5. SEA WATER AND ICE

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2019

Based on the Book:
"Fundamentals of Global Warming"

Presentation Slides about Global Warming

1. Global Warming 1901-2018
2. Influence of the Sun
3. CO2 Emissions and Concentration
4. Forecasting Global Warming
5. Seawater and Ice Conditions
6. Milankovich Cycles
7. Action Plans
8. Target Scenario 2050

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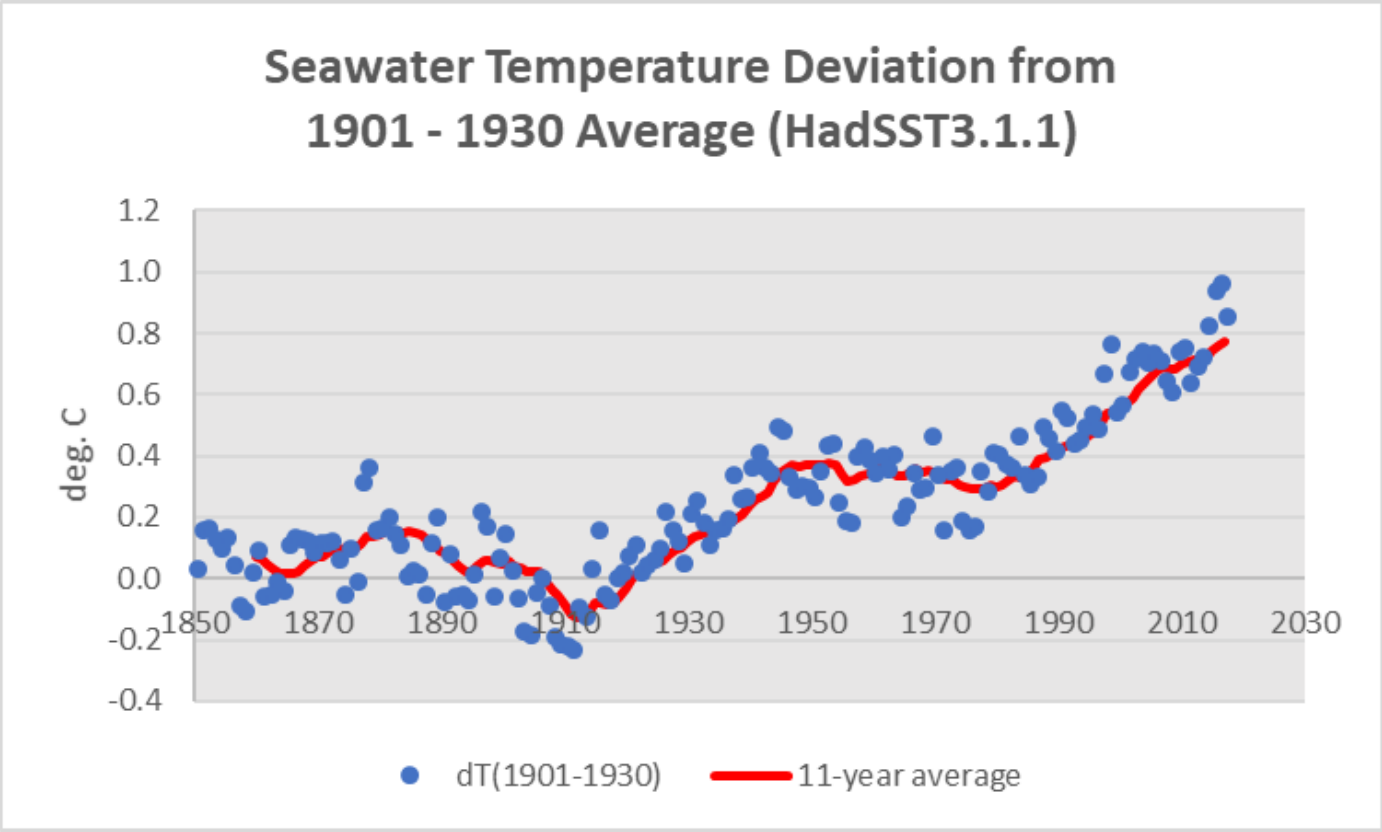
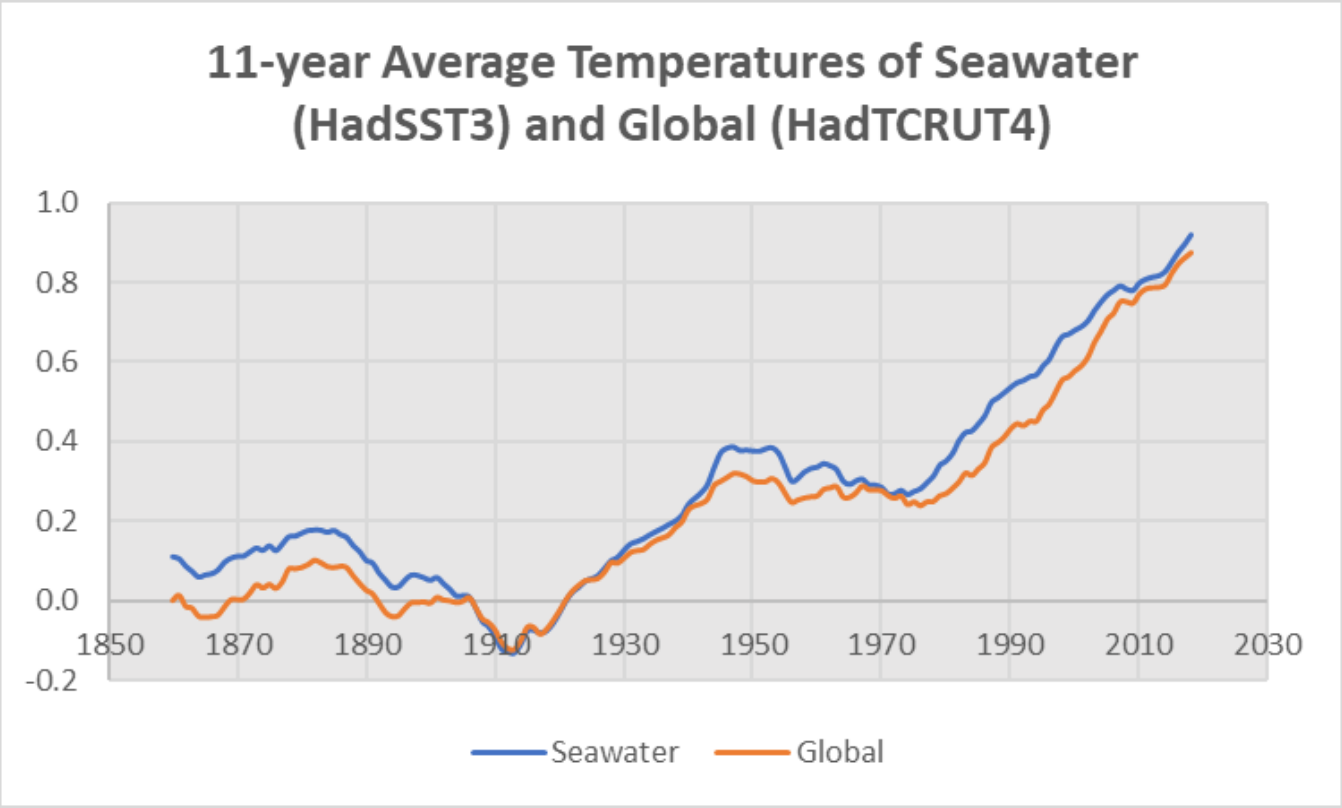
1. TEMPERATURE OF SEA WATER

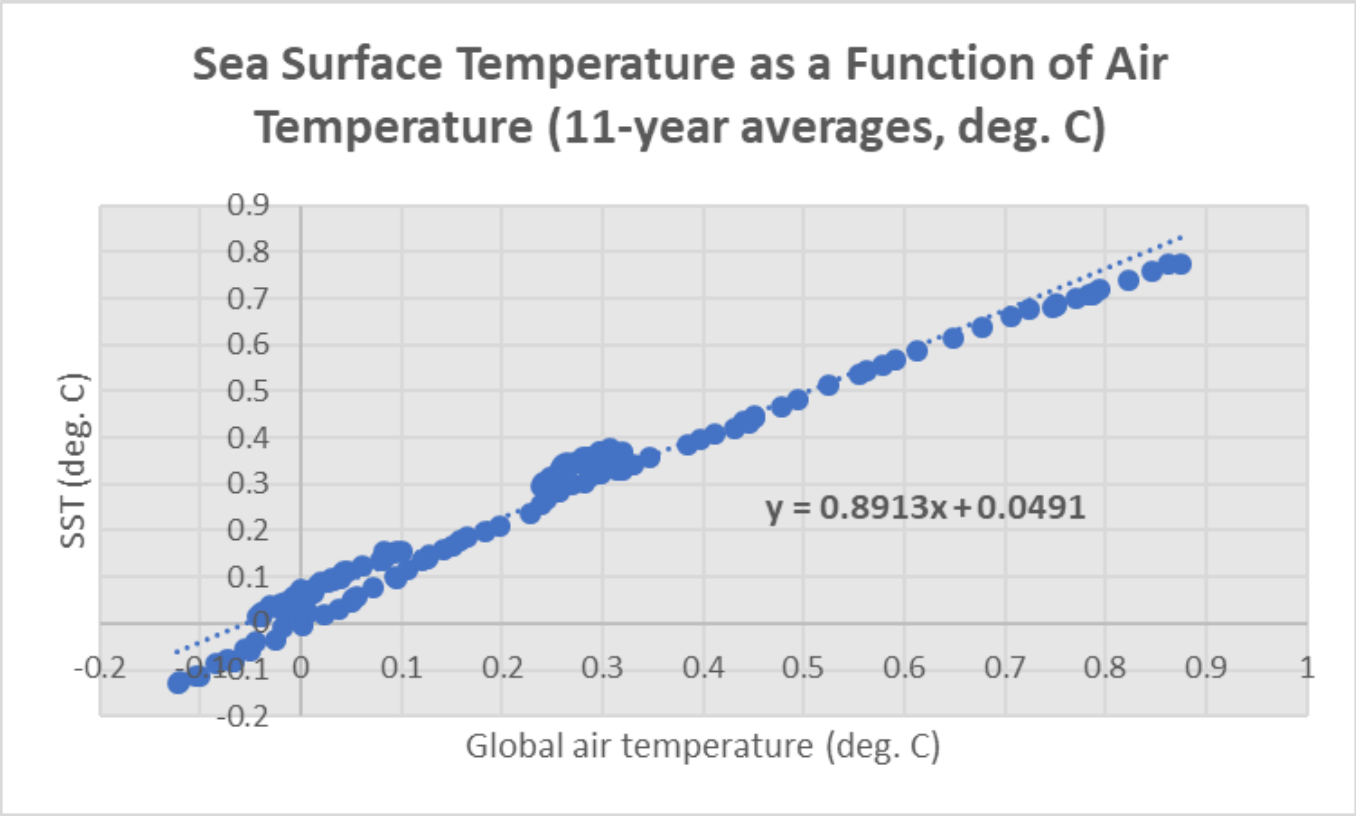
Seawater temperature has been rising 0.8 deg. C since 1901 - 1930



