



# Global Observatory of Lake Response to Environmental Change

Water Quality Information for the Benefit of Society | University of Stirling, 29-31 August 2018

## OPTICAL WATER TYPES & LIMNADES

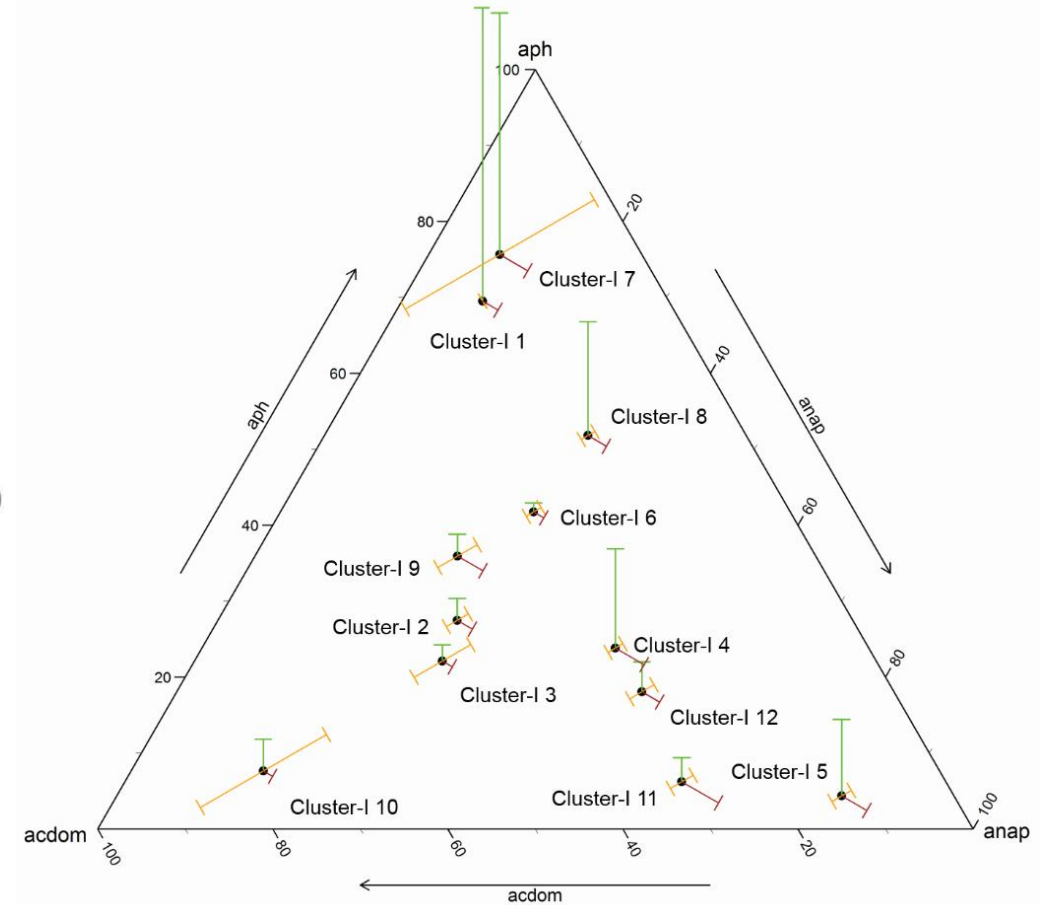
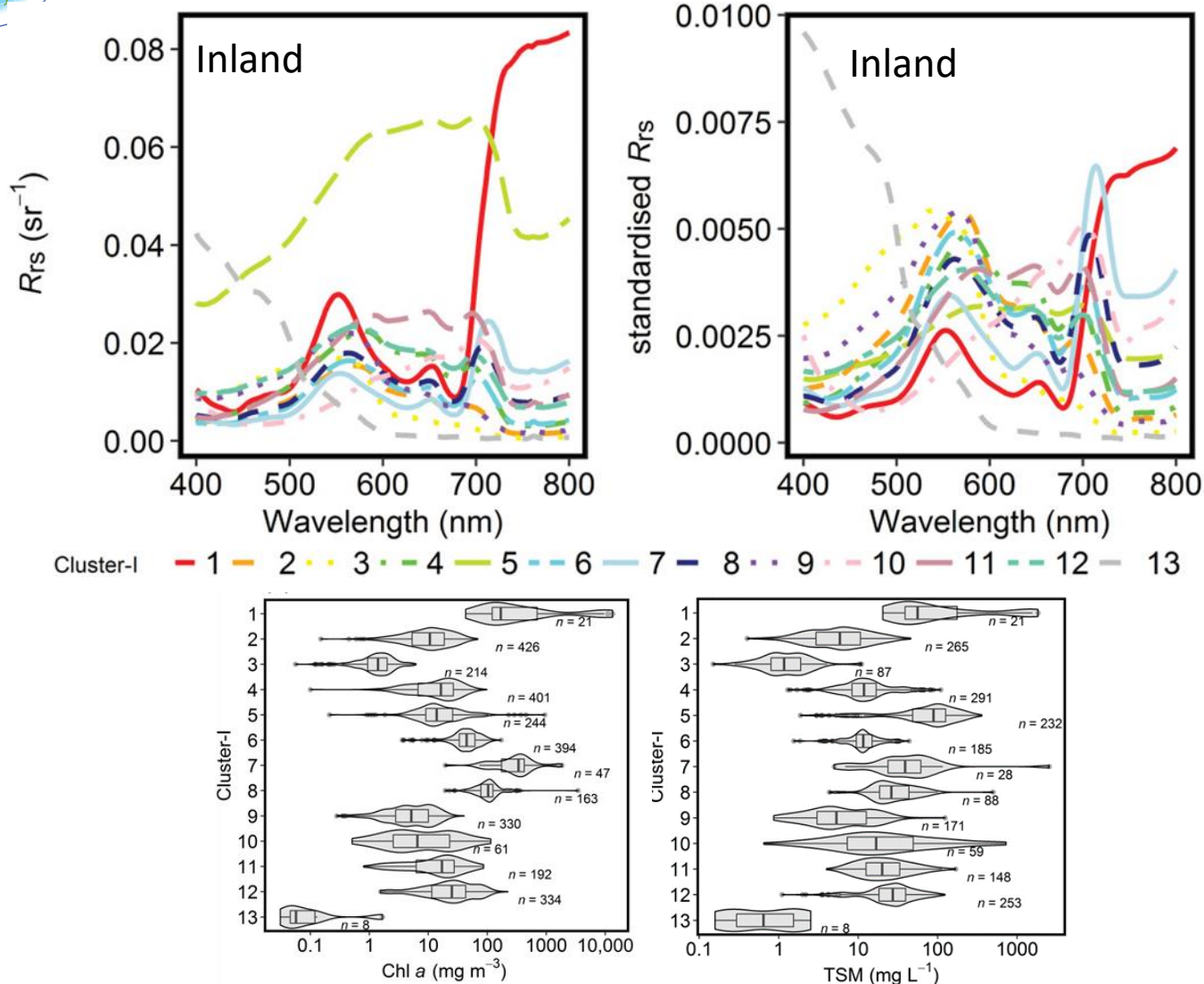
**V. SPYRAKOS**, P HUNTER, C NEIL & A TYLER | University of STIRLING

