# Unfinished Business from Week TWO



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Weather, Climate and Climate Change—What the Data Tell Us 16 Sep 2019

Throughout, material responding to Gary Hardesty's comment about changing atmospheric composition. Outline:

Solar and Terrestrial Radiation

Hurricanes; Is CO2 increasing the number, energetics and strength of Hurricanes?

**Great Atlantic Hurricane of 1944** 

Did Global Warming make Harvey more severe than other Texas Hurricanes?

Great Hurricane of 1780 in the Antilles

CO2, warming effects on plant growth, and global greening

Report from La Brea Tar Pits, Los Angeles. Reports from CO2Science.org

Henry's Law from High School Chemistry

Is more CO2 changing the rate of sea level rise?

Introduction to "100,000-year" and "1000-year" climate cycles

### **Solar and Earth Radiation**





#### http://www.seafriends.org.nz/oceano/currents.htm

Y-Axis Log of Flux Density



### actual solar and terrestrial radiation

The light yellow shape is incoming sunlight above the atmosphere. The dark vellowshape, as it arrives at the surface. The red line is the theorretical radiation from a black body of 6000%. Earth's radiation penetrating the atmosphere is the broken green shape, which fits into a contour of blackbody radiation between 260 and 300%. Vertical scale is log flux density: cal /cm2 /min /micron. Horizontal scale is logwavelength in micron. (From various sources)

Emitted Radiation <a href="https://earthobservatory.nasa.gov/features/ArcticReflector">https://earthobservatory.nasa.gov/features/ArcticReflector</a>



https://www.theguardian.com/environment/2017/aug/29/how-did-climate-change-worsenhurricane-harvey

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#### How did it make it worse?

Warmer seas evaporate more quickly.

Warmer air holds more water vapour. So, as temperatures rise around the world, the skies store more moisture and dump it more intensely.

**Is this speculation or science?** There is a proven link – known as the <u>Clausius-Clapeyron equation</u> – that shows that for every half a degree celsius in warming, there is about a 3% increase in atmospheric moisture content.

Is tropical storm Harvey linked to climate change?



Infrared image of Hurricane Harvey just prior to making landfall along the Texas coast, US. Photograph: NOAA

# This sounds reasonable...

# so, what do the data say?



X-Axis Time Years Y-Axis: Gulf of Mexico Sea Surface Temperature SST Anomaly



http://www.drroyspencer.com/2017/08/texas-major-hurricane-intensity-not-related-to-gulf-water-temperatures/





https://realclimatescience.com/2017/09/record-hurricanes-on-september-16/

On 16 Sep 1988 Hurricane Gilbert hit Mexico with winds close to 200 MPH, and an all time record low barometric pressure of 26.13 inches.



People who say that hurricanes are getting worse come in three categories. – idiots, liars and lying idiots.

### The data show the Guardian's claim that the intensity of the Gulf of Mexico Hurricanes is directly related to Gulf Sea Surface Temperatures is False.



http://www.drroyspencer.com/2017/08/texas-major-hurricane-intensity-not-related-to-gulf-water-temperatures/

# The Guardian says that increasing <CO2> is making rainfall more intense globally.

# What do long-term rainfall data say?

https://notalotofpeopleknowthat.wordpress.com/2015/12/05/november-rainfall/

### England & Wales Rainfall Series - November Precipitation

1766 to 2015



No signature of increasing precipitation, England and Wales, 1990s and beyond, at least not for November

https://notalotofpeopleknowthat.wordpress.com/2018/10/11/extreme-rainfall-in-england-not-getting-worse/



No dramatic increases in precipitation anomalies for SE England or the other charts in this series.

https://notalotofpeopleknowthat.wordpress.com/2018/07/16/ofwat-blames-water-shortage-on-global-warming/

### Annual Precipitation - England SE & Central S

1910 to 2017



#### Rainfall Records confound the "heavy rainfall is increasing" claim

Right: the record book for extreme precipitation in the US.

There are no recent records set in the Continental US.

The 24-hour record was set in 1979.

1-minute, 1956 5-minute, 1960

Extreme Weather: <u>A Guide & Record</u> <u>Book –</u> <u>Christopher C. Burt</u> <u>– Google Books</u>

Time	Rainfall	Location	Date
1 minute	1.23″	Unionville, MD	7/4/1956
5 minutes	2.03″	Alamogordo Creek, NM	6/5/1960
12 minutes	2.30"	Embarrass, WI	5/28/1881
15 minutes	3.95"	Galveston, TX	6/4/1871
30 minutes	7.00″	Cambridge, OH	7/16/1914
40 minutes	9.25"	Guinea, VA	8/24/1906
42 minutes	12.00"	Holt, MO	6/22/1947*
1 hour	13.80"	Central WV	5/4-5/1943
1 hour 30 minutes	14.60"	Central WV	5/4-5/1943
2 hours	15.00"	Woodward Ranch, (D'Hanis) TX	5/31/1935
2 hours 30 minutes	19.00"	Rockport, WV	7/18/1889
2 hours 45 minutes	22.00"	Woodward Ranch, (D'Hanis) TX	5/31/1935*
3 hours	28.50"est.	Smethport, PA	7/18/42*
4 hours 30 minutes	30.70"	Smethport, PA	7/18/42*
12 hours	34.30"	Smethport, PA	7/17-18/1942
18 hours	36.40"	Thrall, TX	9/9/1921
24 hours	43.00"	Alvin, TX	7/25-26/1979
4 days	62.00"	Kukaiau, Hamakua, HI	2/27-3/2/1902
8 days	82.00"	Kukaiau, Hamakua, HI	2/27-3/6/1902
1 month	148.83″	Mt. Waialeale, Kauai, HI	3/1982
1 month (mainland)	71.54"	Helen Mine, CA	1/1909
1 year	704.83"	Kukui, Kauai, Hl	1982
1 year	332.29"	MacLeeod Harbor, AK	1976
1 year (mainland)	204.12"	Laurel Mountain, OR	1996

\*constitutes a world record

#### **U.S. Record Point Rainfalls**

Additional thoughts on this subject:

#### Sunlight (not, e.g., infrared energy in the CO2 band) Heats Seawater

Alarmists claim increasing <CO2> causes increasing Sea Surface Temperatures.

