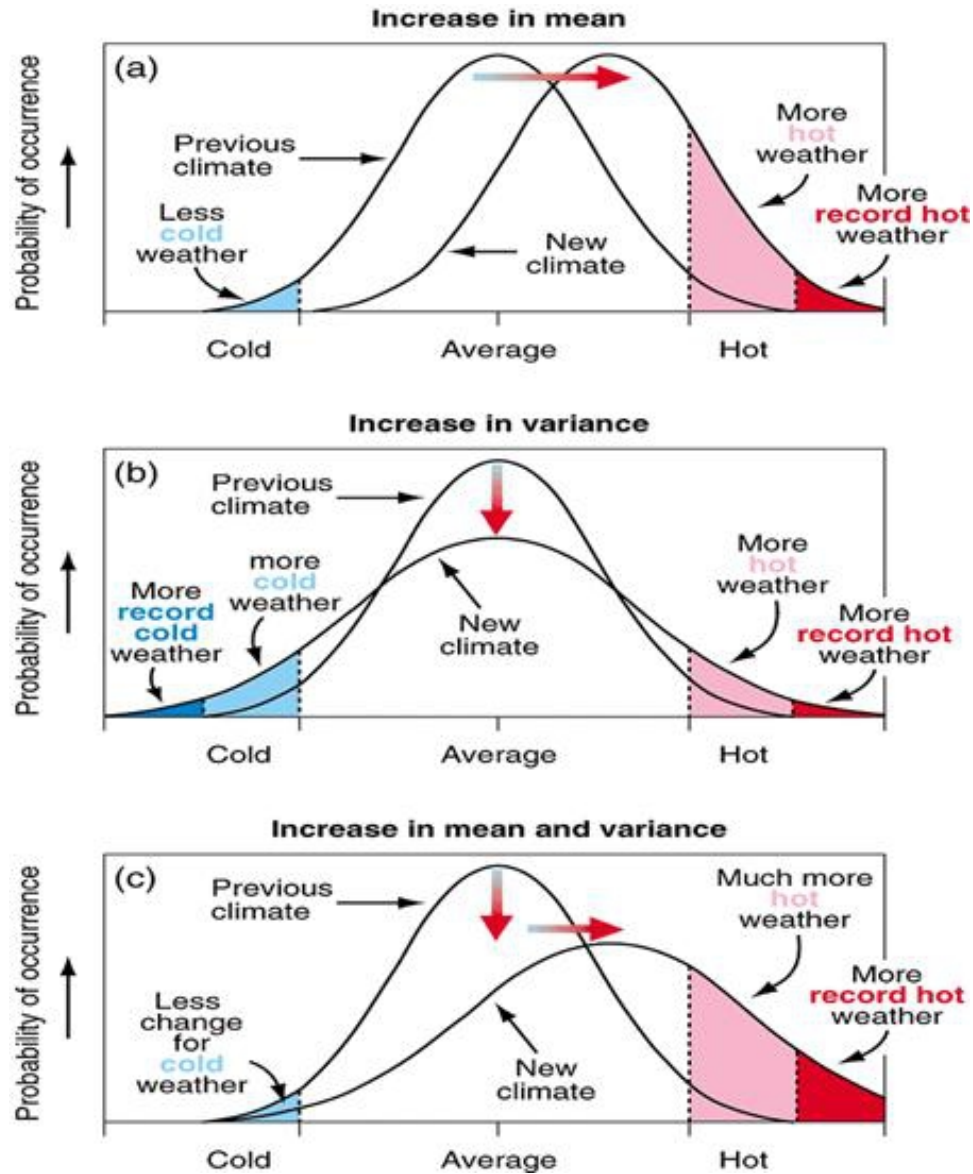


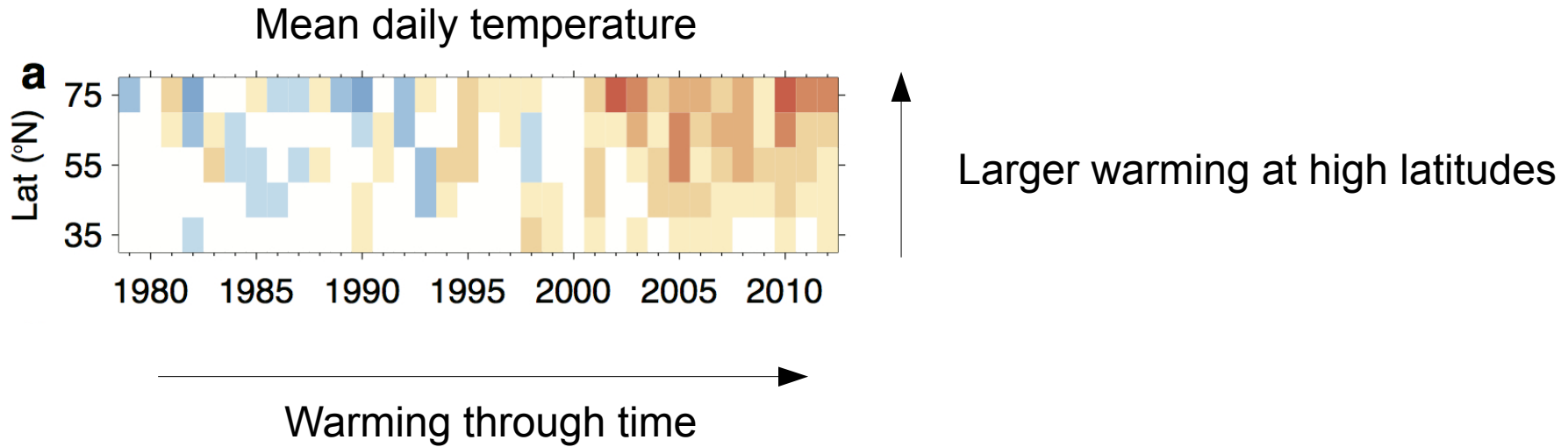


# Decreasing temperature variability over the mid- to high latitude Northern Hemisphere in a warming climate

James Screen, PCWG meeting, 29 January 2014

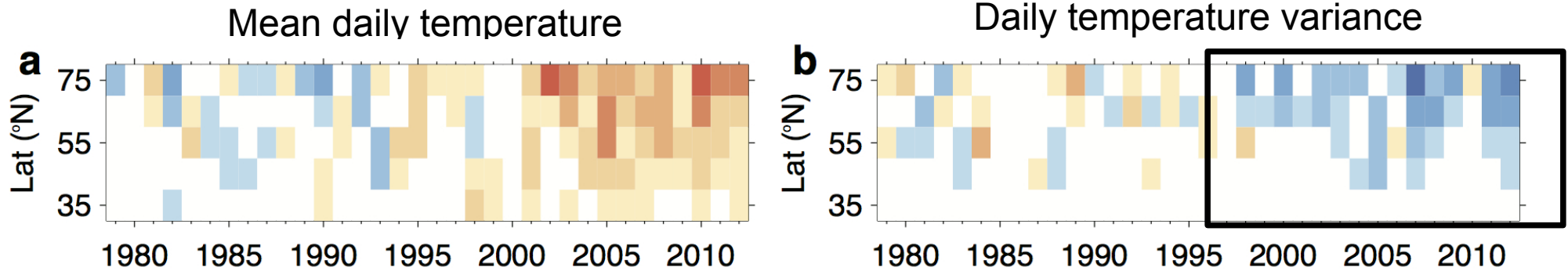
# Climate change and extremes





Autumn-mean anomalies in zonal-mean near-surface land temperature from ERA-Interim.

