



LIMNOLOGY Center

Ecole Polytechnique Fédérale de Lausanne

EDITORIAL

The sustainable use and conservation of natural water resources are among the most important challenges. Water quality and hydrological cycles are affected by various developments on a global scale, including water abstraction / diversion, changes in geochemical rates and fluxes, as well as global warming. Locally, more specific conflicts, such as water allocation, conservation of unique ecosystems and excessive eutrophication are often pressing. The mission of the *LIMNOLOGY Center* is to provide relevant contributions in facing these challenges, on both national and international level. EPFL's competence in technology will form an important base.

We invite everybody to contribute and look forward to your interest in this mission – come and talk to us.

Alfred Wüest, Director *LIMNOLOGY Center*

RESEARCH APPROACH

Innovative — The strength of the *LIMNOLOGY Center* research will be its focus on new technological development – the backbone of EPFL.

International — Despite local anchorage within the Lac Lemman limnological research community, the scope of the research topics as well as the collaboration is international.

Interdisciplinary — The *LIMNOLOGY Center* research reaches beyond the core disciplines of the different Chairs contributing to the Center. Therefore, the nature of the research is interdisciplinary and provides an unique opportunity for collaboration with *Eawag*, *UNIGE*, *INRA Thonon-les-Bains* as well as with international partner institutions.

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 the national and international levels.

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View on Lake Lemman and Vevey: courtesy of Damien Bouffard

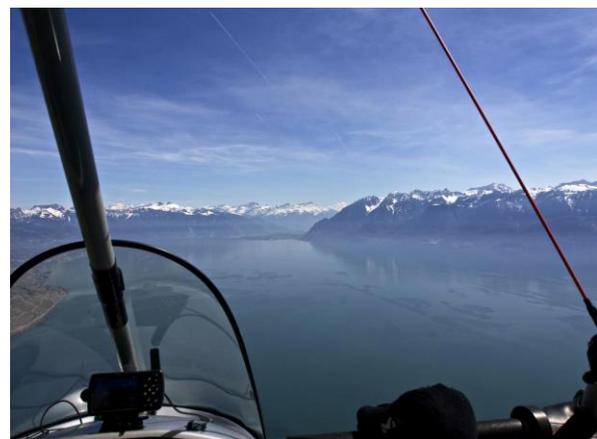
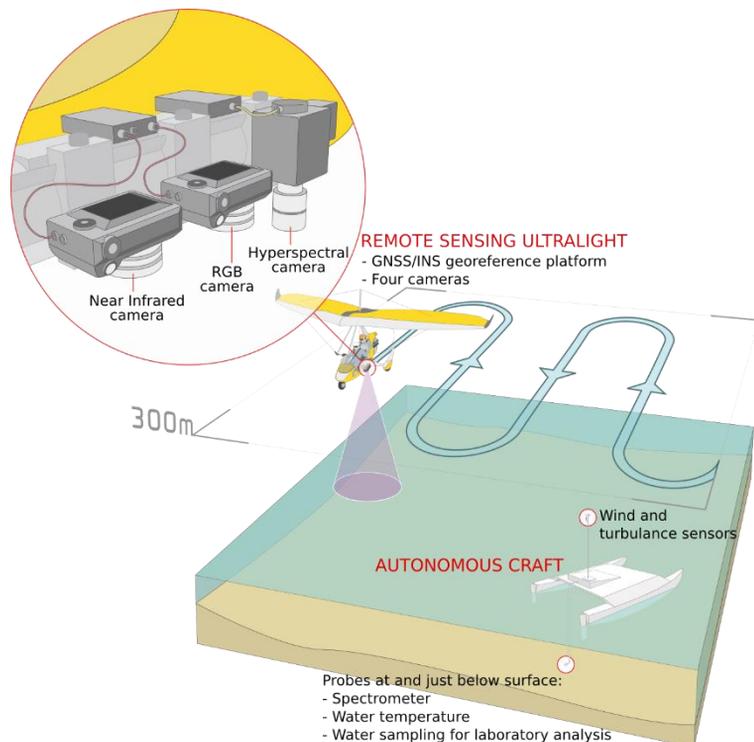
RESEARCH PROJECT

Leman-Baikal Project

The Leman-Baikal project constitutes an international Swiss-Russian collaborative research initiative in the field of physical limnology using ultralight aircraft. The primary aim of the project is to conduct a comparative study of the functioning of Lakes Leman (Switzerland) and Baikal (Southern Siberia region of Russian Federation). The scientific objectives of the project include the analysis of hydrological processes, such as the runoff dynamics of both natural and anthropogenic origin, lake energy balance, and the study of processes pertaining to the land-water and air-water interfaces in lakes.