R O'DONNELL, C MILLER & M SCOTT | University of GLASGOW

S SIMIS, C STEELE & S GROOM | PML

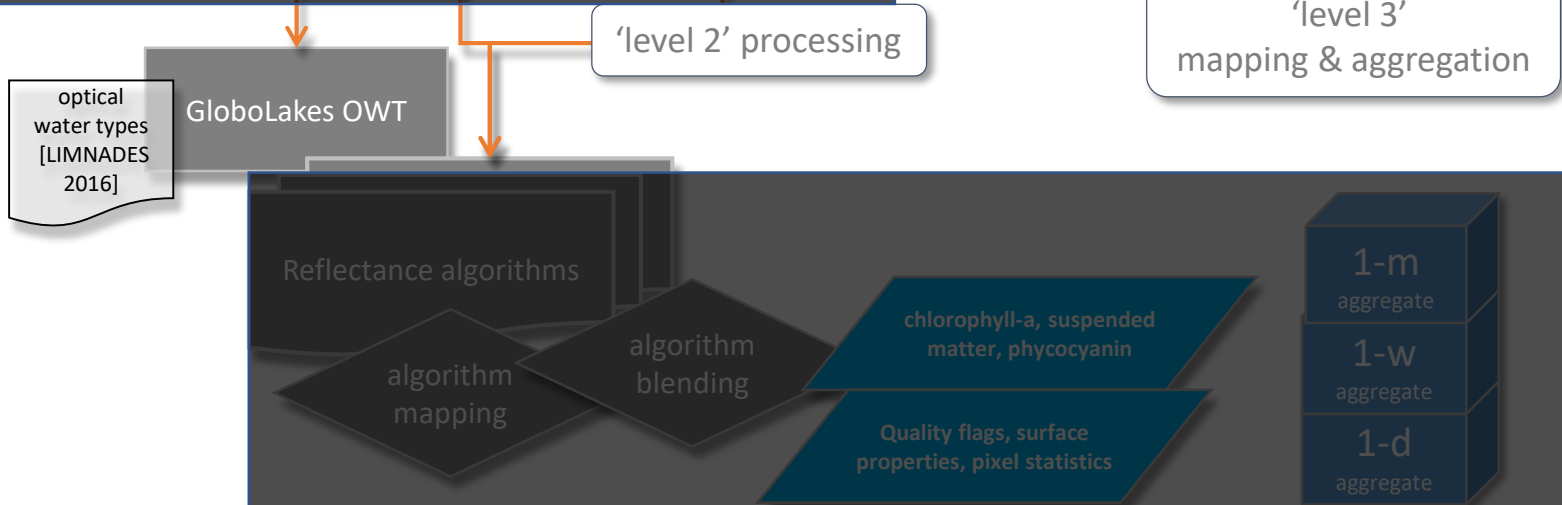
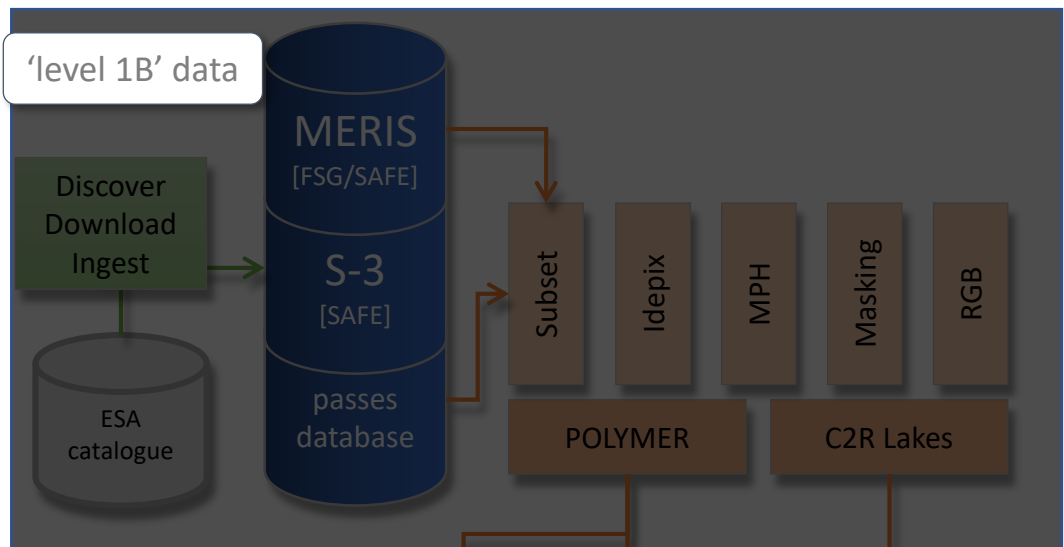
& Data providers





