Table 4: Simulation parameters used in the study.

Parameter	Description	Value
S_{rw}	Residual brine saturation	0.2
$S_{r_{CO_2}}$	Residual CO_2 saturation	0.2
$K_{r_{CO_2}}$	CO_2 relative permeability	$(1 - S_{CO_2} - S_{rw})^2$
K_{rw}	Brine relative permeability	$(S_w - S_{r_{CO_2}})^2$
ρ_{CO_2}	Supercritical CO_2 density at reference pressure	700.15 kg/m^3
ρ_w	Brine density at reference pressure	1033 kg/m^3
C_{rock}	Rock compressibility	0.3×10^{-6} 1/bar
C_{CO2}	CO_2 compressibility	0.375×10^{-4} 1/bar
C_{water}	Water compressibility	0.3×10^{-6} 1/bar
P_0	Reference pressure	400 bar
μ_{CO_2}	CO_2 viscosity	0.04 cP
μ_w	Brine viscosity	0.4 cP
q	Target injcetion rate	3600 m^3/day
P_{cr}	Critical well pressure	400 bar

4 Pressure analysis

We start by discussing the pressure responses for one particular realization. Then, we continue with the full analysis of all the 160 specified realizations made by combining the geological variable levels discussed earlier.

Some of the reported results are chosen at 2.4 hours (0.1 day), because at this time the maximum pressure value is calculated at the injection point compared to other times. In the start of injection, the injected CO_2 has to displace the water. In the start of injection, low CO_2 saturation around the injector causes low mobility for CO_2 and this results in a big pressure build-up (Figure 7).

Four types of responses are considered to compare the different simulation cases. One important question is how fast we can inject a fixed total volume into each realization. Pressure behavior in the system is studied by looking at the average aquifer pressure and the pressure elevation across the well. An overpressure region is defined in which the volumetric spread of over-pressurized locations in the model is measured. Finally, the farthest place from the injection point that a pressure build up has reached is reported for each realization to see the impact of heterogeneity and channels on how the pressure wave travels through the medium.

Figure 8 shows the pressure and saturation responses for the two injection scenarios for a selected simulation case. This realization has one lobe, parallel rock-type stratigraphy (i.e., low aggradation angle), up-dip progradation, high barrier coverage, and is faulted with open faults. The pressure buildup in Figures 8c and 8f tells how heterogeneity impacts the ability to maintain the pressure locally rather than transferring it across the medium. Comparing Figures 8b and 8c with Figures 8e and 8f, we see that imposing a pressure constraint significantly reduces the pressure buildup in the medium (as should be expected). However, the pressure disturbance propagates widely through the system in both cases (Figures 8c and 8f), far beyond the CO_2 invaded zones shown in Figures 8a and 8d.