

# **The challenge of adaptation in the Nordic Region**

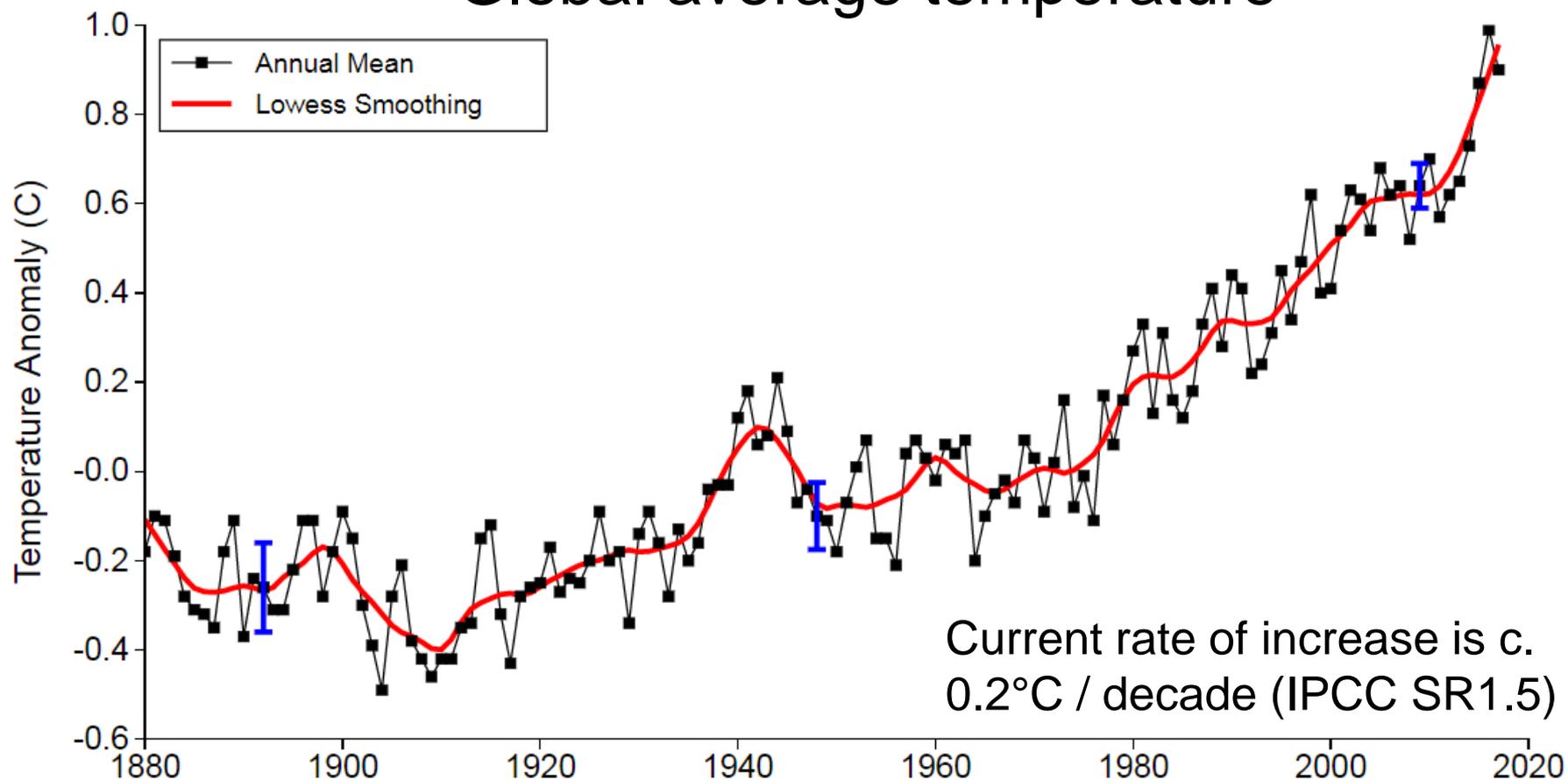
***Nordic Conference on climate change adaptation***