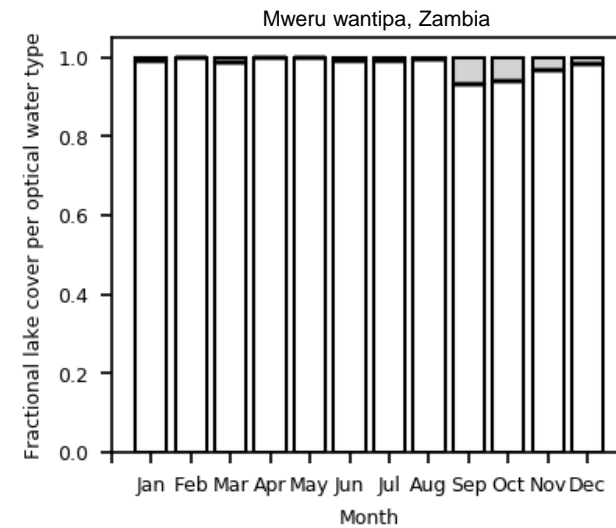
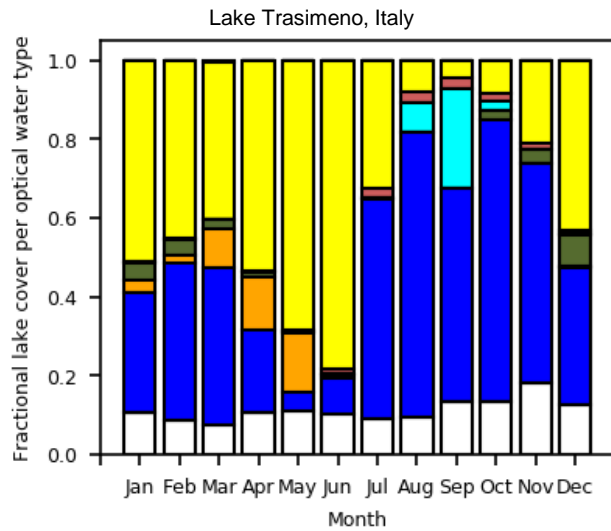
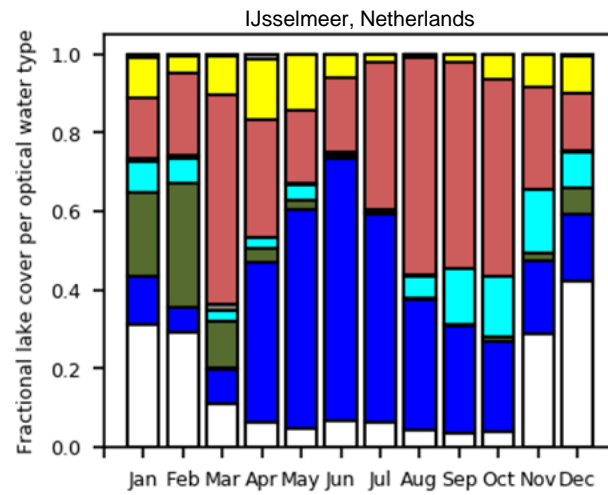
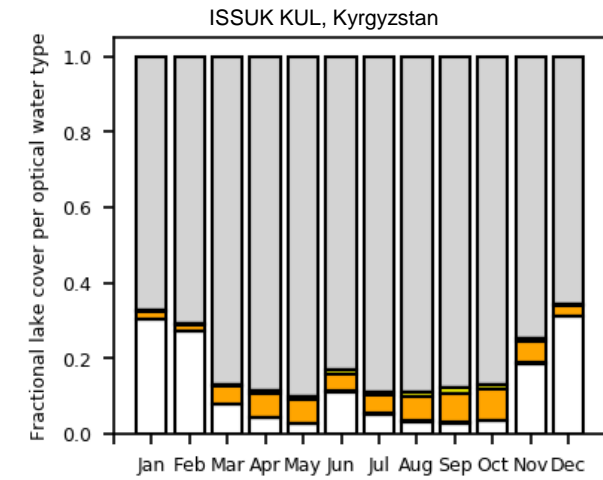
E. Spyarakos et al. 2018: Optical types of inland and coastal waters. *Limnology and Oceanography*

