Global Lake Water Products within the Copernicus Global Land Service

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Copernicus Global Land Service

Copernicus Global Land Service

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

VEGETATION

- Leaf Area Index (LAI)
- Fraction of Absorbed PAR
- Fraction of vegetation cover (FCOVER)
- NDVI
- Vegetation Condition Index (VCI)
- Vegetation Productivity Index (VPI)
- Dry Matter Productivity
- Burnt Area
- Land Cover
- Soil Water Index
- Surface Soil Moisture

ENERGY

- Top-of-Canopy reflectance
- Surface Albedo
- Land Surface Temperature
- Radiation Fluxes

WATER

- Water Bodies
- Lake and river water level
- Lake surface water temperature
- Lake surface reflectance
- Lake turbidity
- Lake trophic state
- Water Level

CRYOSPHERE

- Lake Ice Extent
- Snow Cover Extent
- Snow water equivalent

Product specification

- Parameters
  - Lake Surface Reflectance (all bands)
  - Lake turbidity
  - Trophic state (based on CHL concentration)
  - Lake Water Temperature
- Spatial resolution
  - 300m, 1km
  - 100m (in evolution)
- Temporal aggregation
  - 10days for water LSWT, TUR and TSI
  - Best spectrum within 10days for LSR
- Time span
  - 2002-2012 (MERIS + AATSR)
  - 2016-ongoing (OLCI + SLSTR)
- Service
  - NRT (3 days after last day of decade)
- Status
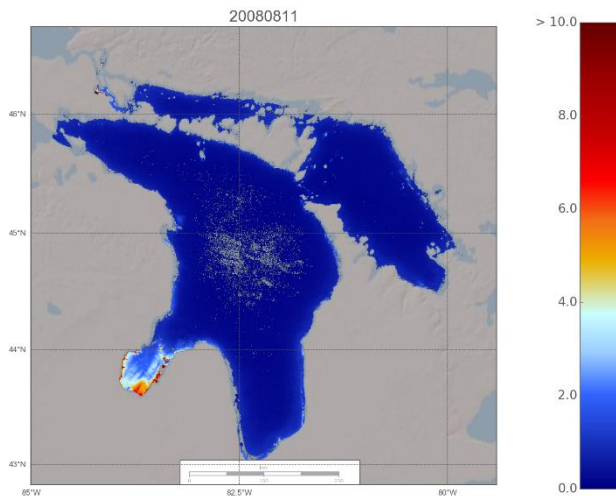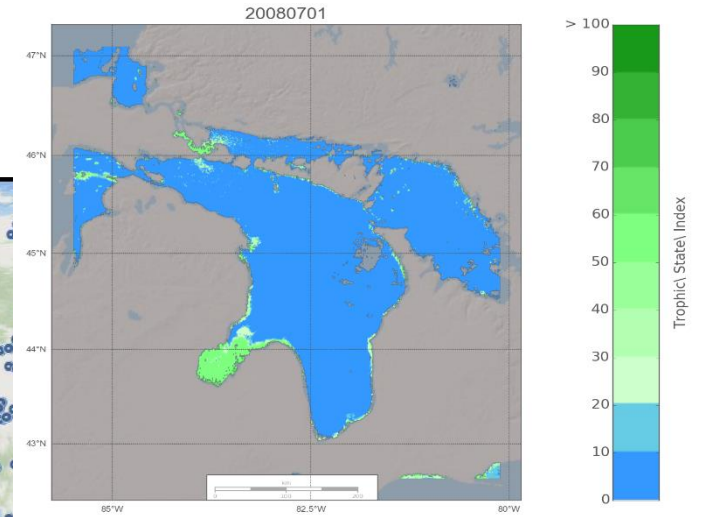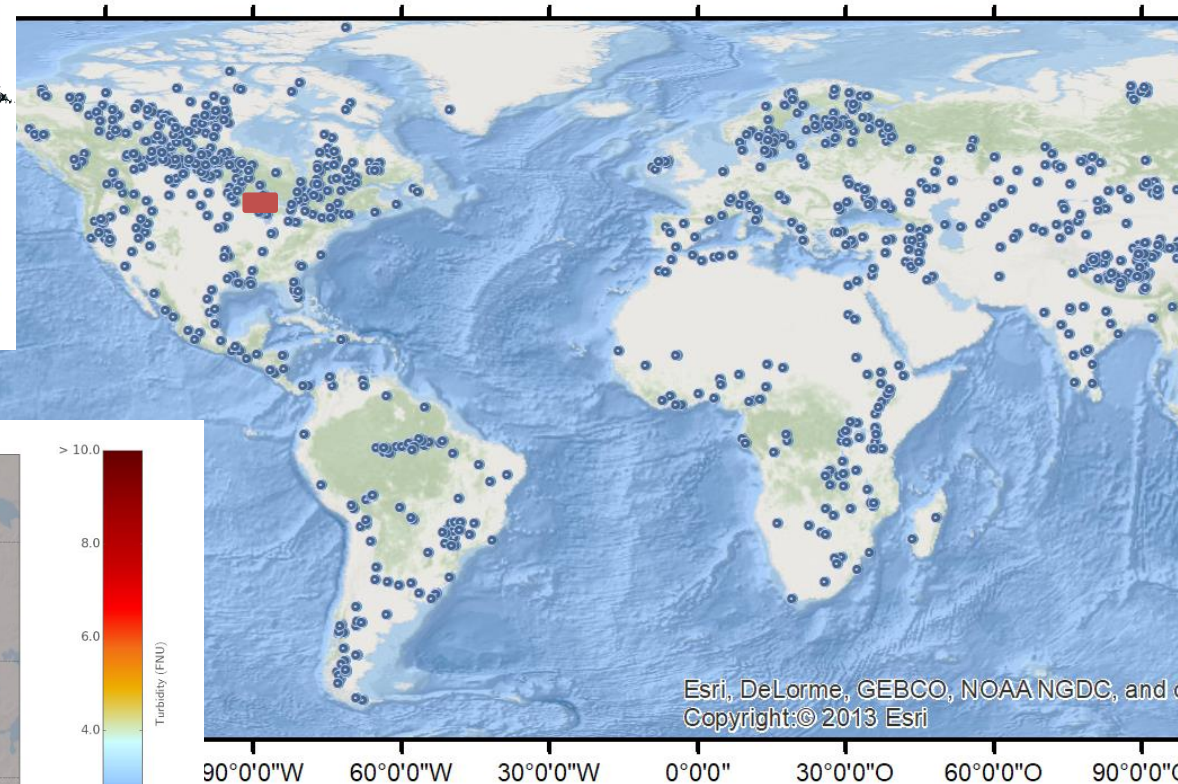 - Publicly released in June 2018 (300m, 1km)

Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors; Copyright:© 2013 Esri
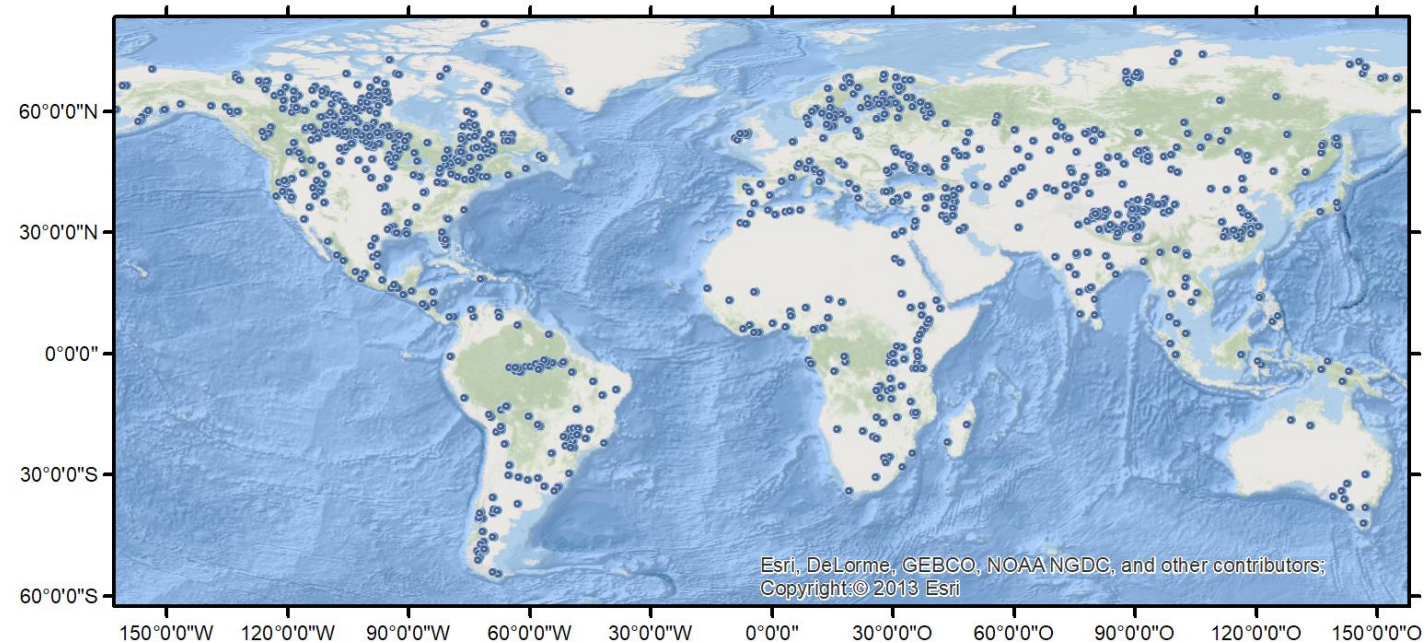
LSWT	=	Lake Surface Water Temperature
TUR	=	Turbidity
TSI	=	Trophic State Index
LSR	=	Lake Surface Reflectances
LWQ	=	Lake Water Quality

