

# Global Climate Model with Three Entities

August 2021

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## References

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- (5) Gröberg, Erk, Grigul: Grundgesetze der Wärmeübertragung, Springer 1955.
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## Introduction

As consequence of use of fossil fuels and biomass concentration of CO<sub>2</sub> in the atmosphere has increased. In 1988 meteorologists' global cooperation organization WMO founded Intergovernmental Panel on Climate Change (IPCC) which claims that removal of CO<sub>2</sub> from the atmosphere “*would plunge the Earth into a frozen state*” (page 667 of reference (3)) and that increase of CO<sub>2</sub> of the atmosphere from 300 ppm to 600 ppm would increase global surface temperature, depending on “cloud feedback” by 2 ... 5 °C (hence forward Dogma) (1)(2)(3) (4).

Both claims are all wrong. *Cloud feedback* is a logical error because in cloud feedbacks using climate models influence of CO<sub>2</sub> on global surface temperature is not determined by CO<sub>2</sub> but by cloud feedbacks. Presently clouds reflect about 50 % of solar radiation back to the space, about 1 % absorbs into the atmosphere and the rest comes on the surface of the ground. In a “*frozen state of the earth*” there would not be clouds whereupon solar radiation on the ground would increase from the present about 170 W/m<sup>2</sup> to about 340 W/m<sup>2</sup> whereupon *the Earth cannot plunge into a frozen state*. Dogma is based on positive cloud feedbacks, which mean that clouds amplify changes of global surface temperature. If this were true, all changes of global surface temperature would continue endlessly whereupon global climate would fluctuate endlessly between frozen and disastrously hot states.

Scientific consensus prevails that 1) there is no empirical evidence on existence of cloud feedbacks 2) even sign of cloud feedbacks, not to mention absolute value is not known, 3) conservation laws

of physics categorically exclude existence of cloud feedbacks. Each of items 1) ... 3) states axiomatically that Dogma is wrong.

Dogma has caused worldwide enormous damage among others by

1. causing demolishing of energy technically necessary fossil power plants which increase photosynthesis of the ecosystem and replacing them by hundreds of billions of euros energy technically invalid and ecologically useless wind turbines and solar panels
2. distorting by legislation and political guidance competition between energies and technologies
3. guiding R&D to economically and ecologically invalid projects
4. distorting liberty of scientific research by funding which is reserved only for the Dogma supporting research
5. emissions trade which can be parallelized with indulgence trade and by gigantic “carbon footprint” business which has no influence on climate
6. causing worldwide angst of misled ignorant children and young people like Greta Thunberg
7. by having caused by decades worldwide totalitarian propaganda that opposing Dogma would be a political suicide for democratically selected politicians and heads of states.
8. aiming at minimizing amount of carbon in the cycle of nature and thus minimizing sustainable production of food and renewable energy.

In this paper the first thermodynamically correct global climate model has been presented and applied to study Dogma.

## Summary

All quantities of global climate are determined by the surroundings of the atmosphere whereupon CO<sub>2</sub>-concentration of the atmosphere, global surface temperature and clouds of global climate do not change each other whereupon Dogma is per se wrong. However, CO<sub>2</sub>-concentration of the atmosphere and global surface temperature have univocal correlation which depends on the change of the surrounding of the atmosphere. During the past 150 years mankind has changed the surroundings of the atmosphere among others by replacing forests by fields and constructed areas. Influence of these changes on climate is much stronger than use of fossil fuels. To investigate Dogma the authors studied global climate in surrounding of the atmosphere where CO<sub>2</sub>-concentration of the atmosphere were 000 ppm, 200 ppm, 400 ppm, 600 ppm assuming that the surroundings were otherwise similar knowing that this assumption is all wrong. The calculated changes of all quantities of global climate are so small that they could not be detected empirically. This result can be made popularly understandable as follows.

Solar radiation is the only significant primary energy flow to the surface of the ground, thermal radiation to the ground – the greenhouse effect – is a consequence of solar radiation to the ground. In all surroundings of the atmosphere clouds control solar radiation to the ground and so the greenhouse effect by reflecting solar radiation back to the space. If clouds would not do that, instead of present 170 W/m<sup>2</sup> solar radiation to the ground would be 340 W/m<sup>2</sup> whereupon present life would not exist. If clouds would reflect all solar radiation global surface temperature would be so small that present life would not exist. So, clouds control sovereignly global surface temperature. Due to thermodynamical properties of water increase of global surface temperature strongly increases global clouds and the opposite whereupon strong inverse correlation prevails between global surface temperature and global clouds.

Due to water vapor, spectral linear emission coefficients in the lowest 1 km of the atmosphere are so large that changes of “greenhouse gas” concentrations change only insignificantly thermal radiation to the ground. Clouds strongly dampen influence of these insignificant changes on global surface temperature whereupon influence of changes of greenhouse gas concentrations on global surface temperature are so small that they could not be detected empirically.

In this study compounds, temperatures, velocities, droplet diameters, volume fractions, number densities, mass fluxes, number fluxes of gas, particles and droplets of global climate were calculated by applying the balance axiom and thermodynamics. Most part of thermodynamic parameters were found from published literature. However, there is no empirical data on particle and droplet densities ( $m^{-3}$ ) of global climate whereupon the parameters of correlations of sources of droplet and particle balance equations ( $m^{-3}s^{-1}$ ) were determined indirectly by matching calculated annual rain on the surface of the ground with the measured one at CO<sub>2</sub> concentration 400 ppm.

All calculated quantities of gas, droplets, and particles of global climate at 400 ppm match the experimental data and calculations respond logically to changes of CO<sub>2</sub> concentration. This is undisputable proof that physical and mathematical foundations of the climate model of this study are correct. This study proves that correlation between CO<sub>2</sub> of the atmosphere and all quantities of global climate is so small that they could not be detected empirically.

