A metastatistical approach for the assessment of frequency and duration of low-wind-power events

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Introduction

- **Long** and **accurate meteorological records** are required to quantify the probability of occurrence of extended **periods with low wind power** and to estimate their characteristics.
- **Datasets** for assessing wind power variability on a multi-hour , regionally-aggregated scale, often span a few decades, which **are too short to provide reliable statistics of extremes** .
- Only a **few independent episodes** of long periods with **low wind speed** occur in a year .
- Here a **methodical analysis** of **low wind period** distributions is presented to understand whether their extremes can be modelled using non-asymptotic extreme value approaches, such as the **Metastatistical Extreme Value Distribution (MEVD)** (Marani and Ignaccolo, 2015)

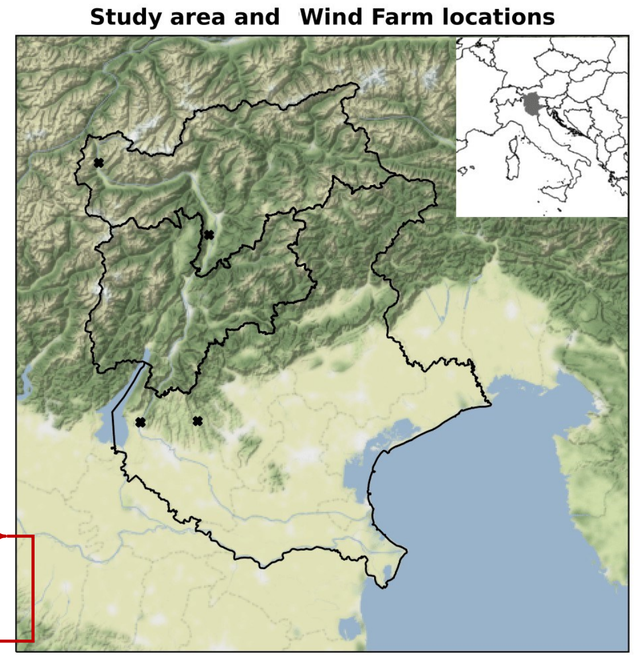
Data & study area

- Hourly U&V components from COSMO-REA6 (distance0.055°) from 2009-2018.
- Selection of pixels corresponding to wind farms in north-eastern Italy.

Wind Farm	Latitude	Longitude
Malles_Venosta	46.73	10.54
Acqua_Spruzza	46.41	11.26
Badia_Calaverna	45.57	11.19
Monte_Danzie	45.56	10.81
Monte_Mesa	45.56	10.81

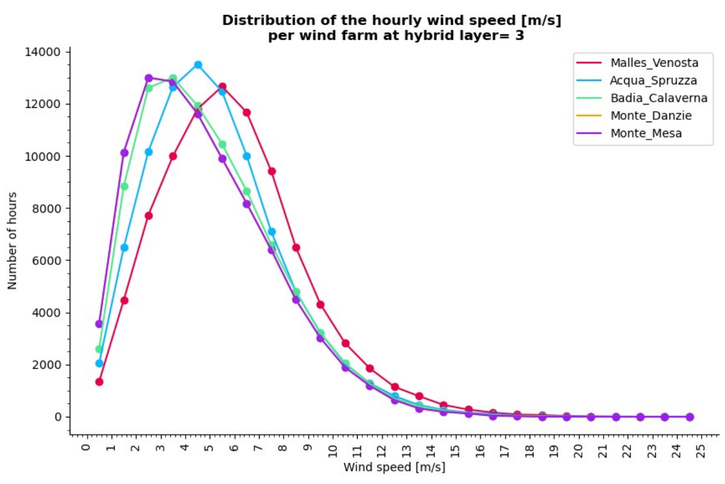
Fall in the same pixel

Study area and Wind Farm locations

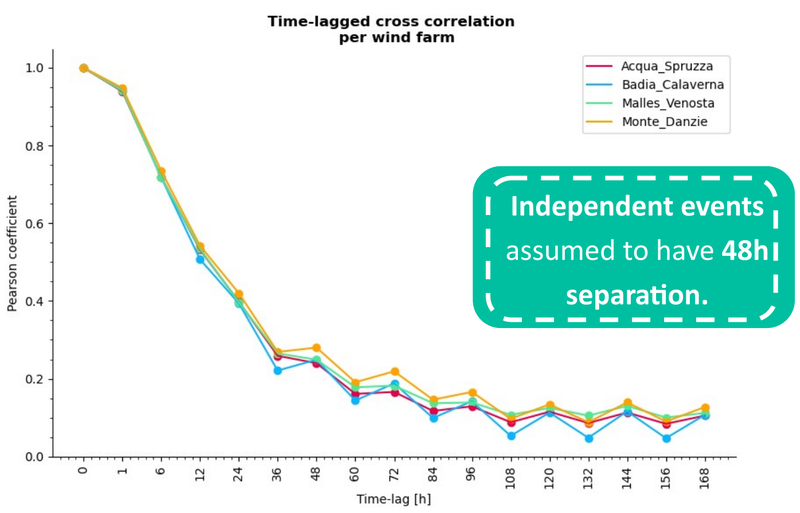


Results

A. Wind speeds frequency distributions:



B. Time lagged cross correlation :



Independent events assumed to have **48h** separation.

C. Selection of ordinary events :

Assumptions:

- Hub height : 116m
- Turbine name : Enercon V117-3.45

Capacity Factor discretised time series.

