Satellite Products and Services Review Board

**Algorithm Theoretical**

**Basis Document**

**Template**

***Compiled by the***

**SPSRB Common Standards Working Group**



**Version 2.2**

**September, 2012**

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Title: ALGORITHM THEORETICAL BASIS DOCUMENT template VERSION 2.2

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**DOCUMENT HISTORY**

**DOCUMENT REVISION LOG**

The Document Revision Log identifies the series of revisions to this document since the baseline release. Please refer to the above page for version number information.

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| **DOCUMENT TITLE: Algorithm Theoretical Basis Document Template** | | | |
| **DOCUMENT CHANGE HISTORY** | | | |
| **Revision No.** | **Date** | **Revision Originator Project Group** | **CCR Approval # and Date** |
| 1.0 | N/A | No version 1 | N/A |
| 2.0 | July 2010 | Initial Release by CSWG. named version 2 to align it with the version 2 SPSRB Document Guidelines | August 2010 |
| 2.1 | May 2011 | Minor revisions to v2.0 | May 2011 |
| 2.2 | September 2012 | Minor revisions to v2.1 | October 2012 |
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**LIST OF CHANGES**

Significant alterations made to this document are annotated in the List of Changes table.

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| --- | --- | --- | --- | --- | --- |
| **DOCUMENT TITLE: Algorithm Theoretical Basis Document Template** | | | | | |
| **LIST OF CHANGE-AFFECTED PAGES/SECTIONS/APPENDICES** | | | | | |
| **Version Number** | **Date** | **Changed By** | **Page** | **Section** | **Description of Change(s)** |
| 2.1 | 04/28/11 | Jensen | 7 | 1.1.2 | DO 1: “project requirements” changed to “requirements”. |
| 2.1 | 5/12/11 | Shontz | 7 | 1.1.1 | DO 34 content revised; heading changed from “Input Satellite Data” to “Satellite Instrument Overview” |
| 2.1 | 5/12/11 | Shontz | 7 | 1.2 | Changed Section 1.2 heading from “Instrument Characteristics” to “Satellite Instrument Description” |
| 2.1 | 5/12/11 | Shontz | 8 | 2.1 | Changed Section 2.1 heading from “Processing Overview” to “Processing Outline” |
| 2.2 | 9/27/12 | King | All | 2.1 | Revised the document to combine the content of the guideline that identifies the writers of individual document objects into the template. |
| 2.2 | 9/27/12 | Cheng | 11 | 3.2 | Revised the description of section 3.2 |
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Figure X – Figure Caption

Table X – Table Title

Note that these figure captions and table titles are generic placeholders. When actual figures and tables are inserted into the SMM, they should be numbered according to this convention:

The first figure for a given main section (e.g. Section 3) should be numbered Figure 3-1, etc.

The first table for a given main section (e.g. Section 2) should be numbered Table 2-1, etc.

# INTRODUCTION

Figures used in Section 1 should be numbered Figure 1-1, Figure 1-2, etc.

Tables used in Section 1 should be numbered Table 1-1, Table 1-2, etc.

## Product Overview

### Product Description

Product description with sufficient detail so that the user understands how to use the product files. *(Document Object 34)[[1]](#footnote-1)*

**Writers:** Algorithm Scientists.

### Product Requirements

State the requirements for each product, either explicitly or by reference to the project's requirements document, if available. Product requirements should include content, format, latency, quality. *(Document Object 1)*

**Writers:** Development Lead.

## Satellite Instrument Description

Describe the attributes of the sensing system(s) used to supply data for the retrieval algorithm at a level of detail sufficient for reviewers to verify that the instrument is capable of supplying input data of sufficient quality. *(Document Object 28da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Development Lead and PAL should collaborate.

# ALGORITHM DESCRIPTION

Figures used in Section 2 should be numbered Figure 2-1, Figure 2-2, etc.

Tables used in Section 2 should be numbered Table 2-1, Table 2-2, etc.

