Monitoring and modelling the microbiological quality of current and future surface waters in West Africa using Earth observation data: MOQA-EO

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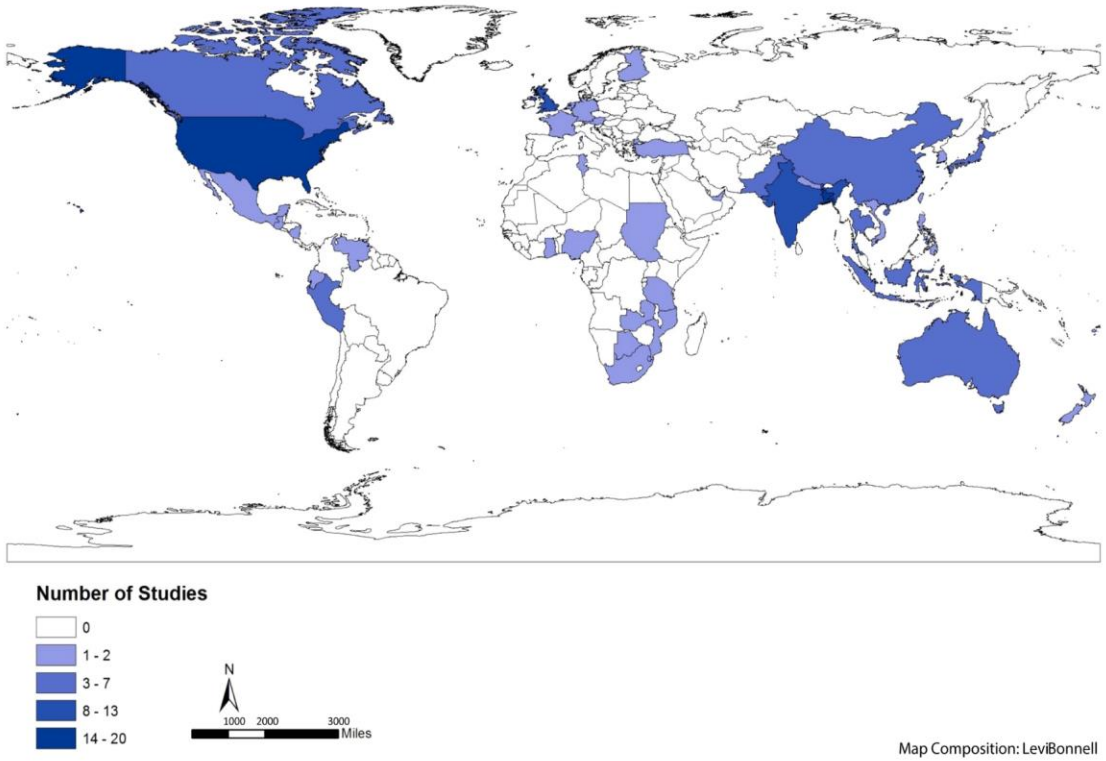
Context, Challenges and objectives

- 1.17 M deaths/year, 411 139 in Sub-Saharan Africa *(Kyu et al. 2024)*.
- High pollution of surface waters by pathogens.
- Widespread use of untreated surface water for domestic, washing, gardening and recreational uses.
- Deficient hygiene and lack of nearby sanitation and health infrastructures *(JMP, 2023).*

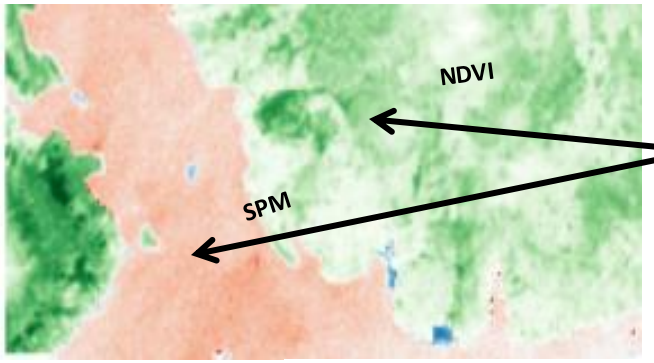
- Few studies in tropical environments:
  - *E. coli* is considered to be the best FIB in temperate areas => in muddy tropical surface water?
  - Link between E. coli-FIB / environmental determinants / diarrheal diseases ? Study to what extent the environment plays a role in the transmission of diarrheal diseases?

