An X-Ray of Connectivity between Climate Change and Particulate Pollutions

*Wilson Nwankwo[1, a *], Kingsley Eghonghon Ukhurebor*
[1]Cyberphysical/Green Computing Lab, Dept. of Computer Science, Edo University Iyamho, Nigeria.
[2]Climatic/Environmental/Telecoms Unit, Department of Physics, Edo University Iyamho, Nigeria.

Abstract- Presently, there has been several scientific debates among climate researchers and environmental engineers regarding the main source of global warming which invariably result to climate change. The obvious argument that the core source of global warming is not just CO_2 heat retention and other greenhouse gases, but particulate pollution that absorbs radiation, heats the troposphere and decreases the effectiveness of atmospheric-convective heat exclusion from the surface of the earth. However, research has continued in a bid to unravel this phenomenon which is a potential cause for alarm to the world we live in. In this review we present a concise but stimulating account on the connection between climate change and particulate pollutions.This paper draws from works done over decades and follows an analytical approach contrary to the position of manyclimate researchers. It is believed that this study would bring clarity to bearas to the understanding of the general public that particulate pollution is a major source of global warming henceshould be adequately addressed.

Keywords: Climate Change, CO_2, Environmental Engineering, Global Warming, Particulate Pollution

INTRODUCTION

The world is witnessing an upsurge of activities and investigations in the domain of climatic studies owing to the increasing spate of weather-related environmental hazards(see Figure 1), the cumulative consequence of which is consistently contributing toa decline in agricultural activities. Other living creatures and their environment are not spared either [1-3]. These climatic processes are described and their values are known by the meteorological conditions of the earth's atmosphere, in addition to their variations and interactions over time [4-7].

Several studies have revealed that the earth is presently experiencing global warming due to anthropogenic greenhouse gases [3, 8-9].In the words of[10], "there are moral explanations to accept as true that political motives are presently driving a considerable amount of the scientific work by the climate science community". Herdon had asserted that pure science, unlike politics, is all about facts. Hitherto, researchers involved inclimatic studieshave failed to produce salient facts through their omission as to not giving the desired attention to the rationale that climate change is exaggerated by tropospheric particulate geo-engineering, which is ongoing for several years now.The Inter-governmental Panel on Climate Change (IPCC) evaluation had considered this failure a sabotage. Furthermore, having regard to publications from several climate scientists, it behoves on investigators to evaluate whether or not political motivations are involved [11-14].

This study is aimed at re-examiningthe debateas to the fundamental source of global warming which is believed,is not the consequence of CO_2 heat retention and other greenhouse gases alone, but also particulate pollution that absorbs radiation, heats the troposphere and decreases the effectiveness of atmospheric-convective heat exclusion from earth's surface. This study is relevant in the sense that it brings to bear the various elements that interact in the climate change chain, the subject of which had become a topical issues not just to climate scientistsand environmental engineers but to all and sundry. In this study, attempt is made to present a coherent connexion between climate change and particulate pollutions that have not received appropriate attention from most climate scientists.

**Corresponding Author: Wilson Nwankwo, Email: nwankwo.wilson@edouniversity.edu.ng*
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

