

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 #1

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The manuscript by Mabrouk et al. contains a literature review of previous studies of the Nile Delta groundwater system, leading to suggestions for future work to assess the aquifers of the region. In my view, the manuscript falls well short of that required for an international publication for a number of reasons. These are listed as follows:

1. The manuscript is very poorly written - the text is overly repetitive and exceedingly wordy, there are extensive grammatical issues and a general weakness in the written English. Examples include: P10874: Lines 9-12 - "different" used 4 times in a sen-

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tence. Reducing the repeated use of specific words will improve the readability - e.g. P10880 contains numerous accounts of "reported", amongst other examples. Line 18 - "in Nile Delta" should be "in the Nile Delta" Line 25 - "rainfall patterns" is not an impact; there needs to be some characteristic of the rainfall patterns causing an impact (likely it is meant to read "changes in rainfall patterns") P10875: Line 2 - "surface and groundwater" should be "surface water and groundwater" Line 4 - "and are developed rapidly" doesn't make sense in the context of the sentence. Perhaps the authors mean to say "and are being developed at a rapid pace" or "have developed rapidly in recent times". In any case, I don't understand what it means to say that socio-economic resources have developed rapidly, or that natural resources have developed rapidly - one might mean that there is a growth in the socio-economics of a region, whereas the other might mean that the natural resources are being increasingly exploited, but neither can be assured from what is written. Line 8 - "of the total agricultural land" needs to have "of Egypt" added to it to be clear about the meaning here. Line 15 - "of the sea level rise" should be "of sea-level rise" Line 17 - comma needed at "unplanned groundwater abstraction, are..." Line 26 - "assure" reads awkwardly here. Lines 28-29 "nature, not covering the whole" is awkward English - suggest "nature, and do not cover the whole" P10876: Line 2 - "from regional perspective" should be "from a regional perspective". The remainder of the manuscript has a high frequency of these sorts of short-comings (e.g. SEAWAT is misspelt as SEWAT, "seawater" is misspelt as "sweater", "reset" should be "recent", "SI" is introduced part way through the paper as an acronym for "groundwater salt intrusion" when all of the text leading to that point refers to seawater intrusion without an acronym) indicate that a thorough proof-read has not been undertaken.

2. The referencing is incorrect, incomplete and not properly applied. Examples include: P10993 Line 9 (and elsewhere) - Here and elsewhere, a paper by Werner et al. (2012) is referred to and listed in the reference list as the Groundwater journal paper on vulnerability indicators. The problem here is that they are referring to the Werner et al. (2013) Advances in Water Resources paper. P10875 L23 to P10876 L2

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- The Introduction refers to "several researchers" multiple times, but there are no references offered to defend these statements about the multitude of studies of the system. The lack of referencing to factual statements is a problem throughout the manuscript - for example, references are needed for sentences in the following places (amongst others): P10874, Line 25 (climate change will have severe impacts in delta areas); P10875, Lines 2-4 (particularly problematic for the Med coastal areas); P10875, Lines 10-12 (aquifer is bound by an upper semi-permeable layer... etc); P10875, Lines 16-18 (extensive and unplanned abstraction resulting in deterioration of gw resources), P10878 L26-29 (Extensive groundwater abstraction a significant factor; Groundwater wells show upconing) and so on. P10875 Line 7 and elsewhere - Statements are made as though the knowledge is current, but then a reference is offered that is older than 10 years. This occurs at P10875 Line 7, P10878 Line 2 ("...repeated in many reviews", and 1993 reference given) P10878, Line 11, and elsewhere - chronological order needed for references. The referencing would be improved by adding Sherif and Singh (1999) Hydrological Processes for their work on modelling SLR impacts on SWI in the Nile Delta aquifer, and Werner et al. (2012)'s Water Resources Management paper that reviews coastal aquifer management approaches taking into account management practices for controlling SWI. P10882 L14 - A reference is referred to as "He" when there are multiple authors, so it should be "They".

