Oriental Renaissance: Innovative, educational, natural and social sciences
SJIF 2023 = 6.131 / ASI Factor = 1.7
(E)ISSN:2181-1784
www.oriens.uz
3(4/2), April, 2023

RADIATION TRANSMISSION IN THE EARTH'S SURFACE AND ATMOSPHERE

T. M. Azimov, A. A. Gulomov
Fergana State University
Faculty of Physics and Technology, Teacher of Physics Department

ABSTRACT

The coefficient of heat transfer of soil plays a crucial role in various engineering and environmental applications as it determines the rate at which heat is conducted through the soil medium. This coefficient is influenced by several factors, with soil composition being one of the key determinants. Understanding the relationship between soil composition and the coefficient of heat transfer is essential for optimizing the design and performance of geothermal systems, underground structures, and soil remediation processes. This abstract provides an overview of the current understanding of the impact of soil composition on the coefficient of heat transfer. It explores the diverse composition of soils, including their mineralogical, organic, and moisture content, and discusses their effects on thermal conductivity, thermal diffusivity, and thermal resistivity. Additionally, the abstract highlights the significance of soil compaction, porosity, and density in influencing heat transfer properties. By understanding the intricate interplay between soil composition and the coefficient of heat transfer, engineers and researchers can develop more accurate models, efficient heat exchange systems, and sustainable soil management strategies. Further investigations and experimental studies are recommended to expand our knowledge in this field and refine the predictive models for enhanced heat transfer analysis in soil systems.

Keywords: *heat transfer, heat conduction, radiation, heat capacity advection.*

INTRODUCTION

Processes occurring on the surface of the earth and in the atmosphere are closely related. Solar radiation reaches the earth's surface, and most of it is absorbed by this surface. The atmosphere receives energy mainly from the earth's surface. Absorbed solar radiation is unevenly distributed over the Earth's surface, and this distribution varies over time. Under the influence of these changes, fluctuations in the amount of heat occur in the thin upper layer, the thickness of which is 10-30 m on land and 200-300 m in the ocean.

Heat exchange between the surface of the earth and the atmosphere, between the surface of the earth and the lower layers of soil or water, and between separate layers of the atmosphere occurs through radiation, heat conduction, and convective heat exchange.

Changes in air temperature mainly occur due to the interaction of the atmosphere with the earth's surface. The direct absorption of solar radiation in the atmosphere can cause the temperature to increase by approximately 0.5°C per day. Air directly touching the earth's surface exchanges heat with the surface through molecular heat conduction. Such changes are very noticeable in the vertical movement of air. In the condensation or sublimation of water vapor in the atmosphere or on the earth's surface, the energy of phase rotations is the separation of latent energy. The reverse process occurs when water evaporates and air cools.

Advective changes in air temperature are observed at certain geographic coordinates and points with a height above sea level (meteorological stations, posts, etc.).

Materials and Methods Earth's surface heat balance equation

Since the temperatures of the Earth and atmosphere are much lower than the temperature of the Sun, the energy they emit corresponds to the invisible infrared spectrum. For all wavelengths, the irradiance of the earth's surface does not differ by the same factor as the irradiance of an absolute black body with the same temperature

$$\boldsymbol{B_0 = \delta\sigma T_0^4}$$

where B_0 is the radiant flux of the earth's surface (kW/m^2), a is the Stefan Boltzmann constant, T_0 is the temperature of the earth's surface, and £ is the absorptivity of the earth's surface or the relative coefficient of absorption.

For various surfaces, 5 the values vary from 0.89 to 0.99. Snow has the highest absorptivity (£=0.995), while water surfaces have the smallest absorptivity - £=0.89. It is assumed to be equal to £=0.95 for the average land surface.

Most of the atmospheric radiation (70%) is radiated towards the earth's surface, and the rest goes out into space. Atmospheric radiation directed towards the Earth's surface is called atmospheric *radiation.* The surface of the earth absorbs the incident radiation almost completely (90-99%). Thus, the incident radiation of the atmosphere is an additional source of heat for the earth's surface.

The incident radiation of the atmosphere is determined according to empirical formulas. In general, it is calculated according to the following formula:

$$B_A = \alpha\sigma T_0^4$$

where α is an indicator characterizing the radiation ability of the atmosphere (α<1) and depends on the amount of water vapor, the amount and height of clouds, and *T* is the air temperature.

