


Climate Change

Part 1 - Green house gases 4.4





**The Estate of
SPERRY H. GOODMAN**

Greenhouse Gases

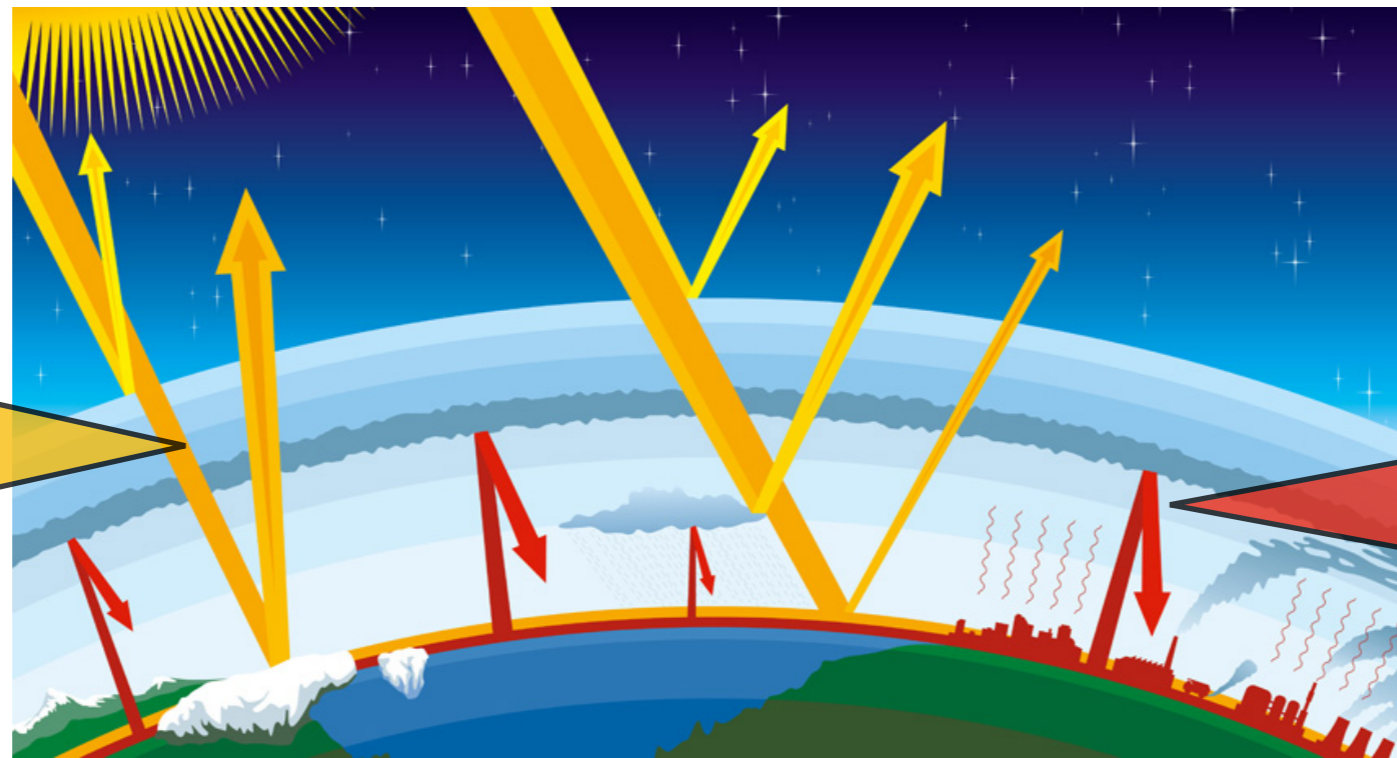


- These gases blanket the Earth
 - allow light to penetrate the atmosphere, but prevent heat from escaping
- CO₂ (2nd)
 - Sources- cellular respiration, combustion, decomposition
 - sinks - photosynthesis, dissolving in seas
- Water Vapour (1st)
 - sources- transpiration, evaporation,
 - sinks - rainfall, snow
- Methane CH₄ (3rd)
 - sources- marshes (decomposition), landfills, livestock
- Nitrous Oxide N₂O
 - bacteria, agriculture, car exhaust