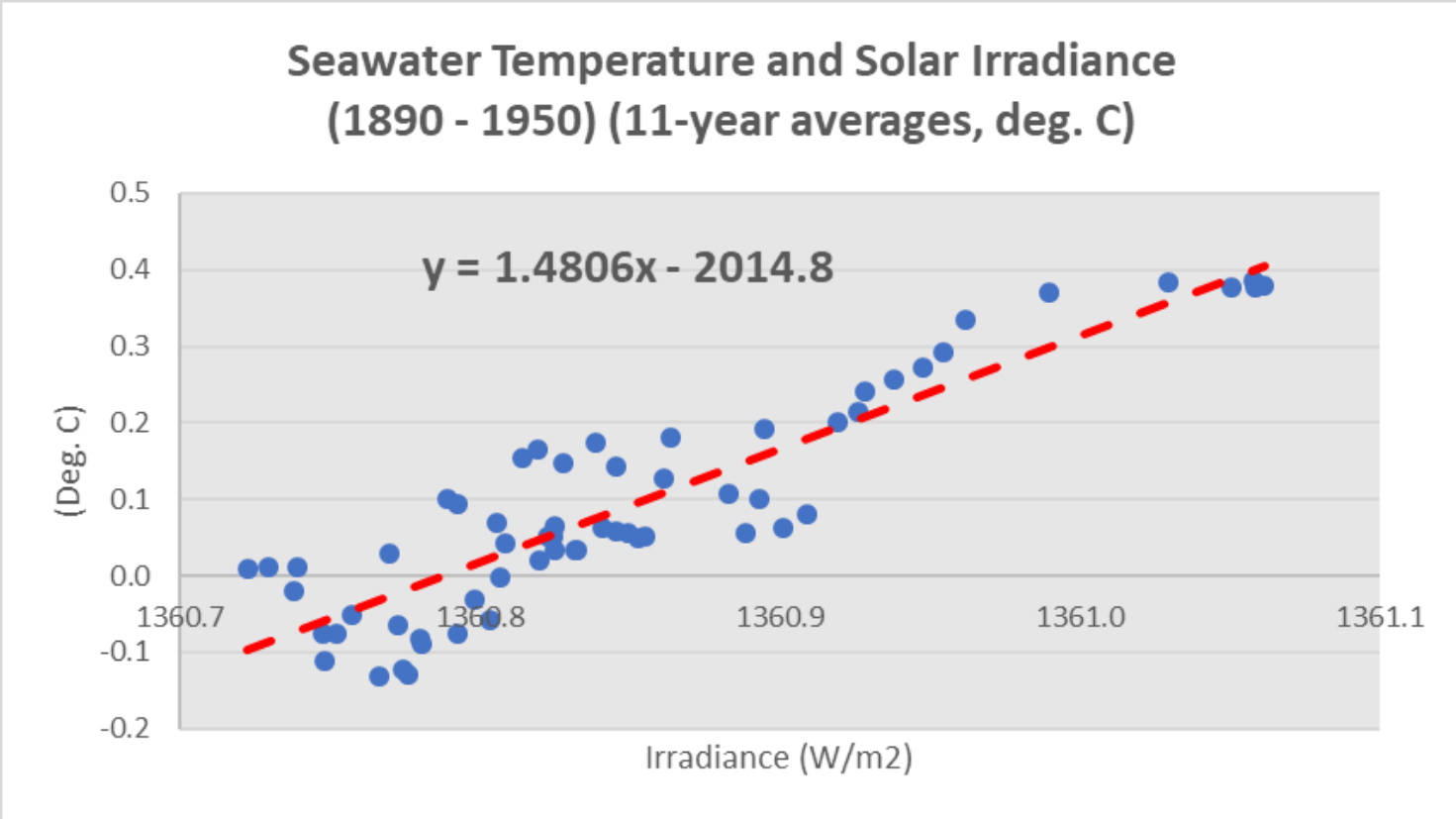
Sewater has been rising with the same rate than global temperature



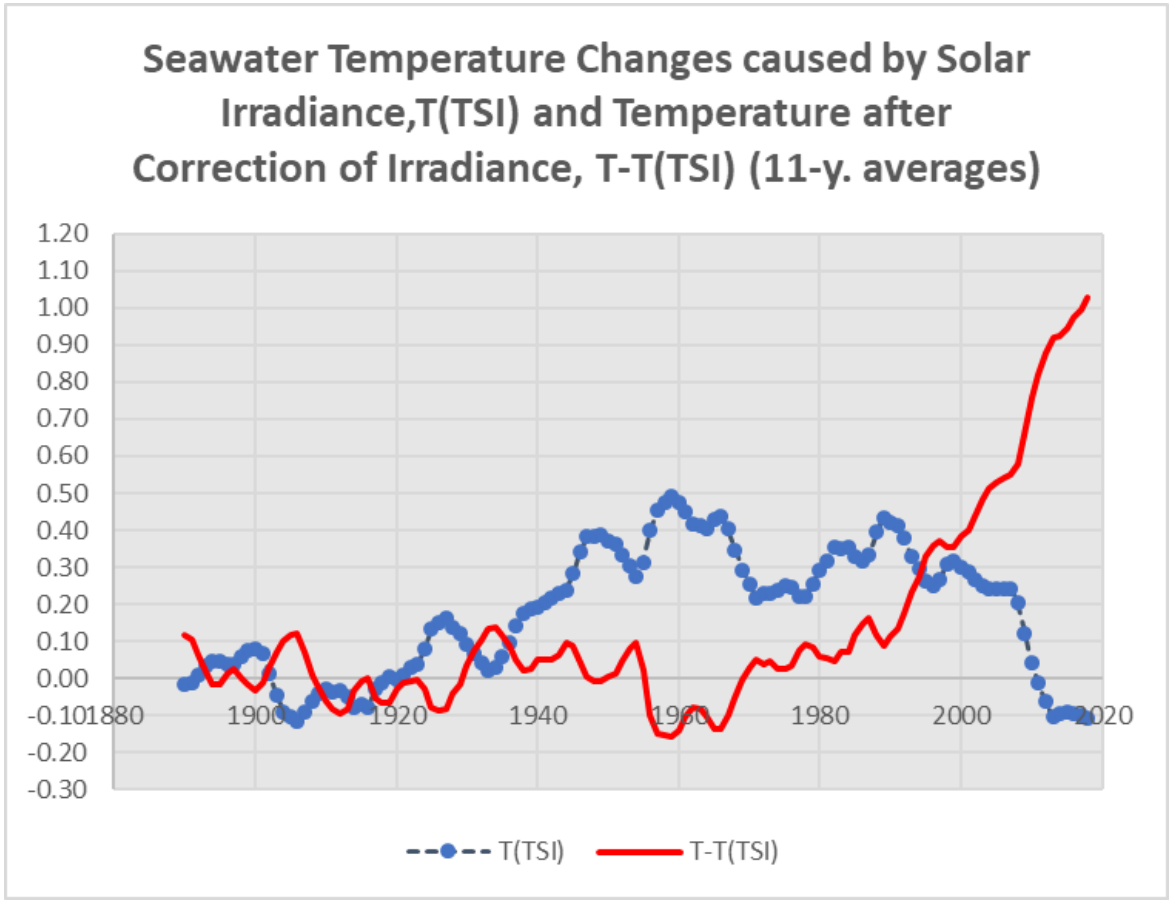
Seawater Temperature Trend has been 90 % from the Global Air Temperature



