



Methane

the Irrelevant GreenHouse Gas

ICSF and CLINTEL presentation

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Dr. Thomas P. Sheahen

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 CH₄ and N₂O

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 *CO₂ 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 H₂O

Not the “US Standard atmosphere” which contains no H₂O

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/m² reaches earth from sun constantly ($\pm 3\%$)

Earth responds:

100 W/m² reflected back into space (30%). $\alpha = 0.3$

239 W/m² enter earth’s atmosphere or surface

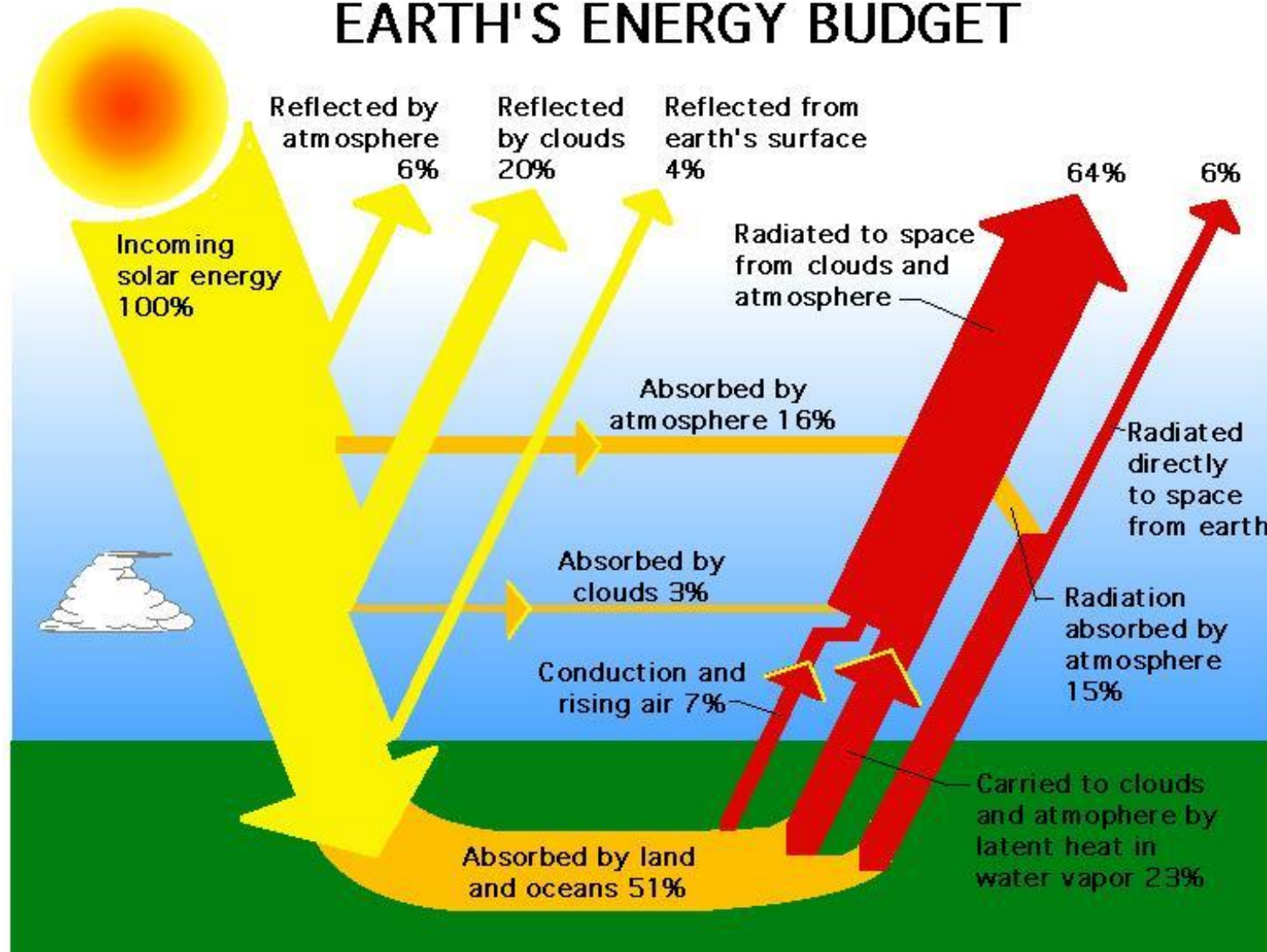
Several mechanisms of energy transfer and disposal

239 W/m² emitted back out into space

Forcing is pertinent to greenhouse calculations

Radiation Input and Output

EARTH'S ENERGY BUDGET



Reflected

$$6\% + 20\% + 4\% = 30\%$$

Radiated to Space

$$64\% + 6\% = 70\%$$

GHG Properties, Per-Molecule

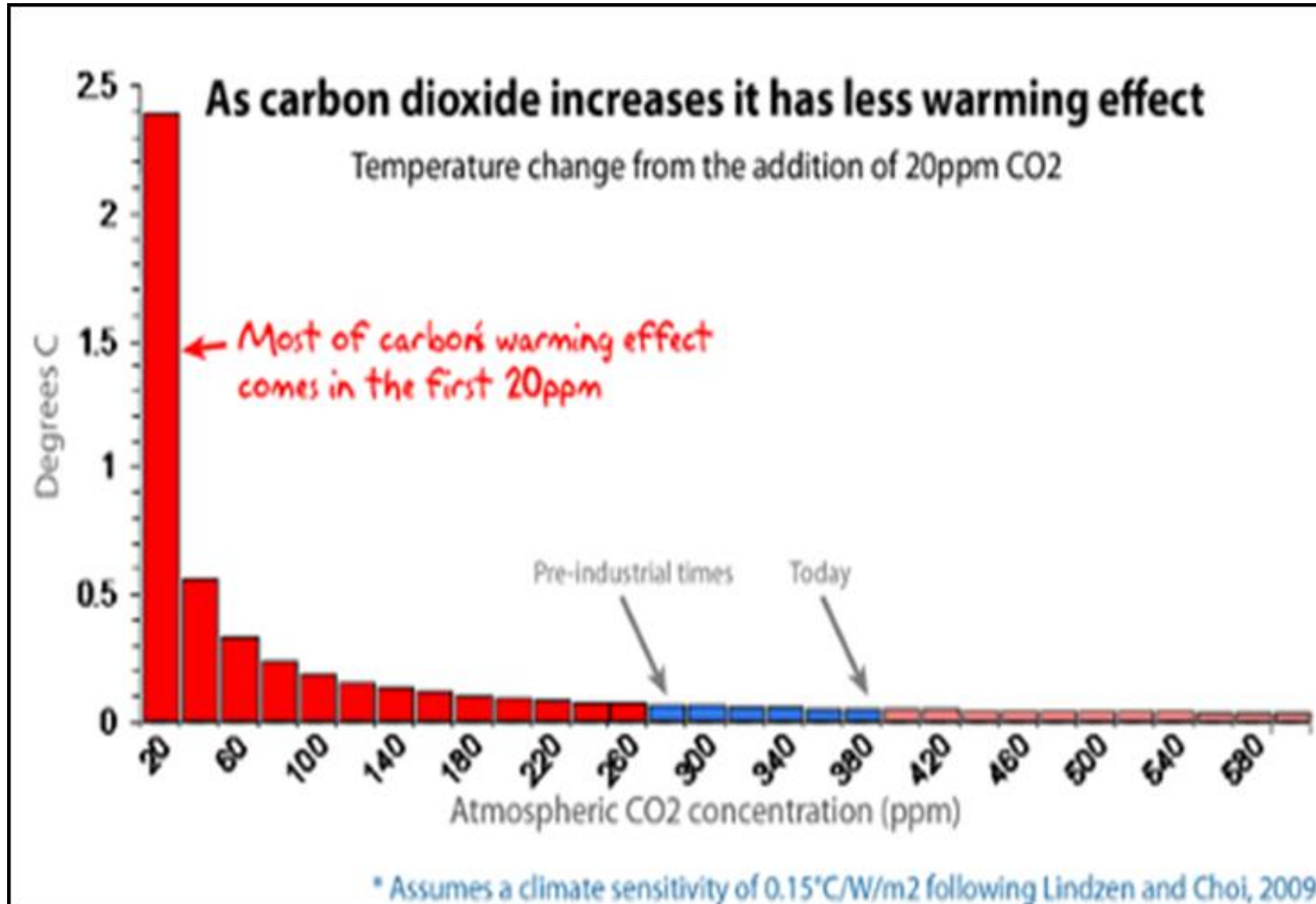
- From a paper by van Wijngaarden & Happer in 2019:

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 CO₂, with lesser but *comparable* forcings by O₃, H₂O, N₂O and CH₄.

“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

CO₂ saturation curve

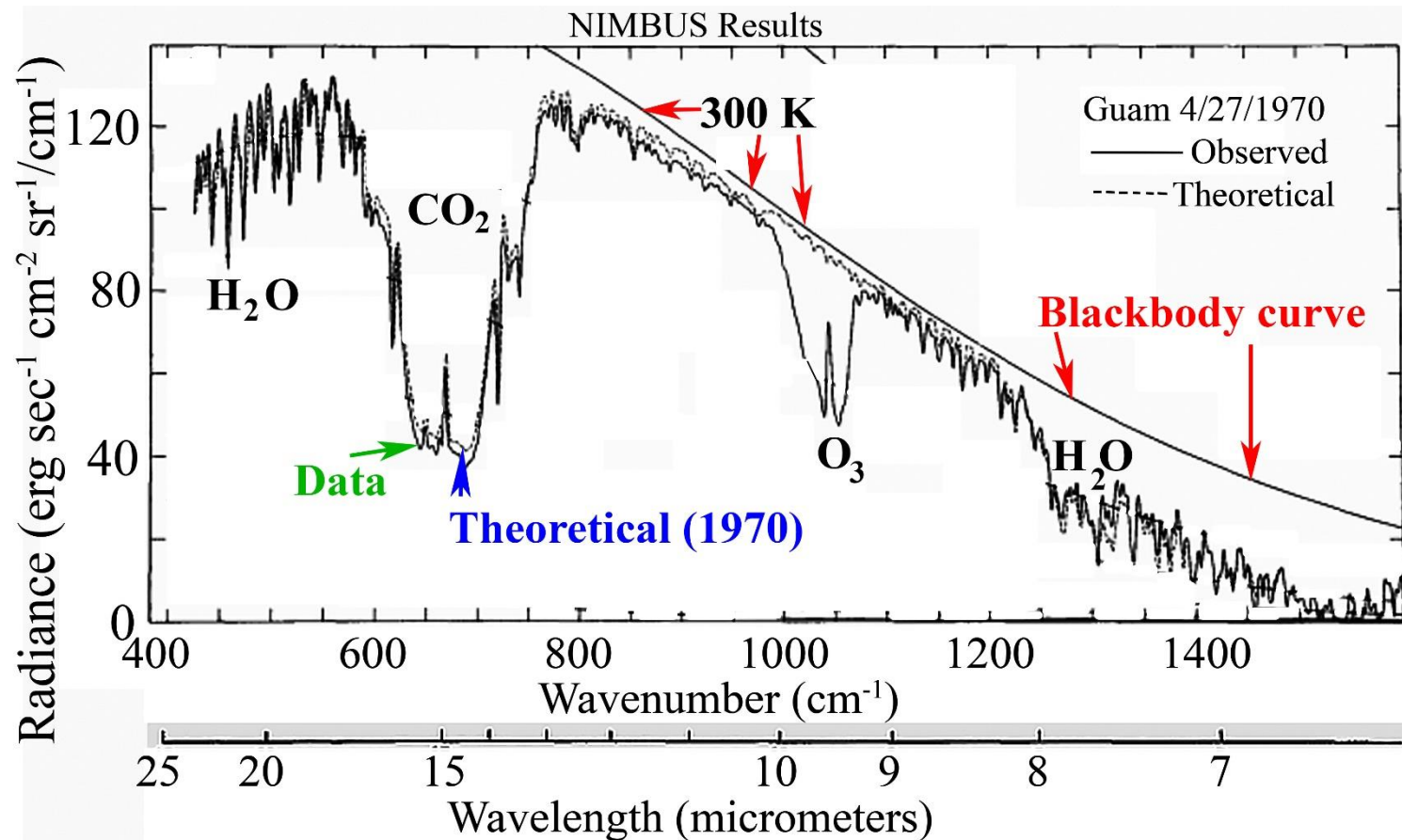


The GreenHouse Effect

- 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 $T_{\text{surface}} \sim 295 \text{ K}$

