

OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check Ref: S3-L2-SD-03-C05-ARG-ATBD Issue: 2.1 Date: 29/09/10 Page 1 of 13

# OLCI Level 2

# Algorithm Theoretical Basis Document

# **Confidence Check**

DOCUMENT REF: DELIVERABLE REF: VERSION: S3-L2-SD-03-C05-ARG-ATBD SD-03-C 2.1



OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

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## **Change record**

Issue	DateDescriptionChange pages		Change pages
1.0	27/08/2009	Version 1 (PDR delivery)	
2.0	08/04/2010	Version 2 (CDR)	Dropped HIPOL (High degree of polarization).
2.1	29/09/2010	CDR updates	Updated Distribution List; Dropped NAVWARN as it will be flagged in the metadata (not considered to be a pixel-based flag); Updated Tables 1 and 2 based on further discussions / OLCI DPM updates



OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check Ref: S3-L2-SD-03-C05-ARG-ATBD Issue: 2.1 Date: 29/09/10 Page 3 of 13

## **Distribution List**

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## Table of Contents

1.	INTRODUCTION	5
1.1	Acronyms and Abbreviations	5
1.2	2 Purpose and Scope	5
1.3	3 Algorithm Identification	5
2.	ALGORITHM OVERVIEW	5
2.1	1 Objectives	5
3. /	ALGORITHM DESCRIPTION	6
3.1	I Theoretical Description	6
3.2	2 Algorithm Validation	11
3.3	3 Practical consideration	12
4.	ASSUMPTIONS AND LIMITATIONS	12
5.	AUXILIARY DATA	12

ARGANS	SENTINEL-3 OPTICAL PRODUCTS AND ALGORITHM DEFINITION	Ref: S3-L2-SD-03-C05-ARG-ATBD Issue: 2.1 Date: 29/09/10 Page 4 of 13
	OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check	

6.	ERROR BUDGET	.12
7.	REFERENCES	.13

## 1. INTRODUCTION

- 1.1 Acronyms and Abbreviations
- ATBD Algorithm Theoretical Basis Document
- ODSI OLCI Differential Snow Index
- OLCI Ocean Land Colour Imager

## 1.2 Purpose and Scope

The confidence check ATBD defines the OLCI classification flags and details of example quality flags that will provide the end users with confidence in the OLCI products.

1.3 Algorithm Identification

This algorithm is identified under reference "SD-03-C06" in the Sentinel-3 OLCI documentation.

## 2. ALGORITHM OVERVIEW

## 2.1 Objectives

To flag the data so that the end users can appropriately determine the data usage for their own applications. This will be complemented by the quality indicators that are being specified within the individual ATBDs.



## 3. ALGORITHM DESCRIPTION

### 3.1 Theoretical Description

In the MERIS Level 2 product there are three different types of flags:

- Classification flags that indicate the type of surface (LAND, CLOUD or WATER).
- Confidence flags that give an indication of the confidence in the parameter quality retrieval; where the flag is raised pixels should be discarded or used very carefully. These are PCD\_1\_13 to PCD\_19.
- Science flags that help in the interpretation of the data. These should be consulted for a full understanding of the retrieved parameter meaning. General science flags are:
  - Coastline: From Level 1b, coastline flag. For the MERIS this differentiates "land" from "ocean".
  - o Cosmetic: From Level 1b, missing data filled in by interpolation.
  - Suspect: From Level 1b, suspect data.

The suggestion for OLCI is that quality flags are created (combines both the MERIS classification and confidence flags); see Table 1, as each product will also have sciences flag and a quality indicator that provides a quantified uncertainty. The science flags are provided in Table 2.

OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

Table	1: Quality Flags for (	OLCI.
Bit	Flag Name	Flag Description
	F	Pixel Classification / Pixel Quality Flags
01	INVALID	Invalid flag: determined from Level1b flags. This exception is not expected ever to happen in nominal OLCI operation [RD-3].
02	WATER	If not INVALID OR LAND OR CLOUD; see OLCI DPM Section 7.3.3.13 [RD-3]
03	LAND	Pixel is over land: Initially set (LAND_F) when the Level 1 bright flag is not raised over land or if the Level 1 bright flag is raised and then (in turn) the snow (through ONSI) and sand tests are positive (see ATBD SD-03-C01 for details). It is then consolidated with the islands flag (ISLAND_F); called LANDCONS_F internally. See OLCI DPM (section 4.5) [RD-3].
04	CLOUD	Pixel is determined to be cloud by ATBD SD-03-C01, also see OLCI DPM (Figure 4-2) [RD-3].
05	SNOW_ICE	Possible sea ice or snow contamination. Based on Level 1 bright flag and ODSI. See ATBD SD-03-C01 for details.
06	INLAND_WATER	Fresh inland waters flag: based on Level 1 land_water flag.
07	TIDAL	Pixel is in shallow water; based on Level 1 land_water flag.
08	COSMETIC	Cosmetic flag (from level-1b): Missing data filled in by interpolation.
09	SUSPECT	Suspect flag (from level-1b): Transmission errors means measurements may be unreliable.
10	HISOLZEN	High solar zenith; $\theta_s > 70$ degrees



OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

Bit	Flag Name	Flag Description
11	SATURATED	Saturation flag; saturated within any band from 400 to 754 nm or in bands 779, 865, 885 and 1020 nm.
	Water Pr	oducts (see OLCI DPM Section 7.3.3.13 [RD-3])
1	MEGLINT	Flag for pixels corrected for glint (see ATBD SD-03-C09 for details).
2	RISKGLINT	Flag for pixels for which the glint correction is not reliable (see ATBD SD-03-C09 for details).
3	WHITECAPS	Whitecaps flag. See ATBD SD-03-C06 for details.
4	ADJAC	Adjacency correction has been applied (not currently in the DPM as pseudocode, but is seen as being an evolution and so section is included).
5	WVFAIL	Water Vapour determination is suspect. Set when one of the following internal flags is raised: ORINPWV_F or OROUTWV_F or W_WV_FAIL. See ATBD SD-03-C02 for details.
6	PAR_FAIL	PAR calculation failed. Internal flag is OC_PAR_FAIL.
7	ACFAIL	Atmospheric correction is suspect: when atmospheric correction fails or there are difficulties with aerosol correction e.g. high aerosol optical thickness, difficulty correcting for absorbing aerosols, low Rayleigh corrected reflectance or negative water- leaving radiance retrieved over water pixels. See ATBDs SD-03- C07 and SD-03-C08 for details.
8	OC4ME_FAIL	OC4Me algorithm failed
9	OCNN_FAIL	IMT NN algorithm failed
10	GSM_FAIL	GSM algorithm failed



Ref: S3-L2-SD-03-C05-ARG-ATBD Issue: 2.1 Date: 29/09/10 Page 9 of 13

OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

Bit	Flag Name	Flag Description
11	KDM_ FAIL	KDM07 algorithm failed
12	KDL_ FAIL	KDL05 algorithm failed
13	ZHL_FAIL	Heated Layer Depth processing failed
14	ZSD_FAIL	Secchi disk depth processing failed
	Land P	roducts (see OLCI DPM Section 7.3.4.4 [RD-3])
1	WVFAIL	Suspect values derived for the Water Vapour over land; see ATBD SD-03-C02 for details. Set when the following internal flags are raised: ORINPWV_F or OROUTWV_F or L_WV_FAIL
2	OGVI_FAIL	Suspect values derived for the OGVI (FAPAR); see ATBD SD- 03-C13 for details. Set when the following internal flags are raised: ORINP1_F or OROUT1_F
3	OTCI_FAIL	Suspect values derived for the OTCI; see ATBD for SD-03-C14 details. Set when the following internal flags are raised: ORINP2_F (OTCI input out of range) or OROUT2_F (OTCI output out of range) or LRAYFAIL_F (problems deriving Rayleigh reflectance).

### Table 2: Science Flags for OLCI.

Status in DPM	Bits Required	Flag Name	Flag Description			
	Water Products (see OLCI DPM Section 7.3.3.13 [RD-3])					
Baseline	8	BPAC_ON	BWAC was switched on and attempted. See ATBD SD-03-C08 for details.			



