The mission of the LIMNOLOGY Center is to provide socially-relevant and multi-disciplinary research to ensure the sustainable use and conservation of natural water resources, both on national and international levels.

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LIMNOLOGY Center

Ecole Polytechnique Fédérale de Lausanne

EDITORIAL

The third year of the Limnology Center (2016) was packed with fieldwork and progress in the preparation of the LéXPLORE platform on Leman.

The second winter expedition to Lake Onego brought 40 scientists from EPFL, UniGe, Eawag, INRA-Thonon and the Observatoire Midi-Pyrenees to Petrozavodsk. This time, also a drone and an AUV were used for hyperspectral images of lake ice structures and under-ice high-resolution transects, respectively. In June, phytoplankton and carbon dioxide were investigated along two transects through the thermal bar. Having achieved the first peer-reviewed publication, we now plan to publish an entire special issue on Lake Onego. This future publication and the planning of the 2017 fieldwork were the focus of a two days retreat in beautiful Lavaux above Léman in November. We appreciated that seven scientists from Petrozavodsk did not shy away from the long journey to EPFL.

In an exploratory expedition in September, we have been searching for meromictic lakes containing ancient deep-water on the west coast of British Columbia. These lakes were formed after the last glaciation, when fjords were cut off from the ocean due to isostatic rebound. Using a hydroplane, we visited 12 lakes and found indeed three new ones with these very specific characteristics.

Besides the scientific work, we can look back to two great additional achievements in 2016: First of all, in October, Hannah Chmiel joined the Limnology Center as a post-doctoral researcher to partly replace the 50% departure of Natacha Pasche to the Polar Center. Welcome in Lausanne! The second good news is that four core partners – UniGE, UniL and Eawag besides EPFL – will contribute to the build-up of the LéXPLORE platform on Leman. We expect the finalization of the construction work in 2017, and plan to start fieldwork already this year.

We warmly thank the researchers, the support personnel and the sponsors for this encouraging constructive Russian-Swiss collaboration and the start of the LéXPLORE platform.

Alfred Wüest, Director LIMNOLOGY Center

View on Vancouver Island Canada from hydroplane

RESEARCH PROJECT: LIFE UNDER ICE

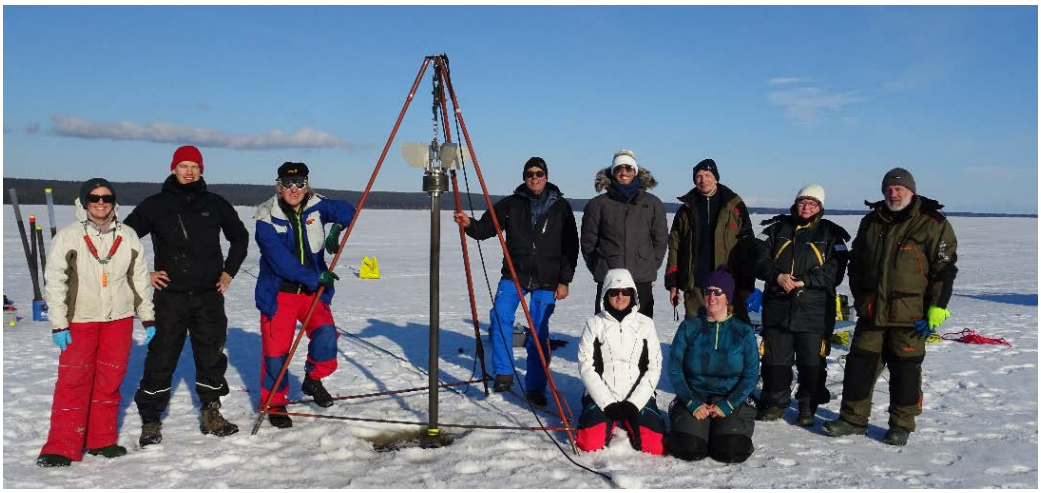
LAKE ONEGO

FIELD CAMPAIGN MARCH 2016

From 9th to 25th March 2016, 40 scientists from 7 subprojects took part in the fourth field campaign on Lake Onego. The safe ice conditions allowed to investigate processes not only at the ice camp, but also along a transect from River Shuya to the open lake. For remote sensing, hyperspectral images of the ice cover were collected with a drone, along satellite tracks, and calibrated in-situ.

The ice camp on Lake Onego with the hovercraft

Compared to 2015, the ice was less transparent and the solar radiation was restricted by clouds, which led to restricted convective mixing. Phytoplankton and zooplankton were less abundant, while the higher CO_2 concentrations showed high spatial and temporal variations. Sediment cores and their bacterial abundance were investigated along the river-open lake gradient. The automated underwater vehicle with multi-parameter sensors was successfully deployed under the ice.



