Attribution of the role of global warming in recent forest fires in Europe

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Recent European forest fires

Wildfires rage in Arctic Circle as Sweden calls for help

Sweden worst hit as hot, dry summer sparks unusual number of fires, with at least 11 in the far north

▲ Firefighters battle a blaze in a forest in western Sweden, the worst-hit country. Photograph: Mats Andersson/EPA

At least 11 wildfires are raging inside the Arctic Circle as the hot, dry summer turns an abnormally wide area of Europe into a tinderbox.

Huge forest fires in Portugal kill at least 60

Many died in their cars as they fled from huge blaze amid severe heatwave on Iberian peninsula

0:00 / 0:36

▲ Wildfires kill dozens in central Portugal

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Is this climate change?

Event definition: Forest fires Sweden 2018

- - Largest forest fires in Sweden in
    modern times
- - all over Sweden
- - Total ~ 250.00 ha area burned
- - Largest fires were in July
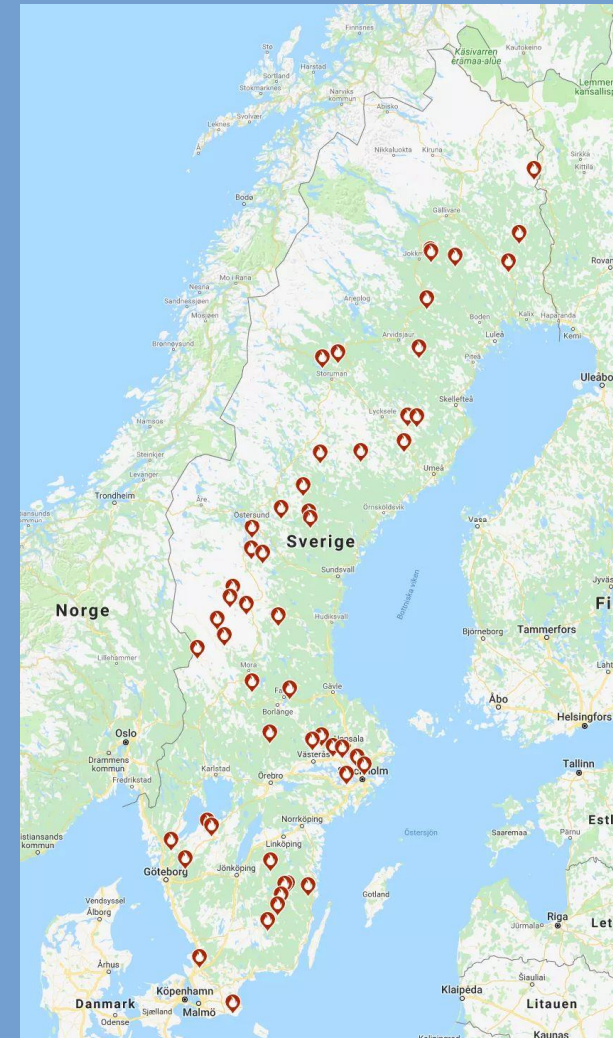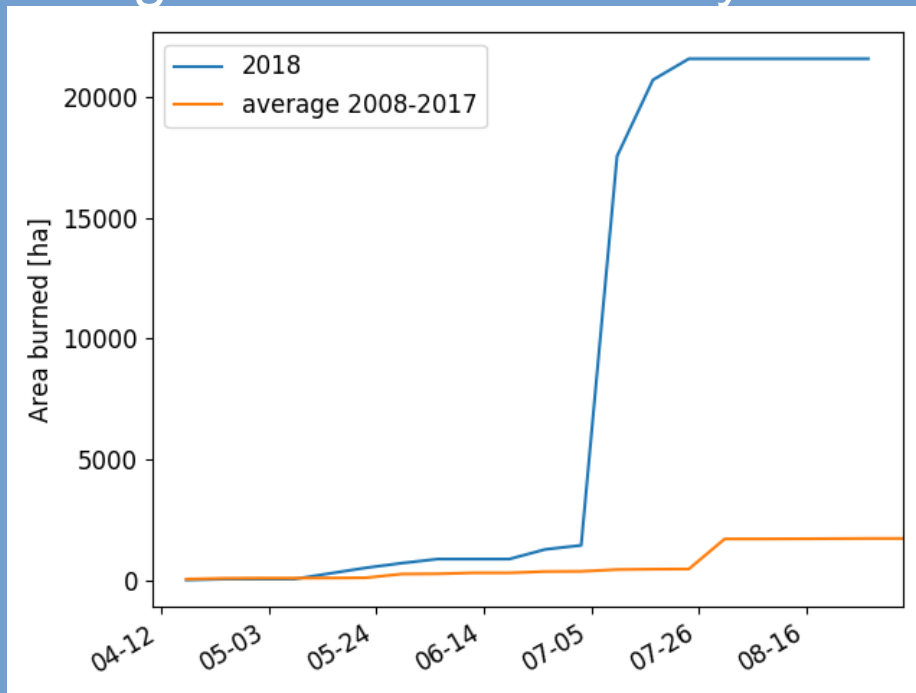
Climate attribution: Was this climate change?

