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Looking for an offshore wind champion: a tight race over the Baltic Sea

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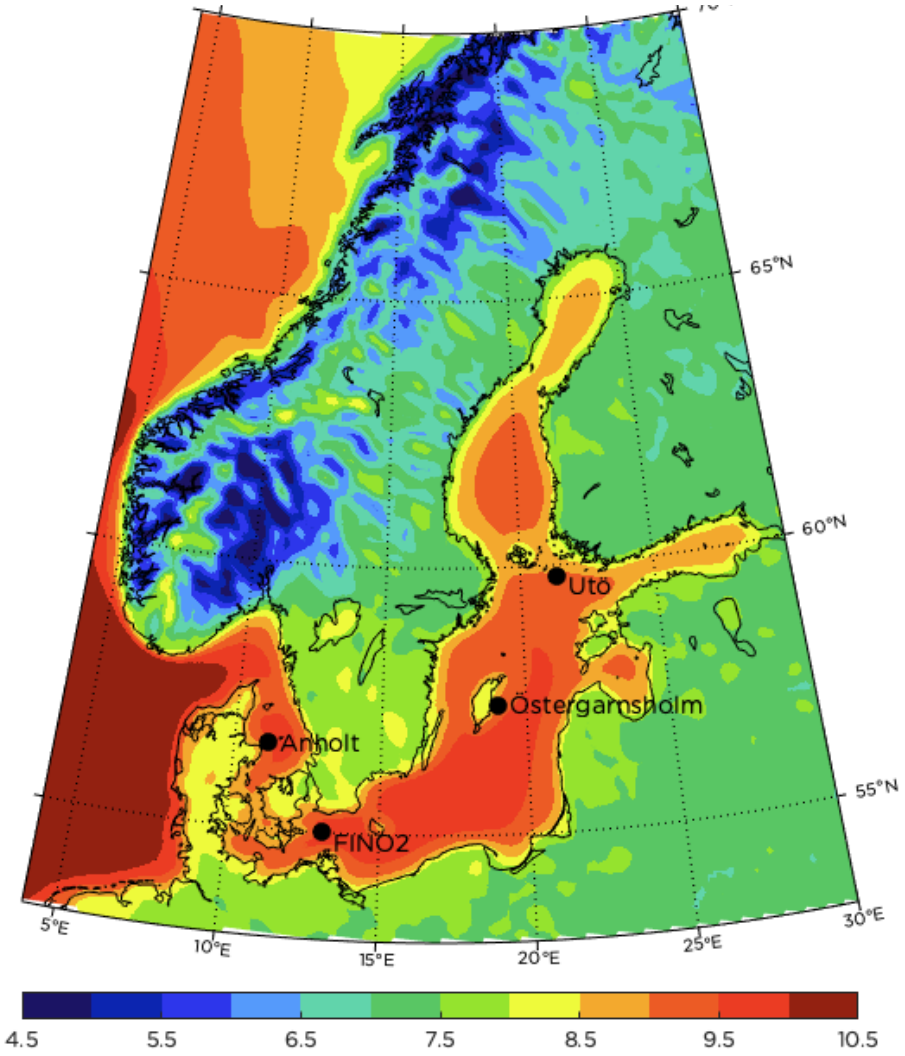
Lidar measurements

- Lidar measurements from four sites
  - Wind profiles up to 300 m
  - 1 – 4 years of data



