

Utsira Nord/Sørlige Nordsjøen Wind conditions

Prof. Joachim Reuder

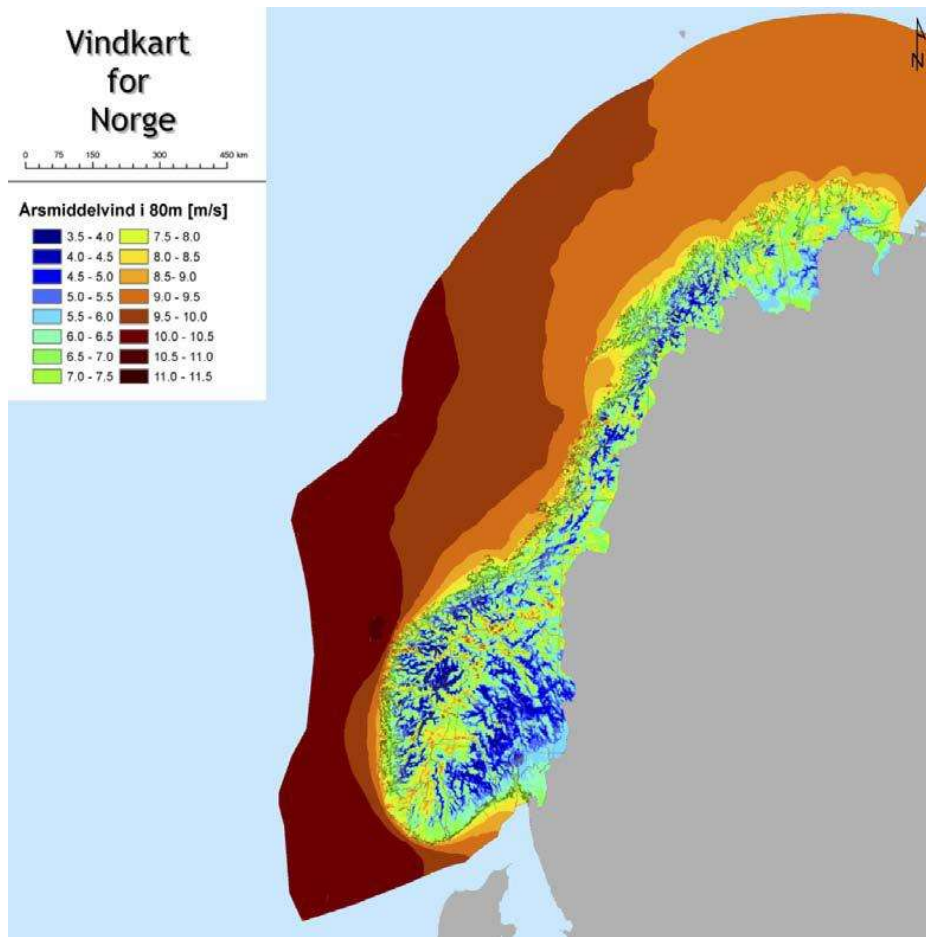
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Photo: Hasager, C. B., Nygaard, N. G., Volker, P. J., Karagali, I., Andersen, S. J., & Badger, J. (2017). Wind farm wake: The 2016 Horns Rev photo case. *Energies*, 10(3), 317.