Ref: S3-L2-SD-03-C05-ARG-ATBD Issue: 2.1 Date: 29/09/10 Page 10 of 13

### OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

Status in DPM	Bits Required	Flag Name	Flag Description	
Baseline	8	WHITE_SCATT	"White" scatterer flag within the water. See ATBE SD-03-C08 for details.	
Baseline	1	LOWRW	$(\rho'_w(b, j, f) < R560MIN)$ or HIINLD_F raised	
Baseline	1	HIGHRW	High RW at 560nm or CASE2_F raised	
Baseline	16	ANNOT	Annotation flag for the quality of the atmospheric correction (see OLCI DPM Table 5.3-32 in Section 5.3.4.3.14, [RD-3])	
Baseline	16	RWNEG	Provides a "negative water-leaving reflectance" flag for each band (see OLCI DPM Section 5.3.4.3.14, [RD-3])	
	Lai	nd Product (see OLCI	DPM Section 7.3.4.4 [RD-3])	
Baseline	1	LRAYFAIL	Problems deriving the Rayleigh reflectance over the land. See ATBD SD-03-C15 for details.	
Baseline	1	OGVI_CLASS_BAD	Flag Bad data from OGVI spectral tests	
Baseline	1	OGVI_CLASS_WS	Flag water or deep shadow from OGVI spectral tests	
Baseline	1	OGVI_CLASS_CSI	Flag Cloud, snow or ice from OGVI spectral tests	
Baseline	1	OGVI_CLASS_BRI GHT	Flag bright from OGVI spectral tests	
Baseline	1	OGVI_CLASS_INV AL_REC	Flag invalid rectification	
Baseline	1	OTCI_BAD_IN	Input data bad quality: (at least one of B12, B11, B10 is not Valid) or (B12-B11) <threshold1 or<="" td=""></threshold1>	



Ref: S3-L2-SD-03-C05-ARG-ATBD Issue: 2.1 Date: 29/09/10 Page 11 of 13

OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

Status in DPM	Bits Required	Flag Name	Flag Description	
			(B11-B10) <theshold2< td=""></theshold2<>	
Baseline	1	OTCI_CLASS_ANG	View angle flag: OTCI_CLASS_IN OK AND view angle> Threshold (TBD) AND Sun angle > Threshold (TBD)	
Needs Evolution	1	OTCI_CLASS_CLS N	Cloud (For the time being this is filled from the OGVI flags) and snow flag: Input data quality flag OK & Cloud shadow / partial snow detected	
Not present, potential evolution	1	OTCI_CLASS_AER	Aerosol related flag; OTCI_CLASS_IN OK AND AOT > Threshold (TBD). At present there is no aerosol product.	
		Potential Cloud I	oducts (Evolution)	
Not present, potential evolution	8	CCI	The Cirrus Cloud In which is scaled bet ATBD SD-03-C01 for	dex is a quality flag, ween 1 and 8 (see r details).
Not present, potential evolution	8	CVI	The Cloud Vicinity Ir which is scaled bet ATBD SD-03-C01 for	ndex is a quality flag, ween 1 and 8 (see r details).

## 3.2 Algorithm Validation

The validation for flags connected to the clear sky classification over water and over land is primarily described within ATBD SD-03-C01 and the OLCI DPM [RD-03]. The remaining flag threshold values are set according to the current ocean colour instruments (MERIS, MODIS



OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

and SeaWiFS) and these will need to be optimised when the processor is tested with simulated data (e.g. SEN3EXP campaign) and verified during the Sentinel-3 commissioning phase.

### 3.3 Practical consideration

The usage of flags is a compromise between the number of flags and whether they're yes/no or an index, and the addition bits that they add to each pixel of the image. In the current configuration, it's assumed each flag needs to be set on a pixel-by-pixel basis. Including vector rather than raster products within the netCDF file (i.e. polygons rather than pixels) would allow for an optimised storage of flags. However, the combined use of these two methods of storage is still not straightforward. File size can also be reduced by compression and this is a potential advantage of using netCDF-4 over netCDF-3, see Section 3.3 [RD-2].

## 4. ASSUMPTIONS AND LIMITATIONS

The flags need to be reviewed each time the individual scientific ATBDs have been revised, and individual flag suggestions evaluated.

### 5. AUXILIARY DATA

Not relevant as this ATBD summaries the outputs of the individual product OLCI ATBDs and the OLCI DPM [RD-3].

### 6. ERROR BUDGET

Not relevant.



OLCI Level 2 Algorithm Theoretical Basis Document Confidence Check

### 7. **REFERENCES**

[RD-1] GlobCOLOUR: An EO based service supporting global ocean carbon cycle research, Product User Guide. GC-UM-ACR-PUG-01. Available at: http://www.globcolour.info/CDR\_Docs/GlobCOLOUR\_PUG.pdf

[RD-2] Technical Note: Sentinel-3 O-L2PP Data Format. S3-L2-SD-01-G05-ARG-TN\_DataFormat\_v1.0-090809

[RD-3] OLCI Detailed Processing Model.S3-L2-SD-07-C-ACR-DPM\_L2OLCIDetailedProcessingModel\_v2.4-100930