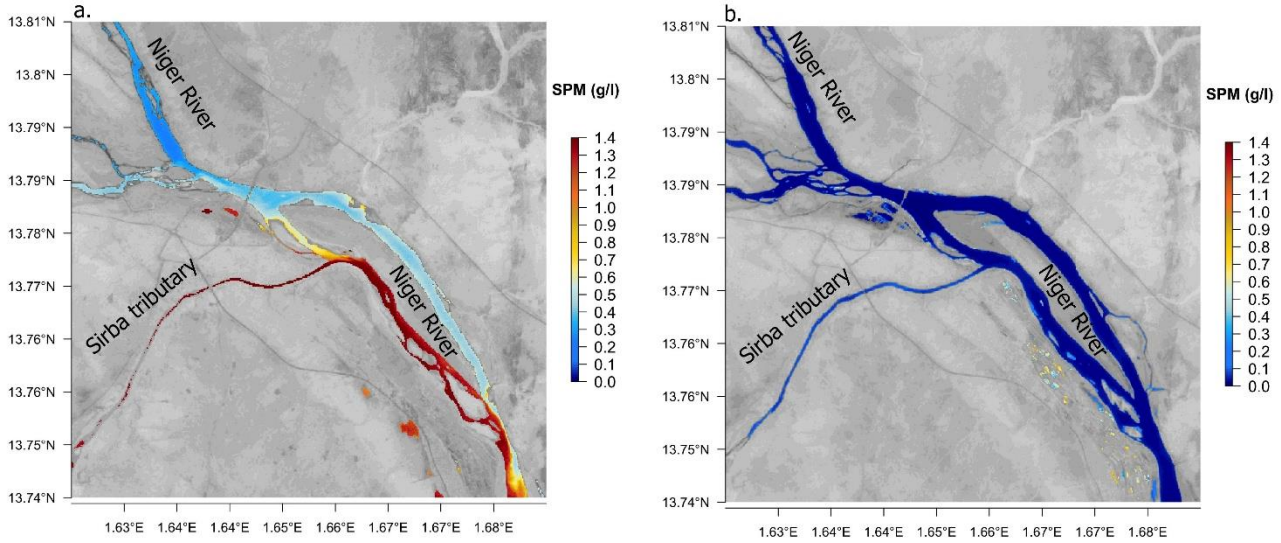


feces. Unsafe water is a risk factor in diarrhea, cholera, dysentery, typhoid, and polio.

Context, Challenges and objectives

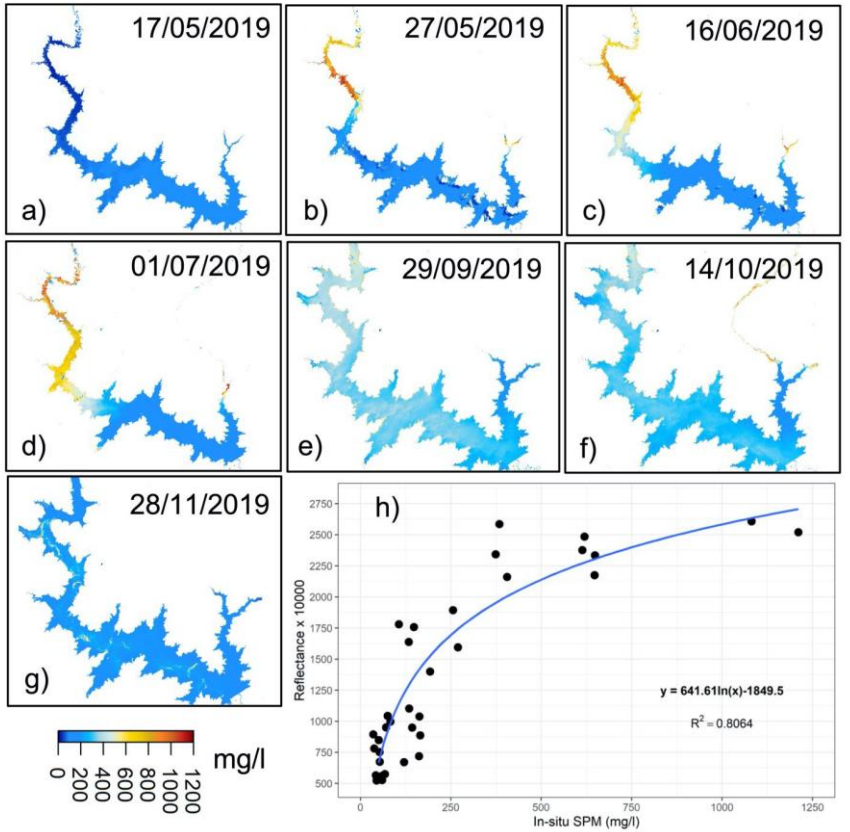
- Tele-epidemiology: powerful tool to study climate-environment-health relationship and to both understand and predict the spatio-temporal distribution of pathogens.
- Global changes: increasing of diarrheal diseases





especially in rural areas (Mecenas & Losch, 2018) and geopolitical insecurity.

