

Groundwater recharge in the Lake Chad Basin

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Hannover

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Content

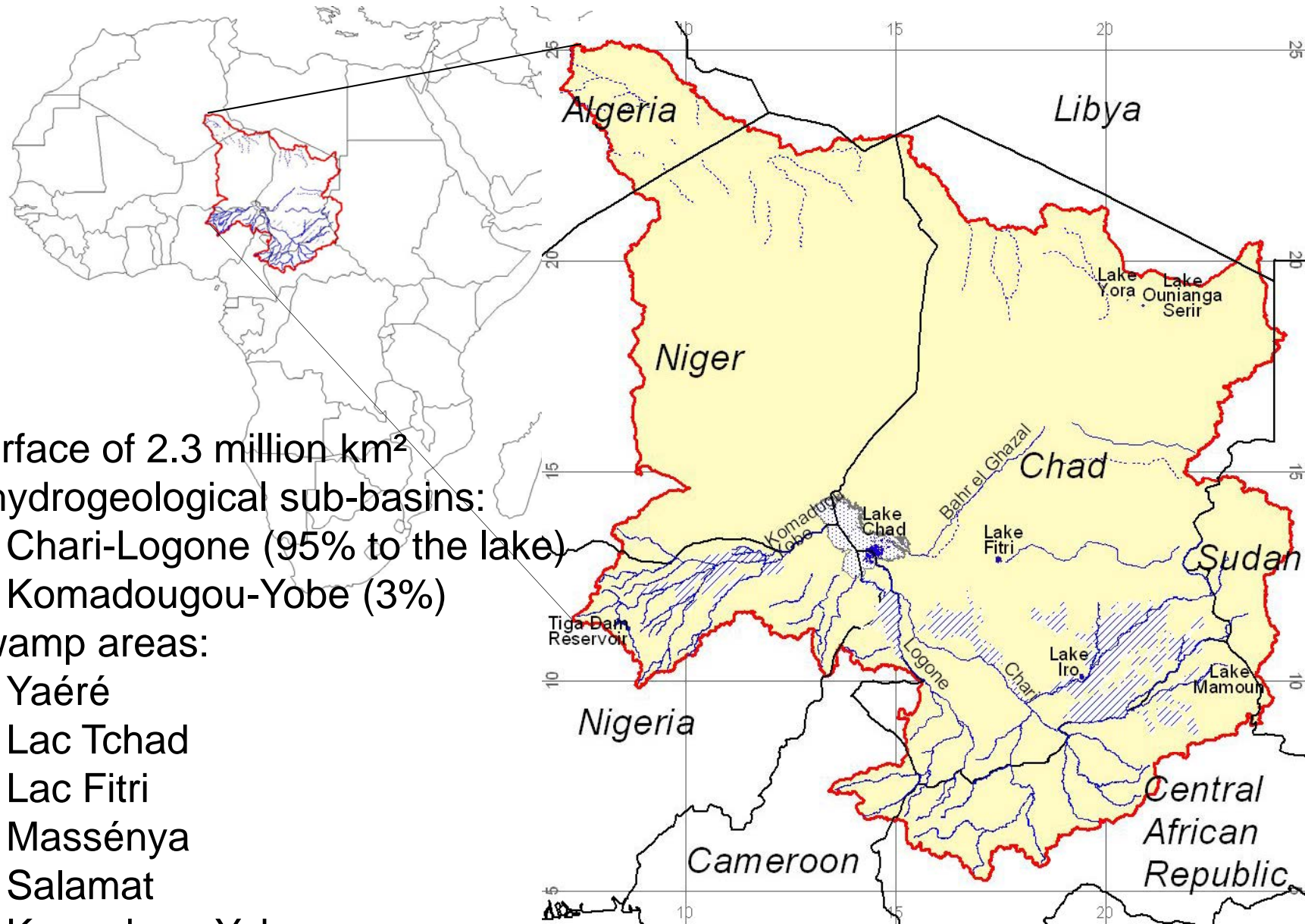
- Lake Chad Basin
 - Location, topography, climate, geology, hydrogeology
- Recharge investigations in Chad
- Results: Gw-contour lines, hydrogeochemistry (sulfate), isotopy
- Summary
- Conclusion

