



JERS Products Comparison ESA - JAXA

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AMENDMENT RECORD SHEET

The Amendment Record Sheet below records the history and issue status of this document.

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1. INTRODUCTION

This Technical Note is in response to an action from the IDEAS+ MTR to assess the quality of JERS-1 SAR data with reference to the corresponding JAXA data. The request was to provide a few bullets on the result of the comparison; however, it was clear that more information was required.

The action was: *MTR#02-04: MC to provide PG with a few bullets on the quality of ESA JERS-1 SAR data compared to JAXA data (ticket #6345).*

1.1 Scope of the comparison

The comparison was done on the format and functionalities between ESA's latest reprocessed products (ESA JERS-1 SAR IPF release v2.05p3), and the processor used by JAXA (a NASDA/RESTEC processor).

It is noted that a further improved version of the ESA IPF also exists (v2.06p1), which incorporates some additional input data recovery capabilities aiming to maximise the production. However, as per agreement with ESA, this updated IPF version has not been used in the current JERS-1 SAR reprocessing.

1.2 Challenges

The main issue encountered during this exercise was the difficulty to obtain comparable products from the JAXA archive and the ESA reprocessed archive. In fact, it was discovered that JAXA no longer provide L1 JERS-1 SAR products. It is not clear when these products stopped being available, but this made the comparison unviable.

1.3 Approach

For this reason, the assessment was instead done using two approaches:

- 1) Comparing information based on documentation (i.e. product format descriptions)
- 2) Using existing IDEAS+ knowledge, through Phoenix Systems expertise, of the differences in processing facilities.

2. COMPARISON FINDINGS

2.1 Documentation based comparison

2.1.1 Documentation used

The documents used for this comparison (latest releases produced) were:

The **JAXA** documentation available was the:

- User's Guide for JERS-1 SAR Data Format, 1st edition, National Space Development Agency of Japan

The **ESA** documentation was the:

- JERS/SEASAT SAR Products CEOS Format Specifications, Issue 1.3, Phoenix Systems, ESA

2.1.2 Comparison results

- Both ESA and JAXA JERS-1 SAR data are/were provided in CEOS format (see Figure 1 for product format).
- The JAXA format specification is provided once for all data product levels, so it isn't clear what fields are relevant for each product level, whereas the ESA document has a format specification for L0 and another for L1.
- The findings relating to product format (based purely on the documentation) are:
 - **Volume Directory File:** both the ESA and JAXA product files have the same format
 - **Leader File:** JAXA products contain more records at L1 than the ESA products (see Table 1)

Table 1 – Comparison between ESA and JAXA Leader file contents

ESA JERS Leader File	JAXA JERS Leader File
File descriptor record	File descriptor record
Data set summary record	Data set summary record
Map projection data record	
Platform position data record	Platform position data record
	Attitude data record
	Radiometric compensation record
	Data quality summary record
	Data histogram record
	Range spectra record
Facility related data record	Facility related data record
Facility related data record PCS quality	



- Within the Leader file, the following was found:
 - The File Descriptor Record is the same in both specifications.
 - The Data Set Summary Record had some differences but the extra fields in the JAXA product are either blank or provided elsewhere in the ESA product. There are also extra fields in the ESA product.
 - According to the JAXA specification, the Map Projection Data Record is not provided at L1, however it is in the ESA product. Therefore, the ESA product provides more information on this.
 - The Platform Position Data record also had extra fields in the JAXA product: all but three of these are provided in the ESA product at L0 only.
 - The Attitude Data Record and Range Spectra Record are in the JAXA products at L1 but are only in the ESA products at L0, so this is extra information in the JAXA L1 product.
 - The Radiometric Compensation Record, Data Quality Summary Record and Data Histogram Record are provided in L1 JAXA products but are not in ESA products at all, so this is also extra information provided in the JAXA product.
 - The Facility Related Data Record appears to have the largest number of differences, but is described in the JAXA documentation as a having a free format, containing information that is strictly facility related. Therefore, these differences are expected. There were 47 fields in the JAXA product not in the ESA product and 69 in the ESA product not in the JAXA format.
 - The extra Facility related data record (PCS quality type) in the ESA product is ESA specific and currently blank filled.
- **SAR Data File:** the contents of the two records in this file have the same format, with the exception that the JAXA products have extra Prefix Data sections. Most of these fields are only present in the L0 ESA products.
- **Trailer File:** the JAXA product contains a Trailer file at L1, whereas ESA's product does not.
- **Null Volume Directory:** this is predominately the same between ESA and JAXA, with the ESA file containing some extra fields. However, these fields aren't new information as they are provided in another file in both the ESA and JAXA products.

