Arctic Extremes Work Shop - Aspen May 2022

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ArctRisk
Risk governance of climate-related systemic risk in the Arctic

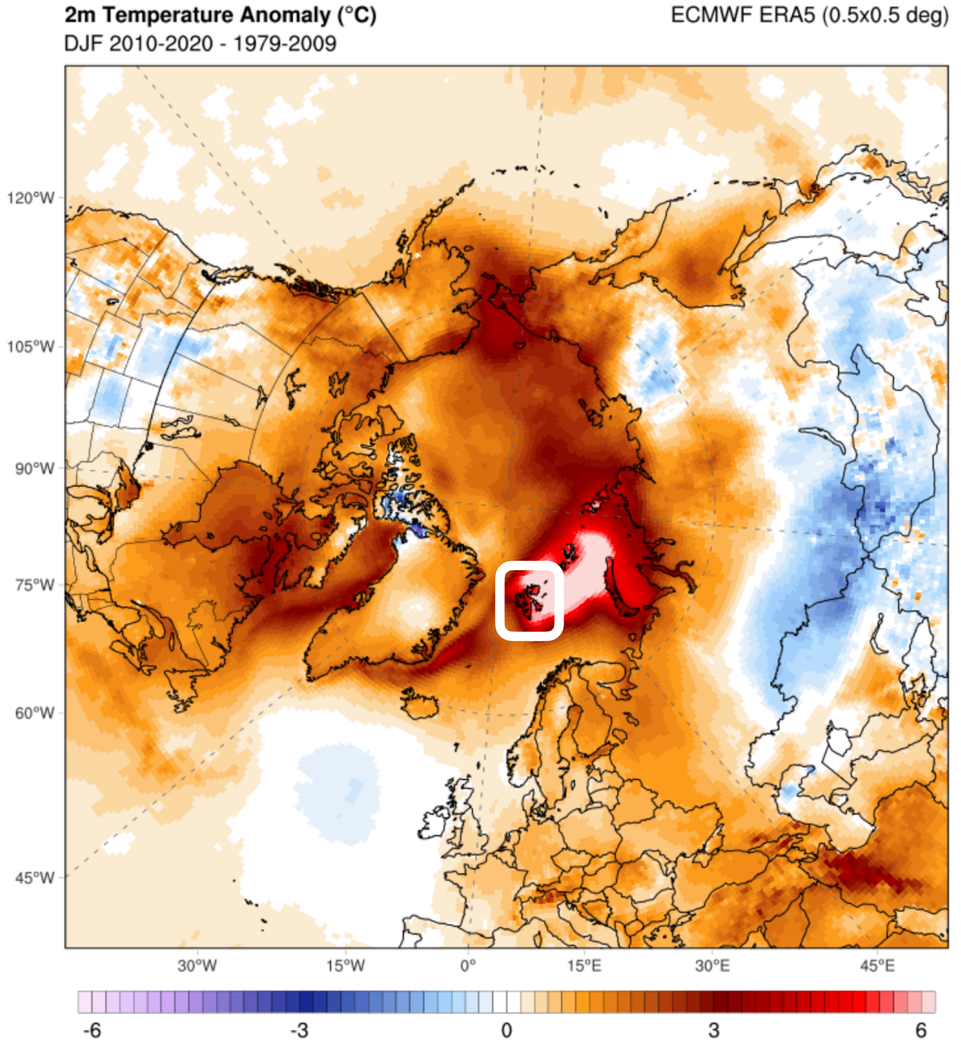
Air Temperature and Precipitation Trends in Svalbard

Affected by Sea Ice Decline and Changes in Atmospheric Circulation

picture: Holt J. Hancock

Svalbard and the European Artic

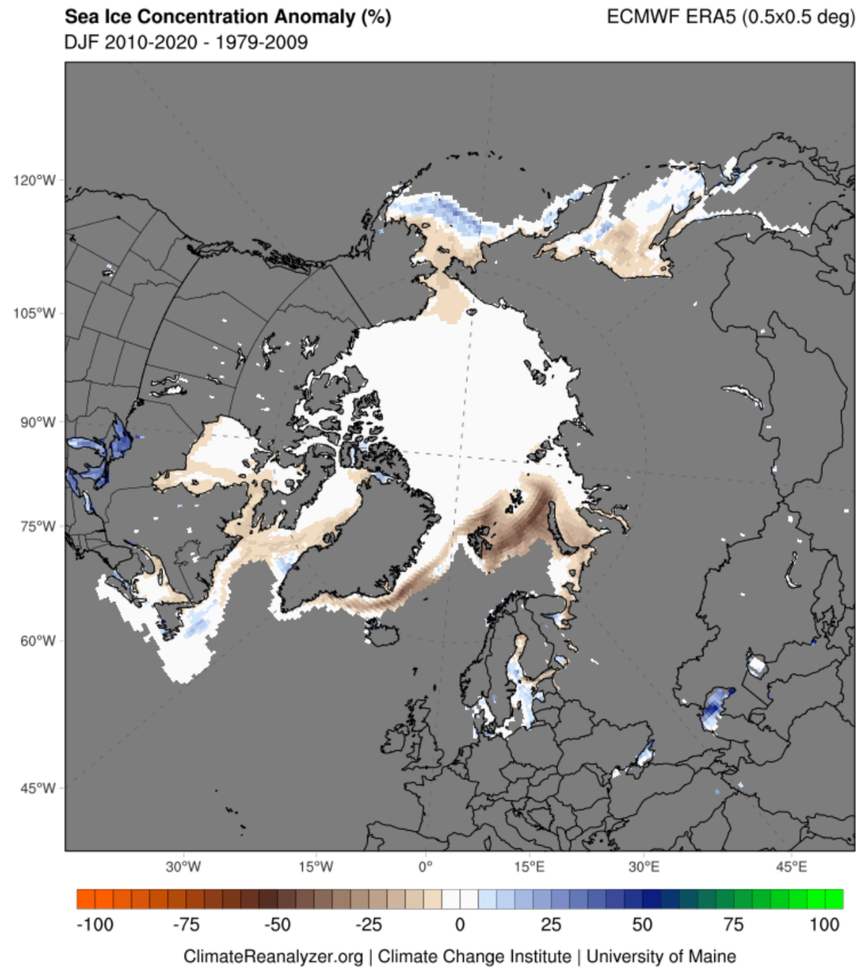
- Svalbard and the Barents Sea are have experienced that fastest winter warming globally
- An approximately 6 °C winter (DJF) warming is observed in Longyearbyen since 1980



