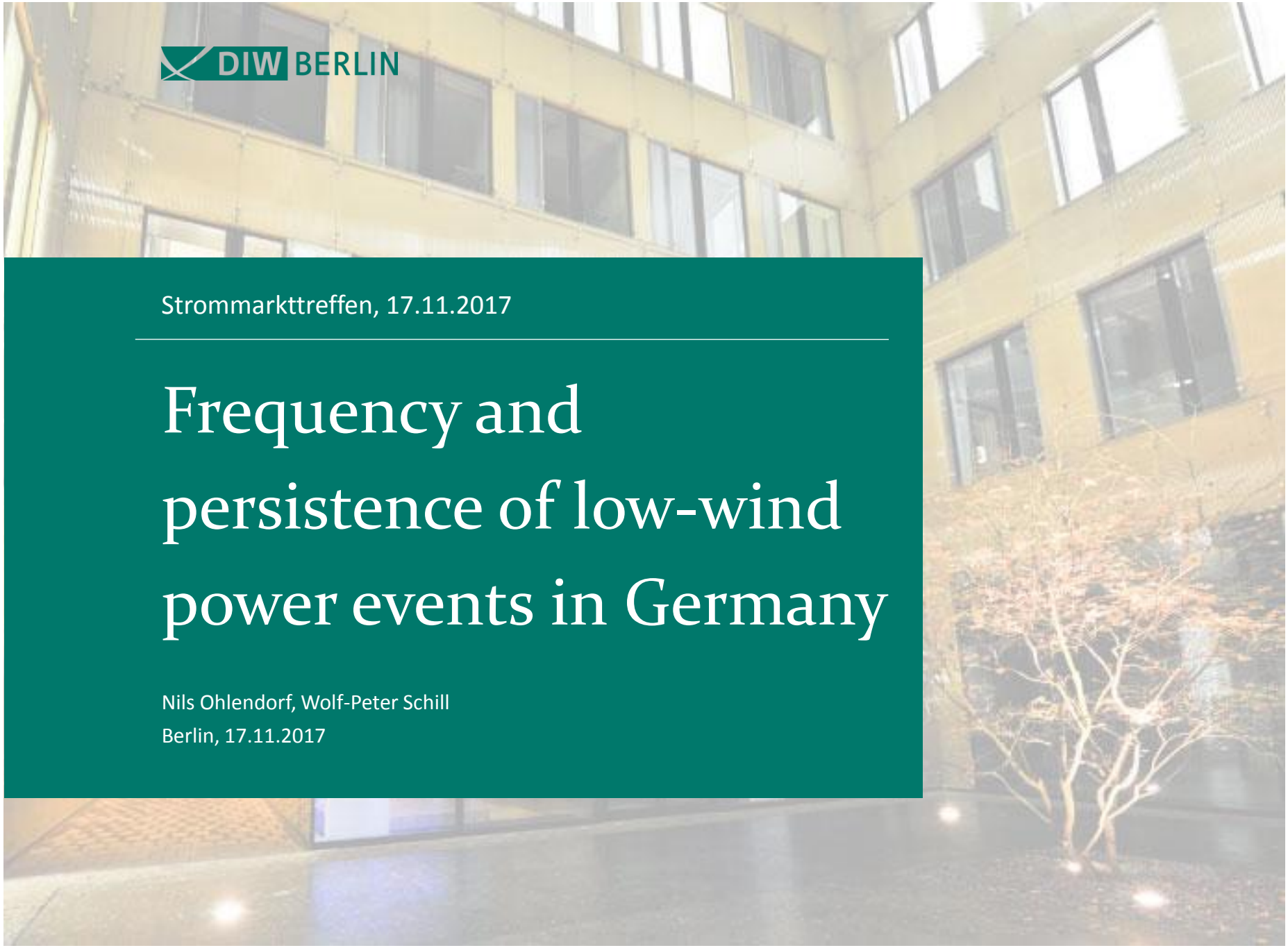


DIW BERLIN

Strommarkttreffen, 17.11.2017

Frequency and persistence of low-wind power events in Germany

Nils Ohlendorf, Wolf-Peter Schill

Berlin, 17.11.2017

1 Motivation

Scope of research

Increasing share of onshore wind power

Public concern: Long periods of low wind

Research questions on low-wind power events:

