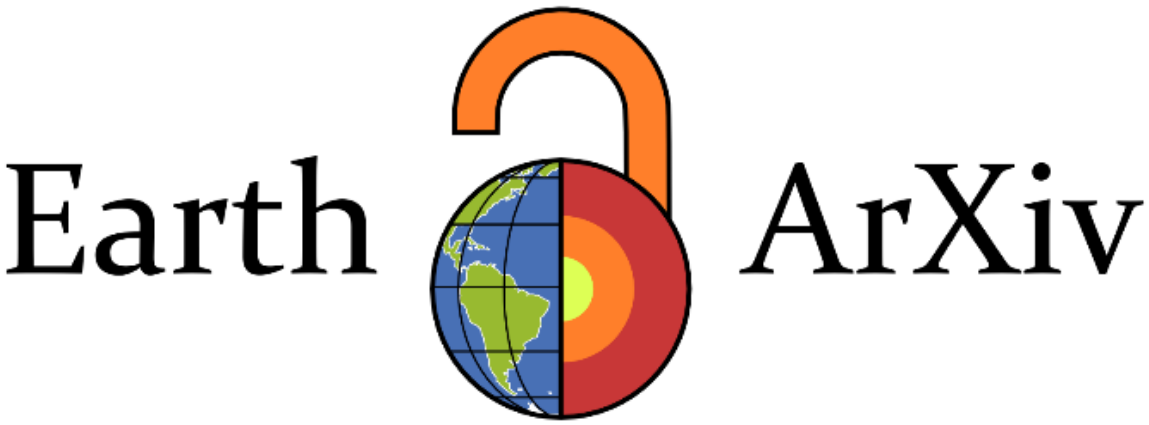

Simple solar system measurements indicate a weaker than expected relevance of Carbon Dioxide to present day earth temperature.

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Abstract

Recent and newly discovered causes of global warming are discussed especially in the context of lower relevance to CO2. Heat transfer mechanisms are discussed. The link between convective heat transfer and the thermodynamic and planetary hypotheses of Nikolov and Zeller are discussed. It is considered that the maximum surface temperature reached on an airless planetary body (planet or moon) is purely a function of solar TSI and albedo. The moon and Phobos are chosen as the first two planetary bodies based on these being close enough to approximate the TSI of earth and Mars respectively. Mercury is forced to be chosen as a third planetary body as Venus does not have a moon. Further, the assumption is made that a planet with an atmosphere will be warmer because of greenhouse warming, however caused. If Nikolov and Zeller hold, the excess temperature of a planet with an atmosphere should be independent of its atmospheric composition. To test this part of the hypothesis, Venus, Mars and Earth are then used. The first two being examples of planets with atmospheres comprising of 95% plus CO2 and the later just over 400 ppm CO2. If XS temperature is independent of planetary atmospheric composition the hypothesis predicts that XS temperature of these three planets should be directly proportional to their atmospheric pressure. If CO2 is the dominant greenhouse gas than earth should not fall in the same linear extrapolation with the other two planets or at least should show a very large negative residual as it has hardly any C02 in its atmosphere, only .0415% as opposed to over 95%. First the proportion of solar TSI arriving at surface of the three airless planetary bodies is linearly regressed against know maximum

temperatures for these bodies. Then known TSI's for earth, mars and Venus are inserted into this algorithm arising to calculate surface temperatures of these planets as though they were airless, i.e. with no atmosphere and no cloud albedo. Next calculate on known maximum measured temperatures for these planets and ascribe the difference to a parameter called excess temperature. This excess temperature is then plotted against surface pressure for the three planets concerned and examine the quality of the regression factor and any residuals. The XS Temp for earth is shown to be (observed) = -.4 and the difference adding almost pure CO2 (95.5%) = +1.98K. , it is estimated from the above that an atmospheric composition of 13.5% CO2 would cause some .8C of warming. Extrapolating to present levels of CO2 i.e. .0415% yields some 3 milli degrees Kelvin of warming i.e. totally insignificant and is exactly as observed recently by the author for Northern mid-Latitudes. CO2 could still technically be classed as a 'greenhouse' gas of very minor, indeed irrelevant proportions but given our real and mobile atmosphere with convection as the main means of shifting heat we need not worry in the foreseeable future. The conclusion is that an atmosphere only traps significantly large heat if it is pressurized to huge amounts as with Venus.

