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TenneT

Wind gusts in a changing climate

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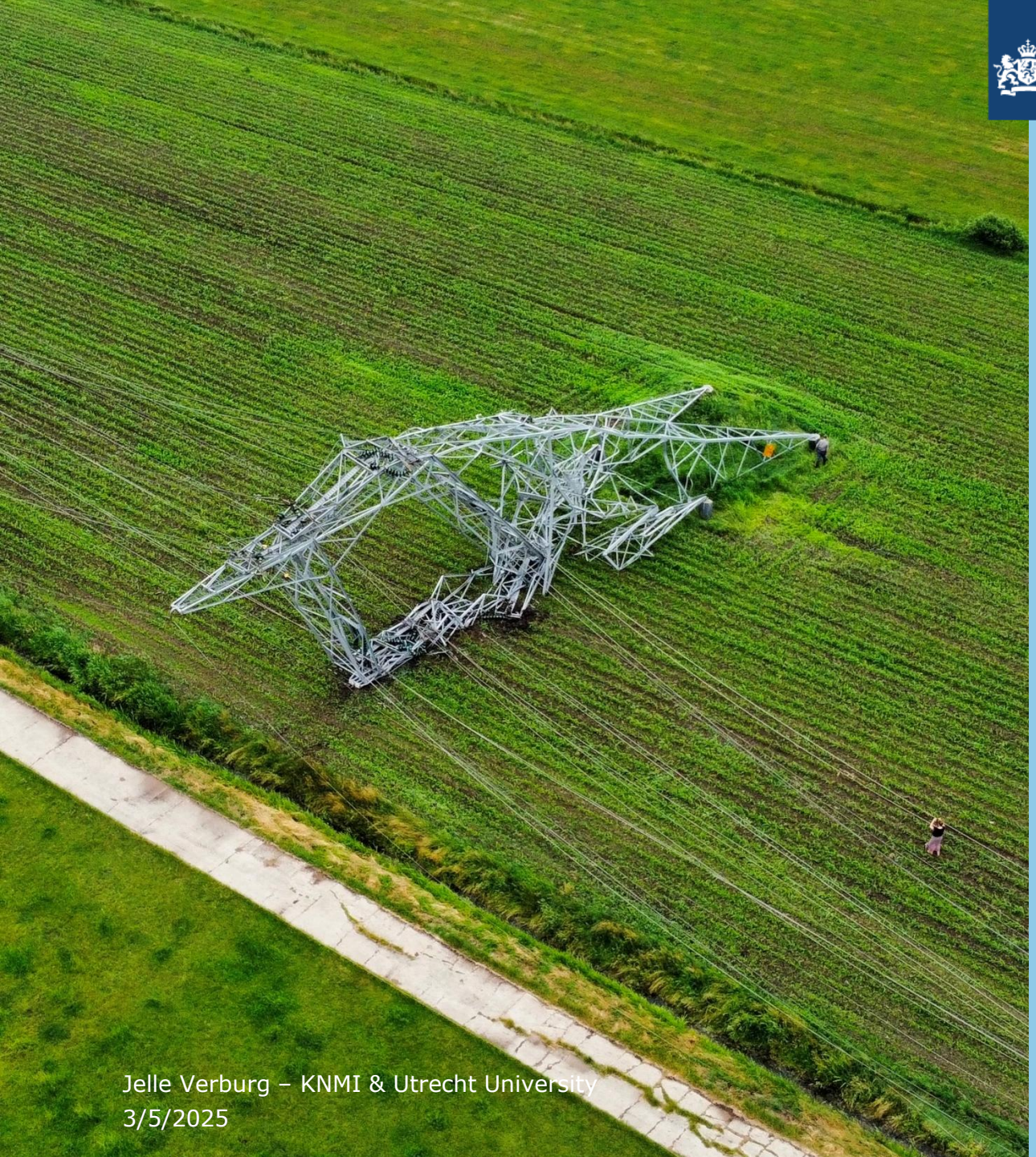
Wind gusts & overhead lines[1]

- The **design wind loads** provide enough safety against synoptic winds but **are uncertain for downburst winds**

- It is **not certain to what extent climate change affects the reliability** in future

1: DNV (2024). Downburst risk analysis.

