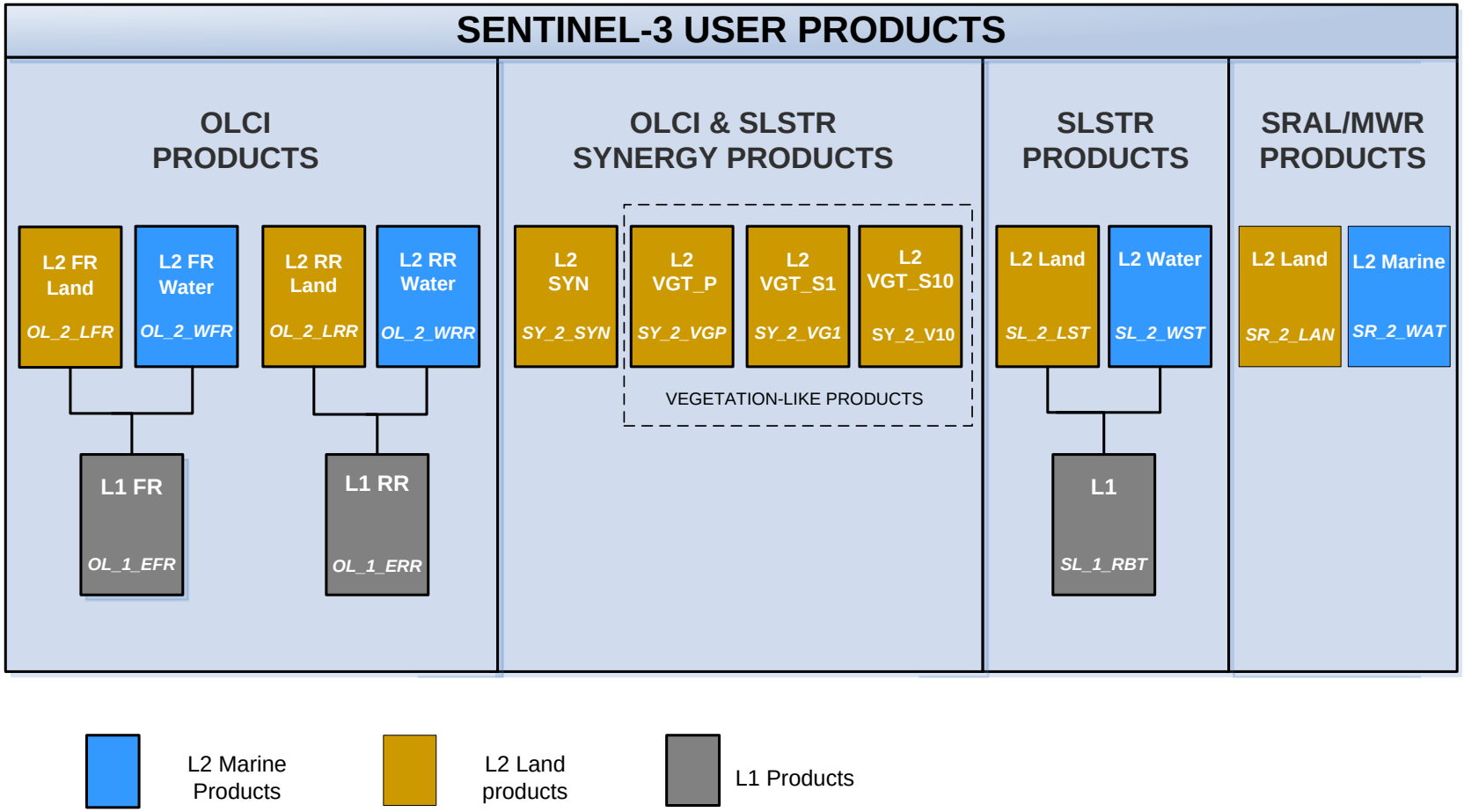
SENTINEL-3 PRODUCT FORMAT
Overview

Philippe Goryl, ESA
IOCS – Darmstadt 6-8 May 2013

Products Organisation



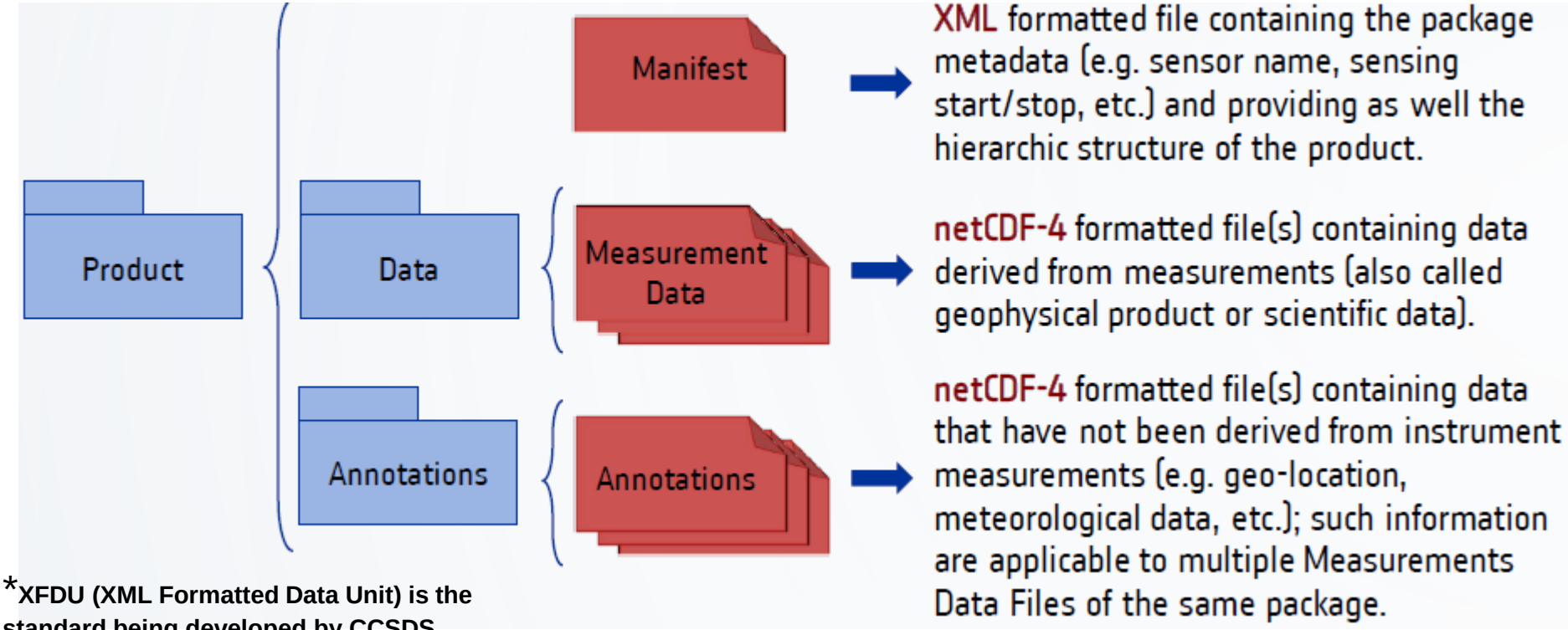
Product Type and Size

Product Type	Level	Description	Size (GByte/orbit)
OL_1_EFR___	1	Full Resolution top of atmosphere	29.90
OL_2_WFR___	2	Full Resolution Water & atmosphere parameters	33.40
OL_2_LFR___	2	Full Resolution Land and Atmosphere parameters	7.32
OL_1_ERR___	1	Reduced Resolution top of atmosphere	1.70
OL_2_WRR___	2	Reduced Resolution Water & atmosphere parameters	2.10
OL_2_LRR___	2	Reduced Resolution Land and Atmosphere parameters	0.50

Product Format

The raw data acquired by the Sentinel-3 satellite are processed according to three levels of data processing: Level 0 (reconstructed and time sorted ISP), Level 1 (TOA radiometric measurements, radiometrically corrected, calibrated and spectrally characterised), Level 2 (geolocated geophysical products).

