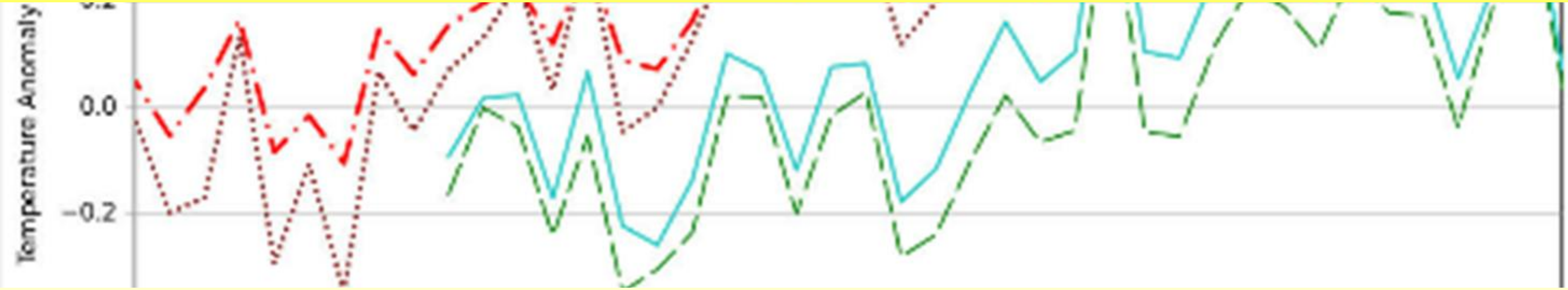
Book Review Part 1:
John Kehr's
"The Inconvenient Skeptic"



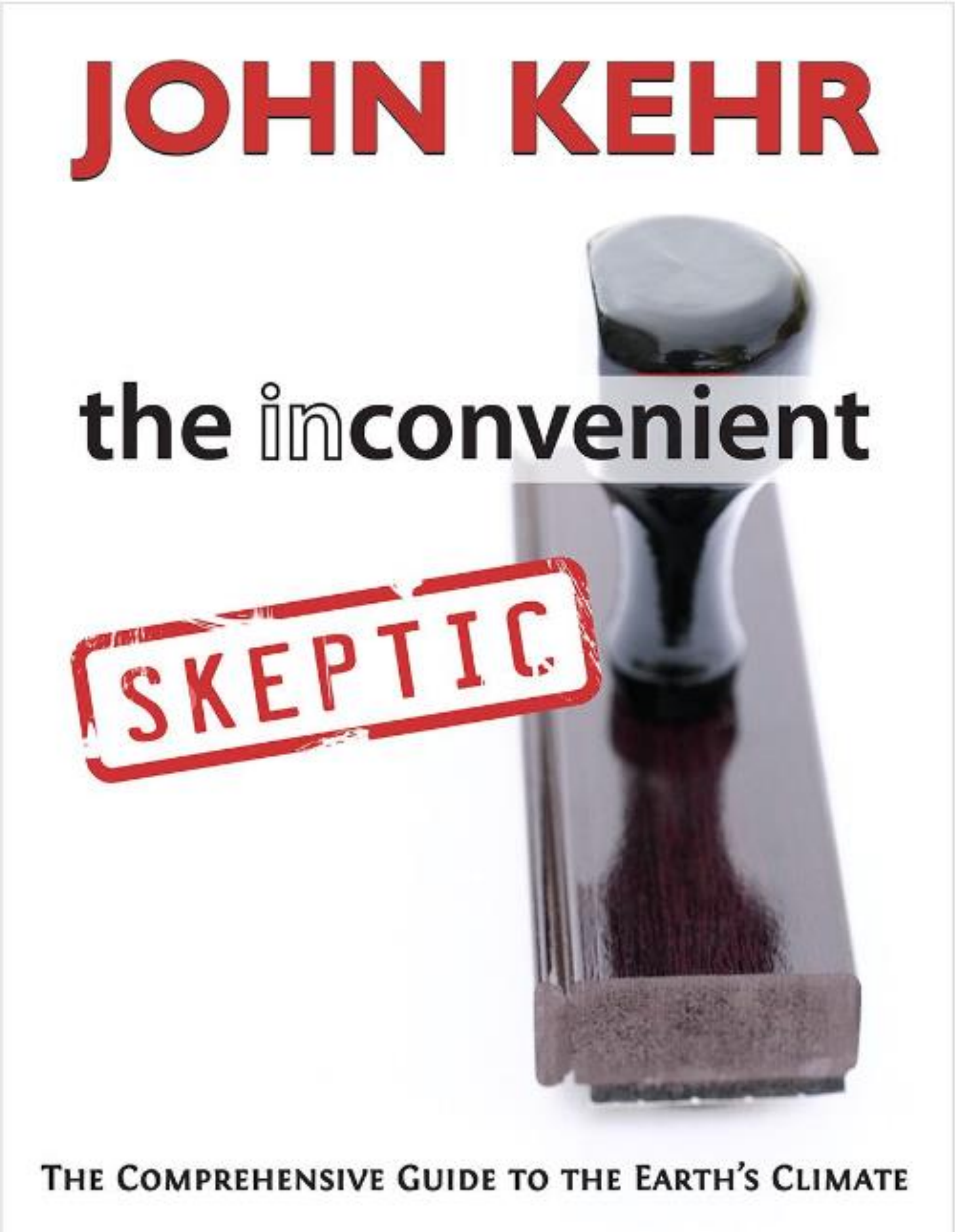
Bob Endlich

bendlich@msn.com

Cruces Atmospheric Sciences Forum

19 Jan 2019

https://read.amazon.com/?asin=B006009P8W



The Inconvenient Skeptic:

The Comprehensive Guide to the Earth's Climate

John Kehr

ISBN 978-0-9847829-1-8 (paperback)

“…I let Jenny know that it was going to take a little longer than expected because I had made my second decision on the issue.

I was going to have to analyze the raw data and analyze it like I would something at work.

I had decided to look at the whole issue and reach an independent conclusion about global warming.”

Kehr, John. The Inconvenient Skeptic: The Comprehensive Guide to the Earth's Climate (p. 4). John Kehr. Kindle Edition.

"In the semiconductor R&D world, one of the most common phrases is "Show me the Data."

That is what this book is intended to do. I will show you the data and you are free to agree with my conclusions or not."

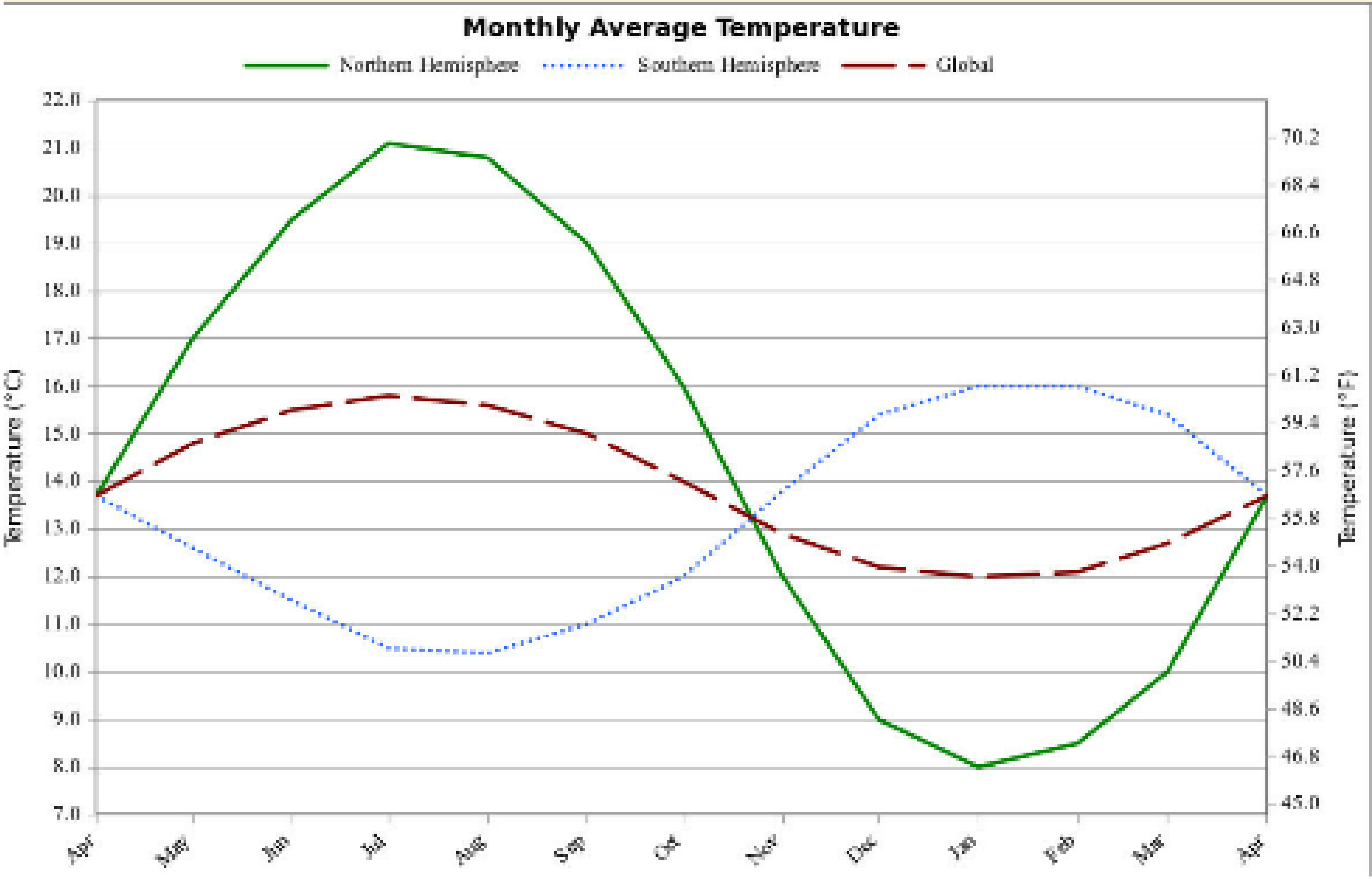
Kehr, John. The Inconvenient Skeptic: The Comprehensive Guide to the Earth's Climate (p. 7). John Kehr. Kindle Edition.

This reviews only the first quarter of the book.

I've edited excerpts for wording, spacing and presentation in this format.

Illustration 1:

Annual Temperature of the Earth and the Northern and Southern Hemispheres.
The average temperature of the Earth is different for each month of the year.



…temperature of Earth is ALWAYS changing.
Depending on the time of year, the average "correct" temperature is always going up or going down, much as temperature changes during the day.

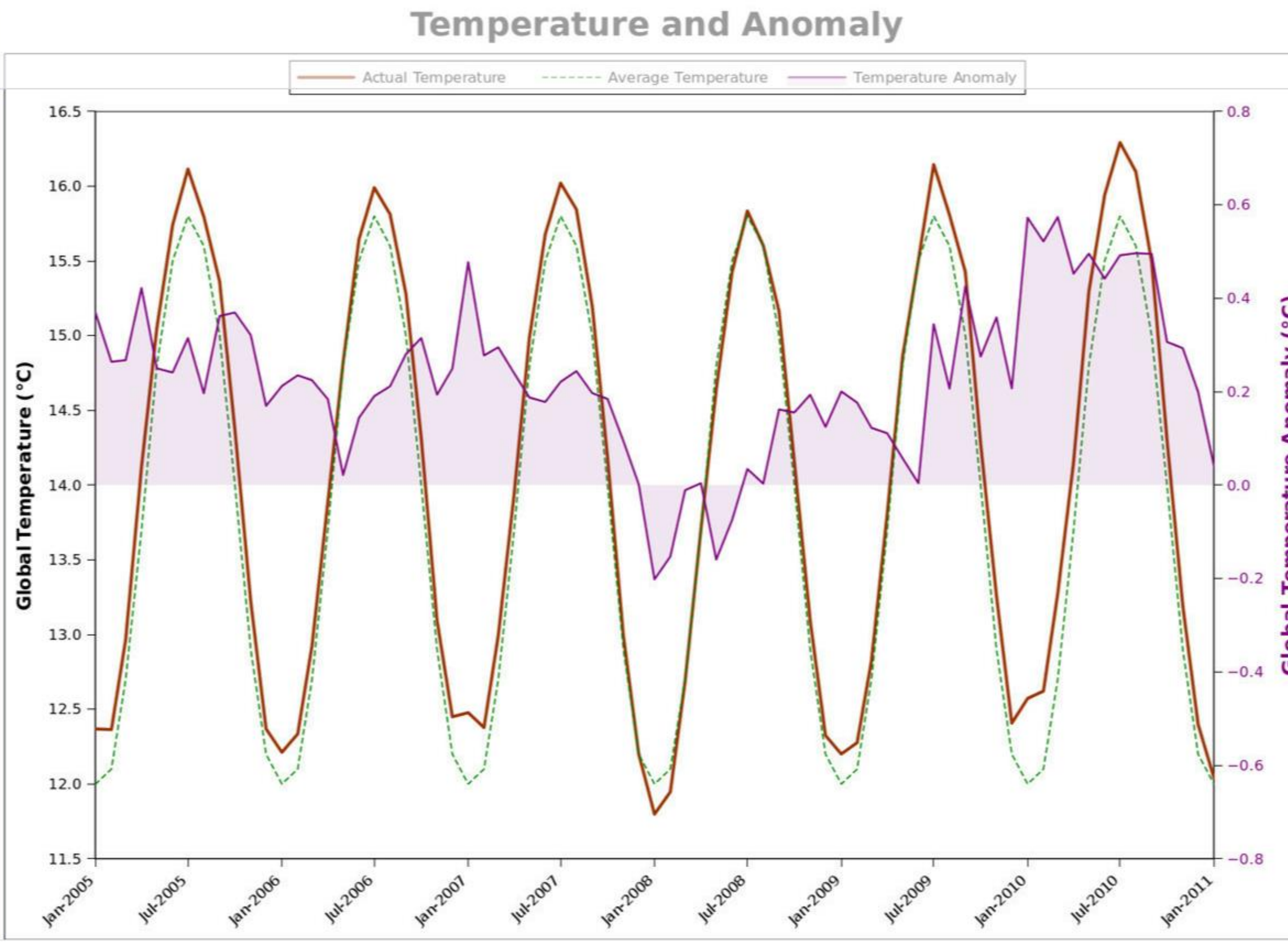
Illustration 2:

(dashed Green)
Average Monthly
Temperature

(Brown)
Actual Monthly
Temperature

(Purple)
Temperature Anomaly

NB:
Temperatures and
Temperature Anomaly
have different scales.

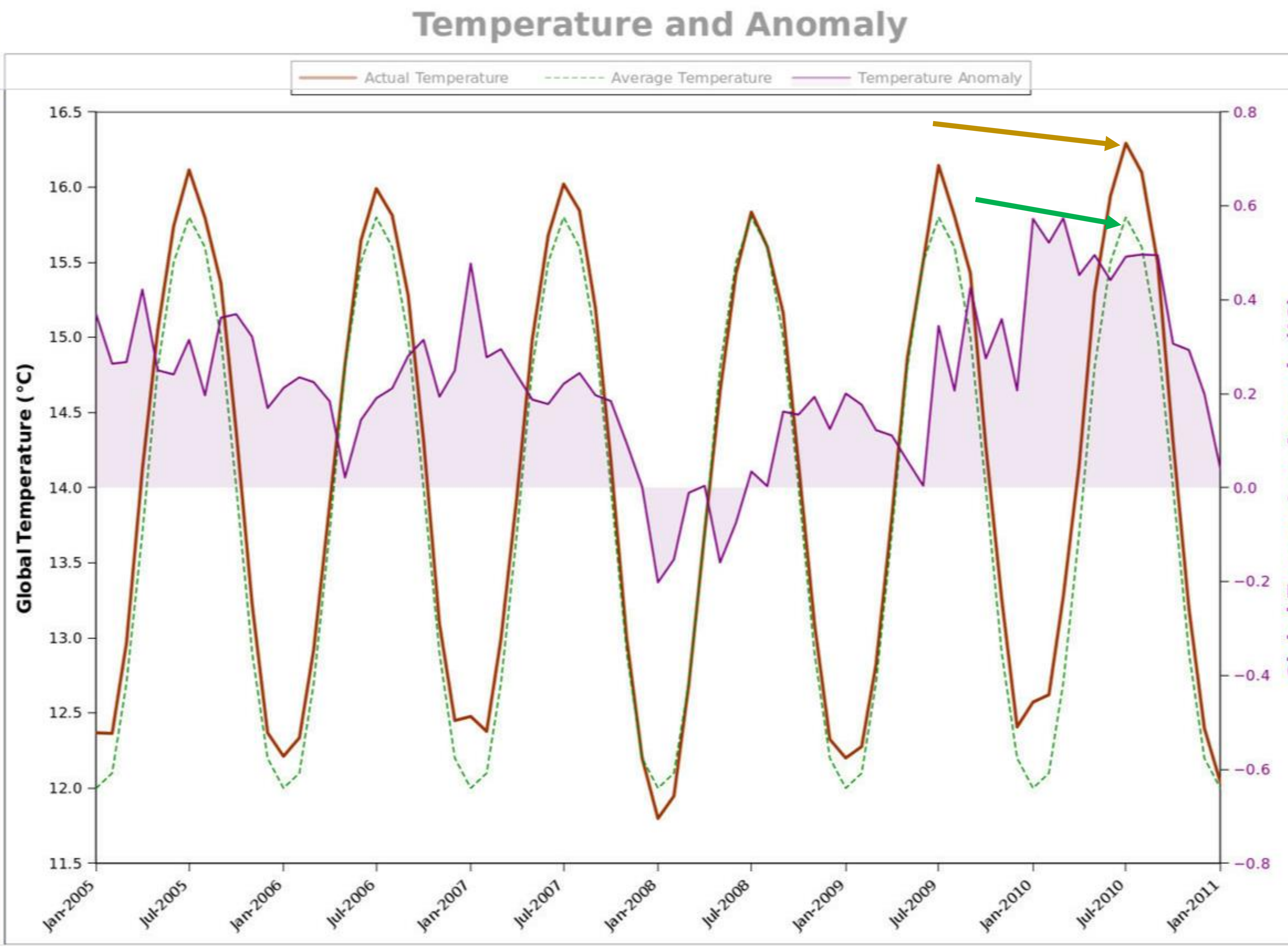


Temperature Anomaly:

Difference between measured temperature and average historic temperature..

When temperature anomaly is used (it's the default temperature used in the debate) for a year or for the months of the year, it shows the difference from average for **that month** of the year.

The **anomaly** is the difference between brown and green arrows.



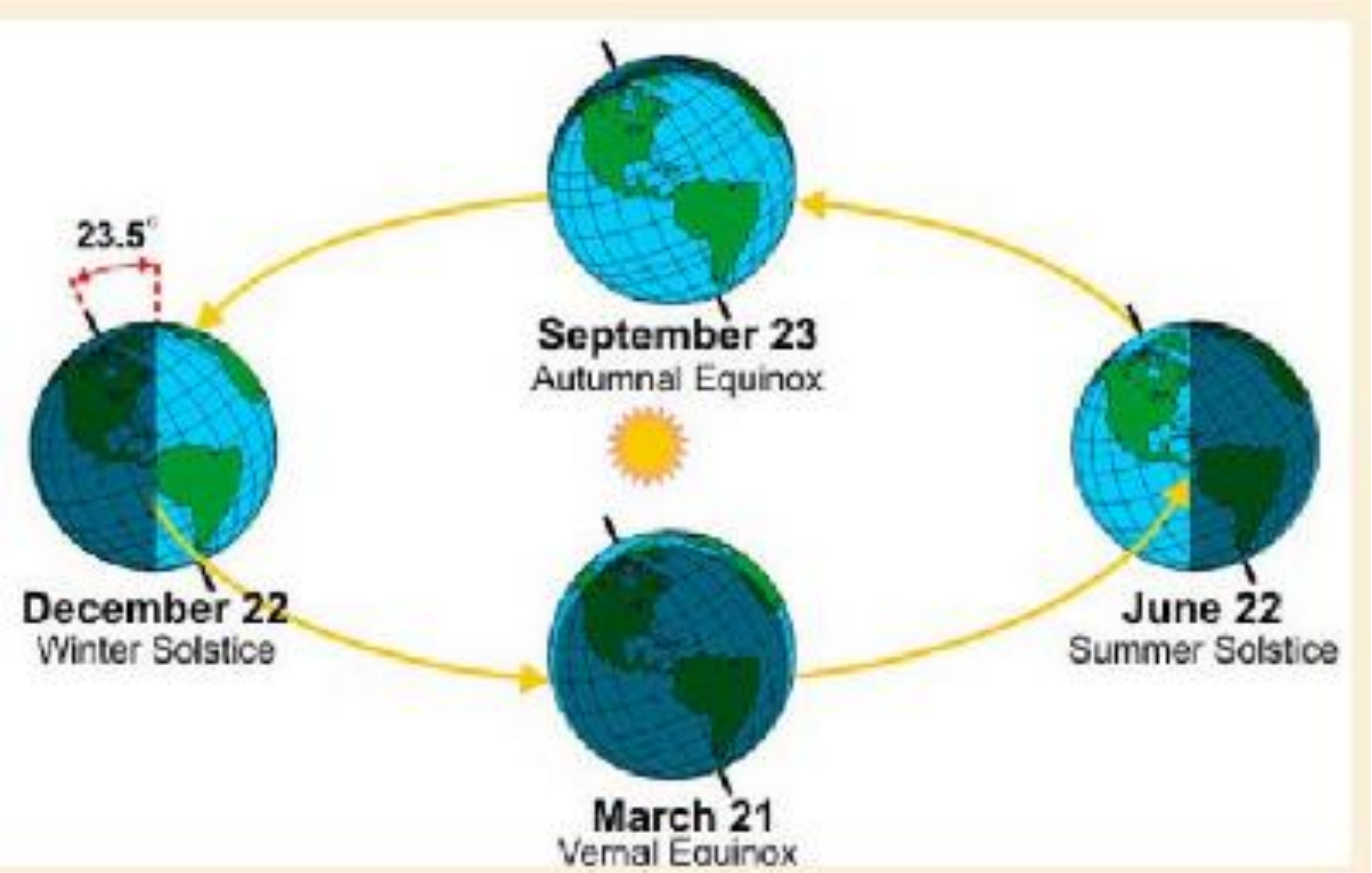


Illustration 3:
The Earth's tilt causes the seasons. Picture from NOAA Online School.

Illustration 4:
Winter Solstice. Notice that the Arctic gets almost no sunlight while the Antarctic is in sun 24 hours a day.

Illustration 5:
Summer Solstice…the Arctic is in sunlight 24 hours a day while the Antarctic gets none.

Illustration 6:
The Northern Hemisphere has twice as much land as the Southern Hemisphere.

The NH has more than twice as much land as the SH.

The North Pole is water surrounded by land.

In summer, land around the North Pole warms much more than the ocean that surrounds Antarctica.

NH warms up more in summer than the SH.

The reverse is true in the winter.
Land around the North Pole (Asia, North America, and Europe) cools more than ocean waters around Antarctica.

The SH has very little land around the South Pole.

The only large piece of land near the South Pole is Antarctica, surrounded by water.

Since the poles experience the most change in weather from season to season the fact that South Pole has land surrounded by water is most important.

Antarctica remains frozen; this is why it has been frozen for such a long time.

Water surrounding it doesn't warm up enough in the summer to cause thawing.
It warms up a bit, not nearly as much as the NH.

Illustration 7:
Southern Hemisphere is mostly open ocean.

