Response to reviewer 1 (Dr. Alejandro Gonzalez-Ollauri)

The reviewer's comments are in normal font and **the authors' responses are in bold font.**

I found your study very interesting and sound. I particularly liked your experimental desing and the approaches followed to showcase the results. Well done! I think your study will be a good contribution to the field of stemflow and will animate discussion.

We would like to thank Dr. Alejandro Gonzalez-Ollauri for all his comments and time spent reviewing the article. We are glad to hear that he sees the timeliness of the messages conveyed in our paper.

However, I am suggesting some major revisions of the text to help convey the message more clearly and to contextualise the study a bit better. I am also suggesting to slightly tone down some of the claims and to stress/clarify the limitations to the study. You will find my comments and revision suggestions in the attached document. I hope you do not find my comments too harsh, as it was my itnention to be as constructive as possible. You will also see that in some sections of the manuscript I am just highlighting text without providing any comments. I encourage the authors to pay attention to these and rephrase the text as appropriate.

Many of the reviewers' comments and suggestions are welcomed to improve the article, and we have improved the manuscript accordingly. But, there are also comments with which we disagree, and where we disagree, we provide a thorough explanation. Given the large number of comments added by the reviewer, we have tried to respond concisely and directly to all of them.

All commentaries are listed below:

1) may play

Change accepted.

2) was any surface runoff observed? Interference with the CS616 in terms of runoff infiltration? Soil moisture before the experiment was conducted? Soil type?

Surface runoff was not observed during the experiment. We will add a statement saying that there was no surface runoff. Soil moisture before the experiment was measured and is shown in Figure 5 and 6, and soil type is described in section 3.1.

3) this finding is a bit trivial - the isotopes and dye were travelling together - yet, it may have been interested to assess isotopes concentration in zones where colorant was not present?

- It is not necessarily trivial when it is understood that in dual-tracer infiltration experiments one tracer can travel farther/extended than the dye other. See:

Nobles et al. (2010) - https://doi.org/10.1016/j.jhydrol.2010.03.014
Schwen et al. (2014) - https://doi.org/10.1016/j.jhydrol.2014.09.028
Luo et al. (2019) - https://doi.org/10.2134/jeq2018.03.0091

- Indeed, we have the isotopic data of zones where no dye was observed. We refer the reviewer to Figure S5 in the Supplementary Material.

4) is there any supporting evidence for this finding?

A decrease in dye concentration and deuterium isotopic composition is owing to dilution and mixing of infiltration waters with soil water. This is a physical process that has been demonstrated some time ago for both Brilliant blue dye (e.g., https://doi.org/10.1016/S0016-7061(00)00027-6) and deuterium (e.g., https://doi.org/10.1016/0022-1694(94)90159-7).

5) please, delete or replace 'heavily'

Change accepted. "heavily" will be deleted.

6) surface runoff has not been mentioned above, see my previous comment,

By demonstrating that stemflow significantly affects soil moisture, we suggest that it would also affect surface runoff in some locations and in events of high intensity or long duration when the soil becomes saturated. However, we never observed surface runoff in the studied plot (flat area with well-structured soils).

7) last sentence is unclear - my understanding is that the authors are striving to gain insights into the soil hydrological processes regulated by stemflow funelling not the other way around?

Yes, that is correct. Thank you for your comment. We will rewrite this sentence to convey the message correctly.

8) I like the monitoring setup. Yet CS TDRs measure the average SWC between 0 and 30 cm below ground. So, if the probes were vertically inserted in the ground, then it would be hard to detect changes in SWC produced by stemflow-derived preferential flow. this could be better sensed with capacitance meters or with the CS TDRs deployed horizontally. I think this is a limitation to the study and was wondering if the authors could comment on this?

As described in section 2.2 of M&M, we installed one set of TDR probes inserted vertically measuring average SWC across the length of the probe (0-30 cm in this case).

