DEPENDENCE OF TOTAL EVAPORATION OF IRRIGATED CULTURES ON CLIMATIC FACTORS: THE HYSTERESIS' EFFECT

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Water-balance accounts (WBA) are a basis of hydrological processes' understanding, as a whole, and one of major practical aspects of irrigated lands' hydrology, in particular. In theory of WBA the wide application was found the empirical equations, which describe dependence of total evaporation (E) from climatic factors (air temperature and humidity, solar radiation, etc.). As a rule, in the theory it is considered established that the dependence of E from climatic parameters is proportional (linear or quasi-linear), and practice of WBA operates with concept of maximal possible evaporation (E_o), which is accepted for a basis of WBA, and the actual E is calculated as a share from E_o. In most cases evaporation from water surface is accepted as E_o. Now concept of E_o has changed, and it is defined as "maximal possible evaporation at optimum soil moisture". But a new concept of E_o is closely adhered to the climatic factors also and is "a water equivalent of heat resources", i.e. again total evaporation E (evapotranspiration) is put in direct dependence on the climatic factors ("heat resources").

Therefore in majority of cases the methods of definition of plants needs to water are considered as dependence of the type

$E = f(E_{max})$, where

E is function of E_o (E_{max}) for the certain time period.

For example, in Central Asia for WBA the dependence

$E = (E_{max})^{1.58}/31.62$ is applied, where

E is evapotranspiration,

E_{max} is water evaporation according to the formula by Ivanov-Molchanov:

$E_{max} = 0.00144 (T + 25)^2 (100 - H)$, where

T is monthly average temperature (^{0}C), and

H is relative air humidity (%).

At the same time, the long-term researches, which have been carried out on largest lysimeters of former Union of SSR (area everyone is equaled 25 m^2, culture - cotton, Tashkent oasis, Uzbekistan) have shown that the linear dependence $E = f(E_{max})$, is a special case only. In the general case this dependence is nonlinear, and for the separate periods – opposite. If connection $E = f(E_{max})$ is used for the monthly data, we will receive a hysteresis' loop, and a curve of dependence $E = f(E_{max})$ for the period (April -October) is necessary to divide into two curves - for the periods April-July and August - October, as they have various character. Accordingly, use of common curve dependence $E = f(E_{max})$ for WBA will have by consequence to overestimate of evapotranspiration's volume for the period April - July and reduction of its volume for the period August - October. For the separate summer periods a paradoxical connection between E and E_{max} is observed, namely, E_{max} (evaporation from water surface) is reduced, but E (evapotranspiration from cotton's field) continues to be increased. Given fact is not taken into account in the theory of WBA. Account of the hysteresis effect at accounts of water consumption by plants (delay in time of maximum of E concerning E_{max}) considerably raises accuracy of WBA for irrigated lands.

Key words: Water-balance accounts**,** Evapotranspiration, Climatic factors, Hysteresis' effect

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