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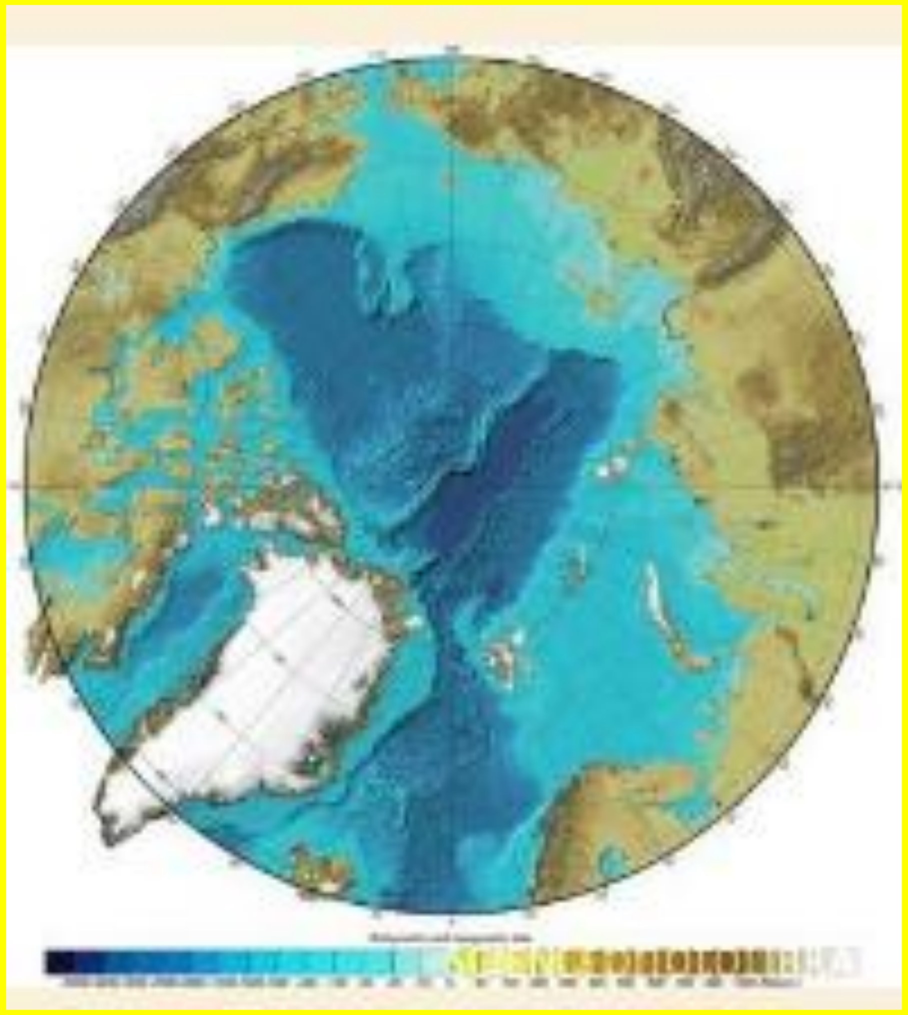


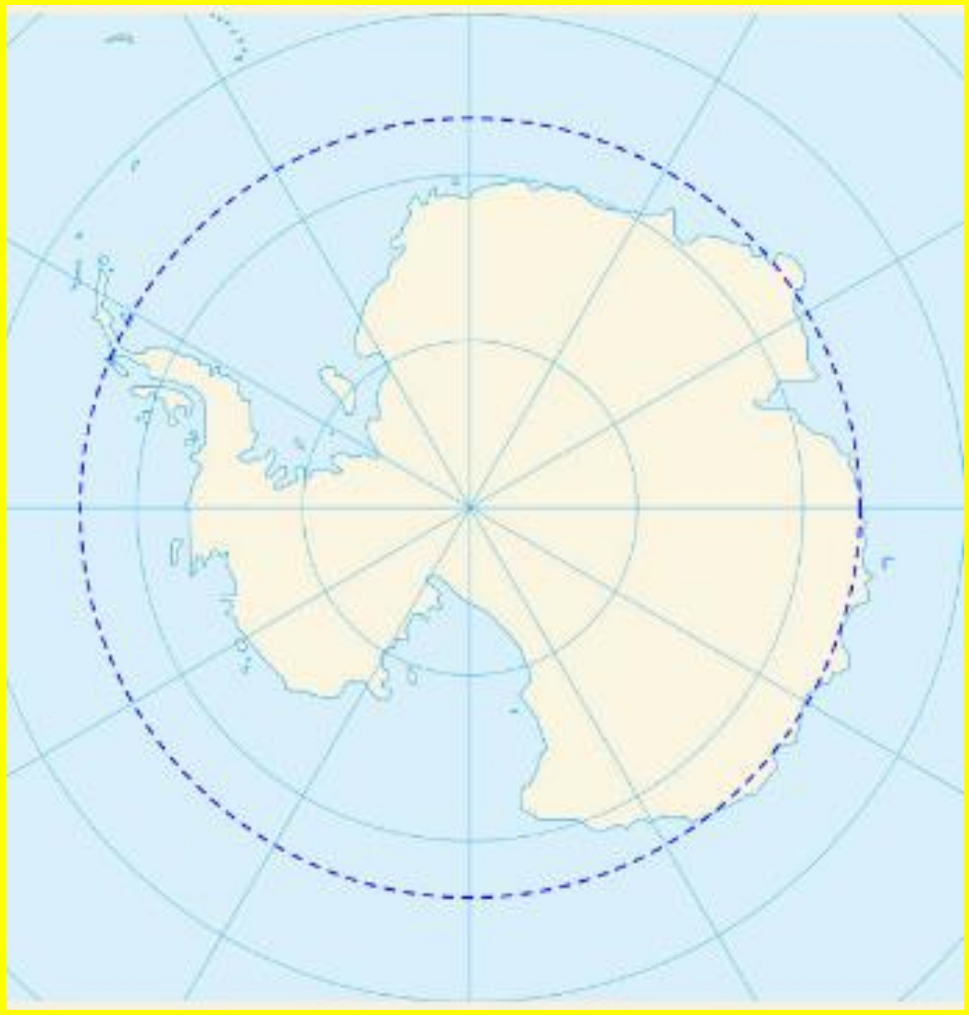
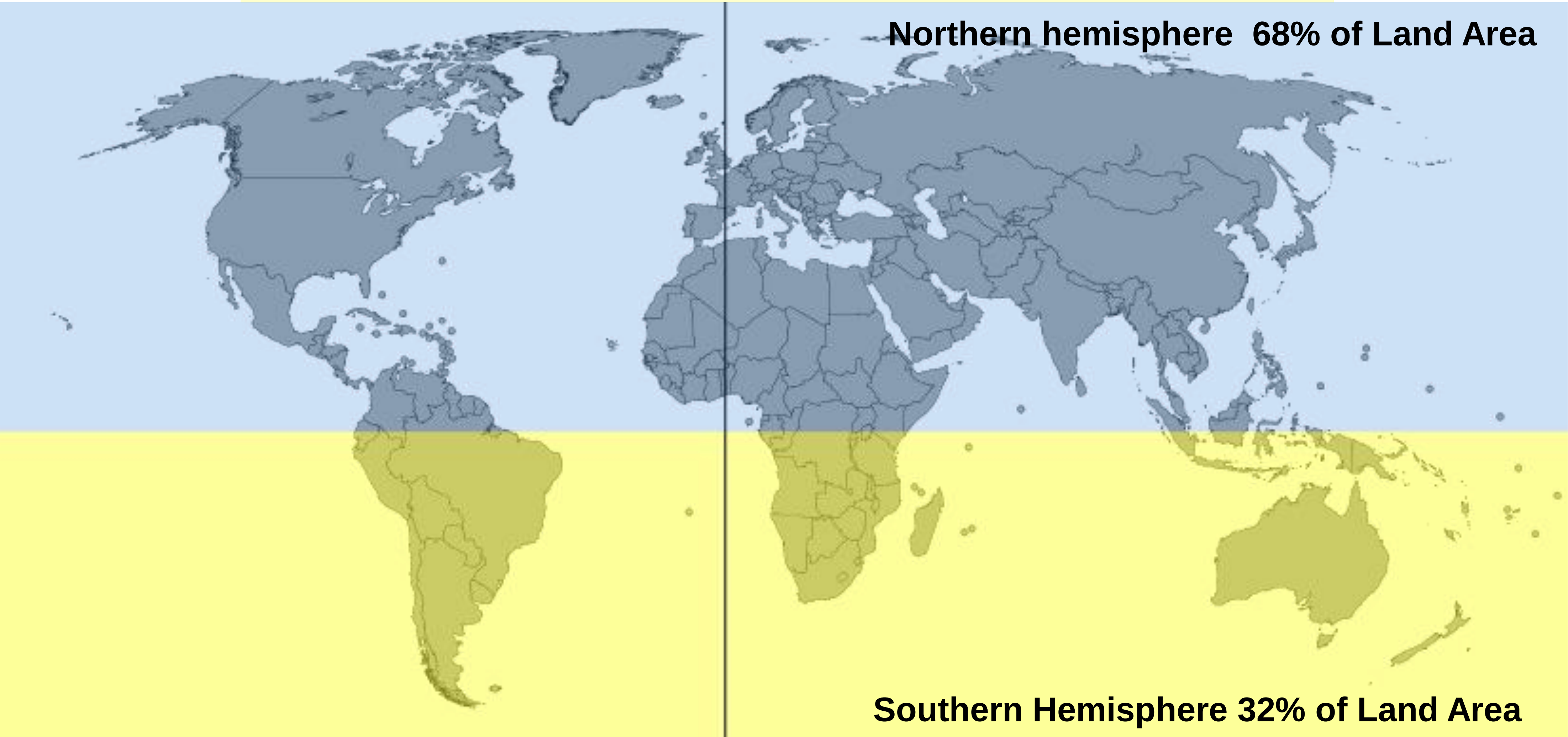


Illustration 8:
Arctic Circle: surrounded by land

Illustration 9:
Antarctic Circle: Mostly land surrounded by ocean.

Oceans have 71% of all of earth surface area
Land has 29% of all of earth surface area

Northern Hemisphere's Land Area drives Annual Earth Temperature Cycle



Now we understand more why the Northern Hemisphere dominates and Why the Southern Hemisphere has so little Influence on Global Average temperature.

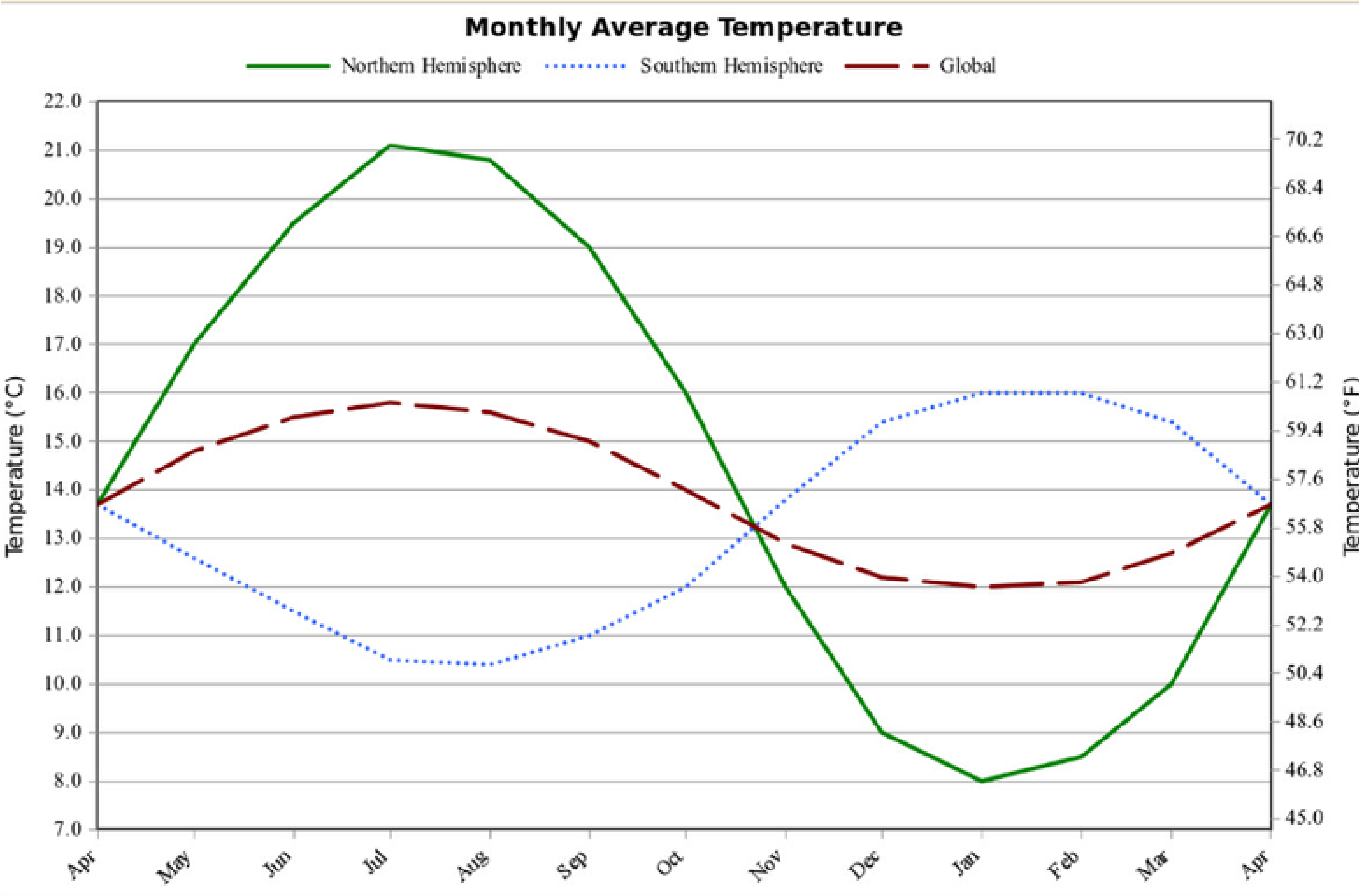


Illustration 1:
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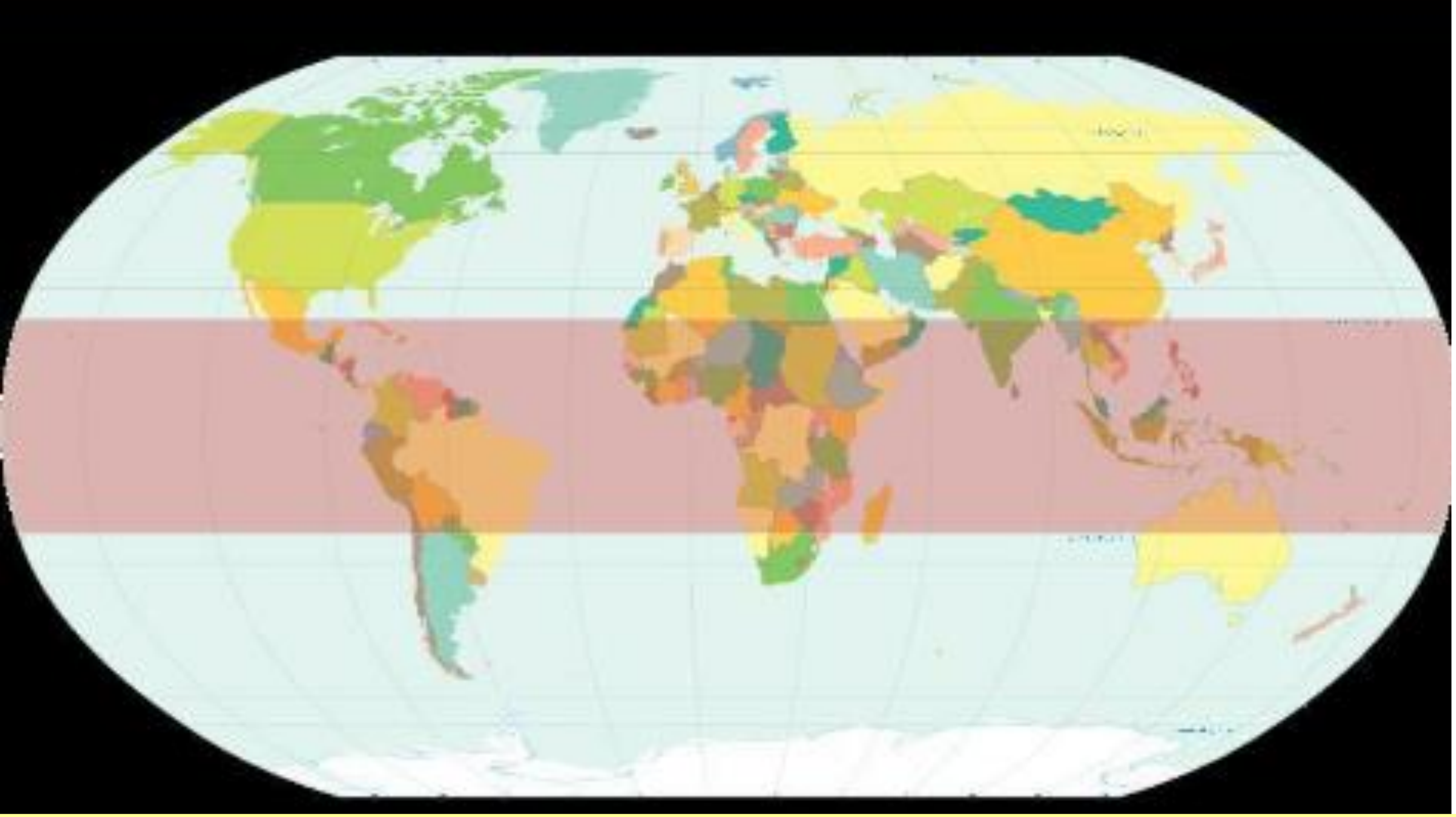


Illustration 10:
Tropics are highlighted.

The tropics receives excess energy from the sun: main driving force for oceanic and atmospheric currents.

Interaction of the ocean currents and atmosphere make Earth livable.

Extra energy from the tropics generates evaporation to drive the rains and snows that make the continents habitable. Ocean currents also drive the winds.

Currents and winds mix oxygen into oceans so sea life can thrive.

Minnesota and France are both the same latitude, but have different climates because the geography of each place is different. Minnesota is far from the stabilizing effect of the ocean while France has extensive coastal areas that moderate its climate. That same reason explains why Antarctica and Greenland are comparable in climate.

Earth has been going through natural cycles for millions, billions of years. It will continue onward for more millions and billions of years. Nothing humanity can do can stop them. These cycles are huge and they will endure.

<u>Warning: Scientific Content!!!</u>

Welcome to the Scientific Content. Each chapter will have a section dedicated to a more in-depth discussion of the content that was presented in the chapter, and more technical details of what I presented in the main chapter.

Earth Temperature:

Measuring Earth's temperature is not easy.
In a way it is much like measuring the temperature of a person.

Where you measure gives different results and what those results indicate….

High and low temperatures each day are averaged for each reading to give the daily average temperature.

Warning: Scientific Content!!!

Bob’s note

Kehr doesn’t mention marine surface air temperature.

Also, my small edits are shown this way < >

Station Method : This is the one that is more familiar to people.

On land, It involves a thermometer that is 1.5 meters above the ground and out of direct sunlight.

Since land is only a third of Earth, temperature readings are also taken by ships or weather buoys at sea, yielding Sea Surface Temperatures (SST).

Ocean temperatures don't vary much between day and night so one reading is generally enough for the ocean surface.

All the numbers are averaged for a day and that is the daily average temperature for the Earth.

The biggest problem with the station method is that thermometers are not all over the Earth. Some places have lots of them (USA, Europe) and some places have hardly any at all (Africa, Antarctica).
In many places a single thermometer is used to measure the temperature for an area larger than Texas.
There’s no way a <single> thermometer can accurately do that.

Warning: Scientific Content!!!

Another problem is where the thermometer is located.

If the thermometer is placed above concrete or asphalt, or in a city surrounded by buildings, high and low temperatures will be higher than in a field of grass.

This is called the Urban Heat Island (UHI) effect.

Bricks, stone, concrete, asphalt all absorb heat and retain heat into the night.

Being in a city makes the temperature several degrees higher than it would be otherwise. Since many measuring stations are in cities (where the people are), the UHI has an impact

Warning: Scientific Content!!!

Satellite Method:

This involves a series of satellites in orbit that measure the electromagnetic transmittance of a region of the atmosphere.

This is converted into a temperature for that particular region of the atmosphere and averaged over the Earth.

The satellites cover far more of the Earth each day than the stations do, but don't cover the entire Earth every day, due to the nature of the orbits …

Satellites cover the oceans and areas without stations more completely than stations can, but don’t measure temperature in the same manner as a thermometer.

Warning: Scientific Content!!!

Temperature data in this book combines two station methods and two satellite methods.

Specifically:

CRU and GHCN station methods

and

UAH and RSS satellite methods.

I incorporate the modern, more sensitive satellite method with the longer period of the station method in my analysis.

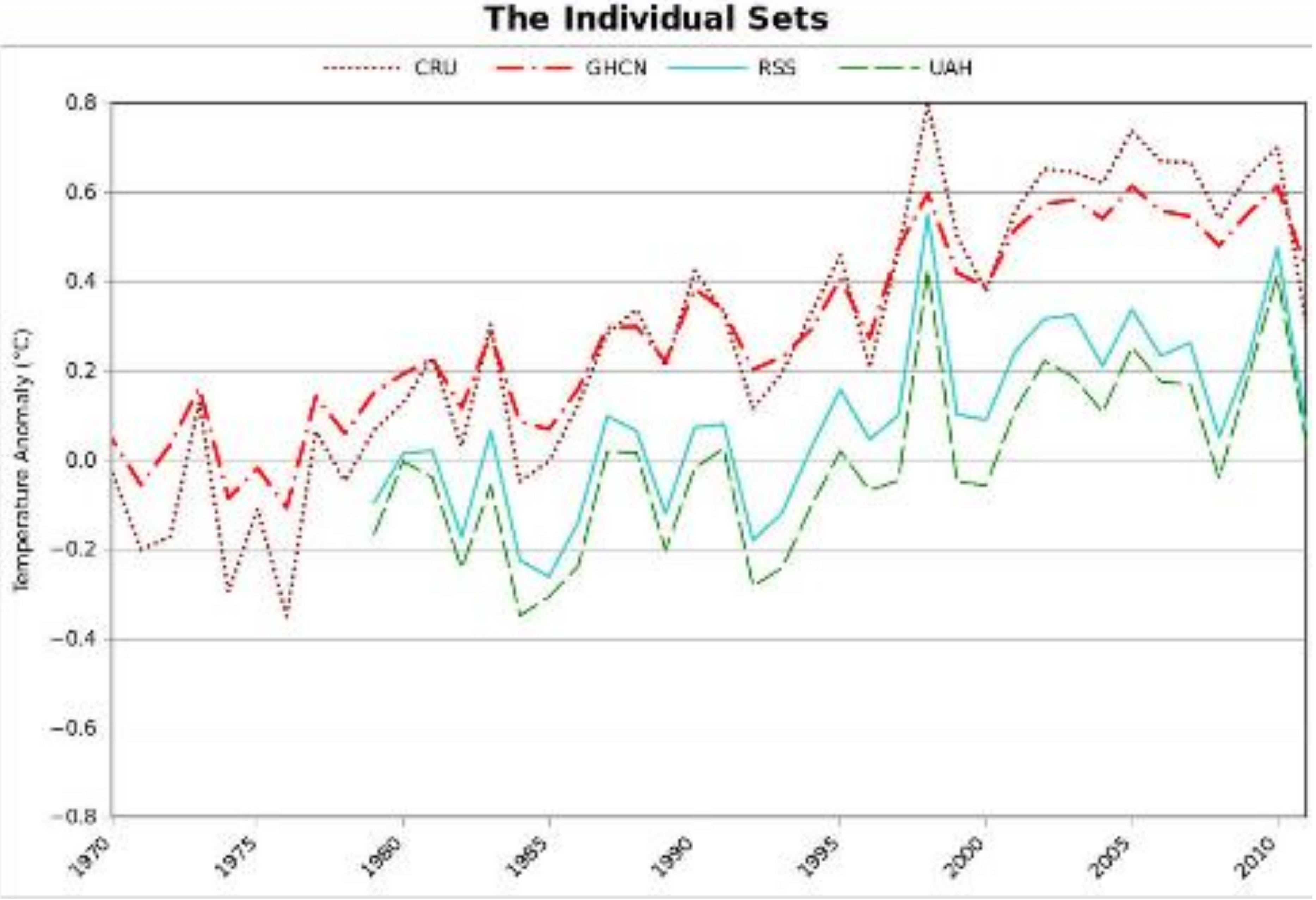


Illustration 11: The station methods are generally warmer than the satellite methods.

Bob comment: RSS changed calculation methodology in 2016

Warning: Scientific Content!!!

The single set I use to show warming since 1850 is the blended set which combines the separate sets.

This set shows more warming than the satellite data, but less than the station data.

It also shows that Earth has warmed up ~0.4 °C since 1980 and I accept that this is an accurate and reasonable measurement, not perfect, but reasonable.

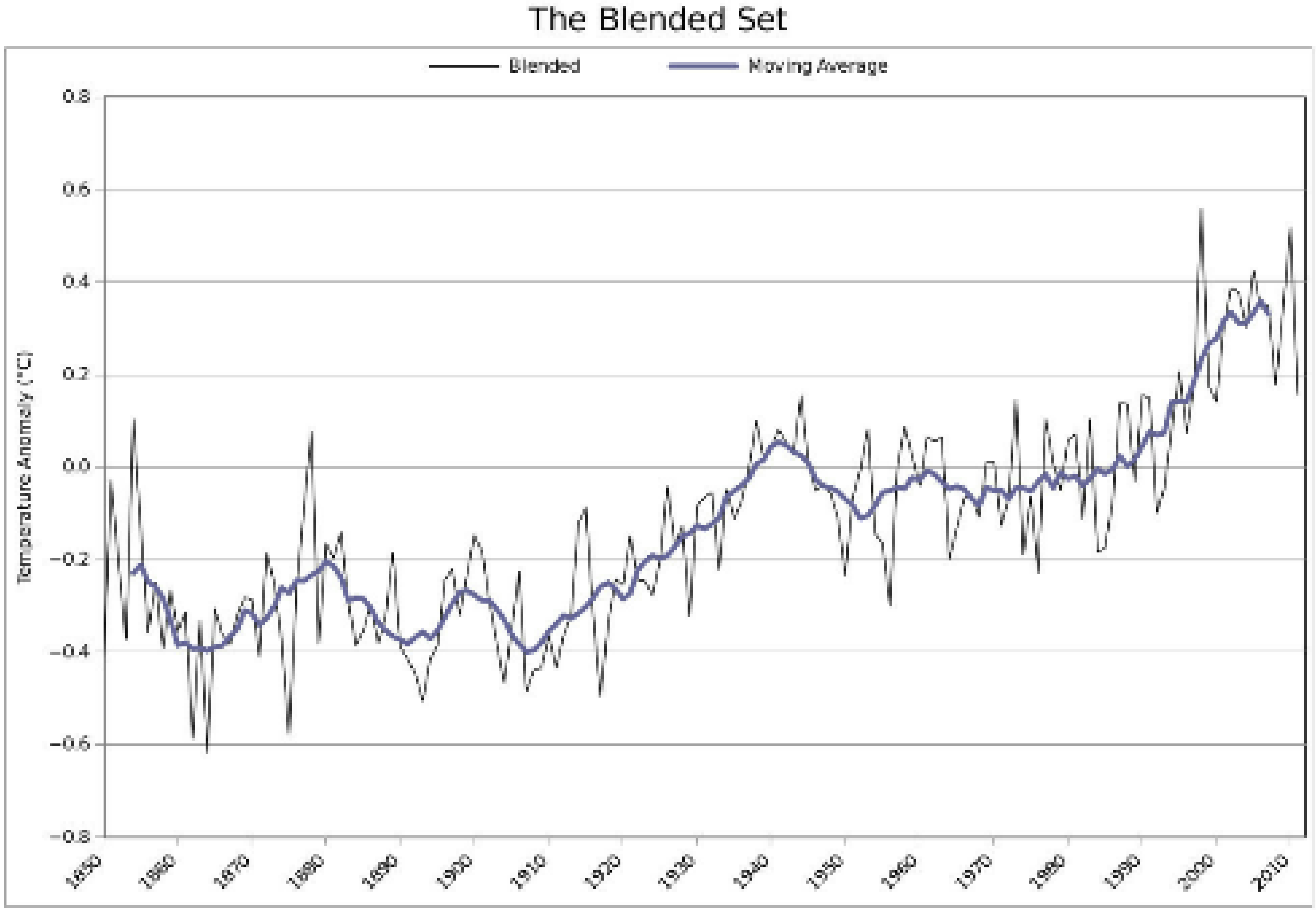
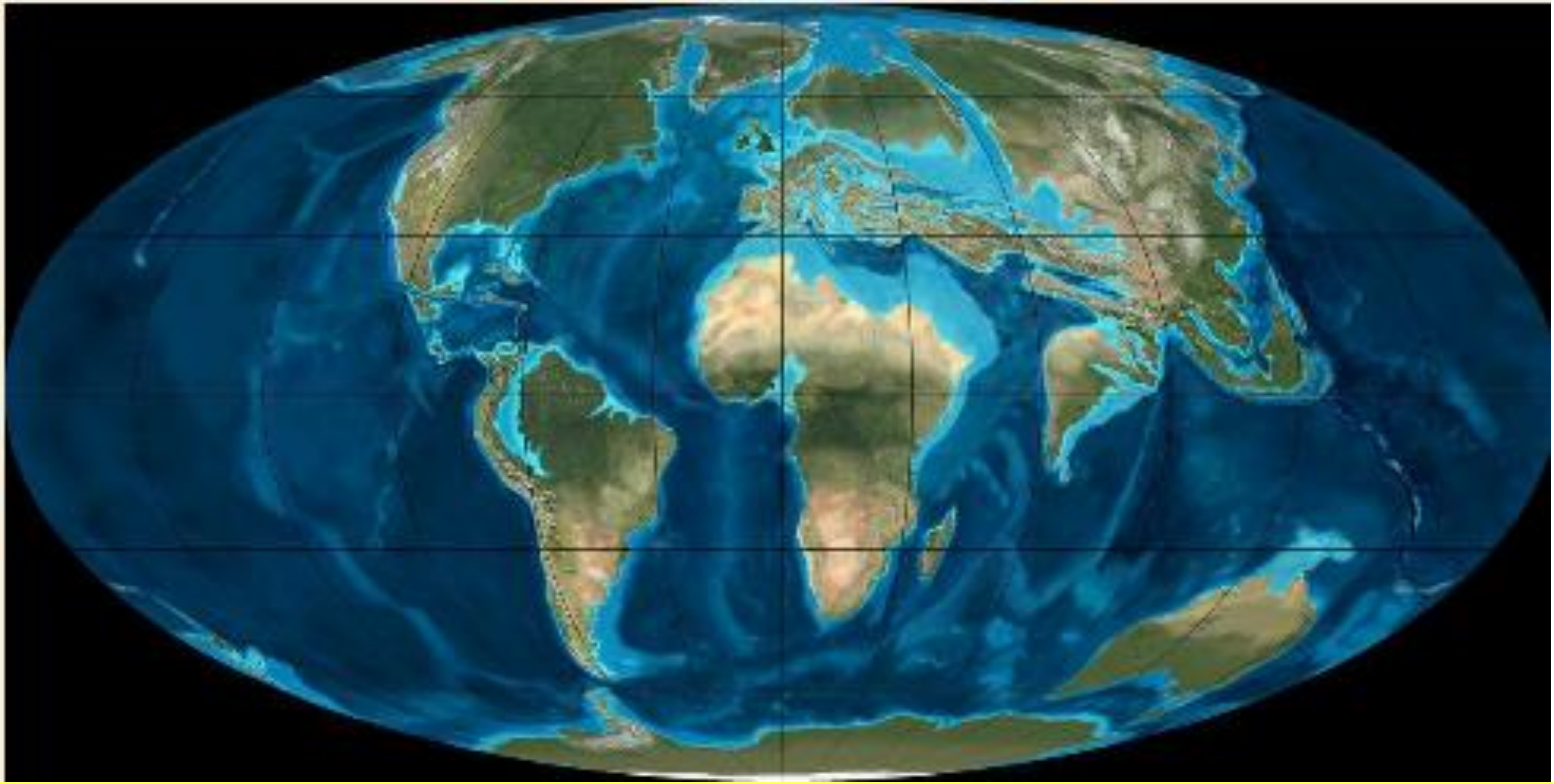


Illustration 12:
Using a single set for most usages is useful and incorporates more information than any single set.