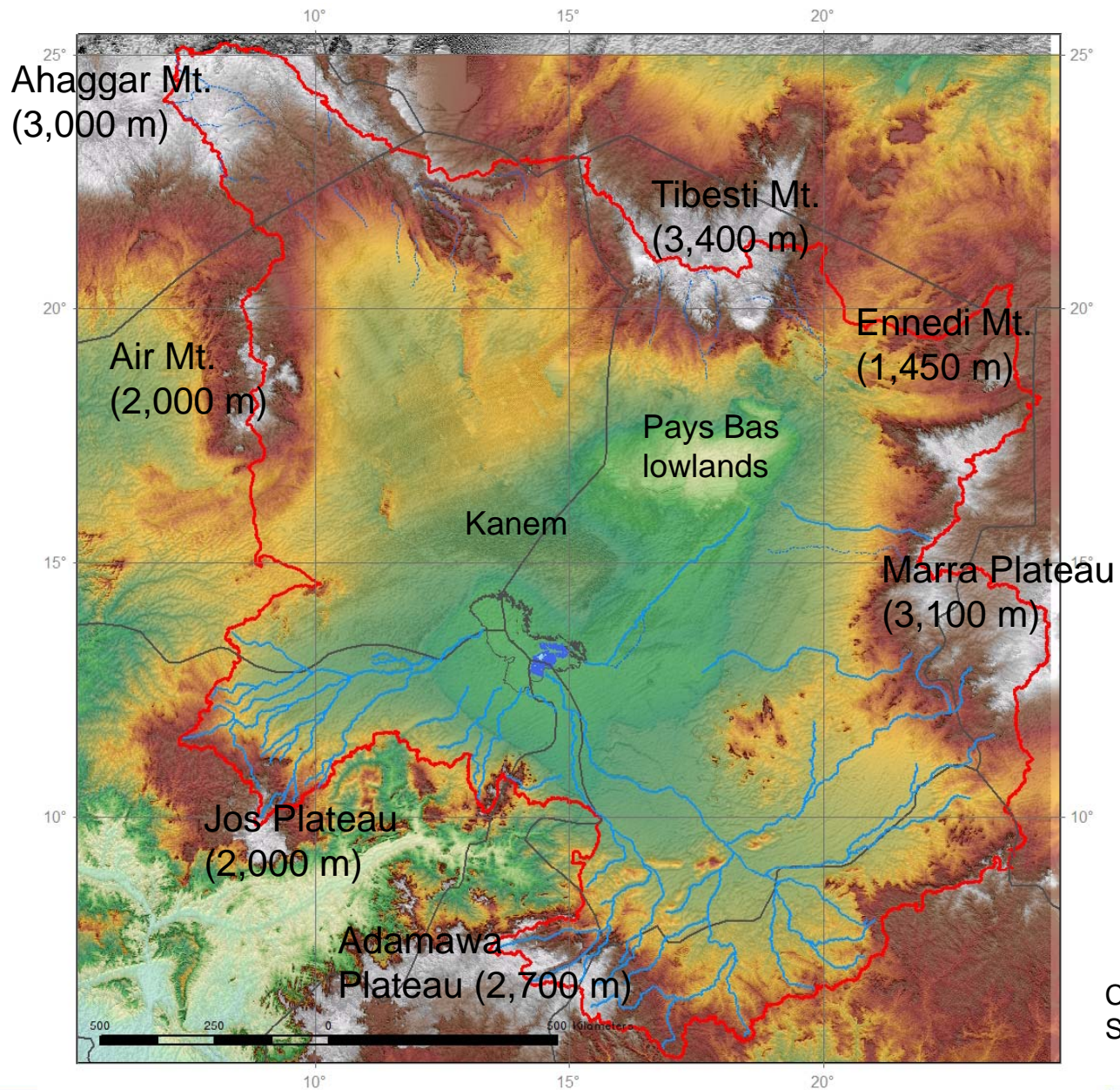
Surface of 2.3 million km²
2 hydrogeological sub-basins:

- Chari-Logone (95% to the lake)
- Komadougou-Yobe (3%)

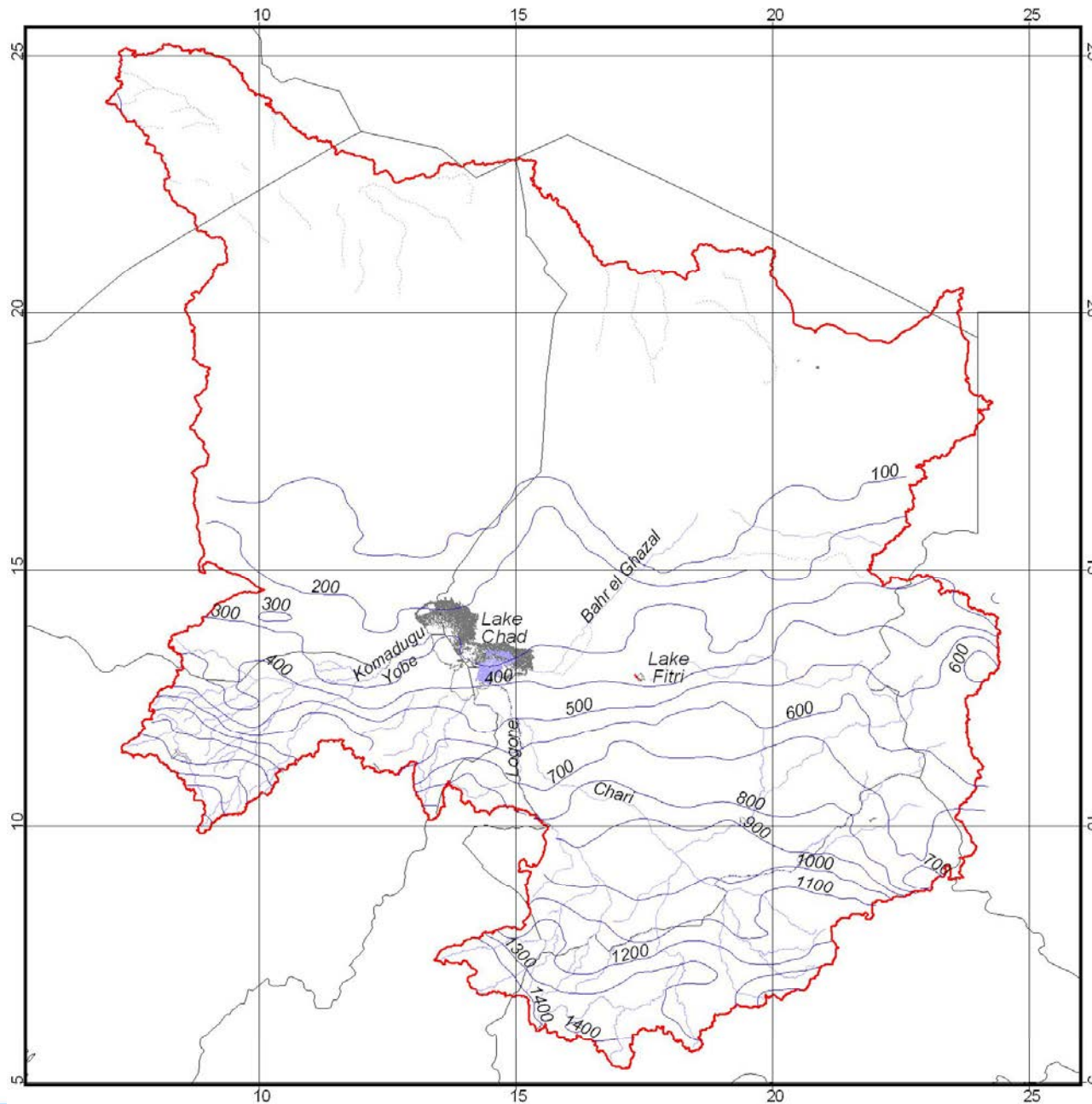
Swamp areas:

- Yaéré
- Lac Tchad
- Lac Fitri
- Massénya
- Salamat
- Komadugu-Yobe

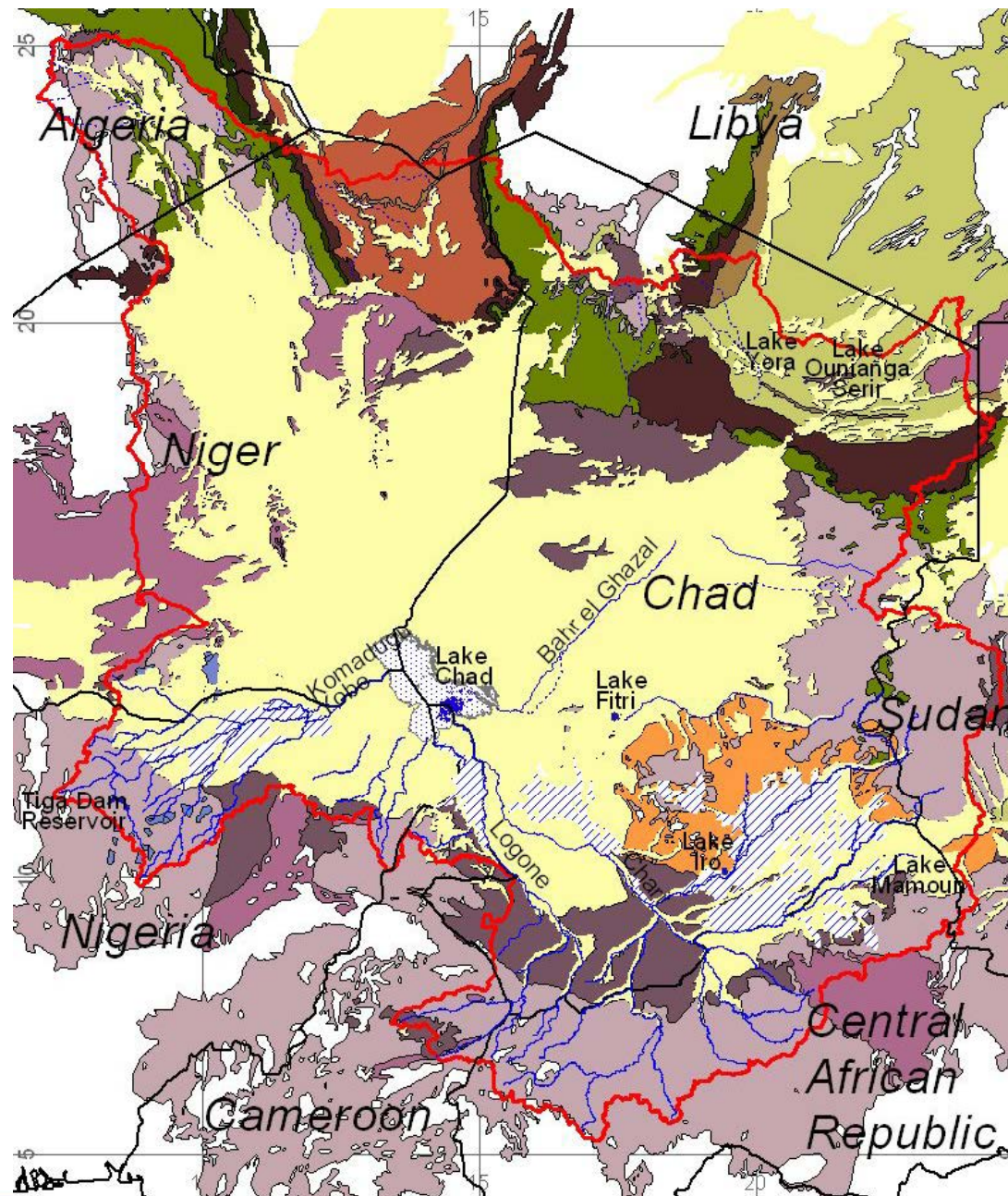




Compiled using
SRTM30 data



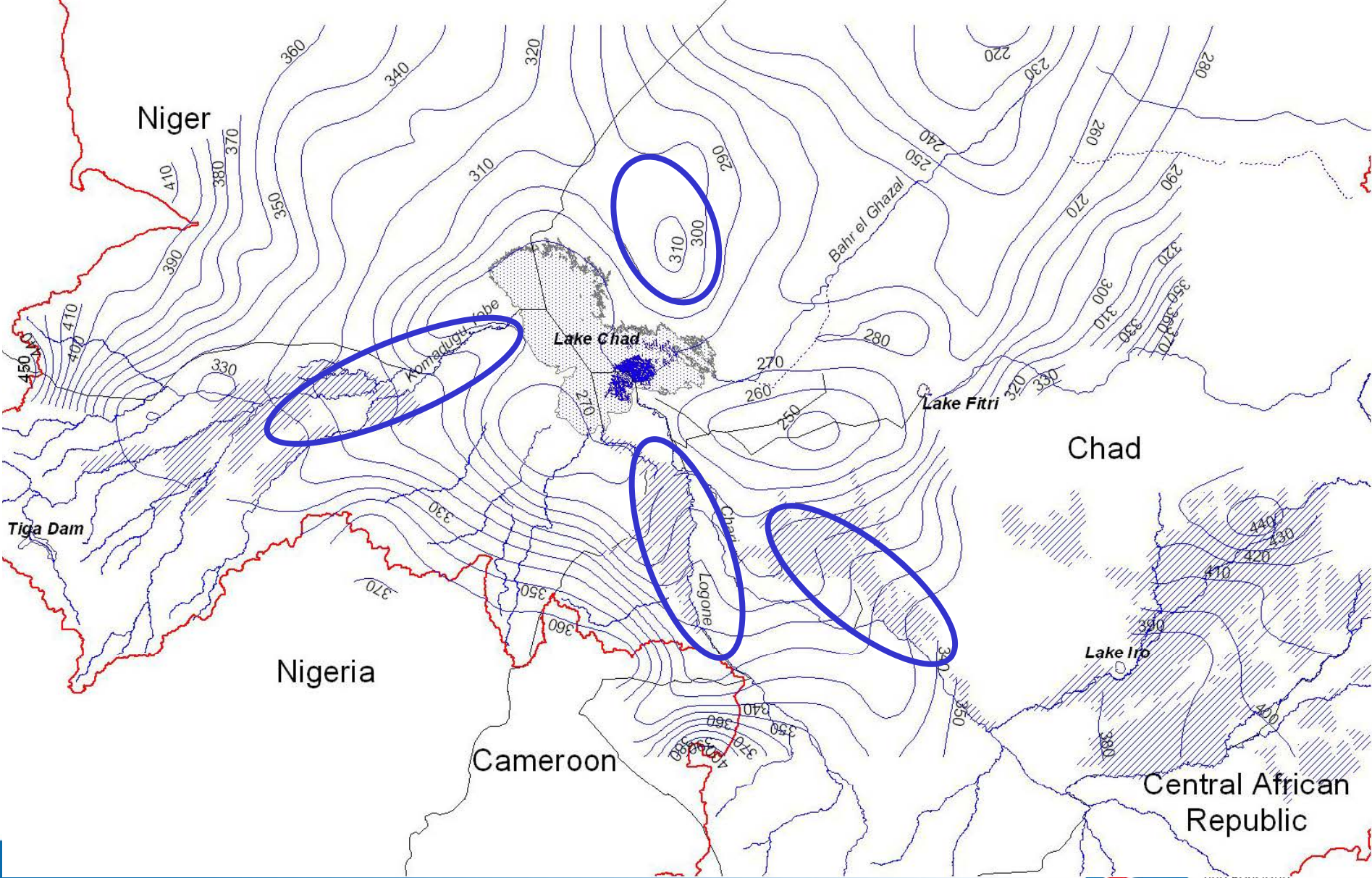
Long-term
mean
1973-2007



Legend

