Vad Du kanske aldrig fått höra om växthuseffekten

Peter Stilbs
KTH

Nature, 30 april 2009

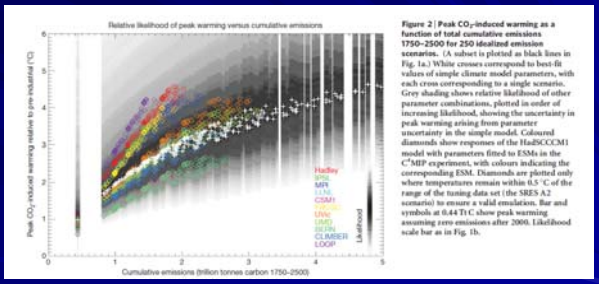
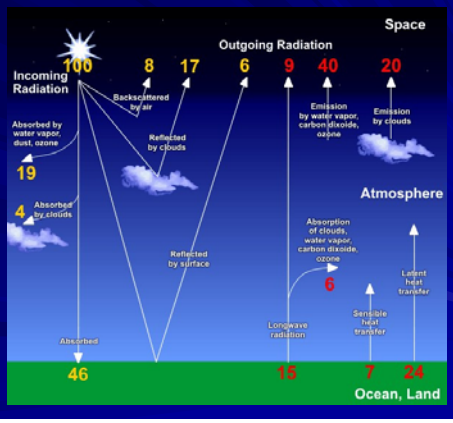
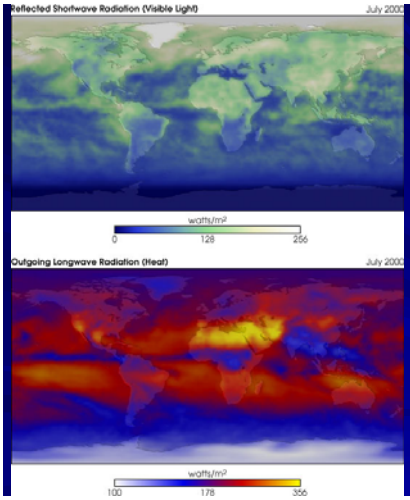


Figure 2 | Peak CO_2-induced warming as a function of total cumulative emissions 1750–2500 for 250 idealized emission scenarios. (A subset is plotted as black lines in Fig. 1a.) White crosses correspond to best-fit values of simple climate model parameters, with each cross corresponding to a single scenario. Grey shading shows relative likelihood of other parameter combinations, plotted in order of increasing likelihood, showing the uncertainty in peak warming arising from parameter uncertainty in the simple model. Coloured diamonds show responses of the HadSCCCM1 model with parameters fitted to ESMs in the C^4MIP experiment, with colours indicating the corresponding ESM. Diamonds are plotted only where temperatures remain within 0.5 °C of the range of the tuning data set (the SRES A2 scenario) to ensure a valid emulation. Bar and symbols at 0.44 TtC show peak warming assuming zero emissions after 2000. Likelihood scale bar as in Fig. 1b.

Modellsimuleringar 1750-2500…

Modell av Jordens strålningsbalans

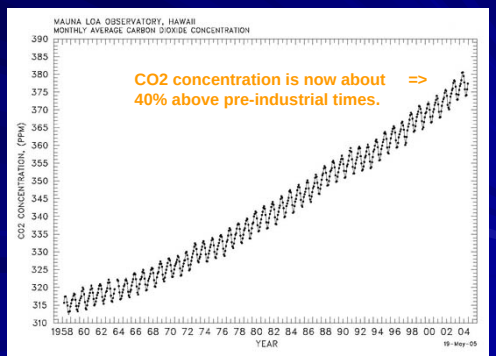


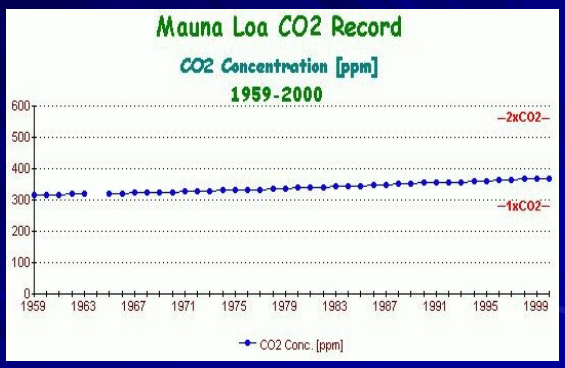


En ”ideal svart kropp” emitterar 460 W/m^2 vid 25 ^{o}C

Global Warming Basic Hypothesis:

1. **Carbon Dioxide is a greenhouse gas,**
2. **It is increasing in the atmosphere (at ½ rate of human production)**
3. **Therefore, the lower atmosphere MUST warm**





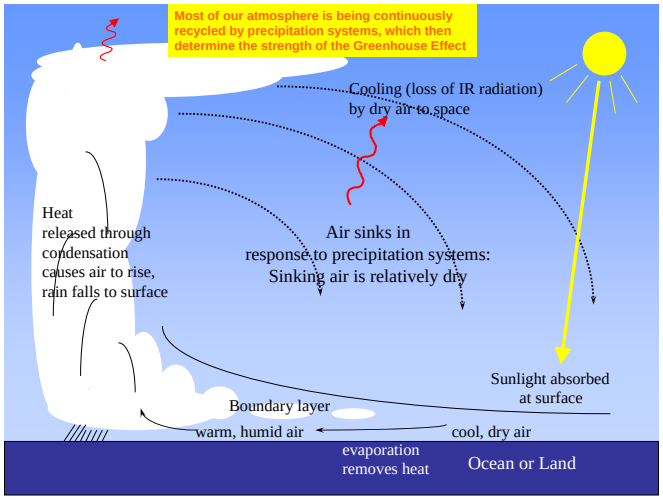
```
*****************************************************************
*** Atmospheric CO2 concentrations (ppmv) derived from in situ  ***
*** air samples collected at Mauna Loa Observatory, Hawaii      ***
***                                                             ***
*** Source: C.D. Keeling                                        ***
***         T.P. Whorf, and the Carbon Dioxide Research Group   ***
***         Scripps Institution of Oceanography (SIO)           ***
***         University of California                            ***
***         La Jolla, California USA 92093-0444                 ***
***                                                             ***
*** May 2005                                                    ***
***                                                             ***
*****************************************************************

Year   Jan.   Feb.  March  April   May    June   July   Aug.  Sept.   Oct.   Nov.   Dec. Annual Annual-Fit

1958 -99.99 -99.99 315.71 317.45 317.50 -99.99 315.86 314.93 313.19 -99.99 313.34 314.67 -99.99 -99.99
1959 315.58 316.47 316.65 317.71 318.29 318.16 316.55 314.80 313.84 313.34 314.81 315.59 315.98 316.00
1960 316.43 316.97 317.58 319.03 320.03 319.59 318.18 315.91 314.16 313.83 315.00 316.19 316.91 316.91
1961 316.89 317.70 318.54 319.48 320.58 319.78 318.58 316.79 314.99 315.31 316.10 317.01 317.65 317.63
1962 317.94 318.56 319.69 320.58 321.01 320.61 319.61 317.40 316.26 315.42 316.69 317.69 318.45 318.46
1963 318.74 319.08 319.86 321.39 322.24 321.47 319.74 317.77 316.21 315.99 317.07 318.36 318.99 319.02
1964 319.57 -99.99 -99.99 -99.99 322.23 321.89 320.44 318.70 316.70 316.87 317.68 318.71 -99.99 319.52
1965 319.44 320.44 320.89 322.13 322.16 321.87 321.21 318.87 317.81 317.30 318.87 319.42 320.03 320.09
1966 320.62 321.59 322.39 323.70 324.07 323.75 322.40 320.37 318.64 318.10 319.79 321.03 321.37 321.34
1967 322.33 322.50 323.04 324.42 325.00 324.09 322.55 320.92 319.26 319.39 320.72 321.96 322.18 322.13
1968 322.57 323.15 323.89 325.62 325.57 325.36 324.14 322.11 320.33 320.25 321.32 322.90 323.05 323.11
1969 324.00 324.42 325.64 326.66 327.38 326.70 325.89 323.67 322.38 321.78 322.85 324.12 324.62 324.60
```

5-siffrig noggrannhet ??

”Non-dispersive IR analyzer”

= Kolorimeter med filter för våglängdsselektion…

Ett instrument med 1% noggrannhet ??



Jordytans termostat

- Cirka 1 meter av världshaven avdunstar varje år – och faller ner som nederbörd eller snö
- Fasövergångarna (regn/snö/is) innefattar enorma värmemängder
- Vattenånga är dessutom den absolut viktigaste (radiativa) växthusgasen
- Moln skärmar/reflekterar strålning till/från Jordytan
- Moln strålar ut värme från övre atmosfären
- Vattenavdunstning tros kyla jordytan med 15 ^{o}C
- Värmeinnehållet i haven är 1000 ggr det i atmosfären …. etc ….

