LESSONS FROM PALEOCLIMATOLOGY – Conveniently Ignored By The IPCC

April 20, 2022
Ireland Beneath The Ice 20,000 Years Ago
Northern Hemisphere Glaciers During The Last Ice Age

Ice sheet extent near the peak of the last ice age

19,000 years ago

NOAA
SETTING THE SCENE

• Climate Change (*not weather!*)
• Variations In Incoming Solar Energy (Milankovitch and other cycles)
• Energy Storage (mechanisms and lags)
• Energy Transport (Ocean Currents, Continental Drift)
• Time (the past 67 million years and further)
• Data: Proxies, Fossils, Isotopes vs Theory
• The Past as a Key to the Present, and Perhaps the Trends of the Future
Earth’s Temperature Proxy vs. Time (compressed)

Temperature of Planet Earth

Note – Horizontal time axis is compressed, and has scale changes
Temperature And Atmospheric CO$_2$ Over Earth’s History

Note – Horizontal time axis is compressed
SEA Level and Glacial Periods in GeoHistory

Wikipedia
Earth Temperature Proxies Since the Dinosaur Extinction

![Graph showing Earth temperature proxies since the Dinosaur Extinction. The graph illustrates temperature changes over millions of years ago, from the Palaeozoic (Pal) to the Present (P). Notable events include the PETM (Paleocene-Eocene Thermal Maximum), Antarctic Glaciation, Antarctic Thawing, Antarctic Reglaciation, and Rapid Glacial Cycles.]
Glaciations During The Past 34 Million Years

18 C

Million Years Ago

Present

Opengeology.org
What has caused this dramatic fall in temperature?

- Solar
- Ocean Energy Storage
- Ocean Currents
- Continental Drift
SOLAR

The Sun: is the primary energy source for climate.

Supernova.eso.org
The Sun: is the primary energy source for climate.

Oceans: the primary energy “storage” mechanism.
The Sun: is the primary energy source for climate.

Oceans: the primary energy “storage” mechanism.

Ocean Currents: the primary energy “transport” and “collection” vehicle.
The Sun: is the primary energy source for climate.

Oceans: the primary energy “storage” mechanism.

Ocean Currents: the primary energy “transport” and “collection” vehicle.

The atmosphere: has a negligible capacity to store long term climate energy.
Water Can Exist In All Three Phases (a unique Greenhouse Gas)
As water changes temperature and phase, sensible heat and latent heat are absorbed or released.
Changes To Ocean Currents

As continents have drifted, ocean passages have opened and closed over time.

As a result, there have been major changes in ocean currents.

This has affected energy collection and transport, and hence, climate.
Physical Changes To The Earth

Pangaea – the “super continent”
Physical Changes To The Earth

Pangaea – the “super continent”

Surrounded by the Tethys Sea

Pangaea break-up began 175 million years ago
Late Cretaceous Period – 66 Million Years Ago

C.R. Scotese 2002
EOCENE 56 Million Years Ago

No Polar Ice Caps

Drake- AA Closed

Arctic Ocean Closed

Australia AA closed

C.R. Scotese, 2002
Eocene 56 MYA Ocean Currents & Connections

- Bering closed
- Closed Arctic basin
- Ural sea open
- Australia to AA closed

Global Equatorial Current

Warm Waters

Closed Drake Passage

Wikimedia
Oligocene – 34 Million Years Ago

Closure of Equatorial Current passages
Opening of Southern Polar Currents

No northern Ice Cap

Drake Opens
Tethys Sea Narrowing
Open Arctic
Tasmania/ AA opens

South Polar ICE SHEETS begin

C.R. Scotese, 2002
Mid-Miocene 14 MYA

Further Restriction and Closure of Equator Current
Opening of Southern Hemisphere Currents

Open polar current
Antarctic Ice Sheets

Panama Narrows
Indonesia narrows

Scotese 2002
Default Climate Condition During The Pleistocene is:
Glacial, Cold, Dusty for the last 3.3 Million Years

Panama and Indonesia Closure, terminating Equatorial Current
Isthmus of Panama Closes 3.3 MYA
THE LAST 5 MILLION YEARS

Temperature Is Falling, with 41,000 and then 100,000 year Glacial Cycles

From Sediment Cores

Panama Closes

Solar Cycles and sinking temperatures
THE PLEISTOCENE

GLACIAL ICE Control  COLD STORAGE 3.3 MYA
NEW DATA RESOURCE

Proxy data from several sources and techniques.