**Erik Kjellström, Rossby Centre, SMHI**

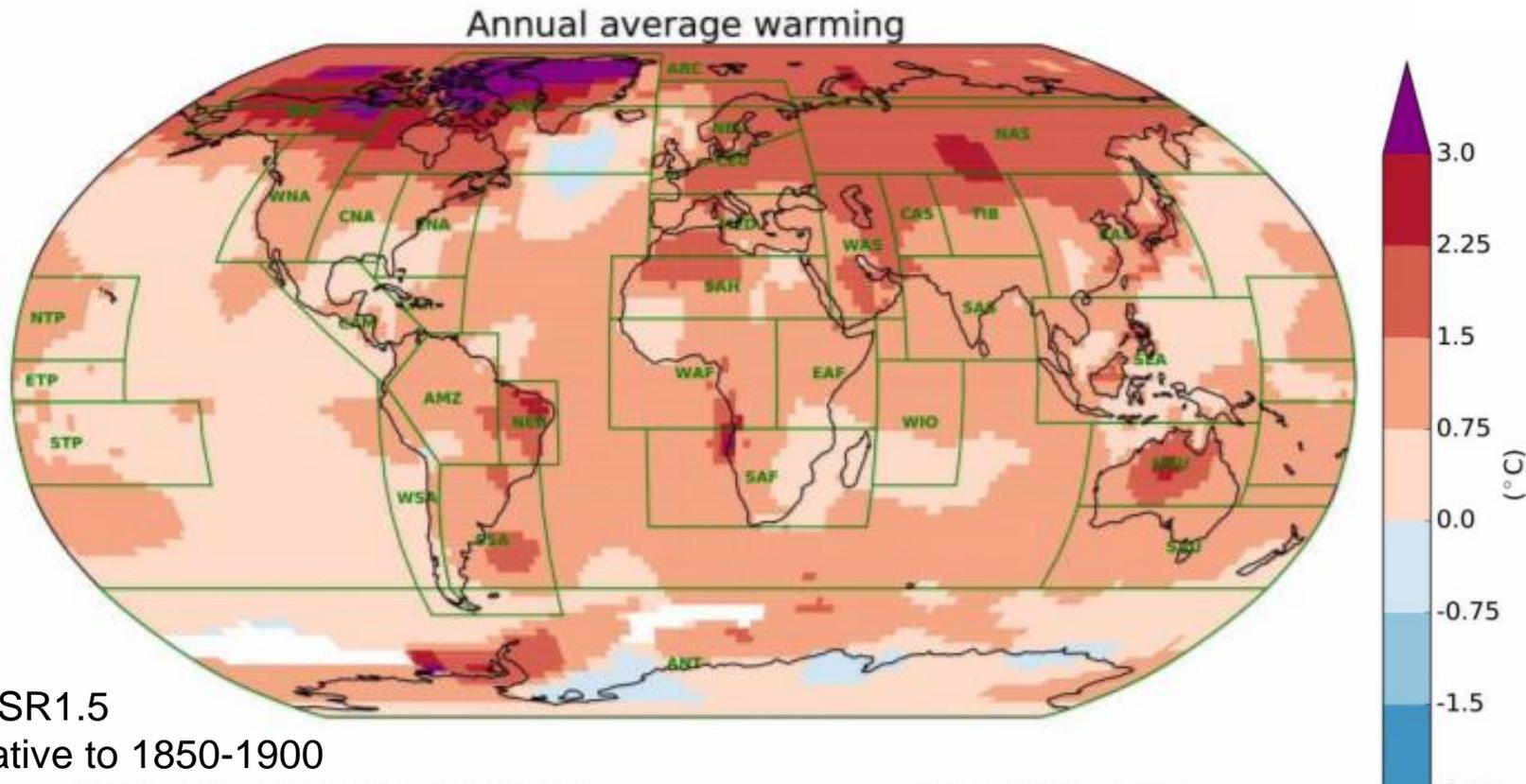
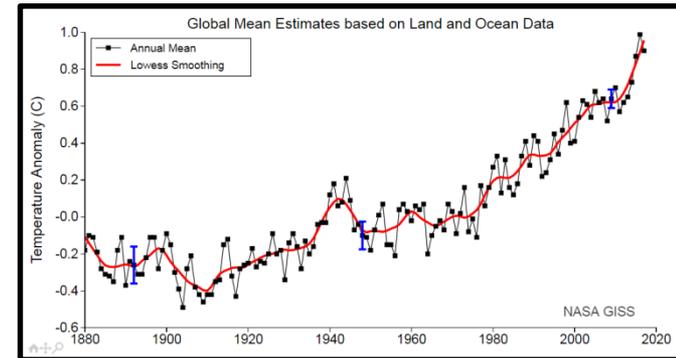
**Norrköping, 23 October 2018**

# Climate is rapidly changing

## Global average temperature



# Changes in the Nordic region are comparatively large



Source: IPCC SR1.5  
2006-2015 relative to 1850-1900

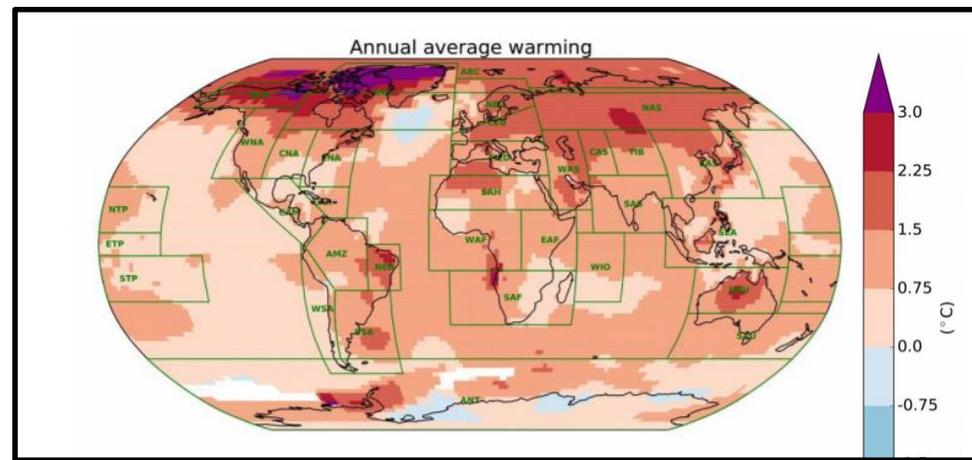
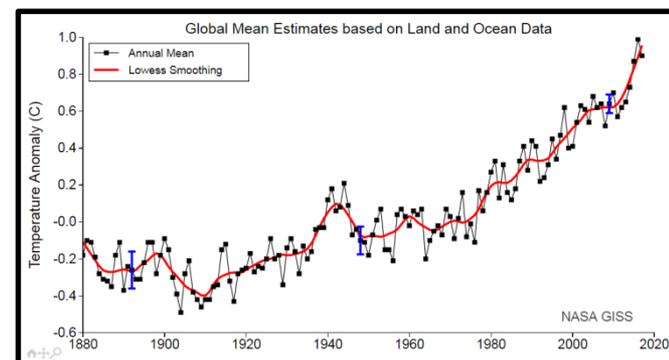
# Changes in the Nordic region are comparatively large