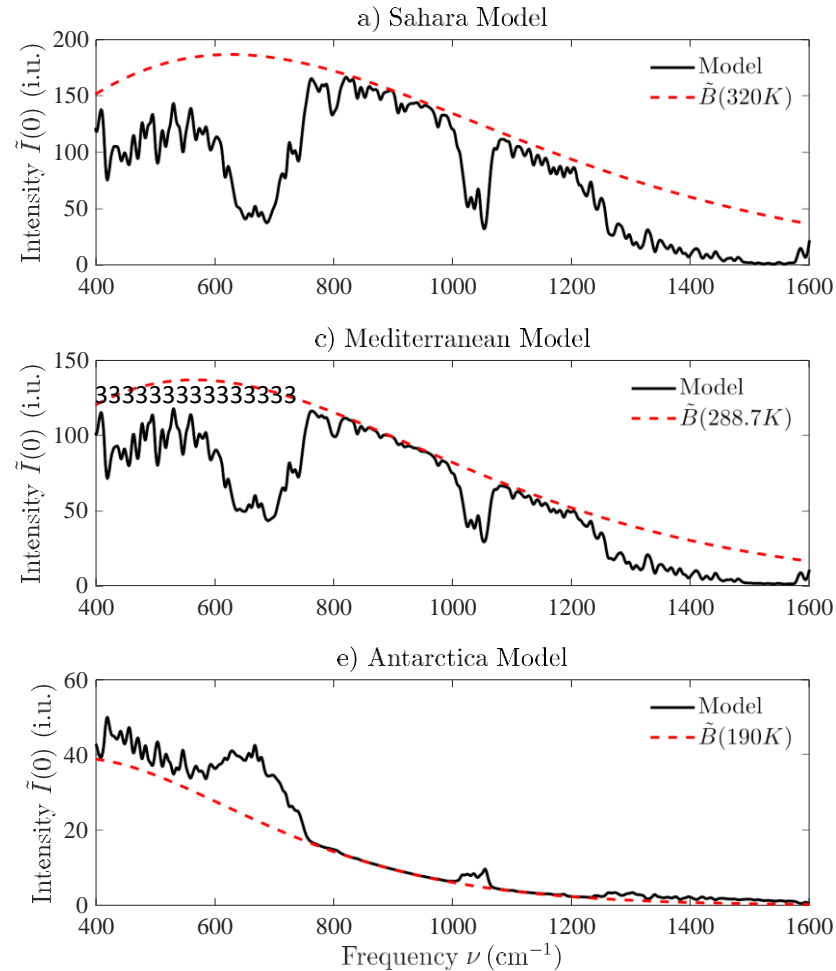


Calculations by van Wijngaarden & Happer

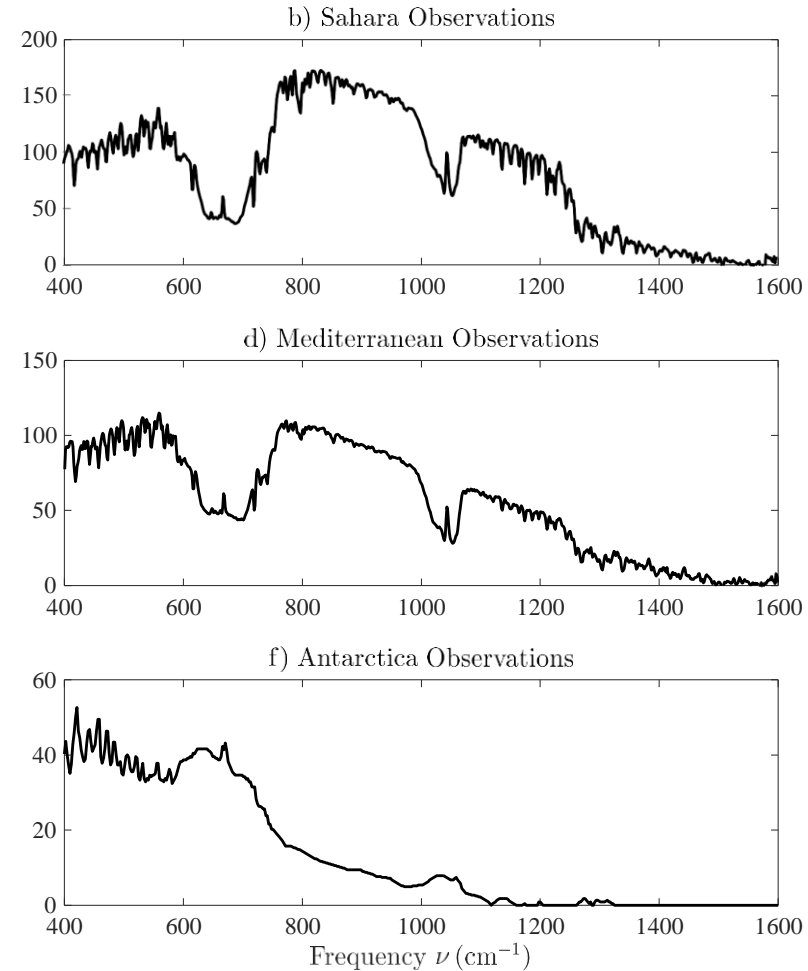
- Calculations were done for the *real* atmosphere
- All five GHGs were present at once
 - Real concentrations used
 - NOT the per-molecule case
 - H₂O and CO₂ were in a state of “saturation”
- H₂O is the dominant GHG (no surprise)
- CO₂ is secondary, but finite (~ 25%)
- O₃ matters in the stratosphere
- CH₄ and N₂O vanish in importance