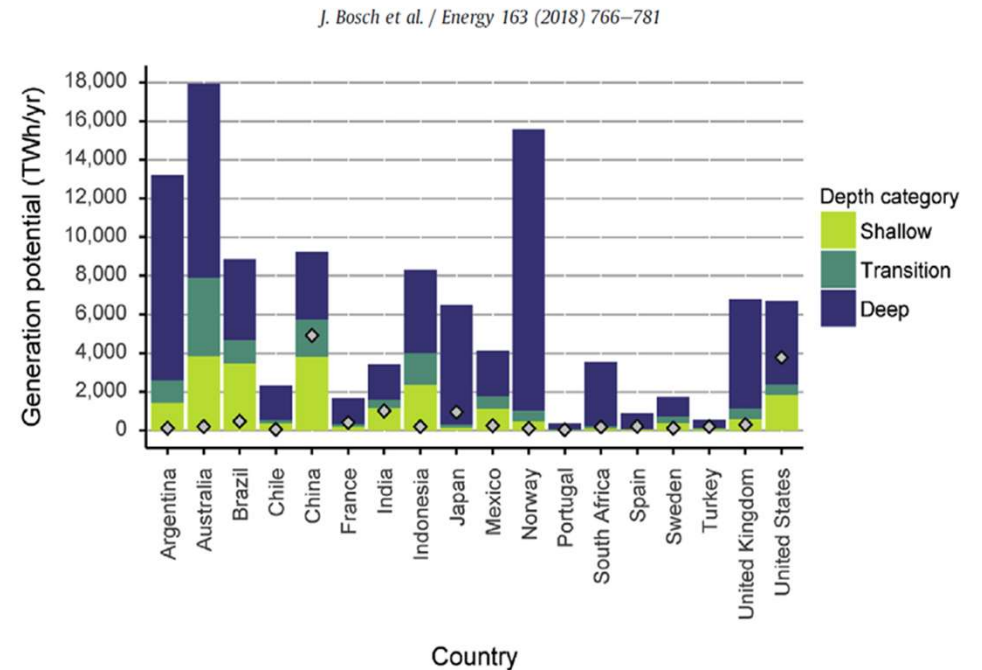
The bigger picture



<http://www.nve.no/Global/Publikasjoner/Publikasjoner%202009/Oppdragsrapport%20A%202009/oppdragsrapportA9-09.pdf>

