European Commission

The Copernicus Inland Water Service of the European Union

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University of Reading

PML Plymouth Marine Laboratory

Brockmann Consult GmbH

CLS Collecte Localisation Satellites

JRC European Commission

Copernicus Europe's eyes on Earth

Copernicus Global Land Service

Monitoring the vegetation, the water cycle and the energy budget at global scale

Bio-geophysical products

- status and evolution of land surface
- at global scale
- at mid and low spatial resolution.
- delivery “in a timely manner”
- complemented by the constitution of long term time series

http://land.copernicus.eu/global/

User Requirements and International Context

International Engagement

European Commission

Climate example

Requirements

Programme Implementation

Services

GCOS

GLOBAL CLIMATE OBSERVING SYSTEM

opernicus

CEOS

ECMWF

GFCS

GLOBAL FRAMEWORK FOR CLIMATE SERVICES

GEO

NASA

USGS

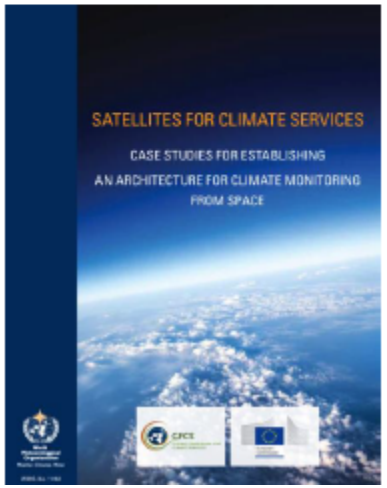
science for a changing world

sansa

SPACE AGENCY

CEOS

Support to International Space Policy Engagement



CBD

UNCCD

Joint Research Centre

Requirements

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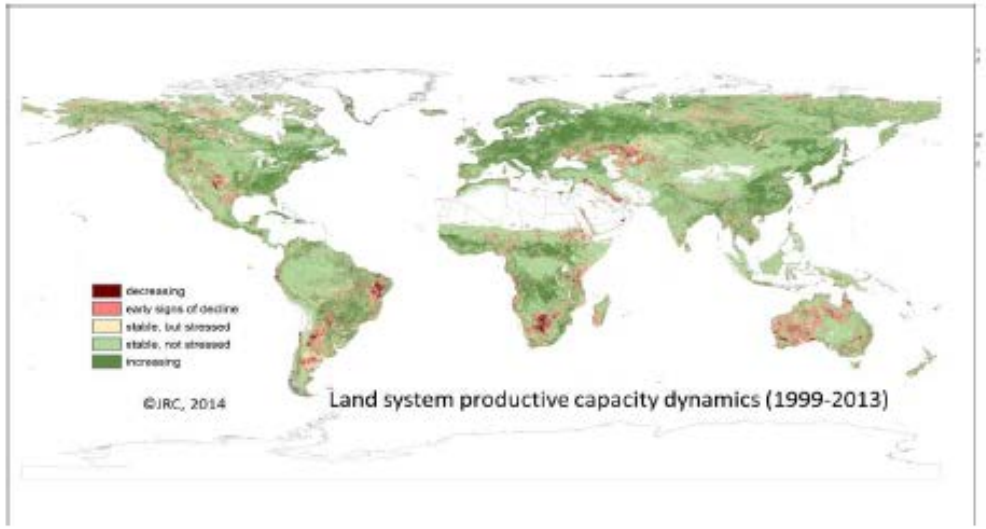
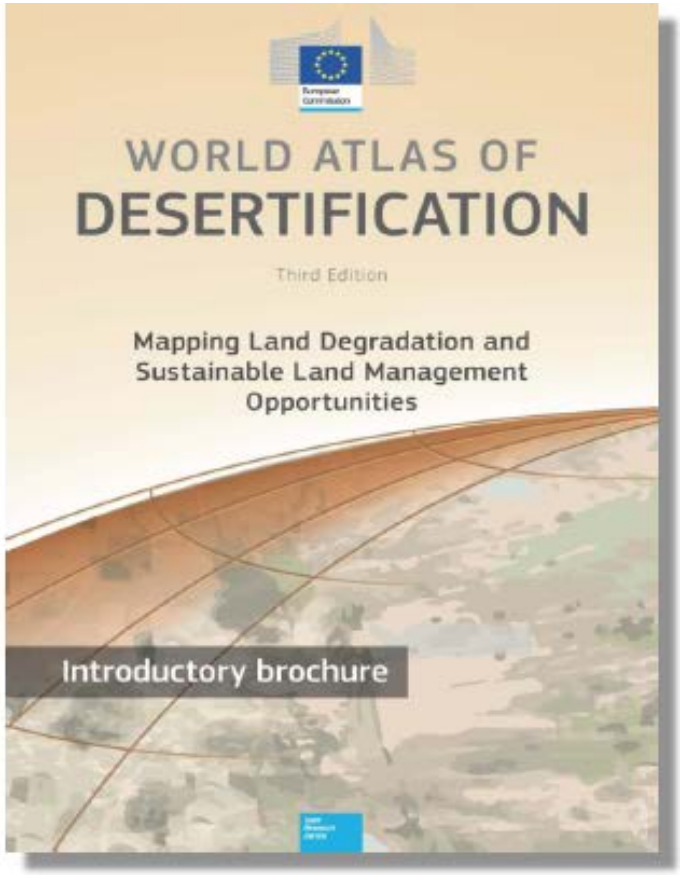
Courtesy Mark Dowell, JRC

