

Platform LÉXPLORE

Annual report July 2020 to June 2021



Summary

During the reporting period, we further optimized the exploitation of LÉXPLORE Platform and managed to successfully deal with the technical challenges. This period was still disturbed by the COVID-19 sanitary crisis. Despite the crisis, all the core data could be collected and the different scientific projects successfully acquired data in parallel. On 7th November 2020, the first results on LÉXPLORE were presented within the Swiss Geoscience Meeting. The data flow within the DATALAKES Platform is now operational, and most of the core dataset is available in real time. The communication around LÉXPLORE was productive with several videos in the media.

1. Administration

The LÉXPLORE Steering Committee (SC) held 4 meetings on the following dates: 16th July 2020, 27th October 2020, 9th March 2021, and 29th June 2021. During those meetings, the SC discussed the technical and scientific organization, and they proposed strategies to promote the science and the international visibility of LÉXPLORE. In addition, the SC validated 9 project applications, and organized a session dedicated to LÉXPLORE within the Swiss Geoscience Meeting on 7th November 2020. The SC also accepted to add conditions on data sharing and publications that project leaders must sign during

the validation process. In 2021, the exploitation costs are still estimated to ~60'000 CHF. The SC has agreed to continue with the institutional rates defined in 2020.

As Prof. Johnny Wüest will retire end August 2021, the SC warmly thank him for his vision and his engagements for LÉXPLORE. In December 2020, the EPFL decided to extend the Limnology Center for the duration of the LÉXPLORE Platform, ensuring the positions from Natacha Pasche and Sébastien Lavanchy. Tom Battin will be representing EPFL in the SC after August 2021. The EPFL technician, Guillaume Cunillera, was extended at 80%, given his numerous accomplishments and the complementarity with the Chief Technical Officer. The other members of the LÉXPLORE team have remained unchanged.

2. Exploitation

The reported period was disturbed by the COVID-19 sanitary crisis. We had to adapt the safety measures on 19th September (8 persons max), 5th November (5 persons max), 31st December (5 persons max), 1st February (5 persons), 1st March (8 persons), 21th April (10 persons) and 4th June (16 persons max). We implemented the safety recommendations given by the OFSP. This crisis generated some delays and prevented the development of international collaborations. However, we managed to maintain the operations as much as possible.

