Methane

the Irrelevant GreenHouse Gas

ICSF and CLINTEL presentation

September 21, 2022

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Essential Clarification

- Methane (CH_4) DOES meet the definition of a GHG
- However, it is ***irrelevant*** because of:
  - the physical properties of the ***real*** atmosphere
  - The numerical realities of infrared absorption
  - The amount and type of radiation emitted from the surface
- It is urgent that this reality becomes widely known
  - Otherwise, money is poured down the drain

Outline: Two Parts

1. Review achievements of van Wijngaarden & Happer

   particularly regarding CH_4 and N_2O

   They Got it Right -- agrees with data

   Their method is valid

   Their projections are trustworthy

2. Explain why *Global Warming Potential* numbers are useless

   oversimplified concept

   applied incorrectly

Bottom Line: tighter regulations are pointless and unnecessary

Acknowledgements

The science reported here is based on the accomplishments of William van Wijngaarden & Will Happer & co-workers.

I’m just the chronicler.

But as a member of the *CO_2 Coalition*, I’m proud to proclaim the significance of their work.

And I hope this will lead to government policy revisions.

Will Happer's presentation of June 2021

several graphs that you saw last year

Wm. Van Wijngaarden & Will Happer on greenhouse gases:
They used the HITRAN data base to calculate the intensities of spectral lines across the infrared

Their model atmosphere was *real*

- Included H_2O
- Not the "US Standard atmosphere" which contains no H_2O
  - remember: a laboratory gas is NOT the real atmosphere !
  - That is an enduring flaw in all the IPCC calculations

They "Got It Right"

- Exceptionally good quantitative agreement with satellite observations

What is “Forcing” ?

Term “Forcing” refers to radiation that carries energy

Customary unit is Watts per square meter

340 W/m^2 reaches earth from sun constantly ($\pm$ 3 %)

Earth responds:

100 W/m^2 reflected back into space (30%). $\alpha = 0.3$

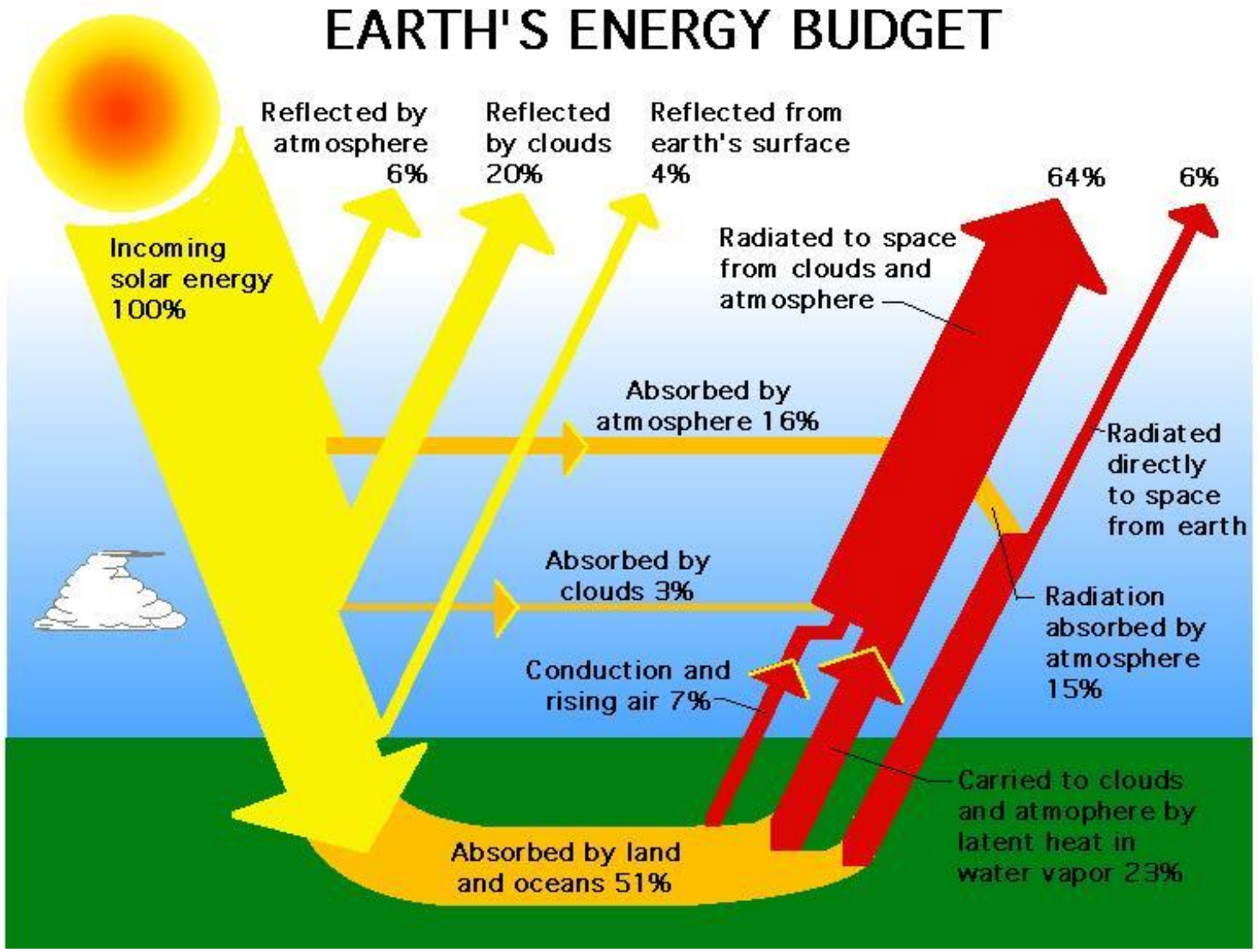
239 W/m^2 enter earth’s atmosphere or surface

