Post-doc position

Improving forecast of water quality in deep-perialpine lakes

Project description

Numerical process-based lake models are powerful tools to simulate processes occurring in aquatic ecosystems and to question the future of lakes. As this regard, one dimensional models have been widely implemented over that last years[1–3], but most of these models are calibrated and validated against very few years of limnological records, potentially limiting the robustness in long-term reconstructions and preventing inclusion of future scenarios. To analysis the variability and the effects of climate change on ecological dynamics of deep hard-water lakes, the successful candidate will rely on the Aquatic Ecodynamics model (AED) and on pluri-decadal series of limnological data collected by the French Observatoire des LAcs (OLA). Model simulation will be further validated with published paleolimnological records of oxygen conditions[4,5], primary productivity and algal communities for the past 300 years. Altogether, the 1D model approach will help at anticipating the future of the water quality of Lake Annecy at the horizon 2100. As part of the "Plan Lac 2030" around Lake Annecy, the project will seek more specifically to transfer knowledge from model simulations to lake managers to anticipate future changes in Lake Annecy; to use the results as a means of preventing, sufficiently early and through sustainable management, critical changes in water quality as well as in biodiversity and the goods and services that depend on it.

Expected results:

1. Lake model simulating water quality dynamics for Lake Annecy and long-term forecast for trends in water quality at the horizon 2100.
2. Improved validation strategies of 1D model approaches based on long-term limnological and paleolimnological records
3. Recommendations for lake managers

Host institution:

The INRAE CARRTEL Center, Technolac, Bourget du lac, France, is a leading limnological institute with a large, diverse and welcoming community of researchers, students, and support staff. CARRTEL contributes to the understanding of how human and climate change affect fundamental resources and ecological functions within lake systems and their watersheds, and how this affects ecosystem services like food, drinking water, biodiversity, maintenance of aquatic fauna and flora, water flow regulation, transfer and sequestration of nutrient or pollutants. CARRTEL has two locations: Technolac campus near Lake Bourget (URL), and a limnological station near Lake Geneva. At the institution level, various in-house technical groups will support the project. In Technolac, the project will be supported by shared analytical platforms, with computing facilities including a shared storage capacity raid and the MUST High Performance Computer cluster. The successful candidate will be fully integrated into the institute, and benefit from full participation in various interactions facilitated by seminar programs, discussion groups and lab meetings, as well as monthly interdisciplinary keynotes given by high-profile researchers.

Specific requirements

- The candidate must hold a PhD's Thesis
- Technical Skills required: Excellent programming skills in typical scientific programming languages (e.g., Python, R, etc.). Willingness to face complex modelling problems. Experience in AED 1D Ecological dynamic model. Ability with mathematics and statistics are essential. Basic knowledge about ecological processes affecting water quality in lakes.
- Proficiency in the English language is required, as well as good communication skills, both oral and written.

Conditions

Funder: Syndicat Mixte du Lac d'Annecy (SILA)
Duration: Fulltime employment contract for 18 months, with possibility of extension
Deadline for application: December 15, 2021
Start of contract: January 2022
Supervisor: Dr Jean-Philippe JENNY (INRAE)
Co-Supervisor: Dr Victor FROSSARD (USMB)

Enquires

For additional information on this project, please contact Dr Jean-Philippe JENNY
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References

1. Bruce, L. C. *et al.* A multi-lake comparative analysis of the General Lake Model (GLM): Stress-testing across a global observatory network. *Environmental Modelling & Software* **102**, 274–291 (2018).
2. Shatwell, T., Thiery, W. & Kirillin, G. Future projections of temperature and mixing regime of European temperate lakes. *Hydrology and Earth System Sciences* **23**, 1533–1551 (2019).
3. Snortheim, C. A. *et al.* Meteorological drivers of hypolimnetic anoxia in a eutrophic, north temperate lake. *Ecological Modelling* **343**, 39–53 (2017).
4. Jenny, J.-P. *et al.* Inherited hypoxia: A new challenge for reoligotrophicated lakes under global warming : Holocene hypoxia dynamics in large lakes. *Global Biogeochemical Cycles* **28**, 1413–1423 (2014).
5. Jenny, J.-P. *et al.* Urban point sources of nutrients were the leading cause for the historical spread of hypoxia across European lakes. *PNAS* **113**, 12655–12660 (2016).