Changes in summer climate extremes over terrestrial Arctic regions in response to a sudden sea ice loss

Steve Delhaye

Thierry Fichefet, François Massonnet, David Docquier, Christopher Roberts, Sarah Keeley, Retish Senan, Rym Msadek, Svenya Chripko, Javier García-Serrano, and Pierre-Antoine Bretonnière

Methods

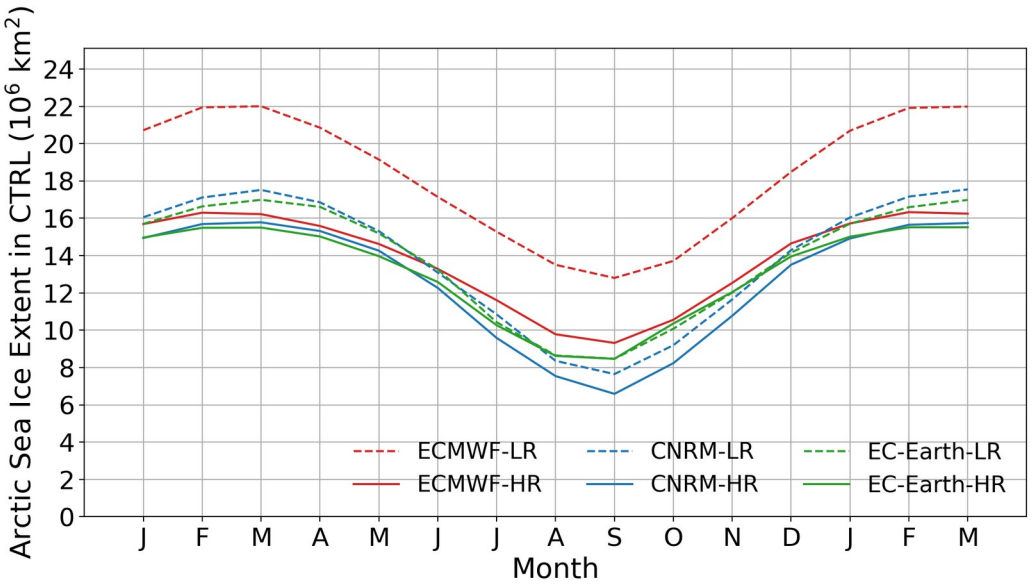
Coupled Models

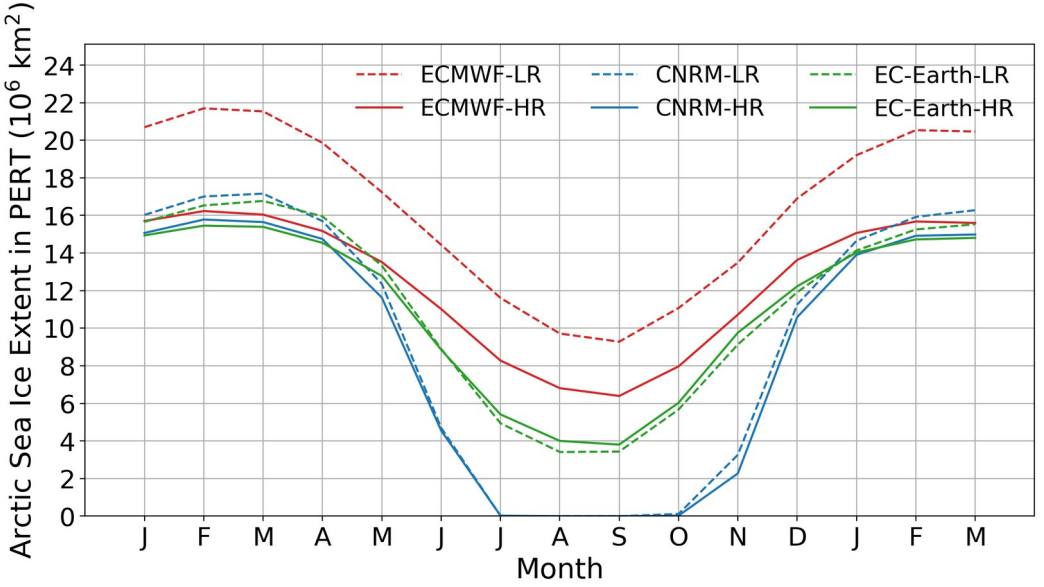
Resolution

	ECMWF-LR	ECMWF-HR	CNRM-LR	CNRM-HR
Ocean (res)	NEMO 3.4 (~1°)	NEMO 3.4 (~0.25°)	NEMO 3.6 (~1°)	NEMO 3.6 (~0.25°)
Atmosphere (res)	IFS (~50km)	IFS (~25km)	ARPEGE 6 (~250km)	ARPEGE 6 (~50km)
Sea Ice	LIM2	LIM2	GELATO6	GELATO6

