DuMu^{x}的应用

Li

Dumux的多相流模拟：Norne油藏模拟

基于opm-data的两相流模拟。孔隙度场、各向异性的渗透率场、计算网格M的单元E、注水和产油井，如图。

计算域用角点网格表征，使用omp-grid的DUNE网格接口。

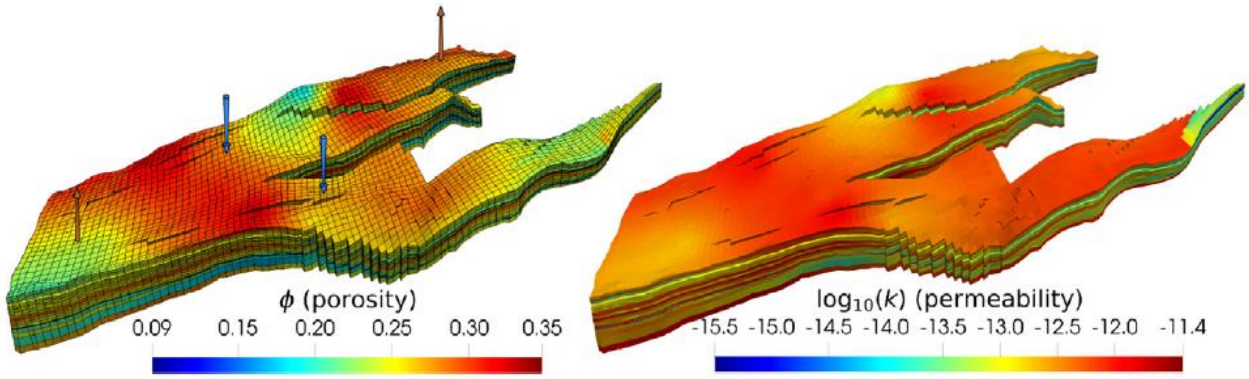


Fig. 4. Porosity and permeability field of the Norne formation. Permeability is isotropic and values are given in m^2. The left image additionally highlights the elements of the grid and displays the location of the injection (blue) and production wells (brown). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

不可压缩、不融合两相流模型方程与参数参考文献70的式56-60及表3。
非线性耦合PDE使用TPFA单元中心有限体积格式空间离散，向后欧拉格式做时间离散。初始条件是计算域完全是饱和石油。从2个井注水。2个抽水井开始产油，之后是水油混合物。
井使用固定的Bore-hole压力的Peaceman井模型来模拟。