# Decreasing variance

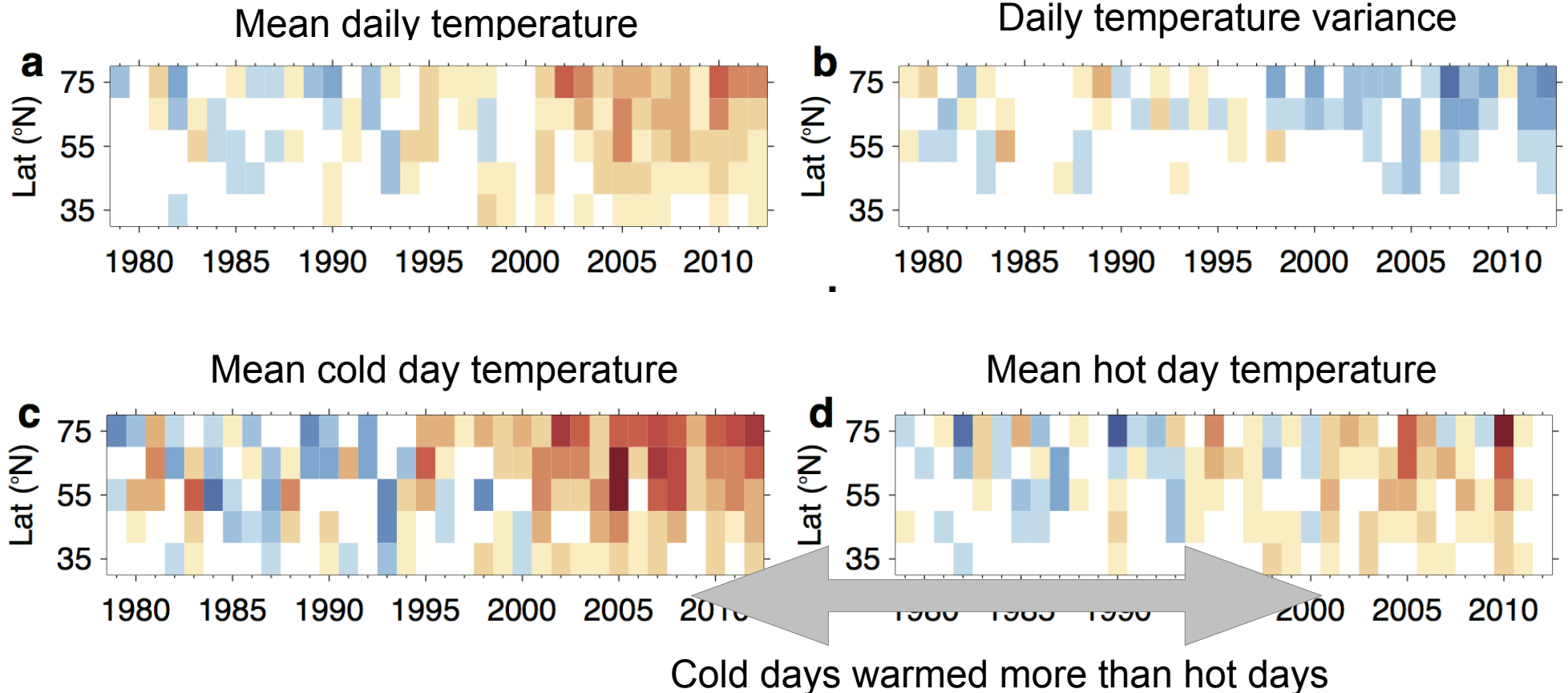


Decreasing variance over latitudes 50-80N

Autumn-mean anomalies in zonal-mean temperature variance from ERA-Interim.

