A very different interpretation of the Keeling curve carbon dioxide data

by Stephen Andrews

My background:

- Training / education has been in primarily in science studying biochemistry / chemistry
- I worked in the pharmaceutical industry as an analyst and in the quality assurance sector
- Substack and Daily Sceptic author

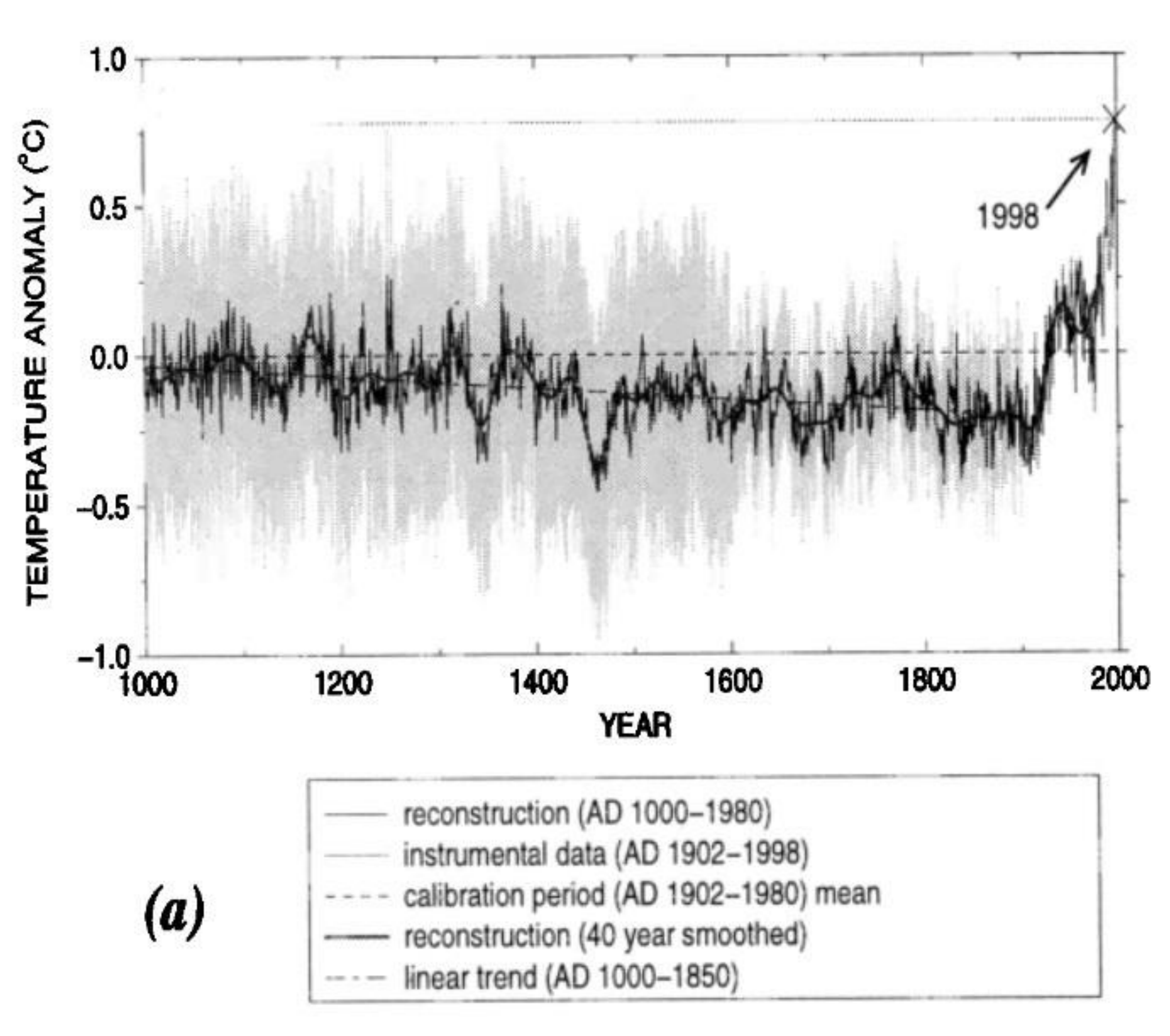
My previous presentations (#253 Oct 16, 2024 & #275 Jan 28, 2025) on Tom's podcast covered the following:

- My data driven journey from a climate change doom monger to an anthropogenic (CO^2) climate change "denier"
- I concluded that cosmic rays and heat transport are the primary drivers of recent climate change.

This presentation provides further data in support of these two theories but also provides evidence that one of the cornerstones of the climate change narrative is going to collapse.

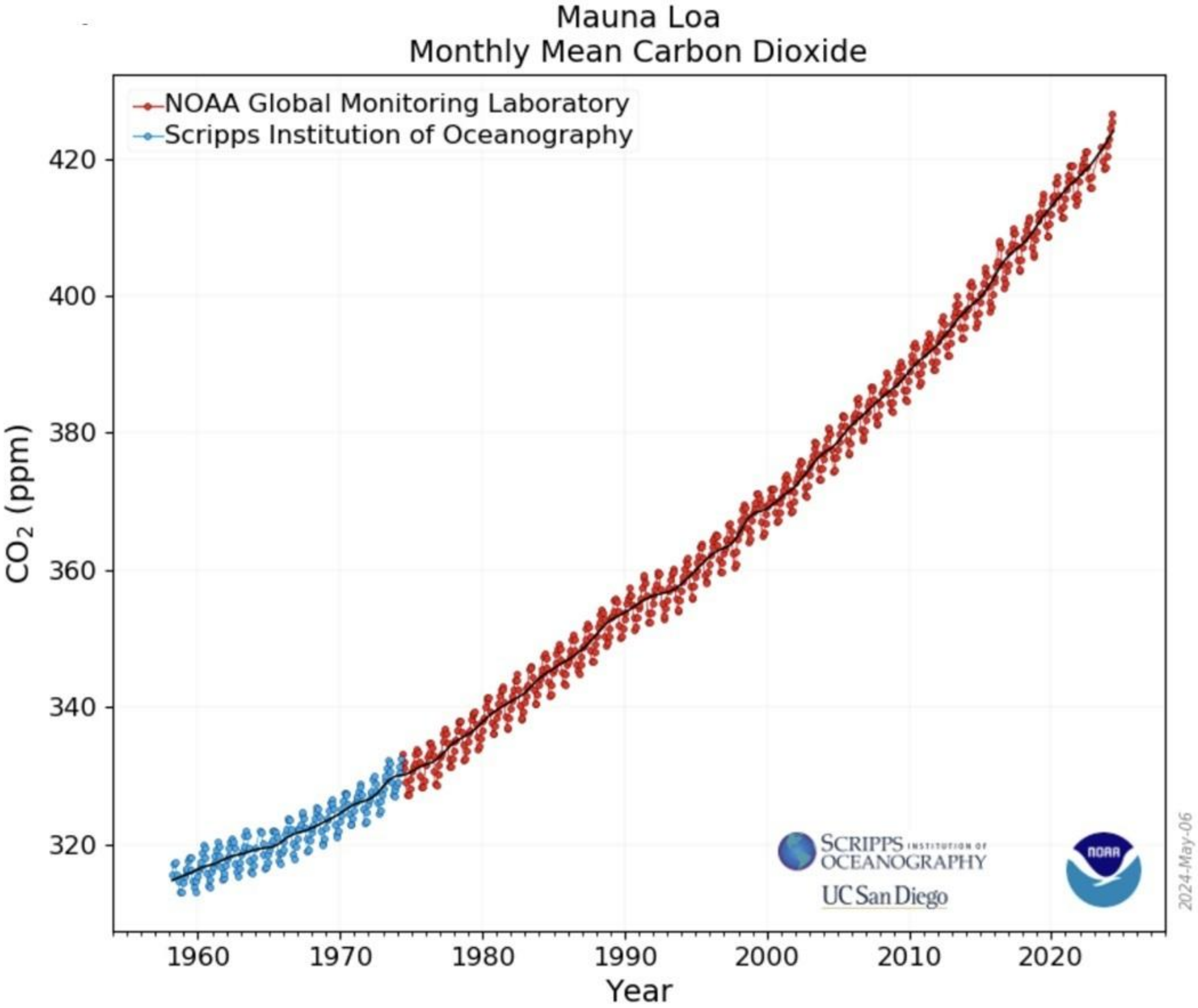
Foundations of the accepted climate change narrative are represented by the following graphs.

The Mann Hockey stick:

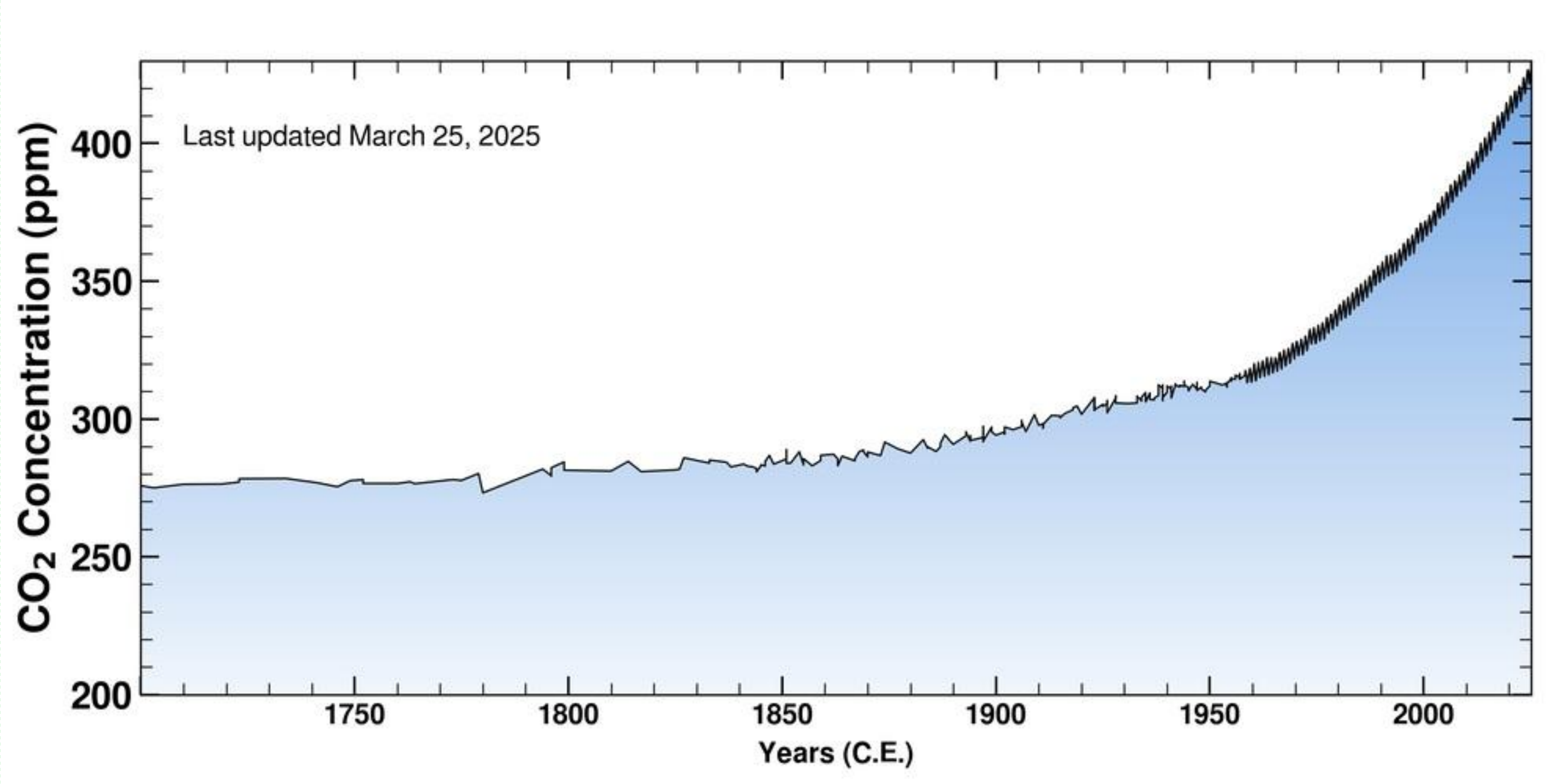


The Keeling curve:

(NOAA – National Oceanic Atmospheric Association)

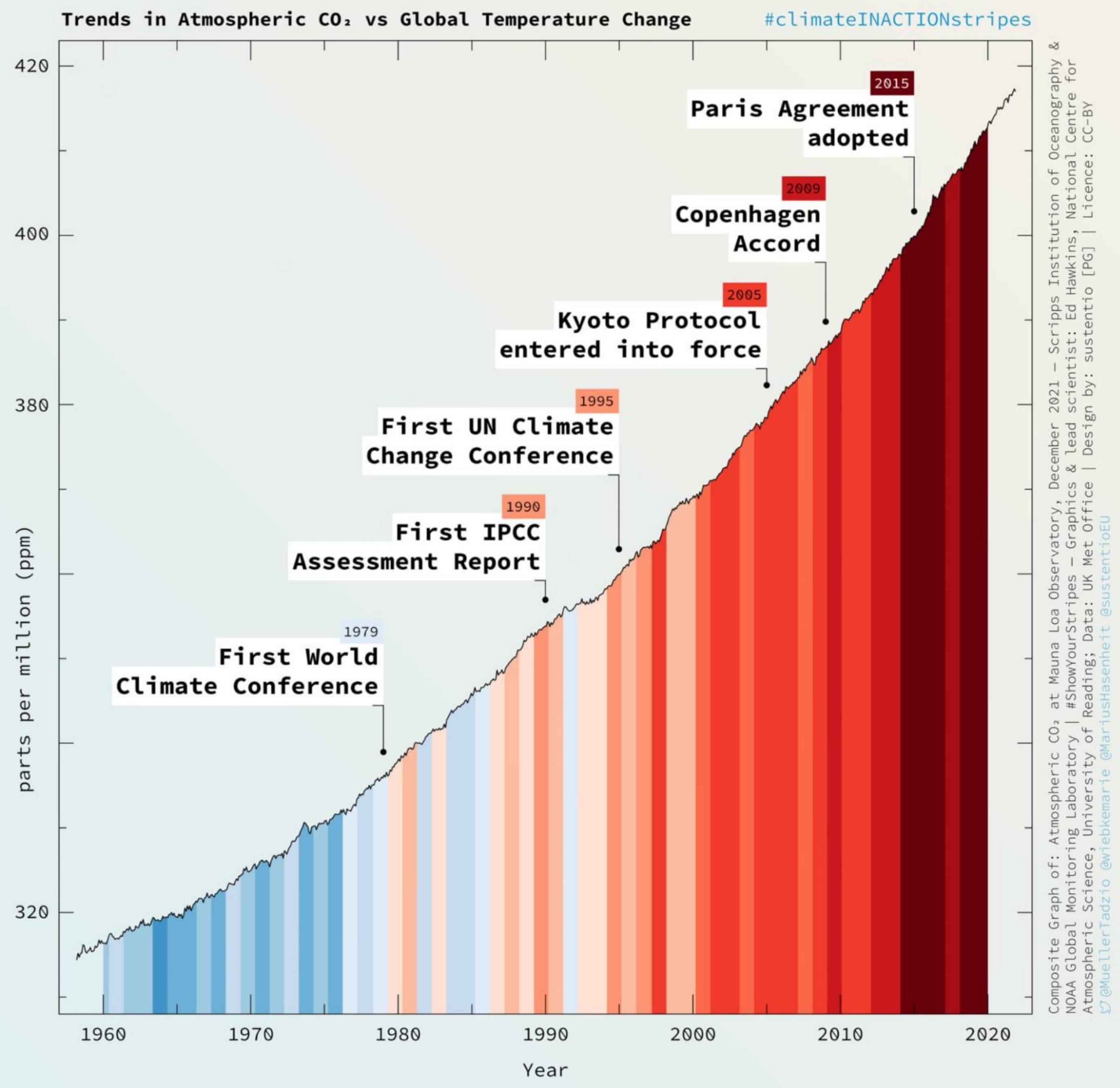


More often the Keeling curve is represented in an extended form using carbon dioxide determined from ice cores:



Depiction of the Keeling curve with temperature bars

(Extinction Rebellion – Climate Inaction Stripes)

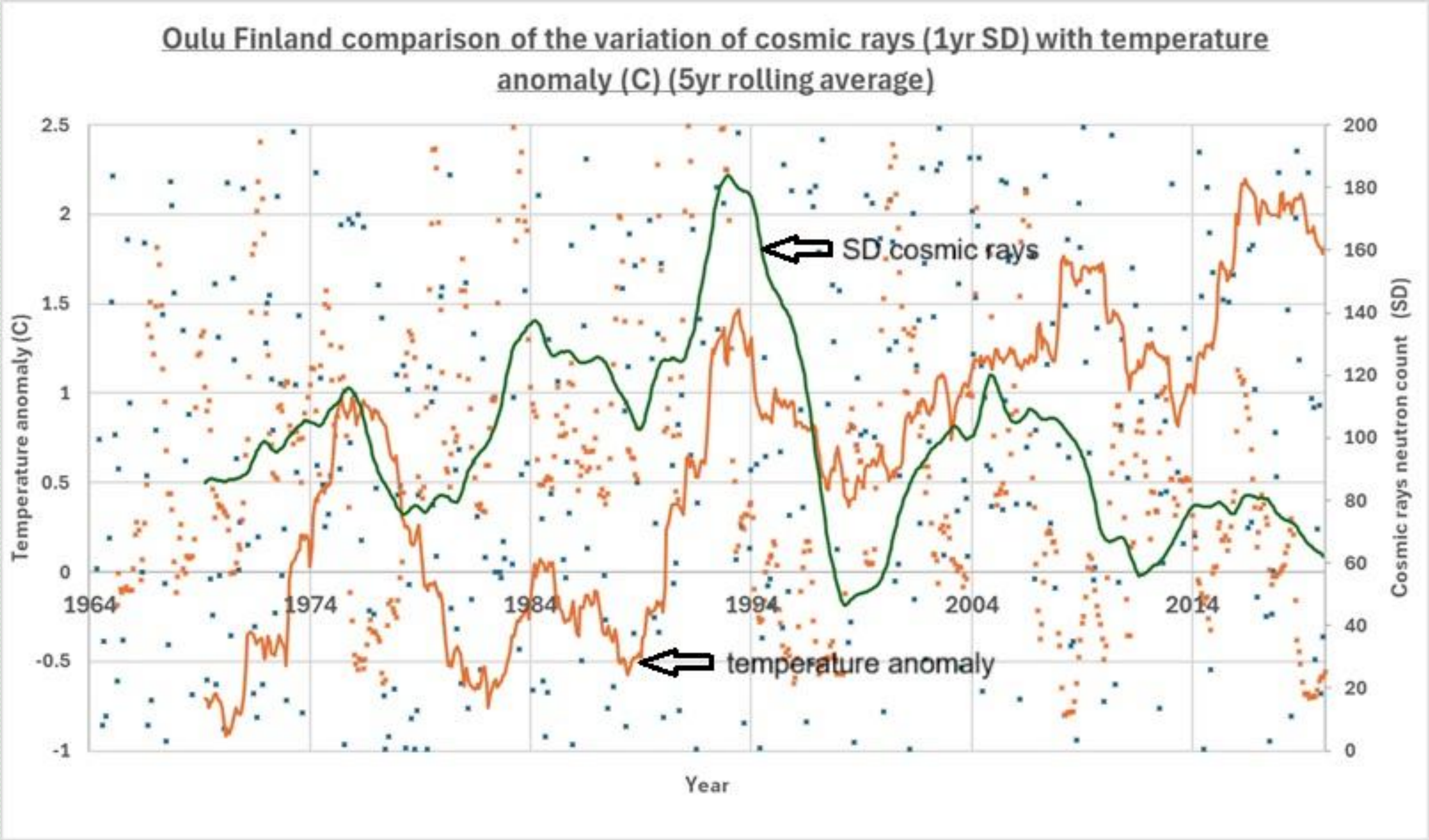


The hypothesis of how cosmic rays influence our climate:

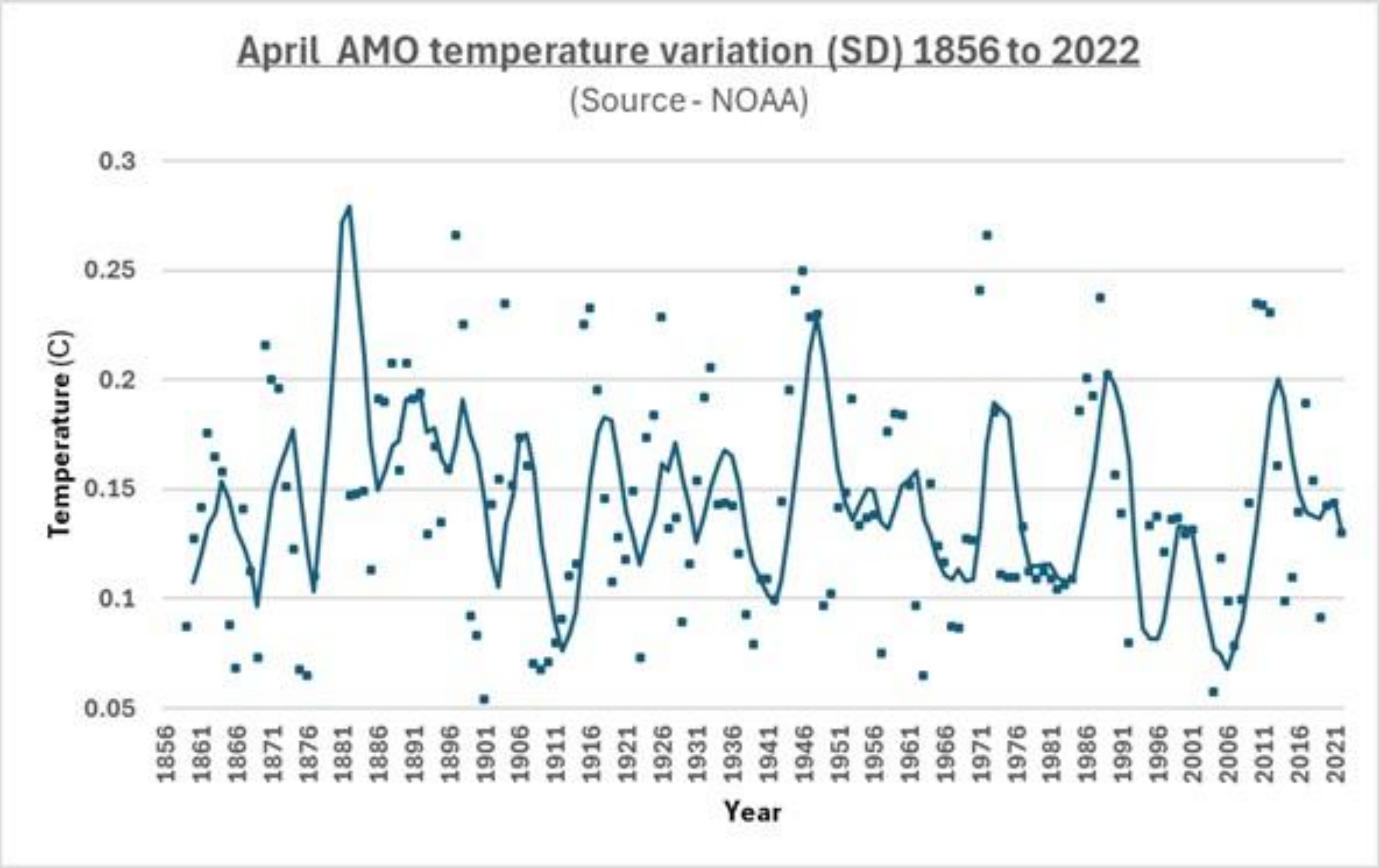
Cosmic rays are continually striking the earth. Their intensity varies with altitude. They create nuclei due to the interaction with the atmosphere which are fundamental to cloud formation. Clouds have a nett cooling affect and therefore they have an impact on our climate. Solar cycles, through magnetic shielding of the earth, cause deviation of cosmic rays and consequencly this is reflected in global temperatures.

Method of finding a solar signal in a dataset which is based on the cosmic ray theory (#275 for more detail):

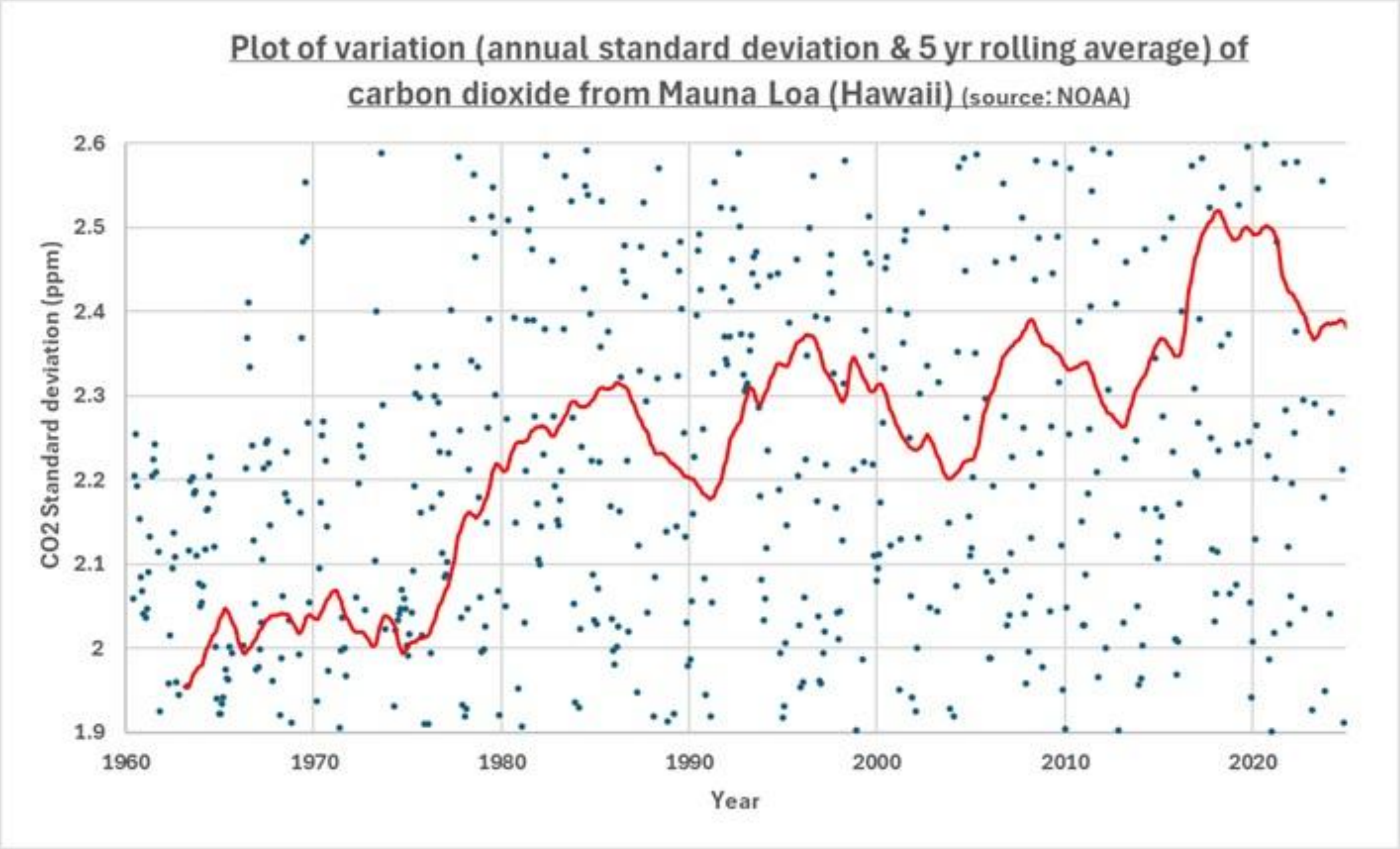
I previously established that using a 1 year standard deviation as a measure of the variation and smoothing the dataset using a 5 year rolling average there was a good correlation between cosmic rays and temperature. This correlation was established for AMO sea surface temperatures and a direct comparison with Oulu data from Finland. Here are those two graphs making that comparison:


Oulu Finland comparison of the variation of cosmic rays (1yr SD) with temperature anomaly (C) (5yr rolling average)
SD cosmic rays
temperature anomaly
Temperature anomaly (C)
Cosmic rays neutron count (SD)
Year
2.5
2
1.5
1
0.5
0
-0.5
-1
200
180
160
140
120
100
80
60
40
20
0
1964
1974
1984
1994
2004
2014

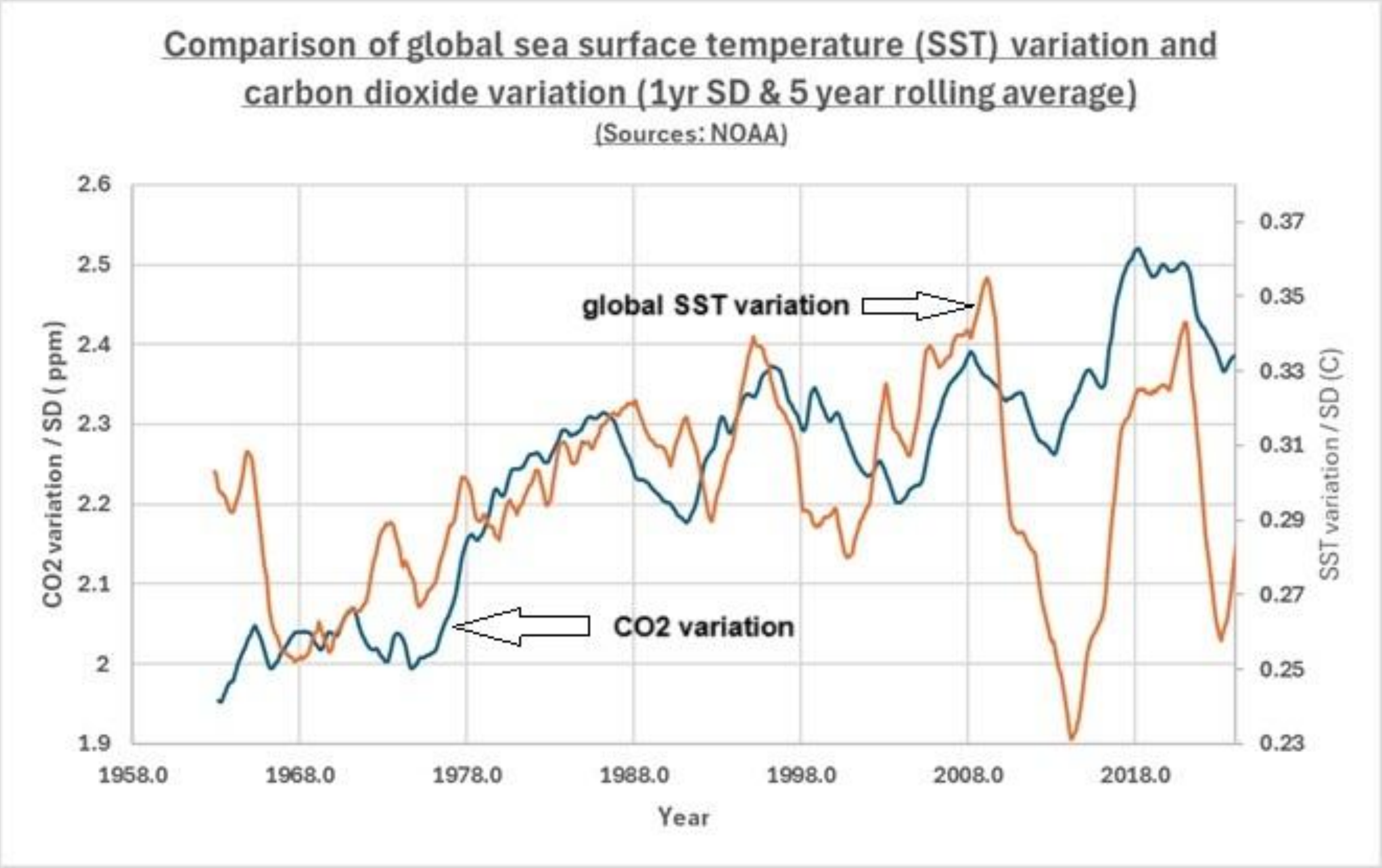
Graph demonstrating strong cycling of AMO sea surface temperature for April:



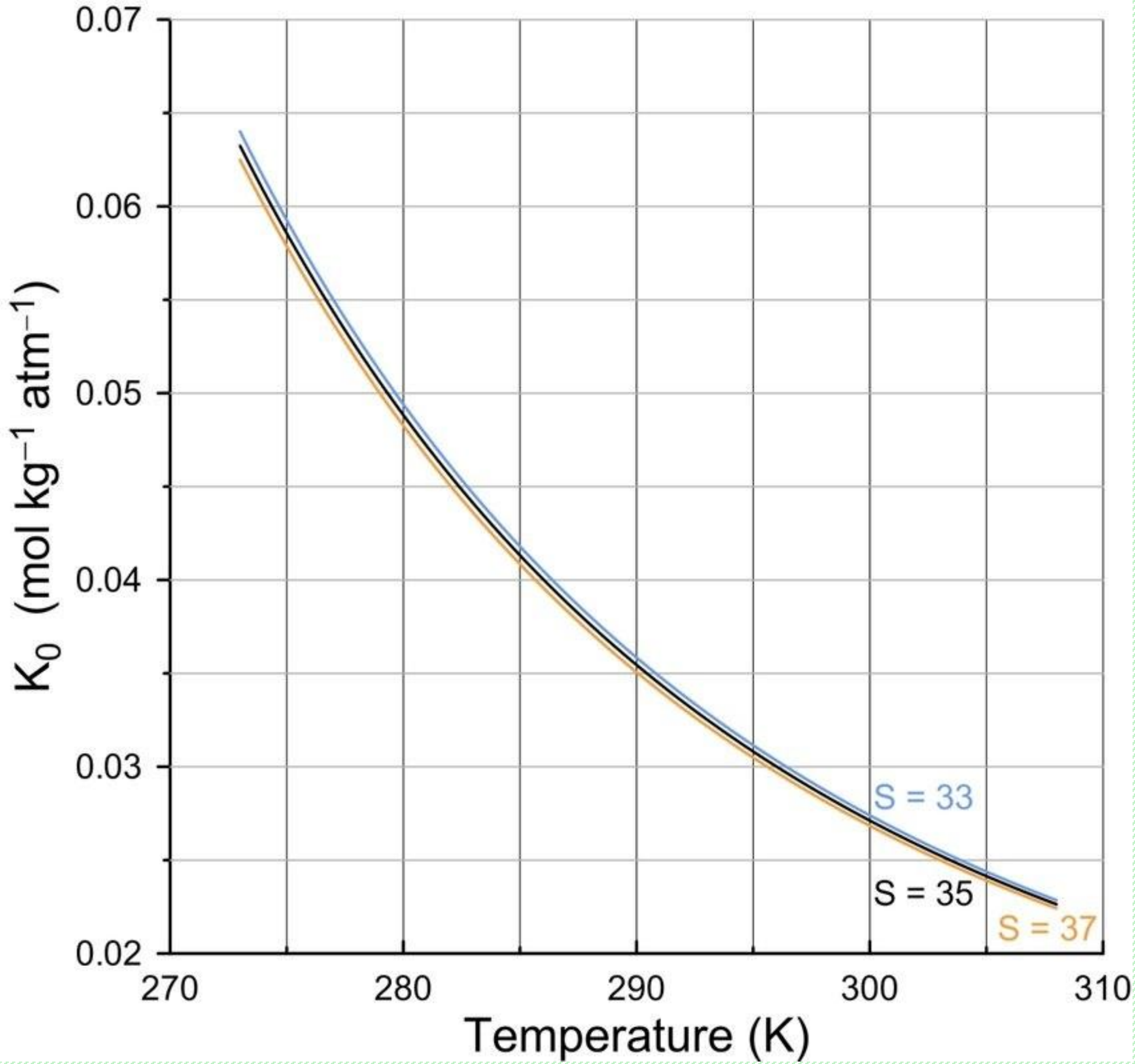
Applying the variation analysis to the Mauna Loa CO2 data:



A direct comparison with sea surface temperature variation and carbon dioxide variation:



This all aligns with the fact that carbon dioxide dissolves in water which is related to temperature and pressure:



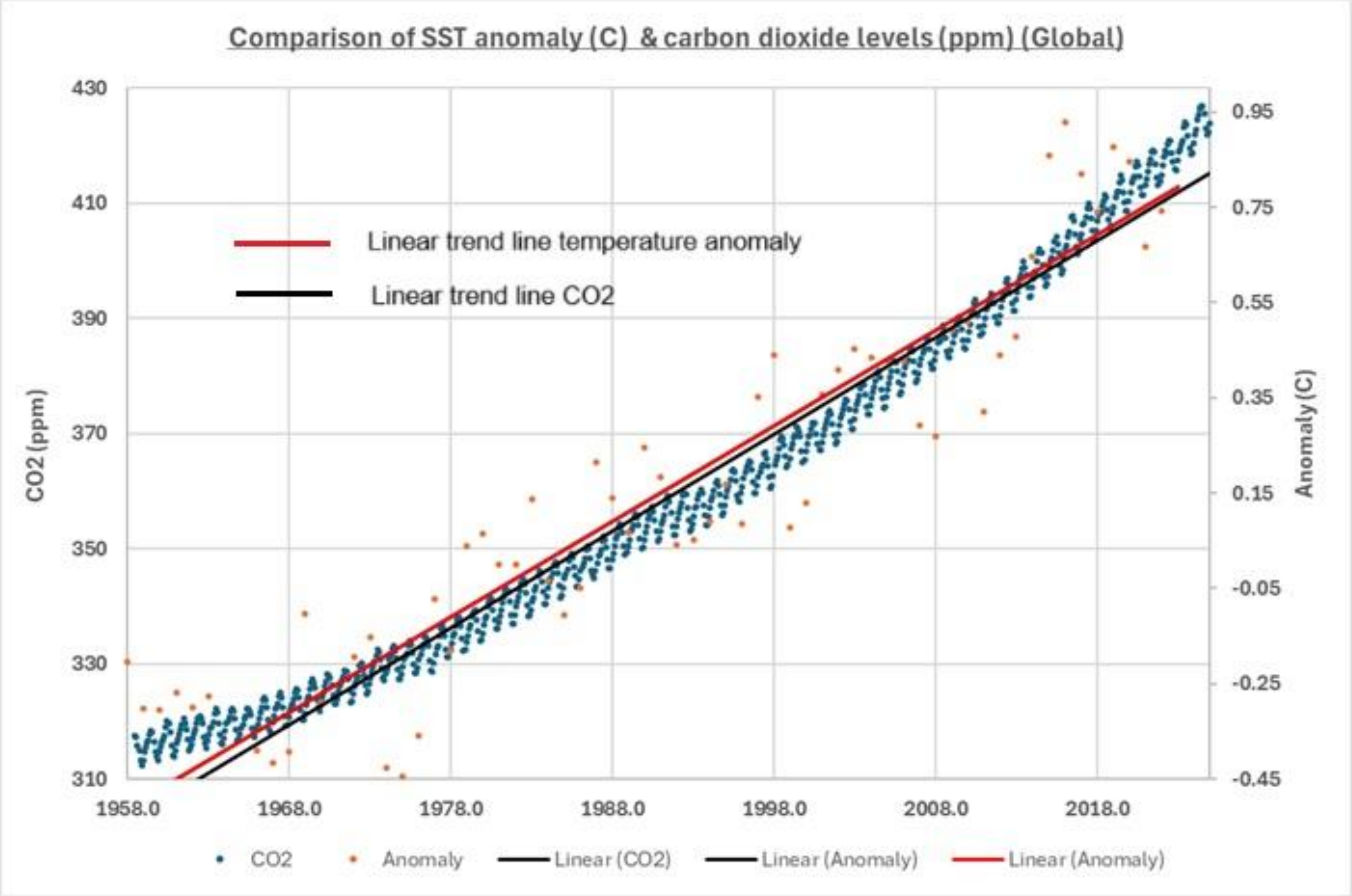
General perspective on the influence of oceans on the earth's climate:

This is from a a paper by Stuart Harris (2023 - Comparison of Recently Proposed Causes of Climate Change)

Thermal Properties of the Earth's Surface

A total of 70% of the Earth's surface consists of water, with the remainder being land (rock, soil, or ice). The albedo of ice ranges from 0.5 to 0.7, so ice- and snow-covered surfaces reflect much of the incoming solar radiation back into space. Water has a very high heat capacity (4.187 mJ/m^3 K), so it can store or transport large quantities of heat in a given volume of water. In addition, it absorbs over five times as much heat as soil or rock since it is translucent. Currents, convection, and wave action mix the water, whereas transmission into a rock or sediment must be by conduction. Reradiation only occurs in the surface layer (water or land).

Linear correlation between the global SST and CO2 data (NOAA):



THE HISTORICAL DATA THE IPCC IGNORED 180 Years of Atmospheric CO2 Measurement By Chemical Methods (Ernst Georg Beck - 2008)

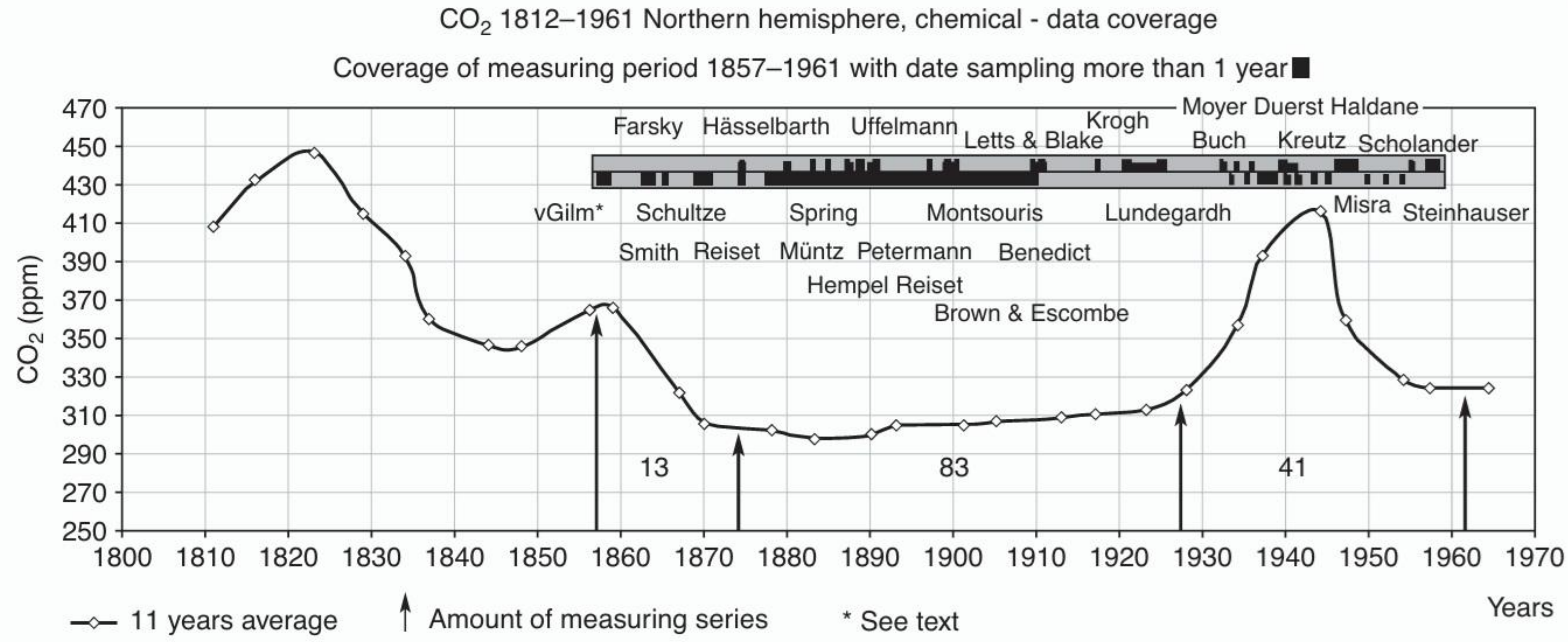
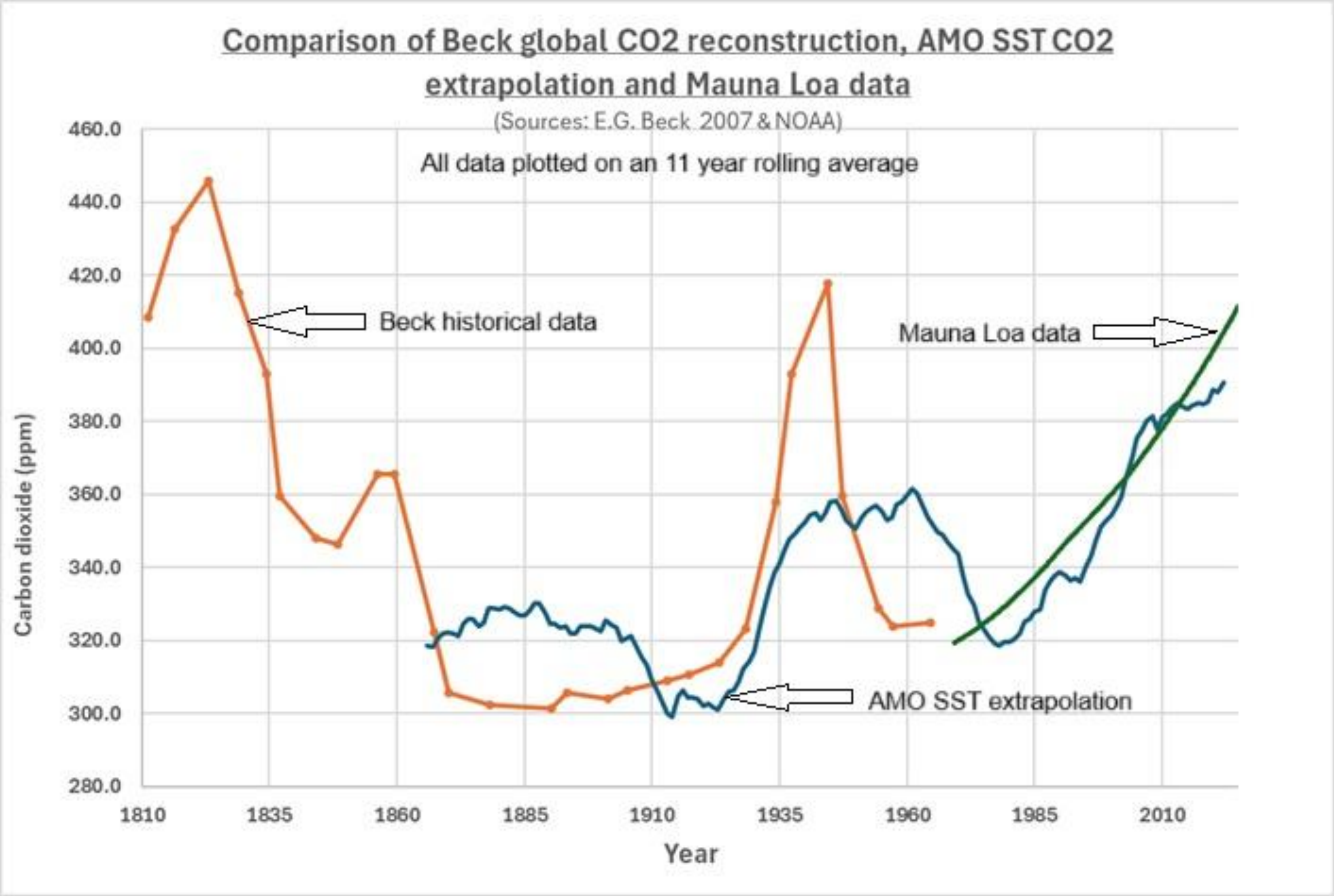
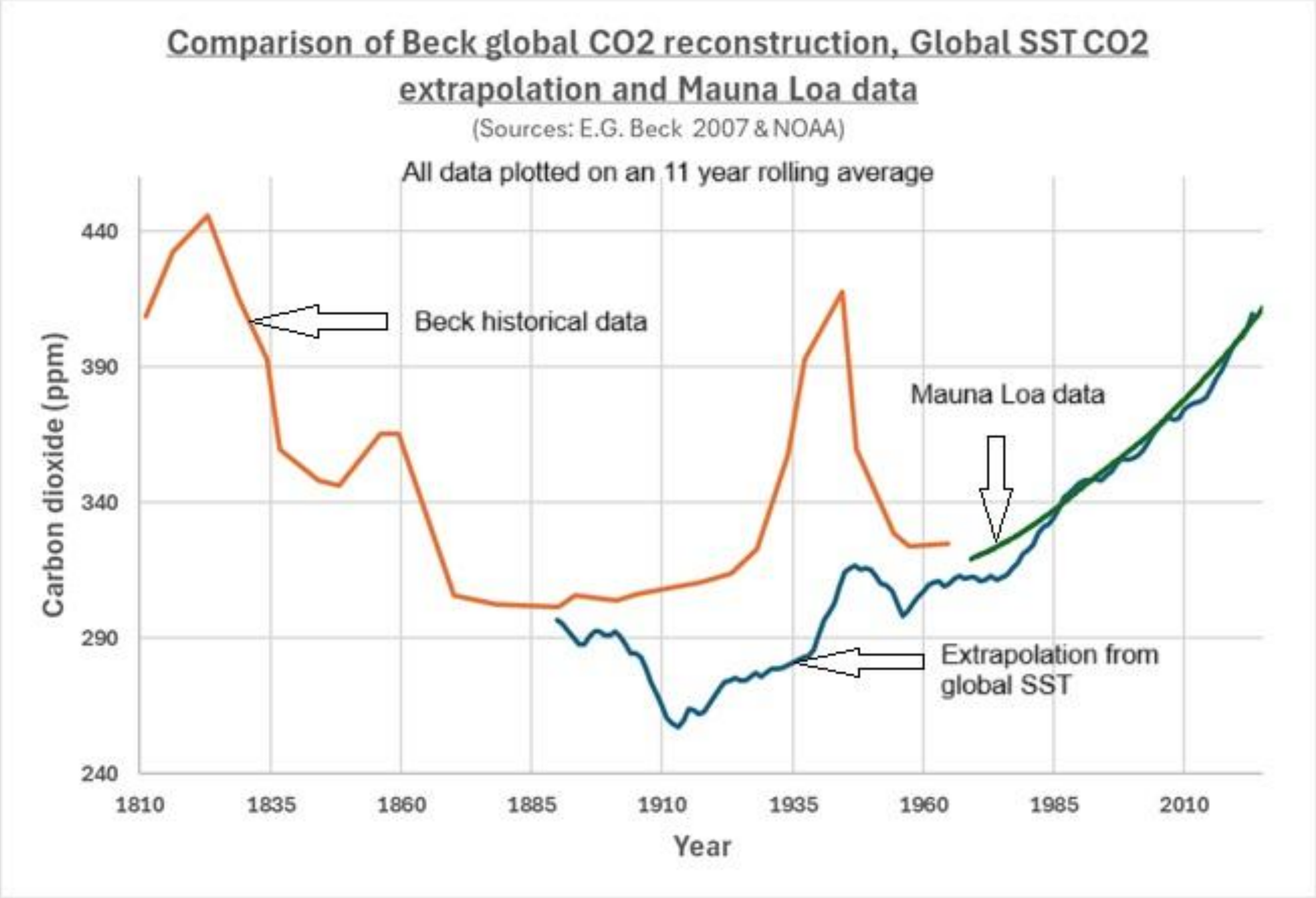


