Greenhouse confusion

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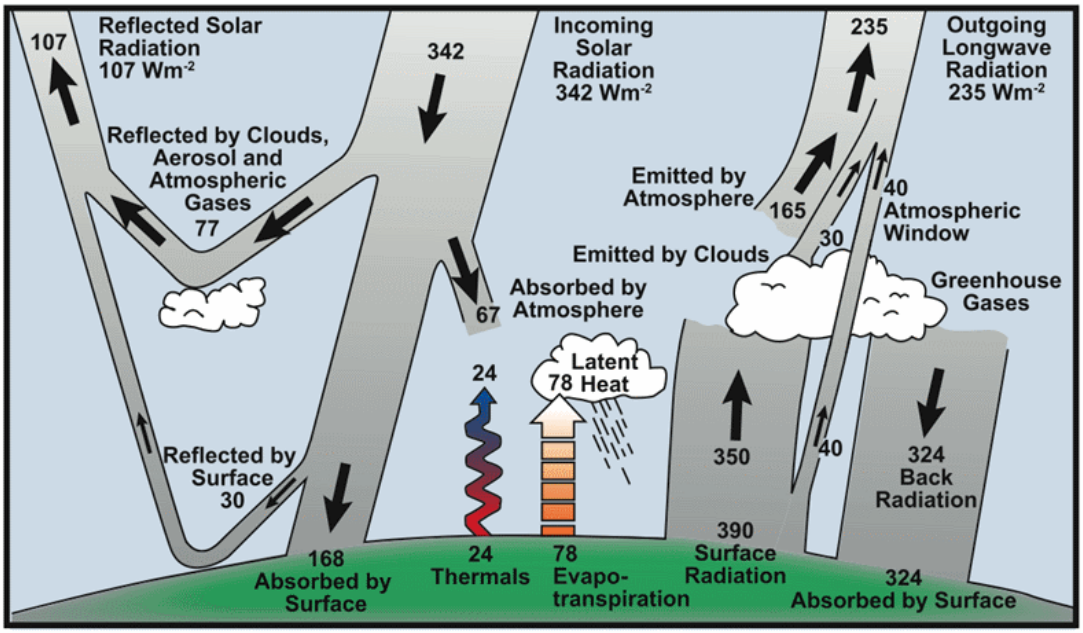

FAQ 1.1, Figure 1. *Estimate of the Earth's annual and global mean energy balance. Over the long term, the amount of incoming solar radiation absorbed by the Earth and atmosphere is balanced by the Earth and atmosphere releasing the same amount of outgoing longwave radiation. About half of the incoming solar radiation is absorbed by the Earth's surface. This energy is transferred to the atmosphere by warming the air in contact with the surface (thermals), by evapotranspiration and by longwave radiation that is absorbed by clouds and greenhouse gases. The atmosphere in turn radiates longwave energy back to Earth as well as out to space. Source: Kiehl and Trenberth (1997).*

Fig. 1. From IPCC, Fourth Assessment Report, Working Group 1, Chapter 01. This is a one-dimensional representation of a four-dimensional process.

Note the phrase in the comment '*The atmosphere in turn radiates longwave energy back to earth as well as out to space'*. Notice also that only 168 of the 342 units of incoming solar radiation are absorbed by the earth's surface whereas there are 390 units of outward radiation from the earth's surface. Then there is another mysterious figure of 324 units of back radiation that is absorbed by the earth's surface. This is considerably more than the 168 units of solar radiation that is absorbed by the earth's surface in the first instance. Where does this additional energy come from?

Working from left to right at the bottom of the figure, 168 units are coming in but 492 units going out, of which 324 come back again in the form of back radiation! **Somebody has cooked the books**. I am sure that my high school science master would be most upset if I produced this figure all those years ago.

Please note

This memo is my serious contribution to the whole climate change issue. The atmospheric greenhouse effect lies at the heart of climate change science. Its very existence is now being challenged. I would have preferred to discuss my views with my professional colleagues in the climatological and environmental sciences. But they will have none of it. Why have these scientists and the South African authorities

deliberately excluded those of us in the engineering professions from participating in the discussions? Is it because they have something to hide?

All agree that this climate change issue is the most important scientific issue facing mankind. Unfortunately it has developed into an unhealthy slanging match instead of a serious international, multidisciplinary effort.

This memo was precipitated by vigorous but healthy exchanges between senior and experienced scientists on the Internet last week.

