Sentinel-3 Core PDGS Instrument Processing Facility (IPF) Implementation

Product Data Format Specification - Product Structures

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Issue: 1.6

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AMENDMENT POLICY

This document shall be amended by releasing a new edition of the document in its entirety. The Amendment Record Sheet below records the history and issue status of this document.

Amendment Record Sheet

ISSUE	DATE	REASON
1.0	01 Oct 2012	DR1 data-package release
1.1	18 Dec 2012	DR1 update and DR2 release
1.2	12 Feb 2013	Change of template
1.3	11 Mar 2013	CDR RID implementation
1.4	15 May 2014	DV2 update
1.5	17 October 2014	RID implementation
1.6	10 Feb 2015	Reference update, typo correction

Document Change Record

No.	Change in Issue	Description	Affected Section
1	1.1	Table 4-3 removed as per exchange with VEGA on the field length representation	
2	1.1	S3IPF-319: type length corrected to be 11 characters	
3	1.1	S3IPF-360: length of product types set to 11 characters in product summary table	
4	1.1	S3IPF-416: typos corrected in table 3. Table 3 removed and merged with table 5-1	
5	1.1	S3IPF-417: package overview updated	
6	1.1	S3IPF-418: TBD removed and clarification included that the Manifest file contains XFDU objects	
7	1.1	S3IPF-422: clarification in the concept of Primary metadata and Secondary metadata	
8	1.1	S3IPF-424: namespace list completed	

No.	Change in Issue	Description	Affected Section
9	1.1	S3IPF-427: header/footer harmonized Reference to manifest schemas included instead of schema content XFDU representation of the wrapped section included	
10	1.1	S3IPF-428: product size summary column removed to avoid duplication with specific volumes	
11	1.1	S3IPF-429: clarification introduced on the possible use of the netcdf 4 internal compression TBC on use of netcdf4 removed	
12	1.1	S3IPF-431: reference to manifest schemas included instead of schema content	
13	1.1	S3IPF-433: RID solved with the metadata specification document provision	
14	1.1	S3IPF-451: CF standard name use is defined	
15	1.1	S3IPF-470: note on empty values for scale factor/offset added	
16	1.1	S3IPF-475: manifest section reviewed	
17	1.1	S3IPF-476: The tables describing the syntax/structure have been moved to product structure document as no relevant info for the instrument specifics are contained.	
18	1.2	Change of template.	Entire document
19	1.3	Implementation of CDR RID PDGS-146	4.2.4
20	1.3	S3IPF-706: clarification on unsynchronized packet definition	2.3
21	1.3	S3IPF-707: netcdf conventions	1.3
22	1.3	S3IPF-710: remove reference to IPF CIDL	1.3.2
23	1.3	S3IPF-712: Clarification and reinsert table 5.2	5.2.1.1
24	1.3	S3IPF-715 and 815: composition of OL_1_CR1___ product completed	5.1
25	1.3	S3IPF-716: table 5.6 moved to section 3	5.4

No.	Change in Issue	Description	Affected Section
26	1.3	S3IPF-717: Captions of tables moved at the end and completed	All
27	1.3	S3IPF-916: Reference to primary metadata corrected	5.2.1.1
28	1.3	S3IPF-920: Product size tables removed from product structure	5.4
29	1.3	SYSTEM CDR PDGS-146	Table 4-4
30	1.4	Updated AD reference table	1.3
31	1.4	Resolve wrong link	4.2.1, 4.2.4, 5.2
32	1.5	S3IPF-525: Include definition of scale and offset application	4.3
33	1.6	Reference update	1.3
34	1.6	Typo correction, missing product	5.1

1. INTRODUCTION

1.1 Purpose and Scope

This document aims to identify and specify the common definitions, structures and conventions of the Sentinel 3 products from Level 0 up to Level 2.

The Product Data Format specifications have to be intended as living documents. They are based on instrument information supplied so far. Parameters and values given in these documents may change as the Instrument Processing Facilities (IPFs) become better defined.

1.2 Structure of the Document

In addition to this introduction, the document is divided into a number of major sections that are briefly described below:

Chapter Number	Title	Contents
1	INTRODUCTION	This section.
2	DEFINITIONS	This section contains definitions of general concepts applicable to the S3 product format specification.
3	PRODUCT SUMMARY TABLE	This section contains the complete list of Sentinel-3 Products.
4	PRODUCT DATA CONVENTION	This section presents convention used in the context of the S3 product format specification.
5	PRODUCT PACKAGE OVERVIEW	A high-level overview on the S3 product package structure is presented.
6	XML SCHEMAS	The xml schemas for the manifest representation are provided in this section.

Table 1-1: Document Structure

1.3 Applicable and Reference Documents

1.3.1 Applicable documents

The following applicable documents contain information supporting this document.

ID	Document	Reference
AD- 1	Sentinel 3 PDGS File Naming Convention	GMES-S3GS-EOPG-TN-09-0009 - EUM/LEO-SEN3/SPE/10/0070, i1r3, 07/11/2012
AD- 2	Drivers for the S3 PDGS Processing Function Implementation	EUM/LEO-SEN3/TEN/09/0183, V1G, ESA:GMES-GSEG-EOPG-TN-11-0062, i1r7, 27/06/2014
AD- 3	Sentinel Standard Archive Format for Europe	GAEL-P264-DOC-0001-01-01, i1r1, 11/06/2012

ID	Document	Reference
AD- 4	S3IPF PDS 008 – Metadata Specification.xlsx	Excel file describing all the manifest content, i3r0.6 *This reference is the baseline document describing the primary and secondary metadata of the product manifests. As soon as this document is consolidated, the tables will be fully included in the present document.*
AD- 5	S3 Product XML Schemas	Zip file containing all the schemas used to represent the metadata, i2r3 – 10/02/2015
AD- 6	Sentinel SAFE control book volume 1 – core specifications	GAEL-P264-DOC-0001-01-01, i1r1, 05/06/2012
AD- 7	Netcdf conventions	http://www.unidata.ucar.edu/software/netcdf/conventions.html

Table 1-2: List of applicable documents

1.3.2 Reference documents

The following documents are supposed to be read in conjunction with the present documents as they are all part of the same package:

ID	Document	Reference
RD- 1	Product Data Format Specification: SRAL and MWR	S3IPF.PDS.003, i1r9, 10/02/2015
RD- 2	Product Data Format Specification: OLCI	S3IPF.PDS.004, i1r9, 10/02/2015
RD- 3	Product Data Format Specification: SLSTR	S3IPF.PDS.005, i1r10, 10/02/2015
RD- 4	Product Data Format Specification: SYNERGY	S3IPF.PDS.006, i1r5 10/02/2015
RD- 5	Product Data Format Specification: Level0	S3IPF.PDS.001, i1r7, 10/02/2015
RD- 6	Auxiliary Data Format Specification	S3IPF.PDS.007, i1r12, 10/02/2015
RD- 7	CCSDS 661.0-B-1 XFDU structure and construction rules	Issue Sept. 2008
RD- 8	Level 0, Level 1a/b/c Products Definition Part 2 : Optical Products Volume 1: Introduction, Conventions and Common Structures	S3-RS-ACR-SY-00001, Issue: i7r0, 21/08/2013

Table 1-3: List of reference documents

1.4 Terms, Definitions and Abbreviated Terms

Acronyms specific to this document are mentioned below.