Seawater temperature rise follows Solar Irradiance dT = 1.425 x TSI

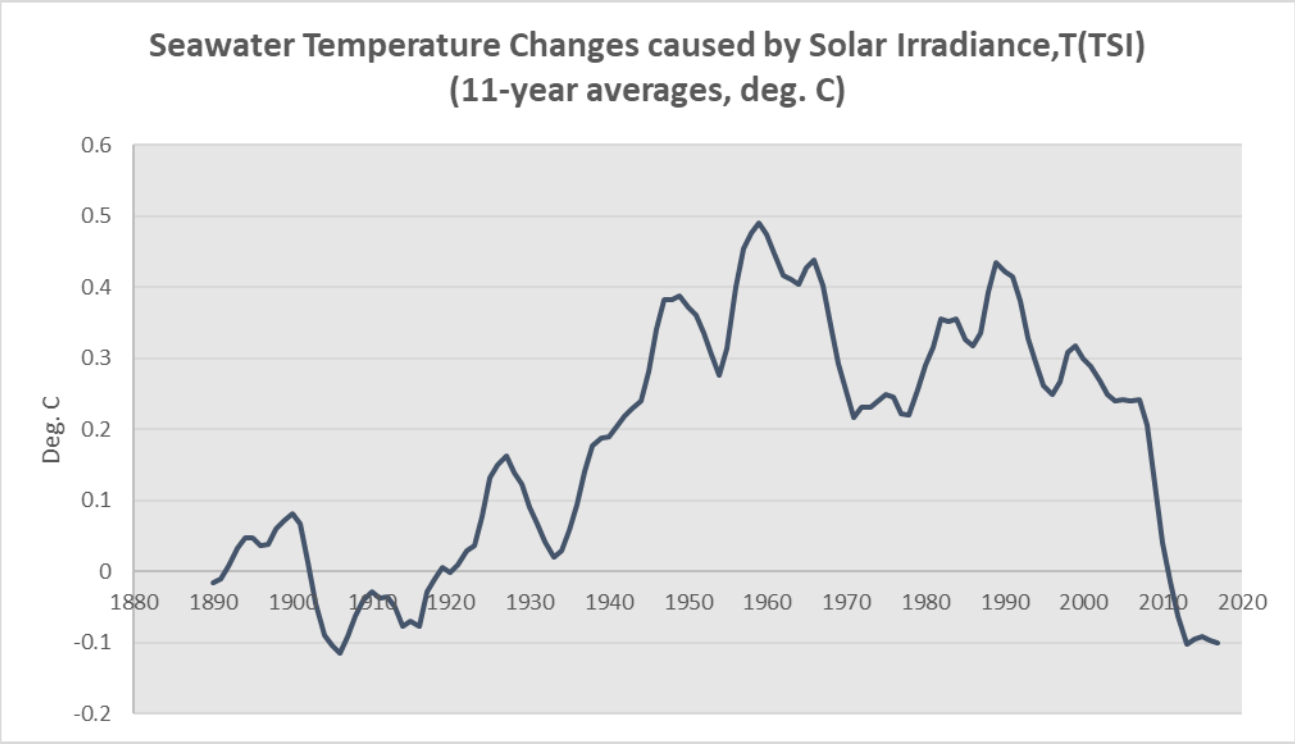


Solar irradiance has caused most of seawater warming until 1990

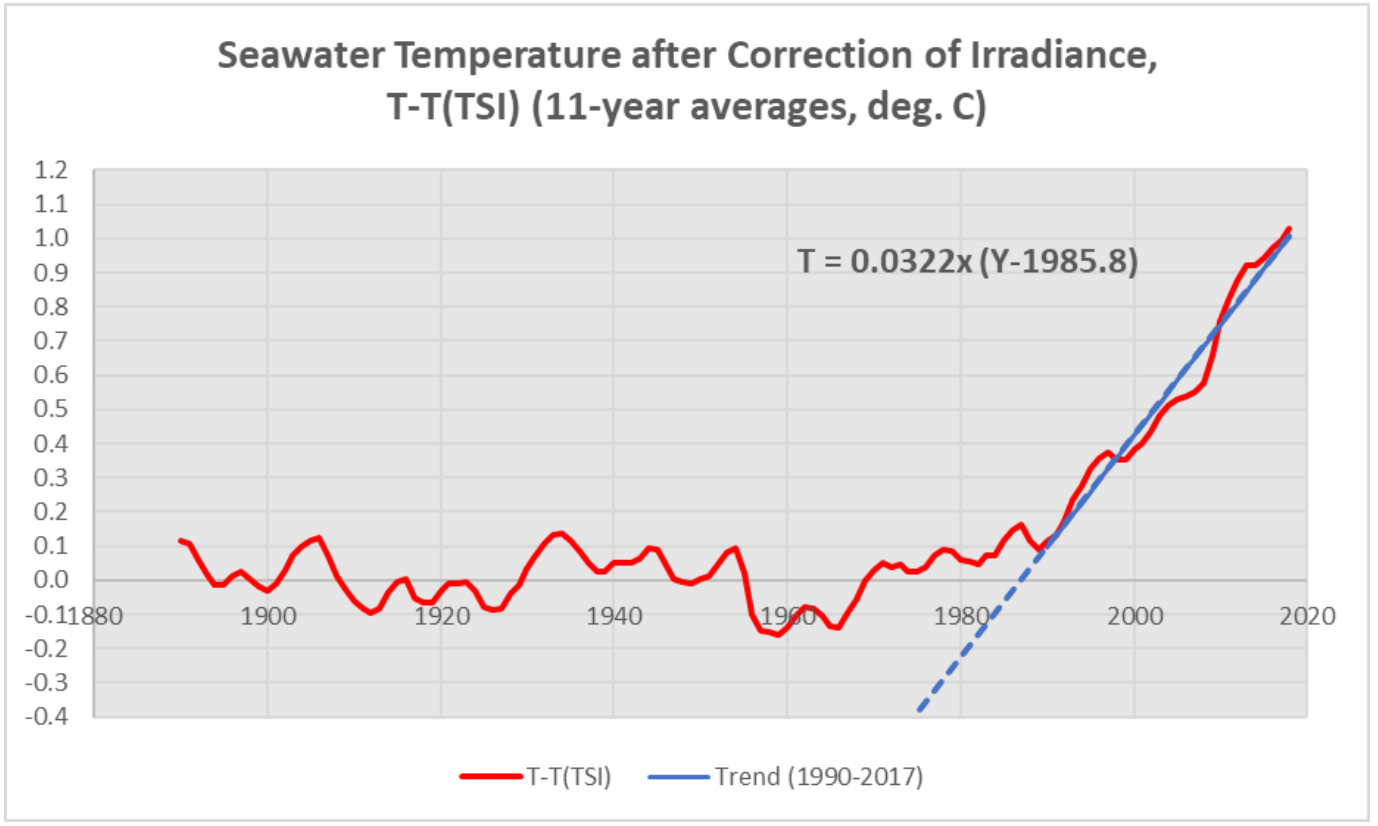


2018 causes: 1.0 by AWG and -0.1 deg. C by YSI

Solar Irradiance has caused +0.5… - 0.1 deg. C changes in seawater temperature

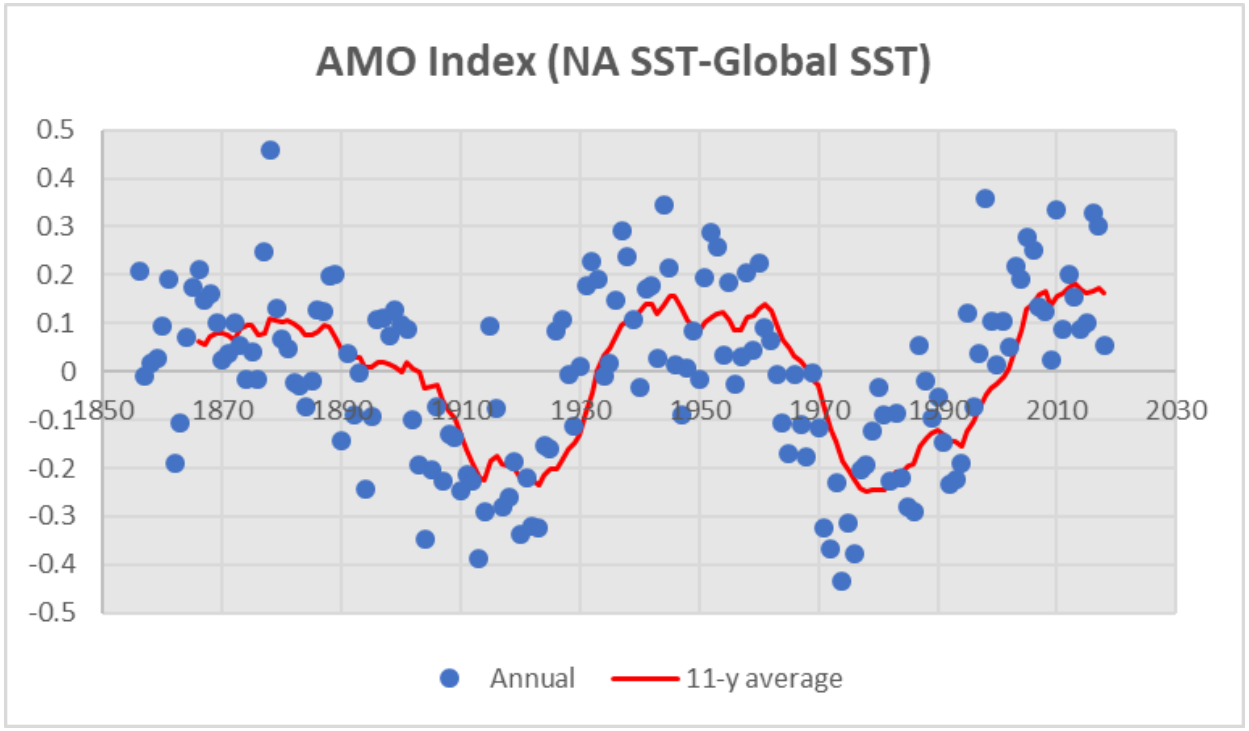


Temperature after Irradiance has been rising 0.32 deg. C/decade



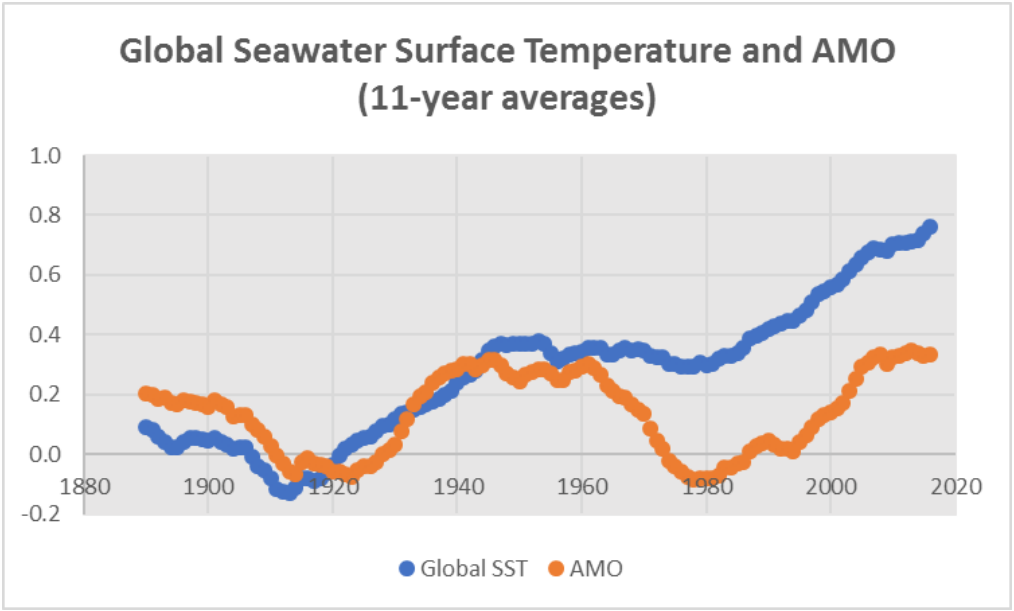
2. ATLANTIC MULTIDECADAL OSCILLATION (AMO)