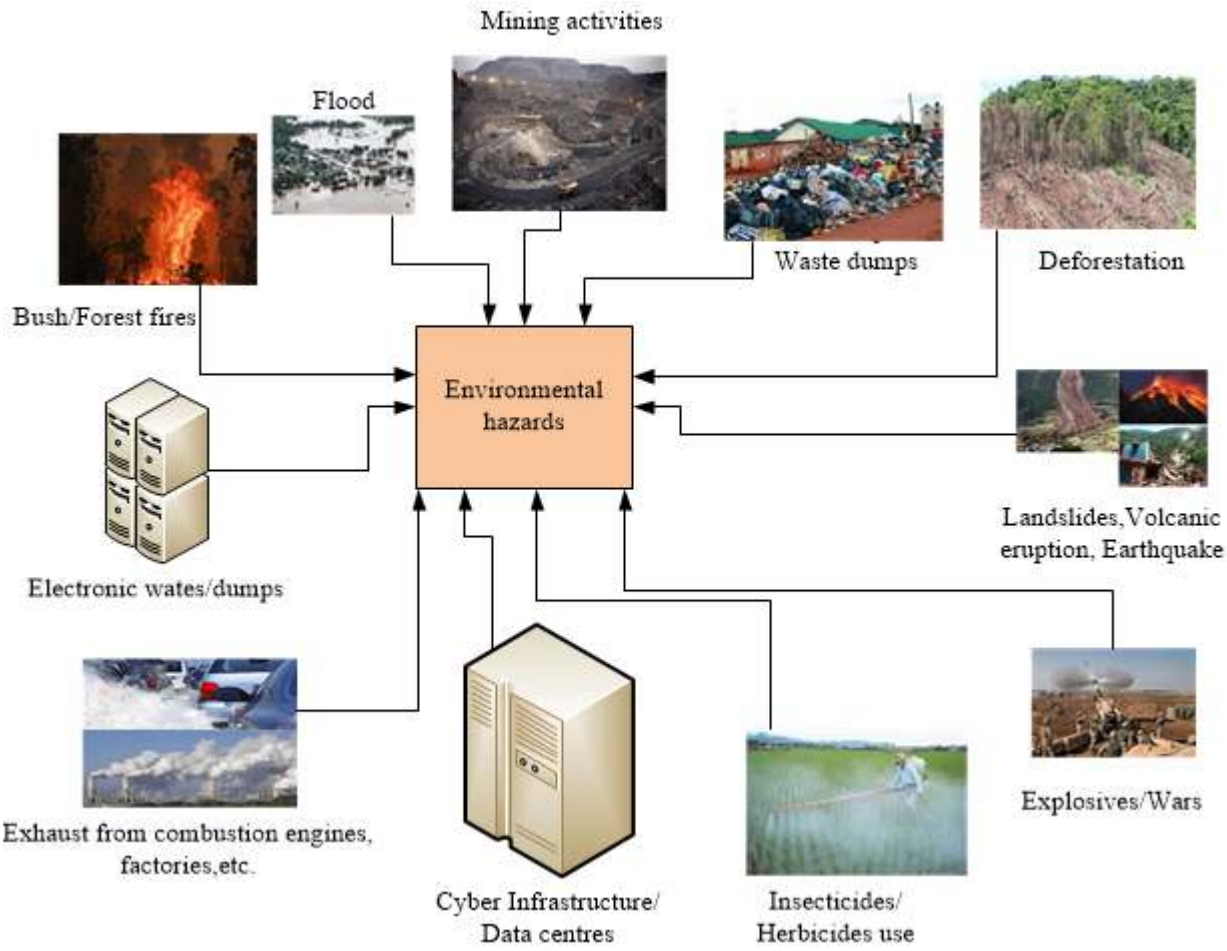

Fig. 1: Environmental hazards

MATERIALS AND METHODS

This study follows a qualitative exploratory narrative-textual approach[15].This approach is considered suitable due to the nature of this study. It is believed that adopting a holistic approach would enable the survey of significant developments in the domain in question in addition tolaying a foundation for presenting a cohesive comparative posture on previous, contemporary and future directions. As research in climate change and environmental engineering is evolving, data available from one geographical zone to another varies markedly hence necessitating a harmonized structure that enables researchers in various climes have a qualitative coverage of such developments. Data collection was by way of desk search across various online and offline bibliographic databases and libraries in America, Asia, Europeand Africa. From a large collection of published and unpublished materials including policy documents, contents relevant to the environmental perspectives buttressed in this paper were selected.

RESULTS AND DISCUSSION

3.1 Tropospheric Particulate Heating

Presently, some scientific research studies have shown that particles either solid or liquid characteristically ≤ 10 μmin the lower atmosphere/troposphereoriginate from several sources [10-22]. Figure 2 shows some of the outstanding sources. Though tropospheric particulates have brief atmospheric life span, they do exert direct climate influence owing to their capability to absorb solar radiation from the earth's surface. Records have it, that they also exhibitsecondary influence on cloud formation and connection with microphysics [23-26]. When a light photon relates with particulate matter, it is either dispersed or absorbed. According to [27], substantial efforts are expended on acquiring reflectance spectral data as a result of their significance in remote imaging technology. Regrettably, there is a deficiency of absorption spectral data as most climate researchers have been deliberately deterred to appreciate its importance. Recently, measuring particulate matter absorption spectra is gaining some relevance. Although, inadequate for instance, in spectral wavelength, it is now possible to make accurate unquantifiable simplifications [11,15-16].

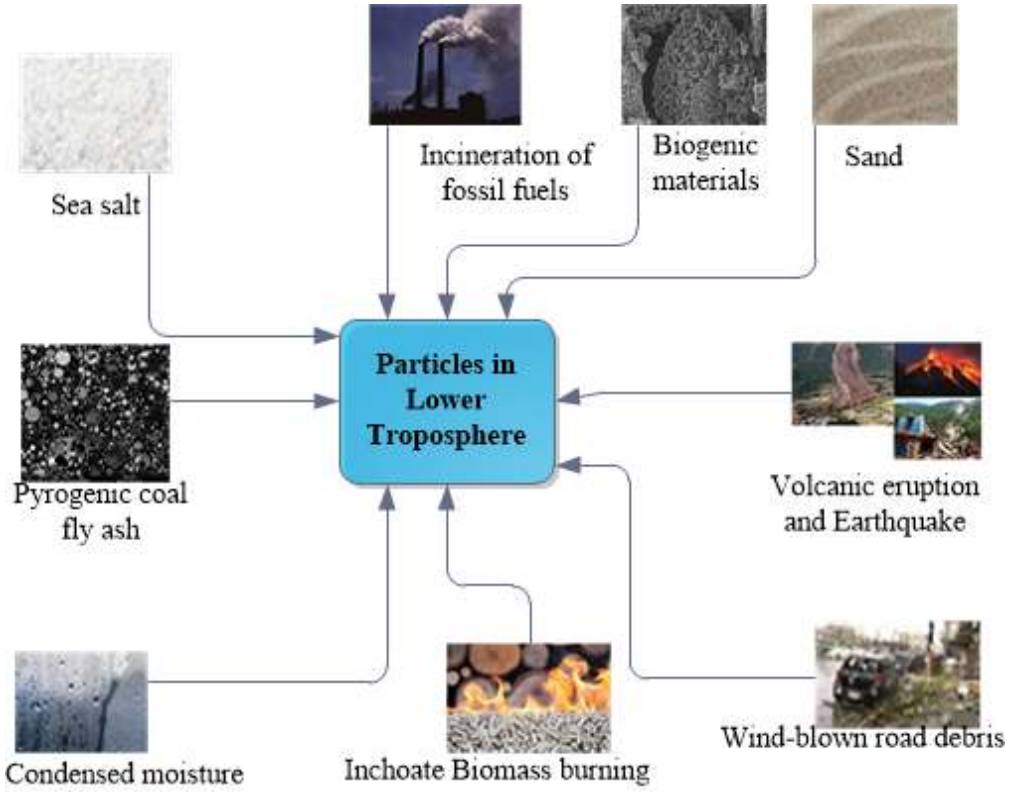

Fig. 2: Origins of particulate matter in the lower troposphere

Aerosol particles interact with solar radiation by scattering (reflecting) or absorbing the radiation, both long-wave and short-wave. Such may get heated and subsequently transfer the heat to the atmosphere via molecular collisions. However, virtually all aerosol particles absorb solar radiation to some extent, including the ones that have a high proclivity to scatter radiation. Quantifying aerosol absorption/scattering presents considerable uncertainties for many reasons including, for example, variations in particle size, surface topography, chemical/mineral composition, surface coatings, in addition to differences in and lack of knowledge of relevant absorption spectra.

