

## ***Interactive comment on “Windstorms in the Northeastern United States” by Frederick W. Letson et al.***

### **Anonymous Referee #2**

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Review of “Windstorms in the Northeastern United States” by Frederick W. Letson, Rebecca J. Barthelmie, Kevin I. Hodges and Sara C. Pryor

The paper presents an analysis of the 10 largest windstorms over the northeastern United States during the past four decades. It combines metrics of extreme winds and precipitation based on both reanalyses and observations with tracks of the associated extratropical cyclones based on both pressure and vorticity. The time evolution of reanalysis and observational data qualitatively agrees during the storm events. The storms show typical tracks for the region but intensity about one magnitude higher than average. Several storms are associated with extreme damages over 1B\$ and their winds show long return periods above one century locally.

The regional focus on the northeastern United States complements earlier windstorm

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studies that focus on northwestern Europe mostly. In that sense, the paper is an important contribution to the windstorm community. However, it suffers from several shortcomings that limit its actual impact. The paper tend to cover too many topics without a clear focus and to combine too many approaches applied in an unusual way. It would benefit from a well-defined scope, standard methods taken from the literature and a better structure altogether. General and specific comments are listed below to help improve the paper quality.

## GENERAL COMMENTS

I. The scope of the paper is vague: it appears to be the 10 most intense (or largest?) windstorms over the 40 year period 1979–2018 but this is not clearly stated or motivated. Ten is not enough for a catalog and not significant to represent severe storms but likely too much for detailed case studies. The authors somehow need to choose between increasing the sample and focusing on a few particular storms.

II. The methods are comprehensive (4 pages of description) but uncommon and not sufficiently explained or motivated: 100 m rather than 10 m winds, 99.9th rather than 98th percentile, intensity defined as instantaneous spatial extent of extreme wind rather than the footprint of, e.g., cubed winds above some threshold. This may result in the obtained ranking of storms not matching their damage.

III. Analyzing compound events is certainly meaningful but throughout the paper it is unclear whether the damages associated with the 10 selected storms are due to wind, precipitation, or both. This is somehow linked to the comment above, which applies to precipitation metrics as well.

## SPECIFIC COMMENTS

I. 1 The title should be more specific, e.g., referring to the most severe windstorms in the region

I. 14–15 “Alberta Clippers”, “Colorado Lows” and “Nor’easters” sound too specific for

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the abstract

- I. 19 Why “those windstorms that occurred after the year 2000” only? What about the others?
- I. 28 In the midlatitudes?
- I. 36–37 The second part of the sentence appears unnecessary
- I. 43 What is to be seen on Fig. 1a?
- I. 48–49 I do not fully understand the sentence and the cited paper describes Europe only
- I. 75–99 (Section 1.2) Many studies and numbers are cited but they lack focus on the topic of the paper: windstorms over the northeastern US
- I. 86 Repetition of I. 33–34
- I. 101–102 This requires more details here and should somehow appear in the title and abstract
- I. 105 Most intense or severe?
- I. 117–120 This paragraph is unclear and seems misplaced
- I. 120 A description of each Section is expected here
- I. 121ff (Section 2) The study period is unclear and inconsistent between subsections
- I. 123 Over long periods? It is not an issue for case studies
- I. 128–129 Hourly or every 20 minutes?
- I. 137–144 The motivation for using winds at 100 m agl is not fully convincing and slightly repetitive; this height is used for wind power mainly and may not reflect the surface impact of windstorms

- I. 145 Why 3-hourly rather than hourly as above?
- I. 155 Which ten storms?
- I. 168–171 I agree but this does not support the use of 100-m winds from ERA5
- I. 175 Twice “product(s)”
- I. 179–183 The two sentences sound repetitive
- I. 193–195 Verb missing?
- I. 194 What is the caveat here? The impact is indeed expected to depend on population density
- I. 210–212 This approach reflects the severity rather than intensity (storm severity index)
- I. 212–215 The motivation for using the 99.9th percentile is unclear; although the approach is disputed by other authors, the choice of the 98th percentile arises from comparison with impact data in Klawa et Ulbrich (2003)
- I. 215–217 Why?
- I. 225 14 days appear as a very long period to separate events
- I. 227 if values are instantaneous then +/-48h makes 96h
- I. 235–236 The focus on the 10 most intense (severe?) storms should be stated clearly and early in the paper
- I. 244 Reference without brackets
- I. 259–266 Do the centroids of extreme ERA5 winds actually coincide with extratropical cyclones, in general and for the 10 most intense cases in particular?
- I. 267–268 If I understand correctly the intensity is solely defined as the maximum instantaneous areal extent of extreme winds?

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- I. 299–305 (Table 2) The windstorm category would be useful here (AC, CL, TC, NE)
- I. 306–311 What are the actual most damaging extratropical cyclones for the considered period, and are they captured by the selection?
- I. 313–320 An additional but crucial explanation may be that the used metric is simply not appropriate. . . In addition to different wind height and percentile, standard metrics are based on a footprint and of some function of winds (typically cubed) rather than on an instantaneous spatial extent
- I. 334–336 The strongest winds often occur to the south of the pressure center but not necessarily related with the cold front (see, e.g., the Hewson and Neu 2015 paper cited above)
- I. 340–345 (Figure 2) What is the reason for the large discrepancy between RV and MSLP tracks in some cases?
- I. 350–351 It would be interesting to know why it is the case (1981 and 2003 storms)
- I. 362 Hurricane Sandy was already introduced
- I. 363–364 How many is “several” or “multiple” grid cells? 20 mm in 24 h is far from extreme. . .
- I. 370 (Figure 4) The histograms do not emphasize extreme (i.e., potentially damaging) precipitation. And what is precipitation type 2?
- I. 387–390 The underestimation of station observations may be explained by the spatial variability of precipitation but there is a factor  $\sim 2$  between ERA5 and radar estimates
- I. 396–406 There is a confusion between clustering on yearly and daily time scales; I would expect the analysis focuses on the latter to distinguish between consecutive storms
- I. 407ff (Section 3.2) This Section generally lacks structure

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- I. 408–412 How are these cyclones selected? Based on thresholds in MSLP or vorticity? The total number of extratropical cyclones likely exceeds 10 tracks per year by far
- I. 410 What are transitory cyclones?
- I. 416–419 This was already stated above.
- I. 425–429 This belongs to the Introduction
- I. 436 The impact of the 2018 (not 2017) windstorm may be due to precipitation rather than wind mostly
- I. 436–447 The impact is already discussed above (e.g., I. 418–424) and in other sections. Please reorganize
- I. 450–460 (Figures 6–7) Same question as I. 340–345 (Figure 2)
- I. 463ff (Section 3.3) I am lost in the numerous details and wonder what to learn from this additional section
- I. 496–502 This belongs to the Introduction
- I. 503 It is the first mention of the “largest” windstorms
- I. 518–520 I do not agree on the accord with damage estimates
- I. 530–533 This is not convincing
- I. 560ff (References) Please . . . increase . . . spacing . . . between . . . lines

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