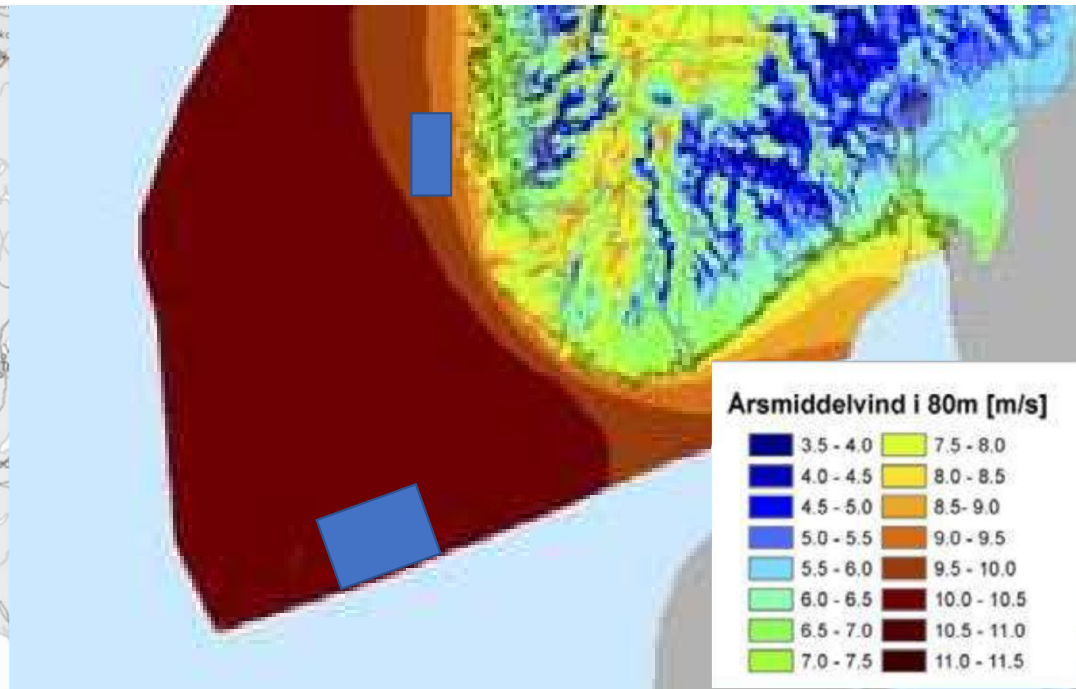
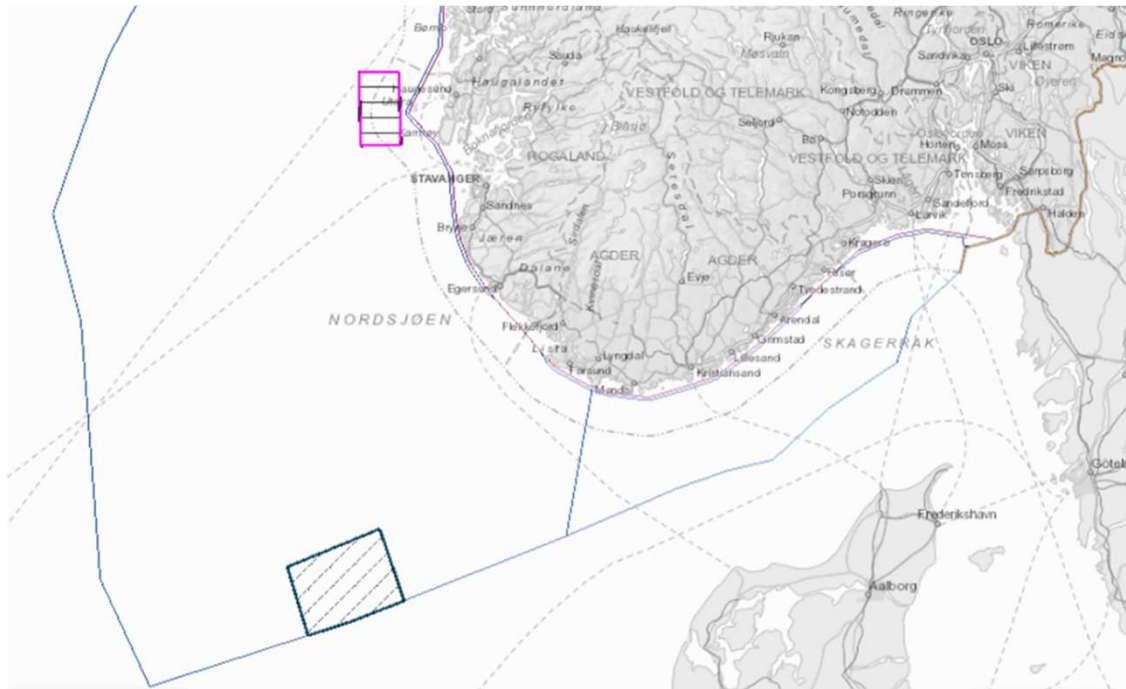
Norway has in general excellent offshore wind conditions

Southwestern Norway has a particular large potential



Bosch, J., Staffell, I., & Hawkes, A. D. (2018). Temporally explicit and spatially resolved global offshore wind energy potentials. *Energy*, 163, 766–781. <https://doi.org/10.1016/j.energy.2018.08.153>