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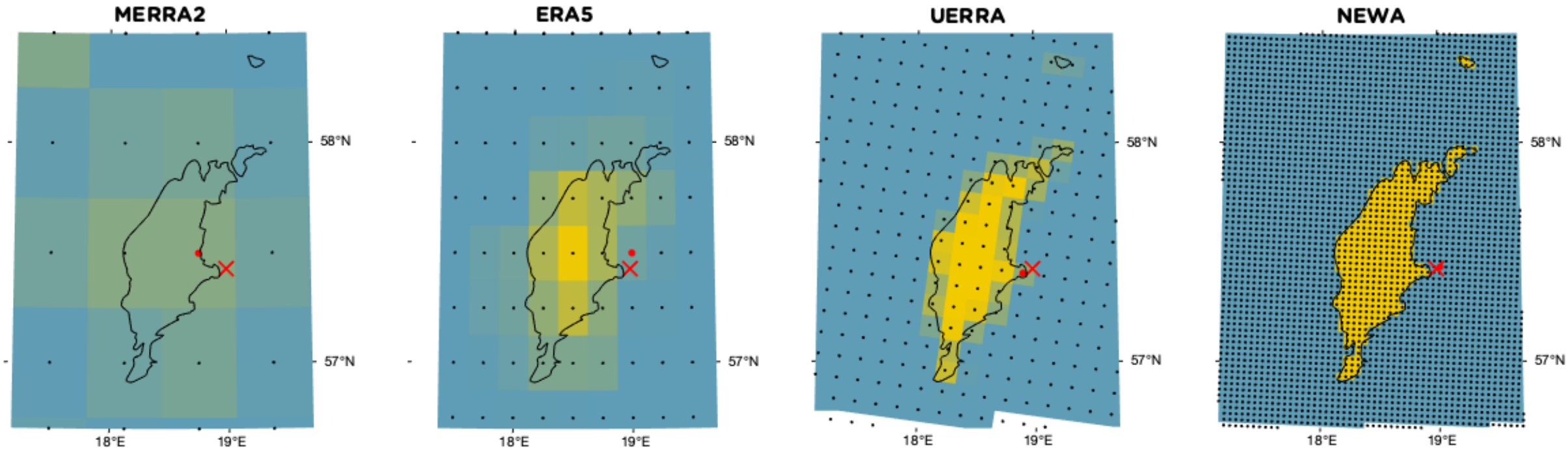
Four reanalyses tested



Global	Global	Europe	Europe
40x55 km	17x31 km	11x11 km	3x3 km
3 h *	1 h	1 h	30 min *

**** to be able to compare: calculating hourly values from all observations and reanalyses***

… and of course a lot of differences regarding vertical resolution, data assimilation, model setup, …

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In our paper

