The study by Engel et al. presents a very interesting approach to examining the hydrological impacts of large-scale tree cover change under future climate scenarios. The interdisciplinary method you employ, combining data from multiple CMIP6 climate models, Budyko models, and the UTrack dataset, provides a good initial estimate of how climate change and tree cover shifts may influence water availability.

The author's acknowledgment of the limitations, particularly the inability of the UTrack dataset to capture energy balance changes in both current climate (CC) and future tree cover change (TCC) scenarios, is well-placed. I appreciate that you have addressed these important limitations in detail within the methodology and discussion sections, providing clarity on the scope of your findings.

Despite these constraints, the manuscript still offers valuable insights into the potential hydrological consequences of tree cover change at a global and regional scale. The authors highlight the complex interplay between climate-driven and vegetation-driven effects on runoff. Future studies that could take a more complex approach and employ fully coupled models and could build on your findings to provide an even more comprehensive understanding.

We thank reviewer 3 for their positive and constructive feedback comments on the paper. We are happy to read that the reviewer appreciates our discussions of the uncertainties and limitations of the study. We address the comments in detail below.

Visualization of Table 1: Consider redrawing Table 1 as a flow chart to clarify the workflow. This could improve the reader's understanding of your methodology at a glance.

We thank the reviewer for raising this point and agree that a simplified flow chart would provide a clear and more accessible overview of our methodology. Therefore, we will add a simplified flow chart (indicating our main research steps) to the methodology section whilst also retaining Table 1 in this section to visualize the detailed layout of the methodology. The proposed flow chart is shown below;

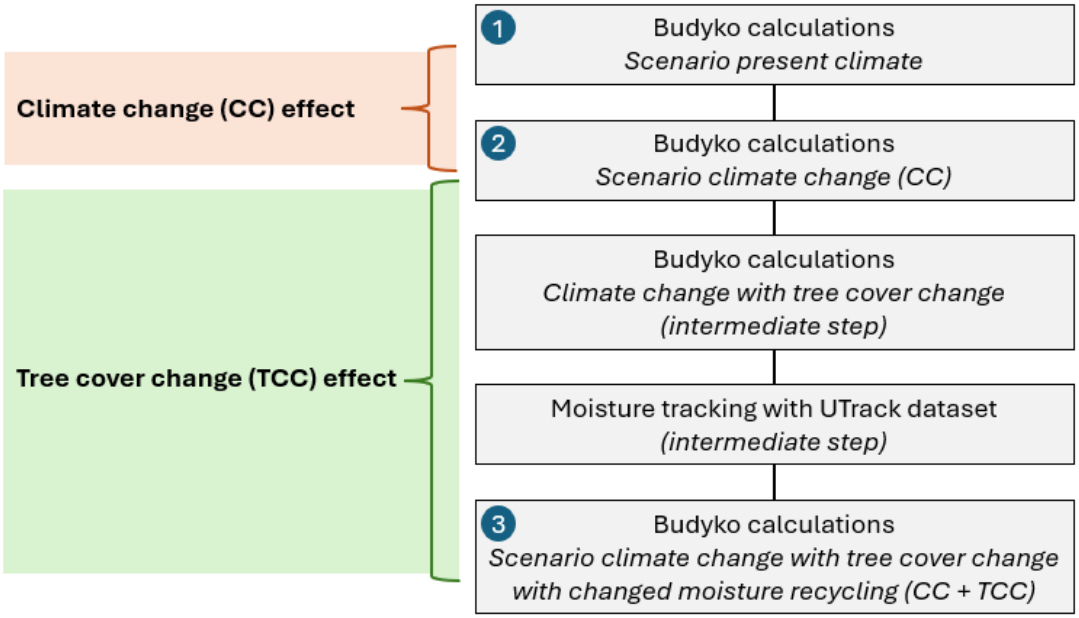

Figure 2. Simplified overview of the main research steps in our methodology. This figure shows the research scenarios: 1) scenario present climate; 2) scenario climate change (CC); 3) scenario climate change with tree cover change with changed moisture recycling (CC + TCC); as well as the intermediate research steps. A detailed overview of the input and output of each step can be found in Table 1.