UCLouvain

Arctic Sea Ice Extent



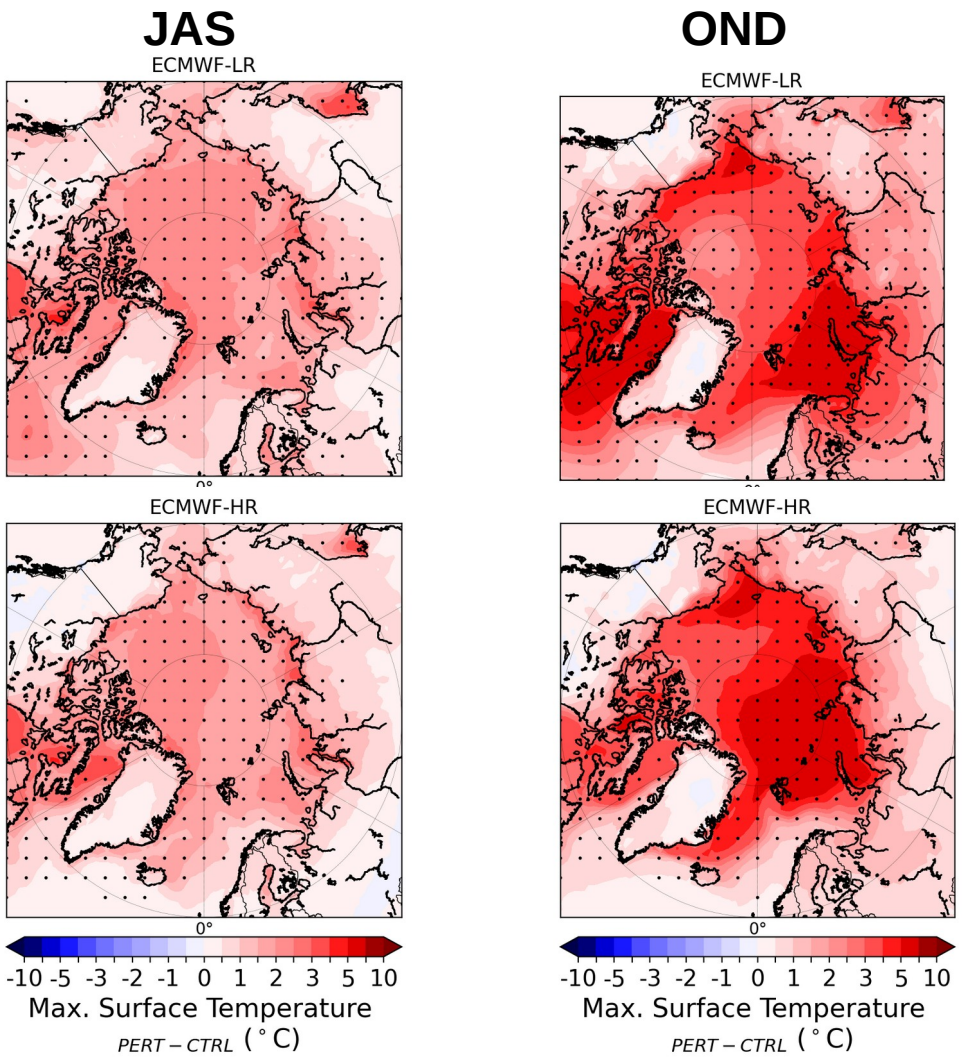


CTRL
Constant forcing of 1950

40 members

PERT
Ice albedo = ocean albedo

Change in Max. T°

