Determination of the Effective Total Emissivity of the Carbon Dioxide in the Venusian Atmosphere, and the Mean Free Path Length and Crossing Lapse (Delay) Time of Photons into the Troposphere of Venus.

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Abstract

This assessment on the effective total emissivity of the carbon dioxide in Venus, and the mean free path length and the crossing lapse time of photons through the Venusian atmosphere demonstrates the "greenhouse" effect in Venus does not exist.

Introduction

Logic does not always reveal the truth behind natural phenomena. For example, if a rooster crowed at midnight and an hour later rain began to fall, one might logically deduce that the rooster was somehow sensitive to impending precipitation. If the rooster crowed again, and two hours later a tornado demolishes the barn, one might logically deduce that the rooster was somehow capable of predicting the occurrence of tornados. However, we know that the rooster is not a meteorologist and that he can barely comprehend the world around him.

By the same logic, one might deduce that Venus is hotter than Mercury and Earth because it holds 43.56 x 10^17 tons of carbon dioxide in its atmosphere (around 95% of the composition of the atmosphere of Venus). As a matter of fact, this is one of the main arguments, which is often wielded by the proponents of the anthropogenic climate change and global warming (CAGW) in support of their ideas. Nevertheless, scientific truth is not on their side — as we shall see.

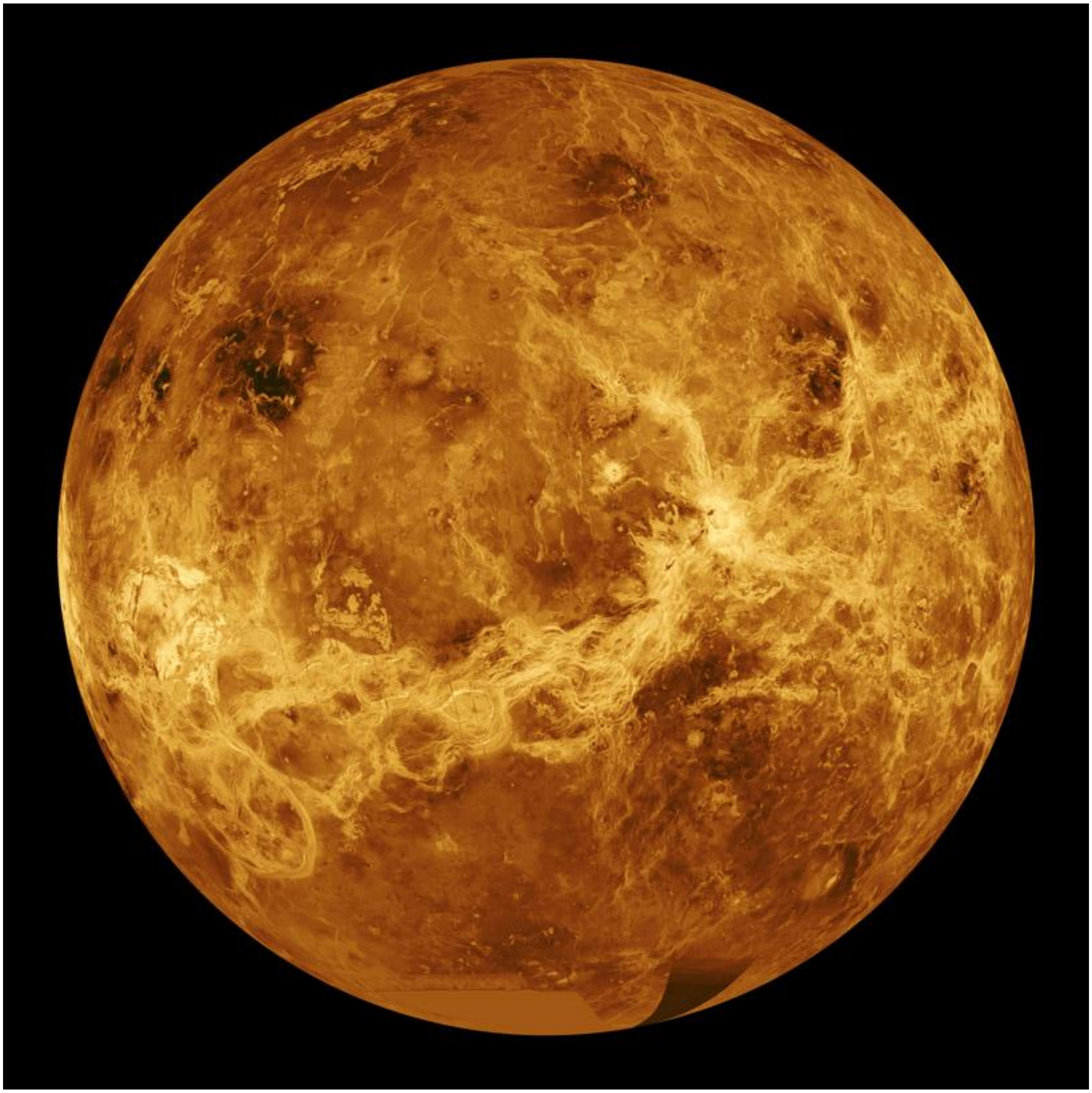

Image credit: NASA

Features of Venus (*ref. 7, 8, 10 and 11*)

Surface pressure: 92 bars

Surface density: ~65 Kg/m^3

Scale height: 15.9 km

Total mass of atmosphere: ~4.8 x 10^20 kg

Mass of CO_2 in Venusian atmosphere: 7.31 x 10^4 g/cm^3

Average surface temperature: 737 K (464 C)

Average tropospheric temperature (at the first 10 Km alt): 696.82 K (423.1 °C)

Diurnal temperature range: ~0

Wind speeds: 0.3 to 1.0 m/s (surface)

Mean molecular weight: 43.45 g/mole

Atmospheric composition (near surface, by volume):

Major: 96.5% Carbon Dioxide (CO_2), 3.5% Nitrogen (N_2)

