Multiphase Modelling of Water Evaporation and Condensation in an Air-Heated Porous Medium

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Supplementary Material

S1. Mesh Analysis

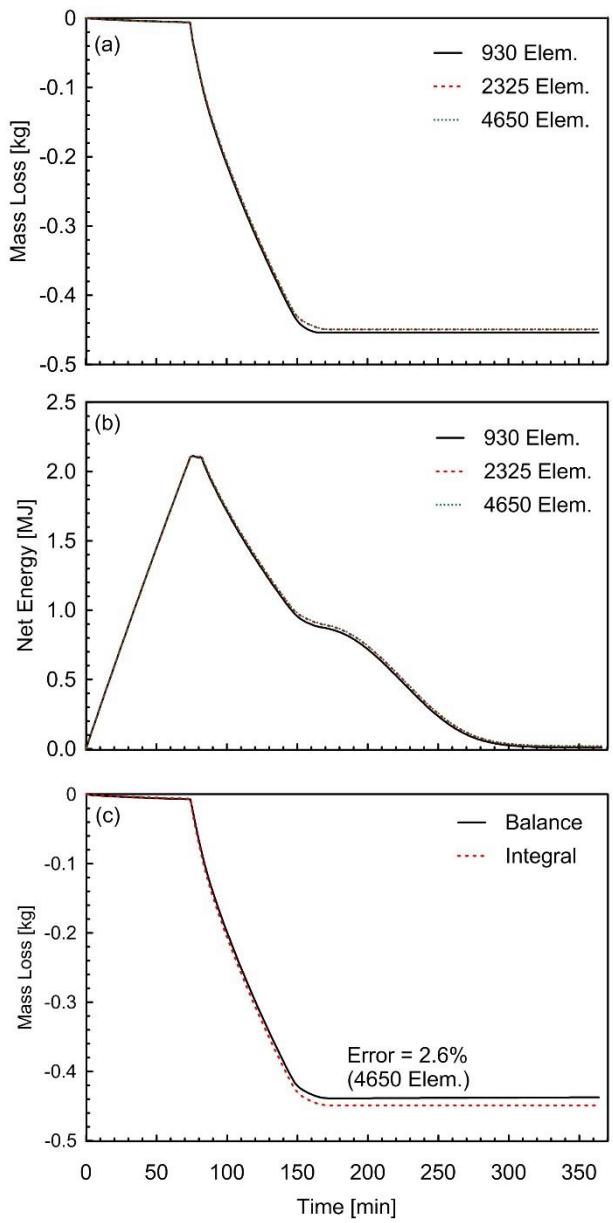

Fig. S1. Mesh analysis for base case: (a) mass loss and (b) net energy. (c) shows the error in the mass loss comparing the results between Eq. (33) and $\int_{0.100}^{0.465} \rho_w A_c \, dx$.

S2. Sensitivity Analysis for Model Calibration

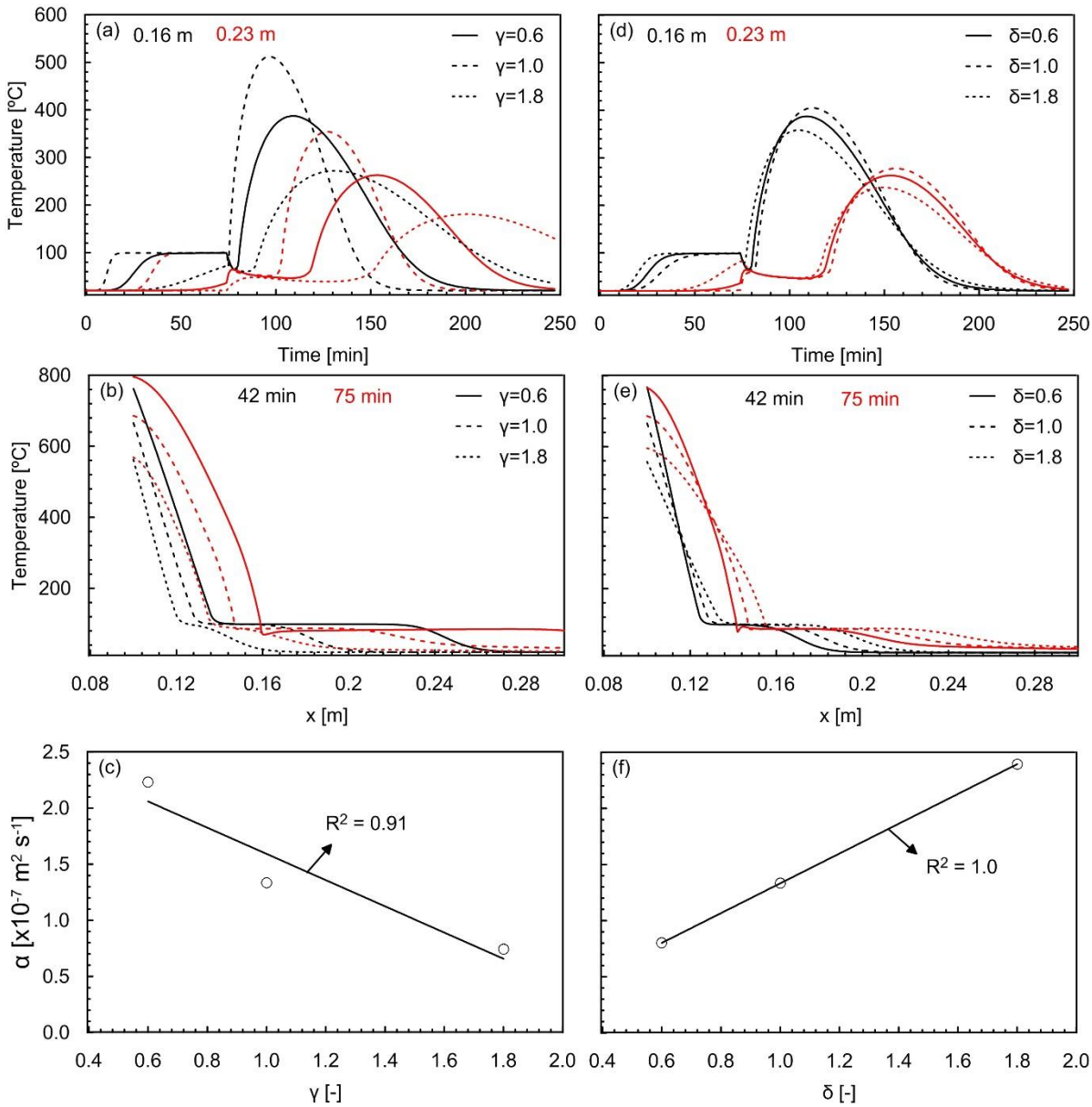

Fig. S2. Sensitivity analysis showing the model-predicted average temperature in (a,d) time and (b,e) space depicted at x = 0.16 m and x = 0.23 m and t=42 min and t = 75 min (heater on, air off) for γ and δ. Thermal diffusivity (α) for (c) γ and (d) δ.