Moussa al. 2022



Papa et al. 2022

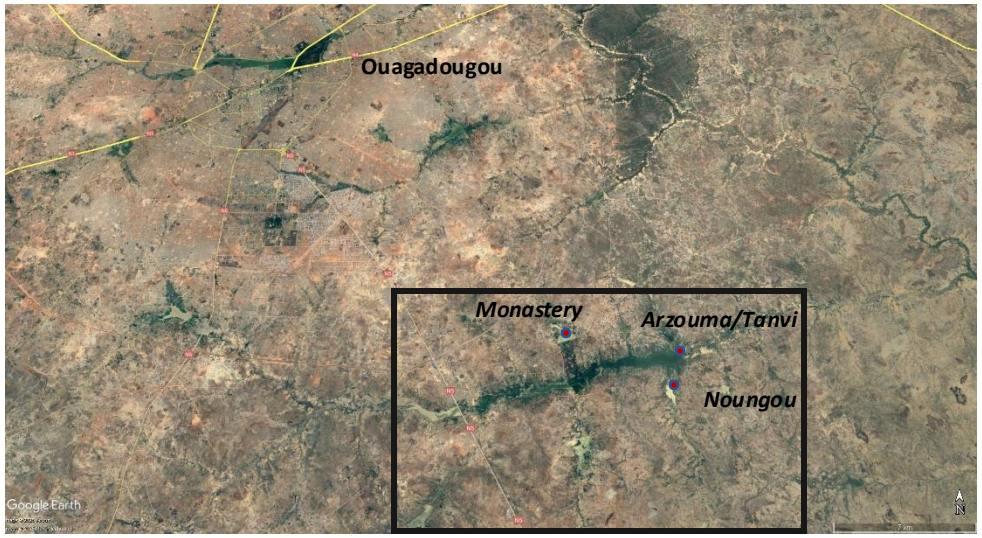
Study area and data used

In-situ

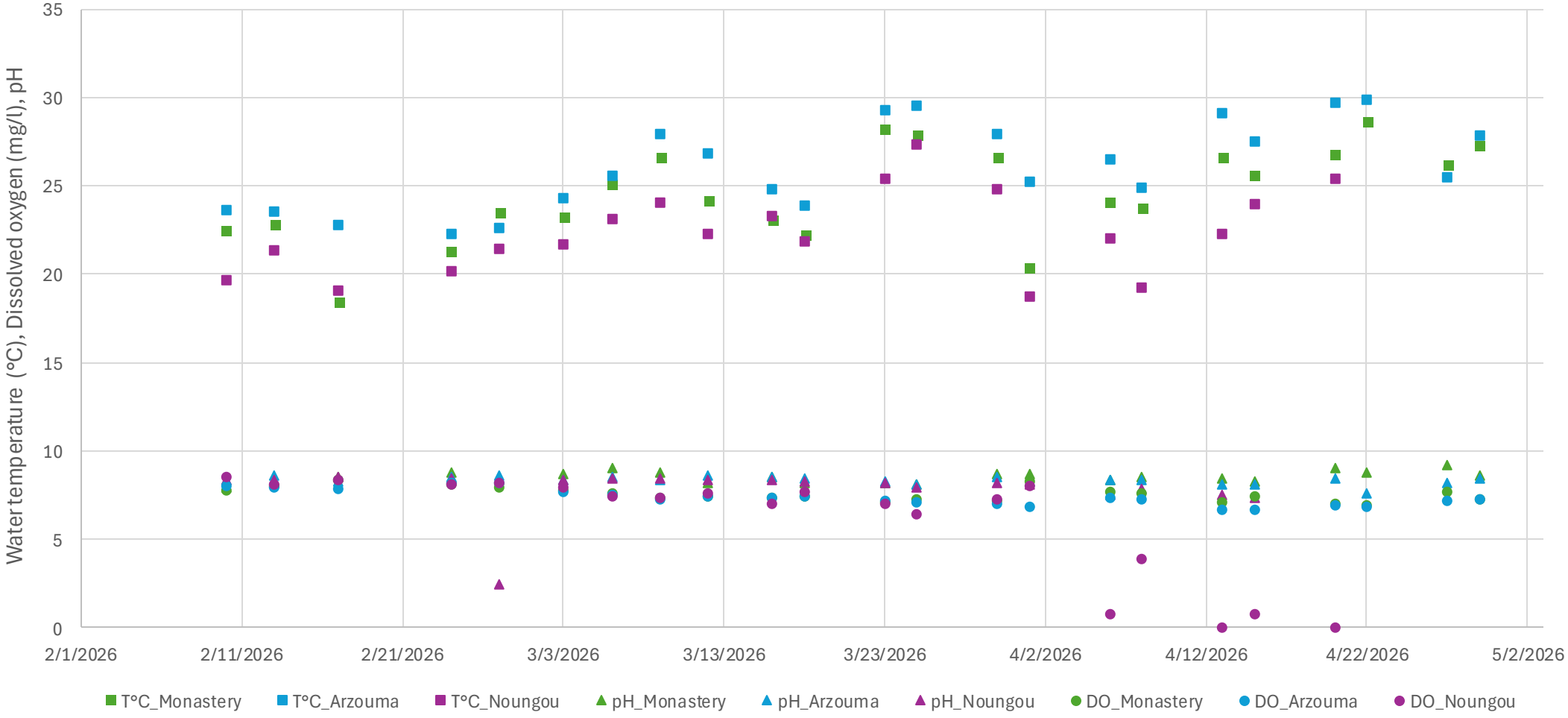
- **In-situ measurements for *E. coli* (microplate) SPM, T°C, pH, O2 dissolved:** Twice a week (February to mid-June, mid-August to end of December), every 2 days (mid-June to mid-August)

