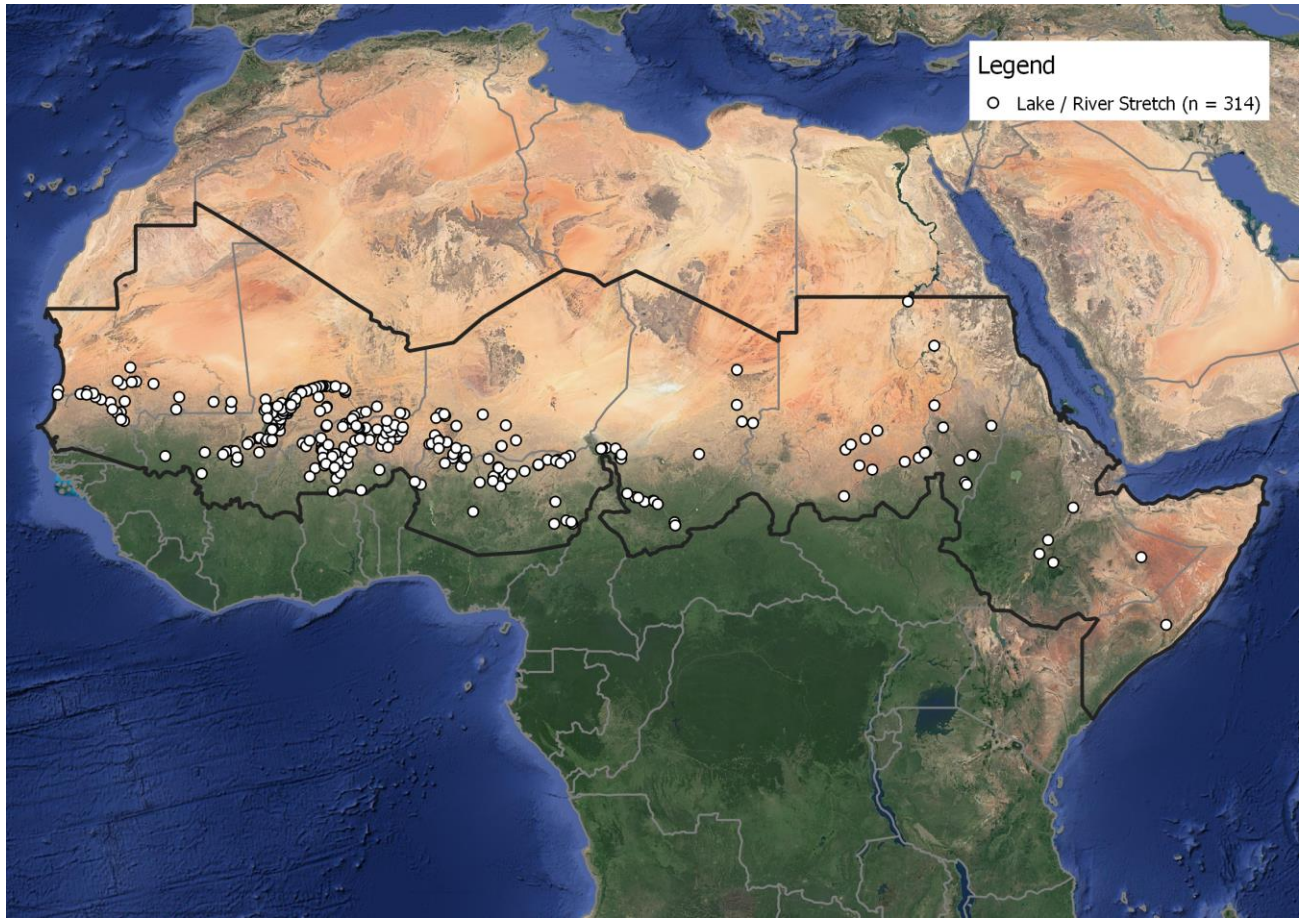
Unraveling the hydrology of water bodies in the Sahel Region based on remote sensing