The Sentinel-3 products are organized in packages, following a **XFDU specialization*** (**SENTINEL SAFE** format). A Product Package is a physical collection of files grouped under a single directory, using a defined packaging scheme.



***XFDU (XML Formatted Data Unit) is the standard being developed by CCSDS**

Source Instrument
OLCI

SENTINEL-3 OLCI LEVEL 1 PRODUCTS

Product Package Type	*Description*
OL_1_ERR	OLCI Level 1 at reduced resolution Product

Product Level	Diss. Timeliness	PDGS Prod. Category	Application Domain	Spatial Resolution
1	NRT - NTC	User	LND MRT	1000m

Product Dissemination Unit	Number of Package components:	Number of Measurement Data files:	Number of Annotation Data files:
Stripe	29	21	7

Number of Representation Information Files: 0

Product Package Structure

Manifest file

	xfdumanifest.xml

Measurement Data files

Foot Note#	File name	Variables contained in the file
	Oa01_radiance.nc	TOA_radiances_Oa01, TOA_radiances_Oa01_er
	Oa02_radiance.nc	TOA_radiances_Oa02, TOA_radiances_Oa02_er
	Oa03_radiance.nc	TOA_radiances_Oa03, TOA_radiances_Oa03_er
	Oa04_radiance.nc	TOA_radiances_Oa04, TOA_radiances_Oa04_er
	Oa05_radiance.nc	TOA_radiances_Oa05, TOA_radiances_Oa05_er
	Oa06_radiance.nc	TOA_radiances_Oa06, TOA_radiances_Oa06_er
	Oa07_radiance.nc	TOA_radiances_Oa07, TOA_radiances_Oa07_er
	Oa08_radiance.nc	TOA_radiances_Oa08, TOA_radiances_Oa08_er
	Oa09_radiance.nc	TOA_radiances_Oa09, TOA_radiances_Oa09_er
	Oa10_radiance.nc	TOA_radiances_Oa10, TOA_radiances_Oa10_er
	Oa11_radiance.nc	TOA_radiances_Oa11, TOA_radiances_Oa11_er
	Oa12_radiance.nc	TOA_radiances_Oa12, TOA_radiances_Oa12_er
	Oa13_radiance.nc	TOA_radiances_Oa13, TOA_radiances_Oa13_er
	Oa14_radiance.nc	TOA_radiances_Oa14, TOA_radiances_Oa14_er
	Oa15_radiance.nc	TOA_radiances_Oa15, TOA_radiances_Oa15_er
	Oa16_radiance.nc	TOA_radiances_Oa16, TOA_radiances_Oa16_er
	Oa17_radiance.nc	TOA_radiances_Oa17, TOA_radiances_Oa17_er
	Oa18_radiance.nc	TOA_radiances_Oa18, TOA_radiances_Oa18_er
	Oa19_radiance.nc	TOA_radiances_Oa19, TOA_radiances_Oa19_er
	Oa20_radiance.nc	TOA_radiances_Oa20, TOA_radiances_Oa20_er
	Oa21_radiance.nc	TOA_radiances_Oa21, TOA_radiances_Oa21_er

Product Package Type	
OL_1_ERR	*(Cont'd)*

Product Package Structure (Cont'd)

Annotation Data Files

Foot Note#	File name	Variables contained in the file
	timeCoordinates	time_stamp
	geoCoordinates	longitude, latitude and altitude
	qualityFlags	quality_flags
	tie_geoCoordinates.nc	Tie_longitude, Tie_latitude
	tie_geometries.nc	SZA, SAA, OZA, OAA
	tie_meteo.nc	Horizontal_wind, Sea_Level_Pressure, Total_Ozone,
	instrumentData.nc	lambda0, FWHM, Solar Flux

Notes:

Reference A [R-A]: S3-RS-ACR-SY-00004 issue 6.0: OLCI Level 0, Level 1a/b/c Products Definition