Minor (ppmV): Sulfur Dioxide (SO_2) - 150; Argon (Ar) - 70; Water (H_2O) - 20; Carbon Monoxide (CO) - 17; Helium (He) - 12; Neon (Ne) – 7

Formula to obtain the effective total emissivity of gases:

ECO_2 = 1-[(a-1 * 1-P_E / a + b – (1 + P_E)) * e [-c (Log_{10} $(paL)_m$ / paL) ^2]] * $(ECO_2)_o$ *(Ref. 1)*

Total Pressure on the surface of Venus: 92 bars *(Ref. 7, 8, 10, 11)*

Proportion of carbon dioxide in Venus atmosphere: 96.5% *(Ref. 7, 8, 10, 11)*

Partial pressure of the carbon dioxide in the atmosphere of Venus: 0.8878 bar *(Ref. 7, 8, 10, 11)*

Temperature on the surface of Venus: 737 K *(Ref. 7, 8, 10, 11)*

Determination of the Effective Total Emissivity of the Carbon Dioxide in the Atmosphere of Venus:

P_E = 9778 bar cm + [0.28 (0.8878 bar cm)] / 100 bar = 106.3 bar

t = 737 K /308 K = 2.54

$(PCO_2L)_m$ = (0.225 * t^2) * $(PCO_2L)_o$ = 0.225 * (2.54) ^2 * 92 bar = 133.5 bar

a = 1 + 0.1/ t^1.45 = 1.1 / 2.112 = 0.52

b = 0.23

c = 1.47

ECO_2 = 1-[(a-1 * 1-P_E / a + b – (1 + P_E)) * e [-c (Log_{10} $(paL)_m$ / paL) ^2]] * $(ECO_2)_o$

Introducing magnitudes:

ECO_2 = 1-[(0.52-1 * 1-106.3 bar/0.52+0.23 – (1 + 106.3 bar)) * e [-1.47 (Log_{10} (133.5 bar)/9 778 bar) ^2]] * 0.2

ECO_2 = 1 – [(-0.47 * 0.962)] * 0.2 = 1.45 * 0.2 = 0.3

$I = ECO2_{Venus} (\sigma) (T)^4/\pi$ (*Ref. 1 and 3)*

Introducing magnitudes:

$I = 0.3 (5.6697 \times 10^{-8} J/m^2) * (737 K)^4) / 3.141592...$

$I = 1597.35 W/m^2 sr$

$q = e A (\sigma) * (\Delta T^4)$

$q = 0.3 (1 M^2) * (5.6697 \times 10^{-8} W/m^2 K^4) * (48253598640 K^4) = 5018 W$

5018 W in one second = 5018 J

$\Delta T = 5018 J / 0.7023 Kg (971 J/kg K) = 5018 J / 681.9 J / K = 7.36 K$ (*Ref. 1, 2, 3 and 6*)

Therefore, the change of temperature caused by the carbon dioxide in the atmosphere of Venus is 7.36 K above the expected temperature. The average temperature of the first 10 Km of the Venusian atmosphere above the surface is 696.82 K; consequently, if the carbon dioxide was eliminated from the Venusian atmosphere, the temperature of the planet would be 696.82 K - 7.36 K = 689.46 K, which would not make a noteworthy difference.

