EPS-SG Generic Auxiliary Data Specification (GADS)

Doc.No. : EUM/LEO-EPSSG/SPE/13/718291
Issue : v4B e-signed
Date : 29 November 2021
WBS/DBS : LEO-EPSSG-925010

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Change Record

Version	Date of Version as on profile	Document Change Request (DCR) Number if applicable	Description of changes
V1 Draft	26/03/2014	N/A	First Draft version
V1B Draft	12/08/2014	NA	Second Draft version
V1C Draft	13/08/2014	N/A	Update following internal review
V1F	02/12/2014	N/A	First version
V1H	11/01/2016	EUM-EPSSG-DCR-184	Section 3.2: added identifier discriminating between global and regional processing Section 2.3.1: added note on BOOLEAN not being supported by NetCDF Table 13: added the following columns: (I) G/R, (II) Required For Local Mission (Y/N), (III) To Be Provided by EUMETSAT For Local Mission (Y/N) Updates following internal review: additions and refinements XML file for manifest file described in section 3.3.1.3 and example of XML file for manifest moved to Annex A.
V2	25/05/2016		Updated description of all common auxiliary data, including summary sheet, where new fields have been introduced (SpacecraftID, Members, GR, Source) and some have been removed (Manifest Filename and Format) Updated list for Data Provider (included: IERS, ICDC,ESA,LPDA) Updated list for Spacecraft to include: **"SGA_"** = for all auxiliary files applicable to Metop-SG-A spacecrafts **"SGB_"** = for all auxiliary files applicable to Metop-SG-B spacecrafts Section 1.3: updated list of acronyms Section 1.4: added [BIPM] to applicable documents Section 1.6: added applicability of [BIPM] Section 3.2 changed ADF_ID to ADF-ID Section 2.3.2: Added Table with compound data

			types Section 3.3.1.3: changed format of times to ISO format, changed type of members to UINT, changed Adf-Type to adfType Appendix A: added XML and schema files, updated XML according to revised metadata description Section 4.2.5. Climatology File and section 4.2.7 IERS Bulletin B have been removed and respective entrances on Table 13 have also been removed. Section 4.2.4 NWP Forecast Data has been updated in particular Table EPS-SG ECMWF Data – Parameters list needed by the PGFs and the Figure Structure of NWP Forecast Data. The section with Sea-Ice Mask has been added. The respective entry has been added in Table 14. Removed IERS Bulletin B (not needed anymore for processing) Removed Climatology File (not needed anymore for processing) Checksum filed removed from manifest file. Table 11: removed tool and toolVersion For all auxiliary data ValidityEndDateTime has been changed to xxxxxxxxxxxxxxZ.
V2A	21/11/2016	EUM-EPSSG-DCR-453	General: minor text improvements and typos fixing. Updated distribution list to include EPS-SG Team (mailing list). Section 1.3: updated acronyms in Table 1. Section 1.4: updated Table 2 information to reflect new applicable documents of added auxiliary files. Section 1.7: updated resume of document structure. Section 2.1: convention examples of Table 5 corrected. Section 3.2: updated Table 9: ▪ Added clarifications to naming conventions. ▪ Removed/Added/Corrected ADF-Types. ▪ Added missing Sources and <FreeText> field. Section 3.3.1.3: Updated Table 10 and Table 11: ▪ Clarified Description and Value for different elements. ▪ Links to identical fields added and removed redundant text. Section 3.3.2.3: updated file types, descriptions in Table 12 and added new file formats. Section 4.1: Table 13:

			▪ Clarified column titles. ▪ Updated table information to reflect changes of each data auxiliary file. Section 4.2.1: updated description, summary sheet and figure for ACE-2 DEM 9 arc-seconds. Section 4.2.2: updated description, summary sheet and figure for ACE-2 DEM 30 arc-seconds. Section 4.2.3: ▪ Updated description, summary sheet and figure for Land-Sea Mask file. ▪ Resolved TBD for number of files. Section 4.2.4: ▪ Updated description, summary sheet and figure for NWP forecast data. ▪ Added “Time of the Run of the Model” as <FreeText>. Section 4.2.5: added NWP Background Error Standard Deviations. Section 4.2.6: added NWP Error Correlation Matrices. Section 4.2.7: updated description (links aligned with applicable documents), summary sheet and figure for IERS Bulletin A.
			Section 4.2.8: ▪ Updated description, summary sheet and figure for Predicted Orbit File. ▪ Added preliminary example of the data file format. ▪ Resolved the TBC for the daily generation frequency and frequency. Section 4.2.9: ▪ Updated description, summary sheet and figure for Chlorophyll-Concentration Database. ▪ Added global attributes to file data format. Section deleted for Emissivity Atlas (removed); Section 4.2.10: ▪ Updated description of Manoeuvre History File. ▪ Removed filename example and added a TBD. ▪ Resolved the TBC for internal file format and added a preliminary example (format and content). Section 4.2.11: ▪ Resolved TBC on Sea-Ice Mask generation frequency and files number.

			▪ Updated description, summary sheet and figure. Section 4.2.12: added Snow/Ice Map (High Resolution). Section 4.2.13: added Map of Surface Albedo/BRDF. Section 4.2.14: added Map of Surface Emissivity. Section 4.2.15: added 3MI BRDM Database. Section 4.2.16: added NDVI Database. Section 4.2.17: added Spectral Database. Section 4.2.18: added LER Database. Appendix A: updated to hold the XML description and schema of the auxiliary data manifest file. Appendix B: added section to hold the XML description of internal auxiliary data files.
V3	12/07/2017	EUM-EPSSG-DCR-690	Section 4.1: Table 13: ▪ Updated PGFs column. Section 4.2.4.4: included resolution of NWP files NWP file: size changed to ~8 GB Appendix C: ▪ Marked as closed in the Appendix C the TBDs and TBCs already solved in V2 ▪ Filename, size and metadata content for POFD defined (open point closed) ▪ Filename of MHF defined (open point closed) and content table added ▪ Size of NWP defined (open point closed) ▪ Structure and filenames of the Map of Surface Albedo/BRDF files defined (open point closed) ▪ Structure and filenames of the Snow/Ice Map High resolution files defined (open point closed) Appendix B: ▪ Integrated the xml files. The corresponding tables in the GADS were updated to be consistent with the xml files. Section 4.2.4: 1. In Table 15 the list of NWP forecast data was updated: ▪ Removed columns of ICI L1 and MWI L1 ▪ Added new parameters ▪ Added S5 L2 column 2. Modified delivery time (Figure 7) 3. The resolution was updated

			Section 4.2.5: Insertion of the CAMS forecast data (CAMS was included in the applicable documents) Section 4.2.1 - 4.2.2: The format and the model of DEM was confirmed (ACE-2)
V3A	27/11/2017	EUM-EPSSG-DCR-724	Section 4.2.4 - 4.2.5: The NWP Forecast data from ECMWF has been split into two separated Aux files: NWP Forecast data (which only contains the forecast parameters) and NWP Analysis data (which contains the analysis parameters). This change is in agreement with ECMWF, which specified that the forecast and analysis parameters cannot be in the same file. The consequence is that TBD-06 and TBC-01 were closed.
	27/11/2017	EUM-EPSSG-DCR-769	Section 3.2 Tab. 9: The S5 L2 Aux data were inserted in the ADS-Types. The ADF-type of the following data have been modified as follows. • GNSS Ground Station Tracking Data (AUX_GSD_), GNSS Ground Station Clock Bias (AUX_GCL_) GNSS Inter Constellation Clock Offset (AUX_GCO_) were removed; • AUX_BNO2_ was renamed NO2 Background Database; • AUX_SPF_ was substituted by AUX_SPSF (S5 Point-Spread Function) AUX_PO3P (Database for Spectral Pattern Correction) was added. AUX_CH4S has been deleted because it does not exist. The description of some Aux data has been updated (only minor changes) Section 4.1 Tab. 13: S5 L2 was added for Chlorophyll-concentration database. Section 4.2.9: Insertion of the Global Ocean Biogeochemistry Analysis and Weekly Forecast data from CMEMS (CMEMS was included in the applicable documents) Section 4.2.6: Insertion of 3MI L2 and MAP L2 in CAMF data. Table 17 was updated:

			▪ Added 3MI L2 and MAP L2 columns ▪ Added the parameter Insp (Logarithm of surface pressure) EOMS-FFS was added as applicable document for the Predicted Orbit File.
V3B	12/03/2018	EUM-EPSSG-DCR-907	Appendix A: The manifest-schema.xsd file has been updated with the new ADF-types. Section 3.2 Tab. 9: The ADF-type of some files have been corrected, taking into account that the ADF-data type consists of 8 chars (the char "_" was added in some cases). The ADS-Types not more existing have been removed (AUX_AOD_, AUX_DAD_, AUX_EOPB) and AUX_PWLR has been added. Appendix C: TBC-02 closed. The 3MI BRDM database provides a bi-weekly global coverage. The resolution of TBC-5 was postponed. General: ▪ Update of the generation frequency for harmonization purpose Appendix B: The auxiliary files in xml have been updated. Some errors (ADF-type/file description) have been corrected. The Global Attributes have been rewritten in agreement with the ncml syntax Sec. 4.1 Tab. 13: IASI-NG L1C has been included in the list of PGFs that use the IERS Bulletin A and VII L2 has been included in the list of PGFs that use the Predicted Orbit File.

V3C	09/05/2018	EUM-EPSSG-DCR-993	Sec. 4.1 Tab. 13: The forecast parameter LNSP (parameter ID 152) belonging to AUX_NWP is wrongly specified in the GADS, because LNSP is a 3D parameter instead 2D. The following inconsistences of aux data files size have been detected during the preparation of E2E auxiliary data package and have been corrected: 1) The actual size of the AUX_LSA database is ~36 GB instead 25 GB. 2) The actual size of the AUX_LSM database is ~33 GB instead 27.9 GB. 3) The actual size of the AUX_BESD database is ~1 GB instead 40 MB. 4) The actual size of the AUX_NWP database is ~9 GB instead 8 GB. 5) The actual size of the AUX_NWPA database is ~20 MB instead 4 MB. Document Change Record: The DCR number for GADS V3B has been added.
V3D	14/03/2019	EUM-EPSSG-DCR-1171	Appendix A: Correction of the typo in the file manifest-schema.xsd (AUX_NISE_ has been substituted with AUX_NISE) Sec. 4.2.7-4.2.10-4.2.11: For data from EMCWF (NWP forecast data, NWP Background Error Standard Deviations and NWP Error Correlation Matrices) it has been clarified that the number of levels in the variable at model level (3D) is not fix, but is changed during the time and could change in future. Sec. 4.2.7-4.2.8-4.2.9: The dissemination schedule for ECMWF data after the run time has been updated Sec. 4.2.7.4 Tab. 15: MWI-ICI L2 will use the parameter Snow Depth (141). It has been updated in Tab. 15. The short name of the parameter Sea Ice Cover has been corrected (CI instead CL). “Sea Ice Area Fraction” has been added to “Sea Ice Cover” to the Long Name, because both names are present in the ECMWF site. Snow Density parameter (RSN) has been added in AUX_NWP because used by S5 L2. The parameters high cloud cover (hcc), snow albedo (asn) and forecast albedo (FAL) have been removed because not more used by S5 L2.

			Sec. 4.1 Tab. 13: Correction of bookmarks and cross-references for CAMS forecast data and correction of the CAMS filename. RO L1B has been removed by the PGS using the IERS Bulletin A (as RO does not use it). The need for local mission of CAMS Forecast Data, Map of surface Albedo and Map of Surface Emissivity has been updated: the aforementioned data are declared required for local mission (only for VII L2 CM). Sec. 4.2.9.4 Tab. 17: Update of parameters used by VII L2, in agreement with the changes of the aerosol information needs, and by S5. The parameter code and description of the Glyoxal parameter is TBD because not yet available. The TBD has been added in the TBD list. The parameters CH4 and CO2 have been removed, as not more needed for S5. The parameters aerext355, ssa355, q and t have been added as required by S5. Sec. 4.2.11.6-4.2.11.7: New dimensions have been added in Tab. 19. New parameters have been added to the internal NetCDF file. The corresponding changes are reflected in the new AUX_ECM.xml file in Appendix B which has substituted the old file. Sec. 4.2.7: The generation frequency and the dissemination schedule of the NWP Forecast Data have been updated in agreement with the new ECMWF specification (4 forecast runs per day, everyone with hourly steps for a total of 90 files) Sec. 4.2.3, 4.2.4 and 4.2.5: The Raster DEM at 9, 15 and 30 arcsec have been added to the Aux files. Tab. 13 has been updated accordingly. The new ADF-Types RD09, RD15 and RD30 have been added in the manifest-schema file. The parameter values TBC have been added in the TBC table. The ESA documents that define the format specification of the files have been put as applicable documents, with the note that they will be only available after the delivery of the ESA EO-CFI V4.17 delivery Sec. 4.2.17: Sea-Ice Mask details have been updated in agreement with the new specification of OSI-SAF. In particular, format, size and values of status_flag have been updated.

			Sec. 3.3.2.3 Tab. 12: SINEX_Bias format has been added to the used formats (needed by RO). This format has been also added in the manifest-schema. Sec. 3.2 Tab. 9: The new auxiliary file AUX_GLOB (GLOBE DEM used by IASI-NG) has been added (also in the manifest-schema). General: Filename and size of some aux data have been corrected Sec. 4.2.10: The TBC on the data format has been closed Sec. 4.2.14.4: Some errors have been corrected in the predicted orbit file. The schema for POFD file has been attached in Appendix A Page 2: Update of Document Signature Table Sec. 4.2.9.4: The resolution of CAMS forecast data has been modified from T1279 (high resolution at 16 km) to T511 (resolution at 40 km) Sec. 4.2.9.2: The internal name of the CAMS forecast data has been modified and the naming convention has been added. The internal name of the NWP forecast data and NWP analysis data TBC with ECMWF
V3E	07/11/2019	EPSG_DCR_1454	Appendix A: manifest-schema.xsd corrected to handle multiple occurrences of the type "dataObject". manifest-schema.xsd and Table 12: Added file types ANTEX (.atx) of the RO file "GNSS Service Auxiliary files (GSA)" and yaml and SQLite of the "RO Configuration Data (CNF) Table 12: format of the file type ".sp3" corrected to "SP3-d" Section 4.2.9.2: validity time of CAMS Forecast data corrected to "snapshot time" Section 4.2.19.2 number of members of file AUX_LSA corrected to 315 Section 4.2.18.2 number of members of file AUX_ICHI corrected to

			314 Section 4.2.6.2 number of members of file AUX_LSM corrected to 315 Section 4.1: Table 13: MWI and ICI L1B removed from "ACE-2 Digital Elevation Model (30 arc-seconds)" raw Sections:.2.3, 4.2.4, 4.2.5: updated raster DEM description and closure of TBC-06. Section 3.3.1.3, Table 10: Apparent-size specified as fileSize. Section 4.2.18.1 : correction of typo on the use of MODIS/Terra MOD10A1 and MODIS/Aqua MYD10A1 for AUX_ICHI
	2/12/2019	EPSG_DCR_1493	Section 4.2.6: The Land-Sea Mask File is now obtained from the MODIS Land Cover Type product (MCD12Q1) version 6 data product instead of version 5, which is not available anymore. The description of AUX_LSM has been changed accordingly in sec. 4.2.6, Table 13 and Table 2. Section 4.2.18: The Snow/Ice Map is now obtained from the MODIS/Terra MOD10A1 and MODIS/Aqua MYD10A1 products version 6 instead of version 5. The description of AUX_ICHI has been changed accordingly in sec. 4.2.18, Table 13 and Table 2. Section 4.2.19: The Map of Surface Albedo/BRDF is now obtained from the MODIS MCD43A1 product version 6 instead of version 5. The description of AUX_LSA has been changed accordingly in sec. 4.2.19, Table 13 and Table 2. Section 4.2.15: Correction of typos: NetCDF file was sometimes referred to as HDF file.
V4	10/07/2020	EPSG_DCR_1800	Added CAMS global delayed-mode analysis and forecast aux file (Section 4.2.24) (AUX_CAMD) Section 4.2.23: updated format and description for LER database. Updated xml description for LER database Appendix B. Updated size from 1GB to 2.2.GB. Section 4.2.11: updated format and description of AUX_CMEM according to the currently available product from CMEMS. Updated size from 400MB to 2.3GB. Section 4.2.6.4 and Section 4.2.7.4: the grid for NWP forecast and analysis data has been changed from

			"0.1° x 0.1° lat/long grid" to "model (Octahedral) O1280 grid". Updated size for AUX_NWP (from 9GB to 13GB) and AUX_NWPA (from 20MB to 26MB) accordingly. Section 4.2.10: corrected size of AUX_ECM (from 2GB to 186MB) Section 4.2.5.2: corrected size of the AUX_LSM file. The previous size erroneously referred to the full available temporal coverage (years from 2001 to 2018). The size has been corrected to represent the actual yearly coverage. The source fields of the filenames have been corrected to have 4 digits (according to Table 9) in Table 13 and in the Auxiliary data summary sheets Table 12: added extension .h5 for HDF5 files. Sec. 4.2.14.2: Corrected AUX_CHL internal filename Sec. 4.2.21.2: Corrected AUX_NDVI internal filename Table 2: removed outdated link to MACC products and replaced it with CAMS reanalysis link. Added reference to LER product user manuals. Updated link to CMEMS products. Sec 4.2.8: corrected description of CAMS forecast data format, corrected description in Auxiliary summary sheet Removed "ACE-2 Digital Elevation Model (9 arc-seconds)" as it is no longer used by any PGSs. Updated manifest-schema.xsd in Appendix A to reflect the above mentioned changes in the Adf-Types. Updated Table 13 in line with the above changes
V4A	14/12/2020	DCR-2005 DCR-2033	Updated Table 13: S5 L2 removed from the list of PGFs that use AUX_CHL and AUX_LSA. Table 12: Removed reference to the RINEX_clocks format. manifest_schema.xsd file updated accordingly in Appendix A Sec. 3.3.2.3: modified global attributes description. Sec. 4.2.19: the Map of surface emissivity is now obtained from the MODIS/Terra MOD11C2 and MODIS/Aqua MYD11C2 products version 6 instead of version 5. The description of AUX_EMI has been changed accordingly in sec. 4.2.19, Table 13 and Table 2 Sec. 4.2.23.4: Dimension of variables polynomial_coefficients_minimum_LER and polynomial_coefficients_mode_LER corrected by using dimension polynomial_coefficients_index Sec. 4.2.10: updated content of NWP Error correlation matrices (AUX_ECM): changed background grid dimensions. Replaced variable

			“ecm_rh_prof” with variable “ecm_q_prof, and changed type from BYTE to FLOAT. The name of internal file of AUX_ECM is changed to ecm_static_back_t_q.nc, and the data size is changed to 305 MB. Corrections to scale factors and attribute types. The changes are reflected in the AUX_ECM xml file in Appendix B Sec 4.2.21: Added table specifying the dimensions for the NDVI database AUX_NDVI (Table 32) and replaced numbers with dimensions in Table 33. Sec. 4.2.22: Added table specifying the dimensions for the Spectral database AUX_SDB (Table 35) and replaced numbers with dimensions in Table 36). Sec 4.2.24.2 Change the internal filename of AUX_CAMD to contain df(delayed forecast) instead of fc(forecast) Correct some typos in the SIP folder and internal file name AUX-LSM: typo in section 4.2.5.2: we replace 4-5MB with <18MB New ADF-type are introduced in GADS: AUX_ODI, AUX_ODC, AUX_RREF, AUX_LALH, AUX_LERO, AUX_LERU, AUX_CAMA are added in ADF-Type Table 9. Updated manifest-schema.xsd in Appendix A to reflect the above mentioned changes in the Adf-Types. HDF-EOS2 and HDF-EOS5 have been explained in file formats Table 12. Update the generation frequency of AUX_CMEMS to Every week (10 files). Regarding the size of AUX_CMEMS, GADS is updated, and the size of one file, is 0.83GB instead of 2.3 GB that was before. “BIO” is dropped from the internal filename. Some corrections in the SIP filename, to indicate the start of the forecast run with the 'R' field in the same way as done for ECMWF and CAMS data. Change the name in the data summary sheet to 'Global Ocean Biogeochemistry Analysis and Weekly Forecast, instead of 'Global Ocean Biogeochemistry Analysis and Forecast. AUX_CAMF: long names for aermr07, aermr08, aermr09, aermr11 in table 17 were accidentally switched, and now put back correctly. Correct some typos in the SIP folder and internal file name. TERMS_OF_USE.TXT file has been added in AUX_RD09 / RD15 / RD30 datasets to comply with (Copernicus) GLO-90 DEM terms of use. GADS has to be updated accordingly Update Appendix A to explain how to populate the manifest in case of multiple occurrence of data files for "dataSection" and "dataObject ID"

			- SIP Folder which contains several files - SIP folder with several subfolders, each containing multiple files Update the manifest schema as follows: 1.filename - minLength value =91, maxLength value="108" 2.class - Schema needs to be updated to consider exactly 4 chars. 3.freeText – add maxLength value="16” Update Table of section §3.3.1.3 which defines the fields of the manifest to comply with the XSD schema included in GADS V3E 1.fileSize – Change the data type to 8-byte unsigned long. 2.filename - Update GADS to reflect XML schema (length between 91 and 108); 3.validityEndDateTime- change data type from dateTime to spdateTime to be in line with the schema 4.DataObject ID -> ID to be in line with the schema
V4B	29/11/2021	DCR-2189	IFCT-5687 Variable tcwv from aux_nwp data in Table15 is needed by PGF L2CM and marked as a variable used by the VII L2 CM PGS IFCT-5688 Unit of Variable O3 (Ozone Mass Mixing Ratio) in Table15 is changed to kgxkg-1 AUX_CAMD: S5 L2 PGF is added in Table 13 in the list of the PGF using this auxiliary file (IFCT-6039) Update of NWP Error Correlation Matrices (AUX_ECM) (IFCT-4690) TERMS_OF_USE.TXT and two configurations files (.xml and .EOF) added to AUX_RD09 / RD15 / RD30 datasets (IFCT-5496, IFCT-6065) Corrected an error introduced in manifest schema in version 4A : <xs:element name="dataObject" type="eps-sg:EPS-SG_dataObject" maxOccurs="unbounded"/> Removed AUX_TLE_” = GEO Sat Two Line Elements from Table 9 Removed AUX_BRDM, AUX_SDB, AUX_NDVI and AUX_CHL from GADS (moved to 3MI L2 and MAP Auxiliary Data Specifications).

			AUX_SEIC: Section 4.2.15.2 (IFCT-6103): • NH for Northern Hemisphere products; • SH for Southern Hemisphere. NH and SH changed to lowercase. AUX COEF has been added in ADF_Types, Table 9. Description of errors.grib and fields.grib of AUX_BESD has been updated (Section 4.2.8.4). Table 2: Update reference for MODIS Terra and Aqua Land Surface Temperature and Emissivity 8-Day L3 Global 0.05deg climate modelling grid [EMI] https://lpdaac.usgs.gov/products/myd11c2v006/ and https://lpdaac.usgs.gov/products/mod11c2v006/

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1 INTRODUCTION

1.1 Purpose and Scope

This document is the Generic Auxiliary Data Specification [GADS] for the EPS-SG Auxiliary Data Files used in the EPS-SG Ground Segment. It specifies the common definitions, structures and conventions of the EPS-SG Auxiliary Data Files (ADFs).

It also defines the detailed content and format of EPS-SG Common Auxiliary Data Files, which are files required by more than one operational Product Generation Function (see Section 4).

The document may be updated to reflect common metadata fields and common auxiliary data identified during the development of the instrument specific Auxiliary Data Specifications (ADSs) prepared for each of the Product Generation Functions (PGFs) of the EPS-SG Ground Segment.

1.2 Relation to other documents

The EPS-SG Generic Auxiliary Data Specification is a System document in the EPS-SG System Specification Tree. It is applicable to the [SRD], [OGSRD], Product Generation Specifications and EPS-SG System and Ground Segment documents including ICDs/IRDs wishing to convey information about the auxiliary data format and content.

