGV__S20201004000000- _XXXXXXXXXXXXZ_G20170826174318_CALV_OPE_OPER.SIP
<b>Description:</b>	The eigenvector files used for the compression and the reconstruction of Level 1C radiances
<b>Spacecraft:</b>	SGA[1-3]
<b>ADF-ID:</b>	IAS___AUX_EIGV
<b>Source:</b>	CALV
<b>Members:</b>	4
<b>Example of internal filename:</b>	IASI-NG-Band-1-EigenvectorFile-1.0.h5
<b>Format of internal file:</b>	HDF5
<b>Auxiliary Data Size:</b>	100 MB
<b>Generation Frequency:</b>	Infrequently (May be frequent during commissioning)
<b>Validity:</b>	Entire mission

##### 3.1.1 Format of internal files

The four eigenvector files (one for each IASI-NG band) share the same format. They are HDF5 files containing three Attributes and five Datasets (one of which is optional), all belonging to the root group, as detailed in the table below:

##### Attributes

Name	Data Type	Description
<b>FirstChannel</b>	int	Channel number of the first channel of the band
<b>NbrChannels</b>	int	Number of channels in the band.

Name	Data Type	Description
<b>NbrEigenvectors</b>	int	Number of eigenvectors included in the file. Can be greater but not smaller than the number of PC scores (for the corresponding band) included in the L1 PCS product.

### Dimensions

Dimension Name	Comment	Dimension length
<b>NbrChannels</b>	Number of channels in the band	
<b>NbrEigenvectors</b>	Number of eigenvectors included in the file. Can be greater but not smaller than the number of PC scores (for the corresponding band) included in the L1 PCS product.	

### Variables

Variables Name	Description	Type	Range or Value	Dimension
<b>Nedr</b>	Random component of the instrument noise used for the computation of the noise normalised residual RMS	double	valid_min to valid_max	NbrChannels
long_name	Description of the variables	string	Random component of the instrument noise used for the computation of the noise normalised residual RMS	—
units	Physical Units	string	$W\ m^{-2}\ sr^{-1}\ m^{-1}$	—
missing_value	Missing value	double		—
<b>Mean</b>	Mean radiance assumed for the PC compression scheme	double	valid_min to valid_max	NbrChannels
long_name	Description of the variables	string	Mean radiance assumed for the PC compression scheme	—
missing_value	Missing value	double		—
<b>Eigenvalues</b>	OPTIONAL. The eigenvalues corresponding to the eigenvector included in the file. Not used for compression/reconstruction. For information to users only.	double	valid_min to valid_max	NbrEigenvectors

Variables Name	Description	Type	Range or Value	Dimension
long_name	Description of the variables	string	OPTIONAL. The eigenvalues corresponding to the eigenvector included in the file. Not used for compression/reconstruction. For information to users only.	—
missing_value	Missing value	double		—
<b>CompressionOperator</b>	The operator used for the compression of IASI-NG L1C radiances.	double	valid_min to valid_max	NbrEigenvectors NbrChannels
long_name	Description of the variables	string	The operator used for the compression of IASI-NG L1C radiances.	—
units	Physical Units	string	$W\ m^{-2}\ sr^{-1}\ m^{-1}$	—
missing_value	Missing value	double		—
<b>Reconstruction-Operator</b>	The operator used for the reconstruction of IASI-NG L1C radiances.	double	valid_min to valid_max	NbrEigenvectors NbrChannels
long_name	Description of the variables	string	The operator used for the reconstruction of IASI-NG L1C radiances.	—
units	Physical Units	string	$W\ m^{-2}\ sr^{-1}\ m^{-1}$	—
missing_value	Missing value	double		—