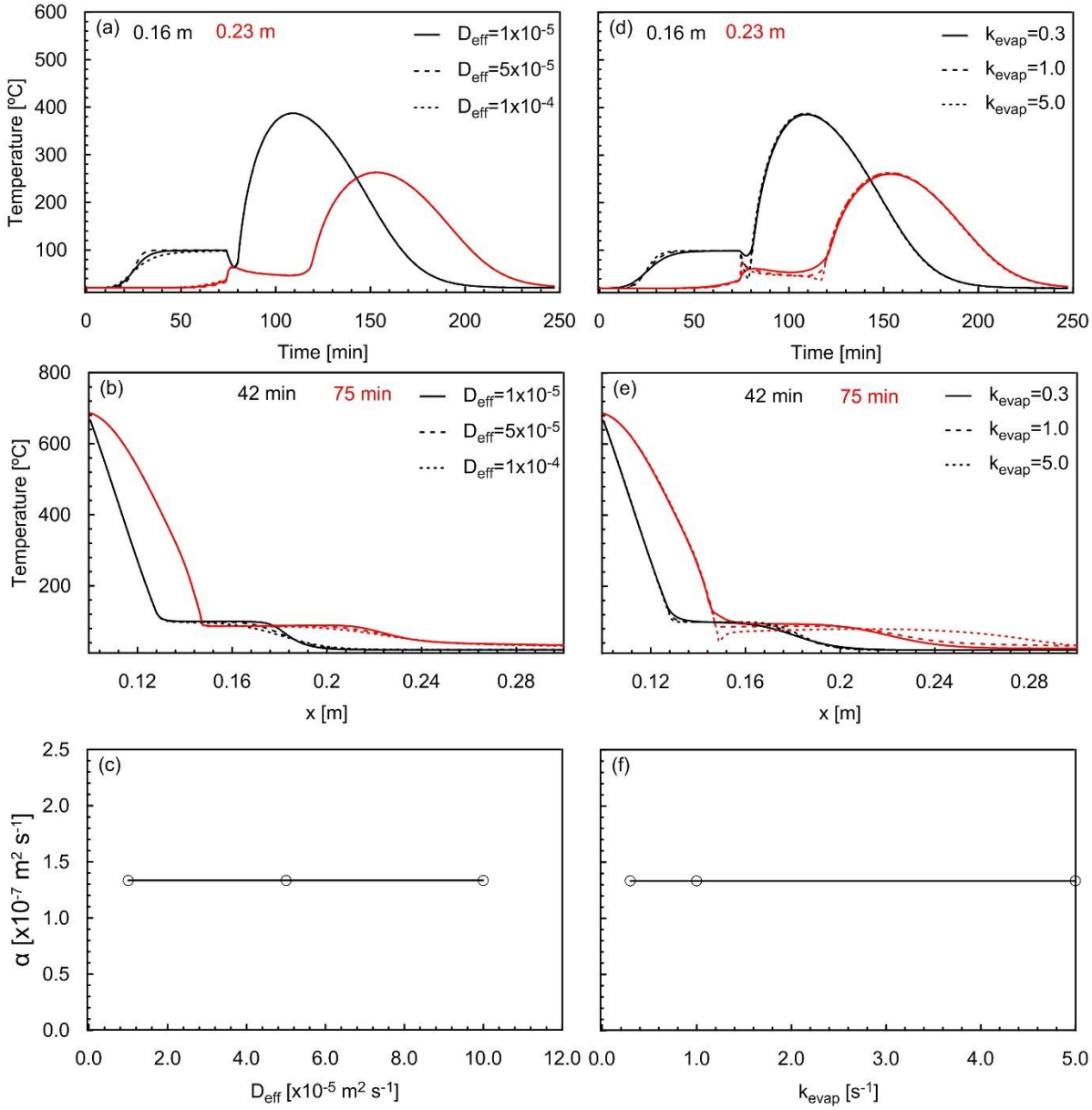

Fig. S3. Sensitivity analysis showing the model-predicted average temperature in (a,d) time and (b,e) space depicted at x = 0.16 m and x = 0.23 m and t = 42 min and t = 75 min for D_{eff} and k_{evap}. Thermal diffusivity α for (c) D_{eff} and (d) k_{evap}.

