How do NEWA and ERA5 compare for assessing offshore wind resources and wind farm siting conditions?

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Agenda

- Introduction
- Background
- Methods
- Results
  - Verification of numerical wind data
  - Analysis and extrapolation of extreme winds
- Conclusion
Introduction

Motivation

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Introduction
Research Questions

1. How do ERA5 and NEWA compare at predicting wind speeds at offshore sites?
2. What are the benefits of NEWA over ERA5 with respect to the offshore wind resource?
3. How do they compare in terms of modeling extreme wind speeds?
Background

Numerical Weather Prediction Models – ERA5, NEWA
Methods

Collection of wind measurements – creation of a database

Criteria:
- Public [see literature]
- Offshore, Europe
- >50 m aMSL
- Period > 3.5 years
- Quality checked and filtered
Results

Wind climatology

- NEWA $\rightarrow$ Higher accuracy
- ERA5 $\rightarrow$ Higher precision
Results

Extreme wind speed

Representation:

- Lower bias with NEWA
- Highest wind speeds underestimated
Results

Extreme wind

Extrapolation and Correction:

- Correction factors similar for all sites
- U50 ratios varying, lower bias with NEWA
Conclusion

- Wind speed: NEWA more accurate, ERA5 more precise
- NEWA more accurate than ERA5 on average, though both underestimate
- Corrections similar, but do not fit for all sites

... for the offshore measurements in this database
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Literature

- [https://www.welt.de/wirtschaft/article160887479/Warum-knicken-derzeit-so-viele-Windraeder-einfach-um.html](https://www.welt.de/wirtschaft/article160887479/Warum-knicken-derzeit-so-viele-Windraeder-einfach-um.html), last Access: 2021-03-15
- Dörenkämper et al. (2020). The Making of the New European Wind Atlas – Part 2: Production and evaluation
- FINO [https://www.fino2.de/de/mediathek/hdr-bilder.html](https://www.fino2.de/de/mediathek/hdr-bilder.html), Last Access: 2021-05-04
- Werkhoven, & Verhoef. (2012). *Offshore Meteorological Mast Ijmuiden: Abstract of Instrumentation Report*.
- Verhoef, Werkhoven, Bergmann, G., & van der Werff, P. A. (2020). *Europlatform Lidar measurement campaign: Instrumentation Report*.

Measurements:

- FuE Kiel GmbH 2021 Fino1, 2, 3 homepage URL [https://www.fino-offshore.de/de/index.html](https://www.fino-offshore.de/de/index.html)
- The Crown Estate 2021 Marine data exchange-wind data URL [http://www.marinedataexchange.co.uk/wind-data.aspx](http://www.marinedataexchange.co.uk/wind-data.aspx)
- TNO Wind Energy Wind op zee URL [https://www.windopzee.net/en/](https://www.windopzee.net/en/)
- Larsen G C and Hansen K S winddata database URL [www.winddata.com](http://www.winddata.com)
Questions?