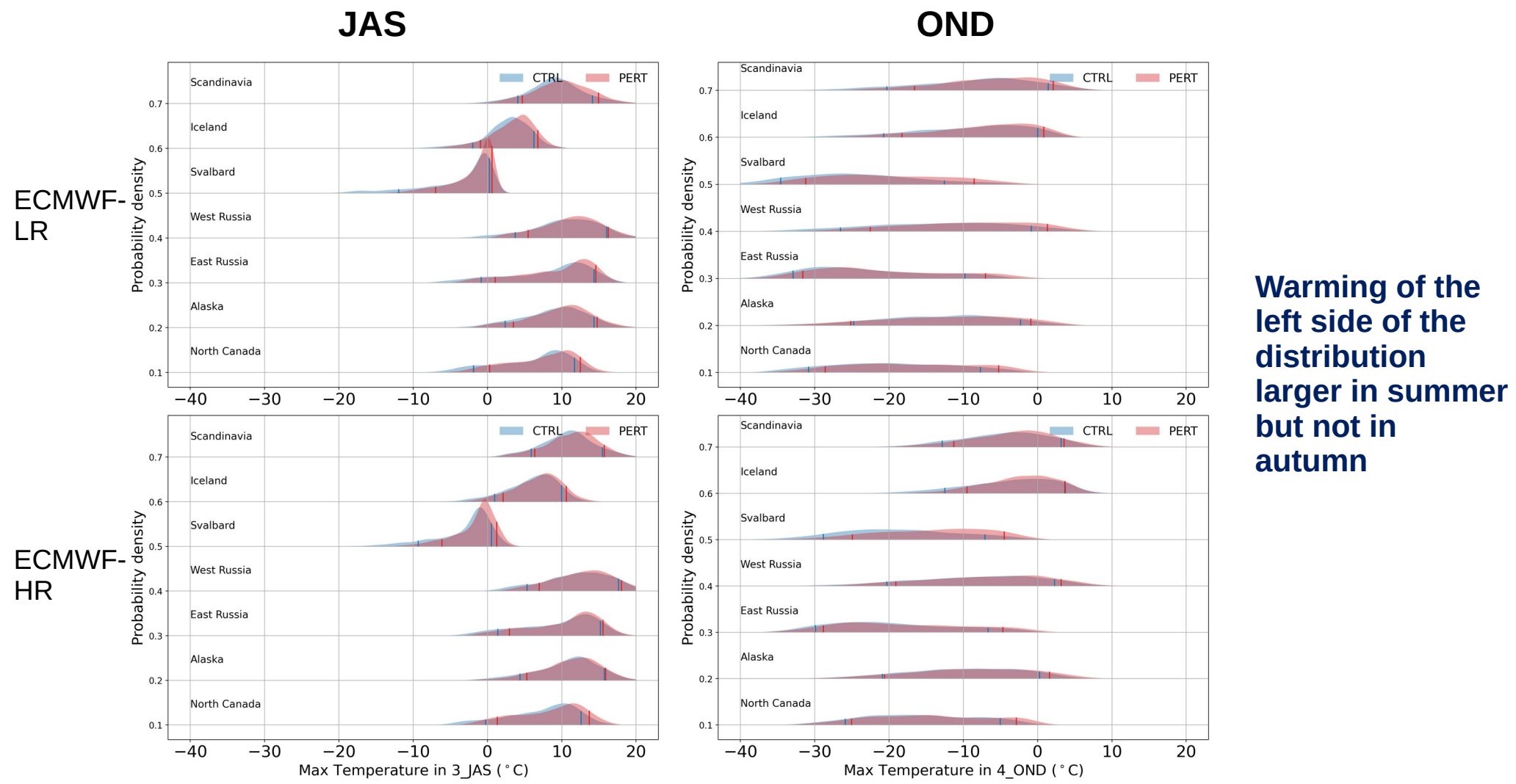


Warming over the Arctic

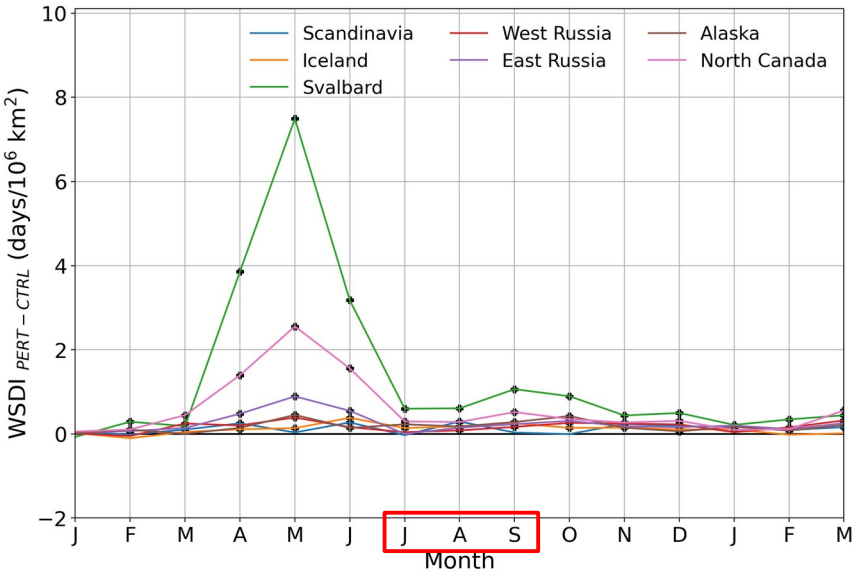
Warming in Max T° is similar to the mean T° (not shown)

