Global Lake Water Products within the Copernicus Global Land Service

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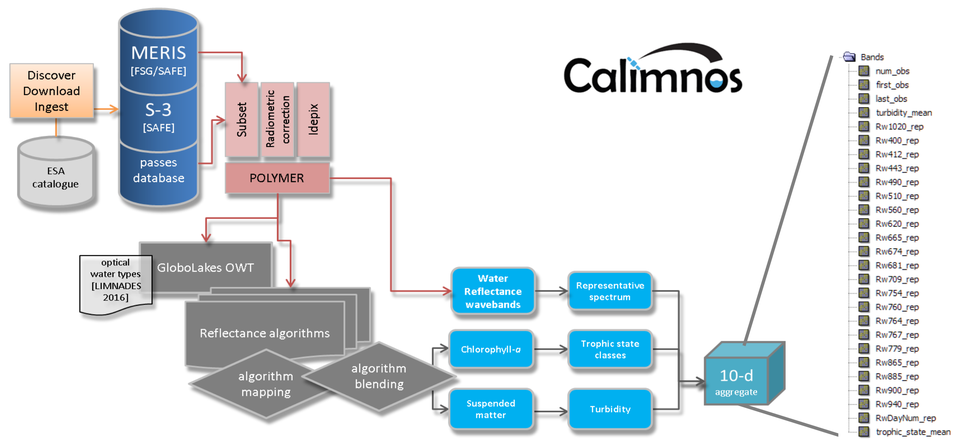
Introduction

Monitoring water quality in lakes and reservoirs is key in maintaining safe water for diverse uses including drinking water, bathing, fishing, agriculture and aquaculture activities. In data-poor regions of the world, monitoring may not be carried out at all. The **Lake Water Products** (lake water quality, lake surface water temperature) within the Copernicus Global Land Service provide a semi-continuous observation record for medium and large-sized lakes. The products are publicly available via the Copernicus Global Land Service Website and Viewing Services.

Production

The Service is systematically producing temporal aggregates at 10-day intervals, mapped to a common global spatial grid at either nominally 1000m and 300m resolutions. A 100m product for the water quality parameters is currently under development. The algorithms for the optical products include several steps as shown below, including an optical water type classification and blending of algorithms. The products cover the timespan 2002 – 2012 (MERIS and AATSR lifetime) and are available as an NRT service derived from Sentinel-3 OLCI and SLSTR and later on from Sentinel-2 MSI.

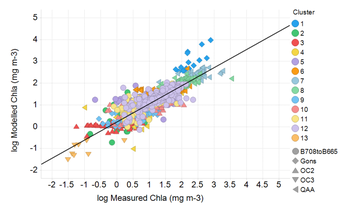


Processing steps for the optical products (Turbidity, Trophic State and Lake Water Reflectances)

Validation

Routine QC and validation is performed on different levels:

- ✓ Algorithm Validation in the scope of developing an OWT based algorithm for MERIS and OLCI
- ✓ Quality control of input products
- ✓ Validation of output products
- ✓ Quality control of output products
- ✓ Spatial and temporal consistency tests



Validation of chlorophyll algorithms among different optical water types. Neil et al. (submitted)

Checking the consistency in space and time and over sensors: visual inspection, time series statistics for Lake Turkana MERIS and OLCI, as well as time series of LSWT comparison between satellite and in-situ data.

Lake Water Products

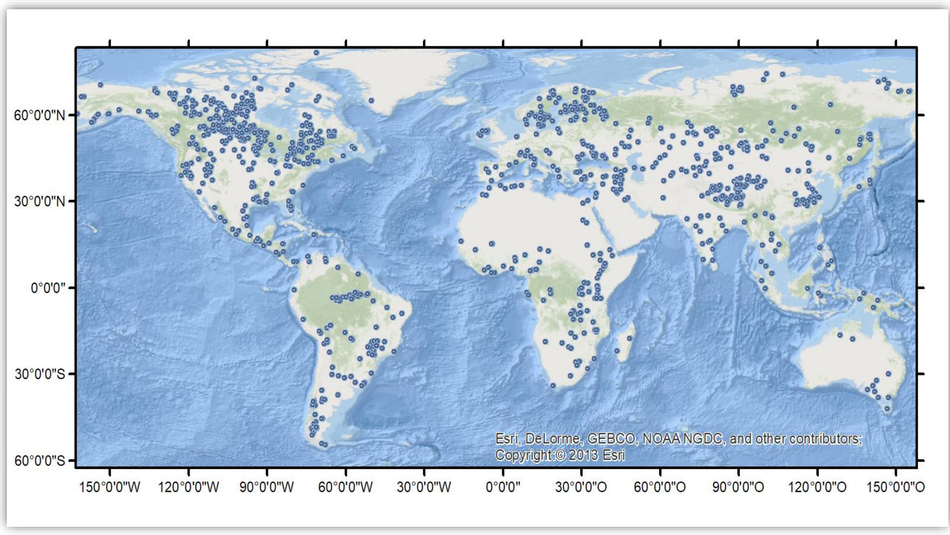
The Lake Water products provide an optical and thermal characterization of nominally 1000 inland water bodies in 10Days averages. The products contain four (sets) of parameters:

(1) *Lake surface water temperature* describes the temperature of the lake surface, one important indicator of lake hydrology and biogeochemistry. Temperature trends observed over many years can be an indicator of how climate change affects the lake.

(2) The *turbidity* of a lake describes water clarity, or whether sunlight can penetrate deeper parts of the lake. Turbidity often varies seasonally, both with the discharge of rivers and growth of phytoplankton (algae and cyanobacteria).

(3) The *trophic state index* is an indicator of the productivity of a lake in terms of phytoplankton, and indirectly (over longer time scales) reflects the eutrophication status of a water body.

(4) Finally, the *lake surface reflectances* describe the apparent colour of the water body, intended for scientific users interested in further development of algorithms. The reflectance bands can also be used to produce true-colour images by combining the visual wavebands.



Global distribution of processed lakes with in the Copernicus global inland water service.

Challenges, Gaps and Evolutions

- Atmospheric correction among wide range of different water types
- SNR of S-2 MSI data
- Artefacts due to merged products (time and space)
- Availability of in-situ data for algorithm calibration and product validation (OLCI + MSI)
- Product evolution
  - 100m spatial resolution based on MSI products
  - TSI - > Chlorophyll conc. under discussion
  - Integration of OLCI-B, SLSTR-B
- Algorithm improvement
  - Generate turbidity directly from reflectances and improve parameter retrieval for clear water types
  - Atmospheric correction for Sentinel-2 MSI and OLCI
- Long-term concept: global products of resolvable water bodies instead of selected (and isolated) lakes

Acknowledgement

The water quality algorithms were tuned, implemented in the Calimnos processing chain and validated against 13 in the NERC (UK) GloboLakes project.

The retrieval of the lake temperature is based on developments from ESA SST-CCI and the algorithm validation was performed in the NERC (UK) Globolakes project.

The Copernicus Global Land Service – Inland Water Products is a service of the European Commission and is managed by the Joint Research Centre. The Prime Contractor for the Service is CLS France.

References

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