Example: Support to UNCCD



UNCCD United Nations Convention to Combat Desertification



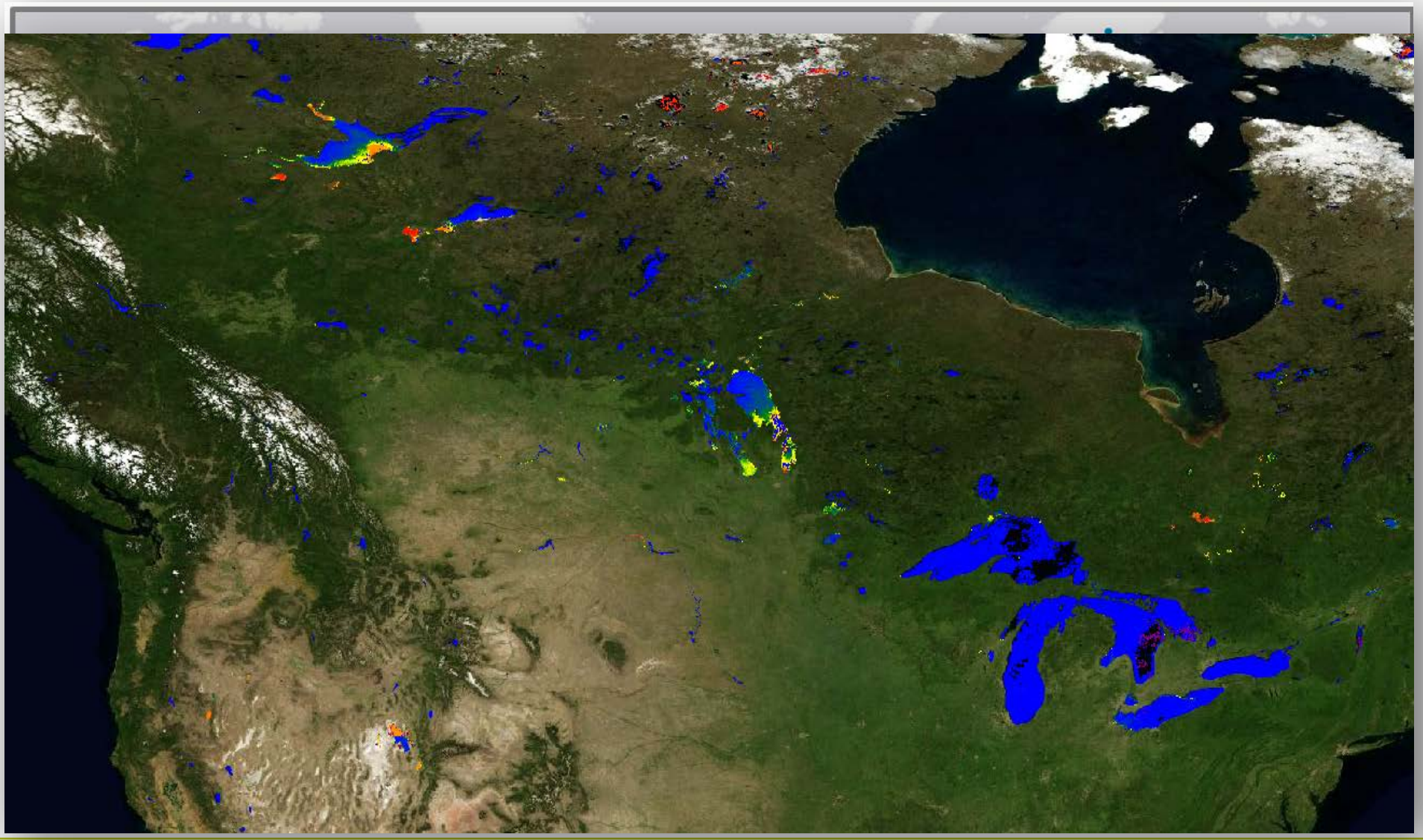
Joint Research Centre

Copernicus | Europe's eyes on Earth

Broadening the Portfolio: Lake Water Theme

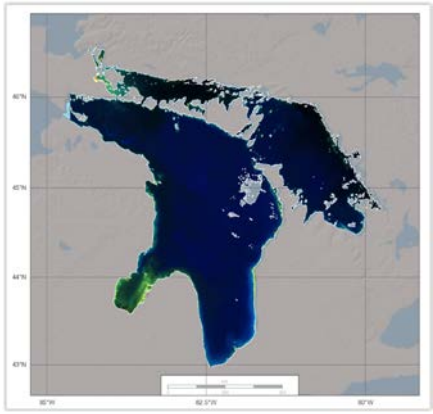
- Copernicus User Forum:
  - „The land monitoring service, which is to provide information on land use and land cover, **cryosphere**, climate change and biogeophysical variables, including their dynamics, in support of the global-to-local environmental monitoring of biodiversity, soil, **inland and coastal waters**, forests and vegetation, and natural resources,…"
- New line of services starting in 2016/217
  - Crospyhere Theme
  - Water Theme
    - Water bodies & Coastal erosion
    - Lake Water
    - Water Level
- Ramp-up phase, integration of new Sentinels, evolution contracts
  - Phasing depending on Technical Readiness Level