Impact of Gases

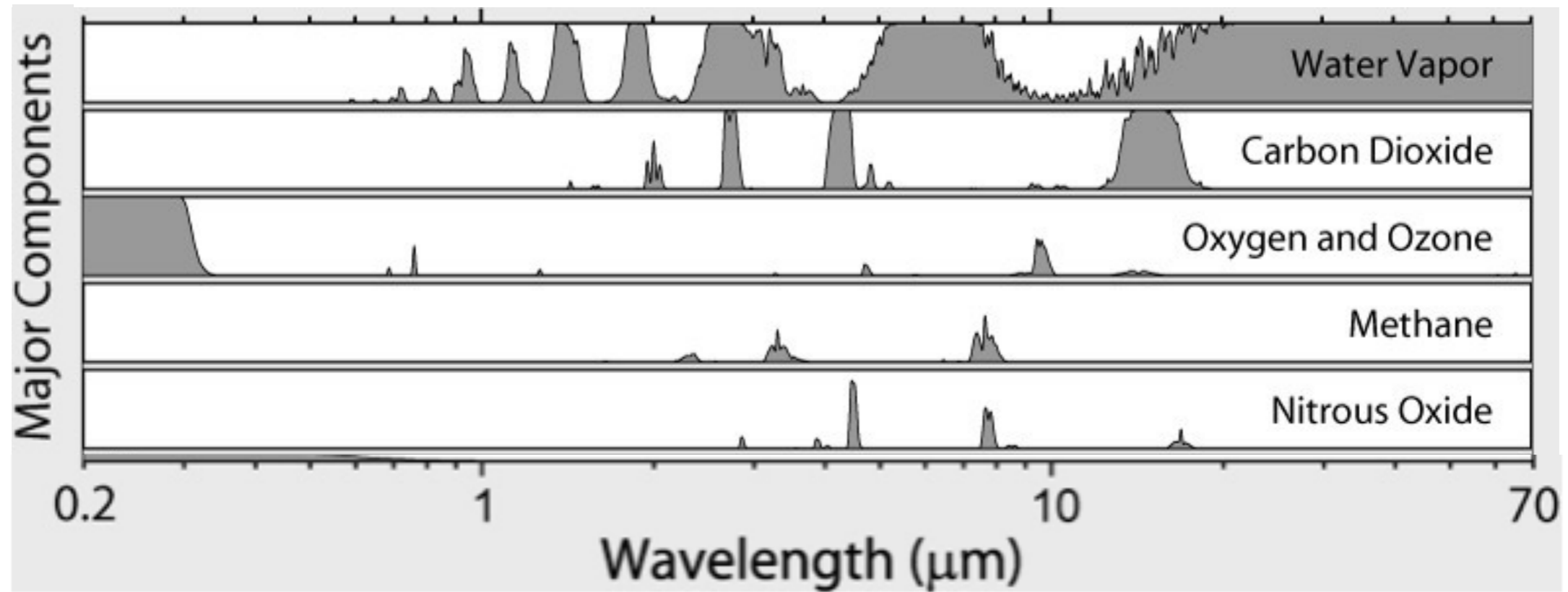
- Recall ;
 - short wavelength (violet, UV, X-rays...)
 - long waves (red, Infrared, microwave...)

- Most wave from sunlight are short wave (400nm).
- These readily penetrate the atmosphere
- maybe reflected out or much will strike the earth to be converted to heat (70-75%)