Several particulates found in the lower atmosphere absorb solar energy to some extent from differentsegments of the wavelength spectrum [29-33]. The spreading of little absorbing particles forms an ideal system to collect radiant energy, transform it to heat, and competently transfer the heat to a surrounding fluid. The volume of such particles is more felt when its characteristic potential to absorbing light that passes through the material enveloping the particles, is greater than the particle diameter.Once sunlight is absorbed, their temperature begins to rise. The effect is that they quickly "releasesome heat whichradiates to the surrounding gas"[34].

Besides, aerosols can alter cloud properties and suppress rainfall, [10-11,16, 35-38] in their respective studies stated that aerosols exert tremendous impact on clouds and precipitation, the duo of whichconstitute majormechanisms of the climate chainand the earth's hydrological cycle. However, records have it that the impacts of aerosol on rainfall and clouds remaineduncleaar [35-38].

In an experiment by [39] they had measured heating rates notwithstanding it relatively in the lowermostof about 3 km of the atmosphere. They had positioned vertically, some stacked lightweight aerial vehicles that operate autonomously without human intervention. It was discovered that the instance which contribute to the absorption of aerosols to the heating rate was in an order of magnitude greater than the involvement of CO_2 and about 75% of the water vapour. While, the procedure employed by the IPCC and most climate scientists focuses principally on the issue of sun-earth radiation balance and departures therefrom. Herndon[11-12, 14]had focussed on unravelling the processes involved in the disposition of absorbed heat, particularly the implications of particulate pollution on atmospheric convection, which they argue is also a principal mechanism for sustaining earth's habitable surface temperature.

3.2 Carbon/Iron and Aerosol Heating

Dark coloured particulates are competent absorbers of solar radiation of which black carbon, like soot, absorbs light over the entire solar spectrum; brown carbon (like soil humus), whereas the absorbs near-UV wavelengths and, to a lesser extent, visible light [39]. Carbon surface deposits on non-carbonaceous aerosols can boost their solar radiation

*Corresponding Author: Wilson Nwankwo, Email: nwankwo.wilson@edouniversity.edu.ng
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

heat potential [39]. Iron is usually found in anthropogenic carbonaceous particles [40]. Iron oxide minerals, although somewhat less efficient solar radiation absorbers than carbon. However, they are dominate among mineral radiation absorbers.

According to[41], where they measured light absorption in samples of desert dust at 2λ (wavelength), 325 nm (ultraviolet) and 660 nm (red light). From their results, they discovered that mineral dust (from Niger, Tunisia, and China) are experimented close to their source. Thus, devoid of anthropogenic carbon contamination. Iron oxide was by far the greatest light absorbing substance with the quantity of absorption being a linear function of Iron oxide content. They further found that the absorption at 325 nm is about 6 times bigger than at 660 nm. In addition, [33, 42] used an airborne laser-induced luminescencedevice to measure the hematite content of the Saharan dust layer which is known to be heated by solar radiation. Deliberated on the relative importance of anthropogenic incineration iron and iron from mineral dust in aerosol heating and they noted that magnetite (Fe_3O_4) remains one of the utmost competent short-wave absorbers among Iron oxides in the atmosphere.

In their study[22] they found that the utmost of the aerosol Iron oxide particles in the Eastern part of Asian continental atmospheric outflows are anthropogenic aggregated magnetite nanoparticles. They reported that in addition to carbonaceous aerosolsare important contributors to short-wave atmospheric heating. According to recent results, the atmospheric weight of anthropogenic Iron of pyrogenic origin is about ten times bigger than earlier estimations.As rightlyreported by [43], there is a strong correlation between anthropogenic FeOx and black carbon particles in the Eastern part of Asian continental outflow of anthropogenic origin. That is not surprising as pyrogenic coal fly ash, in addition to containing magnetite and other iron-oxides, contains carbon particles [44]. For a set of UK coal fly ash samples, the hematite (Fe_2O_3) range was determined as 2.5 – 8.6 wt.%, the magnetite (Fe_3O_4) range as 0.8 – 4.1 wt.%. The carbon content of coal fly ash by one estimate is 2 – 5 wt.% under optimum conditions, and 20 wt.% under non-optimum conditions [45]. Another investigation found the carbon content range of coal fly ash to be 2.7 – 14.5 wt.%. A major conclusion we can draw from these data is that aerosolized coal fly ash proficiently absorbsradiation from the sun and heats the troposphere.

3.3 Forest Fires and Aerosol Heating

The smoke and ash from forest fires which are elevated into the lower atmospherecontains one class of aerosol particulates that contains black carbon, brown carbon and iron oxides [31, 46]. Iron oxides in the ash from forest fires can be converted at high temperatures to magnetite (Fe_3O_4) which is an even more efficient absorber of solar radiation [30].

According to [47], the effect of forest-fire originated brown carbon aerosols on atmospheric heating has probably been underestimated. Since 1999 there has been a four-fold increase in the particulates arising from forest fires in the Americawhich to a large extent appears to be one consequence of the now near-daily, near global aerosol particulate geoengineering [16, 48]. Consequently, corresponding increases have been noted globally [49].

Furthermore, fire increases surface heat and reduces water evaporation by damaging the canopy [48]. According to [50]"forest fires have an instantaneous and profound influence on snow disappearance, earlier springtime meltsin addition to lower summer stream flows".

3.4 Coal Fly Ash and Aerosol Heating

Herndon and his team of researchers have carried out series of researches, aimed at defining the nature and composition of the aerosolized particulates being scattered. According to their initial investigations, evaluation of Internet-posted three element rainwater analyses with corresponding laboratory water-extract analyses of a likely possible aerosol provided the first scientific forensic evidence that the main particulate-substance being jet-sprayed was consistent with the leaching-behaviour coal fly ash. Subsequently, comparing eleven similarly-extracted elements validated their forensic finding [14]. Additional consistency was demonstrated by comparing coal fly ash analyses to fourteen elements measured in air-filter trapped outdoor aerosol particles and to twenty-three elements measured in aerosol particles brought down during a snowfall and released upon snow-melting [14].