Following these procedures, the low radiative power of carbon dioxide is confirmed even at very high concentrations as is the case on Venus. Nevertheless, the mass fraction of carbon dioxide in the Venusian atmosphere reveals that the mean free path length of photons emitted from the surface of Venus must be considerably shorter than the mean free path length of photons emitted from the surface of Earth. For that reason, I decided to make the appropriate calculations to obtain the mean free path length and the lapse time of a photon exiting the Venusian atmosphere towards space.

Carbon dioxide is the same everywhere in the known universe and its physicochemical characteristics are also everywhere the same; therefore, we must apply the same magnitudes that were introduced to calculate the mean free path length and lapse time of photons emitted from the surface of the Earth towards its atmosphere.

Procedures for calculating the mean free path length and the lapse time of IR photons exiting the Venusian atmosphere towards space.

Data Required:

Density of CO_2 in Venus' atmosphere: 7.31 x 10^4 g/cm^3

Molar mass of CO_2 = 44.01 g/mol

Mass of CO_2 = (# of moles) * (molar mass) = 1.81 x 10^3 mol * (44.01 g/mol) =

= 7.97 x 10^4 g

Number of moles of CO_2 = (mass) / (molar mass) = 7.31 x 10^4 (g/cm^3 * cm^3) / 44.01 (g/mol) = 1.7 x 10^3 mol

Number of molecules of carbon dioxide per gram = moles * Avogadro's number / molar mass = (1.7 x 10^3 mol * 6.02 × 10^23 molecules/g) / 44.01 g/mol =

= **2.27 x 10^25 molecules * g**

Avogadro's number (6.02 × 10^23) molecules/g

Thomson's cross section (σ) = 6.7 x 10^-25 cm

Determination of the Mean Free Path Length of photons in the atmosphere before colliding with a molecule of carbon dioxide.

Formula for obtaining the mean free path length of photons before colliding with molecules of CO_2:

l = m / (n σ) *(References 1 and 2).*

Where *l* is for the mean free path length, *m* is for mass of the gas, *n* is for the number of molecules of the substance per gram, and *σ* is for Thomson's Cross Section (6.7 x 10^-25 cm).

Known data:

Thomson's cross section ***(σ)*** = 6.7 x 10^-25 cm

Mass *of CO2* ***(m)*** = 7.31 x 10^4 g

Moles of carbon dioxide = 1.7 x 10^3 mol

Molecules of CO2 per gram ***(n)*** = (1.7 x 10^3 mol * 6.02 × 10^23 molecules) / 44.01 (g/mol) = = 2.27 x 10^25 molecules * g

Introducing magnitudes:

l = (7.31 x 10^4 g) / (2.27 x 10^25 molecules * g) * 6.7 x 10^-25 cm) = **4802 cm**

***l* = 48 m**

Therefore, the mean free path of the surface photon stream (*l*) is 4802 cm, which is the trajectory of a photon crossing the atmosphere before colliding with a molecule of carbon dioxide.

For a more accurate comparison with Earth, I will use the first 7.7 Km of the Venusian atmosphere for the following calculations.

We notice that the mean free path length for photons on Venus is the same as on Earth. Consequently, the time taken by a photon to pass through the first 7.7 kilometers of the Venusian troposphere would be as follows.

Determination of the time taken by a photon to cross the first 7.7 kilometers of the Venusian atmosphere towards space:

Formula for obtaining the time taken by a photon to cross the first 7.7 Km of the Venusian atmosphere after colliding with molecules of CO2:

t = r^2 / (l*c) *(References 1 and 2)*

Known Data:

$r_{trop.}$ = 7.7 x 10^5 cm

l = 4802 cm

c = 2.99909301 x 10^10 (cm/s)

Introducing Magnitudes:

t = r^2 / (l*c) = 5.93 x 10^11 cm^2 / [4802 cm * 2.99909301 x 10^10 (cm/s)] = **0.0041 s**

t = 0.0041 s

The crossing time lapse is almost the same on Venus as it is on Earth. The reason being that the temperature of the atmosphere on Venus is 2.5 greater than the temperature of the atmosphere of Earth, such that the carbon dioxide in the Venusian atmosphere is even more well dispersed than it is in the atmosphere on Earth.