Eleven flights over Lake Leman took place in April and May 2013 using a ULM fitted with RGB, infrared and hyperspectral cameras. Simultaneously, scientists collected in-situ data from a boat for ground truthing. Our initial points of interest included the mouths of the Venoge and Rhône Rivers, which exhibit a particularly rich range of visually observable hydrological phenomena.

The first collected images look promising. They showed a high similarity between spectra measured from the air and in-situ from the lake surface. These encouraging results will soon allow to assess the heterogeneity of water quality parameters, and to describe local mixing phenomena at a higher spatial and temporal resolution than ever achieved. Scientists are currently processing the large amount of collected data.



View on Lake Leman from the ULM

RESEARCH PROJECT

Leman-Baikal Project



View Selenga Delta from the ULM

In June and July 2013, Swiss and Russian scientists collaborated on the first acquisition of remote sensing data using five ULMs. Multispectral and hyperspectral observations were collected above Lake Baikal near the Selenga Delta during thirty-two flights. Strong gradients were observed where the turbid and warm river water mixed with Lake Baikal clear and colder water. A scientific team on the water surface simultaneously took water samples and in-situ measurements to compare and calibrate the remote sensing images. The success of this campaign was ensured by the collaboration of the Russian universities implicated in the project.

In 2014, four Russian students will come for an internship to EPFL to process these raw data and learn how to interpret this amazing information. The next campaign on Lake Baikal is planned for August 2014.

We would like to warmly thank our sponsors:



and coordination:



Consulat honoraire
de la Fédération de Russie
à Lausanne



Mixing of river and lake waters near Selenga Delta

HUMAN RESOURCES

Deputy Director

Dr. Natacha Tofield-Pasche started her function on 1st September 2013. She will coordinate the activities of the Limnology Center and carry out research in lakes. After studying Environmental Engineer at EPFL, she completed a multi-disciplinary PhD thesis on “Nutrient cycling and methane production in Lake Kivu” in 2009. From 2009 to 2012, she set up a monitoring program to survey the impacts of methane extraction from Lake Kivu.



Teams involved within Lemna-Baikal Project

TOPO/LASIG: Dr. Yosef Akhtman, Dragos Constantin, Prof. Bertrand Merminod, Prof. François Golay, M Parkan, Martin Rehak, Dr. Devis Tuia

ECOL: Prof. David Andrew Barry, Abofazel Irani Rahaghi

APHYS-Margaretha Kamprad Chair: Dr. Damien Bouffard, Vincent Maurice Nouchi, and Prof. Alfred Wüest

WIRE: Dr. Valerio Iungo Giacomo and Prof. Fernando Porté-Agel

EFLUM/CRYOS/Princeton: Prof. Mark Hultmark, Dr. Hendrik Huwald and Prof. Marc Parlange

We would like to warmly thank the coordinators: Jean-Denis Bourquin and Prof. Ulrich Lemmin for their constructive, creative and large-volume of work.