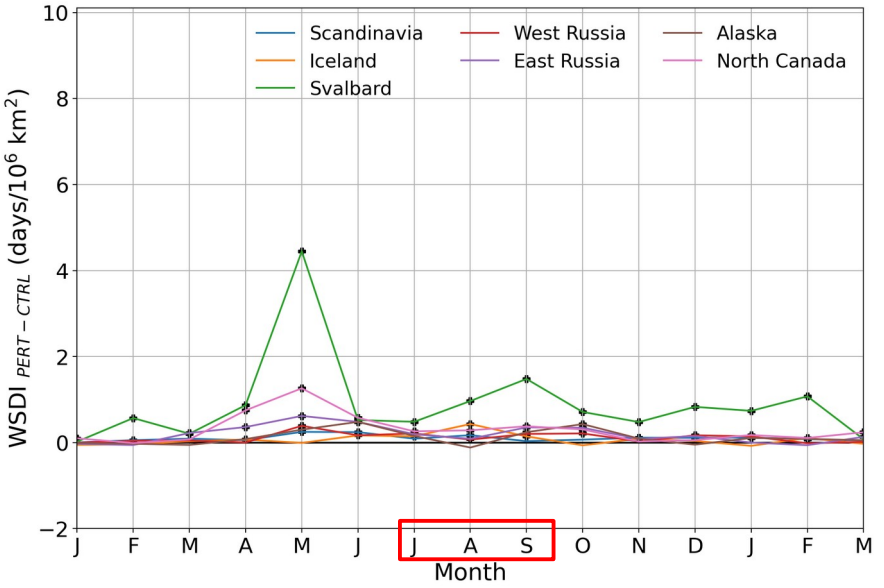
Warming is weaker in summer

Change in Max. T°

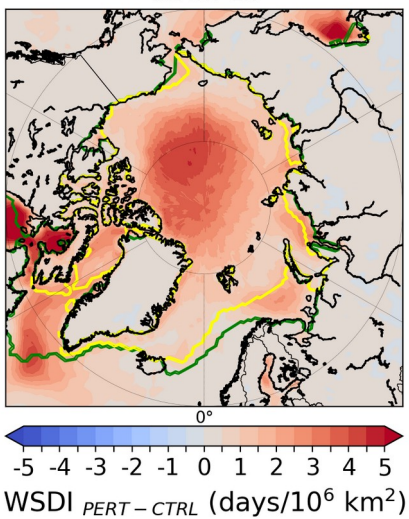


Warming of the left side of the distribution larger in summer but not in autumn





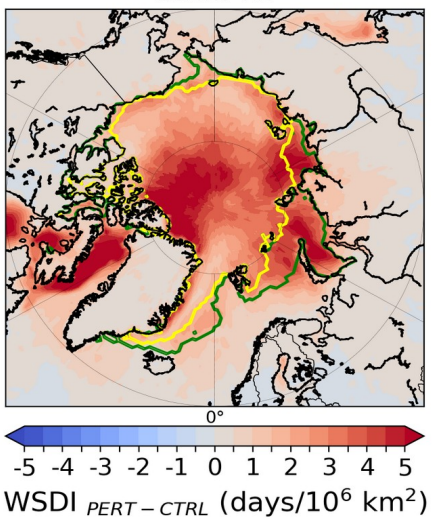
ECMWF-LR

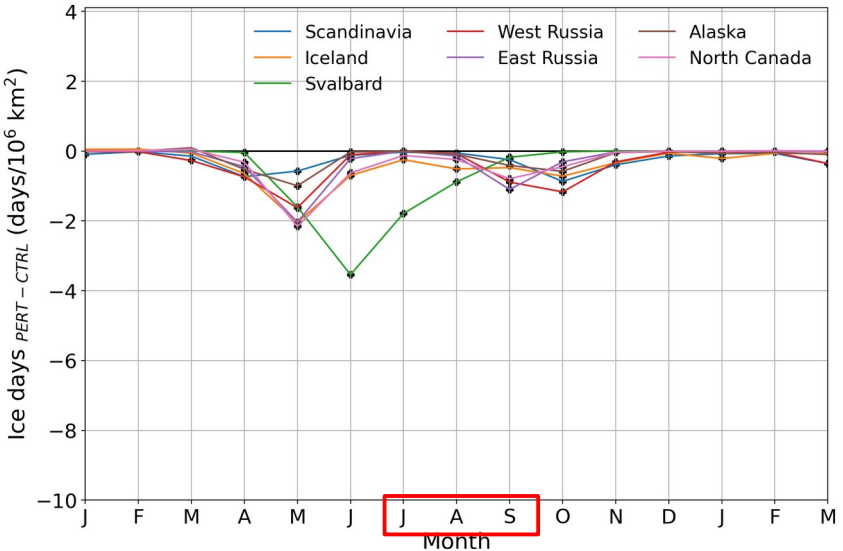


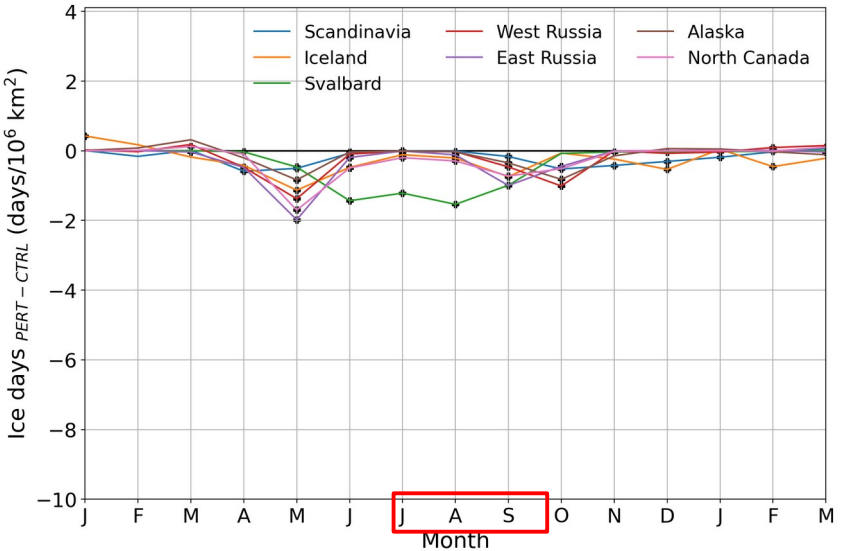
WSDI = Warm Spell Duration Index

(count of days with at least 6 consecutive days when the daily maximum T exceeds the 90th percentile in the calendar 5-day window)