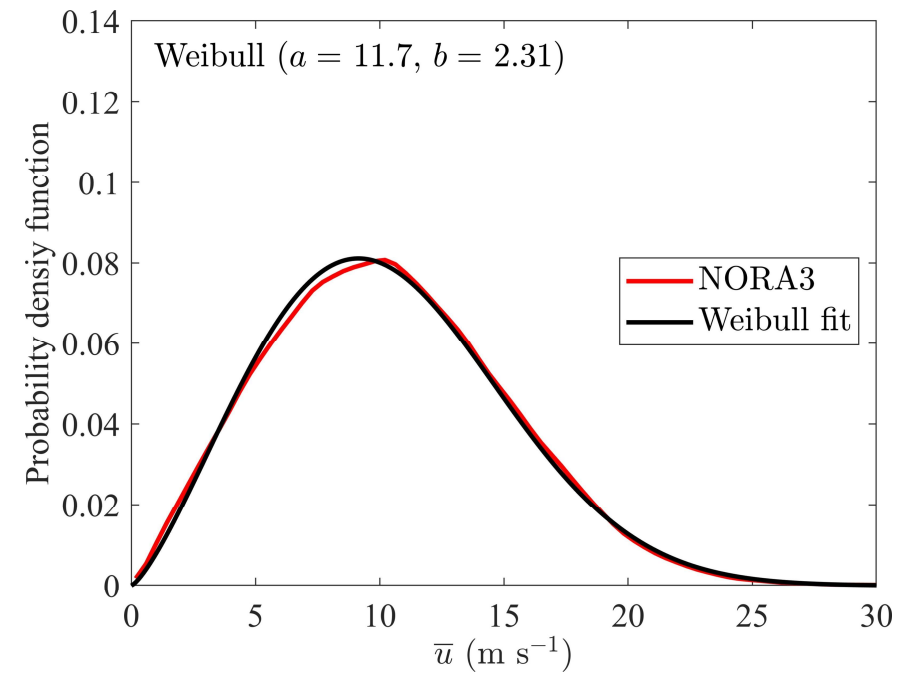
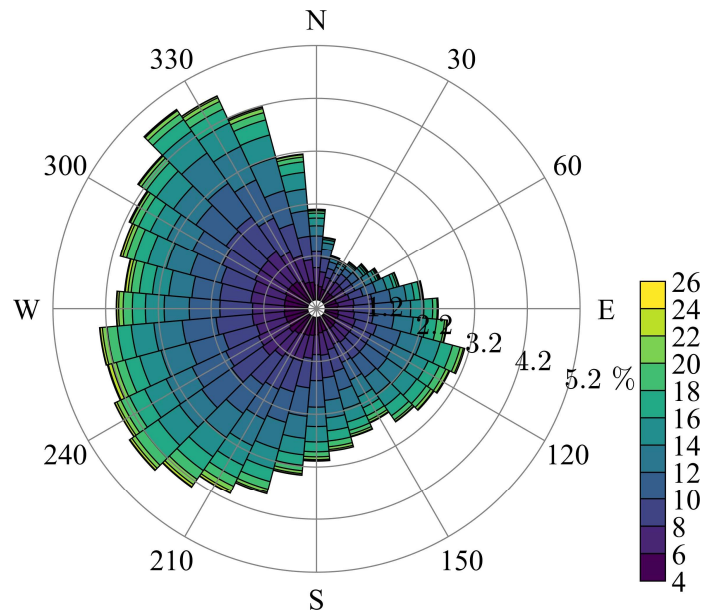
The bigger picture



<https://www.nve.no/energi/energisystem/vindkraft/vindkraft-til-havs/>

<http://www.nve.no/Global/Publikasjoner/Publikasjoner%202009/Oppdragsrapport%20A%202009/oppdragsrapportA9-09.pdf>

Sørlige Nordsjø II



Data from NORA3 hindcast, 18 years (2002-2020)

Mean wind speed 10.5 m/s

The wind conditions at SN II allow for a maximum capacity factor of 62 %

Sørlige Nordsjø II – Stability effects

Air-sea temperature difference
 ΔT (2002-2020)