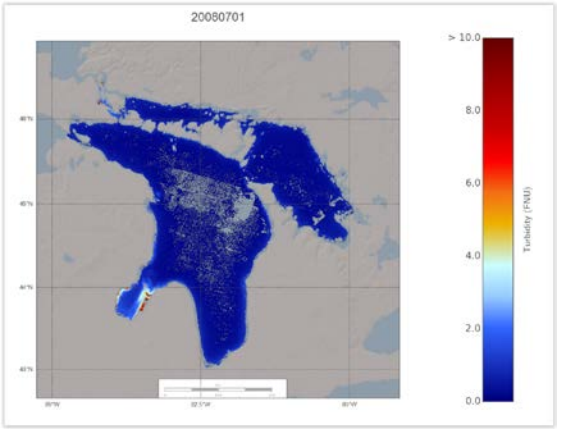
Globally distributed Lakes

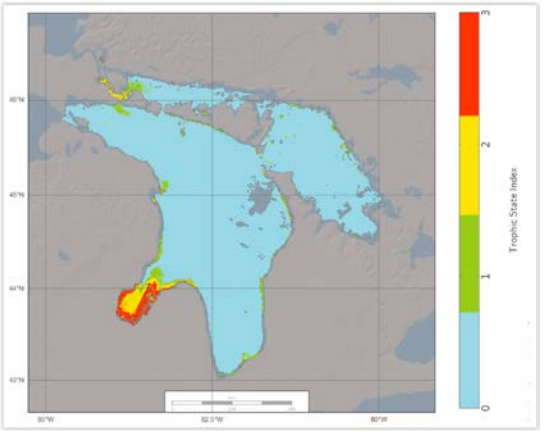


Lake Water Products

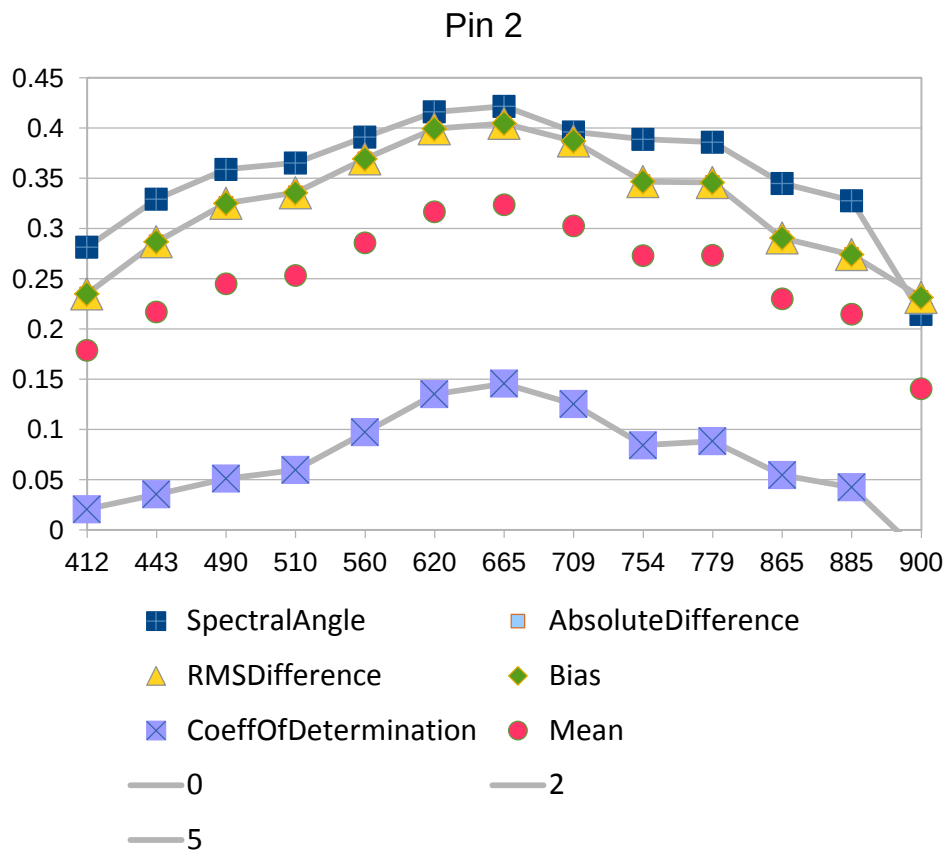
- Parameters:
  - Lake Surface Temperature (LSWT)
  - Lake Surface Reflectances (LSR)
  - Turbidity (TUR)
  - Trophic State Index (TSI)
- Inputs:
  - MERIS (REPROCESSING 300m, 1km)
  - OLCI (NRT 300m, 1km)
  - S-2 MSI (100m)
- Outputs:
  - 10days averages

