

## povrchový odtok

- h - výška hladiny [m]
- o - odtok / přítok [m/s]
- inf - infiltrace [m/s]
- es - efektivní srážka [m/s]
- T - čas [m]
- a, b - parameter odtoku

$$\frac{h_{i,t} - h_{i,t-1}}{\Delta T} = \left( es_{i,t} + \sum_j^m o_{j,t}^{in} - inf_{i,t} - o_{i,t}^{out} \right)$$

$$\frac{h_{i,t} - h_{i,t-1}}{\Delta T} = \left( es_{i,t} + \sum_j^m a_j h_{j,t}^{b_j} - inf_{i,t} - a_i h_{i,t}^{b_i} \right)$$

$$h_{i,t} - \Delta T es_{i,t} - \Delta T \sum_j^m a_j h_{j,t}^{b_j} + \Delta T inf_{i,t} + \Delta T a_i h_{i,t}^{b_i} = h_{i,t-1}$$

$$h_{i,t} - \Delta T \sum_j^m a_j h_{j,t}^{b_j} + \Delta T a_i h_{i,t}^{b_i} = h_{i,t-1} + \Delta T es_{i,t} - \Delta T inf_{i,t}$$

$$h_{i,t} + \Delta T a_i h_{i,t}^{b_i} - \Delta T \sum_j^m a_j h_{j,t}^{b_j} = h_{i,t-1} + \Delta T es_{i,t} - \Delta T inf_{i,t}$$

$$h_{i,t} + \Delta T a_i h_{i,t}^{b_i-1} h_{i,t} - \Delta T \sum_j^m a_j h_{j,t}^{b_j-1} h_{j,t} = h_{i,t-1} + \Delta T es_{i,t} - \Delta T inf_{i,t}$$

$$(1 + \Delta T a_i h_{i,t}^{b_i-1}) h_{i,t} - \Delta T \sum_j^m a_j h_{j,t}^{b_j-1} h_{j,t} = h_{i,t-1} + \Delta T es_{i,t} - \Delta T inf_{i,t}$$

$$pro\ i = 5\ a\ m \in \{7, 8, 9\}$$

$$(1 + \Delta T a_5 h_{5,t}^{b_5-1}) h_{5,t} - \Delta T (a_7 h_{7,t}^{b_7-1} h_{7,t} + a_8 h_{8,t}^{b_8-1} h_{8,t} + a_9 h_{9,t}^{b_9-1} h_{9,t}) = h_{5,t-1} + \Delta T es_{5,t} - \Delta T inf_{5,t}$$

$$(1 + \Delta T a_5 h_{5,t}^{b_5-1}) h_{5,t} - \Delta T a_7 h_{7,t}^{b_7-1} h_{7,t} + \Delta T a_8 h_{8,t}^{b_8-1} h_{8,t} + \Delta T a_9 h_{9,t}^{b_9-1} h_{9,t} = h_{5,t-1} + \Delta T es_{5,t} - \Delta T inf_{5,t}$$

$$\begin{bmatrix} \dots \\ \dots & 1 + \Delta T a_5 h_{5,t}^{b_5-1} & \dots & \Delta T a_7 h_{7,t}^{b_7-1} & \Delta T a_8 h_{8,t}^{b_8-1} & \Delta T a_9 h_{9,t}^{b_9-1} & \dots \\ \dots \\ \dots \\ \dots \\ \dots \end{bmatrix} \begin{bmatrix} \vdots \\ h_{5,t} \\ \vdots \\ h_{7,t} \\ h_{8,t} \\ h_{9,t} \\ \vdots \end{bmatrix} = \begin{bmatrix} \vdots \\ h_{5,t-1} + \Delta T es_{5,t} - \Delta T inf_{5,t} \\ \vdots \\ \vdots \\ \vdots \\ \vdots \\ \vdots \end{bmatrix} \quad (1)$$

rejhy

$$\begin{aligned}h_{sh} &= \min(h, h_{crit}) \\h_{rl} &= \max(h - h_{crit}, 0) \\q_{rl} &= 1/nR(h)^{2/3}i^{1/2}\end{aligned}$$

$$\frac{h_{i,t} - h_{i,t-1}}{\Delta T} = es_{i,t} + \sum_j^n a_j h_{sh,j,t}^{b_j} + \sum_k^m 1/n_k R_k(h_{rl,k,t})^{2/3} i_k^{1/2} - inf_{i,t} - a_i h_{sh,i,t}^{b_i} - 1/nR(h_{rl,i,t})^{2/3} i^{1/2}$$

