

**IN THE SUPREME COURT OF BRITISH COLUMBIA**

BETWEEN

ANDREW WEAVER

PLAINTIFF

AND

TIMOTHY ("TIM") BALL

DEFENDANT

**CERTIFICATION OF EXPERT**

I, Dr. Ferenc Miskolczi, prepared an expert opinion for use in *Mann v. Ball et. al.* Action No. VLC-S-S0111913 Vancouver Registry, a copy of which is attached hereto (the "Report"). I hereby authorize Dr. Timothy Ball and his legal counsel to utilize the Report in *Weaver v. Ball* Action No. VLC-S-110682, Vancouver Registry. I hereby certify that I am aware of my duty to the Court pursuant to the Supreme Court Civil Rules, Rule 11-2(1), as set out below. I further certify that I have made the attached report in conformity with that duty. If I am required to provide oral or written testimony in connection with this matter, I will give such testimony in conformity with that duty. I further confirm that the Report continues to accurately set out my opinions on the matters contained therein.

*11-2 Duty of Expert Witness*

- (1) *In giving an opinion to the Court, an expert appointed under this Part by one or more parties or by the Court has a duty to assist the Court and is not to be an advocate for any party.*

DATED: \_\_\_\_\_, 2017

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FERENC MISKOLCZI

## Expert opinion on the greenhouse gas theories and the observed infrared absorption properties of the Earth's atmosphere

This document was prepared by Dr. Ferenc Miskolczi on December 22, 2016. The purpose of the document is to assist the court with evidence that answers the following questions:

**Do greenhouse gas theories contradict energy balance equations?**

and

**Is the proposed greenhouse effect due to anthropogenic carbon dioxide emissions supported by observed atmospheric thermal and humidity structures and global scale simulations of the infrared absorption properties of the Earth's atmosphere?**

1. Signature:
2. Certificate of impartiality

Hereby I certify that I am fully aware of my duty to assist the court with an expert report on greenhouse effect related issues and not to be an advocate for any of the parties. I have made my report in conformity with that duty and will, if called on to give oral or written testimony, give that testimony in conformity with that duty. Accordingly, my expert report is written from a neutral and impartial perspective, it is compliant with the preparation instructions I was provided by the counsel for Dr. Ball, and it is not biased in any way toward either party.

3. Name: Dr. Ferenc Mark Miskolczi  
Address: 3 Holston Lane, VA 23664, USA  
Area of expertise: Atmospheric radiative transfer and radiation measurements.

To demonstrate my expertise the following documents are supplied as attachments:

- 17 selected scientific works<sup>[R1]</sup>: **R1\_court\_selected\_papers\_presentations.pdf**
- My signed scientific curriculum vita<sup>[M1-1]</sup>: **court\_cv-signed.pdf**
- A white paper submitted to NAS, 2005<sup>[M1-2]</sup>: **NRC\_FarInfrared\_Final.pdf**
- Co-principal investigator duties, NASA proposal, 2003<sup>[M1-3]</sup>: **NRA03OES2.pdf**
- Letter of resignation from NASA-AS&M, 2005<sup>[M1-4]</sup>: **Miskolczi\_resign\_2005.pdf**
- The Miskolczi Greenhouse Theory, Arrak, 2014<sup>[M1-5]</sup>: **Arrak\_2014\_MGT.pdf**

In this report references to publications, presentations, figures, data sets, and other documents are numbered and supplied as separate files identified by different prefix characters and one or two serial numbers separated with a dash. The first number after the prefix is the ID of the multi-file archive and the second number is the file ID (serial number) of the referenced file in that archive. The naming convention is as follows: publications and presentations have prefix '**R**', data sets have prefix '**D**', figures have prefix '**F**', and all other documents have prefix '**M**'. For example the reference to my presentation at a NASA science team meeting in 2005 will look like: *NASA STM*, 2005<sup>[R1-12]</sup>, where **R1** points to the **R1\_court\_selected\_papers\_presentations.pdf** multi-file archive and **12** is the serial number of the file. A list of all attached documents and a list of acronyms (used in this document) are included at the end of this report.

4. The attached **court\_instructions\_guidelines.pdf**, 2016<sup>[M1-6]</sup> file contains the instructions and preparation guidelines supplied by the counsel for Dr. Ball. These instructions were extracted from the electronic mail of Michael R. Scherr sent on 16<sup>th</sup> of September, 2016.
5. I have been asked to provide expert opinions on two different issues which are largely related to the basic physics and the observational evidences of the hypothetical CO<sub>2</sub>

greenhouse effect based anthropogenic global warming (AGW). A short introduction, definitions and problems are given in sections **5a** and **5b**. My expert opinion respecting the theoretical and observational issues above are given in section **6**. The summary of the evidences and facts on which my expert opinion rests are discussed in greater details in section **7**.

## 5a. Do greenhouse gas theories contradict energy balance equations?

**5a-1.** This problem is related to the theoretical foundation of the planetary greenhouse gas (GHG) greenhouse effect (GE). The planetary GE is an observed global radiative phenomenon. In climate science GE is defined as the difference between the surface radiative temperature  $t_s$  and the planetary shortwave effective absorption temperature  $t_A$ :  $\Delta t_A = t_s - t_A$  K, where  $t_A = (F_A / \sigma)^{1/4}$ ,  $F_A$  is the effective available absorbed solar radiation (ASR), and  $\sigma = 5.6699833 \times 10^{-8} \text{ Wm}^{-2}\text{K}^{-4}$  is the Stefan-Boltzmann (SB) constant. Unless specified otherwise, all physical constants were taken from the National Institute of Standards and Technology (NIST), *Mohr, et al. (2006)*<sup>[R2-1],[D1-1]</sup>. The thermodynamic ground surface temperature is  $t_G = t_s / \varepsilon_b^{1/4}$  where  $\varepsilon_b$  is the longwave (LW) surface (lower boundary) flux emissivity. Perfectly black surfaces will have  $\varepsilon_b \equiv 1$ ,  $t_G = t_s$ , and  $S_U = \sigma t_s^4 = S_G = \sigma t_G^4$ , where  $S_G = \sigma t_G^4$  is the upward blackbody radiation from the ground surface. GE may also be expressed by the all-sky greenhouse factor (GF) which is the difference of the respective flux densities (computed via the SB law):  $G_A = \sigma t_s^4 - \sigma t_A^4 = S_U - F_A$ . The ASR depends on the long term mean of the local solar constant  $F_0$ , and the Bond albedo  $\alpha_B$ :  $F_A = F_0(1 - \alpha_B)/4$ , and  $\alpha_B = F_R / F_E$ . Here  $F_E = F_0/4$  is the global mean available shortwave flux density over a unit area at the top of the atmosphere (TOA),  $F_R$  is the reflected part of  $F_E$ , and obviously,  $t_A = ((1 - \alpha_B)F_0 / (4\sigma))^{1/4}$ . Similarly to  $t_A$  one may define the  $t_E = (F_E / (4\sigma))^{1/4}$  effective planetary temperature, and the  $t_R = (F_R / (4\sigma))^{1/4}$  effective reflection temperature of the planet. In astrophysics GE is defined via the total SW energy interacting with the planet:  $G_E = \sigma t_s^4 - \sigma t_E^4$ , and  $\Delta t_E = t_s - t_E$ .  $t_A$  and  $G_A$  are constrained by the energy conservation principle:  $t_A = (t_E^4 - t_R^4)^{1/4}$ , and  $G_A = G_E + F_R$ .

**5a-2.** To determine the GE one needs to know the global mean surface temperature, the solar constant, the Bond albedo and the outgoing longwave radiation (OLR) at the TOA for all-sky condition. The conventional textbook data of these quantities are:  $t_s = t_G = 288$  K,  $F_0 = 1368$  Wm<sup>-2</sup>,  $\alpha_B = 0.3$ , and  $OLR^A = 239$  Wm<sup>-2</sup>, *Schmidt, 2010*<sup>[R2-13]</sup>. Slightly different numbers giving the same  $\Delta t_A$  may be found in *Lacis et al. 2010*<sup>[R2-9]</sup>. Based on these numerical data the greenhouse temperature rise and the corresponding flux density difference are:  $\Delta t_A = t_s - (F_A / \sigma)^{1/4} = 33$  K, and  $G_A = S_U - OLR^A = 151$  Wm<sup>-2</sup>. The often used normalized (dimensionless) greenhouse factor is  $g_A = (S_U - F_A) / S_U = 0.387$ .

**5a-3.** Without internal planetary heat sources (entering into the system at the lower boundary) isolated planets in steady state radiative equilibrium (RE) obey the conservation principle of radiant energy. The long term global mean absorbed part of  $F_E$  should satisfy the  $OLR^A = F_A$  equation. In the example above the planetary RE condition is closely satisfied, the imbalance (rounded to the nearest integer) is zero:  $OLR^A - F_A = 0$  Wm<sup>-2</sup>. In **Fig. F1-1** the spectral aspects of the greenhouse effect are presented. Notice that in the wavenumber domain the areas under each curve are proportional with the spectrally integrated flux densities. The GHG GE hypothesis assumes that the balance requirement is in the form of  $OLR^A(\bar{\tau}_A, S_U) = F_0(1 - \alpha_B)/4 = F_A(F_0, \alpha_B)$  where  $\bar{\tau}_A$  is the IR flux optical depth of an air column. This physical quantity can only be accessed by extremely complex radiative transfer (RT) computations. Keeping the right side at a constant  $F_A$  (meaning that  $F_0$ , and  $\alpha_B$  are constants), then the increased GHG content must be compensated by the LW absorption and emission processes of the surface-atmosphere system. For example in a global average clear atmosphere CO<sub>2</sub> doubling will increase  $\bar{\tau}_A$  by about 0.0242, *Miskolczi and Mlynczak, 2004*<sup>[R1-10]</sup>, pp. 242, Table 6. In *Miskolczi, 2007*<sup>[R1-14]</sup> it was shown with sufficient mathematical rigor that the clear-sky OLR and the surface upward radiation in radiative equilibrium are related by the  $OLR = S_U f(\bar{\tau}_A)$  equation, where  $f(\bar{\tau}_A) = 2(1 + \bar{\tau}_A + \exp(-\bar{\tau}_A))^{-1}$  is the transfer function (see **Fig. F1-5**). Locally, in the stochastic dissipative climate system the radiative equilibrium is not a constraint,  $\bar{\tau}_A$  and

$S_U$  can take any value. However, on global scale the radiative equilibrium is a strict constraint and the  $OLR^A(\bar{\tau}_A, S_U) = F_A$  assumption violates the energy conservation principle. That is, the reduced OLR (due to increased  $\bar{\tau}_A$ ) cannot be restored without adding thermal or radiative energy to the system. The correct relationship must have the form of  $OLR^A(\bar{\tau}_A, S_U, \beta, S_U^C) = F_A(F_0, \alpha_B)$ , where  $\beta$  is the cloud cover,  $S_U^C = S_U^C(h^C)$  is the upward flux density from the cloud top, and  $h^C$  is the average or equilibrium cloud top altitude. Evidently  $\alpha_B$  will also depend on the cloud cover and cloud altitude:  $\alpha_B = \alpha_B(\beta, h^C)$ . The details of the derivation of the equilibrium cloud cover are presented in [R1-17], and in **Figs. F1-14, F1-15, and F1-16**. Note that ignoring the  $OLR^A(\bar{\tau}_A, S_U, \beta, S_U^C) = F_A(F_0, \alpha_B)$  strict energy balance requirement discussion on the GE and the related global climate change does not have much merit.

**5a-4.** Without any theoretical or experimental proofs  $\Delta t_A$  and  $G_A$  are simply attributed to the absorption and re-emission of the surface upward radiation by the infrared (IR) active atmospheric gases. So far no structured GHG GE theories exist which are capable to predict a-priori the observed equilibrium  $\Delta t_A$  and  $G_A$ . Since the definition completely ignores the radiative effect of the cloud cover the missing GHG GE theory is not surprising. The real world  $OLR^A$  must be the weighted sum of the clear-sky and cloudy sky OLRs:  $OLR^A = (1 - \beta) OLR + \beta OLR^C$ . Here  $OLR$  and  $OLR^C$  are the clear-sky and cloudy sky components of the OLR, and  $\beta$  is the cloud fraction. In a two level radiating system (surface and cloud top) the  $\Delta t_A$  or  $G_A$  alone can never be directly associated with the GHG content of the atmosphere.

**5a-5.** In 1896 Svante Arrhenius put forward the question: *“Is the mean temperature of the ground in any way influenced by the presence of heat-absorbing gases in the atmosphere?”*, and he tried to quantify the effect of the CO<sub>2</sub> and associate it with the ice-ages in the planetary climate history, Arrhenius, 1896<sup>[R2-2]</sup> pp. 1. The CO<sub>2</sub> greenhouse

effect hypothesis in its simplest form states that increasing CO<sub>2</sub> content of the atmosphere will increase the absorbed upwelling LW radiation from the surface, will reduce the outgoing LW radiation, and will increase the downward LW radiation received by the surface. As a result, the surface will warm up until the top of the atmosphere radiative balance is restored, *Pierrehumbert*, 2010<sup>[R2-3]</sup> pp. 349-350; *Lindzen*, 2007<sup>[R2-4]</sup> pp. 940, Fig 3; *Nurse and Cicerone*, 2014<sup>[R2-5]</sup> pp. 2; *Smith*, 2008<sup>[R2-6]</sup> pp. 8. Of course this is not a greenhouse theory but an unproven hypothesis which poses deliberate constraint on the atmospheric response to increased greenhouse gas content. The key information which are badly missing here is the expected response of the global mean flux optical depth and the long time RE state of the atmosphere.