Remote sensing

- **Rainfall**: GPM IMERGHHV06 (Giovanni)
- **NDVI**: Sentinel-2 (Theia)
- **Nb of water pixels/flooded surface**: Sentinel-2 (Theia)
- **Water level** Sentinel-3
- **Solar irradiance, relative humidity and soil moisture, wind, runoff, pressure, air temperature:** GLDAS
- **SPM retrieved**: Sentinel-2 (Theia)

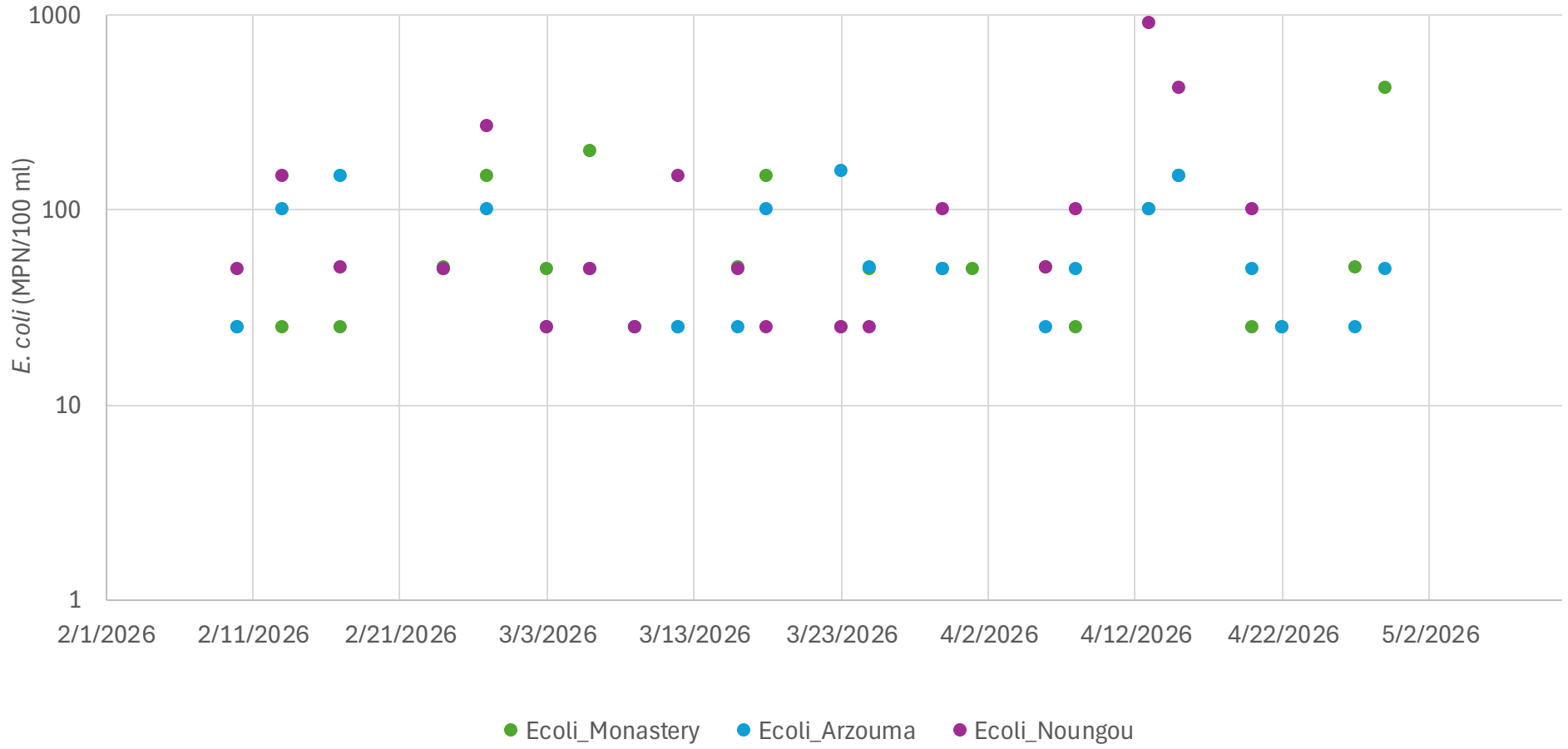


First results/work in progress: in situ measurements



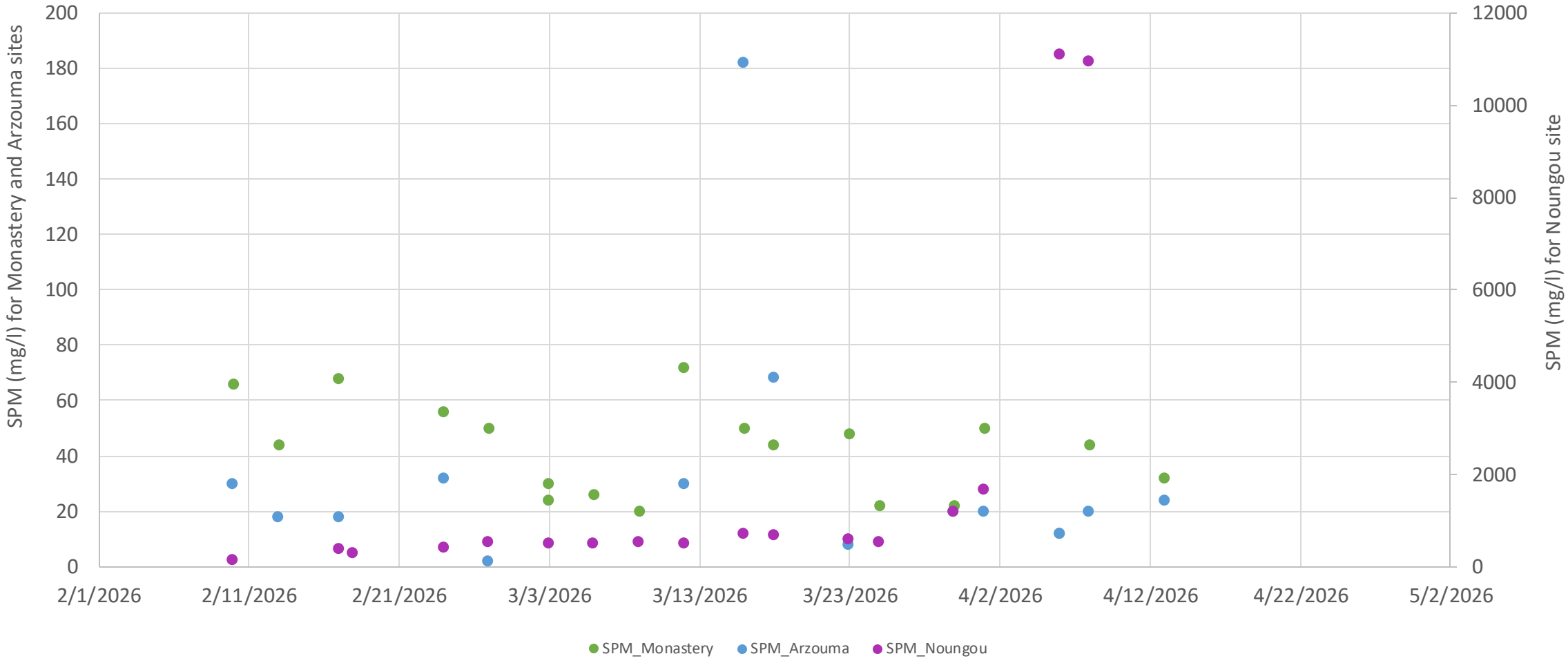
Temporal dynamics of water quality parameters (water temperature, Dissolved oxygen and pH) at Monastery, Arzouma and Noungou sites

