European Climate Research Alliance

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www.ecra-climate.eu

Arctic Climate Change –

Probably the most visible consequence of Global Warming

Arctic Climate Stability and Change

ECRA General Assembly 2019 - "Climate Change and Actionable Information"

February 27 17:15 – 17:45, 2019, Square Brussels Meeting Centre

Chair:
Lars H. Smedsrud, Bjerknes Centre, Norway

Bjerknes Centre for Climate Research

Arctic ECRA - since 2012

A number of workshops ….. recommended that the EU fund collaborative research aiming to answers these questions:

1) **Why is Arctic Sea Ice disappearing so rapidly?**

2) **What are the local and global impacts of Arctic Climate Change?**

3) **How can we best advance environmental prediction for the Arctic?**

How much Arctic Sea Ice is lost while we set here (5 hours)?

A. 6 million kg – 1 soccer field of 1m thick ice
B. 50 mill kg – 8 soccer fields
C. 180 million kg – 27 soccer fields
D. 340 million kg – 52 soccer fields

A

B

C

D

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Arctic Sea Ice Summer Loss: estimates

In September 1980 we had about 7.5 mill km² (about 2 m thick)

In september 2015 we had about 4.5 mill km² (about 1.0 m thick)

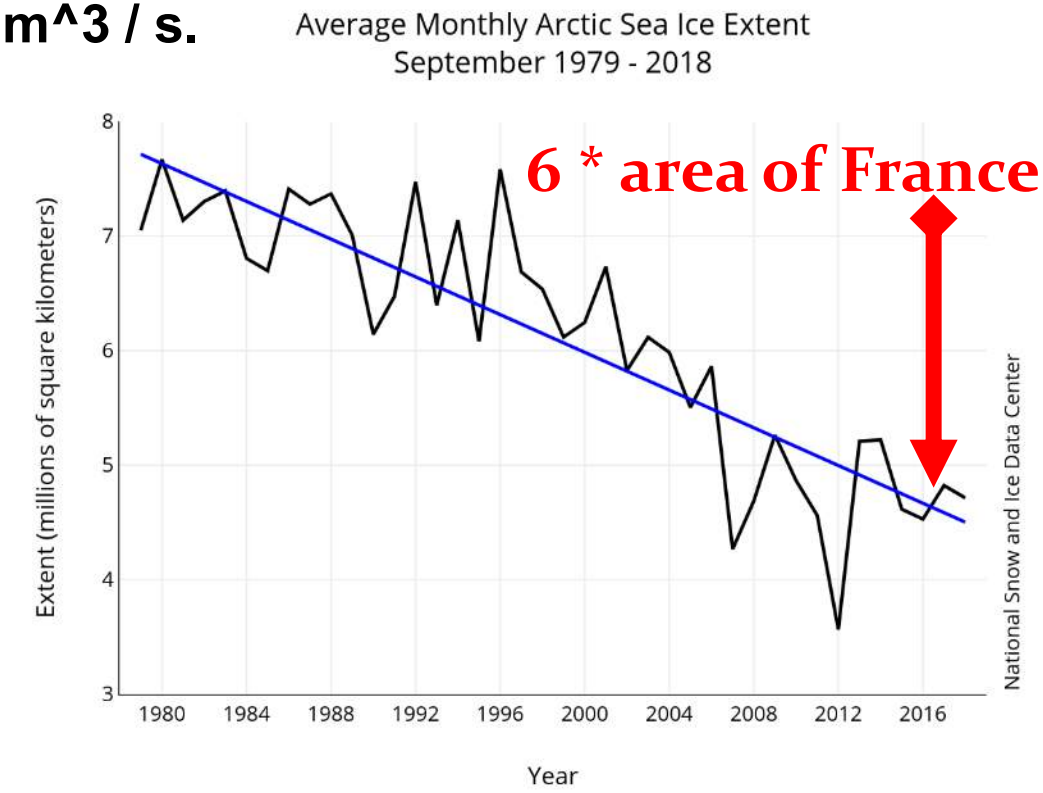
Loss of: (7.5 + 3.5) * 10^12 m^3 / 35 years = 10.000 m^3 / s.

35 years = 10^9 s 5 hours = : 18.000 s

Ice Loss over 5 hours = 180 mill kg,

Or 1 m thick and 200.000 m² = 27 soccer fields.

Alternatively : 1 soccer field lost every 12 min.