Analysis:

The results of the algorithms in the preceding analysis illustrate quite clearly the fallacy of a "greenhouse" effect on Venus caused by carbon dioxide. There is no such "greenhouse" effect on Venus that can be attributed to a high mass fraction of CO_2. The highly misleading schemes on Venus, routinely bandied around as an example of the existence of a "greenhouse" effect here on Earth, can be obtained only by flagrantly ignoring the laws of physics, in particular the expansion of matter as its temperature increases before a change of phase.

From here, we deduce that the cause of the surface temperature anomaly on Venus cannot be attributed to carbon dioxide, but to another factor which has not been properly accounted for. Let us examine some of those features of Venus that have been routinely disregarded by CAGW proponents.

First of all, in considering exclusively the incident solar radiation upon the surface of Venus, we notice that the temperature of the surface of Venus, i.e. the Venusian land, is considerably higher than expected. (*Ref. 7*)

Another Venusian feature routinely ignored by CAGW proponents is that the temperature of the planet's atmosphere is always lower than the surface temperature of the planet (7, 8 and *10*), day and night, such that it is impossible for the atmosphere to heat up the surface — as is also the case here on Earth.

The third feature stubbornly ignored by CAGW climatologists, and which is the principle factor behind the warming of Venus, is that, unlike Earth, Venus does not have a magnetosphere, or magnetic field. Superheated plasma particles strike the atmosphere of Venus directly and drag its components, especially water vapor, out towards space (see an image below) (*10 and 11*).

Notice that water vapor is quite abundant in the outer layer of the Venusian atmosphere and that it has thermal capacities which make it a highly efficient absorber and emitter of thermal energy, unlike carbon dioxide. The absence of a magnetosphere thus allows superheated particles of solar plasma to reach the planet's surface -such that there are two mechanisms heating it up, i.e. the incident solar radiation striking on the surface and the superheated solar plasma particles.

The differences between Venus and Earth are so great that there is no point of similitude between the two planets. The "greenhouse" effect seems to be a myth.

