Description of individual research project and research results achieved to date

The main interest of our research was to derive new mathematical models and simulation techniques to study the migration of CO\textsubscript{2} injected in deep saline aquifers as part of large-scale geological storage projects.

The main hypothesis of our work was that the flow dynamics of such systems is controlled by the difference in density between the injected CO\textsubscript{2} and the natural resident brine. This means that at early times injected CO\textsubscript{2} moves mainly vertically to the top of the formation. After this initial period, the injected plume moves beneath the caprock of the formation and above the resident brine. At this later stage, the problem can be well approximated by vertically integrated equations that gives a 2D description of the problem. As part of our research we implemented a code to solve the resulting equations and to recover the full 3D distribution of the CO\textsubscript{2} through a post-processing step.

As part of our research we demonstrated that the caprock geometry plays a key role in controlling the speed and direction of the CO\textsubscript{2} plume. Moreover, we came out with a straightforward way to incorporate this effect in effective vertical integrated models.

The result of our work were two peer-reviewed articles, in addition to seven conference presentations.