Standard Archive Format for Europe

Mission Specialisation Control Book

ERS

Reference	PDGS-SAFE-GMV-ERS-MISSION	issue 1	revision 1

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Reviewed by	European Space Agency (ESA)	date:

Approved by		date:

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1. Introduction

1.1. Purpose and scope

The present document is part of the Standard Archive Format for Europe specialisation for ERS (SAFE Specialisation for ERS). This specialisation consists of the following set of documents:

- the current book, which is the ERS mission specialisation control book, and is the top-level document of the specialisation, containing all the information that is common to all SAFE ERS products and auxiliary files.
- one ERS product specialisation control book for ERS Level-0 products and auxiliary files.

1.2. Book Organisation

The ERS mission specialisation control book is organized as follows:

Chapter 1: Introduction	Introductory part of the document.
Chapter 2: General Description	Overall description of the mission, instruments and products/auxiliary files generated for each processing level and in scope of this specialisation.
Chapter 3: Metadata Specialisation	SAFE ERS metadata specialisation.
Chapter 4: Naming Conventions	SAFE ERS package names and URN specifications.
Appendix A: Representation Information Packages	List of SAFE ERS Representation Information Packages characteristic of the specialisation.
Appendix B: SAFE Package Examples	List of SAFE ERS EO Product and EO Auxiliary Packages examples.

1.3. Specialisation Volume Set

The following list references the documents that constitute the SAFE ERS specialisation volume set.

[ERS-BOOK-MISSION] ERS Mission Specialisation (PDGS-SAFE-GMV-ERS-MISSION)

[ERS-BOOK-L0] ERS Specialisation for Level 0 products (PDGS-SAFE-GMV-ERS-L0)

The specialised SAFE ERS Representation Information Packages and examples of SAFE ERS EO Product/Auxiliary Packages are also considered part of the present specialisation and are provided alongside the documents as separate files. The complete file list is described in Appendix A and Appendix B.

1.4. Bibliography

[OAIS-RM] *Reference Model for an Open Archival Information System (OAIS)* - 650.0-B-1- January 2002- Blue Book- Copyright © 2002 Consultative Committee for Space Data Systems (CCSDS) -

[OGC EOP O&M] *Earth Observation Metadata profile of Observations & Measurements* – OGC 10-157r3 version 1.0 (Publication Date: 2012-06-12) Copyright © 2012 Open Geospatial Consortium -with the following set of approved Change Requests:

- *Change proposal: EO PMOS SWG Improved expression of EO product quality and status information, OGC 13-085*
- *Change Proposal: EO PMOS SWG Addition of optional group identificator, OGC 13-086*
- *Change Proposal: EO PMOS SWG Improve the description of EO Product Masks, OGC 13-087*
- *Change Proposal: EO PMOS SWG Correct inconsistencies between UML model and tables, OGC 13-088*
- *Change Proposal: EO PMOS SWG Improved way of expressing the timeliness of EO Product acquisition and processing, OGC 13-093*
- *Change Proposal: EO PMOS SWG Add optional elements referring to products instead of images, OGC 13-094*
- *Change Proposal: EO PMOS SWG Replace example of EO Product Metadata extension, OGC 13-098*
- *Change Proposal: EO-PMOS Corrections related to the implementation of the eoptype attribute, OGC 14-031*
- *Change Proposal: EO-PMOS Addition of optional elements creationDate and modificationDate, OGC 14-032*

[SAFE_CORE] *Standard Archive Format for Europe - Control Book - Volume 1 - Core Specifications* - PGSI-GSEG-EOPG-FS-05-0001- v2.3-

[SAFE_REC_SPEC] *Standard Archive Format for Europe - Control Book - Volume 2 - Recommendations for Specialisations* - PGSI-GSEG-EOPG-FS-05-0002- v2.3-

[SI] *The International System of Units (SI)* - 1998- 7th edition- Bureau International des Poids et Mesures - Copyright © 1998 Organisation Intergouvernementale de la Convention du Mètre -

[SI-SUP2000] *The International System of Units (SI)*- Supplement 2000: addenda and corrigenda of the 7th edition (1998) - 1998- 7th edition- Bureau International des Poids et Mesures – Copyright © 1998 Organisation Intergouvernementale de la Convention du Mètre -

[XFDU] *XML Formatted Data Unit (XFDU) - Structure and Construction Rules* - 661.0-B-1- September 2008- Blue Book - Copyright © 2008 Consultative Committee for Space Data Systems (CCSDS) -

1.5. Glossary of Terms

1.5.1. Definitions

1.5.1.1. General

Auxiliary data	All data used to generate a product, other than the direct measurements of the instrument. EO Auxiliary data include calibration data measured on-board that are not part of the main measurements of the instrument, external calibration files from sources other than the satellite, processor configuration files, and any other files needed by instrument processors.
Auxiliary file-type	A file type that characterizes all EO Auxiliary files sharing common representation information.
EO Product	The result of the processing of remote sensing data. Earth Observation products are specific to each mission and sensor combination. A data product can be an entire acquisition strip (the data segment continuously acquired by a ground station) or a single frame (a subset of the acquisition strip of standard length as defined by the WRS).
Manifest	A document containing metadata about Components, and the relationships among them. This information is stored as a Component, using an XML language designed for just this purpose. [XFDU].
Metadata	Data about other Data [OAIS-RM].
Metadata file	A file containing the Metadata associated to an EO Product or EO Auxiliary file.
Product-type	A file type that characterizes all the EO Product files sharing common representation information.
SAFE Package	An XFDU Package specialised for Earth Observation data purposes. In previous versions of SAFE, the term SAFE product was used instead because the content information was limited to Earth Observation products. It has been replaced by SAFE Package because the types of Content Information described by SAFE are not only Earth Observation products, but also Representation Information files and EO Auxiliary files.
SAFE Specialisation	A SAFE Specialisation is a restriction of the SAFE Core specifications for a more specific type of data. Examples of SAFE Specialisation include specialisations for ENVISAT or LANDSAT Products, for CCSDS Telemetry Data, or for SPOT Measurements.
XFDU Package	A Package Interchange File that contains an XFDU Manifest and is conforming to the semantics specified in the XFDU Specifications. An XFDU Package is a specialization of Package Interchange File [XFDU].

1.5.2. Acronyms and Abbreviations

1.5.2.1. General

CCSDS	Consultative Committee for Space Data Systems
EECF	ESRIN ERS Central Facility
EO	Earth Observation
ESA	European Space Agency
GML	Geography Mark-up Language
ISO	International Organization for Standardization
MMCC	Mission Monitoring and Control Center
O&M	Observations and Measurements
OAIS(-RM)	Reference Model for an Open Archival Information System
OGC	Open Geospatial Consortium
SAFE	Standard Archive Format for Europe
SI	The International System of Units
URN	Uniform Resource Name
WRS	World Reference System
XFDU	XML Formatting Data Unit
XML	eXtensible Mark-up Language

1.5.2.2. Specialisation

AMI	Active Microwave Instrument
ATSR	Along Track Scanning Radiometer
ERS	European Remote-sensing Satellite
GOME	Global Ozone Monitoring Experiment
ICD	Interface Control Document
IDHT	Instrument Data Handling and Transmission
LRR	Laser Retro-reflectors
MS	Microwave Sounder
PDS	Payload Data Segment
PF	Processing Framework
PRARE	Precise Range and Range-rate Equipment
RA	Radar Altimeter
S/C	Spacecraft
SAR	Synthetic Aperture Radar
SCAT	Scatterometer
WS	Wind Scatterometer

1.5.3. Conventions Used

The present book assumes that all physical quantities are expressed according to a standard system of units. The selected standard is the SI defined by the Bureau International des Poids et Mesures (BIPM) in documents [SI] and [SI-SUP2000].

2.General Description

2.1. Mission Overview

The European Remote Sensing satellite, ERS-1, launched in 1991, was ESA's first Earth Observation satellite; it carried a comprehensive payload including an imaging Synthetic Aperture Radar (SAR), a radar altimeter and other powerful instruments to measure ocean surface temperature and winds at sea. ERS-2, which overlapped with ERS-1, was launched in 1995 with an additional sensor for atmospheric ozone research.

At their time of launch the two ERS satellites were the most sophisticated Earth observation spacecraft ever developed and launched in Europe. These highly successful ESA satellites collected a wealth of valuable data on the Earth's land surfaces, oceans and polar caps and were called upon to monitor natural disasters such as severe flooding or earthquakes in remote parts of the world.

Both ERS satellites were built with a core payload of two specialised radars and an infrared imaging sensor. The two spacecraft were designed as identical twins with one important difference – ERS-2 included an extra instrument designed to monitor ozone levels in the atmosphere.

Shortly after the launch of ERS-2 in 1995 ESA decided to link the two spacecraft in the first ever “tandem” mission which lasted for nine months. During this time the increased frequency and level of data available to scientists offered a unique opportunity to observe changes over a very short space of time, as both satellites orbited Earth only 24 hours apart.

In March 2000 a computer and gyro control failure led to the ERS-1 satellite finally ending its operations, far exceeding its planned lifetime.

After a final thruster firing to deplete its remaining fuel, ESA's ERS-2 observation satellite was safely taken out of service on 5 September 2011. The satellite's average altitude was lowered from 785 km to about 573 km. At this height, the risk of collision with other satellites or space debris is greatly reduced.

2.1.1. ERS-1

Mission details	Launched: 17 July 1991 End of operations: 10 March 2000
Mission objectives:	Provide environmental monitoring in particular in the microwave spectrum (i.e., regular monitoring of land-surface and ocean-surface processes for change detection). Coverage of a broad range of disciplines and topics: Observation of oceans, polar ice, land ecology, geology, forestry, wave phenomena, bathymetry (water depth), atmospheric physics, meteorology, etc.
Mission orbit:	Sun synchronous, altitude 800 km (Time for one orbit 100 minutes)
Configuration:	The satellite weighed 2400 kg and its measurements were 12 m x 12 m x 2.5 m.
Payload	• **AMI**: consisting of a synthetic aperture radar (SAR) and a wind scatterometer (SCAT) both in the C-band. SAR provides all weather images of land and sea in image mode. In wave mode the spectra characterise ocean surface waves. SCAT measures wind speed and direction at the sea surface. • **RA**: taking precise measurements of the distance from the ocean

	surface and of wave heights. • **ATSR**: measuring sea surface temperatures and the vegetation cover of land surfaces (operating in the infrared and visible ranges). • **PRARE**: ERS orbit and trajectory determination.
Launch	Launch vehicle Ariane 4 (from Kourou)
Flight operations	The satellite was controlled by the Mission Management and Control Centre via the Kiruna ground station.

2.1.2. ERS-2

Mission details	Launched: 21 April 1995 End of operations: 06 July 2011
Mission objectives:	Same objectives than ERS-1 and to measure the chemical composition of the atmosphere, using an instrument named GOME (Global Ozone Monitoring Experiment).
Mission orbit:	Sun synchronous, altitude 800 km (Time for one orbit 100 minutes)
Configuration:	Overall height: 11.8 m Solar generator: 11.7 x 2.4 m SAR antenna: 10 x 1 m Total mass: 2516 kg
Payload	• **AMI**: consisting of a synthetic aperture radar (SAR) and a wind scatterometer (WS) both in the C-band. SAR provides all weather images of land and sea in image mode. In wave mode the spectra characterise ocean surface waves. WS measures wind speed and direction at the sea surface. • **RA**: taking precise measurements of the distance from the ocean surface and of wave heights. • **ATSR-2**: measuring sea surface temperatures and the vegetation cover of land surfaces (operating in the infrared and visible ranges). • **PRARE**: ERS orbit and trajectory determination. • **GOME**: an absorption spectrometer which measures the presence of ozone, trace gases and aerosols in the stratosphere and troposphere. • **MWR**: Water vapour correction for the radar altimeter (RA)
Launch	Launch vehicle Ariane 4 (from Kourou)
Flight operations	The satellite was controlled by the Mission Management and Control Centre via the Kiruna ground station.

