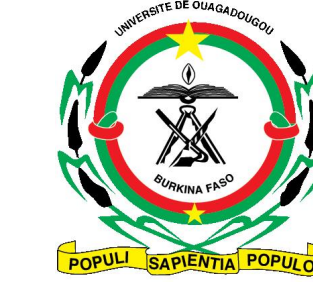


# SPLASH: Small Ponds and LAKES in the Sahel by SWOT and High resolution sensors

M. Grippa, M. de Fleury, F. Girard, L. Kergoat, H. Nikiema, J.M. Dipama, M. Wubda, A. Abdourhamane Touré, M. Boubacar Moussa, I. Mainassara, C. Faye, E. Robert

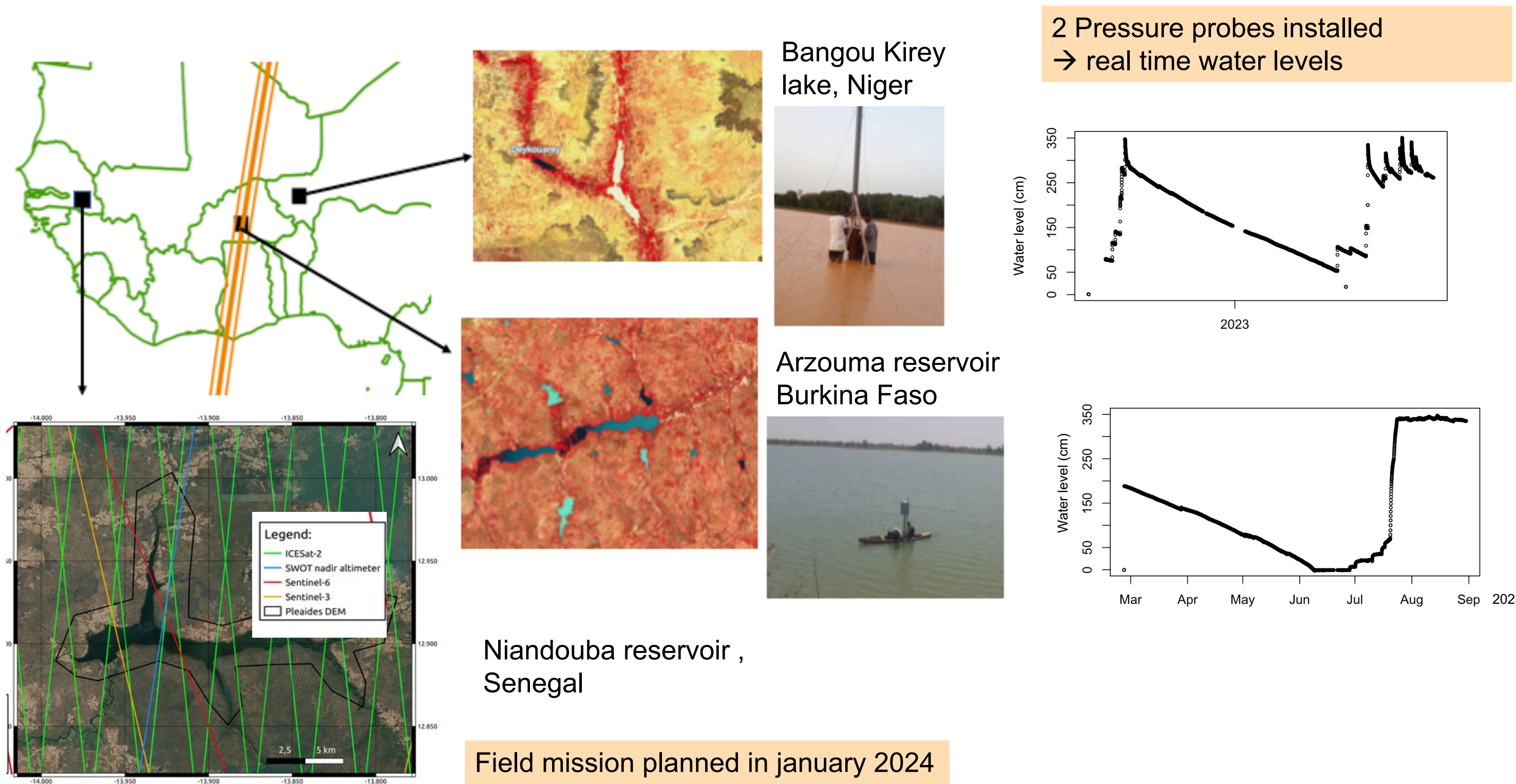


Contact: manuela.grippa@get.omp.eu

**Introduction** : Small water bodies play a pivotal role in the Sahelian region. They are widely distributed across the landscape, making them a fundamental water resource. Given their small size and high temporal