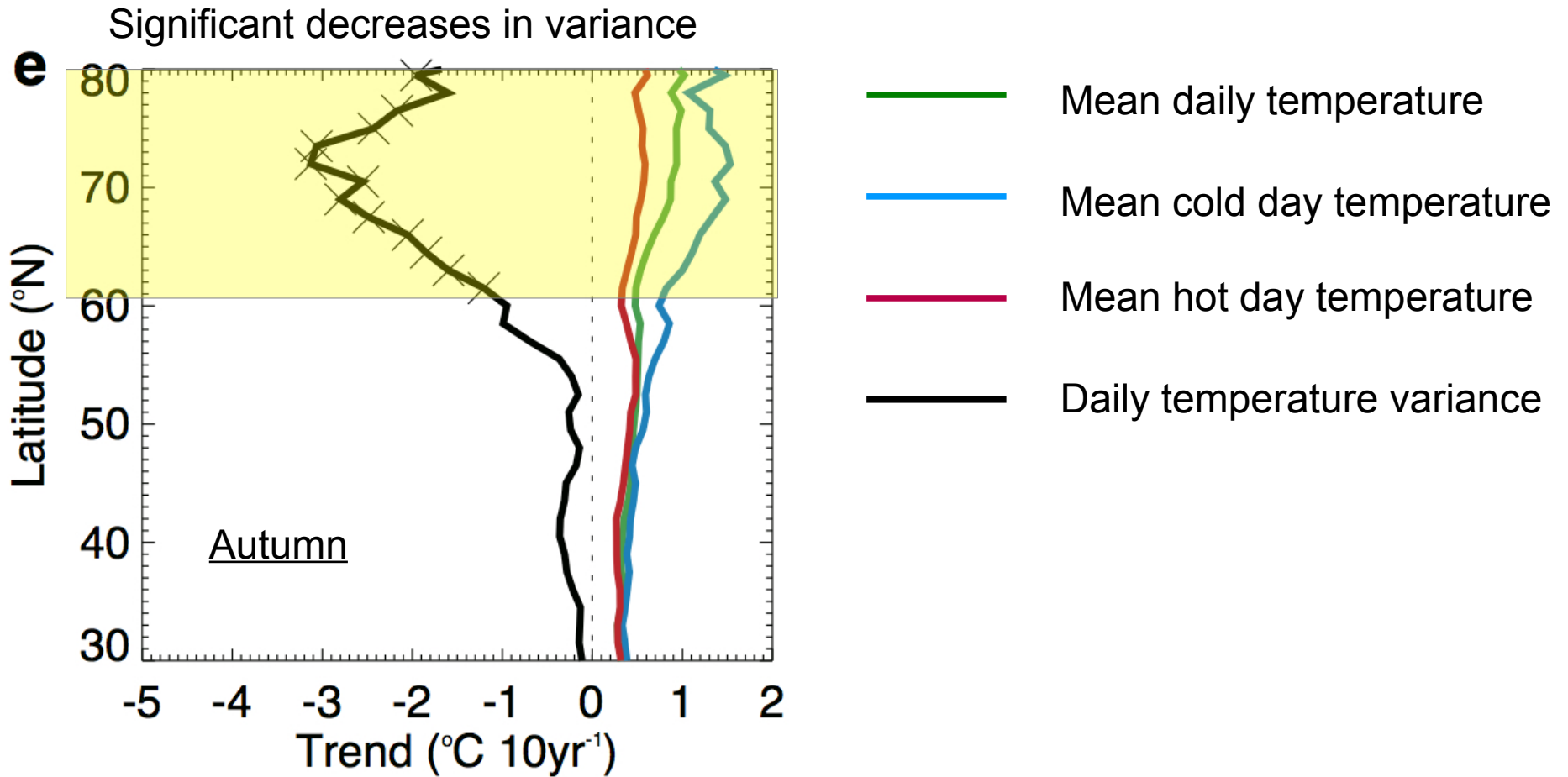


# Changing extremes

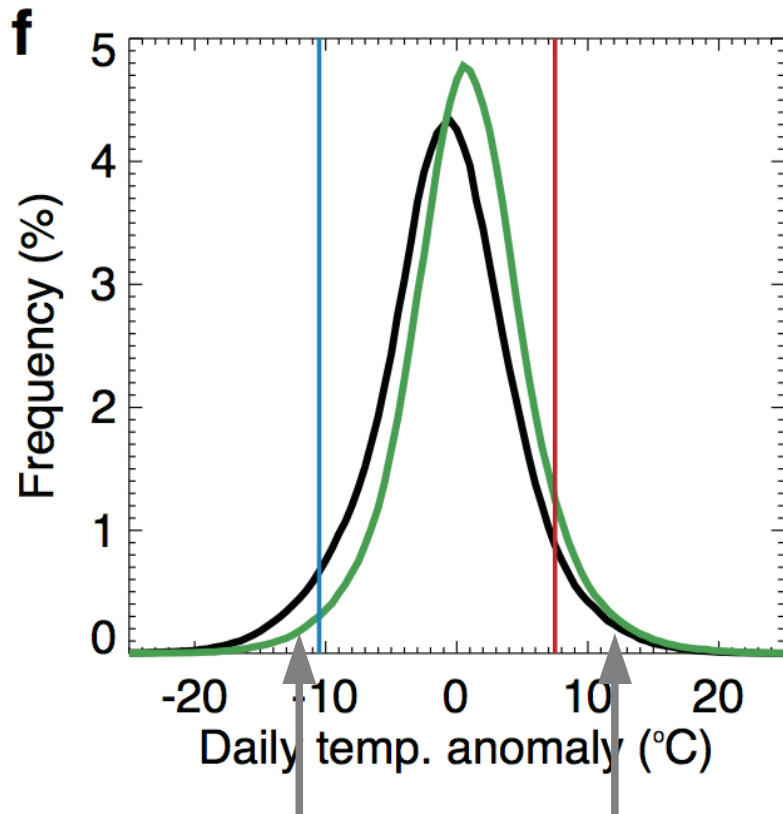


Autumn-mean anomalies in zonal-mean cold and hot day temperature from ERA-Interim.

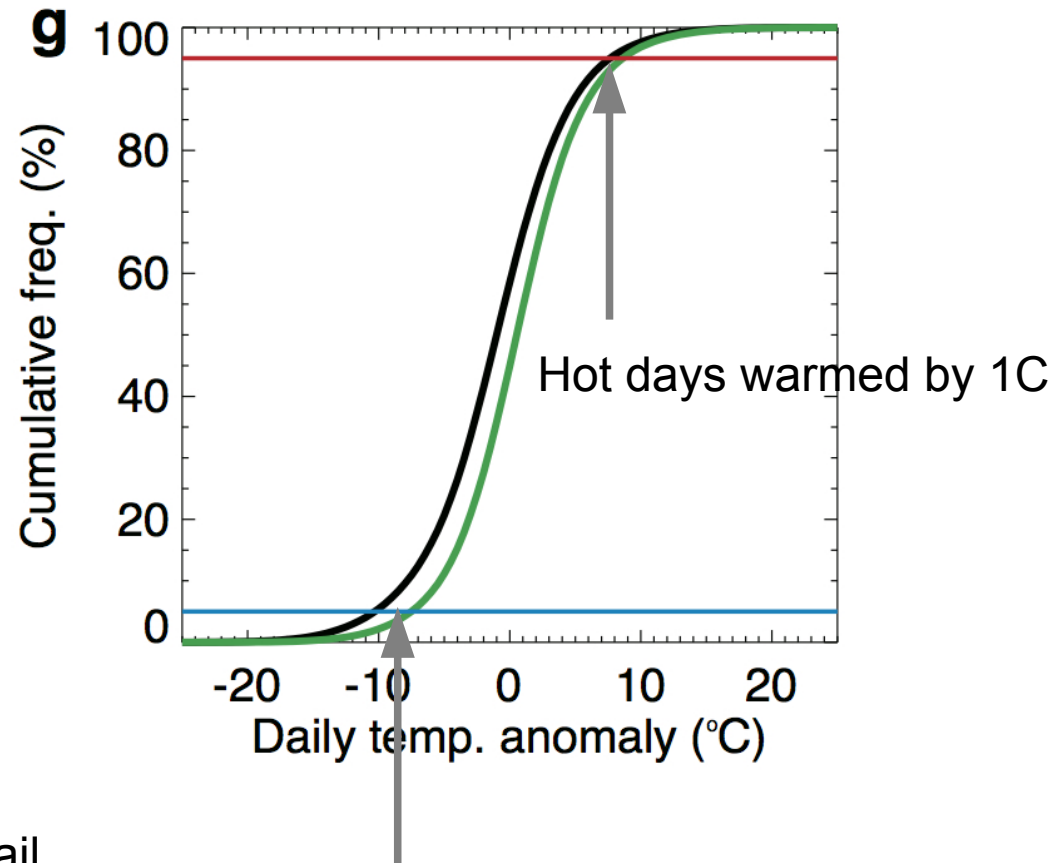
Cold and hot days are those below the 5% and above the 95% percentiles, respectively.



