
Article:
Harpur, C. orcid.org/0009-0009-4123-9679 (2025) Capturing glacier calving with time-lapse camera arrays. Nature Reviews Earth & Environment.

https://doi.org/10.1038/s43017-025-00649-y

Capturing glacier calving using time-lapse camera arrays

Connie Harpur
School of Geography, University of Leeds, Leeds, UK
e-mail: gycmh@leeds.ac.uk

Main text

Glaciers worldwide are losing mass more rapidly due to climate change. Much of this loss happens at their lake and marine margins, where chunks of ice break away through a process termed calving. Assessing the timing, style and volume of individual calving events is important for glaciologists seeking to understand the mechanisms driving glacier retreat, measure ice loss, and predict how glaciers might respond to lake and ocean warming. Although satellite and drone imagery can be used to document calving activity, limitations related to image resolution, cloud cover and constraints on field season lengths mean they are less suited to capturing dense, long-term calving records.

The application of Structure-from-Motion (SfM) photogrammetry to time-lapse camera imagery addresses these challenges. This approach uses an array of automated trail cameras (typically 12 to 15) positioned to photograph a calving front from multiple angles at intervals of several hours. The resulting images, taken over weeks, months, or even years, are processed with SfM techniques to generate detailed 3D models of the glacier front at each timestep. Differencing successive models reveals the precise locations and volumes of individual calving events. Since trail cameras have the durability to withstand deployment over timescales much longer than typical field campaigns, this method can produce records of calving activity spanning both summer and winter months.

The capability of time-lapse SfM photogrammetry is allowing novel insights into the seasonality of calving processes. For example, this technique was used to generate the first year-round volumetric record of calving at a lake-terminating glacier in Greenland, which showed how calving volumes and mechanisms evolved in response to lake conditions. Given likely increases in lake and ocean temperatures, and reduced lake and sea ice-cover, an understanding of the associated implications for ice loss is set to become increasingly critical. Consequently, the combined time-lapse and SfM approach offers an affordable means to unravel the complexities of glacier calving.

Acknowledgements

The author thanks Joseph Mallalieu, who devised this technique, for his helpful advice and

feedback on the article, and acknowledges support from the NERC Panorama DTP (Training Grant NE/S007458/1).

Image

Image credit: Alex Scoffield