PREPRINT #3: Carbon cycle model proves core theory of climate change is wrong

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Key Points:

- IPCC's core theory says human CO_2 caused all the CO_2 increase above 280 ppm and since 1750.
- IPCC's own natural carbon cycle proves IPCC's core theory is wrong.
- IPCC's core theory failure means all peer-reviewed scientific papers that assume IPCC's core theory is true, are invalid.

Abstract

The core theory of the United Nations *Intergovernmental Panel on Climate Change* (IPCC) is that human CO_2 emissions have caused all the increase in atmospheric CO_2 above 280 ppm and since 1750. The Physics carbon cycle model uses IPCC's natural carbon cycle time constants to calculate IPCC's *true* human carbon cycle. IPCC's true human carbon cycle proves IPCC's *claimed* human carbon cycle is wrong. IPCC's *claimed* human carbon cycle is simply a restatement of IPCC's core theory. This proves IPCC's core theory is wrong. Also, the level of atmospheric CO2 before 1960 is greater than the sum of all human CO_2 emissions, which proves IPCC's core theory is wrong. Statistics also prove IPCC's core theory is wrong. Therefore, all peer-reviewed scientific papers that assume IPCC's core theory is true, are invalid. IPCC's true human carbon cycle shows human emissions have added 33 ppm to atmospheric CO_2 as of 2020. Therefore, nature has added 100 ppm to its original 280 ppm. If human CO_2 emissions were to stop in 2020, the human-caused increase would fall by 50% in 20 years and by 83% in 2100. There is no human-caused climate emergency.

Plain Language Summary

A person's death can have many *effects* – on family, on business, maybe even on politics. But no rational person would conclude the *effects* of a death determine the *cause* of the death. Yet, that is how climate alarmists view climate change. They think, incorrectly, that the claimed *effects* of climate change – shrinking glaciers, rising seas, loss of species, even ulcers – prove human CO_2 emissions *cause* the climate change. This paper examines the first *cause* of climate change. The core theory of the United Nations *Intergovernmental Panel on Climate Change* (IPCC) is human CO_2 emissions caused *all* the increase in atmospheric CO_2 above 280 ppm while natural CO_2 emissions stayed constant. This paper uses IPCC's data to prove IPCC's core theory is false. This means all peer-reviewed scientific papers that assume IPCC's core theory is true, are invalid. Human emissions cause about 8 percent of the CO_2 in the atmosphere as of 2020. If human CO_2 emissions were to stop in 2020, the human-caused increase of 33 ppm would fall by 50% in 20 years and by 83% in 2100. Nature, not human CO_2, is the dominant cause of climate change. There is no human-caused climate emergency.

Index Terms

0330, 1615, 1622, 3305, 3367

Keywords

carbon cycle, carbon dioxide, climate change, climate emergency, global warming

1. Introduction

1.1 What this paper does

The core theory of the *United Nations Intergovernmental Panel on Climate Change* (IPCC, 2013) has three parts:

1. The natural atmospheric CO_2 level has remained constant at 280 ppm.
2. Natural CO_2 inflow remained constant to support a constant 280 ppm.
3. Therefore, human CO_2 inflow caused all the CO_2 increase above 280 ppm.

Then, IPCC concludes this "human-caused" increase in atmospheric CO_2 causes the "global temperature" to increase, which in turn causes bad things to happen. There are other scientific papers that question the possible *effects* of the increase in CO_2. This paper focuses entirely on the *cause* of the increase in CO_2.

IPCC's biggest scientific error is to assume its core theory is true. IPCC's entire platform is built upon this assumption. By contrast, the proper scientific approach is to acknowledge IPCC's core theory is a theory that can be proven to be false.

This paper uses independent arguments prove IPCC's core theory is invalid.

1. IPCC claims climate events provide "extensive evidence" that human emissions caused the events. But events cannot prove their cause.
2. IPCC assumes its own core theory is true to argue its core theory is true. This is invalid circular reasoning.
3. The IPCC says its core theory is "incontrovertible." But the scientific method says evidence cannot prove a theory is true. Rather, only one error can prove a theory is false.
4. IPCC's core theory says human and natural CO_2 act differently, e.g., human CO2 sticks in the atmosphere while natural CO2 flows out of the atmosphere. This is impossible because all CO_2 molecules are identical. (Section 1.2 and Figure 5)
5. The correlation between annual human CO_2 emissions and annual atmospheric CO_2 increases is zero, which proves IPCC's core theory is false. (Section 1.5)
6. Ice core data prove IPCC's core theory is false. (Figure 1)
7. Stomata leaf data prove IPCC's core theory is false. (Figure 2)

8. IPCC's human carbon cycle is not a scientific deduction. It is merely a replication of IPCC's core theory.
9. IPCC's human carbon cycle contradicts IPCC's natural carbon cycle, which proves IPCC's core theory is false. (Figure 5)

Not calculated in this paper but derivable from the carbon cycle model presented in this paper is how the small 2020 reduction in atmospheric CO_2 caused by the 2020 reduction of human emissions proves IPCC's core theory is *false*.

This paper expands on argument #8 above to show:

1. IPCC's human carbon cycle merely replicates IPCC's core theory.
2. IPCC's human carbon cycle is incompatible with IPCC's natural carbon cycle.
3. IPCC's self-contradiction proves IPCC's core theory is *false*.

We derive a Physics carbon cycle model for IPCC's four key reservoirs of land, atmosphere, surface ocean, and deep ocean. (Other researchers can add more reservoirs to this Physics carbon cycle model.)

Then we find the time constants (herein called e-times) for the six flows in IPCC's natural carbon cycle.

Then, according to the Equivalence Principle (below), we use IPCC's natural carbon e-times to calculate IPCC's *true* human carbon cycle.

We find that IPCC's *true* human carbon cycle is much different than IPCC's *claimed* human carbon cycle which is merely a replication of IPCC's core theory. Therefore, IPCC's natural carbon cycle proves IPCC's claimed human carbon cycle and IPCC's core theory are invalid.

Therefore, all peer-reviewed scientific papers that assume IPCC's core theory is true, are invalid and cannot be used to support IPCC's core theory. This eliminates the claimed "scientific consensus" support for IPCC's conclusions.

This paper converts carbon units of GtC (Gigatons of Carbon) and PgC (Petagrams of Carbon) into CO_2 units of ppm (parts per million by volume in dry air) using:

1 ppm = 2.12 GtC = 2.12 PgC

1.2 The Equivalence Principle

Nature cannot tell the difference between human and natural carbon because human and natural carbon atoms are identical. Therefore, nature treats human carbon the same as it treats natural carbon. Therefore, all carbon cycle models must treat human and natural carbon the same.

This conclusion is an extension of the Equivalence Principle that Einstein used to derive his theory of relativity. Einstein reasoned, since we cannot do an experiment that will distinguish between gravity and inertial forces, then gravity must be the same as an

inertial force.

The Equivalence Principle applied to climate physics says the human carbon cycle must follow the same physics as the natural carbon cycle. The time constants for human carbon must be the same as the time constants for natural carbon.

1.3 IPCC's arguments do not support its core theory

IPCC's argument #1:

> "The sum of human carbon emissions since 1750 exceeds atmospheric carbon, so human emissions caused all the increase in CO_2."

Figure 1 shows the "Sum of human CO_2 emissions is *less than* "CO_2 level data" before 1960. These data alone prove IPCC's core theory is false and that nature caused most of the increase before 1960 and likely thereafter.

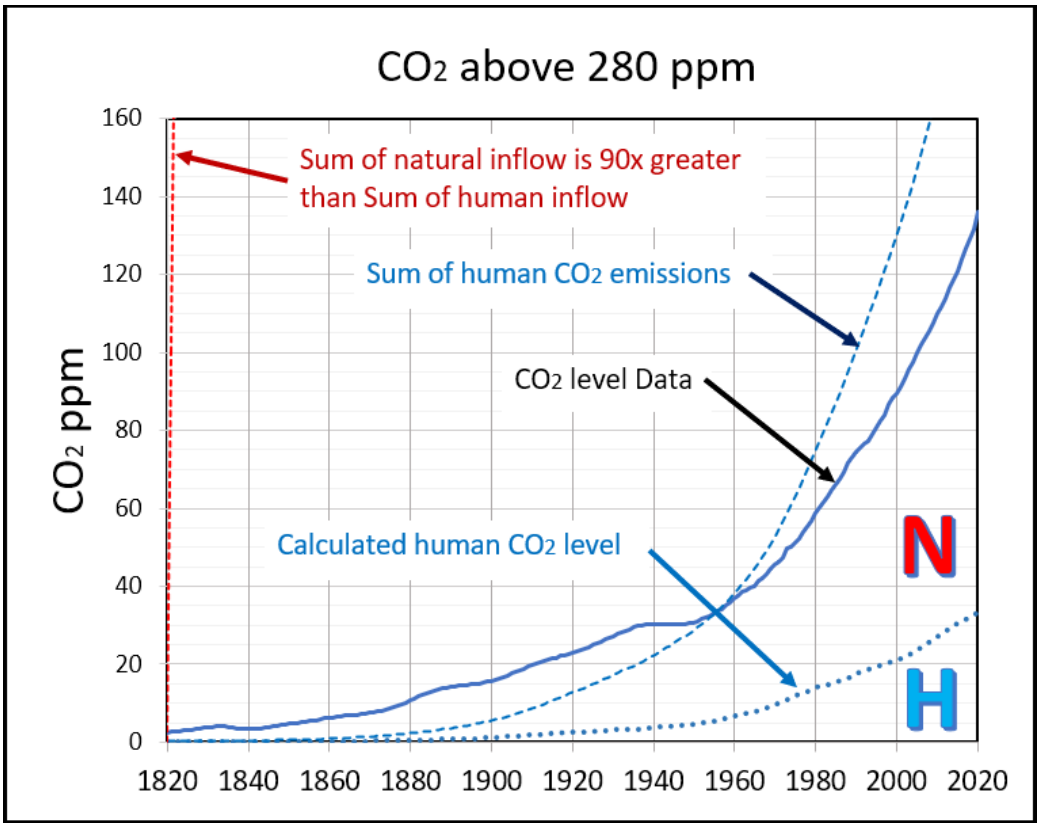

Figure 1. CO_2 level above 280 ppm. *Sum of Human CO_2 emissions* is less than *CO_2 level Data* before 1960, so Argument #1 is invalid. *Calculated Human CO_2 level* is from Section 4.2. H-area is human caused. N-area is nature caused.