Sediment group

RESEARCH PROJECT: LIFE UNDER ICE

LAKE ONEGO

FIELD CAMPAIGN JUNE 2016

The fifth campaign, from 30th May to 11th June, evaluated the spring conditions of Lake Onego. Two transects from the shore to the open lake were investigated to localize the thermal bar. The near-shore areas reached 18°C while the open lake was still at 6°C, showing a gradient in phytoplankton and CO_2 concentrations.

Measuring along a transect on ECOLOG vessel in June 2016

RETREAT NOVEMBER 2016

On 16th and 17th November, Western and Russian scientists worked together on the results from the Life under Ice project. We also agreed on a strategy for publications in a special issue. A smaller group planned the next two campaigns in 2017.

Participants of the retreat 2016

We would like to warmly thank our sponsors:

elemo exploration des eaux lémaniques

FERRING PHARMACEUTICALS

and coordination:

Consulat honoraire de la Fédération de Russie à Lausanne

RESEARCH PROJECT:

Meromictic lakes in British Columbia Canada

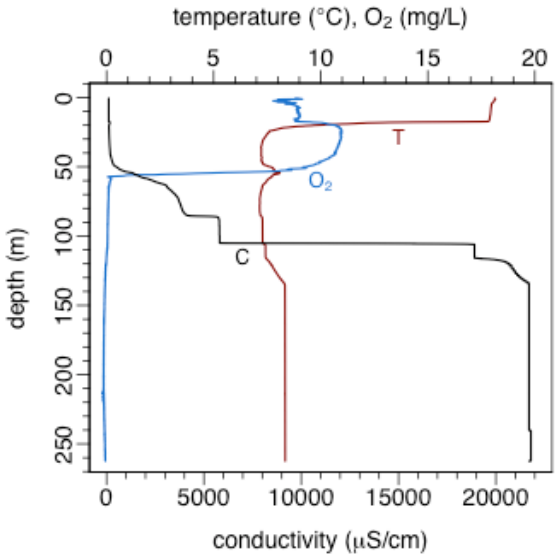
The Pacific Coast of British Columbia in Canada has some unusual lakes containing very old seawater at depth. These lakes were formed after the last glaciation, when former fjords were cut off from the ocean due to the isostatic rebound. The deep layer of relic seawater experiences double diffusion, contains high concentrations of gases and old organic matter, and is anoxic.

Sebastien Lavanchy (left) and Johny Wüest (right) working from the hydroplane on Lake Owikeno

The goal of this first survey was to look for lakes containing a deep layer of relic seawater. From 19th to 27th September, we investigated 12 potentials lakes using a hydroplane. The three lakes, Pack, Henderson and Hesquiat had seawater at depth with an accumulation of gases and nutrients.

View from the hydroplane

This successful survey could lead to a more important multidisciplinary project led by the Limnology Center at EPFL in collaboration with local partners in BC Canada.

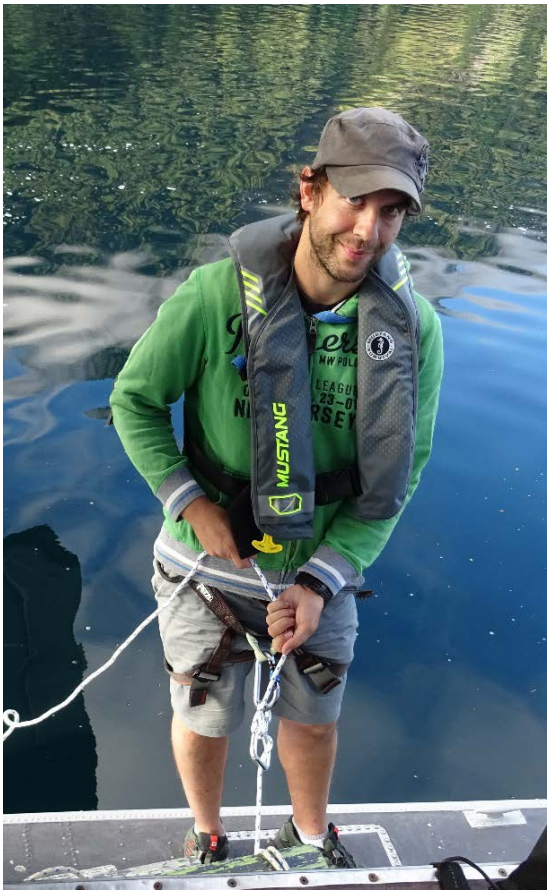


Vertical profiles of temperature, conductivity and oxygen in Henderson Lake

HUMAN RESOURCES:

Human resources

In October 2016, **Hannah Chmiel** joined the Limnology Center as a post-doctoral researcher to help coordinating ongoing activities, and carry out research on lakes. After studying Geosciences at the University of Münster (2004-2010), she completed a multidisciplinary PhD thesis at Uppsala University in 2015, focusing on "The role of sediments in the carbon cycle of boreal lakes". Moving on in her research now from small lake systems to larger lakes, she already participated in the sampling campaign to Russia in March 2016 to investigate carbon cycling in Lake Onego.



