AN ENGINEER'S HYPOTHESIS OF MAJOR CLIMATE CHANGE

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Atmospheric CO_2 Does Not Drive Major Climate Change

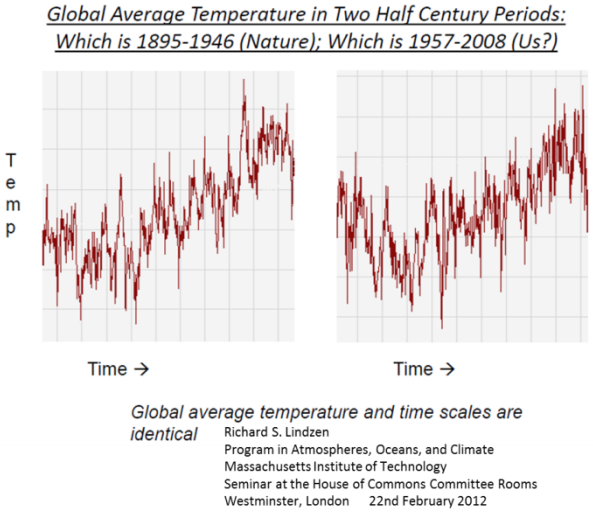
Let's examine, at a high and salient level, the positive-feedback Anthropogenic Global Warming, Green-House-Gas Heating Effect (AGW-GHGHE) with its supposed pivotal role for CO_2. The thinking is that a small increase in atmospheric CO_2 will trigger a more consequential increase in atmospheric Green-House-Gas water vapor. And then the combination of these two enhanced atmospheric constituents will lead to run-away, or at least appreciable and unprecedented – often characterized as catastrophic - global warming.

This theory relies entirely on a powerful positive-feedback and overriding (pivotal) role for CO_2. It further assumes that rising atmospheric CO_2 is largely or even entirely anthropogenic. Both of these points are individually and fundamentally required at the basis of alarm. Yet neither of them is in evidence whatsoever. And neither of them is even remotely true. CO_2 is not only "not pivotal" but it is not even clear that atmospheric CO_2 influences climate in the least measurable way. And the current spike in atmospheric CO_2 is clearly not primarily human caused. Factually, atmospheric CO_2 cannot be beneficially changed by human behavior, regardless of what actions we might take. And climate will always continue to change in significant ways that will most likely be poorly predicted.

Nonetheless both these points, 1) atmospheric CO_2 pivotally controls climate; and 2) we pivotally control atmospheric CO_2, are hard-wired into all General Circulation Models of the climate - Models that attempt to predict the far future behavior of a "coupled, non-linear chaotic system". One is compelled to consider that this modeling effort may well, in fact, be simply impossible. Yet these Models constitute substantially the entire evidentiary basis for Anthropogenic Global Warming (AGW) as opposed to non-anthropogenic global warming (NGW or Natural Global Warming) for which there is a great deal of evidence. There is only one place anywhere in the history of the world where a CO_2 increase causes, or even precedes, a temperature increase and that is in the Models themselves. And while extraordinary claims require extraordinary evidence, after 20+ years and with 10's-100's of Billions of global $'s devoted to this issue, the situation is unchanged. Where is the evidence of CO_2's pivotal water-vapor feedback? And how can you justify a continued belief that rising atmospheric CO_2 is entirely or even largely anthropogenic? The most vocal proponents of AGW-GHGHE theory are reduced to literally ask: "How else do you explain it?" But that is not evidence. And, far more importantly, it is also not clear what needs to be explained. This essay attempts to answer a more important and far more reaching question: "What drives major climate change?"

The AGW-GHGHE proponents pretty well uniformly agree that the global warming during the first half of the last century is natural as this period largely pre-dates global industrialization. On the other hand these same proponents insist that the more recent warming in the second half is unprecedented and therefore "must be manmade, dangerous and must be stopped".

Just for fun, Dr. Lindzen has presented the graphic at right along with the question "Can you tell which is which?" These two pieces of data are from one continuous data set from the Hadley CRUT3 global average temperature record (heavily relied upon by the proponents of AGW-GHGHE). It is simply unclear that the current temperature trend is a profound issue, but it has been made a globally profound issue, so this essay will deal with much of that. (Note: it is so that the more recent of these two portions of data has to be positioned in whole ~0.35°C upward in the "y" axis to properly re-combine them into one data set.)



First, let me make the (actually) profound point that this Earth has gone through 60-70 known major climate transitions over many hundreds, even thousands, of millions of years. It did so while maintaining an exceptionally narrow thermal range (~+/- 6-10°C) throughout all this history. This incredibly tightly controlled, long duration behavior can only be understood in the context of a system overwhelmingly dominated by negative-feedbacks. At an entirely fundamental level this assertion has to be true and profoundly so. However, these negative-feedbacks are poorly represented in our current Modeling efforts and their investigation is underfunded to the point of being ignored.

Further, the ice-core analysis makes clear the relative timing of events. And while it is certain that atmospheric CO_2 lags temperature in both directions, so as to more readily be an effect and not a cause of temperature change, the one fact that is most **un**certain from ice-core analysis is the exact magnitude of the CO_2 spike that accompanies each and every interglacial (and also accompanies warming periods within a given interglacial).

Why? Because, for one, these spikes are, by definition, the highest temporal frequency events - which, of course, bestow on them the greatest sampling uncertainty. But this uncertainty is of magnitude and not of relative timing. The CO_2 peaks, as represented from the ice-cores, are the established values obtainable within a finite (and limited) temporal sampling resolution. If higher sampling resolution could be arbitrarily applied, it could only reveal yet higher peaks (i.e. yet higher frequency events). These are facts of statistical sampling. See Figure A, on p12 below (we are fortunate to get 500 years least-count time resolution on any parameter when we go back more than just a few 1000's of years).

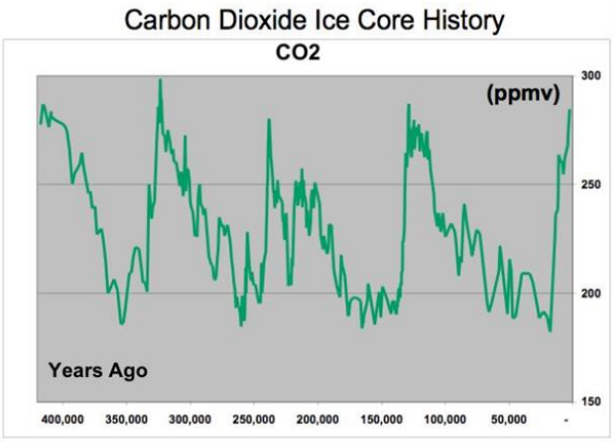
Additionally, this uncertainty of magnitude is further muddied by an incomplete understanding of diffusion processes taking place distributed within an enormous pressure gradient (along with many other poorly understood processes). The uncertainty of this CO_2 diffusion between ice layers can only act in such a way so as to underestimate the peaks of the highest frequency components as these peaks are also exactly, and by definition, where the diffusion gradient too is the very greatest. (There is no method to recover this lost information as it is no longer present within the samples.)

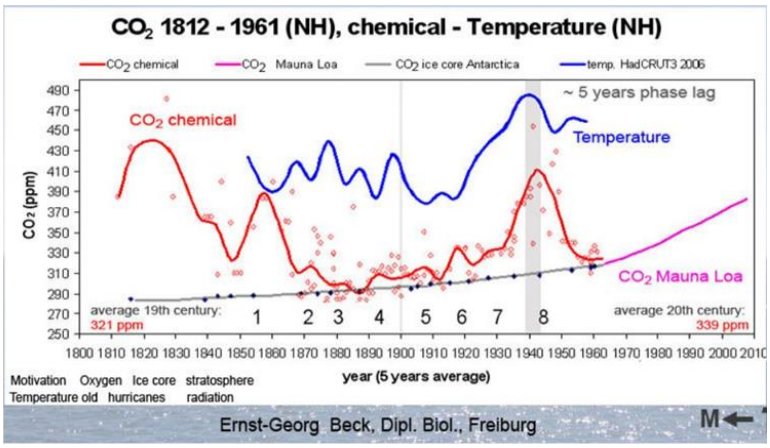
Therefore an exceptionally important aspect regarding the ice-core analysis, and one that is seemingly wholly under-appreciated, is the fact that this uncertainty of magnitude is substantially (entirely) all in one direction. And that direction is up. The highest peaks (ones that might have durations of only several hundred years) would not be temporally resolved at the very same time that unquantifiable diffusion processes would attenuate them preferentially the greatest (and with most likely significant attenuation as the higher and sharper the peak the more and harder our post-dated analysis will knock it down). Both issues, temporal resolution and diffusion-attenuation diminishment, act simultaneously on the CO_2 peaks. Therefore in the end, we do know with certainty that CO_2 lags temperature. But for all we know, atmospheric CO_2 has spiked to over 1000 ppm (not so unlikely), for a relatively short period of time (quite possibly up to 500 years or even more), during each and every prior interglacial (and to only a marginally lesser extent in prior warming periods of the current interglacial).

Let me state this again, differently, and with as much clarity as is possible. All of the ice-core data, each and every piece, without regard to where the analysis might fall within the spatial extent of the physical ice core sample, supports the relative timing of temperature vs. CO_2. And CO_2 lags temperature without doubt. However, when it comes to the highest frequency components (the CO_2 peaks) we can say with certainty that they are under-represented in the analysis. The true reality of the peaks of CO_2 is that they are higher than we have determined, but by an amount higher that we cannot determine. And I would dare to add that prior peaks were very likely >>600 ppm. (I have never found a detailed metrological error analysis of the ice-core data, but the temporal resolution and diffusion-attenuation diminishment points made herein would necessarily become salient elements of any such analysis.)

> This temporal resolution and diffusion-attenuation diminishment of the CO_2 peaks of the ice-core data is readily observed in the graphic below at right (complete elimination of modest perturbation). There are three CO_2 measurement technologies represented. From 1960 to 2010 there is CO_2 by infrared absorption with a standard error of only 0.1%. From 1810 to 1960 we have both, CO_2 by chemical analysis (which continues to agree closely with current infrared analysis, but with a larger measurement uncertainty of 3-5%), along with CO_2 from the ice-cores (with no quantified measurement precision but clearly subject to the significant metrological biases explained above). Given that the CO_2-chemical data reveals variation as great as 35%, with only 3-5% uncertainty, we can readily expect that at least 20-25 percentage points of this 35%'ish variation is truly representative of the atmospheric variation at the 1820's, mid-1850's and early 1940's.
>
> However, we also clearly see in the ice-core data (below at right) that CO_2 diffusion and sampling resolution limitations have removed these chemically established variations entirely (and this is where the smoothing and attenuation is appreciably less than what can be expected for the much older ice-core data below left). So with that said, we can readily surmise that ice-core analysis is completely insensitive (non-resolving) to actual perturbation as large as 20-25% (and possibly yet much larger). Therefore certain statements can be confidently made regarding the 50%'ish variations revealed by the older-ice-core analysis below at left.

1) So while the true reality of the peaks of ice-core CO_2 is that they are higher than we have determined, but by an amount higher that we cannot exactly determine, we can nonetheless confidently surmise that they were appreciably more than 2X what is represented. The atmospheric CO_2 perturbation that is required to produce these results had to be a multiple of what has been represented by at least a factor of 4-5. Such that the actual atmospheric CO_2 spike had to be, at the very least, something appreciably greater than 600ppm in order that near 50% spikes approaching 300ppm could survive the inherent limitations of the ice-core analysis technique.
2) The abrupt transitional timing of these CO_2 spikes is highly indicative of CO_2-sinking saturation events.
3) Lastly, CO_2 has surely spiked to >>400ppm many times during warming periods of the current interglacial.





Next…we then know that every warming period has an attendant, but delayed, atmospheric CO_2 spike. And most likely, the currently observed spike is but a fraction of what has occurred in every prior warming period and therefore most likely, but a fraction of what it is to become in this one – and, quite presumably, for the same natural causes of all prior events. So, why it is that some insist that the currently observed atmospheric CO_2 spike is anomalous, or anthropogenically dominated, is entirely unclear and most likely misguided.

Here are the primary sources of natural CO_2 release in decreasing order of quantity of carbon emitted: oceanic release, microbial decay, insect activity, frozen terrestrial release; volcanic release; forest fire and then mammalia exhalations and emissions - summing to a total of ~325-485 petagrams. Then there is our ~2.0% anthropogenic release at ~8-9 petagrams. (Based on terrestrial sources alone, without oceans, anthropogenic release is ~3-4% of the natural flux. Some argue that the oceans are net absorbers and ignore the oceanic release estimate below. However, according to the argument presented herein the oceans are net emitters as indicated below when warmed by ~0.5^{o}C per century).

Natural Sources of CO_2 Annual Emission Compared to Anthropogenic

Atm. CO_2 Source **Interglacial Estimate**	**Activity Level When Earth is Glaciated**	**Activity Level When Earth is Interglacial** **As is the Case Just Now**
Oceans 130-220 PgC	Cooling oceans absorb vast amounts of atmospheric CO_2, but with thermal delay.	Warming oceans emit vast amounts of CO_2 to the atmosphere, but with thermal delay.
Microbial Activity 85-100 PgC	Slowed generally and brought to a standstill in those portions of Earth that are glaciated.	Microbial activity is accelerated generally and begins to occur in those areas that are no longer glaciated.
Insect Activity 60-90 PgC	Slowed generally and brought to a standstill in those portions of Earth that are glaciated.	Insect activity is accelerated generally and begins to occur in those areas that are no longer glaciated.
Frozen Terrestrial 20-30 PgC	Slowed generally and brought to a standstill in those portions of Earth that are glaciated.	Frozen terrestrial release is accelerated generally and begins to occur in those areas that are no longer glaciated.
Volcanic Release 10-20 PgC	Volcanic activity is shown to be reduced when Earth is glaciated as speculated herein.	Volcanic activity is shown to be enhanced when the Earth is no longer glaciated as speculated herein.
Forest Fire 10-15 PgC	Slowed generally and brought to a standstill in those portions of Earth that are glaciated.	Forest fire is accelerated generally and begins to occur in those areas that are no longer glaciated.
Mammalia 8-12 PgC	Slowed generally and brought to a standstill in those portions of Earth that are glaciated.	Mammalia emissions are accelerated generally and begin to occur in those areas that are no longer glaciated.
Anthropogenic 8-9 PgC	Heretofore nonexistent. Likely to become larger as we struggle with the next glaciation.	Currently growing as with the above. Dominated by fossil fuels. Fission then fusion will likely change the near future.

