

We want to thank the anonymous reviewer #1 for the constructive review. The comments are a great help to improve the manuscript. Below you can find our detailed responses (in red) to the comments (black):

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### General comments

The reported study investigated spatio-temporal variations in the concentrations and stable isotope ratios of C and N in both suspended and infiltrated sediment and traced potential sources of sediment using sediment stable isotope and C/N ratios in the River Enziwigger watershed in Switzerland during a brown trout spawning season. Although similar approaches have been used in many other watersheds, the results on isotope tracers are unique because they were linked to hydrologic conditions to examine effects of rainfall and snowmelt on organic matter export from various sources. In addition, the mixing model tool (IsoSource) was very successfully used and the approach of showing potential source distribution rather than single values could attract a lot of attention among 'isotope trackers'. I would therefore recommend this manuscript for publication in Biogeosciences. Below I provide some suggestions for the authors to improve the manuscript with delivering its key messages and editorial details.

### Specific comments

#### 1. Implications of major findings

Both the abstract and conclusions sections end without explicitly mentioning implications of the major findings. For example, you mentioned that increasing winter temperatures and precipitation lead to a higher contribution of SS from arable land. Does this mean that any future warming trends in the study region could increase soil erosion and C export? Highlight implications of your findings.

**Author reply:** Yes, you are right. We will highlight the implication of the findings in the abstract and the conclusion. Enhanced soil erosion processes on pasture and arable land are probable with increasing torrential rain events and less snow on the land during the winter season. Consequently, organic matter in the river would increase. Both could affect brown trout eggs negatively.

2. Title needs to be more specific in terms of emphasizing major study findings and providing information about the study approach and site. Think about other options. At least, the current version should read "Dynamics of organic matter in sediment and source tracing.....in XXXX"

**Author reply:** We will change the title to “Organic matter dynamics and stable isotope signature as tracers of the sources of suspended sediment”

### 3. Terminology

The consistency of using terms and abbreviations should be checked through the manuscript.

- C/N atomic ratios, C/N ratios, C/Na
- “Fractions” in fractions of organic matter are confusing. I would recommend “concentrations” when they are used for quantification purpose.
- Organic matter or carbon in sediment is usually termed as POM or POC.

**Author reply:** Yes, we will check through the manuscript for terms consistency. We will use the term C/Na and change “fraction” to “concentrations”.

To our understanding, POC stands for particulate organic carbon in the water column. We refer to organic and inorganic carbon in the suspended or infiltrated sediment. In soils, we would term this soil organic carbon. To not confuse the readers, we prefer to refer to  $C_{org}$  and  $C_{tot}$  concentration of the sediment.

### 4. Statistical analysis

From what you described in the methods and results (Tables 1, 3; P460 L13-14, 20-21), it is unclear how you compared differences among three sites. In my view, ANOVA and multi comparison tests would be the most efficient way in showing differences in the cases of two tables. Clarify how you did in the text and indicate any significance in the tables.

**Author reply:** We used t-tests. But you are right, an ANOVA would be better. We will use ANOVA and indicate the significance in the tables as well as clarify it in the text.

### 5. Structure of Results & Discussion

Sections 3.1 – 3.4 could be more efficiently structured. For example, the four sections could be combined so that you could avoid repeated descriptions and the readers easily compare the patterns appeared for different monitoring parameters.

**Author reply:** We believe that the manuscript is easier to understand if we structure it in small sections to avoid reader’s confusion of the different monitoring parameters. Also, this way, it is easier for the reader if she/he is interested in one specific parameter.

### 6. Differential mechanisms for DOC and POC export

P462 L118: You need to distinguish DOC leaching by the well known ‘hydrologic flushing’ from POC export by surface soil erosion. Refer to the following papers and describe differences in hydrologic mechanisms driving DOC vs POC export.

- Hornberger GM, Bencala KE, McKnight DM. 1994. Hydrological controls on dissolved organic carbon during snowmelt in the Snake River near Montezuma, Colorado. *Biogeochemistry* 25: 147-165.
- Inamdar SP, Christopher SF, Mitchell MJ. 2004. Export mechanisms for dissolved organic carbon and nitrate during summer storm events in a glaciated forested catchment in New York, USA. *Hydrological Processes* 18: 2651-2661.

**Author reply:** Yes, you are right. We will discuss DOC leaching on page 462, l.12 and refer among others to Hornberger et al. (1994) and Inamdar et al. (2004). The increase in DOC can be attributable to different processes: During heavy precipitation, previously unsaturated layers of the soil and river channel get connected to the drainage network. This delivers further carbon to the stream as new sources of DOC in upper organic soil horizons are assessed with rising water tables due to infiltrating melt water or high discharge (Dawson 2010, Hornberger et al., 1994). DOC can also be exported with near-surface soil runoff and/or overland flow generated during the storm event (Inamdar et al. 2004).