Illustration 13:
Earth 50 Million Years Ago, early Eocene.

Recent History of Earth



Sea levels, more than 150m (500ft) higher than today; no permanent ice sheets anywhere on Earth.

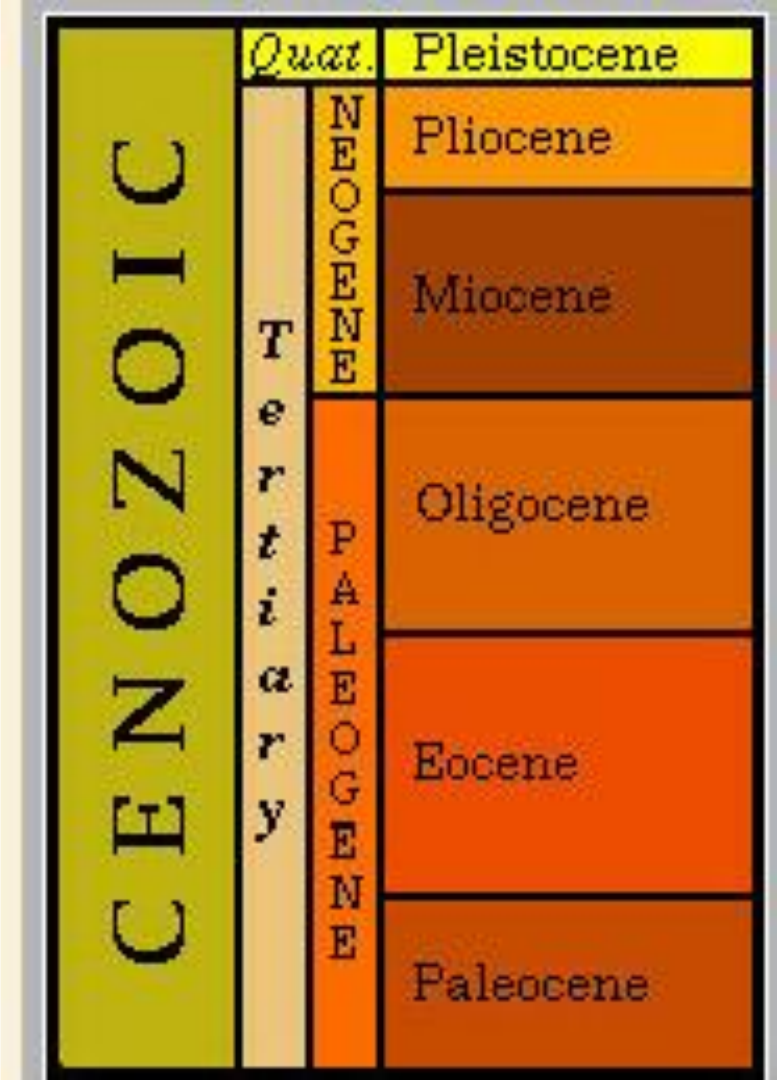


Illustration 14:
Epochs of the Cenozoic.
UC Berkeley.

Oceans and their currents play a critical role in controlling Earth's climate because that's how the Earth transports energy from the tropics poleward.

Anything that alters the flow of energy will have an impact on climate of the Polar Regions.

As the continents drifted, ocean currents changed.

It's clear from geological records that dramatic changes to the climate happened when the ocean currents were changed by the landmasses either moving together, stopping a current, or pulling apart, allowing a new current to form.

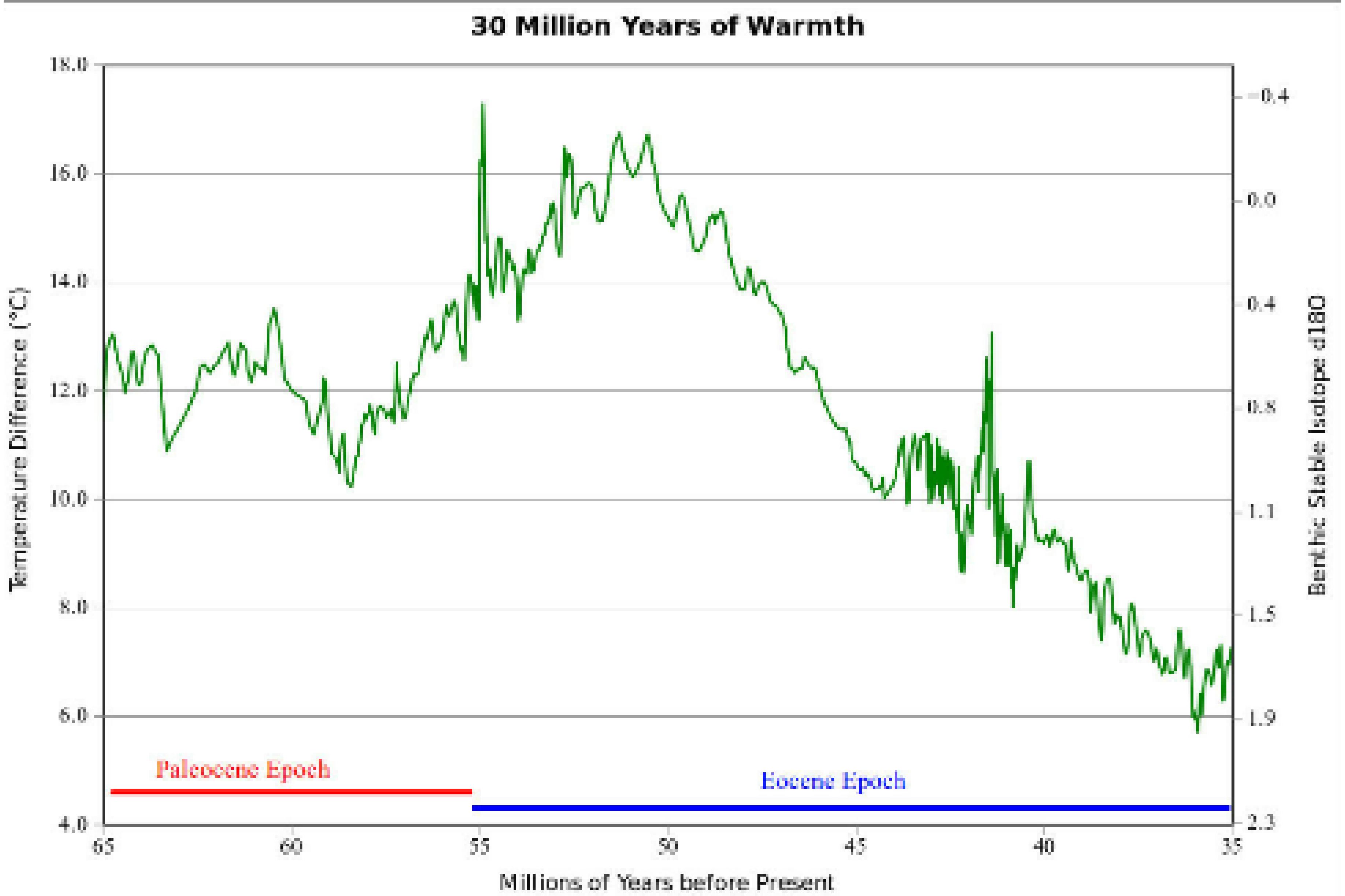


Illustration 15:
Temperature was determined by calibrating stable isotope to temperatures of the recent glacials.
Epochs of the Cenozoic are also shown.

Beginning of Cenozoic: Earth much warmer than today.

Most of the past 65 million years were warmer than today.

Cenezoic Era started off roughly 8-10 °C (18 °F) warmer than today.

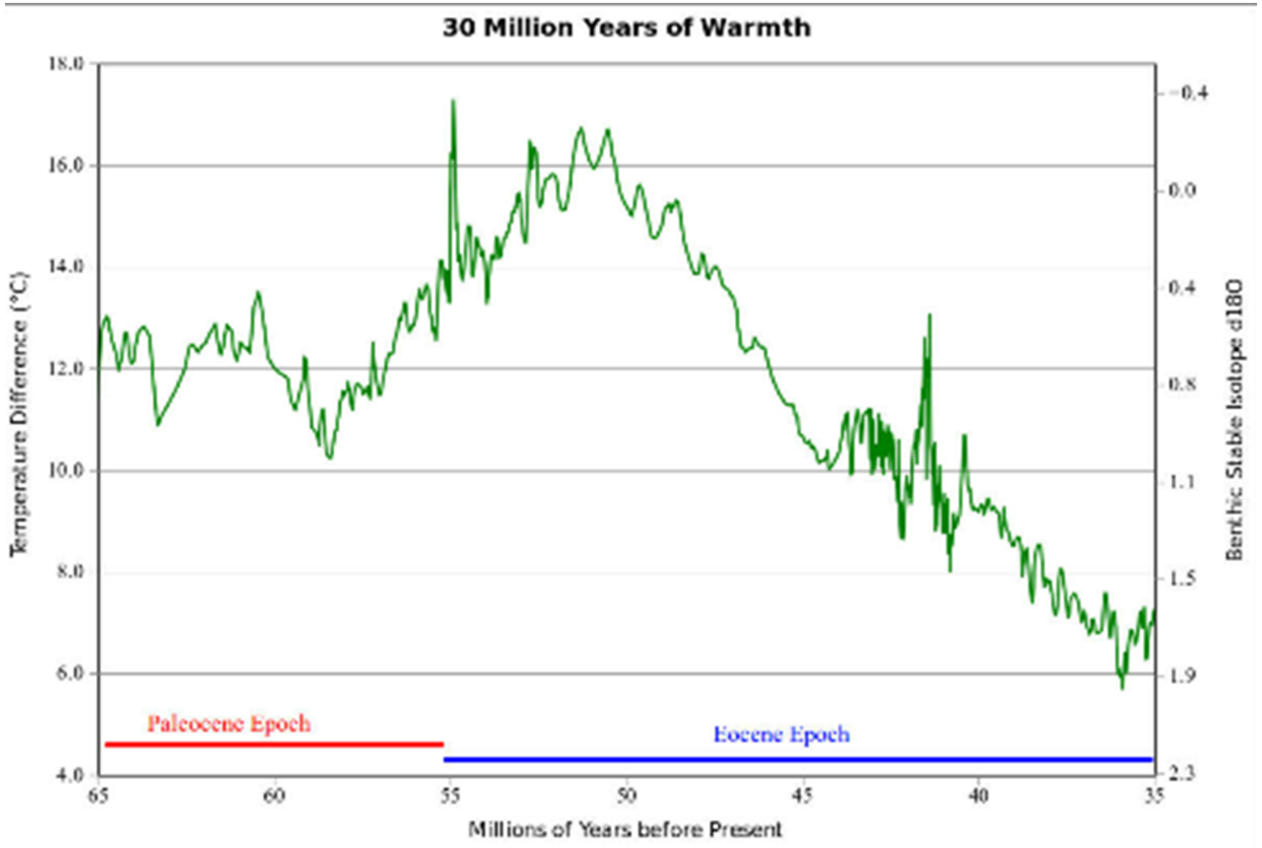
The major difference in temperature was at the poles.

Antarctica had no permanent ice; climate was probably comparable to Canada as we know it today.

The Arctic was probably even warmer than Antarctica.

The tropics, not that much warmer than they are today.

Most of the temperature change happened in the Polar Regions...smallest temperature change happened in the Tropics.



Warmest part of the Cenozoic is the Eocene Optimum.

Happened 50 million years ago.

Was even warmer then, than during the Mesozoic, time of the dinosaurs.

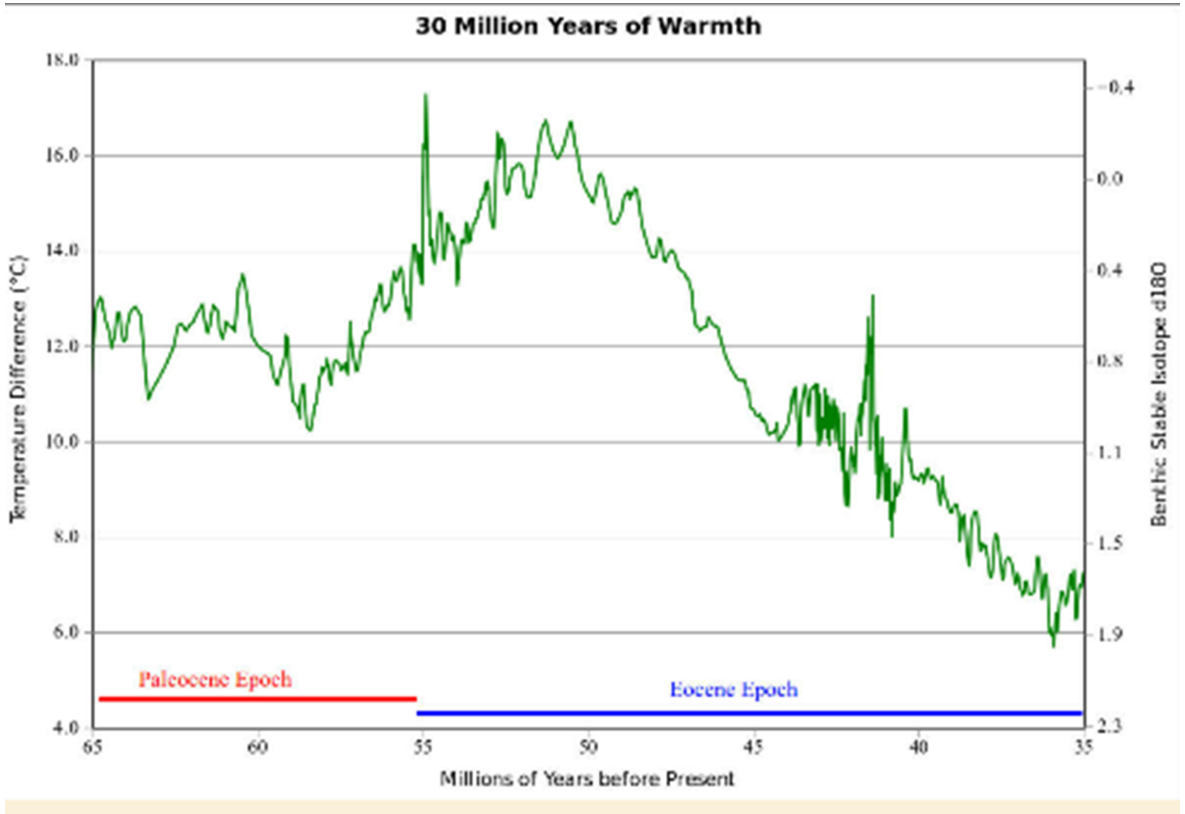
According to global warming theory, Earth in that state should have stayed warm.

CO_2 level was high with many warm, shallow oceans, water vapor in the atmosphere would have been higher than today.

Was the perfect condition for a warm world.

That was also the condition from which the world started to cool down.

Cooling happened with high temperatures in Polar Regions, high atmospheric CO_2 levels.



Wasn't entire Earth cooling;
the real culprit: Antarctica starting to cool.

41 million years ago Antarctica was cold enough for snow and ice to form during winters.

Coincides with opening of Drake Passage between Antarctica - South America.

As Drake Passage became larger, allowed formation of the Antarctic Circumpolar Current (ACC).

As ACC grew in strength, less warmth from Tropics reached Antarctica because ACC surrounds Antarctica.

Changing ocean currents resulted steady average cooling happening 34 to 41 million of years ago.

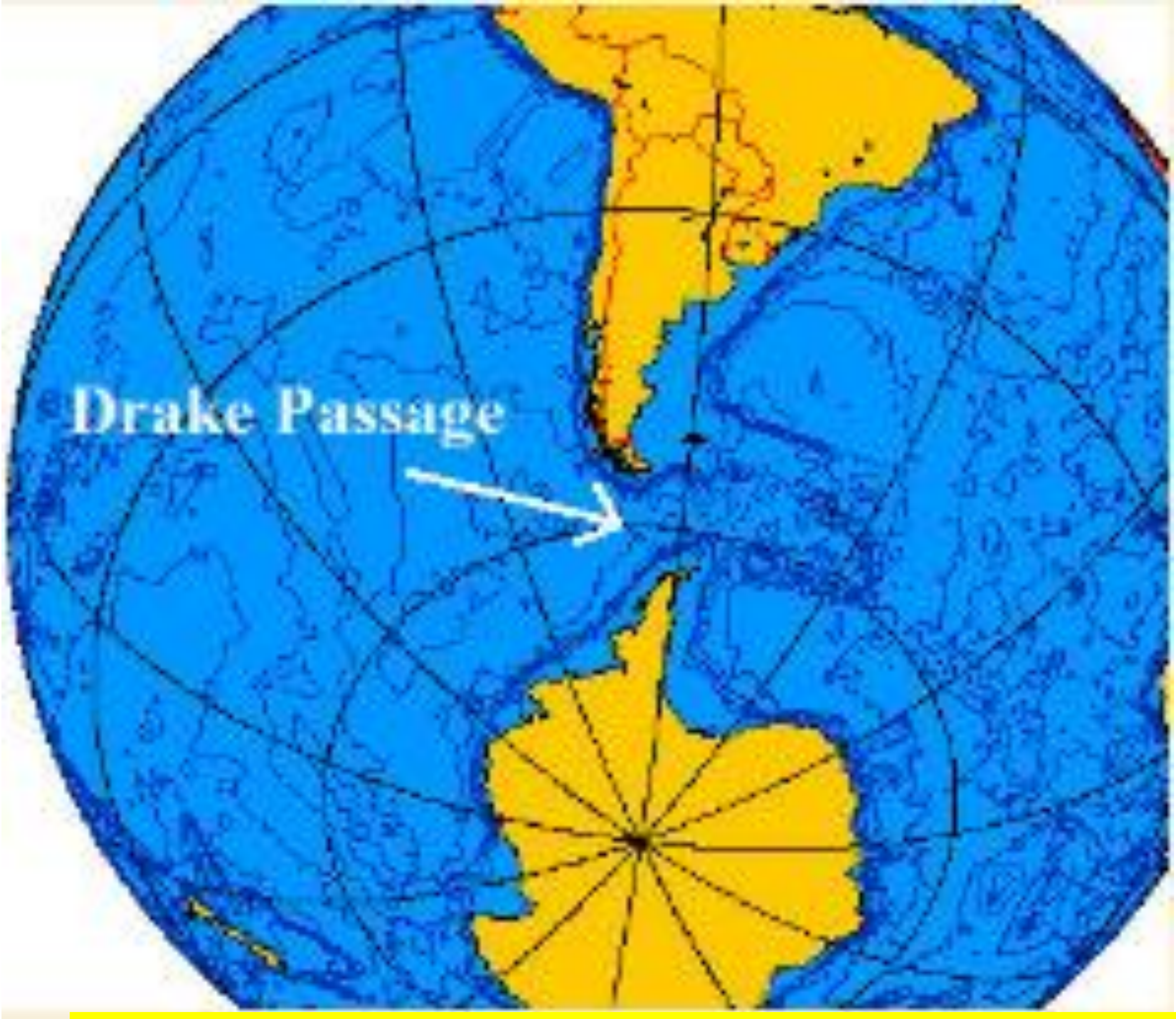


Illustration 16:
Drake Passage was closed in the early Cenozoic.
Opening of the passage altered the Earth's climate.

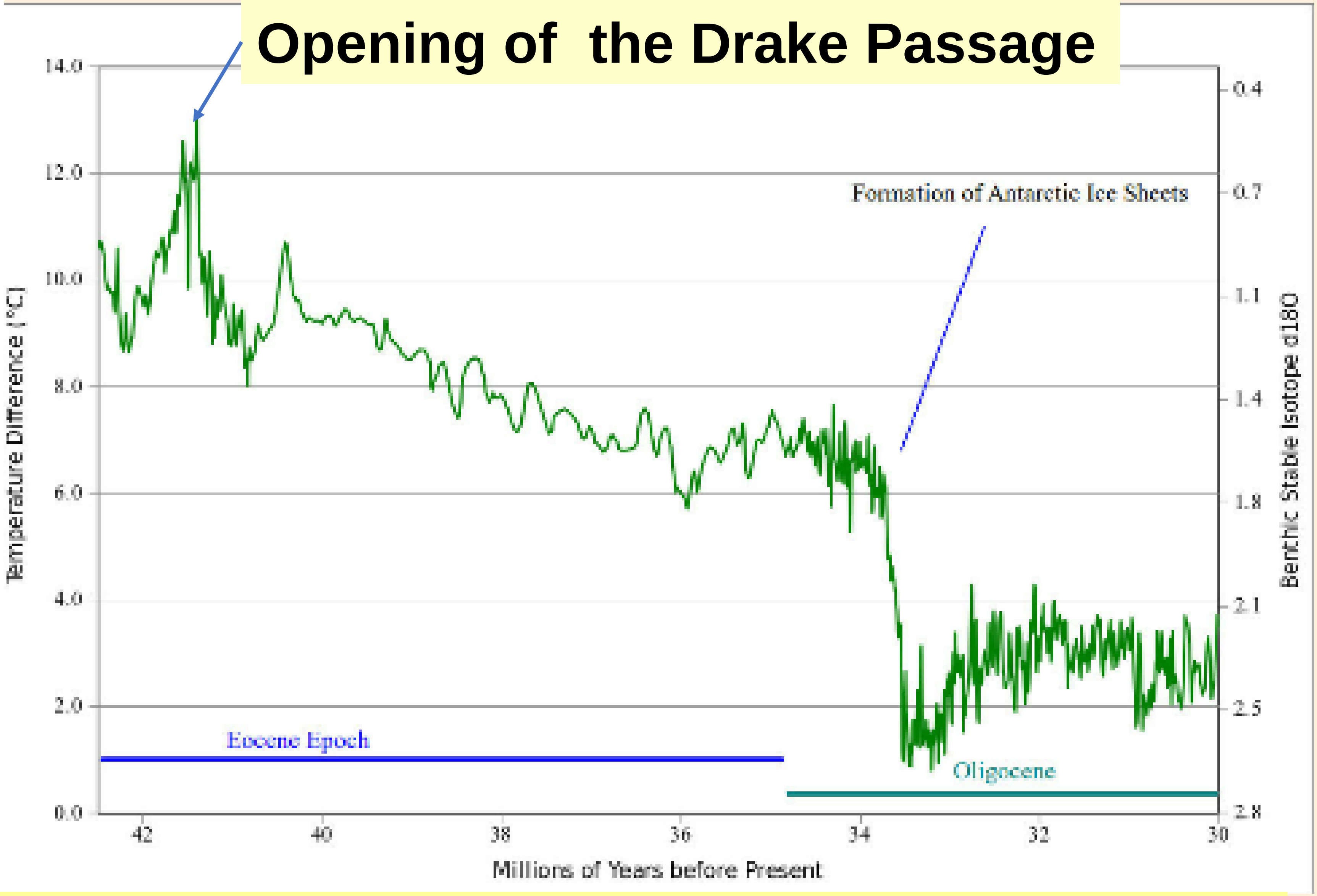


Illustration 17:
Changing geography plays a major role in changes to the Earth's climate. (Zachos, 2008)

…while average temperature of Earth was decreasing, average drop caused by large Antarctic drop in temperature. Whole Earth wasn't getting cooler, Antarctica changed from temperate place to frigid wasteland.

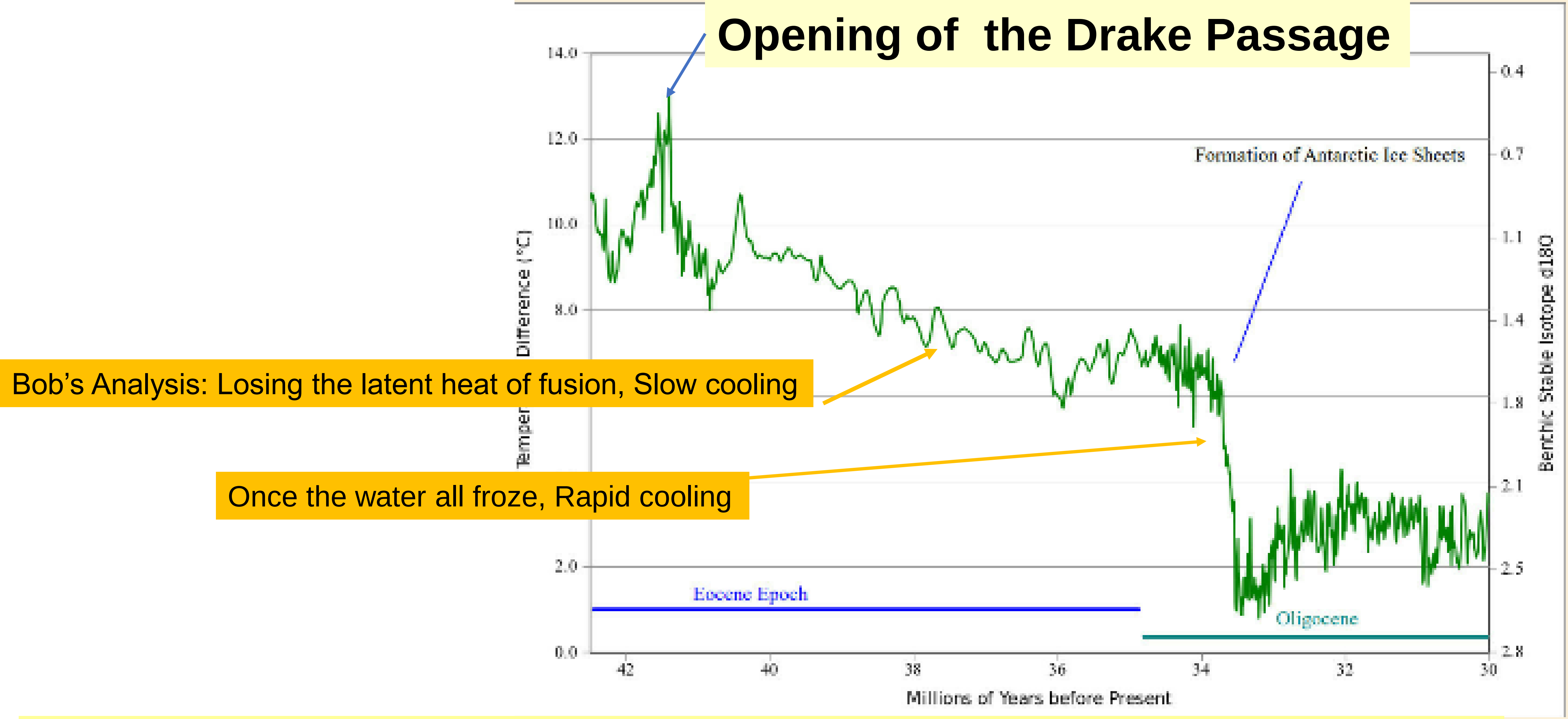


Illustration 17: Changing geography plays a major role in changes to the Earth's climate. (Zachos, 2008)

…while the average temperature of the Earth was decreasing, the average drop was caused by a large drop in temperature in Antarctica. The whole Earth was not getting cooler, Antarctica changed from what was likely a temperate place to a frigid wasteland.