According to [51], burning coal distillates the harmful elements in the ash. From his investigation it was discovered that the heavy ash whichwas formed settles beneath the burner. The light ash, also known as coal fly ash, formed by the condensation and accumulationof thewarm gases above the burners.This was again re-affirmed by [52], when they reported that coal fly ash escapes into the air/atmosphere from smokestacks in India and China, but is usually trapped and confiscated in Western nations.

As posited by researchers in recent times, in 2013 alone the global production of coal fly ash was estimated at 600 million metric tons [16, 53]. It is obvious that coal fly ash could cause serious harm to human and environmental health [11, 16, 53]. This is because it is an ideal particulate for heating the lower atmospherevia absorption of short-wave and long-wave radiation as coal fly ash contains substantial quantities of the Iron oxides, hematite and magnetite, in addition to carbon [44-46, 54-55].[56] noted that coal fly ash "is a economy waste product which could be processed further for use as a jet-sprayed aerosol owing to its particlesizes(only 0.01 – 50 μm in diameter)".

3.5 Aerosol Particulates and Global Warming

According to [57], "aerosol particulates which are heated and transfer heat to the immediate atmosphere could result to variations in the atmospheric temperature structure". To the best of our knowledge from existing literatures from published scientific research work besides report from [58], they barely discuss the implications of such observations on atmospheric convection and the accompanying surface-heat-transfer reduction that results from variations in the atmospheric temperature structure.

Undoubtedly, convection is possibly one of the utmost misinterpreted natural process in the field of earth science. Theoretical convection models of the earth's fluid core and that of the earth's mantle continue to produce some insights. However, continuous thermal convection in each case has been revealed to be physically impossible. Thus, necessitating a basically different Geoscience paradigm[1, 8, 59].

Records have revealed that in the earth's troposphere, the changes in convection is comparatively intricate. Fundamental theoretical models are mathematically intricate and characteristically apply parametrization-based hypothesis interpretation explanations of hydrodynamic equations [60-65]. It is possible to conceal such critical elements of the actual physical process of convection in climatic models.

It is obvious from existing literatures, that the implications of the hostile temperature gradient, described by [60], have not been explicitly considered in either solid-earth or tropospheric convection calculations. According to his submission, a simple classroom illustrative experiment could be used to provide critical insights towards understanding how convection works in both tropospheric andinthe earth's core. Consequently, Herndon recently conducted a convection classroomdemonstration illustrative experiment. In the said experiment he filled a 4-litre beaked-beaker with distilled water and added celery seeds to it. The beaker washeated on a hot plate with regulator. The celery seeds, pulled 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 the temperaturearound the bottom. By this the hostile temperature gradient is reduced [10].

Particulate matter in the lower atmosphere, including the moisture droplets of clouds not only blocks sunlight, but absorbs radiation from both in-coming radiation from the sun and from out-going terrestrial radiation. According to [10-11]"the heated particles transfer their heat to the surrounding atmosphere, increasing its temperature and decrease the hostile temperature gradient relative to the surface". There is a subsequent reduction in adverse temperature gradient, as adduced througha classroom-demonstration conducted by Herndon, which is shown to reduce convective heat transport from earth's troposphere.

3.6 Aerosol Particulates and Its Effects on Surface Warming

Tropospheric aerosol particles, heat the atmosphere, decrease the hostile temperature gradient relative to that of the surface of the earthwhich suppresses atmospheric convection and thus reduces surface heat loss and increases global warming [10-12].

However, according to studies tropospheric particulates have short lifetime, characteristically settling to the surface in days to weeks [26]. If the aerosol particulates settle into bodies of water, their iron components interrupt the natural balance there, hereby causing injurious algae blooms [11]. If the aerosol particulates settle on land, they absorb radiation from the sun and cause more global warming [66].

[67] had noted that if aerosol particulates settle on snow or ice, they have a tendency to affect the albedo leading to a decrease in light reflected off and heightened absorption of light, an occurrence that increases the global warming burden. In a similar vein, it has been estimated that "38% albedo reduction caused by downed aerosol particulates in snow cover on the Tibetan Plateau" [68].As stated earlier, forest fires exert considerableeffects on the disappearance of snow, earlier springtime melt in addition to lower summer stream flows [48].

3.7 Aerosol Transport of Particulates into the Stratosphere

There are several submissions on the presence of tropospheric aerosols in the upper atmosphere/stratosphere [69]. "Several means exist for lofting aerosols from lower atmosphere/troposphere to upper atmosphere/stratosphere, besides super-cell convection and monsoon anticyclonic transport"[70]. Soot aerosol, presumably from airline traffic in flight corridors near 10-12 km altitude, has been detected at approximately 20 km altitude [71].Volcanic ash aerosol was detected at 19 km altitude [72].

It has been documented that "residence time of particulates in the stratosphere is substantially longer than the days to weeks residence time of troposphere aerosols"[23-26]. For example, the average residence time for a tungsten-185 tracer inserted into the equatorial stratosphere about 20 km altitude was discovered to be about 10 months, with several of them conveyed into the lower atmosphere/troposphere occurring at middle latitudes [73].

*Corresponding Author: Wilson Nwankwo, Email: nwankwo.wilson@edouniversity.edu.ng
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

(Whether deliberately, inadvertently, or through natural processes, there are very serious risks linked with the deposition of aerosol particulates in the upper atmosphere/troposphere, The current ongoing near-daily, near-global geoengineering heat-trapping activity masks the effects of potential radiation-altering stratospheric aerosols. They pose significant threats to the overlying ozone layer that protects life from ultraviolet solar radiation. "Appreciable stratospheric ozone destruction has been detected following the outbreaks of El Chichon and Pinatubo" [74].

