
# Rebuttal of Miskolczi's alternative greenhouse theory

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Presentation & discussion
Greenhouse theory of Miskolczi
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## *What is issued here?*

- **Conclusion Miskolczi (2010):**

***More $CO_2$ does not result in a global temperature increase.***

- **We show his theory to be incorrect because:**

-***No support from observations***
-***At odds with fundamental physics***
-***At odds with Miskolczi's own theory***

## Outline

- What is the greenhouse effect?
- What do observations show?
- Miskolczi claims a constant greenhouse effect. Why?
- Conclusion

## Greenhouse effect

- Radiation
- Energy budgets
- Climate sensitivity
- Temperature response

## Radiative Balance of the Climate System

Incoming Solar Radiation
**341** $Wm^{-2}$

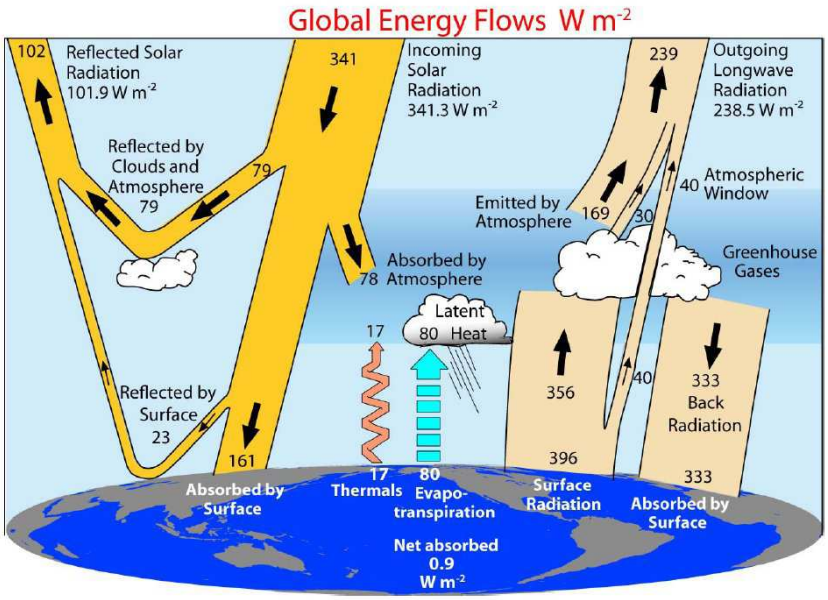
Reflected Solar Radiation
**102** $Wm^{-2}$ (about 30%)

Outgoing Infrared Radiation
**239** $Wm^{-2}$

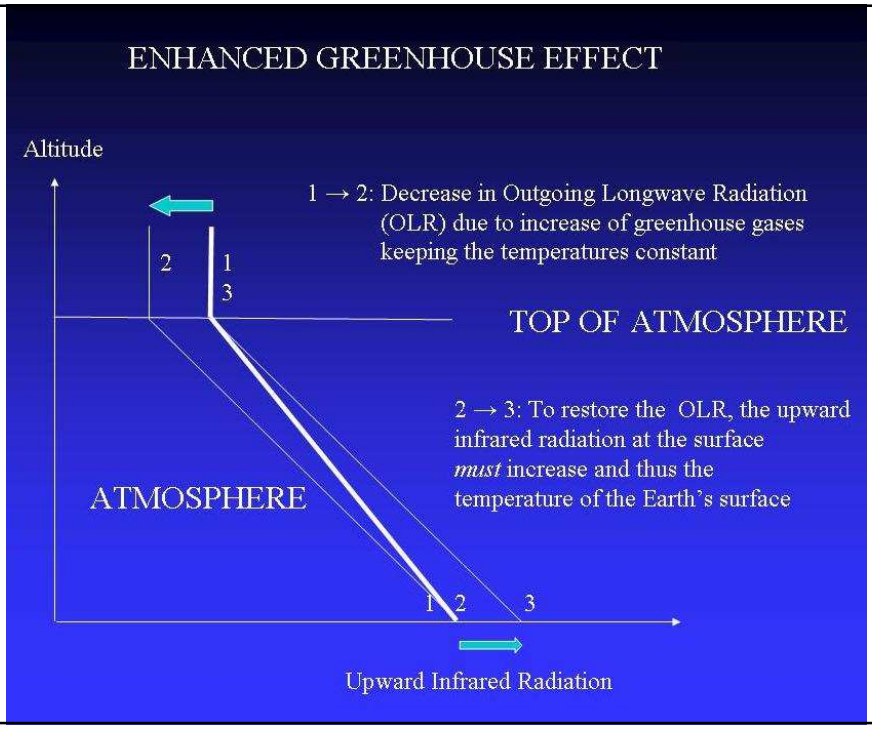
## Conservation of energy

- **This physical law tells us that on the long term the energy we receive from the sun must be balanced by the energy leaving the earth (in the form of infrared radiation).**