2.2. Instrument Overview

2.2.1. AMI Instrument

The AMI instrument was a high-resolution all-weather multi-purpose imager for ocean, land and ice and combined two separate functions: Synthetic Aperture Radar (SAR) and Wind Scatterometer (WS).

2.2.1.1. AMI-SAR (Radar Imagery)

This instrument transmitted a microwave signal at 5.3 GHz and measured the backscattered signals to generate microwave images of the Earth's surface at different spatial resolutions and polarisations.

The AMI-SAR could operate in two modes:

- *Image Mode* (30 m resolution, 100 km swath), obtaining strips of high-resolution imagery. On-ground signal processing was used to build up an image from the backscattered energy, which depends primarily on the roughness and dielectric properties of the illuminated area.
- *Wave Mode* (30 m resolution), providing two-dimensional spectra of ocean surface waves (imagettes, about 5 x 5 km^2 sampled at 200-300 km intervals). For this function the SAR recorded regularly spaced samples within the image swath. The images were transformed into directional spectra providing information about wavelength and direction of wave systems.

Applications include the detection of ocean surface waves, fronts, eddies and oil slicks, detection and tracking of ships from their wakes, operational sea ice forecasting and, on land, the identification of vegetation type and cover, forestry and agriculture applications. The ability of SARs to penetrate cloud cover makes them particularly valuable in rainforest studies and resource monitoring applications.

Type	Imaging radar (SAR)
Technical Characteristics	
Accuracy:	Landscape topography: 3 m, Bathymetry: 0.3 m, Sea ice type: 3 classes
Spatial Resolution:	30 m
Swath Width:	100 km
Waveband:	Microwave: 5.3 GHz (C band), VV polarisation
Earth Topics	All-weather images of ocean, ice and land surfaces. Monitoring of coastal zones, polar ice, sea state, geological features, vegetation (including forests), land surface processes, hydrology.

Table 1: AMI-SAR Instrument summary

2.2.1.2. AMI-WS (Radar Scatterometry)

The purpose of the Wind Scatterometer was to obtain information on wind speed and direction at the sea surface for incorporation into models, global statistics and climatological datasets. It operated by recording the change in radar reflectivity of the sea due to the perturbation of small ripples by the wind close to the surface. This was possible because the radar backscatter returned to the satellite is modified by wind-driven ripples on the ocean surface and, since the energy in these ripples increases with wind velocity, backscatter increases with wind velocity.

Type	Scatterometers

Technical Characteristics	
Accuracy:	Sea surface wind speed: 3m/s, Sea ice type: 2 classes
Spatial Resolution:	Cells of 50km x 50km at 25km intervals
Swath Width:	500km
Waveband:	Microwave: 5.3GHz (C-band), VV polarisation.
Earth Topics	Natural Disasters (Hurricane), Atmosphere (Winds).

Table 2: AMI-WS Instrument summary

2.2.2. ATSR/ATSR-2 Instruments

ATSR actually consisted of two instruments, an Infra-Red Radiometer (IRR) and a Microwave Sounder (MWS). On board ERS-1, the IRR was a four-channel infra-red radiometer used for measuring sea-surface temperatures (SST) and cloud-top temperatures, whereas on board ERS-2 (ATSR-2) the IRR was equipped with additional visible channels for vegetation monitoring. The MWS was a two channel passive radiometer.

The primary mission objective of the ATSR instrument was to provide Sea Surface Temperature (skin temperature). Nevertheless, also surface and cloud studies have stemmed from ATSR data.

Multi-directional radiometers can make observations from more than one incidence angle of the diffused or emitted radiation emitted by a particular element of the Earth's surface or clouds. In this way, information on anisotropies in the radiation may be identified. The emphasis in these instruments is on spectral (rather than spatial) information, with the result that the detection channels, which typically span the visible to the IR, are precisely calibrated and the spatial resolution is usually about 1 km.

Type	Imaging multi-spectral radiometers (vis/IR)
Technical Characteristics	
Accuracy:	Sea surface temperature to <0.5K over 0.5 deg x 0.5 deg (lat/lon) area with 80% cloud cover, Land surface temperature: 0.1K
Spatial Resolution:	IR ocean channels: 1km x 1km, Microwave near-nadir viewing: 20km instantaneous field of view.
Swath Width:	500km
Waveband:	VIS-SWIR: 0.65, 0.85, 1.27 and 1.6m, SWIR-TIR: 1.6, 3.7, 11 and 12m, Microwave: 23.8, 36.5GHz (bandwidth of 400MHz).
Earth Topics	Agriculture (Forestry), Snow and Ice (Sea Ice), Natural Disasters (Fire, Earthquake/Volcano), Ocean and Coast (Sea Surface Temperature), Atmosphere (Clouds/Precipitation).

Table 3: ATSR/ATSR-2 Instrument summary

2.2.3. RA Instrument

The Radar Altimeter was a Ku-band (13.8 GHz) nadir-pointing active microwave sensor designed to measure the time return echoes from ocean and ice surfaces. Functioning in one of two operational modes (ocean or ice), the Radar Altimeter provided information on significant wave height; surface wind speed; sea surface elevation, which relates to ocean currents, the surface geoid and tides; and various parameters over sea ice and ice sheets.

Over ocean, it was used to determine the significant wave height, the wind speed and the mesoscale topography. Over ice, it was used to determine the ice surface topography and ice type.

The microwave measurements comprise the time delay between transmission and reception of a pulse, the slope of the leading edge of the return pulse, the amplitude of the return pulse, and the echo waveforms.

These measurements are used as follows:

- The altitude is determined from the measured delay time after correction of propagation delays caused by ionosphere and troposphere.
- The significant ocean wave height (SWH) is calculated from the slope of the leading edge of the return echo.
- The wind speed over sea surfaces is estimated from the power level of the backscatter signal.
- Radar Altimeter Calibration data products were extracted for MMCC/EECF-defined start and stop times. Up to five commands defining different time intervals could be submitted by the MMCC/EECF per orbit.

Type	Radar Altimeter
Technical Characteristics	
Accuracy:	Wave height: 0.5m or 10% (whichever is smaller), Sea surface elevation: better than 10cm
Spatial Resolution:	Footprint is 16-20km
Swath Width:	-
Waveband:	Microwave: Ku-band: 13.8GHz
Earth Topics	Land (Topography/Mapping), Snow and Ice (Sea Ice), Ocean and Coast (Ocean Currents and Topography, Ocean Waves), Solid Earth (Geoid)

Table 4: RA Instrument summary

2.2.4. PRARE Instrument

The Precise Range And Range-Rate Equipment, PRARE, was a compact, space-borne, two-way, two-frequency microwave satellite tracking system. With the assistance of a global network of mobile, unattended, autonomously operating ground stations, the system performed synchronous two-way pn-coded range (= slant distance) and carrier shifted range-rate (= relative velocity) measurements at a sub-decimeter resp. sub-millimeter/second level of accuracy.

Type	Microwave satellite tracking system
Earth Topics	Solid Earth (Geoid)

Table 5: PRARE Instrument summary

2.2.5. GOME Instrument

GOME was a nadir-scanning ultraviolet and visible spectrometer onboard ERS-2 for global monitoring of atmospheric Ozone. The recorded spectra is used to derive a detailed picture of the atmosphere's content of ozone, nitrogen dioxide, water vapour, oxygen/oxygen dimer and bromine oxide and other trace gases (a key feature of GOME was its ability to detect other chemically active atmospheric trace-gases as well as aerosol distribution).

Type	Atmospheric chemistry spectrometer
Technical Characteristics	
Accuracy:	-
Spatial Resolution:	Vertical: 5km (for O3), Horizontal: 40 x 40 km to 40 x 320 km
Swath Width:	120-960km
Waveband:	UV-NIR: 0.24-0.79Âµm (resolution 0.2-0.4nm)
Earth Topics	Atmosphere (Air Quality (Ozone), Atmospheric chemistry (Trace Gases), Clouds)

Table 6: GOME Instrument summary

2.2.6. MWR Instrument

The main objective of the microwave radiometer (MWR) was the measurement of the integrated atmospheric water vapour column and cloud liquid water content, as correction terms for the radar altimeter signal. In addition, MWR measurement data are useful for the determination of surface emissivity and soil moisture over land, for surface energy budget investigations to support atmospheric studies, and for ice characterization.

Type	Imaging multi-spectral radiometers (passive microwave)
Technical Characteristics	
Accuracy:	Temperature: 2.6K
Spatial Resolution:	20km
Swath Width:	20km
Waveband:	Microwave: 23.8 and 36.5GHz
Earth Topics	Snow and Ice (Sea Ice, Snow and Ice)

Table 7: MWR Instrument summary

2.3. Product and Auxiliary file-type List

The following sections list all the product-types and auxiliary-types which are in scope of the SAFE Specialisation for ERS.

2.3.1. Level 0

2.3.1.1. Product Types

Acronym	Description
SAR_IM__0P	AMI SAR Image mode Level 0 data.
SAR_EWA_0P	AMI Wave mode raw data.

Table 8: L0 product-type list

2.3.1.2. Auxiliary File Types - ERS SAR IM (Native format)

Acronym	Description
PREC	Precise Orbit in native format (PRC_EX)
ORPM	Predicted Orbit in native format (PRD_EX)
ORRM	Restituted Orbit in native format (RES_EX)
PATC	Time Correlation in native format (TIM_EX)

Table 9: L0 auxiliary file type list

NOTE: PRC_EX, PRD_EX, RES_EX and TIM_EX nomenclature is sometimes adopted, but only for alignment with ENVISAT naming conventions.

2.3.1.3. Auxiliary File Types - ERS SAR IM (ENVISAT format)

Acronym	Description
PRC_AX	Precise Orbit in ENVISAT format.
PRD_AX	Predicted Orbit in ENVISAT format.
TIM_AX	Time Correlation in ENVISAT format.

Table 10: L0 auxiliary file type list

2.4. Processing chain description

This section provides a conceptual workflow description for the ERS SAR processing chain, giving general information about the process and the inputs/outputs that are needed/generated in each step.

*2.4.1. L0 WILMA with Native format auxiliary files or WV LRD*F*

2.4.1.1. Overview of processing chain

The following sections assume that processing to any chosen higher level product begins with the processing of a Level 0 file, i.e. that only a single processor is involved.

The general, high level processing chain showing the mandatory inputs and all possible outputs is shown in Figure 1.

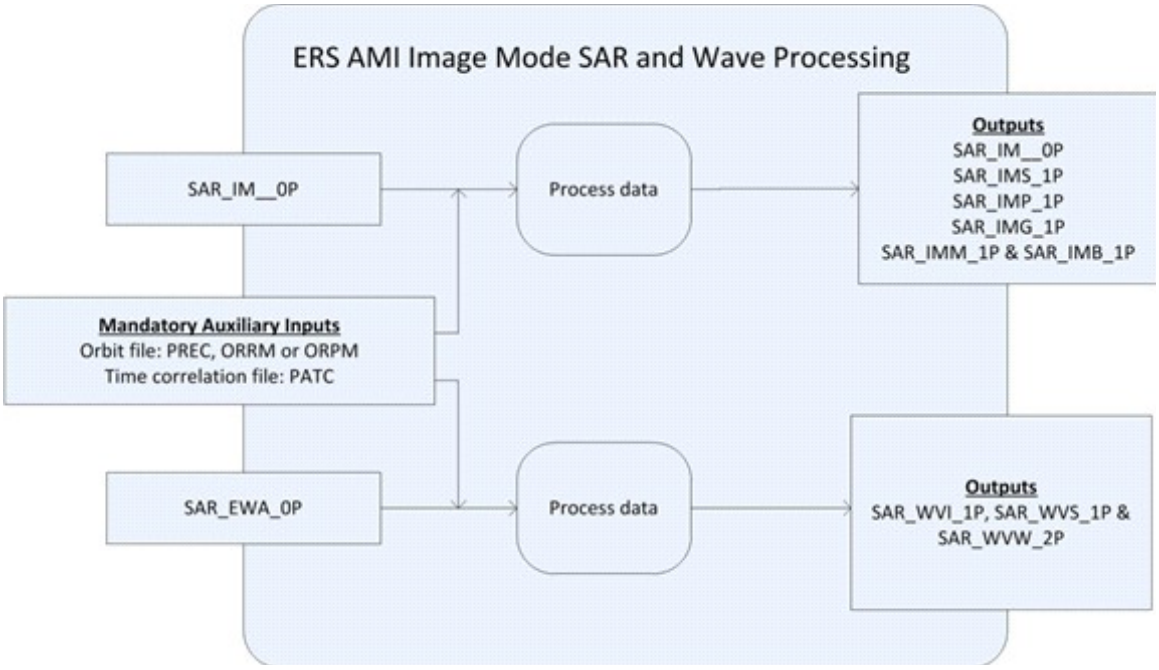

Figure 1: Generic high level processing chain showing inputs and possible outputs of the processing chain.