## Errors of IPCC's climate models

1. In IPCC's climate models “*Subtle changes in cloud properties that accompany anthropogenic warming — cloud feedbacks — can strongly amplify or dampen that warming*” (1). Cloud feedback is a retroactive influence of clouds on global surface temperature. Conservation laws of physics state that only present quantities exist so cloud feedbacks do not exist whereupon Dogma is all wrong. Although cloud feedbacks would exist, Dogma were wrong because even sign, not to mention absolute value, of cloud feedbacks is not known.
2. Thermodynamics states that global surface temperature is determined by energy balance of the surface of the globe. Calculation of global surface temperature by cloud feedbacks is a blatant thermodynamic error which would lead to wrong temperatures even though cloud feedbacks would exist, not to mention that they do not exist.
3. In IPCC's climate models - via positive cloud feedbacks – changes of global surface temperature amplify themselves (3). If this were true every differential change of global surface temperature would continue endlessly. So, positive cloud feedback is both physical and logical error. Dogma is based on cloud feedbacks +0.007...+0.017 °C/ppmCO<sub>2</sub> whereupon Dogma is all wrong. IPCC knows that even sign of cloud feedback is not known, so IPCC tendentiously misleads the world.
4. Even if cloud feedback would exist, it would be a logical error. Firstly, cloud feedback causes that influence of CO<sub>2</sub> on global surface temperature is not determined by CO<sub>2</sub> but by cloud feedback. Secondly, correct cloud feedback could be calculated only when correct global climate is known whereupon cloud feedback would not be needed.

5. In IPCC's climate models CO<sub>2</sub> concentration, global surface temperature and clouds change each other. All quantities of climate are functions of quantities of the surrounding of the atmosphere only – the waterbody, the vegetation, the earth, the atmosphere surrounding universe - whereupon CO<sub>2</sub> concentration, global surface temperature and clouds are not arguments of each other.
6. Necessary condition for correct modeling of quantities of gas, droplet, and particle entities of global climate is that model contains balance equations of the mentioned quantities (equations (1.1) ... (3.5)). Because the mentioned equations are missing from IPCC's climate models, they are per se invalid for calculation global climate.
7. IPCC's climate models are weather models, which can forecast state of the atmosphere for 3 days at most and even for that period only roughly. Calculation of climate demands that state of the atmosphere could be forecasted accurately for infinite time periods, which is not and will never be possible.

### Physical foundations of the model

Climate is defined as longtime average state of the atmosphere in steady state surroundings of the atmosphere. So, quantities of gas, droplets and particles of global climate must be calculated by steady state balance equations of the atmosphere which form a group of steady state differential equations of the earth centered radius. These equations were solved numerically by subdividing the atmosphere into spherical balance volumes, balance equations of global climate were written for numbers, compounds, momentum and energy of gas, droplets, and particles (Entities) of the balance volumes and boundaries of the balance volumes and the Entities. Flows of the balance volumes and the boundaries were calculated by thermodynamic transfer equations. So derived SRclimate model is mathematically a group of algebraic equations. Arguments of the equations are quantities of the Entities of the balance volumes, their boundaries, and the surroundings of the atmosphere. When quantities of the surroundings of the atmosphere are known, SRclimate model determines uniquely all quantities of climate.

### Compound Balances of Entities of global climate

Momentary global balance of compound  $c$  of entity  $p$  of the atmosphere is.

$$\frac{\partial n_{pc}}{\partial t} = -\frac{\partial}{\partial r} (r^2 \dot{N}_{rcp}'') + \sum_{e=1}^{N_p} \dot{N}_{cep}''' + \sum_{r=1}^{N_r} v_{cr} \dot{R}_{rp}''' \quad (1.0)$$

$$c = 1 \cdots N_c, p = 1 \cdots N_e,$$

When equations (1.0) are integrated over infinite time the time derivatives vanish and the equations (1.0) simplify to equations (1.1) where all quantities are time mean averages of infinite time.

$$0 = -\frac{\partial}{\partial r} (r^2 \dot{N}_{rcp}'') + \sum_{e=1}^{N_p} \dot{N}_{cep}''' + \sum_{r=1}^{N_r} v_{cr} \dot{R}_{rp}''' \quad (1.1)$$

$$c = 1 \cdots N_c, p = 1 \cdots N_e,$$

Without significant error it can be assumed that reaction terms of compound balances (1.1) are negligible, that the only significant compound flow between entities is flow of water between entity gas and droplet entities. By neglecting convective mixing of droplets compound balance of compound  $w$  of droplet entity  $d$  is

$$0 = -\frac{\partial}{r^2 \partial r} (r^2 \varepsilon_d n_{wd} v_{rd}) + \dot{N}_{wgd}''' \quad (1.2)$$

Accounting that  $\varepsilon_d = n_d \pi d_d^3 / 6$  equation (1.2) can be written as

$$0 = -\frac{\partial}{r^2 \partial r} (r^2 n_d \pi d_d^3 / 6 n_{wd} v_{rd}) + \dot{N}_{wgd}''' \quad (1.3)$$

$n_d$  = droplet density (m-3)

$n_{cw}$  = density of liquid water (m-3)

$d_d$  = diameter of droplet (m)

$v_{rd}$  = vertical velocity of droplet

Mole flow of compound  $w$  from entity  $g$  to entity  $d$  per surface of the ground ( $mole^{+1} s^{-1} m^{-2}$ ) is

$$\dot{N}_{wgd}'' = A_{gd}'' \frac{\kappa_{gb}}{1 + H_{wgd} \kappa_{gb} / \kappa_{bd}} (n_{wg} - n_{wd} H_{wgd}) \quad (1.4)$$

$A_{gd}''$  = surface between entity  $g$  and  $d$  per surface of the ground

$n_{wg}$  = mole density of compound  $w$  of entity  $g$  ( $mole^{+1} m^{-3}$ )

$n_{wd}$  = mole density of compound  $w$  of entity  $d$  ( $mole^{+1} m^{-3}$ )

$\kappa_{db} = \kappa_{bd}$  = compound transfer coefficient from entity  $d$  to boundary  $b$  ( $m^{+1} s^{-1}$ )

$\kappa_{gb} = \kappa_{bg}$  = compound transfer coefficient from entity  $g$  to boundary  $b$  ( $m^{+1} s^{-1}$ )