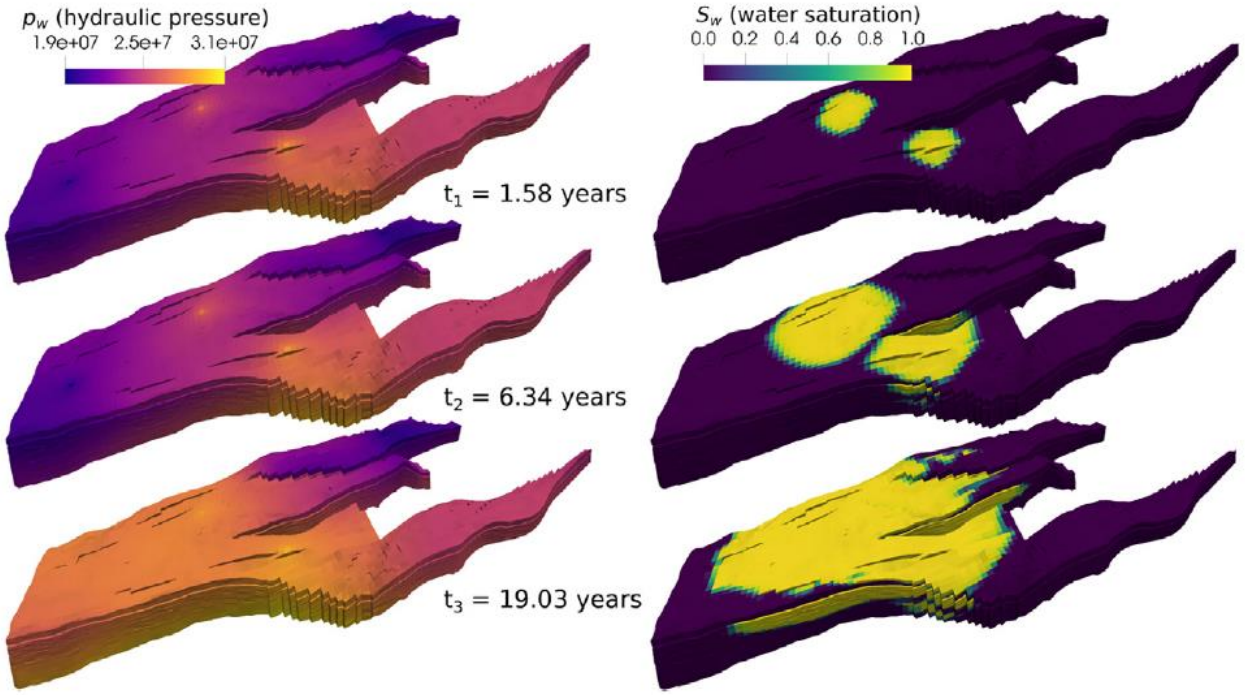


Fig. 5. Evolution of the wetting phase pressure (in Pa) and saturation. This is a new visualization of the data obtained with DuMu^x by Schneider et al. [58], based on the injection scenario originally presented in [70].

DuMux 3.x 的 multi-domain的模型耦合新特性

6. 1算例1：自由表面流动与多孔网络模型的耦合

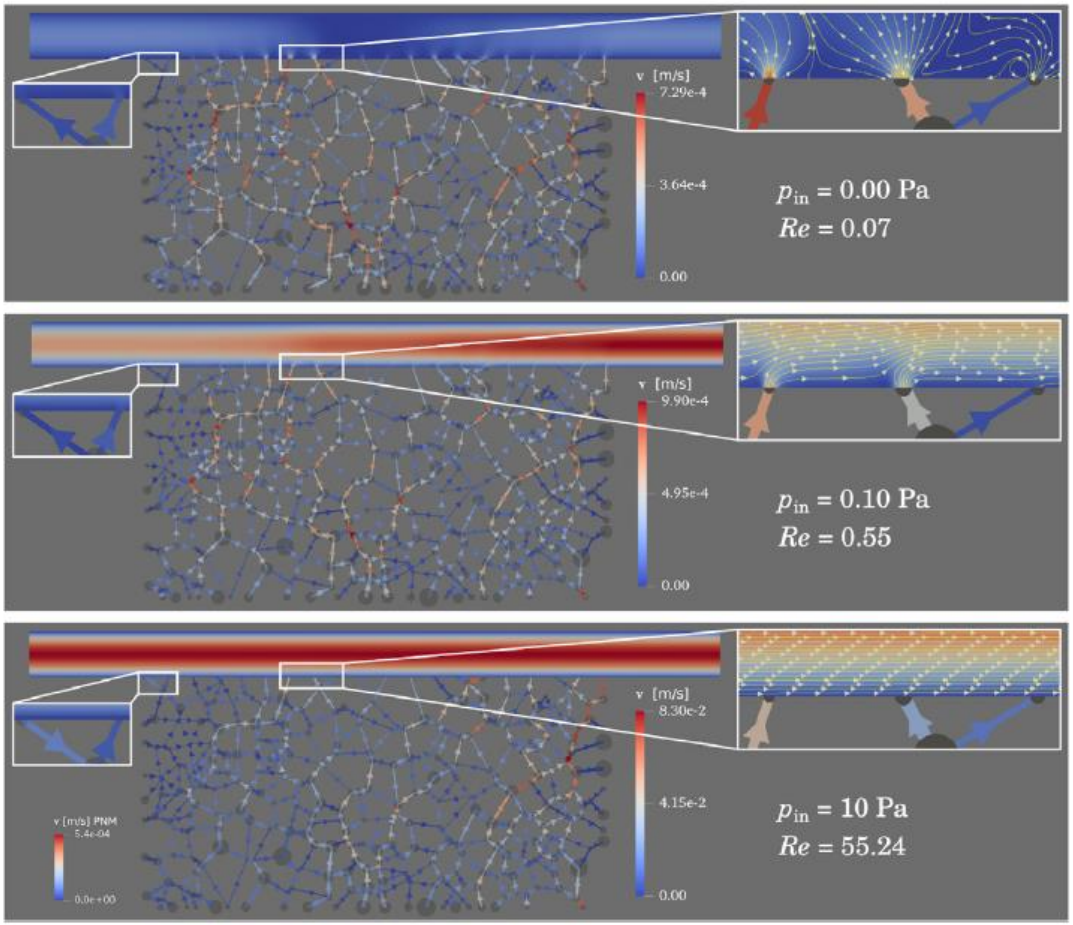


Fig. 6. Velocity fields for the three scenarios. *Re* is based on the averaged velocity within the channel. Note the different color scale for the network in the third scenario (bottom). $p_{out} = 0$. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