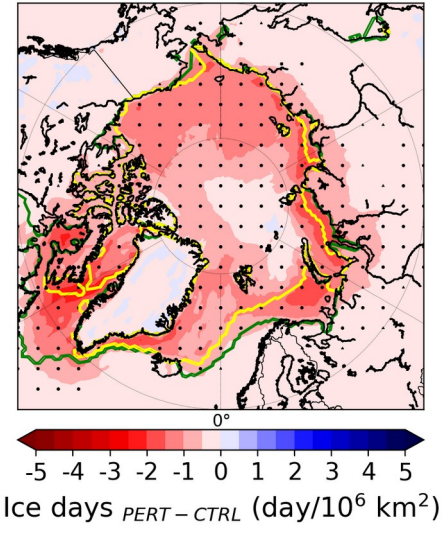
ECMWF-HR







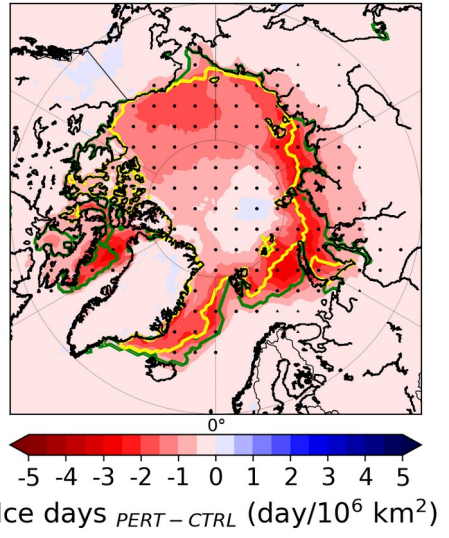
ECMWF-LR



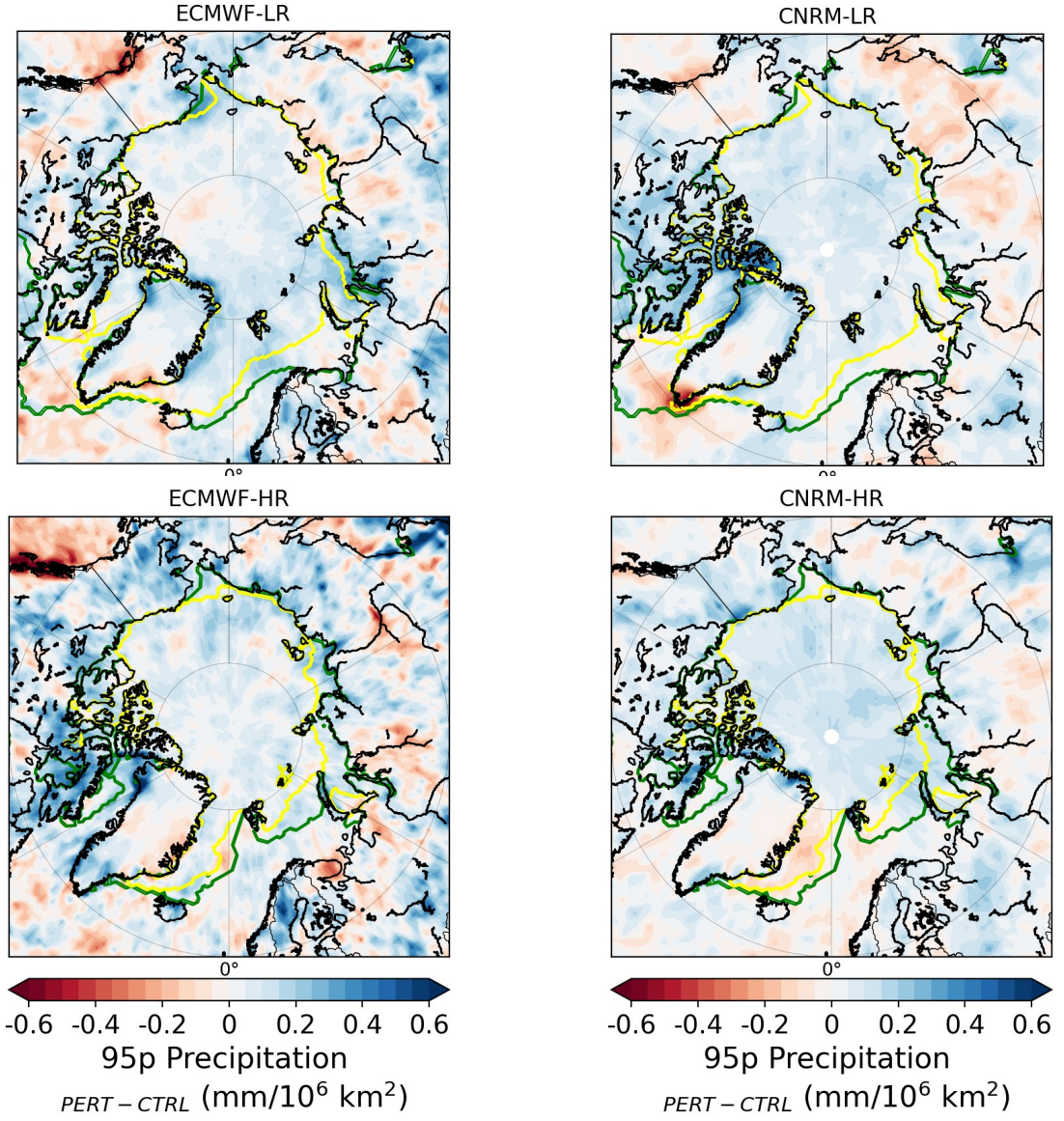
Ice Days