As enunciated by[53], "the range of halogen compositions of coal fly ash, covert geoengineering jet sprays massive quantities of ultra-fine coal fly ash that presumably places high volume bromine, chlorine, fluorine and iodine to the atmosphere". These gases are potential sources of ozone depletion. Coal fly ash aerosols also contain some other substances such as nano-particulates. These particles may adversely affect the ozone substrate.Remarkably, some of these materials when placed in the lower atmosphere/troposphere, may likely be lofted into the stratosphere [69-70, 75-78].
Scientific studies on radiation solar administration geo-engineering abound. From these studies it is adduced that the future solar radiation administration would take place in the upper atmosphere/stratosphere, not just in the lower atmosphere/troposphere alone where our weather mostly occurs.

Evidently, from this survey, climate scientists functioning under the CO_2 paradigm are unlikely to be able to identify other causes of global warming. Moreover, several of them seem to be naïve about the catastrophic dangers proposed by solar radiation administrationalong with other geoengineering systems, and consistently fail to even mention the ongoing tropospheric geoengineering and its risks to human and environmental health.

FINDINGS

1) There is no ambiguity about the upsurge in the earth's temperature. This is presently a threat especially to the entire biosphere. It is therefore imperative for climate science community, IPCC in particular to also consider the role of covert tropospheric geoengineering in global warming that has been ongoing for some decades.
2) It has also been revealed in several recent research studies that climate science has now shift paradigm; in the sense that the core source of global warming is not only carbon dioxide heat retention as it was initially believed but particulate pollution aerosols which heat the lower atmosphere/troposphere and reduce the proficiency of atmospheric convective heat removal from the earth's surface.
3) Most climate scientists treat global warming exclusively as a radiation balance issue which leads to a radically inadequate understanding of the factors affecting earth's surface temperature, as disclosed in several studies.
4) It would not be wrong if we say that some climate researchers/experts do not have appropriate understanding of the role of tropospheric particulates. Several particulates found in the lower atmosphere/troposphere absorb solar energy to some extent from several portions of the wavelength spectrum. Particulate aerosols have direct effects of absorbing radiation in addition to indirect influence on the formation, Microphysicsand lifetime of clouds.
5) Tropospheric aerosol particulates in addition tocloud droplets and their aerosol mechanismsabsorb short and long wave radiation from the sun and absorb long wave radiation from the earth's surface and become heated. Thus, making a substantial contribution to global warming along with climate change.
6) Although, coal fly ash is a major threat to human and environmental health, coal fly ash is otherwise an ideal particulate for heating the lower atmosphere/troposphere through absorption of short-wave and long-wave radiation because they contain substantial quantities of the Iron oxides, hematite and magnetite, as well as carbon.
7) Particulate matter in the troposphere, including the moisture droplets of clouds, not only blocks sunlight, but also absorbs in-coming radiation from the sun and out-going terrestrial radiation. These heated particles transfer that heat to the surrounding atmosphere and decreases the hostile temperature gradient relative to earth's surface. The reduction of hostile temperature gradient concurrently decreases convective heat transport from the earth's surface. This is a general concept that applies globally, regionallyand locally.
8) Several climate researchers and the IPCC seem to have a fundamental misunderstanding about what really causes global warming. Although, they appear to minimize the grave menaces that would arise from proposed geoengineering schemes like stratospheric aerosol injection.
9) More grievously, the complicity of silence among climate researchers cloaks the covert activity of deliberately poisoning the air we all breathe, hereby undermining the calamitous health risks.
10) Resolving the anthropogenic global warming problem is well within the means of contemporary technology. In principle great strides could be accomplished within a short period, due to the short lifetime of tropospheric particulates.

We therefore suggest the following as a way further:

a. Abruptly halting tropospheric particulate geoengineering
b. Trapping particulate emissions from coal-fired industrial furnaces from vehicle exhaust and other sources.
c. Reducing particulate-forming fuel additives.

d. The problem of particulate-caused contamination of the biosphere and the runaway global warming that accompanies it must be addressed immediately if we are to have a worthwhile future.

CONCLUSION

The problem of climate change is one of the furthermost intellectual challenging issues facing the entire human race. This discourse has reasonably established a connection between particulate pollution and climate change. In further to the foregoing the following conclusions are made:

Climate researchers have not paid much attention to the tropospheric particulate geo-engineering that readilycontribute to the global warming problem. Overlooking geo-engineering climate varying events in our climate considerations have in no doubt brought about some contentious outcomes and misrepresentation on climate change. The menacebrought about by the placement of aerosol particulates into the atmosphere, poses severe risks, including the depreciation of atmospheric ozone.

The IPCC and the entire climate science community, should earnestly redirect its attention in not just convincing several political leaders and all other stake holders that fossil-fuel-produced carbon dioxide and other anthropogenic greenhouse gases that trap the heat that would have otherwise been released into space, are the only source of climate change, but should take into contemplation the tropospheric particulate geoengineering that consistently contribute to global warming.

Conclusively, much effort should be channelled towardscontinuous and consistent policies and tasks to protect our environment from these unfavourable effects of climate change. We must brusquely silence tropospheric particulate geoengineering, trap particulate emissions and decrease particulate-forming fuel additives.

ACKNOWLEDGEMENT

The authors express their gratitude to James Marvin Herndon, Ph.D. and other team of scholars who have contributed their quota to this subject matter.

REFERENCES

[1]. J.A. Curry, P.J. Webster, Climate Science and the Uncertainty Monster, Bulletin of the American Meteorological Society, 92(12), (2011) 1667-82.

[2]. K.E. Ukhurebor, T.B. Batubo, I.C. Abiodun, E. Enoyoze, The Influence of Air Temperature on the Dew Point Temperature in Benin City, Nigeria. Journal for Applied Science and Environmental Management, 21(4), (2017) 657-660.

[3]. K.E. Ukhurebor, I.C. Abiodun, Variation in Annual Rainfall Data of Forty Years (1978-2017) for South-South, Nigeria, Journal of Applied Sciences & Environmental Management, 22(4), (2018) 511-518.

[4]. K.E. Ukhurebor, O.J. Umukoro, Influence of Meteorological Variables on UHF Radio Signal: Recent Findings for EBS, Benin City, South-South, Nigeria, IOP Conference Series: Earth & Environment Science, (2018) 173, 012017.

