

Re: R. W. Wood's "Note on the Theory of the Greenhouse"

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- *From:* none <"doug\"@none">
 - *Date:* Sat, 05 Apr 2008 11:10:33 -0700
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tadchem wrote:

On Apr 4, 9:15 pm, Edward Green <spamspamsp...@xxxxxxxxxxxx> wrote:

On Apr 4, 10:16 am, Gene Ledbetter <ledbetterg...@xxxxxxxxxxxx> wrote:

The following sanctimonious statement appears in the current version of the Wikipedia monograph on "Greenhouse Effect": "The term "greenhouse effect" is a source of confusion in that actual greenhouses do not warm by this mechanism (see section Real greenhouses). Popular discussions often imply incorrectly that they do; this error is sometimes made even in materials from scientific or governmental agencies (e.g., the U.S. Environmental Protection Agency[3])." I find this extremely amusing because until recently this very same Wikipedia monograph maintained -- not unsurprisingly -- that the "greenhouse effect" was the mechanism by which greenhouses were warmed. It was, in fact, because of this widely held belief that the term "greenhouse effect" was created. It has been hammered into our heads for decades that glass greenhouses are heated by the greenhouse effect, which effect also accounts for the heating of the atmosphere by greenhouse gases. The Wikipedia

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monograph was recently forced to make an abrupt, and hopefully embarrassed correction because of a century-old report of an experiment (conducted by physicist R. W. Wood) that discredited the original greenhouse effect.

The following article was published in the Philosophical Magazine in

1909 (Vol. 17, pp. 319–320):

XXIV. Note on the Theory of the Greenhouse

By Professor R. W. Wood (Communicated by the Author)

THERE appears to be a widespread belief that the comparatively high

temperature produced within a closed space covered with glass, and

exposed to solar radiation, results from a transformation of wave-

length, that is, that the heat waves from the sun, which are able to

penetrate the glass, fall upon the walls of the enclosure and raise

its temperature: the heat energy is re-emitted by the walls in the

form of much longer waves, which are unable to penetrate the glass,

the greenhouse acting as a radiation trap.

I have always felt some doubt as to whether this action played any

very large part in the elevation of temperature. It appeared much more

probable that the part played by the glass was the prevention of the

escape of the warm air heated by the ground within the enclosure. If

we open the doors of a greenhouse on a cold and windy day, the

trapping of radiation appears to lose much of its efficacy. As a

matter of fact I am of the opinion that a greenhouse made of a glass

transparent to waves of every possible length would show a temperature

nearly, if not quite, as high as that observed in a glass house. The

transparent screen allows the solar radiation to warm the ground, and

the ground in turn warms the air, but only the limited amount within

the enclosure. In the "open," the ground is continually brought into

contact with cold air by convection currents.

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To test the matter I constructed two enclosures of dead black cardboard, one covered with a glass plate, the other with a plate of rock-salt of equal thickness. The bulb of a thermometer was inserted in each enclosure and the whole packed in cotton, with the exception of the transparent plates which were exposed. When exposed to sunlight the temperature rose gradually to 65 oC., the enclosure covered with the salt plate keeping a little ahead of the other, owing to the fact that it transmitted the longer waves from the sun, which were stopped by the glass. In order to eliminate this action the sunlight was first passed through a glass plate. There was now scarcely a difference of one degree between the temperatures of the two enclosures. The maximum temperature reached was about 55 oC. From what we know about the distribution of energy in the spectrum of the radiation emitted by a body at 55 o, it is clear that the rock-salt plate is capable of transmitting practically all of it, while the glass plate stops it entirely. This shows us that the loss of temperature of the ground by radiation is very small in comparison to the loss by convection, in other words that we gain very little from the circumstance that the radiation is trapped. Is it therefore necessary to pay attention to trapped radiation in deducing the temperature of a planet as affected by its atmosphere? The solar rays penetrate the atmosphere, warm the ground which in turn warms the atmosphere by contact and by convection currents. The heat received is thus stored up in the atmosphere, remaining there on account of the very low radiating power of a gas. It seems to me very doubtful if the atmosphere is warmed to any great extent by absorbing the radiation from the ground, even under the most favourable

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conditions.

I do not pretend to have gone very deeply into the matter,
and publish
this note merely to draw attention to the fact that trapped
radiation
appears to play but a very small part in the actual cases with
which
we are familiar.

Without touching on the political minefield, this certainly makes an
interesting 100 year old false oolie!

Now, we might venture (I don't claim this as original) a mechanism for
the failure of the presumably incorrect mechanism that the glass, even
if opaque to IR, heated to the inside temperature, will _emit_ IR as a
blackbody.

However, there are simply no simple adequate arguments here; there is
(unfortunately for those of us bound to armchairs), probably no
substitute for a complete understanding of the various significant
factors involved and their interaction (yawn).

Leaving out the tainted pop-sci, is there a credible mechanism for CO₂
to make the atmosphere a significantly more effective "radiation
trap"?

The 'mechanism' behind the AGW thesis requires that CO₂ in the
atmosphere absorbs IR being radiated from the ground and re-radiate it
preferentially downwards, back towards the ground. You will notice
that their little gee-whiz diagrams never show the CO₂ radiating IR
out into space. Why not? It DOES happen, but that doesn't fit with
their story.

A CO₂ molecule doesn't know up from down. It re-radiates as much IR
out into space as it does back towards the ground, and as much as the
ground would. There is nothing in the physics that would induce the
CO₂ to act as an IR mirror.

This is not quite accurate. As in our disagreement on math proofs,
the difference is between "some" and "any". All of the radiation
that the CO₂ intercepts was headed away from the earth. Yes, it
radiates isotropically, but that means that about half of the radiation
is returned to the earth for heating. This is the way all the
greenhouse effect works.

However, the whole concept of man made warming has a major problem
which never seems to get discussed. The major greenhouse gas is
water which accounts for something on the order of 98.5% of the
effect that we see. CO₂ accounts for roughly 0.15%. As an exercise

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for the students when I taught thermodynamics, the students were to calculate the temperature effect on the earth of a doubling of the CO₂ concentration. Given the temperature to the fourth dependence of blackbody radiation, a doubling of the CO₂ would raise the earth's temperature by less than .1 degree. This inconvenient fact is ignored totally. For CO₂ to have a measurable effect, there would need to be some feedback mechanism that made a large amplification of the contribution from CO₂. But why would that particular contribution be more important than that of water vapor?

As somebody put it (not exactly a catchy slogan, though), and in paraphrase, the issue is the effective black body bulb temperature at which the Earth radiated away just as much energy as it receives, and how this is affected by atmospheric composition. If we can replace all the variable effects by this single temperature, than the only remaining variable must be the effective height of the radiating layer. But anything which can be said in a few paragraphs is bound to be a gross over-simplification.

Tom Davidson
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