

Presentation of 19 May 2011 – Deutsche Bank AG, Frankfurt/M

„Physical and Chemical Properties of Earth Surface Components“

Slide 1 – Introduction ¹

Dear Sirs and Madams,

Over the next 30 minutes through examination of physical and especially chemical properties of earth surface components such as atmosphere, oceans and rocks I'll try to explain you why I am so sure, that CO₂ cools² the atmosphere and thereby the earth surface; our civilization, however, actually warms some limited areas of the earth surface, for example, big cities or surroundings of big power plants.

I will proceed in the following five steps

- First of all I have to emphasize that my aim is not to make you focused on the subject just for today, I'd like you to concern yourselves with the issue of CO₂ even more actively from now on.
- In part two I will explain you the so-called greenhouse effect of carbon dioxide (CO₂) in a way it is usually defined.
- Then we will examine the effect of the gravity on temperature profile dynamics of air, water and rocks by example of Earth and Venus.
- Part four deals with surface temperature of certain substances from the point of view of balance between absorption and emission of electromagnetic solar radiation.
- After that we will surely have considerable knowledge needed for understanding of the reasons why **CO₂ cools the atmosphere by releasing energy into space and does not warm it.**

Slide 2- Two motivation videos

First of all I'll show you two short videos without any comments given.

- The first video will show us Climate Adviser of Federal Chancellor, Professor Schellnhuber, Director of Potsdam Institute for Climate Impact Research
- And on the second video we will welcome physicists and cabaret artist Vince Ebert.

Video 1 and Video 2

Slide 3 – Annual cost of CO₂ emission prevention in EU-27

¹ Slides and videos are enclosed in my two 15 Minutes presentations in German language that can be seen on YouTube:

<http://www.youtube.com/watch?v=ScIFLRe2h7E>

<http://www.youtube.com/watch?v=Hz34FFpgujl>

² This statement is equivalent to the statement: The sun does not circle the earth but the earth circles the sun. I have openly expressed the idea that CO₂ cools and does not warms many times without any 'inquisition' coming for me.

We are neither in a university nor in a cabaret; we are in Deutsche Bank at the moment. The following information provided by EU Commissioner for Climate Action Connie Hedegaard will surely motivate you for serious and lasting concern about the subject in question even more than the video you have just watched. Connie Hedegaard declares the European Union CO₂ policy cost. She says: 'It will cost about 270 billions Euros a year to reduce emission of so-called greenhouse gases by 80 to 95 percent till 2050 in Europe'. She said so before Fukushima disaster occurred or so the Members Newsletter of German Workers Union 'Industriegewerkschaft Bergbau, Chemie, Energie' (IG BCE) dated May 2011 claims. And the IG BCE assumes that Germany's withdrawal from nuclear energy will make it 'even more expensive' so we will feel it.

For me as a scientist a sum of 270 billions Euros a year is a considerable amount. Well, maybe here - in a bank - one has a different opinion on that matter.

Slide 4

But let us get back to the subject.

- The greenhouse effect was defined in 1987 by the German Physical Society (GPS) jointly with German Meteorological Society (GMS) by a statement: 'Without trace gases the global temperature would be -18°C '.
- We will see that a substantial factor and namely gravity and its influence on temperature were omitted. The gravitation field causes 'immobile' temperature conditions of air, water and rocks though.
- We will learn how incredibly wrong was the calculation resulting in value ' -18°C ' as it was made without consideration of chemical processes.
- And at the end we will know why the trace gases cool the atmosphere and thereby the earth surface.

Slide 5 –GPS and GMS proclamation made in 1987

Let us examine the greenhouse effect definition word for word. Both scientific societies have declared in 1987 that water vapour and CO₂ **have** the critical influence on climate. They claimed that without these gases the average temperature of earth surface would be about -18°C because of radiation balance between solar light absorption and its emission by the Earth.

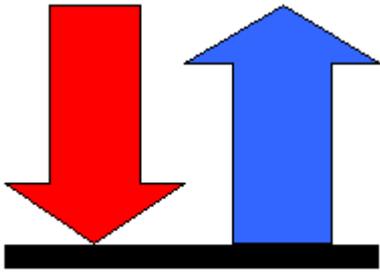
Slide 6 – Managing bodies policy – no science

The mentioned proclamation appeared not only in the members newsletters, 2500 copies were printed and sent to politicians, journalists and manufacturers. This three-sheet letter contained no footnotes with references. There was no peer review as the reviewers themselves published the d. It was a PR action with no science involved. It was policy of managing bodies of two scientific societies.

