Styrtregn over Oslo, 26. juni 2019. Foto: Trine Hegdahl/NVE

NVE

EFFECTS OF CLIMATE CHANGE ON HYDROLOGY

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NORSK KLIMASERVICESENTER

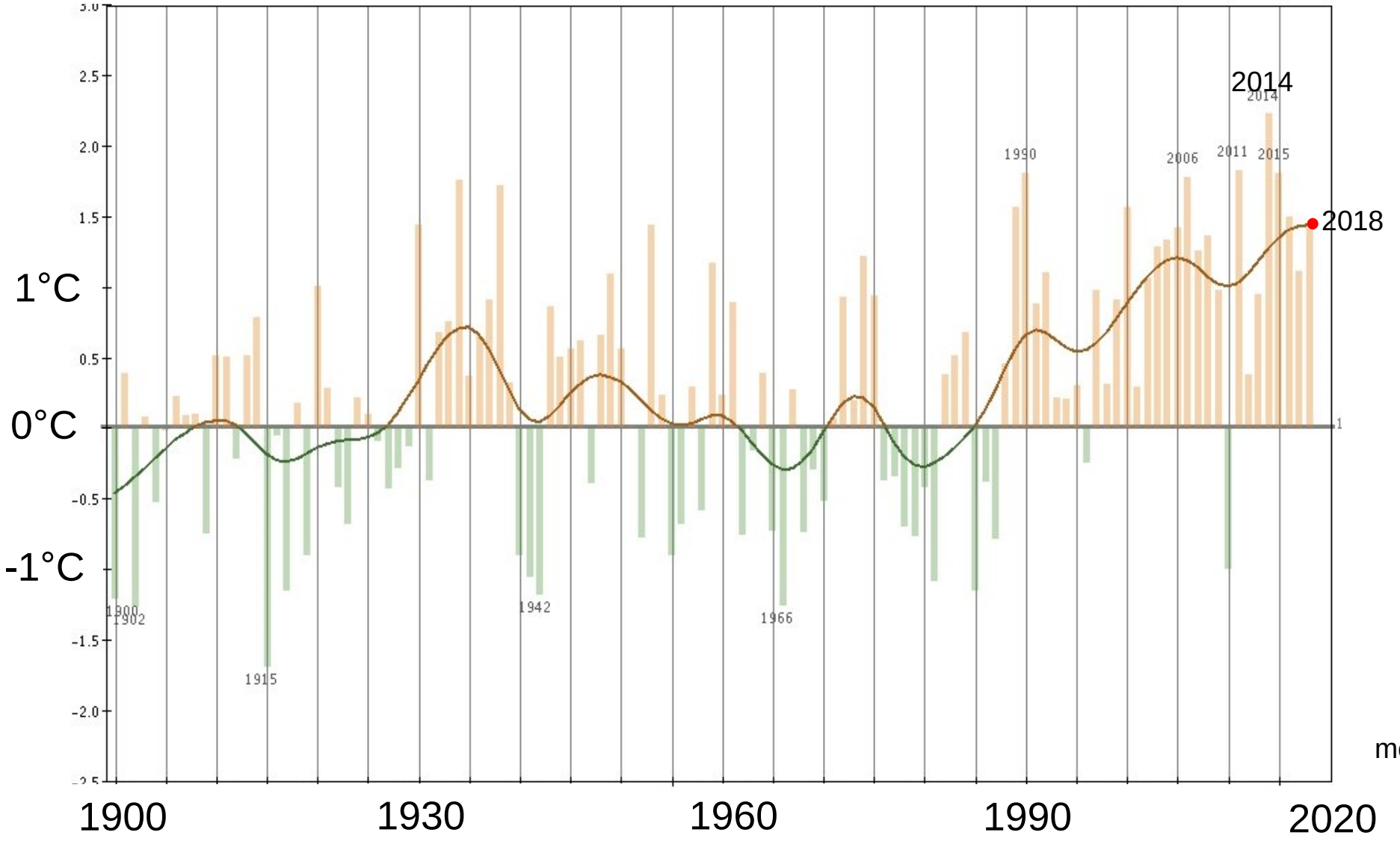
Meteorologisk institutt

Norges vassdrags- og energidirektorat NVE

NORCE

BJERKNES CENTRE for Climate Research

The annual temperature in Norway has increased



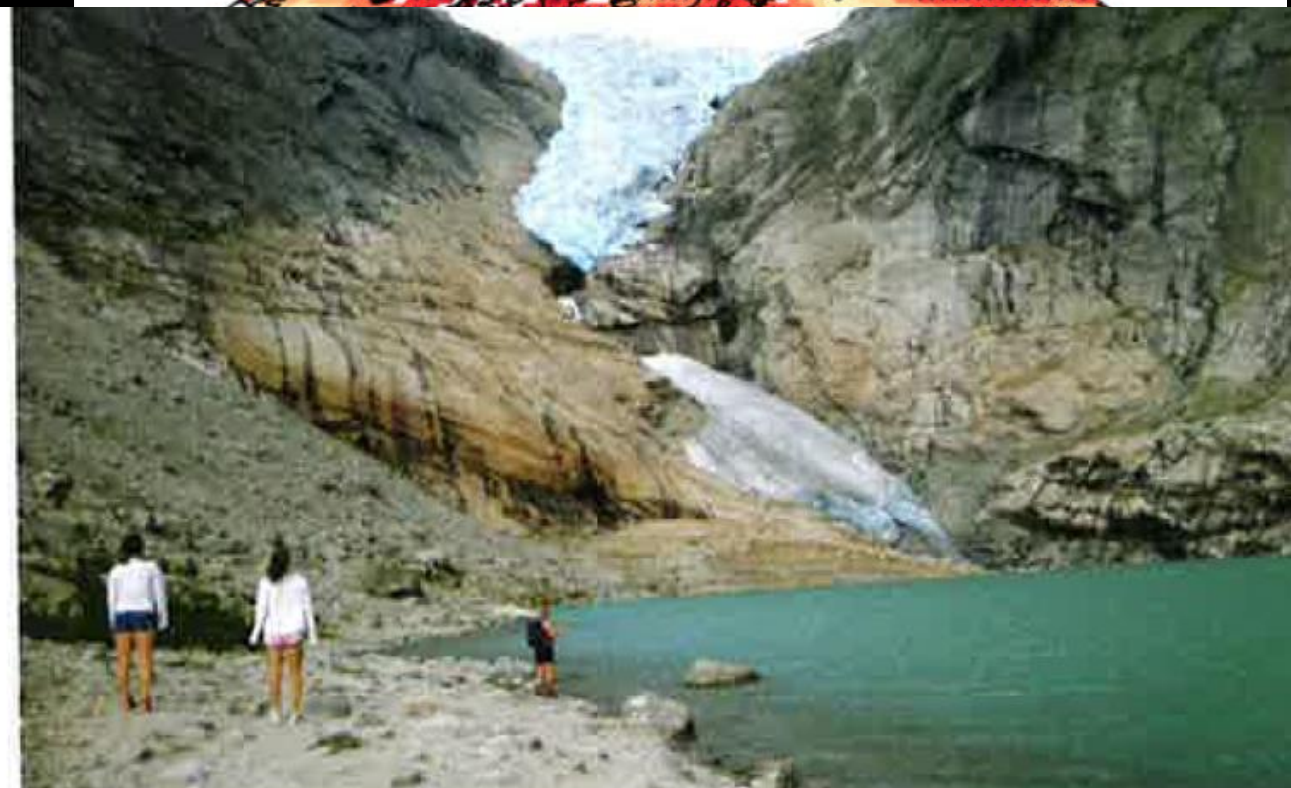
met.no

Task 1: How much warming has Norway experienced compared to the global average warming (for the last three decades)?

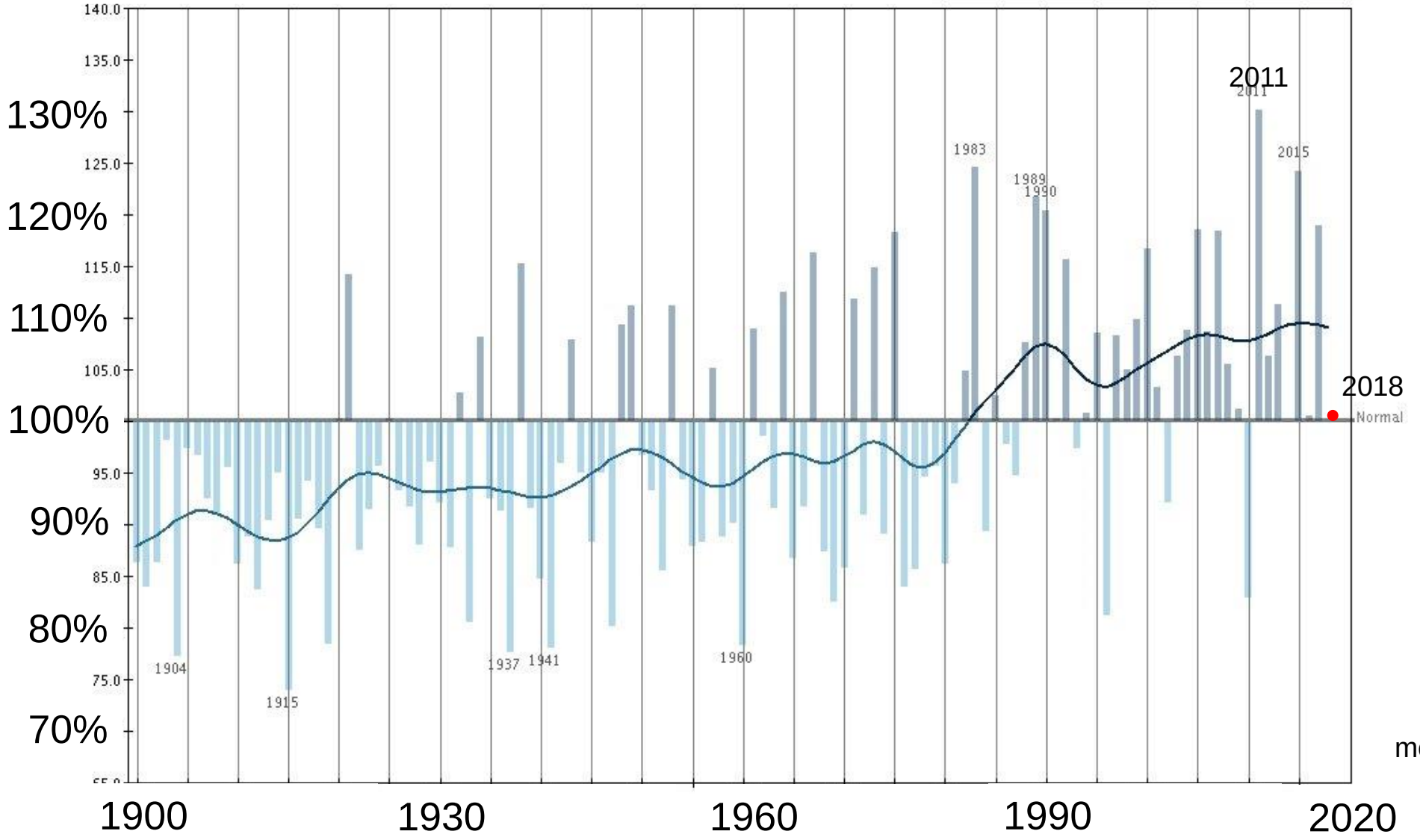
A) There has been an equal warming for Norway and the global average
B) The warming for Norway has been greater than the global
C) The global average warming has been greater than that for Norway

Task 1: How much warming has Norway experienced compared to the global average warming (for the last three decades)?