Summary information about the ERS processing is shown in 11. In the following sections, the term "PF-ERS" is used to refer to the ERS Processing Facility, not intending to refer to a specific implementation of an ERS processor.

Instrument:	ERS AMI (SAR and Wave)
Input Processing Level:	L0 WILMA
Output Processing Level:	L0, L1B and L2
Known/reference implementations	
Developer:	MDA
Documentation reference:	PF-ASAR/ERS ADD, CAE-DD-52-4827.
Possibility to reuse the processor:	Yes (ESA)
Possibility to modify the processor:	No (binary)

Table 11: Summary information about the ERS processing

2.4.1.2. Image Mode L1B SAR processing outputs (SAR_IMx_1P)

The processing chain for L1B SAR image mode data showing the required inputs and possible outputs is shown in Figure 2.

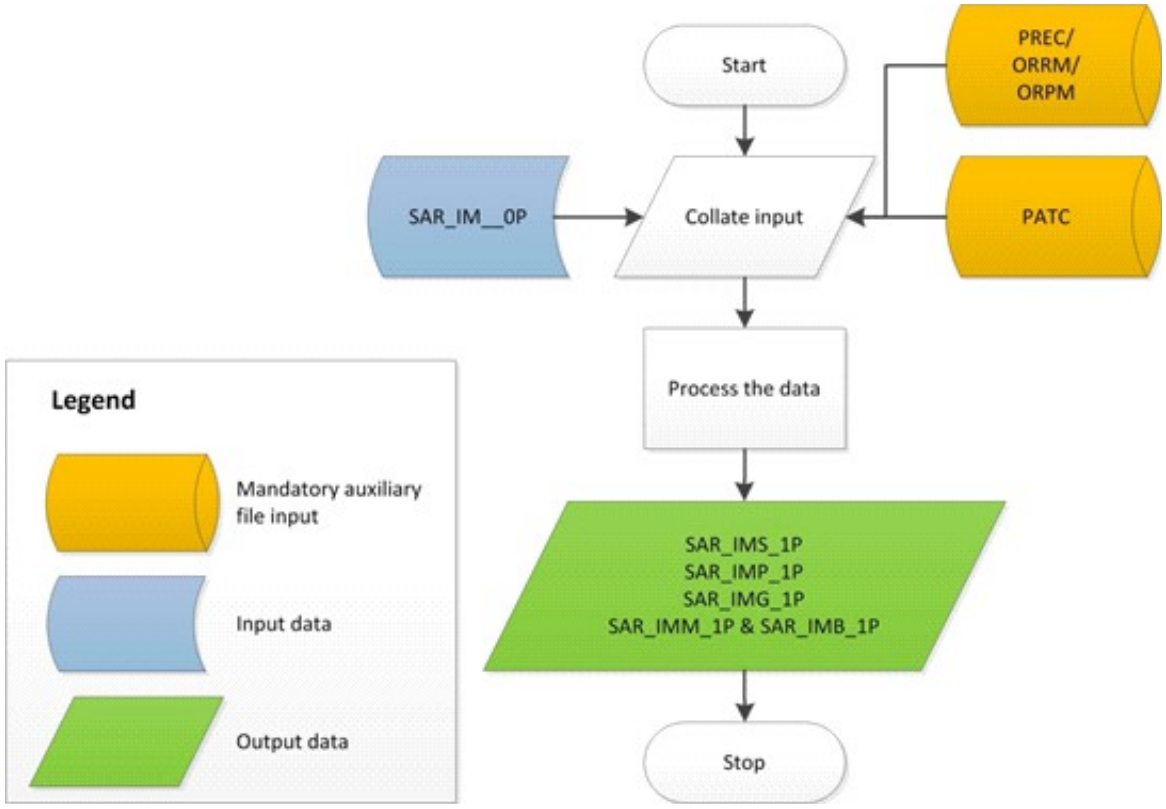

Figure 2: L1B SAR processing chain showing inputs and possible outputs

The inputs required to process each of the L1B SAR outputs which can be generated are listed in the following tables. The processor uses WILMA format L0 SAR input and can produce L1B Single Look Complex (SAR_IMS_1P), Precision Image (SAR_IMP_1P), Geocoded (SAR_IMG_1P) and Medium Resolution and Browse Image products (SAR_IMM_1P and SAR_IMB_1P). The time correlation file and an orbit file are mandatory inputs. The processor should select the most accurate orbit data available; thus the order of preference is: precise, restituted then predicted.

Input	**Processor**	**Output**	**Destination (next Processor)**
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMS_1P	
Auxiliary-types[1]:		**Auxiliary-types:**	
PREC (1)		N/A	
ORRM (2)			
ORPM (3)			
PATC			

Table 12: ERS SAR_IMS_1P processing Inputs/Outputs

1 The numbers in brackets express the order in which these orbit files are selected if more than one type is available covering the required product time.

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMP_1P	
Auxiliary-types[2]:		**Auxiliary-types:**	
PREC (1)		N/A	
ORRM (2)			
ORPM (3)			
PATC			

Table 13: ERS SAR_IMP_1P processing Inputs/Outputs

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMG_1P	
Auxiliary-types[2]:		**Auxiliary-types:**	
PREC (1)		N/A	
ORRM (2)			
ORPM (3)			
PATC			

Table 14: ERS SAR_IMG_1P processing Inputs/Outputs

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMM_1P	
Auxiliary-types[2]:		SAR_IMB_1P	
PREC (1)		**Auxiliary-types:**	
ORRM (2)		N/A	
ORPM (3)			
PATC			

Table 15: ERS SAR_IMM_1P and SAR_IMB_1P processing Inputs/Outputs

2 The numbers in brackets express the order in which these orbit files are selected if more than one type is available covering the required product time.

2.4.1.3. Wave mode L1B and L2 processing outputs (SAR_WVx_nP)

The processing chain for Wave mode data showing the required inputs and output is shown in Figure 3.

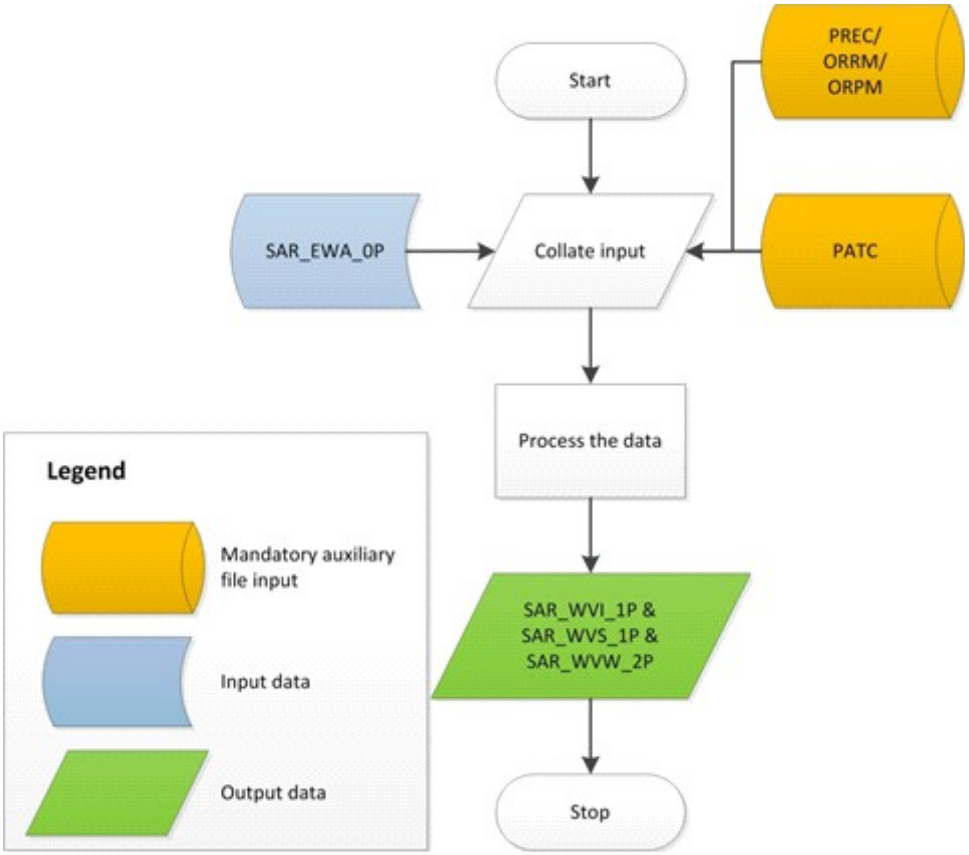

Figure 3: Wave Mode processing chain showing inputs and outputs

The inputs required for Wave Mode processing and the outputs generated are listed in 16. The processor uses EWAC format L0 Wave input and produces L1B Wave Imagettes (SAR_WVI_1P) and Spectra (SAR_WVS_1P), and a L2 Wave Mode Product (SAR_WVW_2P). The time correlation file and an orbit file are mandatory inputs. The processor will select the most accurate orbit data available; thus the order of preference is: precise, restituted then predicted.

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_EWA_0P		SAR_WVI_1P	
Auxiliary-types[3]:		SAR_WVS_1P	
PREC (1)		SAR_WVW_2P	
ORRM (2)		**Auxiliary-types:**	
ORPM (3)		N/A	
PATC			

Table 16: ERS SAR_WVx_nP processing Inputs/Outputs

*2.4.2. L0 and auxiliary files in ENVISAT format or WV LRD*F format*

2.4.2.1. Overview of processing chain

The following sections assume that processing to any chosen higher level product begins with the processing of a Level 0 file, i.e. that only a single processor is involved.

The general, high level processing chain showing the mandatory inputs and all possible outputs is shown in Figure 4.

3 The numbers in brackets express the order in which these orbit files are selected if more than one type is available covering the required product time.

