

Disruption of Earth's Atmospheric Flywheel: Hothouse-Earth Collapse of the Biosphere and Causation of the Sixth Great Extinction

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ABSTRACT

The Anthropocene is the Epoch of Man, in which human activities have drastically changed Earth's geology, landscape, ecosystems, biodiversity and climate. The energy necessary to power modern civilization comes from petroleum, natural gas, and coal, the latter derived from millions of years of photosynthesized vegetation, subsequently stored underground. The best stratigraphic markers of the Anthropocene are combustion products of these fuels such as spherical carbonaceous particles and iron-containing magnetic particles. We have previously shown that particle pollution from combustion sources, not carbon dioxide, is the primary cause of global warming. More recently, we have shown combustion products, notably coal fly ash and HULIS aerosols, not chlorofluorocarbons, are the primary cause of stratospheric ozone depletion. Modern-day transformation of the biosphere is strikingly evident in the atmosphere, which has been polluted to the point of overcoming Earth's atmospheric flywheel (radiation buffering mechanism). The planet is already in a Hothouse Earth phase, with runaway warming triggering multiple "tipping points" that threaten biosphere integrity and human civilization itself. Contrary to the prevailing narrative, the stratospheric ozone layer has been badly damaged, and increasingly deadly ultraviolet radiation now penetrates to Earth's surface. This situation has been made unimaginably worse by the deliberate, covert planetary modification, euphemistically called geoengineering. While the scientific community, government leaders, the mainstream media, and indeed the masses "look the other way" and ignore the obvious atrocities in our skies, ongoing tropospheric aerosol geoengineering operations continue to spray toxic substances, such as coal fly ash, into the atmosphere. Humanity must wake up to the dire reality we face. International cooperation and crash efforts will be necessary to at least slow the rate of biosphere collapse and salvage something of our critical life support systems. Our time is short to phase out and end all geoengineering activities and to reduce and/or eliminate all sources of coal fly ash and HULIS-type aerosols.

Keywords: Ozone hole, Geoengineering, Chemtrails, Troposphere, Global warming, Ultraviolet radiation.

INTRODUCTION

The timeline for Earth's existence over 4.54 ± 0.05 billion years is measured in progressive subdivisions of time with Eons > Eras > Periods > Epochs. Previous global events like Great Extinctions, Ice Ages, Interglacial Periods, and Hothouse Earth conditions can be related to changes in geochemistry and atmospheric chemistry that can be partially identified by examining geological strata. Anthropogenic changes to the Earth's climate, land, sea, and atmosphere, are now so profound that the concept of a new geological epoch, defined by human activity, the Anthropocene, is becoming widely accepted [1].

The last period, the Quaternary, began just 2.6 million years ago, and includes two epochs, the Pleistocene and the Holocene. The Holocene, which began only about 12,000 years ago, was a mild interglacial period that encompasses the entire recorded history of human civilization [2]. However, over the past two to three centuries, the effects of humans on the global ecosystems have expanded at a staggering rate. The Anthropocene might be said to have started in the latter half of the 18th Century, when analyses of air trapped in polar ice showed increasing concentrations of carbon dioxide and methane. This time period coincides with the invention of the steam engine [3]. Steam engines rely on coal burning to produce steam, and were crucial to the industrialization of modern civilization. While some coal, oil, and gas had been used by humans for hundreds of years, industrial-scale coal use led to the global exploitation of fossil fuels [4].

Currently, only three energy sources account for about 77% of global energy usage: petroleum, natural gas and coal in more-or-less roughly equal proportions [5]. Coal is a non-renewable resource as it contains the energy stored by plants that were subjected to heat and pressure after burial under sediment millions of years ago [6]. The energy in coal derives from photosynthesis ($\text{H}_2\text{O} + \text{CO}_2 + \text{sunlight} = \text{O}_2$ and plant tissue) that can be released by combustion, or oxidation, in the reverse process (stored plant material/fuel) + $\text{O}_2 = \text{H}_2\text{O}$ and CO_2 and energy). Whereas products of coal burning today are causing the Earth to overheat, the formation and burial of coal at one time, it has been suggested, almost turned the planet into Snowball Earth [7].

The new term Anthropocene suggests that Earth has already left the stable interglacial Holocene Epoch. Human activities are so universal and pervasive today that in some instances they rival or are even greater than the forces of Nature [8]. Today's biosphere differs significantly from previous microbial and metazoan stages that developed billions to millions of years ago. The modern biosphere is characterized by: (1) Global homogenization of flora and fauna, (2) a single species (*Homo sapiens*) that consumes up to 40% of net primary production while at the same time producing vast amounts of energy by burning fossil fuels, (3) human directed evolution of other species, and (4) the increasing interaction of the biosphere with man-made technology, the so-called "*Technosphere*" [9].

The Anthropocene, beginning around 1800 and coinciding with the onset of industrialization, required vastly more energy than previous agrarian or hunting and gathering societies. The energy necessary to power modern civilization comes mostly from coal which was generated by millions of years of photosynthesis and stored underground [10]. Humans have totally disrupted the long-term carbon cycle. The burning of fossil fuels causes a large increase in the

rate of organic matter oxidation compared to that of the natural weathering process [11]. Modern-day transformation of the biosphere is nowhere more evident than in the atmosphere. While not the direct cause of global warming [12, 13], rising levels of atmospheric carbon dioxide serve as an indicator or marker for the quantity of fossil fuels that have been consumed [14]. Atmospheric concentrations of nitrous oxides and methane have also greatly increased from preindustrial levels [15].

EARTH'S RADIATION FLYWHEEL

Although the Anthropocene Epoch is associated with the human industrialization that began over 200 years ago, only from the mid-20th Century is there clear evidence for fundamental changes, driven by human activity, in the basic functioning of the Earth Systems that are outside of the natural variability of the Holocene. The Great Acceleration is the name given to the continuous and dramatic effects of humans on the global environment which date to about 1950. These human effects include globalization, energy use, population growth, economic activity, water use, food production, transportation, technology, agriculture, deforestation, pollution, and biosphere degradation in general [16, 17]. Of these, air pollution is by far the most detrimental in causing global warming [12, 13, 18], stratospheric ozone depletion [19-21], and concomitant biota loss [22-24].

There is ongoing debate concerning the best stratigraphic markers distinguishing the Anthropocene Epoch from the Holocene. Spheroidal carbonaceous particles (SPC's), a distinct form of black carbon produced from burning fossil fuels, provide unambiguous stratigraphic markers of the human activities that have altered Earth Systems during the Anthropocene. SPC's are found in both terrestrial and marine sediments and ice cores from all over the world. There has been a rapid increase in SPC's since the 1950's which correlate with the Great Acceleration [25].

Data from over 75 lake sediments show a global, synchronous, and marked increase in spherical carbonaceous particle accumulation starting in 1950 and corresponding to the demand in electricity and the introduction of fuel oil combustion and coal as the means to produce it [26]. Spherical carbonaceous particles are a significant component of fly ash, the particulate product of fuel and coal burning. Recently these indelible markers were found in Antarctic ice, thousands of miles away from any potential source. Chemical analysis of these SPC's in Antarctica indicates an origin in coal combustion [27]. Spherical magnetic (iron) particles, originating from coal fly ash also show a rapid accumulation in the post-World War II period, from the 1950's forward [28].

Although there is growing concern about global warming in recent decades, research into the greenhouse effect actually began in the 19th Century. Fournier, Tyndall, and Langley all appreciated that without heat absorbing gases in the atmosphere, the temperature on the ground would be much lower, making life as we know it impossible [29].

The Swedish scientist Svante Arrhenius was the first to quantify the effect of changes in carbonic acid (or CO₂) in the atmosphere on the temperature at Earth's surface. Arrhenius calculated the atmospheric effects caused by concomitant changes in CO₂ and water vapor [30]. He deduced that air retains heat by selective diffusion and absorption. Compared to oxygen and

nitrogen, the primary components of the atmosphere, the selective absorption of heat is accomplished by CO₂ and H₂O vapor. The atoms of these molecules are bound together loosely enough to vibrate with the absorption of infrared radiation, from solar radiation and/or from the Earth. Vibrating molecules re-emit the radiation which is likely re-absorbed by another molecule. This absorption-emission-absorption cycle keeps part of the heat in the lower atmosphere [31], as serves essentially the same purpose as a flywheel in rotating machinery. Not possessing an atmospheric flywheel, lunar night-day temperatures show extreme variation from -130°C to 120°C, respectively.

The lifetime of carbon dioxide in the atmosphere is long, from decades to more than a century [32]. Consequently, atmospheric CO₂ serves as the principal radiation buffer assemblage (analogous to a flywheel) for Earth's atmosphere. Although water vapor, gaseous H₂O, is a more powerful greenhouse gas, its ability to precipitate as rain or snow moderates to some extent the atmospheric flywheel.