Tabea Donauer, Dr. Silvan Ragettli, Dr. Tobias Siegfried, Prof. Dr. Peter Molnar



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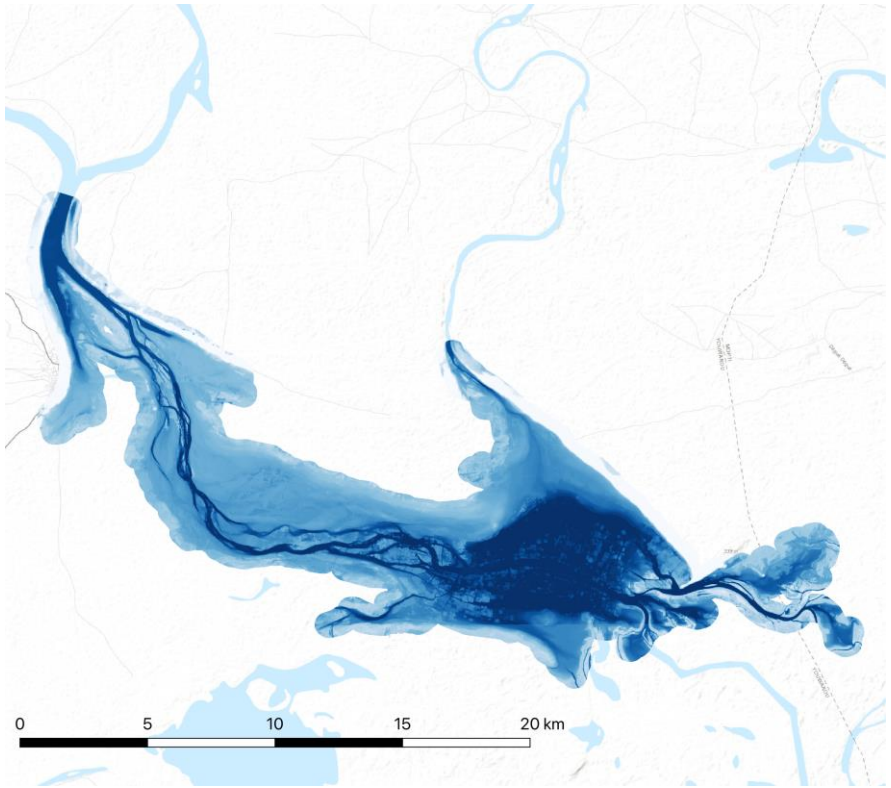
Method

- Optical satellite imagery: Landsat 7/8, Sentinel-2
- Combination of spectral bands (*MNDWI Index*)
- Unsupervised Classification (*Otsu Tresholding*)

