Weather Clim. Dynam. Discuss.,
https://doi.org/10.5194/wcd-2020-36-RC2, 2020

Interactive comment on "Increasing Frequency in Off-Season Tropical Cyclones and its relation to Climate Variability and Change" *by* José J. Hernández Ayala and Rafael Méndez-Tejeda

Jhordanne Jones (Referee)

jhordanne.jones@colostate.edu

Received and published: 22 September 2020

Overview:
Hernandez and Mendez-Tejeda assess trends in off-season storms in global hurricane/typhoon basins and attempts to associate these changes to warming sea surface temperatures and both local and remote climate phenomena. Storms occurring outside the dominant peak are not a common topic of study and are certainly worth looking into. The manuscript is well-written and well-organized, and its results may have implications for global awareness of changes to "off-season" storm activity with

Printer-friendly version

Discussion paper

climate change. I have outlined some comments and questions to the authors below. My comments outline some suggestions and considerations that could help make the manuscript a bit clearer to the reader. The methods are scientifically sound, and the conclusions are reasonable. But I'd also caution the authors on making conclusions about trends in the frequency of off-season storms without also assessing the frequency of in-season storms as well and not so much rely on the conclusions of previous studies. While there is no significant trend in global storm frequency, the significance may vary with individual basins. My recommendation is for a major revision.

Major Comments:

1. Do not confuse the official storm season with storm climatology. While it is true that there are set dates outlining the official hurricane/typhoon seasons, I think it should also be mentioned that this does not mean that it is atypical for storms to occur outside the official season. Storms occur where environmental conditions are relatively favorable. For the Atlantic, the climatological environment becomes favorable in the spring, which means storms are possible as early as April or May and as late as December. However, they usually do not compare to in-season storms in terms of overall numbers, intensity and duration. This is perhaps why May and December is not counted in the Atlantic's official season despite it being very possible to have storms (albeit not very strong ones) develop within these months.

2. I understand it can be pretty tricky to define what "off-season" means. But in my opinion, given the length of each basin's climatological season, there isn't much sense in categorizing storms into pre- versus post-season storms. Just looking at Figures 1(b-e), there are only about 2-4 months out of the year in which the environment is drastically unfavorable for each basin. But, this is a comment and

not really a suggestion to change your methodology at this point.

3. I think a good way to assess whether there is any meaningful change in the number of off-season storms is to show changes in the climatology over time. Just showing the number of off-season storms outside the context of in-season storms makes it harder to interpret the trend. The number of off-season storms is likely related to what happens during the official season since they are driven by the same climate variability and change (as suggested by the papers referenced).

4. I agree with Referee 1 that the manuscript lacks a physical explanation or mechanism for the climate associations the authors make. In what way do SST, GMST and CC alter the number of off-season storms? Is it a shift in the climatology of storms or is there also an increase of storms within the official seasons? How have climate dynamics changed over time in months prior to/post the official season to cause the observed trend without also causing any significant trend in in-season storm frequency? This could help augment your discussion section and provide a better comparison to previous studies.

Minor Comments:

1. Please go through the manuscript carefully to correct grammatical errors, unfinished sentences and repetition.

2. The authors do not define the regions over which sea surface temperature and cloud cover are averaged in each basin. Similarly, how are the ENSO, AMO, IOD and IPO indices defined and over what region?

3. You mention statistical significance quite a bit. But, at what value of Kendall's tau is statistical significance achieved and what frequency is this associated with for each basin?

4. Line 49: Walsh et al. (2016) could be updated to the more recent Walsh et al. (2019). There is also Knutson et al. (2019, 2020) for an updated review of tropical cyclone trends and projections.

   (a) Knutson, T., and Coauthors, 2019: Tropical Cyclones and Climate Change Assessment: Part I: Detection and Attribution. Bull. Amer. Meteor. Soc., 100, 1987–2007, https://doi.org/10.1175/BAMS-D-18-0189.1.

   (b) Knutson, T., and Coauthors, 2020: Tropical Cyclones and Climate Change Assessment: Part II: Projected Response to Anthropogenic Warming. Bull. Amer. Meteor. Soc., 101, E303–E322, https://doi.org/10.1175/BAMS-D-18-0194.1.

   (c) Walsh, K. J., Camargo, S. J., Knutson, T. R., Kossin, J., Lee, T. C., Murakami, H., Patricola, C., 2019: Tropical cyclones and climate change. Tropical Cyclone Research and Review, 8(4), 240-250, https://www.sciencedirect.com/science/article/pii/S2225603220300047.

5. Lines 73-76: Is there a reference or citation for this sentence? Yes, the decade does have the most off-season storms but this could be due to more recent hurricane/typhoon seasons being better observed and measured. And again, May has been the climatological start of most seasons.

6. I think the details outlined in Sections 3 and 4 can be summarized. Further details can be placed in an appendix or supplementary document. Or you can just direct the reader to the proper citations.

7. The stacked columns used in the figures can be incredibly confusing. It's hard to infer any conclusion about trends in pre versus post-season numbers.

8. Is there a baseline number of off-season storms in each basin to compare changes to? How do you assess a statistically significant change or trend?

9. I really like that the p-value column was included in Tables 3 and 4. Not many studies do this.

10. Figure 1(a) doesn't really help since the darker tracks hide the lighter tracks, particularly for the Western North Pacific. A good alternative would be to replace 1(a) with a figure of storm climatology (as you did in Figures 1[b-e]) over the five categories you've created. This would probably address my Major Comment 3 above and most of my comments on changes in trend. You should also note in the caption that Figures 1 (b-e) all have different scales of frequency.

11. In Figures 3-5, all you do is superpose the trends in GMST, ENSO and IPO/AMO onto the same figure of pre and post-season storm numbers. What if you regressed total off-season storm frequency against each decadal index to show how each climate phenomena influenced storm numbers over time?

Please also note the supplement to this comment:
https://wcd.copernicus.org/preprints/wcd-2020-36/wcd-2020-36-RC2-supplement.pdf

---

Interactive comment on Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2020-36, 2020.

Printer-friendly version

Discussion paper