Svalbard and the European Artic

Sea ice

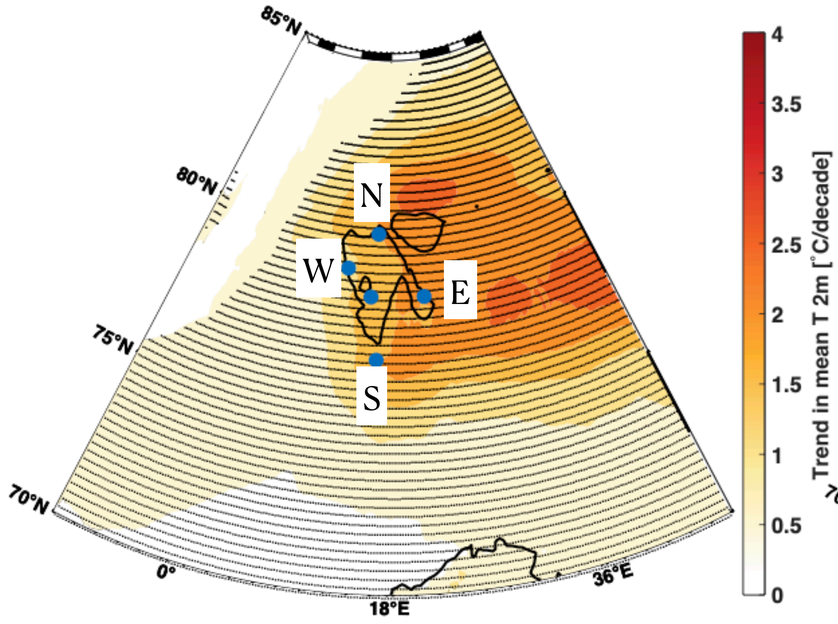
- The warming co-occurs with a winter sea ice decrease.

