Review of "Classification of North Atlantic and European extratropical cyclones using multiple measures of intensity" by J. Cornér et al.

General comments:

This study uses ERA5 reanalyses for 43 extended winters to classify North Atlantic and European extratropical cyclones according to their intensity, based on multiple dynamical and impact-related measures. They perform a principle component analysis and a cluster analysis to find four clusters of extratropical cyclones that differ in terms of intensity, geographical location and characteristics. Cluster HighSSI is associated with the highest mean values in many intensity measures (e.g., low-level vorticity and wind speed), followed by cluster Intense. Despite a relatively small occurrence frequency (<10% of all cyclones), HighSSI contains a large fraction of well-known impactful storms. Most cyclones belong to cluster AvgMST (~44%). They have average intensities and occur preferentially over the main North Atlantic storm track. Cyclones in cluster Weak occur in about 25% of all cases, have relatively weak intensities and mainly occur in the Mediterranean and over Europe.

Overall, the manuscript is interesting to read, the storyline is clear, the methods are appropriate, and the general conclusions are sound. Below are a few minor comments and suggestions.

Specific comments:

1) The paper is rather long. This is not a criticism in itself, as the paper is well-written and interesting. However, maybe you can consider shortening the description of the datasets and methods a bit, such that the reader does not have to wait until page 11 for the results. For instance, although nicely written, it might not be necessary to mention all advantages and disadvantages of ERA5, which is a well-known and widely used reanalysis dataset. And in the result section you might consider moving Fig. 9 and its description to the supplement, to shorten the manuscript a bit (but I would also be fine if you left it in the main part).

2) Abstract and conclusions: Most of the abstract describes your method, but it would be nice if you could add some sentences about your results (e.g., the percentage of cyclones in each of the four clusters and the differences between the clusters in intensity, geographical location and characteristics, etc.). Similarly in the conclusions. As the paper is quite long, a summary of the main results would be helpful.

3) Fig. 8a-d: Please add the units to the colorbar.

4) Fig. 10: Do I understand correctly that the positive trend in the number of intense cyclones and the negative trend in the number of weak cyclones indicates that the cyclones moved from the weak to the intense cluster because of the increase in cyclone-related precipitation?

5) Section 4: To define the clusters, you use four wind-related measures (WS850, VO, WFP and SSI), but only one measure for precipitation. Is this the reason why the cluster analysis discriminates intensity more based on wind than precipitation (see for instance Fig. 6b, c), and that cyclones with heavy precipitation but weak winds like Apollo belong to cluster weak rather than intense? Is this a weakness of the method?

6) Section 4: I find it interesting that many of the well-known storms have below-average precipitation (Fig. 11). You say that this is because you picked many of the storms from the XWS catalogue that uses wind-based measures. I know the paper is already rather long, but maybe you can consider including a few more European cyclones that led to heavy precipitation events. It would be interesting to see whether they are located close to Apollo or rather somewhere else in the phase space.

7) Section 4, line 558: "Moreover, ETCs which do have high precipitation values over land areas occur mostly over North America (not shown)." Where do you get this statement from, is it from your dataset? Over Europe ETCs can also produce substantial amounts of precipitation.

Typos and wording:

8) Line 79: "Section 4 contains .. and Section 6 concludes …"
Section 5 is not mentioned.

9) Line 118: "small scale" – maybe better: "small-scale"

10) Lines 135: "beginning from" should be "beginning at"

11) Line 148: Should it be "obtain" instead of "contain"?

12) Line 151: "… and are available as in the reanalysis." The wording is a bit cumbersome, maybe you can reformulate the sentence.

13) Fig. 1: The abbreviation "ONDJFM" has not been introduced. It would fit in the last sentence of Section 2.1.

14) Line 167: remove empty space between double parentheses.

15) Lines 210, 214, 215: "in (each) grid point" should be "at (each) grid point"

16) Line 211: "… whereas Leckebusch et al. (2008a) …" This part of the sentence is difficult to understand, consider reformulating it. Is it actually necessary?

17) Line 234: "For PRECIP, the chosen time is 12 hours before the time of maximum VO, for the same reason." Can you be a bit more specific and briefly motivate why you investigate PRECIP 12h before the time of maximum VO, i.e., at a different time than the other variables? (It does make sense to me, as the peak in precipitation often occurs before the peak in VO, and I guess you suggest this when you write "for the same reason", but the sentence is a bit vague.)

18) Line 296: "all 11 of the intensity measures" – I would write "all 11 intensity measures"

19) Table 1: The description of the column "Distance" could be more precise in the caption.

20) Caption Fig. 2: "times in the tracks" – I would write "times along the tracks"

21) Caption Fig. 3: "An absolute value of Pearson's r is shown for correlations involving MSLPa to aid comparison with other coefficients." I don't know what you are referring to (I don't see anything that is different for MSLPa compared to the other measures).

22) Line 474: "Atlantic" – I would write "North Atlantic"

23) Line 489: Do you mean the southeastern instead of the northeastern coast?

24) Line 490: "… storm track, and elsewhere …" I would split the sentence into two: "… storm track. Elsewhere …"

25) Line 496: consider reformulating the sentence to "As in cluster Intense, the highest track densities occur at the start of the storm track." The second part of sentence I would leave away, as the values are increased everywhere in the main storm track and not only at the beginning.

26) Line 499: What do you mean by "discontinuous"? Consider reformulating the sentence.

27) Caption Fig. 6: "The percentages in parentheses indicate how large proportion of all tracks is in each cluster." Better: "… indicate the proportion of all tracks in each cluster"

28) Line 502: "over Europe"

29) Line 586: "likened" – Typo: "linked"

30) Line 591: "performed analysis" should be "performed an analysis" or "performed analyses"

31) Line 608: Maybe you can briefly mention what the Petterssen and Smebye types A and B are.

32) Line 665: "correlation of coefficient" should be "correlation coefficient"

33) Lines 662 and 669: I would change "had" to "has" and "were" to "are" to consistently use present tense.

34) Line 666: "This, along with the fact that a much larger proportion of named impactful storms than all ETCs belong to cluster HighSSI, …" Complicated wording, consider reformulating it.

35) Line 671: "… but HighSSI ETCs are almost as frequent everywhere, given the distribution of ETC occurrence in the domain." This part of the sentence is a bit difficult to understand, consider reformulating it.