Acronym	Stands for

Acronym	Stands for
A	
ACQ	Acquisition
AD	Applicable Document
ANSI	American National Standards Institute
ANX	Ascending Node Crossing
APID	Application Process ID
AR	Anomaly Report
ATBD	Algorithm Theoretical Baseline Document
C	
CADM	Configuration And Data Management
CAL	Calibration
CCSDS	Consultative Committee for Space Data Systems
CFI	Customer Furniture Item
CGS	Core Ground Segment
CIDL	Configuration Items Data List
D	
DORIS	Doppler Orbitography and Radio-positioning Integrated by Satellite Instrument
DP	Data Package
DPM	Detailed Processing Model
E	
ECSS	European Cooperation for Space Standardization
EO	Earth Observation
ESA	European Space Agency
EUM	EUMETSAT
G	
GMES	Global Monitoring for Environment and Security
GMT	Greenwich Mean Time
GNSS	Global Navigation Satellite System
GS	Ground Segment
H	
H/W	Hardware
HK(TM)	HouseKeeping (Telemetry)
I	

Acronym	Stands for
ICD	Interface Control Document
ID	Identifier
IEEE	Institute of Electrical and Electronics Engineers
IPF	Instrument Processing Facility
ISP	Instrument Source Packets
J	
JPEG	Joint Photographic Expert Group
L	
LRM	Low Resolution Mode
LTM	Long Term Monitoring
M	
MJD	Modified Julian Day
MWR	Microwave Radiometer
N	
N/A	Not Applicable
NetCDF	Network Common Data Form
NRT	Near Real Time
NTC	Non Time Critical
O	
OBT	On-Board Time
OLCI	Ocean and Land Colour Instrument
P	
PCAT	Packet CATegory
PDGS	Payload Data Ground Segment
PID	Process ID
PM	Processing Manager
PNG	Portable Network Graphics
POD	Precise Orbit Determination
POE	Precise Orbit Ephemeris
Q	
QA	Quality Assurance
R	
RD	Reference Document

Acronym	Stands for
RID	Review Item Discrepancy
S	
SAFE	Sentinel Standard Archive Format for Europe
SALP	Service d'Altimétrie et Localisation Précise
SAR	Synthetic Aperture radar
S-3 or S3	Sentinel-3 mission
SLSTR	Sea and Land Surface Temperature Radiometer
SOW	Statement Of Work
SRAL	SAR Radar Altimeter
STC	Short Time Critical
STM	Surface Topography Mission
T	
TAI	Temps Atomique International
TAR	File archive format
TBC	To Be Confirmed
TBD	To Be Defined
TIFF	Tagged Image File Format
U	
UTC	Universal Time Coordinate
X	
XFDU	XML Formatted Data Unit
XML	Extensible Markup Language
Z	
ZIP	File compression format

Table 1-4: Term, definitions and abbreviations

1.5 Intellectual property rights for specific parts this document

ACRI-ST retains the intellectual property rights for those sections in this document that are specified in the list below. The content of these sections may only be reproduced in whole or in part, stored in a retrieval system, transmitted in any form, or by any means electronically, mechanically, or by photocopying, or otherwise, with the prior written permission of ACRI-ST.

Section	IPR/Document Reference
Section 4.2.4	Document Title: Level 0, Level 1a/b/c Products

Section	IPR/Document Reference
Section 4.2.3	Definition Part 2 : Optical Products Volume 1: Introduction, Conventions and Common Structures Document Reference: S3-RS-ACR-SY-00001 Issue: i7r0 Date: 21/08/2013
Section 4.2.1	

Table 1-5: IPRs

2. DEFINITIONS

2.1 Product Levels

2.1.1 Level 0 Product

Level 0 Product	This term is used to describe reformatted, time-sorted and annotated Instrument Source Packets (ISPs) belong to a single instrument (i.e. no NAVATT ISPs are inserted within Level 0 products). The Level 0 product for all instruments share a common format.

2.1.2 SRAL Products

Level 1 Product	This term is used to describe products containing Level 1 data that has been reported in Engineering unit with instrumental correction applied. They contain the calibrated waveform data.
Level 2 Product	This term refers to products that contain range, orbital altitude, time, water vapour from the MWR, environmental and geophysical corrections, along with significant wave height and wind-speed information.

2.1.3 MWR Products

Level 1 Product	This term is used to describe products containing data that has been converted in Engineering unit with instrumental correction applied. They contain the calibrated waveform data

2.1.4 OLCI Products

Level 1 Product	These products consist of the physical measurements of the instrument, namely top of atmosphere radiances, calibrated to geophysical units (TOA radiance: W.m-2. sr-1 µm-1), geo-referenced onto the Earth surface, as defined by a reference ellipsoid and a Digital Elevation Model (DEM), spatially re-sampled and annotated with Illumination and Observation geometry, and environment data. It shall contain as well pixel quality and surface classification information and annotations regarding acquisition geometry and meteorological data.
Level 2 Product	Products for a given pixel depend whether it was identified as cloud, water or land. The cloudy ones will be trashed, whereas both water and land pixels will get a specific processing. Each product can be provided in reduced or full resolution.

2.1.5 SLSTR Products

Level 1 Product	These products contain data re-sampled in the satellite's projection, quality-controlled and radiometrically calibrated, spectrally characterised, geometrically characterised, annotated with satellite position and pointing, landmarks and preliminary pixel classification (e.g. land/water/bright-pixel mask).The Level 1 product consists of Top of Atmosphere (TOA) radiance ($W.m^{-2}.sr^{-1}.\mu m^{-1}$) or reflectance measurements

Level 2 Product	Products for a given pixel depend whether it was identified as cloud, water or land. The cloudy ones will be trashed, whereas both water and land pixels will get a specific processing, Each product can be provided in reduced or full resolution.

2.1.6 SYN Products

Level 1 Product	The synergy Level 1c product is the combination of OLCI and SLSTR level 1 data. The Level 1c Synergy product contains all OLCI and SLSTR L1 TOA radiance and Brightness Temperature measurements in their acquisition geometry, completed by mis-registration information for resampling to a specific grid.