When Antarctica started to freeze over, Earth was roughly 4-7 °C (12 °F) warmer than today.

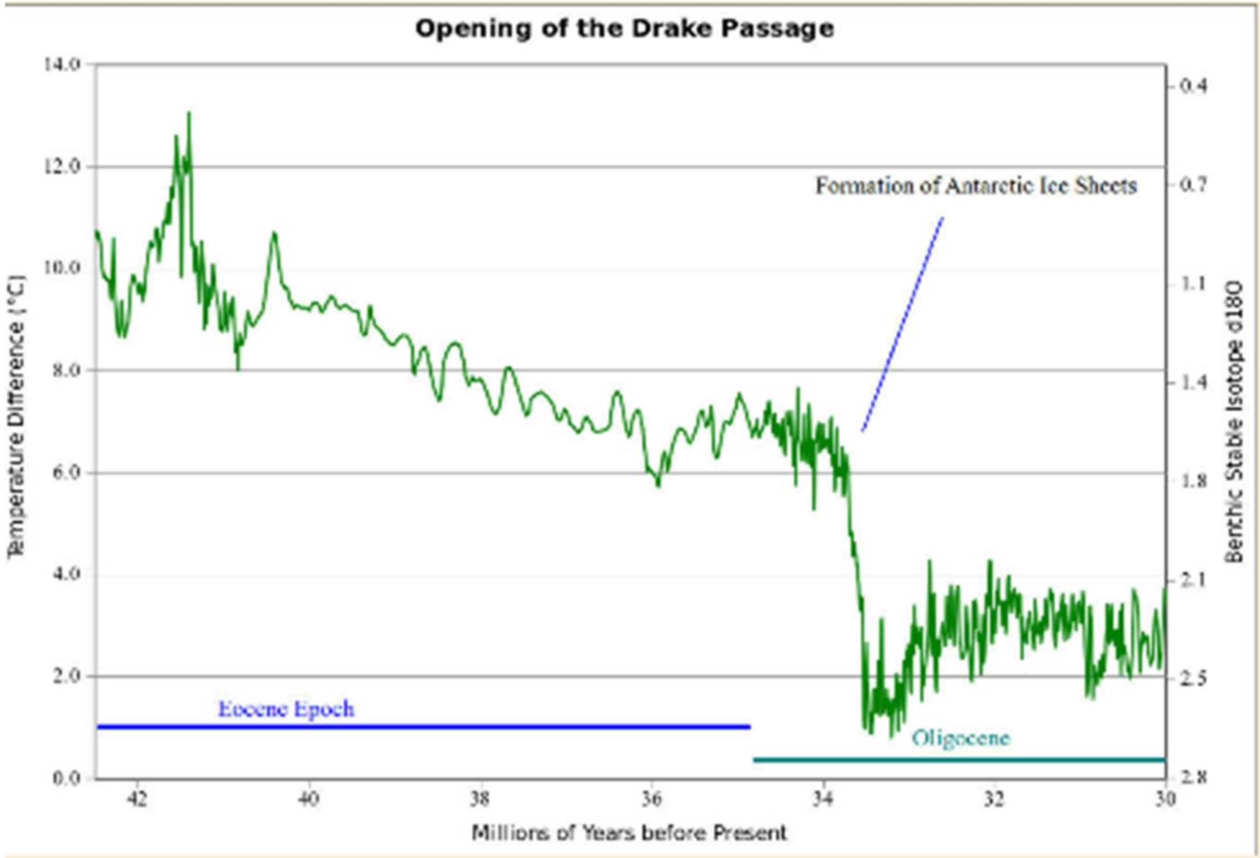
Formation of the ice sheets was enough to drop average Earth temperature to only a few °C above today.

Not caused by a change in the atmosphere, but an alteration of the ocean currents.

When Antarctica stopped getting warm water from the tropics, it started to freeze.

The past 34 million years Antarctica has remained at least partly frozen.

Antarctica froze while average temperature of the Earth was already much warmer than today.

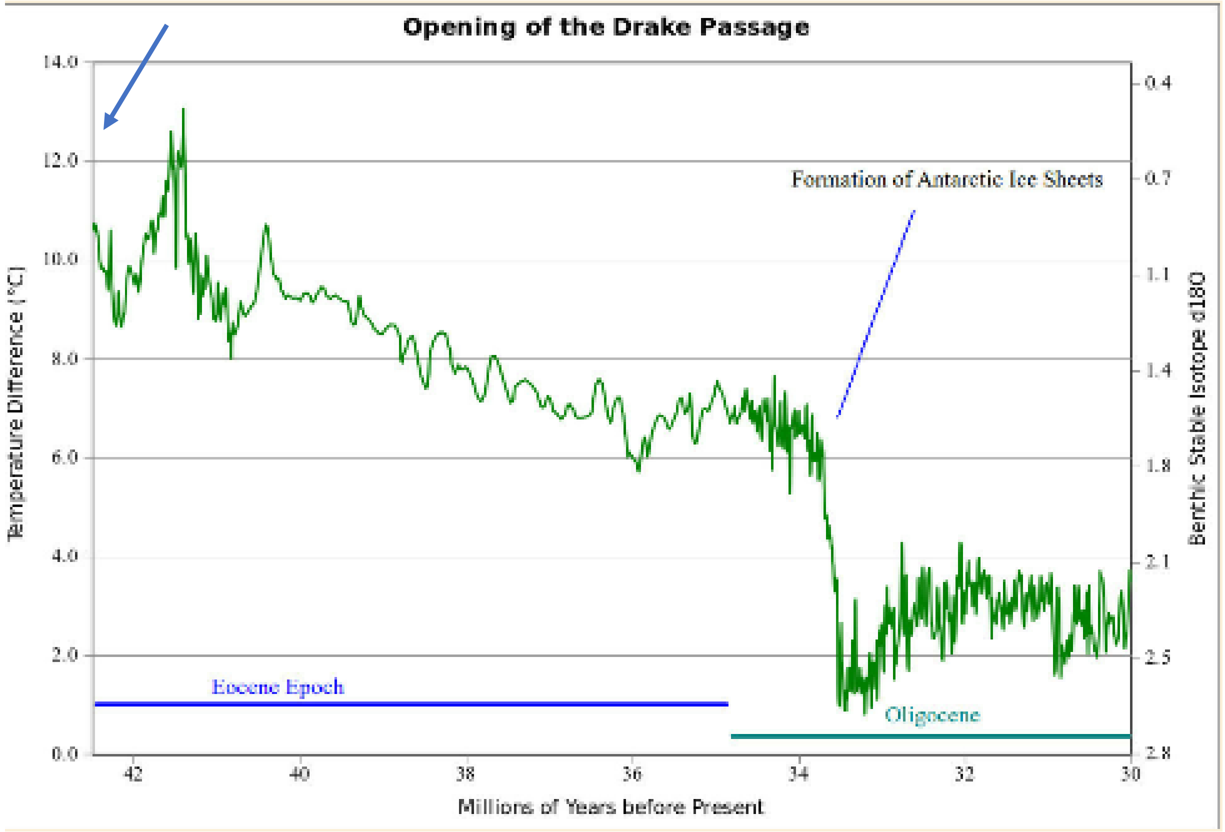


The largest species extinction since the time of the dinosaurs occurred.

Species that had been separated by oceans were free to colonize new continents much to the detriment of the slower and weaker species.

This extinction is called the Eocene-Oligocene extinction.

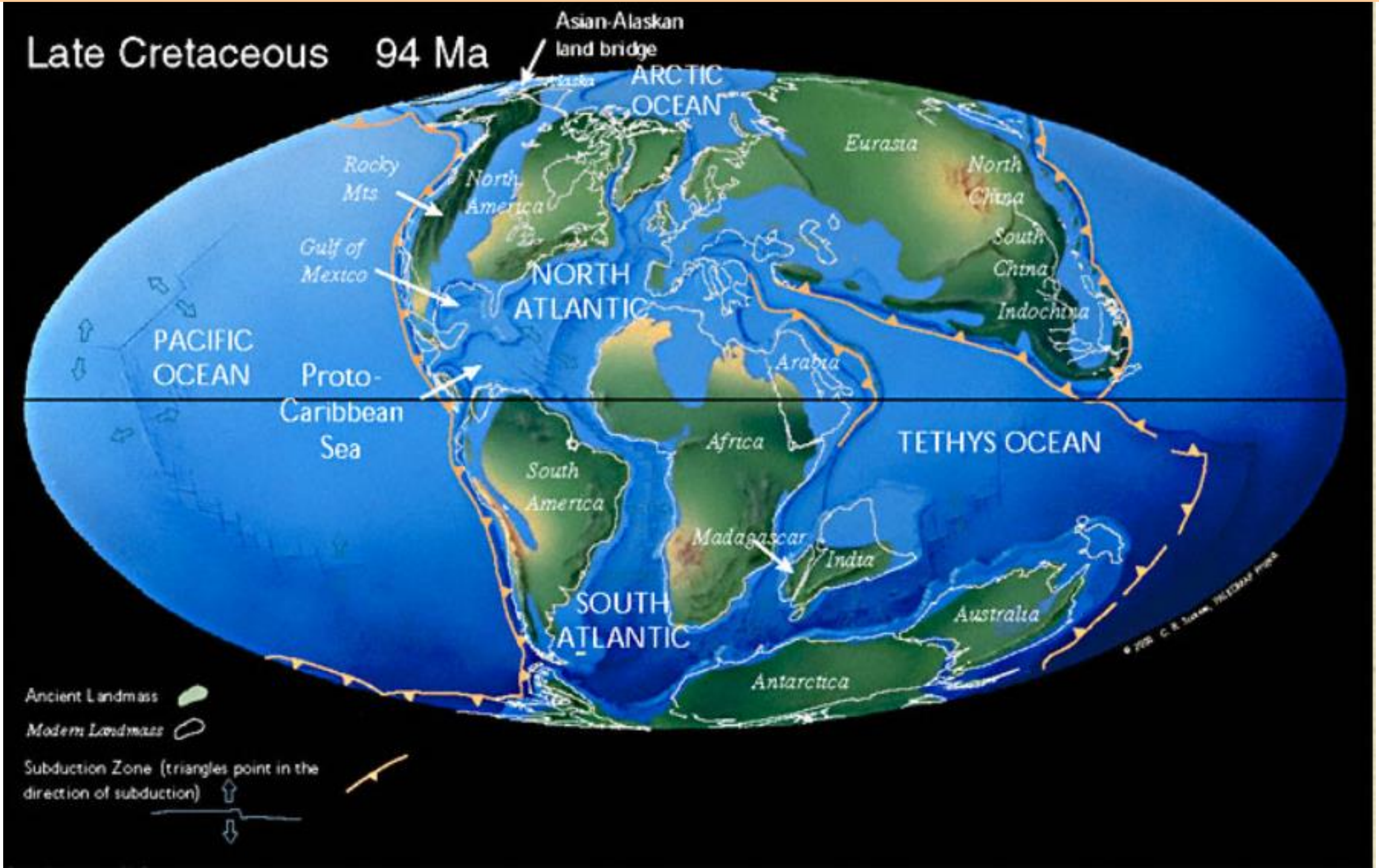
Sea level change, species extinction and radical change in the Earth's climate all naturally occurred as a side effect of the change that happened when Antarctica's climate changed.



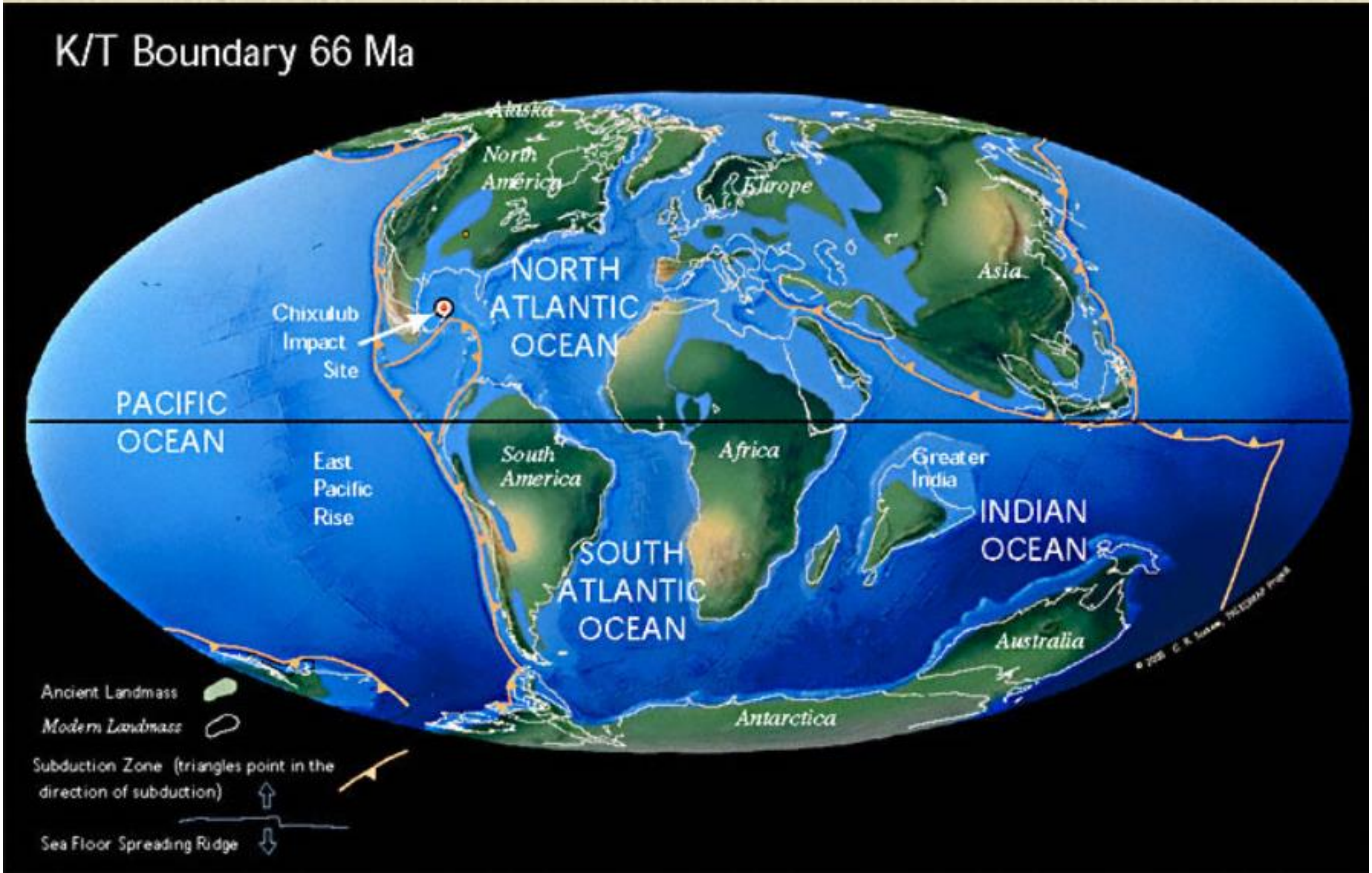
Global effect was significant enough that time before Antarctica froze is the Eocene, the time after, the Oligocene.

It was truly a global change caused by long-term change in ocean currents.

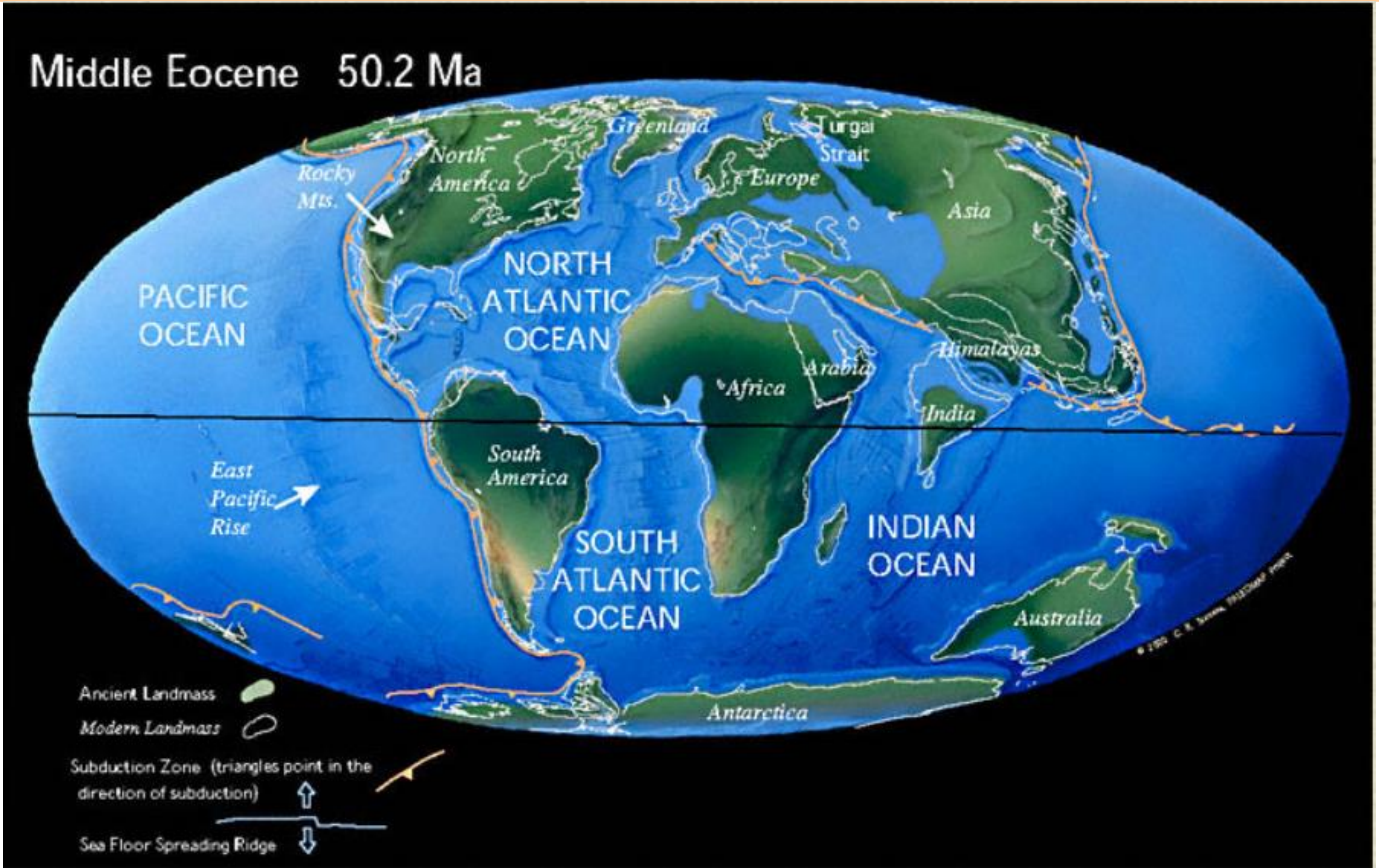
From Scotese's Paleomap Project: http://www.scotese.com/cretaceo.htm



From Scotese's Paleomap Project: http://www.scotese.com/K/t.htm



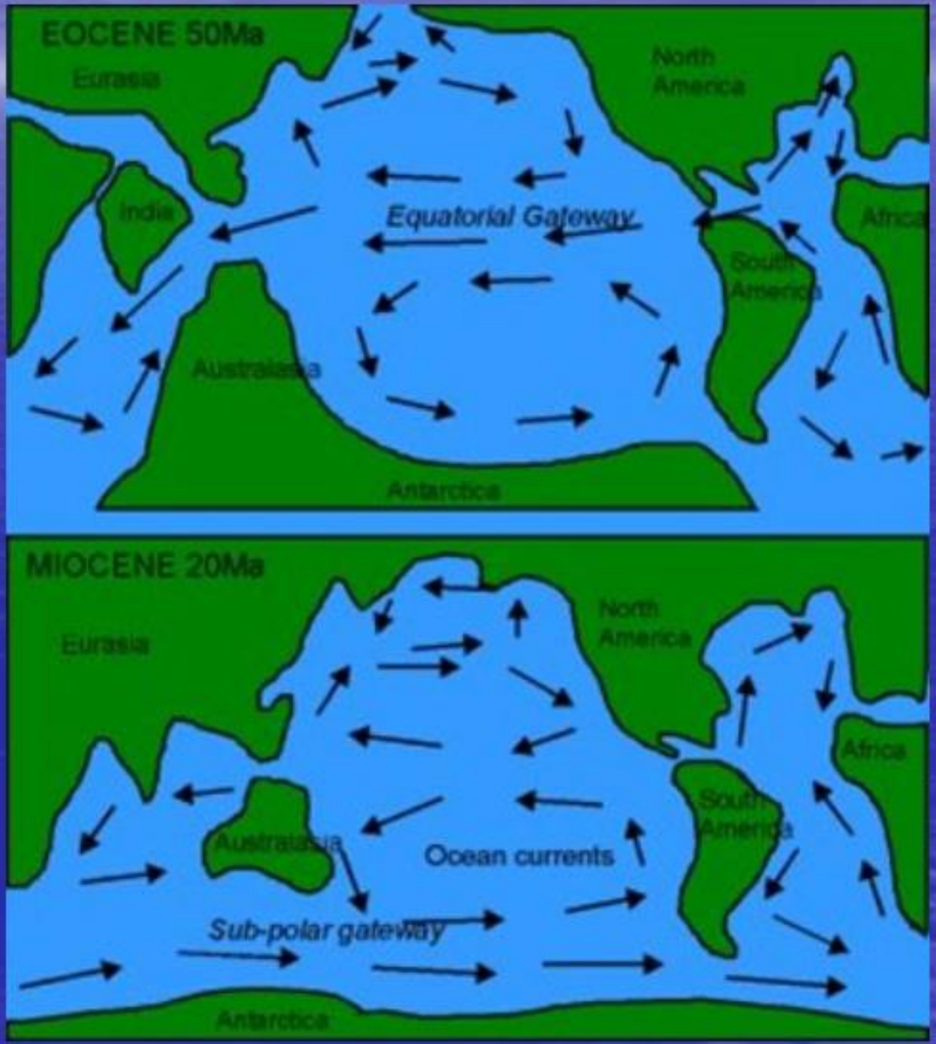
From Scotese’s Paleomap Project: http://www.scotese.com/newpage9.htm