Atlantic Multidecadal Oscillation (AMO)



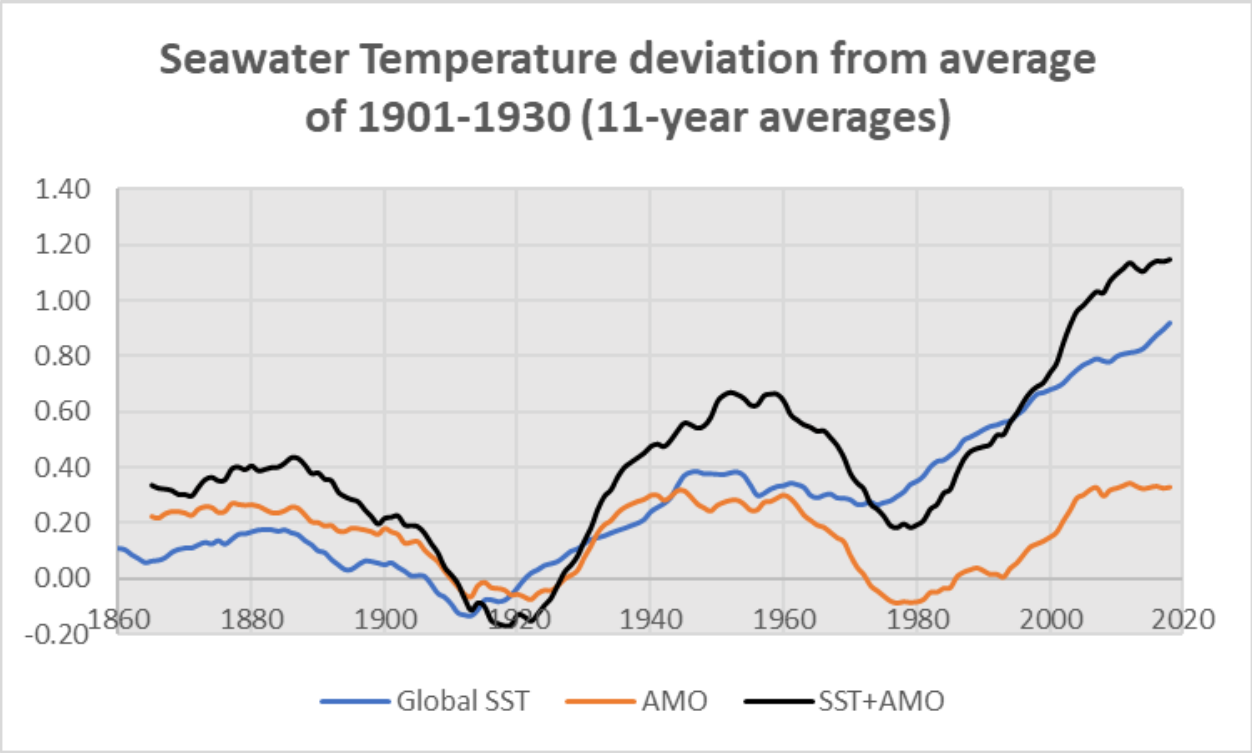
Temperature difference between North Atlantic and Global SST changes in a 60 – 70-year cycle

AMO cycle follows Global SST



Both Global SST and AMO index are peaking today.

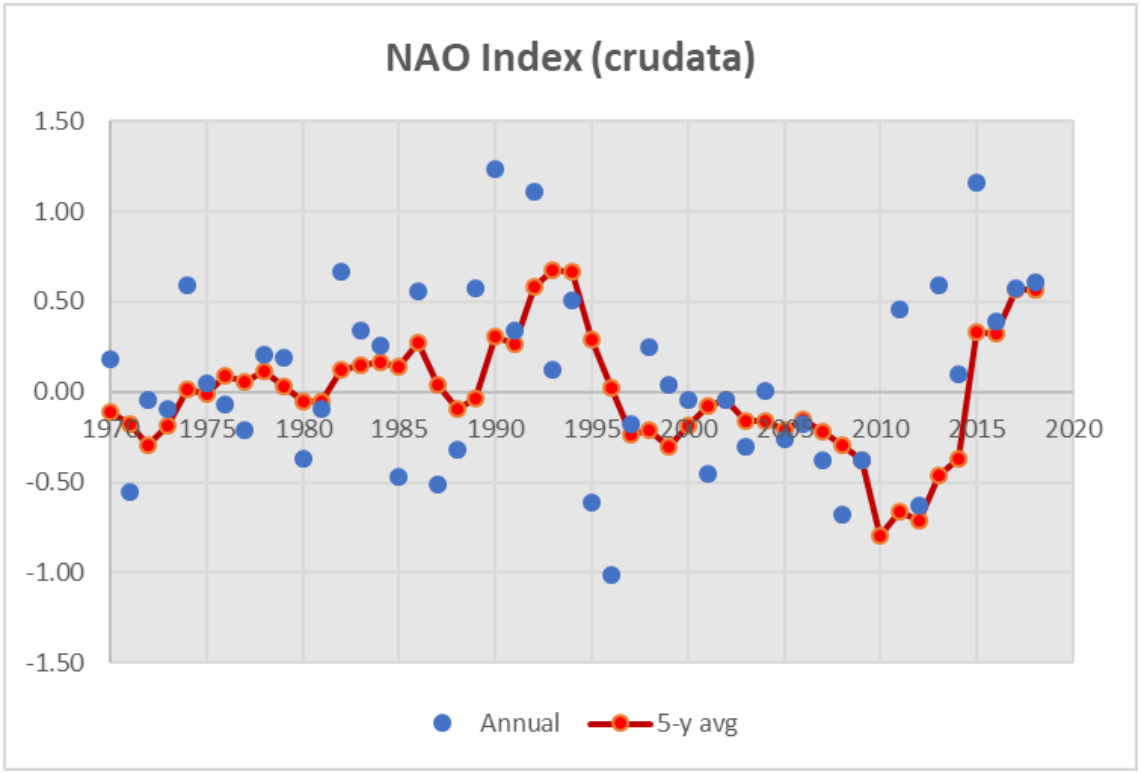
North Atlantic SST is 1.1 deg. C above average of 1901 - 1930



Global SST, AMO index and North Atlantic SST are peaking today.

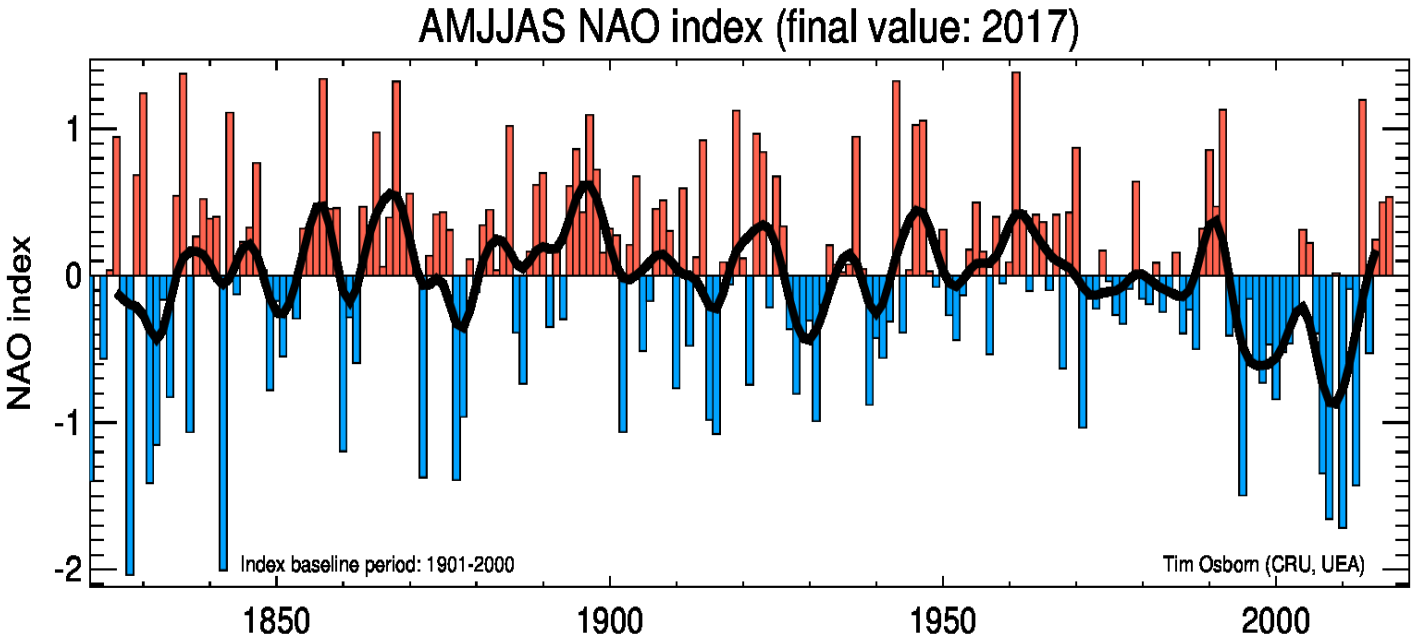
3. North Atlantic Oscillation (NAO)