The H-area is human caused. The N-area is nature caused. But IPCC's core theory claims the N-area is human caused.

Sum of human CO_2 emissions is the sum of annual human CO_2 emissions from Boden and Andres (2017) from 1750 to 2014 plus this paper's estimates through 2019.

CO_2 level data before 1960 are the Etheridge et al. (1996) reconstructed CO_2 levels from Antarctic ice and firn and, after 1960, the Keeling et al. (2001) CO_2 level data.

Calculated human CO_2 level is from the physics carbon cycle model (Section 4.2).

Argument #1 also neglects the "Sum of natural inflow" which is 90 times greater than the "Sum of human CO_2 emissions." It should be obvious that nature has solved the accumulation problem and human CO_2 obeys the same rules as natural CO_2. Natural CO_2 does not accumulate in the atmosphere. Therefore, human CO_2 will not accumulate in the atmosphere.

IPCC's argument #2:

> "Ice-core data show CO_2 remained at 280 ppm for a few thousand years before 1750. Therefore, nature must have remained constant after 1750."

Kouwenberg's (2004) shows that CO_2 levels reconstructed from conifer stomata are significantly greater than the CO_2 levels found in ice-core data. Therefore, ice cores do not properly represent historical CO_2 levels.

Figure 2 shows Figure 4.4 from Kouwenberg (2004). Kouwenberg et al. (2005a, 2006b) published a public version of the same figure. These stomata-derived CO_2 levels are much greater than ice-core derived CO_2 levels.

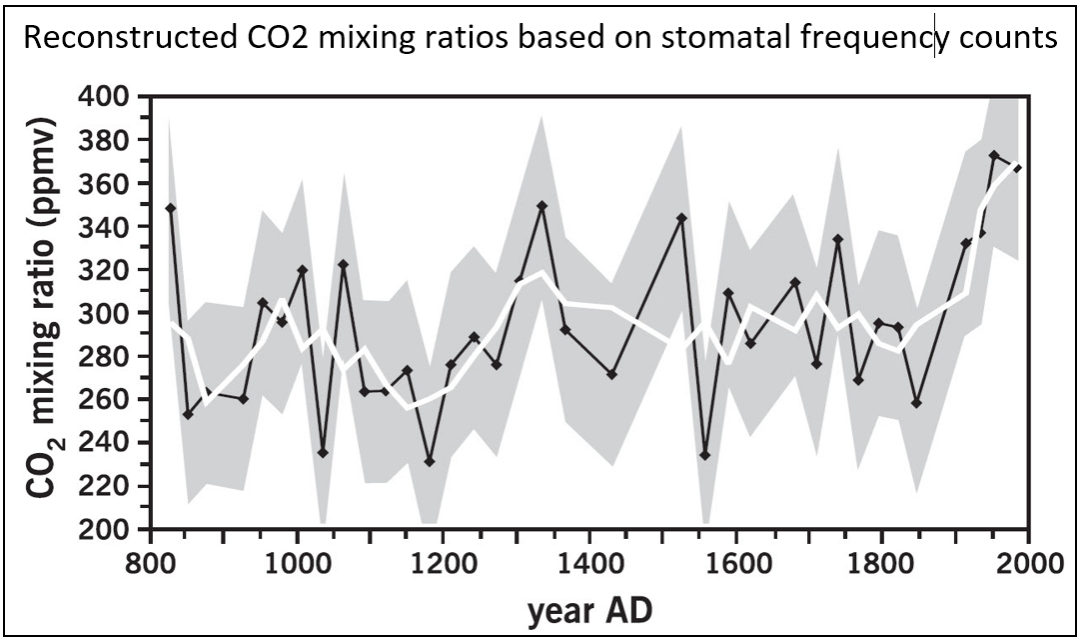

Figure 2. Reconstructed CO_2 mixing ratios based on stomatal frequency counts on Tsuga heterophylla needles for the time period from 800 AD to 2000 AD. Black line are the means of 3–5 needles per sample, thick white line represents a 3-point moving average. Grey area shows confidence interval of ± 1 RMSE. (Kouwenberg, 2004, Kouwenberg et al., 2005a, 2005b)

Kouwenberg (2004) wrote:

> "The highly comparable fluctuations in the paleo-atmospheric CO_2 records, which were obtained from different continents and plant species (deciduous angiosperms as well as conifers) using varying calibration approaches, provide strong evidence for the integrity of leaf-based CO_2 quantification."

Beck (2007) reviews thousands of direct chemical measurements of CO_2 that show the CO_2 level was 450 ppm in 1820, 370 ppm in 1860, 310 ppm in 1920, 420 ppm in 1940 and 430 ppm in 1948.

Therefore, ice-core data do not prove the CO_2 level was constant for thousands of years.

IPCC's argument #3:

> "Nature is a net absorber of human emissions. Therefore, natural emissions cannot have caused the increased."

This argument is invalid because it assumes the act of absorbing human carbon prevents nature from increasing its own emissions. The Physics model (Section 3) shows how these processes are independent and can occur simultaneously. IPCC's physics is faulty.

IPCC's argument #4:

> "Only about 50 percent of annual human carbon emissions show up in the atmosphere annually, so clearly the other 50 percent go to the land or the oceans."

This argument is invalid because it has no evidence. It is merely a restatement of IPCC's core theory which is circular reasoning.

IPCC's argument #5:

> "Isotope data prove IPCC's core theory is true."

Quirk (2009), Harde (2017, 2019), Berry (2019), and others show 14C and 13C data reject IPCC's core theory and support the theory that human CO_2 caused only a small part of the increase in atmospheric CO_2.

IPCC's argument #6:

> "With a very high level of confidence, the increase in CO_2 emissions from fossil fuel burning and those arising from land use change are the dominant cause of the observed increase in atmospheric CO_2 concentration."
>
> "The removal of human-emitted CO_2 from the atmosphere by natural processes will take a few hundred thousand years (high confidence)."

IPCC's argument #6 should begin, "With a very high degree of confirmation bias, ..." that selects data that supports IPCC's theory and rejects data that contradicts IPCC's theory.

No amount of scientific evidence can prove a theory is true, but it takes only one wrong prediction to prove a theory is false. True scientists are always open to the possibility that their favorite theory may be proven to be false, at which time they reject the theory.

1.4 Brief history of carbon cycle research

*Starred papers below support IPCC's core theory. Unstarred reports oppose.

Revelle and Suess (1957) used 14C data to conclude the "average lifetime of a CO_2 molecule in the atmosphere … is of the order of 10 years." From this they concluded,

> "This means most of the CO_2 released by artificial fuel combustion since the beginning of the industrial revolution must have been absorbed by the oceans.
>
> "It seems quite improbable that an increase in atmospheric CO_2 concentration of as much as 10% could have been caused by industrial fuel combustion during the past century, as Callendar's statistical analyses indicate."

* Maier-Reimer and Hasselmann (1987) used an ocean circulation model connected to an atmosphere to reproduce the main features of the CO_2 distribution in the surface ocean. They approximated the flow of CO_2 from the atmosphere into the ocean by a sum of four exponentials with different amplitudes and time constants. This approach is a predecessor to today's Bern model.

Kuo et al. (1990) showed how changes in atmospheric CO_2 level follow changes in global temperature.

*Siegenthaler and Joos (1992) created the original Bern model. They used 14C data to trace the flow of $12CO_2$ from the atmosphere to the upper ocean and to the deep and interior oceans. They had no way to estimate how much human CO_2 really changes atmospheric CO_2 because they had no model for how CO_2 flows through the atmosphere. So, they assumed IPCC's core theory to process their data. All their conclusions derive from their incorrect assumption that IPCC's core theory is true.

Starr (1992) noted that some previous studies had assumed incorrectly that IPCC's core theory is true. He found residence times of 4 to 5 years, which he wrote is

> "much shorter … than the magnitude larger outcomes of the usual global carbon cycle models which are adjusted to fit the assumption that anthropogenic emissions are primarily the cause of the observed rise in atmospheric CO_2."
>
> "The short residence time suggests that anthropogenic emissions contribute only a fraction of the observed atmospheric rise, and that other sources need be sought."

Segalstad (1998) listed 36 other published values with average e-times of 5−15 years.

*Joos (2002) developed the Bern model. The Bern model assumes IPCC's core theory is true and assumes human CO_2 (but not natural CO_2) decreases buffer capacity. Therefore, the Bern model violates the Equivalence Principle.

*Sabine et al. (2004) estimated about 48 percent of human CO_2 emissions from 1800 to 1994 have gone into the oceans. However, this estimate is based upon the assumption that IPCC's core theory is true. It assumes natural emissions stayed constant while only

human CO_2 changed:

> "About two-thirds of these (human) emissions have remained in the atmosphere…"

Therefore, Sabine et al. is irrelevant to this paper.