1. Seasonal frequency
2. Magnitude of extreme events
3. (Geographical distribution)

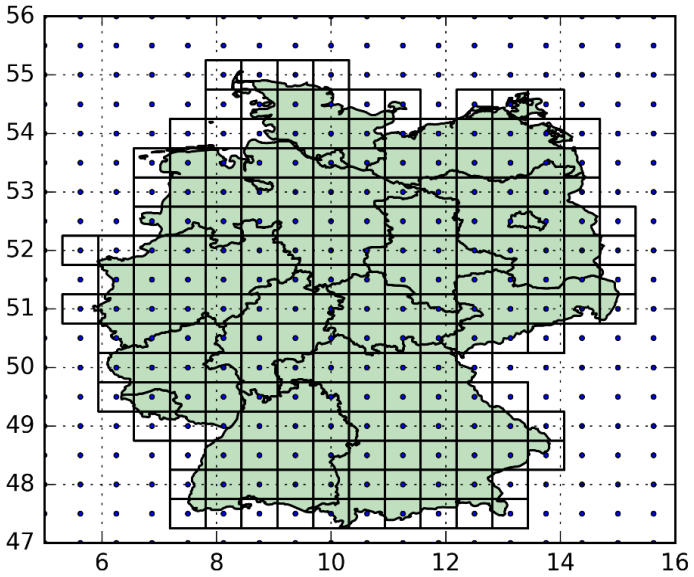
➢Simulation of wind power patterns

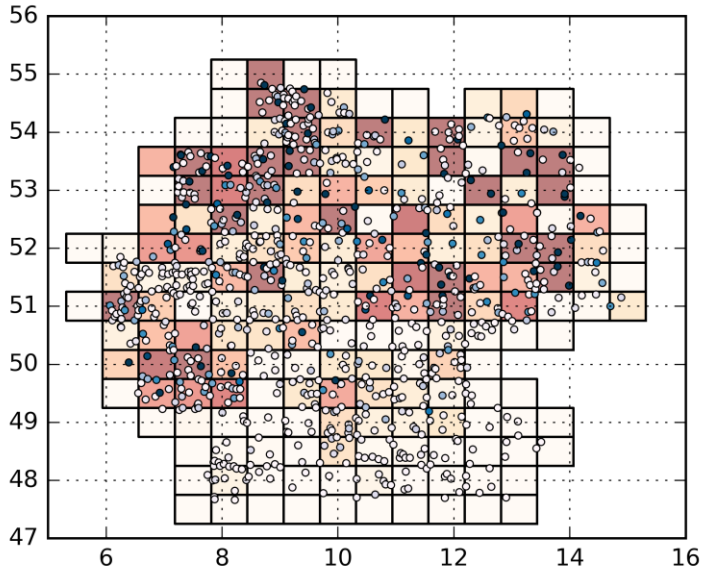
based on weather data and power curves

2.1 Method

Data

- MERRA-2: 1981-2016, hourly resolution, 0.5° x 0.625°, wind speeds 50m above surface
- OPSD: Currently installed onshore wind capacity