(days where the Max. temperature is below 0°C)

ECMWF-HR



JAS

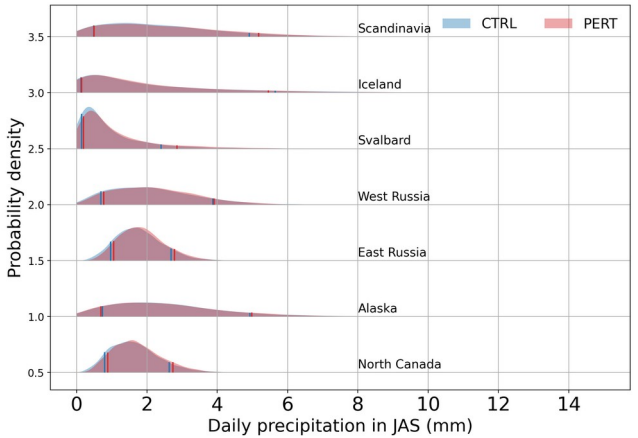


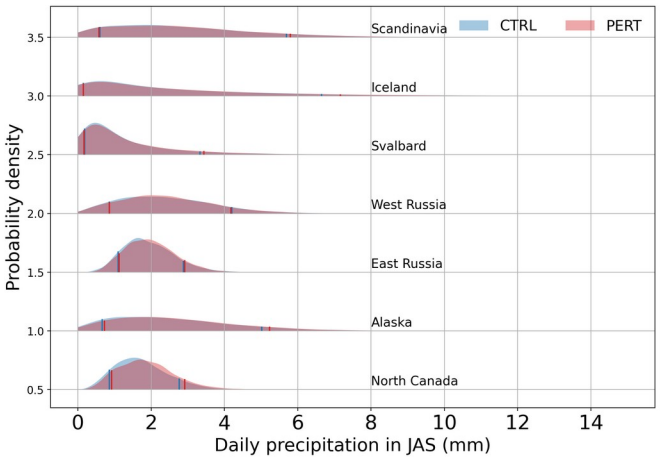
Increase in the intensity of the daily precipitation