$H_{wgd} = n_{wgb} / n_{wdb}$  = Henry coefficient of water on boundary between entities  $g$  and  $d$

$\kappa_{gb} = Sh_{gb} D_d / d_d$  = compound transfer coefficient from entity  $g$  to boundary  $b = \kappa_{bg}$

$Sh_{gb}$  = Sherwood number of entity  $g$  of boundary  $b$

$$Sh_{gb} = 2 + 0.6 Re_{gb}^{0.5} Sc_g^{0.333} \quad (5)$$

$\kappa_{db} = Sh_{db} D_d / d_d$  = compound transfer coefficient from entity  $d$  to boundary  $b = \kappa_{bd}$

$Sh_{db}$  = Sherwood number of entity  $d$  of boundary  $b$

$H_{wgd} = 1.98 \cdot 10^5 e^{-5112/T_b/T_b}$  = mole density of water in gas entity  $g$  / mole density of water in droplet entity  $d$  on boundary between the entities.

Boundary condition of equation (1.4) is  $d_d(H_{max}) = n_d(H_{max}) = 0$ .

Number balance equations of global climate

Number balance of particles of discrete entity  $p$  is

$$0 = -\frac{d}{r^2 dr} [r^2 \dot{N}_p''] + \dot{N}_p''' \quad (1.5)$$

$\dot{N}_p''$  = number flux of particles  $p$  ( $m^{-2} s^{-1}$ )

$\dot{N}_p'''$  = source of particles  $p$  ( $m^{-3} s^{-1}$ )

Because all droplet nucleuses can be assumed to be equal only one droplet entity  $d$  is needed whereupon number density equation of droplets is

$$0 = -\frac{d}{r^2 dr} [r^2 v_d n_d] + \dot{N}_d''' \quad (1.6)$$

$\dot{N}_d''' =$  droplet source ( $m^{-3}s^{-1}$ )

It is justified to assume that  $\dot{N}_d'''$  is proportional to product of vapor pressure of water and number density of droplet creating particles, whereupon

$\dot{N}_d''' = c_d p_{wg} n_p =$  rate of droplet nucleation per volume ( $m^{-3}s^{-1}$ )

$c_d =$ coefficient ( $m^{-3}s^{-1}$ )

$p_{wg} =$  absolute value of pressure of water vapor in gas entity ( $Pa$ )

$n_p =$  number density of droplet forming particles ( $m^{-3}$ )

Boundary condition of the first order differential equation (1.6) is that on upper boundary of the atmosphere  $n_d = 0$ .

Because atmospheric particles are very small, their terminal velocities are small in comparison with convective mixing whereupon

$$0 = -\frac{d}{r^2 dr} \left[ r^2 D_p \frac{\partial n_p}{\partial r} \right] + \dot{N}_p''' \quad (1.7)$$

$D_p =$ convective diffusion coefficient particles ( $m^2s^{-1}$ ). Without significant error can be assumed that velocities of the atmospheric particles are same as gas velocity, whereupon  $D_p = D_g$ .

Because always when a droplet is created one particle vanishes whereupon

$$\dot{N}_p''' = -\dot{N}_d''' = -c_{pd} p_{wg} n_p \quad (1.8)$$

On the surface of the ground boundary condition of the second order differential equation (1.7) is a known particle flow density  $N_{pg}''$  ( $m^{-2}s^{-1}$ ) and on the upper boundary  $n_p = 0$ .

Momentum balances of global climate

In the atmosphere molecular diffusion of momentum is negligible whereupon vertical global momentum balance of entity p is

$$\frac{\partial \varepsilon_p \rho_p v_{rp}}{\partial t} = -\frac{\partial r^2 (\varepsilon_p \rho_p v_{rp} v_{rp})}{r^2 \partial r} - \varepsilon_p \frac{\partial p}{\partial r} + \sum_{e=1}^{N_e} M_{ep}''' (v_{re} - v_{rp}) + \varepsilon_p \rho_p g_r \quad (2.0)$$

When equations (2.0) are integrated over infinite time the time derivatives vanish and the equations (2.0) simplify to equations (2.1) where all quantities are time mean averages of infinite time.

$$0 = -\frac{\partial r^2 (\varepsilon_p \rho_p v_{rp} v_{rp})}{r^2 \partial r} - \varepsilon_p \frac{\partial p}{\partial r} + \sum_{e=1}^{N_e} M_{ep}''' (v_{re} - v_{rp}) + \varepsilon_p \rho_p g_r \quad (2.1)$$

The only significant momentum flows of droplets are momentum flow from gas entity and from the globe (gravity). When in addition  $v_{rg} = 0$  equation (2.1) simplifies to

$$v_{rd} = \varepsilon_d \rho_d g_r / M_{gd}'''.$$

$M_{gd}'''$  = momentum transfer coefficient between entities g and d ( $\text{kg}^+1\text{m}^{-3}\text{s}^{-2}$ )

$\varepsilon_d$  = volume fraction of entity d

$\rho_d$  = mass density of entity d ( $\text{kg}^+1\text{m}^{-3}$ )

$g_r$  = acceleration of gravity in direction of radius ( $\text{m}^+1\text{s}^{-2}$ )

In range  $0.4 < R_{ed} < 500$

$$v_{rd} = - \left[ 1.7(\rho_d - \rho_g)^2 / \rho_g / \mu_g \right]^{1/3} d_d \quad (6) \quad (2.2)$$

Energy balances of global climate

In the atmosphere vertical time mean convection velocity is 0 and molecular diffusion is negligible whereupon the only significant transport mechanism of compounds is convective mixing whereupon  $\dot{N}_{ce}'' = -D_e \partial n_{ce} / \partial r$  whereupon global energy balance of entity  $e$  of climate is

$$0 = - \frac{\partial}{r^2 \partial r} \left[ r^2 \left( E_{re}'' - \sum_{c=1}^{N_c} D_e \frac{\partial n_{ce}}{\partial r} H_{mec}(T_e) \right) \right] + \sum_{c=1}^{N_c} \sum_{f=1}^{N_e} \dot{N}_{cfe}''' H_{mf}(T_{bfe}) \quad (3.1)$$