Consider this hypothetical example: In the absence of other effects, if Earth's surface temperature were governed solely by the balance of radiation from the sun with radiation leaving Earth, the CO₂ buffer assemblage would yield long-term thermal equilibrium, long-term temperature stability. Although radiation balance has long been considered the principle driving force of global warming, that is not the case. Particulate pollution, not carbon dioxide, is the primary culprit. Particulate pollution is an under-appreciated driving force that can overcome the atmospheric flywheel, and is the principal cause of global warming [12, 13, 33-35].

FLYWHEEL DISRUPTION BY PARTICULATE POLLUTION

Academic atmospheric scientists, including those who serve and have served on the United Nation's Intergovernmental Panel on Climate Change (IPCC), have misrepresented climate change, insisting that carbon dioxide (CO₂) is the primary cause of global warming. However, they fail to consider all the factors affecting climate, most notably atmospheric particulate pollution, especially, ongoing covert emplacement of particulates into the troposphere [35-38]. Academic atmospheric scientists employ seriously flawed investigatory methodologies that include ignoring crucial scientific literature and employing assumption-based computational "models." These models, or simulations, are computer programs that are subject to the well-known dictum, "garbage in, garbage out" [33].

Although rising atmospheric CO₂ has been associated with rising global temperatures, data from Vostok ice-core samples indicate that temperatures rise before CO₂ rises, not vice-versa [39]. It is established that rising temperatures in the world's oceans lead to a decrease in CO₂ solubility and associated liberation of CO₂ into the atmosphere [40].

One of the authors (JMH), in an analysis of a well-documented "bump," or spike during World War II in land and sea temperature profiles [41, 42], showed this rise in temperature was not caused by CO₂, but could be explained by war-time particulate pollution (Figure 1) [12]. Also, note in that figure that the proxy curves for aviation fuel, coal and oil production all generally parallel post-WWII global warming [12].

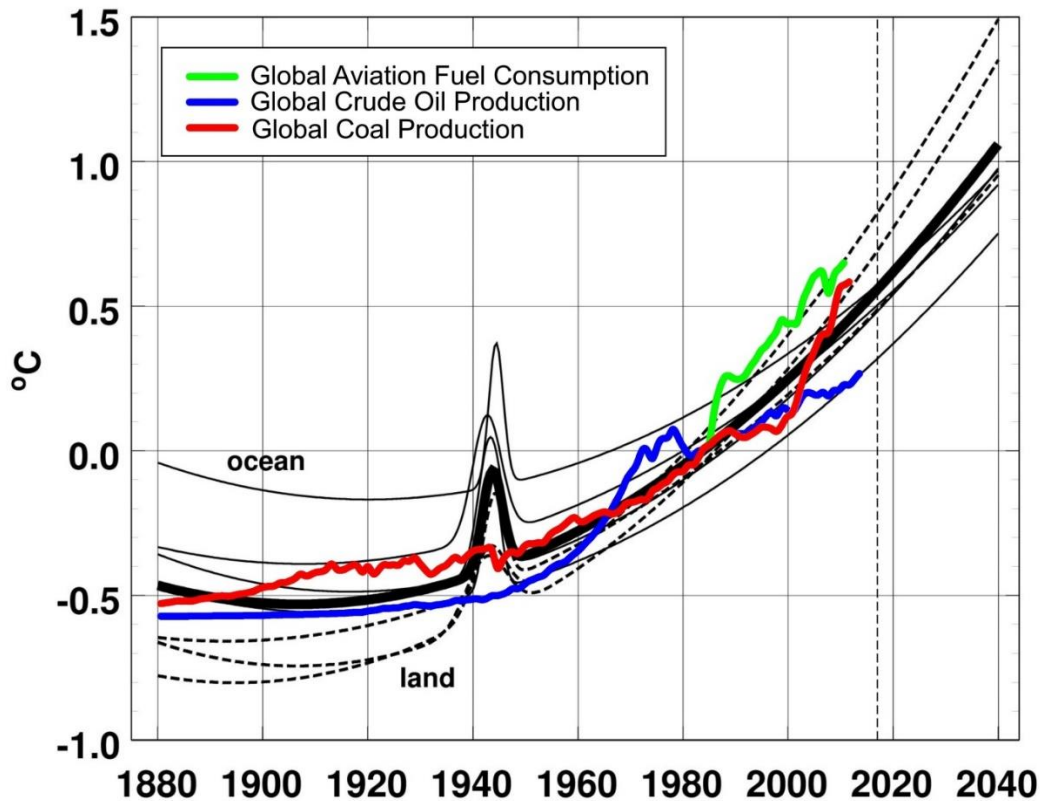


Figure 1: From [12], with three added proxy curves. Each proxy represents the relative increase over time of a major industrial activity or process that globally contributes particulate pollution to the atmosphere.

The proxies employed for global particulate pollution – increasing global coal and crude oil production, as well as aviation fuel consumption – rise in strikingly parallel fashion to the rise in global temperature as shown in Figure 1. The rise in temperature over time during WW2 clearly is not due to greenhouse gases because, if it were, there would be correspondingly great temperature rise immediately after WW2, which did not occur.

What mechanism can overcome the CO₂ radiation flywheel thermal buffer assemblage? Heat loss from the Earth's surface occurs not only by radiation but by convection, the up-down atmospheric circulation. Convection is perhaps the most misunderstood of geophysical phenomena. Untold numbers of scientific articles refer to convection occurring in Earth's fluid core, which is physically impossible as that fluid core is bottom-heavy and is covered by a thermally insulating blanket, the mantle [43].

In 1957, Subrahmanyan Chandrasekhar [44] described convection in the following, easy-to-understand way: *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.

Consider the following example from [43] of a pot of water on the stovetop: Heat at the bottom causes the water to be slightly less heavy (less dense) than the water above. This is an unstable configuration. The heavier (denser) water at the top falls by gravity displacing the lighter (less dense) water at the bottom. The *adverse temperature gradient*, i.e., the bottom being hotter than the top, is maintained by the cooling that occurs at the open water surface. To the best of our knowledge, the consequences of the *adverse temperature gradient*, described by Chandrasekhar [44], have not been explicitly considered in either solid-Earth or tropospheric convection calculations. Despite lengthy literature searches, we were unable to find quantification of the effect of adverse temperature gradient on convection efficiency. The following simple classroom-demonstration experiment, however, can provide critical insight for understanding how convection works and is applicable to a proper understanding of Earth-core convection [45], as well as to tropospheric convection in Earth's atmosphere (Figure 2) [13].

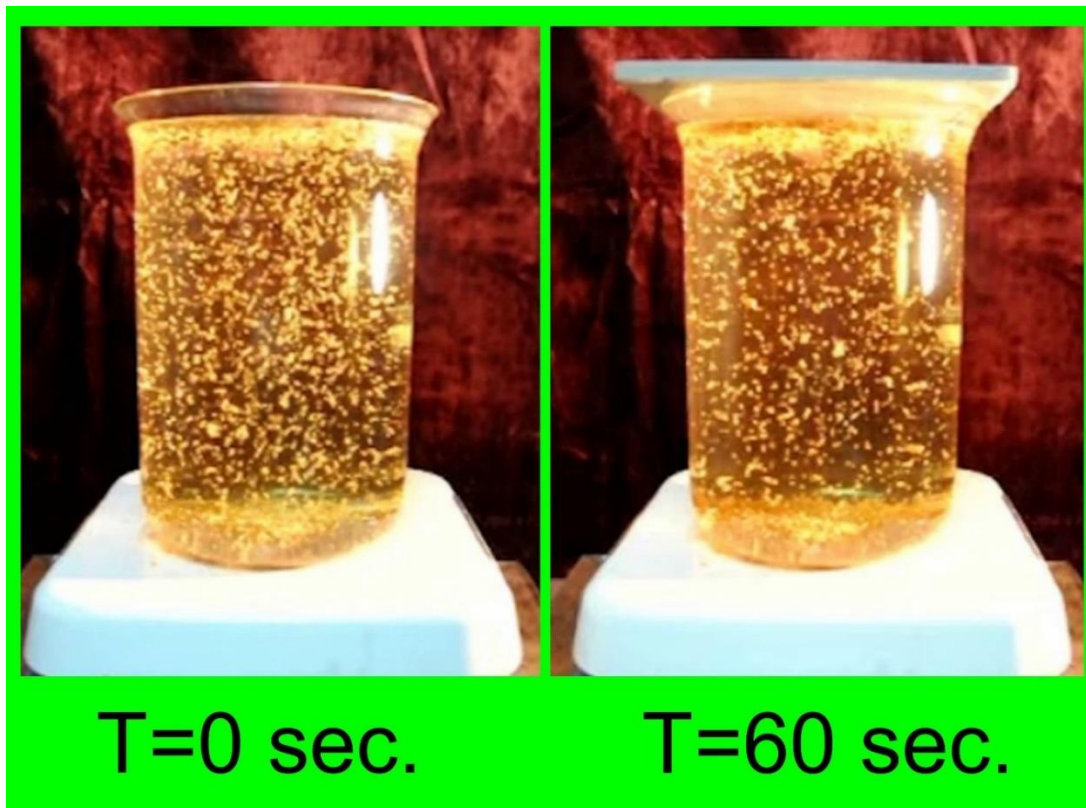


Figure 2. From [13]. A beaked-beaker of water on a regulated hot plate with celery seeds pulled along by the fluid convection motions. Placing a ceramic tile atop the beaker a moment after $T=0$ reduced heat-loss, effectively warming the upper solution's temperature, thus lowering the adverse temperature gradient, and reducing convection, indicated by the decreased number of celery seeds in motion at $T=60$ sec.