➢Geographical weighting with installed capacity

2.2 Method

Capacity factor calculation

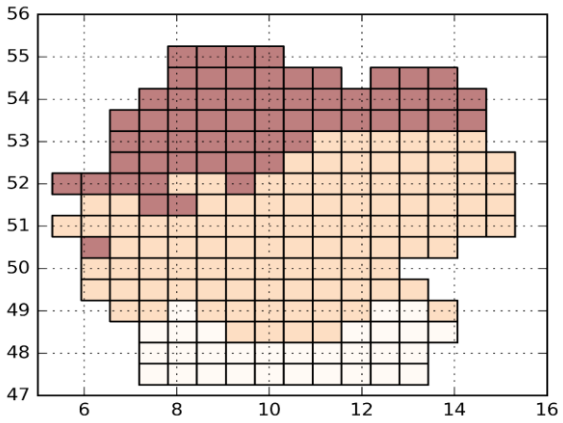
Three wind zones

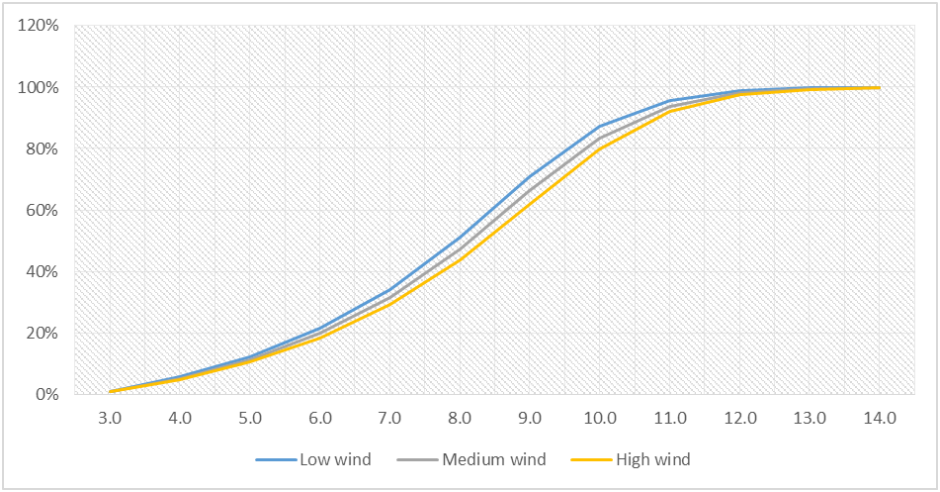
Power curves +

hub heights

(100m, 125m, 139m)

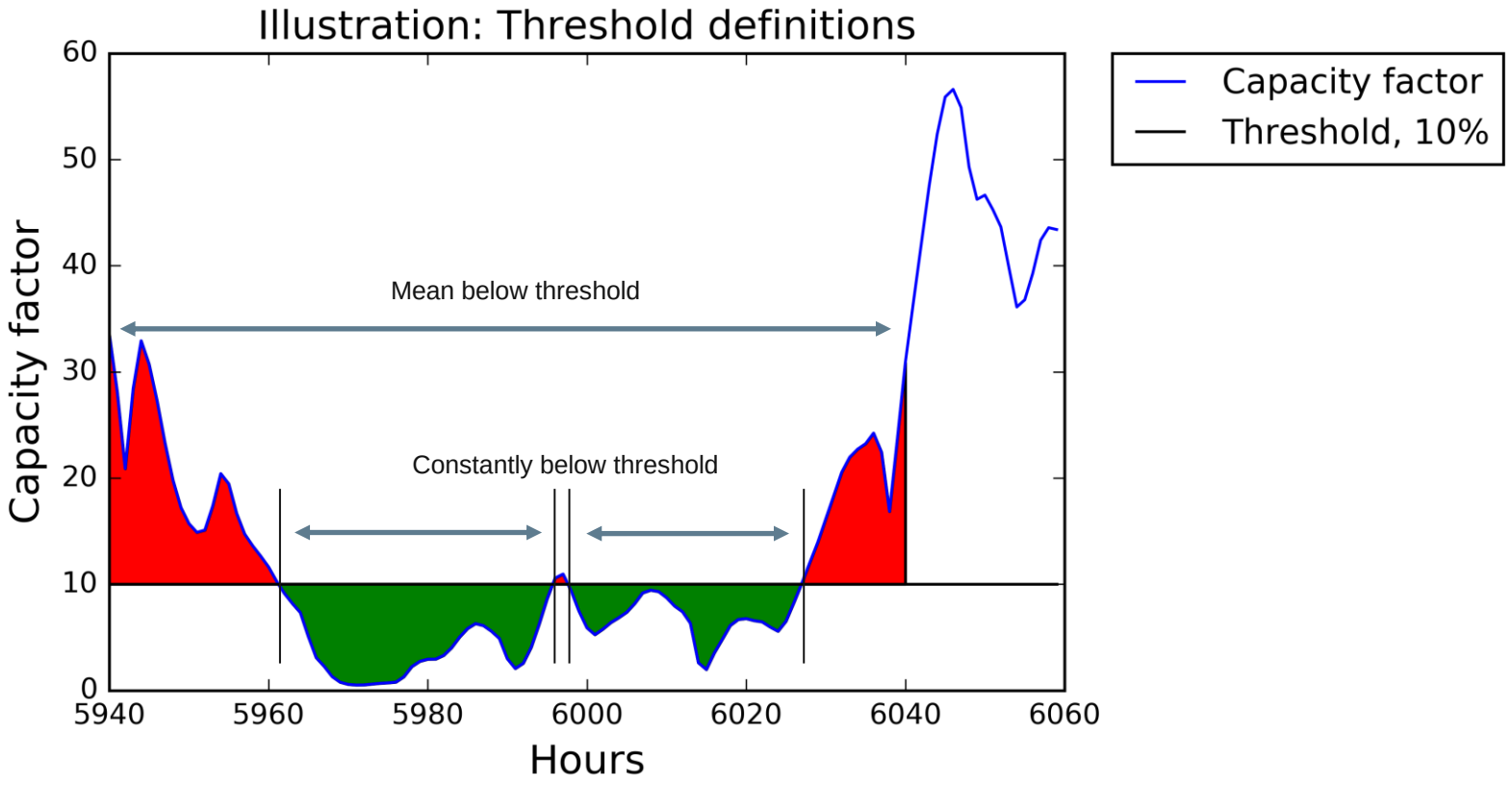
Hourly weighted aggregated capacity factors for Germany