$D_e$  = convective mixing coefficient of entity  $e$  ( $\text{m}^2\text{s}^{-1}$ )

$N_e$  = number of entities

$N_c$  = number of compounds

$E_{re}''$  = net vertical irradiation of entity  $e$  ( $\text{W}^+1\text{m}^{-2}$ )

$\dot{N}_{ce}''$  = vertical mole flux of compound  $c$  of entity  $e$

$\dot{N}_{cfe}'''$  = mole flow of compound  $c$  from entity  $f$  to entity  $e$  ( $\text{mole}^+1\text{s}^{-1}\text{m}^{-3}$ )

$H_{mce}(T_e)$  = molar enthalpy of compound of entity  $e$  ( $\text{J}^+1\text{mole}^{-1}$ )

$T_e$  = temperature of entity  $e$  ( $^\circ\text{K}$ )

$T_{bfe}$  = temperature of boundary between entity  $f$  and  $e$  ( $^\circ\text{K}$ )

By summing equations (3.1) over all entities and by assuming that temperature differences between entities are negligible

$$0 = - \frac{\partial}{r^2 \partial r} \left[ r^2 \left( E_r'' - \sum_{e=1}^{N_e} \sum_{c=1}^{N_c} D_e \frac{\partial n_{ce}}{\partial r} H_{mce}(T) \right) \right] + \sum_{c=1}^{N_c} \sum_{e=1}^{N_e} \sum_{f=1}^{N_e} \dot{N}_{cfe}''' H_{mcf}(T_{bfe}) \quad (3.2)$$

Accounting that  $\dot{N}_{cfe}''' = -\dot{N}_{cef}'''$  and  $\dot{N}_{cee}''' = 0$ ,

$$\sum_{c=1}^{N_c} \sum_{e=1}^{N_e} \sum_{f=1}^{N_e} \dot{N}_{cfe}''' H_{mcf}(T_{bfe}) = \sum_{c=1}^{N_c} \sum_{f=1}^{N_e} \dot{N}_{cfe}''' L_{mcf}(T_{bfe})$$

$E_r''$  = net vertical irradiation ( $\text{W}^+1\text{m}^{-2}$ ). Physical and mathematical theory of calculation of radiative transfer of global climate has been presented in reference (4)

$H_{mec}(T)$  = molar enthalpy of compound  $c$  of entity  $e$  at temperature  $T$  ( $\text{J}^+1\text{mole}^{-1}$ )

$N_e$  = number of compounds

$N_e$  = number of entities

$\dot{N}_{cfe}''' =$  flow of compound  $c$  from entity  $f$  to entity  $e$  ( $mole^{+1}s^{-1}m^{-3}$ )

$L_{mcf}(T_{bfe}) = H_{mcf}(T_{bfe}) - H_{mce}(T_{bfe})$  latent enthalpy of compounds  $c$  of entities  $f$  and  $e$  at temperature of boundary between entities  $f$  and  $e$ .

It is not possible to determine convective mixing coefficients  $D_e$  by direct measurements whereupon they were determined by matching calculated temperatures of the atmosphere with the measured temperatures at CO<sub>2</sub> concentration 400 ppm.

Boundary condition of equation (3.2) on the surface of the ground

Global surface temperature  $T_b$  is determined by energy balance of the surface of the ground

$$h_{eb}(T_e - T_b) + E_{eb} - M_{eb} + \sum_{c=1}^{N_c} \dot{N}_{ceb}'' (H_{mce}(T_b) - H_{mca}(T_b)) + h_{ab}(T_a - T_b) + (E_{abt} + (1 - \rho_{abs})E_s) - M_{ba} = 0. \quad (3.3)$$

$h_{eb}$  = conductance from the earth to the boundary  $b$  ( $W^{+1}m^{-2}^{\circ}C^{-1}$ )

$T_e$  = temperature of the earth

$T_b$  = temperature of the boundary  $b$

$E_{eb}$  = thermal irradiation from the earth to the boundary of ground ( $W^{+1}m^{-2}$ )

$M_{eb}$  = thermal exitance from the boundary  $b$  to the earth ( $W^{+1}m^{-2}$ )

$\dot{N}_{ceb}'' =$  mole flux of compound  $c$  from the earth to the boundary =  $-\dot{N}_{cba}''$  ( $mole^{+1}m^{-2}s^{-1}$ )

$H_{mce}(T_b) =$  molar enthalpy of compound  $c$  of entity  $e$  at temperature  $T_b$  ( $J^{+1}mole^{-1}$ )

$H_{mca}(T_b) =$  molar enthalpy of compound  $c$  of entity  $a$  at temperature  $T_b$  ( $J^{+1}mole^{-1}$ )

$h_{ab}$  = conductance from the boundary to the atmosphere ( $W^{+1}m^{-2}^{\circ}C^{-1}$ )

$T_a$  = temperature of the atmosphere

$E_{abt}$  = thermal irradiation from the atmosphere to the boundary of ground ( $W^{+1}m^{-2}$ )

$\rho_{bas}$  = reflection ratio of solar radiation boundary of the earth to the atmosphere

$E_{abs}$  = solar irradiation to the boundary of ground ( $W^{+1}m^{-2}$ )

$M_{ba} = \varepsilon_{ab}\sigma T_b^4 + (1 - \varepsilon_{ab})(E_{abt} + (1 - \rho_{abs})E_s)$  = exitance from the boundary of the earth to the atmosphere.

Boundary condition of equation (3.2) on upper surface of the atmosphere

The upper boundary of the atmosphere was assumed a surface at temperature 217.6 °K whose emission coefficient of thermal radiation is 0 which corresponds physically to assumption that thermal radiation from the atmosphere surrounding universe is 0. Net convective energy transfer through the surface was assumed to be 0 and solar radiation to the surface was assumed to be 340 W/m<sup>2</sup>.