As described recently [18]: 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 2, from [13], extracted from the video record [46, 47], 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.

We have published a series of articles disclosing that the main cause of global warming is not CO₂ heat retention but instead aerosol pollution [12, 13, 33-35]. Particulate aerosols absorb radiation, heat the troposphere, and greatly reduce the efficiency of atmospheric convective heat removal from Earth [48, 49]. In addition to the WW II data, we [48] outlined separate independent lines of evidence supporting this conclusion including data concerning the 1980 Mount St. Helen's volcanic eruption [50], radiosonde and aethalometer investigations by Talukdar, et al [49], and diurnal temperature range studies showing minimum nighttime temperatures that have exceeded daytime temperatures since 1990 [51].

While acknowledging that aerosols represent the greatest uncertainty in climate science, the climate science community usually maintains that pollution aerosols have a cooling effect. The purported basis of "future" geoengineering schemes including "solar radiation management" to combat global warming due to CO₂ build-up are based entirely on this false climate science. However, ongoing particulate-pollution tropospheric aerosol geoengineering not only fails to reduce global warming; it is a primary cause of global warming [35] and an activity detrimental to life on Earth.

GLOBAL WARMING IN THE GEOLOGICAL PAST

The current anthropogenic burning of fossil fuels and deliberate covert emplacement of particulate matter into Earth's atmosphere far outstrip corresponding non-catastrophic natural rates of these hothouse emissions. Hothouse conditions on Earth have only occurred a few times in the Phanerozoic Eon, during the last 540 million years [52]. There is a fundamental mechanistic similarity with current anthropogenic global warming and global warming in the geological past. Earth's previous five great extinctions correlate with epic volcanic episodes called Large Igneous Province (LIP) [53]. The Permian-Triassic boundary 250 million years ago marks the largest mass extinction of the Phanerozoic, with a loss of 80-90% of both marine and terrestrial life. The Permian-Triassic Extinction is thought to have been caused in part by Hothouse Earth conditions brought about by greenhouse emissions from the Siberian Traps LIP and associated coal-bed intrusions [54]. During this time underground magma penetrating vast coal seams created a hot coal-basalt mixture that released multiple plumes of pyroclastic fly ash, soot, sulfate and basaltic dust which ascended to the upper atmosphere [55]. This material was dispersed throughout the globe, as recently discovered char deposits found in Permian-aged rock are nearly identical to modern-day coal fly ash: Catastrophic dispersion of coal fly ash into the world's oceans created toxic marine conditions [56]. A period of deadly ultraviolet radiation stress during the Permian Period resulted from depletion of stratospheric ozone by the massive quantity of aerosolized coal fly ash and organo-halogens from vast Siberian Traps

volcanism [57]. The Permian was characterized by high levels of CO₂, methane gas, and rapid global warming to levels lethal to most living organisms, or in other words, an environment eerily like our present one [58]. The Sixth Great Extinction, the first to be caused by a single species, is now well underway, with extinction rates many thousands of times greater than the “background rate” otherwise occurring over prior tens of millions of years [59].

Human activities have already pushed critical Earth Systems beyond the stable climate of the Holocene, with potentially catastrophic consequences. Basic Earth processes with thresholds being crossed by human activities have led to unacceptable environmental changes that include biodiversity loss, climate change, nutrient imbalance, ocean acidification, chemical pollution, global freshwater usage, atmospheric aerosol loading, and stratospheric ozone depletion [60]. Transgressing just one or more of these planetary boundaries can trigger abrupt, non-linear environmental changes on a global scale [61]. Two of the core planetary boundaries, climate change and biosphere integrity, have the potential on their own to drive Earth Systems into a dangerous imbalance if they are significantly and persistently transgressed [62]. The planet has already entered a Hothouse Earth phase, with rapid warming driven by emissions of particulate pollution and of fossil fuel burning, as well as “large scale biosphere manipulation” by man [63]. Cascading tipping points occur when global temperatures reach levels that activate ecosystems including polar ice sheet and permafrost melt, global forest die-off, and drastic changes in ocean conditions and currents [64], all of which result from deliberate, covert planetary modification, euphemistically called geoengineering. The term “geoengineering” is a misleading misnomer. Engineering, such as in the example of modern jet engines, involves the application of well-known scientific principles to achieve a technological advance. The science of our complex planet is generally unknown and/or misunderstood by the international geoscience community. So, to imply that Earth can be engineered without causing great harm is a blatant deception. A more precise term is global environment modification.

The bulk of the coal-burning that created the industrial revolution and caused global warming was deposited during the Carboniferous Period 300-350 million years ago, resulting in a significant draw-down in carbon dioxide at that time [7]. Burial in sediments removes carbon from Earth’s surface, preventing it from reacting with molecular oxygen. Earth’s ability to sequester sediments in a stable environment was a crucial process for both the initial evolution of complex O₂-metabolizing animal life and its long-term maintenance. Currently burning billions of tons of carbon stored in fossil fuel returns carbon to the atmosphere as CO₂ while at the same time removing corresponding amounts of oxygen from the atmosphere [65]. Human activities, most notably the burning of fossil fuels, have caused an irreversible decline in atmospheric oxygen. Oxygen is the most essential element on earth for all aerobic organisms that depend on it to release energy from carbon-based macromolecules [66]. The ascent of oxygen to the stratosphere is necessary to maintain the ozone layer. There is currently a continuous decline in lower stratospheric ozone, while tropospheric ozone is increasing, the latter due primarily to air pollution [67].

BEGINNING OF THE END

The late Will Steffen, a well-known Earth Scientist, spent his entire career studying and communicating the dangers of climate change. He became known for his warnings that humans were pushing the planet past tipping points into an irreversible Hothouse Earth. He knew that

humanity was failing to respond to the climate emergency and there would be increasing calls for geoengineering schemes like stratospheric aerosol injection (SAI) to combat runaway warming. Steffen warned these geoengineering techniques would be like “treating symptoms” and “the cure might be worse than the disease.” [68]. What Steffen failed to realize or point out is that for decades several countries and their militaries have been coopted into the aerial spraying of particles into areas where clouds form for purposes of weather control, climate intervention, communication systems, and weather warfare or defense.

Fifty years ago, geoscientist Gordon J.F. MacDonald wrote a book chapter entitled, “How to Wreck the Environment,” in which he described how a nation might alter the environment or change the weather to inflict harm on an enemy nation. MacDonald predicted the future possibility of triggering instabilities in large-scale natural processes to manipulate the weather or even cause earthquakes or tsunamis. He discussed possibilities of changing the climate by altering the planet's energy balance of incoming short-wave solar radiation and outgoing long-wave radiation from the Earth [69]. Somewhat later prominent scientists like Edward Teller, the developer of the hydrogen bomb, would advocate injecting sunlight-scattering particles into the stratosphere, “like a sunscreen for Earth,” to combat global warming [70]. Modern cloud seeding dates from the discovery in 1946 that silver iodide crystals serve as good nuclei for formation of precipitation from cold clouds.

In 1953 U.S. Congress established the Advisory Committee on Weather Control [71]. The U.S. Air Force has for decades been involved in weather control methods [72]. There is an abundance of historical documentation of weather modification techniques, for example, “A recommended National Program in Weather Modification [73], and “Weather Modification Programs, Problems, Policy, and Potential”- U.S. Senate [74], and numerous U.S. Patents and scientific publications pertaining to weather modification [75].