- **This energy balance is realized *on the long term*, since the earth possesses a heat capacity (oceans, ice caps) by which energy can be temporarily stored in the system.**




Source: Trenberth et al., 2009

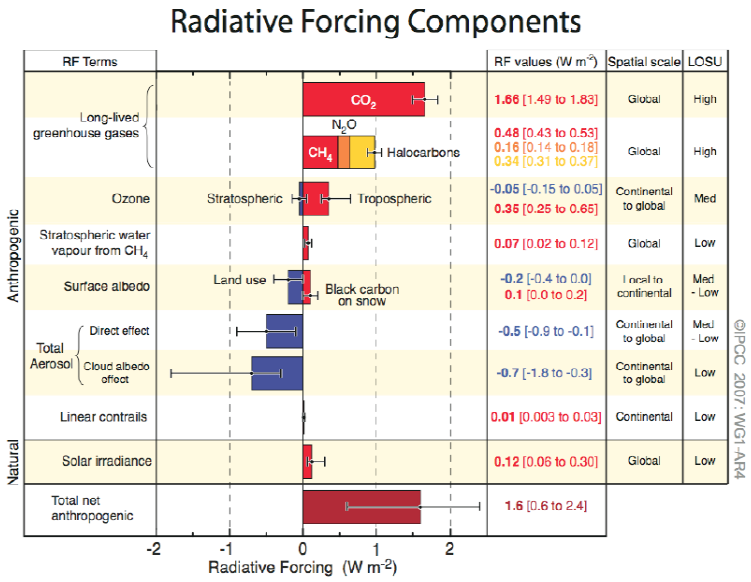


## Relation temperature and upward longwave radiation at the surface

- **The earth's surface absorbs (almost) all incident longwave radiation**
- **Materials with this property are called 'Black Bodies'**
- **They emit longwave radiation (E) according to the 'law of Stefan-Boltzmann', connecting E with temperature (T):**

$$E = \sigma T^4$$

## Radiative Forcing



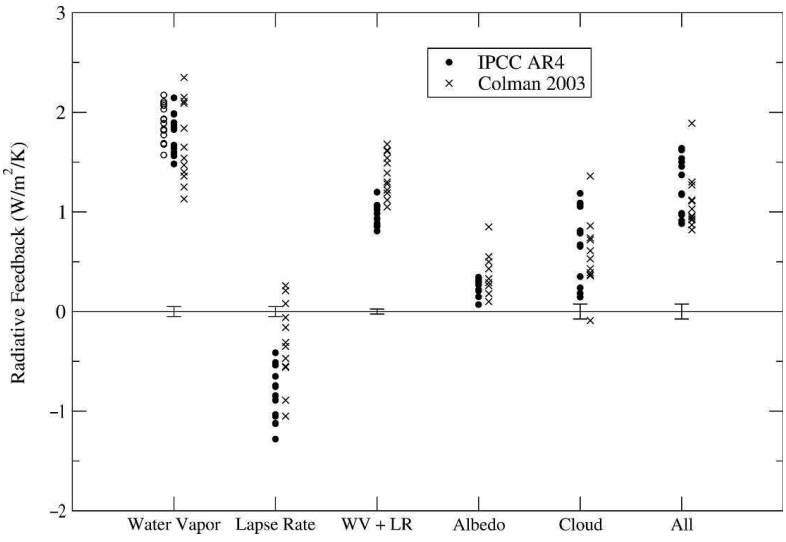
## Radiative Forcing and Climate Response

