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# Coupling porous medium-free flow: Formation and evaporation of multiple droplets at the interface

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Formation a droplet at the interface of a coupled porous medium-free flow system affects the behavior of the whole system by altering the interaction between the two domains. The droplet at the interface acts as an intermediary which not only handles the exchange between the free flow and the porous medium, but also stores mass and energy [1]. Furthermore, the droplet can experience a growth or a shrinkage in its size depending on the feed from the porous medium and the evaporation to the free flow. Such phenomena are of great importance in industrial applications such as water management in fuel cells and cooling systems and even in our daily life where the sweat droplets emerge on our skin. Thus, we developed a new concept to describe the droplet formation and accordingly derived a new set of coupling conditions for a coupled porous medium-free flow system which takes impact of multiple droplets on the whole system into account. Applying the new concept, we developed a model which is able to handle non-isothermal compositional coupled systems. The model consists of a pore network to model the porous medium [2], and Navier-Stokes equations to describe the free flow domain. Selected examples are used to discuss how the developed model enables us to capture the droplet formation and evaporation at the interface between the porous medium and the free flow.

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Germany

## References

[1] Ackermann, S., Bringedal, C., & Helmig, R. (2020). Multi-scale three-domain approach for coupling free flow and flow in porous media including droplet-related interface processes. Journal of Computational Physics, 109993.

[2] Weishaupt, K., Terzis, A., Zarikos, I., Yang, G., Flemisch, B., de Winter, D. A. M., & Helmig, R. (2020). A Hybrid-Dimensional Coupled Pore-Network/Free-Flow Model Including Pore-Scale Slip and Its Application to a Micromodel Experiment. Transport in Porous Media, 135(1), 243–270.

## Time Block Preference

## Participation

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