Key words : Global warming, climate change, CO2, albedo, convection, radiative transfer, heat transfer, atmosphere, Earth, Venus, Mars, Moon, Mercury, GHG, greenhouse gas, albedo, excess temperature, airless planet, adiabatic , lapse rate, atmospheric pressure, black carbon, cloud, clouds, cirrus, cloud albedo, earth temperature.

1. Introduction

1.1 Background

The first and more extensive draft of this work was deposited without full references some time ago on the author's website in December 2019 in the interests of stimulating discussion in climate science and general scientific community. Hyperlinked references were included later. Due to recent findings in some of the author's other published work it has now been deemed appropriate to submit the work in altered pre-print form and also with a view to seeking a peer reviewed platform.

1.2 Recent causes of global warming

The author has recently shown the bulk of warming since 1958 to be coincident with Magnetic Pole shift and its effect on planetary albedo via energetic particle interactions with clouds [1].

Prior to this the author also showed that the same mechanism can simultaneously hindcast both the times and magnitudes of historic cold and warm spells going back as far as the Roman Warm Period (RWP) and only limited by the availability of paleomagnetic data [2]. Moreover, CO2 was shown by reference [2] to have a tiny effect of about 3 mK per decade in Northern mid - latitudes and 32 mK/decade in Southern Polar regions.

Nikolov and Zeller also showed using satellite data (CERES) that all recent warming has been due to albedo shift, leaving no real room for CO2 [3].

1.3 CO2 and AGW

Anthropogenic Global Warming or so called AGW as based on the radiative transfer hypothesis and CO2 gas has, of course, been the mainstay of climate science in recent times. Its popularity can be traced back to Arrhenius (1896) [4] and Callendar (1938) [5]. It must be noted however that these initial hypotheses are both based on notions of infra-red attenuation for isolated gas and not a real atmosphere. However, unlike the huge, predicted values of Arrhenius, Callendar only measured very modest warming of the order of the order of 3 milli-degrees per year.

Considering the findings of references [1-3] one is forced to reach the conclusion that there is something fundamentally wrong about present climate models. Either CO2 could have saturated [ref] or its effects are minimised most of the time. One way this could happen is if other heat transport mechanisms such a convection dominate over radiative transport.

1.4 Heat transfer mechanisms

It is very easy to visualize how AGW effect, if any, can be minimized. To have AGW heat transfer in the atmosphere must be predominantly radiative. However, in the real world on all but the stillest, wind free, days convection dominates. Evaporation also features in shifting surface heat. The effect of wind on the proportions of convection and radiation are shown in figure 1 below:

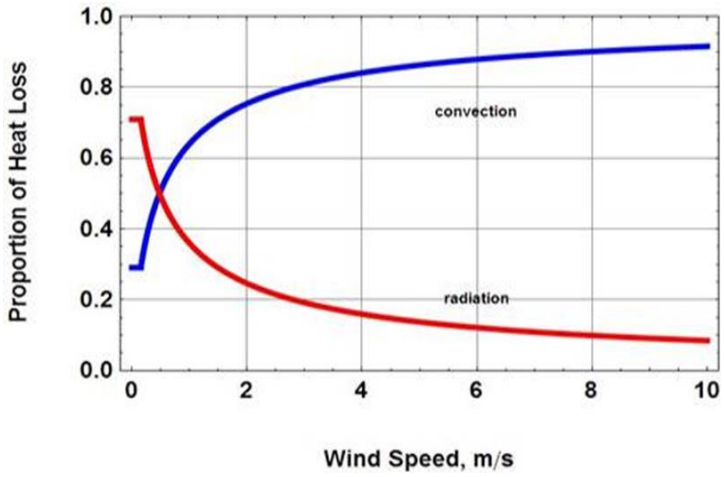

Figure 1 Change in proportion and mechanism of heat loss with wind speed.

