Paper Review Quantitative Comparison of Power Production and Power Quality Onshore and Offshore: A Case Study from the Eastern U.S.

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General

This paper presents an observational analysis of potential onshore and offshore wind power production using data from two buoy-based LiDAR systems (sponsored by the New York State Energy Research and Development Authority, or NYSERDA) located in the New York Bight, and from several sites in the New York State Mesonet profiler network. The authors also complement the short-term LiDAR observation data sets with extrapolated winds from the longer-term ERA5 reanalysis product. Key points of the analysis include that 1) the offshore waters in the New York Bight, as characterized by the NYSERDA buoys, provide a significantly greater wind resource, 2) the offshore wind resource is more persistent (less intermittent) as compared with land-based (and even coastal) observations, 3) there is a summer peak in the frequency of low level jets (LLJs) and higher rotor plane shear, 4) not surprisingly, given the mid-latitude east coast location, geographic diversity (here defined has > 350 km) would reduce the potential for large-scale "wind power droughts", and 5) offshore wind is a more favorable location for load matching given reduced diurnal range of hub height winds and the large coastal populations in the region. Overall, the paper provides a very useful and cogent comparative analysis of the onshore and offshore (potential) wind resource in New York and the adjacent coastal waters. With minor edits, I recommend the draft manuscript for publication.

Specific comments

Page 2, line 45: note that aesthetics—visual blight, commercial fisheries, social equity, and NIMBY (e.g., transmission cable land fall) are significant social barrier issues for offshore wind siting.

Page 3, line 84: in addition to the Aird et al. (2022) paper, McCabe and Freedman (2023; see https://journals.ametsoc.org/view/journals/wefo/38/4/WAF-D-22-0119.1.xml) also recently published on the frequency and physical characteristics of the sea breeze and associated LLJ in the New York Bight and coastal NY (also using the NYSERDA and NYSM LiDARs).

Page 5, 174-176: this sentence is confusing— the ERA5 hourly data "…represent approximately 15- to 20-minute average values…."

Page 7, line 226: essentially $y \equiv r$?

Page 8, line 241: see McCabe and Freedman (2023)

Page 8, line 247: typo or grammar ("…all ERA5 grid-cells in [sic] that contain NYSM….").

Page 8, lines 246 - 259: should be more discussion of the limitations of using ERA5 data (perhaps in section 2.3?)—especially given the use of extrapolating using the calculated shear exponent between 10 m and 100 m. The co-authors of this paper have used ERA5 data sets in previous analyses, and other papers have discussed the issue of ERA5 underestimating near-surface wind speeds and smoothing out potential LLJ profiles (e.g., Kalverla et al. 2020).

Page 8, line 265: the cost recovery factor, CRF is mentioned once and does not appear in Table 1 but is part of the calculation in equation (8). It is defined in Barthelmie et al. (2023).

Page 12, Figure 3: top left graphic is tough to read.

Page 14, Figure 5: tough to clearly see Hudson North and Hudson South on right side figure.

Page 17, lines 410 - 420: should reference McCabe and Freedman (2023) on climatology of the LLJ. Compare and contrast their methods for identifying LLJs.

Page 18, Figure 9: should make this figure larger so can be read more easily.