

THE APPLICATION OF INTERMITTENT REGIMES FOR WHEAT GRAINS BATCH DRYING

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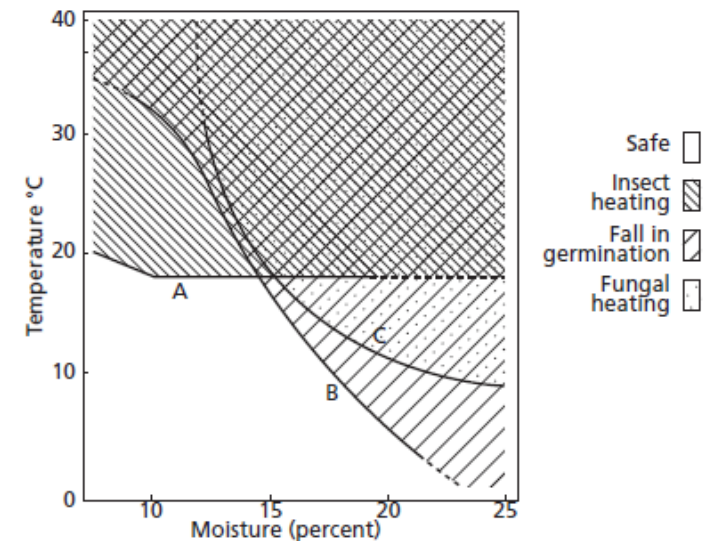
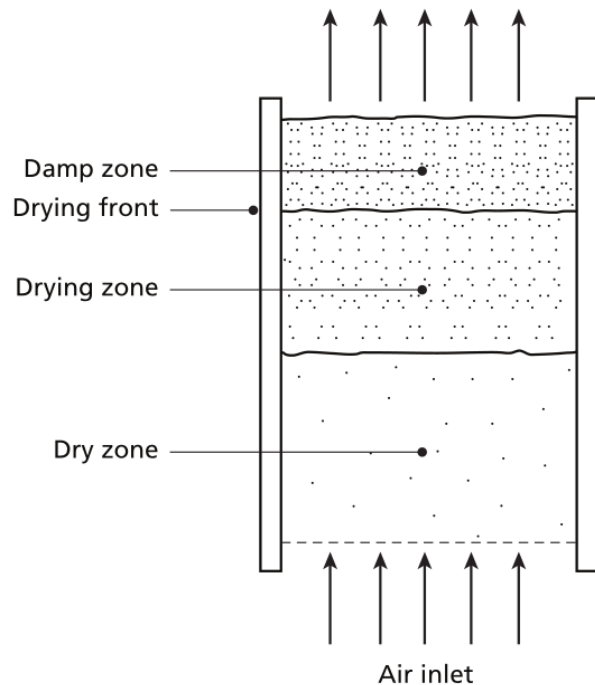


Introduction

- In Republic of Serbia, production of cereal grains makes one of the most important agricultural market branches, used both for domestic consumption purposes and for export to foreign markets. As it is reported at for period 2017-2019, wheat was the culture that gave the largest rate of crop production.
- Drying as a process with intensive energy consumption
- Continuous vs Intermittent

Materials and methods

- High initial moisture content is considered over 25% (dry basis)
- The final moisture content is usually chosen to be 13-14% (dry basis)



- The intermittency ratio of 30 min on / 30 min off is chosen for heater
- It is considered that air fan works continuously without interruptions.
- Temperature periodically changes from 60°C to 23°C

$$\left(\frac{\partial X}{\partial z}\right) = -\left(\frac{\rho_d}{G_a}\right)\left(\frac{\partial M}{\partial t}\right)$$