Calculation of droplet temperatures

Calculation of condensing by equation (1.4) demands that surface temperatures of droplets are known. Energy balance of boundary  $b$  is

$$h_{ab}(T_g - T_b) + \dot{N}_{wab}'' [H_{mwa}(T_b) - H_{mwd}(T_b)] + E_{ab} - M_{ab} + h_{db}(T_d - T_b) + E_{db} - M_{db} = 0 \quad (3.4)$$

$E_{ab}$  = irradiation from the atmosphere to droplet boundary =  $E_{abt} + E_{abs}$

$E_{abt}$  = thermal irradiation from the atmosphere to droplet boundary

$E_{abs}$  = solar irradiation from the atmosphere to droplet boundary

$E_{db}$  = irradiation from droplet to the droplet boundary

Steady state energy balance of droplet states that

$$\frac{d \sum_{c=1}^{N_c} N_{cd} U_{mcd}}{dt} = \sum_{c=1}^{N_c} \dot{N}_{cba} H_{mcd} + E_{db} - M_{db} + h_{db}(T_d - T_b) = 0$$

Steady state compound balance of droplet states that

$$\frac{dN_{cd}}{dt} = \dot{N}_{cbd} = 0$$

By combining these equations, we get

$E_{db} - M_{db} + h_{db}(T_d - T_b) = 0$ , whereupon energy balance of droplet boundary converts to

$$h_{ab}(T_a - T_b) + \dot{N}_{wgb}'' L_{mwg}(T_b) + E_{ab} - M_{ab} = 0$$

$E_{ab} - M_{ab} = \alpha_{adt} E_{ab} - \varepsilon_{adt} M_{ab}$  = radiative energy flow to the droplet. Without significant error can be assumed that  $E_{ab} = M_{ab} = M_{mb}$ . By accounting that  $\dot{N}_{wab}'' + \dot{N}_{wdb}'' = 0$ ,

energy balance of droplet boundary  $b$  simplifies to

$$h_{gb}(T_g - T_b) + \dot{N}_{wgb}'' L_{mwg}(T_b) - (\varepsilon_{gb} - \alpha_{gb}) M_{mb} = 0 \quad (3.5)$$

$h_{gb} = Nu_{gd} \lambda_{gb} / d_d$ ,  $Nu_{gd}$  = Nusselt number from entity  $g$  to boundary  $b$  of droplet entity  $d$

$$Nu_{gb} = 2 + 0.6 Re_g^{0.5} Pr_g^{0.333} \quad (5)$$

$T_g$  = temperature of gas,  $T_b$  = temperature of droplet boundary

Equations (1.1) ... (3.5) with their boundary conditions form a mathematically closed system of equations whose solution determines all quantities of global climate when surrounding of the atmosphere is known.

Results

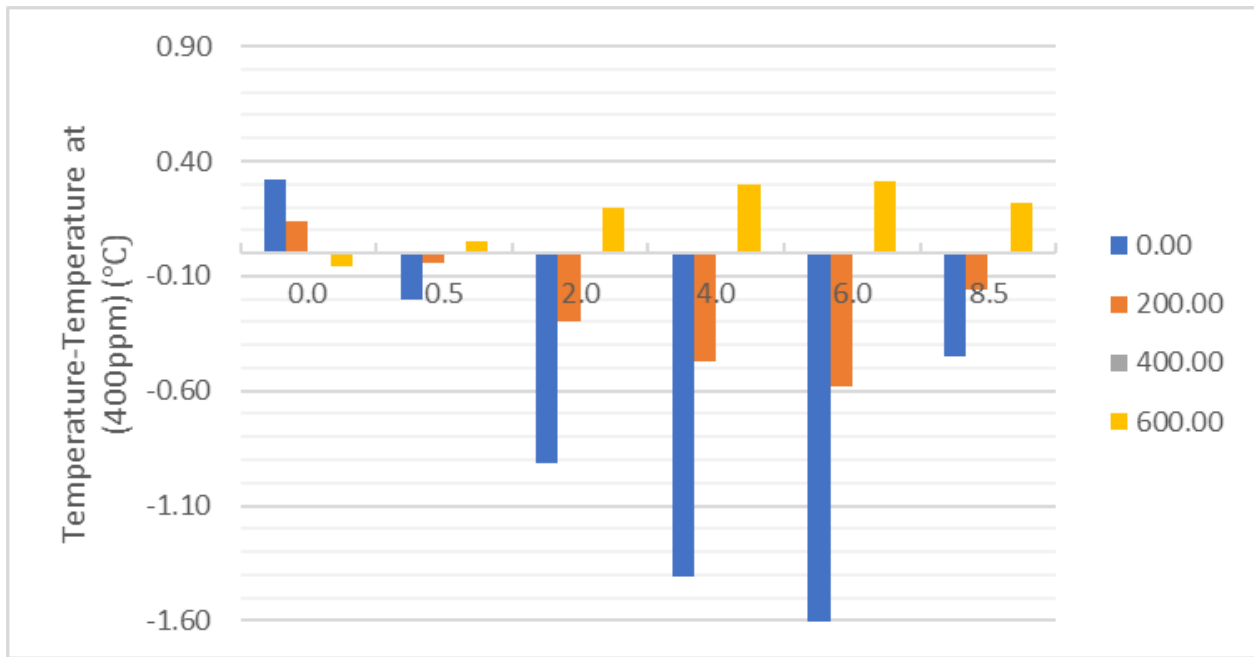


Figure 1. Temperatures at CO<sub>2</sub> concentrations 000 ppm, 200 ppm, 400 ppm, 600 ppm - Temperatures at 400 ppm. Increase of CO<sub>2</sub> concentration decreases temperatures on the surface of the ground but increase temperatures in the atmosphere. The results of figure 1 are explained by the results of the following figures. The temperature changes on the surface of the ground are so small that they could not be detected empirically. Increase of CO<sub>2</sub> concentration decreases global surface temperature, but the decrease is so small that it could not be detected empirically as shown by Figure 1.