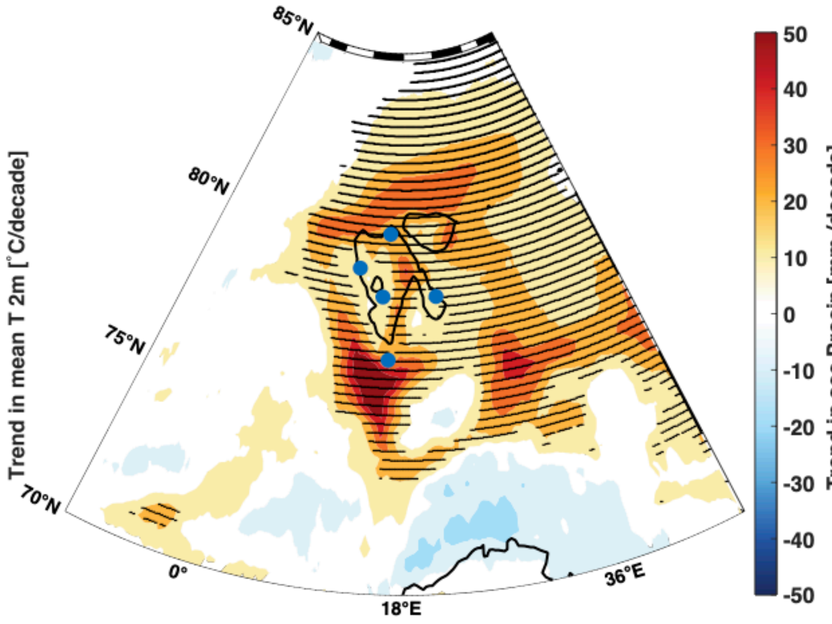


Regional trends in temperature and precipitation

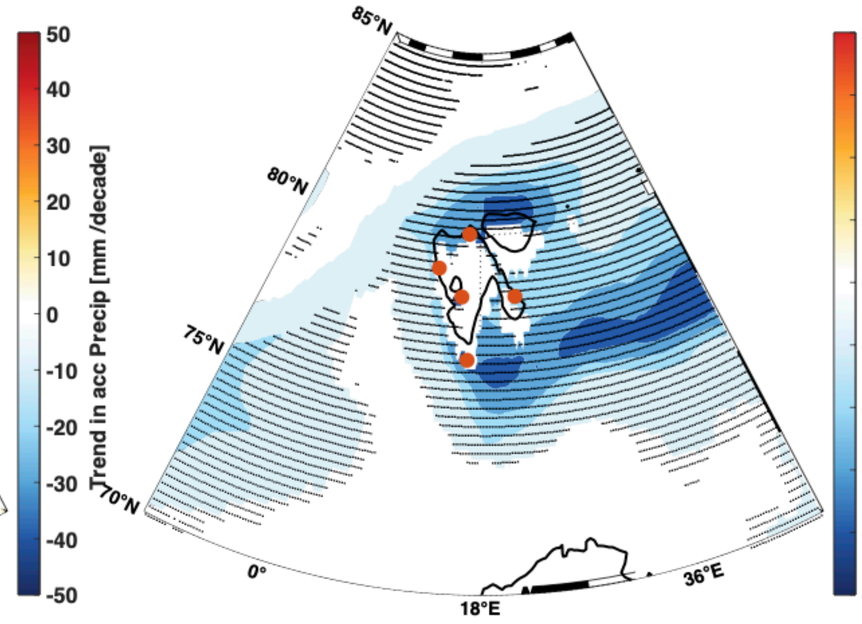
Extended winter (NDJFM) trends 1979-2020

Temperature





Precipitation



Sea Ice

