Geophysical Research Abstracts
Vol. 20, EGU2018-1089, 2018
EGU General Assembly 2018

Analysis of tidewater glacier dynamics from changes in calving front morphology in Gothåbsfjord, southwest Greenland

Charlie Bunce (1), Peter Nienow (1), Noel Gourmelen (1), Andrew Sole (2), and Tom Cowton (3)

(1) University of Edinburgh, School of Geosciences, United Kingdom (c.bunce@sms.ed.ac.uk), (2) University of Sheffield, School of Geography, United Kingdom (a.sole@sheffield.ac.uk), (3) University of St Andrews, School of Geography and Sustainable Development, United Kingdom (t.cowton@st-andrews.ac.uk)

The successful prediction of the response of the Greenland Ice Sheet (GrIS) to climate warming relies in part on the accurate estimation of future ice loss from tidewater glaciers. Calving is an important component of mass loss at marine margins and rates can vary considerably in response both to internal dynamics and external controls. Furthermore, there is limited field data at a sufficiently high spatial and temporal resolution because calving margins are largely inaccessible. Here, we investigate changes in calving front morphology at tidewater glaciers in Gothåbsfjord, southwest Greenland in order to improve our understanding of controls on calving. This aspect of glacier dynamics has received little prior attention and therefore represents a considerable gap in knowledge. We use time-lapse photogrammetry and remote sensing to determine sub-daily morphometric changes at the calving fronts of three tidewater glaciers. We then develop a 'buffer analysis' method to analyse both short-term (every $\sim$ 6 days) terminus retreat patterns and more detailed morphometric change. We subsequently analyse the results in combination with data from key potential controls on retreat (including meltwater run-off estimations and plume observations), in order to more accurately constrain principal mechanisms of retreat at these glaciers. Our results show distinct patterns of morphometric development at calving fronts, related to a variety of controls on calving. An understanding and quantification of the role of morphometric change in glacier dynamics and iceberg calving may provide invaluable new insights into tidewater glacier behaviour and controls on ice loss. Ultimately, this information will feed ice-dynamic models which in turn will lead to better estimations of future mass-loss from the GrIS, and its potential contributions to global sea level rise.