**Table 3.3:** AUX\_EIGV: Variables

### 3.2 IASI-NG PCC Configuration (PCCC)

<b>Name:</b>	IASI-NG PCC Configuration
<b>Example of filename:</b>	SGA1_IAS_1D_AUX_PCCC__S20201004000000- _ExxxxxxxxxxxZ_G20170826174318_CALV_OPE_OPER.SIP
<b>Description:</b>	The number of PC scores to be retained in each band, the coefficients needed for determination of outlier spectra and the quantization factors.
<b>Spacecraft:</b>	SGA[1-3]
<b>ADF-ID:</b>	IAS_1D_AUX_PCCC
<b>Source:</b>	CALV
<b>Members:</b>	1
<b>Example of internal filename:</b>	IASI-NG-PCC-ConfigurationFile-1.0.h5
<b>Format of internal file:</b>	HDF5
<b>Auxiliary Data Size:</b>	0.02 MB
<b>Generation Frequency:</b>	Infrequently (May be frequent during commissioning)
<b>Validity:</b>	Entire mission

### 3.2.1 Format of internal files

#### Dimension

Dimension Name	Comment	Dimension length
<b>n_band</b>	number of spectral band	4
<b>n_fov</b>	number of field of view	16

#### Variables

Variables Name	Description	Type	Range or Value	Dimension
<b>nbr_scores</b>	Number of PC scores for each band	int	valid_min to valid_max	n_band
long_name	Description of the variables	string	Number of PC scores for each band	—
missing_value	Missing value	int		—
<b>quantisation_factor</b>	PC score quantisation factor	double	valid_min to valid_max	1
long_name	Description of the variables	string	PC score quantisation factor	—
valid_min	Minimum value	double	0	—
missing_value	Missing value	double		—
<b>slope</b>	Slope for determination of outliers one for each band	double	valid_min to valid_max	n_band
long_name	Description of the variables	string	Slope for determination of outliers one for each band	—
missing_value	Missing value	double		—
<b>threshold</b>	Thresholds for determination of outliers for each band and detector	double	valid_min to valid_max	n_band n_fov
long_name	Description of the variables	string	Thresholds for determination of outliers for each band and detector	—
missing_value	Missing value	double		—

**Table 3.5:** AUX\_PCCC: Variables

### 3.3 IASI-NG PCC Outlier spectra (OUTL)

<b>Name:</b>	IASI-NG PCC Outlier spectra
<b>Example of filename:</b>	SGA1_IAS_1D_AUX_OUTL_G_S20241004231200- _E20241004231456_G20241004235959_PDP__OPE_OPER.SIP
<b>Description:</b>	Spectra for which the PC compression results in residual RMS which is higher than expected and granule statistics of the residuals are stored.
<b>Spacecraft:</b>	SGA[1-3]
<b>ADF-ID:</b>	IAS_1D_AUX_OUTL
<b>Source:</b>	PDP_
<b>Members:</b>	1
<b>Example of internal filename:</b>	SGA1_IAS_1D_AUX_OUTL_G_S20241004231200- _E20241004231456_G20241004235959.nc
<b>Format of internal file:</b>	NetCDF
<b>Auxiliary Data Size:</b>	4.4 MB/orbit <sup>1</sup>
<b>Generation Frequency:</b>	1 per granule
<b>Validity:</b>	ValidityStart = Start of sensing time of Granule; ValidityStop = End of sensing time of Granule; Validity Duration = 1 Granule

#### 3.3.1 Format of internal files

It is an NetCDF file containing two groups: outliers and statistics. Furthermore the name of the input files are stored as global attributes.

##### Global attribute

Name	Data Type	Description
<b>l1cfile</b>		Name of parent IASI-NG L1C file.
<b>ev1file</b>		Name of IASI-NG Band 1 eigenvector file.
<b>ev2file</b>		Name of IASI-NG Band 2 eigenvector file.
<b>ev3file</b>		Name of IASI-NG Band 3 eigenvector file.
<b>ev4file</b>		Name of IASI-NG Band 4 eigenvector file.
<b>pccfile</b>		Name of IASI-NG PCC Configuration file.

##### Global Dimension

Dimension Name	Comment	Dimension length
<b>n_band</b>	number of spectral band	4
<b>n_wn</b>	number of wave channels	16921
<b>n_out</b>	number of outlier spectra found in the granule	≤ 383 · 14 · 16

##### outliers group

<sup>1</sup>Note: The size is typically very small (i.e. 4.4 MB/orbit) but it can exceptionally increase up to the maximum of 5.000MB. It is expected that these strong increases (between 1GB and 5GB) will only happen approximately once a year whilst moderate increases (between 5 MB and 1GB) will happen more often (weekly).