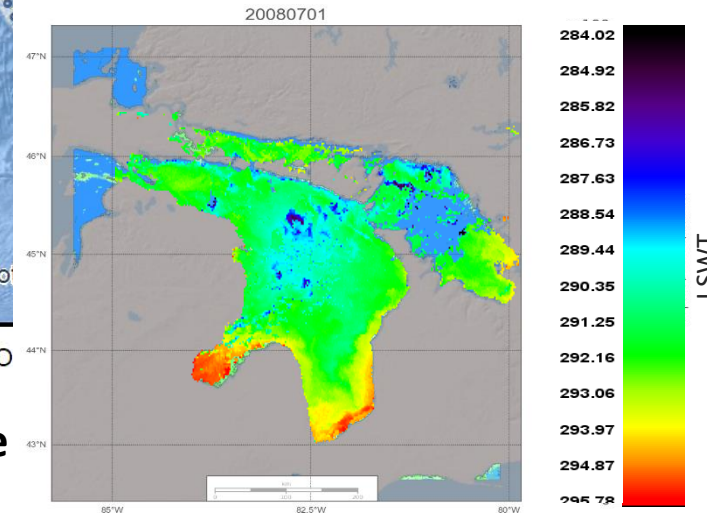# Global distribution of inland water bodies
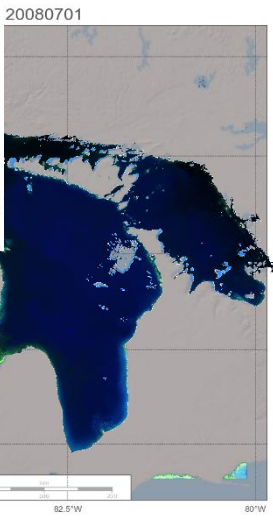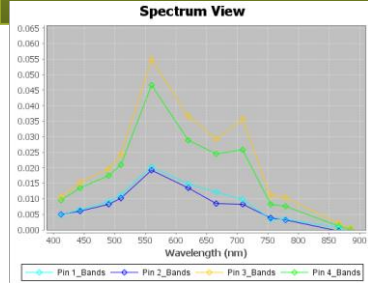
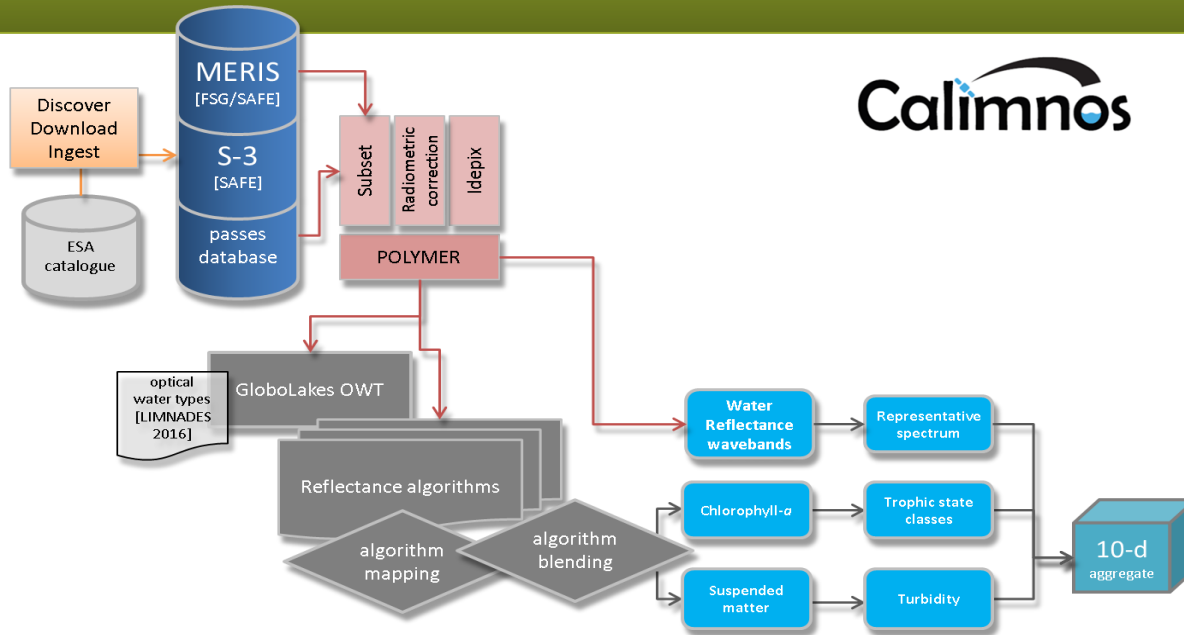**Water Leaving Reflectances**

Trophic State Index

Turbidity

Lake Surface Temperature

The Processing chains

Water Quality products

Discover Download Ingest

ESA catalogue

MERIS [FSG/SAFE]

S-3 [SAFE]

passes database

Subset

Radiometric correction

Idepix

POLYMER

Calimnos

optical water types [LIMNADES 2016]

GloboLakes OWT

Reflectance algorithms

algorithm mapping

algorithm blending

Water Reflectance wavebands

Representative spectrum

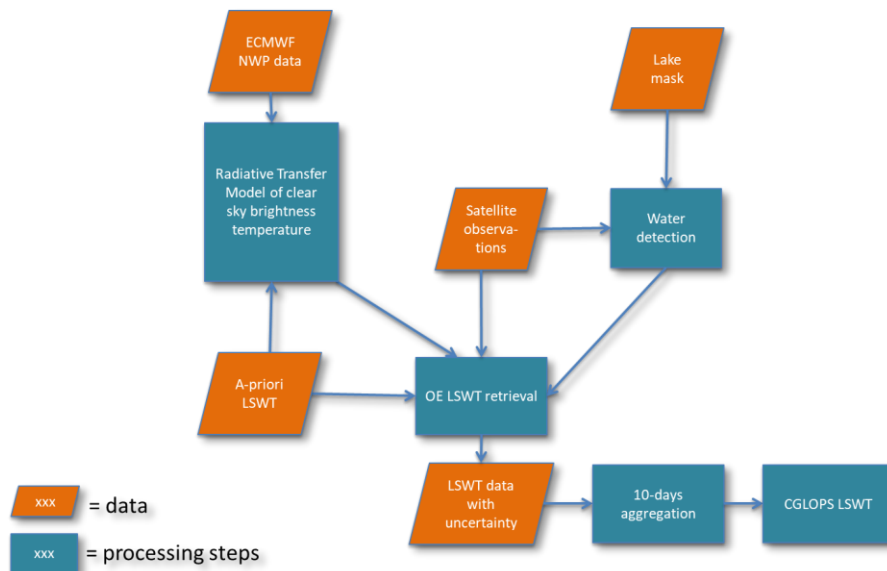Chlorophyll-*a*

Trophic state classes

Suspended matter

Turbidity

10-d aggregate

Started with ESA project Diversity-II, completely reconstructed during Globolakes and finally working horse for operational Copernicus Global Land Service

