Global Warming
Lecture 3.5
Greenhouse Gases

Emissivity review :

Most objects are not blackbodies!

At a given wavelength, a real object emits / absorbs a fraction ε_λ / a_λ of the radiation a blackbody would emit at a given temperature.

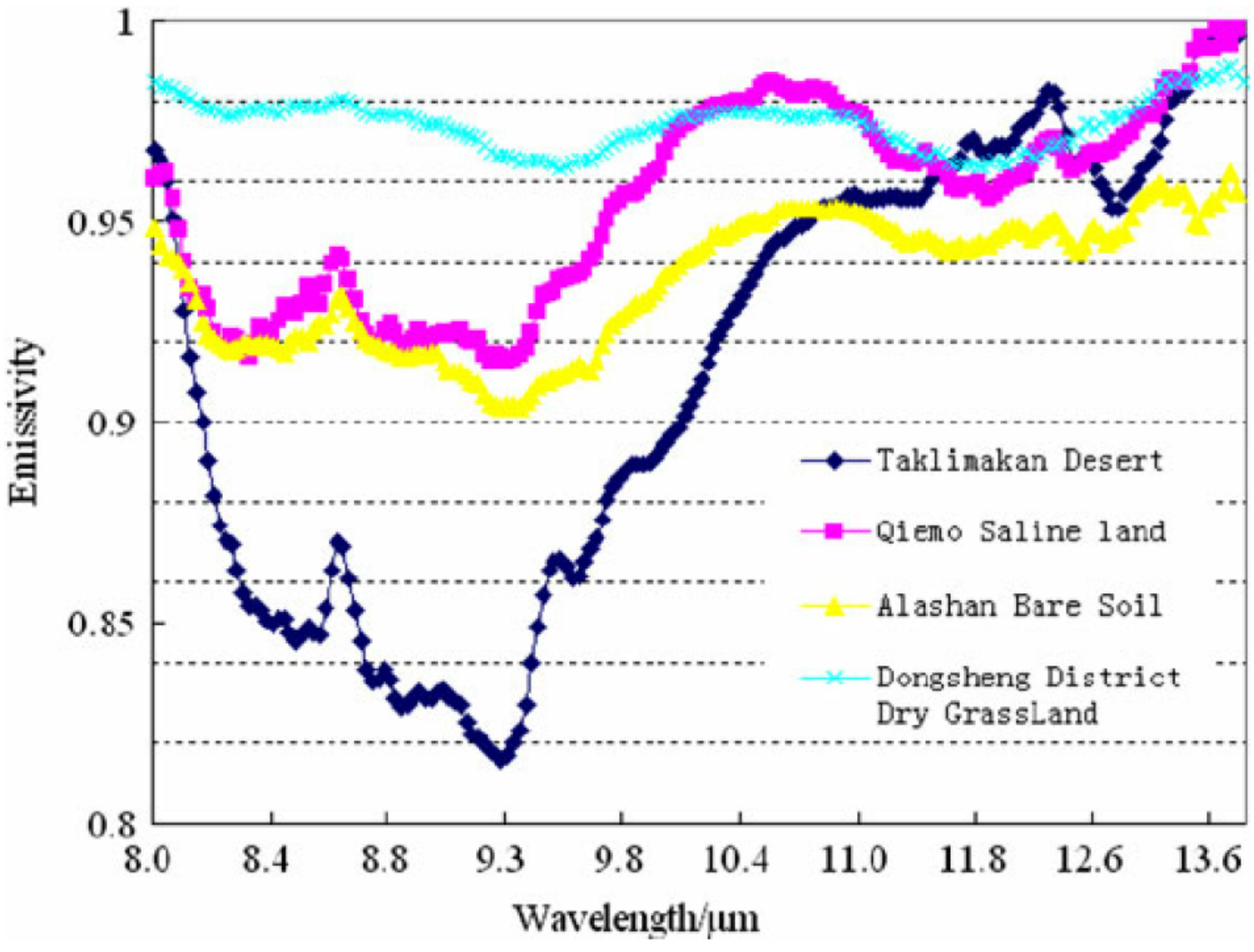
ε_λ = emissivity

a_λ = absorptivity

$$a_\lambda = \varepsilon_\lambda$$

For most solids and liquids ε_λ and a_λ are fairly constant with wavelength, and usually ε_λ and $a_\lambda \sim 1$