1.3 Acronyms

Table 1 – Acronyms

Acronym	Expanded Meaning
ACE-2	Altimeter Corrected Elevations 2
ADF	Auxiliary Data File
ADS	Auxiliary Data Specification - A document describing the detailed format and content of auxiliary data required in input and generated in output by one or more Product Generation Functions. Applicable to L1/L2 Product Generation Functions.
ASCII	American Standard Code for Information Interchange
BIPM	Bureau International des Poids et Mesures
CMG	Climate Modelling Grid
DEM	Digital Elevation Model
ECMWF	European Centre for Medium-Range Weather Forecasts
FDS	Flight Dynamics Subsystem
GADS	Generic Auxiliary Data Specification
GOME	Global Ozone Monitoring Experiment
GRIB	General Regularly-distributed Information in Binary form
GS	Ground Segment
HDF-EOS	Hierarchical Data Format – Earth Observing system
ISO	International Organization for Standardization
IERS	International Earth Rotation and Reference Systems Service
LER	Lambertian Equivalent Reflectance
LPDAAC	Land Processes Distributed Active Archive Center
MODIS	Moderate Resolution Imaging Spectroradiometer
NDSI	Normalised Difference Snow Index
NetCDF	Network Common Data Form
NH	Northern Hemisphere

Acronym	Expanded Meaning
NWP	Numerical Weather Prediction
OSI-SAF	Ocean and Sea Ice Satellite Application Facility
PGF	Product generation function – An EPS-SG Ground Segment function responsible for generation of one or more mission product types in native format. It may also generate auxiliary data.
RINEX	Receiver Independent Exchange Format
SH	Southern Hemisphere
SI	International System of Units
SINEX	Solution (Software/technique) INdependent EXchange Format
SIP	Submission Information Package
SP3-d	Extended Standard Product 3 Orbit Format (SP3-d)
SSMIS	Special Sensor Microwave Imager/Sounder
TAI	International Atomic Time
UT1	Universal Time
UTC	Universal Time Coordinated
XML	Extensible Mark-up Language
XSD	XML Schema Definition according to W3C XSD

1.4 Applicable Documents

Table 2 – Applicable documents

ID	*Title*	*Reference*
[MCSD]	EPS-SG Mission Conventions and Standards Document	EUM/LEO-EPSSG/STD/14/745221
[ACE-2]	ACE-2 Documentation	http://tethys.eaprs.cse.dmu.ac.uk/ACE2/shared/documentation
[LSM-LPDAAC]	Land Cover Type Yearly L3 Global 500 m SIN Grid	https://lpdaac.usgs.gov/products/mcd12q1v006/
[ECMWF]	Set I – Atmospheric Model high resolution 10-day forecast (HRES)	http://www.ecmwf.int/en/forecasts/datasets/set-i
[EOMS-FFS]	Earth Observation Mission Software File Format Specification (V1.1)	PE-ID-ESA-GS-584
[COVAR]	Flow-dependent, geographically varying background error covariances for 1D-VAR applications in MTG-IRS L2 Processing	http://www.ecmwf.int/sites/default/files/elibrary/2012/9997-flow-dependent-geographically-varying-background-error-covariances-1d-var-applications-mtg-irs.pdf
[IERS]	IERS Bulletin	http://www.iers.org/IERS/EN/Publications/Bulletins/bulletins.html
[SEAICE]	OSI-SAF Sea-ice products and documentation	http://osisaf.met.no/p/ice/index.html
[ICHI]	MODIS/Terra & Aqua Snow Cover Daily L3 Global 500m Grid. Version 6	https://nsidc.org/data/MOD10A1 and https://nsidc.org/data/myd10a1

ID	*Title*	*Reference*
[LSA]	MODIS/Terra and Aqua BRDF/Albedo Model Parameters Daily L3 Global 500 m SIN Grid	https://lpdaac.usgs.gov/dataset_discovery/modis/modis_products_table/mcd43a1 and https://modis.gsfc.nasa.gov/data/atbd/atbd_mod09.pdf
[EMI]	MODIS Terra and Aqua Land Surface Temperature and Emissivity 8-Day L3 Global 0.05deg climate modelling grid	https://lpdaac.usgs.gov/products/myd11c2v006/ and https://lpdaac.usgs.gov/products/mod11c2v006/
[BIPM]	International System of Units (SI)	http://www.bipm.org/en/publications/si-brochure/
ICDC	Integrated Climate Data Center	http://icdc.zmaw.de/1/daten/ocean/chl-modis.html
[CAMSreanalysis]	CAMS reanalysis	https://www.ecmwf.int/en/research/climate-reanalysis/cams-reanalysis
[CAMS]	Copernicus Atmosphere Monitoring Service	http://atmosphere.copernicus.eu/about-cams
[CMEMS]	Product User Manual For Global Biogeochemical Analysis and Forecast product	CMEMS-GLO-PUM-001-028 Issue 1, available at Copernicus Marine Environment Monitoring Service website: https://resources.marine.copernicus.eu/?option=com_csw&view=details&product_id=GLOBAL_ANALYSIS_FORECAST_BIO_001_028
[R-DEM1]*	Earth Observation Mission CFI Software EO_DATA_HANDLING SOFTWARE USER MANUAL, EO-MA-DMS-GS-0007	EO-MA-DMS-GS-0007 issue 4.17, available at http://eop-cfi.esa.int
[R-DEM2] *	"Earth Observation Mission Software File Format Specification", PE-ID-ESA-GS-0584	PE-ID-ESA-GS-0584, available at http://eop-cfi.esa.int
LER	GOME-2 surface LER database Product User Manual	SAF/AC/KNMI/PUM/004 Issue 3.2, available at: http://www.temis.nl/surface/gome2_ler.html

* The document will be available only after the ESA delivery of EO-CFI software release 4.17.

1.5 Reference Documents

Table 3 – Reference documents

ID	Title	Reference

ID	Title	Reference
[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
[HQ-BAS]	EPS-SG Data and Products Generation, Archiving and Dissemination Baseline at EUMETSAT HQ	EUM/LEO-EPSSG/SPE/15/819557
[XSD]	W3C XML Schema	http://www.w3.org/XML/Schema

1.6 Conventions and Terminology

Generic terms and definitions applicable to the EPS-SG Programme can be found in [MCSD]. Specific conventions and terminology used in this document (GADS) and in the Auxiliary Data Specifications (ADSs) are described in Section 2.

All representations of numbers and units shall adhere to [BIPM].

1.7 Document structure

Table 4 – Document Structure

Section Number	Title	Content
1	Introduction	The Scope and Purpose of the GADS document is described in this section, along with Open Issues, Assumptions, Applicable and Reference documents.
2	Conventions and Terminology	The conventions and terminology used for specifying the Auxiliary Data Files are described in this section.
3	Overall Structure of EPS-SG Auxiliary Data	A high-level overview on the structure and format of the Auxiliary Data is presented in this section. The Naming convention is also specified here.
4	Common Auxiliary Data	The format of each Common Auxiliary Data (detailed description of the format of the data files including original format where applicable) is described in this section.
APP A	XML Description of EPS-SG Auxiliary Data Manifest File	The .xml and .xsd schemas for the Manifest File is provided in this section.
APP B	XML Description for Internal Files of EPS-SG Auxiliary Data	The .xml description of internal auxiliary data files is provided in this section.

2 CONVENTIONS AND TERMINOLOGY

This section summarizes the auxiliary data conventions used in the Auxiliary Data Specification documents.

2.1 General Conventions

Table 5 – General Conventions

Operation	Meta character(s)	Explanation	Example
Enumerated	|	A **vertical bar** separates alternatives	"IAS" | "VII" | "RO" | "MWS" | "SCA" | "3MI" |"MWI" | "ICI" | "SN5" designates one of "IAS", "VII", "RO", "MWS", "SCA", "3MI", "MWI", "ICI", "SN5"
Grouping	()	**Parentheses** define scope and precedence	**SGA1_SND_(IASx | MWSx)_E_2** designates either **SGA1_SND_IASx_E_2** or **SGA1_SND_MWSx_E_2**
Character class	[]	**Square brackets** designate a set of possible characters to choose from	[1-3] matches 1, 2, or 3
Quantifiers	{min,max}	**Curly brackets** designate the minimum and maximum number of repetitions of the preceding group	(abcd){2,3} designates abcdabcd, or abcdabcdabcd
	?	The **question mark** indicates *zero or one* of the preceding element	ax? designates a or ax
	*	The **asterisk** indicates *zero or more* of the preceding element	ax* designates a, ax, axx, axxx, ...
	+	The **plus sign** indicates *one or more* of the preceding element.	ax+ designates ax, axx, axxx, ...
String	""	Exact string	"Unidata Dataset Discovery v1.0" designates the string within the matched quotes
Character	''	Exact character	',' designates the comma character
Range	< > ≤ ≥	The left and right **angle brackets** indicate "greater than"or "less than", respectively. The other two symbols represent "greater than or equal to" and "less than or equal to", respectively. These symbols may be used to indicate a valid range for a variable.	If X is an integer, then: 0 < X < 500 designates a range for X of any integer value from 1 to 499. 0 ≤ X ≤ 500 designates a range for X of any integer value from 0 to 500. 0 ≤ X designates a range for X of any positive integer or 0. X < 0 designates a range for X of any negative integer If Y is a real value, then: 0 ≤ X ≤ 500 designates a range for Y of any value between 0 and 500.

2.2 Standard Generalised Time

This format is used only in the filename for timing information.

Standard generalised time or generalised time is UTC-based. It is a string of 15 characters terminating in an ASCII 'Z' (indicating Zulu or UTC time). The format is:

(YYYY)(MM)(DD)(hh)(mm)(ss)Z

where:

YYYY: 20[0-9][0-9] : year
MM: [0-1][0-9] : month
DD: [0-3][0-9] : day
hh: [0-2][0-9] : hour
mm: [0-5][0-9] : minute
ss: [0-5][0-9] : second

For example, 21:19:27 on 27 July 2011 would be encoded as: 20110727211927Z.

2.3 Data Types

Data types can be either primitive/atomic data types defined and supported in many programming languages or compound data types which consist of logical compounds of primitive data types.

2.3.1 Primitive Data Types

The following primitive data types are available for the use in Auxiliary Data Specification.

Table 6 – List of primitive data types

Primitive Data Type	Description
BOOL	Boolean (not supported by NetCDF)
BYTE	signed 1 byte integer
UBYTE	unsigned 1 byte integer
CHAR	ISO/ASCII character
STRING	string
SHORT	signed 2 byte integer
USHORT	unsigned 2 byte integer
INT	signed 4 byte integer
UINT	unsigned 4 byte integer
INT64	signed 8 byte integer
UINT64	unsigned 8 byte integer
FLOAT	4 byte floating point number
DOUBLE	8 byte floating point number
COMPLEX	8 byte complex number
DCOMPLEX	16 byte complex number

Data of the same primitive data type can be arranged to one- or more-dimensional arrays.

2.3.2 Compound Data Types

Definition of compound data types might be necessary to store bit samples or numbers with higher precision. For example, a high-precision (picoseconds) date/time compound could be represented as INT holding the date plus a DOUBLE holding the time of the day Details of these will be described in the specific ADS where necessary. Compound data types are listed in Table 7

Table 7 – List of compound data types

Compound Data Type	Description
dateTime	ISO date and time identifier

2.3.3 Presentation of Integer Constants

By default, inter constants are to be interpreted as decimal numbers. Alternative presentations are binary, octal, or hexadecimal numbers, to be indicated by prefixes Bx, Ox, Hx, respectively. For example, the decimal number 11 can be represented as Bx1011, Ox13, HxB.

2.4 Terminology

Table 8 – Terminology

Term	Explanation
Auxiliary Data File (ADF)	An Auxiliary Data File is used or generated by a product generation function. Auxiliary data covers several data categories used at the Ground Segment, either of static or dynamic nature, from sources either internal or external to the ground segment. They are required to process, calibrate or improve the payload science data. This does not include on-board ancillary data received from the Satellite. Categories of data considered as Auxiliary data include: Geophysical corrections, Exogenous Data, External Calibration Data and Observation & Forecast Data.
Auxiliary Data ID (ADF-ID)	Identifier of the auxiliary data.
Filename	File name of the auxiliary data (following naming convention described in section 3.2).
Manifest	An XML containing the metadata for the auxiliary data file.
Manifest Filename	File name of the manifest file that is part of the Auxiliary Data File.
Data File	A Data File is a file containing the actual auxiliary data information included in the SIP package.
Data File Filename	File name of the Data file (s) that is part of the Auxiliary Data File.
SIP	Submission Information Package (SIP) is the format of the ADF in EPS-SG Ground Segment and consisting of a folder including a manifest file (XML format) plus one or more Data File(s) containing the actual auxiliary data information.
Data Type	A data type is a way to encode information following a given data model.
Format	GS format of the auxiliary data (i.e. SIP format).
Format of data files	Format of the Data file (s) that is part of the Auxiliary Data File.
Auxiliary Data Size	Estimated size of the auxiliary data.
Generation Frequency	Generation frequency (e.g. 1 per day).
Validity	Validity time of the Auxiliary data files.
Static/Dynamic Auxiliary data	Auxiliary data file can have static or dynamic nature, depending on the generation frequency. Auxiliary data is considered static if it has an update frequency typically beyond one month.
Internal/External	An auxiliary data is classified as either internal or external, depending on the source (or provider) is internal or external to the Ground Segment.
Source	Source or Provider of the auxiliary data.
Members	Number of physical file members (data files) in the ADF.
Spacecraft	Spacecraft Identifier.

3 OVERALL STRUCTURE OF EPS-SG AUXILIARY DATA

Auxiliary data is information required for the processing of centrally generated EPS-SG L1 and L2 mission products that is not available in the Instrument Source Packets or in the NAVATT Packets and must be retrieved from external inputs. Likewise, auxiliary data may be generated and output by a Product Generation Function (PGF).

3.1 Format Overview

EPS-SG Auxiliary Data File (ADF) is a collection of files aggregated and formatted according to the rules specified in this document.

An auxiliary data file that is SIP formatted (i.e. ADF is packaged in a folder) is a folder which contains the following data file components:

- *Manifest file*;
- *Data File(s)*.

The Manifest file is an XML file formatted according to Appendix A that contains:

- metadata information that describes properties of the auxiliary data;
- information about the data files that are part of the auxiliary data file.

The Auxiliary Data File is a file that contains the specific information required for data processing. The exact content, format and number of data file depend on the type of auxiliary data file and on the type of information that it contains. The Data Files might be eventually organized in a *Data* Folder within the SIP package.

It should be noticed that all the Auxiliary data files provided to the PGFs will be in SIP format as specified in this document. Data files which are available in non-SIP format will be converted to SIP format (i.e. adding a Manifest and filling the relevant metadata fields. The manifest file includes pointing to the original data file(s) and the original data file(s) are kept as received) before being delivered to the PGFs.

Figure 1 presents an overview of the logical structure of EPS-SG auxiliary data files and Figure 2 presents an overview of the physical structure of EPS-SG auxiliary data files.

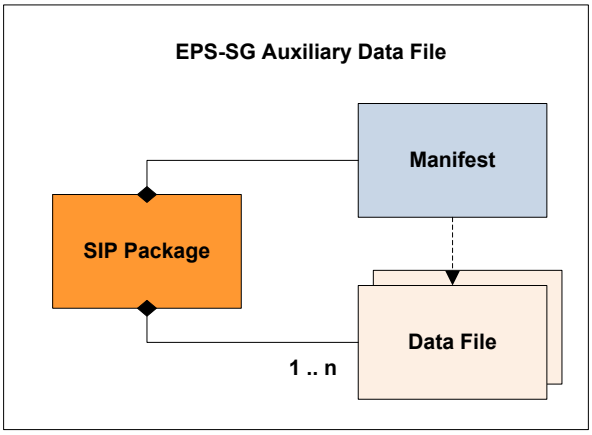


Figure 1 – EPS-SG Auxiliary Data File Logical Structure

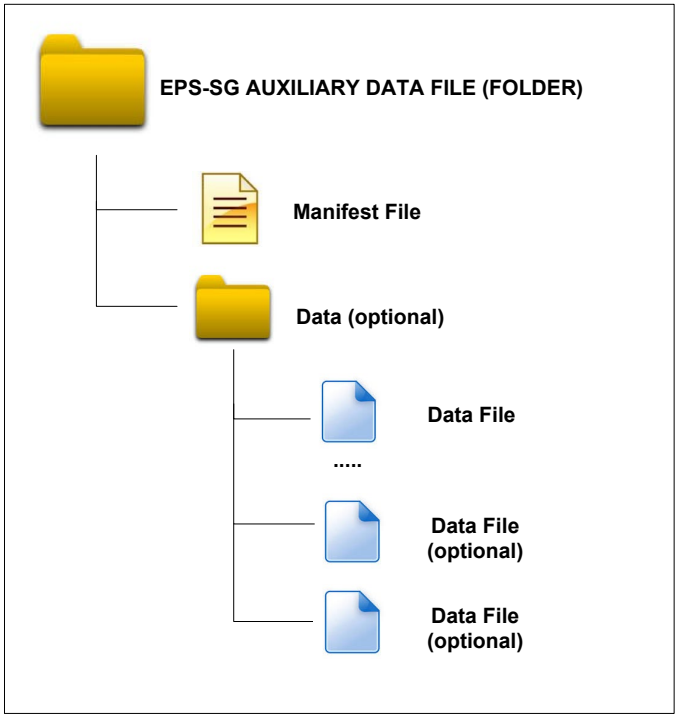


Figure 2 – EPS-SG Auxiliary Data File Physical Structure

3.2 Naming Convention

This section defines the naming convention that is applicable to all EPS-SG Auxiliary Data Files. The auxiliary data files shall be named using a fixed set of elements (each with fixed size) and one optional field (with variable size).

Note:

- Filename fields between < > indicate the mandatory fields, with potential values and sizes as explained in Table 9.
- Filename elements between [ ] are optional.

The naming for EPS-SG Auxiliary Data is identified by the sequence of fields described here below:

<Spacecraft>_<ADF-ID>_<GR>_S<ValidityStartDateTime>_ E<ValidityEndDateTime>_G<GenerationDateTime>_<Source>_<Environment>_<Class>[_<Free Text>].<FileType>

<ADF-ID> = <Instrument>_<ProcessingLevel>_<ADF-Type>

The above set of fields is the minimum set of information needed to ensure that each Auxiliary Data File is unique in the context of the EPS-SG Ground Segment. Table 9 provides the list of elements that constitute the file name with their size in characters and a description of their content.

Table 9 – Auxiliary Data File Naming Elements

Field Name	Characters	Description
Spacecraft	**4**	**Spacecraft and flight model identifier for which data is applicable** Consists of 4 chars, either uppercase letters, digits, or underscores. "**SGA**"**[1-3]** = for specific Metop-SG-A spacecraft "**SGB**"**[1-3]** = for specific Metop-SG-B spacecraft "**SGA_**" = for all Metop-SG-A spacecrafts "**SGB_**" = for all Metop-SG-B spacecrafts "**SG__**" = Not spacecraft related Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS.
Instrument	**3**	**InstrumentIdentifier** Consists of 3 chars, either uppercase letters or digits. "**IAS**" = IASI-NG "**MWS**" = MWS "**VII**" = METimage "**RO_**" = RO "**SCA**" = SCA "**MWI**" = MWI "**ICI**" = ICI "**3MI**" = 3MI "**SN5**" = Sentinel-5 "**___**" = No specific instrument or not instrument related (3 underscores) Other: "**MSP**" = Multi-Sensor Data (single main instrument cannot be assigned) Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS.
ProcessingLevel	**2**	**Identifier of Processing Level** Consists of 2 chars, either uppercase letters or digits. "**1B**" = Level 1B "**1C**"= Level 1C "**1D**" = Level 1D "**02**" = Level 2 "__" = Common to L1 and L2 (2 underscores) Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS.
ADF-Type	**8**	**Unique identifier of an ADF Data Type** Consists of 8 chars, either uppercase letters or digits. *Examples (not exhaustive list) of ADF Data Type ID:* "**AUX_AGPO**" = SCA Transponder Antenna Gain Pattern & Orientations "**AUX_APC_**" = APC Files "**AUX_APCM**" = APC Map Files "**AUX_ATM_**" = Atmospheric Spectra Database

Field Name	Characters	Description
		"**AUX_BESD**" = NWP Background Error Standard Deviations **"AUX_BFDY"** = FDY Background Database **"AUX_BGLY"** = GLY Background Database **"AUX_BNO2"** = NO2 Background Database "**AUX_BRDM**" = 3MI BRDM database "**AUX_BRES**" = Brescia coefficients **"AUX_BSO2"** = SO2 Background Database **"AUX_CAC_"** = Aerosol Correction Climatology **"AUX_CAH_"** = Aerosol Height Climatology "**AUX_CAL_**" = Generated Calibration Data **"AUX_CAMA_"** = Global atmospheric composition analysis data "**AUX_CAMD**"= CAMS (Copernicus Atmospheric Monitoring Service) global delayed-mode analysis and forecast "**AUX_CAMF**" = CAMS (Copernicus Atmospheric Monitoring Service) Forecast File "**AUX_CCDB**" = Calibration Coefficient Database "**AUX_CHL_**" = Chlorophyll-Concentration Database "**AUX_CMEM**" = CMEMS (Copernicus Marine Environment Monitoring Service) Global Analysis data "**AUX_CMG_**" = VII L2 Cloud Mask Generated Internal Auxiliary File "**AUX_CNF_**" or "**AUX_CNFM**" = Configuration File **"AUX_CO3_"** = O3 Climatology **"AUX_CO3P"** = O3 Profile Climatology **"AUX_COEF"=** IASI-NG operational spectral calibration coefficients "**AUX_COF_**" = Context File "**AUX_CRD_**" = IPW Cloud-Radiation Database "**AUX_CSI_**" = Snow/ice climatology **"AUX_CSO2"** = SO2 Profile Climatology **"AUX_CTP_"** = Temperature Profile Climatology "**AUX_DEM_**" = Digital Elevation Model **"AUX_DO3P"** = O3 Profile Database for UV degr. Corr. "**AUX_DTC_**" = Distance to near Coastline "**AUX_ECM_**" = NWP Error Correlation Matrices "**AUX_EIGV**" = Eigenvectors "**AUX_EMI_**" = Map of Surface Emissivity "**AUX_EMS_**" **=** Surface Emissivity Atlas "**AUX_ENG_**" = Engineering Parameters "**AUX_EOP_**" = Earth Orientation Parameters **"AUX_FDYP"** = Formaldehyde Profile Climatology "**AUX_FMEV**" = Forward Model Eigenvectors "**AUX_FRLI**" = FORLI coefficients "**AUX_GCB_**" = GNSS Differential Code Biases (RSN) "**AUX_GCBB**" = GNSS Differential Code Biases (IGS) **"AUX_GLOB"** = Global Land One-kilometer Base Elevation (GLOBE DEM) **"AUX_GLYP"** = Glyoxal Profile Climatology "**AUX_GNB_**" = GNSS Navigation Data Stream (NAVBITS) "**AUX_GNM_**" = GNSS Navigation Messages "**AUX_GOC_**" = GNSS Orbits and Clocks "**AUX_GSA_**" = GNSS Service Auxiliary files "**AUX_GSR_**" = GNSS Service Report "**AUX_HRSS**" = High Resolution Solar Spectrum "**AUX_IBA_**" = IERS Bulletin A "**AUX_ICHI**" = Snow/Ice map (Low/High Resolution) "**AUX_ISRF**" = Instrument Spectral Data Spectrum (ISRF) "**AUX_LAAI**" = LUT Absorbing Aerosol Index "**AUX_LALH**"= ALH NN Model

Field Name	Characters	Description
		"**AUX_LAOD**" = LUT Aerosol Optical Depth "**AUX_LAOP**" = LUT Aerosol Optical Prop. "**AUX_LCLD**" = LUT Cloud "**AUX_LCLF**" = LUT Cloud Fraction "**AUX_LCOP**" = LUT Cirrus Optical Prop. "**AUX_LER_**" = LER Database "**AUX_LERO_**" = Monthly global climatology of surface Lambertian-Equivalent Reflectivities from OMI "**AUX_LERU_**" = Daily global climatology of surface Lambertian-Equivalent Reflectivities in the UV generated by the AC-SAF "**AUX_LFDY**" = LUT FDY Air Mass Factor (AMF) "**AUX_LGLY**" = LUT GLY Air Mass Factor (AMF) "**AUX_LLER**" = LUT Scene Lambertian-equivalent Reflectivity "**AUX_LMDB**" = VII L1B Landmark Database "**AUX_LNO2**" = LUT NO2 Air Mass Factor (AMF) "**AUX_LO3_**" = LUT O3 Air Mass Factor (AMF) "**AUX_LOC_**" = LEO Orbits and Clocks "**AUX_LOG_**" = SCA Transponder Log Files "**AUX_LSA_**" = Map of Surface Albedo / BRDF "**AUX_LSE_**" = Land Surface Emissivity Atlas "**AUX_LSM_**" or "**AUX_MASK**" = Land-Sea Mask "**AUX_LSO2**" = LUT SO2 Air Mass Factor (AMF) "**AUX_LUT_**" or "**AUX_LUTM**" = Look-Up Tables "**AUX_LUV_**" = LUT UV Observed Radiance at Surface and UV Index "**AUX_MHF_**" = Manoeuvre History File "**AUX_NCM_**" = Noise co-variance matrix "**AUX_NDVI**" = NDVI Database **"AUX_NISE"** = Near-real-time Ice and Snow Extent (NISE) snow/ice Dataset "**AUX_NWP_**" = NWP forecast Data "**AUX_NWPA**" = NWP Analysis Data "**AUX_ODB_**" = Operational Spectral Calibration Database "**AUX_ODC_**"= O3P ODC file for UV degradation correction "**AUX_ODI_**"= O3P database of ODI files for UV degradation correction "**AUX_OPF_**" = Operational Parameters File "**AUX_OQM_**" = Offline Quality Monitoring "**AUX_OUTL**" = IASI-NG PCC Outlier Spectra "**AUX_PCCC**" = PCC Configuration "**AUX_PO3P**" =Database for spectral Pattern Correction "**AUX_POFD**" = Predicted Orbit / Flight Dynamics "**AUX_PREP**" = Prep Files "**AUX_PWLR**" = Piecewise Linear Regression "**AUX_RD09**" = Raster Digital Elevation Model (9 arc-seconds) "**AUX_RD15**" = Raster Digital Elevation Model (15 arc-seconds) "**AUX_RD30**" = Raster Digital Elevation Model (30 arc-seconds)"**AUX_RFDY**" = FDY Reference Radiance Database "**AUX_RGLY**" = GLY Background Database "**AUX_RLUT**" = TOA Reflectance LUT (Cloud and Aerosol) "AUX_RREF"= Reference Radiance Database "**AUX_RS__**" = Ring Spectrum "**AUX_RTT_**" = RTTOV Coefficients "**AUX_SAD_**" = Coefficients and Thresholds/Correction Coefficients and Regression Parameters "**AUX_SCHB**" = Spectral Calibration Historical Background "**AUX_SDB_**" = Spectral Database "**AUX_SEIC**" = Sea-Ice Mask

