# Validation and application of a novel, terrestrial biomarker-based paleo thermometer to Holocene sediments of Lake Cadagno, Switzerland

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Lake Cadagno is a relatively small glacial lake in southern Switzerland (1921 m altitude). We recovered a 10.5 m long composite core from the lake covering the sedimentary sequence of the last 11000 yrs. Our aim was to reconstruct past mean annual air temperature (MAAT) using a novel, lipid-based proxy, the MBT/CBT paleothermometer. The MBT/CBT ratios comprise fossilised methyl-branched and cyclic Glycerol Dialkyl Glycerol Tetraethers (GDGTs) of presumably soil bacterial origin that are preserved in the sediments. Our results stand in good agreement with instrumental MAAT values for Lake Cadagno (ca. 0°C, Swiss Meteo). Furthermore, temperature variations recorded by the MBT/CBT paleothermometer match published temperature reconstructions for the last two millennia at nearby locations in timing and magnitude. Major climate anomalies recorded by the independent proxies and by the MBT/CBT paleothermometer are, for instance, the Little Ice Age and the Medieval Warm Period. Furthermore, we detected a cold period lasting from about 2400 - 2000 yrs BP (-0.7°C), which correlates with the disappearance of the last lake dwellings in the European Alps. We also found a cold period during the Bronze Age (3500 - 4500 yrs BP; -0.5°C). In alpine regions, strong rain falls typically lead to increased erosion and flood activities, which are recorded in the sedimentary sequence (frequency and layer thickness of flood deposits). Similarly, pronounced precipitation can induce leaching of basic elements and thus acidification of soils, which has an impact on the CBT ratios. We found strongly enhanced flood activities concomitant with a decrease in soil pH during time periods of major cold spells, which also agrees with earlier reports on alpine lake level stands. Our results strongly emphasise the usefulness of the MBT/CBT paleothermometer for terrestrial climate reconstructions.

# Soil carbon sequestration in olive grove with different soil management

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## Introduction

We have simulated the dynamics of carbon (OC) under two soil management systems (tillage soil and cover plant soil) in a Mediterranean olive grove with the RothC model. We choose two soil management (tillage and cover crop) in three locations (L). The soil OC storage was calculate as difference between the content in both management. Carbon sequestration was calculated as difference between simulated RothC input and soil respiration.

## Discussion of Results

| | Clay | OC input | Carbon storage | Carbon sequestration |
|---|---|---|---|---|
| | % | Mg C $ha^{-1}$ $yr^{-1}$ | | |
| L1 | 45 | 9.39 | 4.53 | 6.48 |
| L2 | 50 | 5.51 | 2.18 | 3.63 |
| L3 | 25 | 8.88 | 5.35 | 7.63 |

**Table 1:** clay content and carbon fluxes in the three locations for the first year after soil management change.

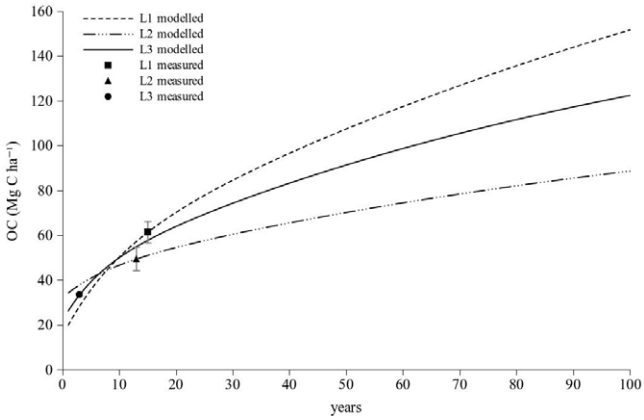


**Figure 1:** OC modelled for the three locations under cover crop.

Differences between the three locations were due to the amount of biomass generated by the cover crop and the clay content. L1 and L2, with high clay content but different carbon input, resulted in high OC for L1 after 100 years (Figure 1). The lower clay content whit high input (L3) was an intermediate position.