The global average windspeed is 6.64 m/s, see for example https://web.stanford.edu/group/efmh/winds/global_winds.html, so this shows that on average all around the world convention dominates heat transfer from earth to the stratosphere.

When convection dominates air parcels loose heat mainly adiabatically. This is standard meteorology. In meteorology, the adiabatic lapse rate describes how the temperature of an air parcel changes as it rises or sinks in the atmosphere without exchanging heat with its surroundings. When unsaturated air rises, it cools due to expansion at the dry adiabatic lapse rate (approximately 9.8°C per kilometre). Conversely, when air sinks, it warms due to compression, also at the dry adiabatic lapse rate. If the air is saturated, the cooling rate is slower (the moist adiabatic lapse rate) due to the release of latent heat from condensation. The dominance of convective heat transfer over radiative heat transfer probably explains to some extent the big differences between Arrhenius' theory [4] and Calendar's measurements [5].

1.5 Related work : Unified Theory of Climate

Nikolov and Zeller 2017 [6] discuss warming as a thermodynamic rather than a radiative process. Their hypothesis is the so-called Unified Theory of Climate. In their paper Unified Theory of Climate Expanding the Concept of Atmospheric Greenhouse Effect Using Thermodynamic Principles : Implications for Predicting Future Climate Change they discuss the greenhouse effect on planets with atmospheres compared with the lack of a greenhouse effect on airless planets in terms of adiabatic compression with gravitational energy providing the excess heat. Some have tried to dismiss this hypothesis as junk science, yet it extends from how meteorology

explains lapse rate. They further conclude that the physical nature of the so-called Greenhouse Effect is in fact a Pressure-induced Thermal Enhancement (PTE), which is independent of the atmospheric chemical composition. Hence, the down-welling infrared radiation (a.k.a. greenhouse or back-radiation) is a product of the atmospheric temperature (maintained by solar heating and air pressure) rather than a cause for it, see [6]. In other words, their results confirm that the GH effect is a thermodynamic phenomenon, not a radiative one as presently assumed.

The equations in Nikolov and Zeller's paper are non-linear and have large error bars which have led to some criticism. Some dismiss their work because they cannot make conceptual links between gravitation air pressure and heating. For the present author, however, this does not present conceptual difficulty. The tube on my car tyre pump gets hot when it pumps the tyre. A young star glows before nuclear fusion ensues.

1.6 Plan of this present work

In the rest of this work, the present author develops his own treatment of using simple solar system measurements to attempt to determine the relevance, if any, of CO2 to excess planetary temperature. The work while in support of Nikolov and Zeller does not directly prove their hypothesis but it does show the irrelevance of CO2. Two possible conclusions can be reached. Either ; 1. Nikolov and Zeller are correct or 2. CO2 warming effect requires concentrations much, much, higher than those we have a present.

2. Hypothesis

It is considered that the maximum surface temperature reached on an airless planetary body (planet or moon) is purely a function of solar TSI and albedo. The moon and Phobos are chosen as the first two planetary bodies based on these being close enough to approximate the TSI of earth and Mars respectively. Mercury is forced to be chosen as a third planetary body as Venus does not have a moon. Further, the assumption is made that a planet with an atmosphere will be warmer because of greenhouse warming, however caused. If Nikolov and Zeller hold, the excess temperature of a planet with an atmosphere should be independent of its atmospheric

composition. To test this part of the hypothesis, Venus, Mars and Earth are then used. The first two being examples of planets with atmospheres comprising of 95% plus CO2 and the later just over 400 ppm CO2. If XS temperature is independent of planetary atmospheric composition the hypothesis predicts that XS temperature of these three planets should be directly proportional to their atmospheric pressure. If CO2 is the dominant greenhouse gas than earth should not fall in the same linear extrapolation with the other two planets or at least should show a very large negative residual as it has hardly any C02 in its atmosphere, only .0415% as opposed to over 95%.

