This study provides a well-structured and comprehensive analysis of global aridity projections based on CMIP6 scenarios. The results are presented clearly, and the methodological approach appears to be sound and well explained. The study is relevant for understanding long-term trends in desertification and future climate impacts.

Comments:

- Aridity classification - The manuscript primarily focuses on desertification, but only includes 1–2 humid categories. Would it be possible to shift the focus slightly toward transitions between different aridity index (AI) classification states rather than focusing exclusively on desertification? If the authors prefer to maintain the current classification, a justification for this choice would be helpful.

Thank you for this comment. The article studies processes of drying and wetting in terms of aridity index, not only comparing the classification in "aridity categories". The classification we used is the same as the one reported in UNESCO 1979.

The aridity index is meaningful only when the ratio precipitation / evapotranspiration is inferior to 1. The "drylands" categories are defined up to a ratio AI = 0.75, that get close to this equilibrium. It does not make sense to define more "humid" categories in the study when studying the shift towards dryer conditions. In addition, that would prevent our categories to be compared with previous studies.

- The AI classification used in this study appears to be slightly different from the classification used by the IPCC Sixth Assessment Report and UNCCD (2024), also cited in this study. See: [Dry sub-humid ($0.5 \leq AI < 0.65$), Semi-arid ($0.2 \leq AI < 0.5$), Arid ($0.05 \leq AI < 0.2$), Hyper-arid ($AI < 0.05$)]. It is only a minor change to the classification but it would make it easier to compare your assessment to more recent publications. See for reference: e.g. Figure CCP3.1 in Mirzabaev, A., L.C. Stringer, T.A. Benjaminsen, P. Gonzalez, R. Harris, M. Jafari, N. Stevens, C.M. Tirado, and S. Zakieldeen, 2022: Cross-Chapter Paper 3: Deserts, Semiarid Areas and Desertification. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 2195–2231, doi:10.1017/9781009325844.020.

In our study, we use the threshold for aridity categories defined in the UNESCO aridity map of 1979. This map was established using the aridity index calculated with the Penman-Monteith evapotranspiration equation, where the thresholds were defined according to the major bioclimatic categories. Later, the Cross-Chapter Paper 3 and the UNCCD report use slightly different boundaries for aridity categories based on the categories adopted by the World Atlas of Desertification published in 1997 (second edition). In the Atlas, the evapotranspiration is calculated using the Thornthwaite equation. The difference of thresholds compared to UNESCO 1979 is deliberately made because of the tendency of the Thornthwaite equation to underestimate evapotranspiration in dry zones, and overestimate it in wet zones.

This article uses the Penman-Monteith evapotranspiration, therefore we kept to the thresholds defined for this equation. The resulting categories are comparable with the categories of the

Cross-Chapter and UNCCD report, that both use thresholds adapted to the use of Hargreaves and Thornthwaite equations.

A paragraph explaining why the thresholds are different has been added line 113:

The climate is then classified into 5 classes depending on their aridity index. The thresholds used in this article were defined in the explicative note of the UNESCO (UNESCO 1979) on the map of the world's arid regions, based on the bioclimatic characteristics of these areas. These thresholds are slightly different to those used in the UNCCD report on desertification (Vincente-Serrano et al. 2024) and in the dedicated chapter of the IPCC AR6 (Mirzabaev et al., 2022), because these two reports use respectively the Hargreaves and Thornthwaite evapotranspiration equations. The two equations underestimate evapotranspiration in dry areas and overestimate it in humid areas. In their case, the hyperarid areas are defined by an aridity index inferior to 0.05 (instead of 0.03 here) and humid areas with an aridity index superior to 0.65 (instead of 0.75 here) in order to match the categories defined with the Penman-Monteith equation.

- Will the dataset produced in this study be made publicly available? A dataset of time-series AI classifications would enable further studies on system-state transitions, which could be valuable for assessing long-term desertification and land degradation trends. Making such data accessible would enhance the impact and usability of this research.

Thank you for noticing this. The dataset was supposed to be publicly available on the Zenodo repository associated with this work. The dataset will be added in the next release.

- **Formatting comments:**
  - There are some inconsistencies in citation formatting. For example, "et" appears to be used as "and" in some cases (e.g., lines 56, 59, and 73). Standardizing the citation format to English would avoid confusion.

This has been corrected for the next submission.

  - Lines 99–100: Please check the units—there appears to be a discrepancy of three orders of magnitude between mJ and MJ.

This has been corrected for the next submission.

  - Lines 545 and 548: The formatting of "CO_2" should be corrected.

All occurrences have been corrected for the next submission.

  - Table 2 should be formatted for easier readability.

Table 2 has been modified to make it more easily readable.