S3. Base Case Model Results at x = 0.10 m

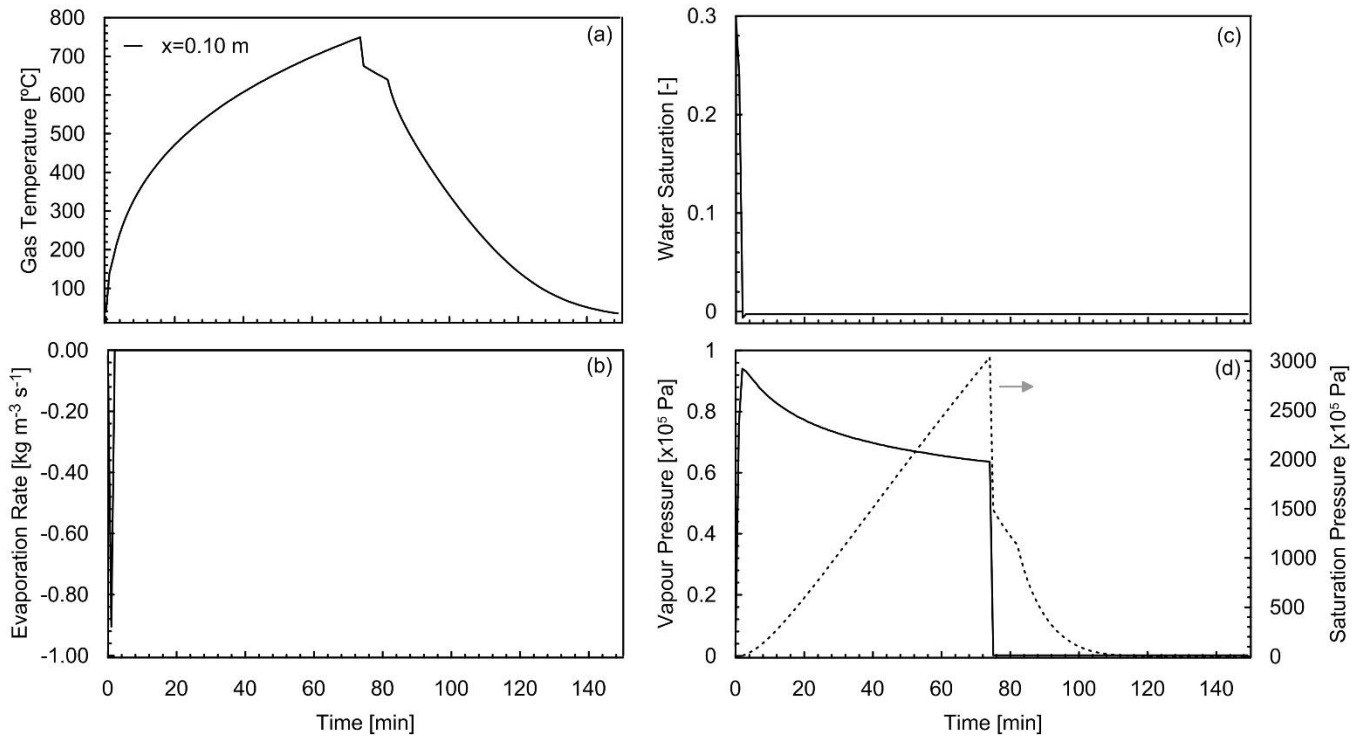

Fig. S4. Model-predicted variables versus time for base case at 0.1 m (heater).

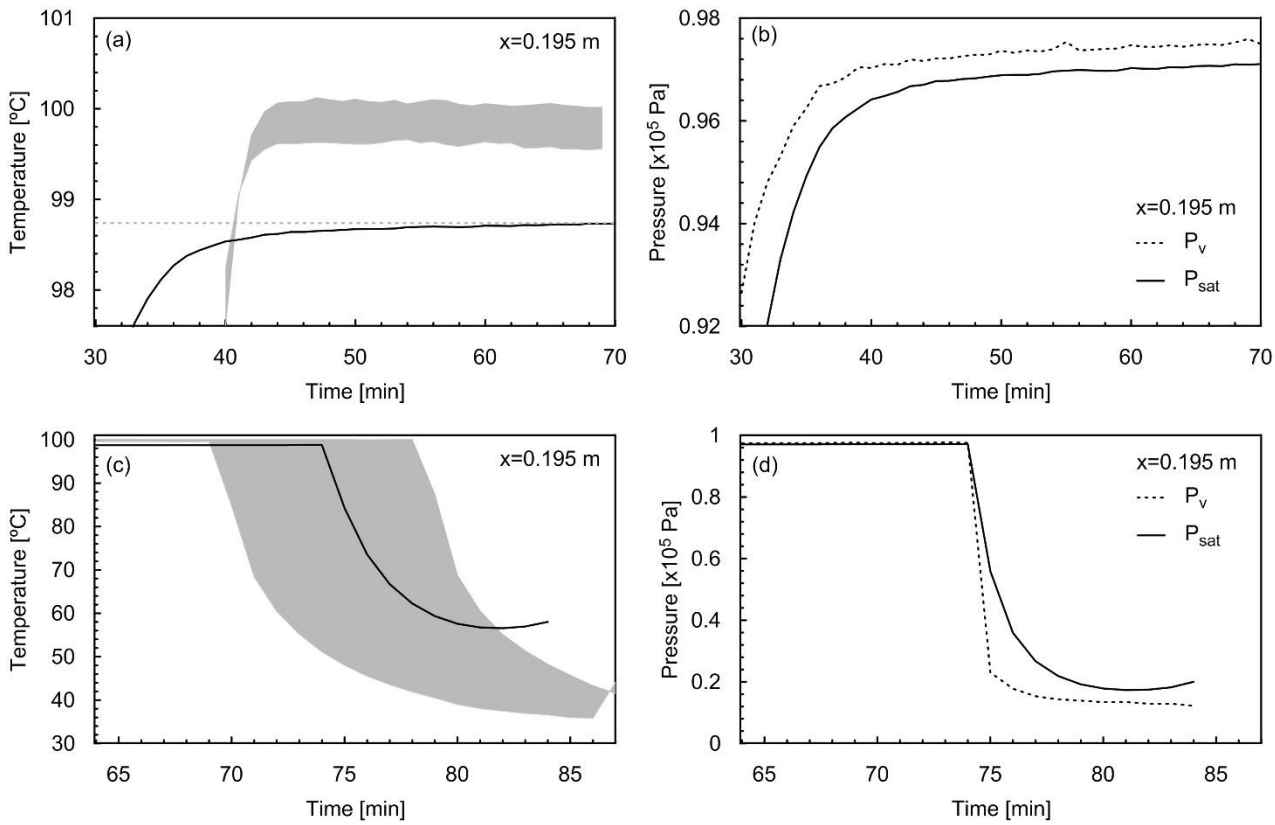

Fig. S5. Zoom-in of the (a,c) temperature plateau and (b,d) vapour and saturation pressures.

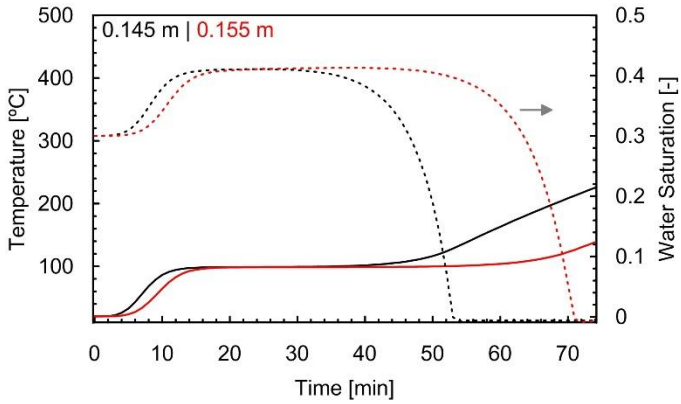

Fig. S6. Model-predicted variables versus time for base case at two positions near the heater

S4. Mass Balance

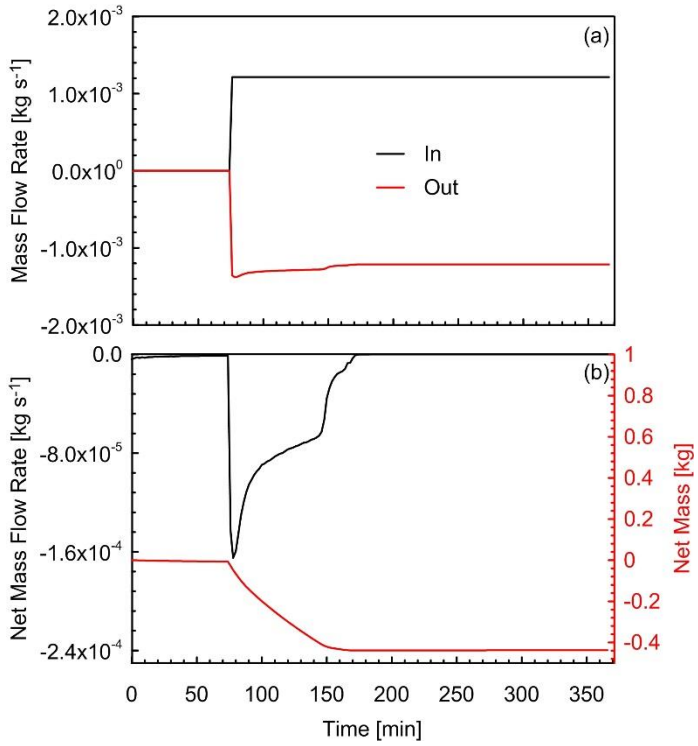

Fig. S7. Mass balance for base case.