6.1算例1：自由流动与多孔网络模型的耦合

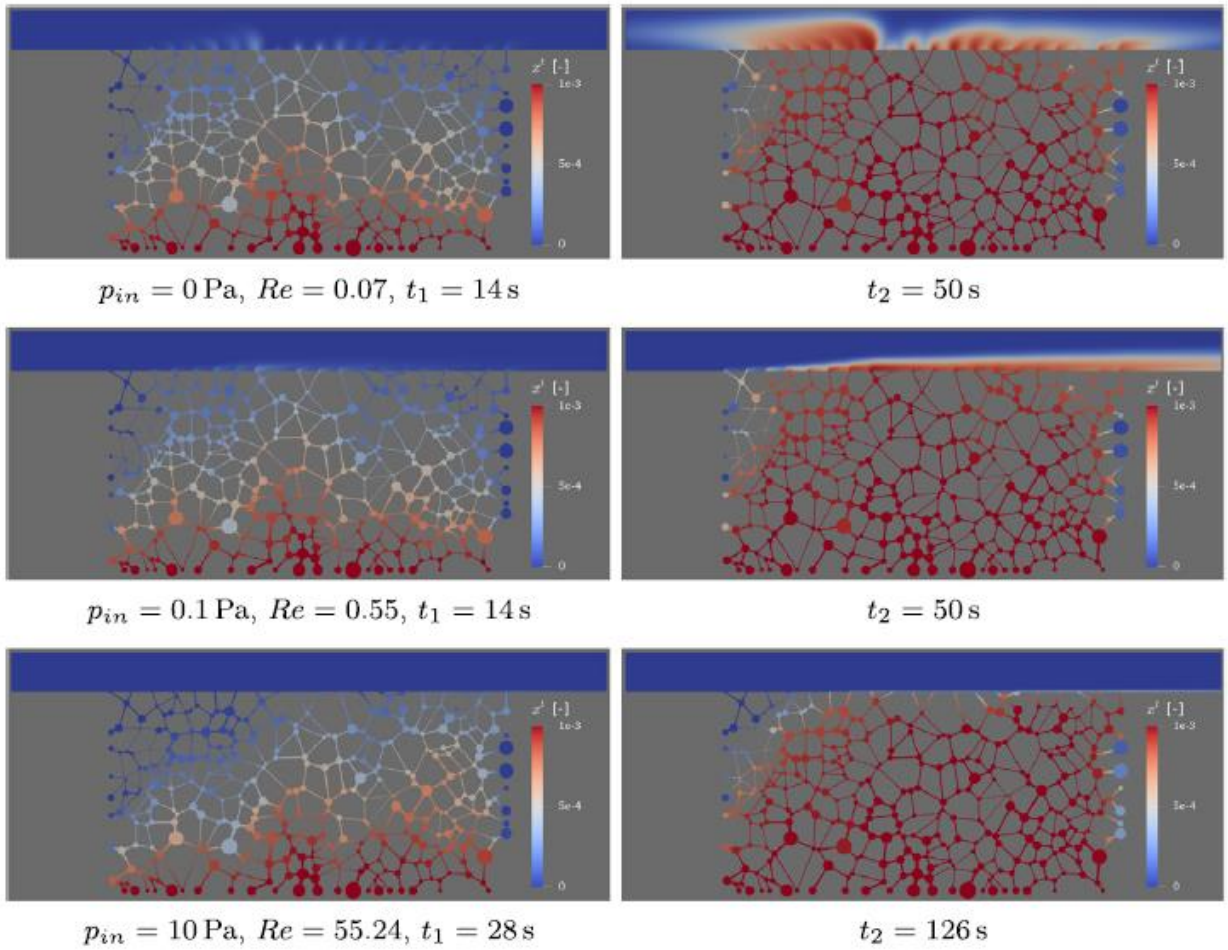


Fig. 7. Distribution of the mole fraction x^t for the three different scenarios at different times. *Source:* Figure adapted from [21] (license: CC BY 4.0).

