

True Science for Government Leaders and Educators: The Main Cause of Global Warming

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ABSTRACT

Government leaders and educators ought to be able to rely on scientists to tell the truth about climate change, but science has been tainted by politics. Real science, unlike politics, is all about telling the truth, truth that is securely anchored to the properties of matter and radiation. The current, high-profile, politically-driven, climate-change debate centers on two disparate ideas, namely, either global warming is caused by carbon dioxide or is not occurring at all. Neither is correct. Evidence from World War II indicates that particulate pollution, not carbon dioxide, is the cause of global warming. The difference between daily high and nightly low temperature data, tracked over time over a large geographic area, provide evidence that global warming is in fact occurring, which is independent of carbon dioxide. Particles in the lower atmosphere (troposphere) are heated by solar radiation and by radiant heat from the Earth, and transfer that heat to atmospheric gases by molecular collisions. The resultant heating increases atmospheric temperature, and reduces the temperature difference relative to air near the surface, which reduces atmospheric convection, and concomitantly reduces convective heat transport from the surface. This is the mechanism whereby particulate pollution causes global warming.

Keywords: Global warming; Climate change; Particulate pollution; Aerosol particulates; Geoengineering.

INTRODUCTION

Climate change, sometimes called global warming, is currently a high-profile subject of public debate, and a matter of grave concern for government leaders and educators. Those individuals ought to be able to rely on trained scientists for guidance, for true understanding, but there is a problem. Science has become tainted by politics. That was not always the case.

During the first half of the 20th century, when important discoveries were made that underpin modern electronics technology, there was virtually no government support for science. The science community was small, but disciplined. New ideas were discussed and debated, and, if unable to be refuted, were acknowledged [1]. This is the way science – real science – should function. After World War II, government support for civilian science burgeoned. Unfortunately, the mechanisms put in place for administering civilian science-funding were badly flawed, which contributed to the progressive corruption of science in America and elsewhere [2]. Science to a large extent has now become politicized, transformed into political-pseudoscience at taxpayer expense.

Real science, unlike politics, is not about promoting consensus-accepted ideas, while ignoring other competing ideas, as currently practiced. Instead, real science is about finding out what is wrong with current scientific concepts and replacing less-correct concepts with concepts that are more-correct. Real science, unlike politics, is all about telling the truth, truth that is securely anchored to the properties of matter and radiation [1,3]. That is how real science progresses.

In the highly politicized domain of *climate change*, there are two schools of thought: The majority view is that global warming is occurring, caused by carbon dioxide (CO₂) and other greenhouse gases trapping heat that would otherwise be released into space. The minority view is that there is no global warming, and any variation in global temperature is natural. Real science, as described below, clearly leads to the conclusion that neither school of thought is correct: Global warming is in fact occurring, but not primarily as a consequence of greenhouse gases. Global warming is primarily caused by particulate pollution [4-10]. The good news is that reducing particulate pollution will rapidly reduce global warming in a matter of days to weeks.

EVIDENCE FROM WORLD WAR II

Harvard physicist Bernard Gottschalk [11,12] noticed a thermal peak coincident with World War II (WW2) in a global temperature profile image on the front page of the January 19, 2017 *New York Times*, and was inspired to investigate further. He applied sophisticated curve-fitting techniques to eight independent global temperature datasets from the U. S. National Oceanic and Atmospheric Administration (NOAA), demonstrated that the WW2 peak is a robust feature, and concluded that the thermal peak “*is a consequence of human activity during WW2*” [11,12].