- **Radiative imbalances can be translated into global mean temperature changes**
- **Conversion factor is the climate sensitivity (λ) parameter, modified by an attenuation and delay due to the heat capacity of the oceans ($f_{oc}$):**

$$\Delta T = f_{oc} \bullet \lambda \bullet \Delta F$$

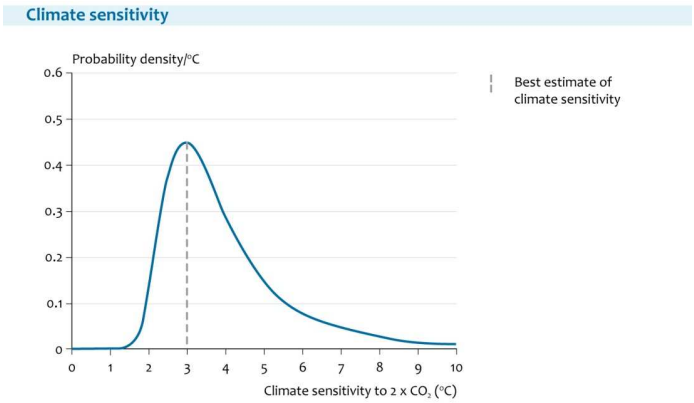
- **The climate sensitivity (using equilibrium response, $|f_{oc}|=1$) in the present generation of GCMs ranges from 0.5 to 1.2 K per $Wm^{-2}$ (best estimate: 0.8 $K/Wm^{-2}$)**
- **Climate sensitivity is model dependent, but independent of the forcing mechanism**
- **Range in λ is mainly caused by differences in the (model)description of temperature dependent processes**

## Feedbacks



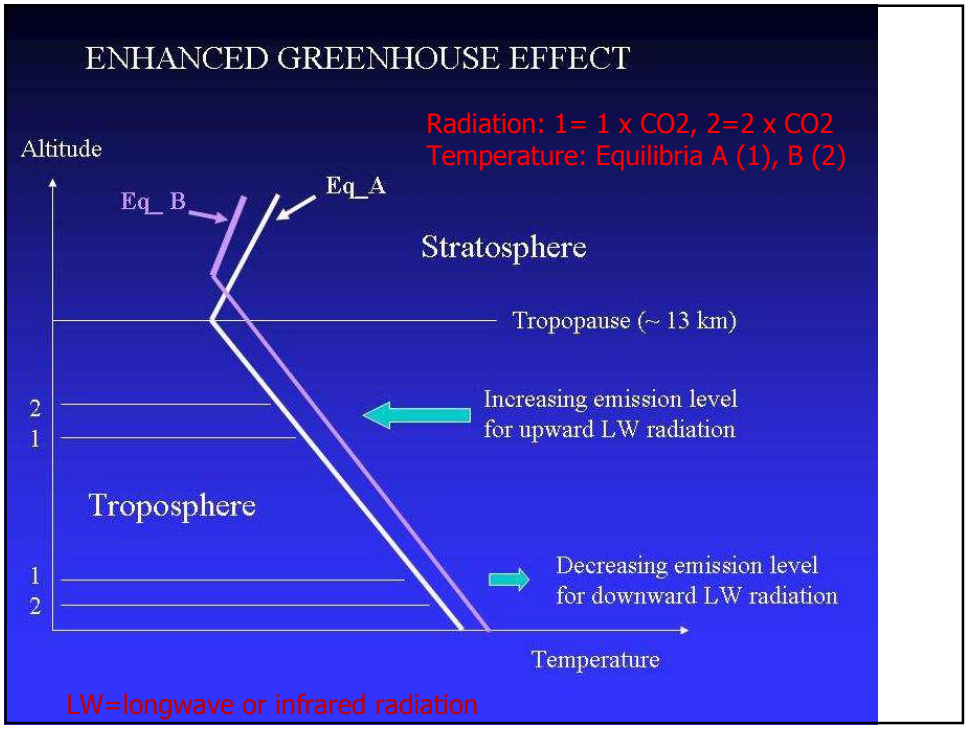

Source: Soden & Held, 2006

# Climate Sensitivity




Conclusions of IPCC AR4:

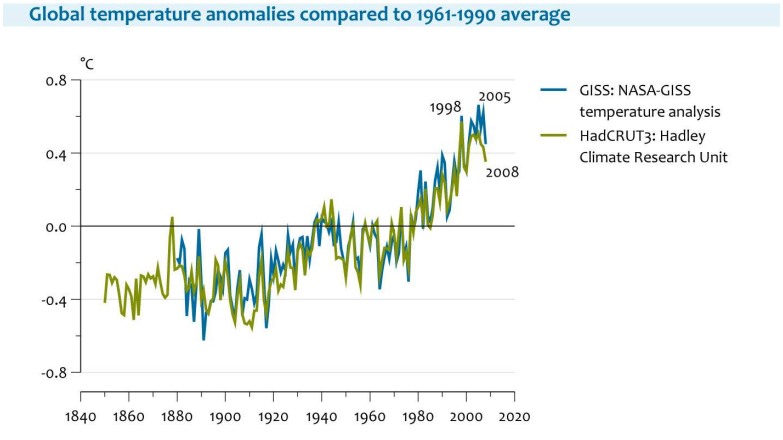
- Best estimate is 3ºC.
- Range: 2 – 4.5ºC, but higher values cannot be ruled out.