Question: How has the risk of the event changed due to climate change?

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Define the event in such a way that is reflects the impact as best possible

We cannot attribute forest fires itself, only forest fire risk

Use Canadian Fire Weather Index (FWI)

Climate attribution: Was this climate change?

Question: How has the risk of the event changed due to climate change?

Use extreme value statistics (GEV) to compute return times of certain events

Climate attribution: Was this climate change?

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Use climate models and observations to get
an estimate for pre-industrial (PI), current and
future climate

- Reanalysis (observations):
  - ERA-Interim, ERA5, JMA55, MERRA2
- Climate models:
  - EC-Earth v2.3, CESM-LENS, W@H
  - Large ensembles of past, present and future climate

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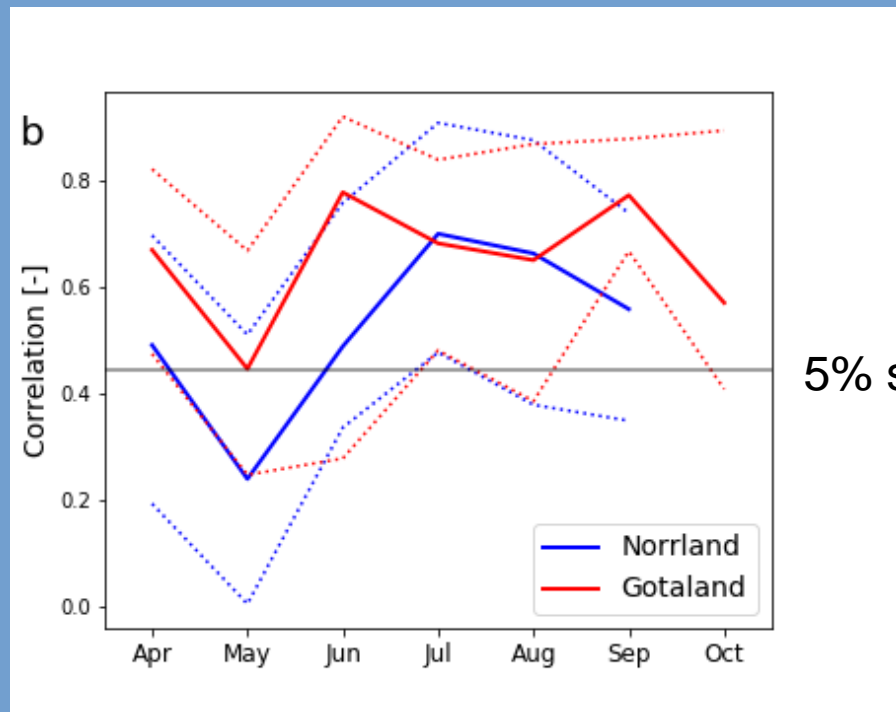
Fire Weather Index (FWI), ERA-Interim, '79-'18
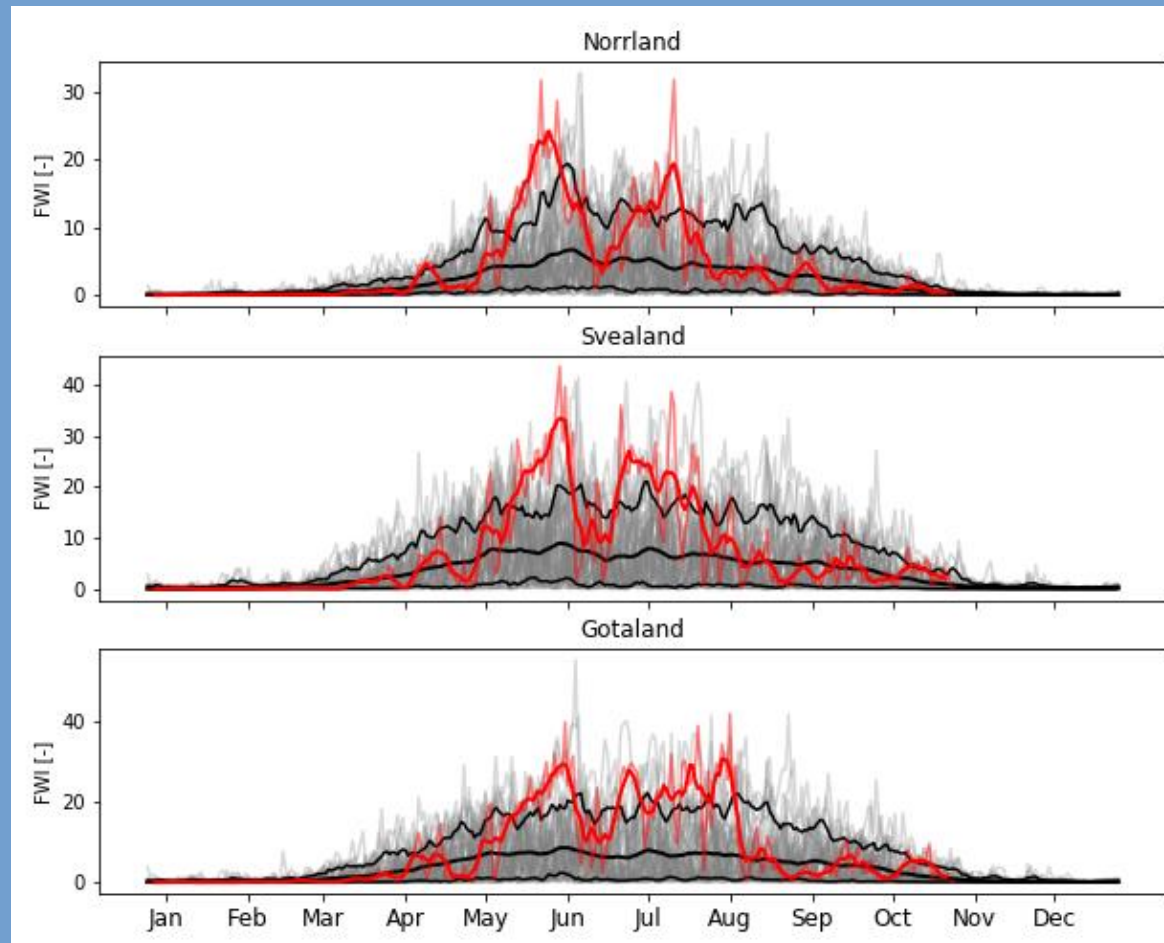
Event definition: Forest fires Sweden 2018

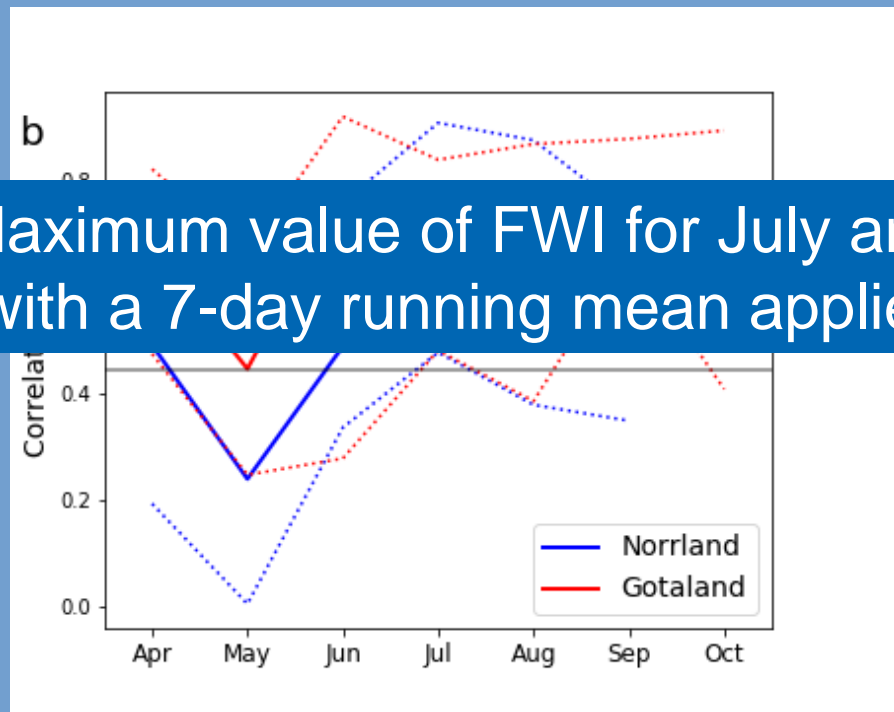## Is FWI good proxy for actual forest fires?