1. Water Surface Detection
2. DEM Generation
3. Water Level Detection
4. Erosion/Deposition Areas



Water Surface Frequency

2000-2020

- 10%
- 20%
- 30%
- 40%
- 50%
- 60%
- 70%
- 80%
- 90%
- 100%

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Method

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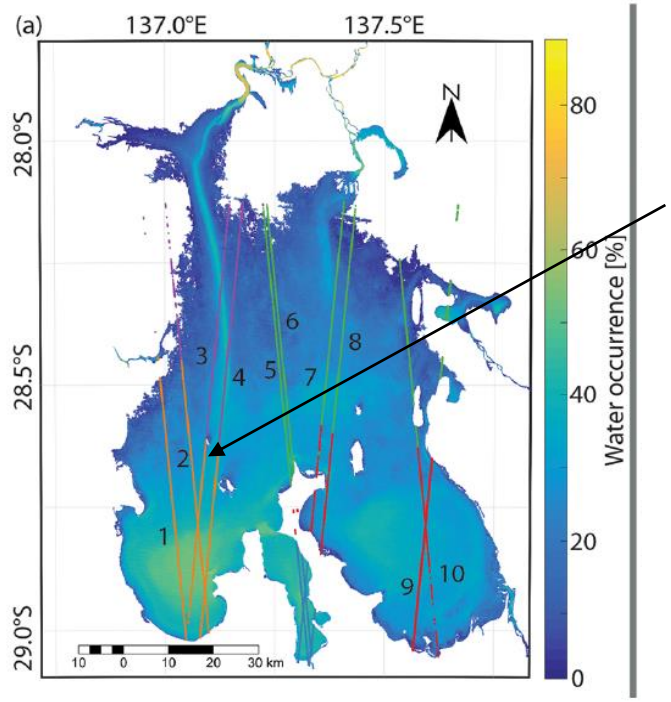
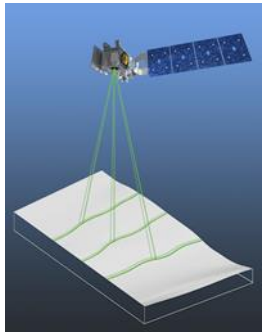
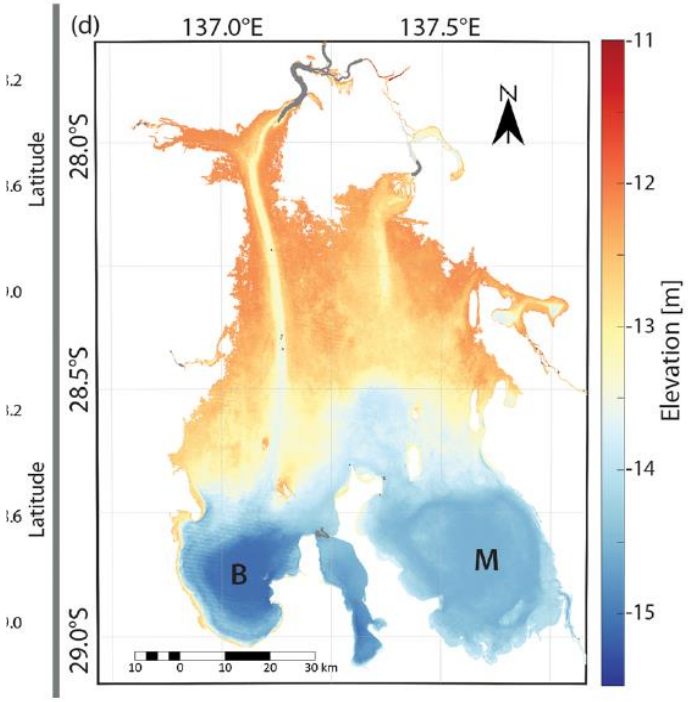




Icesat-2 Altimetry Tracks, October 2018 - July 2020

Water Surface Frequency



Terrain Elevation

Armon et al. (2020): https://doi.org/10.1029/2020GL087367.

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Method

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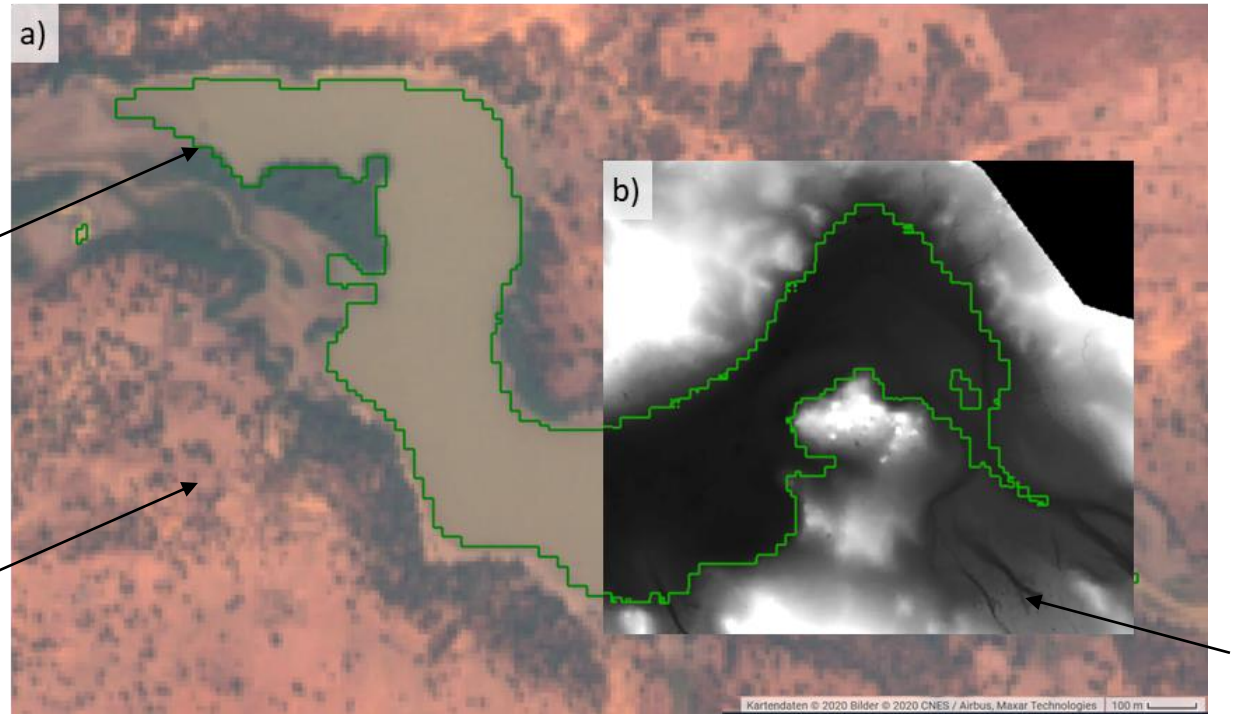
- **Waterline method:**
  Terrain elevation at waterline → water level

