Hot Spots vs. Green House Gases - Contribution to Global Warming – New Theory and Index

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Abstract

In this paper we provide a simple thermodynamic proof that manmade Hot Spot heat generation would also create global warming even if CO_2 emissions were at normal levels. We introduce the concept of global warming industrial revolution equilibrium heat index to establish this proof. We define manmade hot spot emission as unnatural heat emission produced by man that would not have occurred prior to the industrial revolution. The CO_2 theory of global warming, while central to the issue as a huge part of the problem, has created a diversion to this other likely major contributor, namely hot spots contribution to global warming. It is obvious that there is a major focus on CO_2 emissions and absolutely no focus on hot spot reduction in terms of solving the global warming crisis. This paper will hopefully provide motivation for the mitigation of hot spot creation. Knowledge of the root causes of the global warming problem is important to addressing the problem properly.

1. Introduction

We introduce the concepts of hot spots defined as *manmade emission of excessive unnatural heat emission produced by man that would not have occurred prior to the industrial revolution.* We exemplify hot spots further in Section 4 and provide a quantitative example in Section 3. First we will provide the general proof that without CO_2 increase, we would still have some global warming. It is not unreasonable to assume that other authors have shown concern related to heat generation contributing to global warming. However, we address this problem with a different approach to shed insight. Furthermore, while other authors may have shown concern, no actual work is taking place to mitigate or try to calculate this issue properly to judge it significance.

1.1 Global Warming Industrial Revolution Equilibrium Heat Index

In order to provide this proof, we first define the global warming industrial revolution equilibrium heat index $I_{IR\text{-}G}$ as

$$I_{IR-G} = \left(\frac{dS_{generated} / dt}{dS_{released} / dt} \right)_C \tag{1}$$

This differs from the Earths energy budget as the index will be normalize to the industrial revolution. That is, rather than look at the Earth's total energy budget, we look at what is different between the start of the industrial revolution to present day. To do this we enclose the Earth and its atmosphere denoted by C above, then $S_{generated}$ is the entropy generated inside of C while $S_{released}$ is the entropy released out of C both taken per unit time in the above equation.

For those readers not comfortable with entropy variable, one may substitute heat Q to replace S which will provide the same intuition.

We now normalize the index $I_{IR\text{-}G}$ as follows

$$I_{IR-G} = \begin{cases} 1 \ \ for \ \ t \approx IR \\ >1 \ \ for \ \ t \geq IR \end{cases} \tag{2}$$

where $t=IR$ indicates the time t which is the start of the Industrial Revolution (IR). For example, during the ice age, $I_{IR\text{-}G}$ <<1. Emission of CO_2 from volcanoes for example created CO_2 friendly atmosphere warming the Earth. Around the time of the industrial revolution, the Earth temperature was about 0.8C cooler then present day 2019. The figure below shows global warming trends since t=IR.

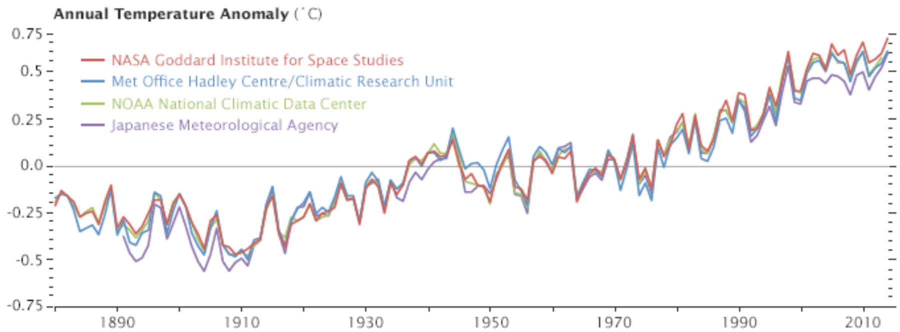

Figure 1 Global temperature increase since t=IR

1.2 Entropy Change at t=IR

For *t=IR* we assume that $S_{generated}$ is only due to solar heating of the Earth, all other entropy contribution enclosed by C are taken to be zero so that entropy generated is totally due to solar heating

$$S_{generated}=S_{solar} \tag{3}$$

Since $I_{IR\text{-}G}=1$ then we must have

$$dS_{generated}/dt = dS_{released}/dt \tag{4}$$

Therefore

$$dS_{generated} = dS_{released} \tag{5}$$

Because of natural levels of CO_2 at t=IR, some entropy is of course unreleased, we model $S_{generated}$ as

$$S_{generated} = \left(S_{released}\right)_{Out\,of\,C} + \left(S_{Unreleased}\right)_C \tag{6}$$

Here, the unreleased entropy is the entropy of the system enclosed by C (Earth plus atmosphere). By Equation 4 then

$$\frac{d\left(S_{Unreleased}\right)_C}{dt} = 0 \quad or \quad \left(S_{Unreleased}\right)_C = \text{Constant} \;\text{ for t=IR} \tag{7}$$

That is the relative amount of entropy enclosed by C at t=IR is relatively constant. At this point, we make the assumption that this unreleased entropy is due to normal levels of CO_2 at t=IR, the start of the industrial revolution.