First results/work in progress: in situ measurements



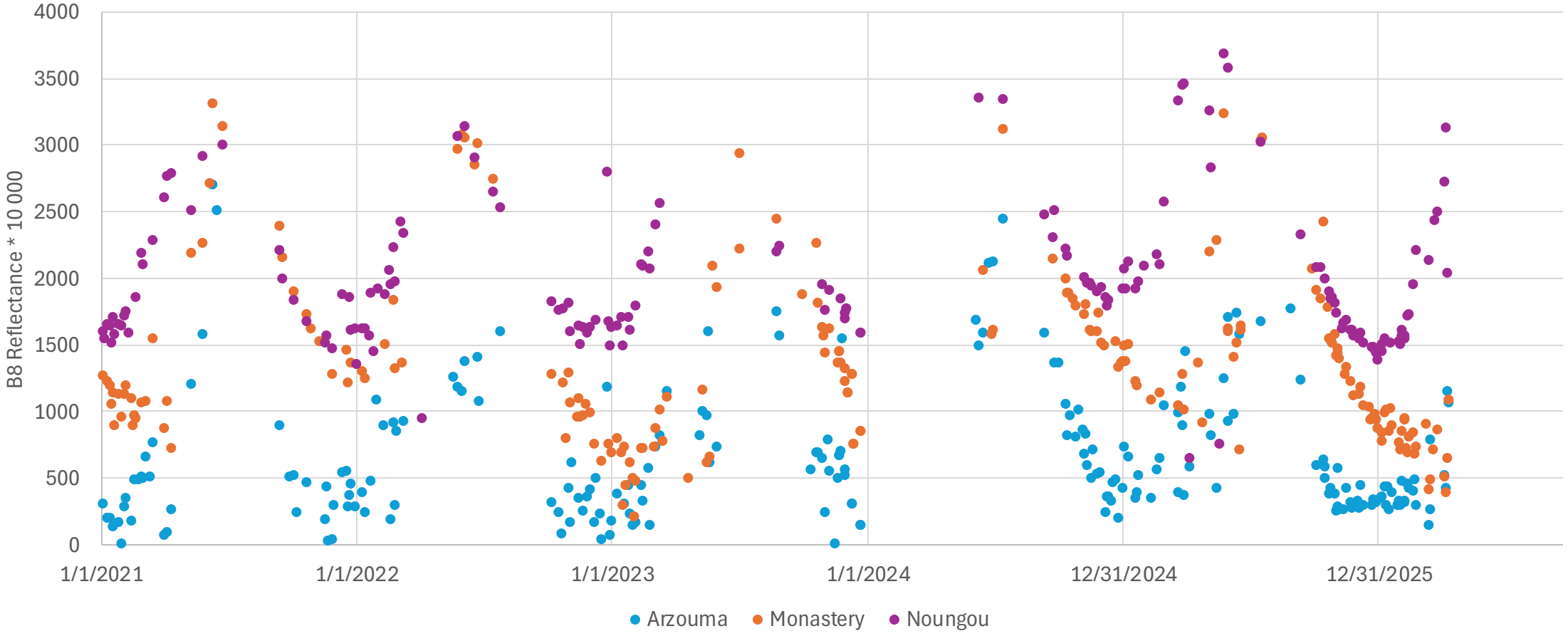
Temporal dynamics of *E. coli* at Monastery, Arzouma and Noungou sites

First results/work in progress: in situ measurements



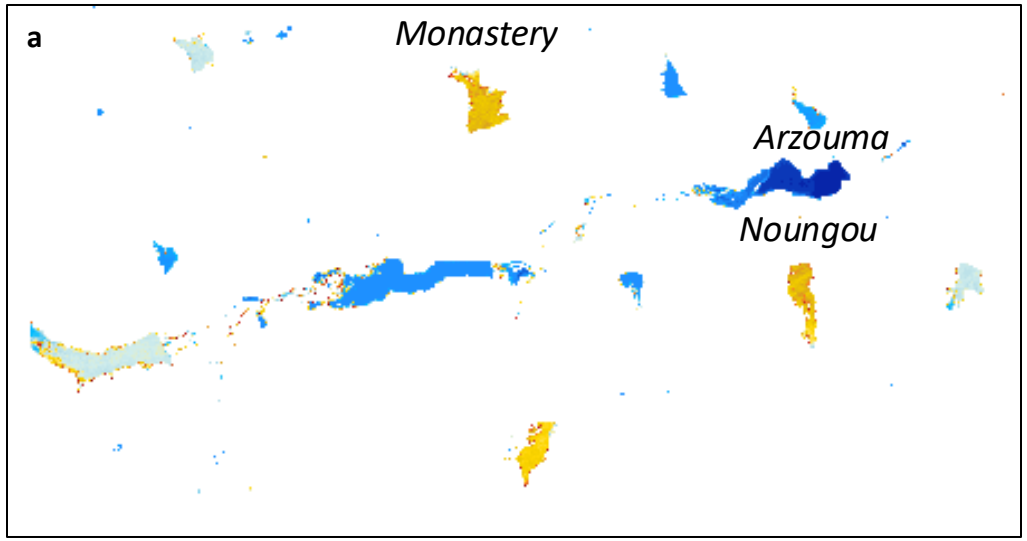
Temporal dynamics of suspended particulate matter (SPM) at Monastery, Arzouma and Noungou sites