2.2 Ancillary/Auxiliary Products Definition

Ancillary Data	Generic term covering all on-board data, other than Observation and HKTM, necessary for the products processing. Classically, this would include not only various instrument parameters and settings but also satellite data such as OBT and Time correlations, Navigation data, etc. In the frame of Sentinel-3, we will distinguish: • *Satellite Ancillary data*, namely the Time, Navigation and Attitude data, which are grouped in dedicated packets. Note: some particular measurements acquired inside the instruments, such as temperatures, may appear both in the HKTM and in the Ancillary data, as soon as they would be used for both purposes, health monitoring on one side, product processing on the other side. • *Instrument Ancillary data*, emitted by the instruments, and generally inserted in the Instrument Source Packets, ISP
Auxiliary Data	Generic term covering several data categories used in the products processing steps at the PDGS, either of static or dynamic nature, from sources either internal or external to the Sentinel-3 System. We should find at least as auxiliary data: • Processing parameters (e.g. in a classical ASCII file format for easy reading and modification) • Characterization database (at instrument and satellite level): this database would be probably static after the launch. • Calibration database: regularly updated through the calibration process. • Climatology database: static • Meteorology data (either forecast or a posteriori analysis), automatically delivered by external providers • Geographic database: static

2.3 Terminology

The S3 PDGS Products are organized in packages.

A **Product Package** is defined as a physical collection of Components that are gathered together, using a defined packaging scheme, into a single container. It includes a manifest file (XML format) describing the contained files and the relationships among those files.

A product package is associated to the concept of **PDGS Product Category** which is defined as an attribute of the Products Package, specifying the scope of a product. Two main categories are actually identified:

- **User Product:** It is a Product Package (Standard or child) which is generated for the operational dissemination to the Sentinel-3 users (e.g. the GMES Service Projects) according to specific timeliness requirements, via subscription or Catalogue.
- **Internal Product:** It is a Product Package generated by the PDGS used only internally for normal processing reasons (e.g. as an intermediate output/input product between two consecutive processing steps) thus it is not made available to the users. These products are not directly linked to a user dissemination timeliness requirement although their processing generation time inside the PDGS is driven by these end-to-end requirements. However these products may be disseminated when needed to identified special users (e.g. cal/val users, SALP, etc.). An Internal Product, depending on the evolution of the mission needs, might change its status into User Product during the mission lifetime.

The concept of Standard or Child product introduced before is related to the actual content of a given Package. More specifically a Product package will be considered:

- **Standard Product** when the Product Package contains the standard full set of file components (metadata, measurements and annotations data files) produced and archived within the PDGS. Its along track coverage (e.g. dump, full orbit, half orbit, frame, etc) is associated to the concept of Product Dissemination Unit.

- **Child Product** when the package consists in an extraction of a number of selected measurements data files from the Standard product package, as defined above, generated and archived by the PDGS.

Regarding timeliness, the Sentinel-3 Products are categorized as:

- **Near Real Time (NRT):** Products generated in order to fulfil operational objectives related in the meteorological and oceanographic domains. They just contain basic geophysical information to be assimilated in forecasting models. They are generated using available NRT auxiliaries file (i.e. may not be most precise orbit state vector or calibration information). Their dissemination by the PDGS is due in less than 3 hours after data acquisition
- **Short Time Critical (STC)**[1]**:** Products generated to fulfil more scientific purposes related to the climate change domain, having an accuracy related to the accuracy of the auxiliary data available at the processing time. STC products are based on preliminary orbit vectors and non-consolidated auxiliaries and their dissemination is due within 48 hours after data acquisition
- **Non Time Critical (NTC):** Products generated to fulfil more scientific purposes related to the climate change domain, having an accuracy related to the accuracy of the auxiliary data used at the processing time. NTC products are consolidated products as they are generated using the most precise auxiliary information available. Their dissemination is due within typically 1 month after data acquisition.

Within Product Data Format Specifications Volume the following terms are also used:

[1] *Available only for SRAL*

- **Product Type** refers to the fixed part of the S3 PDGS file naming convention [AD- 1], including the Data source element the Processing level and the Product Type ID. It consists of a total of 11 characters including the separator element ("_").
- **Product File name**, as defined by the S3 PDGS file naming convention document [AD- 1], refers to the Product Package filename, or in other words it is the name of the directory or of the TAR archive file or the ZIP file used to create the package. It shall not be confused with the Component file name which is referred to the filename of the physical components inside the package.
- **Sensing Start time and Sensing Stop time:** it is the start time and stop time in UTC format when the data sensing occurred on board of the satellite, as calculated from the Satellite Binary Time counter for the first and the last ISP (Instrument Source Packet) in the Level 0 Product.
- **Ascending Node Crossing (ANX)**: it is where the satellite crosses the equator going from South to North.
- **Orbit:** An orbit is one full revolution of the satellite starting and ending at an ascending node. The satellite orbit is specified in two ways: absolute orbit and relative to a specific orbit cycle. The orbit numbers are specified at the sensing start time and sensing stop time of the product.
- **Pass:** A pass spans half an orbital revolution and is either ascending (South-North) or descending (North-South). This means that a pass always starts at the turnover point, i.e. the crossing of the South or North Pole. Pass number represents the number of passes since the beginning of the mission or since the beginning of the cycle (relative). Odd pass numbers are ascending, even are descending.
- **Cycle:** A cycle is one full completion of the repeat period. A cycle starts at the equator of a pass. Absolute Cycle number represents the number of the mission cycle since the beginning of the mission.
- **Granule:** Set of sort and merge ISPs data from the downlink belong to the same instrument and APID. Granule length is configurable per APID and instrument.
- **Unsynchronized packet:** if the OBT is not synchronised with satellite OBT, this flag is raised. It is linked with the 'time status' flag part of the ISP common packet structure.
- **nssdcIdentifier:** Univocally identifies the mission according to standard defined by the World Data Centre for Satellite Information (WDCdlSI), available at http://nssdc.gsfc.nasa.gov/nmc/scdlquery.html

3. PRODUCT SUMMARY TABLE

The complete list of Sentinel-3 Products is summarized in the following table. Product tree for each instrument is described in the specific document with the product size.

