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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Turbulence vertical structure of the boundary layer during the afternoon transition" *by* C. Darbieu et al.

Anonymous Referee #2

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This paper concerns an LES of the afternoon transitional boundary layer, focusing particularly on the spectral characteristics of the decaying convective turbulence. The simulation is based on a well-observed field experiment and comparisons with the observations are included. It is a useful addition to the literature on the BLLAST experiment and on transitional boundary layers more generally. My comments are mainly requests for small clarifications, but, more substantively, I think that additional discussion of the budget of TKE, shown in Fig. 6, would be useful.

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1 Specific Comments

1. p. 32498, L. 16. Does advection here include subsidence?
2. p. 32499, L. 14. What is the height of the flux measurements over the individual surface types? Does the 60m tower have a large enough footprint to give a domain average, even in the most unstable cases, or is the predominance of the moor surface type the key point?
3. p. 32499, L. 15. Do you necessarily expect the latent heat flux to reach 0?
4. p. 32500, L. 1. The boundary conditions need to be described more prominently. I think moving the sentence "A simulation is initialized...advection." to the top of section 3.1 and adding "observed surface heat flux at the moor site" would make this more obvious. The sentence on lines 17 and 18 of this page could then be removed.
5. p. 32502, L.3. It would be interesting to relate Fig. 6 to the budget of TKE, including production, shear etc., to explain why the region of negative buoyancy is deeper. Perahps figures of the non-dimensional budgets at the start of the AT, at the end of the first phase and at the end of the second phase would be useful. As the authors note, in the real atmosphere there was more shear at the top of the BL, so their idealization will underestimate entrainment, but it should be conceptually helpful in underestanding the decay of convective turbulence.
6. p. 32503, L. 13. This paragraph is confusing: "Despite...nevertheless...Despite". It's not clear whether you think the LES is good enough or not. Please be more specific about which aspects of the LES are expected to be realistic and where caution is appropriate.
7. p. 32506, Eq. 16. I wondered whether a weighting with $S_{KL89}(k)$ would improve the measure, so as not to overemphasise noise in weaker parts of the spectrum.

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8. p. 32507, L. 19. I was confused here. Fig. 8 shows higher values of k at 18:00 UTC, implying shorter wavelengths, yet you say Λ_w increases.

9. p. 32508, L. 9. Do you mean "decay of TKE" rather than "decay of TKE dissipation rates"?

10. p. 32509, L. 13. An explanation of why anisotropy or coherent structures could explain this is needed.

11. p. 32510, L. 23. Define LAT.

12. p. 32511, L. 18. Does the decrease actually propagate, or does is it simply that surface-driven turbulence does not rise so high?

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 32491, 2014.