A) There has been an equal warming for Norway and the global average
B) The warming for Norway has been greater than the global (correct)
C) The global average warming has been greater than that for Norway



Preciptation in Norway has increased



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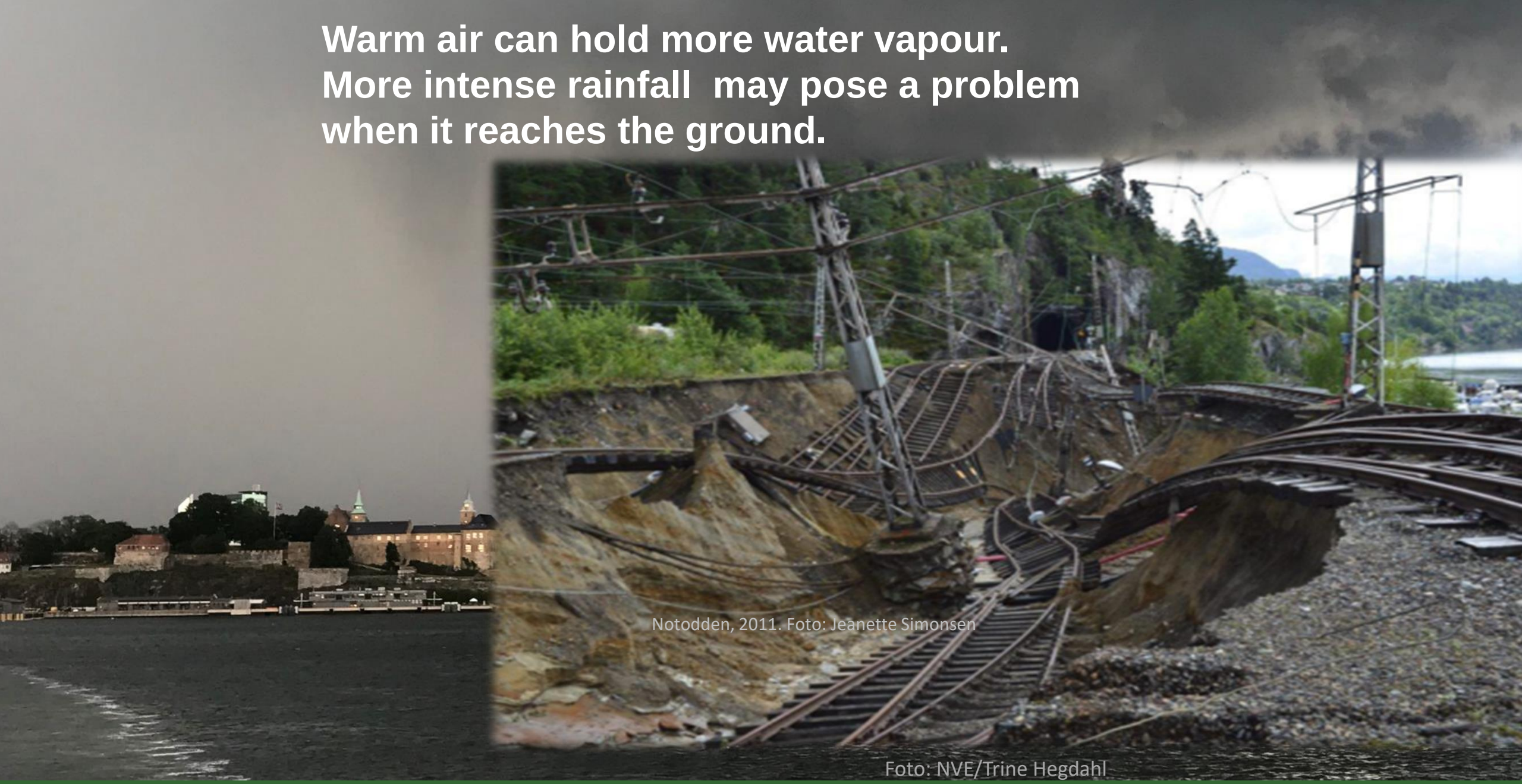
Warm air can hold more water vapour.
More intense rainfall may pose a problem when it reaches the ground.



Notodden, 2011. Foto: Jeanette Simonsen

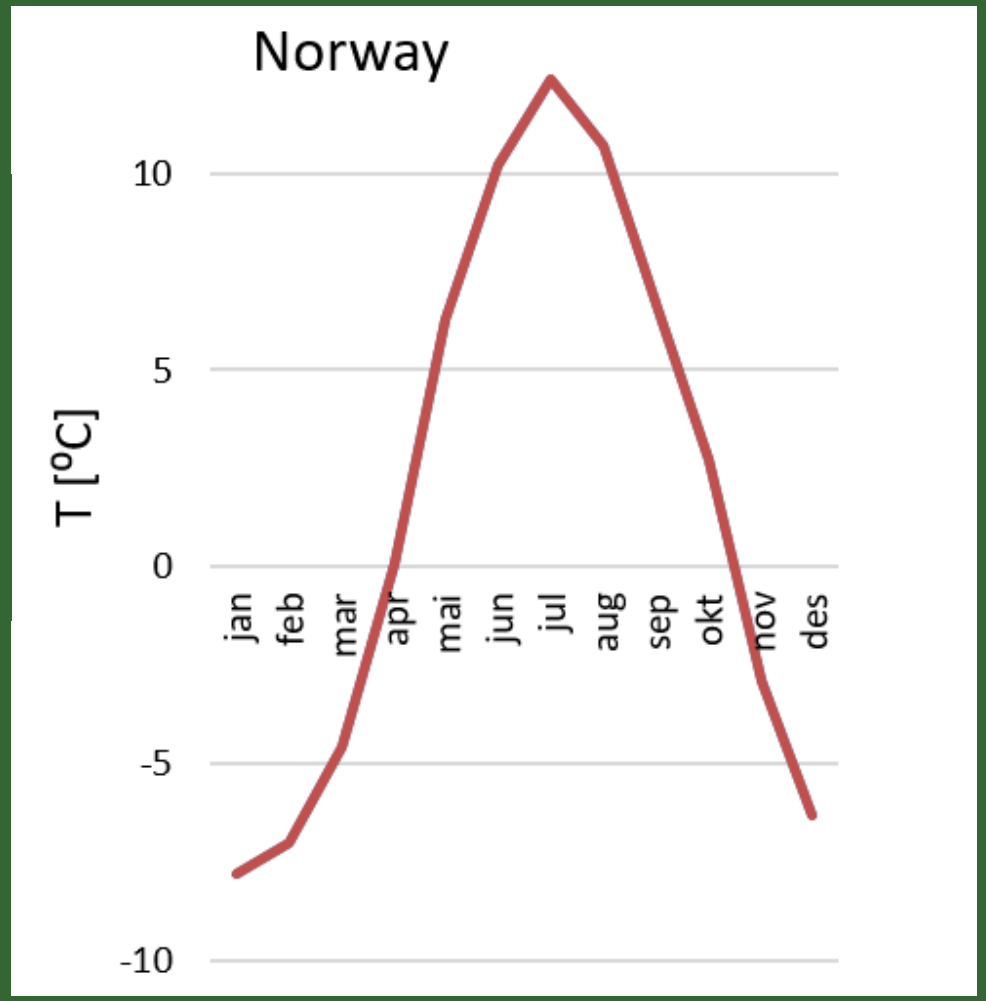
Foto: NVE/Trine Hegdahl

Poll 1: Will I need an umbrella this afternoon?

Poll 2: Will I need to pack a warm jacket for my christmas holiday?

<– Initial conditions

Forcing –>

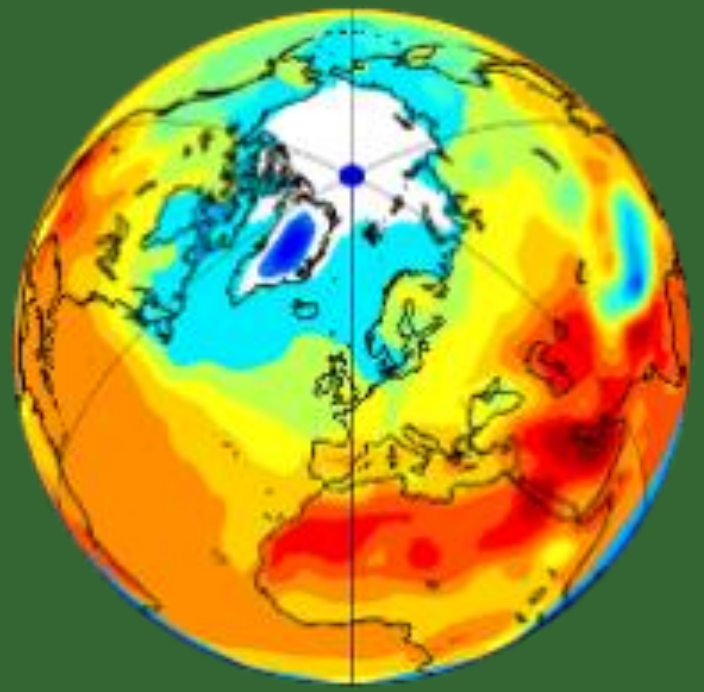


Task 2: What is the difference between a weather foreast model and a climate model?

Although weather forecast models and climate models consist of the same physical equations, their purpose are different