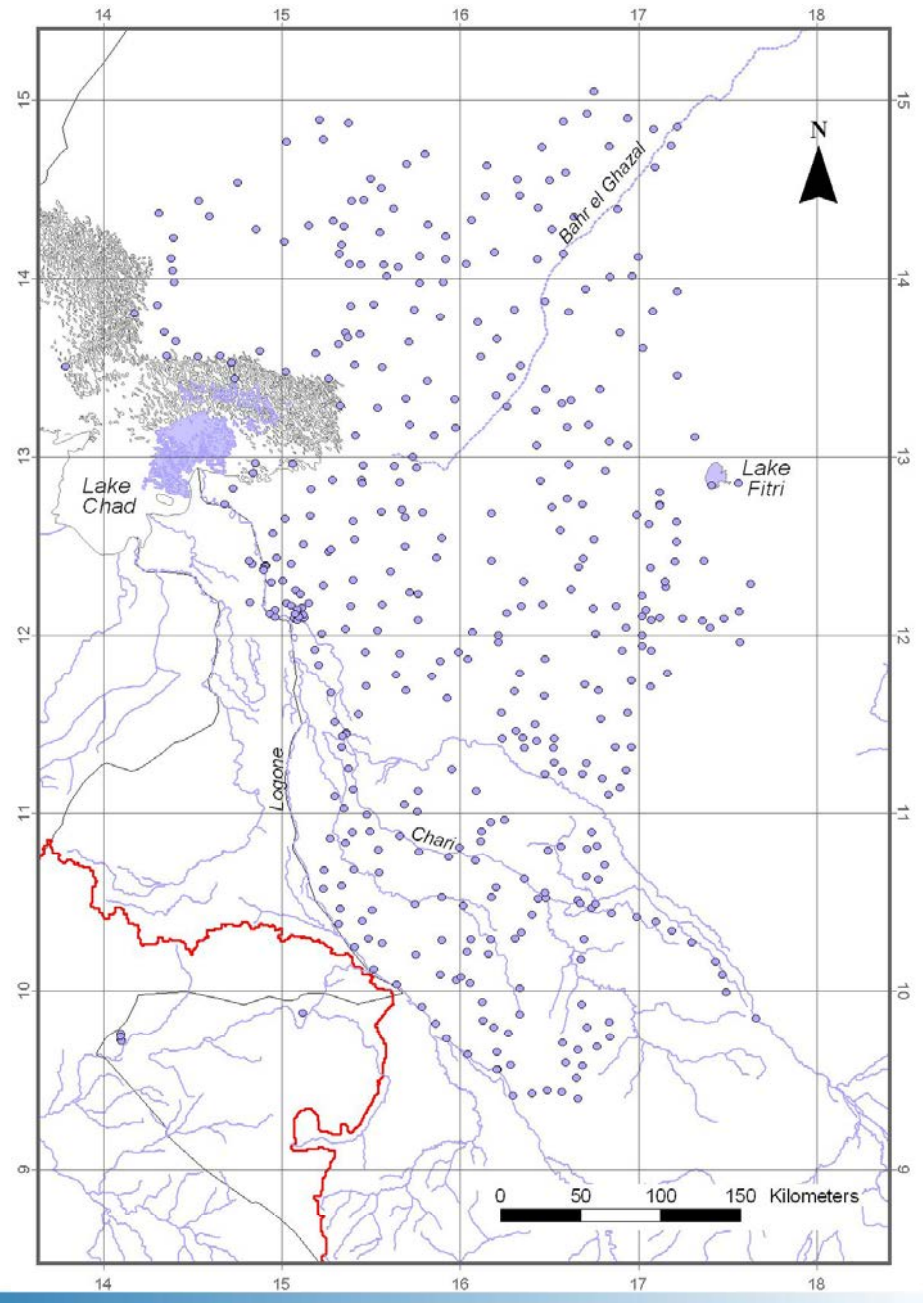
- Quaternary
- Pliocene
- Nubian sandstone
- Tertiary
- Cretaceous
- Jurassic
- Permian
- Carboniferous
- Devonian
- Silurian
- Cambrian-Ordovician
- Basement
- Main rivers
- Secondary rivers
- Lake Chad Basin