Regional weather modification like cloud seeding is a common activity in many countries around the world. Evidence suggests that the existence of a global climate engineering operation grew out of a post-World War II “New Manhattan Project” created by key figures within the Western World military-industrial and academic complex. This massive secret program was spearheaded by scientists like Edward Teller, Vannevar Bush, and John von Neuman, nearly all of whom proclaimed that global warming was the New Enemy to be combatted [76]. The New Manhattan Project was also ultimately about power and control. Paraphrasing President Lyndon Johnson in 1962, “*He who controls the world's cloud layer will be able to control the weather, and he who controls the weather will control the world.*” [77]. Geoengineering, defined as the large-scale manipulation of the planetary environment, includes dispersing particulate matter in the atmosphere to cool the earth by reflecting sunlight, a method of “solar radiation management.” Various methods of dispersing aerosol particles high into the atmosphere to reflect sunlight, and later the use of electromagnetic technology to manipulate air masses (e.g., HAARP – High Altitude Auroral Research Project) were developed [78]. This research, and the resulting geoengineering operations spawned by the New Manhattan Project, were paid for by taxpayer dollars, implemented without public knowledge or consent, and made possible by supranational organizations like the United Nations. The 1978 U.N. “Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques” (ENMOD) [79] was a Trojan horse. Instead of prohibiting

geoengineering operations, this international treaty mandated signatory nations to participate in “*environment modification*” activities “*for peaceful purposes,*” or “*to improve the environment.*”

Article II of the ENMOD agreement defines environmental modification the same way as geoengineering, i.e., “*as any technique for changing through deliberate manipulation of natural processes, the dynamics, composition, or structure of the Earth, including its biota, lithosphere, hydrosphere, and atmosphere, or of outer space.*” [79]. Note that biota includes human beings. Over the past several years (2015-2023), the authors have published numerous peer-reviewed scientific articles on the origin, content, and devastating effects of these sprayed particulate trails, what can be called tropospheric aerosol geoengineering [80]. The persistent white trails emanating from jet aircraft that are clearly visible overhead spread out to resemble cirrus clouds before creating a milky appearance in the sky (Figure 3).



Figure 3. From [81]. Photographs of tropospheric aerial particulate geoengineering trails. Rows top to bottom, left to right: 1) Calgary, Alberta (Canada); Gold Hill, Oregon (USA); 2) Geneva, Switzerland; Ashdod, Israel; 3) Sacramento, California (USA); Yosemite, California (USA).

Concerned citizens observing these particulate trails sometimes took samples of post-spray rainwater, had these samples analyzed at commercial labs, and posted the results on the Internet. Usually analyses were requested for aluminum, sometimes for barium and aluminum and occasionally for strontium, barium and aluminum. However, there were no obvious sources of these pollutants, and natural sources of elements like aluminum are not soluble in water [82]. Coal fly ash, a by-product of industrial coal burning, produces hundreds of million tons of waste material every year [83]. Spanish investigators discovered that at least 38 elements in coal fly ash, including aluminum, barium, and strontium, can be partially dissolved in water [84]. One of the authors (JMH) was the first scientist to determine that the ratio of elements found in post-spray rainwater matched corresponding element pairs extracted into water by coal fly ash [85]. Subsequent investigations by the authors showed that multiple element ratios measured in rain (Figure 4) and in snow (Figure 5) closely match the composition range as corresponding element ratios from water-leach experiments and coal fly ash samples, respectively, from Europe and the United States.

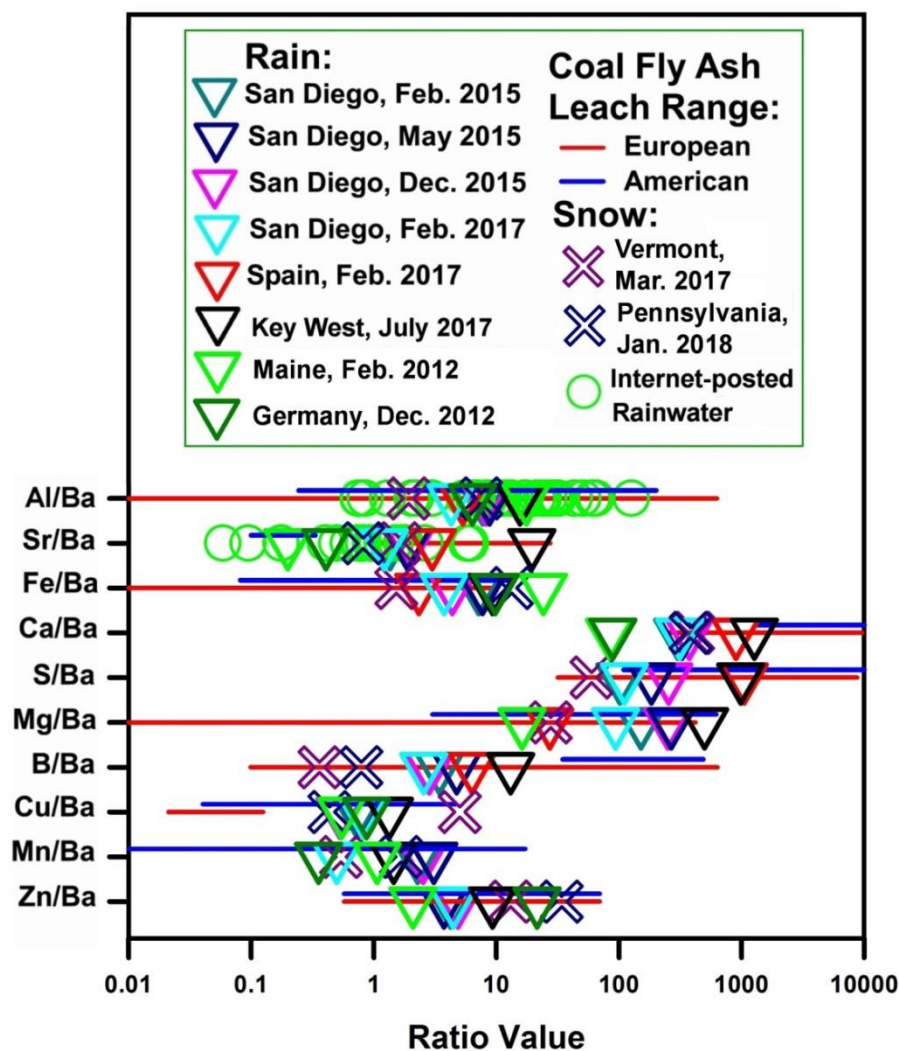


Figure 4: From [22], showing the similarity of element ratios measured in rainwater and snow with the range of comparable element ratios in the laboratory lixiviate of water-leach experiments [84, 86].

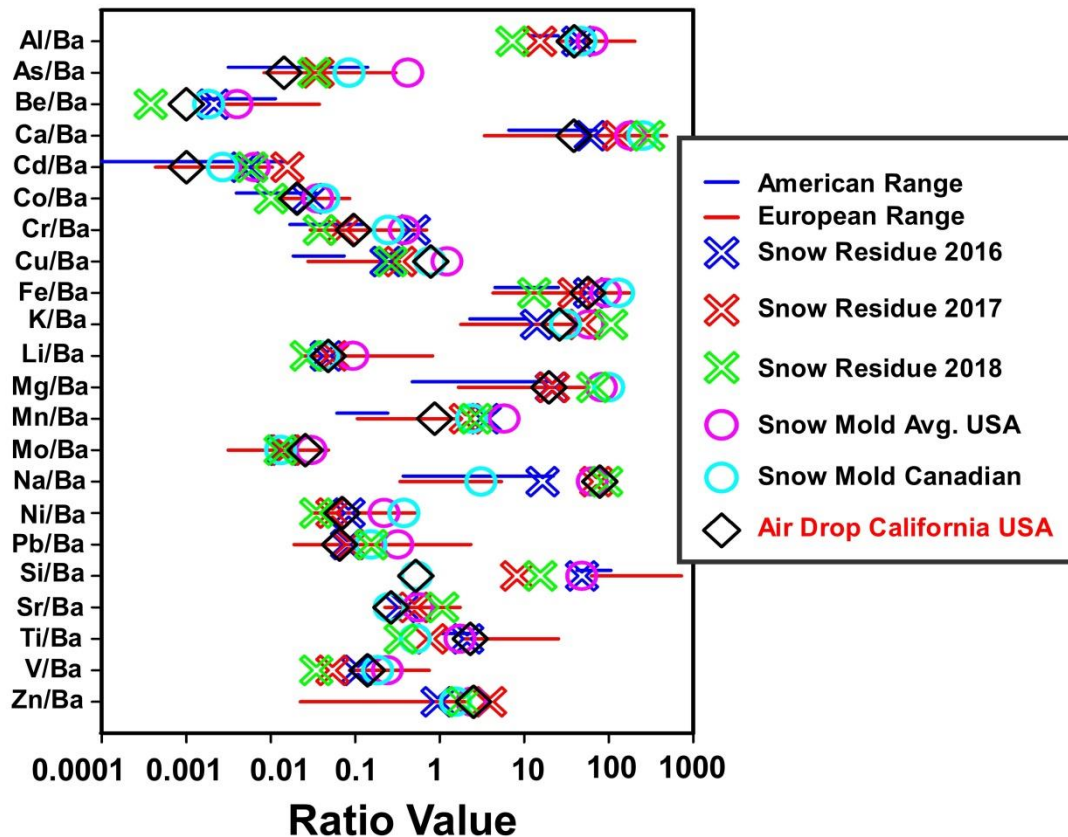


Figure 5: From [81]. Comparison of analytical results with the ranges of European [84] and American [86] coal fly ash samples.

