# Overview:

The manuscript entitled, "Segmented Gurney Flaps for Enhanced Wind Turbine Wake Recovery" by Nirav Dangi, Koen Boorsma, Edwin Bot, Wim Bierbooms, and Wei Yu endeavors to describe differences in wind, turbine week aerodynamics introduced by the presence of a gurney flaps. On the trailing edges of wind turbine Blade tips. There is a long history of flaps as passive or active control, mechanisms for wind, turbines, and a great deal of debate in the literature as to their merit. The authors are strongly encouraged to review this literature and contextualize their work within the spotty before presenting this for publication again. Overall the manuscript reads like a section of a thesis. By itself, the study is not sufficiently detailed or explained and the claims about results are not adequately quantified or justified. There are several sections (regarding the free vortex simulations and the power and loads of the turbine) of the paper that provide no meaningful input and should be removed entirely.

# Comments:

> Frederik et al. (2020); Munters and Meyers (2018); Frederik et al.(2019))
>
> Please order references by year published (older to newer) and by last name of the first author.

> qualitatively validate faster wake breakdown
>
> Why qualitative? The abstract has an adequately defined and quantifiable metric for wake recovery.

> at the tip

> Figure 5: Installed Gurney flaps (Photographed byTNO)
>
> it is difficult to see the actual Gurney flaps in this picture due to low contrast with the rest of the trailing edge. It may be more useful to show an airfoil cross-section with the geometry of the flaps.

> Thus, because of this high uncertainty, the power and loads analysis of field tests is not presentedhere (interested readers may refer Dangi (2023)). estimate the power and loads*
>
> This seems like an important aspect of the study.

> Blue
>
> black?

> The brown lines in Figure 7 indicate two wind direction limits which capture the prevailing wind sector at the test site. TheScanning LiDAR was placed ≈912m upstream of the wind turbine, and the scan settings utilised are shown in Table 1. Theazimuthal (ψ) ranges of these settings are depicted as red lines in Figure 7. The red center line represents the approximate axisof the wind turbine (for 230◦ wind direction with zero yaw misalignment), and the scan pattern was made symmetric aboutit. The scanning LiDAR azimuth (ψ) and elevation (θ) convention is shown in Figure 8. LOS implies the line of sight of the140LiDAR. The scan time was ≈2.8 minutes, this implies that in a ten minute interval, roughly three samples were available atevery point of the scan.
>
> This section is difficult to follow. Along with the information provided in Table 1, I take it that the scanning lidar was collecting line of site wind speed in a large volume that included the turbine and the wake. The scan is relatively highly resolved in space, but the revisit time is 2.8 minutes, which much contribute to the uncertainty in the description of wake turbulence as information is smeared in time. Is this correct? It would be extremely helpful to have a plan view of the experiment and a perspective drawing of the lidar, scan geometry, and turbine.

he steps takenfor the data processing of the scanning LiDAR data are shown in Figure 9. Firstly, a carrier to noise ratio filter was used suchthat data within the range of −23dB and −3dB was preserved (Cassamo et al. (2021))

This sort of hard filtering based on CNR may be overly conservative and reject viable data or overly generous and keep outliers or spurious data. The dynamic procedure proposed by Beck and Kuhn (2017) offers a more localized approach to filtering and is more likely to provide better flow estimates.

Beck, H., & Kühn, M. (2017). Dynamic data filtering of long-range Doppler LiDAR wind speed measurements. Remote sensing, 9(6), 561.

Table 1: Scanning LiDAR settings (Wind turbine is located at ≈41.5◦ azimuth)

Very little information is provided as to how this scan pattern was designed or what it was designed to prioritize. It is especially important with scanning lidars to carefully assess the goals of the observations against the limitations of the lidars themselves (i.e., what makes these the ideal scans for this study?). Please see more in Letizia, Zhan, and Iungo (2021) and related works.

Letizia, S., Zhan, L., & Iungo, G. V. (2021). LiSBOA (LiDAR Statistical Barnes Objective Analysis) for optimal design of lidar scans and retrieval of wind statistics–Part 1: Theoretical framework. Atmospheric Measurement Techniques, 14(3), 2065-2093.

With the filtered data se

This reads like a thesis, rather than the methods section of a peer-reviewed journal article. I recommend reducing the parts of the methods that are considered common practice and rely on citations instead.

The standard error was defined as

The subscript 'samples' can be removed for the sake of clarity. It is defined in the text in the same sentence.

Figure 10: I

Please increase the font size for figures so that they are easily readable. It is difficult to interpret these graphics due to their size.

How many observations go into each of the curves shown in the figure? Are the shaded regions error or measurement uncertainty? Are the dashed lines the hub height of the turbine?

What should we as readers of your work take from these figures? Perhaps it would be helpful to pull out distributions of the hub-height wind speed and turbulence intensity from the measurements to help readers understand the variability in the sample.

Betz limit of roughly 67%.

The Betz limit is approximately 59.3%. See https://en.wikipedia.org/wiki/Betz%27s_law. Does the figure quoted in the text refer to the limit on velocity deficit? Please review and update.

Figure 12:

This figure appears to show velocity deficit. Please update the caption and use throughout the text for consistency.

assess the impact on the retrofitted wind turbine performance

This is not undertaken in the current study.

4.2 Power and Loads Analysis in Various Inflow Conditions

This manuscript effectively omits any information about power and loads. There are new substantial correlations made between the alleged changes in wind, turbine week, aerodynamics and variations in power and loads. Without the state, it is impossible to say, whether the addition of Gurney flaps has any real purpose or meaningful affect on a winter vine. It is not sufficient to say that a change in momentum deficit is enough to justify their presence.

The increased wake recovery is observed in proximity to the rotor in this wind speed bin as well. It should be noted that the285number of scans for the retrofitted configuration are only 6, which means wake measurements during two 10 minute intervalswere used

Example of six observations is sufficient to quantify average statistics, or measuring uncertainty. Without the presence of some indication of variability. Due to the nature of the skin design, the standard error is not an appropriate metric for uncertainty as it does not factor in the temporal and spatial averaging included in the lidar returns.

The sharp profile of the segmented Gurney flaps designed as shown in Figure 4 was expected to cause an increase innoise level

Does this refer to aeroacoustic noise? If not quantitatively assessed in this work, I recommend moving this to a discussion section about other possible impacts that arise from the Gurney flaps.

Overall, great insights into the wind turbine wake were made possiblewith the field tests conducted in this study. A reduction of the velocity deficit of 10% at 5D downstream distance translatesinto a 30% reduced wake loss

This section appears to be purely conjecture, based on theoretical relationships between wind speed and power production. Without the measurements to support these claims, including wake loss mitigation on a downstream turbine, this sort of discussion should be omitted.

The free vortex wake simulations

This is a purely qualitative description of the model outputs and are difficult to reconcile with the limited measurements from the lidar provided above. No effort is made to describe the details of the simulation setup, the inflow conditions, or the state of the turbine, so it is impossible to infer whether the simulation results pictured in Figure 18 even represent the same case.