Temperature products

ECMWF NWP data

Lake mask

Radiative Transfer Model of clear sky brightness temperature

Satellite observations

Water detection

A-priori LSWT

OE LSWT retrieval

LSWT data with uncertainty

10-days aggregation

CGLOPS LSWT
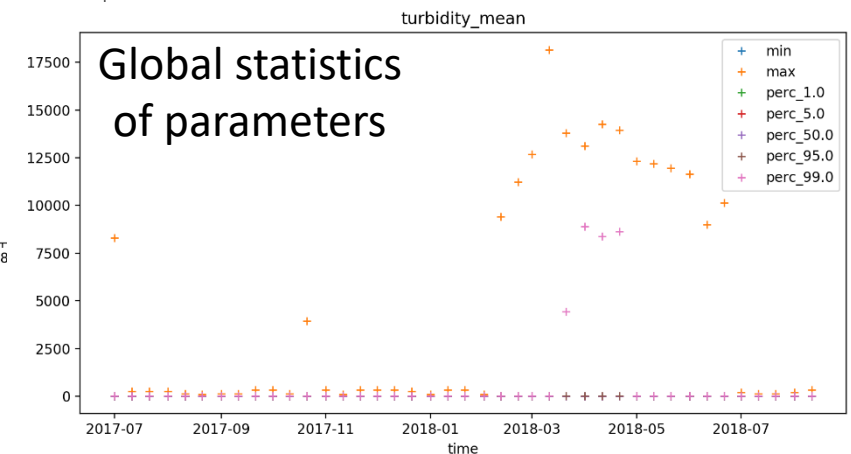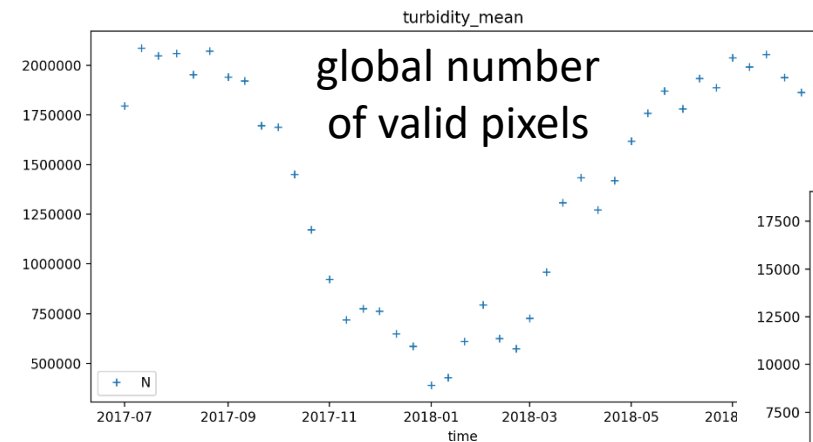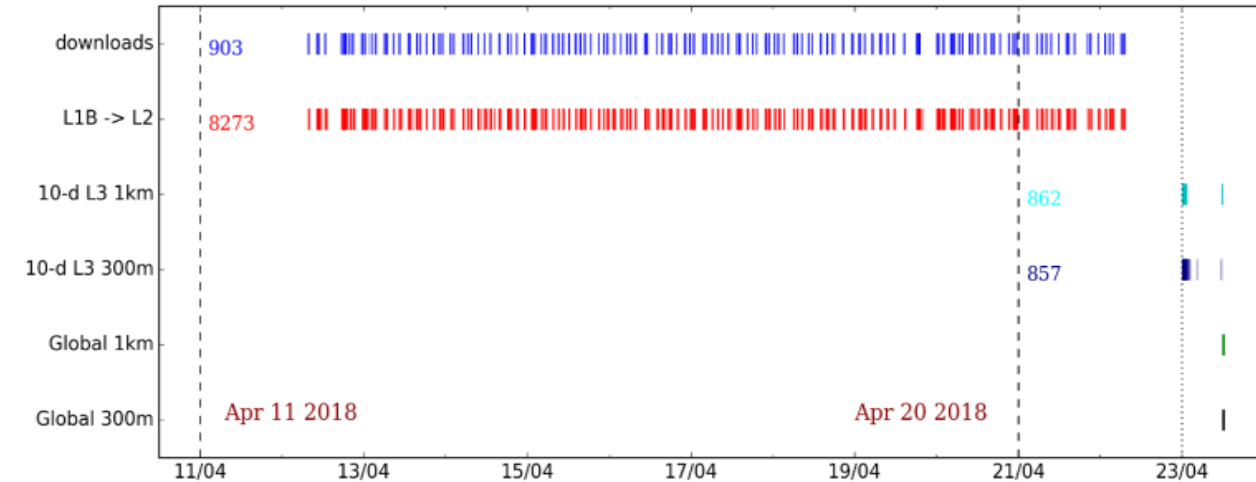
xxx = data

xxx = processing steps

Developments build on ARCLake project and ESA CCI SST, further evolution with Globolakes findings and developments and finally operational processing chain for the Copernicus Global Land Service
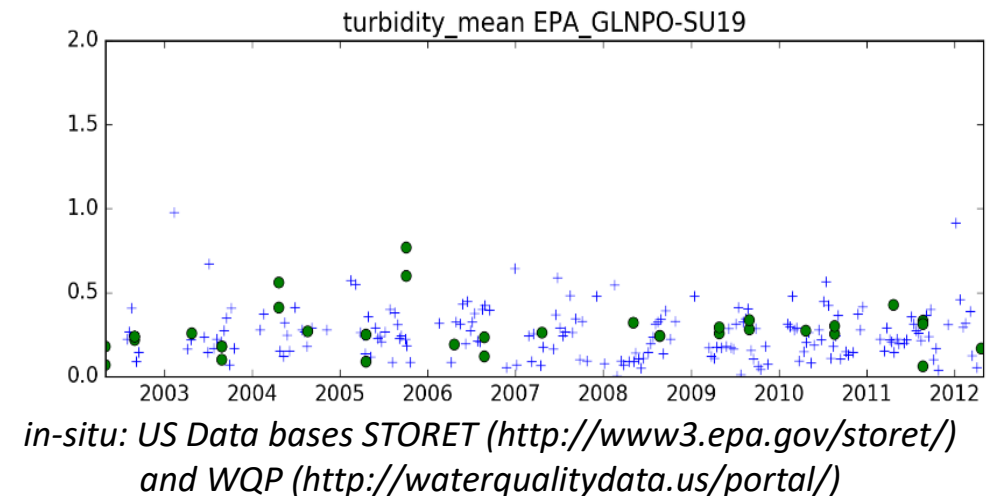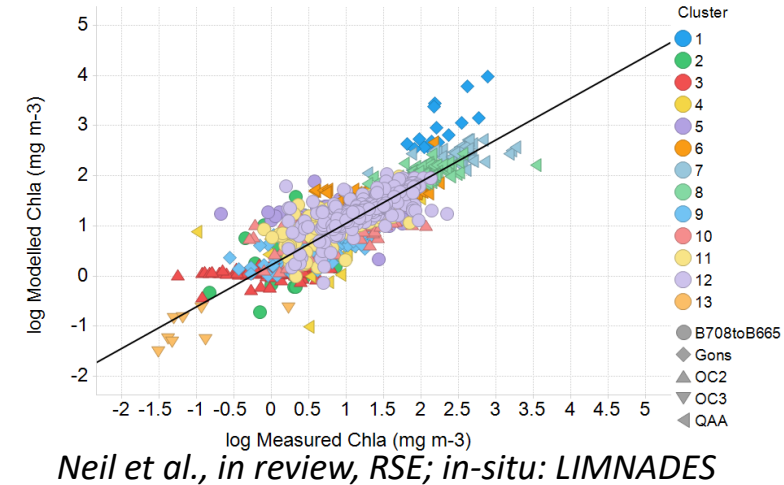
Quality control