Skolboksvarianten av strålningsbalansekvationerna

En marginell ändring av siffran 0.7 gör stor skillnad

Emissiviteten varierar mellan ytor och är inte 1.00

$$0.7 I_i(\pi r^2) = 4\pi r^2 \sigma T_e^4$$

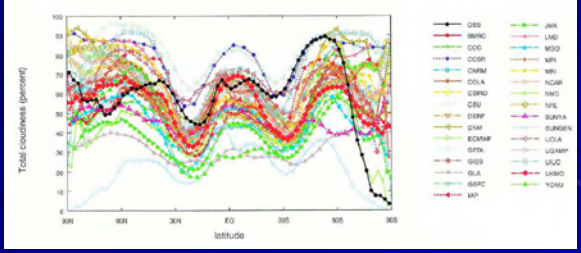
$$T_e^4 = \frac{0.7 I_i(\pi r^2)}{4\pi r^2 \sigma}$$

$$T_e = \left[\frac{0.7(1.4 \times 10^3 \text{ J m}^{-2} \text{ s}^{-1})}{4(5.67 \times 10^{-8} \text{ J s}^{-1} \text{ m}^{-2} \text{ K}^{-4})}\right]$$

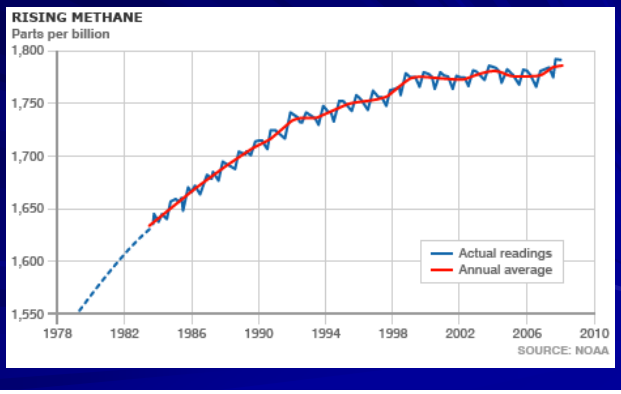
$$= 256 \text{ K}$$

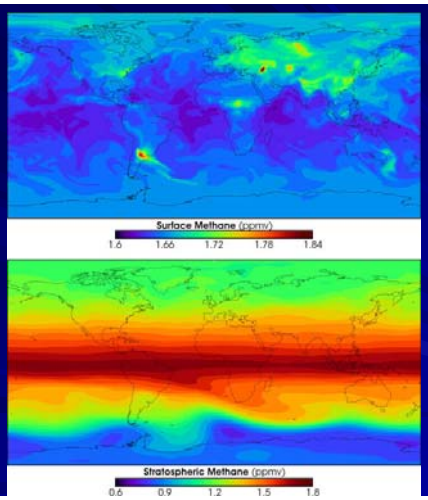
State-of-the Art Molnsimulering

Here we see that treatment of clouds involves errors an order of magnitude greater than the forcing from a doubling of CO_2