1880-1899 to 1998-2017

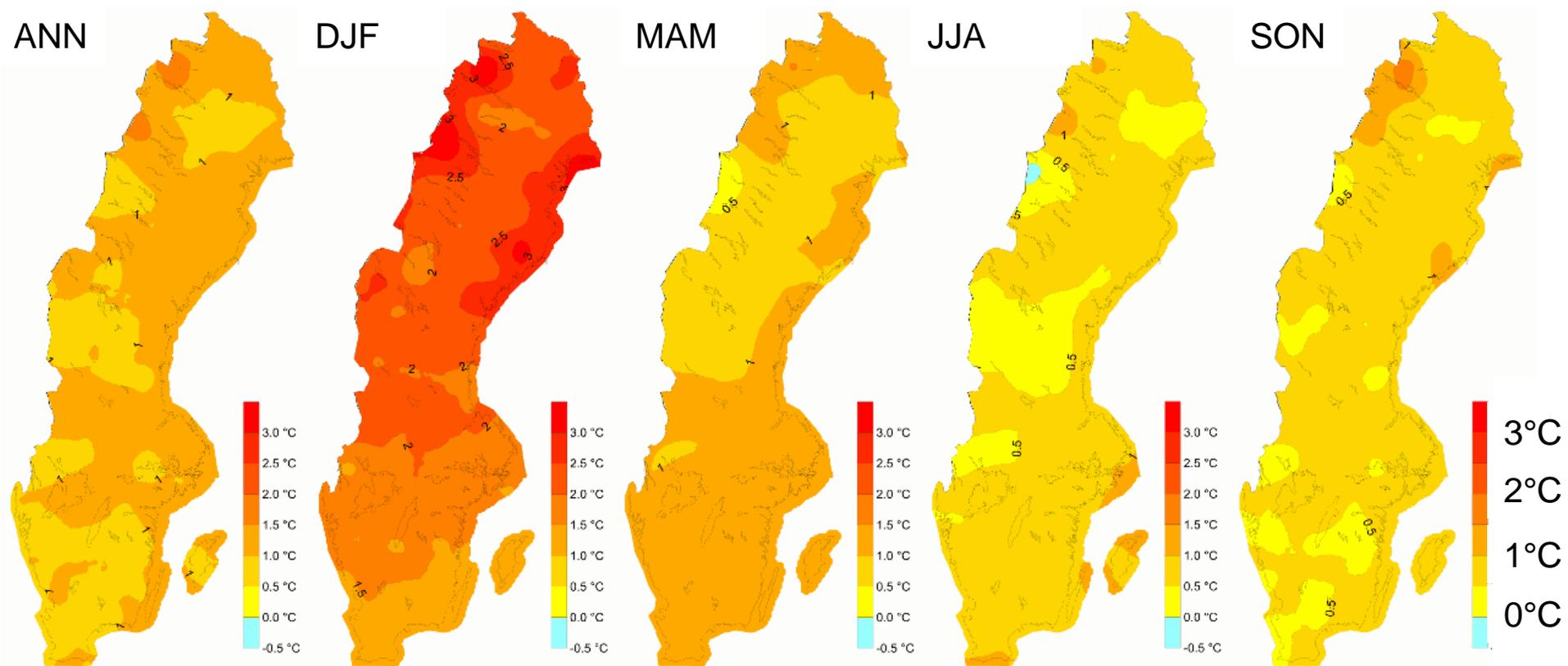
Global mean + 0.87°C

- Iceland + 1.49°C
- Denmark + 1.57°C
- Sweden + 1.64°C
- Norway + 1.68°C
- Finland + 1.74°C

Courtesy: Antti Lipponen, FMI



# Seasonal differences in regional warming



1991-2017 compared to 1961-1990 (data from SMHI)

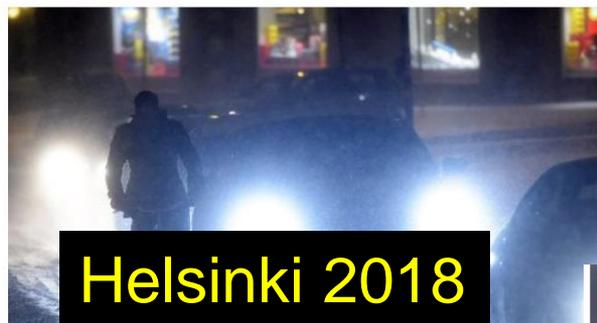
## High-impact events and new records

News 1.2.2018 12:05 | updated 5.2.2018 14:18

### Winter blizzard snarls road traffic, delays planes, trains and buses

Poor road conditions Thursday caused the occasional fender bender while only one runway was operational at the Helsinki-Vantaa airport due to heavy snow.

Recommend 91 people recommend this. Sign Up to see what your friends recommend.



