

Anonymous Referee #3

This paper explores the contribution of anthropogenic influence to the EAWM in the past decades, using the All-Hist and Nat-Hist experiments. They found that the weakening of EAWM in 1960-2012 is mainly attributed to the anthropogenic influence, especially in the frequency of weak EAWM occurrence. Their results are reliable, based on the good performance of the model in simulating EAWM. I suggest for publication after minor revision. The details are shown below:

1. As shown in Figure 2, the EAWM indices in the All-Hist runs during 1960-1970 disagree with the results from reanalysis data. However, the indices during 1970-2013 are closely related to that from reanalysis data. I think it may be due to the uncertainty of the NCEP dataset before 1970. To confirm the relationship, please check the performance of the EAWM indices in the All-Hist runs compared with JRA-55 reanalysis dataset.

Reply: Thank for your comments. We have check the performance of the EAWM indices in the All-Hist runs compared with JRA-55 reanalysis dataset, and the results show similar characteristics (Figure R1 and Table R1).

Table R1 “tr” is an abbreviation for “linear trend coefficient” (EAWMI_HGT/EAWMI_SAT). “cor” is an abbreviation for “correlation coefficient between simulated EAWM index under All-Hist scenario and observed EAWM index” (EAWMI_HGT/EAWMI_SAT), “cor_dec” is an abbreviation for “correlation coefficient in decadal time-scale”. As a reference, the linear trend coefficient of EAWM_HGT/EAWM_SAT is -0.02/-0.023. The red numbers are significant at the 90% confidence level.

| | ensemble_best JRA55 | & | ensemble_best NCEP | & |
|---------|------------------------|---|-----------------------|---|
| Cor | 0.31/0.3 | | 0.31/0.3 | |
| Cor_dec | 0.73/0.69 | | 0.76/0.7 | |
| tr | -0.038/-0.044 | | -0.038/-0.044 | |

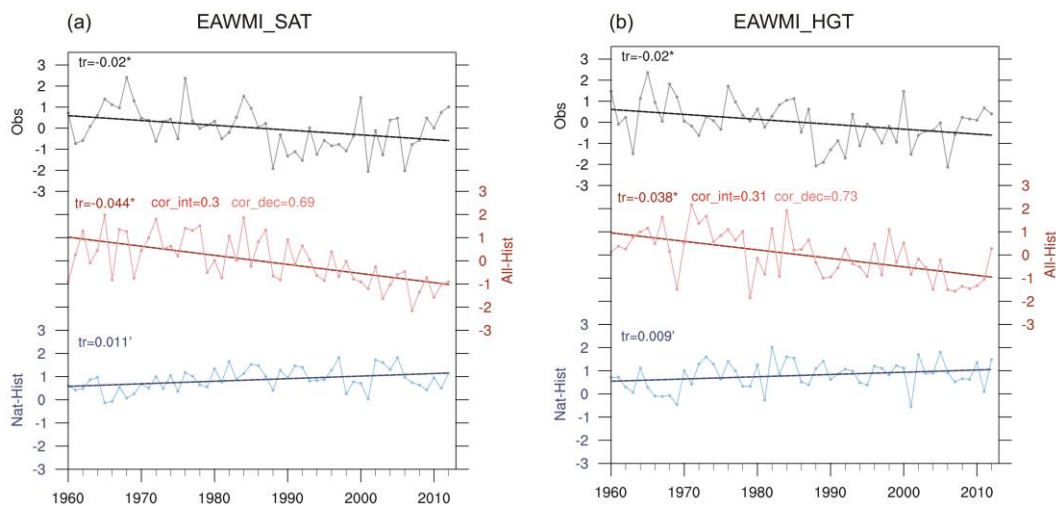


Figure R1 Figure 2 (a) The time series of the normalized EAWMI_SAT (curve) and their linear trend (line) during 1960–2012, based on JRA55 reanalysis dataset (top), outputs of model in All-Hist run (middle), and outputs of models in Nat-Hist run (bottom). (b) As in (a), but for the EAWMI_HGT. “tr” is an abbreviation for “linear trend coefficient”. “*” means the tr is significant at 95% confidence level based on the Mann-Kendall test, and “ ” means the tr is significant at 90% confidence level. “cor” is an abbreviation for “correlation coefficient between simulated EAWM index under All-Hist scenario and observed EAWM index”, “cor_dec” is an abbreviation for “correlation coefficient in decadal time-scale”. Note that the time series of the EAWM indices base on outputs of model in the Nat-Hist runs are standardized by the climatology simulated by the All-Hist runs.

2. Why the time series of the EAWM indices in the Nat-Hist runs are standardized by the climatology simulated in the All-Hist runs? Does it matter the number of the strong or weak EAWM events?

Reply: Thank for your comments. The climatology of the EAWM in the All-Hist runs is very close to the results of reanalysis data, but larger than the climatology in the Nat-Hist runs. It would be more reasonable that the strong/weak events are defined on the same standard, so the EAWMI in the Nat-Hist runs are standardized by the climatology simulated by the All-Hist runs.

3. According to previous studies (Zhu et al. 2015; Wei et al. 2017...), climate-decadal variability (such as PDO) associated with SST is important for the change of East Asian summer monsoon and winter monsoon. This paper indicates that the anthropogenic

influence may be the main factor for the weakening of EAWM in 1960-2013, so what is the contribution of climate decadal variability related to SST? Is it smaller than the anthropogenic influence?

Reference:

Zhu Y, Wang H, Ma J, Wang T, Sun J. 2015. Contribution of the phase transition of Pacific Decadal Oscillation to the late 1990s' shift in east china summer rainfall. J. Geophys. Res. 120:8817–8827.

Wei Y, Yu H, Huang J, He Y, Yang B, Guan X, Liu X (2017) Comparison of the Pacific Decadal Oscillation in climate model simulations and observations. Int J Climatol. <https://doi.org/10.1002/joc.5355>

Reply: Thank for your comments. There is no doubt the PDO is an important reason for the decadal variation of the EAWM. As shown in Fig. 2, an obviously increasing in EAWMI during 1960-1980 in Nat-Hist runs. During 1960-1980, both the PDO and AMO were in a cold phase (Fig. S2), leading an enhanced EAWM. However, the PDO and AMO were out-of-phase after 1980s, causing a combined effect on the EAWM. Thus, we consider that the AMO and PDO may be responsible for the increase trend of EAWMI in Nat-Hist runs. In All-Hist runs, there is an obvious weakening of the EAWM during 1960-2013. In this paper, we think the anthropogenic influence is the essential factor for the linear trend (a weakening) of the EAWM in 1960-2013.

4. Line 17, “... monsoon can be greatly influenced ...” can be changed to “... monsoon is greatly influenced ...”.

Reply: Thank you for your comments. We have revised the mistakes.

5. Lines 186-188, “Meanwhile, in the high-level troposphere, ... over the high-latitude regions under the anthropogenic influence”; Line 195, “ a decrease of SLP in the mid-latitude East Asia”. I suggest that more details should be provided in these descriptions.

Reply: Thank you for your comments. We have revised the mistakes.

6. Line 204, “Interestingly, the two simulated EAWM indices ...”. “Interestingly” is redundant.

Reply: Thank you for your comments. We have revised the mistakes.

7. Line 238, “the interannual and interdecadal variation of the EAWMI_HGT...”. The

“variation” should be “variations”.

Reply: Thank you for your comments. We have revised the mistakes.

8. Line 489, “... and 850 wind ...” should be “... and 850 hPa wind ...”.

Reply: Thank you for your comments. We have revised the mistakes.