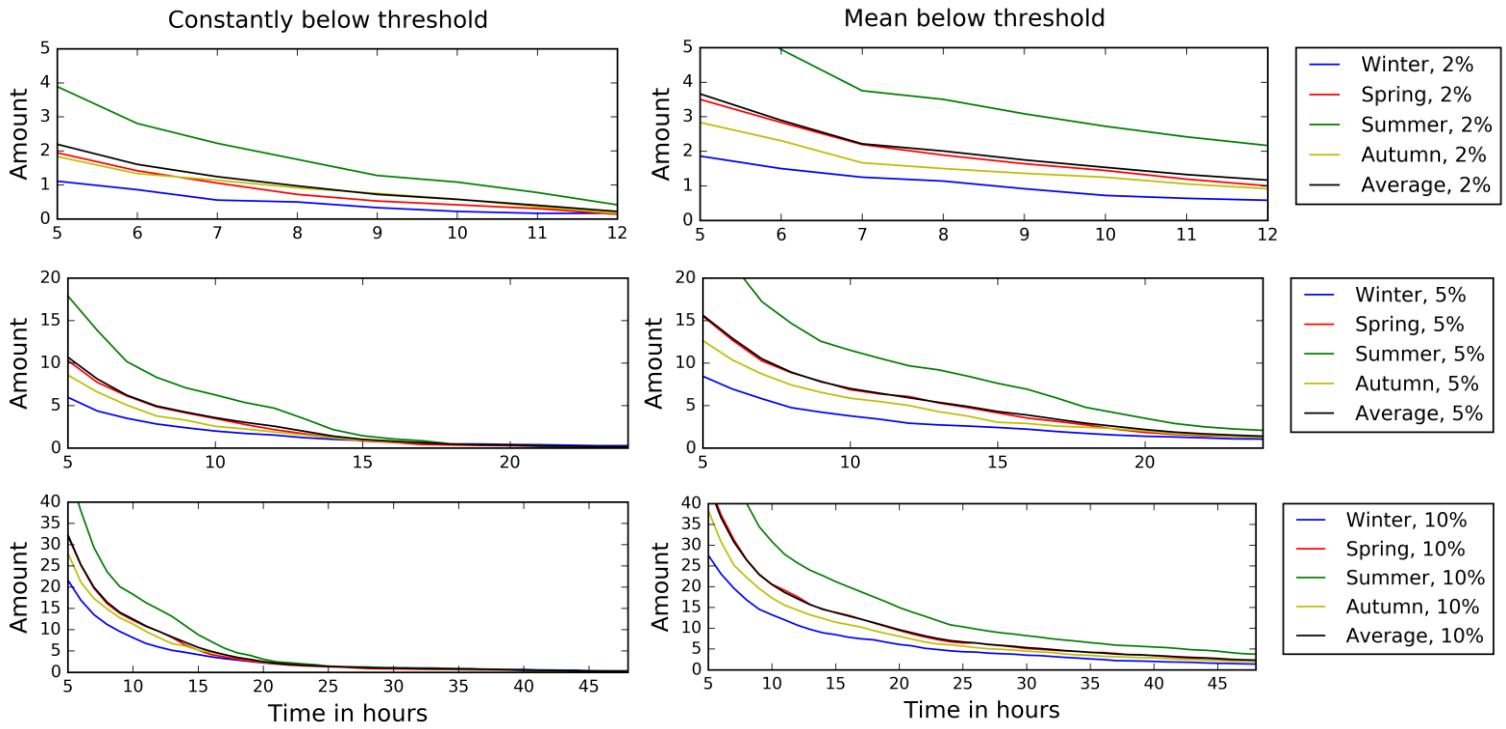
2.3 Method

Definition of low-wind power events



- Three thresholds: 10%, 5%, 2%
- Two definitions: Constantly and mean below threshold