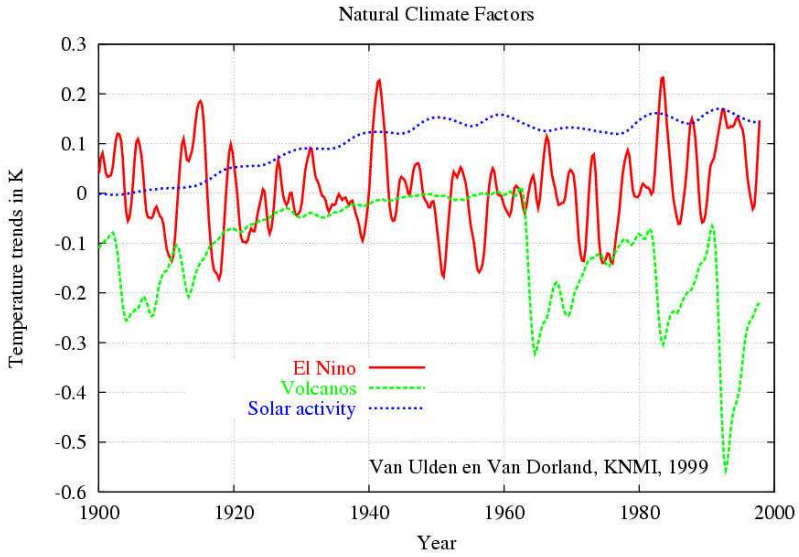
## Observations

- **Temperature**
- **Water vapour**
- **Radiation**

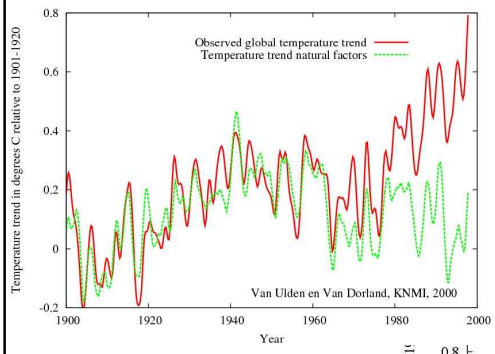
# Global mean temperature



## Linear regression: natural drivers 1900-1998

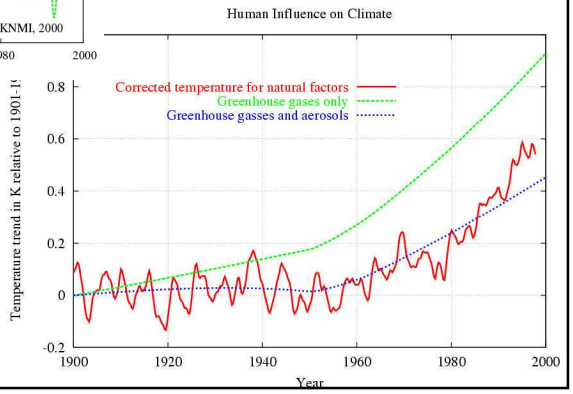



## Attribution of 20th century warming

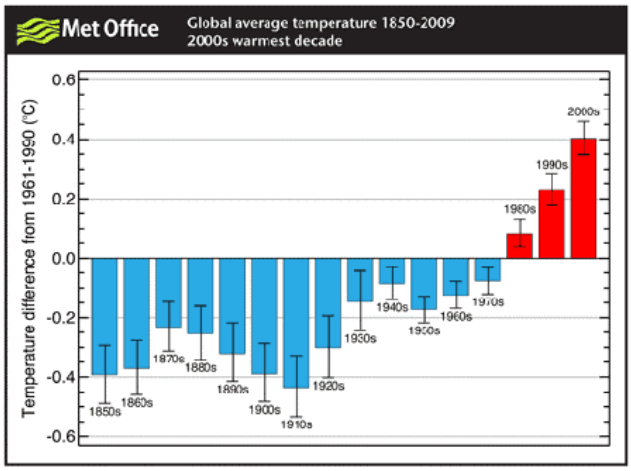



**Temperature trends: Observation & Calculated sum of natural factors**

**Human Influence?**



# 2000-2009 warmest decade




# Upward trends in water vapour in agreement with greenhouse theory

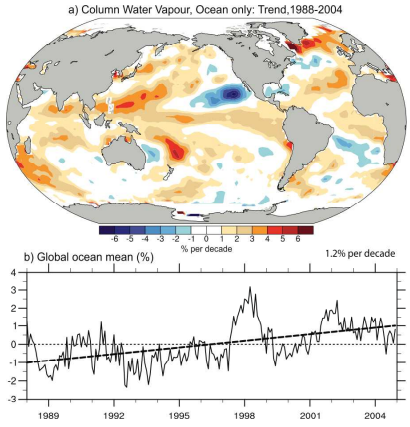
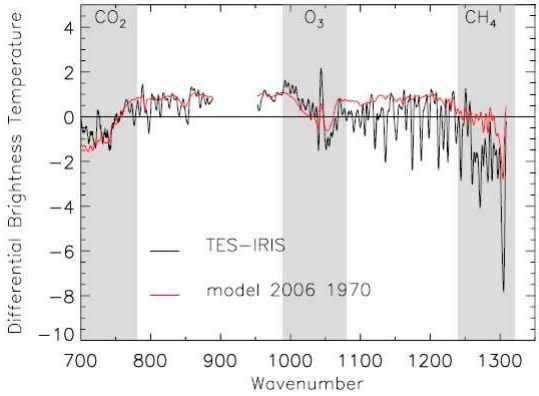



Figure 3. 20

