

ADDIO AI GHIACCI

L'Artico e il cambiamento climatico

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Addio ai ghiacci

Rapporto dall'Artico



Bollati Boringhieri



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Climate Change

Adaptation and Mitigation
Solutions

Department of Excellence
2018 - 2022

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**POLITECNICO
DI TORINO**

Dipartimento di Ingegneria
dell'Ambiente, del Territorio
e delle Infrastrutture

Francesco Laio, Professor of Hydrology
at Politecnico di Torino, cc@polito coordinator



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Project: "Climate change @ Polito"

- Italian Ministry of Education, University and Research (MIUR)
- 8.7 M€ grant
- 5-year project (2018-2022)



POLITECNICO
DI TORINO
Fondazione per l'Innovazione

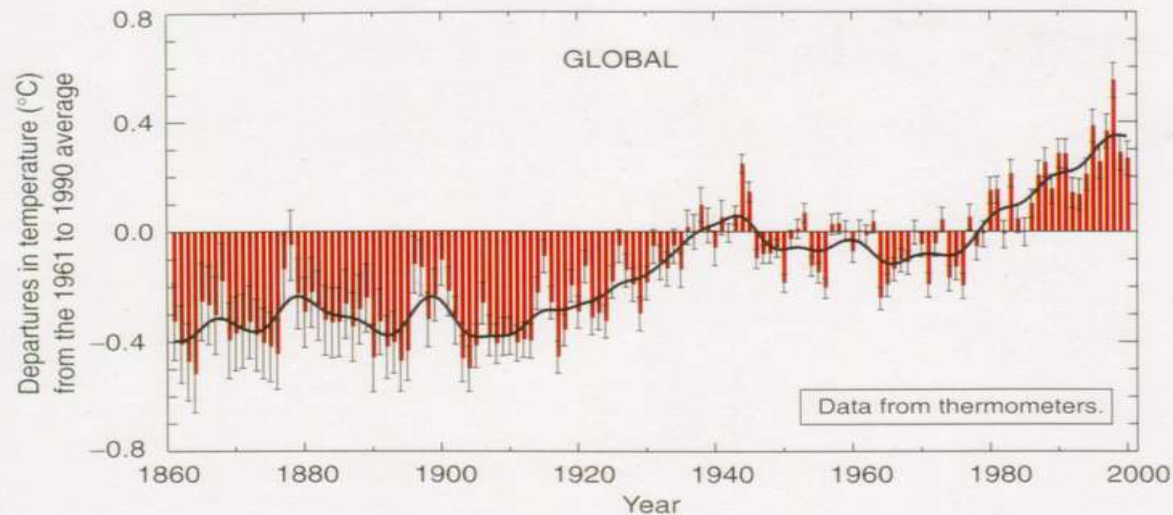
"Excellence
Department"



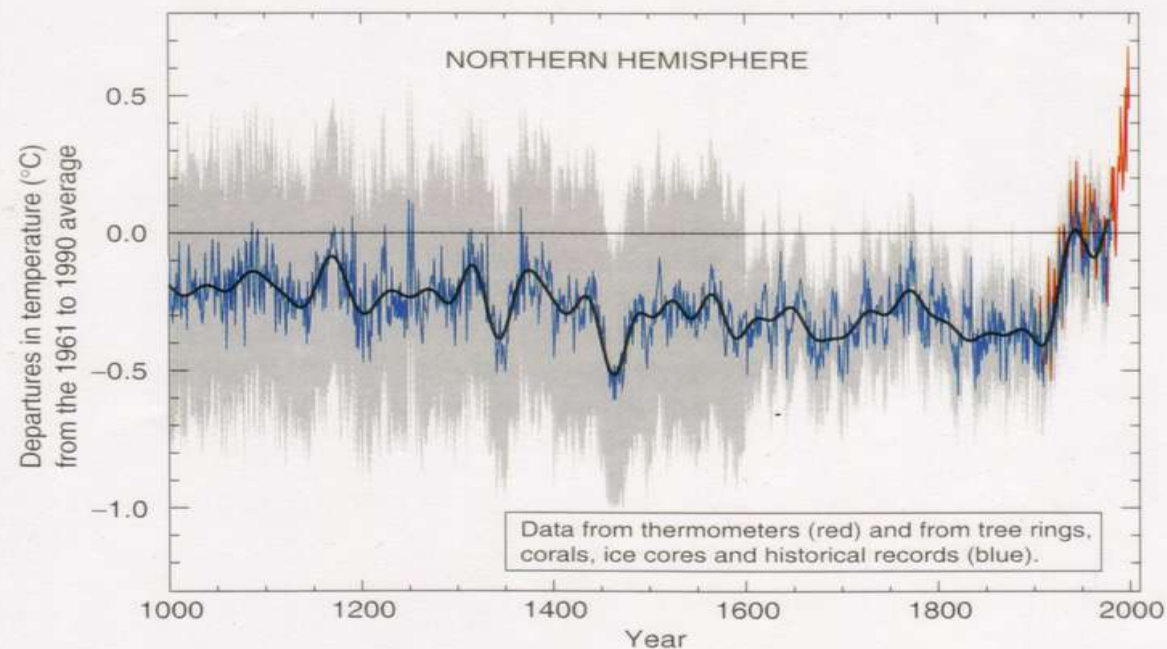
The Earth has
been warming
rapidly since the
mid-19th
Century...

Variations of the Earth's surface temperature for:

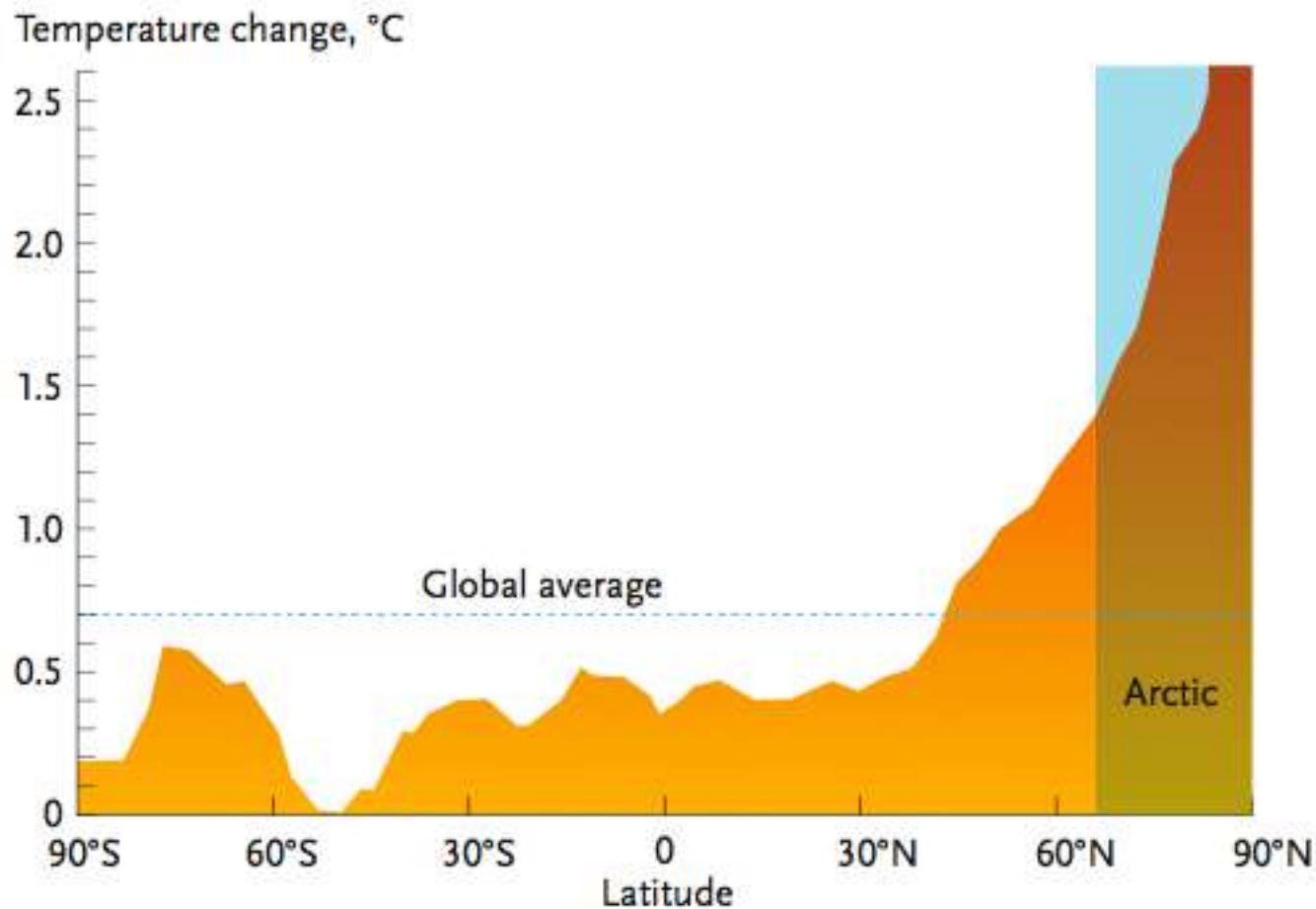
(a) the past 140 years



(b) the past 1,000 years



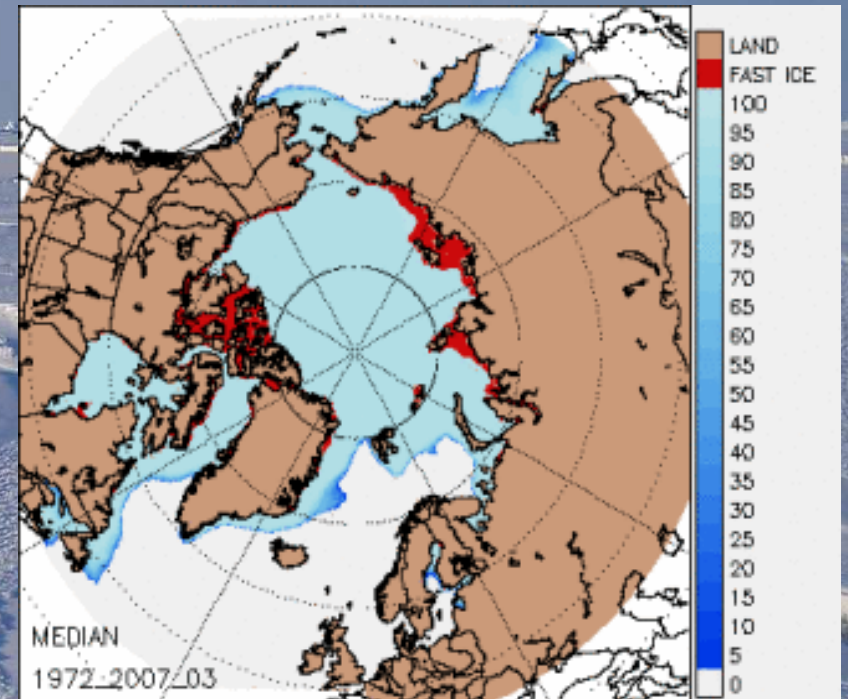
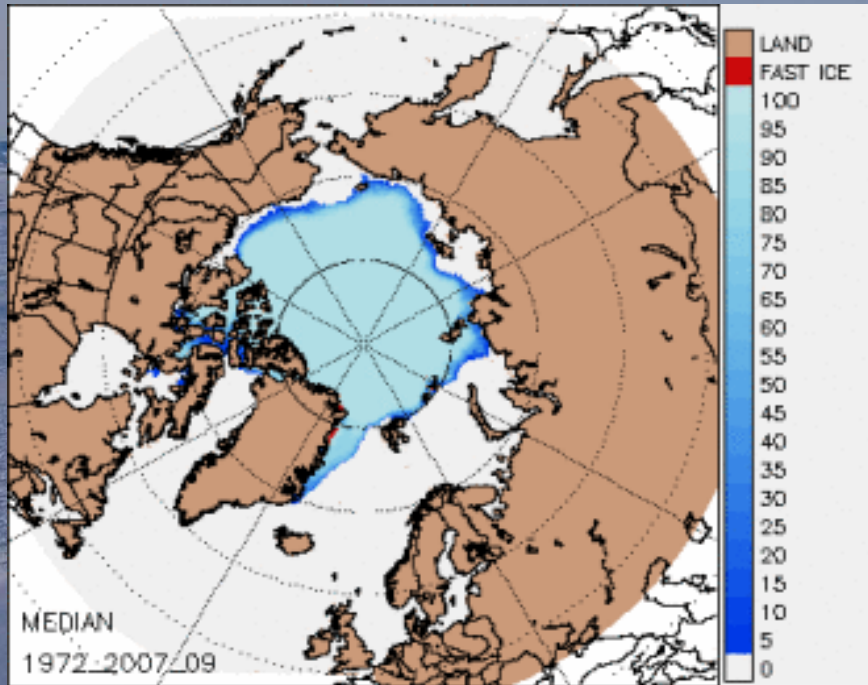
Arctic amplification



The average increase in surface temperature since the 1951–1980 reference period is greatest in the Arctic.