Kouwenberg (2004) showed stomata-derived CO_2 levels are much greater than ice-core derived CO_2 levels. (Figure 2)

Rorsch et al. (2005) developed a carbon cycle model. They show why models that consider only human carbon and neglect natural carbon will produce erroneous flows and e-times.

Beck (2007) published thousands of direct chemical measurements of CO_2 that began in 1810 and are accurate to 3 percent. Beck's Figures 1 and 10 show the CO_2 level was 450 ppm in 1820, 370 ppm in 1860, 310 ppm in 1920, 420 ppm in 1940 and 430 ppm in 1948.

Jaworowski (2007) wrote IPCC's core theory was one of IPCC's four basic lies. He concluded ice cores underestimate CO_2 values by 30 to 50 percent.

MacRae (2008) showed the increase in CO_2 follows increase in global temperature.

Courtney (2008) concluded,

> "there is no evidence that the recent rise in atmospheric CO_2 concentration has a mostly anthropogenic cause or a mostly natural cause."

Quirk (2009) examined 13C data and seasonal and hemispherical variations of CO_2, to conclude,

> "The constancy of seasonal variations in CO_2 and the lack of time delays between the hemispheres suggest that fossil fuel derived CO_2 is almost totally absorbed locally in the year it is emitted. This implies that natural variability of the climate is the prime cause of increasing CO_2, not the emissions of CO_2 from the use of fossil fuels."

*Archer et al. (2009) tested all IPCC's carbon-cycle models and found they all

> "agree that 25-35% of the CO_2 remains in the atmosphere after equilibrium with the ocean (2-20 centuries)."

However, model agreement has no bearing on accuracy because all models assumed IPCC's core theory is true, which makes all these models invalid.

Essenhigh (2009) showed IPCC's e-time for $12CO_2$ is about 4 years and IPCC's longer response time of about 100 years is not caused by human carbon. He wrote,

> "This further supports the conclusion that global warming is not anthropogenically driven as an outcome of combustion."

Carter (2010) published "*Climate: The Counter Consensus*" that discusses the null theory:

> "Given the great natural variability exhibited by climate records, and the failure to date to compartmentalize or identify a human signal within them, the proper null

hypothesis – because it is consistent with the known facts – is that global climate changes are presumed to be natural unless and until specific evidence is forthcoming for human causation."

"The single most important conclusion that can be drawn from the recent climate change for which we have accurate instrumental measurements, including expressly the mild late twentieth century warming, is that the null hypothesis that they have a natural origin remains unfalsified."

*Cawley (2011) used the following invalid argument to support IPCC's core theory:

"Lastly, the rise in atmospheric carbon dioxide closely parallels the rise in anthropogenic emissions … which would be somewhat of a coincidence if the rise were essentially natural in origin!"

"Somewhat of a coincidence" is not a scientific argument.

Ballantyne et al. (2012) found "there is no empirical evidence" that the ability of the land and oceans to absorb atmospheric CO_2 "has started to diminish on the global scale."

Salby (2012) published "*Physics of the Atmosphere and Climate*" that describes data and proxy data that show increases in global temperature cause natural CO_2 emissions to increase. He calculates an increase in global temperature of one-degree Kelvin increases natural CO_2 emissions by about 3.5 ppmv per year.

*Joos et al. (2013) compared the response of atmosphere-ocean models to a pulse emission of human CO_2. However, all models assumed IPCC's core theory is true, which makes all the models invalid.

Humlum (2013) found CO_2 increases do not correlate with human CO_2 emissions. Rather CO_2 increases consistently follow temperature increases by about 9 to 12 months.

Harde (2017) showed data that supports the hypothesis that outflow from the atmosphere is proportional to the CO_2 level divided by an e-time of about 4 years. Harde shows how this contradicts IPCC's core theory. He concluded that human emissions have caused only about 17 ppm of the increase in CO_2 above 280 ppm and the remainder of the increase was caused by natural emissions.

*Kohler et al. (2017) critiqued Harde (2017). They claim human (but not natural) CO2 reduced the "buffer capacity" of the carbonate system. However, they assume IPCC's core theory is true and they treat human and natural CO_2 differently, which violates the physics Equivalence Principle.

*Kohler et al. used Cawley (2011) to "prove" IPCC's case. But Cawley's errors derail the arguments of Kohler et al. that criticize Harde.

Salby (2018) showed the dominant cause of CO_2 increase is the increase in temperature that increases natural carbon emissions.

Harde (2019) showed how Kohler et al. (2017) claims against Harde (2017) are invalid.

Berry (2019) showed how Cawley's (2011) equation #3 contains a steady-state outflow in addition to a level-caused outflow. So, Cawley's equations claim carbon flows out of a reservoir even when there is no carbon in the reservoir. Cawley propagates this physics error throughout his paper. As Cawley was a climate model programmer, this error may exist in IPCC's climate models.

Harde (2019) and Berry (2019) introduced the concept of the Equivalence Principle.

*Gruber et al. (2019) claim they proved human carbon caused the increase in ocean carbon. However, like Sabine et al. (2004), they assumed IPCC's core theory is true which is circular reasoning. They do not consider the possibility that natural carbon may have caused their measured CO_2 increase.

Courtney (2008) (pp. 6-7) concluded in 2008 that the human carbon cycle could not be calculated because its time constants were unknown:

> "… the relatively large increase of CO_2 concentration in the atmosphere in the twentieth century (some 30%) … requires a quantitative model of the carbon cycle, but … such a model cannot be constructed because the rate constants are not known for mechanisms operating in the carbon cycle."

Upon reviewing this paper's Preprint, Courtney (2019) wrote that this paper:

> "… quantifies the anthropogenic and natural contributions to changes in atmospheric CO_2 concentration without need for knowledge of rate constants for individual mechanisms. This is a breakthrough in understanding which [other authors] including myself all failed to make."

1.5 Statistics prove IPCC's core theory is false

The IPCC believes its core theory is true because

> "… the observed rate of CO_2 increase closely parallels the accumulated emission trends from fossil fuel combustion and from land use changes."

Courtney (2008) disputes this IPCC claim with his Figure 1 that shows the level of CO_2 in the atmosphere does not respond to annual human CO_2 emissions.

Munshi (2017) shows the "detrended correlation of annual emissions with annual changes in atmospheric CO_2" is zero. Therefore, statistics show human CO_2 is not the primary cause of the increase in CO_2.

The only way this zero-correlation would not prove IPCC's core theory is false is if large, random natural emissions covered up the human signal. But IPCC's core theory says natural emissions remained constant after 1750. So, either way, Munshi's calculation proves IPCC's core theory is false.

Munshi (2018) shows IPCC's reports use circular reasoning and confirmation bias to

support its core theory:

> "Circular reasoning is a logical fallacy in which research design and methodology as well as the interpretation of the data subsume the finding. This fallacy can be found in published research and it is more common in research areas such as archaeology, finance, economics, and climate change where the data are mostly time series of historical field data with no possibility for experimental verification of causation.
>
> "In biased research of this kind, researchers do not objectively seek the truth, whatever it may turn out to be, but rather seek to prove the truth of what they already know to be true or what needs to be true to support activism for a noble cause.
>
> "Confirmation bias is thought to play a role in climate change particularly since climate science provides the rationale for environmental activism and the noble cause of saving humanity or perhaps the planet from climate cataclysm."

Statistics proves IPCC's core theory is false.

2. IPCC's natural and human carbon cycles

2.1 IPCC's carbon cycles

IPCC's carbon cycle contains four major carbon reservoirs: land, atmosphere, surface ocean, and deep ocean. The "level" of each reservoir is the mass of carbon in each reservoir.

Figure 3, which is part of IPCC's Figure 6.1, shows IPCC's natural and human carbon cycles. IPCC's Figure 6.1 legend says,

> "Black numbers and arrows indicate reservoir mass and exchange fluxes estimated for the time prior to the Industrial Era, about 1750."
>
> "Red arrows and numbers indicate annual 'anthropogenic' fluxes averaged over the 2000–2009 time period. These fluxes are a perturbation of the carbon cycle during Industrial Era post 1750."

The IPCC says, "typical uncertainties are more than 20%". IPCC's data may not be perfect, but it may be the best data we have for the natural carbon cycle. More important than data accuracy is the consistency that must exist between IPCC's claimed human and natural carbon cycles. Human and natural carbon must follow the same physics rules.