Slide 7 – The ' -18°C ' equation:

$$T^4 = 0,7 \times 1371 / (4 \times 0,0000000567051)^3$$

³ Accounted for 100 % "In" and "Out" on a "Black Body" surface only



And now I am going to make a **thorough and precise** examination of the equation resulting in the '-18°C'⁴ value. The only peculiarity of the equation is that instead of a number representing the temperature it has the fourth power thereof on the left side.

Let me explain these particular numerical values.

- The „0,7“ value describes the influence of day clouds which tend to cool the atmosphere as they reflect sunlight.

Night clouds are not considered, although their influence on warming dynamics differs from one of the day clouds. If there are no clouds at night morning temperature is much lower as there is no hindrance for energy emission into space. This is a well-known fact.

However, the greenhouse effect has absolutely nothing to do with warming night cloud cover; invisible trace gases contained in the atmosphere cause it. Omission of the fact that night clouds are like a warming blanket for earth surface was the third mistake in this equation.

- The „1371“ value describes energy input from the sun. This value is equivalent to about two thirds of a common iron used in every household per one square meter.

- The „4“ value is the geometrical factor.

- The only natural law contained in this equation corresponds to the fourth and the last value, which is quite remarkable. It represents the entire physical knowledge of radiation laws. Physicists denote this value as the Stefan–Boltzmann law.

This equation is in principle nothing else but a ratio of dayside energy input of the sun to night side energy output into space. The total effect of a full 24-hour day that is daily variability, daily volatility and daily balance of **energy cash flow results in zero sum game**. The energetic 'real estate' of earth surface is not changed by a zero daily amount. Daily zero transaction volume turns the assets into immovable property.

However, this radiation balance equation is way too far from describing of the real 24-hour day energy cash flow; this is an approximate theoretical solution only. It does not indicate how much solar energy is actually absorbed and irradiated into space by earth surface components. In the language of physical science this means: Radiation laws can only be applied to idealized model of the so-called 'black body'.

The actual daily energy cash flow of air, water and rocks is solely determined by 'chemistry' of these components. Sadly, one could find no 'chemistry' in the '-18°C' equation.

⁴ Degree Celsius is not a common scientific temperature measurement unit; an absolute unit of measurement for temperature called 'Kelvin' is used instead. The value is therefore 255K rather than '-18°C'.

Slide 8 – Assumption: There is a right balance

Let us assume that we are able to understand energetic absorption-irradiation balance of the planet Earth correctly. In this case we could have a real chance to calculate planetary radiant temperature of the Earth in Sun-Earth-Space system. This purely theoretical concept is true for the Earth from the point of view of astronomical physics.

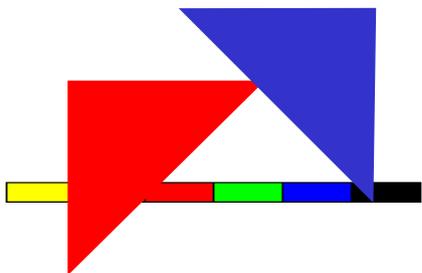
Besides, the geometrical factor 4 is also correct as energy is being irradiated by the whole terrestrial globe surface and this surface is four times larger than the disk-shaped area exposed to radiation of point source of light, i.e. the sun, whose energy it absorbs.

Not physically and for that reason false is the idea that the planet is a 'black body'. The planet consists of chemical substances and the real measurable temperature depends on diverse and varied chemical properties of these substances.

The notion of temperature-relevant nature of 'chemistry' is also supported by devotees of CO₂ warming theory, which means devotees of the greenhouse effect. According to this theory doubling of CO₂ content from 0,03 to 0,06 Vol-% would unleash a catastrophe. You have already heard the opinion of Mr. Schellnhuber on that matter.

Thus, the idea that chemical nature influences emission balance temperature is completely true and the 'black body' approach is therefore completely wrong.

It is obvious that diverse chemical properties of water and rocks result in different effect.



Not accountable because 100 % "In" and "Out" occur in different volume elements over and under the surface, especially in case of ocean water. (This is not a picture of the reality. It is schematically only.)

If we assume that the closer we are to the sun the more energy is available and the further we are to the sun the less energy is available then a triangular arrow diagram is more applicable as a homogenous arrow diagram. The same is also true in case of energy emission into space. It is obvious that this process is much intensive in close vicinity of the space than in the areas situated far from the space. Both triangles are therefore wide at the top and narrow at the bottom; they are, however, of the same size and a negative (minus) plus a positive (plus) is zero.

