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# SSALTO

## ALGORITHM DEFINITION, ACCURACY AND SPECIFICATION VOLUME 5: CMA RADIOMETER LEVEL 2 PROCESSING

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**ABBREVIATIONS**

<b>Abbreviation</b>	<b>Definition</b>
<b>ADA</b>	Algorithm Definition and Accuracy
<b>ADx</b>	Applicable Document x
<b>CLS</b>	Collecte Localisation Satellites
<b>CMA</b>	Centre Multi-missions Altimétrie
<b>CNES</b>	Centre National d'Etudes Spatiales
<b>DAD</b>	Dynamic Auxiliary Data
<b>GDR</b>	Geophysical Data Record
<b>IGDR</b>	Interim Geophysical Data Record
<b>JMR</b>	JASON Microwave Radiometer
<b>JPL</b>	Jet Propulsion Laboratory
<b>NRT</b>	Near Real Time
<b>OFL</b>	Off-Line
<b>PTR</b>	Point Target Response
<b>RDx</b>	Reference Document x
<b>SAD</b>	Static Auxiliary Data
<b>SSALTO</b>	Segment Sol Altimétrie et Orbitographie
<b>TBC</b>	To Be Confirmed
<b>TBD</b>	To Be Defined
<b>UTC</b>	Universal Time Coordinate



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### APPLICABLE AND REFERENCE DOCUMENTS

Reference	Document title
TP2-SB-J0-102-CNES	AD1 JASON-1 Science and Operational Requirements
SMM-ST-M2-EA-10658-CN	AD2 CMA Requirements Specification
SMM-ST-M-EA-10879-CN	AD3 SSALTO Products Specifications - Volume 1: JASON-1 User Products
TP2-SB-J0-459-CNES	AD4 JASON-1 Products Description
TBD	AD5 Spécifications des interfaces internes SSALTO: CMA
SMM-ST-M1-EA-20078-CN	AD6 POSEIDON-2 Level 1.0 Altimeter data product
SMM-ST-M1-EA-31023-CLS	AD7 JMR Level 1.0 data product
SMM-ST-M2-EA-11003-CN	AD8 Algorithm Definition, Accuracy and Specification Volume 2: CMA Altimeter Level 1b Processing
SMM-ST-M2-EA-11004-CN	AD9 Algorithm Definition, Accuracy and Specification Volume 3: CMA Radiometer Level 1b Processing
SMM-ST-M2-EA-11005-CN	AD10 Algorithm Definition, Accuracy and Specification Volume 4: CMA Altimeter Level 2 Processing
SMM-ST-M2-EA-11010-CN	AD11 Algorithm Definition, Accuracy and Specification Volume 9: CMA Mechanisms
SMM-SP-M2-EA-32012-CLS	RD1 CMA production: Specifications of the Data management Algorithms

### TBC AND TBD LIST

TBC/TBD	Section	Brief description
TBC	Applicable and reference documents	Nomenclature of AD5



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## 1. INTRODUCTION

This document is aimed at defining and specifying the main functions of the nominal Level 2 processing of the JASON-1 microwave radiometer (JMR) data.

Regarding the JASON-1 mission, the highest level requirements placed by the JASON Science Working Team upon the JASON project to meet the scientific and operational objectives of the mission are listed in AD1, and the requirements aimed at defining the CMA facility inside the SSALTO system are established in AD2.

The JMR level 2 processing starts from the JMR level 1b parameters defined in AD9, and generates the JMR level 2 parameters to be merged in the altimeter level 2 products. The JMR level 2 processing is thus made of by a subset of algorithms fully described in the altimeter level 2 processing (see AD10).

### Definition of the JMR level 2 processing

The definition of the JMR level 2 processing consists of the identification and the description of its main functions. It will provide the reader with an overview of the procedures and a global understanding of the algorithms.

### Specifications of the JMR level 2 processing

Regarding the specifications of the JMR level 2 processing, two kinds of algorithms are distinguished :

- The “scientific” algorithms, which represent the core of the processing
- The other algorithms, which will be called the “data management” algorithms, ensuring functions such as :
  - To get the input data
  - To prepare the data to be processed (for example to select the orbit data set requested to compute the location of each altimeter measurement)
  - To perform unit conversions or changes in reference systems
  - To perform general checks (relevant for example to the presence of input files, to the data conformity or to the computability of input data with the data set to be processed)
  - To build the output product(s)
  - To manage the processing

The scientific algorithms are specified in this document and in AD11 for the mechanisms, which represent the functions common to several algorithms or the functions frequently requested within an algorithm. The data management algorithms, which strongly depend on the format of the input and output data, are specified in RD1 (and AD11 for the corresponding mechanisms, if any). The complete set of specifications (to be associated with the corresponding interfaces documents) are intended for the team in charge of the software development.

### Conventions

The JMR level 2 processing is represented in this document as a linear set of functions which are aimed at building a set of JMR level 2 parameters from a set of JMR level 1b parameters. This representation has been chosen for historical reasons in order to ease the understanding of the overall processing, but it does not anticipate the organization or the sequencing of the algorithms within the CMA processor.

As the algorithms identified in this document are identical to the ones given in AD10, they will not be repeated here in detail but instead, reference to the document in which they appear will be made.