Several mechanisms of energy transfer and disposal

239 W/m^2 emitted back out into space

Forcing is pertinent to greenhouse calculations

Radiation Input and Output



Reflected
6% + 20% + 4% = 30%

Radiated to Space
64% + 6% = 70%

GHG Properties, Per-Molecule

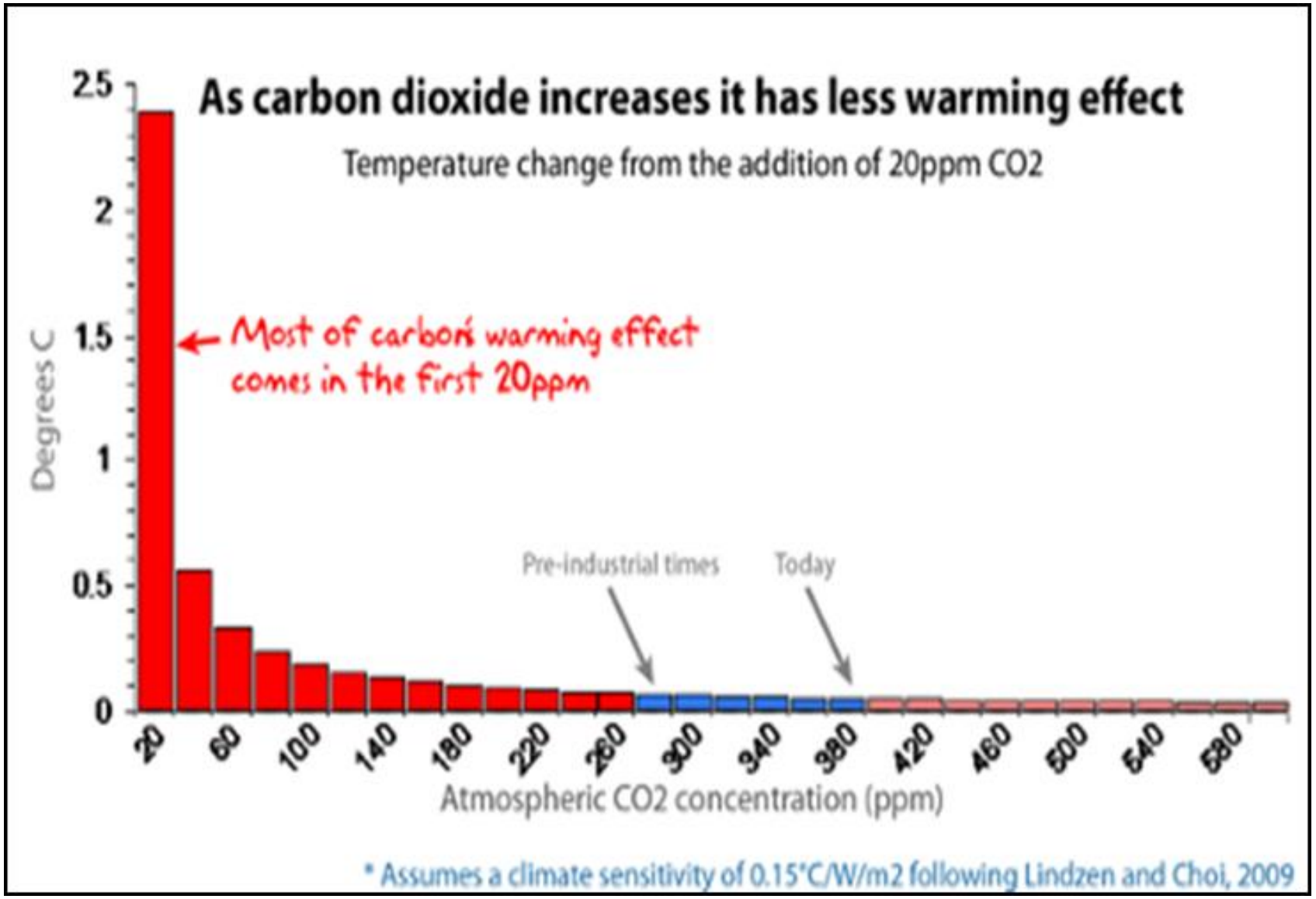
- From a paper by van Wijngaarden & Happer in 2019:

Also calculated are per-molecule forcings in a hypothetical, ***optically thin*** atmosphere, where there is ***negligible saturation*** of the absorption bands, or ***interference*** of one type of greenhouse gas with others. For an optically thin atmosphere, the per-molecule forcings at the tropopause are largest for CO_2, with lesser but ***comparable*** forcings by O_3, H_2O, N_2O and CH_4.

“saturation” of a spectrum

- Molecular energy levels include vibrational and rotational energy
- A molecular spectrum contains thousands of lines
- Center of the band absorbs/emits most intensely
- As density increases, the “wings” of the band participate
- Progression of active states grows logarithmically
- Absorption curve falls off exponentially

CO_2 saturation curve

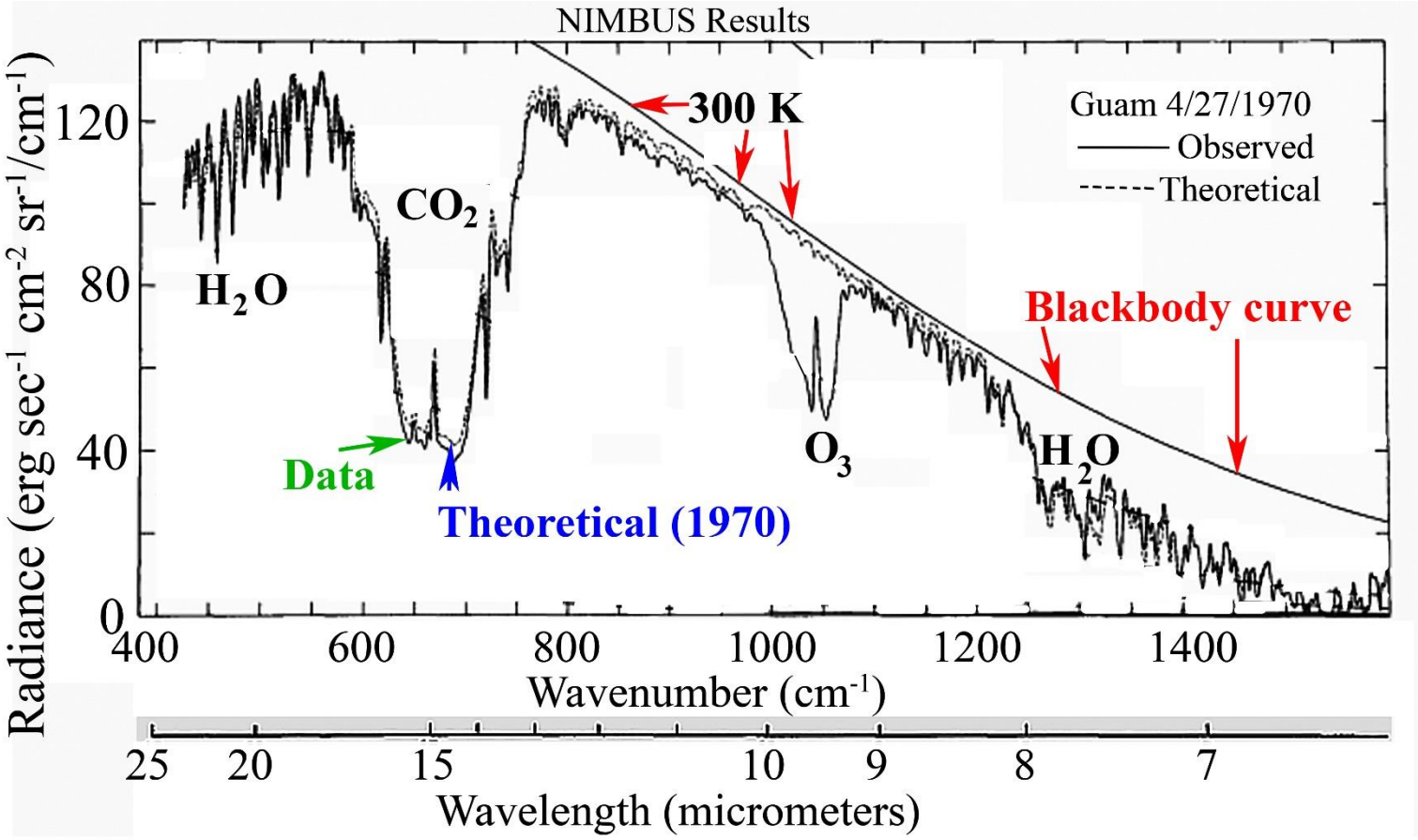


The GreenHouse Effect

- Earth emits BlackBody radiation (smooth curve)
  - Determined by surface temperature
- Atmosphere absorbs and emits *some* radiation
- This slows down the planet's cooling (radiation to space)
  - Surface is warmer than if there were no atmosphere
- Net radiation escaping is *lower than* the BlackBody emission
- Total area between the two curves is the Greenhouse effect