**5a-6.** Climate modelers generally assume a hypothetical positive feedback process which amplifies the initial warming: higher surface and atmospheric temperatures will increase the water vapor content of the atmosphere, and the increased water vapor absorption will further increase the warming effect. This unphysical assumption stems from the Schwarzschild solution of the RE situation in stellar atmospheres, *Schwarzschild*, 1906<sup>[R2-7]</sup> pp. 28, Eq. 11. Since the magnitude and quantitative constraint of this effect is unknown climate models are stabilized with different kinds of ad-hoc H<sub>2</sub>O feedback parameterizations.

**5a-7.** The unresolved theoretical problems of the origin and mechanism of the atmospheric GE will be discussed in detail in paragraph 7. It will be shown that the GE effect is a global scale RE process with a definite equilibrium state of the global mean radiative climate parameters. Related to the GE the most important radiative transfer parameter is the global mean flux optical thickness.

**5b. Is the proposed greenhouse effect due to anthropogenic carbon dioxide emissions supported by observed atmospheric thermal and humidity structures and global scale simulations of the infrared absorption properties of the Earth's atmosphere?**

*In short, analysis of the foregoing shows that the proposed greenhouse effect is impossible.*

**5b-1.** This problem is related to the empirical validation of the hypothetical CO<sub>2</sub> greenhouse effect based AGW. The practical approach to this validation effort is to collect long term geographically diverse global radiosonde data sets containing information about the state of the surface and the atmosphere, and perform high quality radiative transfer computations to obtain the true long time global average radiative structure of the system. Once the reliable global mean flux density components of the system are known then the simple task is to compare the global mean observed greenhouse effect to the predicted one by the GE hypothesis (outlined in paragraphs **5a-4** and **5a-5**).

**5b-2.** The first obvious requirement to conduct such studies are the availability of global scale primary radiosonde observations. Readily available sources of the vertical temperature, water vapor and ozone structures are the world climate data centers and the national meteorological data archives. In our validation efforts we frequently used the following radiosonde data sets: *NOAA-S*<sup>[D1-2]</sup> (one full year of high resolution soundings from the former NOAA testing facility in Sterling VA), *TIGR2*<sup>[D1-5]</sup>, *TIGR2000*<sup>[D1-4]</sup>, and *NOAA-R1*<sup>[D1-3]</sup>. All of these data sets were used in our computations and are attached to this report as supplemental data files. In **Fig. F1-2** comparisons of the thermal and water vapor structures of the global mean TIGR2 and the *USST76*<sup>[R2-8]</sup> atmospheres are presented. Compared to the USST76 atmosphere the significant differences in the vertical temperature and H<sub>2</sub>O structures are obvious. Notice that the USST76 tropospheric lapse rate is much higher, the isothermal stratosphere does not exist, and the H<sub>2</sub>O column amount is about half of the global average. Unfortunately global climatological data sets are also subject to deliberate data manipulations therefore extreme care is needed to identify a suitable archive.

**5b-3.** The second obvious requirement is an adequate high quality radiative transfer (RT) software. It must be quite obvious that the accuracy of a research RT code should not be restricted by speed requirements, vertical resolution or absorption band structures common in radiative transfer modules in climate models. Our choice was the High-resolution Atmospheric Radiative Transfer Code (HARTCODE) which was explicitly developed for extreme numerical accuracy, *Miskolczi, 1989*<sup>[R1-2]</sup>, *Rizziet al., 2002*<sup>[R1-8]</sup>. A short sensitivity summary is presented in *Miskolczi, 2010*<sup>[R1-15]</sup> pp. 257, Table 3.

Comparisons of different RT codes – involving HARTCODE – and their validations may also be found in *Kratz et al., 2005*<sup>[R1-11]</sup> or in *Saunders et al., 2007*<sup>[R1-13]</sup>.

**5b-4.** Further unique features of HARTCODE are the strict preservation of the monochromatic Beer-Lambert law, the Helmholtz reciprocity principle, and the spherical refractive computation of the directional transmittances through every optical path segments. The spectroscopic details of the infrared flux transmittance and optical depth computations are presented in *Miskolczi, 2011*<sup>[R1-16]</sup> pp.6, *Miskolczi, 2014*<sup>[R1-17]</sup> pp. 36. In **Fig. F1-3** the Helmholtz reciprocity principle is demonstrated for vertical and horizontal viewing geometries.

**5b-5.** The average planetary climate – as a set of scalar climate parameters – assumes an extensive global average cloud cover with a characteristic global average cloud altitude. The global average cloud cover breaks up the IR planetary radiation field into three major regions. The three regions and the definitions of the flux density components of interest are displayed in **Fig. F1-4**. From computational point of view – for obtaining accurate flux density components at the external and internal boundaries of the planet – a spherical refractive line-by-line (LBL) flux code should operate over three spherical shell sectors with sufficient vertical, angular and wavenumber resolution and for about thousand atmospheric structures from global radiosonde locations. Such complexity of computations is far beyond the capability of any publicly available LBL code and any climate radiative transfer module built into general circulation models (GCMs).

**5b-6.** In **Fig. F1-4** the transmitted, absorbed, upward and downward emitted, and lower boundary fluxes in the three regions are:  $S_T$ ,  $A_A$ ,  $E_U$ ,  $E_D$ , and  $S_U$  (clear-sky, red shading),  $S_T^C$ ,  $A_A^C$ ,  $E_U^C$ ,  $E_D^C$ , and  $S_U^C$  (above cloud, blue shading),  $S_T^{Cu}$ ,  $A_A^{Cu}$ , and  $E_U^{Cu}$ , and  $S_U$  (below cloud upward, green area),  $S_T^{Cd}$ ,  $A_A^{Cd}$ ,  $E_D^{Cd}$ , and  $S_D^C$  (below cloud downward, green area). The downward upper boundary fluxes at the clear and above cloud regions are zero. The reference altitude is at  $z_0 = 0.0$  km, the TOA altitude is at  $z_{top} = 70.0$  km and the altitude of the top of the equilibrium global average cloud cover is at  $h^C = 1.916$  km.

**5b-7.** Surface fluxes may be referenced to the TOA by applying a spherical correction  $sc$  :  $sc \approx R_E^2 / (R_E + z_{top})^2 = 0.97838$  where  $R_E = 6371000$  m is the volumetric radius of the Earth. Due to refraction (and the related vertical layering) the accurate computation of  $sc$  is far more complex and results in an  $sc = 0.978918$  (0.0547 % larger) value, which corresponds to an effective altitude of  $z_{top}^e = 68.236$  km.

**5b-8.** In cloud free areas the ground surface (having a global average thermodynamic temperature  $t_G$ ) and the semi-transparent atmosphere above (with an average GHG and thermal structure) can directly and freely cool to space. The same is true above an average planetary cloud cover, but with different lower boundary condition. The combined lower boundaries of these two regions constitute the active planetary surface (APS) of the Earth. In the third region (below the cloud cover) the IR radiation cannot escape to space and cannot contribute directly to the planetary RE. Among the flux density components, the  $OLR = S_T + E_U$  ,  $OLR^c = S_T^c + E_U^c$  ,  $OLR^{cu} = S_T^{cu} + E_U^{cu}$  , and the  $OLR^{cd} = S_T^{cd} + E_D^{cd}$  relationships must hold, where  $OLR$  is the clear sky OLR,  $OLR^c$  is the cloudy sky OLR,  $OLR^{cu}$  and  $OLR^{cd}$  are the upward and downward LW radiation below the cloud layer, respectively. According to the long term steady state requirement there cannot be any accumulating direct radiant energy in any of the three regions, however, unlimited transfers of radiant energy to-and-from the global latent heat reservoirs are permitted (as it happens in the real environment through the phase boundaries).

**5b-9.** The most important conclusion of our computations is the solid empirical proof of the existence of the assumed steady state planetary RE. The key planetary IR fluxes from the active planetary surface are:  $OLR^A = (1 - \beta)(S_T + E_U) + \beta(S_T^c + E_U^c) = 238.94 \text{ Wm}^{-1}$ , and  $S_U^A = S_U(1 - \beta) + S_U^c\beta = 341.98 \text{ Wm}^{-1}$ . The astrophysical textbook value of the effective planetary surface (skin) temperature is  $t_G = (16\pi\sigma d_E^2 / L_0^T)^{-1/4} = 278.683 \text{ K}$  which is in perfect agreement with the mean all-sky surface air temperature from radiosonde observations:  $t_s = (S_U^A / \sigma)^{1/4} = 278.68 \text{ K}$ . Here  $L_0^T = (2/5)\pi^{4/3}\sigma^{-1/3}d_E^{8/3}r_0^{-2/3}$  is our theoretical solar luminosity,  $d_E$  is the semi-major axis of the Earth's orbit , and  $r_0$  is the solar radius (both are in meters).

**5b-10.** From the observed fluxes the Bond albedo and the cloud cover may also be easily deduced (see in [R1-17] pp. 33, and pp. 44) :  $\beta = (S_U^A / sc - S_U) / (S_U^C - S_U) = 0.6615$  , and  $\alpha_B = 1 - OLR^A / S_U^A = 0.3013$  . From about thirteen years (1976-1989) of radiosonde observations the indirectly derived solar constant is  $F_0^{obs} = 4S_U^A = 4OLR^A / (1 - \alpha_B) = 1367.93$   $Wm^{-2}$ . Later we shall see that  $F_0^{obs}$  is also in perfect agreement with the  $F_0^T$  theoretical solar constant of  $F_0^T = 1367.9514$   $Wm^{-2}$ .

**5b-11.** From large scale simulations (involving the TIGR2, TIGR2000, NOAA-R1 and NOAA-S radiosonde archives) we gained enough confidence to conclude that the Earth's long time global mean flux optical thickness  $\bar{\tau}_A$  is equal to a theoretically predictable universal constant  $\tau^T$  :  $\bar{\tau}_A = \tau^T = 1.86756$ . This  $\tau^T$  is the solution of a transcendental equation which combines the RE requirement and the conservation principle of the flux optical depth. In **Fig. F1-5** the fundamental radiative transfer functions and the normalized upward atmospheric emissions for about thousand weather balloon observations are displayed. The theoretical  $\tau^T$  may be computed from the  $f(\tau_A) = V(\tau_A)$  equation (red dot), or from the  $g(\tau_A) = 2A(\tau_A)/5$  equation (light blue dot). The theoretical equilibrium optical depth is the natural constraint on the equilibrium mass of the condensing GHG (water vapor) in the atmosphere.

**5b-12.** The constancy of the IR flux optical depth is maintained in each and every randomly selected subsets of different length from a 61 year long NOAA-R1 time series, [D1-2]. In **Fig. F1-6** the increase of the atmospheric carbon dioxide in the studied NOAA-R1 time series are apparently coupled with the decrease of the atmospheric water vapor column amount. Here the CO<sub>2</sub> and H<sub>2</sub>O normalized column amounts are plotted for the 1948-2008 time interval. The constancy of the flux optical depth is demonstrated also in **Fig. F1-7**. Detailed numerical data of the regression analysis of the key variables – altitude, temperature, H<sub>2</sub>O, CO<sub>2</sub>, and flux optical depth – are given in **Fig. F1-8**, *European Geosciences Union (EGU)*, 2011<sup>[R1-16]</sup> pp. 18. According to **Figs. F1-5, F1-6, and F1-7** the long term global mean  $OLR$  and  $S_U$  cannot change independently. Based on the NOAA-R1 soundings and simulations **Fig. F1-20** shows the no-feedback response and

the true observed changes of the *OLR* in the 200-1500  $\text{cm}^{-1}$  spectral range. There is no such thing that the *OLR* remains constant and the surface warms up due to some incorrect GHG GE hypothesis, or because of the outcomes of  $\text{CO}_2$  doubling experiments conducted with never validated GCMs. The Intergovernmental Panel on Climate Change (IPCC) ignores the fact that the clear-sky *OLR* is governed by the unpredictable stochastic nature of the upper tropospheric humidity field (and the global cloudiness) which cannot be modeled by any (deterministic) global climate model. In Fig. **F1–21** a short video demonstrates the changes in the upper tropospheric humidity field. Evidently, to find the solution of the global mean radiation climate (or the GHG GE ) is not an appropriate task for GCMs.

## 6. *My opinion respecting the issues referred to above*

**6a.** In climate science the arbitrary definition of the GE is not suitable to associate the heat absorption properties of the atmosphere with the amount of GHGs present in the atmosphere. The reason is the two level radiative structure of the atmosphere and the unlimited supply of the water vapor in its three phases.

The stochastic nature of the humidity field makes the tracking of the phase changes of the  $\text{H}_2\text{O}$  impossible therefore the quantitative knowledge on the changes of the optical depth (that is related to the phase transitions of the  $\text{H}_2\text{O}$ ) is unknown. The classic GH effect hypothesis is not a theory and it is unable to establish the required quantitative relationship between the GHG content of the atmosphere and the planetary surface temperature. Further on, it violates a long line of well established first principles of theoretical physics.