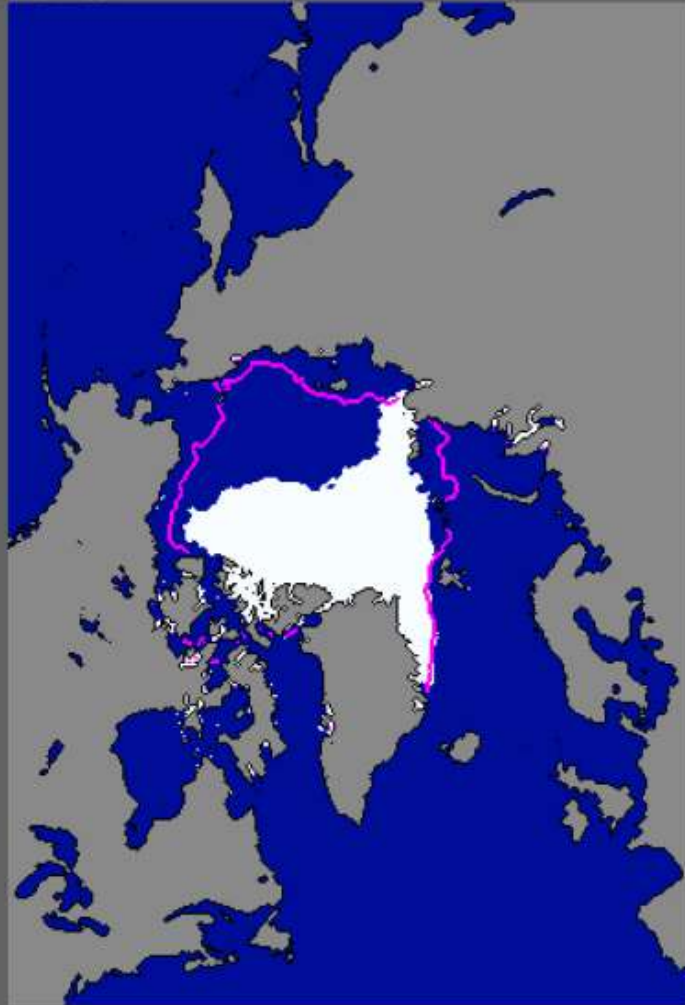


Median summer and winter ice limits 1972-2007



Record minimum ice extent in Sept. 2007

Current Ice Extent
09/16/2007

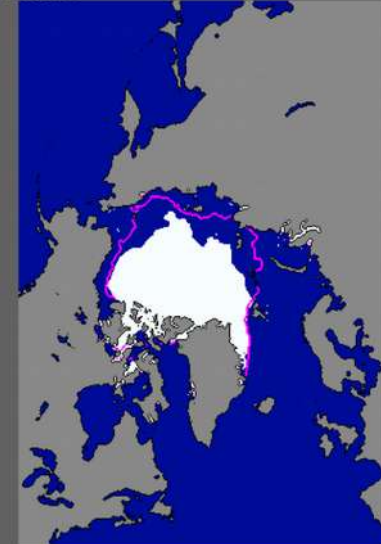


National Snow and Ice Data Center, Boulder, CO

Total extent = 4.1 million sq km

median
ice edge

Current Ice Extent
09/21/2005



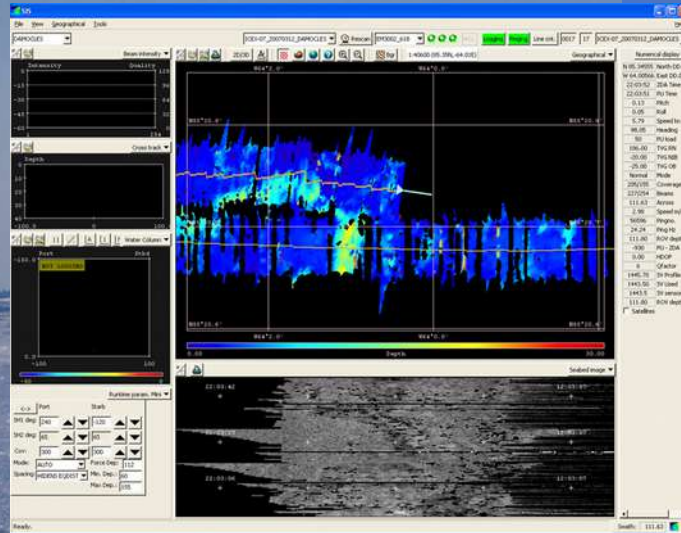
National Snow and Ice Data Center, Boulder, CO

