TOTAL EMISSIVITY OF A MIXTURE OF GASES CONTAINING 5% OF WATER VAPOR AND 0.039% OF CARBON DIOXIDE, AND THE TOTAL EMISSIVITY OF THE CARBON DIOXIDE ON MARS ATMOSPHERE AND ITS EFFECT ON THE TEMPERATURE OF MARS' ATMOSPHERE.

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Abstract

This article is a response to a claim about the positive feedback of water vapor on the total emissivity of the carbon dioxide related to the overlap of absorption-emission bands. I have taken into consideration the total altitude of the atmosphere, answering to another erroneous claim on the sense of including the total path length of the irradiance from the surface. In addition, I have calculated the effect of the carbon dioxide in the temperature of the atmosphere of Mars for demystifying the concept of the carbon dioxide as a warming gas.

Introduction

When I presented my article on the *Total Emissivity of the Carbon Dioxide and its Effect on the Atmospheric temperature*, the main criticisms were on the sense that I had not considered the overlapping absorption and emission bands of the carbon dioxide and the water vapor, as well as the length that I had introduced for making my calculations which, according to those criticisms, it should be 7000 m, which is the altitude of the atmosphere at which the proportion of the gases in the air mixture is more or less uniform, instead 1 m.

I have acceded to those claims and introduced the altitude of 7000 m in the algorithms for calculating the total emissivity of the mixture of water vapor and carbon dioxide in the atmosphere.

In the other hand, there were claims against my decision to obtain the total emissivity of the carbon dioxide alone, when they claimed that the water vapor worked like a positive feedback that enhanced the total emissivity of the carbon dioxide in the region of the emissive spectrum where the emission bands of the carbon dioxide and the water vapor overlaps. I assented to make the calculi for obtaining the amount of total emissivity that the water vapor causes on the total emissivity of the carbon dioxide, precisely there, where the emission bands overlap.

For these calculations, as well as for the total emissivity of the carbon dioxide in the Martian atmosphere, I have applied advanced formulas on radiative heat transfer taken from the Ref. numbered 1, 2 and 3.

The remainder Ref. trace all the data, arguments and assertions used on the elaboration of this manuscript.

TOTAL EMISSIVITY OF THE MIXTURE OF WATER VAPOR AND CARBON DIOXIDE IN THE PRESENT ATMOSPHERE OF THE EARTH

On July 3, 2010, at 10:00 hr (UT), the proportion of the water vapor in the atmosphere at the location situated at 25º 48´ N lat. and 100 º 19' W long., at an altitude of 513 m ASL was 5%. The temperature of the air at 1 m altitude was 310.95 K and the temperature of the soil was 330 K. Find:

1. The correction factor of the total emissivity of the carbon dioxide where the radiative emission bands of water vapor and carbon dioxide overlaps, considering that the partial pressure of the carbon dioxide is 0.00039 atm.

2. The total emissivity of the mixture of water vapor and carbon dioxide in the atmosphere.

3. The total normal intensity of the mixture of water vapor and carbon dioxide in the atmosphere.

4. The change of temperature caused by the mixture of water vapor and carbon dioxide in the atmosphere.

Procedure 1. Obtaining the correction factor for the overlapping emissive bands of $H2O_g$ and $CO2_g$:

For obtaining the total emissivity of the mixture of water vapor and carbon dioxide in the atmosphere, we need to know the equilibrium partial pressures of the mixture of water vapor and carbon dioxide. The formula for obtaining the equilibrium partial pressure (ζ) is as follows:

$\zeta = p_{H2O} / (p_{H2O} + p_{CO2})$ **(*Ref. 2*)**

Where p_{H2O} is the partial pressure of the water vapor, and p_{CO2} is the partial pressure of the carbon dioxide.

Known values:

p_{H2O} = 0.05 atm

p_{CO2} = 0.00039 atm

Introducing magnitudes:

$\zeta = p_{H2O} / (p_{H2O} + p_{CO2})$ = 0.05 atm / (0.05 atm + 0.00039 atm) = 0.992

ζ = 0.992

Procedure 2: Obtaining the total emissivity of the mixture of water vapor and carbon dioxide in the atmosphere:

Now let us proceed to calculate the magnitude of the overlapped radiative emission bands of the water vapor and the carbon dioxide. To do this, we apply the following formula:

ΔE = [[ζ / (10.7 + 101 ζ)] – 0.0089 ζ ^10.4] (log10 [(p_{H2O} + p_{CO2}) L] / (p_{abs}L) $_o$) ^2.76 (***Ref. 2***)