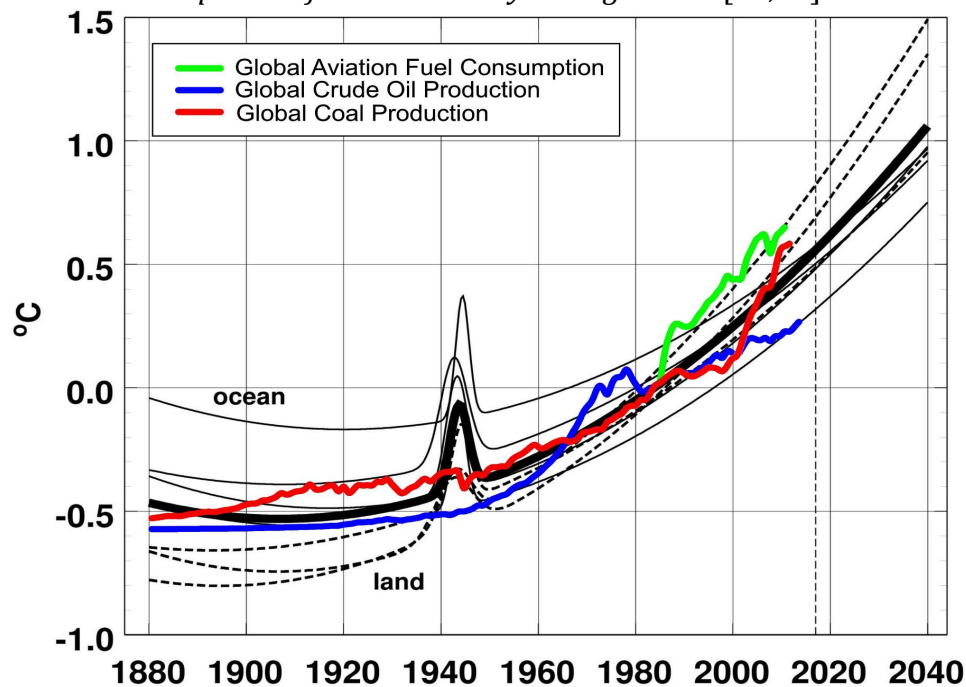


Figure 1. Copy of Gottschalk’s fitted curves for eight NOAA data sets showing relative temperature profiles over time [11] to which are added proxies for particulate pollution. Dashed line: land; light line: ocean; bold line: weighted average. From [4].

The conspicuous aspect of Gottschalk’s global-warming curves [11], shown by the black curves in Figure 1, is that immediately after WW2 the global warming rapidly subsided. That behavior is

inconsistent with CO₂-caused global warming as CO₂ persists in the atmosphere for decades [13,14]. Furthermore, CO₂-caused global warming during WW2 can be ruled out as Antarctic Law Dome Ice core data during the period 1936-1952 show no significant increase in CO₂ during the war years, 1939-1945 [15].

I realized a different explanation. World War II activities injected massive amounts of particulate matter into the lower atmosphere (troposphere) from extensive military industrialization and vast munition detonations, which included demolition of entire cities, and their resulting debris and smoke. The implication is that the aerosolized pollution particles trapped heat that otherwise should have been returned to space, and thus caused global warming at Earth's surface [4] which would have subsided rapidly after hostilities ceased. Rapid cessation of WW2 global warming is understandable as tropospheric pollution-particulates typically fall to ground in days to weeks [16-20].

Figure 1, from [4,11], shows relative-value, particulate-pollution proxies added to Gottschalk's figure: Global coal production [21,22]; global crude oil production [22,23]; and, global aviation fuel consumption [22]. Each proxy dataset was normalized to its value at the date 1986, and anchored at 1986 to Gottschalk's boldface, weighted average, relative global warming curve. The particulate-proxies track well with the eight NOAA global datasets used by Gottschalk [4].

Following the end of WW2 hostilities, wartime aerosol particulates rapidly settled to ground [16], Earth radiated its excess trapped energy, and global warming abruptly subsided for a brief time [4]. Soon, however, post-WW2 industrial growth, initially in Europe and Japan, and later in China, India, and the rest of Asia [24] increased worldwide aerosol particulate pollution and with it concomitant global warming [4]. The rapid non-linear rise in these curves in recent decades presumably has been greatly accelerated by deliberately emplaced tropospheric aerosol particulate-pollution [25,26].

