Dear editorial support team,

We are pleased that the two referees were quite positive about our study, and we are grateful for the time and consideration the SOIL EGUsphere team and reviewers have put towards reviewing our manuscript. The reviewer comments were very appreciated and will help improve its quality. We have done our best to address the comments constructively, as described in more details below.

On behalf of me and my colleagues

Yours sincerely,
Dr. Lauren M. Gillespie

Response to the comments from RC1:

Response: thank you very much for the nice words and constructive comments. We have addressed the minor comments individually below:

RC1: 'Comment on egusphere-2023-255', Anonymous Referee #1, 18 Apr 2023

In their manuscript the authors present results of a study using innovative monitoring technique for analyzing greenhouse gas (GHG) fluxes from forest soils in a mountainous region in Austria. The authors hypothesize that particularly inclination of slopes and the distance from an adjacent stream are important site properties which could explain differences of GHG emission or uptake. Both parameters can be expected to be closely correlated with soil properties like moisture and temperature, which both influence soil biological activity. The results of this well-planned study were carefully statistically analyzed and some of the assumptions could be confirmed, others had to be rejected. In general, the manuscript is written in a precise manner and conclusions are drawn clearly based on the presented and carefully interpreted results. The topic fits well to the scope of the journal and only some minor issues, as listed below, should be considered before the paper seems to be ready for publication.

1. l. 50: Could you please add some information about the processes behind N_2O uptake by soils?

Response: We propose to add:

"Net N_2O uptake (from the atmosphere into the soil) is a complex process closely tied to N_2O consumption (within the soil) that is driven principally by denitrifying bacteria (Liu et al. 2022)."

Although we do not have space to fully explain soil N_2O uptake and N_2O consumption in this study, since it was not the primary focus, the readers will now be able to find additional explanations in the newly added reference.

Liu, H., Li, Y., Pan, B. *et al.* Pathways of soil N_2O uptake, consumption, and its driving factors: a review. *Environ Sci Pollut Res* **29**, 30850–30864 (2022). https://doi.org/10.1007/s11356-022-18619-y

2. l. 98-102: Hypotheses:

   a) In the hypotheses you speak about "inclination *per se*". Could you please explain, what is exactly meant with "*per se*"? For me inclination is mainly a proxy for other directly influencing site or soil parameters like soil moisture of temperature.

Response: We agree with Reviewer 1 that the three "*per se*" 's in the hypotheses do not add any meaningful information and lead to confusion. We will remove them.

   b) Hypothesis No. 3 addresses potential impact on "N_2O emissions". In the following results and discussion sections the term "N_2O fluxes" is primarily used instead of "N_2O emission".

Response: We thank Reviewer 1 for bringing this to our attention. We will make sure to use 'emissions' and 'uptake' when appropriate and only use 'fluxes' when referring to both emissions and uptake.

   c) In the results section data on N_2O uptake are provided but there is no related hypothesis.

Response: N_2O uptake had only recently been measured reliably thanks to advancement in equipment and is generally minimal in comparison with emissions. We believe it important to report on this N_2O uptake since its existence is interesting, but it does not merit a dedicated hypothesis since its occurrence is infrequent and unlikely to play a dominant role in soil greenhouse gas fluxes.

3. 116-117: Some additional information about the investigated forest sites would be helpful here. Are all locations covered by the same tree species or what about the exposition of the slopes?

Response: We agree and will add the exposition of the slope and the adjacent tree species.

4. 172/l. 237/Tab. 1: It is mentioned that the investigated soils have a larger stone content, which is also confirmed by the data in Tab. 1. However, bulk density – explicitly including the coarse soil fraction – with values clearly below 1.0 g cm^{-3} is very low and values of 0.15 or 0.12 g cm^{-3} seem to be unrealistic. The reason for this low bulk density should be explained and data checked (see comment on Tab. 1 below).

Response: Thanks for spotting this; there was indeed an issue with the values in Table 1 (see our response to Reviewer 1's comment 6; the corrected Table 1 can be found in the Supplement document) and the 0.15 and 0.12 g cm^{-3} were incorrect. This has been corrected in the table at the end of our comments to the reviewers. We consider bulk densities below 1.0 g cm^{-3} (0.6-0.8 in our case) are realistic and common for forest soils (Beguin et al. 2017; Llek et al. 2017), even considering the stone content (7-13 % vol).

