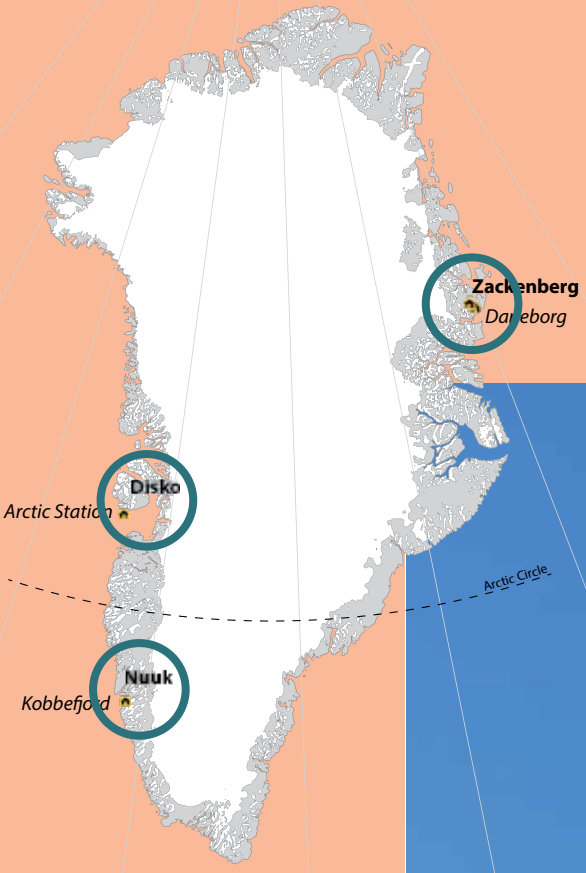
GEM
CLIMATEBASIS PROGRAMME



The GEM ClimateBasis programme monitors climate and hydrology in Zackenberg, Disko and Kobbefjord. The collected data builds base-line information on climate variability and trends used by all the other programmes within GEM and serve as a trustworthy foundation for climate change adaptation strategies for the Greenlandic society. The stations are embedded in an extensive climate and hydrology monitoring network in Greenland run by Asiaq – Greenland Survey.

Monitored parameter groups

- Air Humidity
- Precipitation
- Air Pressure
- Radiation
- River hydrology
- Air Temperature
- Wind
- Snow properties

Run-off data is delivered to the World Hydrological Cycle Observing System (WHYCOS) and the Global Runoff Data Centre (GRDC) networks under the auspices of the World Meteorological Organisation (WMO). Atmospheric parameters are collected redundantly at each location on two separated masts with individual energy supply in order to be able to treat data gaps and sensor biases consistently. Hydrometric parameters are monitored on various automated stations. Effort is put on the establishment of reliable stage-discharge relations, whose temporal stability depends on the river bed. At the river Zackenberg for instance, repeated glacier outburst floods require an updated stage-discharge relation every year, where the related field work is performed together with the GEM GeoBasis programme.

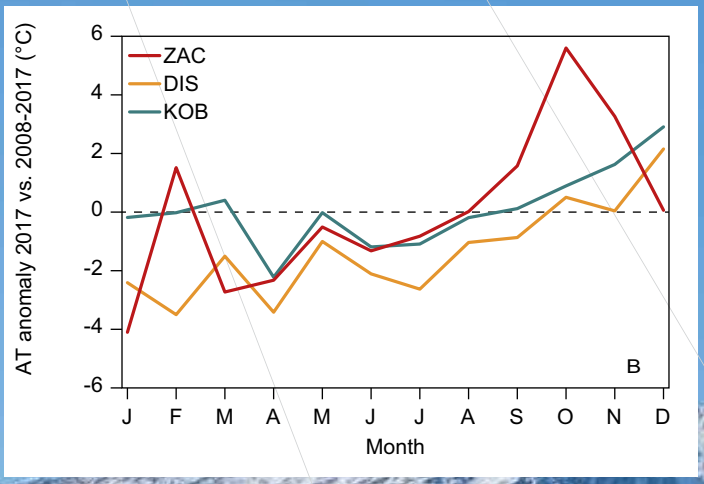


Figure 1. Monthly air temperature anomaly 2017 compared to the common reference period 2008-2017 for Zackenberg (ZAC), Disko (DIS) and Kobbefjord (KOB). The year started colder than usual and ended warmer than usual. Annual temperature at Disko significantly lower than usual (-1.31 oC), while Zackenberg and Kobbefjord was slightly warmer (+0.02 and +0.03 respectively). All numbers refer to the period 2008-2017 where we have overlapping data at all stations.

