THE CONCEPT OF SOLAR RADIATION INTENSITY

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Abstract
The work is devoted to investigations of radiation intensity (insolation) of solar station, placed in Arnasay Region. It has been shown that the size of the insulation depends on the angle of incidence of rays incident on a particular surface and the intensity of solar radiation. The intensity of solar radiation on a surface perpendicular to the sun's rays is denoted by the letter S, and the intensity of the sun's radiation on the horizontal surface at the Zenith.

Keywords: Intensity, solar radiation, the horizontal surface, angle, insolation, Arnasay, station.

Introduction

The concept of solar radiation intensity is used to determine whether the amount of solar energy corresponding to the Earth's surface is more or less. The amount of solar energy falling on a 1 cm^2 surface perpendicular to sunlight in 1 min is called the radiation intensity. The fall of solar radiation on a particular horizontal or curved surface is called insolation. The size of the insulation depends on the angle of incidence of rays incident on a particular surface and the intensity of solar radiation. The intensity of solar radiation on a surface perpendicular to the sun's rays is denoted by the letter S, and the intensity of the sun's radiation on the horizontal surface at the zenith is denoted by the letter S.

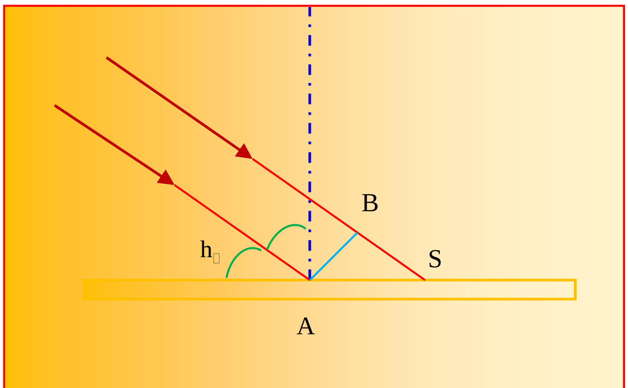

Figure 1. Calculation of horizontal surface insulation.

THE RESULTS AND DISCUSSIONS

We now derive the connection between S and S'. Assume that the rays of the sun are incident on a section of the horizontal surface equal to the section AS (Fig. 1). The angular distance formed by the sun with the horizon is called the altitude of the sun and is denoted by h_Θ. According to Figure 1, the more energy the sun's rays fall on the vertical AB surface at a given time, the more energy falls on the AS surface. If we denote by Q the energy falling on each 1 cm^2 surface at a certain time, we can write:

$$S = \frac{Q}{AB'} \quad \Rightarrow \quad S' = \frac{Q}{AC'} \tag{1}$$

The connection between S and S' can be found from

$$S \cdot AB' = S' \cdot AC' \quad \Rightarrow \quad S' = \frac{S \cdot AB'}{AC'} = S \cdot \sin h_0$$

the expression, so we have

$$S' = S \cdot \sin\, h_0 \tag{2}$$

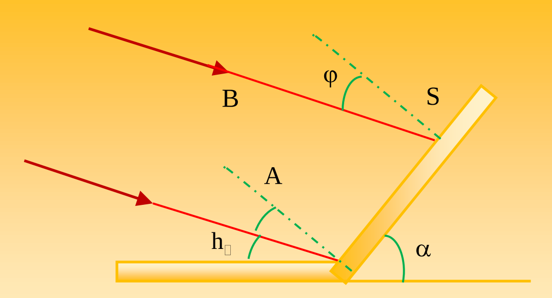

Figure 2. Calculation of horizontal surface insulation.

