Table 1: The facies used in the SAIGUP geological modeling and their scales.

Facies name	**X Scale**	**Y Scale**	**Z Scale**
Offshore transition zone	0.5 m	0.5 m	0.5 cm
Lower shoreface	0.5 m	0.5 m	0.5 – 2.0 cm
Upper shoreface	0.5 m	0.5 m	0.2 – 0.5 cm
Coastal plane	75 m	-	-
Offshore	75 m	-	-
Channels	0.04 – 1 m	0.04 – 1 m	0.5 cm

local pressure rise above 60 bar is simulated near the injection well.

We use the SAIGUP geological realizations to study the pressure in large aquifers. However, the SAIGUP model size (9km $\times$ 3km $\times$ 80m) is considerably smaller than the extent of large aquifers. To compensate for the size, we consider open boundary conditions in the SAIGUP model by exaggerating the pore volume of the cells at the boundaries. This choice of boundary modeling results in an early relaxation of the pressure in the medium when the pressure pulse arrives at the boundary. Overall, the pressure values reported in our study are expected to be higher if they were modeled in a larger model.

This study complements [1, 2], in the sense that we herein analyze the sensitivity of pressure to the same geological parameters. In addition to the injection scenario used in [1, 2], we examine a different injection scenario with more realistic well control for the injection operation. A detailed study is given here for the pressure behavior during and after injection.

2 Geological parameters

In the SAIGUP geological modeling, six rock types were included to model a shallow-marine system. Each rock type was modeled at appropriate scales to honor the interaction of flow with various heterogeneity types at different spatial scales (Figure 1). Each facies was upscaled in a number of stages and finally all the rock types were mapped on a geological model with fine grid. Some of the meter-scale facies were modeled in three dimensions to capture anisotropy. Variation within each rock type was modeled either deterministically by considering a periodic pattern or modeled internally by stochastic population. Channels were modeled in fine grid and went through two stages of upscaling. Tests showed that when upscaled, various grid scale models produced similar results. The specifications of the rock types are given in Table 1. For more detail of the SAIGUP sedimentological modeling see [7].

The wave and fluvial depositional processes acting at the shoreline control the plan-view shape, the channel abundance in the delta plain and the abundance of mud-draped. These parameters were characterized within the SAIGUP modeling and varied in three levels that can be summarized as shorefaces. A wave-dominated deposition produces a straight plan-view shape, very few channels and no dipping barriers. If the river flux is high enough to dominate the wave system in the sea, a lobate shape shoreface generates with moderate numbers of channels and some dipping barriers. Higher levels of fluvial domination end up in two-lobe system with numerous channeling and dip barrier surfaces.