dashes indicate significant trend (95 percentile

Svalbard and the European Artic

Atmospheric and oceanic poleward heat transport

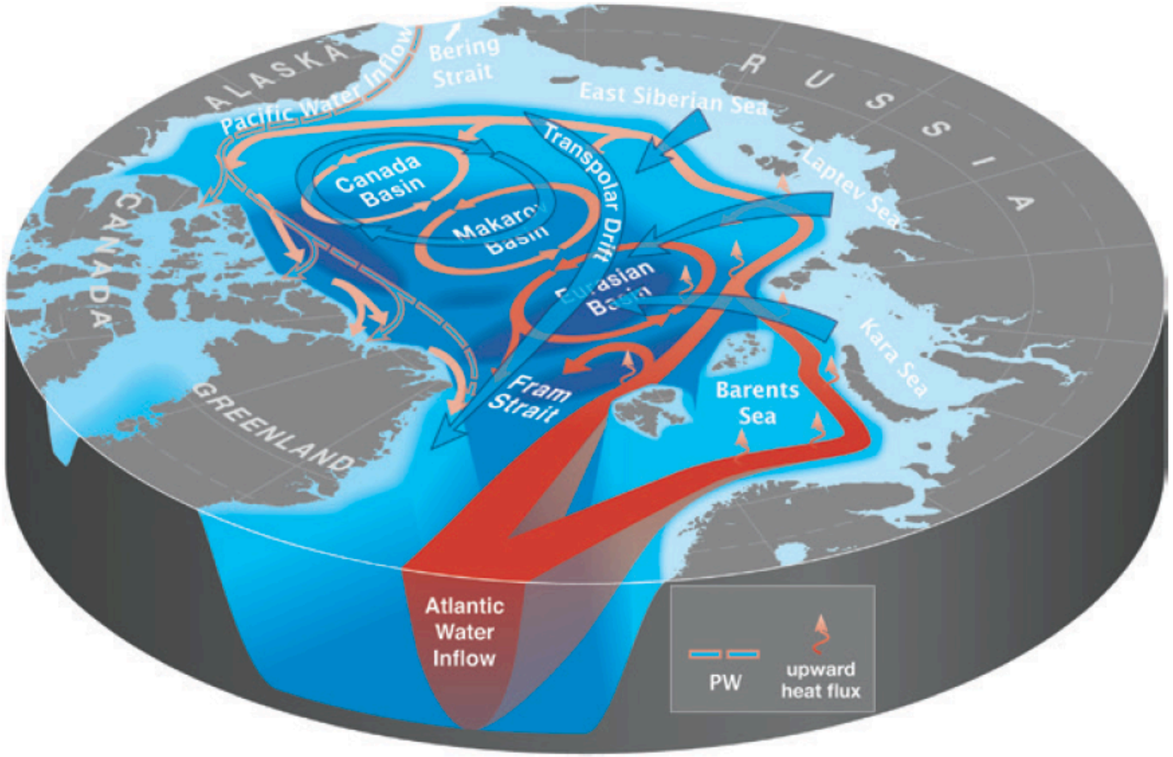
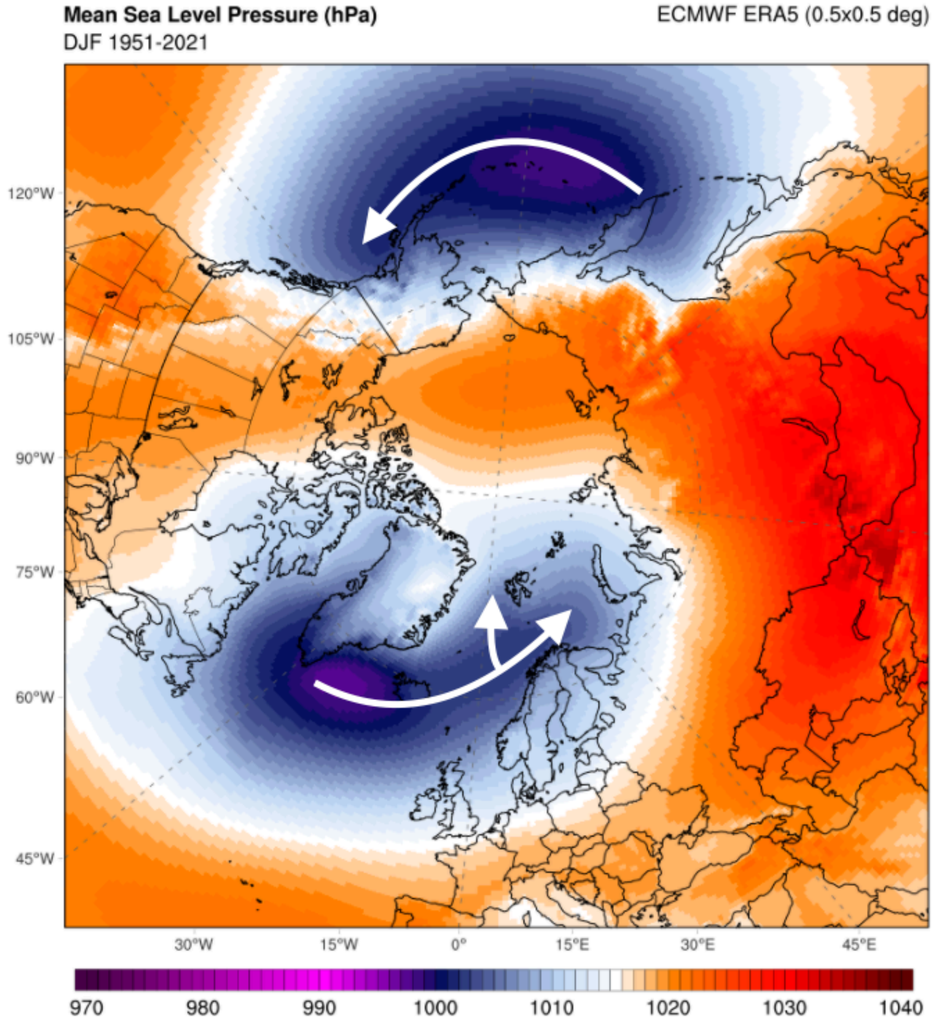