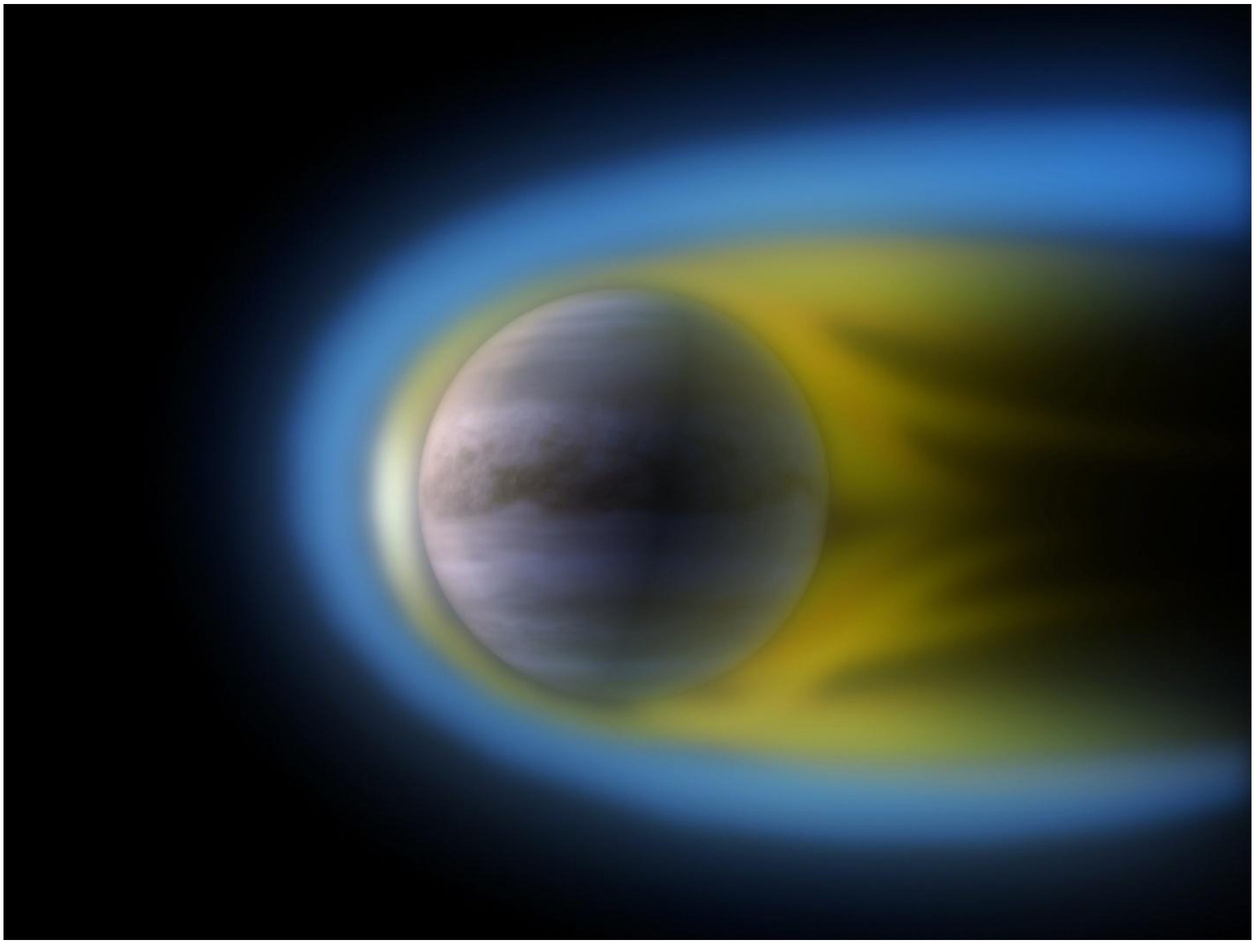

Image Courtesy of European Space Agency

The image shows the interaction between the atmosphere of Venus and the solar plasma (solar wind). The blue layer is water, which is ionized and dragged out from the Venusian atmosphere towards space. The yellow layer is composed of solar plasma particles, SO_2, SO_3 and CO_2. The latter three compounds are part of the atmosphere of Venus.

Conclusion:

Concluding, there is no point of comparison between the temperature on Venus and the temperature on Earth for the following reasons:

1. The temperature of the Venusian atmosphere is 2.5 greater than the temperature of the atmosphere on Earth; therefore, the carbon dioxide on Venus, though more abundant than on Earth, is greatly dispersed

by the thermal expansion effect caused by the high temperature. The thermal expansion is a law of physics and is applicable everywhere and whenever in the known universe. (*Ref. 5 and 9*)

2. Carbon dioxide cannot be parceled in an open atmosphere like the Venusian atmosphere because a substantial volume of matter is dragged out towards the space by solar wind. On the other hand, the volume of the carbon dioxide increases as its temperature increases; consequently, the volume expansion nullifies the effect of the density of the gas.

3. Venus does not have a magnetic field protecting it from the superheated particles of solar plasma striking directly on the Venusian atmosphere and thereby transferring energy to the molecules of gases comprising the atmosphere of Venus. (*Ref. 7, 10 and 11*)

4. Solar plasma particles strike directly on the surface of Venus so that the surface is heated up beyond predictions based on only incident solar radiation striking the surface of the planet. The thermal energy and momentum of the solar plasma particles are transferred to the molecules comprising the surface of the planet, thereby heating the molecules up beyond predictions.

5. The water vapor and a portion of the remaining gases of the Venusian atmosphere are dragged out towards space by the solar wind (*Ref. 10 and 11*). This generates friction and the transfer of thermal energy and momentum from the plasma particles to the molecules of gas in the lower layers of the atmosphere of Venus.

6. Alternatively, the delay that a molecule of carbon dioxide causes to the emission of electrons and photons, after having absorbed a photon, is measured in attoseconds (as), i.e. 10^-18 of a second; consequently, there is no way for the atmospheric carbon dioxide stores energy for periods longer than 20 ± 5 as. (*ref. 12 and 13*)

This analysis demonstrates that the "greenhouse" effect on Venus is a myth.

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