The absence of public disclosure and the highly organized disinformation surrounding the ENMOD-sanctioned environmental modification, including the aerial spraying of toxic particulates is further evidence of its deceitful intent [87]. Most of the scientific and academic community treats climate engineering as “a necessary evil” that will be required at some future date, while otherwise displaying a willful blindness and deadly silence or “*omerta*” in relation to ongoing geoengineering operations being conducted in plain sight over our heads [88].

Jet-sprayed particulate trails, labelled “chemtrails” by the public, have grown into a near daily, near global phenomenon during the 21st Century. Disinformation claiming that the trails represent harmless ice-crystal “contrails” stands in conflict with direct observation and is disputed by scientific evidence [38].

Since that time, we have published several independent lines of evidence revealing the unmistakable footprint of coal fly ash in post-spraying precipitation samples and material from air filters from across the U.S. and Europe. This data has never been seriously challenged: We anticipate confirmation of these findings by independent investigators [18].

When coal is burned, the heavy ash settles, while the light ash, coal fly ash (CFA), forms above the burner and would exit the smokestack if not electrostatically trapped and collected as required in most Western nations. Primary components of CFA include aluminum silicates, an

iron-bearing, magnetic fraction that includes magnetite (Fe_3O_4), and unburned carbon. Primary elements in CFA are oxides of silicon (Si), aluminum (Al), iron (Fe), and calcium (Ca), with less amounts of magnesium (Mg), sulfur (S), sodium (Na), Chlorine (Cl), and potassium (K). Coal fly ash has numerous trace elements including arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), copper (Cu) lead (Pb), manganese (Mn), mercury (Hg), nickel (Ni), phosphorus (P), selenium (Se), strontium (Sr), thallium (Tl), thorium (Th), vanadium (V), and zinc (Zn).

Most of the particles found in CFA show a spherical morphology, like the previously mentioned spherical carbonaceous particles [89, 90]. Concentrations of trace elements in CFA are typically higher than in the Earth's crust, soil, or even solid coal [91]. Coal fly ash "makes clouds" by ice nucleation at conditions existing in upper level (cirrus) or mixed cloud layers clouds [92] Coal fly ash aerosols increase the electrical conductivity of atmospheric moisture making the atmosphere more responsive to manipulation by certain electromagnetic frequencies [84]. Various techniques in the electrical modification of cloud microphysical properties to produce rain have been known for several decades [93]. Coal fly ash aerosols therefore provide a cheap and readily available particulate matter that can be used for the "secret" tropospheric aerosol geoengineering operations justified by the questionably-legal ENMOD treaty. Unfortunately, these programs were initiated without regard for human and environmental health. As will be explained, there is no other substance worse than CFA to spray into the troposphere, or in other words, into the same air column where we all live and breathe [94].

Chemtrails are not to be confused with cloud seeding. Seeding clouds with silver iodide or dry-ice (solid CO_2) triggers rainfall by nucleating raindrops. Chemtrail particulate pollution, on the other hand, increases artificial clouds with particulates that absorb solar radiation and create a "heated blanket" effect over Earth's surface.

Rising temperatures increase evaporation, and for every temperature increase of one-degree Celsius, atmospheric water vapor concentrations increase by about 7%. [95]. Unlike other greenhouse gases, water vapor is normally short-lived in the atmosphere because it condenses and precipitates out. However, atmospheric water molecules are attracted to aerosol particles like magnets, forming water droplets and creating clouds. However, aerosol particles impede the growth of water droplets thereby limiting their growth to a size capable of precipitation.

The addition of aerosol particles changes a cloud's natural properties, leading to accumulation of water droplets that are smaller in size but greater in number [96]. Coal fly ash and HULIS are both hygroscopic aerosols able to form clouds by means of their ice-nucleating particles [97]. Moreover, water vapor amplifies the warming of other greenhouse gases, more than doubling the direct warming from carbon dioxide [98].

JET-SPRAYED DEATH AND DESTRUCTION

The deliberate emplacement of coal fly ash aerosols into the troposphere has devastating effects on nearly all forms of higher life on earth. Air pollution is the leading environmental cause of disease and death in humans [99]. The fossil fuel pollution component of $\text{PM}_{2.5}$ ($<2.5 \mu\text{m}$) contributes a large portion of this mortality burden [100]. Fine particulate matter derived from coal combustion delivers the most potent and harmful elements of air pollution.

Among the most reactive particles in coal fly ash are unburned carbon and transition metals like iron [101]. The primary mechanism of air pollution-induced health effects in humans consists of oxidative stress and chronic inflammation [102]. There are many studies of the toxicity of air pollution particles $<2.5 \mu\text{m}$, in the same size range of most aerosolized coal fly ash particles [103].

We have published peer-reviewed medical and scientific articles showing that aerosolized coal fly ash is a significant risk factor for lung cancer [23], COPD and respiratory disease [104], stroke and neurodegenerative disease [24], and cardiac disease [105]. Ultrafine aerosol particles penetrate deeply into the lungs and can translocate into systemic circulation, affecting multiple organ systems in the body [106]. Electron microscopy reveals that human brain tissue [107] and cardiac tissue [108] contain myriad exogenous spherical magnetic iron particles most consistent with those found in coal fly ash. The magnetic (e.g., magnetite) pollution particles in human brain tissue interact with external electromagnetic fields, likely contributing to neuropathology and dementia [105, 109].

Recent studies confirm that carbonaceous and iron/metal bearing pollution particles from combustion sources are found in human placentas [110]. The totality of these findings provides irrefutable evidence of universal contamination of human tissue by ultrafine particulate matter of fossil fuel origin. Human contamination by these types of particles is from “womb to tomb,” and is cumulative over time [105]. The exogenous pollution particles found in human tissue can be considered key biological markers for the Anthropocene Epoch and for the gross contamination of the biosphere and Homo sapiens by products of fossil fuel combustion and ongoing tropospheric geoengineering operations utilizing coal fly ash.

Global warming and pollution, especially air pollution, are the greatest threats to the environmental health of the planet. “Deliberate” air pollution in the form of tropospheric aerosol geoengineering utilizing coal fly ash poses the greatest danger to the planet short of all-out nuclear war. The deceptive ENMOD treaty coerces sovereign nations, their militaries, mainstream media, tech giants, super-rich elites, transnational “defense contractors,” and complicit government agencies, to participate in these ongoing, global, and non-disclosed, “climate intervention” operations [111].

Human activities have destroyed over two-thirds of the world’s wildlife over the last fifty years. Plant and animal species have suffered a precipitous global decline [112]. We have identified aerosolized coal fly ash as a significant factor in the catastrophic decline of insects [113] and birds [81]. Both insects and birds from around the world show evidence of systemic contamination by multiple toxic elements found in CFA. Bats serve as excellent mammalian bioindicators of environmental pollution. Like birds and insects, bats are suffering a global decline. Based on a review of the literature, we have shown that multiple element ratios in bat tissue and guano are consistent with an origin in coal fly ash aerosols [114]. Particulates used in the aerial spraying, evidenced as coal fly ash, poison soil and water with many toxic elements including mercury and chemically mobile aluminum [115]. Unbound aluminum is toxic to plants and animals [116]. Coal fly ash particles concentrate on the leaves and needles of trees and in the soil around them, adversely affecting the root system. This weakens the trees and makes them susceptible to attack by opportunistic fungi and insects like bark beetles [22].

The constant aerial spraying is a major factor in producing the raging forest fires across the globe by mechanisms that include the exacerbation of drought, tree and vegetation die-off, incendiary dust, and fire ignition by dry lightning [117]. The spraying of coal fly ash particulates into the world's oceans and freshwater creates heating and stratification, worsens acidity, and promotes harmful algae blooms [118].

The aerial spraying poisons crops and disrupts the stable weather patterns that have made agriculture possible. One of the hallmarks of tropospheric aerosol geoengineering is weather patterns that lead to extremes of either "drought or deluge." While global warming produces increased evaporation and precipitation, pollution particles can inhibit rainfall in one area while producing floods in another area [119]. Weather manipulation, "weather warfare," and so-called climate intervention including by both chemical and electromagnetic means threaten total climate collapse and a breakdown of the world's biosphere [120].

