Butterfly Effect Climatology

by Clark M. Thomas

The psychedelic idea of hurricanes or tornadoes on one side of the planet being caused by a butterfly's wings flapping thousands of miles away does cause the mind to flutter. There is in systems theory, under very specific conditions, some justification for large effects possibly following very small events. Nevertheless, not even a large swarm of butterflies flapping wings in unison could by themselves cause any great storm anywhere.[1]

This "flying-flowers insect model" nevertheless opens doors to multiple revelations, and not just about the science of climatology and weather phenomena. An entire field of chaos theory has been inspired by this idea.

[1] https://unsplash.com/photos/Bc9wfAYSJrI

Human thought (intellectual and psychological) is the product of many things, both historical and systemic. We have recently been uniquely able to magnify our logical intelligence through partnership with increasingly powerful calculating machines of our own creation. Here is where our story begins:

From Weather Forecasting to Chaos Theory

Edward Lorenz, as a young mathematician after WWII, was fascinated by weather forecasting. It was difficult to accurately forecast out several days, or even within a day or two. Soon arrived the early computers, giant beasts capable of crunching large amounts of input weather data, and evaluating the results with predictive algorithms. However, these early brainy beasts were hardly better at predicting. What was the real problem?

When he died at 90 from cancer, his obituary said in part:[2]

> A professor at MIT, Lorenz was the first to recognize what is now called chaotic behavior in the mathematical modeling of weather systems. In the early 1960s, Lorenz realized that small differences in a dynamic system such as the atmosphere--or a model of the atmosphere--could trigger vast and often unsuspected results.
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> These observations ultimately led him to formulate what became known as the butterfly effect--a term that grew out of an academic paper he presented in 1972 entitled: "Predictability: Does the Flap of a Butterfly's Wings in Brazil Set Off a Tornado in Texas?"
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> Lorenz's early insights marked the beginning of a new field of study that impacted not just the field of mathematics but virtually every branch of science--biological, physical and social. In meteorology, it led to the conclusion that it may be fundamentally impossible to predict weather beyond two or three weeks with a reasonable degree of accuracy.
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> Some scientists have since asserted that the 20th century will be remembered for three scientific revolutions--relativity, quantum mechanics and chaos.

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[2] http://news.mit.edu/2008/obit-lorenz-0416

> "By showing that certain deterministic systems have formal predictability limits, Ed put the last nail in the coffin of the Cartesian universe and fomented what some have called the third scientific revolution of the 20th century, following on the heels of relativity and quantum physics," said Kerry Emanuel professor of atmospheric science at MIT.

When he first published his theory in 1963 hardly anybody noticed.[3] It was only when Lorenz attached the poetic visual of flapping butterflies to his chaos theory in 1972 that he quickly got widespread attention. Since then the popular idea of butterfly effect meteorology has in some circles seemingly eclipsed his serious science.

At this point we pivot from popular short-term "butterfly effect weather forecasting" to long-term "butterfly effect climatology."

Popular Butterfly Effect Climatology

We are now enjoying the Anthropocene period, the only great period within global history shaped by the activities of just one species. It could be said that the thin veneer of civilization is just now very briefly at "peak humanity." We the living are fortunate.

Much has been made about today's current carbon pollution, and about how much our industrializing societies are related to heating climate change. That was not always the case:

There was a period around 1600 when the global climate cooled a bit. Approximately 90% of the real Americans were killed off by European bacterial and viral diseases for which the locals had no resistance. Not only did the pathogen holocaust make it easy for invading Europeans to impose their alien culture and religious ideas on the surviving indigenous population, vast areas that had been farmed were abandoned. Renewed forests replaced dead farmers' fields. The new trees consumed carbon

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[3] https://en.wikipedia.org/wiki/Butterfly_effect

dioxide. Less greenhouse-gas carbon in the air around 1600 meant less captured solar radiation, and thereby created on the margin a period of cooling climate. Humans thus briefly caused the mild reversal of previous climate homeostasis.

The modern era of carbon-fueled industry can be traced from around 1750, when England first used coal to fuel their emerging economy. Two centuries later the big boost in carbon pollution happened in the decades following WWII, when both populations and standards of living soared. In our current century the United States has recently been replaced by China as the world's top aggregate polluter.