Field Name	Characters	Description
		"**AUX_SIG_**" = SCA Transponder Measurements (Signal Information) "**AUX_SLDB**" = Stray Light Coefficient Database "**AUX_SMR_**" = Satellite Mass Report "**AUX_SOA_**" = Solar Activity "**AUX_SOL_**" = Solar Calibration Coefficient "**AUX_SPSF**" = S5 Point-Spread Function File "**AUX_TUF_**" = TAI - UTC File "**AUX_XS__**" = Cross Section "**AUX_ZGD_**" = Zenith GNSS products Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in the ADS/GADS.
GR	**1**	**Identifier discriminating between global and regional data processing** Consists of 1 char: "**G**" = File generated by the Global processing "**R**" = File generated by the Regional processing "**_**" = no discrimination between global/regional processing Only applicable to generated auxiliary data and set at run-time depending on the context (global mission, regional mission) in which the auxiliary data is generated For other auxiliary data set to "_".
ValidityStartDateTime	**15**	**Standard Generalised Time of validity start** Consists of 15 characters, either uppercase letters or digits (see also section 2.2). Format: - 8 char., all digits, for the date: (***YYYYMMDD)***, year, month, day - 6 char., all digits, for the time: (***hhmmss),*** hour, minutes, seconds - 1 uppercase z: **Z** Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS.
ValidityEndDateTime	**15**	**Standard Generalised Time of validity stop** Consists of 15 characters, either uppercase letters or digits (see also section 2.2). Format: - 8 char., all digits, for the date: (***YYYYMMDD)***, year, month, day - 6 char., all digits, for the time: (***hhmmss),*** hour, minutes, seconds - 1 uppercase z: **Z** For any ADF with indefinite validity the ValidityEndDateTime shall be xxxxxxxxxxxxxxZ. Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS.
GenerationDateTime	**15**	**Standard Generalised Time of data generation (start of the auxiliary data generation)** Consists of 15 characters, either uppercase letters or digits (see also section

Field Name	Characters	Description
		2.2). Format: - 8 char., all digits, for the date: (***YYYYMMDD)***, year, month, day - 6 char., all digits, for the time: (***hhmmss),*** hour, minutes, seconds - 1 uppercase z: **Z** It corresponds to the generation date/time of the SIP package.
Source	**4**	**Data Provider Identifier of the original auxiliary data item** Consists of 4 chars, uppercase letters. *List not exhaustive at this stage - to be completed when all the sources are identified in the Ground Segment design.* "**CALV**" = Cal/Val "**CMEM**" = Copernicus Marine Environment Monitoring Service "**ECMW**" = ECMWF "**ESA_**" = European Space Agency "**FDS_**" = Flight Dynamics Facility "**IERS**" = International Earth Rotation and Reference Systems Service "**IGS_**" = International GNSS Service "**LPDA**" = Land Processes Distributed Active Archive Center "**NOAA**" = National Oceanic and Atmospheric Administration "**NORD**" = NORAD (North American Aerospace Defense Command) "**NSID**" = National Snow & Ice Data Center "**NWCS**" = NWC-SAF "**NWPS**" = NWP-SAF "**O3_S**" = O3-SAF "**OPRP**" = Operations Preparation "**OSIS**" = OSI-SAF "**PDP_**" = Payload Data Processing component "**RSN_**" = RO Support Network "**TEC_**" = IASI-NG TEC "**TP1_**" = SCA Transponder 1 "**TP2_**" = SCA Transponder 2 "**TP3_**" = SCA Transponder 3 "**USNO**" = United States Naval Observatory "**UWIS**" = University of Wisconsin Set as specified in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS.
Environment	**3**	**Environment Identifier** Consists of 3 chars, uppercase letters. "**OPE**" = for operational environment "**VAL**" = for validation environment "**IVV**" = for integration & verification environment "**DEV**" = for development environment "**ENG**" = for engineering environment "**___**" = for data received from external providers (3 underscores) It indicates the environment where the auxiliary data item is generated.
Class	**4**	**Type of activity for which the file is used** Consists of 4 chars, either uppercase letters or digits. "**OPER**" = For routine operations "**TEST**" = For internal tests

Field Name	Characters	Description
		"**TD**" **[00-99]** = For processing test data sets 00,...,99 "**SVT**" **[0-9]** = For SVT tests 0,..,9
FreeText	**Variable length (max 16 chars)**	**Optional free text.** Consists of maximum 16 chars, either letters or digits. Only used when explicitly specified in Auxiliary Data Summary Sheet. Note: When used, the field is always preceded by the field delimiter "_". Only used when explicitly specified in the ADF definition in ADS/GADS.
FileType	**3**	**Representation of data** (filename extension) Consists of 3 chars. "**SIP**" = SIP package containing the complete ADF (Manifest and Data File(s)).

The Auxiliary Data Type always include "AUX" to identify the file as an auxiliary data file within the Ground Segment.

The "*ValidityStartDateTime"* and "*ValidityEndDateTime"* define the validity period of the data included in the auxiliary data file and the "*GenerationDateTime"* defines when the auxiliary data file (i.e. the SIP file) was created in the Ground Segment (start of the generation).

3.3 Format Description

3.3.1 Manifest File

3.3.1.1 Content

The Manifest file of any EPS-SG Auxiliary Data shall comply with Appendix A. It describes all the physical components and interconnects all files of the auxiliary data file. It can be considered as the map of the auxiliary data file and there is one manifest for each SIP Package.

The Manifest file describes the Data File(s) part of the SIP package and provides metadata information for the complete information package and for each Auxiliary Data File.

3.3.1.2 Naming Convention

The manifest file name is fixed and must always be: **manifest.xml**. There will be only one manifest file included in the SIP package.

3.3.1.3 Format

The Manifest file is an XML file that provides all the relevant metadata information for cataloguing and archiving purpose.

The Manifest file comprises:

- The Metadata Section including all of the metadata for all items in the SIP package

- The Data Object Section containing all the physical information needed to get the location of each file composing the SIP package

which are encapsulated in:

- The Information Package Map contains the logical view of the package. It provides a hierarchical view of the content of the package.

The XML schema for the Manifest file is provided in Appendix A.

The following table describes the elements of the Metadata Section.

Table 10 – Manifest File – Elements of Metadata Section

Metadata Element	Description	Value	Byte Length	Data Type
fileName	Filename of the ADF	As set in the Filename	91 chars (including underscores and the '.' before the file type) if no free text added and max of 108 chars if free text is added	String
name	Name of the aux data (e.g "IERS Bulletin A")	As provided in the"Auxiliary Data Summary Sheet" of the ADF in ADS/GADS	Variable	String
description	Short explanation of the content/use of the auxiliary data	As provided in the "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS	Variable	String
satelliteID	Spacecraft name and flight model	See **Spacecraft** in Table 9 As set in the Filename	4 chars	String
instrumentID	Instrument	See **Instrument** in Table 9 As set in the Filename	3 chars	String
processingLevel	Processing Level (processing level for which the auxiliary data is applicable)	See **ProcessingLevel** in Table 9 As set in the Filename	2 chars	String
adfType	ADF type	See **ADF-Type** in Table 9 As set in the Filename	8 chars	String
GR	Identifier discriminating between global and regional data processing	See **GR** in Table 9 As set in the Filename	1 char	String

Metadata Element	Description	Value	Byte Length	Data Type
validityStartDateTime	UTC time in ISO format when the auxiliary data becomes valid in the GS	***YYYY-MM-DDThh:mm:ssZ*** - 10 char., for the date: (*YYYY-MM-DD)*, year, month, day - 1 uppercase t: T - 8 char, for the time: (*hh:mm:ss),* hour, minutes, seconds - 1 uppercase z: Z As set in the Filename, but with different format	20 chars	dateTime
validityEndDateTime	UTC time in ISO format when the auxiliary data becomes invalid in the GS	***YYYY-MM-DDThh:mm:ssZ*** - 10 char., for the date: (*YYYY-MM-DD)*, year, month, day - 1 uppercase t: T - 8 char, for the time: (*hh:mm:ss),* hour, minutes, seconds - 1 uppercase z: Z For any ADS with indefinite validity the ValidityEndDateTime shall be xxxxxxxxxxxxxxZ. As set in the Filename, but with different format	20 chars	spdateTime
generationDateTime	UTC time in ISO format when the auxiliary data is created in the GS (start of the generation time)	***YYYY-MM-DDThh:mm:ssZ*** - 10 char., for the date: (*YYYY-MM-DD)*, year, month, day - 1 uppercase t: T - 8 char, for the time: (*hh:mm:ss),* hour, minutes, seconds - 1 uppercase z: Z As set in the Filename, but with different format	20 chars	*dateTime*
source	Data Provider of ADF	*List not exhaustive at this stage - to be completed when sources are identified in the GS design.* See **Source** in Table 9 As set in the Filename	4 chars	String
environment	Environment where the auxiliary data is generated	See **Environment** in Table 9 As set in the Filename	3 chars	String

Metadata Element	Description	Value	Byte Length	Data Type
class	Type of activity supported by this ADF	See **Class** in Table 9 As set in the Filename	4 chars	String
freeText	Optional free text	- As set in the Filename, only if/when used as specified in the ADF definition in ADS/GADS	Maximum 16 chars	String
members	Number of physical file members (data files) of the same ADF	Provided in "Auxiliary Data Summary Sheet" of the ADF in ADS/GADS	4 bytes	UINT
fileSize	Apparent-size in bytes of the ADF, without manifest	Computed and set at runtime	8 bytes	unsigned long
documentReference	Reference and version to Auxiliary Data Specification document describing the data format and content	Format: [Reference] [Version] Where: • [Reference] = Reference number from EUMETSAT DMT • " ": one space in between • [Version] = v[Major version][sub-version]- Example: EUM/LEO-EPSSG/TEN/16/847505 v1H	String (variable)	String

The following table describes the elements of the Data Object section. Each SIP will contain one or more Data Objects. A data object represents a physical file within the SIP. Below are the properties, which describe a data object.

Table 11 – Manifest File –Elements of Data Object Section

Data Object Element	Description	Value	Byte Length	Data Type
ID	Unique identifier (e.g. the filename) of the data object within this SIP.	Internal filename of the data object inside the SIP package Note: Examples of the internal filename(s) are provided in "Auxiliary Data Summary Sheet" of the ADF in the ADS/GADS	String (variable)	String
fileType	Describes the type of file	Data	String (variable)	String
format	Describes the format of the file.	See Table 12 for possible values	String (variable)	String
size	Size of the data object in bytes	Computed and set at run-time	N/A	UINT
relativePathAndFilename	Relative location of the file within the SIP (i.e. ./)	Defined according to the internal structure of the ADF files as specified in the ADS/GADS	String (variable)	String

3.3.2 Data File

3.3.2.1 Content

The Data File is a file that contains the actual data of interest. The number of Data files within a SIP package depends on the auxiliary data type.

3.3.2.2 Naming convention

No specific naming conventions are applicable to the data files.

3.3.2.3 Format

The file formats used in the context of EPS-SG are summarized in the following table.

NOTE: The following list is not exhaustive at this stage, formats may be modified and/or added.

Table 12 – EPS-SG Data File Formats

Format	File Type	Description
NetCDF-4*	.nc	For Data Files in NetCDF-4 format (See Note on Metadata)
XML	.xml	For Data Files in XML format
ASCII	.asc .dat.txt	For Data Files in ASCII format
Binary	.bin	For Data Files in binary format
HDF5	.hdf5/.h5	For Data Files in HDF5 format
HDF-EOS	.hdf .he2/he4/.hdfeos/ .he5	- Data Files in HDF format - HDF:EOS2:HDF-EOS version 2 based on HDF4 - HDF-EOS5:HDF-EOS version 5 based on HDF5
RINEX	.rnx	For Data Files in RINEX format
SINEX	.snx	For Data Files in SINEX format
SINEX_Bias	.BIA / .bsx	For Data Files in SINEX_Bias format
SP3-d	.sp3	For Data Files in SP3 format
GRIB	grib	For Data Files in GRIB format
ANTEX	.atx	For Data Files in ANTEX format

Format	File Type	Description
YAML	.yaml	For Data Files in YAML format
SQLite	.db	For Data Files in SQLite format

* For auxiliary data items created in NetCDF format, it is recommended (although not mandatory) to include as global attributes in the NetCDF file the same metadata information (fields, values) which are included in the manifest file (with the exception of the following parameters:

- Members;
- fileSize;
- DataObject ID;
- relativePathAndFilename.

3.4 Packaging and distribution of Auxiliary Data Files

All physical files belonging to the same SIP will be packaged for distribution in archive files. This consists of a UNIX tape archive file (tar file). The extension of the auxiliary data file will be "**.SIP.tar**".

4 COMMON AUXILIARY DATA

This section describes Auxiliary data Files that are common to two or more Product Generation Functions.

4.1 Common Auxiliary Data List

Table below provides the full list of Common Auxiliary Data Files within the Ground Segment. The actual list of PGFs requiring the auxiliary file is mentioned in the column "**PGF**".

NOTE: The following list is not exhaustive - Common ADF may be modified and/or added.

Legend for the table below (see Table 8 for further details):

- **File** – name of the Auxiliary Data File
- **PGF** – Product Generation Function that uses the Auxiliary File
- **G/R** – File generated by the Global (G) and/or Regional (R) processing or N/A for files not generated by the processing
- **I/E** – Internal or External Auxiliary File
- **S/D** – Static or Dynamic Auxiliary File
- **Source** – Source of the Auxiliary File
- **Generation Frequency** – Frequency with which the file is generated
- **Format of data file(s)** – Format of the internal files, i.e. the format of the files inside the SIP package
- **Filename of data file(s)** – Filename of the internal Files, i.e. the filename of the files inside of the SIP package
- **Auxiliary Data ID (ADF-ID)** – Unique identifier of the Auxiliary File
- **Auxiliary Data Size** – Size of the SIP package (without manifest)
- **Required For Local Mission (Y/N)** – Y, If the File is required for the Local mission. N, otherwise.

Table 13 – EPS-SG Common Auxiliary Data List

File	PGF	G/R	I/E	S/D	Source	Generation Frequency	Format of data file(s)	Filename of data file(s)	Auxiliary Data ID (ADF-ID)	Auxiliary Data Size	Required For Local Mission (Y/N)
ACE-2 Digital Elevation Model (30 arc-seconds)	IASI-NG L1C	N/A	E	S	ESA_	Infrequently	Binary [ACE-2]	e.g. 45S015E_30S.ACE2	_____AUX_DE30	1.74 GB	Y
Raster Digital Elevation Model (9 arc-seconds)	VII L1B VII L2 CM 3MI L1B 3MI L1C 3MI L2 MAP L2	N/A	E	S	CALV	Infrequently	Binary [Raster]	e.g. 45S045W	_____AUX_RD09	20.7 GB (288 member files, 72 MB per file)	Y
Raster Digital Elevation Model (15 arc-seconds)	S5 L1B S5 L2	N/A	E	S	CALV	Infrequently	Binary [Raster]	e.g. 45S045W	_____AUX_RD15	7.5 GB (288 member files, 25.9 MB per file)	Y
Raster Digital Elevation Model (30 arc-seconds)	IASI-NG L1C (next version)	N/A	E	S	CALV	Infrequently	Binary [Raster]	e.g. 45S045W	_____AUX_RD30	1.86 GB (288 member files, 6.48 MB per file)	Y

File	PGF	G/R	I/E	S/D	Source	Generation Frequency	Format of data file(s)	Filename of data file(s)	Auxiliary Data ID (ADF-ID)	Auxiliary Data Size	Required For Local Mission (Y/N)
Land-Sea Mask File	3MI L1C 3MI L2 IASI-NG L1C VII L1B VII L2 CM VII L2 MAP L2 S5 L2	N/A	E	S	LPDA	1 per year	HDF-EOS [LSM-LPDAAC]	MCD12Q1.A2013001.h00v08.006.YYYYDDDhhmmss.hdf	_____AUX_LSM_	~1.6 GB	Y
NWP Forecast Data	3MI L2 IASI-NG L2 MWI-ICI L2 VII L2 VII L2 CM MAP L2 S5 L2	N/A	E	D	ECMW	Every 6 h (12 files/snapshots per time)	GRIB [ECMWF]	ESS09120000091203001	_____AUX_NWP_	~13 GB	Y
NWP Analysis Data	MWI-ICI L2 VII L2 VII L2 CM S5 L2	N/A	E	D	ECMW	Every 12 hours	GRIB [ECMWF]	ESD05181200051812001	_____AUX_NWPA	~26 MB	Y
CAMS Forecast Data	VII L2 CM VII L2 S5 L2 3MI L2 MAP L2	N/A	E	D	ECMW	Every 12 h (8 files/snapshots per time)	GRIB	z_cams_c_ecmf_20090630000000_prod_fc_006.grib TBC	_____AUX_CAMF	~1.4 GB	Y**

File	PGF	G/R	I/E	S/D	Source	Generation Frequency	Format of data file(s)	Filename of data file(s)	Auxiliary Data ID (ADF-ID)	Auxiliary Data Size	Required For Local Mission (Y/N)
NWP Background Error Standard Deviations	VII L2 CM VII L2 MWI/ICI L2	N/A	E	D	ECMW	Every 12 hours	GRIB	errors.grib fields.grib	_____AUX_BESD	~1 GB	N
NWP Error Correlation Matrices	VII L2 CM VII L2 MWI/ICI L2	N/A	I	S	CALV	Infrequently	NetCDF-4	ecm_static_back_t_q.nc	_____AUX_ECM_	~305 MB	N
Global Ocean Biogeochemistry Analysis and Weekly Forecast	3MI L2 MAP L2 S5 L2	-	E	D	CMEM	1 per week (10 files/snapshots per time	NetCDF-4	mercatorbiomer4v2r1_global_mean_20180214.nc	_____AUX_CMEM	0.83 GB	N
IERS Bulletin A	IASI-NG L1C ICI L1 MWI L1 MWS L1 S-5 L1 SCA L1 3MI L1B 3MI L1C 3MI L2 MAP VII L1B	N/A	E	D	IERS	1 per week	ASCII [IERS]	bulletina-xxix-046.txt	_____AUX_IBA_	~0.1 MB	Y

File	PGF	G/R	I/E	S/D	Source	Generation Frequency	Format of data file(s)	Filename of data file(s)	Auxiliary Data ID (ADF-ID)	Auxiliary Data Size	Required For Local Mission (Y/N)
Predicted Orbit File	L0 IASI-NG L1C ICI L1 MWI L1 MWS L1 S-5 L1 SCA L1 3MI L1B 3MI L1C 3MI L2 MAP VII L1B VII L2	N/A	I	D	FDS_	1 per day	Earth-Observation	SGA1_FDP_FDS__OPE_PRED_ORB__GYYYYMMDDhhmmssZ_SYYYYMMDDhhmmssZ_EYYYYMMDDhhmmssZ.EOF	_____AUX_POFD	3.5 MB	Y
Manoeuvre History File	RO L1B SCA L1B	N/A	I	D	FDS_	Every manoeuvre	ASCII	SGA1_FDP_FDS__OPE_MANO_HIST__GYYYYMMDDhhmmssZ_SYYYYMMDDhhmmssZ_EYYYYMMDDhhmmssZ.txt	_____AUX_MHF_	0.1 MB	Y
Sea-Ice Mask	IASI-NG L2 MWI/ICI L2	N/A	E	D	OSIS	1 per day	NetCDF	ice_conc_nh_polstere-100_multi_201812231200.nc	_____AUX_SEIC	41 MB	N

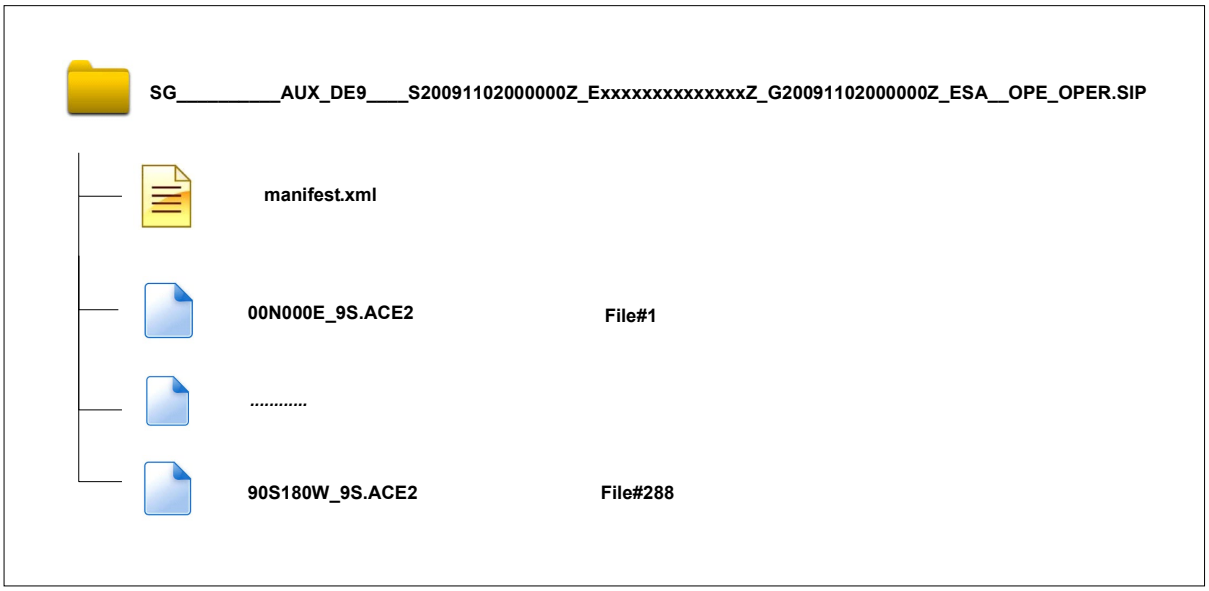
File	PGF	G/R	I/E	S/D	Source	Generation Frequency	Format of data file(s)	Filename of data file(s)	Auxiliary Data ID (ADF-ID)	Auxiliary Data Size	Required For Local Mission (Y/N)
Snow/Ice Map (High Resolution)	VII L2 CM 3MI L2 MAP L2	N/A	E	D	NSID	1 per day	compressed HDF-EOS	MOD10A1.A2003141.h03v06.006.YYYYDDDhhmmss.hdf	_____AUX_ICHI	~1 GB	N
Map of Surface Albedo/BRDF	VII L2 CM 3MI L2 MAP L2	N/A	E	D	LPDA	Every 16 days	HDF-EOS	MCD43A1.A2006153.h13v09.006.YYYYDDDhhmmss.hdf	_____AUX_LSA_	~25.8 GB	Y**
Map of Surface Emissivity	VII L2 CM MAP L2	N/A	E	D	LPDA	Every 8 days	compressed HDF-EOS	MOD11C2.A2007249.006.YYYYDDDhhmmss.hdf	_____AUX_EMI_	86 MB	Y**
LER Database	S5 L2 MAP L2	N/A	I	S	CALV (GOME-2)	Infrequently	NetCDF-4	e.g. GOME-2_MetOp-AB_MSC_025x025_surface_LER_v3.1.nc	_____AUX_LER_	2.2 GB	N
CAMS global delayed-mode analysis and forecast	3MI L2 MAP L2 S5 L2	N/A	E	D	ECMW	Every 24h (16 files / snapshots per time)	GRIB	z_cams_c_ecmf_20090629000000_prod_df_033.grib	_____AUX_CAMD_	200 MB	N

* The auxiliary data item is generated by this PGF in output.

** Only required for local mission by VII L2 CM.

4.2 Common Auxiliary Data File Detailed Format

This section describes the detailed content of each auxiliary data file listed in Table 13, including format of the internal Data File(s) part of the SIP Package.



4.2.1 ACE-2 Digital Elevation Model (30 arc-seconds)

4.2.1.1 Purpose and description

The Altimeter Corrected Elevations (ACE) global Digital Elevation Model (DEM) provides surface elevations at 30'' spatial resolution.
It is composed of a set of 288 files at 30'' resolution, each one associated to one tile of 15° x 15° of the Earth Surface. The DEM gives the height of the Earth surface above the ellipsoid, that will be used for geo-location and/or co-registration purposes in the L1 and L2 processing chains, to provide the geodetic latitude and the longitude both ortho-rectified from the DEM (the model used is ACE-2).

4.2.1.2 Auxiliary Data Summary Sheet

Name	ACE-2 Digital Elevation Model (30 arc-seconds)
Description	Provides surface elevations at 30'' spatial resolution
Example of Filename	SG_____AUX_DE30___S20091102000000Z_Exxxxxxxxxxxxxx_G20091102000000Z_ESA__OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_DE30
Source	ESA_.
Members	288 files (288 tiles of 30" resolution (height dataset)
Example of	45S015E_30S.ACE2

internal filename	
Format of internal file (data file)	Binary [ACE-2] (little-endian byte order, 32 bits per sample)
Auxiliary Data Size (MB)	1.74 GB
Generation Frequency	Infrequently
Validity	Entire mission

4.2.1.3 Format

The physical structure and data file components of the ACE-2 Digital Elevation Model (30 arc-seconds) file is shown in Figure 3. It is composed of a manifest file in XML format and 288 binary files.