In the last decade fundamental structural equations were developed for describing and understanding the global average radiation field and the RE state of the Earth-atmosphere system. The large number of new physical relationships – and new universal constants of radiation physics – converging to form a coherent picture of the planetary IR radiative processes which ultimately establishes the radiative budget of the Earth-atmosphere system.

Compared to surface and satellite flux density observations the rigorous numerical testing of the new equations were not producing any contradictory results. The new equations and

constants were presented in a series of published papers, open conference presentations, and in NASA science team meetings. So far neither the equations nor the numerical results were openly conquered by radiative transfer experts or challenged by the wider climate science community.

It is apparent that the key climate parameters of the planet can be deduced theoretically from purely astronomical considerations and some plausible assumptions on the material composition of the planetary surface and the structure of the atmosphere. The theoretically constant equilibrium flux absorption coefficient of the Earth's atmosphere negates the existence of the Arrhenius type greenhouse gas greenhouse effect. If there is no changes in the greenhouse effect then there is no climate sensitivity to manmade increase of the atmospheric  $\text{CO}_2$ . The excess optical depth from increased  $\text{CO}_2$  will condense into water droplets and will eventually rains out from the atmosphere.

Science is not a talk-show, all arguments and critiques against the new view of the greenhouse effect must be quantitative. If this situation remains for long, then the system of new equations will be upgraded to the only greenhouse theory which explains the observed facts and obeys the fundamental principles of physics.

**6b.** Evaluating the global average flux density components from ground truth observations it is evident that the Earth-atmosphere system is in RE with a theoretical solar constant. All empirical global mean flux density components satisfy the theoretical expectations. The greenhouse effect predicted by the Arrhenius greenhouse theory is inconsistent with the existence of this RE. Hence, the  $\text{CO}_2$  greenhouse effect as used in the current global warming hypothesis is impossible.

**My overall conclusion is that the Arrhenius type greenhouse effect is an incorrect hypothesis and the  $\text{CO}_2$  greenhouse effect based global warming hypothesis is also an artifact without any theoretical or empirical footing.**

## **7. The reasons for my opinion**

**7-1.** All planets in our solar system are isolated celestial objects orbiting around the Sun. Isolated objects can only exchange energy with other objects and the surrounding

environment by means of radiation. The exchange of radiant energy happens through the active planetary surface. By definition the active planetary surface is the sum of the (solid or liquid) surface areas which contributes to the exchange of radiant energy with the Sun and the surrounding (space) environment. The APS may receive inward radiation from the full  $4\pi$  solid angle, and also emits and reflects (or scatters) radiation into the full  $4\pi$  solid angle. Planets with condensing GHG atmospheres usually have complex multi-layer adaptive APS which controls the planetary RE. Further on, we shall use the concept of a 'passive' planet. By definition a passive planet has negligible internal source of thermal energy propagating through the APS and the atmosphere above and contribute to the top of the atmosphere net radiation.

**7-2.** On a properly chosen time scale a passive planet is said to be in steady state RE if the total available (or intercepted) solar SW radiation is equal to the total LW radiation leaving the APS, and the ASR is equal to the OLR leaving at the top of the atmosphere. Such a planet will obey the energy and momentum conservation principles of the radiation field in its simplest form where all planetary LW flux density components are scaled with the solar constant. These are the top level constraints imposed on the radiation field of the Sun-planet system, and actually assures, that a passive planet cannot change the local solar constant. Obviously such a planet is an abstraction, but it is not an unrealistic one. It is quite reasonable to assume that after the formation and during the billions of years of planetary evolution planets have ample time to reach the steady state RE. On the other hand, any power dissipation in the system which is unrelated to the incoming solar radiation will just add an extra (small) energy term to the OLR and move the planetary flux emissivity a little above unity.

**7-3.** It should be recognized that the Sun is a very complex object and the solar constant has its own natural fluctuations. Depending on the state of the Sun  $F_0$  may vary (on different time scales) between  $F_0^{\min} = 1359.7$  and  $F_0^{\max} = 1376.2 \text{ Wm}^{-2}$  introducing 1.2% (quasi-periodic) changes in the short term averages. From  $F_0^{\min}$  and  $F_0^{\max}$  the arithmetic average is  $F_0^{\text{av}} = 1367.95 \text{ Wm}^{-2}$ . It is not very wise to declare an official solar constant and continuously upgrade it according to the relatively short term satellite or ground based

observations. Even NASA warns that their data in the *NASA Fact Sheets*, 2012<sup>[R2-12]</sup> are approximations and they are not appropriate for scientific use. The data are usually given in three or four significant digits and they cannot be consistent with the known physical laws of nature where the key astronomical information and the most fundamental constants of the theoretical physics are given with 10-50 ppm relative accuracy.

**7-4.** Sun is the sources of the observable radiative and not directly observable entropy flux densities and their specific intensity, radiance or brightness counterparts. We have found that the theoretical solar luminosity, solar surface emission and the solar constant may be derived from the next theoretical equation:  $F(d) = (\pi/\sigma)^{1/3} d_E^{8/3} r_0^{-2/3} d^{-2}/10$  where  $F(d)$  is the flux density in  $\text{Wm}^{-2}$ , and  $d$  is the distance from the center of the Sun in meters. In this universal function  $d$  may vary from inside the Sun to anywhere in the solar system. The theoretical solar luminosity, solar surface emission, solar constant and the available SW flux density may easily be computed from  $F(d)$ :  $L_0^T = 4\pi^{4/3}\sigma^{-1/3}d_E^{8/3}r_0^{-2/3}/10$ ,  $E_0^T = (\pi/\sigma)^{1/3}(d_E/r_0)^{8/3}/10$ ,  $F_0^T = (\pi/\sigma)^{1/3}(d_E/r_0)^{2/3}/10$ , and  $F_E^T = F_0^T/4$ . The theoretical solar constant and the available SW radiation are:  $F_0^T = 1367.95145 \text{ Wm}^{-2}$  and  $F_E^T = 341.98785 \text{ Wm}^{-2}$ . The very important point here is the fact that the  $F(d)$  theoretical function depends only on geometrical factors (the solar radius and the semi-major axis of the orbit of the Earth) and of course, independent of any short term or long term satellite or ground based radiation measurements. Consequently, debate on the theoretical  $F_0^T$  solar constant should be restricted to the debate on the accuracy of  $r_0$ , and  $d_E$ . Of course, the barycenter of the solar system and the steady state center of the Sun (as a fixed geometrical point) does not exist. Sun is not a fixed perfect sphere but a rotating and pulsating gas globe which is subject to gravitational perturbations from other members of the solar system. This physical reality reflected in the singularity of the  $F(d)$  function at  $d \equiv 0$  where  $F(0) = \infty$ . The reference solar constant  $F_0^T$  is mathematically consistent with the radiation laws and the known accuracies of the Planck and Boltzmann constants (from NIST). It is also consistent with the most accurate values of  $r_0$ , and  $d_E$ , and with the spectral solar constant of *Chance and Kurucz*, 2010<sup>[R2-10]</sup>. The existence of the theoretical solar constant does not support the idea of introducing a kind of new standard solar constant (and the backward correction of previous

standards) based on purely the newest satellite observations. The accuracy of flux density or radiance measurements will never conquer the accuracy of the measurements of distance, linear size or time.

**7-5.** The extreme stability of the climate over millions of years is obviously based on the existence of the  $F_0^T$  theoretical solar constant. In **Fig. F1–9**  $F_0^T$  is compared to the observed  $F_0^{obs}$  (quoted under paragraph **5b-10**), and the newest satellite observations from *Kopp and Lean, 2010*<sup>[R2–11]</sup>. The  $F_0^T = F_0^{obs}$  equality means that the planet is in strict radiative equilibrium with the theoretical solar constant.

**7-6.** Recently there is a serious problem with the use of the classic definition of the GE given in **5a-1**. The ambiguity arises from the fact that some scientists recognized that the classic GHG greenhouse effect cannot be discussed without the presence of the global cloud cover and started to use the greenhouse effect terminology in a generalized way, including the cloud effect, see **[R2–13]** and **[R2–9]**. This confusion should be avoided, CO<sub>2</sub> is a greenhouse gas and not a solid or liquid substance. If there is no cloud cover present in an air column one has to talk about the clear-sky greenhouse effect, and in fact that is what we are interested in. Based on our global mean atmosphere the global mean clear sky GHG  $\Delta t$  and  $G_F$  are:  $\Delta t = 30.4$  K, and  $G = 141.6$  Wm<sup>-2</sup>. To quantify the cloud effect first the role of the cloud cover in the climate system must be specified, as we did in *Miskolczi, 2014*<sup>[R1–17]</sup>. There is another serious problem with the classic definition, namely the use of the ground surface thermodynamic temperature and assume a perfectly black surface. In reality the ground surface is not black, and what we need to put into the SB law is the true  $t_s$  radiative temperature. Radiosonde observations show that  $t_s = 286.06$  K and the physically meaningful GHG  $\Delta t$  and  $G$  at the ground are:  $\Delta t = 27.9$  K, and  $G = 127.9$  Wm<sup>-2</sup>. In **Fig. F1–10** the vertical contribution to the clear-sky  $G$  factor is demonstrated. Here the different computations of the  $G$  factor gives consistent results. However,  $G_R$  from *Raval and Ramanathan, 1989*<sup>[R2–14]</sup> or *Ramanathan and Inamdar, 2006*<sup>[R2–15]</sup> shows large discrepancy (about 20 Wm<sup>-2</sup> overestimate). The cause is the incorrect mathematical representation of GF, see for example Eqs. 1-2 in **[R2–14]** (NATURE, VOL 342, pp 759).

**7-7.** Climate change will be regarded as deviations from the long term average state due to possible internal (natural random) fluctuations or external perturbations of the total energy input to the system. Internal fluctuations are due to the chaotic nature of the dissipative dynamic climate system and they do not alter the long term radiative balance. Regarding the large variety of time scales of the possible internal fluctuations and external perturbations that may occur one has to be careful with selecting the length of a characteristic averaging time interval for establishing the RE. Planets with large amount of latent heat storage in geological reservoirs may moderate the internal and external fluctuations by phase pinning (Maxwell rule). In the Earth's atmosphere the water vapor is the only condensing GHG, therefore the triple point (we call it phase temperature) of the H<sub>2</sub>O at  $t_p = 273.16\text{ K}$  has a unique role in the climate system. Although the relationship between the thermal history of the Earth and the composition of the atmosphere on evolutionary time scale is an interesting subject, the manmade CO<sub>2</sub> greenhouse problem is only relevant to the last century.

**7-8.** Theoretically steady state RE of non-condensing GHG atmosphere of a planet cannot exist, since the ground surface of such planet would cool down freely to the astronomical limiting temperature dependent partly on the local solar constant and Bond albedo, and partly on the outward diffusion of thermal energy from the planetary interior. In the special case of Earth the astronomical limiting temperature is practically equal to the temperature of the triple point of H<sub>2</sub>O. In other word, at some (sufficiently low) temperature any gas will become a condensing GHG, therefore, without the presence of condensing GHGs in the system there is no atmosphere at all. Note that in gas phase the spectral gas absorption is restricted to certain spectral ranges characteristic of the molecular structure of a particular GHG. An atmosphere with condensing GHGs might have several internal boundaries (cloud layers) at different altitudes which instantly disrupt the propagation of the electromagnetic radiation, consequently, the global mean cloud cover is the major factor in establishing and maintaining the planetary radiative balance.

**7-9.** The above concept is fully consistent with observations of atmospheres of comets and planets in the solar system. A comet starts to build up atmosphere when getting closer to the Sun and the surface materials start to evaporate. On the reverse trajectory when

getting farther from the Sun the atmosphere condenses back to the surface and disappears. In the thin Martian carbon dioxide atmosphere there is no extensive cloud layer and the planetary RE is maintained by the diurnal changes of the mass of the GHG atmosphere and the heat (released or received) at the lower boundary by the phase changes of the CO<sub>2</sub>. In the hot and thick atmosphere of the Venus the complex, fully closed multi-layer cloud structure completely de-couples the radiation field of the ground surface from the OLR. Below the closed cloud layers the IR radiation field is a type of cavity radiation in RE. The planetary RE is maintained solely by the radiation from the cloud top and the atmosphere above.

**7-10.** On the Earth the planetary RE situation is far more complex. Since the phase changes of the H<sub>2</sub>O may happen at any time and anywhere in the system the Earth has an extremely variable cloud, surface ice and snow cover. The combined surfaces where the water vapor is in direct contact with liquid water, snow, and ice will be termed as the phase boundary. Through this hypothetical complex surface the total amount of water vapor in the atmosphere will change by the release or buildup of the latent heat by evaporation, condensation or sublimation. In steady state the net condensation and evaporation associated with rain droplets (within the atmosphere) must be zero and the mass balance of the atmosphere is maintained by the evaporation or sublimation from the ground surface and precipitation or deposition to the ground surface. These processes will result in decrease or increase of the flux optical thickness which is coupled with the mass exchange through the lower boundary. The total mass (or the potential energy) of the atmosphere and the flux optical thickness is controlled by the virial theorem, [R1-17] pp. 45. The mass conservation in the hydrological cycle expresses indirectly the conservation of the flux optical thickness. The observed and theoretically predicted constant flux optical thickness (in [R1-15] pp. 260) is a plain proof of the climate control by the water cycle. In other words, increasing or decreasing the energy input to the system will result in the release or store of the required amount of radiant or thermal energy through the phase boundary to assure the radiative equilibrium while keeping the temperature of the phase boundary unchanged.