Introduction

This whole climate change issue is rapidly collapsing. There is no way that international agreement will be reached on meaningful reductions of undesirable global greenhouse gas emissions. But the morning newspapers of 22 July 2008 quoted our Minister of Environmental Affairs and Tourism presenting his views to participants at a conference on climate change at Kirstenbosch. It was the same old story.

Why is it that our minister keeps distributing these depressing and unsubstantiated claims? Previously it was our Proteas and Quiver trees that were at risk of extinction. I challenged this on the basis that these unique species were in a healthy condition throughout Southern Africa. The alarmists switched tactics and the minister informed the audience that if global temperatures increase by $2,5^0$C compared with the 1990 temperatures as a result of global warming, then this could lead to the extinction of 24% to 59% of mammals, 28% to 40% of birds, 13% to 70% of butterflies, 18% to 80% of other invertebrates, and 21% to 45% of the reptiles in the Kruger National Park.

What the minister did not tell his audience is that this temperature increase is less than that between breakfast and morning tea on a sunny day. Nor did he suggest to his audience that they visit the Kruger Park on a hot day and notice how the animals adapt to this heat by resting in the shade of trees. Nor did he tell his audience why he recently issued an authority to start culling our elephants because of their overpopulation.

He continues making these claims without fear of contradiction from the scientific community. Why is this? Would he dare present the same message to the nearby informal settlements that are now under water?

He said that South Africa had to take very difficult and important decisions relating to its own efforts to reduce and avoid these emissions. Among these was building a low carbon economy; establishing a climate resistant society; and adapting to the unavoidable climate changes. Again he did not mention how this would be achieved and at what costs. Does he really believe that he will be able to persuade the majority of our population to move towards a climate resistant society?

Where does all this nonsense come from? The public believes it because they have faith in scientists. The whole scientist community, by its silence, must bear responsibility for the incredible damage that these unsubstantiated claims will cause to the prosperity of our country, including those living within kilometres of the venue of the conference. In these turbulent (clue) times our minister should be spreading messages of hope, not messages of doom.

One newspaper had another headline in its business section. It stated that increasing numbers of South Africans are selling their houses and "packing for Perth". Last week, one of our foremost climatologists packed his bags and headed northwards. It is terribly sad for our country. These high level alarm and despondency messages can only make the situation worse.

What is the foundation of these nonsensical claims?

The greenhouse effect

In its ***Climate Change 2007 Synthesis Report*** issued at the Bali Conference last December, the IPCC was dishonest when it tried to persuade decision-makers that there was a connection between the increasing carbon dioxide concentrations in the atmosphere and increasing global temperatures. This was the foundation of their claim. Had they produced a graph showing this relationship it would have demonstrated the fallacies in their argument. Then we could all go home and get on with our lives. So they deliberately omitted it.

During the past week there was a vigorous behind the scene's debate on the Internet. The issue was the causes and consequences of the greenhouse effect. The climate alarmists maintain that the increasing levels of carbon dioxide in the atmosphere cause the so-called greenhouse effect. This results in increases in global temperatures with a whole array of serious consequences.

All those participating in the Internet debate agreed that this carbon dioxide/global warming linkage is invalid, but they had differences on the nature of the energy transfer mechanisms between the earth's surface and the upper atmosphere. I soon got lost. Physics was never one of my strong points, although my high school teacher did his best. But he did get one message across -- energy can neither be created nor destroyed.

Is this issue important?

We have been told that the IPCC is alive and well, and proposes producing its next series of assessment reports in 2013/14. This time it will not succeed in brushing aside those contrary reviews. At the very least it will be forced to address them. These are my views on the debate. Feel free to demonstrate that I am wrong.

I am not a physicist, but I do have knowledge of the energy transfer processes in hydrological applications. Radiant energy does not feature in the hydrological cycle. Our interest starts with the evaporation of water from the oceans and ceases when the rivers return the water back to the oceans.

