Exploitation of SENTINEL-2 time series for monitoring ecological quality parameters of french lakes and reservoirs (TELQUEL project)

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TELQUEL project (2015 – 2017) : SENTINEL-2 time series for monitoring ecological quality parameters of French lakes and reservoirs

Presentation of objectives and first results

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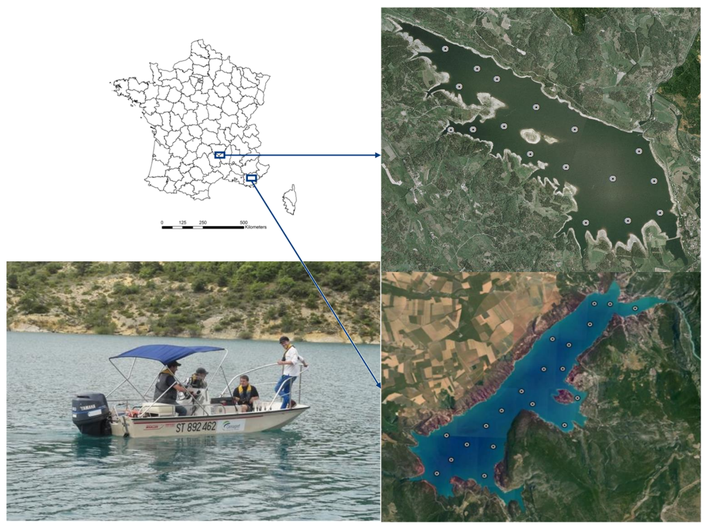
OBJECTIVES

The main objective of the TELQUEL project is to provide quantitative observations to monitor the ecological state of the French lakes.
In this direction, MSI/Sentinel-2 and OLI/Landsat 8 data are exploited to

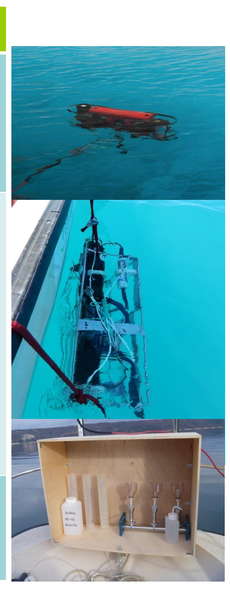
(i) identify/develop a specific atmospheric correction algorithm over lake areas;
(ii) establish bio-optical relationships between the water-leaving radiance and the concentration of the biogeochemical parameters;
(iii) provide bio-optical algorithms to retrieve water transparency and water constituent concentrations (Chl-a, CDOM and TSM).
(iv) use the retrieved bio-optical properties and matter concentrations for enhancing the lake water quality evaluation and biogeochemical models.

STUDY SITES & FIELD DATA



- 8 field campaigns have been planned for collecting **apparent and inherent optical properties** (AOP, IOP), **transparency and biogeochemical concentrations** (see table below for details).
- 1 campaign per season over 2 years.
- 4 campaigns have already been done.
- a comprehensive database has been generated for an easy access to the collected data.

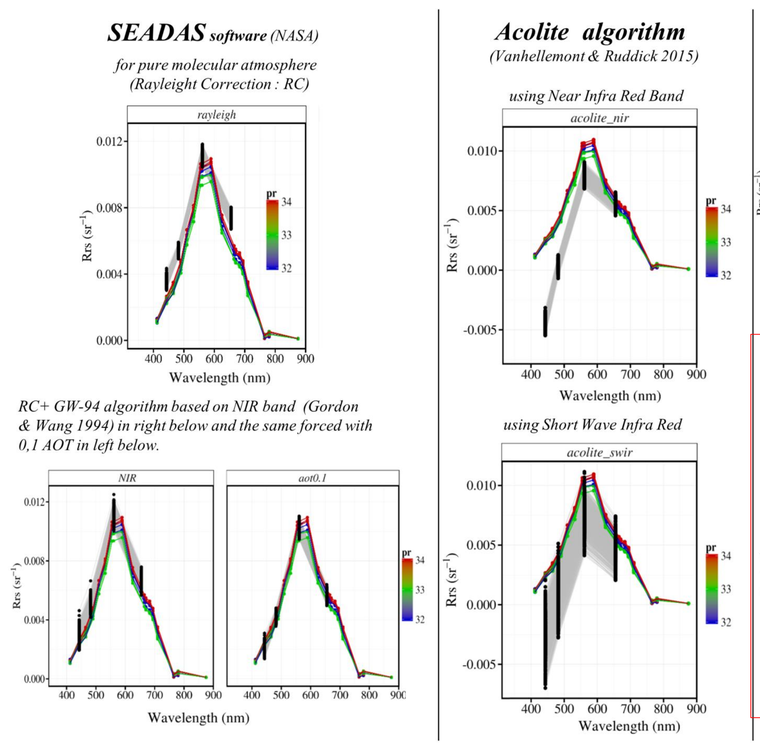
Data Type	Measures	Materials
AOPs	L_u : upwelling radiance E_d : downwelling irradiance E_0 : solar irradiance	C-OPS (Wetlabs Ins.)
IOPs	**c** : attenuation coefficient **a** : absorption coefficient **acdom** : cdom absorption coefficient **bbp** : back-scattering coefficient	AC-S & ECO BB3 (Wetlabs Ins.)
	aphyto : phytoplancton aborption coefficient	Sprectrometer with integrating sphere (in the laboratory)
Biochemical concentrations	TSS : Total Suspended Solids SOM : Suspended Organic Matter Chl-A : Chlorophylle-a concentrations	Filtration rampers Concentrations measurements in the laboratory.

