

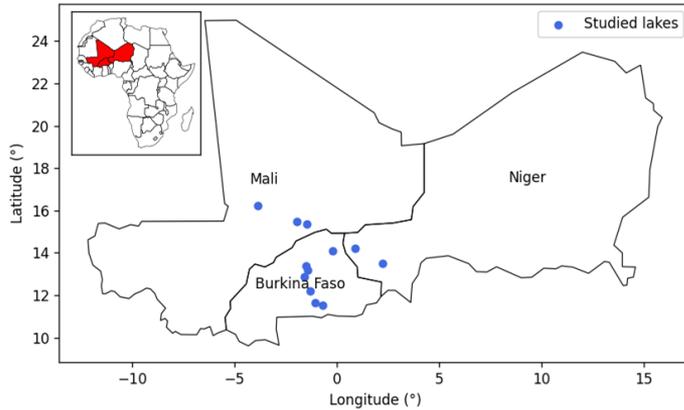
Multi-sensor monitoring of small water bodies volume in West Africa

Fixed contract (APR CNES): Oct. 2021 - Sept. 2022

Félix Girard, Mathilde de Fleury, Manuela Grippa, Laurent Kergoat (GET, Toulouse)



Study area



Arid to semi-arid climate
Rainfall: 200-600mm/year
High seasonality



*Credits:
Google*

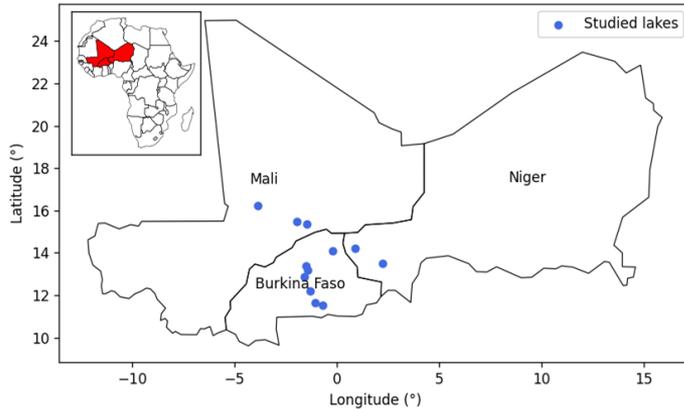
Introduction

Material and methods

Results

Conclusion

Study area



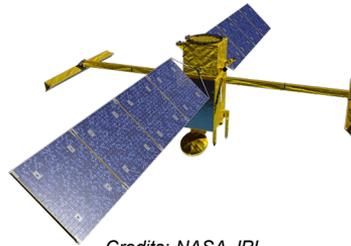
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Scientific context

SWOT mission (Nov. 2022) :
Dense observation of surface waters

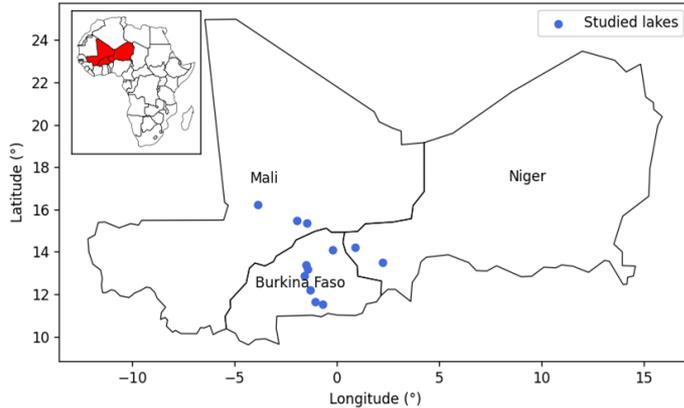


Credits: NASA JPL

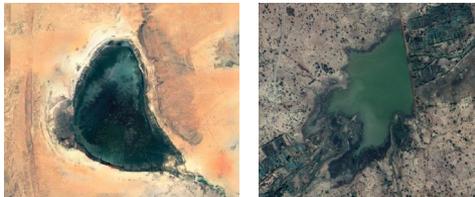
AMMA-CATCH observatory



Study area



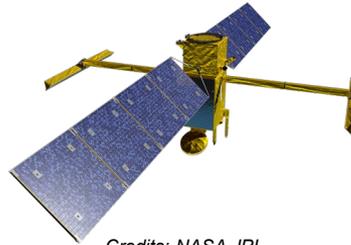
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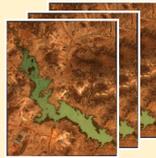


