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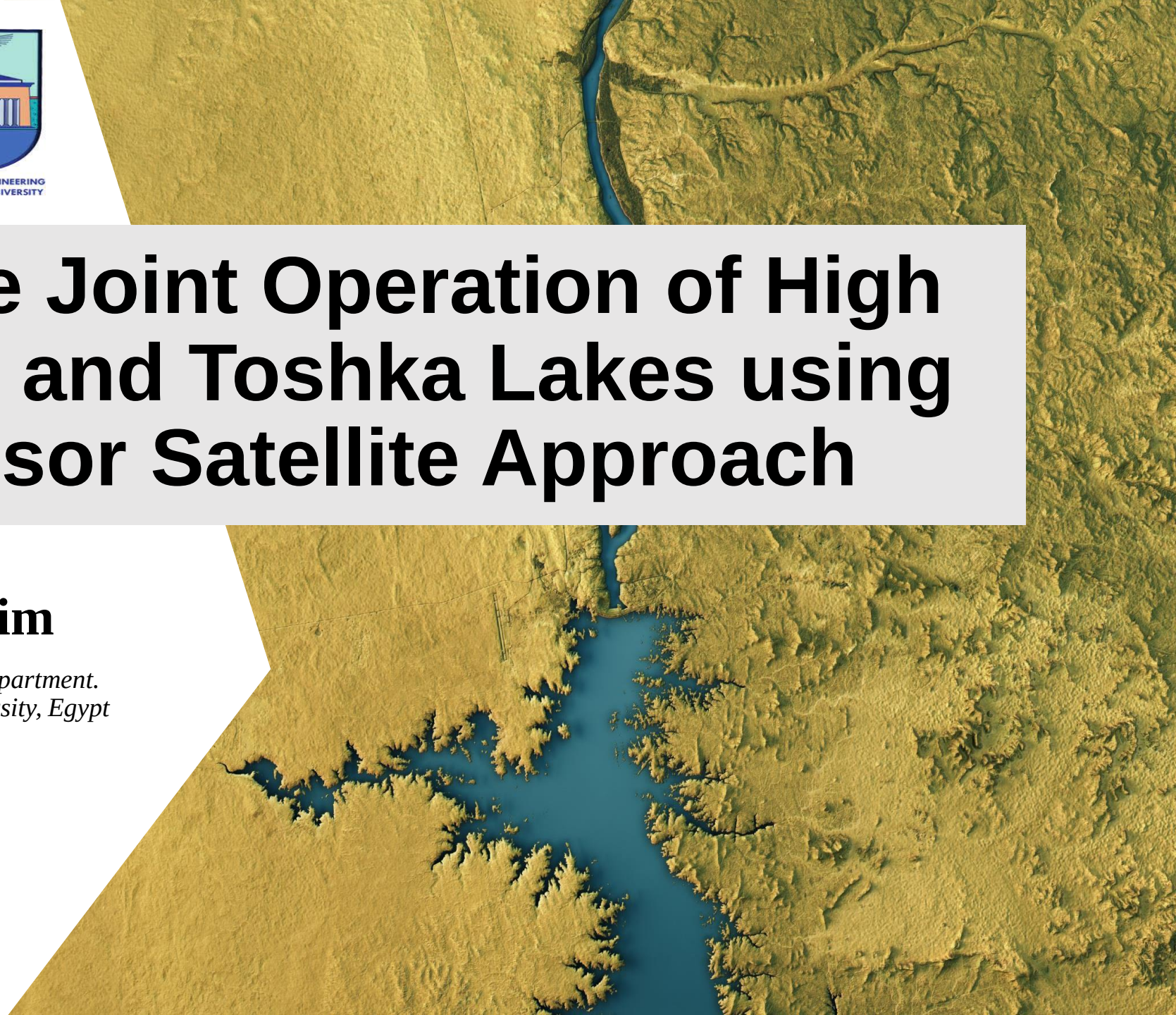
Inferring the Joint Operation of High Aswan Dam and Toshka Lakes using Multi-Sensor Satellite Approach