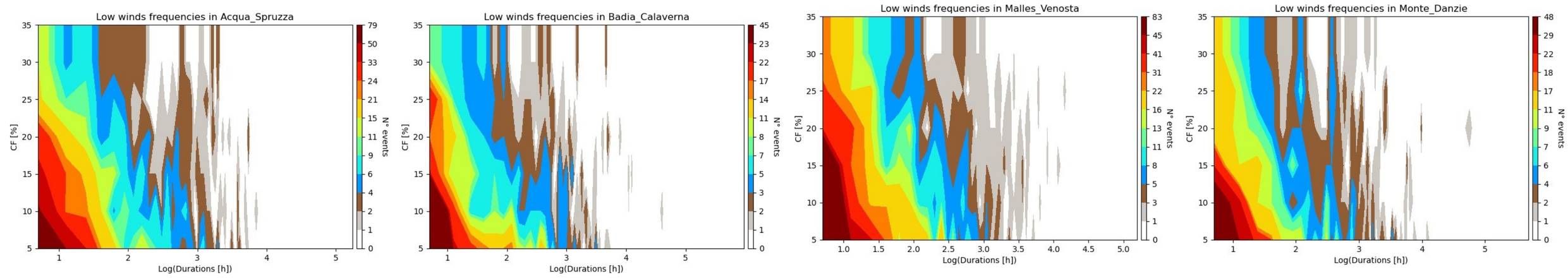
Quantification of event **durations persistently below** systematic **thresholds**.

7 Thresholds/samples

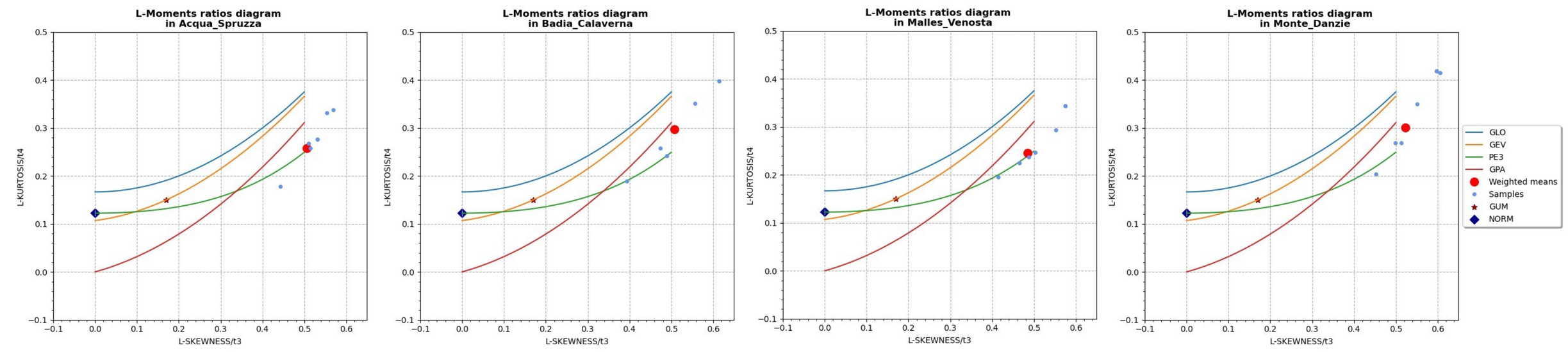
Refer to: Cannon et al. 2020

D. Frequency of the ordinary events:

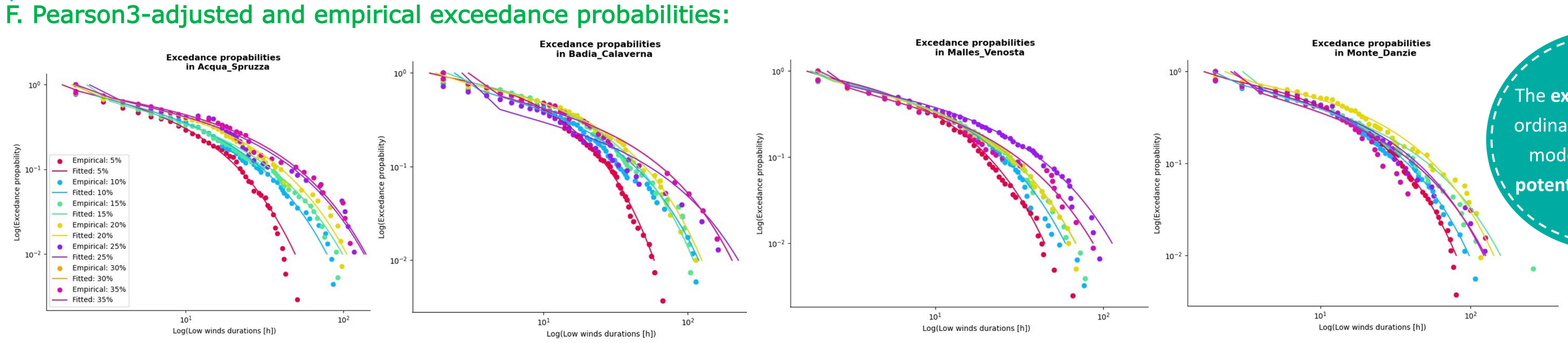
The frequency of events is higher for shorter durations and lower thresholds.



E. Identification of the distribution:



F. Pearson3-adjusted and empirical exceedance probabilities:



The **extremes** of these ordinary events can be modeled through a **potential distribution.**

References

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