We consider that if matric flow occurs, the increase in humidity recorded by the probe will be greater than if preferential flow occurs, since only part of the probe will be affected by an increase in SWC in the occurrence of preferential flow. We could have installed the sensors also horizontally, that is true, but this would average the water contents in horizontal direction, possibly missing vertical preferential flow pathways. We think both approaches have advantages and disadvantages, not none is necessarily better than the other.

9) sentence unclear - please, rephrase. Also, throughfall not defined

We will include the definition of "throughfall" next to the first sentence, which makes the message of the present sentence much clear.

10) not clear from the information provided above

We disagree. Some general examples have been described above that clearly describe the effects of stemflow on the biogeochemistry and ecohydrology of vegetated ecosystems.

11) this sentence is awkward, please rephrase. Rainfall gets channeled/concentrated/funnelled around the branches and stem, but it does not get transformed

Change accepted. "turns" will be replaced by "concentrated" as suggested by the reviewer.

12) funnelling process

Change accepted.

13) citation(s) neded - given that studies on this have been carried out in the past

In this short paragraph we are just defining the concept of "stemflow double funelling" which was introduced by Johnson and Lehmann (2006). Studies on the subject are cited in the following paragraph where specific examples are given.

14) please, rephrase - i would avoid saying well-known here - there is some evidence that it happens, yet there are not theories, models undepinning the double-funnelling process. Also, it does not happen in every tree, soil, rainfall event…(although there is not data published on this)

From the sentence: "While the concept of the double-funnelling phenomenon is well known, clarification of the underlying mechanisms is more challenging" we are referring to the concept/definition, but not to theories or models that as the reviewer states have not yet been developed.

Also, we do not understand how the reviewer states that it does not happen in all trees because so far there is no study that proves the non-existence of stemflow double funnelling, and obviously it does not happen in all rain events since there must be enough rainfall to generate stemflow that can infiltrate into the soil (the degree of infiltration will depend on the soil physical properties such as permeability, texture, hydrophobicity, etc. and topography; i.e. the slope) .

15) stemflow double funnelling - English/grammar should be revised throughout the manuscript - i will try to stick to the science/message, yet i will highlight were revision of the text should be considered

We agree with the reviewer. Thanks for the observation. We will change "double funnelling" by "stemflow belowground funnelling"

16) please, delete ones

Change accepted.

17) please, see my comment above - it should be interesting that the authors stress here and in the Discussion that it is not yet clear or understood under which eco-hydrological conditions stemflow double-funnelling occurs.

Personal communication: i have been monitoring this process for years in over 10 trees growing on the same slope, and it is still unclear why sometimes it happens and sometimes simply doesn't -i.e., most of the stemflow results in surface runoff.

The following sentence will be added within the paragraph: "While the concept of the double-funnelling phenomenon is well known, clarification of the underlying mechanisms is more challenging. *For example, it is possible that once stemflow occurs, after passing a rain threshold, soil physical properties, terrain slope and tree features could be drivers of stemflow belowground infiltration."*

18) vadose zone not introduced

Although "vadose zone" is a basic term in hydrology, we will change "vadose zone" by "unsaturated zone" which is a clear definition.

19) where?

From the previous sentence it is clear that we are referring to the soil.

20) where?

“within the soil” Will be added.

21) under which conditions?

The conditions under the experiment was performed are described throughout section 2.

22) verb missing

Yes, “being” will be added.

23) why was this representative?

Given that tree architectural traits are key to undertstand stemflow yield, could the authors provide some detail on these?

This study is not focused on stemflow production and its biotic or abiotic factors, but rather on the stemflow infiltration into the soil by means of an artificial experiment.

The following sentence will be added “This tree is representative of the plot's DBH distribution with a regular stemflow production according to the monitored period, and has sufficient space within the plot for the placement of all the hydrometric equipment.”

24) why this rate?

This rate reflects the average time stemflow is generated during a 50 mm event according to the monitoring data prior to the experiment. We have mentioned that in the text.

25) how was this achieved?

The plot is located on a flat area within a hill. We will add a sentence to clarify this.

26) why this arrangement was chosen?

