Recurrence relation model for temporal variance of mine water flux

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A model for estimating mine drainage flow rates was developed by analyzing the correlation between records of precipitation and flow rates of 16 abandoned mines. According to the correlation between precipitation and flow rate, the mines were grouped into categories A, B and C. in the case of group A, the mine drainage (q) was proportional to the partial sum of rainfall in a given period (t_s - t_e) and was characterized with a form of the recurrence formula. Group B had some constraints in that flow rate of mine drainage started to increase only after the rainfall reached a certain level (p_{th}), meaning that a small amount of rain did not affect the amount of mine drainages. Group C had a low correlation between rainfall and mine drainages. A formula was derived to estimate flow rate of mine drainage(q_{i+1})using records of precipitation (p_i), area of channel networks (A) overlapped with underground workings and the flow rates of mine drainages measured (eq.1).

$$q_{i+1} = \max\left(q_i + \alpha \sum_{t_e}^{t_s} p_i \frac{A}{1{,}000} - \beta,\ q_{\min} \right),\ p_i \geq p_{th} \quad (eq.1)$$

Where, p_i = Daily rainfall amount (mm)
q_i = Amount of mine drainage (m^3),
A = Area of channel networks overlapped with underground workings(m^2),
α = Coefficients of rainfall infiltration,
β = Rate of decrease in flow rates when it comes to rain
t_s - t_e = Time zone affecting amount of mine drainages (date)
p_{th} = Threshold rainfall (mm)
q_{min} = Minimum mine drainage flow rate (m^3)