- Operational processing monitoring

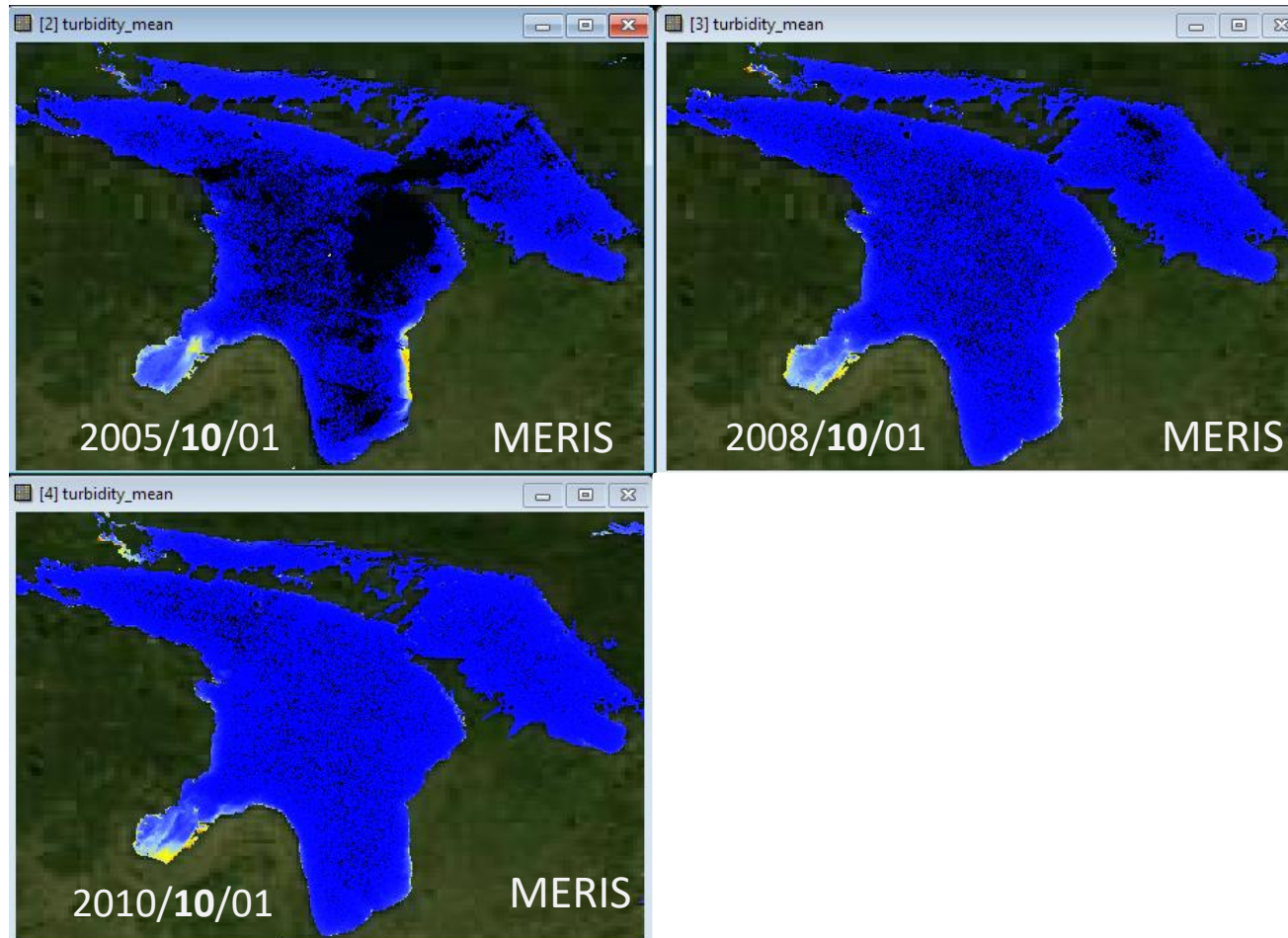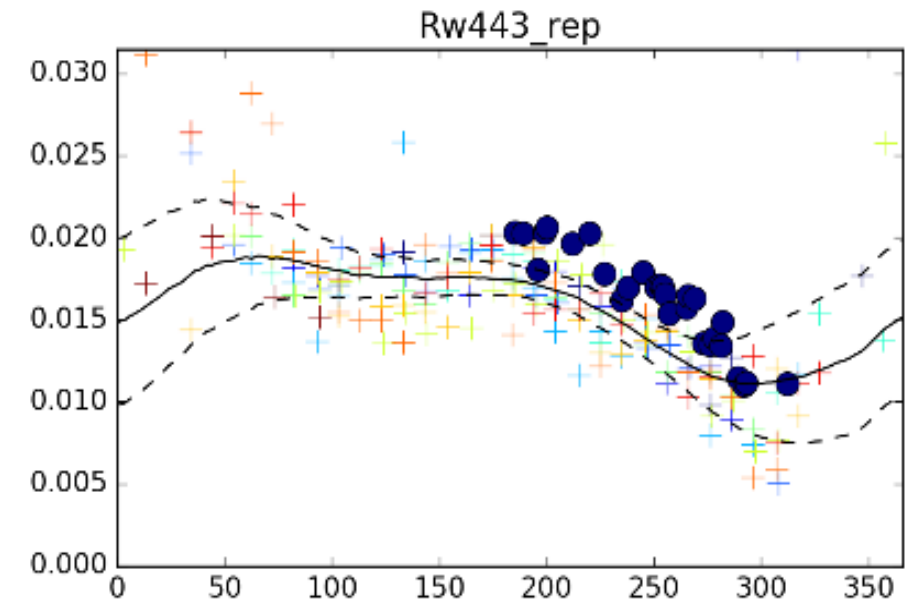- Operational quality control of products