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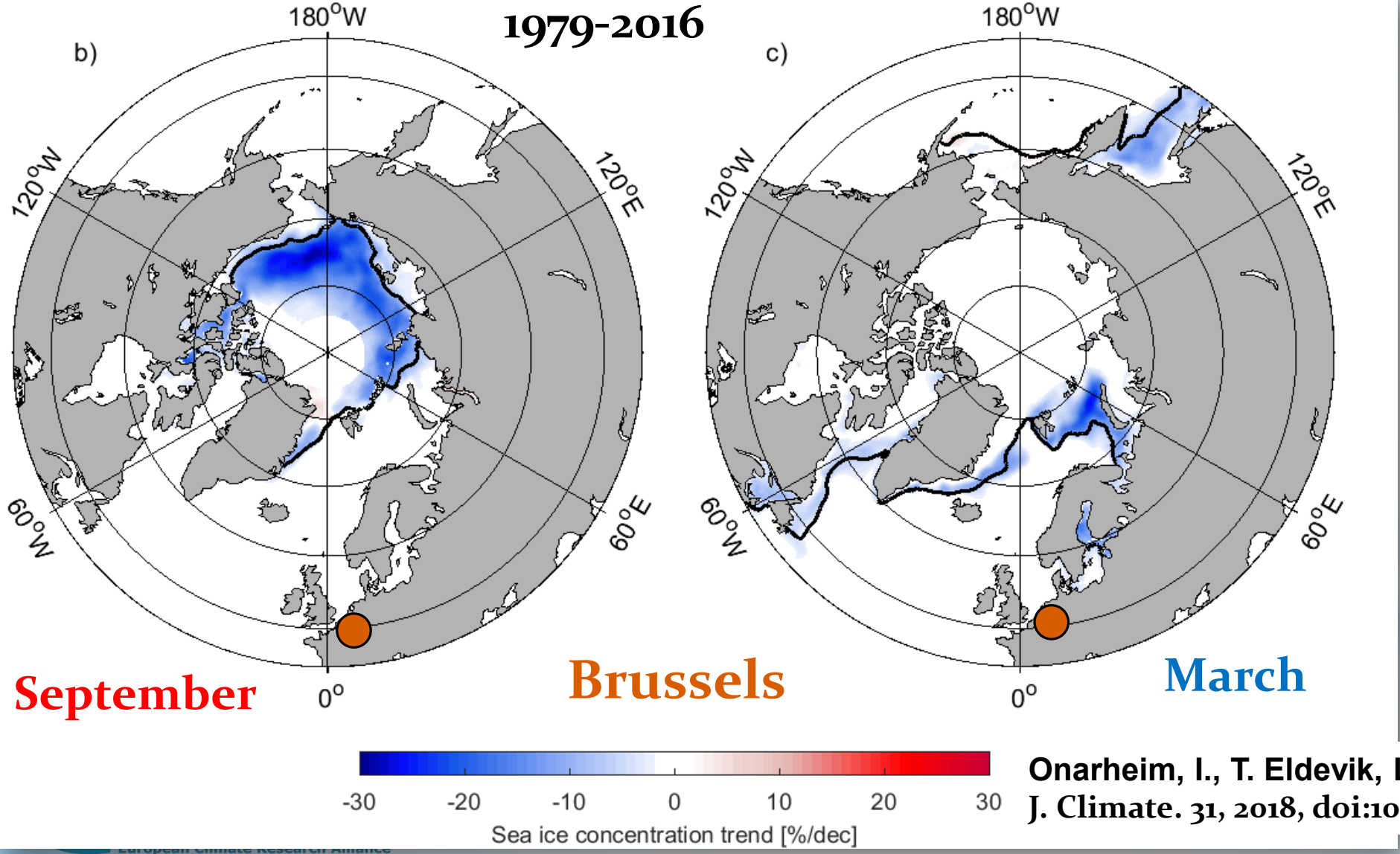
Arctic Sea Ice loss: far away from central Europe…