Source Instrument
OLCI

SENTINEL-3 OLCI LEVEL 2 marine products

Product Package Type	*Description*
OL_2_WFR / OL_2_WRR	Water and atmospheric geophysical products at full spatial resolution / at reduced spatial resolution

Product Level	Diss. Timeliness	PDGS Prod. Category	Application Domain	Spatial Resolution
2	NRT NTC	USER	MRT ATM	300 m / 1 km

Product Dissemination Unit	Number of Package components:	Number of Measurement Data files:	Number of Annotation Data files:
Frame (OL_2_WFR) / Stripe (OL_2_WRR)	32	24	7

Number of Representation Information Files: 0

Product Package Structure

Manifest file

	xfdumanifest.xml

Measurement Data files

Foot Note#	File name	Variables contained in the file
	Oa01_reflectances.nc	BAC_reflectances_Oa01, BAC_reflectances_Oa01_er
	Oa02_reflectances.nc	BAC_reflectances_Oa02, BAC_reflectances_Oa02_er
	Oa03_reflectances.nc	BAC_reflectances_Oa03, BAC_reflectances_Oa03_er
	Oa04_reflectances.nc	BAC_reflectances_Oa04, BAC_reflectances_Oa04_er
	Oa05_reflectances.nc	BAC_reflectances_Oa05, BAC_reflectances_Oa05_er
	Oa06_reflectances.nc	BAC_reflectances_Oa06, BAC_reflectances_Oa06_er
	Oa07_reflectances.nc	BAC_reflectances_Oa07, BAC_reflectances_Oa07_er
	Oa08_reflectances.nc	BAC_reflectances_Oa08, BAC_reflectances_Oa08_er
	Oa09_reflectances.nc	BAC_reflectances_Oa09, BAC_reflectances_Oa09_er
	Oa10_reflectances.nc	BAC_reflectances_Oa10, BAC_reflectances_Oa10_er
	Oa11_reflectances.nc	BAC_reflectances_Oa11, BAC_reflectances_Oa11_er
	Oa12_reflectances.nc	BAC_reflectances_Oa12, BAC_reflectances_Oa12_er
	Oa16_reflectances.nc	BAC_reflectances_Oa16, BAC_reflectances_Oa16_er
	Oa17_reflectances.nc	BAC_reflectances_Oa17, BAC_reflectances_Oa17_er
	Oa18_reflectances.nc	BAC_reflectances_Oa18, BAC_reflectances_Oa18_er
	Oa21_reflectances.nc	BAC_reflectances_Oa21, BAC_reflectances_Oa21_er
	...continue	...continue

Notes:

"BAC" stands for "Baseline Atmospheric Correction algorithm" and it is a Meris heritage [R-C]. The BAC is used for the operational output of the reflectances of this product package.

Reference A [R-A]: S3-L2-SD-08-G-ARG-IODD Sentinel-3 Level 2 Optical Products IODD Part 0 issue 1.7

Reference B [R-B]: S3-L2-SD-08-C-ACR-IODD OLCI L2 IODD issue 2.6

Reference C [R-C]: S3-L2-SD-03-C07-LOV-ATBD v2.2 Clear water atmospheric correction algorithm ATBD.

Reference D [R-D]:S3-L2-SD-03-C17-GKSS-ATBD v1.1 Alternative atmospheric correction algorithm ATBD.

Product Package Type	
OL_2_WFR	*(Cont'd)*

Product Package Structure (Cont'd)

Measurement Data Files (cont'd)

Foot Note#	File name	Variables contained in the file
	chl_oc4me.nc	CHL_OC4ME, CHL_OC4ME_er
	chl_nn.nc	CHL_NN, CHL_NN_er
	tsm_nn.nc	TSM_NN, TSM_NN_er
	trsp.nc	KD490_M07, KD490_M07_er
	iop_nn.nc	ADG_443_NN, ADG_443_NN_er
	par.nc	PAR, PAR_er
	w_aer.nc	T865, T865_er, A865, A865,er
	iwv.nc	IWV, IWV_er