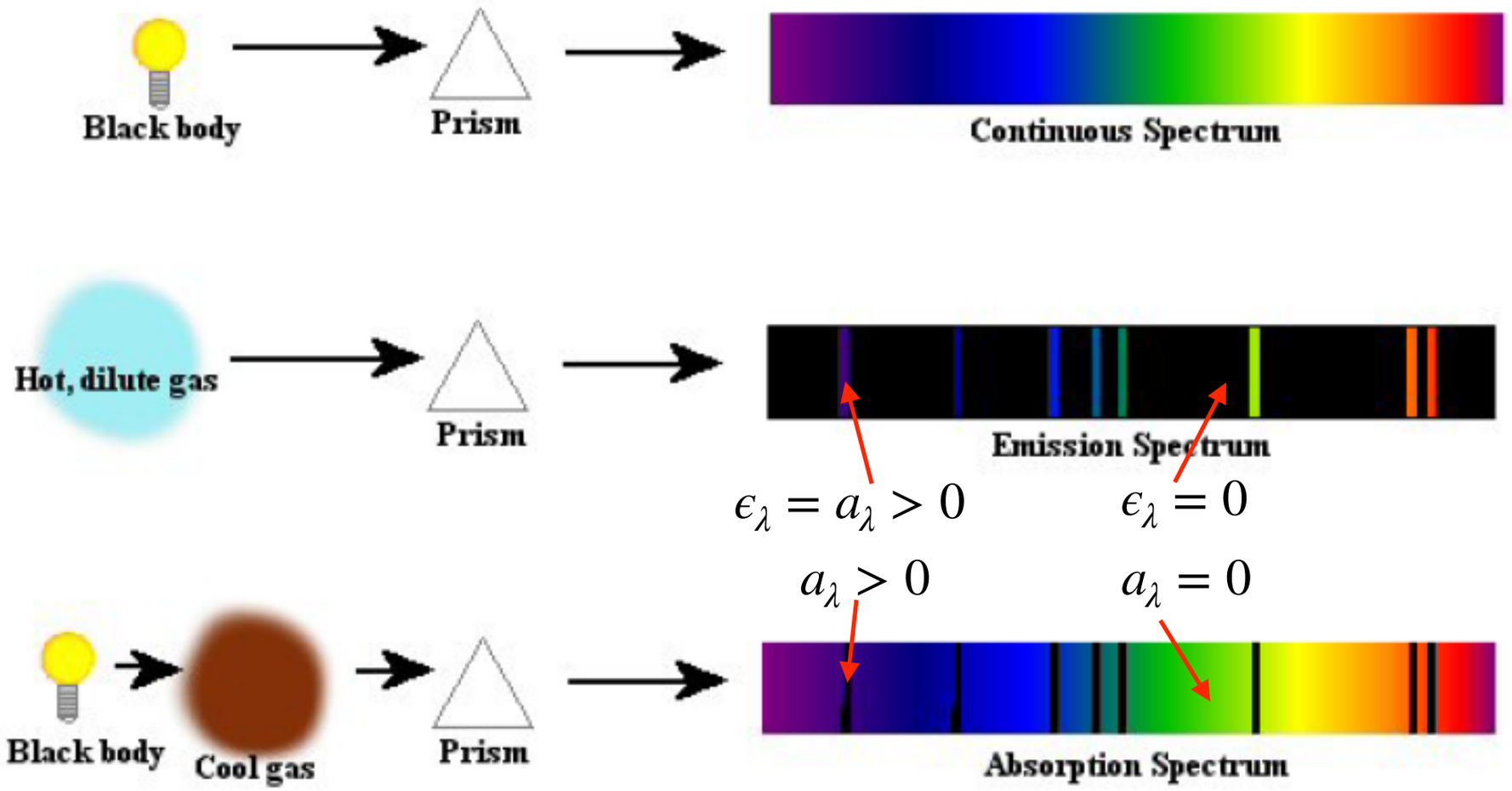
Emissivity of the land surface in different areas of China



Greenhouse gases:

Only particular frequencies/wavelengths of light can be absorbed/emitted by a particular gas.