Instrument	Level	Product type	Description
SRAL	0	SR_0_SRA___	ISPs raw data
		SR_0_CAL___	Calibration from SRAL ISPs
	1	SR_1_SRA___	Echos for LRM and SAR mode
		SR_1_CAL___	Level 1 SRAL calibration parameters
	2	SR_2_LAN___	1-Hz and 20-Hz Ku and C bands parameters (LRM/SAR), waveforms (Over Land)
		SR_2_WAT___	1-Hz and 20-Hz Ku and C bands parameters (LRM/SAR), waveforms (Over Water)
MRW	0	MW_0_MWR___	Observation, calibration and monitoring parameters from MWR ISPs
	1	MW_1_MWR___	Level 1 observation data
	1	MW_1_CAL___	Level 1 calibration and monitoring MWR data
OLCI	0	OL_0_EFR___	Full Resolution ISPs
	0	OL_0_CR0___	Calibration with no spectral relaxation
	0	OL_0_CR1___	Calibration with spectral relaxation
	1	OL_1_EFR___	Full Resolution top of atmosphere
	1	OL_1_ERR___	Reduced Resolution top of atmosphere
	1	OL_1_RAC___	Dark offset and gain coefficients from radiometric calibration
	1	OL_1_SPC___	Wavelength characterization from spectral calibration
	2	OL_2_WFR___	Full Resolution Water & atmosphere parameters
	2	OL_2_LFR___	Full Resolution Land and Atmosphere parameters
	2	OL_2_WRR___	Reduced Resolution Water & atmosphere parameters
	2	OL_2_LRR___	Reduced Resolution Land and Atmosphere parameters
	1	OL_1_EFR_BW	Browse product derived from product type OL_1_EFR___
	1	OL_1_ERR_BW	Browse product derived from product type OL_1_ERR___
	2	OL_2_WRR_BW	Browse product derived from product type OL_2_WFR___
	2	OL_2_LFR_BW	Browse product derived from product type OL_2_WFR___
	2	OL_2_WFR_BW	Browse product derived from product type OL_2_LFR___
	2	OL_2_LRR_BW	Browse product derived from product type OL_2_LRR___
SLSTR	0	SL_0_SLT___	Full Resolution ISPs
	1	SL_1_RBT___	Brightness temperatures and radiances
	2	SL_2_WCT___	Sea Surface Temperature (single and dual view, 2 and 3 channels)
	2	SL_2_WST___	Level 2P Sea Surface Temperature (GHRSST like)
	2	SL_2_LST___	Land Surface Temperature Parameters
	1	SL_1_RBT_BW	Browse product derived from product type SL_1_RBT___
	2	SL_2_WST_BW	Browse product derived from product type SL_2_WST___
	2	SL_2_LST_BW	Browse product derived from product type SL_2_LST___
SYN	1	SY_1_SYN___	All OLCI and SLSTR L1b ungridded bands (L1C)
	2	SY_2_SYN___	Surface Reflectances and Aerosol parameters over Land
	2	SY_2_VGP___	1 km VEGETATION Like product (~VGT-P) - TOA Reflectances
	2	SY_2_VG1___	1 km VEGETATION Like product (~VGT-S1) 1day synthesys surface reflectances and NDVI
	2	SY_2_V10___	1 km VEGETATION Like product (~VGT-S10) 10days synthesys surface reflectances and NDVI
	2	SY_2_SYN_BW	Browse product derived from product type SY_2_SYN___
	2	SY_2_VGP_BW	Browse product derived from product type SY_2_VGP___
	2	SY_2_VG1_BW	Browse product derived from product type SY_2_VG1___
	2	SY_2_V10_BW	Browse product derived from product type SY_2_V10___
GNSS	0	GN_0_GNS___	GNSS ISP
DORIS	0	DO_0_DOP___	Measurements packets including Doppler, datation and test packets
	0	DO_0_NAV___	Navigation packets including ITRF, geodetic and J2000
Telemetry	0	TM_0_HKM___	Payload and Platform House Keeping telemetry packets
	0	TM_0_NAT___	Telemetry Source packets (navigation and attitude)

Table 3-1: S3-Product summary table

4. PRODUCT DATA CONVENTION

This section summarizes the product conventions used in the Product Format Specification Volumes.

4.1 Product Naming Convention

The names of the Sentinel 3 products comply with the Sentinel 3 file naming convention [AD- 1].

4.2 Data Representation

4.2.1 Data Types

The convention applies to the element data types are listed in the next table.

Variable Type	C Type	Abbreviation	Range
Character	char	sc or i8: signed char	-128 to 127 (2's comp.)
		uc or u8: unsigned char	0 to 255
2-byte integer	short	ss of i16: signed short integer	-32768 to 32767 (2's comp)
		us or u16: unsigned short integer	0 to 65535
4-byte integer	long	sl or i32: signed long integer	-2147483648 to 2147483647
		ul or u32: unsigned long integer	0 to 4294967295
8-byte integer	long long	sll or i64: signed long long integer	-9223372036854775808 to 9223372036854775807
		ull or u64: unsigned long long integer	0 to 18446744073709551615
4-byte single precision floating point	float	fl or f32	3.4028e+38 (max) 1.17549e-38 (min)
8-byte double precision floating point	double	D for f64	1.79e+308 (max) 2.22e-308 (min)

Table 4-1: Data types

The ANSI/IEEE 754-1985 is the chosen standard for storing real numbers.

In the manifest file the following additional data type are also used to describe metadata:

Variable Type	C Type	Abbreviation
String	char[2]	S
String enumerative (String with limited number of possible values to be taken out of a set	char	E
String of the type yyyy-mm-ddThh:mm:ss.uuuuuu, representing the UTC date (year, month, day) and time (hours, minutes, seconds) separated by the character T, e.g. 1974-04-18T10:00:00.000000	char	UTC
Fixed String (Only One Value Possible)	char	FS
Boolean (“0” for FALSE, “1” for TRUE)	short	B

Table 4-2: Additional Data types

For the metadata contained in XML files, the lexical representation that can be found in the xml schema part 2: datatypes (see http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/) is followed.

In cases where a field is not fully filled by the value which it contains, placeholder values are used. For ASCII strings, the placeholder character is the ASCII blank space character. For numerical-values, the placeholder value is zero unless otherwise stated.

4.2.2 TIME

Within the PDGS time is expressed as:

- **UTC (Universal Time Coordinate)** almost equivalent to GMT (Greenwich Meridian Time) presented as a string of 26 significant characters with the format:

  yyyy-mm-ddThh:mm:ss.uuuuuu

  where
  YYYY : year [1950..2050]
  MM : month [JAN=01, FEB=02,...NOV=11, DEC=12]
  DD: day [1..31]
  T: character
  hh : hour [00..23]
  mm : minutes [00..59]
  ss : second [00..59]

[2] *It is of variable size, the number of bytes given in the Product Description Tables refers to the maximum number.*

uuuuuu : µs [000000..999999] may be blanked by spaces if irrelevant

e.g., April 18, 1974 at 10:00 is coded as

1974-04-18T10:00:00.000000

- **MJD 2000 (Modified Julian Day 2000)** is the decimal number of day since January 1, 2000 at 00:00 hours. It is represented by 3 long integers (4 bytes each, 12 bytes total) as follows:

N	Description	Units	Byte Lengths	Data Type
1	**Number of days elapsed since the 1st of January 2000 at 0:0 hour. It may be negative, and is thus a signed long integer**	days	4	sl
2	**Number of seconds elapsed since the beginning of that day**	s	4	ul
3	**Number of microseconds elapsed since the last second**	µs	4	ul
Total			12	

Table 4-3: MJD Format

As a general rule, UTC time format is used in the manifest file, while MJD format is used when time stamps are required for Data Objects.

4.2.3 BIT / BYTE NUMBERING

For the purpose of identifying bits within a binary format, the numbering convention shown below is used (big endian rules). Byte 0 is the least significant byte. Within a byte, bit 0 is the least significant bit. Bytes and bits numbering always starts at 0.