# Changing distributions



Cold tail shifts further right than hot tail

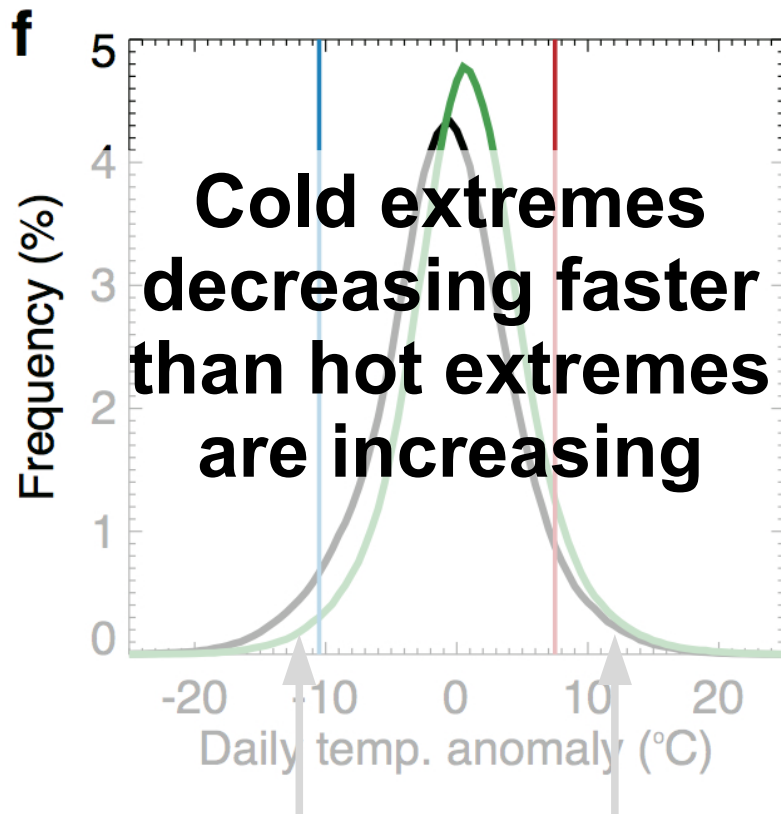


Cold days warmed by 3C

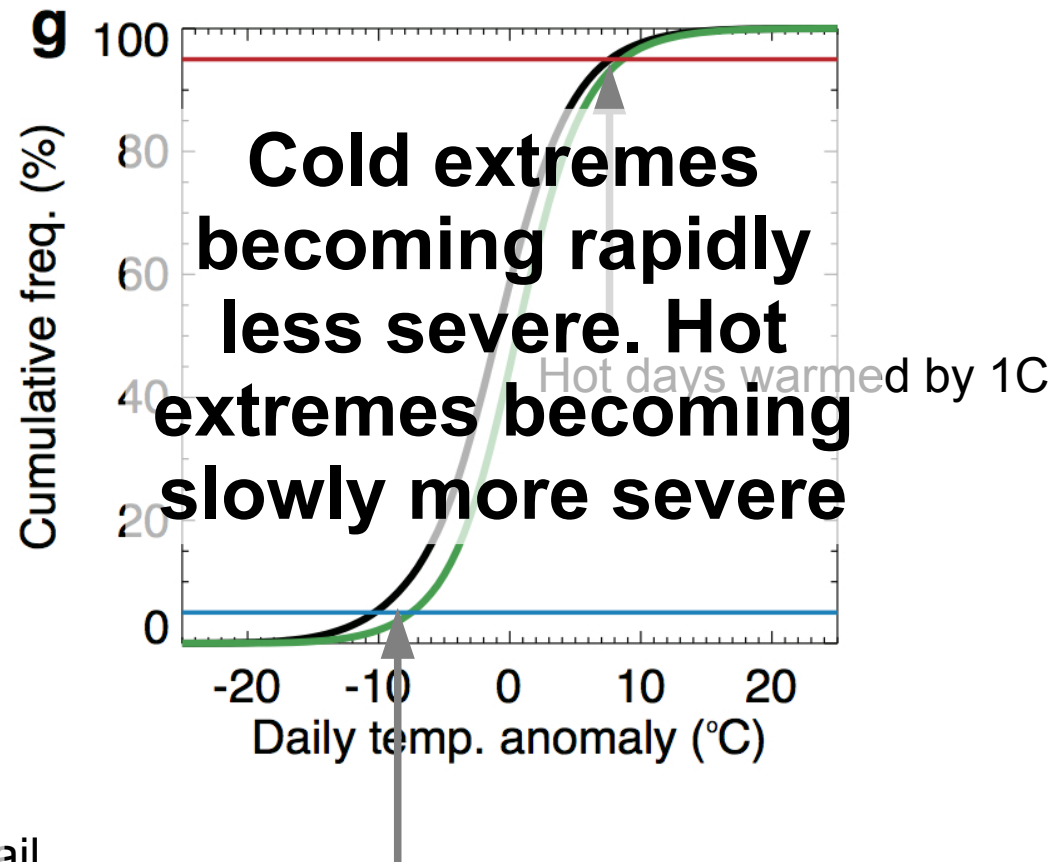
— 1979-1988    — 2003-2012

PDFs of daily temperature anomalies in autumn over 55-80N for two 10-yr periods

# Changing distributions



Cold tail shifts further right than hot tail



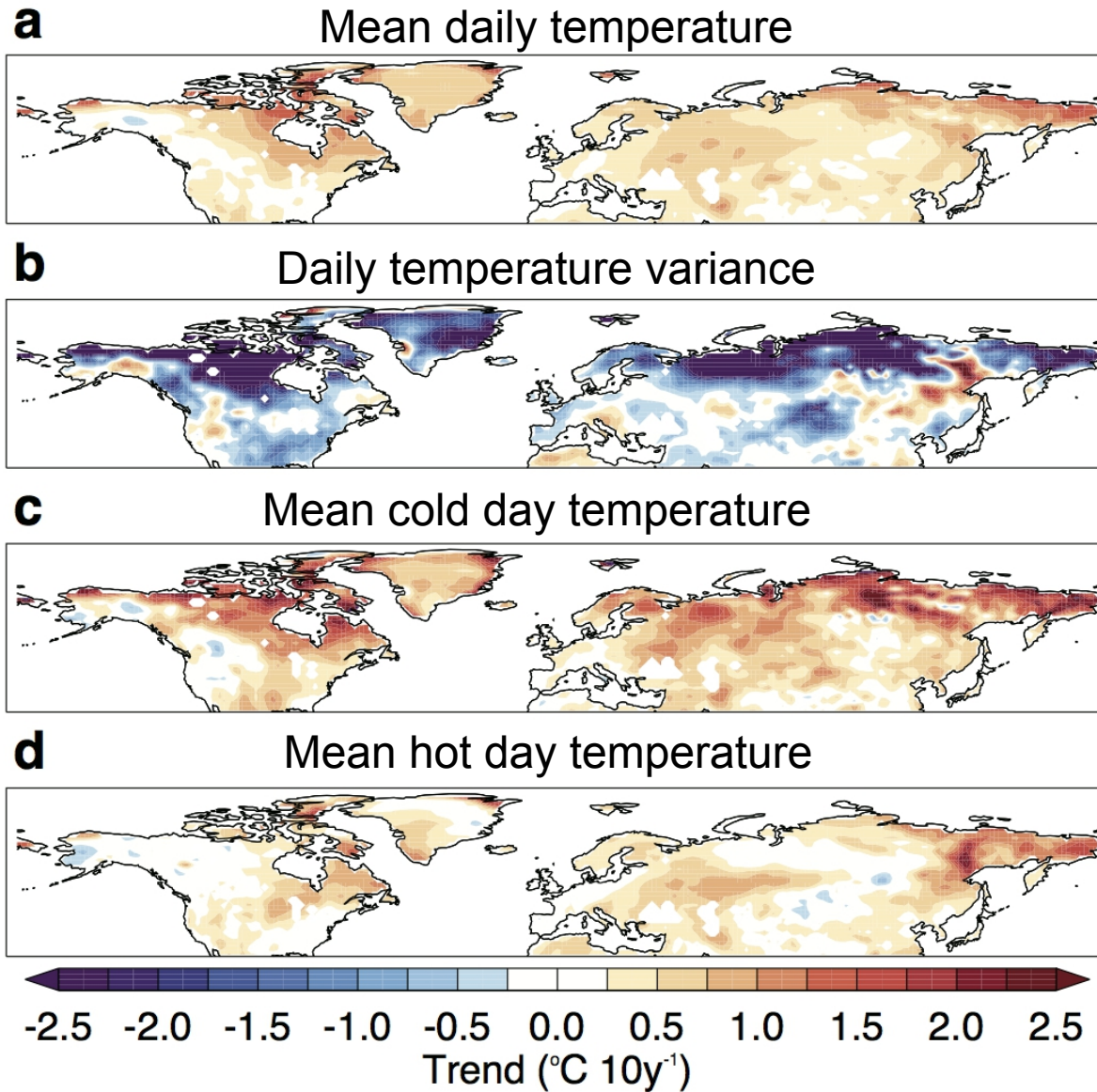
Cold days warmed by 3C

— 1979-1988    — 2003-2012

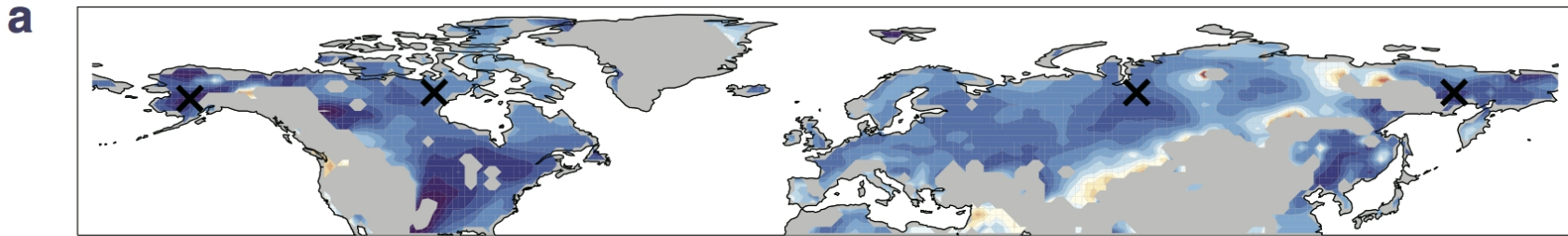
PDFs of daily temperature anomalies in autumn over 55-80N for two 10-yr periods