Stunning agreement with measurements

van Wijngaarden & Happer *calculations*



satellite measurements

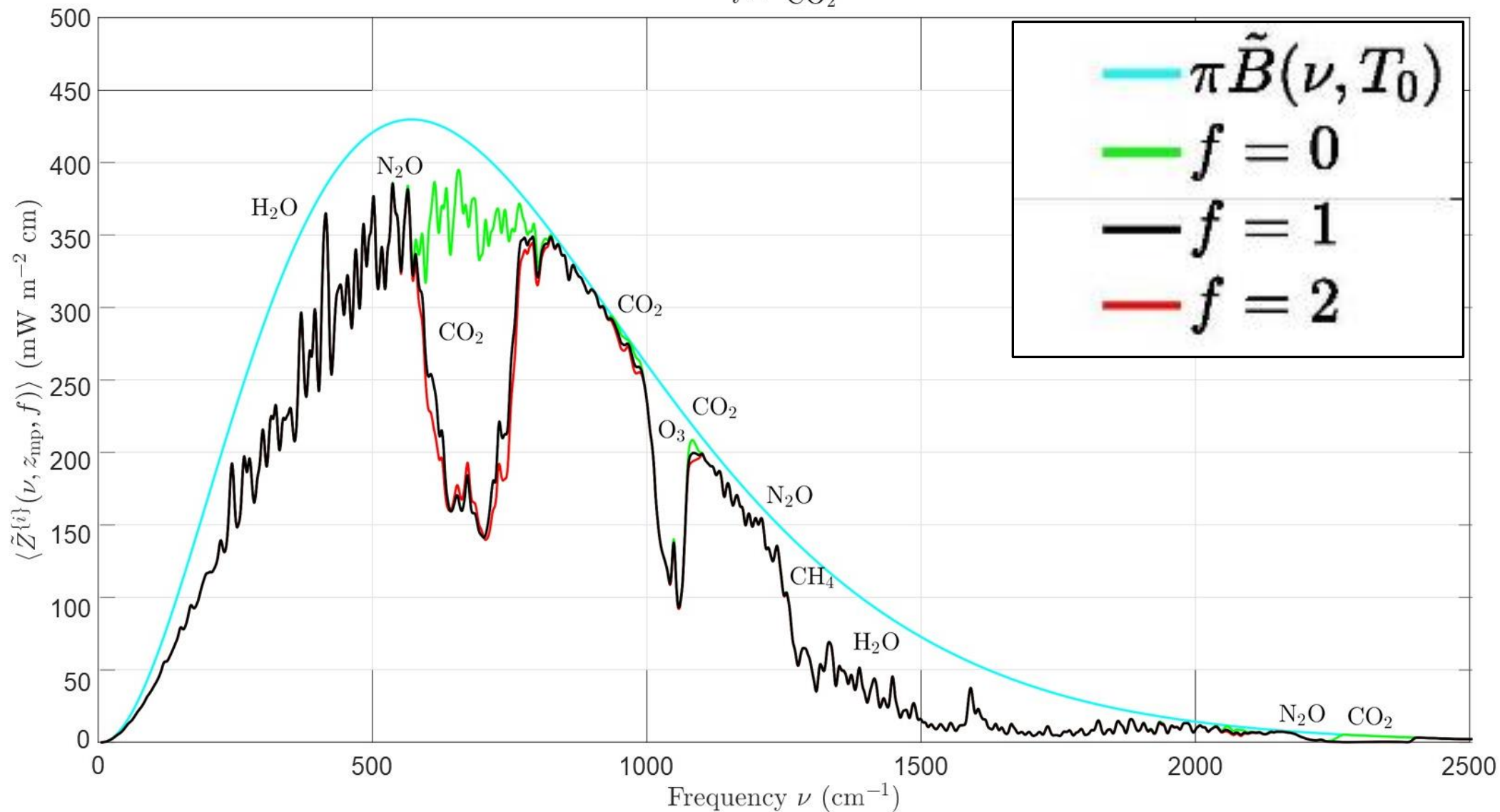


Major Accomplishment

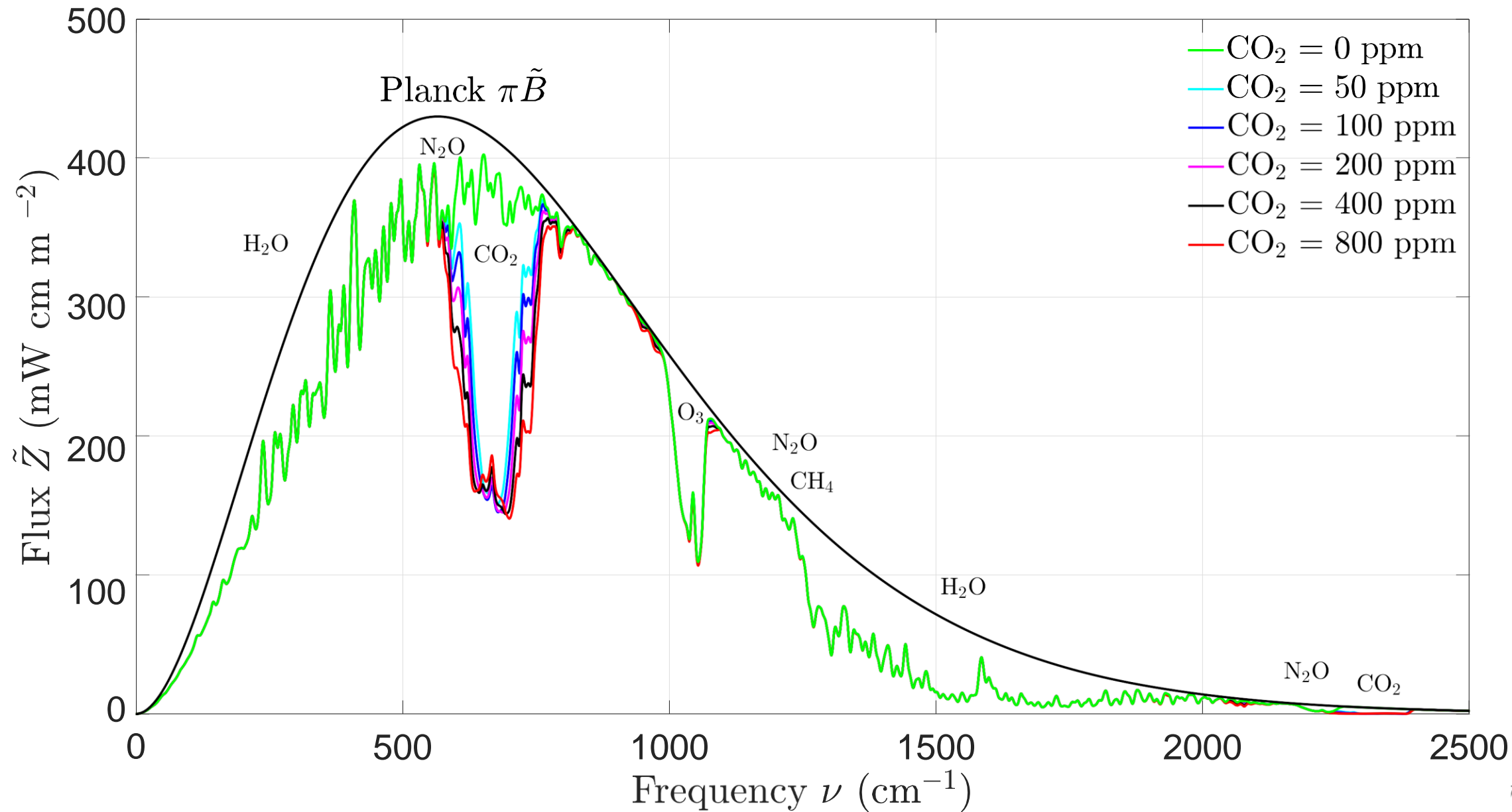
- THIS is the **correct** use of the Scientific Method:
- Because the agreement is so good between their calculations and actual measurements,
- At last we have a computational method that is trustworthy !
- Consequently, we can now conduct numerical experiments with CO₂ doubled, halved, etc.
- We do not have to rely upon artificially constructed numbers like “Global Warming Potential”