Notes: Interglacial estimates come from my notes of IPCC, NASA and NOAA web-sites of 2005 and 2006, when these sites carried detailed analysis of natural CO_2 emission sources. Terrestrial estimates of CO_2 emission place the anthropogenic contribution at ~3-4%. The annual oceanic release estimate above is modeled (from laboratory experiment by NOAA) and would arise only if and when the oceans begin to follow a 0.5^{o}C per century temperature rise profile (as they most likely have been). Thermal modulations to all non-human emission can be expected to be quite large (up to 2X and more at the extremes of global temp). The only value that can be estimated with high accuracy is the anthropogenic contribution which is far less than both the uncertainty and, most importantly, the variability of many of the natural emission sources.

These natural sources all correlate to global temperature, including, at the least, terrestrial volcanism (as recently verified). When the Earth gets warm, for whatever reason, these natural sources all kick-in together to contribute vast quantities of CO_2; and to produce the observed habitual atmospheric CO_2 spikes upward. Conversely, when the Earth gets cold, for whatever reason, they all go into remission together; naturally and (generally) coherently to produce a consequential reduction in atmospheric CO_2. Each spike or dip in CO_2 follows temperature with a lag time averaging 800 years, but proportional to the level and magnitude at which the temperature swings take place.

It is extraordinarily difficult to imagine that these natural sources are not at play during this current period of warming. They most likely are the primary cause of the currently observed CO_2 spike. And yes, we humans, as co-inhabitants of this Earth, are emitting CO_2. But so are microbes and insects emitting. And each of them is emitting with ~10 times our current anthropogenic emission. In both cases (microbes and insects) there is every reason to believe that their populations are geometrically exploding in this current highly favorable environment to their existence. The recently warming oceans are most likely the largest emitter of all. Atmospheric CO_2 is spiking just now. And we have good reason to believe that it is largely, essentially entirely doing so for all the same reasons it has done so within each and every prior warming period of the past. All natural sources of CO_2 emission are currently revved-up and in high gear during this extended interglacial. ~98% of the current spike is natural while we add our anthropogenic 2% (and while thermally stimulated CO_2 emission is being mitigated by greatly stimulated photosynthetic sequestering).

We also have reason to believe that the current spike would be as large, or larger, than now observed, if we humans were never here at all. Why? Because those organisms that would otherwise be here in our stead would most likely emit much more CO_2 than we are. i.e. We humans have chosen to systematically limit the proliferation of micro-organisms and insects in the lands we use for cultivation and occupation - which represents about 1/3rd of all land. And in the other 2/3rds of all land, microbes and insects are each estimated to emit ~10 times our anthropogenic emission (insects alone outnumber humans >>10,000,000,000:1 – enough to fill 10's of large dumpsters per person).

The relative contribution from microbe and insect emissions would have gone up significantly if we were never here (by a very rough factor of up to 1.5*). They would have filled our void geometrically, unlike our anthropogenic contribution. When we humans get rich, we uniquely self-limit our proliferation, by deciding to have fewer children. And our human emission pales in comparison to the emission from these astronomically vast numbers of other organisms. So if we were never here, greatly enhanced populations of microbes and insects would be emitting many times our anthropogenic emission from the very land that we systematically exclude them from. This situation of greatly enhanced microbial and insect populations most likely characterizes the events within prior interglacials.

To put some rough figures on this: current microbial and insect emissions are estimated at ~160 petagrams. If we were never here our 8-9 petagram anthropogenic emission would go away - but only to be replaced by an increase of up to 80 petagrams of additional contribution from microbes and insects. The current spike would then be larger than now observed. And again, this situation most likely characterizes the events within prior interglacials.

> *Certainly our limitation to the proliferation of microbes and insects has not been 100% within the lands we cultivate and occupy. However, this limitation need only be an easily accepted value of ~10% or greater for the assertion to be true: we have reason to believe that the current spike would be as large, or larger, than now observed, if we humans were never here at all. i.e. Humanity's "carbon footprint" may be a net negative contribution and probably is.

And, yes it is so, that our anthropogenic release is largely made of "long-time" sequestered carbon (unlike that of much microbe and insect emission). But the term "long-time" is quite relative. It is certainly a long-time sequestration by our understanding of human existence. However it is not so long at all on a geologic timescale. Massive-scale natural release of "long-time" sequestered carbon has littered this Earth's geologic past (and continues today). Some seem to think that this sequestered carbon is so thinly scattered as to be quite rare. This might lead you to believe that it is geologically a one-way function such that this carbon, in many forms such as fossil fuel, is mostly sequestered and rarely, if ever, naturally released (to some great benefit of climate). But the truth is that "long-time" sequestered carbon is ubiquitous by nature, dominates natural release sources, and is often cataclysmically released on very large scales through many natural processes (such as thawing tundra, volcanic and super-volcanic eruption).

There is little reason to believe that our current 2%-of-flux release of "long-time" sequestered carbon is consequential by any geologic standard of the past. Natural processes have surely produced many periods of hundreds of years of sequestered carbon release, wherein each year provided multiple percentage points addition to the just prior natural flux trend. In fact, anthropogenic release is not only very small when compared to the magnitude, but more importantly, the variability of natural release (the significant point here being that the notion of a steady-state 1:1 pairing of natural CO_2 sources and sinks is wholly unjustified when natural release events regularly produce huge and large-scale, long-duration disruptions). And keep in mind that approximately 50% of natural, steady-state CO_2 release is of "long-time" sequestered carbon while essentially 100% of cataclysmically released carbon is of the "long-time" sequestered variety. Our consequently miniscule use of fossil fuels is most likely irrelevant to atmospheric CO_2, and to climate. It's geologically irrelevant and completely lost in the noise of geologic events.

Separately, we know geologically of extended epochs where atmospheric CO_2 was many times higher than today's value (by >10X). But we know of no tipping point in all of Earth's history (and such an event could not go unnoticed geologically). Epochs where enormously elevated atmospheric CO_2 was falling while the Earth warmed to an interglacial. Epochs where enormously elevated atmospheric CO_2 was rising while the Earth cooled to glaciation. These facts fly directly in the face of CO_2 playing a pivotal role in climate change. In fact they suggest a minor to insignificant role for atmospheric CO_2 as regards climate (while they clearly implicate some other truly-pivotal driver).

If we now turn to the supposed positive-feedback and pivotal role of CO_2 we have great difficulty notwithstanding the forgoing. During each and every one of the past 60-70 known interglacials we know that atmospheric CO_2 spiked. Why didn't that spiking lead to large increases in atmospheric water vapor? Why didn't the two of these enhanced atmospheric constituents lead to significant further warming? And then that additional warming would directly lead to yet more CO_2 and more water vapor; which would lead to yet more warming, and then more CO_2 and more water vapor? Why wasn't there thermal runaway in each, or any, prior interglacial (as is now feared for this interglacial)? We know that the Earth has never experienced thermal runaway (a tipping point). The likely answer is that the theory of pivotal positive-feedback CO_2 may be just plain wrong.

And if CO_2 somehow did play a pivotal positive-feedback role in getting to this warm state (which it most likely did not), then how would the Earth ever subsequently and suddenly transit to glaciation (as it has and does) from this latched-up positive-feedback warm state without invoking a yet vastly more powerful and unidentified climate driver?

The very same problem exists in the reverse. When the Earth is glaciated atmospheric CO_2 falls, and so does water vapor. Why didn't the minimization of these two atmospheric constituents lead to significant further cooling? And then to yet lower atmospheric CO_2 and water? And then more cooling? Why didn't the Earth fully ice-over? Why didn't the ocean depths freeze solid? They never have. The likely answer is that the theory of pivotal positive-feedback CO_2 may be just plain wrong.

And again, if CO_2 did somehow play a pivotal positive-feedback role in getting to this cold state (which it most likely did not), then how would the Earth ever subsequently and suddenly transit to interglacial (as it has and does) from this latched-up positive-feedback cold state without invoking a yet vastly more powerful and unidentified climate driver?

In another way of asking these questions, how does pivotal positive-feedback CO_2 play a role in the major climate transitions? When the Earth is glaciated and atmospheric CO_2 is low, what massive CO_2 release event accounts for the transition to interglacial? (Recognizing that the tiny radiative perturbations of Milankovitch cycles have been relegated to small amplitude variation at frequencies that are only poorly correlated to climate swings generally, but may nonetheless correlate to major swings in ways speculated herein.) The only possibility is large scale volcanism. But volcanoes are very messy and leave lots of geologic evidence. And we know that that these glacial-to-interglacial transitions are not correlated to preceding major volcanic events. We know that enhanced atmospheric CO_2 only arrives, on average, 800 years after the glacial-to-interglacial transition (from natural sources that are consequentially stimulated by the warming). Spiking CO_2 is most likely the effect and not the cause.

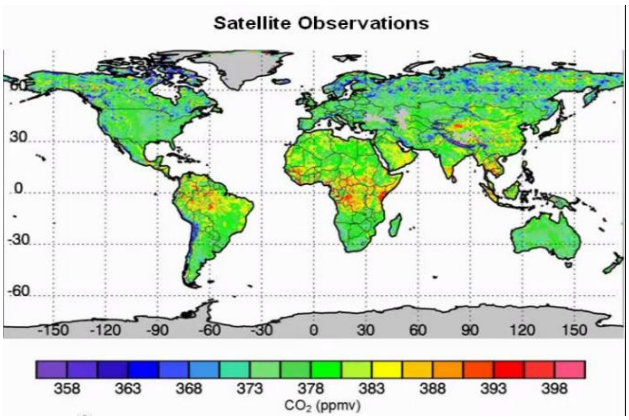
Similarly, when the Earth is warm and atmospheric CO_2 is high, what sudden massive CO_2 sequestering event accounts for the transition to glaciation? There is little opportunity here to even investigate another possibility as there are few massive-scale, rapid sequestering phenomena, other than oceanic absorption. And the cooling oceans

do absorb. But only, on average, 800 years after the climate transition to glaciation (owing to their thermal mass). Again, falling CO_2 is most likely the effect and not the cause.

Then there is the most recently observed global temperature and atmospheric CO_2 trends. Since 1998 our anthropogenic CO_2 emission has skyrocketed (still at ~2% as all natural sources are also just now spiking as a result of the warming). But global temperatures are flat to down. It simply cannot be so that pivotal positive-feedback CO_2 is at work here. These present-day observations directly conflict with this theory. Something else drives climate change while CO_2 is the effect of that change and not the cause.

In the end, it is most safe to say that we simply do not yet know the driver(s) of major climate change. And there is no evidence for a pivotal position regarding CO_2. It is not even clear that CO_2 plays a tertiary role let alone a primary one. And, most likely, atmospheric CO_2 plays no meaningful role at all as regards instigating or amplifying climate change (at <200ppm all life would slowly become crippled; yet CO_2's GHG effect is >95% saturated at this level).

Some have a difficult time with the emphasis I've placed on microbial and insect emissions (by far the #1 and #2 CO_2 emitting life forms on Earth; we humans are a distant 4th – on par with mammalia). In the satellite map at right we cannot observe enhanced CO_2 emissions coming from human centers of industry (the Ohio Valley, Western Europe and Japan). However, we can readily observe enhanced emission coming from the insect and microbe laden jungles of the Amazon Valley, Sub-Saharan Africa and Southeast Asia where vegetation coverage is and has been essentially saturated. We can also observe the CO_2 sinking of stimulated additional vegetation growth in Canada and Northern Eurasia. (Just to be entirely clear, I do not recommend a further anthropogenic attack on microbes or insects.)

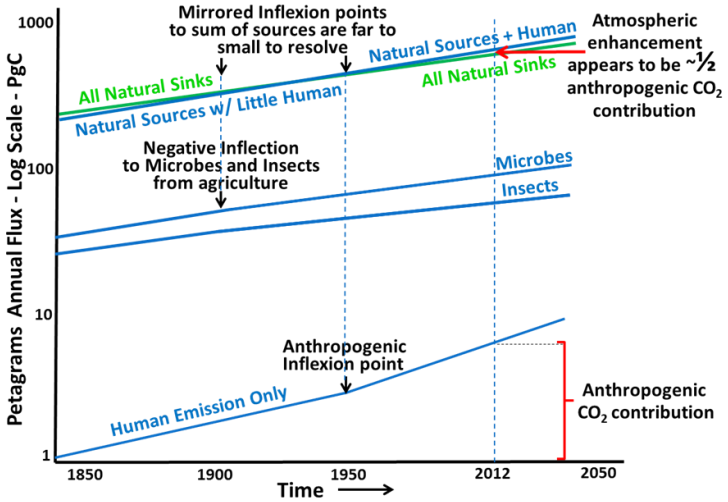


Some have a difficult time with the idea that anthropogenic CO_2 emission is largely irrelevant to atmospheric concentration. Their thinking seems to them to be indisputable. i.e. Since we know that atmospheric enhancement is only about ½ our human emission, then removing our human emission would more than account for a reconciliation.

According to some using this thinking, cutting our emission in half might yield a near perfect reconciliation. As if a reconciliation of any sort might produce some meaningful benefit to climate variations (and it would only be, at most, geologically momentary till some natural event changed things again, one way or the other). The cartoon below attempts to illustrate why it is that our contribution is not particularly relevant using some very rough personal yet rational guestimates to make the point.

PgC/yr. Year	1850	2012	Delta	
Natural Emission	225	400	175	←4
All Absorption	227	404	177	
Human Emission	1	8	7	←3
Delta Emit-Absorb	-1	4	5	
	↑1	↑2		

1) Here CO_2 is falling in the cold of the Little Ice-age at -1 PgC/year.
2) Here it looks as if in the current warming we account for 2X the CO_2 enhancement (8/4).
3) But here we see that humans only account for ~2% of the outgoing CO_2 flux (8/408).
4) And here we see that the natural growth in CO_2 emissions is ~25X the human growth (175/7).