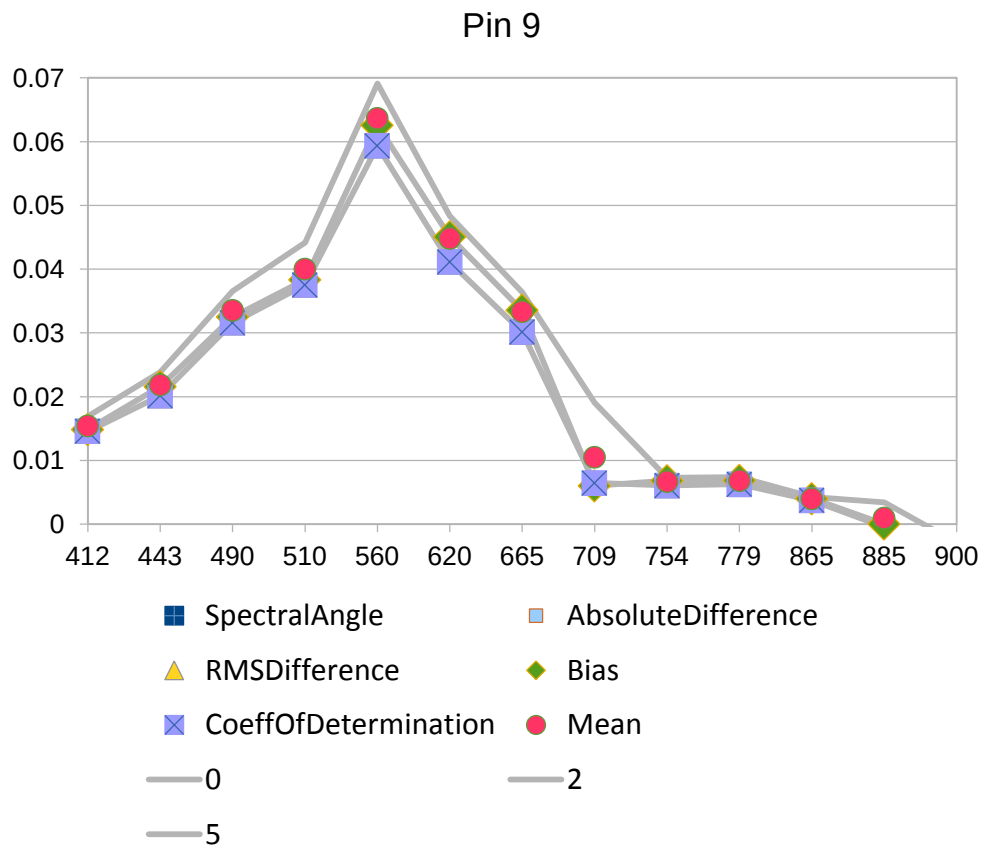






Selection of representative spectrum

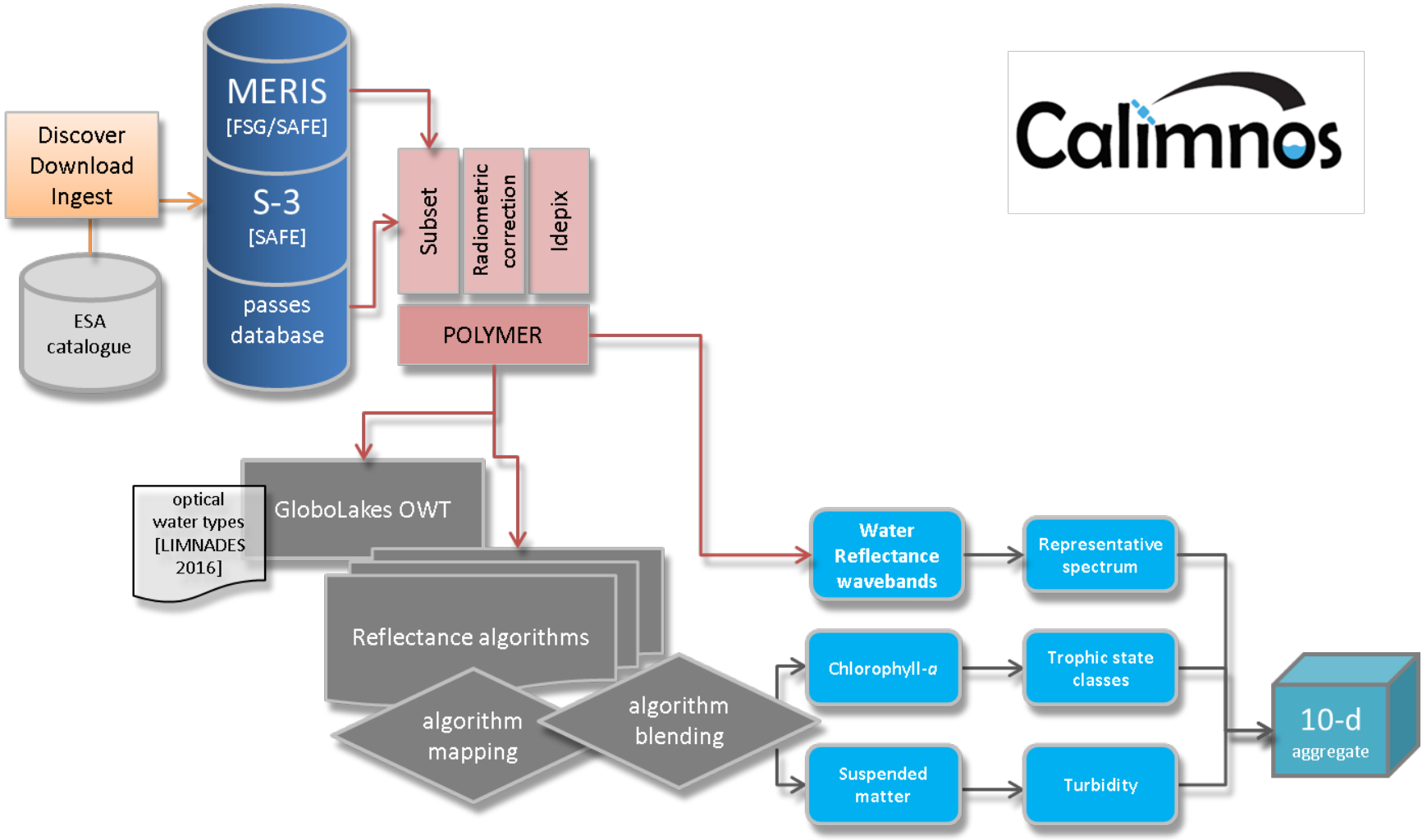




Lake Water: Trophic State (TS)

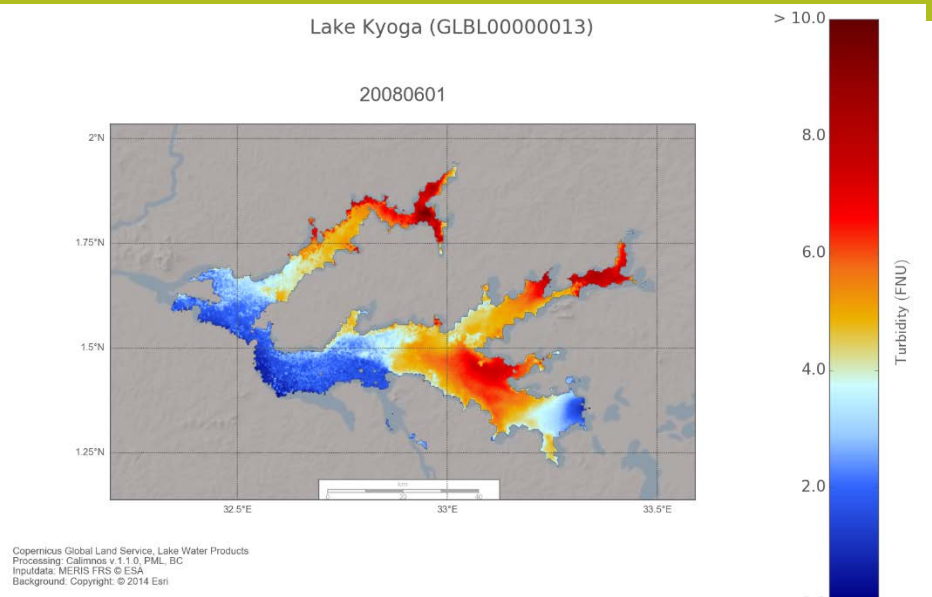
Trophic classification	Trophic State Index	Chlorophyll-a range	Medium resolution mapping	High resolution mapping
Oligotrophic	0	0.04	Absence of Red/NIR signal and Chla fluorescence signature mapped to oligotrophic class. Better specification to TSI possible in lakes with low humic content.	No Red/NIR signal defaults to oligotrophic class without further specification
	10	0.12		
	20	0.34		
	30	0.94		
Mesotrophic	40	2.6	Chla from global lake processors mapped to TSI and class	Classified as mesotrophic if lake is sufficiently turbid to derive NIR/red signal
	50	6.4		Chla from NIR/red ratio algorithms mapped to TSI
Eutrophic	60	20		
	70	56		
Hyper-eutrophic	80	154		
	90	427		
	100	1183		