Stable Isotopes

Many different isotopes
NEW DATA RESOURCE

Proxy data from several sources and techniques.
Continental Drift
NEW DATA RESOURCE

Proxy data from several sources and techniques.

Continental Drift

New, extensive data set became available in September 2020.

High sample density and accuracy.

Very Long Time Series analysis of $^{18}$O and $^{13}$C in microscopic plankton.
Benthic Forams, Cibicidoides & Nuttallides
67 Million Year Record Of Temperature and CO₂ Concentration Using Isotopic Analysis Of Benthic Forams From Sea Sediment Cores

Westerhold - Science, Sept 11th 2020

$^{18}O/^{16}O$ Ratio, Indicative Of Temperature

$^{13}C/^{12}C$ Ratio, Indicative Of CO₂ Concentration

Age Mya

Present
Recurrence Plots of $^{13}\text{C}/^{12}\text{C}$ and $^{18}\text{O}/^{16}\text{O}$ Benthic Forams

Westerhold - Science, Sept 11th 2020
Incoming Solar Energy Is Affected by Cyclic Orbital Variations

Milankovitch Cycles have periods of 24,000, 41,000, and 100,000 years.
Milankovitch Cycles 100,000, 41,000 & 24,000 Years

- **Eccentricity (a)**: The shape of the Earth's orbit varies from a nearly circular orbit to a highly elliptical orbit. The wave pattern shows the variations over 200,000 years.
- **Obliquity (b)**: The angle of the Earth's axis of rotation with respect to its orbital plane changes. The wave pattern shows the variations over 41,000 years.
- **Precession (c)**: The orientation of the Earth's equator and poles changes due to gravitational forces. The wave pattern shows the variations over 24,000 years.

Thousands of years:
- 100,000 year
- 41,000 year
- 24,000 year
FFT Analysis of $^{13}\text{C}/^{12}\text{C}$ and $^{18}\text{O}/^{16}\text{O}$ Benthic Forams

Westerhold - Science, Sept 11th 2020
67 Million Years Of CENOGRID Temperature vs Atmospheric CO$_2$ Concentration

Willis Eschenbach re-plotting of the CENOGRID data

Twitter.com
67 Million Years Of CENOGRID Temperature vs Log Of Atmospheric CO$_2$ Concentration

Blue dots are individual datapoints. Colored/black lines show million year averages.

<table>
<thead>
<tr>
<th>Temperature Anomaly (°C, 0°C is avg. past 10,000 years)</th>
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<tbody>
<tr>
<td>20</td>
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</table>

<table>
<thead>
<tr>
<th>Atmospheric CO$_2$ Concentration (ppmv, log scale)</th>
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<tbody>
<tr>
<td>1200</td>
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</tbody>
</table>

- **LGM**: Last Glacial Maximum
- **Present**: Current conditions

Eschenbach, September 2020
LATEST GLACIAL MAXIMUM (LGM)

120,000 Years ago to 20,000 Years ago
Antarctic Dust Inversely Proportional To Temperature During Glacial Cycles

Sampling the Vostok Cores

CO₂, ppmv

Dust, ppm

Thousands Of Years Ago

Present

100,000 Years

Wikimedia Commons
Recovering From The Latest Significant Glaciation “LGM”
Cycles of Irradiance (rate of “insolation”)

The Default Condition is ICE

100 W/m²

10 deg C

Thousand Years Before Present

Present

LGM

Rapid warming

Slow, long, cooling

WUWT.com
Termination  DURATION From Glacial to Interglacial

Last 9 Glacial Cycles

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<th>Time Period (KYBP)</th>
<th>Duration of transition (KY)</th>
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<tr>
<td>135-130</td>
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<td>741-738</td>
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<td>796-788</td>
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</tbody>
</table>
Latest Glacial Max (LGM) Melt Water Pulses Over The Last 20,000 Years

Present Rate is 2-3 mm/year

40-60 mm/year

120 Metres Change

Thousands Of Years Before Present

SEA LEVEL (Metres)
Changes During The Holocene – The Last 11,000 Years
The Holocene Record