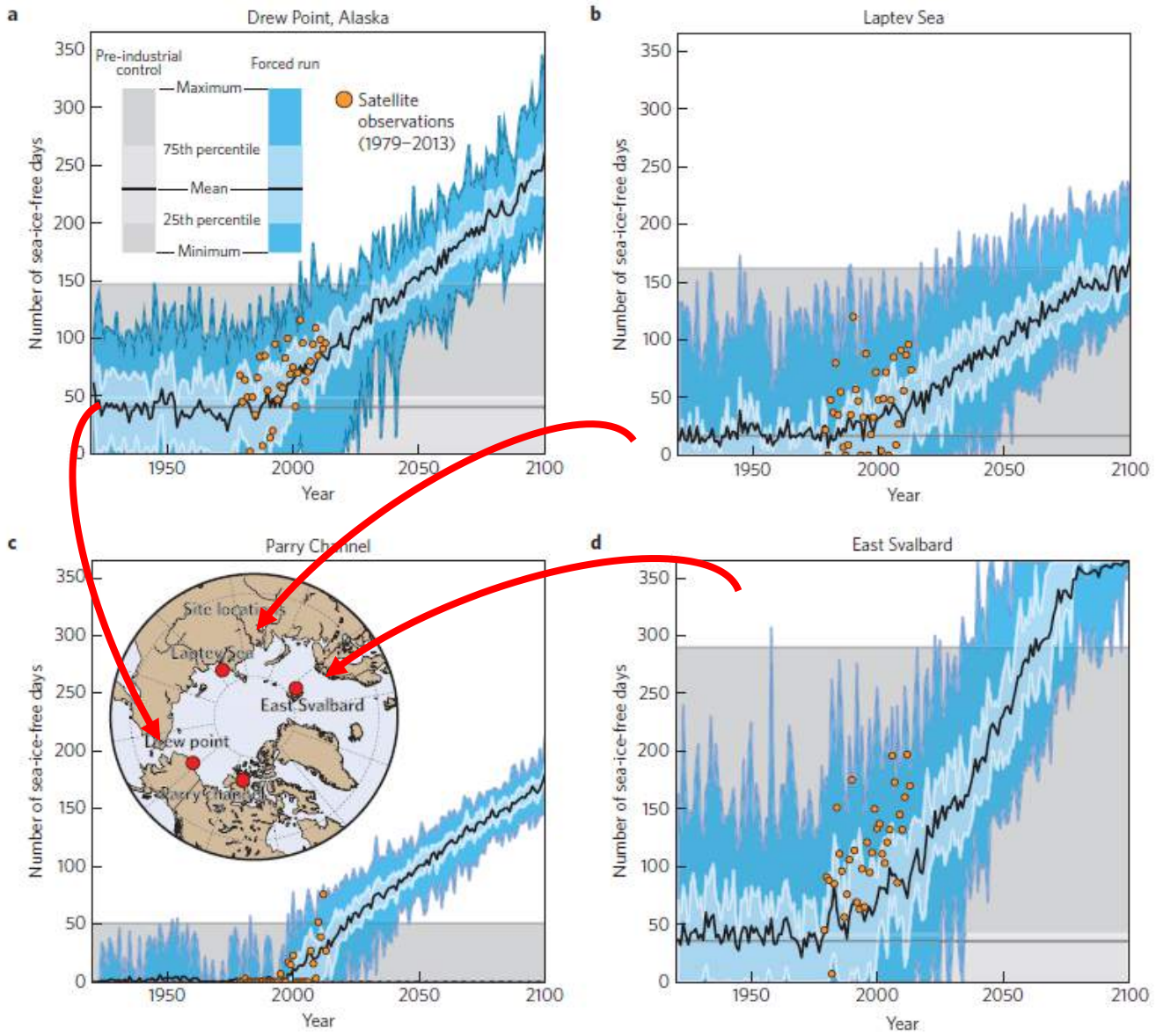
All seas now loose ice…

Summer loss: inside Arctic Basin

Winter loss: Barents Sea + further south

Onarheim, I., T. Eldevik, L. H. Smedsrud, & J. Stroeve
J. Climate. 31, 2018, doi:10.1175/JCLI-D-17- 0427.1

Gradual increase in Arctic open water days

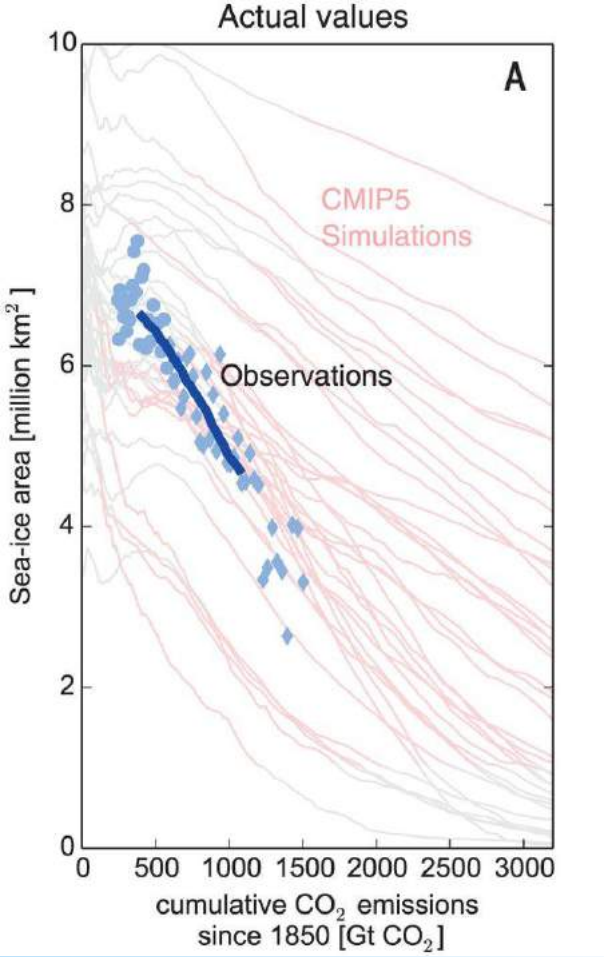


- Models are generally good (enough)
- Some winter ice forms until 2100
- Some nearshore ice loss started in 1990's
- Outside the internal variability range in 2040
- In 2070 ice cover only half the year

Community Earth System Model (CESM)
30-member ensemble,
business-as-usual, 1920 - 2100