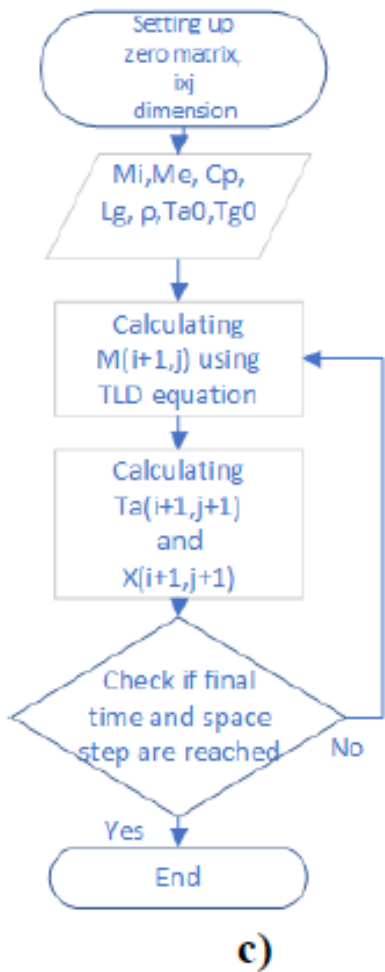
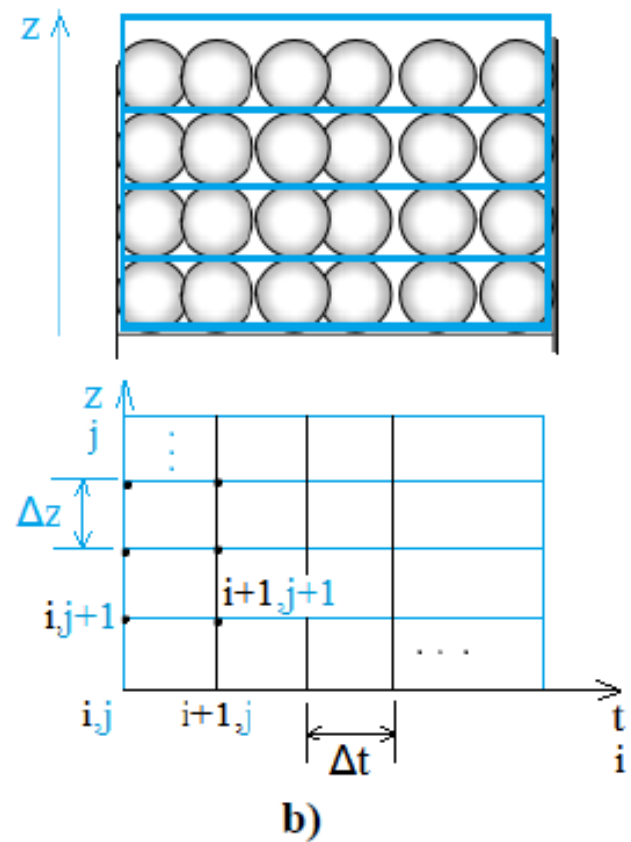
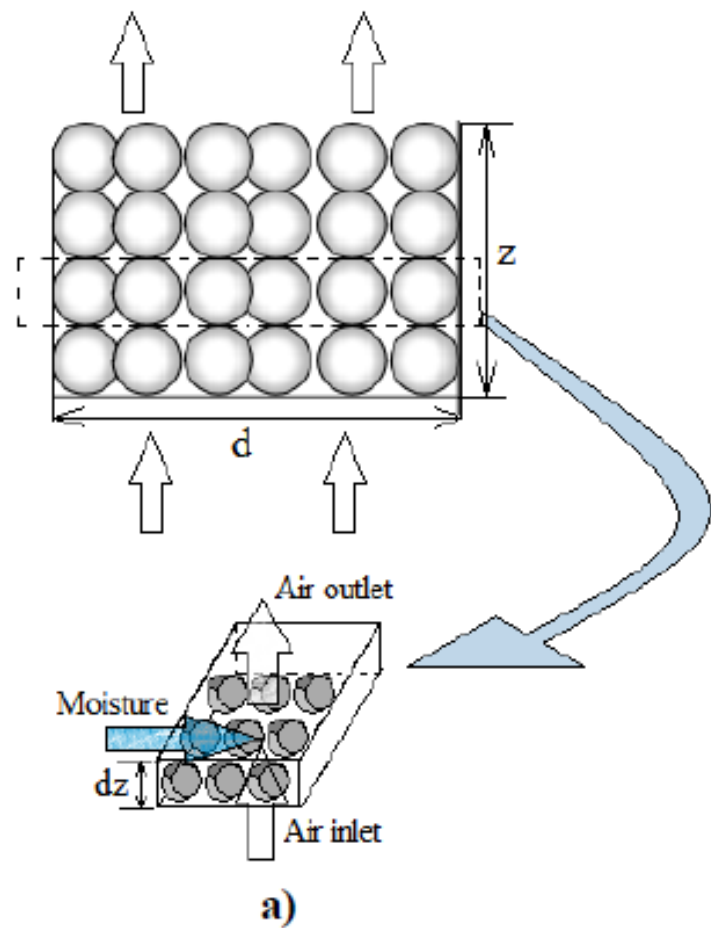
$$\frac{\partial M}{\partial t} = -k(M - M_e)$$

$$\frac{\partial T_a}{\partial z} = \frac{\left(-h_{cv} + C_{pw}\rho_d \frac{\partial M}{\partial t}\right)(T_a - T_g)}{Ga(C_{pa} + C_{pw}X)}$$