# OWT in Calimnos

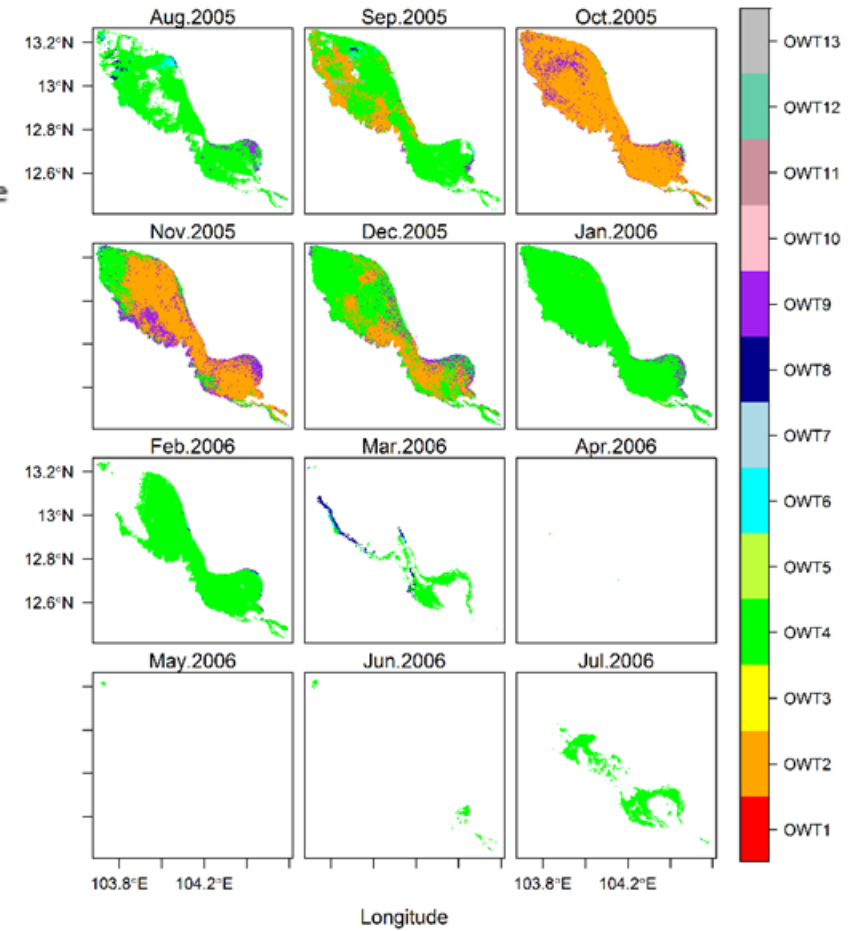


**Calimnos**  
GloboLakes, v1.04

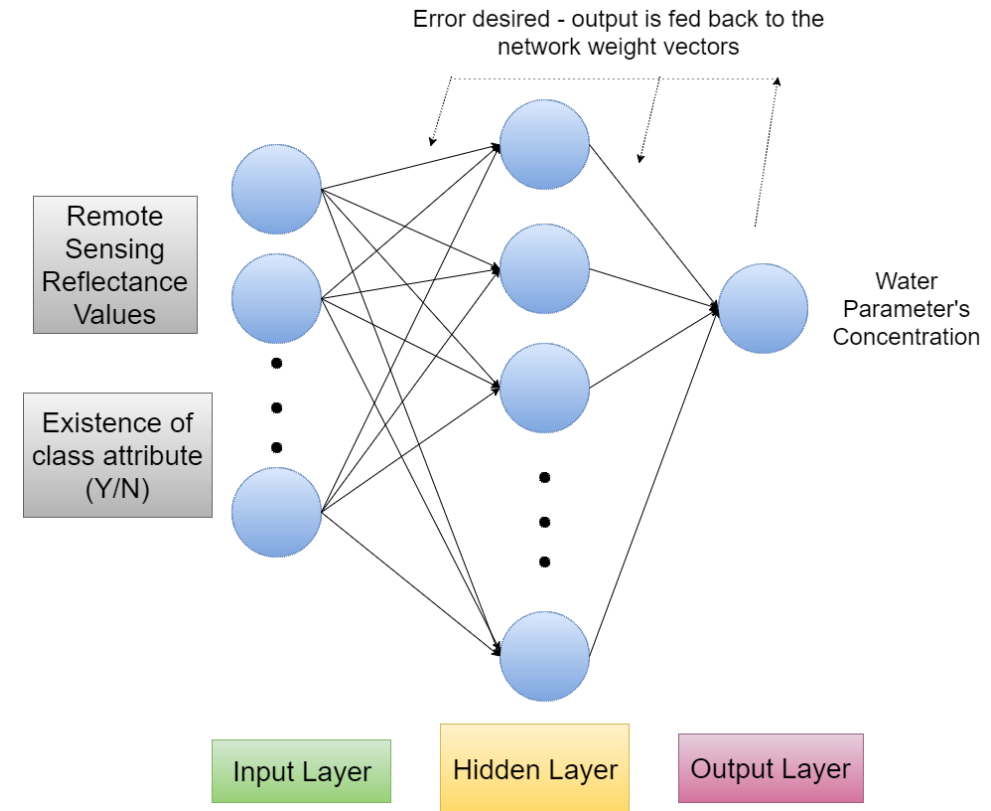
# Typology (1000 lakes 13 OWT 10 years)