S5. Air on ($0 \leq t \leq t_f$), Heater on ($0 \leq t \leq t_f$)

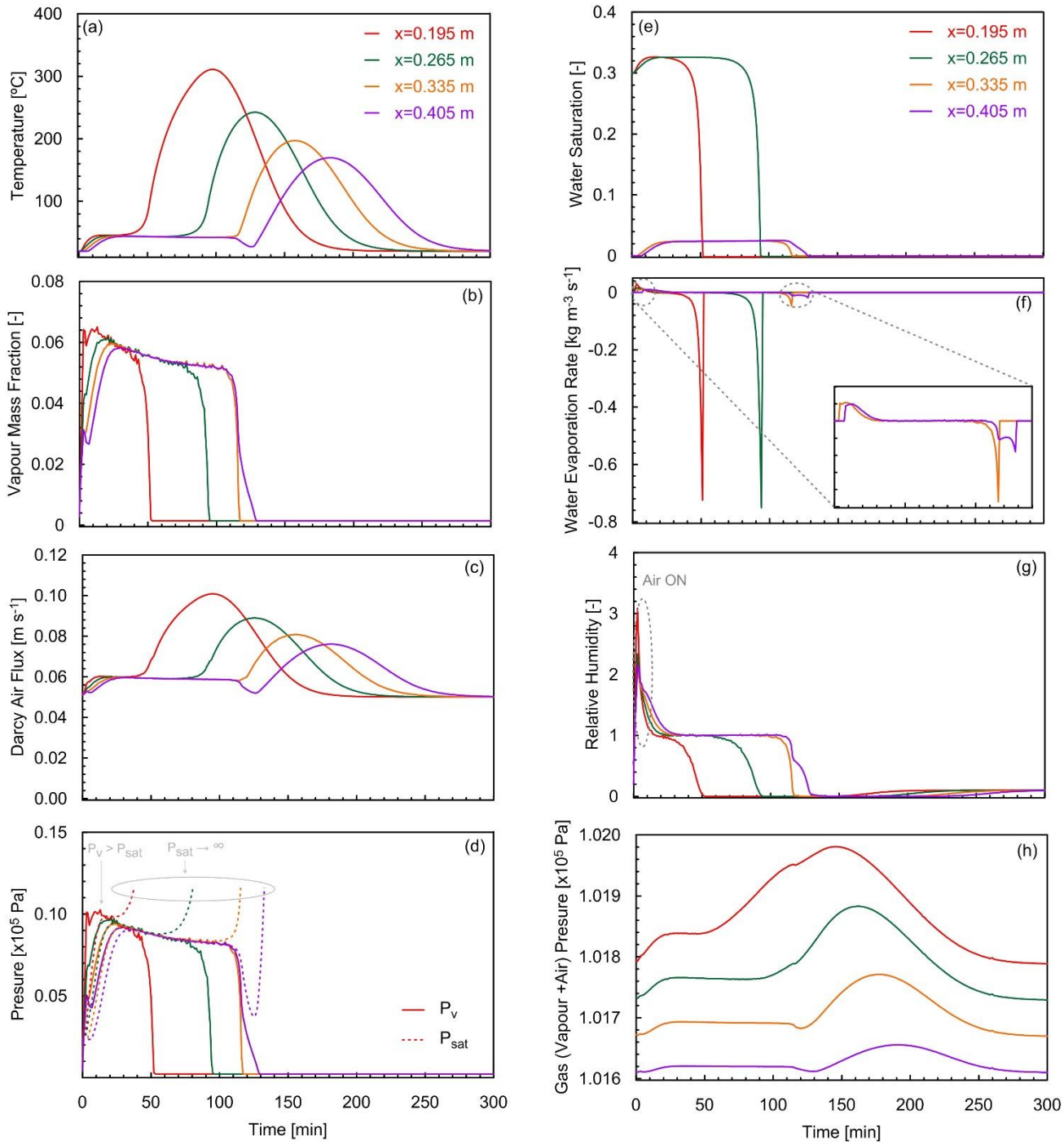

Fig. S8. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for air on ($0 \leq t \leq t_f$), heater on ($0 \leq t \leq t_f$).

S6. Air off ($0 \leq t \leq t_f$), Heater on ($0 \leq t \leq t_f$)

