

Interactive comment on “Soil CO₂ efflux from mountainous windthrow areas: dynamics over 12 years post-disturbance” by M. Mayer et al.

Anonymous Referee #2

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Mayer et al. examined the 12 year dynamics of soil CO₂ efflux on mountainous windthrow area (BGD 11, 6383-6417).

The topic of the current manuscript is interesting and also important. Already decades it has been observed that in the conditions of climate change, heavy winds and storms are more frequent in our region. In today's Europe, wind disturbances are the disturbance type that influences the biggest land areas, thus it is important to have an idea/knowledge what consequences it has.

Below are my comments on the manuscript.

General comments.

The authors have tried to present the 12 year dynamics of soil CO₂ efflux on moun-
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tainous windthrow area, and at the beginning I had an impression that they are really dealing with windthrow areas, but actually they are dealing with managed areas after the windthrow, as the material was removed from the areas - this small detail, that the material was removed, was coming out somewhere in Material and Methods, but it must be clear already when reading the abstract and it must be clear also when stating the objectives and hypothesis in Introduction. I would also consider some change in title, to make it clear already there, that we are dealing with forest areas that are managed after windthrow. I have also some concerns considering study design and how the data collected with such design was analysed and interpreted. It is obvious that these two areas (Rax and Höllengebirge) are so different from each other (soil, stand, climate conditions, etc.) that they must be treated separately and one must be really careful with conclusions like have been drawn out in Fig. 4. But in general the manuscript is interesting, language is good and fluent and the graphical part is also solid.

Specific comments P6384 L5-9: Like mentioned earlier, it must be clear already in Abstract that we are dealing with forest areas that are managed (material was removed) after windthrow.

P6384 L13-14: You are using two phases after windthrow (1-6 and 9-12 years after disturbance). How do we know that the soil was the same on these two areas? Maybe on the area 9-12 years after disturbance, the soil CO₂ efflux was higher already from the beginning, straight after storm. When comparing the CO₂ effluxes from control areas (both sites), we can see that the fluxes from Höllengebirge are much higher, it may affect and probably affects also the post-disturbance fluxes.

P6387 L13: Where the areas totally damaged or partially damaged after wind disturbance? If the material was removed after windthrow, were all the trees removed (also the ones that survived the wind disturbance)? What about uprooted trees, how many of these you had in the areas – if the area was cleaned after windthrow with cable yarding operations (that is not damaging the surface so much in my idea), but you had

a lot of uprooted trees there, with exposed mineral soil layers, this is affecting a lot soil respiration (specially if you have calculated annual sums later). All these things must be somehow mentioned here and described also in Material and Methods section

P6387 L25: As we can see from here these are completely different forests (coniferous dominated and mixed forests) means also different site type and soil chemistry – how you can assume that the initial stage was the same, when combining this data later.

P6388 L5-6: Among the other differences between the sites there is also huge difference in average air temperature – can this be a reason also for different soil temperatures? How this can affect your data interpretation and results? Think it was not mentioned also in Discussion.

P6388 L19: “blown over or suffered wind-snaps” – means there was windthrow with uprooted trees and broken trees (see my comment already on P6387 L13). Were the pits and mounds of the uprooted trees taken somehow into consideration – the CO₂ efflux values from there are completely different compared to undisturbed forest floor (soil not exposed).

P6389 L1: Here you are mentioning first time, that the area was cleaned after windthrow. It must be stated already earlier! Were the areas totally cleaned (also survived trees removed) or some trees were left to the area?

P6389 L9: It was stated that the sites were similar regarding bedrock and soil conditions, but we are missing here some basic soil parameters (pH, C stock, fractionation, etc.) to state that. And obviously if we are dealing with pure coniferous stand and mixed stand, the soil pH and C stock may be different when comparing the sites.

P6390 L21: You mentioned that 65 plots out of 89 in Höllengebirge were used for further analyses. What about these 24, where they then used at all, if not why to mention them at all? Right now there is a lot of talk with 89 plots and then suddenly it was stated that only 65 was used – it makes the things confusing.

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P6390 L25: What is the definition of the plot in this study? How big it is? I can understand that on the plot there is one collar for soil respiration measurements and one 1x1 quadrat for ground vegetation measurements and somewhere also the soil temp. and moisture was measured and that's it. Is the plot and 1x1 square the same and where then the collar is located?

P6391 L4: For how long the concentration increase inside the chamber was measured? 60sec, 120 sec? Why this time was chosen?

P6391 L11-13: This is one of the biggest problem in this work. If measurement cycles took 8 (14) h, and this was done with one day, then we have huge temp variation in these measurements? The temperature in soil changes a lot within 8 (14) hours. And you have stated that plots were measured in the same order through entire study, means some plots were always with much higher soil respiration then others (and this occurred through entire measuring period). Which ones where with the highest temperature? How the measuring order looked like? I'm concerned that this is strongly affecting your results and conclusions, but cant be sure before can have the description about the measuring order.

P6392 L22: From where this 34 vol% is coming? Is it based on your data? I haven't seen any explanation for that value (no graph, no explanation).

P6393 L3: And now from where this 40 vol% soil moisture is coming. Earlier you were saying, that everything above 34 vol% should be OK, as below it soil respiration decreased sharply. Why not to use 35 vol% for example. I'm not trying to ironize here, just you are not explaining from where the parameters are coming.

P6393 L10-11: If you have used F_{soil} through entire text for Soil CO₂ efflux, why to jump now back. Use the same terminology through entire text.

P6394 L24: If you have pointed out the average soil moisture over the whole study period for Höllengebirge, why not to do this also for Rax.

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P6395 L2: No need to give abbreviations for soil CO₂ efflux again. Use only the abbreviation as it is explained already earlier. The same problem continues through entire Results section

P6395 L7-10: It is clearly seen (from the Fig. 4) that we have the difference between the sites (Rax and Höllengebirge), so In my opinion you cant but these two sites together. If we would use only Rax, as this site covers a lot of the “years since disturbance” can we say clearly, that there is rebound and increase during years 6 to 12 after disturbance. And when calculating the curve (parabolic function) in Fig. 4. You cant use both sites as the sites are clearly different from each other.

P6395 L14: Again, I would like to see how this 34 vol% is found?

P6396 L8-13: Are these average annual sums of soil CO₂ efflux already reduced values (because of rock outcrops)?

P6396 L 16-23: Why there is no data presented about Rax area when talking about ground vegetation cover, although in Material and Methods section it is stated that the survey was done there also and some of the results are also visible in Fig. 6?

Table 1: Why to separate the p values into three different categories? What it gives? In Material and methods section it was stated that the $p < 0.05$ was used.

Table 2: Why we have only info about Höllengebirge site, but not for Rax site?

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