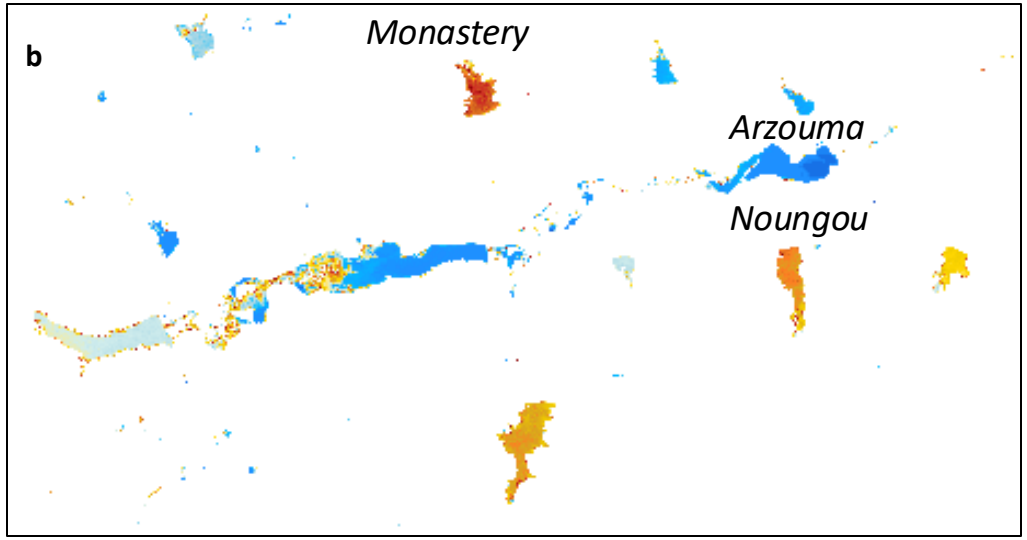
First results/work in progress: Variability of reflectances in the NIR (B8) according to the site studied

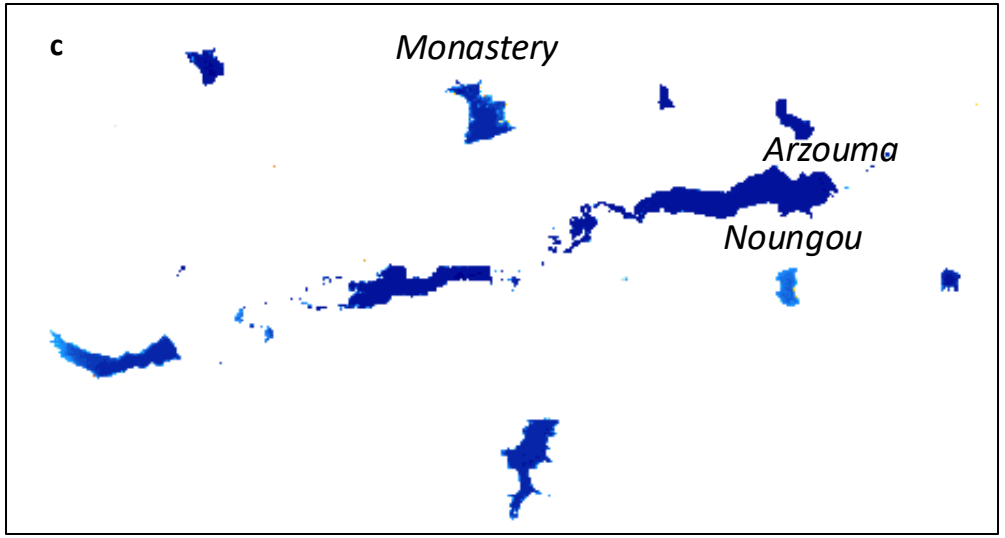


Temporal dynamics of band 8 (NIR) reflectance extracted for each of the sites studied between 2021 and 2026