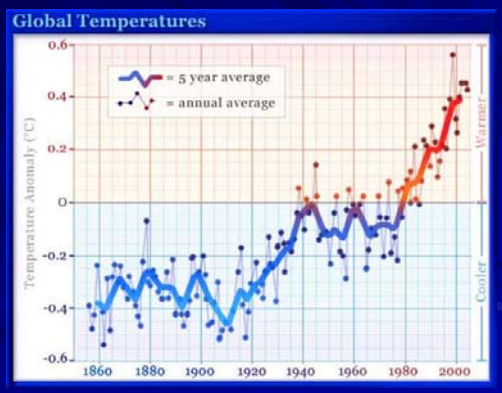
Atmospheric methane

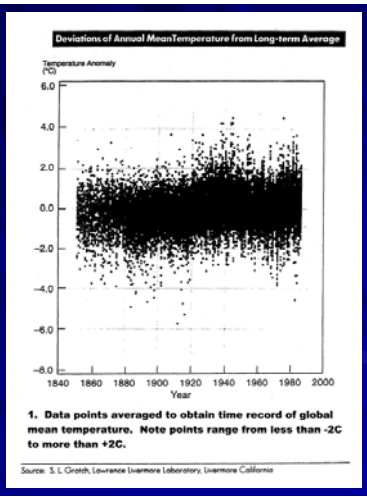


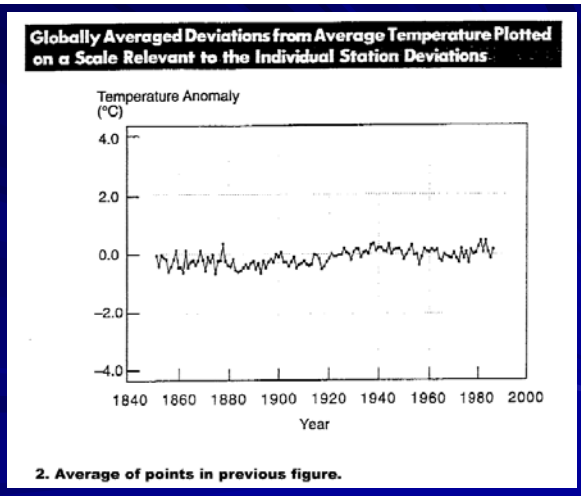


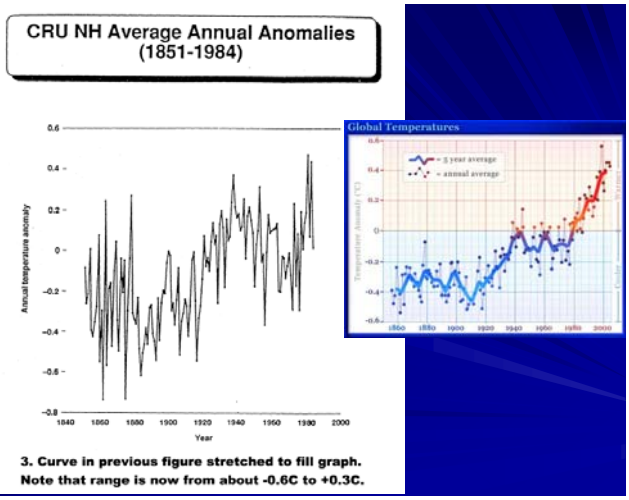
Modellsimuleringar, NASA

Alarmist version (Hansen et al. - GISS)









Att också ha i minnet…

- Urbaniseringskorrektioner kan vara i samma storleksordning (1C)
- Jordytans temperatur kan samma dag variera mellan -80C och +50C …

Varför medelvärde av T ?

Mer relevant med medelvärdet av T^4 ??

Falsification Of
The Atmospheric CO_2 Greenhouse Effects
Within The Frame Of Physics

Version 4.0 (January 6, 2009)

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Radiation greenhouse effect does not exist (115 pages)

IDŐJÁRÁS

Quarterly Journal of the Hungarian Meteorological Service
Vol. 111, No. 1, January–March 2007, pp. 1–40

Greenhouse effect in semi-transparent planetary atmospheres

Ferenc M. Miskolczi

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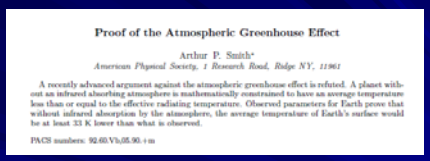
(Manuscript received in final form October 19, 2006)

Greenhouse equations are wrong (40 pages)



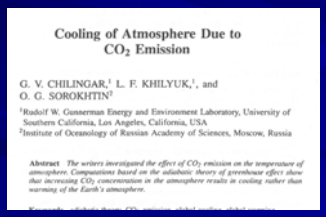
Proof of the Atmospheric Greenhouse Effect

Arthur P. Smith*
American Physical Society, 1 Research Road, Ridge NY, 11961

A recently advanced argument against the atmospheric greenhouse effect is refuted. A planet without an infrared absorbing atmosphere is mathematically constrained to have an average temperature less than or equal to the effective radiating temperature. Observed parameters for Earth prove that without infrared absorption by the atmosphere, the average temperature of Earth's surface would be at least 33 K lower than what is observed.

PACS numbers: 92.60.Vb,05.90.+m

Greenhouse equations are right …



Cooling of Atmosphere Due to CO_2 Emission

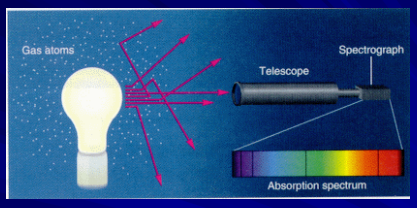
G. V. CHILINGAR,[1] L. F. KHILYUK,[1], and O. G. SOROKHTIN[2]

[1]Rudolf W. Gunnerman Energy and Environment Laboratory, University of Southern California, Los Angeles, California, USA
[2]Institute of Oceanology of Russian Academy of Sciences, Moscow, Russia

Abstract The writers investigated the effect of CO_2 emission on the temperature of atmosphere. Computations based on the adiabatic theory of greenhouse effect show that increasing CO_2 concentration in the atmosphere results in cooling rather than warming of the Earth's atmosphere.

