The Copernicus Inland Water Service of the European Union

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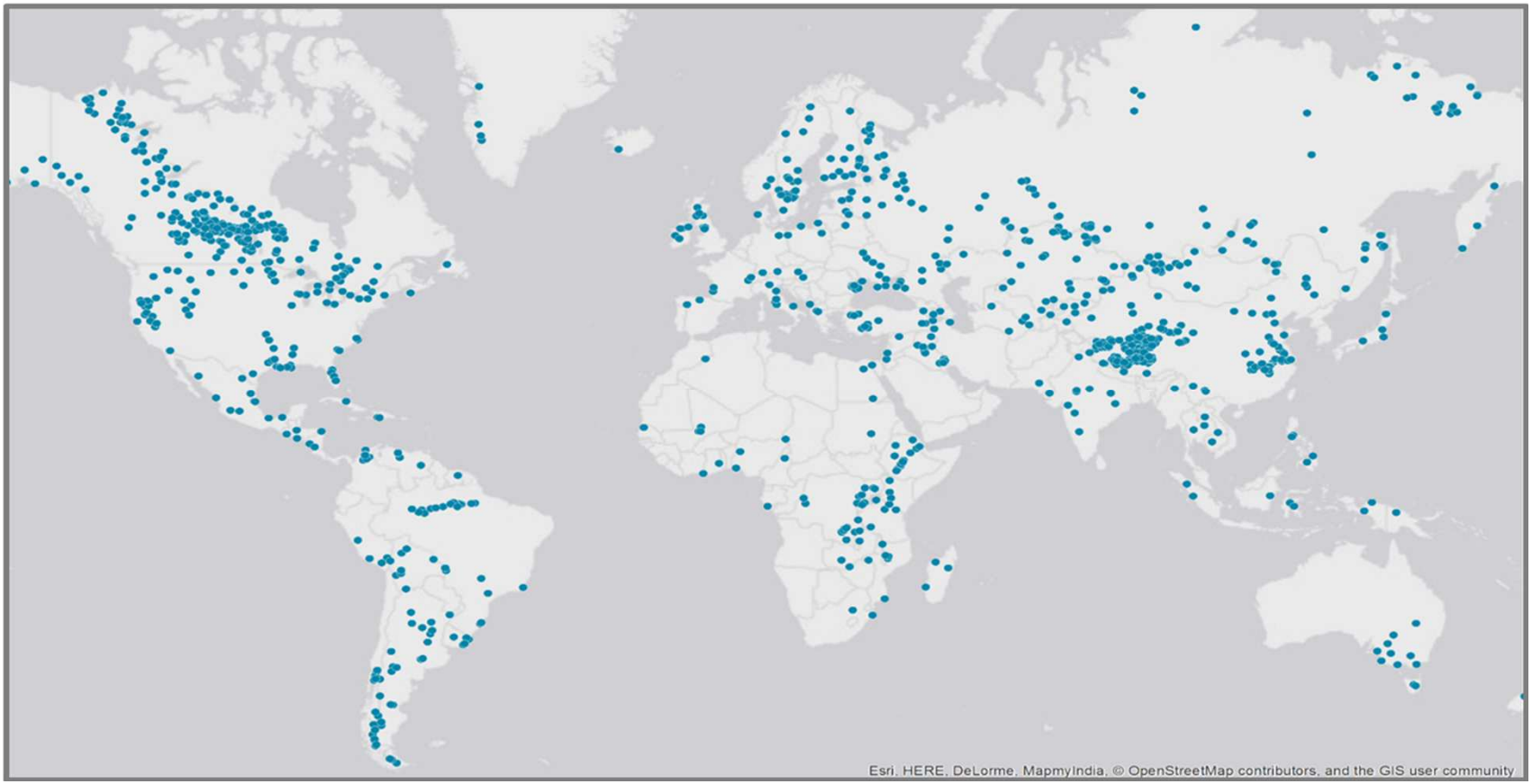
Broadening the Portfolio: Lake Water Theme

- 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 2016/2017
  - Water Theme
    - Water bodies & Coastal erosion
    - Lake Water Quality
    - Water Level
- Ramp-up phase, integration of new Sentinels, evolution contracts
  - Phasing depending on Technical Readiness Level

