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Modelled dynamic retreat of Kangerlussuaq Glacier, southeast Greenland, strongly influenced by the consecutive absence of an ice mélange in Kangerlussuaq Fjord

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Modelled dynamic retreat of Kangerlussuaq Glacier, southeast Greenland, strongly influenced by the consecutive absence of an ice mélange in Kangerlussuaq Fjord, Stockholm, Sweden (jamie.barnett@natgeo.su.se)

Mass loss at the Greenland Ice Sheet is influenced by atmospheric processes controlling its surface mass balance, and by submarine melt and calving where glaciers terminate in fjords. There, an ice mélange – a composite matrix of calved ice bergs and sea ice – may provide a buttressing force on a glacier terminus, and control terminus dynamics as a function of mélange dynamics and strength. Kangerlussuaq Glacier is a major outlet of the Greenland Ice Sheet, for which recent major retreat events in 2004/2005 and 2016-2018 coincided with the absence of an ice mélange in Kangerlussuaq Fjord. To better understand the response of Kangerlussuaq Glacier to climatic and oceanic drivers, a 2D flowline model is employed. Results indicate that an ice mélange buttressing force exerts a major control on calving frequency and rapid retreat: when an ice mélange forms in Kangerlussuaq Fjord, it provides stabilizing forces and conditions favorable for winter terminus re-advance. When it fails to form during consecutive years, modeled retreat of Kangerlussuaq Glacier occurs into the large overdeepenings in Kangerlussuaq Fjord, and to terminus positions more than 30 km farther inland, necessitating to anticipate excessive mass loss from Kangerlussuaq Glacier by the year 2065.