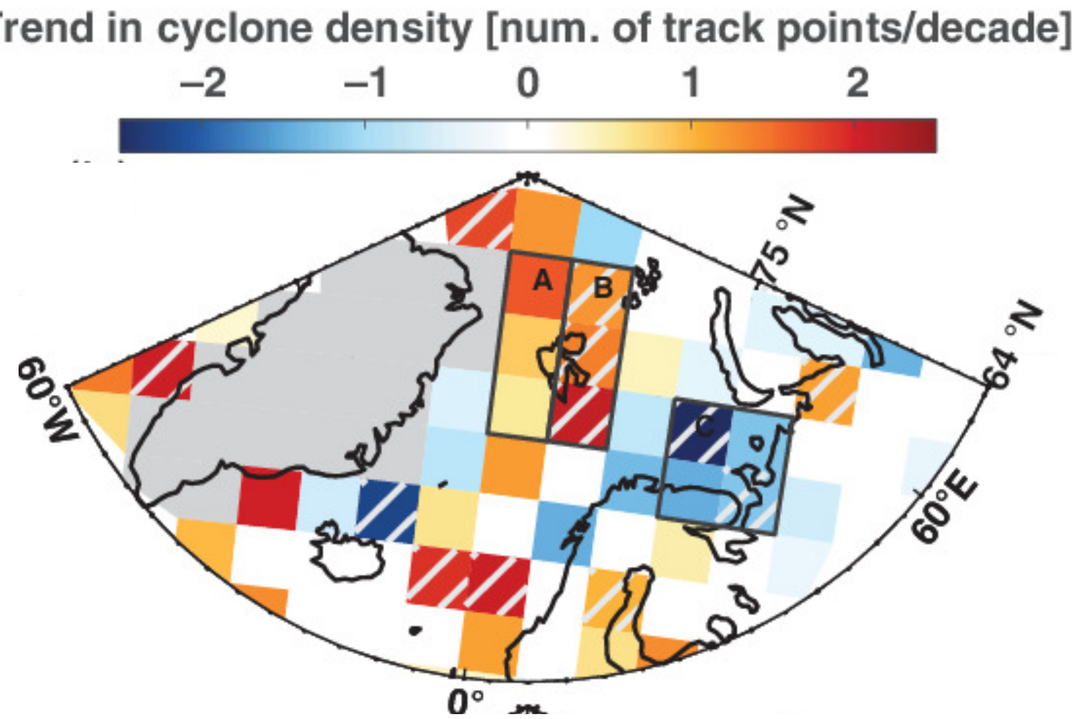
Figure 3 in Carmack et al 2015



Svalbard and the European Artic

Increasing cyclone densities over Svalbard

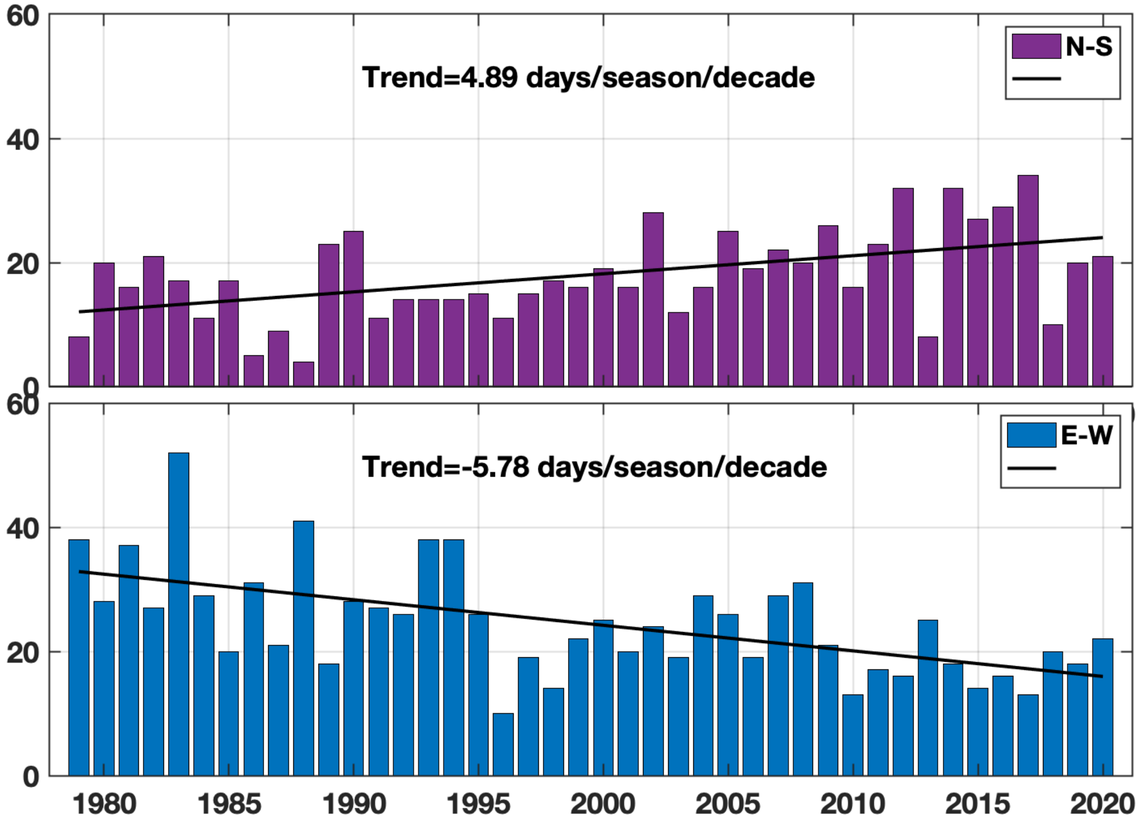
- The position of The North Atlantic storm track controls weather and climate in Svalbard
- An increasing trend in cyclone density over Svalbard and decreasing trend in Southern Barents Sea in the period 1979-2016 (Wickström et al 2020)