The last formula show that, the magnitude of the insulation increases as the Sun rises above the horizon. Insulation on sloping surfaces relative to the horizon can also be determined as above. For example, let the sun's rays fall on an inclined surface facing east at an angle to the horizon. Let us φ denote the angle between the sun's rays and the normal transferred to the curved surface, i.e., the angle of incidence of the sun's rays (Fig. 2). If we denote the AS surface insulation as S_1, we can write:

$$S_1 = S \cdot \cos \varphi \tag{3}$$

It can be seen from formula (3) that the magnitude of the insulation on the curved surface S_1 depends on the intensity of solar radiation and the angle of incidence of sunlight φ. The solar

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radiation, which is directed in an arbitrary direction and falls on the surface as desired, can be determined by the following formula:

$$S_1 = S\cdot[\sin h_0 \cos\alpha + \cos h_0 \sin\alpha \cos(A-\beta)] \quad (4)$$

where h_Θ - height of the sun, α - the angle formed by the horizontal surface with the horizon, A - Solar azimuth, β - the angle between the vertical plane and the meridian plane transferred along the normal to the inclined surface. The heating of the soil layer on sloping surfaces facing in different directions is also not the same. The temperature of the soil layer on the south-facing slope will be higher than the temperature of the soil layer on the other-facing slope.

As the altitude increases, the intensity of direct solar radiation also increases, as the path of sunlight through the atmosphere decreases as the altitude increases, and the role of the atmosphere in absorbing and scattering solar radiation decreases. The intensity of solar radiation is the same at any point outside the atmosphere. Therefore, the intensity of solar radiation outside the atmosphere is called the solar constant. The error of the solar constant depends on the ability of the Sun to radiate.

$$S_{\square} = 1.98\frac{\text{Cal}}{\text{sm}^2\,\text{min}} = 1386\frac{\text{Vt}}{\text{m}^2}.$$

As the sun rises above the horizon and above the Earth's surface, the spectral composition of direct solar radiation also changes as the optical mass of the atmosphere through which sunlight passes changes. This means that when the sun is close to the horizon, only short-wavelength rays reach the earth's surface in greater quantities. The energy of long-wavelength rays is smaller than the energy of short-wavelength rays. Therefore, the intensity of direct solar radiation in the morning or near evening is very low. In addition, the amount of insulation is very small due to the large angle of incidence of sunlight on the horizontal surface when the sun is close to the horizon.

The intensity of direct solar radiation on a surface perpendicular to the sun's rays increases with increasing altitude of the Sun above the horizon, and decreases in the second half of the day. Since the clarity of the atmosphere varies throughout the day, the intensity of direct solar radiation does not change symmetrically relative to its value at noon. During the winter months, the radiation intensity reaches its maximum value. In the warmer months, however, the intensity does not increase as sleep approaches, and sometimes the intensity may decrease during sleep.

This is because in the warmer months of the year, as lunchtime approaches, the amount of water vapor and various dust particles in the atmosphere increases. As a result, the solar radiation falling on the Earth is reduced due to their absorption and scattering of solar radiation. In addition, the intensities of direct solar radiation during the day on the vertical and horizontal surfaces of the rays also differ from each other.

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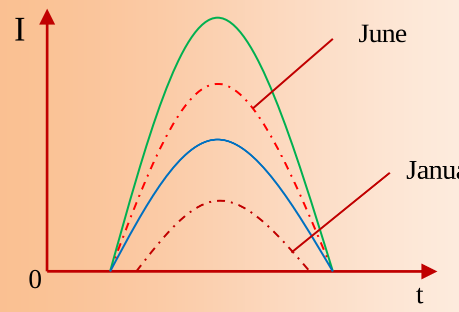

Figure 3. Correct radiation intensity

Figure 3 shows the average values of the daily change in the intensity of direct solar radiation in Arnasay region (Jizzax) in June and January on a surface placed vertically and horizontally in the sun. As shown in Figure 3, the intensity of direct solar radiation on the horizontal surface is less than that on the vertical surface. This difference is especially large in the winter months. In summer, the vertical and horizontal intensities of direct solar radiation are close to each other, as the Sun is much higher in the celestial sphere. Since the height of the sun and its length vary throughout the year, direct solar radiation and insolation vary throughout the year.

CONCLUSION

The concept of solar radiation intensity is considered. It has been shown that, the intensity of direct solar radiation on the horizontal surface is less than that on the vertical surface. This difference is especially large in the winter months. The size of the insulation depends on the angle of incidence of rays incident on a particular surface and the intensity of solar radiation. The intensity of solar radiation on a surface perpendicular to the sun's rays is denoted by the letter S, and the intensity of the sun's radiation on the horizontal surface at the zenith is denoted by the letter S.

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