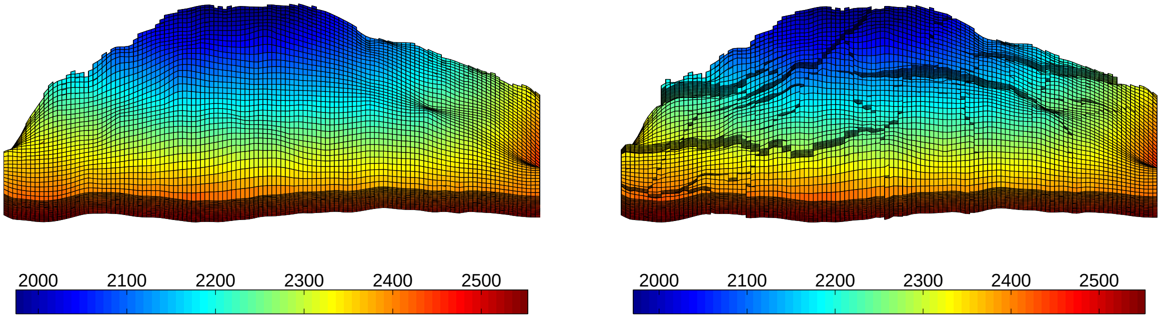

(a) Unfaulted grid. (b) Faulted grid.

Figure 5: Structural models used in the study. Depth in meter is shown by color. In the faulted structure, faults exist both in the dip and lateral directions.

3 Injection scenario

We assume open boundaries on the sides of the simulation model (Figure 6). The spatial dimensions of the model are relatively small (9km×3km×80m). Therefore, assuming closed or semi-closed boundaries results in an unrealistic pressure buildup in the domain due to the injection operation. The open boundaries are modeled by exaggerating the two last cells at the boundaries. The second last cell pore volume is magnified 10^3 times and the pore volume of cells at the boundary is multiplied by 10^6. These values are calculated such that no considerable pressure change occurs in the out-most cells at the boundary. No-flow boundary condition is applied on the top and bottom of the model. Moreover, the evaluated side on the crest is located at a large fault displacement and is considered as a close boundary.

The study will be limited to a single injection point so that we can study how the medium responds to the pressure imposed by a vertical injection well, whose position and completions are assumed to be fixed across all realizations. The position and completions were decided by studying a homogeneous model. One big plume will form around the injection point and migrate upward in the domain because of buoyancy forces. To maximize the potential for structural and residual trapping as the plume migrates in the up-dip direction toward the crest of the model, we chose an injection point down in the flank, some distance away from the lower boundary to reduce the possibility of fluids being pushed out through this boundary in the down-dip direction. The well was completed in the four deepest cells corresponding to the lowest layer of the model. Completing the well in the same four cells for all realizations may exaggerate pressure buildup if the well is completed in a low-permeable region, but has the advantage that we keep the comparison between the different realizations as simple as possible and avoid introducing extra parameters in the study. In a real storage operation, one would likely seek to optimize the injection point and complete the well in geological layers that have a satisfactory injectivity. In a more comprehensive study, one should therefore perform simulations for multiple injection locations, but as this would dramatically increase