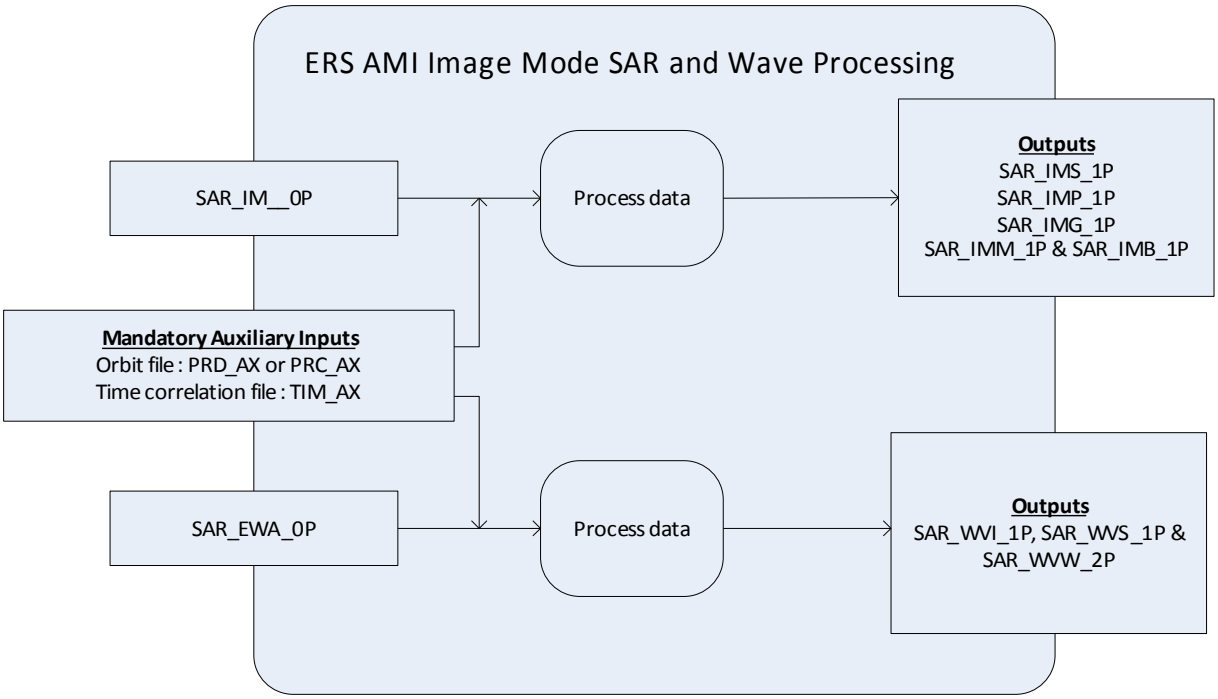

Figure 4: Generic high level processing chain showing inputs and possible outputs of the processing chain.

Summary information about the ERS processing is shown in 17. In the following sections, the term "PF-ERS" is used to refer to the ERS Processing Facility, not intending to refer to a specific implementation of an ERS processor.

Instrument:	ERS AMI (SAR and Wave)
Input Processing Level:	SAR L0 (ENVISAT), Wave L0 (LRD*F)
Output Processing Level:	L1B and L2
Known/reference implementations	
Developer:	MDA
Documentation reference:	PF-ASAR/ERS ADD, CAE-DD-52-4827.
Possibility to reuse the processor:	Yes (ESA)
Possibility to modify the processor:	No (binary)

Table 17: Summary information about the ERS processor.

2.4.2.2. Image Mode L1B SAR processing outputs (SAR_IMx_1P)

The processing chain for L1B SAR image mode data showing the required inputs and possible outputs is shown in Figure 5.

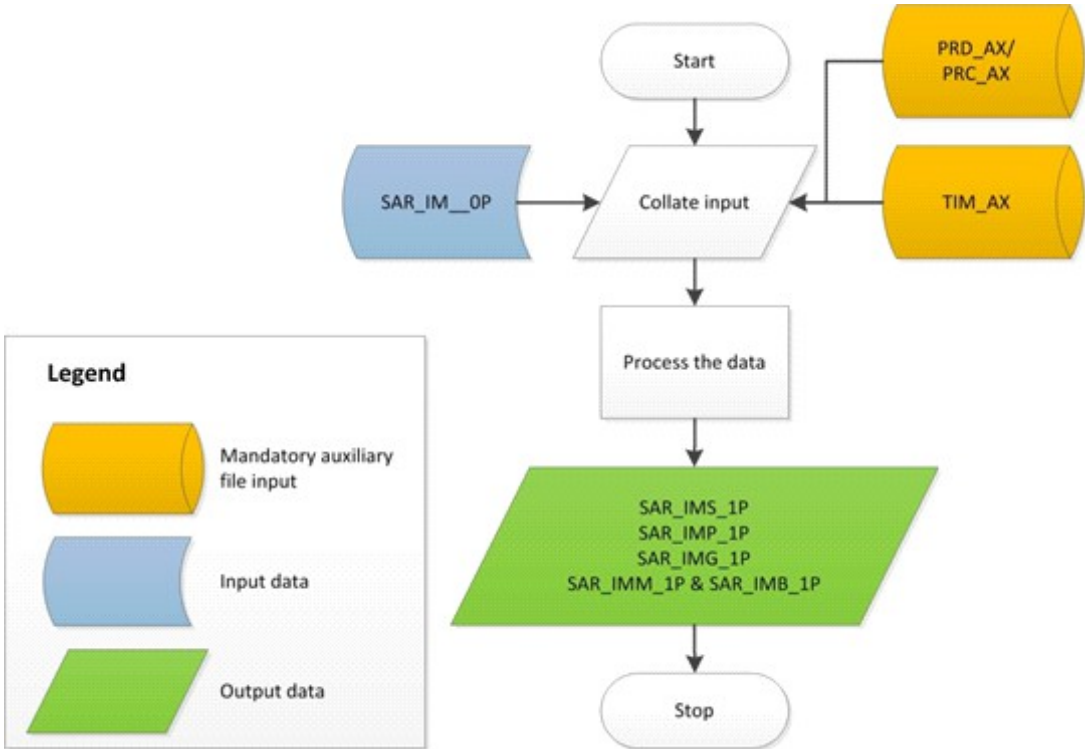

Figure 5: L1B SAR processing chain showing inputs and possible outputs.

The inputs required and the L1B SAR outputs which can be generated are listed in the following tables. The processor uses ENVISAT format L0 SAR input and can produce L1B Single Look Complex (SAR_IMS_1P), Precision Image (SAR_IMP_1P), Geocoded (SAR_IMG_1P) and Medium Resolution and Browse Image products (SAR_IMM_1P and SAR_IMB_1P). The time correlation file and an orbit file are mandatory inputs. The processor should select the most accurate orbit data available; thus the order of preference is: precise, restituted then predicted.

Input	**Processor**	**Output**	**Destination (next Processor)**
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMS_1P	
Auxiliary-types[4]**:**		**Auxiliary-types:**	
PRC_AX (1)		N/A	
PRD_AX (2)			
TIM_AX			

Table 18: ERS SAR_IMS_1P processing Inputs/Outputs

4 The numbers in brackets express the order in which these orbit files are selected if more than one type is available covering the required product time.

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMP_1P	
Auxiliary-types[5]:		**Auxiliary-types:**	
PRC_AX (1)		N/A	
PRD_AX (2)			
TIM_AX			

Table 19: ERS SAR_IMP_1P processing Inputs/Outputs

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMG_1P	
Auxiliary-types[5]:		**Auxiliary-types:**	
PRC_AX (1)		N/A	
PRD_AX (2)			
TIM_AX			

Table 20: ERS SAR_IMG_1P processing Inputs/Outputs

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_IM__0P		SAR_IMM_1P	
		SAR_IMB_1P	
Auxiliary-types[5]:		**Auxiliary-types:**	
PRC_AX (1)		N/A	
PRD_AX (2)			
TIM_AX			

Table 21: ERS SAR_IMM_1P and SAR_IMB_1P processing Inputs/Outputs

5 The numbers in brackets express the order in which these orbit files are selected if more than one type is available covering the required product time.

2.4.2.3. Wave mode L1B and L2 processing outputs (SAR_WVx_nP)

The processing chain for Wave mode data showing the required inputs and output is shown in Figure 6.

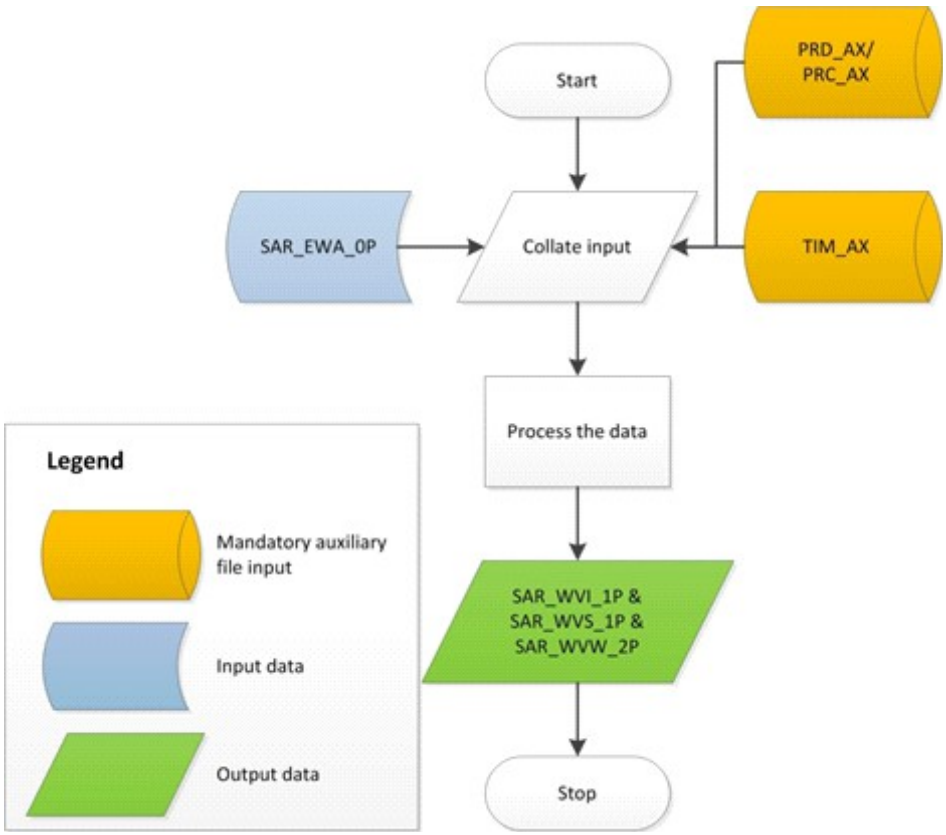

Figure 6: Wave Mode processing chain showing inputs and outputs

The inputs required for Wave Mode processing and the outputs generated are listed in 22. The processor uses EWAC format L0 Wave input and produces L1B Wave Imagettes (SAR_WVI_1P) and Spectra (SAR_WVS_1P), and a L2 Wave Mode Product (SAR_WVW_2P). The time correlation file and an orbit file are mandatory inputs. The processor should select the most accurate orbit data available; thus the order of preference is: precise, restituted then predicted.

Input	Processor	Output	Destination (next Processor)
Product-types:	PF-ERS	**Product-types:**	N/A
SAR_EWA_0P		SAR_WVI_1P	
Auxiliary-types[6]:		SAR_WVS_1P	
PRC_AX (1)		SAR_WVW_2P	
PRD_AX (2)		**Auxiliary-types:**	
TIM_AX		N/A	

Table 22: ERS SAR_WVx_nP processing Inputs/Outputs

6 The numbers in brackets express the order in which these orbit files are selected if more than one type is available covering the required product time.

3. Metadata Specialisation

All metadata types that are defined from scratch or modified by the present specialisation have been included in this section. Several of the non-modified metadata types, such as those from XFDU or from OGC EOP O&M, are not repeated in the present book as they are considered implicitly inherited and therefore, unchanged (the reader is simply referred to the corresponding schemas). However, for some of the OGC EOP O&M metadata types, additional clarifications or restrictions applicable to the SAFE specialisation for ERS are provided.

This section details:

1) the specific metadata elements that are considered applicable from the [OGC EOP O&M] metadata model for the ERS SAFE EO products.
2) the specific metadata elements that are considered applicable from the SAFE scene set metadata model (safe-ssm.xsd) for the EO Scene Product (that can be obtained from the data striplines measured by the AMI-SAR instrument in Image Mode).
3) the specific metadata elements that are considered applicable from the SAFE auxiliary metadata model (safe-aux.xsd) for the ERS Auxiliary files.