Greenhouse gases actually help Earth radiate thermal IR …

Emission and Absorption spectra



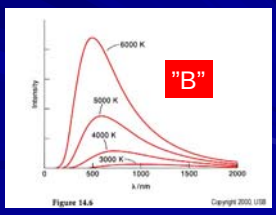
The Schuster-Schwarzschild relation (ca 1915) in integrated one-dimensional transmittance form, for a uniform gas layer, "*z*" thick

$$I = I_o \cdot e^{-k\cdot\rho\cdot z} + B \cdot (1 - e^{-k\cdot\rho\cdot z})$$

"Sink function" + "Source function"

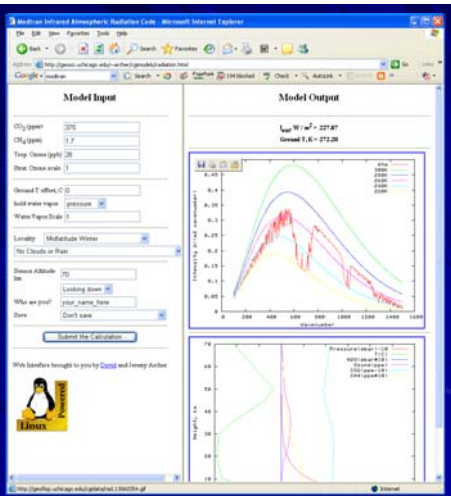
Lambert-Beer's Law + a coupled Emission term

Concepts like "absorption" "re-emission" and "saturation" make no sense here

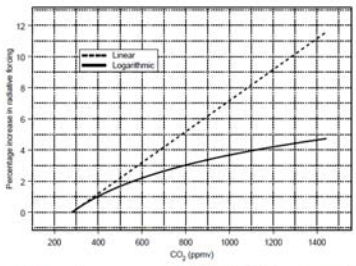


MODTRAN

HITRAN, etc …



The effect is logarithmic:



The CO_2 forcing follows the logarithmic rather than the linear curve. Note that the logarithmic curve rises ever more slowly as the CO_2 increases.

The easiest way to understand this is to consider adding thin layers of paint to a pane of glass. The first layer cuts out much of the light, the next layer cuts out more, but subsequent layers do less and less because the painted pane is already essentially opaque.

Basic radiation-related effect of CO_2

$$dE = \alpha \cdot ln([CO_2]/[CO_2]_{orig})$$

- The effect of CO_2 on temperature is

$$dT/dE = 1/(4 \cdot \sigma \cdot T^3)$$

where alpha is 5.35 (Myhre et al.)
http://www.grida.no/climate/ipcc_tar/wg1/222.htm

- (*dE* is change in forcing using the derivative of the Stefan-Boltzmann relation)

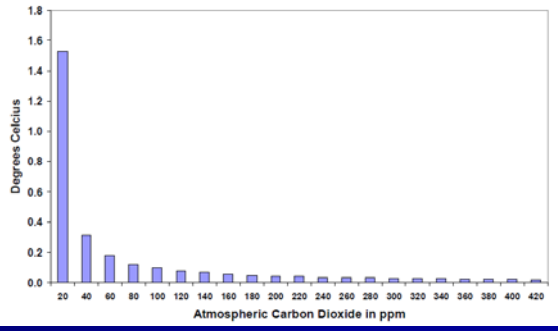
Basic radiation-related effect of CO_2 :

$$dT = \alpha \cdot ln([CO_2]/[CO_2]_{orig})/4 \cdot \sigma \cdot T^3$$

This is the equation without all feedbacks.

- Double CO_2 level and use T= 255K (radiation temperature to space)
  - ➔ dT=0.98 centigrade for a doubling of $[CO_2]$!!
- That's physics. All the rest is models and hype.