Total extent = 5.3 million sq km

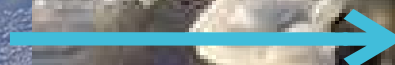
median
ice edge

2005

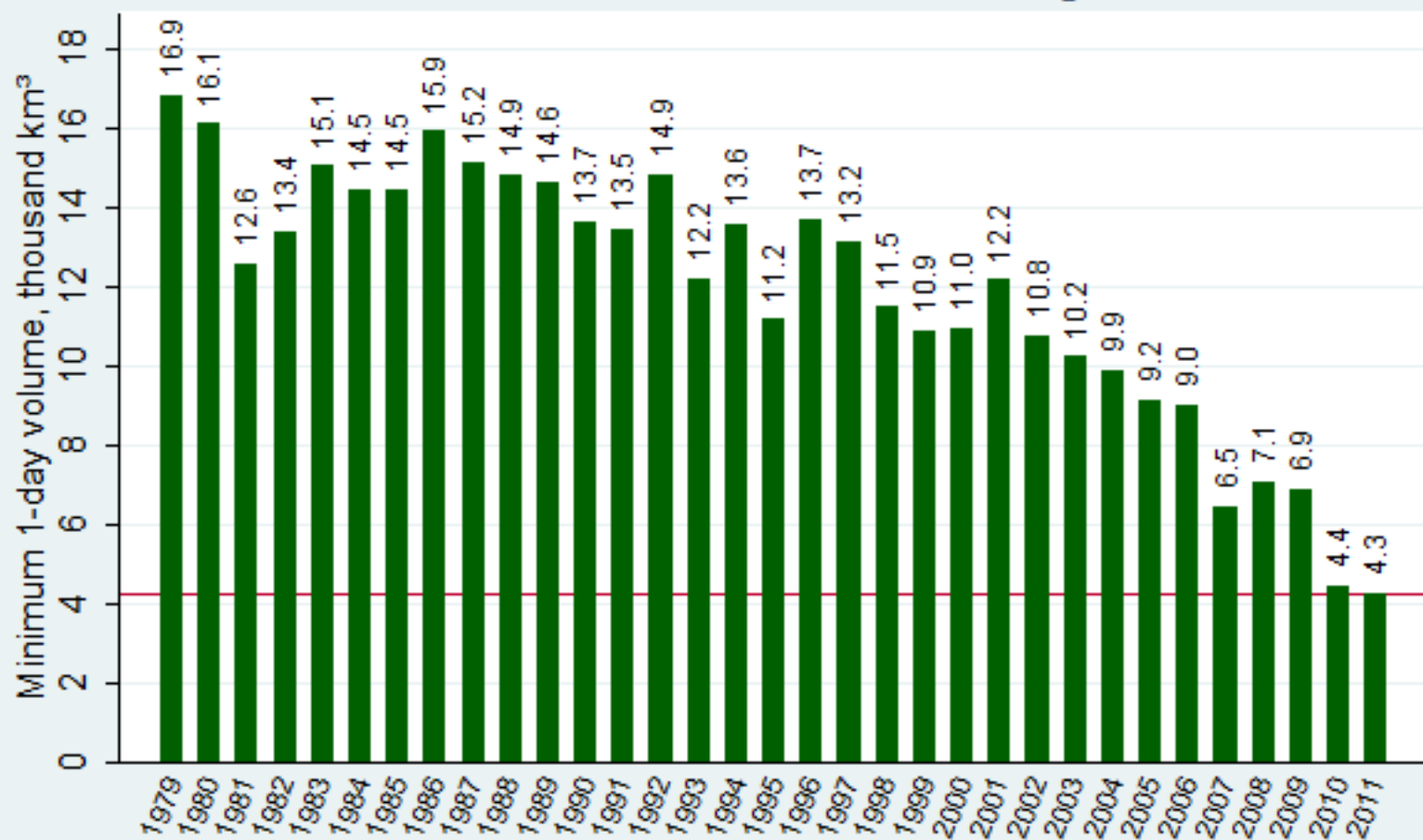
Fitting multibeam to a submarine - HMS "Tireless" March 2007, Arctic Ocean transect



**EM3002 multibeam sonar
in forward sonar dome**



Min Arctic sea ice volume, 1979 through 8/31/2011



graph: L Hamilton

data: PIOMAS



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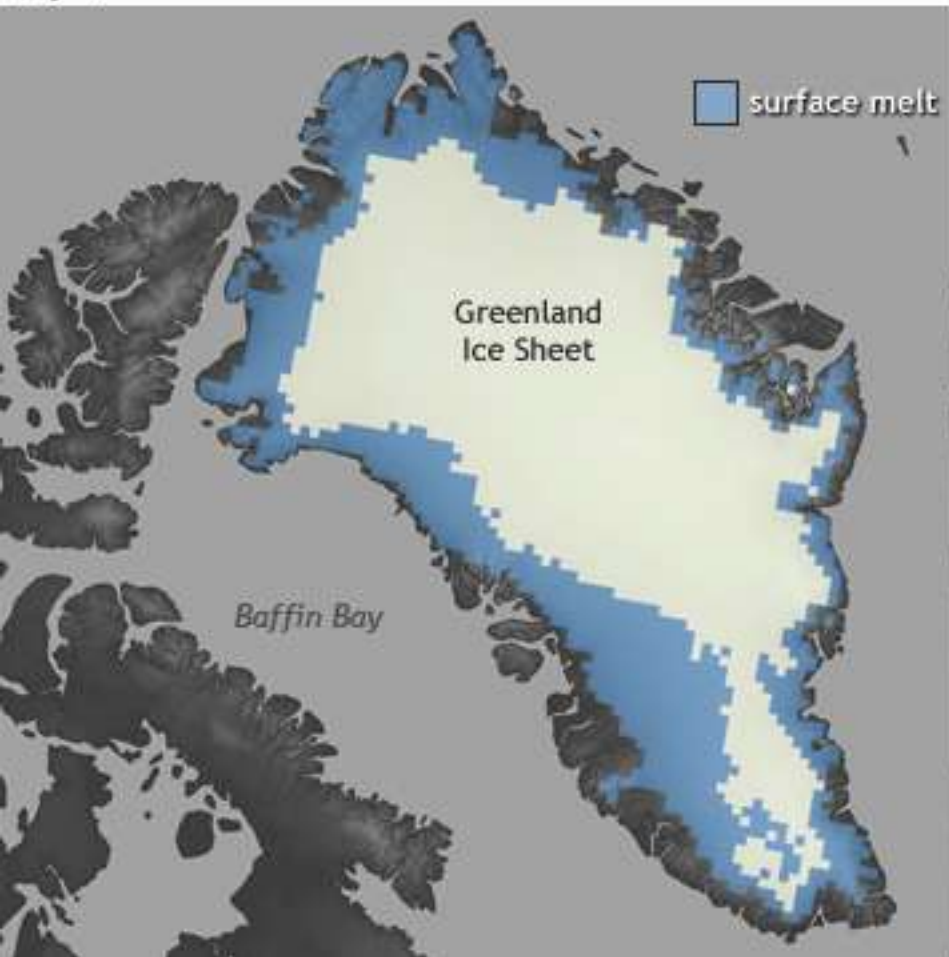
Greatly deepened, repetitive melt pool in multi-year ice
(Beaufort Sea)



