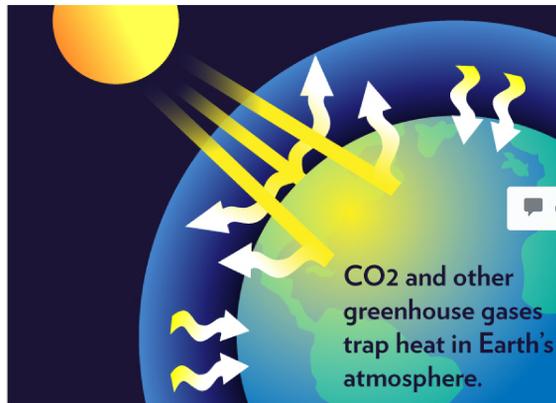


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Warming by greenhouse gases: wrong since 150 years ?



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From time to time comes a paper which has the potential to throw decade or even century long beliefs into the dust bin. Since Svante Arrhenius (1859-1927) climate science assumes that the global temperature of the Earth (or similar celestial bodies with an atmosphere) is commanded by the concentration of greenhouse gases, which produce a heating by trapping upwelling long-wave radiation (the mis-called "greenhouse effect"). This trapping can be observed in the laboratory using for instance a closed volume of CO2 gas. No experimental proof exist if this is also the case in an open atmosphere with strong convective air movements.

Ned Nikolov and Karl Zeller have published in "Environment Pollution and Climate Change" in February 2017 a really revolutionary paper titled "[New Insights on the Physical Nature of the Atmospheric Greenhouse Effect Deducd from an Empirical Planetary Temperature Model](#)". This is a long paper of 22 pages, which demands a couple of readings to get every aspect; there are no overly complicated mathematics involved, and the conclusions are stated quite clearly.

Let me resume in this blog the essentials of the paper which loudly rings unfamiliar bells!

1. The aim of the paper

The paper describes an empirical research to find a set of physical parameters that would predict the GMAT (= Global Mean Annual near surface Temperature) T_s of different celestial bodies: Venus, Earth, Moon, Mars, Titan, Triton. Some of these have an atmosphere, others like the Moon or Triton have none (or almost none). The study uses dimensional analysis (DA), which we all know from our elementary physics courses (an example: an irradiance given in W/m^2 has a dimension of $[MT^{-3}]$).

The following table shows the 6 variables and their physical dimensions used:

Planetary Variable	Symbol	SI Units	Physical Dimension
Global mean annual near-surface temperature (GMAT), the dependent variable (atmosphere)	T_s	K	[Θ]
Solar irradiance (average shortwave flux incident on a plane perpendicular to the stellar rays at the top of a planet's atmosphere)	S	W/m^2	$[M T^{-3}]$
Reference temperature (the planet's mean surface temperature in the absence of an atmosphere or an atmospheric greenhouse effect)	T_r	K	[Θ]
Average near-surface gas pressure representing either partial pressure of greenhouse gases or total atmospheric pressure	P_r	Pa	$[M L^{-1} T^{-2}]$
Average near-surface gas density representing either greenhouse-gas density or total atmospheric density	ρ_s	$kg\ m^{-3}$	$[M L^{-3}]$
Reference pressure (the minimum atmospheric pressure required a liquid solvent to exists at the surface)	P_r	Pa	$[M L^{-1} T^{-2}]$

Let me explain some of these variables and others introduced later:

T_s = GMAT

T_{na} = surface temperature in the absence of an atmosphere

S = solar TOA (top of the atmosphere) irradiance

It can be shown, using data from the Moon, that $T_{na} = 32.44 \cdot S^{0.25}$ (SI units: T_{na} in Kelvin, S in W/m^2)

T_s/T_{na} = RATE = Relative Atmospheric Thermal Enhancement = near surface warming effect of the atmosphere