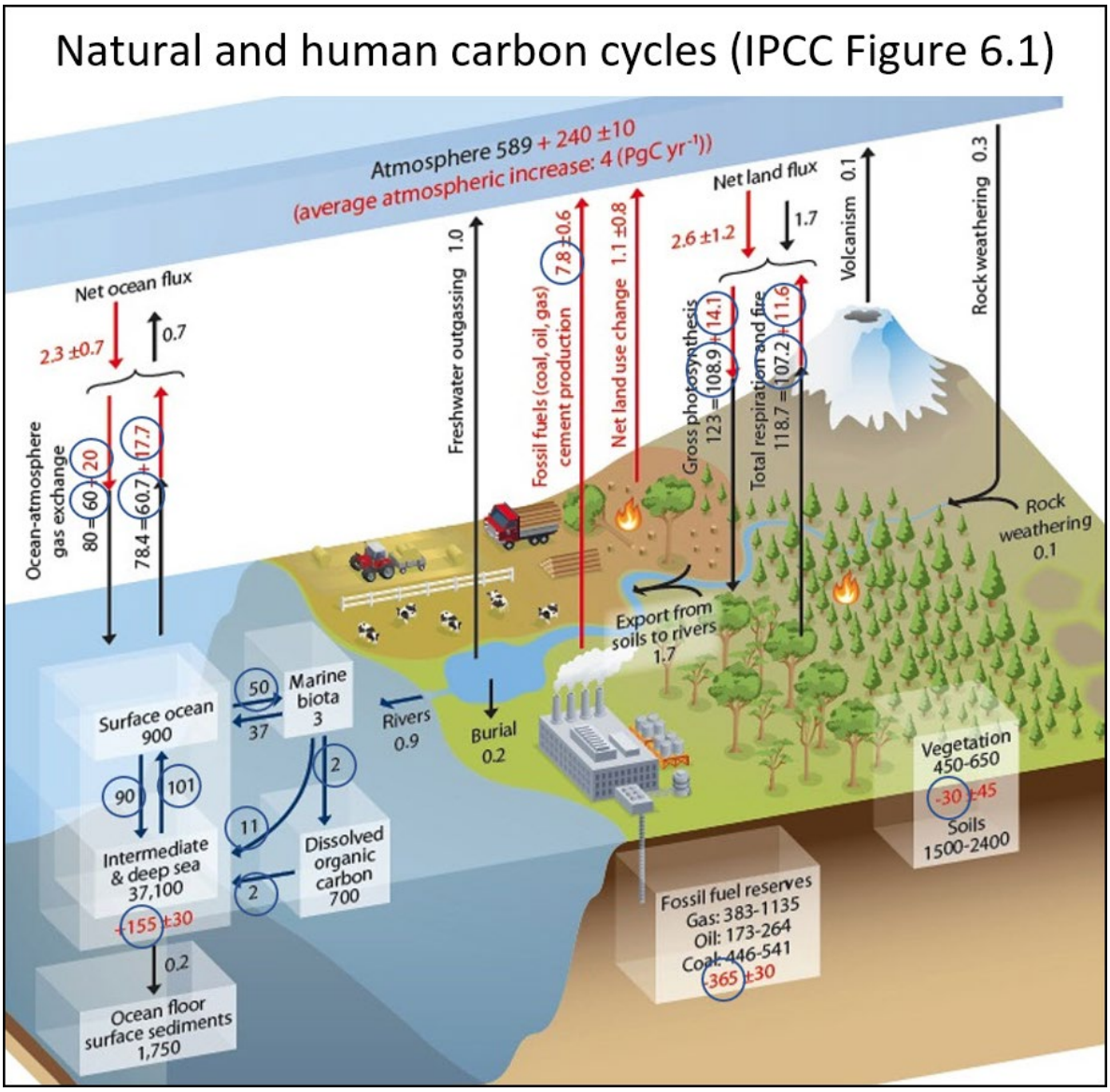

Figure 3. Edited IPCC Figure 6.1 for natural and human carbon cycles. Black numbers are natural carbon. Red numbers are human carbon. Circles show data used in this paper.

IPCC's natural carbon flows are close to net zero. IPCC's core theory requires an equilibrium scenario where the net flows between each reservoir are zero. So, we define a net zero flow scenario that averages IPCC's flows between the reservoirs. Exact averages are not necessary because IPCC's flow data are not exact.

Figure 4 summarizes IPCC's carbon cycle data in Figure 3. Figure 4A shows IPCC's natural carbon levels and equilibrium flows. Figure 4B shows IPCC's claimed human carbon levels and flows.

Figure 4B shows human carbon inflow of 8 PgC per year matches the 8.04 PgC inflow of Boden et al. (2017) data for 2005. However, Figure Boden et al. data also shows the sum

of human carbon emissions does not reach 395 PgC until 2014.

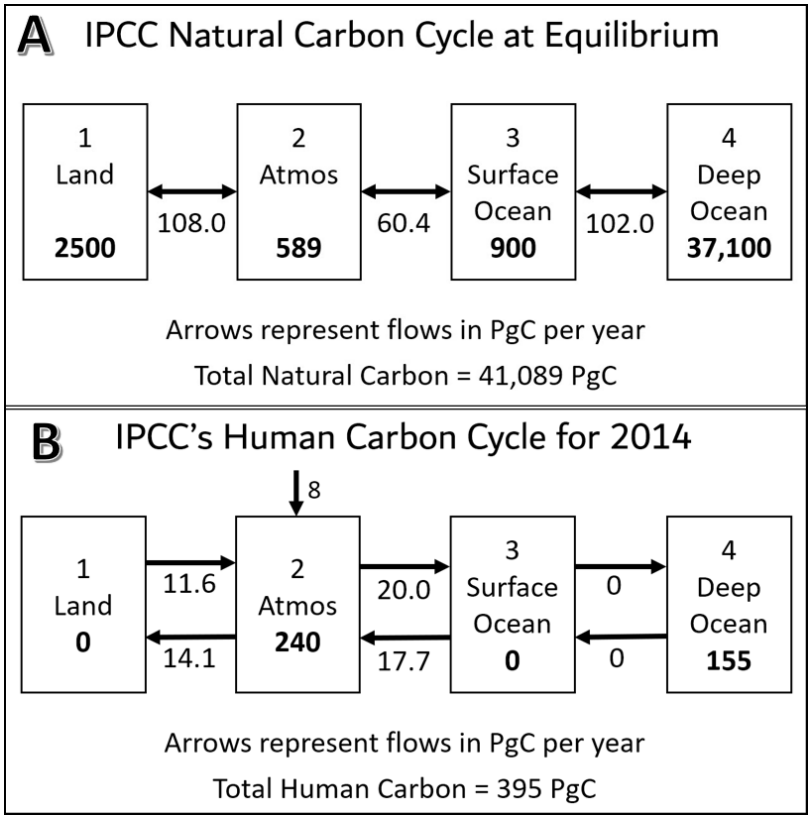

Figure 4. IPCC's natural and human carbon cycle data from Figure 3.

Human carbon comes from burning carbon fuels and producing cement. Carbon from human-caused land-use changes is not counted because it is small and not well quantified.

2.2 IPCC's reservoir percentages

Figure 5 shows IPCC's percentages of carbon in each reservoir from Figure 4.

IPCC's natural carbon data show only 1.43 percent of natural carbon is in the atmosphere and 90 percent is in the deep ocean. IPCC's natural carbon cycle data are at equilibrium. The oceans contain about 50 times as much carbon as the atmosphere.

By contrast, IPCC's claimed human carbon data show 61 percent of human carbon is in the atmosphere and 39 percent is in the deep ocean.

Simple observation of Figure 5 indicates IPCC's claimed human carbon cycle does not use the same physics as IPCC's natural carbon cycle.

Even though IPCC's claimed human carbon cycle is not at equilibrium, the percentage levels for the human carbon cycle should somewhat resemble the percentage levels for IPCC's natural carbon cycle.

Figure 5B shows no human carbon in the land or surface ocean. And without carbon in the surface ocean, no carbon can flow to the deep ocean.

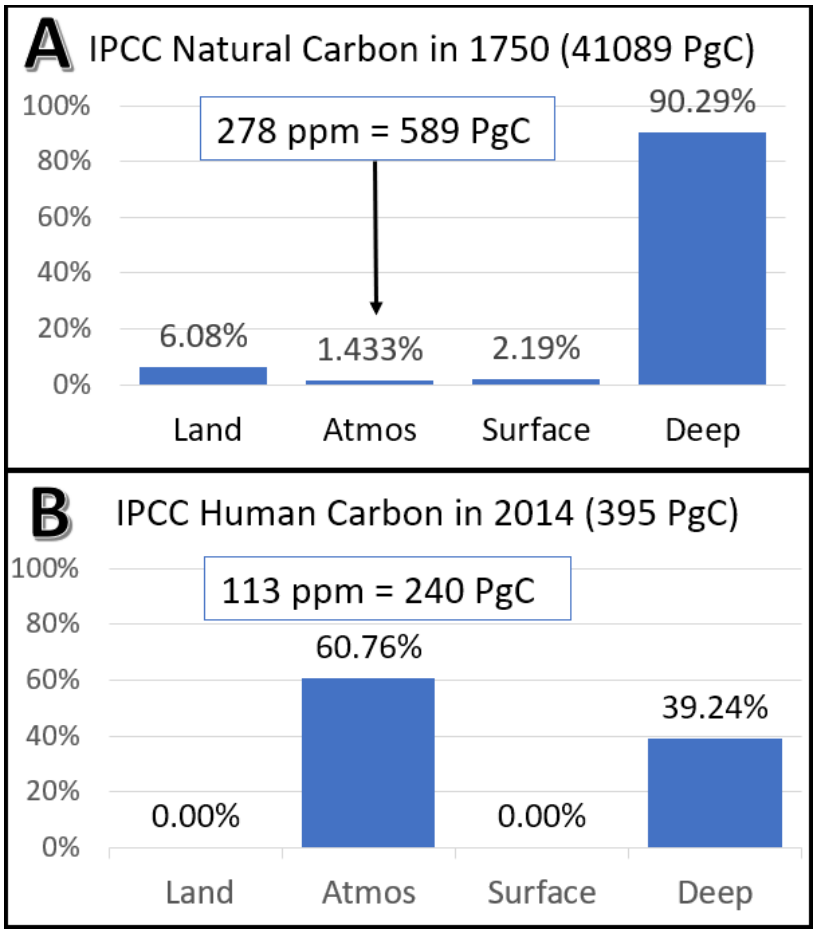

Figure 5. Level percentages for IPCC's natural and human carbon cycles.

To support its core theory, the IPCC simply inserted 61 percent of human carbon into the atmosphere. Then the IPCC dumped the remaining 39 percent into the deep ocean. Therefore, IPCC's claimed human carbon cycle simply replicates IPCC's core theory.

3. The Physics model

3.1 Physics model formulation

A system describes a subset of nature. A system includes levels and flows between levels. Levels set flows and flows set new levels. All models are approximations to reality.

The author can find no referenced publications that provide a formulation of the Physics carbon cycle model as shown below.