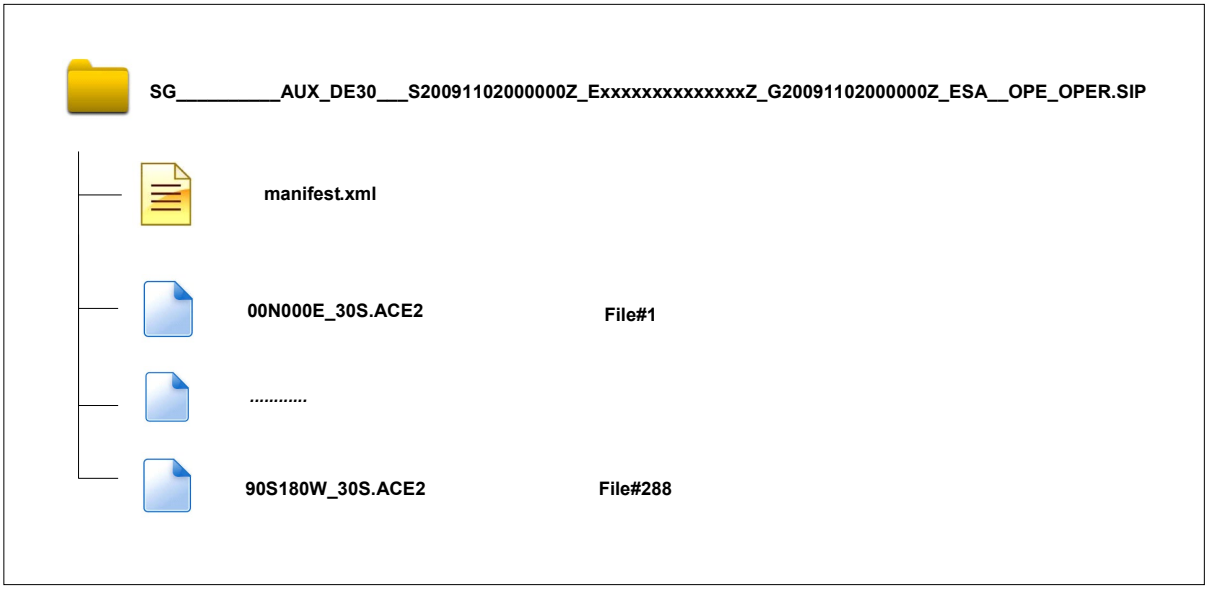


Figure 3 – Structure of ACE-2 Digital Elevation Model (30 arc-seconds)

4.2.1.4 Format of Data Files

The format of these data files are fully described in [ACE-2].
The ACE-2 product comprises of a Height dataset, a Source dataset, an Accuracy dataset and a Confidence dataset. Only the height dataset of the ACE-2 product is relevant for EPS-SG, and included in the SIP file.

To Facilitate Distribution the ACE-2 height dataset have been divided into 288 smaller pieces, or tiles for each dataset. The area from 90 degrees south latitude to 90 degrees north latitude and 180 degrees west longitude to 180 degrees east latitude is covered by 288 tiles (for each dataset), with each tile covering 15 degrees of latitude and 15 degrees of longitude. The tiles names refer to the latitude and

longitude of the South West (lower left) corner of the tile. For example, the coordinates of the lower left corner of tile 45S015E_ace2.bin are 45 degrees south latitude and 15 degrees east longitude.
The height DEM is provided as 4 byte little endian (i.e. least significant byte first) float data in a simple binary raster. There are no header or trailer bytes imbedded in any of the files. The data are stored in row major order (all the data for row 1, followed by all the data for row 2, etc.). Each ACE-2 file is made up of 1800 rows and 1800 columns and contains one spectral band for the height values. In order to ensure that the data is as familiar as possible to users the SRTM (DTED) convention has been followed, so the first row is the northern most data and the last row is the southern most data. So using the previous example 45S014E, the top edge of the first row corresponds to 30°S and the bottom edge of the last row corresponds to 45°S.

In the height files the value used for masking (i.e. land/sea mask) is set to -500 and the value for voids in the SRTM that are unable to be corrected are set to -32768.

4.2.2 Raster Digital Elevation Model (9 arc-seconds)

4.2.2.1 Purpose and description

The Digital Elevation Model (DEM) in raster structure provides surface elevations at 9'' spatial resolution.
It is composed of a set of 288 binary files at 9'' resolution, assuming that the DEM covers globally the Earth surface and each file covers 15 x 15 degrees.
The binary files are associated to two configuration files, in xml format, that will be used to be ingested in EO-CFI software.
The DEM configuration file is described in [R-DEM1] and the DEM raster configuration file is described in [R-DEM2].

4.2.2.2 Auxiliary Data Summary Sheet

Name	Raster Digital Elevation Model (9 arc-seconds)
Description	Provides surface elevations at 9'' spatial resolution
Example of Filename	SG_____AUX_RD09___S20091102000000Z_Exxxxxxxxxxxxxx Z_G20091102000000Z_CALV_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_RD09
Source	CALV
Members	291
Example of internal filename	45S045W MA1_OPER_INT_DEMCFG_00000000T000000_99999999T999999_0001.EOF dem_raster_configuration_file.xml TERMS_OF_USE.TXT
Format of internal file (data file)	Binary [Raster] (little-endian byte order, 16 bits per sample – int16 -) (288 files) XML (2 files) ASCII (1 file)
Auxiliary Data Size (MB)	20.7 GB (288 member files, 72 MB per file)
Generation	Infrequently

Frequency	
Validity	Entire mission

4.2.2.3 Format

The physical structure and data file components of the Raster Digital Elevation Model (9 arc-seconds) file is shown in Figure 4. It is composed of a manifest file in XML format and the following files:

- 288 DEM tiles (e.g. 45S045W) (see [R-DEM2])
- 1 DEM configuration file (see [R-DEM1]) with extension .EOF (e.g. MA1_OPER_INT_DEMCFG_00000000T000000_99999999T999999_0001.EOF).
- 1 DEM Raster configuration file (dem_raster_configuration_file.xml) (see [R-DEM2])
- 1 plain text file (TERMS_OF_USE.TXT)

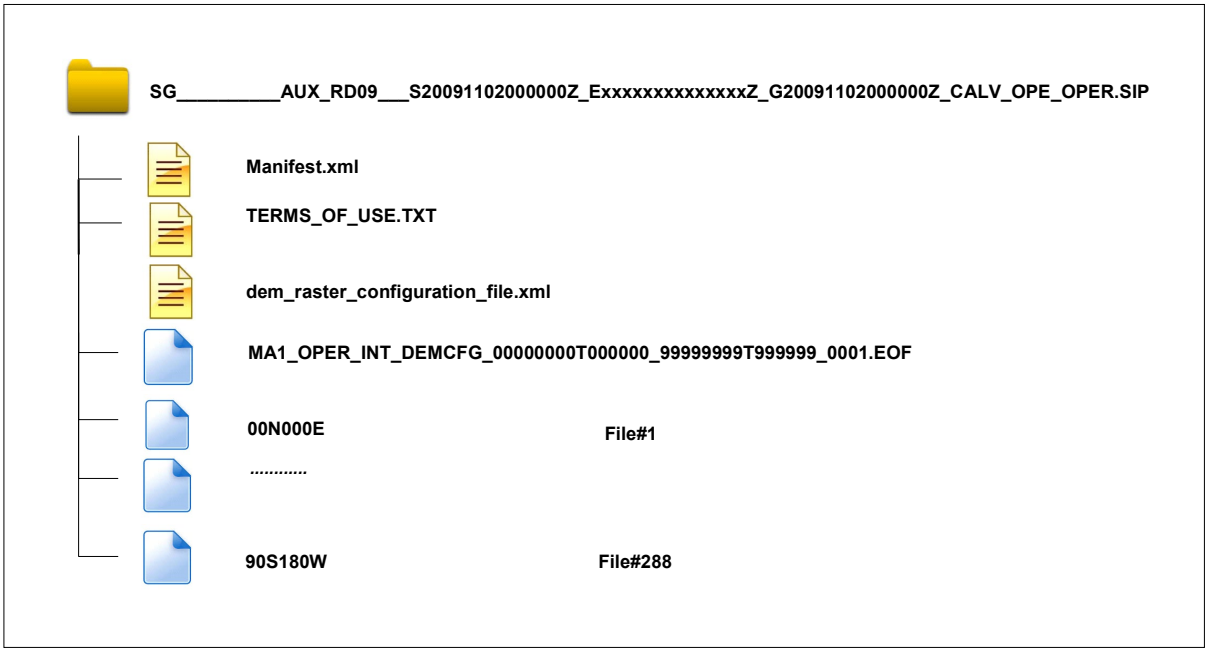


Figure 4 – Structure of Raster Digital Elevation Model (9 arc-seconds)

4.2.2.4 Format of Data Files

The format of these data files are fully described in [R-DEM1] and [R-DEM2].

4.2.3 Raster Digital Elevation Model (15 arc-seconds)

4.2.3.1 Purpose and description

The Digital Elevation Model (DEM) in raster structure provides surface elevations at 15'' spatial resolution.
It is composed of a set of 288 binary files at 15'' resolution, assuming that the DEM covers globally the Earth surface and each file covers 15 x 15 degrees.
The binary files are associated to two configuration files, in xml format, that will be used to be ingested in EO-CFI software.
The DEM configuration file is described in [R-DEM1] and the DEM raster configuration file is described in [R-DEM2].

4.2.3.2 Auxiliary Data Summary Sheet

Name	Raster Digital Elevation Model (15 arc-seconds)
Description	Provides surface elevations at 15'' spatial resolution
Example of Filename	SG_____AUX_RD15___S20091102000000Z_Exxxxxxxxxxxxxx Z_G20091102000000Z_CALV_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_RD15
Source	CALV
Members	291 files
Example of internal filename	45S045W MA1_OPER_INT_DEMCFG_00000000T000000_99999999T999999_0001.EOF dem_raster_configuration_file.xml TERMS_OF_USE.TXT
Format of internal file (data file)	Binary [Raster] (little-endian byte order, 16 bits per sample – int16 -) (288 files) XML (2 files) ASCII (1 file)
Auxiliary Data Size (MB)	7.5 GB (288 member files, 25.9 MB per file)
Generation Frequency	Infrequently
Validity	Entire mission

4.2.3.3 Format

The physical structure and data file components of the Raster Digital Elevation Model (15 arc-seconds) file is shown in Figure 5. It is composed of a manifest file in XML format and the following files:

- 288 DEM tiles (e.g. 45S045W) (see [R-DEM2])
- 1 DEM configuration file (see [R-DEM1]) with extension .EOF (e.g. MA1_OPER_INT_DEMCFG_00000000T000000_99999999T999999_0001.EOF).

- 1 DEM Raster configuration file (dem_raster_configuration_file.xml) (see [R-DEM2])
- 1 plain text file (TERMS_OF_USE.TXT)

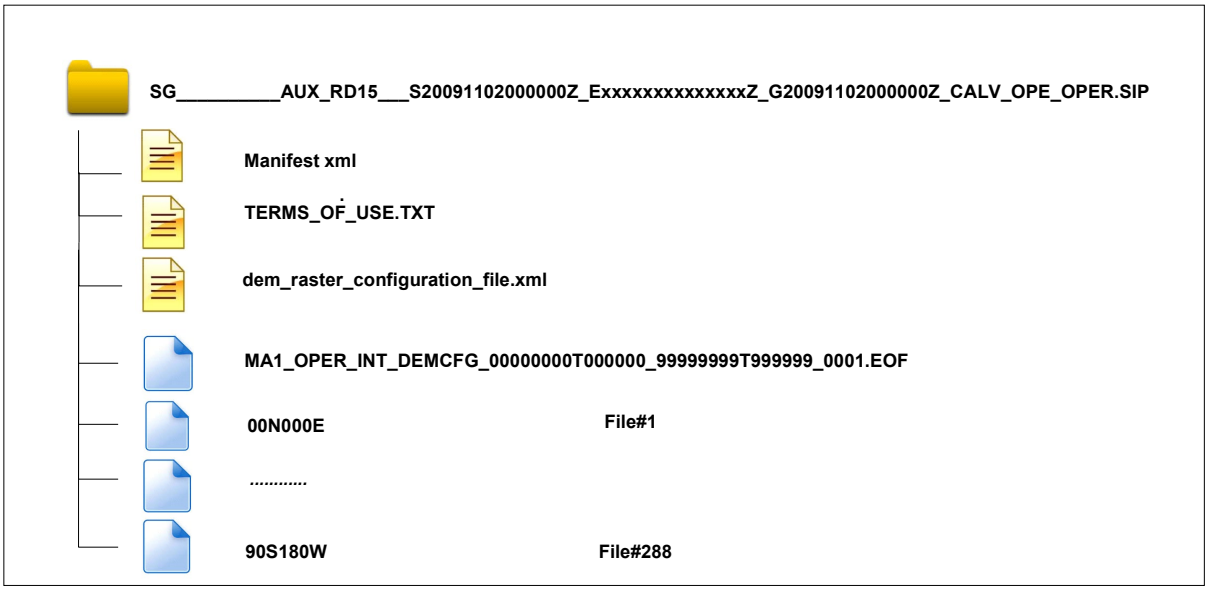


Figure 5 – Structure of Raster Digital Elevation Model (15 arc-seconds)

4.2.3.4 Format of Data Files

The format of these data files are fully described in [R-DEM1] and [R-DEM2].

4.2.4 Raster Digital Elevation Model (30 arc-seconds)

4.2.4.1 Purpose and description

The Digital Elevation Model (DEM) in raster structure provides surface elevations at 30'' spatial resolution.
It is composed of a set of 288 binary files at 30'' resolution, assuming that the DEM covers globally the Earth surface and each file covers 15 x 15 degrees.
The binary files are associated to two configuration files, in xml format, that will be used to be ingested in EO-CFI software.
The DEM configuration file is described in [R-DEM1] and the DEM raster configuration file is described in [R-DEM2].

4.2.4.2 Auxiliary Data Summary Sheet

Name	Raster Digital Elevation Model (30 arc-seconds)
Description	Provides surface elevations at 30'' spatial resolution
Example of Filename	SG_____AUX_RD30___S20091102000000Z_Exxxxxxxxxxxxxx Z_G20091102000000Z_CALV_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_RD30
Source	CALV
Members	291 files
Example of internal filename	45S045W MA1_OPER_INT_DEMCFG_00000000T000000_99999999T999999_0001.EOF dem_raster_configuration_file.xml TERMS_OF_USE.TXT
Format of internal file (data file)	Binary [Raster] (little-endian byte order, 16 bits per sample – int16 -) (288 files) XML (2 files) ASCII (1 file)
Auxiliary Data Size (MB)	1.86 GB (288 member files, 6.48 MB per file)
Generation Frequency	Infrequently
Validity	Entire mission

4.2.4.3 Format

The physical structure and data file components of the Raster Digital Elevation Model (30 arc-seconds) file is shown in Figure 6. It is composed of a manifest file in XML format and the following files.

- 288 DEM tiles (e.g. 45S045W) (see [R-DEM2])
- 1 DEM configuration file (see [R-DEM1]) with extension .EOF (e.g. MA1_OPER_INT_DEMCFG_00000000T000000_99999999T999999_0001.EOF).

- 1 DEM Raster configuration file (dem_raster_configuration_file.xml) (see [R-DEM2])
- 1 plain text file (TERMS_OF_USE.TXT).

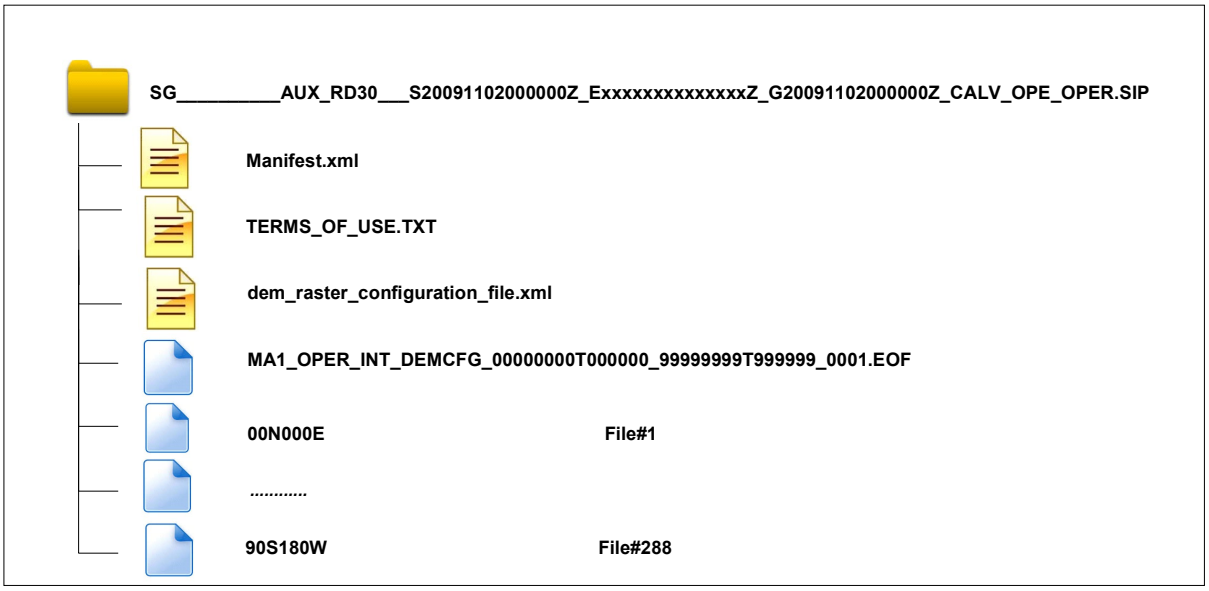


Figure 6 – Structure of Raster Digital Elevation Model (30 arc-seconds)

4.2.4.4 Format of Data Files

The format of these data files are fully described in [R-DEM1] and [R-DEM2].

4.2.5 Land-Sea Mask File

4.2.5.1 Purpose and description

The Land-Sea Mask File is obtained from the MODIS Land Cover Type (MCD12Q1) Version 6 product, that provides data characterizing five global land cover classification systems (Land/Sea or Coastline, land ice or lakes). In addition, it provides a land-cover type assessment and quality-control information. The land cover properties are derived from observations spanning a year's input of Terra- and Aqua-MODIS data.

4.2.5.2 Auxiliary Data Summary Sheet

Name	Land-Sea Mask File
Description	Provides data characterizing five global land cover classification systems (Land/Sea or Coastline, land ice or lakes)
Example of Filename	SG_____AUX_LSM____S20091102000000Z_Exxxxxxxxxxxxxx Z_G20091102000000Z_LPDA_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_LSM_
Source	LPDA
Members	315
Example of internal filename	MCD12Q1.A2013001.h00v08.006.YYYYDDDhhmmss.hdf
Format of internal file (data file)	HDF-EOS [LSM-LPDAAC] (8-bit unsigned integer)
Auxiliary Data Size	~1.6 GB (315 tiles <18 MB each). The size refers to the yearly coverage. The size of each tile depends on the cover type.
Generation Frequency	1 per year
Validity	Entire mission

4.2.5.3 Format

The physical structure and data file components of the Land-Sea Mask File is shown in Figure 7. It is composed of a manifest file in XML format and 315 files.

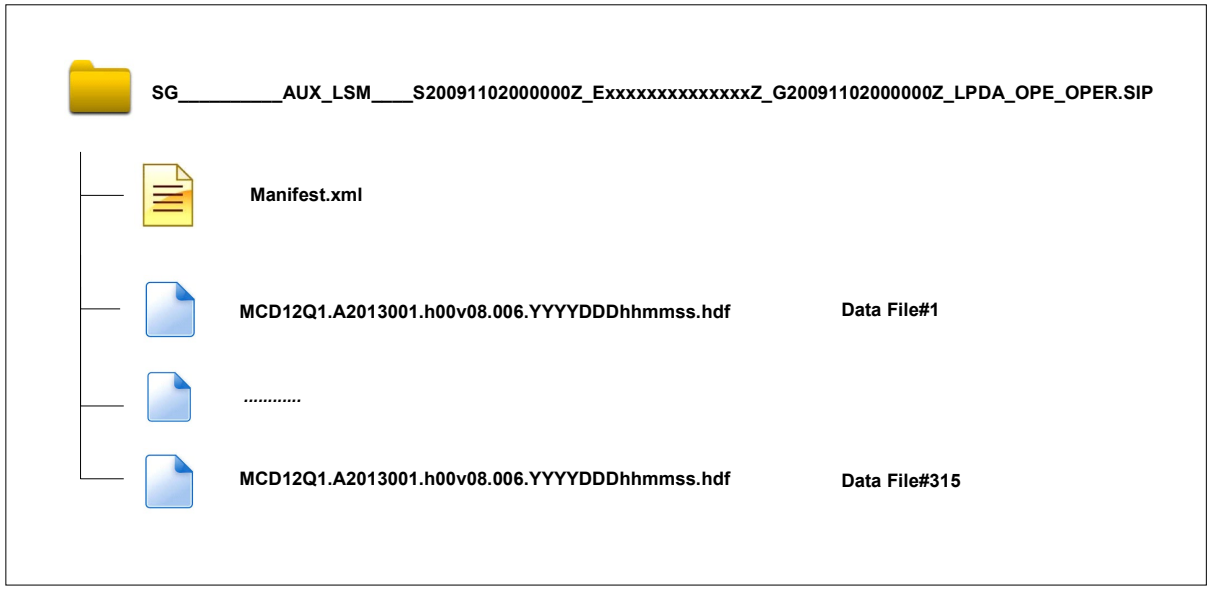


Figure 7 – Structure of Land-Sea Mask File

4.2.5.4 Format of Data Files

The format of this file is fully described in [LSM-LPDAAC].

The MODIS Land Cover Type Product (MCD12Q1) supplies global maps of land cover at Annual time steps and 500 m spatial resolution for 2001 to present.

The product contains five classification schemes, which describe land cover properties derived from observations spanning a year's input of Terra- and Aqua-MODIS data. The primary land cover scheme identifies 17 land cover classes defined by the International Geosphere Biosphere Programme (IGBP), which includes 11 natural vegetation classes, 3 developed and mosaicked land classes, and three non-vegetated land classes.

The MODIS Terra + Aqua Land Cover Type Yearly L3 Global 500 m SIN Grid product incorporates five different land cover classification schemes, derived through a supervised decision-tree classification method:

- Land Cover Type 1: IGBP global vegetation classification scheme
- Land Cover Type 2: University of Maryland (UMD) scheme
- Land Cover Type 3: MODIS-derived LAI/fPAR scheme
- Land Cover Type 4: MODIS-derived Net Primary Production (NPP) scheme
- Land Cover Type 5: Plant Functional Type (PFT) scheme

The MCD12Q1data are provided as tiles that are approximately 10° x 10° at the Equator using a Sinusoidal grid in HDF4 file format. MCD12C1 data are provided as a global mosaic in geographic lat/long projection also in HDF4 file format.

The Data Set characteristics are described in Table 14.

Table 14 – Land-Sea Mask File – Dataset Characteristics

Collection

Characteristic	Description
Collection	Combined MODIS
DOI	10.5067/MODIS/MCD12Q1.006
File Size	~68 MB
Temporal Resolution	Yearly
Temporal Extent	2001-01-01 to 2018-12-31
Spatial Extent	Global
Coordinate System	Sinusoidal
Datum	N/A
File Format	HDF-EOS
Geographic Dimensions	1200 km x 1200 km

Granule

Characteristic	Description
Number of Science Dataset (SDS) Layers	13
Columns/Rows	2400 x 2400
Pixel Size	500 m

4.2.1 NWP Forecast Data

4.2.1.1 Purpose and description

The NWP Forecast Data contains meteo information obtained from ECMWF *Forecast data*. The meteorological parameters retrieved from ECMWF files are organized in one single dissemination file, including parameters in both GRIB-1 and GRIB-2 Format.

The list of parameters used for processing is provided in Table 15.

4.2.1.2 Auxiliary Data Summary Sheet

Name	NWP Forecast Data
Description	Contains forecast meteorological parameters from ECMWF Set I (Atmospheric Model high resolution 10-day forecast –HRES-)
Example of Filename	SG_____AUX_NWP____S20070912030000Z_E20070912030000Z_G20070912054500Z_ECMW_OPE_OPER_R20070912000000Z.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_NWP_
Source	ECMW
Members	1
Example of internal filename	ESS09120000091203001 Filenaming convention:

	<ccSMMDDHHIImmddhhiiE> cc: Dissemination stream name S: Data stream indicator MMDDHHII: Time of the run of the model: MM: Month DD: Day HHII: Hours and Minutes mmddhhii: Time at which the product is valid: mm: Month dd: Day hhii: Hours and Minutes E: Version
Format of internal file (data block)	GRIB [ECMWF]
Auxiliary Data Size	~13 GB
Generation Frequency	Every 6 h (12 files/snapshots per time)
Validity	Validity time of the NWP Forecast Data files is as follows (see Figure 9): • validity start: Time at which the product is valid (snapshot time) • validity stop: Time at which the product is valid (snapshot time) • validity duration: N/A
FreeText	Filled with the "Time of the run of the model". Format: "RYYYYMMDDhhmmssZ", where: • 1 uppercase r: "R" (indicates the "Run of the model"); • 4 char., year ("YYYY") corresponding to the current year. • 8 char., month, day, hour and minutes ("MMDDhhmm") corresponding with the "MMDDHHII" of the filename convention of the original NWP file; • 2 char, minutes and seconds ("ss") is filled with "00"; • 1 uppercase z: "Z".