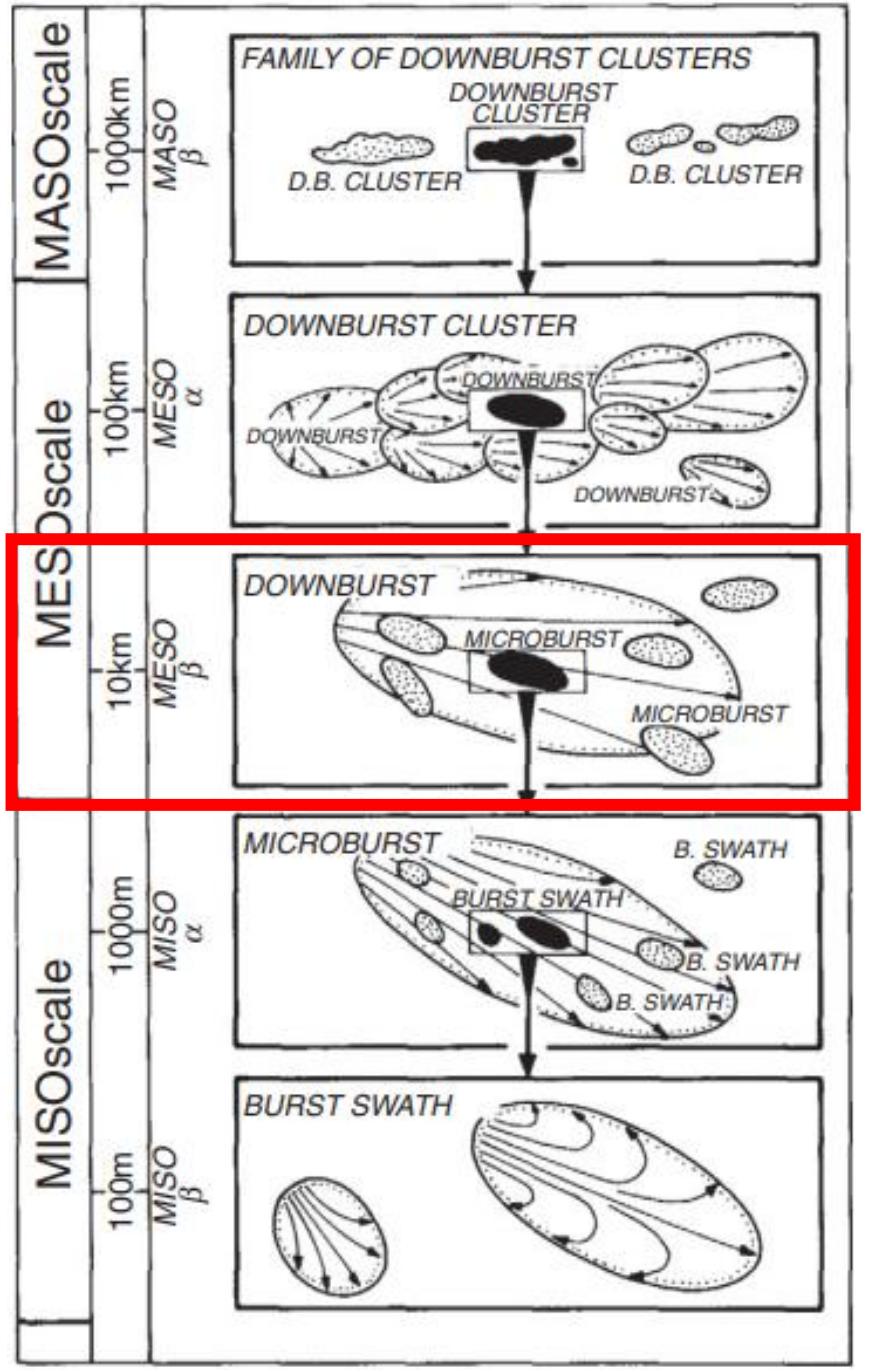


Overview

1. Wind gusts
2. Climate change
3. Analysed event
4. Results

Wind gusts

- Thunderstorms (convective systems)
- Downbursts on different scales
- Higher intensity at smaller scales



2: Fujita, T. & Wakimoto, R. M. (1980). Five scales of airflow associated with a series of downbursts on July 16, 1980.