This is incorrect.

It is **only visible sunlight** which **penetrates sea water** (and other water surfaces) and heats the sea.

Infrared radiation does not penetrate sea water, or any water.

A simple validation of this is viewing into a pool. Solar radiation penetrates the water and illuminates the bottom of the pool.

A percentage of that light reflects from the bottom and comes back through the water and into the air.

The fact that we see the structures on the sides and bottom of the pool is evidence that sunlight penetrates water...(and heats the water as it heats our skin)

Emitted Radiation <a href="https://earthobservatory.nasa.gov/features/ArcticReflector">https://earthobservatory.nasa.gov/features/ArcticReflector</a>







#### Sunlight, not infrared energy heats bodies of water.

When fishing, for instance in the Gulf of Mexico, you see your bait as it sinks into the Gulf.

After a fish is on the line, as you reel in, you can see the fish as it emerges from the depths.

This observation means that sunlight is penetrating the water, heating surface waters, and to several tens of meters deep, and some sunlight reflects off the fish which you can see as the fish gets closer.

Pictured with a screen capture from a YouTube Video on the following slide:

#### Big Bass eats Bluegill: <u>https://www.youtube.com/watch?v=7\_3UUTunxWo</u>



Hurricanes:

Is CO2 increasing the number, energetics and strength of Hurricanes?

https://policlimate.com/tropical/global\_major\_freq.png

#### Global Major Hurricane Frequency -- 12 month running sums

Dr. Ryan N. Maue



#### https://policlimate.com/tropical/global\_running\_ace.png

Global Tropical Cyclone Accumulated Cyclone Energy (ACE) ---Global ---Northern Hemisphere 24-month Running Sums -- Dr. Ryan N. Maue -- Updated October 31, 2018 Running 2400 "Accumulated Cyclone Energy," similar to Kinetic knots<sup>2</sup>) 2000 Energy we learned about in HS Physics Class, defined as ergy 1600 <sup>1</sup>/<sub>2</sub> MV\*\*2 Cycle 1200 Accumulated 800 Cyclone Energy, ACE. Sum of V\*\*2 over all tropical 400 cyclones, storms 74 76 78 80 82 84 86 88 90 92 94 96 98 00 02 04 06 08 10 12 14 16 18 72 and hurricanes, 70 every six hours, X-Axis: Time from 1 Jan 1970 to the present. Y-Axis: ACE every month. each day, every

month, then plotted.

Multidecadal changes, but no trend. Not related to atmospheric <CO2>

#### https://www.livescience.com/50704-hurricane-drought.html

### LIVESCI=NCE

NEWS TECH HEALTH PLANET EARTH

### 4 May 2015

Live Science > Planet Earth

MORE -

### US in Longest 'Hurricane Drought' in Recorded History

By Laura Geggel, Senior Writer | May 4, 2015 07:13am ET



Hurricane Wilma seen by satellite as it crossed Florida in October 2005. Wilma was a Category 3 storm when it made landfall in the state and is the last major hurricane to hit the U.S. since that time. Credit: NOAA/NASA In a stroke of luck, no major hurricanes rated Category 3 or higher have struck U.S. soil during the past nine years, a new study finds.

This is the country's longest "hurricane drought" in recorded history, or since 1851, the researchers said. The previous record lull lasted eight years, from 1861 to 1868, they said.

Hurricane Wilma, a hurricane

that hit Florida in 2005, was the last Category 3 storm to make landfall in the United States. Other storms — including Hurricane Ike (Category 2, 2008), Hurricane Irene (Category 1, 2011) and Hurricane Sandy (Category 1, 2012) — caused significant damage, but their winds weren't as strong. [A History of Destruction: 8 Great Hurricanes]

**Capital Weather Gang** 

# The U.S. coast is in an unprecedented hurricane drought — why this is terrifying



It's been 10 years since a major hurricane has made landfall in the United States. (NASA)

https://www.washingtonpost.com /news/capital-weathergang/wp/2016/08/04/the-u-scoast-is-in-an-unprecedentedhurricane-drought-why-this-isterrifying/

#### 4 August 2016

Hurricanes, large and small, have eluded U.S. shores for record lengths of time. As population and wealth along parts of the U.S. coast have exploded since the last stormy period, experts dread the potential damage and harm once the drought ends. In Week TWO, we looked at the Long Island Express hurricane of 1938.

# Now the Great Atlantic Hurricane of 1944

### 15 Sep 1944

700 Miles of Atlantic A Coast Line Suffers in Fierce Hurricane Blow

Leased Wire Service of The United Press

THE NEWS-HERA



**Exclusive NEA Pictures and Features.** 

Winds Approaching Velocities of 100 Miles Per Hour Lash Norfolk, Atlantic City and New York; Jersey Resort is Hardest Hit.