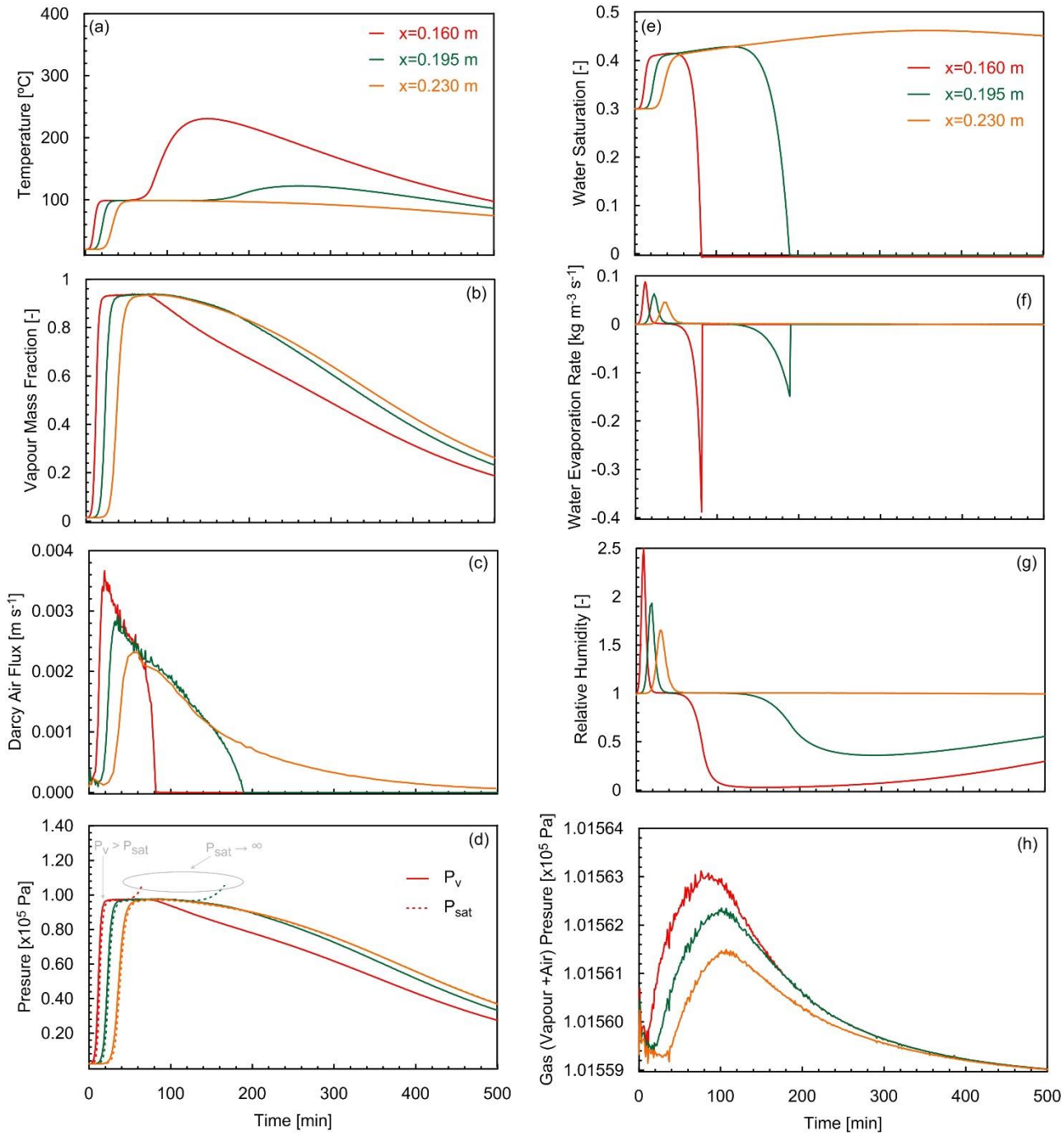

Fig. S9. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for Air off ($0 \leq t \leq t_f$), Heater on ($0 \leq t \leq t_f$).

S7. Sensitivity Analysis *of* u_g, S_w, w_{rel}

S7.1. u_g*=0.03 m s*$^{-1}$

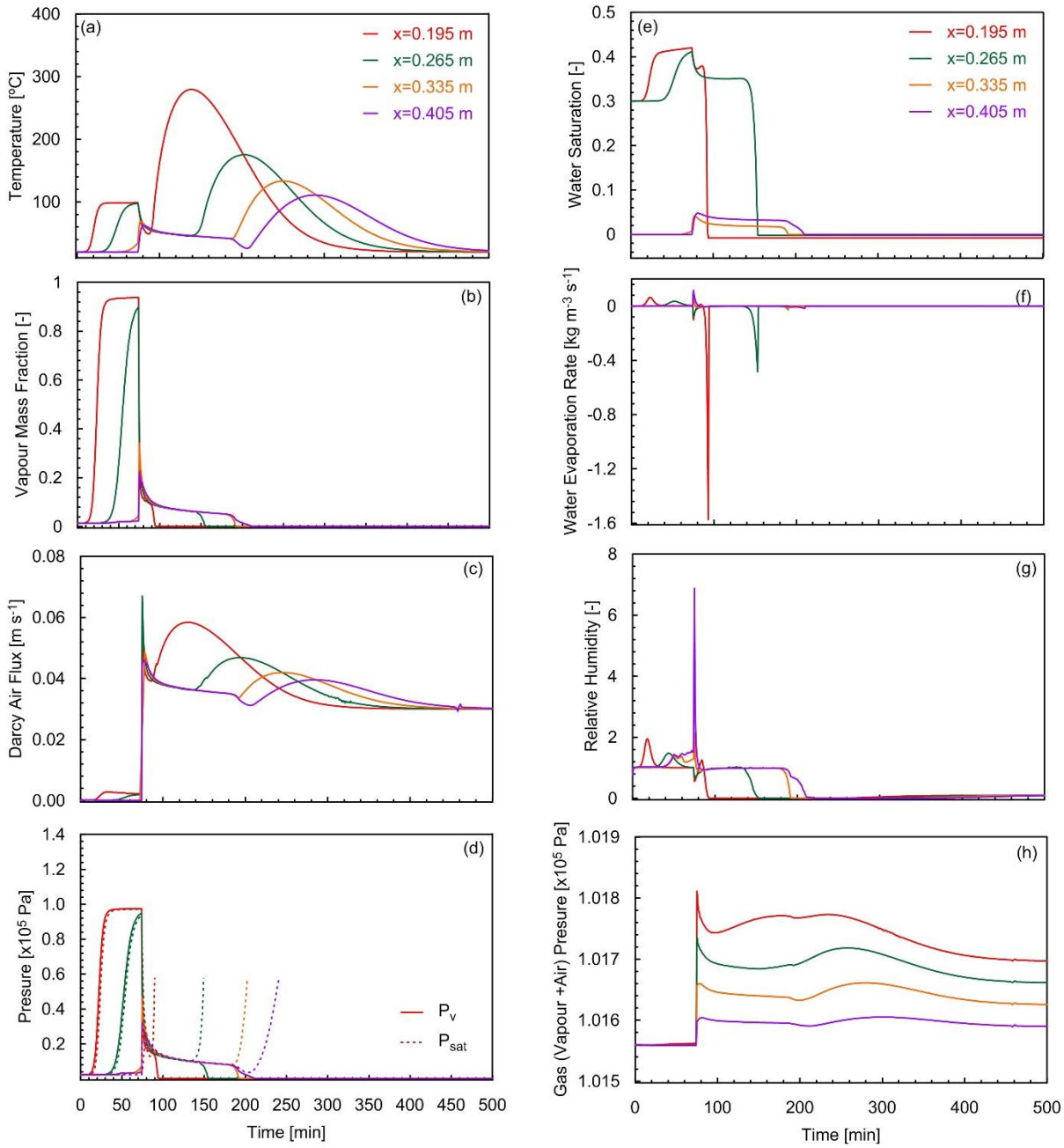

Fig. S10. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for u_g=0.03 m s^{-1}.

