

Interactive comment on “The impact of the diurnal cycle of the atmospheric boundary layer on physical variables relevant for wind energy applications” by Antonia Englberger and Andreas Dörnbrack

Anonymous Referee #2

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General comments:

The paper discusses an LES study of a full diurnal cycle of the ABL that is validated with data from the BLLAST Field program. The study is an intermediate step toward a full LES model that incorporates wind turbine modeling. I have three general concerns regarding the manuscript. The first concern is that the paper does not appear to be sufficiently novel to stand as an independent publication. The contributions of the paper, in their current state, seem more appropriate as a chapter of a larger study. This is due to much of the introduction discussing turbine modeling, something that is not actually

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modeled in the paper. The introduction should put less emphasis on turbine modeling and more emphasis on literature relevant to modeling the full diurnal cycle with realistic boundary conditions. A quick Google search reveals that a number of previous LES publications have studied the full diurnal cycle. What is unique and novel about your approach?

Second, the validation with the BLLAST dataset is unconvincing for two reasons. First, the model was run with winds at 10 m s⁻¹ while the observations showed that the wind speed was closer to 3 m s⁻¹. A convincing validation should match wind speeds. Second, the model is only validated with three potential temperature profiles and the comparison is largely qualitative. I'd like to see a quantification of the errors as well as validation with additional observations from the BLLAST campaign. The discussion of the results then shows that the LES model is able to capture the expected structure of the ABL. The discussion fails to highlight what is novel about these results compared with previous LES studies of the ABL.

Finally, the grammar, sentence structure and general readability of the manuscript need to be improved. I encourage the authors to carefully edit the manuscript and highlight what is unique about their approach/results and resubmit.

Specific Comments

Line 5: "In this way, this contribution to the special issue of ACP 'The Boundary-Layer Late Afternoon and Sunset Turbulence project' satisfies the purpose of the BLLAST experiment: to provide a dataset for the validation of numerical simulations aiming to study transient BL processes" – This is not necessary to include in the abstract, include major conclusions instead.

Line 15 – It may not be necessary to include so much detail regarding the ABL in ACP. Is it possible to include the ABL schematic from Stull?

Line 34 – "initiated by a positive heat flux" – Use "upward" instead of "positive"

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Line 73 – “the inflow wind field a wind turbine is exposed to strongly influences the wake structure and the turbine loading, both affecting the power production of a wind turbine” – Confusing sentence structure. Consider rewording

Line 83 – “Which impact have the individual phases of the diurnal cycle on the physical variables relevant for wind energy applications?” – Confusing, please reword

Line 98 – “Most of the performed LES simulations on the characteristics of the BL, mentioned above, prescribe homogeneous surface conditions. However, the Earth’s surface is not homogeneous. It is strongly affected by different land use, buildings, and so on. Therefore, considering heterogeneous surface conditions will especially improve the turbulence structure close to the ground” – Without validation or a reference, this is a non-sequitur conclusion. Just because “realistic” surface conditions are implemented, it does not guarantee that the model will more accurately capture the near-surface turbulence structure. Please include a reference to where this has been validated or show this with your data.

Line 258 – “validated against the other three measurements” – Name the other three measurements
Figure 1 Caption – “The initial starting profile is also plotted for 0000 UTC” – That’s the dotted line?

Line 309 – “At 2300 UTC, there is a difference prevalent between the measurement and the LES result in the lowest levels.” – It’d be nice to see a bit more discussion on this since it’s the only simulated profile of the SBL

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