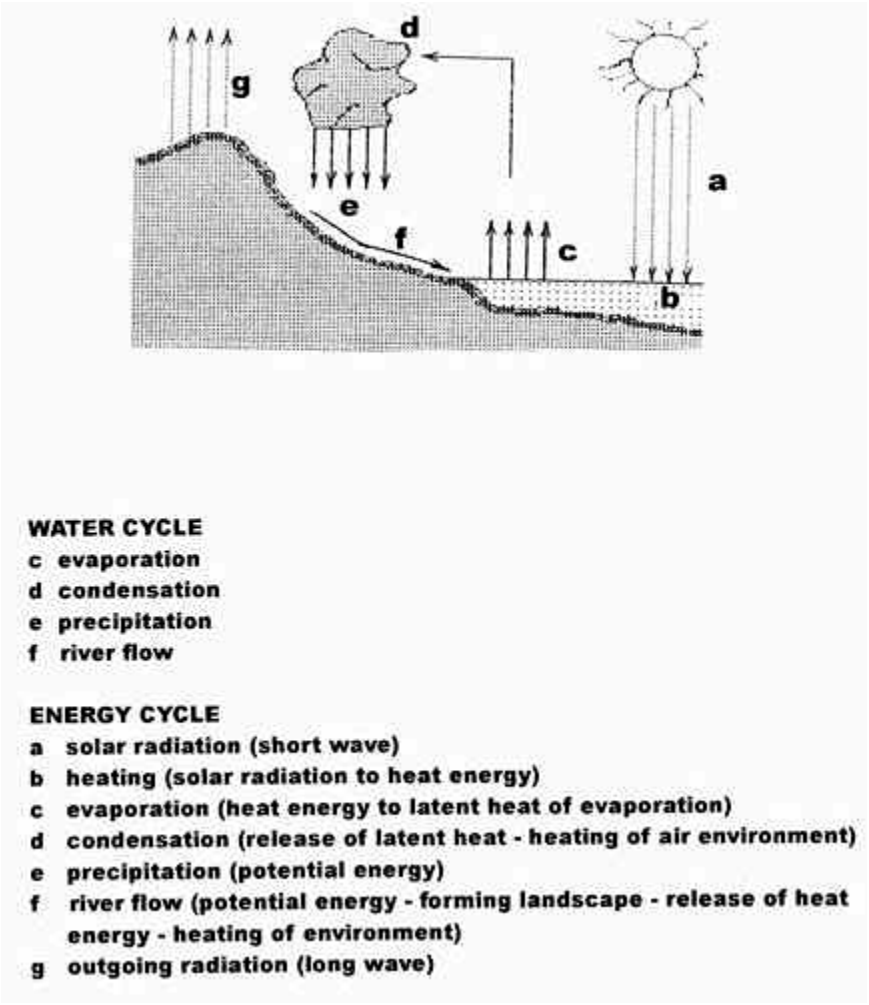

Fig. 2. Basic water and energy cycles and their interactions. This is a two-dimensional representation of a four-dimensional process.

There are several aspects that should be noted in this simple figure. First and most importantly, we are dealing with a self-regulatory process, (a) and (g) must balance. If not, the energy redistribution system will automatically restore the balance. This must be so, otherwise the whole system would have become unstable thousands of years ago.

Consequently, if the incoming solar radiation (a) increases, then the outgoing longwave radiation (g) must also increase. As neither (a) nor (g) can be measured accurately on a global scale, the place to search for changes caused by changes in incoming solar radiation are (e) and (f), not (a) and (g).

Greenhouse gasses cannot change (g) as this has to be in balance with (a). If part of (g) is returned to earth then the total energy input to the earth increases while the output from the earth decreases. The system becomes unstable and unpredictable. This cannot happen.

Taking this further, if part of (g) is radiated back to the earth's surface via the intervening atmosphere, how does this **incoming longwave radiation** react with the atmosphere in its path and eventually the land and ocean surfaces? In what way does

it contribute to the water cycle? This question must be answered because it is claimed that the greenhouse effect will result in '*an intensification of the hydrological cycle*'.

I cannot find any answers in the IPCC's 2007 assessment report of Working Group 1. Did they address it at all?

Nor can I find it in my applied hydrology handbooks. Nor have I come across it in the hydrological publications. Nor was it ever discussed in any conferences and symposia that I attended. When I asked attendees at a recent conference on water issues held in Japan, the unanimous response was that this whole climate change issue was nothing more than an assembly of unverified hypotheses.

Now our Minister of Environmental Affairs and Tourism expects hydrologists to 'adapt' to something that does not exist.

Energy transfers

Those of us involved in applied hydrology are familiar with the energy cycle that drives the hydrological cycle. Energy transfer mechanisms are critical for an understanding of river behaviour. Once again, the lack of interdisciplinary transfer of knowledge has led to a serious misunderstanding of the so-called greenhouse effect. That is now coming under scrutiny.

