Thank you for your question. In response, I would like to provide the following answer.

1. The discussion in this paper focuses on aerobic methane oxidation, rather than anaerobic methane oxidation. Since most studies on aerobic methane oxidation use the term "methane oxidation" without specifying "aerobic," we have omitted this clarification. Then we can change the methane oxidation in the article to aerobic methane oxidation. And upland soils are the primary biological CH_4 sink [1, 2], owing to aerobic methanotroph-mediated CH_4 consumption reaching approximately 30 teragrams per year (Tg yr^{-1}). Our focus is on upland soils, and we aim to investigate the impact of sulfate on the methane oxidation capacity in these soils, specifically concentrating on aerobic methane oxidation.

Furthermore, numerous studies have already provided clear experimental evidence regarding the effect of sulfate on anaerobic methane oxidation, showing that sulfate promotes this process [3, 4, 5]. However, the effect of sulfate on aerobic methane oxidation remains unclear and has not yet been definitively established. Therefore, our intention is to review existing literature on the relationship between sulfate and aerobic methane oxidation, and to clarify the potential mechanisms through which sulfate may influence aerobic methane oxidation. As such, the topic of anaerobic methane oxidation is not addressed in this study. We will also be revising the title of the paper to: *Reviews and syntheses: Contribution of sulfate to* aerobic *methane oxidation in upland soils: a mini-review.*

2. We have reviewed the direct effect of sulfate on aerobic methane oxidation, with sulfate promoting methane oxidation by 3-42% (L. 75). The corresponding references are also listed in the Table 1. Section 3 (L. 187-250) provides a detailed review of the direct impact of sulfate on aerobic methane oxidation. However, we neglected to affirm the conclusion that sulfate affects methane oxidation. We will correct this in the revised version of the paper by affirm that sulfate is affecting methane oxidation before discussing the effect of sulfate on methane oxidation. The reason we stated "due to the

scarcity of studies investigating the direct effect of SO_4^{2-} on CH_4 oxidation, no definitive conclusion regarding its impact could be drawn" (L. 245-247) is because, in our view, there is a lack of sufficient research on the direct influence of sulfate on methane oxidation. As a result, we refrained from directly stating the promoting effect of sulfate on methane oxidation. However, this promoting effect is indeed present, and we will revise the manuscript to clarify and affirm the positive influence of sulfate on methane oxidation.

Our review exclusively focuses on the impact of sulfate on aerobic methane oxidation because our primary concern is with upland surface soils, which are important sites for aerobic methane oxidation and can absorb methane from the atmosphere, thereby reducing atmospheric methane concentrations. Although anaerobic methane oxidation does occur in upland soils, it is limited to deeper soil layers, and the amount of methane oxidized is relatively small. We believe that, even though sulfate acts as an electron acceptor for anaerobic methane oxidation, it is situated far below the aerobic methane oxidation layer and, given the minimal amount of methane oxidized in this context, its contribution to overall methane absorption is likely negligible. Furthermore, most studies on the effect of sulfate on methane oxidation have been conducted in wetlands, marine environments, and paddy fields—anaerobic environments—while little research has been conducted on anaerobic methane oxidation in upland soils. Therefore, we did not review the effect of sulfate on anaerobic methane oxidation, nor did we include treat its contribution as part of the effect of dryland soil sulfate on methane oxidation.

3. We selected only five forests because the effect of sulfate on aerobic methane oxidation has only been mentioned in the literature within these studies. We will revise the title of Table 1 to “Promotion effect of sulfate on methane oxidation in diverse upland soils.” In fact, we subjectively believe that sulfate will inevitably affect aerobic methane oxidation; however, research on this topic is very limited, and we

found that only these studies in five different forests referenced the impact of sulfate on aerobic methane oxidation. Therefore, we have summarized only these studies.

We also recognize that drawing the conclusion of "sulfate promotes aerobic methane oxidation" based on just these five studies is insufficient. Thus, we have summarized the indirect effects of sulfate on aerobic methane oxidation in the article. Our aim is to identify potential links between sulfate and aerobic methane oxidation in soils, thereby providing indirect evidence to support the hypothesis that sulfate can influence aerobic methane oxidation. In addition, we have conducted an experiment on the effect of sulfate addition on aerobic methane oxidation. Through data analysis, we have observed a promoting effect of sulfate on methane oxidation. This article is in the process of being written and we hope it will be published soon and a testament to this review.

4. I understand the issues you raised. We will make the following revisions:

1) We will reduce our discuss of the methane oxidation process and the part of the microorganisms involved.
2) The repetition between Lines 174–182 in Section 2.3 and Lines 60–68 in Introduction will be addressed, and the content will be revised to improve the overall presentation of the article.
3) The content in Section 3 will be revised by adding topic sentences at the beginning of each subsection to enhance clarity and structure.
4) The results presented in Lines 75–78 will be moved from the introduction to the results section.

5. We will review the entire manuscript to address the issue of omitted conjunctions, correct any minor errors, and remove unnecessary line breaks in the tables.

Thank you again for your question. I hope this response satisfactorily addresses your inquiry and that we will carefully revise the article in the light of your comments and in the light of our own reflections.

Reference

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