M2/M1 Research Internship Opportunity

Inferring Antarctic ice-shelf basal melting from phase-sensitive radar data

Where: Laboratoire de Physique - École Normale Supérieure de Lyon & CNRS
When: 3-4 months during calendar year 2027
Prerequisites: Previous coding experience, preferably in Matlab or Python. Some basic understanding of geophysical fluid dynamics and of signal processing is a plus, but not a requirement. Proficiency in English is strictly required.
Perspectives: Training in the processing, analysis and interpretation of geophysical radar data. Exposure to polar oceanography and glaciology.

Research team and supervision:
Irena Vaňková (ENS de Lyon)
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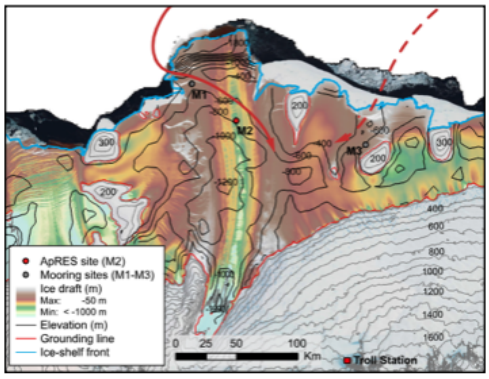

Study site: Fimbul Ice shelf, East Antarctica

Scientific context: **Ice-ocean interactions in Antarctica**
The Antarctic Ice Sheet flows from the continent into the ocean, forming floating ice shelves that melt at their base as they become exposed to ocean heat. Change in the rate of basal melting affects ice dynamics further upstream, and sustained increase in ice-shelf melting can result in significant ice loss from Antarctica, rising sea level and changing ocean circulation. However, variability in ice-shelf basal melting is difficult to monitor – while several satellite-based data products have been produced, they severely overestimate melt-rate variability when compared with in-situ measurements[1,2]. The assessment of present-day ice-shelf melt variability therefore still relies on sparse in-situ observations, typically collected with an ice penetrating phase sensitive radar (ApRES[3]).

Proposed work: Analysis of phase-sensitive radar data from Fimbul Ice Shelf
Several ApRES have been deployed at the Fimbul Ice Shelf (East Antarctica) as part of the Norwegian long-term monitoring campaign[2]. The instruments are located near the grounding line, the location where grounded ice goes afloat, often exhibiting relatively complicated dynamics that needs to be inferred and understood before deriving basal melt rates[4]. The intern will work with these new ApRES data, they will derive melt rate time series and respective uncertainty estimates. They will be involved in physical interpretation of these melt rates and their variability in combination with other oceanographic data that are already available[5].

Application: Interested applicants should email the following documents: 1) a motivation letter written in English, 2) CV in English, and 3) transcripts of all available university grades.

References:
1. Vaňková, I. & Nicholls, K. W. Ocean Variability Beneath the Filchner-Ronne Ice Shelf Inferred From Basal Melt Rate Time Series. *J. Geophys. Res. Oceans* **127**, e2022JC018879 (2022).
2. Lindbäck, K. *et al.* Basal Melting and Oceanic Observations Beneath Central Fimbulisen, East Antarctica. *J. Geophys. Res. Oceans* **130**, e2023JC020506 (2025).
3. Nicholls, K. W. *et al.* A ground-based radar for measuring vertical strain rates and time-varying basal melt rates in ice sheets and shelves. *J. Glaciol.* **61**, 1079–1087 (2015).
4. Vaňková, I., Cook, S., Winberry, J. P., Nicholls, K. W. & Galton-Fenzi, B. K. Deriving Melt Rates at a Complex Ice Shelf Base Using In Situ Radar: Application to Totten Ice Shelf. *Geophys. Res. Lett.* **48**, (2021).
5. Lauber, J. *et al.* Warming beneath an East Antarctic ice shelf due to increased subpolar westerlies and reduced sea ice. *Nat. Geosci.* 1–9 (2023) doi:10.1038/s41561-023-01273-5.