45 degrees means that all cardinal and intercardinal directions will be monitored with reference to the tree, and 10 cm and 30 cm indicated different distances from the tree bole, so that changes in SWC can be monitored.

27) to where?

“as close as possible” to the intended position according to the monitoring design.

28) who? what?

“They” refers to the TDR probes described in the previous sentence. "They" will be changed to "The TDR probes".

29) you mean horizontally? otherwhise, this is not clear. If these probes were deployed at the specified depths, how was it possible? Please ,clarify

Two years prior to the experiment, TDR probes of different lengths were installed vertically at different depths. Holes the size of the distance between the TDR probe external roods were made manually with a soil auger, once the hole had the selected depth the TDR probe was stuck into the not disturbed soil. The text will be modified for clarification.

30) to sample or to measure? were samples collected in the piezometers? Also, could you please explain the rationale for installing the probes at those locations?

Yes, both to measure and sample. Thanks for the observation. The piezometers were installed in two opposite locations to measure and sample groundwater, in order to detect changes in groundwater level or dye presence in water samples respectively.

31) same as above

Similarly, the mini-piezometers were in proximity to the TDR probes locations in order to monitored changes in water level together with the presence of colored water in the shallow soil layer.

32) depth to the ground (z) is not clear, nor the text below. please clarify/rephrase

We have a mesh above ground level, and we measure the depth (or distance) from each intersection of the mesh to the ground. We will change the text to "distance (z) from the mesh intersection to the actual ground surface"

33) Sentence too long and hard to follow. please, rephrase or break into several sentences

The sentence will be modified.

34) where? right at the base of the tree bole or at some distance following surface runoff

We refer at the base of the tree. The sentence will be clarified.

35) this can be quite high in some soils. Please, provide information/data on porosity, bulk density and texture to iilustrate this better

All these data are shown in section 3.1.

36) this is redundant - i also think that this paragraph should come before. You could split this section into experimental setup and monitoring setup?

- We will change "at a flow rate of 7 L h^{-1}" to "at the established flow rate".

- We don't think splitting into two sections is useful, because the text would become repetitive as the "experimental" section will require details of the "monitoring" section.

37) citation or more detail needed

The following citation (Cayuela et al., 2018 - https://doi.org/10.1002/eco.2025), from which the experimental data were obtained, will be added.

38) is this concentration standard?

Yes, it is. For more details check: https://doi.org/10.2134/jeq1994.00472425002300050037x

39) please rephrase - sentence too long and hard to follow

We will split the sentence, but it will not be rephrased, as we consider that the description of the method is clear.

40) sometimes you just refer to experiment, now to dual-labelled water application - please, be consistent throughout. I suggest choosing a simple name to denote this experimental stage - e.g., stemflow experiment, so the reader can follow.

The experiment refers to the whole process, from the installation of the materials, stemflow simulation with dual-labelled water, the excavation of the soil and the sampling. Therefore, here we refer only to the dual-labelled water application because this stage is prior to the excavation.

41) why?

We are not exactly sure what this question refers to. If we excavate more profiles, we can see the extent of infiltration and its redistribution in the soil matrix. Dozens of infiltration studies have used the same method (e.g., http://dx.doi.org/10.1016/j.jhydrol.2012.08.048, https://doi.org/10.2134/jeq2018.03.0091)

42) why 40 cm?

Since stemflow water influences the areas near the stem, we decided that 40 cm was a suitable distance to study stemflow infiltration and its redistribution in the soil matrix. But there is no specific reason to choose 40 cm, it could be 35 or 45 cm also.

43) it is not clear from the text above that all trenches were excavate within one day. Also, excavating trenches under a tree is labour intensive, and it requires to be careful regarding roots and stones. I would be interested to hear how the authors managed to acomplsh this.

We excavated all the profiles in one day. In fact, it was a very laborious task, as the reviewer mentioned. We were a team of six people, and we have meticulously planned and organized the experiment and the tasks beforehand. Additionally, it is worth mentioning that the depth of the profiles was only 30 cm, but nevertheless roots and stones were encountered which made excavation difficult.