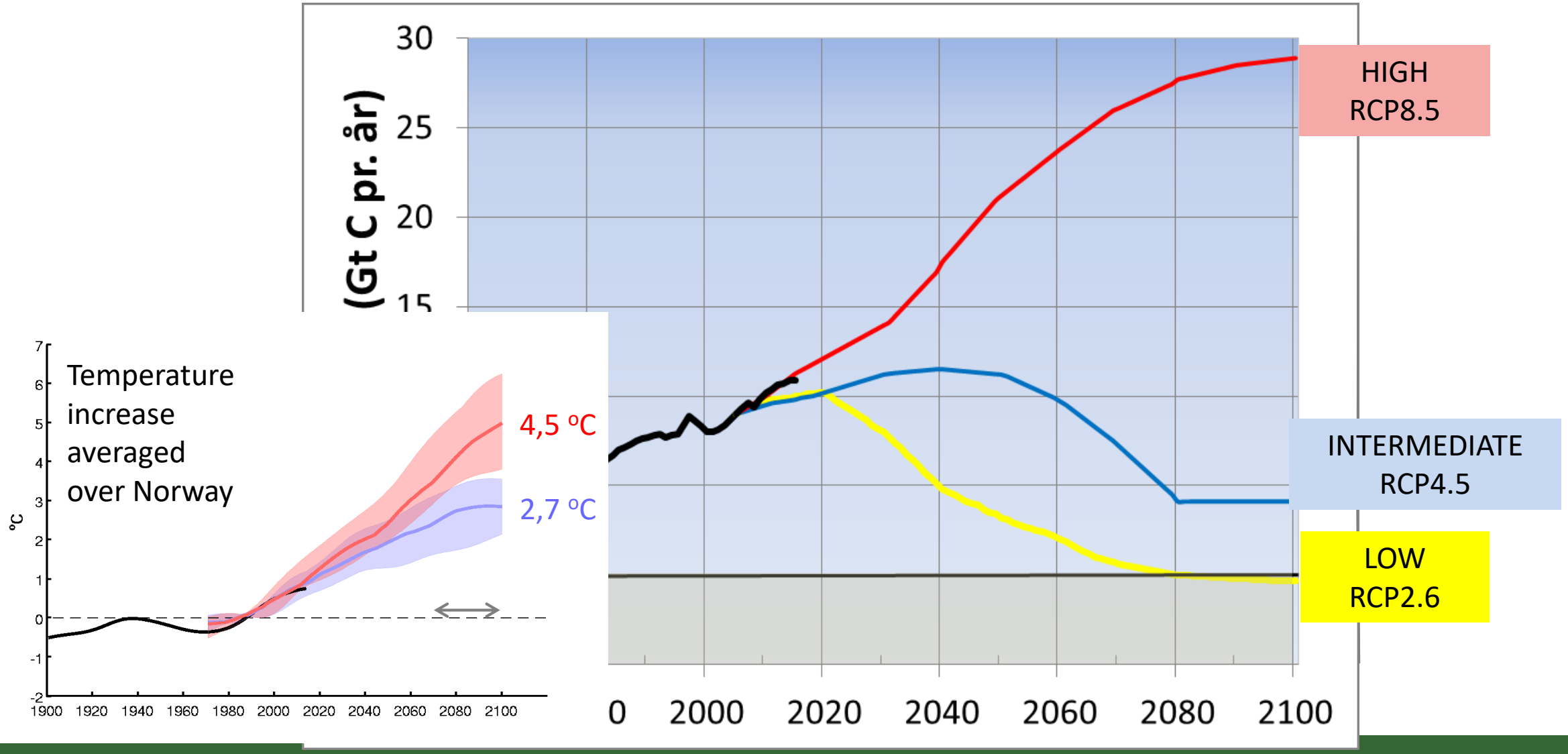
<– Initial conditions

Forcing –>

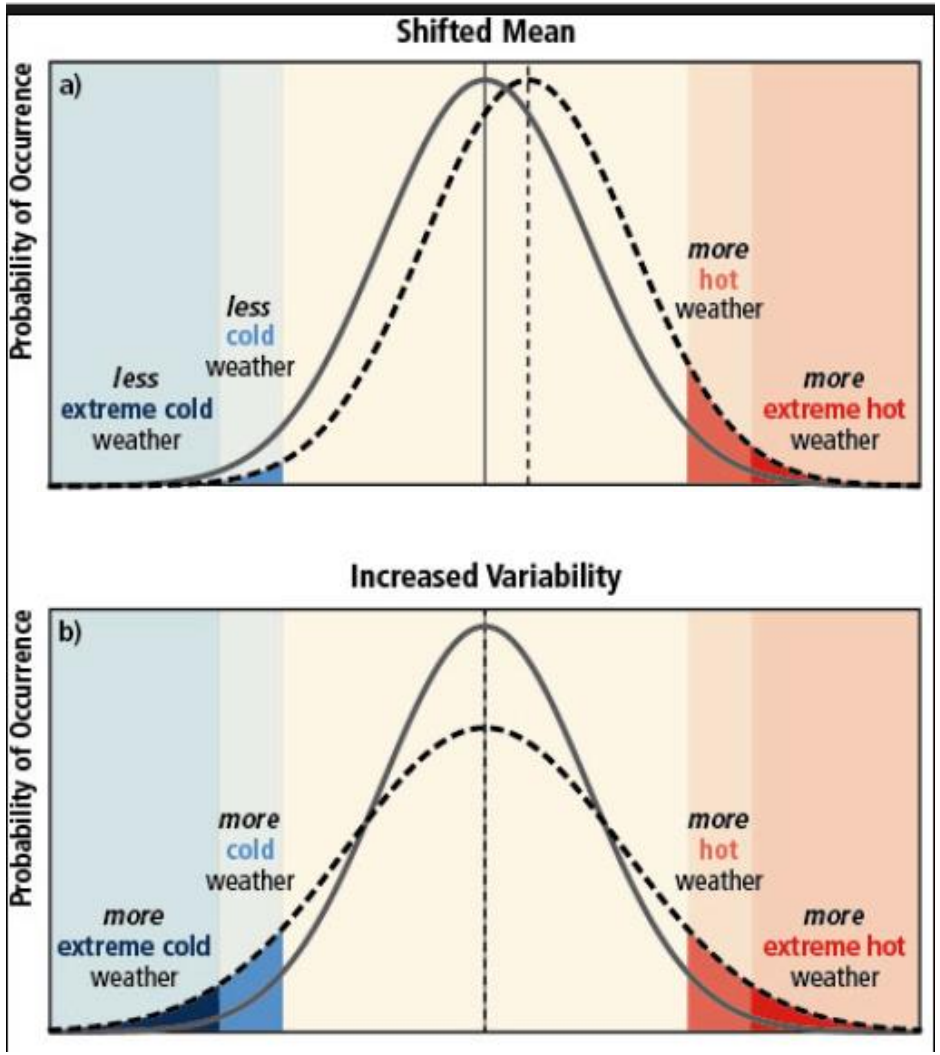


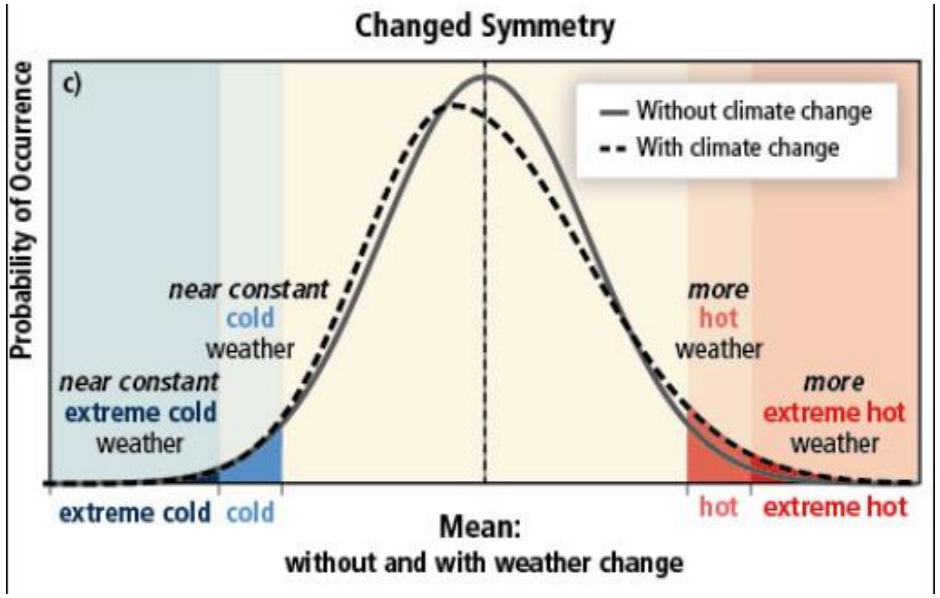
Climate models tell you about long-term weather statistics (anomalies).
They are more predictable on longer time scales.

Global climate scenarios (= forcing to climate models)



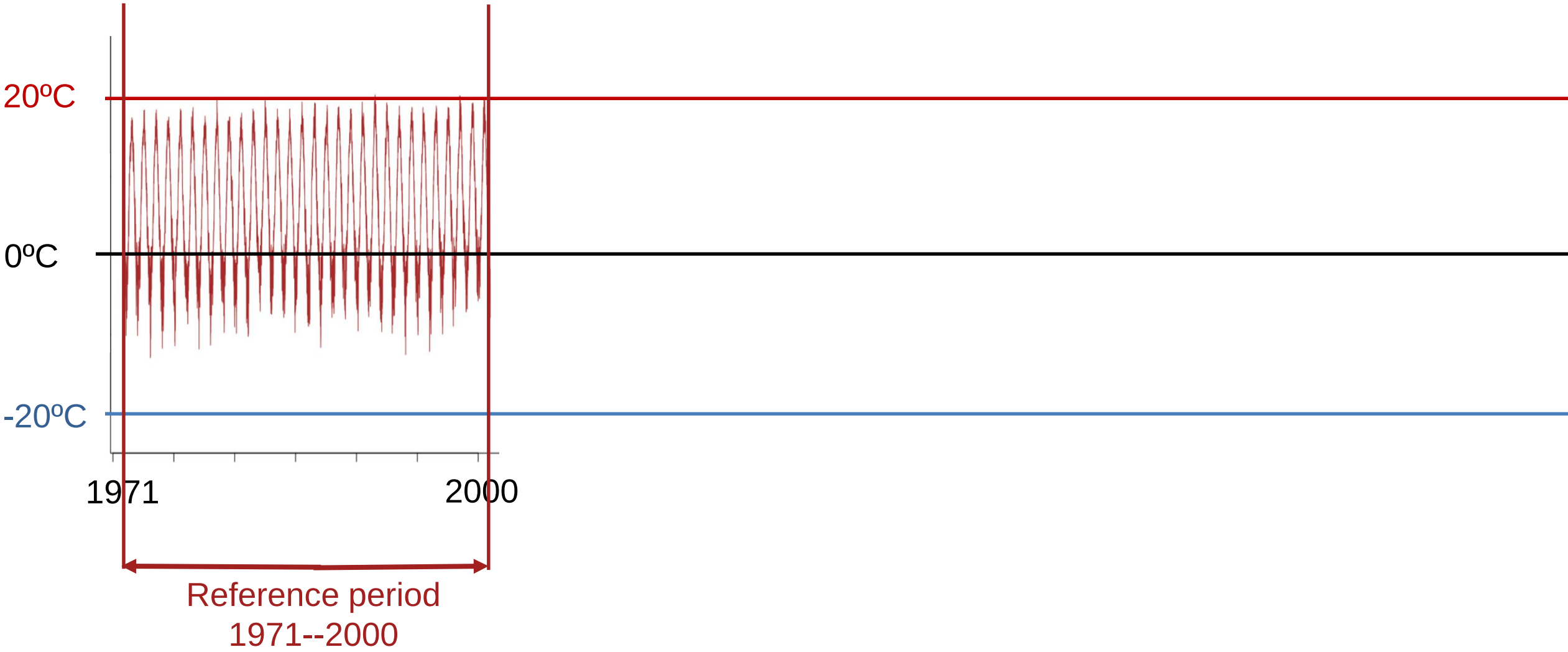
Climate change does not only change the *mean change* (4,5 ºC), but also *other changes* in the weather statistics over long time spans





How does this curve look at a Norwegian measuring station?