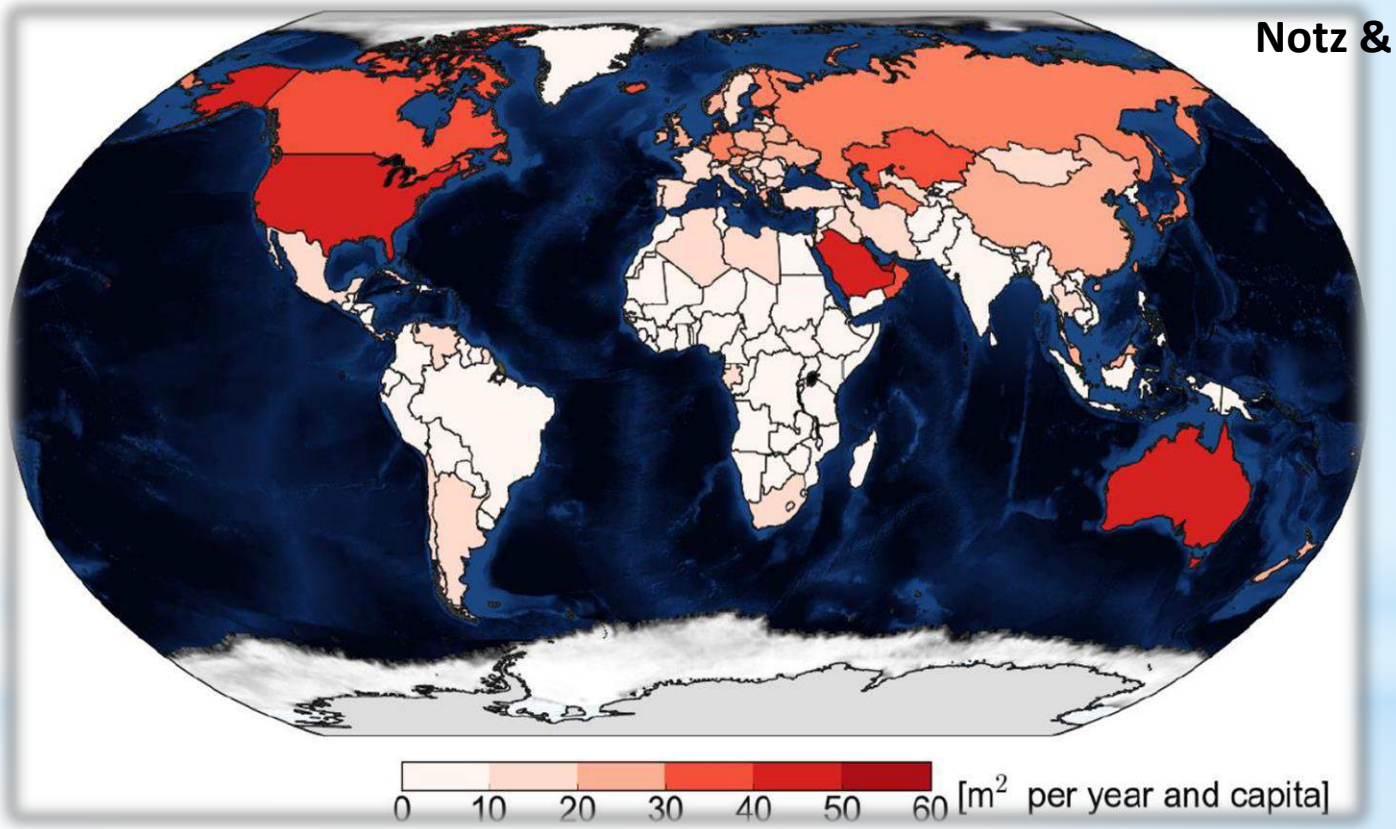
Barnhart et al (2015)

Arctic sea ice decline is linear and caused by me and you…



Annual mean loss of Arctic September sea-ice area caused by average emissions of each citizen

Notz & Stroeve (2016)



3 m² Arctic September sea ice loss = 1 ton anthropogenic CO2 emission

Bergen – Brussels = 0.75 ton CO2 => 2.25 m² is lost because I attend this meeting

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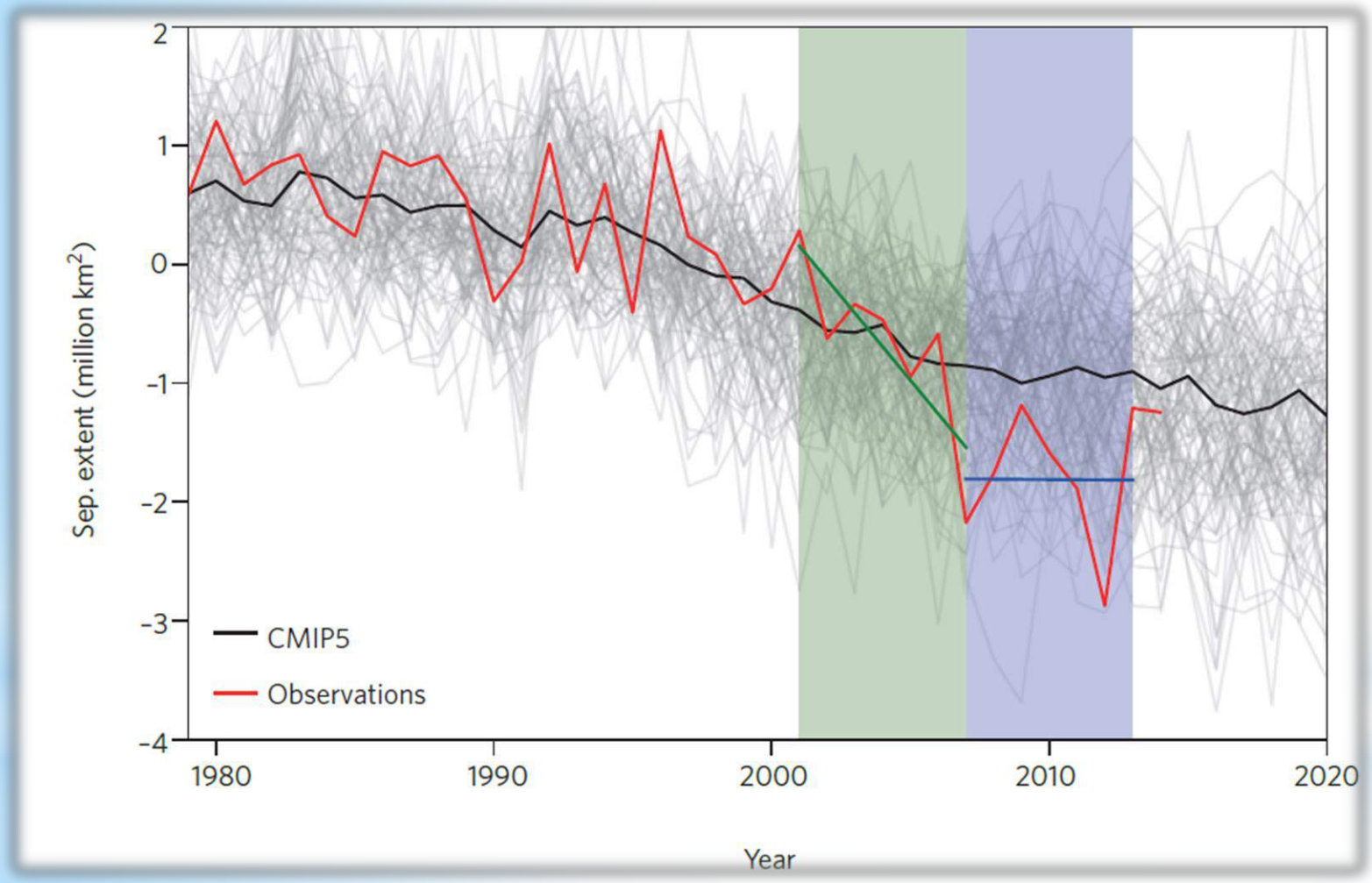
«No loss» since 2007 – is that surprising?