44) this sentence reads like discussion - either delete, rephrase or move below in the paragraph.

Thanks for the observation. The sentence will be modified and moved below. Moreover, to make the paragraph clearer, the following sentence will be added at the beginning of the paragraph: "Photographs of the soil profiles were taken using a cell phone with a dual-lens camera system of 12MP (iPhone 11, Apple Inc., CA, USA)."

45) please, add a bit of detail on what this classification method does and to what aim it was utilised herein.

- The following text will be added: "The maximum-likelihood classification assigns each cell in the input raster to the class that it has the highest probability of belonging to."

- We also state: "used to classify dye-stained and non-stained areas"

46) I think all these indices are a great way of describing quantitatively preferential infiltration from image observation. Please, introduce why these indices were calculated - you may wish to add a sentence refering to this in the Section's opening para? Also, you may want to add something referring to this analysis approach in the Introduction Section?

- These indices were calculated because they are optimal for quantitatively describing preferential flow in soils according to the current literature. All the indices are introduced and justified by references (Flury et al., 1994; Van Schaik, 2009; Bargués-Tobella et al., 2014; Hatano and Booltink, 1992; Hatano et al., 1992).

We will replace the sentence "Six preferential flow indices were then derived from the digitized images" with "Digitized images where then further analyzed to quantify several preferential flow indices."

47) please, elaborate

We are not sure what the reviewer refers to here. "Total dye coverage is lower when there is a higher degree of preferential flow." seems clear to us.

48) how was TSA calculated?

Total stained area (cm^2) is derived from total dye coverage (%) from the digitized images as illustrated in Figure 2.

49) what is the relationship between this and DC?

We do not quite understand the question. When the DC profile is intercepted several times by the total DC value, it indicates higher degree of preferential flow, when there is no preferential flow this value is lower or zero.

50) do you really have to mention this? i have seen this structure above, too, yet it may be better to describe what you did and then add citations as appropriate. This suggestion could improve the reading flow

Yes. The primary reason is that we have not developed the method of dye quantification, but followed the procedures and guidelines established in previous studies. In this study, the procedure of Forrer et al. (2000) was followed as described in the text.

51) Sentence unclear; please, rephrase

When we take a soil sample with a ring, we have two sides (one external and one internal). The external side is the same as the one captured in the photographs. We will clarify this in the text.

52) light? or UV-V

Thanks for the observation. It will be changed to "UV-Vis" spectrometry.

53) is this information relevant?

Yes. The laboratory where the isotopic analysis was carried out must be described since each laboratory has different equipment and methods for analysis and validation.

54) ignore my comment above on info re soil attributes

Done.

55) why not using those equations proposed for European soils? https://bsssjournals.onlinelibrary.wiley.com/doi/full/10.1111/ejss.12192

Also, given the amount of sensors deployed to monitor VSM and matric suction, why not using this information to fit a soil-water retention function and derive Ks?

- This is a good point. We decided to use Rosetta because it is an often-used model and its version 3 is the most updated and improved version for pedotransfer functions. Regardless of

which function is used, the Ks estimate is only used as an informative parameter in our study to show the relative changes in soil properties as a function of depth.

- Matric suction was not monitored in this study, so we cannot develop a water retention curve from our data.

57) this reads a methods, please, consider to move to Section 2

We disagree because in the text we are describing what we are showing in Figure 4, i.e., the results of the soil characteristics.

58) delete this sentence and cross-reference results text and figure, so text flow improves.

We do not agree, because this would unnecessarily lengthen the paragraph by adding (Figure 4a, Figure 4b, Figure 4c... etc.).

59) citation needed

Change accepted. The following citation (Rubio et al., 2008) will be added.

60) could this be due to textural changes?

No, not really, because the soil texture did not drastically change with soil depth (see Figure 4). It is most likely because of higher soil compaction in the subsoil.