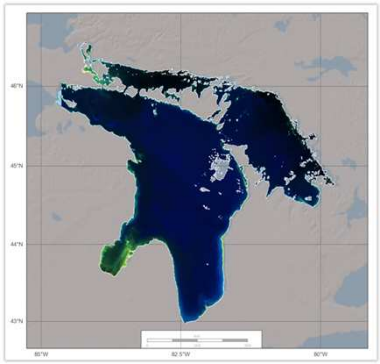
Globally distributed Lakes

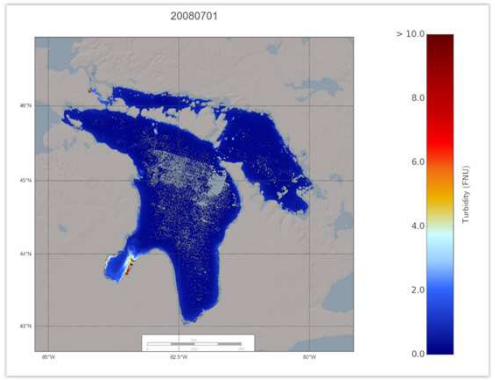


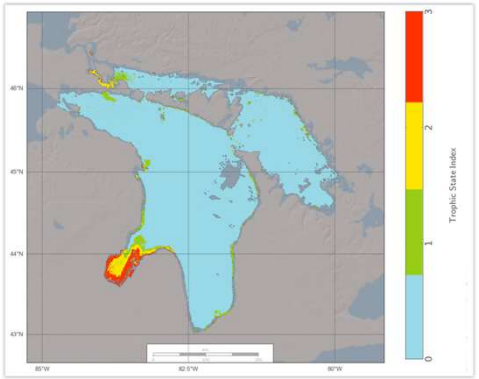
- 1000 lakes, many different to GloboLakes

Lake Water Products

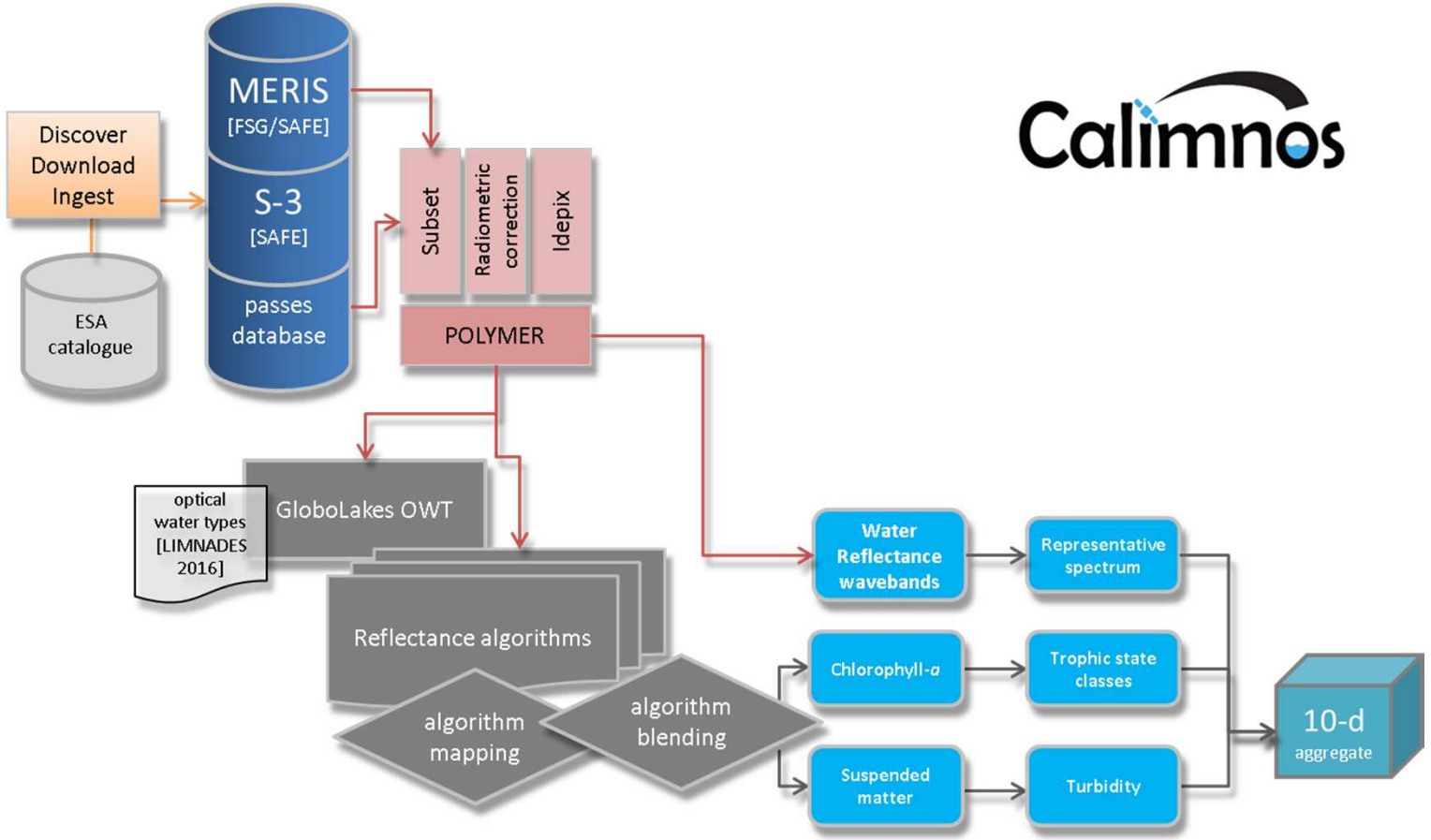
- Parameters:
  - Lake Surface Temperature (LSWT)
  - Lake Surface Reflectances (LSR)
  - Turbidity (TUR)
  - Trophic State Index (TSI)
- Inputs:
  - MERIS (REPROCESSING 300m, 1km)
  - OLCI (NRT 300m, 1km)
  - S-2 MSI (100m)
- Outputs:
  - 10 day averages