Detected waterline

Optical Satellite Image



DEM

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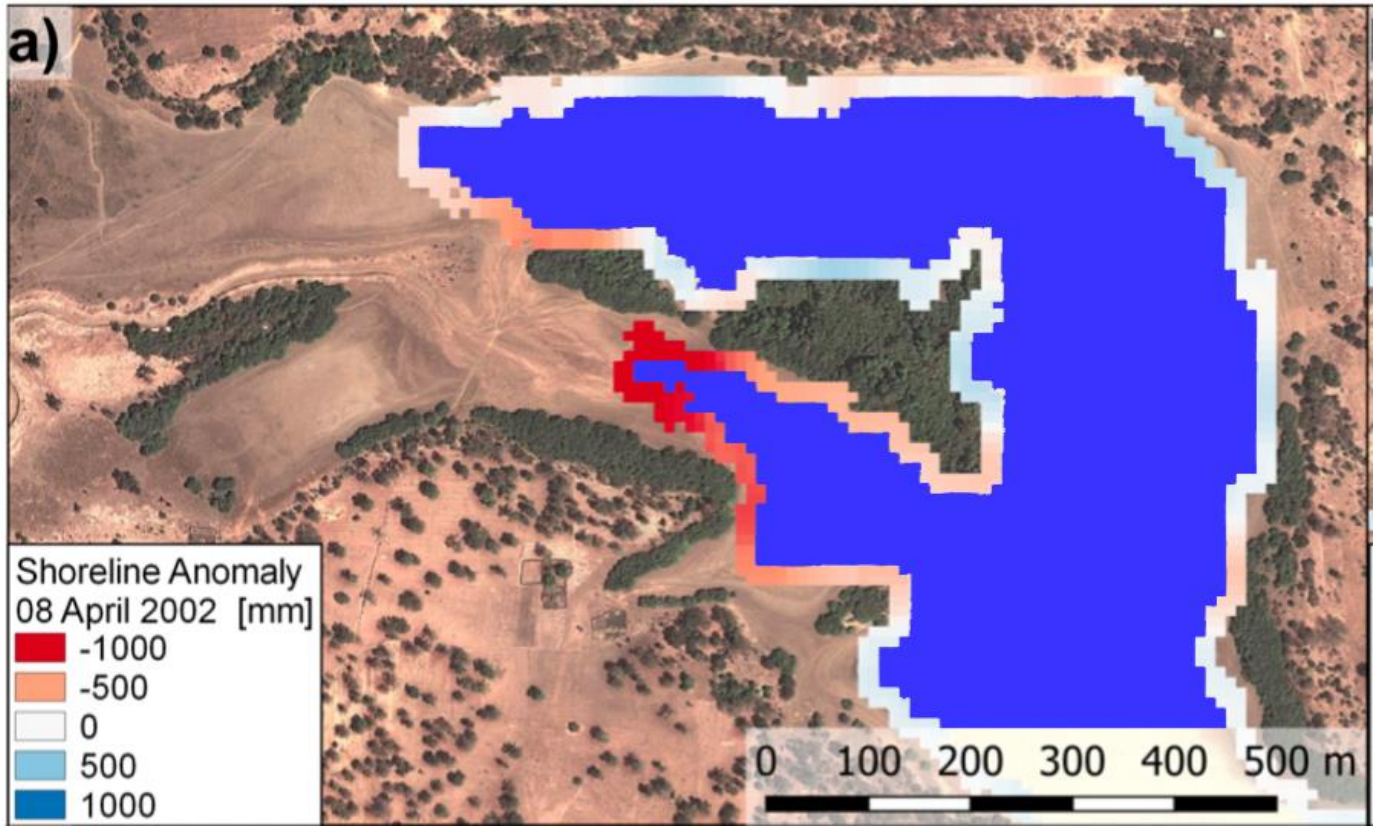
Method

