Existence of solutions for a seawater intrusion problem in a free aquifer

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We study a sea intrusion problem with sharp interface model in a free aquifer.The model is formulated in terms of a two-dimensional coupled system consisting of degenerate parabolic equations. The analysis of this system presents two difficulties: the coupling between equations and the degeneracy due to the possibility to have no saltwater in some zones of the free aquifer. We establish a priori estimations for the $P1$ finite element method applied to this problem. Finally, we propose numerical simulations in order to improve the modele.