The statistical processing of simulation results in vision systems

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The purpose of this research is to study dependence angular distribution of brightness (intensity) of radiation on boundaries of the atmosphere on geometric and optical conditions of observation in the presence of clouds. Vision system is understood as an observation scheme including underlying surface, "cloudy environment" (atmosphere), and an optical device that registers incoming radiation. To study radiation transfer in such systems, the theory of systems and the theory of radiative transfer are traditionally used. The Monte Carlo method was applied to determine the function of brightness. We attempted also to apply correlation-regression analysis for the study and subsequent prediction of regularities of radiation transfer in vision systems in the same way as in construction of radiation models of the atmosphere. In previous works, the regression dependence of the angular brightness distribution on the wavelength was investigated. In the present paper, we examined dependence angular brightness distribution on the geometric parameters of cloudiness - its upper boundary.

The regression equation for the angular distribution of brightness in the cloudy atmosphere relative to upper boundary of cloudy layer was obtained in form $y = b_1 x + b_0$ for all reception angles. Regression coefficients and determination coefficients for the case of isotropic source, wavelength of $\lambda = 0{,}347$ mkm, clouds of the "haze H" model are given in the following table.

Table 1

Coefficients of the regression equation for the cloud atmosphere Model «Haze H»

Angles of reception, grad	Coefficient b_0	Coefficient b_1	Coefficient of determination, R^2
4,5	5,14E-07	-3,07E-08	0,990
13,5	1,53E-07	-7,70E-09	0,975
22,5	5,92E-08	-2,33E-09	0,851
31,5	2,65E-08	-6,54E-10*	0,654
40,5	7,36E-09	-1,75E-10	0,946
49,5	3,60E-09	-6,36E-11	0,625
58,5	2,11E-09	-5,13E-11	0,840
67,5	1,25E-09	-2,96E-11	0,886
76,5	8,35E-10	-2,07E-11*	0,689

Note. * - insignificant coefficient

The analysis shows that between obtained angular distributions of intensity and the upper boundary of cloudiness, there is a link that can be with a good degree of accuracy to describe linear regression equation.