Known values:

ζ = 0.992

p_{H2O} = 0.05 atm

p_{CO2} = 0.00039 atm

(p_{abs}L) $_o$ *(absolute pressure of the mixture of gases at the surface)* = 1 atm m

L = 7000 m

Introducing magnitudes:

ΔE = [(0.992 / 110.892) – (0.0089 * (0.992) ^10.4] * (log10 [(0.05 atm + 0.00039 atm) 7000 m] / (1 atm m)$_o$) ^2.76 *(**Ref. 2**)*

ΔE = [0.00076] * (2.55 atm m / 1 atm m) = 0.0019; rounding up the cipher, ΔE = 0.002

Therefore, the correction factor for the overlapped absorption bands is 0.002

Consequently, the total emissivity of the mixture water vapor and carbon dioxide is as follows:

$E_{mixture} = E_{CO2} + E_{H2O} - \Delta E$ = 0.0017 + 0.4 - 0.002 = 0.3997

Procedure 3. Obtaining the Total Normal Intensity of the energy radiated by the mixture of gases in the air:

Therefore, the total normal intensity (or spectral radiance over wavelength) caused by the mixture of water vapor and carbon dioxide in the atmosphere is:

$I = E_{mix} (\sigma) (T)$ ^4 / π *(Ref. 2 and 3)*

I = 0.3997 (5.6697 x 10^-8 W/m^2 K^4) (310.95) ^4 / 3.1416 = 67.44 W m^2 sr

Procedure 4: Obtaining the change of temperature caused by the mixture of water vapor and carbon dioxide in the atmosphere:

This energy absorbed by the mixture of water vapor and carbon dioxide in the atmosphere could cause the following change of the air temperature:

ΔT = 211.86 W/m^2 / 93.62 W/m^2 K = 2.26 K

However, the carbon dioxide alone causes the following change of temperature:

ΔT = 0.28 W/m^2 / 0.702 W/m^2 K = 0.4 K

0.4 K is 13.4% of the total change of temperature by the mixture of gases.

By way of contrast, the spectral irradiance over wavelength caused by the surface (soil), with a total emissivity of 0.82 (***Ref. 1 and 5***), is as follows:

$I = E_{surface} (\sigma) (T)$ ^4 / π (***Ref. 2 and 3***)

I = 0.82 (5.6697 x 10^-8 W/m^2 K^4) (330 K) / 3.1416 = 203 W/m^2 sr

This magnitude of total normal irradiance from the surface is 2 times higher than the total normal irradiance from the atmosphere (which is 111.5 W/m^2 sr); therefore, the concept of photon stream and induced emission prevails in this case eliminating the speculation of a down-welling radiation that hypothetically warms up the surface. Such is an idea that is absolutely opposed to the second law of thermodynamics. (***Ref. 4***)

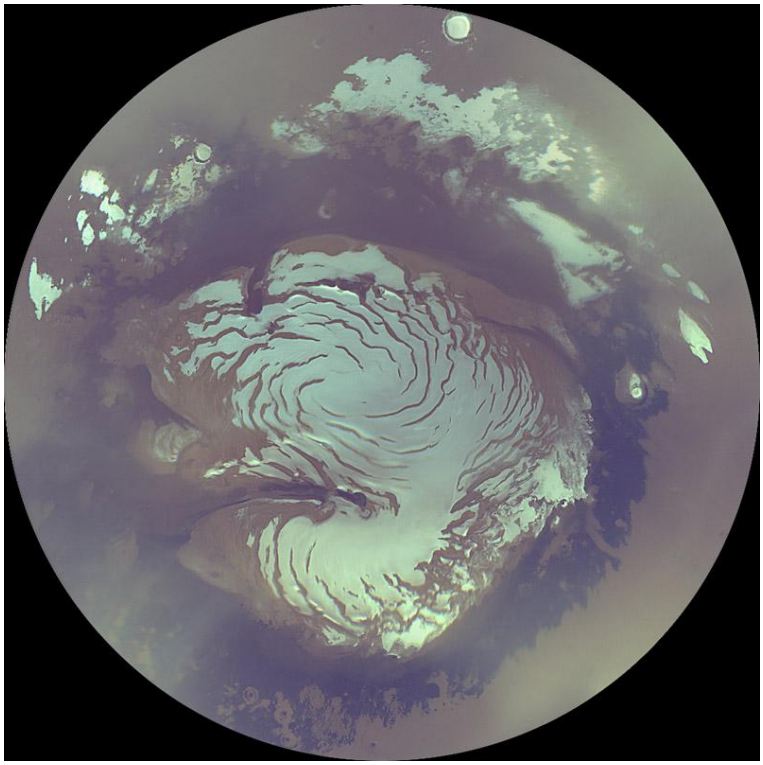
The change of temperature caused by the energy absorbed by the surface is 6 K. The error margin is ±0.4 K. Therefore, the change of temperature of the atmosphere caused by the intensity of the irradiance emitted from the surface to the air is 1.94 ±0.4 K.