**7-11.** The water vapor feedback problem was already mentioned in **5a-6**. From the NOAA-S [D1–2] archive 689 high quality all-sky radiosonde observations were processed to show the relationship between the local mean layer temperature and water vapor column density. During 1992-1993 from the high resolution (6 second) data 654130 individual layer mean temperature and water vapor column density pairs were collected. In **Fig. F1–11** the primary measured relative humidity and the computed H<sub>2</sub>O column density profiles are plotted showing no significant correlation. In **Fig. F1–12** the linear correlation coefficient between the temperature and natural logarithms of the column density is 0.99, which – considering the relevant quantitative theoretical relationships – is not a surprise. In view of the known analytical dependence of the ambient temperature on the water vapor content of an individual air parcel the whole hypothesis seems to be a nonsense. It must be clear that locally the temperature and water vapor content of the air parcels are alternative variables and they are not connected by some ad-hoc positive or negative feedback parameter. According to thermodynamics phase transitions are controlled by the changes in the molar free energy and entropy.

**7-12.** The usual way to support the idea of the classic greenhouse effect is to present planetary energy budget schemes where the global radiative flux density components as well as the sensible and latent heat fluxes in the system are estimated either from direct measurements or from radiative transfer computations. The most well known is the *Kiehl and Trenberth, 1997*<sup>[R2-16]</sup> energy budget. In [R1–17], based on 13 years of radiosonde observations, it was first shown with high degree of accuracy that the Earth-atmosphere system is in the state of radiative equilibrium. The radiative imbalances at the upper and lower boundaries of the atmosphere that appear in recent radiative budget cartoons of *Trenberth et al., 2009*<sup>[R2-17]</sup>, *Stephens et al., 2012*<sup>[R2-18]</sup>, *Wild et al., 2012*<sup>[R2-19]</sup>, or *NASA, 2010*<sup>[R2-20]</sup> do not exist. The radiative equilibrium stems from energy conservation and energy minimum principles and it is the natural state of the Earth-atmosphere system. So far none of the published planetary energy budgets give any bearing to the origin and physics of the atmospheric greenhouse effect and unfortunately, almost all of them suffer from serious errors in the methodology and evaluation. Some of them are listed below.

**7-13.** Quantitative discussion of the greenhouse effect should be based on the strict, detailed, clear, and physically meaningful definition of the phenomenon. For example, in [R2–13] and [R2–9] we see published totally misleading quantitative results about how the share of the present-day global GE is distributed between GHGs and the cloud cover: 50 % from H<sub>2</sub>O, 20 % from CO<sub>2</sub>, 25 % from clouds, and 5 % contribution from minor GHGs. In common understanding these data means that the CO<sub>2</sub> absorption in the 15μm band is half of the absorption of the H<sub>2</sub>O in the whole IR, which is sheer nonsense. Due to the heavily overlapping nature of the terrestrial spectral radiation field it is mathematically impossible to decompose the flux optical depth into the contributions of the individual molecular species, see [R1–14], Appendix A. The LBL computational technique was developed to remove the uncertainties due to the spectral overlaps of the absorption coefficients of different GHGs. Clouds (or any kind of solid or liquid particles in the atmosphere) radiate continuous IR spectra and have nothing to do with the IR spectral absorption of the greenhouse gases. The cloud forcing approach to the greenhouse problem does not help to clarify and quantify the planetary radiative budget. **Fig. F1–4** (or Fig. 28 in [R1-17]) shows that the global average atmosphere is in radiative equilibrium  $F_E = S^A$ , and  $OLR^A = F_A$ . From the confirmed  $G^A = S_V^A - OLR^A = F_R$  and  $S_V^A = F_E$  equalities follow the conservation of radiant energy, radiative equilibrium, and they give solid empirical support to the theoretically introduced equivalent blackbody temperature. Because of the two layer structure of the global average atmosphere the ground surface referenced GE cannot contain any dependences on the albedo, cloud cover, radiative temperature, LW absorption, or flux optical thickness, rendering the GE to observations of  $t_G$ , and  $OLR^A$ , and leaving the greenhouse problem entirely to the mercy of the GCMs and their unphysical assumptions and countless ad-hoc tuning parameters.

**7-14.** No quantitative constraints on the shortwave system albedo, cloud cover and cloud altitude are established. These are key climate parameters, and some kind of theoretical expectation must be referenced or developed. The steady state planetary radiative balance is abandoned in favor of a hypothetical greenhouse warming. In science the quantitative estimate of  $0.6 \pm 17 \text{ Wm}^{-2}$  missing heat [R2–18], means that climatologists

have no idea why and how the hidden (thermal and radiant) energy is distributed among the different latent heat reservoirs.

**7-15.** In the budgets the global mean thermal and GHG structure of the atmosphere is not specified. Generally the LW fluxes relevant only to the USST76 are used as the global average. The most recent NASA [R2–20] budget adopted the flux density components from the KT97 radiative budget which is obviously wrong. Transmitted flux densities from the surface ( $40 \text{ Wm}^{-2}$ ) in KT97 were computed for the USST76 atmosphere and its  $390 \text{ Wm}^{-2}$  surface upward flux. In the NASA picture the corresponding fluxes are 40.1 and  $398.2 \text{ Wm}^{-2}$  which is nonsense. About  $\sim 10 \text{ Wm}^{-2}$  increase in surface upward flux and practically unchanged surface transmitted flux density deserves some explanations.

**7-16.** The most serious problem with the cartoons are the ignorance of a long line of well-known fundamental concepts and principles of theoretical physics. Some of them are: energy and momentum conservation principles of the radiation field, Wien's law, virial theorem, energy minimum principle, Maxwell rule, Kirchhoff law, Helmholtz reciprocity principle, Vogt-Russel theorem, LeChatelier-Brown principle.

**7-17.** We have discovered that vital climatological data sets were deliberately manipulated. The verification of the planetary energy budget and radiative balance require high quality primary information from global scale radiosonde observations. If the radiosonde observations are wrong then no one will trust in the satellite retrievals of the temperature, humidity or ozone structures. Satellite products depend on the calibration and tuning (of the instruments and retrieval algorithms) based on the ground truth information, see Miskolczi, 2005<sup>[R1–12]</sup>. The common mistake of the climatologists is to assume that the satellite information is correct, no matter of anything. This is not true, satellite information cannot ever be more accurate than the ground truth. Scientist must be aware that government research institutions may deliberately manipulate their databases to reflect their wild imagination on how the GE works. Good examples are the TIGR2 and *TIGR2000*<sup>[D1–4]</sup> archives. A closer look at the TIGR2000 revealed that more than half (915 out of 1761) profiles are coincidental and they are included in both archives. The humidity and ozone structures in those coincidental profiles were poorly modified in an obvious way that the original thermal structures were preserved. The authors of the database should have

known that the H<sub>2</sub>O, O<sub>3</sub>, and the thermal structures in the real atmospheres are highly correlated, which property is widely used in water vapor and ozone statistical retrievals from satellite spectral measurements.

**7-18.** In **Fig. F1–13** we present one sample (out of the 915 manipulated profiles) where the increased H<sub>2</sub>O and ozone content resulted in increased flux optical depth (to a value corresponding to a CO<sub>2</sub> doubling). The upper left plot shows the unchanged temperature profile, the right plot shows the manipulated H<sub>2</sub>O profile. The overall effect of cheating with the radiosonde data is summarized in the lower plot. Here the routine comparisons of 42 vital physical parameters that required by correct radiative budget computations are plotted. Two parameters, the normalized equilibrium extropy and the global surface radiative imbalance are out of the acceptable ranges of  $3\sigma$ . As a result of the data manipulation the TIGR2000 archive now contains 915 unrealistic atmospheric structures (mostly with increased upper tropospheric humidity) which makes the database useless for both remote sensing and radiative budget applications. Creating fake radiosonde observations to support the belief in CO<sub>2</sub> GE based global warming is not a scientific approach. The upper tropospheric humidity problem (if there is any) will not be resolved by artificial increase of the humidity data in the raw radiosonde observations. Unfortunately, there are evidences of extended data manipulations in other climate data sets which renders the whole climate science to a hiding game, and largely reduces the chances to obtain scientifically sound answers to the role of the GHGs in the global warming.

**7-19.** To establish the radiative equilibrium at the ground surface the spherical emissivity (or the anisotropy) of the inhomogeneous IR radiation field of the atmosphere has to be considered. The anisotropy of the downward LW radiation is the  $\varepsilon_A = E_D / E_D^i$  ratio, where  $E_D$  is the radiation from the real atmosphere, and  $E_D^i$  is the radiation from an isotropic atmosphere of temperature  $t_s$ . Because of the  $E_D^i \equiv S_U (1 - \exp(-\bar{\tau}_A))$  mathematical identity, the equilibrium ground surface temperature is  $t_G = (S_U / (\sigma \varepsilon_A))^{1/4}$ . From the GAT profile  $\varepsilon_A = E_D / E_D^i = 0.96515341$ , and the ground surface temperature is  $t_G = 288.61$  K. These results are fully consistent with the observed constant flux optical thickness:  $\bar{\tau}_A = \ln [S_U^2 / (S_U^2 - \sigma t_G^4 E_D)] = 1.86912 \approx \tau^T = 1.86756$ . The surface phase temperature  $t_p$  is

$t_p = (\sigma^{-1/3} + \varepsilon_A^{1/4} t_G) / 2 = 273.18 \text{ K}$ . Summarizing our quantitative results in **Figs. F1–17, F1–18, and F1–19** the spectral distributions of the most important flux density components are presented. Compared to the NASA fact sheets the spectrally integrated fluxes are accurate up to 4-5 significant digits.

**7-20.** Almost all attempt to publish the results presented in this report failed. Articles were routinely rejected for publication in the mainstream scientific journals – Science, Astrophysical Journal, Journal of Quantitative Spectroscopy and Radiative Transfer, Journal of Geophysical Researches etc. – mostly without sending for review. Probably this is the reason why it is hard to find any critical comments on the quantitative results in the peer reviewed literature. However the blogosphere is flooded with academically illiterate comments from self-declared experts. As an example at the Miskolczi discussion thread of the Climate Etc. blog the ridiculous comments of *A. Lacis*, 2015<sup>[R2-21]</sup> (moderated by J. Curry) on the *Miskolczi*, 2014<sup>[R1-17]</sup> paper is attached. If this comment – without a single quantitative reference to the presented computational results in the paper – represents the matured opinion of the global warming community on the greenhouse science then certainly the open scientific discussion is impossible on this topic.

## 8. List of Acronyms

anthropogenic global warming (AGW)

greenhouse gas (GHG)

greenhouse effect (GE)

absorbed available shortwave radiation (ASR)

Stefan-Boltzmann (SB)

National Institute of Standards (NIST)

longwave (LW)

greenhouse factor (GF)

outgoing longwave radiation (OLR)

top of the atmosphere (TOA)

radiative equilibrium (RE)

radiative transfer (RT)

infrared (IR)

greenhouse gas (GHG)

High-resolution Atmospheric Radiative Transfer Code (HARTCODE)

line-by-line (LBL)

general circulation models (GCM)

active planetary surface (APS)

Intergovernmental Panel on Climate Change (IPCC)

## 9. List of the attached multi-file archives and their contents

### **R1\_court\_selected\_papers\_presentations.pdf**

01\_ASR\_COSPAR\_Vol1\_1981  
02\_hartcode\_v01\_1989  
03\_AO\_Vol32\_No18\_1993  
04\_JAOT\_Vol111\_No2\_1994  
05\_JAM\_Vol36\_No5\_1997  
06\_NOAA\_AdeosII\_2000  
07\_IDJS\_Vol105\_No4\_2002  
08\_AO\_V41\_No6\_2002  
09\_IDJS\_Vol108\_No1\_2004  
10\_IDJS\_Vol108\_No4\_2004  
11\_JQSRT\_Vol90\_2005  
12\_NASA\_CERES\_STM\_2005  
13\_JGR\_Vol112\_2007  
14\_IDJS\_Vol111\_No1\_2007  
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16\_EGU\_Vienna\_13622\_2011  
17\_DES\_Vol2\_2014

### **R2\_court\_references**

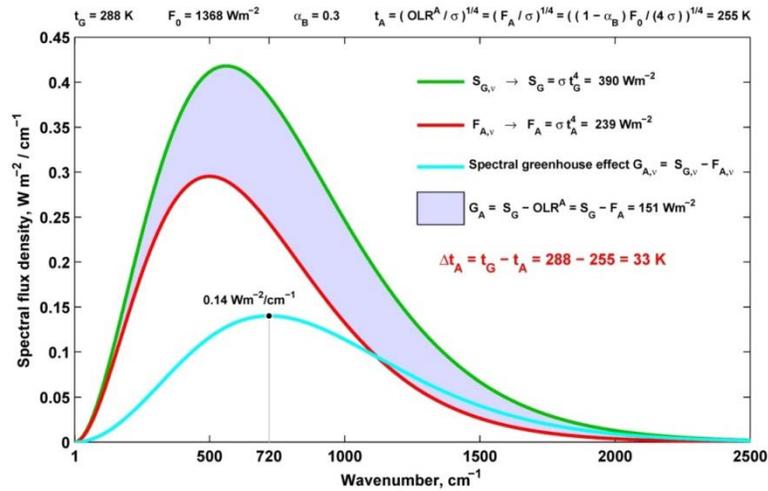
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07\_Schwarzschild\_1906  
08\_USTT76\_1\_36  
09\_Lacis\_Science\_2010  
10\_Chance-Kurucz-solar2010-JQSRT  
11\_Kopp\_et\_al\_2011  
12\_NASA\_Fact\_Sheets  
13\_Gavin\_Schmidt\_etal\_2010  
14\_Raval\_Ramanathan\_1989  
15\_Ramanathan\_Inamdar\_FCMT\_2006  
16\_KT\_97  
17\_Global\_Energy\_Budget\_TFK  
18\_Stephens\_ngeo1580  
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20\_NASA\_Earth\_Energy\_Budget  
21\_A\_Lacis\_comments