- Waterline does not follow elevation contour line
  → **erosion or deposition**



1. Water Surface Detection
2. DEM Generation
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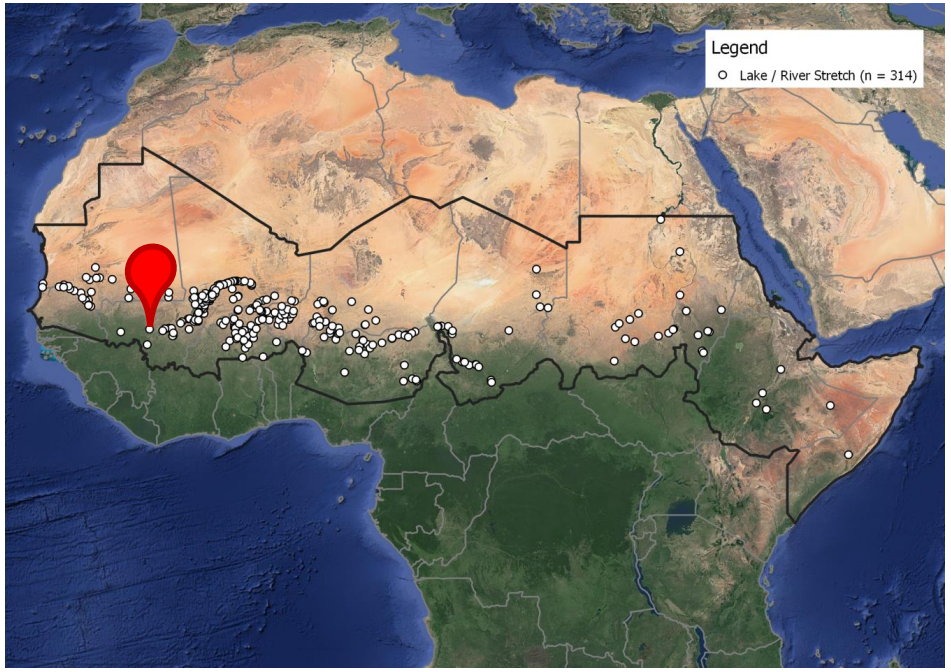
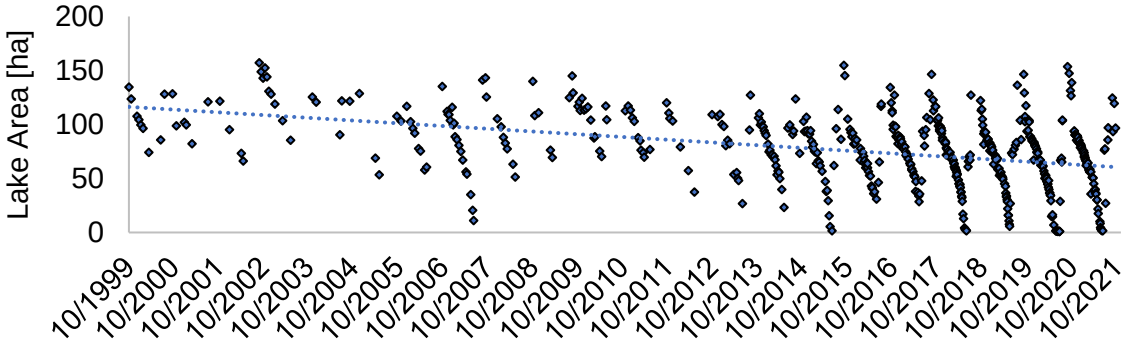
Results