Svalbard and the European Artic

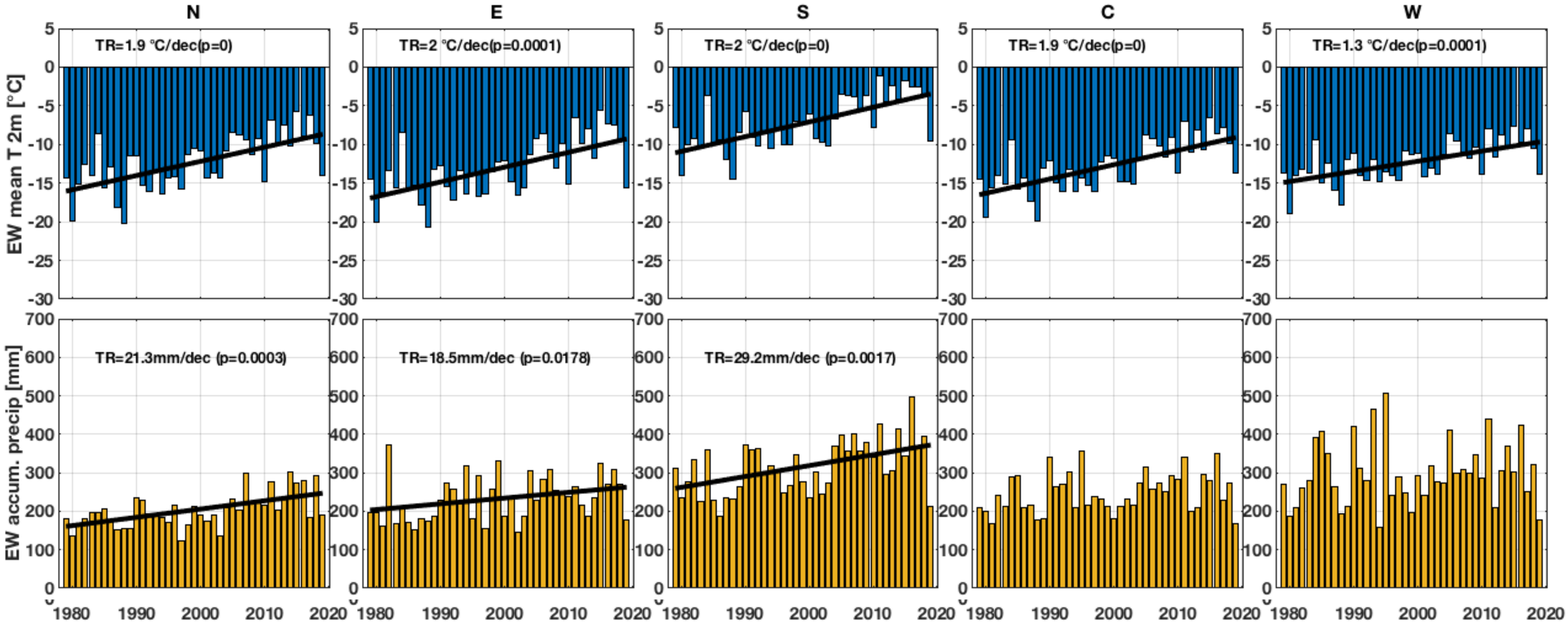
More meridional wind directions

- The position of The North Atlantic storm track controls weather and climate in Svalbard
- An increasing trend in cyclone density over Svalbard and decreasing trend in Southern Barents Sea in the period 1979-2016 (Wickström et al 2020)
- Increasing trend in zonal wind directions (Niedźwiedź, 2013)



Regional trends in temperature and precipitation

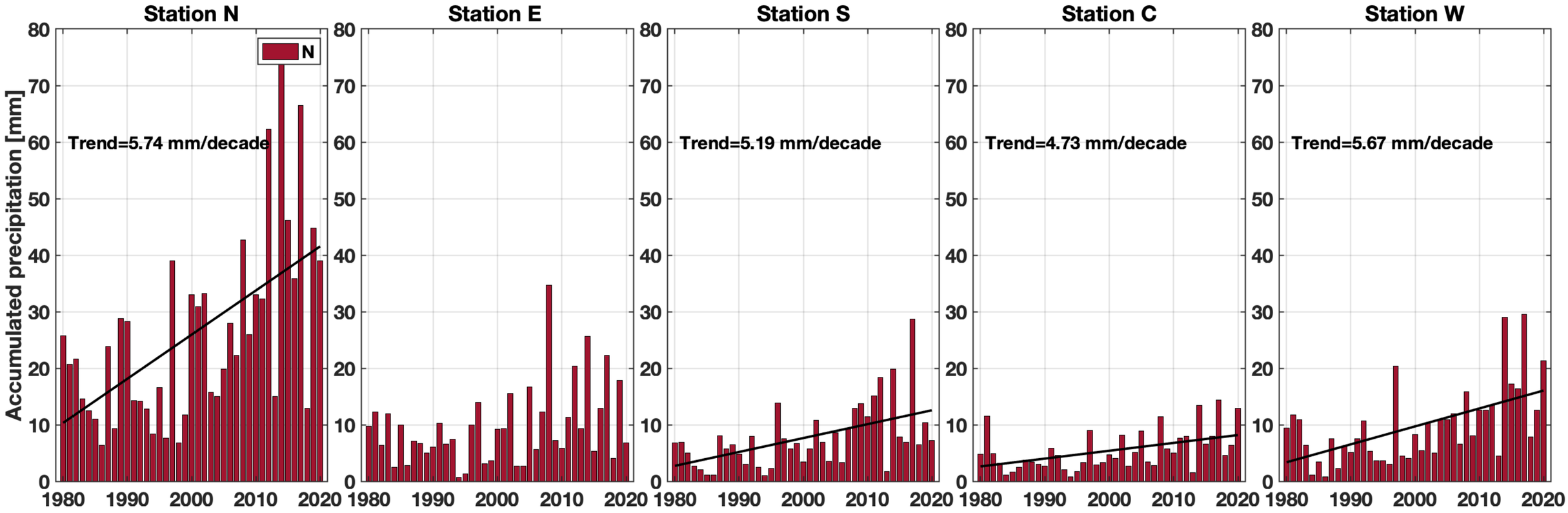
Extended winter (NDJFM)



Regional trends in temperature and precipitation

Which circulation types drive the precipitation changes?

