Response to Referee 3 Comments

MS No.: hess-2024-245

We would like to express our sincere thanks to Dr. Sutanto Samuel Jonson for reviewing our manuscript once again. We deeply appreciate the time and effort you dedicated to thoroughly evaluating the revised version and offering thoughtful and constructive feedback. Your continued insights have played a crucial role in further enhancing the quality of our work. We have carefully addressed all your comments in this revised manuscript, with our detailed responses provided below. Reviewer comments are highlighted in red, and our responses are shown in black.

General Comments

I appreciate the authors' careful consideration of my feedback in their revised manuscript and improved the clarity of the paper. I only have minor textual comments that could be considered when submitting the final version. I accept the manuscript after corrections.

L refers to line

1. L49: Move the reference to the end of the sentence.

Thank you for the suggestion. As advised, the sentence has been revised to move all references to the end. The updated sentence is as follows:

"For example, the SPI has been used to assess droughts in Greece, the United Kingdom, Iran, India, and China by Bhunia et al. (2020), Blain et al. (2022), Kazemzadeh et al. (2022), Livada and Assimakopoulos (2007), Zhang et al. (2012), respectively."

2. L94: EDO is agricultural drought monitoring and therefore it is not impact monitoring.

Thank you for pointing this out. In the revised manuscript, EDO has now been correctly referred to as a system for agricultural drought monitoring. The revised sentence is as follows;

"The European Drought Impact Report Inventory (European Drought Centre, 2025), which monitors drought impacts, and the European Drought Observatory (European Environment Agency, 2025), which monitors agricultural drought conditions, provide region-specific insights, but lack global coverage."

3.L96-98: Better combine these sentences with the next paragraph about GDIS.

Thank you for the suggestion. We have now merged the previously separated sentences into a single, coherent paragraph about GDIS as advised. The updated text is as follows:

“Recently, the Geocoded Disaster (GDIS) dataset has been developed based on EM-DAT, offering geocoded disaster locations at a subnational level (Rosvold and H. Buhaug, 2021), along with detailed data on affected populations, fatalities, and economic losses. By addressing the limitations of EM-DAT, the GDIS dataset provides detailed information on socio-economically affected areas and administrative units in GIS polygon format. This spatially explicit dataset enables analysis of drought impacts across diverse socio-economic contexts. In this paper, we used this newly developed GDIS dataset and show that it enables us to explore the less-understood link between drought hazards and their socio-economic repercussions more accurately and comprehensively.”

4.L161: Please provide reference for NDVI from Modis.

Thank you. As suggested, the reference for NDVI has been added in the revised manuscript as follows:

“We used monthly NDVI data products from the Moderate Resolution Imaging Spectroradiometer (MODIS) (Didan and Huete, 2023) spanning from 2001 to 2021.”

5. L171-172: Redundant statement about GDIS. Maybe remove?

Thank you for pointing this out. We agree that the sentence was redundant and have removed it from the revised manuscript. The deleted sentence was:

“The GDIS dataset is based on the EM-DAT dataset.”

6. L195: Table 1 could be improved by providing columns for e.g., data, description, spatial resolution, and sources.

Thank you for the suggestion. Table 1 has been revised to improve clarity and organization by adding separate columns for data type, description, spatial resolution, and source. The revised Table 1 is as follows:

Table 1. Details of the datasets used for this study.

Data	Description	Spatial Resolution	Source
Rainfall	CHIRPS rainfall data	Original: 0.05° × 0.05° Resampled: 0.1° × 0.1°	https://www.chc.ucsb.edu/data/chirps
Temperature	ERA5-LAND monthly temperature	0.1° × 0.1°	https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means
Soil Moisture	ERA5-LAND monthly volumetric soil moisture	0.1° × 0.1°	https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land-monthly-means
NDVI	MODIS NDVI (MOD 13A3 product)	Original: 1 km × 1 km Resampled: 0.1° × 0.1°	https://modis.gsfc.nasa.gov/data/dataprod/mod13.php
GDIS	Geocoded Disaster dataset based on EM-DAT, event-wise socio-economic impact data	Spatial: Subnational Temporal: Event-wise	https://sedac.ciesin.columbia.edu/data/set/pend-gdis-1960-2018/data

7. L230: Please provides references for PCA when you said widely used.

Thank you for the suggestion. We have added supporting references to justify the statement regarding the widespread application of PCA in atmospheric and hydrological studies. The revised sentence in the manuscript is as follows:

"The Principal Component Analysis (PCA) technique was used to assign weights to all four input indices. PCA has been widely used in atmospheric and hydrological studies to describe dominant patterns in multivariate data (Anon, 2002; Hannachi et al., 2007; Jackson, 1993)."