Daily temperature at Oslo-Blindern, from climate models



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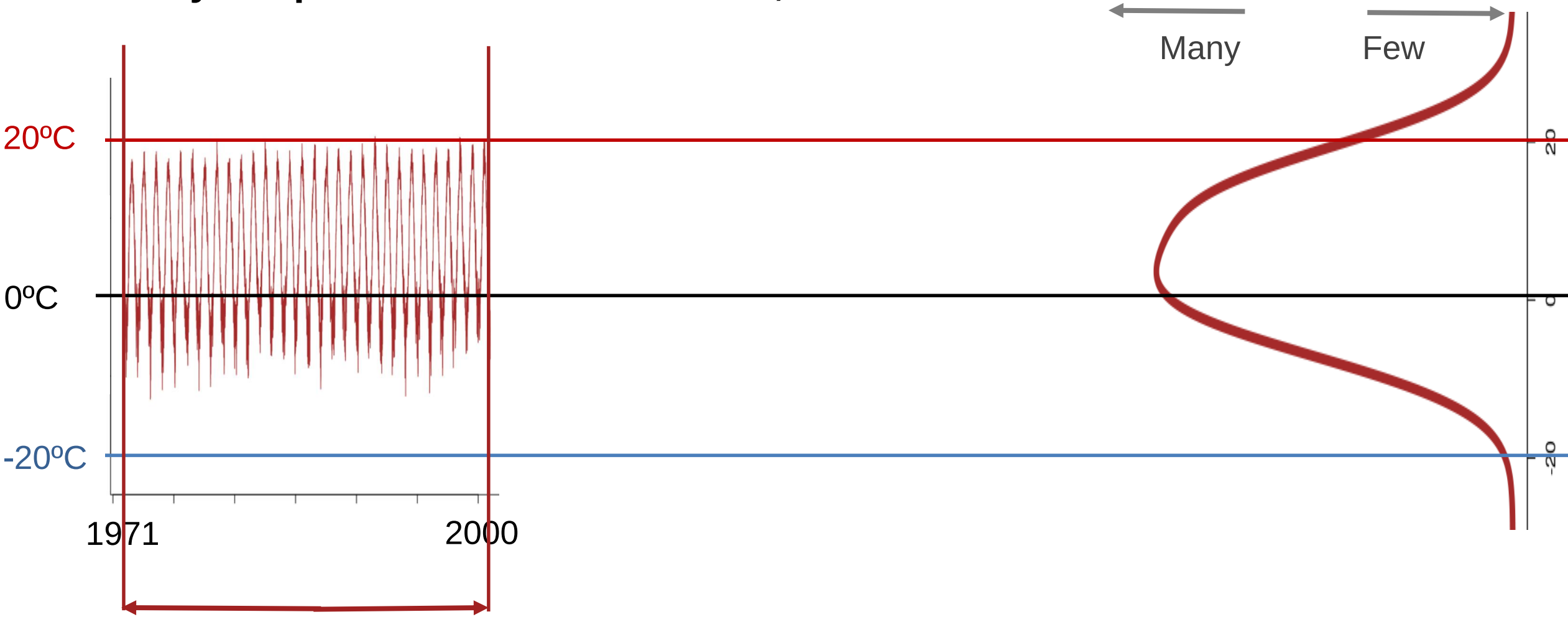
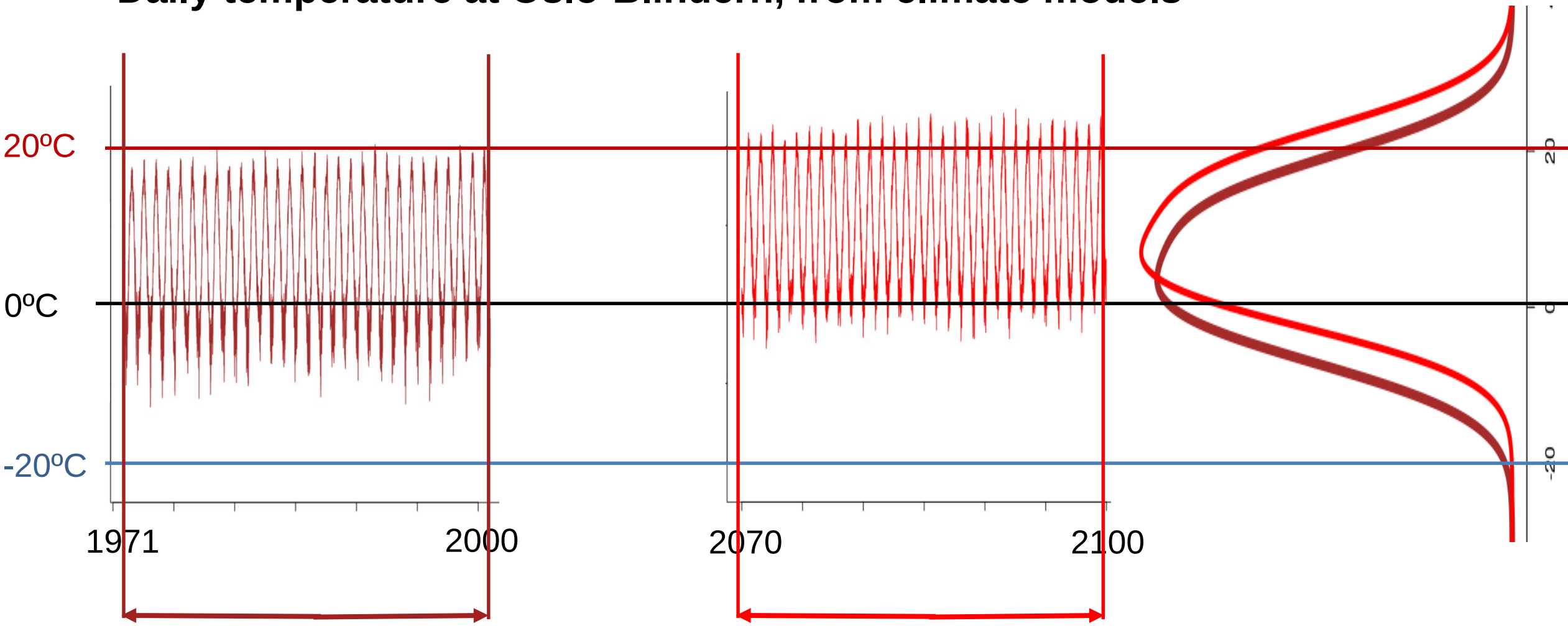


Reference period
1971--2000

Reservation: this curve is smoothed with bw=0,8

Daily temperature at Oslo-Blindern, from climate models



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Future period
2071--2100
RCP 8.5

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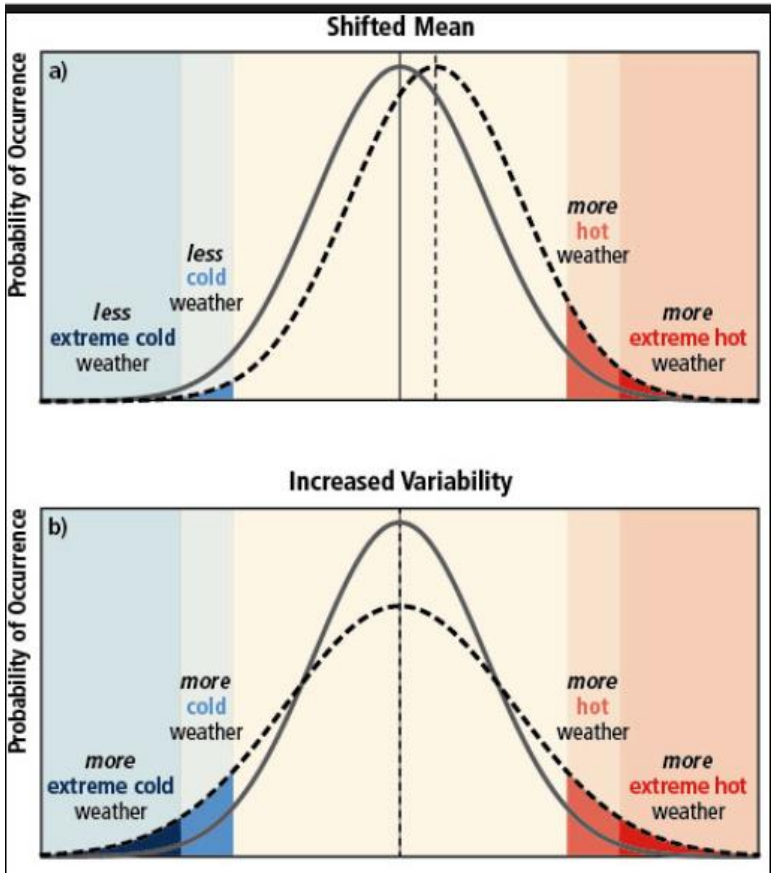
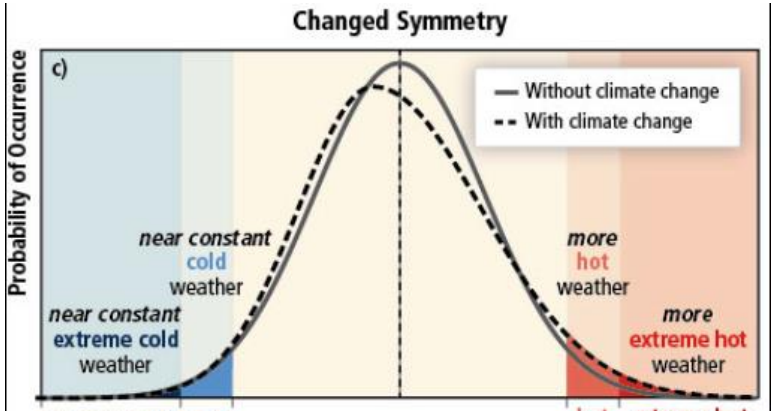
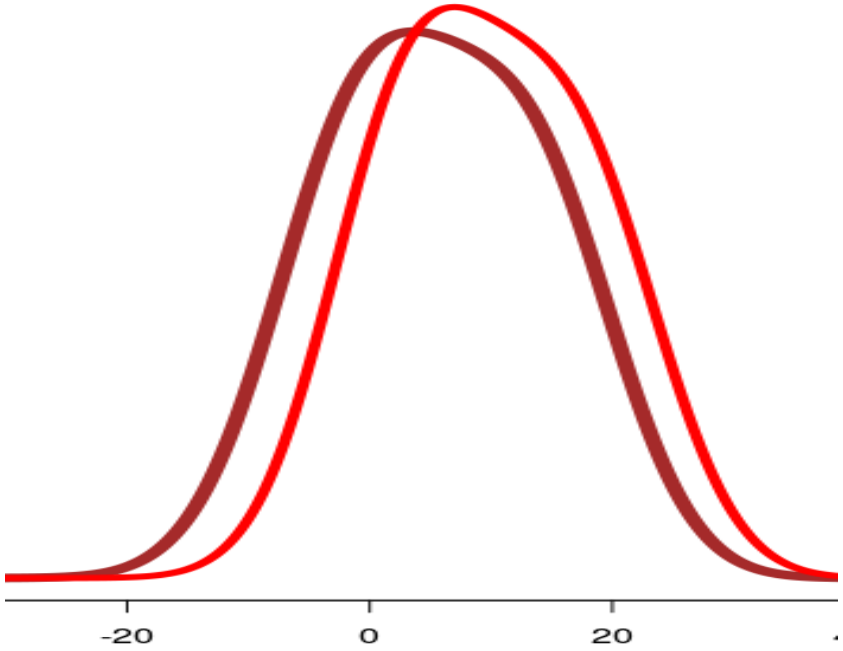