S7.2. u_g=0.08 m s^{-1}

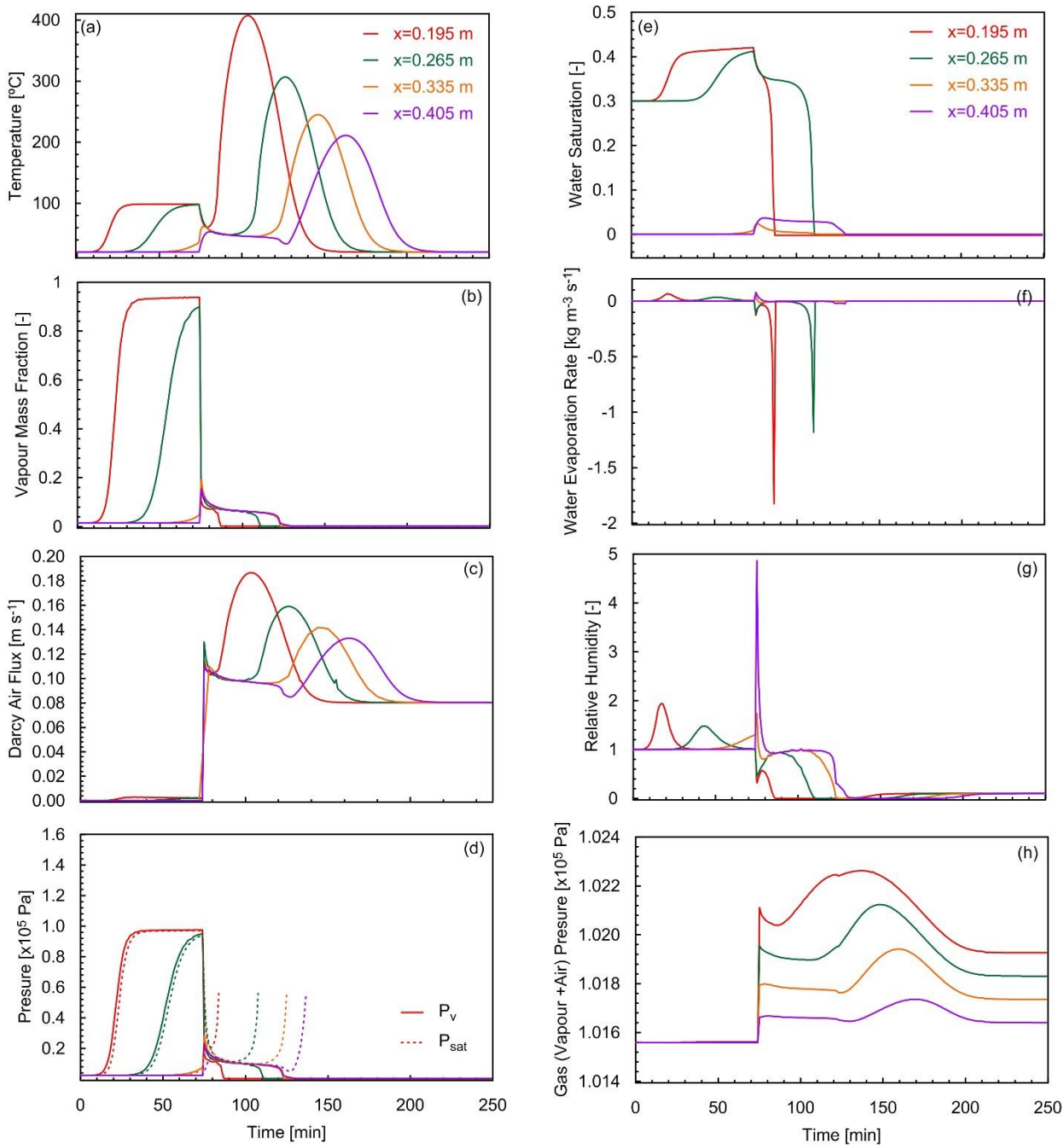

Fig. S11. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for u_g=0.08 m s^{-1}.