No !

…. but there is no «tipping point» behaviour suggested.

Caused by a number of negative feedbacks. Ask if you like…

Swart et al (2015)

Why is continued Arctic Climate research needed?

- We do not know the circulation response to Arctic sea ice loss
- We are not able to forecast Arctic climate well
- We do not know the ecological consequences
- We are not able to explain natural climate variability

Arctic talks tomorrow: 14:30

Thomas Jung (Alfred Wegener Institute, Germany)

APPLICATE: (2016 – 2020) € 8 mill http://www.applicate.eu/

Advancing Predicton in Polar regions and beyond: modelling, observing system design and LInkages associated with a Changing Arctic climate

Marius Årthun (Bjerknes Centre, Norway)

Blue-Action: (2016 – 2020) € 7.5 mill http://www.blueaction.eu/

The changing Arctic and efforts to predict Northern Hemisphere climate

For other EU funded Arctic Projects see The EU Arctic Cluster: www.eu-polarnet.eu/eu-arctic-cluster/

Arctic sea ice loss is mostly caused by human use of fossil fuel – cased closed

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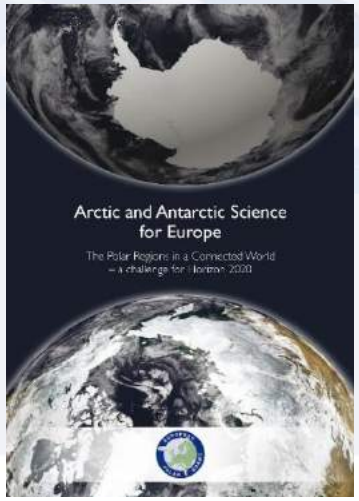
EU-PolarNet

www.eu-polarnet.eu

2015 – 2020

- Sustain an **on-going dialogue** with the European Commission on Polar topics
- Develop an integrated **European polar research programme** co-designed with all relevant stakeholders
- Design a European **infrastructure access and usage plan**
- Improve and strengthen **international cooperation** and implement the **Transatlantic Research Alliance**