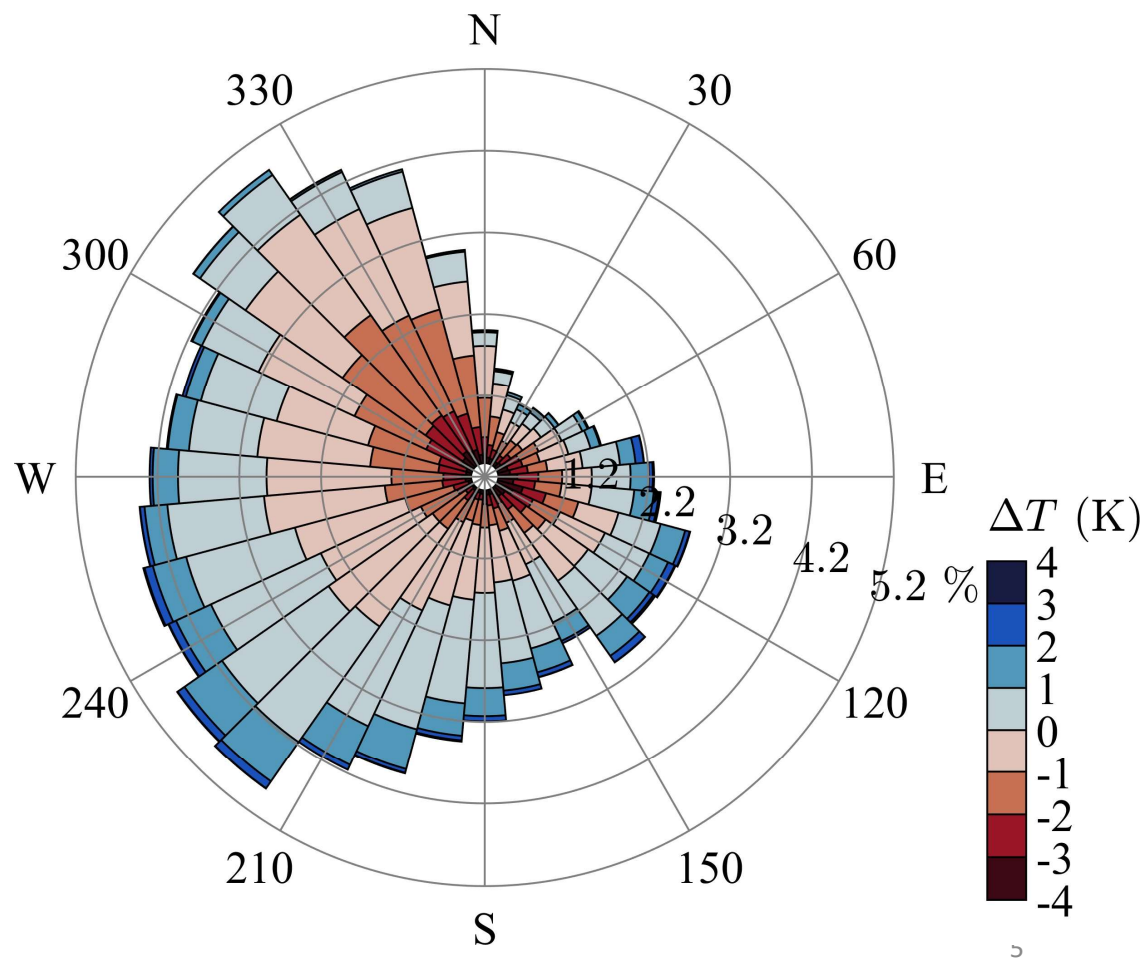
Altitude: 100 m (Direction) and 2 m
(air temperature)

