

Should wind turbines rotate in the opposite direction?

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Referee comments

The authors argue that counter-clockwise rotation wind turbines in northern hemisphere (as opposed to clockwise as is currently done) can lead to a power increase of 11% in the downwind turbine due to constructive interactions between the axial vorticity in the wake and veered Ekman layer, especially when strong stable stratification is present. While I am fascinated by the overall theme of this research, I do not feel that the authors have done a thorough investigation to corroborate their hypothesis. While the paper uses a provocative title and well written, I hesitant in recommending publication at this time since I have the following serious concerns regarding the quality of the numerical simulations performed.

1. The Ekman layers being simulated are highly stratified with very high gradient Richardson numbers. TKE based eddy-viscosity SGS closures are notoriously terrible at stably stratified layers; see the work by Sullivan et. al, (JAS, 2016) where they show grid sensitivities up to 0.25m for similar states of stratification. You must show that the Ozmidov scale is larger than the grid scale, especially for your strongest stratification case for me to accept the accuracy of the SBL simulated using your SGS closure. This is not done in the current version of the manuscript.
2. Since much of the argument made in the paper relies on axial vorticity, the authors need to present a strong case showing that the axial vorticity captured by the their grid resolution and actuator-line parameterization is correct. A grid convergence study might help, although I remain skeptical regarding whether actuator lines can correctly represent axial vorticity. There is substantial discussion on this topic in open-literature.
3. There is new evidence that suggests that ignoring the horizontal component of Earth's rotation (as the authors have done) has a significant quantitative impact on wakes of large turbines representing small Rossby numbers. See the recent work by Howland et al. (2020, JFM) on this topic. Even at approx.. 45deg. Latitudes, I would speculate the direction of wind (Westerly vs Easterly) would affect the power of the downwind turbine by similar order of magnitude as shown by the authors for CW vs CCW rotation.

At this time, I do not feel comfortable recommending publication. However, if the authors systematically address the concerns outlined above and show rigorous grid convergence, I would be happy consider the revised manuscript.