Figure 6 shows the Physics model for carbon in the atmosphere. The same model applies to carbon in any reservoir. The carbon in the atmosphere is in the form of CO_2.

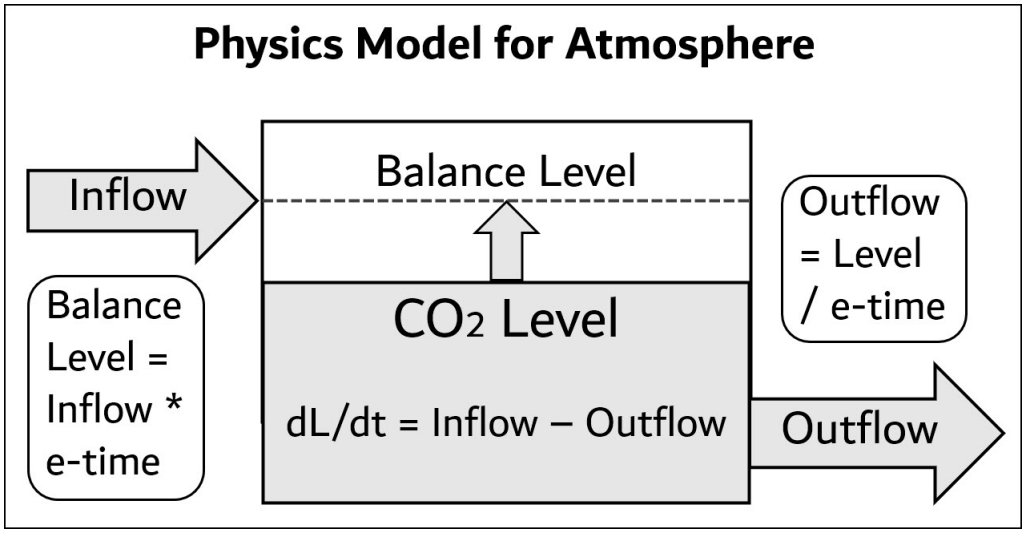

Figure 6. Physics model for carbon in the atmosphere.

Following Berry (2019), the Physics model derivation begins with the continuity equation (1) which says the rate of change of level is the difference between inflow and outflow:

$$dL/dt = Inflow - Outflow \quad (1)$$

where

L = carbon level (in PgC)

t = time (years)

dL/dt = rate of change of L (PgC / year)

Inflow = rate carbon moves into the system (PgC / year)

Outflow = rate carbon moves out of the system (PgC / year)

The Physics model has only one hypothesis: outflow is proportional to level:

$$Outflow = L / Te \quad (2)$$

where *Te* is the "e-folding time" or simply "e-time." E-time is the time for the level to move (1 - 1/e) of the distance from its present level to its balance level.

Substitute (2) into (1) to get,

$$dL/dt = Inflow - L / Te \quad (3)$$

When dL/dt is zero, the level will be at its balance level. Define the balance level, L_b, as

$$L_b = Inflow * Te \quad (4)$$

Substitute (4) for *Inflow* into (3) to get,

$$dL/dt = -(L - L_b) / Te \quad (5)$$

Equation (5) shows the level always moves toward its balance level. The variables *L, Lb*,

and *Te* are functions of time.

In the special case when *Lb* and *Te* are constant, which means *Inflow* is constant, there is an analytic solution to (5). Rearrange (5) to get

$$dL / (L - L_b) = - \text{dt} / Te \qquad (6)$$

Then integrate (6) from L_0 to L on the left side, and from 0 to t on the right side to get

$$\text{Ln}\,[(L - L_b) / (L_0 - L_b)] = - t / Te \qquad (7)$$

where

L_0 = Level at time zero (t = 0)

L_b = the balance level for a given inflow and *Te*

Te = time for L to move (1 – 1/e) from L to L_b

e = 2.7183

The original integration of (6) contains two absolute values, but they cancel each other because both L and L_0 are always either above or below L_b.

Raise e to the power of each side of (7), to get the level as a function of time:

$$L(t) = L_b + (L_0 - L_b) \exp(- t/Te) \qquad (8)$$

Equation (8) is the analytic solution of (5) when L_b and *Te* are constant.

All equations after (2) are deductions from hypothesis (2) and the continuity equation (1).

3.2 Physics model properties

The Physics model's only hypothesis (2) is a linear function of level. This means the Physics model applies independently and in total to human and natural carbon.

The Physics model also applies independently and in total to all definitions of carbon or CO_2. For example, it applies independently to human CO_2, natural CO_2, and their sums, and to $12CO_2$, $13CO_2$, and $14CO_2$, and their sums.

However, if outflow (2) were a "*strictly increasing function*" of level other than level to the power of one, then the Physics model would *not* apply independently and in total to human CO_2 and natural CO_2.

Hypothesis (2) shows it is possible, and preferable, to calculate the natural and human carbon cycles separately. Just *add another instance* of the Physics model for each carbon definition. Then add the separate calculations to produce the total carbon cycle.

Hypothesis (2) is compatible with all applicable physical and chemical laws. It is used in many scientific, climate physics, chemical, and engineering models. It is the simplest hypothesis for carbon cycle models. The IPCC uses this hypothesis to account for its core theory that constant natural carbon inflow causes a constant balance level of 280 ppm.

The Physics model allows external processes to change reservoir levels only by changing the inflows, outflows, or e-times. The Physics model *includes all effects of external processes* (chemical, biological, etc.) on the level of carbon in a reservoir.

While further study of chemical and biological processes will add to knowledge of levels, flows, and e-times, such new knowledge will not change this simple Physics model.

The balance level (4) shows that neither human nor natural emissions accumulate in the atmosphere. Constant inflows maintain constant balance levels.

Equation (5) shows how level moves toward its balance level with a speed determined by e-time. When the level equals its balance level, outflow will equal inflow. At the balance level, constant inflow sets a constant level. Carbon will not accumulate in the reservoir.

If inflow decreases, the balance level decreases, and the level moves toward the new balance level. A level always follows its balance level.

3.3 Physics carbon-cycle formulation

The IPCC defines four key carbon reservoirs: land, atmosphere, surface ocean, and deep ocean. We apply the Physics model to each reservoir. The "level" of each reservoir is the mass of carbon in each reservoir.

Figure 7 shows the Physics carbon cycle model with its 4 reservoirs and 6 outflows where the arrows are all positive numbers. The origin of each arrow is defined as a "node."

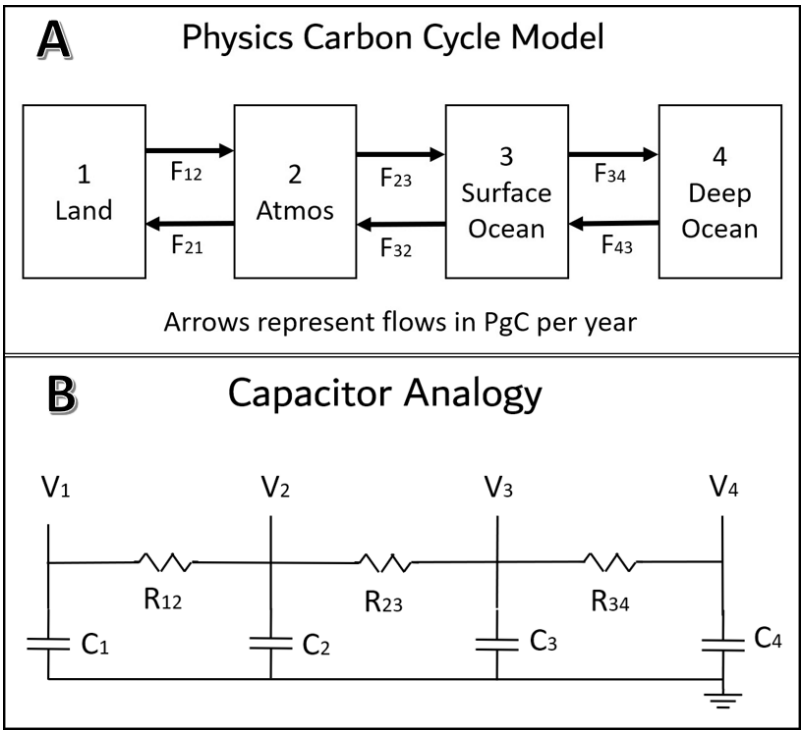

Figure 7. Physics carbon-cycle model and its capacitor analogy.

Define the Levels:

L_1 = level of carbon in the land

L_2 = level of carbon in the atmosphere

L_3 = level of carbon in the surface ocean

L_4 = level of carbon in the deep ocean

Define the individual flows out of the six nodes:

F_{12} = flow from land to atmosphere

F_{21} = flow from atmosphere to land

F_{23} = flow from atmosphere to surface ocean

F_{32} = flow from surface ocean to atmosphere

F_{34} = flow from surface ocean to deep ocean

F_{43} = flow from deep ocean to surface ocean

Define other variables:

t = time in years

H_{fa} = Human-caused flow from fuels to atmosphere

H_{ga} = Human-caused flow from land to atmosphere

The term H_{ga} is included for completeness but it is set to zero in this paper.