Early data – theory comparison

Guam, 1970, with $T_{surface}$ ~ 295 K



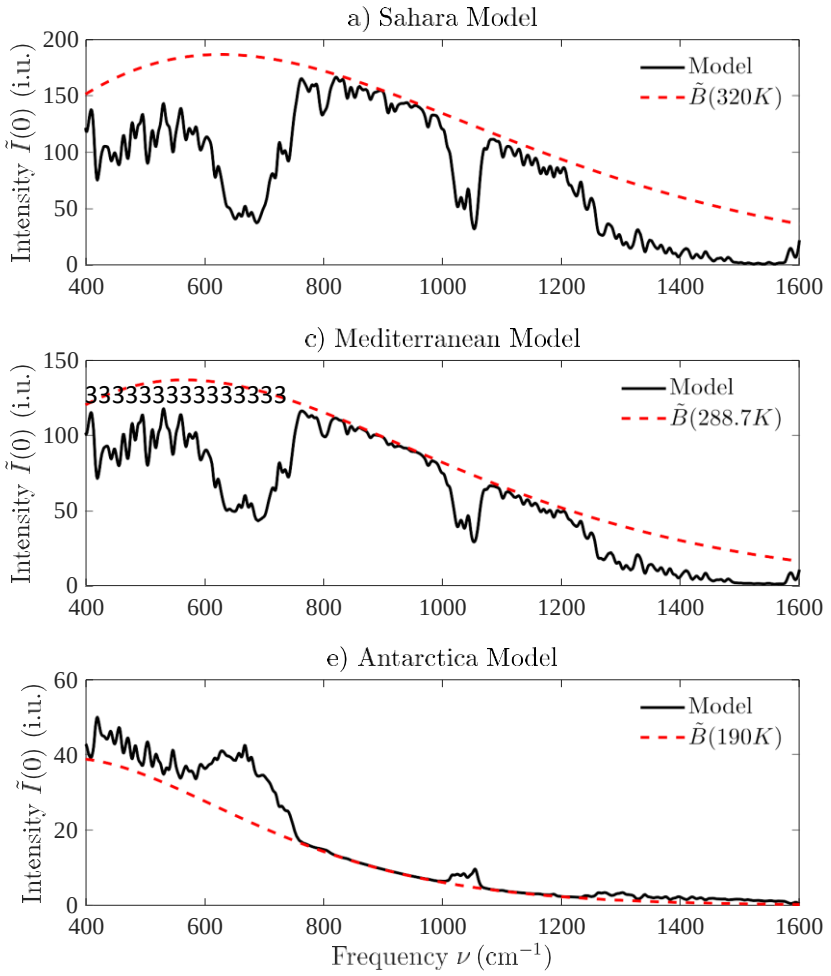
Calculations by van Wijngaarden & Happer

- Calculations were done for the ***real*** atmosphere
- All five GHGs were present at once
  - Real concentrations used
  - NOT the per-molecule case
  - H_2O and CO_2 were in a state of “saturation”
- H_2O is the dominant GHG (no surprise)
- CO_2 is secondary, but finite (~ 25%)
- O_3 matters in the stratosphere
- CH_4 and N_2O vanish in importance

