

General Comments:

The purpose of this paper is to introduce a time-dependent observation-based forcing term into the MJO skeleton model and analyze the characteristics of the MJO and its relationship with ENSO. However, throughout the paper, there is no clear evidence that the method used in this study improves the reproducibility of the MJO, and the contribution of the study is unclear.

Major Comments:

1. No evidence that time-dependent forcing has improved MJO simulation
 - a. This study replaces traditional time-independent forcing with time-dependent forcing; however, there is no clear evidence that this modification has led to any improvement. In fact, there is even a possibility that the model's reproducibility has deteriorated.
 - b. Specifically, the model fails to predict the timing of MJO events and does not capture seasonal variations.
 - c. Moreover, applying a 3-month moving average to the forcing might have smoothed out important time variations, potentially leading to a failure in reproducing the MJO's temporal variability.
 - d. These results contradict the stated research objectives, and the advantages of using time-dependent forcing remain unclear.

2. Agreement in MJO statistical characteristics but failure to predict MJO event timing
 - a. While the study shows that the model reproduces statistical properties such as MJO duration and amplitude, it completely fails to predict the actual timing of MJO events. This raises serious concerns about the model's validity, as the agreement in statistical properties may not be meaningful.
 - b. Since the model in this study fails to predict the timing of MJO events, the agreement in statistical characteristics could result from averaging effects rather than actual model skill. Presenting this as a validation of the model could be misleading.
 - c. It remains unclear whether the agreement in statistical properties is a genuine consequence of incorporating time-dependent forcing or merely a result of parameter tuning to match observed statistics.

3. The model fails to capture ENSO-induced modulations of MJO events
 - a. The model does not reproduce statistically significant differences in MJO characteristics across ENSO phases.
 - b. This suggests that the model fails to properly capture ENSO's influence on MJO variability, contradicting the study's objectives.
 - c. Compared to previous studies demonstrating clear ENSO-related MJO modulations, the results presented in this study appear insufficient in representing the expected ENSO influence.

4. Lack of comparison with traditional models leaves improvements unverified
 - a. The manuscript does not clearly demonstrate what aspects have improved due to the introduction of time-dependent forcing.
 - b. Without a direct comparison to a time-independent forcing version of the model, it is impossible to assess the effectiveness of the proposed approach.

Detailed Comments:

1. **Mathematical formatting:** Equations should be centered, with equation numbers aligned to the right, following standard academic formatting.
2. **Line 55-56:** Specific results might be placed in later sections (results or discussion).
3. **Line 58-63:** Is this about general SST variability or ENSO-driven SST variability? The transition between topics is unclear, making the focus ambiguous.
4. **Line 89:** What modes were retained, and why? How does truncation impact model accuracy?
5. **Line 138:** What advantages do these datasets have compared to other reanalysis datasets? Given the selected resolution, do you believe that the key characteristics of the MJO are adequately captured? How does this resolution affect the representation of small-scale variations in the MJO?
6. **Line 178:** The 3-month averaging may remove key time variations, affecting MJO representation. How would results change with a shorter window (e.g., 1 month) or a different smoothing method?
7. **Line 190:** Why not use RMM directly? How does excluding lower winds affect results? How well does SMM match RMM in identifying MJO? Since SMM fails to capture spatial variations, a direct comparison with RMM is necessary.
8. **Line 211:** Please explain parameter selection. Were sensitivity tests conducted? If values are from past studies, cite references.
9. **Line 250:** Please cite Figure 4c in the text. What causes variance overestimation? What was the basis for choosing the first 14 spatial modes? How important are high-wavenumber modes for MJO representation?