Consider a drop of rainwater on the top of a mountain. It possesses potential energy. The potential energy is relative to baseline that is conventionally seawater level. After the drop of water enters the headwaters of the river it starts moving in a downstream direction. Potential energy is converted to momentum energy. This maintains river flow, conveys sediment and erodes river banks. Through these processes, momentum energy is converted to heat energy, which is transferred back to the local atmosphere, and eventually back into space.

The quantification of these energy transfer mechanisms is very difficult **because of unpredictable turbulence that is present on all scales where three-dimensional movement of a fluid is involved**. For this reason, it is impossible to trace the path of a drop of water along its route to the ocean. While water is an incompressible fluid and can only move in a downstream direction, the oceanic water is unconstrained laterally and vertically. The atmospheric gasses are compressible and can move in all three directions as they are not constrained laterally, or vertically. Three dimensional movement of a fluid cannot be smooth on any time scale due to unpredictable turbulence that is present in all time and space movement. Einstein once described turbulence as being too difficult for him.

Email debate

With this in mind, I started reading the flurry of e-mails during the past week. The discussion was precipitated by a paper by Chilingar et al ***Cooling of the Atmosphere Due to CO2 Emission*** in *Energy Sources*, January 2008. The writers investigated the effect of CO_2 emissions on the temperature of the atmosphere based on adiabatic theory of the greenhouse effect. They showed that increasing CO_2 concentration in the atmosphere results in **cooling** rather than warming of the earth's atmosphere.

In essence, they referred to the traditional view that is based on heat transfer to the atmosphere via radiation, whereas heat from the earth's surface is mainly transferred

by convection. Radiation only accounts for about 8% of the total heat transfer from the earth's surface to the troposphere.

Despite my lack of expertise in the subject, I understood most of the Internet arguments that followed. They started with the mode of energy transfer from the earth's surface through to the upper atmosphere. I had difficulty in understanding the relationship between radiative and convective heat transfer to a unit of carbon dioxide up in the atmosphere. What sort of energy does a unit of carbon dioxide possess out there that is not possessed by the other gasses? If it is not its energy that is important then I assume that it has unique energy-reflective characteristics, and not energy-radiative characteristics..

The debate started with **A**'s comment on the paper. He made the contentious statement that energy cannot move to another, higher energy body. [In my view energy cannot move anywhere. It is converted from one form to another or transferred from one body to another. If it is transferred, there must be an energy gradient for the transfer to take place. If it is converted, then no such gradient is necessary. Evaporation is an example.]

He continued by stating that enough radiant energy simply does not exist to perform the thermal tricks we have been demanding of the atmosphere

Then came **B**'s response. All bodies emit radiation in proportion to their absolute temperature and all bodies in the path of the radiation receive it regardless of their relative temperatures. He was adamant that radiation from every body goes in every direction. [This statement would be far more instructive if he used the description 'radiated energy' instead of 'radiation'. A body cannot emit energy without cooling itself.]

C also entered the fray. He supported B's view regarding the movement of energy from a lower to a higher energy body. [With respect, he also missed the point. Energy transfer in the case of convection (as different from radiation) can indeed only move from a warmer to a cooler body. Heat *per se*, cannot be the deposited anywhere. It is the gasses in the atmosphere that heat or cool. Cool air cannot rise naturally through warmer air. C's explanation would have been much more understandable if he used the term 'energy' instead of 'heat'. The word 'heat' is meaningless unless attached to something. This is the essence of the misunderstanding. Heat cannot be conducted anywhere. It is heat energy that is transferred and determines the receiving body's temperature.]

A responded. He maintained that the statement that half the radiation from the atmosphere goes up and the other half goes down is nonsensical. [See caption in Fig. 1 above.] He then restated his position that energy transfer occurs when a difference exists between two bodies. [I agree, but with the proviso that it is the same type of energy, in this case heat energy.] He continued by stating that radiant energy can also only flow in one direction between two bodies.

[By now, it was very clear that both sides failed to appreciate that they were mixing apples with bananas.]

B, in response insisted that energy of radiation from every source, however great or small, is distributed to every absorber, whether greater or smaller. [I was getting more confused. On a hot day, the warm, moist air (lots of energy) rises through the cooler dry air, taking its energy with it. It cannot possibly convey energy in the opposite direction. But at the same time a hot object suspended in space radiates energy in all

directions. This radiated energy will be absorbed (converted to heat energy) by any object in its path whether colder or hotter. We obviously have two mechanisms at work.]

Then **A** responds stating that if the absorber possesses greater energy it cannot be an absorber.