#### BULLETIN.

BOSTON, Sept. 15.—UP—The tropical hurricane which battered 900 miles of the Atlantic coast, littered a half dozen big cities and 11 states with debris, took 22 lives, and caused damaage estimated at \$30,000,000, was expiring today somewhere off the coast of Nova Scotia.

The famous resort, Atlantic City, N. J., was worst hit but the east's three principal coastal cities, New York, Philadelphia and Boston, were lashed by high winds.

#### https://realclimatescience.com/2017/09/this-day -in-1944-hurricane-damaged-700-miles-of-coast/

#### Famous Piers Take Bad Pounding; Sections of Boardwalk Ripped Out by Big Waves.

ATLANTIC CITY, N. J., Sept. 15.-UP-This glittering resort city was a mass of debris today as it began the job of erasing the devastation of the Atlantic coast hurricane.

In Atlantic City alone two were killed by the storm which raged up 900 miles of the Atlantic coast to Maine. More than 50 others were injured here and damage was estimated at more than \$4,000,000.

The resort's fabulous piers took the worst pounding in the hurricane which reached its peak along the Jersey coast last night. The Steel Pier was buckled in the middle, and the Million Dollar Pier and its smaller neighbors suffered heavy damage.

Waves, whipped to a height of 20 feet by 75-mile-an-hour gales, battered out sections of the Boardwalk and sent the Atlantic Ocean swirling into mid-city streets.

At nearby Ocean City, almost all

### 15 Sep 1944

## THE MORNING NEWS

VOL. XLVIII-NO. 12- Superior A line

DANVILLE, PA., FRIDAY, SEPTEMBER 15, 1944

PRICE-PRICE Case & Const

#### RAGING HURRICANE STRIKES S. NEW ENGLAND 501 JAP PLANES, 173 VESSELS KNOCKED OUT BY U.S. FLIERS 1'Arthur's Troops Land On N. Tip Of Halmahera Group 100-Mi. Wind-Belt Riding 1aps Take Severest Schozzle With a Letted Sugar Along With Killer Hurricane; Damage Big In Atlantic City

Seating Since The Start Of The War

tion Started When American Carrier Planes Swept Over The Southern Philippines Last Friday, Wiping Out The Jap Drive In Germany



MOVES OUT TO SEA Buckes, Sept. 13 USA-The Westher Barras at Barlion reports that the tropical harriceste that rearra through New English fee out to one next this marning Sharity after the shares centre passed sever leasth Weymonth. He Washing Egenus sold, it verred and left the reast.

As Bestan, the Hannacharetti Adjustant-General's Offers reported that the "greatest damage has now been down', High winds are expected with these s.m. Hurricane Leaves A Path Of Destruction Along The Atlantic Coastal Area Stretching From New York To North Carolina; Steel Pier In Atlantic Is Snapped In Two, And The City Flooded, Injuring 50 Persons; Thousands Of Roofs Torn Off: Damage Is Estimated At \$1,000,000

New York, Sept. 14 (27)-A ranner above hadering 8. Inseriously is enverying scenarit a sector "All electric power has been turned of New Electric homen have been turned.

15 Sep 1944, Page 1 – The Danville Morning News at Newspapers.com

#### https://en.wikipedia.org/wiki/1944\_Great\_Atlantic\_hurricane

The **1944 Great Atlantic hurricane** was a destructive and powerful <u>tropical cyclone</u> that swept across a large portion of the <u>United States East Coast</u>, September 1944. Impacts were most significant in <u>New England</u>, though significant effects were also felt along the <u>Outer Banks</u>, <u>Mid-Atlantic states</u>, and the <u>Canadian Maritimes</u>. Due to its ferocity and path, the storm drew comparisons to the <u>1938 Long Island Express</u>, known as one of the worst storms..New England history.



#### 1944 Great Atlantic hurricane



#### https://en.wikipedia.org/wiki/1886\_Atlantic\_hurricane\_season

**1886 : America's Busiest Hurricane Season:** Posted on <u>September 13, 2017</u> The US was hit by <u>seven hurricanes</u> in 1886, the only year that has happened. Three of those hurricanes occurred in June, which never happens any more. Three locations in the US were hit by two hurricanes.

Texas...hit by four hurricanes... Florida...hit by three hurricanes. <a href="mailto:</a>




Some data I collected .... whether Harvey was affected by Human-Caused CO2-fueled Global Warming.



http://www.drroyspencer.com/2017/09/inevitable-disaster-why-hurricanes-cant-be-blamed-on-global-warming/



https://en.wikipedia.org/wiki/Great\_Hurricane\_of\_1780

## The Great Hurricane of 1780

The Great Hurricane of 1780, also known as Huracán San Calixto, the Great Hurricane of the Antilles, and the 1780 Disaster, is the deadliest Atlantic hurricane on record.

**Between 22,000 and 27,501 people died throughout the Lesser Antilles when the storm passed through them from October 10–16..** 



Areas most severely affected by The Great Hurricane of 1780.

Specifics on the hurricane's track and strength are unknown because the official Atlantic hurricane database goes back only to 1851 https://science.howstuffworks.com/nature/natural-disasters/10-worst-hurricanes10.htm



French troops are still stationed at Fort Saint-Louis in Fort-de-France, Martinique. This 17th-century fort survived the Great Hurricane of 1780. The United States as we know it was just a gleam in George Washington's eye when the Great Hurricane of 1780 blasted its way through the Caribbean, killing approximately 22,000 people. Among the dead were British and American soldiers who had been skirmishing in warships scattered throughout the region as part of the **Revolutionary War** 

https://en.wikipedia.org/wiki/Great\_Hurricane\_of\_1780

The hurricane stripped the bark off trees and left none standing on Barbados.