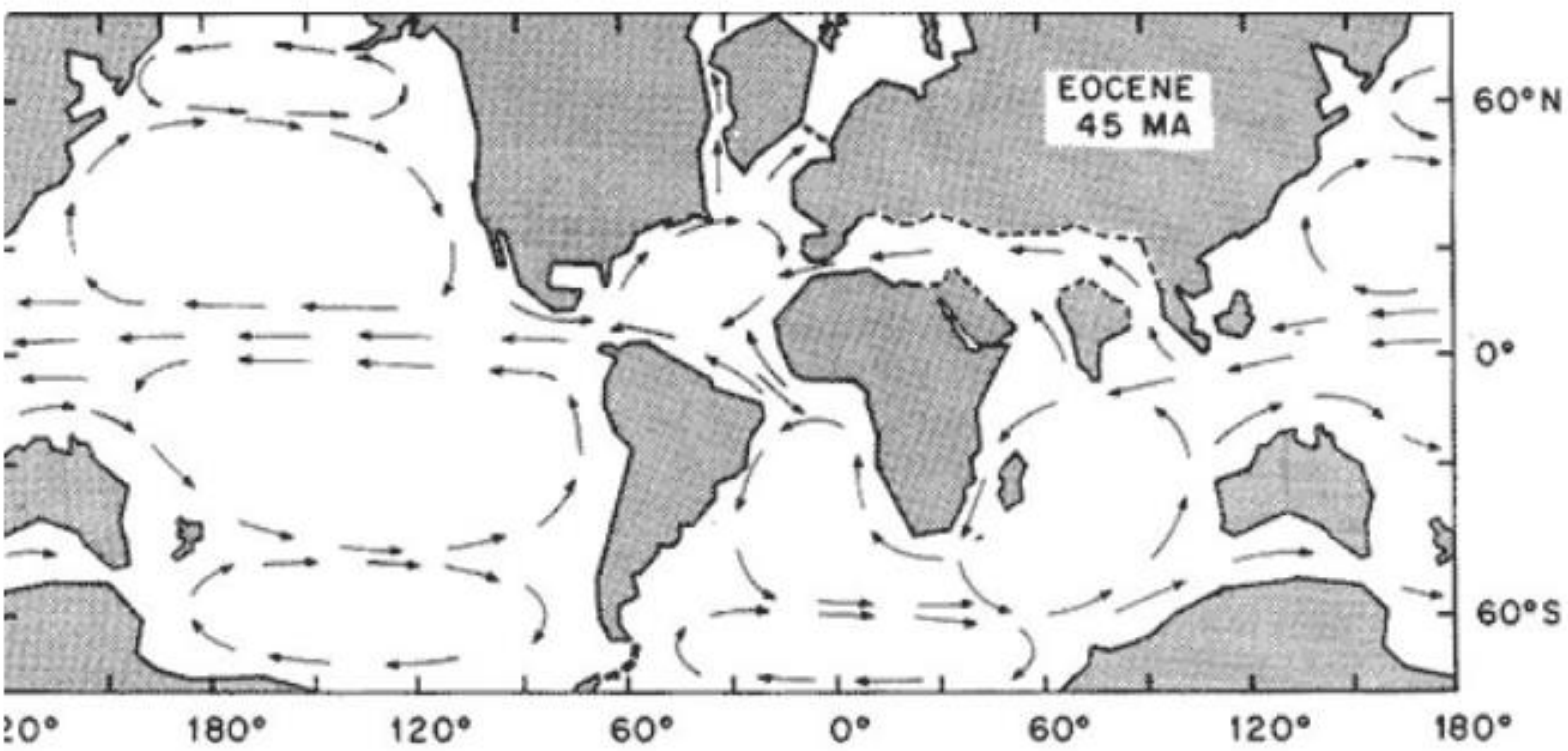
https://slideplayer.com/slide/691274/

Ocean Circulation

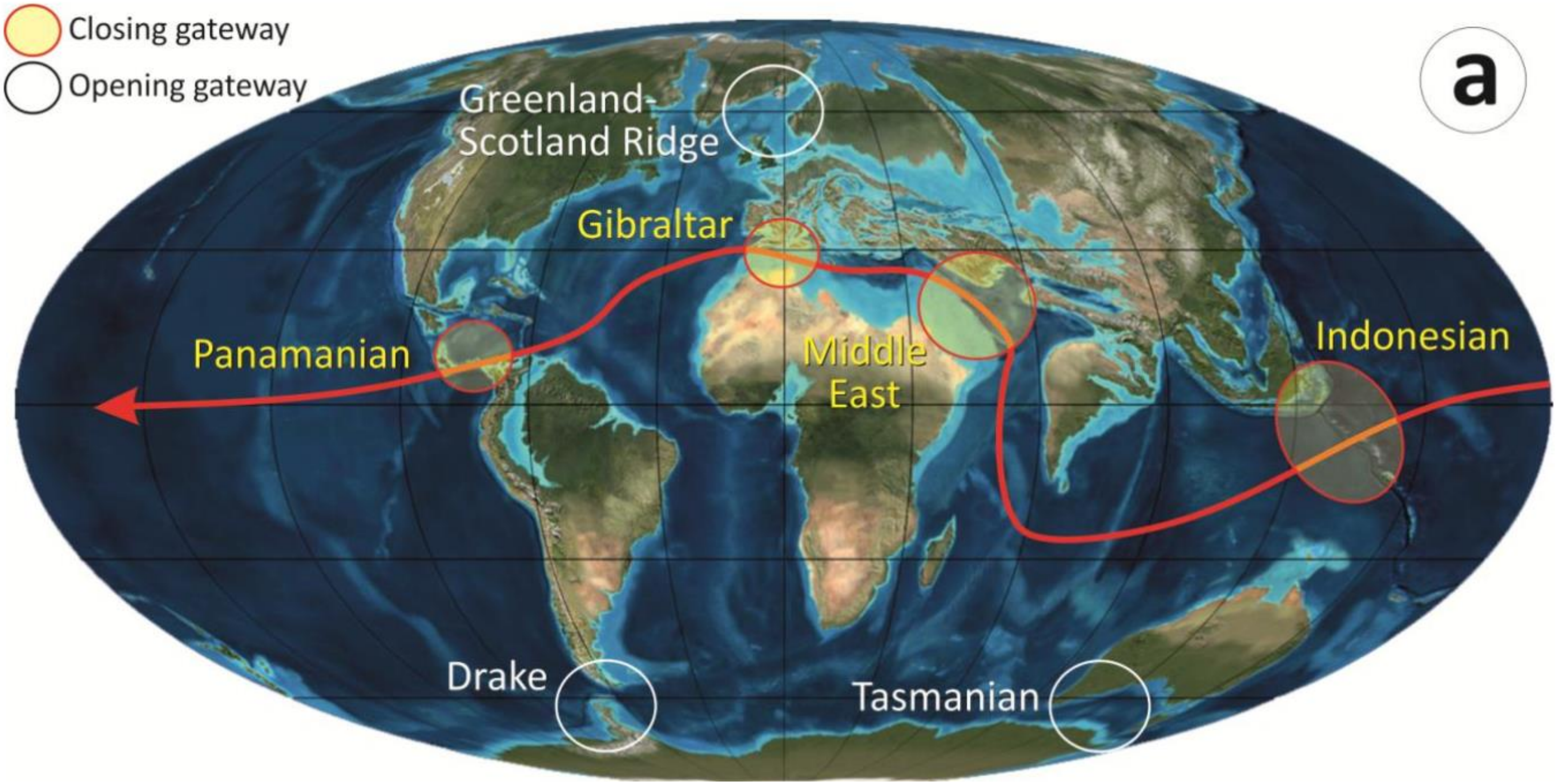
- Some researchers believe that ocean circulation holds key to long-term changes
- Continental drift allowed circumpolar flow around Antarctica in the Miocene
- Renewed glaciers in Antarctica



http://geology.uprm.edu/Morelock/paleoceanog.htm



https://www.researchgate.net/publication/261564563_Contourites_and_associated_sediments_controlled_by_deep-water_circulation_processes_State-of-the-art_and_future_Considerations/download



Back and forth tug-of-war between warmth and cold stopped ~13 million years ago.

Cold won the battle; kept Antarctica in deep freeze since.

If things stayed the same as 13 million years ago average temperature of Earth today would be 3-4 °C (5-7 °F) warmer.

Antarctica froze when Earth was much warmer than today.

Oceans were higher than today; Antarctica has gotten colder over time.

Ice has grown thicker. Life that survived transition from warm to cold has now adapted to today's brutal climate.

Life that did not adapt is now extinct.

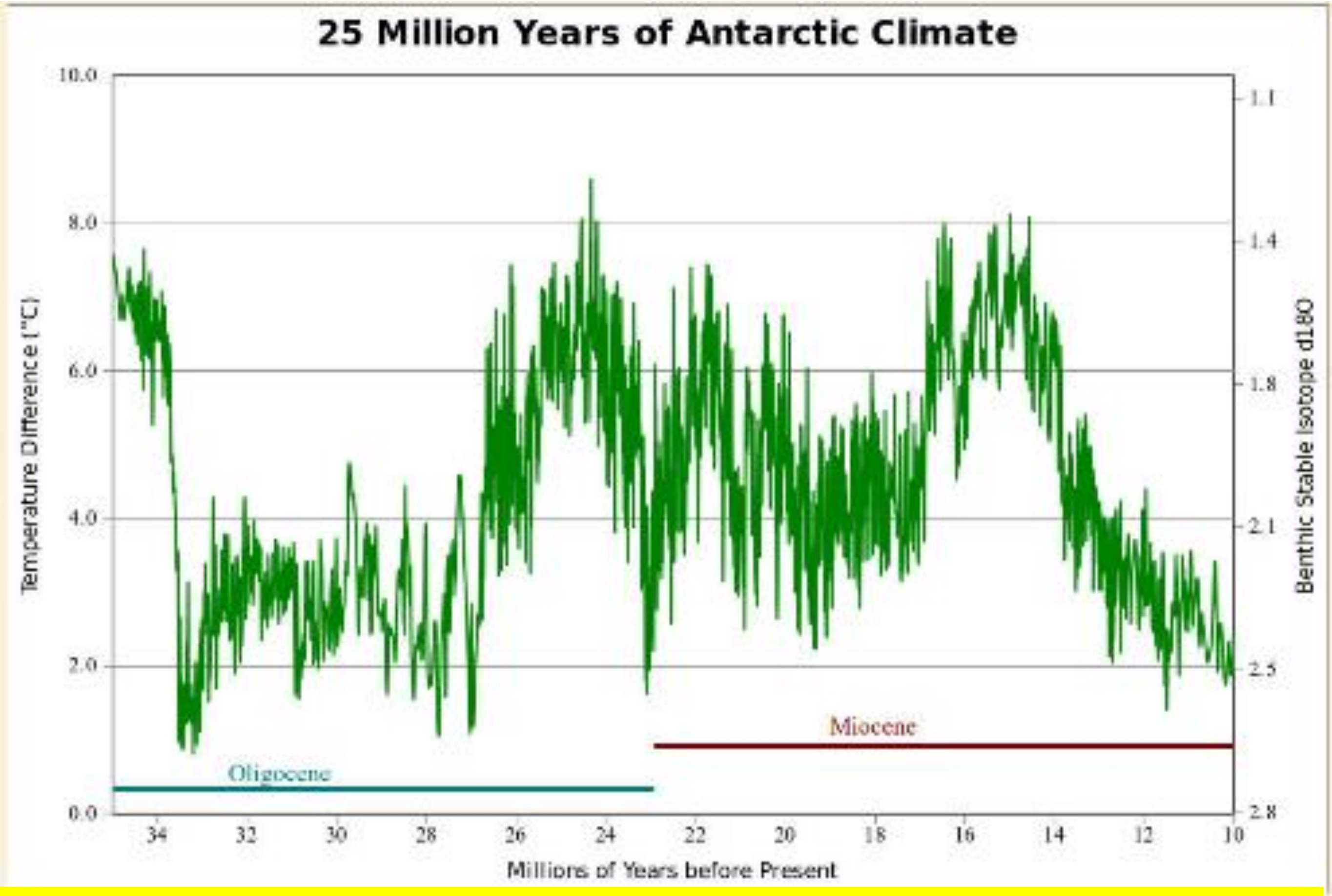


Illustration 18:
Antarctica has experienced wildly variable climate in the past. This included periods of rapidly advancing glaciers and also rapidly retreating glaciers.   (Zachos, 2008)

Antarctica freezing:

Primary cause of cooling Earth experienced past 50 million years.

Tropics experienced very little temperature change in comparison, but because one part of Earth got much colder, the average dropped.

Throughout entire Antarctic cooling, then freezing, the Arctic remained warm.

Tropical ocean currents continued flowing northward; helped keep Arctic warm.

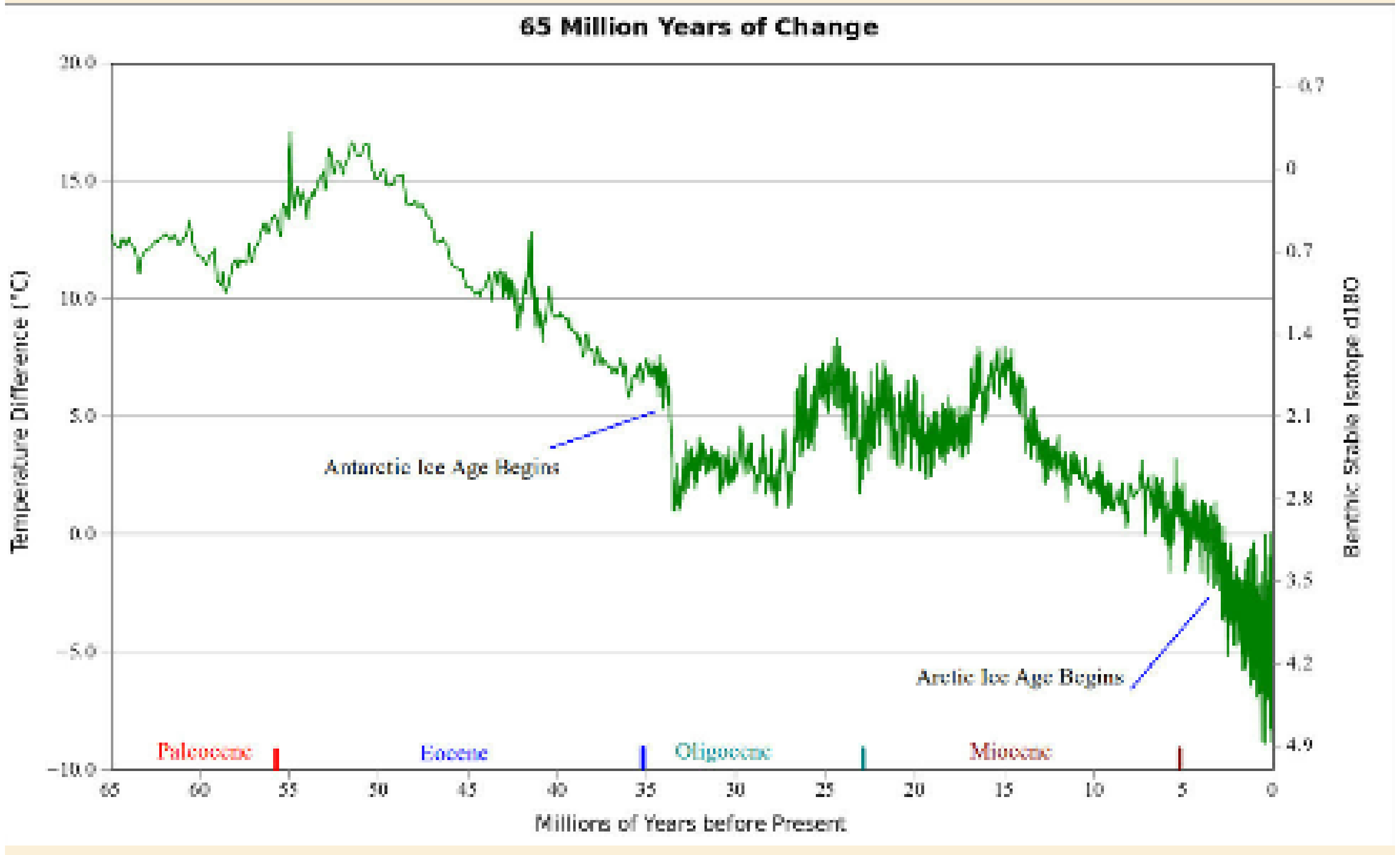


Illustration 19:
The last 1 million years has been the coldest period of the past 65 million years. Same temperature calibration to benthic stable isotope. See science content for details. (Zachos, 2008)

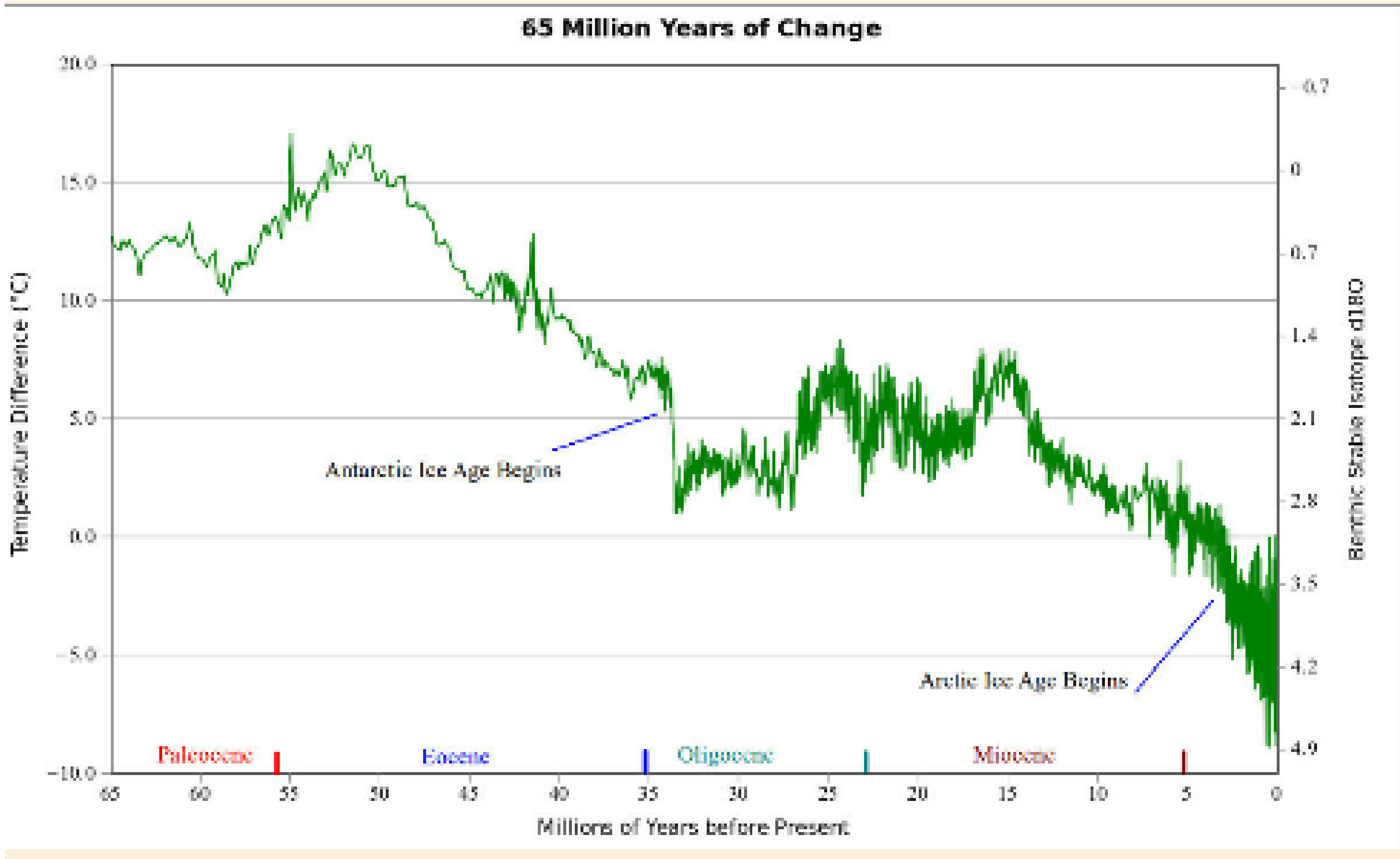
As Europe, Asia merged and India continued to push northward into Asia, warm ocean currents weakened.

As ice sheets in Antarctica grew, sea levels dropped.

Combination continued to weaken warm currents keeping the North Pole warm.

2.6 million years ago it was not enough.

For the first time in the Cenozoic, the Arctic started to freeze, and Earth entered its current Ice Age.



2.6 million years ago the Northern Hemisphere periods of glaciers advance and retreat started.

By these definitions Earth is currently in an Ice Age; experiencing an interglacial period between glacials.

Geologists agree this is the current state of Earth.

Real start of current Ice Age was ice sheets starting to grow in Antarctica.

2.6 million years ago Northern Hemisphere's ice age commencement -- marked with the alternating glacial and interglacial periods.

Ice Age: A time of extensive glaciation covering vast areas of the earth.

Glacial: An interval of time within an ice age that is marked by colder temperatures and glacier advances.

Interglacial: An interval of time within an ice age that is marked by warmer temperatures and glacier retreats. Marks the periods between glacial periods.

Glacial cycles over the past 2.6 million years have taken place on two different time scales.

During the initial period, cycle took ~41,000 years.

Using today as zero temperature anomaly, the temperature range of the Earth during the 41,000 year cycles was from 0 °C to -6 °C.

The cycles behaved in that manner from the start of the current ice age until 1 million years ago.

For the past 1 million years, the length of the cycle has been ~100,000 years, change in temperature became larger.

Average temperature difference of Earth now 10-12C.

Over the past million years, average temperature of Earth varied from anomaly of -11.0C to +4C than today.

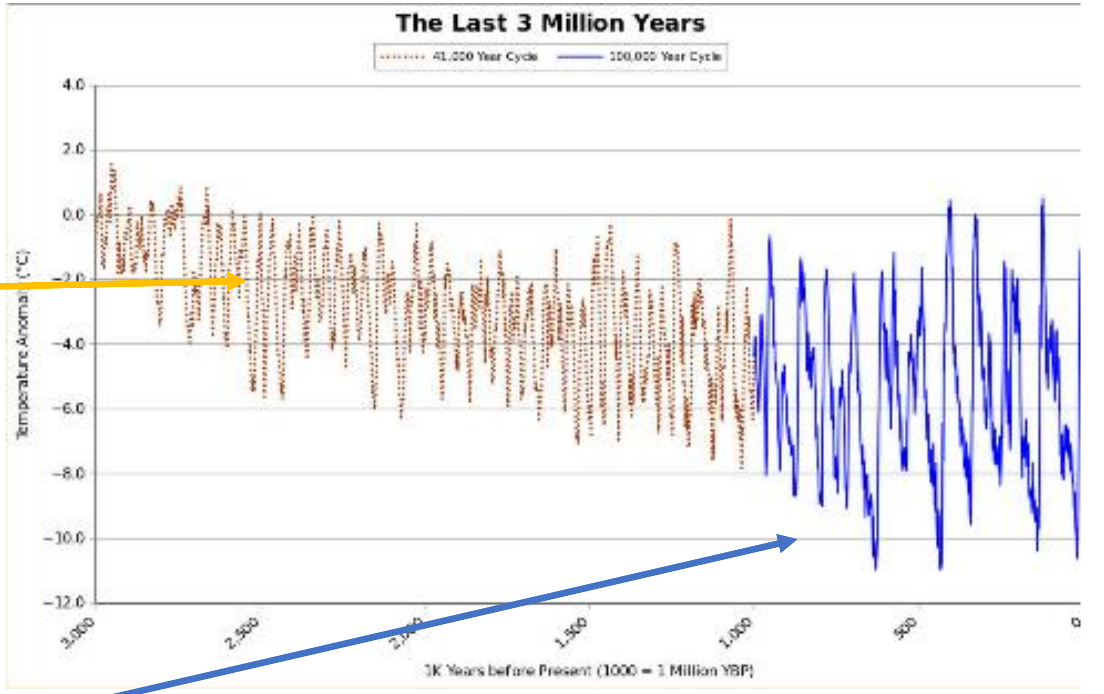


Illustration 20:
Temperature history of the last 3 million years. Different source and slightly different calibration. Each time the temperature goes up on this chart is the start of an interglacial. Each time the temperature drops that is the start of a glacial. (Raymo, 2005)

Over the past 2.6 million years there've been over 40 glacial/interglacial cycles.

My comparison for a glacial/interglacial cycle is comparing each cycle to a single year.

“Winter” is the glacial period, “Summer” is the interglacial.

Transition is compared to the spring and fall.

Much like each year is different from other years, each glacial/interglacial cycle is different.

This combined period of time between Eemian and Holocene covers the last 135,000 years.

That’s the minimum amount of time to understand what’s happening to the Earth today.

Focusing on shorter periods of time without an understanding of the last 135,000 years is a waste of time.

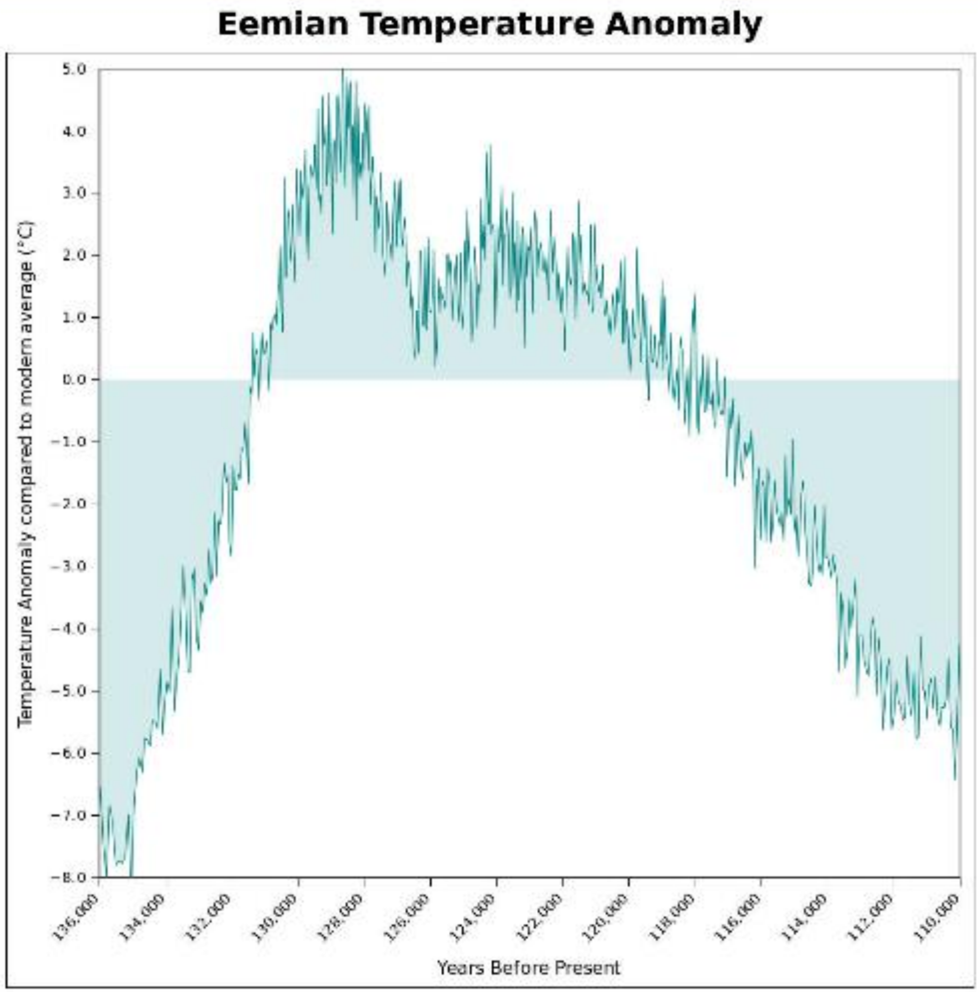
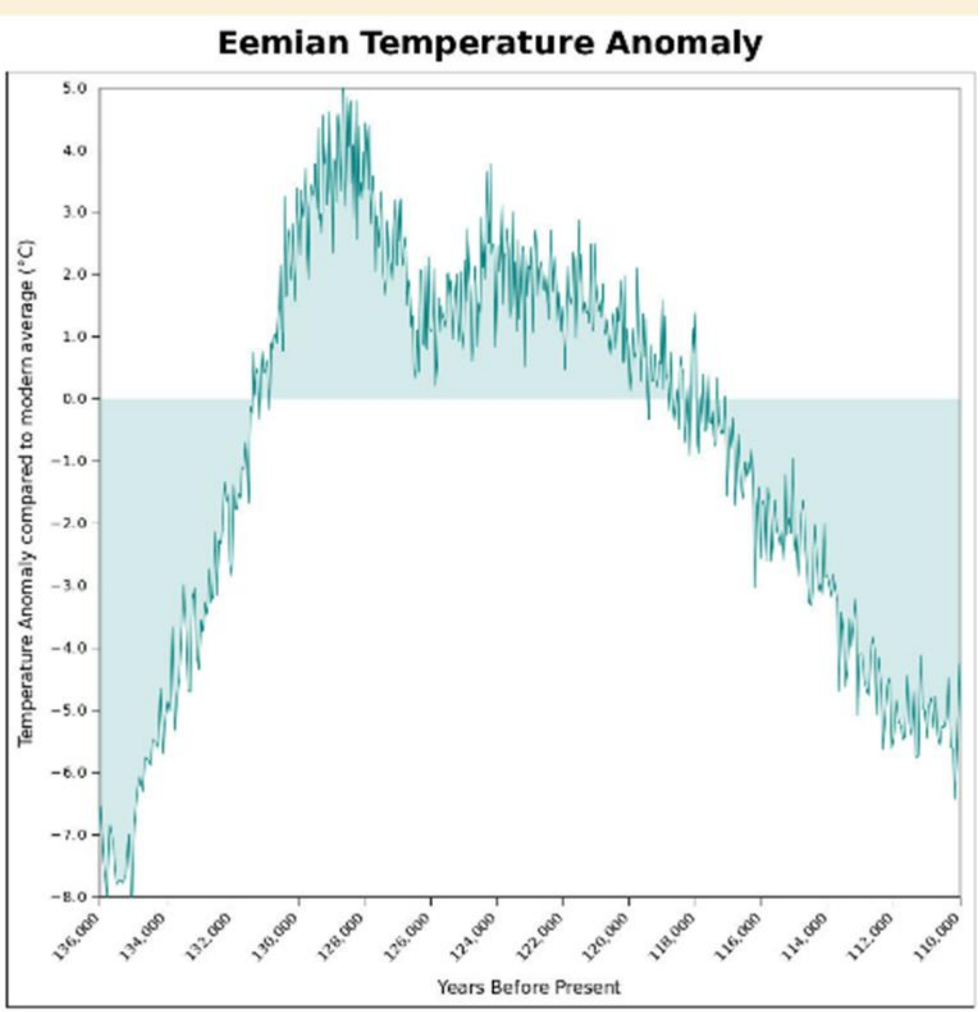


Illustration 21:
Eemian temperature reconstruction from the EPICA ice core, the temperature reconstruction of the last interglacial. This is “the last summer” for comparing the current interglacial.



