



Effect of Sea Level Rise on Saltwater Intrusion in an Unconfined Coastal Aquifer

[Fereydoun . Vafaei فریدون وفايي]

[S.Sadjad . Mehdizadeh Mahali سيد سجاد مهدي زاده محلي]

Key words: Saltwater intrusion, unconfined aquifer, sharp interface approach, sea level rise

Abstract:

In this study, a numerical method is developed to predict saltwater intrusion in to an unconfined coastal aquifer due to sea level rise as a part of climate change impact. The cell-centered finite volume method is adapted to solve the set of coupled nonlinear partial differential equations which describing the motion of seawater and freshwater separated by a sharp interface. A rectangular numerical grid was used and TDMA approach is also implemented to solve the matrix of discrete terms. The model is first verified by two known case studies and then applied to explore the sensitivity of the intrusion mechanism to various involved parameters. Finally we raised the seaside saltwater head of sample case and the toe of new time dependent salt wedge is determined and discussed.

1- Introduction

Groundwater is considered the main source of water supply in coastal regions. However, saltwater intrusion poses a major limitation to utilization of groundwater resources. Saltwater intrusion is a common problem in coastal areas where the aquifers are in hydraulic contact with the sea. Under normal condition without any anthropogenic activities, the fresh water flows into the sea. The increase in abstraction from aquifers may result in inversion of the flow from the sea towards the inland causing saltwater intrusion. Salinization of groundwater is considered a special category of pollution that threatens groundwater resources, because mixing a small quantity (2-3%) of saltwater with groundwater makes a freshwater unsuitable for use and can result in abandonment of freshwater [1].

While anthropogenic activities, such as over pumping is the major cause of saltwater intrusion, it is anticipated that increase in the sea level due to climate change would aggravate the problem. Hydrogeologists have studied the phenomenon of saltwater intrusion for different climatic factors. Ranjan et.al (2006) [2, 3] studied some of these factors such as lack of fresh water recharge or land use change in different part of world arid regions. Gemitzi and Tolikas (2007) [4] presented a GIS linked code and studied the saltwater intrusion into specific real coastal aquifer. Shi et.al (2011) [5] developed a numerical model and validated the steady-state salinity at pumping wells against sand tank experiments. Researcher's recent studies focus on more realistic simulation of this intrusion in