ryhy i plosny

$$\begin{aligned}\frac{h_{i,t} - h_{i,t-1}}{\Delta T} &= es_{i,t} + \sum_j^n a_j \min(h_{j,t}, h_{crit,j})^{b_j} + \sum_k^m 1/n_k R_k(\max(h_{k,t} - h_{crit,k}, 0))^{2/3} i_k^{1/2} - \\&\quad - inf_{i,t} - a_i \min(h_{i,t}, h_{crit,i})^{b_i} - 1/nR(\max(h_{i,t} - h_{crit,i}, 0))^{2/3} i_i^{1/2}\end{aligned}\quad (2)$$

Jakoby jen pokud nastanou rejhy, jinak ta bunka resi rovnici predtim (tu jen bez ryh)

$$\frac{h_{i,t} - h_{i,t-1}}{\Delta T} = es_{i,t} + \sum_j^n a_j h_{crit,j}^{b_j} + \sum_k^m 1/n_k R_k(h_{k,t} - h_{crit,k})^{2/3} i_k^{1/2} - inf_{i,t} - a_i h_{crit,i}^{b_i} - 1/n_i R_i(h_{i,t} - h_{crit,i})^{2/3} i_i^{1/2}$$

$$\frac{h_{i,t}}{\Delta T} + 1/n_i R_i(h_{i,t} - h_{crit,i})^{2/3} i_i^{1/2} - \sum_k^m 1/n_k R_k(h_{k,t} - h_{crit,k})^{2/3} i_k^{1/2} = \frac{h_{i,t-1}}{\Delta T} + es_{i,t} + \sum_j^n a_j h_{crit,j}^{b_j} - inf_{i,t} - a_i h_{crit,i}^{b_i}$$

nasobim 1 jako  $h_{i,t}/h_{i,t}$  nebo  $h_{k,t}/h_{k,t}$ , dle potreby

$$\frac{h_{i,t}}{\Delta T} + 1/n_i R_i(h_{i,t} - h_{crit,i})^{2/3} i_i^{1/2} \frac{h_{i,t}}{h_{i,t}} - \sum_k^m 1/n_k R_k(h_{k,t} - h_{crit,k})^{2/3} i_k^{1/2} \frac{h_{k,t}}{h_{k,t}} = \frac{h_{i,t-1}}{\Delta T} + es_{i,t} + \sum_j^n a_j h_{crit,j}^{b_j} - inf_{i,t} - a_i h_{crit,i}^{b_i}$$

$$\begin{aligned}\left(\frac{1}{\Delta T} + 1/n_i R_i(h_{i,t} - h_{crit,i})^{2/3} i_i^{1/2} \frac{1}{h_{i,t}}\right) h_{i,t} - \sum_k^m \left(1/n_k R_k(h_{k,t} - h_{crit,k})^{2/3} i_k^{1/2} \frac{1}{h_{k,t}}\right) h_{k,t} = \\ \frac{h_{i,t-1}}{\Delta T} + es_{i,t} + \sum_j^n a_j h_{crit,j}^{b_j} - inf_{i,t} - a_i h_{crit,i}^{b_i}\end{aligned}\quad (3)$$

## vysledny set

pro  $h \leq h_{crit}$ :

$$\left( \frac{1}{\Delta T} + a_i h_{i,t}^{b_i-1} \right) h_{i,t} - \sum_j^m a_j h_{j,t}^{b_j-1} h_{j,t} = \frac{h_{i,t-1}}{\Delta} + es_{i,t} - inf_{i,t} \quad (4)$$

pro  $h > h_{crit}$ :

$$\left( \frac{1}{\Delta T} + 1/n_i R_i(h_{i,t} - h_{crit,i})^{2/3} i_i^{1/2} \frac{1}{h_{i,t}} \right) h_{i,t} - \sum_k^m \left( 1/n_k R_k(h_{k,t} - h_{crit,k})^{2/3} i_k^{1/2} \frac{1}{h_{k,t}} \right) h_{k,t} = \frac{h_{i,t-1}}{\Delta T} + es_{i,t} + \sum_j^n a_j h_{crit,j}^{b_j} - inf_{i,t} - a_i h_{crit,i}^{b_i} \quad (5)$$