From the evidence shown in Figure 1, there is one inescapable conclusion: Aerosol particulate pollution, not carbon dioxide, is the main cause of global warming. That conclusion was not at all evident from the "radiation-balance" methodology and parametrized models widely utilized by the climate science community. The concept that aerosol particulate pollution is the main cause of global warming thus constitutes a climate-science paradigm shift. Yet, in certain respects it might have been obvious to those who observe nature and who reason objectively. For example, one might have observed that in the desert cloudy days are usually cooler than non-cloudy days, while cloudy nights are typically warmer than non-cloudy nights.

EVIDENCE OF GLOBAL WARMING

Two measurements, the daily high temperature and the nightly low temperature, when tracked over time over a large geographic area, provide an independent measure of climate change. The daily high temperature minus nightly low temperature, ($T_{\max} - T_{\min}$), called the diurnal temperature range (DTR), is essentially independent of any effects of greenhouse gases [13,27]. Figure 2 from Qu et al. [28] presents yearly DTR, T_{\max} , and T_{\min} mean values over the continental USA throughout most of the 20th century and into the 21st century up to 2010.

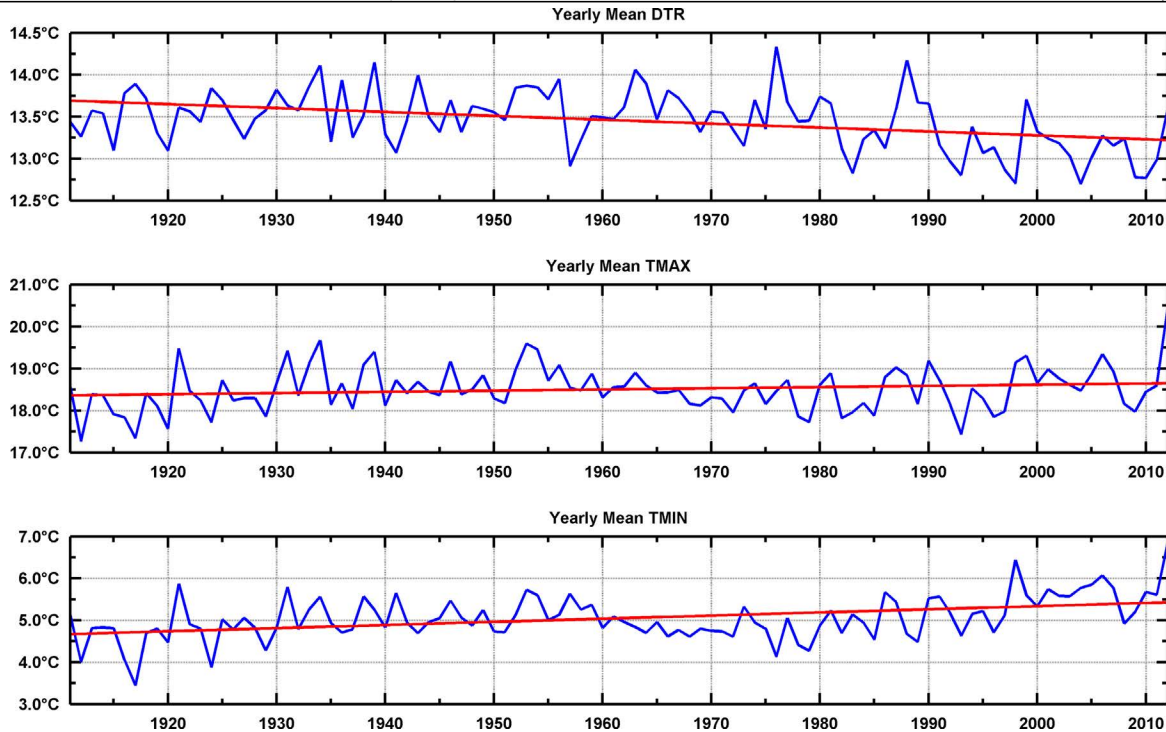


Figure 2. Yearly DTR, T_{\max} , and T_{\min} mean values over the continental USA. The red lines are linear regressions. From [9,28], (<http://creativecommons.org/licenses/by-nc-nd/3.0/>).