[Here I have another problem. They are different types of energy. That water drop on the mountain possesses both potential energy related to his elevation above sea level, and heat energy, directly from the sun. I must stress again that the concept of energy is meaningless unless it related to an object or process.]

D also joined the debate. He mentioned the role of photons. [I was lost. I do not know the difference between a photon and a photograph.]

A responded vigorously. He pointed out that radiant energy merely signals an object's temperature. It is not a heat loss mechanism because no temperature gain occurs by restricting it.

[If we talk of radiant energy, the implication is that energy is leaving the radiating body. But then it is stated that this is not a heat loss mechanism. I am at a loss. The discussion started heating up.]

D responded. He asked the same question that I was mulling over above. He asked, what happens to the energy part of radiant energy if it is not a heat loss mechanism?

A was quick to reply. Then there was another response from **D**, and yet another from **A**, all on the same day.

[This was a healthy debate. Obviously there is no meeting of minds on this critically important subject. I just wish that somebody could reduce this whole argument to a layman's level that I could understand. Otherwise we will get nowhere.]

The following is my understanding of the whole atmospheric greenhouse theory. If you disagree then you will have to explain using terminology and examples that I can understand.

My understanding

The very fact that this vigorous debate by renowned scientists in this field took place over a span of four days demonstrates that the issue is by no means settled. If I am at a loss, then these scientists have a lot of hard work ahead if they want to convince decision-makers and their professional advisors.

These are my questions that require satisfactory answers.

Received solar energy is greatest at the tropics and least at the poles. Consequently, there is an energy gradient. The rate of the redistribution of energy via the atmospheric and oceanic processes is greatest at the mid-latitudes. The tropical cyclones are evidence of this. This redistribution is far from complete. The polar regions receive much less of this energy than the tropical regions. That is why they are ice-covered. So far so good.

We are told in the IPCC reports that the outgoing radiation that balances the incoming radiation, is in the form of longwave radiation. The earth acts as a black box and emits this longwave radiation uniformly irrespective of latitude.

Question #1. My motor car emits carbon dioxide. It finds its way into the upper atmosphere via ordinary convection processes. Now it sits there. It must have the same temperature as the non-harmful gasses around it. Two parcels of infrared radiation from the earth rise up. One strikes the molecule of carbon dioxide and the other a molecule of nitrogen. **What happens next !!!!!**

Question #2: How does this longwave outgoing **energy**, which is supposedly uniformly emitted irrespective of latitude, reach the polar regions in the first place?

Question #3: This 'black box' that is the earth, does **not** have the same temperature on its whole surface between the tropics and the poles. How then can the radiation from it be uniformly distributed irrespective of latitude? The hydrological literature also postulates that outgoing longwave radiation is emitted uniformly from the earth's surface regardless of latitude.

Question #4. A very high proportion of the CO_2 emissions originate in the northern hemisphere in the latitudinal band stretching from Japan in the east through China, India, Europe, the UK to the USA. What is the latitudinal redistribution of these emissions bearing in mind the reduction in energy transfer polewards, and that the high energy originating in the tropical regions is distributed northwards **towards** these CO_2 sources. Together, they will tend to contain the emissions in the northern hemisphere mid-latitudes. How then is it possible for a uniform latitudinal concentration of CO_2 to develop?

Question #5. How do the greenhouse gasses reach the altitude at which they become effective? This can only be by convection and conduction processes. These in turn are temperature dependant. The 'layer' of greenhouse gasses cannot be uniformly 'thick' and therefore their interception of outgoing radiation must diminish polewards.

The explanations given in the IPCC's fourth assessment reports do not accommodate these effects. Their explanation **is a one-dimensional explanation of a four-dimensional problem!** I have very serious reservations. Nowhere in the IPCC assessment reports do the writers seem to appreciate this. I do not for one moment believe that the energy radiated back into space from the earth is evenly distributed in either time or space. Annual averages are meaningless. We are interested in the processes on all time scales.

I do not believe that the atmospheric greenhouse effect exists. Those alarmist statements issued by our minister have no foundation. Efforts to achieve a low carbon economy and climate resistant existence will be an exercise in futility.

Regards

Postscript

See my last memo 24/08 on the case of the multidimensional watermelon. This is a four-dimensional problem that the global warmers are attempting to solve by using one-dimensional analyses. These in turn result in their lack of appreciation of the direction, magnitude and time dependence of the critical processes. **The atmospheric greenhouse effect is a work of fiction.**