RESEARCH CENTERS, **ENT-R**
Limnology Center, **LIMNC**

LIMNOLOGY CENTER

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Experimental Platform

Call for LéXPLORE Projects

Deadline: 31st May 2019

1. About LéXPLORE

From mid-February 2019 until December 2026, the LéXPLORE Platform (www.lexplore.ch) will be anchored on Lake Léman near Pully at a depth of 110 m and at 570 m from the shoreline. The pontoon with a surface of 10 m by 10 m is equipped with electricity and a closed cabin (with toilet). Around the pontoon, a surface of ~15'000 m^2 is protected from drifting nets by a circle of buoys (70 m radius), and allows to deploy submersible instruments. This infrastructure provides excellent working conditions, also to test new technologies in-situ.

The goal of LéXPLORE is to acquire simultaneously physical, geochemical and biological measurements at high temporal and vertical resolutions, days and nights in any weather conditions. This will allow investigating key processes in stratified aquatic systems in unprecedented detail and resolution. To bring many disciplines together, LéXPLORE is a partnership between EPFL, Universities of Lausanne and Geneva, and Eawag (and Thonon-Les-Bain in admission phase). In addition, LéXPLORE is open to any international researcher that would like to collaborate and benefit from the infrastructure / data.

The following scientific instruments are currently planned to be installed on LéXPLORE (by May 2019):

- A meteostation with temperature, pressure, solar radiation, rain, wind speed and direction
- Continuous measurements of temperature, oxygen, photosynthetic active radiation (PAR) at different fixed depths
- Sediment traps to collect sedimenting particles
- A Thetis vertical profiler for detailed optical properties and usual parameters (depth, oxygen, conductivity, PAR, temperature) of the entire water column. It will also be used to calibrate remote sensing.
- A Cytobuoy to determine phytoplankton functional groups in the productive zone
- Idronaut sonde to take vertical profiles of depth, oxygen, Chlorophyll a, Phycoerythrin, Phycocyanin, Redox, pH, temperature and conductivity in the productive zone
- Surface waves with TD waves from RDI
- Inertial sensor to record the position of the pontoon
- Current velocities throughout the water column with two Acoustic Doppler Current Profilers (ADCP)

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2. Call for Projects - conditions

With this ***Call for Projects***, we encourage EPFL research groups to apply for seed money in the range of 20 to 45 kCHF on research questions related to the LéXPLORE Platform.

To be eligible, the principal investigator has to be based at EPFL.

Even if LéXPLORE is strongly adapted for aquatic sciences, we would like to see diversification to studying the lake-water interface, atmospheric and climatic sciences, sensors development and big environmental data, and others…The current ongoing projects are presented in appendix 1.

3. Submission

For the proposal, please fill in the application form containing (< 4 pages in total):

1. Description of the applicant (< 1/3 page)
2. Research question and work plan (< 1.5 page)
3. Technical feasibility (< 1/2 page)
4. Timeline
5. Budget (20 to 45 kCHF)
6. Additional information.

4. Evaluation

The proposal will be evaluated by the member of the Limnology Center by the following evaluation criteria:

- Scientific merit
- Technological innovation
- Feasibility
- Fit to the overall LéXPLORE projects (see appendix).

The evaluation results will be transmitted to applicants latest by mid-June 2019. Successful applicants will receive a grant agreement from Limnology Center and the fund will be paid before the end of 2019. Before any payment, LéXPLORE application form (appendix 2) will have to be filled-in and approved by the LéXPLORE Steering Committee. The Limnology Center will cover your participation fees to LéXPLORE. Be aware, that the Limnology Center can support only a small number of projects, independent of the quality of the proposals.

For any additional information or for the submission, please contact or send to natacha.tofield-pasche@epfl.ch.

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Appendix 1: Limnology Centre - Call for LéXPLORE Projects

Current ongoing projects

CARBOGEN – is led by the PI Marie Perga (UniL) in collaboration with Damien Bouffard (Eawag). A heuristic budget for Lake Geneva shows that the carbon outputs are about twice as much as the carbon inputs. Especially the CO_2 outgassing reaches surprisingly high values. The overall goal of the *CARBOGEN* project is to achieve the necessary understanding of the involved processes on a lake-scale level, which allow to close the budget. This includes (1) quantification of the embedded physical and biogeochemical processes and estimates of their relative contributions, (ii) that those key processes of the lake carbon cycling are adequate resolved an scaled up to lake scale, and (3) human and climate disturbances are considered for the interpretation of the results, keeping in mind that the environmental forces acting on the lake carbon cycle are poorly understood. Because Lake Geneva benefits from an exceptional wealth of data, modelling tools and high-frequency monitoring structures, it has been chosen as a worldwide model system. The motive of *CARBOGEN* is therefore to address the carbon cycle of Lake Geneva through two objectives. The first one is to close the lake carbon budget by refining flux estimates accounting for the large temporal and spatial variability of the carbon processes and by identifying and quantifying the missing sources. The second aims at untying the mechanisms behind the long-term C variability, and therefore to quantify the human contribution to such changes. For that purpose, CARBOGEN relies on an integrated, process oriented perspective on the carbon cycle of Lake Geneva, combining field surveys, high-frequency monitoring, bioassays and modelling.