Linear trends in total column water vapour in % per decade (top) and monthly time series of anomalies relative to the 1988 to 2004 period in % over the global ocean plus linear trend (bottom)
(Source: IPCC, 2007)

## Trends in radiation confirm greenhouse theory




Observed difference spectrum (black line) between 2006 and 1970 (TES – IRIS) and the simulated difference spectrum (red line) for the same time interval.

(Source: Chen et al., 2007; Spectral signatures of climate change in the Earth's infrared spectrum between 1970 and 2006)

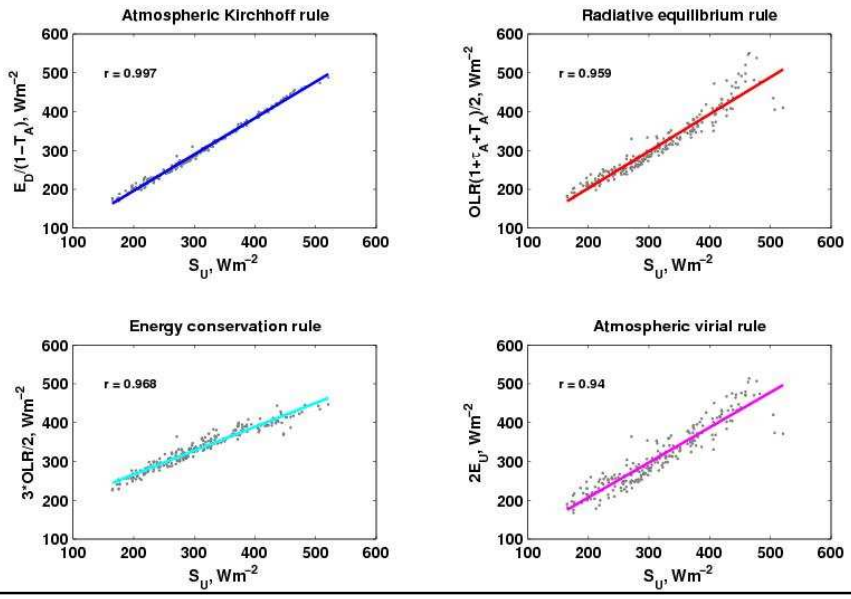
## Why does Miskolczi claim a constant greenhouse effect?