EU-PolarNet

www.eu-polarnet.eu

5 White Papers by selected experts:

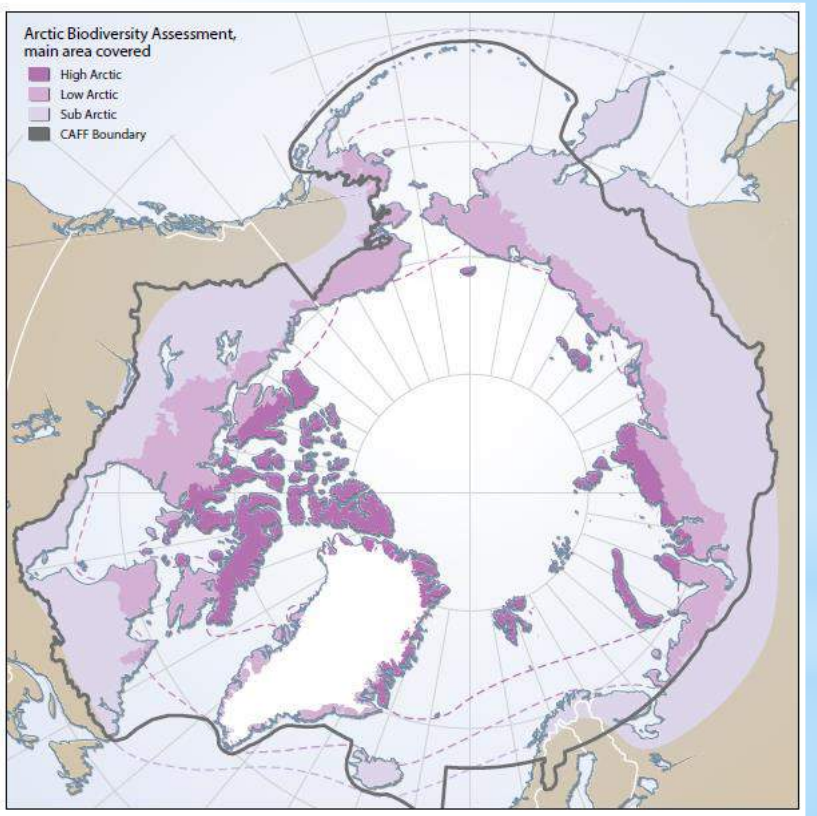
Future EU Polar research should

- **Improve the understanding of polar ecosystems, and how they will change under predicted environmental pressures**
- **Identify the most relevant ecological indicators to evaluate risks to the polar ecosystems**
- **Provide relevant and timely scientific advice to decisionmakers to allow sustainable management of the polar areas**

Key Finding 2:

Climate change is by far the most serious threat to Arctic biodiversity and exacerbates all other threats.

Warming and loss of ice and snow is the main problem, these animals are adapted to a cold climate



ARCTIC COUNCIL

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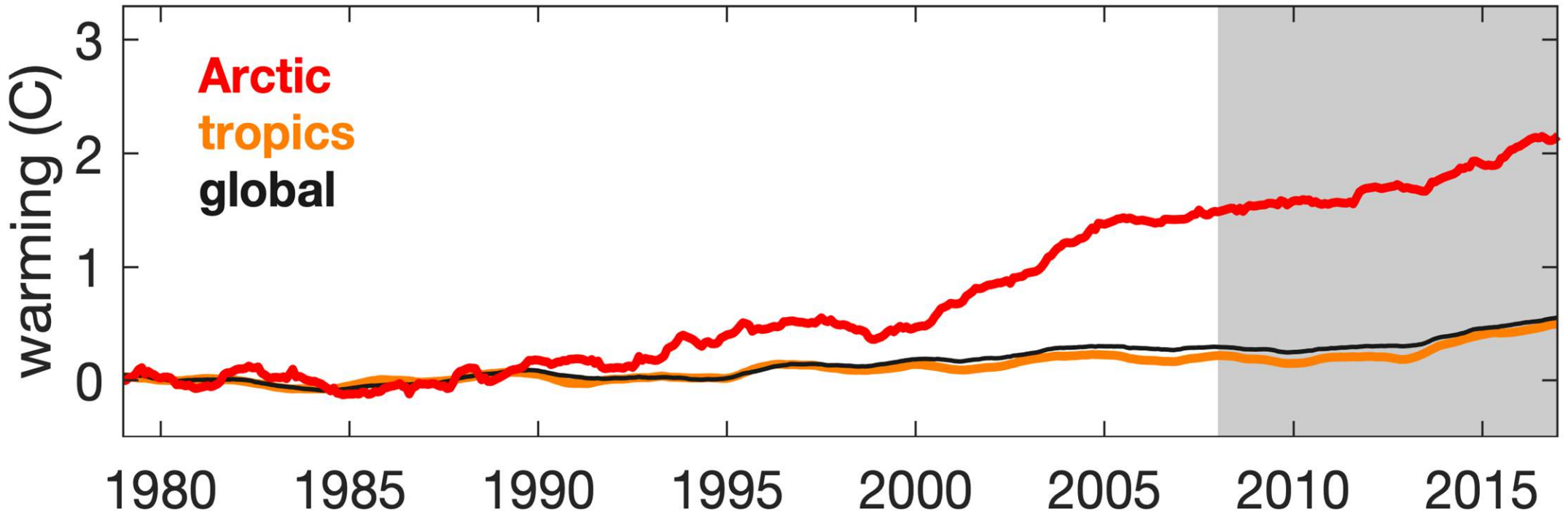
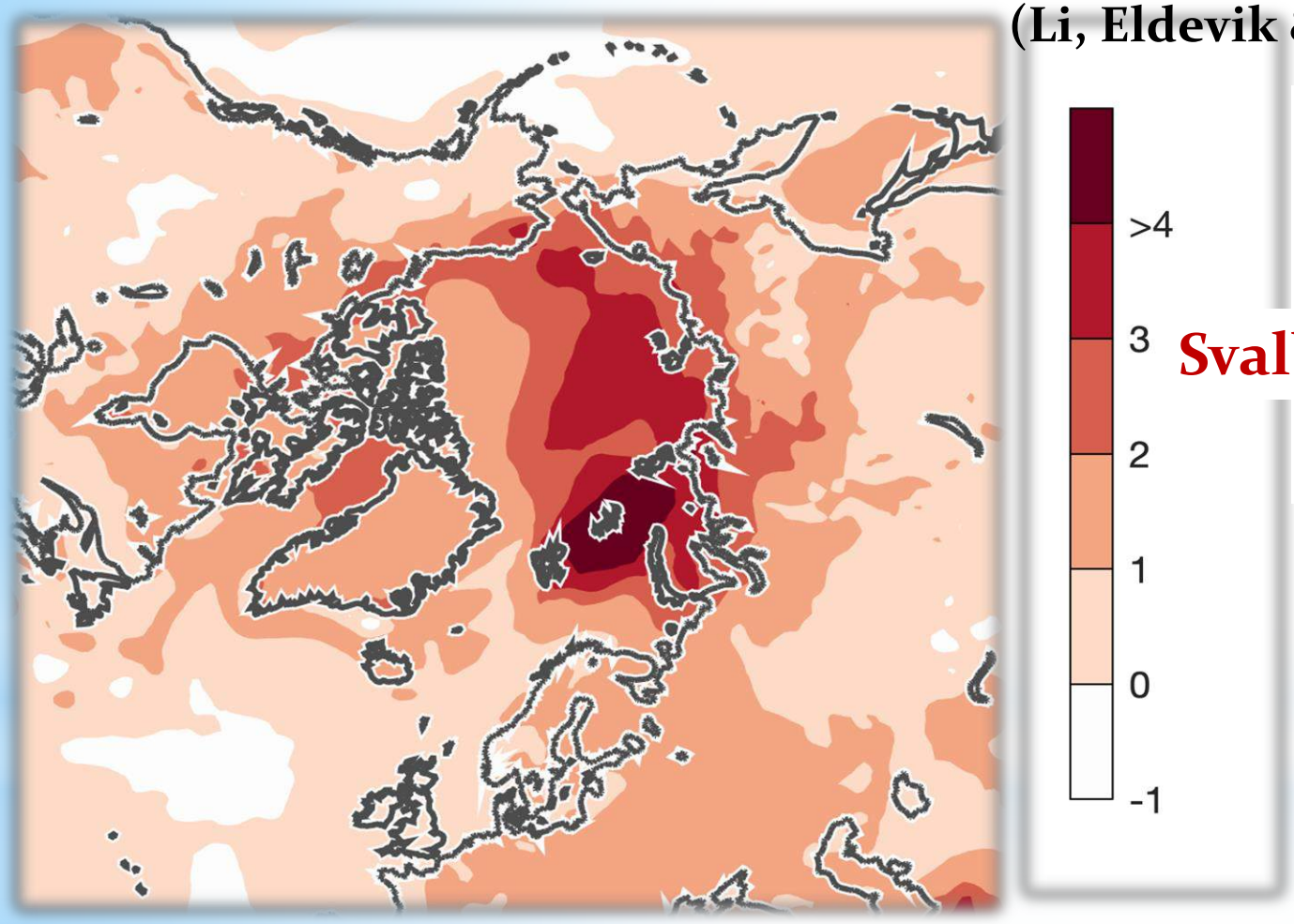
Arctic Amplification varies in time