6.2 算例2：裂隙多孔介质的两相流

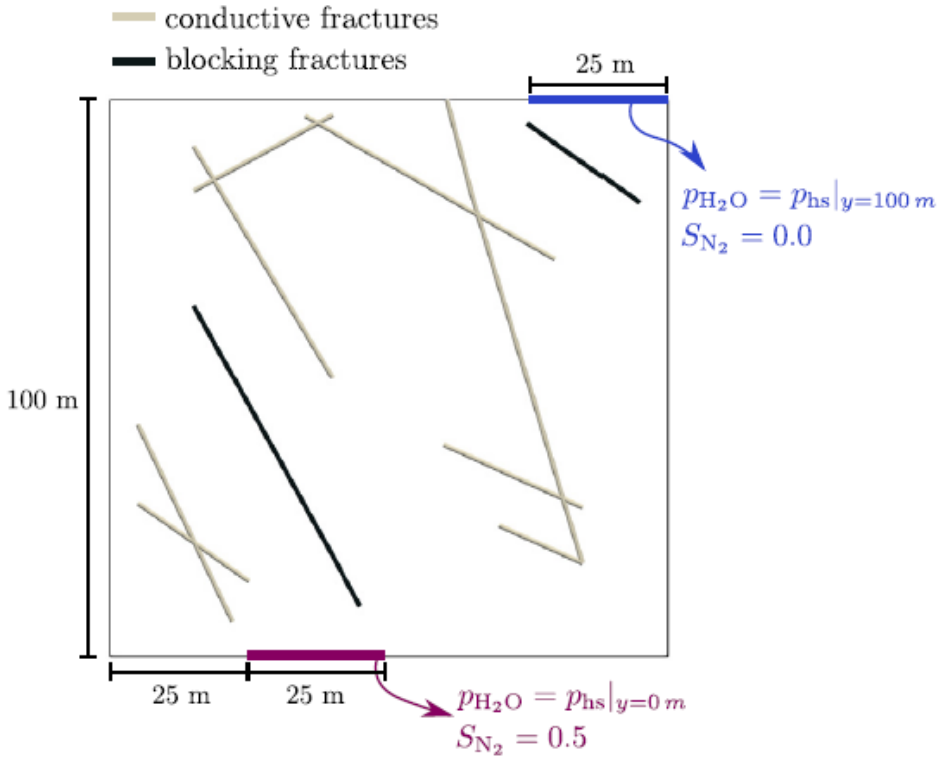


Fig. 8. Domain and Dirichlet boundary conditions for the two-phase flow example through fractured porous media. The subscript hs refers to hydrostatic pressure conditions.