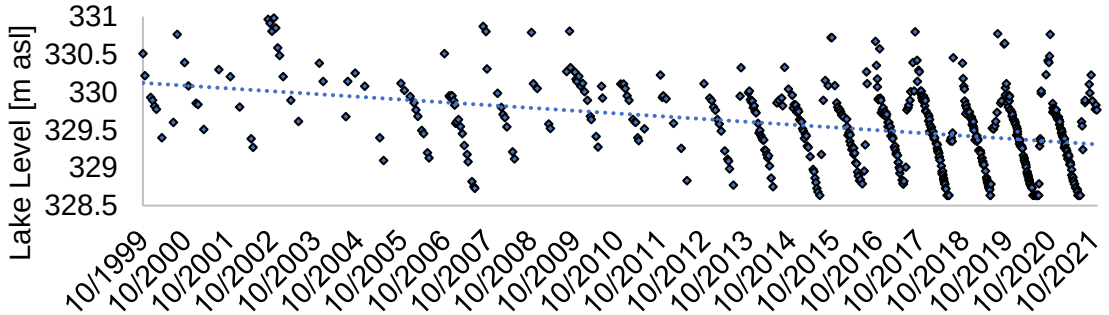
- Time series and multi-year trends for **314 lakes and river stretches**



Water Area:



Water Level:



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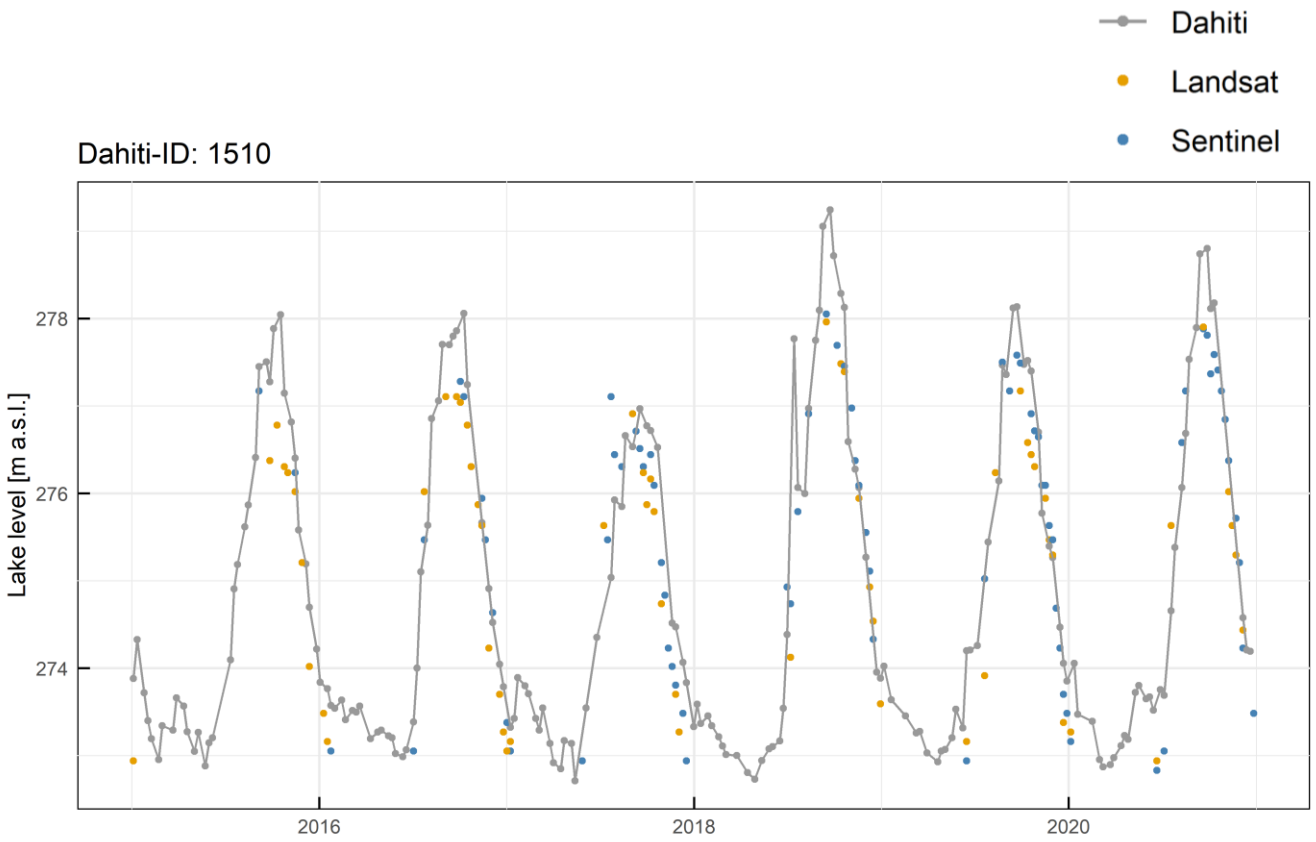
Validation