As shown in Figure 2, T_{\min} increases at a greater rate than T_{\max} causing DTM to decrease over time, a phenomena that is observed in many similar investigations [29-32] but not all [33]. Whereas the reduction in T_{\max} can be explained by sunlight being absorbed or scattered by particulates or by clouds, the increase in T_{\min} is inexplicable within the current consensus-driven climate science paradigm [13].

MECHANISM OF GLOBAL WARMING BY AEROSOL PARTICULATES

Aerosol particles are heated by solar radiation and by radiant heat from the Earth, and transfer that heat to atmospheric gases by molecular collisions. The resultant atmospheric heating has the consequence of reducing atmospheric convection and thus reducing heat loss from Earth's surface [7,9].

Convection is perhaps the most misunderstood natural process in Earth science. Hypothetical convection models of Earth's fluid core [34-37] and of Earth's mantle [38,39] continue to be produced, although sustained thermal convection in each instance has been shown to be physically impossible [40] thus necessitating a fundamentally different geoscience paradigm [41-47].

Chandrasekhar described convection in the following, easy-to-understand way [48]:

The simplest example of thermally induced convection arises when a horizontal layer of fluid is heated from below and an adverse temperature gradient is maintained [i.e. bottom hotter than top]. The adjective 'adverse' is used to qualify the prevailing temperature gradient, since, on account of thermal expansion, the fluid at the bottom becomes lighter than the fluid at the top; and this is a top-heavy arrangement which is

potentially unstable. Under these circumstances the fluid will try to redistribute itself to redress this weakness in its arrangement. This is how thermal convection originates: It represents the efforts of the fluid to restore to itself some degree of stability.

To the best of my knowledge, consequences of the *adverse temperature gradient*, described by Chandrasekhar [48] have not been explicitly considered in either solid-Earth or tropospheric convection calculations. The following simple classroom-demonstration experiment, however, can provide critical insight for understanding how convection works that is applicable to both tropospheric and Earth-core convection [7].

As described recently [9]:

The convection classroom-demonstration experiment was conducted using a 4 liter beaked-beaker, nearly filled with distilled water to which celery seeds were added, and heated on a regulated hot plate. The celery seeds, dragged along by convective motions in the water, served as an indicator of convection. When stable convection was attained, a ceramic tile was placed atop the beaker to retard heat loss, thereby increasing the temperature at the top relative to that at the bottom, thus decreasing the adverse temperature gradient.

Figure 3, from [7], extracted from the video record [49,50], shows dramatic reduction in convection after placing the tile atop the beaker. In only 60 seconds the number of celery seeds in motion, driven by convection, decreased markedly, demonstrating the principle that reducing the adverse temperature gradient decreases convection. That result is reasonable as zero adverse temperature gradient by definition is zero thermal convection.