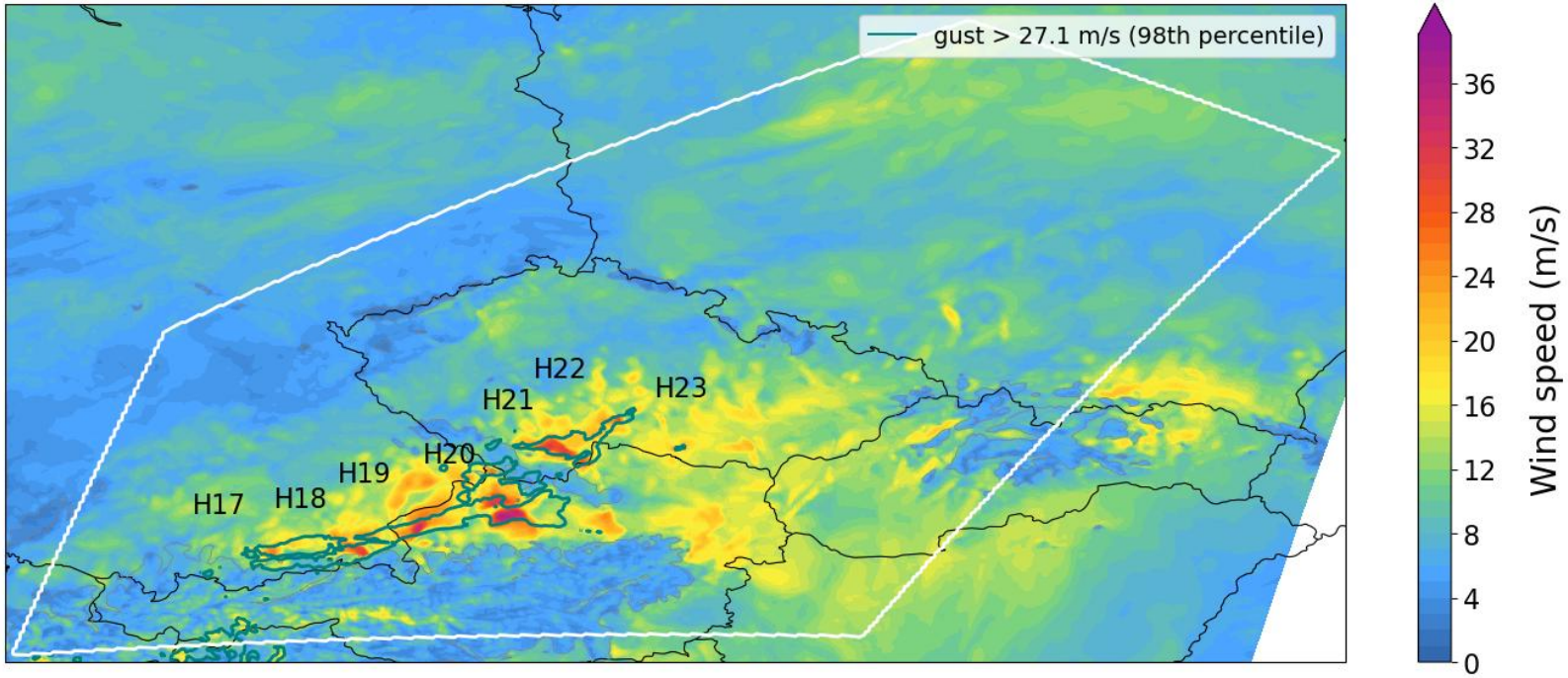
Climate change & extreme wind gusts

- Little available research
- An increase in severity and frequency of thunderstorms[2,3]
- Expected changes in wind gust characteristics[4]
  - Intensify at a rate of ~7.5% $°C^{-1}$
  - increase in the geographical extent ~5 fold

3: Gensini, V. (2021). Severe convective storms in a changing climate.
4: Rädler, A.T. et al. (2019). Frequency of severe thunderstorms across Europe expected to increase […]
5: Prein, A. (2023). Thunderstorm straight line winds intensify with climate change.