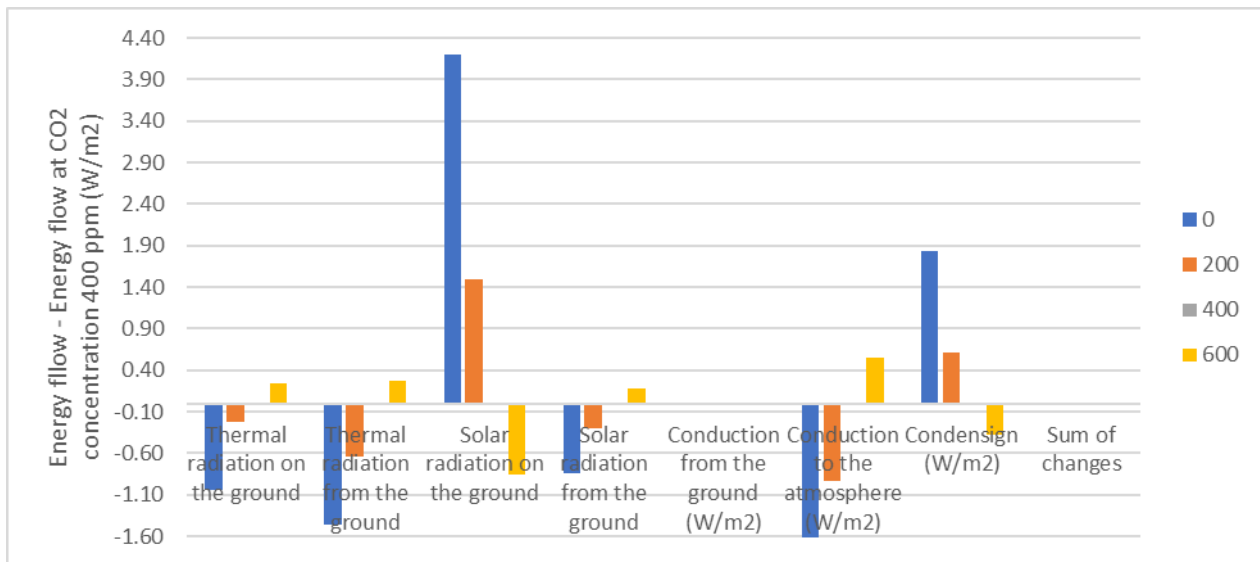


Figure 2. Energy flow (W/m<sup>2</sup>) at CO<sub>2</sub> concentrations 000 ppm, 200 ppm, 400 ppm, 600 ppm – Energy flow at CO<sub>2</sub> concentration 400 ppm on the surface of the ground. Conservation of energy demands that at each CO<sub>2</sub> concentration sum of changes of energy flows is zero as shown by Figure 2. Accordingly, when CO<sub>2</sub> concentration increases global surface temperature decreases and temperatures in the atmosphere increase as shown by Figure 1.

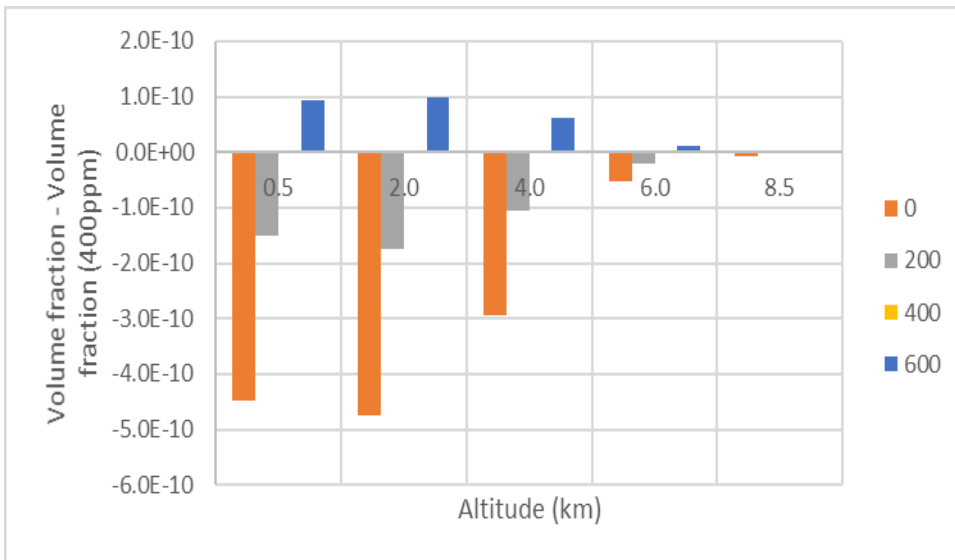


Figure 3. Volume fraction of droplets at CO<sub>2</sub> concentrations 000 ppm, 200 ppm, 400 ppm, 600 ppm – volume fraction of droplets at CO<sub>2</sub> concentration 400 ppm. When CO<sub>2</sub> concentration increases volume fractions of droplets in the atmosphere increases which increases reflection of solar radiation.