- 1 byte structure

BYTE 0
7 6 5 4 3 2 1 0

- 2 byte structure (short)

BYTE 1	BYTE 0
7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0

- 4 byte structure (long):

BYTE 3	BYTE 2	BYTE 1	BYTE 0
7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0	7 6 5 4 3 2 1 0

- 4 byte structure (float):

Use IEEE standard (big endian)

- 8 byte structure (float):

  Use IEEE standard (big endian).

4.2.4 Unit

The convention applies to the element unit are listed in the next table.

Quantity	Unit	Notation
Irradiance	10^{-3} W.m^{-2}.nm^{-1}	IU or mW.m-2.nm-1
Radiance	10^{-3} W.m^{-2}.sr^{-1}.nm^{-1}	LU or mW.m-2.sr-1.nm-1
	W.m^{-2}.sr^{-1}	W.m-2.sr-1
Time	jd or MJD or MJD2000	Jd or MJD or MJD2000
	10^{-6} s	μs
	s	s
Distance	10^{-9} m	nm
	10^{-6} m	μm
	m	m
	10^{3} m	km
	km	km
Velocity	m.s^{-1}	m.s-1
Percentage	%	%
Voltage	V	V
Product Size	bytes	B
Temperature	K (degree Kelvin)	K
	C (degree Celsius)	C
Frequency	Hz	Hz
Resistance	Ohm	Ohm
Latitude	° (degree with positive values for North latitude)	deg
Longitude	° (degree with positive values East of Greenwich meridian)	deg

Angle	° (degree)	deg
	10^{-6} ° (degree)	(1e-6)deg
	rad	rad
	1/3600 ° (arc second)	arc second
Back scatter coefficient	db	db
Solid Angle	sr	sr
Pressure	hPa	hPa
Ozone, Total Column Water Vapour, …	$kg.m^{-2}$	kg.m-2
Dimensionless	nc (numerical count) dl	nc dl
Gamma Parameter	K/km	K/km
Rain rate	mm/h	mm/h
Multiple dimension quantities	md (table constituted with different physical parameters having different units)	md
Wind stress	$N.m^{-2}.s$	$N.m^{-2}.s$
Solar Radiation, heat flux	$W.m^{-2}.s$	$W.m^{-2}.s$

Table 4-4: Unit

4.3 NetCDF files representation convention

NetCDF is a binary file format where the information is broken into four groups:

- *Groups*: group act as an entire NetCDF file and then may have attributes, dimensions, and variables.
- *Dimensions*: dimension is used to define the size of one or more of the multidimensional variables. A dimension has a length and a name. A dimension defined at top-level outside any group is available in all the groups.
- *Variables*: variable represents a multidimensional array of values of the same type. A variable has a name, a data type, and a size described by its list of dimensions.
- *Attributes*: attribute contains information about a variable (variable attribute) or about the whole NetCDF file (global attribute). Attributes may be used to specify properties as units, special values, maximum and minimum threshold values, and packing parameters. Attribute information is represented by single values or one-dimensional arrays of values.

The following convention should be used in documentations to represent all files in the NetCDF format using tables. The goal is to increase the global readability of this kind of long tables. A post-processing Microsoft Word macro will be provided to be able to export the tables into their corresponding CDL NetCDF representation; this tool will be used to do the link between the NetCDF files description and their implementation.

Convention details:

- landscape page orientation is used for the document sections containing NetCDF tables
- only background colours are used to differentiate NetCDF objects (groups, dimensions, variable and attributes): groups are in orange, dimensions in light blue, variables in light yellow and attributes in white with name right-aligned:

Element name	Description	Range or value	T	D
<global common attributes>	Common global attributes as defined in 4.4			
group_name				
dimension_name				
variable_name				
attribute_name				

- the table contains 5 columns:
  - **"Element name":** the name of NetCDF group, dimension, variable or attribute. For groups this is the only column filled, the others are empty.
  - **"Description":** description of the element; for a variable the description must be used to fill its "long_name" attribute (this attribute is then implicit and not described in the variable attributes list)
  - **"Range or value":** range or value of variables, or value of dimensions or attributes. The variable range is given in its geophysical unit, which could be different than the storage range defined by the standard "valid_min" and "valid_max" attributes (in case of NetCDF "packed" storage using the standard "scale_factor" and "add_offset" attributes). If the range is not empty it must be used to compute the "valid_min" and "valid_max" attributes, using the "scale_factor" and "add_offset" attributes if needed

(these attributes are then implicit and not described in the variable attributes list). It is possible to give only one bound of the range (i.e. [1,]).
    - **"T":** type of variables or attributes as defined section 4.2.1, not used for groups and dimensions
    - **"D":** dimensions of the variables or attributes, in the same order than storage and with one dimension per line
- dimensions must be always defined before variables
- dimensions, variables and attributes may be defined at top-level outside any group; in this case they must appear before the first group
- attributes may be global or related to a group instead of a variable; in this case they must appear before dimensions

The table below is an example following this convention, it should be used as a template for each new table.

Element name	Description	Range or value	T	D
<global common attributes>	Common global attributes as defined in 4.4			
lon	**Number of longitude points**	**360**		
lat	**Number of latitude points**	**180**		
lon	**Longitude**	**[-180, 180]**	**fl**	**lon**
units	UDUNITS unit name	degrees_east	S	1
lat	**Latitude**	**[-90, 90]**	**fl**	**lat**
units	UDUNITS unit name	degrees_north	S	1
climatology				
depth	**Number of depth levels**	**11**		
SST	**Sea Surface Temperature climatology**	**[-5, 50]**	**us**	**depth lat lon**
units	UDUNITS unit name	deg_C	S	1
_FillValue	Default value for unused elements	65535	us	1
scale_factor	The data must be multiplied by this factor after reading	0.01	fl	1
add_offset	This offset must be added to the data after reading (and after scaling if needed)	-5	fl	1
chl	**Chlorophyll concentration climatology**	**[0.01, 30]**	**fl**	**lat lon**
units	UDUNITS unit name	mg/m3	S	1
_FillValue	Default value for unused elements	-999	us	1
standard_name	Name of the physical quantity following the NetCDF Climate and Forecast (CF) Metadata Conventions	mass_concentration_of_chlorophyll_a_in_sea_water	S	1

Table 4-5 Template for NetCDF files representation

scale_factor

If present for a variable, the data are to be multiplied by this factor after the data are read by the application that accesses the data.

If valid values are specified using the valid_min, valid_max, valid_range, or _FillValue attributes, those values should be specified in the domain of the data in the file (the packed data), so that they can be interpreted before the scale_factor and add_offset are applied.

add_offset

If present for a variable, this number is to be added to the data after it is read by the application that accesses the data. If both scale_factor and add_offset attributes are present, the data are first scaled before the offset is added. The attributes scale_factor and add_offset can be used together to provide simple data compression to store low-resolution floating-point data as small integers in a netCDF dataset. When scaled data are written, the application should first subtract the offset and then divide by the scale factor, rounding the result to the nearest integer to avoid a bias caused by truncation towards zero.