- **Calculations of Miskolczi do not support his own conclusions**
- **To support his own theory, Miskolczi uses data, which are proven inadequate for this purpose**

## Miskolczi's calculations

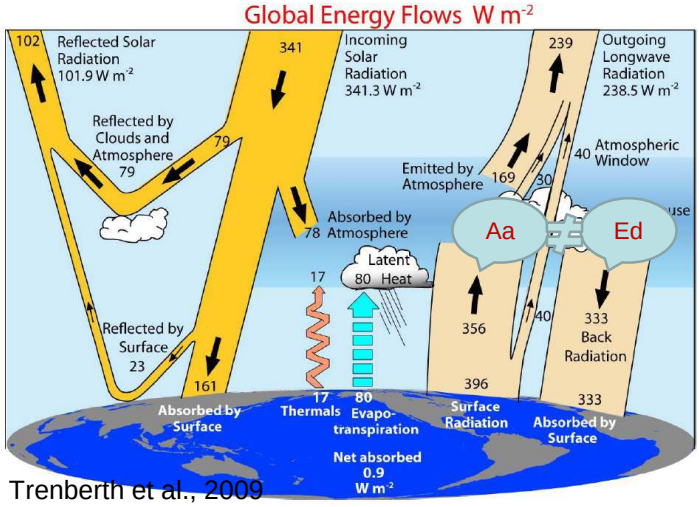
- 228 profiles of temperature, water vapour and ozone, from weather balloon observations (clear-sky)
- Radiation calculations using HARTCODE
- Derivation of new relationships ('rules') between various radiative flux components
- Comparison results with NOAA NCEP/NCAR reanalysis

## Miskolczi's rules (2007)



## ‘Radiative exchange equilibrium’ law:

**Downward thermal infrared flux at the surface (Ed) equals the absorbed infrared radiation from the surface (Aa)**




Source: Trenberth et al., 2009

## ‘Radiative exchange equilibrium’ law

**(atmospheric Kirchhoff rule in 2007)**

- **Miskolczi: Downward thermal infrared flux at the surface (Ed) equals the absorbed infrared radiation from the surface (Aa)**

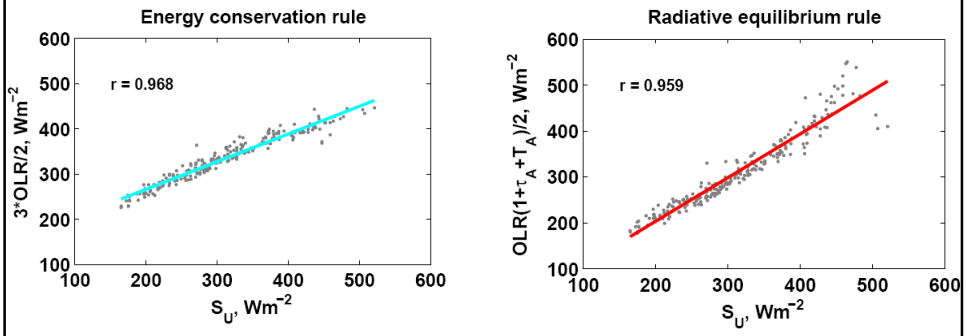
- **Rebuttal:**

**- Ed is approximately equal to Aa due to the fact that most of the surface flux is absorbed in the lower atmosphere, while the downward flux originates largely from the same region. <u>This is greenhouse theory</u>.**

**- Large differences between Ed and Aa would imply huge temperature fluctuations, <u>we don’t observe</u>.**

**- With his overstatement Miskolczi puts an additional unphysical constraint on atmospheric transfer, <u>making things constant, which are in fact variable</u>.**

# Consequences rules Miskolczi (2007)




Blue line: 1.5 OLR = 0.6 Su + 150
Red line: OLR = f(τA) Su , where $f(\tau_A)= 2/\{1+\tau_A+\exp(-\tau_A)\}$

Combined: $OLR=100/(1-0.4/f(\tau_A))$ → the optical thickness ($\tau_A$) determines the OLR
Note: optical thickness is a measure of the total amount of greenhouse gases

**This is at odds with the fact that OLR is determined by both the upward radiation at the surface (Su) and the optical depth ($\tau_A$) in**
**1) the observations**
**2) in Miskolczi's own plots!**

# Optical depth fixes Su and OLR!

| $\tau_A$ | $f(\tau_A)$ | Su ($Wm^{-2}$) | OLR ($Wm^{-2}$) |
|---|---|---|---|
| 0 | 1 | 167 | 167 |
| 1 | 0.84 | 227 | 191 |
| 1.87 | 0.66 | 382 | 253 |
| 2 | 0.64 | 420 | 268 |
| 3.98 | 0.40 | ∞ | ∞ |

