

Earth's Changing Albedo

By Dr Timothy Ball

Albedo is a climate issue that has not received much attention in public and is unknown to most people. Some scientists believe it is important to the critical issue of energy balance and therefore global temperature and may be more important than CO₂ in what is happening. This is important because of the claim that increased CO₂ from human sources is upsetting the global energy balance. Energy comes in to the Earth from the Sun and heat from the surface is partially absorbed by the atmosphere, reducing the outgoing energy. Theory says increased CO₂ will cause a temperature increase until the outgoing energy balances the incoming energy.

When light strikes a surface some light is absorbed and some is reflected. The amount of each is determined by the color of the surface. The amount reflected determines the albedo number. On a pure white shiny surface 100 percent of the light is reflected so the albedo is 100, while on a matte black surface 100 percent is absorbed and the albedo is zero. This is why a solar collector that wants to absorb as much solar energy as possible is matte black.

INCOMING SUNLIGHT

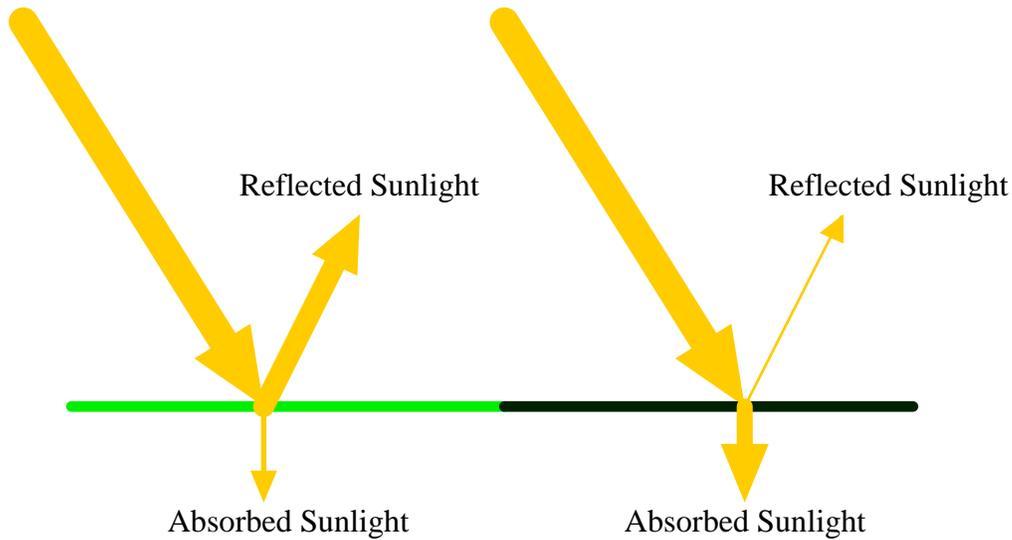


Figure: Albedo is the amount of sunlight reflected from a surface. The amount varies with the colour. The lighter surface at a) reflects more than the dark surface at b).

Different surfaces have different albedo for example,

Fresh snow varies between 75 and 95

Grassy field varies from 10 to 30

Forest varies from 3 to 10

Moonlight is not light generated by the moon, but reflected sunlight. The moon's albedo is 7. Astronauts who went to the moon were surprised by the brightness of the Earth, which is not surprising considering the average albedo of Earth and atmosphere is 30. A major factor in the variability is the type and amount of cloud cover. Thick cloud varies from 60 to 90 and thin cloud from 30 to 50. This variability explains most of the change in albedo shown in the graph below. The right side scale shows changes in energy with a range of about 9 watts per square meter. Compare this with the 2.5 watts per square meter change estimated to be due to human activities.

