The Greenhouse Effect

As the analysis of climate data from a selection of stations across the globe has produced results that are at odds with the pronouncements of the UN IPCC, it is desirable to find a reason for the difference.

Since the very first publication of the UN IPCC, "Climate Change The IPCC Scientific Assessment", 1990, the IPCC has claimed:

"Executive Summary

We are certain of the following:

• there is a natural greenhouse effect which already keeps the Earth warmer than it would otherwise be

• emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases carbon dioxide, methane, chlorofluorocarbons (CFCs) and nitrous oxide....."

In calculating the greenhouse effect, the average temperature of the Earth without the greenhouse effect was taken to be 255 degrees Kelvin (-18 deg.Celsius). This is the result obtained by taking one quarter of the Solar constant of 1370 Watts per square metre, namely 342.5 W/m^2 as the average irradiance over the spherical surface of the Earth relative to a circular disk of the same radius - the area of a sphere being four times that of a circular disk of the same radius. This was reduced by a factor of three tenths to account for the albedo, 0.3, of the Earth's surface giving an amount of 239.8 W/m^2 heating of the surface equivalent to a temperature of 255 deg.K (-18 degrees Celsius) from the Stefan-Boltzmann law.

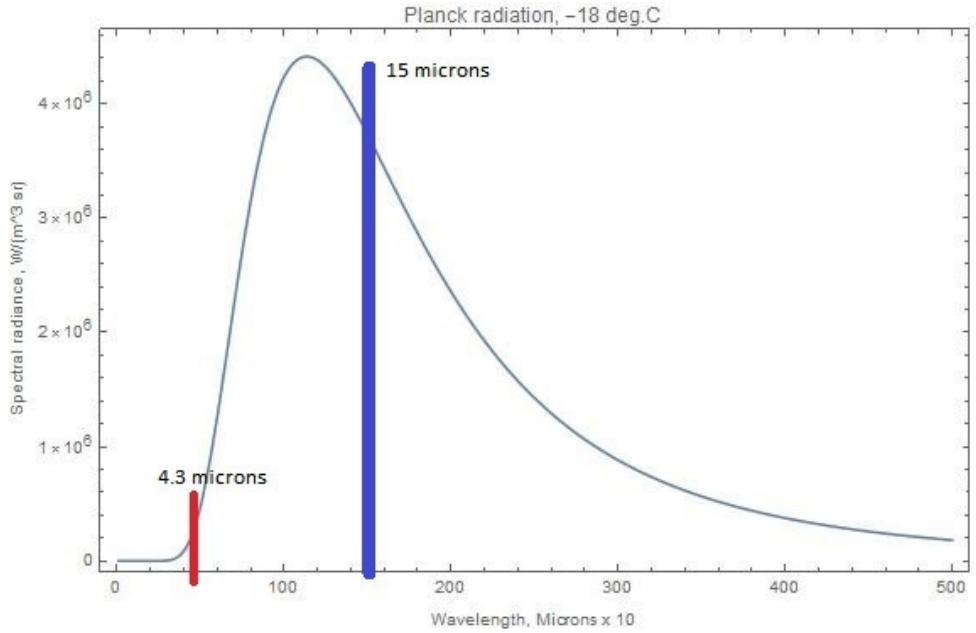

Figure1

The variation of radiant energy from the Planck law for a source at 255 degrees Kelvin with respect to wavelength is shown in Figure 1. The peak radiant energy is 4.42 Watts per cubic metre per steradian at a wavelength of 11.36 microns. The total energy density over all wavelengths is 3.2×10^{-6} Joules per cubic metre.

The temperature of the Earth with greenhouse effect was taken to be 288 deg.K (+15 deg.C), the estimated average temperature of the Earth. At this temperature the Stefan-Boltzmann law determines the radiant exitance for an emissivity of 1 to be 390.1 W/m^2, 63% greater than at 255 degrees Kelvin.

Figure 2 shows the variation of radiant energy from the Planck law for a source at 288 degrees Kelvin with respect to wavelength. The peak radiant energy is 8.12 Watts per cubic metre per steradian at a wavelength of 10.06 microns. The total energy density over all wavelengths is 5.2 x 10^{-6} Joules per cubic metre. Note that the vertical scale is twice that of Figure 1.