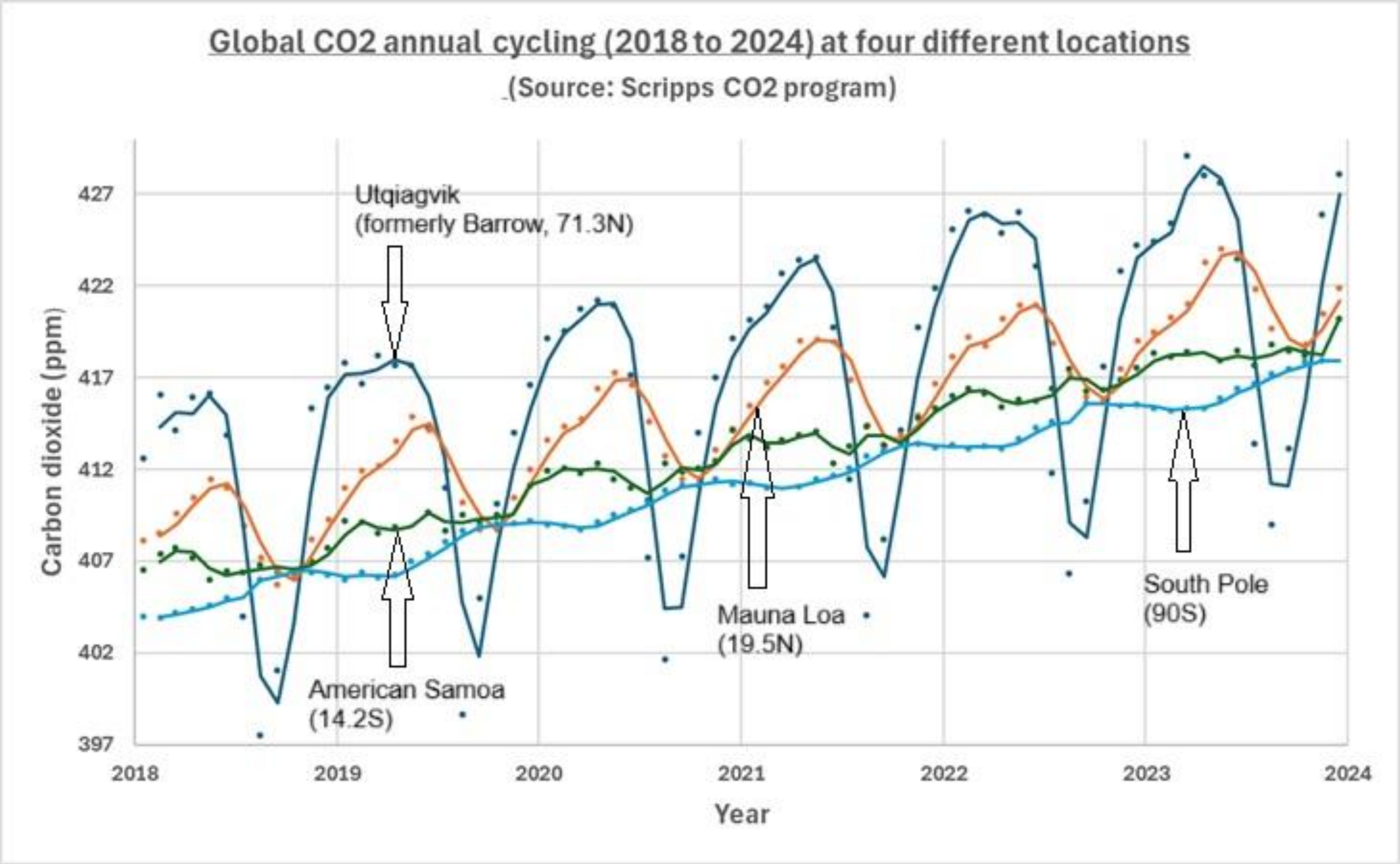
Figure 11: Local CO_2 concentration for the northern hemisphere, determined through chemical analysis between 1812 and 1861. Data plotted as an 11 year average. Data coverage and important scientists indicated in dark grey/black. The curve delineates three major maxima in CO_2 content, though the one situated around 1820 must be treated as provisional only. Data series used: time window 1857–1873: 13 yearly averages, 83 until 1927 and up to 1961 41 data records (eleven interpolated).

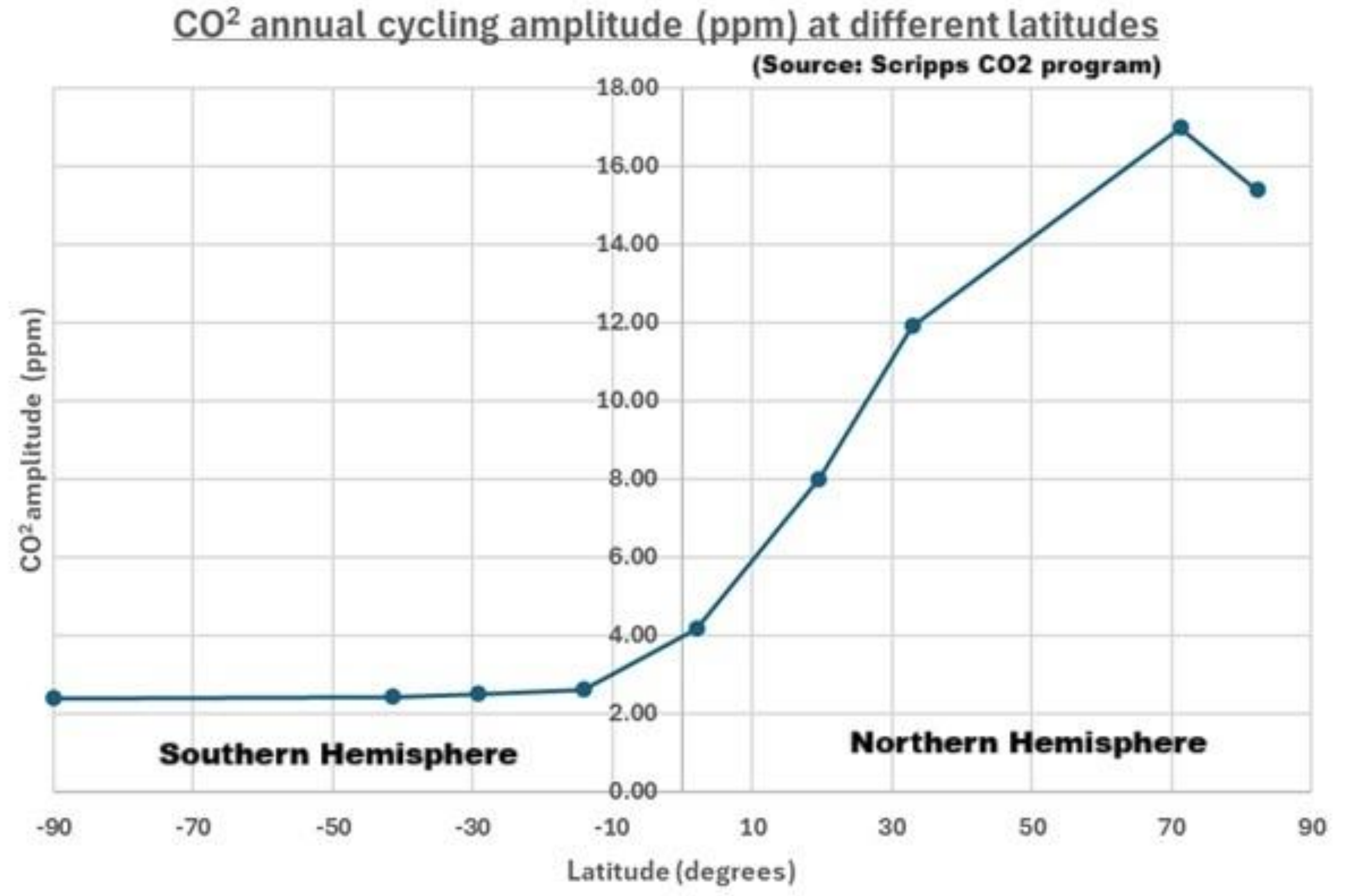
Plotting the three datasets:




Comparison of Beck global CO2 reconstruction, Global SST CO2 extrapolation and Mauna Loa data
(Sources: E.G. Beck 2007 & NOAA)
All data plotted on an 11 year rolling average
Beck historical data
Mauna Loa data
Extrapolation from global SST
Carbon dioxide (ppm)
440
390
340
290
240
1810
1835
1860
1885
1910
1935
1960
1985
2010
Year

Annual cycling of carbon dioxide at different latitudes:




CO2 annual cycling amplitude (ppm) at different latitudes
(Source: Scripps CO2 program)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
CO2 amplitude (ppm)
Southern Hemisphere
Northern Hemisphere
-90
-70
-50
-30
-10
10
30
50
70
90
Latitude (degrees)

What is the accepted narrative explaining this annual cycling? This is taken directly from the NOAA site:

The seasonal cycle of highs and lows (small peaks and valleys) is driven by Northern Hemisphere summer vegetation growth, which reduces atmospheric carbon dioxide, and winter decay, which increases it.