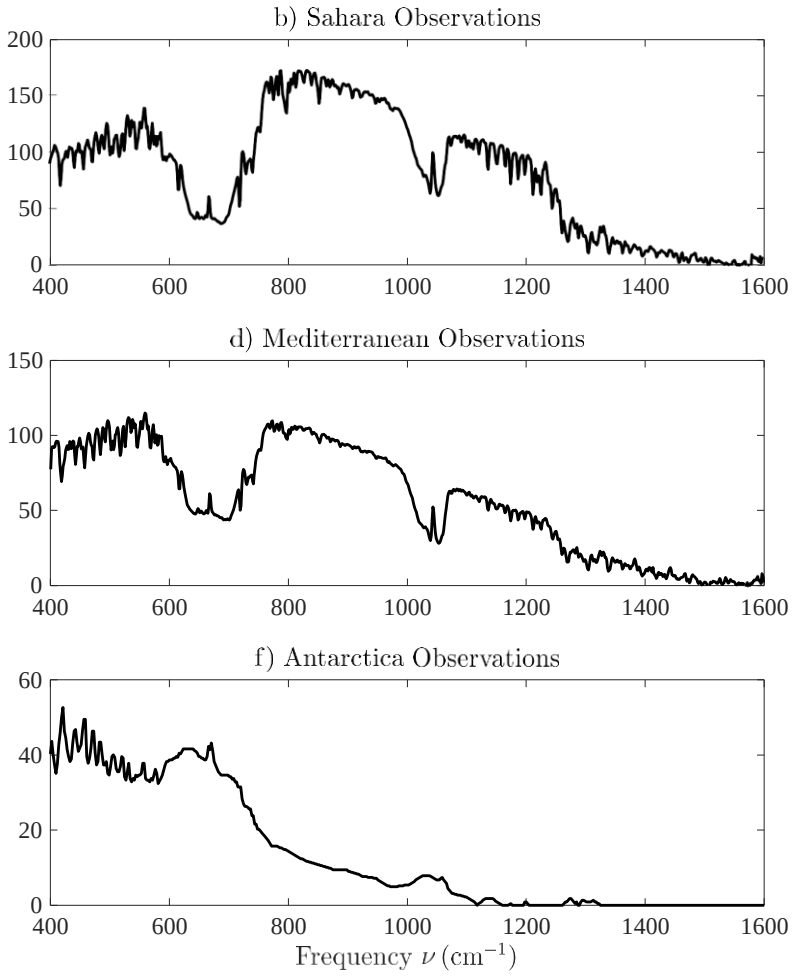
Stunning agreement with measurements

van Wijngaarden & Happer

calculations



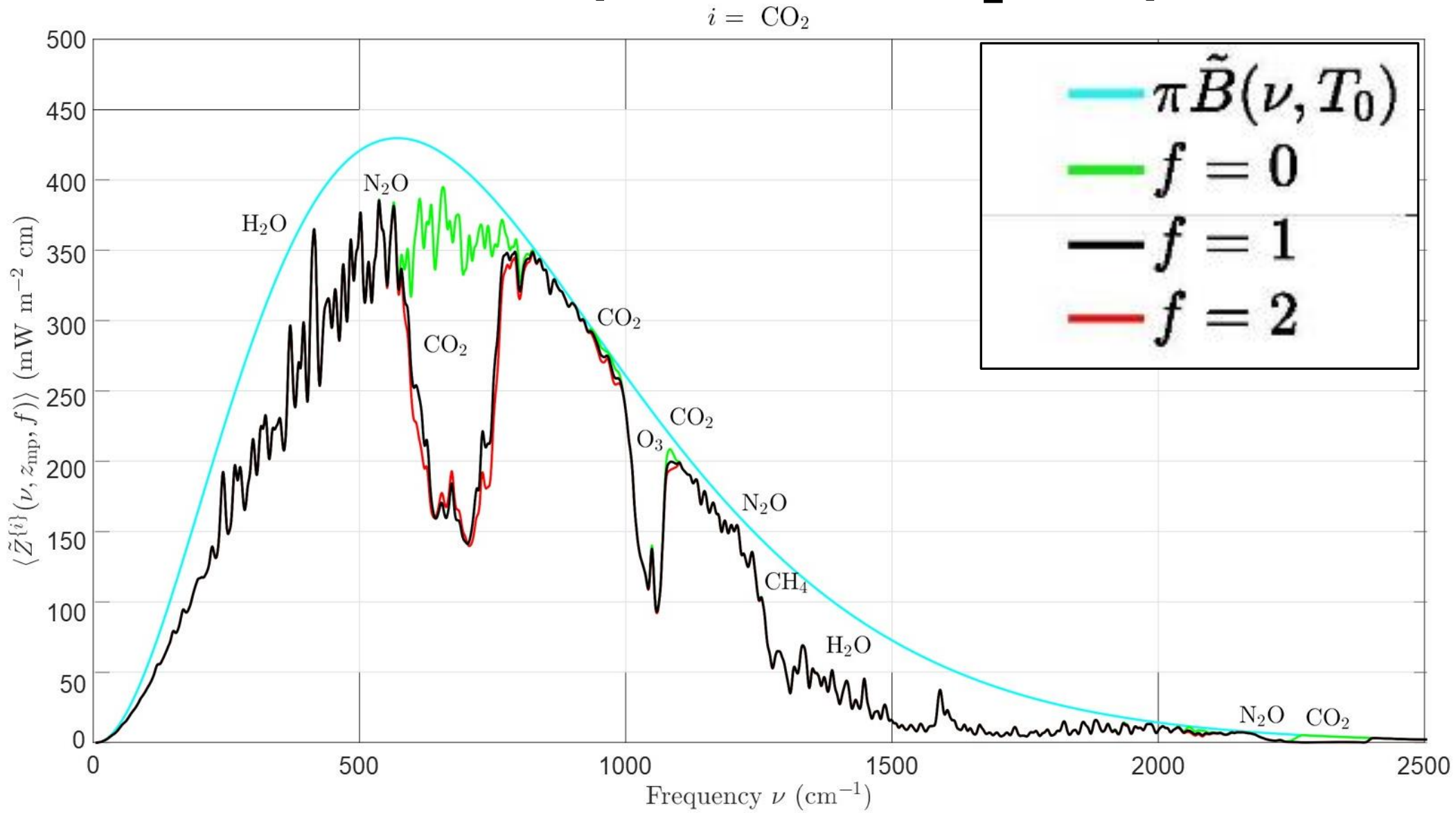
satellite measurements



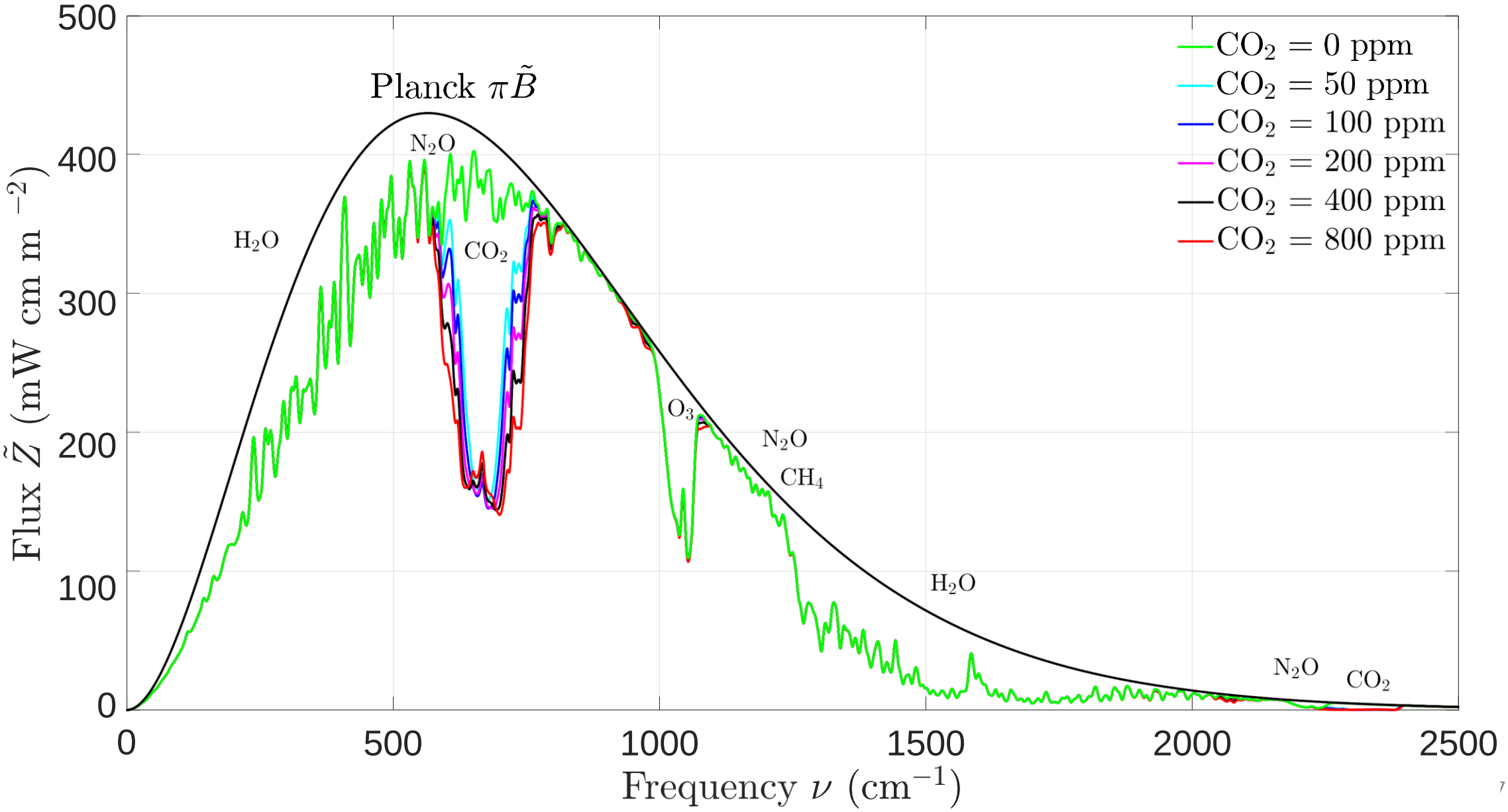
Major Accomplishment

- THIS is the **correct** use of the Scientific Method:
- Because the agreement is so good between their calculations and actual measurements,
- At last we have a computational method that is trustworthy !
- Consequently, we can now conduct numerical experiments with CO_2 doubled, halved, etc.
- We do not have to rely upon artificially constructed numbers like “Global Warming Potential”