[5]. Lamia medouni-haroune, farid zaidi, sonia medouni-adrar, mouloud kecha (2018) olive pomace: from an olive mill waste to a resource, an overview of the new treatments. Journal of Critical Reviews, 5 (6), 1-6. doi:10.22159/jcr.2018v5i5.28840

[6]. Roja Sahu, Rajesh Kumar Sahoo, Shakti Ketan Prusty, Pratap Kumar Sahu. "Urinary Tract Infection and its Management." Systematic Reviews in Pharmacy 10.1 (2019), 42-48. Print. doi:10.5530/srp.2019.1.7

[7]. K.E. Ukhurebor, S.A. Olayinka, W. Nwankwo, C. Alhasan, Evaluation of the Effects of some Weather Variables on UHF and VHF Receivers within Benin City, South-South Region of Nigeria, Journal of Physics: IOP Conference Series, (2019) 1299, 012052.

[8]. T.M. Letcher, Why do we have Global Warming? Managing Global Warming, Elsevier, (2019) 3-15.

[9]. C.P. Summerhayes, J. Zalasiewicz, Global Warming and the Anthropocene. Geology Today, 34(5), (2018) 194-200.

[10]. J.M. Herndon, Role of Atmospheric Convection in Global Warming, Journal of Geography, Environment and Earth Science International,19(4), (2019) 1-8.

[11]. J.M. Herndon, M. Whiteside, Further Evidence that Particulate Pollution is the Principal Cause of Global Warming: Humanitarian Considerations, Journal of Geography, Environment and Earth Science International, 21(1), (2019) 1-11.

[12]. J.M. Herndon, Science Misrepresentation and the Climate Science Cartel, Journal of Geography, Environment and Earth Science International, 18(2), (2018) 1-13.

*Corresponding Author: Wilson Nwankwo, Email: nwankwo.wilson@edouniversity.edu.ng
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

[13]. J.M. Herndon, An Open Letter to Members of AGU, EGU and IPCC Alleging Promotion of Fake Science at the Expense of Human and Environmental Health and Comments on AGU Draft Geoengineering Position Statement. New Concepts in Global Tectonics Journal, 5(3), (2017) 413-6.

[14]. J.M., Herndon, M. Whiteside, Contamination of the Biosphere with Mercury: Another Potential Consequence of on-going Climate Manipulation using Aerosolized Coal Fly Ash. Journal of Geography, Environment and Earth Science International, 13(1), (2017) 1-11.

[15]. W. Nwankwo, A.A. Kifordu, Strengthening Private Sector participation in Public Infrastructure Projects through Concession Policies and Legislations in Nigeria: A Review, Journal of Advanced Research in Dynamical and Control Systems, 11(8), (2019) 1360-1370.

[16]. J.M. Herndon, M. Whiteside, California Wildfires: Role of Undisclosed Atmospheric Manipulation and Geoengineering, Journal of Geography, Environment and Earth Science International, 17(3), (2018) 1-18.

[17]. U. Pöschl, Atmospheric Aerosols: Composition, Transformation, Climate and Health Effects, AngewandteChemie International Edition, 44(46), (2015) 7520-40.

[18]. A. Ito, Atmospheric Processing of Combustion Aerosols as a Source of Bioavailable Iron, Environmental Science & Technology Letters, 2(3), (2015) 70-5.

[19]. A. Ito, S. Myriokefalitakis, M. Kanakidou, N.M. Mahowald, R.A. Scanza, D.S. Hamilton, et al., Pyrogenic Iron: The Missing Link to High Iron Solubility in Aerosols, Science Advances, 5(5), (2019) 7671.

[20]. J. Fan, Y. Wang, D. Rosenfeld, X. Liu, Review of Aerosol Cloud Interactions: Mechanisms, Significance and Challenges, Journal of the Atmospheric Sciences, 73(11), (2016) 4221-52.

[21]. H. Matsui, N.M. Mahowald, N. Moteki, D.S. Hamilton, S. Ohata, A. Yoshida, et al., Anthropogenic Combustion Iron as a Complex Climate Forcer, Nature Communications, 9(1), (2018) 1593.

[22]. N. Moteki, K. Adachi, S. Ohata, A. Yoshida, T. Harigaya, M. Koike, et al., Anthropogenic Iron Oxide Aerosols Enhance Atmospheric Heating, Nature Communications, 8, (2017) 15329.

[23]. S. Poet, H. Moore, E. Martell, Lead 210, Bismuth 210 and Polonium 210 in the Atmosphere: Accurate Ratio Measurement and Application to Aerosol Residence Time Determination, Journal of Geophysical Research, 77(33), (1972) 6515-27.

[24]. M. Baskaran, G.E. Shaw, Residence Time of Arctic Haze Aerosols using the Concentrations and Activity Ratios of 210Po, 210Pb and 7Be, Journal of Aerosol Science, 32(4), (2001) 443-52.

[25]. P. Quinn, T. Bates, E. Baum, N. Doubleday, A. Fiore, M. Flanner, et al., Short-lived Pollutants in the Arctic: Their Climate Impact and Possible Mitigation Strategies. Atmospheric Chemistry and Physics, 8(6), (2008) 1723-35.

[26]. J. Ogren, R. Charlson, Elemental Carbon in the Atmosphere: Cycle and Lifetime. Tellus B., 35(4), (1983) 241-54.

[27]. R. Kokaly, R. Clark, G. Swayze, K. Livo, T. Hoefen, N. Pearson, et al., USGS Spectral Library Version 7 Data, US Geological Survey Data Release, (2017).

[28]. M.Z. Jacobson, Effects of Biomass Burning on Climate, Accounting for Heat and Moisture Fluxes, Black and Brown Carbon and Cloud Absorption Effects, Journal of Geophysical Research: Atmospheres, 119(14), (2014) 8980-9002.

[29]. A. Ito, G. Lin, J.E. Penner, Radiative Forcing by Light-Absorbing Aerosols of Pyrogenetic Iron Oxides, Scientific Reports, 8(1), (2018) 7347.

