SOIL Discuss., referee comment RC1
https://doi.org/10.5194/soil-2021-109-RC1, 2021

Comment on soil-2021-109

Anonymous Referee #1

Referee comment on "Microbial soil characteristics of grassland and arable soils linked to thermogravimetry data: correlations, use and limits" by Helena Doležalová-Weissmannová et al., SOIL Discuss., https://doi.org/10.5194/soil-2021-109-RC1, 2021

General comment

This paper tries to connect soil thermal fractions with different chemical and biological properties. This connection is well referenced by literature and there are different studies reporting results about this topic. In this paper, authors change the common procedure trying to settle correlations using soil fractions from very narrow temperature ranges and they relate this narrow ranges versus total C, or total N or total microbial biomass and microbial activity. The last is difficult to understand and it is causing spurious correlations since those temperature intervals are changed based on the existence or not of the correlation. It is not clear the real goal of this work and which is the advantage of the procedure. Authors also report a high number of correlations without an interpretation of the equations obtained.

Specific comments

Introduction

Lines 45 to 50: It is truth that the organic mass lost by thermogravimetry can be overlapped with clay mass and carbonates depending on the clay types and clay content of samples, but evaporation occurs before the organic mass starts to combust and it can be determined by thermogravimetry as the mass lost from 50 to 180 ºC.

Lines 50-51: only to try to separate CO2 and water from clays and organic samples…….which is not possible even by those methods because the CO2 from clay and

organic matter overlaps from 200 to 650 ºC. This is significant for soils with low organic C content but not for soil with high C content where the contribution of clay masses is very low. I do not think they can be argued as limitations in the superficial way that is done by authors.

Line 59: Check the sentence after the references. It is the term "vary" correct there?

Experimental

2.2 TG analysis and TML determination

Lines 85-86: Considering that samples are combusted through the temperature scan, and that water is lost only during the first 180 ºC (excepting adsorbed water in clays) and can be easily measured, what is the reason for the procedure exposed dealing with RH?

Lines 88-90: Most of studies using TG for soils report air flows of 50 ml/ min and temperature rates of 10 ºC / min. There is literature showing how these rates may change the evolution of the DTG curves. Is there any reason for changing those rates to 100 ml/min and 5 ºC / min?. Specifically, too fast air flow rates can limit the complete oxidation of the organic matter.

Lines 92-93: I do not know what you mean as "the obtained dependences of mass loss on temperature were averaged". Do you mean the soil organic matter was fractionated for different temperature intervals and shown as the average of the three replicates done? What you write is not understandable.

2.3 Determination of chemical and MB properties of soils. What is MB here? Why do you symbolize *Microbial soil properties* as MB? Would not it mean Microbial Biomass, MB ?

Lines 125-127: Why the water content change from 60 % of WHC for RB to 40 % of WHC for Rs? Substrate induced respiration adding glucose depends on water content as basal respiration.

2.4 Statistical data treatment

What is TML/LTML´s ?

What is the sense of searching for correlation with TMLs for such a low interval of temperature, 10 ºC? What is the connection of a 10 ºC soil organic matter fraction with any of the mentioned properties? To me, that criterion may yield spurious correlations. In special if you use as a criterion to increase the temperature interval when there is not a correlation with the 10 ºC interval until you find the correlation.

Then, how you can compare two sets of independent samples that have "different number of samples"? 11 grasslands versus 5 grasslands, and 21 arable samples versus 10? That is against the comparative criteria settled by statistics.

I do not think the statistical design be correct.

Results

Figure 1: Do you represent the same SOC of one sample versus the 94 different TMLs? What is the sense of this method? What is the advantage to show results by this way? From my perspective it results very confusing and difficult to interpret. Which is the meaning of the negative correlations observed for some of the parameters?

How can you explain the high correlation for RS values from 300 to 450 ºC if you added glucose? Priming effect? Is not the glucose added consumed but the C soil?

Line 172-173: Which are the criteria to select LTMLs? In fact, the fractions would be the ones settled for the labile and recalcitrant organic matter which is something very well known.

Which the usefulness or advantage of Table 1?

Discussion

Authors can not explain most of the results obtained excepting the common ones linked to chemical soil properties.

Arguments exposed for the differences of TN among grassland and arable lands are

speculative. Lower correlation simply would involve less organic N since it is not as attached to the mass lost from 200 to 450 ºC as in grasslands. The content of inorganic C, clays and carbonates of the samples could be influencing also the results.

Lines 205-206: what do you mean as "prediction of microbial activity" by the TML? In special by TML100, the fraction where evaporation starts and volatiles taking part of the organic matter are lost.

Table 3: As an example, the first equation shows the highest correlation with SOC at 200-300 ºC for grasslands and at 300-450 for arable lands. Do you really think we must use that equation to calculate SOC from those intervals? What is the really meaning and advantage of those equations given for such a narrow range of temperature? What is the meaning of the slope , SOC per degree of temperature? Or is that most of the soil C is lost so fast from 200 to 300 ºC? What is the meaning of the ordinate, the A value of the straight line?

Table 4: That is only for the temperature interval given in Table 4? What is the criterion to settle the applicability?

With respect to Cbio: Can we consider calculating the soil microbial biomass by the equations in table 3? Both are quite similar with the exception of the A value. What about the difference?

Lines 260-265: It follows the same trend of the carbon. Why the correlation is lower with most of the parameters you use after 400 ºC? SOM percentages obtained by TG from 180 to 600ºC usually correlate well with total C and organic C in literature. That is the correct way to settle the correlation since what you measure is the total C and N in soil. Your procedure makes sense if you could obtain the C for the same temperature intervals by the elemental analysis.

Conclusions

First paragraph: This paragraph is confusing because of the vague definition of MB commented before. TG is an useful technique to calculate soil organic matter, SOM, and there are different references about correlations of the thermal SOM fractions given by the TG with soil elemental properties and even with soil microbial metabolism.

Lines 269 to 271: You have to check that in your paper. There is not experimental evidence in your paper for that conclusion.