61) if there only are few studies, could you just mention them or more than just one here? or does this citation refer to a Review? if this is the case, does the latter study reflect more recent studies? I am at least aware of this one - Gonzalez-Ollauri et al. 2020. (https://www.sciencedirect.com/science/article/abs/pii/S0022169419311837?via%3Dihub)

The citation (Carlyle-Moses et al. 2020) corresponds to the latest review of the topic where the study by Gonzalez-Ollauri et al. (2020) is also included. It will be modified as follows "(see the review by Carlyle-Moses et al. 2020)".

62) phasion? in any case, it is interesting that stemflow infiltrated the soil this way - could the authors comment on that this was because the studied tree was growing on flat ground?

I am pointing this out because stemflow only occurs on one side of the stem when trees are growing on a slope. I think this should be commented/discussed.

- Thanks for this comment. We will add in the M&M section a sentence explaining that the tree is on flat ground.

- In the paper the effect of stemflow on trees growing on slopes will be discussed.

63) how far from the tree bole this was?

Thanks for the observation, unfortunately we did not measure the radius because it was not a perfect annulus, however we provided the stemflow infiltration area.

64) this statement disagrees with the revision carried out by Van Stan et al. 2021 (https://www.frontiersin.org/articles/10.3389/ffgc.2020.00061/full) and it should be acknowledged. It should also be acknowledged or at least suggested that this observation depends on soil moisture conditions. When the soil is dry, it can be expected a much larger radius (or so I have observed) due to soil's low capacity to infiltrate water under these conditions, thus stemflow resulting into surface runoff.

- "Heterogeneous volumetric SWC around a tree, induced by stemflow….." the present statement is not really related to the Van Stan et al. (2021) study which focuses on the estimation of stemflow infiltration areas, so we think it is difficult to compare these two studies.

- The following sentence will be added: "It should be noted that SWC response caused by stemflow infiltration can change depending on antecedent soil moisture conditions which could lead to different water flow dynamics (Kobayashi & Shimizu, 2007)."

65) also, see my comment in Fig. 4 and above

Figure 4: soil mositure by the TDRs is averaged between 0 and 30 cm b.g.l, the soil porosity profile indicates that the soil profile was nearly saturated when the experiment was conducted (given that SWC was ca. 32 %). This has an important impact on the ability of the soil to let water through. Could the auhtors comment on this?

We agree. Thanks for the observation. We have already added a sentence commenting on this issue in comment 64 above.

66) i really like Figure 5 - a lot of information can be drawn from it. why stemflow mostly occured in the direction observed? was there a relationship with the site's topography - see my comment above

Thanks, we are happy to hear that the reviewer likes our Figure 5. In the last paragraph we suggest possible explanations for the phenomenon shown in Figure 5. There does not seem to be any relationship with micro-topography, as can be seen in Figure 1, the level changes are quite small in the infiltration area. Again, the tree is not located on a slope, but on flat ground.

67) please, provide a radius above for the ring produced by stemflow, as it will help interpret this finding. Also, see my comments on this above - some studies (not all) seem to provide evidence on that a lot of stemflow ends up infiltrating away from the tree bole. 30 cm from the tree bole is relatively significant from the rhyzosphere scale perspective. This having said, could the authors comment on it?

Stemflow infiltrates in immediate vicinity of tree stem, however, we did not measure the radius because it was not a perfect annulus. Yes, stemflow infiltrated away from the tree trunk, mainly by funneling into the coarse roots. We argue in the manuscript that root architecture is the main driver of vertical and horizontal redistribution of stemflow water. Examples of the root architecture of Scots pine species are shown in Figure S2.

68) can you really compare species without considering bark roughness? (in turn dependent on age?). could the authors comment on this, too?

also, sycamore and maple seems redundant, please delete maple

- We will include the study by Carlyle-Moses et al. (2018) that analyzed stemflow in juvenile lodgepole pines. Since there are no more studies on pine species for comparison, it is feasible to compare our results with others of different species even if they are contrasting.

- Change accepted. "maple" will be deleted.