Cuban meteorologist José Carlos Millás has estimated that this damage could be caused only by winds exceeding 200 miles per hour (320 km/h). Every house and fort on Barbados was destroyed.

According to British Admiral <u>George</u> <u>Brydges Rodney</u>, the winds carried their heavy cannons aloft 100 feet (30 m).

## Great Hurricane of 1780



Warehouses on the beach of St. Eustatius were damaged by the hurricane. https://notalotofpeopleknowthat.wordpress.com/2019/09/11/are-category-5-hurricanes-such-as-dorian-thenew-normal-asks-michael-mann/#more-41316

"On the Classification of Extreme Atlantic Hurricanes Utilizing Mid-Twentieth-Century Monitoring Capabilities"

## Abstract Next slide has the important conclusion

An investigation is conducted to determine how improvements in observing capabilities and technology may have affected scientists' ability to detect and monitor Saffir-Simpson Hurricane Wind Scale Category 5 hurricanes in the Atlantic Ocean basin during the mid-twentieth century. Previous studies state that there has been an increase in the number of intense hurricanes and attribute this increase to anthropogenic global warming. Other studies claim that the apparent increased hurricane activity is an artifact of better observational capabilities and improved technology for detecting these intense hurricanes. The present study focuses on the 10 most recent Category 5 hurricanes recorded in the Atlantic, from Hurricane Andrew (1992) through Hurricane Felix (2007). These 10 hurricanes are placed into the context of the technology available in the period of 1944–53, the first decade of aircraft reconnaissance. A methodology is created to determine how many of these 10 recent Category 5 hurricanes likely would have been recorded as Category 5 if they had occurred during this period using only the observations that likely would have been available with existing technology and observational networks. Late-1940s and early-1950s best-track intensities are determined for the entire lifetime of these 10 recent Category 5 hurricanes. It is found that likely only 2 of these 10-both Category 5 landfalling hurricanes -would have been recorded as Category 5 hurricanes if they had occurred during the late-1940s period. The results suggest that intensity estimates for extreme tropical cyclones prior to the satellite era are unreliable for trend and variability analysis.

https://notalotofpeopleknowthat.wordpress.com/2019/09/11/are-category-5-hurricanes-such-as-dorian-thenew-normal-asks-michael-mann/#more-41316

"On the Classification of Extreme Atlantic Hurricanes Utilizing Mid-Twentieth-Century Monitoring Capabilities":

https://journals.ametsoc.org/doi/full/10.1175/JCLI-D-11-00420.1

"It is found that likely only 2 of these 10—both Category 5 landfalling hurricanes—would have been recorded as Category 5 hurricanes if they had occurred during the late-1940s period."

..results suggest that intensity estimates for extreme tropical cyclones prior to the satellite era are unreliable for trend and variability analysis.

## Is CO2

# (being added to the atmosphere by fossil fuels) harmful?

Adding more CO2 to the air will result in a little warming (all other things being equal)

But climate is always changing on its own ...so can't have all other things being equal

Maybe 1C warming for a doubling of <CO2>, BUT

**TEMPERATURE** controls <CO2> (Henry's Law)

https://www.usatoday.com/story/weather/2015/05/20/cold-weather-deaths/27657269/



"... risk of mortality due to extremely cold or hot days is actually higher, they are less frequent,"

...author Antonio Gasparrini, London School of Hygiene & Tropical Medicine.

The study...(was)...published in the British journal *The Lancet...* 

## http://www.co2science.org/articles/V18/aug/a11.php

## Cold waves kill many more people than heat waves.

Percent of Deaths Due to Moderate and Extreme Episodes of Heat and Cold



Fraction of all-cause mortality attributable to moderate and extreme hot and cold temperature by country. (Source: Gasparrini et al., 2015).



http://www.campaignlifecoalition.com/shared/media/editor/image/Population\_density\_map\_of\_Canada\_600x413.jpg

## Is CO2 (being added to the atmosphere by fossil fuels) harmful?

To the contrary; fossil fuel use enriches the atmosphere with this life-sustaining gas.

Craig Idso's many points on this:

Web site: <a href="http://www.co2science.org/">http://www.co2science.org/</a>

Two-minute video <a href="https://youtu.be/P2qVNK6zFgE">https://youtu.be/P2qVNK6zFgE</a>

https://youtu.be/Gzn9tXp\_v34 Presentation at ICCC-12

Book:

https://www.amazon.com/Many-Benefits-Atmospheric-CO2-Enrichment/dp/0981969429

Plant Growth Data base: <a href="http://www.co2science.org/data/plant\_growth/plantgrowth.php">http://www.co2science.org/data/plant\_growth/plantgrowth.php</a>

< Medieval Warm Period Project: <u>http://www.co2science.org/data/mwp/mwpp.php</u> >

Climate Change Reconsidered: Lead Author (with late Robert Carter and Fred Singer)

http://climatechangereconsidered.org/

https://youtu.be/P2qVNK6zFgE



More CO2 will be a very significant benefit to agriculture! Many of these slides came from Dr. Will Happer of Princeton. See his essay at https://thebestschools.org/special/karoly-happer-dialogue-global-warming/happer-major-statement/#top



https://thebestschools.org/special/karoly-happer-dialogue-global-warming/happer-major-statement/#top

# CO<sub>2</sub> is not a pollutant!



## Power plant's breath: 70% N<sub>2</sub> 5% O<sub>2</sub> 5% H<sub>2</sub>O 20% CO<sub>2</sub>

Alice's breath: 75% N<sub>2</sub> 15% O<sub>2</sub> 6% H<sub>2</sub>0 4% CO<sub>2</sub>

Main components of exhaust gases of a modern power plant are similar to components of human breath

https://thebestschools.org/special/karoly-happer-dialogue-global-warming/happer-major-statement/#top

# CO<sub>2</sub> is not a pollutant!



Figure 3. The main components of the exhaust gas of a modern power plant are similar to the components in human breath.