Wind speed range: 5 m/s – 25 m/s

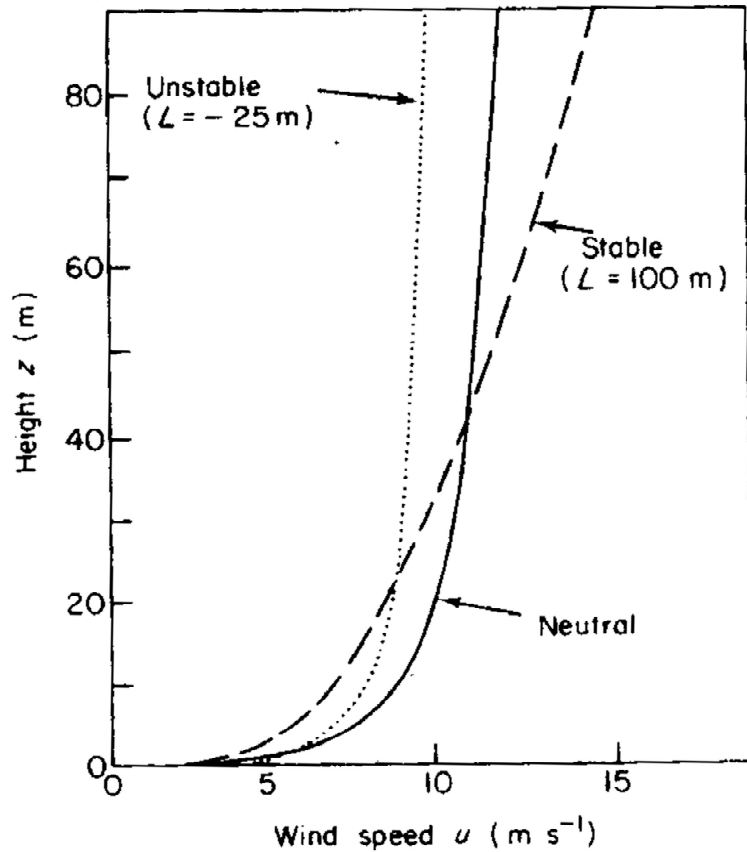
Data Source: NORA3 + ERA5

Blue: stable

Red: unstable

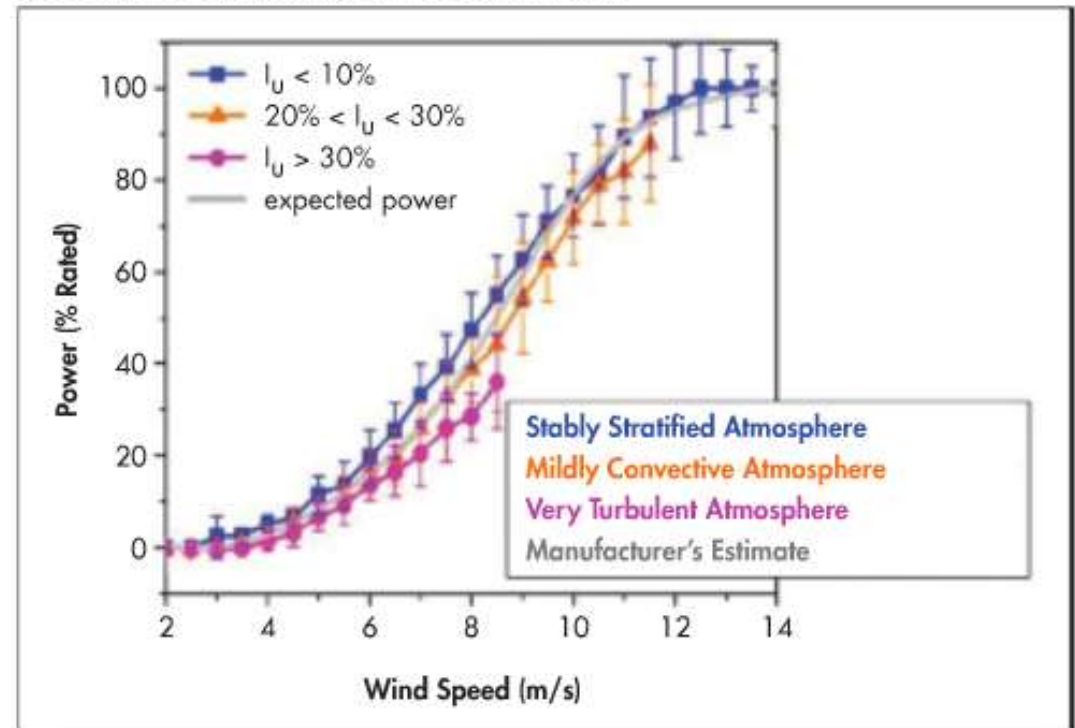


Stability effect on wind profiles



Source: Sørensen, B., *Renewable Energy*, Elsevier Academic Press, 2004

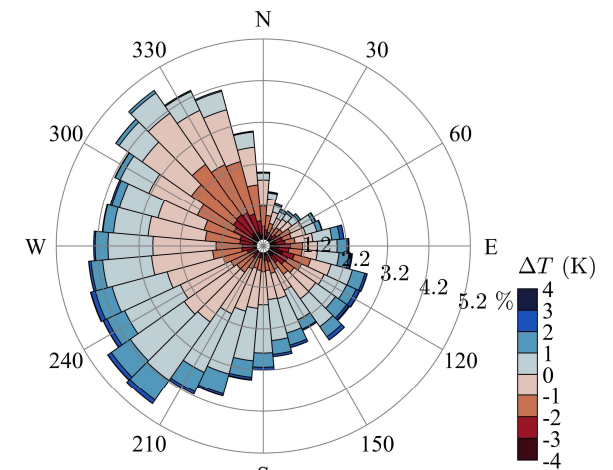
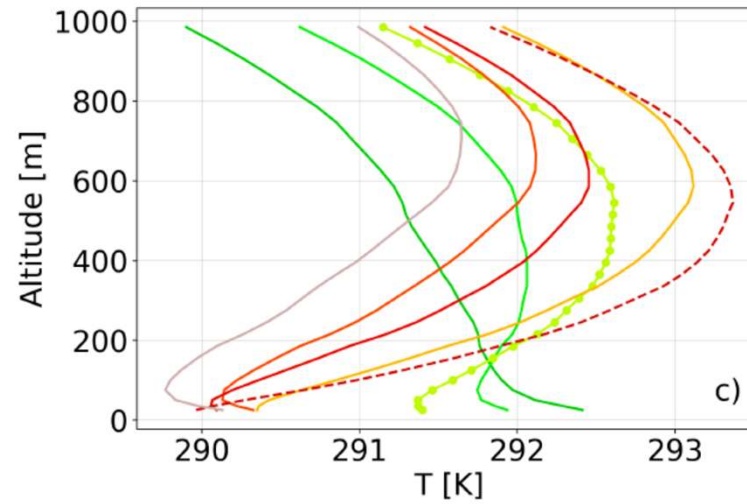
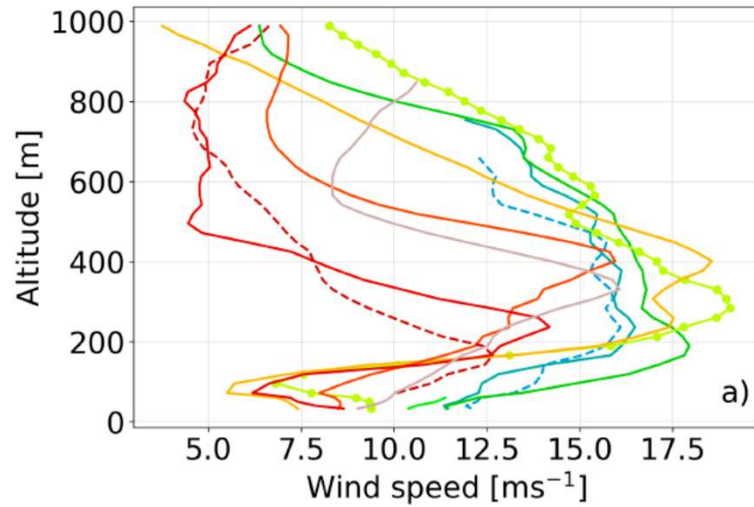
Figure 2: Power Curve Variability with Turbulence Intensity



Source: American Meteorological Society

Source: <https://docs.wind-watch.org/Turbulence-fig2.png>

Low-level jet (LLJ) measured at FINO1



Wagner, D., Steinfeld, G., Witha, B., Wurps, H., & Reuder, J. (2019). Low Level Jets over the Southern North Sea. *Meteorologische Zeitschrift*, (1993). <https://doi.org/10.1127/metz/2019/0948>



Thank you



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