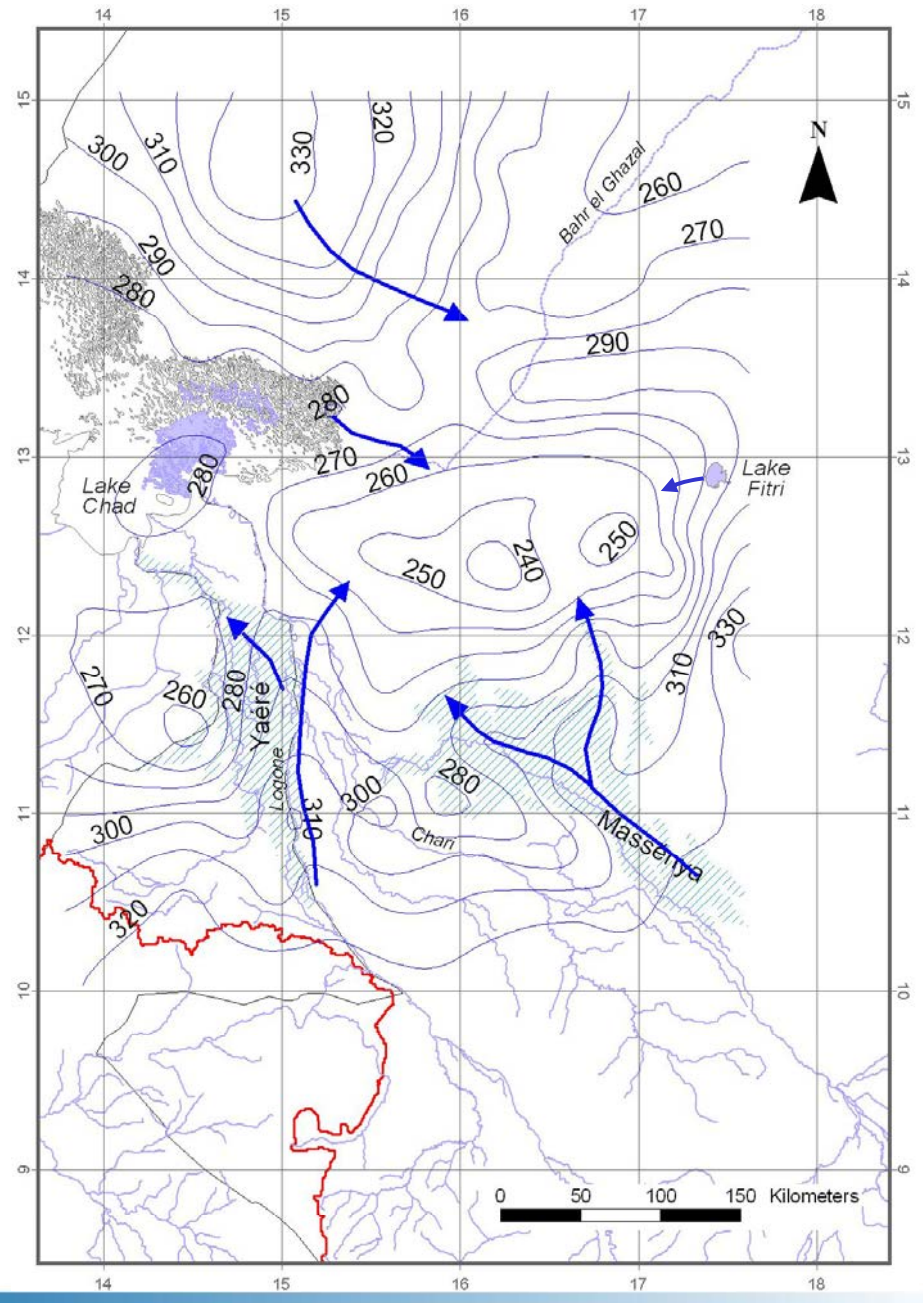
recharge



Investigations

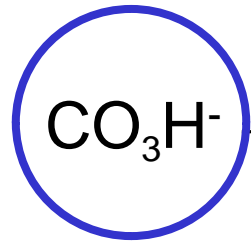
- Location (GPS)
- Water level (groundwater)
- Sampling
 - Anions, cations and tracer elements
 - Isotopes: ^{18}O and ^2H (383), ^3H (54)
- 443 water points (surface- and groundwater)