1.2 Entropy Change for t>IR

After the industrial revolution started at present day we have

$$\frac{d\left(S_{Unreleased}\right)_C}{dt} = \left(\frac{\mathrm{dS_{CO2+}}}{\mathrm{dt}} + \frac{\mathrm{dS_{Hot\ Spots}}}{\mathrm{dt}}\right)_C \quad for\ t>IR \tag{8}$$

where

$$d(S_{Unreleased}) = \begin{cases} dS_{CO2+} & Entropy\ Increase\ due\ to\ new\ C0_2\ increase\ t>IR \\ dS_{Hot\,Spot} & Entropy\ \ Increase\ due\ to\ fraction\ of\ heat\ not\ escaping\ C \end{cases} \tag{9}$$

This represents only the change in entropy. For example, a hot spot will emit radiation, some fraction of the radiation will increase the entropy enclosed by C and most of the heat radiated will escape the Earth's atmosphere (see Example below). We are only concerned with the fraction of hot spot heat amount that does not escape. Thus we are not saying that all heat generated by hot spots creates global warming, it is only a fraction that does not escape the Earth's atmosphere and is reflected back that contributes to C added entropy since t>IR at present day (see quantitative fuel example 2.1 below). Then the IR Global index change is

$$I_{IR-G} = \left(\frac{dS_{generated} / dt}{dS_{released} / dt} \right)_C = \left(\frac{dS_{released} / dt + dS_{unreleased} / dt}{dS_{released} / dt} \right)_C = \left(1 + \frac{\frac{\mathrm{dS_{CO2+}}}{\mathrm{dt}} + \frac{\mathrm{dS_{Hot\ Spots}}}{\mathrm{dt}}}{dS_{released} / dt} \right)_C > 1 \tag{10}$$

We see that even if $\frac{\mathrm{dS_{CO2+}}}{\mathrm{dt}}=0$, we still would have $I_{IR\text{-}G}$ greater than 1. We now need to model $\frac{\mathrm{dS_{Hot\ Spots}}}{\mathrm{dt}}$ to assess how much of this heat is dissipated. It is unlikely that global warming is due only to CO_2 levels increase. Although this seems like an obvious statement, it is not so obvious in the media as everyone is focusing on $\frac{\mathrm{dS_{CO2+}}}{\mathrm{dt}}$.

2. Modeling $\frac{\mathrm{dS_{Hot\ Spot}}}{\mathrm{dt}}$ Contribution

This Model is being worked on currently. A preliminary model should be ready by December 2019.

Section 3.1 Example will provide insight into our model.
Please re-download the paper at that time.

3. Which is greater, $\mathrm{dS_{CO2+}}$ or $\mathrm{dS_{Hot\ Spots}}$

What has caused this entropy increase to C creating this small but important rise of 0.8C since t>IR present day is the question. The end result shown in Figure 1 as a 0.8C rise in global temperatue. This rise in entropy since t=IR, is it due to primarily to $\mathrm{dS_{CO2+}}$ or $\mathrm{dS_{Hot\ Spots}}$, or something else. In terms of manmade Global warming we should not ignore either contribution

$$d\left(S_{Unreleased}\right)_C = \left(\mathrm{dS_{CO2+}}\right)_C + \left(\mathrm{dS_{Hot\ Spots}}\right)_C \tag{11}$$

Currently, there is little effort to reduce Hot Spot creation (such as electric cars, better albeto construction etc in road work and building). It is as if we assume that all the Hot Spot creation escapes C (the Earth and its atmosphere). This is likely an enormous error in judgment. In fact, what if

$$\left(\mathrm{dS_{Hot\ Spots}}\right)_C > \left(\mathrm{dS_{CO2+}}\right)_C \tag{12}$$

We provide a basic perhaps insightful example below and are working to complete Section 2 currently.