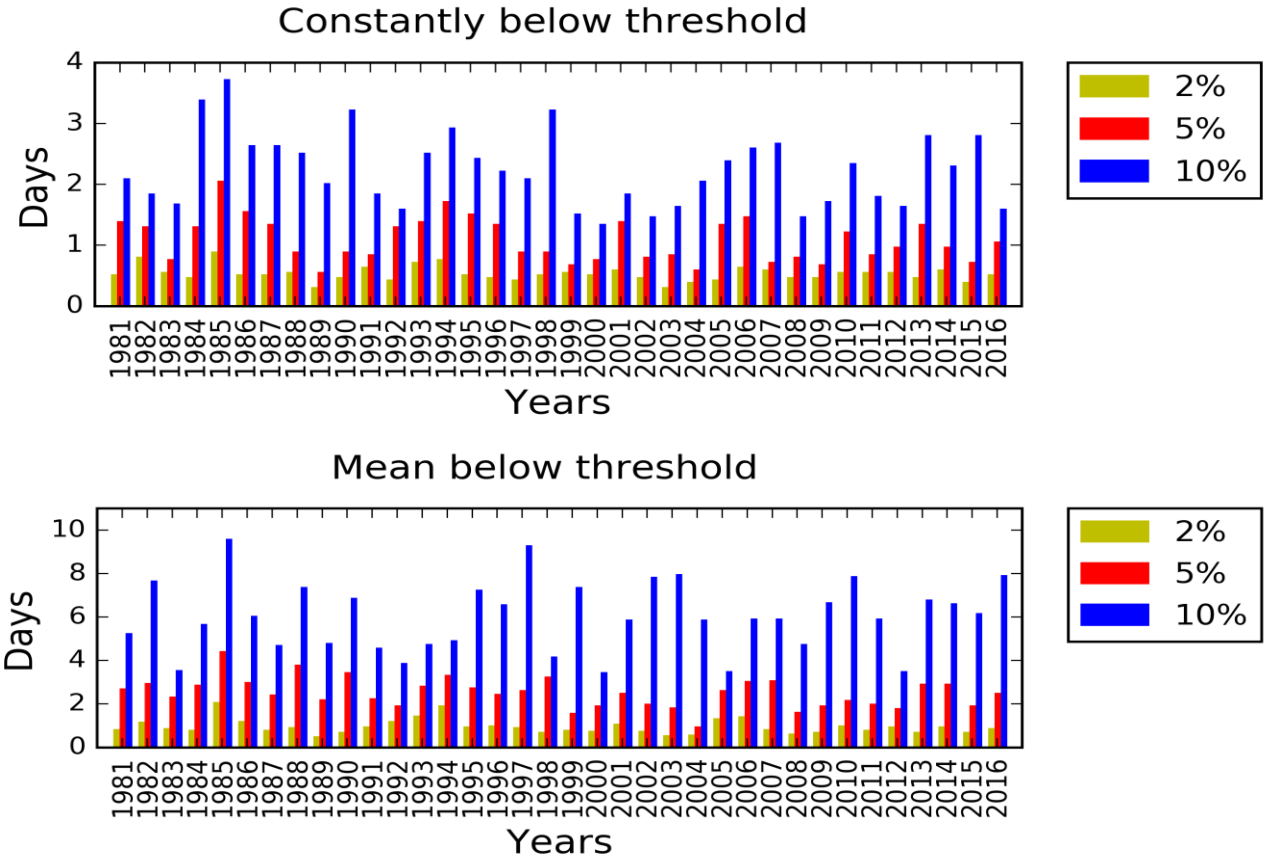
Frequency and seasonal persistence



- Winter: Fewest low-wind power events