About the mirrored inflection points graphically shone above:
A) The tiny negative inflection to the larger microbial / insect contribution is far too small to resolve in the immense summation.
B) The large positive inflection to the tiny anthropogenic contribution is also far too small to resolve in the summation at Mauna Loa.
C) Net human activity (apposing at ~2% each) is entirely irrelevant within our limits of current global CO_2 detection and evaluation.
D) A geologically instantaneous substitution of approximately equal CO_2 emission has taken place between Earth life forms.

During the Little Ice Age, natural sinks had overtaken sources so atmospheric CO_2 fell (caused by cooling). The warming since then has stimulated natural sources which, in turn, have stimulated natural sinks. And the sources are now out in front, with our modest help to be sure. But both sources and sinks have been growing far more rapidly than our anthropogenic contribution in absolute terms. So if our contribution were to be removed in its entirety, there would be little identifiable change. Microbial and insect emissions would more than make up the difference if we let them**. And had we not contributed our 2%, the vegetative sinks would have been most likely under-stimulated by a somewhat similar amount such that there would be little identifiable change. (The water tub analogy where a spigot is filling the CO_2 tub, while a drain is draining it, is entirely misleading in the way it is often presented as there is a clearly coupled relationship between changes to the rates of input and output – at least till a saturation event occurs.)

And if the Earth continues to be warm but then starts to cool, at some likely predictable point the photosynthetic sequestering sinks will saturate (so that their increasing capacity to sink CO_2 will quit increasing; and then for the same continued cooling causes, these sinks will subsequently and rapidly reverse to a decreasing capacity to absorb CO_2; while the emission sources more slowly respond; and the oceans, in particular, fail to respond for many decades). Then very steep atmospheric spiking will ensue just as it so often has in the past. It is very likely that photosynthetic sequestering (biological response) provides an enormous (geologically real-time) negative feedback to additional atmospheric CO_2 until such time as it saturates. This predicted saturation event is not likely very near if the planet continues to warm or slide sideways on temp. However, a near-term solar-driven mini ice age may likely accelerate this predictable spiking event into the near term (i.e. atmospheric CO_2 will likely increase yet more sharply soon as the Earth begins to cool - because of photosynthetic saturation – but for a limited time till the oceans begin to absorb).

> **If, for some inexplicable reason, we somehow came to conclude that life-based Earthly atmospheric CO_2 emission should be driven down by our future anthropogenic actions, the most obvious (and simple) actions we could take would involve our further limiting the exponentially growing contribution coming from our competitors in this arena: microbes and insects. A yet further global reduction in their competitive contribution by only ~6% would more than account for the otherwise complete elimination of our anthropogenic CO_2 contribution in its entirety. And while this course of action is loaded with potential pitfalls, it is trivially within our anthropogenic means (e.g. aerial spraying). We have already accumulated a great deal of experience in this regard and already have insight to its pitfalls (something similar to but certainly much less drastic than what we have done in the lands we use for cultivation and occupation might be performed in certain other lands that we do not currently treat as such). It could likely be done in such a way as to yet further increase crop yields while further minimizing the spread of disease. And it likely is far less subject to unintended consequence than many (all) geo-engineering proposals on the table at this time that I know of - none of which make any sense to me - including this particularly obvious and simple suggested course of action. Why in the world would we choose it inhibit the proliferation of all life on Earth by offsetting our 2% Vitamin C(O_2)? Especially when any anthropogenic CO_2 reduction effort will necessarily fail as Nature will continue to wield its overwhelming 98% in ways totally out of our anthropogenic control.

High Atmospheric CO_2 is Good for All Life on Earth

At an atmospheric concentration of 380ppm and higher the limited long-wave spectral absorption of CO_2 is essentially saturated. Consequently, yet more atmospheric CO_2 becomes vanishingly less relevant to a greenhouse effect (if at all). And when more atmospheric water vapor is objectively evaluated its net-effect is found to be a negative-feedback rather than a positive one (in direct contradiction to the presumption of the Models). However, enhanced atmospheric CO_2 clearly stimulates the proliferation of all forms of life. You might best call it Vitamin C...(O_2).

Some believe that the reason our immediate celestial neighbors (Venus and Mars) don't have life is that they have high concentrations of atmospheric CO_2. But the reality is entirely upside-down from this notion. The primary reason our neighbors have high concentrations of atmospheric CO_2 is simply that they have no life. Earth started the very same way (with high atmospheric CO_2). But life evolved here. We humans and all other life here on Earth are part of Earth's naturally sequestered CO_2. The "non-life" CO_2 that we humans "un-sequester" with fossil fuel consumption, is CO_2 beneficially returned to the immediate opportunity to become life once again. Life on Earth is exploding just now but we humans seem to want to deny it. However, it is true. And our CO_2 release is one for the things we are favorably contributing to this highly desirable process. These are exceptionally good times for life on Earth.

$$CO_2 + H_2O + \text{photons} \rightarrow CH_2O + O_2$$
$$\text{carbon dioxide + water + light energy} \rightarrow \text{carbohydrate + oxygen}$$

Here is an important fact: CO_2 is a fundamental building block required by all life. Its availability, in large part, regulates the maximum level at which any and all life can proliferate. All life on Earth is booming just now and it could not do so without elevated atmospheric CO_2. Photosynthetic processes require three primary ingredients: sunlight, water and CO_2. We have known for a very long time that the abundance of sunlight and water are critical to the growth of vegetation. But now, not so surprisingly, we have discovered that the abundance of CO_2 is critical also. Vegetation on Earth is exploding just now due to elevated levels of atmospheric CO_2. This is supported by innumerable agricultural studies of CO_2 effects while commercial greenhouses intentionally spike their internal CO_2 (internal CO_2 spiking is well known by greenhouse managers to stimulate growth and therefore improve profits).

And then there is the food chain: omnivores feed on carnivores that feed on herbivores that feed on vegetation (both terrestrially and in the oceans). There is only one organism on Earth today that is limiting its prolific celebration of the currently enhanced atmospheric CO_2 levels. And it's the only organism intelligent enough to be entirely confused. There is no replacement that we might beneficially "migrate to" for this functionality. CO_2 is required for this life-benefit regardless of that we might think to imagine or otherwise pass into law. This inevitable cycle will continue. And no matter how diligently some might confusedly think it should be arrested, we cannot arrest it. It should not be arrested. And it will continue to climb (naturally) so long as the Earth continues to warm (and likely for some time thereafter). Elevated CO_2 is factually stimulating the proliferation of all life on Earth (including for polar bears).

So if, as is so commonly assumed, the current spike in atmospheric CO_2 is substantially or entirely anthropogenic, one then needs to ask what has inhibited the natural spiking that would normally accompany this 150 year long warming trend (actually 400 years of warming since the coldest depths of the Little Ice Age) such that our anthropogenic release could act as the sole (or primary) source of the current spike? A partial answer to this important question may be largely or at least substantially explained above. i.e. We have inhibited insect and microbial emission and substituted a smaller quantity of our own. Then, is the current spike anthropogenic? Certainly it is not. The current atmospheric CO_2 spike would be similar, most likely larger, if we were never here.

But a primary difference remains in that our emission is largely of long-time sequestered CO_2 while insect/microbial emission is largely not. Regarding this difference it must be recognized that the notion of a steady-state 1:1 pairing of

natural CO_2 sources and sinks is wholly unjustified when natural release events regularly produce huge and large-scale, long-duration disruptions. And if 1:1 pairing of natural sources and sinks did exist, why do we observe the habitual interglacial CO_2 spiking and glacial CO_2 dips (is this not simple proof that they are not 1:1 paired)? The CO_2 that we humans emit has the most life-generating-value of all CO_2 to be emitted, for the very same reason that it is erroneously "perceived" to be the most detrimental. i.e. The "long time" sequestered CO_2 that we emit is, in fact, an incremental amount that becomes available to stimulate an additional abundance of life on Earth just because it was "long-time" sequestered (and the same is true for most all naturally released carbon which is mostly "long-time" sequestered itself). Instead, we assail our CO_2 as a pollutant when yet more, lots more, would be further beneficial.

It is extraordinarily difficult to imagine that the natural sources described above are not at play during this current period of warming. They most likely are the primary cause of the currently observed CO_2 spike. However, much conventional thinking posits that this current spike is entirely anthropogenic. And even further, that human emission is so extreme that Mother Nature can only choke down half of it while the other half accumulates in the atmosphere to produce the observed spike. This notion is a monumentally incredible "leap of dis-faith and misunderstanding".

Erroneous $^{12}C/^{13}C/^{14}C$ ratio analysis is said to confirm this notion but this single study very much lacks reasonable scrutiny and more recent studies dispute it entirely. Erroneously long atmospheric CO_2 residence time is required to support this notion but many recent studies all show a very short residence time. Erroneous 1:1 delicately balanced pairing of natural CO_2 sources and sinks is required to support this notion when the Earth regularly absorbs huge natural disruptions and current studies show an enormous Earthly ability to rapidly sink and source additional or incremental CO_2. Wholesale disregard of all prior interglacial CO_2 spiking is required while it is obvious that our estimates can only be lower than reality. Disregard of the warming stimulation of all natural CO_2 sources is required. Circular thinking of the "missing heat" accumulating in the oceans is required. Dismissal of the fact that additional oceanic heat would necessarily stimulate enormous scale oceanic out-gassing of CO_2 is required (and of course this is so that the oceans are warming so as to become the overriding CO_2 emitter). Thousands of pre-industrial measurements of atmospheric CO_2, measured to be substantially higher than today, have to be disregarded. Enormous evidence of recent climate variation, far greater than any observed in the last 100 years, has to be disregarded. The implications of seasonal atmospheric CO_2 variation, being several multiples of anthropogenic release, have to be ignored. Satellite maps showing little to no spatial correlation of elevated atmospheric CO_2 to centers of industry have to be disregarded. Belief that the Little Ice Age and Medieval Warm Period, each lasting several hundreds of years, were nonetheless small-scale regional phenomena is required. The fact that atmospheric CO_2 spiking might reasonably be more than now observed, if we were never here, has to be ignored. And finally, the obvious life-stimulating benefits of enhanced atmospheric CO_2 have to be disregarded to the point of being assailed.

Individually each of these notions is a significant oversight. Collectively they make a compelling case for additional scrutiny. Can it really be rationally argued that all these natural sources are not being stimulated by the current warming; that these enormous natural sources are all in quiescent stasis? Or that there is some predetermined, delicately balanced 1:1 pairing with identically stimulated sinks (why then did CO_2 ever spike or dip in prior climate transitions?). And that our growing tiny contribution has taken control of a very much larger growing flux whose variability dwarfs what we know to be our small fractional contribution?

For all the legitimate argumentation regarding an enormously exaggerated role for CO_2 in forcing climate change, little attention is being paid to the so easily argued and overwhelming likelihood that we are contributing a vanishingly tiny **(and fundamentally beneficial)** percentage of the observed naturally occurring atmospheric CO_2 variation - a contribution that would most likely be larger if we were never here.

Truly draconian measures to our fundamental means of wealth generation (use of energy) could, say, diminish this tiny contribution by half – from 2% to, say, 1%. But then aren't we still left with the vast majority (99%) of the current natural trend? It is not only so that the currently observed spike in atmospheric CO_2 has little to do with future climate change; but our opportunity to meaningfully affect its future course is simply non-existent; and there is a great deal of evidence that all life on Earth is prolifically celebrating the conditions that we are confusedly committing ourselves to try to stop. You might best call it Vitamin C…(O_2). Meanwhile, it is profoundly so that energy use is identically equal to human accomplishment and prosperity. Nikolai Kardashev and Freeman Dyson found it most useful and logical to classify potential intelligent alien life based on their level of mastery of energy. At the highest and most salient levels, CO_2 as a prime driver of climate not only fails, but it fails miserably and, quite frankly, inexcusably for so long.

The Hypothesis of Major Climate Change?

The AGW-GHGHE theory supposes a powerful, pivotal, positive-feedback role for CO_2. This is certainly not so. Something else drives climate change. And we do not as yet know what that is. It has always been difficult for humanity to throw away one theory before another, more promising one, can take its place. Unpleasant as it is, we are often reduced to the conundrum "How else do you explain it?" And that is the situation just now. However, the case in evidence for pivotal, positive-feedback CO_2 is not just terribly weak, but rather non-existent and essentially upside-down. It behooves us to look diligently for the true driver(s) of climate change; and especially for <u>major</u> events.

I would like to offer a common-sense climate driver hypothesis that possibly you have heard at least parts of before. But then I would like to offer an investigative method that I suspect you haven't heard before; and one that you may become interested in promoting – the investigation, that is. Call it an easily tested prediction. I'm a career Engineer/Manager and would like to share some simple perspectives on the issue of <u>major</u> climate change.