This more realistic balance diagram displays that there is no horizon - I mean a horizontal line - between the top and the bottom in air, water or ground where a local balance goes to zero. There can be no area whose temperature can be calculated by using the balance = zero model.

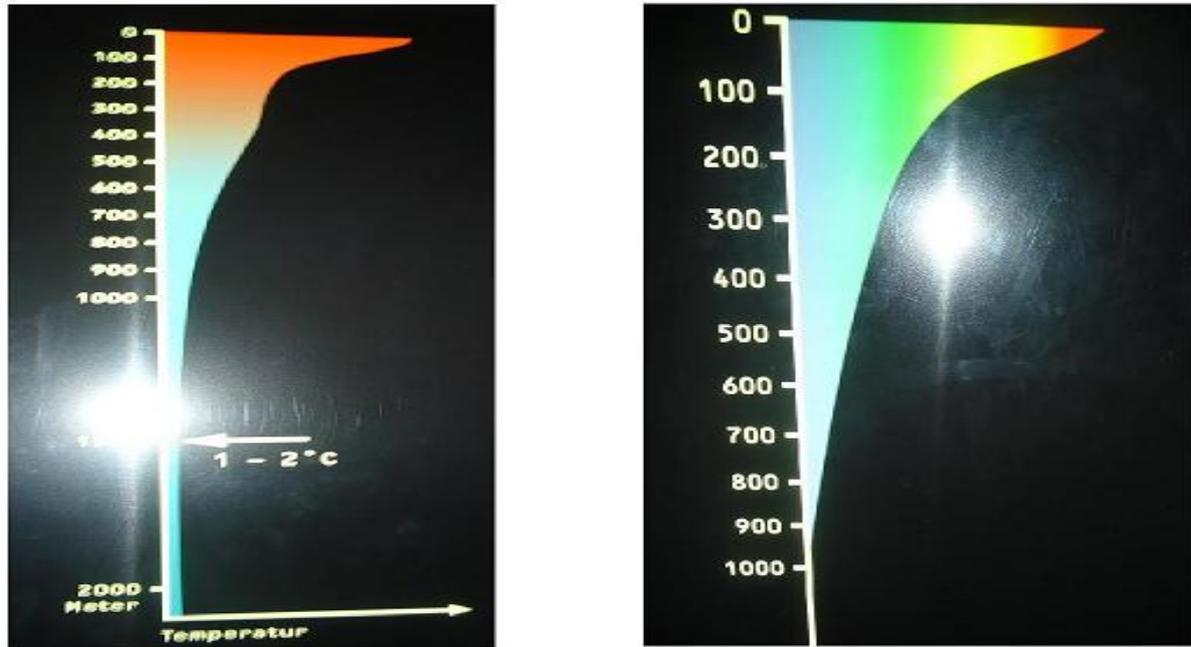
Particularly interesting is a part of sun energy triangle lying below earth surface. The next slide will show you that this energy intake through earth surface into earth substance and then to the ocean is just enormous.

Slide 9 – Water as no 'black body'

What you see on the right picture is the penetration depth of visible light into the ocean. I took this picture at deep-sea exhibition in Senckenberg Institute in Frankfurt/M. It is clear that penetration depth of the light depends on its spectral colour that

is prismatic colour. Penetration depth of the red is about 30 meters; according to Senckenberg Institute penetration depth of the most energy intensive blue light is about 1000 meters.

Water temperature displayed on the left part of the picture changes in correspondence with this penetration depth values, decreasing light flow results in lower temperatures. Temperature of deep-sea lever below the maximal penetration depth of the light is 1-2°C and remains unchanged. We will get back to this fact later.



Slide 10 – Correction factors of physical chemistry

The 'omitted chemistry' mistake of the '-18°C' equation can be corrected by means of physical chemistry.⁵ This can be done by adding two chemical factors to the '-18°C' equation.

So, physically and chemically correct equation of radiation balance temperature has to be like that:

$$T^4 = \alpha \times 0,7 \times 1371 / (\epsilon \times 4 \times 0,0000000567051)$$

⁵ We have already seen that influence of water, as a chemical component is so wide that the solar energy input does not stop on the surface but penetrates deep into substance of the Earth. With a few exceptions, this is true for any material surface, but this penetration is never as extreme as in case of the water.

