SCIENCES & BIOENGINEERING SCIENCES

The Research Group

Physical Geography

has the honor to invite you to the public defense of the PhD thesis of

Harry ZEKOLLARI

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

Modelling the evolution of glaciers and ice caps in a changing climate

Promotor:
Prof. dr. Philippe Huybrechts

The defence will take place on

Friday June 9 2017 at 17:00 h

in Auditorium E.0.12 at the campus Humanities, Sciences and Engineering of the Vrije Universiteit Brussel, Pleinlaan 2 - 1050 Elsene, and will be followed by a reception.

Members of the jury:

Prof. Dr. Matthieu Kervyn (chairman)
Prof. Dr. Philippe Claeys (secretary)
Prof. dr. Philippe Huybrechts (promotor)
Prof. Dr. Ann Van Griensven
Prof. Dr. Nicole Van Lipzig (KU Leuven)
Prof. Dr. Christine Hvidberg (Univ. of Copenhagen)
Prof. Dr. Daniel Farinotti (ETH Zürich)

Curriculum vitae

Harry Zekollari (Brussels, 1988) graduated from the Master of Science in Geography program (VUB/KU Leuven) in 2011. In 2013 he started a PhD funded by the Research Foundation Flanders (FWO). During the last year of his PhD, he stayed at the Swiss Federal Institute of Technology (ETH Zürich). Harry published six papers in international peer-reviewed journals (five of which as a first author). For presenting his work at international conferences, he obtained a total of five awards and grants. Among his outreach activities, Harry was interviewed for national television (KETNET/EEN), by newspapers (De Morgen, HLN) and he presented his work in several schools.

Abstract of the PhD research

In recent decades, glaciers and ice caps worldwide have lost a significant fraction of their volume in response to increasing temperatures. This global ice loss has severe implications related to the availability of water resources, natural hazards and the human perception of mountains as a recreational environment. Furthermore, glaciers and ice caps are major sea level contributors, and their contribution is projected to play a prominent role in future sea level rise as well. As there are about 200,000 glaciers and ice caps worldwide, global estimates of their contribution to sea level rise necessarily have to rely on simple scaling arguments and statistical methods, which do not explicitly account for ice dynamics. To increase the reliability of such generalisation methods, it is essential to model in detail a larger sample of representative glaciers and ice caps. In this PhD thesis we contributed to this endeavour by simulating the time evolution of the alpine Morteratsch glacier (Switzerland) and the Arctic Hans Tausen ice cap (Greenland). This allows to better understand the mechanisms affecting the evolution of glaciers and ice caps under changing climatic conditions.

The transient evolution of the Morteratsch glacier was simulated with an ice flow model accounting for longitudinal stresses. For this, we relied on a vast dataset on ice thickness, surface mass balance and surface velocity measurements that was collected since 2001. This allowed us to get insights in the glacier's response time and climate-geometry imbalance. We furthermore contributed to an improved understanding of the surface mass balance of alpine glaciers by using statistical methods.

The work on the Hans Tausen ice cap consisted of using a variety of field and remote observations to construct a 3-D coupled ice flow - surface mass balance model. At present, it is the world's northernmost ice cap and it contains around 750 km^3 of ice, which is about a tenfold of the total ice volume of all glaciers in the European Alps. Through various numerical simulations, we showed that the ice cap is very sensitive to changes in climatic conditions. In a moderate to extreme warming scenario, the ice cap will entirely be lost within a few centuries. We finally also modelled the Holocene ice cap evolution and used this to get new insights on the climatic evolution of the high Arctic over the last 10,000 years. This is particularly interesting, as temperatures during the early Holocene were higher than today and could thus provide indications about changes to come in a future warmer climate.