A North Sea climatology of anomalous wind events

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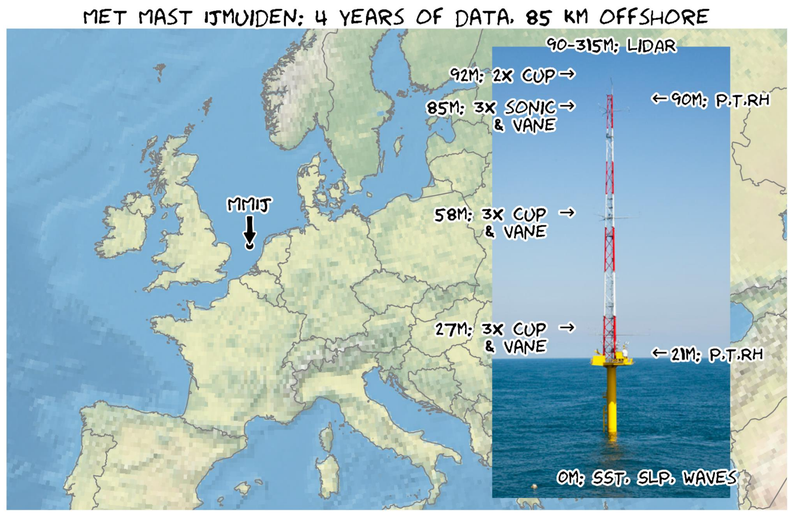
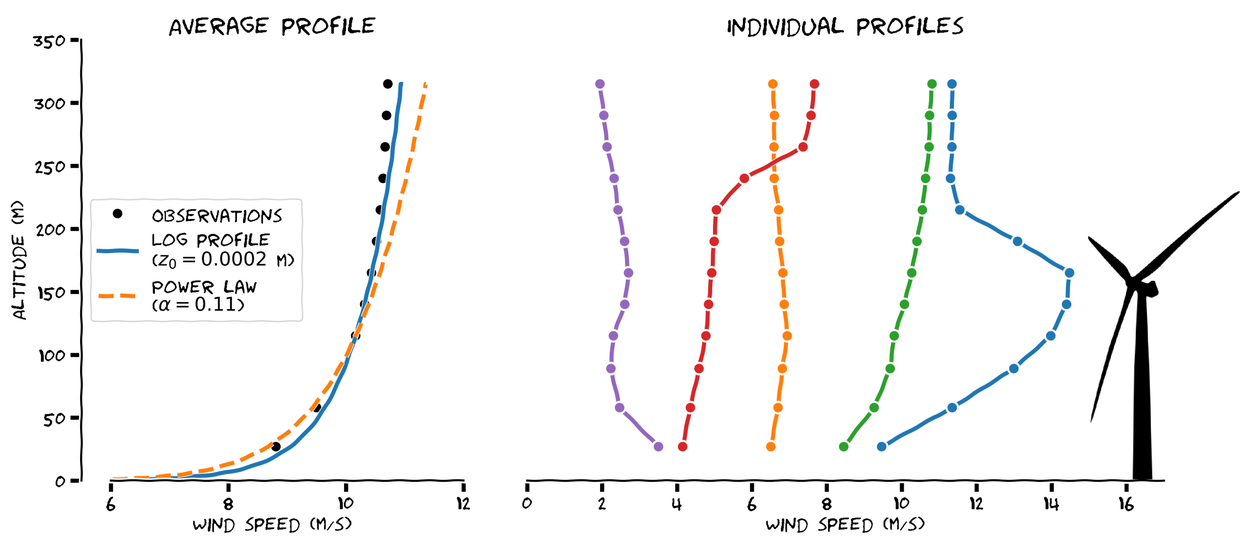
1. Introduction: Background and motivation

