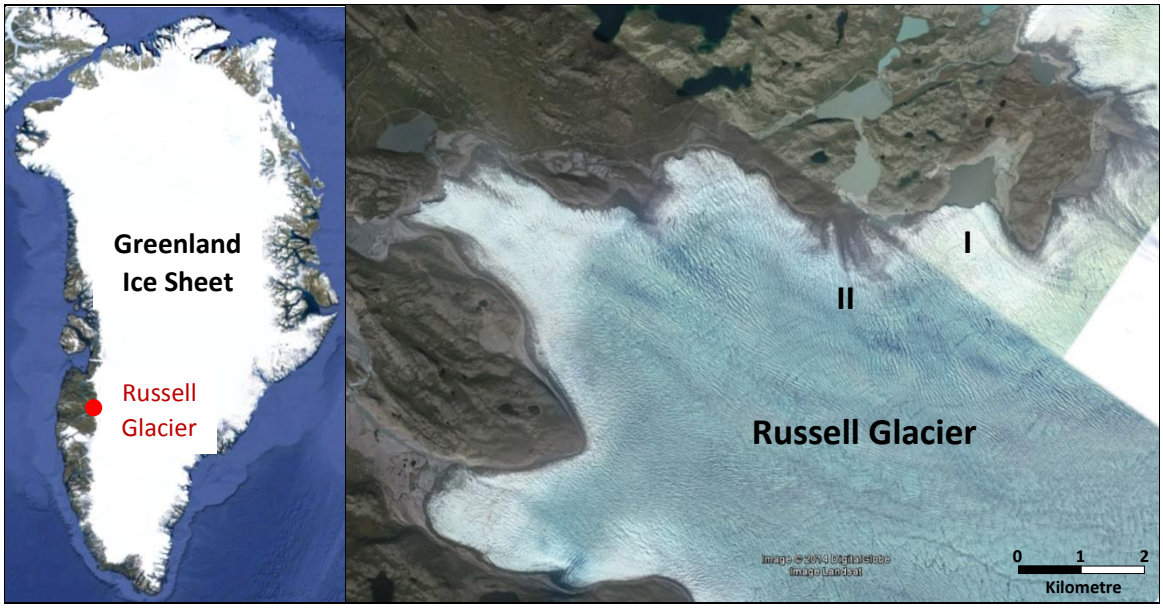
Evaluating the impact of a proglacial lake and debris cover on ice loss from Russell Glacier, west Greenland

This project aims to assess the impact of an ice-marginal lake and ice-surface debris cover on ice losses from a portion of Russell Glacier, central-west Greenland.



Glaciers are shrinking at an accelerating rate and are a major contributor to sea level rise. Consequently, it is vital to understand the factors driving this ice loss. Iceberg calving is a primary component of losses from marine- and lake-terminating glaciers, but the calving process and its triggers are not properly understood. Surface debris has also been identified as an important control on mass loss rates, via its impact on melting: thin surface debris can accelerate melting due to its darker colour, where as a thicker layer can insulate ice and supress melting. However, this process is also poorly understood. This project investigates these controls at Russell Glacier central-west Greenland, using a combination of terrestrial time lapse photography and direct melt measurements.

The project will:

1. Obtain high temporal resolution images of the lake-terminating portion of Russell Glacier using two terrestrial time lapse cameras.

2. Construct digital elevation models (DEMs) from these images, to calculate calving losses at sub-daily to weekly timescales and their relationship to changes in lake level and lake and air temperature.

3. Map the terminus using a Terrestrial Laser Scanner (TLS), to validate the time lapse approach.

4. Quantify surface melt rates in areas with different debris thickness and use measurements to calibrate thermal band satellite imagery.

5. Evaluate the impact of the proglacial lake and debris on ice loss rates at present and in the past, using satellite imagery.

Results from Russell Glacier will improve our understanding of the impact of proglacial lakes on iceberg calving in polar regions. Moreover, this process-based knowledge is important for areas with large and rapidly expanding proglacial lakes, such as the Himalaya and New Zealand, where outburst floods from these lakes represent major natural hazards. This work is done in collaboration with Prof. Andy Russell at Newcastle University and Dr Jonathan Carrivick and Joseph Mallalieu at University of Leeds.