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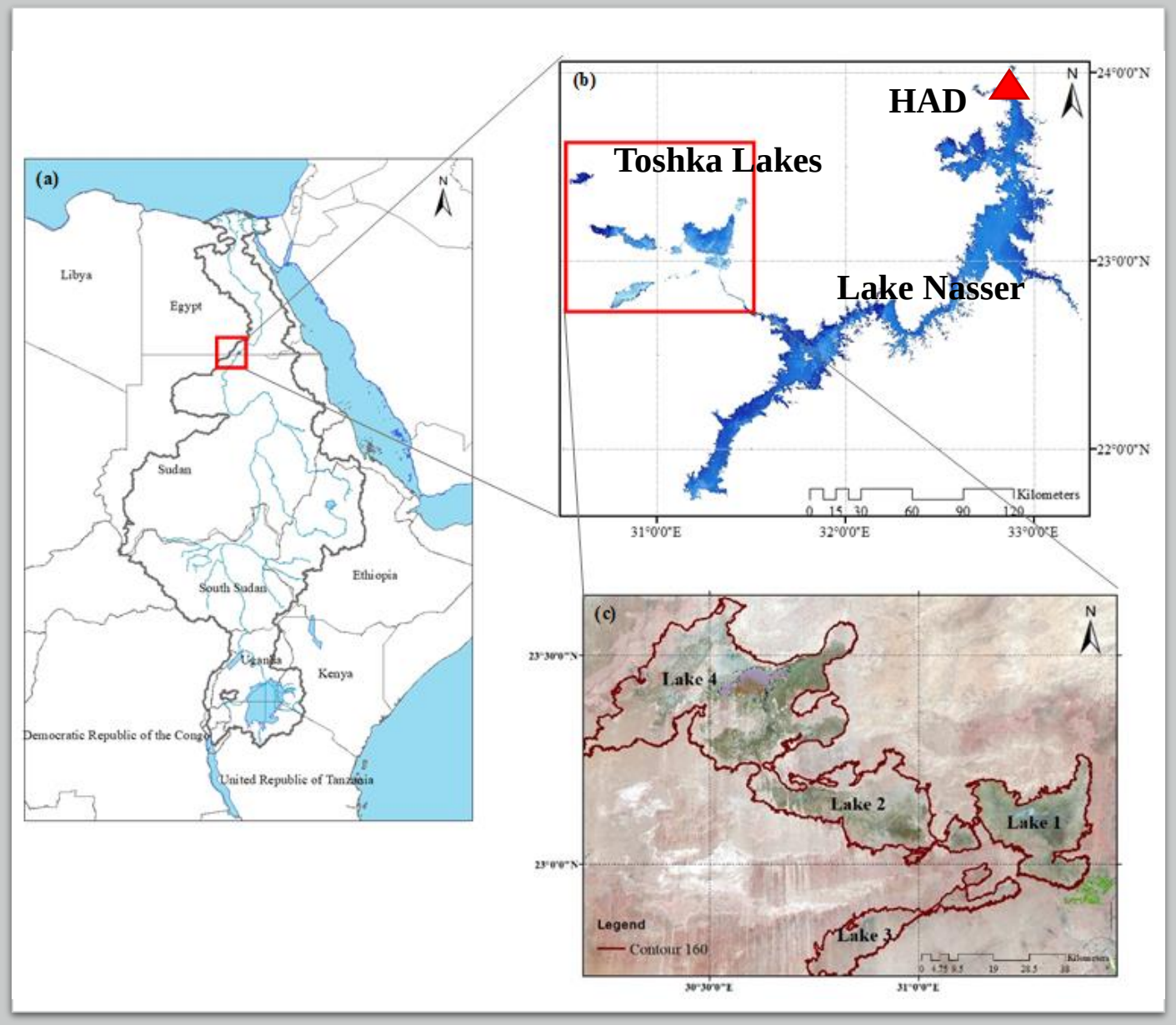