External Advisory Group

The Limnology Center will invite three well-recognized scientists every one to two years for review and recommendations:

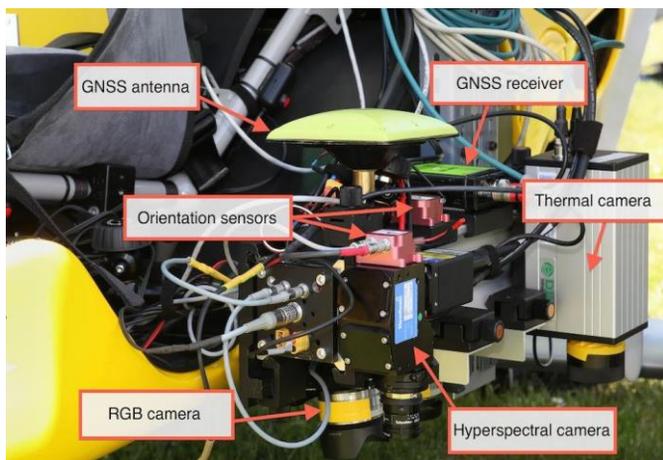
Prof. Eddy Carmack, Institute of Ocean Sciences, Sidney, BC, Canada

Prof. Warwick F Vincent, Université Laval, Québec, Canada

Prof. Roland Psenner, Vice Rector University of Innsbruck, Innsbruck, Austria

MAJOR ACQUIRED EQUIPMENT

Development of remote sensing platform with hyperspectral , RGB and thermal cameras



Ground truthing instruments to measure radiative spectra on and below the water column.
Accessories to deploy on a research catamaran.

Development of high-precision sensor for the Atmospheric Boundary Layer.
Development of fast-response, sub-miniature sensors to measure small scale turbulence and humidity in the atmosphere



SCIENTIFIC PUBLICATIONS

Two MIR submersibles explored Lake Lemman in 2011 to investigate deep currents, geology of the lake bottom, micropollutants and their degrading microorganisms. For more info: www.elemo.ch

Special issue in Aquatic Sciences on Elemo project for February 2014:

Corella JP, Arantegui A, Loizeau JL, DelSontro T, Le Dantec N, Stark N, Anselmetti FS, Girardclos S (2014) Sediment dynamics in the subaquatic channel of the Rhone Delta (Lake Lemman, France/Switzerland).

Gascon Diez E, Bravo AG, Porta N, Masson M, Graham ND, Stoll S, Akhtman Y, Amouroux D, Loizeau JL (2014). Mercury content and speciation related to sediment surface patterns in contaminated Vidy Bay, Lake Lemman, Switzerland.

Hoerger CC, Akhtman Y, Martelletti L, Rutler R, Bonvin F, Grange A, Arey JS, Kohn T (2014) Spatial extent and ecotoxicological risk assessment of a micropollutant-contaminated wastewater plume in Lake Lemman.

Masson M, Tercier-Waeber ML (2014) Trace metal speciation at the sediment-water interface of the Vidy Bay: Influence of contrasting sediment characteristics.

Razmi AM, Barry DA, Lemmin U, Bonvin F, Kohn T, Bakhtyar R (2014) Direct effects of dominant winds on residence and travel times in a wide and open lacustrine embayment: Vidy Bay (Lake Lemman, Switzerland).

Sauvain L, Bueche M, Junier T, Masson M, Wunderlin T, Kohler-Milleret R, Gascon Diez E, Loizeau JL, Tercier-Waeber ML, Junier P (2014) Bacterial communities in trace metal contaminated lake sediments are dominated by endospore-forming bacteria.

Sollberger S, Corella JP, Girardclos S, Randlett ME, Schubert CJ, Senn D, Wehrli B, DelSontro T (2014) Spatial heterogeneity of benthic methane dynamics in the subaquatic canyons of the Rhone River Delta (Lake Lemman).

Wunderlin T, Corella JP, Junier T, Bueche M, Loizeau JL, Girardclos S, Junier P (2014) Endospore-forming bacteria as new proxies to assess impact of eutrophication in Lake Lemman (Switzerland-France).

Wüest A, Anselmetti FS, Arey JS, Ibelings BW, Loizeau JL, Vennemann T, Lemmin U (2014) Into the abyss of Lake Lemman – Interdisciplinary field investigations using the MIR submersibles.