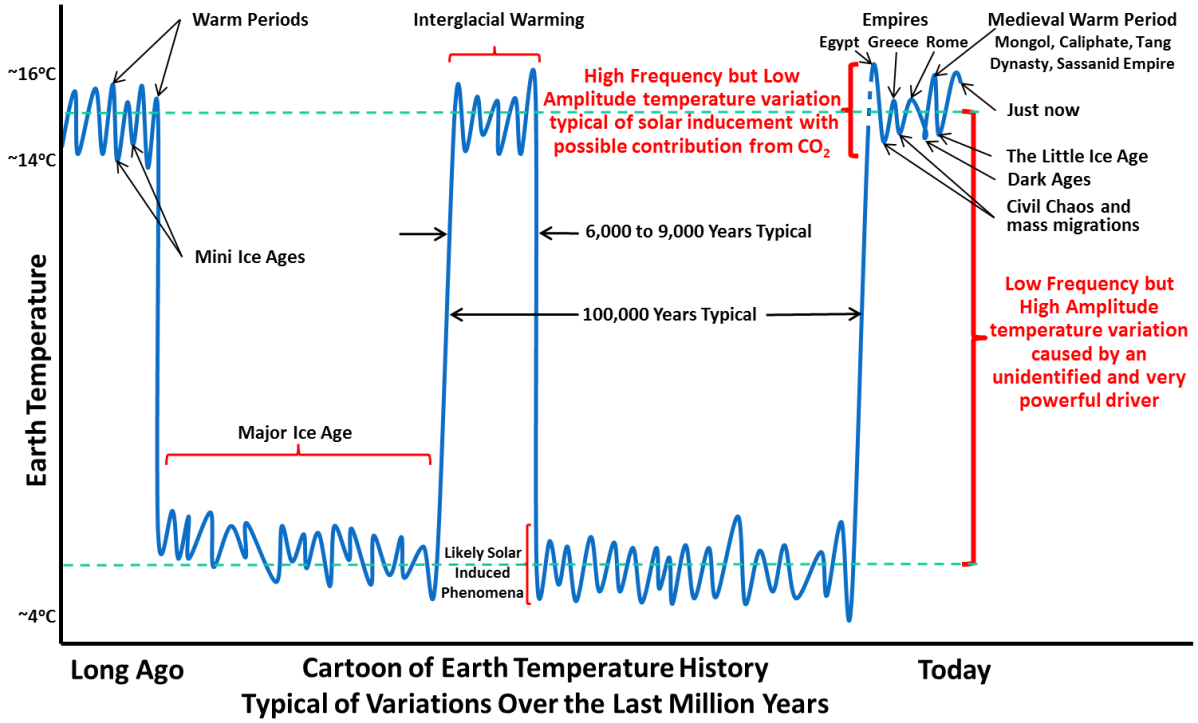
I believe that it is obvious that the prime climate driver is not CO_2 and that it is also not the Sun (in spite of solar influence being far greater than CO_2). The issue with the Sun as <u>not</u> being the prime driver is, I believe, perfectly understandable at the highest and most salient levels (i.e. not buried in some immense depth-of-detail confusion).

The variability of the Sun clearly does have its significant high-frequency but low-amplitude signature on climate (by solar variability, I mean all of its many variants: mean brightness, mean solar distance, sun-spot cycles, coronal discharge events, cosmic ray modulations, etc.). However, the Sun operates on the Earth with huge positive feedbacks. This simple fact all but eliminates it as the prime-driver. When I say prime, I'm talking about the prime-driver-force that accounts for the repeated low-frequency but high-amplitude major transitions to and from major glaciation.

When the Earth is glaciated, it becomes highly reflective of solar radiation and, as such, should latch hard and permanently to this cold glacial state; if not for some other powerful driver that repeatedly overwrites this situation. Similarly, when the Earth is interglacial, it becomes highly absorbing of sunlight and so should latch hard and permanently to this warm interglacial state; if not for some other powerful driver that repeatedly overwrites this situation. But we know that both these situations have been repeatedly overwritten.

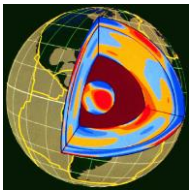
If you go through what is required in order to explain these major transitions, with positive-feedback solar-variation, you get a highly choreographed set of improbable conditions. A set of conditions that requires great solar variability (larger than the Earth albedo change) and critical timing (so as not to ice-ball or scorch the planet) and repeated performance (60-70 known events); such that the Sun is easily dismissed as the prime-driver even as it imprints its high-frequency but low-amplitude signature in many significant ways (CO_2, of course, suffers this very same dilemma).

The question then is: "just what is this immensely powerful, low-frequency but high-amplitude driver that repeatedly overwrites (hammers) these stable solar latching-states to cause abrupt major climatic transitions?" I theorize that the answer is very likely the second most profound source of Earthly energy…the central-core nuclear reactor.



Here is a simplistic yet accurate and useful "big-picture" de-convolution of the observed temperature variations typical of the last million+ years. During this most recent interglacial, the only time that literate humans have existed, there is a stunning correlation of enhanced human prosperity, and very presumably of all life, to low-amplitude, warm, high CO_2 periods. (CO_2 is rightfully shown to be, at most, a bit-player in a bit-player regime as regard to influencing climate.)

We have known for a long time that the Earth is exothermic and to an extent that would easily cause the primordial interior to go cool long before its 4.5B year's age. We also know that other planets in our solar system are exothermic; and most likely for the very same reason. It really doesn't take much leap-of-faith to recognize that there is a huge and very hot nuclear reactor at the center of this currently interglacial Earth. Internal convective motions of the mantel would have thermally homogenized the Earth's interior save the presence of a centralized heat source.



The earth originated as a molten ball that was entirely molten through and through. We strongly believe that heavy elements like iron and nickel gravitationally precipitated to the center. But what about even heavier elements like thorium and uranium? These radioactive materials would have precipitated to the center of the center. And we also know that sufficient quantity of these radioactive elements with, most importantly, sufficient proximity-density, will spontaneously chain react to generate enormous heat.

So it seems likely that such a reactor may exist. And this explanation becomes the "Occam's razor" answer to the question: "just where is it that the enormous amounts of heat energy come from that drive ongoing continental drift, tens of thousands of volcanoes, the circulation of the vast internal mantel and all the Earth's repeated earthquakes?" This energy is not residual primordial heat and it certainly cannot be explained by solar phenomena. Likely, it comes from a central core nuclear reactor. (There are theories to partially explain these

phenomena with distributed radioactive decay. However, a central reactor explanation is a much better overall fit – especially as regards the amount of required energy as well as the sustained enormous thermal gradient of the interior). And strong evidence for a central geo-reactor exists while its size is all that is disputed.

But here is the real leap-of-faith (I think not really). We now know that the Sun has complicated internal weather patterns; weather patterns that account for many phenomena we observe. We also know that the Earth has complicated internal weather patterns that account for magnetic-flipping (both just recently understood). So how hard can it be to imagine that the center of the core of the Earth might also have internal weather patterns?

One can easily theorize a viscous yet swirling pool of fissioning heavy-materials, at the core of the core of the Earth (estimated at >10 kilometers diameter) – accounting for a significant primary-heat to create and sustain an interglacial period (and to drive more rapidly continental drift along with earthquake/volcanic activity). When peaking in rate of reaction kinetics, chaotic pushes and shoves, from fluid flows outside this center, might occasionally disrupt it; so as to scatter the materials into a relatively larger volume with lower proximity-density. And then the rate of reaction kinetics drops significantly (as would the rate of continental drift and the frequency of earthquake/volcanic activity).

One can also easily theorize that these chaotic pushes and shoves are the rule, rather than exception (i.e. Chaotic pushes and shoves rule when the reaction kinetics are peaking.) such that the reactor spends most of its life at a reduced output with its fissionable materials relatively scattered – just as the Earth spends most of its time in glaciation (for at least the last million years or so and very possibly very much longer). One can also theorize that over extended time, relative stability slowly materializes from the chaos. Gravitational precipitation slowly re-emerges and the reaction kinetics take off for an enduring yet relatively short period of time – just as the Earth experiences sustained, yet relatively short-lived interglacial warming periods. I submit that this predicted weather variability to the reactor's rate of reaction kinetics is the prime-driver to major Earth climate changes (the pacing for this reactor variability may, in fact, be modulated by celestial mechanics as suggested by Piers Corbyn: axial obliquity and perhaps also precession).

The Dutch, until recently, have been trying to finance the building of an anti-neutrino detection facility off the coast of Venezuela for the purposes of beginning to monitor this central-core-reactor and, of course, to simply establish its true presence. However, let's assume that there is a central core-reactor and that its output variability truly accounts for major climate transitions.

There should then be some correlation of the timing of major climatic transitions to volcanic activity though this has not been established in spite of several attempts. But that might be because we've looked for the wrong correlation. And as we know, most all volcanic activity takes place under the oceans so this may also be shielding most of the correlation. But what is more, the AGW CO_2-biased attempts at establishing a correlation have looked for major volcanic events to precede transitions from glaciation-to-interglacial (so as to then be identifiable as the cause with their attendant large CO_2 release). And this has not been borne out in the attempted correlations (ironically, major volcanic events result in short-term cooling with no identifiable ensuing warming in spite of their large CO_2 release).

However, if central-reactor variability is the real cause, then increased volcanic/earthquake activity might more likely follow transitions from glaciation-to-interglacial. And then reductions in volcanic/earthquake activity might more likely signal the reverse transitions from interglacial-to-glaciation. Maybe this correlation can be established if it is objectively looked for? And indeed, a recent study has shown this volcanic correlation may exist.

But here is what I think is the more interesting part – a smoking gun if you will. If this is true, that central reactor variability drives major climate change, then the rate of sub-oceanic crust formation (and the rate of continental drift) should correlate well to major climate transitions; though possibly, or even likely, phase-shifted in time.

We have become quite expert at measuring continental drift and its current rates. If these rates can be plotted backward in time far enough to cover several major climate transitions, a high level of correlation may be observed.

The reason I'm excited about the possibility of a continental-drift-rate correlation to major climate-transitions is that continental-drift (or the creation of sub-oceanic crust) is a slow and continuous process that leaves "continuous" temporal evidence in the ocean floors (like the ice-cores left essentially "continuous" CO_2 concentration and temperature evidence – within its metrological limits). Volcanic/earthquake activities, on the other hand, are spurious "slip-stick" events that do not leave a continuous trail and so any correlation would be necessarily more difficult to establish.

To my knowledge, no attempt has been made to establish this type of correlation (continental drift rate, or crust creation rate, to major climate changes) but it might likely be possible; and it would provide compelling evidence to the hypothesis of central-core reactor-variability as the primary cause of major climate transitions. Additionally, the size and shape of the temporal shift would provide great insight into all manner of thermal dynamics from the center to the crust.

We studied ice-cores at low temporal resolution and came to support erroneous conclusions from our initial analysis (CO_2 drives temperature). Then we went back and did a higher temporal resolution analysis which showed a very much more informed result (temperature drives CO_2). Your guess is as good as mine to explain why this obvious fact hasn't already changed our AGW direction (by replacing the "A" with an "N" for Natural Global Warming). But what I'm suggesting is that we do a similar thing with sub-oceanic crust samples and go back to see if the rate of crust growth (or continental drift) does directly correlate to the time-line of major climate swings.

This might be a big project; but it could be very worthwhile; the most worthwhile I can think of. It fits well into the "smoking gun" category. For all I know, a reassessment of the currently taken oceanic crust samples would reveal the correlation; in which case the project scope might be fairly small. However, a higher temporal analysis may be required (not so likely) and that might significantly complicate the size and scope of the project.

This Earth has spent >11,000 years in this current major thermal upswing (more likely 18-20ky depending how you look at it). On average the Earth spends ~90,000 years glaciated, then 6,000-15,000 years interglacial, before dropping back to ~90,000 more years of glaciation. This cycle has repeated itself for about a million years for sure, and quite possibly very much longer. So it is a stark fact that we are overdue for the next fall to major glaciation.

We have no idea as to exactly when this will occur, as we don't yet know what even causes these major swings. It could be 500 or 1,000 years in front of us - somewhat unlikely. It could be that the next fall to glaciation is about to start - we just do not yet know. But we do know this: it will happen, it will be abrupt (in geologic terms), and it will be severe to us and all other forms of life here on Earth. And it is not too difficult to imagine that if central-reactor variability is the real cause, then elevated levels of earthquake and volcanic activity would accompany the scattering event which would largely shut the reactor down and precipitate the next fall to glaciation. This just might be where we find ourselves right now today!! (It's actually more likely that the scattering event has already occurred a short geologic time ago and we are now experiencing the "thermal residue" of diminished reactor output.)

The requested correlation analysis could be done many different ways. Here is one approach that may (likely) be somewhat oversimplified:

For each adjacent pair of sub-oceanic crust samples A and B

< to US East Coast or < to Mid-Atlantic Ridge	$Sample_A$ with $Location_A$ & $Date_A$	$Sample_B$ with $Location_B$ & $Date_B$	to Mid-Atlantic Ridge > or to European West Coast >

$Rate = (Location_A - Location_B) / (Date_A - Date_B)$ and $Time = (Date_A + Date_B) / 2$

Then plot Rate vs. Time for all the pairs of samples and overlay Earth glacial history. The correlation is there or it is not. There may likely be a time phasing offset between the two data sets arising from a delay between reactor output change "cause" and Earth surface change "effect". However, this possible phasing offset may be minimal if one assumes that crust creation rate is an early indicator of changes to reactor kinetics (this may well be so and might lead to enormous predictive value).

Somehow we have managed to convince ourselves to be looking for a subtle, nuanced needle-in-a-haystack (large variation from tiny perturbation). What we should be looking for is a hammer in an otherwise empty drawer (a significant perturbation). There is nothing subtle about these major climate-transitions. They're very abrupt and severe (even more so than our "smoothed" back casting is able to reveal). It is manifest that whatever causes them, it overwrites all other considerations (including solar-induced stable latching states). Yet many of us remain convinced we are sinners who must punish ourselves for nuanced CO_2 emissions. This is inconsistent with both the evidence and any common sense evaluation of it. We are not sinners. We are the good custodians of this Earth (as we respond to our misdeeds geologically instantaneously). In fact, we are the "nature" of this Earth. Can you imagine visiting aliens coming to a different conclusion? And enhanced atmospheric CO_2 stimulates the proliferation of all forms of life. Inevitably this Earth will fall to the next glaciation and that is what we must begin to prepare for.

CO_2 Predictions to a Geo-Reactor Explanation of Major Climate Change

A yet higher time-resolved analysis of the ice-cores may be called for (if that is possible?). According to the hypothesis herein, when the Earth first moves toward warming (for major climate transitions), the first thing we should observe is an initial drop in atmospheric CO_2. Similarly, when the Earth first moves toward cooling, atmospheric CO_2 should continue to rise for a short period of time. Of course, a yet higher temporal analysis of the ice-cores would also necessarily resolve more of the above predicted higher interglacial (and short term warming) CO_2 peaks.

It has been several years since we did a high(er) temporal resolution analysis of the ice cores. That is when we first discovered that **only after it gets warm**, does atmospheric CO_2 spike up; and that **only after it gets cold**, does atmospheric CO_2 crash down – like geologic clockwork every time (and for readily identified reason).