**Su** is the upward infared radiation at the surface, a measure of the surface temperature (Su=382 $Wm^{-2}$ corresponds with Ts=13.5℃).
**OLR** is the Outgoing Longwave Radiation

**Implication: the OLR of a planet determines the amount of greenhouse gases in its atmosphere. This is at odds with observations!**

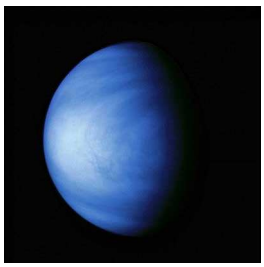
## Greenhouse effect Earth, Venus and Mars

**The greenhouse effect is determined by:**
1) distance sun - planet
2) planetary albedo
3) composition atmosphere
4) surface pressure and gravity
5) temperature dependent processes

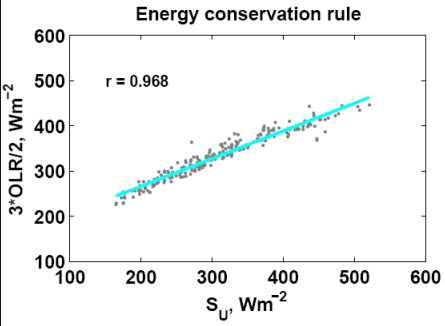
**Venus:** ≈ 500 K
surface temperature = 733 K

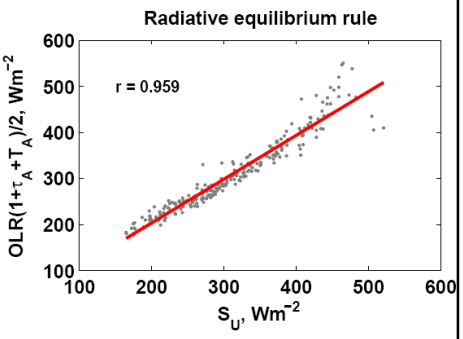
**Mars:** ≈ 3 K
surface temperature = 218 K