Primary Production Under Reoligotrophication – is led by the PI Alfred Wüest (EPFL) in collaboration with postdocs in APHYS group and partners in the **Primary Production consortium** in the Limnology Center. Currently, research groups from EPFL, UniL, UniGE, SUPSI, Eawag, University of Constance and INRA (Thonon-les-Bains) collaborate on various projects related to primary production in large lakes. The overall goal of the project is to explain why the primary production in medium to large lakes has decrease only little in the last decades despite the massive decrease the phosphorus (~80% in case of Lake Geneva). The specific goals of the project are to improve the quantification of primary production (PP) in stratified natural waters and to disentangle the interplay of biotic and abiotic drivers. The objectives are to develop, test and apply a model-based approach using statistical inference for process identification and parameter estimation of the simultaneous application of the diel oxygen (DO) and carbon dioxide (CO_2) technique, for (i) quantifying recent PP and (ii) reconstructing PP during the period of oligotrophication of several large lakes in Switzerland over past decades. The three main activities will included: (a) High-resolution acquisition of CO_2 and DO vertical profiles, (b) turbulence measurements and (c) modelling of primary production. From the results, we expect a much more reliable parameterization of PP and of the reconstruction of PP over the past decades for various well-monitored lakes.

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Revisiting phytoplankton paradox - is led by Bastiaan Ibelings (UniGE). Typically we sample lakes at low frequency, once, perhaps twice per month. Phytoplankton are microbes with short generation times, which fast development requires daily sampling. At present, we hardly have any idea about the true dynamics in lake plankton communities, and this limits our understanding. Scientifically our key question are: what drives plankton community assembly? What determines which taxa or functional traits are present in a lake? Is this simply filtering by abiotic environmental conditions, like temperature and phosphorous or do biological interactions like competition for limiting resources, facilitation, predation and parasitism predominate? All these processes arguably leave recognizable traces in plankton community dynamics. With LéXPLORE, we use clever machines and analyses to – almost for first time – get a view of plankton dynamics in Lake Geneva. The key instruments are a scanning flowcytometer and image analysis. We operate these as profiling systems to capture important gradients in plankton and their resources with depth. We aim to integrate this with remote sensing to capture lateral gradients. Ultimately, our goal is to be able to perform ecological forecasting, which is hard given the complex, even chaotic nature of phytoplankton. We aim to make use of our high frequency data on environmental variables and plankton dynamics, coupled to machine learning tools to parametrize mechanistic models of phytoplankton growth. Then with a mechanistic understanding of lake plankton combined with models on future environmental change, we hope to arrive at reliable forecasts of plankton in a warmer future. One of the big risk everybody talks about is a worldwide increase in blooms toxic cyanobacteria. Can we predict if this is likely to happen?

HYPOlimnetic THErmal SYphonS (HYPOTHESYS) **-** is led by Damien Bouffard (Eawag). Lakes are often seen as ideal ecosystems with well-defined boundary conditions. However, most studies have focused on vertical fluxes in the pelagic main water body thereby minimizing horizontal inhomogeneity and transport. Horizontal exchanges generally play key roles in all water systems on Earth, with the most important one being the thermohaline oceanic circulation. Such gap in the integration of littoral and pelagic dynamics clearly hampers our ability to properly elucidate lake dynamics and to ultimately understand and model the whole lake ecosystem.

A central yet overlooked mechanism of horizontal transport is the buoyancy-driven nearshore flows (thermal syphons) resulting from nighttime cooling. This process transports littoral water into the pelagic zone either in the weakly stratified epilimnion, or directly into the deep interior. By shifting oxygen, nutrients and carbon from the littoral to the dilute pelagic waters, such lateral fluxes have major biogeochemical implications. This project aims at investigating the role of buoyancy-driven nearshore flows induced by night cooling in a high altitude small wind sheltered lake and a large low land lake. The approach combines extensive in situ observations analyzed with numerical models.

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Appendix 2: Limnology Centre - Call for LéXPLORE Projects

LéXPLORE application form

For your information only, you will need to fill in this form if your project is selected.

1. Name and affiliation of the applicants
2. Name of the project
3. Summary of the proposal (max 15 lines)
4. Duration and timeline of the proposal
5. Technical specifications:

   5.1 Material to be installed on the platform. Specify any technical constrains (need for anchorage, power supply and power consumption…). Sensitive to damage in wave actions? Mechanical issues.

   5.2 Experiments to be conducted on the platform; instruments installed on the platform; installed in moorings in the protected area. Simply drawing of the set-up if helpful.

   5.3 Frequency of visit on the platform and required sensors maintenance routine.

   5.4 Dedicated manpower : Amount of required and allocated technician time.

   5.5 Is there any potential (physical) interference with other instruments / moorings?

   5.6 Do you have your own boat to reach the platform?

   5.7 What are your power requirement?
6. Data

   6.1. What data will be produced (type, units, frequency) and how do you plan to handle and manage data storage and QA/QC?

   6.2 Policy for data sharing. When will the data become publically available (expected end if PhD project?; expected publication?).(to be linked with data policy)

   6.3 Is there a need for additional data that are monitored on the platform
7. Considered collaboration within LéXPLORE
8. Consent to appear on the LéXPLORE website
9. Project funded. Specify the cost of the proposal, whether there is manpower funded and who will conduct the field work. Please note that the use of the Lexplore platform induces a contribution to its maintenance cost (usually 10% of total project cost). Specify how you plan to cover these costs.