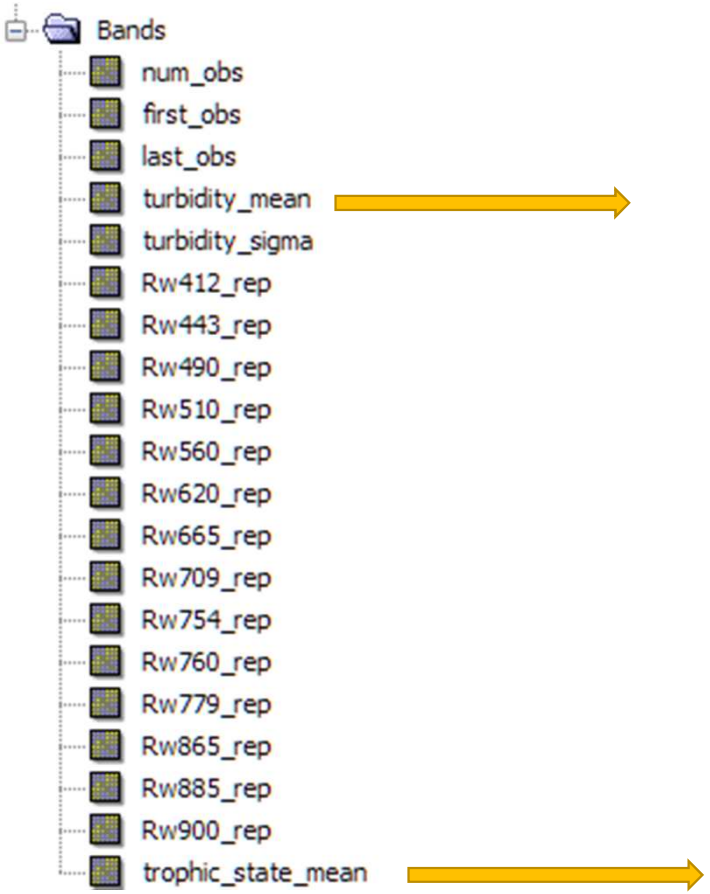


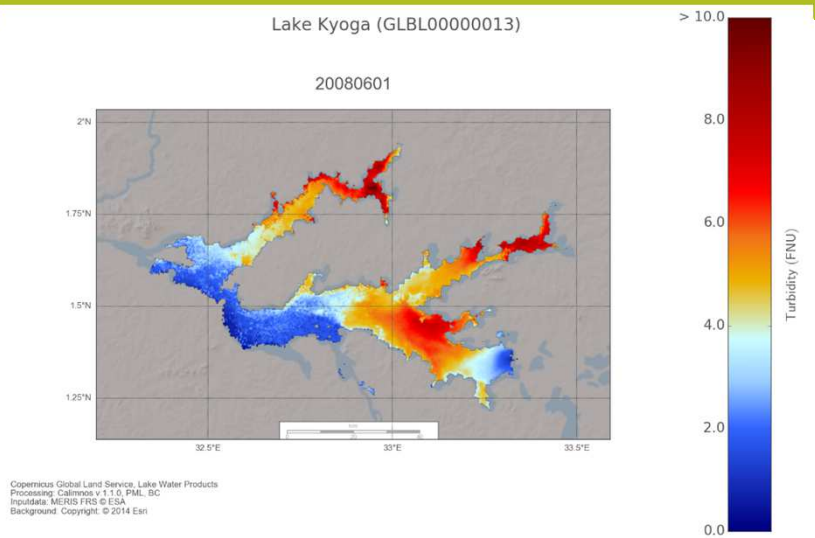


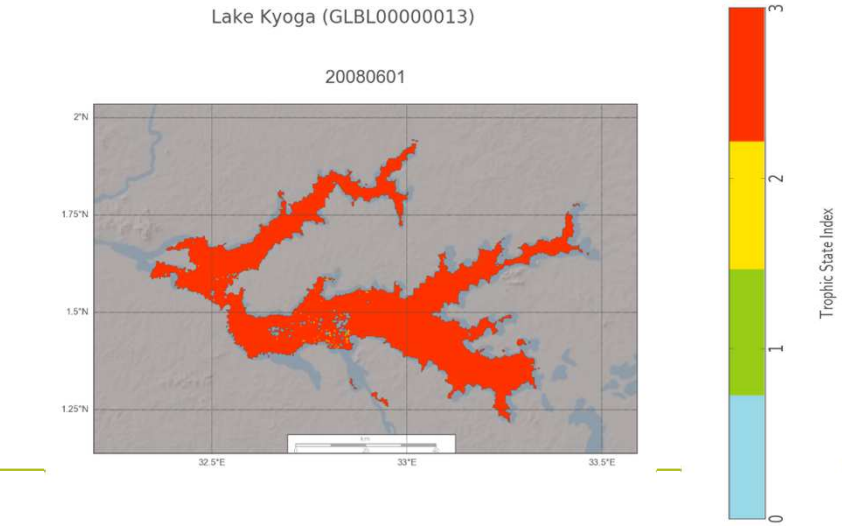
Processing Chain



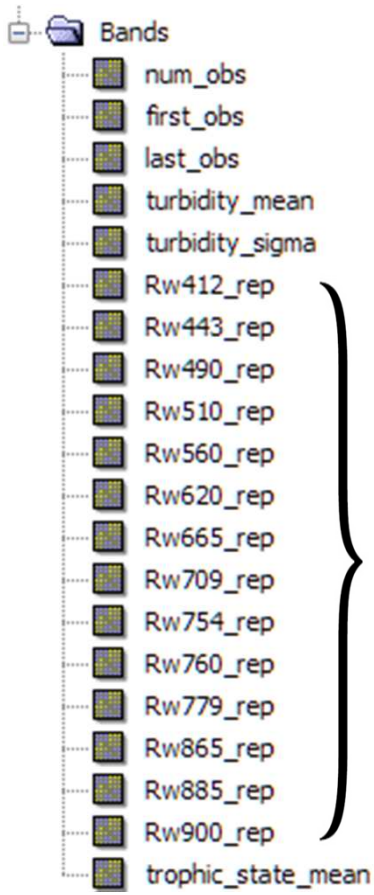
Products & Metadata



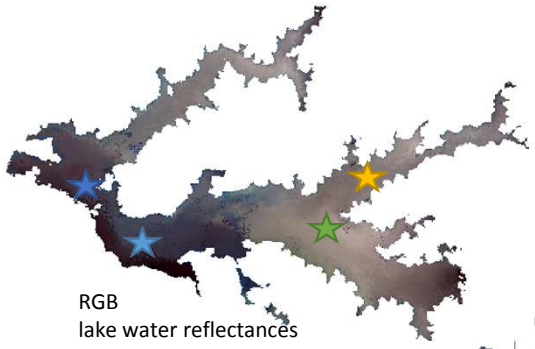