69) please, make a reference to this in Section 2 when describing the experimental approach

We don't think a reference to section 2 is needed here, because the methods have been described already and it should be obvious that we refer to our own experimental methods here.

70) could not this be produced by surface runoff followed by matrix infiltration? is there any other supporting evidence within this study to support this statement? could the authors comment on this?

- As we stated above, surface runoff was not generated during this experiment. Stemflow water infiltrated a very small infiltration adjoining the tree bole.

- Yes, we observed the presence of stained areas around the coarse roots during excavation at different distances (10 cm, 25 cm and 40 cm). In addition, this was also found in other studies (e.g., Spencer and van Meerveld, 2016).

71) figure?

We cannot add "figure" here because the figures must be indicated in order with the text, so we will add "(see section 3.5)".

72) could the authors comment on why these species develop coarse roots in these directions?

We are not sure how to answer this question. This question relates to forest ecology and evolutionary development of root morphology which we are not confident to discuss.

73) please, see my comment in Fig. 6

Figure 6: this plot indicates that soil moisture mostly changed in the topsoil, which could be a result of stemflow ending up in surface runoff and then matrix flow. Unless the tree individual had lateral roots favouring stemflow water transport. Could the authors comment on this?

Again, surface runoff was not generated during this experiment. Indeed, we have argued within the manuscript that lateral flow through the roots occurs transporting stemflow water in shallow and deeper soil layers.

74) could you please elaborate on this? also refer to my comment in Fig. 6. While the authors are reporting the results very well, there is little discussion/interpretation of the results. I think the authors should consider to discuss the results in more depth without extending the lenght of the text substantially. I am aware this is not easy, yet it would help stress the relevance and impact of the study.

Thanks for the observation the following sentence will be added: "Bypass flow leads to spatially irregular wetting of the soil profile with differing flow velocities that allow infiltrating water to move farther or reach deeper layers with minimal interaction with the bulk soil (Gerke, 2014)."

75) these claims are arguable - figure 6 shows that changes mainly occured within the first 10 cm of the soil - this has not been mentioned or acknowledged here at all. As shown in Fig. 6, SWC changes in depth are rather subtle and this should be highlighted here as well. Please, revise these claims and conenct them better whith what it is shown in Fig. 5 and 6. If my interpretation is wrong, please, explain better your findings here.

After considering the reviewers comments, we will move this paragraph to the end of section 3.5 "Image analysis of stemflow stain patterns and preferential flow paths". Together with the dye tracer data, our statement can be better supported. We now write:

"The non-uniform dye patterns and the SWC heterogeneity around the tree during the stemflow experiment can be attributed to four factors: (1) preferential flow of stemflow on the trunk itself (as shown in Pinos et al., 2021), (2) preferential flow of stemflow infiltrating into the soil due to the presence of coarse roots that redistribute water flow both vertically and horizontally (Schwärzel et al., 2012), (3) the temporary presence of local perched water tables, and (4) heterogeneous soil structure (Metzger et al., 2017)."

76) please, see my comment in Fig. 7

Figure 7: it is somehow interesting that the formation of perched water tables does not coincide with SWC dynamics in Fig. 5. I wonder if water accumulation shown in dark blue was due to the presence of stones? sudden changes in texture? Could the authors comment on this?

Does this figure suggest that most of the water flow through the profile? - given that water is not perching in most of the assessed locations.

However, it should be clarified that SWC TDRs measure the average profile moisture and the piezometers are only reading what happens at 30 cm b.g.l. Could the authors comment on this? I think this has some implications for interpreting the results.

- The number of stones was small, and no relationship between stones and water level was observed during the excavation. On the other hand, as can be seen in Figure 4, there are no abrupt texture changes in the profiles.

- Yes correct. Most of the water flow preferentially through the profile by the roots and macropores.

- We agree. One of the study limitations is that the maximum analyzed depth was 30 cm b.g.l. We will add a sentence highlighting this shortcoming.