3. Table 2 is copy-and-pasted from another paper without modification or permission. On P10883, the table is then wrongly referred to as Table 1. Taking the work of others and inserting into new papers without obtained proper permission is a practice that needs to be avoided, and I implore HESS to offer guidance to the authors on this issue. The table also refers to the wrong reference - i.e. the table is not from the reference that it cites.

4. There are several statements that are incorrect, possibly due to English issues but in some cases there seems to be misguided concepts being suggested. Examples include: P10874 L6 - The salinization of "all coastal land" in the Nile Delta is simply

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not possible. P10878 L24 - "quantification of such impacts is lacking" (referring to SLR impacts on SWI) is not true. Sherif and Singh (1999) have attempted to quantify SWI from SLR in the Nile Delta. Werner and Simmons (2009) study the general case of SLR impacts on SWI, amongst other subsequent papers which offer a broader range of cases. A recent Nature paper by Ferguson and Gleeson also comments on the topic of SLR impacts on SWI and compare it to pumping impacts - highly relevant to the current investigation. P10879 L1-3 - This statement is untrue "Studies showing the degree of climate change and sea level rise impact on seawater intrusion compared to other factors such as development-induced groundwater abstraction do not exist" - there are several studies that explore this topic - Ferguson and Gleeson (Nature Climate Change), Werner et al. (Groundwater, 2012). P10884 L21-22 - This statement doesn't make sense "...stated that SEAWAT code is accurate and consequently can be used to represent hydrodynamic surface-water flow..." - there is no link between a model's accuracy and its capacity to simulate surface water flow. In any case, SEAWAT does not simulate surface water flows. P10890 L12-13 - 3D models of seawater intrusion are most certainly not capable of assessing "all potential threats of salinization of the whole Nile Delta aquifer". A SWI model is useful for assessing SWI. If agricultural salinisation is an issue, then a different model is needed, mostly likely that incorporates unsaturated zone processes.

5. Much of the text is dedicating to making statements that are entirely obvious to those working in the specialisation of the manuscript. P10881 L27-29 is one example - "However, these hydrological data should be always monitored and updated in order to be integrated in groundwater modeling and give reliable findings", amongst many others. It is a significant weakness in the manuscript to have to wade through all of these obvious statements, which are offered as advice as though they are new ideas. The manuscript can be reduced to 25% of its current length by removing these.

6. Finally, and perhaps most importantly, the Conclusion to go to 3D modelling is misguided. The idea that a large 3D model will resolve a significant number of issues that

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others have been unable to overcome requires further consideration. Such a model will require a coarse level of discretisation due to the size of the study area, and hence run-times will be extensive. A 3D model of seawater intrusion of this large area will be very unweildy, and not allow the best use of the available data because it will be entirely un-calibratable, at least using current and widely applied techniques. The coarse discretisation will not allow for accurate prediction of salinity at specific sites, and will be only a "regionally accurate" predictor, at best, providing a very rough overview of possible movements in the wedge. Simpler models will be easier to construct and run and are more likely to allow for improved insight into the study area - i.e. because a large number of parameters can be assessed and feedback from the modelling process comes sooner. Critically, the accumulation of all available information into a working conceptualisation, and the associated "back of the envelope calculations (water balance, steady-state heads and sharp-interface position) will likely provide significantly more insightful management inputs than labouring to develop a large 3D model. A range of tools is needed to properly understand the Nile Delta's groundwater system. There is no silver bullet here. Prevailing wisdom would suggest that one ought to apply the simplest available methods of analysis and prediction in the first instance, and add complexity as the management questions require them. Following on from this, a DSS of the Nile Delta will require a host of modelling applications to allow for the range of issues in the region to be considered and compared, and linked to socio-economic factors. Hence, investing heavily in a 3D simulator, when simpler and less resource-intensive methods will provide perhaps accurate-enough estimates and allow for the expenditure of resources on other aspects e.g. surface water processes, data collection, socio-economic factors, agricultural practices, etc, seems misguided, and potentially leading to a considerable waste of resources, given the "all eggs in one basket" notion of building such a model. The idea that is being offered here that a 3D model of seawater intrusion is the best use of limited available resources for management the Nile Delta system is very difficult to defend, and in my opinion, inappropriate.

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