Helsinki 2018



Bergen 2018

OVERVANN: I dag tidlig så det store vannmengdene. FOTO: EIRIK BREKKE

Starten på høsten har vært den våtteste i nyere tid



Reykjavik 2015

December has been a month of snow and storms in Iceland. Reykjavik has already had a record breaking month of snowfall, with the snow measuring 42cm this

SVERIGE 14 juli 2018 21:27

### Skogsbränder rasar över hela Sverige

Skogsbränder härjar på olika håll i hela landet. I Värmland brinner det på 250 000 kvadratmeter – och i Västerbotten skrämmar prognoser om ytterligare åskväder. Storbranden i Finnerödja har dock släckts.



Sweden 2018



Sweden 2006

Copenhagen 2011



## High-impact events: weather/climate change?

- Natural part of our climate
- Global and large-scale changes seen over time
- Difficult to say that a single event is a result of climate change
- Global warming leads to more warm temperature extremes (& less cold), stronger precipitation extremes
- Impacts may change due to a combination of effects (wind storms when the ground is not frozen)

News 13.2.2015 12:25 | updated 5.2.2015 14:10

### Winter blizzard snarls road traffic, delays planes, trains and buses

Poor road conditions Thursday caused the occasional fender bender while only one runway was operational at the Helsinki-Vantaa airport due to heavy snow.

1 people recommend this. Sign Up to see what your friends recommend.



In 12 hours the system dumped more than 15 centimetres of snow on the ground in some areas. Image: Visa bilderna i Lättläsa



Liggsvägen vid den DM efter en rekordoborstur i Capenhagen on 2 July 2011. Photo Finn Mayegård



of snow and storms in Iceland. Reykjavik has already seen a depth of snowfall, with the snow measuring 42cm thick

änder rasar över hela

Skogsbränder härjar på olika håll i hela landet. I Värmland brinner det på 250 000 kvadratmeter - och i Västerbotten skrämmar prognoser om ytterligare åkålväder. Storbranden i Finnersdja har dock släckts.



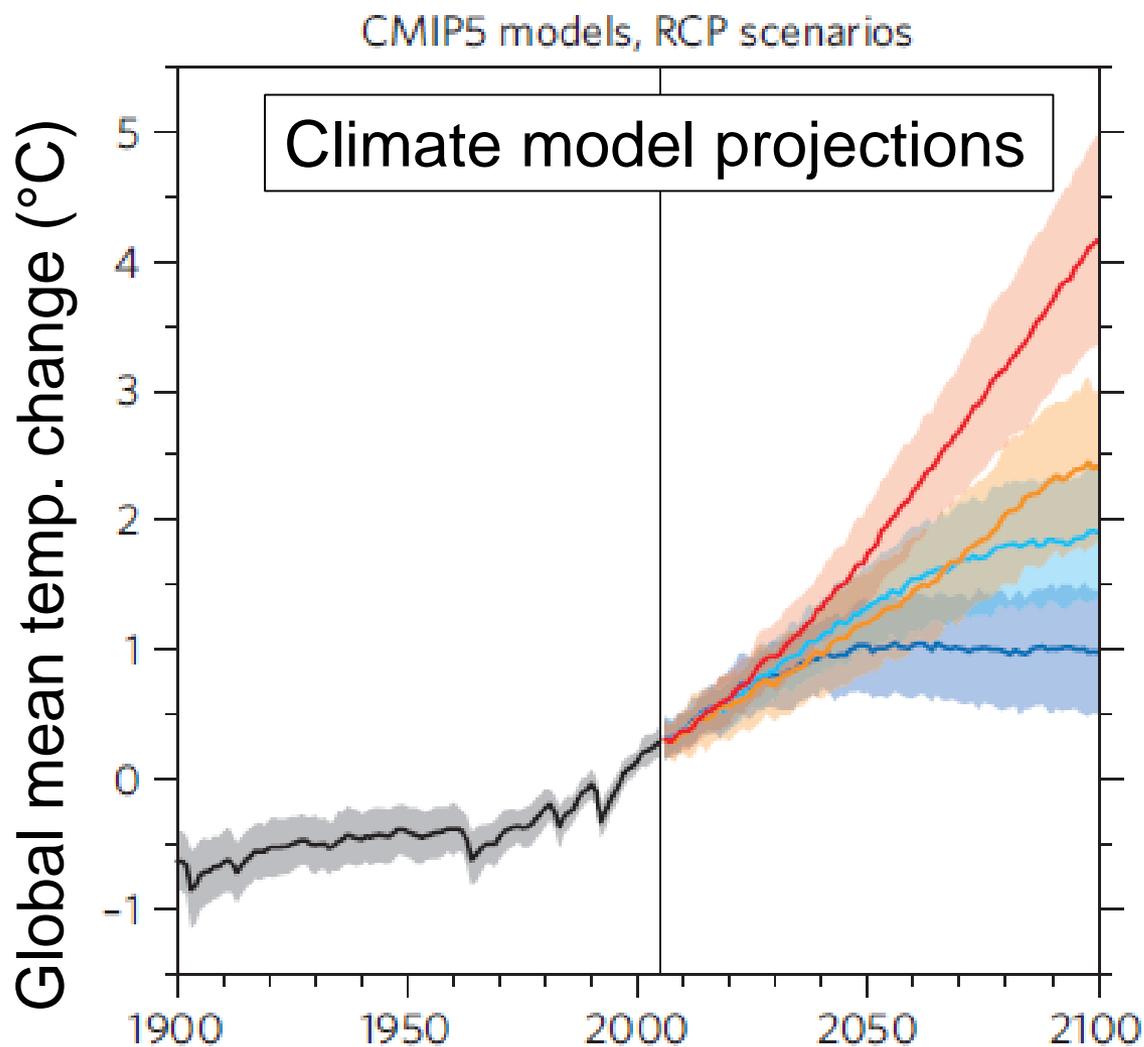
ÖVERVÄN! I såg till sig ett vitt ut i Sæden i Bergen. En typisk helde problem med å korre seg hen i de store vannenglene. FOTO: Eirik Sæviak