In addition, the heat radiation is not emitted by the surface but comes from the inside of the substance.

However, solar energy penetration of is much deeper than emission height of heat radiation into space.

This results in time shift between energy absorption and energy emission, which varies depending on each particular substance. This means in turn that energy is stored by a substance permanently and thereby causes permanent temperature rise. Exact values are substance-related which means that theoretical understanding of radiation balance temperatures, which vary depending on each particular substance, is quite simple.

These two new factors are the absorption coefficient α 'Alpha' and the emission coefficient ϵ 'Epsilon'. They differ for each particular chemical substance with their numeric value lying between zero and one.

Due to these two new factors the equation may result in virtually any random low or high value of radiation balance temperature.

Slide 11 – Radiation and chemistry – Another four examples

I'd like to give you the following examples to be found in natural world just briefly:

- Green leaves transform solar energy into 'chemical energy', which is then stored in plant matter.
- Eye photoreceptors convert sun light into electric nerve impulses.
- 'Cold red light' produced by certain technical lamps does not warm the skin. Patients with dermal cancer receiving photodynamic therapy know it well.
- Gaseous oxygen is normally transformed into ozone under the influence of solar ultraviolet radiation high in the stratosphere. And ozone dissociation into oxygen warms the stratosphere.

Slide 12 - Conclusion

Knowledge of physical effects has to be founded on results of actual experiments but not on results of abstract calculations especially ones based on incorrect approaches. The greenhouse effect theory cannot be proved in this way.

The result of equation could be '+18°C' and not '-18°C'; this would mean the greenhouse gases cool the atmosphere and not warm it, that is if they are relevant for climate of course.

The result for a planet consisting only of water with water-relevant 'Alpha' and 'Epsilon' values would be about of +50°C. In this case earth surface would be cooled and not warmed by the atmosphere due to the greenhouse effect.

Slide 13 – Gravity as a temperature defining factor

We now are approaching to the most important issue: states of air, water and rocks, or more specifically 'thermodynamic states' or 'temperature states' of the substance in concrete terms.

- Let us imagine we fly from Frankfurt/M over the pole to Tokyo.
- Then we'll explore a deep cave leading deep underground to the centre of the Earth.
- And finally we'll make a deep-sea dive under the arctic ice beginning from Atlantic Ocean to Pacific Ocean and then to the North Pole.

If you are flying high enough it doesn't matter whether you are over the pole or over the equator; at a height of 10000 meters we have virtually constant ambient temperature of about -50°C.

If you descend deep underground to the centre of the Earth you will experience steadily rising temperature of about one °C per each 30 meters of depth. And if you were able to reach the interior of the earth you could witness extreme temperatures of many thousands °C existing there.

At the same time, deep-sea temperatures everywhere on the earth globe remain unchanged and make about 1- 2°C.

We moved around geographical positions where the temperatures obviously have nothing to do with the sun and the space. The temperatures dominating there are permanent; we may suppose they'll remain unchanged forever. So how do we explain these permanent temperature states where the zone of variable temperatures of weather and climate appears to be somehow embedded into them?

If these thermodynamic state values are influenced by energy cash flow of the sun and the space even slightly we have to ask how do these stable temperature states exist?