1. General wind characteristics
   - Wind profile
   - Wind speed distributions
   - Taylor diagrams
   - Average wind shear

2. Low level jets
   - Hits, false alarms, correct rejections, misses
   - Frequency bias
   - Annual and diurnal cycle
   - Core height and core speed

Mesoscale phenomena are very common in the coastal zone (sea breeze, low level jets, boundary layer rolls, …)

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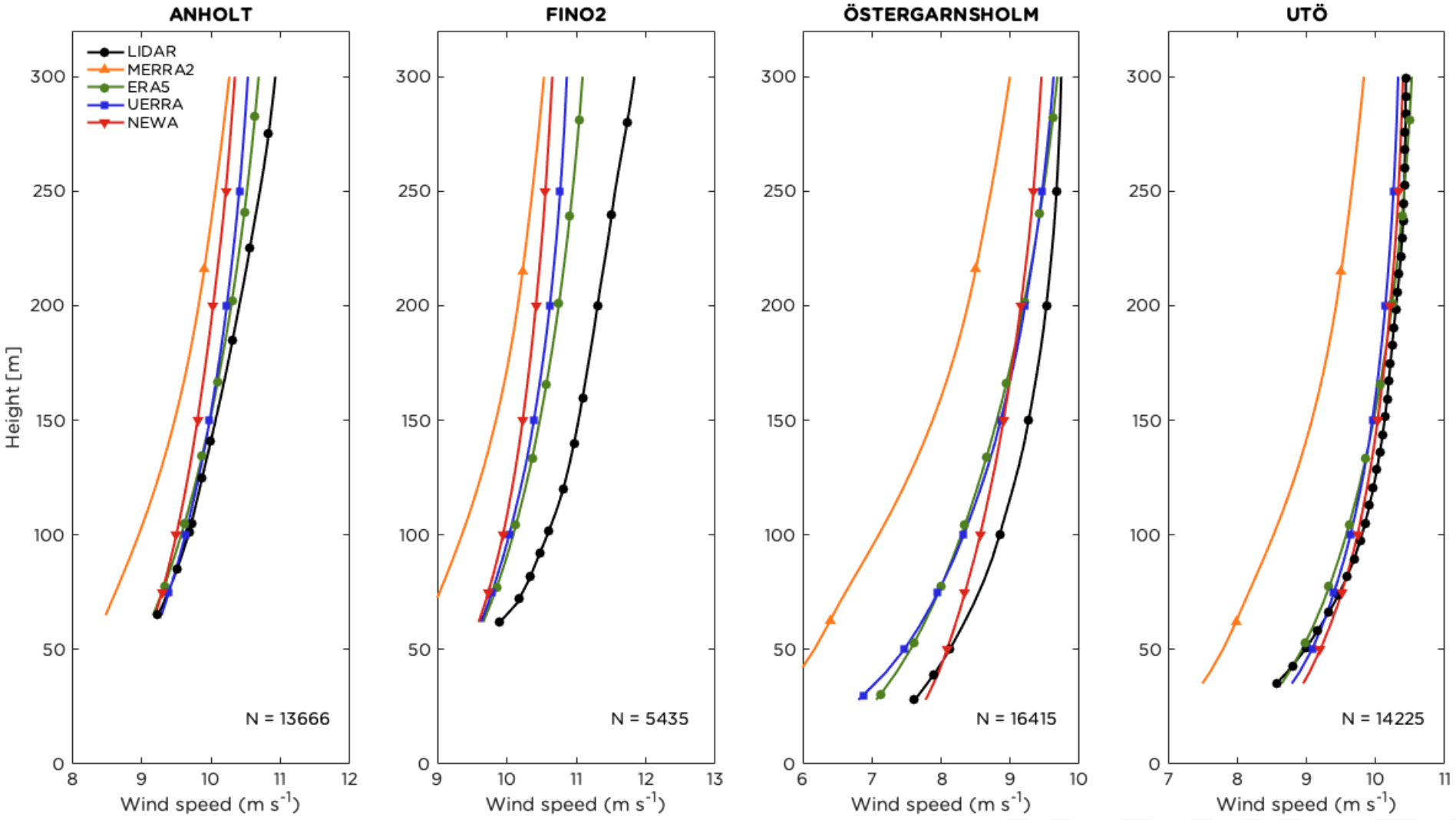
Wind profile



