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On atmospheric turbidity factor given by Linke

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Study of Atmospheric turbidity is important for purposes of meteorology, ecology, climatology and monitoring of atmospheric pollution. Data on atmospheric turbidity is also necessary for estimation of global spectral radiation, for development of solar photo elements and other devices.

The Linke atmospheric turbidity factor is determined as

$$T_L = \frac{log\,F_0 - log\,F\,(m)}{log\,F_0 - log\,F_R\,(m)}, \tag{1}$$

where F_0 - solar constant; $F\,(m)$- the measured value of solar radiation directly passed through the atmosphere upon the optical air mass m; $F_R\,(m)$ - solar radiation passed through the dry and pure Reylaigh atmosphere, measured at the same value of m at the sea level.

The important requirement for Linke factor as an universal parameter of Atmospheric turbidity is its non-dependence from m. But practically all experimental researches exposed the factual dependence of T_L from m.

Till now some scientists attempt to remove this dependence suggesting various modification of formulation of Linke factor.

Here with we shall show, that dependence of T_L from m is inherent for formula (1) given by Linke in 1922, and this feature of T_L cannot be removed.

As a result of mathematical analysis of formula (1) we under leadership of prof. Asadov Kh.G. obtain following new mathematical formula for Linke factor

$$T_{L,\,new} = \frac{F'\,(m)/F\,(m)}{F'_R\,(m)/F_R\,(m)}. \tag{2}$$

On the basis of Bouguer-Beer law we have

$$F\,(m) = \int_{\lambda_{min}}^{\lambda_{max}} F_0\,(\lambda) \cdot e^{-\tau_{at}(\lambda)m} d\,\lambda \tag{3}$$

$$F_R\,(m) = \int_{\lambda_{min}}^{\lambda_{max}} F_0\,(\lambda) \cdot e^{-\tau_R(\lambda)m} d\,\lambda \tag{4}$$

where τ_{at}optical thickness of atmosphere; τ_R- optical thickness of aerosol.

Taking into consideration formulas (3) and (4) we find out that

$$F'\,(m) = -\int_{\lambda_{min}}^{\lambda_{max}} \tau_{at}\,(\lambda)\,F_0\,(\lambda) \cdot e^{-\tau_{at}(\lambda)m} d\,\lambda, \tag{5}$$

$$F'_R\,(m) = -\int_{\lambda_{min}}^{\lambda_{max}} \tau_R\,(\lambda)\,F_0\,(\lambda) \cdot e^{-\tau_R(\lambda)m} d\,\lambda. \tag{6}$$

Taking into account formulas (2)-(6) we can conclude that only if τ_{at} and τ_R are not depend on λ the suggested new formulation of Linke factor (2) can be transformed to well-known formula of Linke factor

$$T_L = \frac{\tau_{am}}{\tau_R} \tag{7}$$

Thus it is proved, that non-dependence of T_L from m is possible only if τ_{at} and τ_R are not depend on λ, that is impossible.