Holocene Temperature Reconstruction Lake Greifen Switzerland

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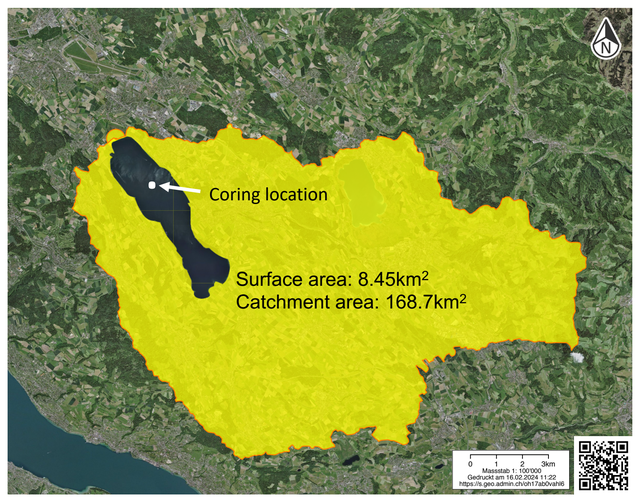
Introduction & Motivation

- The Holocene is globally characterized by relatively stable temperature conditions
- Centennial to millennial temperature trends and regional to global temperature variations remain an area of active research and debate
- Deviations in temperature reconstructions, based on records of different proxies and natural archives, are primary explained by regional climate variations and proxy limitations
- Further research is required to get a better understanding of regional temperature variations, as well as to investigate the applicability and limitations of proxies

- **This study aims to provide a high-resolution Holocene temperature reconstruction through the application of multiple temperature proxies on lake Greifen sedments**

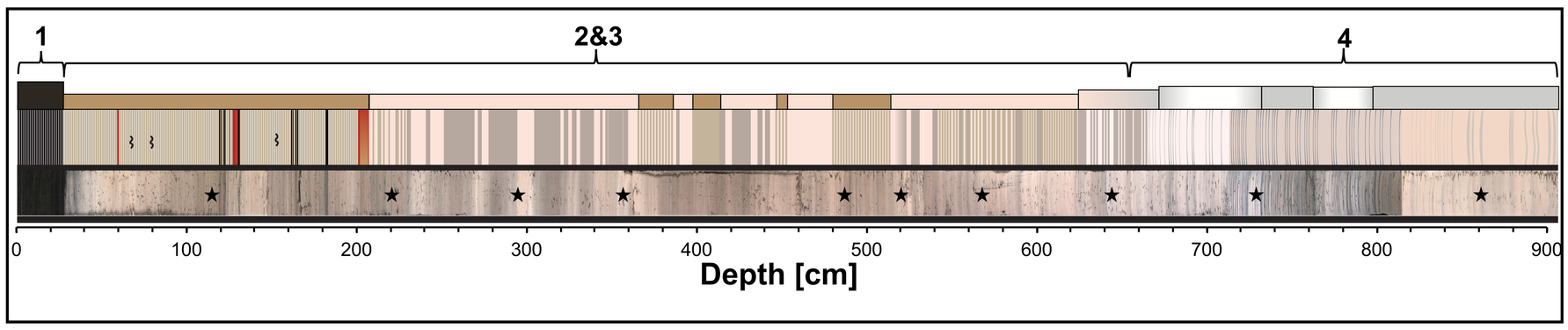


Site description

- Small and shallow lake in the canton of Zurich, Switzerland (47°21'N 8°40'E)
- Formed after the LGM
- Monomictic
- Sediment-formation primarily trough calcite precipitation in surface water

Sediment Core

- **Lithotypes:**
  1: dark laminated (varved) carbonaceous/calcareous mud
  2&3: light thinly to medium bedded & laminated (varved) calcareous mud
  4: grey thinly to medium bedded sandy silts
- ^{14}C measurements ★



Calcite wt%

- Calcite precipitation is primarily dependent on (spring/summer) water temperature
- high wt% of $CaCO_3$ = warmer temp.

$\delta^{18}O$ of authigenic Calcite

- Three factors affect $\delta^{18}O$ of calcite:
  -Temperature
  -$\delta^{18}O$ of water
  -Disequilibrium effects
  (Leng & Marshall, 2004)

