Quantitative Methods: Student Work

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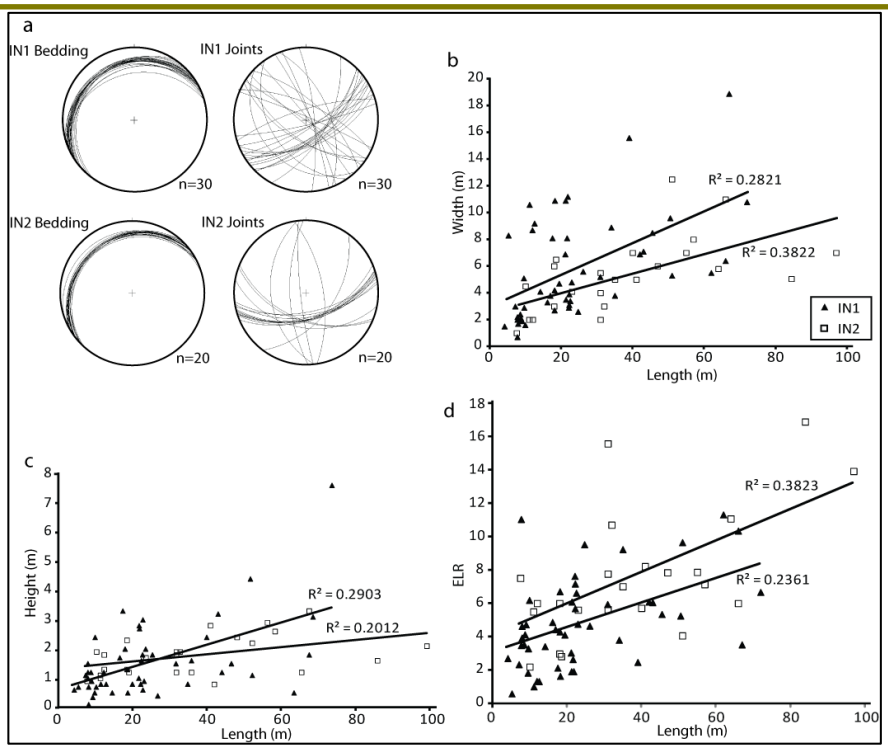
Course: PhD in Glacial Geomorphology

What was the focus of your PhD?

My thesis looked at the outlet glaciers of the Uummannaq region in West Greenland, trying to understand their long-term (>3 million years), and more recent (25,000 years) development. I combined geomorphological and sedimentological analysis with geochronology to understand landscape development in a region that has been repeatedly inundated by the Greenland Ice Sheet.

Fieldwork: West Greenland

In the field, I mapped glacial and fluvial features in order to understand how extensive and thick the Greenland Ice Sheet has been over the past 25,000 years. This was done systematically over the region we were studying, and was complemented by remote mapping with aerial photographs. When found, we also analysed the sediment that was left behind by the ice sheet. Study of these deposits allowed us to understand how the glacier behaved in different parts of the landscape. Alongside this we needed to understand when the ice sheet retreated during the past 25,000 years, and how quickly this happened. This meant sampling rocks from the landscape to date using surface exposure dating, and sediment from the bottom of lakes to date using radiocarbon.



These figures present data from measurements taken of bedrock bedforms in West Greenland. Stereonets visually represent the bedrock joint and bedding plane directions in host bedrock. The graphs display a comparison of two data sets from each site. They represent two very different populations with regard to their height vs length, but in other parameters are less easily differentiated between.

Quantitative Methods

Using GIS, I combined the data collected from aerial photos and features mapped in the field and produced digital maps. Some chronological data required statistical analysis and modelling, including Bayesian modelling. This is a method not previously used for geochronological data, and allows interrogation of the dataset and a better understanding of the robustness of the data.

What did you find?

My work provided clear evidence for the impact of changes in air temperature; ocean temperature; and underlying topography on glacier behaviour over the past 25,000 years. Regional topography (both on land and underwater) can have an important impact on ice sheet behaviour, and is vital to understand for predictions of future ice sheet change.