Wind Energ. Sci. Discuss., author comment AC1
https://doi.org/10.5194/wes-2021-36-AC1, 2021

Reply on CC1

Adam S. Wise et al.

Author comment on "Meso- to microscale modeling of atmospheric stability effects on wind turbine wake behavior in complex terrain" by Adam S. Wise et al., Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-36-AC1, 2021

Dear Dr. Peña,

Thank you very much for your kind remarks and questions. And thank you for sharing your work for Alaiz, it was a really interesting read. To address each one of your questions:

- You are correct in that we do not nudge our simulations. We felt that nudging was not necessary because there was reasonably good agreement between our results and the observations. We think that nudging is only necessary when there is a serious mismatch with observations. For example, in Arthur et al. 2020, nudging was used because WRF in forecast mode had trouble predicting the dynamics and timing of the frontal passage. In our case, the mesoscale forcing was not drifting from observations. In the runs using ERA5, the height of the jet was severely underestimated and we think that it is unlikely that nudging these runs would have led to better agreement. We could explore nudging more but feel that it is beyond the scope of our work.
- Thank you for sharing your work. It was an interesting read with some great figures. We do not have results without CPM. CPM does not add computational cost, and our previous work in this domain, for different cases, suggested that CPM enhanced agreement with tower observations. More detail regarding the CPM methodology can be found in Connolly et al. 2021. In our stable case, CPM only triggers and accelerates any small scale turbulent structures, which are mainly below the jet. However, in complex terrain, the terrain itself induces enough turbulence that it is difficult to determine the exact role of CPM.
- Thanks for the suggestions! We are actually currently working on this as a separate paper, including your suggestion and also analyzing the Perdigao case with an additional turbulence closure model. More closely examining the turbulence quantities such as dissipation, TKE, and variances is really important. Connolly et al. 2021 provided some comparisons for total TKE to observations.

Thanks so much for your questions!

Connolly, A., van Veen, L., Neher, J.M., Geurts, B.J., Mirocha, J., and F.K. Chow. 2021. Efficacy of the cell perturbation method in large-eddy simulations of boundary layer flow over complex terrain. *Atmosphere* ***12****(1),* 55,1-28. doi.org/10.3390/atmos12010055

Arthur, R.S., Mirocha, J.D., Marjanovic, N., Hirth, B.D., Schroeder, J.L., Wharton, S. and F.K. Chow. 2020. Multi-scale simulation of wind farm performance during a frontal passage. *Atmosphere* **11**(1), 245, 1-17. doi.org/10.3390/atmos11030245