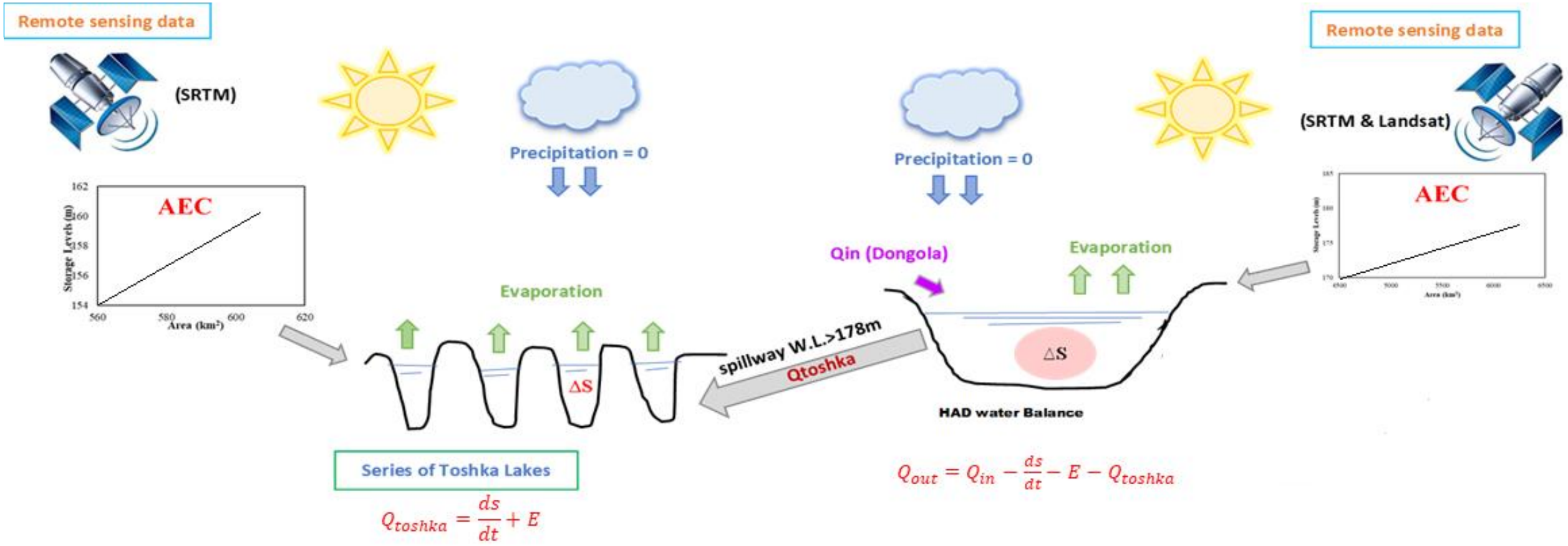
Study Area

