Blackbody Radiation absorbed by Atmospheric Carbon Dioxide

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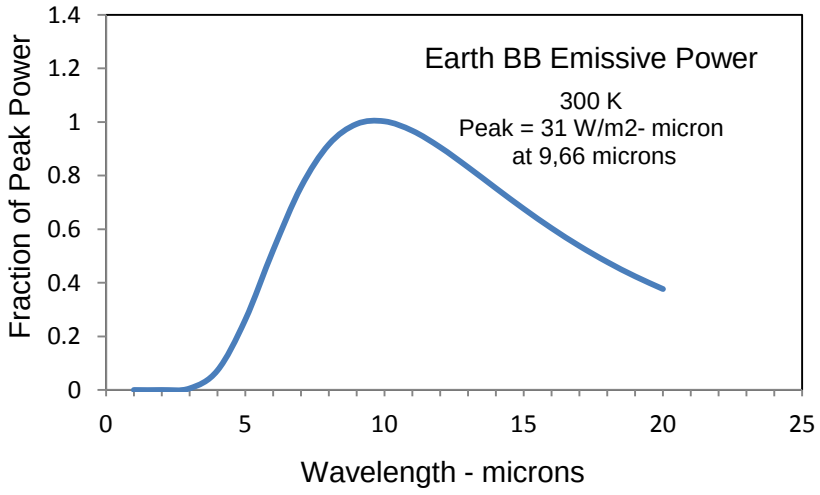
In global warming, the greenhouse gases in the atmoshere allow solar radiaiton in the VIS to pass through to warm the Earth while acting as a barrier to trap the long wavelength IR radiaiton from escaping to space. Carbon dioxide CO2 is thought to absorb the EM radiation and by backradiation return a a portion to further warm the Earth. On this premise, CO2 is considered to be a contributor to global warming.

An important issue is whether BB radiation from the Earth is absorbed by the CO2 in the atmoshere. For the Earth at 300K, Wien's law gives the peak BB emission at about 9.66 microns. Since CO2 absorbs at 14 microns, skeptics say CO2 simply passes through the atmos;phere without contributing to global warming and should not be legislated. However, BB radiation is broadband and has content at 14 microns. How much of the BB radiation content at 300 K is at 14 microns can be determined from Planck's theory,

$$e_\lambda = \frac{2\pi hc^2}{\lambda^5}\frac{1}{\left[\exp\left(\frac{hc}{\lambda kT}\right)-1\right]}$$

where, eλ is the emissive power, h Planck's constant,c the velocity of light, k Boltxmann's constant, T temperature, and λ wavelength. For the Earth at 300 K, the BB emissive power normalized to the peak at 9.66 microns is shown below.



The Figure shows the peak emissive power of 31 W/m^2-micron at 9.66 microns is reduced 25 % at 14 microns to 22.5 W/m^2-micron. Earth's BB radiation is therefore absorbed by CO2 in the atmosphere, a portion of which returned by backradiation further warms the Earth.