Numerical experiment: CO₂ comparison

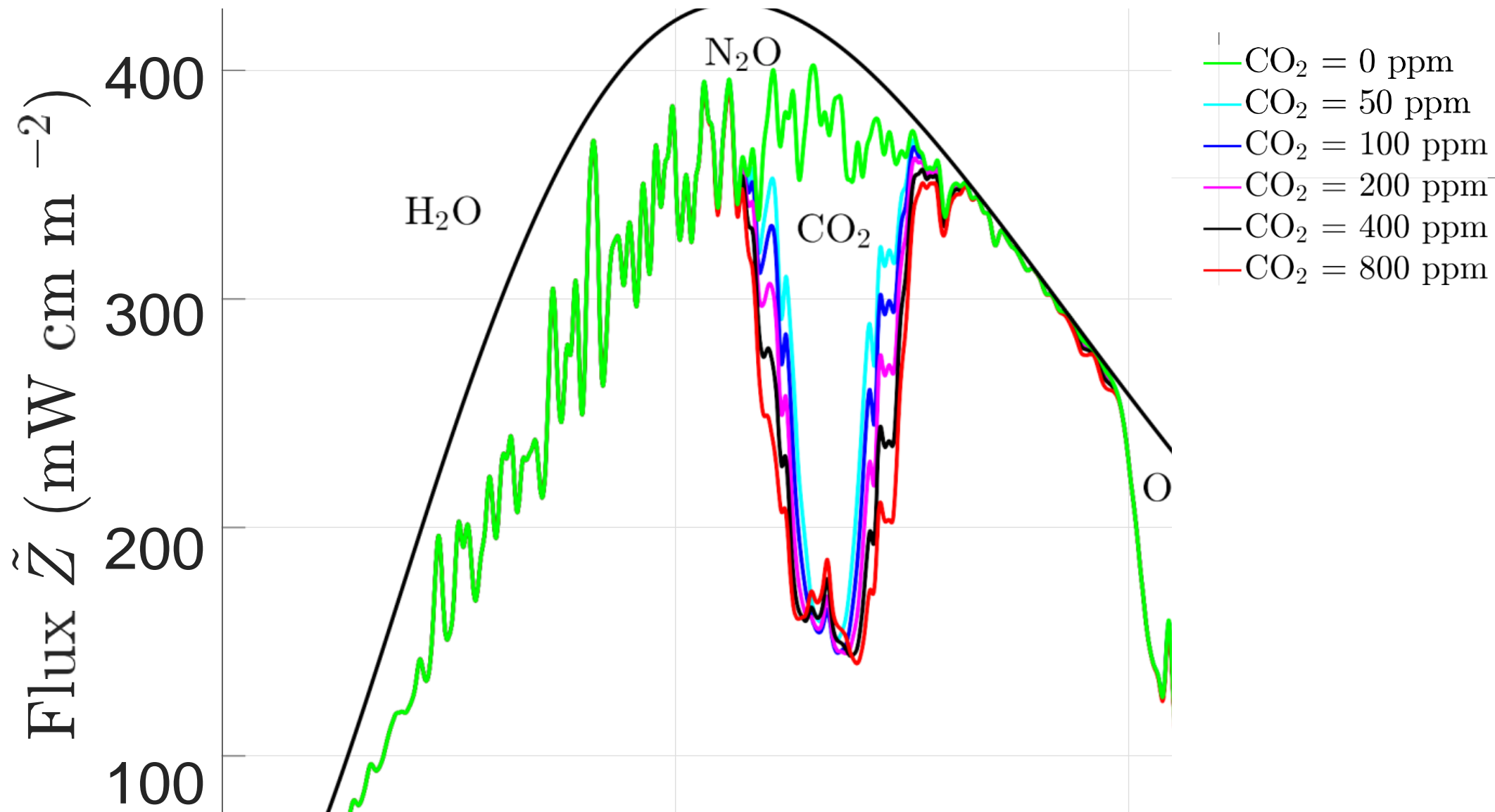
$i = \text{CO}_2$



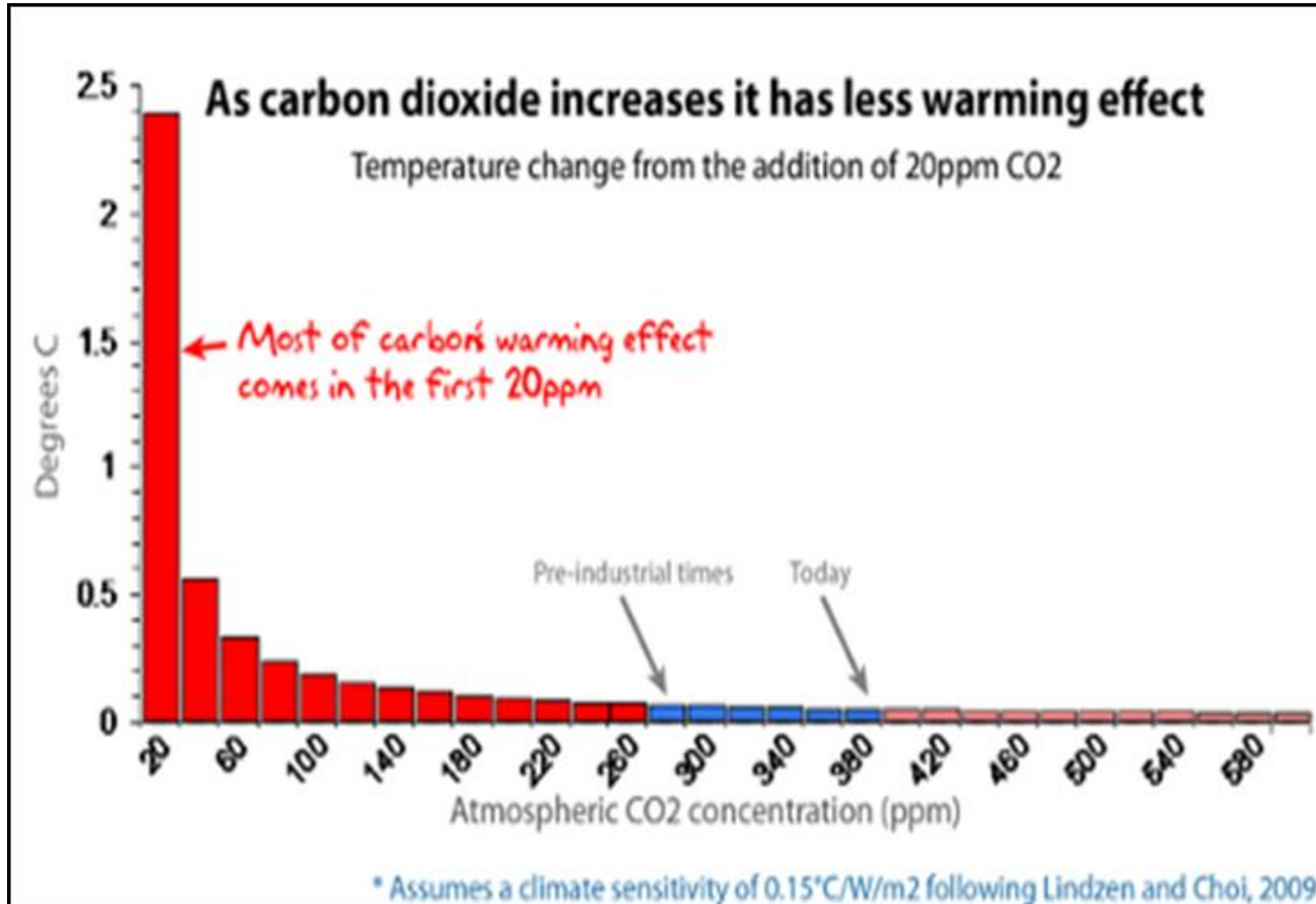
Effect of adding increments of CO₂