Correlation between observed area burned and FWI (ERA-Interim), monthly averaged data 1996-2015

Event definition: Forest fires Sweden 2018

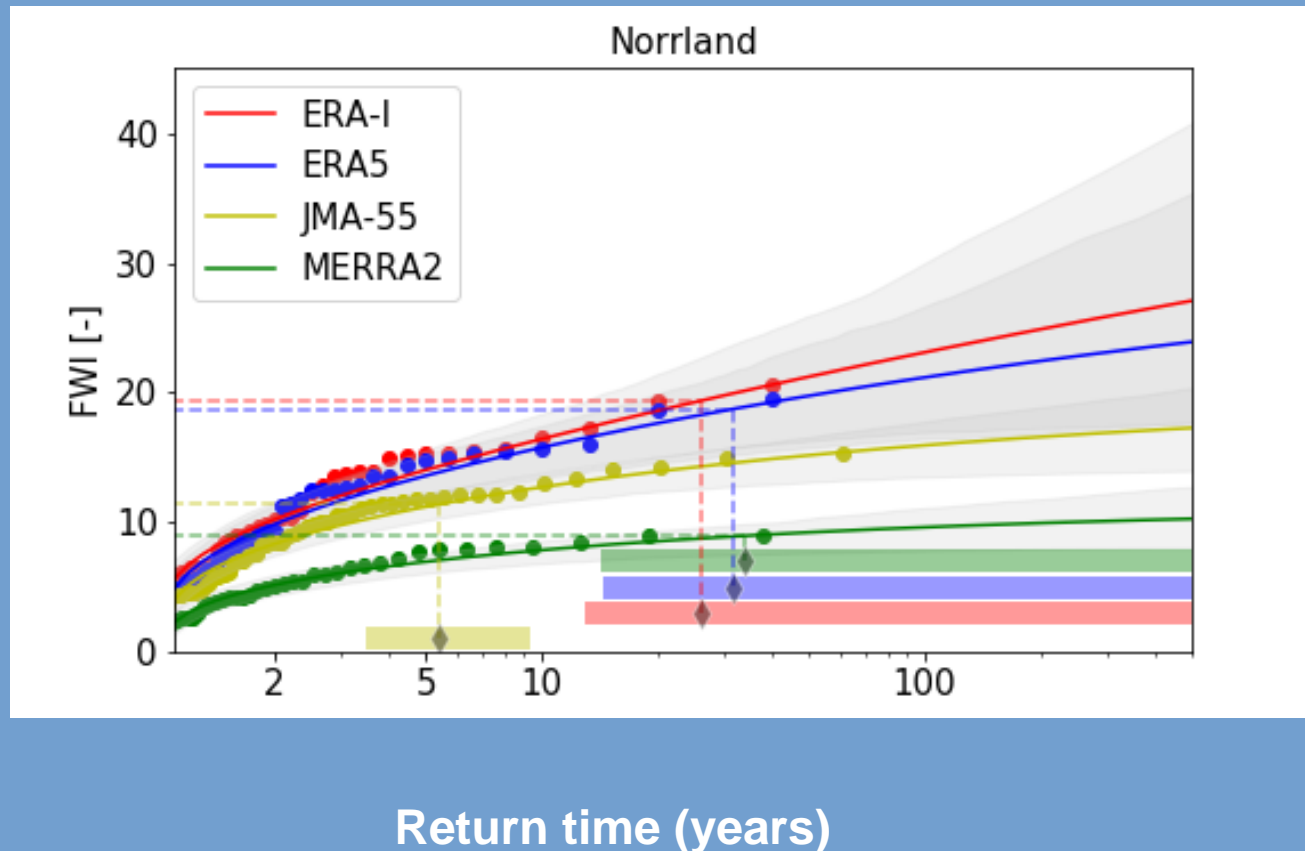## Is FWI a good proxy for actual forest fires?