variability, their dynamics remain poorly understood and difficult to model, raising questions about their future evolution in a context of environmental and anthropogenic changes.

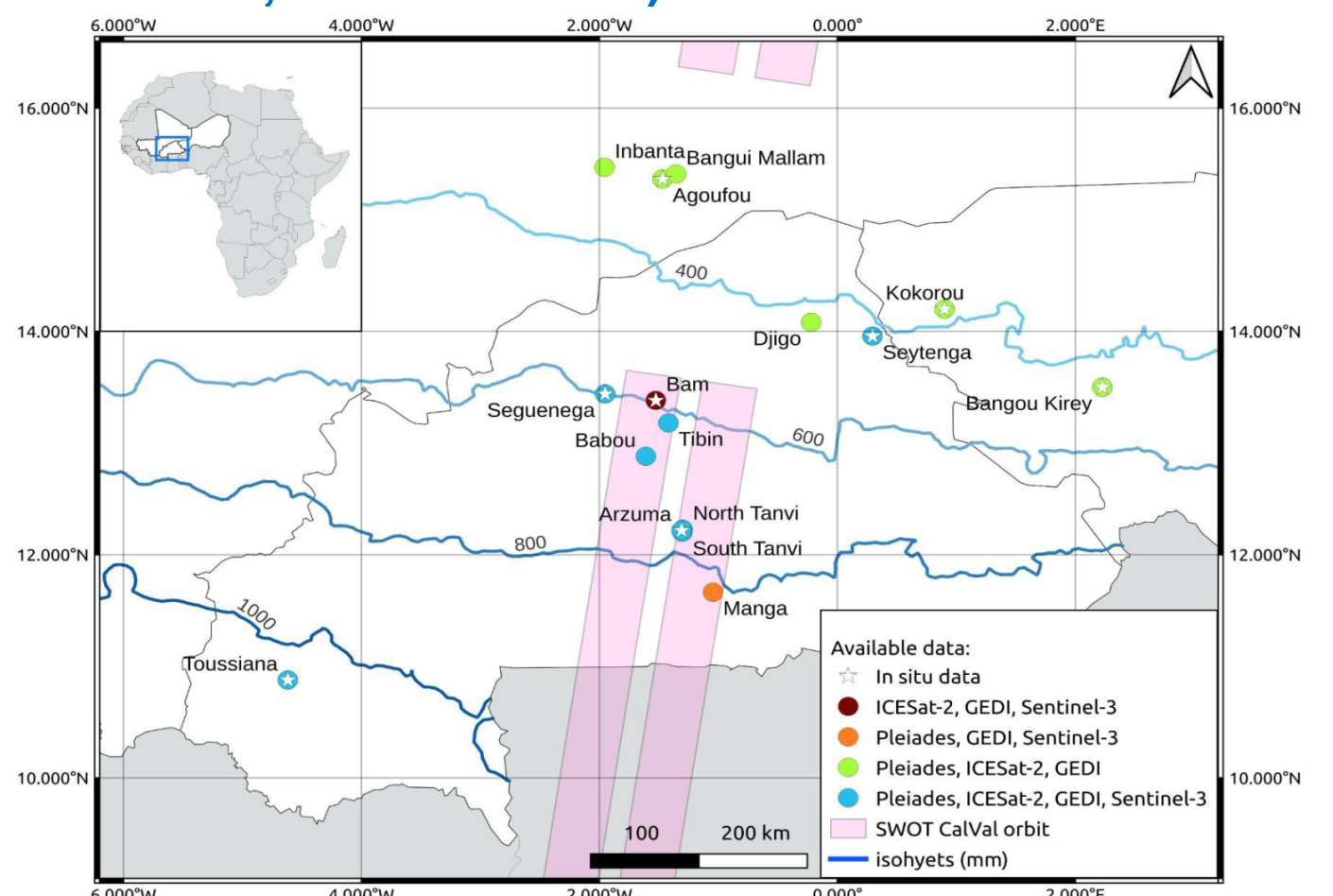
The SPLASH project aims to estimate both water quantity and water quality in small Sahelian water bodies, to better understand their hydrological behaviour and their seasonal, interannual and long term evolution using high resolution satellite sensors. SWOT data will be crucial to estimate water volumes, quantify water fluxes and assess their past changes.

