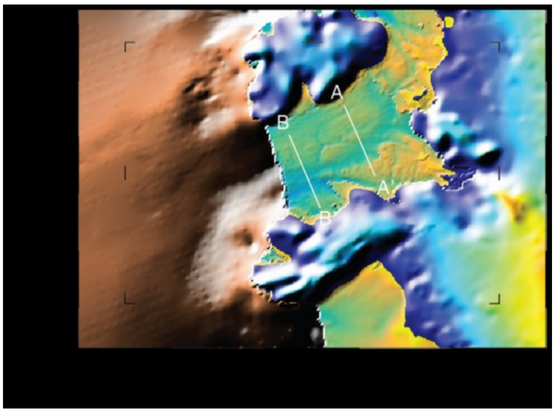

Credit: Ted Scambos, NSIDC

1. **Project title**
   Controls on ice shelf thinning around the Antarctica and Greenland Ice Sheets

2. **Supervisors with affiliations**
   Noel Gourmelen[1], Dan Goldberg[1]
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3. **Primary supervisor contact email**
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4. **Project background**

The majority of meteoric ice that forms in Antarctica leaves the ice sheet through floating ice shelves; and the majority of these ice shelves play a significant role in “buttressing” against the loss of grounded ice and subsequent sea level rise [*Furst et al.,* 2015]. A significant proportion of ice removal from these shelves occurs by submarine melting [*Shepherd et al.,* 2003; *Rignot et al.,* 2013; *Depoorter et al.,* 2013]. While a certain level of melting may be required to maintain ice thickness [*Jenkins and Doake,* 1991], increase in melt above this level can lead to ice shelf thinning and potential buttressing loss. Over the last 25 years observations over ice shelves around west Antarctic ice sheet have revealed widespread ice shelf thinning [*Shepherd et al.,* 2003; *Rignot et al.,* 2013; *Depoorter et al.,* 2013; *Pritchard et al.,* 2012; *Paolo et al.,* 2015], largely attributed to increased melting.
There is mounting evidence that submarine melting can exhibit high spatial and temporal variability [*Bindschadler et al.,* 2011; *Dutrieux et al.,* 2013]. Meanwhile, numerical studies suggest buttressing loss is sensitive to the location of ice removal within a shelf [*Furst et al.,* 2015; *Goldberg et al.,* 2012]. Thus it is important that we observe patterns of ice shelf thinning as well as magnitudes – both to assess the impact on ice sheet flow and to better understand ocean drivers of thinning.

5. **Key research questions**
   The aim of this project is to investigate the pattern of ice shelf thinning around Antarctica and Greenland. Specific research questions to drive the project are:

a. Where does thinning of ice shelf occur?

b. What controls ice shelf thinning?

c. What are the implications for future projections of sea level change?

6. **Methodology**, including a timetable for the programme of research

   a. Produce high resolution surface elevation change for ice shelves in Antarctica and Greenland from archive and existing Earth Observation (18 months).

   b. Model the observe surface elevation change and investigate causes of ice shelf thinning and impact on SLR (18 month)

   c. Production of thesis and publications to scientific journals (6 months).

7. **Training**

A comprehensive training programme will be provided comprising both specialist scientific training and generic transferable and professional skills. Specifically for this project, the student will receive training in valuable and employable glaciological techniques including remote-sensing and modelling, as well as multidisciplinary training in the use and analysis of climatic, hydrologic and glaciologic records. She/he will benefit from working with an internationally leading team based in the Edinburgh Earth and Environment (E3) Doctoral Training Partnership. Conceived as a key part of the scientific training, the student will also receive support to attend national and international meetings (conferences and workshops) to disseminate findings to the (inter)national scientific community, and be encouraged to prepare and submit scientific papers to peer-reviewed literature during the course of the studentship. In addition to the above, the student will also have the opportunity to participate in a multitude of transferrable skills training run by the University of Edinburgh, including through participation in the School of GeoSciences Graduate School, a friendly environment in which you can practice research skills such as preparing and delivering conference talks. The student will be encouraged to participate in summer schools in glaciology.

8. **Requirements**

We seek an enthusiastic student with a suitable Undergraduate and/or Masters Degree qualification equipped with quantitative skills in earth sciences, physical geography, remote-sensing, physics, and/or mathematics.

9. **Further reading or any references referred to in the proposal**

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Mankoff, K. D., S. S. Jacobs, S. M. Tulaczyk, and S. E. Stammerjohn (2012), The role of Pine Island Glacier ice shelf basal channels in deep-water upwelling, polynyas and ocean circulation in Pine Island Bay, Antarctica*, 53*, 23-28.

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Rignot, E., S. Jacobs, J. Mouginot, and B. Scheuchl (2013), Ice-Shelf Melting Around Antarctica*, Science}, 341*, 266-270.

Sergienko, O. V. (2013), Basal channels on ice shelves*, Journal of Geophysical Research: Earth Surface, 118*, 1342-1355.

Shepherd, A., D. Wingham, T. Payne, and P. Skvarca (2003), Larsen ice shelf has progressively thinned*, Science, 302*, 856-859.

Thurnherr, A. M., S. S. Jacobs, P. Dutrieux, and C. F. Giulivi (2014), Export and circulation of ice cavity water in Pine Island Bay, West Antarctica*, Journal of Geophysical Research: Oceans, 119*, 1754-1764.

Vaughan, D. G., H. F. J. Corr, R. A. Bindschadler, P. Dutrieux, G. H. Gudmundsson, A. Jenkins, T. Newman, P. Vornberger, and D. J. Wingham (2012), Subglacial melt channels and fracture in the floating part of Pine Island Glacier, Antarctica*, Journal of Geophysical Research: Earth Surface, 117*, n/a-n/a.

10. **A project summary -** (30 words max) which could be used for advertising
Investigating controls on changes in Ice shelf thickness and their implications for future