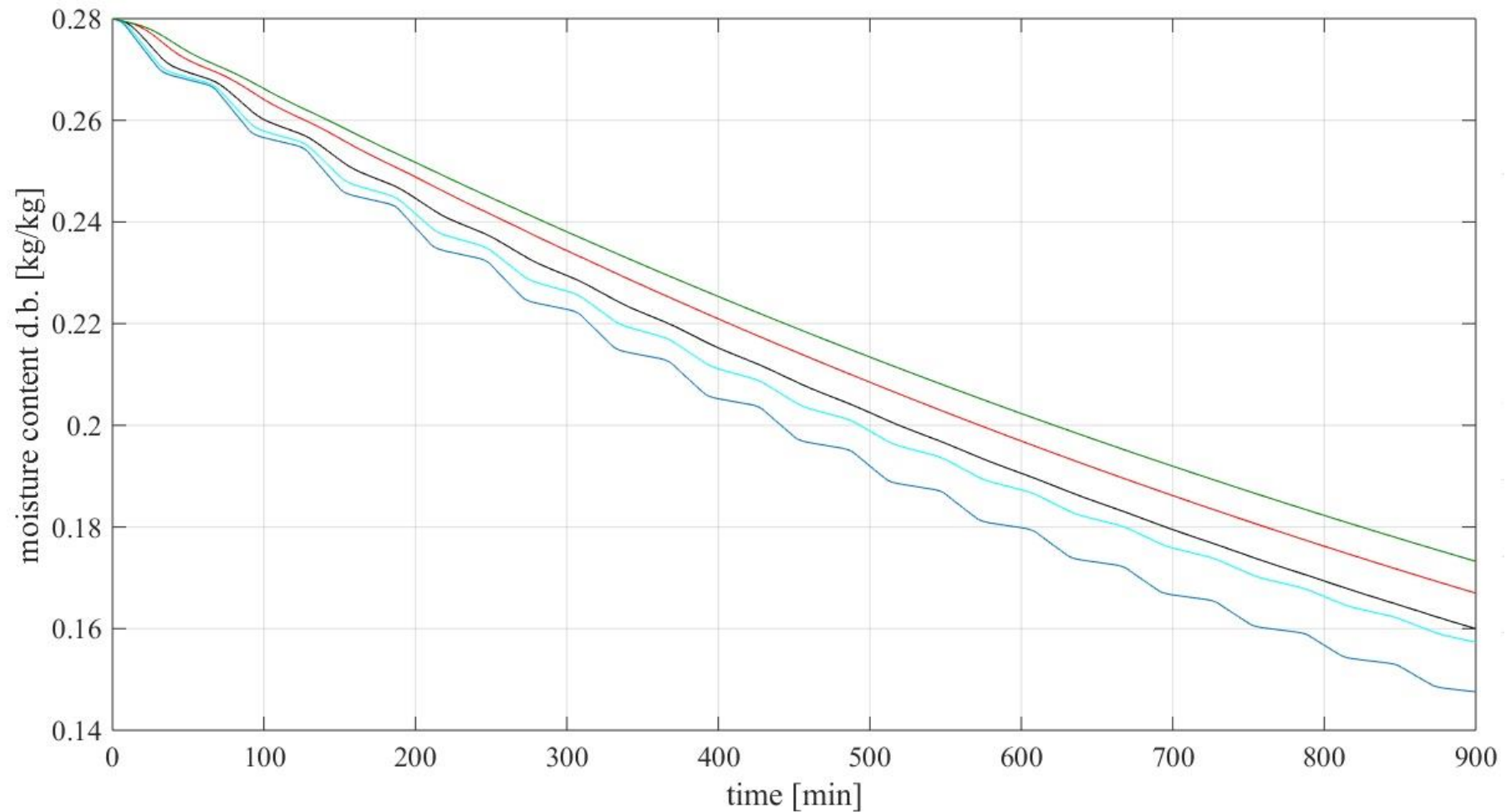
$$k = \frac{\pi^2 \cdot D_{eff}}{r^2}$$

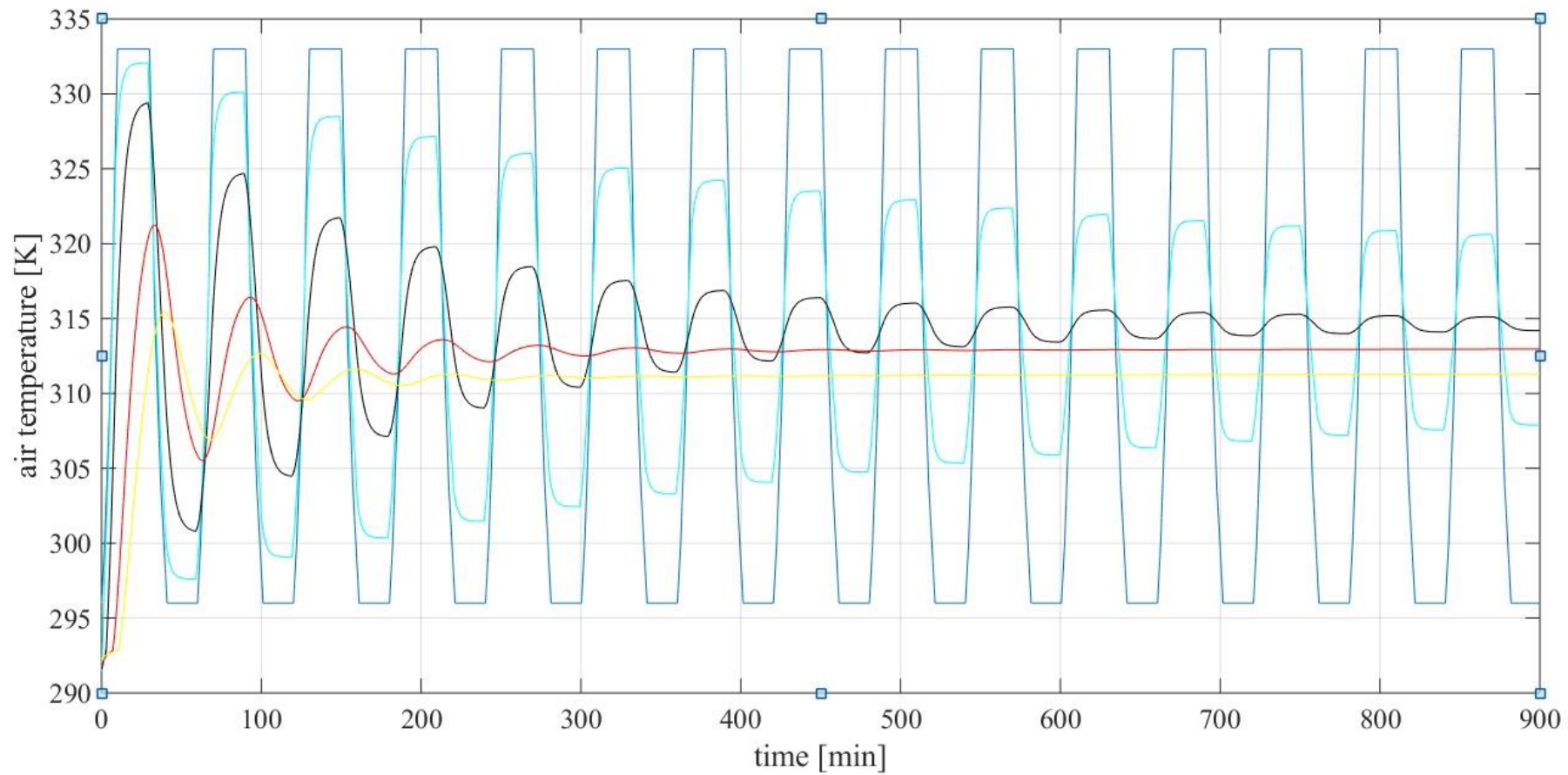
$$D_{eff} = 5.68 \cdot 10^{-5} \cdot \exp\left(-\frac{35328}{R \cdot T_a}\right)$$