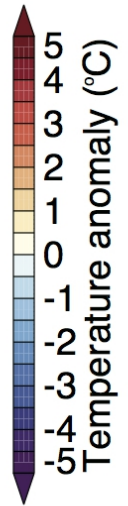
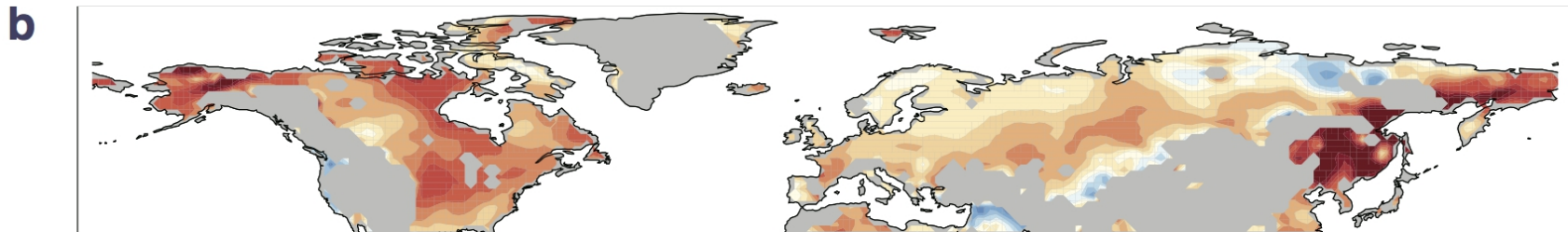
# Regional changes