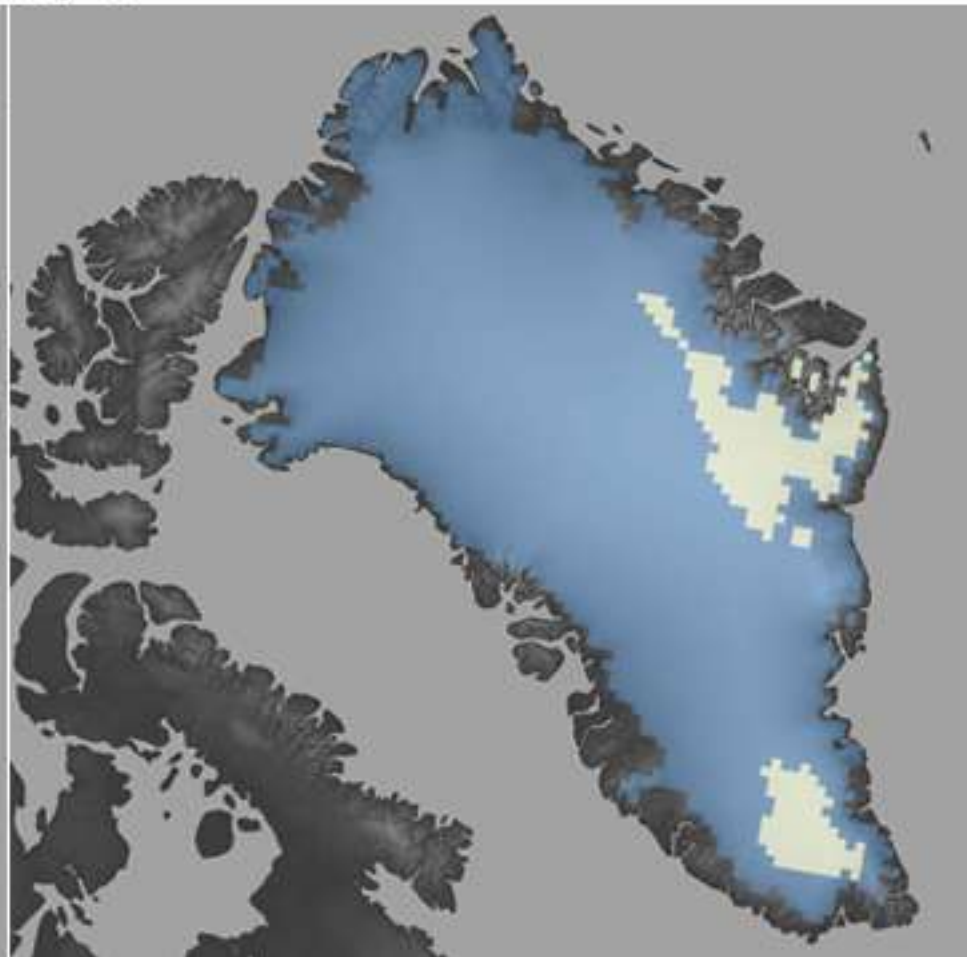


2012 Greenland surface melt

July 1



July 11



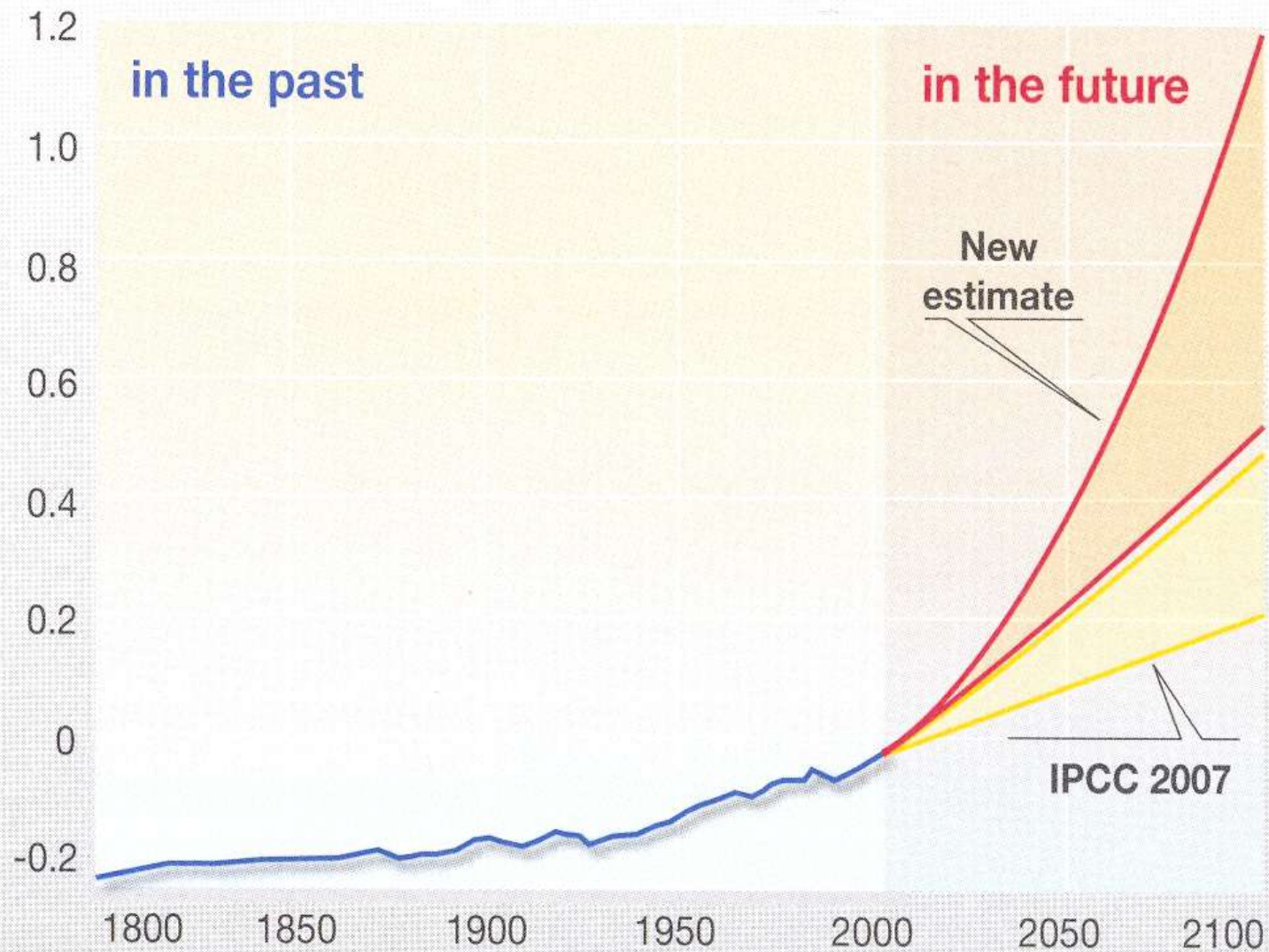
Aug 1 2019. Biggest one-day loss of ice from Greenland Ice Sheet.
12.5 billion tons lost. Air temperature 21 C