As part of this specialisation, the following sections describe the extensions that are needed to be included in the metadata models to allocate a particular metadata not foreseen by the model, and/or to restrict the metadata model to accommodate some of the values that are required by the ERS products/auxiliary files.

The metadata specialisation considers 3 different abstraction levels:

- Mission level: These metadata are common to all products generated for the mission (analogue for the auxiliary files).
- Instrument level: These metadata are common to all products generated for a specific instrument (analogue for auxiliary files).
- Processing level: These metadata are common to all products generated for a specific product level. In this case, the specialisation is specified in a separate ERS control book (i.e. [ERS-BOOK-L0] for L0 products/auxiliary files).

3.1. EO Products

The following table represents the metadata specialisation with respect to the OGC EOP O&M metadata model applicable to all products of the ERS mission (applicable version of the OGC EOP O&M metadata model is referenced in [OGC EOP O&M]).

Where:

- ***XML element or attribute***: Element or attribute from the EOP O&M metadata model (leaf node is in black).
- ***Cardinality:*** Cardinality of the element/attribute tailored for the mission.

- ***Description:*** Brief description of the element/attribute.
- ***Format/Allowed Values:*** Expected format and possible values identified for the mission.

3.1.1. Metadata specialisation at Mission level

The following table describes all the metadata elements that must be present in the metadata file of a SAFE EO Product package generated for ERS:

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
eop:EarthObservation/ *om:phenomenonTime/* *gml:TimePeriod/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
eop:EarthObservation/ *om:phenomenonTime/* *gml:TimePeriod/* **gml:beginPosition**	1	Acquisition start date time in ISO 8601 format.	Format: CCYY-MMDDThh:mm:ss.cccZ
eop:EarthObservation/ *om:phenomenonTime/* *gml:TimePeriod/* **gml:endPosition**	1	Acquisition end date time in ISO 8601 format	Format: CCYY-MMDDThh:mm:ss.cccZ
eop:EarthObservation/ *om:resultTime/* *gml:TimeInstant/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
eop:EarthObservation/ *om:resultTime/* *gml:TimeInstant/* **gml:timePosition**	1	The time when result becomes available in ISO 8601 format.	Format: CCYY-MMDDThh:mm:ss.cccZ Same value as the metadata element: *eop:EarthObservation/* *om:phenomenonTime/*

XML element or attribute	Cardinality	Description	Format/Allowed values
			gml:TimePeriod/ **gml:endPosition**
sar:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
eop:EarthObservation/ *om:procedure/* *eop:EarthObservationEquip-ment/* *eop:platform/* *eop:Platform/* **eop:shortName**	1	Platform short name.	Format: String Value: **ERS**
eop:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* *eop:platform/* *eop:Platform/* **eop:serialIdentifier**	0,1	Platform serial identifier	Format: String Possible values: • **1** • **2**
eop:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* *eop:instrument/* *eop:Instrument/* **eop:shortName**	1	Instrument (Sensor) name	Format: String Value: **AMI-SAR**
eop:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* *eop:sensor/* *eop:Sensor/* **eop:sensorType**	1	Sensor type.	Format: String Value: **RADAR**
eop:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* *eop:sensor/* *eop:Sensor/* **eop:operationalMode**	1	Sensor mode. Possible values are mission specific and should be retrieved using codeSpace.	Format: String Possible values: • **Image** • **other: Wave**

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:orbitNumber**	1	Acquisition orbit number	Format: Integer
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:orbitDirection**	1	Acquisition orbit direction	Format: String Possible values: • **ASCENDING** • **DESCENDING**
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:wrsLongitudeGrid**	1	Track number	Format: String
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ eop:wrsLongitudeGrid/ **@codeSpace**	1	Code space of the WRS	Format: String Possible values: • **urn:esa:eop:ERS:1:relativeOrbits** • **urn:esa:eop:ERS:2:relativeOrbits**
eop:EarthObservation/ **om:observedProperty**	1	xlink to the observed property definition	This field is mandatory but not used and has to be set to null as reported below. `<om:observedProperty xsi:nil="true" nilReason="inapplicable"/>`
eop:EarthObservation/ om:result/ eop:EarthObservationResult/ ***@gml:id***	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	String.The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
eop:EarthObservation/ om:result/ eop:EarthObservationResult/ eop:product/ eop:ProductInformation/ eop:fileName/ ows:ServiceReference/	1	URN Reference to the EO product package.	Format: String

XML element or attribute	Cardinality	Description	Format/Allowed values
@xlink:href			
eop:EarthObservation/ om:result/ eop:EarthObservationResult/ eop:product/ eop:ProductInformation/ eop:fileName/ ows:ServiceReference/ **ows:RequestMessage**	1	OWS request message.	This mandatory element shall be left blank
eop:EarthObservation/ eop:metaDataProperty/ eop:EarthObservationMetaData/ ***eop:identifier***	1	Identifier for metadata item, includes ground segment namespace to guarantee uniqueness within EOP (Product name without extension)	Format: String
eop:EarthObservation/ eop:metaDataProperty/ eop:EarthObservationMetaData/ **eop:acquisitionType**	1	Used to distinguish at a high-level the appropriateness of the acquisition for "general" use.	Format: String Value: **NOMINAL**
eop:EarthObservation/ eop:metaDataProperty/ eop:EarthObservationMetaData/ **eop:productType**	1	Describes product type in case that mixed types are available within a single collection, this is ground segment specific definition.	Format: String Possible values: • **SAR_IM__0P** • **SAR_EWA__0P**
eop:EarthObservation/ eop:metaDataProperty/ eop:EarthObservationMetaData/ **eop:status**	1	Product status.	Format: String Value: **ARCHIVED**
eop:EarthObservation/ eop:metaDataProperty/ eop:EarthObservationMetaData/ eop:downlinkedTo/ eop:DownlinkInformation/ **eop:acquisitionStation**	1	Acquisition Station of downlinked satellite data	Format: String Possible values: • See Appendix C. for station 3 letter code
eop:EarthObservation/ eop:metaDataProperty/ eop:EarthObservationMetaData/ eop:downlinkedTo/ eop:DownlinkInformation/ ***eop:acquisitionStation/***	1	Acquisition Station codespace	Format: String Value: **urn:esa:eop:facility**

XML element or attribute	Cardinality	Description	Format/Allowed values
@codeSpace			
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:processing/* *eop:ProcessingInformation/* **eop:processingCenter**	1	Processing centre code.	Format: String Possible values: (Three letter code operationally defined)
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:processing/* *eop:ProcessingInformation/* ***eop:processingCenter/*** **@codeSpace**	1	Processing centre codespace	Format: String Value: **urn:esa:eop:ERS:facility**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* eop:processing/ eop:ProcessingInformation/ **eop:processingDate**	1	Processing date time	Format: CCYY-MMDDThh:mm:ss.cccZ
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:processing/* *eop:ProcessingInformation/* **eop:processorVersion**	1	Processor software version.	Format: CCYY-MMDDThh:mm[:ss[.cc]]Z
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:processing/* *eop:ProcessingInformation/* ***eop:processingLevel***	1	Processing level.	Format: String Value: **other: L0**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[missionPhase]**	1	The pair localAttribute/localValue is used to provide additional attributes in the product metadata without changing the model.	Format: String Value: **missionPhase**
eop:EarthObservation/	1	Mission Phase.	Format: String

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:metaDataProperty/ *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localValue** **[missionPhase]**			Possible values: If ERS-2 then Mission Phase = 'A' If ERS-1 then Mission Phase depends on the Acquisition start/end date time: • from 1991-07-25T20:52:34Z to 1991-12-10T22:33:02Z: Mission Phase ='A' • from 1991-12-28T07:36:19Z to 1992-04-01T04:48:52Z: Mission Phase ='B' • from 1992-04-02T15:58:35Z to 1992-04-14T07:58:35Z: Mission Phase ='R' • from 1992-04-14T06:17:59Z to1993-12-23T10:56:48Z: Mission Phase ='C' • from 1993-12-23T17:39:06Z to 1994-04-10T15:58:38Z: Mission Phase ='D' • from 1994-04-10T17:39:05Z to 1994-09-28T00:50:19Z: Mission Phase ='E' • from 1994-09-28T02:30:57Z to 1995-03-21T09:01:33Z: Mission Phase ='F' • from 1995-03-21T09:01:49Z to 2000-03-11T00:33:05Z: Mission Phase ='G'

Table 23: EOP O&M Metadata tailoring for ERS SAR EO Products

3.1.2. Metadata specialisation at Instrument level

The following sections describe the metadata elements that must be present in a metadata file of a SAFE EO Product package depending on the Instrument.

3.1.2.1. AMI-SAR Image Mode

The following table specifies the metadata elements that must be present in a metadata file of a SAFE EO Product package obtained from the data measured by the AMI-SAR instrument in Image Mode:

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* *eop:sensor/* *eop:Sensor/* **eop:resolution**	1	Image resolution	Format: String Value: **25**

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:sensor/ eop:Sensor/ eop:resolution/ **@uom**	1	Resolution unit of measure	Format: String Value: **m**
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:sensor/ eop:Sensor/ **eop:swathIdentifier**	1	Swath identifier. Value list can be retrieved with codeSpace.	Format: String Value: **IS2**
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:startTimeFromAscendingNode**	1	Start time of acquisition in milliseconds from Ascending node date. From 0 to 6059000	Format: Double
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ eop:startTimeFromAscendingNode/ **@uom**	1	unit of measure	Format: String Value: **msec**
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:completionTimeFromAscend-ingNode**	1	Completion time of acquisition in milliseconds from Ascending node date. From 0 to 6059000	Format: Double
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ eop:completionTimeFromAscend-ingNode/ **@uom**	1	unit of measure	Format: String Value: **msec**

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **sar:polarisationMode**	1	Polarisation Mode	Format: String Value: **S** *(S: single)*
eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **sar:polarisationChannels**	1	Polarisation Channels	Format: String Value: **VV**
eop:EarthObservation/ om:featureOfInterest/ eop:Footprint / **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
eop:EarthObservation/ om:featureOfInterest/ eop:Footprint / eop:multiExtentOf/ gml:MultiSurface/ **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
eop:EarthObservation/ om:featureOfInterest/ eop:Footprint / eop:multiExtentOf/ gml:MultiSurface/ gml:surfaceMember/ gml:Polygon/ **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
eop:EarthObservation/ om:featureOfInterest/ eop:Footprint / eop:multiExtentOf/ gml:MultiSurface/ gml:surfaceMember/ gml:Polygon/ gml:exterior/ gml:LinearRing/	1	Acquisition footprint coordinates, described by a closed polygon (last point=first point), using CRS:WGS84, Latitude,Longitude pairs (per-WGS84 definition of point ordering, not necessarily per all WFS implementations).	Format: String The footprint is made by the following points (seen from flight direction): • first right • right side standard scene corners • last right • last left

XML element or attribute	Cardinality	Description	Format/Allowed values
gml:posList			• left side standard scene corners • first left • first right (repeated to close the polygon) The Polygon geometry shall be encoded in the EPSG:4326 geographic coordinate reference system and the coordinate pairs shall be ordered as lat /lon. Polygons enclose areas with points listed in CCW direction.
eop:EarthObservation/ *om:featureOfInterest/* *eop:Footprint /* *eop:centerOf/* *gml:Point/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
eop:EarthObservation/ *om:featureOfInterest/* *eop:Footprint /* *eop:centerOf/* *gml:Point/* **gml:pos**	1	Acquisition centre coordinates	Format: String The center position is the central coordinate of the acquisition line at the centre time of the stripline The coordinate pair shall be ordered as lat /lon.
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productQualityDegradation**	0,1	Quality degradation percentage. ERS M: :Expresses the percentage of missing lines with respect to the total number of lines in the stripline (derived from aggregation of similar information at scene level) ERS S: Expresses the percentage of missing lines with respect to the total number of lines in the portion of the stripline covering the corresponding scene	Format: String
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* ***eop:productQualityDegradation/*** ***@uom***	0,1	Unit of Mesure It is mandatory if **productQualityDegradation** is available.	Format: String Value: **%**

