



Supplement of

The distribution and evolution of supraglacial lakes on 79° N Glacier (north-eastern Greenland) and interannual climatic controls

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Supplement

Teleconnections:

All teleconnection indices used in the discussion are the definitions from the NOAA Climate Prediction Centre. Only a brief description is given here. Refer

to <u>https://www.cpc.ncep.noaa.gov/products/precip/CWlink/daily_ao_index/history/history.shtml</u> for data and description of the methods used. The North Atlantic Oscillation is a normalised mean sea-level pressure (MSLP) index between two observation stations located in the Azores and in Iceland (Jones et al 1997, Hanna et al 2014b). NAO indices are related to the Arctic Oscillation (AO), which is defined as the first EOF of atmospheric pressure variability north of 20°N (Thompson and Wallace, 1998, Hanna et al 2014b). The NAO is also negatively correlated to the Greenland Blocking Index (GBI): the area-averaged 500hPa geopotential height over the majority of Greenland (60-80°N, 60-20°W). Finally, the East Atlantic (EA) index, in connection with the NAO, is a further teleconnection identified as being important for the climate in the northeast of Greenland by Lim et al (2016). The EA is the second prominent mode of variability for the North Atlantic, which has a similar, but southward shifted, structure as the NAO. Monthly GBI data were taken from https://psl.noaa.gov/gcos_wgsp/Timeseries/GBI_UL/.

WRF setup

Table S1: Select physics options used in the PWRF simulations by Turton et al. (2020).

Physics option	Selected scheme
Land surface model	Noah LSM
Microphyises	Morrison two moment scheme
Surface layer physics	Eta similarity scheme
Boundary layer scheme	Yonsei University Scheme (YSU)
Convection	Kain-Fritsch scheme in D01
Radiation scheme	Rapid Radiative Transfer Model (RRTM) longwave and Goddard
	shortwave.
Fractional sea ice	On



Figure S1: (Left) A zoomed in section of 79 °N Glacier highlighting the surface rivers and linear SGLs on the tongue of the glacier. Image from Sentinel 2b on July 31st, 2019. (Right) A calving event on the Spalte Glacier tributary to the north of 79 °N Glacier was observed in summer 2019 and 2020. Image from Sentinel 2b on August 27th, 2020



Figure S2: a) Sentinel 2 RGB of date July 31st, 2019. Red squares: example lakes 247 (upper right, close to grounding line) and 533 (lower left). b & c: Grayscale images of band 2 (blue) for lakes 247 (b) and 544 (c) from the same date. Red lines are the profile lines for the blue spectrum profiles on the right. Blue spectrum profiles for lake 247 (d) and lake 544 (e), standardized using the granule band 2 mean and standard deviation, starting at northwest. Horizontal lines show the lake level for this date.



Figure S3: Rapid drainage event chain between August 2nd and 6th, 2019. Following the total lake area peak on August 2nd, a larger lake at 950m a.s.l. drains in under 24 hours through a moulin. The following day (August 4th), a calving event starts. The next day, two lakes downstream the first event (800m a.s.l.) and a large lake close to the grounding line drain rapidly, accompanied by a further spread of the calving. The last day (August 6th), again, two lakes close to the grounding line drain rapidly. The rapid drainage event series reduce the total lake area by 18.5% within 96 hours. Red rectangles surround drained lakes, green rectangles the increasing calving zone. Purple lines are 100m isolines.



Figure S4: The SMB the week preceding July 21st 2017 (a) and August 17th 2017 (b) and the difference in SMB between them (c).