The Warming Effect of Atmospheric Carbon Dioxide



Basen för all klimatalarmism

- En högre temperatur ska leda till högre vattenavdunstning, som förstärker vattenångans redan dominerande växthuseffekt

och

- Ökad avsmältning av is som ändrar Jordens albedo i en värmande riktning

Du är här: SvD.se > Startsidan > Inrikes > Miljöboven lustgas ska renas

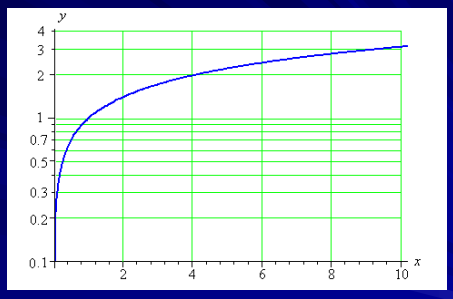
FOTO: FELIPE MORALES

Fatma Kükük får hjälp av barnmorskan Kerstin Hedin att hålla andningsmasken på plats. För att rena gasen ska även utandningen se ske i masken.

Miljöboven lustgas ska renas

Publicerad: 13 juli 2007, 19.43. Senast ändrad: 27 september 2007, 19.59

Lustgas, det vanligaste bedövningsmedlet vid förlossningar i Sverige, är samtidigt en aggressiv växthusgas. Flera landsting jobbar nu med att minska lustgasutsläppen. Stockholm är föregångare med sin unika destrueringsmaskin.



CH_4 , N_2O, SF_6 etc are NOT 25-100 etc. times more <u>potent</u> greenhouse gases than CO_2 !!!

The contributions from different gases are NOT additive !

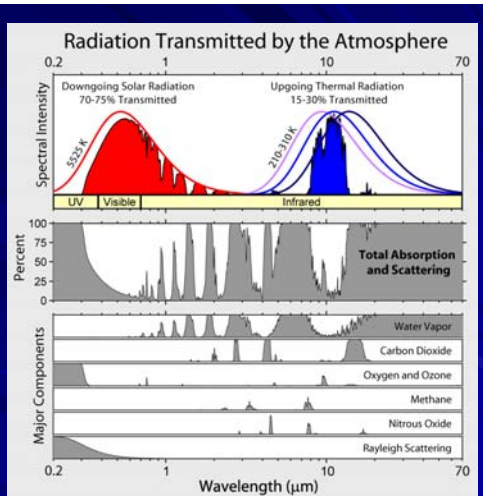
The main greenhouse gases

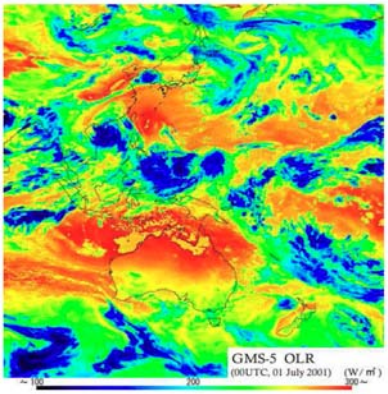
Greenhouse gases	Chemical formula	Pre-industrial concentration	Concentration in 1994	Atmospheric lifetime (years)***	Anthropogenic sources	Global warming potential (GWP)*
Carbon-dioxide	CO^2	280 ppmv	358 ppmv	50-200	Fossil fuel combustion Land use conversion Cement production	1
Methane	CH_4	700 ppbv	1720 ppmv	12-17	Fossil fuels Rice paddies Waste dumps Livestock	21 **
Nitrous oxide	N_2O	275 ppbv	312 ppmv	120-150	Fertilizer Industrial processes combustion	310
CFCs	CFC12	0	503 pptv	102	Liquid coolants. Foams	125-152
HCFCs	HCFC-22	0	105 pptv	13	Liquid coolants	125
Perfluorocarbon	CF_4	0	110 pptv	50 000	Production of aluminium	6 500
Sulphur hexa-fluoride	SF_6	0	72 pptv	1 000	Production of magnesium	23 900

Note : ppbv= 1 part per billion by volume, ppbv= 1 part per billion by volume, ppmv= 1 part per million by volume

* GWP for 100 year time horizon. ** Includes indirect effects of tropospheric ozone production and stratospheric water vapour production. *** On page 15 of the IPCC SAR. No single lifetime for CO_2 can be defined because of the different rates of uptake by different sink processes.