3. Method

First the proportion of solar TSI arriving at surface of the three airless planetary bodies is linearly regressed against know maximum temperatures for these bodies. Then known TSI's for earth, mars and Venus are inserted into this algorithm arising to calculate surface temperatures of these planets as though they were airless, i.e. with no atmosphere and no cloud albedo.

Next calculate on known maximum measured temperatures for these planets and ascribe the difference to a parameter called excess temperature. This excess temperature is then plotted against surface pressure for the three planets concerned and examine the quality of the regression factor and any residuals.

4. Data employed

The raw data employed in shown in Table 1

Raw Data			
Body	Phobos	Moon	Mercury
Max T Kelvin	269	379	700
TSI W/m^2	590	1367.6	9082.7

Albedo	0.071	0.12	0.068
Calc. Surface Radiation	548.7	1203	8467

Table 1 : Data for airless celestial bodies.

The temperature versus surface irradiance for these airless celestial bodies is plotted as a linear regression in figure 2 below.

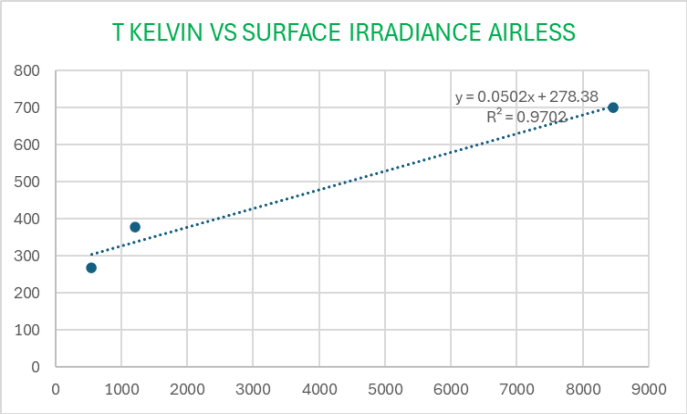

Figure 2 : Temperature versus surface irradiance for chosen airless celestial bodies.

5. Results

The regression yields an algorithm T airless = 278.38 + .0502 * si

Where si = surface irradiance

Mars airless temperature maximum = 278.38 + .0502*590 = 308 K Mars actual maximum 308 K Difference = 0 K

Earth airless maximum = 278.38 + .0502*1025 = 329.4 Earth actual maximum 329 K Difference = -.4 K

Venus airless maximum = 278.38 + .0502* 2622 = 404.62 K Venus maximum 735 K Difference = + 330.38 K

5.1 Pressure Plot

A linear regression plot is made of the atmospheric pressures versus calculated excess temperatures for Mars, Earth and Venus, see figure 3 below. It should be noted with caution however that reference 6 including Titan produces a non-linear relationship.

Mars Pressure = .008 atmos

Earth Pressure = 1 atmos

Venus Pressure = 93 atmos.

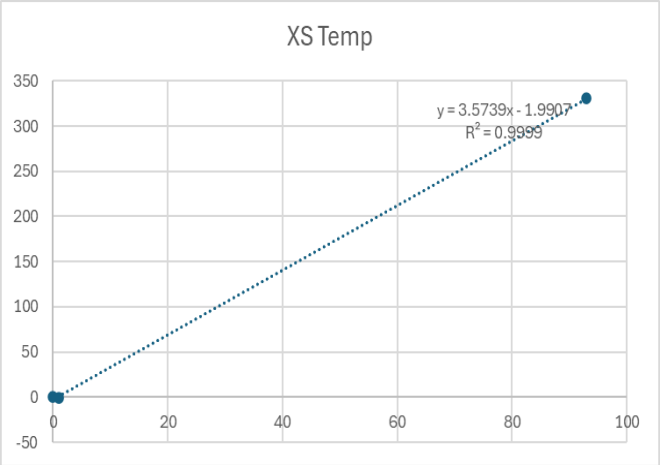

Figure 3 Plot of calculated XS temperature (K) versus celestial body atmospheric pressure atmospheres.