## In-situ measurements for SWOT



## SWOT evaluation plan

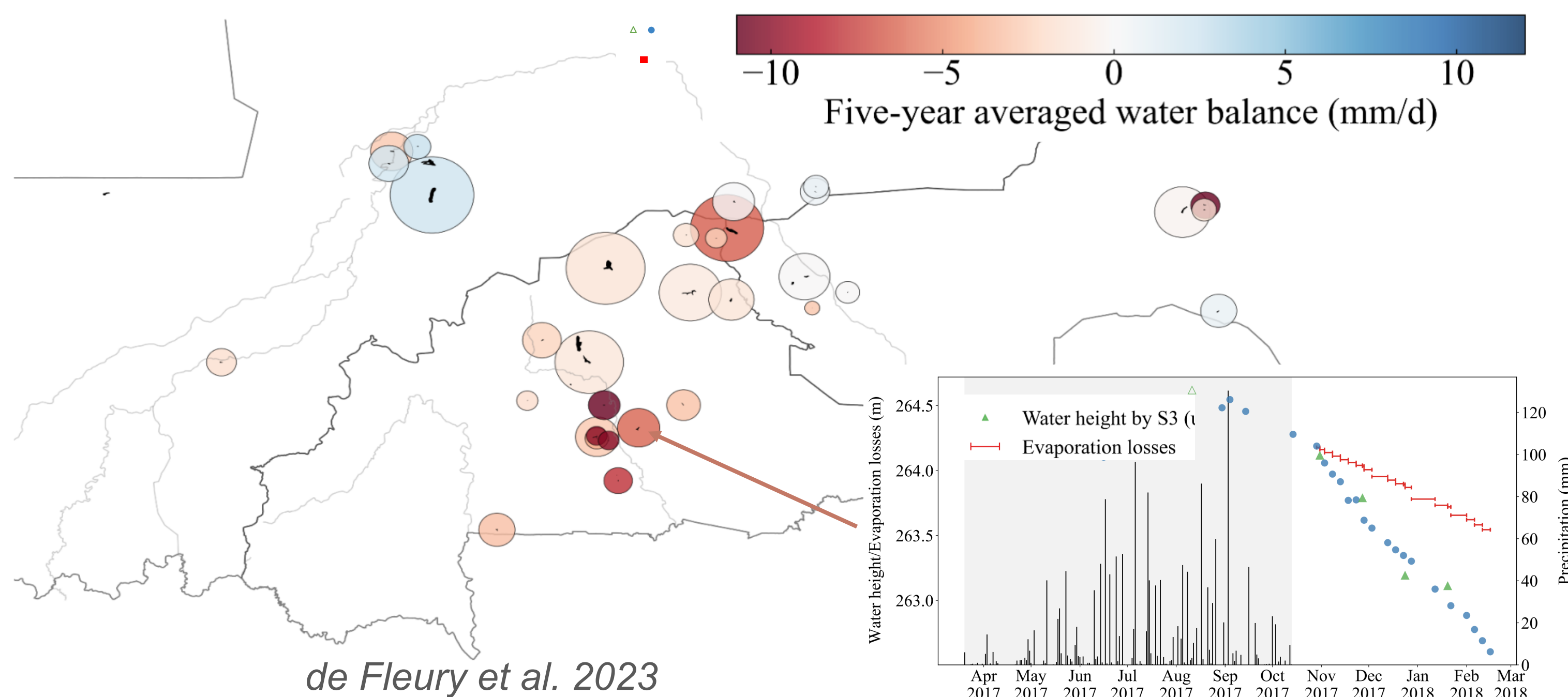
1. Direct comparison of the different SWOT products with in-situ measurements
2. Comparison of SWOT derived hypsometric relationships with dataset of hypsometric relationships available from in-situ and multisensors data over 16 lakes and reservoirs
3. Comparison of SWOT h and S to simultaneous estimations by other sensors (i.e. Sentinel3/6, Sentinel2)
4. Evaluation of the water balance variability during the dry season



