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Interactive comment on "Atmospheric boundary layer modeling based on mesoscale tendencies and data assimilation at microscale" *by* J. Sanz Rodrigo et al.

Anonymous Referee #1

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Review of "Atmospheric boundary layer modeling based on mesoscale tendencies and data assimilation at microscale" by J. Sanz Rodrigo, M. Churchfield and B. Kosovic

The manuscript describes a series of simulations done with a RANS-type model with different closures and used to simulate the various GABLS intercomparison cases. The GABLS cases are setup in a single-column mode and the GABLS 1 and 2 tests show high consistency between the various closures. The GABLS 3 simulations are initialized and forced by advection terms derived from mesoscale modeling using the WRF model downscaling from ERA-interim reanalysis.

I believe the results are interesting, but the manuscript fails to argue why these experiments are relevant to wind energy applications. What do we really learn from such

a setup? In this rather flat and uniform site small-scale advection terms are probably unimportant and thus the WRF advective terms are closer to reality. But I fail to see how such a setup could be used in simulations in more complex terrain, where the small scale horizontal terms become more important. This needs to be addressed both in the introduction and then again in the discussion and conclusion section.

I have also a few more technical issues.

1. I believe the title is a bit misleading. What is done in this paper is not really data assimilation. There is a strong debate in the meteorological community, which does not consider "nudging" a data assimilation technique. Data assimilation methods take into account the error characteristics of the data being assimilated. Here that is not taken into account. I suggest that you substitute "data assimilation" by simply nudging or newtonian relaxation.

2. Is the setup double counting the forcing of the WRF data in the RANS model? Both advection terms and nudging are used to drive the results towards the results of the WRF simulations.

3. There are serious problems with the WRF setup. It is not appropriate to downscale directly from ERA-Interim at a grid spacing of $\sim$80 km to 9 km. The scales are just too different, and the simulation is likely missing some of the large-scale forcing. Please see http://www2.mmm.ucar.edu/wrf/users/workshops/WS2014/ppts/best_prac_wrf.pdf page on "Nesting, Resolution and Domain Size".

4. In P3. L9-10. I don't really understand what you mean by "... there is a strong coupling between the geostrophic wind speed and the surface temperature." Please explain.

5. In P12, L26. 'Interestingly, the advective wind makes a 360 deg turn throughout the cycle'. But the "large" fluctuations in direction advection coincide with very small fluctuations in wind speed advection. So, they are probably not meaningful. In this

case it would be better to avoid the separation in wind speed and direction and use zonal and meridional wind.

6. Figure 3. I don't understand what this figure is about. What does sensitivity analysis means? What are the figures of? What are the colors? The figure caption is not very informative.

Other minor editorial changes.

Many places with jargon or informal english. P2. L10-11, "... include relevant physics...", should be include the relevant physical processes, or physical-dynamical processes. "physics" does not mean anything P3, L29, "first-order physics" P17, L6, "are way off", L7 "doesn't", L17 "haven't".

Paragraph starting in P3, L20. I think the grammar is quite inconsistent. What is it that you mean?

P4, L2, "to count with" better will be "to have"

P9, L2. K h-1 is not standard units. K/hour would be better.

P9, L20, "are almost never happening" is weird. How about "almost never happen"?

P9, L25, "... based on observations, from the CASES-99..." the comma should not be there.

P11, L 20, the USGS land use is a map of surface characteristics parameter not a model.

P14, L19. There is rather a long jump in figure number. To Fig 12, then back to Fig 11. It is easier for the reader if these are in order in the text.

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