North Atlantic Oscillation (NAO) Index is also peaking

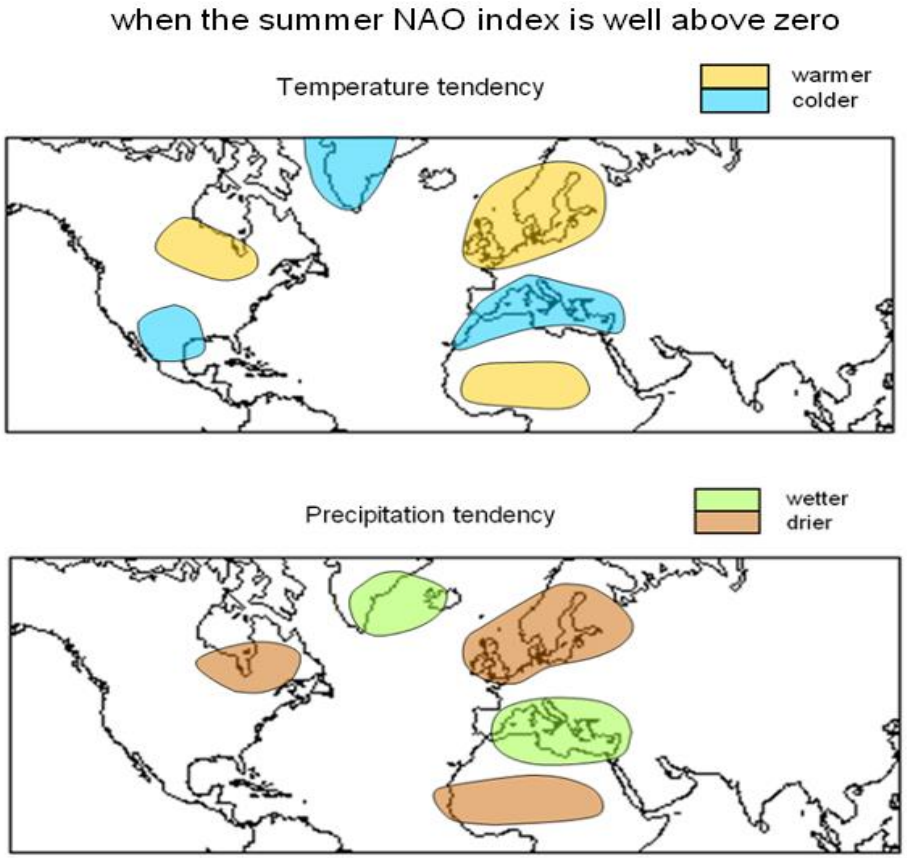


NAO Index is air pressure difference between Gibraltar and Iceland

NAO Index has been high during summer after 2012

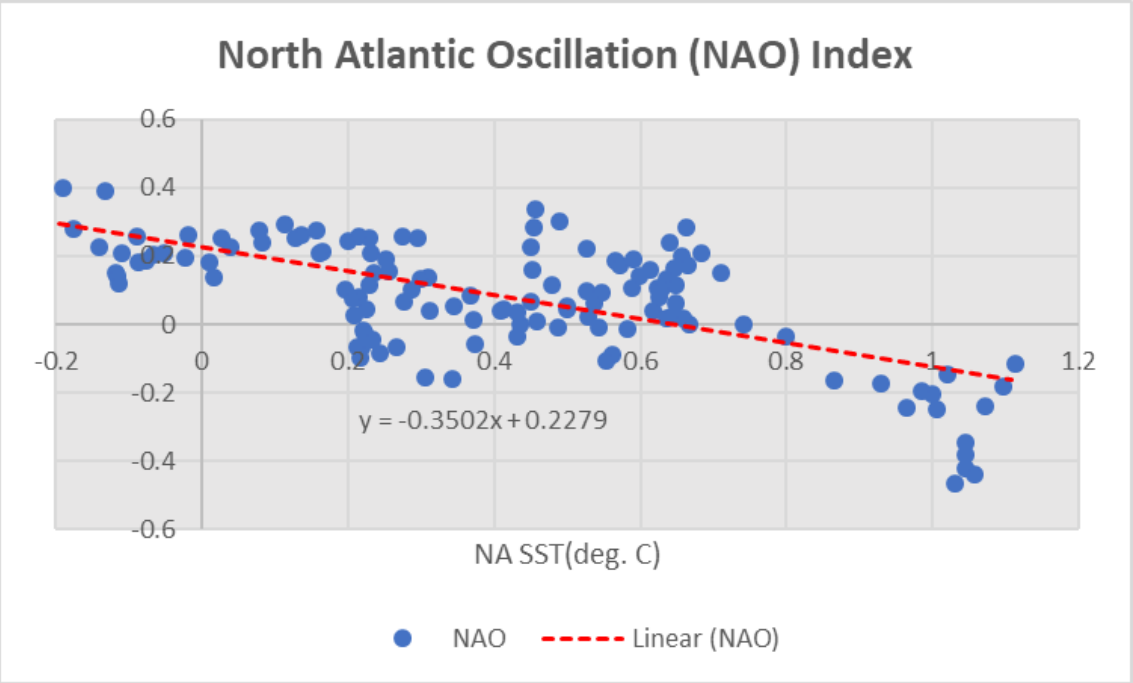


If NAO Index is high during the summer



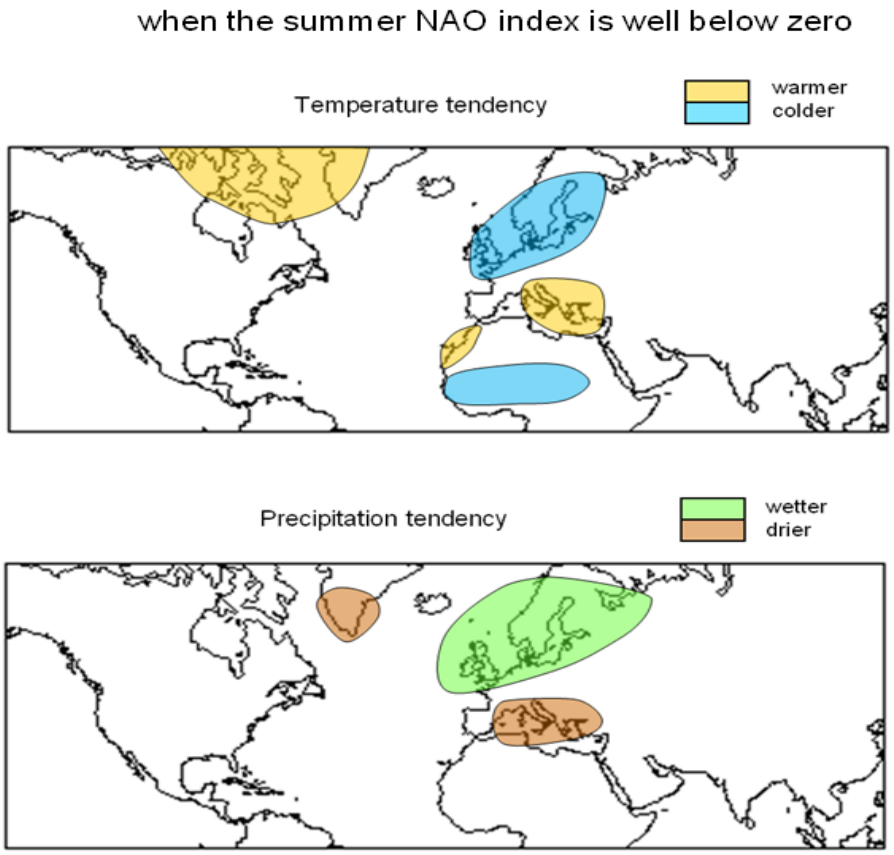
Warm and dry in North-West Europe

North Atlantic Oscillation (NAO) is depenging on SST in North Atlantic



When SST increases, NAO index decreases

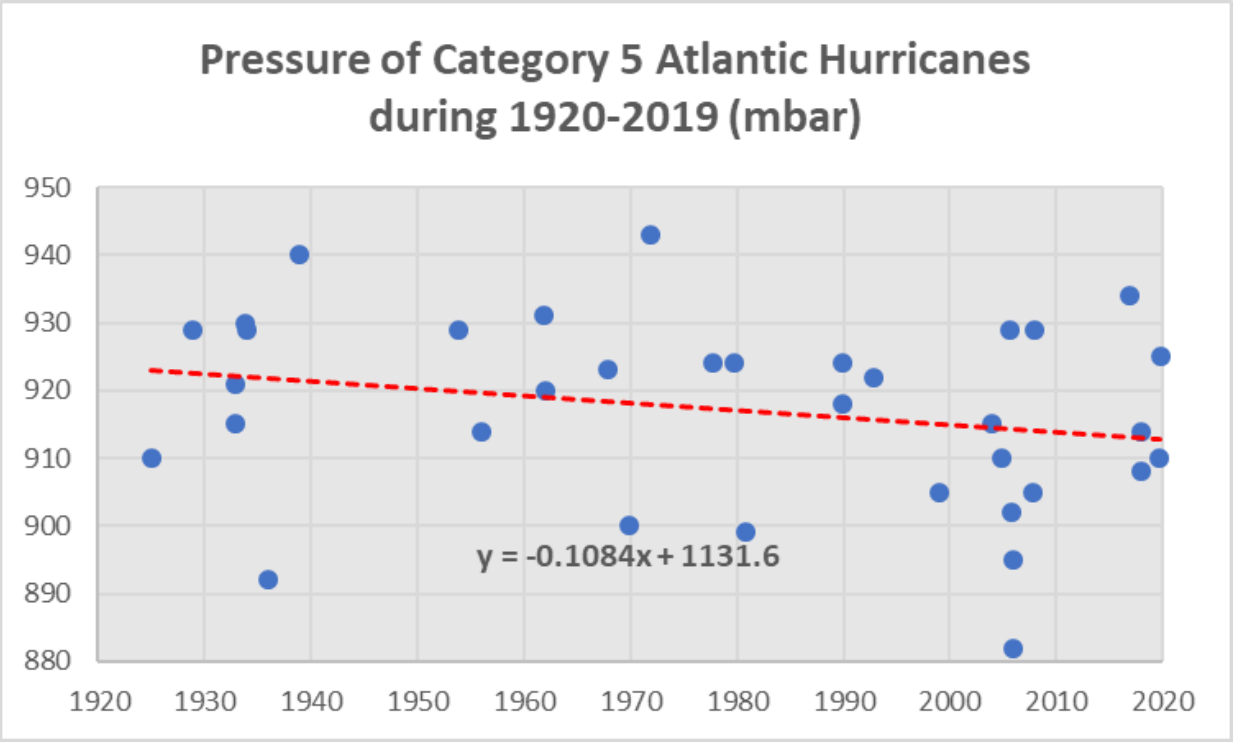
If NAO Index is low during the summer



Colder and wetter in North-West Europe

