Reviewer 2

Anonymous Referee #2:

General comments The manuscript entitled " Phosphorus Transport in Subsurface Flowat Beech Forest Stands: Does Phosphorus Mobilization Keep up with Transport? ",written by Michael Rinderer, Jaane Krüger, Friederike Lang, Heike Puhlmann, and Markus Weiler, presents valuable results that contribute to the understanding of phosphorus transport in and phosphorus losses from the soil. The topic falls into the scope of Biogeosciences. The manuscript comprises results from large sprinkling experiments at three beech forest sites in Germany. The methods are adequate to test the research questions. The results are described in detail and can be used to answer the research question. The text is easily understandable, tables and figures are well-arranged and the conclusions are sound. Hence, I would recommend to consider this manuscript for publication in Biogeosciences after minor revision.

We thank the reviewer2 for his/her positive assessment of our paper manuscript and the useful comments to improve the text. In the following we respond to each comment. Also here we have uploaded a pdf file as supplement that provides a response (in red color) to each of the comments suggested.

Specific comments

L 14 The values differ from those in Tab. 1.

We corrected the values to match Table 1.1

L75/76 The time of the two experiments was not well chosen if microbial conditons – like soil moisture, temperature, litter fall – should differ. Rather late autumn/early winter (november; wet, cold, a lot of litter) and summer (july/august; dry, warm, less litter) should have been chosen.

We agree that a stronger contrast in seasonality would have been better to evaluate seasonal effects. However, this was a sub-ordinate part of the study and is therefore not listed as a separate research question in our paper. Still we think it is interesting to mention our results in the text. When choosing our days of sprinkling we were restricted to the vegetation period (i.e., the time when trees had leaves and active photosynthesis) as we were also monitoring tree water uptake and P-transport in trees during the subsequent 4 to 6 weeks after the sprinkling experiment (papers in preparation).

However, we will rewrite the text as follows:

"We performed two sprinkling experiments at each site to capture potential differences in P fluxes within the vegetation period (i.e., between summer/fall and spring). …"

And we deleted the part "…and litter fall is not evenly distributed across the year." from the manuscript.

L 227 trise20 of the event water fraction is in Tab. 5 and trise20 of SSF in Tab.4

Thanks for pointing this out. We corrected it.

L 233-252 Results of the statistical analyses are not displayed anywhere and the statistical approach is not described in the materials and methods section.

In addition to Figure 4 we will add another figure that presents the results in form of boxplots that better illustrated what we describe in the text. We also add a paragraph in the method section.

L 295/296 "A peak of high event water at the beginning of the sprinkling experiments,..." I could not find this result in the presented data (Fig. 3?).

We agree that this is difficult to see as the total SSF at the beginning of the event is small in general. We will upload an example plot that shows new water fraction as a function of time. However, the high content of pre-event water in SSF during the entire experiment suggests, that preferential flow is a secondary process.

L 302 Tab. 1 (skeleton content) and Fig. 1 (soil bulk density)

We will add/correct the cross-references

L 315-317 Why is the Ptot concentration from the mineral soil in vertical SSF in MIT lower than from the forest floor?

Probably your question aims at the fact that only in MIT the Ptot concentration in LATERAL SFF from mineral soil is higher than in the LATERAL SFF from the humus layer. A possible explanation is given in Line 317-320: "*This is explained by the difference in P-stocks of the forest floor and mineral soil of the three sites. While Ptot stocks in the forest floor at MIT are only 7 g/m^2 it is almost 2 times higher at CON (13 g/m^2) and almost three times higher at TUT(19 g/m^2) (see* ***Error! Reference source not found.****). On the contrary the Ptot stocks in the mineral soil at MIT (624 g/m^2) are almost 3 times higher than at CON (230 g/m^2) and more than three times higher than at TUT (189 g/m^2)".*

In addition lateral SSF from the forest floor at MIT was larger than lateral SSF from the mineral soil while this is not the case for CON and TUT (see Fig. 3b)."

L 339/340 This is only true for vertical SSF, isn't it?

Yes, we will add vertical SSF

L345 This is predominately the case for LY1B, isn't it (Suppl. Tab.1)?

Yes, we will delete the sentence in L345f and fit the information at the end of section 3.4.1.

L 350/351 Which soil properties?

We add e.g. , drainable porosity

L 361 It is unlikely that adsorption explains the difference, since adsorption is very small in the forest floor. How large was the P flow from the 3 sites in g/m2 (in cormparison to the soil P stocks of the 3 sites)? Compare it with values from the literature that you cited in the introduction (L 30 and others).

We will rewrite this part to make clear that we think most of the lateral SSF from the forest floor is likely to occur at the contact face between the relatively high permeable forest floor and the lesser permeable mineral soil. So TR1B likely receives water that was flowing at or near the surface of the mineral soil towards the trench. Along this surface of the mineral soil, adsorption can happen. LY1B is installed below the forest floor but on top of the mineral soil and therefore collects water that did not have contact with the mineral soil.

Tab.2 Why was the soil depth of the installations in the subsoil in CON different from MIT?

The depth of installation was adapted to the depth of the soil horizons that differ between sites.

Tab. 4 and 5: You abbreviate both variables with trise20; better add "in SSF" in Tab. 4 and "in event water fraction" in Tab. 5.

We will do this

Fig. 3b Reorder the labels (TR1B, TR2B, TR3B)according to the labels in Fig. 3a (from forest floor to saprolite).

We will address this in the final version

Fig. 5 The unit of the flow on the x-axis is mm/h, isn' it?

Yes, we will change that. Thank you!

Technical corrections:

Thanks for pointing these issues out. We will address all technical corrections

L 29 forest ecosystem -> forest ecosystems

L 66 In biopores-> Biopores

L 171 chemotatic -> chemostatic

L 225 paranthesis is missing

L 287suction caps -> suction cups

L 332 Makoswski et al -> Makowski et al.

L 338 suggest-> suggests

L 345 was -> were

L 357 and 370 expect -> except

Tab. 1 Dominant vegetation and Annual precipitation for TUT: d -> c

Fig. 5 and Fig. 6 Labels -> Label