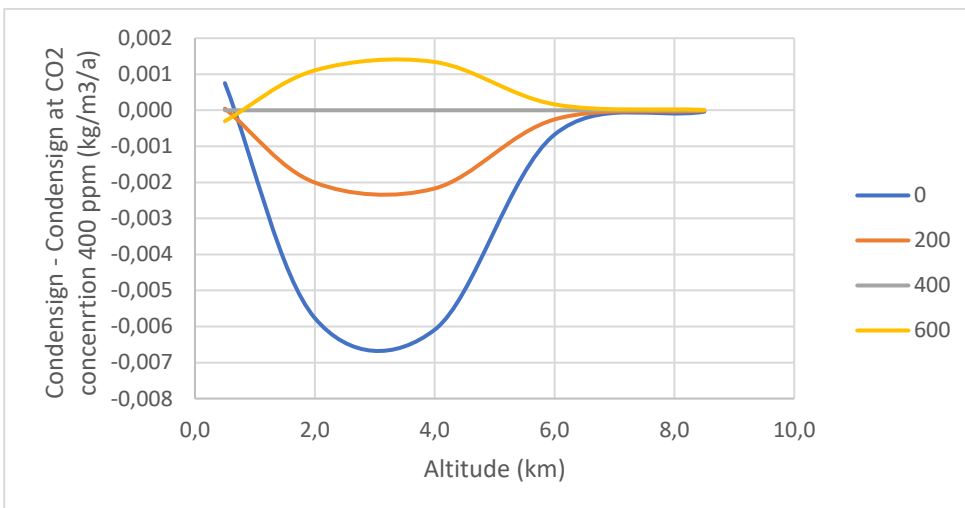


Figure 4. Condensing density at CO<sub>2</sub> concentrations 000 ppm, 200 ppm, 400 ppm, 600 ppm – Condensing density (kg/m<sup>3</sup>/a) at CO<sub>2</sub> concentration 400 ppm with CO<sub>2</sub> concentration as parameter. When CO<sub>2</sub> concentration increases condensing in the atmosphere increases which increases annual rain and thus vaporization of water on the surface of the ground.

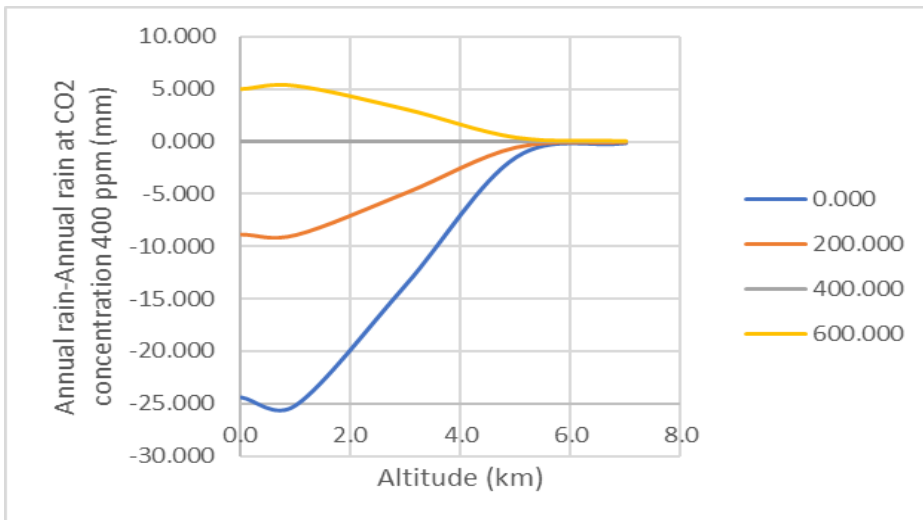


Figure 5. Annual global rain at CO<sub>2</sub> concentrations 000 ppm, 200 ppm, 400 ppm, 600 ppm – Annual rain at CO<sub>2</sub> concentration 400 ppm with CO<sub>2</sub> concentration as parameter. When CO<sub>2</sub> concentration increases condensing in the atmosphere increases which increases annual rain and thus vaporization of water on the surface of the ground (figure 4).

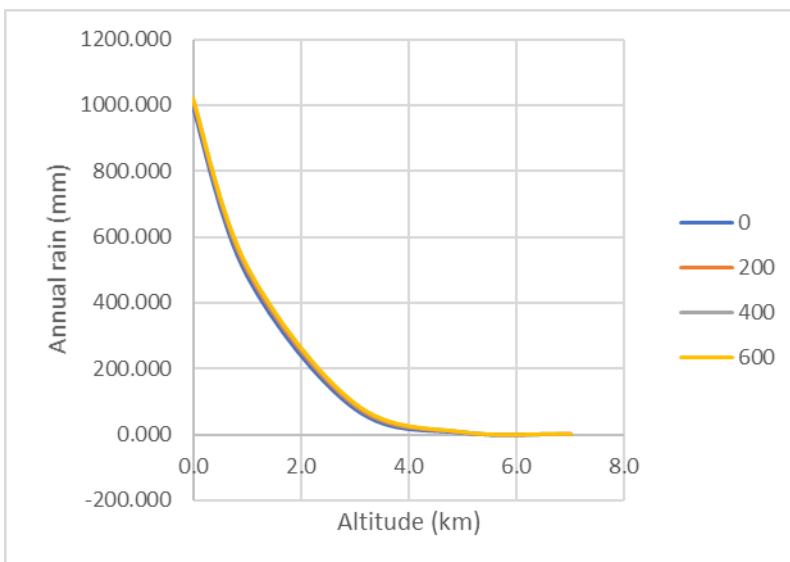


Figure 6. Annual global rain on the surface the ground at CO<sub>2</sub> concentrations 000 ppm 200 ppm, 400 ppm, 600 ppm. When CO<sub>2</sub> concentration decreases global rain increases. However, correlation between CO<sub>2</sub> concentration and global rain is so weak that it could not be detected empirically.

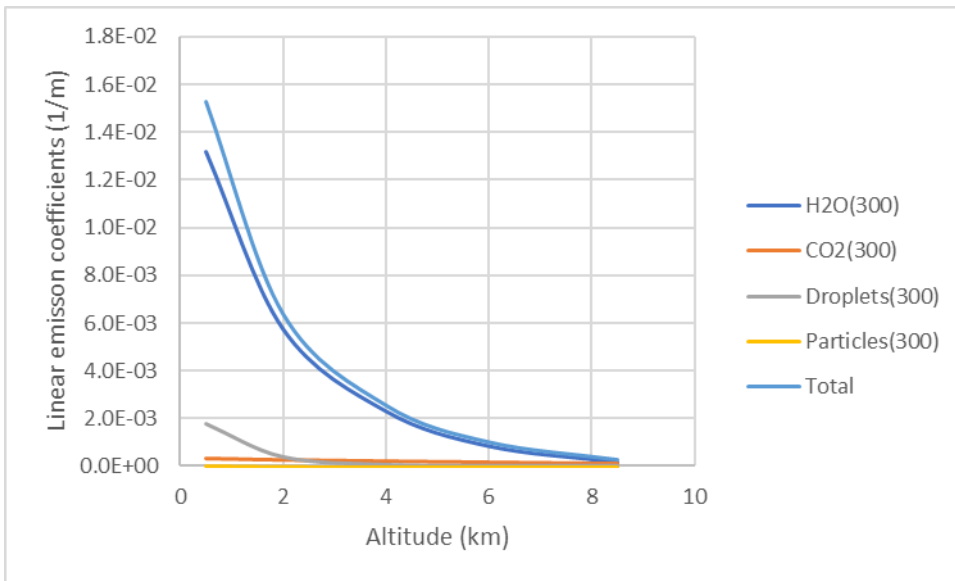


Figure 7. Linear thermal emission coefficients of the atmosphere at CO<sub>2</sub> concentration 300 ppm.