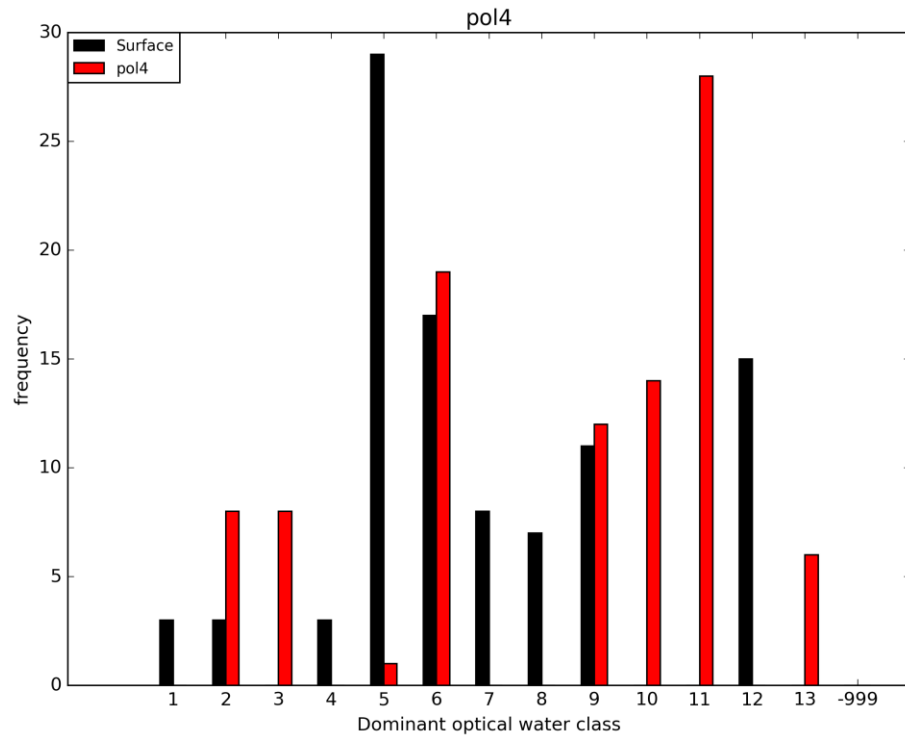
## TONLÉ SAP Lake



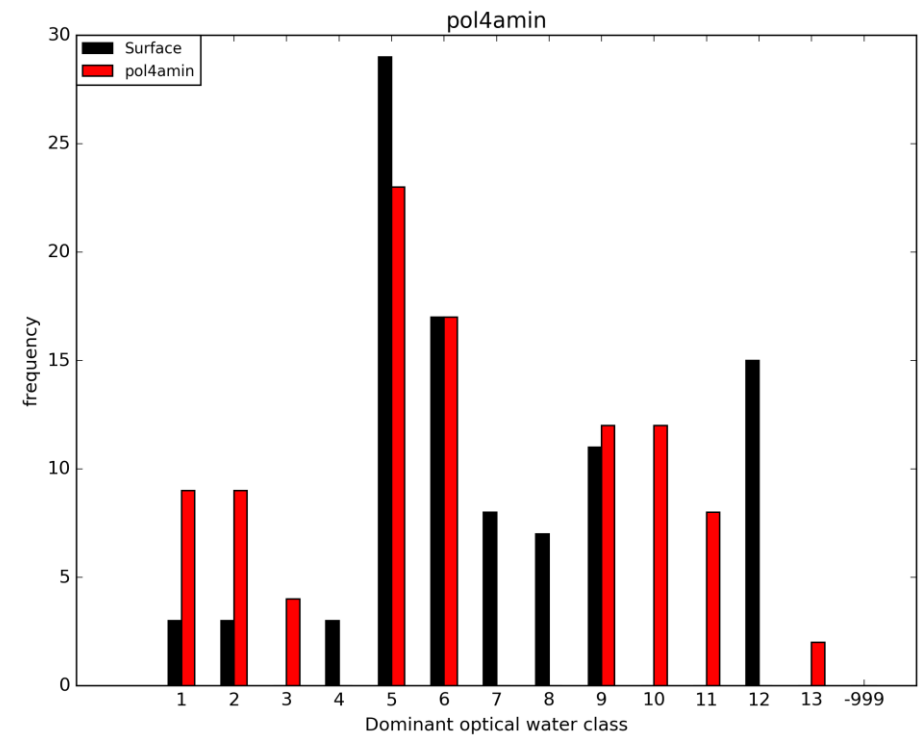
- Use of OWTs framework always improved the retrieval of Chl-a, TSM and  $a_{\text{CDOM}}$  in algorithm blending
- Use of OWTs as class attribute in machine learning always improved the retrieval of Chl-a, TSM and  $a_{\text{CDOM}}$