XML element or attribute	Cardinality	Description	Format/Allowed values
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* ***eop:productQualityDegradationQuotationMode***	0,1	Indicator to know how the quality degradation percentage has been calculated. It is mandatory if ***productQualityDegradation*** is available.	Format: String Value: **AUTOMATIC**
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productQualityStatus**	0,1	Quality status, e.g. after the product passed a quality check.	Format: String Possible values: • **DEGRADED** • **NOMINAL** Limitations: ERS M: N/A
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productQualityDegradationTag**	0,1	Keywords giving information on the degradations affecting the product, provided eop:productQualityStatus value is DEGRADED.	Format: Integer Value: from 0 to 255 For values above 100 eop:productQualityStatus is DEGRADED Limitations: ERS M: N/A
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:productQualityDegradationTag/* **@codeSpace**	0,1	ProductQualityDegradationTag codespace Mandatory if productQualityDegradationTag is available.	Format: String Value: **urn:esa:eop:ERS:SAR:Image:QualityDegradationTag**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[gaps]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Value: **gaps**
eop:EarthObservation/ *eop:metaDataProperty/*	0,1	See previous `eop:localAttribute` field.	Format: integer

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservationMetaData/ *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localValue** **[gaps]**		Number of gaps in the stripline or scene	ERS M: Gaps in the stripline (derived from aggregation of similar information at scene level) ERS S: Gaps in the portion of the stripline covering the corresponding scene
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[lines]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Value: **lines**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localValue** **[lines]**	0,1	See previous `eop:localAttribute` field. Number of lines in the stripline or scene	Format: integer ERS M: Lines in the stripline (derived from aggregation of similar information at scene level) ERS S: lines in the portion of the stripline covering the corresponding scene
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[qualityAssessmentWarning]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Value: **qualityAssessmentWarning**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localValue** **[qualityAssessmentWarning]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Warning Message returned by quality assessment

Table 24: EOP O&M Metadata tailoring for ERS SAR Image Products

3.1.2.2. *AMI-SAR Wave Mode*

The following table specifies the metadata elements that must be present in a metadata file of a SAFE EO Product package obtained from the data measured by the AMI-SAR instrument in Wave Mode:

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ **om:featureOfInterest**	1	Feature of interest	This field is mandatory but not used and has to be set to null as reported below: <om:featureOfInterest/>
eop:EarthObservation/ *om:result/* *eop:EarthObservationResult/* *eop:product/* *eop:ProductInformation/* **eop:size**	1	Product size.	Format:gml:MeasureListType Unit: bytes

Table 25: EOP O&M Metadata tailoring for ERS SAR Wave Products

3.2. EO Scene Products

SAFE EO Product Packages will always contain a single XML file applying to the whole product (based on the [OGC EOP O&M] model as described in previous section) and optionally, another XML file containing scene information that can be extracted from the data striplines measured by the AMI-SAR instrument in Image Mode.

The following table provides the tailoring of the XML elements to be used in this optional metadata file inside the EO Product Packages considering the scene set metadata model specified for SAFE (safe-ssm.xsd).

Where:

- ***XML element or attribute***: Element or attribute from the EOP O&M metadata model (leaf node is in black).
- ***Cardinality:*** Cardinality of the element/attribute tailored for the mission.
- ***Description:*** Brief description of the element/attribute.
- ***Format/Allowed Values:*** Expected format and possible values identified for the mission.

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:SceneSetMetadata/ *eop:EarthObservation/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:phenomenonTime/* *gml:TimePeriod/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:phenomenonTime/* *gml:TimePeriod/* **gml:beginPosition**	1	Acquisition start date time in ISO 8601 format. For the first scene in the scene set metadata it corresponds to the stripline beginPosition plus 1 second	Format: CCYY-MMDDThh:mm:ss.cccZ
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:phenomenonTime/* *gml:TimePeriod/* **gml:endPosition**	1	Acquisition end date time in ISO 8601 format For the last scene in the scene set metadata it corresponds to the stripline endPosition time minus 1 second	Format: CCYY-MMDDThh:mm:ss.cccZ
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:resultTime/* *gml:TimeInstant/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:resultTime/* *gml:TimeInstant/* **gml:timePosition**	1	The time when result becomes available in ISO 8601 format.	Format: CCYY-MMDDThh:mm:ss.cccZ Same value as the metadata element: *eop:EarthObservation/* *om:phenomenonTime/* *gml:TimePeriod/* **gml:endPosition**
sar:EarthObservation/ *om:procedure/* *eop:EarthObservationEquipment/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquip-ment/ eop:platform/ eop:Platform/ **eop:shortName**	1	Platform short name.	Format: String Value: **ERS**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:platform/ eop:Platform/ **eop:serialIdentifier**	0,1	Platform serial identifier	Format: String Possible values: • **1** • **2**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:instrument/ eop:Instrument/ **eop:shortName**	1	Instrument (Sensor) name	Format: String Value: **AMI-SAR**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:sensor/ eop:Sensor/ **eop:sensorType**	1	Sensor type.	Format: String Value: **RADAR**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:sensor/ eop:Sensor/ **eop:operationalMode**	1	Sensor mode. Possible values are mission specific and should be retrieved using codeSpace.	Format: String Possible values: • **Image** • **other: Wave**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:sensor/	1	Image resolution	Format: String Value: **25**

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:Sensor/ **eop:resolution**			
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:procedure/* *eop:EarthObservationEquipment/* *eop:sensor/* *eop:Sensor/* *eop:resolution/* **@uom**	1	Resolution unit of measure	Format: String Value: **m**
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:procedure/* *eop:EarthObservationEquipment/* *eop:sensor/* *eop:Sensor/* **eop:swathIdentifier**	1	Swath identifier. Value list can be retrieved with codeSpace.	Format: String Value: **IS2**
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:procedure/* *eop:EarthObservationEquipment/* *eop:acquisitionParameters/* *sar:Acquisition/* **eop:orbitNumber**	1	Acquisition orbit number	Format: Integer
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:procedure/* *eop:EarthObservationEquipment/* *eop:acquisitionParameters/* *sar:Acquisition/* **eop:orbitDirection**	1	Acquisition orbit direction	Format: String Possible values: • **ASCENDING** • **DESCENDING**
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:procedure/* *eop:EarthObservationEquipment/* *eop:acquisitionParameters/* *sar:Acquisition/* **eop:wrsLongitudeGrid**	1	Track number	Format: String
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:procedure/* *eop:EarthObservationEquipment/*	1	Code space of the WRS	Format: String Possible values:

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:acquisitionParameters/ sar:Acquisition/ eop:wrsLongitudeGrid/ **@codeSpace**			• **urn:esa:eop:ERS:1:relativeOrbits** • **urn:esa:eop:ERS:2:relativeOrbits**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:wrsLatitudeGrid**	1	Frame number From 9 to 7191 Steps of 18	Format: String
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ eop:wrsLatitudeGrid/ **@codeSpace**	1	Code space of the WRS	Format: String Value: **urn:esa:eop:ERS:SAR:Image:frames**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:startTimeFromAscendingNode**	1	Start time of acquisition in milliseconds from Ascending node date. From 0 to 6059000	Format: Double
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ eop:startTimeFromAscendingNode/ **@uom**	1	unit of measure	Format: String Value: **ms**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **eop:completionTimeFromAscend-ingNode**	1	Completion time of acquisition in milliseconds from Ascending node date. From 0 to 6059000	Format: Double

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ eop:completionTimeFromAscend-ingNode/ **@uom**	1	unit of measure	Format: String Value: **ms**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **sar:polarisationMode**	1	Polarisation Mode	Format: String Value: **S** *(S: single)*
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **sar:polarisationChannels**	1	Polarisation Channels	Format: String Value: **VV**
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ **sar:dopplerFrequency**	0,1	Doppler Frequency of acquisition at scene centre in Hz	Format: Double
ers:SceneSetMetadata/ eop:EarthObservation/ om:procedure/ eop:EarthObservationEquipment/ eop:acquisitionParameters/ sar:Acquisition/ sar:dopplerFrequency/ **@uom**	0,1	Doppler Frequency unit of measure	Format: String Value: **Hz**
ers:SceneSetMetadata/ eop:EarthObservation/ **om:observedProperty**	1	xlink to the observed property definition	This field is mandatory but not used and has to be set to null as reported below. `<om:observedProperty xsi:nil="true" nilReason="inapplic-able"/>`

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:featureOfInterest/* *eop:Footprint/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:featureOfInterest/* *eop:Footprint/* *eop:multiExtentOf/* *gml:MultiSurface/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:featureOfInterest/* *eop:Footprint/* *eop:multiExtentOf/* *gml:MultiSurface/* *gml:surfaceMember/* *gml:Polygon/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:featureOfInterest/* *eop:Footprint/* *eop:multiExtentOf/* *gml:MultiSurface/* *gml:surfaceMember/* *gml:Polygon/* *gml:exterior/* *gml:LinearRing/* **gml:posList**	1	Acquisition footprint coordinates, described by a closed polygon (last point=first point), using CRS:WGS84, Latitude,Longitude pairs (per-WGS84 definition of point ordering, not necessarily per all WFS implementations).	Format: String The footprint is made of the 4 standard scene corner coordinates of the scene starting with the first-right in flight direction and proceeding counterclock-wise. Per convention, the first point has to be added also as fifth point to close the polygon The Polygon geometry shall be encoded in the EPSG:4326 geographic coordinate reference system and the coordinate pairs shall be ordered as lat /lon. Polygons enclose areas with points listed in CCW direction.
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:featureOfInterest/* *eop:Footprint/* *eop:centerOf/* *gml:Point/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
ers:SceneSetMetadata/	1	Acquisition centre coordinates	Format: String

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:EarthObservation/ *om:featureOfInterest/* *eop:Footprint/* *eop:centerOf/* *gml:Point/* **gml:pos**			The center position is the central coordinate of the acquisition line at the centre time of the scene The coordinate pair shall be ordered as lat /lon.
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:result/* *eop:EarthObservationResult/* **@gml:id**	1	Mandatory identifier required by GML. Its value must be unique among all the gml:id attributes of the XML file.	Format: String The convention is to use eop:identifier + _N (as a suffix), where N is a counter starting from 1 and incremented with each gml:id attribute present in a given file.
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:result/* *eop:EarthObservationResult/* *eop:product/* *eop:ProductInformation/* *eop:fileName/* *ows:ServiceReference/* **@xlink:href**	1	URN Reference to the EO product package.	Format: String
ers:SceneSetMetadata/ *eop:EarthObservation/* *om:result/* *eop:EarthObservationResult/* *eop:product/* *eop:ProductInformation/* *eop:fileName/* *ows:ServiceReference/* **ows:RequestMessage**	1	OWS request message.	This mandatory element shall be left blank
ers:SceneSetMetadata/ *eop:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:identifier**	1	Identifier for metadata item, includes ground segment namespace to guarantee uniqueness within EOP.	Format: String Possible values: *Product filename without extension.*
ers:SceneSetMetadata/ *eop:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:acquisitionType**	1	Used to distinguish at a high-level the appropriateness of the acquisition for "general" use.	Format: String Value: **NOMINAL**

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:SceneSetMetadata/ *eop:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productType**	1	Describes product type in case that mixed types are available within a single collection, this is ground segment specific definition.	Format: String Possible values: • **SAR_IM__0P** • **SAR_EWA__0P**
ers:SceneSetMetadata/ *eop:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:status**	1	Product status.	Format: String Value: **ARCHIVED**
ers:SceneSetMetadata/ *eop:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:downlinkedTo/* *eop:DownlinkInformation/* **eop:acquisitionStation**	1	Acquisition Station of downlinked satellite data	Format: String Possible values: • (See Appendix C. for station 3 letter code)
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:downlinkedTo/* *eop:DownlinkInformation/* *eop:acquisitionStation/* **@codeSpace**	1	Acquisition Station codespace	Format: String Value: **urn:esa:eop:facility**
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productQualityDegradation**	0,1	Quality degradation percentage. ERS M: :Expresses the percentage of missing lines with respect to the total number of lines in the stripline (derived from aggregation of similar information at scene level) ERS S: Expresses the percentage of missing lines with respect to the total number of lines in the portion of the stripline covering the corresponding scene	Format: String
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/*	0,1	Unit of Mesure It is mandatory if **productQualityDegradation** is available.	Format: String Value: **%**