Using (2), the flows out of the six nodes are:

$$F_{12} = L_1 / T_{12}$$

$$F_{21} = L_2 / T_{21}$$

$$F_{23} = L_2 / T_{23}$$

$$F_{32} = L_3 / T_{32}$$

$$F_{34} = L_3 / T_{34}$$

$$F_{43} = L_4 / T_{43} \qquad (9a)$$

The same equations in term of e-times are:

$$T_{12} = L_1 / F_{12}$$

$$T_{21} = L_2 / F_{21}$$

$$T_{23} = L_2 / F_{23}$$

$$T_{32} = L_3 / F_{32}$$

$$T_{34} = L_3 / F_{34}$$

$$T_{43} = L_4 / F_{43} \qquad (9b)$$

Using (9) and (1), the rate equations for each reservoir are:

$$dL_1/dt = F_{21} - F_{12} - H_{ga}$$

$$dL_2/dt = F_{12} - F_{21} + F_{32} - F_{23} + H_{fa} + H_{ga}$$

$$dL_3/dt = F_{23} - F_{32} + F_{43} - F_{34}$$

$$dL_4/dt = F_{34} - F_{43} \quad (10)$$

Equations (9) and (10) are used to calculate the natural and the human carbon cycles.

3.4 Capacitor analogy for the carbon-cycle

William Happer and W.A. van Wijngaarden proposed the capacitor analogy shown in Figure 7B. It exactly matches the Physics model. As an interesting by-product, the following derivations show how electrical circuit theory uses the Physics model outflow hypothesis (2).

The four capacitors represent the four reservoirs. The charge on the capacitors represents the carbon levels in each reservoir. And three resistors represent the "resistance to flow" between the four reservoirs.

The Physics model defines the ends of each resistor as "nodes." Current is the analogy of flow. Equation (11) shows how the outflow hypothesis (2) is the same as electrical circuit theory:

$$Outflow = L / Te = I = V / R = Q / RC \quad (11)$$

Where

I = current outflow

V = voltage on the capacitor

R = resistance to outflow

Q = charge on the capacitor

C = capacitance of the capacitor

In electrical terms, Ohm's law requires the net flow between nodes to be

$$\text{Net}\_F_{jk} = (V_j - V_k) / R_{jk} \quad (12a)$$

$$\text{Net}\_F_{jk} = F_{jk} - F_{kj} \quad (12b)$$

Therefore, the outflow from each node is

$$F_{jk} = V_j / R_{jk} \quad (13)$$

where the resistance between nodes j and k is bidirectional

$$R_{jk} = R_{kj} \quad (14)$$

The charge on a capacitor is the analog of the carbon level, L, so

$$V_j = L_j / C_j \quad (15)$$

Substituting (15) into (13), we get the flow out of each node:

$$F_{jk} = L_j / R_{jk} C_j \quad (16)$$

Comparing (16) to (9) shows the capacitor analogy of *Te* is

$$T_{jk} = R_{jk} C_j \quad (17)$$

Therefore, the nodal flows for the capacitor analogy are the same as the nodal flows for the Physics model (9) when (17) replaces the T_{jk} in (9).

At equilibrium, all *Vj* are equal. Therefore, (15) means

$$L_j / C_j = L_k / C_k \quad (18)$$

In an electrical RC circuit, the time constant "*Tau*" is

Tau (seconds) = *C* (Farads) * *R* (Ohms) (19)

The capacitor analogy uses the same equations and data as the Physics carbon cycle model. Therefore, their results will be identical. Students can build a capacitor model.

3.5 The Revelle effect

The Revelle effect (Revelle and Seuss, 1957) changes the chemical calculation for the flow of CO_2 between the atmosphere and the surface ocean. The Revelle effect says the ocean will not absorb as much CO_2 as in previous calculations because of human CO_2.

Theoretically, the Physics model includes the Revelle effect. Rather than *decrease the ocean's absorption*, the Physics model (2) *increases the ocean's outflow* which accomplishes the same thing.

The Revelle effect, if not already included in the data, would decrease e-time T_{32} which will increase the flow F_{32} from surface ocean to atmosphere. Therefore, the net result of the Revelle effect is to increase the atmosphere level until its outflow balances its inflow.

Do IPCC's natural carbon cycle numbers (Figure 3) include the Revelle effect?

The IPCC has had many years to include the Revelle effect in its natural carbon cycle. So, this paper assumes IPCC's natural carbon cycle (Figure 3) includes the Revelle effect.

Revelle thought his effect would cause 80 percent of human CO_2 to stay in the atmosphere forever. He was wrong. The Revelle effect cannot cause human carbon to behave differently than natural carbon. Revelle did not consider the Equivalence Principle.

Kohler et al. (2017) claim human carbon but not natural carbon changes the Revelle effect. Their claim violates the Equivalence Principle.

Kohler et al. assume IPCC's core theory is true and that human (but not natural) CO_2 reduced the "buffer capacity" of the carbonate system:

"… the rise in atmospheric and oceanic carbon content goes along with an increase in the Revelle factor, a phenomenon which is already measurable. This implies that the oceanic uptake of anthropogenic carbon will become slower if we continue to increase anthropogenic CO_2 emissions. This is already seen in all CHIMP5 model simulations."

Their last sentence shows their fallacy. IPCC's climate models assume IPCC's core theory is true. Therefore, IPCC's climate models are not evidence that IPCC's core theory is true. To claim otherwise is circular reasoning.

4. Carbon cycle calculations

4.1 Method of calculation

Set the flows in (9a) to equal IPCC's equilibrium flows shown in Figure 4A:

$F_{12} = L_1 / T_{12}$ = 108.0 PgC/Year

$F_{21} = L_2 / T_{21}$ = 108.0 PgC/Year

$F_{23} = L_2 / T_{23}$ = 60.4 PgC/Year

$F_{32} = L_3 / T_{32}$ = 60.4 PgC/Year

$F_{34} = L_3 / T_{34}$ = 102.0 PgC/Year

$F_{43} = L_4 / T_{43}$ = 102.0 PgC/Year (20)

Set the levels to equal IPCC's equilibrium levels shown in Figure 4A:

L_1 = 2500 PgC

L_2 = 589 PgC

L_3 = 900 PgC

L_4 = 37,100 PgC (21)

Use (9b) to calculate the nodal e-times and use (17) to equate to RC e-times:

T_{12} = 2500 / 108 = 23.1481 years = $R_{12} C_1$

T_{21} = 589 / 108 = 5.4537 years = $R_{12} C_2$

T_{23} = 589 / 60.4 = 9.752 years = $R_{23} C_2$

T_{32} = 900 / 60.4 = 14.9007 years = $R_{23} C_3$

T_{34} = 900 / 102 = 8.8235 years = $R_{34} C_3$

T_{43} = 37100 / 102 = 363.7255 years = $R_{34} C_4$ (22)

Note that the extended decimal places are not physically relevant. These decimal places are relevant only to those who wish to check the carbon cycle calculations.

These e-times derive from IPCC's natural carbon cycle. These same e-times must apply to

IPCC's true human carbon cycle.

If the IPCC were to update its natural carbon cycle, we would update (20), (21), and (22).

The calculation of IPCC's true human carbon cycle begins with the levels in all reservoirs at zero in 1750. Each numerical time step inserts human carbon and allows carbon to flow between reservoirs.

The numerical calculations use annual time steps and proceed as follows:

4. Begin with levels.
5. Calculate nodal flows using (9a).
6. Calculate level rates of change using (10). This adds human carbon inflow.
7. Multiply level rates of change by time step to get changes of levels.
8. Add changes of levels to levels to get new levels.
9. Repeat for next time step.

Boden et al. (2017) provide data for human carbon emissions from 1750 to 2014. This paper adds estimates of human emissions for 2015 through 2019.

Berry (2020) provides a downloadable Excel file that includes all the data, calculations, and resulting figures used in this paper.

William Happer and W.A. van Wijngaarden used a relaxation method to show the numerical calculations results reported herein are accurate to 2 decimal places.

4.2. IPCC's true human carbon cycle

The IPCC says human carbon is a "perturbation" on the natural carbon cycle. The implication is human carbon disrupts the "perfect" natural carbon cycle. The implication is incorrect.

Perturbation analysis as used in science has another meaning. It means to use the solution for one problem to solve a similar problem. The key is that the unsolved problem must have the same fundamental properties as the solved problem.

Figure 8 shows the time series calculation of the level of human CO_2 in the atmosphere. This curve is also shown in Figure 1.

Figure 8 shows if human CO_2 emissions were to stop in 2020, the human CO_2 level of 33 ppm would fall to 14 ppm by 2040, 10 ppm by 2100, and 5 ppm by 2200.

Continuing human emissions support a balance level (4) proportional to the inflow rather than an increasing level.

If the natural level decreased to 280 ppm, the 2020 level of human CO_2 added to 280 ppm would increase the CO_2 level to 313 ppm.

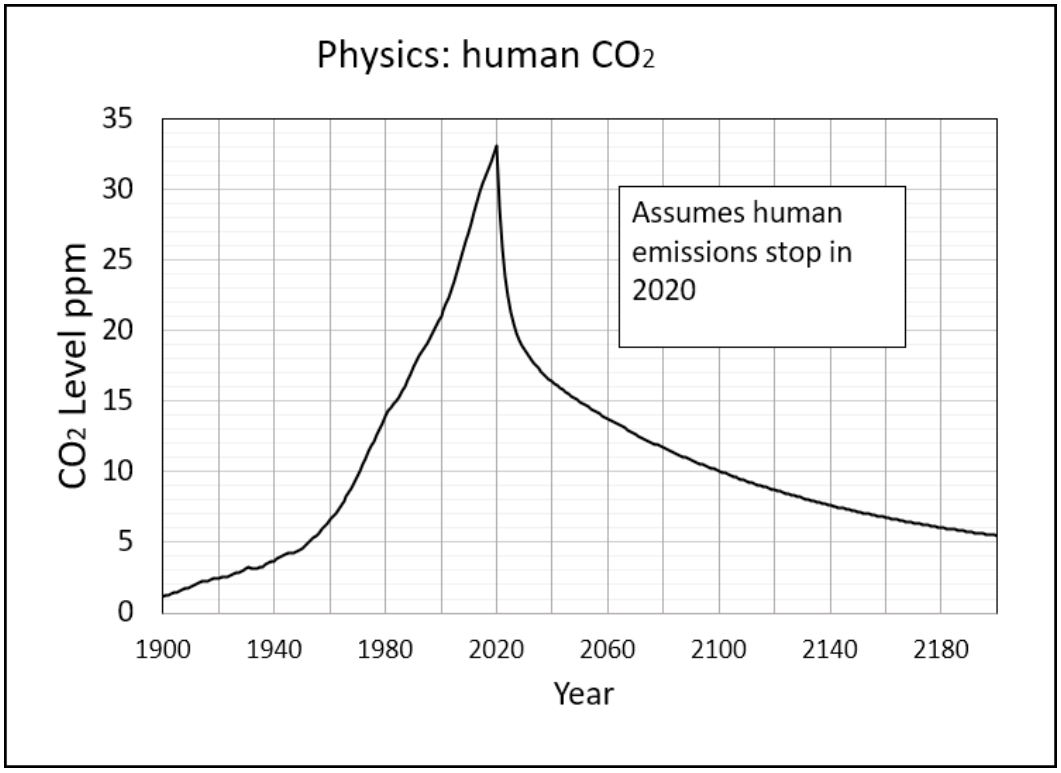

Figure 8. How human CO_2 has added to atmospheric CO_2 and how fast human CO_2 would decrease if all human CO_2 emissions were to stop in 2020.

