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Hydrology and Earth System Sciences
Discussions

Interactive comment on "A review of seawater intrusion in the Nile Delta groundwater system – the basis for assessing impacts due to climate changes and water resources development" *by* M. B. Mabrouk et al.

Anonymous Referee #2

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The manuscript by Mabrouk et al. is focused on the environmental problems caused by seawater intrusion in the Nile delta groundwater system. A particular attention is given to the possible consequences on groundwater salinization coming from sea level variations due to climate changes and water balance variations due to water pumping changes. In the paper many topics are treated, like climate change, aquifer properties, previous large scale aquifer model, groundwater local models, etc., but all of them in a quite superficial way and on the basis of a limited literature review.

The paper seems more appropriate for a technical conference and could be of some utility for local engineers, physicist and agronomist involved with Nile delta action planning.

Finally, the main reason of paper inadequacy is in the final Authors' idea on future research activity from Nile delta aquifer coming from their context analysis. They suggest the use of a 3D, unsteady state, variable density computation for large scale modeling of the groundwater. Some details are also given on the possible cell dimension of the model, 1-2 Km length in plane and of the order of meters in the vertical direction.

The idea of using a model like SEAWAT with such a computational grid and for long time simulation comes from a lack in experience in the use of such models. I was hardly capable of performing a field scale hydrodynamic simulation on salt wedge intrusion in the groundwater below an industrial area in presence of a pump and treat. Model stability was obtained only by adopting a refined grid (1 .5 million cells, with a length to height ratio of 10 to 1, and very small time steps, of fractions of second). As a consequence of the small time step necessary for computation, a steady state constant density model was used, for the prediction of field scale contaminant transport. The presence of the salt wedge was neglected and only the seafront boundary conditions were changed to take into account the presence of the salt layer.

I am reasonably sure that with the length to height ratio of the grid cell proposed by the Authors the model will crash. But even in presence of a very stable solver, the computational time required by the model is prohibitive even for simulating few minutes of groundwater movement.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 10873, 2013.