This manuscript presents an improved coupled carbon–water model incorporating dynamic water-use efficiency to attribute water yield changes across China to climate, vegetation, and atmospheric CO_2. The attempt to explicitly represent CO_2 physiological effects is valuable and addresses an important limitation in Budyko-type frameworks. However, several conceptual, methodological, and interpretational issues limit the robustness of the conclusions. Concerns remain regarding the attribution framework, model assumptions, and the interpretation of CO_2 effects.

Major Comments

(1) The manuscript estimates WUE using the formulation of Cheng et al. (2017), which is derived from stomatal conductance theory and incorporates variables such as VPD, CO_2 concentration, and LAI. While this formulation captures key physiological controls, it is fundamentally rooted in leaf- to canopy-scale transpiration processes rather than directly representing ecosystem-scale evapotranspiration (ET). This raises a conceptual concern regarding its subsequent use in estimating total ET via ET=GPP/WUE. The formulation appears more consistent with transpiration-based WUE, whereas total ET also includes soil evaporation and interception loss. The authors should clarify the scale and interpretation of WUE (leaf, canopy, or ecosystem level) and provide stronger justification for its application to total ET estimation.

(2) The scenario-based attribution approach assumes that climate, vegetation, and CO_2 effects can be isolated by fixing other variables. However, these drivers are not independent, as vegetation dynamics are strongly influenced by climate and CO_2 (as partially acknowledged in Lines 575–583). This introduces non-orthogonality in attribution, meaning the reported contributions cannot be interpreted as strictly separable. The authors should quantify the associated uncertainty and discuss potential interaction effects among drivers.

(3) The study assumes WY=P-ET with negligible storage change. This assumption may not hold in regions with significant groundwater depletion or reservoir regulation. The authors should explicitly discuss the limitations of this assumption and clarify the temporal scale at which it is considered valid.

(4) The manuscript concludes that CO_2 may drive a +1.29% annual increase in water yield under SSP585. This conclusion appears overstated, as it does not account for potential counteracting effects such as increasing VPD or saturation of WUE under elevated CO_2 and drought stress. The authors should clarify the assumptions underlying these projections and provide a more balanced discussion of uncertainties.

(5) The main methodological novelty appears to be the use of a dynamic WUE formulation to estimate ET, compared to previous approaches using static WUE. However, the improvement in model performance (e.g., R^2 increasing from 0.68 to 0.70 in Figure 4) is relatively modest. The authors should better articulate how this

methodological refinement leads to new insights, particularly in terms of water yield dynamics, and clarify the fundamental differences between the two approaches beyond marginal statistical improvement.

Minor Comments

(1) Lines 44–61; The importance of computing water yield as a key metric is not clearly articulated. The authors should explicitly state why water yield is chosen and how it relates to the broader research motivation presented in this section.

(2) Line 271; The term “trend” is not clearly defined. Please clarify whether it refers to a linear slope or another metric, and provide details of the calculation method.

(3) Figure 3b: The color legend is missing, and the unit of the values shown in panel (b) is unclear. Please add a complete legend and specify units.

(4) Figure 3a: The map is too small to interpret clearly, and the meaning of the legend (e.g., f–g) is not well explained. Please enlarge the figure and provide a more detailed caption.

(5) Lines 83–93; Multiple variables are represented using the same symbol “n,” which creates confusion. It is recommended to use distinct symbols or explicitly state variable names to improve clarity.

(6) Figure 5: The spatial patterns in the panels are highly similar. Consider retaining only the relative change map and enlarging it for clarity, while moving the remaining panels to the supplementary material.

(7) Discussion section

The discussion is primarily organized by river basins. It would be beneficial to also analyze results across different climate zones to provide more process-based insights.

(8) Lines 16–18;The sentence structure is unclear (e.g., “integrating dynamic WUE better capture…”). Please revise for grammatical correctness and clarity.

(9) Lines 56–61; There is redundancy in describing the importance of the study. This section could be shortened to improve conciseness.

(10) Throughout the manuscript, units are not consistently formatted (e.g., mm/yr vs mm/year). Please standardize unit notation throughout the manuscript.