

Single-well and inter-well tracer test design for CCS pilot site assessment



MUSTANG EC FP7, Collaborative Large Scale Integrating Project



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AIM of tracer tests : quantify single-phase and two-phase transport properties of storage formation

PRINCIPLES of tracer tests :

Inter-well tracings can be used to determine fluid residence time distributions (RTD). 'Statistical' moments of RTDs provide important information about the reservoir:

- the zeroth-order RTD moment can tell something about reservoir boundaries;
- the first-order RTD moment (MRT) represents a measure of reservoir size;
- higher-order RTD moments provide information about reservoir heterogeneity.

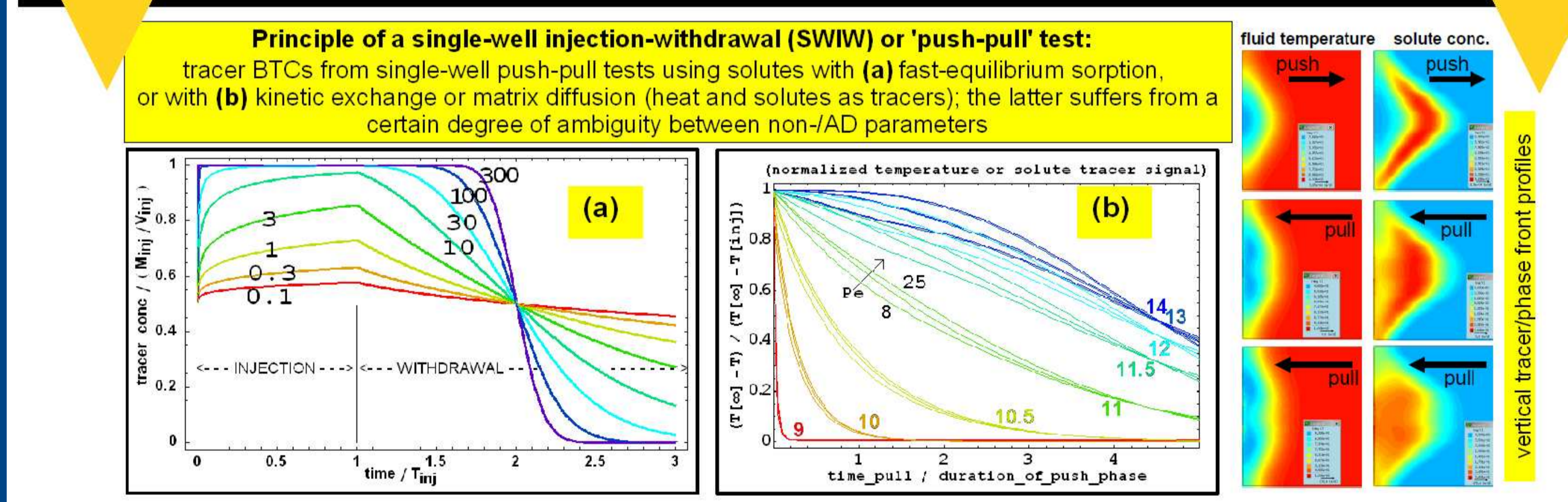
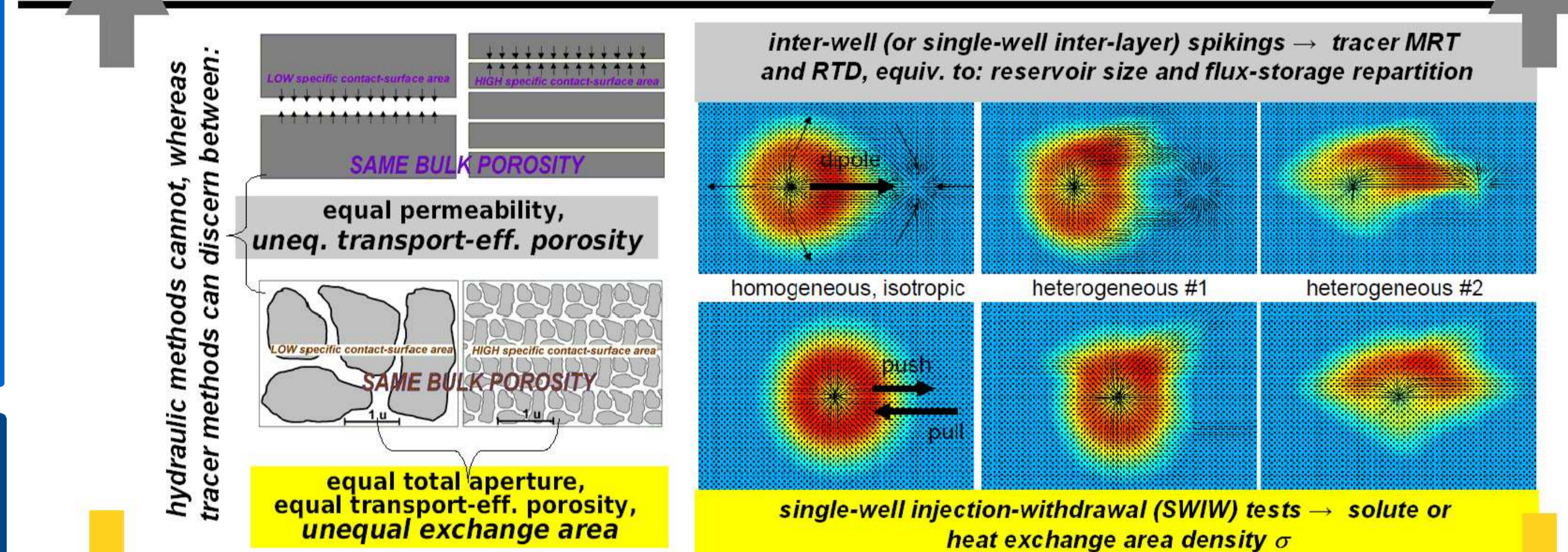
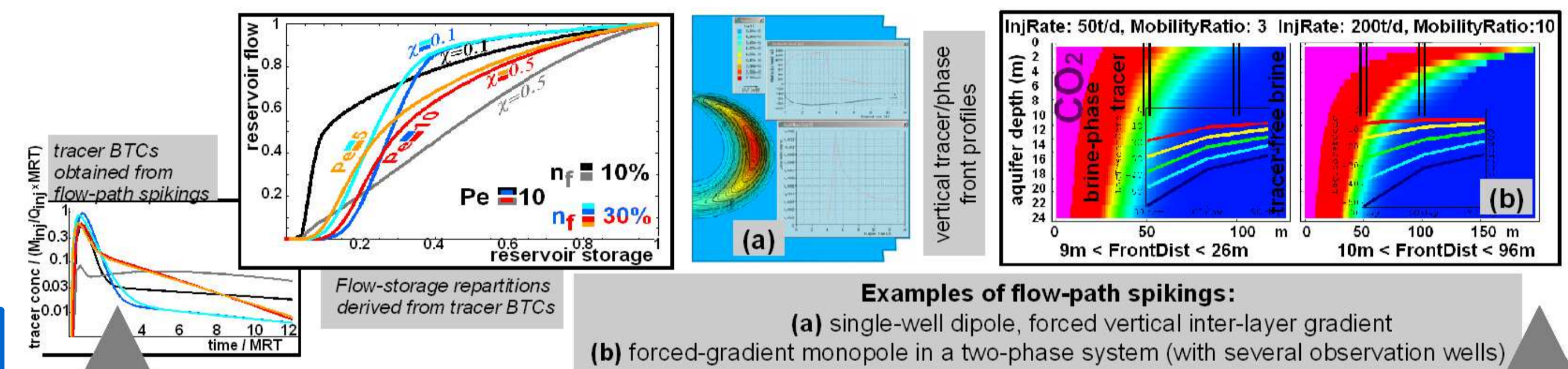
Single-well push-pull tracings can be used to quantify non-advective processes.