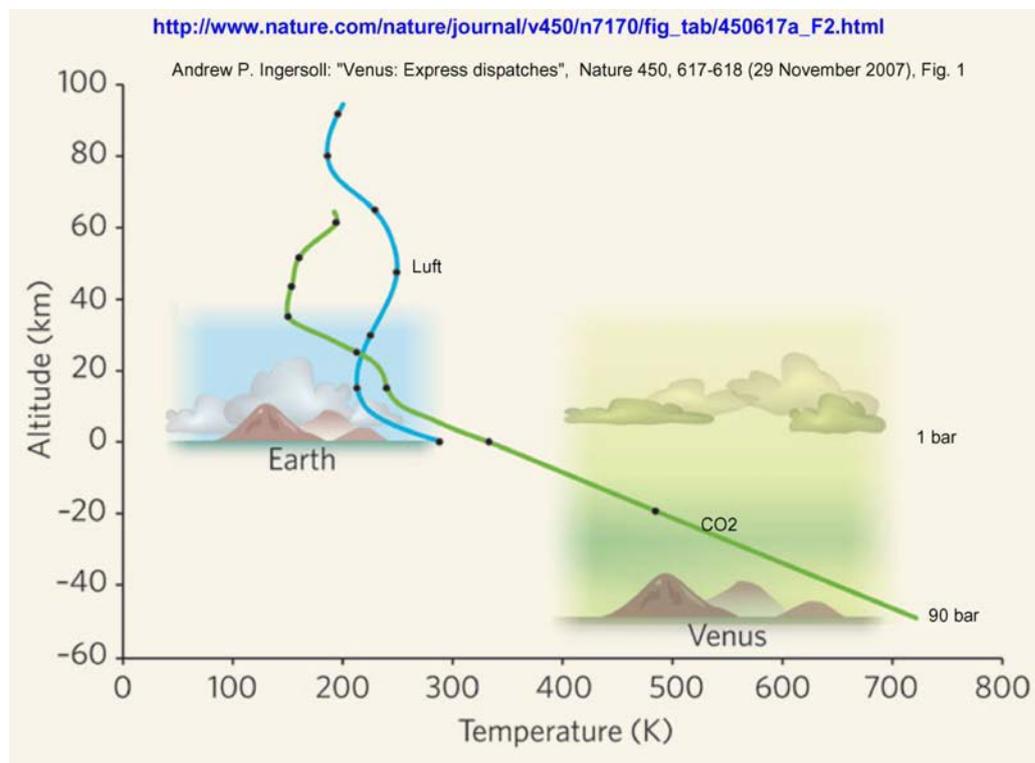
The answer is simple. Gravity is the 'energetic real estate' of the matter and temperature values are influenced by the gravity.

The gravity not only raises the pressure which impacts everything that lies beneath the more intensive the higher the mass is but also raises the temperature in parallel relation to pressure increase. This influence of the gravity on pressure and temperature is known long ago. I have already described this phenomenon in my high school book in physics.⁶

Omission of the immovable energetic real estate of the matter in a gravitational field is the irreparable fatal mistake of the '-18°C' equation. This mistake cannot be corrected even by introduction of chemical values 'Alpha' and 'Epsilon'.

Slide 14- The Earth and the Venus

Height profiles of atmospheres of the Earth and the Venus show us influence of the gravitation. This is a picture from an article published in 'NATURE' containing data received by space probe 'Venus Express' in 2007.



⁶ Professor (em) Dr. Horst Lüdecke is a physicist and the Press Spokesman of EIKE e.V. Jena. He defines the obvious influence of the gravity on temperature as 'non-sense' and admits its influence on pressure only.

Height, pressure and temperature ratio is linear at the ground level and similar both on Earth and on Venus.

This picture shows us that atmospheric pressure on Venus is 90 bar that is much higher than one on Earth, which is 1 bar. The gravitation line on Venus is therefore much longer than on the Earth. In both cases the linear gravitational effect reaches the surface. For this reason temperature of Earth ground is 15°C and temperature of Venus ground is more than 450°C.

The 100°C difference between these two gravitation lines is explained by the fact that distance of Venus to the sun is much shorter than one of Earth. Dissimilar solar influence results in 100°C difference. And dissimilar gravitational influence results in about 400°C difference.

Atmospheres of both planets at the ground level have no further peculiarities, for example no greenhouse effect.

However, atmospheres of both planets have some specific features in their higher layers, which are closer to the sun as the gases are chemically changed by solar ultraviolet light. I have already mentioned warming ozone change processes taking place in atmosphere of the Earth.

Slide 15 - „Understanding the reason why CO₂ cools and not warms“

Our next, the most significant step is to understand the reason why CO₂ cools and not warms. We will use the knowledge of physically and chemically correct ‘-18°C’ equation amended by introduction of ‘Alpha’ and ‘Epsilon’ values for this.

We have to find ‘Alpha’ and ‘Epsilon’ values of a substance that is optimal to be used for solar water heating installations. In narrow sense we are talking about a surface optimal for pipe installations, which, for example, can be found in Cyprus on every house, as there is much sun there, so it’s worth paying even without state funding.

This monograph published in the 90s will make the optimisation much easier for us. It consists of about 900 pages and deals with all aspects outlined in its title ‘Thermal Radiation Heat Transfer’, which is exactly the subject of the greenhouse effect. This term is not to be found in this monograph, though.

Slide 16 ‘Thermal Radiation Heat Transfer’

I would like to briefly revise the basics.

It’s important that ‘Alpha’ value is as high as possible, preferably one. This means optimal solar energy absorption. ‘Epsilon’ value has to be as low as possible, preferably zero. This means minimal heat loss by its emission into space.