NEWSPAPER ARTICLES

Swiss

- 2013-02-25, Migros Magazine - Etude des lacs: l'EPFL se jette à l'eau
- 2013-04-24, 24 Heures - Un ULM vole au-dessus du Léman
- 2013-05-14, SF Tagesschau - Schweiz-russisches Forschungsprojekt am Lac Léman
- 2013-05-14, La Télé - Collaboration entre la Russie et l'EPFL
- 2013-05-15, La Côte - Un mois de la Suisse à la Russie en ULM
- 2013-05-15, Tribune de Genève - Des ULM de l'EPFL vont voler jusqu'au lac Baïkal
- 2013-05-15, 24 Heures - Des pilotes d'ULM vont voler jusqu'au lac Baïkal sous la bannière de l'EPFL
- 2013-05-15, Nasha Gazeta - Du Léman au Baïkal au bord de l'ULM
- 2013-05-16, Batimag - Du Léman au Baïkal, une aventure entre la Suisse et la Russie
- 2013-07-10, Tribune de Genève - Après le Léman, les ULM quadrillent le lac Baïkal

Russian

More than eleven articles were published in Russia in 2013 and can be download from the website <http://www.lemo.ch/ulm/press>

International

2013-10-28, Forbes Life - Soaring Over Siberia With Extreme Billionaire Explorer Frederik Paulsen

CONFERENCES AND WORKSHOPS

Yosef Akhtman, Léman-Baïkal: remote sensing from ultra-light planes. Meeting of the Swiss Society for Photogrammetry and Remote Sensing (SSPT). Lausanne, Switzerland. November 2013.

Yosef Akhtman, Remote sensing methodology for an ultralight plane. Swiss Geoscience Meeting (SGM). Lausanne, Switzerland. November 2013.

Yosef Akhtman, ULM: Léman-Baïkal. Workshop at the Russian Academy of Agriculture, Ulan-Ude, Russian Federation. August 2013.

Yosef Akhtman, ULM: Léman-Baïkal. VII Summer School on Sustainable Development, Istomino, Russian Federation. June 2013.

Yosef Akhtman, UAS aided hyperspectral remote sensing: State-of-the-art and future outlook. 4th Lithuanian Space Conference - SEMWO, Vilnius, Lethuania. November 2012.

Damien Bouffard, Alfred Wüest, Bas Ibelings and Tuia Devis, S3VT ESA workshop. Ground truthing in Alpine lakes, Frascati, Italy. November 2013.

Marcus Hultmark, Well resolved measurements of the turbulent fluxes in the atmospheric surface layer. European Turbulence Conference (ETC14) in Lyon, France. Septembre 2013.

Marcus Hultmark, Well resolved measurements of the turbulent fluxes in the atmospheric surface layer. Davos Atmosphere and Cryosphere Assembly (DACA13), Davos, Switzerland. July 2013.

OUTLOOK

In 2014, the Limnology Center would like to promote the following projects:

Research Platform on Lake Lemán

The aim of this research platform is to acquire continuous records of physical properties, biogeochemical processes, as well as phytoplankton and zooplankton on Lake Lemán. This platform should also promote international collaboration with other research groups interested in this facility and will strongly expand the collaboration between EPFL, UNIGE and INRA Thonon-les-Bains. The equipment will be part of a Requête proposal to FNS in May 2014. Given the support from Canton Vaud and Geneva, we have started the administrative procedures.

Underwater Automatic Vehicles to investigate ecological niches

This interdisciplinary project is a collaboration with Prof. Bas Ibelings from UNIGE and Prof. Alcherio Martinoli from DISAL laboratory at EPFL. The goal is to use underwater automatic vehicles to investigate the spatial heterogeneity of physico-biological processes in lakes. The proposal will be submitted on 15 January 2014.

Mitigate eutrophication in Lake Prespa

Lake Prespa is an ancient lake shared between Macedonia, Greece and Albania. Its great biodiversity is endangered by eutrophication. The aim of this project is to determine the sources of phosphate pollutions by a two years monitoring, and to test different scenarios for pollution reduction using a model of the lake and a catchment model. A proposal was sent to UNDP in October 2013 and we are waiting for the final decision.

Limnology under ice in Lake Ladoga

The main goal of this research is to study the development of under-ice convection in Lake Ladoga and its implications for algae development under ice. First contacts were taken with the Petrozavodsk University to start the project after a meeting in Switzerland early 2014. This project is still under development.