However, according to the hypothesis herein other, more subtle behaviors can be predicted. For example, let's start with a warm, interglacial Earth with high atmospheric CO_2 coming from the above mentioned natural sources. The geo-reactor is now peaking in its rate of reaction-kinetics. This high-core-temperature situation has lowered the viscosity of the central reactor fluid mechanics creating more vigorous, violent and susceptible fluid flows. Before long a random fluid-flow (could be instigated by celestial mechanics, axial obliquity or more likely orbital eccentricity) chaotically scatters the fissioning materials into a larger volume. This then diminishes the radioactive proximity density and drives the rate of reaction-kinetics to a low value. Heat generation drops. Fluid viscosity goes up. Fluid mechanics slow. And the Earth consequentially cools toward a sustained glacial period.

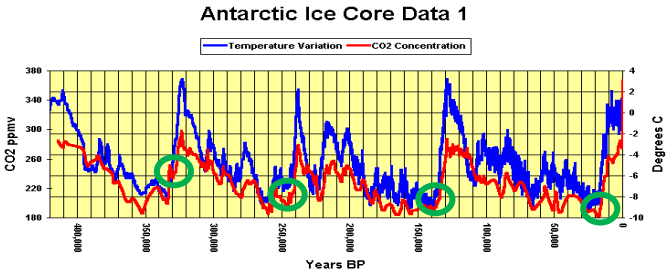
The above mentioned natural sources of CO_2 now all go into remission. However, going into remission doesn't mean that microbial decay, insect activity, frozen terrestrial release, forest fire and mammalia exhalations and emissions now begin to absorb CO_2. Rather they just quit emitting so very much. Ultimately the more slowly cooling oceans have to quit emitting and begin to absorb all the excess atmospheric CO_2, as this is the primary warming source that can revert to a large-scale cooling sink. Therefore, atmospheric CO_2 should continue to go up for a short time (possibly 50-100 years or more), even after the temperature has started to go down, owing to the thermal mass of the oceans and their delayed absorption. (We may be directly observing this today as CO_2 is going up but temperature has flat-lined and may well be headed down – especially when viewed from the Holocene temperature maximum.)

Now let's examine the reverse major climate transition. The Earth is now glaciated with a low level of atmospheric CO_2 and the now cool oceans are particularly rich in dissolved CO_2. In spite of the higher viscosity and slowed fluid mechanics of the core geo-reactor, gravitational precipitation eventually re-emerges from the chaos. And after a

consequentially extended period of time the reactor's proximity-density is re-established. Geo-reactor kinetics begin to take-off. Heat generation goes up. Fluid viscosity goes down. Fluid mechanics increase. And the Earth now rapidly moves toward a warm interglacial period.

The first thing to happen should be a further drop in atmospheric CO_2 from its already low value. Why? Because before microbes, insects, forest fire, and mammalia exhalations and emissions can go into full swing, additional vegetation has to grow. However, this initial growth requires removing CO_2 from the already low atmospheric concentration in order to grow the vegetation. Frozen terrestrial release will be delayed in its emission. Likely, the warming oceans ultimately supply the vast majority of the needed CO_2. In fact, microbes, insects, forest fire, and mammalia exhalations and emissions only put back into the atmosphere some of the CO_2 that vegetation growth has previously sequestered. They are not initially CO_2 sources in and of themselves. However, these various biological responses to the availability of increased atmospheric CO_2 are likely to be quite rapid (virtually real-time) such that this reverse time delay is likely to be quite short and therefore more difficult (maybe impossible) to resolve.

A highly time-resolved analysis of the ice cores might be able to show this small predicted initial drop in atmospheric CO_2 after the temperature starts to go up; as well as a predicted rise in atmospheric CO_2 after the temperature starts to go down. It is difficult to say for sure but these behaviors appear to be evidenced at the scale of time resolution in the graph at right. And while these behaviors support my hypothesis, they would sharply disconnect from CO_2 as a driver.



What About Ocean Acidification?

Some argue that the currently observed rising CO_2 (falling pH) of the ocean's surface is evidence that the foregoing is wrong (at least in part). This is not necessarily so (and I think it's simply not so).

We don't know for sure that the oceans are net-absorbers or net-emitters at this time. Just as we don't know for sure that the oceans are net-cooling or net-warming at this time. However, I have to say that it appears entirely plausible, and in evidence, that the oceans have recently been net-emitters (and largely, almost entirely, accountable for the current spike in atmospheric CO_2). The Earth has been warming for ~150 years since the Little Ice Age (actually ~400 years since the coldest depths of the Little Ice Age). Regardless of their enormous thermal mass, the oceans have to respond to this thermal trend at some point (historically they respond vigorously at our current level of <800y least-count detection). And if they are warmed, the oceans will surely dump a component of their vast dissolved CO_2 into the atmosphere (as they most likely have been).

However, if the oceans are net emitters of CO_2, how does one explain the observed increased CO_2 (drop in ocean pH) at their surface? The CO_2 diffusion gradient from uniformly warmed (or surface solar warmed) oceans would result in a drop in dissolved CO_2 near the surface. But we believe that the CO_2 concentration near the surface is going up.

An increasing CO_2 concentration near the surface could exist by virtue of elevated atmospheric absorption, as is commonly assumed (I believe incorrectly assumed). But such a gradient could also exist if supported by a sufficiently large thermal gradient. That is, if the oceans are being warmed from below, by a core geo-reactor, a thermal gradient could then exist to support a reverse CO_2 gradient. And as such, the near surface CO_2 concentration of the oceans could be going up at the very same time that the oceans themselves are net-emitters of CO_2 to the atmosphere.

Another possibility is that the geo-reactor induced oceanic warming may likely have an attendant vast sub-oceanic volcanic CO_2 release associated with it. In this case the CO_2 concentration of the oceanic bulk could therefore be rising and again there would be cause to observe an elevated near-surface CO_2 concentration from net-emitting oceans. Of course, both these possibilities are likely at play if either is (and I would propose that they both are, in fact, at play).

If I'm right about this, then enhanced photosynthetic sequestering is not only partially absorbing our anthropogenic emission, but also substantially absorbing oceanic emission (as well as the warming stimulated emission from other natural sources - examine the seasonal CO_2 variation). The net difference is accumulating in the atmosphere. And it just happens to be instantaneously so in this current state of Earthly disequilibrium that the enhancement of atmospheric CO_2 appears to be about one half of our anthropogenic emission. Future studies will very likely reveal that both the quick response time and sheer magnitude of natural photosynthetic sequestering have been heretofore significantly underestimated (i.e. Photosynthetic sequestering is an enormous and rapid negative feedback to increased atmospheric CO_2 that is emitted from any source). And indeed, very recent studies do reveal such things.

A sub-oceanic heating gradient might also have a continental land mass analog in that detailed analysis consistently demonstrates a bottom-up melting behavior for glaciers during this current interglacial. What is more, recent studies have identified increasing oceanic temperature at the extreme depths of the oceans – entirely consistent with the hypothesis presented herein.

It has always been difficult for humanity to throw away one theory before another, more promising one, can take its place. Like it or not, we are often reduced to the unpalatable conundrum "How else do you explain it?" It behooves us to look diligently for the true driver(s) of climate change. A validation of the various predictions outlined herein would provide compelling evidence for the hypothesis of variable geo-reactor kinetics as the primary cause of major climate change. See: Six Specific Predictions" at the end of this essay.

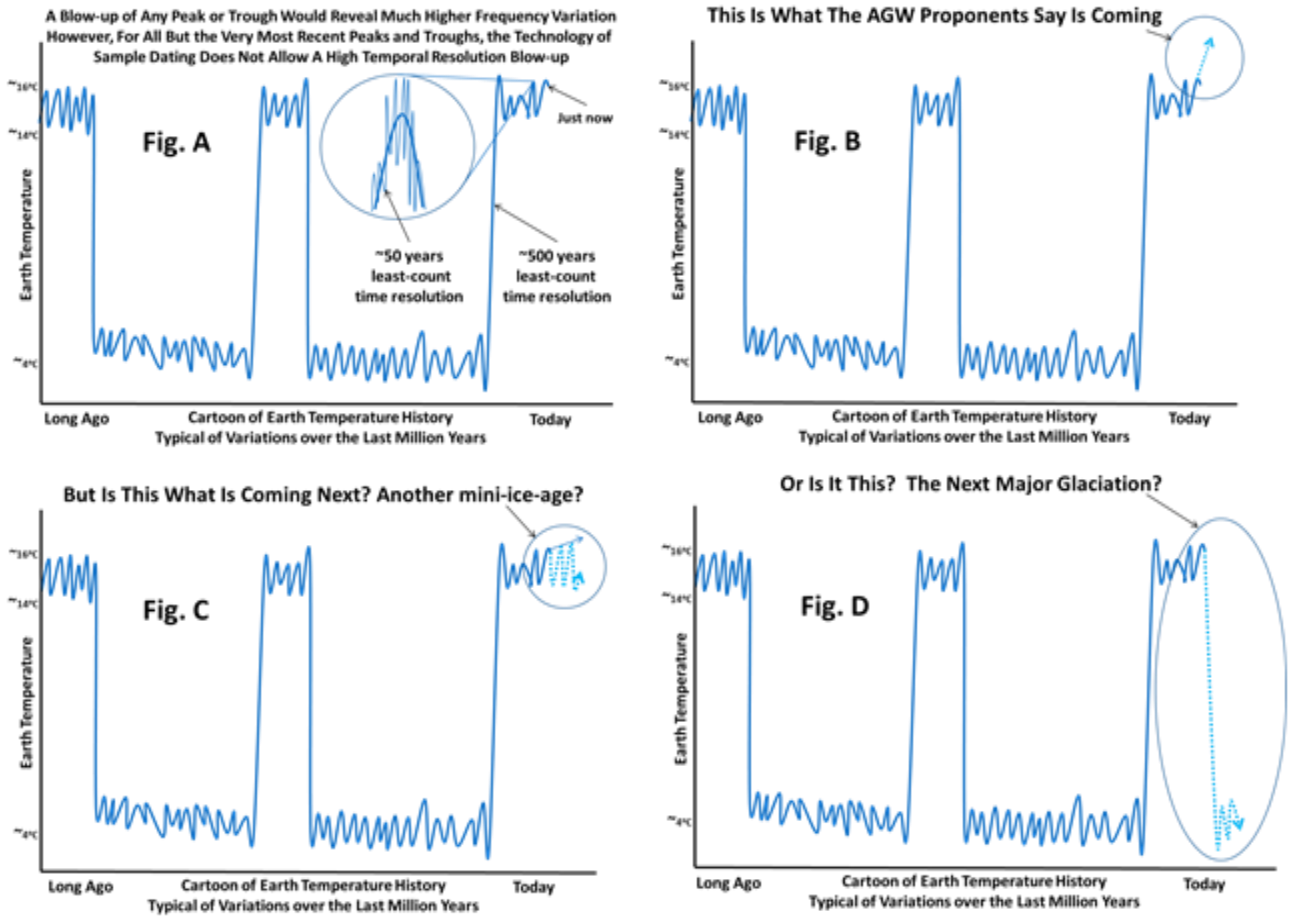
What Should We Be Preparing For?

Many AGW-GHGHE proponents project runaway global warming as in Figure B below. The thinking behind this projection has no basis in observation and no basis whatsoever for likelihood. However, what is likely is that the Earth has begun, or is on the precipice for cooling; and current solar studies strongly support the projection of Figure C. For all the undue alarm that has surrounded the notion of a runaway future, a likely climate return to at least a mini ice-age would indeed have significant global consequence.

But how do we know that Figure D is not in the making? This is a distinct possibility as it would be a continuation of a multi-million year trend. The currently observed levels of earthquake and volcanic activity may very well be an indication of peaking (or, more likely, recently peaked) core geo-reactor kinetics. The next major climate event that humanity needs to prepare for will likely be, at the least, a mini ice-age. But what if it's a major glaciation?

Some as yet unidentified and very powerful climate driver has produced this multi-million year low-frequency but high-amplitude trend. And a major ice-age, even as a low probability, would warrant exceptional and expedient global preparation (I personally believe the probability is quite high, possibly in the realm of a small double digit percentage).

For all their warts, the ice-core analyses makes clear that if this emanate (solar driven) temperature dip is not the next big one, we are nonetheless very close to the next big temperature dip. And for all the misplaced human energy that has been expended with angst over the carrying capacity of an interglacial Earth, the Earthly carrying capacity during a major glaciation will be far less than today. If ever it is appropriate to invoke a "precautionary principle" (and pretty much it never is appropriate), I would suggest that this may be a reasonable issue for such a thing.



Summary

1. Climate science is very complicated and very far from being settled.
2. Earth's climate is overwhelmingly dominated by negative-feedbacks that are currently poorly represented in our Modeling efforts and not sufficiently part of ongoing investigations.
3. Climate warming drives atmospheric CO_2 upward as it stimulates all natural sources of CO_2 emission. Climate cooling drives atmospheric CO_2 downward.
4. Massive yet delayed thermal modulations to the dissolved CO_2 content of the oceans is what ultimately drives and dominates the modulations to atmospheric CO_2.
5. The current spike in atmospheric CO_2 is largely natural (~98%). i.e. Of the 100ppm increase we have seen recently (going from 280 to 380ppm), the move from 280 to 378ppm is natural while the last bit from 378 to 380ppm is rightfully anthropogenic.
6. The current spike in atmospheric CO_2 would most likely be larger than now observed if human beings had never evolved. The additional CO_2 contribution from insects and microbes (and mammalia and un-human-abated forest fire) would most likely have produced a greater current spike in atmospheric CO_2.