77) i think this statement should be revised or explained better - even though no response was noticed with the TDRs because soil was nearly saturated, changes should still be registered by the piezometers, given that the latter probes should be able to measure the hydralic head when pore-water pressure is positive. Could the authors comment on this?

We describe and discuss this observation in the previous sentence: "Even near-saturated locations (TDR probes swc-SE30 and swc-W30) received stemflow water, as indicated by the occurrence of blue water in nearby mini-piezometers wt-SE20 and wt-W20, respectively (Figure S3). However, no SWC response to stemflow was observed at these locations because the soil was already saturated."

78) could the authors explain (or suggest) why this was the case?

The following sentence will be added: "This result is likely due to water flowing rapidly through the preferential flow channels and not reaching a positive pore water pressure."

79) this Section is a bit hard to follow - perhaps with the figure closer to the text, the information could be easier to digest. I am wondering if the authors could provide a better synthesis/message from what it was observed with the piezometers?

Since the table and figures are at the end of the article, we understand that it is difficult for the reviewer to follow the text. However, the article will be formatted by the publisher when it is in production. We will shorten this paragraph to make it easier to understand.

80) when looking at the figure, i actually undestood the oposite. Please, add a label/title showing the distance, so it is easier to interpret.

Thanks for the observation. Change accepted.

81) you should clarify the topographic conditions on which the tree individual is growing. In light of the observed pattern of stemflow, It seems like it was growing on flat ground. This must be made clear prior to comparing with other studies in which tree individuals are growing on slopes, and on which stemflow only tends to occur in one direction. Also, please, stress this point in the text.

Yes, we have already addressed this issue by adding a new sentence in M&M. See previous replies on this issue.

82) could the authors elaborate on this?

We do not understand what is to be elaborated. It is evident that the greater the DC near the trunk, the greater the vertical infiltration, or in the opposite case, the greater the DC far from the trunk, the greater the horizontal infiltration.

83) see my comment above - this should be made clear earlier

Yes, we have already addressed this issue by adding a new sentence in M&M. See previous replies on this issue.

84) this somehow contradicts what it was captured with the TDRs - see my comment above - could the authors clarify/explain?

I understood there was a response from sensors located away from the tree bole but then most of the dye was found closer to the tree bole - could the authors explain this?

Also, could be that the dye did not manage to make it far away from the tree bole due to filtration/adsortion/,,, and thus most of the dye was observed closer to the bole? could the authors comments on this?

yes, i want to believe that stemflow mostly leads to preferential flow and yet evidence has to be taken with care.

- Yes, there was a response of sensors located away from the tree bole and most of the dye was found closer to the tree bole. We must stress that the dye only indicated the flow pathways by which water moved within the soil matrix and is not an indicator of SWC.

- Yes, the concentration of dye is reduced by sorption the further it travels in the soil. See Figure 10. However, the concentration used in this study was more than sufficient to detect preferential pathways. Several studies on different soil types have used a similar or lower concentration and found the dye at greater depths (e.g., https://doi.org/10.1002/2013WR015197, https://doi.org/10.1002/hyp.7302, https://doi.org/10.1016/j.jhydrol.2010.03.014). Therefore, it is not a limiting factor.

85) citation needed

Accepted. "Noguchi et al (1997)" will be added.

86) see my comment in Fig.9

Figure 9: While it is clear that coarse roots channeled the dye, dye is also visible in sections of the soil profile where coarse roots are not present. This is quite clear in West, South images - could the authors comments on this?

Yes, as described in the manuscript, the coloured water is mainly channeled through the coarse roots and macropores.

87) and this is a great finding

We thank the reviewer for his comment.

88) citation needed - this should be intorduced in Section 1 (intro) as it sets the basis for undertanding under which soil conditions preferential flow may occur?

- Accepted. "Beven and Germann (2013)" will be added.

- We do not necessarily agree with having this mentioned in the introduction. It is not necessary to add the bypass flow mechanism between macropores in the introduction section, but it is used as an interpretation for the coloration patterns we have found in the profiles.

