

The Research Group
Physical Geography

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

Chloë Paice

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

**Towards an ice-free continent?
Assessing the long-term evolution and
feedbacks of the Greenland ice sheet with
a coupled high-resolution regional climate and ice sheet model**

Supervisor:

Prof. dr. Philippe Huybrechts (VUB)

Co-supervisor:

Prof. dr. Xavier Fettweis (ULiège)

The defence will take place on

Friday, October 16, 2026 at 5 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene,
in auditorium I.2.03

Members of the jury

Prof. dr. Matthieu Kervyn (VUB, chair)

Prof. dr. Harry Zekollari (VUB)

Prof. dr. Christoph Kittel (VUB)

Prof. dr. Christine Schøtt Hvidberg (University of
Copenhagen, DK)

Prof. dr. Ruth Mottram (Danish Meteorological
Institute, DK)

Prof. dr. Miren Vizcaíno (Technische Universiteit
Delft, NL)

Curriculum vitae

After obtaining an MSc in Geography (2020) at VUB and KUL, Chloë Paice was awarded an FWO doctoral fellowship. During her PhD, she specialized in ice sheet-atmosphere interactions through model coupling, and she participated in several glaciological expeditions in the Swiss Alps and Kyrgyz Tien Shan. She is lead author of a peer-reviewed highlight paper and co-author of four additional publications. She has presented her work at national and international conferences, including three invited talks, and received the Best ECS Poster Award at the BE-POLAR Conference 2025. Passionate about science outreach and communication, she has engaged with diverse audiences through science festivals, educational initiatives, and media contributions.

Abstract of the PhD research

With a volume of 7.4 m s.l.e., the Greenland ice sheet is among the largest contributors to global sea level rise. Despite increasing observations and research efforts, substantial uncertainty remains regarding its long-term sea level contribution and interactions with the atmosphere. To better understand these complex interactions, we have coupled the Greenland Ice Sheet Model (GISM) to the Modèle Atmosphérique Régional (MAR) that was specifically designed for polar regions. This represents a significant improvement compared to coupling with global climate models and required the development of a new iterative coupled model initialization procedure.

With the initialized coupled model, we performed high-resolution simulations forced by a high-emissions climate scenario over the next three centuries. The influence of rising ocean temperatures was accounted for through an empirically based parameterization. The results indicate that although surface melt and discharge contribute similarly to mass loss throughout the 21st century, surface melt becomes dominant over time as the ice sheet progressively retreats onto land. Furthermore, they demonstrate that surface melt and marine discharge are mutually competitive processes, such that present-day mass loss rates cannot simply be extrapolated into the future. For the first time, we also separated peripheral glaciers and ice caps from the main ice sheet in the model to avoid ambiguity regarding their sea level contribution. Under the high-emissions scenario, by 2200 they have entirely disappeared.

However, feedback mechanisms between the ice sheet and atmosphere only become discernible over longer timescales. We therefore extended some simulations until the year 3000, under constant climate forcing. They represent the first millennial-length coupled simulations of an ice sheet and regional climate model and reveal that the ice sheet evolution is determined by positive as well as negative feedback mechanisms, acting over different timescales. The main observed negative feedback in our simulations is related to changing wind speeds that reduce surface melt at the ice sheet margins. Over time however, positive feedback mechanisms related to decreasing surface elevation, namely the melt – elevation feedback and changes in cloudiness and orographic precipitation, dominate the ice sheet – climate system and strongly accelerate mass loss. As a result, within a millennium the ice sheet has almost entirely disappeared, with a sea level contribution of 7.135 m s.l.e., compared to significantly smaller contributions when not accounting for these feedbacks. This highlights the importance of accurately representing ice sheet – atmosphere interactions for long-term assessments of the Greenland ice sheet.