Numerical experiment: CO_2 comparison



Effect of adding increments of CO_2



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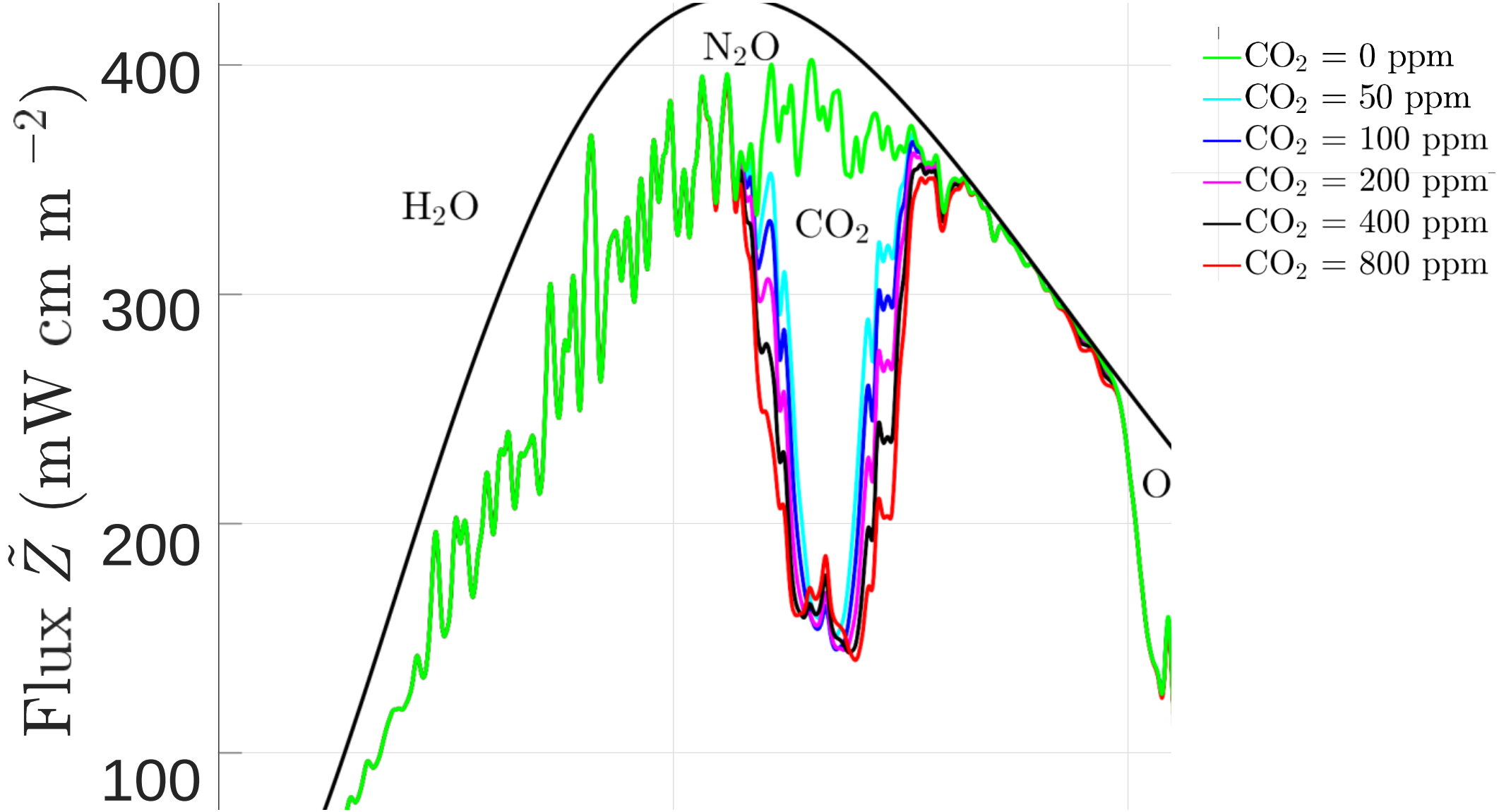
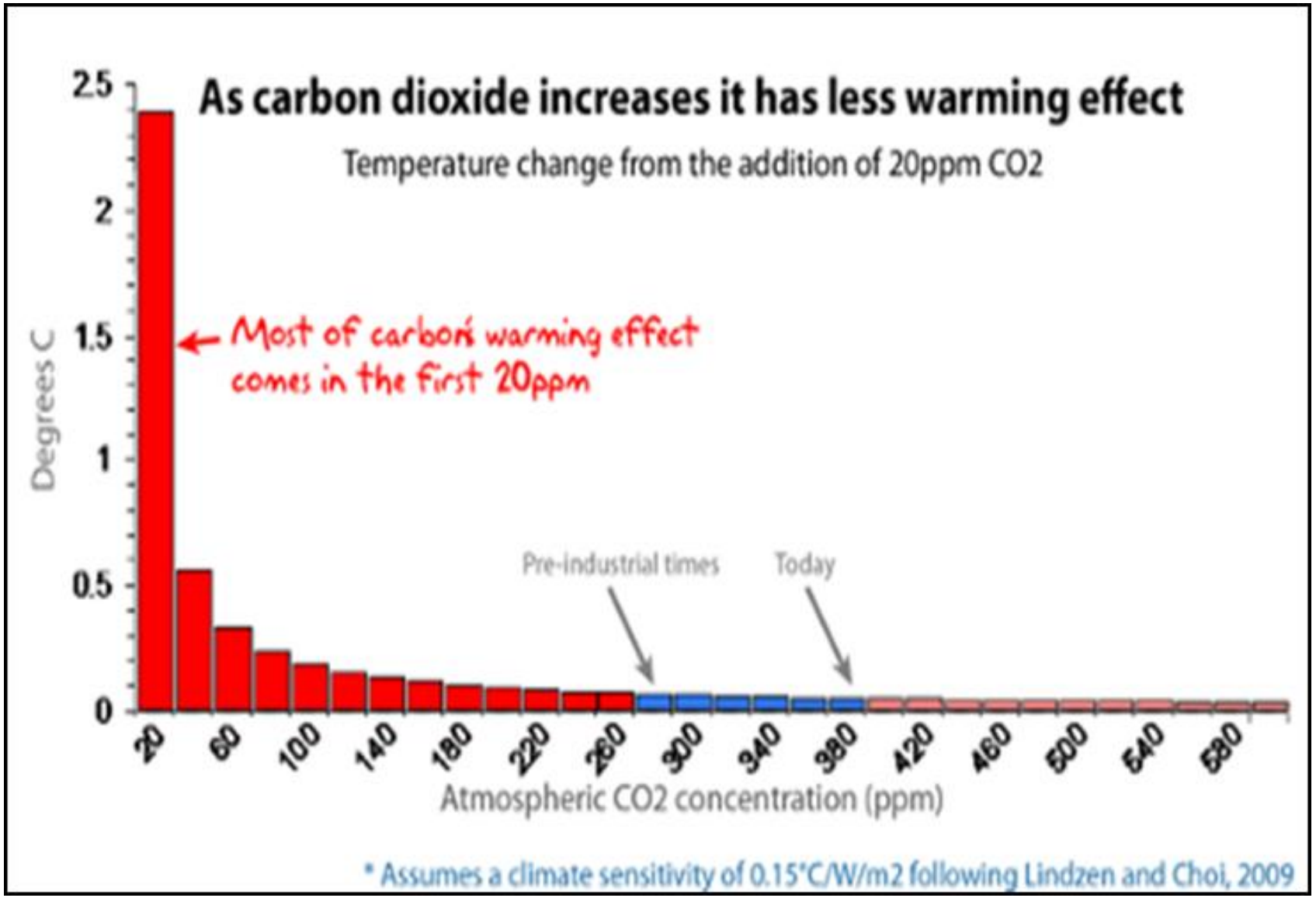
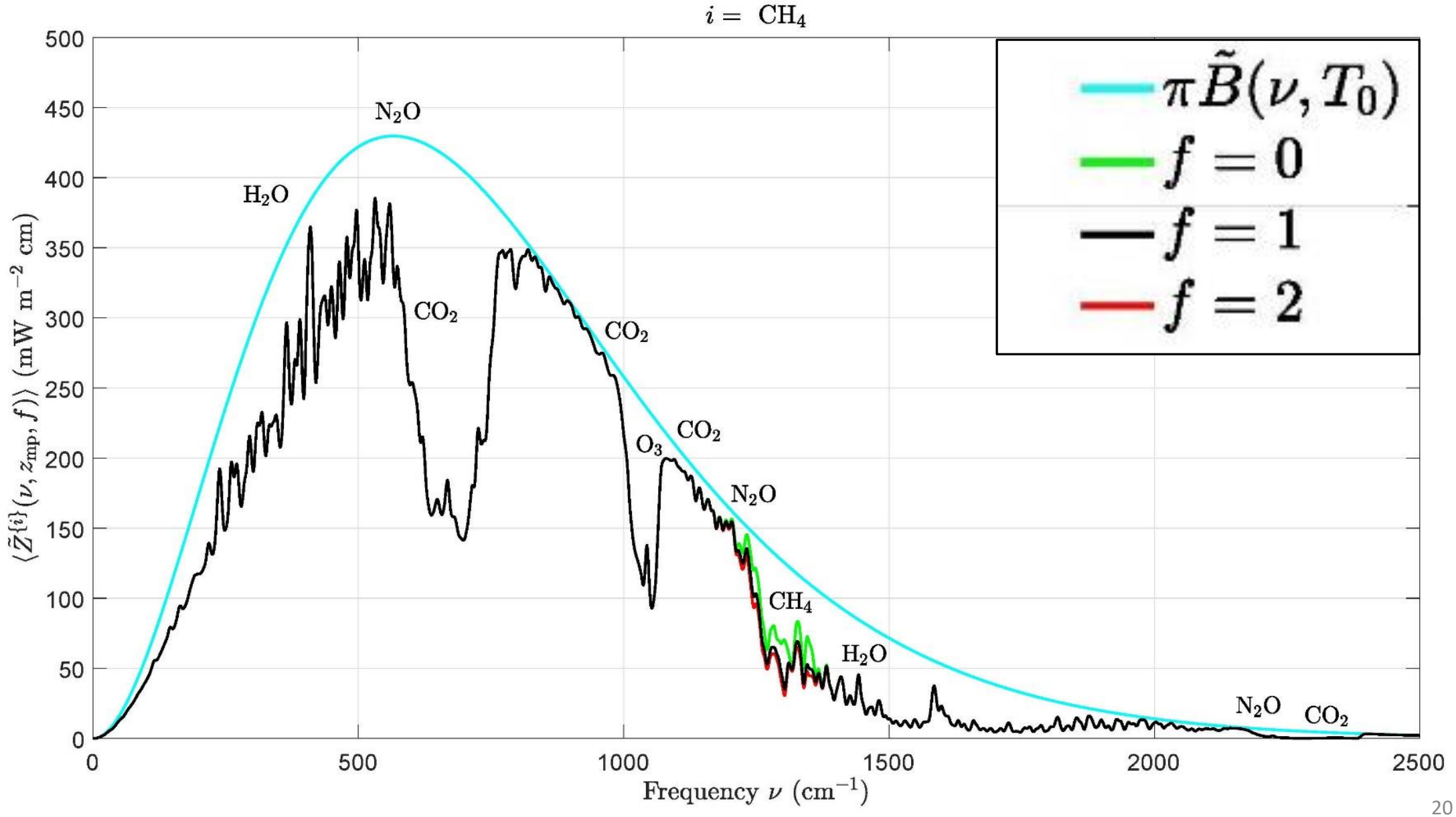


