Characteristics of convective wind gusts in Germany

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Motivation
- Convectively-driven strong winds usually associated with thunderstorms frequently cause substantial damage to buildings and other structures in many parts of the world.
- Due to the small-scale and non-stationary nature of those events, there is a considerable lack of knowledge regarding the characteristics and statistics of gusty events.
- According to this, convective wind events are not included in the present wind load standards of buildings and structures, which so far have been based solely on the characteristics of synoptically-driven winds in the near-surface boundary layer.

In an effort to remedy this situation, the overarching objectives of the DFG-project “Convective Wind Gusts” (ConWinG) are an improvement of the fundamental understanding:
1) of convective gusts concerning their characteristics and statistics in Germany (Meteorological part) and
2) ... of their interaction with urban structures and influence on buildings (Engineering part).

Seasonal variability

How is the monthly distribution of convective gusts in Germany?

Temporal scale

How is the temporal scale of convective gust events?

Return values & periods

Which return values can be expected?

How do return values of convective and turbulent gusts differ in their strength and spatial distribution?

Differences:
Mean ± Std: 7.3 ± 3.9 m/s
North: 9.0 ± 3.2 m/s
South: 5.6 ± 3.8 m/s

Conclusions
- The frequency of gusty events is higher in southern Germany compared to the north. A relation between gust intensity/probability to orography or climate conditions cannot be identified. In fact, it is the reverse: high wind speeds above 30 m s⁻¹ can be expected everywhere in Germany with a similar occurrence probability.
- A comparison of 20-year return values of gusty events with those of turbulent gusts demonstrates that the latter have higher frequencies, especially in northern Germany. Reason is the higher frequency of low pressure systems coming from the Atlantic Ocean in the north than as the thunderstorm activity in that area.
- Convective gusts can have very high rise time within one minute and event duration of less than 10 minutes.
- High velocities caused by downbursts can be conserved over long distances within street canyons.