- Earth's Obliquity
- Temperature (Temp)
- CO₂
Holocene: Thermal Maximum vs. Neoglacial
HOLOCENE Warm And Cool Periods

- **Latest Glacial Max**
- **HOLOCENE**

### Temperature

- **GISP 2, Greenland**

### CO₂ Concentration

- **Atmospheric CO₂ from EPICA Dome C ice core**

Approximate Temperature Anomaly (Deg C)

- Minoan Warm Period
- Roman Warm Period
- Medieval Warm Period
- Little Ice Age

Years before now

- 11000
- 10000
- 9000
- 8000
- 7000
- 6000
- 5000
- 4000
- 3000
- 2000
- 1000
- 0

- 285
- 280
- 275
- 270
- 265
- 260
- 255

Climate4you.com
Rates of Holocene Temperature Change

GiSP 2, Greenland

Approximate global temperature anomaly (Deg C)

Air temperature (Deg C) at the summit of the Greenland ice sheet

Years before now

Mönsen warm period
Roman warm period
Medieval warm period
Little Ice Age
Modern warm period

Atmospheric CO₂ (ppm)

Atmospheric CO₂ from EPICA Dome C ice core
HOLOCENE Warming Rates of Change

Years per One degree C

<table>
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<th>Year BP</th>
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<th>Rate of Change slope</th>
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<td>0.0032</td>
</tr>
<tr>
<td>today</td>
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Rate Of Change Of Temperature (Degrees C/Year)

Early Holocene Optimum Rates of Change

HOLOCENE Temperature Change Rates

Roman 2

Minoan

Roman

Medieval

Modern

Neoglacial Rates Of Change

WARMING CYCLE
Modern Period (the last few hundred years)

400 Years of Sunspot Observations

World Ocean review

Wikipedia

Climate.gov
Modern Period (the last few hundred years)

Climate and Weather are driven by:

- Solar Cycles
- Oceanic Currents
- Oceanic Oscillations (Creating lag and a periodic frequency)
- Regional Oceanic Energy conditions that drive long term regional pulsating climate variations
NASA Predicted Solar Cycle 25
Upper Atmospheric $^{10}\text{Be}$ Correlates With Sunspot Activity

Commons.Wikimedia.org
Today’s Ocean Currents and Climate

• El Nino Southern Oscillation (ENSO)
• Pacific Decadal Oscillation (PDO)
• Japanese Current
• Atlantic Multidecadal Oscillation (AMO)
• Gulf Stream Current
Modern Earth’s Ocean Currents

NASA earth Nullschool
El Niño Vs La Niña Pacific: ENSO Temp
Pacific Decadal Oscillation (PDO)
El Niño Southern Oscillation (ENSO)
Infrared Image Of Northern Polar Vortex Hole

Jan 29, 2019
Atlantic Multidecadal Oscillation (AMO)
Atlantic Multidecadal Oscillation (AMO)

Monthly values for the AMO index, 1856 - 2013
The Gulf Stream and South American Current
Paleoclimatology

Climate Change Science badly needs to involve factual information from the Earth Sciences. “Theory” must be consistent with millions of years of evidence from real data. It is NOT.

Earth Temperature is not controlled by or directly related to CO2 concentration over 200 ppm.

Oceanic energy accumulation, storage and movement have created unique climates throughout earth history. These climates required specific continental positions. Only by Duplicating these conditions could we recreate any similar Temperatures.

Humans have been lucky to live in the Holocene, a small island of warmth in a time dominated by glaciation.

In the Holocene, there is nothing unusual about our current Rate Of Warming.

Embrace the warmer, humid, “CO₂ fertilized times” now.

Prepare for more glaciation ahead.
Man Is Not Causing A “Climate Emergency”

We Must Learn To Adapt To Naturally-Occurring Climate Changes

Enjoy The Warmth (While We Have It)!
THE END

YouTube Videos With More Information:

Paleoclimatology Part 1  https://youtu.be/K6tWEjkEiZU

Paleoclimatology Part 2  https://youtu.be/iZSYSWPYEbU

Paleoclimatology Part 3  https://youtu.be/YMHKt9ylPpQ