7. Atmospheric CO_2 has a tertiary to non-existent impact on the instigation and amplification of climate change. CO_2 is not pivotal. Modulations to atmospheric CO_2 are the effect of climate change and not the cause.
8. Elevated atmospheric CO_2 is best recognized as elevated Vitamin C…(O_2) in that it stimulates all life on Earth to the great benefit of all life on Earth.
9. Human use of fossil fuels beneficially returns sequestered carbon to the life-cycle of the planet.
10. Increased energy consumption is identically equal to increased human prosperity. However, warm climate periods with relatively high atmospheric CO_2 are also historically required to enable human prosperity.
11. The Sun clearly imprints several high-frequency but low-amplitude signatures on climate (ones that dwarf any signature that might be attributable to an atmospheric CO_2 effect as this effect is, so far, immeasurable).
12. We do not yet know the drivers of major low-frequency but high-amplitude climate change. However, these powerful drivers overwrite all other consideration including, for example, solar induced stable latching states.
13. Milankovitch cycles have been extensively studied to only account for small amplitude (Solar-radiative) thermal perturbations at frequencies that may or may not correlate to climate swings. However one intermediate frequency, the 100,000 year (orbital eccentricity) cycle in particular, certainly does correlate and may gravitationally influence the core geo-reactor as speculated herein.
14. The Earth very likely has a core-fission-reactor. Modulations to the output of this geo-reactor's rate of reaction kinetics may very well account for major low-frequency but high-amplitude changes to climate.
15. The next major climate event that humanity needs to prepare for will likely be, at least, a mini ice-age if not a major ice-age. Consequently, greatly expanded energy use will become appropriate. (I hope I'm wrong.)

Finally, regardless of the correctness, or not, of a geo-reactor explanation to major climate change, this salient understanding of atmospheric CO_2 is clearly evident and compels further climate investigation. It invokes very different social, economic and energy policy than is being contemplated. Much more objective, observational and experimental study is needed before further consequential action is taken. Climate science is surely not at all settled.

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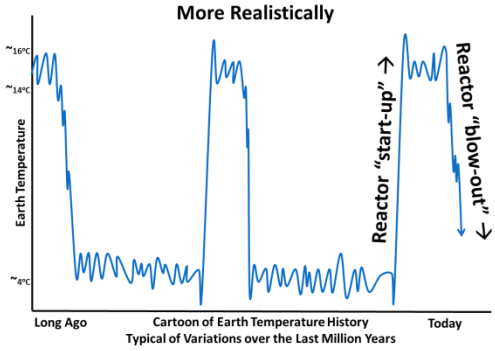
Fremont, CA

Author's Commentary, Further Evaluation and Rebuttals to Critics

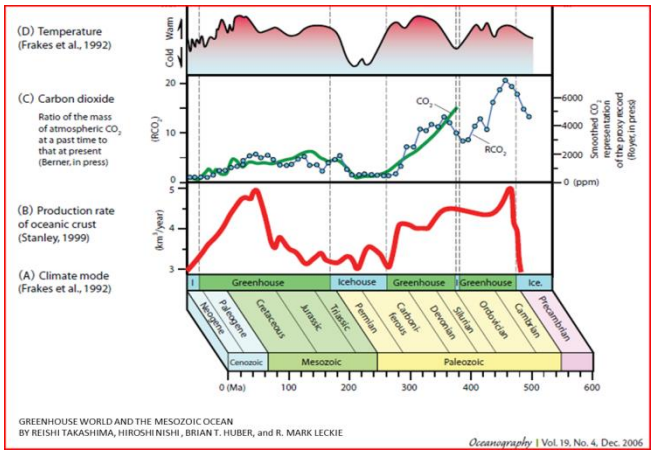
The cartoons used above are distorted from reality to clarify the frequency and amplitude aspects of the temperature variations being discussed. In reality the large amplitude temperature variations are asymmetric as below.



It might easily be so that the gravitationally precipitated "start-up" of a previously "blown-out" core geo-reactor is geologically observed to be a smooth and rapid function, as observed. Once the process begins in nascent form it might likely proceed uninterrupted and very quickly as a relatively high viscosity / low-fluid dynamics situation is transformed to a lower viscosity / higher fluid dynamics one. Only after a geologically short delay would accumulated heat and enhanced reaction kinetics give rise to more vigorous, violent and susceptible activity (as the reactor continues to grow in size).

On the other side, the "blow-out" of this now enlarged and highly energetic reactor is likely to be far more chaotic with its high fluid dynamics. It might be a staged process wherein an initial chaotic external fluid flow scatters one now-giant reactor into a few large spatial components that individually continue to be large enough to be highly reactive. This external fluid flow already had to be very hot to be so dynamic as to enter the central core. This then slows the overall kinetics but possibly only partially. The variously sized reactor sub-components might then likely experience their own chaotic, incoherent shut-downs (dispersions) and occasional restarts as gravitational influences begin to act on these large (now randomly displaced) spatial components of the original reactor. Consequently the whole of the shutdown process might be geologically step-staged over time, as observed, and the asymmetry of large amplitude temperature swings may well be consistent with the overall hypothesis presented herein. (It appears obvious to consider that these asymmetries are fundamental to the primary driver itself and not some artifact of other less influential drivers.)

The figure at right indicates that previous work has shown that at least a broad correlation between climate and oceanic crust creation rate may exist as predicted herein. It is, indeed, difficult to credibly posit alternative explanations as to why or how significant modulations to the production rate of oceanic crust could arise in the absence of a modulation to internally generated heat. This result is already looking to me like a smoking-gun. However, the least-count time resolution at right is a few million years (in its near term and 10's-100's of Myrs thereafter) such that a relationship on the scale of 100k years would not be temporally resolved at all. Recent work at University of Wyoming has improved the technology of dating ocean crust samples such that a much more definitive and detailed relationship may be able to be revealed.



I have considered herein how the 100,000 year Milankovitch cycle (orbital eccentricity) might instigate the shutdown of a peaking core geo-reactor as at this presumably chaotic time the reactor is more susceptible to the perturbations of celestial mechanics. However, on further reflection, I must admit this speculation requires some extraordinary and unlikely timing. i.e. That the reactor starts up and rapidly climbs to its peak output (repeatedly) just in front of a 100,000 year Milankovitch gravitational perturbation. This is not likely, so let me try something else that may work.

Suppose that a previously shut-down reactor has gravitationally precipitated to a high-proximity-density situation that is lacking appropriate moderation to chain react. A 100,000 year Milankovitch cycle then provides a unique fluid flow event that gives rise to an appropriate core insertion of a natural moderator from the surrounding (when the Earth's orbit becomes nearly most elliptical, the convolution of this event plus, say, a planetary alignment of Venus or, Jupiter and Saturn, to the Earth, may provide the gravitationally perturbed impetus for such an event). The reactor then suddenly lights up (chain-reacts) and provides the energy for a rapid climate transition to interglacial.

When peaking in output the reactor may generally grow to become so energetic as to become inherently unstable (for the current availability of fuel). Before long virtually any random perturbation then initiates the step-staged shut-down process described above. This line of thinking comports much better from a synchronization standpoint but requires the introduction of a moderator (normally required***) that I personally have no insight into. However, from a timing standpoint the more easily accepted requirement in this scenario is for gravitational precipitation to slowly give rise to a new high-proximity-density situation that is again lacking appropriate moderation to chain react; and to do so over the ensuing ~90 thousand years. The process then repeats. This might better be how it goes.

> ***It is certainly so that human built nuclear power generating facilities require moderation to sustain a chain reaction in order to slow emitted neutrons to a kinetic energy range that allows a far greater level of interaction with surrounding nuclei. However, the available mean-free-path of an emitted neutron in human built reactors is measured in meters (or even fractions thereof). The available mean-free-path of a neutron emitted in a core geo-reactor is likely measured in kilometers and possibly even 10's or even 100's of kilometers (several orders of magnitude larger). This fact very likely plays a substantial role in the differential nature of moderation requirements that would apply to a core geo-reactor. Further, the exceptionally high operating temperature and pressure of a core geo-reactor are so radically different from human built reactors as to raise many other issues as to how, why and when a chain reaction might be sustained or terminated.

The 100ky Milankovitch cycle is confoundedly known as having a particularly small radiative thermal influence while having the strongest temporal correlation to major climate change (even if 180^{O} out-of-phase – an issue resolved herein). However, if I am right about this perturbation instigating the "light-up" of a core geo-reactor then another correlation can be predicted. The ice cores give a temporal spacing between major transitions to interglaciation of about 100kys but with some variability. This variability may result from the gravitational convolution speculated above. i.e. When the Earth's orbit becomes most elliptical (~100kys spacing) it is essentially at its peak eccentricity for a few hundreds of years on either side of this peak; and during this several hundred year window of essentially maximum eccentricity there likely will come to exist an incoherent first convolution with planetary alignment of Venus at Earth's perihelion or Jupiter/Saturn at Earth's aphelion (one or the other of these events may be the repetitious trigger event but possibly both, or a series of them, are required to achieve some internal resonance from coming at regular intervals). The incoherency of these convolved events may explain the modulations to the timing of major transitions from glaciation to interglacial. Such critical celestial timing may be readily resolved today if looked for.

Other work has estimated the current output of a potential core geo-reactor at only 3TW while the Earth is estimated to be exothermic to the tune of 44TW. The distributed radioactive decay component of this 44TW total is estimated at 20TW. But the combination of a geo-reactor's output plus distributed radioactive decay pretty well has to add up to the overall exothermic Earth value. So it's not clear how well any of these numbers can be relied upon. The "geologically real-time" overall exothermic value of 44TW may well be the most reliable figure. However, even if the geo-reactors output was substantially the whole of this 44TW estimate that would only translate to a miniscule $0.09 W/m^2$ if uniformly presented to the Earth surface. This tiny thermal contribution may not be considered of significant climate consequence and seems to fly in the face of some of the argument presented herein.

However, this tiny thermal contribution (perturbation) ought not to be considered the same way that radiative forces are dealt with normally. This 0.006 - 0.09 W/m^2 (from a 3 - 44TW reactor) is not likely to be spatially or temporally homogeneous when it arrives at the surface. It is likely presented to the surface via sporadic regional magma upwellings. And as such its intermittent and spatially confined presentation to the surface might likely produce observable climate modulation on regional if not global scales for short periods (just a few to 50 years or more). These speculated phenomena may well be largely indistinguishable today from solar driven high frequency but low amplitude climate variation. And possibly these perturbations arrive under the oceans (in an Old-Faithful like "accumulate-then-release, accumulate-then-release" fashion) to give rise to ENSO and PDO type phenomena.

Further, these geologically "real-time" estimates are quite reasonably presumed not to be the peak transitional values. That is, ~18,000 years ago some very powerful climate driver catapulted the Earth from glaciation to interglacial. This may have been a core geo-reactor driven event where the reactor output rapidly climbed and peaked at, say, 500-1000TW of power for a period of many hundreds or even thousands of years. In this case there are 1-2 W/m^2 on average (also likely to arrive in a somewhat spatially and temporally inhomogeneous way) coming from under the ice and snow such that an abrupt transition to interglacial could be expected.

However, this current interglacial appears to have statistically run its course for duration (it's longer than 5 of the last 6 recorded in the ice-cores by some estimates). And that might be because a geologically recent "blow-out" has occurred to yield a significantly diminished reactor output of somewhere up to, possibly near, 44TW. And as speculated above gravitational precipitation may now drive fits of chaotic restarts and shutdowns as fissile materials migrate back to the center.

So, several things can be said about these radioactive power estimates:

1. The 3TW estimate is one which is teased from the data while great uncertainties surround our understanding of materials and nuclear processes at intense temperatures and pressures leading to a possible significant underestimation.
2. The current geo-reactor estimate might reasonably be valued at anywhere between 3TW and 44TW. If the 20TW distributed radioactive decay estimate is relied upon then the current geo-reactor output might be presumed to be 24TW (44TW-20TW).
3. We don't know what time lags exist and as such a current, geologically real-time 3-44TW estimate might represent the output of a recently "blown-out" geo-reactor that a geologically short time ago was producing far more output – in which case we are on our way toward a major glaciation. See Figure D above.
4. Yet another possibility (I think somewhat unlikely), a current, geologically real-time 3-44TW estimate might represent the output of a very recently re-establishing geo-reactor that in a geologically short time may begin producing far more output – in which case we may be on our way toward a new warm climate optima, notwithstanding a likely solar-driven near term mini-ice-age. And as such we can expect significant further increases in earthquake/volcanic activity and, less consequentially to humankind, increased rates of continental drift (this, in spite of a near term solar driven mini-ice-age). See Figure C above.

Some might reasonably argue that the guess of peak transitional reactor power I've used above (500-1000TW) is extreme in that it implies a modulation to a natural process at 90-95% or even higher. To wit I respond 1) while this level of natural modulation seems high, nothing prohibits it from being so high - after all we are talking about modulations that involve the transitions between chain-reacting and not, and 2) suppose then that the reactor peaks at 250TW for a more easily accepted modulation of 80-90%. This still results in ~0.5W/m^2 on average at the surface. And keep in mind that just 4cm of snow has an albedo of ~90% across the infrared to deep infrared. And here the snow is insulating the heat escape from below such that the heat will accumulate till the ice and snow surely melt.

Some have argued that the Earth may have been an ice-ball one or more times in the past (the Snowball Earth hypothesis). This is an issue of considerable controversy and it nonetheless has little to do with the positions presented in this essay. If you presume a very cold, highly glaciated, ice-ball state for the Earth, the argument against CO_2 or the Sun and in favor of some other "truly pivotal" driver gets yet more compelling. However, a discussion of the ice-ball Earth possibility provides a useful segue into a short discussion of cosmic-ray/cloud theory.

Let's suppose a globally ice-balled Earth. Global mean air temperature is at, or most likely below, 0^oC. The liquid underlying oceans are rich in CO_2. The atmosphere is dry with very little CO_2. And Earth's albedo is very, very high. This is a latched-up-**hard** cold state. Most all of the Sun's UV and visible radiation is reflected from the surface. And consequently there is little shift from incident UV and visible (high energy photon) to infrared (low energy photon) wavelengths. So the atmosphere, which not only has few greenhouse gases to trap infrared radiation, has very little infrared radiation to trap (if this happens at all). How then does the Earth suddenly jump from this latched-up-**hard** cold state to a subsequent interglacial? If CO_2 or the Sun did somehow play a significant positive-feedback role in getting to this super-cold state (which they most likely did not), just where do we go from here without invoking a yet vastly more powerful and unidentified climate driver to force a glacial termination (one which is, in fact, pivotal)?

Some might like to speculate that a massive volcanic event might spew so much black ash as to significantly diminish the ice-balled Earth's albedo (after being spread around) at the same time that it contributes a large atmospheric injection of both CO_2 and water vapor. But such events cannot go geologically unnoticed and they are simply not in evidence.

