Comment 1:

This study calculates the differences in I_E and evaluates how these differences influence the estimates of root zone storage capacities. It further examines how uncertainties in root zone storage capacities affect streamflow predictions in hydrological models. To some extent, the manuscript is well-structured, detailed, and presents valuable ideas. However, several concerns need to be addressed. Additionally, inconsistent formatting and grammar errors diminish the quality of the paper. Overall quality needs to be enhanced.

Reply:

We thank the reviewer for his/her detailed and constructive comments. We highly appreciate the overall positive assessment of our analysis. We will carefully revise the formatting and grammar errors in the revised manuscript.

Comment 2:

Using absolute values of the I_A deviation in Figure 8 cannot effectively reflect the change in I_A. Using percentage changes would better illustrate how I_A changes to reflect multi-decadal climatic variability. Your use of percentage changes in Figure 12 (c) for root zone storage capacity changes is a good approach.

Reply:

We completely agree with the reviewer that for many purposes, the analysis of relative changes in I_A is more suitable to meaningfully describe the observed pattern. For our analysis we seek to quantify absolute changes in $S_{r,max}$ over time. To achieve this, we need to quantify the absolute changes in E_A (over $I_E = E_A/P$), which in turn depend on changes in absolute values of $I_A = E_P/P$, as dictated by the Tixeront-Fu equation (Eq.1 in the manuscript). We acknowledge that our description of the procedure has not been sufficiently clear in the original manuscript. We will provide a clearer explanation in the revised manuscript.

Comment 3:

Are the values of the aridity index in Figures 1-3 calculated for the entire period? If so, while the values of I_A deviation in Figure 8 are calculated by decades, it might be better to find a consistent way to present I_A and I_A deviation using the same time period (either the entire period or by decades).

Reply:

Indeed, the aridity index in Figures 1 – 3 is based on the entire study period, to provide the reader with an overall hydro-climatic context. However, we agree with the reviewer that the actual I_A per decade may be interesting to see. We will include such a Figure in the revised manuscript.

Comment 4:

If percentage changes in I_A are small for most catchments, climatic variability is small. Then is the conclusion that hydrological responses, in terms of changes in I_E, root zone storage capacities, and streamflow, are generally minor under changing climatic conditions reliable?

Reply:

This is an interesting question. With the available past data records, no fully conclusive answer can be given. In our analysis we only draw the conclusion that effects of the *observed past changes* of I_A remain rather minor. With hypothetically more pronounced changes in I_A, it may plausibly assumed that the effects may be more relevant. However, there is at this point little empirical evidence that such more pronounced changes in I_A have occurred elsewhere over the last 120 years as recently demonstrated by Ibrahim et al. (2024; Figures 4 and S1 therein), nor is there evidence that future changes will significantly exceed those of our analysis at least over the next few decades (Jaramillo et al., 2022; Figures 3 and 4 therein). Both of these previous studies show that globally changes in I_A have in the past and will in the future remain well with in the range of $I_A \sim \pm 0.1$ for the vast majority of catchments.

Comment 5:

Related to 1.c: How many catchments exhibit distinct changing climate conditions? Can percentage changes in I_A and I_E by decades effectively reflect that? If the climate changes are small, their impact on root zone storage capacity changes might be less significant.

Reply:

As shown in Figure 8, less than ~5% of the study catchments exhibit a change of $I_A > \pm 0.1$. A comparable pattern can be found for catchments world-wide (Jaramillo et al., 2022; Ibrahim et al., 2024). Indeed, we agree that if changes in climatic conditions are small, changes in $S_{r,max}$ can also be expected to be low. The actual magnitudes of the change in $S_{r,max}$ are exactly what we aim to quantify in our analysis.

Comment 6:

The legends in Figures 1 and 2 should use periods instead of commas, so they should be 0.1 – 0.2, 0.2 – 0.3, etc., not 0,1 – 0,2, 0,2 – 0,3, etc. Additionally, the title of the legends should be "Aridity Index I_A," with the A as a subscript.

Reply:

Indeed! We agree. This will be corrected in the revised manuscript.

Comment 7:

Figure 11 could be removed; the information is clearly conveyed in the text.

Reply:

We agree. We will remove this figure.

Comment 8:

Units of Figure 13 are incorrect.

Reply:

Thank you for pointing this out. Will be corrected in the revised manuscript.

Comment 9:

Lines 332 to 331, do you mean Figure 13?

Reply:

Yes. We will correct that in the revised manuscript.

Comment 10:

Line 405: The reference Wang et al., 2016 is missing from the list of references. There may be other missing references as well. A comprehensive reference check is recommended.

Reply:

We will add the reference to the list and carefully check the rest of the list.

Comment 11:

Line 684: two references listed in one line.

Reply:

Will be corrected.

References:

Ibrahim, M., Coenders-Gerrits, M., van der Ent, R., & Hrachowitz, M. (2024). Catchments do not strictly follow Budyko curves over multiple decades but deviations are minor and predictable. Hydrology and Earth System Sciences Discussions, 2024, 1-27.

Jaramillo, F., Piemontese, L., Berghuijs, W. R., Wang-Erlandsson, L., Greve, P., & Wang, Z. (2022). Fewer basins will follow their Budyko curves under global warming and fossil-fueled development. Water resources research, 58(8), e2021WR031825.