barriers. If the river flux is high enough to dominate the wave system in the sea, a lobate shape shoreface generates with a moderate number of channels and some dipping barriers. Higher levels of fluvial domination end up in two-lobe system with numerous channeling and dip barrier surfaces.

Shale-draped surfaces may provide both horizontal and vertical barriers to fluid flow and are common in fluvial-dominated systems. They are the product of very short-term fluctuations in the fluvial systems and periodic floods in the delta. Shore line shape is correlated to the shape of these flow barriers; straight shorelines typically have planar seaward-dipping clinoforms and curved shorelines have clinoforms that resemble top-truncated cones. Within SAIGUP, these barrier surfaces were modeled as stepped transmissibility multipliers on the cell faces. Dipping barriers were not included in the flat shoreline models and in the realizations with lobosity, between one and three barriers were included. For the purpose of SAIGUP, three levels of barrier coverage were modeled for all of the SAIGUP models (10%, 50% and 90% coverage). All levels of coverage were subsequently slightly modified by removing the barriers where the fluvial channel deposits were present, since clinoforms are a feature of the delta front and not formed within a channel setting.

Aggradation angle models the variation of shoreline in a 2D depositional dip-orientated cross-section. Within SAIGUP, the trajectory varies between horizontal progradation and pure vertical aggradation. Aggradation angle is a function of the balance between sediment supply and the rate of accommodation in the sea. When the fluvial flux increases in level, the deposition from the river toward the sea pile toward the sea and makes the aggradation angle.

The final factor varied during the sedimentological modeling was the progradation or depositional-dip direction. Figure 2 shows a schematic of each geological parameter with its variation. The progradation direction is important for CO_2 injection operations because the structural dip controls the injection well position and the direction of CO_2 plume movement during injection. In Figure 3, injecting in high permeability channels enhances the well injectivity and lowers the pressure buildup in the medium.

The faults are modeled as post-depositional with no related changes in facies thickness or shoreline orientations. Faulting process causes layers with different quality to become adjacent (Figure 4). This can enhance the pressure connectivity by breaking sealing layers, or it can produce sealed compartments that are not connected to the rest of the domain.

In the last step of the SAIGUP modeling process, the geological realizations were upscaled via flow-based methods to a coarse grid that was found suitable for detailed flow simulations. Details of geological and simulation grids are given in Table 2.

Herein, we have selected four of the geological parameters from the SAIGUP project (Figure 2) to study the impact of heterogeneity in the petrophysical parameters on the pressure responses in a typical CO_2 injection problem. Altogether, this gives 54 different petrophysical realizations. In addition, we consider three different degrees of faulting in the models: unfaulted, open, and closed faults (Figure 5). Combining all the features and levels makes 162 cases. However, two cases were missing in the original data set and in the following we will therefore consider 160 different models. Each of these models are represented with different colors, line types, and marker types and sizes, as explained in Table 3.