

GREENHOUSE EFFECT

GLOBAL TEMPERATURE AND SEA LEVELS

There are a great many factors that affect the temperature of the earth. These include solar radiation, radioactive decay within the earth, ocean phenomena, clouds, water vapor, geologic phenomena, and numerous other independent and interrelated factors. At the present time, as a result of the complexity of these factors and their interrelationships and of the incomplete measurements available, no computer models have been developed that reliably predict long term weather patterns.

One of the many weather factors is the greenhouse effect. Solar radiation that penetrates into the atmosphere has a different energy distribution than does thermal radiation that radiates out of the atmosphere. Since radiation absorption and reflection by atmospheric components is energy dependent, some components are more transparent to incoming energy than they are to outgoing energy. These components tend, therefore, to cause an accumulation of energy which raises atmospheric temperatures.

One of the earth's atmospheric greenhouse components is carbon dioxide (CO₂). Carbon dioxide is also a greenhouse component on Venus and Mars. Carbon dioxide greenhouse warming measurements on these three planets agree very well with one another and obey quite simple relationships. It is, therefore, possible to reliably calculate the maximum amount of greenhouse warming that could accompany increased carbon dioxide in the earth's atmosphere.

These calculations give an upper limit to the actual warming to be expected from any change in CO₂ concentration. In a complex, steady-state system like the atmosphere there is often a tendency for the system to adjust in a direction opposite to that of an induced change. Therefore, as carbon dioxide warms the atmosphere, other components adjust to partly offset the warming. Regardless of this adjustment, however, what is the upper limit?

The upper limit, the maximum temperature increase possible from unopposed carbon dioxide warming is known to be about 0.4°C or 0.7°F per increase of 300 parts per million (ppm) carbon dioxide.

During the past 300 years, CO₂ has increased about 100 ppm to its present level of about 360 ppm. About 50 ppm of that increase has come in the last 40 years. Even though, as we shall see below, an increase of 300 ppm in CO₂ to a level of about 600 ppm would be very desirable for the earth's environment, it is clear that any increase achievable in the reasonable future will have a maximum greenhouse effect of less than 1°F.