- **High Aswan Dam (HAD)** controls the water flowing into **Egypt** (the most downstream country in the **Nile river**).
- **Lake Nasser (reservoir of HAD)** has a storage capacity of 162 Km^2.
- **HAD reservoir** is supported by **Toshka Lakes** to discharge **excess flow.**
- If the water levels at HAD > **178** m → flow is directed to Toshka Lakes.

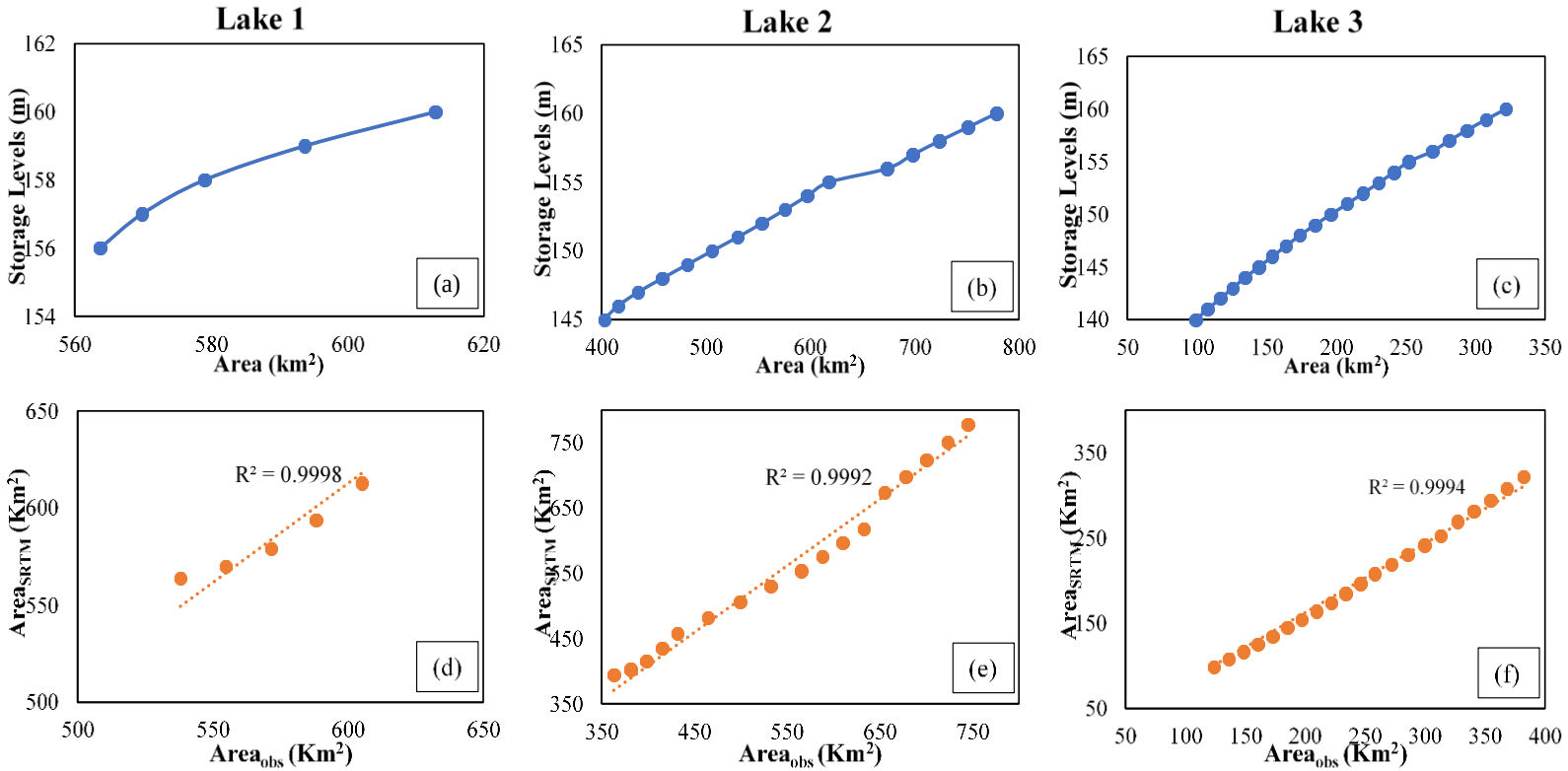


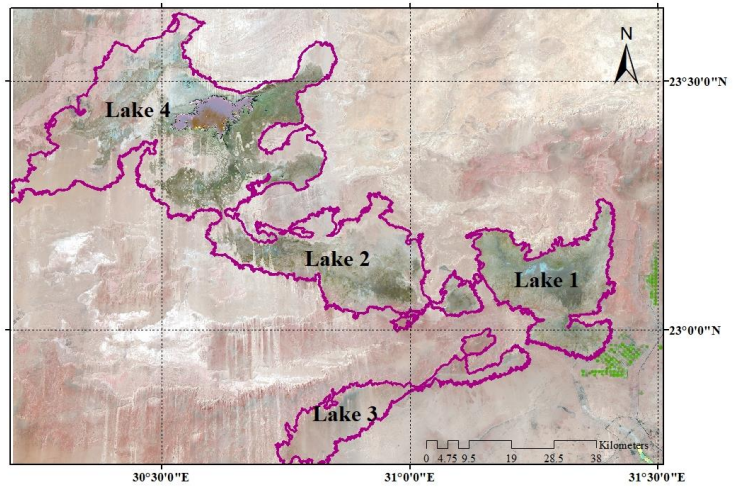
Methodology



1) Deriving Area-Elevation Curve

Toshka Lakes



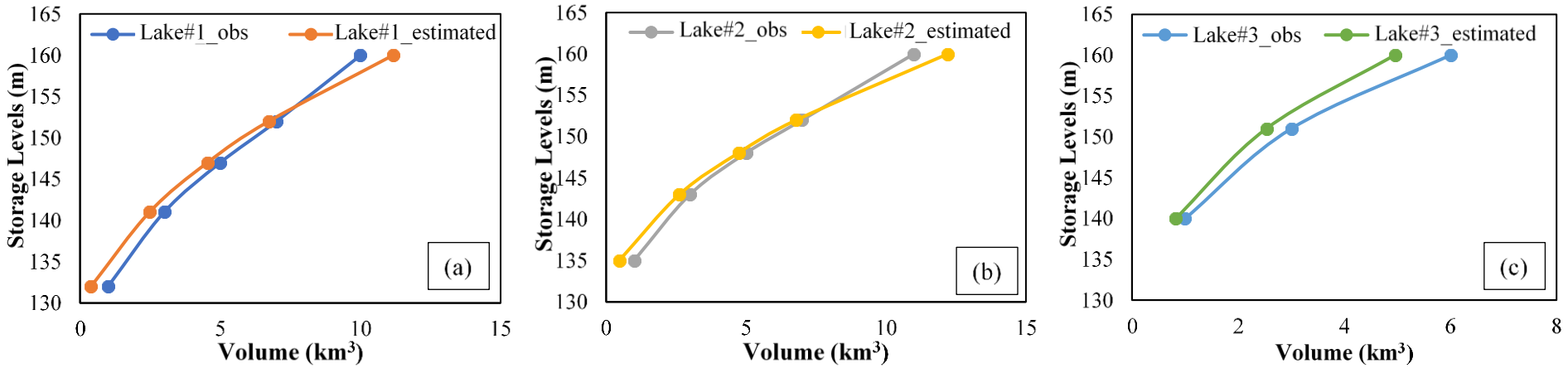


2) Estimation of Volume

Using Trapezoidal Method $V = D[\left(\frac{A_1 - A_N}{2}\right) + (A_2 + A_3 + .. + A_{N-1})]$

Where, V is the total volume, D is the contour interval and A is the area.