(Li, Eldevik & Smedsrud, unpublished, 2019)



Area-averaged warming (2m Surface Air Temperature [° C] ERA-Interim).
Arctic (60N-90N), tropics (30S-30N) and globally, relative to 1979-1998 baseline.
Monthly means; seasonal cycle removed, 5-year running mean applied.

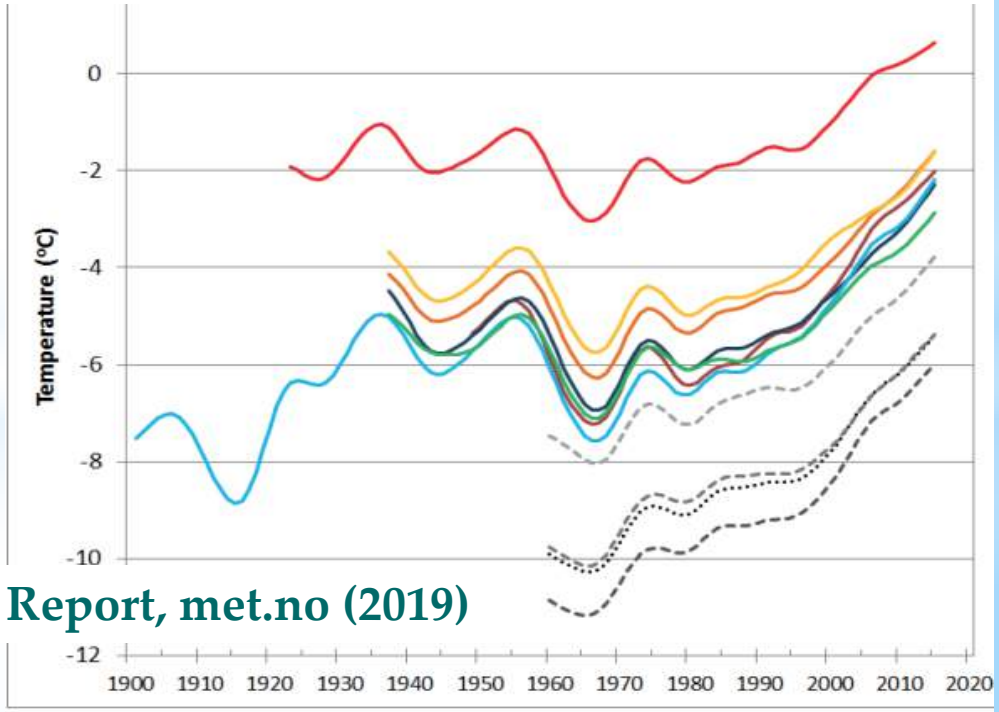
Arctic Amplification vary spatially



(Li, Eldevik & Smedsrud, unpublished, 2019)

Spatial pattern of recent warming
Annual-mean values (2008 – 2017).
(2m SAT [° C], ERA-Interim).

