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Interactive comment on "Improving boundary layer flow simulations over complex terrain by applying a forest parameterization in WRF" *by* Johannes Wagner et al.

Anonymous Referee #2

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Review of "Improving boundary layer flow simulations over complex terrain by applying a forest parameterization in WRF" by Wagner et al.

The manuscript by Wagner et al., 2019 provides interesting research on a very recent topic on coupled meso-microscale simulations over forest using the Weather Research and Forecasting model that was enhanced by a forest parametrisation. In general the paper ist quite well written and presents novel and interesting research. However, I have two major and a number of minor points to be accounted for before I can recommend the publication as scientific paper in WESC.

Major Points:

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1) Nudging of the simulations When looking at the namelists that the authors provided as supplementary material it becomes clear that an analysis nudging is not applied in neither the short nor the long simulations. In case of the short simulations this might still be meaningful but for the 1.5 months simulation, a nudging should be applied to reduce the model error growth. This could in particular also improve the correlation that is investigated for the long term simulations.

2.) Wind power density discussion. Especially in situations with a local jet, the wind power of an assumed turbine of a certain size instead of the wind power density is much more meaningful. The rotor is integrating the power over the rotor area. Thus, I suggest to calculate the wind power using a rotor equivalent wind speed method here.

Minor Points:

Page 1 - Line 10 (Abstract): low-level jet events over the double-ridge -> better: across?

Page 2 - Line 2: The correct forecast of boundary layer flows -> I suggest rewriting to: An accurate forecast of boundary layer flows and surface winds is of special interest for wind power assessments

Page 2 Li- Line 12-13: Several modelling and measurement studies.... analysed the effect of a forest parametrisation -> How can a measurement study analyse the effect of a parametrisation? I guess you mean validation studies?

Page 2 - Line 24: Conlusions and an outlook is.... -> ARE finally given

Page 3 - Caption Table 1: For towers only data at the respective highest available altitude are used. -> This sentence sounds very odd. I suggest to consider rewriting to something like: The data from the highest available measurement device were used in case of tower data...

Page 3 - Line 3-4: .. in complex terrain and was part ... -> I suggest: conducted / organized in the framework of the NEWA proejct

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Page 3 - Line 14: ... which are mostly night-time phenomena... -> You should add "at the site". There are other LLJ like coastal LLJ that are NOT nighttime jets.

Page 4 - Line 8-9: The data repository of the field campaign is provided.... -> I had to read this line several times to understand that one needs to go to the website and search for "Perdigao Field Experiment (2019)". I suggest to add a real reference (in case of LaTeX "misc") to the respective website: http://re3data.org/repository/r3d100013152

Page 4 - Line 17: with and without forest parametrisation -> Better: With and without the (or a) forest parametrization

Page 4 - Line 19: In-situ observation... -> This is all based on mast data in case of your study only isn't it?. Then you can write: Met mast observations

Figure 1 - Size: ->I think the labels inside the figure are large enough. However, in the final publication I would recommend to increase the figure by about 50%.

Page 6 - Line 10: set at 80m, 50m, 15m and 10m above ground level (AGL). -> With the WRF eta levels I assume that adding the word "approximately" here makes sense.

Page 6 - Line 11: In D1 and D3 the Mellor-Yamada-Janjic turbulent kinetic energy (TKE) scheme... -> Why not the MYNN scheme?

Page 7 - Line 7: for power and load estimations in site assessment of wind turbines -> I suggest rewriting: and load estimations in the assessment of wind turbine sites....

Page 7 - Line 12 ... compared to mesoscale simulations, where in most cases only the roughness length is used to characterize the rough surface. -> I disagree with this sentence because the land use characteristics are also used to define e.g. the albedo and other properties of the surface. Rewriting to "characterize the roughness of the surfce" could help or being more precise here. This is also true for the following sentence. Is it really just the roughness length or are other surface properties also prescribed in WRF-LES?

Page 8 - Line 1: The tree type is defined by means of the leaf area index LAI. -> One sentence here what LAI is and describes could be very helpful for the reader.

Page 8 - Line 8: In WRF simulations -> I suggest rewriting to: In the WRF model, the LAI is retrieved from....

Page 8 - Line 10: As the forest height is not known... -> I suggest to add "for this site" somewhere in the sentence

Page 9 - Line 1: These dates were selected as the jets were very stationary during these events. -> How was this selection made? Based on which data? Visual inspection of the scanning lidar data?

Figure 3 - market with a red dot -> The red dot is very difficult to see in b) - maybe use a grey dot?

Page 11 - Line 9: ... directly over the surface... -> ABOVE the surface?

Page 11 - Line 10: Largest diffeerences are visible -> I suggest adding a difference plot (panel plot) between the lidar and simulation data.

Page 11 - Line 17: It is for example shown... -> Doesn't this sentence repeat what the sentence before says and can be completely removed?

Figure 4: -> Is it really relevant to show the information above 1.5 km height here? Reducing this could give some more detail of the flow inside the LLJ.

Figure 5 - Caption: As in... -> This is really confusing as Figure 4 is measurement and 5 model data. I support using this to reduce repetitions but in this case it confuses from my point of view.

Page 17 - Line 3-4: Tower data with a temporal resolution of 5 minutes are used.... -> I suggest to use the same averaging intervals in both cases.

Page 17 - Line 5: ... at all towers for simulation... -> I think it would be helpful to add

the towers as vertical lines or dots in all panel plots.

Page 18 - Line 1: ... which are covered by forest in the model but are mostly free of trees in reality? -> Why? Couldn't you manually change the tree coverage in the model?

Figur 9 - Label in Figures: -> cor/rmse/bias are much too small, fontsize should be increased.

Page 22 - Line 13 - ... on RANS simulations with grid sizes in the order of 1 km. ->Should this really depend on the grid size or rather the distribution of layers in the lowest height above the ground?

Page 22 - Line 22ff - Ideally seasonal landuse data sets should bus used in the future... -> I support this idea. Can you name data sources for this? Do satellite data exist from which these seasonal land uses can be gerived.

Page 23 - Data Availability: -> I suggest to add information of the availability of boundary condition data (e.g. the ECMWF data) and share the namelists and the geo_em files via a github repository.

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