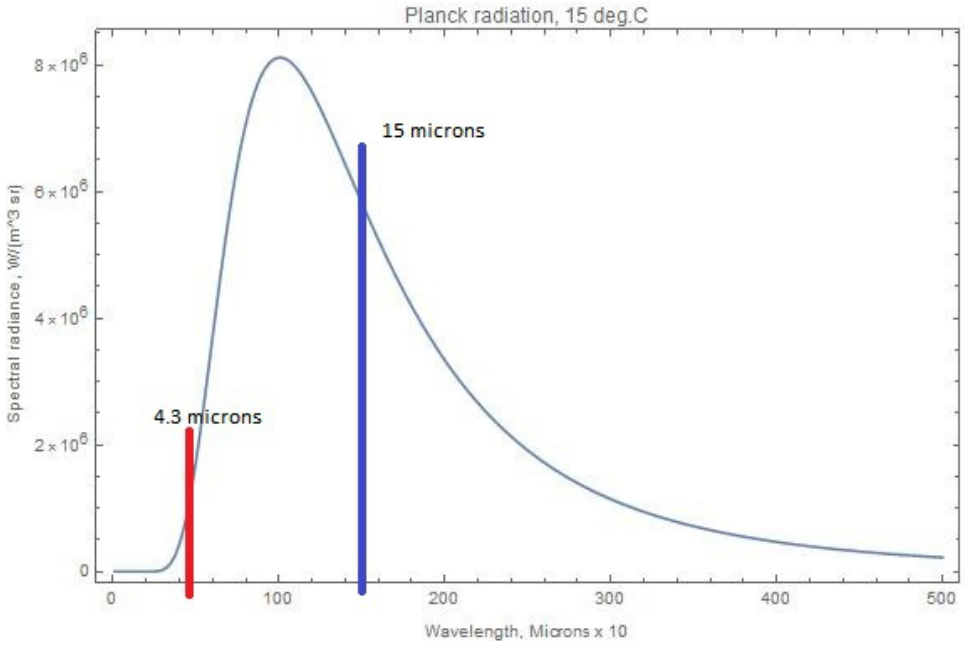

Figure 2

Planck's formula determines the energy density for a body at 255 deg.K to be 3.199 x10^-6 Joules per cubic metre and for 288 deg.K to be 5.205 x10^-6 J/m^3. The difference of 2.006 x10^-6 J/m^3 must be the energy generated by the greenhouse effect which causes the Earth surface, with greenhouse effect, to be radiating 1.63 times more energy than it would without the greenhouse gases.

Comparison between Figures 1 and 2 shows that the source of higher temperature has its peak radiant energy at a shorter wavelength (higher frequency) and its amplitude is larger at all wavelengths. As heat from a source of higher temperature is required to increase the temperature of a receiving body, that heat must fit these conditions of greater amplitude and a peak at shorter wavelength. Also notable is the fact that the part of the spectrum of shorter wavelength than the peak contains about one quarter of the total radiant energy of a source.

If all of the Earth's radiant energy at 288 deg.K was to be absorbed and re-radiated by the atmospheric gases, less than one quarter would be directed towards the Earth surface, namely, less than 1.301 x10^-6 J/m^3. Of this only seven tenths could be absorbed by the surface due to the 0.3 albedo, that is, 0.911 x10^-6 J/m^3, and only one quarter could effectively increase the surface temperature. That amounts to an effective back-radiation of 0.228 x10^-6 J/m^3, almost one ninth of the supposed 2.006 x10^-6 J/m^3 from the greenhouse effect making that effect not physically possible.

Added to that is the fact that only a small proportion of the atmosphere contains radiative molecules and those that are energised by the Earth's outgoing radiation are likely to transfer that energy to kinetic energy of motion when they collide with other molecules and the Greenhouse Effect proposition loses all credibility as a source of heat for the Earth's surface.

Despite this, the last UN IPCC report AR5, "Climate Change 2014" under "Summary for Policymakers" stated:

SPM 2. Future Climate Changes, Risks and Impacts

Continued emission of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of severe, pervasive and irreversible impacts for people and ecosystems. Limiting climate change would require substantial and sustained reductions in greenhouse gas emissions which, together with adaptation, can limit climate change risks. ***{2}***

SPM 2.1 Key drivers of future climate

Cumulative emissions of CO_2 largely determine global mean surface warming by the late 21st century and beyond. Projections of greenhouse gas emissions vary over a wide range, depending on both socio-economic development and climate policy. ***{2.1}***

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CO_2 Emission Spectrum

Using the facility on the HITRAN website [ref. 12], a listing of the emission spectra for isotopologue $^{16}O^{12}C^{16}O$ was calculated for a temperature of 280 degrees Kelvin (7 deg. C) and pressure of 0.9 atmospheres, roughly the conditions at an altitude of 1000 metres above sea level. This isotopologue has a natural abundance of 0.984 so is a reasonable representation of the atmospheric CO_2 absorption.