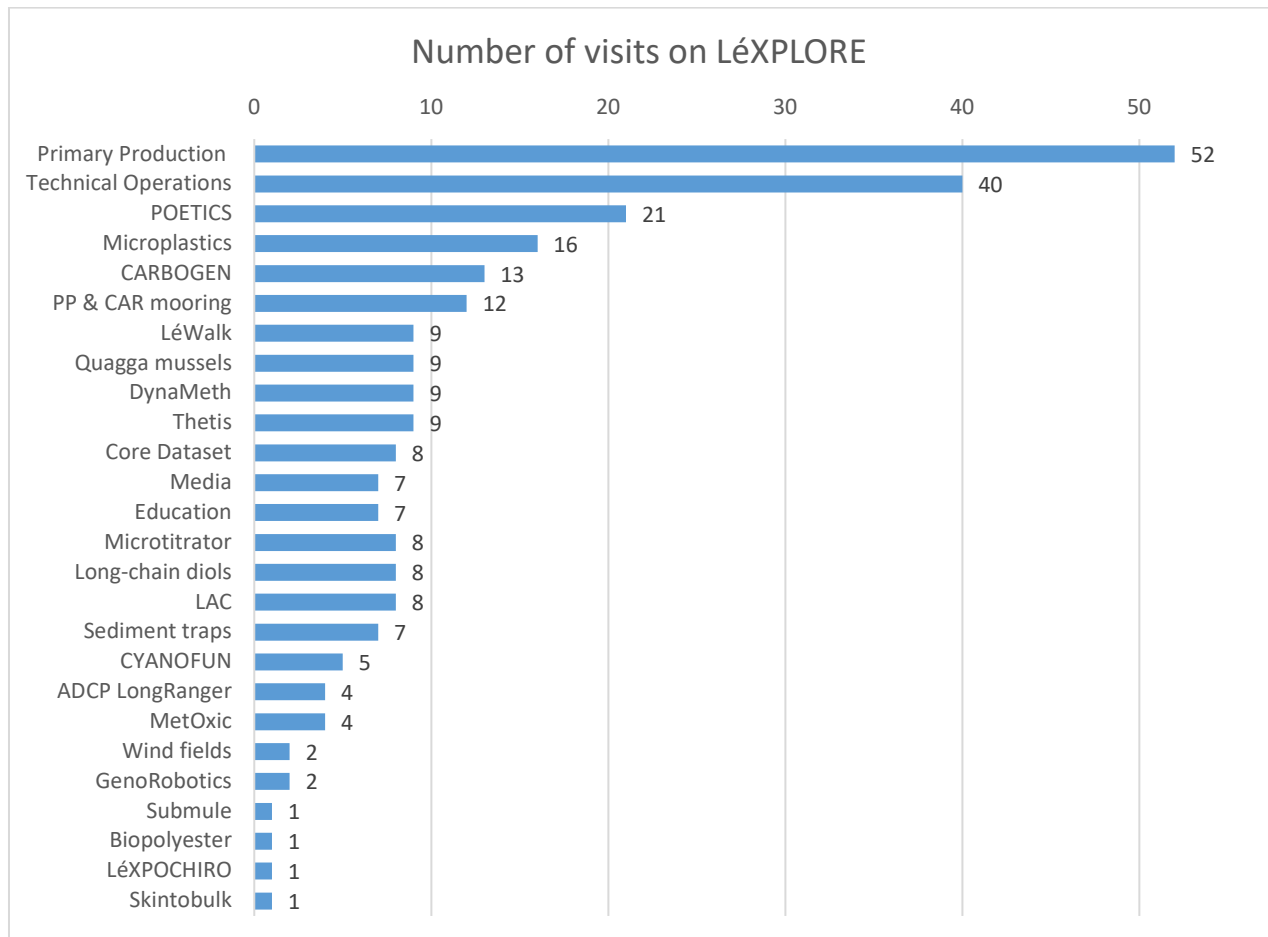
The Limnology Center managed the day-to-day exploitation of LÉXPLORE that included: to organize major maintenance works (black waters, generator), to process the project applications, to coordinate the scientific projects, to respond to special requests, and to manage the finances.

For the data management, DATALAKES (www.datalakes-eawag.ch) was further developed with additional datasets. Currently, seven datasets taken from LÉXPLORE are available in real time (<https://lexplore.info/available-dataset/>): vertical temperature array, meteorological station, near-surface and deep current velocities (since July 2020), CTD and oxygen profiles from Thetis, and multi-parameters profiles with Idronaut. In addition, other datasets include the deep manual CTD profiles as well as oxygen, temperature and PAR data from the Primary Production mooring. In addition, data at level 2 include heat fluxes and parameters interpolated with depth and time grids.

The Technical Pool worked intensively to safely install the equipment for the scientific projects, to improve the LÉXPLORE infrastructure and to maintain LÉXPLORE. All the broken large buoys (and some lamps) from the protection perimeter were replaced, and the surface lines delineated with small buoys were removed. Due to limited solar radiations this winter, the batteries were completely empty on 5th January, and had to be recharged with the generator. A health and safety plan was developed together with the [DSPS](#) from EPFL. The organisation of the Technical Pool was further improved and consolidated. Since 2021, the external technicians regularly come to EPFL to advance specific tasks with the EPFL team. Concerning the core dataset, a new OxyPAR mooring was set up on 30th March 2021. This mooring has two sets of oxygen and PAR sensors, to avoid any data gaps. The technicians from CARTEL maintain this mooring and check the sensors against a reference. After the installation of the Idronaut profiler in June 2020, some adaptations allow to take regular profiles every 3 hours

since January 2021. As some sensors were broken, a new temperature chain purchased through ENAC call for equipment was installed on 14th April 2021.

The logbook continuously registered the staff presence and the use of LÉXPLORE per project. From 1st July 2020 to 30th June 2021, the platform was used at 268 occasions during 150 days, representing 59% of the total working days. During 72 days, the projects worked in parallel (from 2 up to 7 teams per day). The number of days per projects were distributed as shown in the graph.



