



PROGRAMME OF  
THE EUROPEAN UNION



## SPECIFICATIONS

### Sentinel-5P Product Unit Definition and Metadata ICD

**Prepared by**  
**Reference**  
**Issue/Revision**  
**Date of Issue**  
**Status**

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**ESA-EOPG-EOPGC-SP-4**  
**1.6**  
**22/03/2024**  
**Issued**

# APPROVAL

<b>Title</b> Sentinel-5P Product Unit Definition and Metadata ICD	
<b>Issue Number</b> 1	<b>Revision Number</b> 6
<b>Author</b> CSC Operations Team	<b>Date</b> 22/03/2024
<b>Reviewed By</b>	<b>Date of Approval</b>
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# CHANGE LOG

Reason for change	Issue Nr.	Revision Number	Date
Introduction of GS Element Applicability	1	1	Feb. 2020
Document structure and content aligned to the new specification	1	2	Jan. 2021
“Checkpoint 2022” update	1	3	Sep. 2022
[AD-1] version and date update; FRESCO products alignment	1	4	Apr. 2023
Addition of new VIIRS AUX file types to be managed and change of packaging	1	5	Jul. 2023
Update of Sentinel-5P Product Attributes Mapping Excel file and update for L2_FRESCO distribution	1	6	Mar. 2024

# CHANGE RECORD

<b>Issue Number</b> 1	<b>Revision Number</b> 1		
Reason for change	Date	Pages	Paragraph(s)
Introduction of GS Element Applicability	Feb. 2020	6, 7	Table 2-1

Issue Number 1	Revision Number 2		
Reason for change	Date	Pages	Paragraph(s)
Document structure and content aligned to the new specification	Jan. 2021	All	All

Issue Number 1	Revision Number 3		
Reason for change	Date	Pages	Paragraph(s)
Addition of [AD-1] applicable document	Sep. 2022	5	1.2
Addition of GeoFootprint property	Sep. 2022	12	Table 3-1
Removal of “coordinates” OData attribute in favour of the usage of Footprint and GeoFootprint properties	Sep. 2022	14	Table 4-1
Addition of VDAF and PyCAMA attributes mapping and MPC applicability	Sep. 2022	14	Table 4-1
Replacement of Data Distribution (DD) with Data Access (DA)	Sep. 2022	6, 12, 14	1.4, Table 3-1, Table 4-1

Issue Number 1	Revision Number 4		
Reason for change	Date	Pages	Paragraph(s)
Update of [AD-1] version and issue date	Apr. 2023	5	1.2
Alignment with Attributes Mapping and [AD-1] for FRESCO products	Apr. 2023	6	Table 2-1

Issue Number 1	Revision Number 5		
Reason for change	Date	Pages	Paragraph(s)
Addition of new VIIRS_CP, VIIRS_DCOMP and VIIRS_CTH AUX file types	Jul. 2023	10	Table 2-2
Update of packaging format for VIIRS_CM files	Jul. 2023	10	Table 2-2

Issue Number 1	Revision Number 6		
Reason for change	Date	Pages	Paragraph(s)
Moved L2_FRESCO from Sentinel-5P Products list (Table 2-1) to Sentinel-5P Auxiliary Data list (Table 2-2)	Mar. 2024	9	Table 2-2
Update of Sentinel-5P Product Attributes Mapping Excel file	Mar. 2024	n/a	Sentinel-5P Product Attributes Mapping_v1.6.xlsx

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## 1 INTRODUCTION

### 1.1 Purpose and Scope

The scope of this document is to be used as an annex for the CSC Common Entity Definition Document [RD-3] in order to describe the Product Entity Properties, the Product Attributes and the corresponding metadata elements that shall be catalogued and queryable for Sentinel products. This document provides the mapping and applicability for Sentinel-5P products.

