In this manuscript, Cook et al. present their study on **"Modelling the nutritional implications of ozone on wheat protein and amino acids"** to improve the DO$_3$SE-CropN model. Through simulations of nutrition-based ozone risk assessment in Indian wheat, the authors develop a flexible framework for crop models by incorporating the antioxidant responses, as well as leaf and stem nitrogen dynamics under ozone exposure. This study provides valuable data and is aligned with the journal's scope. The manuscript is well-written; however, some corrections are required to improve the quality.

I recommend publication after a relatively minor revision as follows:

Line 40: Update "Mills et al. 2018b" to "Mills et al. 2018a" for the first citation of Mills et al. in 2018. The subsequent citation with the same author and year should be referenced as "Mills et al. 2018b."

I thank the reviewer for bringing this to my attention. I contacted the copy-editing team for the journal, and they have informed me that the in-text references should match the bibliography which is sorted alphabetically. In my case, my first reference is to the tropospheric ozone assessment report paper from Mills et al. (2018), which occurs later alphabetically than the other Mills et al. (2018) paper and receives the tag "b" to distinguish it.

Mills, G. et al. (2018a). Ozone pollution will compromise efforts to increase global wheat production. Global Change Biology, 24 (8), pp.3560–3574. [Online]. Available at: doi:10.1111/gcb.14157.
Mills, G. et al. (2018b). Tropospheric Ozone Assessment Report: Present-day ozone distribution and trends relevant to human health. Elementa: Science of the Anthropocene, 6 (47). [Online]. Available at: doi:10.1525/elementa.302.

Based on the comments of the copy-editing team this reference does not require changing

Lines 40-42: Expand briefly on the TOAR-I report's findings regarding current ozone trends.

We thank the reviewer for their suggestion and have now included a summary of some of the key findings from the first phase of the tropospheric ozone assessment report:

"From the first phase of TOAR, it was observed that tropospheric O$_3$ increased globally in the 20th century, with atmospheric chemistry and climate modelling studies finding that O$_3$ production is greatest in mid to high latitudes due to greater emissions of O$_3$ pre-cursors (Archibald et al., 2020; Cooper et al., 2014). Additionally, using the database Mills et al. (2018b) found that in East Asia O$_3$ concentration metrics for wheat growing locations where much greater than in Europe. Several authors for the first phase of TOAR commented on the underrepresentation of some key wheat producing areas (particularly India but also for China and Russia) in the database, which limited some of the analysis (Cooper et al., 2014; Mills et al., 2018; Schultz et al., 2017)."

Lines 42-44: Make this sentence clear by breaking it into two sentences.

We agree that the sentence was long and clunky, instead of breaking it into 2 we have removed the unnecessary information and simplified it to say: "This paper is part of the second phase of TOAR (https://igacproject.org/activities/TOAR/TOAR-II), which expands on the first phase to investigate O$_3$ impacts on human health and vegetation."

Lines 72-73: Provide possible reasons for the high O_3 concentration in this region for better context.

We thank the reviewer for this comment. We have added the following sentence to explain the high O_3 concentrations:

"These high O_3 burdens occur due to increasing pre-cursor emissions and insufficient pollution control measures (Archibald et al., 2020; Singh et al., 2023; Wang et al., 2023)."

Lines 76-77: Rephrase this sentence, as comparing present-day conditions to seasonal changes may not appropriately represent O_3 concentration variations.

We understand the point the reviewer makes here. We were aiming to highlight that the greatest increase in O_3 concentrations in India will occur during the wheat growing season, which will threaten wheat production further in the country. We appreciate this was not particularly clear. We provide further information on the findings of Kumar et al. (2018) which we then link to the dry, wheat growing season in the second sentence to make the O_3 concentration variations clearer.

"Using a Nested Regional Climate Model with Chemistry, Kumar et al. (2018) projected that O_3 concentrations across India will rise under RCP 8.5, while remaining comparable to current levels under RCP 6.0. For the dry, wheat growing season, the authors projected that O_3 concentrations across the IGP will increase under both RCP 6.0 and RCP 8.5, with a much larger increase under RCP 8.5."

Line 125: Introduce the existing DO₃SE-Crop model here, summarizing essential inputs and its application in a few sentences for reader comprehension.

We agree that it would be useful for the reader to understand this information in the introduction before reaching the methods section.

We add the following brief information to provide some context on the DO3SE-Crop model (purple text):

"Currently, only one model has been developed which captures the effect of O_3 on crop nutrition: DO₃SE-CropN (Cook et al., 2024). DO₃SE-CropN is built on the existing DO₃SE-Crop model, which takes inputs of hourly meteorology and O_3 concentrations to simulate crop phenology, O_3-impacted net photosynthesis, dry matter partitioning, grain filling and O_3 impacted crop senescence (Pande et al., 2024). The DO₃SE-CropN model then simulates crop N, and models explicitly the effect of O_3 on reducing the amount of N from the leaves and stems that is available for the grain."

Line 156: "recovery from O_3 damage overnight" Please clarify the phrase.

We agree that the previous phrasing of the sentence is confusing. We modify it to be clear that it is the O_3 effect on photosynthesis that the plant can recover from overnight

"The DO₃SE-Crop model is a coupled stomatal conductance-photosynthesis model, which simulates stomatal O_3 uptake, its impact on photosynthesis which the plant can recover from overnight, as well as O_3 induced accelerated crop senescence (Pande et al., 2024)."

Line 172: Specify which antioxidants are considered for model integration, as "antioxidants" is a generalized term.

We thank the reviewer for their comment and understand that the current framing of this section makes the antioxidants considered unclear to the reader. In this case we do not consider specific antioxidants, we simply consider antioxidants as a general pool. We add the following make this clearer:

"For the purposes of this study, we do not consider individual antioxidants (e.g. superoxide dismutase (Tiwari and Agrawal, 2018)). Instead, we model a general pool of N that we hypothesise to be associated with antioxidants. This antioxidant pool of N is subsequently unavailable to the grain and is suggested to partially explain the decrease in grain protein of Indian wheat under O_3 exposure."

Line 347: "Error! Reference source not found. shows the results of the DIAAS calculation." Correct the sentence "Table 1 shows the results of the DIAAS calculation"

We thank the reviewer for pointing this out, we have now corrected this

Line 503: "(Error! Reference source not found., Fig.'s 5b and 5d)." Correct the sentence.

We thank the reviewer for pointing this out, this should have been Table 1 and we have now corrected this

Line 522: Replace "O3" with "O_3"

We have corrected this

Line 634: Reference is incomplete, please address the missing information.

We thank the reviewer for bringing this to our attention, this is a person's PhD thesis and so we have now included the associated university

We would like to extend our gratitude to the reviewer for their attention to detail and suggestions to the manuscript. We feel the clarity of the paper is much improved by their suggestions.