Objectives

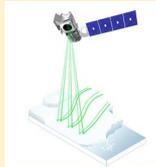
- Build a reference database of lakes (heights, areas, hypsometric curves) for **SWOT data validation**
- Develop **new methods** for lake volume variations monitoring
- Investigate the Sahelian hydrological changes **over the past three decades** (future PhD)

Hypsometric curve processing chain

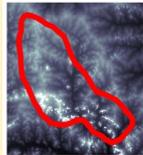
Inputs



**Sentinel-2
images
collection
20mx20m
(GEE)**

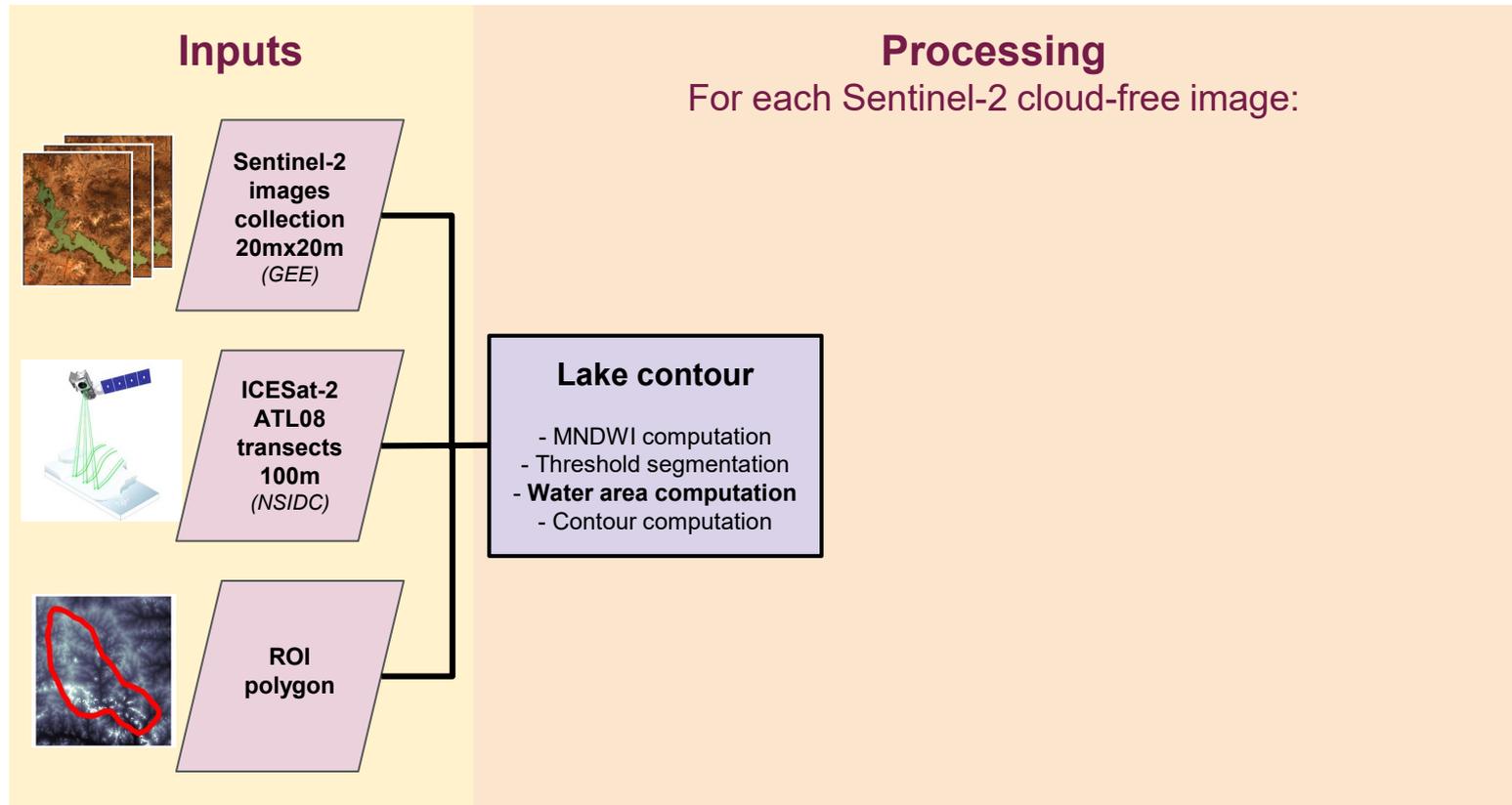


