

Evaluating Evaporation and Seepage Losses in Lakes Using Sentinel Images and the Water Balance Equation

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Abstract : The main objective of this study is to assess changes in the water capacity of Aswan High Dam Lake (AHDL) caused by evaporation and seepage losses. To achieve this objective, a comprehensive methodology was employed. The methodology involves acquiring Sentinel-3 imagery and extracting the surface area of the lake using remote sensing techniques. Using water areas calculated from sentinel images, collected field data, and the lake's water balance equation, monthly evaporation and seepage losses were estimated for the years 2021 and 2022. Based on the water balance method results, the average monthly evaporation losses for the year 2021 were estimated to be around 1.41 billion cubic meters (Bm3), which closely matches the estimates provided by the Ministry of Water Resources and Irrigation (MWRI) annual reports (approximately 1.37 Bm3 in the same year). This means that the water balance method slightly overestimated the monthly evaporation losses by about 2.92%. Similarly, the average monthly seepage losses for the year 2022 were estimated to be around 0.005 Bm3, while the MWRI reports indicated approximately 0.0046 Bm3. By another means, the water balance method overestimated the monthly seepage losses by about 8.70%. Furthermore, the study found that the average monthly evaporation rate within AHDL was 210.88 mm/month, which closely aligns with the computed value of approximately 204.9 mm/month by AHDA. These findings indicated that the applied water balance method, utilizing remote sensing and field data, is a reliable tool for estimating monthly evaporation and seepage losses as well as monthly evaporation rates in AHDL.

Keywords : Aswan high dam lake, remote sensing, water balance equation, seepage loss, evaporation loss

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