4.2.1.3 Format

The physical structure of the NWP Forecast Data is shown in Figure 8. It is composed of XML manifest (header file) and 1 file containing all the parameters identified in Table 15.

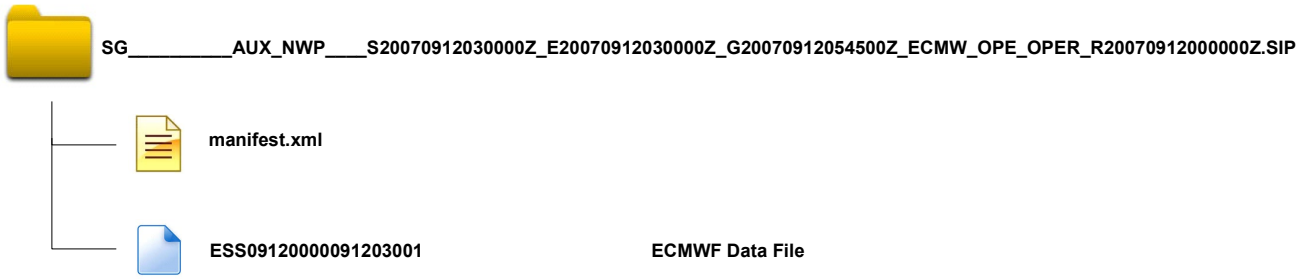


Figure 8 – Structure of NWP Forecast Data File

4.2.1.4 Format of Data Files

The format of the forecast file is fully described in [ECMWF]. The files contains 2D (single level data) parameters in GRIB1 format and 3D (model level) parameters in GRIB-2 format. At model level the current number of levels is 137, but it is changed during the time (in the past only 91 levels were available) and could change in future. The data are provided on model (Octahedral) O1280 grid.

The list of parameters used for Single level and Model Level is provided in Table 15.

Table 15 – EPS-SG ECMWF Data –Forecast Parameters list needed by the PGFs

Short name	Long name	Description	Unit	Parameter Code	2D (Single Level Data)/ 3D (Model Level Data)	3MI L2 PGF	IASI-NG L2 PGF	MWI-ICI L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	MAP L2 PGF	S5 L2 OP	RO (Offline)	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
	Latitude and Longitude of the Forecast Grid Points			N/A	N/A	X	X	X	X	X	X	X			
LNSP	Logarithm of Surface Pressure			152	3D			X					X		X
10U	10 Metre U-velocity		$m\ s^{-1}$	165	2D		X	X				X		X	
10V	10 Metre V-velocity		$m\ s^{-1}$	166	2D		X	X				X		X	
2T	2m Temperature		K	167	2D	X	X	X	X	X	X			X	

Short name	Long name	Description	Unit	Parameter Code	2D (Single Level Data)/ 3D (Model Level Data)	3MI L2 PGF	IASI-NG L2 PGF	MWI-ICI L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	MAP L2 PGF	S5 L2 OP	RO (Offline)	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
2D	2m Dewpoint Temperature		K	168	2D	X	X	X	X	X	X			X	
MSL	Mean sea-level pressure		Pa	151	2D		X							X	
SKT	Skin Temperature	Temperature of the surface skin (radiative surface temperature). Before 01/10/2008 the skin temperature as equal to the bulk SST over the ocean.	K	235	2D	X	X	X	X	X	X			X	
SP	Surface Pressure		Pa	134	2D	X	X		X	X	X	X		X	
TCWV	Total Column Water Vapour	Vertically integrated water vapour	kg m^{-2}	137	2D		X		X					X	
O3	Ozone Mass Mixing Ratio		kg kg^{-1}	203	3D	X	X		X	X	X				X
T	Temperature		K	130	3D	X	X	X	X	X	X	X	X		X
Q	Specific Humidity	Grid box mean (mass of water vapour / mass of moist air)	kg kg^{-1}	133	3D	X	X	X	X	X	X	X	X		X
CLWC	Specific Cloud Liquid Water Content	Grid-box mean specific cloud liquid water content (mass of condensate / mass of moist air)	kg kg^{-1}	246	3D		X	X							X

Short name	Long name	Description	Unit	Parameter Code	2D (Single Level Data)/ 3D (Model Level Data)	3MI L2 PGF	IASI-NG L2 PGF	MWI-ICI L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	MAP L2 PGF	S5 L2 OP	RO (Offline)	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
CIWC	Specific Cloud Ice Water Content	Grid-box mean specific cloud ice water content (mass of condensate / mass of moist air)	kg kg^{-1}	247	3D		X	X							X
CRWC	Specific Rain Water	Grid-box mean specific precipitating rain water content from stratiform cloud (mass of condensate / mass of moist air).	kg kg^{-1}	75	3D			X							X
CSWC	Specific Snow Water	Grid-box mean specific snow water content (representing aggregated ice particles) from stratiform cloud (mass of condensate / mass of moist air).	kg kg^{-1}	76	3D			X							X
U	U-velocity		m s^{-1}	131	3D	X			X	X	X				X
V	V-velocity		m s^{-1}	132	3D	X			X	X	X				X
CC	Cloud Cover	Horizontal fraction of the grid box covered by cloud	0-1	248	3D			X							X
TCO3	Total column Ozone	Vertically integrated ozone. Before 20010612 was in Dobsons. 1 Dobson = 2.1415E-5 kg m**-2.	kg m-2	206	2D							X		X	
SD	Snow depth		m of	141	2D			X				X		X	

Short name	Long name	Description	Unit	Parameter Code	2D (Single Level Data)/ 3D (Model Level Data)	3MI L2 PGF	IASI-NG L2 PGF	MWI-ICI L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	MAP L2 PGF	S5 L2 OP	RO (Offline)	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
			water equival ent												
CI	Sea Ice Cover / Sea Ice Area Fraction	Fraction of grid box that is covered with sea ice (kept constant during forecast)	(0-1)	31	2D			X				X		X	
RSN	Snow density	Snow mass per unit of volume	Kg m-3	33	3D							X		X	

The ECMWF forecast data files will be delivered at hourly steps (1,2,3…90) four times per day (from the four run of the model at 00, 06, 12 and 18 UTC), and delivered respectively at 5:45 UTC, 11.45 UTC, 17.45 UTC and 23.45 UTC separated by few minutes, as shown in Figure 9.

The ECMWF dissemination schedule is available between 5.40 h and 6.12 h after the run of the model time.

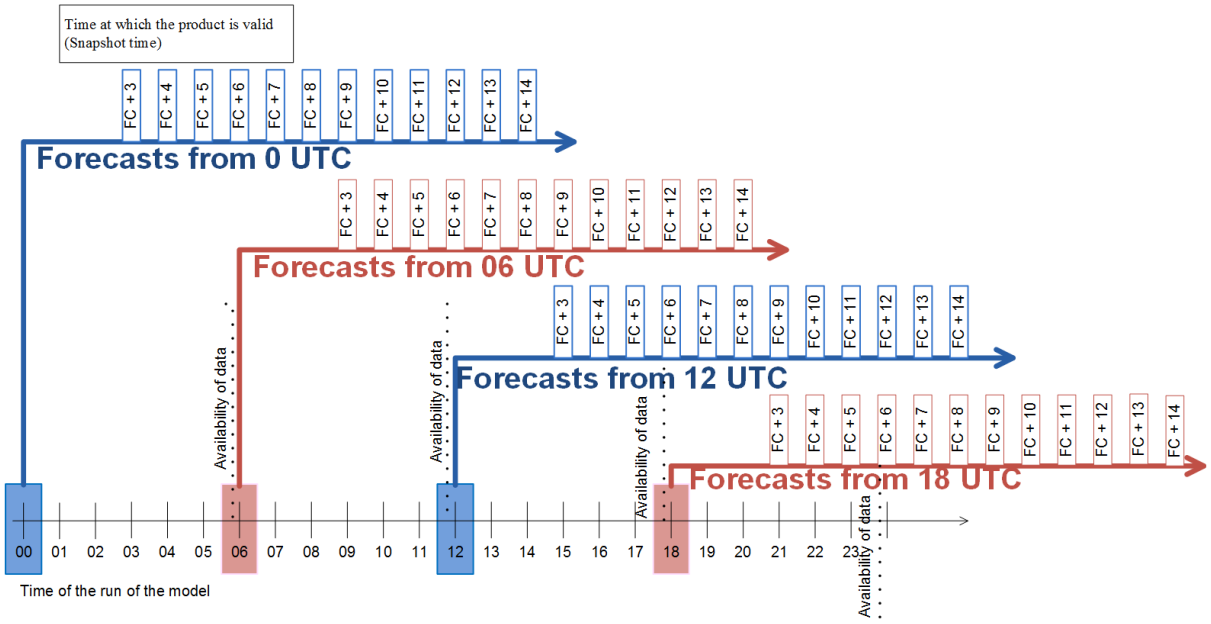


Figure 9 – ECMWF Forecast Dissemination System Configuration

4.2.2 NWP Analysis Data

4.2.2.1 Purpose and description

The NWP Analysis Data contains meteo information obtained from ECMWF *Analysis data*. The meteorological parameters retrieved from ECMWF files are organized in one single dissemination file containing parameters in GRIB-1 Format.

The list of parameters used for processing is provided in Table 16.

4.2.2.2 Auxiliary Data Summary Sheet

Name	NWP Analysis Data
Description	Contains analysis meteorological parameters from ECMWF Set I (Atmospheric Model high resolution 10-day forecast –HRES-)
Example of Filename	SG_____AUX_NWPA___S20090518120000Z_E20090518120000Z_G20090518174500Z_ECMW_OPE_OPER_R20090518120000Z.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_NWPA
Source	ECMW
Members	1
Example of internal filename	ESD05181200051812001 Filenaming convention: <ccSMMDDHHIImmddhhiiE> cc: Dissemination stream name S: Data stream indicator MMDDHHII: Time of the run of the model: MM: Month DD: Day HHII: Hours and Minutes mmddhhii: Time at which the product is valid: mm: Month dd: Day hhii: Hours and Minutes E: Version
Format of internal file (data block)	GRIB [ECMWF]
Auxiliary Data Size	~26 MB
Generation Frequency	Every 12 hours
Validity	Validity time of the NWP Analysis Data files is as follows (see Figure 9): • validity start: Time at which the product is valid • validity stop: Time at which the product is valid

	• validity duration: N/A
FreeText	Filled with the "Time of the run of the model". Format: "RYYYYMMDDhhmmssZ", where: • 1 uppercase r: "R" (indicates the "Run of the model"); • 4 char., year ("YYYY") corresponding to the current year. • 8 char., month, day, hour and minutes ("MMDDhhmm") corresponding with the "MMDDHHII" of the filename convention of the original NWP file; • 2 char, minutes and seconds ("ss") is filled with "00"; • 1 uppercase z: "Z".

4.2.2.3 **Format**

The physical structure of the NWP Analysis Data is shown in Figure 10. It is composed of XML manifest (header file) and 1 file containing all the parameters identified in Table 16.

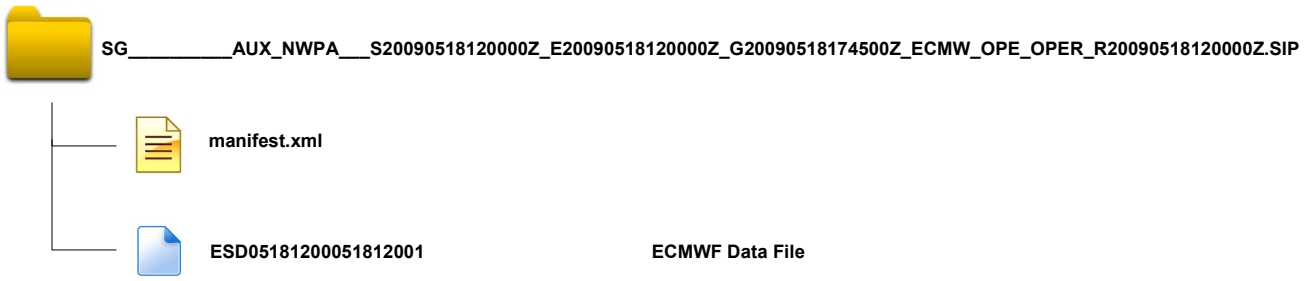


Figure 10 – Structure of NWP Analysis Data File

4.2.2.4 Format of Data Files

The format of the forecast file is fully described in [ECMWF]. The file includes meteorological parameters in GRIB-1 format. The data are provided on model (Octahedral) O1280 grid.

The list of parameters used is provided in Table 16.

Table 16 – EPS-SG ECMWF Data –Analysis Parameters list needed by the PGFs

Short name	Long name	Description	Unit	Parameter Code	2D (Single Level Data)/ 3D (Model Level Data)	3MI L2 PGF	IASI-NG L2 PGF	MWI-ICI L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	MAP L2 PGF	S5 L2 OP	RO (Offline)	SINGLE LEVEL – ANALYSIS – GRIB-1
LSM	land/sea mask	Fractional land cover at grid points	(0 - 1)	172	2D			X	X	X				X
Z	Geopotential		$m^2 s^{-2}$	129	2D			X	X			X	X	X

The model is run 4 times per day at 0 UTC, 6 UTC, 12 UTC and 18 UTC. For EPS-SG, only the ECMWF analysis data files corresponding to the model run at 12UTC that is available and delivered approximately at 17:40 UTC, and the file corresponding to model run 00 UTC that is available and delivered approximately at 5:40 UTC, as shown in Figure 11.

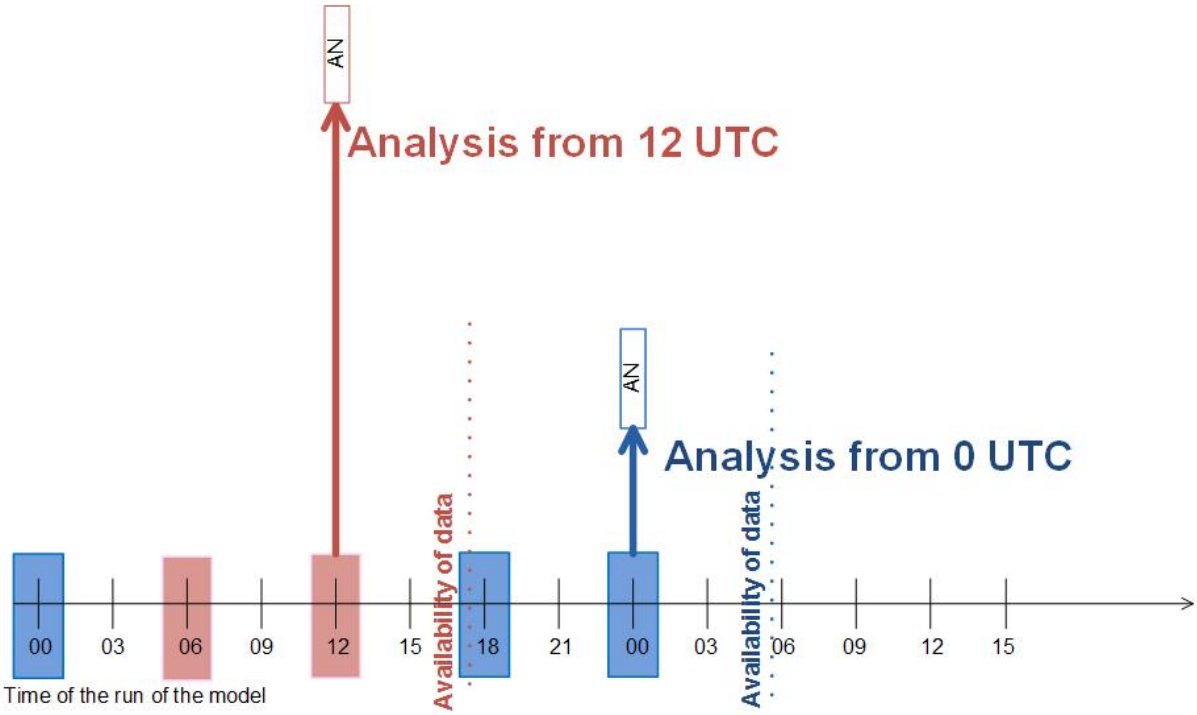


Figure 11 – ECMWF Analysis Dissemination System Configuration

4.2.3 CAMS Forecast Data

4.2.3.1 Purpose and description

The CAMS Forecast Data provide the atmospheric aerosol information required by several EPS-SG processor (i.e., VII L2 CM, VII L2, S5,…). The atmospheric parameters are organized in one single dissemination file, including parameters in both GRIB-1 and GRIB-2 Format.

4.2.3.2 Auxiliary Data Summary Sheet

Name	CAMS Forecast Data
Description	Atmospheric parameters from CAMS
Example of filename	SG_____AUX_CAMF___S20090630060000Z_E20090630060000Z_G20090630100000Z_ECMW_OPE_OPER_R20090630000000Z.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_CAMF
Source	ECMW
Members	1 (global coverage)
Example of internal filename	z_cams_c_ecmf_20090630000000_prod_fc_006.grib Filenaming convention: < z_cams_c_ecmf_yyyymmddhhmmss_vvvv_tt_sss > • ecmf: WMO location indicators • yyyymmddhhmmss: base date and time of the forecast • vvvv: version or experiment identifier: *prod* will be used for operational products, *test* (or experiment ID) will be used for testing purposes, *rean* for reanalysis if needed • tt: type of data, fc - forecast, an - analysis • sss: forecast hour time step. For accumulation and averages, it is the end time. This number must be zero padded to 3 digits, e.g. step 24 is given as 024
Format of internal file (data file)	GRIB
Auxiliary Data Size	~1.4 GB
Generation Frequency	Every 12 h (8 files/snapshots per time)

Validity	Validity time of the CAMS Forecast Data files is as follows (see Figure 13): • validity start: Time at which the product is valid (snapshot time) • validity stop: Time at which the product is valid (snapshot time) • validity duration: N/A
FreeText	Filled with the "Time of the run of the model". Format: "RYYYYMMDDhhmmssZ", where: • 1 uppercase r: "R" (indicates the "Run of the model"); • 4 char., year ("YYYY") corresponding to the current year. • 8 char., month, day, hour and minutes ("MMDDhhmm") corresponding with the "MMDDHHII" of the filename convention of the original CAMS file; • 2 char, minutes and seconds ("ss") is filled with "00"; • 1 uppercase z: "Z".

4.2.3.3 **Format**

The CAMS Forecast Data is composed of a XML header file and one internal file in GRIB format.

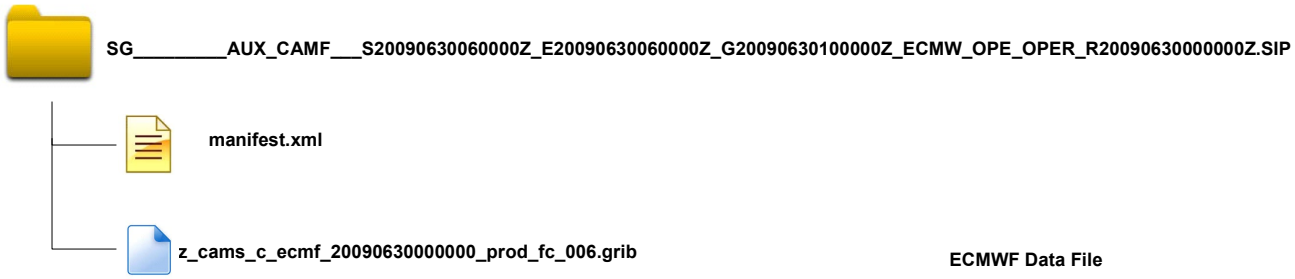


Figure 12 – Structure of CAMS Forecast Data File

4.2.3.4 Format of Data Files

The format of the forecast file is fully described in [CAMSreanalysis]
The list of parameters used for is provided in Table 17. The horizontal resolution is on model (Reduced Gaussian) TL511. The number of levels for mode level parameters is 60.

Table 17– EPS-SG CAMS forecast data – Parameters list needed by the PGFs

Short name	Long name	Description	Unit	Parameter Code	3MI L2 PGF	MAP L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	S5 L2 OP	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
	Latitude and Longitude of the Forecast Grid Points				X	X	X	X	X		
gtco3	GEMS Total column ozone		kg m-2	210206					X	X	
go3	GEMS Ozone		kg kg-1	210203					X		X
no2	Nitrogen dioxide		kg kg-1	210121	X	X			X		X
so2	Sulphur dioxide		kg kg-1	210122					X		X
hcho	Formaldehyde		kg kg-1	210124					X		X
	Glyoxal	TBD	kg kg-1	TBD					X		X

Short name	Long name	Description	Unit	Parameter Code	3MI L2 PGF	MAP L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	S5 L2 OP	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
co	Carbon monoxide		kg kg-1	210123					X		X
aerext355	Aerosol extinction coefficient at 355 nm +		m-1	215180					X		X
ssa355	Single scattering albedo at 355 nm +		(0 – 1)	215133					X		X
q	Specific humidity +		kg kg-1	133					X		X
t	Temperature +		K	130					X		X
aod469	Total Aerosol Optical Depth at 469nm			210213	X	X				X	

Short name	Long name	Description	Unit	Parameter Code	3MI L2 PGF	MAP L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	S5 L2 OP	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
aod550	Total Aerosol Optical Depth at 550nm			210207	X	X	X	X		X	
aod670	Total Aerosol Optical Depth at 670nm			210214	X	X				X	
aod865	Total Aerosol Optical Depth at 865nm			210215	X	X				X	
aod1240	Total Aerosol Optical Depth at 1240nm			210216	X	X				X	
aermr01	Sea Salt Aerosol (0.03 - 0.5 um) Mixing Ratio		kg kg-1	210001	X	X	X	X			X
aermr02	Sea Salt Aerosol (0.5 - 5 um) Mixing Ratio		kg kg-1	210002	X	X	X	X			X
aermr03	Sea Salt Aerosol (5 - 20 um) Mixing Ratio		kg kg-1	210003	X	X	X	X			X
aermr04	Dust Aerosol (0.03 - 0.55 um) Mixing Ratio		kg kg-1	210004	X	X	X	X			X
aermr05	Dust Aerosol (0.55 - 0.9 um) Mixing Ratio		kg kg-1	210005	X	X	X	X			X

Short name	Long name	Description	Unit	Parameter Code	3MI L2 PGF	MAP L2 PGF	VII L2 Cloud Mask PGF	VII L2 PGF	S5 L2 OP	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
aermr06	Dust Aerosol (0.9 - 20 um) Mixing Ratio		kg kg-1	210006	X	X	X	X			X
aermr07	Hydrophilic Organic Matter Aerosol Mixing Ratio		kg kg-1	210007	X	X	X	X			X
aermr08	Hydrophobic Organic Matter Aerosol Mixing Ratio		kg kg-1	210008	X	X	X	X			X
aermr09	Hydrophilic Black Carbon Aerosol Mixing Ratio		kg kg-1	210009	X	X	X	X			X
aermr10	Hydrophobic Black Carbon Aerosol Mixing Ratio		kg kg-1	210010	X	X	X	X			X
aermr11	Sulphate Aerosol Mixing Ratio		kg kg-1	210011	X	X	X	X			X
lnsp	Logarithm of surface pressure			152	X	X			X		X

The CAMS data files will be delivered at steps 6, 9, 12, 15, 18, 21, 24, 27 twice a day (from the two analysis cycles at 00 and 12 UTC), as shown in Figure 13.
The CAMS dissemination schedule is as per ECMWF; it is available 10 h after the run model time.

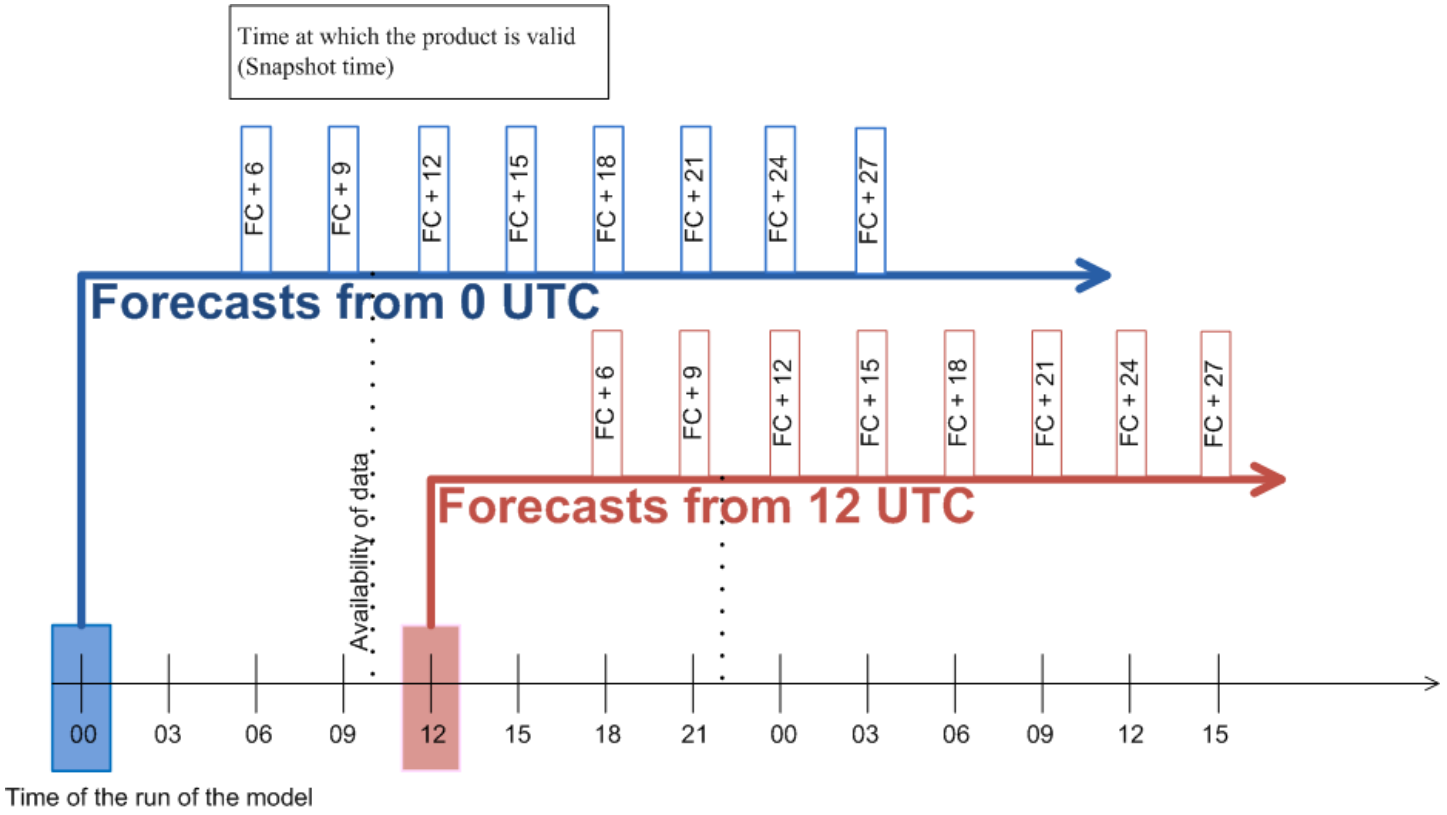


Figure 13– CAMS Dissemination System Configuration

4.2.4 NWP Background Error Standard Deviations

4.2.4.1 Purpose and description

This external dynamic file provides the error standard deviations of background atmospheric variables (temperature and humidity profiles).

