**MWR-D-24-0102, Biernat et al., Responses to Reviewers**

The authors thank the reviewers for their thoughtful feedback on the revised manuscript. Our responses (red) to the comments (black) are given below. Line numbers correspond to the latest version of the manuscript and indicate where changes were made.

**Responses to Reviewer #2**

I was the second reviewer in the initial round, and my biggest concern was how well the paper expanded beyond past work (the main comment from Reviewer 2). Major comment 1 from Reviewer 3 was along similar lines, although they highlighted Biernat et al. (2023) rather than Ban et al. (2023). I envisioned two possible ways to satisfy the concern: First, a certain way to do so would be to push further. The analysis presented does not fully accomplish the goal of isolating the factors causing lower forecast skill in the subset of strong, low-skill cyclones being examined. Comparisons with other Arctic cyclone subsets (e.g., strong, high-skill or non-strong, low-skill) would accomplish this. This approach would connect to major comment 3 from Reviewer 3, which asks a question related to such an idea. Second, I allowed for a text-only approach that better positioned this paper as an extension of prior work but could not guarantee that would be satisfactory. The authors elected for the latter option (which, being more expedient and requiring fewer changes, is not surprising). Given that 1) the authors have added two good general areas of justification into the manuscript (highlighting different methodology and a larger ensemble) and 2) neither of the other reviewers stated that more analysis was necessary, I think that is \*\*a satisfactory approach\*\*.

When reading through again, I looked specifically for whether these prior papers are adequately referenced for context throughout the results and the summary. What I see in the results is great. But I also think the authors are still under-selling the novelty in summary. So here are the suggestions, two proofreading and three minor text suggestions in the summary:

**Response:**

We thank the reviewer for their feedback.

Line 129: Change "compliment" to "complement".

**Response:**

We have made this change on L129 of the latest version of the manuscript.

Lines 789-796: Somewhere here, remind the reader that the analysis being done on AC16 is bigger and better than previous work - bigger because it has more variables and a 51-member ensemble for the ESA analysis and better because the benefits of the ESA analysis (i.e., a briefer version of what they highlighted in lines 522-531 of the response to reviewers). I'm envisioning like one sentence, maybe two.

**Response:**

On L802–809 of the latest version of the manuscript, we added a sentence that discusses how the examination of AC16 in the present study adds to the study by Ban et al. (2023) on AC16 and a sentence that discusses benefits of the ESA technique.

Because we now state that AC16 is a representative strong low-skill AC in the new sentence on L802–806 of the latest version of the manuscript, we deleted “, which is a representative strong low-skill AC,” after “The synoptic-dynamic analysis of AC16” on L828 of the latest version of the manuscript to avoid redundancy.

Lines 861-863: The restatement of the definition of strong low-skill ACs here is redundant with the explanation on lines 849-850. Given that this is all the same paragraph, I think second restatement is unnecessary -- and that an already long paragraph is better without it. (Also, this should help maintain word count since I know I'm demanding an addition in the previous comment.)

**Response:**

We agree with the reviewer. We have deleted this sentence on L861–863 of the previous version of the manuscript.

Lines 814-868: I think in part to accommodate reviewer comments, these last two paragraphs are now quite large. It's going to be easier for readers if they are split up into smaller paragraphs. I leave it to the authors to assess where is most logical.

**Response:**

We split the paragraph on L814–841 of the previous version of the manuscript into two paragraphs on L828–855 of the latest version of the manuscript. We decided not to split the paragraph on L856–880 of the latest version of the manuscript into two paragraphs because the sentences in this paragraph on L860–880 of the latest version of the manuscript tie directly into the first two sentences of this paragraph on L856–860 of the latest version of the manuscript.

Also, we deleted the comma immediately following “TPVs” on L847 of the latest version of the manuscript to clearly indicate that the “upper-tropospheric features” stated on L846 of the latest version of the manuscript include the “TPVs” and “upper-tropospheric troughs and ridges” stated on L847 of the latest version of the manuscript.

Line 863: Rather than "features and processing", I believe this reads better as "features and processes" (as in the title).

**Response:**

We have changed “processing” to “processes” on L876 of the latest version of the manuscript.

**Responses to Reviewer #3**

This revision is a considerable improvement from the previous version of the manuscript. The authors have adequately addressed my comments for the most part, but I do have a few minor comments in response. Therefore, I recommend that once addressed, this article be published in Monthly Weather Review.

**Response:**

We thank the reviewer for their feedback.

Minor comments:
1) In addition to my comment, Reviewer 1 also pointed out confusion of showing a geographic map background in the composite plots. In the response to Reviewer 1, the authors argue that there are advantages and precedent to showing a geographic map background, but do not
seem to have made any changes to the manuscript. I understand the reasoning for showing a map background, and do not advocate changing the plots, however, as stated in Schultz (2013), "The readers should understand the meaning of the figure from the caption alone."
Therefore, I strongly recommend adding information to the caption to state something along the lines that the map background is only shown to demonstrate scale. Otherwise, I think there will be confusion, because the readers will only be able to understand what the figure is displaying unless they go into the text to read that detail.

**Response:**

At the end of the figure captions for Figs. 4–7, we added the following sentence: “Geography in (a)–(f) is shown for reference and is not representative of any particular AC in the composite.” See L312–313, L351–352, L391–392, and L465–466 of the latest version of the manuscript for this new sentence.

2) 161: So just to double check, if a cyclone reaches 70N, is located at that location for at least 6 hours, and has a lifetime of over 48 hours, it is not considered an Arctic Cyclone?

**Response:**

The reviewer’s understanding is correct.

3) 166-167: Over what range of years were considered? I'm assuming it is summer cyclones only from 2007-2017 as in Biernat et al. (2023), but I'm left to assume this since it is not explicitly
stated.

**Response:**

We added a sentence earlier in the paragraph on L162–164 of the latest version of the manuscript to make clear that the low-skill ACs during low-skill periods, and correspondingly, the strong low-skill ACs are considered for the summers (June–August) of 2007–2017.