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DESCRIPTION

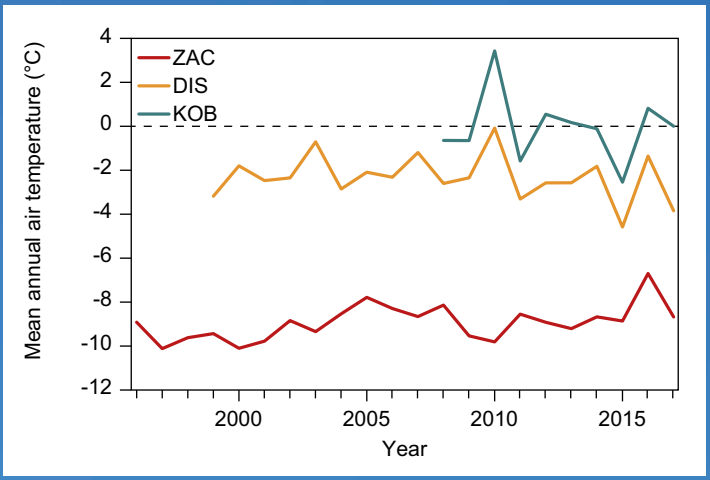

Figure 2. Mean annual air temperature at the three GEM sites Zackenberg (ZAC), Disko (DIS) and Kobbefjord (KOB). Very different temperature regimes can be pointed out with mean annual temperatuers way below zero at Zackenberg, a few degrees below zero at Disko and around zero in Kobbefjord. Despite the month-to-month variability not being very high in Kobbefjord (Fig. 1), the interannual variability is particularly strong. The overall trend is significantly positive for Zackenberg.

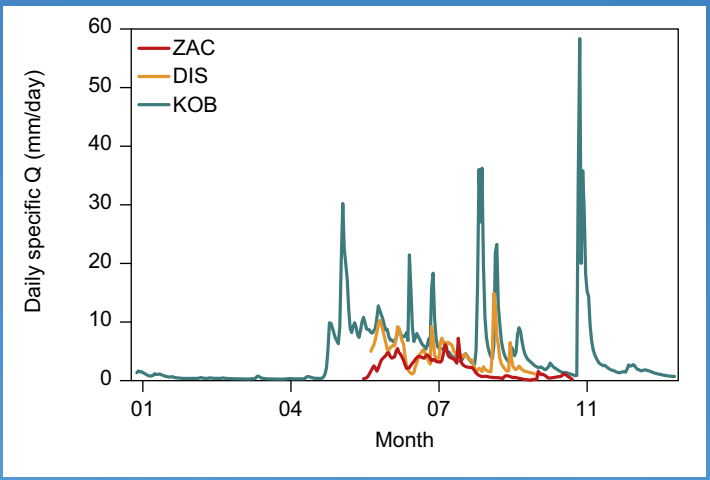

Figure 3. Specific daily discharge (run-off per unit area) at the three GEM sites Zackenberg (ZAC), Disko (DIS) and Kobbefjord (KOB) during 2017. While Zackenberg and Disko have no runoff during winter (and thus no permanently installed measurement setup), Kobbefjord shows year-round discharge. The different climatic conditions are mirrored in the discharge time-lines. Zackenberg shows the least specific discharge and Kobbefjord the highest. Autumn storms bring strong discharge pulses in Kobbefjord with up to almost 60 mm/day.

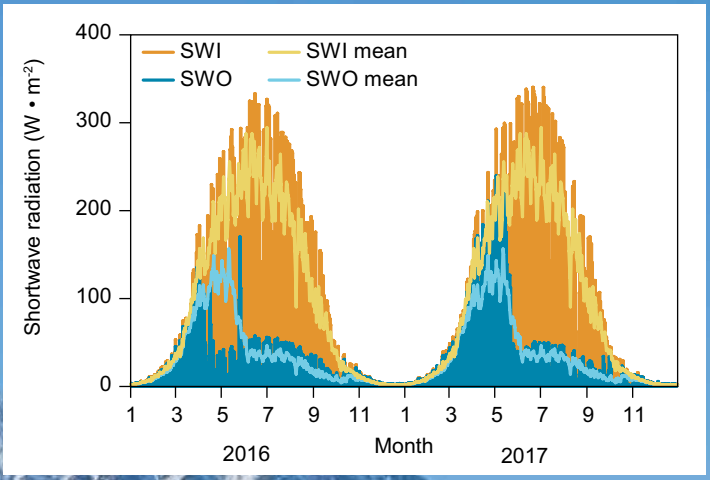

Figure 4. Shortwave incoming radiation (yellow) and shortwave outgoing radiation (blue) for 2016-2017 from Kobbefjord with their respective means since 2008 in grey tones. 2016 had one of shortest snow cover periods since 2008. This had a strong effect on the surface energy balance in winter and spring. While the incoming shortwave radiation (SWI) was similar for two consecutive years, the outgoing shortwave radiation (SWO) was quite different in sping, even when compared to the mean SWO from a ten year time series data (SWO mean).

(Photo: Jakob Abermann).