BrGDGTs

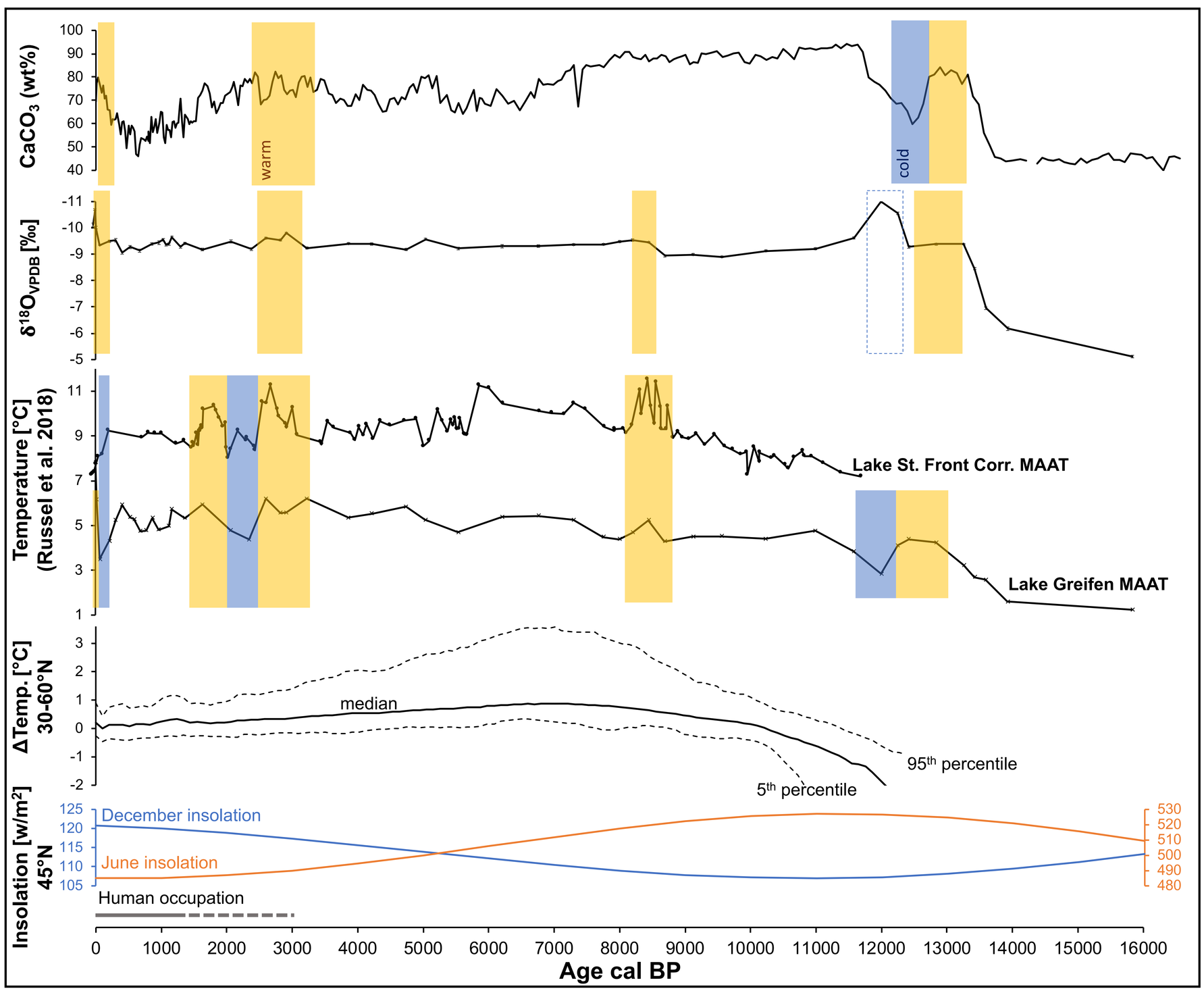
- Distribution of BrGDGT's correlates with mean annual air temperature (MAAT)
- Temperature reconstruction by calibration from (Russell et al, 2018)
- Comparison with Lake St. Front (Martin et al. 2019)

Temperature 12k database

- Extensive database of paleo temperature time series
- Multy proxy mean surface temperature reconstruction (Kaufman et al. 2020)

Insolation

- Change in Insolation is thought to be a main driver of Holocene temperature trends & variations



Preliminary conclusions

- All proxy records show a generally stable trend, albeit with small scale variations
- The $\delta^{18}O$ signal appears to be controlled by both, temperature and changes in water isotopic composition. Additional proxy data is needed to disentangle these competing effects.
- BrGDTGs derived temperature reconstructions trends are reproducible between the different calibrations applied, suggesting applicability of the proxy for temeperature reconstruction in Lake Greifen.
- BrGDTGs show an increasing trend in temperature trough the Holocene
- BrGDGTs -based absolute temperature values are generally offset towards temperatures that appear too cold to be realistic in this setting

Further investigations

- Disentangle temperature and precipitation influence on $\delta^{18}O$ record
- Measurement of leaf wax n-alkanes δD values (proxy for isotopic composition of rainfall)
- Explore which temperature calibration can best be used for BrGDGT record.

References

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