Clarity in Methodology: The beginning of the methods section could be more accessible. I suggest explaining the necessity of including multiple Budyko models for the uncertainty estimate earlier in the section to guide readers through your approach. Streamlining Table 1, possibly by replacing it with a simplified flow chart, and moving the detailed Table 1 to the appendix could help improve clarity.

We thank the reviewer for raising this point and as also mentioned above we will insert a simplified flow chart for additional clarity. Furthermore, we suggest the following changes in lines 89 - 93 at the start of the methodology section, whereby Fig. 2 would refer to the flowchart:

'The three research scenarios are: 1) scenario present climate, 2) scenario climate change (CC), and 3) scenario climate change with tree cover change and moisture recycling change (CC + TCC) (Fig. 2, Table 1). We calculate the effects of climate change as the difference between scenario present climate and scenario CC, and we calculate the effects of tree cover change as the difference between scenario CC and scenario CC + TCC (Fig. 2). In our study we adapt the general research methodology from Hoek van Dijke et al. (2022). For each research scenario, we use P and potential evapotranspiration (PET) datasets from five CMIP6 climate models (Sect. 2.1), along with a tree cover dataset (Sect. 2.2), as inputs for Budyko model calculations (Sect. 2.3) to generate ET and Q fluxes.'

We also agree with the reviewer that we should more clearly state the necessity of including multiple Budyko models, however, we prefer addressing this in the section dedicated to the

Budyko models (Section 2.3). We suggest the following explanation (in purple) starting at line 154:

'Each of these Budyko models was calibrated with lysimeter data originating from different river basins, thereby representing different vegetation types (e.g. plantation or natural vegetation, or deciduous or evergreen forest) and climate conditions. Therefore, we include multiple Budyko models for our global scale calculations to represent the spread between different models and minimize potential biases related to e.g. climate conditions.'

Use of the UTrack Dataset: The decision to use the UTrack dataset at a 1° resolution, when it is available at 0.5°, warrants an explanation.
The datasets of the CMIP6 models that fulfilled our predetermined conditions (mentioned in lines 109 - 113 of the manuscript) were only available at a relatively coarse spatial resolution (see also Table 2 in the manuscript). Therefore, we decided to use the UTrack dataset at the coarser spatial resolution of 1° by 1° instead of remapping the climate datasets to a higher spatial resolution. Additionally, we perform all calculations on this 1° by 1° spatial resolution for consistency. We will mention our motivation for using the 1° by 1° UTrack dataset in the revised version of the manuscript.

Additionally, a recent preprint (https://www.researchsquare.com/article/rs-4177311/v2) has highlighted a potential issue with the water balance in the dataset, which should be acknowledged, particularly since it is being utilized for water balance estimations. Ensuring that the global water balance checks out would strengthen the validity of your analysis.
Thank you for notifying us of this paper. We will refer to the paper in section '2.4 Utrack moisture recycling dataset'. During our analyses we indeed checked for closure in the water balance, whereby we found an almost negligible difference ($\times 10^{-14}$) between the global change in ET and global change in P, which we related to rounding effects.

Furthermore, here are two papers that may be relevant, as they utilize the UTrack dataset for basin-level estimations and also account for the impact of land use changes. These references could provide additional context and support for your analysis (https://www.nature.com/articles/s44221-024-00291-w, https://doi.org/10.1029/2023EF003837).

Thank you for bringing these papers to our attention. The paper by Fahrländer et al (2024) fits well in our introduction, and we will cite it in line 28.

References:

Fahrländer, S.F., Wang-Erlandsson, L, Pranindita, A., and Jaramillo, F.: Hydroclimatic Vulnerability of Wetlands to Upwind Land Use Changes, Earth's Future, 12, 3, e2023EF003837, https://doi.org/10.1029/2023EF003837, 2024