Starten på høsten har vært den våteste i nyere tid

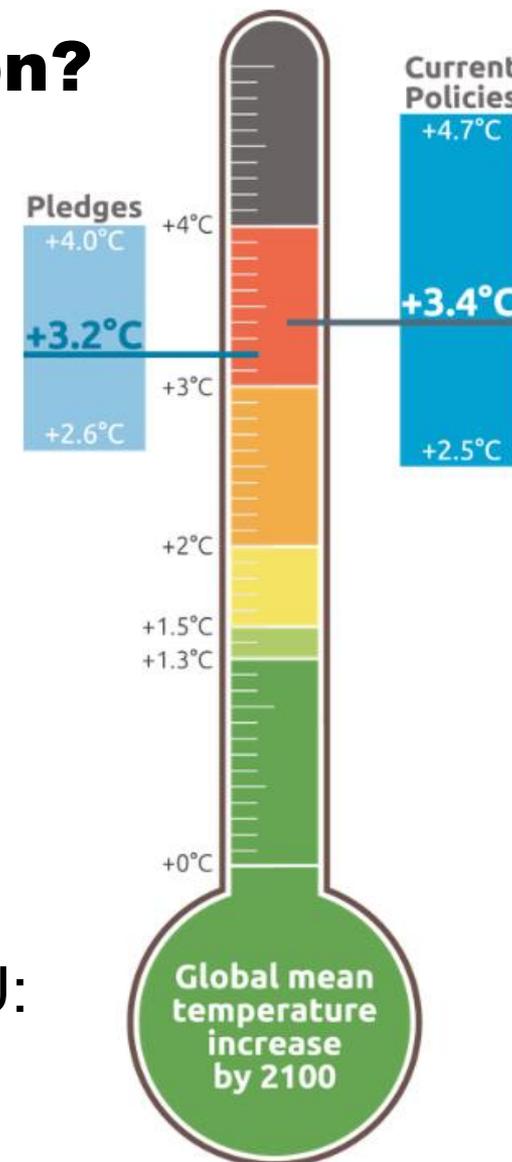


©Kjartan kommune/Anders Nelson

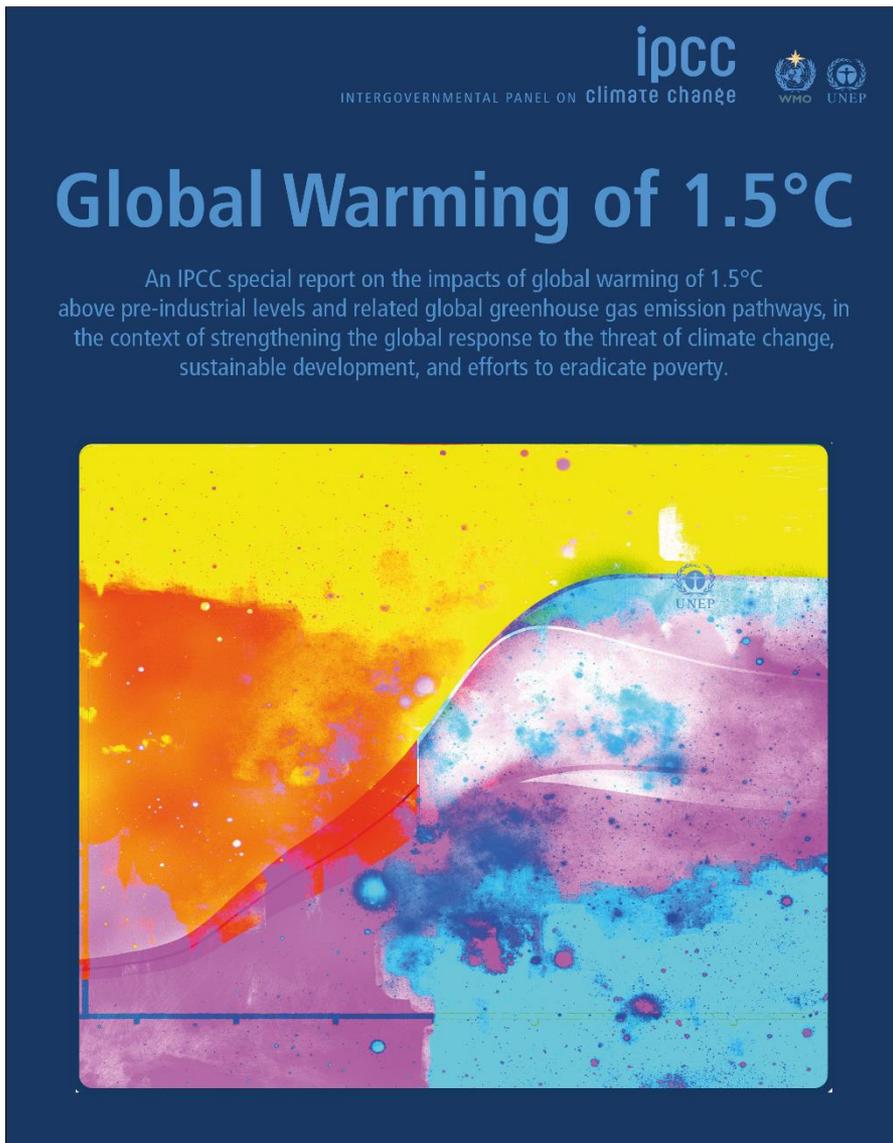
# What will happen in the future?