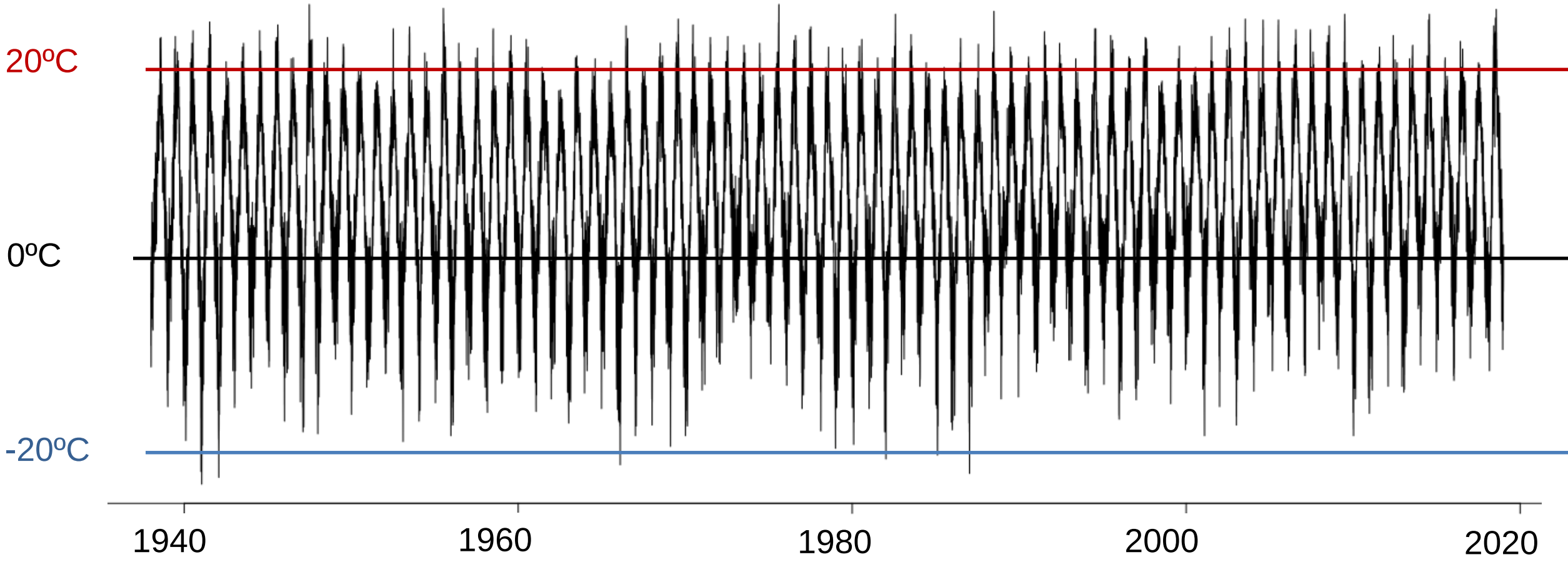




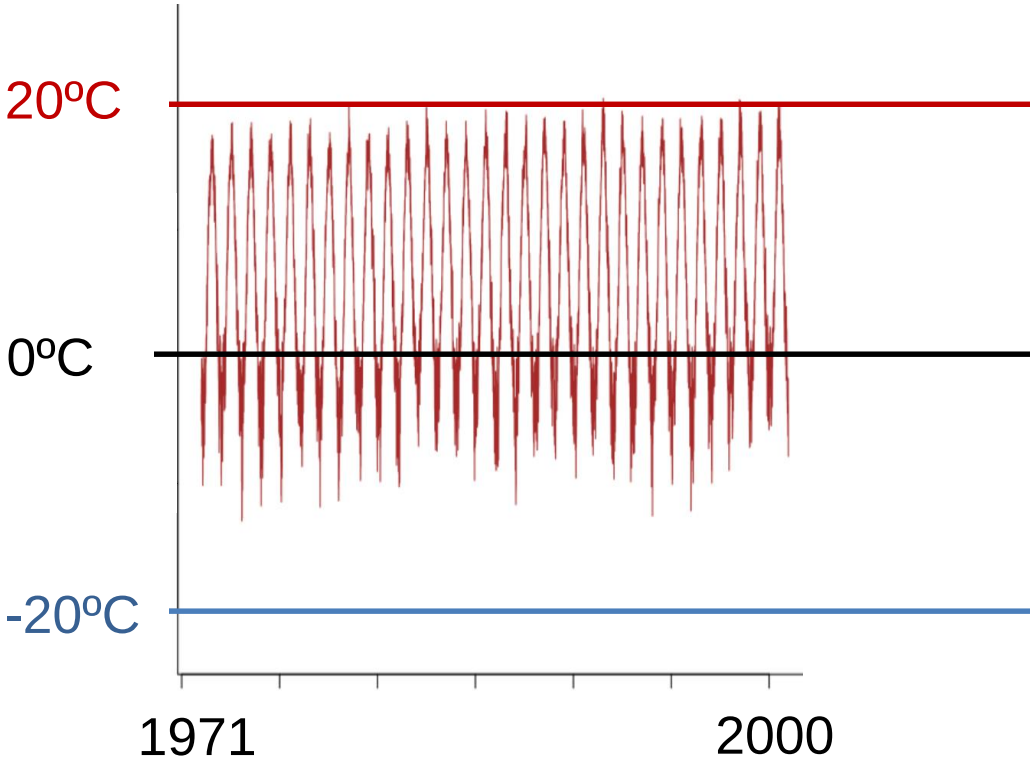
Reference period
1971--2000

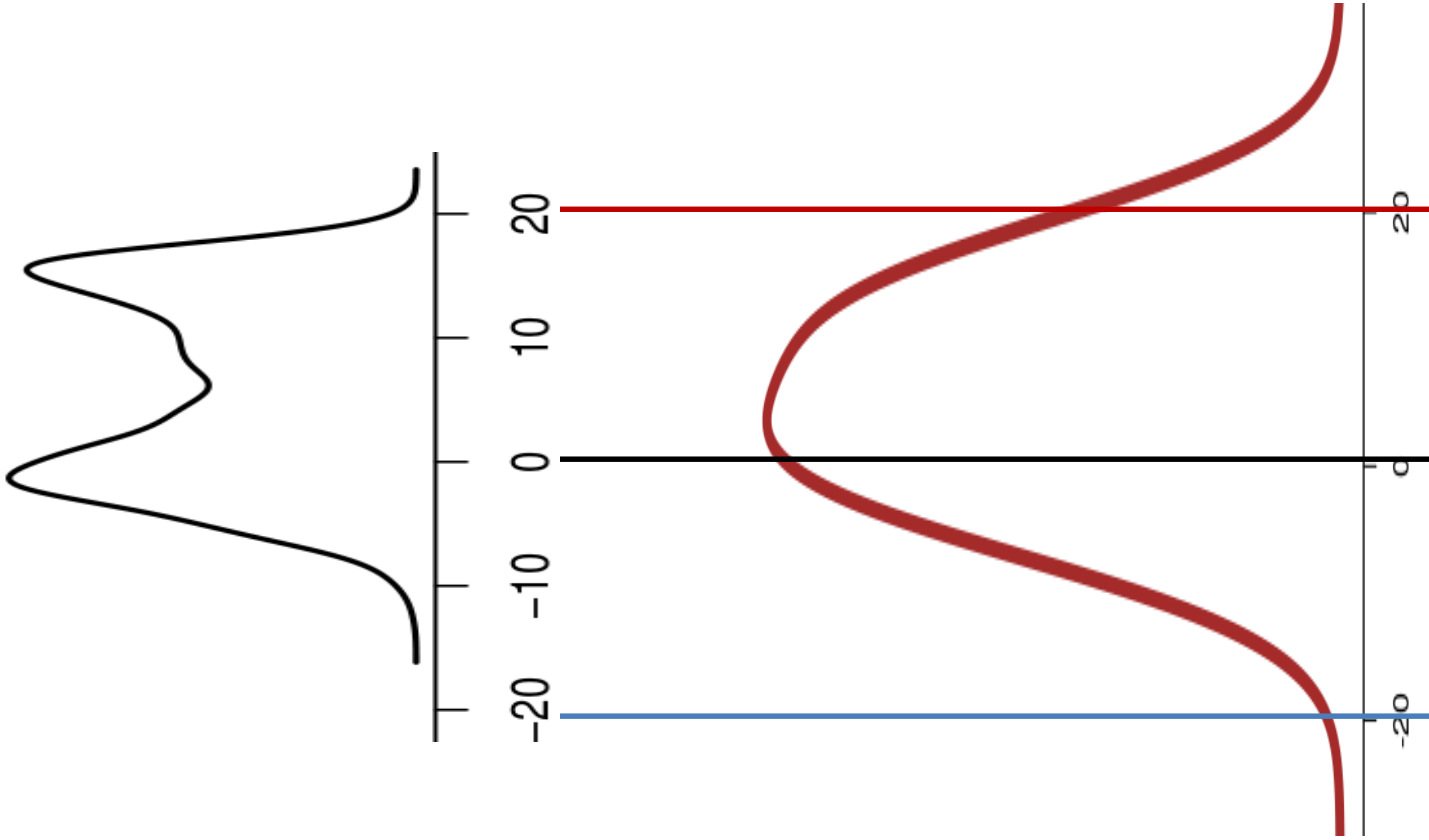
Future period
2071--2100
RCP8.5

Poll 3: are daily temperatures at Blindern observation station really normally distributed?



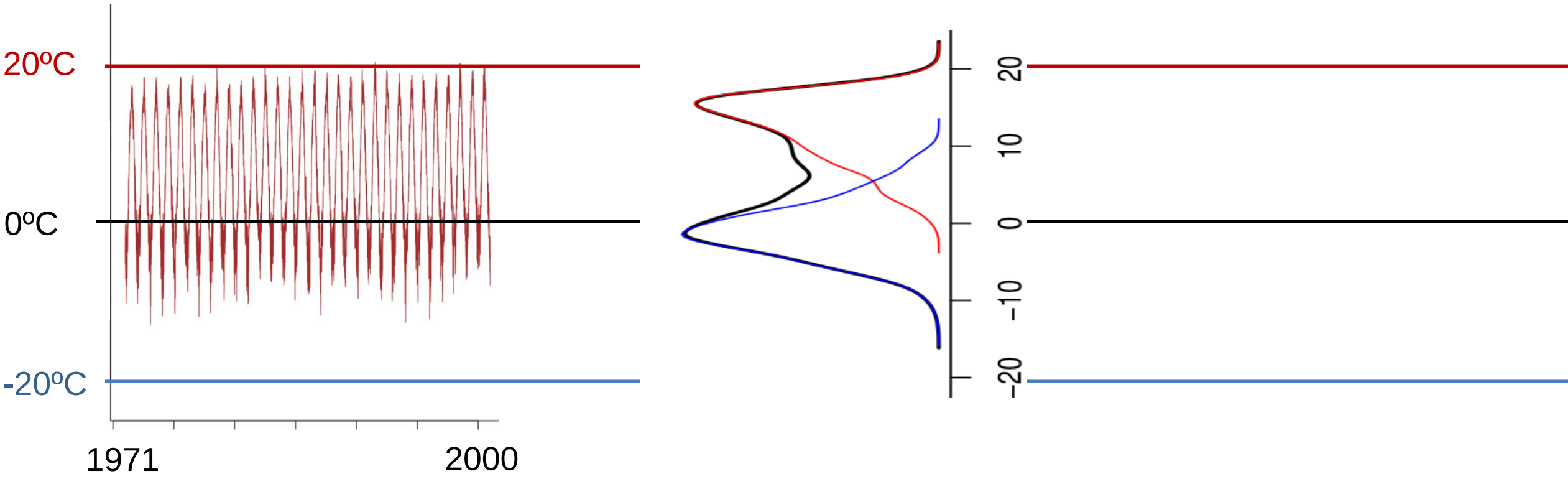
NO! The temperature at Blindern has a bimodal distribution!





Reservation: this curve is smoothed with bw=0,8

…there is a winter regime (around 0 °C) and a summer regime (around 15 °C)



Do winter and summer temperatures increase equally much?