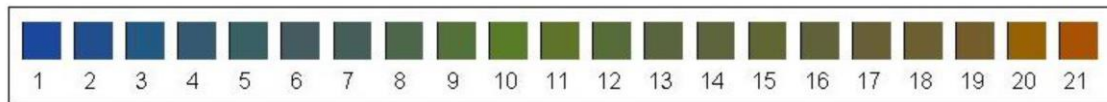
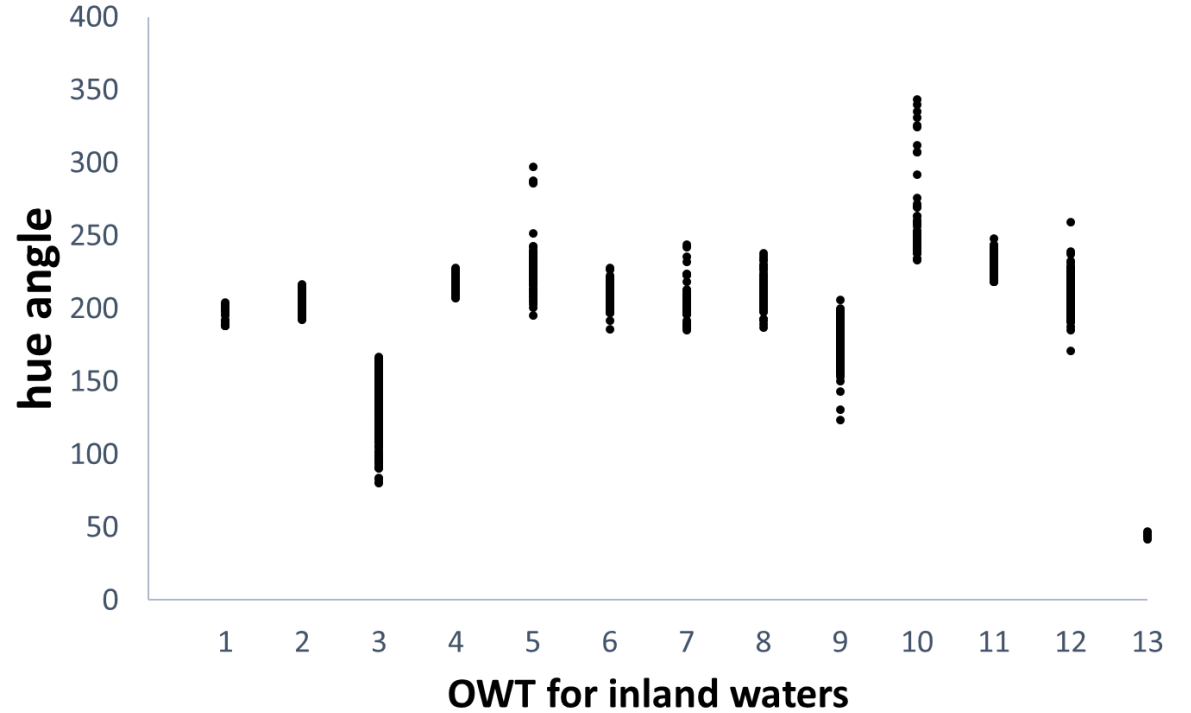
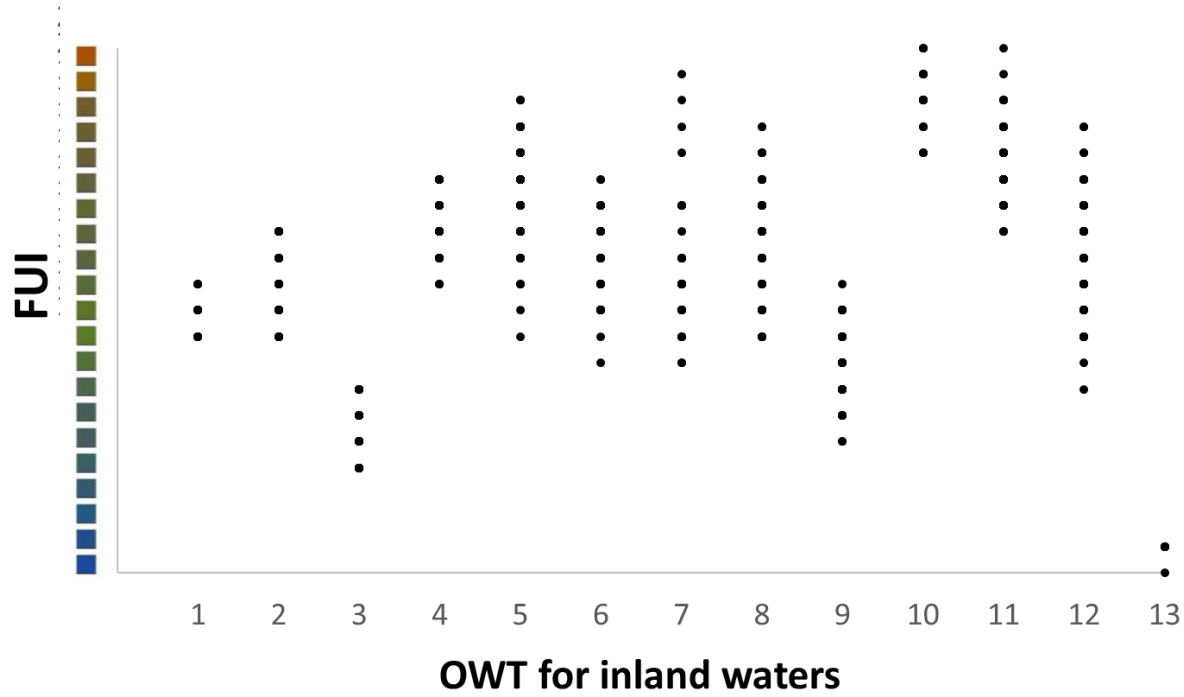


