



Figure 10: Pressurized volume fraction for all cases in the rate-constrained scenario.

starts by a local pressure build-up. Heterogeneity on the scale of aquifer plays a considerable role in the range of variations in Figures 9a and 9b. In the pressure-constrained scenario, local pressure is controlled by putting a constraint on the well. Hence, the pressure drop variations are controlled by the average aquifer pressure.

As we see in Figure 8b, low aggradation angle and down-dip progradations result in a poor injectivity and high pressure buildup in the injector. Vertical transmissibility drops dramatically for low aggradation angles [1]. This restricts the pressure transfer within the injection layer, and therefore the pressure builds up locally around the well. Moreover, in cases with down-dip progradation the low permeability rocks surrounding river branches near the injector result in a local pressure buildup.

A group of cases in Figure 9 have a relatively low pressure drop of less than 50 bar. These cases have a good injection quality, and the pressure is released through open boundaries easier than other cases. The rest of the cases show higher pressure drop because of the heterogeneities in the larger scale, far from the injector. These results are obtained for a fixed injection location to examine the heterogeneity impact on injectivity. Herein, we aim to honor the geological uncertainty. In practice, the injector must be drilled and completed in the best formation with highest possible injectivity.

Faults influence both local pressure build-up near the injector as well as the average aquifer pressure. Therefore, they have a visible trend in many cases in Figures 8b and 9b (for example, see the three cases denoted by red circles in the right end of Figure 8b). This is specially more apparent in cases with high level of barriers.

### 4.3 Pressurized region

Here, we study the overpressure distribution in the medium. An absolute pressure limit of 300 bar is set as threshold, such that all cells with a pressure higher than this value form a region that is called the pressurized region. The volumetric fraction of this region is defined by the ratio of pressurized volume to the total volume of all active cells in the model.

Histogram and case plot of the pressurized volume fraction at the start of injection are