3. Scientific Projects

By end June 2021, we had a total of 29 projects: 15 running projects, 5 upcoming projects and 9 completed projects. In addition, two projects are in the validation phase and the project Winterblitz was cancelled. This year, we compiled a scientific report describing the results from all the projects. The list below presents the project title with their collaborators.

Current running projects:

1. Wüest Alfred, Fernández Castro Bieito, Ulloa Hugo, Minaudo Camille, Lavanchy Sébastien, Krishna Shubham, Piccolroaz Sebastiano, Chmiel Hannah: **Primary production under oligotrophication in lakes**
2. Perga Marie-Elodie, Perolo Pascal, Lambert Thibault, and Escoffier Nicolas: **CARBOGEN - carbon cycling in Lake Geneva**

3. Bouffard Damien, Fotis Georgatos, Bouillet Eric, Perez Cruz Fernando, Minaudo Camille, Lavanchy Sébastien, Sukys Jonas, Safin Artur, Tran-Khac Viet, Runnalls James: **Datalakes - heterogeneous data platform for operational modeling and forecasting of Swiss lakes**
4. Odermatt Daniel, Runnalls James: **Whitening detection and optical characterization (W-DOC)**
5. Breider Florian, Vernez Karine, Coudret Sylvain, Loizeau Jean-Luc: **Deposition and accumulation of microplastics in lake sediments (Microsed)**
6. Fernández Castro Bieito, Gil Coto Miguel, Lavanchy Sébastien, Bouffard Damien: **LéWalk - autonomous turbulence profiling**
7. Bahr Alexander, Schill Felix, Lavanchy Sébastien, Cunillera Guillaume: **SUBMULE – easy access to submerged data**
8. Gallorini Andrea, Arpagaus Philippe, Loizeau Jean-Luc: **MetOxiC - methylmercury in Oxic water Column**
9. Jézéquel Didier, Perga Marie-Elodie, Escoffier Nicolas: **DynaMeth - dynamics and origin of methane in the water column of Lake Geneva.**
10. Ibelings Bastiaan, Thomas Mridul, Fillion Roxane, Mesman Jorrit, Devanthery Matthieu, de Loes Sebastien, Müller Beat: **POETICS - PlanktOn vErTICal Structure**
11. Carratalà Anna, Chmiel Hannah, Joost Stéphane, Janssen Elisabeth, Kohn Tamar: **Unravelling the diversity, functioning and toxin production of cyanobacteria populations in lake Geneva (CYANOFUN)**
12. Ferrari Benoît, Beauvais Rébecca, Casado-Martinez Carmen, Thiemann Christina : **Effects of the quality of lake suspended matter on growth, emergence and molecular endpoints in Chironomus riparius (LéXPOCHIRO)**
13. Guillard Jean, Tran-Khac Viet, Goulon Chloé: **LéXfish - monitoring fish presence below LéXPLORE**
14. Bouffard Damien, Fernández Castro Bieito, Piccolroaz Sebastiano, Perolo Pascal, Perga Marie-Elodie, Wüest Alfred: **Skin2Bulk - investigating the surface boundary layer**
15. Hedou Maxime, Luterbacher Jeremy, Manker Lorenz: **Biodegradability assessment of PAX, a sustainable bio-polyester developed at EPFL**

Upcoming projects:

1. Schirmer Kristin, Maner Jenny, Renaud Philippe: **Rainbow_{flow} chip_{online} - fishcell biosensor for automated water quality testing**
2. Ibelings Bastiaan, Thomas Mridul, Suarez Ena, Fillion Roxane: **Plankton in Lake Geneva : you can't have it both ways**
3. Bellouard Yves, Arabadzhiev Ivo, Ibelings Bastiaan, Pomati Francesco, Ribi Sebastiano, Tardif Manon: **PhytoWaveTaxa - Geneva Lake microalgae monitoring**
4. Bernier-Latmani Rizlan, Maerkl Sebastian, Adam Nicolas, Selz Jonathan: **GenoRobotics – CoWaS (continuous water sampling)**
5. Piccolroaz Sebastiano, Cunillera Guillaume, Chmiel Hannah, Perolo Pascal, Lavanchy Sébastien: **caGAStrophic: designing a low-cost, automated, floating chamber for gas flux measurements at the air-water interface of water bodies**

