

Dear hongqiang shi,

We sincerely thank you for your constructive and insightful comments, which have greatly improved the quality and clarity of our manuscript. Below, we provide detailed point-by-point responses to all comments. Your comments are presented in **bold**, and our responses are given in regular text.

Sincerely,

Zhuoxin Chen (on behalf of all authors)

General comments

1. I came across the preprint of this paper on ResearchGate and found it very interesting, so I would like to share a few thoughts and comments here. Overall, this is a nice piece of work with rare field data, Most existing studies rely on large-scale remote sensing for water quality analysis, but field monitoring at the gully scale is still very limited. This is understandable, because gully flow is intermittent and hard to capture, and remote sensing basically cannot do this. So any field data at this scale are rare and valuable.

Response: We sincerely thank the commenter for the positive and encouraging remarks. We appreciate the recognition of the challenges associated with field monitoring at the gully scale, particularly given the intermittent nature of gully flow and the limitations of remote sensing approaches. We are pleased that the value of these rare field observations is acknowledged and hope that this study contributes to improving process-based understanding of gully-scale hydrological and nutrient transport dynamics.

2. Gully development rate, driving factors, and modeling have already been well studied. But as the authors also mention, gullies are important hydrological pathways, not only erosion features. The problem is that monitoring gullies under natural rainfall is very challenging. Because of this, studies on how gullies regulate dissolved N and P are almost absent. At least, I have not seen many papers doing this with real field data. So I think this work fits well in HESS, and it also fills a gap in current gully research.

Response: We sincerely thank the commenter for the thoughtful and encouraging remarks. We fully agree that, although gully development processes and driving mechanisms have been extensively investigated, their hydrological and biogeochemical roles remain insufficiently explored, particularly under natural rainfall conditions. As noted, the intermittent nature of gully flow makes continuous field monitoring extremely challenging, which partly explains the limited availability of field-based studies on dissolved nitrogen and phosphorus transport. We appreciate the recognition that this work helps address this research gap and contributes to advancing the understanding of gullies as functional hydrological pathways rather than solely erosion features.

Specific comments

Below are some questions and suggestions that may help improve the manuscript.

1. Line 14: I think there is a small issue with the abbreviations. N is used first, but then NH_4^+ and NO_3^- appear directly later. It might be clearer to define NH_4^+ and NO_3^- directly at the beginning, to avoid confusion between abbreviations. If similar issues appear elsewhere, I suggest checking

and revising them as well. In addition, I think lines 14-17 could be merged into one sentence, which may help emphasize the role of the gully more clearly.

Response: We agree that defining NH_4^+ and NO_3^- at their first occurrence would improve clarity. In the revised manuscript, we will introduce these terms explicitly and ensure consistent abbreviation usage throughout. We also agree that merging Lines 14–17 into one sentence will better emphasize the role of gully in regulating dissolved nitrogen and phosphorus losses, and we will revise this section accordingly.

2. Lines 68–78: In my opinion, this part may not need too much description about the proportion of grain production, although it is important. After that, it might be better to further emphasize that more fertilizer input is needed to maintain high crop yields, which increases the risk of agricultural non-point source pollution in this region. Given that gullies act as important transport pathways but are rarely studied, this logic may make the motivation of the study clearer. Just a suggestion for the authors.

Response: We fully agree with this suggestion. Since the focus of our study is dissolved nitrogen and phosphorus pollution, greater emphasis should be placed on fertilizer inputs required to sustain crop production and the associated environmental risks. Given that gullies serve as important hydrological connectors between hillslopes and downstream waters, their role becomes particularly relevant in this context. We will revise and expand this part accordingly in the revised manuscript.

3. Lines 91–92: For the soil properties mentioned here, it would be helpful to clarify which soil layer they refer to (e.g., topsoil, ploughed layer, etc.).

Response: We appreciate your careful observation. The statement refers specifically to the plough layer, and we will clarify this explicitly in the revised manuscript.

4. Lines 95–96: I think this sentence is repetitive, as similar information has already been mentioned before. It could be simplified to make the text more concise.

Response: We thank you for this helpful comment. We agree that this sentence is repetitive and will simplify it in the revised manuscript to improve conciseness. We will also carefully review the manuscript to remove any additional redundant expressions.

5. From the survey results in lines 95–100, about 90% of the gullies are active, which explains why F1 and F2 were selected. However, in lines 101–110, the development status of these two selected gullies is not clearly described. I think the authors should add some explanation here to better justify the selection.

Response: We agree that the development status of the selected gullies should be more clearly described to justify their selection. In the revised manuscript, we will provide additional information on their activity and geomorphic characteristics, including photographs of active gully heads and descriptions of vegetation cover, to strengthen the rationale for selecting F1 and F2.

6. Line 115: For the instruments used in the study, I suggest adding manufacturer information to improve reproducibility. For example, Specord M40 (VEB Carl Zeiss, Jena, Germany).

Response: We agree that providing manufacturer information improves reproducibility. In the revised manuscript, we will add the manufacturer details for all instruments used.

7. Line 130: Similarly, the previous sentence seems redundant and could be removed. Also, in line 131, adding instrument details would be helpful.

Response: We agree that the previous sentence is redundant and will remove it in the revised manuscript. We will also add the relevant instrument details in Line 131 to improve clarity and reproducibility.

8. One question I have is whether the monitored gully has baseflow during non-rainfall periods. If so, should the baseflow-related nutrient flux be excluded when calculating rainfall-event N and P losses?

Response: We thank you for raising this important point. Gullies differ substantially from rivers in that they generally do not sustain baseflow in the absence of rainfall, particularly for hillslope gullies. Therefore, baseflow effects are not relevant for the two selected gullies in this study. To avoid potential misunderstanding, we will clarify this point explicitly in the revised manuscript.

9. I noticed that correlation analysis and some other statistical analyses were used. Should these methods be briefly described in Section 2.4 as well?

Response: We agree that the statistical methods, including correlation analysis and related approaches, should be briefly described in Section 2.4. We will add a concise description to improve methodological clarity.

10. The Results and analysis section is clear and easy to follow. The key findings are well presented, and the figures are also nicely prepared.

Response: We appreciate your positive comments and are glad that the Results section and figures are clear and easy to follow.

11. The Discussion could possibly be strengthened by comparing the function of natural gullies with artificial drainage ditches, and by referencing relevant studies. This may help further highlight the uniqueness and importance of erosional gullies, and also better connect with the points raised in the Introduction.

Response: We agree that comparing artificial drainage ditches with naturally formed gullies is an interesting and meaningful perspective. Following your suggestion, we will review relevant literature on drainage ditches and strengthen the comparison and discussion in the revised manuscript to better highlight the distinct characteristics of gullies and the significance of this study.

12. Overall, I think this is a high-quality and innovative study. After addressing the issues mentioned above, the manuscript can be considered for publication in HESS.

Response: We appreciate your positive assessment and constructive comments. We will carefully revise the manuscript to further improve its quality.