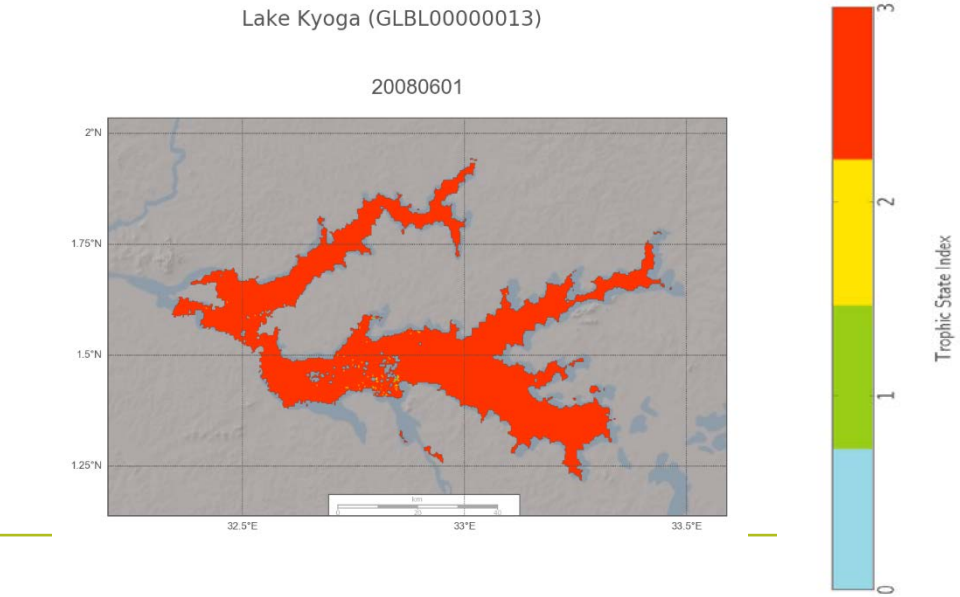
Processing Chain



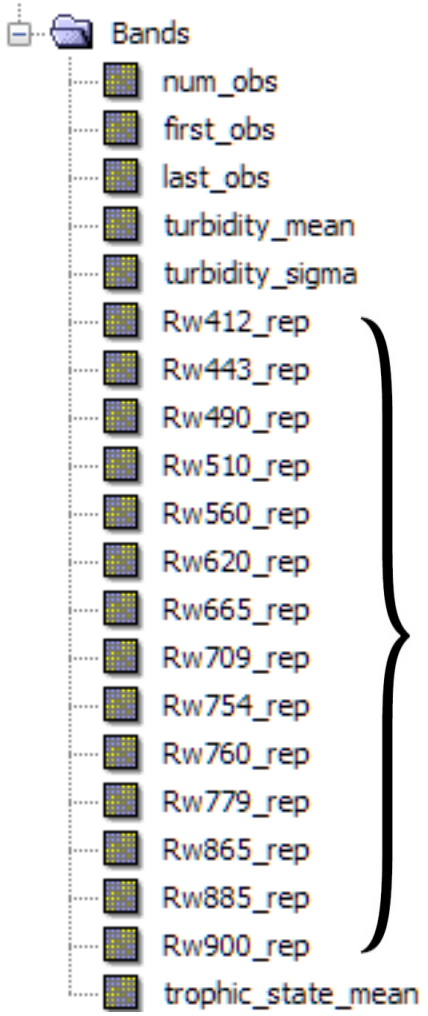
Products & Metadata

- Bands
  - num_obs
  - first_obs
  - last_obs
  - turbidity_mean
  - turbidity_sigma
  - Rw412_rep
  - Rw443_rep
  - Rw490_rep
  - Rw510_rep
  - Rw560_rep
  - Rw620_rep
  - Rw665_rep
  - Rw709_rep
  - Rw754_rep
  - Rw760_rep
  - Rw779_rep
  - Rw865_rep
  - Rw885_rep
  - Rw900_rep
  - trophic_state_mean