Variables Name	Description	Type	Range or Value	Dimension
<b>linenumber</b>	Outlier spectra line number within the parent IASI-NG L1C file.	int	valid_min to valid_max	n_out
long_name	Description of the variables	string	Outlier spectra line number within the parent IASI-NG L1C file.	—
valid_min	Minimum value	int	0	—
missing_value	Missing value	int	2147483647	—
<b>pixelnumber</b>	Outlier spectra pixel number within the parent IASI-NG L1C file.	short	valid_min to valid_max	n_out
long_name	Description of the variables	string	Outlier spectra pixel number within the parent IASI-NG L1C file.	—
valid_min	Minimum value	short	0	—
valid_max	Maximum value	short	119	—
missing_value	Missing value	short	32768	—
<b>sensingtime</b>	Sensing time of outlier spectra.	double	valid_min to valid_max	n_out
long_name	Description of the variables	string	Sensing time of outlier spectra.	—
units	Physical Units	string	seconds since 2020-01-01 00:00:00.000	—
valid_min	Minimum value	double	-1000000000.	—
valid_max	Maximum value	double	1000000000.	—
missing_value	Missing value	double	1.7e+308	—
<b>longitude</b>	Longitude of outlier spectra.	short	valid_min to valid_max	n_out
long_name	Description of the variables	string	Longitude of outlier spectra.	—
units	Physical Units	string	degrees_east	—
valid_min	Minimum value	short	-32767	—
valid_max	Maximum value	short	32767	—
scale_factor	Scale factor	float	0.005493332	—
add_offset	Offset	float	0.0	—
missing_value	Missing value	short	32768	—
<b>latitude</b>	Latitude of outlier spectra.	short	valid_min to valid_max	n_out
long_name	Description of the variables	string	Latitude of outlier spectra.	—
units	Physical Units	string	degrees_north	—
valid_min	Minimum value	short	-32767	—
valid_max	Maximum value	short	32767	—
scale_factor	Scale factor	float	0.002746666	—
add_offset	Offset	float	0.0	—
missing_value	Missing value	short	32768	—
<b>residualrms</b>	Noise-normalised residual RMS per band for outlier spectra.	float	valid_min to valid_max	n_out n_band

Variables Name	Description	Type	Range or Value	Dimension
long_name	Description of the variables	string	Noise-normalised residual RMS per band for outlier spectra.	—
missing_value	Missing value	float	3.4e+38	—
<b>l1cradiance</b>	Radiance of IASI-NG LIC outlier spectra.	float	valid_min to valid_max	n_out n_wn
long_name	Description of the variables	string	Radiance of IASI-NG LIC outlier spectra.	—
units	Physical Units	string	$W/(m^2 \cdot sr \cdot m^1)$	—
missing_value	Missing value	float	3.4e+38	—

**Table 3.8:** statistical\_retrieval: Variables for outliers group

### statistics group

Variables Name	Description	Type	Range or Value	Dimension
<b>nbrcases</b>	Number of spectra used for the residual statistics.	int	valid_min to valid_max	1
long_name	Description of the variables	string	Number of spectra used for the residual statistics.	—
missing_value	Missing value	int	2147483647	—
<b>residual_mean</b>	Noise-normalised residual mean.	float	valid_min to valid_max	n_wn
long_name	Description of the variables	string	Noise-normalised residual mean.	—
missing_value	Missing value	float	3.4e+38	—
<b>residual_stdv</b>	Noise-normalised residual standard deviation.	float	valid_min to valid_max	n_wn
long_name	Description of the variables	string	Noise-normalised residual standard deviation.	—
missing_value	Missing value	float	3.4e+38	—

**Table 3.9:** statistical\_retrieval: Variables for statistics group

**A XML DESCRIPTION OF AUX\_OUTL**

This appendix includes the XML description of AUX\_OUTL.