Predicting climate requires understanding the climate of the past and knowing why it behaved that way.

In the past 65 million years, Earth did not experience a period free of change.

Different parts of the world often show different trends in temperature. That makes a global average much less useful in predicting short-term behavior because the Earth is not uniform in its change.

Antarctica's history shows its ice age started more than 30 million years before the Northern Hemisphere started the current ice age.

In the past 65 million years average temperature of Earth has been at least 16 °C (29 °F) warmer than now and 10 °C (18 °F) colder than today.

During that period, oceans have been at least 150m (500ft) higher and 130m (425ft) lower than today.

Lower limit of the sea levels happened a mere 20,000 years ago, a blink of time for the Cenozoic in which we live.

Warning: Scientific Content!!!

The Oxygen 16 / Oxygen 18 ratio is used as
the proxy for temperature.
The methods of both Zachos and Raymo are
 shown.
*****
50 million years ago there was no Mediterranean Sea, only a vast ocean from India to the continental shelf north of Africa.

NEXT SLIDE

 Spain to the Himalayas was a series of tropical islands surrounded by warm oceans. The lands have merged; the warm oceans and seas that separated them are gone.

Only the small Mediterranean Sea remains.

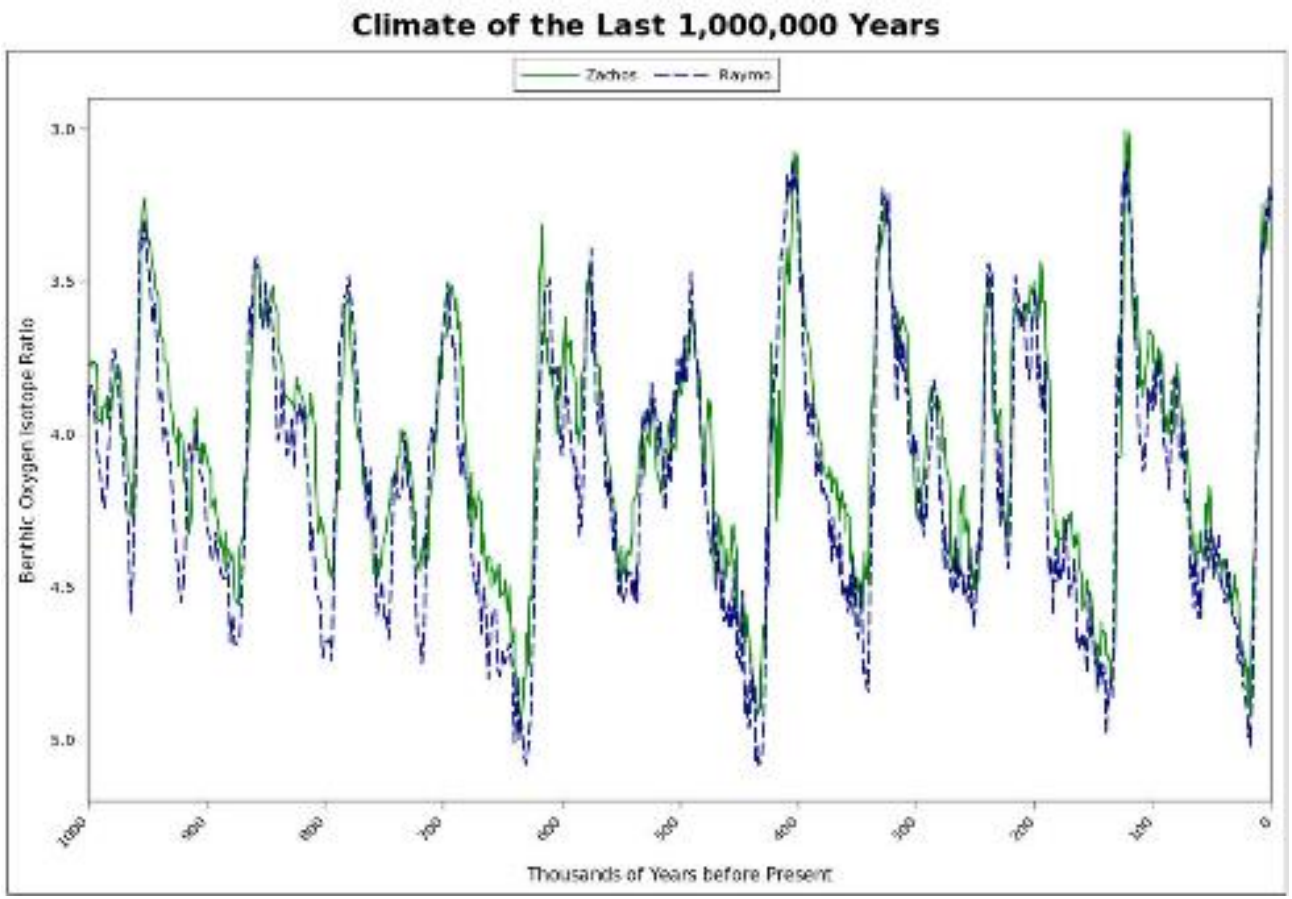
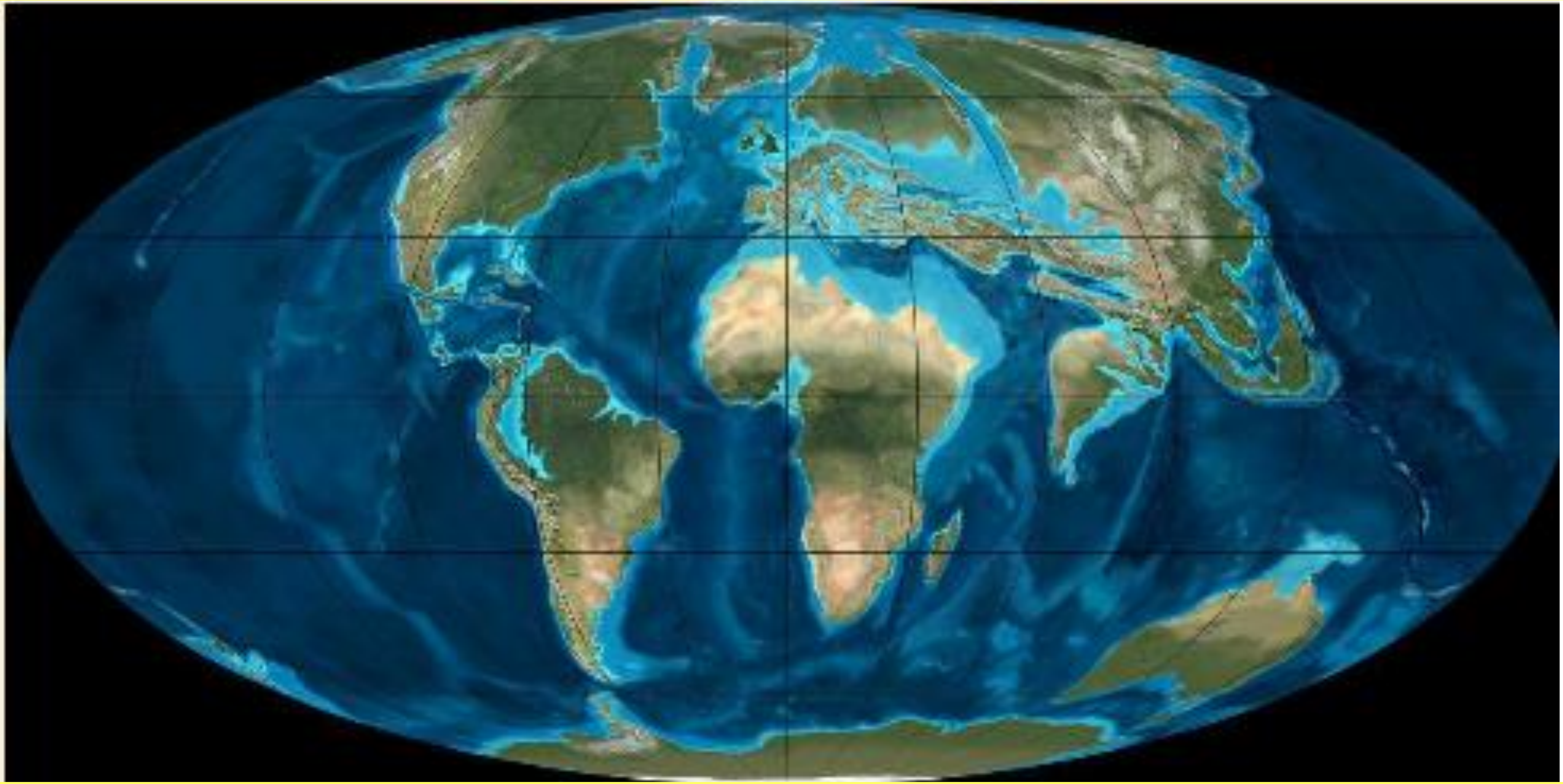


Illustration 22:
 Two different sources of the benthic stable oxygen isotope data that is used to reconstruct the Earth's temperature for the past 1,000,000 years.

Illustration 13:
Earth 50 Million Years Ago,
early Eocene.

Recent History of Earth



Sea levels, more than 150m (500ft) higher than today; no permanent ice sheets anywhere on Earth.

55 million years ago was the Paleocene-Eocene Thermal Maximum (PETM).

In a very short period of time the temperature of the Earth increased rapidly.

While generally the chart may slightly over-estimate the temperatures 55 million years ago, it is possible that the spike in temperature at that point was much, much larger than the chart can show.

The Arctic Ocean exceeded 22 °C in this period.

There are many theories as to what happened…

All that is really known is that the Earth had a period of very rapid warming and for about 200,000 years the Earth was much warmer than at any other time in the past 65 million years.

Earth then cooled down almost as rapidly as it warmed up.

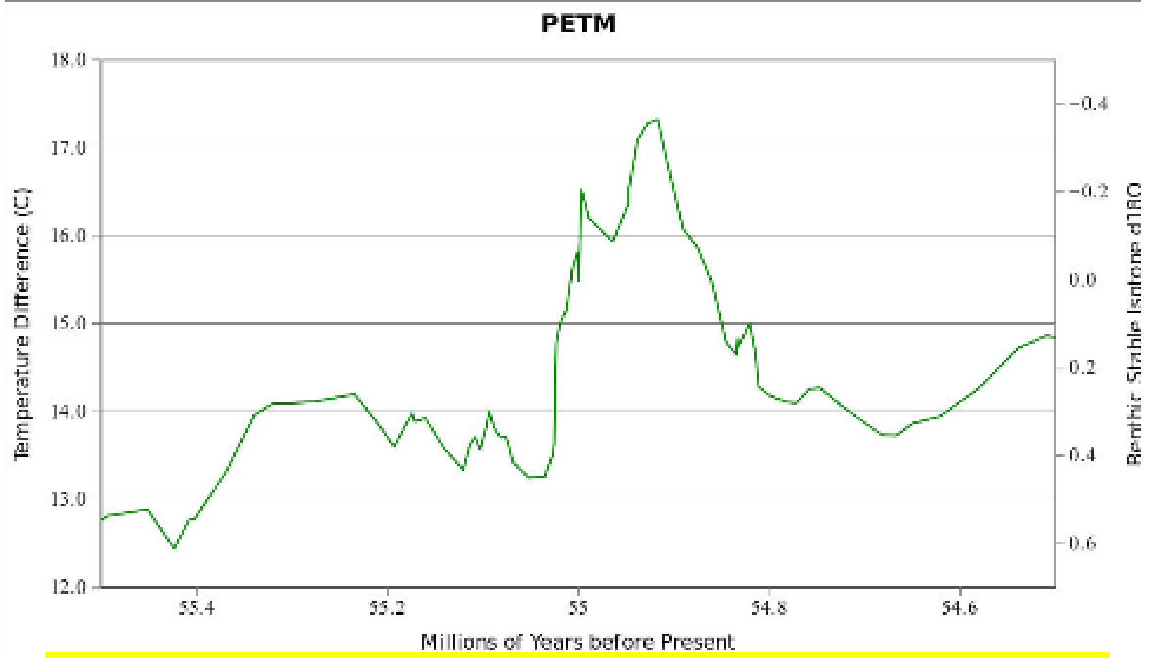


Illustration 23:

The Earth has experienced rapid warming in the past. Scientists have many theories for the rapid warming 55 Million YBP.

Warning: Scientific Content!!!

The Climate Cycle.

The climate cycle has seasons just like the yearly cycle does. In the climate cycle each point is 1,000 years.

Two different cycles operating on very different time scales.

Earth just recently (~15,000 years ago) experienced it's 8th significant warming period in the past 720,000 years.

The climate cycle is almost as predictable as the other ones.

Problem: it takes place on a time scale that's closer to the age of humanity than the lifetime of a single person. It cannot be seen in our lifetime therefore, it's harder to observe and people are less aware of it.

The evidence is obvious, but for the most part only scientists study it.

Also, it's only in the past 40 years that scientists have really started to understand climate cycles.

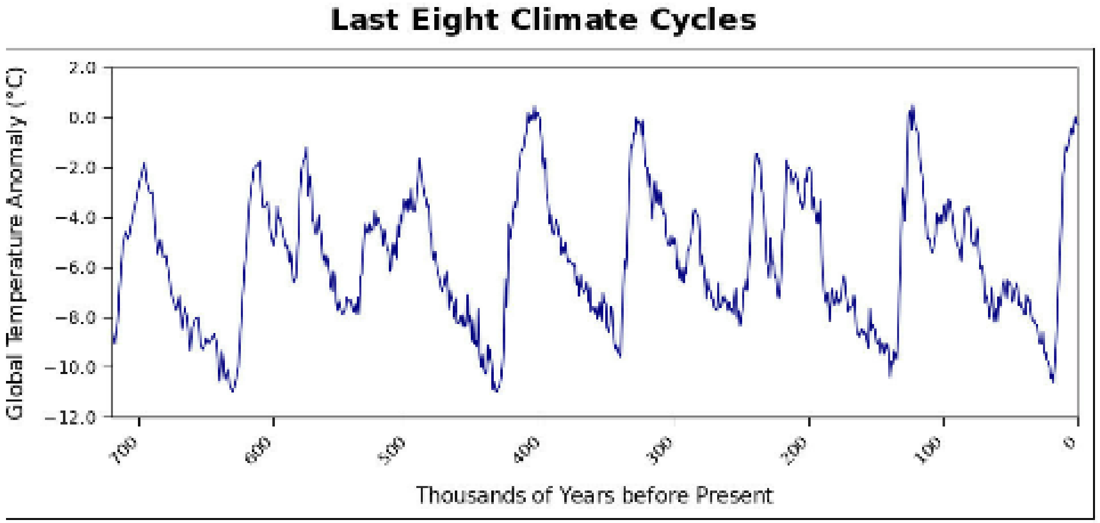


Illustration 24:
Temperature reconstruction using deep sea sediment cores. (Raymo, 2005)

	Hours	Days	Years
Daily Cycle	24	1	0.00274
Yearly Cycle	8766	365	1
Climate Cycle*	876,600,000	36,525,000	100,000

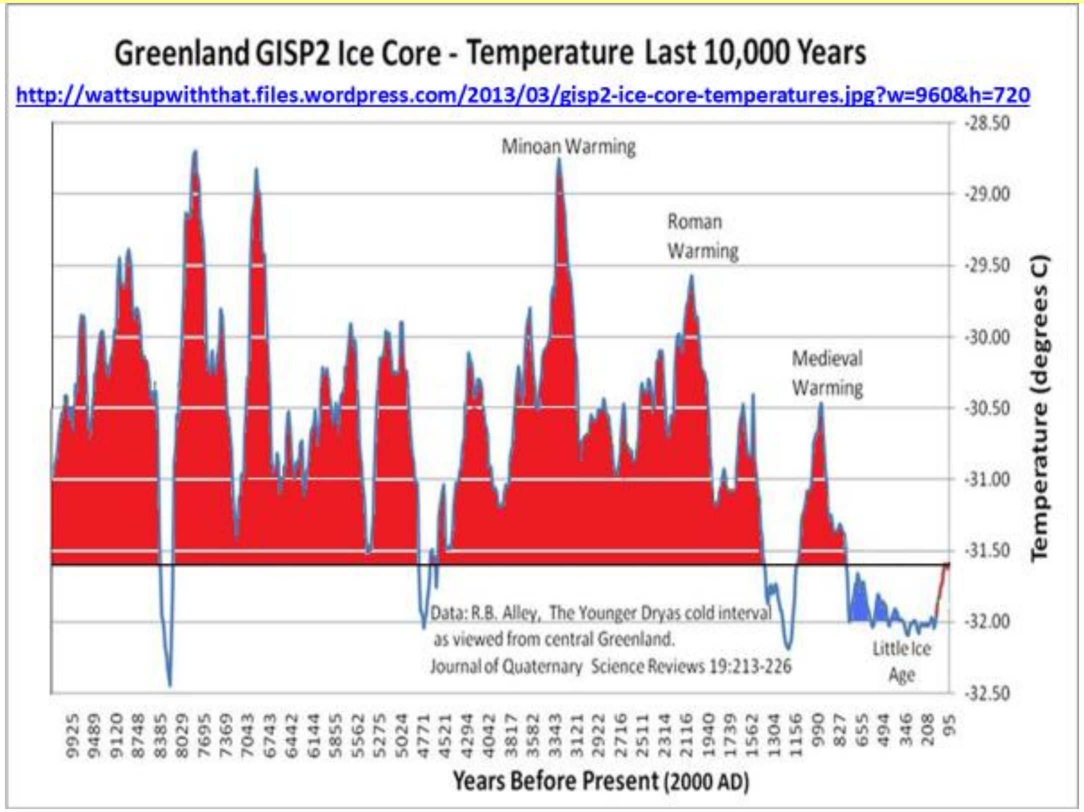
* There's been some variation of the climate cycle over the past 1,000,000 years.

Bob's comment:

Climate alarmists frequently say, at 410 Parts Per Million CO2, present CO2 is, "highest in 800,000 years!"

Granted that's true, but from the previous slide, Earth just recently (~15,000 years ago) experienced it's 8th significant warming period in the past 720,000 years.

The Greenland Ice Cores the GSIP2 data show that it was warmer than today from 8000 to 4000 years ago.



So, thinking critically:

Al Gore cites ice core records as figures of merit for paloclimate

How could the 8th significant warming start when temps and CO2 were significantly lower than today?

And

If CO2 controls temperatures, how could temperatures have been warmer than today 8000 to 4000 years before today?

I’ll start with the spring of the climate cycle.

Spring is still very, very cold, but temperature is rising. Ice sheets and glaciers in the Earth's Polar Regions retreat. Climate spring lasts about 6,000 years, average temperature changes +6 °C (11 °F) or more. Spring is the most intense period of climate change Earth experiences.

The longest interglacial in the past million years was the one ending 400,000 years ago after lasting ~20,000 years.
<Marine Isotope Stage 11, aka the Holstein Interglacial>

Climate **summers** are great times for life on Earth. Forests expand into areas covered with ice sheets; animals expand with the forests. Warmer oceans allow coral reefs to expand; life blooms all over Earth. Average temperature of Earth is 10-14 °C (18-25 °F) warmer than the climate winter.

Climate **fall** can be every bit as unpredictable as yearly autumn.

Climate fall can have abrupt and unpredictable changes. The official fall season will last about as long as the spring; generally it takes about 5,000 years for temperature to transition fully into glacial winter.

	Spring	Summer	Fall	Winter
Daily Cycle	Dawn-Noon	Noon-Evening	Evening-Sunset	Sunset-Sunrise
Yearly Cycle	Mar 21st - June 21st	June 21st – Sep. 21st	Sep. 21st - Dec 21st	Dec 21st - Mar 21st
Climate Cycle	5-7,000 years	8k-20k years	5-7,000 years	80-100,000 years

Duration of each “season” in the different cycles of the Earth.

Glaciers that melted away during the summer start to form again during fall.

There is no better indicator that fall has arrived than the formation of new glaciers.

The farther from the poles that glaciers can be found, the deeper into the climate fall the season is.

Duration of each "season" in the different cycles of the Earth.

	Spring	Summer	Fall	Winter
Daily Cycle	Dawn-Noon	Noon-Evening	Evening-Sunset	Sunset-Sunrise
Yearly Cycle	Mar 21st - June 21st	June 21st – Sep. 21st	Sep. 21st - Dec 21st	Dec 21st - Mar 21st
Climate Cycle	5-7,000 years	8k-20k years	5-7,000 years	80-100,000 years

Together the first three seasons are referred to as *the interglacial*.

Together they last about 20,000 years in total with the different seasons lasting more or less, but the total is about the same each time.

Of those 20,000 years in total, about 12,000-14,000 years can be as warm or warmer than the Earth is today.

The remainder is either warming from winter or cooling to the next winter.

Winter: The truly dominant season of the modern climate cycle.

Climate winters (*glacials*) have averaged 80,000 years long, for the past million years the but have been nearly 100,000 years long at times.

Climate winter is a long and difficult "season."

It has it's own cycles and variations, but in general, for the entire duration, Earth is much colder than today.

Glaciers that started in the fall slowly grow into continental ice sheets that are miles deep.

These ice sheets weigh so much that they cause the continents themselves to sink deeper into the Earth .

The trend for the past 2.6 million years is for increasingly longer and colder climate winters.

Climate cycles aren't quite as regular as yearly cycles, but considering time scales and the significant changes that happen to Earth during each cycle, that's not a surprise. The last warm period also appears to be late in arriving when compared to the earlier cycles.

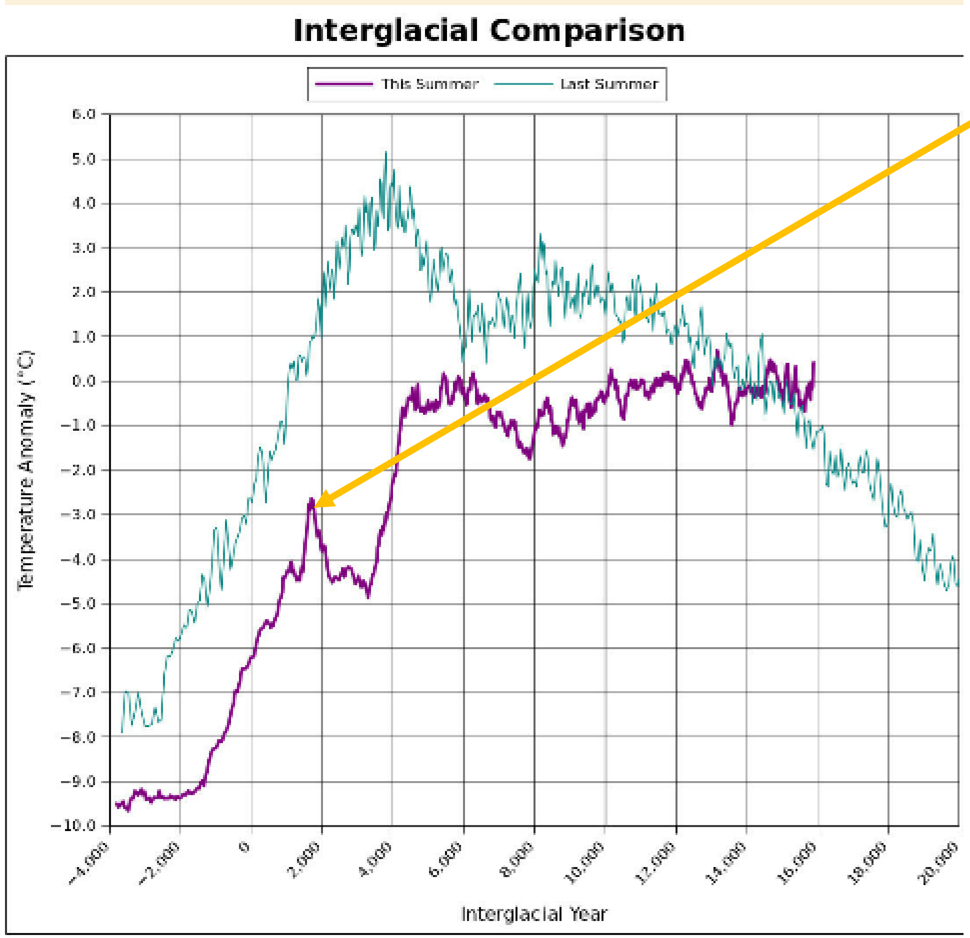
Pretend that the date is Oct 15th and we are brand new to the Earth and settling in Manhattan, Kansas. When we get there the average temperature is 15 °C (59°F) and the temperature trend the past 5 days is +0.96 °C/day.

What is the correct path to take? Will it get warmer or will it get colder? **Some people argue that the past doesn't matter and only the current trend matters.**

Anyone who has grown up in the Northern Hemisphere will understand October is not a good time to plant crops.

It will get colder no matter what the trend has been for a few days. In Kansas, it could be warm far into the Fall, but temperature can change drastically in a single day.

Illustration 25:
Weather.com has a useful way of showing how each month behaves over the course of the year. Their view of Manhattan, Kansas.



Bob’s Comment: Note the Younger Dryas

Illustration 26:

EPICA ice core for the Eemian and Holocene interglacials.
Holocene, this summer.   Eemian, last summer.

By using the EPICA ice core data, I compare the Eemian to the Holocene.

The last climate summer started 135,000 years ago and lasted until 110,000 years ago.

So we will use that 25,000 year period as the basis for understanding how an interglacial behaves.

In comparison to the last interglacial the current one is much cooler than the last one. The month-to-month comparison also shows that the Earth is currently cooler now than it was 17,000 years into the interglacial.

There is absolutely no indication Earth is abnormally warm for where it is in the climate cycle.

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Warning: Scientific Content!!!

Within natural Earth cycles, it's very common for the short-term behavior to be opposite of the long-term trend.

In the spring and the fall that behavior is even more common.

Those two seasons are particularly notorious for rapidly changing weather conditions.

Summer weather is usually the most predictable.

In the daily cycle it is very common for weather to alter the normal daily temperature cycle.

Clouds that show up early in the day can prevent a day from warming up like it would on a clear day..

People readily accept that each day could bring weather that is not the average.

No one panics if the sun comes out in the afternoon and causes warming to happen in the part of the day that is normally cooling.

In the fall and spring the temperature is especially unpredictable.

To illustrate, here are day-to-day changes to the average temperature in Manhattan, KS in 2006.

Most of May-Oct few day-to-day changes exceed 5 °C.

In spring they can exceed 10 °C in either direction.