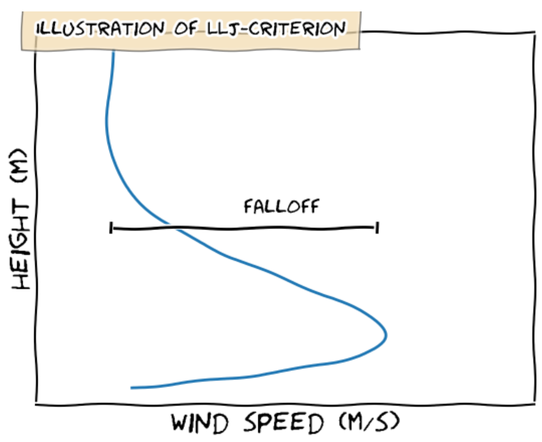


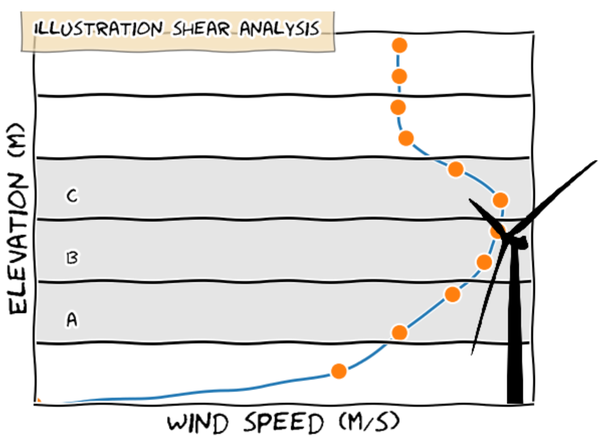


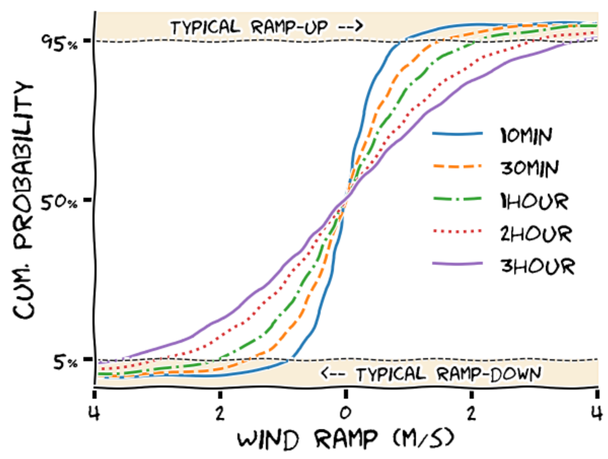
Met Mast IJmuiden data provide a unique opportunity to investigate the far offshore wind climate up to high altitudes.

Average wind profiles are (reasonably) well captured by traditional methods, but individual profiles do not always adhere to these idealized descriptions.