Alice inhales an atmosphere of 21% Oxygen and 415 PPM CO2

Alice exhales an atmosphere of 15% Oxygen and 40,000 PPM CO2

Human Exhalation is a common source of CO2 concentrations in excess of the ambient outside conditions.

Spacecraft and Submarines are enclosed spaces with CO2 concentrations in excess of ambient outside conditions...

## http://www.nap.edu/read/11170/chapter/5

THE NATIONAL ACADEMIES PRESS

OPENBOOK

Emergency and Continuous Exposure Guidance Levels for Selected Submarine Contaminants (2007) Chapter: 3 Carbon Dioxide

Submarine crew are reported to be the major source of CO<sub>2</sub> on board submarines (Crawl 2003).

Data collected on nine nuclear-powered ballistic missile submarines indicate an average  $CO_2$  concentration of 3,500 ppm with a range of 0-10,600 ppm,

and data collected on 10 nuclear-powered attack submarines indicate an average  $CO_2$  concentration of 4,100 ppm with a range of 300-11,300 ppm (Hagar 2003).

# CO<sub>2</sub> Concentration **Parts Per Million**

# Is CO2 Plant Food?

## Here is what happens with more CO2



## Experimental Plots for Measuring Response to CO<sub>2</sub> Enrichment



#### **CO2 Enrichment of Greenhouses**



Typical sales pitch: "CO2 enrichment at 2, 3, and 4 times natural concentration will cause plants to grow faster and improve plant quality. ... The \*\*\*\* generator automatically provides the carbon dioxide to meet maximum growing potential."

Cost < \$1000 plus cost of propane.

## **Global Greening From CO2 Fertilization: 1982-2010**



Increase = 11% in areas studied

Donohue et al, GRL (June 2013) DOI: 10.1002/grl.50563

https://nhm.org/site/sites/default/files/rancho\_la\_brea/pdf/ward,%20harris%20publication %20PNAS.pdf Date: 18 Jan 2005

## Carbon starvation in glacial trees recovered from the La Brea tar pits, southern California

Joy K. Ward\*<sup>1+</sup>, John M. Harris<sup>§</sup>, Thure E. Cerling<sup>11</sup>, Alex Wiedenhoeft<sup>1</sup>, Michael J. Lott<sup>1</sup>, Maria-Denise Dearing<sup>1</sup>, Joan B. Coltrain\*\*, and James R. Ehleringer<sup>1</sup>

\*Department of Ecology and Evolutionary Biology, University of Kansas, 1200 Sunnyside Avenue, Lawrence, KS 66045; \*Department of Biology, University of Utah, 257 South 1400 East, Salt Lake City, UT 84112-0840; \*The George C. Page Museum of La Brea Discoveries, 5801 Wilshire Boulevard, Los Angeles, CA 90036; \*Department of Geology and Geophysics, University of Utah, 135 South 1460 East, Salt Lake City, UT 84112; Forest Products Laboratory, U.S. Department of Agriculture Forest Service, One Gifford Pinchot Drive, Madison, WI 53726-2398; and \*\*Department of Anthropology, University of Utah, 270 South 1400 East, Salt Lake City, UT 84112

The Rancho La Brea tar pit fossil collection includes *Juniperus (C3)* wood specimens that 14C date between 7.7 and 55 thousand years(kyr) B.P., providing a constrained record of plant response for southern California during the last glacial period...

... Atmospheric CO2 concentration ([CO2]) ranged between 180 and 220 ppm during glacial periods, rose to 280 ppm before the industrial period, and is currently approaching 380 ppm in the modern atmosphere...

... As a result, glacial trees... indicating that <u>glacial trees were undergoing</u> <u>carbon starvation</u>.

emphasis added

PNAS



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#### http://www.co2science.org/data/plant\_growth/plantgrowth.php



In this section of our web site we maintain an ever-expanding archive of the results of peerreviewed scientific studies that report the growth responses of plants to atmospheric CO2 enrichment. Results are tabulated according to two types of growth response (Dry Weight and Photosynthesis). To begin, click on the response you are interested in below.

#### Dry Weight (Biomass)

Photosynthesis (Net CO2 Exchange Rate)



DO PLANTS LIKE MORE CO2?

SEARCH BY TOPIC ABCDEEGHIJKLM NOPORSIUVWXYZ http://www.co2science.org/data/plant\_growth/dry/dry\_subject\_c.php



## Plant Dry Weight (Biomass) Responses to Atmospheric CO2 Enrich

С

		300 ppm		600 ppm			
Plant Name	Number of Studies	Arithmetic Mean	Standard Error	Number of Studies	Arithmetic Mean	Standard Error	
C4 Grass [Cleistogenes squarrosa]	2	24.5%	17.3%				
Cabbage [Brassica oleracea]	11	47.2%	8.2%	9	59.6%	11.7%	

This says that an enrichment of 300 Parts Per Million CO2 INCREASES the biomass of cabbage by over 47%!

