

# Gyre research in Lake Geneva

Autor(en): **[s.n.]**

Objektyp: **Article**

Zeitschrift: **Helvetia : magazine of the Swiss Society of New Zealand**

Band (Jahr): **85 (2019)**

Heft [1]

PDF erstellt am: **12.07.2024**

Persistenter Link: <https://doi.org/10.5169/seals-943835>

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## Gyre Research in Lake Geneva



Huge systems of rotating water masses - called gyres - form in oceans and large lakes. Two EPFL laboratories, working with the University of California, Davis, are using an underwater glider to explore one such gyre in Lake Geneva and learn more about how it affects the three-dimensional structure of the aquatic ecosystem.

In a first for Lake Geneva, researchers are about to gain unprecedented insight into the influence of gyres on lake ecology thanks to an underwater glider on loan from the United States. The yellow two-winged vehicle, which is able to dive down to 1,000 meters below the ocean's surface, will take measurements of Lake Geneva's turbulence for several weeks.

Ocean gyres, which are fed by wind and the earth's rotation, are hundreds of kilometers across. Through centripetal force, as an example, they turn plastic wastes in the ocean into huge vortexes of garbage.

Gyres occur in Lake Geneva as well, the result of the lake topographic form and the prevailing wind along the lake axis. From June to October, two gyres, each around 10 kilometers in diameter, often form in the widest parts of the lake south-west of Morges and south-east of Lausanne. The researchers decided to study the first one, where there are fewer boats around that could collide with the glider whenever it surfaces.

We still have a lot to learn about gyres. Just ask Alexander LeBaron Forrest, professor at the University of California, Davis, and a top expert in this field. He has led several research projects into gyres around the world using autonomous robots. He has also gathered data in

Lake Tahoe in California, which is similar to Lake Geneva in a number of ways. "Our goal is to measure turbulence in gyres as accurately as possible, so that we can learn more about how the hydrodynamics affects the lake environment.

What does the gyre at the eastern end of Lake Geneva stir up in the middle of the lake and wash onto the lakeshore? What is its impact on the nutrients that it pulls up to the surface or down to the depths? What role does it play in oxygenating the water's surface? How much chlorophyll does it hold? Oscar Sepúlveda, from EPFL's Physics of Aquatic Systems Laboratory (APHYS), hopes to identify the gyre's impact on the layer of phytoplankton that forms each summer in the lake's waters: "I'd like to know whether the turbulent mixing caused by the gyre affects the structure and distribution of phytoplankton in the lake."

To answer all these questions, it took the expertise of Alcherio Martinoli who heads the Doctoral Program in Robotics, Control and Intelligent Systems (DISAL) but also a battery of sensors integrated into their own robots. These include a miniaturized high-frequency temperature sensor implemented at EPFL's labs by Hydromea, one of the school's startups.

"We used to collect data by attaching sensors to a profiler and dropping them straight down into the water from a boat. We learned a lot about turbulence and exchange with the sediment using this technique, but unfortunately only at specific locations. With this advanced glider from UC Davis, we will be able to cover very large areas within the gyre,"

says Johny Wüest, who heads the APHYS lab and is also a researcher in Aquatic Physics at the Swiss Federal Institute of Aquatic Science and Technology (Eawag).

The glider can operate autonomously for several days at a time, surfacing every four hours to transmit some of its data via a satellite connection. Since it is not self-propelled, the glider does not interfere with the measurements it takes. It can descend to a maximum depth of 250 meters in Lake Geneva, moving up and down as it glides by changing its center of gravity and the position of its batteries. This yo-yo path means it can collect data both vertically and laterally throughout its journey of many km length.

*actu.epfl.ch/news*



### Switzerland's army to be headed by a woman for the first time

Viola Amherd, one of two new women joining Switzerland's seven-member executive team on 1 January 2019, will head the Federal Department of Defence, Civil Protection and Sport (DDPS), a position focused mainly on military matters.

This will be the first time the position has been held by a woman, according to RTS. Amherd, a lawyer from Brigue-Glis in Valais, is a member of the PDC (CVP) party.

There are currently very few women in the Swiss military compared to some other European countries. In 2017, less than 1% of Swiss military personnel were women. The percentages of women in the armed forces are significantly higher in Sweden (16%), Germany (12%), France (15%) and Norway (12%).

Most Swiss women are opposed to gender neutral conscription, according to a survey in 2015 in which 74% of women said they were against obligatory military service.

In 2016, conscription of both women and men began in Norway, where four of the last five defence ministers have been women. Last year the Swiss government said it would examine the Norwegian model.

13/12/2018 BY LE NEWS