3.1 Example of C Heating due to Hot Spot Gasoline Use in USA:

How many joules of heat is generated and anticipated to be captured by C from US heat emissions of aircraft and automobiles per day?

This is an example of how such an estimate would be calculated and is by no means a definitive answer.

The USA consumes 390 Million gallons gas per day and 186 million gallons of aviation gasoline. According to estimates there is 120 Million Joules in a gallon of gas. Let's assume 70% of this goes into heat (roughly the automotive efficiency and assume the same for aircraft) and the rest goes into work. Thus the heat generated per day in the US is

Hot Spot Heating Due to Cars and Planes in US= 0.7x120E6 Joules/Gallon x (390E6+186E6) gallons
=4.84E16 Joules per day

Now we need to make an assumption, we will assume that 99.5% escapes C

Hot Spot Heating Due to Cars and Planes is then US=2.4E14 joules captured by C due to hot spots trapped by green house gases. That is

$$\left(\mathrm{dQ}_{\text{Hot Spots}}\right)_C = 2.4E14\, Joules\ per\ day$$

The Hot Spot entropy increase per day due to fuel in the USA is

$$\left(\mathrm{dS}_{\text{Hot Spots}}\right)_C = 2.4E14J/300K = 8E11J/K\ per\ day$$

*We assumed 99.5% escapes the Earth atmosphere this is a total guess. Nevertheless it is unrealistic to assume that it all escapes. That is Green house gases get excited by any heat not just solar infrared emission. Then it is re-radiated some back to Earth. Now one 100 Watt light bulb is 100Wx3600sec*24 Hrs=8.6E6 joules per day. Then this Hot Spot emission form USA fuel is about the heat generated by 28 Million, 100 watt light bulbs all creating C heating per day.*

It is difficult to know the contribution this created to Global warming as this calculation is in error and is provided only as an example.

4. Examples of Hot Spots

We have defined hot spots as manmade emission of excessive unnatural heat emission produced by man that would not have occurred prior to the industrial revolution. Table 1 is an incomplete list that further defines hot spots example items.

Table 1 *Some Key Examples of Hot Spots*

Hot Spot Example	Comment
Burning Fossil Fuels	Due to Emission of Heat
Burning Coal Fuel	Due to Emission of Heat
Explosion (Bombs)	Due to Emission of Heat
Nuclear Power	Due to Emission of Heat
Engines (Cars)	390 Million gallons gas per day in the USA
Aviation	186 million gallons of aviation gasoline in USA
Roads – Conversion Solar to heat Roof Tops	Black pavement black Roofs, both have very low Albedo compared to no roads and no roof tops. We take the difference from t>IR. Here we need to subtract out what would occur if we had no roads & roof tops just Earth absorption.
Buildings – Conversion Solar to heat and Air condition Use	Again a decrease in Albedo from t>IR. Here we need to subtract out what would occur if we had building. Then we need to add the effect of energy heat emitted from air conditioner use.

We see there had been no attempt in city planning to reduce hot spot emissions.

Figure 1 Thermal image showing a Hot Spot emission from black roof tops and roads

Roads all over the world are covering the Earth with Asphalt, having very low albedo creating hot spot emissions.

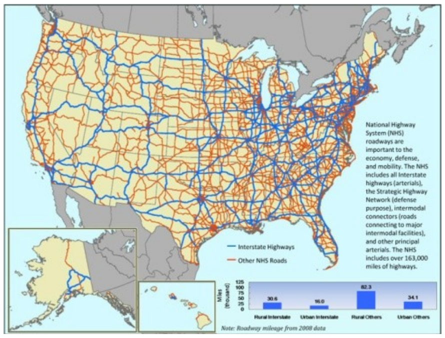

Figure 2 The increase of Black asphalt roads all over the world. Here displayed in the U.S. New pavement is getting blacker today with lower albeto.

Biography

Alec Feinberg is the founder of DfRSoft. He has a Ph.D. in Physics and is the principal author of the books, Design for Reliability and Thermodynamic Degradation Science: Physics of Failure, Accelerated Testing, Fatigue, and Reliability Applications. DfRSoft provides consulting in reliability and shock and vibration, training classes and DfRSoftware. Please contact us if you need help. Alec has provided reliability engineering services in diverse industries (AT&T Bell Labs, Tyco Electronics, HP, NASA, etc) for over 35 years in aerospace, automotive and electrical and mechanical systems. He has provided training classes in Design for Reliability & Quality, Shock and Vibration, HALT and ESD. Alec has presented numerous technical papers and won the 2003 RAMS best tutorial award for the topic, "Thermodynamic Reliability Engineering."