Plant Dry Weight (Biomass) Responses to Atmospheric CO2 Enrichment

#### С

	300 ppm		600 ppm			900 ppm			
Plant Name	Number of Studies	Arithmetic Mean	Standard Error	Number of Studies	Arithmetic Mean	Standard Error	Number of Studies	Arithmetic Mean	Standard Error
C4 Grass [Cleistogenes squarrosa]	2	24.5%	17.3%						
Cabbage [Brassica oleracea]	11	47.2%	8.2%	9	59.6%	11.7%			
Cajanus cajan [Pigeon Pea]	6	68.8%	14.1%						
Calamagrostis angustifolia [Reed Grass]	24	14.8%	2.1%						
Calamagrostis purpurea [Scandinavian Small Reed]	2	18%	7.8%						
Calamagrostis epigeios [Chee Reedgrass]	2	98.5%	0.4%						
Calcidiscus leptoporus [Marine Coccolithophore]	2	18.5%	3.2%						
Calluna vulgaris [Heather]	9	17.1%	5.4%						
Camphorweed [Heterotheca subaxillaris]	1	20%	0%						
Canada Cockleburr [Xanthium strumarium]	7	30.6%	6.4%						
Canary Grass [Phalaris arundinacea]	8	34.3%	12.1%						
Cantaloupe [Cucumis melo]	3	4.7%	0.7%	3	13.7%	1.8%	3	34.3%	4.4%
Capsicum annuum [Sweet Pepper]	2	53%	9.9%						
<u>Capsicum chinense [Yellow</u> Lantern Chili]	1	49%	0%				1	168%	0%
<u>Caragana microphylla [Littleleaf</u> Peashrub]	1	19%	0%						

http://www.co2science.org/data/plant\_growth/dry/dry\_subject.php



Other biomass gains, by crop, with 300 PPM over ambient <CO2>

Sweet Pepper53%Sweet Cherry60%Sweet Orange38%Corn27%Cucumber49%

Red Raspberry	100%
Rice	36%
Common Wheat	36%
Soybean	46%
Sugarcane	34%



# Climate Shorts are on the web site:

https://casf.me/climate-shorts/

# Climate Short Henry's Law, from 175 years ago: Temperature Controls <CO2>



http://chemistry.stackexchange.com/questions/47519/non-linear-solubility-trend

Henry's Law applied to CO2 and Water:

As the **temperature of the water increases**, the ability of water to hold CO2 in solution **decreases**, and the CO2 is given off into the atmosphere.



**X-Axis: Water Temperature** 

Y-Axis: CO2 Solubility

## Henry's Law, named for William Henry, British chemist

Loosely, where temperatures and pressures in the water and air are those commonly found at Earth's surface,

"In aqueous solution, as the temperature of the solution increases, dissolved gases in the solution are driven into the air until the partial pressure of the gas in the air matches its pressure in the solution," and conversely.

Ocean, lake and river waters contain dissolved air.

Air is: 78% Nitrogen, 21% Oxygen, 1% Argon, and now, 415 parts/million CO2.

This means the TEMPERATURE of WATER bodies at Earth's surface containing dissolved air determine, to first approximation,

whether CO2 goes out of the water into the air <increasing water temperatures> for instance, Warm Western Pacific El Nino waters displacing cooler Pacific waters.

or,

<u>whether CO2 goes from air into the water</u> <decreasing water temperatures> for instance, strong upwelling of cold water from West Coasts of North and South America.



### X-Axis: Time, Years, starting 1980

Y-Axis: 12-month Change of global atmospheric <CO2> (NOAA; green)

### **Y-Axis:** Global sea surface temperature (HadSST2; blue)

Y-Axis: Global surface air temperature (HadCRUT3; red dotted).

Thin white horizontal is the Zero Change Line, from which 12-month differences are displayed. Filtered values: (DIFF12, the difference between the average of the last 12 months and the average for the previous 12 months for each data series). <u>https://www.researchgate.net/publication/257343053 The phase relation between</u> <u>atmospheric carbon dioxide and global temperature</u>
**Next Chart:** 

### **Antarctic Ice Cores showing Temperature and Carbon Dioxide over Time:**

### X-Axis is time, from 20,000 years ago to NOW

Y axis, (purple) is Temperature over time

Y-Axis, (red) is Carbon Dioxide over time

### http://carbon-sense.com/category/the-evidence/

### Henry's Law explains the correlation between Temperature and CO2



#### **Anther demonstration that atmospheric CO2 does NOT control temperature:**

Next chart: Temp, CO2, and Dust over time from the Vostok Ice Cores in Antarctica

### X-Axis, Time ~400,000 years, 4 glacials, 5 interglacials.

**Y-Axis (Blue) Temperature.** Present interglacial warm period, the Holocene, also called Marine Isotope Stage 1, MIS 1, is the coolest of the past 5 interglacials.

### Y-Axis (Green) Atmospheric <CO2>

#### **Present CO2** has risen from ~280 to over 410 PPM; this is off the chart.

If CO2 controls temperature, this would be the hottest interglacial, but it is the coolest

The reason, Henry's Law.

Briefly, Temperature of the solution, sea water, controls amount of dissolved gases (N2, O2, Ar, and CO2) (air) in the solution

(we are concerned about sea water and atmospheric pressures at sea level, not in the soft drink or beer processing plant)

Catastrophic Global Warming posits that atmospheric <CO2> controls air temperature, clearly falsified by the data.