The trends of figures 1... 3 is explained by figure 7. At altitudes less than 6 km total linear emission coefficient of the atmosphere is, due to water vapor and droplets, so large that thermal radiation is near Stefan-Boltzmann radiation whereupon increases of CO<sub>2</sub> concentration has negligible influence on thermal radiation. Only at altitudes more than 6 km, total linear emission coefficient is so small that thermal radiation increases when CO<sub>2</sub> concentration increases causing warming in upper atmosphere and cooling of surface of the ground (Figure 1).

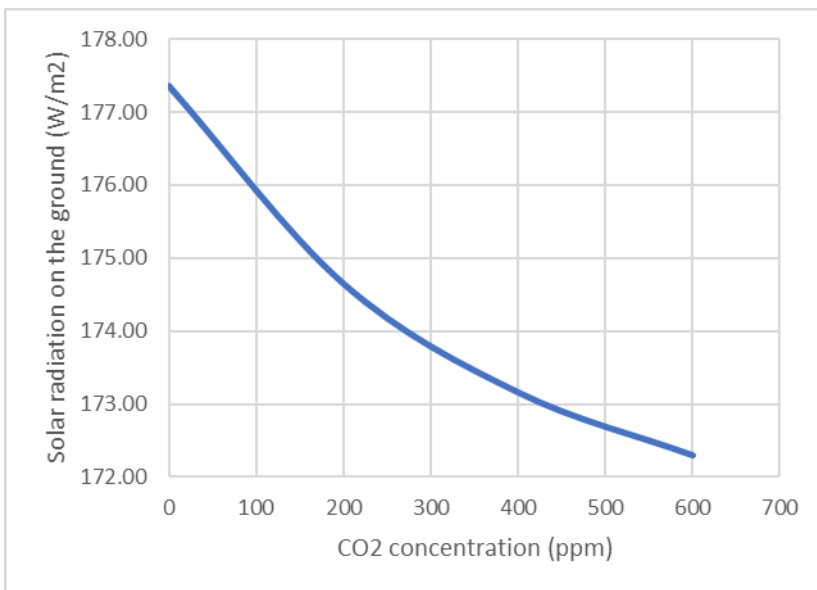


Figure 8. Solar radiation on the surface of the ground as function of CO<sub>2</sub> concentration. The decrease of solar radiation on the surface of the ground is due to that increase of CO<sub>2</sub> concentration increases volume fraction of droplets in the atmosphere and thus reflection of solar radiation (Figure 3)

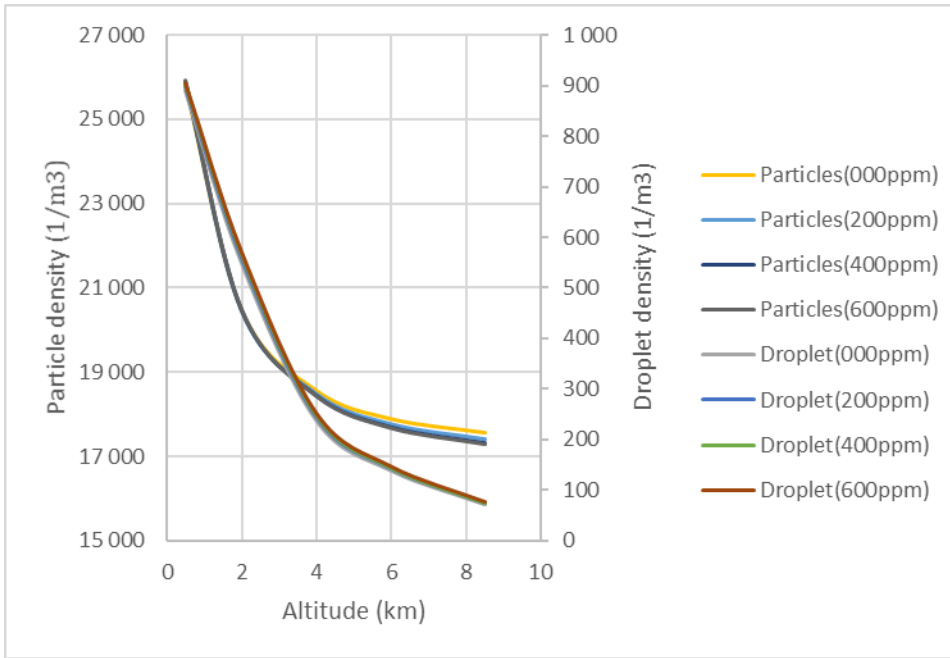


Figure 9. Particle and droplet densities ( $m^{-3}$ ) of global climate as functions of altitude and  $CO_2$  concentration as parameters. The only physically relevant available empirical information for determining particle and droplet densities of global climate is annual rain. Mathematically they are determined by parameters  $c_{pd}$  and  $\dot{N}_{pg}''$  which were determined as follows. For a selected  $c_{pd}$   $\dot{N}_{pg}''$  was determined by matching calculated annual rain on the surface of the ground at  $CO_2$  concentration 400 ppm to 1000 mm. In this study  $c_{pd} = 1.11 \cdot 10^{-8} m^{-3} s^{-1}$  and  $\dot{N}_{pg}'' = 3100 m^{-2} s^{-1}$ . By these parameters calculated particle and droplet densities are presented in Figure 9.