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Where is global warming when we need it?

Mohamed Gad-el-Hak

Following record-breaking snowfall in Washington and Virginia, many water-cooler conversations began with “What global warming?” The East Anglia’s debacle did not help either. But global warming is real, and this article retells the “inconvenient truth”. First a disclaimer: I am not a climatologist, but a concerned citizen who knows something about how science works, or doesn’t, as well as about the importance of informed citizenry.

Global warming refers to the increase in the average temperature of Earth’s near-surface air and oceans during the twentieth century, but more ominously, its projected continuation. What happened up to now is irrefutable. Measurements coupled with sophisticated analysis to glean trends from the random daily and seasonal variations indicate that the global temperature increased 0.74°C (1.3°F) between the start and end of the 20th century, and that the last decade is the warmest on record. But is the trend

continuing for the next 100 years? And, whether it is past or future trend is it human-caused or part of the natural cycle that existed since the Earth formed 4.5 billion years ago? The answers are yes and the calamity is anthropogenic.

Less than one degree temperature rise per century seems innocuous enough. But a couple more degrees like that and ice in the Arctic and Antarctica melts, sea level rises, coastal cities disappear, and desertification spreads. So, even if the looming catastrophe is not human-caused, the only species that is capable of doing something to slow down the trend should aggressively tackle the problem, whatever the sacrifice.

That the atmosphere and oceans have been warming up since 1900 is beyond doubt because reliable satellite, ground and water measurements document the trend. What is more difficult is to predict the future. Scientists employ the laws of nature as they understand them, and by solving the resulting dynamical equations, the future can be predicted. For the case of planet orbits around the Sun, the equations can be solved to a high degree of precision, and humans have been able to predict Sun and Moon eclipses, ocean tides and other phenomena dependent on those orbits. The predictions were tested through the years, and we now have a high-degree of confidence in calling the next eclipse.

Unfortunately, the equations needed to predict average temperatures are much more complicated and even the fastest computer cannot deliver precise answers in a reasonable time. So, scientists simplify the laws of nature using heuristic models, to the point at which supercomputers can provide answers. The reliability of the answer diminishes as the degree of simplification increases. Climate change over a decade is less reliable than weather forecast for the next three days. Predictions are made statistically, for example if current trends continue, there is a 25% probability that warming over the next 25 years will exceed 2°C. Certainty is replaced by likelihood. Nevertheless, both short-term weather forecast and long-term climate prediction are pretty good. The accelerated Earth warming that was predicted back in 1990 is right on the mark when 2000 and 2010 rolled along. In fact, summer time melting of Arctic sea-ice has accelerated far beyond the expectation of climate models. Furthermore, the existing models predict increased severity and frequency of both hot and cold weather events. This puts to rest the sneering every time a cold wave or a snowstorm hits. Broadcasters Rush Limbaugh and Matt Drudge and Senator Jim Inhofe (R-Oklahoma) are no more right about a single snow event (or two or three) proving global cooling than the lack of snow in Vancouver confirming global warming.

Added to the combustible mix albeit locally is Virginia Attorney General Ken Cuccinelli who recently filed a petition on behalf of the state asking the federal Environmental Protection Agency to reconsider its December 2009 finding that global warming poses a threat to people. He also filed a petition with the federal appeals court in Washington seeking a review of the EPA ruling. Governor Bob McDonnell supported his attorney general. Dismissing the science because of its inability to provide certainty but rather likelihood is playing Russian roulette with the health, prosperity and happiness of future generations. The issue here cannot be treated like a murder trial, which has to be proven beyond reasonable doubt. Cigarette smoking is accepted as hazardous to health on a preponderance of evidence.

Confidence in existing models to predict settles the question whether warming trends will continue at a given rate. What is causing global warming is, however, a more challenging question. There is evidence that the current warming is part of a natural cycle, but is this trend anthropogenic, i.e. exacerbated by human activities?

Ice or glacial ages occur on Earth quasi-periodically on time scales of millions of years. Within a long-term ice age, short-term pulses of extremely cold climate (*glacial periods*) and warm climate (*interglacial periods*) occur, also quasi-periodically but on time scales of tens of thousands of years. Earth has been experiencing an ice age for the past 2.588 million years, with the peak of the last glacial taking place 20,000 years ago. Earth has been in an interglacial period for the last 10,000 years. In other words, our world is in the midst of a natural warming period, and for most of those years humans have insignificant influence on the rate of warming.

Among the hypothesized causes for the natural cycles of warming and cooling are atmospheric composition, cyclical changes in Earth orbit, and motion of tectonic plates. Greenhouse gases, such as water vapor, carbon dioxide, methane and ozone, contribute to global warming when released into the atmosphere in quantities beyond a delicate balance: less than that balance and cooling ensues, and more results in warming. Almost all greenhouse gases are released and absorbed naturally. For example, carbon dioxide is released as a result of animal metabolism, volcano eruptions, and forest fires. The same gas is absorbed in the oceans and by rain forests.

But the natural global warming that started 10,000 years ago accelerated quite a bit since the start of the industrial revolution when increased amounts of fossil fuel began to supply our energy needs. The sudden change in the rate of global warming correlates strongly with the increased release into the atmosphere of human-caused carbon dioxide and, to a lesser extent, other greenhouse gases such as nitrous oxide and chlorofluorocarbons. Furthermore, climate models that take into account fossil fuel usage and production of CO₂ have consistently and correctly predicted an increase in surface temperature beyond that predicted from the interglacial Earth is currently experiencing.

Additional to demonstrating how science works, it is important to demonstrate how it does not. Science works via a tight system of checks and balances. Peer review, empirical validation, and independent reproducibility are examples. Some scientists fabricate, cherry-pick or embellish data, are biased by certain preconceived ideas, or simply make mistakes. But those are few and far between, and the system is designed to expose the charlatans, the misguided and the foolish. Cold fusion announced at the University of Utah in 1989 is an example of misinterpretation of data, and this was rapidly exposed. More related to global warming is “Climategate”. Over 1,000 emails were hacked and released from the servers of the University of East Anglia in England, home of a leading climate research unit. The messages hint at manipulation and selective destruction of data to bolster the case for human-accelerated global warming. An independent inquiry is being conducted there and another one was just completed at Pennsylvania State University (at the other end of many of the emails). There is some damage to the case of anthropogenic global warming, but it appears that this episode does not rise to the level of dishonesty or misconduct, but rather sloppiness and overzealousness with unofficial, non-journal writings. Archival evidence from many other researchers for human-caused global warming still stands high.

In Woody Allen’s film “Sleeper”, Miles Monroe is a health-food store operator who is revived from deep freeze 200 years in the future. There the anti-hero finds a world where fatty food and smoking are good for your health. When the next glacial period arrives thousands of years from now, perhaps humans will be encouraged to waste energy, buy house-size SUVs, and burn whatever fossil fuel is still left. But for the foreseeable future, *Homo sapiens* need to conserve energy, seek alternatives to fossil fuel, control population growth, and provide sustainable balance to the delicate ecosystem we call home.

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