The tiny radiative perturbations of Milankovitch cycles are not likely to explain this subsequent transition to interglacial for obvious reason (a high albedo Earth is not going to be responsive to tiny solar perturbation). And neither can cosmic-ray/cloud theory in that this theory deals with cloud induced albedo modulations that become largely irrelevant to a high albedo glaciated Earth. i.e. You cannot very well modulate a white ice-balled Earth to be more or less white buy modulating cloud cover. If you try to do such a thing you have to turn the cosmic-ray/cloud theory up-side-down and speculate that more clouds warm the Earth rather than cooling it as fewer clouds cannot reverse this ice-balled scenario. And in this dry cold atmosphere there is little water vapor for cosmic-rays to seed as clouds in any event.

A similar problem exists in the reverse to use cosmic-ray/cloud theory to explain major transitions to glaciation. Cosmic-ray seeded enhanced cloud cover might well cool an interglacial Earth, but it's not going to get very cold before there is little water vapor left to continue the process.

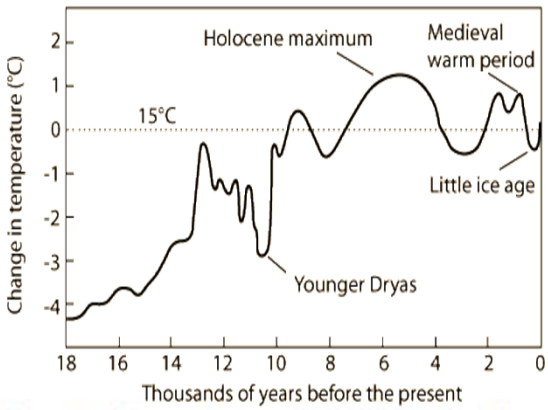
Cosmic-ray/cloud theory likely does help explain high-frequency but low-amplitude solar signatures during an interglacial. But using it to explain major transitions to and from glaciation is somewhat problematic. (Separately, it seems to me that a more complete understanding of cosmic ray modulation might significantly enhance the temporal certainty of ^{14}C dating technology.)

One of the predictions included in revisions of this essay since 2009 has been:

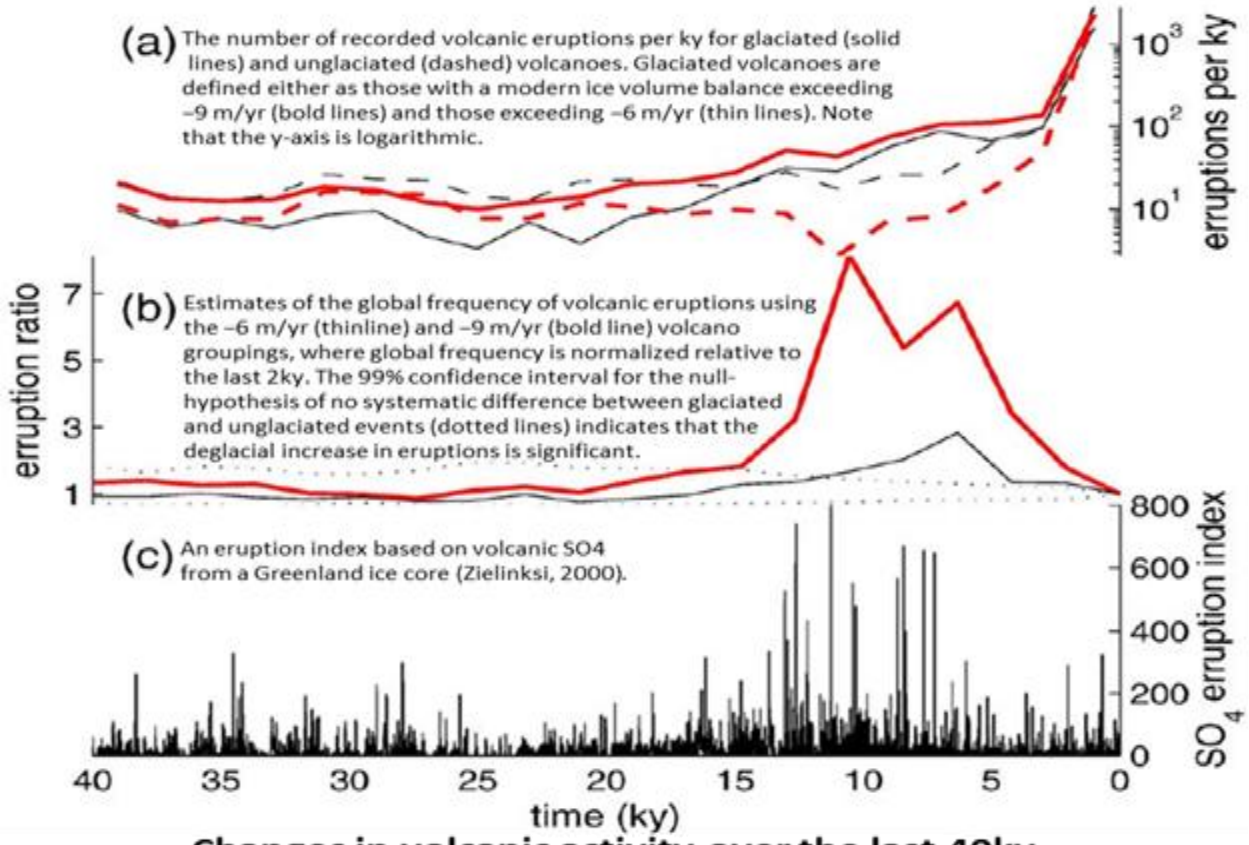
> Let's assume that there is a central core-reactor and that its output variability truly accounts for major climate transitions. There should then be some correlation of the timing of major climatic transitions to volcanic activity though this has not been established despite several attempts. But that might be because we've looked for the wrong correlation as the AGW CO_2-biased attempts at establishing a correlation have looked for major volcanic events to precede transitions from glaciation-to-interglacial. But if central-reactor variability is the real cause, then increased volcanic/earthquake activity might more likely follow transitions from glaciation-to-interglacial. And then reductions in volcanic/earthquake activity might more likely signal the reverse transitions from interglacial-to-glaciation. Maybe this correlation can be established if it is objectively looked for?

Well…I believe I found that that correlation may in fact exist. Recently a paper by Huybers and Langmuir titled: "Feedback between deglaciation, volcanism, and atmospheric CO_2" has come to my attention.

An excerpt from that paper is shown below estimating total earthly volcanic activity over the last 40k years. The figure at right is roughly aligned to scale to facilitate observing earthly temperature variation over the last 18k years (during which the most recent climb from major glaciation has occurred). It is readily apparent that increased volcanic activity might more likely follow transitions from glaciation-to-interglacial. Further, and assuming that we are, indeed, on our way toward the next major glaciation, it would appear that reductions in volcanic activity might more likely signal the reverse transition from interglacial-to-glaciation.



P. Huybers, C. Langmuir / Earth and Planetary Science Letters 286 (2009) 479–491



Changes in volcanic activity over the last 40ky.

Drs. Huybers and Langmuir agree that increased terrestrial volcanism follows deglaciation (increased by 6X and more; and this then might suggest a natural modulation to the core geo-reactor of >85%), They go on to speculate that reduced glacial pressure loading is what incites the increase - in spite of some spatial inconsistency. As a corollary to this thinking they speculate that sub-marine volcanic activity might be reduced during an interglacial due to increased loading. However, my prediction is that this too increases during an interglacial (i.e. future proxies of long term oceanic CO_2 or SO_4 content or by other means may be able to validate that sub-oceanic volcanism also increases during an interglacial – coherently with observed terrestrial volcanism). Note: figure (a) in the preceding graphic is heavily influenced by observation bias and doesn't speak to the magnitude of the events. Figure (c) is most likely to capture the integration of both the number of events and their magnitude.

This particular and most recent glacial termination is the only one we can observe with high temporal resolution. It began to occur ~18ky ago. The preceding termination began ~118ky ago, and the one before that ~218ky ago, and so on. So it becomes obvious as to why the detailed timing of this one transitional event is most well-known. Consequently, this is the only transition where we might observe a core "start-up" process in detail. It may be that a core geo-reactor event, sometime around or before 18ky, was primarily responsible for this most recent transition to interglaciation. But then there is that Younger Dryas event which confounds many and continues to be inadequately explained. However, in the context of a core geo-reactor, it might readily be incorporated. So let me give that a try.

There may well be fits of chaotic start-ups, blow-outs and re-starts associated with the whole of the core geo-reactor "light-up" process (though most likely temporally compressed and therefore largely unobservable in prior transitions,

i.e. nuclear transitions into high energy chaos will likely happen far more quickly than transitions out of that higher energy chaos). We can see in this most recent glacial termination where the surface temperature effect of an initial core "light-up" takes place smoothly from 18ky to 13.5ky. But then between 13.5ky and 13ky we see the surface effect of the reactor whose output has climbed very, very rapidly – presumably resulting in more vigorous, violent and susceptible activity internal to the reactor. The ensuing period, from 13ky to 10.5ky is when the reactor almost experienced a complete "blow-out" event. (And had a complete "blow-out" occurred, the size and duration of a consequently diminished and abbreviated interglacial would still fit within the distribution of sizes&shapes observed over the last 1My.) But fortunately for us, the reactor re-started to significantly extend the duration of the current interglacial. We can also observe the delayed, as predicted, volcanic activity that would be associated with these geo-reactor modulations. It may be that those who study detailed celestial mechanics could shed some light on the timing of gravitational perturbations that might coincide with the overall geo-reactor "light-up" and "re-light-up" timing of these events (both events occurring within the most recent maximum elliptic, but ~7kya apart).

Also, it appears that the reactor activity was still sufficiently high (or there at least continued to be sufficient thermal residue), at the time of the solar Maunder Minimum (Little-Ice-Age), to avert a crash to the next major glaciation. But solar scientists are now reporting that solar conditions, similar to the ones that are believed to have produced the Maunder Minimum, are now developing within our sun. If true, then conditions would appear quite ripe for the next plunge to major glaciation (if not this solar cycle these drivers will, nevertheless, soon constructively interfere to force the next major glaciation).

Some geologists have great difficulty with my hypothesis on the basis that, according to their thinking, the conduction of geo-reactor heat from the core to the surface would require many millions of years. And I agree with them that heat transported by "conduction" would take an extraordinarily long time – disconnecting with my hypothesis. However, it is not difficult to imagine that if a core geo-reactor were to suddenly "light-up" and peak at 250-1000TW of power, the ensuing heat transport processes would become dominated by very rapid convective processes. And the fact that we don't observe much in the way of "very rapid" convective processes today might simply be a function of the hypothetical "blow-out" event that may have occurred a few thousand years ago. To the extent that this hypothesis prevails, it can be inferred that the convective time delay associated with modulated heat transport from core geo-reactor to surface (for the re-light-up case at least) might be only several hundred years (and possibly even less). While the volcanic activity data suggest that a substantially complete "blow-out" event may have begun to occur ~6-7ky ago.

Near the top of this essay I made the statements: "The most vocal proponents of AGW-GHGHE theory are reduced to literally ask: "How else do you explain it?" But that is not evidence." Let me explain these statements further in that I believe it's an issue that ties strongly into there being no generally acceptable explanation of "major" climate change.

Scientists like Hansen and Mann tend to dismiss solar influence; not because it can't adequately explain high-frequency but low-amplitude climate change as observed through the Holocene; but because it's difficult to imagine a solar explanation to major climate change in the absence of powerful positive feedbacks. And when you invoke powerful positive feedbacks to create an explanation, you then get caught up into alarming tipping-point hypothesis.

Both of these scientists have been confounded by their studies of Venus. Its surface temperature is far higher than radiative-balance calculations would predict. I believe the answer to this dilemma is that Venus too has a core geo-reactor - but one with sufficient conditions of fuel availability and moderation such that the reactor is essentially on-hard in perpetuity – and not that its dense CO_2 rich atmosphere is the sole explanation, or even an explanation at all.

Two additional comments: 1) the Faint Young Sun Paradox might well be best explained by a core geo-reactor in that a Young Earth Core Geo-Reactor is likely to have been more energetic than today and 2) a portion, and possibly a large, even overriding portion of the 33^{o}C black-body discrepancy that is normally assigned solely to greenhouse gasses is likely attributable to a core geo-reactor (keeping in mind the likely spatial and temporal inhomogeneity of a core geo-reactor output and its integrated and averaged effect over extended time).

Clearly this entire essay is dedicated to the possibility (I think likely) that not only are the perturbations of the Sun and cosmos consequential to Earth's climate but so are perturbations to the Earth's internal energy source. And there is, I believe, good reason and evidence to suggest that this internal influence may well be the most significant influence of all based on its potential variability (chain-reacting or not) and opportunity to influence low frequency but high amplitude climate change. It may well be the hammer we've (I've) been looking for. And it can be validated (or not).

On the other hand, even if major climate change isn't driven by geo-reactor weather variability (which it likely is), it seems strange to me to speculate that, based on Milankovitch cycles, we are hundreds or thousands of years from the next major glaciation. For all their warts, the ice-core analyses makes clear that if this emanate (solar driven) temperature dip is not the next big one, we are nonetheless very close to the next big temperature dip. We cannot tell today, and likely won't know for yet another 15 years or likely more, if this is a major move to glaciation – but it is a distinct possibility. And if true, we only have a few generations to make major preparation.

Geologic history suggests that the life carrying capacity of the planet will take a divide by 2-4 hit even if the next major glaciation is just average in scope. Today's technology will minimize this hit to the human species – but it cannot be fully mitigated. There will be huge losses. For all the misplaced human energy that has been expended with angst over the carrying capacity of an interglacial Earth, the Earthly carrying capacity during a major glaciation will be far less than today - and horrendously consequential.

Mass hysteria management will be required globally as unprecedented social unrest sweeps through all societies. Few, if any, will be immune. New power generating facilities should be located and facilitated with this possibility in mind. Exploitation of northern (and extreme southern) energy reserves might be stepped-up as this exploitation may likely become impossible during an extended glaciation. Other more equatorial energy reserves might be saved for later exploitation. Significant development of nuclear power and safe storage of nuclear fuel would make sense.