### 1.2 Applicable Documents

ID	Document Reference	Document Title
[AD-1]	ESA-EOPG-EOPGC-TN-58	Copernicus Ground Segment Sentinels Data Flow Configuration

**Table 1-1 – Applicable Documents**

### 1.3 Reference Documents

ID	Document Reference	Document Title
[RD-1]	S5P-PDGS-DLR-ISP-3011	Sentinel-5 Precursor PDGS Lo Product Format Specification
[RD-2]	S5P-KNMI-Lo1B-0014-SD	Metadata specification for the TROPOMI L1b products
[RD-3]	ESA-EOPG-EOPGC-IF-5	Copernicus Space Component Ground Segment - Common Entity Definition Document
[RD-4]	OGC 17-003r0	OGC EO Dataset Metadata GeoJSON(-LD) Encoding Standard
[RD-5]	OGC 10-157r4	OGC Earth Observation Metadata profile of Observations & Measurements
[RD-6]	ESA-EOPG-EOPGC-TN-13	Copernicus Space Component Ground Segment Operations Glossary

**Table 1-2 – Reference Documents**

## 1.4 Acronyms, Definitions and Abbreviations

Acronym	Description
CSC	Copernicus Space Component
DA	Data Access
GS	Ground Segment
ICD	Interface Control Document
JSON	JavaScript Object Notation
LTA	Long Term Archiving
NetCDF	Network Common Data Format
ODP	On-Demand Processing
PR	Systematic Production

**Table 1-3 – Acronyms and Abbreviations**

## 2 SENTINEL-5P PRODUCTS AND AUXILIARY DATA

### 2.1 Sentinel-5P Product List

The following table presents the list of Sentinel-5P products which are required to be circulated within the Copernicus Space Component (CSC) Ground Segment (GS) elements (e.g. from Systematic Production to Long Term Archiving or Data Access systems).

Payload	Level	Product Type Code
TROPOMI	Lo	Lo__ENG_A__
		Lo__ODB_1__
		Lo__ODB_2__
		Lo__ODB_3__
		Lo__ODB_4__
		Lo__ODB_5__
		Lo__ODB_6__
		Lo__ODB_7__
		Lo__ODB_8__
		Lo__PDQ__
		Lo__SAT_A__
	L1	L1B_CA_SIR
		L1B_CA_UVN
		L1B_ENG_DB
		L1B_IR_SIR
		L1B_IR_UVN
		L1B_RA_BD1
		L1B_RA_BD2
		L1B_RA_BD3
		L1B_RA_BD4

		L1B_RA_BD5
		L1B_RA_BD6
		L1B_RA_BD7
		L1B_RA_BD8
	L2	L2__AER_AI
		L2__AER_LH
		L2__CH4__
		L2__CLOUD__
		L2__CO__
		L2__HCHO__
		L2__NO2__
		L2__NP_BD3
		L2__NP_BD6
		L2__NP_BD7
		L2__O3__
		L2__O3__PR
		L2__O3_TCL
		L2__SO2__
	Calibration	ICM_CA_SIR
		ICM_CA_UVN
		ICM_CKDSIR
		ICM_CKDUVN
	VDAF	L2VOAER_AI
		L2VOAER_LH
		L2VO_CH4__
		L2VO_CLOUD__
		L2VO_CO__
		L2VOHCHO__
		L2VONO2__
		L2VOO3_TCL
		L2VOO3__PR
		L2VOO3__
		L2VOSO2__
	PyCAMA	MPC_AER_AI
		MPC_AER_LH
		MPC_CH4__
		MPC_CLOUD__
		MPC_CO__
		MPC_FRESCO
		MPC_HCHO__
		MPC_NO2__
		MPC_O3_TCL
		MPC_O3__
		MPC_O3__PR

		MPC_SO2____
		MPC_NP_BD3
		MPC_NP_BD6
		MPC_NP_BD7

**Table 2-1 – Sentinel-5P Products list**

## 2.2 Sentinel-5p Products Packaging

All Sentinel-5P products follow the corresponding Product Format Specifications. All L1B products are distributed in netcdf compressed format.





### 2.3 Sentinel-5P Auxiliary Data List

The following table presents the list of Sentinel-5P Auxiliary (AUX) Data which are required to be circulated between the CSC GS elements.