89) could the authors also stress here that topography has an important effect, too? and potentially. climate. as there is clear evidence that the soil water mass balance (which depends on climate) is a clear driver of vertical root distribution - please, comment.

Yes. Thanks for the comments. We will add a sentence highlighting the importance of the topography. Climate will not be added because different species are inherently different for each type of climate, so it is implicit when talking about different species.

90) where? could you pelase be more specific here?

Thanks for the observation. It will be changed to "In some near-stem locations"

91) was root architecture mapped? or quantified? this claim is hard to undertad - or at least i did not find enough supporting evidence in the text above.

Yes, you observed flow bypassed the topsoil with the dye - (not really with the sensors, to my understanding, this is a limitation that should be clearly noted; see my comment above).

I think the findings should be organised/sumamrised better here - perhaps from the most relevant to the least, and also clarify the contribution of the findings to the current understanding of stemflow?

- Mapping the root architecture is way beyond the scope of the present study. However, there are multiple studies on the root architecture of Scots pine in the literature. In Figure S2 we show some examples of these trees growing in flat terrain. Moreover, we observe some root architectural traits (as superficial horizontal large roots) during the excavation.

- Yes, we observe bypass flow mainly by analyzing dye patterns, and to lesser extend by one set of TDR probes placed at different depths. We do mention that dye staining is excellent tool to identify flow patterns, but cannot quantitatively determine flow.

- **We summarize the main findings of the study in the last paragraph in form of implications. We do not want to summarize the results here, as this would be repetitive with the abstract.**

92) see my comment above - the study is very interesting, yet this seems to be overclaiming

We don't believe we are "overclaiming". It is quite possible that more probes or improved designs could be used for study stemflow belowground funnelling much better, as well as simpler designs. However, we demonstrate with our experimental setup the stemflow infiltration dynamics, thus we consider that we don't overclaim when we stated that our design "delineates and quantifies stemflow belowground funnelling very well."

93) see my comment above - the study is very interesting, yet this seems to be overclaiming - dye observations somehow verify preferential flow but this was not clear with the TDRs. In fact, and assuming that i understood well, figs. 5,6 vs 8 contradict with each other a bit - and this should be made clear

We do not think that Figs 5, 6, and 8 are contradicting each other. For the most part these figures support our conclusions of preferential flow along roots and differential infiltration of stemflow water into the soil matrix. There is, of course, noise in the data, and spatial variability caused different sensors to react differently, which makes it sometimes difficult to discern the general patterns.

94) this claim should be revised/toned down, too - only one tree was studied, yet the authors are upscalling without referring to other environmental conditions/attributes influencing stemflow. In fact, the authors should refer to these factors more in the text, as indicated in my comments above.

Our experiments with one tree clearly demonstrate that stemflow double funneling can occur in our Pine forest. Although we studied one tree only, there is no reason to believe that it will be different during a rainfall on more trees.

In the discussion, we added that: "The stemflow infiltration area found in this study should be interpreted with caution, as it corresponds to a specific amount (50 mm) and discharge (7 L h^{-1}) and to specific antecedent moisture conditions and soil physical properties, and we suspect that it may vary as any of these conditions change."

95) figure needs some labels, so it is easier to follow. split figure 1 into 1a and 1b?, so it is easier to follow

We will split in Fig 1a and Fig 1b

96) please, explain further what the two figures are showing by adding more text/detail to the legend (Figure 2)

We will change the caption to: "Top view of experimental plot with squares indicating the location of the vertical soil profiles excavated around the tree (left). Schematic of vertical soil profiles with dye patterns (right)."

97) very nice way of portraying this

We thank the reviewer for his comment.

98) it is not clear what it is portrayed in balck and grey, respectively. please, clarify by adding a legend? or more text in the caption text? please, add a title-label indicating the distance, too

In the figure caption we explain the black and gray shades: “Dye coverage (black = soil-stained areas; grey = root-stained areas) of the different soil profiles. We will add a title-label indicating the distance of the profiles.