Svalbard has warmed most – Arctic Wide:



Climate in Svalbard 2100 – Report, met.no (2019)

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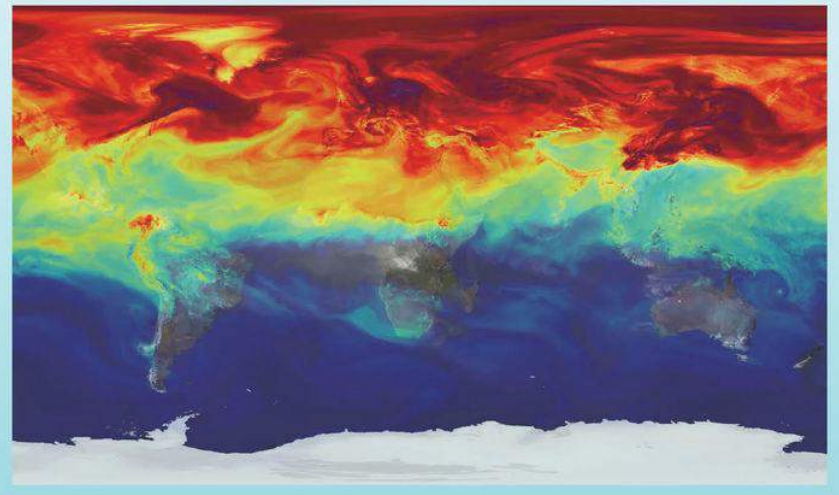
European Academies
easac
Science Advisory Council

Negative emission technologies:
What role in meeting Paris Agreement targets?



EASAC policy report 35

February 2018

ISBN: 978-3-8047-3841-6

This report can be found at
www.easac.eu

Science Advice for the Benefit of Europe

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Science Advice for the Benefit of Europe

EASAC is the voice of independent science advice, mobilizing Europe's leading scientists to guide EU policy for the benefit of society. It brings together the National Academies of Science of the EU Member States, Norway and Switzerland.

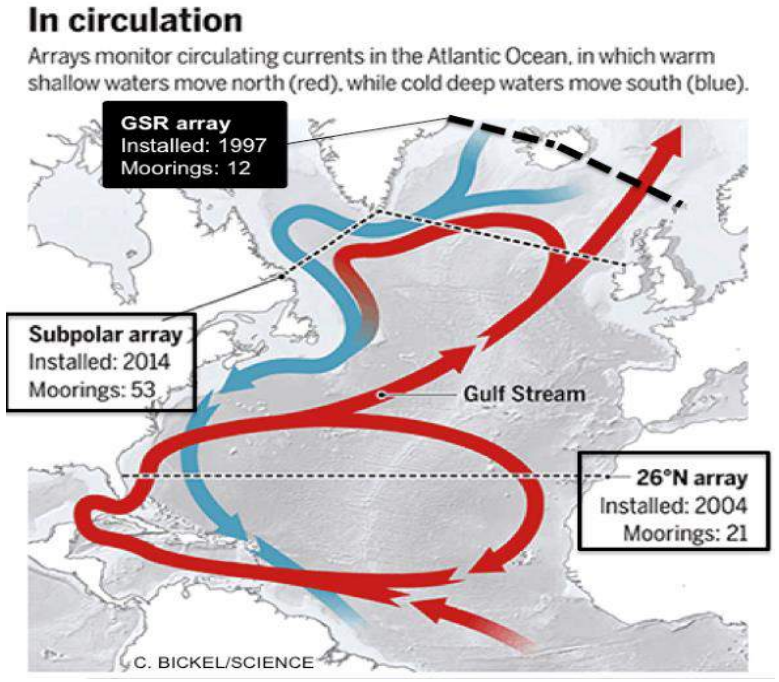
Recent relevant examples of EASAC reports

Changes in ocean circulation and consequences for European coastal regions

European Academies Science Advisory Council

Prof Tor Eldevik & Prof Lars H. Smedsrud
Geophysical Institute, University of Bergen & Bjerknes Centre for Climate Research, Norway

What are the main consequences for coastal regions from changes in large-scale ocean circulation, and particularly those related to present and future climate change?



- A large part of Europe's population resides in coastal regions
- Large scale climate change is "known" - regional impacts is "unknown"
- Wind driven horizontal gyres (Gulf Stream & North Atlantic Current)
- Poleward heat transport and vertical overturning may reduce 20%

Improving actionable knowledge on coastal regions and communities by exploring future coastal impacts in a range of likely scenarios

Interaction between ocean circulation and

1) **Coastal sea level rise**
2) **Carbon transport, cycling, storage and related acidification**
3) **Ocean ecosystem services and ocean economy**
4) **Coastal predictions based on advected heat anomalies**

First results to be presented at second UN Ocean Conference, Lisbon 2020.

Summary

- Arctic ECRA is a network of leading climate research institutions – existed since 2012
- For 2016 – 2020 much of the work is is happening in EU funded projects: Talks tomorrow from APPLICATE & Blue Action
- We know (very) well why the Arctic looses sea ice, snow and glaciers
- Arctic Biodiversity is threatened by the same climate warming
- Environmental management is a challenge but needs to happen NOW
- Natural climate variability may be larger than most people think