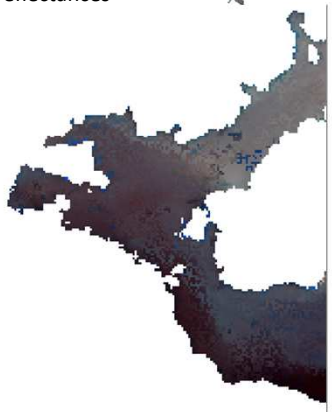
Products & Metadata



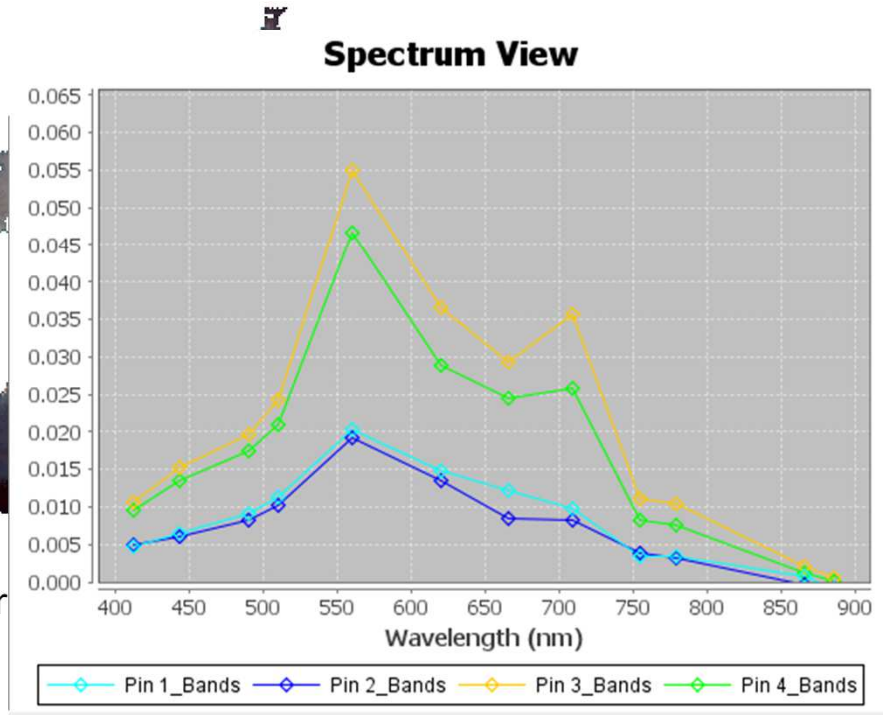
Representative spectrum



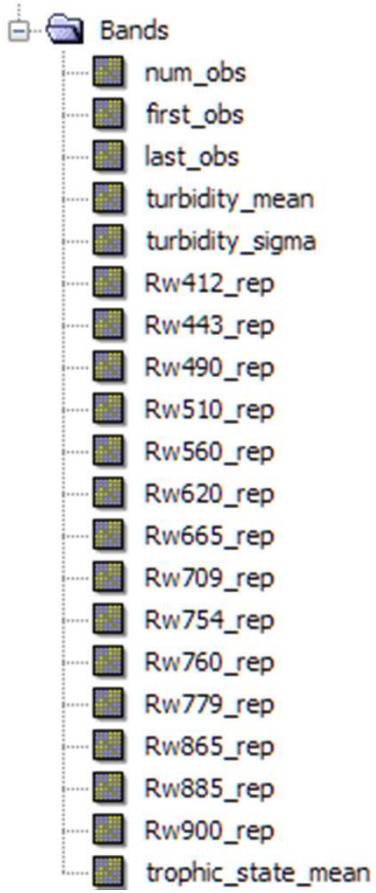
RGB
lake water reflectances



RGB
lake water r



Products & Metadata