[30]. M.R. Olson, V.M. Garcia, M.A. Robinson, P. Van Rooy, M.A. Dietenberger, M. Bergin, et al., Investigation of Black and Brown Carbon Multiple- Wavelength- Dependent Light Absorption from Biomass and Fossil Fuel Combustion Source Emissions, Journal of Geophysical Research, Atmospheres, 120(13), (2015) 6682-97.

[31]. F.D. Oeste, R.D. Richter, T. Ming, S. Caillol, Climate Engineering by Mimicking Natural Dust Climate Control: The Iron Salt Aerosol Method, Earth System Dynamics. 8(1), (2017) 1-54.

[32]. L. Liu, J. Zhang, L. Xu, Q. Yuan, D. Huang, J. Chen et al., Cloud Scavenging of Anthropogenic Refractory Particles at a Mountain Site in North China, Atmospheric Chemistry and Physics, 18(19), (2018) 14681-93.

[33]. A.J. Hunt, Small Particle Heat Exchangers. University of California, Berkeley Report No. LBL 7841 (1978).

[34]. I. Koren, Y.J. Kaufman, D. Rosenfeld, L.A. Remer, Y. Rudich, Aerosol Invigoration and Restructuring of Atlantic Convective Clouds, Geophysical Research Letters, 32(14) (2005).

[35]. D. Rosenfeld, TRMM Observed First Direct Evidence of Smoke from Forest Fires Inhibiting Rainfall, Geophysical Research Letters, 26(20), (1999) 3105-8.

[36]. A. Givati, D. Rosenfeld, Quantifying Precipitation Suppression due to Air Pollution, Journal of Applied Meteorology, 43(7), (2004) 1038-56.

[37]. C. Guo, H. Xiao, H. Yang, W. Wen, Effects of Anthropogenic Aerosols on a Heavy Rainstorm in Beijing, Atmosphere, 10(4), (2019) 162.

[38]. P. Shamjad, S. Tripathi, N.M. Thamban, H. Vreeland, Refractive Index and Absorption Attribution of Highly Absorbing Brown Carbon Aerosols from an Urban Indian City-Kanpur, Scientific Reports, 6, (2016) 37735.
[39]. Y. Derimian, A. Karnieli, Y. Kaufman, M. Andreae, T. Andreae, O. Dubovik, et al., The Role of Iron and Black Carbon in Aerosol Light Absorption, Atmospheric Chemistry and Physics, 8(13), (2008) 3623-37.
[40]. S. Alfaro, S. Lafon, J. Rajot, P. Formenti, A. Gaudichet, M. Maille, Iron Oxides and Light Absorption by Pure Desert Dust: An Experimental Study, Journal of Geophysical Research: Atmospheres, 109 (D8) (2004).
[41]. J.P. Dunion, C.S.Velden, The impact of the Saharan Air Layer on Atlantic Tropical Cyclone Activity, Bulletin of the American Meteorological Society, 85(3), (2004) 353-66.
[42]. A. Yoshida, S. Ohata, N. Moteki, K. Adachi, T. Mori, M. Koike, et al., Abundance and Emission Flux of the Anthropogenic Iron Oxide Aerosols from the East Asian Continental Outflow, Journal of Geophysical Research: Atmospheres, (2018).
[43]. L. Silva, T. Moreno, X. Querol, An Introductory TEM Study of Fe-Nano Minerals within Coal Fly Ash, Science of the Total Environment, 407(17), (2009) 4972-4.
[44]. K. Styszko-Grochowiak, J. Golas, H. Jankowski, S. Kozinski, Characterization of the Coal Fly Ash for the Purpose of Improvement of Industrial on-line Measurement of Unburned Carbon Content, Fuel, 83(13), (2004) 1847-53.
[45]. Y. Zhang, H. Forrister, J. Liu, J. Dibb, B. Anderson, J.P. Schwarz, et al., Top-of-Atmosphere Radiative Forcing Affected by Brown Carbon in the Upper Troposphere, Nature Geoscience, 10(7), (2017) 486.
[46]. R. Bahadur, P.S. Praveen, Y. Xu, V. Ramanathan, Solar Absorption by Elemental and Brown Carbon Determined from Spectral Observations, Proceedings of the National Academy of Sciences, 109(43), (2012) 17366-71.
[47]. K.E. Gleason, J.R. McConnell, M.M. Arienzo, N. Chellman, W.M. Calvin, Four-fold Increase in Solar Forcing on Snow in Western US Burned Forests Since 1999, Nature Communications, 10, (2019) 2026.
[48]. C.D. Allen, D.D. Breshears, N.G. McDowell, On Underestimation of Global Vulnerability to Tree Mortality and Forest Die-off from Hotter Drought in the Anthropocene, Ecosphere, 6(8), (2015) 1-55.
[49]. F. Li, D.M. Lawrence, B Bond-Lamberty, Impact of Fire on Global Land Surface Air Temperature and Energy Budget for the 20th Century due to Changes within Ecosystems, Environmental Research Letters, 12(4), (2017) 044014.
[50]. H.J, Gluskoter, Trace Elements in Coal: Occurrence and Distribution, Illinois State Geological Survey Circular, (1977) 499.
[51]. Y. Chen, N. Shah, F. Huggins, G. Huffman, A. Dozier, Characterization of Ultrafine Coal Fly Ash Particles by Energy Filtered TEM, Journal of Microscopy, 217(3), (2005) 225-34.
[52]. J.M. Herndon, M. Whiteside, I. Baldwin, Fifty Years after How to Wreck the Environment, Anthropogenic Extinction of Life on Earth, Journal of Geography, Environment and Earth Science International, 16(3), (2018) 1-15.
[53]. G. Montes-Hernandez, R. Perez-Lopez, F. Renard, J. Nieto, L. Charlet, Mineral Sequestration of CO2 by Aqueous Carbonation of Coal Combustion Fly-ash, Journal of Hazardous Materials, 161(2), (2009) 1347-54.
[54]. M. Fan, R.C. Brown, Comparison of the Loss-on-Ignition and Thermogravimetric Analysis Techniques in Measuring Unburned Carbon in Coal Fly Ash. Energy & Fuels, 15(6), (2001) 1414-7.
[55]. Y. Zhuang, Y.J. Kim, T.G. Lee, P. Biswas, Experimental and Theoretical Studies of Ultra-fine Particle Behaviour in Electrostatic Precipitators, Journal of Electrostatics, 48(3), (2000) 245-60.
[56]. V. Ramanathan, P. Crutzen, J. Kiehl, D. Rosenfeld, Aerosols, Climate, and the Hydrological Cycle, Science, 294(5549), (2001) 2119-24.
[57]. T. Stocker, D. Qin, G. Plattner, M. Tignor, S. Allen, J. Boschung, et al., Climate Change, The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge Univ. Press, Cambridge, UK, 2013, pp 535.
[58]. C.P. Summerhayes, J. ZalasiewiczGlobal warming and the Anthropocene, Geology Today, 34(5), (2018) 194-200.
[59]. S. Chandrasekhar, Thermal Convection, Proc AmerAcad Arts Sci., 86(4), (1957) 323-39.
[60]. Y. Ogura, The Evolution of a Moist Convective Element in a Shallow, Conditionally Unstable Atmosphere: A Numerical Calculation, Journal of the Atmospheric Sciences, 20(5), (1963) 407-24.
[61]. J.R. Herring, Investigation of Problems in Thermal Convection: Rigid Boundaries, Journal of the Atmospheric Sciences, 21(3), (1964) 277-90.
[62]. J.P. Chollet, M. Lesieur, Parameterization of Small Scales of Three-Dimensional Isotropic Turbulence Utilizing Spectral Closures, Journal of the Atmospheric Sciences, 38(12), (1981) 2747-57.
[63]. K.A. Emanuel, M. Živkovic-Rothman, Development and Evaluation of a Convection Scheme for use in Climate Models. Journal of the Atmospheric Sciences, 56(11), (1999) 1766-82.