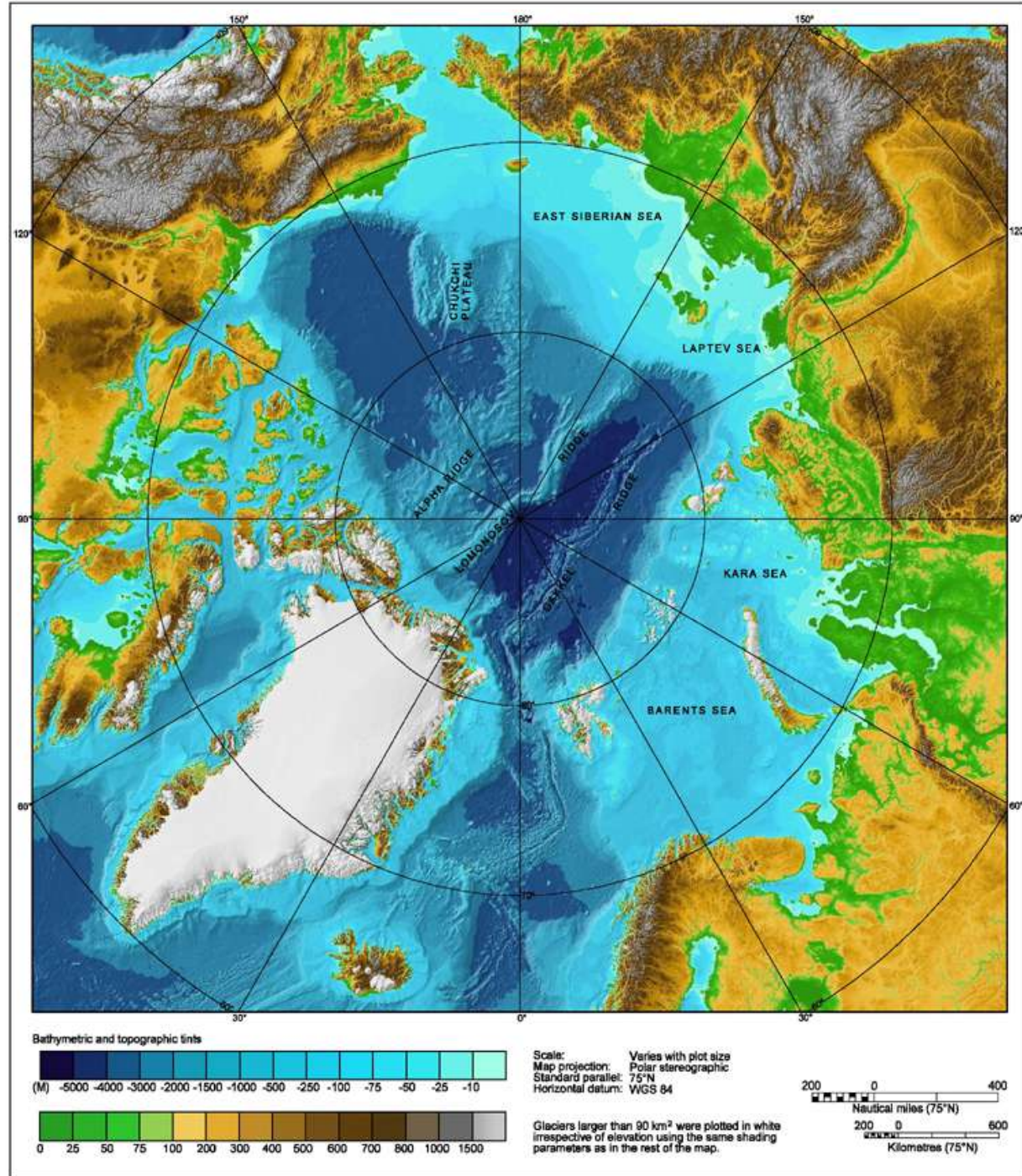


Global sea level

Metres



Source: Cazenave and Llovel, 2009.



27 Мар 12

09:57:50

0.316

5.0

0.316

5.0

0.316

5.0

Кам



047



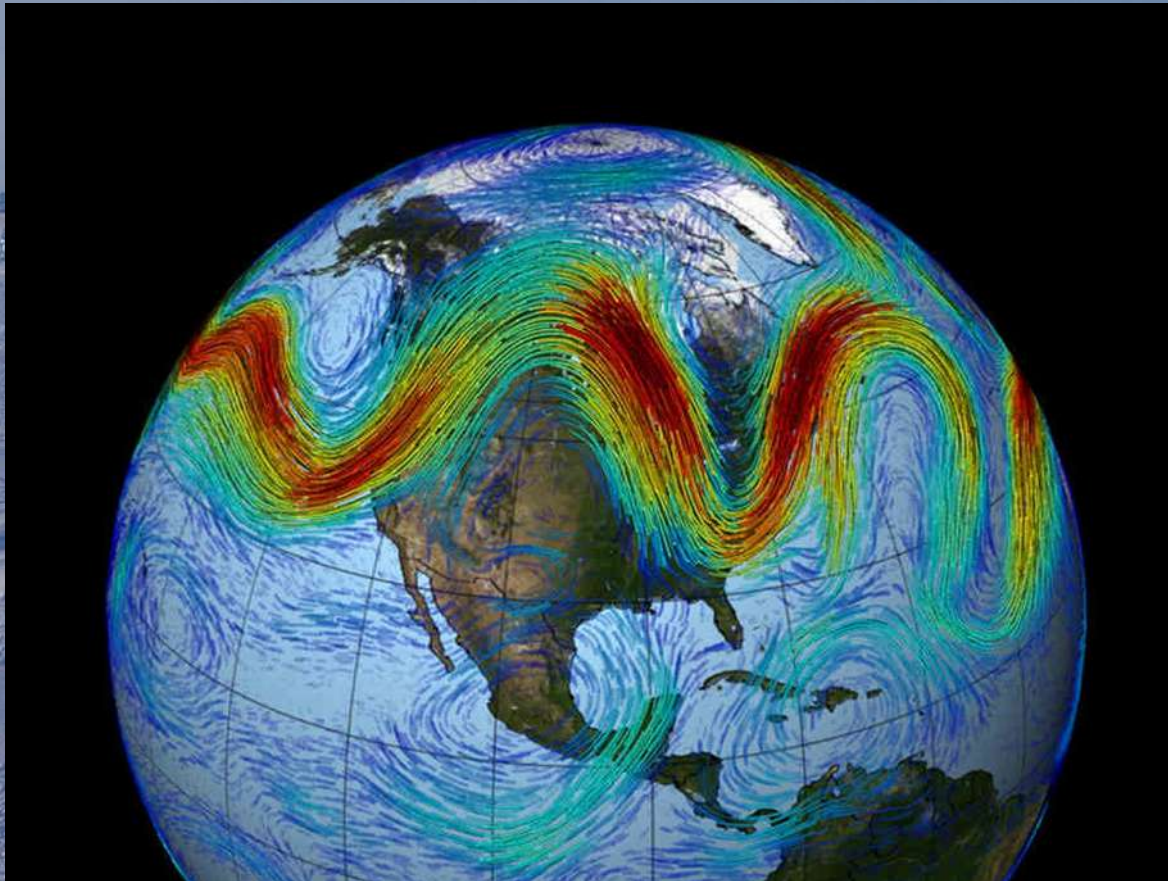
047

Автоглубина: 2.2m



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Simulation of jet stream (NASA)

