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WATER INFILTRATION FRONTS IN HETEROGENEOUS POROUS MEDIA

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Summary. When modeling immiscible displacement in heterogeneous porous media, such as water infiltration into soil or displacement of water by oil, it is often necessary to describe the fluid distribution in an averaged sense, using upscaled models. An important quantity that should be reproduced by an equivalent homogeneous model is the width of the front. The macroscopic interfacial area between the fluids can be assumed to be related to the front width. As the width may quantify a real change of saturation or the fluctuations of a roughening sharp fluid-fluid interface, which would yield very different measures for the interface, the front roughness is needed as additional information to capture the front behaviour. Similar to the concept of dilution and dispersion in solute transport theory, these two measures differ in their relation to processes at the fluid interfaces. Besides the transition zone from high to low displacing fluid content, it is important to capture in an upscaled model fluid exchange with patches of quasi-immobile displaced fluid in the rear of the displacement front. Such patches are also important to capture if macroscopic interfacial area between the fluids need to be quantified. In this contribution we show some examples of displacement experiments, where the occurring of immobile zones in the vicinity of displacement fronts, as well as the transition zones of the displacement fronts are illustrated. We also present an upscaled model, which has a memory term to capture the capillary exchange with immobile zones in a general displacement problem.