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project	Copernicus Global Land Service – Lake Water	ascii
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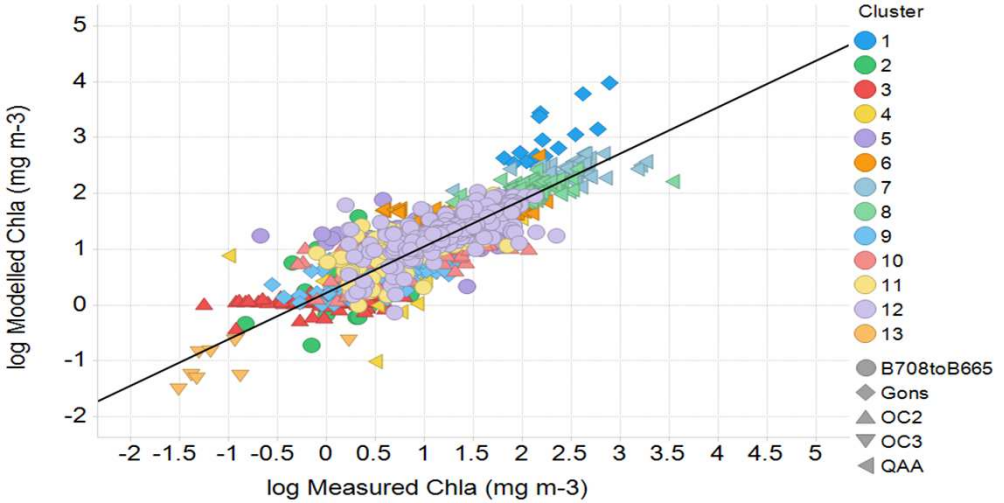
Validation

- 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