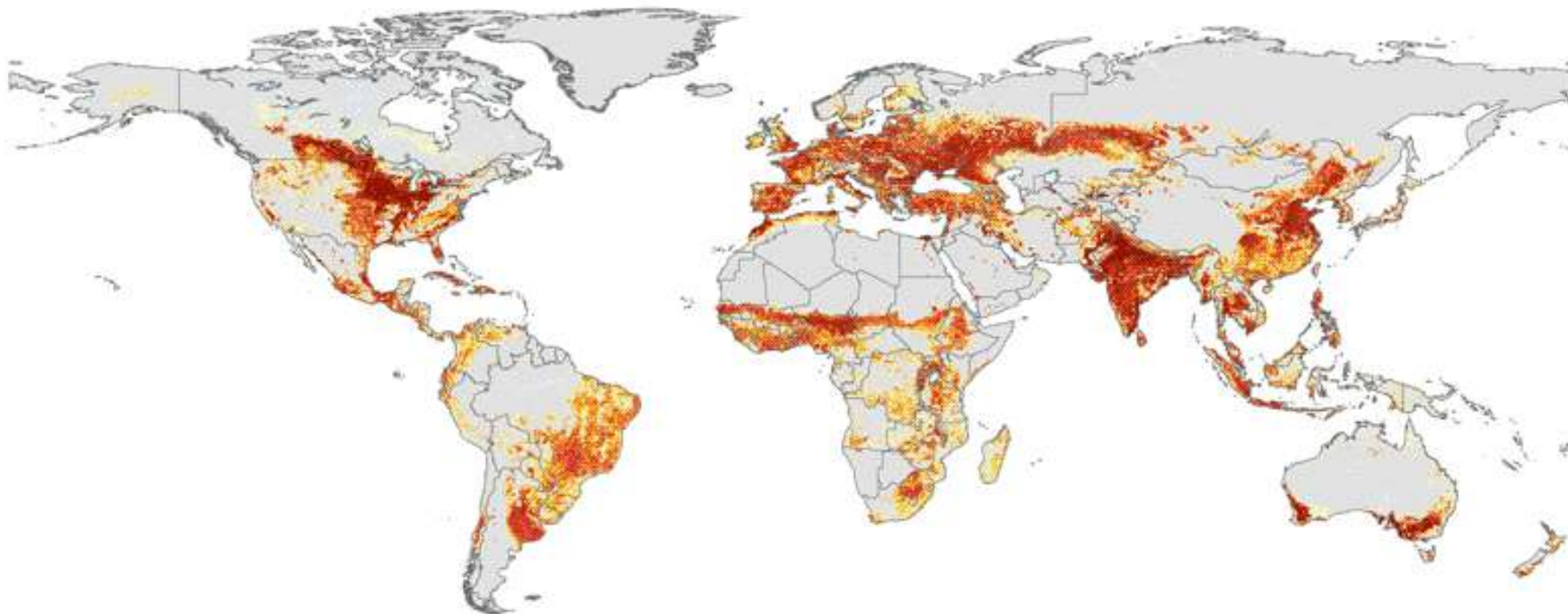


Crops



FAO Poverty Mapping Project

Map 5.2: Occurrence of cropland
FGGD Module 5: Land use patterns and land cover



Occurrence defined as percent area of the pixel

0 - 3

3 - 5

5 - 10

10 - 20

20 - 40

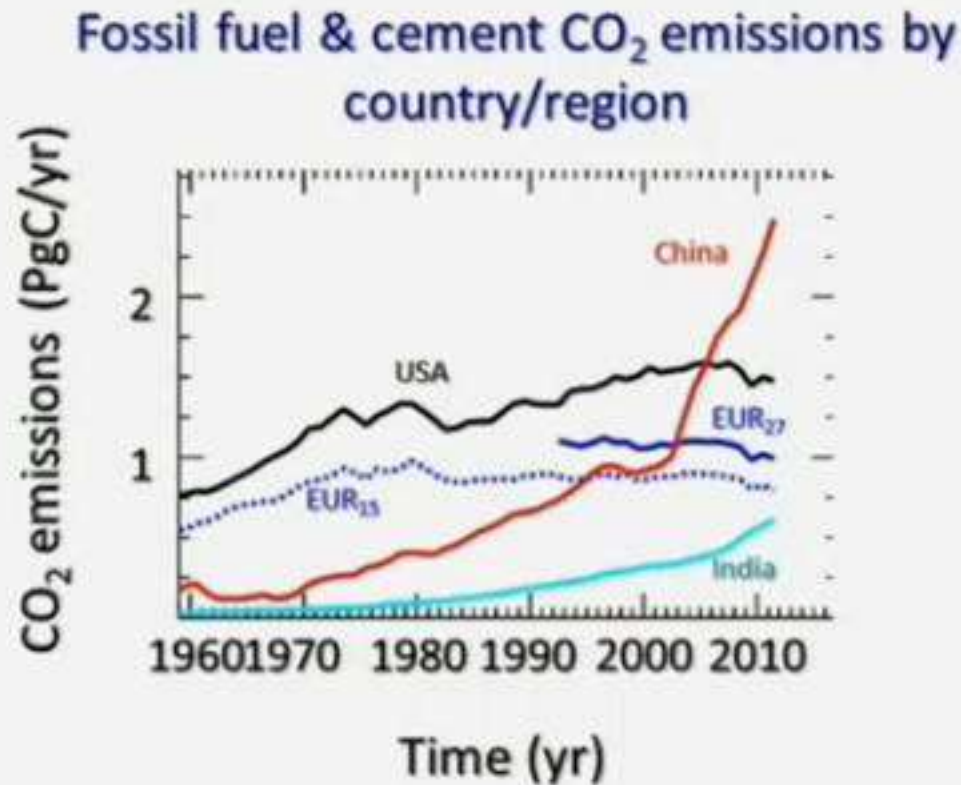
40 - 60

60 - 80

80 - 100

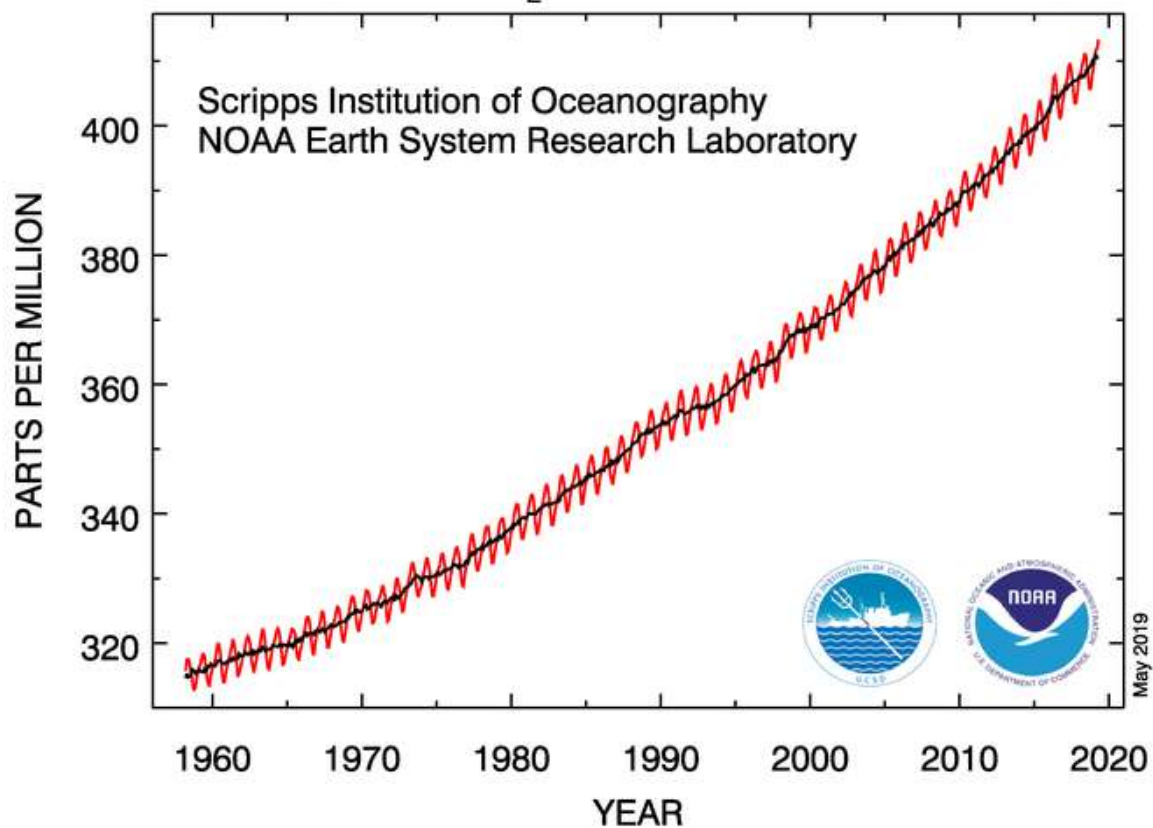
inland water bodies

What can we do?