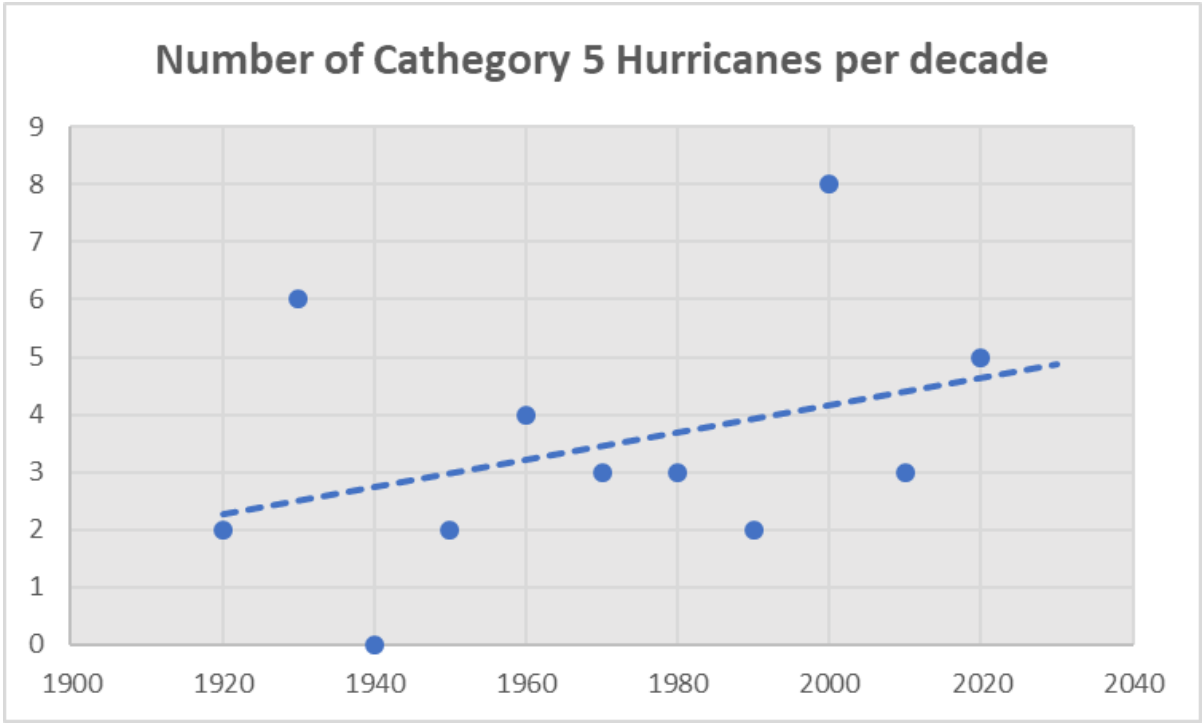
4. Atlantic Hurricanes

Strength of Category 5 Hurricanes is increasing



Pressure has been dropping 1.1 mbar/decade

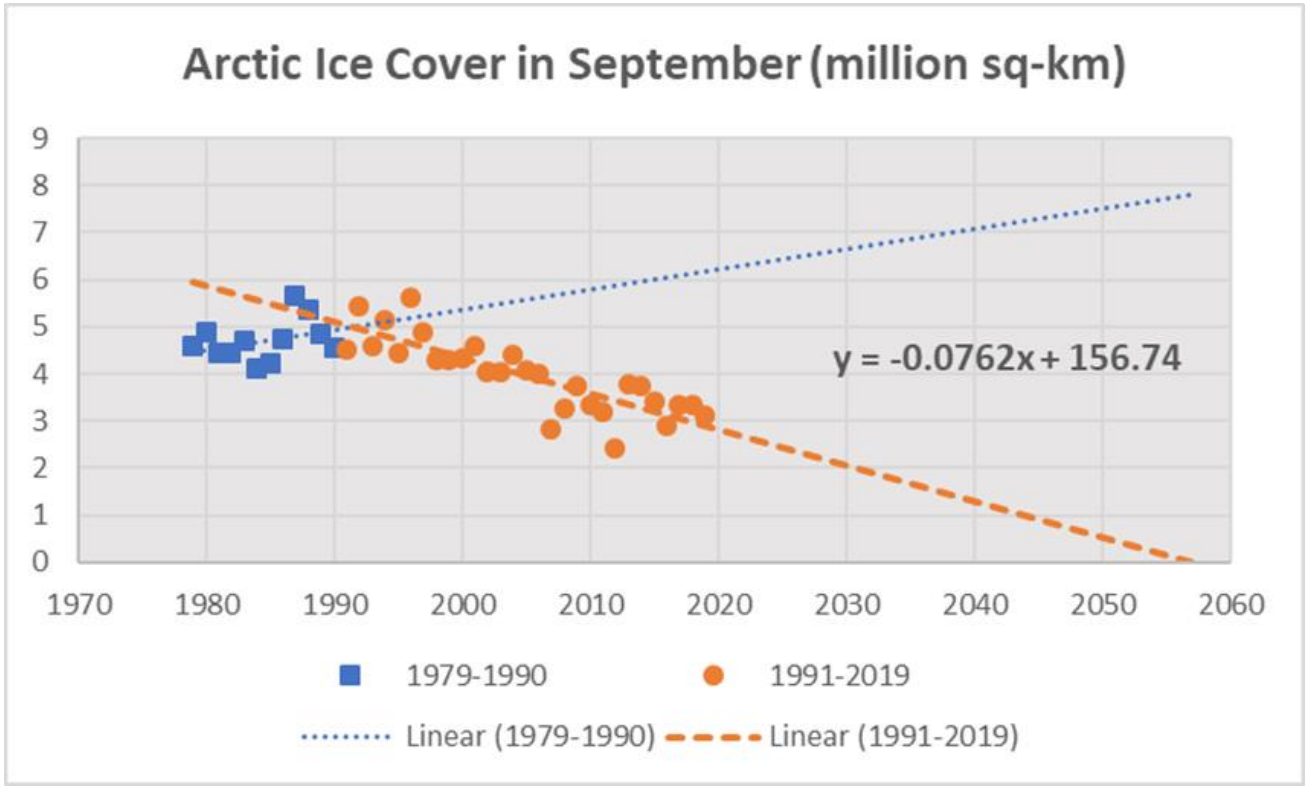
Number of Category 5 Hurricanes is increasing



There have been 16 category 5 hurricanes after the year 2000 (one/year). Only 10 between 1925 – 1960 (0.3/year)

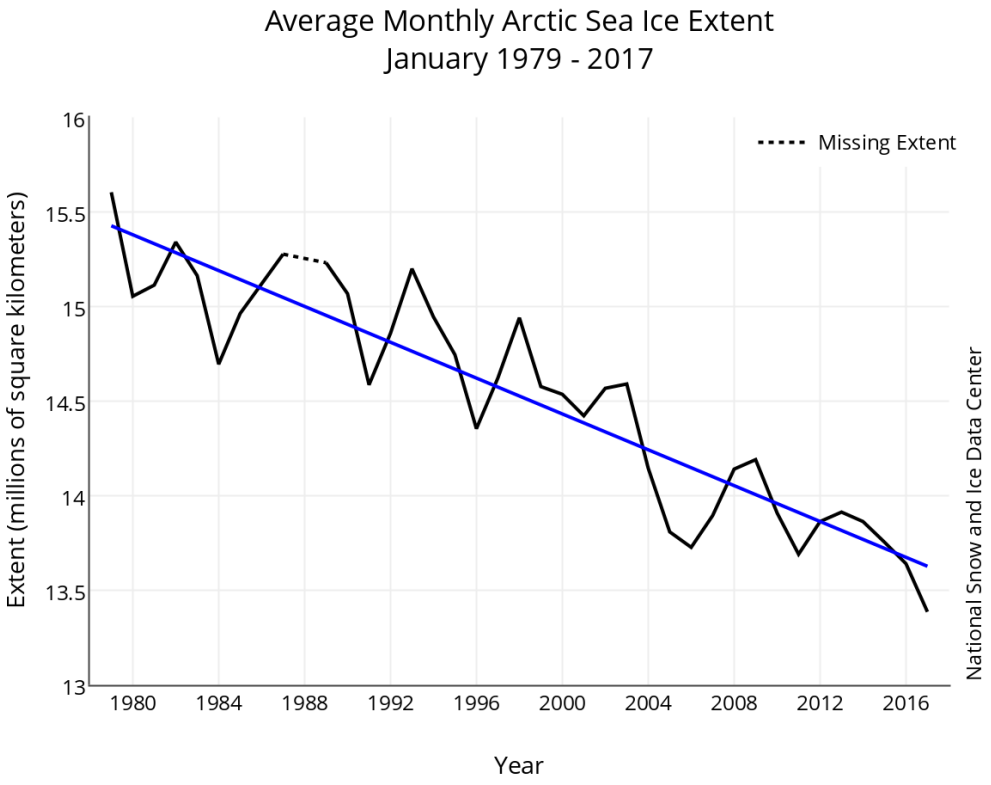
5. SEA ICE AND GLAZIERS

Arctic sea ice extend has been declining 0.8 million sq-km / decade

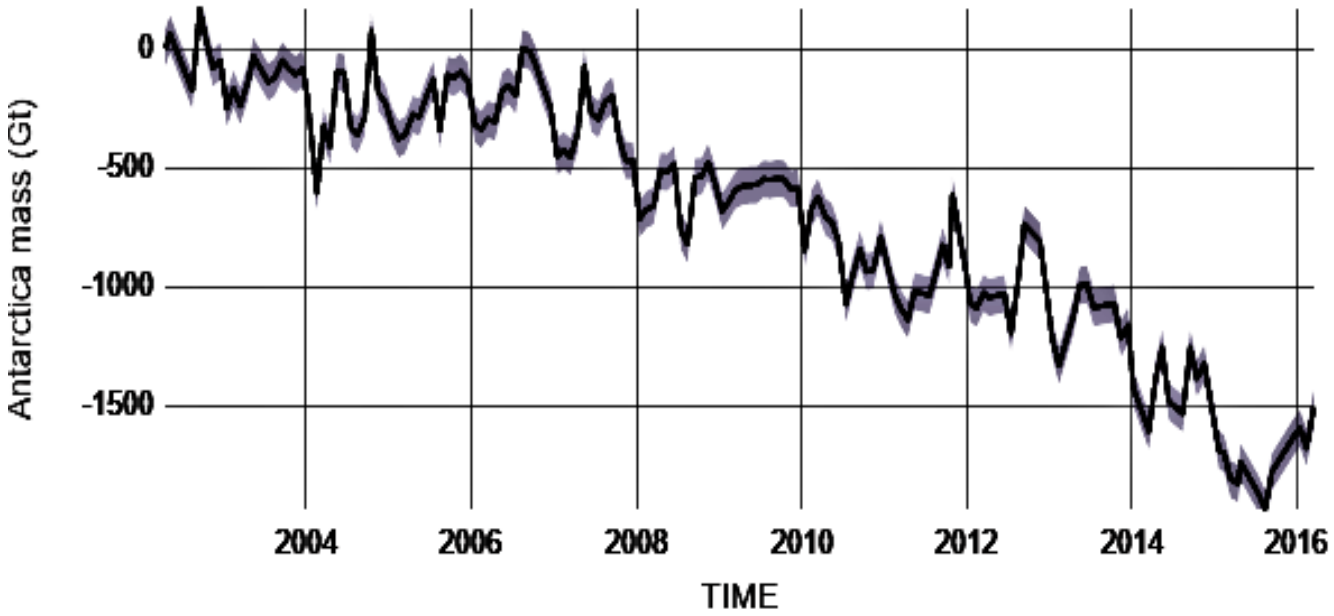


There will be no ice in Arctic seas in September by 2060.