Correlation between observed area burned and FWI
(ERA-Interim), monthly averaged data 1996-2015

Event: Maximum value of FWI for July and August,
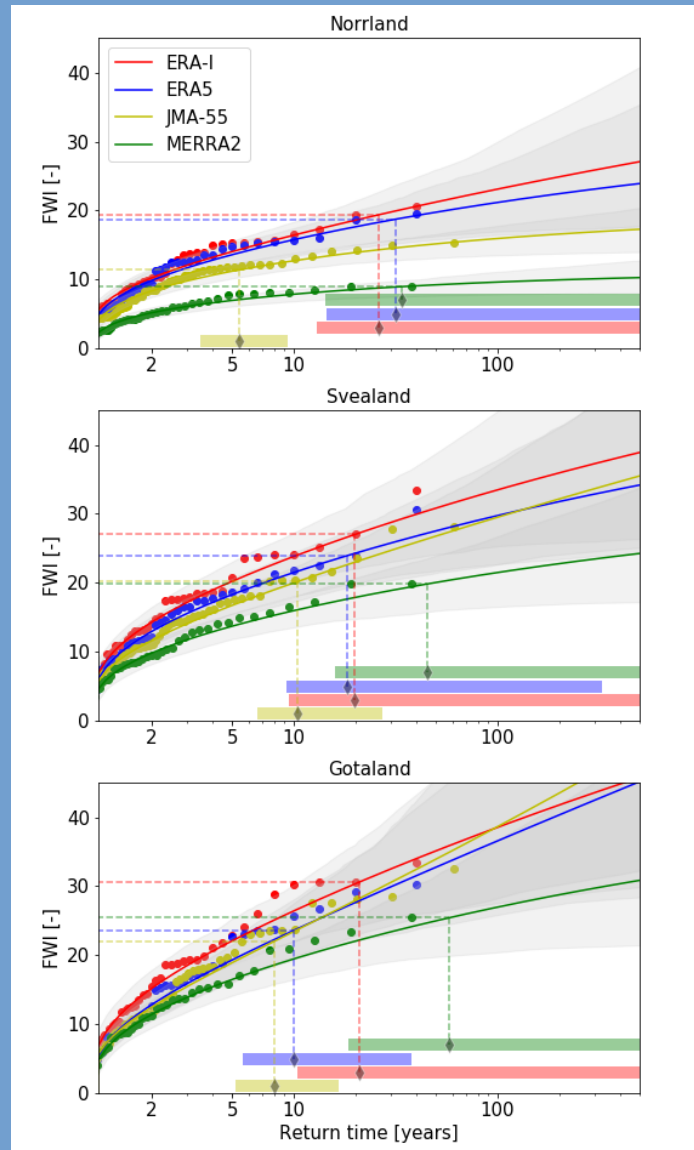with a 7-day running mean applied

How extreme was the 2018 event?

ERA-Interim FWI 1979-2018:
return time ~ 25 yrs
large uncertainty due to limited data size

Return time (years)

How extreme was the 2018 event?