**F1\_court\_referenced\_figures.pdf**

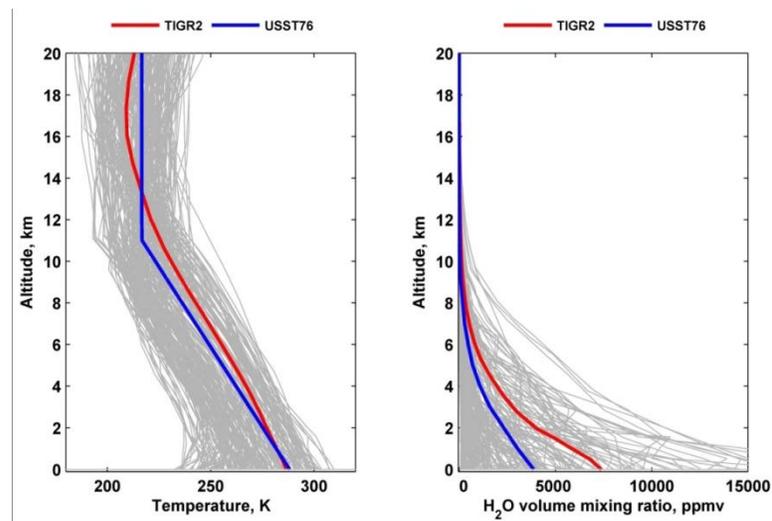
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07\_noaa-r1\_subsets  
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09\_solar\_constant  
10\_GE\_layer\_contribution  
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12\_noaa-r1\_t\_h2o  
13\_TIGR2000-TIGR2  
14\_cloud\_equations  
15\_cloud\_optimiziaton  
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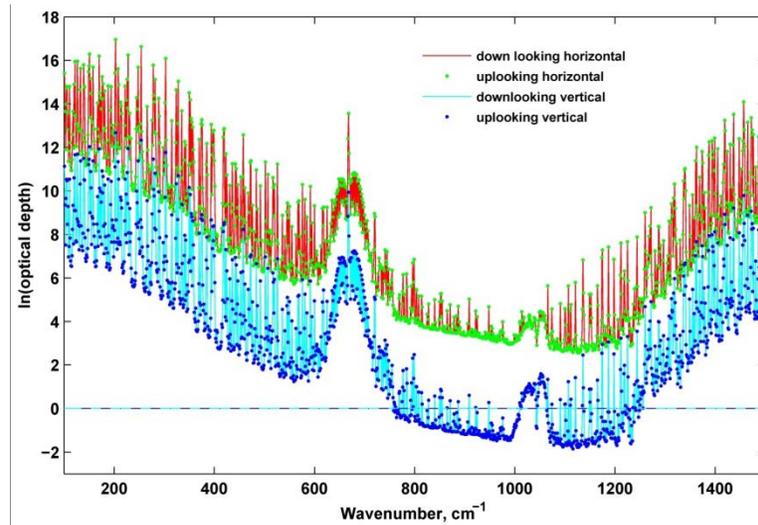
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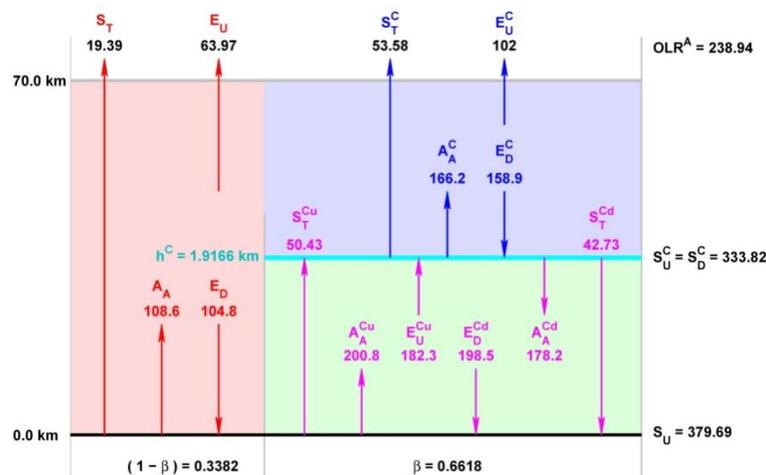
**Fig. 1** Textbook definition of the atmospheric greenhouse effect. The greenhouse warming in steady state radiative equilibrium ( $F_A = OLR^A$ ) is the  $\Delta t_A = 33$  K difference between the surface thermodynamic temperature  $t_G$  and the planetary effective absorption temperature  $t_A$ . The greenhouse factor  $G_A = 151$   $\text{Wm}^{-2}$  is the difference in the respective flux densities (blue shaded area). In this view the planetary ground surface (lower boundary) is assumed to be perfectly black and  $t_G$  is equal to the surface radiative temperature  $t_S$ :  $t_S = t_G = 288$  K, and  $S_U = \sigma t_S^4 = \sigma t_G^4 = S_G = 390$   $\text{Wm}^{-2}$ , where  $S_U$  is the surface upward infrared flux density.



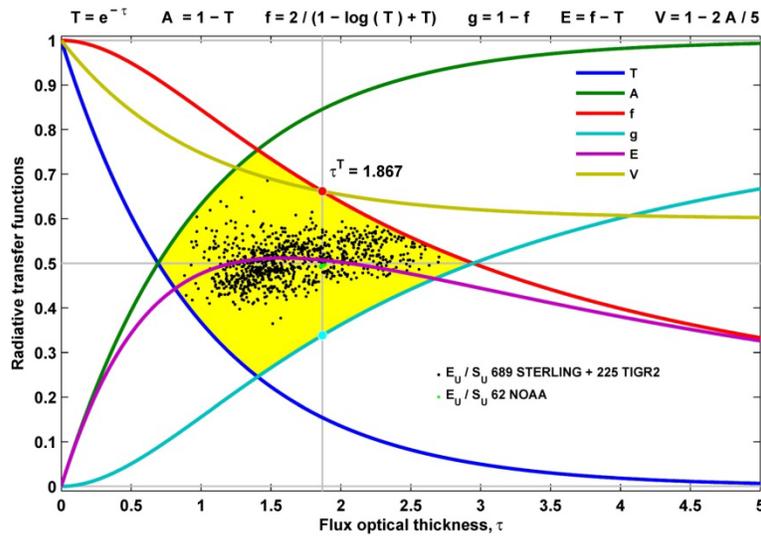
**Fig. 2** Comparisons of the vertical thermal and humidity profiles of the global average *TIGR2* (GAT) <sup>[D1–5]</sup> and the *US Standard Atmosphere, 1976* <sup>[R2–8]</sup> (USST76) atmospheres. Thin gray lines are the individual radiosonde data as it was observed by the TIGR2 global radiosonde archive. One has to notice the significant differences between the averages in both the thermal and humidity profiles (blue and red lines). Such differences adversely affect on the flux density simulations.



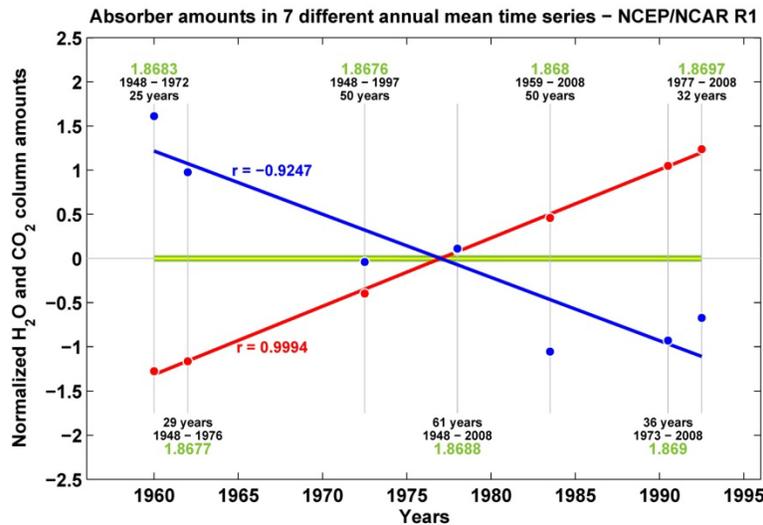
**Fig. 3** Helmholtz reciprocity principle requires the equal line of sight optical depth (and path transmittance) for every slanted atmospheric optical paths. In this test vertical and horizontal viewing were considered. High resolution HARTCODE spectral optical depth computations perfectly reproduces the principle. Note that the Helmholtz principle is not valid for spherically integrated (hemispheric) flux optical depths.



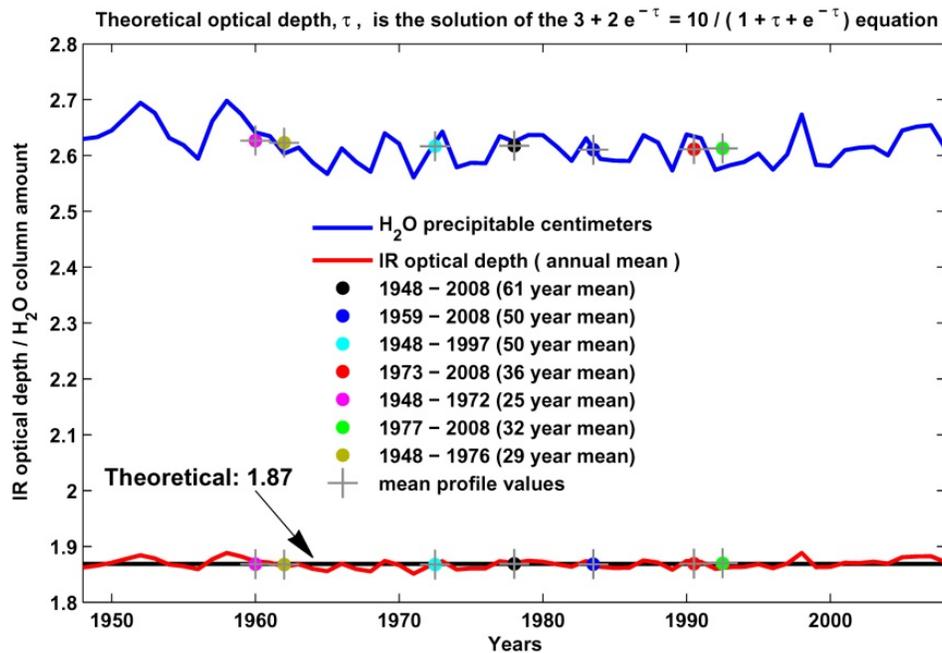
**Fig. 4** All-sky IR radiative flux components ( $\text{Wm}^{-2}$ ). The red, blue and green regions represent the sum of the clear, above cloud and below cloud portions (spherical shell sectors) of the atmosphere. This view is not a kind of simplified model, the flux density arrows are the real global mean fluxes of a spherical refractive atmosphere as it was observed by the TIGR2 global radiosonde archive. The numerical accuracy of the flux density components are five significant digits.



**Fig. 5** Radiosonde observations show that the  $E = E_U / S_U$  ratios and the optical depth  $\tau_A$  are theoretically constrained by the radiative transfer functions. Here  $T$ ,  $A$ ,  $f$ ,  $g$ ,  $E$ , and  $V$  are the transmission, absorption, transfer, greenhouse, emission and virial functions respectively (see the exact definitions later). The average  $\tau_A$  of the NOAA-R1 annual global means (green dots) and the global mean  $\tau_A$  of the GAT atmosphere are equal to  $\tau_A = 1.867$ .



