

Hydrological regime of Sahelian small water bodies from combined Sentinel-2 MSI and Sentinel-3 SRAL data



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CONTEXT

In semi-arid regions and especially in the Sahel, water bodies such as small lakes, and ponds are vital resources for people. Most studies on inland waters in Africa focus on large lakes like Lake Chad for example, but the numerous lakes and ponds, which are found near almost every village in Sahel, are poorly known. These small water bodies (SWB) are critical in terms of water resources and important for greenhouse gases and biodiversity. SWB increased in numbers and surface recently, due to changes in land surface properties after the big Sahelian drought of the late 20ieth century, and to dam building, as for instance in Burkina Faso. For a more detailed assessment of changes in water resources, it is necessary to quantify water volumes variability and hydrological **regime** of these SWB at the regional scale.

MATERIALS AND METHOD

Study sites and lakes



Remote sensing data

- Optical imagery : **Sentinel-2 MSI** (S2) \hookrightarrow water surface time series
- Altimetry : **Sentinel-3 SRAL** (S3)
 - \hookrightarrow water height time series



- Integrated Multi-satellitE Retrievals for GPM \hookrightarrow daily precipitations
- Mutliple climate variable from **ERA5**
 - \hookrightarrow evaporation (Penman)

Residual water balance = hydrological fluxes (runoff, groundwater, overflow, infiltration, use)



RESULTS : Five-year averaged residuals water balance during the dry season

Water supply during the dry season is mainly found on the lakes of the Inner Niger Delta region or near other main river networks. Conversely, lakes showing water losses are mainly located in the center of Burkina while lakes in northern Burkina Faso show smaller water losses that could indicate a less significant water use, that may be linked to conflicts developing in this area.



RESULTS : Interannual variability



0 2 4 km

120





Interannual variability in rainfall, length of the dry season, changes in inflow or outflow, and anthropogenic activities can impact the residual water balance. For example, the Gomde reservoir shows a significant change after 2018 that is likely due to attacks by armed groups leading to dam damage and water leaks.

CONCLUSION

This study highlights hydrological behaviours and water exchanges at a large scale. Overall remote sensing data have been shown useful to detect hydrological behaviours of natural and anthropogenic origins. Data from SWOT, recently lauched, will allow us to extend this study to all lakes in the region. To have a global vision of these lakes and reservoirs it would be interesting to cross-reference other information with these results, such as water color information.