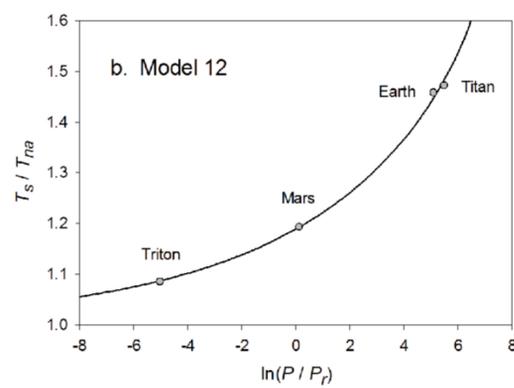
An example: for the Earth, $T_{na} = 197\ K$, RATE = 1.459 so $T_s = 197 \cdot 1.459 = 287.4\ K$

The next table shows the numerical values of these different parameters for the celestial bodies included in the study:

Intermediate Variable or Dimensionless Product	Venus	Earth	Moon	Mars	Titan	Triton
Average molar mass of greenhouse gases, $M_{g,av}$ ($kg\ mol^{-1}$) (Eq. 7)	0.0440	0.0216	0.0	0.0440	0.0160	0.0160
Near surface partial pressure of greenhouse gases, $P_{g,s}$ (Pa) (Eq. 9)	$8.974 \cdot 10^{10} \pm 1.96 \cdot 10^{10}$	283.8 ± 0.02	0.0	697.7 ± 13.9	$7.188 \cdot 3 \pm 4.9$	$9.6 \cdot 10^4 \pm 2.9 \cdot 10^4$
Near surface density of greenhouse gases, $\rho_{g,s}$ ($kg\ m^{-3}$) (Eq. 9)	64.441 ± 0.429	$2.57 \cdot 10^{-1} \pm 4.3 \cdot 10^{-1}$	0.0	$0.018 \pm 3.1 \cdot 10^{-4}$	$0.148 \pm 8.4 \cdot 10^{-4}$	$4.74 \cdot 10^2 \pm 1.3 \cdot 10^2$
Radiating equilibrium temperature, T_r (K) (Eq. 3)	195.0	256.4	269.7	211.9	63.6	39.2
Average atress spherical temperature, $T_{a,s}$ (K) (Eq. 4c)	231.7	197.0	197.0	159.6	63.6	35.9

3. The best model

Using these variables, the authors tried to build a model that is dimensionally correct, physically sound (using only standard thermodynamics) and that gives the best fit to the observational parameters. It comes as a surprise that two fractions T_s/T_{na} and P/P_r are enough to obtain the GMAT for all bodies (P is the average pressure of the atmosphere at the surface, and P_r is a reference pressure = pressure on Mars). The next plot shows how good their best model fits the observational data ($R^2 = 0.9999$!):



The conclusion is breathtaking: the surface temperature T_s (actually the mean surface temperature over at least 30 years) depends only on the solar irradiance (through T_{na}) and the atmospheric pressure at the surface: **greenhouse gases are not needed to obtain this average global temperature!**

4. The main conclusions.

I will partially use the authors text to give the conclusions:

- Since the late 1800s all climate models are built on the premise that the atmosphere warms the Earth by limiting radiant heat losses of the surface through the action of IR absorbing gases (= the greenhouse theory).
- The new model shows that what is called "the greenhouse effect" is in fact a pressure induced thermal enhancement.
- Down-welling long-wave (LW) radiation is not a global driver of surface warming.
- Albedo is a byproduct of the climate system (and not an independent driver).
- GMAT (do not forget this is a long-time average!) will remain stable (within +/- 1K) as long as TOA solar irradiance and atmospheric mass are stationary; there are no climate tipping points. The RATE thermal enhancement can be understood as the collective effect of a myriad of simultaneous adiabatic processes in the atmosphere.
- The positive feedback of water vapor (always used in warming scenarios) is a climate model artifact.

All this brings the authors to write that **there is a need for a paradigm shift in the understanding of key macro-scale atmospheric properties.**

I recommend to read this paper carefully, and ask yourself if we might be betting on the wrong horse with our CO2-centered climate policies.

PS1: You may want to look at this short [interview](#) of Dr. Nikolov on Youtube.

PS2: ... and read this rather [harsh critique](#) in the Washington Post (September 2016)

PS3: ... and this page on a "Unified Theory of Climate" of the authors

History: 24 June 2017: added PS1 ... PS3; slight change of wording in point e. of last paragraph and other minor editing.

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