Geophysical Research Abstracts
Vol. 21, EGU2019-15901, 2019
EGU General Assembly 2019

Modelling the near-future evolution of Kangerdluggsuaq Glacier, south-east Greenland

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Kangerdluggsuaq Glacier (KG) is one of Greenland's largest outlet glaciers, draining ∼5% of the entire ice sheet. In the mid-2000s, it underwent a major phase of retreat, acceleration and thinning. This markedly increased its ice discharge, which, together with Helheim Glacier, accounted for ∼ 30% of ice loss for south-east Greenland between 2000 and 2006 (Howat et al., 2007). Following this, KG's discharge rapidly reduced to pre-retreat rates. However, our observations show that KG began a new phase of retreat in 2017/18, which has brought its terminus to its most inland position since records began in the mid-20th century. Furthermore, retreat has brought KG's calving front to the top of a major basal over-deepening, which extends ∼15 km inland. Here we use the numerical model Ua to assess the future evolution of KG, with a particular focus on its behaviour once it enters the over-deepened trough. We set up the model with data for 2017, prior to the latest phase of retreat. We conducted a transient run with no forcing, to determine the impact of the basal trough and KG's response to current conditions. Our results suggest that the terminus rapidly retreats through the over deepening (<20 years). We altered surface mass balance (SMB), both positively and negatively, and determined that even with large changes in SMB (e.g. +1 m SMB per year), KG still retreated rapidly through its basal trough.