Validation Lake Water Quality

- **Algorithm Validation in the scope of algorithm development**
  - Globolakes: development of OWT based algorithm (MERIS)

Neil et al., in review, RSE; in-situ: LIMNADES

- **Quality control of input products**

- **Validation of output products**
  - In-situ data from various sources

- **Quality control of output products**
  - Spatial and temporal consistency tests

in-situ: US Data bases STORET (http://www3.epa.gov/storet/) and WQP (http://waterqualitydata.us/portal/)
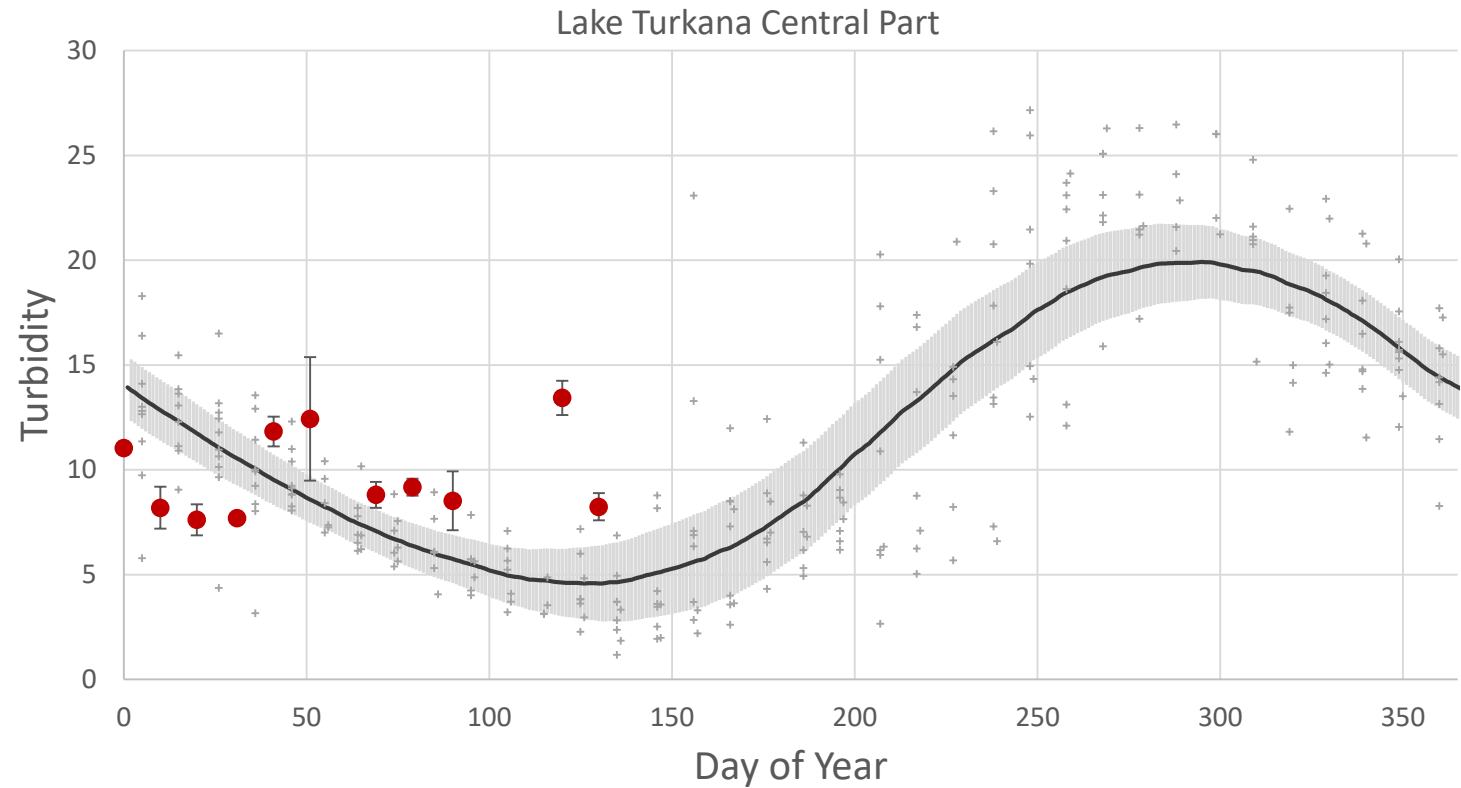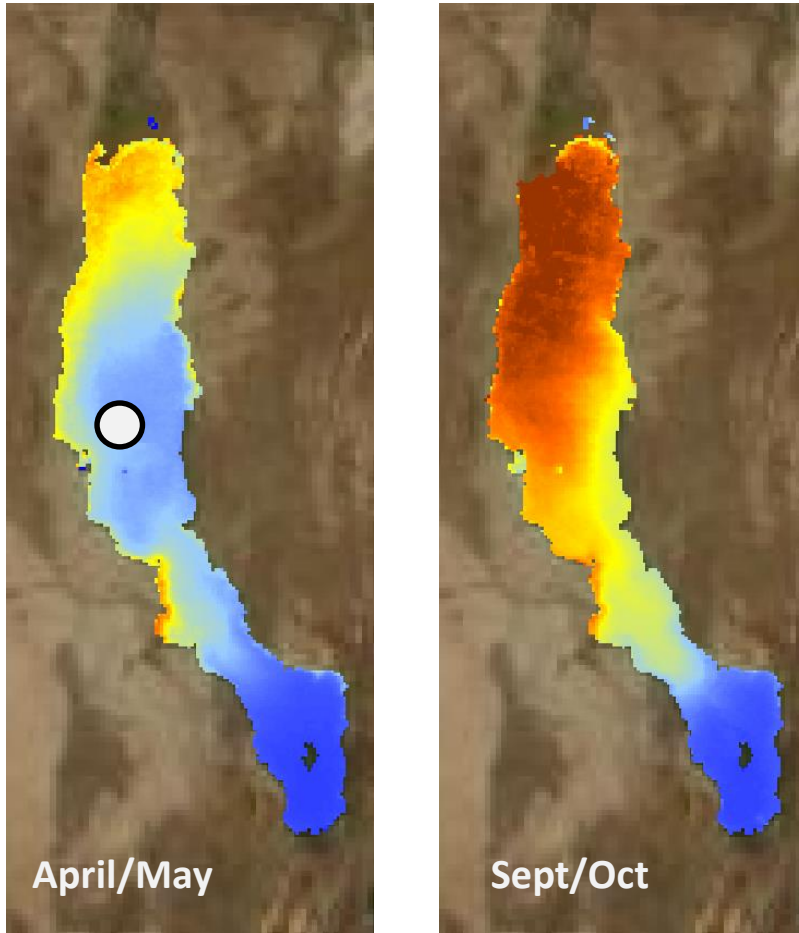
OLCI consistency based on MERIS

