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A new approach for the assessment of temporal clustering of extratropical wind storms

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A widely-used methodology to assess the clustering of storms in a region is based on dispersion statistics of a simple homogeneous Poisson process. This clustering measure is determined by the ratio of the variance and the mean of the local storm statistics per grid point. Resulting values larger than 1, i.e. when the variance is larger than the mean, indicate clustering; while values lower than 1 indicate a sequencing of storms that is more regular than a random process. However, a disadvantage of this methodology is that the characteristics are valid for a pre-defined climatological time period, and it is not possible to identify a temporal variability of clustering. Also, the absolute value of the dispersion statistics is not particularly intuitive.

We have developed an approach to describe temporal clustering of storms which offers a more intuitive comprehension, and at the same time allows to assess temporal variations. The approach is based on the local distribution of waiting times between the occurrence of two individual storm events, the former being computed through the post-processing of individual windstorm tracks which in turn are obtained by an objective tracking algorithm. Based on this distribution a threshold can be set, either by the waiting time expected from a random process or by a quantile of the observed distribution. Thus, it can be determined if two consecutive wind storm events count as part of a (temporal) cluster.

We analyze extratropical wind storms in a reanalysis dataset and compare the results of the traditional clustering measure with our new methodology. We assess what range of clustering events (in terms of duration and frequency) is covered and identify if the historically known clustered seasons are detectable by the new clustering measure in the reanalysis.