The background error standard deviations are retrieved from ECMWF ensemble data assimilation system as model level 3-dimensional GRIB fields for the day and time required. The current number of levels is 137, but it is changed during the time (in the past only 91 levels were available) and could change in future.

The temperature and humidity profiles corresponding to these error standard deviations (i.e., the "background fields" produced by the ECMWF ensemble data assimilation system at the same time, spatial resolution and model levels) are also included. Further information is available in [COVAR].

4.2.4.2 Auxiliary Data Summary Sheet

Name	NWP Background Error Standard Deviations
Description	Dynamic error standard deviations and corresponding fields of background temperature and humidity profiles from ECMWF forecast.
Example of Filename	SG_____AUX_BESD___S20210101120000Z_E20210102000000Z_G20210102060000Z_ECMW_OPE_OPER. SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_BESD
Source	ECMW
Members	2 files
Example of internal filename	errors.grib fields.grib
Format of internal file (data block)	GRIB
Auxiliary Data Size	~1 GB
Generation Frequency	Every 12 hours
Validity	Validity start: 09h UTC validity stop: 21h UTC Validity start: 21h UTC validity stop: 09h UTC (next day)

4.2.4.3 Format

The physical structure of the NWP Background Error Standard Deviations is shown in Figure 14. It is composed of a XML header file and two internal files in GRIB format.

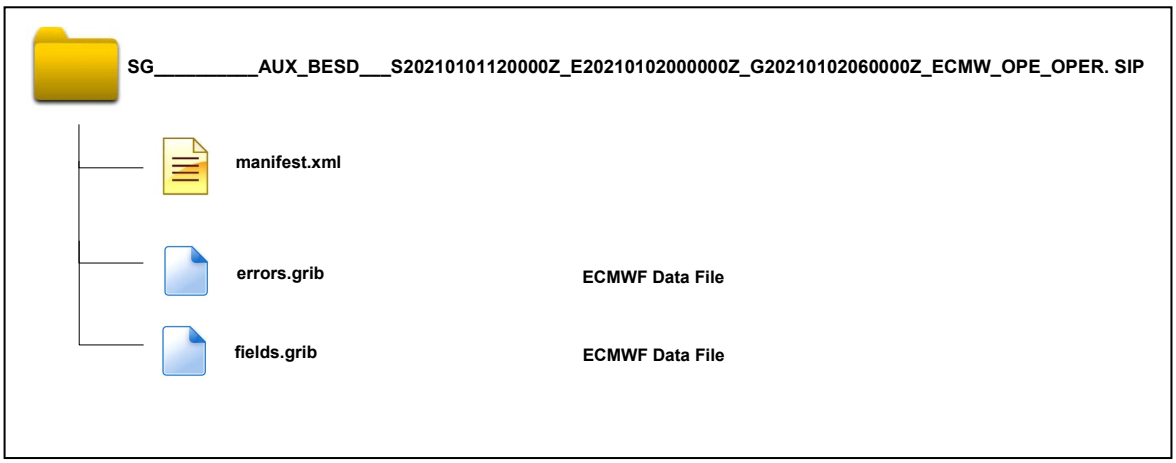


Figure 14 – Structure of NWP Background Error Standard Deviations File

4.2.4.4 Format of Data Files

Both internal files are in GRIB format. All variables contained in these 2 files are 3D GRIB fields, i.e., profiles on 137 model levels. The content of each file is as follows:

1) errors.grib: This file contains the ECMWF parameters 130 and 133 of the ELDA stream (i.e., the standard deviations of specific humidity profile in kg/kg and temperature profile in K).

2) fields.grib: The file contains the ECMWF parameters 130 and 133 of the OPER stream (i.e., the specific humidity profile in kg/kg and temperature profile in K).

The profiles and errors are provided on 137 model levels and on lat/lon grid (named 'gg' in ECMWF database) with a resolution of about 125 km. The grid is extracted from the same files (errors.grib and fields.grib), as for AUX_NWP grid.

4.2.5 NWP Error Correlation Matrices

4.2.5.1 Purpose and description

This internal static file provides the error correlation matrices of background atmospheric variables (temperature and humidity profiles) and additional background information.

The error correlation matrices are originally derived from ECMWF ensemble data assimilation statistics; each variable has a separate set of vertical error correlation matrices. The current number of levels is 137, but it is changed during the time (in the past only 91 levels were available) and could change in future. The error correlations are provided as a binary file which is only updated infrequently, following major changes in the ECMWF system (changes in vertical resolution, horizontal density of the matrices or other major upgrades; there is also an option for seasonal or more frequent updates to the correlation matrices). Further information is available in [COVAR].

The database described here is derived by converting this binary file to NetCDF format in order to reduce the size and file loading time and to wrap it with static additional information needed by the Product Generation Function (i.e., averaged values of background fields and error standard deviations produce offline), as explained in Section 4.2.10.4.

4.2.5.2 Auxiliary Data Summary Sheet

Name	NWP Error Correlation Matrices
Description	Error correlations matrices and static standard deviations and corresponding fields of background temperature and humidity profiles from ECMWF forecast.
Example of Filename	SG_____AUX_ECM____S20210101120000Z_Exxxxxxxxxxxxxx Z_G20210102060000Z_CALV_OPE_OPER. SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_ECM_
Source	CALV
Members	1 file
Example of internal filename	ecm_static_back_t_q.nc
Format of internal file (data block)	NetCDF-4
Auxiliary Data Size	~305 MB
Generation Frequency	Infrequently
Validity	Entire mission

4.2.5.3 Format

The physical structure of the NWP Error Correlation Matrices is shown in Figure 15. It is composed of a XML header file and one internal file in NetCDF format.

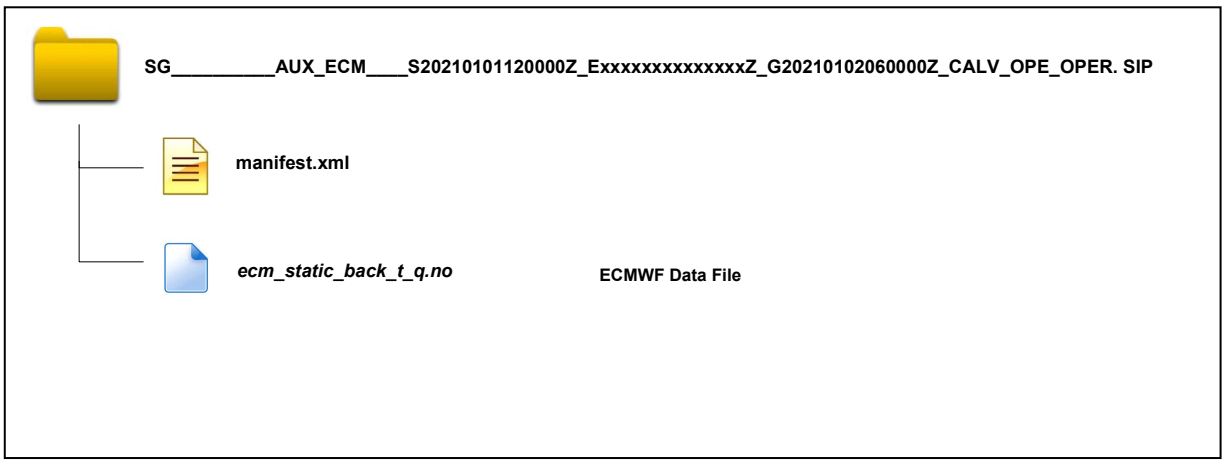


Figure 15 – Structure of NWP Error Correlation Matrices File

4.2.5.4 Format of Data Files

This section describes the detailed format of the NWP Error Correlation Matrices auxiliary data file. The NetCDF file XML description is available in section Appendix B. The NetCDF file contains global attributes and one single group of variable called “Data”.

4.2.5.5 Attributes (global)

The NetCDF file contains the following Global Attributes:

Table 18 – Global attributes for the NWP Error Correlation Matrices

Name	Type	Value
fileName	string	!--e.g. SGA_____AUX_ECM____S20210101120000Z_Exxxxxxxxxxxxxxz_G20210102060000Z_CALV_OPE_OPER.SIP--
name	string	NWP Error correlation matrices
description	string	Error correlations matrices and static standard deviations and corresponding fields of background temperature and humidity profiles from ECMWF forecast
satelliteID	string	SG__
instrumentID	string	___
processingLevel	string	__
adfType	string	AUX_ECM_
GR	string	_
validityStartDateTime	string	!--e.g. 2021-01-01T12:00:00Z--
validityEndDateTime	string	!--e.g. XXXX-XX-XXTXX:XX:XXZ--
generationDateTime	string	!--e.g. 2021-01-02T06:00:00Z--
source	string	EUMETSAT(CALV)

environment	string	OPE
class	string	OPER
documentReference	string	e.g. EUM/LEO-EPSSG/SPE/13/718291 V4
fileType	string	SIP
format	string	NetCDF-4
size	unsigned int	295MB

4.2.5.6 Data: Dimensions

The NetCDF dimensions of these arrays of the "Data" group are as follows:

Table 19 – Global dimensions for the NWP Error Correlation Matrices

Name	Length
nlev	137
ecm_grid_np_lat	32
nlev_static	54
ecm_grid_np_lon	64
npc_qprof	18
npc_tprof	28
npc_sem	8
n_chan	20

4.2.5.7 Variables (global)

The internal NetCDF file contains the following arrays in the "Data" group (Table 20):

1) Error correlation matrix of the temperature profile (on a configurable number of levels and spatial grid);
2) Error correlation matrix of the humidity profile (on a configurable number of levels and spatial grid);
3) Latitude of the grid points for the error correlation matrices;
4) Longitude of the grid points for the error correlation matrices;
5) Static background temperature profile produced offline (on a configurable number of levels and spatial grid);
6) Static background humidity profile produced offline (on a configurable number of levels and spatial grid);
7) Static background error standard deviations of the temperature profile produced offline (on a configurable number of levels and spatial grid);
8) Static background error standard deviations of the humidity profile produced offline (on a configurable number of levels and spatial grid);
9) Latitude of the grid points for the static background parameters;
10) Longitude of the grid points for the static background parameters.
11) Global average humidity profile
12) Global average temperature profile
13) Global average surface emissivity spectral distribution
14) Eigenvectors of the of the global error covariance matrix of the humidity profile

15) Eigenvectors of the of the global error covariance matrix of the temperature profile
16) Eigenvectors of the of the global error covariance matrix of the surface emissivity spectral distribution.

Table 20 – Root: Global variables for the NWP Error Correlation Matrices

Name	Description	Type	Units/Values	Dimension
ecm_q_prof	Error correlation matrix of the specific humidity profile	float		ecm_grid_np_lat ecm_grid_np_lon nlev nlev
	valid_max	float	1	
	valid_min	float	-1	
	missing_value	float	-9.e9	
ecm_t_prof	Error correlation matrix of the temperature profile	byte		ecm_grid_np_lat ecm_grid_np_lon nlev nlev
	valid_max	float	1	
	valid_min	float	-1	
	missing_value	float	-9.e9	
latitude_ecm	Latitude of ECM grid-points	float	degrees-north	ecm_grid_np_lat ecm_grid_np_lon
	valid_max	float	90	
	valid_min	float	-90	
	missing_value	float	-9.e9	
longitude_ecm	Longitude of ECM grid-points	float	degrees-east	ecm_grid_np_lat ecm_grid_np_lon
	valid_max	float	360	
	valid_min	float	0	
	missing_value	float	-9.e9	
static_bkg_t_prof	Static background temperature profile	unsigned byte	K	nlev_static
	valid_max	float	300	
	valid_min	float	0	
	missing_value	float	-9.e9	
static_bkg_q_prof	Static background specific humidity profile	float	kg/kg	nlev_static
	valid_max	float	100	
	valid_min	float	0	
	missing_value	float	-9.e9	
static_bkg_covar_t	Static background covariance of the temperature profile	float	K	nlev_static nlev_static
	valid_max	float	10	
	valid_min	float	-10	
	missing_value	float	-9.e9	
static_bkg_covar_q	Static background covariance of the specific humidity	float	kg/kg	nlev_static nlev_static

	profile			
	valid_max	float	1.e9	
	valid_min	float	-1.e9	
	missing_value	float	-9.e9	
qprof_ave	Global average humidity profile	float	kg/kg	nlev_static
	valid_max	float	100	
	valid_min	float	0	
	missing_value	float	-9.e9	
tprof_ave	Global average temperature profile	float	K	nlev_static
	valid_max	float	300	
	valid_min	float	0	
	missing_value	float	-9.e9	
sem_ave	Global average surface emissivity spectral distribution	float		n_chan
	valid_max	float	1	
	valid_min	float	0	
	missing_value	float	-9.e9	
Mev_qprof (*)	Eigenvectors of the of the global error covariance matrix of the specific humidity profile	float	kg/kg	npc_qprof nlev_static
	valid_max	float	1.e9	
	valid_min	float	-1.e9	
	missing_value	float	-9.e9	
Mev_tprof (*)	Eigenvectors of the of the global error covariance matrix of the temperature profile	float	K	npc_tprof nlev_static
	valid_max	float	1.e9	
	valid_min	float	-1.e9	
	missing_value	float	-9.e9	
Mev_sem (*)	Eigenvectors of the of the global error covariance matrix of the surface emissivity spectral distribution	float	1-emissivity	npc_sem n_chan
	valid_max	float	1.e9	
	valid_min	float	-1.e9	
	missing_value	float	-9.e9	

(*) These parameters are used only by METimage.

4.2.6 Global Ocean Biogeochemistry Analysis and Weekly Forecast

4.2.6.1 Purpose and description

The CMEMS Global Ocean Biogeochemistry Analysis and weekly Forecasts is obtained by the Operational Mercator Ocean biogeochemical global ocean analysis and forecast system at 1/4 degree, that provides 10 days of 3D global ocean forecasts updated weekly. The time series is aggregated in time, in order to reach a two full year's time series sliding window. This product includes daily and monthly mean files of biogeochemical parameters (chlorophyll, nitrate, phosphate, silicate, dissolved oxygen, dissolved iron, primary production, phytoplankton, PH, and surface partial pressure of carbon dioxyde) over the global ocean. The weekly mean files are updated on Thursdays around 12:00 UTC, whereas the monthly mean files are updated on the 14th day of month around 12:00 UTC.

The global ocean output files have a 0.25° horizontal resolution with regular longitude/latitude equirectangular projection, and they are delivered in NetCDF format. The vertical coverage includes 50 levels ranging from 0 to 5700 meters.

4.2.6.2 Auxiliary Data Summary Sheet

Name	Global Ocean Biogeochemistry Analysis and Weekly Forecast
Description	CMEMS Global Ocean Biogeochemistry Analysis and Forecast
Example of Filename	SG_____AUX_CMEM___S20180214120000Z_E20180214120000Z_G20210219232100Z_CMEM_OPE_OPER_R20180214000000Z.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_CMEM
Source	CMEM
Members	1
Example of internal filename	mercatorbiomer4v2r1_global_mean_20180214.nc
Format of internal file (data file)	NetCDF-4
Auxiliary Data Size	0.83 GB
Generation Frequency	1 per week (10 files/snapshots per time)
Validity	Validity start = validity end = 12:00 UTC of the day that the filename refers to Analysis time: The start of the forecast is at 00:00 UTC of every Wednesday

4.2.6.3 Format

The physical structure and data file components of the Global Ocean Biogeochemistry Analysis and Weekly Forecast is shown in Figure 16. It is composed of a XML header file and one internal file in NetCDF-4 format.

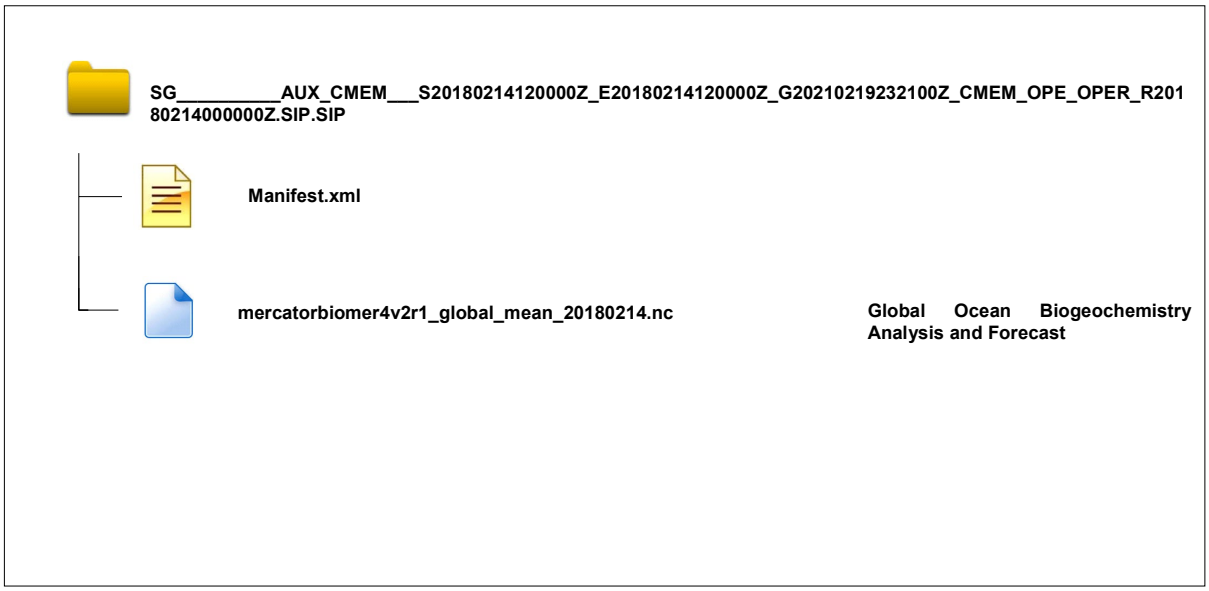


Figure 16 – Structure of Global Ocean Biogeochemistry Analysis and Weekly Forecast

The Global Ocean Biogeochemistry Analysis and Weekly data is in NetCDF-4 format.

4.2.6.4 **Format of Data Files**

Please see [CMEMS] .

4.2.7 IERS Bulletin A

4.2.7.1 Purpose and description

The IERS Bulletin A provides current information on the Earth's orientation in the IERS Reference System. This includes Universal Time, coordinates of the terrestrial pole, and celestial pole offsets. The standard solution is given weekly in Bulletin A. It is issued by the International Earth Rotation Systems Service.

4.2.7.2 Auxiliary Data Summary Sheet

Name	IERS Bulletin A
Description	Provide current information on the Earth's orientation in the IERS Reference System
Example of Filename	SG_____AUX_IBA____S20091102000000Z_Exxxxxxxxxxx Z_G20091102000000Z_IERS_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_IBA_
Source	IERS
Members	1 file
Example of internal filename	bulletina-xxix-046.txt
Format of internal file (data block)	ASCII [IERS]
Auxiliary Data Size	~0.1 MB
Generation Frequency	1 per week
Validity	The "IERS Bulletin A" is published every Thursday. Validity start: start of the day of the first real EOP measurement ▪ day of publication – 6 days at Time 00:00:00, i.e. always a Friday Validity stop: day of the last predicted EOP values ▪ day of publication + 1 year at Time 23:59:59

4.2.7.3 Format

The physical structure and data file components of the IERS Bulletin A is shown in Figure 17. It is composed of an XML header file and 1 file in ASCII format.

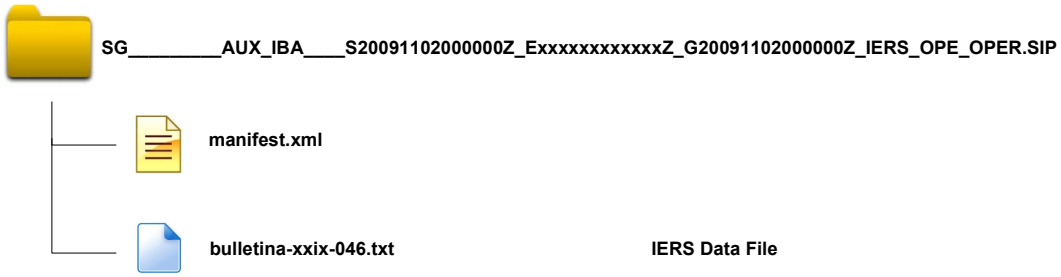


Figure 17 – Structure of IERS Bulletin A file

4.2.7.4 Format of Data Files

The file is provided in ASCII format on a weekly basis and it is fully described in:

- [IERS]
- http://hpiers.obspm.fr/eoppc/bul/bulb/explanatory.html

IERS Bulletin A contains Earth orientation parameters x/y pole, UT1-UTC and their errors at daily intervals and predictions for one year into the future.

The contents of IERS Bulletin A are divided into four sections:

1. General information including key definitions and the most recently adopted values of DUT1 and TAI-UTC.
2. Quick-look daily estimates of the EOPs determined by smoothing the observed data. This involves the application of systematic corrections and statistical weighting. The results are published with a delay of about one to three days between the date of publication and the last available date with estimated EOP.
3. Predictions of x, y, and UT1-UTC, up to 365 days following the last day of data. The predictions use similar algorithms based on seasonal filtering and autoregressive processing for x, y, and UT1.
4. The combination series for the celestial pole offsets. Bulletin A contains celestial pole offsets with respect to the IAU1980 Nutation theory (dpsi and deps) and the IAU 2000 Resolutions (dX and dY), beginning on 1 January 2003.

4.2.8 Predicted Orbit File

4.2.8.1 Purpose and description

The Predicted Orbit File contains Orbit State Vectors for a given Metop-SG satellite with a time step of 1 minute and in Earth-Fixed reference frame. The file is generated by the Flight Dynamic System (FDS) everyday in the morning (at about 6:30 UTC). The file is satellite specific and covers 2 day in the past (determined orbit) and 3 days in the future (predicted orbit).

4.2.8.2 Auxiliary Data Summary Sheet

Name	Predicted Orbit File
Description	Contain Orbit State Vectors (OSVs)
Example of Filename	SGA1_____AUX_POFD___S20090209000000Z_E20090214000000Z_G20090211000000Z_FDS__OPE_OPER.SIP
Spacecraft	SG[A|B][1-3]
Auxiliary Data ID (ADF-ID)	_____AUX_POFD
Source	FDS_
Members	1 file
Example of internal filename	SGA1_FDP_FDS__OPE_PRED_ORB___GYYYYMMDDhhmmssZ_SYYYYMMDDhhmmssZ_EYYYYMMDDhhmmssZ.EOF
Format of internal file (data block)	Earth-Observation
Auxiliary Data Size	3.5 MB
Generation Frequency	1 per day
Validity	Validity start: 00h of generation day minus 48h (2 days) Validity stop: 00h of generation day plus 72h (3 days) Validity duration: 5 days

4.2.8.3 Format

The physical structure and data file components of the Predicted Orbit File are shown in Figure 18. It is composed of an XML header file and a one internal file in Earth-Observation format.