Sebastien Lavanchy, technical specialist from APHYS laboratory, has participated in all the field campaigns from the Limnology Center to support scientists and to prepare the equipment. The center thanks him for his precious help.

HUMAN RESOURCES: LIFE UNDER ICE

In Russia:

Northern Water Problems Institute, KRC RAS, Petrozavodsk:

Physic group: Dr. Arkady Terzhevik, Dr. Roman Zdorovennov, Dr. Galina Zdorovennova

Biological group: Dr. Natalja Kalinkina, Chekryzheva Tatjana, Tekanova Elena, Syarki Maria, Georgiev Andrei

Chemical group: Dr. Petr Lozovic, Rodkina I.S., Efremova T.A., Ptitca A.I, Stepanova I.A., Zobkova M.V., Basova S.V., Efremenko N.A., Dmitrieva Yu.F., Zobkov M.B., Galakhina N.E., Kalmykov M.V., Ikko O.I.

Hydrology-climate group: Prof. Nikolay Filatov, Larisa Nazarova, Nikolai Palshin, Tatjana Efremova, Andrey Balagansky, Vasili Kovalenko

Sediment group: Dr. Dmitry Subetto, Dr. Natalia Belkina, Makarova Elena, Liudmila S. Syrykh

Limnological Institute St-Petersburg: Anna V. Ludikova

Arctic and Antarctic Research Institute: Dr. Boris Ivanov

Nansen International Environments and Remote Sensing Center: Dr. Anton Korosov and Vladimir Volkov.

In France:

UMR CARRTEL, INRA-Thonon-les-Bains: Dr. Emilie Lyautey, Dr. Marie-Elodie Perga, Dr. Victor Frossard, and Dr. Thomas Camille

OMP-LEGOS: Dr. Alexei V. Kouraev.

In Switzerland:

University of Geneva: Prof. Daniel Ariztegui, Prof. Bastiaan W. Ibelings, Marie-Caroline Tiffay, Ena Suarez Bolanos, and Dr. Patrick Venail

Eawag: Dr. Nathalie Dubois, Mischa Haas, Alois Zwyssig, Dr. Beat Müller and Dr. Carsten Schubert

University of Constance: Dr. Hilmar Hofmann

Within EPFL:

APHYS-Margaretha Kamprad Chair: Dr. Damien Bouffard, Love Raman, Sebastien Lavanchy, Dr. Natacha Pasche, Dr. Hannah Chmiel and Prof. Alfred Wüest

DISAL: Dr. Felix Schill, Dr. Alexander Bahr, and Prof. Alcherio Martinoli

TOPO: Kevin Barbieux, Sergei Smirnov, Aleksandrs Trufanovs, and Prof. Bertrand Merminod

PUBLICATIONS

SCIENTIFIC PUBLICATIONS

Ice-covered Lake Onega: effects of radiation on convection and internal waves
Damien Bouffard, Roman E. Zdorovennov, Galina E. Zdorovennova, Natacha Pasche, Alfred Wüest and Arkady Y. Terzhevik
Hydrobiologia, 2016 doi:10.1007/s10750-016-2915-3

Vertex: A New Distributed Underwater Robotic Platform for Environmental Monitoring (accepted). *Felix Schill, Alexander Bahr, Alcherio Martinoli*
DARS 2016: 13th International Symposium on Distributed Autonomous Robotic Systems, http://dars2016.org/papers/

Intrasecular Variability in the Level of the Largest Lakes of Russia.
Filatov N. N, T. Yu. Viruchalkina,N. A. Dianskiyc, L. E. Nazarovaa, and V. N. Sinukovich. Doklady Earth Sciences, 2016, Vol. 467, Part 2, pp. 393–397.

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Calibration of airborne water reflectance measurements
SPIE – remote sensing**.** *Kevin Barbieux,* http://spie.org/newsroom/6734-calibration-of-airborne-water-reflectance-measurements

NEWSPAPER ARTICLES

Flash no°3 – 13.04.16, p24. EPFL researchers in Russia : Cold ? No. “Normal!”