- Larger thresholds strongly increase frequency

3.2 Results

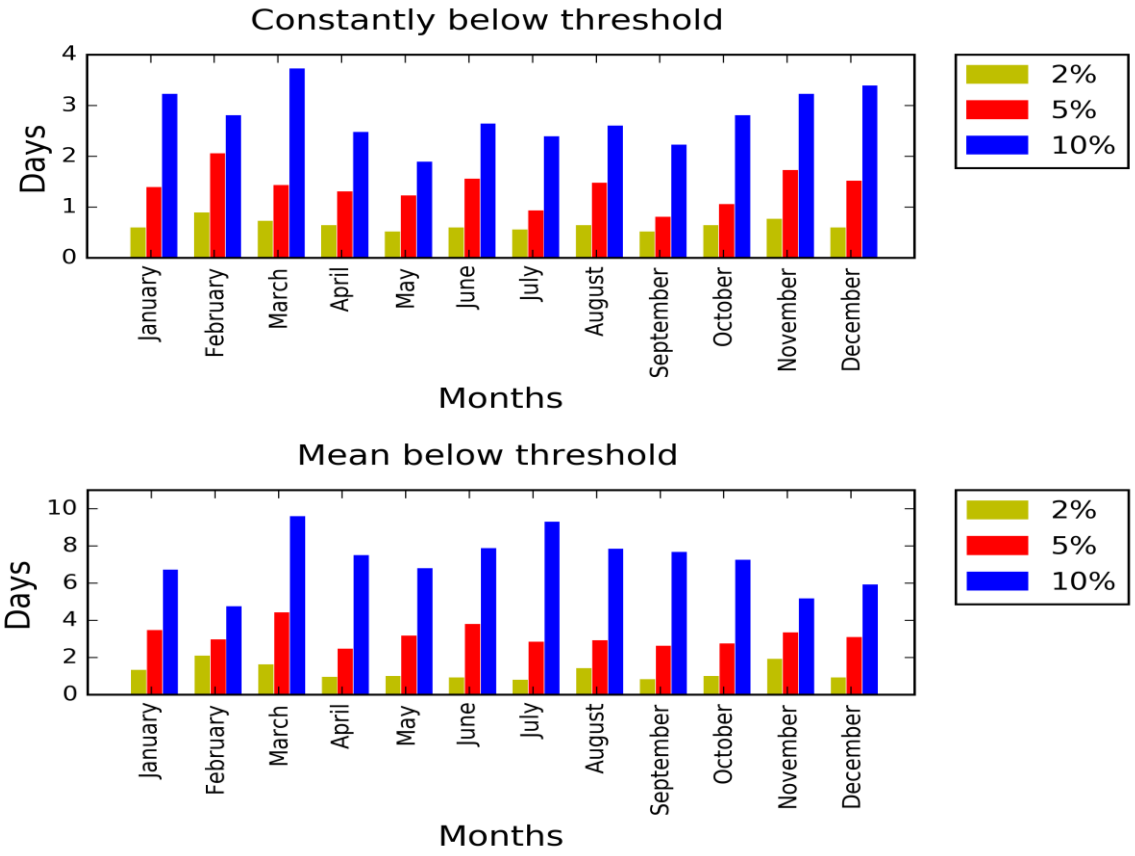
Magnitude of annual extreme low-wind power events