Beguin, J., Fuglstad, G. A., Mansuy, N., & Paré, D. (2017). Predicting soil properties in the Canadian boreal forest with limited data: Comparison of spatial and non-spatial statistical approaches. *Geoderma, 306*, 195-205.
Ilek, A., Kucza, J., & Szostek, M. (2017). The effect of the bulk density and the decomposition index of organic matter on the water storage capacity of the surface layers of forest soils. *Geoderma, 285*, 27-34.

5. 218: Please write the term abbreviated as "AIC" in full when the abbreviation is used for the first time.

Response: Ok, this will be added.

6. 234-239/Tab. 1: Please check this section and the data provided in Tab. 1: According to Tab. 1 litter depth and weight has lowest values at GC5 not at GC0.5. The same is true for soil C and N content. The data shown in Tab. 1 obviously need some corrections: E.g., pH values of 0.65 or 0.34 in soils (as shown for GC5 and GC15, respectively) are extremely unlikely and also C:N ratios of 1.35 or even 0.81 are not really realistic. Most probably, some of the average values and values of standard error have been exchanged in single columns and for some of the parameters.

Response: We are very thankful that Reviewer 1 brought this to our attention. There was indeed an issue with the updated table. This has now been corrected which can be found in the Supplement document. The values are now consistent with the observations made in the text.

Table 1: Average value and standard error of litter and soil parameters at each distance from the stream. "CG" indicates chamber group, with the numbers 0.5, 5, 10, and 15 defining the distance to the stream (m). Different letters indicate differences between distances (Dunn multiple comparison test after Kruskal–Wallis test, $p < 0.05$) for each variable.

Variable	Unit	Distance			
		0.5 m	5 m	10 m	15 m
Litter depth	cm	4.4 ± 0.7^{a}	7.0 ± 1.2^{ab}	8.5 ± 1.0^{b}	8.0 ± 1.4^{b}
Litter weight	g m^{-2}	147.7 ± 23.1^{a}	311.8 ± 47.0^{ab}	358.5 ± 100.0^{ab}	622.2 ± 362.1^{b}
Soil N content	%	0.25 ± 0.06^{a}	0.39 ± 0.09^{ab}	0.6 ± 0.26^{b}	0.42 ± 0.18^{ab}
Soil C content	%	4.12 ± 0.78^{a}	6.35 ± 1.65^{ab}	10.15 ± 4.8^{b}	7.85 ± 4.29^{ab}
Soil CN ratio		16.56 ± 1.35^{a}	16.24 ± 0.81^{a}	17.07 ± 1.81^{a}	18.23 ± 1.99^{a}
Bulk density*	g cm^{3}	0.81 ± 0.15^{a}	0.73 ± 0.12^{a}	0.6 ± 0.11^{a}	0.81 ± 0.08^{a}
Volumetric stone content	%	7.59 ± 8.4^{a}	7.84 ± 2.57^{a}	10.79 ± 2.78^{a}	13.16 ± 2.24^{a}
Porosity†		0.75 ± 0.01^{a}	0.79 ± 0.03^{ab}	0.87 ± 0.04^{b}	0.80 ± 0.02^{ab}
Organic material	%	9.25 ± 1.4^{a}	13.87 ± 3.73^{ab}	20.86 ± 8.01^{b}	16.70 ± 7.02^{ab}
Soil pH		5.57 ± 0.65^{a}	4.00 ± 0.34^{ab}	4.01 ± 0.34^{ab}	3.78 ± 0.31^{b}
Sand content	%	598.970 ± 7.5^{a}	52.0 ± 9.5^{a}	40.6 ± 3.7^{a}	41.6 ± 4.4^{a}
Silt content	%	38.5 ± 7.7^{a}	45.1 ± 8.5^{a}	53.1 ± 4.5^{a}	52.0 ± 5.0^{a}
Clay content	%	2.5 ± 0.3^{a}	2.9 ± 1.4^{a}	6.3 ± 1.4^{b}	6.5 ± 0.7^{ab}

*with coarse material

†without coarse material