**ICESat-2
ATL08
transects
100m
(NSIDC)**



**ROI
polygon**

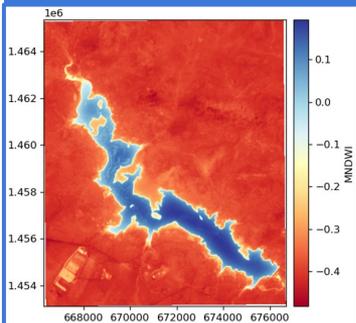
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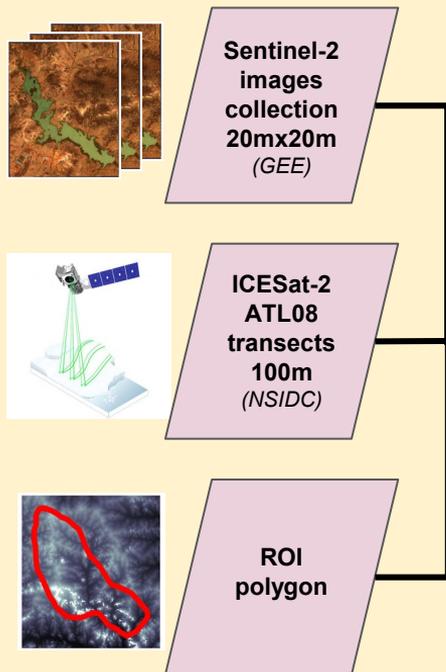
Hypsometric curve processing chain

$$MNDWI = \frac{Green - SWIR}{Green + SWIR}$$

Green : 560nm, res 10m
SWIR : 2190nm, res 20m

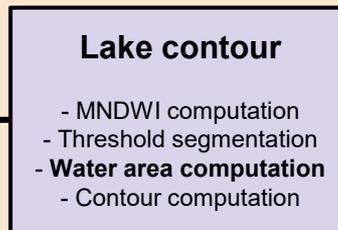


Inputs



Processing

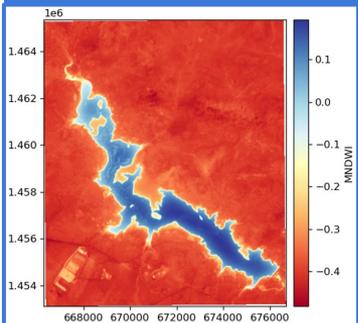
For each Sentinel-2 cloud-free image:



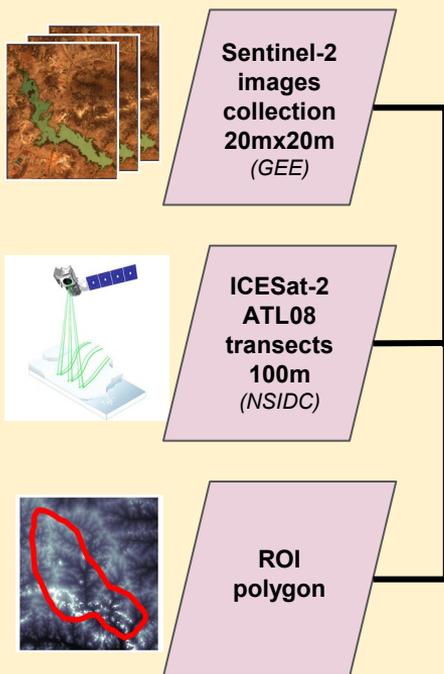
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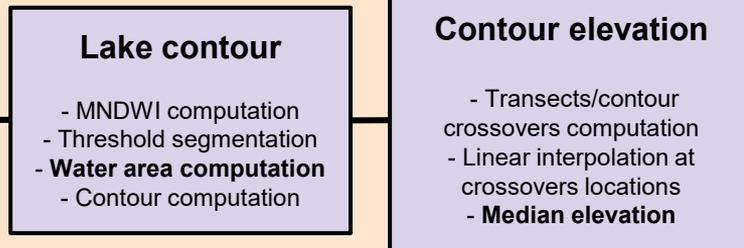


Inputs



Processing

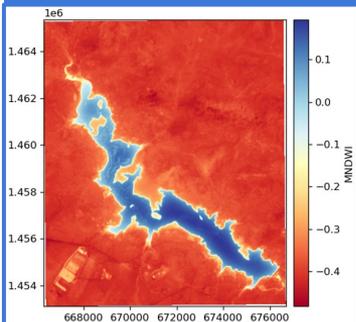
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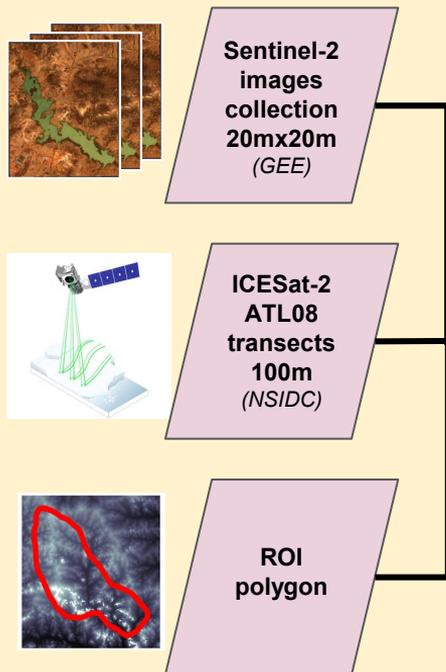
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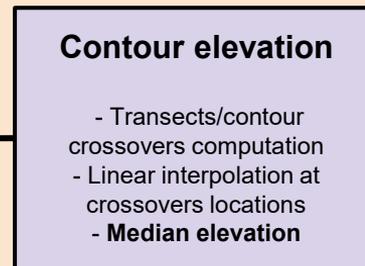
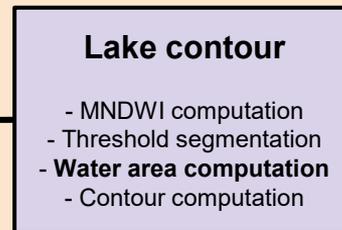