Figure 9 shows IPCC's true human carbon cycle histogram. Figure 9A shows only 33 ppm or 15.5 percent of all human carbon remains in the atmosphere as of 2020. This result means nature added about 100 ppm to atmospheric CO_2 since 1750.

Figure 9B assumes all human carbon emissions stop in 2020. In this scenario, half of the human-caused increase is removed in 20 years. And by 2100, only 5 percent (10 ppm) of the human-caused increase would remain.

Figure 9B is consistent with IPCC's natural carbon cycle in Figure 5A. Given enough time without human carbon emissions, the level percentages of human carbon will become like the level percentages of natural carbon in Figure 5A. That is because human carbon behaves exactly like natural carbon.

IPCC's *claimed* human carbon cycle, shown in Figure 5B, should look like IPCC's true human carbon cycle, shown in Figure 9A. It does not.

Therefore, IPCC's *claimed* human carbon cycle is wrong and IPCC's core theory is wrong.

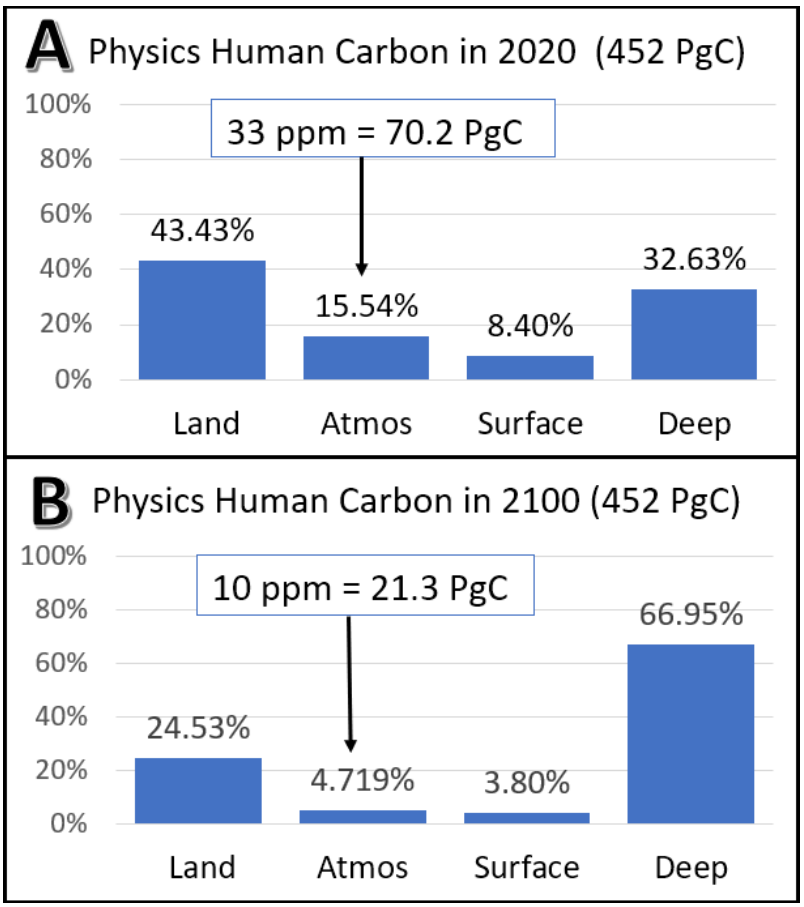

Figure 9. IPCC's true human carbon cycle for 2020. Figure 8B assumes all human carbon emissions stop in 2020.

Equation (22) shows the e-times that produce the 33 ppm in Figures 8 and 9A.

The IPCC says its natural carbon cycle flows are accurate to 20-percent. Therefore, the extreme predicted values for IPCC's true human carbon cycle can be found by adjusting the e-times to the 20-percent borders.

The following e-times maximize atmospheric CO_2 from 33 ppm to 48 ppm:

T_{12} = (2500 / 108 = 23.1481) * 0.67 = 15.43

T_{21} = (589 / 108 = 5.4537) * 1.20 = 6.544

T_{23} = (589 / 60.4 = 9.752) * 1.20 = 11.70

T_{32} = (900 / 60.4 = 14.9007) * 0.67 = 9.98 (23)

The following e-times minimize atmospheric CO_2 from 33 ppm to 24 ppm:

T_{12} = (2500 / 108 = 23.1481) * 1.49 = 34.49

T_{21} = (589 / 108 = 5.4537) * 0.80 = 4.36

T_{23} = (589 / 60.4 = 9.752) * 0.80 = 7.80

T_{32} = (900 / 60.4 = 14.9007) * 1.49 = 22.20 (24)

The e-times for the deep ocean have little effect on the level of atmospheric CO_2.

In summary, IPCC's natural carbon cycle data with IPCC's 20-percent error bounds show human CO_2 has increased atmospheric CO_2 by 33 ppm with a range of 24 ppm to 48 ppm, as of 2020. The probability of occurrence of the extremes of 24 ppm and 48 ppm is very small.

As of 2020, human CO_2 has added about one percent to the carbon in IPCC's natural carbon cycle.

4.3 IPCC's airborne fraction

Jones et al. (2007) defined the Airborne Fraction (*AF*) as,

> "The fraction of anthropogenic carbon emissions that remain in the atmosphere after natural processes have absorbed some of them."

The definition of AF is:

$$AF = La / S \quad (25)$$

Where

La = the CO_2 increase caused by human emissions

S = the sum of all human CO_2 emissions since 1750

However, Jones et al. assume IPCC's invalid core theory is true, so their *La* equals total atmospheric CO_2 minus 280 ppm.

By contrast, the True AF (*TAF*) uses the value of *La* calculated from IPCC's true human carbon cycle.

Whereas *AF* is 60 percent in 2020, *TAF* is about 20 percent. AF has no physical meaning.

4.4 IPCC's Bern model

Joos (2002) presented the integral equation for the Bern model.

The Bern model assumes human carbon enters the atmosphere in sequential annual pulses and the carbon in each pulse flows out of the atmosphere independently from all other annual pulses. The Bern model integrates these annual inflows and their expected outflows over time.

To deconstruct Joos's integral equation, let inflow occur only in the year when Joos's *t*' equals zero. Then the integral disappears, and Joos's Bern model becomes a level equation that depends on its starting level, *Lo*:

$$L(t) = L_0 [A_0 + A_1 \exp(-t/T_1) + A_2 \exp(-t/T_2) + A_3 \exp(-t/T_3)] \quad (26)$$

Where

t = time in years

L_0 = level of atmospheric CO_2 in year $t = 0$

$L(t)$ = level of atmospheric CO_2 in year t

Joos derived these Bern TAR (Third Assessment Report) standard values for the Bern coefficients by curve-fitting the Bern model to the Airborne Fraction (AF):

$A_0 = 0.152$

$A_1 = 0.253$

$A_2 = 0.279$

$A_3 = 0.316$

$T_1 = 171$ years

$T_2 = 18.0$ years

$T_3 = 2.57$ years

The A-values weight the four terms on the right-hand side of (24), so,

$$A_0 + A_1 + A_2 + A_3 = 1.000 \qquad (27)$$

In (24), set t equal to infinity to get,

$$L = A_0 L_0 = 0.152\, L_0 \qquad (28)$$

Equation (28) predicts 15.2 percent of each one-year inflow will stick in the atmosphere forever.

The Bern model has several fundamental problems.

The Bern TAR standard values are a curve fit to AF. But AF assumes IPCC's invalid core theory is true. Therefore, the Bern model is invalid.

The IPCC Bern model traps human CO_2 and lets natural CO_2 flow freely out of the atmosphere. Therefore, the Bern model violates the Equivalence Principle.

The Bern model separates CO_2 into four artificial bins according to the percentages defined by the A_0, A_1, A_2, A_3. The trapped CO_2 flows out of each bin according to T_0, T_1, T_2, T_3, where T_0 is infinity. That is like having three holes in the bottom of a bucket of water and restricting certain percentages of the water to go out defined holes. The Bern model is unphysical.

The Bern model is not a "model" because it is a function of its starting level Lo and time t. A true model must be a function of its instantaneous level L. The starting level is history. Nature does not know its history. Nature only knows its present and acts accordingly.

The Bern model integrates over sequential pulses. The overall e-time of each pulse is a function of the levels in each bin. Therefore, the overall e-time of each pulse changes with

time. The Bern model has pulses with different overall e-times in process simultaneously. This is not physical.