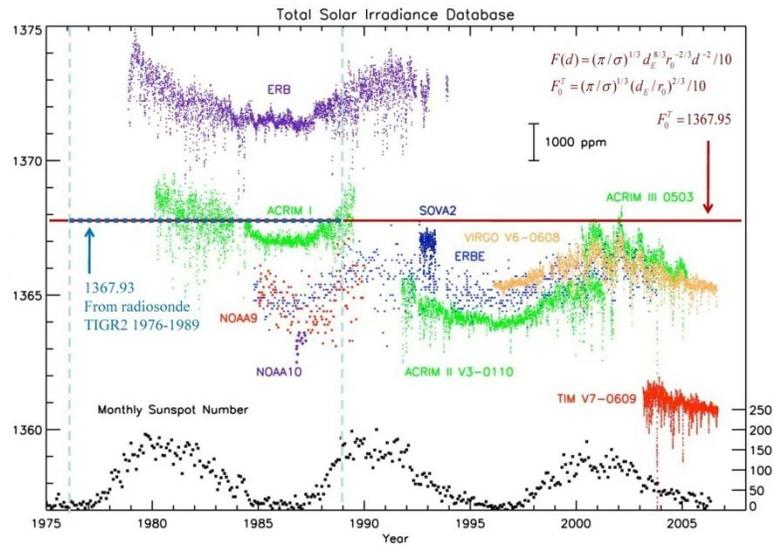
**Fig. 6** Changes of  $H_2O$  and  $CO_2$  (normalized) column amounts in 7 different time series. Data are from the NOAA-R1 (sometimes called NCEP/NCAR R1) radiosonde archive [D1–3]. The sign of the  $H_2O$  regression coefficient (in blue color) clearly an indication of the  $H_2O$  climate stabilizing role. The green and yellow trend lines (deviations from the sample mean and deviations from the  $\tau^T = 1.867$  theoretical value) show no tendency.



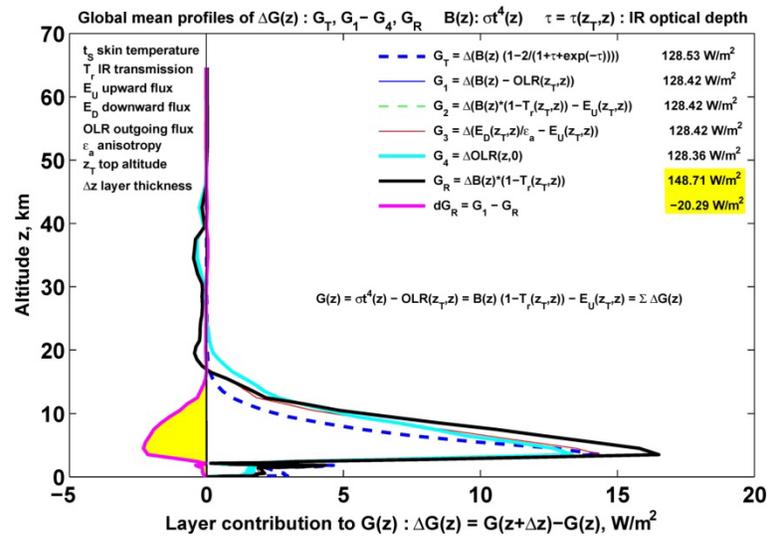
**Fig. 7** The constancy of the annual mean flux optical depth in 7 time series of different length. Computations were based on the NOAA-R1 radiosonde archive [D1–3].  $H_2O$  column amounts are in pcm. Notice that the random fluctuation in the IR optical depths (red line) correlate well with the  $H_2O$  column amounts (blue lines).

Time period	Centre Years	Altitude	Temperature	$H_2O$	$CO_2$	Tau	
1948–2008	1978	61	0.7931	0.8183	-0.2841	0.9839	0.06488
1959–2008	1983.5	50	0.8059	0.8349	0.04499	0.9937	0.2976
1948–1997	1972.5	50	0.6621	0.6625	-0.4843	0.9827	-0.2284
1973–2008	1990.5	36	0.6947	0.7987	0.1148	0.9974	0.3491
1948–1972	1960	25	-0.005748	0.1731	-0.5907	0.983	-0.4184
1977–2008	1992.5	32	0.58	0.7424	0.03992	0.9973	0.267
1948–1976	1962	29	0.001769	0.0584	-0.6048	0.9804	-0.4396

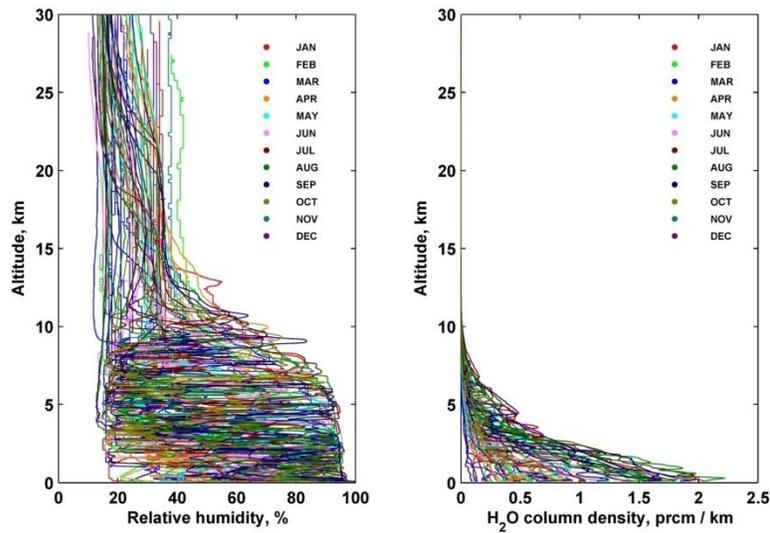
**Fig. 8** Trend line correlation summary of the seven NOAA-R1 time series. The last five columns are linear regression coefficients for the top altitude of the air column, surface temperature, water vapor and carbon dioxide column amounts, and the flux optical depth. The IR flux optical depth has no correlation with time and the strong signal of increasing atmospheric  $CO_2$  content in any time series is not present in the IR flux optical depth data [D1–3,R1–5]. Consequently, the atmospheric  $CO_2$  increase cannot be the reason of global warming.



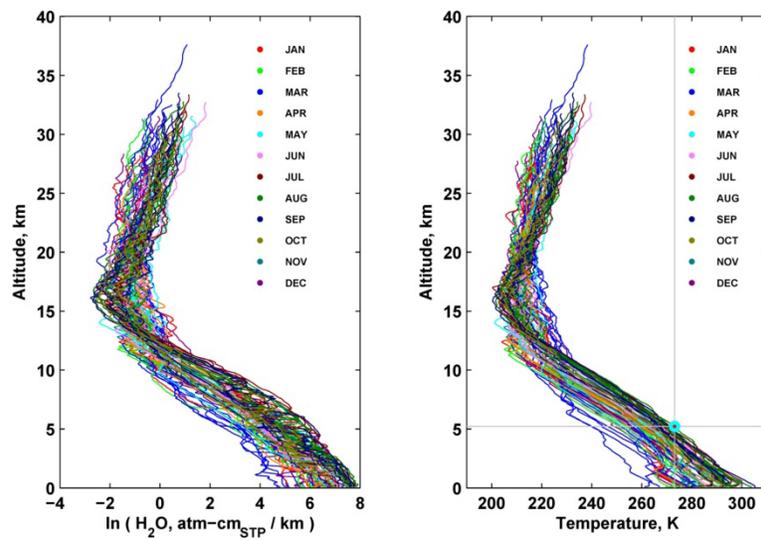
**Fig. 9** Comparisons of the theoretical solar constant with direct satellite observations in [R2–11], and with LW flux density simulations from the TIGR2 archive. The blue dotted line is at  $F_0^{obs} = 4S_U^A$ , and  $S_U^A$  is the all-sky global mean surface upward flux density from the active planetary surface. The  $F_0^{obs} = F_0^T$  is the indication of strict planetary radiative equilibrium. (TSI and fluxes are in  $Wm^{-2}$ .)



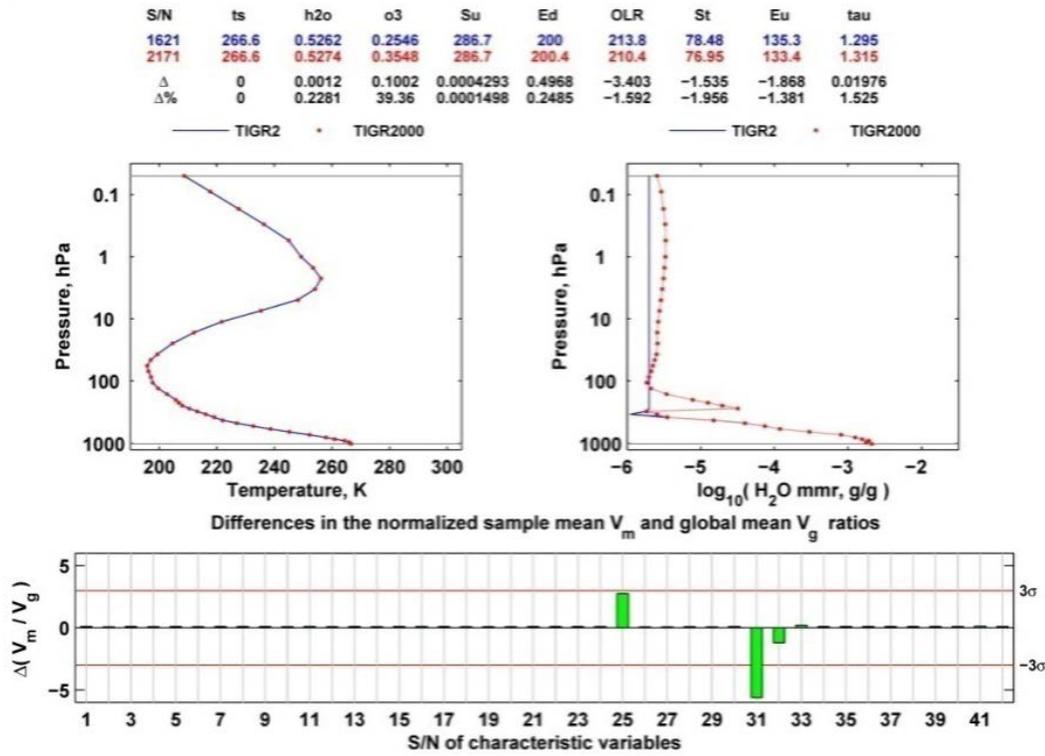
**Fig. 10** Layer contributions to the greenhouse factor. Except  $G_R$  in Raval and Ramanathan, 1989[R2–14] different greenhouse factors are in good agreement. The mathematically incorrect representation of  $G_R$  gives about  $-20 Wm^{-2}$  cumulative error (overestimate) at the TOA.



**Fig. 11** High resolution radiosonde observations from NOAA Sterling, Virginia. The  $\text{H}_2\text{O}$  column density directly enters to the LBL computation of the layer flux transmittance and optical thickness. The left panel shows, that the tropospheric relative humidity is a true stochastic component of the climate system.



**Fig. 12** High resolution radiosonde observations from NOAA Sterling, Virginia. The temperatures and  $\text{H}_2\text{O}$  column density are highly correlated, and they follow the relevant theoretical relationships. Many climatologists mistakenly call this relationship as positive feedback. The light blue dot around 5 km (in the right plot) is the observed maximum altitude of the  $\text{H}_2\text{O}$  condensation temperature at Sterling.



**Fig. 13** Evidences of large scale data manipulation in radiosonde observations. Comparing the two versions of the TIGR database shows that in more than 50 % of the humidity profiles the upper tropospheric  $H_2O$  mass mixing ratio were increased. In this example the changes resulted in  $3.4 \text{ Wm}^{-2}$  decrease in OLR and significant increase in the flux optical depth. In the lower plot variables #25  $sn_G$  and #31  $exw_{m,G}$  are outliers. See the text for the definitions of  $sn_G$ ,  $exw_{m,G}$ .

#### Planetary radiative equilibrium cloud cover at $h^c$ altitude

$$F_A = (1 - \beta^A) \text{OLR} + \beta^A \text{OLR}^c$$

$$F_E = (1 - \beta^E) S_U + \beta^E S_U^c$$

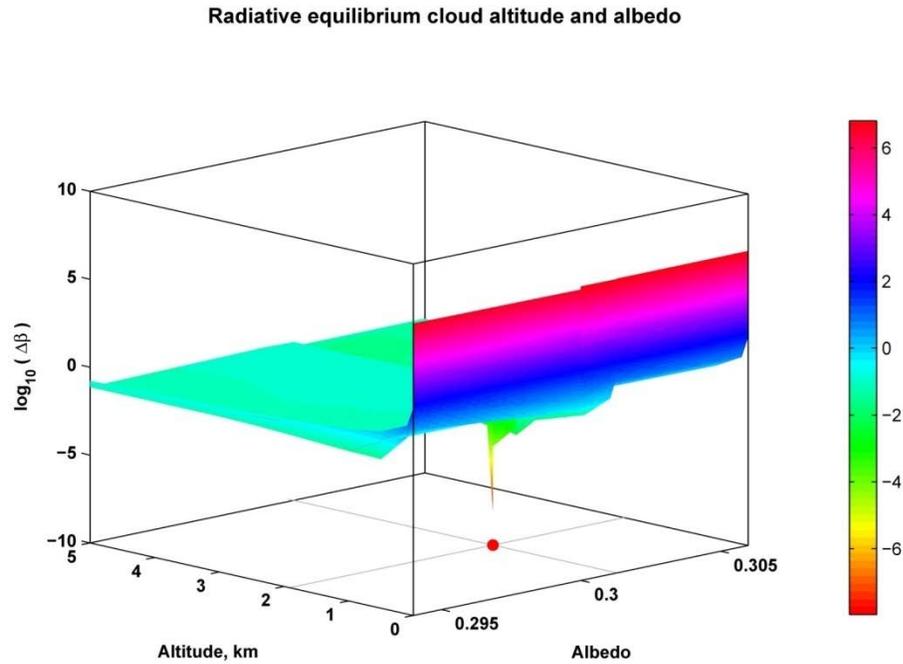
$$\beta^A (F_A, h^c) = (F_A - \text{OLR}) / (\text{OLR}^c (h^c) - \text{OLR})$$