January sea ice extend has been declining (2 Mkm2/40 years)

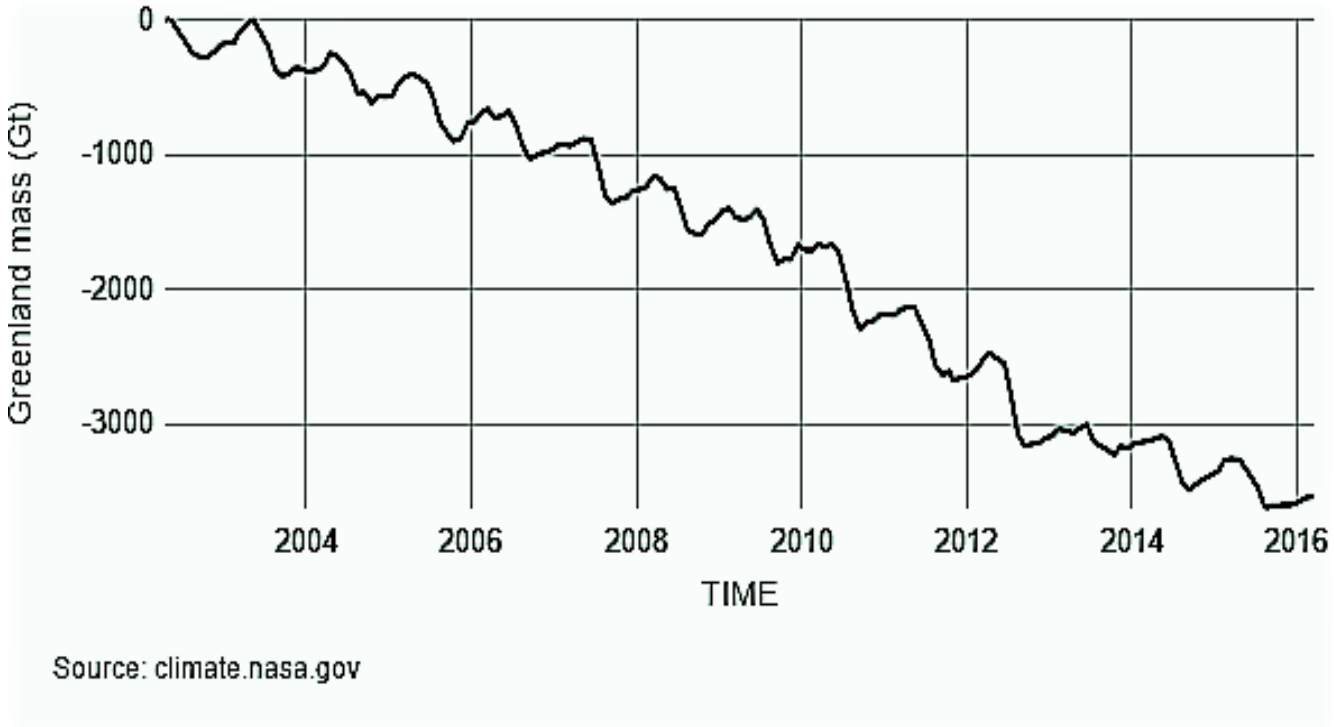


Mass of ice in Antarctica has been declining



Source: climate.nasa.gov

Mass of ice in Greenland has been declining

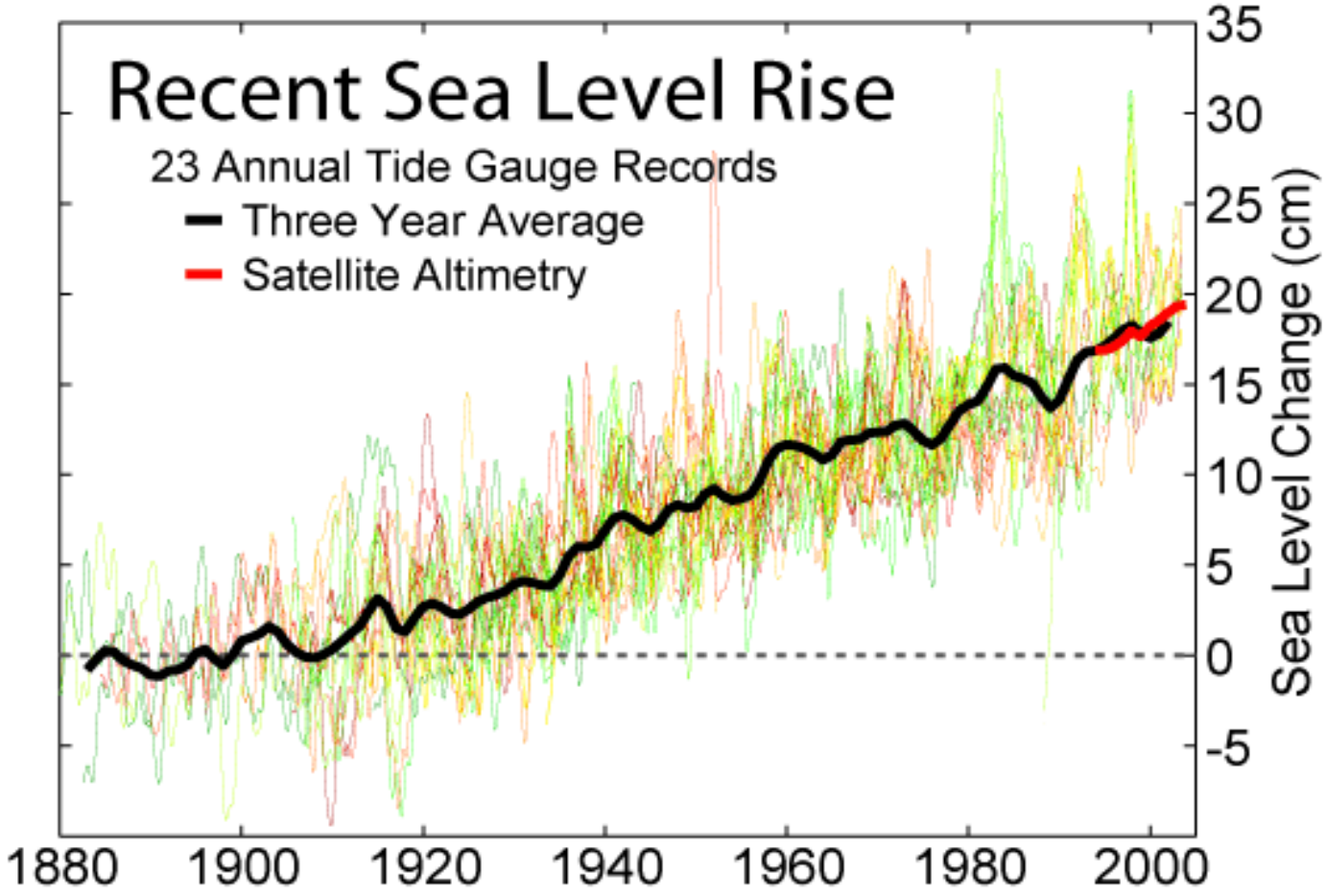


Loss of ice has been 658 Gt/yr. Equivalent of 1.8 mm/yr. sealevel rise

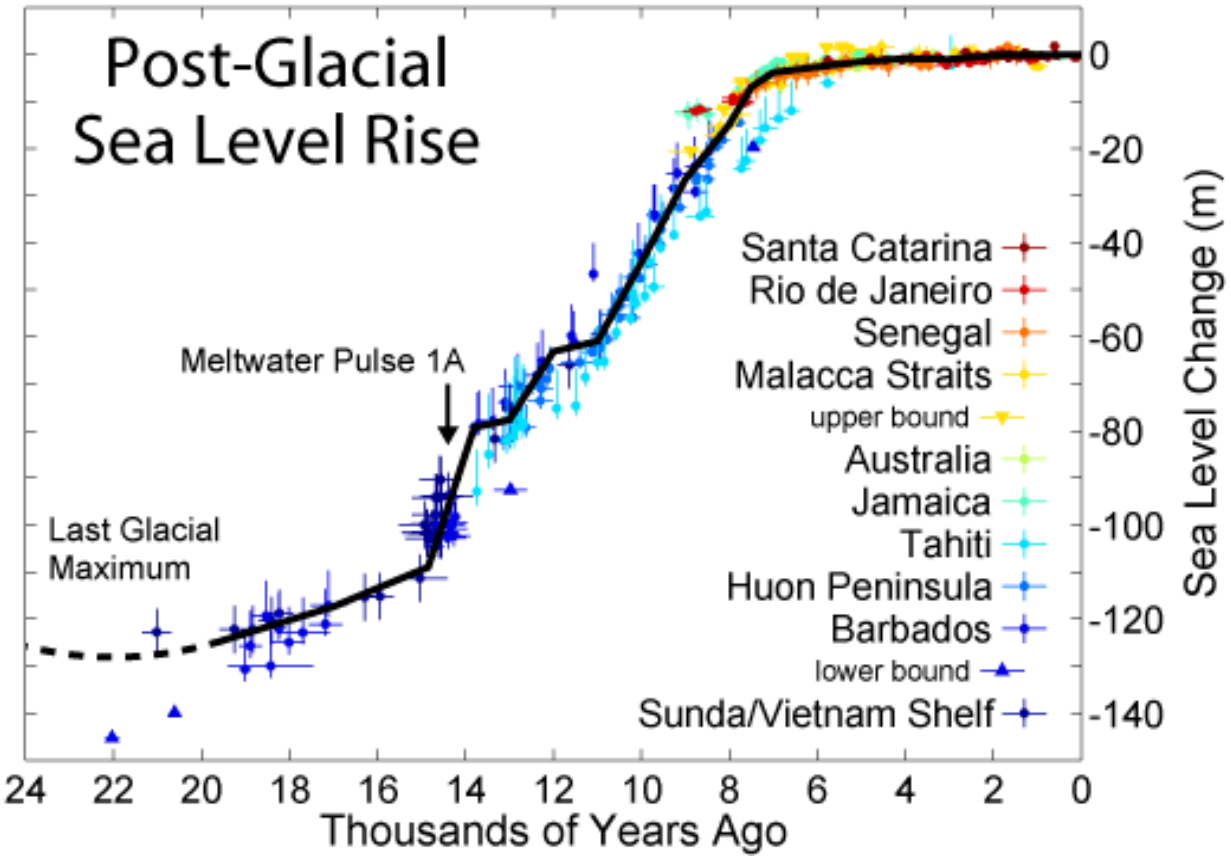
		Antarctica	Greenland	Glaziers	Total
Sealevel equivalent					
Volume of water	M cub.km	24.33	2.61	0.15	27.44
Area of seas	M sq.km	361.8	361.8	361.8	361.8
Equivalent sea rise	m	67.2	7.2	0.4	75.8
Change in ice mass					
Loss of ice mass	Gt/year	118	281	259	658
Years 2002-2016	cub.km, Gt	1652	3934	3626	9212
Area of seas	M sq.km	361.8	361.8	361.8	361.8
Equivalent sea rise	mm	4.6	10.9	10.0	25.5
	mm/decade	3.3	7.8	7.2	18.2
Time to melt down	thousand years	206	9.3	0.57	42

6. FUTURE DEVELOPMENT