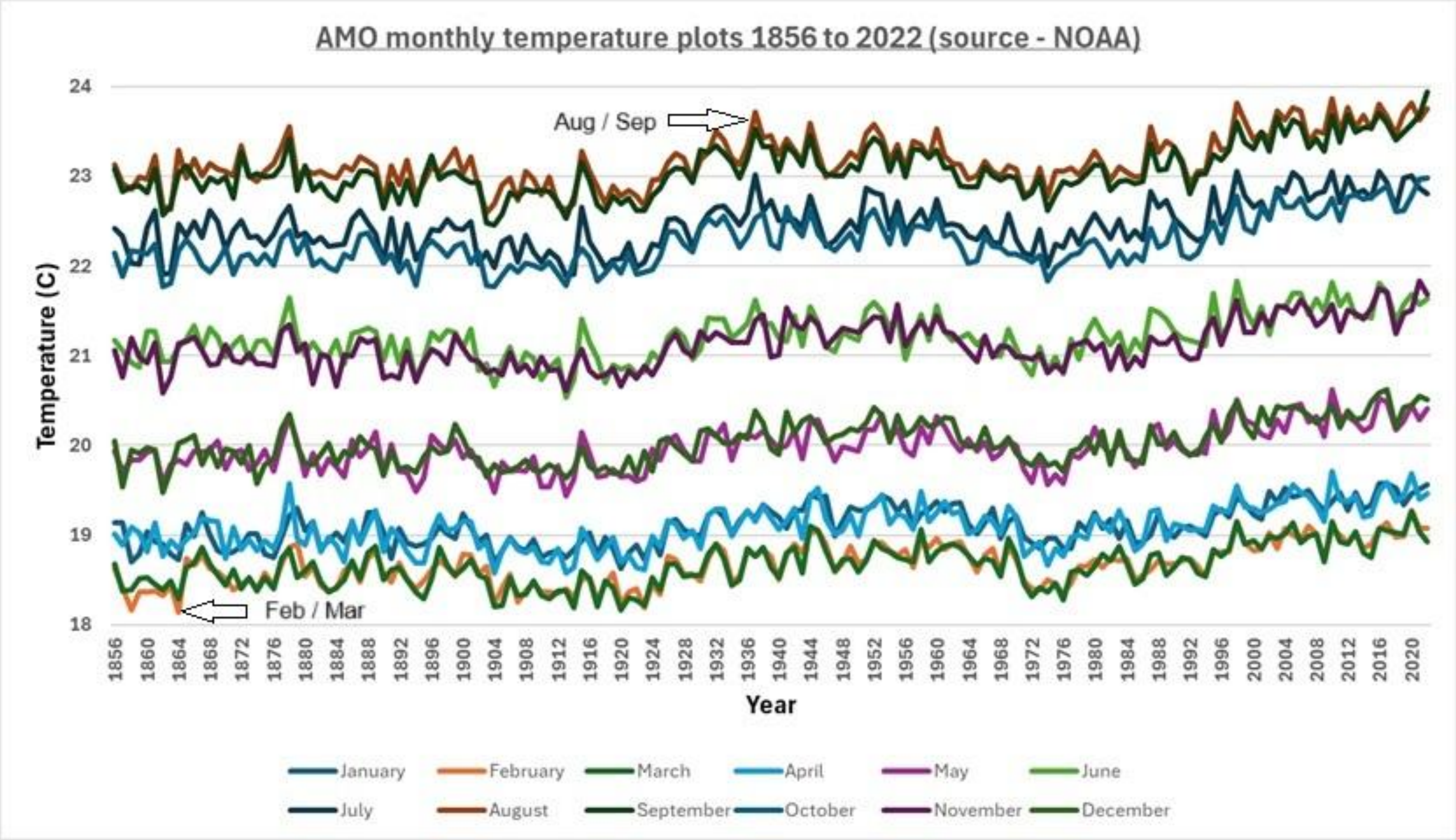
An alternative explanation:

As there is much greater ocean area in the Southern Hemisphere CO^2 released during seasonal warming readily equilibrates with the ocean as it moves from the equatorial zones towards the colder and more absorbent waters of the South Pole. Whilst in the Northern Hemisphere the increasing land mass restricts this equilibrium process and gives rise to an accumulation of CO^2 and a greater amplitude of cycling. This process reverses as we go from the winter to summer in the respective hemispheres and is magnified by the changing ratio of land mass to ocean as we move from North to South. This gives rise to the differences in amplitude of annual cycling at different latitudes seen above.

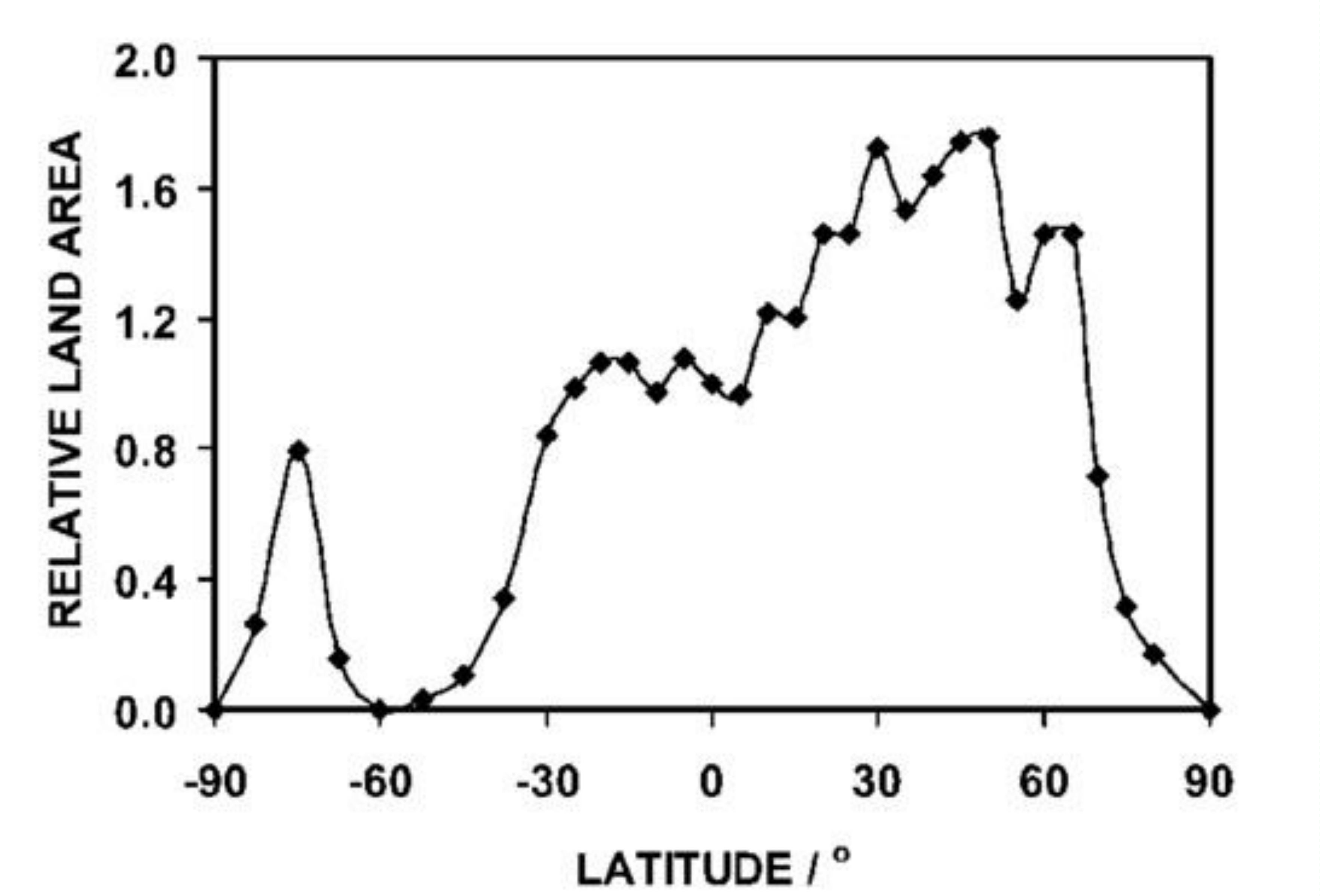
<u>Both of these explanations must be correct but to what to what degree?</u>

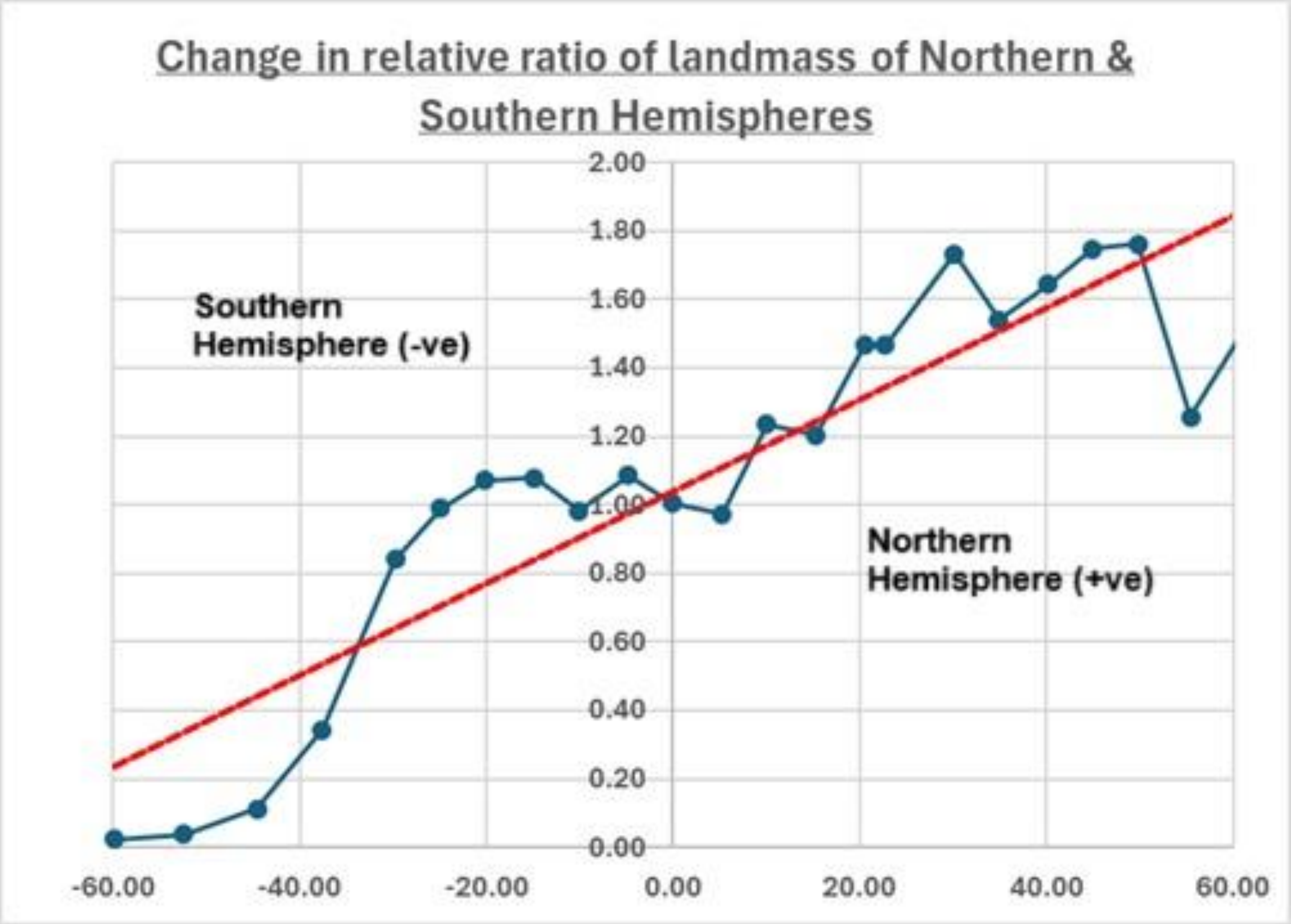
The second explanation relies on how responsive the oceans are to seasonal temperature change and consequent absorption and release of carbon dioxide?

Ocean seasonal temperature sensitivity can be assessed by examining the monthly response of SST. This is a plot of monthly AMO SST:

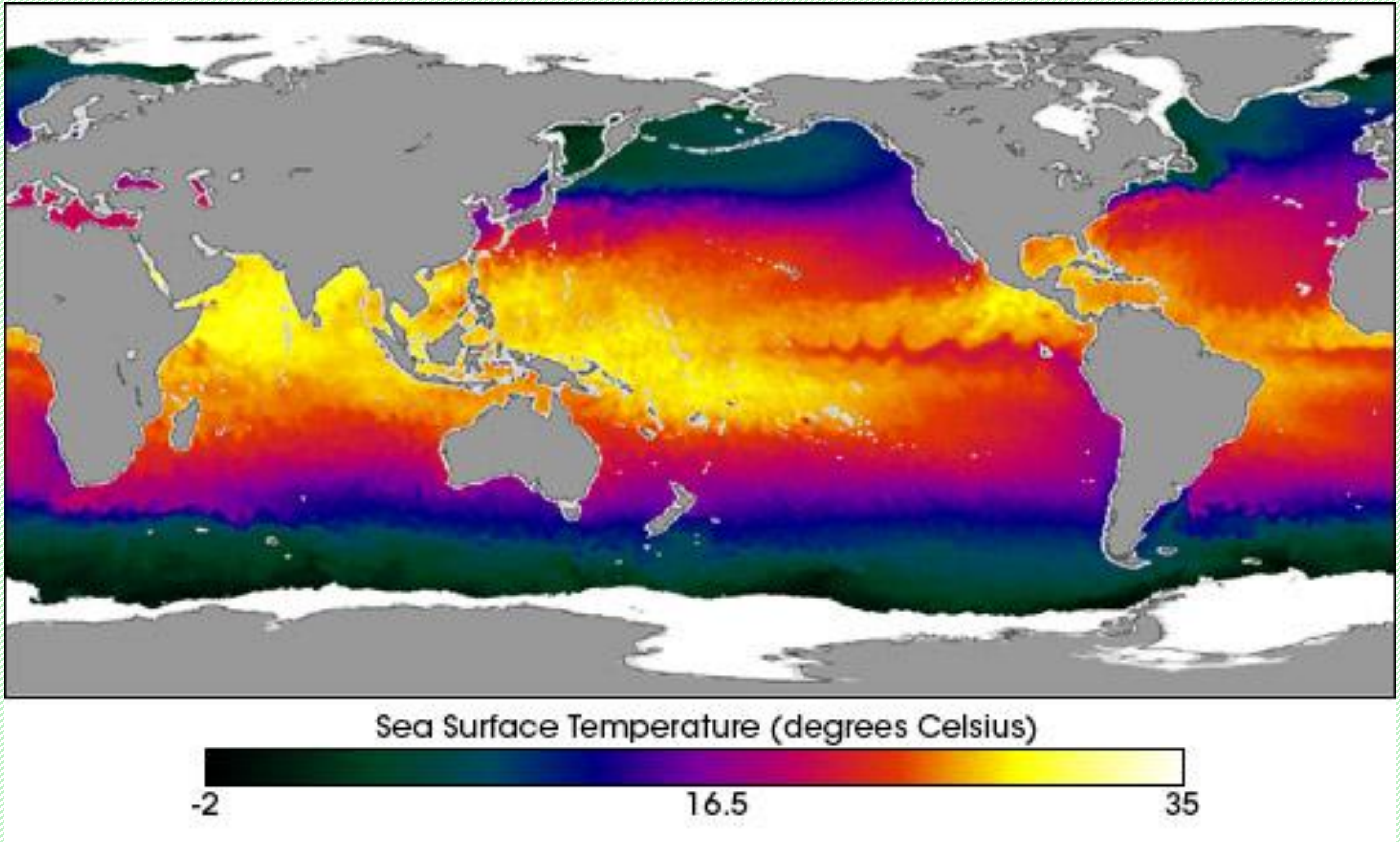

AMO monthly temperature plots 1856 to 2022 (source - NOAA)
Aug / Sep
Feb / Mar
Temperature (C)
24
23
22
21
20
19
18
Year
1856
1860
1864
1868
1872
1876
1880
1884
1888
1892
1896
1900
1904
1908
1912
1916
1920
1924
1928
1932
1936
1940
1944
1948
1952
1956
1960
1964
1968
1972
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
January
February
March
April
May
June
July
August
September
October
November
December

Land / ocean surface explanation:

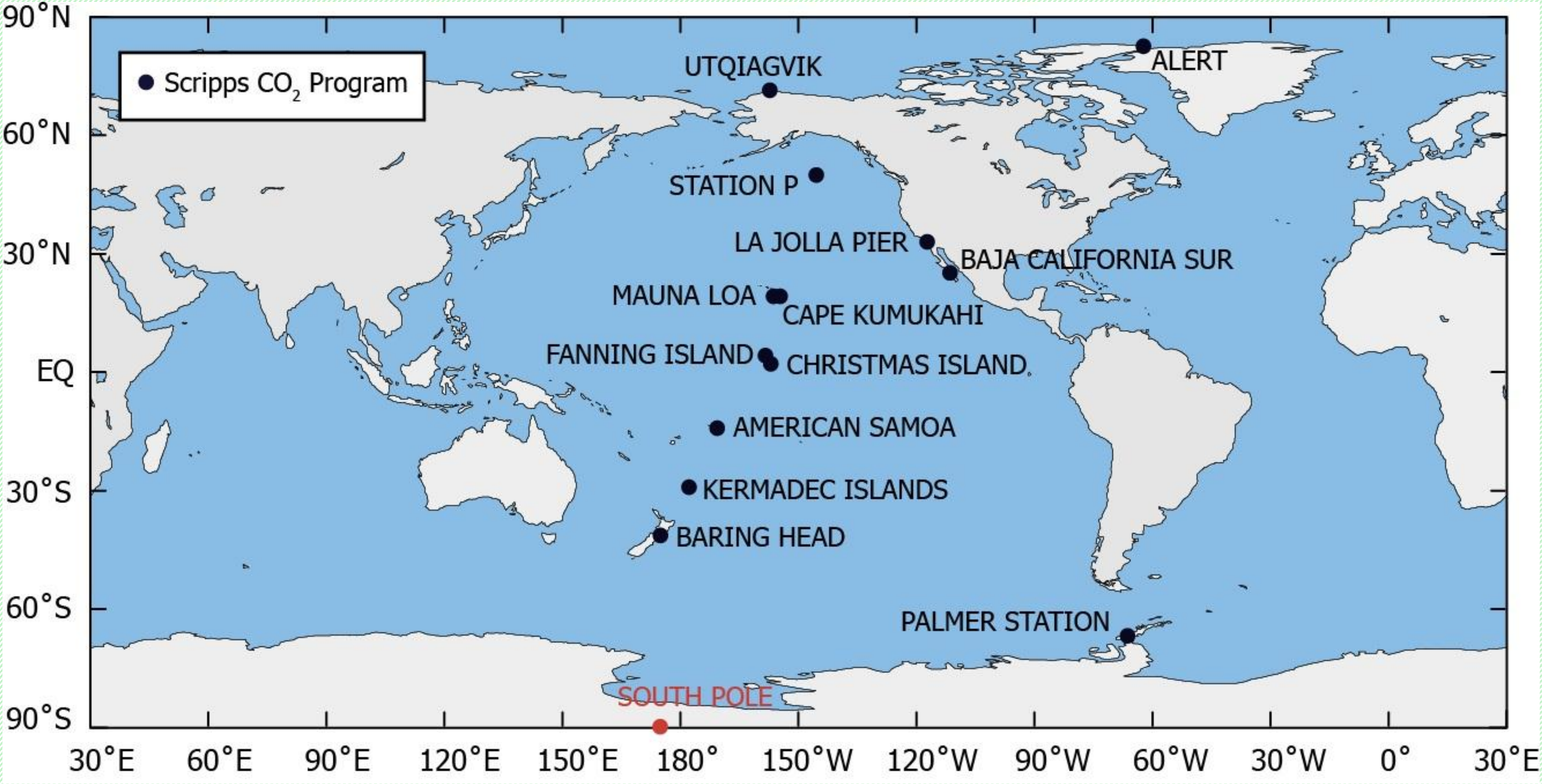



Change in relative ratio of landmass of Northern & Southern Hemispheres
Southern Hemisphere (-ve)
Northern Hemisphere (+ve)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-60.00
-40.00
-20.00
0.00
20.00
40.00
60.00

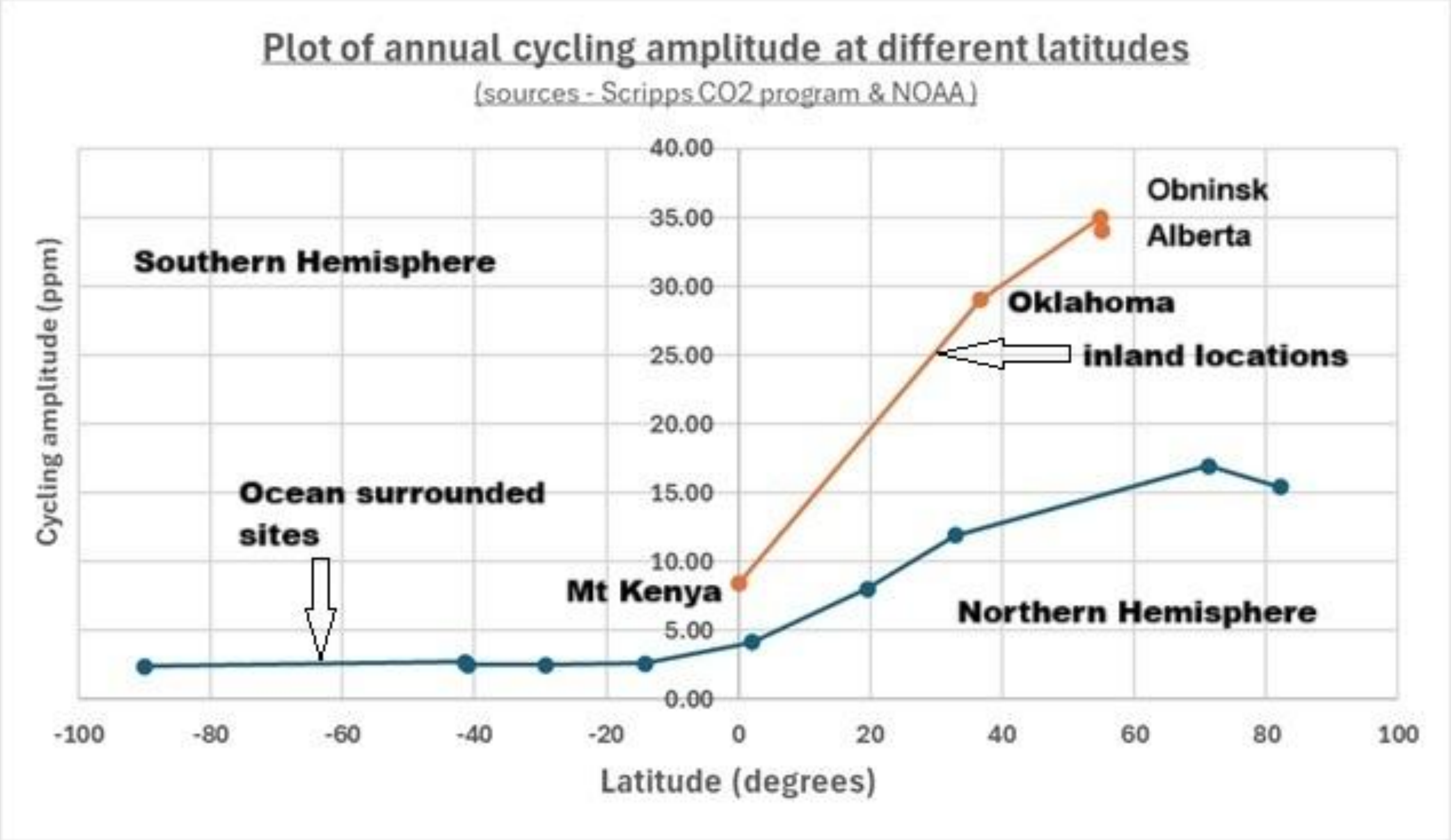
Satellite determined SST on 01 June 2003 (Source NASA)



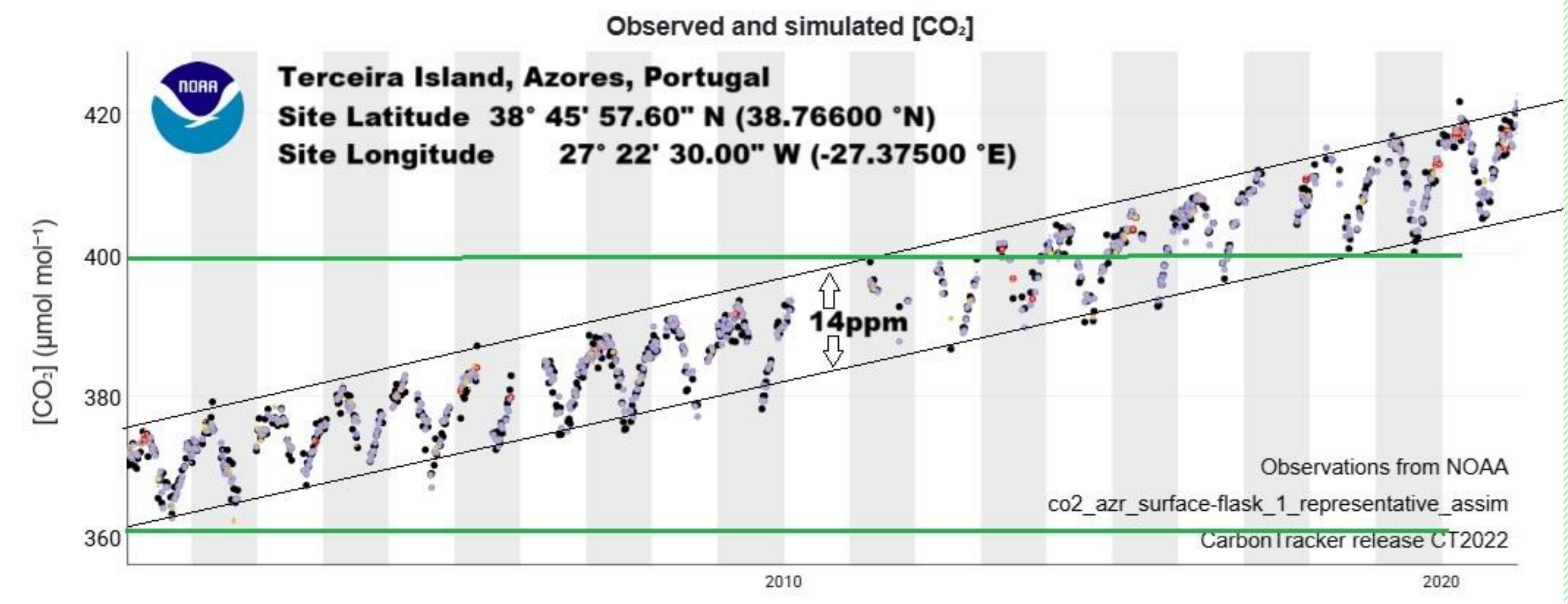
Scripps CO2 program data locations

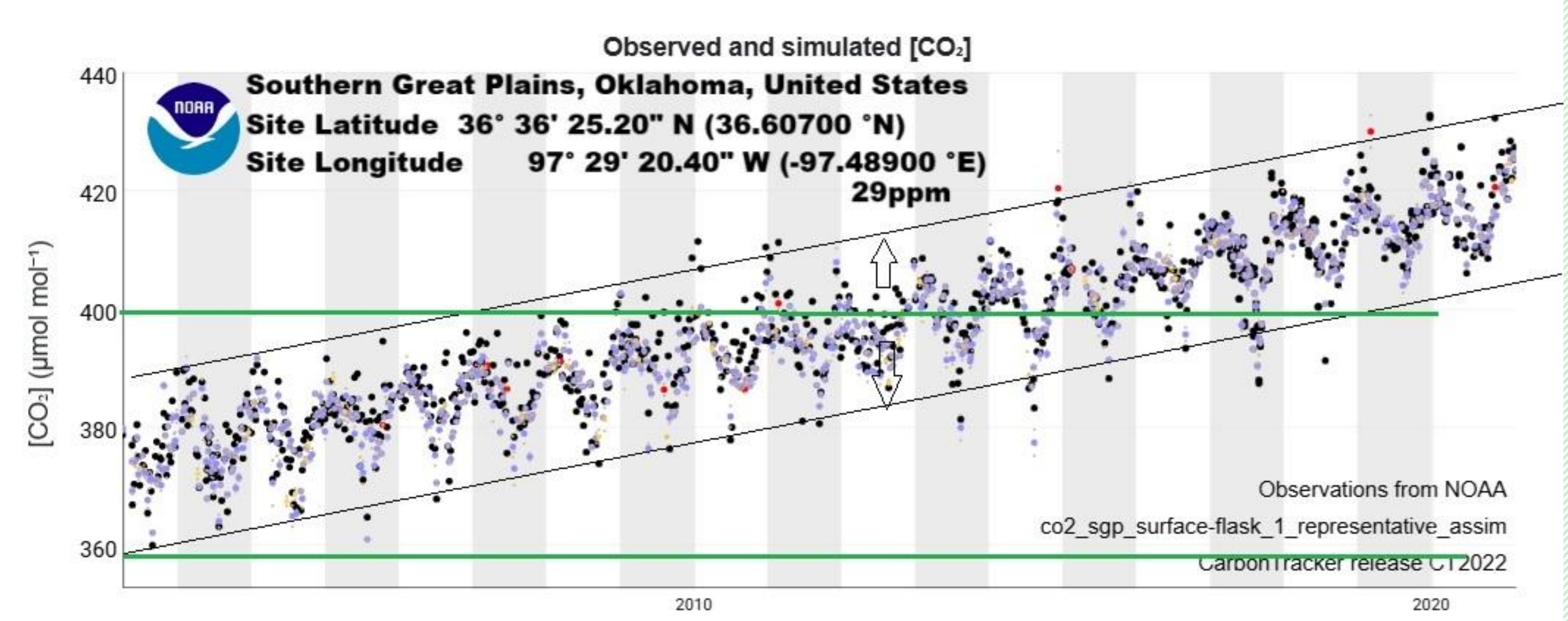


If the Oceans have a dominant influence on the annual amplitude cycling and this is related to surrounding landmass, we should be able to see a difference between ocean and inland locations. Here is a plot of 4 locations that have a significant surrounding landmass and have carbon dioxide flask measurements that are comparable to the previous analysis:


Plot of annual cycling amplitude at different latitudes
(sources - Scripps CO2 program & NOAA)
Cycling amplitude (ppm)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-100
-80
-60
-40
-20
0
20
40
60
80
100
Latitude (degrees)
Obninsk
Alberta
Southern Hemisphere
Oklahoma
inland locations
Ocean surrounded sites
Mt Kenya
Northern Hemisphere