Temperature anomalies for northerlies

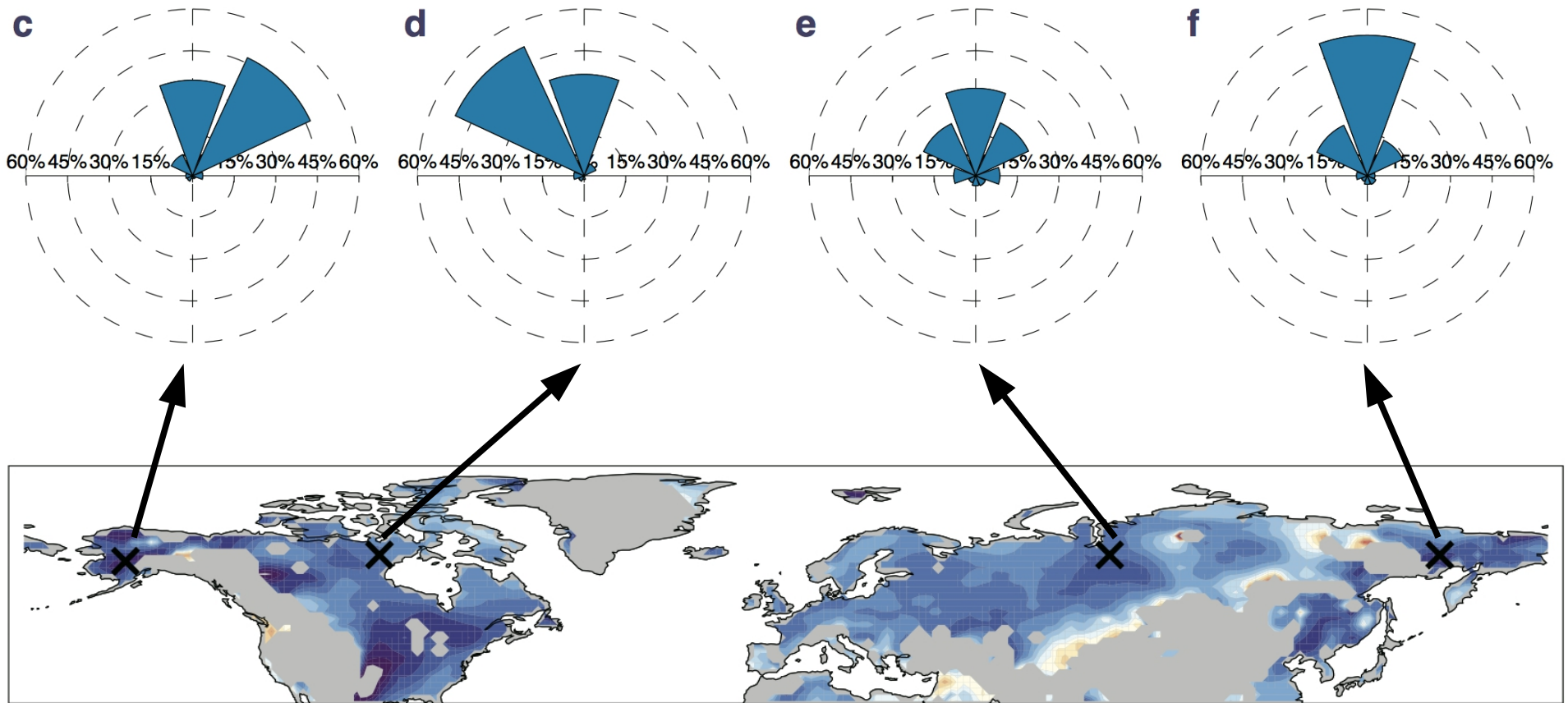


Temperature anomalies for southerlies

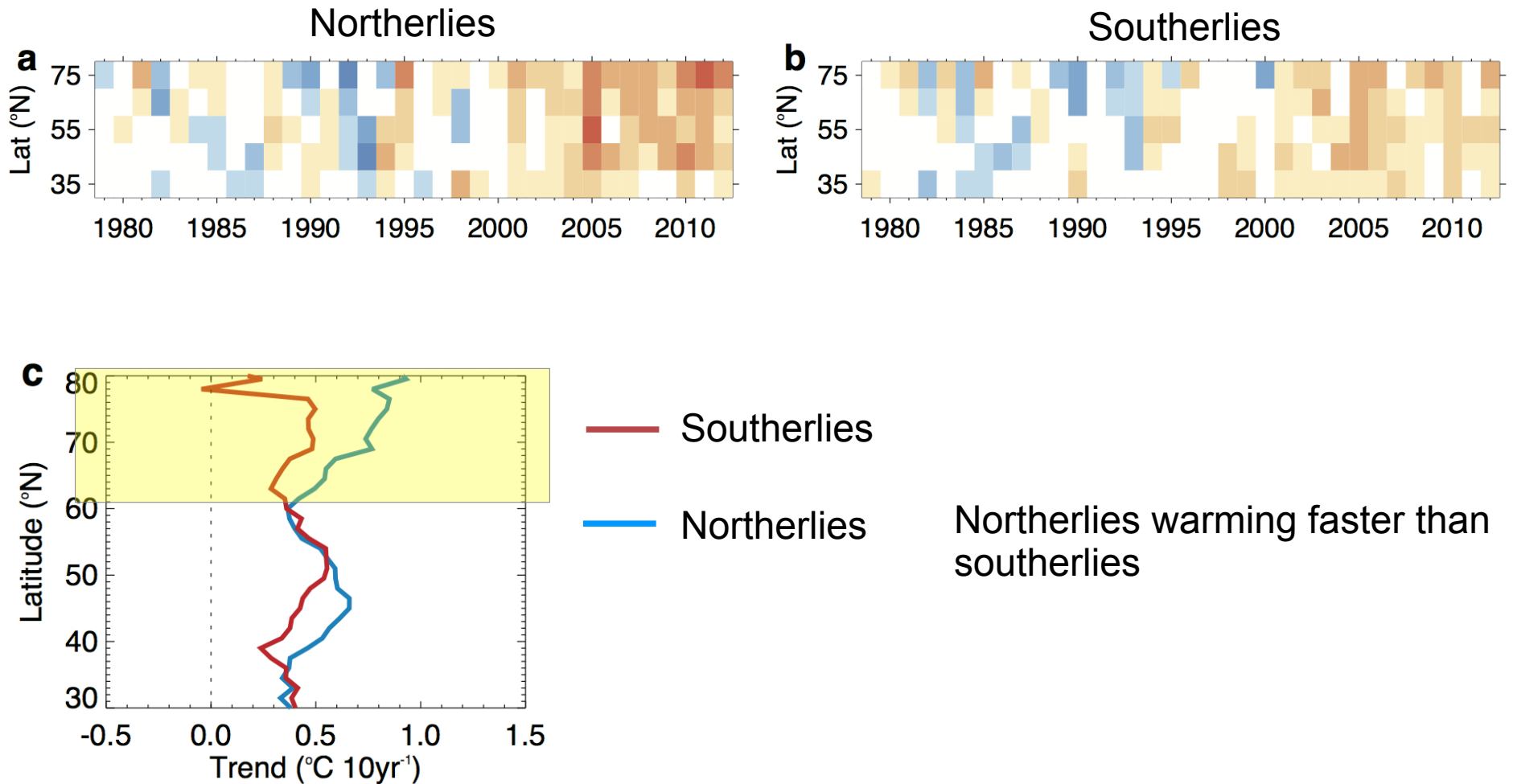


■ Mountains (surface pressure < 925h hPa)

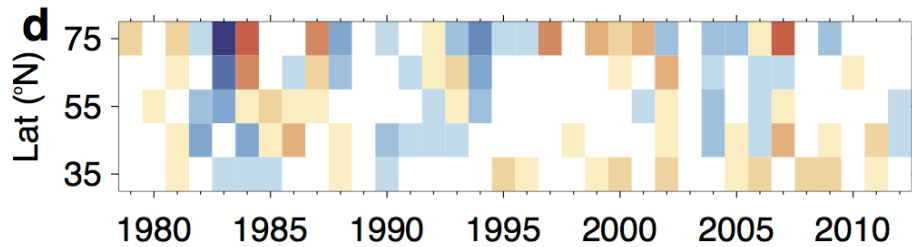
Wind roses for autumn cold days at four locations



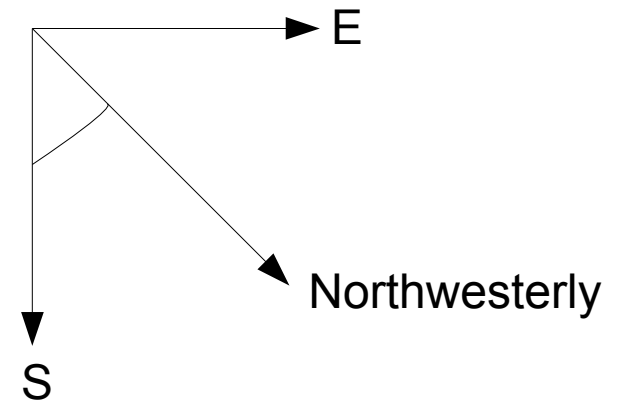
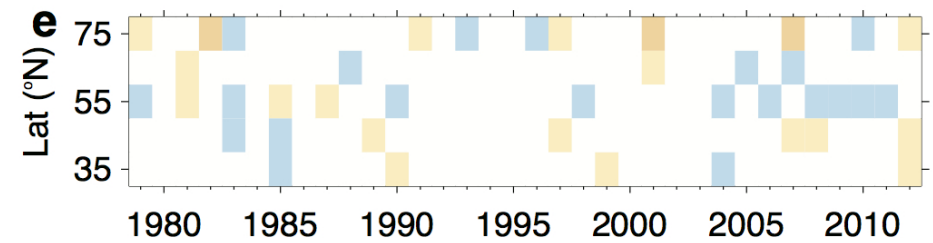
# Asymmetric warming trends



Frequency of northerlies

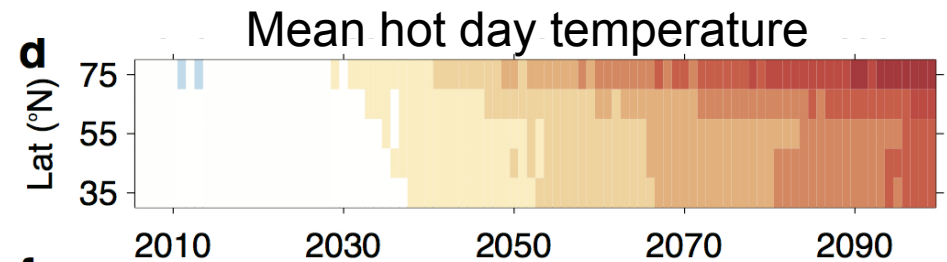
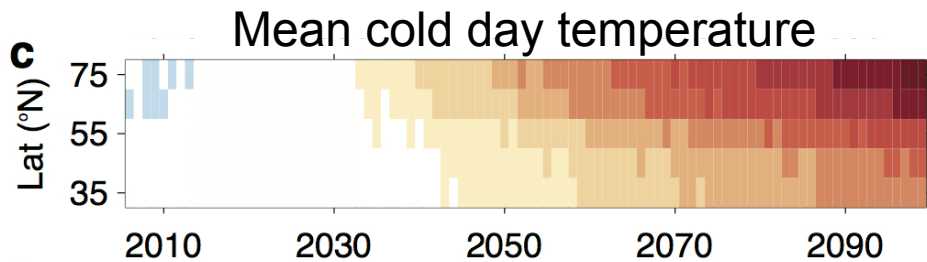
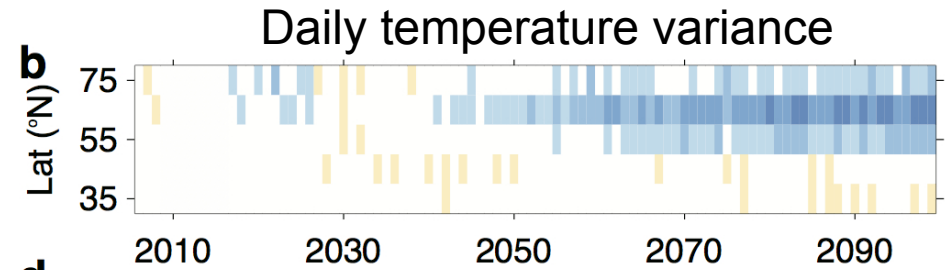
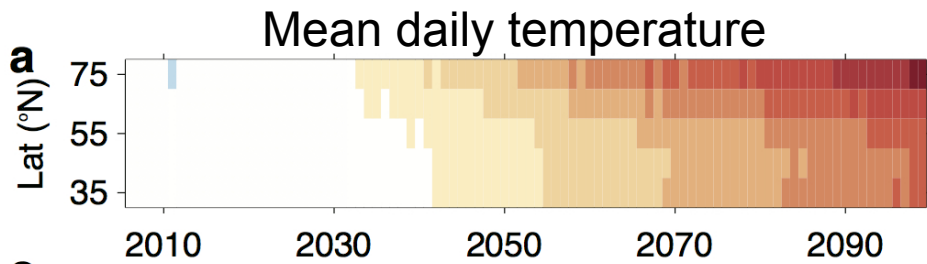