6.2 算例2：裂隙多孔介质的两相流

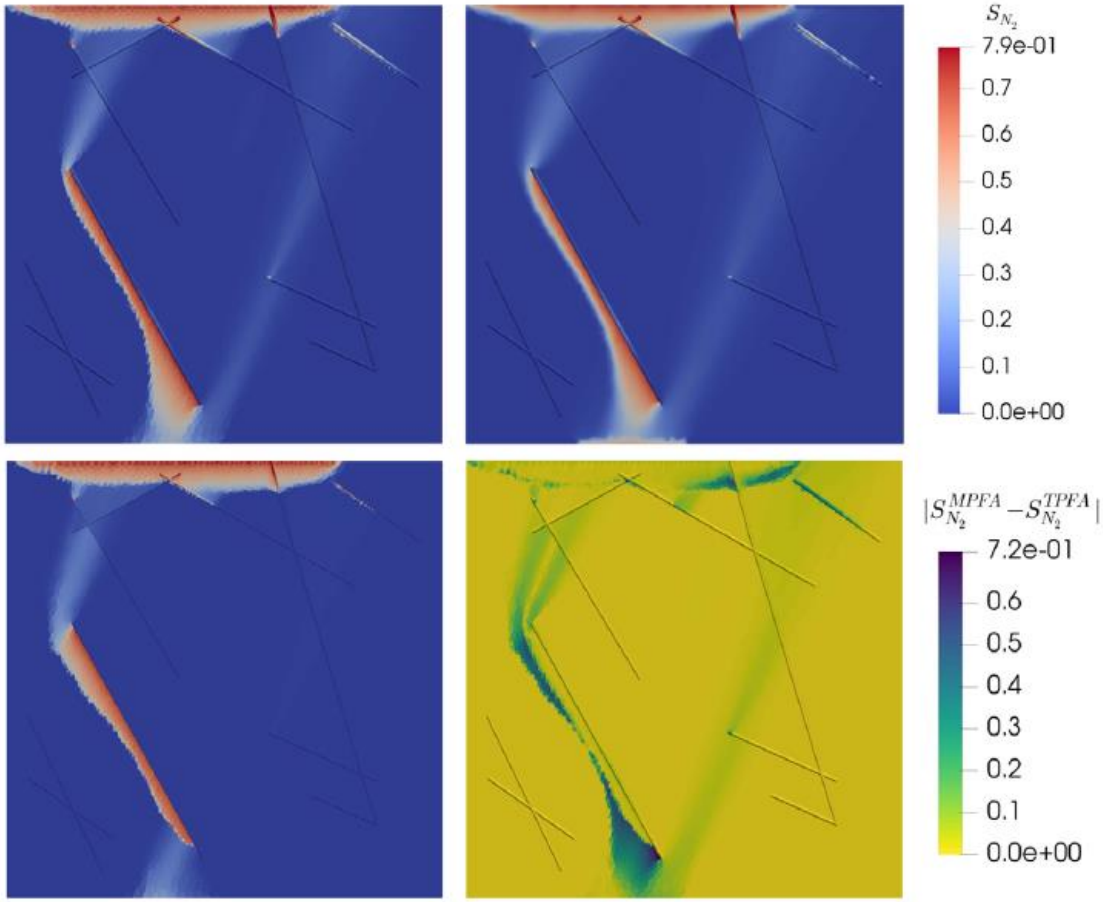


Fig. 9. Nitrogen saturation distribution at the final simulation time $t = 75\,000$ s obtained with the MPFA-O scheme (upper left), the BOX scheme (upper right) and the TPFA scheme (lower left) for the example application of two-phase flow through a fractured porous medium. The lower right image shows the difference in the saturations obtained with the MPFA-O and the TPFA scheme.