Effect of adding increments of CO₂

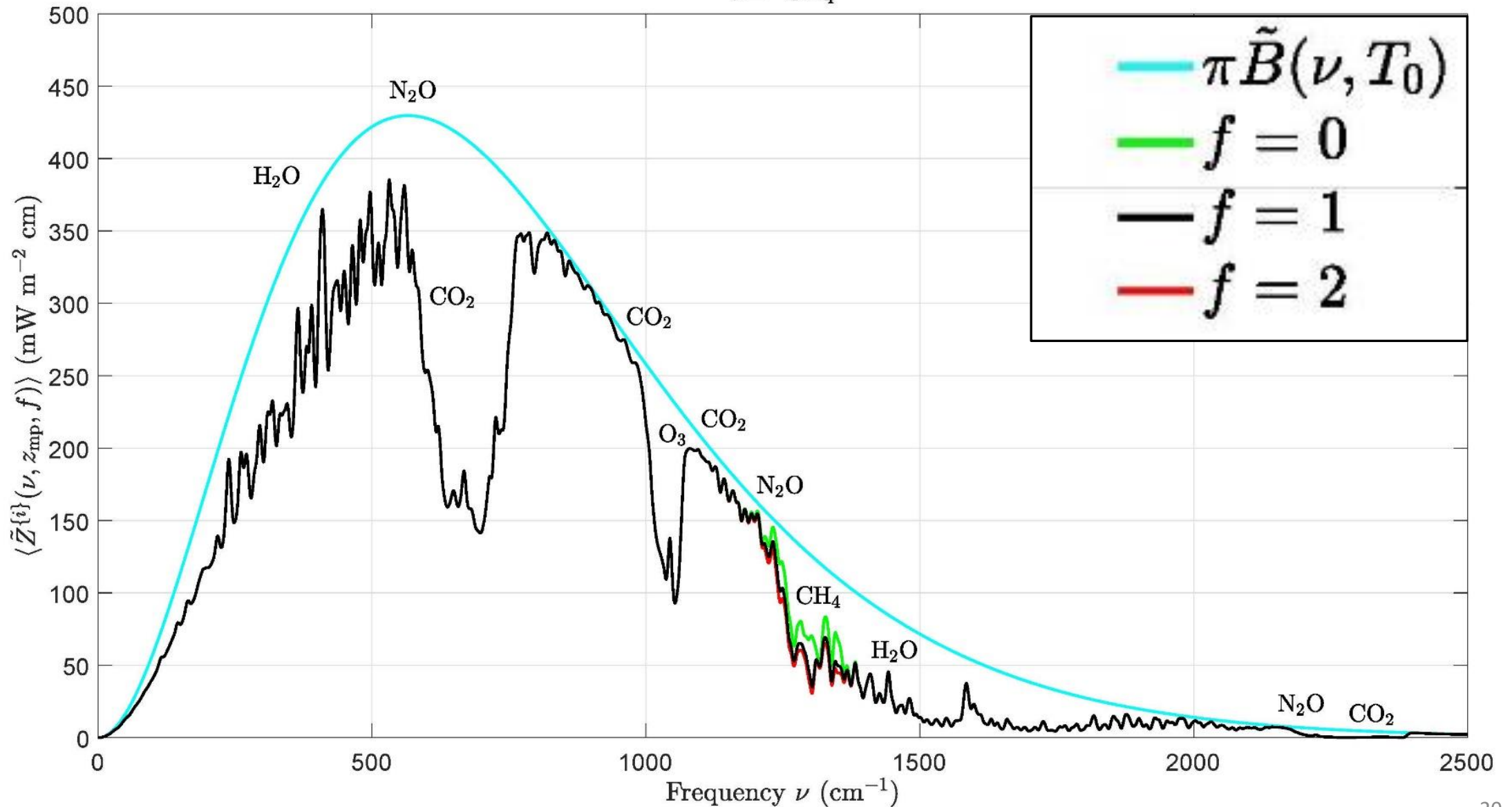


CO₂ saturation curve

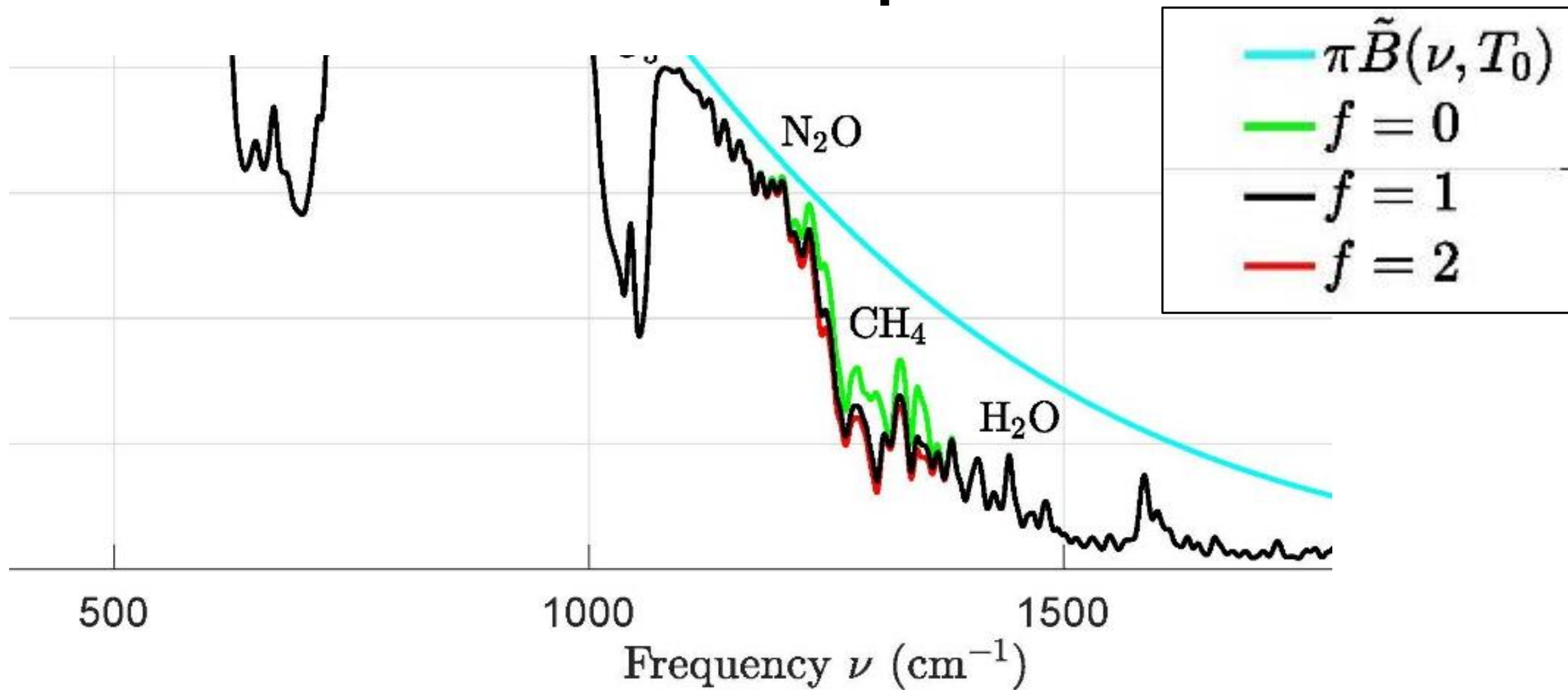


CH4 Comparison