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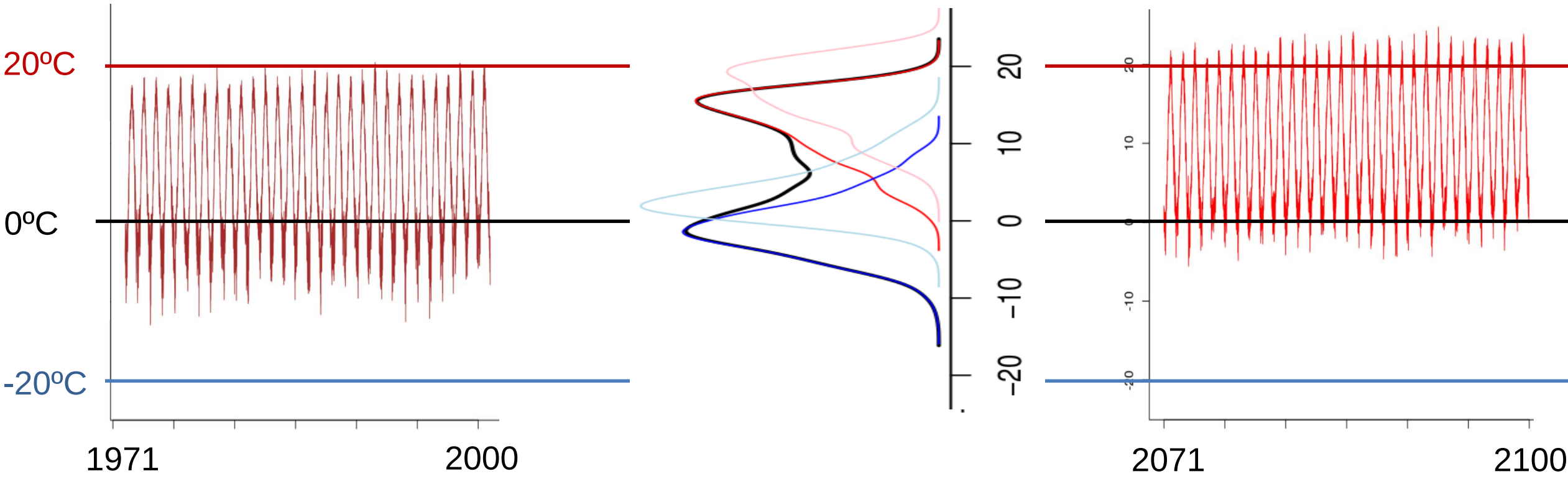
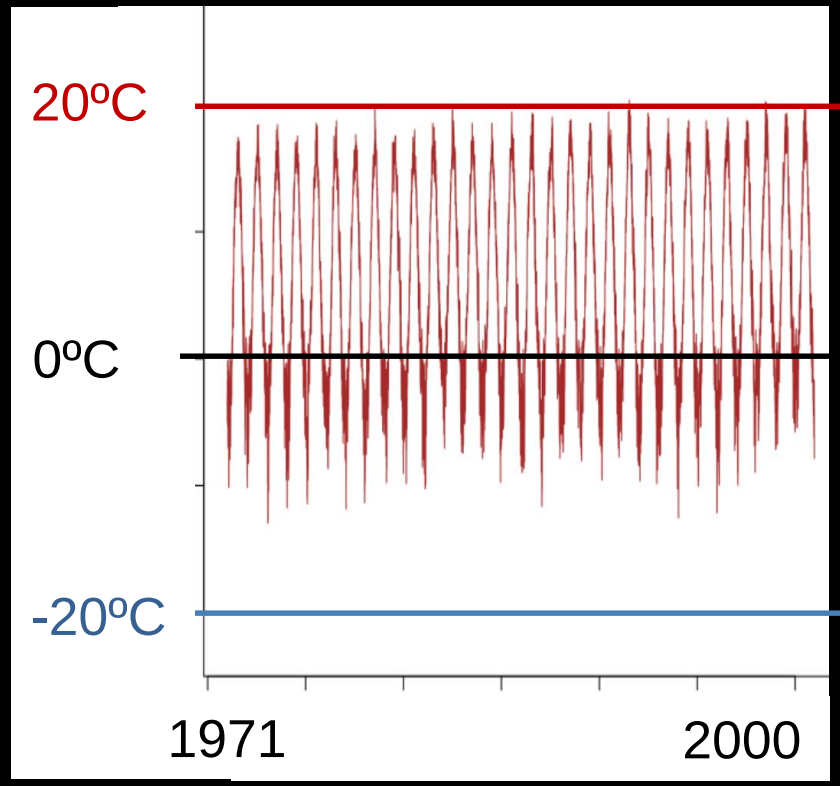
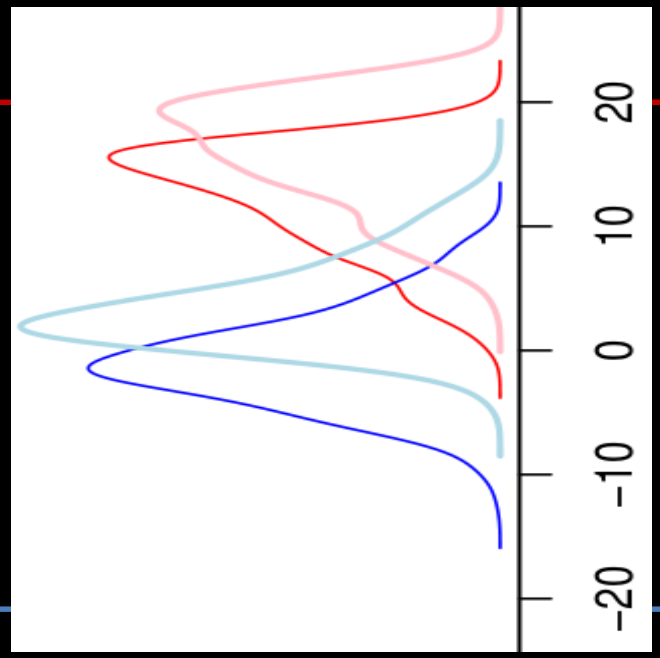
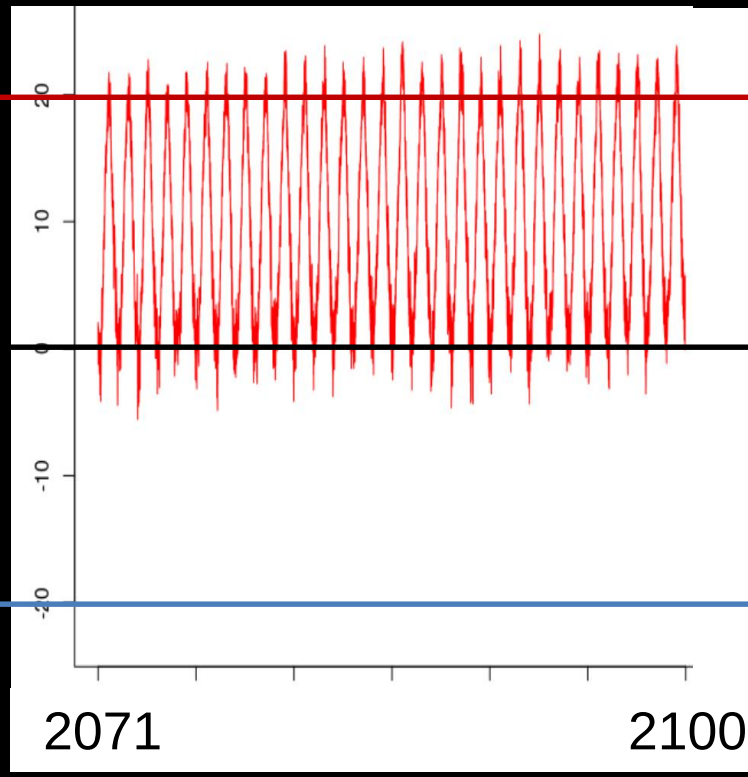


Do winter and summer temperatures increase equally much?
What about extremes?

Task 3: Do winter and summer temperatures at Blindern change equally much towards the end of the century (assume high emissions, RCP8.5)?

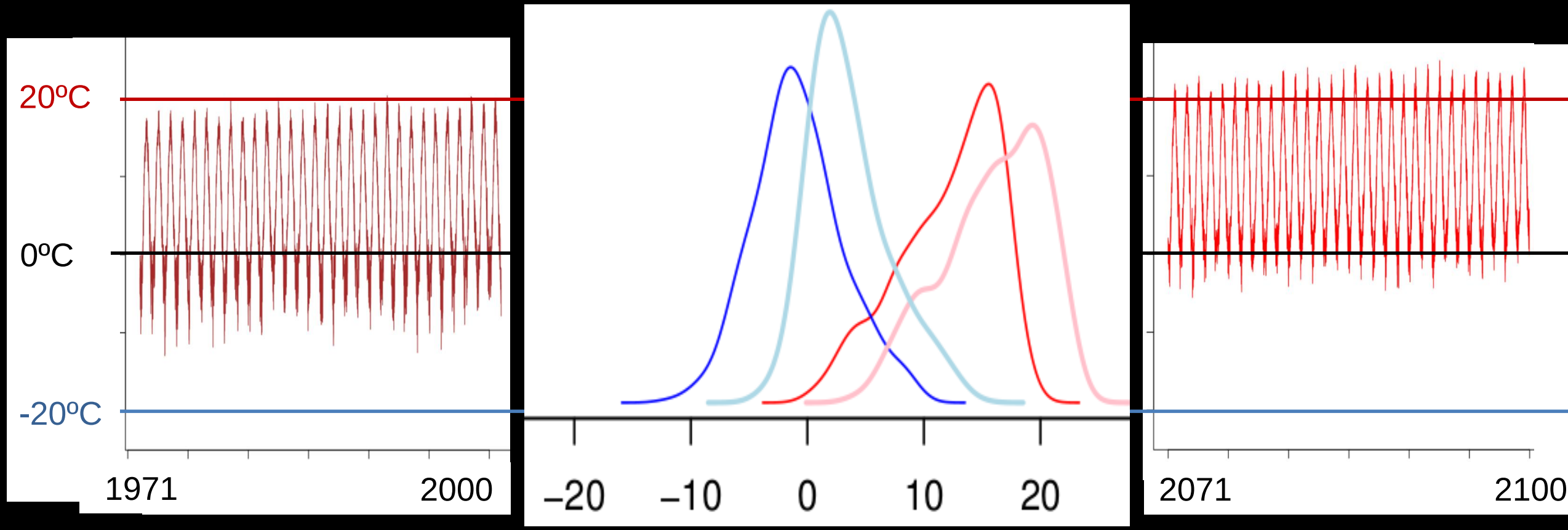






A) summer temperatures increase most
B) winter temperatures increase most
C) summer and winter temperatures increase equally much

Task 3: Do winter and summer temperatures at Blindern change equally much towards the end of the century (assume high emissions, RCP8.5)?



A) summer temperatures increase most

B) winter temperatures increase most (correct)

C) summer and winter temperatures increase equally much

Warm air can hold more water vapour.