When scale_factor and add_offset are used for packing, the associated variable (containing the packed data) is typically of type byte or short, whereas the unpacked values are intended to be of type float or double. The attributes scale_factor and add_offset should both be of the type intended for the unpacked data, e.g. float or double.

Note: scale_factor/add_offset values might be defined via processing parameters read by the processor at runtime, this explains that for some variables the values remain empty.

4.4 Common global attributes

All files stored in formats that allow metadata definition (for example NetCDF or GeoTIFF) should contain the global attributes presented in the table below, except for “validity_start_time” and “validity_stop_time” which are only related to ADFs.

For GeoTIFF these attributes are defined as GeoTIFF “private tags” which are stored in the “GeoKeyDirectoryTag” Image File Directory (IFD). The private tags start at number 32768.

Element name	Description	Range or value	T	D
<format>_version	Version of the <format> library used to generate the file.		S	1
product_name	Name of the product including extension and without path		S	1
title	High-level descriptive title for the product		S	1
institution	Location where file was produced		S	1
source	Method of production of data		S	1
history	Provides an audit trail for modifications to the original data. Each program which modified the product must append a new line at the end of history following this format: “timestamp: program_name args” with timestamp in the UTC YYYY-MM-DDThh:mm:ssZ CCSDS format.		S	1
references	References describing data and methods used to produce the file (i.e. Product Definition document, ATBD, DPM as a minimum) in a comma separated list		S	1
contact	URL or email of supporting organization		S	1

Element name	Description	Range or value	T	D
creation_time	Creation date and time in the UTC YYYY-MM-DDThh:mm:ssZ CCSDS format		S	1
validity_start_time	Validity start date and time in the UTC YYYY-MM-DDThh:mm:ssZ CCSDS format		S	1
validity_stop_time	Validity stop date and time in the UTC YYYY-MM-DDThh:mm:ssZ CCSDS format		S	1

Table 4-6 Common global attributes

4.5 XML files representation convention

The following convention should be used in documentations to represent all files in the XML format using tables. The goal is to increase the global readability of this kind of long tables.

Convention details:

- landscape page orientation is used for the document sections containing XML tables
- light yellow background colour is used to differentiate “containers” which are always delimited by “Open” and “Close” rows, variables are left-aligned and attributes right-aligned:

Element name	Description	Range or value	Unit	T	C
container_name	**Open container**				
simple_element_name					
attribute_name					
container_name	**Close container**				

- the table contains 5 columns:
  - **“Element name”:** the name of XML container, simple element or attribute
  - **“Description”:** description of the element; for containers the first ligne must be always “Open container” or “Close container”
  - **“Range or value”:** range or value of variables or attributes. It is possible to give only one bound of the range (i.e. [1,]).
  - **“Unit”:** type of variables or attributes as defined section 4.2.4, not used for containers
  - **“T”:** type of variables or attributes as defined section 4.2.1, not used for containers
  - **“C”:** cardinality of elements (1, [0..1], [1..], [x..y] or a fixed value)
- attributes may be related to variables or containers

The table below is an example following this convention, it should be used as a template for each new table.

Element name	Description	Range or value	Unit	T	C
Formats	**Open container**				**1**
JPEG2000	**Switch to enable the JPEG2000 image format**			**B**	**1**
quality	JPEG2000 compression quality (default: 25). A value of 50 means the file will be half-size in comparison to uncompressed data, 33 means 1/3, etc…	[0, 100]		sl	1

Element name	Description	Range or value	Unit	T	C
reversible	Switch to enable the JPEG2000 lossless compression mode (default: FALSE)			B	1
GEOTIFF	**Switch to enable the GeoTIFF image format**			**B**	**1**
compress	GeoTIFF internal compression (default: ”None”)	{“None”, “PACKBITS”}		S	1
Formats	**Close container**				**1**

Table 4-7 Template for XML files representation

5. PRODUCT PACKAGE OVERVIEW

This section describes the high-level format and structure of the Sentinel-3 products. The term *product* is used to refer a package that contains information grouped together to form a complete product.

The format of the Sentinel-3 products is derived from the XML Formatted Data Unit (XFDU) by using a specialisation process that maximises the reuse of the namespaces and schemas as defined in the Sentinel-SAFE format.

The XFDU is the CCSDS standard for packaging data and metadata, into a single package.

Sentinel-SAFE (Sentinel Standard Archive Format for Europe) is an ESA's file format standard based on SAFE and designed to act as a standard format for Sentinel platforms data that conforms to the XFDU construction rules and adapts it to Earth Observation products. In particular, the Sentinel-SAFE format specification includes the definition of a new name space (Sentinel-SAFE) which contains the definition of a set of metadata xml type specific for Earth Observation missions.

An XFDU package is made of a physical container (such as a ZIP file) that contains a manifest file that describes what is inside the container and how it is organised.

The definition of the format of Sentinel-3 products is based on a packaging concept that is done building on the SAFE experience and that implement a restriction of XFDU specific for the Sentinel missions.

In particular, the specialisation for the Sentinel 3 products consists of the specialisation of the XFDU schema defined at the Core Specification Layer to restrict existing types and include new types specific to the product. Specialisation can take place at several stages and at each stage the specialisation inherits the results of the previous stages.

At product level, some restrictions have to be applied, typically to quality information tags and orbit information tags (depending on the orbit file used for that processing level).

Another aspect common to the definition of the Sentinel-3 products is the concept of having the Measurement Data File distributed in different files associated with a common set of Annotation Data Information.

5.1 High Level Product Package Data Structure

The purpose of this section is to describe the high level product structure of the Sentinel-3 products without requiring an extensive knowledge of the XML Schema and NetCDF format details.

The high level physical structure of the Sentinel-3 product package is reported in Figure 5-1.