FWI [-]

Return time (years)

Norrland ~25 year return time
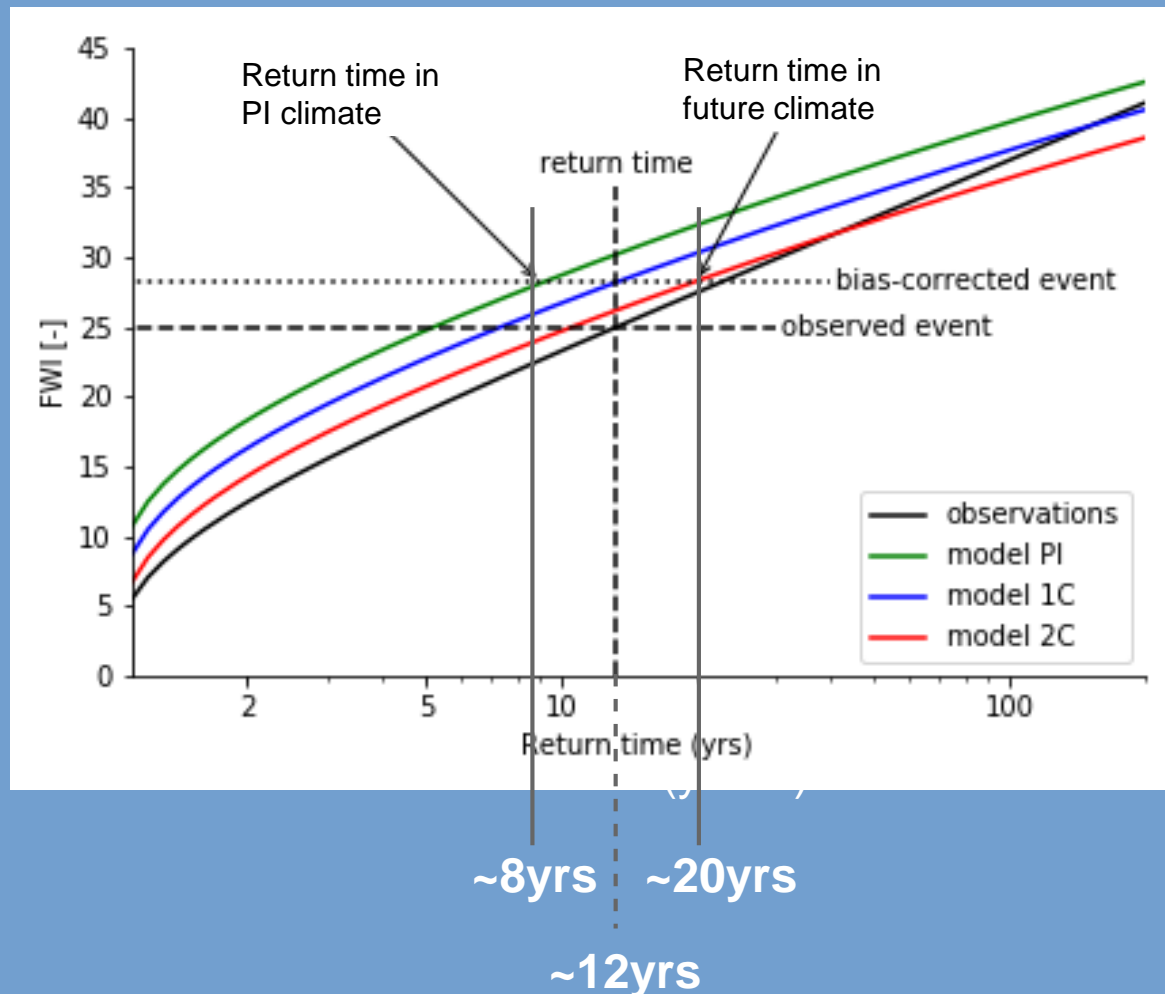
Svealand ~25 year return time

Gotaland ~25 year return time

Large uncertainty due to limited data size of reanalyses!

Has this changed relative to PI-climate?

How are risk ratios calculated?
Has the event become more or less liley due to climate change?

Risk ratio:
Current climate
8 / 12 = 0.67

Future climate
8 / 20 = 0.4

Event has become less likely to happen due to climate change in this case

~8yrs   ~20yrs

~12yrs

Will the 2018 Swedish fire event become more likely?

Risk ratio – relative to early 20th century climate

Conclusions

- The 2018 fire events in Sweden were quite extreme with return times of ~25 years, though with large uncertainty in the reanalysis products.

- We find a small increased risk for such events in the current climate relative to PI climate models (not significant).

- We find a significantly increased risk of ~2 times in the +2^{0}C climate for all three regions in Sweden.

- Large ensembles of climate modeling data are crucial for accurate projections of weather extremes, since trends in extremes often differ from trends in the mean!