## 7. Rainfall-induced increases in nitrate leaching

P463 L6-19: Your finding on increasing nitrate conc with rising discharge contrasts with other findings showing dilution-induced decreases. You could briefly mention about the uniqueness of your system (not supply limited during rainfall events) by comparing with other studies (e.g., Wagner et al. 2008. Stream nitrate and DOC dynamics during three spring storms across land uses in glaciated landscapes of the Midwest. *Journal of Hydrology* 362: 177-190)

**Author reply:** Inamdar et al (2004) and Wagner et al. (2008) both noticed that nitrate and DOC losses generally occur during precipitation events. Uncertainty remains on the processes controlling the delivery of nitrate and DOC. There are studies showing peaks of nitrates and DOC on the rising limb and other showing peaks of DOC and nitrate after the peak discharge. In our study we did not investigate the DOC and nitrate dynamics in such a detail. We only took water samples about every second week. Consequently we can not draw any detailed conclusions about the leaching processes. Nevertheless, we will add a sentence and refer to Wagner et al. (2008) and Inamandar et al. (2004).

## Technical corrections

### 8. Abstract L3: by “affecting” health and fitness

**Author reply:** Yes, changed

### 9. Abstract L2-6: The backgrounds were described in too much detail, at least the third sentence.

**Author reply:** We deleted the second and third sentence.

10. Abstract L9: Add briefly site information.

**Author reply:** We added: “in a small, canalized river of the Swiss Plateau”

11. P455 L7: “the frequency and intensity” of heavy rain events?

**Author reply:** Yes, changed.

12. P455 L18: Are the redds the common term used in your field?

**Author reply:** A “redd” is a shallow depression created by the female brown trout in which eggs and sperm are deposited. Afterward, the female covers the fertilized eggs with gravel. We will explain this briefly.

13. P456 L9: “Sediment tracer-based methods with natural tracers” is redundant and a bit weird expression.

**Author reply:** Yes, you’re right. We deleted “with natural tracers”

14. P456 L11-12: “reliable” tracers

**Author reply:** Yes, done

15. P456 L17: “potential” SS origin sounds better.

**Author reply:** Yes, done

16. P456 L19-20: This sentence is difficult to understand. Do you mean “.....potential sources that are greater than the number of isotope tracers by one”?

**Author reply:** We changed the sentences to “The disadvantage of these models is generally the limitation in detecting potential sources by the number of isotope tracers. With  $n$  isotope tracers,  $n + 1$  potential sources can be detected. The model is mathematically underdetermined if the number of potential sources exceeds  $n + 1$ , resulting in an equation system with less equations than unknown variables and therefore no single solution is possible”

17. P457 L7: a total watershed “area” of

**Author reply:** Yes, done.

18. P457 L8: hydro-power “facilities” or “plants”

**Author reply:** We wrote “hydro-power facilities”

19. P457 L10: modified through what?

**Author reply:** We changed the sentence to: “...its morphology is strongly modified: Only 5% is close to natural or natural, 21% is little affected and 74% is strongly affected or even artificial, including terraces that have been inserted to prevent deep channel erosion and

scouring of the bed during flood events (classified with the Swiss modular stepwise procedure for ecomorphology)."

20. P457 L18; Napf, "where"

**Author reply:** Yes, done

21. P458 L5: By "the coarse rest" you mean "remaining coarse sediment"?

**Author reply:** Yes, exactly. Changed.

22. P458 L11: Describe the location of "interstitial water samples".

**Author reply:** We added the sentence "The mini piezometers were 300 mm deep and perforated in the lower 160 mm. They were designed after ..."

23. P458 L17-18: each "sampling" spot

**Author reply:** Yes, changed.

24. P461 L7: Corg "concentrations" in IS....

**Author reply:** Yes, changed.

25. P461 L13: What's the difference between "Corg and particulate organic carbon"?

**Author reply:** Yes, you are right. We deleted Corg and only wrote "particulate organic carbon..."

26. P462 L1: "assessed DOC values" sounds weird, did you mean "measured DOC concentrations"?

**Author reply:** Changed to "measured DOC concentrations"

27. P463 L9: A nitrate "concentration"

**Author reply:** Yes, changed

28. P464 L20-21: remove "thus"; in the same range as "those for soil samples"

**Author reply:** Yes, changed

29. P465 L23: enriched "in" 13C

**Author reply:** Yes, changed

30. P466 L17: "soils" of forests.....

**Author reply:** Yes, changed

31. P467 L9: "were connected with" could be replaced simply with "showed"

**Author reply:** Changed to: "Modeling results of these sites have higher uncertainty as there..."

32. P468 L3: “exfiltrating” is the common term? Otherwise, use easy words like “discharging” or “draining”

**Author reply:** Changed to “draining”

33. P469 L8-9. You could provide your opinion on the ultimate source of this riverbed sediment. Considering different isotope ratios, this bed sediment appear quite different from forest soils.

**Author reply:** We added a sentence about this on page 465, l. 18. “The sediment probably originates mainly from the bedrock molasse. Very low Corg concentrations with a mean of 0.2 % support this assumption.

34. Fig. 2 captions: “mean values of all samples” from all three sites?

**Author reply:** Yes, samples from all three sites. We added this information.