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:productQualityDegradation/ ***@uom***			
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* ***eop:productQualityDegradationQuotationMode***	0,1	Indicator to know how the quality degradation percentage has been calculated. It is mandatory if ***productQualityDegradation*** is available.	Format: String Value: **AUTOMATIC**
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productQualityStatus**	0,1	Quality status, e.g. after the product passed a quality check.	Format: String Possible values: • **DEGRADED** • **NOMINAL** Limitations: ERS M: N/A
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* **eop:productQualityDegradationTag**	0,1	Keywords giving information on the degradations affecting the product, provided eop:productQualityStatus value is DEGRADED.	Format: Integer Value: from 0 to 255 For values above 100 eop:productQualityStatus is DEGRADED Limitations: ERS M: N/A
sar:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:productQualityDegradationTag/* **@codeSpace**	0,1	ProductQualityDegradationTag codespace Mandatory if productQualityDegradationTag is available.	Format: String Value: **urn:esa:eop:ERS:SAR:Image:QualityDegradationTag**
ers:SceneSetMetadata/ *eop:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:processing/* *eop:ProcessingInformation/* eop:processingLevel	1	Processing level.	Format: String Value: **other:L0**

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:SceneSetMetadata/ *sar:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific[1]/* *eop:SpecificInformation/* eop:localAttribute [baselinePerpendicularOffset]	0,1	The pair localAttribute/localValue is used to provide additional attributes in the product metadata without changing the model.	Format: String Value: **baselinePerpendicularOffset**
ers:SceneSetMetadata/ *sar:EarthObservation/* *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific[1]/* *eop:SpecificInformation/* **eop:localValue** **[baselinePerpendicularOffset]**	0,1	Baseline perpendicular offset	Format: String
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[gaps]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Value: **gaps**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localValue** **[gaps]**	0,1	See previous eop:localAttribute field. Number of gaps in the stripline or scene	Format: integer ERS M: Gaps in the stripline (derived from aggregation of similar information at scene level) ERS S: Gaps in the portion of the stripline covering the corresponding scene
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[lines]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Value: **lines**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/*	0,1	See previous eop:localAttribute field.	Format: integer

XML element or attribute	Cardinality	Description	Format/Allowed values
eop:vendorSpecific/ *eop:SpecificInformation/* **eop:localValue** **[lines]**		Number of lines in the stripline or scene	ERS M: Lines in the stripline (derived from aggregation of similar information at scene level) ERS S: lines in the portion of the stripline covering the corresponding scene
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localAttribute** **[qualityAssessmentWarning]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Value: **qualityAssessmentWarning**
eop:EarthObservation/ *eop:metaDataProperty/* *eop:EarthObservationMetaData/* *eop:vendorSpecific/* *eop:SpecificInformation/* **eop:localValue** **[qualityAssessmentWarning]**	0,1	This pair of localAttribute/localValue elements can be used to provide, additional attributes in the product metadata without changing the model.	Format: String Warning Message returned by quality assessment

Table 26: SAFE Scene Set Metadata model tailoring for ERS SAR Scene Products

3.3. Auxiliary files

The following table provides the tailoring of the XML elements to be used in the metadata file of ERS EO Auxiliary Packages considering the auxiliary metadata model specified for SAFE (safe-aux.xsd).

Where:

- ***XML element or attribute***: Element or attribute from the SAFE auxiliary metadata model (leaf node is in black).
- ***Cardinality:*** Cardinality of the element/attribute tailored for the mission.
- ***Description:*** Brief description of the element/attribute.
- ***Format/Allowed Values:*** Expected format and possible values identified for the mission.

XML element or attribute	Cardinality	Description	Format/Allowed values
ers:auxiliaryMetadata/ **safe-aux:auxFileType**	1	Code identifying the type of the auxiliary file, counterpart to the product-type for EO Products.	Format: String
ers:auxiliaryMetadata/ **safe-aux:validityStartTime**	1	Start date/time of the auxiliary file's validity period.	Format: dateTime
ers:auxiliaryMetadata/ **safe-aux:validityStopTime**	1	Stop date/time of the auxiliary file's validity period.	Format: dateTime
ers:auxiliaryMetadata/ **safe-aux:creationDate**	1	Creation date/time of the auxiliary file.	Format: dateTime
ers:auxiliaryMetadata/ **safe-aux:version**	1	Version of the auxiliary file itself, just to avoid duplication for regenerated files.	Format: String
ers:auxiliaryMetadata/ **ers:qualityInformation**	0,1	Orbital precision (only applicable to orbit files)	Format: String (1 character) Possible values: • **0** • **1** • **2** Where 0: PRECISE, 1: PREDICTED and 2: RESTITUTED

Table 27: SAFE Auxiliary Metadata model tailoring for ERS SAR Auxiliary files

4. Naming Conventions

4.1. ERS SAR IM (WILMA format)

4.1.1. Level 0 Products

4.1.1.1. Package Names

Representation Information Metadata Package
ERx_SAR_IM__0P_WIL_RPI-MTD_<*cccc*>.SAFE
Representation Information Data Package
ERx_SAR_IM__0P_WIL_RPI-DAT_<*cccc*>.SAFE
Naming convention
ER<*satID*>_SAR_IM__0P_<*start*>_<*stop*>_<*procCenter*>_<*orbit*>_<*nnnn*>_<*cccc*>.SAFE

Table 28: SAFE Package Names for ERS SAR IM L0 products (WILMA format)

Where:

<*satID*>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<*start*>	Start date/time of the product from the UTC time of the first DSR (15 characters: YYYYMMDD_hhmmss)
<*stop*>	Stop date/time of the product (15 characters: YYYYMMDDThhmmss)
<*procCenter*>	Processing center (3 characters)
<*orbit*>	Orbit number (4 characters)
<*nnnn*>	Numerical wrap-around counter for quick file identification (4 characters).
<*cccc*>	Is the CRC-16 value calculated over the manifest file inside the SAFE Package (4 characters).

4.1.1.2. URN Specifications

Representation Information Metadata Package
urn:x-safe:ERS:ERx_SAR_IM__0P_WIL_RPI-MTD
Representation Information Data Package
urn:x-safe:ERS:ERx_SAR_IM__0P_WIL_RPI-DAT
Naming convention for product packages
urn:x-safe:ERS:ER<*satID*>_SAR_IM__0P_<*start*>_<*stop*>_<*procCenter*>_<*orbit*>_<*nnnn*>

Table 29: URN Specifications for ERS SAR IM L0 products (WILMA format)

Where:

<satID>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<start>	Start date/time of the product from the UTC time of the first DSR (15 characters: YYYYMMDD_hhmmss)
<stop>	Stop date/time of the product (15 characters: YYYYMMDDThhmmss)
<procCenter>	Processing center (3 characters)
<orbit>	Orbit number (4 characters)
<nnnn>	Numerical wrap-around counter for quick file identification (4 characters).

4.1.2. Level 0 Auxiliary files

4.1.2.1. Package Names

Representation Information Metadata Package
ERx_*<auxFileType>*_RPI-MTD_*<cccc>*.SAFE
Representation Information Data Package
ERx_*<auxFileType>*_RPI-DAT_*<cccc>*.SAFE
Naming convention for product packages
ER*<satID>*_PATC_*<YYMMDD><oo><dd><nnnn>*_*<cccc>*.SAFE
ER*<satID>*_ORPM_*<YYMMDD><oo><dd><nnnn>*_*<cccc>*.SAFE
ER*<satID>*_ORRM_*<YYMMDD><oo><dd><nnnn>*_*<cccc>*.SAFE
ER*<satID>*_PREC_*<YYMMDD>*_*<nnnn>*_*<vvvv>*_*<cccc>*.SAFE

Table 30: SAFE Package Names for ERS SAR IM L0 auxiliary files (Native format)

Where:

<auxFileType>	Auxiliary file type (4 characters); any of: • PREC • ORPM • ORRM • PATC
<satID>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<YYMMDD>	Creation Date (6 characters)
<oo>	Originator (2 characters)
<dd>	Destination (2 characters)
<nnnn>	Cyclic counter (4 characters)
<cccc>	Is the CRC-16 value calculated over the manifest file inside the SAFE Package.
<vvvv>	Version tag (e.g. rev2) (4 characters)

4.1.2.2. URN Specifications

Representation Information Metadata Package
urn:x-safe:ERS:ERx_<*auxFileType*>_RPI-MTD
Representation Information Data Package
urn:x-safe:ERS:ERx_<*auxFileType*>_RPI-DAT
Naming convention for product packages
urn:x-safe:ERS:ER<*satID*>_PATC_<*YYMMDD*><*oo*><*dd*><*nnnn*>
urn:x-safe:ERS:ER<*satID*>_ORPM_<*YYMMDD*><*oo*><*dd*><*nnnn*>
urn:x-safe:ERS:ER<*satID*>_ORRM_<*YYMMDD*><*oo*><*dd*><*nnnn*>
urn:x-safe:ERS:ER<*satID*>_PREC_<*YYMMDD*>_<*nnnn*>_<*vvvv*>

Table 31: URN Specifications for ERS SAR IM L0 auxiliary files (Native format)

Where:

<*auxFileType*>	Auxiliary file type (4 characters); any of: • PREC • ORPM • ORRM • PATC
<*satID*>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<*YYMMDD*>	Creation Date (6 characters)
<*oo*>	Originator (2 characters)
<*dd*>	Destination (2 characters)
<*nnnn*>	Cyclic counter (4 characters)
<*vvvv*>	Version tag (e.g. rev2) (4 characters)

4.2. ERS SAR IM (ENVISAT format)

4.2.1. Level 0 Products

4.2.1.1. Package Names

Representation Information Metadata Package
ERx_SAR_IM__0P_ENV_RPI-MTD_<*cccc*>.SAFE
Representation Information Data Package
ERx_SAR_IM__0P_ENV_RPI-DAT_<*cccc*>.SAFE
Naming convention
ER<*satID*>_SAR_IM__0P<*state*><*orig*><*start*>_<*duration*><*phase*><*cycle*>_<*relOrb*>_<*absOrb*>_<*nnnn*>_<*cccc*>.SAFE

Table 32: SAFE Package Names for ERS SAR IM L0 products (ENVISAT format)

Where:

<*satID*>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<*state*>	Processing state flag (1 character) • "N" for Near Real Time product • "V" for fully validated (consolidated) product • "T" for Test product • "S" for a special product. *Letters between N and V are assigned in order of level of consolidation (i.e., closer to V = better consolidated)*
<*orig*>	Identification of the center which generated the file (3 characters)
<*start*>	Start date/time of the product from the UTC time of the first DSR (15 characters: *YYYYMMDD_hhmmss*)
<*duration*>	Time coverage of the product expressed in seconds (8 characters).
<*phase*>	Mission phase identifier (1 character)
<*cycle*>	Cycle number within the mission phase (3 characters)
<*relOrb*>	Relative orbit number within the cycle at the beginning of the product (5 characters)
<*absOrb*>	Absolute orbit at the beginning of the product (5 characters)
<*nnnn*>	Numerical wrap-around counter for quick file identification. For a given product type the counter is incremented by 1 for each new product generated by the product originator (4 characters).
<*cccc*>	Is the CRC-16 value calculated over the manifest file inside the SAFE Package (4 characters).