A gas emits and absorbs at the same frequencies/ wavelengths



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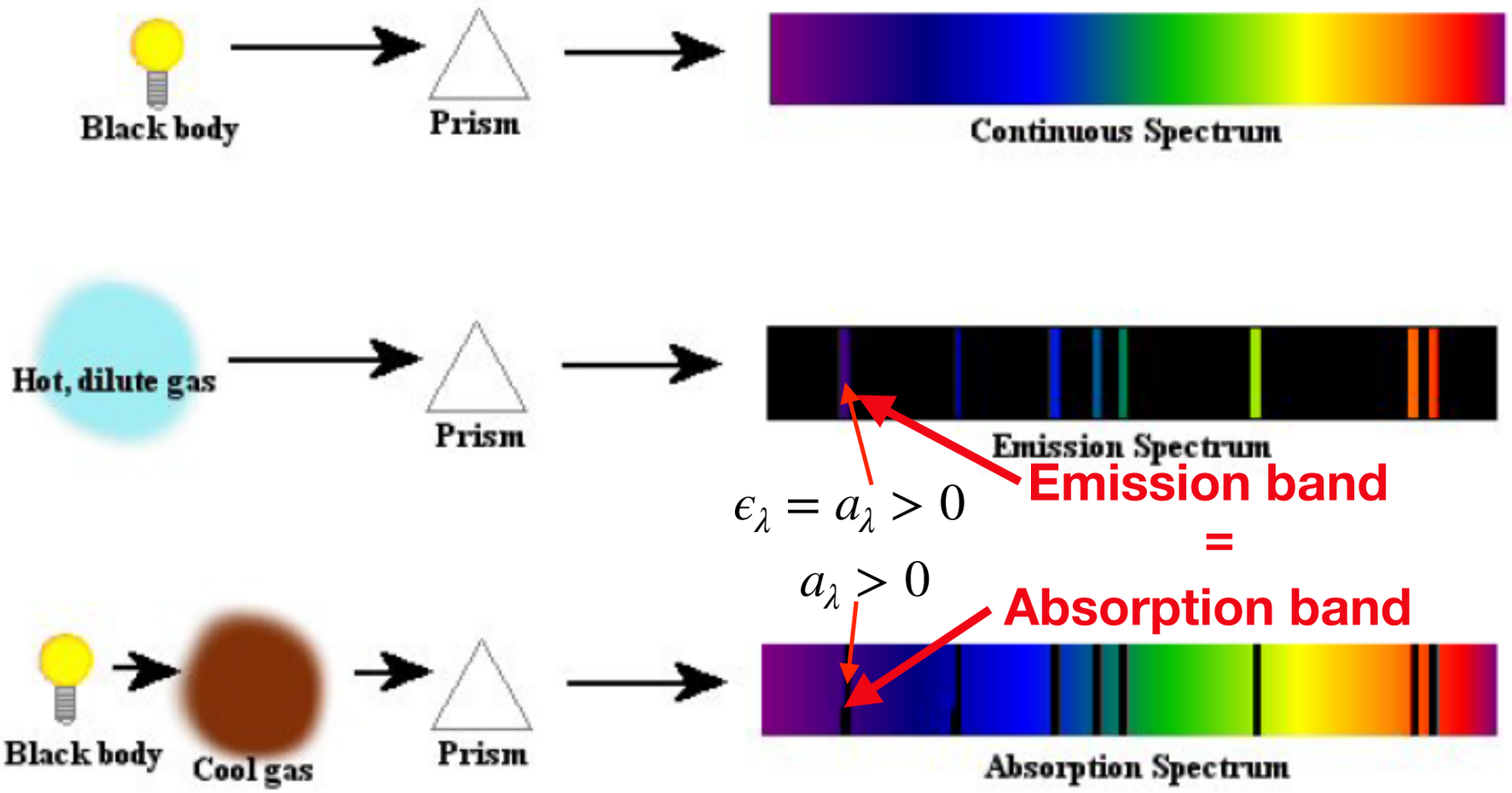
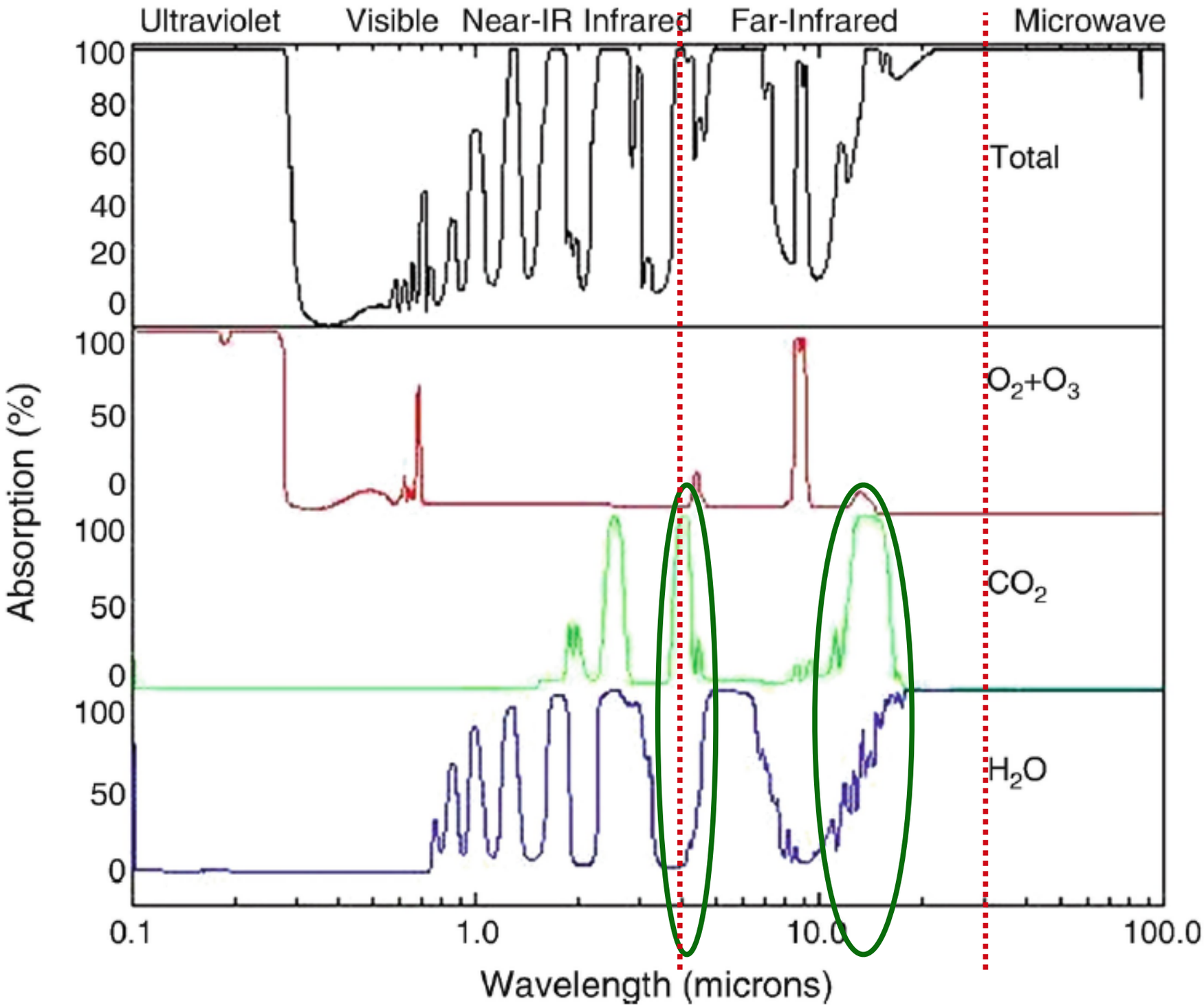
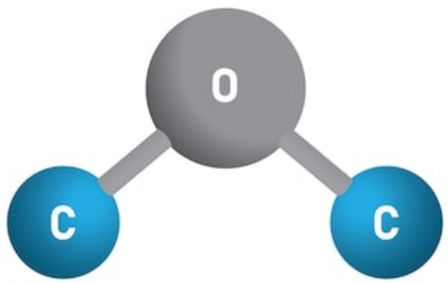


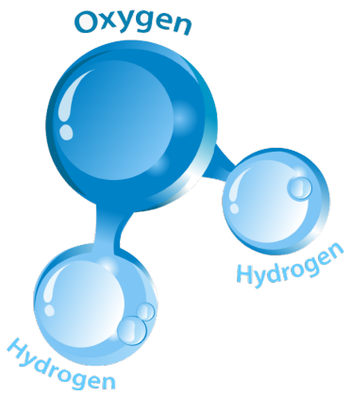
Important greenhouse gases:

Earth emits a lot of infrared light between 5–30 um.





CO_2 Carbon dioxide



For a gas to be an important greenhouse gas on Earth, it has to:

(a) absorb strongly in some band

(b) not have other gases absorbing strongly there (otherwise nothing happens when you add it to the atmosphere)

(c) Earth has to be emitting a lot of electromagnetic radiation in that band for the gas to block