Geopanorama 2.2016. **Le projet Léman-Baikal: Analyser la qualité de l’eau par les airs**

TELEVISION

Russian TV, Ch 1: 10.03.2016. Interview of Nikolai Filatov and Natacha Pasche

BLOG

Life under ice
http://epfloutthere.tumblr.com/tagged/lifeundertheice

CONFERENCES

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Goldschmidt, Yokohama, June 2016
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Thomas C, Lyautey E, Ariztegui D, Bouffard D, Dubois N, Frossard V, Tofield-Pasche N, Perga M-E & Life under Ice scientific team

SIL2016, Torino, August 2016
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Natacha Pasche, Sebastian Sobek, Carsten J. Schubert, Beat Müller, Hilmar Hofmann, Petr A. Lozovik, Life Under Ice Scientific Team
Filatov N. N. and Kalinkina N.M

8th International Symposium on Stratified Flows (ISSF), San Diego, September 2016
Effects of solar radiation on convection and internal waves in ice-covered lake
Bouffard D., Zdorovennov R., Zdorovennova G., Terzhevik A., Wüest A

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Life under the ice: microbial diversity and methane cycling in the sediment of the ice-covered Lake Onego, Russia
C. Thomas, E. Lyautey, D. Ariztegui, N. Dubois, V. Frossard, N. Pasche, M.-E. Perga and the Life Under the Ice Scientific Team

The 2nd International conference “Paleolimnology Paleolimnology of Northern Eurasia. Experience, Methodology, Current Status”. Yakutsk, Russia, August 2016. Subetto D., and Belkina N. 1 proceeding

2nd Pan-Eurasian Experiment (PEEX). Conference and the 6th PEEX Meeting. ISBN 978-952-7091-46-3 Bejing. China. May, 2016. Filatov N. N., Belkina N.M.
VI All-Russian scientific conference with international participation "Ecological problems of the northern regions and ways to solve them." Apatity, 2016. Efremova T.V., R. Zdorovennov, 2 proceedings

All Russian conference on Large Inland waters (V Lake Ladoga symposium), St-Petersburg, November 2016. Filatov N. N, Palshin N.I., Efremova T.V., Kovalenko V.N., Nazarova LE., Sabilina A.V., Subetto D.A., Lozovik P.A., Zobkova M.V Kalinkina N.M. Zdorovennova G.E, 10 proceedings

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Kevin Barbieux, Vincent Nouchi and Bertrand Merminod. **Airborne hyperspectral sensor radiometric self-calibration using near-infrared properties of deep water and vegetation**, *Proc. SPIE* 9999, Remote Sensing of the Ocean, Sea Ice, Coastal Waters, and Large Water Regions 2016, 99990M (October 19, 2016); doi:10.1117/12.2241251; http://dx.doi.org/10.1117/12.2241251

OUTLOOK

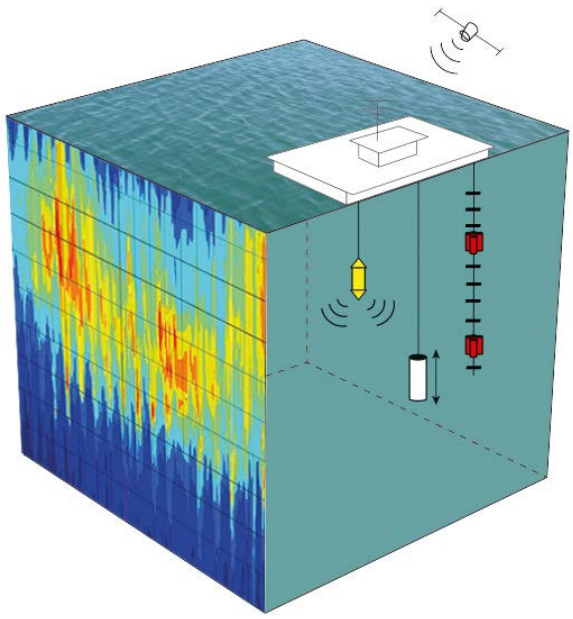
In 2017, the Limnology Center would like to promote the following projects:

Research Platform LÉXPLORE on Lake Leman

The goal of LéXPLORE platform on Lake Leman is to acquire physical, chemical and biological data at a high spatial and temporal resolution. This platform will also promote international and regional collaboration with other research groups.

The association to protect of the Port of Pully (ASHPA http://www.ashpa.ch) opposed the project and delayed it substantially. The Tribunal Cantonal from Canton Vaud rejected this objection in September 2016. The responsible department confirmed that the concession will be issued beginning of January 2017, and will be valid for 10 years.

In parallel, the consortium Kindlimann Naval Architecture Gmbh, Sagrave SA and Mabo Metallbau Gmbh has worked out the detailed planning, so that the bids offers can be sent out to companies. We expect to sign the contracts for the platform construction beginning of 2017. We hope that the platform could be anchored on the lake by the end of 2017.



Platform and sensor deployment on Lake Leman for real-time measurements

Lakes in Antarctica

This project aims at studying double diffusion in permanently ice-covered lakes in Antarctica. The Limnology Center will work with the newly founded Swiss Polar Institute. Other potential interested parties are EPFL, ETHZ, WSL and Eawag.