Source: IPCC radiative forcing report , Climate change 1995, The science of climate change, contribution of working groups 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

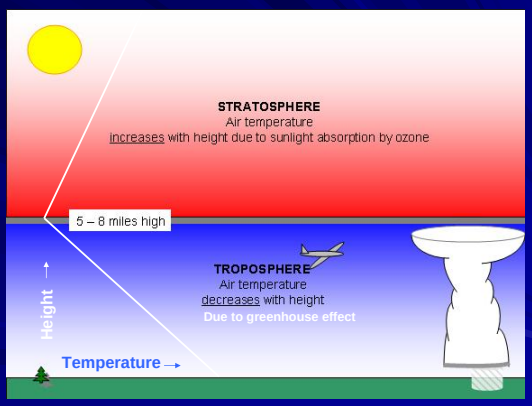




Radiation to space varies in time and space

The colour image represents emission of infrared radiation to space as measured by the Japanese geostationary satellite GMS-5. The blue shadings are low emission intensities representing infrared emanating from cloud tops in the higher colder atmosphere. The red shadings represent high emission intensities emanating from the lower warmer atmosphere and generally cloud-free regions.

Utstrålningen antas ske från övre troposfären



Temperatur vid jordytan baseras på modellering !

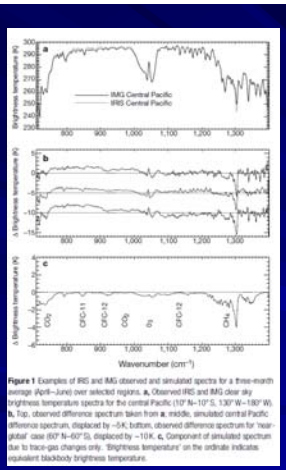


Figure 1 Examples of IRIS and IMG observed and simulated spectra for a three-month average (April–June) over selected regions. **a**, Observed IRIS and IMG clear sky brightness temperature spectra for the central Pacific (10° N–10° S, 130° W–180° W). **b**, Top, observed difference spectrum taken from **a**; middle, simulated central Pacific difference spectrum, displaced by −5 K; bottom, observed difference spectrum for 'near-global' case (60° N–60° S), displaced by −10 K. **c**, Component of simulated spectrum due to trace-gas changes only. 'Brightness temperature' on the ordinate indicates equivalent blackbody brightness temperature.

Increases in greenhouse forcing inferred from the outgoing longwave radiation spectra of the Earth in 1970 and 1997

John E. Harries, Helen E. Brindley, Pretty J. Sagoo & Richard J. Bantges

Space and Atmospheric Physics Group, Blackett Laboratory, Imperial College, London SW7 2BW, UK

The Nobel Prize in Chemistry 1903

"in recognition of the extraordinary services he has rendered to the advancement of chemistry by his electrolytic theory of dissociation"

Svante August Arrhenius

Sweden

Stockholm University
Stockholm, Sweden

b. 1859
d. 1927

Arrhenius hävdas "korrekt ha förutspått" en temperaturhöjning på 3-4 grader vid en fördubbling av CO_2-halten i atmosfären

THE
LONDON, EDINBURGH, AND DUBLIN
PHILOSOPHICAL MAGAZINE
AND
JOURNAL OF SCIENCE.

[FIFTH SERIES.]

APRIL 1896.

XXXI. *On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground.* By Prof. SVANTE ARRHENIUS *.

I. *Introduction: Observations of Langley on Atmospherical Absorption.*

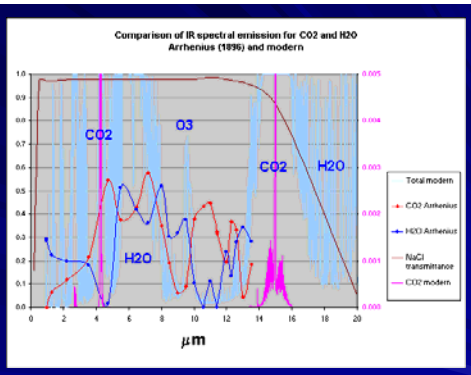
A GREAT deal has been written on the influence of the absorption of the atmosphere upon the climate. Tyndall † in particular has pointed out the enormous importance of this question. To him it was chiefly the diurnal and annual variations of the temperature that were lessened by this circumstance. Another side of the question, that has long attracted the attention of physicists, is this: Is the mean temperature of the ground in any way influenced by the presence of heat-absorbing gases in the atmosphere? Fourier‡ maintained that the atmosphere acts like the glass of a hot-house, because it lets through the light rays of the sun but retains the dark rays from the ground. This idea was elaborated by Pouillet § and Langley was by some of his researches led to the view, that "the temperature of the earth under direct sunshine, even though our atmosphere were present as now, would probably fall to −200° C. if that atmosphere did not possess the quality of selective

* Extract from a paper presented to the Royal Swedish Academy of Sciences, 11th December, 1895. Communicated by the Author.
† 'Heat a Mode of Motion,' 2nd ed. p. 476 (Lond., 1865).
‡ *Mem. de l'Ac. R. d. Sci. de l'Inst. de France*, t. vii. 1827.
§ *Comptes rendus*, t. vii. p. 41 (1838).