## What action is there on mitigation?

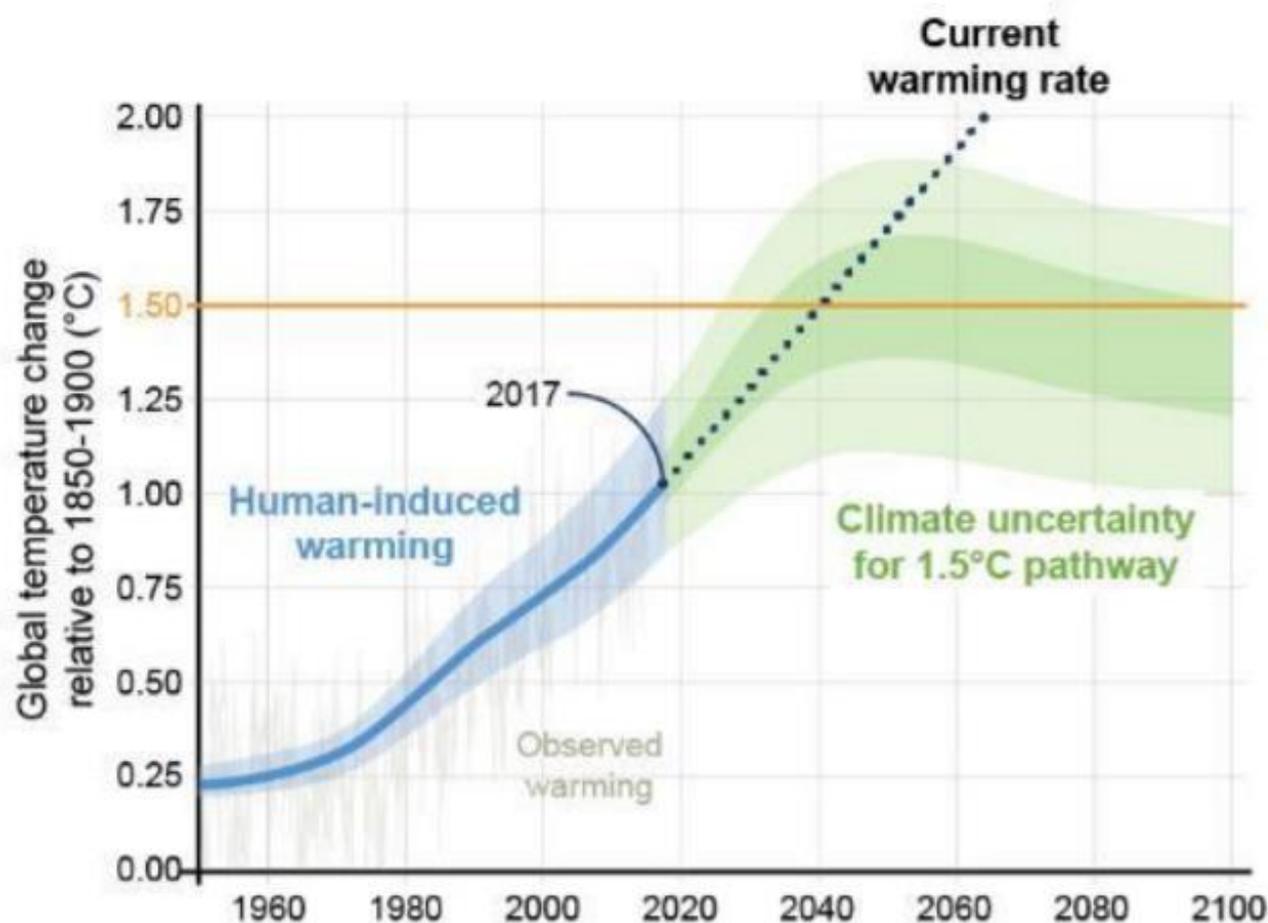


The Nordic countries have pledges as the EU:  
 40% reduction of domestic GHG emissions  
 2030 compared to the 1990 level



