Anonymous Referee #1
Received and published: 9 September 2020

This study examines the decadal change in the TC frequency during TC-inactive seasons and its linkage to climate variability. It is well written and shows a few interesting results. However, the results of this study are primarily based on the unreliable and inconsistent TC best tracks. It is not known whether the findings of this study are induced by artificial effect or real physics. Therefore, I suggest a major revision.

Specific comments:

1. The authors have already mentioned that TC best tracks before the satellite era is unreliable. Regardless of what modification that they apply, the modified data is still of lower quality. There are several decades from 1966 to present, which is long enough for an analysis on the decadal time scale. Thus, I would recommend the authors analyze the data since 1966.

The authors appreciate the referee's comments on the temporal limitations of the TC best tracks dataset. However, many studies have used the pre-satellite era TC track data to examine trends in TC frequency (Landsea et al. 2006; Landsea 2007; Mann et al, 2007; Mann et al, 2009), of course applying corrections for the TCs that might have stayed over the ocean. We are aware that the modifications done to the pre-satellite best track data is of lower quality than the post-satellite data, yet we argue that even with those limitations associated with the track count corrections, our results should be presented for both the entire period starting in the 1900s and for the 1966 to present. In the paper we also discussed the results since 1966, this is what we wrote:

"The EP and NA basins exhibited statistically significant increasing trends even if the analysis was done from the 1960s instead of the 1900s. The WP basin showed an overall increasing trend in the total number of off-season TCs per decade, yet if the analysis is done from the 1960s to the present, no statistically significant increasing trend is found. However, the three basins that reflected an overall increase in decadal off-season TC frequency had their most active decades after the 1970s."

2. Another issue related to TC data is the uncertainty in observing the weakest TCs, e.g. tropical depressions. The observation of tropical depressions is highly sensitive to the TC-detecting technologies. I would suggest the author exclude tropical depressions in a revised manuscript.

We understand the reviewers concern with the uncertainty in observing the weakest TCs, e.g. tropical depressions. However, a tropical depression is still a tropical cyclone and we believe that they should be included in any kind of analysis of TC frequency. Since our study focuses on off-season storms, we are already working with a limited number of TCs and excluding the weaker ones might be detrimental to our analysis that focuses on frequency and not on TC intensity. We will be examining the off-season TC intensity question in future research.

3. Since the MK test is a well-documented method to detect potential trends, there is no need to represent the detailed algorithm in the paper.

The authors agree with the reviewers suggestion of removing the MK test equations from the paper.

4. Where is the cloud cover dataset obtained from? Before the introduction of satellites, are these cloud cover data reliable?

The Cloud Cover dataset used in this study comes from the International Comprehensive Ocean-Atmosphere Data Set (ICOADS) which offers surface marine data spanning the past three centuries, and simple gridded monthly summary products for 2° latitude x 2° longitude boxes back to 1800 (and 1°x1° boxes since 1960)—these data and products are freely distributed worldwide. I got this from their website "As it contains observations from many different observing systems encompassing the evolution of measurement technology over hundreds of years, ICOADS is probably the most complete and heterogeneous collection of surface marine data in existence." Similar to the SST used in this study, it seems that the CC data from ICOADS is also reliable. Check this for more info:
https://icoads.noaa.gov/icoads_brochure_20160308_8.5x11.pdf

5. Considering the increasing TC frequency shown by the authors and global warming, it is natural that the correlation between TC frequency and GMST is significant. To make this point clearer, the author should further examine the spatial patterns of the changes in the TC occurrence and the SST. Does the region with rising SST? correspond to the region with more TC formation?

The authors appreciate the referee's suggestion to examine the spatial relationship between rising SST and off-season TC formation. For that reason, we decided to add the off-season TC tracks to Figures 3, 4 and 5 and there we show that off-season TC occurrence has been in areas that have experienced statistically significant increasing trends in SST and CC. Here is a sample of one of those figures:

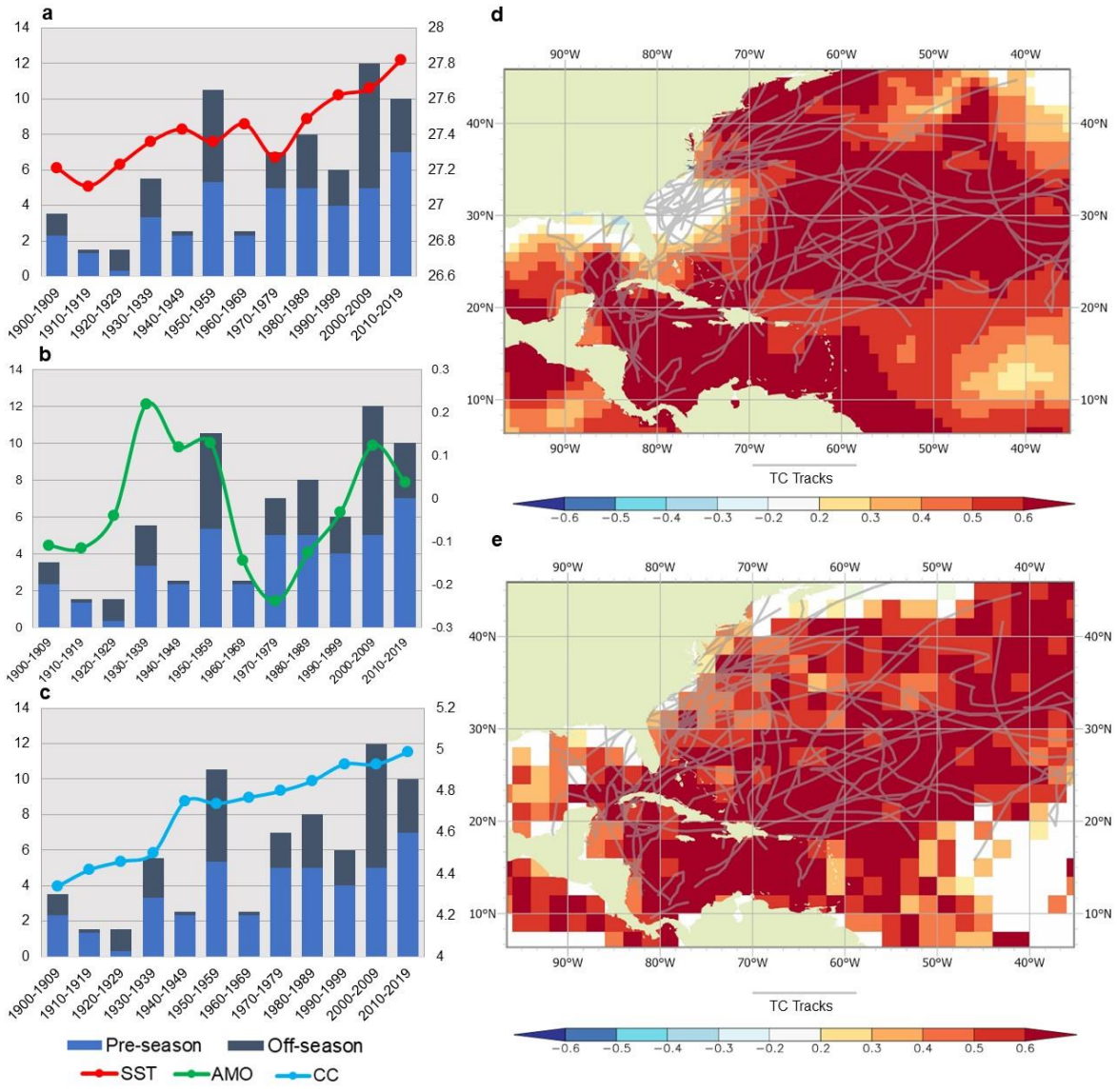

Figure 4. Decadal TC counts for the NA off-seasons and decadal average SSTs (a), decadal TC counts for the NA off-seasons and decadal average AMO (b), decadal TC counts for the NA off-seasons and decadal average Correlation between Time and Dec-May averaged CC (c), correlation between Time and Dec-May averaged SST (C°) for the 1900-2019 period (d) and correlation between Time and Dec-May averaged CC (oktas) for the 1900-2019 period (e).

6. Since the significant increasing trend in the TC frequency, the correlation between TC number and climate indices might be reduced. Therefore, I would suggest the authors compute the correlation coefficients after removing long-term trends, to highlight the potential relationship on the decadal time scale.

We removed the long-term trends for the basins that showed statistically significant trends and for the SST time series and we found that the correlations were still significant even after removing the trend using the constant method (e.g., the mean value over the entire series) to detrend. Here are the results for the off-season TCs in the Atlantic and SST after detrending both series.

```
Coefficients:
                          Estimate Std. Error t value Pr(>|t|)
(Intercept)               -284.651     95.388  -2.984   0.0137 *
Detrend_Data$`NA`          10.924      3.587   3.046   0.0123 *
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Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 2.783 on 10 degrees of freedom
Multiple R-squared:  0.4812,   Adjusted R-squared:  0.4293
F-statistic: 9.276 on 1 and 10 DF,  p-value: 0.01234
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