S7.3. S_w=0.1

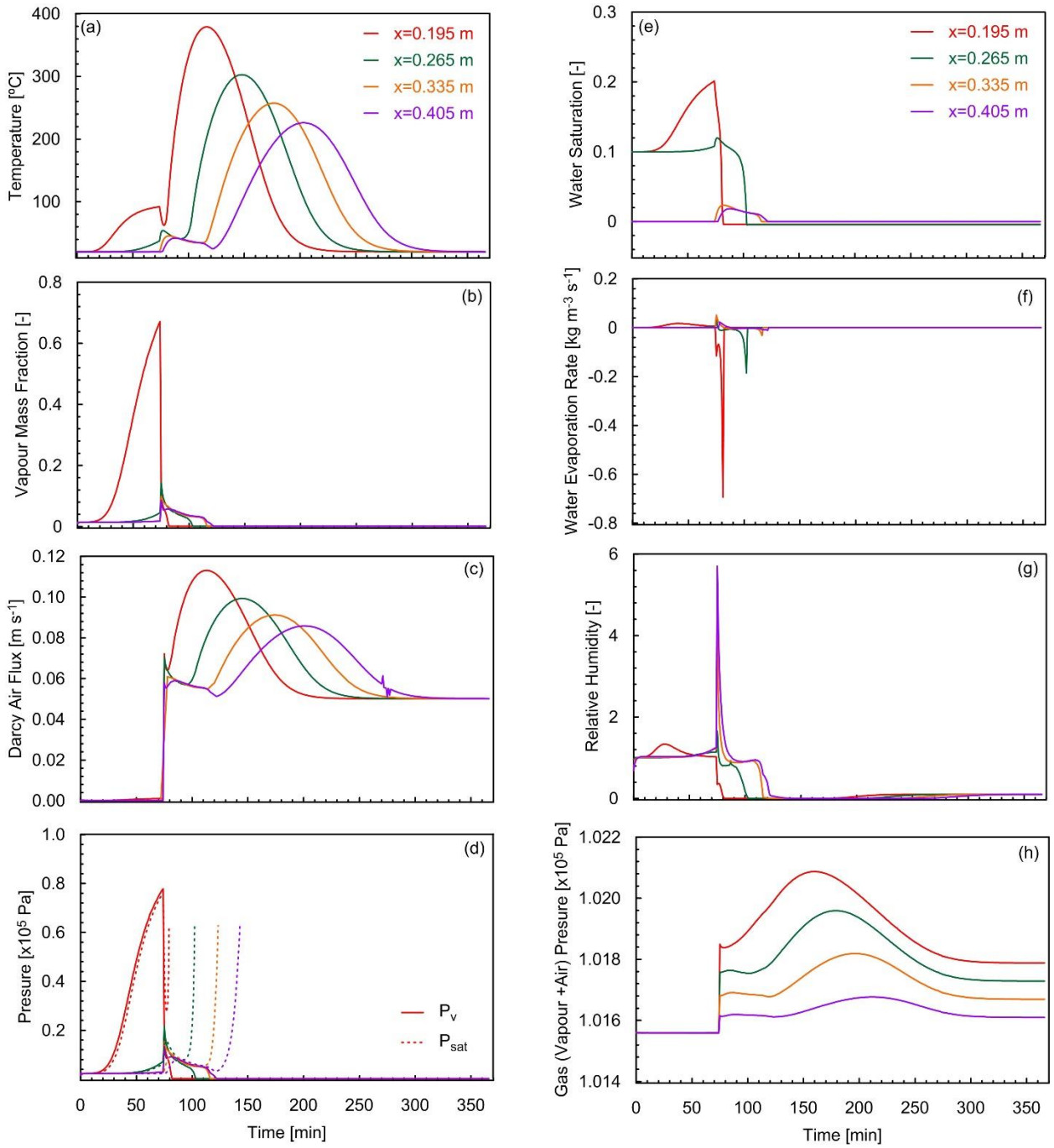

Fig. S12. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for S_w=0.1.

S7.4. S_w=0.5

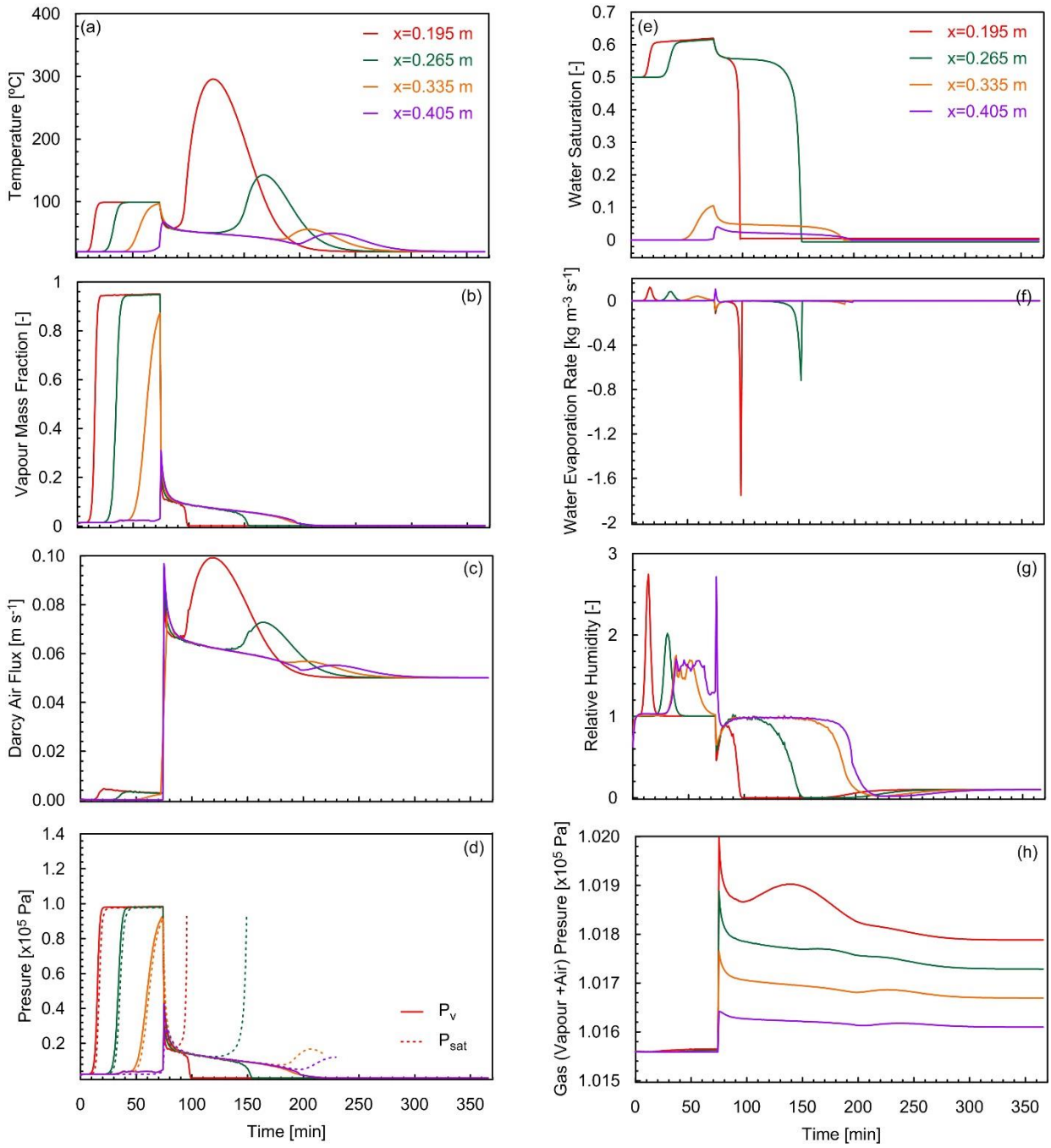

Fig. S13. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for S_w=0.5.