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



## Next charts have to do with sea level, sea level history,

and rate of change of sea level.

http://sealevel.info/acceleration\_primer.html

<u>Sealevel.info</u>  $\rightarrow$  <u>AvgSLR</u>  $\rightarrow$  acceleration\_primer

# How to recognize "acceleration" in a graph

Do you know how to recognize "acceleration" in a graph, at a glance?

It is very simple. In a nutshell:

Neither concave-up nor concave-down. If the graph shows a straight line, then it is said to be "linear." That means there is no acceleration, or "acceleration is zero." Here are three examples:



If that is unclear, Google will find some videos which explain it: https://www.google.com/search?q=what+does+acceleration+look+like+on+a+graph&tbm=vid **Concave-up.** If the graph (with "time" or "age" represented by the horizontal "x-axis," and "position" or "level" represented by the vertical "y-axis") "**curves upward**" then it represents positive **acceleration** (regardless of whether the overall trend is upward or downward). Here are three examples:



**Concave-down.** If the graph (with "time" represented by the "x-axis") "**curves downward**" then it represents **deceleration**, a/k/a "negative acceleration," (regardless of whether the overall trend is upward or downward). Here are three examples:



### http://www.sealevel.info/MSL\_graph.php?id=Battery

The Battery in Manhattan is one of the longest-lived tide gage stations in the USA; the data begin in May 1856, five years before the US' Civil War begins.



# The rate of sea level rise in the over 160 years for which there are data show that the RATE IS UNCHANGED over this time. It's Linear!



Fossil fuels consumption in particular and anthropogenic CO2 emissions in general plodded along steadily at about 1 GtC/year (gigatons of carbon per year) during the 1900 to 1945 period.

Then, after 1945, human emissions exploded. They reached 4 GtC/year by the 1970s, 6 GtC/year by the 1990s, and 10 GtC/year by 2014.

http://notrickszone.com/wp-content/uploads/2016/11/CO2-Emissions-1900-2014-GtC -per-year-ps-.jpg



The rate of sea level rise in the over 160 years for which there are data show that the RATE IS UNCHANGED over this time. It's Linear!

# The German Bight Deutche Bucht





What about data from the German Bight? No Acceleration!

Auswertung von Küsten-Pegeln in der Deutschen Bucht (Daten [9])

This is from Judith Curry's Congressional Testimony, using data from the IPCC



**Figure 6.** 18-year trends of global mean sea level rise estimated at 1-year intervals. The time is the start date of the 18-year period, and the shading represents the 90% confidence. The estimate from satellite altimetry is also given, with the 90% confidence given as an error bar. [AR5 WGI Figure 3.14] In 2006, Church and White published, "<u>A 20th century acceleration in global sea-level rise</u>." It got huge press, and to this day it is still frequently cited as proof that man-made global warming is causing accelerated sea-level rise.

However, their reported error bar for the amount of acceleration they found for the 20th century as a whole went all the way down to zero, and one detail that their paper didn't mention was that *all* of the acceleration they found was prior to 1925 — which means it was almost certainly unconnected to anthropogenic GHG emissions.

In 2009, Church and White posted a new data set on their web site, but, mysteriously, published no paper about it.

I wondered about that, so I reproduced their 2006 calculations using their 2009 data.

Guess what? All the 20th century acceleration was gone.

I shared my results with Drs. Church & White, and on June 18, 2010, Dr. Church cordially replied, confirming my analysis:

"For the 1901 to 2007 period, again we agree with your result and get a non-significant and small <u>deceleration.</u>"

Bolding, Underlining added.

The IPCC AR5 concludes:

*"It is very likely that there is a substantial contribution from anthropogenic forcings to the global mean sea level rise since the 1970s."* 

Global sea level has been rising for the past several thousand years. The key issue is whether the rate of sea level rise is accelerating owing to anthropogenic global warming.

It is seen that the rate of rise during 1920-1950 was comparable to, if not larger than, the value in recent years (a period contributing less than 10% of the human caused CO2 emissions since 1900).

Hence the data does not seem to support the IPCC's conclusion of a substantial contribution from anthropogenic forcings to the global mean sea level rise since the 1970s

# **Brief Introduction to Climate Cycles**

**References for my Temperature and Carbon Dioxide data plot:** 

http://www.scotese.com/ http://ajsonline.org/content/301/2/182.abstract



[American Journal of Science, Vol. 301, February, 2001, P. 182–204]

# GEOCARB III: A REVISED MODEL OF ATMOSPHERIC $\mathrm{CO}_2$ OVER PHANEROZOIC TIME

#### ROBERT A. BERNER and ZAVARETH KOTHAVALA

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ABSTRACT. Revision of the GEOCARB model (Berner, 1991, 1994) for paleolevels of atmospheric  $CO_2$ , has been made with emphasis on factors affecting  $CO_2$  uptake by continental weathering. This includes: (1) new GCM (general circulation model)



At ~7000 Parts per Million CO2 in the Cambrian, there was ~18X the present amount of CO2 at 415 PPM.

The lowest <CO2> was at the depth of the Wisconsin Ice Age Joy Ward reports 180-220 PPM CO2 low enough to carbon-starve Junipers from La Brea Tar Pits

For the Class:

Where did the CO2 go?

### Geologic History of <CO2> and Temperature as published in <u>Hayden's Primer on CO2</u> And Climate.



**Figure 24:** Phanerozoic  $CO_2$ :  $CO_2$  concentrations for the past 600 million years, in parts per million (left) and as multiples (up to a factor ~20) of current concentration (right). The past 400,000-year period is squeezed into a thin sliver on the left. Dots represent data, and lines represent various models [Hayden 2007]. Note the significant downard trend in  $CO_2$  levels in the past 200 million years.