ESA JERS-1 SAR

L1 SLC (1 look) and PRI (4 looks) products

VOLUME DIRECTORY FILE	VOLUME DESCRIPTOR RECORD
	LEADER FILE POINTER RECORD
	DATA FILE POINTER RECORD
	TEXT RECORD
LEADER FILE	FILE DESCRIPTOR RECORD
	DATA SET SUMMARY RECORD
	MAP PROJECTION DATA RECORD
	PLATFORM POSITION DATA RECORD
	FACILITY RELATED DATA RECORD [GENERAL TYPE]
	FACILITY RELATED DATA RECORD PCS QUALITY TYPE
SAR DATA IMAGERY OPTIONS FILE	FILE DESCRIPTOR RECORD
	PROCESSED SIGNAL DATA RECORD
NULL VOLUME DIRECTORY FILE	NULL VOLUME DESCRIPTOR RECORD

JAXA JERS-1 SAR

L1 (1 look), L1.1 (1 look and 3 looks) products

VOLUME DIRECTORY FILE	VOLUME DESCRIPTOR RECORD
	LEADER FILE POINTER RECORD
	DATA FILE POINTER RECORD
	TRAILER FILE POINTER RECORD
	TEXT RECORD
LEADER FILE	FILE DESCRIPTOR RECORD
	DATA SET SUMMARY RECORD
	PLATFORM POSITION DATA RECORD
	ATTITUDE DATA RECORD
	RADIOMETRIC COMPENSATION RECORD
	DATA QUALITY SUMMARY RECORD*
	DATA HISTORGRAM RECORD**
	RANGE SPECTRA RECORD
	FACILITY RELATED DATA RECORD
SAR DATA IMAGERY OPTIONS FILE	FILE DESCRIPTOR RECORD
	PROCESSED SIGNAL DATA RECORD
TRAILER FILE	FILE DESCRIPTOR RECORD
NULL VOLUME DIRECTORY FILE	NULL VOLUME DESCRIPTOR RECORD

*The Data Quality Summary record is only in the L1.1 products
 **The Data Histogram record is only in the L1.1 3 looks product

Figure 1 - JERS SAR product formats

2.2 Phoenix Systems knowledge based comparison

- The primary objective of the ESA JERS-IPF was to allow ESA systematic access to their WILMA JERS raw archives. Previously they were processed by a stand-alone system (from MDA). That system, aside from the inconvenience of being stand-alone exhibited notoriously large georeferencing errors in its products (tens of km along track). The initial ESA IPF system exhibited the same behaviour, ultimately traced to errors in the original WILMA data archival time-stamp generation. That is fixed in the ESA IPF (by development of a software PCM decoder to access the embedded low-rate frames and accessing/interpreting the JERS satellite binary clock in conjunction with historic JAXA time correlation records).
- The ESA IPF focus and along-track georeferencing quality is as exact as the quality of the ancillary data – which, while not at the same level as ALOS JAXA, is very good, and, from Phoenix’s knowledge of the fairly basic SAR processor used by JAXA, it would be very surprising if the ESA IPF product quality was not noticeably better in detailed comparisons.



- There is a residual issue with the cross-track georeferencing – some scenes are exact, whereas others exhibit a small range bias. The hypothesis is that, at some point during the JERS mission, the platform changed to a back-up TWT with a slightly different calibration. At one point Phoenix did suggest trying to tie this down, but it was decided to reconsider, following the results of the ACS reprocessing.
- The JERS IPF incorporates an effective RFI filter, which is important since many JAXA scenes are materially degraded by RFI associated with coastal, airport and AD radar systems.



3. CONCLUSIONS

- Key format differences identified through the analysis of the available documentation are:
 - There are noticeable differences in the Leader File, including extra records in both the JAXA and ESA products
 - The JAXA products contain a Trailer file, which the ESA products do not
- The unavailability of comparable JAXA products makes it impossible to derive quantitative conclusions on the data quality, coverage, accuracy, processing completeness, etc.
- However, the expectation is that the ESA processor implements some significant improvements on data recovery and RFI filtering, which indicate a likely higher capability.
- Also, the fact that JAXA no longer provide L1 products highlights the importance of the ESA JERS-1 SAR dataset.

4. ACRONYMS

The acronyms used in this document are provided below:

Acronym	Definition
AD	Air Defence
ALOS	Advanced Land Observing Satellite
CEOS	Committee on Earth Observation Satellites
ESA	European Space Agency
IDEAS+	Instrument Data quality Evaluation and Analysis Service
IPF	Instrument Processing Facility
JAXA	Japan Aerospace Exploration Agency
JERS	Japanese Earth Resources Satellite
L0	Level 0
L1	Level 1
MDA	MacDonald, Dettwiler and Associates
MTR	Mid Term Review
NASDA	National Space Development Agency
PCM	Pulse Code Modulation
PRI	Precision
RESTEC	Remote Sensing Technology Center of Japan
RFI	Radio Frequency Interference
SAR	Synthetic Aperture Radar
SLC	Single Look Complex
SPPA	Sensor Performance, Products and Algorithms
TWT	Travelling Wave Tube
WILMA	Wide Long term Multi-satellite Archive

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