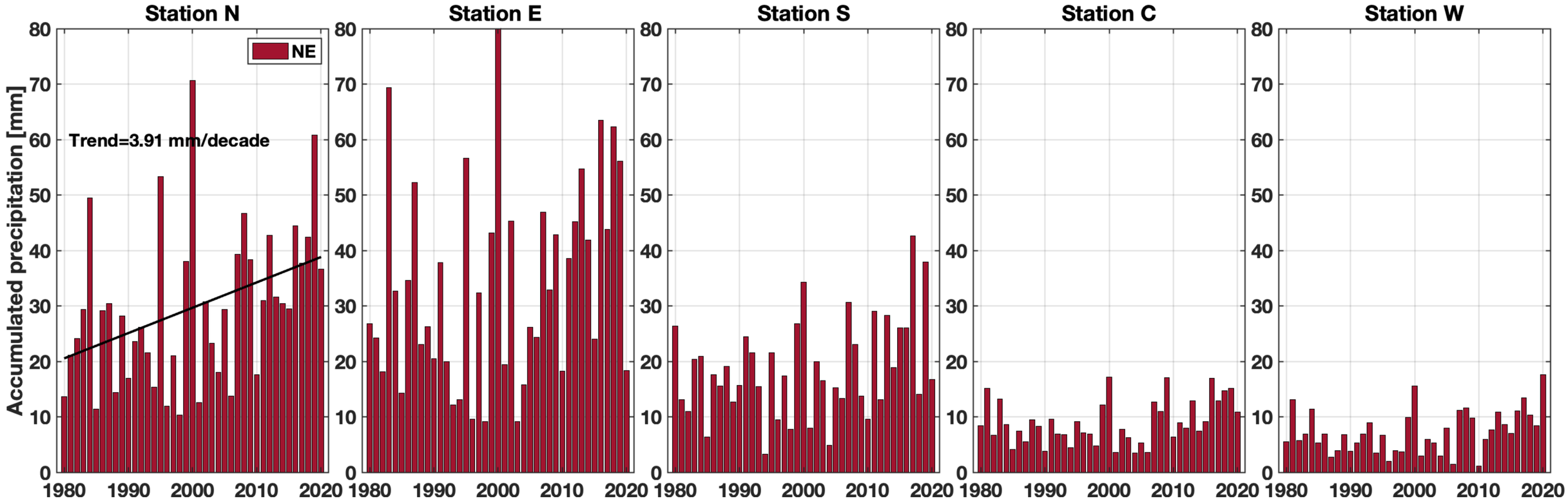
Large-scale winds from the north



Regional trends in temperature and precipitation

Which circulation types drive these precipitation changes?

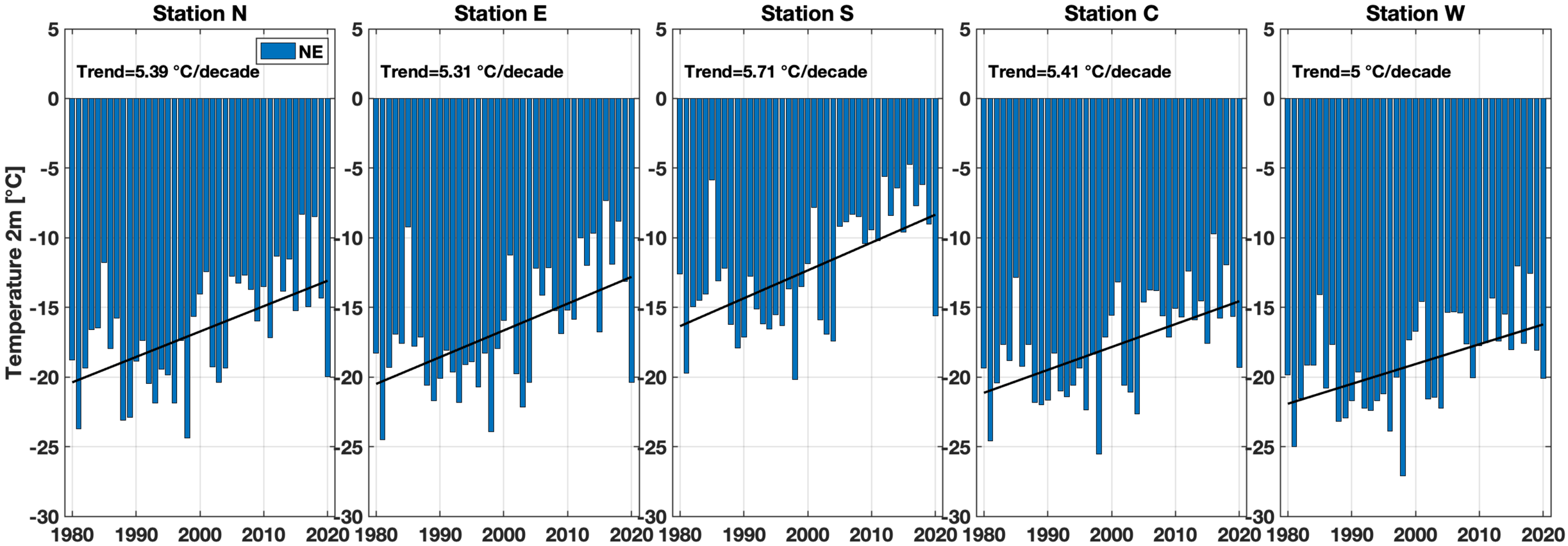
Large-scale winds from the northeast



Regional trends in temperature and precipitation

NE atmospheric circulation contributes most to the warming

Large-scale winds from the northeast



Changing air mass or atmospheric circulation?