Measured sea level rise has been 18 cm in 100 years or 1.8 mm/yr.

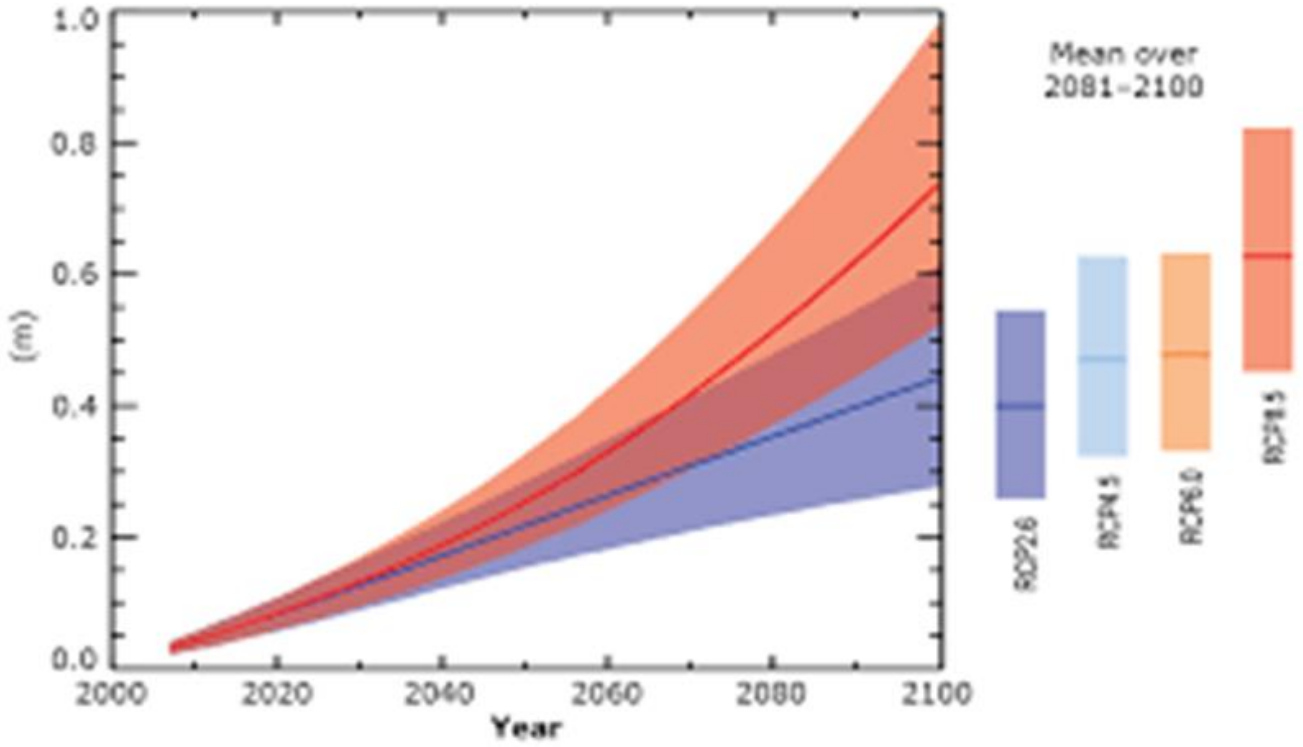


Today's rise of 18 cm/100 years is small compared with 100 m/8000 yr.



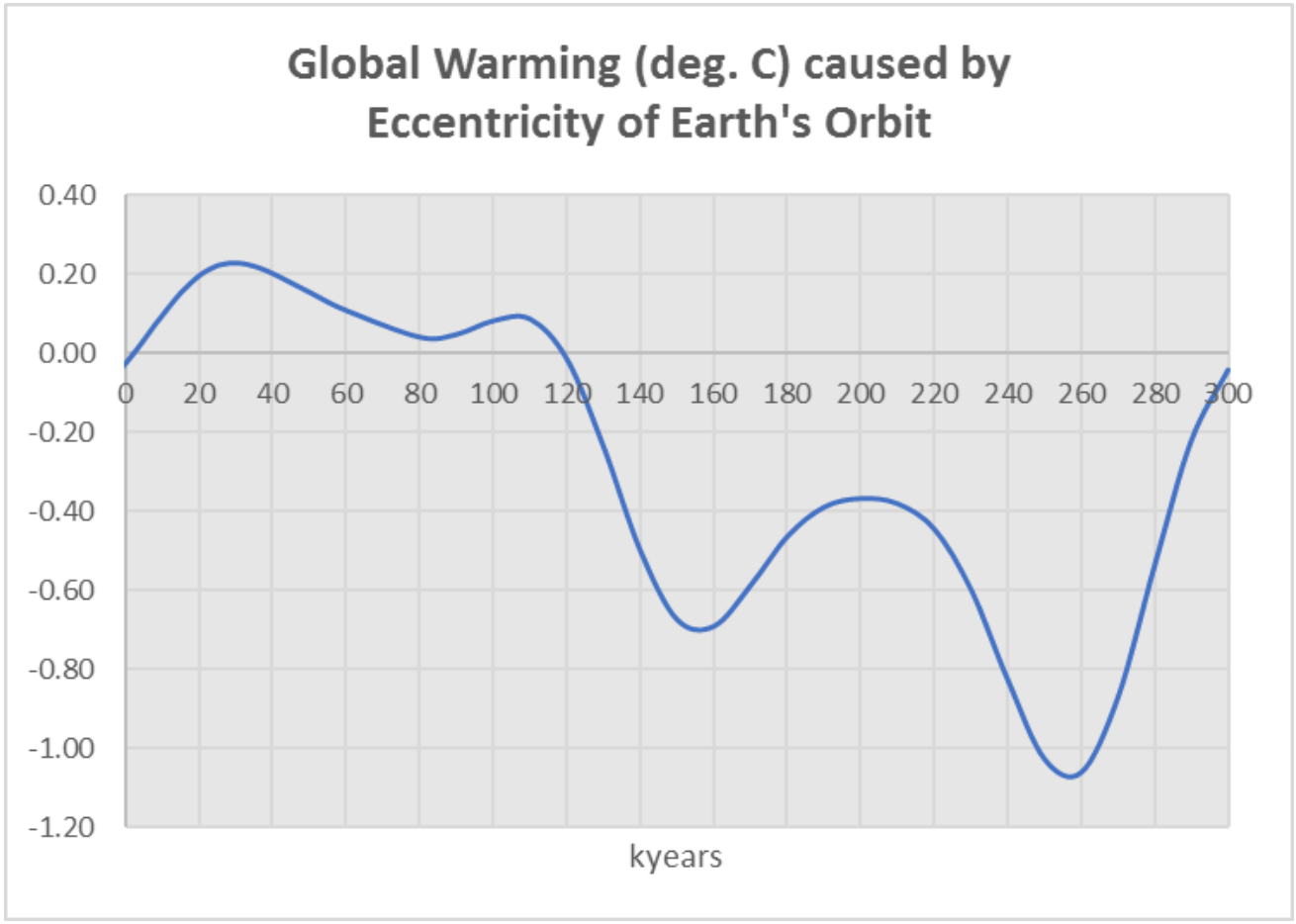
100 m/8000 yr. = 1.25 m/100 years

Future sea level rise will be 30 – 100 cm by 2100



Source: European Environmental Agency 2019

In very long-term cooling will start after 120,000 years from today



New ice age is probably coming after 250,000 years

Global temperature will drop by 1 deg. C by the year 250,000

7. Summary

Seawater temperature has been rising almost as much as the global air temperature

Sewater level has rised 18 cm after 1901 and will be rising about 30-100 cm until the year 2100

The global cooling will start about 120,000 years from today

We could have the next ice age by the year 250,000

Reference

The book

“Fundamentals of Global Warming” can be downloaded from

www.ekoenergo.fi