AEROSOL HARM

Aerosols are of central importance for atmospheric chemistry and physics, the climate, and public health. Particles in the micron and submicron size range influence the energy balance of the Earth, the hydrological cycle, atmospheric circulation, and quantities of greenhouse and reactive gases [121]. Coal fly ash is an abundant, cheap, and easily accessible waste product from coal burning that contains many ultrafine particles that require minimal processing before being utilized in tropospheric aerosol geoengineering.

If human and environmental health were of no concern, coal fly ash is an ideal particulate for heating the troposphere because it has many small particles that absorb or reflect short and long wave radiation. Most particles found in the troposphere absorb solar energy from one or more portions of the wavelength spectrum [35]. A dispersion of sunlight-absorbing particles in the atmosphere is an ideal system for collecting radiant energy, converting it to heat, and transferring this heat to the surrounding atmospheric gases [122].

In coal fly ash, carbon and iron are two of the most important contributors to atmospheric heating. Black carbon (or soot) is known to heat the atmosphere by absorbing light over a wide solar spectrum. Brown carbon (including HULIS - humic-like substance) absorbs highly energetic ultraviolet light [123]. Carbon deposits on non-carbonaceous aerosols enhance their solar radiation heat potential [124]. Iron oxides like magnetite dominate among radiation-absorbing minerals. Anthropogenic iron magnetite particles in the atmosphere result in short-wave atmospheric heating comparable to carbonaceous particles [125]. Particulate matter in the troposphere, including the moisture droplets in clouds, blocks some sunlight, but also absorbs in-coming solar radiation and out-going terrestrial radiation. Heated particles transfer that heat to the surrounding atmosphere, reducing the adverse temperature gradient relative to Earth's surface. This reduction of the adverse temperature gradient concomitantly reduces atmospheric convection, which diminishes heat-loss from Earth's surface [35].

Throughout Earth's history, geosphere-biosphere interactions have been an internal driver of the Earth system. The climate change planetary boundary is a proxy for the geosphere, and therefore climate change and biosphere integrity are considered "core boundaries" in the planetary boundary framework. The planetary boundary framework, updated to the current

year (2023), finds that six of nine boundaries are transgressed, indicating that Earth is well outside of the safe operating space for humanity. The six boundaries transgressed include biosphere integrity, climate change, land system change, freshwater change, novel entities, and biochemical flows [126].

We have shown that coal fly ash, including its use in tropospheric aerosol geoengineering, has major adverse consequences on climate change and biosphere integrity. Coal fly ash aerosols grossly contaminate both biosphere and hydrosphere, and they are a primary cause of global warming. Unacknowledged coal fly ash aerosols from global climate engineering have almost certainly precipitated cascading tipping points including global forest destruction, polar ice melt, and ocean superheating and stratification. Coal fly ash causes global warming by heating the upper troposphere and thus reducing atmospheric convection. Coal fly ash particles deposited on polar snow, ice, and glaciers induce rapid melting and reduction of albedo [37]. The 2023 update of planetary boundaries, while allowing for large uncertainties, suggests that the three boundaries not yet transgressed are atmospheric aerosol loading, stratospheric ozone depletion, and ocean acidification [126]. However, by recognizing the profound impact of non-disclosed coal fly ash tropospheric geoengineering carried out over the past 2-3 decades, it becomes obvious that the last 3 planetary boundaries have been greatly exceeded or “transgressed.” Atmospheric aerosol loading has never been greater, with hundreds of millions of tons of aerosol particles having been deliberately emplaced in the atmosphere. Coal fly ash, as previously discussed, is known to produce catastrophic changes in ocean chemistry. The stratospheric ozone layer is collapsing, as will be discussed. There can be no doubt that the planet has already transitioned into an irreversible Hothouse Earth and that humans are rapidly destroying the habitability of Earth. One of the most dire and immediate threats we face in the new Hothouse Earth is the increasingly deadly ultraviolet B and C radiation now penetrating to Earth’s surface.

DESTROYING STRATOSPHERIC OZONE

It is claimed that that stratospheric ozone (O_3) and atmospheric oxygen (O_2) prevent over 90% of ultraviolet radiation B (UV-B) and all ultraviolet radiation C (UV-C) from reaching Earth’s surface [127]. Over the past four decades, the geoscience community has focused on depletion of stratospheric ozone in relation to the Antarctic ozone hole and held to the theory adopted by the 1987 Montreal Protocol, that the man-made chemicals, chlorofluorohydrocarbons (CFC’s), are primarily responsible for ozone depletion. We disputed this theory based on our knowledge of coal fly ash geoengineering, our skepticism of the so-called “ozone hole recovery,” and the visible destructive changes of extreme UV radiation on the natural world, especially trees. For these reasons we conducted our own multifold measurements of solar irradiance spectra showing conclusively that all wavelengths in the range of 200-400 nm (including portions of both UV-B and UV-C) reach Earth’s surface, contrary to the prevailing narrative [128]. Our data closely matched previously disputed data of NASA scientists [129] that were at first critiqued, but not repeated, and subsequently ignored by the geoscience community. This work called into question all standard measurements of UV wavelengths in this range from the top of the atmosphere.

After first documenting deadly UV-B and UV-C radiation penetrating to earth, the authors, together with metrologist Raymond Hoisington, used radiometric evidence to prove that

chemtrails are not contrails. This was done by demonstrating that the sprayed particulate trails block ultraviolet radiation within a specific UV wavelength, because UV absorption by ice and water vapor is negligible [38]. Additionally, these articles reviewed the hazards of UV-B and UV-C radiation on the natural world.

UV-B is a global stressor with a large negative effect on survival and growth of organisms that cross life histories, trophic groups, and habitats [130]. Both extreme UV-B and UV-C are highly damaging to coral reefs [131, 132]. Enhanced UV-B radiation reduces genome stability in plants [133] and can cause decreased reproduction or even sterilization in trees [134]. The toxicity of UV-C (100-280 nm) is well known, with lethal effects on both insects and microorganisms ([135, 136]. More recently we obtained unequivocal evidence of UV-C penetration to Earth's surface by using a novel technique that eliminates the technical problem of stray light. This method confirms penetration of UV radiation in the range of 250-300 nm to Earth's surface. Wavelengths in this range cause the maximum mutagenicity and lethal action of ultraviolet radiation. Ultraviolet radiation C poses its greatest biological hazard at 270 nm, the wavelength with peak absorbance by human DNA [137].

Measurements of deadly UV-B and UV-C penetrating to Earth's surface is solid evidence that the stratospheric ozone level is not recovering as is widely claimed. Scientists at the National Aeronautics and Space Administration (NASA) and the National Oceanic and Atmospheric Administration (NOAA) in 2018 admitted that ozone declines in the lower stratosphere were offsetting the overall ozone layer recovery. They stated they didn't know the causes of this depletion and emphasized that *"the causes need to be urgently established"* [67].

In 2022, a massive ozone hole was reported over the tropics [138]. Some of the largest Antarctic ozone holes have been observed just since 2020 [139]. It became apparent to us that Rowland and Molina's theoretic proposal that chlorofluorocarbons (CFC's) were the primary cause of stratospheric ozone depletion [140] was simply wrong, and the United Nation's Montreal Protocol in 1989 banning these man-made chemicals had misdiagnosed the problem, a potentially fatal mistake for mankind.

Recent discoveries about the causes of previous Great Extinctions including the Permian ("The Great Dying") 250 million years ago (5) suggested another more likely cause of ozone layer depletion, i.e., coal fly ash and other organic material lofted up to the stratosphere by widespread volcanic activity [55]. In a series of articles since 2022, the authors have provided compelling evidence that aerosolized coal fly ash particles are the main agents responsible for stratospheric ozone depletion [19-21, 141]. Aerosolized coal fly ash particles, uplifted to the stratosphere, not only serve as ice-nucleating agents, but are trapped and concentrated in Polar Stratospheric Clouds. In springtime, as stratospheric clouds begin to melt/evaporate, coal fly ash particles are released and react to consume stratospheric ozone [19].

Particles in the upper troposphere can be uplifted into the stratosphere by convection [142]. Particles collected in the stratosphere and analyzed by laser mass spectrometry contain primary elements found in coal fly ash including iron, carbon, sulfates, and aluminum, as well as halogens (bromine and iodine) and trace elements like mercury [143]. Both chemical analysis and morphology studies by scanning electron microscopy (SEM) of particles collected

in the Arctic vortex and polar stratospheric clouds are consistent with particles found in coal fly ash [144].

Numerous constituents of coal fly ash itself can destroy ozone [145, 146]. Halogens found in coal fly ash can destroy ozone [147]. There is reactive uptake of ozone on oxides of aluminum, silicon, and iron, all significant components of CFA [148]. Submicron carbon and iron aerosol particles destroy ozone efficiently, with the implication that these particles in the stratosphere are a significant cause of ozone depletion [149]. Iron is one of the most reactive elements in coal fly ash, and it is associated with reactive oxygen species like the hydroxyl radical, which destroys ozone in the stratosphere [20].