File Type	Data Provider	Description	Format
L2_FRESCO	PDGS	L2 TROPOMI	netCDF-4
AUX_BGHCHO	PDGS (UPAS-BC)	Background correction for HCHO product	netCDF-4
AUX_BGSO2_	PDGS (UPAS-BC)	Background correction for SO2 product	netCDF-4
AUX_BGO3__	PDGS (UPAS-BC)	Background correction for O3	netCDF-4
AUX_BGCLD_	PDGS (UPAS-BC)	Background correction for CLOUD	netCDF-4
AUX_CTMCH4	KNMI	CTM model field of CH4 for use with CO and offline CH4 retrieval (CO for NRT, and CO and CH4 for OFFL)	Full tar archive, covering 6 – 9 months in daily files
AUX_CTM_CO	KNMI	CTM model field of CO for use with CO and offline CH4 retrieval (CO for NRT and CO and CH4 for OFFL)	Single netCDF4 file, containing 12 monthly fields
AUX_CTMFCT	KNMI	CTM model field of NO2, SO2 and HCHO for use with NO2 retrieval	Tar archive with 5 days (4-day redundancy). Five files in Net-CDF-4
AUX_CTMANA	KNMI	CTM model field of NO2, SO2 and HCHO for use with NO2 retrieval	Single netCDF4 file, covering 1 day
AUX_NISE	NASA	Snow and ice cover	HDF-EOS file format
AUX_MET_2D	ECMWF	Meteorological surface fields (wind, surface pressure, . . . )	GRIB
AUX_MET_QP	ECMWF	Meteorological specific humidity profile	GRIB
AUX_MET_TP	ECMWF	Meteorological temperature profiles	GRIB

AUX_IERS_B	IERS	This difference between UT1 and UTC is published by IERS in Bulletin B	ASCII (plain text)
AUX_IERS_C	IERS	Leap second information	XML
AUX_ISRF	KNMI	Instrument spectral response function file.	netCDF-4 (*.nc)
AUX_L1_CKD	KNMI	The in-flight calibration key data product	HDF5 (*.h5)
AUX_O3_M	KNMI	O3 profile shape climatology	netCDF-4 (*.nc)
MPL_NPIF_	FOS	The NPIF is the output of the FOS Mission Planning System in response to the Nominal Baseline Schedule file (NPPF) provided by KNMI	TGZ contains two files, *.HDR and *.DBL
MPL_SAF	FOS	The Station Availability file contains all PDGS scheduled Sentinel-5p ground station contacts	TGZ contains single *.EOF file
MPL_SPF	FOS	The orbital events file is a XML file containing a list of S/C events derived from the S/C orbit history file	TGZ contains two files, *.HDR and *.DBL
MPL_ORBP	FOS	This file contains the Orbit State Vectors (OSV) predicted by the FOS	XML file, *.EOF
MPL_TLEPRE	FOS	This file contains the orbit predicted by the FOS, defined as a set of Two Line Elements	TGZ contains two files, *.HDR and *.DBL
VIIRS_CM	NOAA	VIIRS Cloud Mask EDR	.tar (containing .nc)
VIIRS_L1B_GEO	NOAA	PGE302a VIIRS L1 Moderate Resolution Geolocation	compressed HDF5
VIIRS_L1B_RR	NOAA	VIIRS Moderate Resolution Radiance/Reflectance Data Band 7,9,11	compressed HDF5
VIIRS_CP	NOAA	VIIRS Cloud Phase EDR	.tar (containing .nc)
VIIRS_DCOMP	NOAA	VIIRS Daytime Cloud Optical and Microphysical Properties	.tar (containing .nc)
VIIRS_CTH	NOAA	VIIRS Cloud Top Height EDR	.tar (containing .nc)

**Table 2-2 – Sentinel-5P Auxiliary Data list**



### 3 SENTINEL-5P PRODUCT ENTITY PROPERTIES MAPPING

[RD-3] defines the Generic CSC Common Entity Properties. Table 3-1 below, provides the mapping between these Generic Product Entity Properties and the Sentinel-5P product metadata. Most of the properties defined in [RD-3] are generated by the CSC services. The following table describes the properties that map directly to the Sentinel-5P product metadata.