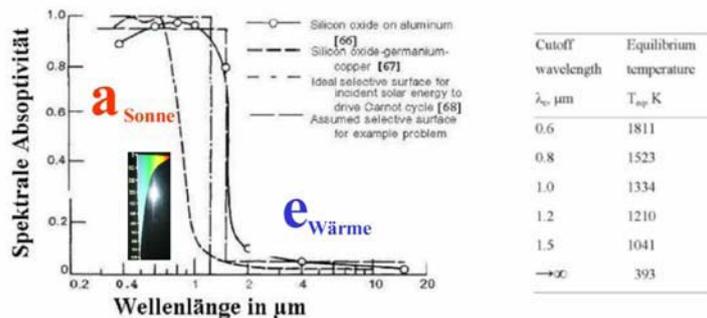
The optimum of the 90s is described on the next slide.

Slide 17 – Sun heating material

This diagram shows us how the ‘Alpha’ and ‘Epsilon’ values can be optimized for use of solar thermal energy. A NASA researcher was involved into the project by the way.

Solarwärmematerialien

Abbildung 3: Berechenbare Gleichgewichtstemperaturen von Oberflächen und spektrale Absorptivität / Emissivität je nach Lage der ‚Cutoff‘ Wellenlänge



„Figure 5-29“ und „Lösungen des „Example 5-1““ aus der Monographie von Robert Siegel und John R. Howell, Thermal Radiation Heat Transfer, New York, 2002

Don't be confused by these curves. They depict 'Alpha' values of sunlight spectral range, shown in this little window, that are close to 1 and 'Epsilon' values of thermal radiation spectral range that has to be as low as possible. It's all we need to know. We won't deal with spectroscopic data. The diagram on the right also spares us time for calculations by providing temperature values.

Slide 18 – Black body

This slide depicts a 'black body' with 'Alpha' and 'Epsilon' values both equal to one, that is optimal energy absorption but optimal energy output at the same time, which means cooling and therefore low temperatures.

Slide 19 – Temperature rise at low 'Epsilon' values

The next page shows us two examples of how the temperature can rise with decreasing 'Epsilon' value and unchanging high 'Alpha' value. In this case we deal with enormous temperature effects of 1000°C to 2000°C in contrast to '-18°C' of a 'black body'.

Slide 20 – Optimal 'Alpha' – „Epsilon“ jump – about 2000°C

This slide shows us the part of spectral range where high temperature rise is caused by 'Alpha'– 'Epsilon' jump. Spectral location of this optimum lies at about 0,6 μm (wavelength). Such a substance would have a radiation balance temperature of about 2000°C – instead of -18°C. Such a jump can be made by calculations only and not by today's technology yet.

Slide 21 – The best solar heating material 1990: SiO₂ - Al

Radiation balance temperature of the best solar heating material would be about 800°C as per calculations of 1990.

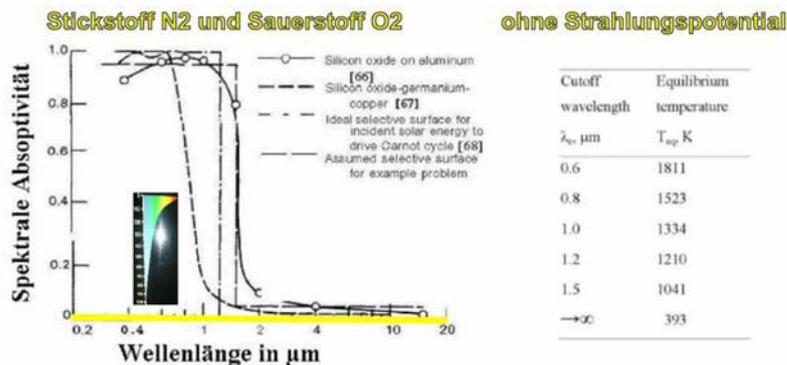
It is obvious that no material can have as high radiation balance temperature as this theoretically calculated one. Water flowing through the pipes made of such material would transmit the solar thermal energy absorbed. Even if a pipe just hangs in the air its hot surface would transmit its thermal energy to the air and heat it.

Slide 22 – The main atmosphere elements N₂ and O₂

This slide shows us 'Alpha' and 'Epsilon' values of nitrogen and oxygen that are main elements contained by the atmosphere. What we have here are 'Alpha' and 'Epsilon' values virtually equal to zero. The most significant is the fact that 'Epsilon' value is vir-

tually equal to zero and irradiates virtually no energy to the space trough heat emission.