S7.5. w_{rel}=0.0

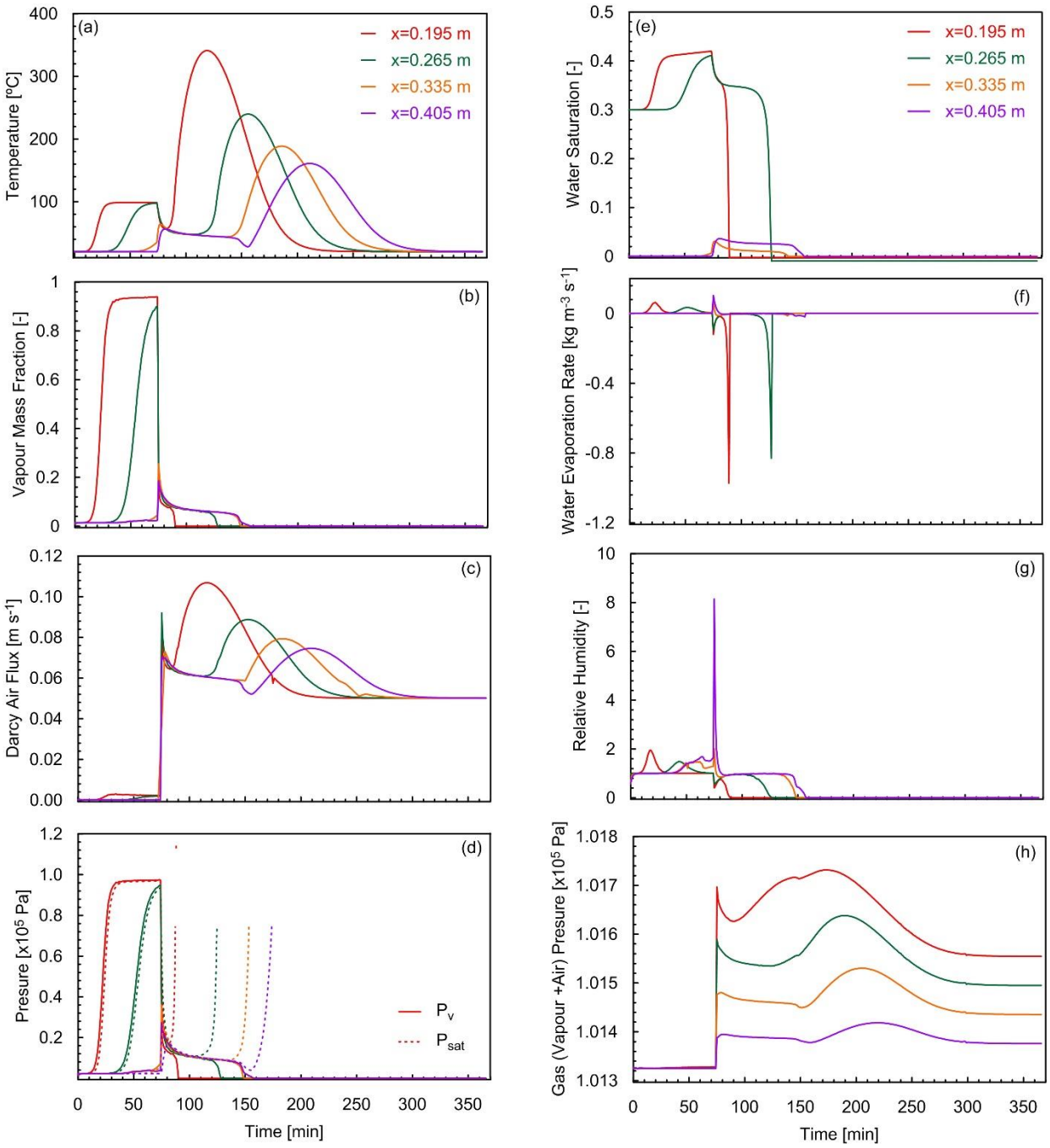

Fig. S14. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for w_{rel}=0.0.

S7.6. w_{rel}=0.9

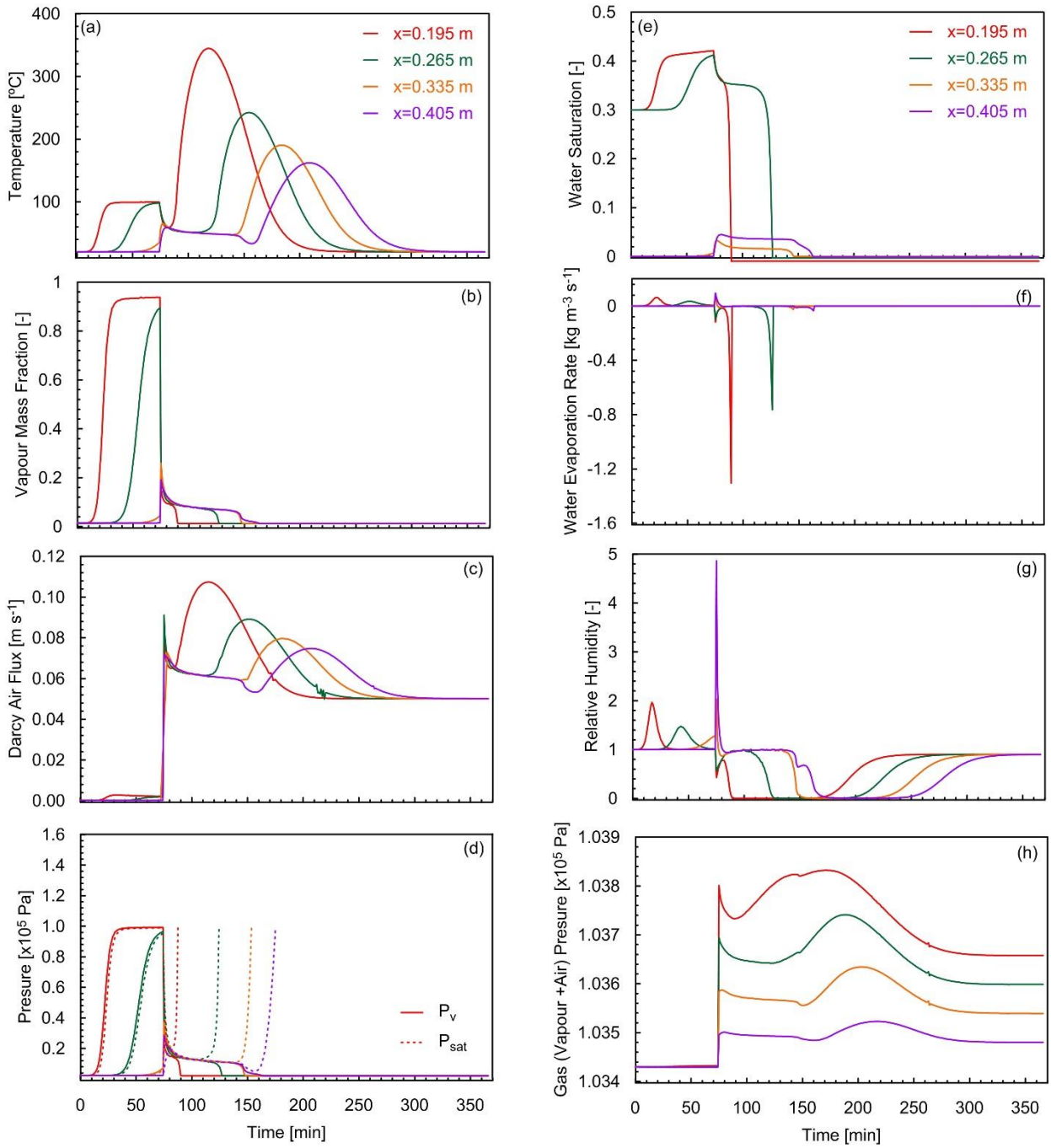

Fig. S15. Solid lines describe (a) average solid and gas model-predicted temperature and (b-h) the model-predicted variables versus time from 0.195 to 0.405 m with 0.07 m intervals for w_{rel}=0.9.