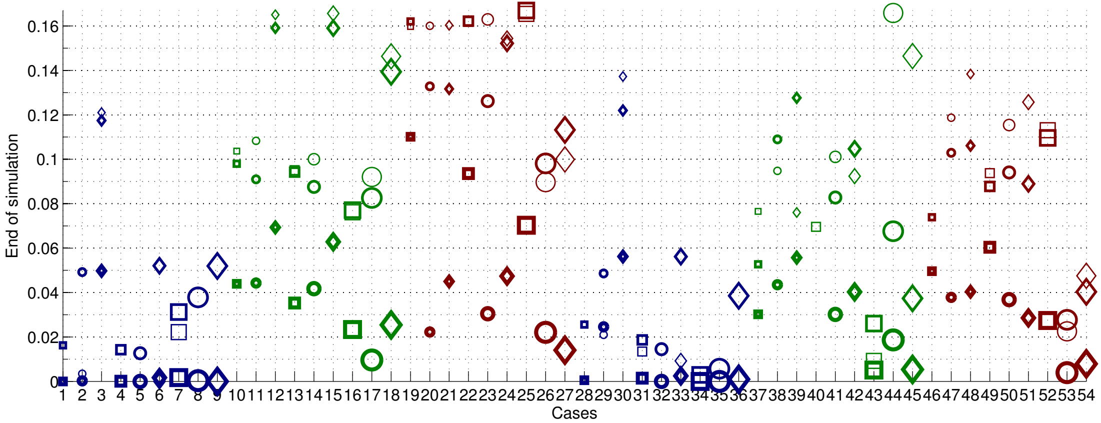

Figure 9: Leakage risk at end of simulation for linear relative permeabilities.

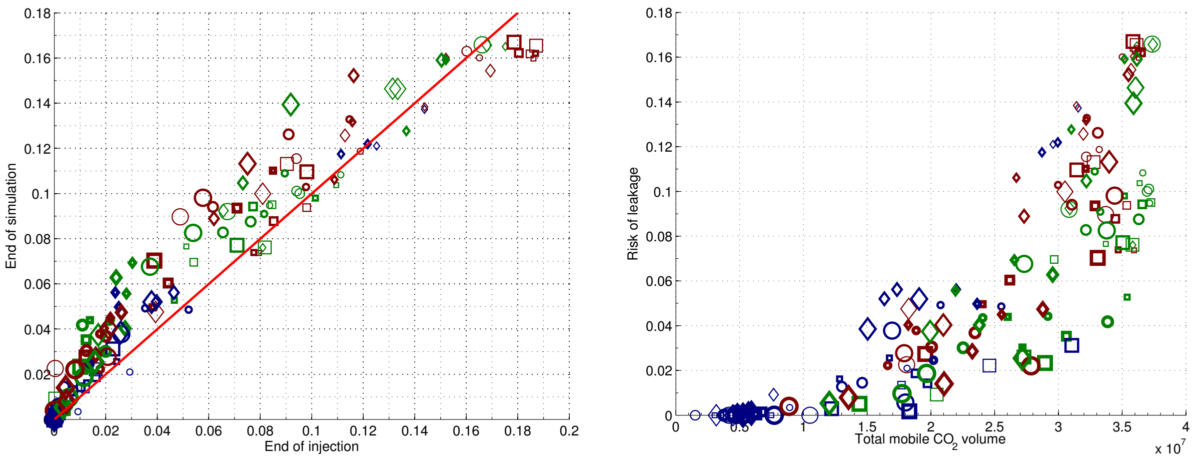

Figure 10: The left plot shows a cross-plot of leakage risk for linear relative permeability function. The right plot shows mobile CO_2 volume versus leakage risk at the end of simulation.

under the caprock as a number of plumes with variable sizes. For each cell along the top surface, we now define the risk as the probability of point leakage weighted by the size of the CO_2 plume that the cell is part of. We then sum the values for all the topmost cells, normalize this sum, and use the resulting single number as a measure of leakage risk. The worst possible case would be if all the injected CO_2 volume forms a mobile plume that contacts every point along the top surface; this gives a risk value equal to one. For all actual cases, however, the risk value will be less than one because not all of the CO_2 will be mobile (because of residual trapping and loss of volumes across the open boundaries), because the mobile volume may form more than one plume, or because not all the mobile volume has reached the top due to reduced vertical mobility.

Figure 9 shows the resulting leakage risks for all cases at the end of simulation computed using linear relative permeabilities. Similarly, the left plot in Figure 10 shows how the risk develops during the seventy year period from the end of injection to the end of simulation, whereas the right plot shows a cross-plot of the leakage risk versus the total volume of mobile CO_2. The plots lead to the rather obvious conclusion that improved vertical connection will increase the risk of leakage through possible imperfections in the caprock and that there is a positive correlation between the volume of mobile CO_2 in the system and leakage risk. However, we also observe that there are cases which have zero leakage risk. These are cases with low aggradation, for which the flow stays in the injected layers and moves laterally towards the open boundaries, resulting in a low amount of mobile CO_2 in the system. Furthermore, these cases have (almost) no cross-layered CO_2 movement, which means that (almost) no CO_2 reaches the top surface. In other words, the low-aggradation cases, which have seemed to be infeasible because of high injection pressure, larger lateral spread, and loss of volumes through the open boundaries in our discussion in the previous two sections, here appear as the most feasible with