If this sounds overly dramatic…maybe so, then please show me that no correlation exists between crust creation rate and climate. And then, more importantly, explain why the obvious clockwork signature of the last million+ years is going to be interrupted, to yield something more favorable to us this go-round, just because we are here.

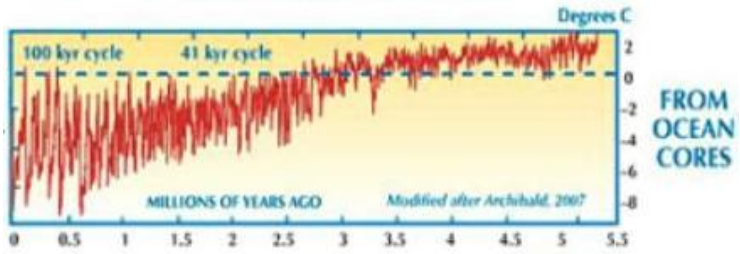
Hypothesis Summary to a Geo-Reactor Explanation of Major Climate Change

Any attempt to confine the scope of major climate change drivers to CO_2 or solar phenomena (or both) is bound to run afoul of "first principles". There simply is no climate "hammer" to be found in these areas. Without a "hammer" we become compelled to search for powerful positive feedback amplifiers to explain major change driven by small perturbations. But such amplifiers always and intrinsically lead to an unstable and precarious system (and therefore, most likely don't exist). The Earth is some 4.5B years old. And we know that the climate has been remarkably stable (in spite of what we consider to be major climate change) for the last 3.5B or so of those years (~+/-6-10^{O}C). It simply cannot be so that extraordinary interventions allowed a steady stream of calamities to be dodged, each and every time, throughout these last 3.5B years, such that no positive-feedback runaway event could occur. Somewhere there must be a "hammer" – a powerful and overriding, yet limited in extent, driver **that comes and goes without feedbacks, positive or negative**. Otherwise we would not be here to debate this issue. The intrinsic instability of a system where small perturbations are amplified by powerful positive feedbacks is a system that will soon experience a runaway condition. And in the case of this Earth, it would have happened long ago.

An examination of the ice core data reveals that this hypothetical climate "hammer" is able to move the nominally equilibrated mean temperature of the Earth by as much as 10-12^{O}C as its modulating effect comes in and out of play. I propose that this temperature modulation arises from a core geo-reactor that takes on two primary states. In one state, its fissionable materials are relatively scattered such that the reactor kinetics are characterized by little chain-reaction. It is in this state that the Earth experiences major glaciation. In the other state, the core geo-reactor's fissionable materials are highly proximate and appropriately moderated such that the reactor kinetics are characterized by a great deal of chain-reaction. It is in this state that the Earth experiences the warming of an interglacial period.

I further propose that in the early history of the Earth, when the nuclear fuel available to power this geo-reactor was more abundant, the geo-reactor's duty-cycle was characteristically in the "on" state, with only sparsely spaced shorter periods of scattered low activity. Collectively these epochs are known as the "hot house". As time passed and fuel availability diminished the geo-reactor's duty-cycle shifted over time to the state of affairs observed over the last several million years (most likely many). This more recent duty-cycle is characterized by generally being in the "off" state with only sparsely spaced shorter periods of high activity. Collectively this more recent period of time is also known as the "ice-house". (Fuel availability may have shifted the duty-cycle rather abruptly ~25M years ago.)

I further propose that the impetus for generating these recent, sparsely spaced, shorter periods of high activity has become synchronized to the celestial mechanics of the 100k year Milankovitch Cycle of orbital eccentricity (for the last 1My or so). And while the classic interpretation of Milankovitch Theory has been confounded in that it expects glacial events to fall on eccentricity maxima, when empirical data show them falling on eccentricity minima the proposal herein resolves this matter. According to the proposal herein, eccentricity maxima incite high geo-reactor kinetics for a limited period of time (an interglacial), leaving the longer glacial period to exist during eccentricity minima.



Further, during the 4My prior to the last 1My, I propose that the intermediate fuel availability of this period allowed the synchronization to be paced by the smaller, more rapid celestial perturbations of obliquity and/or precession.

If the foregoing statements are true, there should be a significant correlation to be discerned between rates of tectonic activity and large scale Earth temperature swings. In order to determine rates of tectonic activity over time it is required to accurately date sub-ocean crust samples. However, the current state-of-the-art regarding oceanic crust sample dating is very limited. Least count time resolution of this type of sample dating has, until recently, been limited to a few million years leaving no opportunity to observe a tectonic activity rate relationship to the 100ky orbital eccentricity cycle. Recent work at the Univ. of Wyoming has provided an improved, albeit laborious and expensive, dating technology for sub-oceanic crust samples. The new technique yields a least count time resolution of ~10ky which should be readily capable to resolve the proposed relationship.

In the event that the proposed relationship can be definitively established, I further propose that this would constitute substantial and compelling evidence of major climate change being primarily driven by geo-reactor energy output variability. Only a very short time ago we considered solar activity to be substantially invariant. We now know otherwise. It may well be so that the core geo-reactor is similarly highly variant, but yet more consequentially so; and currently synchronized to orbital eccentricity.

Dr. Murry Salby's recent analysis of the Mauna Loa CO_2 record has confirmed that the current spike in atmospheric CO_2 is largely, if not essentially entirely natural. His work also confirms CO_2's minimalist, if not non-existent, climatic effect. Meanwhile, solar scientists are making great progress at explaining the natural causes of high-frequency but low-amplitude climate variation during this most recent and current interglacial.

However, when it comes to low-frequency but high-amplitude climate change, there is a dearth of acceptable scientific explanation. Many are trying to extend the high-frequency but low-amplitude effects of solar and cosmic ray influences into this low-frequency but high-amplitude domain – but with limited to marginal success, at least so far. And CO_2 is rightfully no longer in the running for such a possible explanation. We now debate exactly how minimalist CO_2's influence so obviously is and whether or not its influence can actually be detected. Meanwhile solar drivers are easily validated with their substantial influence (at least solar drivers are substantially influential during an interglacial but not likely the prime-driver for major transitional events).

Yet it appears manifest that these major climate swings are caused by an overriding and truly "pivotal" driver – one whose influence handily overrides the substantial albedo modulations of solar and cosmic ray influences. I submit that there must be another yet far more consequential driver whose investigation warrants exceptional attention. This essay attempts to point the science community toward a possible explanation of major, low-frequency but high-amplitude climate change.

Admittedly, this essay contains many raw speculations regarding a central core geo-reactor's potential weather variability. However, science is about testing testable hypothesis. I submit that I've laid out a plausible hypothesis that attempts to explain many broad observations - and one that is indeed quite testable. I've also made several supporting predictions that are, themselves, individually testable. At the highest and most salient levels, this hypothesis rings true over extended time and right through to the very present.

It seems to me that a detailed analysis of the long term time-dependency of continental drift rates would have great value in many other regards, even if it is uncorrelated to major earth climate swings. But I'll be surprised if the correlation is not there.

I'm not personally in a position to test this continental drift rate prediction, but here in California we would call this "low hanging fruit". I'm hoping to get this essay to some bodies that may appropriately already have the data and temerity to look for the predicted correlations.

End of current rebuttals. Now as Buzz Lightyear would say: To Infinity and Beyond!

How Might We Avert the Next Major Glaciation?

Some may likely accuse me of "going Sci-Fi" with what I'm about to suggest. Others may want to assert that I already went Sci-Fi starting with my introduction to a geo-reactor explanation of major climate change at p7. Nevertheless, I'm compelled to take things a step or two further.

Let's assume that the salient elements of this essay are substantially correct. The Earth's major climate swings are largely driven by geo-reactor weather variability. The reactor has recently experienced a natural cyclical "blow-out" event starting ~6-7ky ago. The Earth is heading for the next major glaciation (geo-reactor and solar influences will soon constructively interfere). And my descriptions of the events of the Younger Dryas are also largely correct.

Humanity may be able to artificially recreate a core "re-light-up" so as to yet further extend this current interglacial (possibly by several hundred or even thousands of years). The celestial perturbations that extended this interglacial from the Younger Dryas are most likely far too big to recreate, of course. But the Earth's core most certainly has a natural resonance. And resonance is extraordinarily powerful if maintained long enough with appropriate coherency. Presumably, seismic analysis can reveal the nature of this core resonance in sufficient detail such that we could act. A series of appropriately timed, deep underground thermonuclear detonations may be able to ring the nuclear core's bell much like what celestial mechanics did for it at the Younger Dryas (to essentially recompose and reset the reactor). I'm thinking here of possibly several dozen critically timed detonations – ones that are engineered as shaped-charges directed at the core of the Earth. Sounds crazy…but maybe not too crazy.

Now let's go Sci-Fi yet one more step. Let's suppose that sometime down the road we give this core "re-light-up" an anthropogenic try and we find that we prevail. We now may have the best possible recipe for terraforming Mars. Being much smaller, Mars' geo-reactor lit for a while but ultimately blew-out and never re-lit. Some residual geo-reactor activity may likely still remain even though its magnetic field is essentially gone. Through a series of appropriate investigations we might acquire sufficient knowledge so as to repeat a similar process on Mars and re-light its core geo-reactor – and possibly the investigations and "light-up" process could be performed without ever necessarily putting a human foot on the ground there.

With its geo-reactor re-lit, Mars would develop a magnetic field; develop a denser atmosphere; warm to release lakes of liquid water; and generally become more habitable. Introduction of appropriate microbes could then go about the business of transforming its CO_2, H_2O, and N_2 rich atmosphere into one that is appropriately oxygen rich. These transformations would not have to happen on natural geologic time scales. Humans might be able to freely walk around on Mars in as little as 1-2 hundred years from now - and possibly even sooner. Some might consider it prudent to explore this re-light-up process on Mars first though I doubt it could happen that way. We may need for it to work here on Earth in fairly short order.

On to predictions:

Six Specific Predictions of the Geo-Reactor Hypothesis

If any one of these following six predictions is invalidated, my hypothesis is largely (if not entirely) invalidated. On the other hand, if they are all validated, I then assert that Earth's major climate change is, in fact, largely driven by variable geo-reactor kinetics.

I predict that:

1) The current rate of continental drift* is somewhat diminished from what its rate was near the beginning to the middle of the Holocene (but likely only marginally so, and possibly almost indistinguishably so, but nonetheless a diminished current rate as compared to early Holocene).
2) That both of these above rates of drift (on either end of the Holocene) are quite distinguishably higher (> 2X and likely 5-10X) than what existed during the previous major glaciation – say, higher than during the period of 25ky ago.

> *The use of the term "continental drift rate" above is just as well replaced with "tectonic activity rate" or "production rate of oceanic crust".

I further predict that:

3) Some exceptional Earthly gravitational perturbation, or confluence of such perturbations**, occurred ~18ky ago (say, within a range of, 32-16ky ago) to initiate a core geo-reactor light-up.
4) A subsequent exceptional Earthly gravitational perturbation, or confluence of such perturbations**, occurred ~11ky ago (say, within a range of, 19-10ky ago) to initiate a core geo-reactor re-light-up.

> **When the Earth's orbit becomes most elliptical there likely will come to exist an incoherent first convolution with planetary alignment of Venus at Earth's perihelion or Jupiter/Saturn at Earth's aphelion (either or both, possibly, even likely constructively interfering with lunar perturbation). One or the other of these gravitational perturbations may be the repetitious trigger event that recomposes and resets the geo-reactor. But possibly (even likely) both, or even a series such events are required to achieve some internal resonance from coming at short intervals.
>
> In both cases, 3) and 4) above, there is expected to be a delay between an exceptional gravitational perturbation result predicted to be found within the "say-ranges" above and the current Earth surface change estimates (18ky and 11ky). These delays are owing to some unknown time delay between the core "light-up" initiation and its corresponding Earth surface effect. The expected delay in the first of these (item 3) is predicted to likely be a longer delay than what may be expected for the re-light-up case of item 4, as thermal transport channels would not yet have fully dissipated. And these transport channels likely haven't yet fully dissipated even as of today - allowing the continued potential expedient benefit of the proposed anthropogenically induced relight-up process articulated above in this essay.
>
> These statements assume that there is one primary perturbation, or one primary confluence of such perturbations, within each "say-range" which can be identified as the potential instigator of enhanced geo-reactor kinetics. Unfortunately, it isn't necessarily so that there will be only one such event within each "say-range" (even as there certainly will be one incoherent **first** such event and then one incoherent **second** such predicted event – both occurring incoherently within the time frame of the most recent "essentially maximum" Earthly orbital eccentricity). Nonetheless I'm expecting that there will, in fact, be some readily identifiable confluence of events, in each case, that stands out as an identifiably exceptional gravitational perturbation (ones that meet some quantifiable minimum perturbation level that can be subsequently observed as causative in prior glacial terminations).

I further predict that:

5) Sub-oceanic volcanism has increased/decreased coherently with terrestrial volcanism during the prior major glaciation and into/through the Holocene.
6) The bulk CO_2 content of the oceans has been rising during the Holocene owing to the sub-oceanic volcanism of item 5.

Regarding predictions 1 and 2, the University of Wyoming is a recent developer of enhanced sub-oceanic sample dating technology which is likely to be able to validate, or repudiate, items 1 and 2. This University has respectfully complained of a full plate, competing priorities and funding issues regarding my request for further investigation. Maybe some of you have ideas as to how these obstacles might be overcome? Or maybe you can suggest an alternative investigator?

Regarding predictions 3 and 4, Dr. Willie Soon has also respectfully complained of a full plate, competing priorities and funding issues. Maybe some of you have ideas as to how these obstacles might be overcome? Or maybe you can suggest an alternative investigator?

Regarding predictions 5 and 6, I'm quite open to suggestions as to how to proceed with validation or repudiation.

3/1/2014: Another prediction regarding this hypothesis has occurred to me. There are several Earthly volcanic island chains that are composed of a chronological series of island creations. It's likely that dating of these individual island creations will show that their appearances tend to be coherent with the timing of interglacials so as to support prediction 5) above. However, this will not be easy as a cursory look shows these island creations to appear over very great periods of time and likely the result of many episodes before reaching the ocean surface.

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