Nevertheless, the IPCC uses its invalid Bern model to make false claims about human CO_2.

4.5 Bern versus Physics model pulse decay

Figure 10 shows how a pulse of carbon in the atmosphere will flow to the other reservoirs in 100 years using IPCC's e-times for natural carbon.

The solid line in Figures 10A and 10B is the same Physics pulse decay.

Figure 10A shows how carbon moves through the reservoirs. After 10 years, 15 percent of human carbon is left in the atmosphere.

After 100 years, only 5 percent of human carbon remains in the atmosphere, 28 percent is in the land, and 64 percent is in the deep ocean. This is almost the same as the distribution of human carbon in Figure 8B, which began with a different scenario.

The land reservoir is the fastest to accept carbon from the atmosphere. But after 15 years, the land reservoir sends its carbon back through the atmosphere to the ocean reservoirs. The land reservoir is responsible for the initial rapid decay of the atmosphere carbon but ultimately the deep ocean reservoir controls the final decay.

Figure 10A shows the "overall e-time" (for atmospheric pulse decay) increases with time. Yet, all the e-times are constant. The overall e-time changes because the weights of the six e-times change as the levels in the reservoirs change.

The result looks like the "long tail" that Archer (2009) assumed was caused by an increasing e-time and thereby drew incorrect conclusions.

Figure 10B compares the Physics model with IPCC's invalid Bern model.

The Bern model calculates the pulse decrease with its equation (24). The Bern pulse decays to 55 percent in 10 years and to 30 percent in 100 years and will never get below 15 percent. The Bern model cannot predict where the carbon goes because it not a carbon cycle model. The Bern model merely replicates IPCC's invalid core theory.

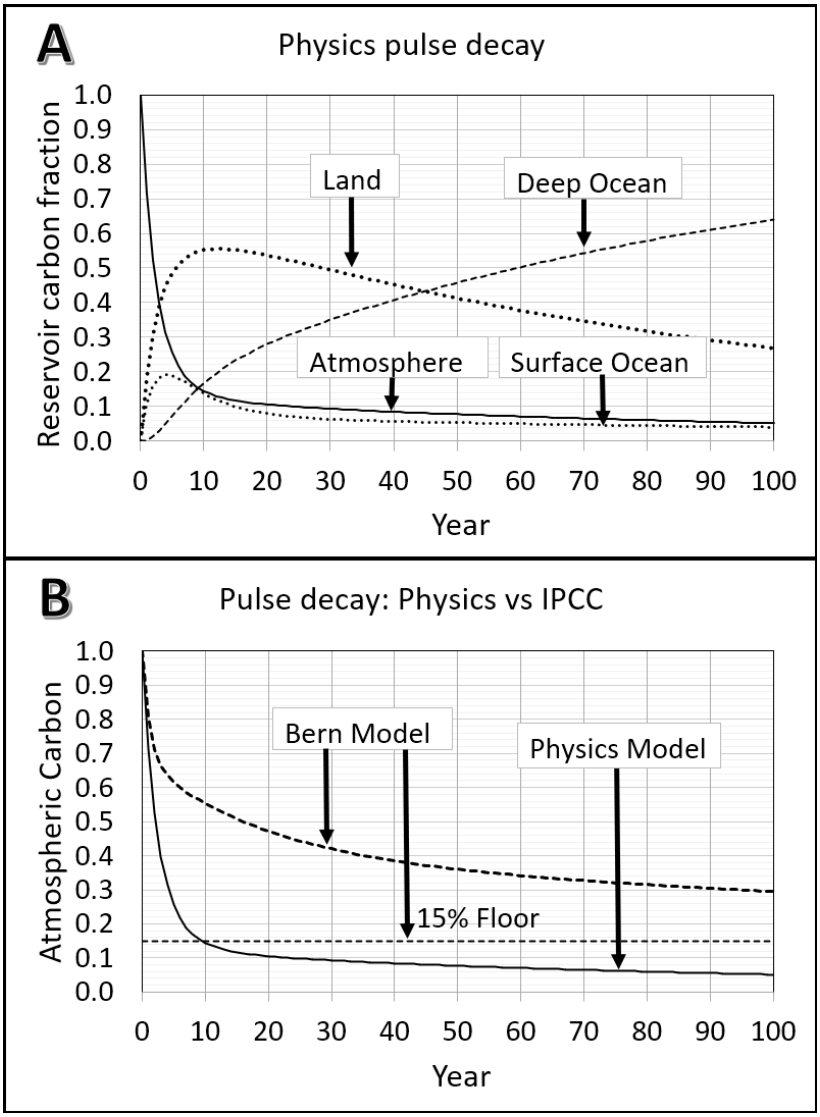

Figure 10. The solid line in Figures 10A and 10B is the same Physics pulse decay. Figure 10A shows how carbon moves through the reservoirs. Figure 10B compares the Physics model with IPCC's invalid Bern model.

4.6 How did nature add 100 ppm?

The answer to this question is outside the scope of this paper. However, here are some general comments.

Nature may add to atmospheric CO_2 in two ways:

1. Add new carbon to the natural carbon cycle. To add 100 ppm to atmospheric CO_2 would require adding 3.8 percent to the carbon in IPCC's natural carbon cycle.
2. Gradually reduce IPCC's e-times to keep more carbon in the atmosphere.

Scenario #1 keeps e-times constant. Scenario #2 would increase e-times T_{12}, T_{32}, and T_{43}. These e-time increases would slow the flows from land to atmosphere, from surface ocean

to atmosphere, and from deep ocean to surface ocean.

Surface temperature increase may add new carbon or changes e-times.

Kuo et al. (1990) shows changes in atmospheric CO_2 lag temperature changes by five months.

Kouwenberg (2004) provides evidence that temperature drives the CO_2 level:

> "temperature-driven changes in CO_2 flux between ocean surface waters and atmosphere may be invoked as a plausible mechanism to explain at least a substantial part of the reconstructed CO_2 variations over the last Millennium."

MacRae (2008) and Salby (2012, 2018) show the rate of increase of CO_2 is a function of surface temperature.

Harde (2017, 2019) shows how the CO_2 level increases with surface temperature.

Cork Hayen (2020 email to large group) asked the critical question:

> "How did the Milankovitch cycles cause the CO_2 concentration to change so the temperature would then change?"

Of course, the only answer to this question is Milankovitch cycles can change only the temperature. Therefore, temperature changed the CO_2 level.

4.7 Critique of this paper

Of course, there will be questions about the scientific meaning of this paper. Here are answers to questions received and anticipated.

1. Does this paper prove IPCC's core theory is false?

Yes. This paper shows the IPCC simply inserted its core theory into its claimed human carbon cycle, and this claimed human carbon cycle is physically incompatible with IPCC's own natural carbon cycle.

2. Is it possible to model the carbon cycle with linear rate equations?

Yes. The Physics model hypothesis (2) is the source of its linear rate equations. It says outflow is proportional to level to the first power. If outflow depends upon level to any power other than one, the rate equations will be nonlinear … and unphysical.

The outflow of CO_2 from the atmosphere is proportional to the partial pressure of CO_2 in the atmosphere, which is proportional to level according to the perfect gas law. Chemical reactions are proportional to their levels. Pharmacology uses models like the Physics model where outflow is proportional to level. Dalton's Law of Partial Pressures requires the linear hypothesis (2).

There are no data that indicate the level should be raised to a power other than one.

The IPCC claims nature treats the human carbon cycle much differently than it treats the

natural carbon cycle. IPCC's claim violates the Equivalence Principle.

Even if hypothesis (2) were to require a non-linear correction the non-linearity would be relevant only when the carbon cycle is not near equilibrium. At equilibrium, the non-linearity would not be detectable.

IPCC's natural carbon cycle is near equilibrium. The relatively small amount of added human carbon does not change this equilibrium. All calculations in this paper apply to IPCC's natural carbon cycle near equilibrium.

3. Does this paper omit important ocean data?

Not unless the IPCC omitted important ocean data. If the IPCC omitted important data, then that alone would falsify IPCC's core theory.

4. Must this paper identify the source of postulated natural CO_2?

No. Proving a theory wrong does not require new explanations for things left unexplained.

Conclusions

IPCC's core theory claims human CO_2 emissions have caused all the increase in atmospheric CO_2 above 280 ppm and since 1750. However, all IPCC's arguments to support its core theory fail.

Data show the CO_2 level exceeded the sum of all human CO_2 emissions before 1960. This also proves IPCC's core theory is wrong. Statistics prove IPCC's core theory is wrong.

The Physics carbon cycle model uses IPCC's natural carbon cycle time constants to calculate IPCC's *true* human carbon cycle. IPCC's true human carbon cycle proves IPCC's *claimed* human carbon cycle is wrong. IPCC's *claimed* human carbon cycle replicates IPCC's core theory. Therefore, IPCC's core theory is wrong.

Therefore, all peer-reviewed scientific papers that assume IPCC's core theory is true, are invalid. They cannot be used as support for IPCC's failed core theory.

There is no replacement for IPCC's core theory. Therefore, there is no scientific basis to claim human emissions caused all the rise in CO_2.

IPCC's true human carbon cycle shows human emissions have added only 33 ppm to atmospheric CO_2 as of 2020. The range within IPCC's stated 20-percent accuracy is 24 ppm to 48 ppm. This conclusion requires that nature has added about 100 ppm to its original 280 ppm.

If human CO_2 emissions were to stop in 2020, the human-added 33 ppm would decrease by half in 20 years and by 83 percent in 2100.

IPCC's true human carbon cycle shows human CO_2 emissions do not have long-term consequences and do not cause a climate emergency.

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