Completed projects:

1. Joost Stéphane, Carratalà Anna, Vajana Elia, Guillaume Annie, Martinoli Alcherio, Quraishi Anwar, Kohn Tamar: **Local adaptation of bacteria communities to environmental conditions (LAC)**
2. Barry Andrew, Foroughan Mehrshad, Porté-Agel Fernando: **Spatio-temporal analysis of wind field characteristics over Lake Geneva**

3. Müller Beat, Kathriner Patrick: **In-situ pursuit of whitening events applying on-site analysis and profiling**
4. Bouffard Damien, Ulloa Hugo, Ramon Casanas Cintia, Doda Tomy: **Buoyancy driven nearshore flows in lakes (Thermal Syphon)**
5. Vennemann Torsten, Cotte Gabriel: **Mixing of Rhône River in Lake Geneva**
6. Piccolroaz Sebastiano, Troy Cary, Fernández Castro Bieito, Chmiel Hannah, Camille Minaudo, Pascal Perolo, Wüest Alfred: **Surface turbulence and CO₂ lake exchange experiment (CO2LEX)**
7. Spaak Piet, Dennis Stuart, Haltiner Linda: **Life in the deep: colonisation by Dreissena along a depth gradient**
8. Lattaud Julie: **Variability in stable isotopic composition of long-chain diols as a proxy for environmental conditions in lakes**
9. Wynn Htet Kyi, Barry Andrew, Piton Violaine, Reiss Rafael: **Test measurements with an ADCP Long Ranger 150 KHz**

During this period, two 24h campaigns were organized on 14-15th July 2020 for the CARBOGEN project, and on 23-24th July 2020 on 13-14th October 2020 for the Primary Production.

4. Communication

The following communication and outreach activities took place during the reported period:

- 9th and 16th June 2021: Filming with children for the EPFL Science Outreach Department
- 19th May 2021: RTS 36.9°: [Microplastics – quels dangers pour la santé?](#), 24 min
- 22nd April 2021: RTS on va vers le beau, [Rhône, Léman et écologie \(4/5\) – Un labo flottant pour comprendre les processus climatiques](#), 30 min on radio
- 1st April 2021: ZDF, plan B: [Wärme dank Hanf und Hightech, Neue Wege zur Energiewende](#)
- 4th April 2021: RTS Téléjournal 19h30, [La pollution des eaux par les résidus de pneus affecte aussi les poissons](#)
- 25th March 2021: SRF Einstein, Introduction to [Tauchen im Mittelmeer: Leben und forschen auf dem Meeresgrund | 2](#)
- 18th March 2021: SRF Einstein, Introduction to [Tauchen im Mittelmeer: Leben und forschen auf dem Meeresgrund | 1](#)
- 16th March 2021: Filming with Geneva Water Hub for the [World Water Day 2021: Valuing Water for Peace](#)
- 22nd October 2020, Damien Bouffard presented **Datalakes, a data platform for lakes** at GLEON 21.5 Virtual Meeting, as a keynote presentation.
- 7th October 2020: Public presentation of LÉXPLORE for the Société Vaudoise des Sciences Naturelles, in Lausanne
- The website www.lexplore.info has been updated with the new information, new projects and the first scientific publications.
- A 2 min trailer on LÉXPLORE was edited by ENAC

For the Swiss Geoscience Meeting held online on 6 and 7th November 2020, the first session on [Limnology in Switzerland and the new LÉXPLORE infrastructure](#) was organized together with the Swiss

Society for Hydrology and Limnology. In total, 8 of the 14 talks and 8 of the 19 posters presented research on LÉXPLORE.