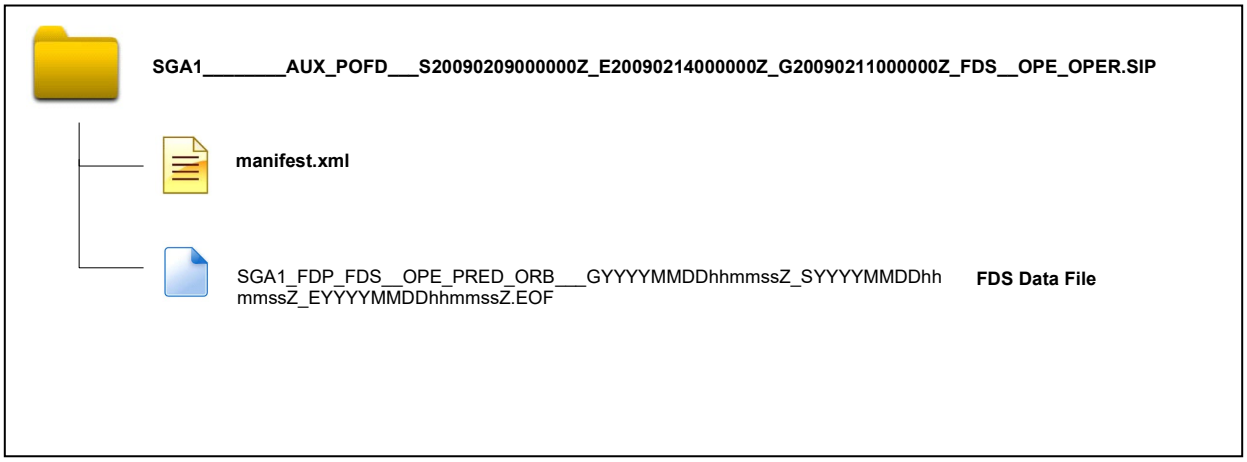


Figure 18 – Structure of Predicted Orbit File

4.2.8.4 Format of Data Files

The orbit prediction file is formatted using XML-tags. Each Predicted Orbit File consists of a single file containing both the Header and the Datablock sections, as defined in the EO File Format Specification (refers to [EOMS-FFS]) amended by the schema attached. The amendment is only related with the filename since the EPS-SG Filename convention is to be followed.

The fixed header format is as follows:

Table 21 – Predicted orbit file fixed header format

XML Tag Name Level 1	Level 2	Value	Description
File_Name			As defined without the extension.
File_Description		FDS Predicted Orbit File	Description of the file
Notes		<User Configurable>	Free Text
Mission		Metop-SG #N	# indicates the spacecraft model; A,B N indicates the spacecraft family; 1,2,3
File_Class		<User Configurable>	Consistent with Class (see Table 9) e.g., OPER
File_Type		<User Configurable>	Same as File Type, that is, PRED_ORB
Validity_Period			
Validity_Start		Variable	UTC time consistent with Validity Start Date. Format: UTC=yyyy-mm-ddThh:mm:ss
Validity_Stop		Variable	UTC time consistent with Validity Stop Date.

XML Tag Name Level 1	Level 2	Value	Description
			Format: UTC=yyyy-mm-ddThh:mm:ss
File_Version		Variable	Starting from 0001, the number increases if another file with the same name has been sent.
EOFFS_Version		3.0	Version of the applicable Earth Observation File Format Standard
Source			
	System	MCO	
	Creator	<User Configurable>	Name of tool creating the file. e.g. FDS
	Creator_Version	<User Configurable>	Version of the tool creating the file, e.g., 1.0
	Creation_Date	Variable	UTC time consistent with Generation Date. Format: UTC=yyyy-mm-ddThh:mm:ss

The variable header format is as follows:

Table 22 – Predicted orbit file variable header format

XML Tag Name Level 1	Level 2	Value	Description
Ref_Frame		EARTH_FIXED	Orbit State Vector co-ordinate system reference frame, EARTH_FIXED.
Time_Reference		UTC	The value supplied will be used by the target system to define which of the time values supplied for each OSV will be used as the base time

The Datablock format is as follows:

Table 23 – orbit file data block format

XML Tag Name	Type	Unit	Precision	C Format	Description
TAI	date	string			TAI date and time of OSV, in ASCII standard time format, including time reference and micro-seconds. TAI=yyyy-mm-ddThh:mm:ss.ssssss

XML Tag Name	Type	Unit	Precision	C Format	Description
UTC	date	string			UTC date and time of OSV, in ASCII standard time format, including time reference and microseconds. UTC=yyyy-mm-ddThh:mm:ss.ssssss
UT1	date	string			UT1 date and time of OSV, in ASCII standard time format, including time reference and microseconds. UT1=yyyy-mm-ddThh:mm:ss.ssssss
Absolute _Orbit	int			%+05ld	Absolute orbit counter This counter is incremented by a single unit from one record to the next. It must be differentiated with the real absolute orbit number on which the state vector belongs i.e: If the Z value of the OSV is >= 0 then “real” absolute orbit number equals the absolute orbit counter. if the Z value of the OSV is < 0 then “real” absolute orbit number equals the absolute orbit counter minus 1. Notice that absolute orbit numbers are numberd from 1.
X	float	m	10-3	%+012.3lf	X position in earth-fixed coordinate system.
Y	float	m	10-3	%+012.3lf	Y position in earth-fixed coordinate system.
Z	float	m	10-3	%+012.3lf	Z position in earth-fixed coordinate system.
VX	float	m/s	10-6	%+012.6lf	X velocity in earth-fixed coordinate system.
VY	float	m/s	10-6	%+012.6lf	Y velocity in earth-fixed coordinate system.
VZ	float	m/s	10-6	%+012.6lf	Z velocity in earth-fixed coordinate system.
Quality	String	String		%s13	This parameter is added to keep format compatibility with Cryosat format.

XML Tag Name	Type	Unit	Precision	C Format	Description
					Default (“not used”) value is “0000000000000”

An example of Predicted Orbit file is given below.
The schema can be found in Appendix A; it will be substituted by the schema provided by the contractor when available.

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<Earth_Observation_File xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="“<schemas URL>schemas_PRED_ORB_v3\EO_OPER_AUX_ORBRES_0300.XSD""<!-->
schemaVersion="3.0" xmlns="“<schemas URL>”<!-->>
  <Earth_Observation_Header>
    <Fixed_Header>
     <File_Name>SGA1_FDP_FDS__OPE_PRED_ORB___G20070912063000Z_S20070910000000Z_E20070915000000Z</File_Name>
      <File_Description>FDS Predicted Orbit File</File_Description>
      <Notes></Notes>
      <Mission>Metop-SG 1A</Mission>
      <File_Class>OPER</File_Class>
      <File_Type>PRED_ORB__</File_Type>
      <Validity_Period>
        <Validity_Start>UTC=2007-09-10T00:00:00</Validity_Start>
        <Validity_Stop>UTC=2007-09-15T00:00:00</Validity_Stop>
      </Validity_Period>
      <File_Version>0001</File_Version>
      <EOFFS_Version>3.0</EOFFS_Version>
      <Source>
        <System>MCO</System>
        <Creator>FDS</Creator>
        <Creator_Version>1.0</Creator_Version>
        <Creation_Date>UTC=2007-09-12T06:30:00</Creation_Date>
      </Source>
    </Fixed_Header>
    <Variable_Header>
      <Ref_Frame>EARTH_FIXED</Ref_Frame>
      <Time_Reference>UTC</Time_Reference>
    </Variable_Header>
  </Earth_Observation_Header>
  <Data_Block type="xml">
    <List_of_OSVs count="7201">
      <OSV>
        <TAI>TAI=2007-09-10T00:00:33.000000</TAI>
        <UTC>UTC=2007-09-10T00:00:00.000000</UTC>
        <UT1>UT1=2007-09-09T23:59:59.831093</UT1>
        <Absolute_Orbit>+04621</Absolute_Orbit>
        <X unit="m">+1573637.247</X>
        <Y unit="m">+0156791.704</Y>
        <Z unit="m">-7030960.425</Z>
        <VX unit="m/s">+5741.143063</VX>
        <VY unit="m/s">-4690.509338</VY>
        <VZ unit="m/s">+1180.414481</VZ>
        <Quality>0000000000000</Quality>
      </OSV>
      <OSV>
        <TAI>TAI=2007-09-10T00:01:33.000000</TAI>
        <UTC>UTC=2007-09-10T00:01:00.000000</UTC>
        <UT1>UT1=2007-09-10T00:00:59.831092</UT1>
        <Absolute_Orbit>+04621</Absolute_Orbit>
        <X unit="m">+1913665.860</X>
        <Y unit="m">-0126252.140</Y>
        <Z unit="m">-6946736.253</Z>
        <VX unit="m/s">+5589.481102</VX>
        <VY unit="m/s">-4741.079114</VY>
        <VZ unit="m/s">+1626.173895</VZ>
        <Quality>0000000000000</Quality>
      </OSV>
[...]
    </List_of_OSVs>
  </Data_Block>
</Earth_Observation_File>
```

4.2.9 Manoeuvre History File

4.2.9.1 Purpose and description

The Manoeuvre History File (MHF) includes the acceleration profiles of the manoeuvres applied to the Metop-SG satellites. It contains information about future manoeuvres and it is updated every time a manoeuvre information is updated by Flight Dynamics (FDS). The file is satellite specific and covers from the beginning of the mission until the last planned manoeuvre.

4.2.9.2 Auxiliary Data Summary Sheet

Name	Manoeuvre History File
Description	It contains all the manoeuvres applied to the Metop-SG, including future manoeuvres.
Example of Filename	SGA1_____AUX_MHF____S20091102000000Z_E20251231235959Z_G20251231235959Z _FDS__OPE_OPER.SIP
Spacecraft	SG[A|B][1-3]
Auxiliary Data ID (ADF-ID)	_____AUX_MHF_
Source	FDS_
Members	1 file
Example of internal Filename	SGA1_FDP_FDS__OPE_MANO_HIST__GYYYYMMDDhhmmssZ_SYYYYMMDDhhmmssZ_EYYYYMMDDhhmmssZ.txt
Format of internal file(s)	ASCII
Auxiliary Data Size	0.1 MB
Generation Frequency	Every manoeuvre Note: Updated every time a manoeuvre is planned by Flight Dynamics (FDS).
Validity	Validity start: beginning of mission Validity stop: time of the last manoeuvre planned by FDS

4.2.9.3 Format

The physical structure and data file components of Manoeuvre History File is shown in Figure 20. It is composed of an XML header file and of one file in ASCII format.

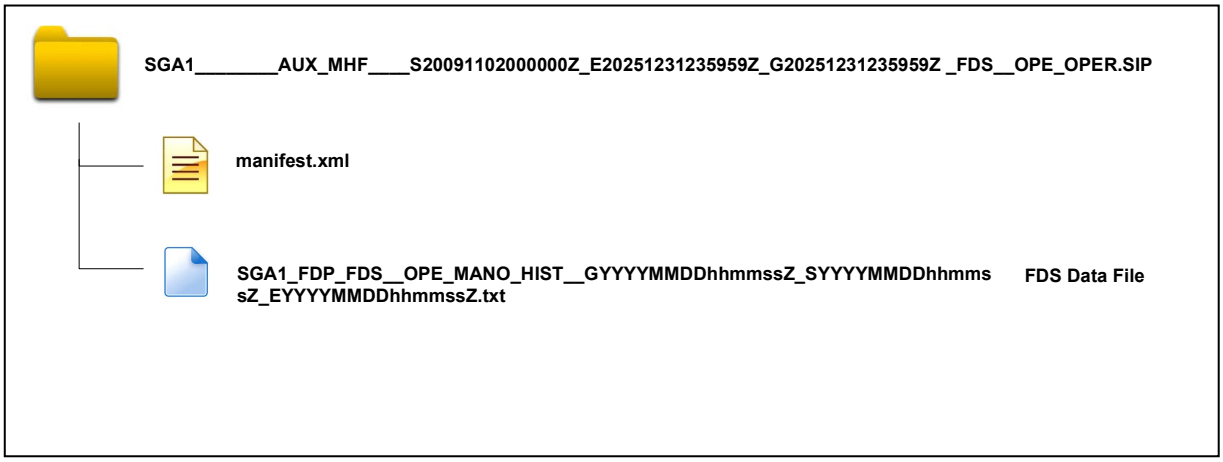


Figure 19 – Structure of the Manoeuvre History File

4.2.9.4 Format of Data Files

The Datablock format is as follows:

Table 24 – MHF datablock data record format

Value	Fortran format	Description
Time	A23, 1X	File update time as: YYYY/MM/DD-HH:MM:SS.SSS
Satellite ID	I3, 80X	ESOC satellite ID
Epoch	A23, 4X	Burn start or stop time, as YYYY/MM/DD-HH:MM:SS.SSS
Acceleration	3(D15.8)	Three components of the acceleration [km/s^2]
Flag	I5	Record flag. If >0, this is a manoeuvre start record. If 0, it is a manoeuvre end record. On a start record, value 1 indicates that the components are radial, along-track and cross-track respectively and value 2 that they are along the J2000.0 X-, Y- and Z- axes respectively
Extra	1X, A12	For internal use by FDS TCS generation.

An example of the file content is given below.