- Longest event in 1985: 10 days of less then 10% mean capacity

Results

Magnitude of monthly extreme low-wind power events



- Extreme events in winter months similar in magnitude to summer

4 Conclusion

Summary

Statistical analysis of frequency and persistence of low-wind power events based on weather data

- Low wind power events more frequent in summer
- Magnitude of most extreme low-wind events:
  - Differs strongly between years
  - Winter and summer months almost similar
  - Up to 10 days of mean capacity factors below 10%
  - Relevant for dimensioning of generation / flexibility options

Further research:

- Inclusion of offshore wind and European perspective
- Combined analyses covering wind power and PV

Vielen Dank für Ihre Aufmerksamkeit.

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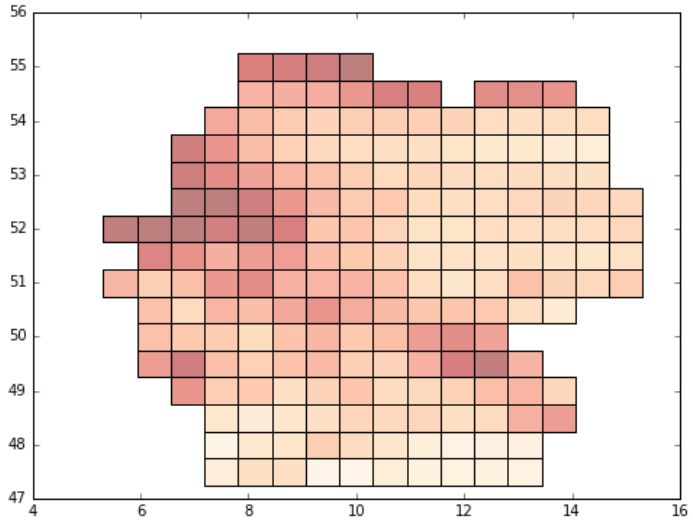
3.4 Results

Longest winter extreme events, 10% threshold

Mean below threshold

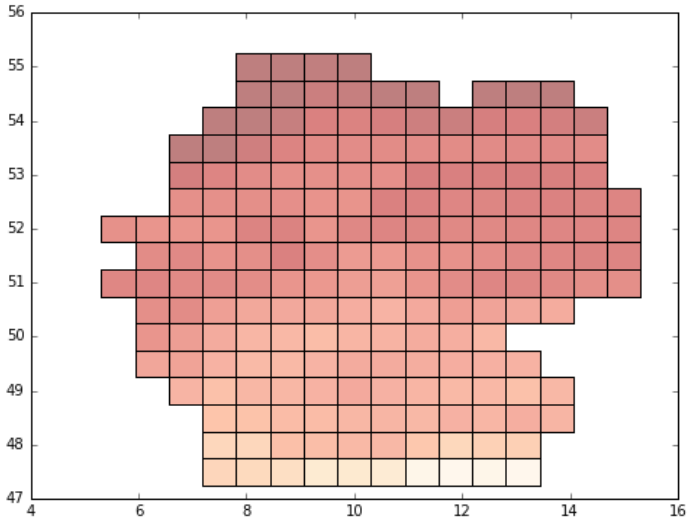
160 hours, 05.01.1997 – 11.01.1997



Scale: 0 – 20%

Annual mean capacity factors

in 1997



Scale: 5 – 50%

➢ Decentral solutions would be strongly affected by low-wind events