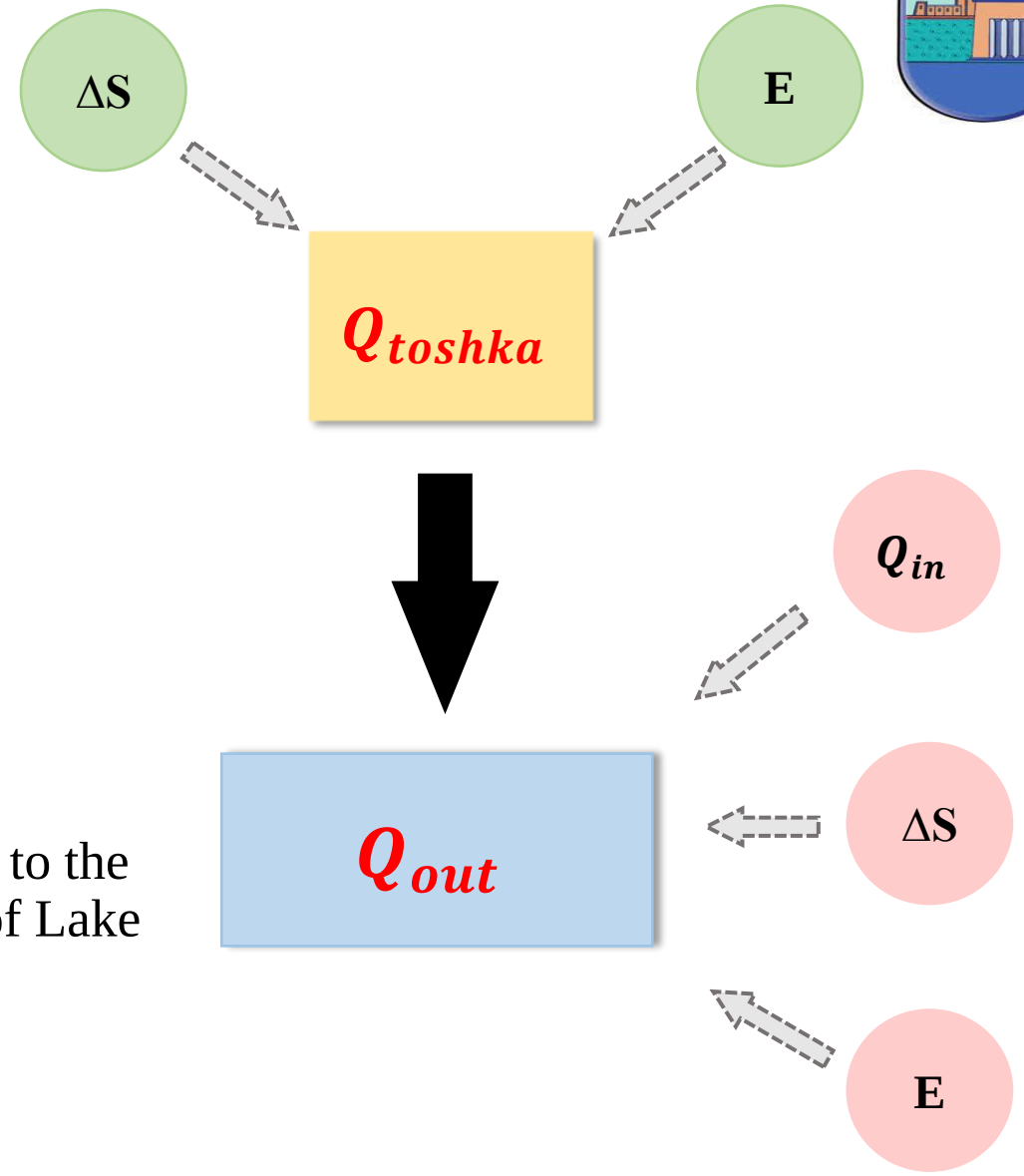
Toshka Lakes



3) Water Balance Modeling

$$Q_{out} = Q_{in} - \frac{ds}{dt} - E - Q_{toshka}$$

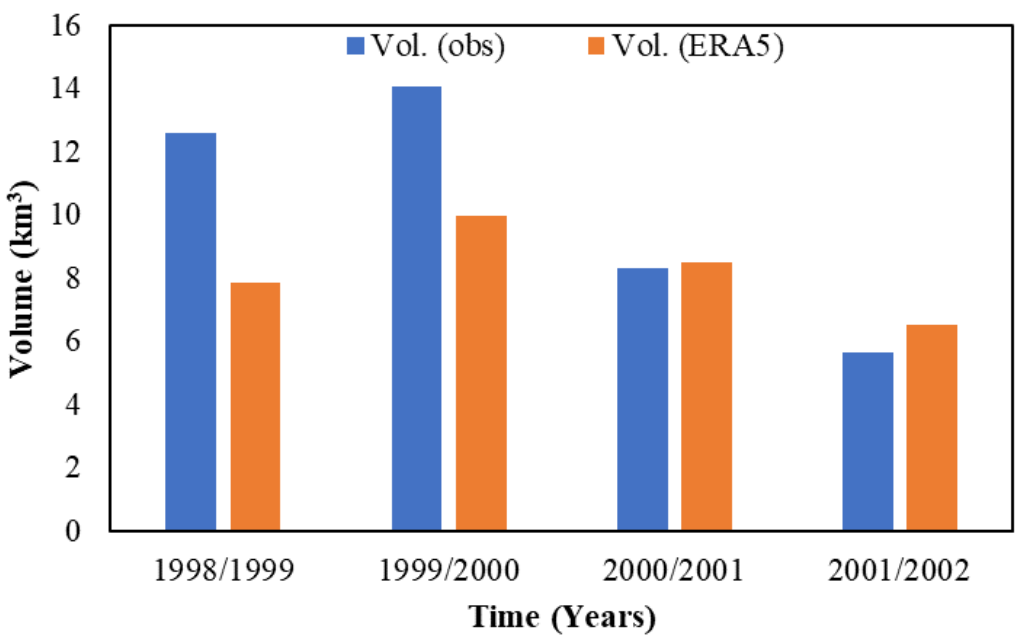
$$Q_{toshka} = \frac{ds}{dt} + E$$



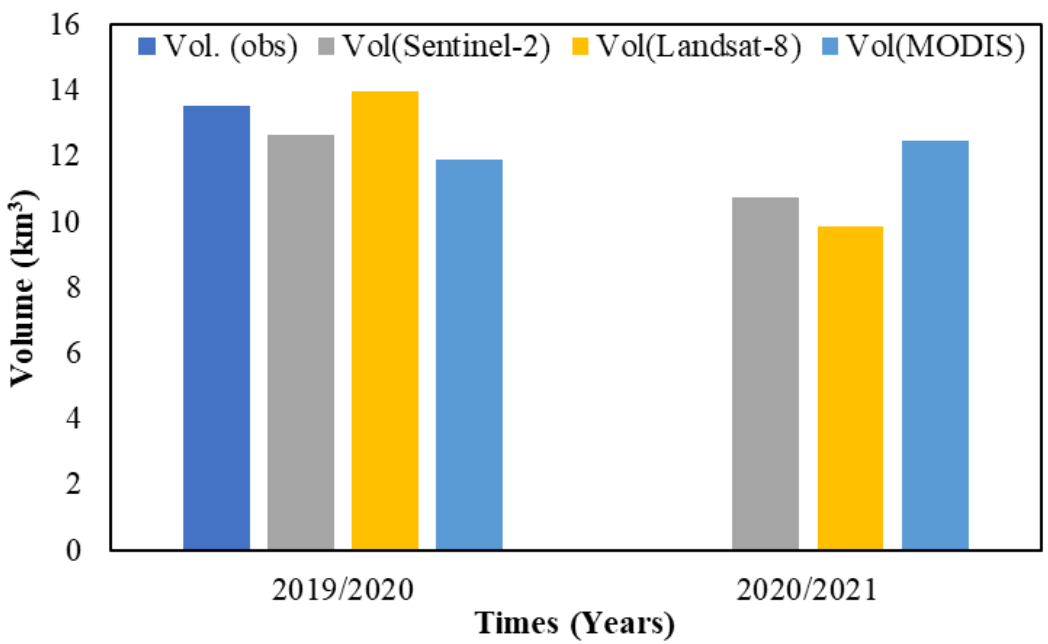
Where,

- Q_{out} (m^3/month) is the outflow downstream the HAD,
- Qin (m^3/month) is the inflow into HAD and is set equal to the measured discharge at Dongola station (right upstream of Lake Nasser),
- ds/dt represents the monthly storage change, and
- E (m/month) is the monthly evaporation over lakes.

