

# Review of: "Saltwater Intrusion in Coastal Aquifers: A Comprehensive Review and Case Studies from Egypt"

Luiz Eduardo Panisset Travassos

**Potential competing interests:** No potential competing interests to declare.

The introduction lays a solid framework by stressing the value of groundwater, particularly in coastal areas. The writers highlight Egypt's dependence on groundwater and its function in fulfilling water requirements, second only to the Nile River. This background demonstrates how urgent it is to solve SWI and places the following talks in a larger environmental and socioeconomic framework.

The concept of seawater intrusion (SWI) is given in an easy-to-read manner in the article, along with an explanation of how saltwater intrusion affects groundwater quality and how it moves into freshwater aquifers. The causes of SWI are thoroughly discussed, considering both human and natural elements. In light of the world's present environmental difficulties, it is especially pertinent to emphasise that over-abstraction, climate change, and sea level rise are the main causes of SWI.

The authors include a range of monitoring approaches, including isotopic techniques, geophysical and geochemical studies, and measurements of groundwater heads. Each method is well discussed, emphasising how crucial it is to determine the precise level of SWI. The debate gains credibility and depth when concrete examples and references to reputable studies are included.

A comprehensive and organised assessment of management tools and countermeasures is provided. Remote sensing, field surveys, modelling techniques, computer codes, optimisation techniques, and integrated approaches are the categories into which the authors divide the methodologies. This classification makes it easier to comprehend the various approaches to managing SWI. The thorough explanation of the benefits and drawbacks of each strategy offers insightful information on their real-world uses.

Well-detailed methods to limit SWI include subsurface barriers, land reclamation, increased groundwater recharge, and decreased pumping rates. The essay does a good job of explaining the benefits and drawbacks of each strategy, assisting readers in comprehending the intricacies and possible restrictions of various methods. The conversation is further enhanced by cutting-edge methods like Abstraction, Desalination, and Recharge (ADR).

The Egyptian case studies are real-world examples of managing social entrepreneurship and give a regional perspective on the global problem. The thorough summaries of the numerous research projects in areas such as the Sinai Peninsula, the Nile Delta, and Egypt's northwest coast demonstrate the continuous attempts to lessen SWI. The case studies highlight the significance of customised solutions based on local traits and unique problems.

The authors acknowledge the shortcomings of the existing SWI research, especially concerning the resolution and accuracy of numerical models and the difficulties in gathering large-scale, long-term data. This frank evaluation

strengthens the article's credibility and highlights the need for more study and better techniques.

The suggestions for more research are realistic and prospective. Current developments in environmental research are well-aligned with an emphasis on multidisciplinary approaches, advanced model development, and more thorough data-gathering methodologies. Translating research results into practical management methods requires close collaboration between scientists, local people, and government.

The article's compelling overview of the main ideas emphasises the need to regulate SWI to safeguard coastal groundwater supplies. The writers emphasise the necessity for integrated management plans that consider both quantity and quality views as they summarise the various approaches and tactics fairly. The article's significance as a thorough analysis of SWI is further increased by including suggestions for more research and the acceptance of its limits.

Overall, with an emphasis on Egypt specifically, the paper by Ahmed M. Saqr and Mahmoud E. Abd-Elmaboud provides a comprehensive and well-researched overview of saltwater intrusion in coastal aquifers. Researchers, practitioners, and policymakers involved in groundwater management will find the thorough analysis of causes, monitoring methods, management tools, and case studies invaluable. This study significantly advances our understanding and management of SWI because of the authors' systematic and straightforward presentation of intricate material and useful insights and suggestions.

### **Strengths**

This study offers a thorough analysis of seawater intrusion (SWI), including definitions, contributing variables, influencing factors, monitoring methods, and management approaches. It is an invaluable resource for readers who wish to comprehend the complex nature of SWI because of its all-encompassing approach.

Including case studies from Egypt provides useful information and illustrates how the presented ideas are used in the actual world. This regional emphasis aids in placing the worldwide problem of SWI in perspective.

The document is easy to read and follows a clear format with distinct parts and subsections. Every segment is comprehensive, offering profound insights into particular facets of SWI.

Using diagrams and figures to help visualise complicated topics and improve reader comprehension is a good idea.

Examples of these are sketches illustrating the occurrence of saltwater intrusion and various modelling techniques.

The study cites various studies, offering a strong basis for current research and emphasising the need for ongoing research on SWI.

### **Points of Improvement**

Although the study offers a thorough analysis, further in-depth explanations of the case studies' techniques would be beneficial. It would be easier to trust and replicate the work if the data-gathering procedures, analytical strategies, and modelling approaches were all explained in detail.

Including a comparative study of many SWI-affected areas or nations might offer a wider viewpoint and draw attention to particular problems and solutions. The paper would become more globally relevant as a result.

By combining hydrogeological, geophysical, and socioeconomic data, for example, the research might highlight the significance of integrating interdisciplinary approaches. This would offer a more comprehensive comprehension of SWI

and its consequences.

Keeping the document up to date would require including cutting-edge approaches to controlling and monitoring SWI and recent technological breakthroughs. Showcasing recent tools, research, or case stories would highlight how the sector is always changing.

Although the article covers management instruments and preventative actions, it should include more specific policy suggestions. It would improve the paper's practical application if policymakers and managers of water resources were given explicit suggestions or tactics.

While acknowledging its limits, the work might benefit from a more thorough examination of the difficulties associated with SWI research and administration. Giving other researchers useful guidance would include pointing out particular gaps in the present understanding and recommending focused topics for future investigation.

It is important to guarantee technical accuracy and clarity in language. The article will be easier to read for a wider audience, including non-experts in the area, if any confusing terminology or complicated jargon is removed.