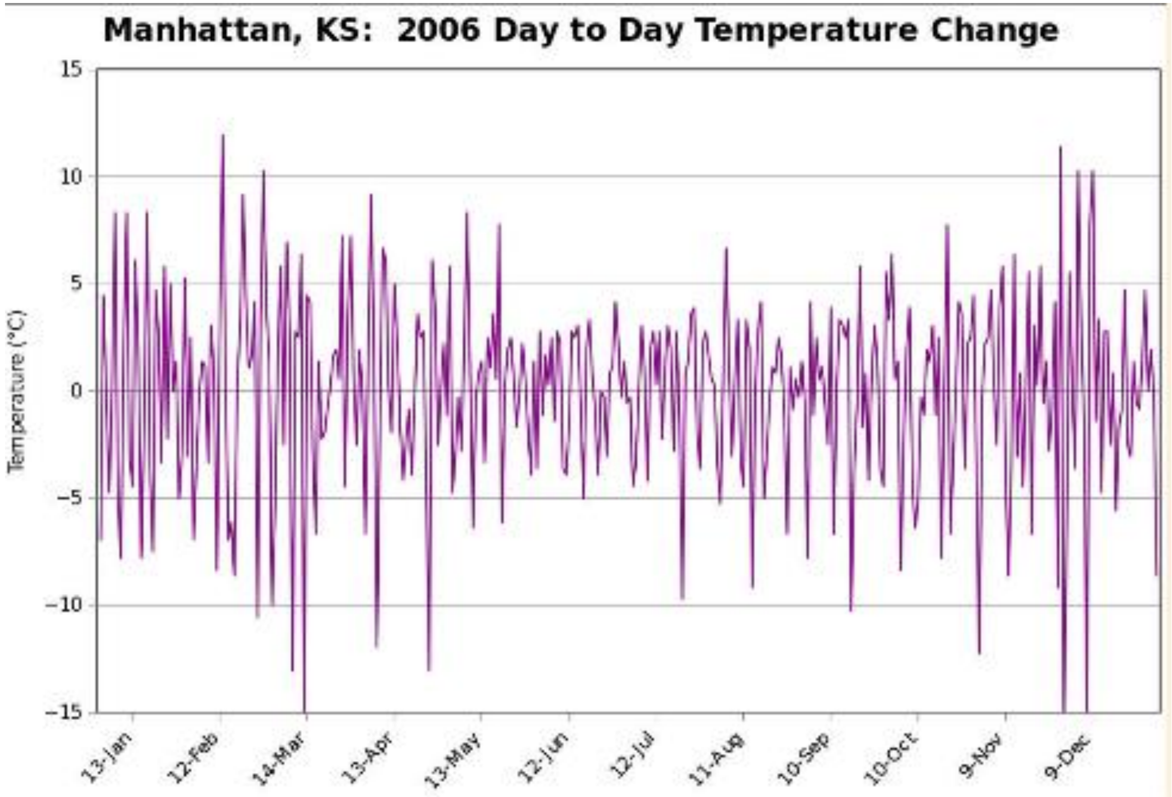
That same behavior also happens in the fall.

There is more daily temperature variation when the seasons are changing.

That's also natural.

It's clear in the amount of variation that happens in the monthly temperature.

Standard deviation by month shows the least variation in the warm part of the year, and the most in the rest of the year.



Jan Mar Jun Sept Dec

Illustration 27:
Throughout the year the temperature can drastically change from day to day. Spring and Autumn experience the most variable temperature.

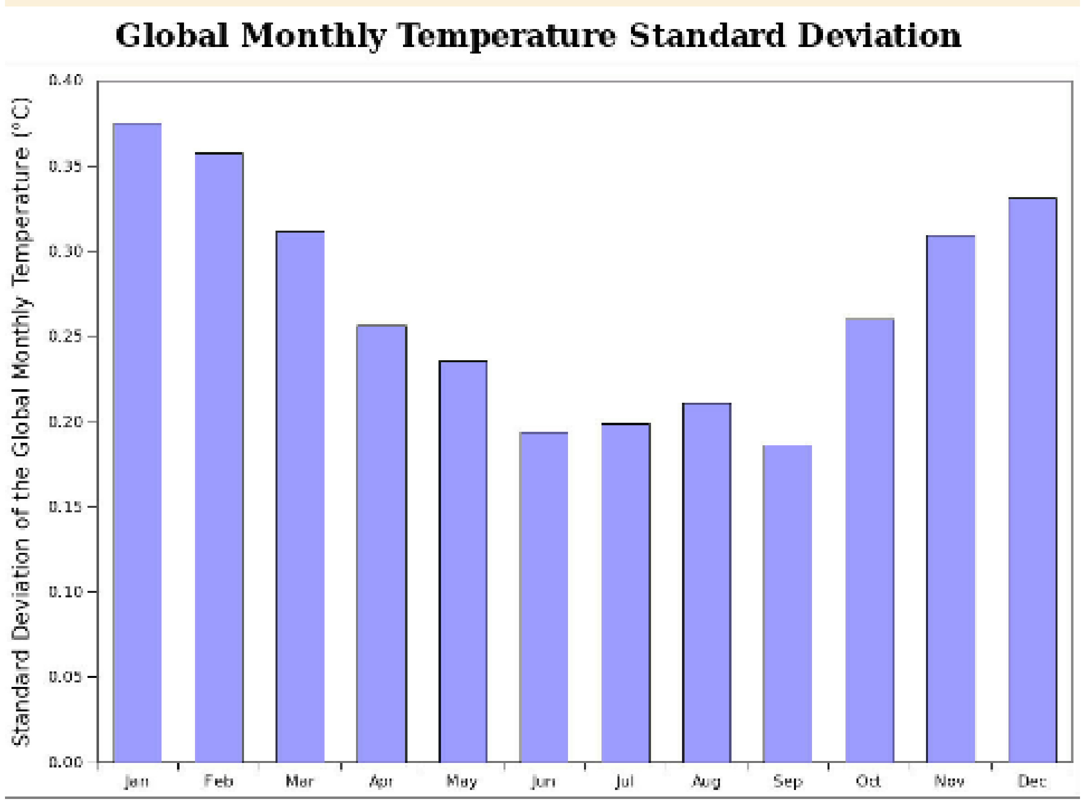


Illustration 28:

June-September show the least year to year variation in temperature. December-February are the most unpredictable.

How does this apply to the climate cycle?

It shows Earth doesn't behave predictably.

General behavior for one year applies to the next year, but trying to predict the exact temperature for Oct 15th of any particular year is a guess.

The climate cycle is even more unpredictable.

When a warm period starts, Earth is in a glacial period. This means vast ice sheets and glaciers will be melted away

Each spring melt differs in the NH; same applies to glacial cycle. <See the Younger Dryas! >

All of this makes the climate cycle more complex and unpredictable one than the yearly cycle.

Would it be a surprise to find Earth's temperature varies greatly within large periods of the climate cycle, especially if the Earth was near the spring or fall of the climate cycle?
During those periods very strong reversals are likely in the trend that could last hundreds of years.

This is why understanding the climate cycle is important.

The Last Climate Summer:

Whenever the Eemian Interglacial comes up, think of comparing two different summers you've experienced.

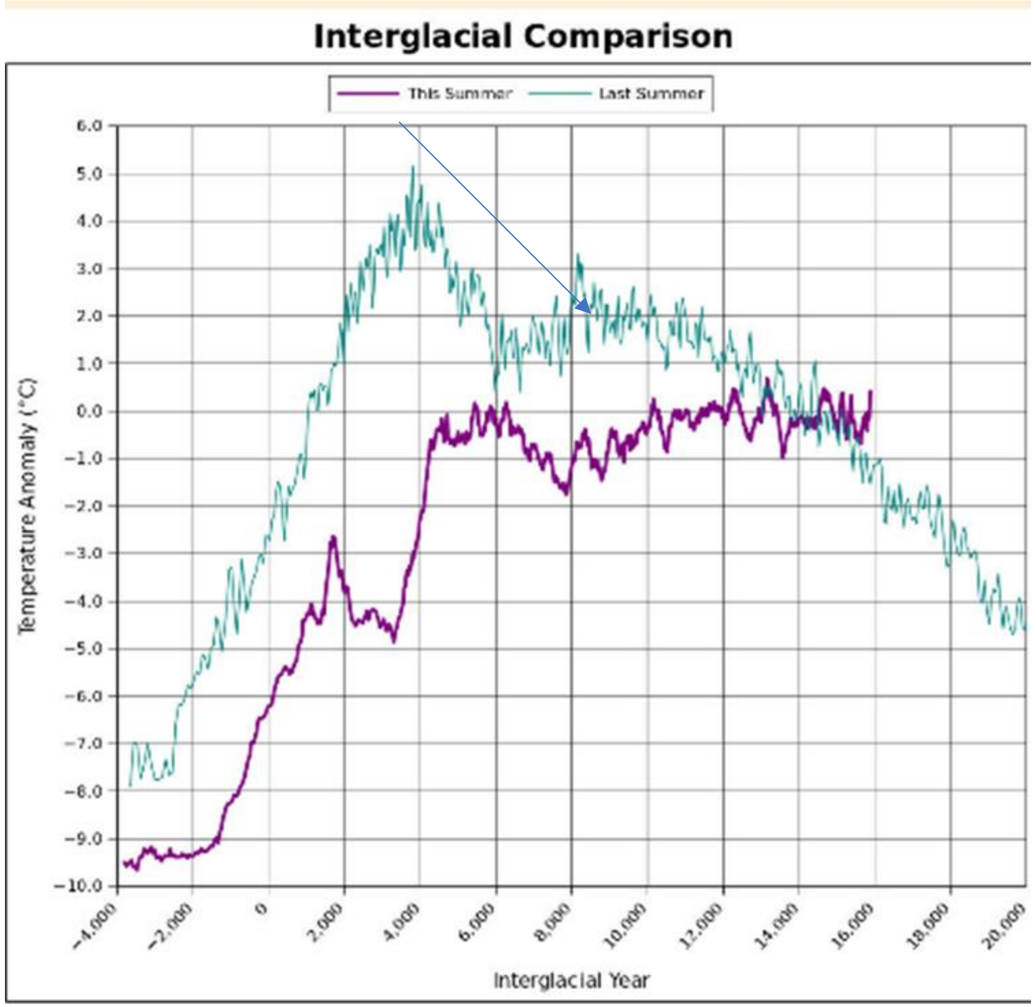
The Eemian Interglacial was one of the warmer interglacials in the last couple million years. It wasn't the longest, but it was much warmer than the current.

The Northern Hemisphere, and especially Arctic regions, had the most warming. This is how all interglacials have been for the past 2.6 million years and is simply how climate cycles behave.

One of the best measures to compare interglacials is to find poleward forest extent, the Arctic Tree Line.

More poleward regions cannot grow trees because of a combination of extreme cold and permafrost.

Extreme cold freezes sap inside trees during winter; permafrost prevents trees putting roots into the ground.



The tree line is a good indicator because it takes centuries for a forest to develop. As Earth started to warm up 135,000 years ago it allowed forests a chance to grow northward.

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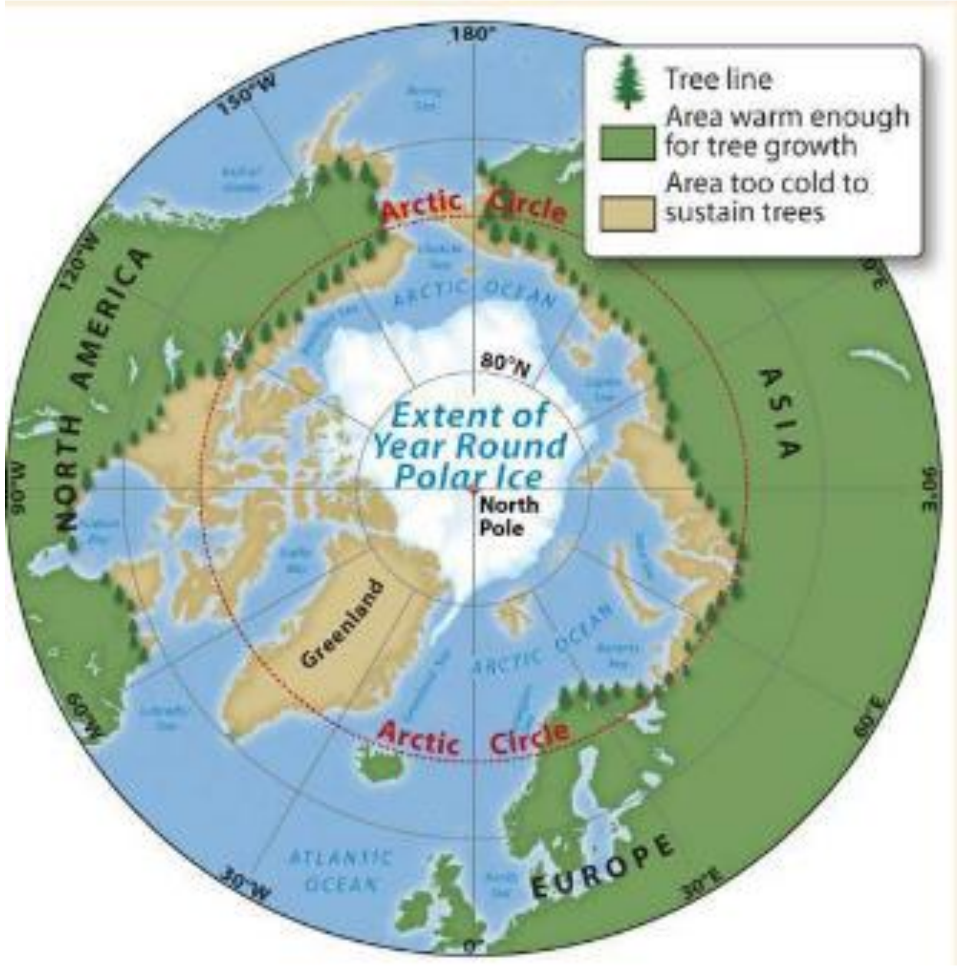


Illustration 29:
Modern Day Tree Line. Primarily only Greenland was north of the tree line during the Eemian.
Source: Smithsonian Map Factory

When peak warmth was reached 128,000 years ago the forests reached northernmost North America and Asia.

The modern tree line is hundreds of kilometers further south today in most places.

Eemian comes from the river Eem in the Netherlands. In the 1870's Dr. Peter Harting found large numbers of warm water sea life fossils in the soil at various locations in the Netherlands.

The shells were from a warmer climate and didn't match life currently found in the North Sea.

They didn't know exactly how long before it had been warmer in the Netherlands, but the fossils were in soil that was only 17m deep, indicating the recent past.

Netherlands study revealed the area was warmer and filled with many life forms that can’t survive present climate. Geologic maps now reveal many parts of Netherlands were underwater during the Eemian Interglacial.

The Eemian was significantly warmer than Earth today.

Of particular interest to believers in global warming, the Eemian was more than 3 °C warmer than the Earth is now, for thousands of years.

Warmest of the Eemian matches the direst predictions of global warming for Earth caused by CO_2 levels.

Understanding Eemian climate provides better understanding of the ‘horrific world’ the warmists claim will exist if the projected warming occurs in the next hundred years and beyond.

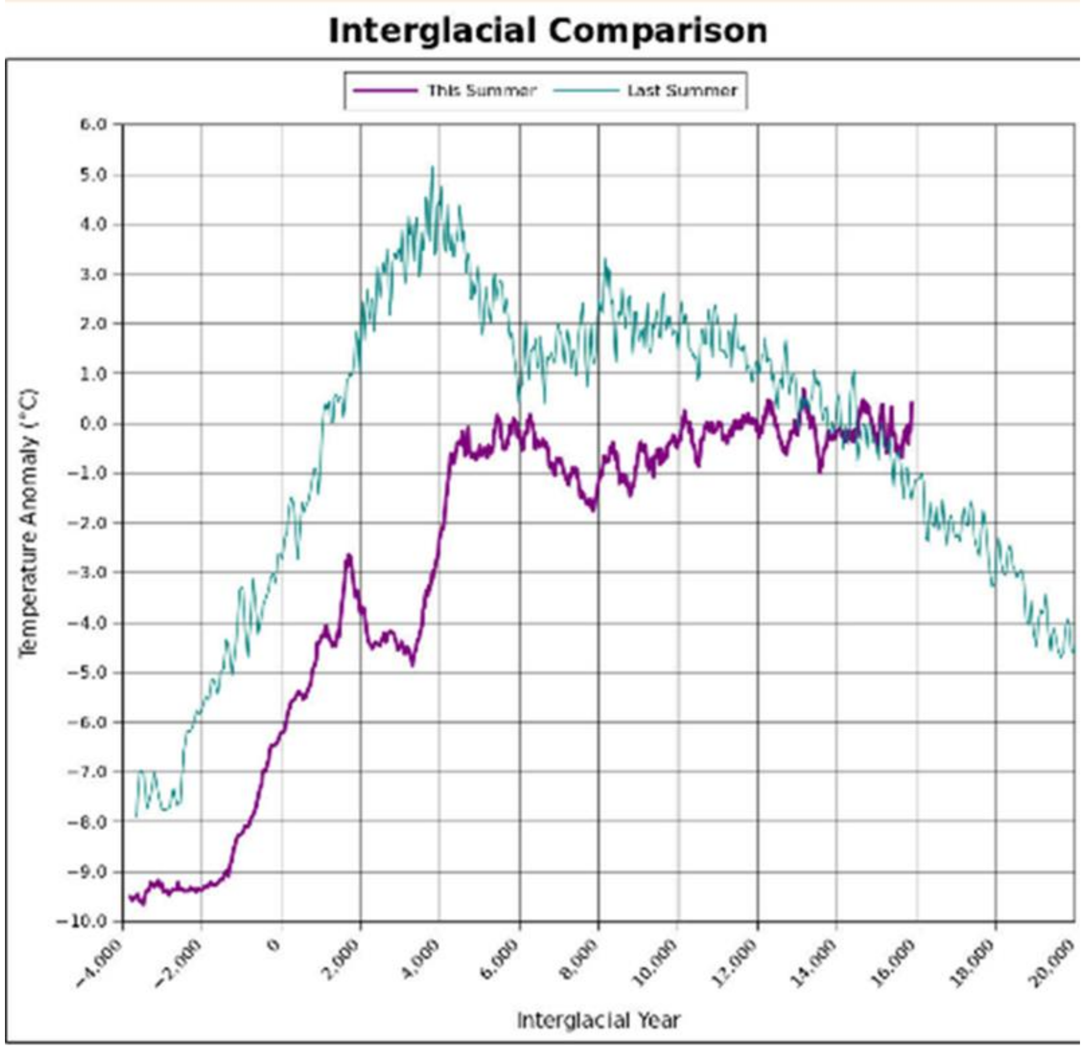
Earth recently experienced many different climates. Reasonable predictions can be made simply by looking when the climate was different from today.

Earth was 3-5 °C warmer when CO_2 levels were 270-280 ppm, in the Eemian.

During the Eemian, Earth was warmer than it is now for a period of 13,000 years, from 118K-131K before present.

How warm was the Eemian?

The very peak temperature was ~5.5 °C warmer than the average of the past 100 years.



Bob's comment:
Recall the Ice Age began in Antarctica;
has been in the Arctic for shorter duration.

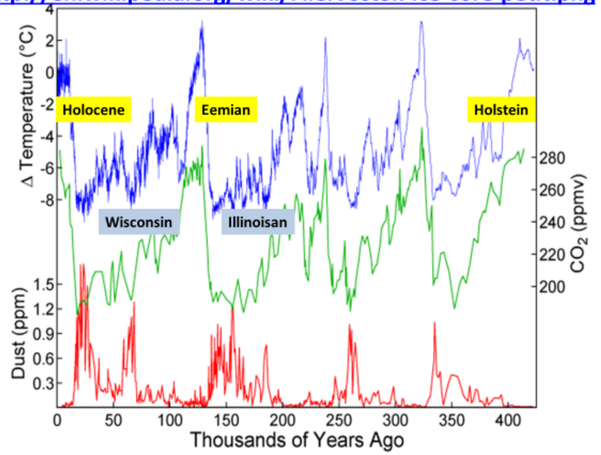
Vostok Ice Cores are of the order of 400,000 years,
Greenland Ice Cores are of order of 100,000 years.
<last 10,000 years shown in graphic right below>

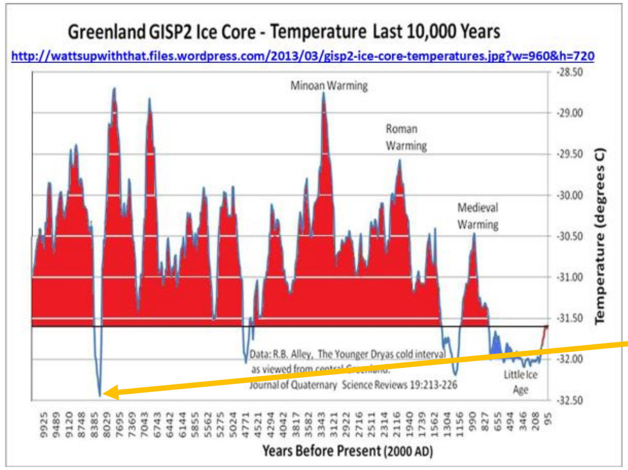
Vostok shows Antarctica, GISP2, Greenland, but Ice
a lot more extensive and deep in Antarctica.
Land masses a lot different, NH vs SH.

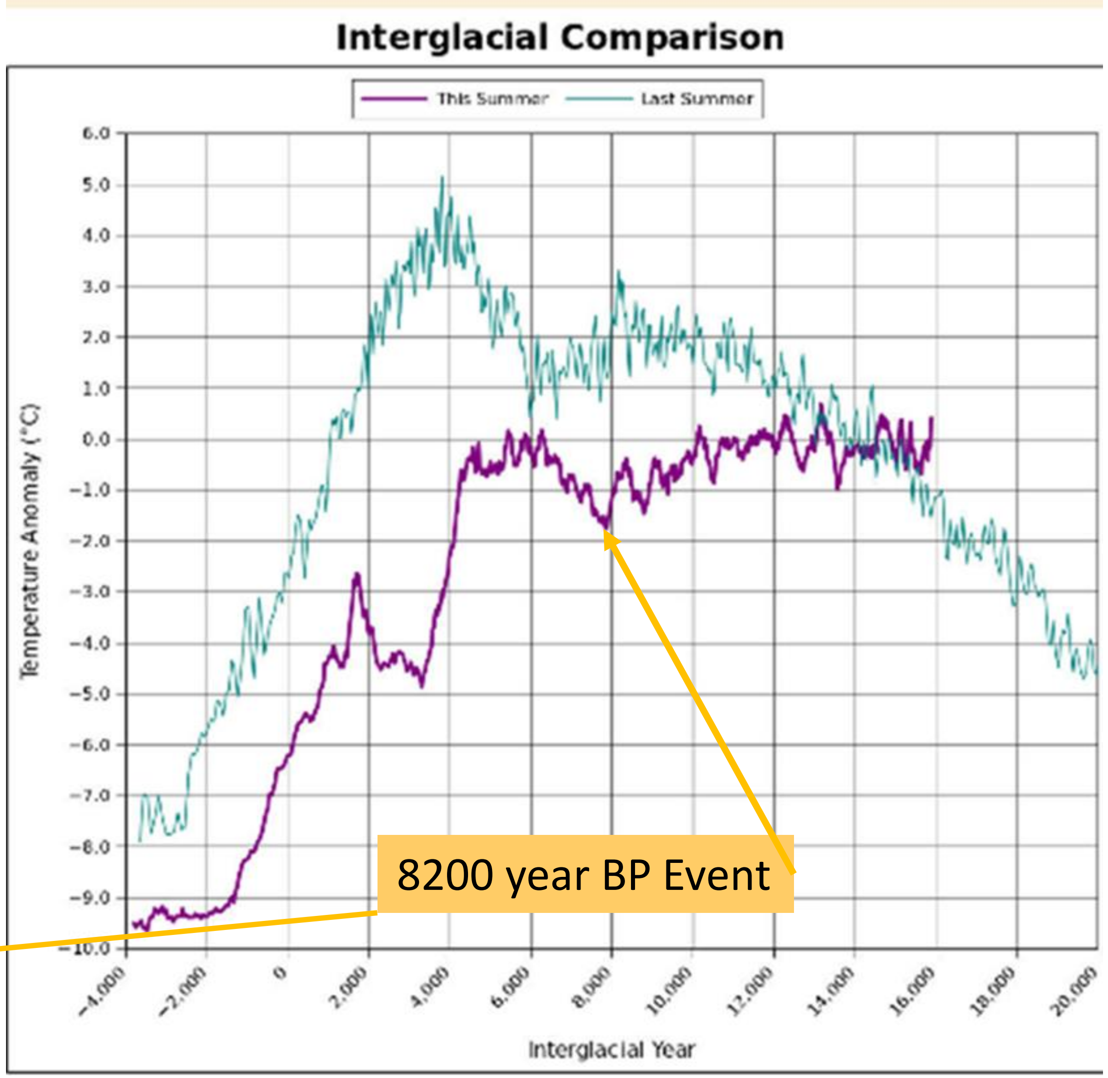
Nonetheless, Eemian a lot warmer than Holocene with
a lot less CO2.

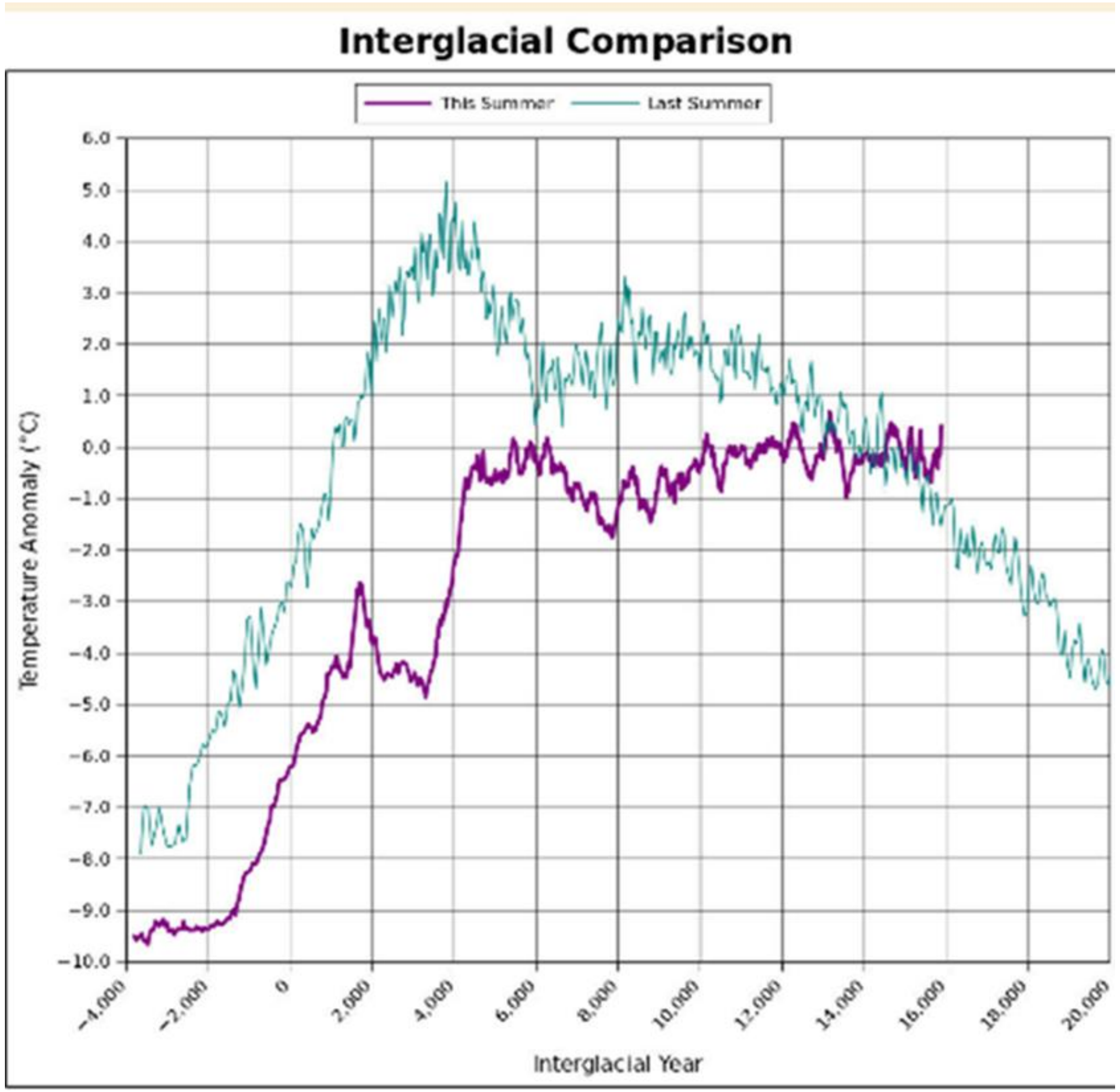
The very peak temperature was ~5.5 °C warmer than the average of the past 100 years.

http://en.wikipedia.org/wiki/File:Vostok-ice-core-petit.png









Why was the Eemian so much warmer than Earth today, especially considering that the CO2 levels were so much lower then, than they are now?