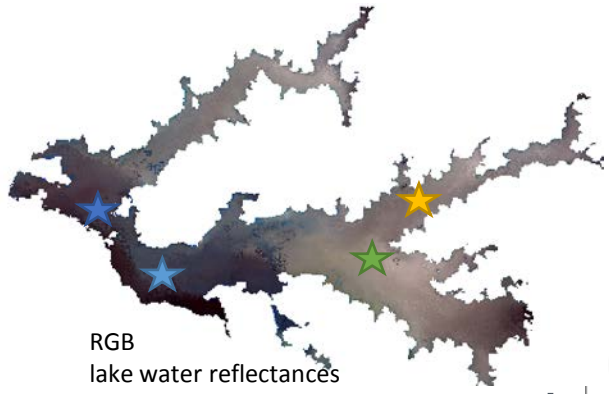




Products & Metadata

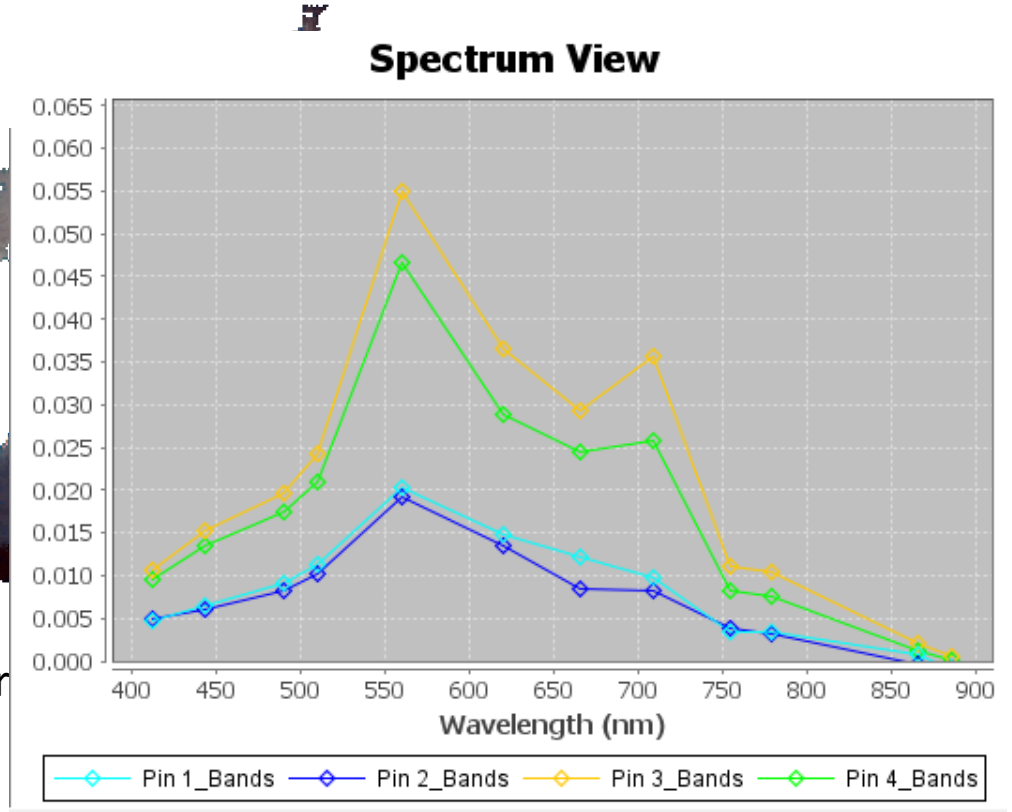


Representative spectrum

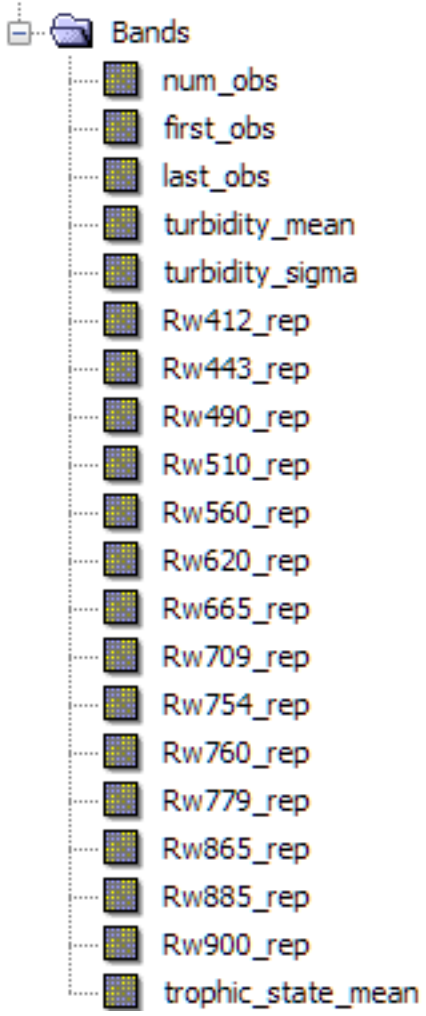


RGB
lake water reflectances

RGB
lake water r



Products & Metadata



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processingCentre	Plymouth Marine Laboratory	ascii
project	Copernicus Global Land Service – Lake Water	ascii
contact	calimnos-support@pml.ac.uk	ascii
processingTime	2017-04-13T17:29:17.887492	ascii
trackingID	36d1913f-a3df-4989-bb54-a0d9747c2ef4	ascii
processingStage	L3_Aggregation	ascii
aggregationPeriod	10D	ascii
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Name	Value	Type
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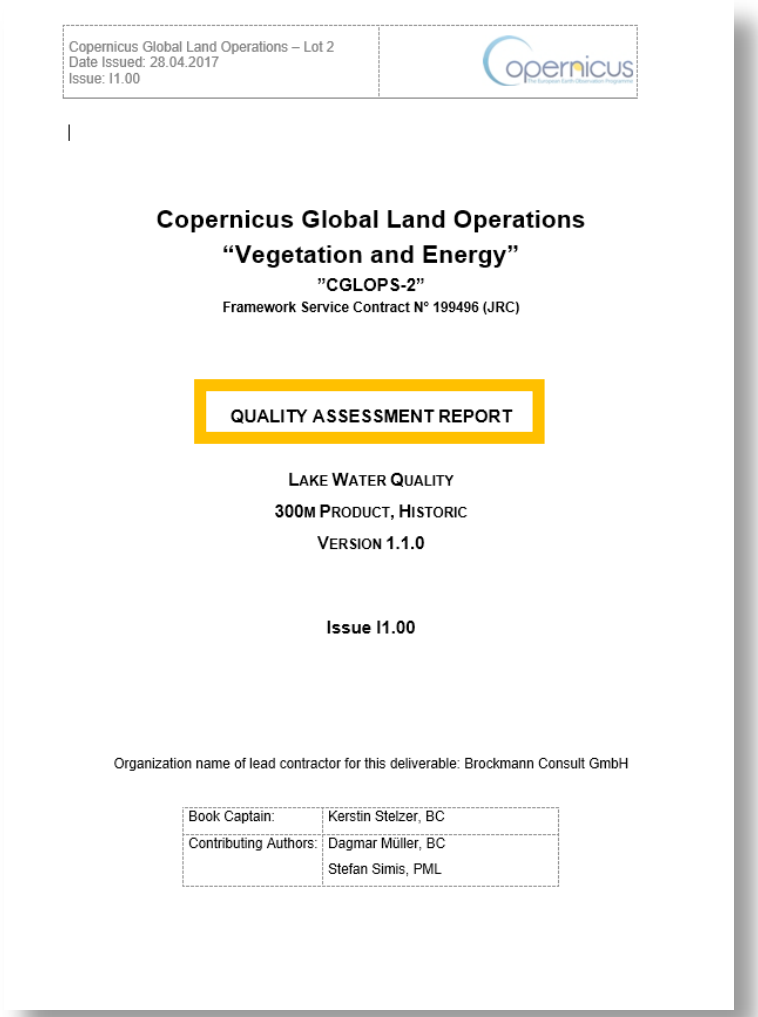
Documents



Copernicus Global Land Operations – Lot 2
Date Issued: 28.04.2017
Issue: I1.00

Copernicus Global Land Operations
"Vegetation and Energy"
"CGLOPS-2"
Framework Service Contract N° 199496 (JRC)