- **Validation** against DAHITI water level time series: https://dahiti.dgfi.tum.de/en/
- **Peer-reviewed method**, preprint: https://esurf.copernicus.org/preprints/esurf-2021-99/esurf-2021-99.pdf

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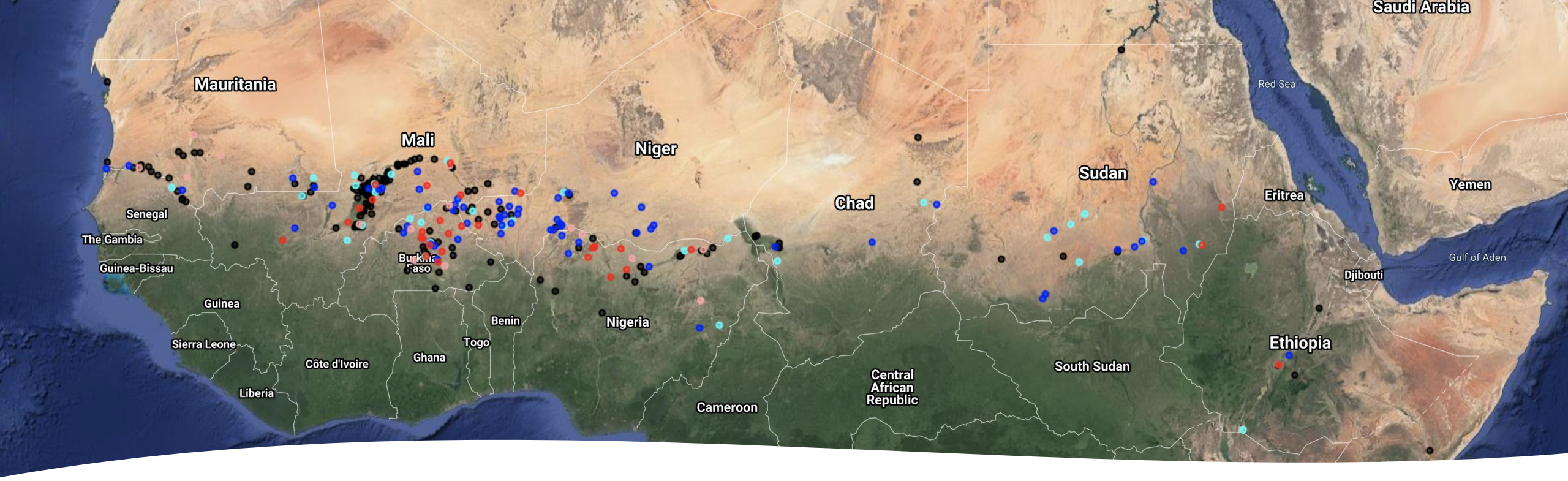

Sahel-Water App

Web App

https://hydrosolutions.users.earthengine.app/view/sahel-water

Outputs

- Water areas (daily)
- Water levels (daily)
- Deposition and erosion rates in water bodies
- Multi-year trends