THEIR APPLICATION within CCS-MMV program at R&D pilot site :

At the Heletz site in Israel (former oil exploration field), three tracer tests will be conducted:

1. prior to CO₂ injection: dual-tracer single-well push-pull test (monopole divergent followed by convergent flow field), using tracers with contrasting sorption and diffusion properties, aimed at characterizing fluid-rock interfaces and estimating fluid-rock interface densities;
2. prior to CO₂ injection: brine-phase dual-tracer inter-well circulation test (forced-gradient, divergent-convergent dipole flow field), aimed at estimating storage reservoir size, determining brine RTD and FSR, characterizing reservoir-scale heterogeneity
3. during CO₂ injection: dual-tracer, inter-well injection-extraction test (forced-gradient, divergent-convergent dipole flow field), using single-phase and phase-partitioning tracers, aimed at quantifying the storage capacity, characterizing brine displacement processes, and determining RTD and FSR under two-phase flow conditions.

Unlike the brine-phase spiking conducted at the Ketzin site in Germany (www.co2sink.org), where only passive sampling was possible (yielding so-called 'resident' values of tracer concentration, inconsistent with the reservoir-scale transport equations), the Heletz experiment offers the advantage of fluid extraction at well-defined rates, rendering measured values of tracer concentrations (actually, tracer fluxes) consistent with the transport equations from which parameter inversion is endeavored. Forced-gradient extraction of fluid is not meant to be representative of how a CCS site would be operated in reality, but it ensures the meaningfulness of measured experiment quantities.



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Contact

www.co2mustang.eu
 www.gebo-nds.de