poly4

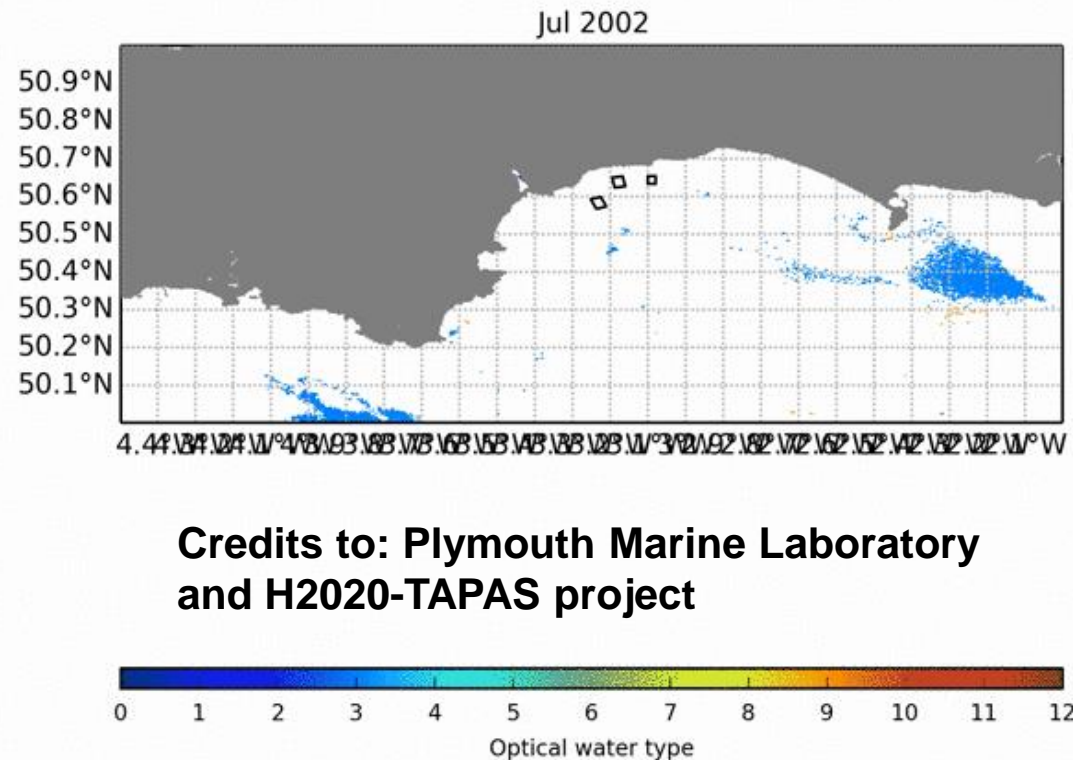


poly4 + mineral correction



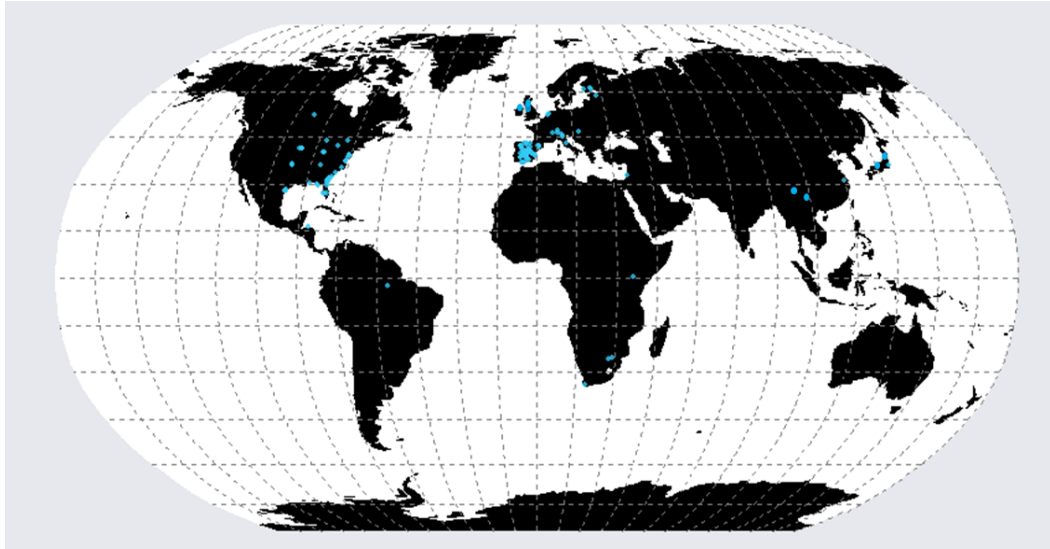


Credits to Shenglei Wang



- NERC KE fellowship  
Captures variability in UK lakes but OWT 3 had to be divided into 2 different types
- H2020 EOMORES  
Adaptation to S2
- H2020 Tapas, H2020 CoastObs, ORSECT  
Extend use to near-shore and transitional waters

