Response to Reviewer 1 Comments

The manuscript presents an interesting and relevant study on forecasting SPI using a hybrid model that combines existing methodologies in a novel way. The approach, which integrates signal decomposition (SG, CEEMDAN) with traditional (ARIMA) and deep learning (LSTM) techniques, addresses a crucial topic with significant potential impact, particularly for data-scarce regions like uMkhanyakude, South Africa. Although the study does not introduce entirely new methods, the unique combination and application of established techniques offer valuable insights and could help advance drought forecasting.

Major Comments:

- Terminological Precision and Focus on Introduction: The manuscript frequently uses the term "drought" without clearly specifying its type until late in the introduction. The initial sections should explicitly state that the study focuses on meteorological drought, as defined by the Standardized Precipitation Index (SPI), which only reflects precipitation. This clarification is crucial to avoid confusion and help set the stage for the study's objectives, contributions, and context within the broader field of drought research. Additionally, the introduction should discuss the scope and limitations, particularly noting that the study is a new method for SPI forecasting.

Reply: *We would like to thank the reviewer for this comment. This is now done. We have revised the introduction and address the reviewers' comments.*

- Methodological Framing and Clarity: The Methods section should provide a clearer and more focused explanation of the hybrid modeling framework. This includes: the rationale behind combining SG filtering with CEEMDAN decomposition prior to modeling; how the decomposition into intrinsic mode functions (IMFs) enhances forecasting accuracy, as indicated by the improved RMSE and values shown in Table 4; the stepwise integration of the ARIMA and LSTM models on decomposed components, and how these components are recombined for final predictions; the comparative advantages of this hybrid method over standalone models or simpler combinations, evidenced by the superior performance of the SG-CEEMDAN-ARIMA-LSTM model across all SPI timescales, as shown in Figures 11-16. While a diagram is present, these aspects should be emphasized to highlight the novel integration strategy, rather than detailing standard approaches like ARIMA or LSTM. These well-known methods can be briefly summarized, with detailed descriptions moved to the appendix to lighten the paper and assist the reader.

Reply: *We would like to thank the reviewer for this comment. This was done. We have revised the methodology and address the reviewers' comments.*

- Streamlining Content: To improve readability, consider moving detailed descriptions of well-known methods to an appendix. This will allow the main text to focus more on the innovative aspects of the study and its implications.

Reply: We would like to thank the reviewer for this important comment. We considered explaining details of each methodology that assisted us built our new proposed SG-CEEMDAN-ARIMA-LSTM hybrid model because details of all these methodologies seem to be very important for the readers. To create a flow and a better readability of our materials and method section, we have added a section that introduce what we are doing in the section and why. We did this to show that such a structured presentation ensures transparency in model development and establishes a comprehensive methodological framework for the proposed forecasting system (SG-CEEMDAN-ARIMA-LSTM).

- Justification for Methodological Choices: While the manuscript acknowledges the limitations of SPI, it should provide a more robust justification for its selection over SPEI, particularly under climate change conditions. Addressing this could strengthen the methodological rationale by discussing factors such as data availability or regional relevance.

Reply: We would like to thank the reviewer for this comment. We have revised and address the reviewers' comments. Some of the important points about using SPI is that:

- *Data simplicity: Only precipitation data needed; SPEI requires reliable temperature data.*
- *Less uncertainty: PET estimates can be inaccurate, especially in regions with limited meteorological stations.*
- *Consistency in long-term studies: Historical precipitation data may go back decades or more, while temperature and PET records may be shorter or less reliable.*
- *Focus on rainfall-driven drought: In regions where evapotranspiration is not the dominant driver, SPI is sufficient.*
- *Comparability: SPI is widely reported globally; easier to benchmark across regions and studies.*

- Literature Review Organization: The literature review should be reorganized to group studies thematically, highlighting insights that motivate the proposed model and clarifying the research gap that this study aims to address. This will provide a clearer context for the study's contributions.

We would like to thank the reviewer for this comment. We have revised the literature review and address the reviewers' comments.

- Abstract and Title Refinement: The abstract should be concise and precise, clearly outlining the study's objectives and methods. Similarly, consider revising the title to avoid redundancy and focus on the paper's core contributions.

Reply: *We would like to thank the reviewer for this comment. We have revised the abstract, tittle and address the reviewers' comments.*

In summary, the manuscript is potentially interesting and relevant, offering valuable insights through its novel combination of established methodologies. However, it would benefit from a rewrite to clarify key sections in the Introduction and Methods, and from streamlining redundant content to enhance readability and focus.

Reply: *We would like to express our gratitude to the reviewer for their invaluable suggestions and comments.*