CO_2 saturation curve



CH4 Comparison



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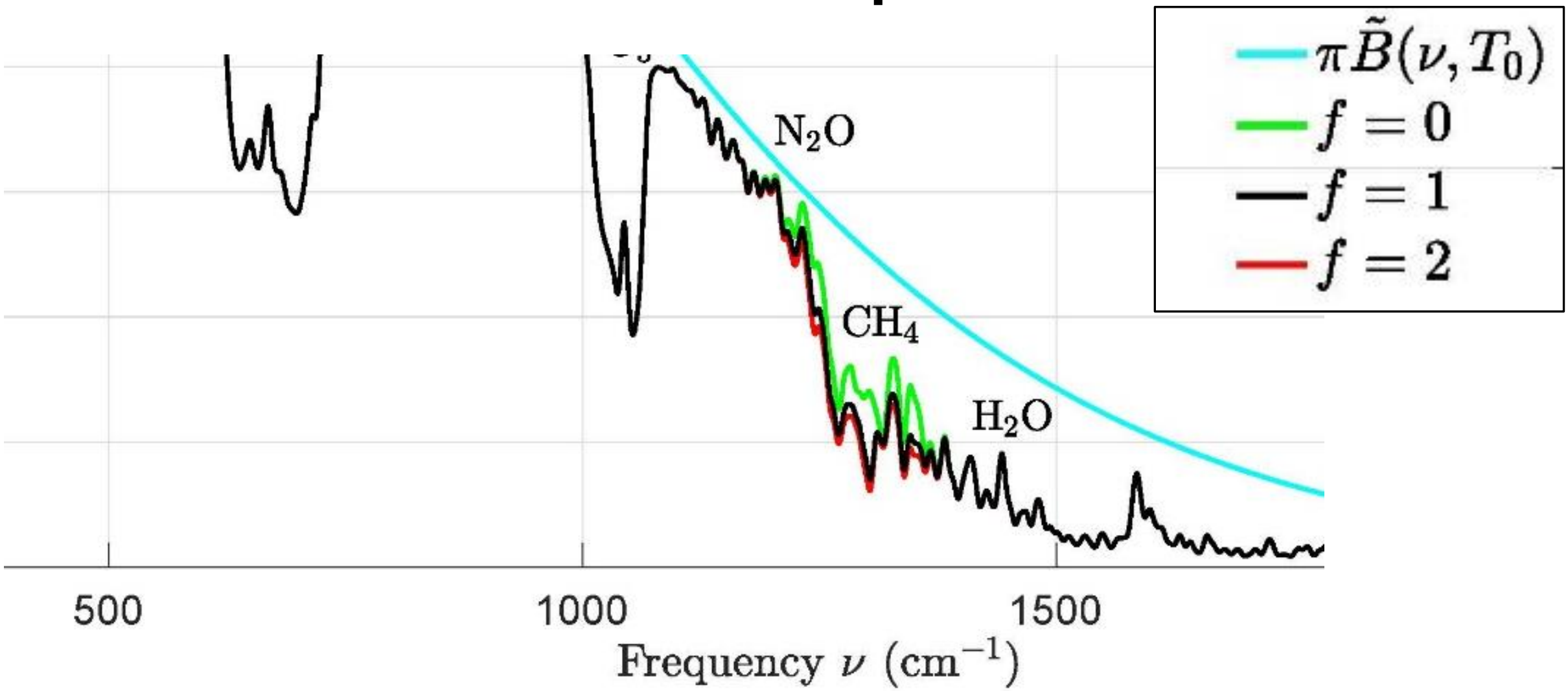
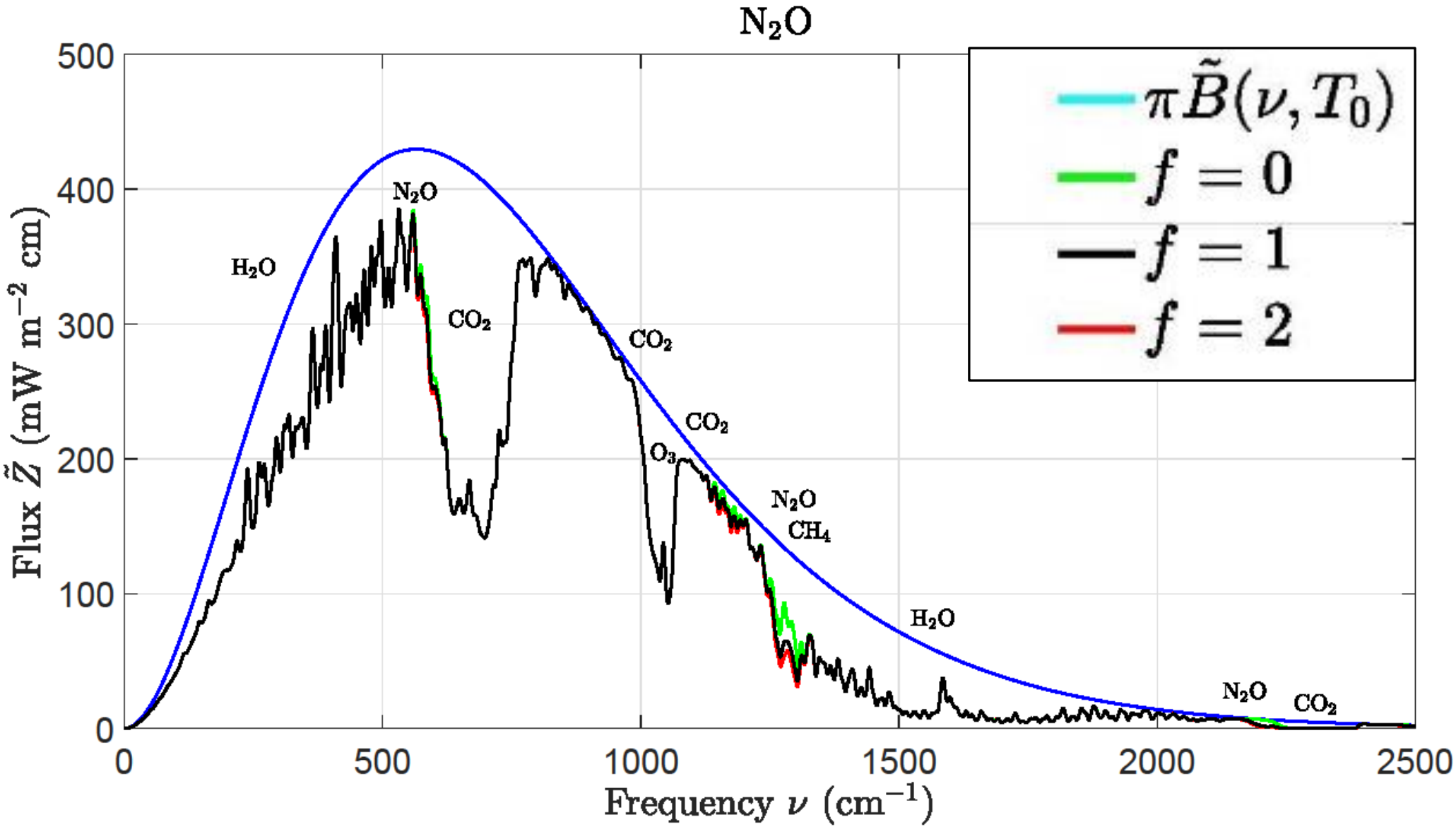
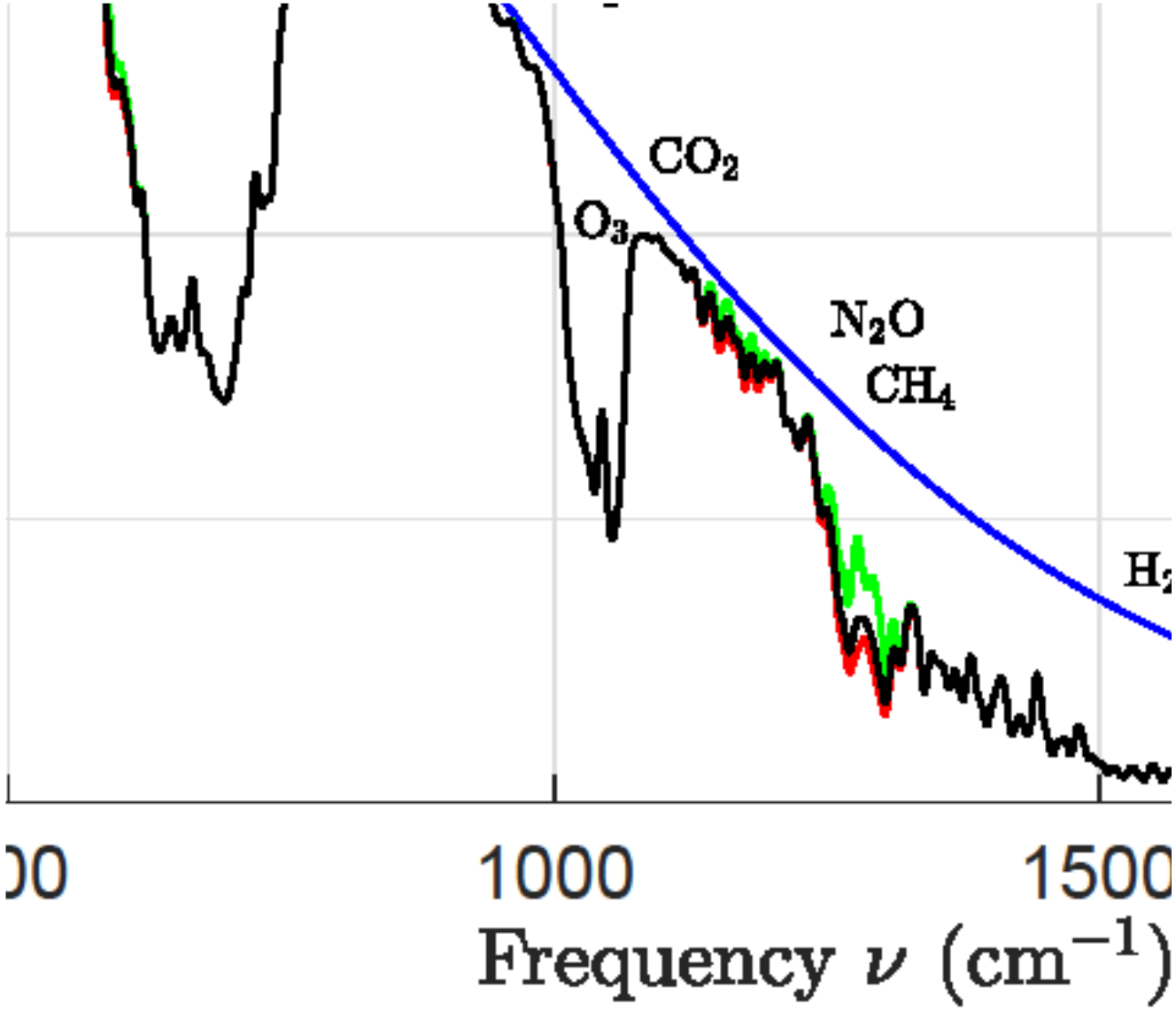


N_2O comparison



N_2O comparison



$\pi \tilde{B}(\nu, T_0)$

$f = 0$

$f = 1$

$f = 2$

Results of Numerical Experiments
(What it All Means)

- If CO_2 <u>were</u> zero, it would make a big difference (about 25%),
  and the earth would be cooler
- If CO_2 were doubled, it would make a very small difference
- CH_4 and N_2O are extremely hard to find on any graph
  Clearly, their contribution to the greenhouse effect is trivial
- Molecules of tiny concentration have even less effect
  - Example of HFCs, with extremely high GWP numbers

Scientific Implications

- Agreement between theory and experiment
  is the hallmark of good science
- The method of van Wijngaarden & Happer meets that criterion
- It is far superior to the GCM results featured in IPCC reports,
  which always predict too high Temperatures.

More CO_2 makes only a tiny difference

More N_2O or CH_4 is tinier still, far less than CO_2's effect

Policy Implications

Acknowledge that “They Got it Right.”

Accept the results of van Wijngaarden & Happer,

instead of words in IPCC Summary-for-Policymakers

There is NO climate emergency !

Greenhouse gases can’t stop the ever-changing climate

Therefore:

- Do <u>not</u> take expensive actions to mitigate climate change
- Do <u>not</u> strive to reduce CO_2 or other GreenHouse Gases

How did we get into today's situation ?

- A "Summary for Policy-Makers" is written by *diplomats*
  NOT scientists !
- Busy people only read the highlights of the summary
- Real science gets buried very deep inside
- IPCC reports are lengthy and detailed
  - Working Group 1 examines the science
  - Working Group 2 asks what will happen
  - Working Group 3 asks what should be done about it.
- If WG1 said "no problem," WG2 & WG3 would be out of business
  - Prestige, money, and momentum all reject that possibility.