Given the emissivity of the soil (0.82) (***Ref. 1 and 5***) compared with the emissivity of the carbon dioxide (0.0017), the load of energy from the surface to the space capable of causing induced emission from the mass of carbon dioxide in the atmosphere is 53 W/m^2 sr; in contrast, the load of energy emitted by the carbon dioxide to all directions gives a total of 0.28 W/m^2 sr, at all wavelengths corresponding to the spectral emission of carbon dioxide at all bands. (***Ref. 3***)

As a result, the fraction of photons in the photon stream formed from the surface to the space, which is able of causing induced emission, overwhelms the irradiance of energy by the carbon dioxide towards all directions (isotropic) by a percentage of 99%.

Are the proponents of the anthropogenic global warming expecting that physicists believe in the down-welling fallacy?

CARBON DIOXIDE IN MARS



Credit Image: 2008. http://www.jpl.nasa.gov/images/mro/20080515/npolarcap-browse.jpg

Introduction

The atmosphere of Mars, almost completely saturated by the carbon dioxide, is frequently offered like a good example of the greenhouse effect. It is usual reading from several authors (***Ref. 8***) that, without the carbon dioxide at a proportion of 95.32% (953,200 ppmV), the temperature of Mars would be 5 degrees below its current temperature, i.e. Mars' average temperature would be 245 K, or -28 °C). The latter is a fallacy because the partial pressure of the carbon dioxide in the Mars atmosphere is rather low, notwithstanding its high mass fraction.

Total Pressure on the surface of mars: 0.0067 atm ***(Ref. 6 and 7)***

Proportion of carbon dioxide in Mars atmosphere: 95.32% ***(Ref. 6 and 7)***

Partial pressure of the carbon dioxide in the atmosphere of Mars: 0.0064 atm *(Ref. 6 and 7)*

Temperature in the surface of Mars: 250 K ***(Ref. 6 and 7)***

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. 2)***

P_E = 0.0067 + [0.28 (0.0064)] / 0.0067 atm = 1.27 atm

t = 250 K/308 K = 0.81

$(PCO_2L)_m$ = (0.225 * t^2) * $(PCO_2L)_o$ = 0.225 * (0.812) ^2 * 0.0064 atm m = 23.2 atm m

Introducing magnitudes:

ECO_{2Mars} = 1-[((1.49-1) * 1-1.27 atm) / 1.49 + 0.23 – (1 + 1.27 atm)) * e [-1.47 (Log_{10} (23.2 atm m / 0.0064 atm m) ^2]] * (0.0435)

ECO_{2Mars} = 1- [(-0.132 / -0.55) * 0.000000082] * 0.0435 = 0.99999 * 0.0435 = 0.043

ECO_{2Mars} = 0.043

Total normal Intensity on Mars:

$I = ECO_{2Mars} (\sigma) (T)$ ^4/π (***Ref. 2 and 3***)

Introducing magnitudes:

I = 0.043 (5.6697 x 10^-8 W/m^2 K^4) (250) ^4 / 3.1416

I = 0.043 (5.6697 x 10^-8 W/m^2 K^4) (250) ^4 / 3.1416 = 3.03 W/m^2 sr

This causes a change of temperature by the concentration of carbon dioxide in the Mars' atmosphere of:

ΔT = 3.03 J / 0.02 Kg (735 J/Kg K) = 0.206 K. (***Ref. 1 and 3***)

There are problems with partial pressure of the carbon dioxide and the absolute pressure of the Mars' atmosphere, Uh?

According to the physics of radiative heat transfer, the total emissivity of the carbon dioxide at its current mass fraction, absolute pressure and partial pressure in the atmosphere of Mars is so low that it cannot cause the temperature of the planet increases by more than 0.21 K. Then, what the cause that Mars is 5 K warmer than the expected is?

As I have pointed out in my article "*Induced Emission and Heat Stored*" (***Ref. 9***), the induced emission of radiation caused by the solar photon stream during daytime and the surface photon stream during daytime and nighttime overwhelms the spontaneous emission by the carbon dioxide (read the first section of this paper).

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