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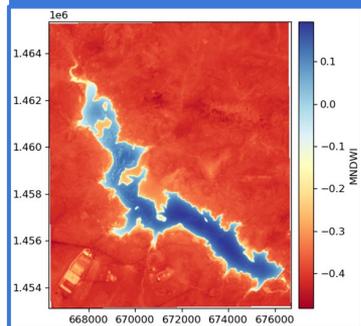
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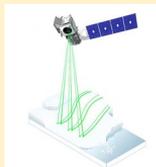
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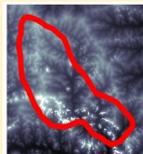
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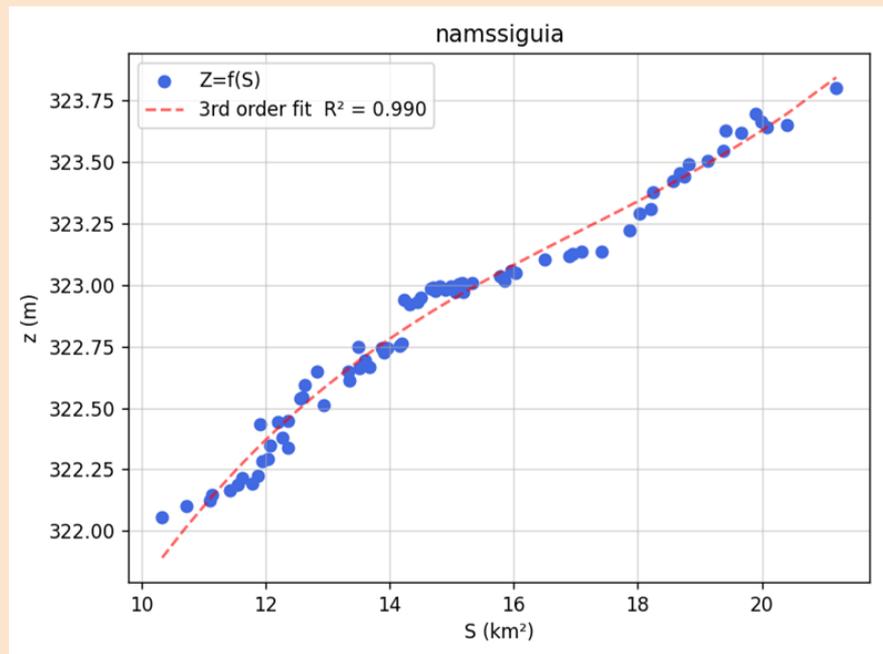


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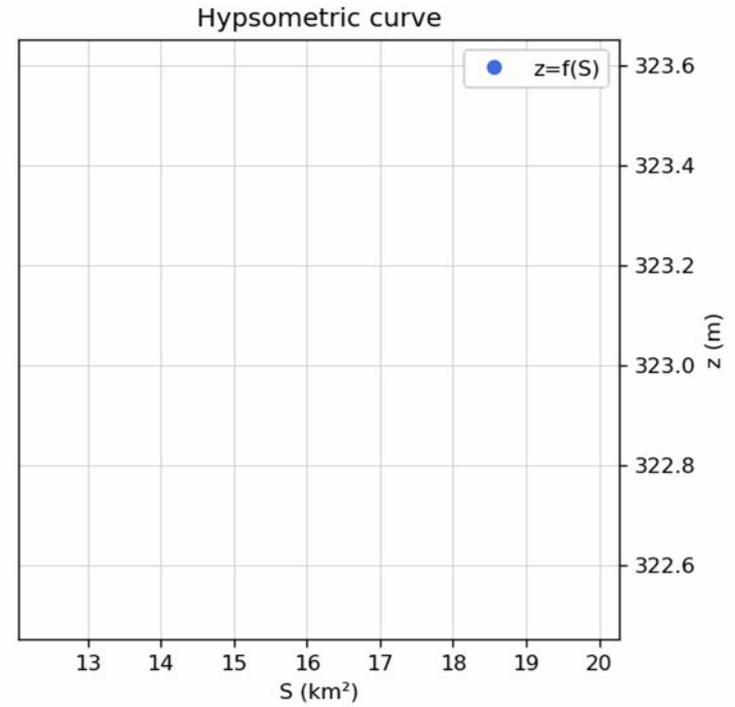
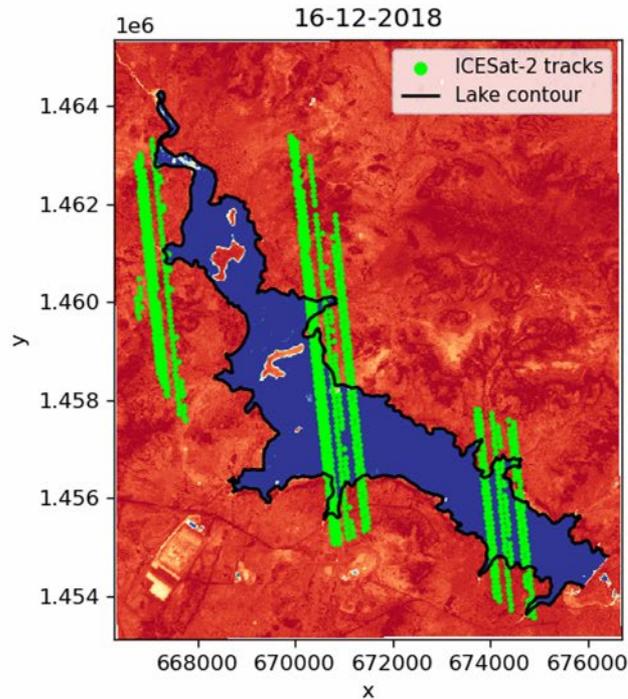