That is only the first of two major problems that the Eemian gives to the theory that CO2 is a driving factor in global temperature.

The Earth was much warmer 128,000 years ago, but CO2 levels were nothing special.

Perhaps something other than CO2 levels caused the Earth to be much warmer during the Eemian besides CO2 levels?

According to the IPCC estimates, the Eemian is what the Earth will be like if CO2 levels reach 1,100 ppm.

In no place was this more evident than in the Northern Hemisphere (NH). There were dramatic differences throughout the entire hemisphere, especially the farther north one looks.

Perhaps the most surprising find were the fossils of many tropical African animals that lived as far north as Germany during the Eemian.

The Hippo can only live in warm climates.

An important factor in this is water temperature.

Hippopotami use water to stay cool. The hippopotami bones that have been found in Germany that date to 125,000 years ago are a very good indication of how warm it was throughout the year in that part of the world.

Winters would have had to have been much warmer than they are today, meaning that Germany was much more tropical during the Eemian interglacial.

Illustration 31:
Hippopotamus today is only found in Africa.

Arctic regions, North America, Asia and Europe all experienced much more temperature change than the tropics.

The Northern Hemisphere experiences the most temperature change in the climate cycle.

Expanded hippopotamus range is a good example of how great that change can be.

Illustration 32:
The Water Buffalo today is mostly in India and Pakistan.

Another odd animal found in Germany is the Water Buffalo.

These two animals cannot survive significant frost, much less extended freezes.

That their remains have been found in Germany from the Eemian is an indication that the winters in that area were much warmer than they are today.

Average winter temperatures must have been above 0 °C (32 °F) for them to have survived there for extended periods of time.

It is clear from the fossils in the Netherlands that the seas around Europe were much warmer than they are today.

Germany was warm enough for the hippopotamus and water buffalo to survive.

There are indications that **the elephant and other African animals** were able to survive in that region, another good indicator of how much warmer the Eemian period was in Europe.

Illustration 33:
Momma bear and cub, courtesy USGS.

For people worried about polar bears, the Eemian is especially interesting.

Oldest fossils for polar bears date to the Eemian.

DNA tests show modern Grizzly was parent species for the polar bear; the two animals can still have fertile offspring.

Since the two are so specialized in their habitats they are considered separate species.

It’s considered probable that a group of Grizzly bears became isolated with the rapid onset of the glacial as the Eemian ended.

This group of bears then evolved to the current species we all know as the polar bear.

It’s even possible that the polar bear exists today because a group of Grizzly bears became isolated on one of the Arctic islands as sea ice melted completely for several thousand years.

Such isolation would have given polar bears the start at favoring skill in swimming that provides such an advantage today.

Polar bears are very capable of surviving a wide variety of climates; in fact it was the big changes in climate that appears to have given polar bears the chance to exist in the first place.

Oceans experienced the largest change during the Eemian; average ocean temperatures are comparable to the current temperatures, but the warmer waters extended much farther north.

Much more of the Greenland ice sheets melted during the Eemian than have melted in modern times.

The oceans were likely to have been at least 10m (33ft) higher than modern sea level.

Compare this much higher sea level to the estimated 1 meter change in sea level that is projected for a CO_2 level of 600ppm.

In the past, seas were <10m> higher when CO_2 levels were less than 300ppm.

This is especially a problematic because CO_2 levels for the past several thousand years were identical to CO_2 levels during the Eemian.

Yet, **during the Eemian, Earth was warmer and sea levels were higher**.

Coral reefs that lived during the Eemian are now above sea level, easily proving oceans were higher during the Eemian than they are today.

Fossil coral reefs can be seen on many of the islands in the Pacific Ocean.

Coral reefs can be a powerful tool in understanding how ocean temperatures change, but any corals that lived during the Eemian died when the oceans started to drop when the Eemian ended 115,000 years ago.

The biggest problem that the Eemian presents to the theory of global warming is that it ended.

120,000 years ago Earth was warmer than it is today by a degree or so. CO_2 levels were ~270 ppm at that point. By 115,000 YBP Earth temperature had dropped 4 °C, but CO_2 levels were still ~270ppm.

Earth had shown dramatic cooling in a 5,000 year period while CO_2 levels remained almost identical to what they'd been.

Global temperature dropped more than 10 °C, while CO_2 levels remained constant ~270ppm.

<u>If the greenhouse effect of CO_2 is so strong, why did the CO_2 level during the Eemian fail to keep the interglacial from ending?</u>

Since the CO_2 level did not drop until long after the temperature dropped, some other factor must have caused Earth's cooling.

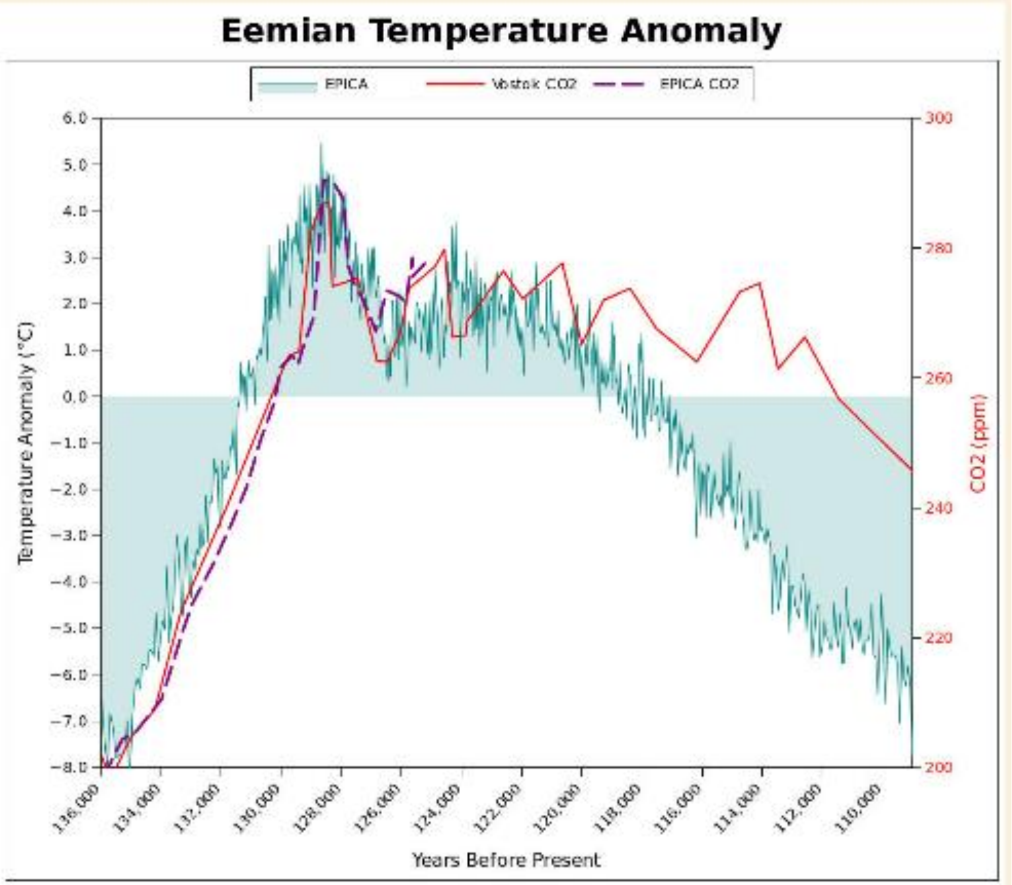


Illustration 34:
CO_2 levels dropped ~8,000 years AFTER the temperature dropped. Cooling could not have been caused by dropping levels of CO_2.

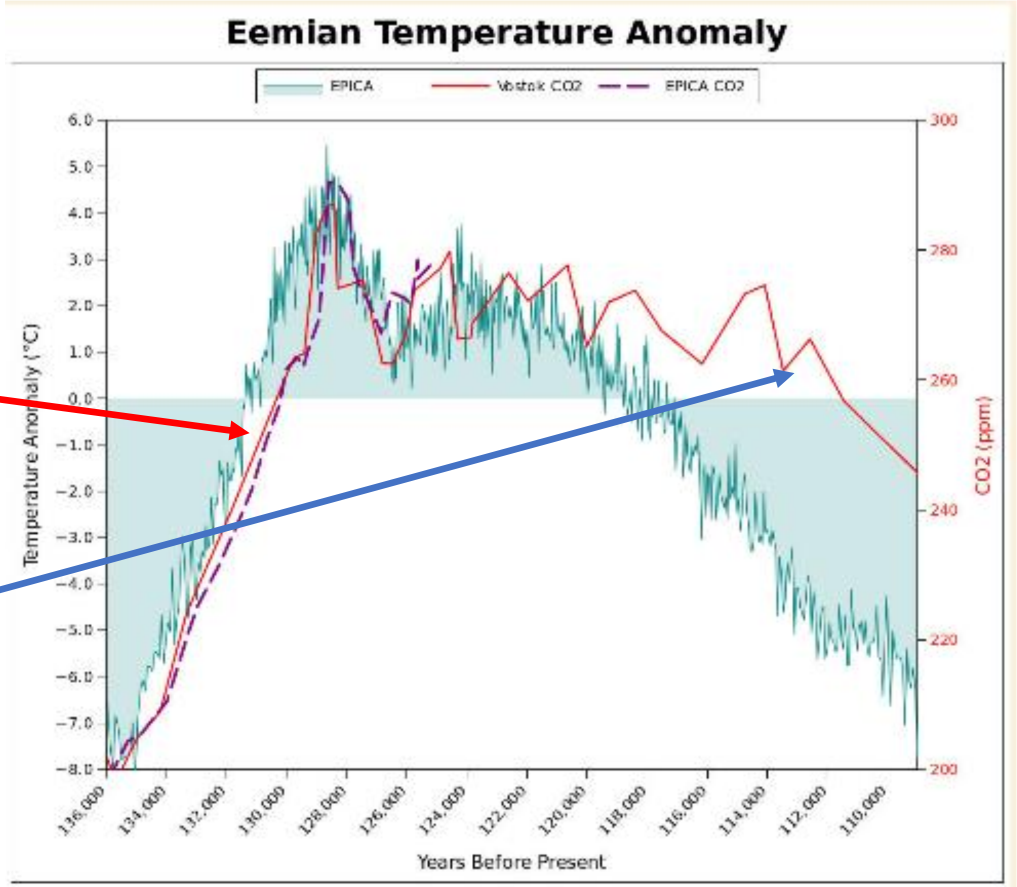
How is it possible to correlate CO2 levels to temperature when the range of temperature for given CO2 levels is so broad?

That is the only reason why CO2 is associated with temperature change in the past, but the problem is it only matches temperature change when Earth is warming.

When Earth is cooling, CO2 stays at the same level while the temperature drops.

Only after Earth cools… CO2 levels start to drop.

This should make scientists wonder just how much influence CO2 has on global temperatures.



In addition, "What caused Earth to warm in the first place?

The average temperature of the Earth increased 13 °C at the beginning of the Eemian.

Warming started while CO2 levels were very low

<u>In both interglacial spring and fall, temperature change happened before CO2 levels changed.</u>

…especially evident when Earth cooled.

Two questions need to be answered.

What caused the Eemian interglacial?

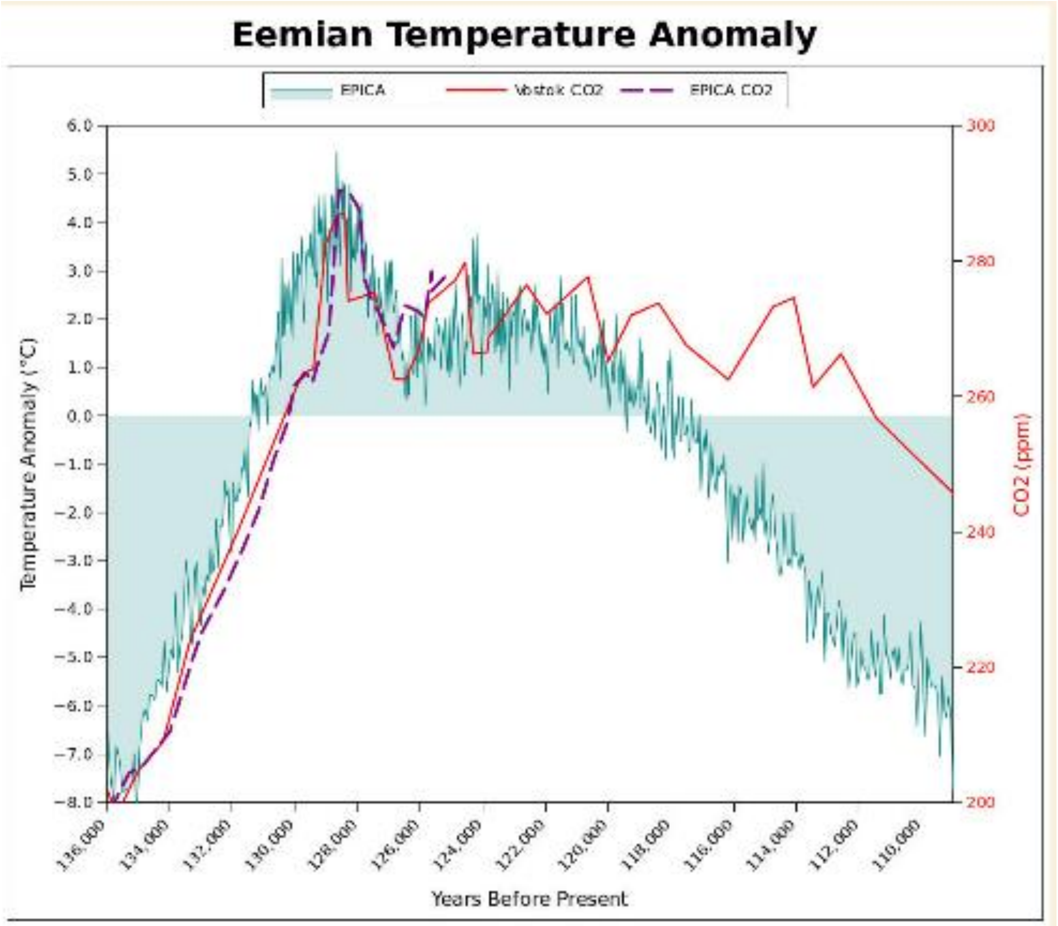
What caused it to end?

The answer to these questions is critical.

Since Earth has been repeating the same cycle for hundreds of thousands of years, it is important to understand what should naturally happen next.

Only by understanding what should be happening now is it possible to understand if what's happening now is natural, or not.

It's very clear from many different types of proxy data that the Eemian was warmer than Earth has been during the modern interglacial. Sea levels were also higher.



Warning: Scientific Content!!!

The geologic time scale is useful, but it is so full of assumptions, that it creates bias without intending to.

The current glacial / interglacial behavior is the perfect example of this problem.

The Eemian does not exist according to the geological naming system.

All previous cycles are stuffed into a single epoch, *Pleistocene.*

The current interglacial is given an epoch all to itself, *Holocene.*

The current interglacial is treated in a very different way, even in how it is named.

This introduces a bias that this current interglacial is unique, but it is not.

Only from human lifetime perspective does Earth climate seem stable.

Geologists are not immune from bias.

Certainly in the past there was good reason to suspect the Holocene was unique, but that's no longer the case.

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Not everyone uses *Eemian* referring to the last interglacial.

Geologists from different continents named them differently.

There are at least 5 different names describe the same time.

https://en.wikipedia.org/wiki/Eemian

Eemian

From Wikipedia, the free encyclopedia

The Eemian (also called the last interglacial, Sangamonian, Ipswichian, Mikulin, Kaydaky, penultimate, Valdivia or Riss-Würm) was the interglacial period which began about 130,000 years ago at the end of the Penultimate Glacial Period and ended about 115,000 years ago at the beginning of the Last Glacial Period.

The main methods of reconstructing past temperatures are deep sea cores and ice cores that measure the oxygen isotope ratios.

The ratio of heavy to light oxygen is the standard measurement.

Water made of the heavy oxygen condenses more easily.

This means that the warmer the oceans are near the location of the ice sheets, the more heavy oxygen there is in the ice core.

The warmer the water is near the location of the ice core, the higher the content of heavy water there will be in the core.

Since Greenland is near the end of the path for the Gulf Stream and most of the water vapor in the atmosphere there is from the Gulf Stream, ice cores from Greenland are good indicators of North Atlantic Ocean Temperature.

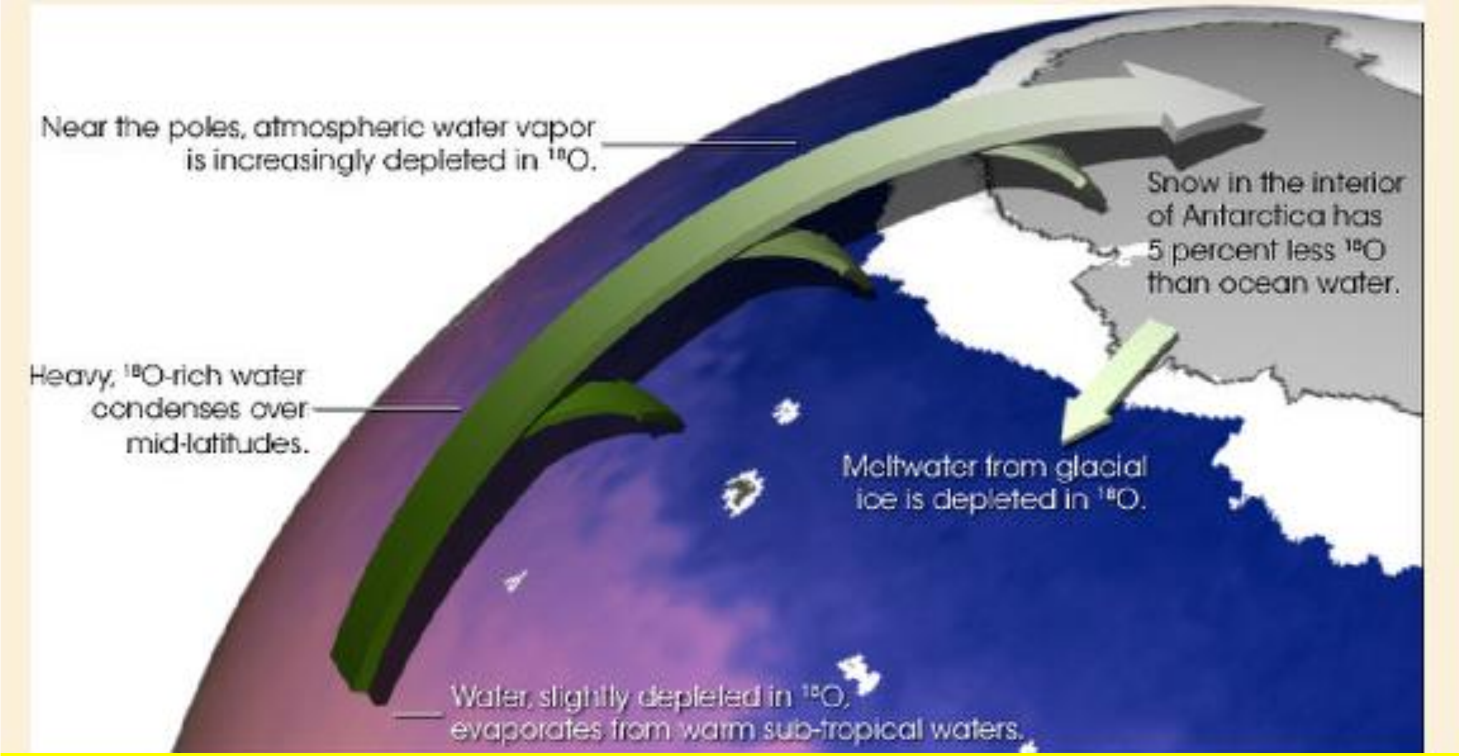


Illustration 35: Heavy Oxygen Cycle: NASA Earth Observatory

Warning: Scientific Content!!!

This section refers to the two isotopes of Oxygen, O16 and O18. The Heavy isotope of Oxygen is the O18 form.

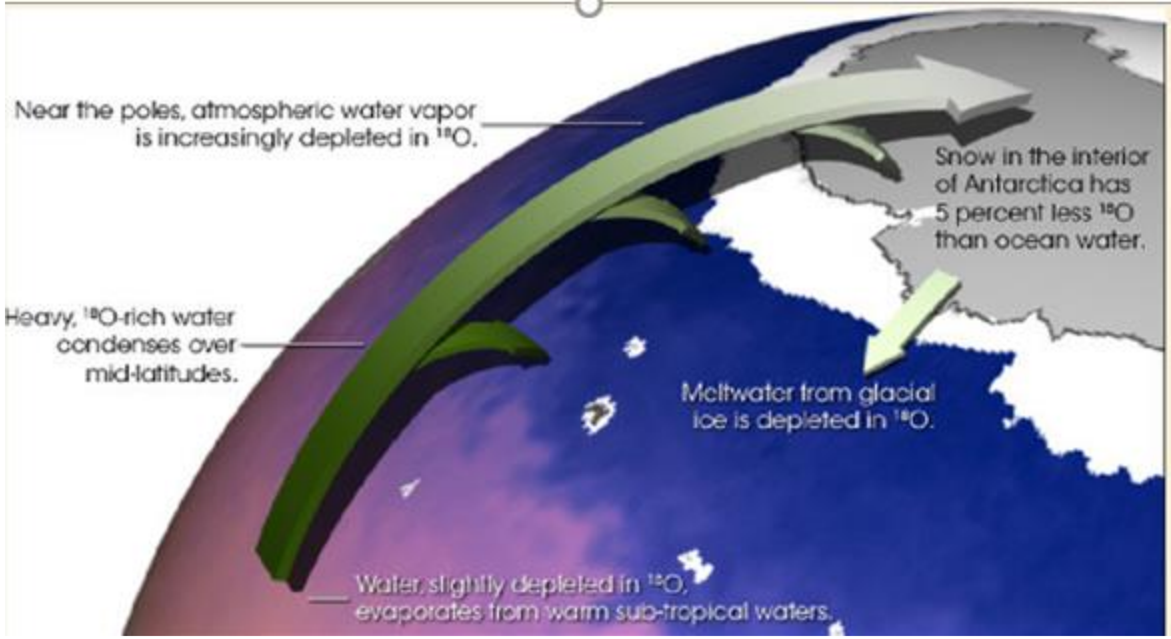
Simplest reason that it works, is cold water does not evaporate very much. Water that is 25 °C (77°F) evaporates about twice as much water vapor as water that is 15 °C (59°F).

Since there is much more light oxygen than heavy oxygen, cold water evaporates very little heavy oxygen .
The warmer the water, the more heavy oxygen evaporates.

Ice cores are really telling a larger story than they are often given credit for. That is why they are so useful in understanding the global climate.

…especially true for the past couple million years… most of the climate changes have been far stronger in the Northern Hemisphere than they have in any other place on Earth.

Ice cores in Antarctica can measure changes mostly happening in the Northern Hemisphere

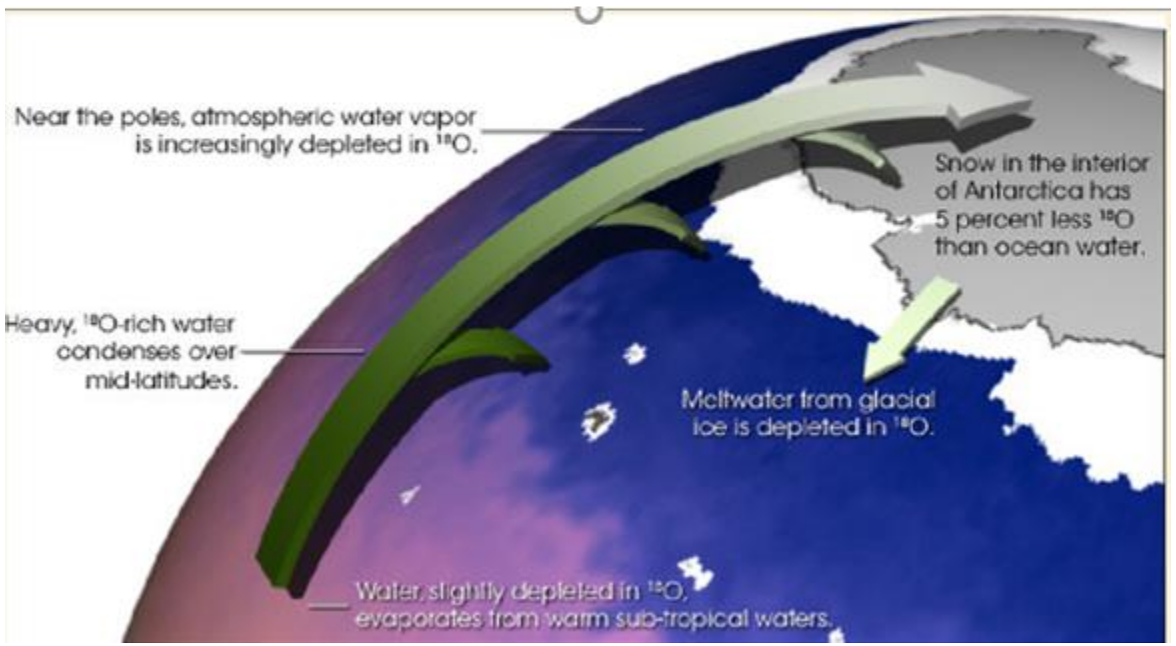


Temperatures in Antarctica don’t change as much as the ice cores indicate.

What does change is how much warm water is close to Antarctica.

During a glacial, oceans near both poles are colder, so the amount of heavy oxygen is very small.

When the northern hemisphere is warmer (like now) oceans have higher sea levels and warmer water is closer to both poles.



Even if a location in Antarctica stayed the same temperature for 100,000 years, the ice core at that location would tell the temperature record of the ocean that evaporated the water that fell as snow at that location.

Ice cores do not reflect the temperature of the location they are drilled. Ice cores primarily tell the record of the ocean the snow evaporated from and how far that water vapor traveled.

Ice cores give the broadest temperature reconstruction because of how the record accumulates.
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Each layer is distinct and can provide a wide view of the climate for the region for that specific year.

This information is recorded for the period that matches the age of the ice sheet.

The bottom and older layers get squeezed by the weight above, but reliable ice cores hundreds of thousands of year old have been recovered.