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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Role of the residual layer and large-scale subsidence on the development and evolution of the convective boundary layer" *by* E. Blay-Carreras et al.

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This work investigates when and how the residual layer and the subsidence condition the evolution of the CBL through numerical modelling taking advantage of the observations made in the campaign BLLAST in summer 2011. The approach is well defined and the conclusions are clear. I have no major discrepancies with the work but before it can be accepted for publication some issues need to be better described, which leads me to propose Major Revisions, for the sake of improvement of the final version of the paper

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Interactive Discussion
Discussion Paper

1. On the wind structure: the paper is not clear on the treatment of the wind. No wind profiles are given, neither the criteria why these particular profiles have been chosen or what are the surface boundary conditions (z0, u*). Since shear production is a major point here, it is necessary to document well all these points and to put them in relation to observations. In particular I question myself on how these choices are related to the observations in the campaign, where heterogeneity of the terrain was significant. Also the jump from the BL to the FA seems very large (from 3.5 to 10 m/s). How this transition is imposed? Do these 10 m/s correspond to actual observations or numerical model analysis? In the initial part of the runs (when CBL is not yet developed) do you take 10 m/s just above the surface inversion? If so, is this in agreement with the observations that night? As mentioned, the paper would become much clearer if all these issues were well discussed and the decisions taken well justified.

2. On the LES choices: the domain is large enough and the statistics make sense. The resolution (not explicitly given) is 50 m in the horizontal and 10 m in the vertical. Some justification on why these resolutions are taken is missing, especially since this is a sensitive issue at the entrainment zone. A more elaborate description on why the prescribed fluxes are used as a sinusoidal form (only mentioned in table 1) is needed, especially when there is so much observational information. At least a comparison of these formulae with the observations at the central site would be needed and justified.

3. On the interpretation of the TKE budget: the focus is put on RL versus no-RL in absence of subsidence. I miss the interpretation with/without subsidence for completeness. Besides it is difficult to comprehend the role of shear production (SP) without knowing how the wind behaves (see comment #1). Please clarify how the diferent terms are computed (for instance, average of the vertical gradients or vertical gradient of the averaged profile?). I find very interesting the result in figure 7 that indicates that SP is much smaller without RL. It is partially attributed to a smaller vertical integration domain. I believe this interpretation would be much enriched if the profiles of the fluxes and the gradients were shown for both cases (or the 4 cases even better). Assuming

ACPD
13, C11485–C11487, 2014

that within the central part of the CBL the gradients of the mean wind are small, most of the contribution to this term should come from the surface and the entrainment layers. If most of the differences between RL and no RL take place at the top of the CBL, this would mean that SP there is smaller when RL is not present, which is a result that deserves further discussion.

4. On the significancy and novelty of the results: I believe more detail is needed in the conclusions on how this study is bringing new insight in the study of the sheared CBL, especially through the use of the observations of the BLLAST campaign.

I hope that these comments may be useful for the authors and the editors to get a better description of the work done, and that I did not misunderstand or just missed relevant information already included in the paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 31527, 2013.