MSc thesis position

Global glacier ice flow modelling

Supervisors:

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Description:

We are looking for a student to work on a new implementation of the current flowline approach of ice dynamics in the Open Global Glacier Model (OGGM, Maussion et al., 2019). OGGM is a community-based open-source framework coded in Python, aimed at developing scientific tools for large-scale glacier modelling and hydrology. Simulating all the 200,000 glaciers on Earth is a very computationally expensive task, with a lot of room from improvement. By speeding up some key parts of OGGM, we aim at shortening the time to get results, thus speeding up the pace at which research questions can be answered with OGGM, while reducing CO2 emissions linked to large numerical simulations. Having a faster flowline and 2D version of the OGGM ice flow model can help improve future projections of global glacier changes or studying the influence of sliding on future ice cap evolution.

The main goal of this MSc thesis will be to implement new versions of the 1D ice flow model used in OGGM in the Julia programming language. A 2D version will also be envisaged if the time frame allows it. Julia is a relatively new programming language which aims at solving "the two language problem". Julia is as fast as C, but as easy to code as Python. These performance advantages have already been proven in ODINN, a new modelling framework combining OGGM and scientific machine learning libraries from Julia. The idea behind this MSc is to couple features of ODINN into OGGM, in order to improve its performance. This will take part in the growing open-source glacier modelling community based around the models OGGM, ODINN and PyGEM.

The suggested tasks of the thesis will include (but will be open to suggestions from the candidate):

- Implement a cross-language strategy to call Julia from Python (using JuliaCall) in the OGGM framework
- Code a new flowline model for OGGMl in Julia
- Find a suitable numerical solver for the ice flow model
- Explore new ways to improve the ice flow model, e.g. implementing a 2D version, or using machine learning

Contract and location:

The position will be paid according to French law, at ~600€ net per month, for a duration of ~6 months. The position will be based at IGE in Grenoble (France), but a visit to the University of Innsbruck (Austria) can be potentially planned for scientific reasons.

Requirements:

- *Good coding skills: Julia and/or Python.*
- *Motivation to work at the intersection of computer science and earth sciences.*
- *Background on calculus and numerical solvers.*
- *Background in glaciology and/or climate science is a plus.*
- *We welcome candidates with no experience in Julia, as long as they already have a good proficiency in a similar language and the motivation to learn Julia.*
- *We also welcome a large diversity of applicants, particularly from minorities.*

Apply by sending an e-mail with your CV and statement of motivation to: j.bolibar@uu.nl, nicolas.champollion@univ-grenoble-alpes.fr and fabien.maussion@uibk.ac.at.