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Evaporation from a semi-infinite porous medium: The role of capillary flow H.K. NAVAZ, B. MARKICEVIC, Kettering University, S.J. PAIKOFF, DTRA — The liquid evaporation from the semi-infinite porous medium is solved numerically using the dynamic capillary network model in which the interface shape and multiphase flow front thickness between dry and fully wet parts of porous medium are tracked in time. Both convective and diffusion mass transport limited regimes are identified and liquid pseudo-velocity due to the evaporation is calculated. The numerical analysis is extended for in-parallel capillary flow and evaporation liquid transport, and again, the changes of the interface shape and multiphase flow front thickness are investigated. It turns out that the convective evaporation is prolonged due to the capillary flow as evaporated liquid close to the evaporating boundary is replenished by capillary flow. However, the evaporation curve has an elongated "tail" for longer evaporation times as capillarity tends to transport the liquid deeper into the porous medium. The contributions of the capillary flow and the mass transport on the overall evaporation dynamics is best visible by comparing the liquid pseudo-velocity for pure evaporation and evaporation with capillary flow. Two pseudo-velocities are equal for time for which there is a transition from convection to diffusion controlled evaporation. In this point, the remaining liquid is always distributed in the multiphase pattern, where the thickness of the multiphase region depends on capillary flow and mass transport rates.

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