Abbildung 3: Berechenbare Gleichgewichtstemperaturen von Oberflächen und spektrale Absorptivität / Emissivität je nach Lage der ‚Cutoff‘ Wellenlänge

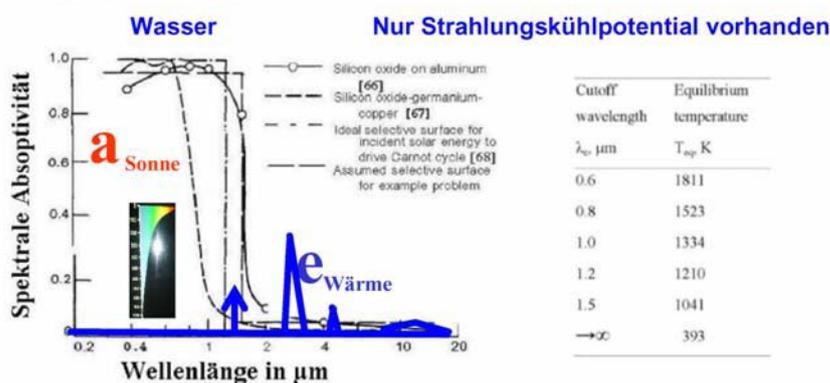


„Figure 5-29“ und Lösungen des „Example 5-1“ aus der Monographie von Robert Siegel und John R. Howell, Thermal Radiation Heat Transfer, New York, 2002

However, the air absorbs heat by directly contacting to earth surface. The fact that it cannot be cooled trough the contact of its main mass to the space by irradiation makes it an ideal warming coat that surrounds the Earth.

The next two slides will show you why water and CO₂ have such a great ability to cool the atmosphere.

Abbildung 3: Berechenbare Gleichgewichtstemperaturen von Oberflächen und spektrale Absorptivität / Emissivität je nach Lage der ‚Cutoff‘ Wellenlänge



„Figure 5-29“ und Lösungen des „Example 5-1“ aus der Monographie von Robert Siegel und John R. Howell, Thermal Radiation Heat Transfer, New York, 2002

Slide 23 – Water – Its emission dynamics that can result only in cooling ,Alpha‘ and ,Epsilon‘ values of water are marked by deep blue colour.

‘Epsilon‘ value of the water differs from ones of nitrogen and oxygen and is definitely not equal to zero. Thus, in case of condensation heat transfer at formation of cloud droplets or crystallization heat transfer at formation of snow clouds the energy is emitted directly into space.