Hydrogeochemistry

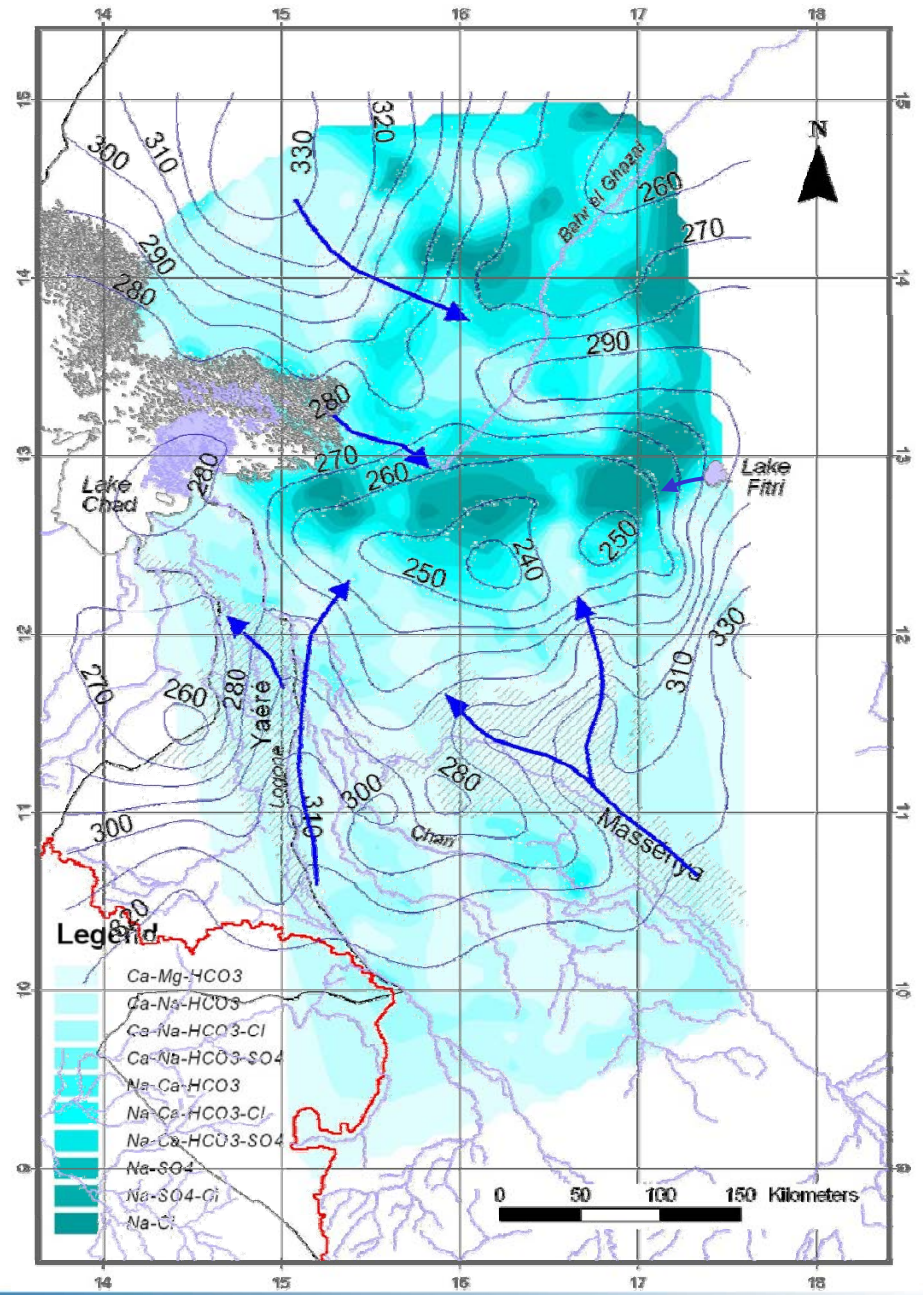
flow residence time in the aquifer



close to
recharge
region

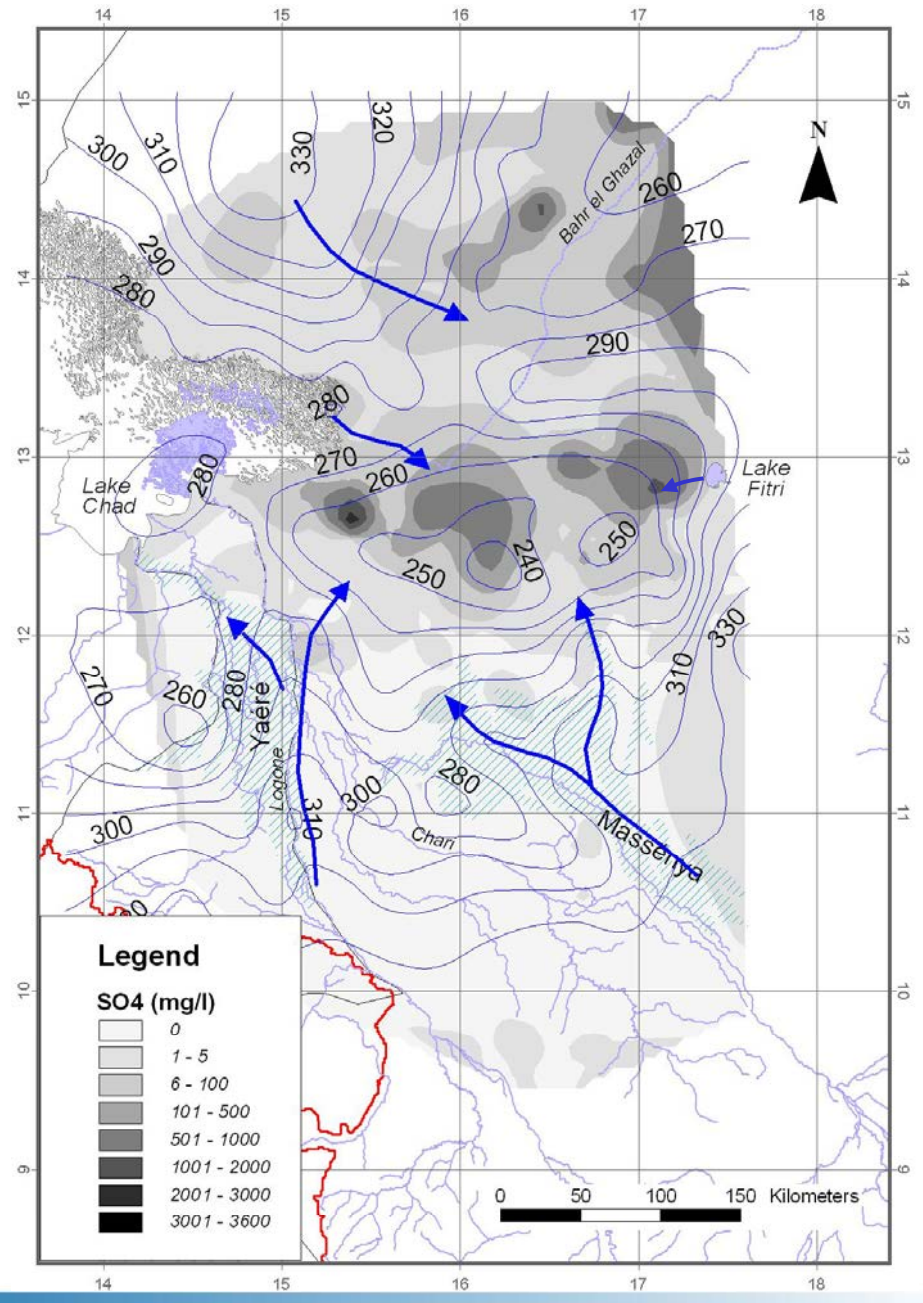


salinity increases



Sulfate

- Does not exist in rainfall
- Surface water in the Lake Chad area with concentrations < 0.5 mg/l
⇒ low concentration at zones recharged by surface water