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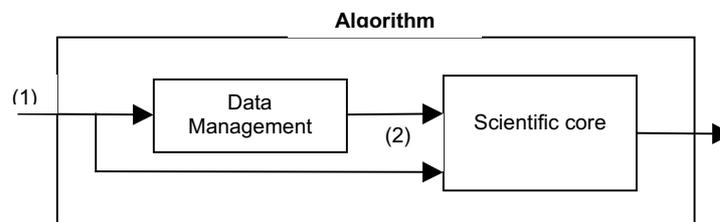
### Organization of the document

- The interfaces of the JMR Level 2 processing (input and output data) are defined in § 2.
- The JMR Level 2 algorithms are described in § 3.

The description of the JMR Level 2 processing consists of:

- An overview of the overall processing (brief description of the processing and list of functions).
- The definition and the specification of the algorithms, using the following items :
  - Name and identifier of the algorithm
  - Heritage
  - Function
  - Applicability to the various procedures
  - Algorithm definition :
    - \* Input data
    - \* Output data
    - \* Mathematical statement
  - Algorithm specification :
    - \* Input data
    - \* Output data
    - \* Processing
  - Accuracy (if any)
  - Comments (if any)
  - References (if any)

As previously mentioned, only the scientific core of each algorithm is specified in this document. For each algorithm, the input data (1) identified in the "Algorithm definition" section corresponds to the input data required for the global processing (Data Management and Scientific Core), while the input data (2) identified in the "Algorithm specification" section corresponds to the data requested for the scientific core only.



The general information necessary for a global understanding of the algorithm within the overall processing is provided in the "Algorithm definition" sections.

The detailed information required by the team in charge of the software development is provided in the "Algorithm specification" sections, which precisely define the scientific part (i.e. the core) of the algorithms.



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## Basic rules

The following basic rules are applied to the specification of the algorithms:

- The specifications of an algorithm are always relevant to the processing of a single data point and not to a set of data points
- Elementary functions which are common to several algorithms (also called “mechanisms”) are specified in AD11.
- The input and output data are always identified by a precise description, an explicit name (that could be used in the coding phase), a unit and, if necessary, a reference system
- Regarding the errors that may occur during the processing functions (for example, negative argument for logarithmic or square root functions), the algorithms systematically output an execution status. The building and the management of this information will be defined during the architectural design of the software.
- Regarding the representation of tables, the following conventions are used in the following:
  - $X[N_1:N_2]$  represents a one-dimension table whose elements are  $X(i)$  (or  $X_i$ ) with  $i \in [N_1, N_2]$
  - $X[N_1:N_2][M_1:M_2]$  represents a two-dimension table whose elements are  $X(i,j)$  (or  $X_{ij}$ ) with  $i \in [N_1, N_2]$  and  $j \in [M_1, M_2]$
  - And so on

## 2. INPUT AND OUTPUT DATA

### 2.1. INPUT DATA

Two types of input data may be discriminated (see AD2):

- "Product" data, which correspond to measurements performed by the altimeter or the radiometer instruments:
  - JMR level 1b parameters
  - Altimeter time, from POSEIDON-2 level 1b parameters
- Auxiliary data, which may be dynamic or static:
  - Dynamic auxiliary data (DAD) are the time-varying data
  - Static auxiliary data (SAD) are constant data.

The altimeter and radiometer datasets on input represent each a sequential set of measurements.

#### 2.1.1. PRODUCT DATA

The JASON-1 JMR Level 1b parameters consist of the JMR level 1.0 parameters required on input of the level 2 processing and of the parameters computed by the JMR level 1b algorithms (see AD9).

The JASON-1 POSEIDON-2 Level 1b parameters consist of the POSEIDON-2 level 1.0 parameters required on input of the level 2 processing and of the parameters computed by the POSEIDON-2 level 1b algorithms (see AD8).

These parameters are considered as intermediate parameters within a global processing of the altimeter and radiometer measurements from level 1.0 (see AD6 for the altimeter and AD7 for the radiometer) to Level 2 (see AD3).



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### 2.1.2. AUXILIARY DATA

- **Dynamic auxiliary data:**

None

- **Static auxiliary data:**

Static auxiliary data for the JMR Level 2 processing consist of the following data described in AD5:

- Processing parameters (all the constant parameters used in the processing, such as thresholds, etc)

### 2.2. OUTPUT DATA

It is assumed that the JMR level 2 processing does not modify the organization of the input data. Therefore, level 2 processing outputs one set of level 2 parameters that is structured identically to the set of Level 1b input parameters.

The JMR Level 2 parameters are described in AD3.



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### 3. JMR LEVEL 2 PROCESSING

#### 3.1. PROCESSING OVERVIEW

##### 3.1.1. BRIEF DESCRIPTION

A brief overview of the functions of the JMR Level 2 processing is given in this section. A detailed description is provided in § 3.2.

- The brightness temperatures and the corresponding quality flags and surface type are interpolated to the time tag of the altimeter measurement.
- The geophysical parameters are computed from the interpolated brightness temperatures (water vapor path delay, radiometer wind speed, cloud liquid water content and water vapor content).

##### 3.1.2. LIST OF FUNCTIONS

A list of the functions of the JMR Level 2 processing is given in **Figure 1**.

FUNCTION
RAD_MAN_INT_01 - To interpolate radiometer data to altimeter time-tags
RAD_PHY_GEN_01 - To compute the JMR geophysical parameters

**Figure 1: Functions of the JASON-1 Radiometer Level 2 processing**

#### 3.2. FUNCTIONS

The detailed description of the functions of the nominal JMR Level 2 processing is given in AD10.

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