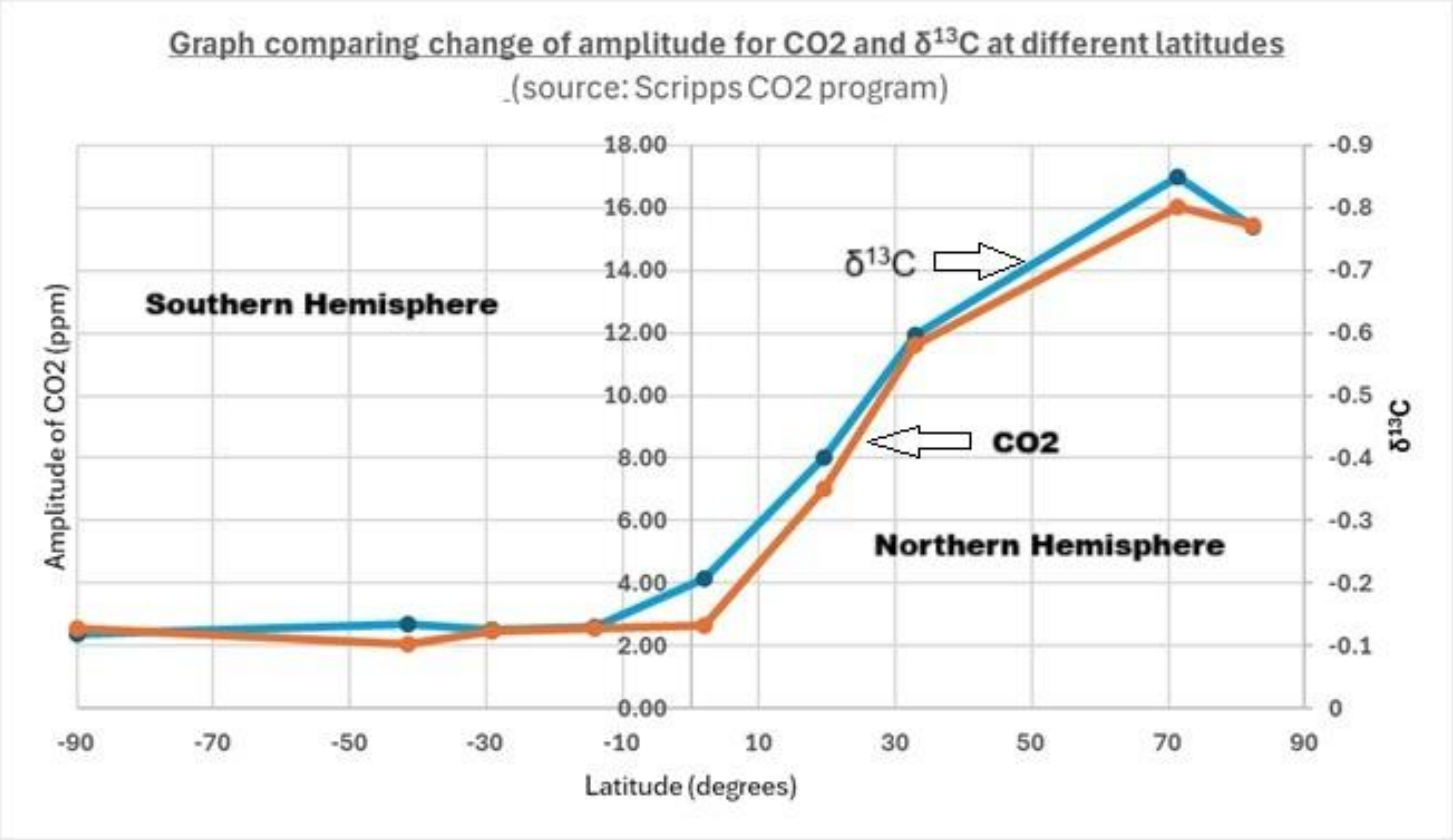
Comparison of two locations at similar northern latitudes comparing variation in carbon dioxide (NOAA Carbon Tracker CT2022 - 2000 to 2022)





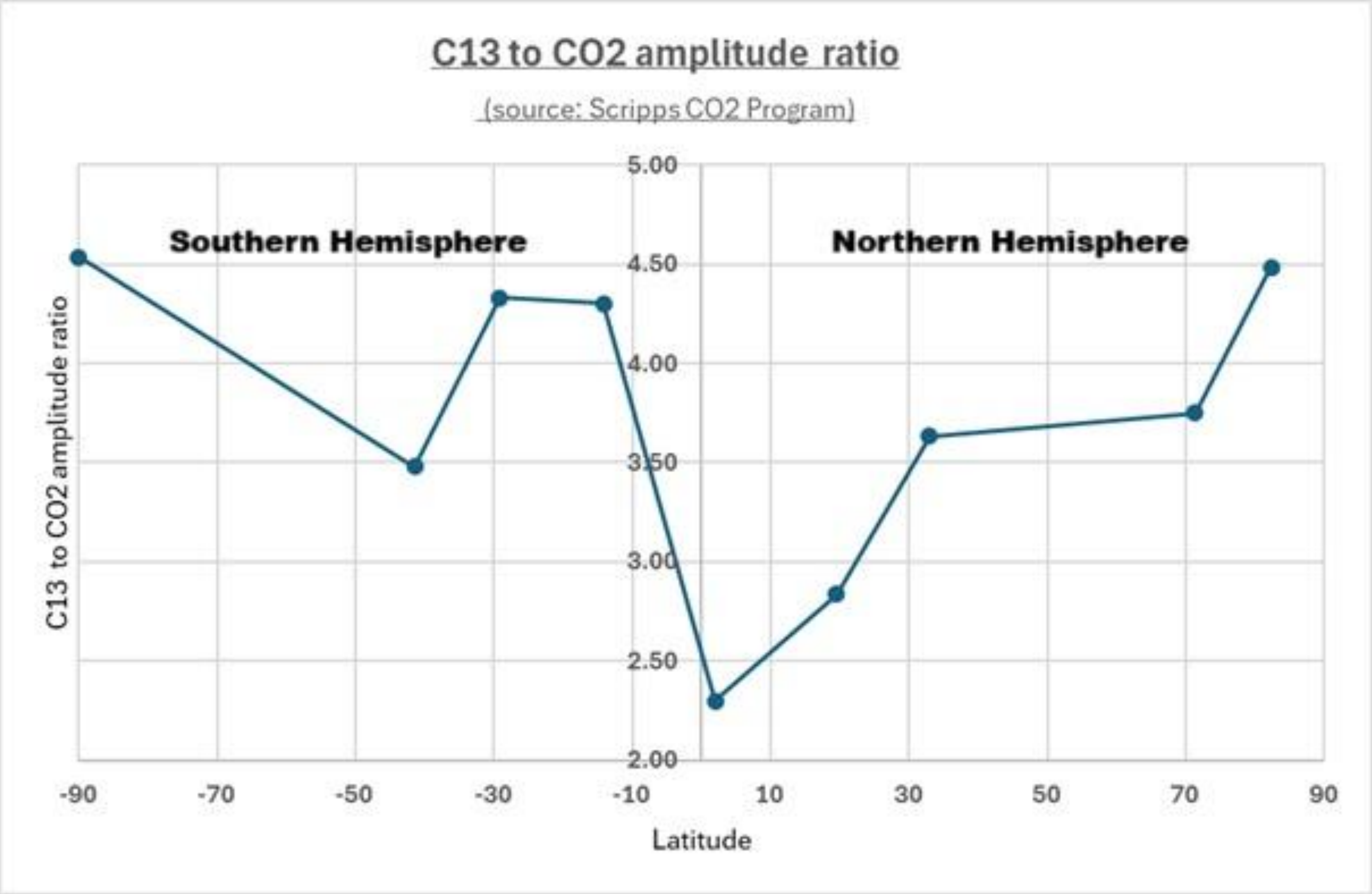
What other datasets support the release of CO_2 from the equatorial ocean zones and circulation towards the poles?

The Scripps CO_2 program monitors the carbon (C12/C13) isotope ratios at several locations and this data is also available. This parameter is measured as it is believed that changes in the isotope ratios reflect the burning of fossil fuels. This data also has annual amplitude cycles. This is a graph comparing both the CO_2 and isotope ratio amplitudes directly:



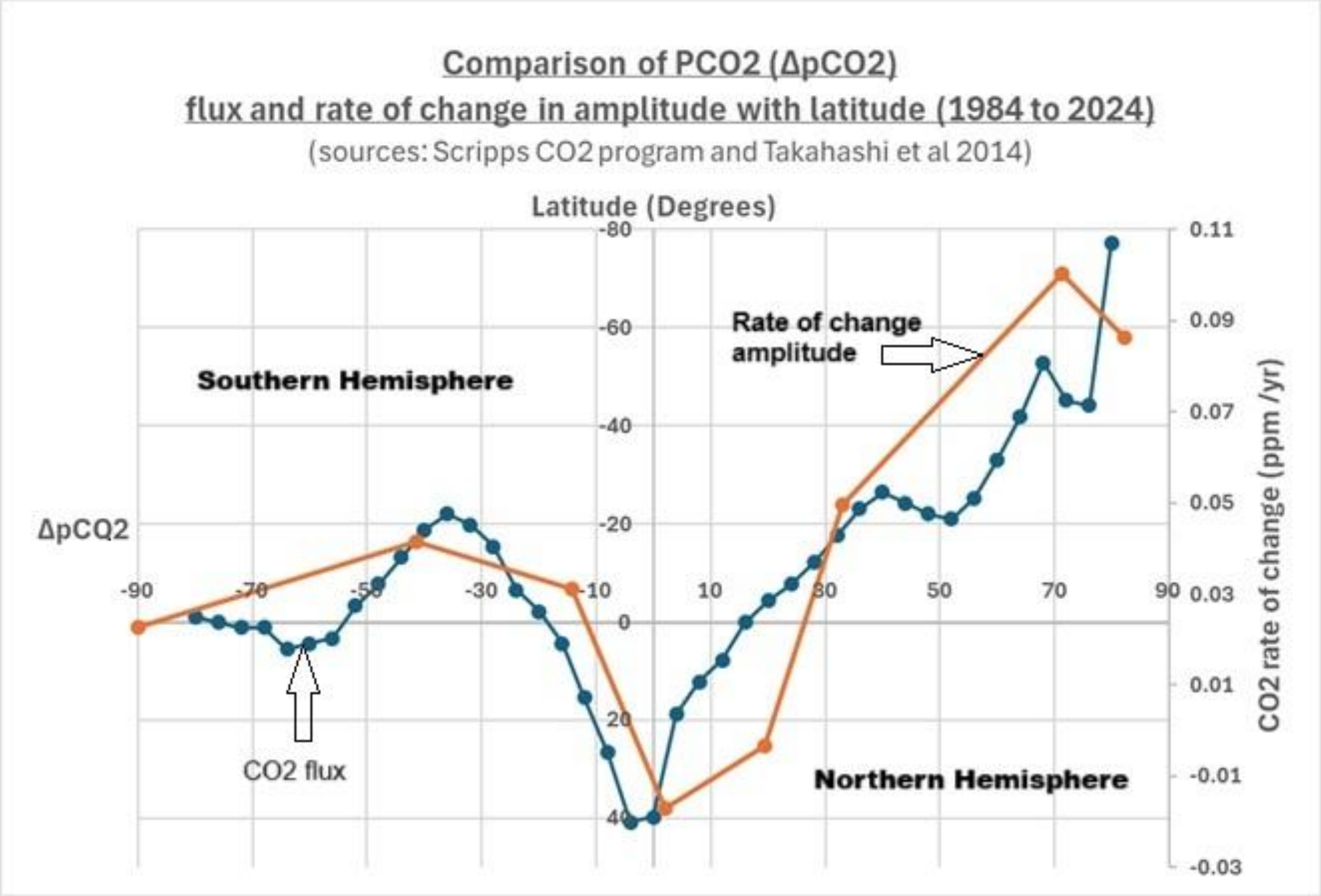
Graph comparing change of amplitude for CO2 and δ13C at different latitudes
(source: Scripps CO2 program)
Amplitude of CO2 (ppm)
δ13C
Southern Hemisphere
Northern Hemisphere
CO2
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0
-90
-70
-50
-30
-10
10
30
50
70
90
Latitude (degrees)

Whilst CO_2 and C13/C12 ratio track one another in terms of cycling amplitude, it maybe possible to see the lighter C12 isotope being transported away from the equator more readily than the heavier C13 fraction during this warming period. So, if we compare the amplitude ratio it should demonstrate a movement away from the equator towards both poles:


C13 to CO2 amplitude ratio
(source: Scripps CO2 Program)
Southern Hemisphere
Northern Hemisphere
C13 to CO2 amplitude ratio
5.00
4.50
4.00
3.50
3.00
2.50
2.00
-90
-70
-50
-30
-10
10
30
50
70
90
Latitude

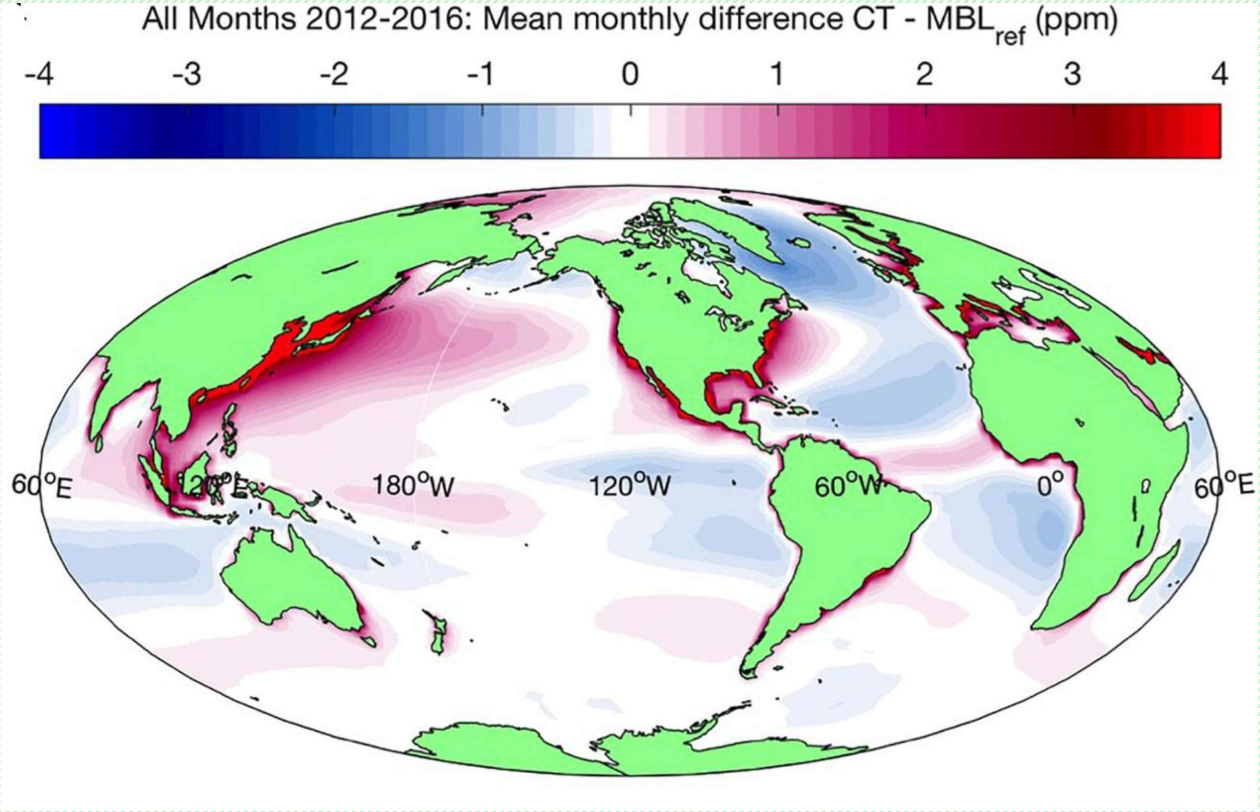
Other supporting data – Sea surface carbon dioxide flux

