

Referee comment (egusphere-2024-4201)

Ms. Title: The Impact of Geological Structures on Groundwater Potential Assessment in Volcanic Rocks of the Northwestern Ethiopian Plateau: A Review

This manuscript provides a comprehensive review of the influence of geological structures on groundwater potential in the volcanic rocks of the Northwestern Ethiopian Plateau. The authors effectively synthesize existing research, highlighting the critical role of faults, fractures, lineaments, and folds in shaping groundwater dynamics. The review is well-structured, with a clear focus on the interplay between tectonic processes, lithological heterogeneity, and groundwater movement. The incorporation of case studies from the Northwestern Ethiopian Plateau and the East African Rift System adds depth to the discussion, illustrating the practical implications of the reviewed concepts. The manuscript is well-written, with a logical flow and appropriate use of references to support key points. However, there are areas where the manuscript could be improved, particularly in terms of clarity, depth of analysis, and addressing potential limitations.

Specific Comments on each sections

Abstract and Introduction:

The abstract provides a good overview of the review's scope and key findings. However, it could be more concise and focused. For instance, the sentence "The review underscores the importance of integrating geological, geophysical, and hydrological methods for effective groundwater exploration and management" could be rephrased to emphasize the novelty or specific contributions of the review.

The introduction effectively sets the stage for the review by highlighting the importance of groundwater in arid and semi-arid regions and the role of geological structures in groundwater dynamics. However, how it could benefit and advance existing knowledge?

Methods for Assessing Structural Influence on Groundwater Potential:

This section talks about several methods, including geological mapping, geophysical surveys, remote sensing, and hydrogeological studies. However, the discussion could be enhanced by providing more specific examples or case studies where these methods have been successfully applied in the Northwestern Ethiopian Plateau or similar regions.

The authors mention the use of remote sensing and GIS for lineament mapping but could elaborate on the limitations of these techniques, particularly in regions with complex geology or limited data availability.

Role of Geological Structures in Groundwater Potential

The discussion on faults, fractures, lineaments, and folds is thorough and well-supported by references. However, the authors could provide more critical analysis of the variability in the impact of these structures on groundwater potential. For example, while faults can act as conduits or barriers, the conditions under which they favor one role over the other could be explored in greater detail.

Case Studies

The case studies for the Northwestern Ethiopian Plateau and the East African Rift System are informative and relevant. However, the authors could provide more detailed analysis of the specific geological and hydrological conditions in these regions, particularly how they influence groundwater potential. For instance, the discussion on the East African Rift System could include more information on the variability in groundwater potential across different segments of the rift by associating with clear structural influence by reviewing different works.

The authors mention the challenges of over-extraction and environmental degradation but could provide more specific examples or data to support these claims.

Challenges and Opportunities:

This section focuses on challenges and limitations is well-articulated, particularly the discussion on data scarcity and structural complexity. However, the authors could provide more specific recommendations for addressing these challenges, such as the use of advanced geophysical techniques or the integration of machine learning algorithms for data analysis.

The opportunities section is promising but could be expanded to include more specific examples of how advanced mapping techniques and integrated approaches have been successfully applied in similar regions.

Conclusion and Recommendations:

The conclusion effectively summarizes the key findings of the review and highlights the importance of integrating multidisciplinary approaches for groundwater management. However, the authors could provide more specific recommendations for future research, particularly in terms of addressing data gaps and developing predictive models.

Technical Corrections:

Line 8-9: "This review examines the influence of geological structures on groundwater potential in the volcanic rocks of the Northwestern Ethiopian Plateau." Consider rephrasing for clarity: "This review examines how geological structures influence groundwater potential in the volcanic rocks of the Northwestern Ethiopian Plateau."