

Wind Energ. Sci. Discuss., referee comment RC2
<https://doi.org/10.5194/wes-2021-79-RC2>, 2021
© Author(s) 2021. This work is distributed under
the Creative Commons Attribution 4.0 License.



Comment on wes-2021-79

Anonymous Referee #2

Referee comment on "Vertical wake deflection for floating wind turbines by differential ballast control" by Emmanouil M. Nanos et al., Wind Energ. Sci. Discuss.,
<https://doi.org/10.5194/wes-2021-79-RC2>, 2021

Report on the manuscript submitted to Wind Energy Science
"Vertical wake deflection for floating wind turbines by differential ballast control"
by Nanos, Bottasso, Manolas and Riziotis

The paper investigates the feasibility of tilting floating wind turbines to steer the wake in the vertical direction by pitching the floater with differential ballast control. The work continues and extends the one presented by Nanos et al. at Torque 2020 by considering a 10MW turbine model instead of a 5MW one, and considering two specific semi-submersible platform designs. The paper clearly deserves to be published in Wind Energy Science: it is interesting, well written, it clearly defines the problem at hand, provides a good panorama of previous work and defines specific objectives. The findings are discussed in a convincing way highlighting the original results of the study. There are, however, a few issues that should be considered before publication.

- I am concerned with the $\Delta P(\text{tilt angle})$ curve reported in Figure 8a. As mentioned in the manuscript, previous work on wake steering where the rotor hub is tilted or yawed shows curves of the type $P=P_0 (\cos(\text{angle}))^p$ which, as such, are very "flat" near the reference position with no effective yaw or tilt (see e.g. Fig. 10 in the Nanos et al. Torque 2020 paper). This is not what is observed in Fig.8a where the slope of the $\Delta P(\text{tilt angle})$ curve is large and strongly discontinuous through the zero-tilt. The effect of the vertical displacement of the hub in a sheared mean wind, mentioned in the discussion of Fig. 8a, does not explain the behavior of the curve as it would be associated to a non-zero but *continuous* slope of the curve through zero-tilt; indeed, in the chosen configuration, the effect of the vertical displacement of the hub is to induce a negative ΔP for a decreased hub height (negative tilt, negative floater pitch) but a positive ΔP for an increased hub height (positive tilt, positive floater pitch) which is not observed in Fig.8a. Furthermore, with this type of curve, the cosine-power-law fit is highly questionable (as would be probably apparent by comparing the fit to the actual curve in Fig 8a) and so is the fitted exponent $p=3.5$.

The authors should clarify this issue which is of primary importance for the subsequent discussion of tilt-induced power change of the cluster.

- The study includes a detailed analysis of the loads experienced by the unwaked tilted turbine (that would be the most upwind one in a wind plant). It would be interesting to know also the loads experienced by the downwind fully waked turbine in the case where it is not tilted, but possibly also in a tilted case that would be expected if additional turbines were added in the column. It would be great if the authors could add this analysis to the revised paper but if they can't, they should at least emphasize in the conclusions that additional work is needed to estimate the loads experienced by the waked floating turbine.
- The stability bounds on the tilt angle that can be accessed with the proposed technique should be clearly mentioned/discussed, possibly by showing/discussing at least the hydrostatic restoring moment curve as a function of the tilt (or pitch) angle. Also, the approximate position of the center of gravity should be reported in figures 11 and 12, where the center of flotation is shown.