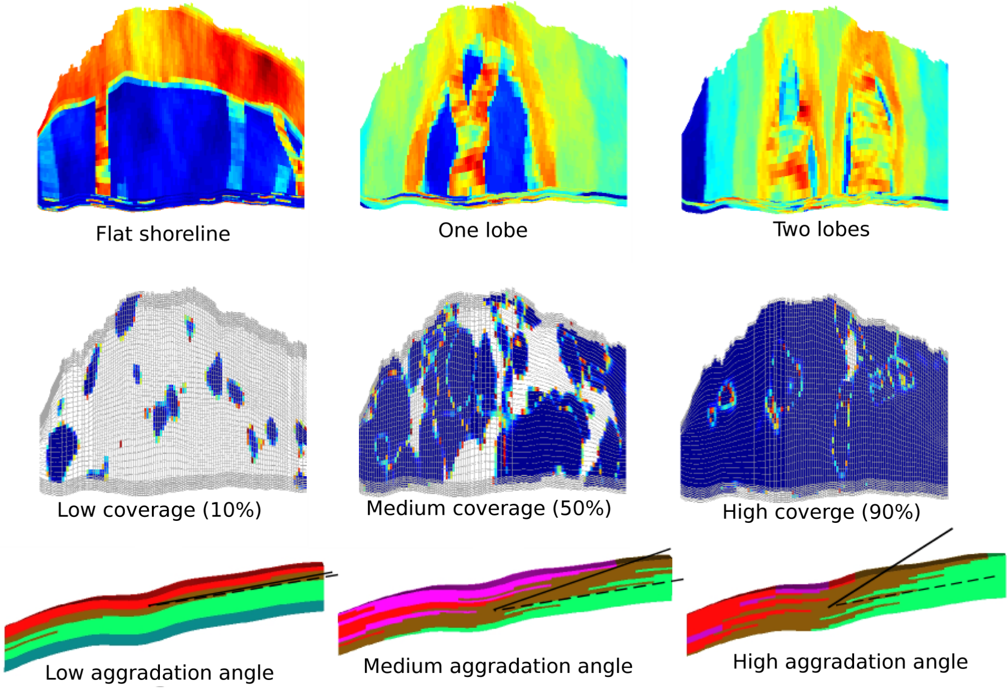

Figure 1: Illustration of geological parameters from the SAIGUP study: the top row shows three different lobosities for up-dip progradation (if the lobes flip over the long axis, we will have down-dip progradation); the middle row shows barriers representing different degrees of mud-draped coverage; and the bottom row shows aggradation angle.

Table 1: Geological features from the SAIGUP project included in this study. The last column reports markers used to distinguish different features in the plots.

Feature	Levels	Marker
Lobosity	flat, one-lobe, two-lobe	square, circle, diamond
Barrier	low(10%), medium(50%), high(90%)	small, medium, large
Aggradation	low(parallel layering), medium, high	blue, green, red
Progradation	up-dip, down-dip	first half, second half
Fault	unfaulted, open faults, closed faults	thin, medium, thick

Fault – are represented by three different parameters in the SAIGUP study: fault type, intensity, and transmissibility. Herein, we limit our study to compartment faults of medium intensity and consider three parameter choices: no faults, open faults, and closed faults.

Table 1 lists the markers (shape, size, color, thickness) that will be used to signify different parameters values in plots of simulation results later in the paper.

We will consider storage of forty million cubic meters of supercritical CO_2, which amounts to approximately 20% of the total pore volume in the aquifer and will be injected from a single well over a period of thirty years. After the injection period, seventy years of plume migration is simulated for all cases. If the medium was homogeneous, we would expect that the injection will create one big plume that moves upward because of the gravity force until it accumulates under the structural trap of the caprock, i.e., migrating from the injection point and upward to the crest of the aquifer. The idea is therefore to inject as deep as possible to increase the travel path and the volume swept by the plume before it reaches the crest. To this end, the injector is placed down in the flank and only completed in the three lowest layers of the aquifer. Hydrostatic boundary conditions are imposed on the sides, except at the faulted side on the crest, and no-flow boundary conditions are imposed on the top and bottom surfaces.

The injected CO_2 is assumed to be a supercritical fluid with density 700 kg/m^3 and viscosity 0.04 cP. The supercritical fluid is modeled as a dead oil with a formation factor of 1.1 at 0 bar and 0.95 at 400 bar. Brine is assumed to be slightly compressible ($3.03 \cdot 10^{-6}$ psi^{-1}) with density 1033 kg/m^3 and