The following empirical formula of D. Brent is the widest is used

$$B_A = \alpha\sigma T_0^4(a_1 + b_1\sqrt{e})$$

this where a=0.526, 6=0.065, and *e* is the water of steam partial pressure (GPa). Cloudiness increases with do not meet radiation increases because of clouds himself, energy strong shines. Hit latitudes in the plains do not meet of radiation average intensity 0.21-0.28 kW/m^2, mountainous at stations - 0.07-0.14 kW/m^2 is enough. Meeting atmosphere of radiation such decrease up water as it rises steam of quantity decrease with is explained. On the equator of the atmosphere, where radiation does meet, the most difference will be because there is a lot of warm atmosphere and water rich in steam. At equatorial latitudes, average yearly radiation is equal to 0.35-0.42 kW/m^2, and polar widths up to 0.21 kW/m^2 decrease.

Earth's surface radiation and that of the atmosphere do not meet radiation between differences in effective radiation that are called:

$$B_e = B_0 - \delta B_A$$

this on the ground δB_A- of the atmosphere do not meet radiation.

R of the Earth's surface radiation balance the incoming part consists of absorbed parts of direct radiation *(1-A)J'*, and scattered radiation *(1-A)D, as well as incident radiation of the atmosphere* dB_a will consist of The radiation of the earth's surface to the output of *K is* B_0 enter

$$\mathrm{R} = (1 - A)J' + (1 - A)D + \delta B_a + B_0$$

or $$R = (J' + A)(1 - A) - B_0$$

Given these, it can be written as follows:

$R = Q(1\text{-}A)\text{-}B$, or R $=J_{wv}$ -B_0

Equations are different forms of the earth's surface radiation balance equation, which is a special case of the general equation of energy conservation.

The radiation balance of the Earth's surface has a great influence on the temperature distribution in the near-surface and soil layers of the atmosphere, the processes of snow melting and evaporation, the formation of frosts and fogs, and changes in the properties of air masses.

The amount of heat received by the earth's surface as a result of radiation heat exchange is determined by the radiation balance value *R*. During the day, this quantity is positive, which causes the surface of the earth to warm up and its temperature to be higher than the temperature of the air layer and the lower layers of soil or water (Fig. 1).

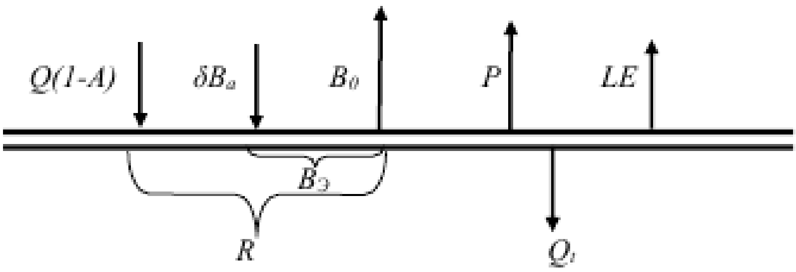

Figure 1. Earth's surface balances of the daytime in time to organize doers.

Warmer has been the surface of heat one part of the air adds layers gives *(R*, kW/m^2). The first name of heat, molecular heat conductivity with soil or of water lower to atlas q, is transmitted. This heat flow Q_t that let's define. Heat, known by Q's name, of water from the earth's surface to evaporation is spent. This size *LE* that let's define it on the ground *L* - of evaporation comparison heat; *E* - evaporated water mass. The algebraic sum of all the heat coming to and leaving the surface of the earth at a given moment of time should be equal to zero. This condition is expressed by *the surface heat balance equation*:

$$\mathbf{R+P+Q_t+LE=0}$$

At night, when R<0, the earth's surface cools and its temperature is lower than the temperature of the air and the lower layers of soil or water. As a result, all heat currents change their signs to the opposite. Heat is transferred from the surface atmosphere to the lower layers of the soil by heat conduction.