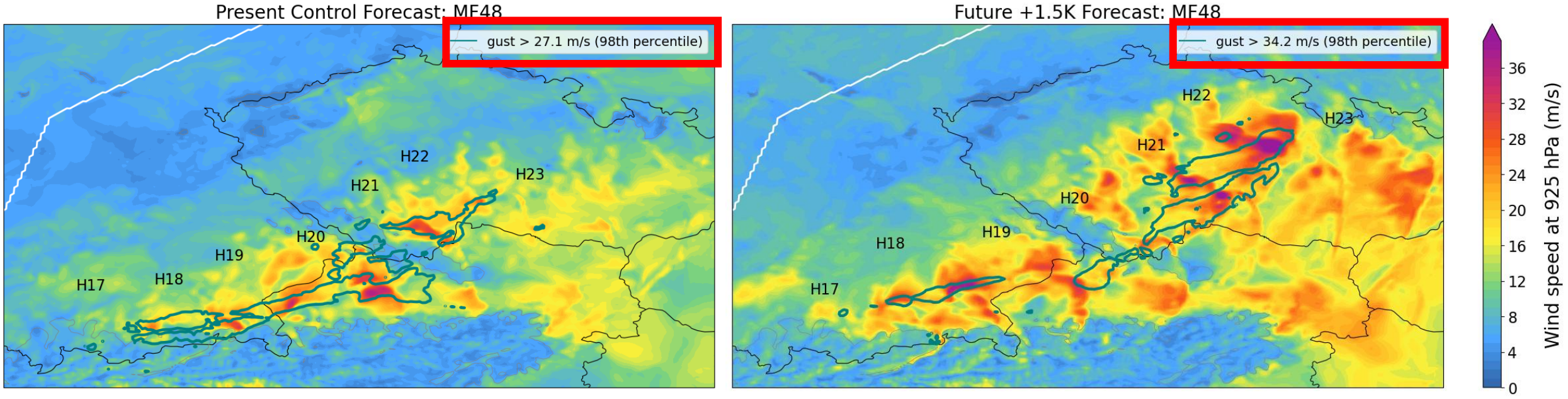
Case-study of event

- Reanalysis of event
- Present day climate
- System located north of the Alps



First impression impact climate change (+1.5 °C)

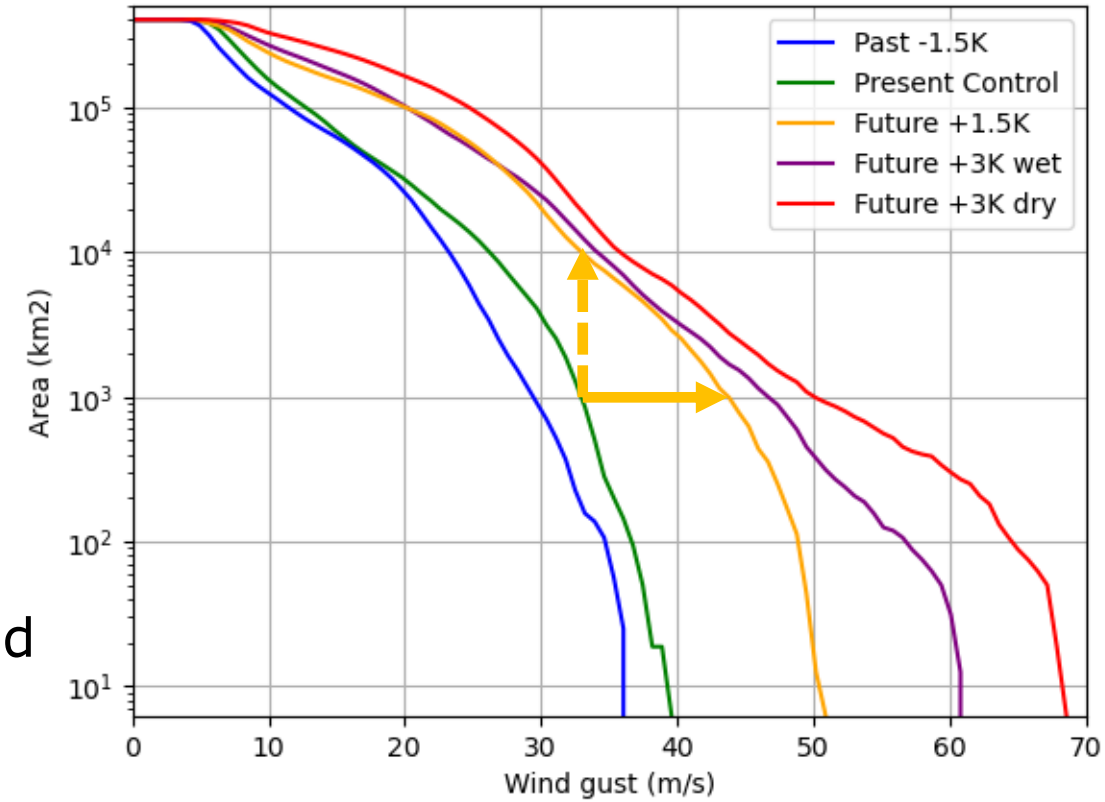
- Present day climate, 2023
- Recognisable downburst patterns



Results from south German case-study

Identified changes in characteristics

- Increase of intensity →
  - Force on pylon increased
- Increase in geographical extend ↑
  - Probability to hit overhead lines increased



Conclusion

- Results are preliminary, but strong
  - Valid for south Germany
  - Not directly applicable for NL (work in progress)

- One case-study which leaves a high uncertainty on exact changes
  - Intensification requires high wind-shear
  - Lower risk of high wind-shear

- Wind gusts require our attention, but should not cause panic

Questions