



Hydrological conditions determine branched glycerol dialkyl glycerol tetraether distributions in soils of the Iberian Peninsula

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Temperature is one of the key environmental factors driving climate change, but past continental temperature records are constrained by the few proxies that can be applied in these environments. The MBT-CBT proxy is based on the distribution of branched glycerol dialkyl glycerol tetraethers (brGDGTs), bacterial membrane lipids in soils¹. Since the degree of cyclisation of the GDGTs (CBT) was found to correlate to soil pH, while tindex degree of methylation (MBT) correlates to mean annual temperature and soil pH. A combination of these two indices allows the estimation of mean annual temperature (MAT). However, it has been suggested, that other factors such as the hydrological conditions can also influence the MBT², although it has never been tested directly. To assess the effect of hydrological conditions on the MBT-CBT a set of 25 soil samples of the Iberian Peninsula covering a temperature range from 10-18°C and a wide range of hydrological regimes was analysed (405 mm to 1455 mm per year). We found that CBT was significantly correlated to soil pH confirming it even at a regional scale as a robust proxy for soil pH. The MBT was also shown to relate to soil pH, but the expected relation between MBT and MAT could not be established. In fact, the correlation between MBT and MAT was inverse to the one expected according to previous studies and presented large scatter ($R^2=0,2$). Consequently the MAT estimation using the MBT-CBT proxy leads to an underestimation of MAT, which is most prominent at the driest sites and reaches up to 24°C. Instead we found a significant correlation between MBT and annual mean precipitation as well as the Aridity Index (AI)³, a parameter quantifying water availability in soils. This suggests that in dry environments or under moisture shortage the influence of the degree of methylation of branched GDGTs is not coupled to temperature but to the degree of water availability.

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2. Peterse, F., et al. 2012, GCA. 96, 215, 229
3. Trabucco, A., and Zomer, R.J. 2009. <http://www.cgiar.org>