PECULIARITIES OF RADIATION BALANCE ON SLOPES AND THE IMPORTANCE OF THESE PECULIARITIES FOR THE COMPUTATION OF EVAPORATION FROM MOUNTAIN BASINS

V. VUGLINSKY
State Hydrological Institute, 23, 2nd line, St.-Petersburg, 199053, Russia

Determination of the radiation balance of some areas as a factor of energy resources is the objective of many climatic and hydrologic computations. The methods available make it possible to compute the radiation balance on a flat terrain quite accurately. In mountains, however, it is necessary to compute the radiation balance on slopes that differ in steepness and exposure. To solve this problem, a theoretical scheme has been developed to compute the mean long-term radiation balance of slopes; and appropriate computations have been made at six sites in the Trans-Baikal mountains and on the adjacent terrain.

Data of actinometric and meteorologic standard observations were used for the computations. Monthly radiation balances of slopes of different exposures and steepness were computed from the following equation.

$$R_{sl} = (Q_{sl} + q_{sl})(1 - \alpha) - I_{sl} \qquad (1)$$

where
Q_{sl} and q_{sl} = mean monthly values of direct and dispersed solar radiation on the slope on account of cloudiness,
α = mean monthly reflective capacity of the slope (albedo)' and
I_{sl} = effective radiation of the slope.

The greatest difficulty was encountered in the computation of mean monthly total solar radiation ($Q_{sl} + q_{sl}$) on the slope. Therefore, a special theoretical formula has been developed.

Computations of mean long-term monthly radiation balances of mountain slopes show a need to account for the variation in R_{sl} depending on the exposure and steepness from May to September only. During the other months these variations are negligible..

It has also been established that changes in the radiation balance on gentle slopes, depending on their exposure, are also small in summer. The radiation balance tends to increase with the increase in slope steepness; at a steepness of 25°, the radiation balance on the northern slope may be 25 - 30% less than that on a flat terrain, and the radiation balance on the southern slope is 10-20% less than that on a flat terrain.

The results obtained from this study were taken into account for the computation of evapotranspiration from the mountain basins in the Vitim River basin in the Trans-Baikal region. An improved equation of M.I.Budyko was used for the assessment of evapotranspiration.

These results demonstrate quite convincingly the necessity to account for changes in the radiation balance on slopes (depending on the slope steepness and exposure) in the assessment of evapotranspiration from mountain basins. For example, errors in the normal annual evaporation from mountain basins, without taking account of the above factor, attain +37% on the northern slope (steepness 20%) and -11% for the basin on the southern slope (steepness 25°). Some case studies are given in the paper.

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