EGU24-17151, updated on 03 Nov 2024
https://doi.org/10.5194/egusphere-egu24-17151
EGU General Assembly 2024

Unraveling the link between precipitation and land use changes to water quality in Lake Victoria using remote sensing

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Due to the continued increase in land use changes and changing climatic patterns in the Lake Victoria basin, understanding the impacts of these changes on the water quality of Lake Victoria is imperative for safeguarding the integrity of the freshwater ecosystem. Thus, we analyzed spatial and temporal patterns of land cover, precipitation, and water quality changes in the Lake Victoria basin from 2000 to 2022 using processed remote sensing (RS) data. Focusing on chlorophyll-a (Chl-a) and turbidity (TUR) in Lake Victoria, we used statistical metrics (correlation coefficient, trend analysis, change budget, and intensity analysis) to understand the relationship between land use and precipitation changes in the basin with changes in Chl-a and TUR at two major pollution hotspots on the lake i.e. Winam Gulf and Inner Murchison Bay (IMB).

Results show that the Chl-a and TUR concentrations in the Winam gulf increase with increases in precipitation. Through increases in precipitation, the erosion risks are increased and transport of nutrients from land to the lake system, promoting algal growth and turbidity. In the IMB, Chl-a and TUR concentrations decrease with increase in precipitation, possibly due to dilution, but peak during moderate rainfall. Interestingly, LULC changes showed no substantial correlation with water quality changes at selected hotspot areas even though LULC change analysis showed a notable 300% increase in built-up areas across the Lake Victoria basin. These findings underscore the dominant influence of precipitation changes over LULC changes on the water quality of Lake Victoria for the selected hotspot areas.