For comparison:
**Earth:** ≈ 33 K
surface temperature = 288 K



## Consequences rules Miskolczi (2007)



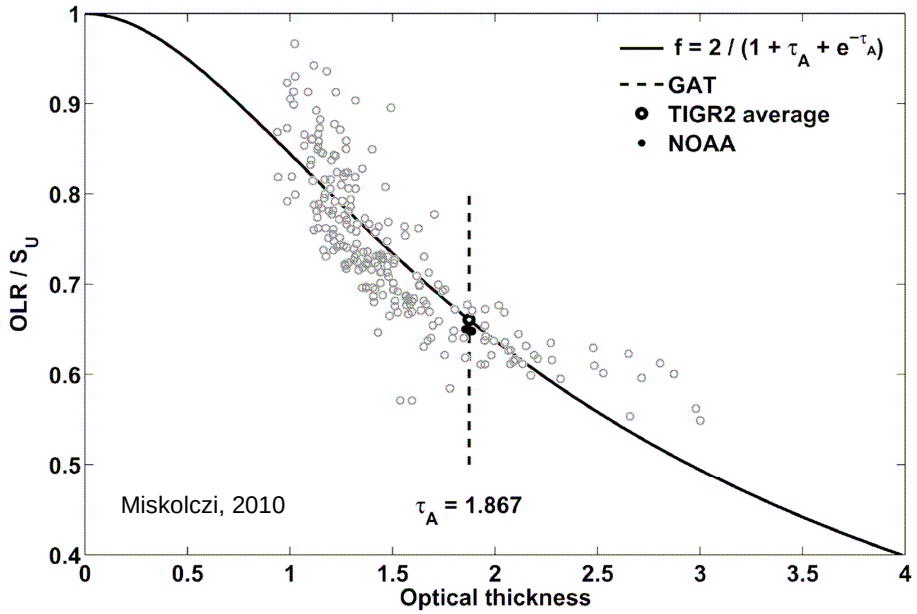




**<u>Conclusion</u>:**

**Both Miskolczi's rules exclude each other**

**→ At least one of them is false!**

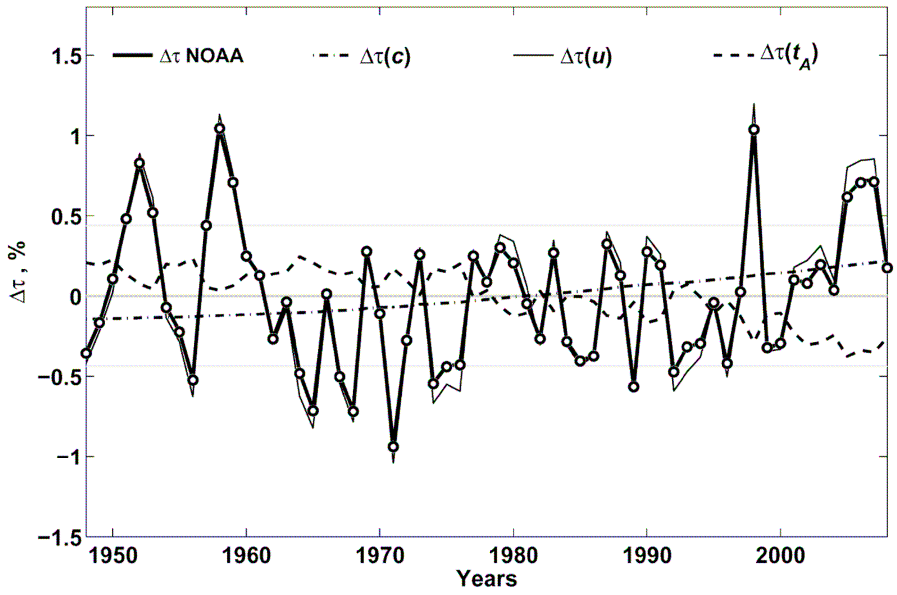
## Optical thickness vs. OLR/Su




## Miskolczi claims a constant greenhouse effect from theoretical considerations

- **Miskolczi's figure shows that the optical thickness is *not* constant**
- **There is no physical reason why the greenhouse effect should remain fixed at the present global averaged value of 1.87 (for the clear-sky case)**
- **Deviations from his best fit of the optical thickness function ($f(\tau_A)$) are very large, up to 40 $Wm^{-2}$**

## Optical thickness from reanalysis data




## Miskolczi claims a constant greenhouse effect from NOAA/NCEP reanalysis data

- **Miskolczi's figure shows that the optical thickness is *not* constant**
- **Instead, the NOAA/NCEP reanalysis data set shows year-to-year variations in global average optical thickness.**
- **These variations are mainly caused by water vapour fluctuations, which is a reasonable finding**
- **A constant greenhouse effect implies that an increasing trend in $CO_2$ must be counteracted by a decrease in water vapour**

## Miskolczi claims that NOAA/NCEP reanalysis data show a decreasing water vapour trend

- **However it is known that the NCEP model (used for reanalysis) has a bias towards high water vapour amounts in the 50s and 60s.**

- **This is due to the fact that the number and kind of observations changed through time. In the 50s and 60s those observations were merely based on radio sondes, while data over large parts of the southern hemisphere were missing. From the 80s onwards more direct observations of the OLR using satellites were assimilated into the model.**

## Trends in water vapour

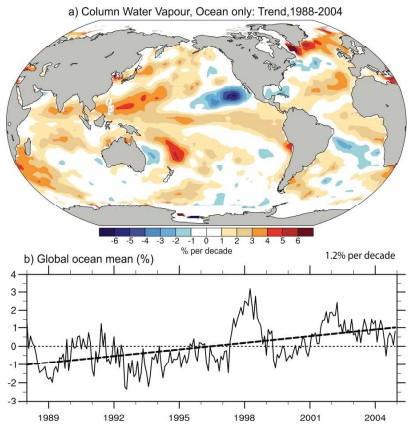



**Figure 3.20**

Linear trends in precipitable water (total column water vapour) in % per decade (top) and monthly time series of anomalies relative to the 1988 to 2004 period in % over the global ocean plus linear trend (bottom), from RSS SSM/I
(Source: IPCC, 2007, updated from Trenberth et al., 2005)

## Conclusions regarding the alternative greenhouse theory of Miskolczi

- **There is no physical reason why the greenhouse effect should remain fixed.**

- **Miskolczi's own results contradicts his own interpretation. His figures show that the greenhouse effect varies enough to drive significant surface temperature change.**

- **The reanalysis data are not suitable for trend analysis of water vapour. Direct observations clearly show an increasing trend in water vapour amplifying the greenhouse effect by carbon dioxide.**