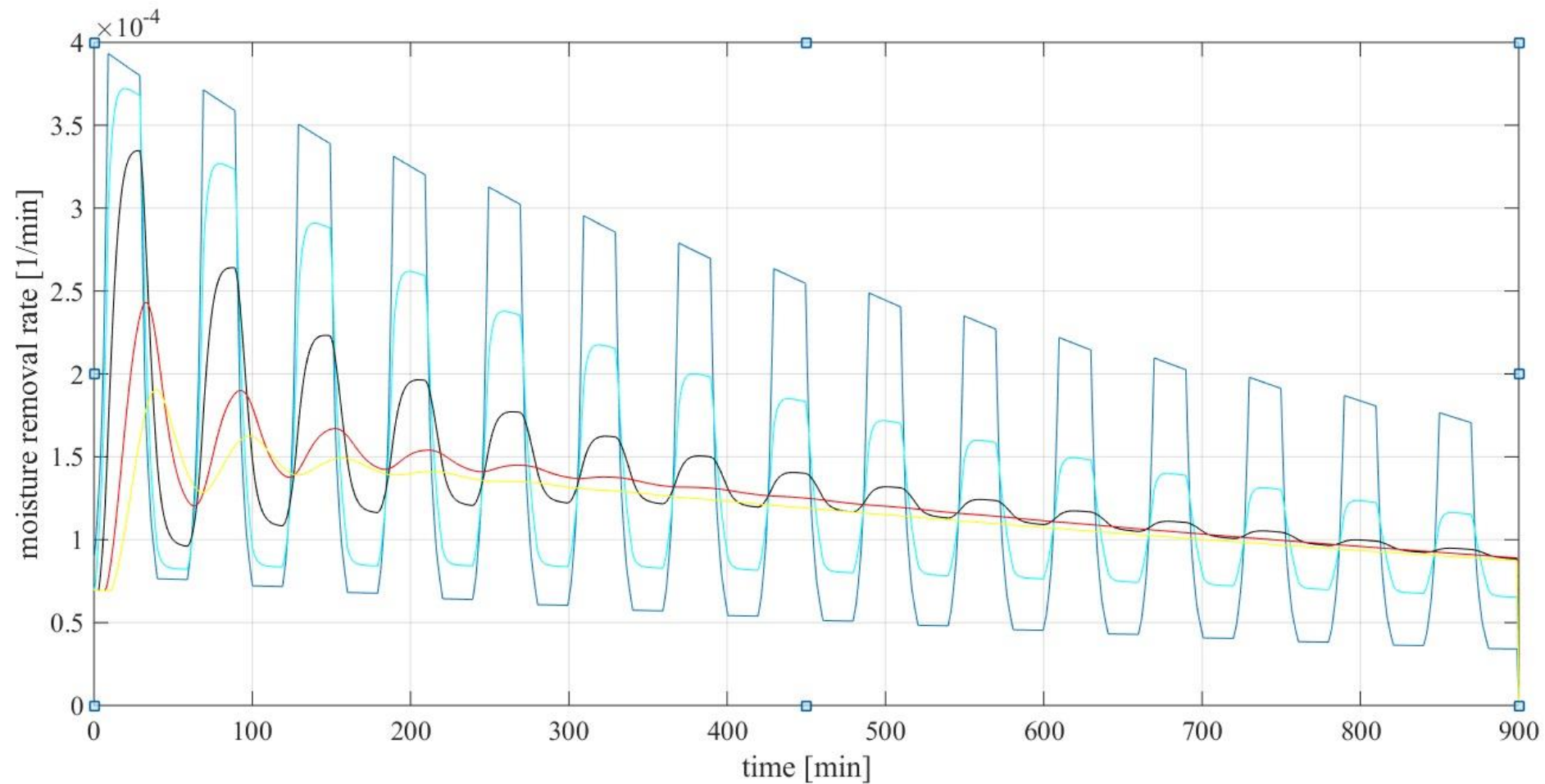
$$\frac{\partial T_g}{\partial t} = \frac{h_{cv}(T_a - T_g)}{\rho_d(C_{pg} + C_{p1}M)} + \frac{\rho_d(L_g + (C_{pw} - C_{p1})T_g)\left(\frac{\partial M}{\partial t}\right)}{\rho_d(C_{pg} + C_{p1}M)}$$



Results and discussion







Conclusions

- Temperature variation doesn't show any significant effect on higher layers of wheat bed (above approximately 30 cm), but it can only cause slower drying.
- For higher layers, intermittency should be conducted with shorter periods (e.g. 45 min on / 15 min off) where the heater is turned off.
- Intermittent drying affects the results highly at first 300 min, while the later period shows no significant changes in parameters.