IPCC's fundamental errors (1)

- Real air vs. Dry air
  - The "standard atmosphere" doesn't exist in the real world
  - It is a laboratory gas, made by artificial means
    - It's easy to do calculations about dry air
  - Real air *always* contains some H_2O
    - Enough so that saturation of the absorption bands occurs
- H2O is the ***major*** greenhouse gas
  - It should be calculated first, not later
    - Nobody ever does "perturbation" calculations that way

IPCC's fundamental errors (2)

- Feedback mechanism
  - IPCC assumed *positive* feedback
    - Rising T → more H2O evap → GHGs closer to ground → rising T
      - Ref: Manabe's Nobel Lecture
  - Nature contains *negative* feedback mechanisms
    - LeChatelier's Principle
  - Feedback amplification misunderstood (Monckton *et al*)
    - Feedback acts on the entire signal, not just the delta

Part 2: Why GWP is Useless

- Computational method is described in AR 4, pp 210 – 214
- Intent is to get a *ratio* of this gas compared to CO_2
- The text presents an equation containing a triple integral
  - That intimidates most readers
  - People skim over the pages of verbiage that follows
- Simplifying assumptions immediately follow
  - Because of scant data, complicated functions are set = 1
  - Happer: "fuzzed up with poorly-known forcing times, indirect effects, etc."
- A lengthy table of GWP values is presented
  - Notably CH_4 & N_2O, but many more, including Freons.

Three Reasons why CH_4 is Irrelevant
[same is true for N_2O]

- 1. There isn't very much methane (< 2 ppm)
  - Compare: CO2 = 400 ppm and H2O = `15,000 ppm ±
- 2. H_2O out-competes CH_4 in the same spectral region

  Collision-broadening of lines creates "overlap" in the troposphere

  Only up in stratosphere do the "comb" of lines miss each other
- 3. Little energy emitted by earth in CH_4's absorption band

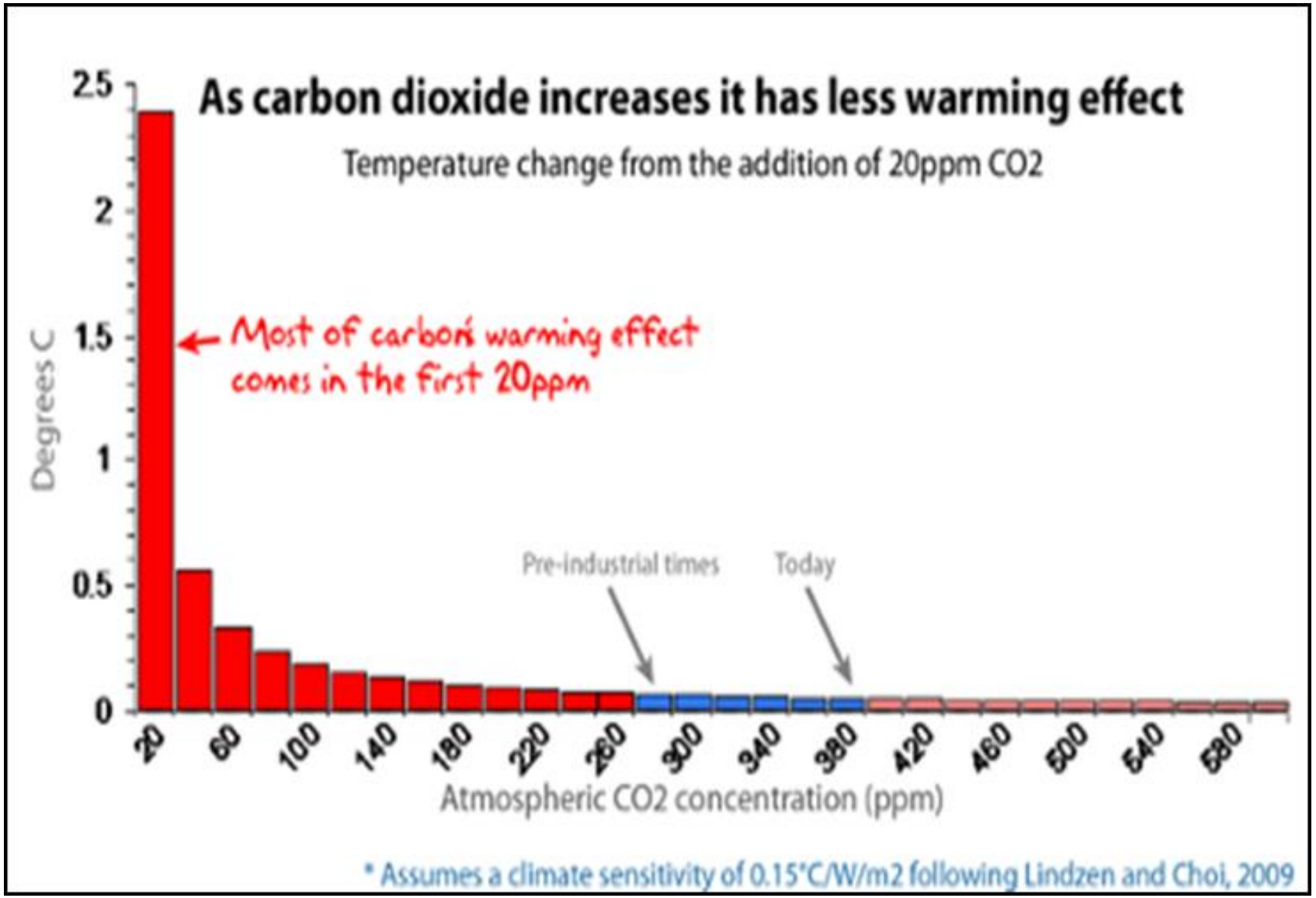
  Remember: blackbody spectrum for 288 ^oK peaks at 15 microns
  - less that 20% of peak at 7.5 microns
  - CH_4 absorption band is very narrow
- **None of these are taken into account in GWP factor**

Global Warming Potential

GWP is the ratio of two slopes

- Compares *saturation* curve for 2 gases
  - Vertical axis is absorption
  - Horizontal axis is concentration
- Concentration of CO_2 = 385 ppm (in AR 4, 2007)
  - CO_2 absorption is very nearly saturated
  - Curve is very close to flat, and slope is a tiny negative number
- Concentration of CH_4 = 1.8 ppm
  - Absorption curve declines steeply at low concentration
  - Slope is a substantial negative number

CO_2 saturation curve



“Diminutive Denominator” problem

- Q = N / D
- You can’t divide by zero
- When the denominator is close to zero, the quotient will be huge
- For an increase (delta) of only 1 ppm:
  - CO_2 saturation curve changes very little
    - 410 → 411 ppm
    - Near-flat slope hardly changes at all
  - CH_4 saturation curve changes a lot
    - 1.8 → 2.8 ppm
    - Large slope becomes slightly less large

Tiny denominator yields:

- CH_4: GWP ~ 28
- N_2O: GWP ~ 300
- Freons: GWP > 1000
- Every one of these numbers is ***meaningless***
- The actual spectrum (vW & H) shows the reality

Famous Last Words

- The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future exact climate states is not possible.

-- *IPCC, Third Assessment Report*

- This needs to be made clear to Elected officials everywhere

Policy Implications

Accept the results of van Wijngaarden & Happer,

rather than the IPCC Summary-for-Policymakers

OR the faulty contrived GWP values

The trace gases don't influence the greenhouse effect

There is NO climate emergency

Greenhouse gases can't halt the ever-changing climate

Therefore:

- Do <u>not</u> take expensive actions to mitigate climate change
- Do <u>not</u> strive to reduce CO_2 or other greenhouse gases
- **Do <u>not</u> impose new regulations upon farmers**

Questions?