$$\beta^E (F_E, h^c) = (F_E - S_U) / (S_U^c (h^c) - S_U)$$

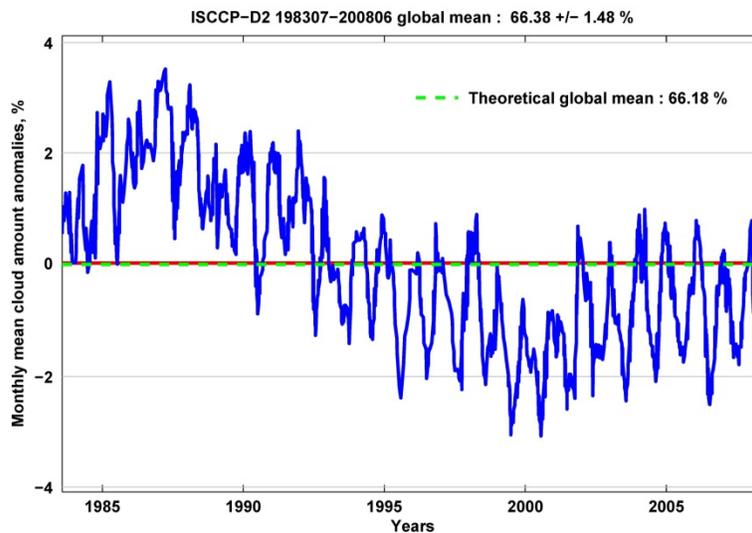
$$F_A = (1 - \alpha_B) F_E$$

$$\min ( \| \beta^A (h^c, \alpha_B) - \beta^E (h^c, \alpha_B) \|^2 )$$

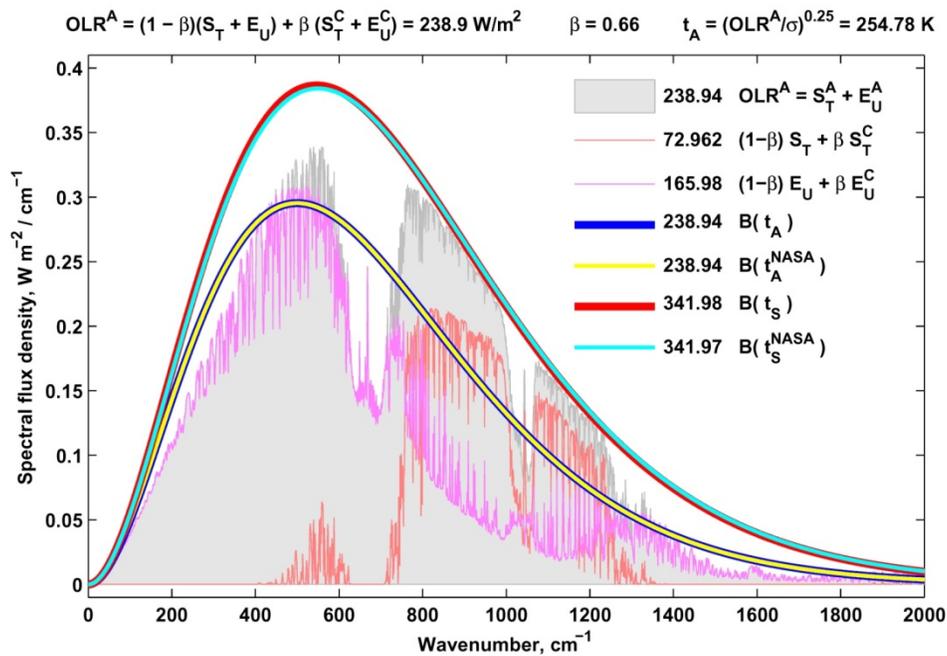
**Fig. 14** Radiative equilibrium cloud cover constraints. At the TOA LW fluxes from the APS must be equal to  $F_E$ , the all-sky outgoing LW radiation must be equal to  $F_A$ , and the cloud covers from the two constraints must be equal.



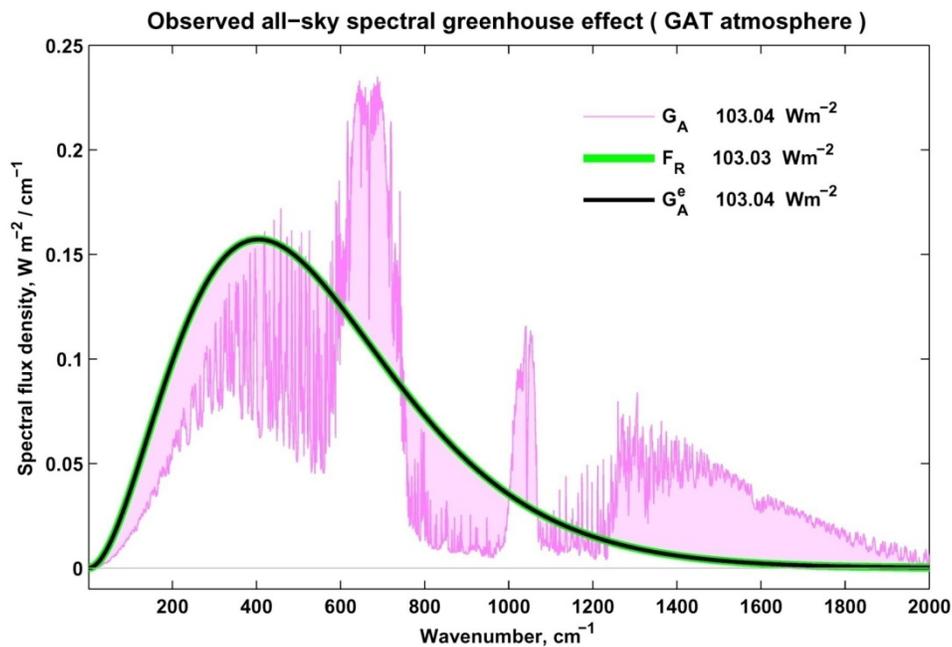
**Fig. 15** The multi-parameter optimization algorithm. Sharp minimum found at  $\alpha_B = 0.3013$  and  $h^C = 1.9166$  km.



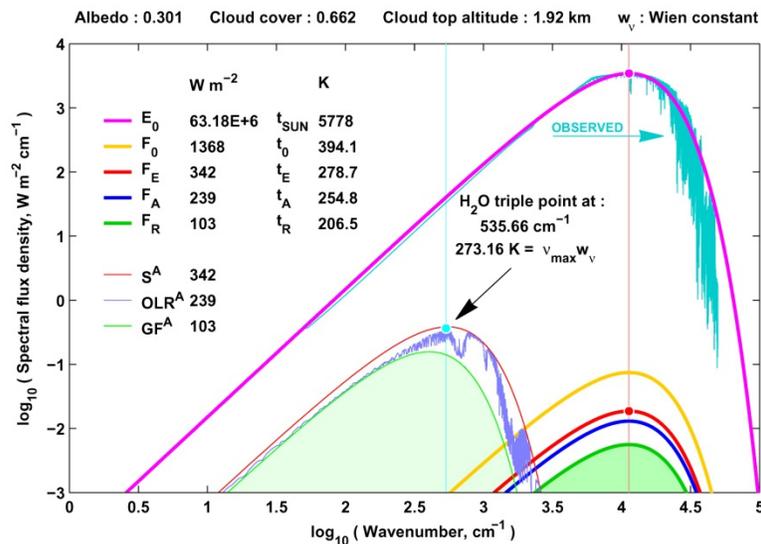
**Fig. 16** The theoretical cloud cover (green dashed line) is compared with satellite observations in the 1983-2008 time interval (red line). The agreement is well within the uncertainty of the satellite observations. The theoretical equilibrium cloud cover is practically equal to the theoretical transfer function:  $\beta = 2(1 + \tau^T + \exp(-\tau^T))^{-1}$ , where  $\tau^T = 1.8676$  is the theoretical equilibrium flux optical depth.



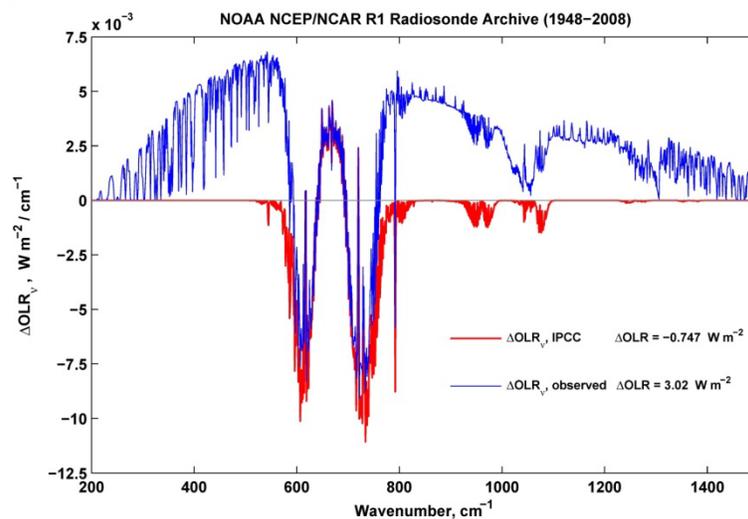
**Fig. 17** Flux density spectra of the all-sky GAT atmosphere. The equivalent blackbody spectra  $B(t_A)$ , and  $B(t_S)$  are equal to the equivalent spectra from  $B(t_A^{NASA})$ , and  $B(t_S^{NASA})$ . This is indication that the GAT atmosphere is close to the real global average atmospheric structure.



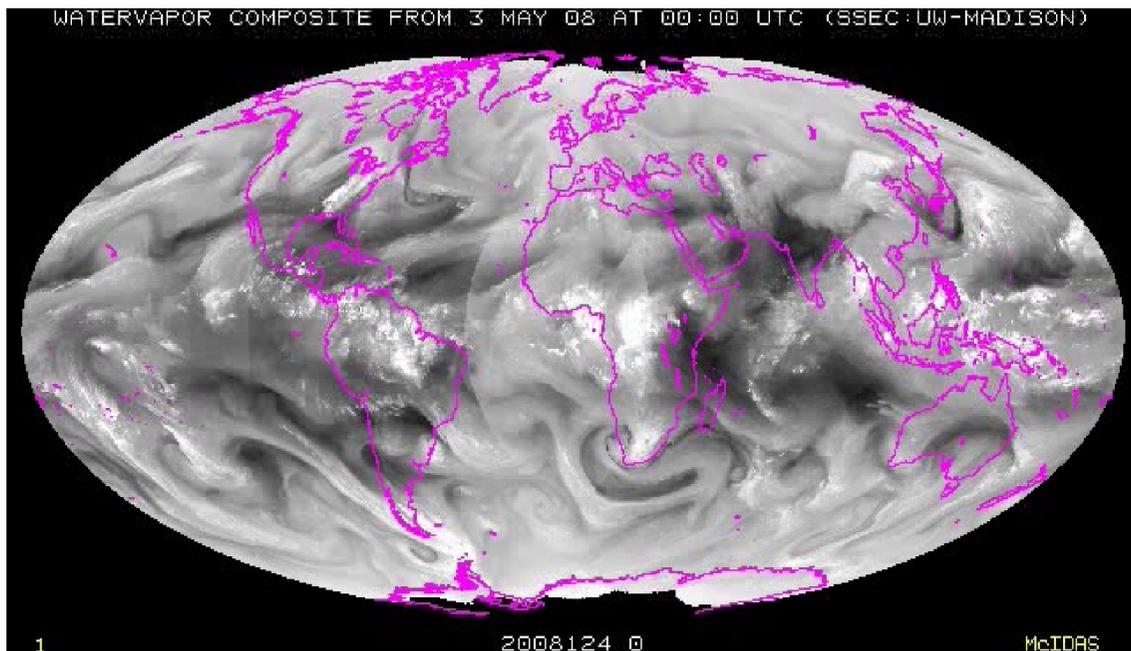
**Fig. 18** Spectral all-sky greenhouse effect referenced to the APS. The integrated flux densities from the  $G_A$  and  $F_R$  curves agree reasonably well. While the surface referenced clear sky greenhouse effect ( $\sigma t_G^4 - OLR^A = 154.5 \text{ Wm}^{-2}$ ) has no clear physical meaning the APS referenced GF can easily be associated with the deposited momentum by the reflected radiation.



**Fig. 19** Solar and terrestrial equilibrium blackbody spectra. The observed solar reference spectrum (dark cyan line) is from *Chance and Kurucz, 2010*<sup>[R2–10]</sup>. The light blue line is the observed TOA  $OLR^A$  from the TIGR2 radiosonde archive. The light cyan dot at the maximum of the  $OLR^A$  shows that the Earth has a special orbit where the Wien temperature is equal to the  $t_p$  phase temperature of the H<sub>2</sub>O. Obviously  $OLR^A$  has the maximum entropy flux density.



**Fig. 20** Comparison of the observed and expected changes in the clear-sky spectral  $OLR$ . The IPCC type no-feedback response to 23.56 % increase in carbon dioxide is negative. The real atmosphere does not follow the GHG GE hypothesis of the IPCC, [R1–17] pp. 34 Fig. 1. The observed true change in the  $OLR$  is positive and the atmosphere does not resume the initial state. The fictitious no-feedback response is unrelated to climate change.