## SWOT contribution to overall knowledge and science questions

### 1- Hydrological regimes and anthropogenic impact on water fluxes

- Assessing water level changes during the dry season allows identifying different hydrological regimes, including water withdrawals for anthropogenic uses (irrigation) and connections to river network or water table which are very poorly known at the regional scale (de Fleury et al. 2023)



### 2- Long term evolution of surface water resources

Water areas have largely increased in the last 70 years all over the Sahel despite the long droughts in the 70-80 periods (Sahelian paradox). Mechanisms and processes responsible for this increase and the role of climate variability and human activities are still debated (Gal et al. 2016)

→ SWOT will provide area-volume relationships for each reservoir and lake that will provide volume changes over time and allow attribution studies

→ SWOT will allow to assess water fluxes over all reservoirs and lakes (few thousands in this area!)

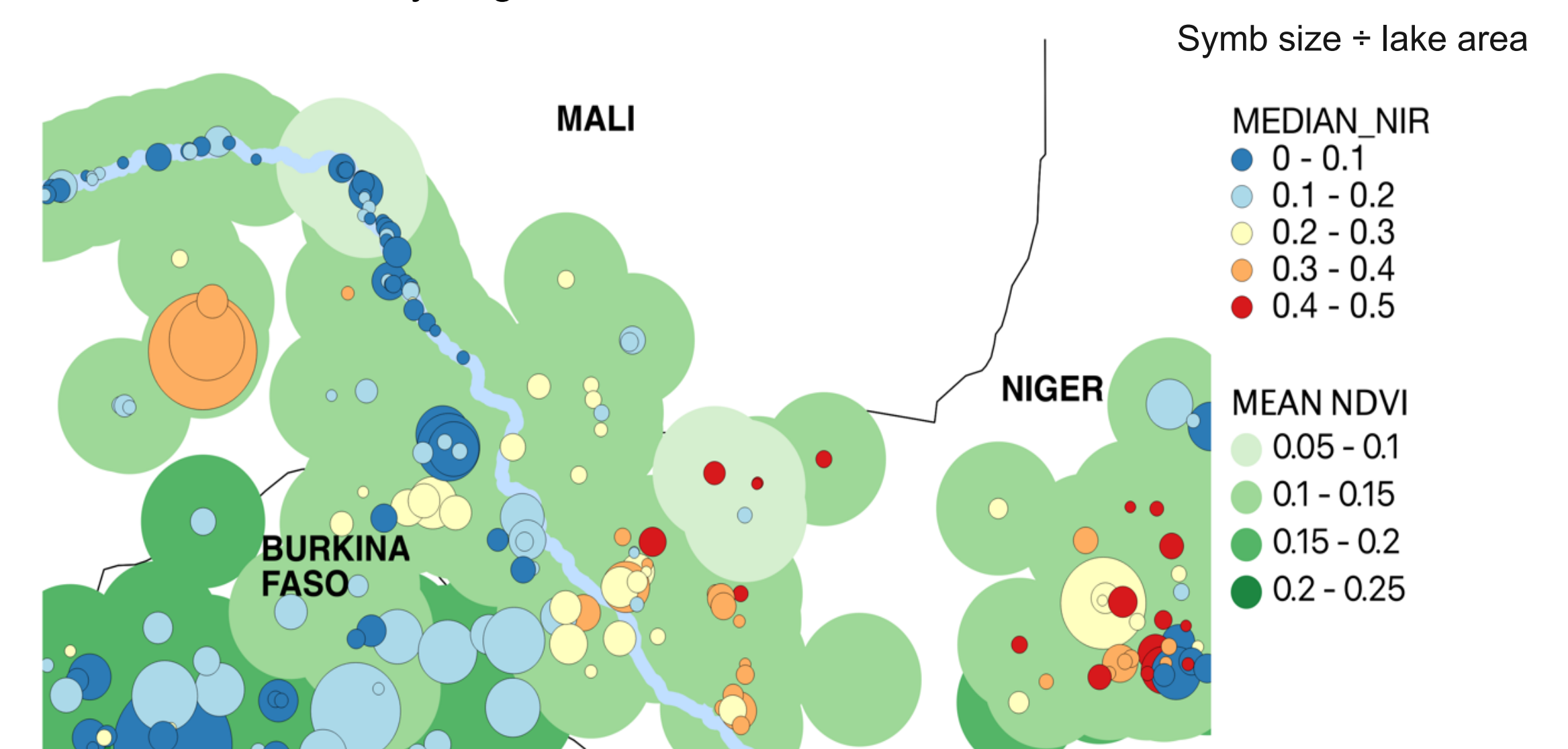
### 3- Impacts on water quality and related health issues

Water reflectance by optical sensors can be used to infer water quality information and particularly Suspended Particulate Matter (SPM) concentration in this area (Moussa Boubacar et al. 2022, Papa et al. 2022)

SPM generally favours bacteria development (Robert et al 2021) but sources of pollution, hydrological regimes and waterbody characteristics play also a role that needs to be better understood