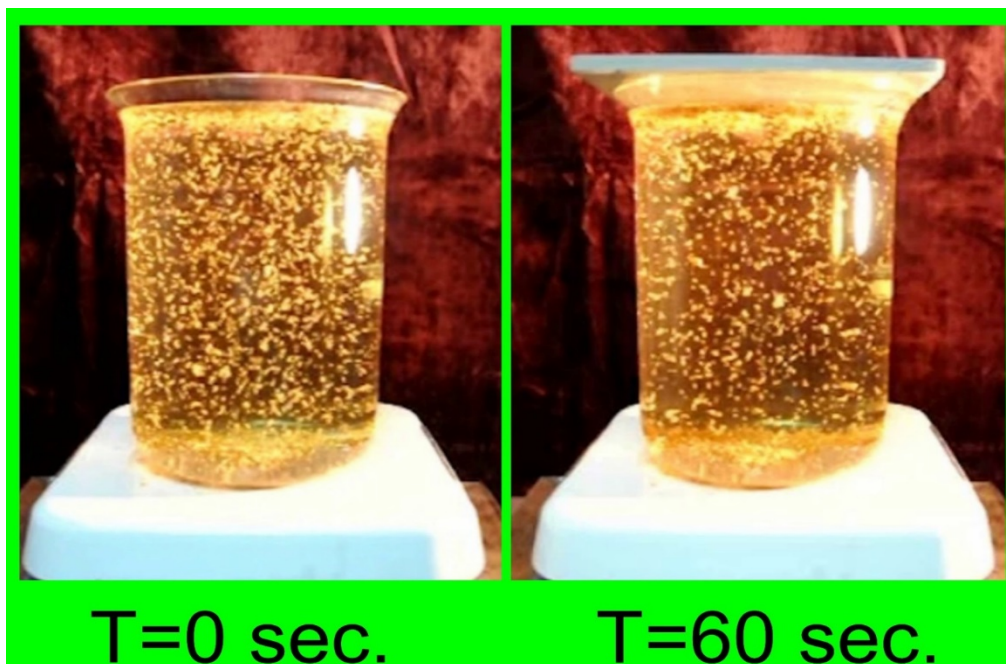


Figure 3. From [7]. A beaked-beaker of water on a regulated hot plate with celery seeds pulled along by the fluid convection motions. Placing a ceramic tile atop the beaker a moment after T=0 reduced heat-loss, effectively warming the upper solution's temperature, thus lowering the adverse temperature gradient, and reducing convection, indicated by the decreased number of celery seeds in motion at T=60 sec.

Particulate matter in the troposphere, including the moisture droplets of clouds, as described here, not only blocks sunlight, it also absorbs radiation both from in-coming solar radiation and from outgoing terrestrial radiation. The thusly heated aerosol particles transfer that heat to the surrounding atmosphere which increases its temperature and reduces the adverse temperature gradient relative to air near the surface. The reduction of adverse temperature gradient, as demonstrated by the above classroom-demonstration, concomitantly reduces convective heat transport from the surface. This is the mechanism whereby particulate pollution causes global warming.

STOPPING GLOBAL WARMING AND IMPROVING HEALTH

Life on Earth is possible because of the natural balance of interactions by and between myriad biota and the physical processes of their environments. For more than three billion years, as long as life has existed on Earth, this balance has maintained itself without human intervention despite being bombarded by potentially variable solar radiation from above [51,52] and potentially variable planetary energy from below [40-43,47]. Even now there is natural variability. Heat exiting from within the Earth is increasing [53]. The intensity of the geomagnetic field is decreasing [54]. Humans can learn to adapt to natural variability and can prosper. But *unnatural* variability is not only unhealthy, but potentially devastating to humans and other biota [25,26].

Anthropogenic (human-created) global warming is one particularly devastating form of *unnatural* variability. Its cause, however, has been grossly misunderstood. It is neither necessary to trap and sequester carbon dioxide [55] nor to emplace particles in the upper atmosphere (stratosphere) to reflect sunlight [56], a disastrous “cure” that in the extreme might even initiate a new ice age. Significantly reducing tropospheric particulate pollution, as real scientific evidence indicates, will quickly lead to reduced global anthropogenic warming and to great improvements in human and environmental health.

Air pollution is the leading environmental cause of disease and death worldwide, and it is increasing at an alarming rate [57]. Exposure to air pollution particles is a significant risk factor for premature death, including ischemic heart disease, chronic obstructive pulmonary disease, and respiratory infections [58]. Long-term, cumulative exposure to fine particulate matter in the United States is associated with all-cause mortality, cardiovascular disease, and lung cancer [59]. In recent years, emerging evidence from clinical, observational, epidemiological and experimental studies strongly suggest that Alzheimer’s Dementia, Parkinson’s, and thrombotic stroke are associated with ambient air pollution [60]. Children residing in highly polluted urban environments were found to have cognitive deficits, and the majority of them showed brain abnormalities on MRI [61]

The combined-causes of air pollution and runaway global warming are modifiable in a short time-frame by reducing industrial and deliberate particulate pollution. But corrective actions hinge embracing the real climate-science paradigm-shift [4,7,9,25,26] and not continuing to promote flawed and harmful political dictums that serve vested self-interests. In the light of real scientific truth, leaders should strive for international cooperation at all levels of authority.

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