Phil. Mag. S. 5. Vol. 41. No. 251. *April* 1896. S

Ett mycket imponerande arbete på 42 sidor…

Men …



Arrhenius' IR-spektra 1896 var tyvärr helt till råttorna…

Arrhenius hade fel ekvation

- (Schuster-Schwarzschild-ekvationen är från ca 1915)

$$I = I_o \cdot e^{-k \cdot \rho \cdot z} + B \cdot (1 - e^{-k \cdot \rho \cdot z})$$

- Arrhenius fick dock fram en resulterande logaritmisk typ av relation:

$$dE = \alpha \cdot ln([CO_2]/[CO_2]_{orig})$$

Arrhenius borde ha fått 1 grad – inte 3-4

- Vattenånga ? Arrhenius räknade med ökad luftfuktighet vid högre temperatur
- …men inte på ett skenande sätt

(max 0.1 °C via vattens ångtryckskurva)

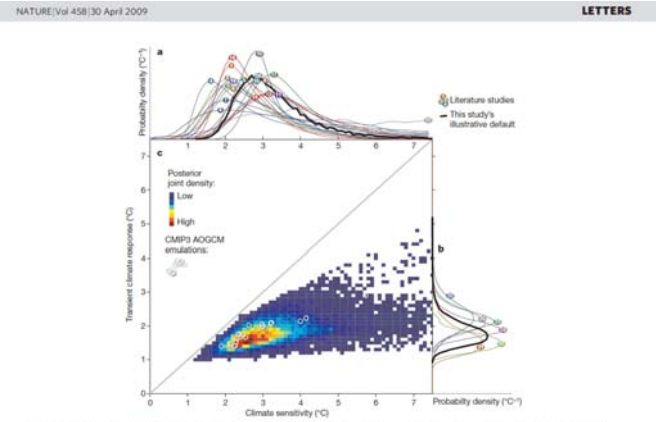
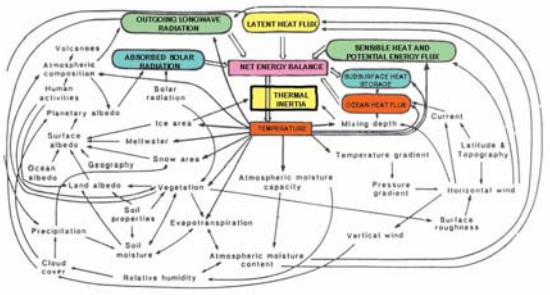


Figure 1 | Joint and marginal probability distributions of climate sensitivity and transient climate response. a, Marginal probability density functions (PDFs) of climate sensitivity; **b,** marginal PDFs of transient climate response (TCR); **c,** posterior joint distribution constraining model parameters to historical temperatures, ocean heat uptake and radiative forcing under our representative illustrative priors. For comparison, TCR and climate sensitivities are shown in c for model versions that yield a close emulation of 19 CMIP3 AOGCMs (white circles)[18]. Data sources for curves 1–25 are given in Supplementary Information.

Växthusgaser i klimatsimuleringar

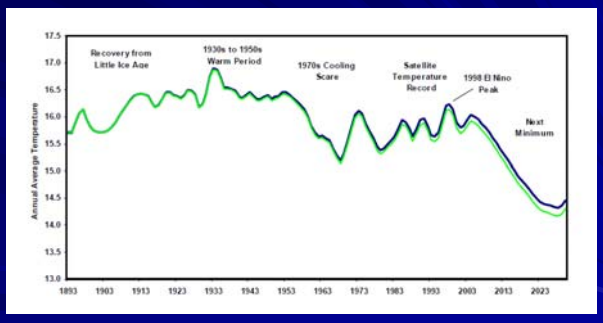
- Modellpåverkan är dold i 100.000-tals rader programkod, utan explicit ”ekvation”
- Vattenånga delparametriseras via Clausius-Clapeyron’s ekvation …
  (alltid 100% luftfuktighet … ???)

Vad klimatsimuleringar BORDE inkludera…



Flow diagram for climate modeling, showing feedback loops.
From Robock (1985).

Kanske detta är verkligheten ? ☺



Grönt = Utan fossil CO_2 Blått = Med fossil CO_2

A human “greenhouse” stops **convection**