Humic-like substance aerosols (HULIS) are important components of fine particulate matter, or PM_{2.5} emitted from the combustion of coal and biomass. HULIS is a category of organic molecules isolated from fog, clouds, and rainwater that resembles the organic material in river, seawater and soil formed by the breakdown of biological matter. HULIS has received increasing attention in recent years due to its ubiquity and high concentration in both biogenic and anthropogenic aerosols, its participation in many atmospheric reactions, its optical processes, and its effects on clouds and climate [150]. Having common sources, coal fly ash and HULIS aerosols are frequently mixed, along with secondary organic aerosols formed from aging organic matter [151].

The authors recently reviewed the evidence that HULIS aerosols are another major cause of stratospheric ozone depletion [141]. Like coal fly ash, atmospheric humic-like substances are also oxidized by ozone ([152]. Significant changes in stratospheric chlorine and ozone were observed over the Southern Hemisphere and mid-latitudes following the massive Australian wildfires in 2020 [153], and it has now become evident that wildfire smoke contributes to stratospheric ozone depletion [154].

Wildfires are a factor in stratospheric ozone depletion over both the Arctic and the Antarctic [155]. HULIS is a prominent component of wildfire smoke and is likely a cause of the ozone depletion. Chemical interactions of fulvic acids in HULIS facilitate the uptake of ozone on liquid organic aerosols [156], and experimental work demonstrates photo-enhanced ozone uptake on both humic acid films and submicron HULIS-type aerosol particles [157]. Humic-like substance is a unique material that contributes to warming of land, sea, and air. Studies show HULIS aerosols strongly absorb solar radiation in the ultraviolet range [158], with absorption extending down to UV-C levels of 100-280 nm [159]. The HULIS fraction of brown carbon contributes to atmospheric warming over the Western Pacific [160]. The Arctic is warming at an excessive rate relative to the rest of the planet, and it has been shown that brown carbon and its HULIS fraction impose strong circum-Arctic warming [161]. In lakes and coastal oceans, dissolved organic material, with its UV-absorbing HULIS fraction, is accelerating and is associated with greater runoff, decaying biota, and atmospheric deposition. Freshwater ecosystems are warming at unprecedented rates while simultaneously experiencing increased runoff of humic substances that appear as “brownification” of surface waters. Brownification of freshwater and coastal marine water is associated with major impacts on environmental conditions and biodiversity [162]. Ultraviolet and light-absorbing brown and black carbon reduce snow albedo, thus accelerating polar and glacier melting [163].

Human-induced climate change and climate intervention have already brought record high land and sea temperatures, catastrophic floods and epic drought, deadly wildfires, and record low sea ice at both poles. Often omitted from the discussion of global warming is the profound effect of water vapor, which represents about one-half of the greenhouse effect. Water vapor has broad absorption of infrared radiation, from solar and Earth's surface, compared to greenhouse gases like CO₂ or methane [164].

Changes in stratospheric chemistry are dependent on transport of tropospheric gases, particles, and water vapor into the lower stratosphere from the tropopause. Pollution particles and water vapor in the troposphere can be transported to the stratosphere by convection [165]. The increasing emissions of methane can be transformed into water by chemical reactions in the stratosphere. More stratospheric water contributes to both ozone loss and global warming [166]. Rapid ozone depletion was documented after the Hunga Tonga underwater volcanic eruption in 2022 that injected large amounts of water into the stratosphere [167].

Satellite and radiosonde temperature measurements document a significant warming of the troposphere and an associated cooling of the stratosphere from 1979 through 2018 [168]. These findings strengthened other evidence of a large human influence or fingerprint on the thermal structure of the atmosphere [169]. The lowest level of the atmosphere, the troposphere, has also risen significantly (50-60 meters per decade), with most of this height increase due to warming. The troposphere warmed faster in the Northern Hemisphere between 2000 and 2020 than between 1980 and 2000, a change attributed to human emissions, particulate pollution augmented by greenhouse gases and ozone-depleting substances [170]. Tropospheric expansion caused by global warming may be responsible for the ongoing reduction of lower stratospheric ozone. Strengthened upwelling and tropospheric expansion are correlated with global warming, and both processes contribute to ozone depletion, especially in the tropics [171].

There is an increase in in tropical tropopause layer (TTL) temperature and water vapor found in polluted clouds over Asia. Polluted clouds have a smaller ice effective radius and higher temperature and specific humidity near the tropopause and stratosphere than clean clouds. Given the heating and chemical effects of stratospheric water vapor, the increasing emissions of aerosols over Asia may have profound effects on stratospheric chemistry, global energy balance, and the water cycle [172]. High water content favors sulfate and secondary organic aerosol formation from fossil fuel combustion emissions [173].

In the last two decades, the richest source of "polluted clouds" have arisen from HULIS aerosols from biomass burning and coal fly ash from a variety of sources, but most importantly from tropospheric aerosol geoengineering, which emplaces these fine particles at the level of cirrus clouds high in the atmosphere. Since both HULIS and coal fly ash aerosols heat the atmosphere and destroy stratospheric ozone, it should be apparent that these two types of aerosols can account for both observed atmospheric temperature changes and stratospheric ozone depletion.

We are already immersed in Will Steffen's Hothouse Earth scenario, from whence there will be no return. The activation of a global cascade of tipping points has produced this new and much

less habitable state of the planet. The world is hotter and stormier. Killing heat waves are already occurring all over the world. Forests have been dying and now are burning on a global basis. Permafrost is melting with its methane pouring into the atmosphere. Both Antarctic and Arctic ice is rapidly melting. Oceans have become superheated, stratified, and acidic, leading to a profound loss of marine biodiversity and human livelihood. Coral reefs are dying everywhere. The loss of Arctic sea-ice and Greenland glacier melt along with its influx of fresh water has already slowed the Atlantic Meridional Overturning Circulation (AMOC), a key part of global heat and salt transport by the ocean. These global and interrelated cascading tipping points represent a climate emergency and an existential threat to civilization. The time left to prevent major tipping points has already passed, and the time needed to achieve zero net emissions would likely be several decades [174, 175].

As the late Will Steffen said, “it is becoming abundantly clear that (a) the current system is incompatible with a well-functioning Earth System at the planetary level, (b) the current system (i.e., of neoliberal economies and capitalism) is eroding human and societal well-being, even in the wealthiest countries, and (c) collapse is the most likely outcome of the present trajectory of this system, as prophetically predicted in the 1972 Limits to Growth work” [176, 177].

Steffen epitomized the ethos of the social contract between scientist and society in his pursuit of and sharing knowledge regarding the grand challenge of climate change. Steffen could be scathing in his disdain for “the fossil fuel elite,” writing that “these people have no right to destroy my daughter’s future and those of her generation” [178]. Beyond global species extinctions, the Earth is experiencing huge population declines in flora and fauna, and extirpations that will have adverse cascading consequences on ecosystem functioning and services vital to sustaining civilization.

The term “biological annihilation” has been used to describe the current ongoing Sixth Great Extinction [179]. The true science underlying these issues is strong, but the awareness is weak. Humans have grossly underestimated the enormity of the problems we face and the massive challenges of avoiding a ghastly future for our children [180]. Meanwhile, both the scientific community and the masses alike continue to ignore “the elephant in the room,” which is the catastrophic damage inflicted on the planet by ongoing geoengineering operations, primarily aimed at polar melting for solely economic reasons, such as new transport lanes and access to under-ice natural resources.

Svante Arrhenius predicted well over 100 years ago that coal combustion would heat the atmosphere to the boiling point within a few thousand years [181].

At Toronto Conference on Changing Atmospheres in 1988 it was announced that global warming was a security threat second only to global nuclear war [182]. The fossil fuel industry’s own internal data projected rapid global warming, contradicting what they led the public to believe [183]. An international coalition of climate scientists recently reported that Earth’s vital signs have worsened beyond anything humans have witnessed to the point that life on the planet is imperiled. They found little progress in fighting climate change [184]. An update on Limits to Growth predicts a halt in welfare, food, and industrial production within this decade, and with the greatest declines associated with uncontrolled pollution [185]. Although there

many contributors to climate change-induced morbidity and mortality, the “Four Horsemen” of climate endgame are likely to be famine, extreme weather, global conflict, and infectious disease. These will be worsened by mortality from air pollution and sea level rise.