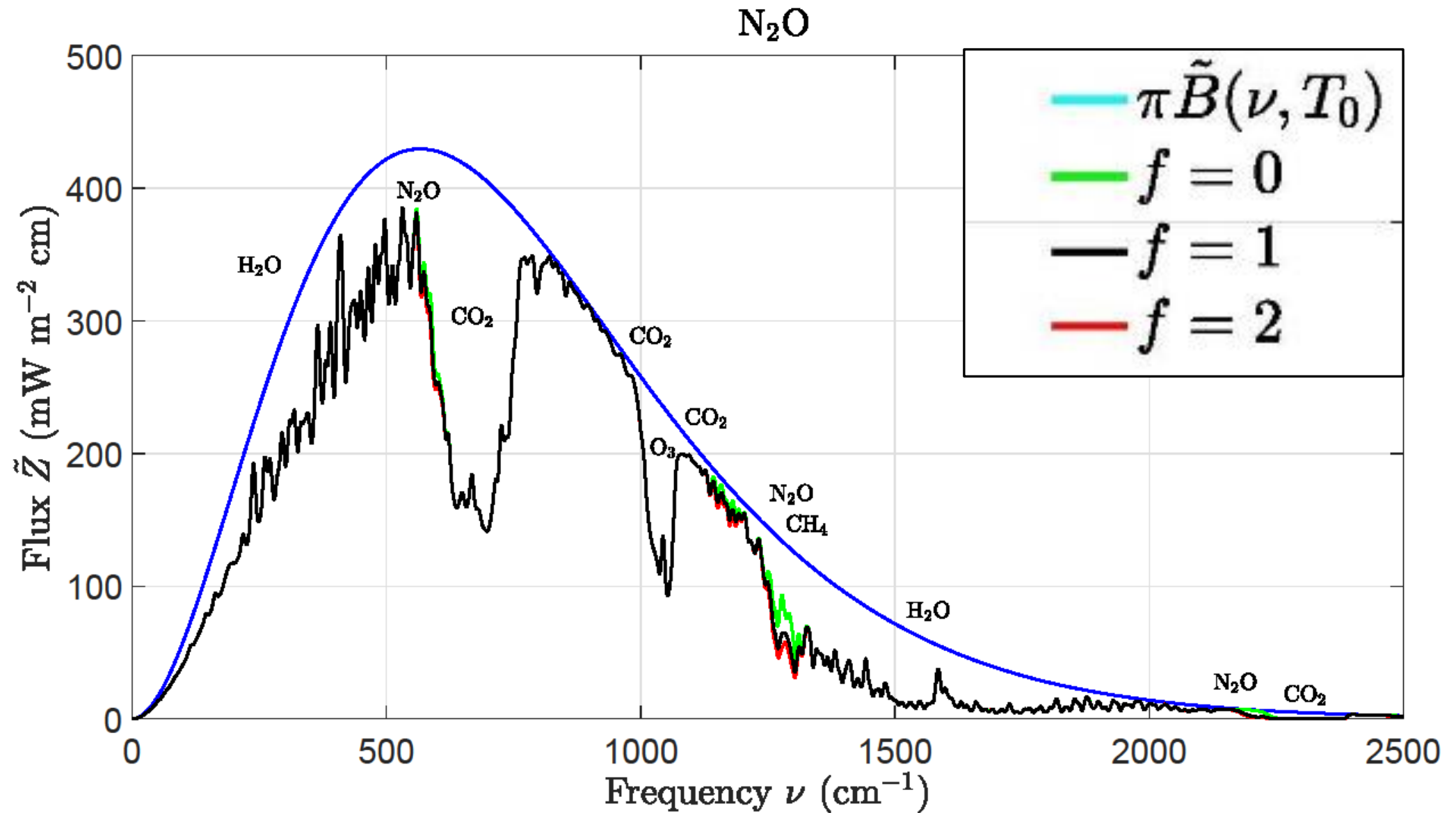
$i = \text{CH}_4$



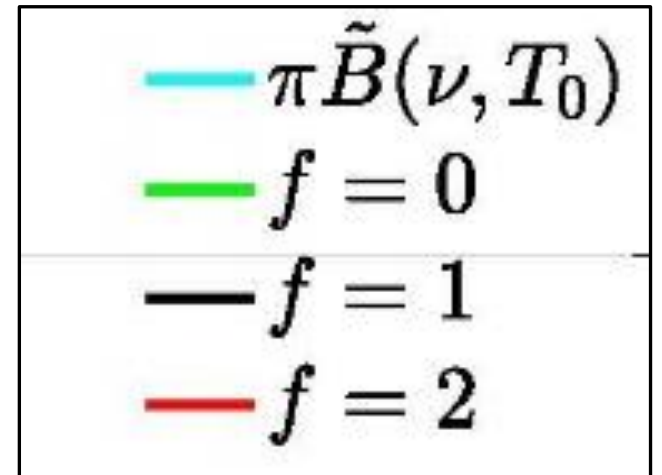
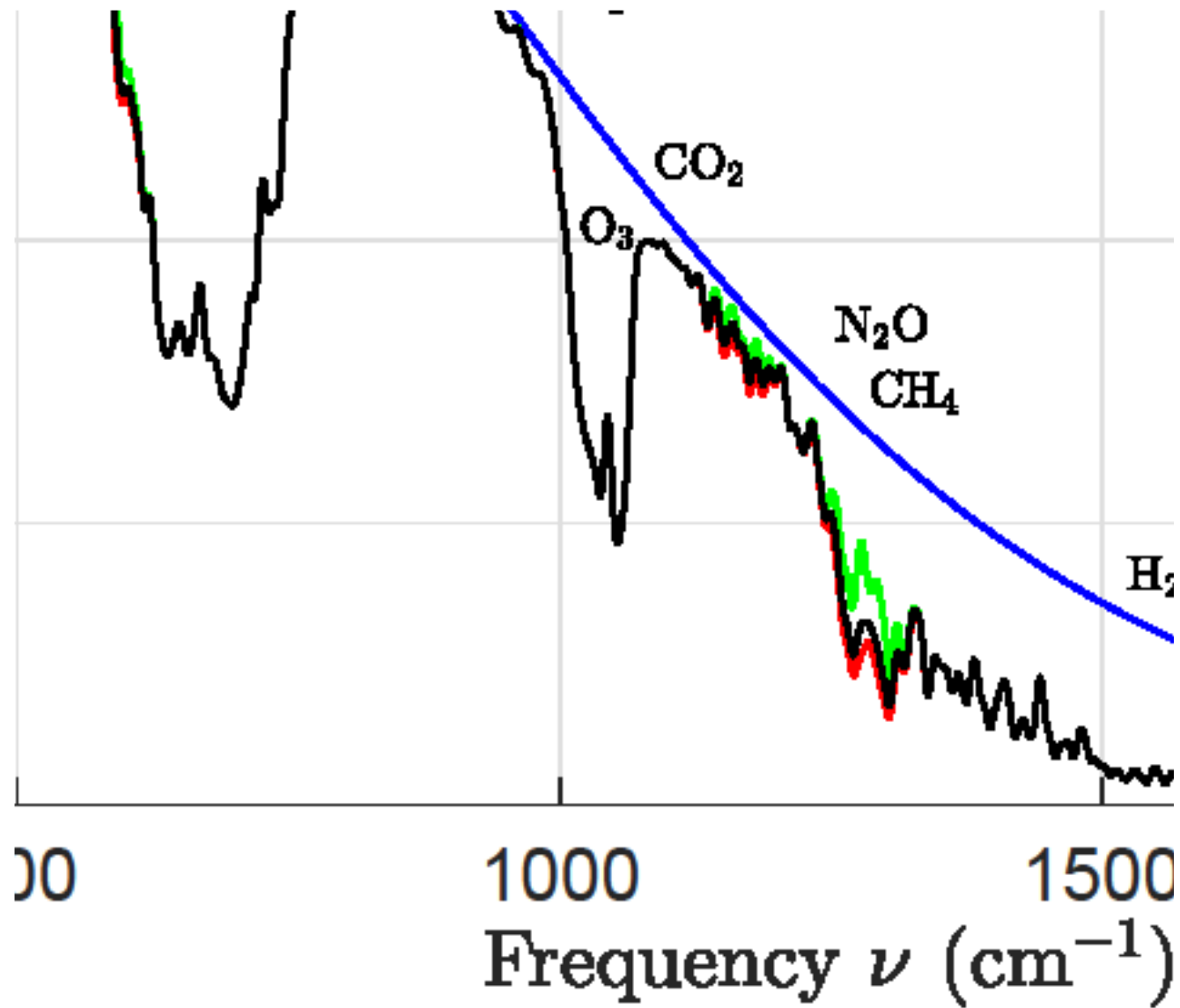
CH4 Comparison