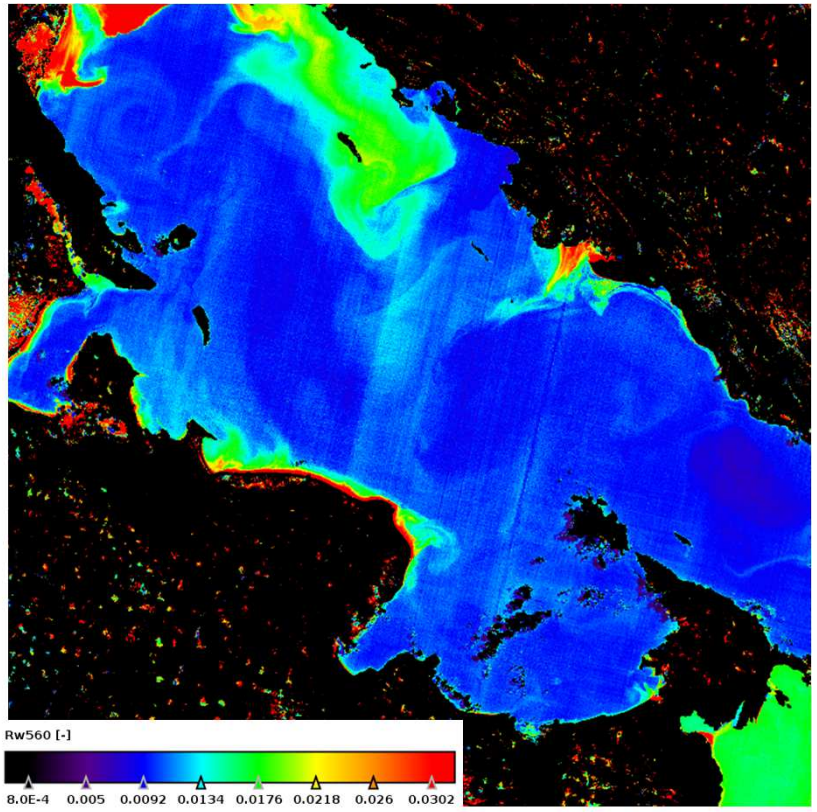


In situ data: LIMNADES, Globolakes

Evolution: Increasing spatial resolution to 100m

- Sentinel 2 MSI as data source
- HYGEOS 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