8. L366: To me, CDI maps provided in Appendix C are more important than the PCA weighting values (Figure 3). Considering to swap Figures.

Yes, we agree with your thoughts. In the revised manuscript, we have swapped the figures: Appendix C is now Figure 3, and vice versa. (Due to this change, the earlier appendix sequence has been slightly modified to maintain the flow of the write-up. What was previously Appendix B is now Appendix C, and the former Figure 3 is now Appendix B.

9. L565: Figure 9. For the legend, I think better if you write: >0.5 instead of 0.5<

Thank you for pointing out this. In the revised manuscript, >0.5 has been used in figure 9. The updated figure is as follows:

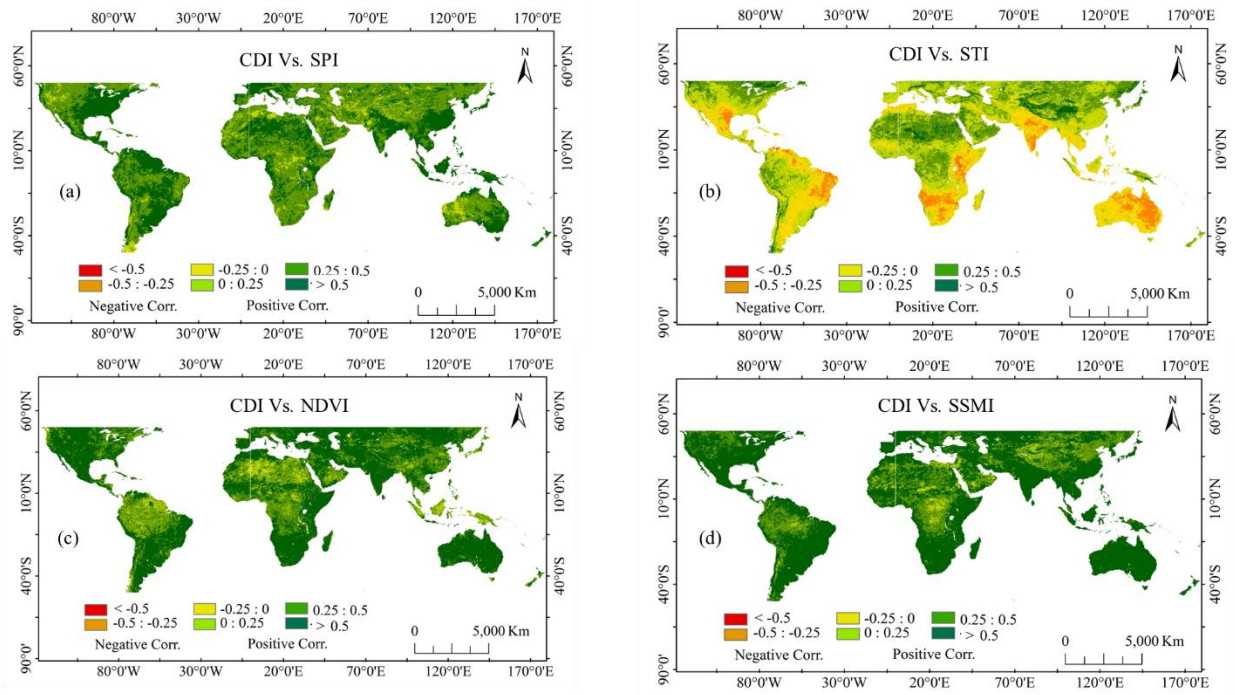

Figure 9. Spatial correlation between CDI and single input-based traditional indices for a sample month (April): (a) CDI vs. SPI, (b) CDI vs. STI, (c) CDI vs. NDVI, and (d) CDI vs. SSMI. Negative correlations are represented in shades from yellow to red, while positive correlations are shown in shades from light green to dark green.

10. L569: Aftereffect or after effect?

Thank you for the suggestion. We have revised the text to use “after effects” as recommended.

11.L584: Maybe provide reference from WMO (2012)? https://library.wmo.int/records/item/39629-standardized-precipitation-index-user-guide.

Thank you for the suggestion. The reference has been given to the sentence as follows:

“SPI-1 and SPI-3 are effective for detecting meteorological and agricultural droughts, respectively, while longer time scales (e.g., SPI-6 or SPI-12) are more suitable for identifying hydrological droughts (World Meteorological Organization, 2012).”