OData Product Entity Properties	Type	Description	Cardinality	Corresponding Sentinel-5P Metadata			Example	GS Element Applicability			
				L0	L1 & L2	AUX		PR	MPC	LTA	DA
<b>Name</b>	String	Data file name (according to the Sentinel file naming conventions) plus the file extension	1	n/a	n/a	n/a	S5P_NRTI_L2_HCHO__20190802T112419_20190802T112919_09336_01_010107_20190802T120808.nc	X	X	X	X
<b>ContentDate</b>	TimeRange	The sensing range period. Compound property with start and end times in UTC in the format YYYY-MM-DDThh:mm:ss.sssZ	1	<b>startTime</b> <b>stopTime</b>	eop:EarthObservation/om:phenomenonTime/gml:TimePeriod/ <b>gml:beginPosition</b>  eop:EarthObservation/om:phenomenonTime/gml:TimePeriod/ <b>gml:endPosition</b>	<b>validity_start</b> <b>validity_stop</b>	"ContentDate": { "Start": "2019-08-02T11:24:19.022Z", "End": "2019-08-02T11:29:19.872Z" }	X	X	X	X
<b>Footprint</b>	Geography	Footprint of the product	0..1	n/a	eop:EarthObservation/om:featureOfInterest/eop:Footprint/eop:multiExtentOf/gml:MultiSurface/gml:surfaceMember/gml:Polygon/gml:exterior/gml:LinearRing/ <b>gml:posList</b>	n/a		X	X	X	

OData Product Entity Properties	Type	Description	Cardinality	Corresponding Sentinel-5P Metadata			Example	GS Element Applicability			
				L0	L1 & L2	AUX		PR	MPC	LTA	DA
<b>GeoFootprint</b>	Geography	Footprint of the product following the GeoJSON format	0..1	n/a	eop:EarthObservation/ om:featureOfInterest/ eop:Footprint/ eop:multiExtentOf/ gml:MultiSurface/ gml:surfaceMember/ gml:Polygon/ gml:exterior/ gml:LinearRing/ <b>gml:posList</b>	n/a		X	X	X	X

**Table 3-1 – Product Entity Properties mapping to Sentinel-5P metadata**

## 4 SENTINEL-5P PRODUCT ATTRIBUTES MAPPING

All relevant metadata elements of the Sentinel-5P products shall be indexed in the Product Attributes, additional metadata elements may also be identified if appropriate. In order to provide a harmonised model across the Sentinel missions the JSON property naming from [RD-4] is preferred for the Attributes Ids. In case an attribute is not defined in [RD-4] the naming used in the mission specific metadata file is preferred. The Product Attributes mapping for all Sentinel-5P products is described in the Excel file “Sentinel-5P Product Attributes Mapping”, which is packaged with this document. A summary of the Sentinel-5P Product Attributes mapping across all products is presented in Table 4-1. It should be highlighted that, in order to harmonise the metadata model across the Sentinels, in some cases an “alias” for the value defined in the metadata is mapped to a standardised value to be used by the CSC GS elements, in other cases a standard value is defined where it is otherwise unavailable from the product.

The following table is filled with an x in case the attribute is used, additional symbols are used and the specific meaning is specified as:

- “\*” Attribute not available within the legacy PDGS
- “#” Attribute is only available for auxiliary data generated by Processor CFI

OData Attribute Id	Sentinel-5P Metadata Mapping						Applicability			
	Level-0	Level-1	Level-2	VDAF	PyCAMA	AUX	PR	MPC	LTA	DA
platformShortName	x	x	x	x	x	x	x	x	x	x
instrumentShortName	x	x	x				x	x	x	x
processingLevel	x	x	x				x	x	x	x
beginningDateTime	x	x	x	x	x	x	x	x	x	x
endingDateTime	x	x	x	x	x	x	x	x	x	x
processingCenter	x	x	x			x	*	*	x	x
processorName	x	x	x	x	x		x	x	x	x
processorVersion	x	x	x	x	x	#	x	x	x	x
processingDate		x	x	x	x	x	x	x	x	x
processingLevel	x	x	x				x	x	x	x
processingMode		x	x				x	x	x	x

<b>orbitNumber</b>	X	X	X				X	X	X	X
<b>productClass</b>	X	X	X	X	X	X	X	X	X	X
<b>baselineCollection</b>		X	X	X	X		X	X	X	X
<b>productType</b>	X	X	X	X	X	X	X	X	X	X
<b>doi</b>			X				*	*	X	X
<b>identifier</b>		X					X	X	X	X
<b>parentIdentifier</b>		X	X				X	X	X	X
<b>acquisitionType</b>		X					X	X	X	X
<b>qualityStatus</b>			X				*	*	X	X

**Table 4-1 – Sentinel-5P Product Attributes mapping**