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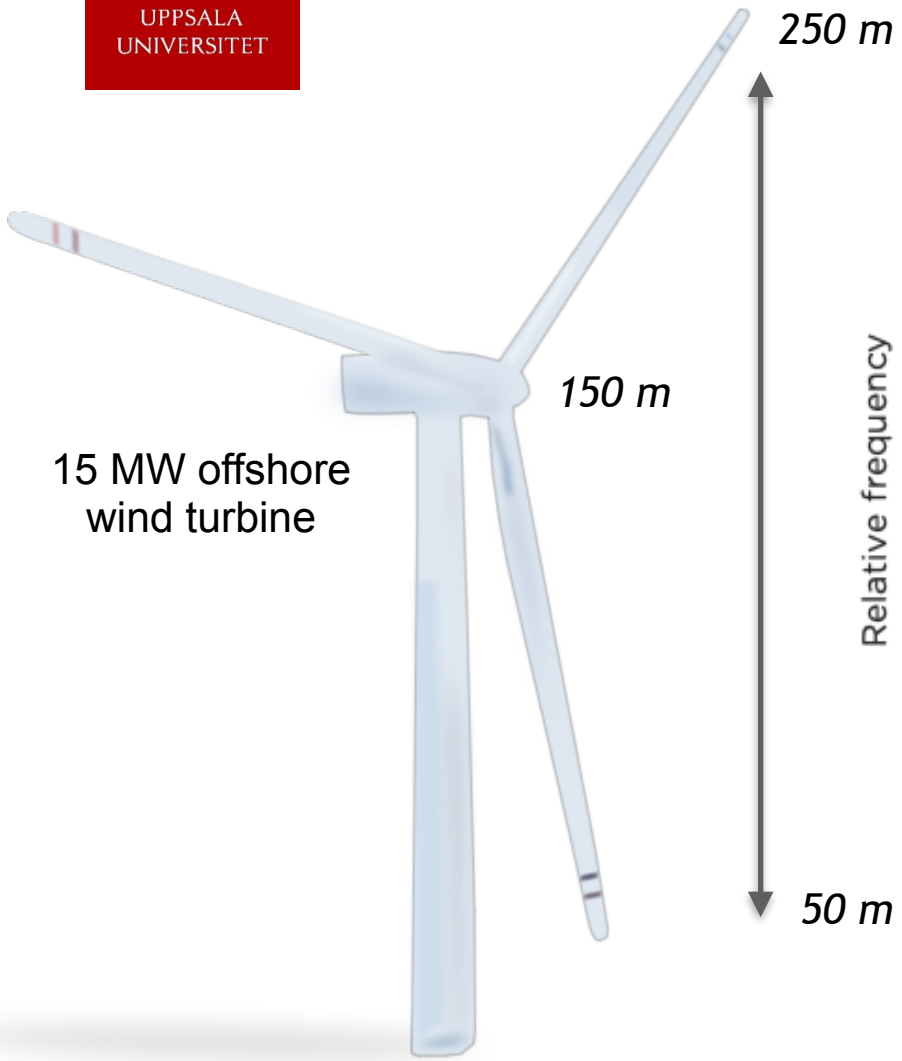
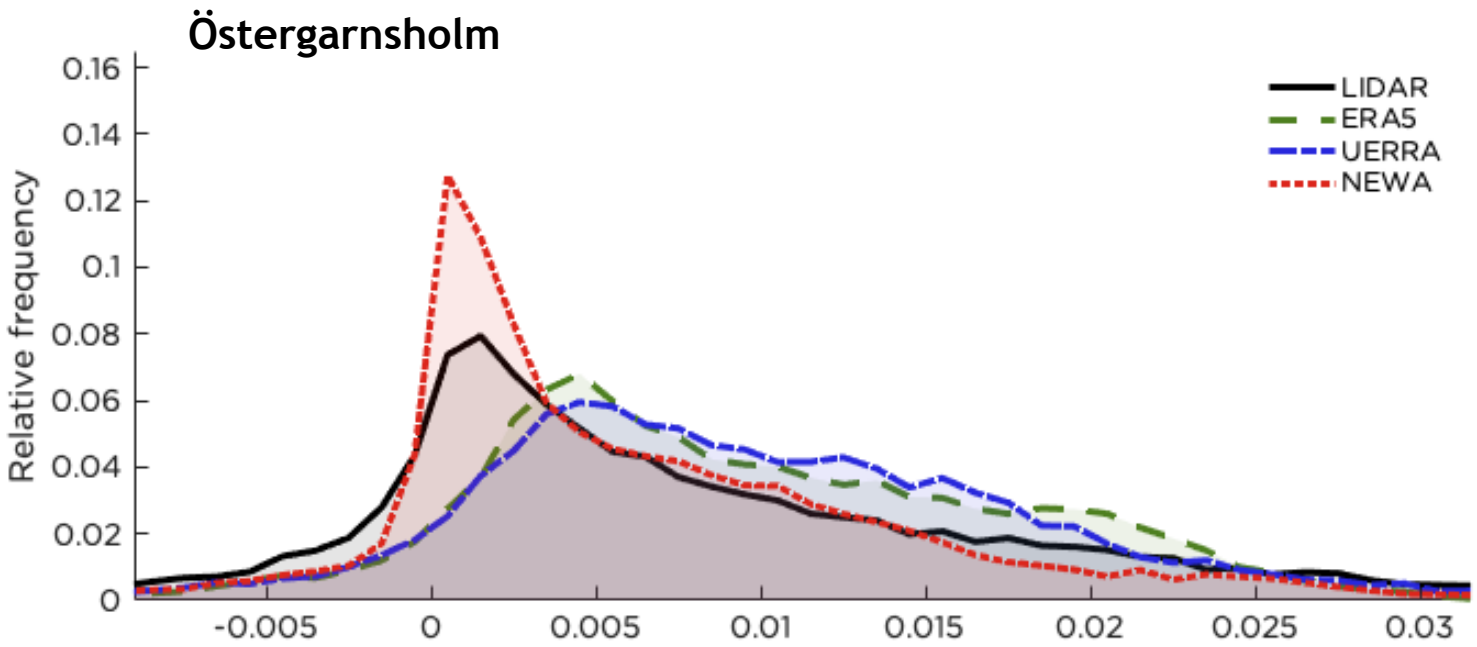
Average wind shear