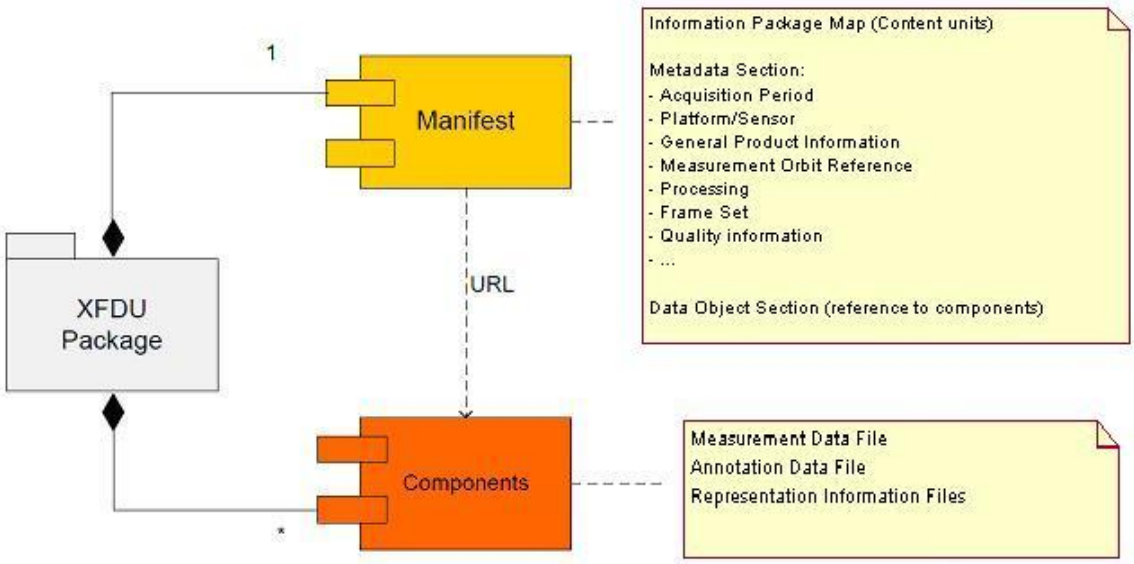

Figure 5-1: Sentinel 3 Product Structure: High Level View

A multi-file structure is associated within a single package, based on a multiple instance of file *Components* and a set of Metadata included in the *Manifest*.

The Manifest file can be split into three different parts at higher level:

- The *Information Package Map* contains the logical view of the package. It provides a hierarchical view of the content of the XFDU using a series of nested Content Unit elements. Content Units contain pointers to data objects and to the metadata associated with those data objects.
- The *Metadata Section* records all of the metadata for all items in the package. The Sentinel-3 Product packages can contain Referenced Metadata (that points to a representation data file), Wrapped Metadata (information included directly in the manifest file) and data object pointer (that points to an external annotation data file). Regarding Wrapped Metadata, two classes of metadata have been individuated:
    - *Primary Metadata*: metadata common to all products, regardless of the instrument or the level of processing
    - *Secondary Metadata*: metadata specific for each instrument and/or level of processing.
- The *Data Object Section* contains all the physical information needed to get the location of each file composing the package.

There are three different categories of components:

- *Measurement Data file*: this file contains binary information (also called geophysical product or scientific data) which cause the existence of the product package itself. In other words a Measurement data file is part of the core of a product around which all the other information is embedded. A Measurement Data can be organized in a single file or in a set of physical files.
- *Annotation Data file*: It is a file that contains data other than instrument measurements. The information contained in this file can be common to several measurements data files contained in the same package.

- *Representation Data file*: this file describes the structure of a measurement data file or annotation file which has not been implemented in a well-known standard format. In case of S3 PDGS these files are used for Level-0 products only.

Table **5**-**1** presents an overview of the composition of Sentinel-3 products.

Instrument	Product type	Manifest	Measurement data files	Annotation data files	Representation Data files
SRAL	SR_0_SRA___	x	x	x	x
	SR_0_CAL___	x	x	x	x
	SR_1_SRA___	x	x		
	SR_1_CAL___	x	x		
	SR_2_LAN___	x	x		
	SR_2_WAT___	x	x		
MRW	MW_0_MWR___	x	x	x	x
	MW_1_MWR___	x	x		
	MW_1_CAL___	x	x		
OLCI	OL_0_EFR___	x	x	x	x
	OL_0_CR0___	x	x	x	x
	OL_0_CR1___	x	x	x	x
	OL_1_EFR___	x	x	x	
	OL_1_ERR___	x	x	x	
	OL_1_RAC___	x	x	x	
	OL_1_SPC___	x	x	x	
	OL_2_WFR___	x	x	x	
	OL_2_LFR___	x	x	x	
	OL_2_WRR___	x	x	x	
	OL_2_LRR___	x	x	x	
	OL_1_EFR_BW	x	x		
	OL_1_ERR_BW	x	x		
	OL_2_WRR_BW	x	x		
	OL_2_LFR_BW	x	x		
	OL_2_WFR_BW	x	x		
	OL_2_LRR_BW	x	x		
SLSTR	SL_0_SLT___	x	x	x	x
	SL_1_RBT___	x	x	x	
	SL_2_WCT___	x	x	x	
	SL_2_WST___	x	x		
	SL_2_LST___	x	x	x	
	SL_1_RBT_BW	x	x		
	SL_2_WST_BW	x	x		
	SL_2_LST_BW	x	x		
SYN	SY_1_MISR__	x	x	x	
	SY_2_SYN___	x	x	x	
	SY_2_VGP___	x	x	x	

	SY_2_VGK___	x	x	x	
	SY_2_VG1___	x	x	x	
	SY_2_V10___	x	x	x	
	SY_2_SYN_BW	x	x		
	SY_2_VGP_BW	x	x		
	SY_2_VG1_BW	x	x		
	SY_2_V10_BW	x	x		
GNSS	GN_0_GNS___	x	x	x	x
DORIS	DO_0_DOP___	x	x	x	x
	DO_0_NAV___	x	x	x	x
Telemetry	TM_0_HKM___	x	x	x	x
	TM_0_NAT___	x	x	x	x

Table 5-1: Sentinel-3 Products Composition

5.2 Manifest File

The Manifest of any S3 Product shall comply with [AD- 3] and contains information relevant to the product data composition. It describes all the physical components and interconnects all objects of the product. It can be considered as the map of the product and there is one manifest for each product.

The Manifest file is an XML file that provides all the relevant product information for cataloguing and archiving purpose. Implementation of the Sentinel-SAFE format is handled via XML schemas that are included in the specific instrument's volumes. In this volume the manifest content is represented with tables that specify the sequential order of the data and their definition. The table describing the entire content of the Manifest file have four columns described below:

- *Name*: name of the Element or of the Object in the Manifest file, i.e. tag name in XML format
- *Description*: Free text that defines the Element or the Object
- *Type*: Data Element type
- *Occurrence*: Number of Elements or Objects

The Manifest file contains XFDU objects, the table described in this paragraph are used to describe those objects.

The structure of the Manifest element is as follows:

Name	Description	Data Type	Reference	Occ.
version	Attribute containing the relative path for the *xfdu.xsd* XML schema corresponding to the product	string	-	1
informationPackageMap	Contains a high-level textual description of the product and references to all product components	informationPackageMapType	See IPF specific sections of the PDS	1
metadataSection	Contains the product Metadata	metadataSectionType	See section 5.2.1	1
dataObjectSection	Contains references to the physical information needed to get the location of each file composing the package	dataObjectSectionType	See section 5.2.2	1

Table 5-2: XFDU Manifest

5.2.1 Metadata Section

The manifest contains one *Metadata Section*. The Metatada Section contains a list of *metadata objects* as described in the following:

- *dataObjectPointer*: Data Object Pointer is used when the metadata object is an Annotation Data File. The data object pointer is used to point to the applicable Annotation data file.
- *metadataWrap:* Metadata Wrap is used to include metadata directly in the manifest file.
- *metadataReference:* Metadata Reference is used when the metadata object is a Representation Data File. The *Metadata Reference* is used to specify the physical file location of the applicable Representation Data file.