In addition, the following educational activities took place:

- 14 to 16th June: field camp for UNIL Master students
- 10th June: training on microstructure
- 11th May and 7th June: visit of EPFL students for the limnology course
- 3rd May 2021: visit of UNIL students

5. Scientific Publications

Wüest A., D. Bouffard, J. Guillard, B.W. Ibelings, S. Lavanchy, M-E. Perga, N. Pasche (2021) **LÉXPLORE – a floating laboratory on Lake Geneva offering unique lake research opportunities**. WIREs Water 8(5), e1544; [doi:10.1002/wat2.1544](https://doi.org/10.1002/wat2.1544) or [PDF](#)

Fernández Castro B., H. E. Chmiel, C. Minaudo, S. Krishna, P. Perolo, S Rasconi and A. Wüest (2021). **Primary and net ecosystem production in a large lake diagnosed from high-resolution oxygen measurements**. Water Resources Research 57(5): e2020WR029283. [doi:10.1029/2020WR029283](https://doi.org/10.1029/2020WR029283).

Perolo, P., Fernández Castro, B., Escoffier, N., Lambert, T., Bouffard, D., and Perga, M.-E.: (2021). **Accounting for surface waves improves gas flux estimation at high wind speed in a large lake**, *Earth Syst. Dynam. Discuss.* [preprint] doi.org/10.5194/esd-2021-30.

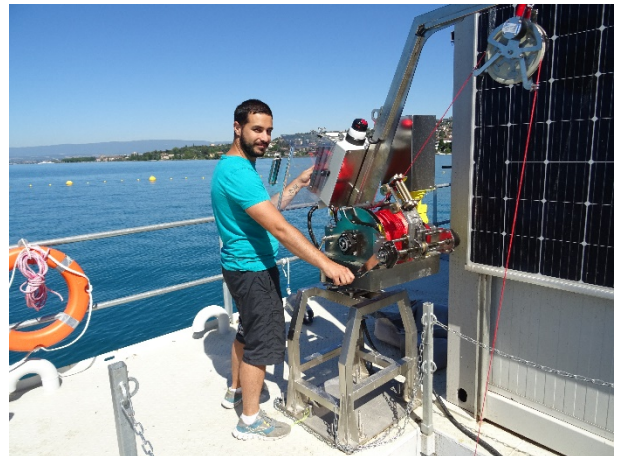
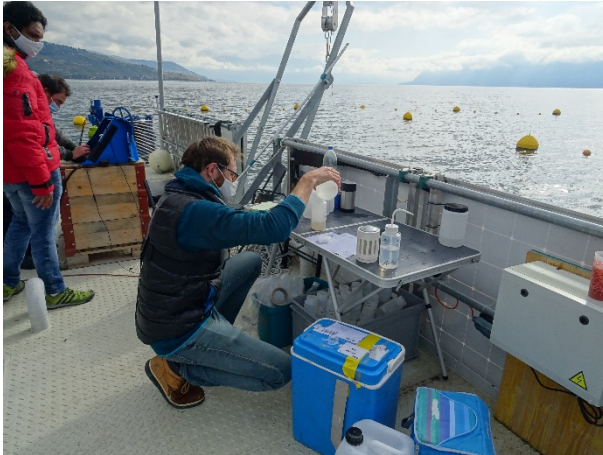
Cotte G. and Vennemann T. (2020): **Processes driving nutrient dispersion in Lake Geneva during the stratification period** (study using the LÉXPLORE platform). Chapter from PhD thesis at UNIL.

6. Way Forward

The next steps for LÉXPLORE are the following:

- Ensure an optimal exploitation of LÉXPLORE and continue to improve the infrastructure.
- Continue to automatize the data pipeline within the DATALAKES Platform for the core dataset, and explore the possibilities to upload the data collected for the different projects.
- Present the results on LÉXPLORE at the Swiss Geoscience Meeting on 19th and 20st November 2021, and promote interdisciplinary exchanges during a LÉXPLORE workshop in early 2022.
- Promote international scientific collaborations by presenting LÉXPLORE at international conferences and congresses.
- Provide public presentations when requested, and organize annual visits for the public, when the situation is back to normality after the COVID-19 sanitary crisis.
- Develop the possibilities to use LÉXPLORE for summer schools and other educational purposes
- Promote collaborative projects around LÉXPLORE.

- Engage navigators for a participatory science project in collaboration with the Association pour la Sauvegarde du Léman (ASL) in the next years.
- Prepare an exhibition on LÉXPLORE for the 100 years of SIL in Berlin in 2022, as well as for the INTECOL meeting hosted at UniGe.



Images from scientists at work on LÉXPLORE Platform