4) Toshka Inflow during flooding events

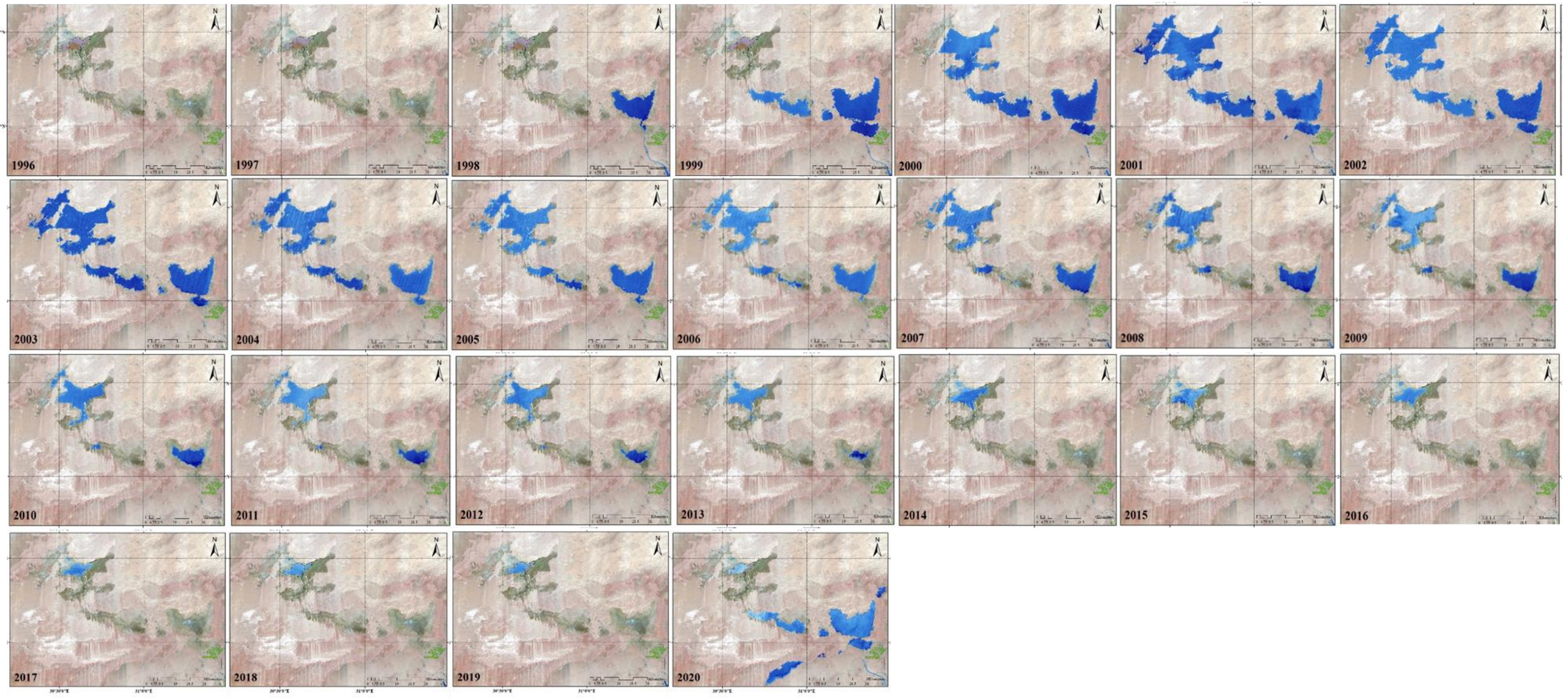


First event (1998-2002)



Second event (2019-2020)

5) Spatial Dynamics of Toshka Lakes



6) High Aswan Dam Operation (1998-2002)

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Conclusion

Understanding the dynamics of Toshka lakes and its link to HAD operation is crucial for **future planning of water resources in Egypt**.

This is particularly important with the construction of the **Grand Ethiopian Renaissance Dam (GERD)**.

**Abdelmoneim, H., Eldardiry, H., Moghazy, H., and Eladawy, A. (submitted) "Inferring the Joint Operation of High Aswan Dam and Toshka Lakes using Multi-Sensor Satellite Approach". International Journal of Water Resources Development*

Special thanks to my coauthors

Hisham Eldardiry, Hossam Moghazy, and Ahmed Eladawy

For any questions, please feel free to contact me at hadir_a_moneim@yahoo.com