Lake Turkana – Use Case based on CGLOPS products

Long-term average situation

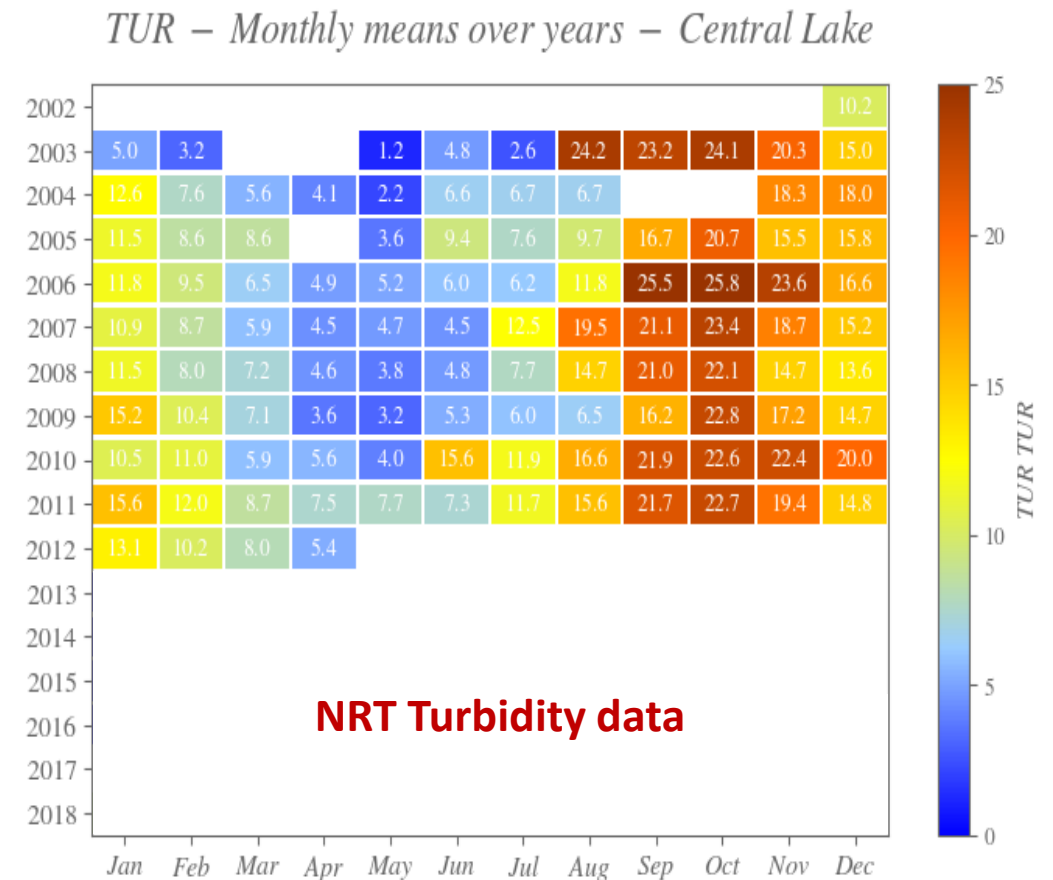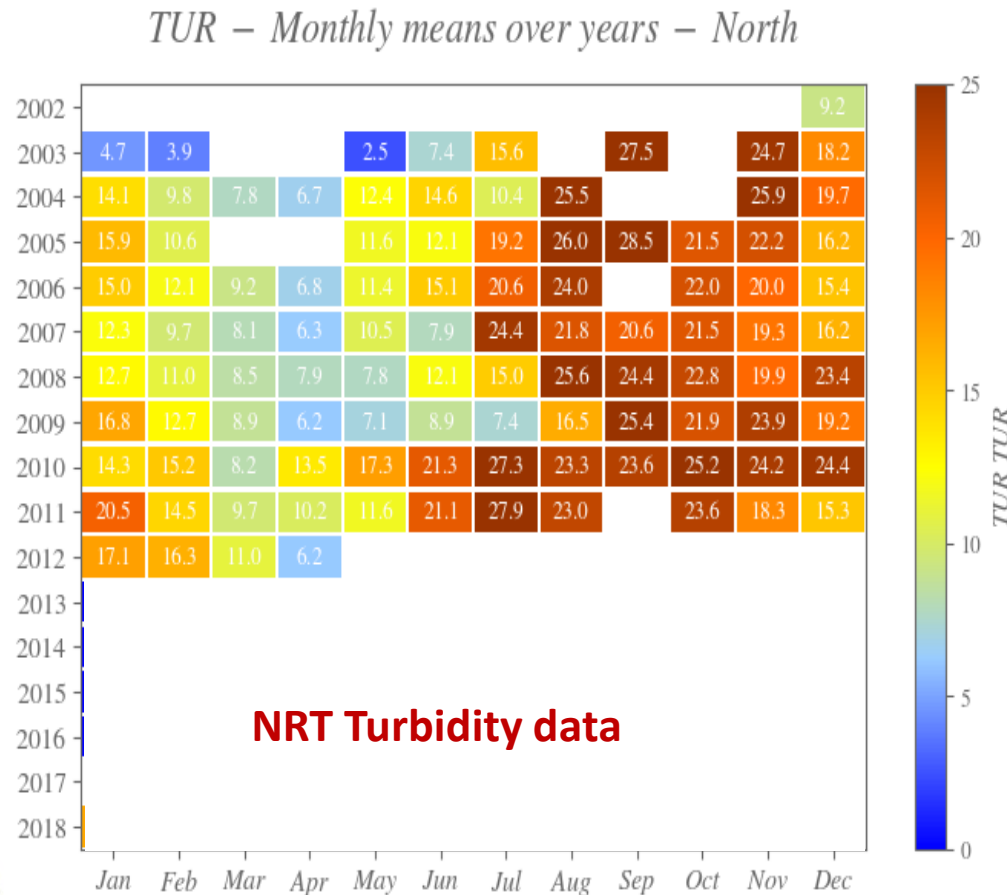April/May