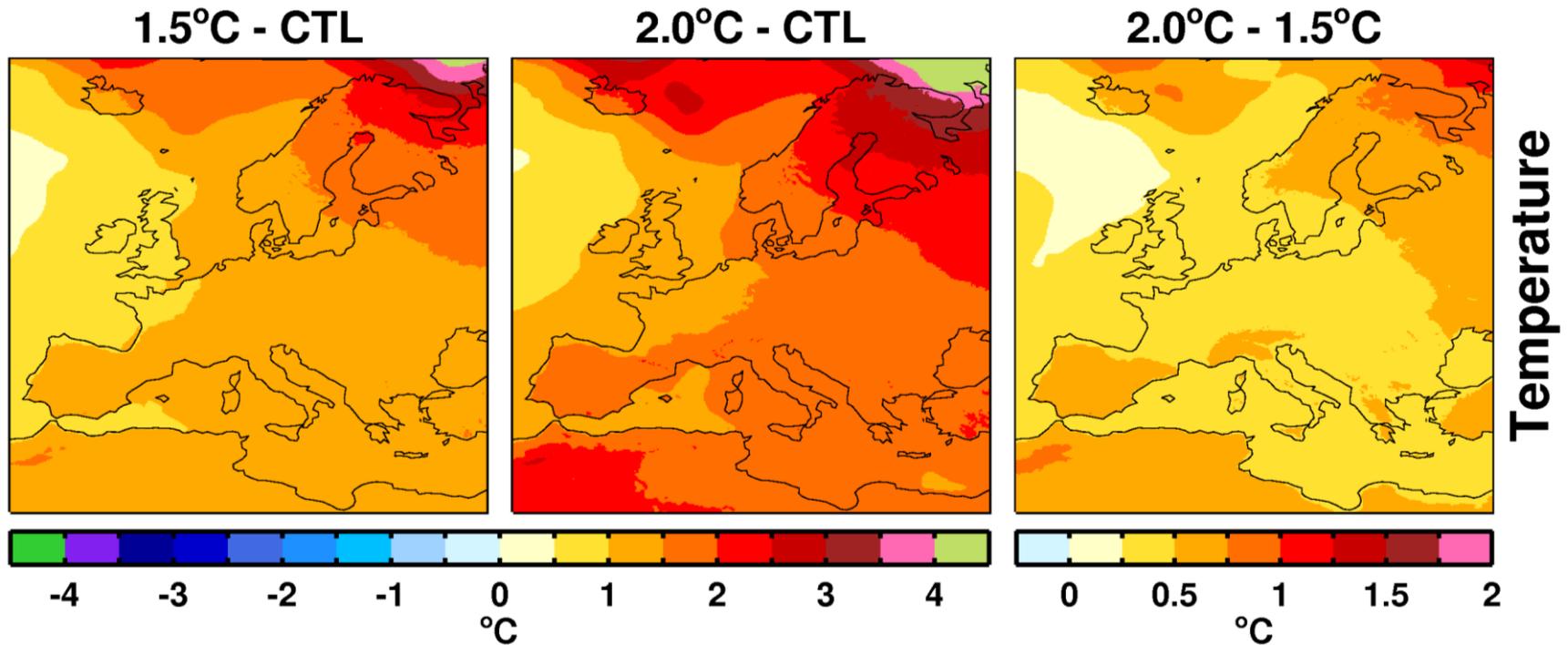
# IPCC Special report on 1.5°C (October 2018)

## Is +1.5°C feasible?



- 1.5°C requires rapid reduction and net zero emissions around 2050
- 2°C requires net zero emissions around 2075
- Carbon dioxide removal (CDR) needed

# Changes at 1.5 & 2°C



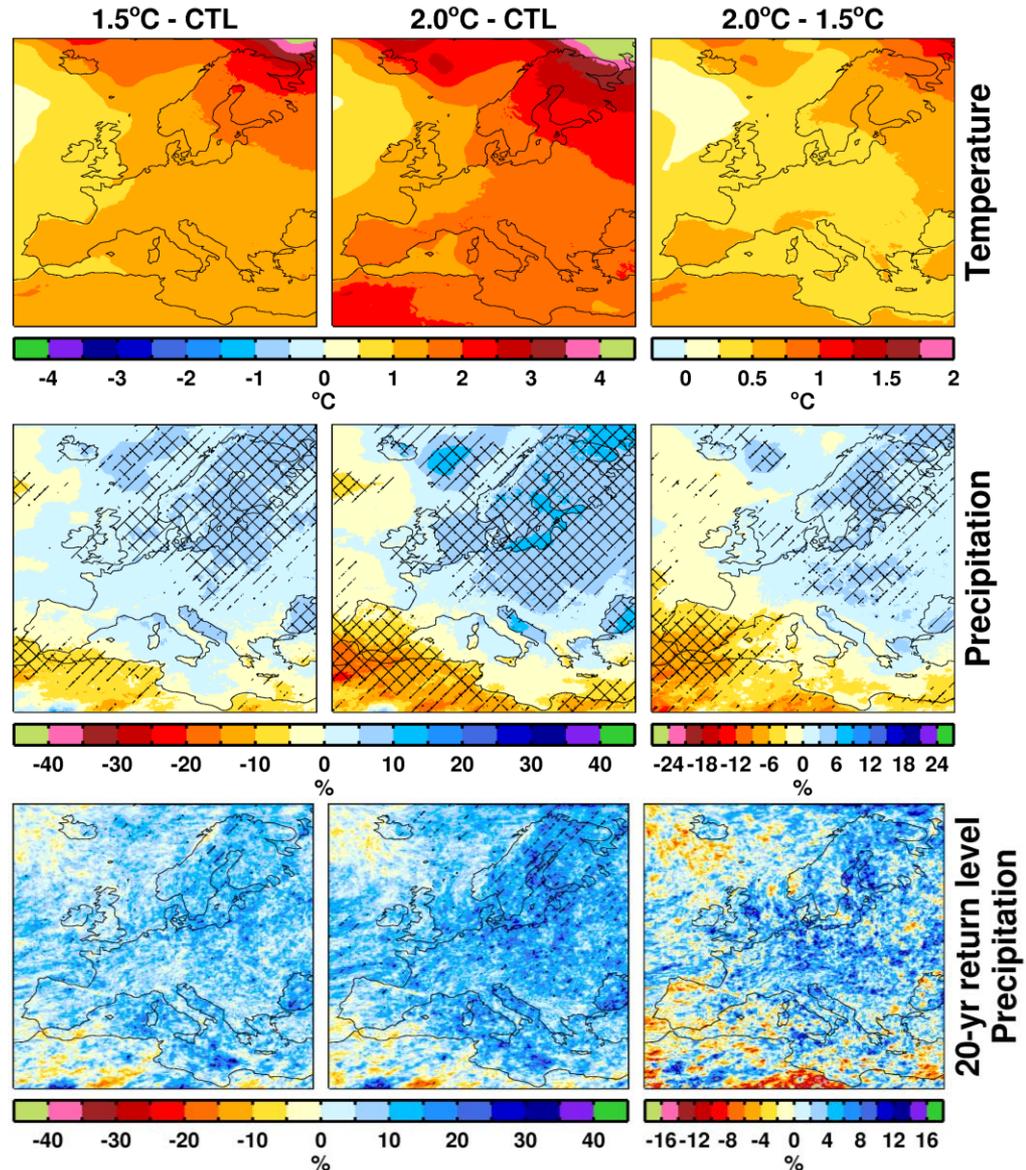
Based on EURO-CORDEX RCM climate change projections (Kjellström et al., 2018)