## Processing Outline

Full description of the processing outline of the retrieval algorithm. All key elements and sub-elements needed to convey a comprehensive sense of the algorithm should be included. The level of detail should be consistent with the current maturity of the software architecture (which will improve with each revision). A data flow diagram consistent with the software architecture is preferred. *(Document Object 13da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

## Algorithm Input

Full description of the attributes of all input data used by the algorithm, including primary sensor data, ancillary data, forward models (e.g. radiative transfer models, optical models, or other model that relates sensor observables to geophysical phenomena) and look-up tables. Do not include file formats; these will be documented elsewhere. *(Document Object 14da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

## Theoretical Description

### Physical Description

Comprehensively describe the sensor physics and the associated geophysical phenomenology key to the product retrieval. *(Document Object 15da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

### Mathematical Description

Comprehensively describe the mathematics used by the algorithm, including all assumptions, simplifications, approximations. *(Document Object 16da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

## Algorithm Output

Describe the output data products - not format - at a level of detail to determine if the product meets user requirements. *(Document Object 17da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

## Performance Estimates

### Test Data Description

Description of data sets used for V&V, including unit tests and system test, either explicitly or by reference to the developer's test plans, if available. This will be updated during operations to describe test data for maintenance. *(Document Object 31da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Development Testers

### Sensor Effects

Characterize sensor effects that may contribute to retrieval error. Include the following effects if relevant:

o Flowed-through effects of sensor noise (radiometric, thermal, or other) on the quality of products, using text and graphics (scatter plots, image displays, etc.).

o Flowed-through effects of calibration errors (radiometric, including structured scenes and response versus scan, or any sensor biases) on the quality of products, using text and graphics.

o Flowed-through spatial and spectral error effects (pointing and geolocation errors, apodization, modulation transfer function (MTF), point-spread function (PSF), out-of-band (OOB) response, near-field stray light, Earth shine, solar contamination, polarization, cross talk, etc.) on the quality of products, using text and graphics.

o Flowed-through effects of un-modeled or neglected geophysical phenomena on the quality of products, using text and graphics.

*(Document Object 18da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

### Retrieval Errors

Accuracy of products, as measured by V&V testing, and compared to accuracy requirements. Refer to relevant test reports. *(Document Object 39da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists and Development Testers should collaborate

Organize the various error estimates into an error budget, presented as a table. Error budget limitations should be explained. Describe prospects for overcoming error budget limitations with future maturation of the algorithm, test data, and error analysis methodology. *(Document Object 19da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

## Practical Considerations

### Numerical Computation Considerations

Describe how the algorithm is numerically implemented, including possible issues with computationally intensive operations (e.g., large matrix inversions, truncation and rounding). *(Document Object 21da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Development Programmers.

### Programming and Procedural Considerations

Describe any important programming and procedural aspects related to implementing the numerical model into operating code. *(Document Object 22da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Development Programmers.

### Quality Assessment and Diagnostics

Describe how the quality of the output products and the retrieval itself is assessed, documented, and any anomalies diagnosed. *(Document Object 23da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

### Exception Handling

List the complete set of expected exceptions, and describes how they are identified, trapped, and handled. *(Document Object 24da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Development Programmers.

## Validation

Describe how the algorithm has been or should be validated at a level of detail appropriate for the current algorithm maturity. *(Document Object 26da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

# ASSUMPTIONS AND LIMITATIONS

Figures used in Section 3 should be numbered Figure 3-1, Figure 3-2, etc.

Tables used in Section 3 should be numbered Table 3-1, Table 3-2, etc.

## Performance Assumptions

Describe all assumptions that have been made concerning the algorithm performance estimates. Note any limitations that apply to the algorithms (e.g., conditions where retrievals cannot be made or where performance may be significantly degraded. To the extent possible, the potential for degraded performance should be explored, along with mitigating strategies. *(Document Object 20da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

## Potential Improvements

Describe potential future enhancements to the algorithm, the limitations they will mitigate, and provide all possible and useful related information and links. *(Document Object 25da website) this is on the S in the System Maintenance Manual Guideliness)*

**Writers:** Algorithm Scientists.

# REFERENCES

List all references to external documents.

END OF DOCUMENT

1. If Document Objects have been written, the indicated object should be directly inserted to satisfy each template instruction. Document Objects are described in the Algorithm Theoretical Basis Document Standards and Guidelines <http://projects.osd.noaa.gov/spsrb/standards_data_mtg.htm> [↑](#footnote-ref-1)