```
2009/08/17-08:57:07.000 92
2016/03/06-03:00:38.500 -0.56458909D-09 0.11746626D-05 0.12369455D-07 1 054760000101
2016/03/06-03:00:41.500 -0.56458909D-09 0.11746626D-05 0.12369455D-07 0 054760000101
2016/03/10-04:39:47.045  0.78711666D-09 0.10000000D-09 0.16316695D-05 1 054880000401
2016/03/10-04:44:00.147  0.78711666D-09 0.10000000D-09 0.16316695D-05 0 054880000401
2016/03/12-01:59:58.500 -0.23783149D-09 0.11723037D-05 0.78137968D-07 1 054900000101
2016/03/12-02:00:01.500 -0.23783149D-09 0.11723037D-05 0.78137968D-07 0 054900000101
2016/03/12-02:50:12.039 -0.22495864D-09 0.11103699D-05-0.76533390D-07 1 054900000104
2016/03/12-02:50:15.039 -0.22495864D-09 0.11103699D-05-0.76533390D-07 0 054900000104
```

4.2.10 Sea-Ice Mask

4.2.10.1 Purpose and description

The Sea-Ice Mask is an auxiliary data composed of external files obtained from the OSI-SAF and containing updated maps of sea-ice coverage on a daily basis.

The OSI-SAF sea ice products are delivered with global coverage on two files, on for the Northern and on for the Southern Hemisphere. These file provide a distinction between open water and sea-ice.

The sea ice concentration products have been developed to be derived from passive Microwave (SSMIS) sensors. The sea ice fields are available daily within 6 hours after the last satellite data acquisition. This means within 06 UTC each day.

4.2.10.2 Auxiliary Data Summary Sheet

Name	Sea-Ice Mask
Description	Sea Ice Concentration Maps on 10 km Polar Stereographic Grid
Example of Filename	SG_____AUX_SEIC___S20091102000000Z_E20091102235959Z_G20091102000000Z_OSIS_OPE_OPER.SIP
Spacecraft	SG_
Auxiliary Data ID (ADF-ID)	_____AUX_SEIC
Source	OSIS
Members	2

Example of internal filename	ice_conc_nh_polstere-100_multi_201812231200.nc
	
	The following table gives the file name convention used on the OSI SAF FTP server.
	ice_conc_<hemisphere>_polstere-100_multi_<date12>.nc
	where:
	• <hemisphere>:
	  ○ nh for Northern Hemisphere products;
	  ○ sh for Southern Hemisphere.
	• <date12>: Date and time of the product on format YYYYMMDDHOMI, e.g. 201501011200
	
	Example for the Northern Hemisphere:
	ice_conc_nh_polstere-100_multi_201610011200.nc
	
	Example for the Southern Hemisphere:
	ice_conc_sh_polstere-100_multi_201610011200.nc

Format of internal file (data file)	NetCDF
Auxiliary Data Size	41 MB Northern Hemisphere file: 23MB Southern Hemisphere file: 18MB

Generation Frequency	1 per day
Validity	Validity start: start of covered day at 00h UTC Validity stop: end of covered day at 23:59:59 h UTC

4.2.10.3 Format

The physical structure and data file components of the Sea-Ice Mask file is shown in Figure 21. It is composed of a XML header file and the internal files in NetCDF format.

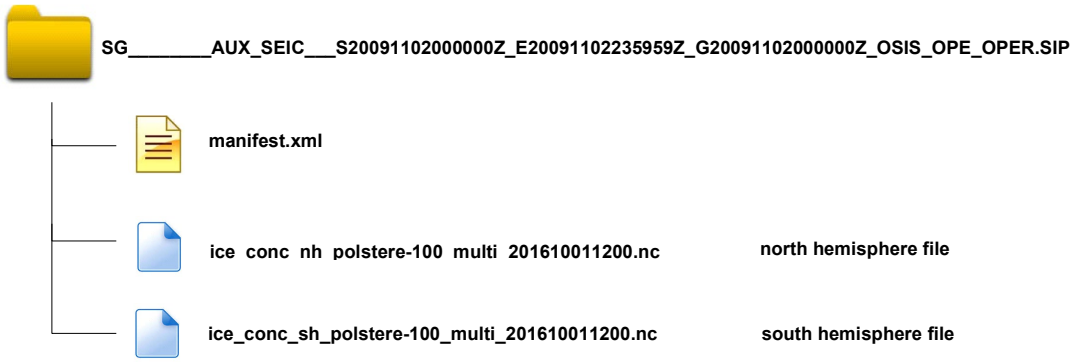


Figure 20 – Structure of Sea-Ice Mask File

4.2.10.4 Format of Data Files

The content and format of this file is fully described in [SEAICE].
The sea ice concentration product is available on NetCDF file format. The sea ice concentration parameter indicates the areal fraction in percentage of the water in a given grid point covered by sea ice. In the NetCDF file the sea-ice concentration is given as a real number between 0 and 10000 (with a scale factor equal to 0.01). The FillValue is equal to -999.
In order to distinguish the status of the concentration of sea ice retrieval, the variable "status_flag" has to be considered. The "status_flag" is a integer number:

- 0 : nominal value from algorithm is used;
- 2: sea ice algorithm is applied over lake;
- 10: maximum climatology test applied;
- 12: open water filter applied;
- 100 : missing value due to over land;
- 101: missing value due to missing data;
- 102: unclassified pixel.

The product grids are stereographic grids and their details are defined in [SEAICE]. There is one grid for the Northern Hemisphere product (NH) and one grid for the Southern Hemisphere product (SH).

4.2.11 Snow/Ice Map (High Resolution)

4.2.11.1 Purpose and description

The high resolution information (500m) on the snow/ice coverage of global land surface is retrieved daily from the NSID database and corresponds to the combination of MODIS/Terra MOD10A1 (morning coverage) and MODIS/Aqua MYD10A1 (afternoon coverage) products (version V6). The MODIS snow cover data are based on a snow mapping algorithm that employs a Normalized Difference Snow Index (NDSI) and other criteria test.
It is assumed that only MODIS/Terra MOD10A1 are downloaded for the snow/ice map generation; MODIS/Aqua MYD10A1 are assumed as backup solution.

4.2.11.2 Auxiliary Data Summary Sheet

<table>
<tr><td>Name</td><td>Snow/Ice Map (High Resolution)</td></tr>
<tr><td>Description</td><td>MODIS snow/ice map from LPDAAC</td></tr>
<tr><td>Example of Filename</td><td>SG_____AUX_ICHI___S20210101000000Z_E20210102000000Z_G20210102060000Z _NSID_OPE_OPER.SIP</td></tr>
<tr><td>Spacecraft</td><td>SG__</td></tr>
<tr><td>Auxiliary Data ID (ADF-ID)</td><td>_____AUX_ICHI</td></tr>
<tr><td>Source</td><td>NSID</td></tr>
<tr><td>Members</td><td>314 files</td></tr>
<tr><td>Example of internal filename</td><td>MOD10A1.A2003141.h03v06.006.YYYYDDDhhmmss.hdf

MOD10A1
MYD10A1

<table>
<tr><td>MOD</td><td>MODIS/Terra (or MYD for MODIS/Aqua)</td></tr>
<tr><td>10A1</td><td>Type of product</td></tr>
<tr><td>A</td><td>Acquisition date</td></tr>
<tr><td>2003</td><td>Year of data acquisition</td></tr>
<tr><td>141</td><td>Day of year of data acquisition (day 141)</td></tr>
<tr><td>h03v06</td><td>Horizontal tile number and vertical tile number.</td></tr>
<tr><td>006</td><td>Version number</td></tr>
<tr><td>YYYY</td><td>Year of production</td></tr>
<tr><td>DDD</td><td>Day of year of production</td></tr>
<tr><td>hhmmss</td><td>Hour/minute/second of production in GMT</td></tr>
<tr><td>hdf</td><td>HDF-EOS data form</td></tr>
</table></td></tr>
</table>

Format of internal file (data file)	compressed HDF-EOS
Auxiliary Data Size	~1 GB 314 files: 0.8-6.7 MB per each ~1200×1200 km tile, i.e., 2400×2400 pixels at Nadir
Generation Frequency	1 per day
Validity	Validity start: 00h UTC of generation day Validity stop: 00h UTC of generation day plus 24h

4.2.11.3 Format

The physical structure and data file components of the Snow/Ice Map (High Resolution) file is shown in Figure 22. It is composed of a XML header file and 314 internal files (tiles) in compressed HDF-EOS format providing a daily global coverage.

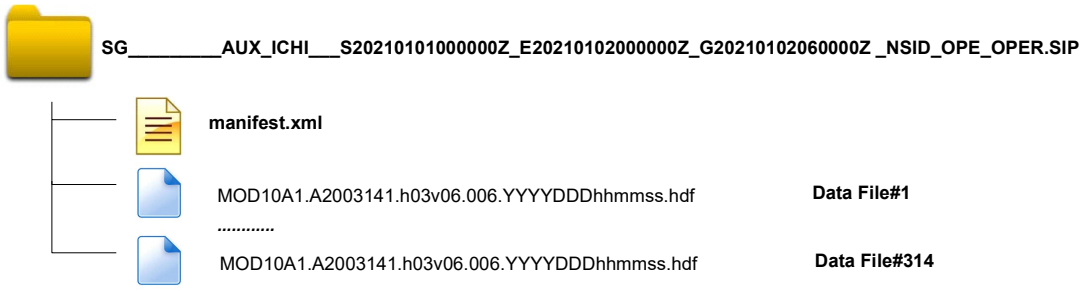


Figure 21 – Structure of Snow/Ice Map (High Resolution) File

4.2.11.4 Format of Data Files

The content and format of this file is fully described in [ICHI].

The MODIS MOD10A1/MYD10A1 products are gridded in equal-area tiles in a sinusoidal map projection. Each tile consists of 1200×1200 km data arrays (2400×2400 pixels) at 500m resolution formatted in compressed HDF-EOS files. Each tile has a size between 0.8 and 6.7 MB depending on its geographical location, for a total data volume of ~1 GB for global coverage (compressed).

The snow/ice information is contained in the `NDSI_Snow_Cover` scientific dataset, available from the NSIDC database as HDF_EOS formatted data file. The possible values for the `NDSI_Snow_Cover` are defined in Table 28.

Table 25 – NDSI_Snow_Cover possible values

Value	Description

0-100	NDSI snow cover
200	missing data
201	no decision
211	night
237	inland water
239	ocean
250	cloud
254	detector saturated
255	fill value

4.2.12 Map of Surface Albedo/BRDF

4.2.12.1 Purpose and description

The map of land surface albedo and BRDF are retrieved from the MODIS BRDF/albedo Model Parameters Daily L3 Global 500 m SIN Grid products version 6 (MCD43A1v006), distributed by LPDAAC.
The MCD43A1v006 product is produced daily using 16 days of Terra and Aqua MODIS data at 500 m resolution. Data are temporally weighted to the ninth day of the retrieval period, which is reflected in the Julian date in the file name. The product contains the three model weighting parameters (isotropic, volumetric, and geometric) to be used to derive the surface black- and white-sky albedo and BRDF at 500 m resolution.

4.2.12.2 Auxiliary Data Summary Sheet

Name	Map of Surface Albedo/BRDF
Description	MODIS surface Albedo/BRDF map from LPDAAC.
Example of Filename	SG_____AUX_LSA____S20210101000000Z_E20210109000000Z_G20210109060000Z_LPDA_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_LSA_
Source	LPDA
Members	315 files
Example of internal filename	MCD43A1.A2006153.h13v09.006. YYYYDDDhhmmss.hdf Same as AUX_ICHI file (see Section 4.2.17) where “MCD” stands for “MODIS combined Terra/Aqua”
Format of internal file (data file)	HDF-EOS
Auxiliary Data Size	~25.8 GB Between 1 MB and 100 MB per each 10×10 lat/lon tile, i.e., 2400×2400 rows/columns
Generation Frequency	Every 16 days
Validity	Validity start: 00h UTC of generation day Validity stop: 00h UTC of generation day plus 384h (16 days later)

4.2.12.3 Format

The physical structure and data file components of the Map of Surface Albedo/BRDF are shown in Figure 23. It is composed of a XML header file and 315 internal files (tiles) in HDF-EOS format providing global coverage (over land only) Every 16 days.

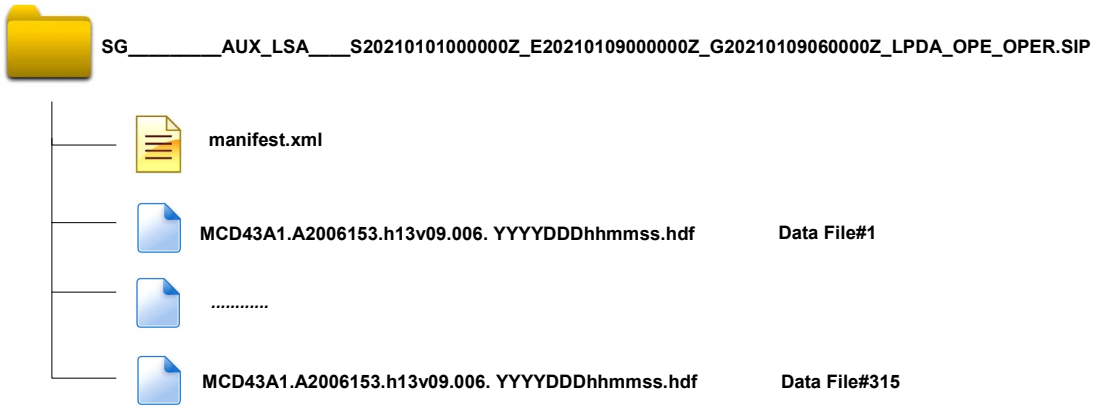


Figure 22 – Structure of the Map of Surface Albedo/BRDF File

4.2.12.4 Format of Data Files

The internal data files are fully described in [LSA].

The MODIS MCD43A1v006 products are gridded in equal-area tiles in a gridded data sinusoidal map projection. Each tile covers a 10×10 lat/lon area (2400×2400 pixels) at 500m resolution and is provided as a HDF-EOS file of size ~55 MB, for a total data volume of ~25.8 GB for global coverage (without compression).

Each tile contains 20 HDF layers: 10 of them are quality flags per each band, and they are not described in this document, whereas the remaining 10 layers contain the BRDF/albedo Model Parameters (Iso, Vol and Geo) at different wavelengths. Parameter values are stored as 16-bit unsigned integer (no units), with a valid range from 0 to 32766, to be multiplied by a scale factor of 0.001. The fill value is 32767. The HDF layers are ordered as follows:

- BRDF_Albedo_Parameters_Band1: 3D Parameter (iso, vol, geo) for Band 1.
- BRDF_Albedo_Parameters_Band2: 3D Parameter (iso, vol, geo) for Band 2.
- BRDF_Albedo_Parameters_Band3: 3D Parameter (iso, vol, geo) for Band 3.
- BRDF_Albedo_Parameters_Band4: 3D Parameter (iso, vol, geo) for Band 4.
- BRDF_Albedo_Parameters_Band5: 3D Parameter (iso, vol, geo) for Band 5.
- BRDF_Albedo_Parameters_Band6: 3D Parameter (iso, vol, geo) for Band 6.
- BRDF_Albedo_Parameters_Band7: 3D Parameter (iso, vol, geo) for Band 7.
- BRDF_Albedo_Parameters_vis: 3D Parameter (iso, vol, geo) for vis broadband.
- BRDF_Albedo_Parameters_nir: 3D Parameter (iso, vol, geo) for NIR broadband.
- BRDF_Albedo_Parameters_shortwave: 3D Parameter (iso, vol, geo) for shortwave broadband.

4.2.13 Map of Surface Emissivity

4.2.13.1 Purpose and description

The "Map of surface emissivity" is retrieved from LPDAAC and corresponds to the combination of MODIS/Terra MOD11C2 (morning coverage) and MODIS/Aqua MYD11C2 (afternoon coverage) land surface temperature and emissivity (LST/E) products (version V006). These products are updated daily and stored as the average values of land surface temperature and emissivity during a 8-day period.
It is assumed that only MODIS/Terra MOD11C2 are downloaded for the map of surface emissivity generation; MODIS/Aqua MYD11C2 are assumed as backup solution.

4.2.13.2 Auxiliary Data Summary Sheet

Name	Map of Surface Emissivity
Description	MODIS surface emissivity map from LPDAAC.
Example of Filename	SG_____AUX_EMI____S20210101000000Z_E20210102000000Z_G20210102060000Z_LPDA_OPE_OPER.SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_EMI_
Source	LPDA
Members	1 file
Example of internal filename	MOD11C2. A2007249.006.YYYYDDDhhmmss.hdf MOD11C2 MYD11C2 Same as AUX_ICHI file (see Section 4.2.17) where "MOD" stands for "MODIS/Terra" products, and "MYD" for "MODIS/Aqua" products
Format of internal file (data file)	compressed HDF-EOS
Auxiliary Data Size	86 MB
Generation Frequency	Every 8 days
Validity	Validity start: 00h UTC of generation day Validity stop: 00h UTC of generation day plus 8*24h = 192 h.

4.2.13.3 Format

The physical structure and data file components of Map of Surface Emissivity is shown in Figure 24. It is composed of a XML header file and 1 internal file (tile) in HDF-EOS format.

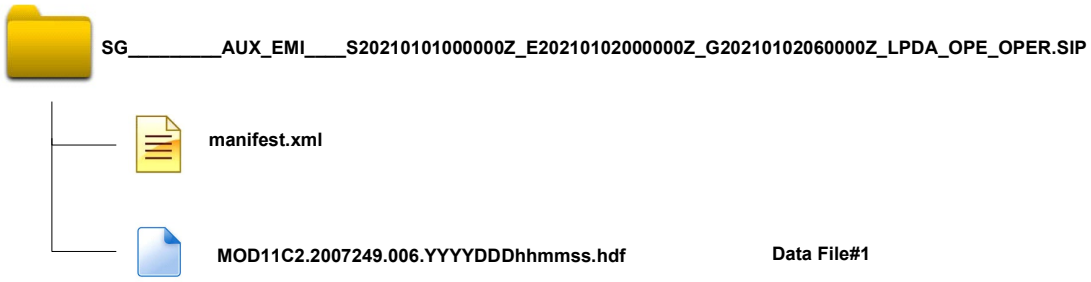


Figure 23 – Structure of the Map of Surface Emissivity File

4.2.13.4 Format of Data Files

The internal data files are fully described in [EMI].

The MODIS MOD11C2 (or MYD11C2) products consist of a single tile covering the whole globe (land only) and gridded in on a 0.05×0.05 deg lat/lon climate modelling grid (CMG), i.e., a grid of 3600×7200 pixels. The 0.05 deg spatial resolution corresponds to ~5.6 km at the Equator, i.e., lower than the one of METimage (500m). However, these products provide the closest match to METimage requirements for spatial/temporal resolution and wavelength coverage (3.7 up to ~14μm) available at the moment.

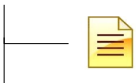
Each product is a HDF-EOS file of size ~70 MB (compressed). Each file contains 17 Science Data Sets (SDSs). Most of these SDSs contain quality information. The following 6 SDSs contain the surface emissivity values, stored as 8-bit unsigned integer (no units) and ranging from 1 to 255 (to be multiplied by a scaling factor of 0.002 and corrected by an offset of 0.49):

- Emis_20: surface emissivity in MODIS band 20 (3.79 μm)
- Emis_22: surface emissivity in MODIS band 22 (3.96 μm)
- Emis_23: surface emissivity in MODIS band 23 (4.06 μm)
- Emis_29: surface emissivity in MODIS band 29 (8.52 μm)
- Emis_31: surface emissivity in MODIS band 31 (11.02μm)
- Emis_32: surface emissivity in MODIS band 32 (12.03 μm).



manifest.xml

3mi_brdm.nc PDP Data File

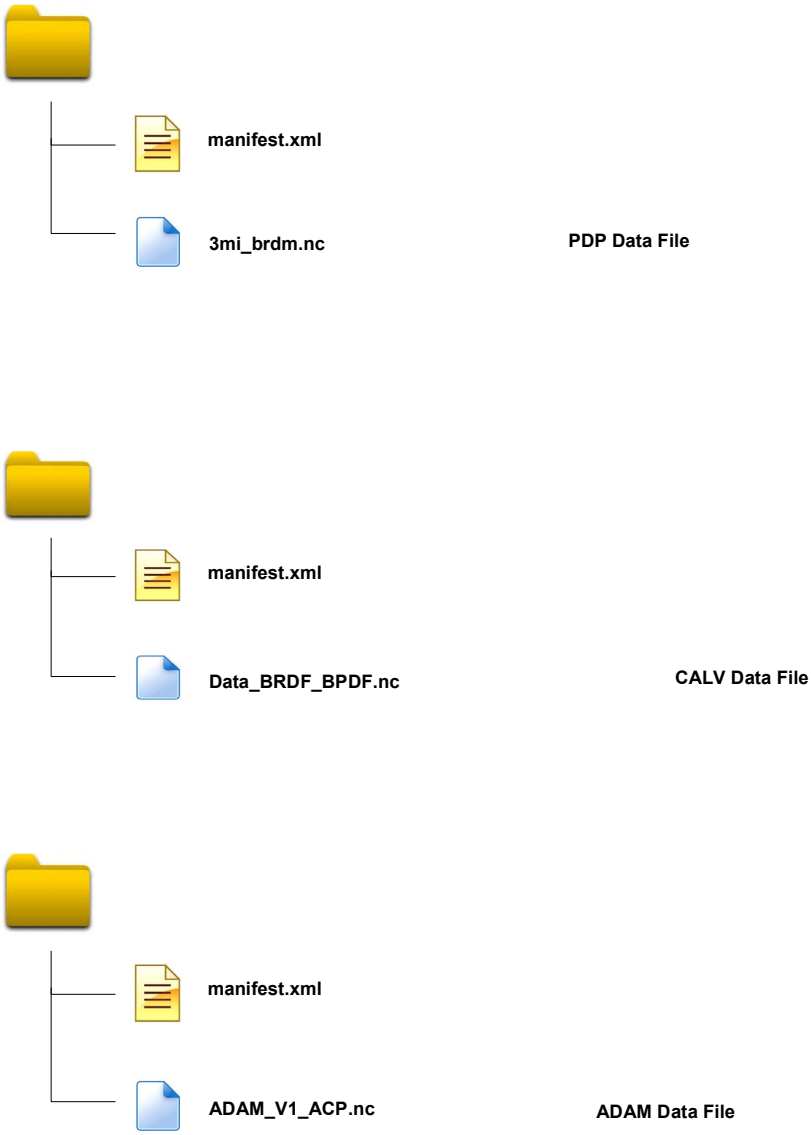


manifest.xml

Data_BRDF_BPDF.nc CALV Data File



manifest.xml

ADAM_V1_ACP.nc ADAM Data File



LER Database

4.2.13.5 Purpose and description

The GOME-2 surface LER database contains the Lambertian-equivalent reflectivity (LER) of the Earth's surface at 26 one-nm wide wavelength bins between 328 and 772 nm. The LER albedo values were derived from GOME-2 data using the Doubling-Adding KNMI (DAK) polarised radiative transfer code. The model consists of an atmosphere for which Rayleigh scattering and ozone absorption are taken into account, and which is bounded below by a Lambertian surface. The surface

LER is available for each month of the year for the all globe. The spatial resolution of the database grid is 0.25°×0.25°. Detailed information about the product and its format can be found in [LER].

4.2.13.6 Auxiliary Data Summary Sheet

Name	LER Database
Description	Lambertian Equivalent Reflectance database.
Example of Filename	SG_____AUX_LER__G_S20210101120000Z_Exxxxxxxxxxxxxx_G20210102060000Z_CALV_OPE_OPER. SIP
Spacecraft	SG__
Auxiliary Data ID (ADF-ID)	_____AUX_LER_
Source	CALV (GOME-2)
Members	1 file
Example of internal filename	GOME-2_MetOp-AB_MSC_025x025_surface_LER_v3.1.nc
Format of internal file (data file)	NetCDF-4
Auxiliary Data Size	2.2 GB
Generation Frequency	Infrequently
Validity	Entire mission

4.2.13.7 Format

The physical structure and data file components of LER Database is shown in Figure 28. It is composed of a XML header file and 1 internal file providing global coverage.

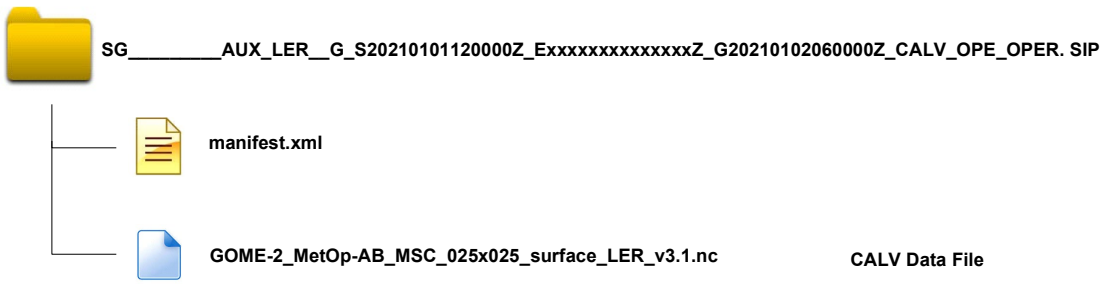


Figure 24 – Structure of the LER Database File

4.2.13.8 Format of Data Files

The internal NetCDF-4 file obtained from GOME-2 provides 15 mode/minimum surface LER between 328 and 772 nm and associated quality parameters for all 12 months of the year and for the all globe. The intrinsic resolution of the LER database is 1°×1°, but increased to 0.25°×0.25° near coastlines and certain snow covered mountain ranges. The spatial resolution of the database grid therefore is 0.25°×0.25°.

The NetCDF-4 file contains the variables presented in the following tables .Its XML description is available in Appendix B

Table 26 – LER Database: dimensions

Dimension name	description	Value
Wavelength (nwav)	Number of wavelength bands	26
Longitude (nlon)	Number of longitude grid points	1440
Latitude (nlat)	Number of latitude grid points	720
Month (nmon)	Number of months	12
polynomial_coefficients_index	Number of polynomial coefficients for the minimum and mode LER	3

Table 27 – LER Database: variables and their attributes

Variable Name	Description	Type	Range or Value	Dimensions
wavelength	central wavelength of band	FLOAT		nwav
long_name			central wavelength of the wavelength band	
units			nm	
standard_name			radiation_wavelength	
longitude	longitude of the centre of the grid cell	FLOAT		nlon
long_name			longitude of the centre of the grid cell	
Units			degrees_east	
standard_name			longitude	
latitude	latitude of the centre of the grid cell	FLOAT		nlat
long_name			latitude of the centre of the grid cell	
units			degrees_north	
standard_name			Latitude	
month	Calendar month	STRING		nmon
long_name			Name of the month	
units			1	
minimum_LER	surface LER retrieved according to the MIN-LER approach	FLOAT		nmon,nwav,nlon,nlat
long_name			surface LER retrieved according to the MIN-LER approach	
units			1	
_FillValue	Filling/Missing value	FLOAT	NaN	
_ChunkSizes		UINT	2 5 288 144	

mode_ler	surface LER retrieved according to the MODE-LER approach	FLOAT		nmon,nwav,nlon,nlat
long_name			surface LER retrieved according to the MODE-LER approach	-
units			1	-
_FillValue	Filling/Missing value	FLOAT	NaN	-
_ChunkSizes		UINT	2 5 288 144	-
uncertainty_due_to_systematic_errors	estimated uncertainty in the surface LER due to systematic errors	FLOAT		nmon,nwav,nlon,nlat
long_name			estimated uncertainty in the surface LER due to systematic errors	-
units			1	-
_FillValue	Filling/Missing value	FLOAT	NaN	-
_ChunkSizes		UINT	2 5 288 144	-
flag	flag indicating the processing history	SHORT		nmon,nlon,nlat
long_name			flag indicating the processing history	
flag_values		SHORT	0 1 2 3 4 5	
flag_meaning			0= no_corrections_applied 1= cloud_contamination_fixed 2=cloud_contamination_remains 3= cell_replaced_by_donor_cell 4= no_donor_cell_found 5= unphysical_value	
units				
_ChunkSizes		UINT	6 720 360	
snow_ice_field	flag indicating the presence of snow and ice	SHORT		nmon,nlon,nlat
long_name			flag indicating the presence of snow and ice	
flag_values			0 1 2 3 127 255	
flag_meaning			0=land 1= permanent_ice 2= sea_ice 3= snow 127= undefined 255= water	
units			1	
comment			the value 127 indicates that the grid cell changed nature during the month due to temporary snow cover (over land) or temporary sea ice	

			presence (over water	
polynomial_coefficients_index	index of the polynomial coefficients	SHORT		3
long_name			index of the polynomial coefficients	
units			1	
comment			the polynomial expansion of the directionally dependent surface LER consists of three terms	
polynomial_coefficients_minimum_LER	polynomial coefficients for the directionally dependent surface minimum LER	FLOAT		nmon,nwav,nlon,nlat,polynomial_coefficients_index
long_name			polynomial coefficients for the directionally dependent surface LER retrieved according to the MIN-LER approach	
units			1	
comment			further information is provided in the GOME-2 surface LER ATBD	
_FillValue	Filling/Missing value	FLOAT	NaN	
_ChunkSizes		UINT	2 6 360 180 1	
polynomial_coefficients_mode_LER	polynomial coefficients for the directionally dependent surface mode LER	FLOAT		nmon,nwav,nlon,nlat,polynomial_coefficients_index
long_name			polynomial coefficients for the directionally dependent surface LER retrieved according to the MODE-LER approach	
units			1	
comment			further information is provided in the GOME-2 surface LER ATBD	
_FillValue	Filling/Missing value	FLOAT	NaN	
_ChunkSizes		UINT	2 6 360 180 1	

4.2.14 CAMS global delayed-mode analysis and forecast

4.2.14.1 Purpose and description

3D CO2 and CH4 data from CAMS global delayed-mode analyses and real-time forecasts. The parameters are organized in one single dissemination file, including parameters in GRIB-2 Format.

4.2.14.2 **Auxiliary Data Summary Sheet**

Name	CAMS global delayed-mode analysis and forecast
Description	CAMS global delayed-mode analyses and real-time forecasts of CO2 and CH4
Example of filename	SG_____AUX_CAMD___S20090630090000Z_E20090630090000Z_G20090630100000Z_ECMW_OPE_OPER_R20090629000000Z.SIP
Spacecraft	SGA_
Auxiliary Data ID (ADF-ID)	_____AUX_CAMD_
Source	ECMW
Members	1 (global coverage)
Example of internal filename	z_cams_c_ecmf_20090629000000_prod_df_033.grib Filenaming convention: < z_cams_c_ecmf_yyyymmddhhmmss_vvvv_tt_sss > • ecmf: WMO location indicators • yyyymmddhhmmss: base date and time of the forecast • vvvv: version or experiment identifier. prod will be used for operational products, test (or experiment ID) will be used for testing purposes, rean for reanalysis if needed • tt: type of data, df – delayed forecast • sss: forecast hour time step. For accumulation and averages, it is the end time. This number must be zero padded to 3 digits, e.g. step 24 is given as 024
Format of internal file (data file)	GRIB
Auxiliary Data Size	200 MB
Generation Frequency	Every 24h (16 files / snapshots per time)
Validity	Validity time of the CAMS global delayed-mode analysis and forecast is as follows (see Figure 30): • validity start: Time at which the product is valid (snapshot time) • validity stop: Time at which the product is valid (snapshot time) validity duration: N/A

FreeText	Filled with the "Time of the run of the model". Format: "RYYYYMMDDhhmmssZ", where: • 1 uppercase r: "R" (indicates the "Run of the model"); • 4 char., year ("YYYY") corresponding to the current year. • 8 char., month, day, hour and minutes ("MMDDhhmm") corresponding with the "MMDDHHII" of the filename convention of the original CAMS file; • 2 char, minutes and seconds ("ss") is filled with "00"; • 1 uppercase z: "Z".

4.2.14.3 **Format**

The CAMS global delayed-mode analysis and forecast is composed of a XML header file and one internal file in GRIB format.

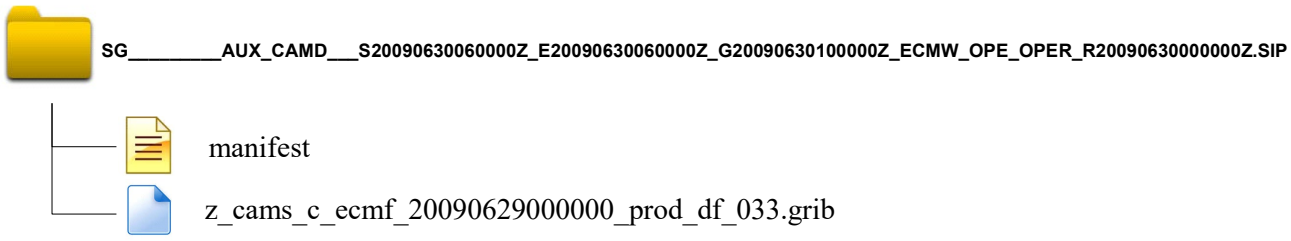


*Figure 25 – Structure of **CAMS global delayed-mode analysis and forecast***

4.2.14.4 Format of Data Files

The list of parameters used for is provided in Table 39. The horizontal resolution is a reduced Gaussian grid Tco1279. At model level the current number of levels is 60, but it can be changed in the future.

Table 28– EPS-SG CAMD delayed forecast data – Parameters list needed by the PGFs

Short name	Long name	Description	Unit	Parameter Code	SINGLE LEVEL – FORECAST – GRIB-1	MODEL LEVEL – FORECAST GRIB-2
	Latitude and Longitude of the Grid Points					
co2	Carbon dioxide		kg kg-1	210061		X
ch4	Methane		kg kg-1	210062		X

The CAMS global delayed-mode analysis and forecast files will be delivered at steps 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72, 75, 78 once a day (from the analysis cycles at 00 UTC), as shown in Figure 30.
The CAMS global delayed-mode analysis and forecast files dissemination schedule is as per ECMWF; it is available 36 h after the run model time.

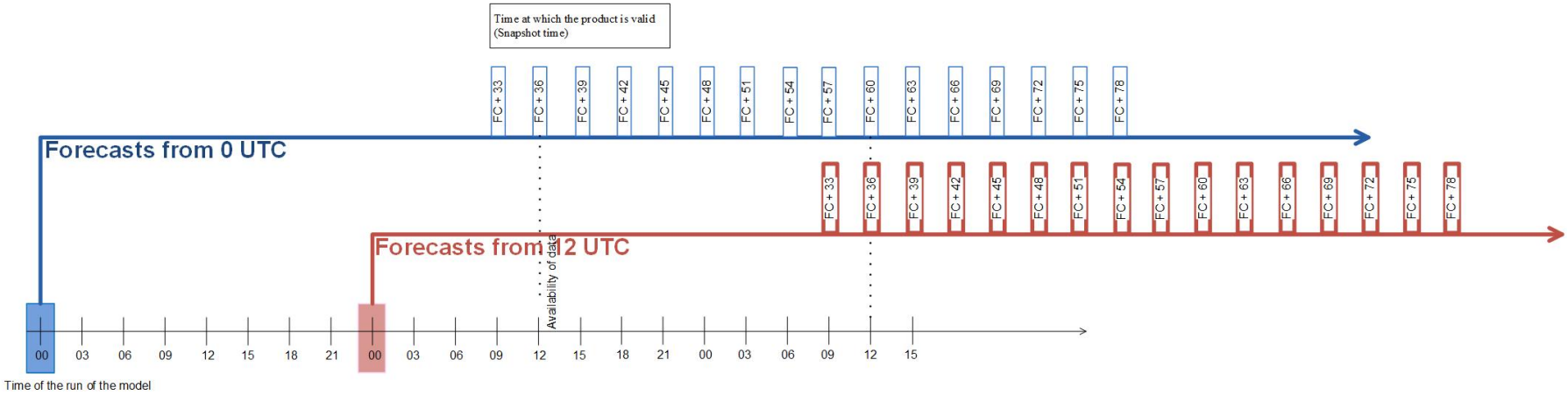


Figure 26– CAMS Dissemination System Configuration

Appendix A XML DESCRIPTION OF EPS-SG AUXILIARY DATA MANIFEST FILE

This appendix includes an example of the XML description of the manifest file of "IERS Bulletin A" and the XML schema definition file (manifest.xsd) for the manifest.

An example of the EPS-SG manifest file for the IERS Bulletin A auxiliary data is attached in the file manifest.xml:

manifest.xml

The XML schema definition for the EPS-SG manifest file is attached in the file manifest-schema.xsd:

manifest_schema.xsd

Explanation on SIP folder Structure

1) In case there is a SIP folder which contains several files.
   The manifest file contains only one dataSection. This dataSection includes several dataObjects, which are distinguished by the relativePathAndFilename.

2) In case there is a SIP folder with several subfolders, each containing multiple files.
   Then the manifest file contains one dataSection for each folder (which means that we have multiple dataSections), and each dataSection contains several dataObjects.
   The dataSections are again distinguished by the relativePathAndFilename.

The XML schema definition for the Predicted Orbit File is attached below.

schemas_PRED_ORB_v3.7z

Appendix B XML DESCRIPTION FOR INTERNAL FILES OF EPS-SG AUXILIARY DATA

AUX_ECM (NWP Error Correlation Matrices)

EPS-SG-AUX_ECM.xml

AUX_LER_ (LER Database)

AUX_LER_.xml

Appendix C LIST OF TBC AND TBD

This section lists TBCs and TBDs affecting the current version of the document.

The following table presents the TBDs.

ID	Description
TBD-02	Closed
TBD-05	Closed
TBD-06	Closed
TBD-08	Closed. The model is ACE-2
TBD-09	Closed
TBD-10	Closed
TBD-11	Closed Last version: v1.31
TBD-12	Closed
TBD-13	Closed
TBD-14	The parameter Glyoxal in CAMS Forecast data is not currently available, but it will be distributed in the future. The parameter code and description are TBD.

The following table presents the TBCs.

ID	Description
TBC-01	Closed
TBC-02	Closed
TBC-03	Closed
TBC-04	Closed
TBC-05	Closed
TBC-06	Closed
TBC-07	The internal name of the NWP forecast data, NWP analysis data and CAMS forecast data is TBC with ECMWF.