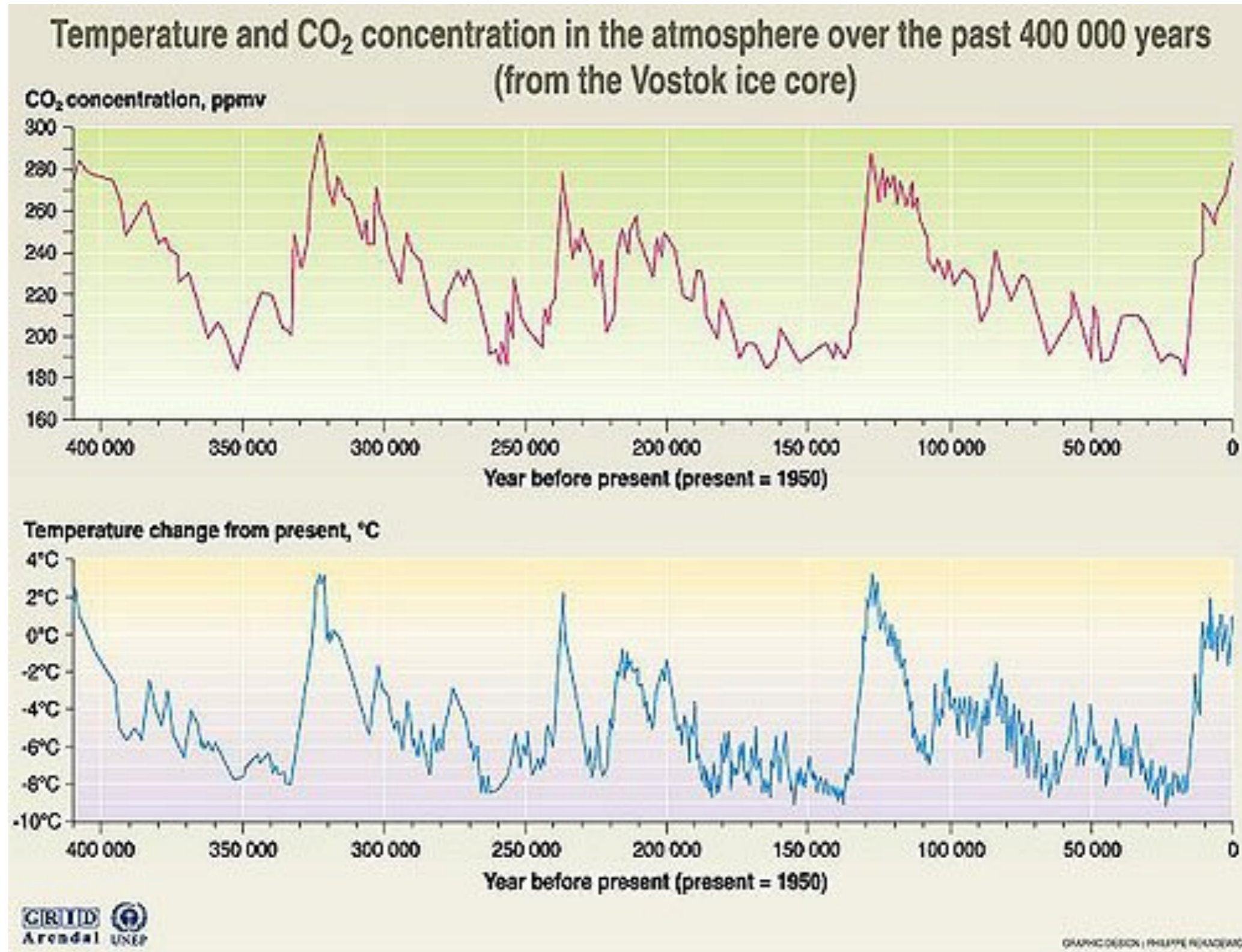
- a warm earth emits long waves (10,000nm)
- long waves are absorbed by greenhouse gas (70-85%)
- this heat energy is reemitted to earth, which provides a livable planet

Long-wave Absorption Vs gas



- Water vapour has the greatest contribution to long wave absorption
- all gases absorb some long waves
- planet 32°C warmer than if not present

Historical Greenhouse Gas Pattern



Source: J.R. Petit, J. Jouzel, et al. Climate and atmospheric history of the past 420 000 years from the Vostok ice core in Antarctica, *Nature* 399 (3, June), pp 429-436, 1999.

Historical Greenhouse Gas Pattern

- Data collected through ice cores with trapped bubbles
- a fragment of ancient atmosphere in each bubble
- bubbles are analyzed for gases present
- global temperature are deduce through water molecule composition
 - <https://www.scientificamerican.com/article/how-are-past-temperatures/>
- There exists a constant correlation between Greenhouse gases and average earth temperature.