First results/work in progress: SPM algorithm





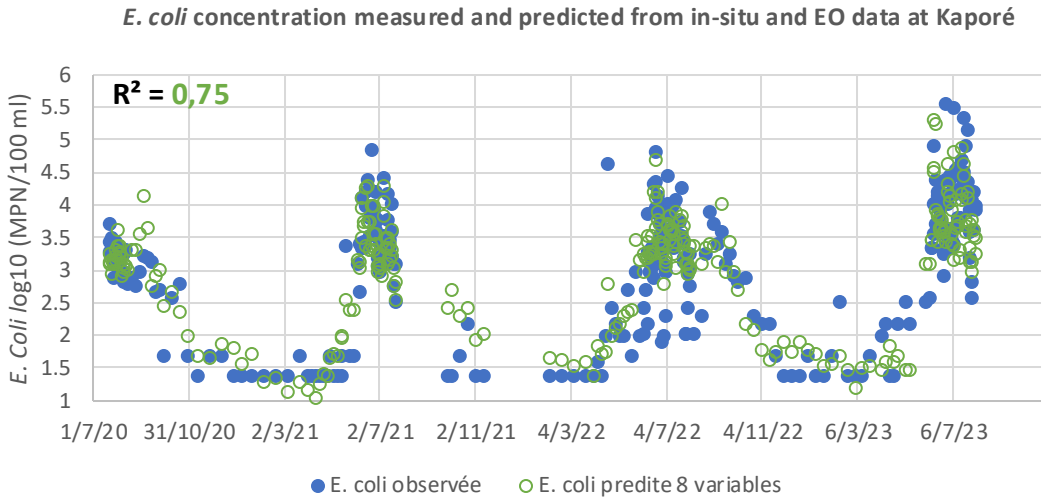


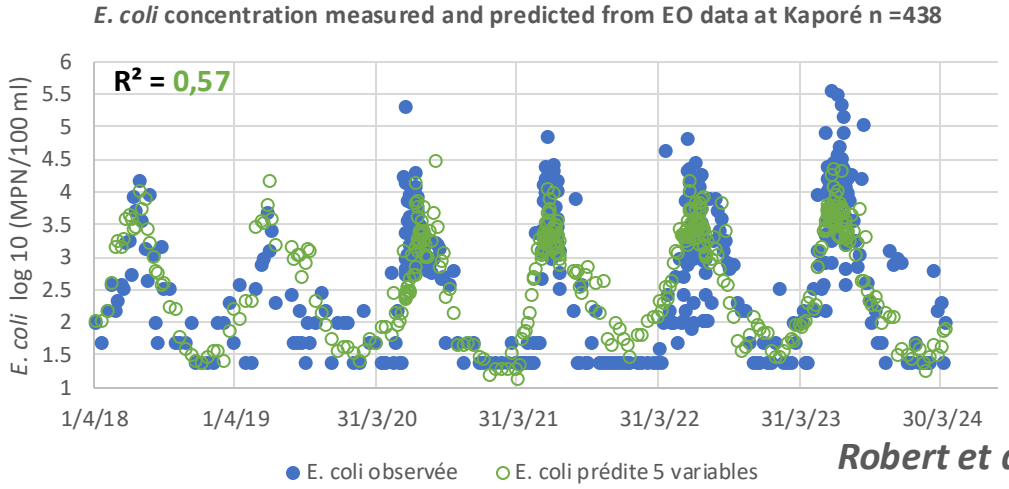
Inversed SPM from the NIR band (band 8) Sentinel2: a for 25/06/2022, b for 16/07/2025 and c for 12/01/2026

The SPM inversion formula is from Robert et al. (in preparation).

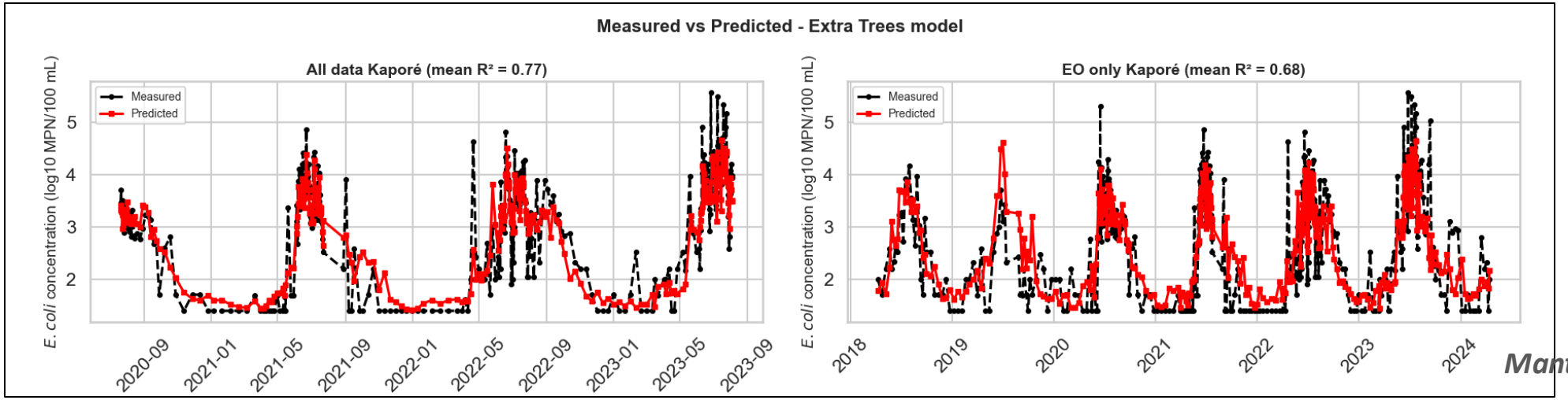
Outlooks

- Continue in-situ measurements, with the rainy season as a key consideration.
- SPM inversion algorithm.
- *E. coli* modeling at 3 sites: in-situ, in-situ + EO, and EO only.





Robert et al. en prep.



Mant al. 2025

Thank you for your attention