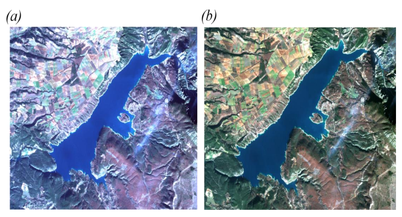


FIRST RESULTS

Atmospheric correction algorithm

Remote sensing reflectance (Rrs) of Landsat-8 image recorded on October, 30 2015 over lake Ste-Croix retrieved from different atmospheric correction algorithms (black points) versus Rrs derived from C-OPS in situ data (in color) at different stations.





Landsat-8 image acquired on Oct., 30 2015 . (a) : TOA reflectance, (b) : Rrs using Rayleigh correction.

Satisfactory results for Rrs from the products routinely provided for land surfaces

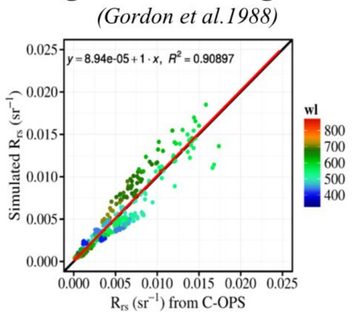
(https://peps.cnes.fr/rocket/#/home)

Aerosol optical thickness (AOT) provided by MACCS

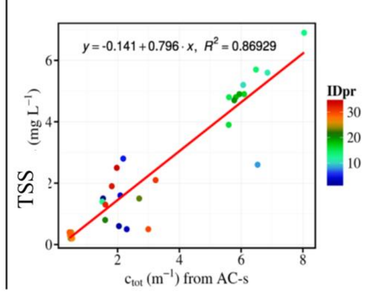
Bio-optical relationships

Several bio-optical relationships were explored using traditional ocean optics algorithms. **Promising correlations are observed** between (i) Rrs derived from C-OPS and simulated from IOPs (see A); (ii) IOPs and total suspended matter (TSS) concentrations (see B); (iii) measured IOPs and IOPs retrieved from C-OPS and Landsat-8 data (see C).

A- Rrs from C-OPS vs. simulated Rrs from IOPs *using Gordon-88 algorithm (Gordon et al.1988)*

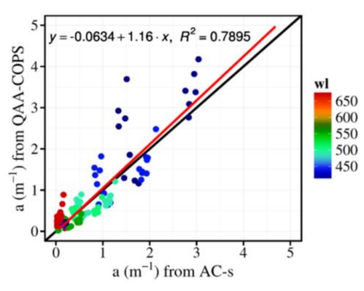


B- IOPs (c) vs. TSS

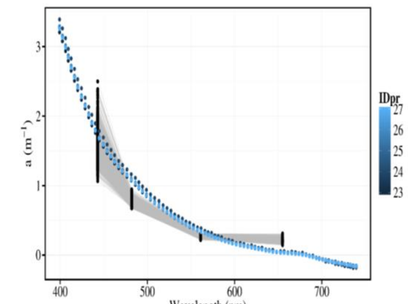


C- IOPs vs. simulated IOPs *using QAA algorithm (Lee et al.2002)*

from C-OPS



from Landsat 8 (30th October 2015)



IN THE FUTURE

1- Exploitation of MACCS algorithm coupled with corrections for both sky (already developed) and sun (ongoing) reflections on water surface.

2- Building specific bio-optical algorithms for OLI and MSI sensors based on Lee et al. 2002 algorithm calibrated from our field data.

3- Testing the biogeochemical products retrieved from Landsat 8 and Sentinel-2 for evaluation and modeling of lake ecological state.

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