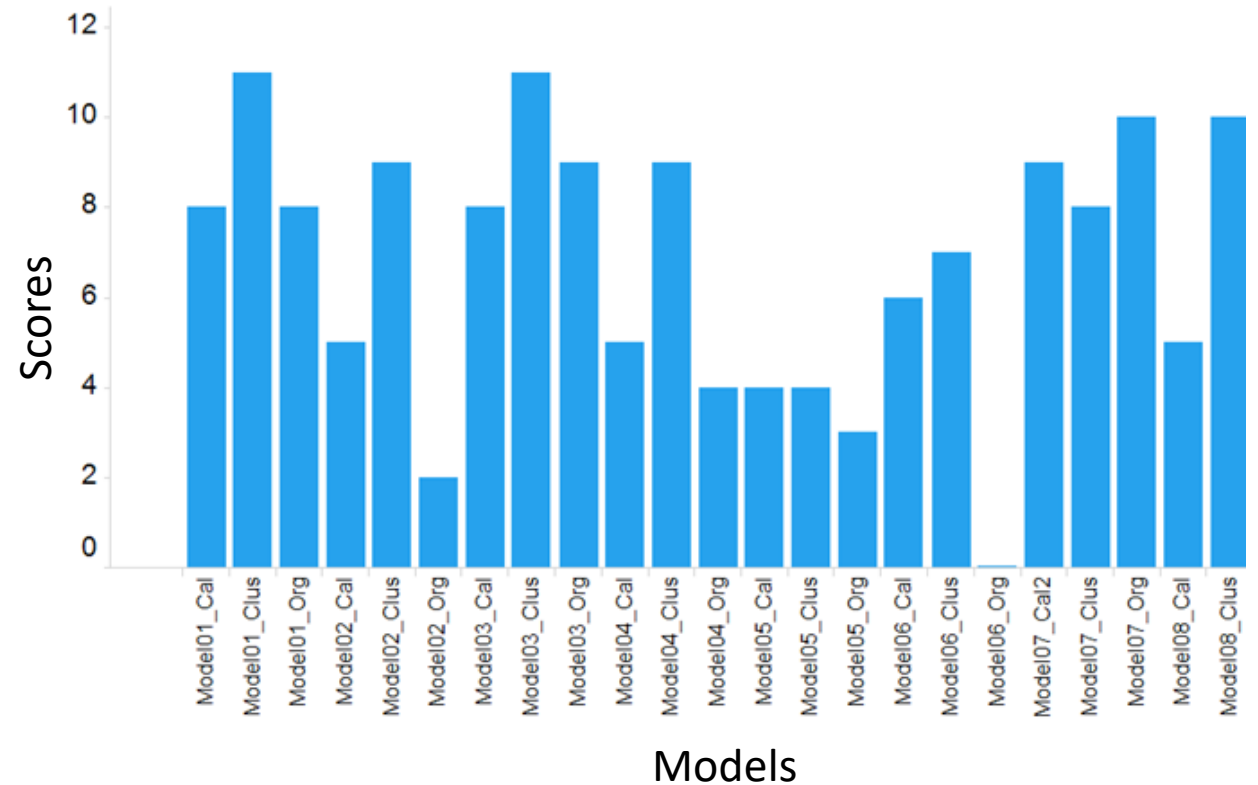




- data from almost 1500 inland systems
- radiometric data ~4000 stations >250 lakes
- at least 40 peer-reviewed papers

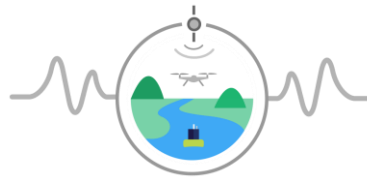
Parameter	Units	Range	Median	Lakes
Chla	mg m <sup>-3</sup>	0.03-13296.70	12.34	208
PC	mg m <sup>-3</sup>	0 – 24677	28.79	60
TSM	mg L <sup>-1</sup>	0.09-2533.30	10.54	81
ISM	mg L <sup>-1</sup>	0.01-359.42	13.35	10
a <sub>CDOM</sub> (442)	m <sup>-1</sup>	0.004-42.467	0.8206	83
a <sub>ph</sub> (442)	m <sup>-1</sup>	0.036-454.976	0.5148	19
a <sub>NAP</sub> (442)	m <sup>-1</sup>	0.004-12.540	1.3875	23

- AC of MERIS era sensors
- benchmarking retrieval algorithms and test their limits
- development and validation of retrieval algorithm
- Simulated datasets
- functional relationships for parameterisation of biogeochemical variables in terms of optical properties
- requirements for remote sensing and assists in the standardisation of methods and protocols



- Northern Hemisphere: May-Sep 80%
- Chla\_SPEC: 72%; no corrections for phaeophytin; a variety of extraction solvents
- Continuing need for high quality in situ matchup data for EO, currently are limited
- biogeochemical >> radiometry > radiances/irradiances
- Chla > TSM >> CDOM > PC > Kd
- backscattering scattering data & AOT
- Clear lakes with varying cdom (PhD USTIR/PML/EAWAG)

**LIMNADES database**





# The GloboLakes dataset

2013 onwards

> 650 sites visited

> 4,000 L filtered

> 1,000 optics casts

> 200,000 above water reflectance measurements

Inland (e.g. 10 UK lakes, Markermeer, Vanern, (Kis-)Balaton, Geneva, Biel, lakes in Danube Delta)

Coastal (e.g. Black Sea, Atlantic)

## *At each site:*

- Chl-*a*, Phycocyanin, chloroplastic pigments,  $a_{\text{CDOM}}(\lambda)$ ,  $a_{\text{NAP}}(\lambda)$ ,  $a_{\text{ph}}(\lambda)$ , TSM, PIM, POM, DOC, POC
- Temperature,  $c_{\text{pd}}(\lambda)$ ,  $a_{\text{pd}}(\lambda)$ ,  $b_{\text{pd}}(\lambda)$ ,  $b_{\text{p}}(\lambda)$
- $E_{d(0^+, \lambda)}$ ,  $E_{d(0^-, \lambda)}$ ,  $E_{d(z, \lambda)}$ ,  $L_{u(0^+, \lambda)}$ ,  $L_{u(0^-, \lambda)}$ ,  $L_{u(z, \lambda)}$ ,  $L_{\text{sky}(0^+, \lambda)}$
- AOT

## *Occasionally:*

- Primary production, fractionated Chl-*a*, fractionated IOPs, particle size, particle composition, taxonomy, CDOM fluorescence Em/Ex
- Field/Lab intercomparison of Trios RAMSES, Satlantic HyperSAS, WISP, ASD



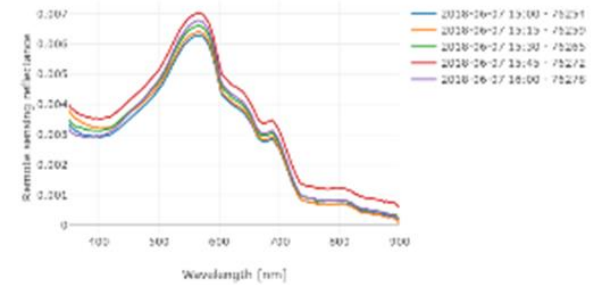
Fixed position WISP installed at CEH buoy



CIMEL sunphotometer at Loch Leven



WISPstation data from 2018-06-07T15:00 to 2018-06-07T20:00



# Thank you

Vagelis Spyrakos  
Lecturer in Earth observation  
University of Stirling

e [evangelos.spyrakos@stir.ac.uk](mailto:evangelos.spyrakos@stir.ac.uk)

[www.globolakes.ac.uk](http://www.globolakes.ac.uk)



@globolakes

This research was funded by the Natural Environment Research Council (NE/E009328)