Regression value, R = .9999

The excess temperature for a celestial body at any pressure is given by the slope,

XS Temp = 3.763 x Pressure atmospheres -1.9907

To calculate the excess temperature for earth it is only necessary to substitute a value of 1 atmosphere in algorithm to give XS Temp for Earth if atmosphere almost all CO2 (95.550%) = 1.58K

XS Temp for earth from above (observed) = -.4 K

Difference adding almost pure CO2 (95.5%) = +1.98K.

6. Conclusions and Further Discussion.

The above work clearly shows that simple planetary albedo, excess temperature and pressure calculations indicate that to a very good first order approximation the maximum excess temperature of a planet depends only on its atmospheric pressure and is almost independent of atmospheric composition. Thus, to a first approximation theory of Nikolov and Zeller is supported and the effect of CO2 is significantly weaker than expected.

A small second order effect exists as the atmospheric composition approaches very high carbon dioxide concentrations. Given the exponential nature of the increase, it is estimated from the above that an atmospheric composition of 13.5% CO2 would cause some .8C of warming. Extrapolating to present levels of CO2 i.e. .0415% yields some 3 milli degrees Kelvin of warming i.e. totally insignificant and is exactly as observed recently by the author for Northern mid-Latitudes. CO2 could still technically be classed as a 'greenhouse' gas of very minor, indeed irrelevant proportions but given our real and mobile atmosphere with convection as the main means of shifting heat we need not worry in the foreseeable future. The conclusion is that an atmosphere only traps significantly large heat if it is pressurized to huge amounts as with Venus.

This result does not mean the author does not have other personal concerns regarding climate. From a previous study there could be increasing problems with aviation and the effects of power systems on clouds [1]. Lindzen has criticised on 'all eggs in one basket' approach to climate science and has stressed the importance of meridional heat transport [7] and has also commented on problems with cirrus cloud. Clouds are of course of critical importance because they shift the adiabatic lapse rate and thereby the cooling system of the planet. Moreover, the author has potential concern about the effects of Black Carbon from industrial, shipping, aviation and biomass burning sources being transported to polar regions, shifting ice albedo and causing earlier spring melting , see for example but not exclusively Jiao C., and M. G. Flanner

(2016) [8]. In a sense one could say Carbon and not Carbon Dioxide is potentially a truer bane of global change.

This work has shown the C02 effect to be weaker than expected. A convection dominated heat transfer system and additional thermal energy according to Nikolov and Zeller could hold the answer. In the simple convective scenario CO2 losses could be 10% of expectation. This would reduce Arrhenius 5 to 6 C expectation for doubling down to .5C. Several recent authors have arrived at a similar figure. For example in a ground-based experiment, using pure CO2 Yiannis et al (2020) [9] shows slowing of heat loss in a ballon but also shows that convective heat transfer can account for 89% of change. Alternatively, perhaps quantum mechanics may hold the answer, see Macdonald, Blair D. "Quantum Mechanics and Raman Spectroscopy Refute Greenhouse Theory." (2019) [10]. This and similar papers argue that the greenhouse effect, as traditionally described, is misconceived. It uses quantum mechanics to assert that atmospheric gases like nitrogen (N2) and oxygen (O2), which constitute ~99% of the atmosphere, emit and absorb infrared (IR) radiation at their quantum-predicted spectra (2338 cm^{-1} for N2 and 1556 cm^{-1} for O2), as observed by Raman spectroscopy. The authors claim that CO2's role in the greenhouse effect is overstated because all atmospheric gases absorb and emit IR radiation, challenging the idea that CO2 is uniquely responsible for heat trapping. They suggest that the greenhouse effect theory, which assumes N2 and O2 are radiatively inert, contradicts quantum mechanics and thermodynamics principles like equipartition.

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