Parameterization of wetlands water level in land surface model

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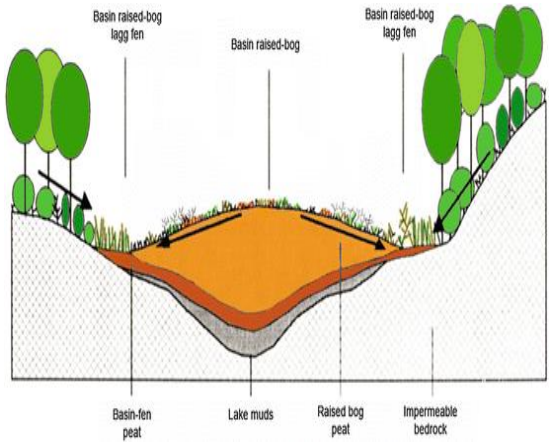
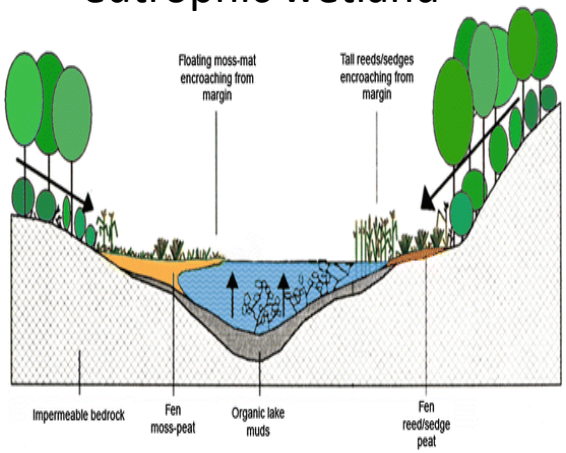
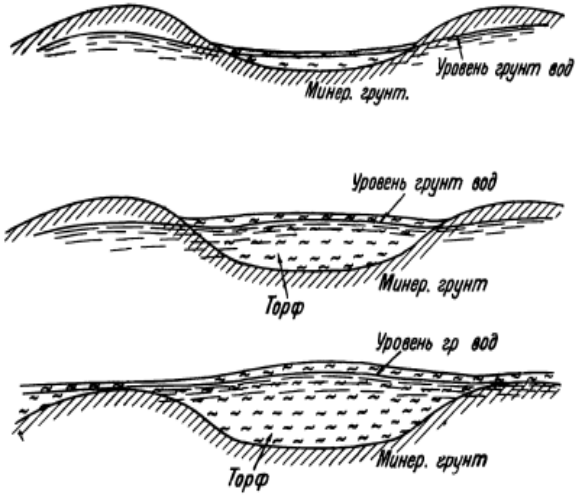
oligotrophic wetland



eutrophic wetland



Dyukarev, Geogr. and Nat. Res. 2013 No.1.

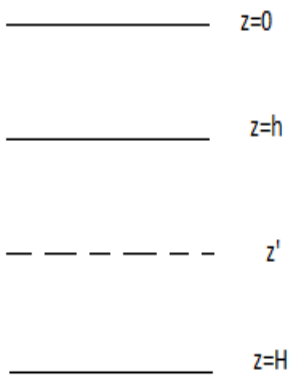


K.E. Ivanov. Hydrology of swamps. Gidrometizdat 1953. 296 s

Mathematical formulation

$$\frac{\partial \rho_w}{\partial t} = -\mathrm{div}\overrightarrow{F_w} \qquad (1)$$

$$F_{w_x} = \rho_{w_o} V_{f_x}\,; \quad V_{f_x} = k\frac{\partial}{\partial x}\Phi^* \qquad (2)$$



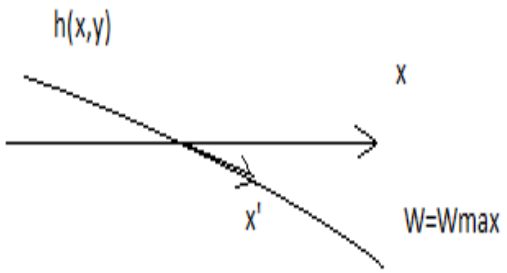
Let there be some level in the soil $z = h$ such that for $z > h(x, y)$:

$$-g = \frac{\partial \Phi^*}{\partial z} \quad (3)\,;\; W \approx W_{\max}$$

that is, the soil is saturated and the hydrostatic equation is fulfilled with good accuracy.