The worse-case scenarios correspond to the Hothouse Earth state [186]. As noted, mass extinctions including the Permian have been attributed to widespread volcanic activity associated with ascent of coal fly ash and other organic material to the stratosphere, resulting in collapse of the ozone layer. The Siberian Traps eruption raised ambient temperatures to at least 35-40 °C, with likely lethal effects. Most plants and animals suffer major physiological damage at these temperatures [187]. Extreme heat and ultraviolet B and C radiation cause damage to photosynthesis of plants at multiple sites [188]. Effective photosynthesis for most plants is inactivated at 40 °C [189].

The ultimate climate emergency consists of the so-called “runaway greenhouse,” a hot and water vapor-rich atmosphere that limits emission of thermal energy to space, causing runaway warming. It has become possible that human climate-altering activities could bring about this scenario that Venus experienced in the past, the so-called “Venus Syndrome” [190].

Until recently the scientific community widely believed that the Montreal Protocol, which gradually phased out the usage of chlorofluorocarbons (CFC's), not only averted further damage to the stratospheric ozone layer but helped prevent significant climate change [191]. This narrative was endorsed by government agencies as recently as 2022 [192], and it has been widely promoted by the mass media. Unfortunately, nothing could be further from the truth. As previously discussed, we have documented UV-B and UV-C penetration to Earth, verifying similar data from NASA scientists 20 years ago, and questioning all measurements of UV radiation in these wavelengths at top-of-the-atmosphere. We have shown that coal fly ash and HULIS aerosols destroy stratospheric ozone, and it is now widely recognized that large forest fires deplete stratospheric ozone. If not through false data or deliberate deception, how could climate scientists have gotten things so wrong?

The distribution of ozone in the stratosphere is highly variable and in constant flux due to factors like the Brewer-Dobson circulation, in which air ascends in the tropics and then moves poleward in both hemispheres [193]. The measurement of stratospheric ozone by the Dobson spectrophotometer is often inaccurate because of errors caused by interfering absorbing species such as sulfa dioxide (SO₂), NO₂, and photochemically produced O₃ in polluted air [194]. The presence of SO₂ especially leads to Dobson ozone amounts that are higher than the actual values [195]. Ultraviolet radiances at Earth's surface are measured at the 290-400 nm (UV-B) range, and estimated using ozone amount, cloud transmittance, aerosol amounts, and surface reflectivity from the solar UV radiation backscattered from the Earth's atmosphere as measured by the total ozone mapping spectrometer (TOMS). TOMS, Dobson, and Brewer systems are all affected by UV-absorbing aerosols [196]. Measurement of solar irradiance in the UV-B range by array spectroradiometers has large uncertainties due to issues such as stray light [197]. Ultraviolet irradiances at Earth's surface show larger increases than those estimated by satellite data, even though both tropospheric ozone and aerosols reduce UV irradiances appreciably at Earth's surface [198].

It is becoming increasingly apparent that the stratospheric ozone layer is still breaking down, imperiling all higher life on Earth. The question becomes, *“what is the true situation and just how bad is it?”* Reconstructing the history of the discovery of the Antarctic ozone hole reveals much data and other information that contradicts the prevailing narrative of ozone depletion by CFC’s as well as “ozone layer recovery.”

The Antarctic ozone hole was discovered on-site in the mid-1980’s by British scientists using Dobson spectrophotometers. Their data, later verified, showed that ozone levels in this area had fallen by 40% from 1975-1984, with depletion of 80% at the center of the hole [199]. At the time it was known that there were increased emissions from the Erebus volcano in Antarctica, which some researchers later blamed for the original ozone hole [200]. A different technique using spectrographic plates had recorded extremely low ozone levels in Antarctica as early as 1958, calling into question the ozone-loss/CFC theory [201].

When the Montreal Protocol was signed in 1987, the Antarctic ozone hole as measured by satellites had reached 22 million square kilometers with ozone concentrations down to 109 Dobson units [DU], compared to average stratospheric concentrations over 300-350 DU [?]. There were large upward trends of ultraviolet B radiation associated with ozone depletion measured at ground level in Toronto from 1989-1993 [202]. In the 1990’s, the British Antarctic surveys at the Halley Research Center showed ozone hovered around 120-150 DU, less than one-half of the values during the 1960’s [203].

A recently published scientific article documents a continued decline in middle stratospheric ozone since 2004, with the development of some of the largest and deepest Antarctic ozone holes just since 2020. The most recent ozone holes are linked to changes in air entry into the polar vortex and factors “other than CFC’s,” including wildfires and volcanic emissions [204]. Fairly constant minimum Antarctic ozone levels near 110 DU have been observed in the 1990s and 2000s, except for exceptions of 2002 and 2019 [205]. Large Arctic ozone holes have been observed in the Arctic since 2011 [206], with associated high levels of UV radiation documented [207]. Since 2022, the highest UV irradiances in more than two decades have been recorded in Antarctica [208].

The stratospheric ozone layer is a critical life support system which protects all higher life on Earth from damaging ultraviolet radiation. Despite this importance, stratospheric ozone depletion is one of the problems least understood by the general public. Moreover, the climate science community has misdiagnosed the cause of the problem, a tragic mistake for mankind. It has become apparent that both global warming and stratospheric ozone depletion share the common cause of pollution aerosols, yet scientists continue to primarily blame carbon dioxide for global warming, and CFCs for stratospheric ozone depletion, instead of coal fly ash and HULIS.

There was never any significant “ozone recovery” as a result of the Montreal Protocol, which phased out and later banned CFC’s. The truth is that the stratospheric ozone layer is already severely depleted, and the situation is getting worse every year. The true severity and extent of this depletion can only be estimated. Stratospheric ozone is continually forming and breaking down, with large seasonal and regional differences in the Total Ozone Column.

The formation of stratospheric ozone depends on replacement by atmospheric oxygen, which is declining. As discussed, satellite measurements of stratospheric ozone are unreliable, and they do not measure those wavelengths in the UV-C range with the greatest UV absorbance. Dobson spectrophotometers compare wavelengths of 305 nm (UV-B) and 325 nm (UV-A), and these measurements are affected by pollution aerosols.

Instruments (e.g., ozonesondes) carried by balloons that measure stratospheric ozone by electro-chemical reactions may have better accuracy than those that use optical techniques [209]. The most reliable long-term data on stratospheric ozone comes from polar regions where it is known that the ozone layer is the thinnest. At Halley Station in Antarctica, ground level measurements of stratospheric ozone indicate that depletion started in the 1990's, with depletion reaching some of the highest levels in the 1990's, and no recovery through 2010. Year to year maximum loss of ozone has averaged over 50% at this site. New monitoring stations at mid-latitudes have shown average maximum ozone losses of 10-40% [210]. As previously noted, some of the largest and deepest Antarctic ozone holes have been documented just since 2020, including 2023. Compared to Antarctic ozone loss, Arctic ozone loss has been more limited. However, in the Arctic Spring 2020, the polar vortex showed a highly depleted layer of ozone with losses averaged over sondes peaking at 93% at 18 km [211]. We contend the best estimate of the true severity of stratospheric ozone loss must include accurate measurements of the increases of extreme UV-B and UV-C radiation reaching Earth's surface along with further documentation of the discernable biological damage caused by these wavelengths.

CONCLUSIONS

Anyone with deep connections to nature can see how badly the natural world is suffering, with dying ecosystems throughout the world that include both forests and oceans. The richness and diversity of life on earth is disappearing at an incredible rate. As Will Steffen have said, *"we are already deep into the trajectory toward the collapse of civilization, which is now inevitable with the activation of multiple climate tipping points."* The first dominoes have already fallen, and Hothouse Earth is here to stay, with no chance of reversal within any meaningful time frame. The burning of fossil fuels by modern "civilized" man has gone a long way to "wreck the planet" within just a few hundred years. Few scientists have found the courage to sound the alarm and tell the truth about our dire situation, and fewer yet realize that the collapse of our biosphere has been caused by deliberate, covert military and United Nations sanctioned operations worldwide, and overt human economic activity.

The biosphere breakdown is the direct result of human activities that include first and foremost the deliberate large-scale manipulation of Earth's climate and weather, otherwise known as geoengineering. While the mass of humanity "looks the other way" and ignores the obvious atrocities in our skies, ongoing tropospheric aerosol geoengineering programs continue to spray the worst substances, e.g., coal fly ash, that could possibly be introduced into the upper atmosphere.

Among many anthropogenic threats to the stratospheric ozone layer, coal fly ash and HULIS aerosols have caused the greatest damage to this most critical life support system. We are currently attempting to assess the true extent of stratospheric ozone depletion based on increasing rates of short-wave solar radiation penetrating to Earth, but it is increasingly evident

that this depletion is severe. International cooperation and broad-scale initiatives will be needed to gain a clear international understanding necessary to at least slow the rate of biosphere collapse and salvage something of our critical life support systems. Our time is short to permanently phase out and end all geoengineering activities and reduce and/or eliminate all sources of coal fly ash and HULIS-type aerosols [63].

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