The short-term rainfall is expected to increase by approximately 40 %

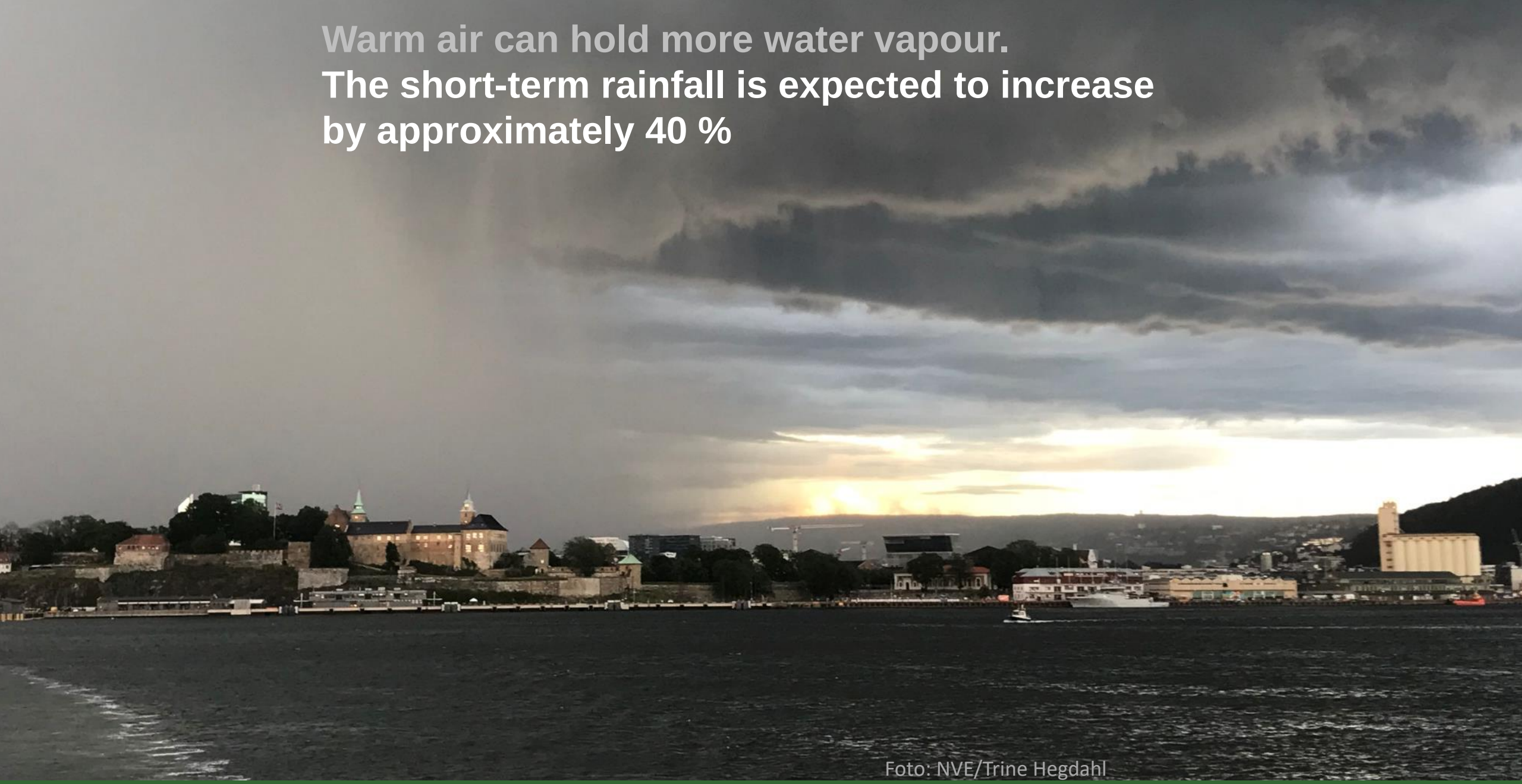
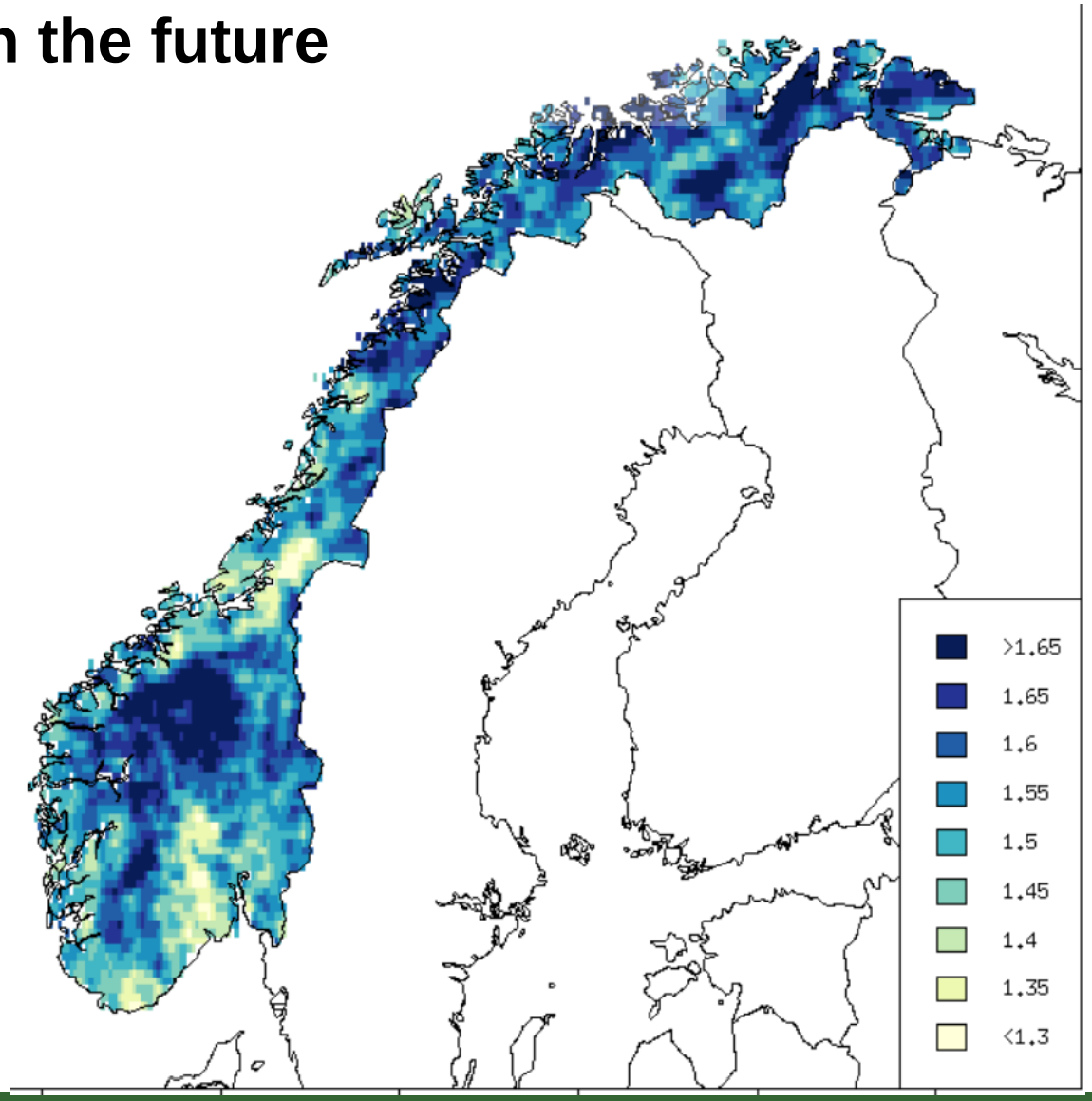


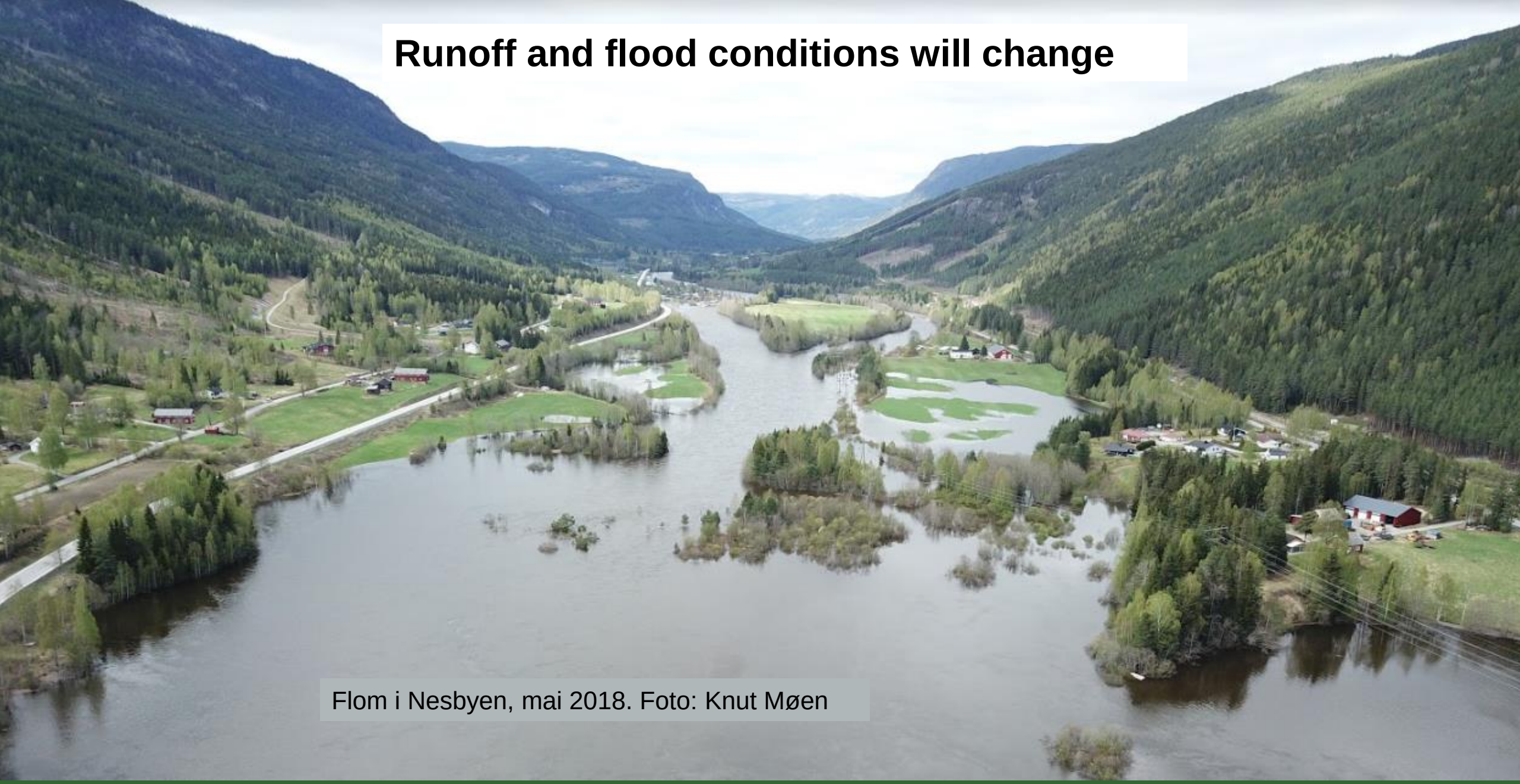
Foto: NVE/Trine Hegdahl

We have to prepare our sewage systems to handle 40 % more water during extreme events in the future

Kvinesdal 2015. Foto: Rolf Kristoffersen



Runoff and flood conditions will change



Flom i Nesbyen, mai 2018. Foto: Knut Møen

Task 4: How do we expect runoff regimes (including floods) to change under climate change?