In cases where the temperature of the earth's surface changes, based on the law of conservation of energy, it can be written as ∂ for a vertical column of soil thickness.

$$\Delta\frac{\partial}{\partial t}(C_t\rho_t T) = R + P + Q_t + LE$$

Here ρ_t-soil density, C_t,-soil heat capacity, *T*-its temperature. The limit on the left side of the equation describes the rate of change of the heat content of the vertical layer of soil with a thickness of, Δ depending on the factors listed above. The thickness of this layer in the soil is several millimeters. All heat fluxes entering the soil layer from the upper and lower boundaries on the right side of the equation are taken with a "plus" sign, and those leaving the layer with a "minus" sign.

Dissipation of heat in soil

The heat reaching the surface of the earth is dispersed into the soil by molecular heat conduction. Heat flux $-\frac{\partial T}{\partial \xi} Q_t$ *at an* arbitrary depth x proportional to the vertical gradient:

$$Q_t = -\lambda \frac{\partial T}{\partial \xi}$$

this on the ground l - *soil q's heat conductivity coefficient* that is named proportionality coefficient of.

Temperature depth thus when it decreases $\frac{\partial T}{\partial \xi}<0$ heat, the soil inside oriented and positive will be $Q_t<0$. Such a situation during the day gives at night depth, thus, temperature increases $\frac{\partial T}{\partial \xi}>0$ and read $Q_t<0$.

Heat permeability of the coefficient, the virtues of soil Q_t mineral composition, wetness level, as well as his to the representation of a garden of the soil main structural parts, heat conductivity is according to the tune: peat for-0.88, mel for-0.92, lime for-1.77, minerals for-2.43, and sand for-1.10-2.80.

Of the soil hard q structural parts heat conductivity the air molecular heat from conductivity about 100 times big. That's why for soil q, that is in the soil the air occupied of size of soil q common size of the ratio back work with his heat conductivity sharp decreases. That's it because of it's time of soil heat conductivity dense soil, sand of soil heat conductivity another kind of to soils relatively camrock will be soil when wet in it the air one the part heat conductivity into the air relatively about 20 times big has been water occupies. That's it because of soil wetness increases with his heat conductivity.

Depth thus of soil properties is one different that, for example, your temperature time according to change The Fure equation can be expressed by:

$$\frac{\partial T}{\partial t} = k_t \frac{\partial^2 T}{\partial \xi^2}$$

this on the ground $k_t = \lambda / c_{\cdot} \rho_{\cdot}$- **soil q's temperature permeability coefficient of.**

This is called heat permeability equation.

CONCLUSIONS

Of the soil type, look closely at the temperature of vibrations and period depth, which thus do not change. This is not enough soil for 24 hours on the surface, but also in depth to the period where there has been per diem and for a period of 12 months, there has been a yearly walk existence means.

The arithmetic progression of chukk urk is as follows as in the increase of amplitude geometric progression on this decrease. If on the surface daily amplitude is equal to 30°C, 5°C at a depth of 20 cm, and at a depth of 40 cm it is less than 1°C.

Temperature of vibrations yearly amplitude, and depth this is the law based on decrease. One q yearly of vibrations to spread time demand done for they are larger q to the depth spread out. Yearly of vibrations amplitudes are polar in latitudes at about 30 m, and urta at 15-20 m in latitudes, 10 m in depth in the tropics in practice. This is where the constant yearly temperature begins.

Per diem and yearly walking maximum temperature and to a minimum reach to the depth proportional, respectively, will be late. This situation of heat to the depth spread for time needs to be explained. Per diem extremes of depth every 10 cm for 2.5-3.5 hours will be late. From this comes Chikadiki, for example, at a depth of 50 cm daily maximum from midnight after observetion. Annual maximums and minimums of depth of one per meter for 20-30 days will be late. An example for, at a depth of 5 m temperature minimum in January not, small, maximum while in July not in October observation can constant per diem and yearly temperature of layers depths mutually vibrations square roots of the period ratio as, i.e. 1: divide √365 means. From this come annual the vibrations are constant depth per diem vibrations presenter 19 times greater than depth.

So in soil the heat spread of the year's marrow in season soil during the day receives of heat big part at night into the atmosphere transmits.

Earth's surface, atmosphere, and in general, to the planet's radiation coming in the form of radiant energy heat flow belong to radiation balance equations which are described. Swallowed radiation and this of objects each from one private radiation between difference this of Eqs generality determines.

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