5.2.1.1 Wrap Metadata

The S3 metadata elements are directly embed in the manifest file via XML file. They are classified as:

- Primary Metadata: common to all S-3 products
- Secondary Metadata: specific for the instrument and for the level of the processing

In Table 5-3 the list of Primary Metadata is provided. The Secondary Metadata is described in the specific Product Data Format Specification Document.

Inside the manifest file, the set of primary metadata is to be embedded into a section identified by the tag: <generalProductInformation> and the set of secondary metadata is to be embedded into a specific instrument section identified by the tag: <*instrument*ProductInformation> (e.g. olciProductInformation …).

The table describing the content of the Wrap metadata has six columns as described below:

- *Element name*: consists of element names in the Manifest. Element can contain other elements and attributes about these elements. In this case they are shown one level right in the table wrt the parent element. Particularly attributes are highlighted in brown colour and in *italic* letter.
- *Description*: free text that defines the Element
- *Range or value*: range of data of the Element (if available, left empty otherwise)
- *Data Type*: data element type
- *Byte Length*: dimension in bytes of the Element
- *Unit:* units of data of the Element

The following namespaces are used in the generation and validation of the manifest files and in all other schemas used within the S3 products:

http://www.w3.org/2001/XMLSchema

http://www.w3.org/2001/SMIL20/

http://www.w3.org/2001/SMIL20/Language

http://www.w3.org/XML/1998/namespace

http://www.gael.fr/2004/12/drb/sdf

urn:ccsds:schema:xfdu:1

http://www.w3.org/1999/xlink

http://www.opengis.net/gml

http://www.ccsds.org/xfdu/2004

http://www.esa.int/safe/sentinel/1.1

http://www.esa.int/safe/sentinel/1.1/sentinel-3

*< Complete primary metadata is described in details in [*AD- 4*].*
The content of this table will be embedded in the document when it will be finalized>

Table 5-3: Primary Metadata

XFDU representation of the wrapped section shall follow the following syntax:

Name				Description	Occ.
metadataObject					
	ID			identifier	1
	classification			concrete type of metadata represented by this element of metadataObjectType	0..1
	category			type of metadata class to which this metadata belongs	0..1
	metadataWrap				*
		textInfo		a label to display to the viewer of the XFDU document identifying the metadata	0..1
		vocabularyName		the name of the well known standard vocabulary of the metadata being pointed at	1
		mimeType		the MIME type for the metadata being pointed at	0..1
			xmlData	Wrapper to contain metadata	1

Table 5-4: XFDU Representation

5.2.1.2 Metadata Reference

Metadata Objects can be also references to external files containing Metadata.

Metadata reference components are described in details in the Level 0 Product Data Format Specification Volume (since Representation Data files are used for Level-0 products only).

Name			Description	Data Type	Occ.
metadataObject					
	ID		identifier		1
	classification		concrete type of metadata represented by this element of metadataObjectType		0..1
	category		type of metadata class to which this metadata belongs		0..1
	metadataReference				*
		ID	identifier		0..1
		textInfo	a label to display to the viewer of the XFDU document identifying the metadata		0..1
		locatorType	the type of locator contained in the body of the element		1
		href	actual location		1
		vocabularyName	the name of the well known standard vocabulary of the metadata being pointed at		1
		mimeType	the MIME type for the metadata being pointed at		0..1

Table 5-5: Reference Metadata Object

5.2.2 Data Object Section

The Data Object structure is as follows in Table **5**-**6**.

Name				**Description**	**Data Type**	**Occ.**
dataObject				This element references the *Data Component* included in the L0 product.	U	1..*
	ID			*Data Component*;ID	S	1
	repID			List of IDs of all XML Schemas associated to *Data Component*	S	1
	byteStream			Pointer to the *Data Component*	U	1..*
		mimeType		The MIME type for the referenced *Data Component*	E	1
		size				
		fileLocation		Describe the location of file	U	1
			ID			
			locatorType	Type of the file location	URI	0..1
			locator			
			textInfo	Textual description of the *Data Component*	S	0..1
			href	Relative path of the file (in the file system) containing the referenced *Data Component*	URI	
		checksum		Checksum for the *Data Component*	U	1
			checksumName		E	1

Table 5-6: Data Object Structure

Note: In the specific instrument specification documents, the information package maps are detailed; the dataObjectPointer elements, values for the "Data Object pointer ID" (ID) and "Data Object element ID".(dataObjectID) are equivalent.

dataObjectPointer		
	ID	Data Object pointer ID
	dataObjectID	Data Object element ID

Table 5-7: Data Object Pointer Structure

5.3 Product Components

5.3.1 Measurement Data File

The Measurement Data File is a file that contains:

- Binary information derived from instrument data
- images derived from instrument data

The measurement data file formats used in the context of Sentinel-3 are:

- L0 products: file in pure binary format containing the ISPs
- L1 and L2 products: NetCDF4 format. The NetCDF internal compression might be optionally used by the IPFs.

5.3.1.1 Level 0 Format

Binary format of Level 0 Products is specified in the Product Format Specification Document specific to Level0 product [RD- 5].

5.3.1.2 NetCDF Format

The NetCDF binary format and conventions used in the frame of the project are described sections 4.3 and 4.4.

5.3.1.3 Browse products Format

The Browse products format is configurable, the following formats are available:

- JPEG (Joint Photographic Experts Group, .jpg extension): lossy compression, RGB or greyscale modes supported
- JPEG2000 (.jp2 extension): lossy or lossless compression, RGB or greyscale modes supported
- GeoTIFF (.tif extension): none or lossless compression, RGB, greyscale and paletted modes supported
- PNG (Portable Network Graphics, .png extension): lossless compression, RGB, greyscale and paletted modes supported

5.3.2 Annotation Data File

Annotation Data Files are files that contain metadata (i.e. data that describes characteristics of the product) as:

- Time stamp file
- Geolocation file
- Quality flags file
- Tie Points Annotations file
- General Information Data File
- OnLine Quality Control Report

The content of each Annotation Data File is described in the related Product Format Specification Document, specific for each instrument and product.

The OnLine Quality Control report is generated by the OnLine QC processor, which is the PDGS component in charge of checking Sentinel 3 Products before dissemination. It performs basic checks on a systematic basis to verify internal consistency and to provide a high-level quality flag. The format of this report is described in [TBC].

5.3.3 Representation Data File

The Representation Data Files are XML schemas describing the measurement component. Only L0 products include this type of file. The content of the Representation Data File is described in the Level 0 Product Format Specification Document [RD- 5].

6. XML SCHEMA

To avoid duplication, XML schemas are kept in separate files delivered along with the product specification documents (see AD- 7).

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