Areas of Interest

- 314 lakes and river stretches in the Sahelian region

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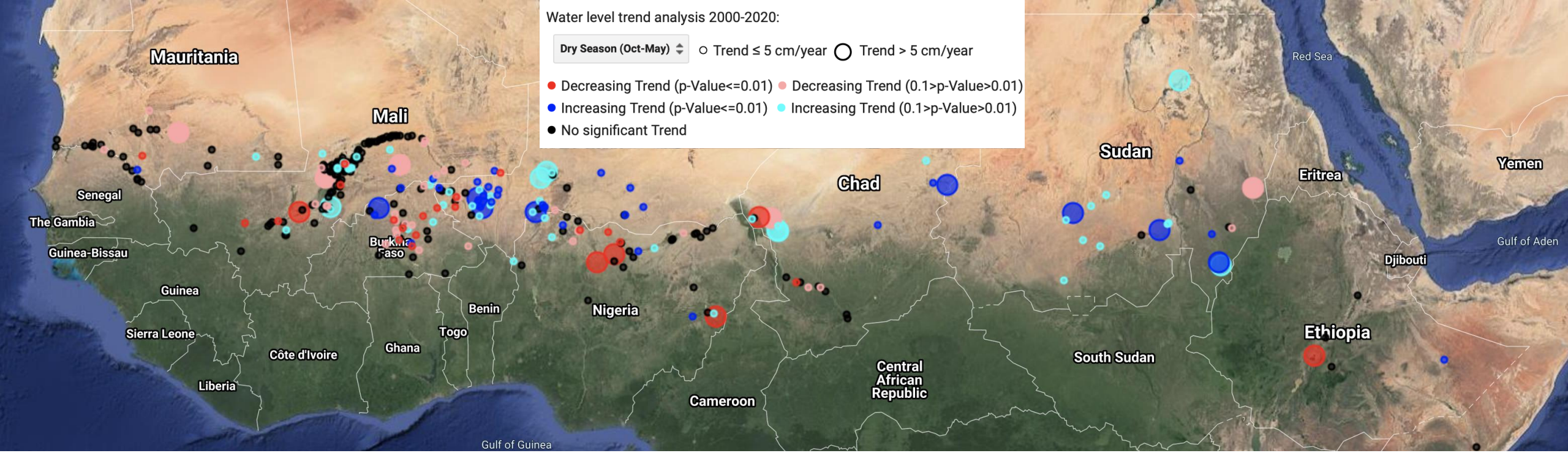
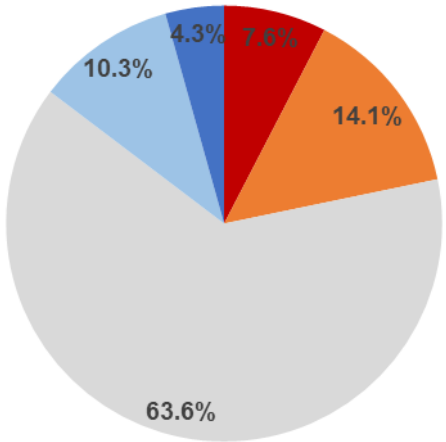


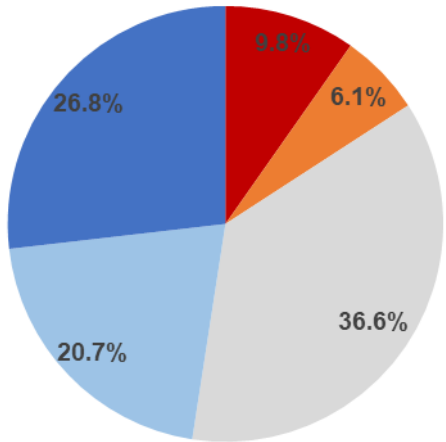
Dry-Season Trends

- Decreasing, p-value <= 0.01
- Decreasing, 0.01 < p-value <= 0.1
- No trend
- Increasing, 0.01 < p-value <= 0.1
- Increasing, p-value <= 0.01

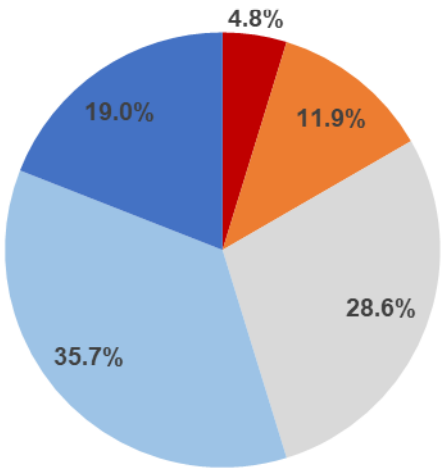
West



Central



East



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