**Fig. 21** Satellite view of the changes in the upper tropospheric humidity field. The global mean atmospheric IR emission to space is controlled by the chaotic changes of the humidity field. GCMs are unable to model the stochastic nature of the radiation climate, and the theoretical constraints governing the global mean radiation components are also not part of the GCMs. Click to activate the video.

**From: Michael Scherr**  
**Sent: Friday, September 16, 2016 5:47 PM**  
**To: 'fmiskolczi@cox.net' <fmiskolczi@cox.net>**  
**Subject: RE: Mann vs. Ball et al.**

The purpose of the report is to assist the court and not to be an advocate for any of the parties. This duty is so important that the civil rules require that you, as an expert, provide a certification that you are aware of the duty to assist the court and not be an advocate for any party, that you have made your report in conformity with that duty and that if called upon to give oral or written testimony, you will give that testimony in conformity with your duty to assist the court and not advocate for either party.

Thus, in preparing any report, it should be written from a neutral and impartial perspective. If the report is biased or argumentative, it may well be excluded from evidence.

The necessary components that are required in every expert's report are as follows:

1. The expert's signature;
2. The certification of impartiality referred to above;
3. Your name, address, and area of expertise;
4. The instructions provided to you as an expert;
5. The nature of the opinions being sought and the issues that it relates to;
6. Your opinion respecting the issues referred to above;
7. Your reasons for your opinion, including:
  - a. A description of the factual assumptions;
  - b. A description of any research conducted by you and in respect of your opinion; and
  - c. A list of every document relied on by you in forming the opinion. Thus, you must list and describe every document in sufficient details for others to be able to review those documents that are relied on in forming your opinion.

Under the Rules of Court, it is also important to understand that your complete expert file is subject to disclosure upon demand. This is a marked departure from many jurisdictions where the expert's file cannot be obtained until trial. Under our Rules of Court, a party of record may request to review and copy the expert's file relating to the preparation of the opinion. If the request is made 14 days before a scheduled trial date, the expert must reply promptly and if the request is made at any other time, the expert must comply with the request at least 14 days before the scheduled trial date. As a result, everything that is written down may be producible to opposing counsel upon demand.

Specifically, our Rules state that we must provide any written statement or statements of facts upon which your report or opinion is based promptly on being asked. We must produce any record of any independent observations made by you as an expert in relation to the report promptly upon being asked. We must produce any data compiled by you in relation to the report

promptly upon being asked. We must produce the results of any tests conducted by or for you, or if any inspection conducted by you, if you have relied on that test or inspection in forming your opinion. This is in addition to the obligation to produce the entirety of your file set out earlier.

My suggestion as to format is that the report ought to be provided into segments and each segment should have a separate heading. If the report is lengthy, a table of contents ought to be provided. At a minimum, the following sections should be included:

1. Certification: The certification section which will include the required statement concerning your duty to the court:
2. Introduction and Background: An introduction and background in which the identification of the subject matter of the report is set out and the purpose for which it is being presented.
3. Qualifications: Your qualifications as an expert. Your resume will also be attached to the report as an exhibit but under this heading you should summarize your particular experience and qualifications that are relevant to the subject matter of the report. This helps the court to understand your expertise as it relates specifically to the issue before the court.
4. Facts and Assumptions: As the nature of your report will be somewhat technical in an area which I do not possess expertise, I will require your assistance in framing the facts and assumptions which you are to assume for the purpose of your report. These are the facts which we will need to prove based on the evidence before the trial judge. In addition, in this section you should list any of the documents that you have relied upon for the purpose of obtaining information or formulating your opinion.
5. Questions to be addressed: Under this heading, the specific questions we have asked you to express an opinion on should be set out.
6. Opinion: Here is where you would actually set out the body of your opinion with respect to the question posed. Where there are multiple questions, it is preferable to address each one separately with discrete subheadings in a logical order.

What I will need to understand is:

1. What are the key facts that should be provided to the court to ensure a full understanding of the issue upon which you express an opinion?
2. What are the sources for the facts? I assume many facts are based on observations and data collected by others so we will need to know the details of these facts.

The issues for your opinion are:

1. **Greenhouse gas theories contradict energy balance equations;**
2. **The proposed a greenhouse effect due to anthropogenic carbon dioxide emissions is not supported by observed atmospheric thermal and humidity structures and global scale simulations of the infrared absorption properties of the Earth's atmosphere. Analysis of the foregoing shows that the proposed greenhouse effect is impossible.**

As an expert, you are only entitled to provide opinion evidence in an area in which you have specialized knowledge. Thus, if you do not have specialized knowledge with respect to any of the issues we have posed to you, please contact me to discuss the same. It may well be necessary to obtain an alternate expert to address that point. It is much better to say so now than to attempt to answer the question based on limited expertise.

**Michael R. Scherr, Managing Partner**

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Barristers and Solicitors  
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**Independent Research Scientist****2006-present**

Due to unresolved publication issues that was related to my anthropogenic global warming related results in 2006 I resigned from my last job at the Analytical Services & Materials Inc. (former NASA contractor). Since then my research interest remained the theoretical and empirical problems of the CO<sub>2</sub> greenhouse effect based hypothetical global warming.

**PROFESSIONAL EXPERIENCE****Senior Principal Scientist****2001-2006**

*Analytical Services & Materials Inc., Hampton, Virginia*

- Analyzed the information content of the far infrared spectral range for remote sensing of the water vapor and temperature profiles using hyper-spectral measurements. Developed spectral filtering and cleaning procedure for the comparisons of the AIRS – CERES window radiances. Worked on the far infrared climatology and the theoretical assessment of the far infrared greenhouse effect. Derived a mathematically correct relationship between the surface upward and outgoing longwave radiation for semitransparent planetary atmospheres in radiative equilibrium. Developed new greenhouse effect formulation for global change applications. For BSRN radiation measurement applications (at the Chesapeake Lighthouse, North Atlantic Ocean) I developed an interactive quality checking and correction software. Worked on the problems of aerosol sounding in the oxygen-A band using the NASA- LAABS narrow-band visible spectrometer.

**Senior Principal Scientist****1999-2001**

*Raytheon STX Corporation, Lanham, Maryland*

- Worked on the development of the data evaluation software for the Ozone Mapping and Profiling Suite (OMPS) instrument of the National Polar-orbiting Operational Environmental Satellite System. In particular, developed correction algorithms for the limb sensor to compensate for the line-of-sight irregularities in the vertical ozone profile.

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**PROFESSIONAL EXPERIENCE (Continued)****Assistant Research Scientist****1996-1999***Department of Meteorology, University of Maryland*

- Involved as a Co-Principal Investigator in a NASA EOS validation project. Deployed multi-channel sun-tracking photometers with satellite uplink at various geographical locations for validating aerosol optical depth retrievals.
- As a station scientist of the Ilorin BSRN station in Nigeria deployed a full set of radiation measurement instrumentation. Continuously monitored the routine operation of the station, performed the quality control and reporting obligations toward the WMO.
- Worked on projects related to the Global Imager (GLI) instrument of the Advanced Earth Observing Satellite II (ADEOS) of National Space Development Agency (NASDA) of Japan. Developed algorithms for retrieval of surface temperature, outgoing long wave radiation (OLR) and precipitable water from radiances of the ADEOS and GOES Imagers.
- Implemented CO<sub>2</sub> Q-band line mixing computation algorithm into the HARTCODE line-by-line computer code using the most accurate relaxation operator method.
- Worked on the evaluation of the performance of the HIS and other infrared interferometers, and joined in several validation campaigns aimed to identify the deficiencies of the different high-resolution spectral radiance codes. Focused on the problems of the accurate empirical H<sub>2</sub>O continuum parameterization.

**Research Associate****1991-1996***Department of Meteorology, University of Maryland*

- Worked on the measurement and utilization of the photosynthetically active radiation (PAR) and its optimal conversion to photosynthetic photon flux density (PPFD).
- Developed the spectral flux version of HARTCODE line-by-line radiative transfer code. Using the improved HARTCODE flux algorithm, evaluated the operational accuracies of pyrgeometers.

**Research Associate****1987-1989***International Center for Theoretical Physics, Trieste, Italy*

- Worked on problems of validation of satellite IR measurements and the evaluation of surface downward IR radiation flux density, using pyrgeometers. Determined the quantitative effect of the non-uniform spectral distribution of the (silicon) dome transmittance on the accuracy.

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**PROFESSIONAL EXPERIENCE (Continued)**

- Awarded research grants by the International Center for Theoretical Physics, to work at the Istituto per lo Studio delle Metodologie Geofisiche Ambientali (IMGA-CNR) in Modena, Italy, on problems of radiation measurements and radiative transfer, in particular, on the development of a new IR high-resolution transmittance code (HARTCODE).

**Senior Lecturer****1983-1987***Department of Physics, University of Calabar, Calabar, Nigeria*

- I worked as the leader of the Atmospheric Physics Group and the Geo-environmental Field Station, was a member of the Departmental Graduate Committee and Chairman of the Laboratory Physics Program Panel.
- Taught physics, physical meteorology, meteorological instrumentation and data analysis at both undergraduate and graduate level.

**Head of the Department of Atmospheric Radiation****1975-1983, 1990-1991***Institute for Atmospheric Physics, Budapest, Hungary*

- Organized and performed various field measurement projects as needed for industrial and regional planning. Also, worked on the computerization of radiation measurements and implementation of new measuring instruments at the Budapest BSRN station.
- Participated with standard radiometers and a Dobson spectrophotometer in international calibration campaigns organized by the WMO in Davos and Arosa, Switzerland.
- In cooperation with the Department of Atomic Physics of the Eötvös University (in Budapest, Hungary) I worked on the problems of the greenhouse effect and the thermal history of the Earth.

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**EDUCATION**

- Ph.D. Degree in Earth Sciences, (1981)  
Hungarian Academy of Sciences, Budapest, Hungary  
Thesis:  
*Determination of Total Ozone and the Main Characteristics of the Vertical Distribution of Ozone Using Satellite Infrared Measurements.*
- Ph.D. Degree in Physics, (1975)  
Eotvos Lorand University, Budapest, Hungary  
Thesis:  
*Evaluation of the CO<sub>2</sub> Atmospheric Transmission Functions for Remote Sensing of Temperature Profiles.*
- MS. Degree in Physics, (1971)  
Eotvos Lorand University, Budapest, Hungary  
Thesis:  
*Activation Analysis Using 14MeV Neutrons.*
- Diploma in High-level Computer Programming, (1974)  
International Educational Center for Computer Technique, Budapest, Hungary

**SELECTED PUBLICATIONS and PRESENTATIONS**

1. G. MARX and F. MISKOLCZI, (1981):  
The CO<sub>2</sub> Greenhouse Effect and the Thermal History of the Atmosphere  
*Advances in Space Research, Vol. 1, pp. 5-18, © COSPAR, 1981, Printed in Great Britain*
2. F. MISKOLCZI, (1989):  
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3. F. MISKOLCZI and R. GUZZI, (1993)  
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4. F. MISKOLCZI, (1994)  
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5. F. MISKOLCZI, R. T. PINKER and T. O. ARO, (1997)  
Surface Radiative Fluxes in Sub-Sahel Africa  
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6. F. MISKOLCZI (2000)  
Remote Sensing Using the IR Channels of the Global Imager on Board the Advanced Earth Observing Satellite II.  
*Presentation at the National Oceanic and Atmospheric Administration, Silver Spring. Washington DC. in 2000, 1-50*
7. F. MISKOLCZI (2002)  
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*IDŐJÁRÁS, Vol. 105, No. 4 - Vol. 106, No. 1, October 2001-March 2002, 243-251*
8. R. RIZZI, M. MATRICARDI and F. MISKOLCZI, (2002)  
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9. F. M. MISKOLCZI and M. G. MLYNCZAK, (2004)  
Implementation of CO<sub>2</sub> Q band line mixing computations into line-by-line atmospheric radiative transfer codes  
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**SELECTED PUBLICATIONS and PRESENTATIONS (Continued)**

10. F. M. MISKOLCZI and M. G. MLYNCZAK (2004)  
The greenhouse effect and the spectral decomposition of the clear-sky terrestrial radiation.  
*IDŐJÁRÁS, Vol. 108, No. 4, October–December 2004, 209–251*
11. D. P. KRATZ, M. G. MLYNCZAK, C. J. MERTENS, H. BRINDLEY, L. L. GORDLEY, J. MARTIN-TORRES, F. M. MISKOLCZI, D. D. TURNER (2005)  
An inter-comparison of far-infrared line-by-line radiative transfer models  
*JQSRT, Vol. 90 (2005) 323–341*
12. F. M. MISKOLCZI and M. G. MLYNCZAK (2005)  
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13. R. SAUNDERS, P. RAYER, P. BRUNEL, A. von ENGELN, N. BORMANN, L. STROW, S. HANNON, S. HEILLIETTE, X. LIU, F. MISKOLCZI, Y. HAN, G. MASIELLO, J.-L. MONCET, G. UYMIN, V. SHERLOCK, and D. S. TURNER (2007)  
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*JGR-Atmosphere, Vol. 112, D01S90, 2007, 1-17*
14. F. M. MISKOLCZI (2007)  
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<http://www.seipub.org/des>