

WHAT IS MICROWAVE RADIATION AND HOW DOES EARTH EMIT IT?

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As the Earth absorbs energy from the Sun, the surface of the Earth heats up. If the average absorption increases (as by "greenhouse effect"), the average temperature of the planet will increase. If the average absorption decreases (as by increased snow or cloud cover reflecting more), the average temperature decreases.

The hotter a surface, the faster it radiates energy away. Thus, the Earth, as it absorbs the Sun's energy, continues to heat up until it is hot enough to radiate energy away to space at exactly the same rate it absorbs it from the Sun, on average. At all times the average surface temperature heads toward this equilibrium. Thus, at night, when there is no solar input, Earth's temperature drops steadily until dawn. After sunrise, the temperature begins rising again due to solar heating and continues to rise until 3 or 4 in the afternoon. At this point, the surface reaches a high enough temperature to radiate energy out at just the rate its coming in from the Sun (whose input has been declining since noon).

The total rate of radiation from a square foot of Earth is about 22 watts, averaged over the whole planet and averaged over 24 hours. Microwaves make up only part of Earth's thermal radiation. If "microwave" is taken to mean the whole microwave spectrum (from wavelengths of 1 mm to 1 meter) then the microwave portion of Earth's natural radiation is about 1/100,000 of the total, or about 0.2 milliwatts for the square foot. (If "microwave" is taken to mean only the tiny slice of the spectrum at 2.45 GHz that is used by microwave ovens, then the output is minuscule, about a millionth of a millionth of a watt (1.4×10^{-12} watt)! For this tiny slice of spectrum, the entire Earth radiates only about as much as just eight ovens.)

Like radio waves, microwaves penetrate clouds when they are radiated back into space and, though the amount of microwave radiation that Earth emits is quite small, certain satellite-mounted sensors can detect it from space. Images made from Earth's microwave emissions are very useful to scientists because they can depict Earth conditions both at night and in bad weather. They are especially useful for Antarctica, which is under cloud cover much of the year.