# Changes at 1.5 & 2°C

✓ Temperature increase highly significant and robust

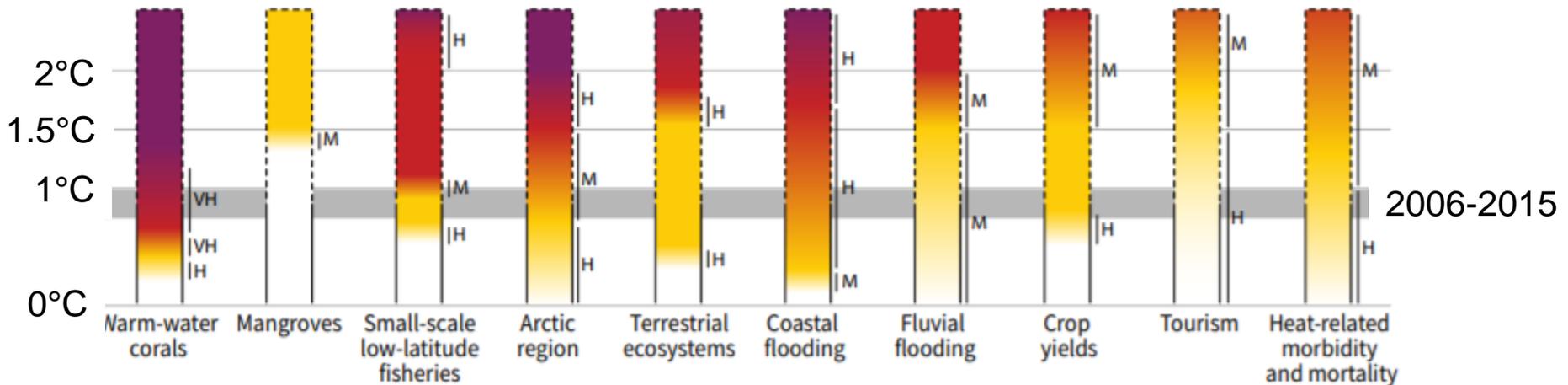
✓ Precipitation increases, some regional and seasonal uncertainties

✓ Heavy precipitation extremes increases



# Impacts and risks

Impacts and risks for selected natural, managed and human systems



- Impacts may be long-lasting or irreversible
- Regions at disproportionately higher risk include Arctic ecosystems, ...

# Sustainable Development Goals (SDGs)



# Adaptation, Mitigation and the SDGs



- Adaptation options may have benefits for sustainable development and poverty reduction with global warming of  $1.5^{\circ}\text{C}$ , although trade-offs are possible
- Mitigation options consistent with  $1.5^{\circ}\text{C}$  pathways are associated with multiple synergies and trade-offs across the SDGs.
- Sustainable development, eradicating poverty and reducing inequality can support limiting warming to  $1.5^{\circ}\text{C}$

## Carbon dioxide removal (CDR)

- Strategies to limit warming to 1.5°C all include enhanced GHG removals
- Large-scale deployment of land-based CDR would have far reaching implications for land and water availability.
- Potential impact on food production, biodiversity and the provision of other ecosystem services

13 CLIMATE ACTION

7 AFFORDABLE AND CLEAN ENERGY



15 LIFE ON LAND

2 ZERO HUNGER



## **In summary**

- Climate is rapidly changing
- The Nordic region shows comparatively large changes
- Impacts are already seen
- Climate will continue to change
- A fundamental change is needed to limit warming to 2°C (and even more to 1.5°C)
- Strong impacts requiring adaptation already at 1.5°C
- Adaptation needs increase with global warming
- Adaptation (and mitigation) increases the chance to fulfil the SDGs (and work with the SDGs may lead to synergies)

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## **Concerns (for a climate researcher)**

- Understanding - some features of the climate system are less well known/understood
- Uncertainties – climate models are simplifications and may under(over)estimate features of climate change
- Unknowns – processes that are not included in an adequate way (CH<sub>4</sub>, other feedback mechanisms?)
- Are there "tipping points"?
- The natural variability is large, making it difficult to say what will happen the next years/decades