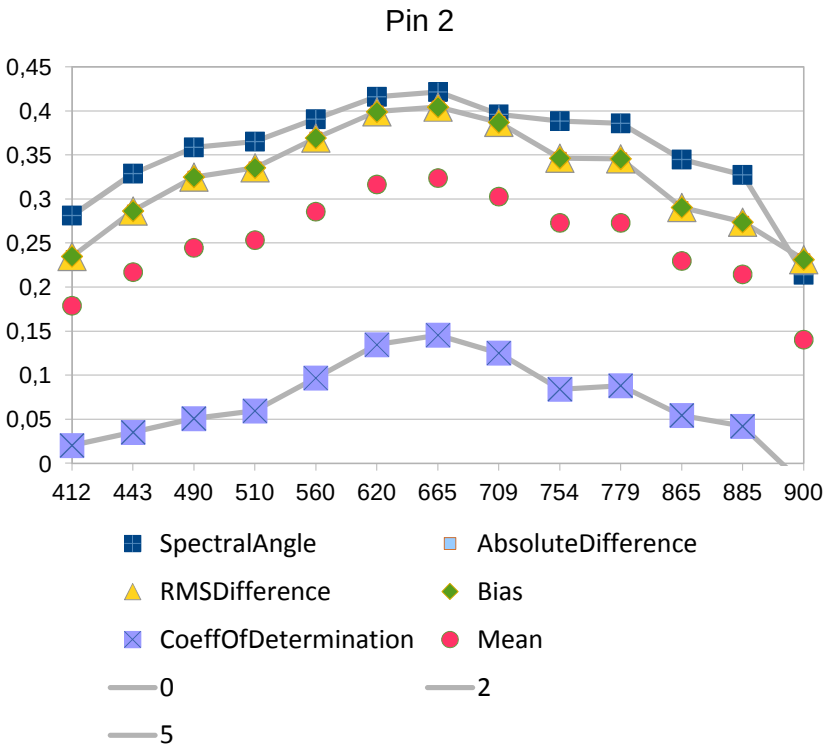


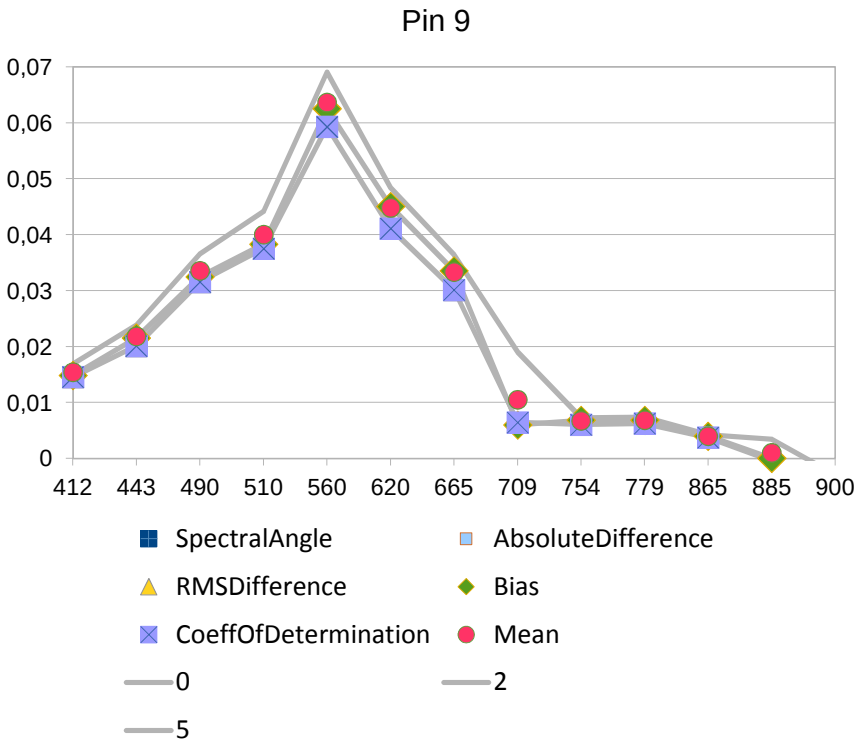
Status and Evolution

- 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 gives good coverage
  - OLCI reprocessing from beginning of mission

- THANK YOU

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		