2. Methods: Definition of anomalous wind events (3 examples)





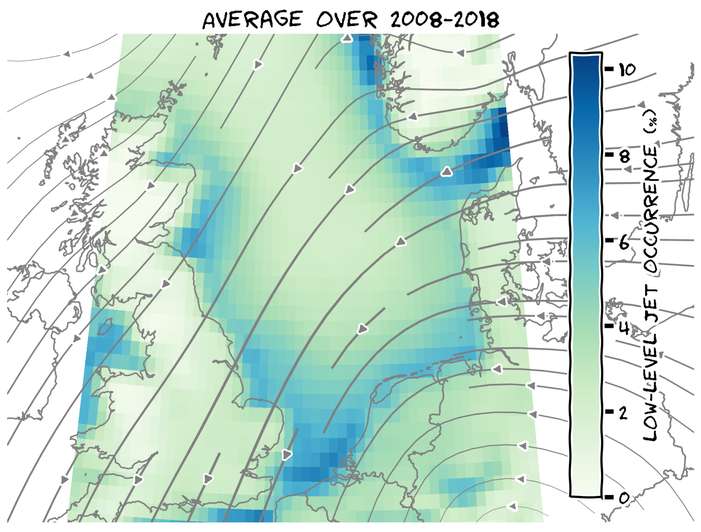


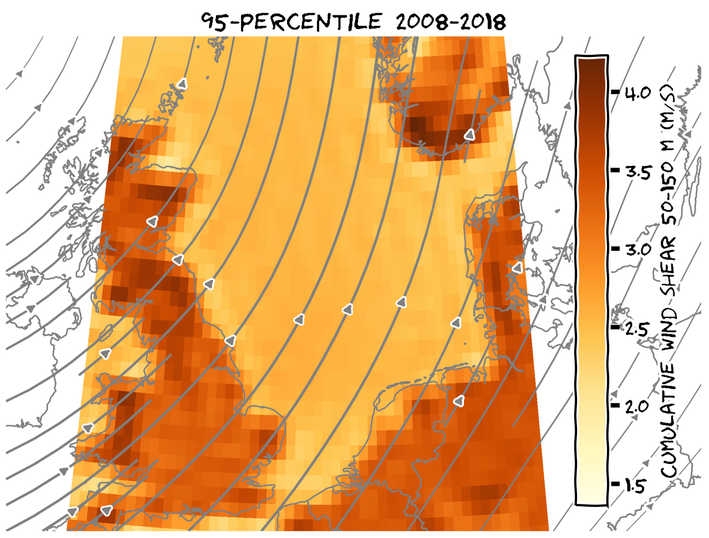
Low-level jets: Wind speed maxima close to the surface. Falloff criterion e.g. > 2 m/s.

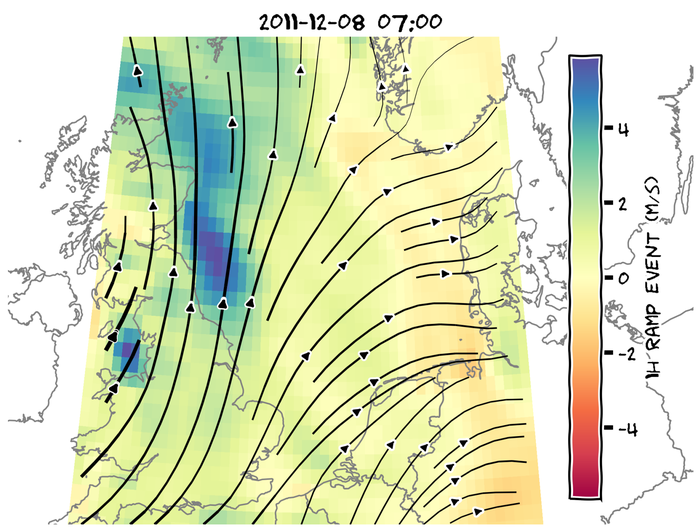
Extreme shear: accumulated shear in relevant layers is larger than the 95-percentile.

Wind ramps: rapid changes of wind in time, below and above the 5- and 95-percentiles.

3. Results: Characterization of anomalous wind events (now extended with ERA5 spatial data)







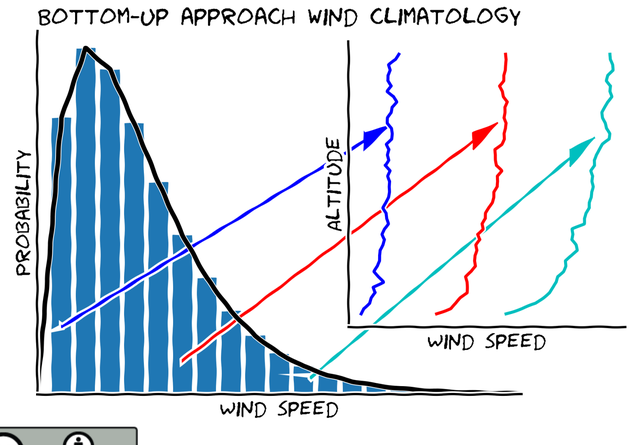
Low-level jets concentrate along the coast and occur predominantly in spring and summer. Favourable weather patterns are weak synoptic flow regimes or flows with a pronounced easterly component (overlaid).

Strong shear is typically associated with the passage of midlatitude cyclones. Shown here is wind *speed* shear, but the method can distinguish between streamwise- and normal components, thereby improving upon traditional methods.

Example ramp event along Scottish coast. ERA5 generally underestimates the ramp magnitude, but provides much insight into the spatial structure and evolution. This ramp peaks as the front moves offshore.

4. Conclusions, implications and outlook

1. Anomalous wind events: a useful framework to extend upon the standard wind climatology
2. Observations lead to a valuable characterization, but only at a specific site
3. ERA5 data provide important spatial information, but should be handled with care!
4. To embed anomalous events in standard practice, we need a paradigm shift:



FROM IDEALIZED WIND CONDITIONS TO REALISTIC INFLOW FIELDS