→ SWOT will provide crucial data to investigate the links between hydrological variability and water quality

Water reflectance in the NIR band of Sentinel2 (2019): extremely bright waters found in this area!



## References

- de Fleury et al. 2023: "Hydrological regime of Sahelian small water bodies from combined Sentinel-2 MSI and Sentinel-3 SRAL data." *Hydrol. Earth Syst. Sci.*, <https://doi.org/10.5194/hess-2022-367>
- Gal et al. 2016: "Modeling the paradoxical evolution of runoff in pastoral Sahel. The case of the Agoufou watershed, Mali." *Hydrol. Earth Syst. Sci.*, 21, 4591-4613, doi:10.5194/hess-2016-623
- Grippa et al 2019: "Potential of SWOT for monitoring water volumes in Sahelian ponds and lakes." *IEEE J-STARS*, vol 12, N 7, 2541-2549
- Moussa Boubacar et al. 2022: "Spatio-temporal dynamics of suspended particulate matter in the middle Niger River using in-situ and satellite radiometric measurements." *Journal of Hydrology - Regional Studies*, 41, 101106, <https://doi.org/10.1016/j.ejrh.2022.101106>
- Papa et al. 2022: "Water Resources in Africa under Global Change: Role of Earth Observation and Models for Monitoring Surface Waters" *Surveys in Geophysics*, <https://doi.org/10.1007/s10712-022-09700-9>
- Robert et al. 2021: "Environmental determinants of E. coli, link with the Diarrheal diseases and vulnerabilities in tropical area (Kapore, Burkina Faso)" *PLOS Neglected Tropical Diseases*, <https://doi.org/10.1371/journal.pntd.0009634>