A) A stronger seasonality towards more winter runoff but smaller snowmelt floods in spring

B) More runoff and larger flood magnitudes in all rivers

C) More floods in large rivers and fewer/smaller floods in small rivers

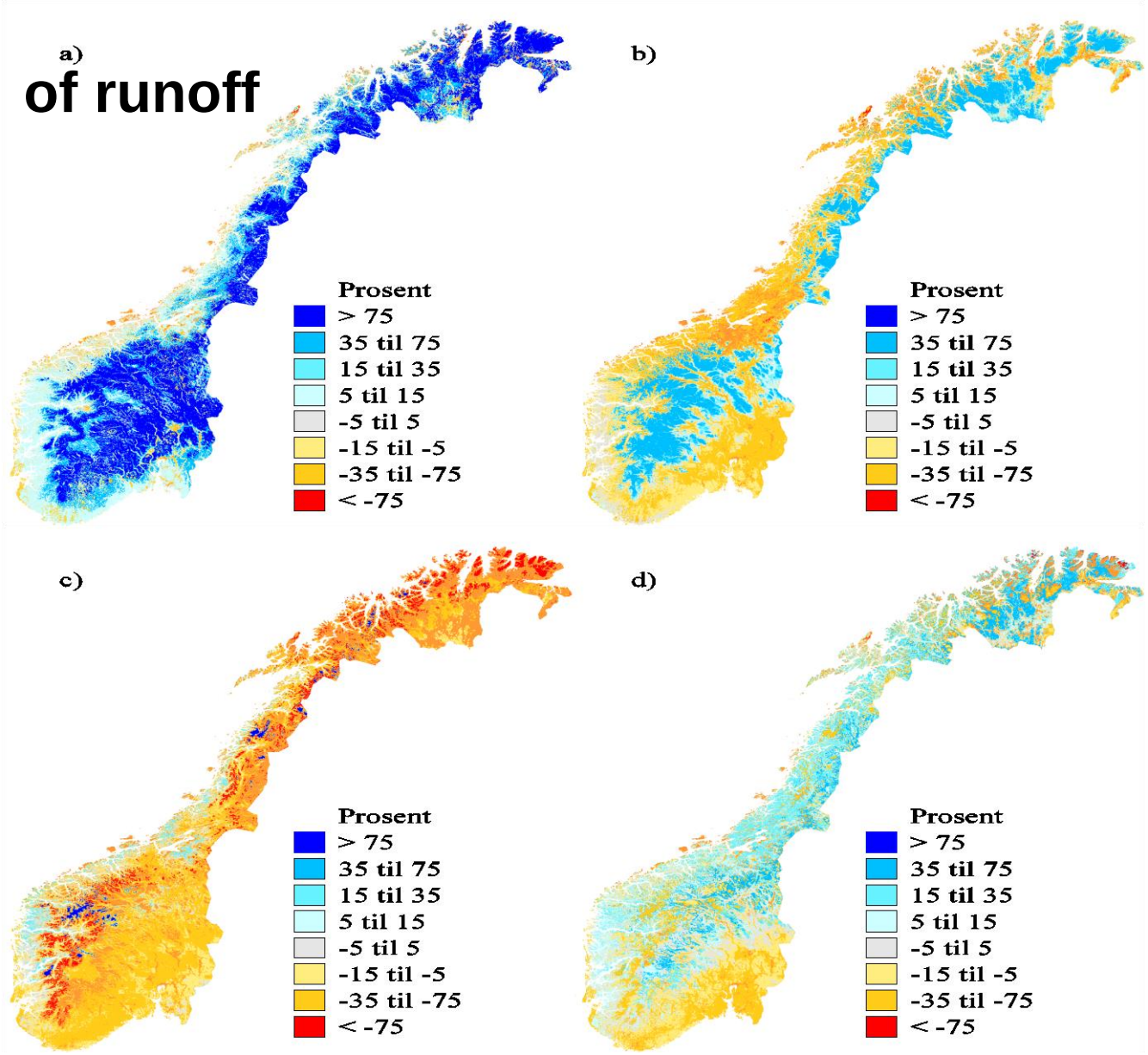
We expect changed seasonality of runoff

a) Vinter: +

b) Vår: fjellet +, lavlandet –

c) Sommer –

d) Høst: ~ 0



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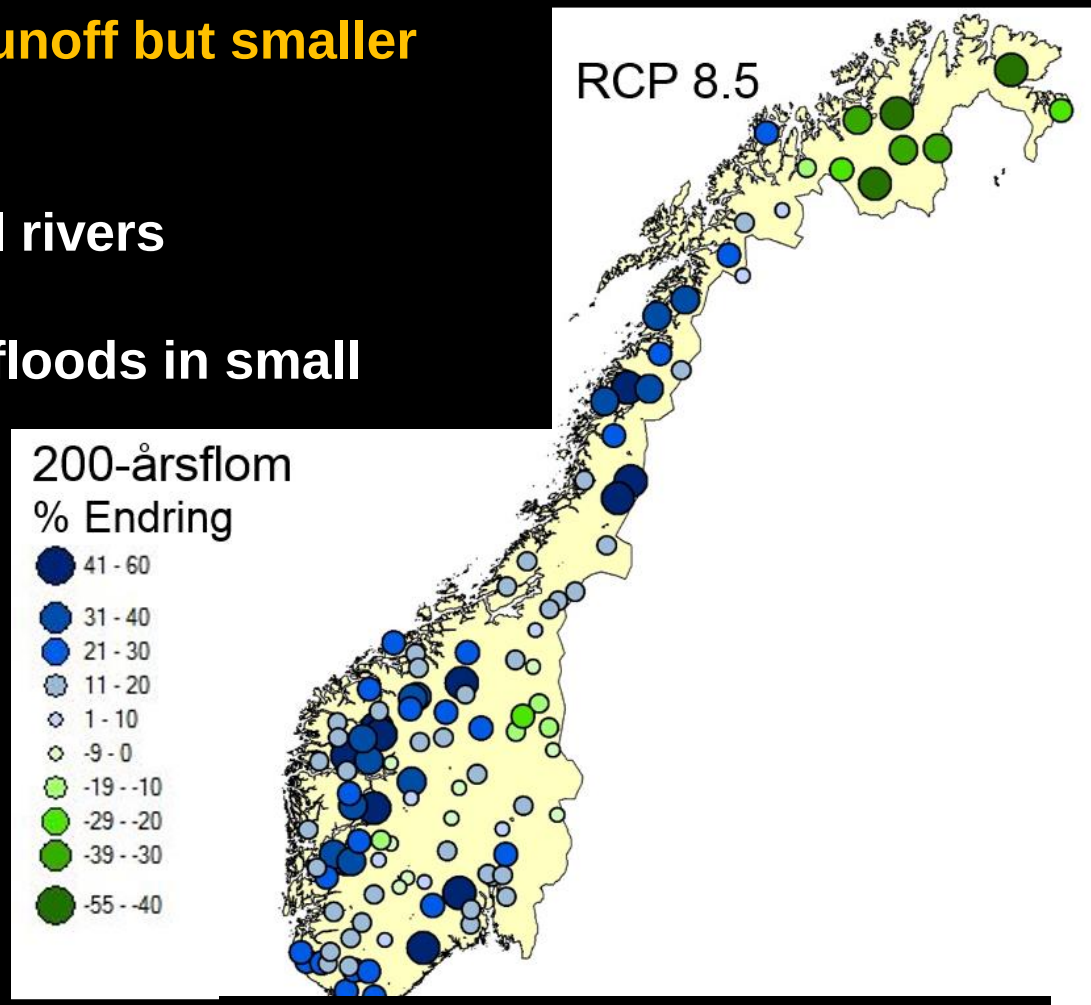


Reduction

- In large catchments dominated by rainfall floods

Increase

- In catchments where rainfall floods dominate in the future
- All small catchments reacting quckly to rainfall

Natural hazards change with climate change. Thus, houses that were built on safe areas may not be considered safe in the future.

That's why climate adaptation is important - so that you can be safe

Kvam i Gudbrandsdalen 2011
Håkon Mosvold Larsen, NTB scanpix

ØKT SANNSYNLIGHET

Kraftig nedbør	**Kraftig nedbør**
Regnflom	**Regnflom**
Jord-, flom- og sørpeskred	**Jordskred, flomskred**
Stormflo	**Stormflo**

MULIG ØKT SANNSYNLIGHET

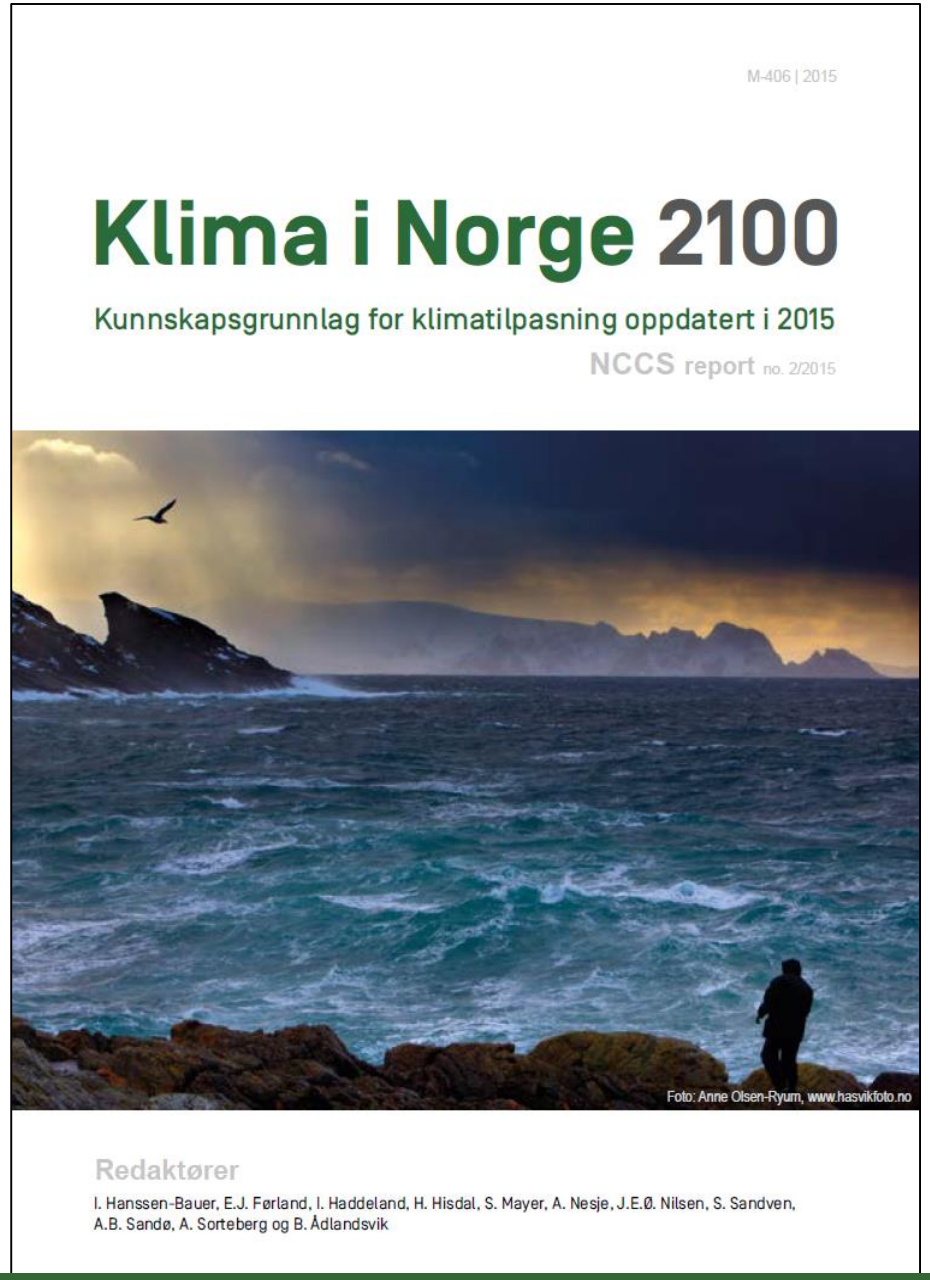
Tørke	**Tørke**
Isgang	**Isgang**
Snøskred	**Snøskred**
Kvikkleireskred	**Kvikkleireskred**

UENDRET ELLER MINDRE SANNSYNLIG

Snøsmelteflom	**Snøsmelteflom**

USIKKERT

Sterk vind	**Sterk vind**
Steinsprang og steinskred	**Steinsprang**
Fjellskred	**Fjellskred**



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