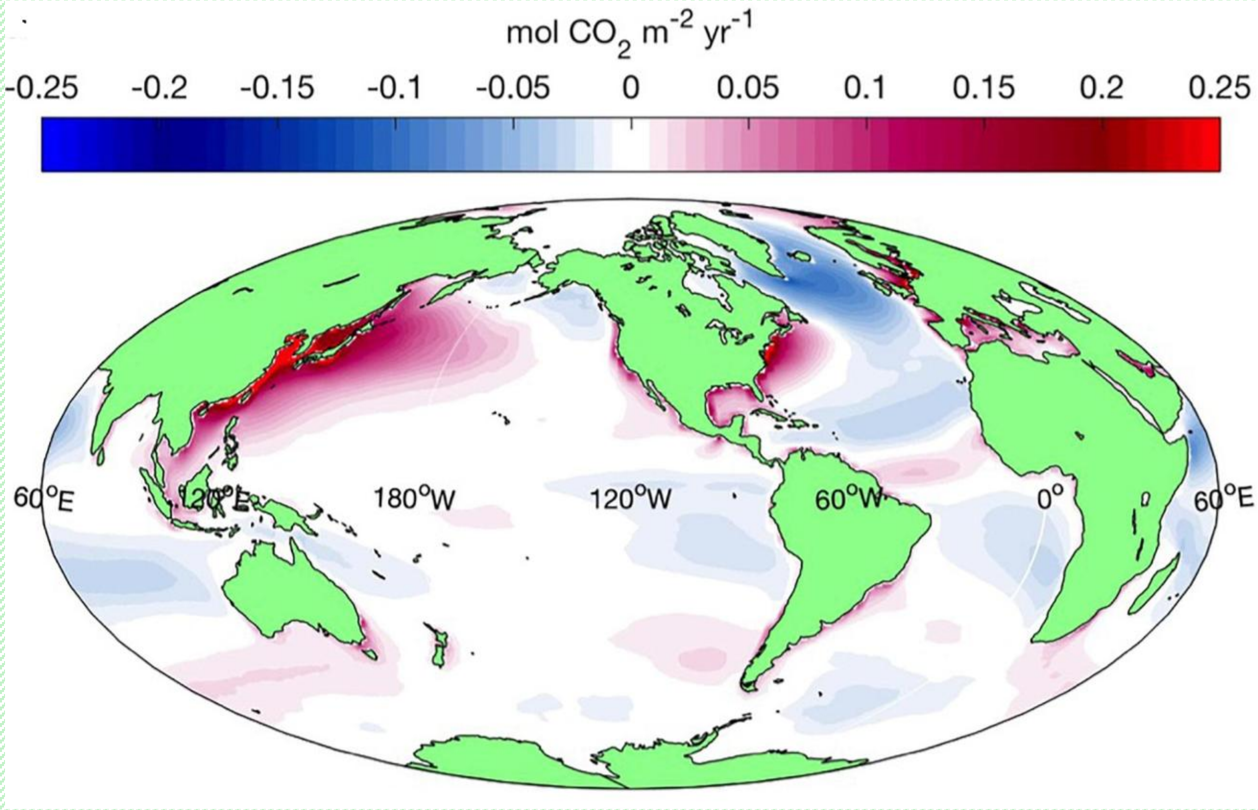
This is a measure of the of the absorption and release of carbon dioxide by the oceans and has been measured at different latitudes. If the oceans have a profound influence on the level of carbon dioxide in the atmosphere and this is reflected in the rate of change of cycling amplitude, then they should track one another. This is a graph making that comparison:


Comparison of PCO2 (ΔpCO2)
flux and rate of change in amplitude with latitude (1984 to 2024)
(sources: Scripps CO2 program and Takahashi et al 2014)
Latitude (Degrees)
-80
-60
-40
-20
0
20
40
-90
-70
-50
-30
-10
10
30
50
70
90
0.11
0.09
0.07
0.05
0.03
0.01
-0.01
-0.03
ΔpCQ2
CO2 rate of change (ppm /yr)
Southern Hemisphere
Northern Hemisphere
Rate of change amplitude
CO2 flux

Marine boundary layer (MBL) Monthly mean difference and Annual difference CO2 flux (2012 to 2016)

(source – 2019 A Surface Ocean CO_2 Reference Network, SOCONET and Associated Marine Boundary Layer CO_2 Measurements)

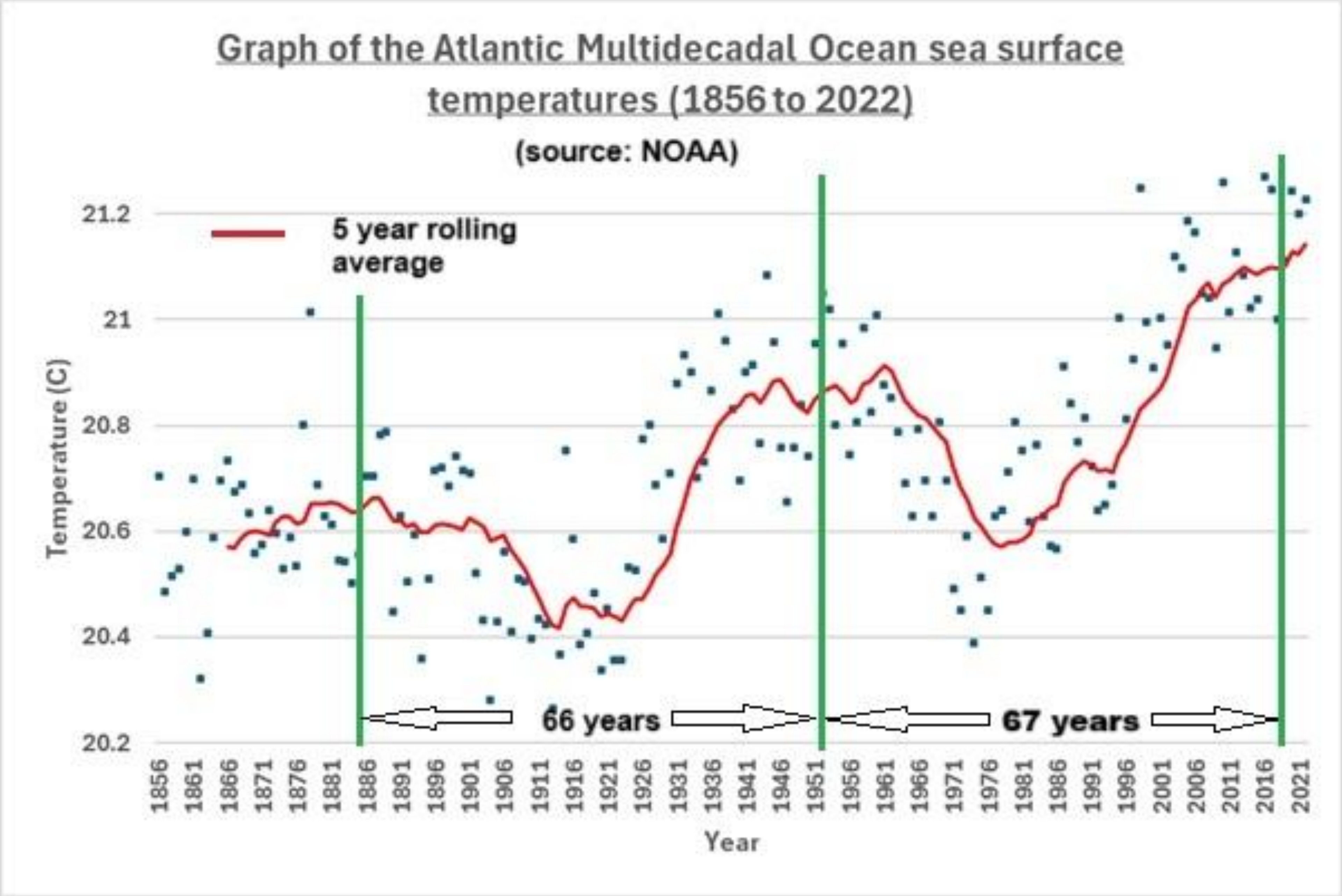


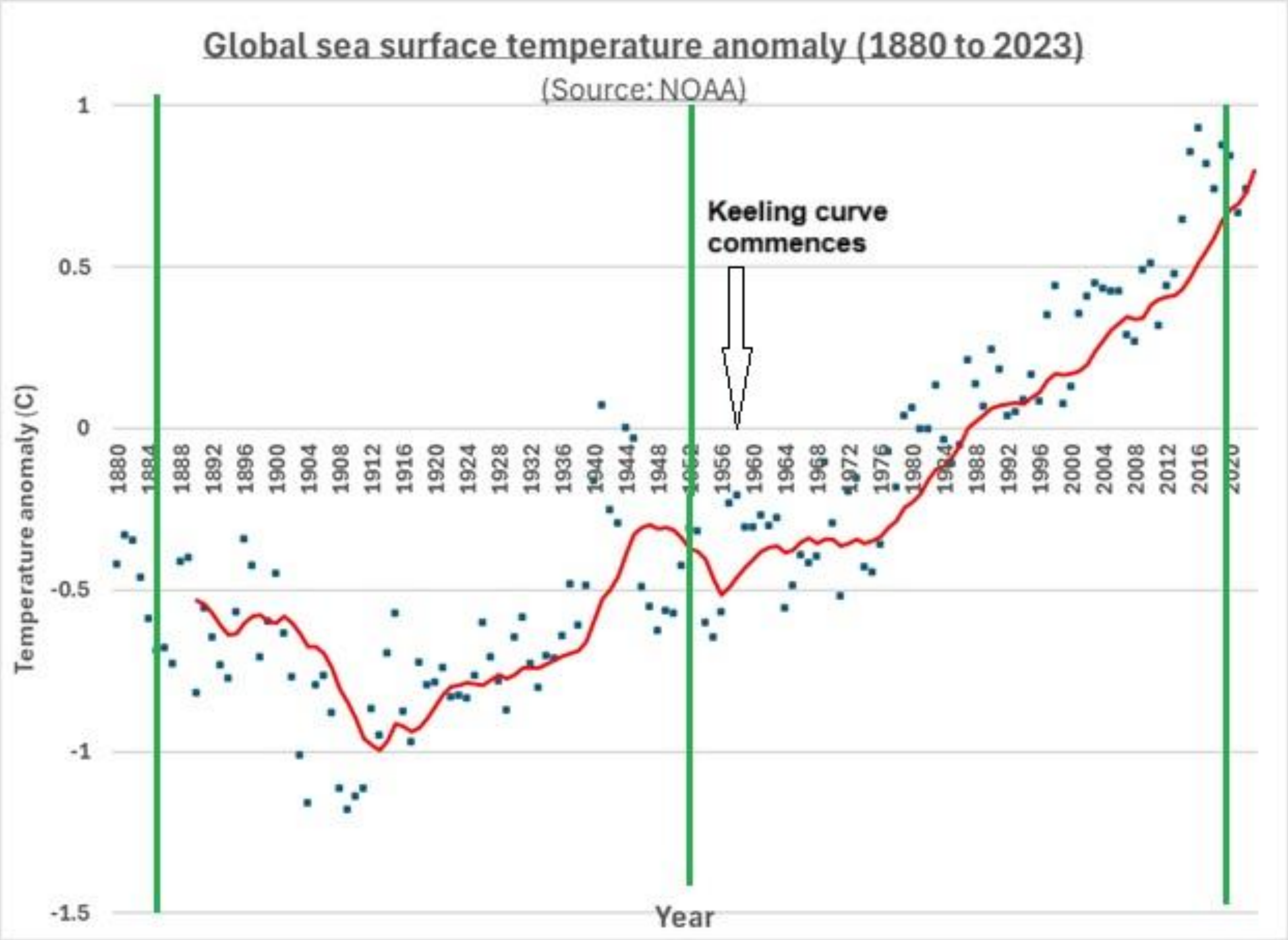


Conclusions:

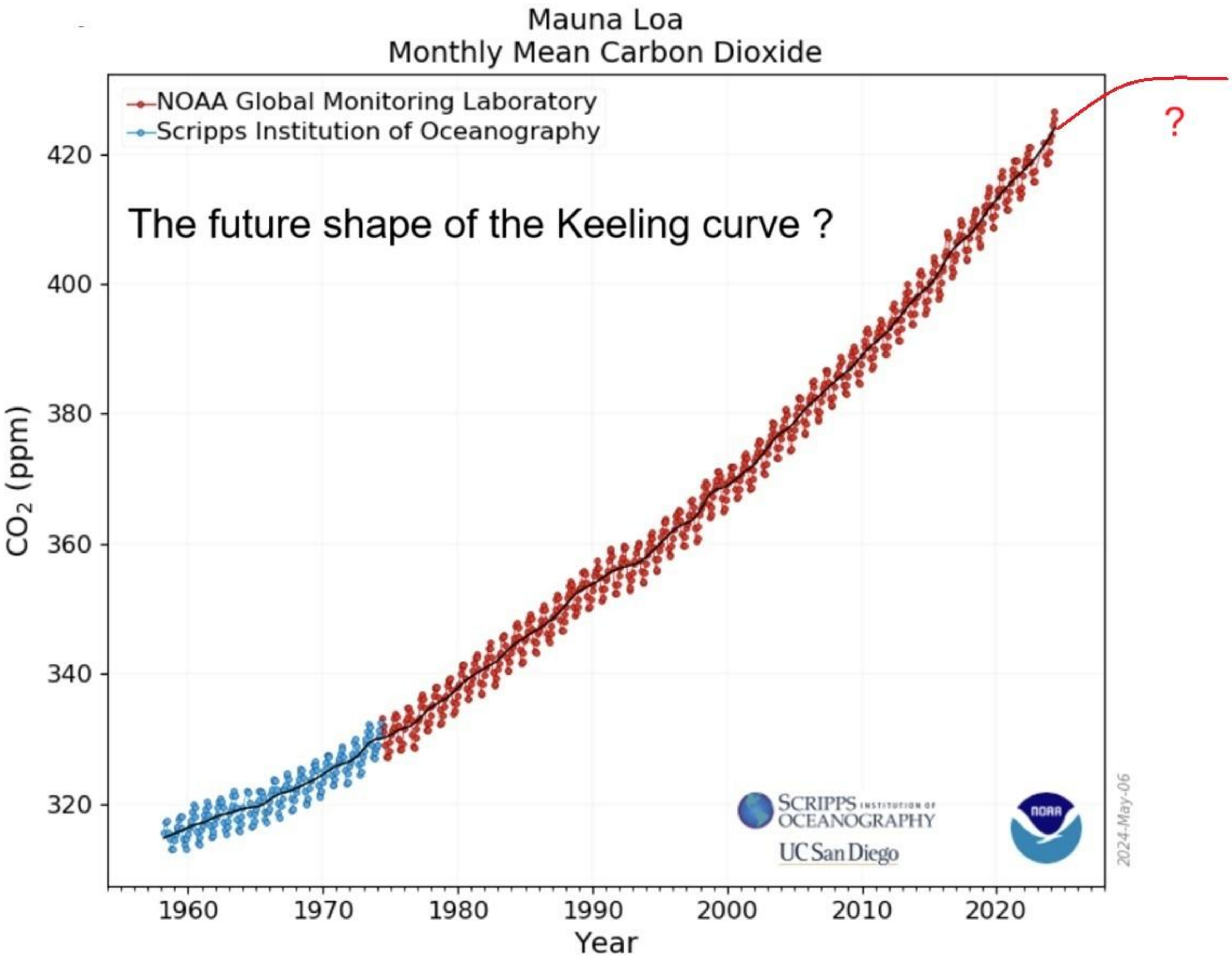
The interpretations of the data in this presentation, indicate that the oceans are having a much more profound impact on the absorption and control of carbon dioxide in the atmosphere than is portrayed in the accepted narrative. If this is correct, in conjunction with the work of David Dilley, Valentina Zharkova and Stuart Harris we will see a cooling period in the next 5 to 10 years. This will cause SST to drop with net absorption of CO2 and the Keeling curve will turn over as would have occurred if measurements had extended back to 1942.

What can we predict from trends in sea surface temperature?


Graph of the Atlantic Multidecadal Ocean sea surface temperatures (1856 to 2022)
(source: NOAA)
5 year rolling average
66 years
67 years
Temperature (C)
Year
21.2
21
20.8
20.6
20.4
20.2
1856
1861
1866
1871
1876
1881
1886
1891
1896
1901
1906
1911
1916
1921
1926
1931
1936
1941
1946
1951
1956
1961
1966
1971
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021



Global sea surface temperature anomaly (1880 to 2023)
(Source: NOAA)
Keeling curve commences
Temperature anomaly (C)
Year
1
0.5
0
-0.5
-1
-1.5
1880
1884
1888
1892
1896
1900
1904
1908
1912
1916
1920
1924
1928
1932
1936
1940
1944
1948
1952
1956
1960
1964
1968
1972
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020


Mauna Loa
Monthly Mean Carbon Dioxide
NOAA Global Monitoring Laboratory
Scripps Institution of Oceanography
The future shape of the Keeling curve ?
?
CO_2 (ppm)
420
400
380
360
340
320
1960
1970
1980
1990
2000
2010
2020
Year
SCRIPPS INSTITUTION OF OCEANOGRAPHY
UC San Diego
NOAA
2024-May-06

Thank you for watching this presentation

The end
(of the accepted narrative?)