Isotopes

- H₂O with different atomic weight, due to different number of neutrons in the oxygen and hydrogen molecules

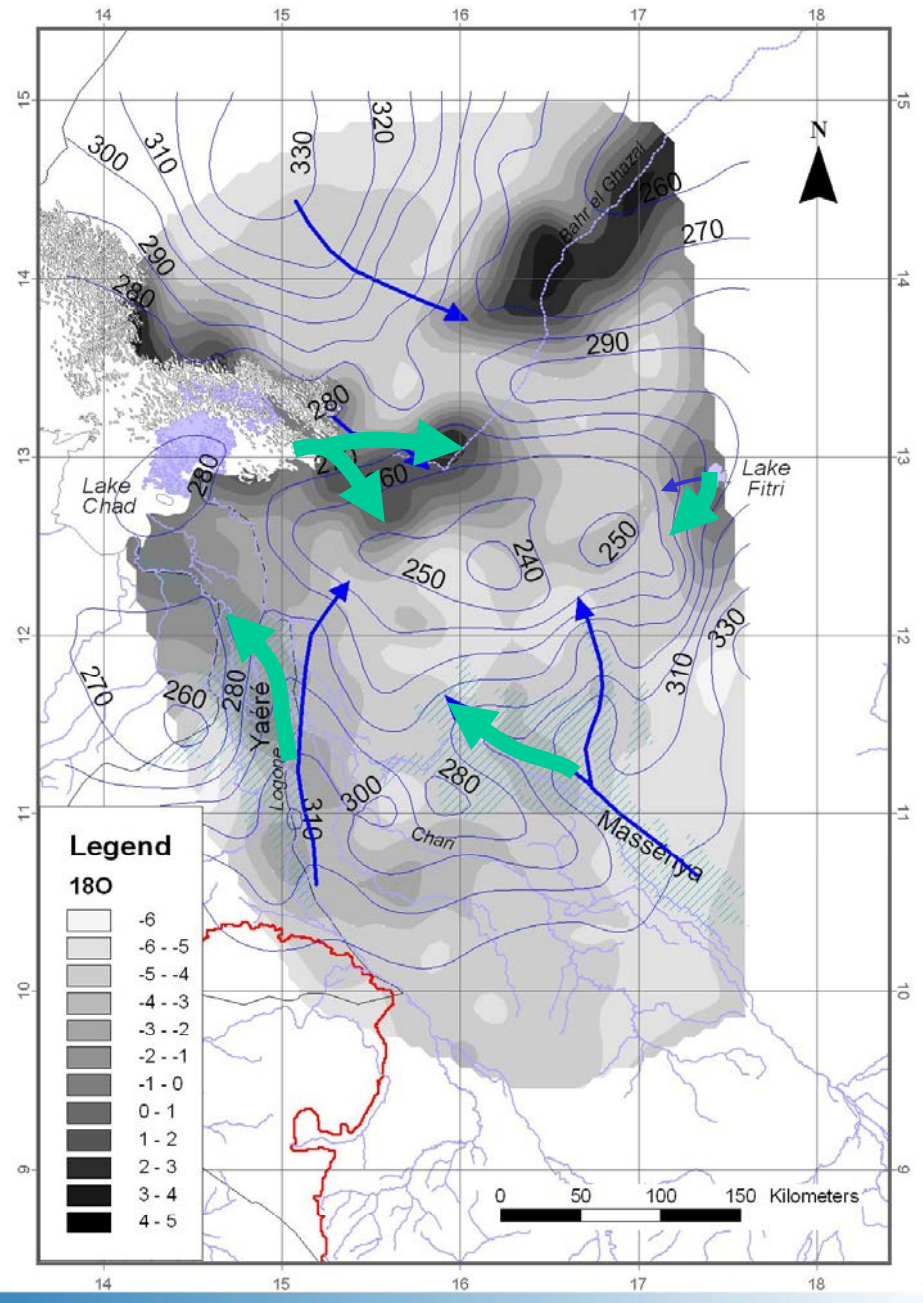


- It tends to rain first the heavy atoms
- It tends to evaporate first the light atoms

Isotopes

- Because evaporation involves light isotopes surface water tends to become „heavy“

⇒ heavy isotopes at zones recharged by surface water (swamps, lakes, rivers...)



Summary

The Quaternary aquifer receives recharge from different sources:

- Leakage from Yaéré, Massénya and Logone River, not from the Chari River
- The Lake Chad “looses” water towards the east-south-east at very low velocity
- At the Kanem region, it received direct recharge before the 70ies

Conclusion

⇒ Swamp areas are essential for groundwater (quantity and quality) and should be protected

Thanks!