JAS

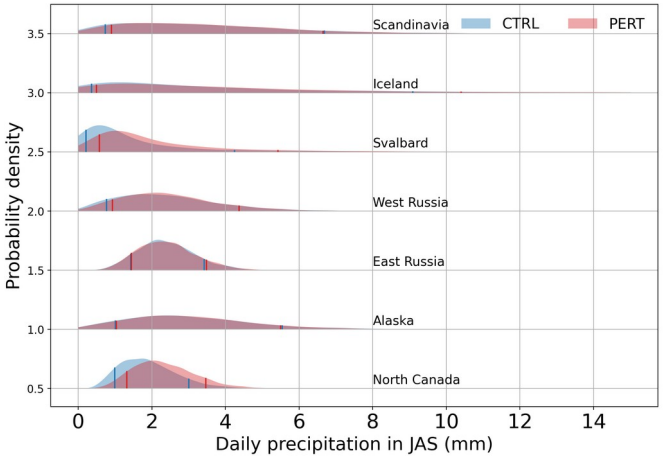
LR

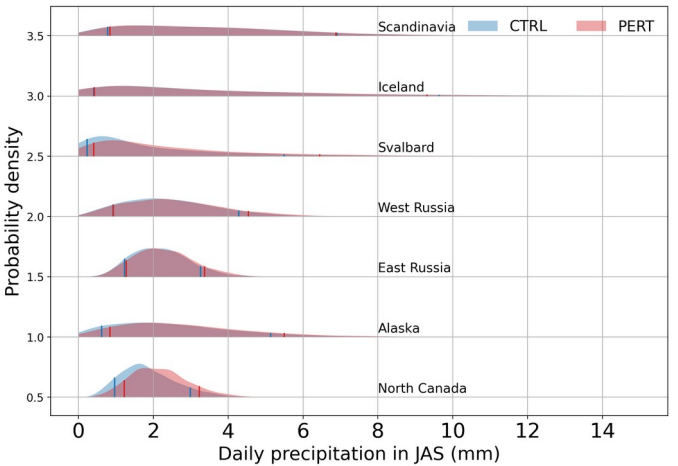
HR





ECMWF

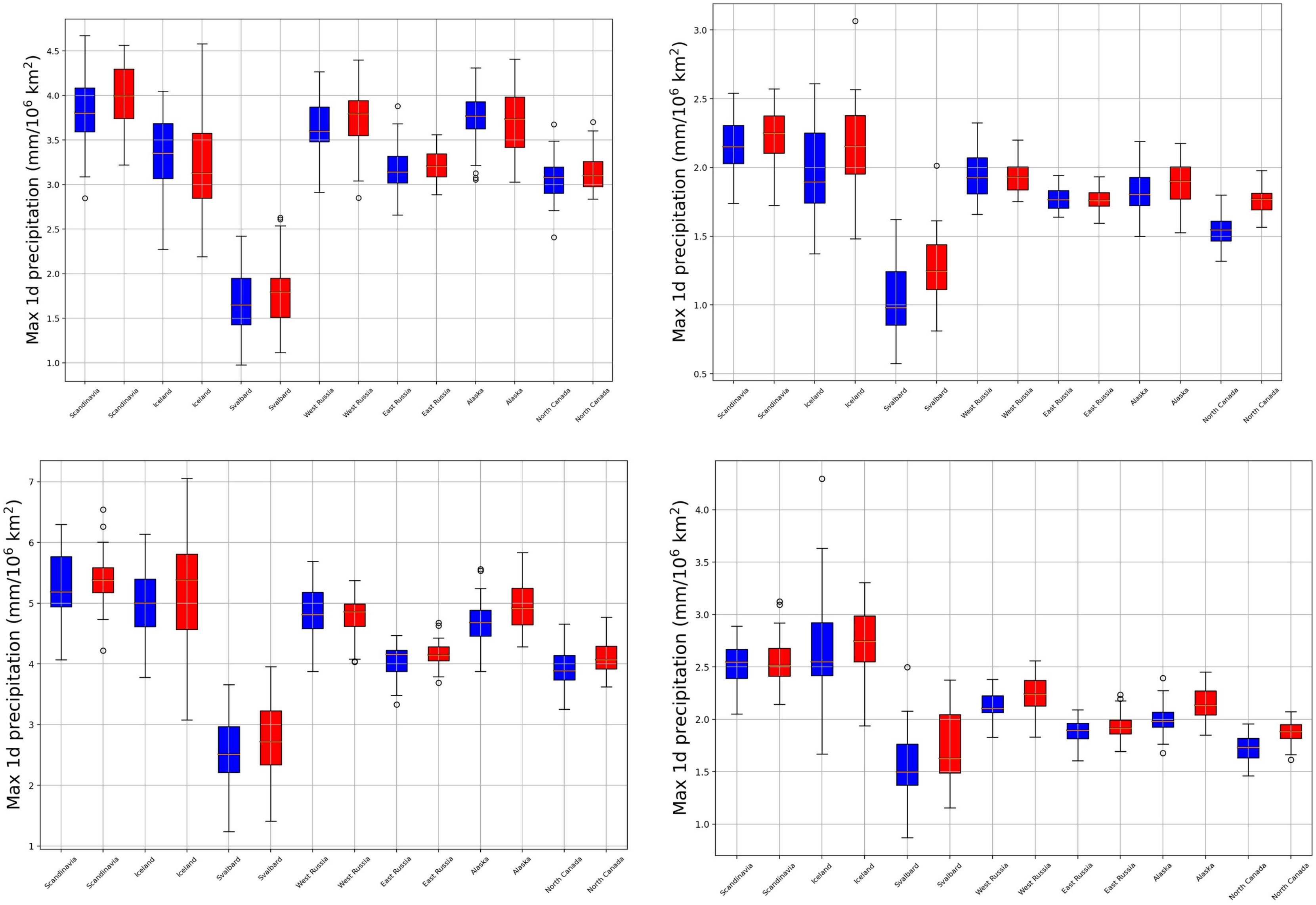




CNRM

Shift to the right of the daily precipitation Distribution mainly over Svalbard and N. Canada