At ~7000 Parts per Million CO2 in the Cambrian, there was ~18X the present amount of CO2 at 415 PPM.

The lowest <CO2> was at the depth of the Wisconsin Ice Age Joy Ward reports 180-220 PPM CO2 low enough to carbon-starve Junipers from La Brea Tar Pits

Where did the CO2 go? Hint: CaO+CO2=>CaCO3

ANSWER: to CaCO3 in Limestone, Dolomite, Coral Reefs, Oolite, Marble

Examples:



## **Redwall Limestone**

# The Grand Canyon of Arizona

# Gibraltar

The Rock of Gibraltar



Figure 14. Washington Monument, showing *Texas* marble on the bottom third and *Cockeysville marble* on the upper two thirds. The Jefferson stone is in the foreground. Compare with the 1851 view in Figure 2.



Figure 34. National Gallery of Art West Building, *Tennessee marble*. Note stronger banding on outermost columns.



The Bedford Limestone, also called the Bedford Oolitic Limestone is favored in many construction projects.

Left, the Empire State Building

Below, the Jefferson Memorial (the dome)

Next, the Pentagon.







Introducing Climate Cycles

~100,000 year cycles

Temperatures in Blue Show Interglacials (in yellows), Glacials (in Blue) Zero, current mean Temp

<CO2> in Green

MIS 1 Holocene is the coolest of the five interglacials.

Present <CO2> is now 415 PPM, off scale high.

Shows that CO2 does not control temperature, but responds to temperature.

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



### Greenland GISP2 Ice Core - Temperature Last 10,000 Years

http://wattsupwiththat.files.wordpress.com/2013/03/gisp2-ice-core-temperatures.jpg?w=960&h=720

Climate Cycles in the Holocene, also from Ice Cores



### http://www.greenworldtrust.org.uk/Science/Images/Main/Warm\_periods.jpg



Calendar years

http://www.drroyspencer.com/wp-content/uploads/2000-years-of-global-temperatures-industrial-revolution-start.jpg



temperature\_variability\_in\_the\_extra-tropical\_Northern\_ Hemisphere\_during\_the\_last\_two\_millennia Period allegedly warmed by human activities https://science.sciencemag.org/content/278/5341/1257

# Science

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#### SHARE RESEARCH ARTICLE

A Pervasive Millennial-Scale Cycle in North Atlantic Holocene and Glacial Climates 



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Gerard Bond<sup>\*</sup>, William Showers, Maziet Cheseby, Rusty Lotti, Peter Almasi, Peter deMenocal, Paul Priore, Heidi Cullen, Irka ... See all authors and affiliations.



Science 14 Nov 1997: Vol. 278, Issue 5341, pp. 1257-1266 DOI: 10.1126/science.278.5341.1257



Article

Figures & Data

Info & Metrics

eLetters



A graph of "observed temperature" for the Northern Hemisphere was included in the paper to illustrate these climatic trends.



indotrate these climate trends.



The National Center for Atmospheric Research, NCAR, reported much the same result.



This graphic from NCAR was part of the SCIENCE Section in the 28 April 1975 edition of NEWSWEEK. ...article's headline was , "The Cooling World."




Annual temperature change in New Mexico forces concentration changes in the most important greenhouse gas, water vapor.

Range of Dew Points and Mixing Ratios from ABQ NWS

0F Td ~ 1 g/Kg = 1 parts/1000 =1,000 PPM

68F Td ~14 g/Kg= 14 parts/1000 =14,000 PPM The absolute highest dew point recorded in the region and therefore the world (of which I am aware) was 95° at Dhahran, Saudi Arabia at <u>3 p.m. on July 8, 2003.</u> The dry bulb temperature stood at 108° at the time, so theoretically the heat index was 176°.

Sharjah in the United Arab Emirates (UAE) apparently once recorded a dew point of 93.2° (date unknown) according to 'Weather Climate Extremes' Army Corps of Engineers TEC-0099 report.

## Dhahran, Saudi Arabia in 2003, Dewpoint 95F





Natural changes in the composition of the atmosphere are driven by the behavior of the water vapor in the atmosphere.

0F Td ~ 1 g/Kg = 1 parts/1000 =1,000 PPM

34C Td ~35 g/Kg= 35 parts/1000 =35,000 PPM

There is 35 times more water vapor in the air in Persian Gulf summers than New Mexico winters.

Natural atmospheric water vapor changes from the evaporation and condensation of water vapor, from the most important greenhouse gas...drive important atmospheric composition changes Water Vapor

0F Td ~ 1 g/Kg = 1 parts/1000 =1,000 PPM

34C Td ~35 g/Kg= 35 parts/1000 =35,000 PPM

There is 35 times more water vapor in the air in Persian Gulf summers than New Mexico winters.

These are natural atmospheric water vapor changes from the evaporation and condensation of water vapor, the most important greenhouse gas. Carbon Dioxide

At the beginning of the industrial revolution <CO2> was ~283 PPM according to CDIAC

<CO2> has changed from 283 PPM to 415 PPM today

In the Cambrian, <CO2> was ~ 7000 PPM, 535 MY Ago

30,000 years ago <CO2> was about 180 PPM and Juniper Trees were CO2-Starved.

So, CO2 has changed from 283 PPM to 415 PPM or an increase of 46% from LIA and pre-industrial revolution days

If we assume they have the same global warming potential, they don't, it would be +132 PPM vs +34,000 PPM increases.

Natural Changes ~ +35 times vs +46%