Position Description

1. General Information

Name of the position	**Snow on Antarctic Sea Ice**
Foreseen date of enrolment	1 October 2023
Position is funded by	• COFUND, Marie Skłodowska-Curie Actions (MSCA), Horizon Europe, European Union • Université Grenoble Alpes (UGA) • University of Tasmania (UTAS)
Research Host	Université Grenoble Alpes
PhD awarding institutions	Université Grenoble Alpes & University of Tasmania
Locations	Primary: Grenoble, France Secondary: Hobart, Australia
Supervisors	Ghislain Picard (UGA) Petra Heil (UTAS)
Group of discipline	Glaciology, Ocean-sea ice-atmosphere, radiative transfer, albedo

2. Research topics (only one of these projects will be funded)

Project 1*: Investigation of spring transition of Antartic sea ice and its snow cover*

The high-latitude Southern Ocean is covered by sea ice, which undergoes a large seasonal cycle, reaching maximum annual extent in September. Once the surface ocean has frozen over, this sea-ice cover provides a surface for (solid) precipitation to accumulate. This precipitation may build up on the sea ice and take a range of shapes, including so-called dunes unless transported away by advection. As this snow on sea ice ages it undergoes metamorphism, which changes its physical structure including grain size, density, albedo and others.

Close to the Antarctic coast fast ice is a dominating feature. It provides a substrate that supports ecosystems ranging from primary production to higher predators including penguins and seals. Fast ice is also underpinning a range of operational activities. Hence, understanding the processes that modify the characteristics of the fast ice is critical.

Here we will research the changes in the fast ice and its snow cover with focus on the spring transition. At this time increased shortwave radiation is available at the snow- and sea-ice surface. While the relatively high albedo of both snow and sea ice reflects much of the incoming radiation, a significant amount contributes to the melt of snow or sea ice near the surface and some of the radiation also being absorbed by the snow and the sea ice. This study will assess (a) the ratio of reflected versus absorbed shortwave radiation and its dependency on the surface characteristics; (b)

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement № 101081465

the radiative processes associated with these and if they can be observed by remote-sensing methods; and (c) the internal erosion near the sub-surface of the sea ice including how this changes the physical and biological environment within the sea-ice column. The results from this project will be invaluable to understanding how small-scale processes in the ice-snow system impact the regional characteristics of Antarctic sea ice.

Supervisors:
Ghislain Picard (UGA)
Stuart Corney [TBC] (IMAS, UTAS) & Petra Heil (AAPP, IMAS, UTAS & AAD)

Research Fields: Glaciology, Ocean-sea ice-atmosphere, radiative transfer, albedo

Project 2: *Radiative signature of Antarctic icebergs*

As the glacial ice slides off the Antarctic continent it grows floating ice shelves, which at their base are exposed to ocean water. At this interface, given correct conditions, marine ice may attach itself to the base ice the ice shelf. This marine ice has a different appearance than the glacial ice. Once an iceberg has calved from the ice shelf, it undergoes melt and consequently may roll over, hence exposing marine ice above the sea surface. The exposed marine ice may be of green, blue or intermediate colour, leading to the naming of green or jade bergs. The variation in colour is most likely due to different ratios of iron or trace elements within the ice matrix of the berg. As icebergs traverse huge distances before they finally melt and disperse meltwater and with it any enclosed substances, it is important to understand the particle- and hence nutrient transport in the Soutehrn Ocean due to iceberg motion.

Here we will study the radiative signatures of icebergs across a range of satellite-borne sensors to check if different coloured icebergs can be identified, and if the sensors can detect differences in the particle load of the icebergs.

Supervisors:
Ghislain Picard (UGA)
Stuart Corney [TBC] (IMAS, UTAS) & Petra Heil (AAPP, IMAS, UTAS & AAD)

Research Fields: Glaciology, Ocean-sea ice-atmosphere, radiative transfer, albedo

Project 3: *Satellite-based detection of snow wetness and wave-induced surface wetting of Antarctic sea ice*

Wave-ice interaction is a dominant process in characterizing the Antarctic sea ice including the seasonal evolution of the sea-ice extent. Wave interaction is a process that defines the Marginal Ice Zone, which separates the blue water from the established pack ice. Wave action also gives rise to the overwash of the sea ice, wetting the sea-ice surface and with it of any snow that may be present on top of the sea ice. This overwash does affect the morphology of the snow cover and the upper ice surface and may support the formation of meltponds on the sea ice. All these will change the radiative transfer at the sea-ice surface and will modify the remotely sensed signature of the snow and the sea ice.