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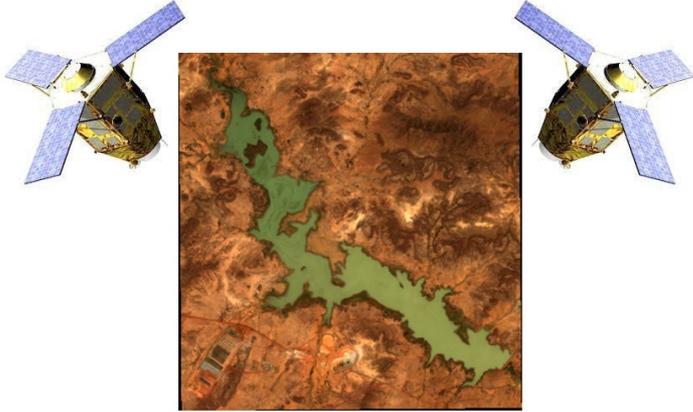
Hypsometric curve



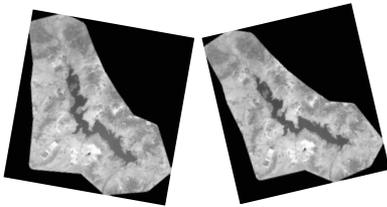
Hypsometric curve



Comparison with Pléiades DEM



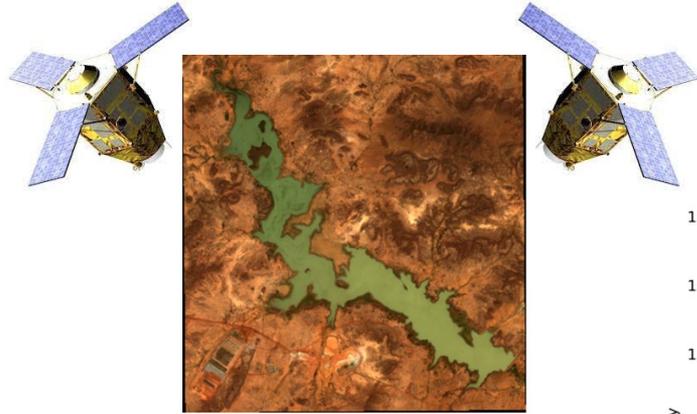
Acquisition when lake is driest



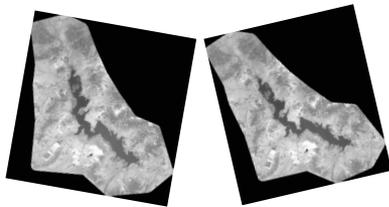
*Credits:
Airbus DS*

Resolution: 0.5m x 0.5m

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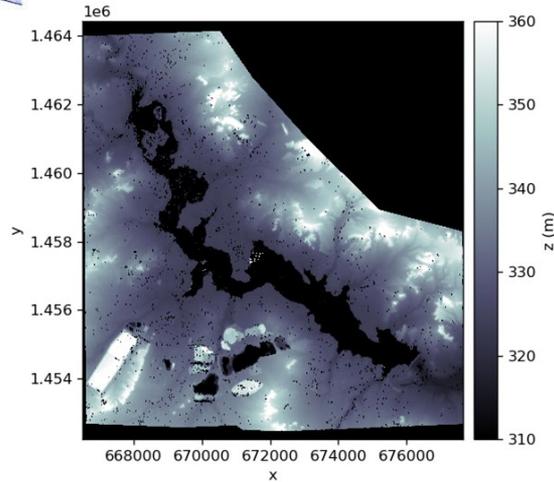
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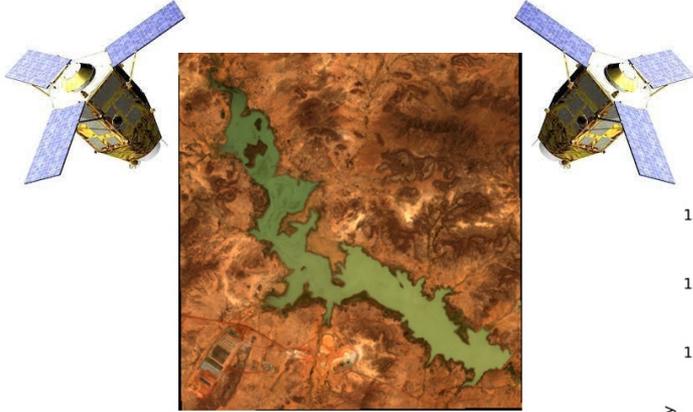
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Digital Elevation Model

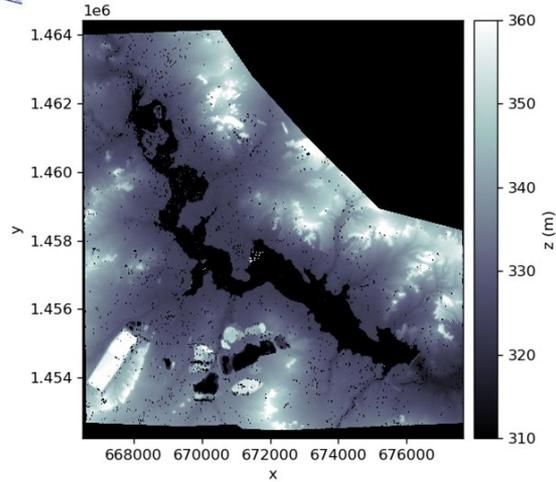


Resolution: 1m x 1m

Comparison with Pléiades DEM

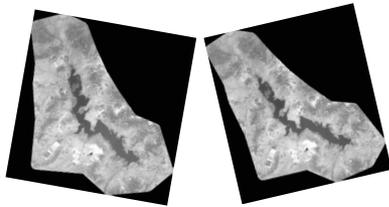


Digital Elevation Model



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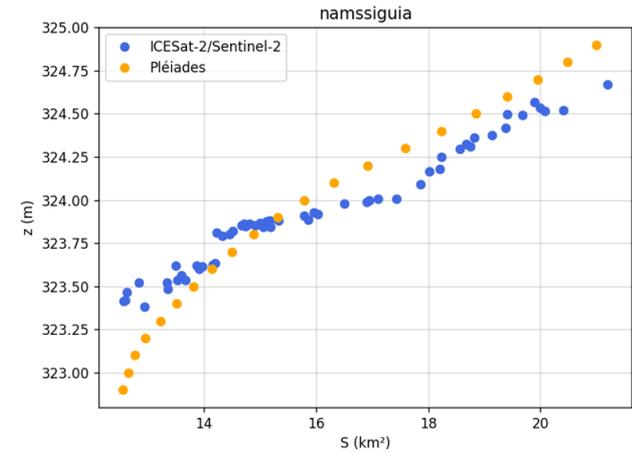
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Comparison



In short

- Water areas and lake contours by **MNDWI thresholding** on Sentinel-2 images
- Water levels by **crossovers computation** of lake contours with ICESat-2 tracks
- Construction of **hypsothetic curve**

Summary and outlook

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Ongoing quality assessment

- **Uncertainties on water detection** (clouds, aquatic vegetation, dry lakes)
- **Uncertainties and quantity of ICESat-2 elevation data** (clouds, vegetation on banks, small lakes)
- **Few data for in-situ validation**

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- Results valorisation: **(Girard et al. in prep)**
- Construction of the **reference database** for future comparisons with SWOT data

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PhD thesis starting Nov. 2022: *Potential of SWOT for monitoring of small water bodies volume in West Africa*

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Thank you for listening!

felix.girard@get.omp.eu