JAS



Max 1d precipitation (mm/10^6 km^2)
Scandinavia
Iceland
Svalbard
West Russia
East Russia
Alaska
North Canada

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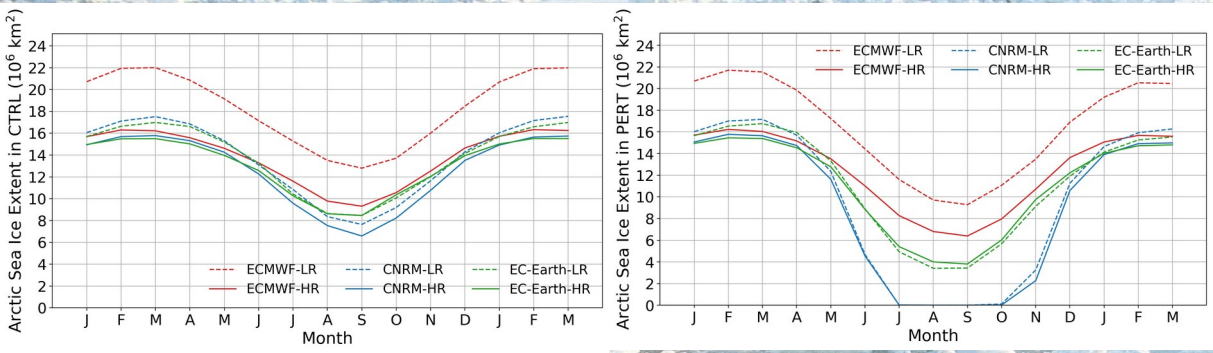

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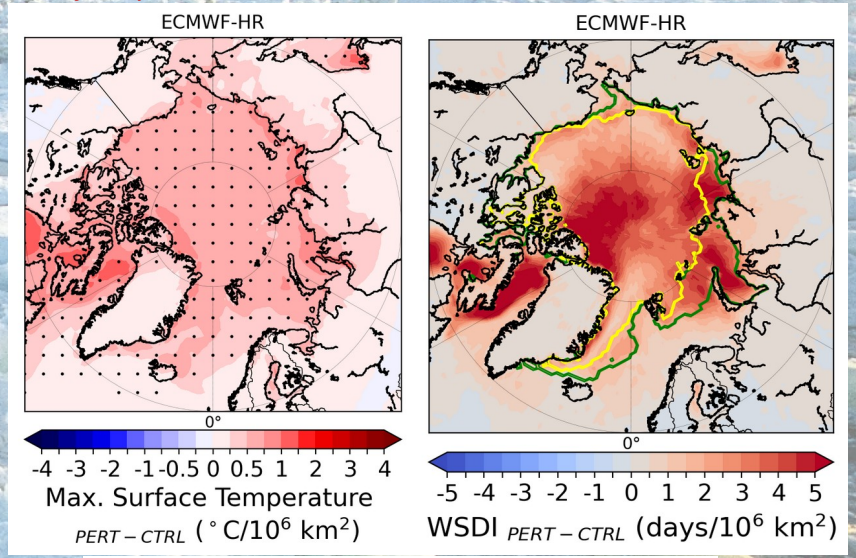

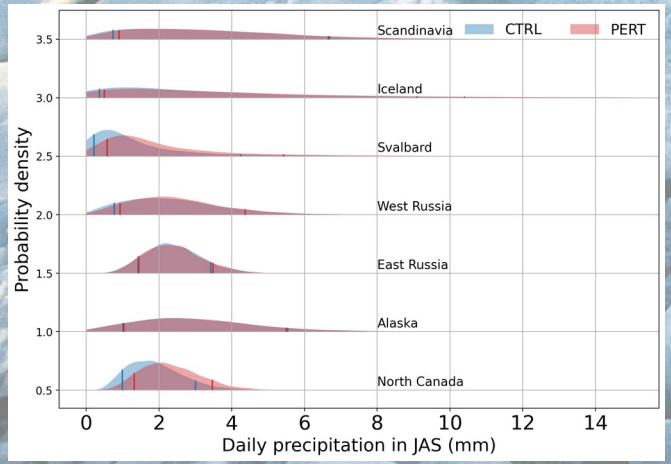

- 3 GCMS (and 2 horizontal resolutions)
- Different amount of sea ice loss
- Warming of the left side of the distribution larger in summer
- Change in intensity (T°) extends towards continents
- Change in persistence (T°) remains above the Arctic Ocean
- Shift to the right of the daily precipitation distribution