This project will research if the modification of the snow (and sea-ice surface) induces radiative signatures that can be detected by satellite-based sensors, and will be using data from satellite-borne altimeters (i.e., ICESat-2) to correlate these marginal-ice zone processes, such as wave invasion into the sea-ice zone.

Supervisors:
Ghislain Picard (UGA)
Stuart Corney [TBC] (IMAS, UTAS) & Petra Heil (AAPP, IMAS, UTAS & AAD)

Research Fields: Glaciology, Ocean-sea ice-atmosphere, radiative transfer, albedo

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement Nº 101081465

3. Employment Benefits and Conditions

The Université Grenoble Alpes offers a 36-months full-time work contract (with the option to extend up to a maximum of 42 months). There is a probation period of 2 months and the total working hours per week is 36h40.

The remuneration, in line with the European Commission rules for Marie Skłodowska-Curie grant holders, will consist of a gross annual salary of 27,907 EUR. Of this amount, the estimated net salary to be perceived by the Researcher is 1,870 EUR per month. However, the definite amount to be received by the Researcher is subject to national tax legislation.

Benefits include

- Access to all the necessary facilities and laboratories at Université Grenoble Alpes and University of Tasmania, including GRICAD computational facilities.
- Tuition fees exemption at both PhD awarding institutions.
- Yearly travel allowance to cover flights and accommodation for participating in AUFRANDE events.
- 10,000 EUR allowance to cover flights and living expenses for up to 12 months in Australia.
- 45 days paid holiday leave.
- Sick leave.
- Parental leave.

4. PhD enrolment

Successful candidates for this position will be enrolled by the following institutions and must comply with their specific entry requirements, in addition to AUFRANDE's conditions.

Université Grenoble Alpes

To enrol in a Doctorate program you must meet the general conditions, namely:

- to hold a French diploma conferring the degree of master at the end of a training programme establishing the aptitude for research;
- to hold a foreign diploma of equivalent level (obtained at the end of a training programme establishing the aptitude for research). In this case, you should request an exemption from the Master's degree when you apply;
- benefit from the validation of prior learning as provided for by the Education Code.

More information: https://doctorat.univ-grenoble-alpes.fr/preparing-a-phd/doctorate-enrolment/apply-and-register-in-doctoral-school-890537.kjsp?RH=1611137559271

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement № 101081465

University of Tasmania

The minimum course entry requirements for a Doctoral Degree are:

i. Completion of a previous qualification in a relevant discipline that includes a substantive thesis, where the research component of that degree comprises:
   - 50% of a Bachelor Honours (equivalent to AQF Level 8) with an overall grade of at least Second Class Upper (Class IIA) standard, or
   - 25% of a two-year Masters Coursework degree (equivalent to AQF Level 9) with a thesis component grade of at least Distinction grade, or
   - Masters Research degree (equivalent to AQF Level 9) of at least Distinction grade.

OR

ii. A record of research or professional qualifications deemed by the Dean, to be of a standard equivalent to at least Bachelors Honours degree Second Class Upper (Class IIA) and providing a suitable background for the Doctoral research the candidate is proposing to undertake.

In addition, an applicant must provide evidence of their English language proficiency in accordance with the University of Tasmania's requirements at the time they submit their application. Note that results of an English language proficiency test must have been awarded within 2 years of application date.

Furthermore, international applicants must satisfy the Australian Department of Home Affairs English language proficiency criteria to obtain a student visa to study in Australia. This requirement is in addition to the applicant meeting the University's English language proficiency requirements.

More information: https://www.utas.edu.au/policy/procedures

This project has received funding from the European Union's Horizon Europe research and innovation programme under the Marie Skłodowska-Curie grant agreement № 101081465