*Corresponding Author: Wilson Nwankwo, Email: nwankwo.wilson@edouniversity.edu.ng
Article History: Received: July 02, 2019, Accepted: Sep 28, 2019

[64]. E. Guilyardi, A. Wittenberg, A. Fedorov, M. Collins, C. Wang, A. Capotondi, et al., Understanding El Niño in Ocean–Atmosphere General circulation Models: Progress and Challenges, Bulletin of the American Meteorological Society, 90(3), (2009) 325-40.

[65]. Y. Qian, T.J. Yasunari, S.J. Doherty, M.G. Flanner, W.K. Lau, J. Ming, et al., Light-Absorbing Particles in Snow and Ice: Measurement and Modelling of Climatic and Hydrological Impact, Advances in Atmospheric Sciences, 32(1), (2015) 64-91.

[66]. M. Ramana, V. Ramanathan, D. Kim, G. Roberts, C. Corrigan, Albedo, Atmospheric Solar Absorption and Heating Rate Measurements with Stacked UAVs, Quarterly Journal of the Royal Meteorological Society: A Journal of the Atmospheric Sciences, Applied Meteorology and Physical Oceanography, 133(629), (2007) 1913-31.

[67]. Y. Zhang, S. Kang, M. Sprenger, Z. Cong, T. Gao, C. Li, et al., Black Carbon and Mineral Dust in Snow Cover on the Tibetan Plateau, Cryosphere, 12(2), (2018) 413-31.

[68]. A. Delany, J. Shedlovsky, W. Pollock, Stratospheric Aerosol: The Contribution from the Troposphere, Journal of Geophysical Research, 79(36), (1974) 5646-50.

[69]. P. Yu, K.H. Rosenlof, S.Liu, H. Telg, T.D. Thornberry, A.W. Rollins, et al., Efficient Transport of Tropospheric Aerosol into the Stratosphere via the Asian Summer Monsoon Anticyclone, Proceedings of the National Academy of Sciences, 114(27), (2017) 6972-7.

[70]. F.J. Rietmeijer, A Model for Tropical-Extratropical of Volcanic Ash in the Lower Stratosphere, Geophysical Research Letters, 20(10), (1993) 951-4.

[71]. R. Pueschel, K. Boering, S. Verma, S. Howard, G. Ferry, J. Goodman, et al., Soot Aerosol in the Lower Stratosphere: Pole-to-Pole Variability and Contributions by Aircraft, Journal of Geophysical Research: Atmospheres, 102(D11), (1997) 13113-8.

[72]. P.H. Gudiksen, A. Fairhall, R.J. Reed, Roles of Mean Meridional Circulation and Eddy Diffusion in the Transport of Trace Substances in the Lower Stratosphere, Journal of Geophysical Research, 73(14), (1968) 4461-73.

[73]. D.E. Kinnison, K.E. Grant, P.S. Connell, D.A. Rotman, D.J. Wuebbles, The Chemical and Radiative Effects of the Mount Pinatubo Eruption, Journal of Geophysical Research: Atmospheres, 99(D12), (1994) 25705-31.

[74]. M.D. Fromm, R. Servranckx, Transport of Forest Fire Smoke above the Tropopause by Supercell Convection, Geophysical Research Letters, 30(10) (2003).

[75]. M. Whiteside, J.M. Herndon, Coal Fly Ash Aerosol: Risk Factor for Lung Cancer, Journal of Advances in Medicine and Medical Research, 25(4), (2018)1-10.

[76]. M. Whiteside, J.M. Herndon, Role of Aerosolized Coal Fly Ash in the Global Plankton Imbalance: Case of Florida's Toxic Algae Crisis, Asian Journal of Biology, 8(2), (2019) 1-24.

[77]. D. Koch, A. Del Genio, Black Carbon Semi-Direct Effects on Cloud Cover: Review and Synthesis, Atmospheric Chemistry and Physics, 10(16), (2010) 7685-96.