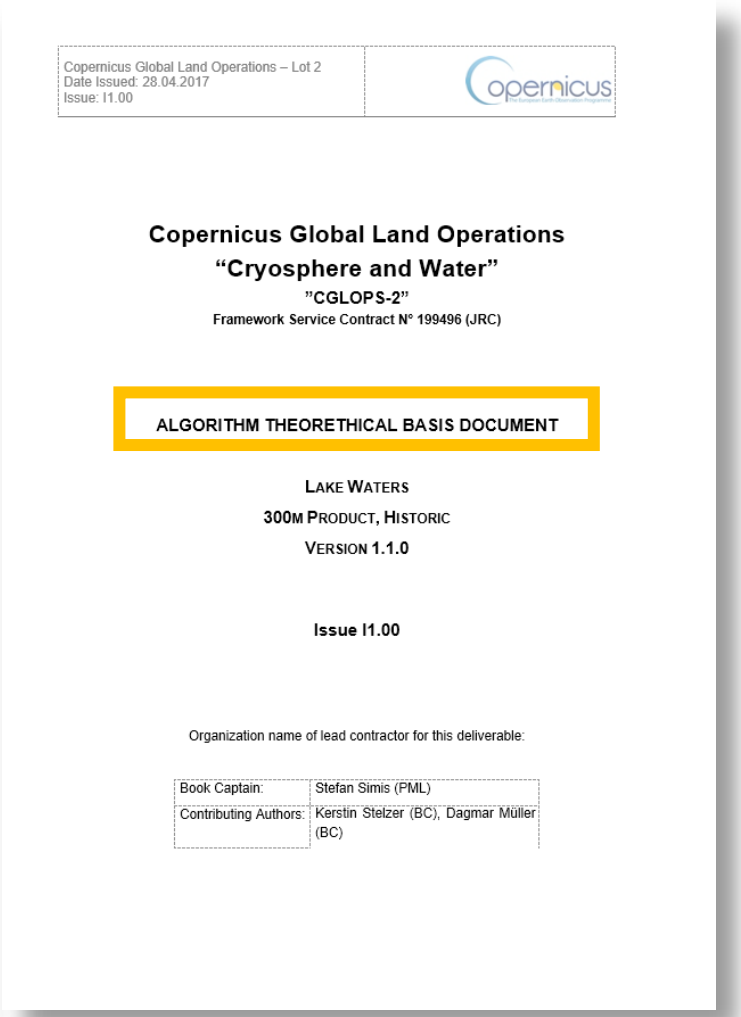
QUALITY ASSESSMENT REPORT

LAKE WATER QUALITY
300M PRODUCT, HISTORIC
VERSION 1.1.0

Issue I1.00

Organization name of lead contractor for this deliverable: Brockmann Consult GmbH

Book Captain:	Kerstin Stelzer, BC
Contributing Authors:	Dagmar Müller, BC Stefan Simis, PML



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Copernicus Global Land Operations
"Cryosphere and Water"
"CGLOPS-2"
Framework Service Contract N° 199496 (JRC)

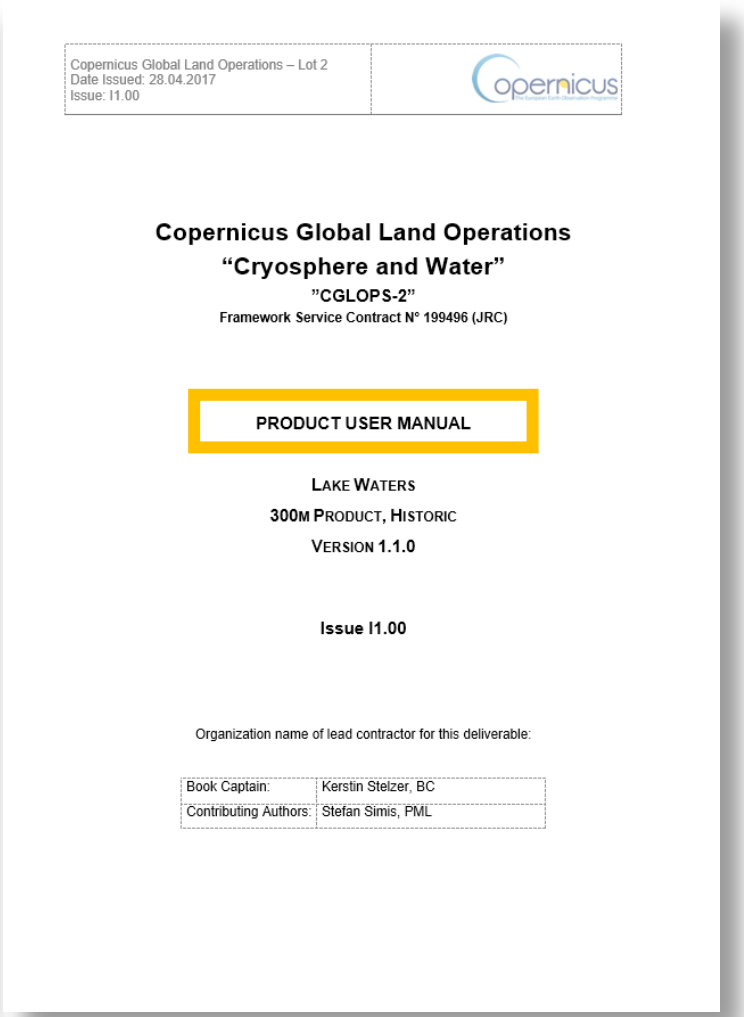
ALGORITHM THEORETHICAL BASIS DOCUMENT

LAKE WATERS
300M PRODUCT, HISTORIC
VERSION 1.1.0

Issue I1.00

Organization name of lead contractor for this deliverable:

Book Captain:	Stefan Simis (PML)
Contributing Authors:	Kerstin Stelzer (BC), Dagmar Müller (BC)



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Copernicus Global Land Operations
"Cryosphere and Water"
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PRODUCT USER MANUAL

LAKE WATERS
300M PRODUCT, HISTORIC
VERSION 1.1.0

Issue I1.00

Organization name of lead contractor for this deliverable:

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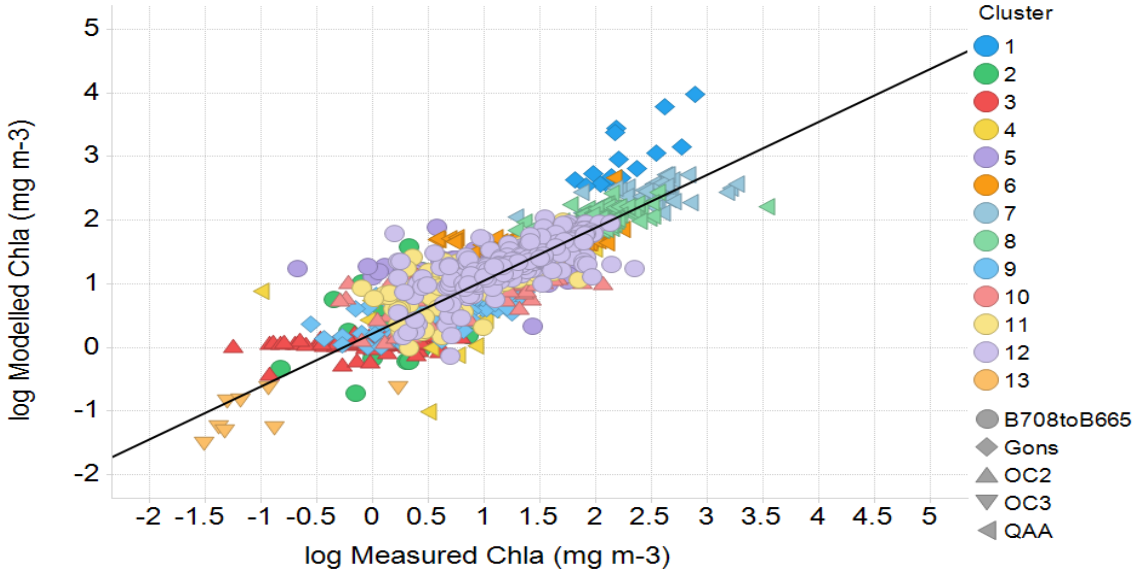
Validation

- Visual inspection
  - Plausibility of spatial patterns → mapping
  - Plausibility of temporal patterns → time series
  - Identification of Artefacts → mapping
  - Assessment of values in known lakes
- Comparison with in situ data
  - In situ data sources LIMNADES
  - US data bases for lake assessment (EPA)
  - National lake monitoring programs

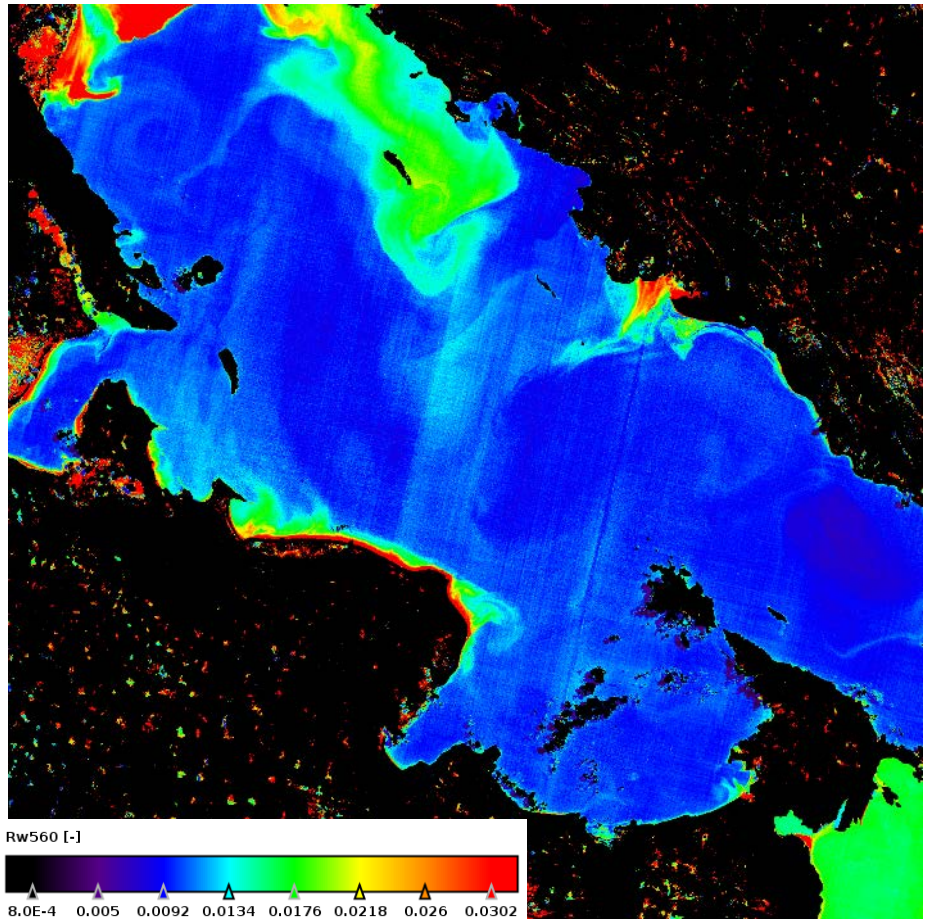


In situ data: LIMNADES, Globolakes

Evolution: Increasing spatial resolution to 100m

- S2 MSI as data source
- Polymer for AC
- In-water processing unchanged
- Flagging of S-2/MSI products:
  - Integrate a land mask
  - Integrate a cloud mask and evaluate the possibility of integration of a cloud shadow mask
  - Implement specific flags if necessary

S-2/MSI Polymer processing
Lake Titicaca, 2016-03-18



Status and Evolution

- Archive Processing MERIS completed, public release June 2017
- Integration of OLCI ongoing;
- NRT service starting October 2017
- Evolution workpackage to increase spatial resolution
  - 100m products with Sentinel-2

- Improvement of the scientific quality of product
  - POLYMER for Sentinel and turbid waters -> improve R_w
  - Develop end-to-end chain for turbidity (now based on TSM)
- Improvement of product time span
  - 10 years of MERIS already good coverage of data
  - OLCI data need to be started with NRT
  - OLCI reprocessing from beginning of mission

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