Contribution ID: **456** Type: **Poster + 3 Minute Pitch**

About front dynamics and up-scaling multiphase flows in heterogeneous porous media

Wednesday, 16 May 2018 17:04 (2 minutes)

Up scaling techniques allowing to use coarser meshes have rigorous fundations as well as the underlying heterogeneous porous medium presents some statistical homogeneity. In that situation, homogenization theory works well and provides closure problems, the solution of which gives rises to up scaled paramters. These assumptions break down in presence of a front corresponding for example to water flooding of an oil reservoir, or to situations leading to miscible viscous fingering. Breaking translational invariance leads to revisit existing up scaling techniques: it is possible to use standard up scaling far from the front, and to adapt the methods in coarse grid blocks close to the front? It is possible to use effective transport and pressure equations defined at coarse scale accounting for subgrid heterogeneities? It is possible to get a deeper understanding of the coupling between instabilities and heterogeneities?
In that presentation, we will present some approaches and some existing results or conjectures on that issue.

References

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Session Classification: Parallel 8-F

Track Classification: MS 1.09: front & interface dynamics and up scaling transport properties in porous media