Review of *'Detection and global climatology of two types of cyclone clustering'* by Weijenborg and Spengler

Summary
This work introduces a new climatology of cyclone clustering using a novel detection and classification algorithm. The work and associated findings are interesting, and some new insights are provided, however I question the definition of clustering used here compared to some of the previous scientific literature. The authors use a fixed clustering threshold everywhere and largely identify clustering in the core of the storm track, where more cyclones are found. Whereas previous efforts have identified clustering as abnormal periods of high cyclone activity. Therefore, I would like to see more justification from the authors as to their methodological choices and explanation of novelties relative to prior studies, and how this work differs from a simple classification of the storm tracks. I recommend major revisions for this work, and detail my points, both major and minor, below.

Major Comments

1. My main concern surrounds the choice of the algorithm and justifications made by the authors. The method is to group cyclone travelling via a similar track or close in space/time, which their method does. However, this appears to by default just largely characterise the main storm tracks of the globe (Figs. 2,4). The standard view of clustering (e.g. Mailier et al., Pinto et al., Priestley et al.) characterises clustering as an abnormal rate of cyclone occurrences. Therefore, I would like to see more justification from the authors on their choice of thresholds for their detection method. If they are more strict, what events do they identify? Do signals become weaker as the frequency of events decreases, or are a different subset of events identified. Please clarify this and consider adding new results into the manuscript.

Minor Comments

1. L17/18 – rephrase to "is often quantified to be associated with European weather extremes"
2. L23 – not all references discussed in L22 are related to statistical quantification of clustering
3. L27-29 – I find some of your discussion of overdispersive hard to follow here. The sentence "In contrast, a region is overdispersive when cyclones occur less regularly compared to a Poisson process." Is to me incorrect. Overdispersive is the deviation from a poisson process. Perhaps stated as when the rate of cyclones is variable compared to a Poisson process?
4. L32 "generally small and have large uncertainties"
5. L33 – how is it a problem to define clustering in a relative sense?
6. L41 – I would argue that these studies do not use an "impact-based definition", but instead the clustering method introduced by Pinto et al. (2014) classifies storms into clusters that then happen to cause impacts.

7. L48/49 – this is incorrect. The algorithm does not a priori assume clustering is due to secondary cyclogenesis. Just that secondary cyclogenesis often contributes to clustering.
8. L78 – why are you using ERA-Interim and not ERA5. Interim is now very outdated and limited in time.
9. L89 – 'meters'
10. L104 – I am confused as to your overlapping criteria. On L94 you mention a 36 hour threshold, which I believe is the time difference for a cyclone to be within 1.5 Rossby radius, then what is the 2 days relating to? Must they be within 36 hours/1.5RR for 2 days of each cyclones lifecycle? This whole section is quite hard to follow so I suggest editing to improve readability.
11. L114 – 'yields all cyclone clusters' – what does this mean?
12. L115-120 – for analysis I understand that you only take the part of the track that contributes to that part ofa cluster in the analysis. Does this mean that in the track densities and intensity calculations, you only use fractional parts of the tracks? Please clarify this? If later on you search for the most intense storm in a cluster, does this mean you are not using all the information of each track to do this analysis?
13. L121 – stagnant clusters do not travel far, but in your schematic of figure 1 track 2 does travel a long way. If you are taking just the end part of the track at 'stagnant' you can't really say that it has not travelled far in my opinion.
14. L129 – the statement on only using the connected parts of tracks in clustered cyclones, does this impact your findings?
15. L139 – how 'similar'? Please give some more quantitative information to this statement
16. L143 and figure 2 – I don't understand the units here or how to interpret them. Is this the fraction of total cyclones, and then Fig. 2c,f is the fraction of clustered compared to clustered+solo? Please explain these units and the interpretation of the figure more clearly in the caption and the text.
17. L147-149 – these irregularities are surely the interesting part, as your method largely detects regular activity. Can you detect such irregularities using this method?
18. L151 I would argue from Figure 2a that solo cyclones are not just on the exit of the storm track, but mainly where cyclones just have more infrequent occurrence. Consider rephrasing.
19. L156 – you are comparing different things here. In Priestley et al. (2020) this percentage is of family cyclones in total, these do not have to contribute to clusters as in this analysis here.
20. Figure 2 – I would suggest making the upper limit of your colourbar higher as it is hard to detect some of the maxima within your figures due to the colour saturation. This is especially the case in b/f.
21. L197/198 – some reference editing is needed here, should be in brackets.
22. L209/210 – would you not expect the strongest cyclone in a cluster to be stronger than random most of the time anyway, as you are preselecting a strong cyclone?
23. L225/226 – to clarify this, for this analysis you calculate the 90^{th} percentile at all locations and this is how often a cyclone has intensity exceeding this value?
24. Figure 8 – caption should be blue shading for your stagnant clusters
25. Figure 10 – I don't fully understand what you are using to generate this information. Is the length of overlap for how long the cyclones overlap for from the point of

genesis? The same with Time of overlap, is this for two connected storms, or just the length of the cluster? Please make the text associated with this figure clearer as to how this is interpreted and generated.

26. Figure 11 – are these results the same if you use something like MSLP or cyclone size? Theories on clusters are that the final storm is more intense and larger and so would be good to document alongside this result.