$$V_{f_x} = k\left[\left.\frac{\partial \Phi^*}{\partial x}\right|_{h(x,y)} + \frac{\partial h}{\partial x}\left(g + \left.\frac{\partial \Phi^*}{\partial z}\right|_{z=h(x,y)}\right)\right] = B_x$$

$$-\frac{\partial F_{W_x}}{\partial x}-\frac{\partial F_{W_y}}{\partial y}=-\rho_{w_o}\left[\frac{\partial B_x}{\partial x}+\frac{\partial B_y}{\partial y}\right]$$



$$\Phi(x,y,z,t)\rightarrow\Phi(x',y,z',t)$$

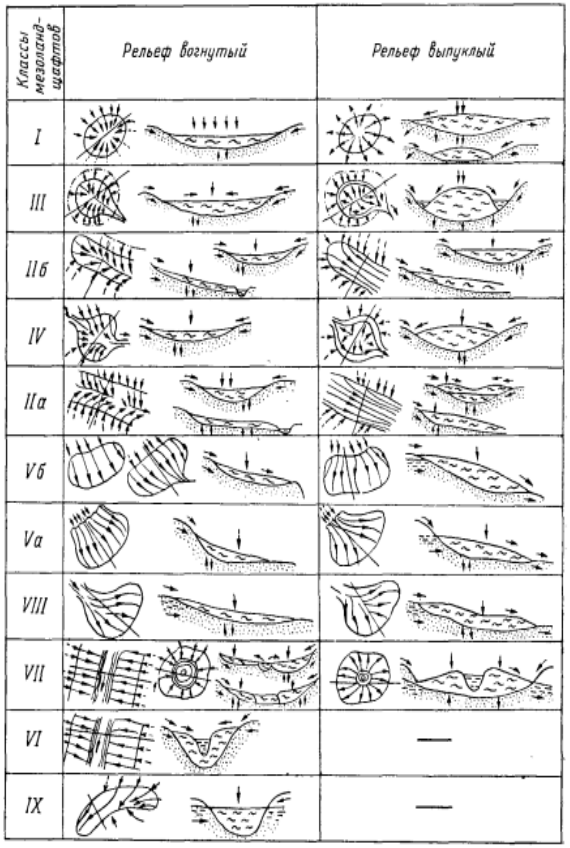
Based on our assumptions, we know that:

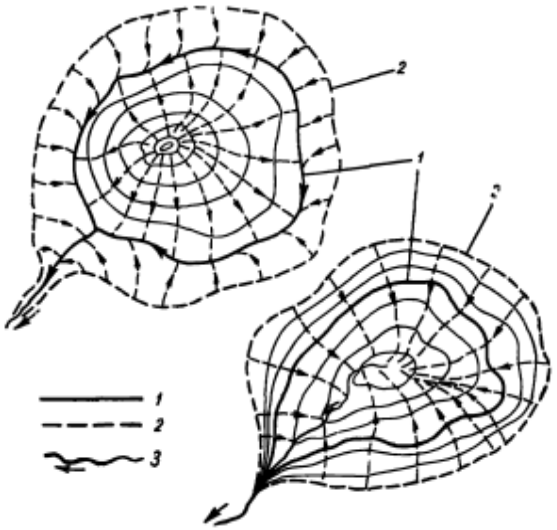
$$\frac{\partial W}{\partial x'}=0,\frac{\partial \Phi}{\partial z}=-g$$

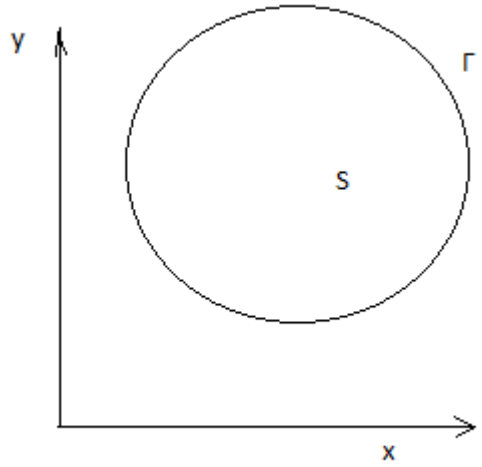
Wounded (2) can be reduced to the form

$$\left.\frac{\partial \Phi^*}{\partial x}\right|_{h(x,y)}=-\,\mathrm{g}\tan\alpha$$

Averaging Equations?







Scheme of water stagnation on bog massifs (Ivanov, 1953)
1 - swamp border, 2 - watershed line, 3 - streams

Development of bog mesolandscapes in different relief conditions. (Ivanov, 1975).

$$\frac{\partial \overline{W}}{\partial t} = -\frac{1}{\rho_d}\frac{\partial \bar{F}_{W_z}}{\partial z} + \mathrm{k}g\frac{\rho_{w_o}}{\rho_d}\nabla h \oint_{\Gamma} \vec{n}\, dl$$

Thanks for attention!