Taking a cutoff level of one thousandth of the maximum line strength gave three absorption peaks. These were :
(a) the maximum of 3.687E-18 cm/molecule at wavelength 4.23 microns within the band 4.19 microns to 4.37 microns,
(b) a lessor maximum of 3.106E-19 cm/molecule at wavelength 14.98 microns within the band 14.09 microns to 16.19 microns, and
(c) the third maximum of 6.169E-20 cm/molecule at wavelength 2.68 microns within the band 2.67 microns to 2.8 microns.
The position of the first two bands is shown on Figures 1 and 2 with the 4.23 micron band in red and the 14.98 micron band in blue.

As the wavelength for (b) is greater than that for the peak for the assumed average temperature of the Earth, 10.06 microns, it cannot cause the Earth's temperature to increase. It is 'colder' than the Earth. Only radiation in (a) the 4.23 micron band and (c) the 2.68 micron band can increase the Earth's temperature, that is, radiation of shorter wavelength than the peak.

For a source at 288 degrees Kelvin, Planck's law determines that the 2.68 micron band has an energy density of 5.016 x 10^-11 Joules per cubic metre and the 4.23 micron band has an energy density of 5.344 x 10^-9 J/m^3, making a total of 5.39416 x 10^-9 J/m^3 radiated from

the Earth's surface. Of this, one quarter may be back-radiated towards the Earth where the surface, due to the albedo, may absorb seven tenths as heating, which is 0.944 x 10^-9 J/m^3 or one part in 21.25 of the supposed Greenhouse Effect. If there is to be a Greenhouse Effect then the UN IPCC needs to explain from where do they source the other 95% of the back-radiation energy.

Furthermore, if there is back-radiation of the Earth's emitted heat energy by the atmosphere, there must also be back-radiation of the incoming Sun's energy by the atmosphere.

For the radiant energy from a 5772 degrees Kelvin source at the Earth's distance from the Sun as source, the 4.23 micron band would have an energy density of 1.725 x 10^-8 J/m^3 and the 2.68 micron band would have 6.214 x 10^-8 J/m^3. That is, a total of 7.939 x 10^-8 J/m^3. If two-thirds is radiated out into space, that is a loss of 5.3 x 10^-8 J/m^3 or 56 times the supposed energy heating of the Earth's surface by CO_2 back-radiation of the Earth's outgoing energy. That means that if the Greenhouse Effect is operative then CO_2 would be causing cooling of the Earth due to part of the Sun's incoming radiation being back-radiated into space.

Explanation

The above results need further explanation as to the cause of the discrepancy between the results and the statements by the UN IPCC.

The model used to determine the Greenhouse Effect took the incoming Solar constant of 1370 Watts per square metre and spread that across the whole spherical surface of the Earth giving 342.5 W/m^2 as the average irradiance. That is, the model had no night or day and no polar ice caps or Equatorial tropical zone, simply the same irradiance causing the same constant temperature everywhere. This means a non-rotating, non-orbiting Earth receiving equal radiation from all directions of the three dimensional Universe.

This is manifestly different to reality, whereby, at any instant in time there is only one spot on the surface potentially receiving the full irradiance of 1370 W/m^2. That spot circumnavigates the globe every 24 hours along a different path each time but always lies within the Equatorial zone. The remainder of that part of the globe facing the Sun receives the Solar constant reduced by the sine of the angle of inclination of the surface with respect to the incoming radiation. This diminishes to zero along the circumference of the plane facing the Sun and over all of the surface facing away from the Sun. That is, the temperature is always fluctuating back and forth between daily maxima and minima and these constantly change as the Earth orbits the Sun.

Astrophysicist Joseph Postma [ref. 13] has devised a rational model for the Sun warming the Earth which gave a result of +15.5 degrees Celsius for the average surface temperature of the Sun-lit side, an acceptable estimate without invoking a Greenhouse Effect.

In summary, the UN IPCC model defines an isolated sphere in space exhibiting no change in surface temperature whatsoever in marked contrast to the ever-changing temperature both with time and location across the Earth's surface. The contrived 33 degree Kelvin Greenhouse Effect is not a property of the atmosphere but a measure of the bias inherent in the artificial model used to estimate the average temperature of the surface of an

imaginary Earth.