If the USA were to immediately eliminate all greenhouse gas emissions, but the Chinese did little amelioration, the world would still race to a climate catastrophe. Even the relatively weak Paris Agreement on climate change,[4] if globally implemented, would not prevent ice caps from melting, just slow down the inevitable.

What about the butterflies? Earth is experiencing accelerating climate change, not just linear change.[5] Humans are used to dealing with perceived linear problems, not complex accelerating problems. Solutions that in the past would have helped with ordinary climate challenges are now virtually meaningless. There is no "butterfly" solution to the dual monster of rising heat and rising sea levels that human industry has incrementally created.

The *real butterflies* have been the summation of local lives, yielding accelerating feedback effects, leading to the climate change hurricane. We have all acted locally in our immediate interests – and thus our collective "butterfly actions" have threatened humanity itself all over the globe. This is action with consequences, but without global consciousness.

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[4] https://www.cnn.com/2018/12/16/health/sutter-cop24-climate-talks/index.html

[5] http://astronomy-links.net/Accelerating.climate.change.pdf

Denial is Not The Nile

The actual Nile river is easily visualized. Climate danger denial is delusional. Cause and effect can be scrambled in our minds, at least for a short while. Puppet politicians of billionaire carbon polluters (and their media allies) can and will incessantly lie and deny to confuse voters about what is scientifically proven by any gold standard.

Another version of confused denial involves how people are led to believe that global warming does exist – but is just part of nature's grand cycle of continuity through change. The biosphere is seen as fundamentally stable, although for now oscillating around a new norm that is slightly more extreme than earlier annual cycles.

The key here is how some of us have a pseudo-scientific basis for arguing that we may be experiencing modest global climate change – but it is all natural, and not really caused by polluting humans. Real climate science is thus eligible for the fake news label. In the near term, politician-purchasing polluters continue to squeeze out more billions; and a few more people in West Virginia can continue digging coal.

For decades the global biosphere has been shifting toward a "new climate normal" that has has not been seen for over 420 million years.[6] Such a hot world would be very, very hostile to humankind. Because of today's greedy cultures with myopic rising expectations at all costs, we could approach an equivalent thermal "new norm" within two hundred years.

There is a very recently published scientific study based on CO_2 climate models, and generated by supercomputers. It shows what may happen to stratus clouds that now reflect sunlight back into space. The new model predicts that future levels of CO_2 may

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[6] https://www.techtimes.com/articles/203865/20170406/earth-could-reach-warming-state-unseen-in-the-last-420-million-years-study-warns.htm

become sufficient to break up protective reflecting clouds, leading to an **additional eight degrees Celsius** average temperatures above previously projected hothouse levels. Earth's atmosphere could reach this trigger level in about two centuries.[7]

There is a map[8] prepared over a decade ago showing the Earth at **four degrees C** on top of what we have today (which is just one degree C above levels two centuries ago). Flash another eight degrees – for a total of **twelve degrees C above today's levels** – and whatever will still be alive in that future dystopic ecosystem will live with crocodiles at the poles.

Humanity still has a compressed opportunity to utilize solar panels, wind, tidal waves, and geothermal; including advanced conservation and insulation. All of these replacement energy technologies must be fully activated immediately if not sooner, and in conjunction with a lid on further population growth.

If global temperatures were to flash up following vanished reflecting clouds another eight degrees beyond what the map in the 8th footnote below shows at four degrees, there could be additional *billions of people rapidly killed* directly and indirectly by heat, ocean anoxia, and agricultural devastation.

Frankly, I don't know which suicidal horror would be worse – the flash climate nightmare; or the flash of several thermonuclear bombs – either of which would be entirely human-made.

As Pogo said, "We have met the enemy, and he is us."

Will conserving wisdom lead us through the next two centuries; or will it be greed as usual?

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[7] https://www.sciencealert.com/high-levels-of-co2-could-stop-these-cooling-clouds-from-forming-warn-scientists

[8] https://bigthink.com/strange-maps/what-the-world-will-look-like-4degc-warmer