as a measure of the loads on the turbine



15 MW offshore wind turbine



MERRA2 not included due to poor vertical resolution

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LLJ definition

- Low level jets can form in many different ways

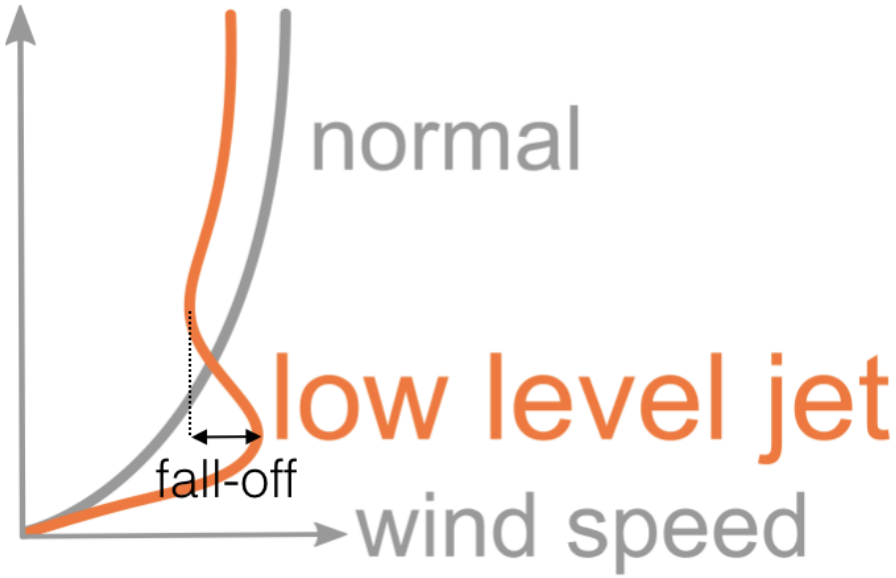
Typical formation over Baltic Sea:

- late spring/early summer: warm air advected over colder water, stability increases, frictional decoupling

But also:

- sea-breeze induced LLJs, coastal jets, …

- Fall-off criteria tested: 1 m/s and 2 m/s



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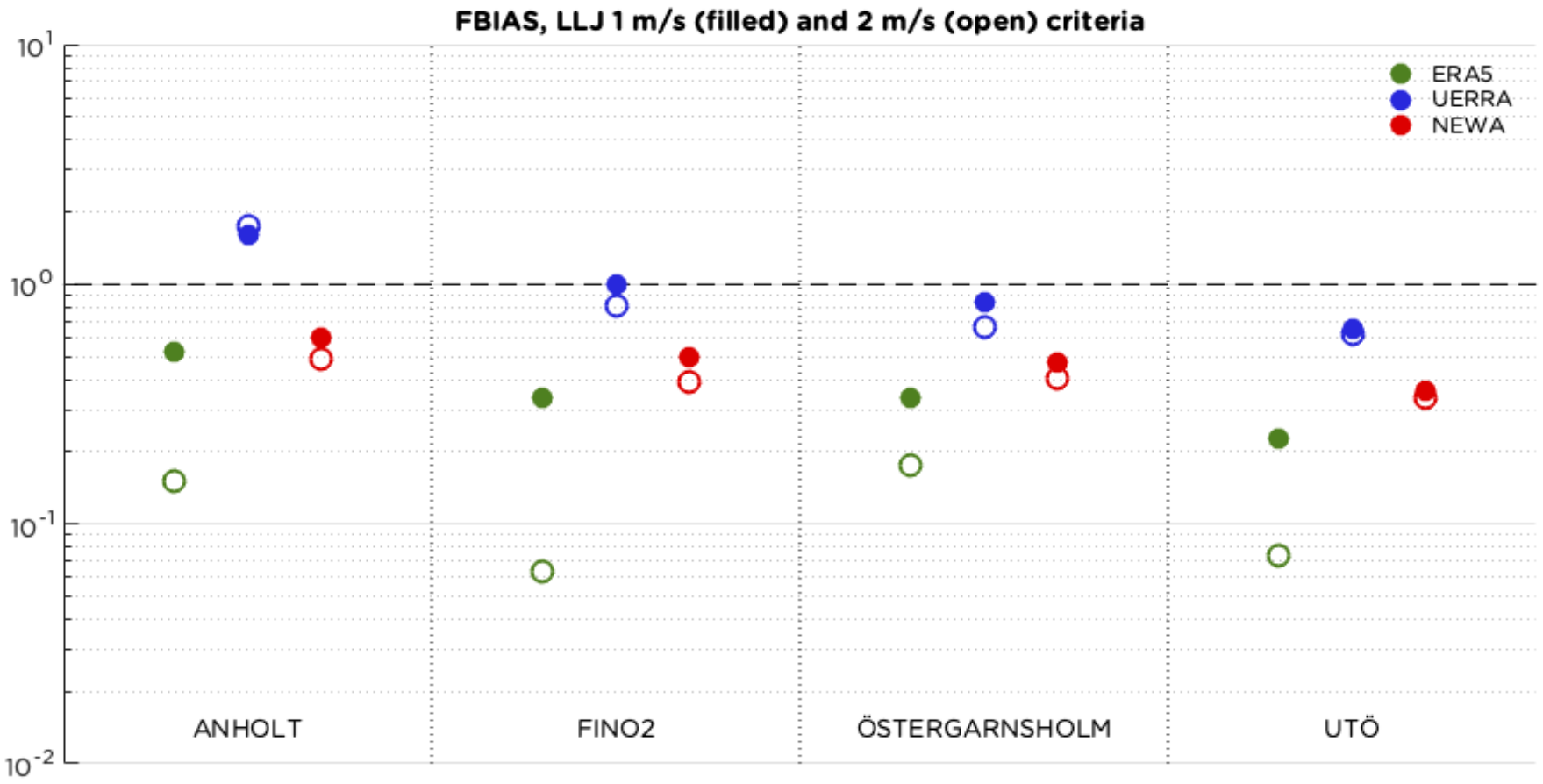
Frequency bias