Sept/Oct

Lake Turkana Central Part

Archive Turbidity data over 10 years, seasonal trends

NRT Turbidity data

Lake Turkana – changes of seasonal patterns?

- Due to dam constructions along the Omo River
- Expectation to have a reduction of seasonality
- Tool for comparing seasonal patterns: Heatmaps derived from 12 years of data

TUR – Monthly means over years – North

NRT Turbidity data

TUR – Monthly means over years – Central Lake

NRT Turbidity data

Free and open product access

Anonymous query; data access after registration
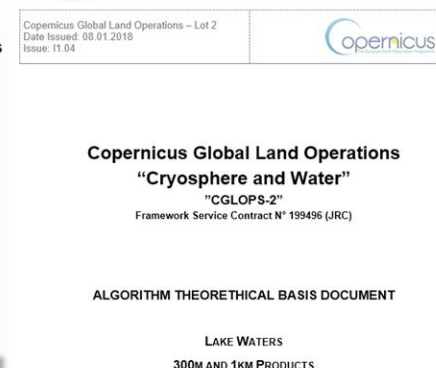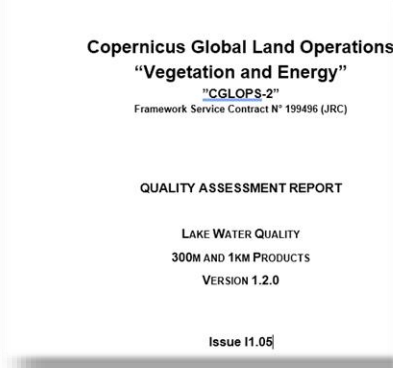
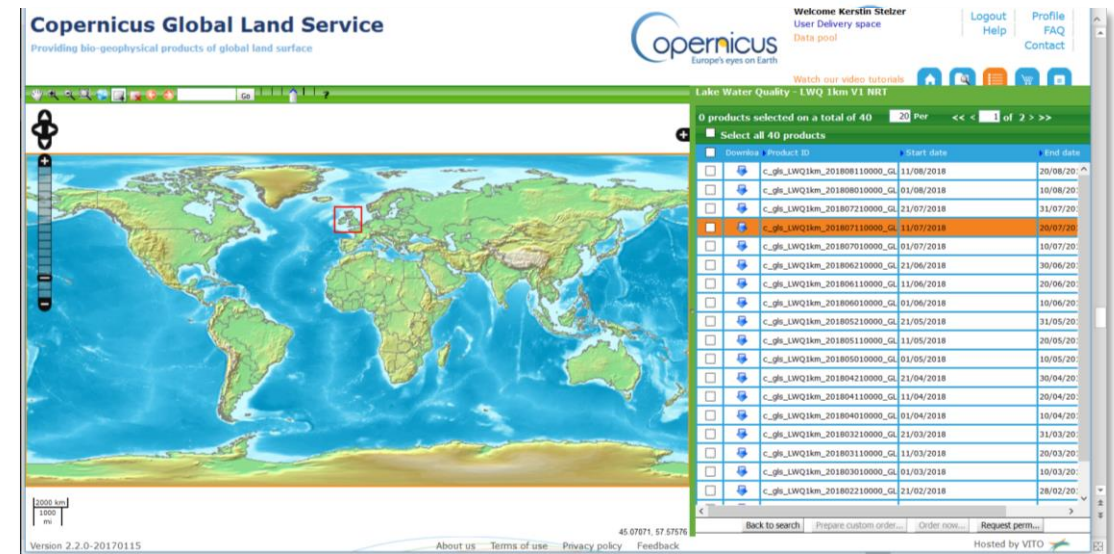Catalogue search & Subscription

Fast HTTP Access

Documentation

Each product comes with a set of documents:

- ATBD (Algorithm Baseline Document)
- PUM (Produce User Manual)
- QAR (Quality Assessment Report)

Products and Documents undergo a review cycle by external reviewers

Challenges, Gaps and Evolutions

- Transfer of scientific sound results into operational services
- Atmospheric correction among wide range of different water types
- Reduce artefacts due to merged products (time and space) as ̶ ̶ ̶ ̶sible
- SNR of S-2 MSI data and consistency of sensors
- Availability of in-situ data for algorithm calibration ̶ ̶ ̶ ̶ ̶ ̶t validation (OLCI + MSI)
- Product evolution
    - 100m spatial resolution based on MSI pro̶ ̶ ̶ ̶
    - TSI - > Chlorophyll conc. under disc̶ ̶ ̶
    - Integration of OLCI-B, SLSTR-̶ ̶
- Algorithm improvement
    - Generate turbidity̶ ̶ ̶ ̶ ̶ ̶ ̶ ̶m reflectances & improve parameter retrieval for clear water types
    - Atmospheric̶ ̶ ̶ ̶ ̶ ̶ ̶ ̶ for Sentinel-2 MSI and OLCI
    - Pixel c̶ ̶ ̶ ̶ ̶ ̶ ̶ shoreline pixels, ice, cloud, cloud shadow
- Lon̶ ̶ ̶ ̶ ̶ ̶ ̶ept
    - ̶ ̶ ̶ ̶ ̶products of resolvable water bodies instead of selected (and isolated) lakes

Happy to welcome you at the poster for further discussions