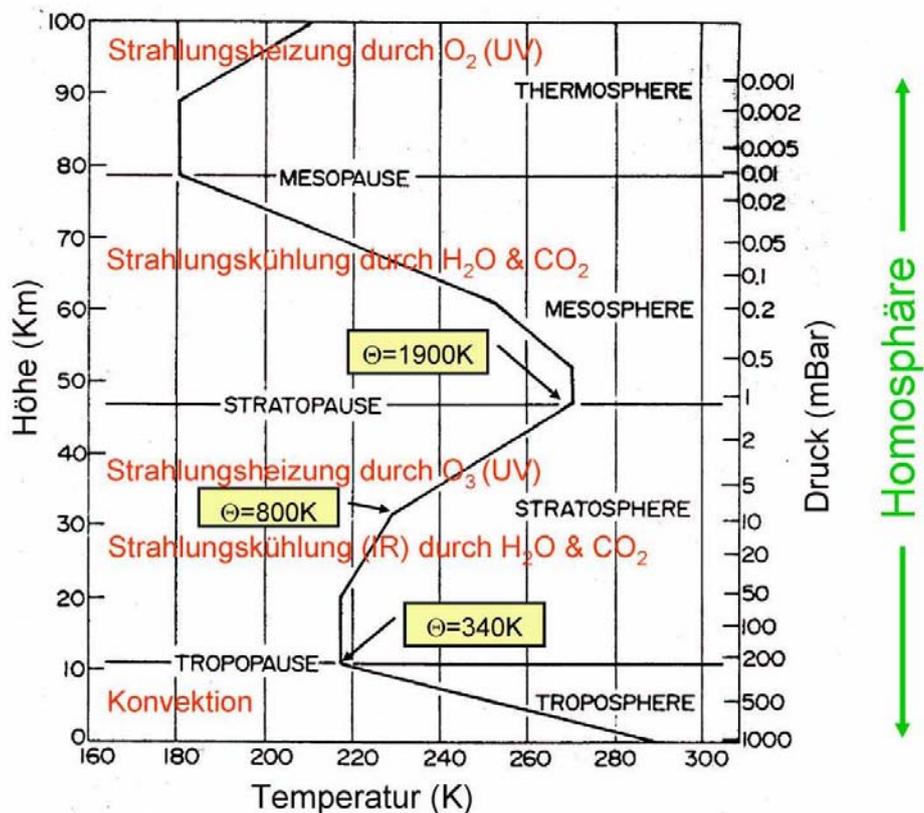
Slide 24 - CO₂

And finally, we need only to examine CO₂. Its 'Alpha' and 'Epsilon' values are marked by light blue colour. Its 'Epsilon' value is even lower than one of the water but differs from zero explicitly. Energy emission of each particular CO₂ molecule into space is lower than one of a water molecule; however this cooling effect is much higher than cooling ability of the main atmosphere elements, which is virtually equal to zero.

By this presentation I tried to prove you that the trace gases cool the atmosphere and do not warm it.

Slide 25 – Radiative cooling of H₂O und CO₂ – Heidelberg University

The last slide will show you that this radiative cooling of water and CO₂ molecules is well known to university atmosphere studies. This is the slide containing data received by Institute of Environmental Physics of Heidelberg University I found in the Internet.



You can clearly see two inscriptions saying: 'Radiative cooling by H₂O und CO₂' on this diagram describing atmosphere height profiles. I hope you will be convinced by results of Heidelberg University studies if not by my presentation.

In any case, I thank you very much for your attention and look forward to the discussion with you. And before I stop talking, I'd like to thank Professor Hopp for his support at writing of this book⁷ and arranging of this event. I'm also very thankful to my co-authors Dr. Thüne and Dr. Wagner as well as to about 20 members of Interdisciplinary Working Group of Environmental Science Study, Darmstadt – Frankfurt, and, last but not least, to Deutsche Bank for the opportunity to speak here today.

⁷ ISBN 978-3-18-325515-3 (VDI Verlag GmbH, Düsseldorf, Germany, 2011)

Fortschritt-Berichte VDI

VDI

Reihe 15

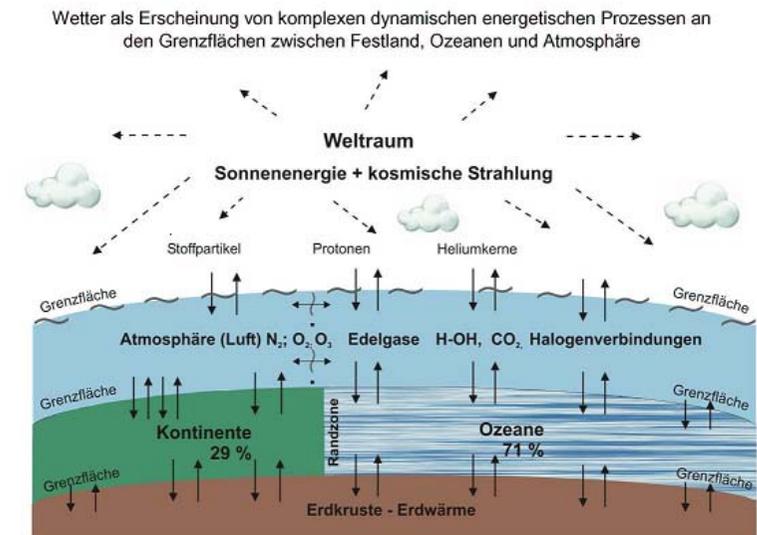
Umwelttechnik

Prof. Dr.-Ing. Vollrath Hopp,
Dreieich

Nr. 255

Atmosphäre, Wasser, Sonne, Kohlenstoff- dioxid, Wetter, Klima - einige Grundbegriffe

Atmosphäre, Wasser, Sonne, Kohlenstoffdioxid, Wetter, Klima – einige Grundbegriffe



von
Prof. Dr.-Ing. Vollrath Hopp, Chemiker
Dr. Gerhard Stehlik, Physikochemiker
Dr. Wolfgang Thüne, Meteorologe
Dr.-Ing. Edmund Wagner, Ingenieur

Herausgeber:
Verein Deutscher Ingenieure, Bezirksverein Frankfurt-Darmstadt
Fachgruppe Umwelt, Obmann Prof. Dr.-Ing. Vollrath Hopp

August 2010