FBIAS = Total predicted / total observed



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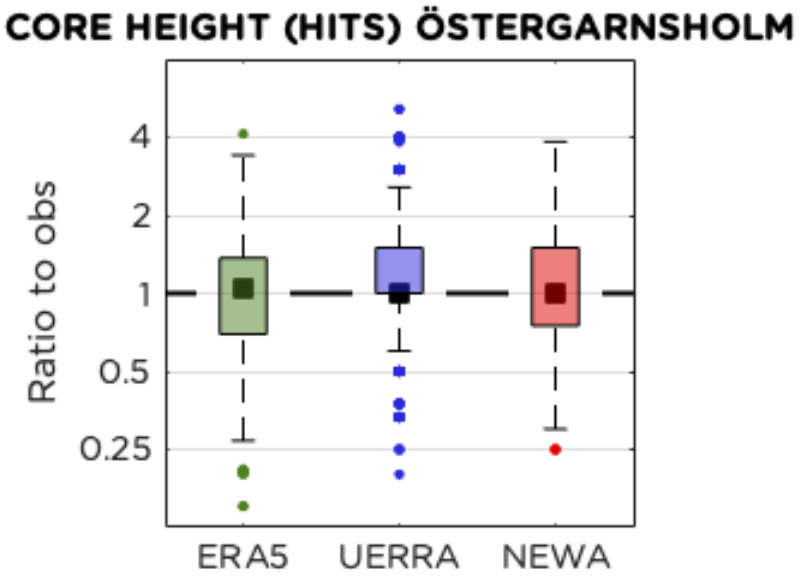

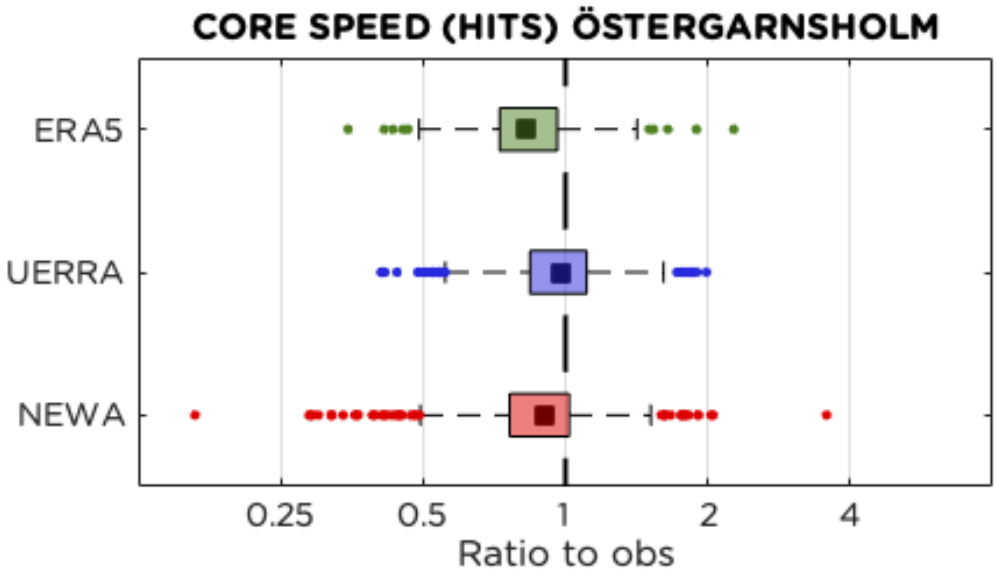

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Summary

- MERRA2: vertical resolution not good enough
- ERA5 and UERRA better than NEWA regarding wind profiles and 1:1 correspondence in Taylor diagram
- But NEWA has better average wind shear (loads on turbine)
- Mesoscale phenomena are important in coastal areas, UERRA describes LLJs best (but diurnal cycle cannot be trusted!)