4.2.1.2. URN Specifications

Representation Information Metadata Package
urn:x-safe:ERS:ERx_SAR_IM__0P_ENV_RPI-MTD
Representation Information Data Package
urn:x-safe:ERS:ERx_SAR_IM__0P_ENV_RPI-DAT

Naming convention for product packages
urn:x-safe:ERS:ER<satID>_SAR_IM__0P<state><orig><start>_<duration><phase><cycle>_<relOrb>_<absOrb>_<nnnn>

Table 33: URN Specifications for ERS SAR IM L0 products (ENVISAT format)

Where:

<satID>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<state>	Processing state flag (1 char) • "N" for Near Real Time product • "V" for fully validated (consolidated) product • "T" for Test product • "S" for a special product. *Letters between N and V are assigned in order of level of consolidation (i.e., closer to V = better consolidated)*
<orig>	Identification of the center which generated the file (3 characters)
<start>	Start date of the product from the UTC time of the first DSR (15 char: *YYYYMMDD_hhmmss*)
<duration>	Time coverage of the product expressed in seconds (8 characters).
<phase>	Mission phase identifier (1 character)
<cycle>	Cycle number within the mission phase (3 character)
<relOrb>	Relative orbit number within the cycle at the beginning of the product (5 character)
<absOrb>	Absolute orbit at the beginning of the product (5 character)
<nnnn>	Numerical wrap-around counter for quick file identification. For a given product type the counter is incremented by 1 for each new product generated by the product originator (4 characters).

4.2.2. Level 0 Auxiliary files

4.2.2.1. Package Names

Representation Information Metadata Package
ERx_<auxFileType>_RPI-MTD_<cccc>.SAFE
Representation Information Data Package
ERx_<auxFileType>_RPI-DAT_<cccc>.SAFE
Naming convention for product packages (ENVISAT format)
ER<satID>_PRC_AXNXXX<creationDate>_<start>_<stop>_<cccc>.SAFE
ER<satID>_PRD_AXNXXX<creationDate>_<start>_<stop>_<cccc>.SAFE
ER<satID>_TIM_AXNXXX<creationDate>_<start>_<relOrb>_<cccc>.SAFE

Table 34: SAFE Package Names for ERS SAR IM L0 auxiliary files (ENVISAT format)

Where:

<auxFileType>	Auxiliary file type (6 characters); It can be any of the following: • PRC_AX • PRD_AX • TIM_AX
<satID>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<creationDate>	Creation date/time: yyyymmdd_hhmmss (15 characters)
<start>	Validity start date/time: yyyymmdd_hhmmss (15 characters)
<stop>	Validity stop date/time: yyyymmdd_hhmmss (15 characters)
<cccc>	Is the CRC-16 value calculated over the manifest file inside the SAFE Package (4 characters)
<relOrb>	Relative orbit number within the cycle (at start of product) (7 characters)

4.2.2.2. URN Specifications

Representation Information Metadata Package
urn:x-safe:ERS:ERx_*<auxFileType>*_RPI-MTD
Representation Information Data Package
urn:x-safe:ERS:ERx_*<auxFileType>*_RPI-DAT
Naming convention for product packages
urn:x-safe:ERS:ER*<satID>*_PRC_AXNXXX*<creationDate>*_*<start>*_*<stop>*
urn:x-safe:ERS:ER*<satID>*_PRD_AXNXXX*<creationDate>*_*<start>*_*<stop>*
urn:x-safe:ERS:ER*<satID>*_TIM_AXNXXX*<creationDate>*_*<start>*_*<relOrb>*

Table 35: URN Specifications for ERS SAR IM L0 auxiliary files (ENVISAT format)

Where:

<auxFileType>	Auxiliary file type (6 characters); It can be any of the following: • PRC_AX • PRD_AX • TIM_AX
<satID>	Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.
<creationDate>	Creation date/time: yyyymmdd_hhmmss (15 characters)
<start>	Validity start date/time: yyyymmdd_hhmmss (15 characters)
<stop>	Validity stop date/time: yyyymmdd_hhmmss (15 characters)
<relOrb>	Relative orbit number within the cycle (at start of product) (7 characters)

4.3. ERS SAR EWAC

4.3.1. Level 0 Products

4.3.1.1. Package Names

Representation Information Metadata Package
ERx_SAR_EWA_0P_RPI-MTD_<*cccc*>.SAFE
Representation Information Data Package
ERx_SAR_EWA_0P_RPI-DAT_<*cccc*>.SAFE
Naming convention
ER<*satID*>_SAR_EWA_0P_<*start*>_<*stop*>_<*station*>_<*orbit*>_<*cccc*>.SAFE

Table 36: SAFE Package Names for ERS SAR EWAC L0 products

Where:

<*satID*> Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.

<*start*> Validity start date/time of the product (15 char: *YYYYMMDDThhmmss*)

<*stop*> Validity stop date/time of the product (15 char: *YYYYMMDDThhmmss*)

<*station*> Where data was processed (2 character):

- KS (Kiruna Station)
- HL (Hobart)
- FS (Fucino Station)
- GS (Gatineau Station)
- MS (Maspalomas Station)
- ES (EECF Station)
- PS (Prince Albert Station)

<*orbit*> Orbit number (5 character)

<*cccc*> Is the CRC-16 value calculated over the manifest file inside the SAFE Package (4 characters).

4.3.1.2. URN Specifications

Representation Information Metadata Package
urn:x-safe:ERS:ERx_SAR_EWA_0P_RPI-MTD
Representation Information Data Package
urn:x-safe:ERS:ERx_SAR_EWA_0P_RPI-DAT
Naming convention for product packages
urn:x-safe:ERS:ER<*satID*>_SAR_EWA_0P_<*start*>_<*stop*>_<*station*>_<*orbit*>

Where:

<*satID*> Satellite ID (1 character). '1' or '2' for ERS-1 or ERS-2 respectively.

<*start*> Validity start time of the product (15 char: *YYYYMMDDThhmmss*)

<*stop*> Validity stop time of the product (15 char: *YYYYMMDDThhmmss*)

<*station*> Where data was processed (2 character):

- KS (Kiruna Station)
- FS (Fucino Station)
- GS (Gatineau Station)
- MS (Maspalomas Station)
- ES (EECF Station)
- PS (Prince Albert Station)

<*orbit*> Orbit number (5 character)

Appendix A. Representation Information Packages

SAFE ERS Representation Information Packages are characteristic of the SAFE ERS specialisation and during the nominal operations of a SAFE archive such Packages will not normally be created. Therefore, the packages listed in the following sections can be used as-is to introduce ERS support to a SAFE archive.

A.I. Rep. Info Packages for Level 0 products/auxiliary files

The files listed below are distributed together with the set of documents that constitute the SAFE specialisation for ERS L0. Each SAFE Package is compressed into a zip file which should be decompressed before usage.

These SAFE Packages may contain either the representation information of the target of preservation EO product/Auxiliary data (RPI-DAT) or the representation information of the metadata (RPI-MTD) for the product types and auxiliary file types.

[ERS-BOOK-L0] provides a detailed description of those schemas (stored in the RPI-DAT packages) describing the data structure of the target of preservation.

#	Filename
1	ERx_ORPM_RPI-DAT_4838.SAFE.zip
2	ERx_ORPM_RPI-MTD_1005.SAFE.zip
3	ERx_ORRM_RPI-DAT_4524.SAFE.zip
4	ERx_ORRM_RPI-MTD_4126.SAFE.zip
5	ERx_PATC_RPI-DAT_2169.SAFE.zip
6	ERx_PATC_RPI-MTD_5103.SAFE.zip
7	ERx_PRC_AX_RPI-DAT_4233.SAFE.zip
8	ERx_PRC_AX_RPI-MTD_5389.SAFE.zip
9	ERx_PRD_AX_RPI-DAT_4981.SAFE.zip
10	ERx_PRD_AX_RPI-MTD_4508.SAFE.zip
11	ERx_PREC_RPI-DAT_1133.SAFE.zip
12	ERx_PREC_RPI-MTD_4991.SAFE.zip
13	ERx_SAR_EWA_0P_RPI-DAT_2299.SAFE.zip
14	ERx_SAR_EWA_0P_RPI-MTD_2675.SAFE.zip
15	ERx_SAR_IM__0P_ENV_RPI-DAT_4368.SAFE.zip
16	ERx_SAR_IM__0P_ENV_RPI-MTD_2046.SAFE.zip
17	ERx_SAR_IM__0P_WIL_RPI-DAT_5311.SAFE.zip
18	ERx_SAR_IM__0P_WIL_RPI-MTD_5257.SAFE.zip
19	ERx_TIM_AX_RPI-DAT_3704.SAFE.zip
20	ERx_TIM_AX_RPI-MTD_2396.SAFE.zip

Appendix B. SAFE Package Examples

The packages listed in the following subsections are examples of SAFE ERS EO Product and EO Auxiliary Packages distributed only for illustrative purposes together with the set of documents that constitute the SAFE specialisation for ERS.

Each SAFE Package is compressed into a zip file which should be decompressed before usage.

B.I. SAFE Package examples for L0

#	Filename
1	ER2_SAR_IM__0PXASI19990705_110000_00000017A044_00094_21992_9004_3532.SAFE.zip
2	ER1_SAR_IM__0P_19940205_013918_19940205_014110_GAT_13375_0000_5626.SAFE.zip
3	ER2_SAR_EWA_0P_20100907T191823_20100907T192424_KS_80428_2431.SAFE.zip
4	ER2_ORPM_020307MCME2666_3499.SAFE.zip
5	ER2_ORRM_020307MCME2673_1085.SAFE.zip
6	ER2_PATC_020307CFME9591_3846.SAFE.zip
7	ER1_PREC_950730_21131_rev2_3823.SAFE.zip
8	ER2_PRC_AXNXXX20041021_091255_20010725_232600_20010731_000000_4069.SAFE.zip
9	ER2_PRD_AXNXXX20050202_231508_20050202_090031_20050210_080846_2497.SAFE.zip
10	ER2_TIM_AXNXXX20050907_131515_20010730_080810_0032812_2875.SAFE.zip

Appendix C. Acquisition stations

In the following table the list of ERS Acquisition stations are reported.

Station name	2-char station code	3-char station code
Fairbanks	AF	ASF
AliceS pring	AS	ASA
Atlanta Test Site	AT	ATL
Beijing	BJ	BJG
Bishkek	BK	BSK
Cordoba	CA	COA
Cachoeira Paulista	CP	CPA
Chetumal	CM	MEX
Cotopaxi	CO	CPE
Cuiaba	CU	CUB
Fucino	FS	FUI
Gatineau	GH	GAT
Grimstadt	GR	GRS
Hatoyama	HA	HAJ
Hyderabad – former Shadnadar	SE	HYD
Hobart	HO	HOA
Hawaii	HW	HW
Hyderabad	HY	HYD
PariPari	IN	DKI
TelAviv (IR)	IR	ISR
Johannesburg	JO	JOS
Kitab	KB	KTB
Khanty Mansisk	KM	KMY
Kiruna	KS	KIR
Kumamoto	KU	KUJ
Libreville	LI	LBG
Matera	MA	MTI
Miami	MI	MIM
Malindi	ML	MLD

Station name	2-char station code	3-char station code
McMurdo	MM	MMR
Maspalomas	MS	MPS
Moscow	MW	MSW
Norman	NO	NOM
Neustrelitz	NZ	NSG
O'Higgins	OH	OHG
PrinceAlbert	PH	PAS
Rhyad	SA	RSA
Singapore	SG	SGP
Syowa	SY	SYW
O'Higgins	TF	OHG
Bangkok	TH	BKT
Taipei (Taiwan)	TP	TPE
Tromsoe	TS	TRS
Istanbul	TU	IST
Chung-Li (Taiwan)	TW	TWN
Ulan Bator	UB	ULB
UNKNOWN	XX	XXX
West Freugh	WF	WFR