6.3算例3：植物根系-土壤相互作用

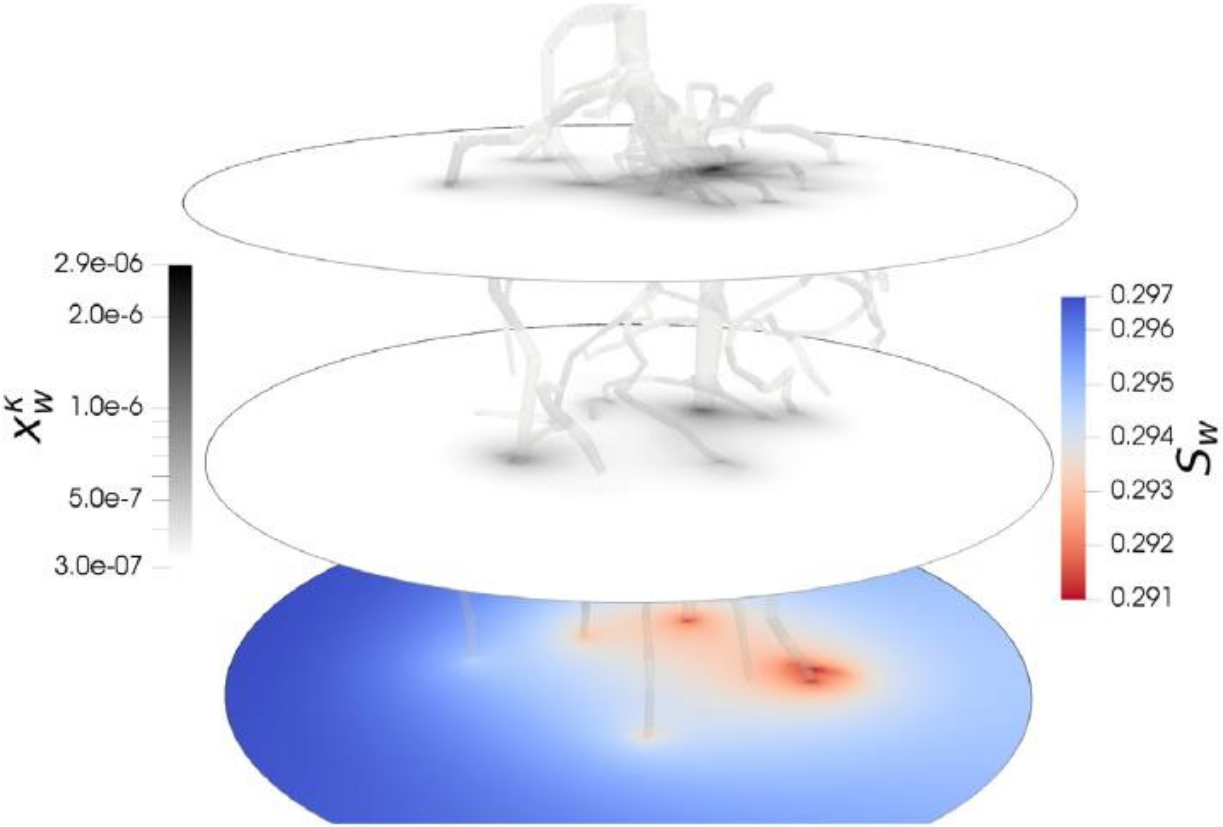
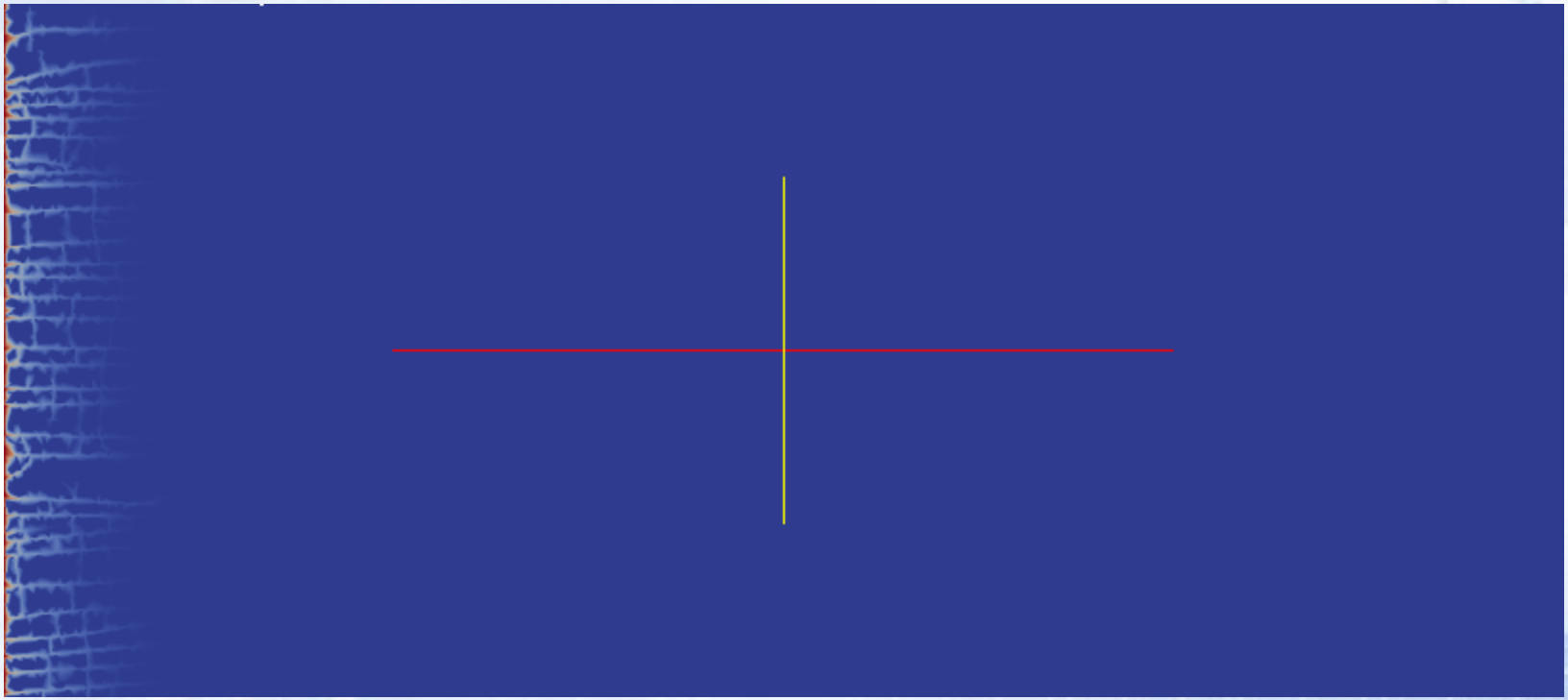
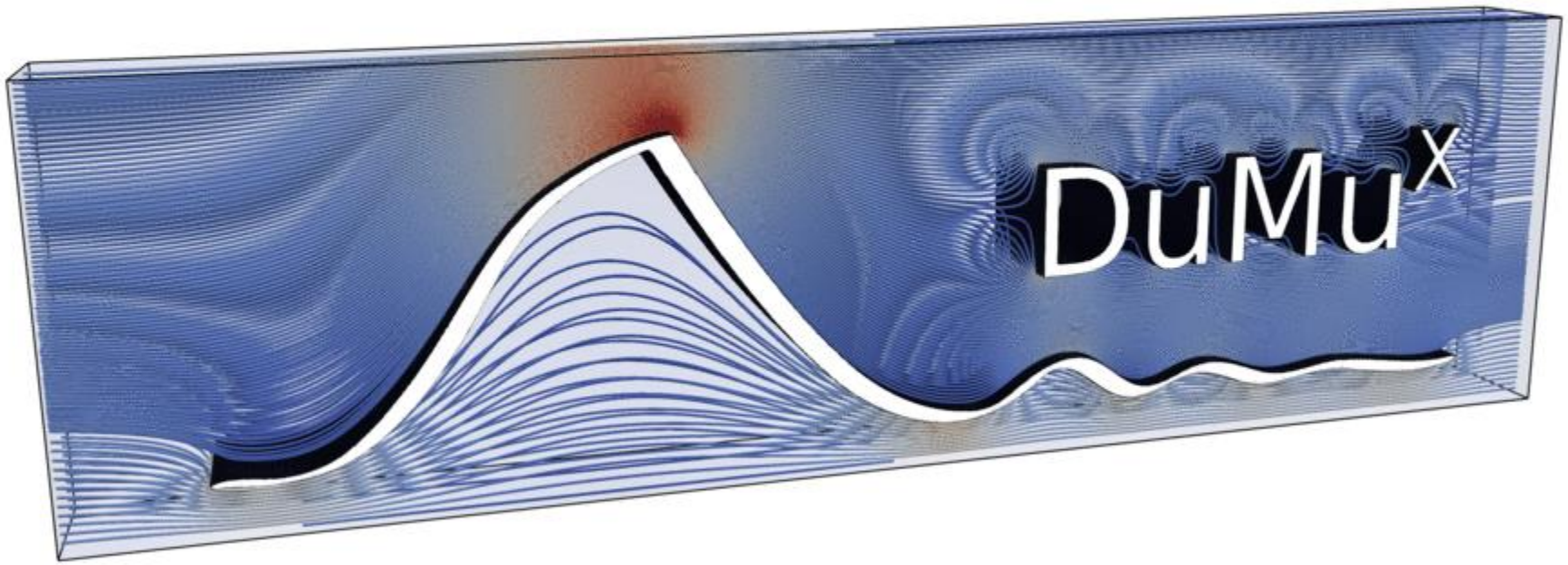


Fig. 10. Simulation of root-water uptake of a white lupin and simultaneous tracer transport in the soil, shown at $t = 3$ d. Three horizontal cuts through the soil domain are shown. The tracer, with mole fraction x_w^K, is not taken up by the roots and accumulates, particularly where the root water uptake rate is highest. On the bottom slice, the water saturation S_w is shown. The saturation slightly decreases close to the roots. Its spatial gradient depends on the flow resistances in soil and root, the current water distribution, and the prescribed transpiration rate r_T.

Dumux主页上展示的其他模拟功能



Satellite image: ©GeoBasis-E/BKG (2020)


DuMu^x