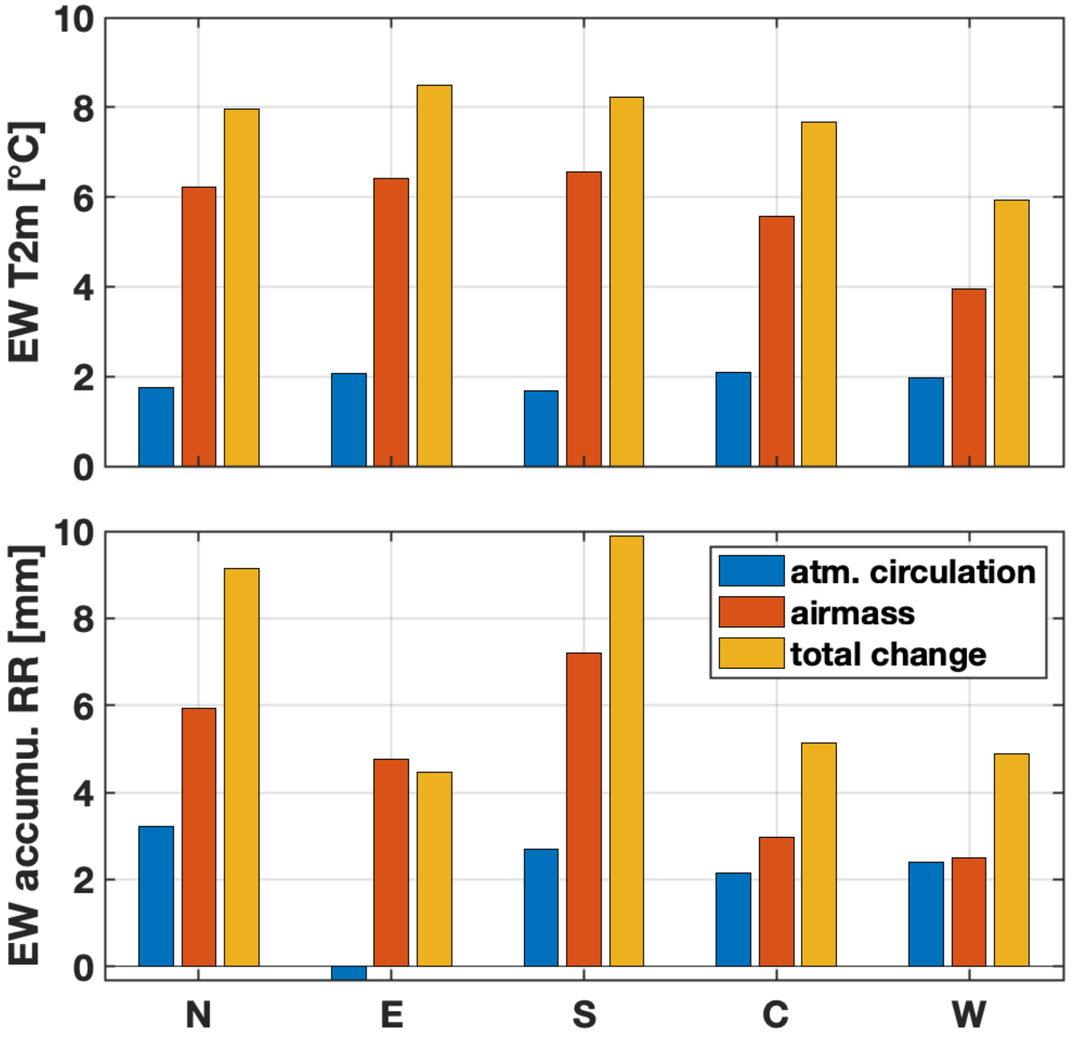
Temperature and accumulated precipitation

- Temperature and precipitation seems to be driven by changes in airmass properties.
- Precipitation changes have more regional variability

Following Isaksen et. al 2016

$$T_{ac} = \sum_{i=1}^{n} \Delta f_i \times \underline{T_i}$$

$$T_{am} = \sum_{i=1}^{n} \Delta T_i \times \underline{f_i}$$



Changing air mass or atmospheric circulation?

- Temperature and precipitation seems to be driven by changes in airmass properties.
- Precipitation changes have more regional variability.
- Sea ice decrease modifies the upwind conditions and hence the air masses reaching Svalbard.

14 August 2016

Earth slide

Jordskred vest for Carolinedalen på Svalbard. Foto: Lufttransport

Home › Geofarer

Jordskred på Svalbard

https://geo365.no/geofarer/jordskred-pa-svalbard/