Annotation Data Files

Foot Note#	File name	Variables contained in the file
	wqsf.nc	WQSF
	geoCoordinates.nc	longitude, latitude, altitude
	tie_geoCoordinates.nc	Tie_longitude, Tie_latitude
	tie_geometries.nc	SZA, SAA, OZA, OAA
	tie_meteo.nc	Horizontal_wind, Sea_Level_Pressure, Total_Ozone,
	timeCoordinates.nc	Time_stamp
	instrumentData.nc	lambda0, FWHM, Solar Flux

Representation Information Files

Foot Note#	File name	Variables contained in the file
	none	

Notes:

Reference A [R-A]: S3-L2-SD-08-G-ARG-IODD Sentinel-3 Level 2 Optical Products IODD Part 0 issue 1.7

Reference B [R-B]: S3-L2-SD-08-C-ACR-IODD OLCI L2 IODD issue 2.6

Level 2 Water Geophysical Products Description

OLCI Instrument		
Geophysical Product	*Description*	*Algorithm*
Water-leaving reflectance	Surface directional reflectance, corrected for atmosphere and Sun specular reflection	Based on the Antoine and Morel method developed for MERIS (1998); multiple scattering algorithm where the path reflectance is derived globally instead of assessing separately ρ_a and ρ_r. Aerosol properties and diffuse transmittance are retrieved from LUTs generated from RT computations.
CDM Absorption coefficient	Absorption of Coloured Detrital and Dissolved Material at 443 nm	Retrieved from directional water leaving reflectance using a Neural Network as a multiple non-linear regression technique. The coefficients of the NN are determined by a training process based on the usage of a radiative transfer model including a bio-optical model describing the water IOPs.
Algal pigment concentration	Chlorophyll-a concentration	Retrieval based on two different algorithms: 1. the "OC4Me" algorithm (Morel et al. 2007a). It is a polynomial based on the usage of a semi-analytical model; 2. from the phytoplankton pigments absorption coefficient obtained as output from a NN. The IOPs retrieved via the NN are converted into concentration of water constituents (e.g. CHL) by simple regression.
Total Suspended Matter concentration	Total Suspended Matter concentration	Computed from the total backscattering coefficient obtained as output from a Neural Network. The IOPs retrieved via the NN are converted into concentration of water constituents (e.g. TSM) by simple regression.
Diffuse attenuation coefficient	Diffuse attenuation coefficient for downwelling irradiance at 490 nm	OK2-520 algorithm (Morel et al. 2007); based on a polynomial using the 490-560 reflectance ratio and pre-defined coefficients.
Photosynthetically active radiation	Quantum energy flux from the Sun in the spectral range 400-700 nm.	Derived from the irradiance above water pixels, under a tabulated relationship. The provided geophysical product is an instantaneous PAR (iPAR).
Aerosol optical thickness	Aerosol load expressed in optical depth at 865 nm	By-products of the atmospheric correction
Aerosol Ångström exponent	Spectral dependency of the aerosol optical depth between 779 and 865 nm	By-products of the atmospheric correction
Integrated water vapour column	Total amount of water vapour integrated over an atmosphere column	Based on the exploitation of the pronounced water vapour absorption band around 950 nm using the differential absorption of water vapour. Retrieval limited to daytime observations above cloud-free regions. It is best applicable over land, whereas over ocean only sea ice and sun glint regions can be sensed with a comparable accuracy. Due to the dominating influence of atmospheric scattering over dark surfaces, a reduced accuracy over ocean is to be expected

Conclusion

- Format SENTINEL SAFE package → XML + NETCDF4
- 1 measurement data set = 1 netcdf-4 (measurement + uncertainty)
- 1 Annotation = 1 netcdf-4
- Format, product description, algorithm will be available with the SENTINEL-3 product handbook later 2013/2014
- 2 Posters at IOCS:
  - Sentinel-3 Optical Sensors Products and Algorithms, (Carla Santella et al.)
  - The Sentinel-3 Payload Data Ground Segment (Carolina Nogueira Loddo et al.)