N₂O comparison



N₂O comparison



Results of Numerical Experiments

(What it All Means)

- If CO₂ were zero, it would make a big difference (about 25%),
and the earth would be cooler
- If CO₂ were doubled, it would make a very small difference
- CH₄ and N₂O 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 CO₂ makes only a tiny difference

More N₂O or CH₄ is tinier still, far less than CO₂'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 not take expensive actions to mitigate climate change
- Do not strive to reduce CO₂ 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 H₂O
 - 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 CO₂
- 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 CH₄ & N₂O, but many more, including Freons.

Three Reasons why CH₄ is Irrelevant

[same is true for N₂O]

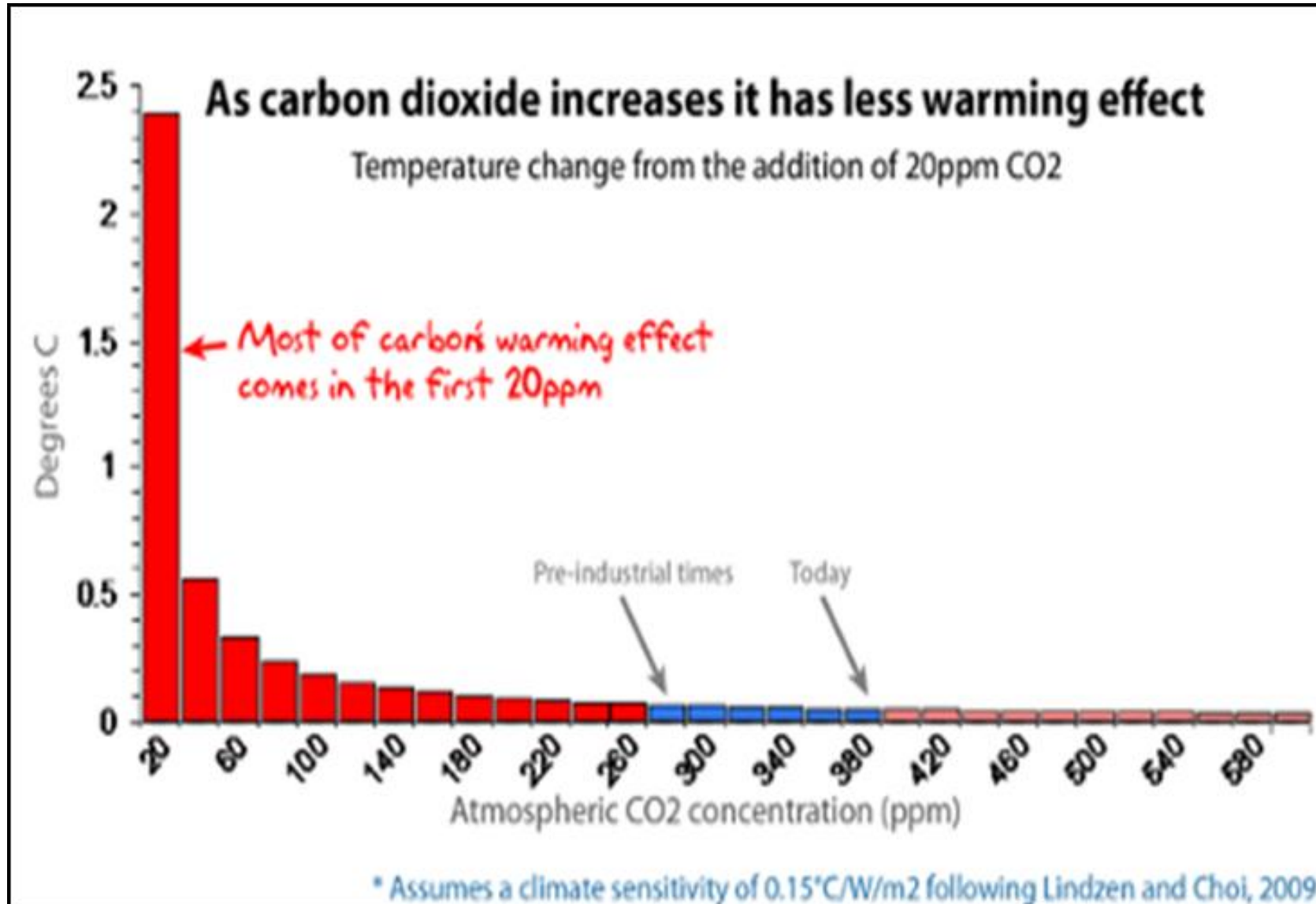
- 1. There isn't very much methane (< 2 ppm)
 - Compare: CO₂ = 400 ppm and H₂O = ~15,000 ppm ±
- 2. H₂O out-competes CH₄ in the same spectral region
 - Collision-broadening of lines creates “overlap” in the troposphere
 - Only up in stratosphere do the “comb” of lines miss each other
- 3. Little energy emitted by earth in CH₄'s absorption band
 - Remember: blackbody spectrum for 288 °K peaks at 15 microns
 - less than 20% of peak at 7.5 microns
 - CH₄ 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 $\text{CO}_2 = 385$ 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 $\text{CH}_4 = 1.8$ ppm
 - Absorption curve declines steeply at low concentration
 - Slope is a substantial negative number

CO₂ 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:
 - CO₂ saturation curve changes very little
 - 410 → 411 ppm
 - Near-flat slope hardly changes at all
 - CH₄ saturation curve changes a lot
 - 1.8 → 2.8 ppm
 - Large slope becomes slightly less large

Tiny denominator yields:

- CH₄: GWP ~ 28
- N₂O: 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.

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-- *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 not take expensive actions to mitigate climate change
- Do not strive to reduce CO₂ or other greenhouse gases
- **Do not impose new regulations upon farmers**

Questions?