Degree of "northerliness"



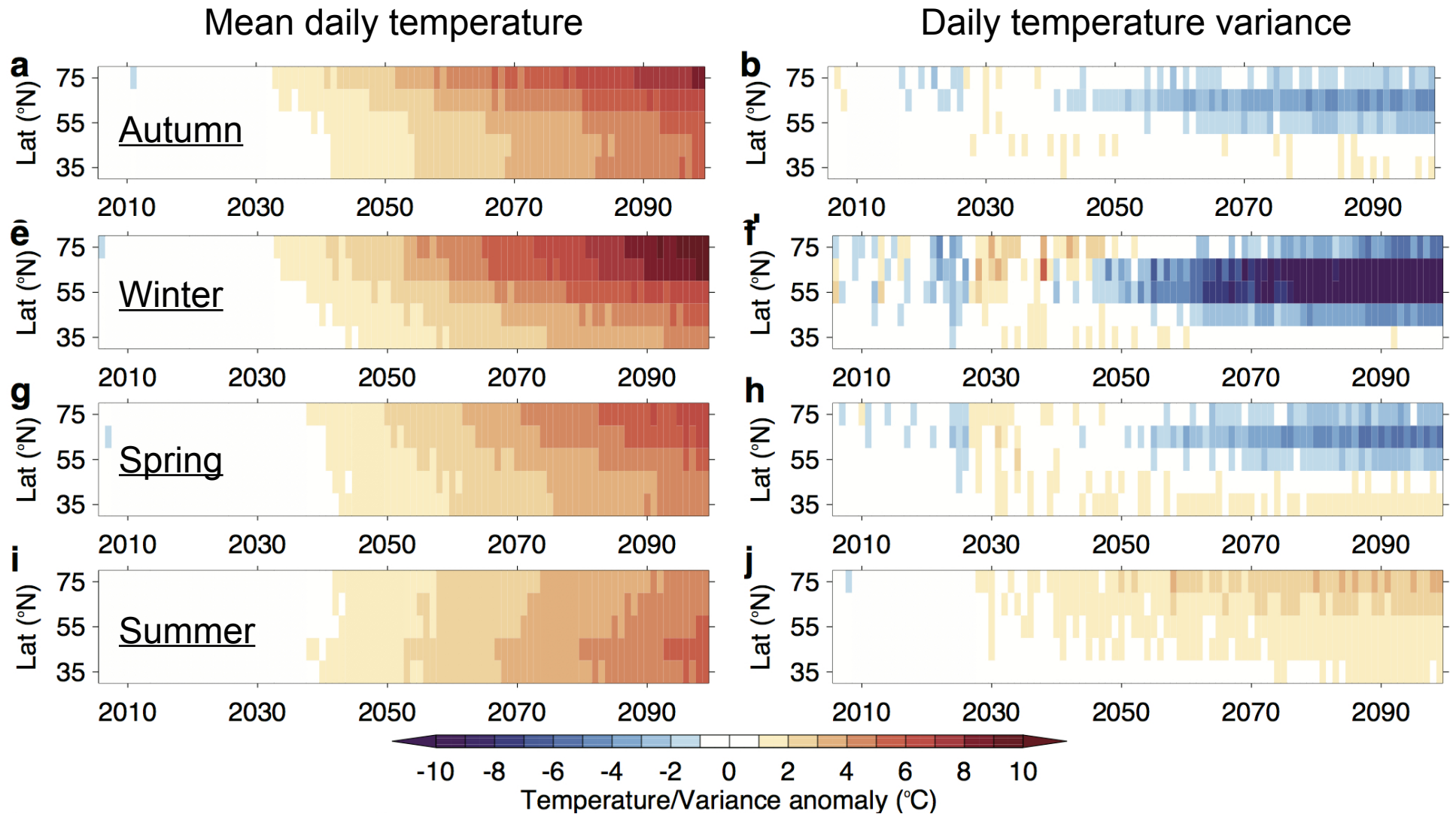


# Projected changes out to 2100



Multi-model mean from 31 CMIP5 models under RCP8.5 scenario

# Changes in other seasons

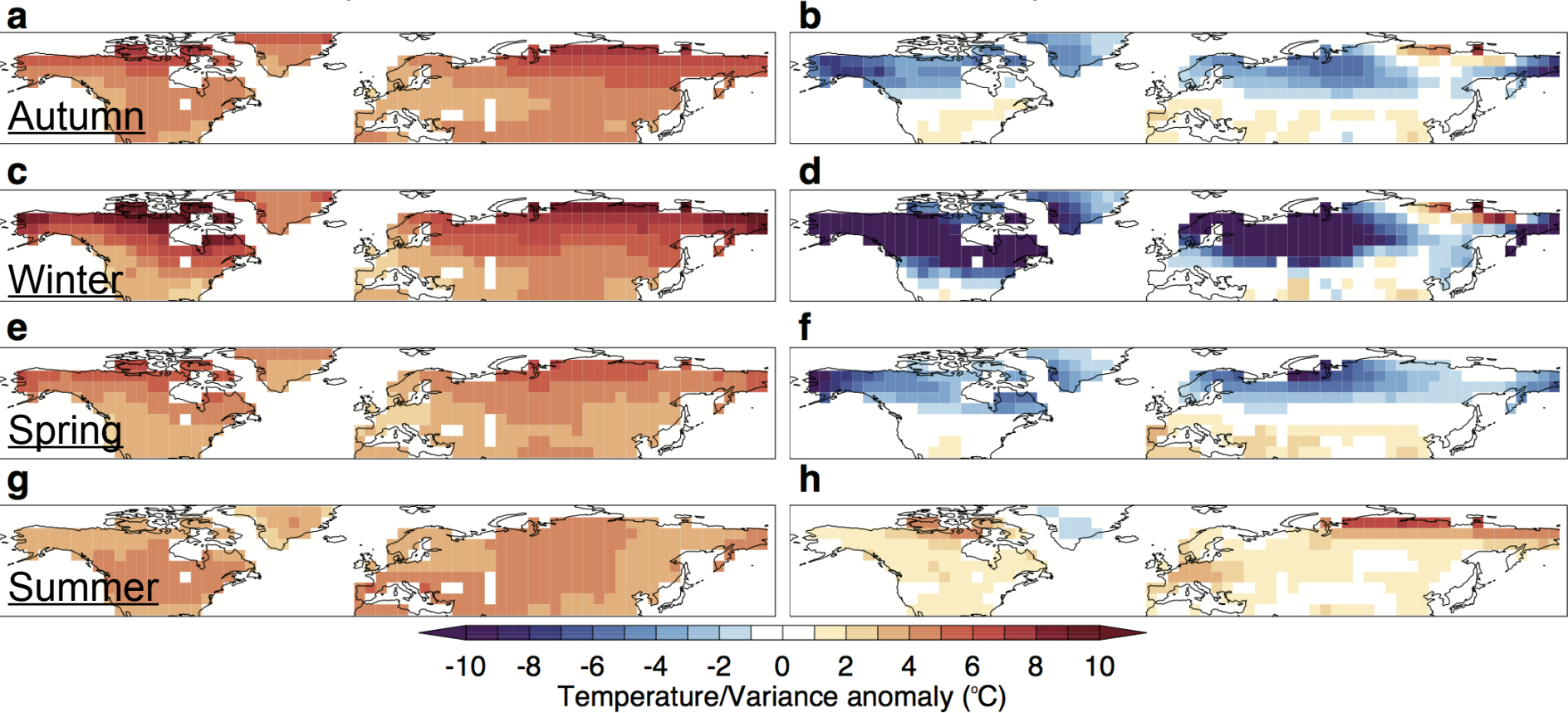


Multi-model mean from 31 CMIP5 models under RCP8.5 scenario

# Projected regional changes

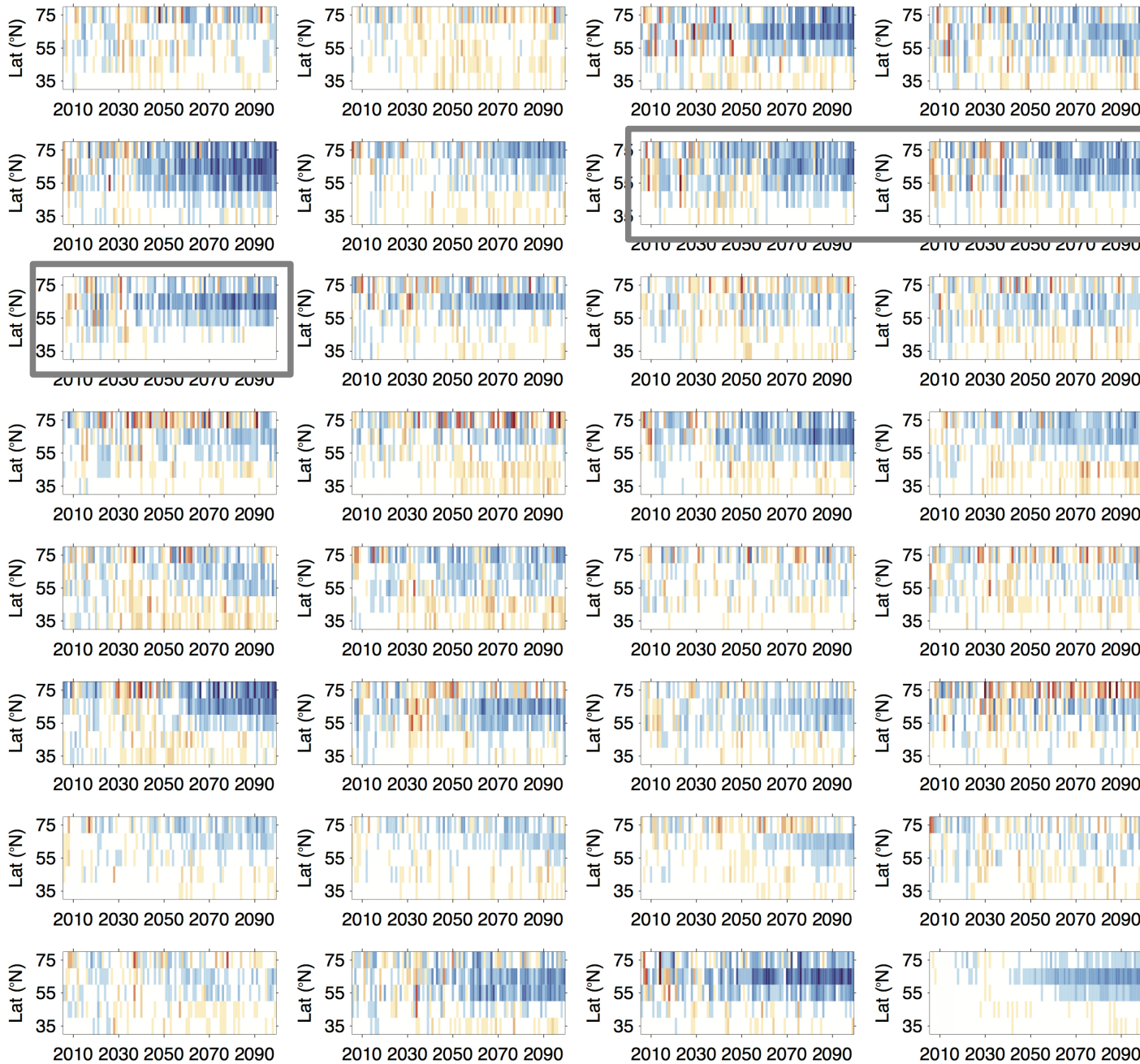
Mean daily temperature

Daily temperature variance

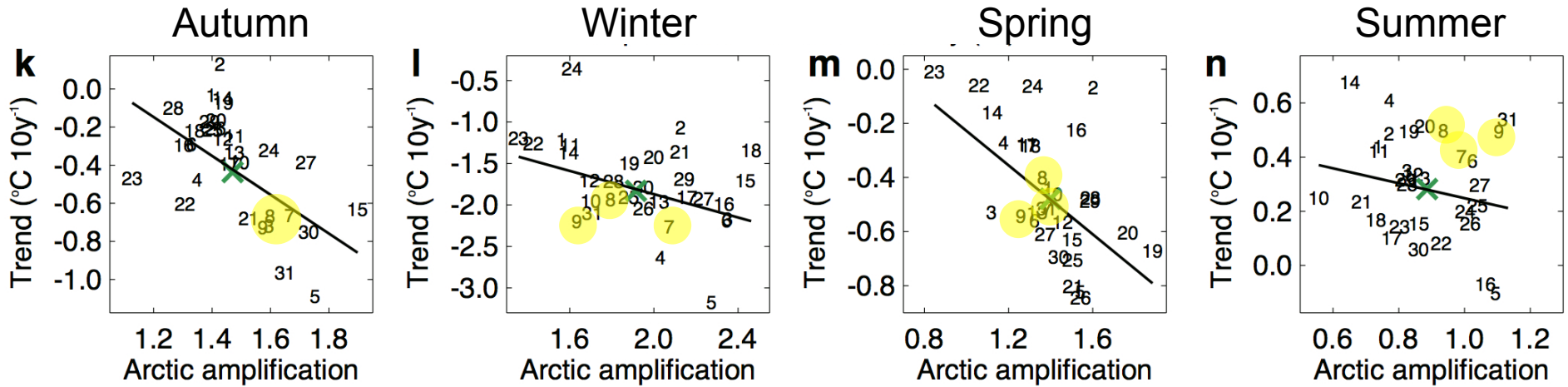


Multi-model mean from 31 CMIP5 models under RCP8.5 scenario  
Anomalies for 2070-2099 wrt 2006-2035

# Robust across models



- #7 CCSM4
- #8 CESM1-BGC
- #9 CESM1-CAM5



Generally, models with larger Arctic amplification depict larger decreases in variability



- Decreases in subseasonal variability are observed
- Northerly winds and cold extremes have warmed more than southerly winds and warm extremes
- Linked to AA and weakened north-south temperature gradient
- Historical changes are largest in autumn, when AA is most pronounced
- Models project decreasing variance in all seasons in summer
- Response strengths and extend further south in the future
- Robust change across the models – supporting simple thermodynamic mechanism rather than dynamical changes

And hot of the press.....

- Similar changes are identified in models forced only by sea ice loss and in a simple dynamical model with imposed surface heating in the Arctic.