

**The Secret Lives of Glaciers.** M. Jackson. 2019. Brattleboro, Vermont: Green Writers Press. xiii + 277 p, hardcover. ISBN 9780996267670. USD 19.95.

As a physical glaciologist, I am often asked how I *feel* about climate change and glacial retreat. It is a question I actively deflect: yes, glaciers are overwhelmingly retreating worldwide, but I am not sad, or upset, or depressed about it: I am interested and keen to measure them. It was therefore a compelling and appealing exercise to read a book devoted to exactly that: how people feel about climate change and receding glaciers. During a time where, despite strong scientific consensus on climate change, there are remarkably divisive political narratives, understanding how communities perceive these transitions is essential to cultivating scientific education and outreach programmes and diagnosing where the disconnects between scientists, science communicators and the public occurs. This unique perspective is what makes M. Jackson's book so relevant and timely.

In *The Secret Lives of Glaciers*, Jackson explores the perceptions and opinions of Icelanders living in Höfn, Hornafjörður, a town in the shadow of Europe's largest ice cap, Vatnajökull. Jackson interviews residents on their understanding of, and belief in climate change, how it is affecting the local glaciers (Breiðamerkurjökull, Skálafellsjökull, Heinabergsfjöll, Fláajökull and Hoffellsjökull), and what the future might hold for these ice bodies. This approach is relatively unique: most glaciology, if it involves a human component at all, tends to focus on either the utility of glaciers or the impacts of climate change, such as the amount of water a glacier can provide downstream communities or how anthropogenic climate change has increased annual ablation rates. Thus, the big question addressed by this book is asked through a feminist lens: what do people believe is happening with glaciers?

Jackson first produces a comprehensive overview of the history of Icelandic glacial research, including the long-standing tradition of glacier monitoring by volunteers, and national pride in important glaciological scientific achievements. The importance of glaciers to the Icelandic economy and identity is clearly demonstrated, and it is clearly stated that many in Hornafjörður comprehend local glacial changes as originating from anthropogenic sources. Jackson exhaustively examines the short-term benefits of climate change and increased glacial melt, as witnessed through an exponential expansion of last-chance tourism. However, Jackson also exposes the apparent conflict between these concepts for a portion of the population. Icelanders are connected, through a shared national identity, to their glaciers: they are proud of the scientific record; however, some members of this same group will essentially reject that climate change is impacting Hornafjörður. The reasoning is often anecdotal and lacks necessary overarching context: for example, suggesting that a glacier is growing because there was a large snow year, as evidenced by colder water, that "sometimes the glaciers build up, sometimes they get smaller" (p.125), or that the winters and summers are variable. It is clear from the long-term data that Icelandic glaciers are overall retreating, so why do those living in their shadows not always believe it? Unfortunately, Jackson does not classify the interviews or provide any meaningful metrics: is climate-change uncertainty a dissident opinion, or the majority view? Knowing this would help situate the reader by providing context on the prevailing beliefs in Höfn, and in inferring the importance of these opinions.

I suggest that there are a few missed opportunities in the book to include nuanced scientific context for the reader, which could help explain the disconnect between the importance of glaciers to these Icelanders and their perceived denial of some aspects of climate change. One particular issue is the lack of clarity and clear definition of several key terms: for a non-expert, many of the glacier theories which Jackson skirts around would be difficult to understand without prior knowledge. In particular, the presence of surge-type glaciers alters the connotations of this story, and Jackson does not comprehensively explain these phenomena. Surge-type glaciers undergo cyclic oscillations between short 'active' periods of fast flow and terminus advance (typically lasting from months to years) and long 'quiescent' periods of little to no flow and terminus stagnation or retreat (lasting from decades to centuries). Glacier velocities can fluctuate by orders of magnitude between the active surge and the quiescent phase; for example, large parts of Tungnaárjökull, an outlet of western Vatnajökull ice cap, were accelerated from <0.1 m/day to >3 m/day over just a few months in 1994. While oral histories relating jökulhaups to the destruction of homes in Iceland are common, there is evidence that surge-type glaciers

have also posed hazards in the region. During a surge, the terminus can advance so rapidly that infrastructure is unable to be saved from the advancing ice: for example, Jackson credits the 1600 surge of Breiðamerkurjökull with the destruction of homes and livestock (p. 11).

Iceland has a large concentration of surge-type glaciers, with at least 26 currently identified. All of Vatnajökull's major outlet glaciers are surge-type, and Breiðamerkurjökull has surged 11 times between 1794 and 1969. Aside from Eyjabakkajökull which has surged at least 4 times between 1890 and 1972, the other glaciers in the Hornafjörður/Höfn drainage region are not surge-type: although Jackson suggests a surge of Fláajökull (pp.90, 93), there is no evidence of this from peer-reviewed research and this glacier is not included as surge-type in either the Icelandic Glacier Society or the World Glacier Monitoring Service databases. Regardless, perhaps, the proximity to such active surging glaciers (Breiðamerkurjökull and Eyjabakkajökull) might be influencing opinions on climate change. To a non-expert, surge-type glaciers might appear to advance and retreat seemingly at random: rather than being driven by climate, surges appear to be controlled by internal dynamics related to transitions in subglacial hydrology or thermal regime. In a warming climate, a surging glacier will undergo phases of both terminus advance and retreat. This phenomenon is still poorly understood: the reasons why some glaciers surge and neighbouring ones do not, why some surge once and then not again and what controls when a glacier surges are all still unanswered. It is unsurprising that locals might be confused about the state of their glaciers: even glaciologists are still figuring out the whole story! Without connecting the still-progressing science to local opinions, Jackson neglects to adequately explain the complicated nature of how glaciers work, and this lack of science

communication can lead to public misperceptions of what's driving glacier changes, despite people's perceived intimacy with the subject.

In addition, Jackson only slightly touches on the Icelandic Sagas and their potential influence. The importance of oral history in shaping local, traditional knowledge is well documented; this could have been a unique opportunity to compare and contrast glacial stories in the Sagas, what is interpreted by this group of Icelanders, and what is happening according to glaciologists working in the region. Aside from the main criticisms, it was disappointing that Jackson only wades shallowly into the following themes, which are owed more explanation and exploration: the importance of landscapes as assemblages, glacier power, animism and feminist glaciology. I should finally mention that there are several stylistic and editing issues: there are several occasions where Jackson repeats the same quote or fact multiple times without explaining the additional importance, and considerable use of technical jargon. Finally, the end notes do not associate numerically with the text in the main book – these are quite useful, but difficult to follow as they lack clear documentation.

Overall, while this is an interesting perspective on glaciers (and one that is needed), Jackson neglects to connect some of the dots: perhaps the reason why “chimeric plasticity of glaciers [can] verify multiply conflicting narratives all at once” (p.140) is because glacial dynamics are exceedingly complicated and have not been well explained to non-experts. Perhaps also, the scientific community needs to find a more effective way to explain these intricacies. (Brittany Main, Laboratory for Cryospheric Research, University of Ottawa, Canada ([brittany.main@uottawa.ca](mailto:brittany.main@uottawa.ca)))

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