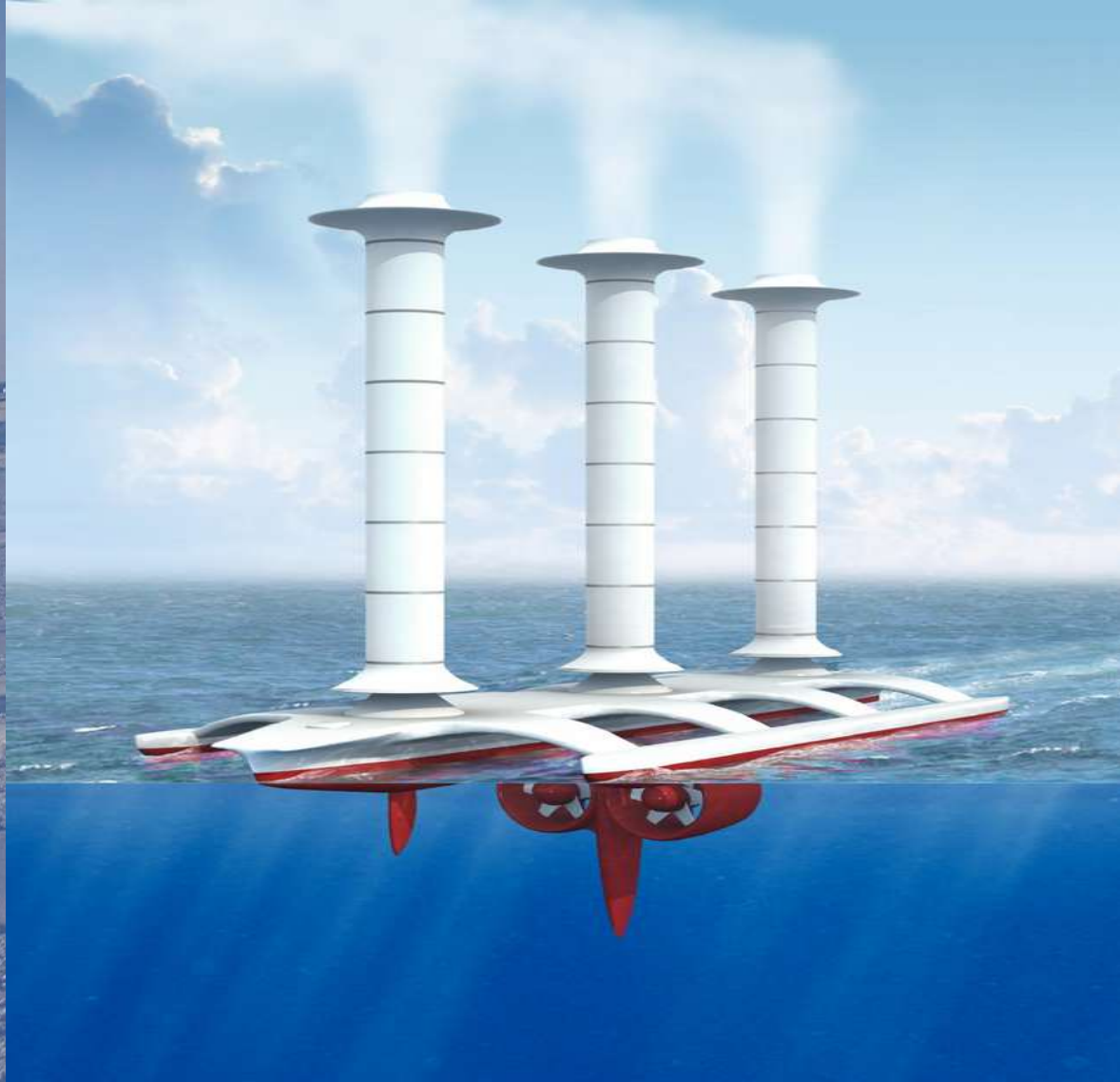


Source: Peters et al. Nature Climate Change submitted, based on CDIAC data and BP energy statistics

Atmospheric CO₂ at Mauna Loa Observatory



Marine Cloud Brightening - Salter, Edinburgh



Direct Air Capture (DAC) - Carbfix, Iceland



Blue Planet Ltd., Los Gatos, California





Biochar production, Hago Research, Camarillo, California





